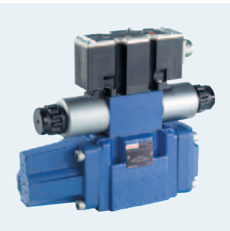
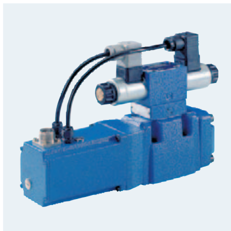
The Drive & Control Company

Rexroth
Bosch Group

Product catalog Industrial hydraulics

Part 5: Proportional servo valves












Product catalog Industrial hydraulics

Part 5: Proportional servo valves

Product catalogs Industrial hydraulics of Bosch Rexroth at a glance:

Part 1:	Pumps	RE 00112-01
Part 2	Motors	RE 00112-02
Part 3:	Cylinders	RE 00112-03
Part 4:	On/off valves	RE 00112-04
Part 5:	Proportional servo valves	RE 00112-05
Part 6:	Electronics	RE 00112-06
Part 7:	Systems	RE 00112-07
Part 8:	Power units, Manifolds and plates, Accumulators	RE 00112-08
Part 9:	Filters	RE 00112-09
Part 10:	ATEX units for potentially explosive atmospheres	RE 00112-10

For the latest product information from Bosch Rexroth, please visit our website: www.boschrexroth.com/ics

Publisher **Bosch Rexroth AG**
Zum Eisengießer 1
97816 Lohr, Germany
Phone +49(0)9352/18-0
Fax +49(0)9352/18-40
info@boschrexroth.de
www.boschrexroth.com

Catalog No. Document no.: RE 00112-05
Material no.: R999000306
Edition: 2013-08
Replaces: RE 00112-03_2008-11

Should you have queries with regard to the products in this catalog, please contact the Rexroth sales partner in your vicinity.

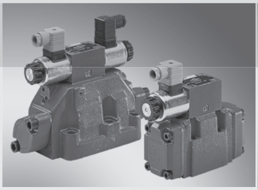
www.boschrexroth.com/contact

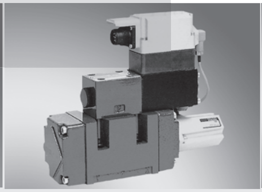
Contents

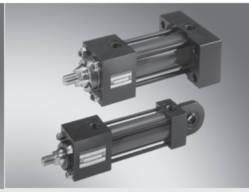
General

General product information on hydraulic products

RE 07008/02.05







DE	Ihre Sprache? – Siehe Rückseite!
EN	Your language? – See back page!
FR	Votre langue ? – Voir au dos !
IT	La vostra lingua? – Vedi retro!
FI	Kohdekielet? – Katso takankatta!
ES	¿Su idioma? – ¡Vea al dorso!
NL	Uw taal? – Zie achterzijde!
SV	Ditt sprak? – Se omslagets baksida!
PT	O seu idioma? – Consulte a contracapa!
DA	Dit sprog? – Se bagside!
EL	Η γλώσσα σαρ; – Βλέπε πίσω πλευρά!

Contents

Contents Page

1 Important basic information

1.1 Conventions used in this product information

Cross-references are printed in *italics*.

⚠ DANGER

This symbol indicates a threat of danger which will result directly in death or very serious injury if not avoided.

⚠ WARNING

This symbol indicates a threat of danger which may result in death or very serious injury if not avoided.

⚠ CAUTION

This symbol indicates possible danger which may lead to minor or serious injury and/or to material damage.

IMPORTANT

This symbol indicates additional information.

1.2 What you need to know about this product information

This product information applies to the following types of hydraulic products:

- Hydraulic components
- Hydraulic power units
- Hydraulic systems.

This product information applies exclusively to hydraulic products that are operated with mineral-oil-based pressure fluids, if the *Operating Instructions* do not expressly permit the use of other pressure fluids.

IMPORTANT

As this product information for Rexroth hydraulic products applies in a general sense, some of the content may not necessarily apply to the hydraulic product you have purchased.

However, only by strictly observing this product information and the Operating Instructions can accidents be prevented and problem-free operation of your Rexroth hydraulic product be guaranteed.

Observing the product information and Operating Instructions

- reduces downtimes and maintenance costs
- increases the service life of your hydraulic products.

The Operating Instructions must be directly accessible to one of the personnel at the hydraulic product and kept readily available at all times in a place known to the personnel.

The Operating Instructions must be read and understood and all its provisions observed by those responsible and by the operative personnel. We recommend that a record is made in writing of the employees' familiarisation with all the relevant parts.

The cross-references to directives, standards and regulations contained in this product information refer to the versions current at the time of writing of this product information, which can be obtained from the title page of this product information.

1.3 The contents of this product information

In addition to this document, product information for Rexroth hydraulic products normally includes Operating Instructions consisting of three parts:

- **Part I**, the general Operating Instructions for the relevant class of products
- **Part II**, the Technical Datasheet
- **Part III**, the Product- and Application-specific Operating Instructions.

If you do not have all three parts, please request the missing part from Bosch Rexroth. Only if all the information contained in all parts of the three-part Operating Instructions is observed can safe operation of Rexroth hydraulic products be ensured.

Specific cross-references are used to draw your attention to information that you can find in the Operating Instructions.

The Operating Instructions contain detailed information about the product, including

- Information about the scope of delivery
- Safety instructions
- Technical data and operating limits
- Information about bringing into (first) use and maintenance
- Information about the mode of operation
- Layouts, drawings
- Parts lists if appropriate
- Information about replacement parts and accessories.

2 Scope of delivery and responsibilities

2.1 Scope of delivery and responsibilities of Bosch Rexroth

Rexroth hydraulic products fulfil all safety requirements applicable to fluid power systems and their components.

IMPORTANT

For the scope of delivery and the responsibilities of Bosch Rexroth with respect to the product, please refer to the *Product-specific Operating Instructions*.

2.2 Responsibilities of the plant operator

⚠ CAUTION

If Rexroth hydraulic products are positioned in the vicinity of sources of ignition or strong radiators of heat, protection must be put in place that would prevent any escaping pressure fluid from igniting and the hose lines from aging prematurely.

Mineral-oil-based pressure fluid is hazardous to water and flammable. It may only be used if the relevant safety datasheet from the manufacturer is available and all the measures stipulated therein have been implemented.

If there is a risk of fluid leaking from the hydraulic product and contaminating water or the ground, the hydraulic product in question must be placed in a suitable collecting trough. In connection with this, the applicable statutory regulations must be observed.

You must also observe the EU directives for the use of work equipment (Directive 89/391/EC) and the associated individual directives, especially Directive 1999/92/EC for the protection from the danger arising from potentially explosive atmospheres and their implementations in national legislation. The legislation contains minimum requirements with respect to the making available by the employer of work equipment and for the use of work equipment by employees at work, including the regulations for operating equipment requiring supervision and the obligation to produce explosion protection documentation. This involves, for example, dividing areas endangered by potentially explosive atmospheres into zones and specifying suitable work equipment and procedures for these areas.

2.2.1 Noise protection

The A-weighted equivalent continuous sound power level of Rexroth hydraulic products can be obtained from the relevant *Operating Instructions*. If no values are documented then it can be taken that the value is less than 70 dB(A).

Installation of Rexroth hydraulic products in a machine or system may increase this value, and if so, the manufacturer of the machine/system must document this.

At or above 85 dB(A), the plant operator must make suitable hearing protection available to the personnel.

2.2.2 Special points concerning the installation of certain products

A Rexroth hydraulic product is intended above all for installation in machines, systems and power units as a part machine or a component for installation into another machine or system and is not a complete machine in the sense of the EU directive. In addition to the Machinery Directive, still further directives may apply, such as the Pressure Equipment Directive or the Explosion Protection Directive.

A wide range of dangers can arise from the combined actions of the hydraulic product and the machine or system in which the hydraulic product is installed. Therefore you must always make sure that the hydraulic product is also suitable without restriction for the proposed application at the installation location. The interfaces with the overall machine and the operating conditions are also of the greatest importance. We recommend that the results of the hazard analysis (risk assessment) of the overall machine are taken into account in the design of the hydraulic product.

The functioning of the hydraulic product is also influenced by the machine or system in which it is installed.

For this reason, you must also always observe the Operating Instructions of the overall system in which your hydraulic product is installed. It is most important for you to also consider the possible use of the hydraulic product in a potentially explosive atmosphere (see 94/9/EC).

IMPORTANT

Bosch Rexroth points out that, at the time of their first introduction on to the market, hydraulic products comply with the requirements of all relevant EU directives and/or their implementation into national legislation in Germany. If the scope of delivery is intended to be installed in a machine or system, then the Machinery Directive applies as appropriate – including the then currently applicable amendments – in that the scope of delivery does not necessarily comply with the requirements of the Machinery Directive because the scope of delivery is intended for installation in a machine or because the scope of delivery is intended for combination with other machines into a machine or a hydraulic system.

The bringing into use of the scope of delivery shall therefore not be permitted until the machine or system in which the scope of delivery is to be installed or of which it represents a component complies with the requirements of all relevant EU directives.

Details of further responsibilities can be found in *3 Important basic safety instructions* and in the *Operating Instructions*.

2.3 Liability, guarantee, warranty

Bosch Rexroth shall not be liable for damages that result from non-compliance with or disregard of these and other parts of the Operating Instructions.

Unauthorised tampering shall render the warranty null and void.

Bosch Rexroth shall only be liable if the scope of delivery was shown to be defective. Bosch Rexroth shall not be liable if a deficiency occurs that involves parts having been replaced by the customer with equivalent but not identical parts as specified by the manufacturer.

Please refer to our general terms of supply or your contract for details of the guarantee and manufacturer's warranty.

2.4 Copyright

This product information may only be reproduced – electronically or mechanically, in whole or in part – with the express written permission of Bosch Rexroth. It may likewise not be distributed, amended, transmitted, translated into another language or employed or copied for other purposes or by other parties without such consent.

3 Important basic safety instructions

3.1 What to do in an emergency

In the event of an emergency, fault or other abnormal occurrences:

1. Switch off the hydraulic system.
2. Secure the main switch against being unintentionally switched on again.
3. Secure the danger area so that no one can enter the danger area unknowingly or uncontrolled.
4. Notify the relevant specialist personnel immediately.
5. In the event of fire, observe the provisions of the safety datasheets issued by the manufacturer of the pressure fluid and the fire precautions specifically applicable to your place of work, which must be documented in the plant operator's operating manual.

⚠ WARNING

Fighting fires with materials other than those permitted can lead to explosions and/or more rapid spread of the fire!
Danger to life from smoke inhalation!

3.2 Safety labelling on the hydraulic product

IMPORTANT

➢ The meanings of the safety labelling on the Rexroth product are explained in the *Operating Instructions*.

➢ For a diagram of the nameplate and an explanation of the information on it please refer to the *Operating Instructions*.

3.3 Proper use

Rexroth hydraulic products are designed and constructed for the provision, transmission, control or regulation of energy and signals using the flow of oil.

Unless otherwise agreed, the Rexroth hydraulic product satisfies at least safety category B in accordance with EN 954-1.

If the hazard analysis/risk assessment of the overall machine in which the Rexroth hydraulic product is to be installed indicates that a safety category higher than category B in accordance with EN 954-1 is required for the Rexroth hydraulic product, then a correspondingly higher rated hydraulic product can be supplied and installed only after special agreement with Bosch Rexroth.

IMPORTANT

The hydraulic product shall be operated exclusively with pressure fluids complying with DIN 51524. Where other pressure fluids are permitted, for example brake fluids for brake valves, this is specially mentioned in the *Operating Instructions*.

For details on proper use see *4 Technical data and ambient conditions*.

The following information can be found in the *Operating Instructions*:

➢ the proper use, specific to the hydraulic product

➢ where applicable, the safety category in accordance with EN 954-1

➢ non-permitted and improper use.

3.3.1 Proper use, requirements before operation

➢ Rexroth hydraulic products may only be operated if they are in perfect technical condition.
- In the event of disturbances in the power supply and/or damage to the electrical equipment, switch off immediately and secure the main switch against being switched on again without authorisation.
- Report and rectify all faults and damage indicated by the system or discovered by other means.

➢ The connections, operating conditions and performance data specified in the *Operating Instructions* must be observed and never changed.

➢ Rexroth hydraulic products shall not be converted or otherwise modified without prior consultation with Bosch Rexroth.

➢ The plant operator shall not modify the program code of programmable control systems.

➢ Dependencies and time factors shall not be modified without prior consultation.

➢ The safety devices fitted by Rexroth must be present, properly installed and in full working order – except when this is impractical during setting up or maintenance work. They shall not be relocated, bypassed or rendered ineffective.

➢ Safety components such as limit switches, valves and other control components shall not be rendered inoperative.

➢ Tamperproof lead seals installed by the manufacturer shall not be removed or damaged except when this is necessary in the course of maintenance tasks defined in the *Operating Instructions.*

➢ The specified maintenance tasks in the *Operating Instructions* shall be carried out at the intervals stated in the *Operating Instructions*.

1

- Uncontrolled access by persons unfamiliar with the system to the immediate operating zone of Rexroth hydraulic products is prohibited (even if the product in question has been shut down).
- Rexroth hydraulic products must never be assembled, operated or maintained by persons under the influence of alcohol, drugs or other medication which affect one's ability to react.

3.4 Requirements for personnel, duty of care

3.4.1 Qualifications of specialist personnel

A specialist person is someone who, using his specialist training, knowledge and experience as well as familiarity with the relevant conditions, can

- safely carry out the tasks allocated to him and correctly assess the scope and implications of his work
- recognise possible dangers
- undertake the necessary measures to eliminate possible accidents.

3.4.2 Requirements for hydraulics maintenance personnel

In accordance with DIN 31051, maintenance comprises the individual activities of **inspection**, **servicing** and **repair**. All personnel involved in maintenance shall be familiar with and observe all parts of the Operating Instructions and this product information.

Inspection personnel shall fulfil the following requirements:

- They have been instructed in the relevant activity.
- Specialist knowledge of hydraulics is not required for purely inspection activities but the personnel must be aware of the particular dangers associated with hydraulic products.

Servicing personnel (who carry out filter and oil changes, for example) shall fulfil the following requirements:

- They have been instructed in the relevant activity.
- Specialist knowledge of hydraulics is not required to carry out servicing work.

Repair personnel shall fulfil the following requirements:

- The personnel must be hydraulics experts, who have been instructed and meet the definition given above,
- Repair personnel must be familiar with the function of the hydraulic system as a whole, from subsystems to their interaction with the function of the entire machine.
- Repair personnel must be able to read hydraulic circuit diagrams, interpret individual functions from their symbols and understand function diagrams.
- Repair personnel must possess knowledge of the function and construction of hydraulic elements.

3.4.3 Requirements for electrical maintenance personnel

All work on electrical equipment shall only be carried out by an authorised, qualified electrician, or by instructed persons under the guidance and supervision of a qualified electrician, in accordance with the rules applicable to electrotechnical products.

3.4.4 Minimum age

Persons under the age of 18 who are currently receiving instruction or training or are working under supervision may not work on Rexroth hydraulic products.

This does not apply to young persons of 16 or over if

- working on Rexroth hydraulic products is necessary in order for them to accomplish a training objective
- their protection is guaranteed by the supervision of an experienced, competent person
- they are allowed to use only tools, work implements and protective gear that preclude the risk of injury.

3.4.5 Training

The plant operator using Bosch Rexroth hydraulic products shall train his personnel regularly in the following subjects:

- Observation and use of the Operating Instructions and legal requirements
- Proper operation of the Rexroth hydraulic product
- Observation of the instructions of safety officers and the plant operator's operating manual
- What to do in an emergency.

IMPORTANT

Bosch Rexroth can provide you with training support in specialist areas.

An overview of the training can be found on the Internet at **http://www.boschrexroth.de/didactic**.

3.5 General ancillary dangers and protective measures when operating hydraulic products

⚠ DANGER

In the interests of your safety, all safety instructions shall be carefully observed, especially those in the Operating Instructions.

In spite of the high intrinsic safety of Rexroth hydraulic products, the risk of personal injury or damage to the environment cannot be excluded, even when the equipment is properly used.

New, additional dangers may arise if the hydraulic product is installed in another machine or installed with other machines in a system. This shall apply in particular to mechanical movements generated by the hydraulic product.

Information on these additional dangers can be found in the overall operating manual of the supplier of the overall system in which the hydraulic product is installed.

3.5.1 Dangers from pressure fluid

⚠ CAUTION

Handling pressure fluid without protection is **hazardous to health**.

Please observe the manufacturer's safety instructions and the safety datasheets for the pressure fluid that you are using.

⚠ DANGER

Serious damage to health or death may result if pressure fluid enters the blood stream or is swallowed. If this occurs, contact a doctor immediately!

3.5.2 Malfunctions due to contamination of pressure fluid

Contamination of the pressure fluid can be caused by:

- Wear during operation of the machine/system (metallic and non-metallic abrasion)
- Leaks of the hydraulic product
- Contaminants introduced during servicing/repair
- The use of dirty (unfiltered) pressure fluid when the pressure fluid is changed.

Contaminants lead to malfunctions, increased wear and shorter service life of the hydraulic product. This can have negative effects on the safety and reliability of the hydraulic product.

Therefore the maintenance tasks specified in the *Operating Instructions* shall be carried out at regular intervals and the utmost cleanliness is required during work on the hydraulic product.

⚠ CAUTION

When changing the pressure fluid, always use factory-fresh pressure fluid and filter it before filling to remove any contaminants in the pressure fluid that it often contains from the packaging container (drum). Flush out lines and hoses before installation.

The cleanliness class of a pressure fluid is specified in accordance with ISO 4406. Detailed information can be obtained from the relevant datasheet or the *Operating Instructions*.

1

In older datasheets, the cleanliness class is sometimes specified in accordance with NAS 1638. The following table can be used to convert this to an equivalent ISO 4406 cleanliness class:

Comparison table for cleanliness classes

Earlier class to NAS 1638	**Current class to ISO 4406 (c)**
Class 7	Class 18/16/13
Class 9	Class 20/18/15

3.5.3 Electrical dangers

When working on electrical systems:

- De-energise the hydraulic system before beginning any maintenance work.
- Cordon off the working area with red-white safety chain and warning signs.
- Lock the main switch, remove the key and keep it in a safe place until the work is completed.
- Attach a warning sign to the main switch.
- Check that there is no voltage using a **two-pole** voltage detector.
- Earth and short-circuit the point where you are working.
- Cover neighbouring live parts.
- Clear your workplace to prevent contact with live parts as a result of tripping or slipping. Wear safety footwear.
- Always use electrically insulated tools.
- Disconnect plugs at sensors and valves – even those with low voltages – after the system has been de-energised.

⚠ DANGER

Even after disconnection of the electrical supply (main switch OFF) the following supply systems/danger areas can still give rise to life-threatening voltages:

➢ Electrics, electronics, hydraulics (e.g. accumulators, rechargeable batteries)

➢ Main switch

➢ Power supply cables

➢ Points identified with an electric shock warning sign.

3.5.4 Product-specific ancillary dangers

All product-specific ancillary dangers and precautions can be found in the relevant *Operating Instructions*.

3.5.5 Disposal

➢ Take metal, cable and plastic ducts to a recycling materials collection centre.

➢ Dispose of electronic components as electronic waste.

➢ Dispose of back-up batteries as special waste.

➢ Cleaning agents, operating fluids and other materials:

⚠ CAUTION

Please observe the disposal regulations specified in the appropriate *Safety Datasheets*.

1

4 Technical data and ambient conditions

IMPORTANT

The product-specific technical data, operating limits and ambient conditions for the operation of your Rexroth hydraulic product can be found in the *Operating Instructions*.

This includes the following information:

- Minimum flow rate for adequate cooling
- Permissible maximum temperature of the coolant
- Performance data
- Type of control and regulation functions
- Permissible pressures, flow rates
- Connections.

4.1 Information about pressure fluids

Unless otherwise indicated in the Operating Instructions, the following specification applies to the pressure fluid to be used:

- Mineral-oil-based pressure fluid complying with the requirements of DIN 51524.
- Operating temperature range 0 °C…+80 °C (in tank < 72 °C).

Any deviations from this can be found in the *Operating Instructions*.

IMPORTANT

Bosch Rexroth recommends a maximum operating temperature of 55 °C, because the rate of ageing of the pressure fluid increases and the service life of the seals and hoses is reduced at higher temperatures.

- Viscosity ranges:
  see RE 07075 and RE 90220
- Max. permissible contamination class of the pressure fluid in accordance with ISO 4406: see *3.5.2 Malfunctions due to contamination of pressure fluid*.

The maximum permissible cleanliness class can be found in the *Operating Instructions*. The following types of pressure fluids shall be used.

IMPORTANT

Rexroth hydraulic components are tested with test oil MZ45 manufactured by ESSO (class ISO VG 46 at 40 °C), (Viscosity η = approx. 46 mm^2/s).

4.2 Ambient conditions

4.2.1 Use in potentially explosive atmospheres

⚠ DANGER

Rexroth hydraulic products shall be used in potentially explosive atmospheres only if they are designed for this purpose and this is expressly stated in the *Operating Instructions*.

IMPORTANT

Directive 1999/92/EC of the European Parliament and Council dated 16 December 1999 concerning the minimum requirements for improving the safety and health protection of workers potentially at risk from explosive atmospheres governs protection from danger from potentially explosive atmospheres. Observe the requirements contained in the regulations for operating equipment requiring supervision and the obligation to produce explosion protection documentation.
This involves, for example, dividing areas endangered by potentially explosive atmospheres into zones and specifying suitable work equipment and procedures for these areas.

Observe the requirements of *Directive 94/9/EC of the European Parliament and Council dated 23 March 1994 on the approximation of laws of the member states concerning equipment and protective systems intended for use in potentially explosive atmospheres* (ATEX Product Directive) and/or the corresponding national legislation by means of which the Directive was implemented in law in the EU member states. The directive contains requirements for the use of equipment and protective systems in potentially explosive atmospheres.

4.2.2 Climatic operating conditions

Unless otherwise indicated in the Operating Instructions, the permissible ambient temperature

- for control units: 0 °C…+50 °C
- for drive units with electric motors without heat exchangers, surface-cooled by free air circulation: 0 °C…+30 °C
- for drive units with heat exchangers: < +40 °C.

Unless otherwise specified, Rexroth hydraulic products are designed for use in temperate climate zones and in covered areas (not in the open air) at relative air humidities of < 70 % and at room temperatures of 22 °C.

IMPORTANT

For systems with oil-air heat exchangers:
Observe the information given in the circuit diagram in the *Operating Instructions*.

In relation to the electronic equipment, the permissible ambient conditions apply to installed and protected electrical connections of class IP 55.

- Ambient temperature +5 °C…+40 °C
  assuming that the average air temperature over a 24 hour period does not exceed +35 °C.
- Relative air humidity: 23…95 %, non-condensing.
- Altitude: up to 1000 m above national datum.

⚠ DANGER

Rexroth hydraulic products shall not be used in aeronautical equipment, except where they have been specially approved and appropriately labelled to this effect.

1

5 What you need to know about pressure fluids

5.1 How to handle pressure fluids safely

⚠ DANGER

Mineral-oil-based pressure fluid is hazardous to water and flammable.
It may only be used if the relevant safety datasheet from the manufacturer is present and all the measures stipulated therein have been implemented.

5.2 Functions and effectiveness

Due to the many tasks of pressure fluid, its selection, inspection and maintenance are of vital importance for:

- proper functioning
- operating safety
- service life
- and the cost effectiveness of the hydraulic product.

The tasks of pressure fluid:

- to transmit hydraulic energy from the pump to the hydraulic cylinder/motor
- to lubricate parts moving against one another
- corrosion protection
- to remove contaminants
- to remove locally accumulated heat.

5.2.1 Reduced function due to ageing

The effectiveness of pressure fluid diminishes as it ages (undergoes chemical changes). Acids and resinous residues form, which may cause valve spools to stick.

The following factors accelerate the ageing process:

- high temperatures
- oxygen in the pressure fluid
- air humidity
- water
- metallic catalysers
- operating pressure
- contaminants.

IMPORTANT

Observe the following rules of thumb:
At pressure fluid temperatures >70 °C, the rate of ageing doubles for each 10 °C.

5.3 Viscosity

5.3.1 Viscosity grades

The most important characteristic of a pressure fluid is its viscosity, i.e. stickiness. Viscosity range always plays a priority role in the selection of a pressure fluid.

Viscosity is measured in the SI unit [mm^2/s]. Many manufacturers still provide their information in centiStoke [cSt], the equivalent of [mm^2/s].

The viscosity grades (VG = viscosity grade) in accordance with ISO 3448 relate to the viscosity at 40 °C. The viscosity grade is appended to the type designation or the commercial name of the pressure fluid.
Example: A pressure fluid with a viscosity grade of ISO VG 46 has a viscosity of 46 mm^2/s at 40 °C.

The relationship between medium temperature and viscosity for hydraulic oil (example)

Medium temperature	Viscosity
3 °C	800 mm^2/s
8 °C	500 mm^2/s
25 °C	100 mm^2/s
60 °C	20 mm^2/s
77 °C	12 mm^2/s

Too high a viscosity leads to the formation of air and vapour bubbles as a result of low pressure (cavitation). Too low a viscosity leads to increased leakage losses. Increased leakage losses cause the pressure fluid to heat up more, leading in turn to a further reduction in viscosity. The pressure fluid then loses its ability to lubricate.

Valves, pumps and hydraulic motors, in particular, require exact compliance with the defined viscosity ranges.

For certain ambient and operating temperatures, not all the requirements can always be covered with the available ranges of the viscosity grades.

In order to comply with all the requirements, high viscosity pressure fluids with viscosity index improvers or a pressure fluid cooler/heater may be used.

5.4 Leakage fluid

Clearances and play mean that some leakage fluid escapes from all hydraulic products. Leakage fluid can be lead away internally or externally, depending on the component. It can be fed back into the tank or must be disposed of.

⚠ CAUTION

Make sure that the leakage fluid is fed back into the tank in a proper manner.
Dispose of leakage fluid that is not fed back into the tank properly, in compliance with the applicable environmental protection regulations.

5.5 Topping up/refilling

⚠ CAUTION

When topping up/refilling your hydraulic system, make sure that you use pressure fluid of the same sort and type and from the same manufacturer.

If the fluid is heavily contaminated or prematurely aged, then the system, including the tank must be cleaned and flushed before refilling. New pressure fluid must always be filtered in accordance with the required cleanliness class, as it does not normally meet the required cleanliness class in the as-supplied state.

6 Construction and mode of operation of a hydraulic system

6.1 Definitions of terms

Hydraulics (fluid technology)

Transmission, control and distribution of energy and signals using a pressurised fluid medium.

Hydraulic system

Arrangement of interconnected components for transferring and controlling hydraulic energy.

Component

A single unit (e.g. a valve, filter, cylinder, motor) that consists of one or more parts and which is a functional constituent of a hydraulic system.

Drive

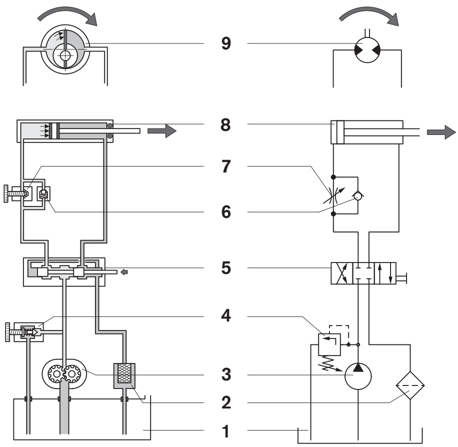
A component that converts the energy of the hydraulic fluid into mechanical energy (e.g. motor, cylinder).

6.2 Schematic

In a system operated with hydraulic oil, first of all mechanical energy is converted into hydraulic energy, transported and controlled in this form, to finally be converted once more into mechanical work.

The hydraulic elements are arranged in accordance with these functions. The following diagram shows a schematic representation of the elements of a complete hydraulic system.

To demonstrate their operating principle, standardised symbols (ISO 1219) are used instead of sectional diagrams of the various devices. Line connections are represented by simple lines, as can be seen in the example.



1	Tank	Oil preparation
2	Filter	
3	Pump	Energy conversion
4	Pressure limiting valve	Energy control
5	Directional valve	
6	Check valve	
7	Throttle valve	
8	Hydraulic cylinder	Energy conversion
9	Hydraulic motor	

6.3 Safety concept

Hydraulic products contain sensors and actuators, the interaction of which is particularly important with regard to the fulfilment of technical safety functions.

Individual hydraulic products form part of an overall safety concept.

Applications required to perform safety functions are designed using special hydraulic components that satisfy the requirements of the relevant directives, such as the Pressure Equipment Directive and other standards.

The manufacturer of the overall machine or system defines and bears responsibility for the safety category to EN 954-1 to be fulfilled.

IMPORTANT

A more detailed description of the safety concept and the specific safety components installed can be found in the *Operating Instructions* and the *Operating Instructions of the supplier of the overall system* in which the hydraulic product is installed.

7 Moving hydraulic units/components

Hydraulic units or components may be moved by a fork-lift truck or a hoist, depending on their size and the local conditions.

IMPORTANT

For details see the *Operating Instructions*.

⚠ CAUTION

Always ensure hydraulic products are empty of pressure fluid for transportation.

Rexroth hydraulic products are delivered empty of pressure fluid. However, products may contain oil residues left over from the final inspection at our factory.

8 Storage and longer standstills

8.1 Hydraulic systems - subsequent bringing into use after storage

Corrosion, especially oxidation, can cause metal surfaces to lose the standard of surface finish required for the hydraulic system to function properly.

Rust and other metallic and non-metallic particles lead to abrasive wear (erosion), which detrimentally affects the functioning of the hydraulic system.

⚠ CAUTION

If a hydraulic system is to be brought into use again following a long standstill, it must first be flushed clean.

8.1.1 Factory-applied corrosion protection

Rexroth hydraulic products are tested in accordance with Class III using a hydraulic oil that has additional anti-corrosive properties. The film of oil that remains in the product after the test provides sufficient internal corrosion protection.

This factory lubrication ensures that valves do not stick during subsequent use of the hydraulic product, and guarantees compatibility with seals and the pressure fluid to be used.

IMPORTANT

The factory-applied corrosion protection is adequate provided that

- no condensation or leakage water can enter the system
- long standstills are avoided.

Contact Bosch Rexroth if you are not clear about the consequences of long standstills on the state of the hydraulic product.

8.1.2 Storage times in relation to the ambient conditions

Delays in bringing into use, long shipping and storage times or long periods of non-use can lead to rust formation in Rexroth hydraulic products. Additional corrosion protection measures must be implemented to prevent this.

IMPORTANT

If all the openings on the hydraulic products are not sealed so as to be air-tight, this will reduce the storage life of the hydraulic product by nine months.
After the specified storage time has expired, in any event not longer than 24 months, the corrosion protection must be checked and further conservation measures applied if necessary.

8.2 Seals, hoses and hose lines

CAUTION

Seals:
Observe the requirements of ISO 2230 and/or DIN 7716 and the specific manufacturer's data on seals.

Hoses and hose lines:
In the Federal Republic of Germany, please observe the requirements of *DIN 20066, ZH 1/74 Safety rules for hydraulic hose lines* and the specific manufacturer's data on hoses and hose lines.

In addition, the following conditions shall be observed:

- Seals, hoses and hose lines are stored in cool, dry and dust-free conditions.

The hoses and hose lines can be enclosed in plastic foil to ensure low-dust storage conditions. Ideal storage conditions for hoses and hose lines are temperatures from +15 °C to +25 °C and a relative humidity of below 65 %.

- Do not store elastomers below –10 °C. The ideal storage conditions for seals are temperatures from +10 °C to +20 °C and a relative humidity of between 65 % and 75 %.
- Store hoses and hose lines in the original packaging if possible. Prevent the entry of air.
- Avoid direct sunlight and UV radiation and shield from nearby sources of heat.
- Darkened storage locations are preferred.
- Do not use ozone-forming light sources or equipment (e.g. fluorescent lamps, mercury-vapour lamps, copiers, laser printers) or electrical spark-forming devices in the vicinity of hoses and hose lines.
- Seals, hoses and hose lines must not come into contact in particular with materials or vapours that could damage them (e.g. acids, alkalis, solvents).
- Store seals, hoses and hose lines lying down and free from tension. If the hoses and hose lines are coiled, take care not to bend them to less than the smallest bending radius specified by the manufacturer.

Maximum storage times

- NBR seals: 4 years
- FKM seals: 10 years
- Hoses: 4 years
- Hose lines: 2 years

For reasons of safety, seals, hoses/hose lines shall not be used once these permissible storage times are reached or exceeded. Permissible storage times could be considerably reduced if the permissible storage conditions are not maintained. If you are not clear about the storage times and/or storage conditions then you should not use the product.

9 Assembly and bringing into first use

IMPORTANT

Only the permissible pressure fluids given in the Operating Instructions are to be used. Information on other pressure fluids can be found in the *Operating Instructions* or are available on request.

Filling the pressure fluid tank must always take place through a suitable filter unit. Experience has shown that even new pressure fluid can often have more than the maximum permissible level of contamination.

All information specific to assembly and bringing into first use can be found in the *Operating Instructions*.

Pay attention to cleanliness:

- ➢ Do not use cleaning wool or cloths containing fibres for cleaning.

  Depending on the condition of the system or machine, cleaning with fibre-free cloths may be sufficient. Use suitable liquid cleaning agents to remove lubricants and other stronger contaminants. Make sure that cleaning agent does not get into the hydraulic system.
- ➢ Never use hemp and putty as sealants.

The functional or failure behaviour of identical hydraulic products may vary due to conditions specific to the machine or system in which the hydraulic product is installed (mass, speed, electrical triggering at setpoint values, etc.), see also Section *11 Trouble-shooting*.

9.1 Safety advice for assembly and bringing into first use

⚠ DANGER

Hydraulic products are generally intended for installation in machines/systems or devices.

The function of the hydraulic product must therefore always be seen in relation to the function of this machine – i.e. seemingly identical hydraulic products may demonstrate different functional behaviours as a result of the function of the machine in which they are installed.

For this reason, a hydraulic drive must not be brought into use until it has been determined that the machine in which it is installed conforms to EU standards.

Do not bring hydraulic drives into use until you have familiarised yourself completely, firstly with the function of the hydraulic product and hydraulic equipment and secondly with the hydraulically powered machine functions, and have clarified and dealt with any possible dangers.

Bringing into (first) use shall only be done by an instructed, authorised hydraulics expert who has the required specialist knowledge.

Specialist hydraulics knowledge means, among other things, that the person can read and fully understand hydraulics drawings. In particular, he must fully comprehend the range of functions of the integrated safety components as part of the overall safety concept.

9.2 Before bringing into first use

1. Check the scope of delivery for transport damage.
2. Check that the Operating Instructions for the Rexroth hydraulic product are present and complete.
   Contact us if the Operating Instructions are not there or are incomplete.
3. Assemble the hydraulic product.
   - Observe the *Operating Instructions* and this product information.
   - Assemble the hydraulic components, so that they are mounted strain-free on even surfaces.
   - Tighten the fastening bolts evenly using the specified tightening torque.
4. Ensure that the interfaces of the system/machine and the installation conditions provide for safe operation of the hydraulic product. If in doubt, consult the people responsible for the overall system/functional machine.
5. Check the construction of the hydraulic product against the circuit diagrams, lists of equipment and assembly drawings. If there are any differences, draw this to the attention of the people responsible. If important documents are missing, they can be requested from Bosch Rexroth. Only documents issued by the bodies authorised to do so shall be used.
6. Based on the *Operating Instructions* for the system or machine in which the hydraulic product is installed, check whether bringing the hydraulic system into use could lead to uncontrolled, dangerous movements. Where appropriate, take into account the hazard analysis/risk assessment for the system or machine.
7. Take the precautions appropriate to the anticipated dangers, e.g.
   - Ensure that the cylinder piston rod can move out without danger.
   - Use a hoist or other lifting device to additionally secure lifted loads.

8. As part of bringing into (first) use, check whether the electric motors and valve solenoids can be switched manually using the electrical controls of the system/machine. If they cannot be switched manually – or can but with difficulty – you must provide a remote control (e.g. test boxes for Rexroth proportional valves) for the internal function test of the hydraulic system.

IMPORTANT

Starting up the hydraulics solely by means of emergency manual operation is not recommended, as several valves at once cannot be switched as required in the correct sequence.

9. Draw up a sequential program for bringing into (first) use and store it with the technical documentation as an appendix to the Operating Instructions.
   For this you should consider the following:
   Hydraulic drives basically consist of the following functional groups
   - Pump circuit (generation of pressurised oil flow); pump, electric motor, oil tank, filters, monitoring devices, etc.
   - Control system for at least one hydraulic consumer (cylinder, motor); directional control valves, pressure and flow control valves, check valves
   - Hydraulic consumers (cylinders, motors) with specially assigned valves, e.g. braking valve.
10. Divide the functional circuit diagram into separate mini-circuits that can each be started up in succession.
11. Read the functional circuit diagram and seek clarification of any unclear text or diagrams. More information about the functioning of components, e.g. a pump regulator, is available in the *Technical Datasheet*.
12. Establish into which position valves are to be switched, or how valves are to be set.
13. Put up any necessary directional, prohibitive or informative signs and check whether the meaning of these signs are explained in the *Operating Instructions*.
14. Follow this sequence for bringing into (first) use
   - Pump circuit
   - Parts of control system:
     e.g. pressure cut-off and switchover,
     open centre,
     pressure reduction etc.
   - Cylinder and motor circuits:
     First move,
     fill and bleed,
     then finally optimise all settings.

9.3 Bringing into first use, subsequent bringing into use

⚠ DANGER

Before bringing into (first) use, have all pressure accumulators and safety systems checked by an expert or specialist in accordance with national regulations.

1. Clean the lock on the transport and storage container before opening.
2. Clean the hydraulic unit and all other component groups, so that no dirt can get into the hydraulic system during bringing into (first) use.
3. Check the paint on the tank for integrity.
4. Flush the connection lines to remove dirt, scale, chips etc.
5. Pickle and flush welded pipes.

   ⚠ CAUTION

   Remove all residues of water and cleaning agents before performing further work.

6. Clean the interior of the hydraulic components to get rid of contaminants:
   - Clean the filler plug of the pressure fluid tank.
   - Remove dust and chips using an industrial vacuum cleaner, by rinsing parts or similar cleaning method.
   - Completely remove any oil residues left over from the factory test.
   - Remove any gummed oil which may have formed due to incorrect storage.
7. Connect up all connection lines.

   ## IMPORTANT

   Observe the installation instructions from the manufacturer of the connection components.

   ⚠ DANGER

   Make sure that pipes and hoses are connected at all ports or that the ports are sealed with screw plugs.

8. Carry out a special check to make sure that the union nuts and flanges are correctly tightened at the pipe connections and flanges.

1

IMPORTANT

Mark all the checked connections, e.g. with paint.

Make sure that all pipes and hoses and every combination of connection pieces, couplings or connection points with hoses or pipes are checked for their operational safety by someone who has the appropriate knowledge and experience.

9. Connect the hydraulic consumers. Dimension the connection lines in accordance with the performance data in the *Circuit Diagram* and the *Operating Instructions*.
10. Install the electrical system for the drive and control system:
    - Check the connected loads.
    - Connect coolant water if necessary.
    - Check the direction of rotation of the pumps (e.g. as indicated by attached arrow markings).
11. Check the pressure fluid to ensure that no water has entered it.
12. Before filling the pressure fluid tank, please observe the following requirements:
    - ➢ The pressure fluid must conform to the specification in the *Operating Instructions*.

    ⚠ CAUTION

    Never fill new hydraulic products with used pressure fluid.

    - ➢ The drums of pressure fluid must be sealed and clean on the outside.

IMPORTANT

If the pressure fluid has a high level of initial contamination (see *4 Technical data and ambient conditions*):

Use a filter unit to fill the pressure fluid tank. Ensure that the filter element is clean.

IMPORTANT

The fineness of the filter shall correspond to the cleanliness class required by the overall system and if possible be even finer.
The filter unit used shall fulfil the requirements for functional safety and service life.

- If possible, fill the pressure fluid tank via a filling coupling, using a return filter if possible.

⚠ CAUTION

Use oil filler units (filter units) suitable for pressure fluids.

- Do not remove the filter strainers from filler necks or the filter element from filters before filling the pressure fluid tank.

13. Fill the pressure fluid tank up to the upper mark on the inspection window. Observe the maximum fluid level, taking into consideration the volume in the connection lines and hydraulic consumers.
14. Set the pressure and flow control valves, pump regulator, signalling elements such as pressure switches, limit switches and temperature regulators to the settings and values defined in the sequential program (see *9.2 Before bringing into first use*).

⚠ DANGER

Do not change the settings of valves with a safety function, valves with a position switch or valves with preset electronics.

- Set operating-pressure valves and flow control valves to the lowest possible values.
- Set directional control valves to their basic setting.
- Reduce the setpoint values of proportional valves to minimum values.
- Do not remove the tamperproof lead seals. Damaged or removed tamperproof lead seals indicate improper use of the hydraulic product.

15. If applicable:
    Fill the pressure accumulator to the specified gas precharge pressure and then check the pressure, see *Operating Instructions*.
16. Fill the pump body:
    Use the leakage oil port to fill pump bodies that have this feature, see *Operating Instructions*.
17. If applicable:
    Open the cocks in the suction line.
18. Start the drive motors:
    - With electric motor in jogging mode, allow to start briefly
    - Combustion engines in idle
    - Pay attention to the direction of rotation.

19. Bleed the hydraulics (valve, pump, motor, line, cylinder).

    IMPORTANT

    Details on bleeding can be found in the *Operating Instructions*.

    - Operate the hydraulic product at low pressure until it is fully bled.
    - Bleed the hydraulics lines to consumers or measuring points at the highest point, if possible.
    - Operate the directional valves in jogging mode.
    - Next, advance and retract all hydraulic consumers several times.
    - Increase the load slowly. Check the pressure fluid level in the pressure fluid tank. If necessary, top it up with pressure fluid.

Bleeding has been accomplished fully and correctly if the pressure fluid in the tank does not foam, if the hydraulic consumers do not make any jerky movements and if no abnormal noises can be heard.

20. Set the valves and sensors and start up the machine:

    - Set the switching operations of valves with a switching time adjustment/ramp in accordance with the dynamic conditions, see *Operating Instructions*.
    - Finely adjust and optimise the setting of proportional valves without on-board electronics (OBE).

Manufacturing tolerances mean that valves and amplifiers have to be adjusted in line with one another. Valves with in-built electronics (OBE, On Board Electronics) have the valve and amplifiers adjusted in line with one another at the factory.

Amplifiers for valves without OBE are supplied from the factory with a basic setting. Depending on the type of valve and amplifier, you may have to fine-tune the null point and sensitivity before bringing the valve into use.

IMPORTANT

Details on fine-tuning can be found in the *Operating Instructions*.

21. Check the operating temperature after the machine has been running continuously for several hours. Too high an operating temperature indicates that there are faults that need to be analysed and rectified.

22. Rectify any leakages, e.g. by relieving couplings from pressure and then retightening.

IMPORTANT

Apart from moisture, which should not be sufficient to form one drop, no measurable, unintentional leakage shall be found.

23. After bringing the machine into first use, have a sample of the pressure fluid analysed to ensure that it achieves the required cleanliness class. Change the pressure fluid if the required cleanliness class is not achieved.
    If the pressure fluid is not tested in the laboratory after bringing the machine into first use:
    Change the pressure fluid.

24. Replace the pressure fluid filter.

25. Document and file all set values.

⚠ DANGER

26. To ensure the safety of persons and the system, after bringing the machine into first use, perform the following tests using the defined maximum values:

    - Function test
    - Pressure test.

    Prepare a record of the bringing into (first) use or acceptance and have it signed by the plant operator. This record is an important document and requires to be filed.

    IMPORTANT

    Information on how to perform the function test and pressure test can be found in the *Operating Instructions*.

1

10 Operation

IMPORTANT

Please refer to the *Operating Instructions* for all information on how to operate the Rexroth hydraulic product.

11 Trouble-shooting

11.1 What to do in the event of a fault

DANGER

In the event of abnormal occurrences or malfunctions, stop all work on the Rexroth hydraulic product immediately and inform the responsible personnel.

IMPORTANT

A table for product-specific trouble-shooting can be found in the *Operating Instructions*.

If the responsible personnel are unable to rectify the problem immediately:

- Switch off the main switch. If applicable, turn off any combustion engines used as drive motors.
- Secure the main switch against being unintentionally switched on again.
- Inform the machine manufacturer.

11.2 The basic approach to trouble-shooting

The information in this section is intended to help you create the ideal conditions for carrying out trouble-shooting as efficiently as possible.

11.2.1 General conditions

➢ Is all the necessary technical documentation to hand?

➢ If no hydraulic circuit diagram is available:
Can a hydraulic circuit diagram be drawn using the structure, signs and labelling of the equipment?

➢ Are there enough measuring points?

➢ Has the customer provided useful information about how the malfunction manifests itself and about the functional behaviour of the system/component prior to the malfunction?

➢ Is there a machine record book that may document similar malfunctions in the past?

11.2.2 Recommended way of working when trouble-shooting

Successful trouble-shooting for a hydraulic product requires precise knowledge about the structure and method of operation of the individual components.
Where hydraulics are combined with electrics/electronics, in particular, trouble-shooting is rendered more difficult and co-operation between electricians and hydraulic specialists is required.

- Even if you are under time pressure, proceed systematically and methodically.
  Indiscriminate, hasty dismantling and readjustments may, in the worst case, result in the original cause of failure being impossible to determine.
- Make sure that you gain an overview of the function of the hydraulics in respect of the overall system in which the hydraulics are installed.
- Try to find out whether the hydraulics performed the required function in the overall system prior to the occurrence of the fault.
- Try to determine any modifications to the overall system in which the hydraulics are installed:
  ➢ Have the operating conditions or operating range of the hydraulics been changed?
  ➢ Have modifications (e.g. retrofitted equipment) or repairs been carried out on the overall system (machine/system, electrics, control system) or on the hydraulics? If yes: What were they?
  ➢ Have the set values of the hydraulics been changed?
  ➢ Have the hydraulics recently undergone maintenance?
  ➢ Has the hydraulic product/machine been operated improperly?
  ➢ How does the malfunction manifest itself?
- Form a clear picture of the cause of the fault. Ask the machine operators directly, if necessary.
- Document any work undertaken, changed set values, etc.
- Document any amendments/additional information that should be included in the *Operating Instructions*.

11.2.3 Systematic trouble-shooting procedure

- Is there an inspection and maintenance book which might provide information about the trend of test parameters (e.g. temperature of hydraulic fluid, replacement intervals of filter elements, noises)?
- Have there been any identical or similar failures in the past?
    - Make a note of causes of failures with a low probability. Only investigate the failure causes you have noted down if all failure causes with a high probability have been proven to be inapplicable.
    - Draw up a list of priorities of the most probable failure causes.
    - Verify these listed failure causes one after the other (by means of theoretical conclusions, disassembly, measurements or tests).
    - Document the causes of failure you have discovered, and note down how you discovered them.

11.3 Trouble-shooting tables

IMPORTANT

The causes of failure in hydraulic systems can be extremely complex. Therefore, general rules for trouble-shooting can only be laid down to a limited degree.

Please refer to the relevant *Operating Instructions* for product specific information about trouble-shooting the Rexroth hydraulic product.

12 Maintenance

12.1 Definitions of terms

The term **Maintenance** as defined in DIN 31051 encompasses all measures to maintain and restore the desired conditions and to determine and assess the actual condition of the technical devices of a system .

These measures are divided into the following categories:

- Inspection (determining the actual condition)
- Servicing (maintaining the desired condition)
- Repair (restoring the desired condition).

The above measures include:

- Adapting maintenance objectives to suit company objectives
- Determining appropriate maintenance strategies.

12.2 Safety during maintenance tasks

⚠ DANGER

In the interests of safety, please observe all the following safety instructions carefully and at all times.

- Check safety devices regularly to see that they are working properly.
- Perform all maintenance work properly, completely and within the stipulated periods and make a record of the work.
- Inform all personnel before commencing maintenance work.
- Generously cordon off the maintenance zone before commencing work.
- Inform all persons of ongoing maintenance work by means of the appropriate signs.
  In particular, attach warning signs to the control cabinet, main switch, actuators and points of access.

If you have to switch off the hydraulic product, secure it against being unintentionally switched on again as follows:

- Switch off all drives, disconnect the hydraulics from the mains at the main switch.
- Depressurise the hydraulic product (relieve any pressure accumulators of pressure).
- Secure the main switch against being unintentionally switched on again.

Before undertaking any manual intervention in the Rexroth hydraulic product:

⚠ DANGER

Please refer to the *Operating Instructions* for all the necessary information on depressurisation and on those parts of the Rexroth hydraulic product that are not depressurised automatically.

- **Advance all cylinders to their safe end position.**
- **Lower all loads.**
- **Switch off all pumps.**
- **Mechanically support vertical cylinders so that they cannot drop. Never perform any maintenance work on raised units without external support.**
- **Relieve any accumulators of pressure in the proper manner.**
- **Switch off the pressure supply and secure the hydraulic product against being inadvertently switched on again.**
- **Ensure that only authorised personnel remain in the work zone.**
- **Wear safety glasses, gloves and boots.**
- **Allow pressure lines and sections of the system which have to be opened to cool down before commencing maintenance work.**
- **Open with care any segments that have to remain under pressure.**

Since check valves are located in the pressure lines above the pumps, the hydraulic system may still be under pressure even after it has been disconnected from the actual pressure supply.

Certain segments, such as servo cylinders, also continue to remain under pressure because the proportional valves remain in the closed position (all valves are illustrated in their basic position in the hydraulics diagram).

Observe the following:

- Only new, interchangeable and tested components, replacement parts and lubricants in original-equipment quality are approved for use/replacement.
- For reasons of safety, the installation of used and/or untested components is strictly prohibited and leads to loss of EU Conformity.

Exercise extreme vigilance when operating the hydraulic product in maintenance mode, which may in certain circumstances necessitate the temporary removal of certain safety devices.

Make sure that all safety devices are properly installed and have undergone a function test before bringing the system (back) into use.

- Perform welding, burning or grinding work on the hydraulic unit or its attachments only with the approval of local safety authorities/fire brigade and with suitable protective covering to prevent ingress of contaminants.
- When performing assembly work above your height, use the steps and platforms provided by the plant operator. Do not climb on any parts of the system.
- Remove all tools and materials needed for maintenance from the hydraulic product.
- Always rectify any leakage from the hydraulic product immediately.
- Always inform personnel before (re)starting the hydraulic product.

12.3 Inspection and servicing

The objective of inspection and servicing is

- To maintain all system functions along with the initial parameters of the system
- To ensure continual availability of the system
- To detect weak points
- To ensure that the system attains the required service life.

IMPORTANT

The following general specifications are based on use of the hydraulic product in central Europe and under the usual operating conditions of commercial and industrial plants.

We strongly recommend the use of an inspection and servicing book, in which all work specific to that site, and all inspection and servicing intervals should be defined and documented.

An inspection and servicing book is also helpful in that

- It provides comparison values to aid with early detection of malfunctions
- It allows warranty claims to be dealt with more easily.

⚠ CAUTION

Ensure cleanliness during all work.

- Please observe the requirements for pressure fluids mentioned in Section *9 Assembly and bringing into first use*.
- Clean the external environment of couplings/joints and devices before disassembly. Do not use cleaning wool or cloths containing fibres for cleaning.
- Seal all openings using protective caps.
- Bleed the hydraulic product after each item of servicing work.
- Document and file details of any work undertaken, changed set values, etc.
- Document and file details of any amendments/additional information that should be included in the Operating Instructions.
- Modifications and additions could affect the validity of the EU Conformity Declaration/Manufacturer's Declaration. Always consult Bosch Rexroth about any proposed modifications or additions.

12.3.1 Inspection procedures and test equipment, general

The following are some of the typical inspection and testing procedures that are regularly used in connection with hydraulic systems and components.

IMPORTANT

Keep the indicated typical test equipment ready for this type of work.

Type of test	Typical test equipment	Typical testing activities
Pressure measurement	Pressure gauge or sensor with suitable measuring range and connection pipe and connection coupling	Checking of • specified pressure • opening pressure • pressure difference before and after the object under test
Visual inspection	–	Checks for • all components securely seated • damage • wear • leakage (formation of oil droplets) • presence of all warning and informative signs
Touch inspection	–	Checks for • unusual local vibrations
Temperature inspection	Temperature measuring instrument	Checks for • unusual local temperature zones
Acoustic inspection	–	Checks for • changes in running noise of the unit • changes in flow noise • changes in operating noise in the unit and valve control.

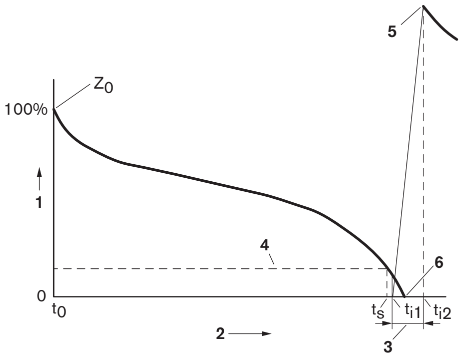
12.3.2 Location of testing and measuring points

IMPORTANT

Please refer to the *Operating Instructions* for the installation location of filling level indicators, filling points, drainage points, filters, testing points, strainers, solenoids, etc. that require regular inspection and servicing.

12.3.3 Inspection and servicing plan, hydraulic products, general

The graph illustrates the concept of wear/wear margin.
The wear margin is a characteristic feature used to describe the condition of the system for the purpose of maintenance.



1 Wear margin Z_0
2 Time t
3 Repair (corrective maintenance) time ($t_{i2} - t_{i1}$)
4 Damage threshold (damage time t_S)
5 Desired condition after corrective maintenance
6 Failure

The reduction in the wear margin reflects wear. The curve represents one possible form of the wear profile during the period of use. It is determined during inspection and varies depending, firstly, on the system itself (e.g. material selection, surface treatment, quality) and secondly on external influences or boundary conditions such as servicing levels, corrosive circulating air and dust. Thirdly, it depends on how the system is operated; whether with partial load or partially with excess load, whether it is subject to surge loads or steady load, etc. Where hydraulic systems are concerned, the curve is also influenced by the cleanliness class and degree of fouling of the pressure fluid, the number of cycles and the ambient conditions.

All the factors mentioned above can exert an influence on the curve but this need not necessarily adversely affect the quality of its information, as wear always signifies the reduction in the wear margin, which is understood to be the primary initial variable before wear commences.

Consequently, this means that a sudden change in the wear margin must also count as wear, and that the element of time on its own is not of decisive importance for wear, but is of considerable interest in the assessment and evaluation of such wear.

An increase in the wear margin to over 100 % above its baseline may be achieved through corrective maintenance, if such measures entail an improvement and this increase is established as the new desired condition for future corrective maintenance.

Certain system parts may be subject to a wear margin which diminishes in such a way that the time available for use is insufficient for the requirements of the plant or operation. In this case, investigations must be carried out to ascertain whether the introduction of suitable technical measures might counter this reduction in the wear margin to a satisfactory extent. The time and expenditure required for such measures must naturally be kept in reasonable proportion to the expected degree of success.

If such conditions arise, we refer to these parts as weak points. Since their elimination may provide economic and safety advantages, weak points require to be rectified immediately.

IMPORTANT

The inspection and servicing plan for your particular product can be found in the *Operating Instructions*.

12.3.4 Inspection and servicing plan, electrohydraulic systems

Electrohydraulic systems with proportional valves must be serviced in accordance with hydraulic requirements and strategies. However, technical control components must also be incorporated in these servicing cycles.

On this basis, an overall strategy for system servicing must be developed and documented.

IMPORTANT

The appropriate component characteristics relevant to servicing can be found in the *Operating Instructions*.

12.3.5 Inspection and servicing plan: electrics and control system

IMPORTANT

The product-specific inspection and servicing plan for electrics and control systems can be found in the *Operating Instructions*.

12.3.6 Lubrication points, lubricants, intervals

IMPORTANT

The details of the specified lubricants, lubrication points and associated lubrication cycles can be found in the *Operating Instructions*.

12.3.7 Set values of valves, regulators and signalling elements

Pressure and flow control valves, pump regulators and signalling elements such as pressure sensors, pressure switches, limit switches and temperature regulators are given their optimum setting when the system is brought into first use.

Check regularly whether all values are correctly set with the aid of the hydraulics diagram and the documented values.

⚠ DANGER

The set values of valves with position switches shall only be calibrated or readjusted at the factory.
The set values of safety valves shall not be altered by the user. Any readjustment shall be performed by authorised testing bodies only.

Too low a pressure difference between the operating pressure and the opening pressure can lead to frequent opening of safety valves. This leads to increased power losses and an unacceptable increase in temperature of the pressure fluid. In this event, select a lower operating pressure.

1

12.3.8 Replacement of pressure fluid filters and ventilation filters

⚠ CAUTION

Unfiltered pressure fluid filters lead to increased wear of all the system's hydraulic products and can cause functional failures with dangerous effects. Therefore, always replace contaminated oil filters immediately.

Clogged ventilation filters result in inadequate cooling and can therefore cause excessive heating up and malfunctions of the hydraulic system. Therefore, always replace contaminated ventilation filters immediately.

- Clogged filters must always be replaced immediately. Do not clean clogged filters.
- Allow the contents of the replaced oil filter to drip and fully drain.
- Dispose of the filter in accordance with the applicable regulations.

Exact instructions on how to replace a filter can be found in the *Filter manufacturer's instructions for use.*

12.3.9 Checking filters with a contamination indicator

Filters with contamination indicators continuously measure the degree of fouling. The dirt-retention capacity of the filter is utilized to the full.

IMPORTANT

Check the contamination indicator when the pressure fluid is warm (during or immediately after operation).

If the ambient temperature is low or the pressure fluid is cold, its high viscosity may cause clogging to be indicated, although the pressure fluid is in fact clean.

Procedure:

1. Wait until the hydraulic product has reached operating temperature.
2. Press the indicator button (check function):
   If the indicator button pops out again immediately, the filter must be replaced by the end of the shift at the latest.

Due to the progressive loss in pressure as the filter becomes increasingly contaminated, the indicator point has a certain reserve capacity, i.e. generally sufficient for a work shift of 8 h.

If the filter is not replaced after 8 h, dirt may penetrate the system, resulting in contamination of the hydraulic product.

⚠ CAUTION

In certain circumstances the contamination indicator does not show a required filter replacement.

If the check function never indicates filter replacement and the contamination indicator is functioning correctly, this may have the following causes:

- ➢ Faulty filter
- ➢ A bypass valve may have been installed and is not closing correctly, e.g. due to the entry of dirt particles.

12.4 Service and storage lives of hose lines

IMPORTANT

In terms of the service life of hydraulic hose lines in these Operating Instructions, replacement and storage lives are measured from the date of manufacture of the hose line.

Even when properly stored and subjected to permissible loads, seals, hoses and hose lines undergo a natural ageing process.

The replacement and storage lives of seals, hoses and hose lines are therefore limited (see *8.2 Seals, hoses and hose lines*).

⚠ DANGER

Hose lines must be replaced in accordance with the provisions of the servicing plan, even if there are no detectable technical defects in the hose line.

Hoses that have already been used as part of a hose line shall not be reused in a hose line.

The first use may have changed the properties of the hose material to such an extent that reuse of the hose represents a very high risk.

12.5 Topping up the pressure fluid

IMPORTANT

Only pressure fluids specified in the *Operating Instructions* are to be used.

When changing or topping up the pressure fluid, fill the pressure fluid tank on the hydraulic product as follows:

1. Fill the pressure fluid tank using a special filling unit with an integral filter (min. 10 µm).
2. Drop the system pressure right down by resetting the pump. Set the pressure setting value on the pump pressure control to minimum or zero pressure.
3. Fill and bleed the line system of the hydraulic product from the unit to the cylinder. To do this actuate the cylinder in both directions, see *Operating Instructions*.
4. Top up the pressure fluid volume to the specified quantity.
5. Raise the pump pressure to the system pressure.

The hydraulic product is ready for operation.

6. Carry out a test run.
7. Check the level of the fluid after the hydraulic product has warmed up to the operating temperature and adjust if necessary.

IMPORTANT

Check the contamination indicator when the pressure fluid is warm (during or immediately after operation).

If the ambient temperature is low or the pressure fluid is cold, its high viscosity may cause clogging to be apparently indicated.

12.6 Servicing pressure accumulators

⚠ DANGER

Pressure accumulators are subject to the national legislation on safety requirements for pressure vessels applicable in the place of installation.

Observe the Pressure Equipment Directive 97/23/EC.

IMPORTANT

The gas precharge pressure is measured with a testing and filling device.

Details of the procedure can be found in the *Operating Instructions*.

Inspection and servicing

- Carry out the tests required by law.
- Test and monitor the gas precharge pressure regularly.

12.7 Repair

IMPORTANT

Repair (corrective maintenance) is the restoring of the desired condition.

In addition, observe the special safety instructions in *12 Maintenance* and the safety instructions in the *Operating Instructions*.

⚠ DANGER

Ensure cleanliness during all work.

- Clean the external environment of couplings/joints and devices before disassembly. Do not use cleaning wool or cloths containing fibres for cleaning.
- Seal all openings using protective caps.
- Bleed the hydraulic product after each item of repair work.
- If appropriate, follow the procedure for bringing into first use, see *9.3 Bringing into first use, subsequent bringing into use.*
- Document any amendments/additional information that should be included in the Operating Instructions.

1

12.7.1 General safety instructions for repair work

⚠ DANGER

Repair work shall only be done by an authorised hydraulics expert who has the required specialist hydraulics knowledge.

Specialist hydraulics knowledge means, among other things, that the person can read and fully understand hydraulics drawings. In particular, he must fully comprehend the range of functions of the integrated safety components.

Components may only be dismantled for the purpose of repair to the extent described in the *Operating Instructions*.

Never repair a defective safety valve. It must be completely replaced.

Faulty parts may only be replaced by new, interchangeable, tested components in original-equipment quality. Any deviations from this can be found in the *Operating Instructions*.

Before each subsequent bringing into use after repair work, the hydraulic product shall be accepted by a hydraulics expert.

The operator of the hydraulic product is required to check by means of a servicing record that the inspection and servicing plan as been complied with.

Pressure vessels have to be pressure tested every 10 years and the information recorded in accordance with the Pressure Equipment Directive 97/23/EC or its implementation in national legislation.

13 General information about hydraulic pressure accumulators

13.1 General

The regulations applicable at the place of installation concerning hydraulic pressure accumulators (hydrostatic accumulators) must be observed before bringing into use and during operation.

The plant operator bears sole responsibility for compliance with the existing regulations.

Hydrostatic accumulators are subject to the national implementation of the EU Pressure Equipment Directive 97/23/EC.

Documents supplied with accumulators must be preserved with care; they will be required during recurring inspections by specialists.

The bringing into use of hydrostatic accumulators shall be carried out by trained expert personnel only.

⚠ WARNING

Do not perform any welding, soldering or mechanical work on accumulator vessels.

Welding and soldering carry a risk of explosion!

Mechanical tampering may cause the vessel to burst and the operating permit will be withdrawn.

Do not charge hydrostatic accumulators with oxygen or air. Risk of explosion!

Depressurise the system before working on hydraulic installations.

Improper installation can lead to serious damage to persons and property.

13.2 Safety devices relating to hydraulic pressure accumulators

The equipping, installation and operation of hydrostatic accumulators is regulated by the national implementation of the EU Pressure Equipment Directive 97/23/EC and additionally in the Federal Republic of Germany by the *Technical Regulations for Pressure Vessels (TRB)*. This legislation requires the following safety equipment:

- Device to protect against excessive pressure (prototype-tested)
- Pressure relief device
- Pressure measuring device
- Test gauge connection
- Shut-off device
- Optional: electromagnetically operated pressure relief device
- Safety device to protect against overheating.

IMPORTANT

See the *Operating Instructions*.

14 Hydraulic systems

Hydraulic systems are generally intended for installation in machines or systems. In addition to the basic information about the installed components, the information contained in the Operating Instructions made available for each hydraulic system by Bosch Rexroth also applies to hydraulic systems.

By installing the hydraulic system in a machine or system, the interaction of the hydraulic system with the overall machine may give rise to changes in the potential dangers. In particular the effect of hydraulic and electrical control of hydraulic drives that create mechanical movement are to be considered.

This information shall be included in the hazard analysis/risk assessment of the overall machine carried out by its supplier and in the *Operating Instructions of the overall machine*. This also applies to the specification of the interfaces between the hydraulic system and the overall machine.

Hydraulic systems are subject to legislation including the Pressure Equipment Directive and other relevant EU directives that have been implemented in national legislation. Exact information can be found in the EU Conformity Declaration or Manufacturer's Declaration that is supplied with the hydraulic system or the hydraulic product.

⚠ WARNING

Before installing a hydraulic system in a machine or modifying an existing hydraulic system in a machine, satisfy yourself that

- the hydraulic system is suitable for its application in the machine
- the ambient conditions in the machine are suitable and/or permissible for the use of the hydraulic system
- other installed items on or in the machine cannot disturb or endanger the functioning or the safe operation of the hydraulic system.

If the overall machine is to be used in a potentially explosive atmosphere, then it must be ensured that the hydraulic system has been designed and is suitable for this use.

14.1 Effects of leaks in the hydraulic system on the machine

If pressure fluid escapes from the hydraulic system and comes into contact with hot surfaces on the machine, this can lead to the generation of life-threatening smoke, fire and/or other dangerous operating conditions.

These risks shall be determined by the machine manufacturer by means of a hazard analysis and if necessary provision made for the appropriate safety devices.

DE	Bestellinformation für deutsche Produktinformation:	RD 07008
EN	Ordering Information for Product Information in English:	RE 07008
FR	Information de commande pour la notice française Informations générales sur les produits :	RF 07008
IT	Informazioni d'ordine per le informazioni tedesche sul prodotto:	RI 07008
ES	Información para el pedido de la información del producto en español:	RS 07008
FI	Tilaustiedot - suomenkieliset tuotetiedot:	RSF 07008
NL	Bestelinformatie voor Nederlandse productinformatie:	RNL 07008
SV	Beställningsnummer för svensk produktinformation:	RSK 07008
PT	Informação dos dados de encomenda para informação de produto alemã:	RP 07008
DA	Bestillingsinformationer vedr. dansk produktinformation:	RDK 07008
EL	Πληροφορίερ παραγγελίαρ για τιρ γερμανικέρ πληροφορίερ προϊόντορ:	RGR 07008

http://www.boschrexroth.com/bri-products
→ Datenblatt-Suche/Datasheet search
→ Suche nach Datenblatt/Search by datasheet

07008

Bosch Rexroth AG
Hydraulics
Zum Eisengiesser 1
97816 Lohr am Main, Germany
Tel. +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

Installation, Commissioning and Maintenance of Servo and High-response Control Valves

RE 07700/08.06
Replaces: 12.02

1. **General**

   Before commissioning servo valves, the guidelines stated within the following data sheets have to be taken into account:

   – Relevant catalogue sheet

   – The German standard DIN 24346

   – ISO standard ISO 4413

   Note:

   Each servo valve is subjected to functional tests prior to delivery. This functional test is documented in test reports, which can be ordered when a valve is purchased.

   Commissioning must be carried out by specialist personnel using the relevant calibration equipment.

   Depending on the size and the requirements of an installation, the customer‘s operating personnel may carry out the commissioning (provided that they have a sufficient experience with hydraulics or have completed a corresponding training course).

2. **Flushing of the system**

   The system must be flushed without the servo valves being fitted. Instead of the servo valves use either flushing plates or, if the system allows, directional valves of the same size (Spool symbol G or H), thus, allowing also the service lines and the actuator to be flushed. With an external pilot oil supply make sure that this line is also flushed.

In order to obtain the required minimum cleanliness the hydraulic system must be flushed for a sufficiently long time.

The oil volume in the system should be flushed through the filter at least 150 to 300 times. As a rough guide, the flushing time may be calculated as follows:

$$t = \frac{V}{q_V} \text{ x } 2{,}5 \text{ to } 5$$

With:

t = flushing time in hours

V = tank capacity in litres

q_V = pump flow in l/min

A decisive factor for the flushing time is the degree of contamination of the hydraulic fluid according to paragraph 6.2., which can only be determined by continuous monitoring by means of a particle counter.

When changing over to special fluids, which are **not** compatible or cannot be mixed with the hydraulic fluids used so far, the required flushing time may be considerably longer.

During the flushing procedure, check all the filters at short intervals and, if required, replace the filter elements.

3. Rules for correct installation

3.1 Cleanliness

– When installing or removing valves, take care that the immediate area is clean.

– The tank must be fitted with a filler breather to prevent external contamination from entering the tank and to permit the fluid level to vary according to system requirements. For servo systems a pore size of 5 µm is recommended.

– Piping and reservoir must be cleaned of dirt, scale, swarf, etc. before being installed into the system.

– Hot-bent or welded pipes must then be pickled, flushed and oiled.

– Use only lint-free cloth or special paper for cleaning.

3.2 Valve assembly

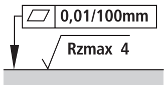
When assembling the valve care is to be taken, to ensure that the valve and subplate mounting surfaces are dry and free of oil. If it is not possible to carry out the assembly without oil being present then the fixing screws must be tightened manually, not with the aid of power tools. If there are more than four fixing screws then care should be taken to ensure that the centre screws are tightened first.

By adhering to these procedures it is ensured that the seal rings correctly seal against the valve connection surface.

3.3 Sealing materials such as hemp, putty or sealing tape are not permissible.

3.4 Hoses, especially for the connection to the actuator, should be avoided wherever possible.

3.5 The connecting lines to the actuator should be kept as short as possible. We recommend that the servo valve is mounted directly onto the actuator. The required finish of the mounting face is as follows:



3.6 Pipes should be seamless precision pipes to DIN 2391/C in order to ensure the required pressure resistance.

3.7 Before installing the valve, compare the nameplate of the valve with the ordering data.

3.8 Install the servo valves after completion of the flushing procedure and observe strictest cleanliness.

Remove the protective cover from the servo valve only immediately prior to the installation of the valve and keep it safe for possible maintenance work (paragraph 7.3) in the future.

3.9 Tighten the fixing screws to the torque specified in the data sheet.

3.10 All hydraulic functions must first be tested at low pressures under controlled conditions.

To facilitate commissioning and trouble-shooting, battery or mains powered control units are available for the servo valves.

4. Installation position

A horizontal position is preferred, but the possible spool position in relation to the type of feedback being used must be taken into account.

If the servo valve is mounted directly onto an actuator, a position in which the valve spool is in parallel to the actuator‘s direction of acceleration should be avoided.

5. Electrical connection

For the electrical connection, please refer to the relevant data sheet. The servo valve can be operated in parallel or series circuits. For reasons of operational safety and to reduce the coil inductivity we recommend that a parallel circuit is used.

Special types of electrical insulation require special measures to be taken to ensure the safe operation of the system.

6. Commissioning

6.1 Hydraulic fluid

The preferred fluid is mineral oil to DIN 51524. Other hydraulic fluids on enquiry. In order to protect the hydraulic fluid the manufacturer‘s recommendations concerning maximum temperatures should be observed. In order to obtain constant response characteristics from the system, it is recommended that the fluid temperature should be held constant (± 5 °C).

6.2 Filtration

– Install a filter with high pressure differential without by-pass, if possible with a clogging indicator, immediately before the servo valve (possibly a sandwich plate filter).

– Permissible maximum degree of contamination of the hydraulic fluid for internally pilot operated valves:
class 18/16/13 - cleanliness class to ISO 4406 (c).

– For externally pilot operated valves, the permissible maximum degree of contamination in the “X”-line is: class 18/16/13 - cleanliness class to ISO 4406 (c);
in the “P”-line: class 20/18/15 - cleanliness class to ISO 4406 (c).

– When changing the filter observe absolute cleanliness:

• Contamination on the inlet side reduces the service life of the filter elements.

• Contamination on the outlet side of the filter will be flushed into the system and eventually cause the system to completely break down.

6.3 As part of the final inspection in the factory, the hydraulic zero point of every valve is adjusted. However, in order to obtain an optimum control quality for the specific application, it may be necessary to re-adjust the hydraulic zero point either on the valve or in the closed loop control electronics.

7. Maintenance

7.1 f the tank volume is topped up by more than 10 % or if an oil change is carried out, the system must again be flushed according to paragraph 2.

7.2 Contamination in the flapper jet system is caused by insufficient system filtration of the hydraulic fluid.

Without special knowledge of servo valves, servicing is limited to changing the protective filter inside the valve and to re-adjusting the valve zero point.

7.3 Return of valves for repair

When returning a defective servo valve, it is necessary to fix a clean protective plate (see paragraph 3.7) to the base of the valve. Careful packaging is advisable in order to prevent any damage during transportation.

7.4 Storage

When storing servo valves for periods longer than 6 months, they should be filled with a clean preservative oil.

Storage rooms must meet the following requirements: dry, dust-free, low humidity, free of corrosive materials and vapours, and no wide temperature fluctuations.

Notes

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

Installation, commissioning and maintenance of proportional valves

RE 07800/07.05
Replaces: 12.02

1. **General**

Before commissioning proportional valves, observe the notes in the following data sheets:

– Associated data sheet

– German standard DIN 24346

– ISO standard ISO 4413

2. **System flushing**

With external pilot oil supply, it must be ensured that this port is also flushed.

The hydraulic fluid volume contained in the system should be flushed at least 150 to 300 times through the filter. This results in the following flushing time guideline:

$$t \approx \frac{V}{q_V} \text{ x } 2.5 \text{ to } 5$$

Where:

t = flushing time in hours

V = tank capacity in litres

q_V = pump flow in l/min

The decisive factor for the flushing time is the degree of contamination of the hydraulic fluid according to section 4.3. The hydraulic system must be flushed until the required minimum cleanliness is achieved. This is only possible with permanent monitoring with the help of a particle counter.

When changing over to special fluids, which are not compatible or miscible with the hydraulic fluid used so far, considerably longer flushing times may be required.

During flushing, check all filters at short intervals and change the filter elements as required.

Continued on page 2

3. Installation

3.1 Rules for the installation

Before installing the valve in the system, compare the type designation of the valve with the ordering data.

– Cleanliness:
  - Ensure cleanliness of both, the surroundings and the proportional valve when installing the component
  - The tank must be sealed against external contamination
  - Clean pipes and tanks from dirt, scale, sand, chips, etc. before installing the valve
  - Hot-bent or welded pipes must be pickled, flushed and oiled
  - Use only lint-free cloth or special paper for cleaning
– Sealing materials such as hemp, putty or sealing tape are not permitted.
– In the interest of obtaining high stiffness, hoses between valves and the actuators should be avoided.
– Use seamless precision steel pipes to DIN 2391/ parts 1 and 2 for the pipework.
– The connecting pipes between the actuator and the valve should be as short as possible; we recommend the installation of the hydraulic valve as close as possible to the actuator. The mounting face must feature a surface quality of $R_{t\,max} \leq 4$ µm and a flatness of ≤ 0.01 mm/100 mm length.
– Fixing screws must be of the dimensions and strength class specified in the data sheet and be tightened to the prescribed tightening torque.
– As a filler/breather filter we recommend a filter with the same mesh width as the filters used in the hydraulic system!

3.2. Valve mounting

When mounting the valve, take care that the base of the valve and the subplates are dry and free from oil. If mounting without the presence of oil is impossible, the fixing screws must generally be tightened manually and not with the aid of power tools. In the case of more than 4 fixing screws, care should be taken to tighten the central screws first.

This ensures that the seal rings seal correctly on the valve mounting face.

3.3. Installation orientation

Preferably horizontal; however, if the proportional valve is to be mounted onto an actuator, see to it that the valve spool is not arranged in parallel to the direction of acceleration of the actuator.

3.4. Electrical connection

For the electrical connection, please refer to the relevant data sheet.

Special types of protection require special measures that are described in the relevant data sheet.

4. Commissioning

4.1. Hydraulic fluid

Observe the recommendations given in the data sheet!

Observe pressure and temperature ranges!

In general, the following fluids can be used:

– Mineral oil to DIN 51524 (HL; HLP) [1)]

Fast bio-degradable hydraulic fluids to VDMA 24568 (see also RE 90221)

– HETG (rape seed oils) [1)]
– HEPG (polyglycols) [2)]
– HEES (synthetic esters) [2)]

Other hydraulic fluids on enquiry!

[1)] Suitable for NBR and FKM seals

[2)] Suitable only for FKM seals

Whenever possible, the maximum temperatures recommended by the manufacturer should not be exceeded in order to the spare the hydraulic fluid. To ensure stable response characteristics of the system, it is recommended that the hydraulic fluid temperature be kept constant (± 5 °C).

4.2. Are the seal materials used compatible?

For hydraulic fluids (e.g. HEPG and HEES) and in the case of temperatures > 80 °C FKM seals **must** be used (identified with “V” in the type code).

4.3. Filtration

– Reliable supply filtration (10 µm absolute) prolongs the service life of the pilot control.

Please take also note of the recommendations for the max. permissible degree of contamination of the hydraulic fluid to ISO 4406 (c) in our data sheet.

– The permissible maximum differential pressure across the filter element must not be exceeded.
– We recommend filters with clogging indicators.
– Observe strictest cleanliness when changing filters.

Contamination on the outlet side of the filters is flushed into the system and cause malfunction.

Contamination on the inlet side reduces the service life of the filter element.

4.4. Operating pressure for the pilot valve

– For pilot operated proportional directional valve type WRZ:

The pilot pressure must not be less than 30 bar. If the pilot pressure exceeds 100 bar, a sandwich plate pressure reducing valve must be installed in the supply line. Pressure surges from the tank line can be avoided with the help of a check valve.

– For other pilot operated proportional directional valves:

The pilot pressure for other proportional directional valves can be found in our data sheet.

4.5 Solenoid bleeding

To ensure proper functioning, the valve must be bled at the highest point during commissioning. Depending on the installation situation, draining of the tank line must be prevented by installing a preload valve.

5. Maintenance

5.1 . Return of the valve for repair purposes

When returning a defective valve, the base of the valve must be protected against contamination.

Careful packaging is recommended to prevent any further damage in transit.

6. Storage

Requirements for the storage room:

– Dry, dust-free room, free from etching agents and vapours

For storage periods longer than 3 months:

– Fill the housing with preservative oil and close the valve

Notes

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

Installation, commissioning and maintenance of hydraulic systems

RE 07900/10.06
Replaces: 08.06

1. General

1.1 Long service life and functional reliability of hydraulic systems and their components depend on correct handling.

Ensure trouble-free operation by observing the following points:

– The specific installation and operating instructions for the relevant components

– Special instructions in individual cases

– Technical data in the data sheet.

In addition, we would like to draw your attention to the following regulations:

– German standard “Hydraulic systems“ DIN 24346

– ISO standard ISO 4413

2. Installation

2.1 Preparatory work for the installation

– Sauberkeit der Anlage gewährleisten!

• For the surroundings:

Keep power units, line connections and components clean or clean them (e.g. pickling after, for example, processes have been carried out that involve heat, i.e. welding, hot bending, etc.)!

• For hydraulics fluids:

Take care of contamination and humidity; contamination from the environment must not enter the tanks! Fill oil tanks only through filters, preferably system filters or portable filter stations with fine filters.
Internal protective coatings, if any, must be resistant to the hydraulic fluid used!

• For parts taken from stock:

The storage of parts that were not filled or treated with anti-corrosion fluid can lead to the formation of resin. Solve the resin using a grease solvent and renew the lubricating film.

– Check to see that all of the parts required for the installation are available!

– Take note of any transport damage!

2.2 Carrying out the montage

– Use lifting lugs and transport facilities!

– Do not apply force to prevent transverse forces and tension on pipes and components. The valve mounting surfaces must be perfectly even. The fixing screws must be tightened evenly at the specified torque.

Take care that pipes are adequately fixed!

– When selecting pipes, hoses and fittings/flanges, observe the correct pressure stage (wall thickness, material). Use only seamless precision steel pipes.

- Do not use hemp or putty as sealing materials! This may cause contamination and thus malfunction.
- To prevent external leakage, observe the installation instructions of the pipe fittings' manufacturer. We recommend the use of fittings with elastic seals.
- Make sure that hoses are properly laid! Rubbing and abutting of the lines must be prevented.
- Provide the correct hydraulic fluids
  - Mineral oils:
    HLP hydraulic oils according to DIN 51524 part 2 are generally suitable for standard systems and components.
  - Fast bio-degradable hydraulic fluids:
    VDMA 24568.

    For these fluids, the system and components must be matched.
  - Hardly inflammable hydraulic fluids:
    VDMA 24317. For these fluids, the system and components must be matched. (Before filling in the special media, check, whether the system is compatible with the intended fluid.)

The following points must be observed in accordance with the relevant requirements:

- Viscosity of the hydraulic fluid
- Operating temperature range
- Type of seals used on the components fitted

3. Commissioning

When the installation has been carried out correctly, proceed with commissioning and functional testing.

3.1 Preparations for trial run

- Tank cleaned?
- Lines cleaned and properly installed?
- Fittings, flanges tightened?
- Lines and components correctly connected in line with installation drawings and circuit diagram?

Is the accumulator filled with nitrogen? Fill in nitrogen until the pre-charge pressure p0 as specified in the cicuit di agram is reached. (On the fluid side the system must be pressureless!). It is recommended that the gas precharge pressure is marked on the accumulator itself (e.g. self-adhesive label) and in the hydraulic circuit so that a comparative check is possible, if required.

⚠ **Caution!** Use only nitrogen as pre-charge gas!

Accumulators must comply with the safety regulations valid at the place of installation.

- Are the drive motor and pump properly installed and aligned?
- Is the drive motor correctly connected?
- Are filters with the prescribed filter rating used?
- Are filters fitted in the correct direction of flow?
- Has the specified hydraulic fluid filled up to the upper marking?

As the hydraulic fluids often do not comply with the required cleanliness, the fluids must be filled through a filter. The absolute filter rating of the filling filter should be at least that of the filters installed in the system.

3.2 Trial run

- For safety reasons, only personnel of the machine manufacturer and, if required, maintenance and operating personnel should be present.
- All pressure relief valves, pressure reducing valves, pressure controllers of pumps must be unloaded. An exemption to this are TÜV-set valves.
- Open isolator valves completely!
- Switch the system on briefly and check whether the direction of rotation of the drive motor matches the prescribed direction of rotation of the pump.
- Check the position of the directional valves and, if necessary, move the spool to the required position.
- Set the control spool to by-pass.
- Open suction valves of the pump. If required for design reasons, fill pump housing with hydraulic fluids to prevent bearings and parts of the rotary group from running dry.
- If a pilot oil pump is provided, commission it[1)].
- Start up the pump, swivel it from its zero position and listen for any noises.
- Swivel the pump slightly out (ca. 5°)[1)].
- Bleed the system
  Carefully loosen fittings or bleed screws at high points in the system. When the escaping fluid is free from bubbles, then the filling process is completed. Re-tighten fittings.
- Flush the system; if possible, short-circuit actuators. Flush the system until the filters remain clean; check the filters!
  With servo-systems, the servo-valves must be removed and replaced by flushing plates or direction valves of the same size. Short-circuit the actuators. During flushing, the hydraulic fluid in the complete hydraulic system should reach temperatures that are at least as high as later during operation. Change the filter elements as required.
  Flushing continues until the required minimum cleanliness is reached. This can only be achieved by continuous monitoring using a particle counter.
- Check the system functions under no-load conditions, if possible, by hand; cold-test the electrohydraulic control.
- When the operating temperature has been reached, test the system under load; slowly increase the pressure.
- Monitor control and instrumentation equipment!
- Check the housing temperature of hydraulic pumps and hydraulic motors.
- Listen for noises!
- Check the hydraulic fluid level; if required, top up!

[1)] As far as possible with the control elements fitted; otherwise, start up at full displacement. In conjunction with combustion engines, start up at idle speed.

- Check the setting of pressure relief valves by loading or braking the system.
- Inspect the system for leaks.
- Switch off the drive.
- Retighten all fittings, even if there is no evidence of leakage.

  ⚠ **Caution!** Only tighten fittings when the system is depressurised!
- Is the pipe fixing adequate, even under changing pressure loads?
- Are the fixing points at the correct positions?
- Are the hoses laid so that they do not chamfer, even under pressure load?
- Check the fluid level.
- Test the system for all functions. Compare measured values with the permissible or specified data (pressure, velocity. Adjust further control components).
- Jerky movements indicate, amongst other things, the presence of air in the system. By briefly swivelling the pump in one or both directions with the actuator being loaded or braked, it is possible to eliminate certain air pockets. The system is completely bled when all functions are performed jerk-free and smoothly and the sur face of the hydraulic fluid level is free from foam. Experience has shown that foaming should have ceased one hour after start-up at the latest.
- Check the temperature.
- Switch off the drive.
- Remove filter elements (off-line and full-flow filters) and inspect them for residues. Clean filter elements or replace them, if required. Paper or glass fibre elements **cannot** be cleaned.
- If further contamination is found, additional flushing is required to prevent premature failure of the system components.
- All the adjustments made are to be recorded in an acceptance report.

3.3 Commissioning of fast running systems

Such system can often not be commissioning using the normal measuring instruments (such as pressure gauges, thermometers, electrical multimeters, etc.) and standard tools. Optimization is also not possible.
These systems include, for example, forging presses, plastics injection moulding machines, special machine tools, rolling tools, crane controls, machines with electro-hydraulic closed-loop control systems.
Commissioning and optimization of these systems often require more comprehensive measuring equipment to allow several measurements to be taken at a time (e.g. several pressures, electrical signals, travel, velocities, flows, etc.).

3.4 The most common faults occurring during commissioning

Apart from servicing, commissioning is very decisive for the service life and functional reliability of a hydraulic system.

For this reason, faults during commissioning must be avoided as far as possible.

The most common faults are:

- The fluid tank is not inspected.
- The hydraulic fluid is not filtered before being filled in.
- The installation is not checked before commissioning (subsequent conversion with loss of fluid!).
- System components are not bled.
- Pressure relief valves are set only slightly higher than the operating pressure (closing pressure differential is not observed).
- Pressure controllers of hydraulic pumps are set higher or to the same pressure as the pressure relief valve.
- The flushing time of servo systems is not adhered to.
- Abnormal pump noise is ignored (cavitation, leaking suction lines, too much air in the hydraulic fluid).
- Transversal loads on cylinder piston rods are not observed (installation error!).
- Hydraulic cylinders are not bled (damage to seals!)
- Limit switches are set too low.
- The switching hysteresis of pressure switches is not taken into account when settings are made.
- Hydraulic pump and hydraulic motor housings are not filled with hydraulic fluid prior to commissioning.
- Settings are not documented.
- Adjustment spindles are not secured or sealed.
- Unnecessary personnel present during commissioning of the system.

4. Maintenance

According to DIN 31 051 the term “maintenance” includes the following fields of activity:

- **Inspection**

  Measures to recognise and assess the actual situation, i.e. recognise how and why the so-called wear reserve continues to decrease.
- **Maintenance**

  Measures to preserve the nominal conditions, i.e. to take precautions in order that the reduction in the wear reserve during the useful life is kept as low as possible.
- **Repair**

  Measures to restore the nominal condition, i.e. compensate for reduction in performance and restore the wear reserve.

Maintenance measures must be planned and taken in accordance with the operating time, the consequences of a failure and the required availability.

4.1 Inspection

The individual points to be inspected should be summarised for a specific system in so-called inspection lists in order that the inspections can be carried out adequately by employees with different qualification levels.

Important points of inspection are:

- Checking the hydraulic fluid level in the tank.
- Checking the heat exchanger (air, water) for effectiveness.

1

- Checking the system for external leakage (visual inspection).
- Checking the hydraulic fluid temperature during operation.
- Checking pressures
- Amount of leakage
- Checking the cleanliness of the hydraulic fluid

  ⚠ **Caution!**

  Visual inspections can only give an approximation (clouding of the hydraulic fluid, darker appearance than at the time of filling, sediments in the fluid tank).

  If conventional particle counting is impossible, the following three methods can be used for establishing the fluid cleanliness:

  - Particle counts using electronic counting and sorting equipment.
  - Microscopic examination.
  - Gravimetric establishment of solids by means of finest filtration of a certain fluid volume (e.g. 100 ml) and weighing of the filter paper before and after the filtration process. This allows the establishment of the amount of solid particles in mg/l.
- Check the contamination of filters. A visual inspection of deep filters, which are widely used today, is **no** longer possible.
- Analyse the chemical properties of the hydraulic fluid.
- Check the temperature at points where bearings are located.
- Check the generation of noise.
- Test performance and velocity.
- Inspect pipes and hoses.

  ⚠ **Caution!**

  Damaged pipes and hoses must be immediately replaced.
- Inspect accumulator stations.

4.2 Maintenance

In practice, inspection, maintenance and repair work is not as strictly separated as the definitions may suggest. Servicing is often done in conjunction with inspections.

For safety reason, pipe fittings, connections and components **must not** be loosened or removed as long as the system is pressurised.

Important service work is:

- Create a maintenance book

  We recommend that a maintenance book is created to lay down the parts to be inspected.
- Check the hydraulic fluid level
  - continuously during commissioning
  - shortly after commissioning
  - later, at weekly intervals
- Inspect filters
  - during commissioning every two to three hours and, if necessary, replace them.
  - daily during the first week and replace them as required.
  - After one week, the filters should be cleaned as required.
  - Maintenance of suction filters:

    Suction filters require particularly thorough servicing. After the running-in period, they must be inspected at least once a week and cleaned, if necessary.
- Service the system fluid
  - Maintenance intervals depend on the following operating factors:
    - Hydraulic fluid condition (e.g. water in oil, strongly aged oil)
    - Operating temperature and oil fill

    We recommend that the fluid be changed in dependence upon an oil analysis. With systems whose oil is not analysed at regular intervals the fluid should be replaced every 2000 to 4000 operating hours at the latest.
  - Drain the system fluid at operating temperature and change it.
  - Severely aged or contaminated system fluid **cannot** be improved by adding new fluid!
  - Only fill in oil via filters that have at least the same separation capacity as the filters installed in the system, or use a system filter.
  - Take samples of the system fluid to have the type, size and amount of particles analysed in the lab. Record the results.
- Check the accumulator for its pre-charge pressure; for this, the accumulator must be depressurised on the fluid side.

  ⚠ **Caution!**

  Work on systems that include accumulators may only be carried out after the fluid pressure was unloaded.

  Welding or soldering work or any mechanical work on accumulators is not permitted.

  Improper repairs can lead to severe accidents. Repairs on hydraulic accumulator may therefore only be carried out by Rexroth Service service personnel.
- The operating temperature must be measured. An increase in the operating temperature indicates increasing friction and leakage.
- Leakage in the pipework

  Leakage, especially with underfloor piping, represents, apart from loss of fluid, a risk for equipment and concrete floors.

  For safety reasons, sealing work on the pipes may only be carried out when the system is depressurised. Leakage at points that are sealed with soft seals (O-rings, form seal rings, etc.) **cannot** be eliminated by tightening as these sealing elements are either destroyed or hardened. Sealing can only be achieved by replacing the sealing elements.

– Check main and pilot pressure
  - Check interval: One week
  - Document pressure corrections in the maintenance book.
  - Frequent pressure adjustments indicate, among other things, wear of the pressure relief valve.

4.3 Repair

Locate and eliminate malfunction and damage.

– Fault localisation

A precondition for system repairs is successful, i.e. systematic fault search.

This requires in any case detailed knowledge of the structure and the operating principle of the individual components as well as of the entire system. The required documentation should be available and easily accessible.

The most important measuring instruments (thermometer, electrical multimeter, industrial stethoscope, stop watch, rpm counter, etc.) should also be available in the vicinity of the system, especially in the case of large systems.

– Fault correction

When carrying out any work, observe strictest cleanliness. Before loosening fittings, clean the surrounding area.

Generally, defective components should not be repaired on site, since for the proper repair, the required tooling and the required cleanliness are usually not given on site. On site, only complete components should be changed whenever possible, in order

- to keep the time for which the opened system is exposed to ambient influences to a minimum,
- to keep the fluid loss as low as possible,
- to ensure the shortest possible downtime through the use of overhauled and tested components.

After failed components are located, it is essential to check whether the entire system or parts of the system have been contaminated by broken parts or larger amounts of abraded metal.

4.4 Repair and major overhaul of hydraulic components

Generally, it can be said that only the component manufacturer can carry out major overhauls in the most efficiently and reliably (same quality standard, trained personnel, test facilities, warranty, etc.).

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Telefon +49 (0) 93 52 / 18-0
Telefax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Telefon +49 (0) 93 52 / 18-0
Telefax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

Rexroth
Bosch Group

Reliability characteristics $MTTF_d$ regarding the functional safety according to EN ISO 13849

RE 08012/07.11
Replaces: 03.10

$MTTF_d$ values

Table of contents

Determination MTTF$_d$ values according to EN ISO 13849-1:2006

Using reliability characteristics MTTF$_d$ (mean time to dangerous failure) of components, the probability of a dangerous failure per hour PFH$_d$ of a machine or system is calculated and kept low, to a justifiable degree.

For hydraulic components, the standard EN ISO 13849-1:2006 specifies an MTTF$_d$ value of 150 years if the "basic" and "well-tried" safety principles are complied with. The following is, for example, demanded for hydraulic valves used in safety-related parts of control systems:

– Automatic reaching of the safe position in case of energy failure (de-energisation principle)
– Reliable keeping of the the safe position
– Sufficient overlap with spool valves in safe position

Hydraulic components not satisfying these safety principles are not suitable to be used in safety-related parts of control systems.

Rexroth has carefully tested their products with regard to all relevant "basic" and "well-tried" safety principles according to a method acknowledged by IFA (Institute for Occupational Safety and Health of the German Social Accident Insurance).

Compliance with safety principles, application notes

The products listed in the following are suitable to be used in safety-related parts of a control system according to EN ISO 13849-1:2006.

According to EN ISO 13849-2:2008, these products satisfy the

– **Basic** safety principles
– **Well-tried** safety principles.

For evaluating and interpreting the control system’s reliability, use the following key figures for the products:

MTTF$_d$ = see table page 3 to 7

T_M = 20 years (maximum mission time according to EN ISO 13849-1:2006)

In this use, please ensure compliance with the subsequently specified application notes!

Application notes:

The additional basic and well-tried safety principles according to EN ISO 13849-2:2008 for the implementation and the operation of the product are to be complied with.

– For operation and handling of the products, adhere to the operating data and conditions given in the data sheet and operating instructions.
– Only use the hydraulic fluids specified in the data sheets and comply with the oil cleanliness class for the whole mission time.
– If on/off spool valves are not actuated for a longer period of time, the spool may get stuck. We therefore recommend switching the valve regularly, at reasonable time intervals.
– If you use the product for safety-related structures with higher categories (2 to 4) according to EN ISO 13849-1:2006 section 6, consider the requirements (e. g. CCF, DC, PLr, software, systematic failures) specified there.
– According to EN ISO 13849-1:2006, the maximum mission time - complying with the oil cleanliness according to ISO 4406:1999 - is T_M = 20 years. In terms of preventive maintenance, it is recommended replacing the components already before expiry of the maximum mission time.
– Industrial valves are usually designed for 10 million switching cycles. If the maximum number of switching cycles is exceeded within the mission time, accordingly shorter replacement intervals are to be determined.

Use of valves with integrated electronics as safety related parts of control systems:

– In case the safety function is required, the voltage supply of the valve electronics is to be switched off by a suitable switching element with appropriate reliability. In the table (pages 4 and 7), these valves are marked with the comment "Switch off OBE voltage supply".
– If persons have to enter the hazard zone with activated valve electronics, additional measures for guaranteeing their safety have to be taken for the reasons above.

Directional on/off valves

Type	Size	Data sheet	$MTTF_d$ value according to EN ISO 13849 in years	Position monitoring	Admissible spool types [1)]; maximum longitudinal spool acceleration	Exceptions/ limitations
.WE 6 .6X/.EG…	6	23178	150	Optional QM,QR	A, C, D, B, Y, E, F, G, J, L, M, P, Q, R, T, U, W as well as A9, B9, E67, U10, Y11, J2, X7, X34, X139, L42; < 15 g/11 ms [2)]	Impulse spool design "O" and valves for alternating voltage "W" [3)]
.WE . .73-3X/…A12…; .WE . .73-6X/…A12…	6, 10	23183	150	Optional QM	A73, D73, B73, Y73, E73, G73, J73, R73, W73; < 10 g/11 ms [2)]	–
.WE 10 .3X/.C…; .WE 10 .4X/.C…	10	23327	150	Optional QM	A, C, D, B, Y, E, F, G, J, L, M, P, Q, R, T, U, W; < 10 g/11 ms [2)]	Impulse spool design "O" and valves for alternating voltage "W" [3)]
5-.WE 10 .3X/.C…	10	23351	150	Optional QM	A, C, D, B, Y, E, F, G, J, L, M, P, Q, R, T, U, W, as well as J2, X84, E67; < 15 g/11 ms [2)]	
Z4WE 6 .-3X/E…	6	23193	150	Optional QM	D24, D27, E51, E53, E56, E63, E68, E127, E129, E130, E131, E132, E134, E135, E136, E137, E141, E144, E145, E146, E166; < 15 g/11 ms [2)]	Valves for alternating voltage "W" [3)]
.SEC 6 .1X/.C…	6	22035	150	–	E69A, E35, E100, E13, E22, EA, EB, E, E61, E40, E89, E18	
M-.SED 6 .-1X…	6	22049	150	Optional QMA, QMB	PK, NK, UK, CK	
M-.SED 10 .1X…	10	22045	150	Optional QMA, QMB	UK, CK	
M-.SEW 6 .-3X…	6	22058	150	Optional QMA, QMB	P, N, U, C	630 bar version
M-.SEW 10 .1X…	10	22075	150	Optional QMA, QMB	U, C	
Z4SE 10 .-1X/C	10	[4)]	150	–	A, B, E	
.WEH . ../.6E…; .WH …	10 to 25	24751	75 150	Optional QM	A, B, C, D, E, F, G, H, J, K, L, M, P, Q, R, S, T, U, V, W, Y, Z; < 15 g/11 ms [2)]	Impulse spool version type "O"; spool return hydraulic
Z4WEH …; Z4WH …	10 to 22	24753, 24761, 24768	75 150	Optional QM	E62, E63, E68, E50, E51, E52; < 15 g/11 ms [2)]	Valves for alternating voltage "W" [3)]

Explanation of the foot notes see page 8.
Further MTTFd values for products and special versions not listed here upon request!

1

Proportional directional valves

<table>
<tr><th>Type</th><th>Size</th><th>Data sheet</th><th>MTTF$_d$ value according to EN ISO 13849 in years</th><th>Position monitoring</th><th>Admissible spool types [1]; maximum longitudinal spool acceleration</th><th>Exceptions/ limitations</th></tr>
<tr><td>4WRA(E) . ..-2X…</td><td>6, 10</td><td>29055</td><td>150</td><td>–</td><td>E, W;
in case of shock load, the spool overlap can be left for a short period</td><td>Switch off "OBE" voltage supply</td></tr>
<tr><td>4WRE(E) . ..-2X…</td><td>6, 10</td><td>29061</td><td>150</td><td>–</td><td>E, W;
in case of shock load, the spool overlap can be left for a short period</td><td rowspan="2">Switch off "OBE" voltage supply</td></tr>
<tr><td>4WREEM . …-2X…</td><td>6, 10</td><td>29064</td><td>150</td><td>Yes</td><td>E, W;
in case of shock load, the spool overlap can be left for a short period</td></tr>
<tr><td>4WRPE . …-2X…</td><td>6, 10</td><td>29024,
29025</td><td>150</td><td>–</td><td>EA, E, W;
< 15 g [2]</td><td>Switch off "OBE" voltage supply; size 10: max. operating pressure 250 bar</td></tr>
<tr><td>4WRPEH . …-2X…</td><td>6, 10</td><td>29035,
29037</td><td>150</td><td>–</td><td>C1, C3, C4, C5;
< 10 g [2]</td><td rowspan="2">Switch off "OBE" voltage supply; size 6: except q_V = 40 l/min size 10: max. operating pressure 250 bar</td></tr>
<tr><td>4WRPNH …-2X…</td><td>6, 10</td><td>29191</td><td>150</td><td>–</td><td>C1, C3, C4, C5;
< 10 g [2]</td></tr>
<tr><td>4WRKE . …-3X…</td><td>10 to 35</td><td>29075</td><td>75</td><td>–</td><td>E, R, W;
< 15 g [2]</td><td rowspan="5">Switch off "OBE" voltage supply</td></tr>
<tr><td>4WRZ(E)M . ..-1X…;
4WRHM . ..-1X…</td><td>10 to 25</td><td>29117</td><td>75
150</td><td>Yes</td><td>E, W;
< 9 g [2]</td></tr>
<tr><td>4WRZ(E) 32 ..-7X...402,
4WRH 32 ..-7X...402,</td><td>32</td><td>[5]</td><td>75
150</td><td>Yes</td><td>E, W;
< 9 g [2]</td></tr>
<tr><td>4WRL(E)…-3X…</td><td>10 to 27</td><td>29087,
29089</td><td>75</td><td>–</td><td>E, E1, E(Z), E1(Z), E4, W, W1, W(Z), W1(Z)R, W2, W3, W4, R3, R5;
Size 10 and 16: < 15 g [2]
Size 25 and 27: < 10 g [2]</td></tr>
<tr><td>4WRTE…-4X…</td><td>10 to 35</td><td>29083</td><td>150</td><td>–</td><td>E, E1,W6, W8, Q2, R;
in case of shock load, the spool overlap can be left for a short period</td></tr>
</table>

Explanation of the foot notes see page 8.

Further MTTFd values for products and special versions not listed here upon request!

2-way cartridge valves: Directional function

Type	Size	Data sheet	MTTF$_d$ value according to EN ISO 13849 in years	Position monitoring	Admissible spool types [1]; maximum longitudinal spool acceleration	Exceptions/ limitations
LC . A…7X…; LC . B…7X…	16 to 63	21010	150	–		Cracking pressure "00" (without spring)
LC . A…6X…; LC . B…6X…	80 to 100		150	–		
LFA . D-7X…; LFA . H-7X…	16 to 63	21010	Not relevant	–		Observe the reliability characteristic of the pilot control valve
LFA . D-6X…; LFA . H-6X…	80 to 100					
LFA . G-7X…; LFA . GW.-7X…; LFA . KW.-7X…	16 to 63	21010	Not relevant	–		
LFA . G-6X…; LFA . GW.-6X…; LFA . KW.-6X…	80 to 100					
LFA . WE.-7X…; LFA . WEM.-7X…; LFA . WECA-7X…	16 to 63	21010	Not relevant	–		
LFA . WE.-6X…; LFA . WE.8-6X…; LFA . WEA9-6X…	80 to 100					

Explanation of the foot notes see page 8.
Further MTTFd values for products and special versions not listed here upon request!

2-way cartridge valves: Pressure function

Type	Size	Data sheet	MTTF$_d$ value according to EN ISO 13849 in years	Position monitoring	Admissible spool types [1)]; maximum longitudinal spool acceleration	Exceptions/ limitations
LC . DB ..7X…	16 to 63	21050	150	–		Cracking pressure "00" (without spring)
LC . DB ..6X…	80 to 100	21050	150	–		
LC . DR ..7X…	16 to 63	21050	150	–		
LFA . DB.-7X…; LFA . DBW.-7X…; LFA . DBWD.-7X…	16 to 63	21050	150	–		With pressure relief valve type DBD...1X
LFA . DBS.-7X…	40 to 63	21050	150	–		
LFA . DBEM-7X…	16 to 40	21050	–	–		Observe the reliability characteristic of the pilot control valve
LFA . DB.-6X…; LFA . DBW.-6X…; LFA . DBWD.-6X…; LFA . DBS.-7X…	80 to 100	21050	150	–		With pressure relief valve type DBD...1X
LFA . DBE-7X…	16 to 40	21050	–	–		Observe the reliability characteristic of the pilot control valve
LFA . DR.-7X…; LFA . DRW.-7X…	16 to 50	21050	150	–		With pressure relief valve type DBD...1X

2-way cartridge valves: Active logics

Type	Size	Data sheet	MTTF$_d$ value according to EN ISO 13849 in years	Position monitoring	Admissible spool types [1)]; maximum longitudinal spool acceleration	Exceptions/ limitations
LC2A . D.-1X…; LC2A . A.-1X…; LC2A . B.-1X…	16 to 100	21040	150	–		Cracking pressure "00" (without spring)

Explanation of the foot notes see page 8.

Further MTTFd values for products and special versions not listed here upon request!

1

Isolator valves

Type	Size	Data sheet	MTTF$_d$ value according to EN ISO 13849 in years	Position monitoring	Admissible spool types [1]; maximum longitudinal spool acceleration	Exceptions/ limitations
Z2S 6 ..6X…	6	21548	150	–		Only mutual load of channel A and B with max. operating pressure 315 bar
SV 6 ..-6X…; SL 6 ..-6X…	6	21460	150	–		–
SV . …-4X…; SL . …-4X	10 to 32	21468	150	Optional		–

Pressure valves

Type	Size	Data sheet	MTTF$_d$ value according to EN ISO 13849 in years	Position monitoring	Admissible spool types [1]; maximum longitudinal spool acceleration	Exceptions/ limitations
DBD…1X…	6 to 30	25402	150	–		–
DR 6 DP.-5X…	6	26564	150	–		–
ZDR 6 D..-4X…	6	26570	150	–		–
3DREP(E) 6 .-2X…	6	29184	150	–	< 9 g [2]	Switch off "OBE" voltage supply
DBET(E)-6X…	6	29162	150	–		
(Z)DRE 6 ..-1X…	6	29175	150	–		–
ZDRE(E) 10 VP2-2X…	10	29279	150	–		Switch off "OBE" voltage supply

Pressure switches and sensors

Type	Size	Data sheet	MTTF$_d$ value according to EN ISO 13849 in years	Position monitoring	Admissible spool types [1]; maximum longitudinal spool acceleration	Exceptions/ limitations
DSM1-10-1X…	–	30267	75	–	–	–
HEDE 10 A1-2X…	–	30276, 30278	25	–	–	–

Explanation of the foot notes see page 8.
Further MTTFd values for products and special versions not listed here upon request!

Explanation of the foot notes

1) Spool versions specified here are suitable to be used in safety-related parts of a control system.
Spool versions not specified here upon request.

2) Adequate spool overlap according to EN ISO 13849-2:2008 available under sine-shaped shock and vibration load according to EN 60068-2-27:2009. Observe installation position!

3) Use mating connector with installed rectifier!

4) Installation drawing R900270193, upon request

5) Installation drawing R900277922, upon request

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

Rexroth
Bosch Group

Hydraulic fluids based on mineral oils and related hydrocarbons

RE 90220/05.12 1/16
Replaces: 05.10

Application notes and requirements for Rexroth hydraulic components

Hydraulic fluids

Title	**Hydraulic fluids based on mineral oils and related hydrocarbons**	Environmentally acceptable hydraulic fluids	Fire-resistant, water-free hydraulic fluids	Fire-resistant, water-containing hydraulic fluids
Standard	**DIN 51524**	ISO 15380	ISO 12922	ISO 12922
Data sheets	**RE 90220**	RE 90221	RE 90222	RE 90223 (in preparation)
Classification	**HL HLP HLPD HVLP HLPD and more**	HEPG HEES partially saturated HEES saturated HEPR HETG	HFDR HFDU (ester base) HFDU (glycol base) and more	HFC HFB HFAE HFAS

Contents

1 Basic information

1.1 General instructions

The hydraulic fluid is the common element in any hydraulic component and must be selected very carefully. Quality and cleanliness of the hydraulic fluid are decisive factors for the operational reliability, efficiency and service life of a system.

Hydraulic fluids must conform, be selected and used in accordance with the generally acknowledged rules of technology and safety provisions. Reference is made to the country-specific standards and directives (in Germany the directive of the Employer's Liability Insurance Association BGR 137).

This data sheet includes recommendations and regulations concerning the selection, operation and disposal of hydraulic fluids based on mineral oils and related hydrocarbons in the application of Rexroth hydraulic components.

The individual selection of hydraulic fluid or the choice of classification are the responsibility of the operator.

It is the responsibility of the user to ensure that appropriate measures are taken for safety and health protection and to ensure compliance with statutory regulations. The recommendations of the lubricant manufacturer and the specifications given in the safety data sheet are to be observed when using hydraulic fluid.

This data sheet does not absolve the operator from verifying the conformity and suitability of the respective hydraulic fluid for his system. He is to ensure that the selected fluid meets the minimum requirements of the relevant fluid standard during the whole of the period of use.

Other regulations and legal provisions may also apply. The operator is responsible for their observance, e.g. EU directive 2004/35/EG and their national implementations. In Germany the Water Resources Act (WHG) is also to be observed.

We recommend that you maintain constant, close contact with lubricant manufacturers to support you in the selection, maintenance, care and analyses.

When disposing of used hydraulic fluids, apply the same care as during use.

1.2 Scope

This data sheet must be observed when using hydraulic fluids based on mineral oils and related hydrocarbons in Bosch Rexroth hydraulic components.

Please note that the specifications of this data sheet may be restricted further by the specifications given in the product data sheets for the individual components.

The use of the individual hydraulic fluids in accordance with the intended purpose can be found in the safety data sheets or other product description documents of the lubricant manufacturers. In addition, each use is to be individually considered.

Rexroth hydraulic components may only be operated with hydraulic fluids based on mineral oils and related hydrocarbons according to DIN 51524 if specified in the respective component data sheet or if Rexroth approval for use is furnished.

Notes:
In the market overview RE 90220-01, hydraulic fluid based on mineral oil are described which, according to the information of the lubricant manufacturer, feature the respective parameters of the current requirements standard DIN 51524 and other parameters which are of relevance for suitability in connection with Rexroth components.

These specifications are not checked or monitored by Bosch Rexroth. The list in the market overview does not therefore represent a recommendation on the part of Rexroth or approval of the respective hydraulic fluid for use with Rexroth components and does not release the operator from his responsibility regarding selection of the hydraulic fluid.

Bosch Rexroth will accept no liability for its components for any damage resulting from failure to comply with the notes below.

1.3 Safety instructions

Hydraulic fluids can constitute a risk for persons and the environment. These risks are described in the hydraulic fluid safety data sheets. The operator is to ensure that a current safety data sheet for the hydraulic fluid used is available and that the measures stipulated therein are complied with.

2 Solid particle contamination and cleanliness levels

Solid particle contamination is the major reason for faults occurring in hydraulic systems. It may lead to a number of effects in the hydraulic system. Firstly, single large solid particles may lead directly to a system malfunction, and secondly small particles cause continuous elevated wear.

For hydraulic fluids, the cleanliness level is given as a three-digit numerical code in accordance with ISO 4406. This numerical code denotes the number of particles present in a hydraulic fluid for a defined quantity. Moreover, foreign solid matter is not to exceed a mass of 50 mg/kg (gravimetric examination according to ISO 4405).

In general, compliance with a minimum cleanliness level of 20/18/15 in accordance with ISO 4406 or better is to be maintained in operation. Special servo valves demand improved cleanliness levels of at least 18/16/13. A reduction in cleanliness level by one level means half of the quantity of particles and thus greater cleanliness. Lower numbers in cleanliness levels should always be striven for and extend the service life of hydraulic components. The component with the highest cleanliness requirements determines the required cleanliness of the overall system. Please also observe the specifications in table 1: "Cleanliness levels according to ISO 4406" and in the respective data sheets of the various hydraulic components.

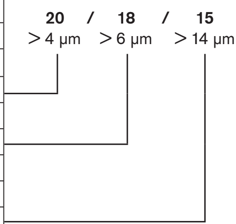
Hydraulic fluids frequently fail to meet these cleanliness requirements on delivery. Careful filtering is therefore required during operation and in particular, during filling in order to ensure the required cleanliness levels. Your lubricant manufacturer can tell you the cleanliness level of hydraulic fluids as delivered. To maintain the required cleanliness level over the operating period, you must use a reservoir breather filter. If the environment is humid, take appropriate measures, such as a breather filter with air drying or permanent off-line water separation.

Note: the specifications of the lubricant manufacturer relating to cleanliness levels are based on the time at which the container concerned is filled and not on the conditions during transport and storage.

Further information about contamination with solid matter and cleanliness levels can be found in brochure RE 08016.

Table 1: Cleanliness levels according to ISO 4406

Particles per 100 ml		Scale number
More than	Up to and including	
8,000,000	16,000,000	24
4,000,000	8,000,000	23
2,000,000	4,000,000	22
1,000,000	2,000,000	21
500,000	1,000,000	20
250,000	500,000	19
130,000	250,000	18
64000	130,000	17
32000	64000	16
16000	32000	15
8000	16000	14
4000	8000	13
2000	4000	12
1000	2000	11
500	1000	10
250	500	9
130	250	8
64	130	7
32	64	6



3 Selection of the hydraulic fluid

The use of hydraulic fluids based on mineral oils for Rexroth hydraulic components is based on compliance with the minimum requirements of DIN 51524.

3.1 Selection criteria for the hydraulic fluid

The specified limit values for all components employed in the hydraulic system, for example viscosity and cleanliness level, must be observed with the hydraulic fluid used, taking into account the specified operating conditions.

Hydraulic fluid suitability depends, amongst others, on the following factors:

3.1.1 Viscosity

Viscosity is a basic property of hydraulic fluids. The permissible viscosity range of complete systems needs to be determined taking account of the permissible viscosity of all components and it is to be observed for each individual component.

The viscosity at operating temperature determines the response characteristics of closed control loops, stability and damping of systems, the efficiency factor and the degree of wear.

We recommend that the optimum operating viscosity range of each component be kept within the permissible temperature range. This usually requires either cooling or heating, or both. The permissible viscosity range and the necessary cleanliness level can be found in the product data sheet for the component concerned.

If the viscosity of a hydraulic fluid used is above the permitted operating viscosity, this will result in increased hydraulic-mechanical losses. In return, there will be lower internal leakage losses. If the pressure level is lower, lubrication gaps may not be filled up, which can lead to increased wear. For hydraulic pumps, the permitted suction pressure may not be reached, which may lead to cavitation damage.

If the viscosity of a hydraulic fluid is below the permitted operating viscosity, increased leakage, wear, susceptibility to contamination and a shorter component life cycle will result.

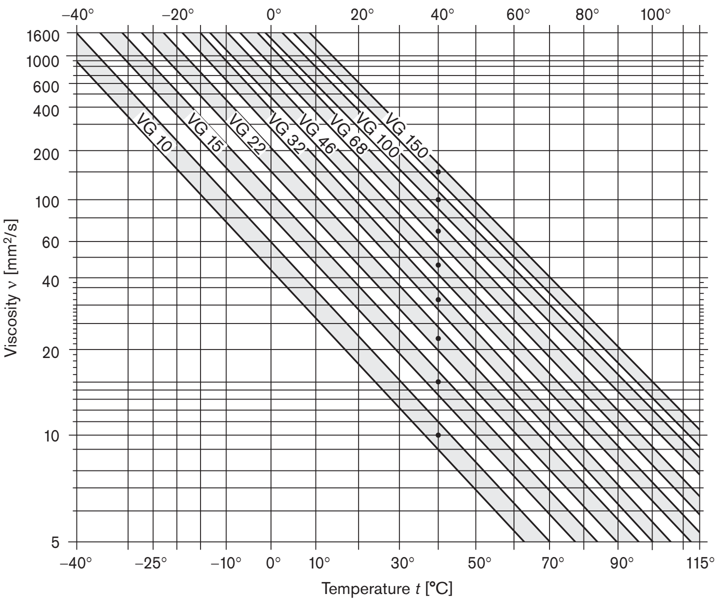
3.1.2 Viscosity-temperature behavior

For hydraulic fluids, the viscosity temperature behavior (V-T behavior) is of particular importance. Viscosity is characterized in that it drops when the temperature increases and rises when the temperature drops; see Fig. 1 "Viscosity temperature chart for HL, HLP, HLPD (VI 100)". The interrelation between viscosity and temperature is described by the viscosity index (VI).

The viscosity temperature diagram in Fig. 1 is extrapolated in the < 40 °C range. This idealized diagram is for reference purposes only. Measured values can be obtained from your lubricant manufacturer and are to be preferred for design purposes.

1

Fig. 1: Viscosity-temperature chart for HL, HLP, HLPD (VI 100, double logarithmic representation)



3.1.3 Wear protection capability

Wear protection capability describes the property of hydraulic fluids to prevent or minimize wear within the components. The wear protection capability is described in DIN 51524-2,-3 via test procedures "FZG gear test rig" (ISO 14635-1) and "Mechanical test in the vane pump" (ISO 20763). From ISO VG 32 DIN 51524-2,-3 prescribes a rating of at least 10 (FZG test). At present, the FZG test cannot be applied to viscosity classes < ISO VG 32.

3.1.4 Material compatibility

The hydraulic fluid must not negatively affect the materials used in the components. Compatibility with coatings, seals, hoses, metals and plastics is to be observed in particular. The fluid classifications specified in the respective component data sheets are tested by the manufacturer with regard to material compatibility. Parts and components not supplied by us are to be checked by the user.

Table 2: Known material incompatibilities

Classification	Incompatible with:
HLxx classifications	with EPDM seals
Zinc- and ash/free hydraulic fluids	with bronze-filled PTFE seals

3.1.5 Aging resistance

The way a hydraulic fluid ages depends on the thermal, chemical and mechanical stress to which it is subjected. Aging resistance can be greatly influenced by the chemical composition of the hydraulic fluids.

High fluid temperatures (e.g. over 80 °C) result in a approximate halving of the fluid service life for every 10 °C temperature increase and should therefore by avoided. The halving of the fluid service life results from the application of the Arrhenius equation (see Glossary).

Table 3: Reference values for temperature-dependent aging of the hydraulic fluid

Reservoir temperature	Fluid life cycle
80 °C	100 %
90 °C	50 %
100 °C	25 %

Hydraulic fluids based on mineral oils and related hydrocarbons are tested with 20% water additive during testing of aging resistance according to ISO 4263-1.

The calculated fluid service life is derived from the results of tests in which the long-term characteristics are simulated in a short period of time by applying more arduous conditions (condensed testing). This calculated fluid service life is not to be equated to the fluid service life in real-life applications.

Table 3 is a practical indicator for hydraulic fluids with water content < 0.1%, cf. chapter 4.10. "Water".

3.1.6 Air separation ability (ASA)

The air separation ability (ASA) describes the property of a hydraulic fluid to separate undissolved air. Hydraulic fluids contain approx. 7 to 13 percent by volume of dissolved air (with atmospheric pressure and 50 °C). Hydraulic fluids always contain dissolved air. During operation, dissolved air may be transformed into undissolved air, leading to cavitation damages. Fluid classification, fluid product, reservoir size and design must be coordinated to take into account the dwell time and ASA value of the hydraulic fluid. The air separation capacity depends on the viscosity, temperature, basic fluid and aging.
It cannot be improved by additives.

According to DIN 51524 for instance, an ASA value ≤ 10 minutes is required for viscosity class ISO VG 46, 6 minutes are typical, lower values are preferable.

3.1.7 Demulsifying ability and water solubility

The capacity of a hydraulic fluid to separate water at a defined temperature is known as the demulsifying ability. ISO 6614 defines the demulsifying properties of hydraulic fluids.

For larger systems with permanent monitoring, a demulsifying fluid with good water separation capability (WSC) is recommended. The water can be drained from the bottom of the reservoir. In smaller systems (e.g. in mobile machines), whose fluid is less closely monitored and where water contamination into the hydraulic fluid, for instance through air condensation, cannot be ruled out completely, an HLPD fluid is recommended.

The demulsifying ability up to ISO-VG 100 is given at 54 °C, and at 82 °C for fluids with higher viscosity.

Water emulsifying HLPD hydraulic fluids have no, or a very poor, demulsifying ability.

3.1.8 Filterability

Filterability describes the ability of a hydraulic fluid to pass through a filter, removing solid contaminants. The hydraulic fluids used require a good filterability, not just when new, but also during the whole of their service life. Depending on the basic fluid used and the additives (VI enhancers) there are great differences here.

The filterability is a basic prerequisite for cleanliness, servicing and filtration of hydraulic fluids. Filterability is tested with the new hydraulic fluid and after the addition of 0.2 % water. The underlying standard (ISO 13357-1/-2) stipulates that filterability must have no negative effects on the filters or the hydraulic fluid, see chapter 4 "Hydraulic fluids in operation".

3.1.9 Corrosion protection

Hydraulic fluids should not just prevent corrosion formation on steel components, they must also be compatible with non-ferrous metals and alloys. Corrosion protection tests on different metals and metal alloys are described in DIN 51524. Hydraulic fluids that are not compatible with the materials listed above must not be used, even if they are compliant with ISO 51524.

Rexroth components are usually tested with HLP hydraulic fluids or corrosion protection oils based on mineral oils before they are delivered.

3.1.10 Additivation

The properties described above can be modified with the help of suitable additives. A general distinction is made for fluids between heavy metal-free and heavy metal-containing (generally zinc) additive systems. Both additive systems are most often incompatible with each other. The mixing of these fluids must be avoided even if the mixing ratio is very low. See chapter 4, "Hydraulic fluids in operation”.

Increasing additivation generally leads to deteriorated air separation ability (ASA) and water separation capability (WSC) of the hydraulic fluid. According to the present state of knowledge, all hydraulic fluids described in this document, independently of the actual additivation, can be filtered using all filter materials with all known filtration ratings ≥ 1 μm without filtering out effective additives at the same time.

Bosch Rexroth does not prescribe any specific additive system.

3.2 Classification and fields of application

Table 4: Classification and fields of application

Classification	Features	Typical field of application	Notes
HL fluids according to DIN 51524-1 VI = 100	Hydraulic fluids predominantly only with additives for oxidation and corrosion protection, but no specific additives for wear protection in case of mixed friction	HL fluids can be used in hydraulic systems that do not pose any requirements as to wear protection.	HL fluids may be used only for components whose product data sheet specifically allows HL fluids. For components which have not been approved according to the product data sheet, please consult your Bosch Rexroth sales partner. Hydraulic fluids that only comply with the requirements of classes HL and HR in accordance with ISO 11158 without proving that DIN 51524-1 is also met may be used only with written approval of Bosch Rexroth AG. Observe restrictions as to pressure, rotation speed etc.
HLP fluids according to DIN 51524-2 VI = 100	Hydraulic fluid with corrosion, oxidation and verified wear protection additives	HLP fluids are suitable for most fields of application and components provided the temperature and viscosity provisions are observed.	For information on approved components, please refer to the respective product data sheet. For components which have not been approved according to the product data sheet, please consult your Bosch Rexroth sales partner. For the viscosity classes VG10, VG15 and VG22, DIN 51524 defines no requirements as to wear protection (DIN 51354 part 2 and DIN 51389 part 2). Beyond the requirements of DIN 51524 part 2, we require the same base oil type, identical refining procedure, identical additivation and identical additivation level across all viscosity classes.

Continued on page 8

Table 4: Classification and fields of application (continued from page 7)

Classification	Features	Typical field of application	Notes
HVLP fluids according to DIN 51524-3 VI > 140	HLP hydraulic fluid with additional improved viscosity temperature behavior	HVLP fluids are used in systems operated over a wide tempera-ture range.	For information on approved components, please refer to the respective product data sheet. For components which have not been approved according to the product data sheet, please consult your Bosch Rexroth sales partner. The same notes and restrictions as defined for HLP fluids apply accordingly. The effect on Rexroth components (e.g. compatibility with material seals, wear resistance capacity) may differ when using related hydrocarbons instead of mineral oils, cf. Table 6, line 8. When using HVLP fluids, the viscosity may change on account of the shear of the long-chain VI enhancers. The viscosity index, high at the start, decreases during operation. This needs to be taken into account when selecting the hydraulic fluid. The only value at present that can be used to assess viscosity changes in operation is the result of the test in accordance with DIN 51350 part 6. Please note that there are practical applications that create a much higher shear load on such fluids than can be achieved by this test. Up to VI < 160, we recommend a maximum permitted viscosity drop of 15 %, viscosity at 100 °C. The viscosity limits given by Bosch Rexroth for its components are to be observed for all operating conditions, even after the hydraulic fluids have sheared. HVLP fluids should be used only if required by the temperature ranges of the application.
HLPD fluids according to DIN 51524-2, HVLPD fluids in accordance with DIN 51524-3	HLP and HVLP hydraulic fluid with additional detergent and or dispersant additives	HLPD and HVLPD fluids are used in systems where deposits as well as solid or liquid contamination need to be kept temporarily suspended	For information on approved components, please refer to the respective product data sheet. For components which have not been approved according to the product data sheet, please consult your Bosch Rexroth sales partner. Some of these fluids are able to absorb significant quantities of water (> 0.1 %). This may have negative implications for the wear protection and the aging properties of the fluid. The wetting ability of these fluids varies largely depending on the product. Therefore it is not correct to say that they are generally all very well able to prevent stick-slip. In individual cases where higher water contamination is to be expected (such as in steelworks or under humid conditions), the use of HLPD/HVLPD fluids cannot be recommended as the emulsified water does not settle in the reservoir but is evaporated in heavily loaded positions. For such cases, we recommend using HLP hydraulic fluids with particularly good demulsifying ability. The water collected at the reservoir bottom is to be drained regularly. If HLPD/HVLPD fluids are used, contamination does not settle. It rather remains suspended and needs to be filtered out or removed by appropriate draining systems. For this reason, the filter area must be increased. HLPD/HVLPD fluids may contain additives that in the long run are incompatible with plastics, elastomers and non-ferrous metals. Furthermore, these additives may lead to the premature clogging of hydraulic filters. Therefore, test the filterability and the selection of the filter material in consultation with the filter manufacturer.

4 Hydraulic fluids in operation

4.1 General

The properties of hydraulic fluids can change continually during storage and operation.

Please note that the fluid standard DIN 51524 merely describes minimum requirements for hydraulic fluids in new condition at the time of filling into the bins. The operator of a hydraulic system must ensure that the hydraulic fluid remains in a utilizable condition throughout its entire period of use.

Deviations from the characteristic values are to be clarified with the lubricant manufacturer, the test labs or Bosch Rexroth.

Please note the following aspects in operation.

4.2 Storage and handling

Hydraulic fluids must be stored correctly in accordance with the instructions of the lubricant manufacturer. Avoid exposing the containers to lengthy periods of direct heat. Containers are to be stored in such a way that the risk of any foreign liquid or solid matter (e.g. water, foreign fluids or dust) ingression into the inside of the container can be ruled out. After taking hydraulic fluids from the containers, these are immediately to be properly resealed.

Recommendation:

– Store containers in a dry, roofed place

– Store barrels on their sides

– Clean reservoir systems and machine reservoirs regularly

4.3 Filling of new systems

Usually, the cleanliness levels of the hydraulic fluids as delivered do not meet the requirements of our components. Hydraulic fluids must be filtered using an appropriate filter system to minimize solid particle contamination and water in the system.

As early as possible during test operation, new systems should be filled with the selected hydraulic fluid so as to reduce the risk of accidentally mixing the fluids (see chapter 4.5 "Mixing and compatibility of different hydraulic fluids"). Changing the hydraulic medium at a later point represents significant additional costs (see following chapter).

4.4 Hydraulic fluid changeover

Changeovers, in particular between hydraulic fluids with heavy metal-free and heavy metal-containing (generally zinc) additives, frequently lead to malfunctions, see chapter 3.1.10 "Additivation".

In the case of changeovers of the fluid in hydraulic systems, it is important to ensure compatibility of the new hydraulic fluid with the remainder of the previous hydraulic fluid. We recommend obtaining a written performance guarantee from the manufacturer or supplier of the new hydraulic fluid. The quantity of old fluid remaining should be minimized. Mixing hydraulic fluids should be avoided, see following chapter.

For information on changing over hydraulic fluids with different classifications please refer to VDMA 24314, VDMA 24569 and ISO 15380 appendix A.

Bosch Rexroth will not accept liability for any damage to its components resulting from inadequate hydraulic fluid changeovers!

1

4.5 Mixing and compatibility of different hydraulic fluids

If hydraulic fluids from different manufacturers or different types from the same manufacturer are mixed, gelling, silting and deposits may occur. These, in turn, may cause foaming, impaired air separation ability, malfunctions and damage to the hydraulic system.

If the fluid contains more than 2 % of another fluid then it is considered to be a mixture. Exceptions apply for water, see chapter 4.10 "Water".

Mixing with other hydraulic fluids is not generally permitted. This also includes hydraulic fluids with the same classification and from the market overview RE 90220-01. If individual lubricant manufacturers advertise miscibility and/or compatibility, this is entirely the responsibility of the lubricant manufacturer.

Bosch Rexroth customarily tests all components with mineral oil HLP before they are delivered.

Note: With connectible accessory units and mobile filtering systems, there is a considerable risk of non-permitted mixing of the hydraulic fluids!

Rexroth will not accept liability for any damage to its components resulting from mixing hydraulic fluids!

4.6 Re-additivation

Additives added at a later point in time such as colors, wear reducers, VI enhancers or anti-foam additives, may negatively affect the performance properties of the hydraulic fluid and the compatibility with our components and therefore are not permissible.

Rexroth will not accept liability for any damage to its components resulting from re-additivation!

4.7 Foaming behavior

Foam is created by rising air bubbles at the surface of hydraulic fluids in the reservoir. Foam that develops should collapse as quickly as possible.

Common hydraulic fluids in accordance with DIN 51524 are sufficiently inhibited against foam formation in new condition. On account of aging and adsorption onto surfaces, the defoamer concentration may decrease over time, leading to a stable foam.

Defoamers may be re-dosed only after consultation with the lubricant manufacturer and with his written approval.

Defoamers may affect the air separation ability.

4.8 Corrosion

The hydraulic fluid is to guarantee sufficient corrosion protection of components under all operating conditions, even in the event of impermissible water contamination.

During storage and operation, hydraulic fluid based on mineral oils with anti-corrosion additives protect components against water and "acidic" oil degradation products.

4.9 Air

Under atmospheric conditions, the hydraulic fluid contains dissolved air. In the negative pressure range, for instance in the suction pipe of the pump or downstream of control edges, this dissolved air may transform into undissolved air. The undissolved air content represents a risk of cavitation and of the diesel effect. This results in material erosion of components and increased hydraulic fluid aging.

With the correct measures, such as suction pipe and reservoir design, and an appropriate hydraulic fluid, air intake and separation can be positively influenced.

See also chapter 3.1.7 "Air separation ability (ASA)".

4.10 Water

Water contamination in hydraulic fluids can result from direct ingress or indirectly through condensation of water from the air due to temperature variations.

Water in the hydraulic fluid may result in wear or direct failure of hydraulic components. Furthermore, a high water content in the hydraulic fluid negatively affects aging and filterability and increases susceptibility to cavitation.

Undissolved water can be drained from the bottom of the reservoir. Dissolved water can be removed only by using appropriate measures. If the hydraulic system is used in humid conditions, preventive measures need to be taken, such as an air dehumidifier at the reservoir vent. During operation, the water content in all hydraulic fluids, determined according to the "Karl Fischer method" (see chapter 6 "Glossary") for all hydraulic fluids must constantly be kept below 0.1% (1000 ppm). To ensure a long service life of both hydraulic fluids and components, Bosch Rexroth recommends that values below 0.05% (500 ppm) are permanently maintained.

To ensure a long service life for the hydraulic fluids and the components, we recommend that values below 0.05 % (500 ppm) are permanently maintained. Detergent and or dispersant hydraulic fluids (HLPD / HVLPD) are able to absorb (and keep suspended) more water. Prior to using these hydraulic fluids, please contact the lubricant manufacturer.

4.11 Fluid servicing, fluid analysis and filtration

Air, water, operating temperature influences and solid matter contamination will change the performance characteristics of hydraulic fluids and cause them to age.

To preserve the usage properties and ensure a long service life for hydraulic fluid and components, the monitoring of the fluid condition and a filtration adapted to the application requirements (draining and degassing if required) are indispensable.

The effort is higher in the case of unfavorable usage conditions, increased stress for the hydraulic system or high expectations as to availability and service life, see chapter 2 "Solid particle contamination and cleanliness level".

When commissioning a system, please note that the required minimum cleanliness level can frequently be attained only by flushing the system. Due to severe start-up contamination, it may be possible that a fluid and/or filter replacement becomes necessary after a short operating period (< 50 operating hours).

The hydraulic fluid must be replaced in regular intervals and tested by the lubricant manufacturer or recognized, accredited test labs. **We recommend a reference analysis after commissioning.**

The minimum data to be tested for analyses are:

- Viscosity at 40 °C and 100 °C
- Neutralization number NN (acid number AN)
- Water content (Karl-Fischer method)
- Particle measurement with evaluation according to ISO 4406 or mass of solid foreign substances with evaluation to EN 12662
- Element analysis (RFA (EDX) / ICP, specify test method)
- Comparison with new product or available trend analyses
- Assessment / evaluation for further use
- Also recommended: IR spectrum

Compared to the pure unused hydraulic fluid, the changed neutralization number NN (acid number AN) indicates how many aging products are contained in the hydraulic fluid. This value must be kept as low as possible. As soon as the trend analysis notes a significant increase in the acid number, the lubricant manufacturer should be contacted.

In case of warranty, liability or guarantee claims to Bosch Rexroth, service verification and/or the results of fluid analyses are to be provided.

5 Disposal and environmental protection

Hydraulic fluids based on mineral oil and related hydrocarbons are hazardous for the environment. They are subject to a special disposal obligation.

The respective lubricant manufacturers provide specifications on environmentally acceptable handling and storage. Please ensure that spilt or splashed fluids are absorbed with appropriate adsorbents or by a technique that prevents it contaminating water courses, the ground or sewerage systems.

It is also not permitted to mix fluids when disposing of hydraulic fluids. Regulations governing the handing of used oils stipulate that used oils are not to mixed with other products, e.g. substances containing halogen. Non-compliance will increase disposal costs. Comply with the national legal provisions concerning the disposal of the corresponding hydraulic fluid. Comply with the local safety data sheet of the lubricant manufacturer for the country concerned.

6 Other hydraulic fluids based on mineral oil and related hydrocarbons

Table 6: Other hydraulic fluids based on mineral oils and related hydrocarbons

Serial number	Hydraulic fluids	Features / Typical field of application / Notes
1	Hydraulic fluids with classification HL, HM, HV according to ISO 11158	– Can be used without confirmation provided they are listed in the respective product data sheet and are compliant with DIN 51524. Conformity with DIN 51524 must be verified in the technical data sheet of the fluid concerned. For classification see Table 4: "Hydraulic fluid classification". – Fluids **only** classified in accordance with ISO 11158 may be used only with prior written approval of Bosch Rexroth AG.
2	Hydraulic fluids with classification HH, HR, HS, HG according to ISO 11158	– May not be used.
3	Hydraulic fluids with classification HL, HLP, HLPD, HVLP, HVLPD to DIN 51502	– DIN 51502 merely describes how fluids are classified / designated on a national level. – It contains no information on minimum requirements for hydraulic fluids. – Hydraulic fluids standardized according to DIN 51502 can be used without confirmation provided they are listed in the respective product data sheet and are compliant with DIN 51524. Conformity with DIN 51524 must be verified in the technical data sheet of the fluid concerned. For classification see Table 4: "Hydraulic fluid classification".
4	Hydraulic fluids with classification HH, HL, HM, HR, HV, HS, HG according to ISO 6743-4	– ISO 6743-4 merely describes how fluids are classified / designated on an international level. It contains no information on minimum requirements for hydraulic fluids. – Hydraulic fluids standardized according to ISO 6743 -4 can be used without confirmation provided they are listed in the respective product data sheet and are compliant with DIN 51524. Conformity with DIN 51524 must be verified in the technical data sheet of the fluid concerned. For classification see table 4: "Classification and fields of application".
5	Lubricants and regulator fluids for turbines to DIN 51515-1 and -2	– Turbine oils can be used after confirmation and with limited performance data. – They usually offer lower wear protection than mineral oil HLP. Classification of turbine oils to DIN 51515-1 comparable to HL, turbine oils to DIN 51515-2 comparable to HLP. – Particular attention must be paid to material compatibility!
6	Lube oils C, CL, CLP in accordance with DIN 51517	– Lube oils in acc. with DIN 51517 can be used after confirmation and with limited performance data. They are mostly higher-viscosity fluids with low wear protection. Classification: CL similar to HL fluids and CLP similar to HLP fluids. – Particular attention must be paid to material compatibility, specifically with non-ferrous metals!
7	Fluids to be used in pharmaceutical and foodstuff industries, in acc. with FDA / USDA / NSF H1	– There are medical white oils and synthetic hydrocarbons (PAO). – Can only be used after consultation and approval for use in the specific application, even if they are compliant with DIN 51524. – May be used only with FKM seals. – Other fluids used in pharmaceutical and foodstuff industries may be used only after confirmation. – Attention is to be paid to material compatibility in accordance with the applicable food law. **Caution!** Fluids used in pharmaceutical and foodstuff industries should not be confused with environmentally acceptable fluids!

Continued on page 13

Table 6: Other hydraulic fluids based on mineral oils and related hydrocarbons
(continued from page 12)

Serial number	Hydraulic fluids	Features / Typical field of application / Notes
8	Hydraulic fluids of classes HVLP and HVLPD based on related hydrocarbons	– Can only be used after consultation and approval for use in the specific application, even if they are compliant with DIN 51524. – Lower pour point than HLP – Other wetting (polarity)
9	Automatic Transmission Fluids (ATF)	– ATF are operating fluids for automatic gearboxes in vehicles and machines. In special cases, ATFs are also used for certain synchronous gearboxes and hydraulic systems comprising gearboxes. – To be used only after confirmation! – Some of these fluids have poor air separation abilities and modified wear properties. – Check material compatibility and filterability!
10	Multi-purpose oil (MFO) – Industry	– Multi-purpose oils (industry) combine at least two requirements for a fluid, for instance metal machining and hydraulics. – To be used only after confirmation! – Please pay particular attention to air separation ability, modified wear properties and the reduced material life cycle. – Check material compatibility and filterability!
11	Multi-purpose oils (MFO) – Mobil UTTO, STOU	– Multi-purpose oils combine requirements for wet brakes, gearboxes, motor oil (STOU only) and hydraulics. – Fluids of the types: – UTTO (= universal tractor transmission oil) and – STOU (= Super Tractor super tractor universal oil) – To be used only after confirmation! – Please pay particular attention to shear stability, air separation ability and modified wear properties. – Check material compatibility and filterability!
12	Single-grade engine oils 10W, 20W, 30W	– To be used only after confirmation! – Please pay particular attention to the air separation ability and filtering ability.
13	Multi-grade engine oils 0Wx-30Wx	– To be used only after confirmation! – Please pay particular attention to air separation ability, changes in wear protection capability, viscosity changes during operation, material compatibility, dispersant and detergent properties and filterability. **Caution!** Multi-grade engine oils have been adapted to specific requirements in combustion engines and are suitable for use in hydraulic systems only to a limited extent.
14	Hydraulic fluids for military applications to MIL 13919 or H 540, MIL 46170 or H 544, MIL 5606 or H 515, MIL 83282 or H 537, MIL 87257	– To be used only after confirmation! – Please pay particular attention to air separation ability, changes in wear protection capability, viscosity changes during operation, material compatibility, water separation capability and filterability. **Caution!** Hydraulic fluids for military applications do not meet the current requirements for high-quality hydraulic fluids and are suitable for use only to a limited degree.
15	Motor vehicle transmission oils	– Motor vehicle transmission oil can be used after confirmation and with limited performance data. – Pay particular attention to wear protection, material compatibility, specifically with non-ferrous metals, as well as viscosity!

Continued on page 14

Table 6: Other hydraulic fluids based on mineral oils and related hydrocarbons
(continued from page 13)

Serial number	Hydraulic fluids	Features / Typical field of application / Notes
16	Diesel, test diesel in acc. with DIN 4113	– Diesel / test diesel has poorer wear protection capabilities and a very low viscosity (< 3 mm²/s). – May be used only with FKM seals – Please note their low flash point! – To be used only after confirmation and with limited performance data!
17	Hydraulic fluids for roller processes	– Hydraulic fluids for roller processes have lower wear protection capabilities than mineral oil HLP and a lower viscosity – Please note their low flash point! – Hydraulic fluids for roller processes with limited performance data can be used only after confirmation.
18	Fluids for power steering, hydro-pneumatic suspension, active chassis etc.	– Can only be used after consultation and approval for use in the specific application, even if they are compliant with DIN 51524. – Please note the low viscosity! – In most cases they have poor water separation capability – Check the material compatibility!

7 Glossary

Additivation
Additives are chemical substances added to the basic fluids to achieve or improve specific properties.

Aging
Hydraulic fluids age due to oxidation (see chapter 3.1.5 "Aging resistance"). Liquid and solid contamination acts as a catalyzer for aging, meaning that it needs to be minimized as far as possible by careful filtration.

API classification
Classification of basic fluids by the **A**merican **P**etroleum **I**nstitute (API) – the largest association representing the US oil and gas industry.

Arrhenius equation
The quantitative relation between reaction rate and temperature is described by an exponential function, the Arrhenius equation. This function is usually visualized within the typical temperature range of the hydraulic system. For a practical example, see chapter 3.1.5 "Aging resistance".

Related hydrocarbons
Related hydrocarbons are hydrocarbon compounds that are not classified as API class 1, 2 or 5.

Basic fluids
In general, a hydraulic fluid is made up of a basic fluid, or base oil, and chemical substances, the so-called additives. The proportion of basic fluid is generally greater than 90%.

Demulsifying
Ability of a fluid to separate water contamination quickly; achieved with careful selection of base oil and additives.

Detergent
Ability of certain additives to emulsify part of the water contamination in the oil or to hold it in suspension until it has evaporated with increasing temperature. Larger water quantities, in contrast (above approx. 2 %), are separated immediately.

Dispersant
Ability of certain additives to keep insoluble liquid and solid contamination in suspension in the fluid.

Diesel effect
If hydraulic fluid that contains air bubbles is compressed quickly, the bubbles are heated to such a degree that a self-ignition of the air-gas mix may occur. The resultant temperature increase may lead to seal damage and increased aging of the hydraulic fluid.

Hydraulic fluids based on mineral oils
Hydraulic fluids based on mineral oils are made from petroleum (crude oil).

ICP (atomic emission spectroscopy)
The ICP procedure can be used to determine various wear metals, contamination types and additives. Practically all elements in the periodic system can be detected with this method.

Karl Fischer method
Method to determine the water content in fluids. Indirect coulometric determination procedure in accordance with DIN EN ISO 12937 in connection with DIN 51777-2. Only the combination of both standards will assure adequately accurate measured values.

Cavitation
Cavitation is the creation of cavities in fluids due to pressure reduction below the saturated vapour pressure and subsequent implosion when the pressure increases. When the cavities implode, extremely high acceleration, temperatures and pressure may occur temporarily, which may damage the component surfaces.

Neutralization number (NN)
The neutralization number (NN) or acid number (AN) specifies the amount of caustic potash required to neutralize the acid contained in one gram of fluid.

Pour point
The lowest temperature at which the fluid still just flows when cooled down under set conditions. The pour point is specified in the lubricant manufacturers' technical data sheets as a reference value for achieving this flow limit.

RFA (wavelength dispersive x-ray fluorescence analysis)
Is a procedure to determine nearly all elements in liquid and solid samples with nearly any composition. This analysis method is suitable for examining additives and contamination, delivering fast results.

Shearing/shear loss
Shearing of molecule chains during operation can change the viscosity of hydraulic fluids with long chain VI enhancers. The initially high viscosity index drops. This needs to be taken into account when selecting the hydraulic fluid.

The only value at present that can be used to assess viscosity changes in operation is the result of the test in accordance with DIN 51350 part -6. Please note that there are practical applications that create a much higher shear load on such hydraulic fluids than can be achieved by this test.

Stick-slip effect (sliding)
Interaction between a resilient mass system involving friction (such as cylinder + oil column + load) and the pressure increase at very low sliding speeds. The static friction of the system is a decisive value here. The lower it is, the lower the speed that can still be maintained without sticking. Depending on the tribologic system, the stick-slip effect may lead to vibrations generated and sometimes also to significant noise emission. In many cases, the effect can be attenuated by replacing the lubricant.

Viscosity
Viscosity is the measure of the internal friction of a fluid to flow. It is defined as the property of a substance to flow under tension. Viscosity is the most important characteristic for describing the load-bearing capacity of a hydraulic fluid.

Kinematic viscosity is the ratio of the dynamic viscosity and the density of the fluid; the unit is mm^2/s. Hydraulic fluids are classified by their kinematic viscosity into ISO viscosity classes. The reference temperature for this is 40 °C.

Viscosity index (VI)
Refers to the viscosity temperature behavior of a fluid.
The lower the change of viscosity in relation the temperature, the higher the VI.

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

No statements concerning the suitability of a hydraulic fluid for a specific purpose can be derived from our information. The information given does not release the user from the obligation of own judgment and verification.

It must be remembered that our products are subject to a natural process of wear and aging.

Subject to change.

Rexroth
Bosch Group

Environmentally acceptable hydraulic fluids

RE 90221/05.12 1/14
Replaces: 05.10

Application notes and requirements for Rexroth hydraulic components

Hydraulic fluids

Title	Hydraulic fluids based on mineral oils and related hydrocarbons	**Environmentally acceptable hydraulic fluids**	Fire-resistant, water-free hydraulic fluids	Fire-resistant, water-containing hydraulic fluids
Standard	DIN 51524	**ISO 15380**	ISO 12922	ISO 12922
Data sheets	RE 90220	**RE 90221**	RE 90222	RE 90223 (in preparation)
Classification	HL HLP HLPD HVLP HLPD and more	**HEPG HEES partially saturated HEES saturated HEPR HETG**	HFDR HFDU (ester base) HFDU (glycol base) and more	HFC HFB HFAE HFAS

Contents

1 Basic information

1.1 General instructions

The hydraulic fluid is the common element in any hydraulic component and must be selected very carefully. Quality and cleanliness of the hydraulic fluid are decisive factors for the operational reliability, efficiency and service life of a system.

Hydraulic fluids must conform, be selected and used in accordance with the generally acknowledged rules of technology and safety provisions. Reference is made to the country-specific standards and directives (in Germany the directive of the Employer's Liability Insurance Association BGR 137).

This data sheet includes recommendations and regulations concerning the selection, operation and disposal of environmentally compatible hydraulic fluids in the application of Rexroth hydraulic components.

The individual selection of hydraulic fluid or the choice of classification are the responsibility of the operator.

It is the responsibility of the user to ensure that appropriate measures are taken for safety and health protection and to ensure compliance with statutory regulations. The recommendations of the lubricant manufacturer and the specifications given in the safety data sheet are to be observed when using hydraulic fluid.

This data sheet does not absolve the operator from verifying the conformity and suitability of the respective hydraulic fluid for his system. He is to ensure that the selected fluid meets the minimum requirements of the relevant fluid standard during the whole of the period of use.

Other regulations and legal provisions may also apply. The operator is responsible for their observance, e.g. EU directive 2004/35/EG, 2005/360/EG and their national implementation. In Germany the Water Resources Act (WHG) is also to be observed.

We recommend that you maintain constant, close contact with lubricant manufacturers to support you in the selection, maintenance, care and analyses.

When disposing of used hydraulic fluids, apply the same care as during use.

Environmentally acceptable hydraulic fluids have been used successfully for many years. In some countries, the use of environmentally acceptable hydraulic fluids is already prescribed in ecologically sensitive areas (e.g. forestry, locks, weirs).

Environmentally acceptable hydraulic fluids may only be used in the pharmaceutical and food industry subject to required certification to FDA/USDA/NSF **H1**.

1.2 Environmental compatibility

There is no unambiguous legal definition for environmentally acceptable hydraulic fluids as different testing procedures can be applied for biological degradation and toxicity.

According to ISO 15380 the definition of "environmentally acceptable" is as follows: Humans, animals, plants, air and soil must not be endangered. With regard to hydraulic fluids in an unused condition in the bin this mainly means:

– biological degradation at least 60 % (according to ISO 14593 or ISO 9439)
– acute fish toxicity at least 100 mg/l (according to ISO 7346-2)
– acute daphnia toxicity at least 100 mg/l (according to ISO 5341)
– acute bacteria toxicity at least 100 mg/l (according to ISO 8192)

The same amount of care should be taken when handling environmentally acceptable hydraulic fluids as for mineral oils, leakage from the hydraulic system should be avoided. Environmentally acceptable hydraulic fluids are designed so that in the event of accidents and leakage,less permanent environmental damage is caused than by mineral oils, see also chapter 5 "Disposal and environmental protection".

In comparison to mineral oil HLP/HVLP , the biological degradation of environmentally acceptable hydraulic fluids may change fluid aging, see chapter 3.1.5 "Aging resistance", 3.1.6. "Biological degradation" and 4 "Hydraulic fluids in operation".

1.3 Scope

This data sheet must be applied when using environmentally acceptable hydraulic fluids with Rexroth hydraulic components. The specifications of this data sheet may be further restricted by the specification given in the data sheets for the individual components.

The use of the individual environmentally acceptable hydraulic fluids in accordance with the intended purpose can be found in the safety data sheets or other product description documents of the lubricant manufacturers. In addition, each use is to be individually considered.

Rexroth hydraulic components may only be operated with environmentally acceptable hydraulic fluids according to ISO 15380 if specified in the respective component data sheet or if a Rexroth approval for use is furnished.

The manufacturers of hydraulic systems must adjust their systems and operating instructions to the environmentally acceptable hydraulic fluids.

Notes:
In the market overview RE 90221-01, environmentally acceptable hydraulic fluids based on mineral oil are described which, according to the information of the lubricant manufacturer, feature the respective parameters of the current requirements standard ISO 15380 and other parameters which are of relevance for suitability in connection with Rexroth components.

These specifications are not checked or monitored by Bosch Rexroth. The list in the market overview does not therefore represent a recommendation on the part of Rexroth or approval of the respective hydraulic fluid for use with Rexroth components and does not release the operator from his responsibility regarding selection of the hydraulic fluid.

Bosch Rexroth will accept no liability for its components for any damage resulting from failure to comply with the notes below.

1.4 Safety instructions

Hydraulic fluids can constitute a risk for persons and the environment. These risks are described in the hydraulic fluid safety data sheets. The operator is to ensure that a current safety data sheet for the hydraulic fluid used is available and that the measures stipulated therein are complied with.

2 Solid particle contamination and cleanliness levels

Solid particle contamination is the major reason for faults occurring in hydraulic systems. It may lead to a number of effects in the hydraulic system. Firstly, single large solid particles may lead directly to a system malfunction, and secondly small particles cause continuous elevated wear.

For mineral oils, the cleanliness level of environmentally acceptable hydraulic fluids is given as a three-digit numerical code in accordance with ISO 4406. This numerical code denotes the number of particles present in a hydraulic fluid for a defined quantity. Moreover, foreign solid matter is not to exceed a mass of 50 mg/kg (gravimetric examination according to ISO 4405).

In general, compliance with a minimum cleanliness level of 20/18/15 in accordance with ISO 4406 or better is to be maintained in operation. Special servo valves demand improved cleanliness levels of at least 18/16/13. A reduction in cleanliness level by one level means half of the quantity of particles and thus greater cleanliness. Lower numbers in cleanliness levels should always be striven for and extend the service life of hydraulic components. The component with the highest cleanliness requirements determines the required cleanliness of the overall system. Please also observe the specifications in table 1: "Cleanliness levels according to ISO 4406" and in the respective data sheets of the various hydraulic components.

Hydraulic fluids frequently fail to meet these cleanliness requirements on delivery. Careful filtering is therefore required during operation and in particular, during filling in order to ensure the required cleanliness levels. Your lubricant manufacturer can tell you the cleanliness level of hydraulic fluids as delivered. To maintain the required cleanliness level over the operating period, you must use a reservoir breather filter. If the environment is humid, take appropriate measures, such as a breather filter with air drying or permanent off-line water separation.

Note: the specifications of the lubricant manufacturer relating to cleanliness levels are based on the time at which the container concerned is filled and not on the conditions during transport and storage.

Further information about contamination with solid matter and cleanliness levels can be found in brochure RE 08016.

Table 1: Cleanliness levels according to ISO 4406

Particles per 100 ml		Scale number
More than	Up to and including	
8,000,000	16,000,000	24
4,000,000	8,000,000	23
2,000,000	4,000,000	22
1,000,000	2,000,000	21
500,000	1,000,000	20
250,000	500,000	19
130,000	250,000	18
64000	130,000	17
32000	64000	16
16000	32000	15
8000	16000	14
4000	8000	13
2000	4000	12
1000	2000	11
500	1000	10
250	500	9
130	250	8
64	130	7
32	64	6

20 / 18 / 15

$> 4\ \mu m$ $> 6\ \mu m$ $> 14\ \mu m$

3 Selection of the hydraulic fluid

Environmentally acceptable hydraulic fluids for Bosch Rexroth hydraulic components are assessed on the basis of their fulfillment of the minimum requirements of ISO 15380.

3.1 Selection criteria for the hydraulic fluid

The specified limit values for all components employed in the hydraulic system, for example viscosity and cleanliness level, must be observed with the hydraulic fluid used, taking into account the specified operating conditions.

Hydraulic fluid suitability depends, amongst others, on the following factors:

3.1.1 Viscosity

Viscosity is a basic property of hydraulic fluids. The permissible viscosity range of complete systems needs to be determined taking account of the permissible viscosity of all components and it is to be observed for each individual component.

The viscosity at operating temperature determines the response characteristics of closed control loops, stability and damping of systems, the efficiency factor and the degree of wear.

We recommend that the optimum operating viscosity range of each component be kept within the permissible temperature range. This usually requires either cooling or heating, or both. The permissible viscosity range and the necessary cleanliness level can be found in the product data sheet for the component concerned.

If the viscosity of a hydraulic fluid used is above the permitted operating viscosity, this will result in increased hydraulic-mechanical losses. In return, there will be lower internal leakage losses. If the pressure level is lower, lubrication gaps may not be filled up, which can lead to increased wear. For hydraulic pumps, the permitted suction pressure may not be reached, which may lead to cavitation damage.

If the viscosity of a hydraulic fluid is below the permitted operating viscosity, increased leakage, wear, susceptibility to contamination and a shorter life cycle will result.

Please ensure that the permissible temperature and viscosity limits are observed for the respective components. This usually requires either cooling or heating, or both.

1

3.1.2 Viscosity-temperature behavior

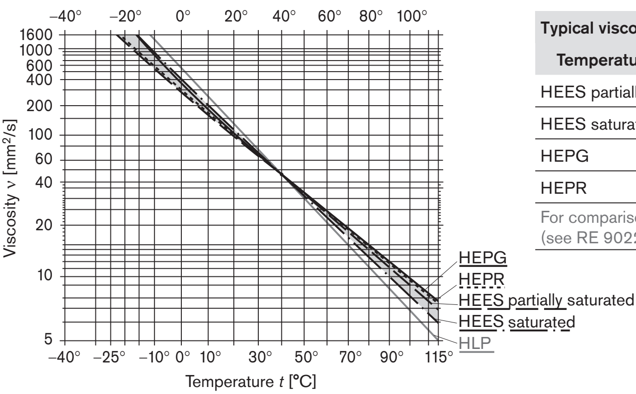
For hydraulic fluids, the viscosity temperature behavior (V-T behavior) is of particular importance. Viscosity is characterized in that it drops when the temperature increases and rises when the temperature drops. The interrelation between viscosity and temperature is described by the viscosity index (VI).

If exposed to the cold for several days, viscosity may rise significantly (HETG and HEES). After heating, the characteristic values as specified on the data sheet are restored. Please ask your lubricant manufacturer for the " Flow capacity after 7 days at low temperature" (ASTM D 2532) of fluid classifications HETG and partially saturated HEES.

All known environmentally acceptable hydraulic fluids have better viscosity temperature behavior than mineral oil HLP and generally feature greater shear stability than HVLP mineral oils. This should be taken into consideration when selecting hydraulic fluid for the required temperature range. A lower viscosity level can frequently be used to save any drive power during a cold start and avoid viscosity being too low at higher temperatures. The required viscosity and temperature limits in the product data sheets are to be observed in all operating conditions.

Depending on the basic fluid types/classes, VI indices can be achieved of 140–220, see Fig. 1: "Examples: V-T diagrams in comparison to HLP (reference values)" and Table 4: "Classification and fields of application of environmentally acceptable hydraulic fluids".

Fig. 1: Examples V-T diagrams in comparison to HLP (reference values, double-logarithmic representation)



Typical viscosity data [mm²/s]			
Temperature	–20 °C	40 °C	100 °C
HEES partially saturated	1250	46	9
HEES saturated	2500	46	8
HEPG	2500	46	10
HEPR	1400	46	10
For comparison HLP (see RE 90220)	4500	46	7

Detailed V-T diagrams may be obtained from your lubricant manufacturer for their specific products.

3.1.3 Wear protection capability

Wear protection capability describes the property of hydraulic fluids to prevent or minimize wear within the components. The wear protection capability is described in ISO 15380 via test procedures"FZG gear test rig" (ISO 14635-1) and "Mechanical test in the vane pump" (ISO 20763). From ISO VG 32, ISO 15380 prescribes a rating of at least 10 (FZG test). At present, the FZG test cannot be applied to viscosity classes < ISO VG 32. The wear protection capability of environmentally acceptable hydraulic fluids in relation to the two test procedures is comparable to that of mineral oil HLP/HVLP.

3.1.4 Material compatibility

The hydraulic fluid must not negatively affect the materials used in the components. Compatibility with coatings, seals, hoses, metals and plastics is to be observed in particular. The fluid classifications specified in the respective component data sheets are tested by the manufacturer with regard to material compatibility. Parts and components not supplied by us are to be checked by the user.

Table 2: Known material incompatibilities

Classification	Incompatible with:
HE... general	One-component color coatings, lead, galvanized zinc coatings, some non-ferrous metals, seals made of NBR. In some cases, the latter show major increases in volume when impermissibly aged hydraulic fluids come into contact with the material. NBR is only permitted by prior consent, please observe the customary seal and tube replacement intervals. Do not use any hydrolysis/susceptible polyurethane qualities. **Note** Please check seals and coatings of control cabinets, outer coatings of hydraulic components and accessories (connectors, cables, control cabinets) for resistance to vapors issuing from hydraulic fluids.
HETG/HEES	Zinc, some non-ferrous alloys with zinc
HEPG	Steel/aluminum tribocontacts, paper filters, polymethylmethacrylate (PMMA), NBR **Note** Check plastics for resistance

The material incompatibilities mentioned here do not automatically result in function problems. However the elements of the materials are found in the hydraulic fluids after use. The biological degradation of hydraulic fluids is negatively influenced.

3.1.5 Aging resistance

The way an environmentally acceptable hydraulic fluids ages depends on the thermal, chemical and mechanical stress to which it is subjected. The influence of water, air, temperature and contamination may be significantly greater than for mineral oils HLP/HVLP. Aging resistance can be greatly influenced by the chemical composition of the hydraulic fluids .

High fluid temperatures (e.g. over 80 °C) result in a approximate halving of the fluid service life for every 10 °C temperature increase and should therefore by avoided. The halving of the fluid service life results from the application of the Arrhenius equation (see Glossary).

Table 3: Reference values for temperature-dependent aging of the hydraulic fluid

Reservoir temperature	Fluid life cycle
80 °C	100 %
90 °C	50 %
100 °C	25 %

A modified aging test (without adding water) is prescribed for fluid classifications HETG and HEES. Hydraulic fluids with HEPG and HEPR classification are subjected to the identical test procedure as mineral oils (with 20 % water added). The calculated fluid service life is derived from the results of tests in which the long-term characteristics are simulated in a short period of time by applying more arduous conditions (condensed testing). This calculated fluid service life is not to be equated to the fluid service life in real-life applications.

Table 3 is a practical indicator for hydraulic fluids with water content < 0.1%, cf. chapter 4.10. "Water".

3.1.6 Biological degradation

Environmentally acceptable hydraulic fluids are ones which degrade biologically much faster than mineral oils. Biological degradation is a biochemical transformation effected by micro-organisms resulting in mineralization. For environmentally acceptable hydraulic fluids that make reference to ISO 15380, biological degradation according to ISO 14593 or ISO 9439 must be verified. 60% minimum degradation is defined as limit value. Proof of biological degradation is furnished for the new, unmixed, ready-formulated hydraulic fluids. Aged or mixed hydraulic fluids are less able to degrade biologically. Biological degradation outside the defined test procedure is subject to a variety of natural influences. The key factors are temperature, humidity, contamination, fluid concentration, type and quantity of micro-organisms. Environmentally acceptable hydraulic fluids require no extended maintenance in comparison to mineral oils, please observe chapter 4 "Hydraulic fluids in operation".

3.1.7 Air separation ability (ASA)

The air separation ability (ASA) describes the property of a hydraulic fluid to separate undissolved air. Hydraulic fluids always contain dissolved air. During operation, dissolved air may be transformed into undissolved air, leading to cavitation damages. Fluid classification, fluid product, reservoir size and design must be coordinated to take into account the dwell time and ASA value of the hydraulic fluid. The air separation capacity depends on the viscosity, temperature, basic fluid and aging. It cannot be improved by additives.

According to ISO 15380, for instance, an ASA value ≤ 10 minutes is required for viscosity class ISO VG 46, 6 minutes are typical, lower values are preferable.

3.1.8 Demulsifying ability and water solubility

The capacity of a hydraulic fluid to separate water at a defined temperature is known as the demulsifying ability. ISO 6614 defines the demulsifying properties of hydraulic fluids.

Fluids classified HETG, HEES and HEPR separate from water. HETG and HEES hydraulic fluids have a different water separation ability to mineral oil HLP/HVLP. At 20 °C, in comparison to mineral oil HLP/HVLP, a multiple (> factor 3) of water can separate in the hydraulic fluid. Water solubility is also more temperature-dependent than for mineral oils. With regard to water solubility, HEPR hydraulic fluids behave like HVLP hydraulic fluids (see RE 90220). In the majority of cases, HEPG-classified fluids HEPG dissolve water completely , see chapter "4.10 Water".

3.1.9 Filterability

Filterability describes the ability of a hydraulic fluid to pass through a filter, removing solid contaminants. The hydraulic fluids used require a good filterability, not just when new, but also during the whole of their service life. Depending on the different basic fluids (glycols, saturated and partially saturated ester oils, hydrocrack oils, polyalpha olefins, triglycerides) and additives (VI enhancers), there are great differences here.

The filterability is a basic prerequisite for cleanliness, servicing and filtration of hydraulic fluids. Rexroth therefore requires the same degree of filterability of environmentally acceptable hydraulic fluids as for mineral oils HLP/HVLP to DIN 51524. As ISO 15380 does not comment on the filterability of hydraulic fluids, filterability comparable to that of mineral oils HLP/HVLP must be requested of lubricant manufacturers.

Filterability is tested with the new hydraulic fluid and after the addition of 0.2 % water. The underlying standard (ISO 13357-1/-2) stipulates that filterability must have no negative effects on the filters or the hydraulic fluid, see chapter 4 "Hydraulic fluids in operation".

3.1.10 Corrosion protection

Hydraulic fluids should not just prevent corrosion formation on steel components, they must also be compatible with non-ferrous metals and alloys. Corrosion protection tests on different metals and metal alloys are described in ISO 15380. Hydraulic fluids that are not compatible with the materials listed above must not be used, even if they are compliant with ISO 15380.

Rexroth components are usually tested with HLP hydraulic fluids or corrosion protection oils based on mineral oils before they are delivered.

3.1.11 Additivation

The properties described above can be modified with the help of suitable additives. Environmentally acceptable hydraulic fluids should never contain heavy metals. According to the present state of knowledge, all hydraulic fluids, regardless of additivation, can be filtered with all customary filter materials in all known filtration ratings (≥ 0.8 µm), without filtering out effective additives at the same time.

Bosch Rexroth does not prescribe any specific additive system.

3.2 Classification and fields of application

Table 4: Classification and fields of application

Classification	Features	Typical field of application	Notes
HEPG according to ISO 15380 Density at 15 °C: typically > 0.97 kg/dm³ VI: typical > 170	Basic fluid, glycols	Systems on exposed water courses (locks, weirs, dredgers)	For information on approved components, please refer to the respective product data sheet. For components which have not been approved according to the product data sheet, please consult your Bosch Rexroth sales partner. – Very good viscosity/temperature characteristics, shear stability – Resistant to aging – Incompatible with mineral oil (exceptions must be confirmed by the lubricant manufacturer) – Can be water-soluble – Can be mixed with water – Very good wear protection properties – A higher implementation temperature with the same viscosity in comparison to mineral oil is to be expected – Due to the higher density in comparison to HLP, lower suction pressures are to be anticipated for pumps. Reduce the maximum speed as required and optimize suction conditions. – Classified as insignificantly water-endangering (water hazard class WGK 1) – Prior to commissioning, contact the lubricant manufacturer, as the components are tested with mineral oil HLP/corrosion protection oil.
HEES partially saturated according to ISO 15380 Density at 15 °C: typically 0.90–0.93 kg/dm³ VI: typical > 160 Iodine count < 90	Basic fluid: Ester based on renewable raw materials, synthetic esters, mixtures of various esters, mixtures with polyalphaolefines (< 30%)	Suitable for most fields of application and components.	For information on approved components, please refer to the respective product data sheet. For components which have not been approved according to the product data sheet, please consult your Bosch Rexroth sales partner. – Preferred use of FKM seals. Please enquire for shaft seal rings and implementation temperatures under –15 °C. – In operation, a higher temperature in comparison to mineral oil HLP/HVLP is to be expected given identical design and viscosity – Limit lower (depending on viscosity class) and upper implementation temperatures (maximum 80 °C due to aging) – Good viscosity/temperature characteristics, shear stability. – Good corrosion protection, if correspondingly additivized – Mostly classed as insignificantly water-endangering (water hazard class WGK 1), in some cases as not water-endangering – High dirt dissolving capacity on fluid changeovers – In unfavorable operating conditions (high water content, high temperature), HEES on ester basis have a tendency to hydrolysis. The acidic organic decomposition products can chemically attack materials and components.

Continued on page 9

Table 4: Classification and fields of application (continued from page 8)

Classification	Features	Typical field of application	Notes
HEES saturated according to ISO 15380 Density at 15 °C: typically 0.90–0.93 kg/dm³ VI: typical 140–160 Iodine count <15	Basic fluid: Ester based on renewable raw materials, synthetic esters, mixtures of various esters, mixtures with polyalphaolefines (< 30%)	Suitable for most fields of application and components. Saturated HEES should be preferred over partially saturated HEES and HETG for components and systems exposed to high stress levels.	For information on approved components, please refer to the respective product data sheet. For components which have not been approved according to the product data sheet, please consult your Bosch Rexroth sales partner. – Preferred use of FKM seals. Please enquire for shaft seal rings and implementation temperatures under –15 °C. – In operation, a higher temperature in comparison to mineral oil HLP/HVLP is to be expected given identical design and viscosity – Good viscosity/temperature characteristics, shear stability – Good corrosion protection, if correspondingly additivized – Mostly classed as insignificantly water-endangering (water hazard class WGK 1), in the case of low viscosity classes (up to ISO VG 32) also classed as not water-endangering – High dirt dissolving capacity on fluid changeovers
HEPR according to ISO 15380 Density at 15 °C: typically 0.87 kg/dm³ VI : typical 140–160	Basic fluid: synthetically manufactured hydrocarbons (polyalpha olefins PAO) partly mixed with esters (< 30 %)	Suitable for most fields of application and components. HEPR should be preferred over partially saturated HEES and HETG for components and systems exposed to high stress levels.	For information on approved components, please refer to the respective product data sheet. For components which have not been approved according to the product data sheet, please consult your Bosch Rexroth sales partner. – Behaves similarly to HVLP- hydraulic fluids, individual products comply with ISO 15380 HEPR and DIN 51524-3 HVLP – Preferred use of FKM seals. Please enquire for shaft seal rings and implementation temperatures under –15 °C. – Good viscosity-temperature behavior – Classified as insignificantly water-endangering (water hazard class WGK 1) **Note:** Note shear stability (see chapter 4.11 "Fluid servicing, fluid analysis and filtration" and chapter 6 "Glossary")
HETG according to ISO 15380 Density at 15 °C: typically 0.90-0.93 kg/dm³ VI: typical > 200 Iodine count > 90	Basic fluid: vegetable oils and triglycerides	Not recommended for Rexroth components!	Practical requirements are frequently not fulfilled by hydraulic fluids in this classification. Use only permissible after consultation. – Viscosity is not stable over time – Very fast fluid aging, very hydrolysis-susceptible (please observe neutralization number) – Tendency to gumming, gelling and setting. – Limit the lower (depending on viscosity class) and upper implementation temperatures (see chapter 3.1.5) – Only limited material compatibility – Filterability problems at water ingress – High dirt dissolving capacity on fluid changeovers – Mostly classed as not water-endangering

1

4 Hydraulic fluids in operation

4.1 General

The properties of hydraulic fluids can change continually during storage and operation.

Please note that the fluid standard ISO 15380 merely describes minimum requirements for hydraulic fluids in new condition at the time of filling into the bins. The operator of a hydraulic system must ensure that the hydraulic fluid remains in a utilizable condition throughout its entire period of use.

Deviations from the characteristic values are to be clarified with the lubricant manufacturer, the test labs or Bosch Rexroth.

Bosch Rexroth will accept no liability for damage to its components within the framework of the applicable liability legislation insofar as the latter is due to non-observance of the following instructions.

Please note the following aspects in operation.

4.2 Storage and handling

Hydraulic fluids must be stored correctly in accordance with the instructions of the lubricant manufacturer. Avoid exposing the containers to lengthy periods of direct heat. Containers are to be stored in such a way that the risk of any foreign liquid or solid matter (e.g. water, foreign fluids or dust) ingression into the inside of the container can be ruled out. After taking hydraulic fluids from the containers, these are immediately to be properly resealed.

Recommendation:

– Store containers in a dry, roofed place

– Store barrels on their sides

– Clean reservoir systems and machine reservoirs regularly

4.3 Filling of new systems

Usually, the cleanliness levels of the hydraulic fluids as delivered do not meet the requirements of our components. Hydraulic fluids must be filtered using an appropriate filter system to minimize solid particle contamination and water in the system.

As early as possible during test operation, new systems should be filled with the selected hydraulic fluid so as to reduce the risk of accidentally mixing fluids (see chapter 4.5 "Mixing and compatibility of different hydraulic fluids"). Changing the hydraulic medium at a later point represents significant additional costs (see following chapter).

4.4 Hydraulic fluid changeover

In particular with the changeover from mineral oils to environmentally acceptable hydraulic fluids, but also from one environmentally acceptable hydraulic fluids to another, there may be interference (e.g. incompatibility in the form of gelling, silting, stable foam or reduced filterability or filter blockage).

In the case of changeovers of the fluid in hydraulic systems, it is important to ensure compatibility of the new hydraulic fluid with the remains of the previous hydraulic fluid. Bosch Rexroth recommends obtaining verification of compatibility from the manufacturer or supplier of the new hydraulic fluid. The quantity of old fluid remaining should be minimized. Mixing hydraulic fluids should be avoided, see following chapter.

For information on changing over hydraulic fluids with different classifications, please refer to VDMA 24314, VDMA 24569 and ISO 15380 appendix A.

Bosch Rexroth will not accept liability for any damage to its components resulting from inadequate hydraulic fluid changeovers!

4.5 Mixing and compatibility of different hydraulic fluids

If hydraulic fluids from different manufacturers or different types from the same manufacturer are mixed, gelling, silting and deposits may occur. These, in turn, may cause foaming, impaired air separation ability, malfunctions and damage to the hydraulic system.

If the fluid contains more than 2 % of another fluid then it is considered to be a mixture. Exceptions apply for water, see chapter 4.10 "Water".

Mixing with other hydraulic fluids is not generally permitted. This also includes hydraulic fluids with the same classification and from the market overview RE 90221-01. If individual lubricant manufacturers advertise miscibility and/or compatibility, this is entirely the responsibility of the lubricant manufacturer.

Bosch Rexroth customarily tests all components with mineral oil HLP before they are delivered.

Note: With connectible accessory units and mobile filtering systems, there is a considerable risk of non-permitted mixing of the hydraulic fluids!

Rexroth will not accept liability for any damage to its components resulting from mixing hydraulic fluids!

4.6 Re-additivation

Additives added at a later point in time such as colors, wear reducers, VI enhancers or anti-foam additives, may negatively affect the performance properties of the hydraulic fluid and the compatibility with our components and therefore are not permissible.

Rexroth will not accept liability for any damage to its components resulting from re-additivation!

4.7 Foaming behavior

Foam is created by rising air bubbles at the surface of hydraulic fluids in the reservoir. Foam that develops should collapse as quickly as possible.

Common hydraulic fluids in accordance with ISO 15380 are sufficiently inhibited against foam formation in new condition. On account of aging and adsorption onto surfaces, the defoamer concentration may decrease over time, leading to a stable foam.

Defoamers may be re-dosed only after consultation with the lubricant manufacturer and with his written approval.

Defoamers may affect the air separation ability.

4.8 Corrosion

The hydraulic fluid is to guarantee sufficient corrosion protection of components under all operating conditions, even in the event of impermissible water contamination.

Environmentally acceptable hydraulic fluids are tested for corrosion protection in the same way as mineral oil HLP/HVLP. When used in practice other corrosion mechanisms are revealed in detail and in individual cases, for the most part in contact with non-ferrous and white alloys.

4.9 Air

Under atmospheric conditions the hydraulic fluid contains dissolved air. In the negative pressure range, for instance in the suction pipe of the pump or downstream of control edges, this dissolved air may transform into undissolved air. The undissolved air content represents a risk of cavitation and of the diesel effect. This results in material erosion of components and increased hydraulic fluid aging.

With the correct measures, such as suction pipe and reservoir design, and an appropriate hydraulic fluid, air intake and separation can be positively influenced.

See also chapter 3.1.7 "Air separation ability (ASA)".

4.10 Water

Water contamination in hydraulic fluids can result from direct ingress or indirectly through condensation of water from the air due to temperature variations.

HEPG dissolves water completely. This means that any water that has ingressed into the system cannot be drained off in the sump of the reservoir.

In the case of hydraulic fluids classed HETG, HEES and HEPR undissolved water can be drained off from the reservoir sump, the remaining water content is however too high to ensure that the maximum permissible water limit values are observed in the long term.

Water in the hydraulic fluid can result in wear or direct failure of hydraulic components. Furthermore, a high water content in the hydraulic fluid negatively affects aging and filterability and increases susceptibility to cavitation. During operation, the water content in all hydraulic fluids, determined according to the "Karl Fischer method" (see chapter 6 "Glossary") for all environmentally acceptable hydraulic fluids must constantly be kept below 0.1% (1000 ppm). To ensure a long service life of both hydraulic fluids and components, Bosch Rexroth recommends that values below 0.05% (500 ppm) are permanently maintained.

Due to the higher water solubility (except for HEPR) in comparison to mineral oil HLP/HVLP it is urgently advised that precautions be taken when using environmentally acceptable hydraulic fluids, such as a dehumidifier on the reservoir ventilation.

Water content has an affect particularly in the case of HETG and partially saturated HEES in that it accelerates aging (hydrolysis) of the hydraulic fluid and biological degradation, see chapter 4.11 "Fluid servicing, fluid analysis and filtration".

4.11 Fluid servicing, fluid analysis and filtration

Air, water, operating temperature influences and solid matter contamination will change the performance characteristics of hydraulic fluids and cause them to age.

To preserve the usage properties and ensure a long service life for hydraulic fluid and components, the monitoring of the fluid condition and a filtration adapted to the application requirements (draining and degassing if required) are indispensable.

The effort is higher in the case of unfavorable usage conditions, increased stress for the hydraulic system or high expectations as to availability and service life, see chapter 2 "Solid particle contamination and cleanliness levels".

When commissioning a system, please note that the required minimum cleanliness level can frequently be attained only by flushing the system. Due to severe start-up contamination, it may be possible that a fluid and/or filter replacement becomes necessary after a short operating period (< 50 operating hours).

The hydraulic fluid must be replaced at regular intervals and tested by the lubricant manufacturer or recognized accredited test labs. **We recommend a reference analysis after commissioning.**

The minimum data to be tested for analyses are:

- Viscosity at 40 °C and 100 °C
- Neutralization number NN (acid number AN)
- Water content (Karl-Fischer method)
- Particle measurement with evaluation according to ISO 4406 or mass of solid foreign substances with evaluation to EN 12662
- Element analysis (RFA (EDX) / ICP, specify test method)
- Comparison with new product or available trend analyses
- Assessment / evaluation for further use
- Also recommended: IR spectrum"

Differences in the maintenance and upkeep of environmentally acceptable hydraulic fluids with the corresponding suitability characteristics (as required in market overview RE 90221-01) in comparison to mineral oil HLP/HVLP are not necessary. Attention is however drawn to the note in chapter 1.3.

After changing over hydraulic fluids it is recommended that the filters be replaced again after 50 operating hours as fluid aging products may have detached themselves ("self-cleaning effect").

Compared to the pure unused hydraulic fluid the changed neutralization number NN (acid number AN) indicates how many aging products are contained in the hydraulic fluid. This difference must be kept as low as possible. As soon as the trend analysis notes a significant increase in the values, the lubricant manufacturer should be contacted.

A higher viscosity than that of new materials indicates that the hydraulic fluid has aged. Evaluation by the test lab or lubricant manufacturers is however authoritative, whose recommendation should be urgently observed.

On systems where the possibility of water contamination cannot be completely ruled out (also condensation), it should be ensured via the hydraulic system circuit that fluid aging products are not accumulating in individual areas of the hydraulic system, but are being removed from the system in a controlled manner via the filtration system. This should be ensured via suitable hydraulic circuits (e.g. flushing circuit) or system manufacturer's operating instructions/specifications.

In case of warranty, liability or guarantee claims to Bosch Rexroth, service verification and/or the results of fluid analyses are to be provided.

5 Disposal and environmental protection

All environmentally acceptable hydraulic fluids, are like mineral oil-based hydraulic fluids, subject to special disposal obligations.

The respective lubricant manufacturers provide specifications on environmentally acceptable handling and storage. Please ensure that spilt or splashed fluids are absorbed with appropriate adsorbents or by a technique that prevents it contaminating water courses, the ground or sewerage systems.

It is also not permitted to mix fluids when disposing of hydraulic fluids. Regulations governing the handing of used oils stipulate that used oils are not to mixed with other products, e.g. substances containing halogen. Non-compliance will increase disposal costs. Comply with the national legal provisions concerning the disposal of the corresponding hydraulic fluid. Comply with the local safety data sheet of the lubricant manufacturer for the country concerned.

6 Glossary

Additivation
Additives are chemical substances added to the basic fluids to achieve or improve specific properties.

Aging
Hydraulic fluids age due to oxidation (see chapter 3.1.5 "Aging resistance"). Liquid and solid contamination acts as a catalyzer for aging, meaning that it needs to be minimized as far as possible by careful filtration. Please refer to Hydrolysis.

Arrhenius equation
The quantitative relation between reaction rate and temperature is described by an exponential function, the Arrhenius equation. This function is usually visualized within the typical temperature range of the hydraulic system. For a practical example, see chapter 3.1.5 "Aging resistance".

Basic fluids
In general, a hydraulic fluid is made up of a basic fluid, or base oil, and chemical substances, the so-called additives. The proportion of basic fluid is generally greater than 90%.

Diesel effect
If hydraulic fluid that contains air bubbles is compressed quickly, the bubbles are heated to such a degree that a self-ignition of the air-gas mix may occur. The resultant temperature increase may lead to seal damage and increased aging of the hydraulic fluid.

Saturated esters
Esters differ by the number of C atoms (chain length) and position of the bonds between the C atoms. Saturated esters do not have double/multiple bonds between C atoms and are therefore more resistant to aging than partially saturated esters.

Partially saturated esters
In contrast to saturated esters, partially saturated esters have double/multiple bonds between C atoms. Rexroth defines partially saturated esters as unsaturated bonds and mixtures of esters with unsaturated and saturated bonds. Esters with unsaturated bonds are produced on the basis of renewable raw materials.

Depending on their number and position, these unsaturated bonds between the C atoms are instable. These bonds can detach themselves and form new bonds, thus changing the properties of those liquids (an aging mechanism). One of the underlying requirements for inclusion in the market overview RE 90221-01 is an aging stability characteristic. Attention is however drawn to the note in chapter 1.3.

Hydrolysis
Hydrolysis is the splitting of a chemical bond through the reaction with water under the influence of temperature.

ICP (atomic emission spectroscopy)
The ICP procedure can be used to determine various wear metals, contamination types and additives. Practically all elements in the periodic system can be detected with this method..

Iodine count
The iodine count is a yardstick for the quantity of single and multiple unsaturated bonds between C atoms in the basic fluid. A low iodine count indicates that the hydraulic fluid contains few unsaturated bonds and is thus considerably more resistant to aging than a hydraulic fluid with a high iodine count. A statement about the position at which these multiple bonds are located and about how "stable" they are against influencing factors cannot be derived simply by stating the iodine count.

Karl Fischer method
Method to determine the water content in fluids. Indirect coulometric determination procedure in accordance with DIN EN ISO 12937 in connection with DIN 51777-2. Only the combination of both standards will assure adequately accurate measured values. For hydraulic fluids based on glycol, DIN EN ISO 12937 is to be applied in conjunction with DIN 51777-1.

Cavitation
Cavitation is the creation of cavities in fluids due to pressure reduction below the saturated vapour pressure and subsequent implosion when the pressure increases. When the cavities implode, extremely high acceleration, temperatures and pressure may occur temporarily, which may damage the component surfaces.

Neutralization number (NN)
The neutralization number (NN) or acid number (AN) specifies the amount of caustic potash required to neutralize the acid contained in one gram of fluid.

Pour point
The lowest temperature at which the fluid still just flows when cooled down under set conditions. The pour point is specified in the lubricant manufacturers' technical data sheets as a reference value for achieving this flow limit.

RFA (wavelength dispersive x-ray fluorescence analysis)
Is a procedure to determine nearly all elements in liquid and solid samples with nearly any composition. This analysis method is suitable for examining additives and contamination, delivering fast results.

Shearing/shear loss
Shearing of molecule chains during operation can change the viscosity of hydraulic fluids with long chain VI enhancers. The initially high viscosity index drops. This needs to be taken into account when selecting the hydraulic fluid.

The only value at present that can be used to assess viscosity changes in operation is the result of the test in accordance with DIN 51350 part -6. Please note that there are practical applications that create a much higher shear load on such hydraulic fluids than can be achieved by this test.

Stick-slip
Interaction between a resilient mass system involving friction (such as cylinder + oil column + load) and the pressure increase at very low sliding speeds. The static friction of the system is a decisive value here. The lower it is, the lower the speed that can still be maintained without sticking. Depending on the tribologic system, the stick-slip effect may lead to vibrations generated and sometimes also to significant noise emission. In many cases, the effect can be attenuated by replacing the lubricant.

Viscosity
Viscosity is the measure of the internal friction of a fluid to flow. It is defined as the property of a substance to flow under tension. Viscosity is the most important characteristic for describing the load-bearing capacity of a hydraulic fluid.

Kinematic viscosity is the ratio of the dynamic viscosity and the density of the fluid; the unit is mm^2/s. Hydraulic fluids are classified by their kinematic viscosity into ISO viscosity classes. The reference temperature for this is 40 °C.

Viscosity index (VI)
Refers to the viscosity temperature behavior of a fluid. The lower the change of viscosity in relation the temperature, the higher the VI.

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

Rexroth
Bosch Group

Fire-resistant, water-free hydraulic fluids (HFDR/HFDU)

Application notes and requirements for Rexroth hydraulic components

Hydraulic fluids

Title	Hydraulic fluids based on mineral oils and related hydrocarbons	Environmentally acceptable hydraulic fluids	**Fire-resistant, water-free hydraulic fluids**	Fire-resistant, water-containing hydraulic fluids
Standard	DIN 51524	ISO 15380	**ISO 12922**	ISO 12922
Data sheets	RE 90220	RE 90221	**RE 90222**	RE 90223 (in preparation)
Classification	HL HLP HLPD HVLP HLPD and more	HEPG HEES partially saturated HEES saturated HEPR HETG	**HFDR HFDU (ester base) HFDU (glycol base) and more**	HFC HFB HFAE HFAS

Contents

1 Basic information

1.1 General instructions

The hydraulic fluid is the common element in any hydraulic component and must be selected very carefully. Quality and cleanliness of the hydraulic fluid are decisive factors for the operational reliability, efficiency and service life of a system.

Hydraulic fluids must conform, be selected and used in accordance with the generally acknowledged rules of technology and safety provisions. Reference is made to the country-specific standards and directives (in Germany the directive of the Employer's Liability Insurance Association BGR 137).

This data sheet includes recommendations and regulations concerning the selection, operation and disposal of fire-resistant, water-free hydraulic fluids in the application of Rexroth hydraulic components.

The individual selection of hydraulic fluid or the choice of classification are the responsibility of the operator.

It is the responsibility of the user to ensure that appropriate measures are taken for safety and health protection and to ensure compliance with statutory regulations. The recommendations of the lubricant manufacturer and the specifications given in the safety data sheet are to be observed when using hydraulic fluid.

This data sheet does not absolve the operator from verifying the conformity and suitability of the respective hydraulic fluid for his system. He is to ensure that the selected fluid meets the minimum requirements of the relevant hydraulic fluid standard during the whole of the period of use.

The currently valid standard for fire-resistant hydraulic fluids is the ISO 12922. In addition, other, more detailed documents, guidelines, specifications and legislation may also be valid. The operator is responsible for ensuring that such regulations are observed, for example:

- 7th Luxembourg Report: Luxembourg, April 1994, Doc. No. 4746/10/91 EN "Requirements and tests applicable to fire-resistant hydraulic fluids for hydrostatic and hydrokinetic power transmission and control"
- VDMA 24314 (1981-11): "Changing hydraulic fluids – guidelines"
- VDMA 24317 (2005-11): "Fire-resistant hydraulic fluids – minimum technical requirements"
- FM Approval Standard 6930 (2009-04): "Flammability Classification of Industrial Fluids" (only available in English)
- DIN Technical Report CEN/TR 14489 (2006-01): "Selection guidelines for protecting safety, health and the environment"

We recommend that you maintain constant, close contact with lubricant manufacturers to support you in the selection, maintenance, care and analyses.

When disposing of used hydraulic fluids, apply the same care as during use.

1.2 Fire resistance

There is no clear legal definition of fire-resistant hydraulic fluids. There are great differences regarding fire resistance. The selection is the sole responsibility of the system operator with respect to requirements (application, construction and design of the system, hottest source in the system, necessary fire protection).

Different test procedures are applied for evaluating fire resistance.

Fire resistance test procedure according to ISO 12922:

- Ignition properties of spray according to ISO 15029-1 (Spray flame persistence – hollow-cone nozzle method)
- Ignition properties of spray according to ISO 15029-2 (Stabilized flame heat release)
- Wick flame persistence of fluids according to ISO 14935 (average flame persistence)
- Determination of the flammability characteristics of fluids in contact with hot surfaces, ignition process according to ISO 20823 (ignition temperature, flame spread)

In general, fire-resistant hydraulic fluids are distinguished between **water-containing** fire-resistant and **water-free** fire-resistant hydraulic fluids. Water-containing fire-resistant hydraulic fluids are described in RE 90223.

Water-free, fire-resistant hydraulic fluid means hydraulic fluids with a water-proportion of 0.1% by volume ("Karl Fischer method", see chapter 6 "Glossary"), measured at the time of filling in the transport container.

In Europe water-free, fire-resistant hydraulic fluids are not approved for use in underground coal mining. The classification HFDU is no longer included in the VDMA 24317: 2005.

Note
In contrast to water-containing fluids, all water-free, fire-resistant hydraulic fluids have a flash point and a fire point. Specific parameters for flash point and fire point can be found in the technical and/or safety data sheet for the hydraulic fluid concerned.

Just as much care should be taken when working with fire-resistant hydraulic fluids are with other hydraulic fluids, e.g. mineral oils. A leak from the hydraulic system must be avoided. The best and most cost-effective protection against fire and explosion is to prevent leakage with meticulous service, maintenance and care of the hydraulic system.

1.3 Scope

This data sheet must be applied when using water-free, fire-resistant hydraulic fluids with Rexroth hydraulic components. The specifications of this data sheet may be further restricted by the specifications given in data sheets for the individual components concerned.

The use of the individual water-free, fire-resistant hydraulic fluids in accordance with the intended purpose can be found in the safety data sheets or other product description documents of the lubricant manufacturers. In addition, each use is to be individually considered.

Rexroth hydraulic components may only be operated with water-free, fire-resistant hydraulic fluids according to ISO 12922 if specified in the respective component data sheet or if a Rexroth approval for use is furnished.

The manufacturers of hydraulic systems must adjust their systems and operating instructions to the water-free, fire-resistant hydraulic fluids.

Bosch Rexroth will accept no liability for its components for any damage resulting from failure to comply with the notes below.

1.4 Safety instructions

Hydraulic fluids can constitute a risk for persons and the environment. These risks are described in the hydraulic fluid safety data sheets. The operator is to ensure that a current safety data sheet for the hydraulic fluid used is available and that the measures stipulated therein are complied with.

2 Solid particle contamination and cleanliness levels

Solid particle contamination is the major reason for faults occurring in hydraulic systems. It may lead to a number of effects in the hydraulic system. Firstly, single large solid particles may lead directly to a system malfunction, and secondly small particles cause continuous elevated wear.

For mineral oils, the cleanliness level of water-free, fire-resistant hydraulic fluids is given as a three-digit numerical code in accordance with ISO 4406. This numerical code denotes the number of particles present in a hydraulic fluid for a defined quantity. Moreover, foreign solid matter is not to exceed a mass of 50 mg/kg (gravimetric examination according to ISO 4405).

In general, compliance with a minimum cleanliness level of 20/18/15 in accordance with ISO 4406 or better is to be maintained in operation. Special servo valves demand improved cleanliness levels of at least 18/16/13. A reduction in cleanliness level by one level means half of the quantity of particles and thus greater cleanliness. Lower numbers in cleanliness levels should always be striven for and extend the service life of hydraulic components. The component with the highest cleanliness requirements determines the required cleanliness of the overall system. Please also observe the specifications in table 1: "Cleanliness levels according to ISO 4406" and in the respective data sheets of the various hydraulic components.

Hydraulic fluids frequently fail to meet these cleanliness requirements on delivery. Careful filtering is therefore required during operation and in particular, during filling in order to ensure the required cleanliness levels. Your lubricant manufacturer can tell you the cleanliness level of hydraulic fluids as delivered. To maintain the required cleanliness level over the operating period, you must use a reservoir breather filter. If the environment is humid, take appropriate measures, such as a breather filter with air drying or permanent off-line water separation.

Note: the specifications of the lubricant manufacturer relating to cleanliness levels are based on the time at which the container concerned is filled and not on the conditions during transport and storage.

Further information about contamination with solid matter and cleanliness levels can be found in brochure RE 08016.

Table 1: Cleanliness levels according to ISO 4406

Particles per 100 ml		Scale number
More than	Up to and including	
8,000,000	16,000,000	24
4,000,000	8,000,000	23
2,000,000	4,000,000	22
1,000,000	2,000,000	21
500,000	1,000,000	20
250,000	500,000	19
130,000	250,000	18
64000	130,000	17
32000	64000	16
16000	32000	15
8000	16000	14
4000	8000	13
2000	4000	12
1000	2000	11
500	1000	10
250	500	9
130	250	8
64	130	7
32	64	6

20 / 18 / 15
$>$ 4 µm $>$ 6 µm $>$ 14 µm

3 Selection of the hydraulic fluid

Water-free, fire-resistant hydraulic fluids for Bosch Rexroth hydraulic components are assessed on the basis of their fulfillment of the minimum requirements of ISO 12922.

3.1 Selection criteria for the hydraulic fluid

The specified limit values for all components employed in the hydraulic system, for example viscosity and cleanliness level, must be observed with the hydraulic fluid used, taking into account the specified operating conditions.

Hydraulic fluid suitability depends, amongst others, on the following factors:

3.1.1 Viscosity

Viscosity is a basic property of hydraulic fluids. The permissible viscosity range of complete systems needs to be determined taking account of the permissible viscosity of all components and it is to be observed for each individual component.

The viscosity at operating temperature determines the response characteristics of closed control loops, stability and damping of systems, the efficiency factor and the degree of wear.

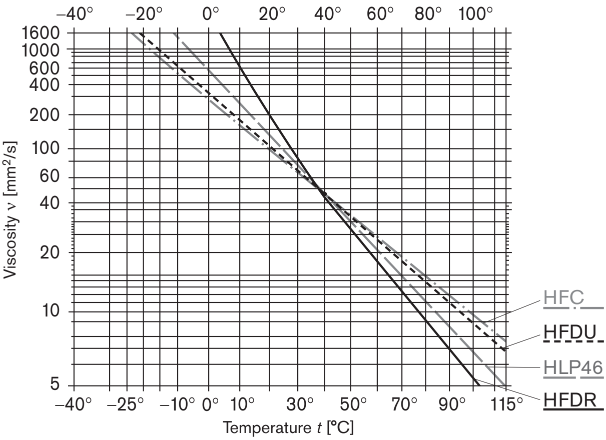
We recommend that the optimum operating viscosity range of each component be kept within the permissible temperature range. This usually requires either cooling or heating, or both. The permissible viscosity range and the necessary cleanliness level can be found in the product data sheet for the component concerned.

If the viscosity of a hydraulic fluid used is above the permitted operating viscosity, this will result in increased hydraulic-mechanical losses. In return, there will be lower internal leakage losses. If the pressure level is lower, lubrication gaps may not be filled up, which can lead to increased wear. For hydraulic pumps, the permitted suction pressure may not be reached, which may lead to cavitation damage.

If the viscosity of a hydraulic fluid is below the permitted operating viscosity, increased leakage, wear, susceptibility to contamination and a shorter component life cycle will result.

Please ensure that the permissible temperature and viscosity limits are observed for the respective components. This usually requires either cooling or heating, or both.

Fig. 1: Examples V-T diagrams for water-free, fire-resistant hydraulic fluids in comparison to HLP and HFC (reference values, double-logarithmic representation)



Typical viscosity data [mm²/s] at temperature	0 °C	40 °C	100 °C
HFDR	2500	43	5,3
HFDU (ester base)	330	46	9,2
HFDU (glycol base)	350	46	8,7
For comparison HLP (see RE 90220)	610	46	7
For comparison HFC (see RE 90223)	280	46	

Detailed V-T diagrams may be obtained from your lubricant manufacturer for their specific products. Descriptions of the individual classifications can be found in chapter 3.2 and in Table 4.

3.1.2 Viscosity-temperature behavior

For hydraulic fluids, the viscosity temperature behavior (V-T behavior) is of particular importance. Viscosity is characterized in that it drops when the temperature increases and rises when the temperature drops. The interrelation between viscosity and temperature is described by the viscosity index (VI).

For cold testing over a period of several days, the viscosity of ester-based HFDU can increase greatly. After heating, the characteristic values as specified on the data sheet are restored. Please ask your lubricant manufacturer for the "Flow capacity after seven days at low temperature" (ASTM D 2532) for the fluid classification ester-based HFDU .

HFDU fluid based on ester and glycol have better viscosity/temperature characteristics than mineral oil HLP (see Fig. 1). This should be taken into consideration when selecting hydraulic fluid for the required temperature range. The viscosity and temperature limits required in the product data sheets are to be observed in all operating conditions.

Note
For ambient temperatures below 0 °C, fire-resistant, **water-containing** hydraulic fluids of classification HFC are to be preferred because they observe the component-related viscosity ranges and because the have better pour points (see RE 90223).

3.1.3 Wear protection capability

Wear protection capability describes the property of hydraulic fluids to prevent or minimize wear within the components. The wear protection capability is described in ISO 12922 via test procedures"FZG gear test rig" (ISO 14635-1) and "Mechanical test in the vane pump" (ISO 20763). The wear protection capability of water-free, fire-resistant hydraulic fluids in relation to the two test procedures is comparable to that of mineral oil HLP/HVLP.

3.1.4 Material compatibility

The hydraulic fluid must not negatively affect the materials used in the components. Compatibility with coatings, seals, hoses, metals and plastics is to be observed in particular. The fluid classifications specified in the respective component data sheets are tested by the manufacturer with regard to material compatibility. Parts and components not supplied by us are to be checked by the user.

Table 2: Known material incompatibilities

Classification	Incompatible with:
HFD in general	Seals, plastics and coatings of control cabinets, outer coatings of hydraulic components and accessory components (connectors, wiring harnesses, control cabinets) are to be tested for stability. **Note:** hydraulic fluid vapors can also lead to incompatibility!
HFDR	Individual component color coating, lead, galvanic zinc-plating, in part non-ferrous metals with zinc, tin and aluminum in a tribological system. Sealing elements made of NBR. In some cases, the latter show major increases in volume when impermissibly aged hydraulic fluids come into contact with the material. Do not use any hydrolysis/susceptible polyurethane qualities.
HFDU based on ester	Single-component color coatings, lead, galvanized zinc coatings, in part non-ferrous metals with zinc, tin, seals made of NBR. In some cases, the latter show major increases in volume when impermissibly aged hydraulic fluids come into contact with the material. Do not use any hydrolysis/susceptible polyurethane qualities.
HFDU based on glycol	Single-component color coatings, steel/aluminum tribocontacts, paper filters, polymethylmethacrylate (PMMA). The compatibility of NBR is to be examined for individual case.

The material incompatibilities mentioned here do not automatically result in function problems. However the elements of the materials are found in the hydraulic fluids after use. The material incompatibilities described here may lead to accelerated aging of the hydraulic fluid and to reduced fire resistance.

3.1.5 Aging resistance

The way a water-free, fire-resistant hydraulic fluid ages depends on the thermal, chemical and mechanical stress to which it is subjected. The influence of water, air, temperature and contamination may be significantly greater than for mineral oils HLP/HVLP. Aging resistance can be greatly influenced by the chemical composition of the hydraulic fluids.

High fluid temperatures (e.g. over 80 °C) result in a approximate halving of the fluid service life for every 10 °C temperature increase and should therefore by avoided. The halving of the fluid service life results from the application of the Arrhenius equation (see Glossary).

Table 3: Reference values for temperature-dependent aging of the hydraulic fluid

Reservoir temperature	Fluid life cycle
80 °C	100 %
90 °C	50 %
100 °C	25 %

A modified aging test (ISO 4263-3 or ASTM D943 – without the addition of water) is specified for fluid classification HFDU. Fluid classification HFDR is described with a special procedure with respect to oxidation stability (EN 14832) and oxidation service life (ISO 4263-3). The calculated fluid service life is derived from the results of tests in which the long-term characteristics are simulated in a short period of time by applying more arduous conditions (condensed testing). This calculated fluid service life is not to be equated to the fluid service life in real-life applications.

Table 3 is a practical indicator for hydraulic fluids with water content < 0.1%, cf. chapter 4.10. "Water".

3.1.6 Environmentally acceptable

HFDU fluids based on ester and glycol are hydraulic fluids which may also be classified as environmentally acceptable. The main criteria for fire-resistant, water-free hydraulic fluids are the leak-free, technically problem-free use and the necessary fire resistance. Environmentally acceptable is merely a supplementary criterion. Notes on environmentally compatible hydraulic fluids can be found in RE 90221.

3.1.7 Air separation ability (ASA)

The air separation ability (ASA) describes the property of a hydraulic fluid to separate undissolved air. Hydraulic fluids always contain dissolved air. During operation, dissolved air may be transformed into undissolved air, leading to cavitation damages. Fluid classification, fluid product, reservoir size and design must be coordinated to take into account the dwell time and ASA value of the hydraulic fluid. The air separation capacity depends on the viscosity, temperature, basic fluid and aging. It cannot be improved by additives.

According to ISO 12922 for instance, an ASA value ≤ 15 minutes is required for viscosity class ISO VG 46, practical values on delivery are < 10 minutes, lower values are preferable.

3.1.8 Demulsifying ability and water solubility

The capacity of a hydraulic fluid to separate water at a defined temperature is known as the demulsifying ability. ISO 6614 defines the demulsifying properties of hydraulic fluids.

The fluid classifications HFDU based on ester and HFDR separate water, but HFD hydraulic fluids have a different water separation ability to mineral oil HLP/HVLP. At 20 °C, in comparison to mineral oil HLP/HVLP, a multiple (> factor 3) of water can separate in the hydraulic fluid. Water solubility is also more temperature-dependent than for mineral oils. The fluid classification HFDU based on glycol usually dissolves water completely, see chapter "4.10 Water".

3.1.9 Filterability

Filterability describes the ability of a hydraulic fluid to pass through a filter, removing solid contaminants. The hydraulic fluids used require a good filterability, not just when new, but also during the whole of their service life. This can differ greatly depending on the different basic fluids (glycols, esters) and additives (VI enhancers, anti-fogging additives).

The filterability is a basic prerequisite for cleanliness, servicing and filtration of hydraulic fluids. Rexroth therefore requires the same degree of filterability of water-free, fire-resistant hydraulic fluids as for mineral oils HLP/HVLP to DIN 51524.
As ISO 12922 does not comment on the filterability of hydraulic fluids, filterability comparable to that of mineral oils HLP/HVLP must be requested of lubricant manufacturers.

Filterability is tested with the new hydraulic fluid and after the addition of 0.2 % water. The underlying standard (ISO 13357-1/-2) stipulates that filterability must have no negative effects on the filters or the hydraulic fluid, see chapter 4 "Hydraulic fluids in operation".

3.1.10 Corrosion protection

Hydraulic fluids should not just prevent corrosion formation on steel components, they must also be compatible with non-ferrous metals and alloys. Corrosion protection tests on different metals and metal alloys are described in ISO 12922.

Rexroth components are usually tested with HLP hydraulic fluids or corrosion protection oils based on mineral oils before they are delivered.

3.1.11 Additivation

The properties described above can be modified with the help of suitable additives.
Bosch Rexroth does not prescribe any specific additive system.

3.2 Classification and fields of application

Table 4: Classification and fields of application

Classification	Features	Typical field of application	Notes
HFDU (glycol-based) according to ISO 12922 Density at 15 °C: typically > 0.97 kg/dm³ VI: typical > 170 The classification "HFDU" is no longer listed in the current standard sheet VDMA 24317.	Base fluid: Glycols	Mobile systems with high thermal loading	For information on approved components, please refer to the respective product data sheet. For components which have not been approved according to the product data sheet, please consult your Bosch Rexroth sales partner. – Very good viscosity/temperature characteristics, shear stability – Resistant to aging – Can be water-soluble – Can be mixed with water – Very good wear protection properties – A higher implementation temperature with the same viscosity in comparison to mineral oil is to be expected – Due to the higher density in comparison to HLP, lower suction pressures are to be anticipated for pumps. Reduce the maximum speed as required and optimize suction conditions. – Prior to commissioning, contact the lubricant manufacturer, as the components are tested with mineral oil HLP/corrosion protection oil. – Incompatible with mineral oil (exceptions must be confirmed by the lubricant manufacturer).
HFDU (ester-based) according to ISO 12922 Density at 15 °C: typically 0.90-0.93 kg/dm³ VI: typical > 160 Iodine count < 90 The classification "HFDU" is no longer listed in the current standard sheet VDMA 24317.	Base fluid: Ester based on regenerative raw materials, synthetic ester and mixtures of different esters Because of the fire resistance, HFDU hydraulic fluids based on ester are usually partially saturated esters	Suitable for most fields of application and components.	For information on approved components, please refer to the respective product data sheet. For components which have not been approved according to the product data sheet, please consult your Bosch Rexroth sales partner. – Preferred use of FKM seals. Please enquire about shaft seal rings and implementation temperatures under –15 °C. – Note shear stability (see chapter 4.11 "Fluid servicing, fluid analysis and filtration" and chapter 6 "Glossary") – Fire resistance is not stable over time – In operation, a higher temperature in comparison to mineral oil HLP/HVLP is to be expected given identical design and viscosity. Please check ATEX approvals for hydraulic components. – Limit the lower (see chapter 3.1.2) and upper implementation temperatures (see chapter 3.1.5) – Good viscosity-temperature behavior – Usually classified as insignificantly water-endangering (water hazard class WGK 1) – High dirt dissolving capacity on fluid changeovers – In unfavorable operating conditions (high water content, high temperature), HFDU on ester basis have a tendency to hydrolysis. The acidic organic decomposition products can chemically attack materials and components.

Classification	Features	Typical field of application	Notes
HFDR according to ISO 12922 Density at 15 °C: typically 1.1 kg/dm³ VI : typical 140–160	Base fluid: phosphoric acid ester	Turbine control systems	For information on approved components, please refer to the respective product data sheet. For components which have not been approved according to the product data sheet, please consult your Bosch Rexroth sales partner. – Classified as hazardous materials (for transportation and storage) – Hazardous working material – Water-endangering (Water hazard class 2 – WGK2) – Develops toxic vapors in case of fire – Preferred use of FKM, and possibly PTFE seals. Please enquire for shaft seal rings and implementation temperatures under –15 °C. – In operation, a higher temperature in comparison to mineral oil HLP/HVLP is to be expected given identical design and viscosity – Phosphoric acid esters display a tendency to hydrolysis when they come into contact with moisture. Under the influence of water/moisture, they become unstable or form highly aggressive, acidic components which could damage the hydraulic fluid and component beyond repair. – Poor viscosity/temperature characteristics – Due to the higher density in comparison to HLP, lower suction pressures are to be anticipated for pumps. Reduce the maximum speed as required and optimize suction conditions. – In unfavorable operating conditions (high water content, high temperature), HFDR have a tendency to hydrolysis. The acidic inorganic decomposition products chemically attack materials and components.
HFDU (continued)	Based on triglycerides, mineral oils or related hydrocarbons	Not recommended for Rexroth components!	Hydraulic fluids based on polyalphaolefines are not recommended on account of their poor fire resistance. This classification can usually be identified from: density $<$ 0.89; VI $<$ 140 to 160 Hydraulic fluids based on triglycerides are not recommended on account of their aging resistance. This classification can usually be identified from: density $>$ 0.92; VI $>$ 190; iodine count $>$ 90 Consult your lubricant manufacturer or your Bosch Rexroth sales partner if the classification of a hydraulic fluid is not clear.
HFDS HFDT	Based on halogenated hydrocarbons or mixtures with halogenated hydrocarbons	Not approved for Rexroth components!	HFDS and HFDT have not been permitted to be manufactured or used since 1989 for environmental reasons.

4 Hydraulic fluids in operation

4.1 General

The properties of hydraulic fluids can change continually during storage and operation.

Please note that the fluid standard ISO 12922 merely describes minimum requirements for hydraulic fluids in new condition at the time of filling into the bins. The operator of a hydraulic system must ensure that the hydraulic fluid remains in a utilizable condition throughout its entire period of use.

Deviations from the characteristic values are to be clarified with the lubricant manufacturer, the test labs or Bosch Rexroth.

Bosch Rexroth will accept no liability for damage to its components within the framework of the applicable liability legislation insofar as the latter is due to non-observance of the following instructions.

Please note the following aspects in operation.

4.2 Storage and handling

Hydraulic fluids must be stored correctly in accordance with the instructions of the lubricant manufacturer. Avoid exposing the containers to lengthy periods of direct heat. Containers are to be stored in such a way that the risk of any foreign liquid or solid matter (e.g. water, foreign fluids or dust) ingression into the inside of the container can be ruled out. After taking hydraulic fluids from the containers, these are immediately to be properly resealed.

Recommendation:

– Store containers in a dry, roofed place

– Store barrels on their sides

– Clean reservoir systems and machine reservoirs regularly

4.3 Filling of new systems

Usually, the cleanliness levels of the hydraulic fluids as delivered do not meet the requirements of our components. Hydraulic fluids must be filtered using an appropriate filter system to minimize solid particle contamination and water in the system.

As early as possible during test operation, new systems should be filled with the selected hydraulic fluid so as to reduce the risk of accidentally mixing fluids (see chapter 4.5 "Mixing and compatibility of different hydraulic fluids"). Changing the hydraulic medium at a later point represents significant additional costs (see following chapter).

4.4 Hydraulic fluid changeover

Problems may be encountered in particular when changing over from water-containing, fire-resistant hydraulic fluid or mineral oils to water-free, fire-resistant hydraulic fluids (e.g. incompatibilities in the form of gelling, silting, stable foam, reduced filterability or filter blockage). This may also happen when changing products within the same classification.

In the case of changeovers of the fluid in hydraulic systems, it is important to ensure compatibility of the new hydraulic fluid with the remains of the previous hydraulic fluid. Bosch Rexroth recommends obtaining verification of compatibility from the manufacturer or supplier of the new hydraulic fluid. The quantity of old fluid remaining should be minimized. Mixing hydraulic fluids should be avoided, see following chapter.

Information about changing to a hydraulic fluid of a different classification can be found, for example, in VDMA 24314 and in ISO 7745. In addition, the information given in chapter 3.1.4 "Material compatibility" is also to be observed.

Bosch Rexroth will not accept liability for any damage to its components resulting from inadequate hydraulic fluid changeovers!

4.5 Mixing and compatibility of different hydraulic fluids

If hydraulic fluids from different manufacturers or different types from the same manufacturer are mixed, gelling, silting and deposits may occur. These, in turn, may cause foaming, impaired air separation ability, malfunctions and damage to the hydraulic system.

If the fluid contains more than 2 % of another fluid then it is considered to be a mixture. Exceptions apply for water, see chapter 4.10 "Water".

Mixing with other hydraulic fluids is not generally permitted. This includes hydraulic fluids with the same classification. If individual lubricant manufacturers advertise miscibility and/or compatibility, this is entirely the responsibility of the lubricant manufacturer.

Bosch Rexroth customarily tests all components with mineral oil HLP before they are delivered.

Note: With connectible accessory units and mobile filtering systems, there is a considerable risk of non-permitted mixing of the hydraulic fluids!

Rexroth will not accept liability for any damage to its components resulting from mixing hydraulic fluids!

4.6 Re-additivation

Additives added at a later point in time such as colors, wear reducers, VI enhancers or anti-foam additives, may negatively affect the performance properties of the hydraulic fluid and the compatibility with our components and therefore are not permissible.

Rexroth will not accept liability for any damage to its components resulting from re-additivation!

4.7 Foaming behavior

Foam is created by rising air bubbles at the surface of hydraulic fluids in the reservoir. Foam that develops should collapse as quickly as possible.

Common hydraulic fluids in accordance with ISO 12922 are sufficiently inhibited against foam formation in new condition. On account of aging and adsorption onto surfaces, the defoamer concentration may decrease over time, leading to a stable foam.

Defoamers may be re-dosed only after consultation with the lubricant manufacturer and with his written approval.

Defoamers may affect the air separation ability.

4.8 Corrosion

The hydraulic fluid is to guarantee sufficient corrosion protection of components under all operating conditions, even in the event of impermissible water contamination.

Water-free, fire-resistant hydraulic fluids are tested for corrosion protection in the same way as mineral oil HLP/HVLP. When used in practice other corrosion mechanisms are revealed in detail and in individual cases, for the most part in contact with non-ferrous and white alloys.

4.9 Air

Under atmospheric conditions the hydraulic fluid contains dissolved air. In the negative pressure range, for instance in the suction pipe of the pump or downstream of control edges, this dissolved air may transform into undissolved air. The undissolved air content represents a risk of cavitation and of the diesel effect. This results in material erosion of components and increased hydraulic fluid aging.

With the correct measures, such as suction pipe and reservoir design, and an appropriate hydraulic fluid, air intake and separation can be positively influenced.

See also chapter 3.1.7 "Air separation ability (ASA)".

4.10 Water

Water contamination in hydraulic fluids can result from direct ingress or indirectly through condensation of water from the air due to temperature variations.

HFDU hydraulic fluids on glycol basis are water-soluble or can be mixed with water. This means that any water that has ingressed into the system cannot be drained off in the sump of the reservoir.

In the case of HDFU hydraulic fluids on ester basis, undissolved water can be drained off from the reservoir sump, the remaining water content is however too high to ensure that the maximum permissible water limit values are observed in the long term.

With the fluid classification HFDR, the greater density of the ester means that the any water that has ingressed will be on the surface of the hydraulic fluid. This means that any water that has ingressed into the system cannot be drained off in the sump of the reservoir.

Water in the hydraulic fluid can result in wear or direct failure of hydraulic components. Furthermore, a high water content in the hydraulic fluid negatively affects aging and filterability and increases susceptibility to cavitation. During operation, the water content in all hydraulic fluids, determined according to the "Karl Fischer method" (see chapter 6 "Glossary") for all water-free, fire-resistant hydraulic fluids must constantly be kept below 0.1% (1000 ppm). To ensure a long service life of both hydraulic fluids and components, Bosch Rexroth recommends that values below 0.05% (500 ppm) are permanently maintained.

Due to the higher water solubility in comparison to mineral oil HLP/HVLP it is urgently advised that precautions be taken when using water-free, fire-resistant hydraulic fluids, such as a dehumidifier on the reservoir ventilation.

Water content has an affect particularly in the case of HEDU hydraulic fluid on ester basis and HFDR in that it accelerates aging (hydrolysis) of the hydraulic fluid and biological degradation, see chapter 4.11 "Fluid servicing, fluid analysis and filtration".

4.11 Fluid servicing, fluid analysis and filtration

Air, water, operating temperature influences and solid matter contamination will change the performance characteristics of hydraulic fluids and cause them to age.

To preserve the usage properties and ensure a long service life for hydraulic fluid and components, the monitoring of the fluid condition and a filtration adapted to the application requirements (draining and degassing if required) are indispensable.

The effort is higher in the case of unfavorable usage conditions, increased stress for the hydraulic system or high expectations as to availability and service life, see chapter 2 "Solid particle contamination and cleanliness levels".

When commissioning a system, please note that the required minimum cleanliness level can frequently be attained only by flushing the system. Due to severe start-up contamination, it may be possible that a fluid and/or filter replacement becomes necessary after a short operating period (< 50 operating hours).

The hydraulic fluid must be replaced at regular intervals and tested by the lubricant manufacturer or recognized accredited test labs. **We recommend a reference analysis after commissioning.**

The minimum data to be tested for analyses are:

- Viscosity at 40 °C and 100 °C
- Neutralization number NN (acid number AN)
- Water content (Karl-Fischer method)
- Particle measurement with evaluation according to ISO 4406 or mass of solid foreign substances with evaluation to EN 12662
- Element analysis (RFA (EDX) / ICP, specify test method)
- Comparison with new product or available trend analyses
- Assessment / evaluation for further use
- Also recommended: IR spectrum

No differences are needed in the maintenance and care of water-free, fire-resistant hydraulic fluids with the appropriate suitability parameters compared to HLP/HVLP mineral oils. Attention is however drawn to the note in chapter 1.3.

After changing over hydraulic fluids it is recommended that the filters be replaced again after 50 operating hours as fluid aging products may have detached themselves ("self-cleaning effect").

Compared to the pure unused hydraulic fluid the changed neutralization number NN (acid number AN) indicates how many aging products are contained in the hydraulic fluid.
This difference must be kept as small as possible. The lubricant manufacturer should be contacted as soon as the trend analysis notes a significant increase in values.

A higher viscosity than that of new materials indicates that the hydraulic fluid has aged. Evaluation by the test lab or lubricant manufacturers is however authoritative, whose recommendation should be urgently observed.

On systems where the possibility of water contamination cannot be completely ruled out (also condensation), it should be ensured via the hydraulic system circuit that fluid aging products are not accumulating in individual areas of the hydraulic system, but are being removed from the system in a controlled manner via the filtration system. This should be ensured via suitable hydraulic circuits (e.g. flushing circuit) or system manufacturer's operating instructions/specifications.

In case of warranty, liability or guarantee claims to Bosch Rexroth, service verification and/or the results of fluid analyses are to be provided.

5 Disposal and environmental protection

All water-free, fire-resistant hydraulic fluids, are, like mineral oil-based hydraulic fluids, subject to special disposal obligations.

The respective lubricant manufacturers provide specifications on environmentally acceptable handling and storage. Please ensure that spilt or splashed fluids are absorbed with appropriate adsorbents or by a technique that prevents it contaminating water courses, the ground or sewerage systems.

It is also not permitted to mix fluids when disposing of hydraulic fluids. Regulations governing the handing of used oils stipulate that used oils are not to mixed with other products, e.g. substances containing halogen. Non-compliance will increase disposal costs. Comply with the national legal provisions concerning the disposal of the corresponding hydraulic fluid. Comply with the local safety data sheet of the lubricant manufacturer for the country concerned.

6 Glossary

Additivation
Additives are chemical substances added to the basic fluids to achieve or improve specific properties.

Aging
Hydraulic fluids age due to oxidation (see chapter 3.1.5 "Aging resistance"). Liquid and solid contamination acts as a catalyzer for aging, meaning that it needs to be minimized as far as possible by careful filtration. Please refer to Hydrolysis.

Arrhenius equation
The quantitative relation between reaction rate and temperature is described by an exponential function, the Arrhenius equation. This function is usually visualized within the typical temperature range of the hydraulic system. For a practical example, see chapter 3.1.5 "Aging resistance".

Basic fluids
In general, a hydraulic fluid is made up of a basic fluid, or base oil, and chemical substances, the so-called additives. The proportion of basic fluid is generally greater than 90%.

Diesel effect

If hydraulic fluid that contains air bubbles is compressed quickly, the bubbles are heated to such a degree that a self-ignition of the air-gas mix may occur. The resultant temperature increase may lead to seal damage and increased aging of the hydraulic fluid.

Partially saturated esters
In contrast to saturated esters, partially saturated esters have double/multiple bonds between C atoms. Rexroth defines partially saturated esters as unsaturated bonds and mixtures of esters with unsaturated and saturated bonds. Esters with unsaturated bonds are produced on the basis of renewable raw materials.

Depending on their number and position, these unsaturated bonds between the C atoms are instable. These bonds can detach themselves and form new bonds, thus changing the properties of those liquids (an aging mechanism). Attention is however drawn to the note in chapter 1.3.

Hydrolysis
Hydrolysis is the splitting of a chemical bond through the reaction with water under the influence of temperature.

ICP (atomic emission spectroscopy)
The ICP procedure can be used to determine various wear metals, contamination types and additives. Practically all elements in the periodic system can be detected with this method.

Iodine count
The iodine count is a yardstick for the quantity of single and multiple unsaturated bonds between C atoms in the basic fluid. A low iodine count indicates that the hydraulic fluid contains few unsaturated bonds and is thus considerably more resistant to aging than a hydraulic fluid with a high iodine count. A statement about the position at which these multiple bonds are located and about how "stable" they are against influencing factors cannot be derived simply by stating the iodine count.

Karl Fischer method
Method to determine the water content in fluids. Indirect coulometric determination procedure in accordance with DIN EN ISO 12937 in connection with DIN 51777-2. Only the combination of both standards will assure adequately accurate measured values. For hydraulic fluids based on glycol, DIN EN ISO 12937 is to be applied in conjunction with DIN 51777-1.

Cavitation
Cavitation is the creation of cavities in fluids due to pressure reduction below the saturated vapour pressure and subsequent implosion when the pressure increases. When the cavities implode, extremely high acceleration, temperatures and pressure may occur temporarily, which may damage the component surfaces.

Neutralization number (NN)
The neutralization number (NN) or acid number (AN) specifies the amount of caustic potash required to neutralize the acid contained in one gram of fluid.

Pour point
The lowest temperature at which the fluid still just flows when cooled down under set conditions. The pour point is specified in the lubricant manufacturers' technical data sheets as a reference value for achieving this flow limit.

RFA (wavelength dispersive x-ray fluorescence analysis)
Is a procedure to determine nearly all elements in liquid and solid samples with nearly any composition. This analysis method is suitable for examining additives and contamination, delivering fast results.

Shearing/shear loss
Shearing of molecule chains during operation can change the viscosity of hydraulic fluids with long chain VI enhancers and anti-fogging additives. The initially high viscosity index drops. This needs to be taken into account when selecting the hydraulic fluid.

The only value at present that can be used to assess viscosity changes in operation is the result of the test in accordance with DIN 51350 part -6. Please note that there are practical applications that create a much higher shear load on such hydraulic fluids than can be achieved by this test.

Viscosity
Viscosity is the measure of the internal friction of a fluid to flow. It is defined as the property of a substance to flow under tension. Viscosity is the most important characteristic for describing the load-bearing capacity of a hydraulic fluid.

Kinematic viscosity is the ratio of the dynamic viscosity and the density of the fluid; the unit is mm^2/s. Hydraulic fluids are classified by their kinematic viscosity into ISO viscosity classes. The reference temperature for this is 40 °C.

Viscosity index (VI)
Refers to the viscosity temperature behavior of a fluid. The lower the change of viscosity in relation the temperature, the higher the VI.

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

The data specified above only serve to describe the product. No statements concerning a certain condition or suitability for a certain application can be derived from our information. The information given does not release the user from the obligation of own judgment and verification.

It must be remembered that our products are subject to a natural process of wear and aging.

Subject to change.

Proportional servo valves

Proportional directional valves
Proportional directional valves are used asdirectional, pressure and flow control valves. Using integrated electronics (OBE), they reduce the cabling effort and simplify handling while offering exact reproducibility and low manufacturing tolerances.

Directional control valves
Directional control valves are compact and robust. They are convincing in their high dynamics and control accuracy with closed-loop control of position, velocity, pressure and force.

Directional servo-valves
Directional servo-valves are hydraulically pilotoperated 2- or 3-stage directional valves. Because of their high dynamics they are used predominantly for the closed-loop controls of position, force or pressure, and velocity.

Proportional directional valves

Designation	Type	Size	Component series	p_{max} in bar	Data sheet	Page
Direct operated, subplate mounting						
Without electrical position feedback	4WRA, 4WRAE	6/10	2X	315	29055	111
With electrical position feedback	4WRE, 4WREE	6/10	2X	315	29061	127
With integrated control electronics, electrical position feedback and monitoring of the spool position, with test certificate	4WREEM	6/10	2X	315	29064	149
With integrated digital electronics and field bus interface	4WREF	10	2X	315	29048	165
With integrated digital axis controller (IAC-P), with pQ-functionality and fieldbus interface	4WREQ	6/10	2X	315	29050	187
With integrated digital axis controller (IAC-P), with pQ-functionality	STW 0195 STW 0196	6/10	1X/2X	250	29014	213
Direct operated, block installation						
With solenoid actuation, block installation	VEPS-10A-43	10	0	350	18162	231
With solenoid actuation, block installation	KKDSR1	1	B	350	18139-06	247
With solenoid actuation, block installation	KKDSR2	2	A	350	18139-09	259
Pilot operated, subplate mounting						
Without electrical position feedback	.WRZ, .WRZE, .WRH	10 ... 52	7X	350	29115	269
Without electrical position feedback, with spool position indication	4WRHM, 4WRZM, 4WRZEM	10 ... 25	1X	350	29117	297
With electrical position feedback	4WRKE	10 ... 35	3X	350	29075	317

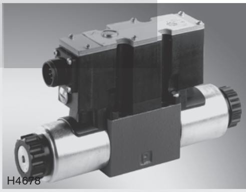
2

4/2- and 4/3-way proportional directional valves, direct operated, without electrical position feedback, without/with integrated electronics (OBE)

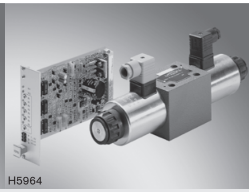
RE 29055/10.05
Replaces: 08.01

Types 4WRA and 4WRAE

Nominal sizes 6 and 10
Component series 2X
Maximum operating pressure 315 bar
Maximum flow: 42 l/min (NS6)
75 l/min (NS10)



Type 4WRAE 6 …-2X/G24K31/.V with integrated electronics (OBE)



Typ 4WRA 10 …-2X/G24…K4/V with plug-in connectors and associated control electronics (separate order)

Overview of contents

For information regarding the available spare parts see: www.boschrexroth.com/spc

Features

– Direct operated proportional directional valve without electrical position feedback and integrated electronics (OBE) for type 4WRAE
– Control the direction and magnitude of a flow
– Actuation by means of proportional solenoids with central thread and removable coil
– For subplate mounting:
  Connection position to ISO 4401
  Subplates to catalogue sheets RE 45052 (NS6) or RE 45054 (NS10) separate order, see page 12 to 15
– Spring centred control spool
– Control electronics
  • 4WRAE:
    - integrated electronics (OBE) with voltage input or current input (A1 resp. F1)
  • 4WRA:
    - digital or analogue amplifier in Eurocard format (separate order)
    - analogue module amplifier

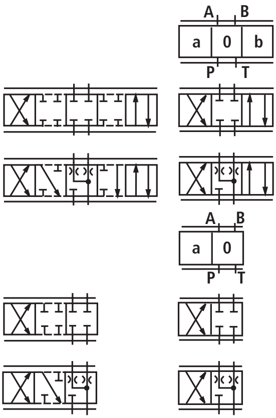
Ordering details

4WRA				–2X / G24		/	V	*

Without integrated electronics (OBE) = **No code**
With integrated electronics (OBE) = **E**

Nominal size 6 = **6**
Nominal size 10 = **10**

Spool symbols



= **E**
E1–

= **W**
W1–

= **EA**

= **WA**

With spool symbols E1– and W1–:
P → A: $q_{V\,max}$ B → T: $q_V/2$
P → B: $q_V/2$ A → T: $q_{V\,max}$

Note:
With spools W and WA, in the neutral position, there is a connection from A to T and B to T with approx. 3 % of the relevant nominal cross-section.

Further details in clear text

Seal material
V = FKM seals, suitable for mineral oil (HL, HLP) to DIN 51524

Electronic interfaces A1 or F1 for 4WRAE
A1 = Command value input ± 10 V
F1 = Command value input 4 to 20 mA
No code = For 4WRA

Electrical connections
for 4WRA:
K4 [2] = **Without** plug-in connector, with component plug to DIN EN 175301-803 plug-in connector – separate order, see page 7
for 4WRAE:
K31 [2] = **Without** plug-in connector, with component plug to DIN EN 175201-804 plug-in connector – separate order, see page 7

Special protection
No code = Without special protection
J [1] = Sea water resistant (only for NS6)
For details regarding the sea water resistant versions see RE 29055-M

G24 = Supply voltage 24 VDC

2X = Component series 20 to 29 (20 to 29: unchanged installation and connection dimensions)

Nominal flow at a valve pressure differential Δp = 10 bar

	NS6
07 =	7 l/min
15 =	15 l/min
30 =	26 l/min
	NS10
30 =	30 l/min
60 =	60 l/min

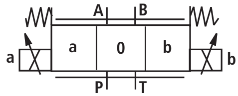
[1] Other types of electrical protection on request

[2] Only for NS6: for version "**J**" = sea water resistant only state "**K31**"!

Symbols

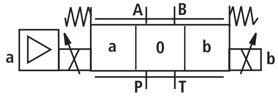
Without integrated electronics

Type 4WRA…

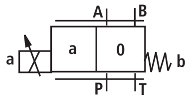


With integrated electronics (OBE)

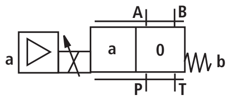
Type 4WRAE…



Types 4WRA…**EA**…; 4WRA…**WA**…



Types 4WRAE…**EA**…; 4WRAE…**WA**…



Function, section

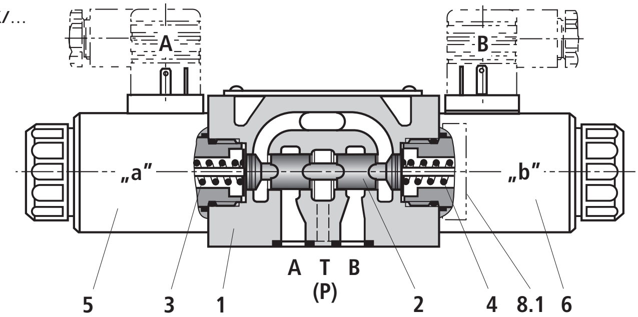
The 4/2- and 4/3-way proportioanl directional valves are designed as direct operated components for subplate mounting. They are actuated by means of proportional solenoids with central thread and removable coil. The solenoids are controlled either by external control electronics (type 4WRA) or by integrated control electronics (type 4WRAE).

Design:

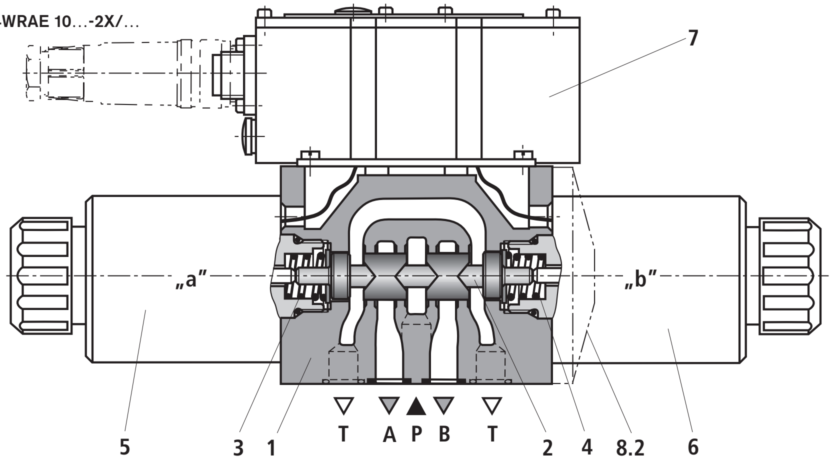
The valves basically consist of:
- Housing (1) with mounting surface
- Control spool (2) with compression springs (3 and 4)
- Solenoids (5 and 6) with central thread
- Optional integrated electronics (7)

Function:
- With the solenoids (5 and 6) de-energised, the control spool (2) is held in the central position by compression springs (3 and 4)
- Direct actuation of the control spool (2) by energising a proportional solenoid
  E.g. energinsaion of solenoid "b" (6)
  → The control spool (2) is moved to the left in proportion to the electrical input signal
  → connection from P to A and B to T via orifice-like cross-sections with progressive flow characterisics
- De-energisation of the solenoid (6)
  → The control spool (2) is returned to the central position by compression spring (3)

Type 4WRA 6…-2X/…



Type 4WRAE 10…-2X/…



Valve with 2 spool positions:

(Type 4WRA…**A**…)

In principle, the function of this valve version corresponds to that of the valve with 3 spool positions. However, the valves with 2 spool positions are **only fitted with solenoid "a"**. Instead of the the 2nd proportional solenoid a plug (8.1) is fitted for NS 6 or for NS 10 a cover (8.2).

Note for type 4WRA 6…-2X/…:

Draining of the tank line is to be avoided. With the appropriate installation conditions, a back pressure valve is to be installed (back pressure approx. 2 bar).

Technical data (for applications outside these parameters, please consult us!)

General

Nominal size		NS	**6**	**10**
Installation			optional, preferably horizontal	
Storage temperature range		°C	–20 to +80	
Ambient temperature range	4WRA	°C	–20 to +70	
	4WRAE	°C	–20 to +50	
Weight	4WRA	kg	2.0	6.6
	4WRAE	kg	2.2	6.8

Hydraulic (measured with HLP46, $\vartheta_{oil} = 40\ °C \pm 5\ °C$)

Max. operating pressure	Ports A, B, P	bar	315	
	Port T	bar	210	
Nominal flow $q_{V\ nom}$ at $\Delta p = 10$ bar		l/min	7, 15, 26	30, 60
Max. permissible flow		l/min	42 (80)[1]	75 (140)[1]
Pressure fluid			mineral oil (HL, HLP) to DIN 51524 other pressure fluids on request!	
Pressure fluid temperature range		°C	–20 to +80 (preferably +40 to +50)	
Viscosity range		mm^2/s	20 to 380 (preferably 30 to 46)	
Max. permissible degree of pressure fluid contamination cleanlisness class to ISO 4406 (c)			class 20/18/15 [2]	
Hysteresis		%	≤ 5	
Reversal error		%	≤ 1	
Response sensitivity		%	≤ 0.5	

[1] Max. permissible flow with a dual flow path

[2] The cleanliness class stated for the components must be adhered too in hydraulic systems. Effective filtration prevents faults from occurring and at the same time increases the component service life.
For the selection of filters see catalogue sheets RE 50070, RE 50076, RE 50081, RE 50086 and RE 50088.

Technical data (for applications outside these parameters, please consult us!)

Electical

Nominal size		NS	**6**	**10**
Voltage type			DC	
Command value signal	Voltage input „A1“	V	±10	
with type WRAE	Current input „F1“	mA	4 to 20	
Max. current per solenoid		A	2.5	
Solenoid coil	Cold value at 20 °C	Ω	2	
resistance	Max. warm value	Ω	3	
Duty		%	100	
Max. coil temperature [1]		°C	150	
Electrical connections	4WRA		with component plug to DIN EN 175301-803 or ISO 4400	
see page 7			plug-in connector to DIN EN 175301-803 or ISO 4400 [2]	
	4WRAE		with component plug to DIN EN 175201-804	
			plug-in connector DIN EN 175201-804 [2]	
Valve protection to EN 60529			IP65 with mounted and fixed plug-in connector	

Control electronics

For 4WRA	Digital amplifier in Eurocard format [2]		VT-VSPD-1-2X (to RE 30523 - middle of 2006)
	Analogue amplifier in Eurocard format [2]		VT-VSPA2-1-2X/… to RE 30110
	Analogue module amplifier [2]		VT-MSPA2-1-1X to RE 30228
For 4WRAE			integrated into the valves, see page 8
	Analogue command value module		VT- SWMA-1-1X/... to RE 29902
	Analogue command value module		VT-SWMKA-1-1X/... to RE 29903
	Digital command value card		VT-HACD-1-1X/… to RE 30143
	Analogue command value card		VT-SWKA-1-1X/... to RE 30255
Supply voltage	Nominal voltage	VDC	24
4WRAE, 4WRA [3]	Lower limiting value	V	21 / 22 (4WRA); 19 (4WRAE)
	Upper limiting value	V	35
Amplifier current	I_{max}	A	1.8
consumption	Max. impulse current	A	3

[1] Due to the occurring surface temperature of the solenoid coils, the European Standards DIN EN 563 and DIN EN 982 must be taken into account!

[2] Separate order

[3] With Bosch Rexroth AG control electronics

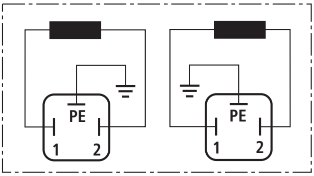
☞ **Note:** For details regarding the **environmental simulation test** covering EMC (electro-magnetic compatibility), climate and mechanical loading see RE 29055-U (declaration regarding environmental compatibility).

Electrical connection, plug-in connectors

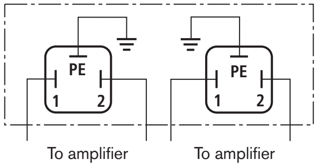
For type WRA

(**without** integrated electronics – **not** for version "**J**" = sea water resistant)

Connection on component plug



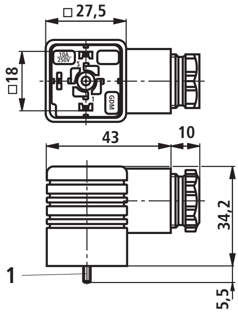
Connection on plug-in connector



Plug-in connector CECC 75 301-803-A002FA-H3D08-G
to DIN EN 175301-803 or ISO 4400

Solenoid **a**, colour grey
Separate order: Material No. **R901017010**

Solenoid **b**, colour black
Separate order: Material No. **R901017011**



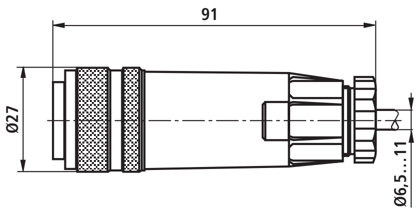
1 Fixing screws M3
Tightening torque M_A = 0.5 Nm

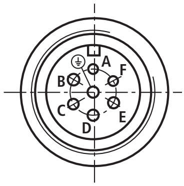
For type WRAE

(**with** integrated electronics (OBE) and for version "**J**" = sea water resistant)

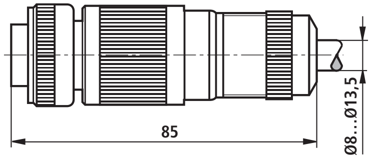
For pin allocation, see block circuit diagram on page 8

Plug-in connector to DIN EN 175201-804
Separate order: Material No. **R900021267**
(plastic version)



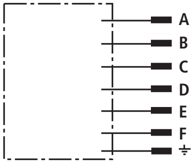


Plug-in connector to DIN EN 175201-804
Separate order: Material No. **R900223890**
(metal version)



Integrated electronics (OBE) for type WRAE

Pin allocation of the component plug



Integrated control electronics (see below)

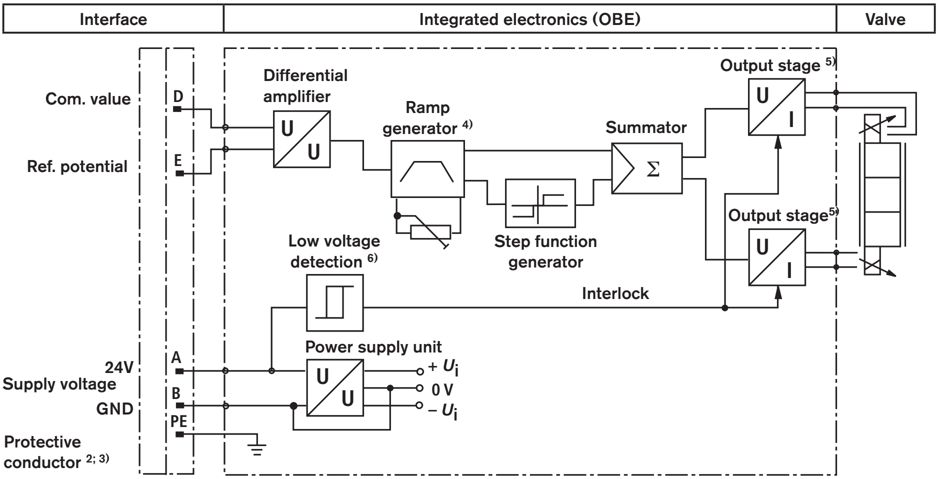
Pin allocation	Contact	Signal
Supply voltage	A	24 VDC (19 to 35 VDC)
	B	GND
	C	n.c. 1)
Differential amplifier input	D	Com. value (± 10 V / 4 to 20 mA)
	E	reference potential
	F	n.c.

Com. value: Positive command value (0 to 10 V or 12 to 20 mA) at D and reference potential to E causes flow from P to A and B to T.
Negative command value (0 to – 10 V or 12 to 4 mA) at D and reference potential to E causes flow from P to B and A to T.
For valves with a solenoid on side „A“ (spool variants **EA** and **WA**) a positive command value at D and reference potential to E (NS 6: 4 to 20 mA and NS 10: 12 to 20 mA) causes flow from P to B and A to T.

Connection cable: Recommendation: – up to 25 m cable length type LiYCY 5 x 0.75 mm²
– up to 50 m calbe length type LiYCY 5 x 1.0 mm²
External diameter 6.5 to 11 mm
Connect screen to PE only on the supply side.

1) Contacts C and F must not be connected!

Block circuit diagram / connection allocation



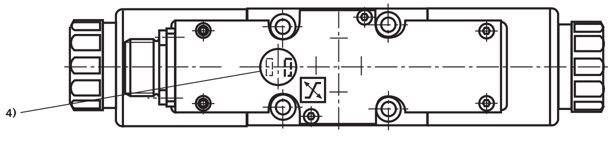
2) PE is connected to the cooling body and the valve housing

3) Protective conductor screwed to the valve housing and cover

4) Ramp can be externally adjusted from 0 to 2.5 s; the same applies for T_{up} and T_{down}

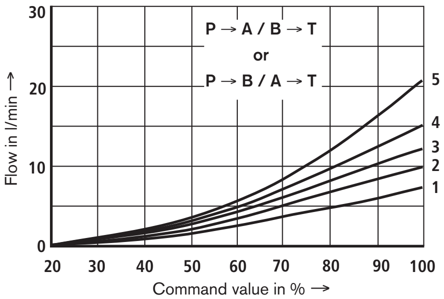
5) Output stages current regulated

6) Low voltage detection is **not** carried out for component type 4WRAE 10-2X.

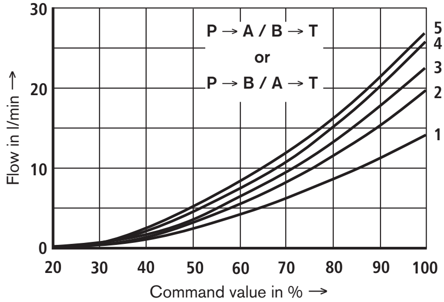


Characteristic curves (measured with HLP46, $\vartheta_{oil} = 40\ °C \pm 5\ °C$) NS6

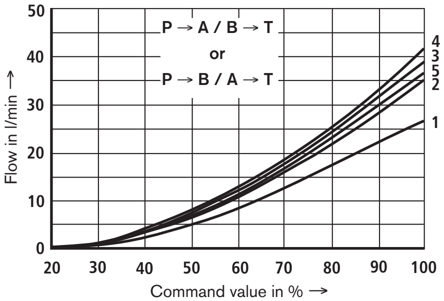
7 l/min nominal flow at 10 bar valve pressure differential



15 l/min nominal flow at 10 bar valve pressure differential



30 l/min nominal flow at 10 bar valve pressure differential

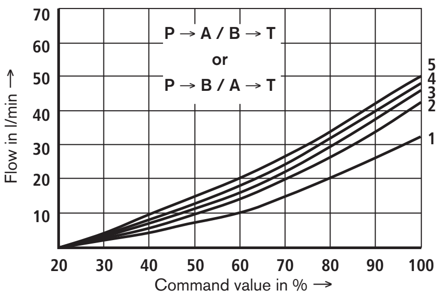


1 $\Delta p = 10$ bar constant
2 $\Delta p = 20$ bar constant
3 $\Delta p = 30$ bar constant
4 $\Delta p = 50$ bar constant
5 $\Delta p = 100$ bar contant

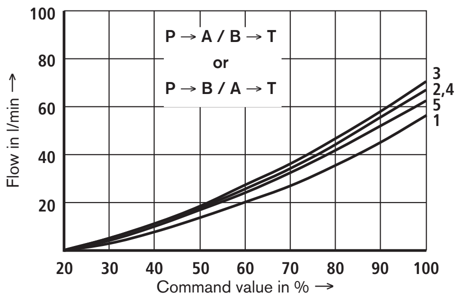
Δp = Valve pressure differential (inlet pressure p_P minus load pressure p_L and minus return pressure p_T)

Characteristic curves (measured with HLP46, $\vartheta_{oil} = 40\ °C \pm 5\ °C$) NS10

30 l/min nominal flow at 10 bar valve pressure differential



60 l/min nominal flow at 10 bar valve pressure differential



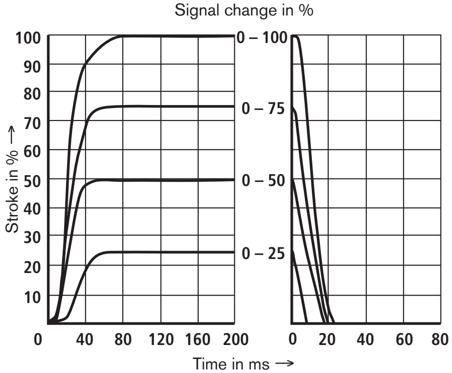
1 $\Delta p = 10$ bar constant
2 $\Delta p = 20$ bar constant
3 $\Delta p = 30$ bar constant
4 $\Delta p = 50$ bar constant
5 $\Delta p = 100$ bar contant

Δp = Valve pressure differential (inlet pressure p_P minus load pressure p_L and minus return pressure p_T)

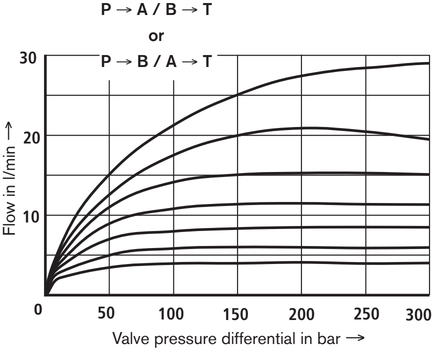
Characteristic curves (measured with HLP46, $\vartheta_{oil} = 40\ °C \pm 5\ °C$) NS6

Transient functions with stepped form of electrical input signals

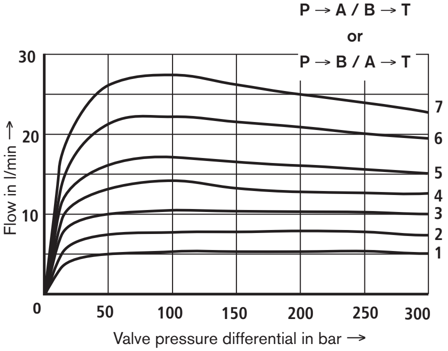
Types 4WRA and 4WRAE



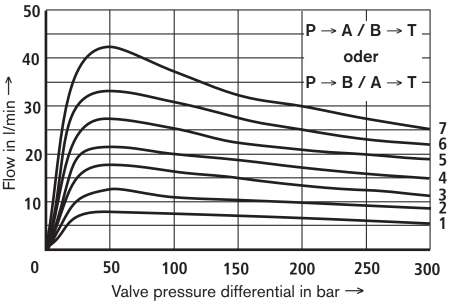
Performance limit, nominal flow 7 l/min



Performance limit, nominal flow 15 l/min



Performance limit, nominal flow 30 l/min

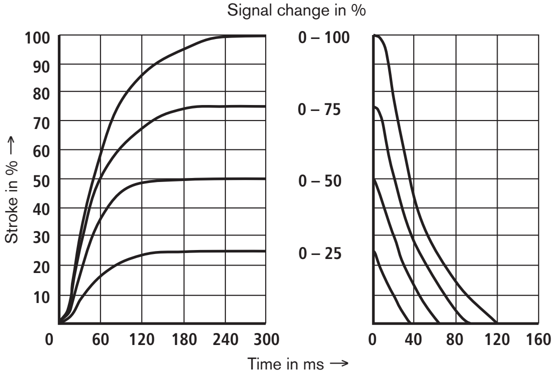


1 Com. value = 40 %
2 Com. value = 50 %
3 Com. value = 60 %
4 Com. value = 70 %
5 Com. value = 80 %
6 Com. value = 90 %
7 Com. value = 100 %

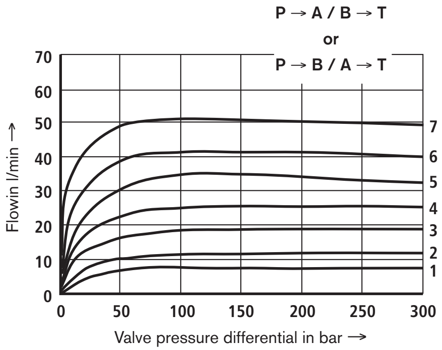
If the performance limits are exceeded then flow forces occur which lead to uncontrolled spool movements.

Characteristic curves (measured with HLP46, $\vartheta_{\text{oil}} = 40\ °C \pm 5\ °C$) **NS10**

Transient functions with stepped form of electrical input signals

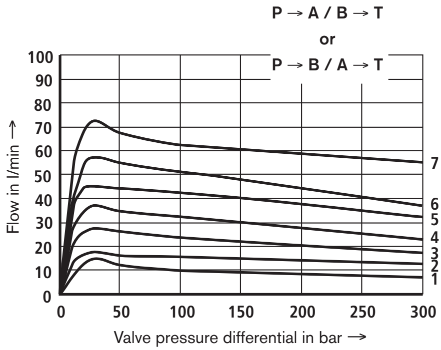


Performance limit, nominal flow 30 l/min



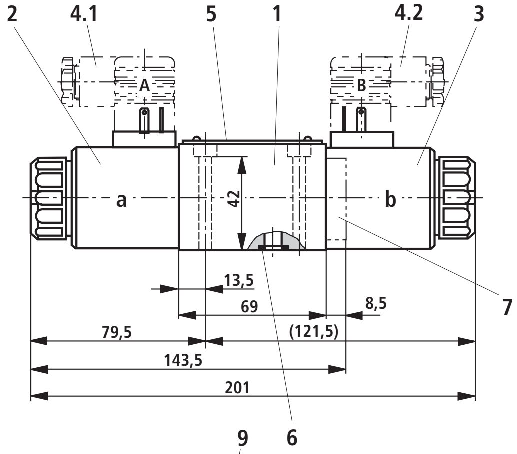
1 Com. value = 40 %
2 Com. value = 50 %
3 Com. value = 60 %
4 Com. value = 70 %
5 Com. value = 80 %
6 Com. value = 90 %
7 Com. value = 100 %

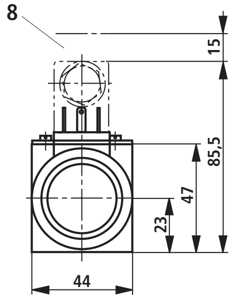
Performance limit, nominal flow 60 l/min

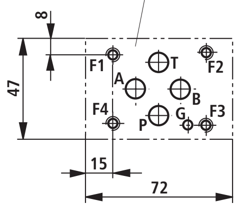


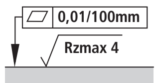
If the performance limits are exceeded then flow forces occur which lead to uncontrolled spool movements.

Unit dimensions: Type 4WRA 6 (nominal dimensions in mm) NS6









Required surface finish of the valve mounting surface

Tolerances to: – General tolerances ISO 2768-mK

1 Valve hounsing

2 Proportional solenoid "a"

3 Proportional solenoid "b"

4.1 Plug-in connector "A", colour grey, separate order, see page 7

4.2 Plug-in connector "B", colour black, separate order, see page 7

5 Name plate

6 Identical seal rings for ports A, B, P and T

7 Plug for valves with one solenoid (2 switched positions, versions **EA** or **WA**)

8 Space required to remove the plug-in connector

9 Machined valve mounting surface,
Connection location to ISO 4401 (**with** locating pin hole)
Code: 4401-03-02-0-94 (explanation to ISO 5783)
Deviation from the standard:
- without locating pin hole „G“
- ports P, A, B and T mit Ø8 mm

Subplates to catalogue sheet RE 45052 and valve fixing screws must be ordered separately.

Subplates: G341/01 (G1/4)
G342/01 (G3/8)
G502/01 (G1/2)

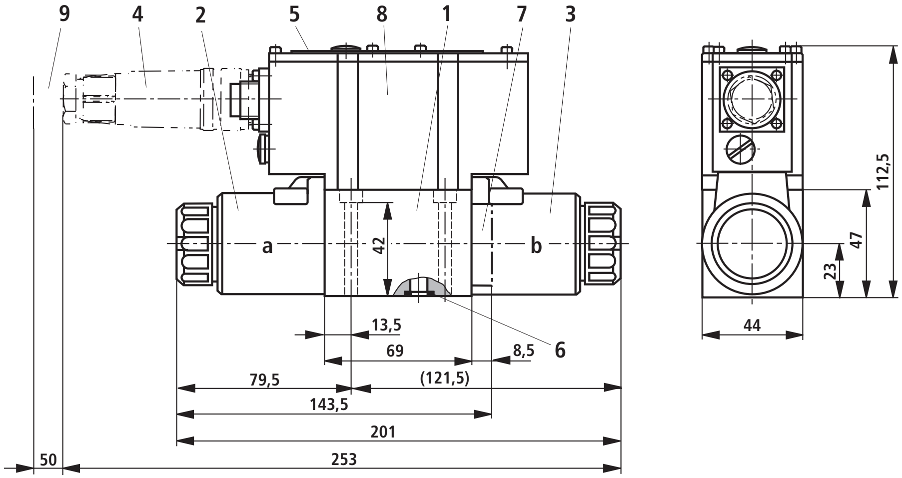
Valve fixing screws (separate order)
The following valve fixing screws are recommended:

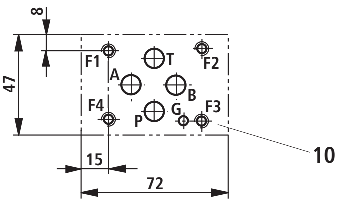
– **4 S.H.C.S. ISO 4762 - M5 x 50 - 10.9-flZn-240h-L**
(friction value μ_{total} = 0.09 to 0.14)
Tightening torque M_A = 7 Nm ± 10%
Material No. **R913000064** (separate order)

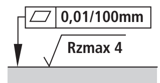
or

– **4 S.H.C.S. ISO 4762 - M5 x 50 - 10.9**
(friction value μ_{total} = 0.12 to 0.17)
Tightening torque M_A = 8.9 Nm ± 10%

Unit dimensions: Type 4WRAE 6 ...K31/..V (nominal dimensions in mm) NS6







Required surface finish of the valve mounting surface

Tolerance to: – General tolerances to ISO 2768-mK

1 Valve housing
2 Proportional solenoid "a"
3 Proportional solenoid "b"
4 Plug-in connector to DIN EN 175201-804, separate order, see page 7
5 Name plate
6 Identical seal rings for ports A, B, P und T
7 Plug for valves with one solenoid (2 switched positions, versions **EA** or **WA**)
8 Integrated electronics (OBE)
9 Space required for the connection cable and to remove the plug-in connector
10 Machined valve mounting surface,
Connection location to ISO 4401 (**with** locating pin hole)
Code: 4401-03-02-0-94 (explanation to ISO 5783)
Deviation from the standard:
- without locating pin hole „G“
- ports P, A, B and T mit Ø8 mm

Subplates to catalogue sheet RE 45052 and valve fixing screws must be ordered separately.

Subplates: G341/01 (G1/4)
G342/01 (G3/8)
G502/01 (G1/2)

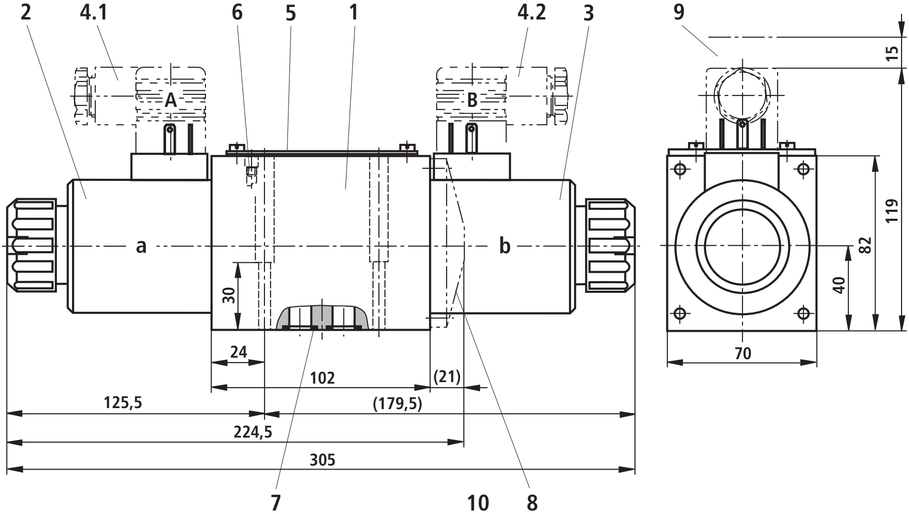
Valve fixing screws (separate order)
The following valve fixing screws are recommended:

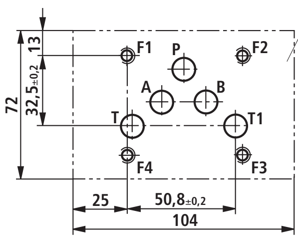
– **4 S.H.C.S. ISO 4762 - M5 x 50 - 10.9-flZn-240h-L**
(friction value $\mu_{total} = 0.09$ to 0.14)
Tightening torque $M_A = 7$ Nm ± 10%
Material No. **R913000064** (separate order)

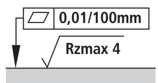
or

– **4 S.H.C.S. ISO 4762 - M5 x 50 - 10.9**
(friction value $\mu_{total} = 0.12$ to 0.17)
Tightening torque $M_A = 8.9$ Nm ± 10%

Unit dimensions: Type 4WRA 10 (nominal dimensions in mm) NS10







Required surface finish of the valve mounting surface

Tolerances to: – General tolerances to ISO 2768-mK

1 Valve housing
2 Proportional solenoid "a"
3 Proportional solenoid "b"
4.1 Plug-in connector "A", colour grey, separate order, see page 7
4.2 Plug-in connector "B", colour black, separate order, see page 7
5 Name plate
6 Valve bleed screw
Note: The valves are bled before delivery.
7 Identical seal rings for ports A, B, P and T (T1)
8 Cover for valves with one solenoid (2 switched positions, versions **EA** or **WA**)
9 Space required to remove the plug-in connector
10 Machined valve mounting surface,
Connection location to ISO 4401 (**with** locating pin hole)
Code: 4401-05-04-0-94 (explanation to ISO 5783)
Deviation from the standard: Port T1 Ø11.2 mm

Subplates to catalogue sheet RE 45054 and valve fixing screws must be ordered separately.

Subplates: G66/01 (G3/8)
G67/01 (G1/2)
G534/01 (G3/4)

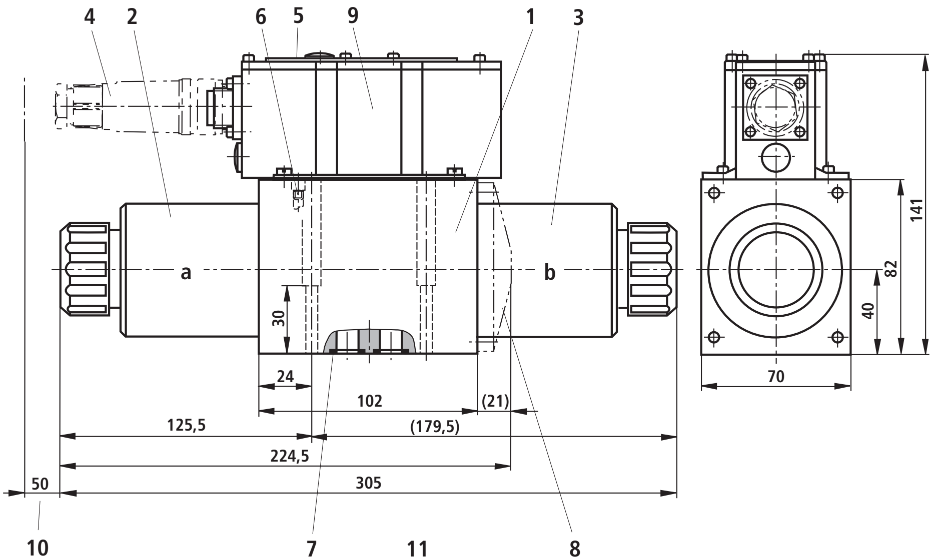
Valve fixing screws (separate order)
The following valve fixing screws are recommended:

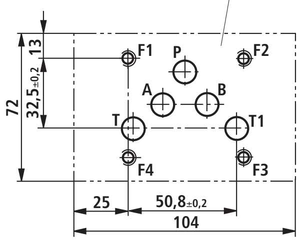
– **4 S.C.H.S. ISO 4762 - M6 x 40 - 10.9-flZn-240h-L**
(friction value μ_{total} = 0.09 to 0.14)
Tightening torque M_A = 12.5 Nm ± 10%,
Material No. **R913000058** (separate order)

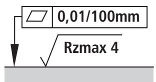
or

– **4 S.C.H.S. ISO 4762 - M6 x 40 - 10.9**
(friction value μ_{total} = 0.12 to 0.17)
Tightening torque M_A = 15,5 Nm ± 10%

Unit dimensions: Type 4WRAE 10 (nominal dimensions in mm) NS10







Required surface finish of the valve mounting surface

1 Valve housing

2 Proportional solenoid "a"

3 Proportional solenoid "b"

4 Plug-in connector to DIN EN 175201-804, separate order, see page 7

5 Name plate

6 Valve bleed screw
Note: The valves are bled before delivery.

7 Identical seal rings for ports A, B, P, T

8 Cover for valves with one solenoid (2 switched positions, versions **EA** or **WA**)

9 Integrated electronics (OBE)

10 Space required for the connection cable and to remove the plug-in connector

11 Machined valve mounting surface, connection location to ISO 4401 (**with** locating pin hole)
Code: 4401-05-04-0-94 (explanation to ISO 5783)
Deviation from the standard: Port T1 Ø11.2 mm

Tolerances to: – General tolerances to ISO 2768-mK

Subplates to catalogue sheet RE 45054 and valve fixing screws must be ordered separately.

Subplates: G66/01 (G3/8)
G67/01 (G1/2)
G534/01 (G3/4)

Valve fixing screws(separate order)
The following valve fixing screws are recommended:

– **4 S.H.C.S. ISO 4762 - M6 x 40 - 10.9-flZn-240h-L**
(friction value μ_{total} = 0.09 to 0.14)
Tightening torque M_A = 12.5 Nm ± 10%,
Material No. **R913000058** (separate order)

or

– **4 S.H.C.S. ISO 4762 - M6 x 40 - 10.9**
(friction value μ_{total} = 0.12 to 0.17)
Tightening torque M_A = 15,5 Nm ± 10%

2

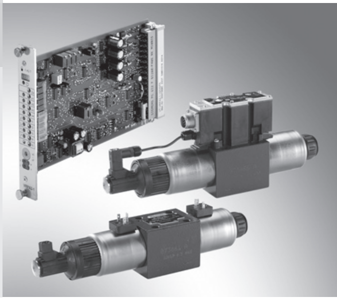
Notes

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Telefon +49 (0) 93 52 / 18-0
Telefax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

4/2 and 4/3 proportional directional valves, direct operated, with electrical position feedback, without/with integrated electronics (OBE)

RE 29061/11.12
Replaces: 05.12

Type 4WRE and 4WREE



Size 6 and 10
Component series 2X
Maximum operating pressure 315 bar
Maximum flow: 80 l/min (size 6)
180 l/min (size 10)

Table of contents

Features

– Direct operated proportional directional valve with electrical position feedback and integrated electronics (OBE) with type 4WREE
– Control of flow direction and size
– Operation by means of proportional solenoids with central thread and detachable coil
– For subplate mounting: Porting pattern according to ISO 4401
– Spring-centered control spool
– Control electronics
  • Type 4WREE:
  integrated electronics (OBE) with voltage or current input (A1 and/or F1)
  • Type 4WRE (4/3 version), separate order:
  - digital and analog amplifier in Euro-card format
  - analog amplifier in modular design
  • Type 4WRE…A (4/2 version), separate order:
  - analog amplifier in modular design

Information on available spare parts:
www.boschrexroth.com/spc

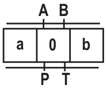
Ordering code

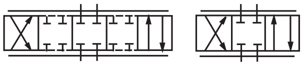
4WRE				–2X /	G24	/	V	*

Without integrated electronics (OBE) = **no code**
With integrated electronics (OBE) = **E**

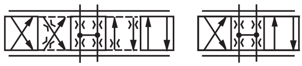
Size 6 = **6**
Size 10 = **10**

Control spool symbols

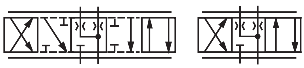




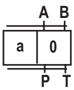
= **E**
E1–



= **V**
V1–



= **W**
W1–



= **EA**

= **WA**

With symbol E1–, V1– and W1–:
P → A: $q_{V\,max}$ B → T: $q_V/2$
P → B: $q_V/2$ A → T: $q_{V\,max}$

Notice:
In the zero position, spools W and WA have a connection from A to T and B to T with approx. 3 % of the relevant nominal cross-section.

Further details in the plain text

Seal material
V = FKM seals [1]

Electronic interface
A1 = Command value ±10 V
F1 = Command value 4 to 20 mA
no code = Type 4WRE

Electrical connection
Type 4WRE:
K4 = **Without** mating connector, with connector according to DIN EN 175301-803
Mating connector (solenoid, position transducer), separate order, see page 8
Type 4WREE:
K31 = **Without** mating connector, with connector according to DIN EN 175201-804
Mating connector – separate order, see page 9

Supply voltage
G24 = Direct voltage 24 V

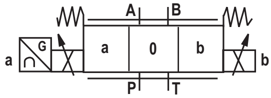
2X = 20 to 29
(20 to 29: unchanged installation and connection dimensions)

Rated flow at valve pressure differential Δp = 10 bar
Size 6
04 = 4 l/min
08 = 8 l/min
16 = 16 l/min
32 = 32 l/min
Size 10
25 = 25 l/min
50 = 50 l/min
75 = 75 l/min

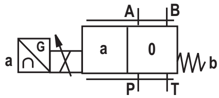
[1] Design SO660 with NBR seals at the valve connection surface

Symbols

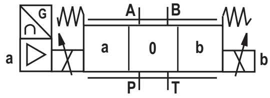
Proportional directional valve without integrated electronics
Type 4WRE…



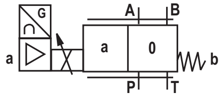
Type 4WRE…**A**…



Proportional directional valve with integrated electronics
Type 4WREE…



Type 4WREE…**A**…



Function, section

Type 4WRE …-2X/…

The 4/2 and 4/3 proportional directional valves are designed as direct operated devices in plate design. Operation is effected by proportional solenoids with central thread and detachable coil. The solenoids are controlled by external electronics.

Set-up:

The valve basically consists of:

- Housing (1) with connection surface
- Control spool (2) with compression springs (3 and 4) and spring plate (5 and 6)
- Solenoids (7 and 8) with central thread
- Position transducer (9)

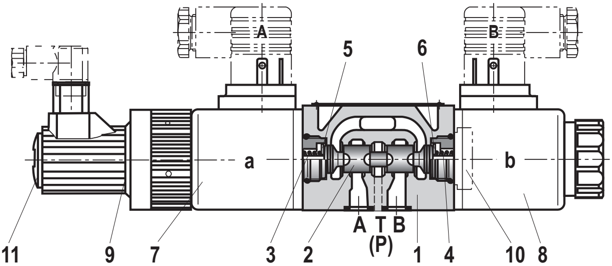
Important note!

The PG fitting (11) must not be opened. Mechanical adjustment of the adjustment nut located below is prohibited and damages the valve!

Function:

- With de-energized solenoids (7 and 8), central position of the control spool (2) by compression springs (3 and 4) between spring plates (5 and 6)
- Direct operation of the control spool (2) by controlling a proportional solenoid, e.g. solenoid "b" (8)
  - → Displacement of the control spool (2) to the left proportional to the electric input signal
  - → Connection from P to A and B to T via orifice-type cross-sections with progressive flow characteristic
- Switching off of the solenoid (8)
  - → The compression spring (3) brings the control spool (2) back into the central position

In the de-energized condition, the control spool (2) is held in a mechanical central position by the return springs. With control spool symbol "V", this position does not correspond to the hydraulic central position! When the electric valve control loop is closed, the control spool is positioned in the hydraulic central position.



Valve with 2 spool positions: (Type 4WRE…**A**…)

The function of this valve design basically corresponds to the valve with three spool positions. The 2 spool position valves are, however, only equipped with solenoid "a" (7). Instead of the 2nd proportional solenoid, there is a plug screw (10).

Notice!

Due to the design principle, internal leakage is inherent to the valves, which may increase over the life cycle.

Notice!

The tank line must not be allowed to run empty. With corresponding installation conditions, a pre-charge valve (pre-charging pressure approx. 2 bar) is to be installed.

Function, section

Type 4WREE …-2X/…

The 4/2 and 4/3 proportional directional valves are designed as direct operated devices in plate design. Operation is effected by proportional solenoids with central thread and detachable coil. The solenoids are controlled by the internal electronics.

Set-up:

The valve basically consists of:

- Housing (1) with connection surface
- Control spool (2) with compression springs (3 and 4) and spring plate (5 and 6)
- Solenoids (7 and 8) with central thread
- Position transducer (9)
- Integrated electronics (13)
- Electric zero point adjustment (12) accessible via Pg7

☞ **Important note!**

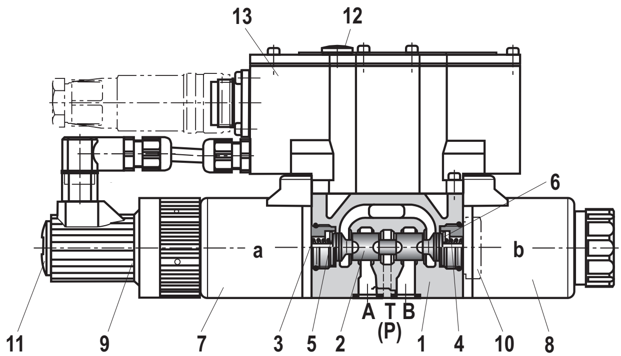
The PG fitting (11) must not be opened. Mechanical adjustment of the adjustment nut located below is prohibited and damages the valve!

Function:

- With de-energized solenoids (7 and 8), central position of the control spool (2) by compression springs (3 and 4) between spring plates (5 and 6)
- Direct operation of the control spool (2) by controlling a proportional solenoid, e.g. solenoid "b" (8)
  - → Displacement of the control spool (2) to the left proportional to the electric input signal
  - → Connection from P to A and B to T via orifice-type cross-sections with progressive flow characteristic
- Switching off of the solenoid (8)
  - → The compression spring (3) brings the control spool (2) back into the central position

In the de-energized condition, the control spool (2) is held in a mechanical central position by the return springs. With control spool symbol "V", this position does not correspond to the hydraulic central position! When the electric valve control loop is closed, the control spool is positioned in the hydraulic central position.

2



Valve with 2 spool positions: (Type 4WREE…**A**…)

The function of this valve design basically corresponds to the valve with three spool positions. The 2 spool position valves are, however, only equipped with solenoid "a" (7). Instead of the 2nd proportional solenoid, there is a plug screw (10).

☞ **Notice!**

Due to the design principle, internal leakage is inherent to the valves, which may increase over the life cycle.

☞ **Notice!**

The tank line must not be allowed to run empty. With corresponding installation conditions, a pre-charge valve (pre-charging pressure approx. 2 bar) is to be installed.

Technical data (For applications outside these parameters please consult us!)

general

Sizes		Size	6	10
Weight	– Type 4WRE	kg	2.2	6.3
	– Type 4WREE	kg	2.4	6.5
Installation position			Any, preferably horizontal	
Ambient temperature range	– Type 4WRE	°C	–20 to +70	
	– Type 4WREE	°C	–20 to +50	
Storage temperature range		°C	–20 to +80	
$MTTF_d$ values according to EN ISO 13849		Years	150 [1)] (for more information see data sheet 08012)	

hydraulic (measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C and p = 100 bar)

Maximum operating pressure	– Port A, B, P	bar	315	
	– Port T	bar	210	
Rated flow $q_{V\ rated}$ with Δp = 10 bar		l/min	4, 8, 16, 32	25, 50, 75
Recommended maximum flow		l/min	80	180
Hydraulic fluid			See table below	
Hydraulic fluid temperature range		°C	–20 to +80 (preferably +40 to +50)	
Viscosity range		mm^2/s	20 to 380 (preferably 30 to 46)	
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Class 20/18/15 [2)]	
Hysteresis		%	≤ 0.1	
Range of inversion		%	≤ 0.05	
Response sensitivity		%	≤ 0.05	
Zero shift upon change of hydraulic fluid temperature and operating pressure		%/10 K	≤ 0.15	
		%/100 bar	≤ 0.1	

1) With control spool types E, E1, EA, W, W1, WA; in longitudinal control spool direction, there is sufficient positive overlap without shock/vibration load; observe the installation orientation with regard to the main direction of acceleration.

2) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components.
For the selection of the filters see www.boschrexroth.com/filter

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons		HL, HLP	NBR, FKM	DIN 51524
Flame-resistant	– Containing water	HFC (Fuchs HYDROTHERM 46M, Petrofer Ultra Safe 620)	NBR	ISO 12922

☞ **Important information on hydraulic fluids!**

- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!
- The flash point of the process and operating medium used must be 40 K higher than the maximum solenoid surface temperature.
- **Flame-resistant – water-containing**: Maximum pressure differential per control edge 175 bar. Pressure pre-loading at the tank port > 20 % of the pressure differential; otherwise, increased cavitation.

  Life cycle as compared to operation with mineral oil HL, HLP 50 % to 100 %.

Technical data (For applications outside these parameters please consult us!)

electric

Size		Size	**6**	**10**
Voltage type			Direct voltage	
Solenoid coil resistance	– Cold value at 20 °C	Ω	2.65	4.55
	– Maximum hot value	Ω	4.05	6.82
Duty cycle		%	100	
Maximum coil temperature [1]		°C	up to 150	
Electrical connection see page 8 and 9	– Type 4WRE		With connector according to DIN EN 175301-803 and ISO 4400	
			Mating connector according to DIN EN 175301-803 and ISO 4400 [2]	
	– Type 4WREE		With connector DIN EN 175201-804	
			Mating connector DIN EN 175201-804 [2]	
Protection class of the valve according to EN 60529			IP65 with mating connector mounted and locked	

Control electronics

Type 4WRE	4/3 version				
		Amplifier in euro-card format [2]	Digital	VT-VRPD-2-2X/V0/0 according to RE 30126	
			Analog	VT-VRPA2-1-1X/V0 according to data sheet 30119	VT-VRPA2-2-1X/V0 according to data sheet 30119
		Module amplifier [2]	Analog	VT-MRPA2-1 according to data sheet 30219	VT-MRPA2-2 according to data sheet 30219
Type 4WRE…A…	4/2 version				
		Module amplifier [2]	Analog	VT-MRPA1-1 according to data sheet 30219	VT-MRPA1-2 according to data sheet 30219
Type 4WREE				Integrated in the valve, see page 9	
		analog command value module		VT- SWMA-1-1X/... according to data sheet 29902	
		analog command value module		VT-SWMAK-1-1X/... according to data sheet 29903	
		analog command value card		VT-SWKA-1-1X/... according to data sheet 30255	
		digital command value card		VT-HACD -1-1X/... according to data sheet 30143	
Supply voltage		Nominal voltage	VDC	24	
		lower limit value	V	19.4	
		upper limit value	V	35	
Current consumption of the amplifier		I_{max}	A	< 2	
		Pulse current	A	3	

[1] Due to the temperatures occurring at the surfaces of the solenoid coils, the European standards ISO 13732-1 and EN ISO 4413 need to be adhered to!

[2] Separate order

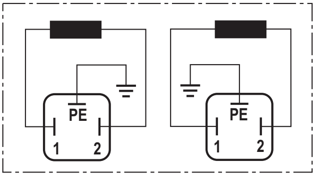
Notice: For information on the **environmental simulation testing** for the areas EMC (electromagnetic compatibility), climate and mechanical load see data sheet 29061-U (declaration on environmental compatibility).

2

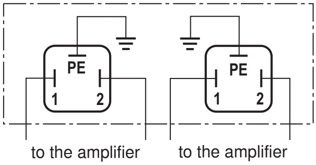
Electrical connection, mating connectors (dimensions in mm)

Type 4WRE (**without** integrated electronics)

Connection to connector



Connection to mating connector

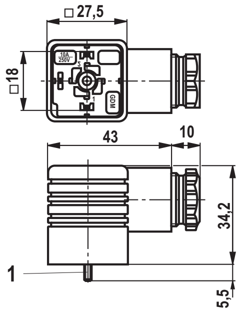


Mating connector CECC 75 301-803-A002FA-H3D08-G
according to DIN EN 175301-803 and ISO 4400

Solenoid **a**, color gray
separate order under the Material no. **R901017010**

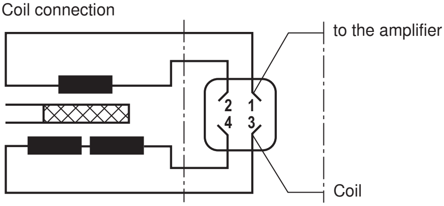
Solenoid **b**, color black
separate order under the Material no. **R901017011**

1 Mounting screw M3
Tightening torque M_A = 0.5 Nm + 0.1 Nm

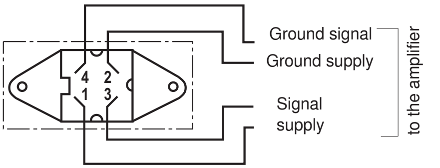


Inductive position transducer

Coil connection



Connection to plug-in connector



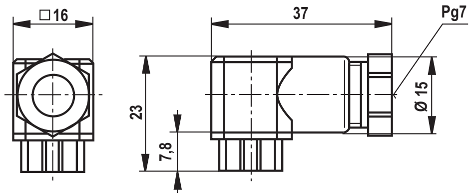
Mating connector 4-pole Pg7-G4W1F

separate order under the Material no. **R900023126**

Connection cable:

Recommendation:
up to 50 m cable length type LiYCY 4 x 0.25 mm²

Connect shield to PE only on the supply side.



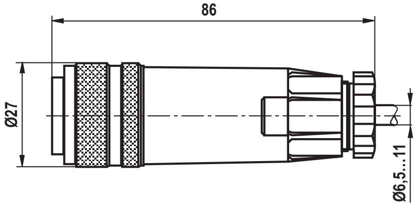
Electrical connection, mating connectors (dimensions in mm)

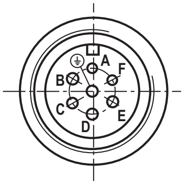
Type 4WREE (**with** integrated electronics (OBE)

Mating connector according to DIN EN 175201-804
separate order under the Material no. **R900021267** (plastic version)

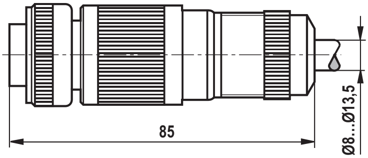
Angular design – separate order under the Material no. **R900217845**

Pin assignment see also block diagram page 10





Mating connector according to DIN EN 175201-804
separate order under the Material no. **R900223890** (metal version)



Device connector allocation	Contact	Signal with A1 interface	Signal with F1 interface
Supply voltage	A	24 VDC (u(t) = 19.4 to 35 V); $\boldsymbol{I}_{max}$ = 2 A	
	B	0 V	
Reference potential actual value	C	Reference contact F; $\boldsymbol{R}_e$ > 50 kΩ	Reference contact F; $\boldsymbol{R}_e$ < 10 Ω
Differential amplifier input	D	±10 V command value; $\boldsymbol{R}_e$ > 50 kΩ	4 to 20 mA command value; $\boldsymbol{R}_e$ > 100 Ω
	E	Reference potential command value	
Measuring output (actual value)	F	±10 V actual value (limit load 5 mA)	4 to 20 mA actual value, load resistance max. 300 Ω
	PE	Connected to cooling element and valve housing	

Command value: Positive command value 0 to +10 V (or 12 to 20 mA) at D and reference potential at E result in flow from P → A and B → T.
Negative command value 0 to –10 V (or 12 to 4 mA) at D and reference potential at E result in flow from P → B and A → T.

For valves with 1 solenoid on side a (e. g. variant **EA** and **WA**), a positive command value 0 to +10 V (or 4 to 20 mA) at D and reference potential at E result in flow from P → B and A → T.

Actual value: Actual value 0 to +10 V (or 12 to 20 mA) at F and reference potential at C result in flow from P → A and B → T, actual value 0 to –10 V (or 4 to 12 mA) result in flow from P → B and A → T.

With valves with 1 solenoid, a positive actual value 0 to +10 V (or 4 to 20 mA) at F and reference potential at C result in flow from P → B and A → T.

Connection cable: Recommendation: – up to 25 m cable length type LiYCY 7 x 0.75 mm²
– up to 50 m cable length type LiYCY 7 x 1.0 mm²

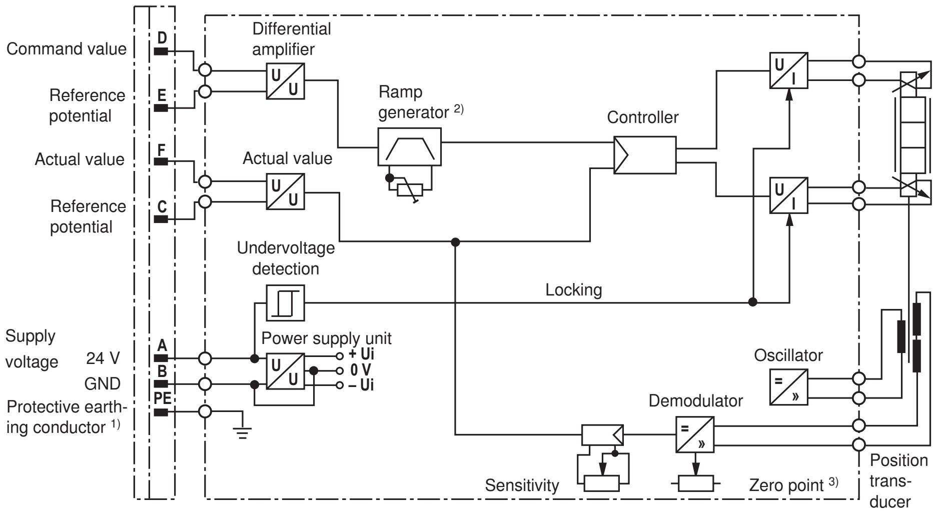
External diameter see sketch of mating connector

Connect shield to PE only on the supply side.

Integrated electronics (OBE) type 4WREE

Block diagram / pin assignment

Interface	Integrated electronics (OBE)	Valve

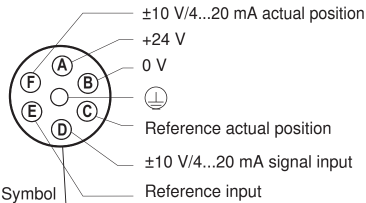


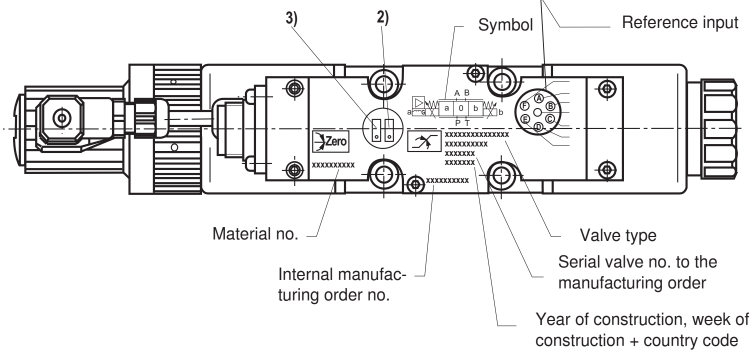
Notice: Electric signals taken out via control electronics (e.g. actual value) must not be used for switching off safety-relevant machine functions!

1) The protective earthing conductor (PE) is connected to cooling element and valve housing!

2) Ramp can be set from 0 to 2.5 s from the outside, identical for T_{up} and T_{down}

3) Zero point can be set from the outside

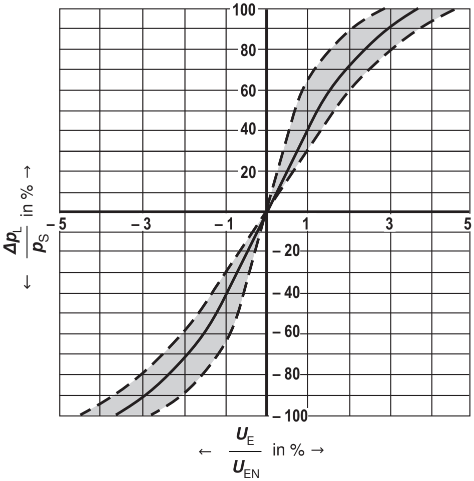




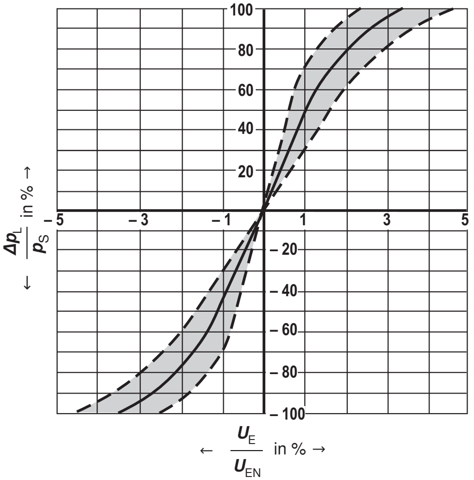
Characteristic curves: Type 4WREE (measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C) Size 6 and 10

Pressure signal characteristic curve (control spool V),
p_s = 100 bar

Size 6



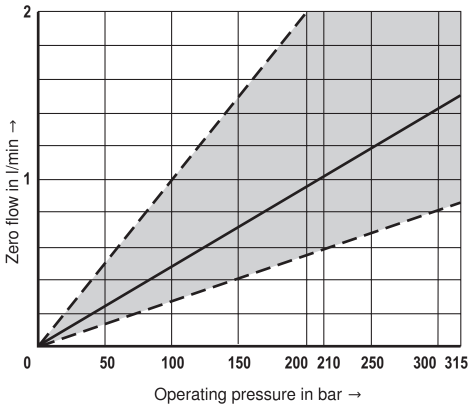
Size 10



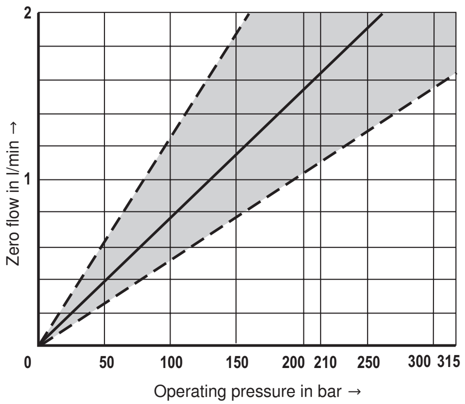
Characteristic curves: Type 4WREE (measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C) Size 6 and 10

Zero flow with central control spool position

Type 4WREE 6 V32

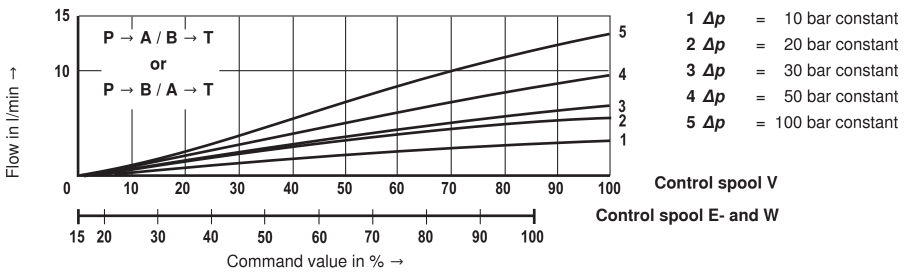


Type 4WREE 10 V75



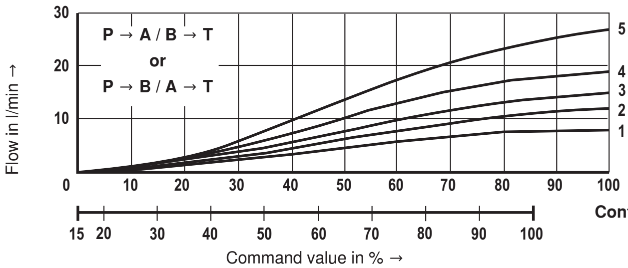
Characteristic curves: Type 4WREE (measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C and p = 100 bar) Size 6

4 l/min rated flow with 10 bar valve pressure differential



Characteristic curves: Type 4WREE (measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C and p = 100 bar) Size 6

8 l/min rated flow with 10 bar valve pressure differential

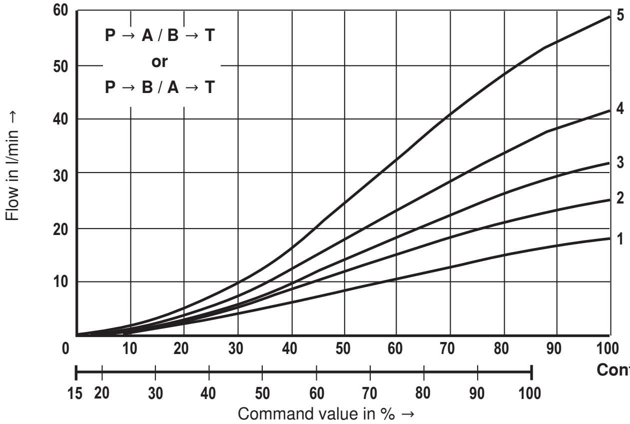


Control spool V

Control spool E- and W

1 *Δp* = 10 bar constant
2 *Δp* = 20 bar constant
3 *Δp* = 30 bar constant
4 *Δp* = 50 bar constant
5 *Δp* = 100 bar constant

16 l/min rated flow with 10 bar valve pressure differential

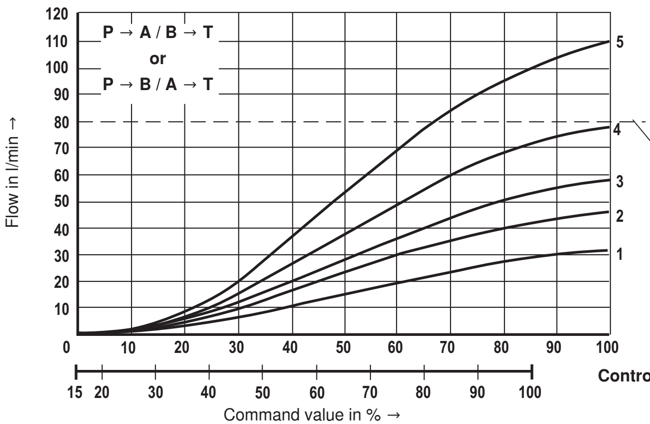


Control spool V

Control spool E- and W

1 *Δp* = 10 bar constant
2 *Δp* = 20 bar constant
3 *Δp* = 30 bar constant
4 *Δp* = 50 bar constant
5 *Δp* = 100 bar constant

32 l/min rated flow with 10 bar valve pressure differential



Control spool V

Control spool E- and W

1 *Δp* = 10 bar constant
2 *Δp* = 20 bar constant
3 *Δp* = 30 bar constant
4 *Δp* = 50 bar constant
5 *Δp* = 100 bar constant

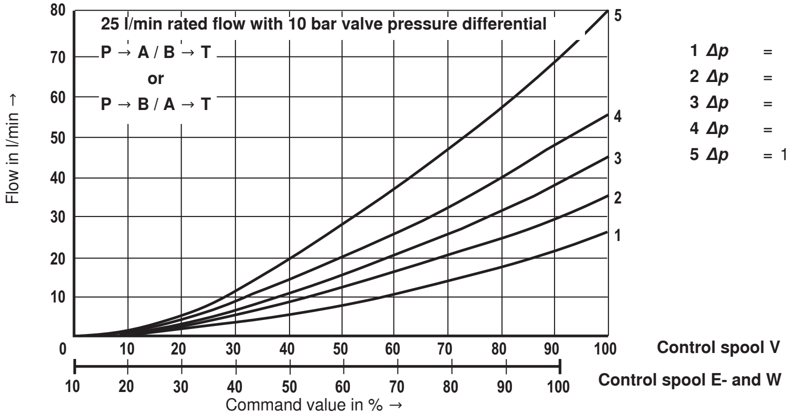
Maximum admissible flow

Notice:
Observe the performance limits on page 15!

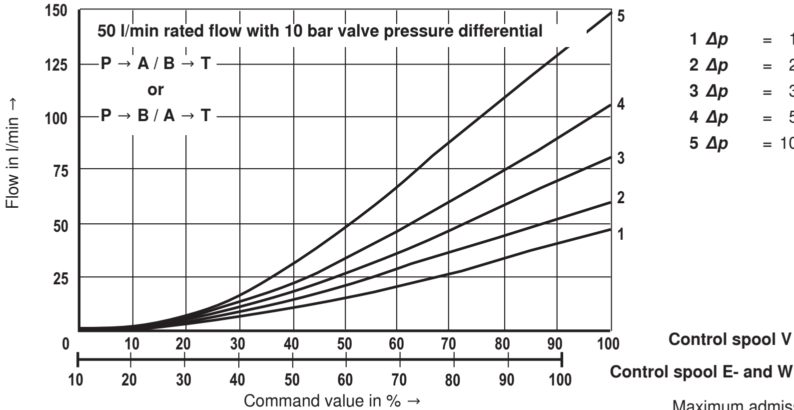
Δp = Valve pressure differential (inlet pressure p_P minus load pressure p_L minus return flow pressure p_T)

2

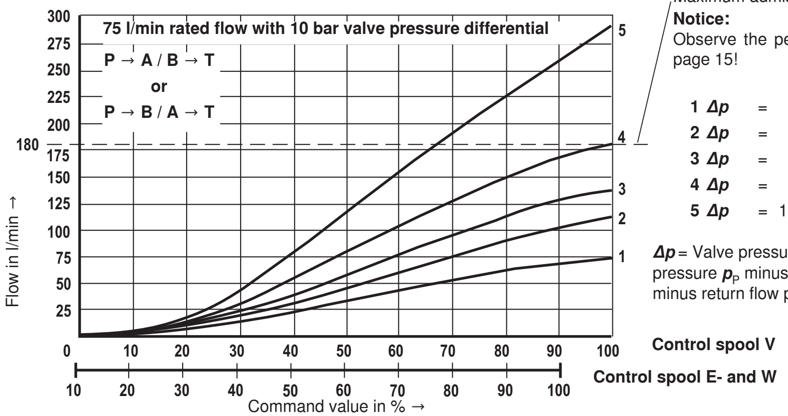
Characteristic curves: Type 4WREE (measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C and p = 100 bar) Size 10



1 **Δp** = 10 bar constant
2 **Δp** = 20 bar constant
3 **Δp** = 30 bar constant
4 **Δp** = 50 bar constant
5 **Δp** = 100 bar constant



1 **Δp** = 10 bar constant
2 **Δp** = 20 bar constant
3 **Δp** = 30 bar constant
4 **Δp** = 50 bar constant
5 **Δp** = 100 bar constant



Maximum admissible flow

Notice:
Observe the performance limits on page 15!

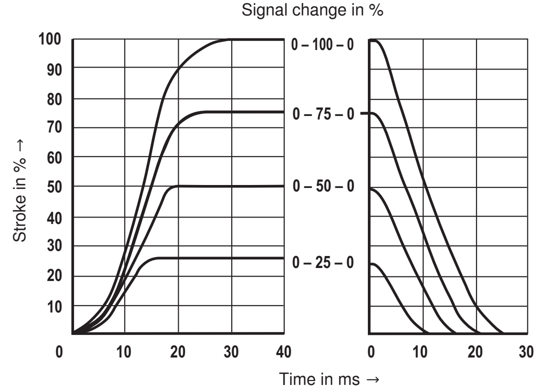
1 **Δp** = 10 bar constant
2 **Δp** = 20 bar constant
3 **Δp** = 30 bar constant
4 **Δp** = 50 bar constant
5 **Δp** = 100 bar constant

Δp = Valve pressure differential (inlet pressure p_P minus load pressure p_L minus return flow pressure p_T)

Transition function with stepped electric input signals: Type 4WREE Size 6
(measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C and p_s = 10 bar)

4/3 valve version

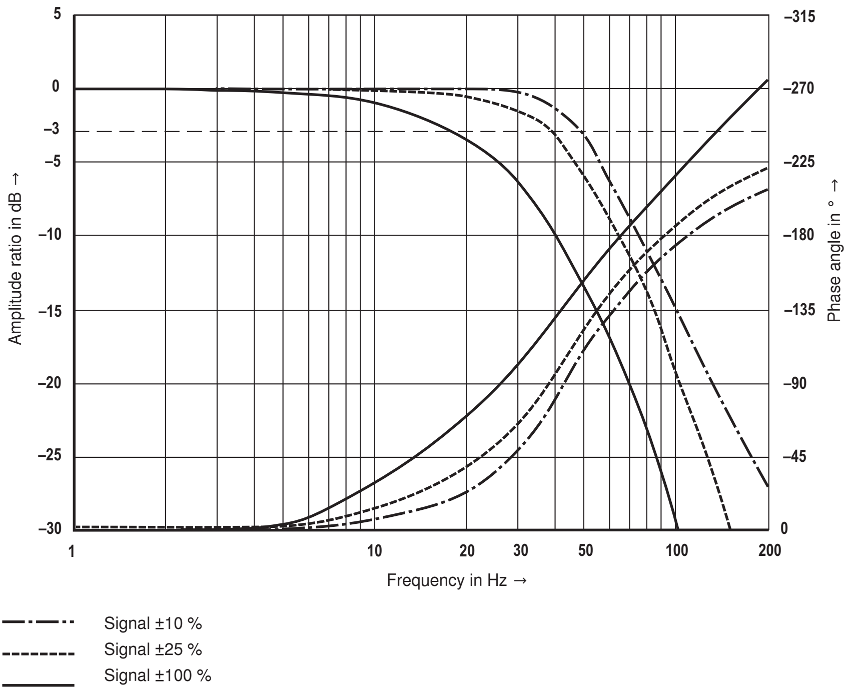
Control spool E



Frequency response characteristic curves: Type 4WREE
(measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C, p_s = 10 bar) Size 6

4/3 valve version

Control spool V

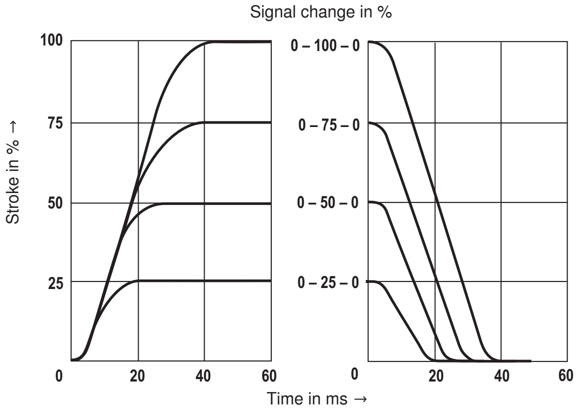


Transition function with stepped electric input signals: Type 4WREE — Size 10

(measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C and p_s = 10 bar)

4/3 valve version

Control spool E

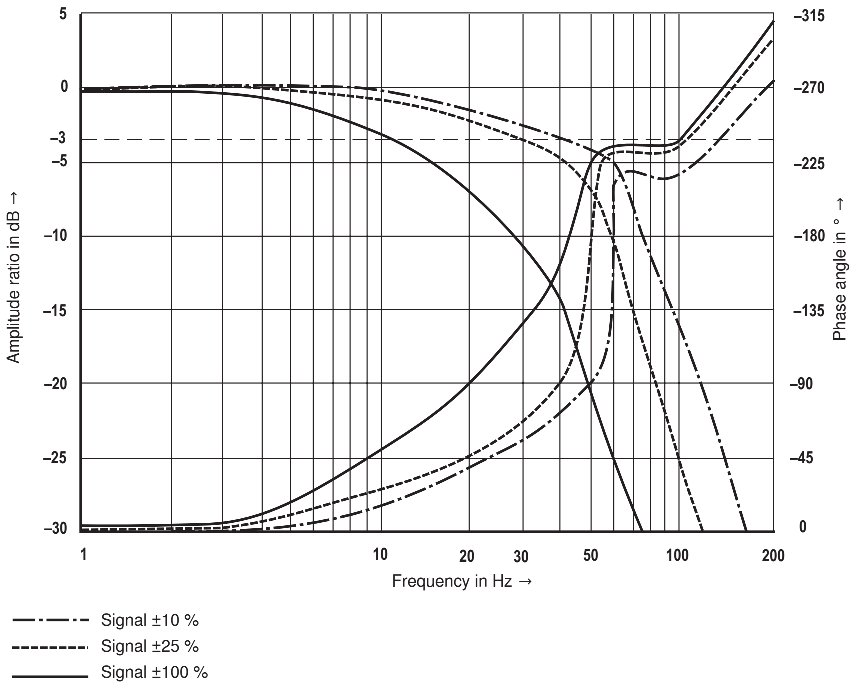


Frequency response characteristic curves: Type 4WREE

(measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C, p_s = 10 bar) **Size 10**

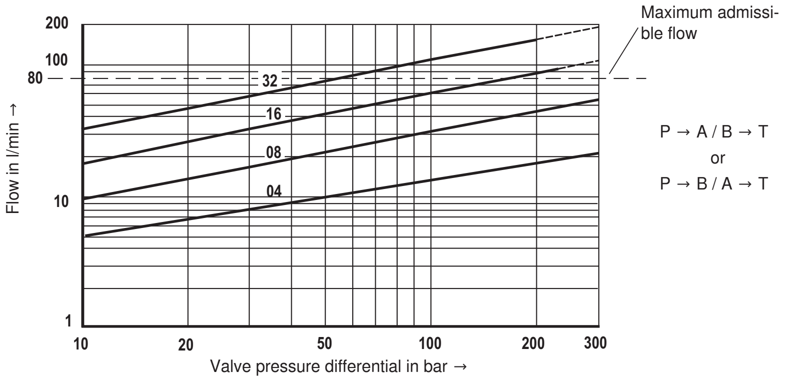
4/3 valve version

Control spool V



Flow: Type 4WREE (measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C) Size 6

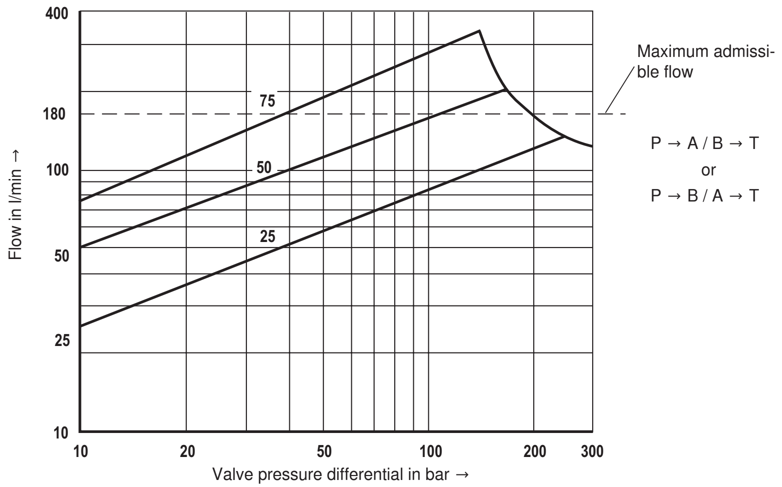
Load function with maximum valve opening
Rated flow 4, 8, 16 and 32 l/min
Control spool V



Observe the maximum admissible flow of 80 l/min!

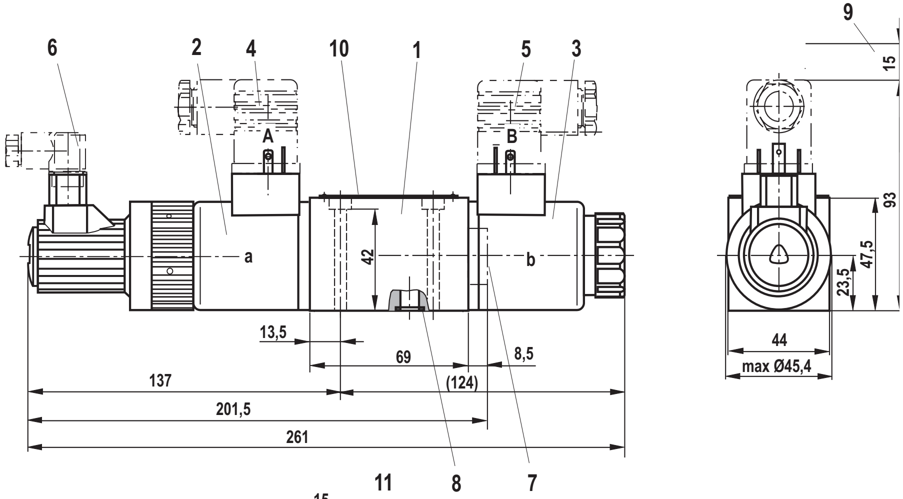
Flow: Type 4WREE (measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C) Size 10

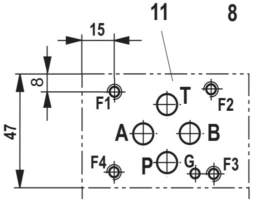
Load function with maximum valve opening
Rated flow 25, 50 and 75 l/min
Control spool V

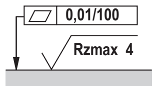


Observe the maximum admissible flow of 180 l/min!

Unit dimensions: Type 4WRE (dimensions in mm) **Size 6**





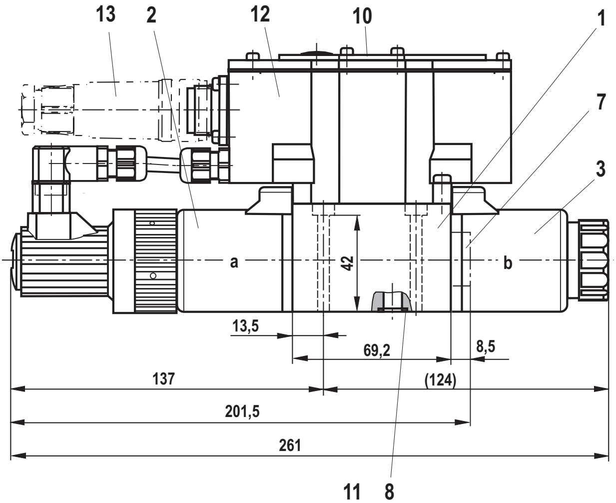


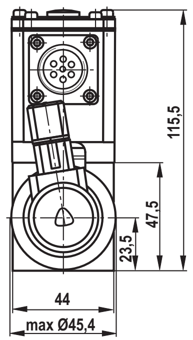
Required surface quality of the valve mounting face

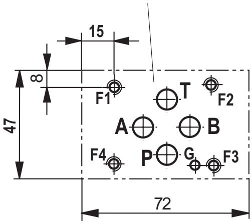
1 Valve housing
2 Proportional solenoid "a" with inductive position transducer
3 Proportional solenoid "b"
4 Mating connector "A", color gray, separate order – see page 8
5 Mating connector "B", color black, separate order – see page 8
6 Mating connector for inductive position transducer, separate order – see page 8
7 Plug screw for valve with one solenoid (2 spool positions, version **EA** or **WA**)
8 Identical seal rings for ports A, B, P, and T
9 Space required to remove the mating connector
10 Name plate
11 Machined valve mounting face, porting pattern according to ISO 4401-03-02-0-05 (**with** locating hole)
Deviating from the standard:
- without locating hole "G"
- Ports P, A, B and T with Ø 8 mm

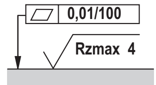
Subplates and valve mounting screws see page 22

Unit dimensions: Type 4WREE (dimensions in mm) **Size 6**









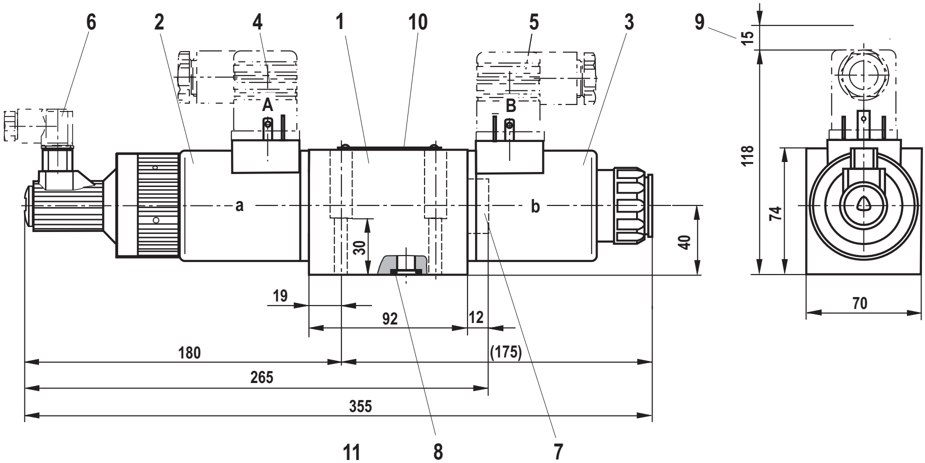
Required surface quality of the valve mounting face

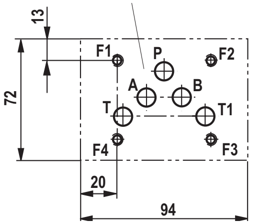
General tolerances according to ISO 2768-mK

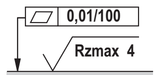
1 Valve housing
2 Proportional solenoid "a" with inductive position transducer
3 Proportional solenoid "b"
7 Plug screw for valve with one solenoid (2 spool positions, version **EA** or **WA**)
8 Identical seal rings for ports A, B, P, and T
10 Name plate
11 Machined valve mounting face, porting pattern according to ISO 4401-03-02-0-05 (**with** locating hole)
Deviating from the standard:
- without locating hole "G"
- Ports P, A, B and T with Ø 8 mm
12 Integrated electronics (OBE)
13 Mating connector, separate order – see page 9

Subplates and valve mounting screws see page 22

Unit dimensions: Type 4WRE (dimensions in mm) **Size 10**







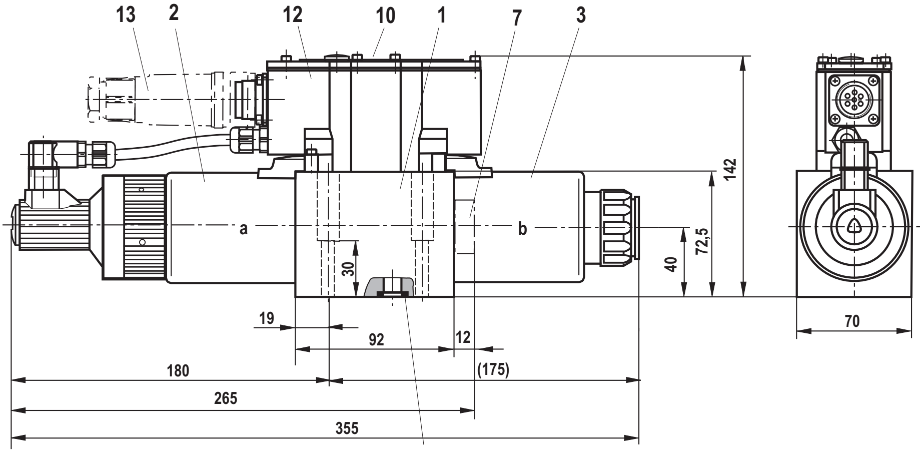
Required surface quality of the valve mounting face

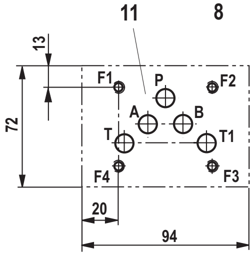
General tolerances according to ISO 2768-mK

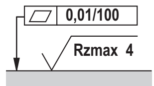
1 Valve housing
2 Proportional solenoid "a" with inductive position transducer
3 Proportional solenoid "b"
4 Mating connector "A", color gray, separate order – see page 8
5 Mating connector "B", color black, separate order – see page 8
6 Mating connector for inductive position transducer, separate order – see page 8
7 Plug screw for valve with one solenoid (2 spool positions, version **EA** or **WA**)
8 Identical seal rings for ports A, B, P, T and T1
9 Space required to remove the mating connector
10 Name plate
11 Machined valve contact surface, porting pattern according to ISO 4401-05-04-0-05 differing from the standard: Connection T1 Ø 11.2 mm

Subplates and valve mounting screws see page 22

Unit dimensions: Type 4WREE (dimensions in mm) **size 10**







Required surface quality of the
valve mounting face

General tolerances according to ISO 2768-mK

1 Valve housing
2 Proportional solenoid "a" with inductive position transducer
3 Proportional solenoid "b"
7 Plug screw for valve with one solenoid (2 spool positions, version **EA** or **WA**)
8 Identical seal rings for ports A, B, P, T and T1
10 Name plate
11 Machined valve contact surface, porting pattern according to ISO 4401-05-04-0-05 differing from the standard: Connection T1 Ø 11.2 mm
12 Integrated electronics (OBE)
13 Mating connector, separate order – see page 9

Subplates and valve mounting screws see page 22

Unit dimensions

Hexagon socket head cap screws		**Material number**
Size 6	4x ISO 4762 - M5 x 50 - 10.9-flZn-240h-L Tightening torque M_A = 7 Nm ±10 % or 4x ISO 4762 - M5 x 50 - 10.9 Tightening torque M_A = 8.9 Nm ±10 %	R913000064
Size 10	4x ISO 4762 - M6 x 40 - 10.9-flZn-240h-L Tightening torque M_A = 12.5 Nm ±10 % or 4x ISO 4762 - M6 x 40 - 10.9 Tightening torque M_A = 15.5 Nm ±10 %	R913000058

Notice: This tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure!

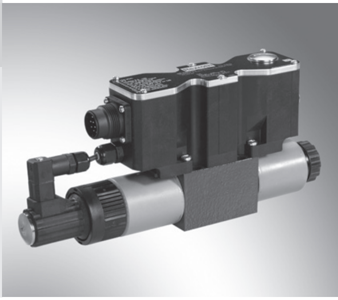
Subplates	**Data sheet**
Size 6	45052
Size 10	45054

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
documentation@boschrexroth.de
www.boschrexroth.de

4/3 proportional directional valve direct operated, with integrated electronics

RE 29064/03.13
Replaces: 12.12

Type 4WREEM



Sizes 6 and 10
Component series 2X
Maximum operating pressure 315 bar
Maximum flow: 90 l/min (size 6)
180 l/min (size 10)

Table of contents

Features

- Direct operated proportional directional valve for controlling flow direction and flow size
- Operation by means of proportional solenoids with central thread and detachable coil
- Electrical position feedback
- Integrated electronics (OBE) with B6 interface
- Monitoring of control spool position
- With or without step function
- Spring-centered control spool
- For subplate mounting: Porting pattern according to ISO 4401

Information on available spare parts:
www.boschrexroth.com/spc

Ordering code

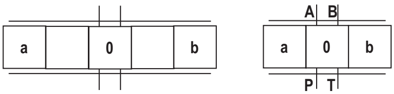
4WRE	E	M				–2X/	G24	K34/	B6	V	*

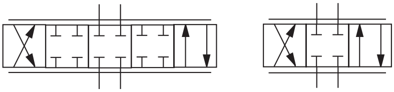
With integrated electronics (OBE) **= E**

Monitoring of control spool position **= M**

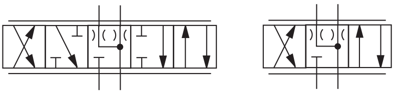
Size 6 **= 6**
Size 10 **= 10**

Control spool symbols





= E; E1–



= W; W1–

With symbols E1– and W1–:
P → A: $q_{V\,max}$ B → T: $q_V/2$
P → B: $q_V/2$ A → T: $q_{V\,max}$

Notice:
In the zero position, spools W and WA have a connection from A to T and B to T with approx. 3 % of the relevant nominal cross-section.

Rated flow with valve pressure differential Δp = 10 bar

	Size 6
04 =	4 l/min
08 =	8 l/min
16 =	16 l/min
32 =	32 l/min
	Size 10
25 =	25 l/min
50 =	50 l/min
75 =	75 l/min

Option
no code = Without step function
J = Electr. compensation of the control spool overlap

2X = 20 to 29
(20 to 29: Unchanged installation and connection dimensions)

Supply voltage
G24 = Direct voltage 24 V

Electrical connection
K34 = Without mating connector with connector according to DIN 43 651
Mating connector - separate order, see page 5

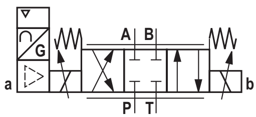
Electronics interface
B6 = Command value ±10 VDC

Seal material
V = FKM seal

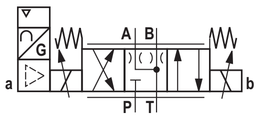
Further details in the plain text

Symbols

Type 4WREEM . **E**…



Type 4WREEM . **W**…



Function, section

The 4/3 proportional directional valves are designed as direct operated devices in plate design. Operation is effected by proportional solenoids with central thread and detachable coil. The solenoids are controlled by the internal electronics.
In version 4WREEM..., the valve is equipped with a symmetric spool overlap and features an operating direction and spool central position monitoring function.
In addition, the 4WREEM...J... model has a step function to compensate this overlap. This means that the spool overlap is quickly passed. The valve is mainly used in machines with high safety requirements, e.g. in hydraulic press controls.

Set-up:
The valve basically consists of:

- Housing (1) with connection surface
- Control spool (2) with compression springs (3 and 4)
- Solenoids (5 and 6) with central thread
- Position transducer (7)
- Integrated electronics (8)

Functional description:

- With de-energized solenoids (5 und 6), central position of the control spool (2) by compression springs (3 and 4)
- Direct operation of the control spool (2) by controlling a proportional solenoid, e.g. solenoid "b" (6)
  - → Displacement of the control spool (2) to the left proportional to the electric input signal
  - → Connection from P to A and B to T via orifice-type cross-sections with progressive flow characteristic
- Switching off of the solenoid "b" (6)
  - → The compression spring (3) brings the control spool (2) back into the central position

If no enable signal is available, the output stage is locked and the valve is not functional. The readiness for operation of the output stages can be queried via pin 8. If the supply voltage fails or if no command value is available, the valve control spool is maintained in the central position by centering springs. In this spool position of the E spool: A, B, P and T are blocked and in the W spool: A and B are connected to T

Monitoring function:

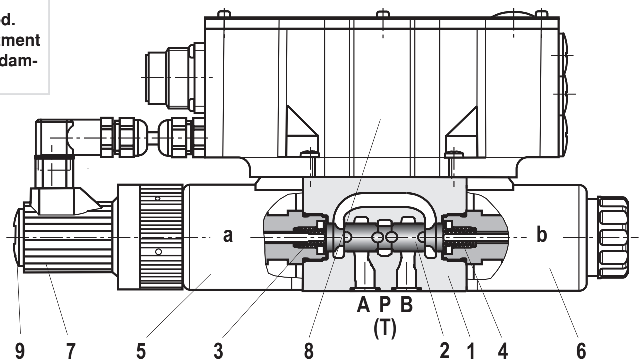
- Monitoring the control spool position via an inductive position transducer
- Output signals of the integrated electronics can be evaluated by an external safety control in order to detect any malfunction of the valve
- The power output stages are blocked by switching off the voltage for release (pin 3)
  Notice: Not released for switching-off according to EN13849!
- The output stages are enabled via the enable input (pin 3). The status message is sent via pin 8
- Leading out the signals to the signal outputs pin 9, pin 10 and pin 11 of the connector
  Triggering of the logic switching status signals when the threshold values (+ Xw and – Xw) are exceeded
- Use of the switching signals in a superior control for monitoring functions

Precondition for the use as safety-relevant component in hydraulic circuits:

- The entire control must meet the requirements of the standards that are relevant for the application, such as e.g. EN693, EN12622 or EN13849
- If the safety is called up or if the control detects an error, switching off the supply voltage (pin 1 and pin 2) and release (pin 3) must cause the valve to be switched off
- The valve must not be operated vertically with the spool position sensor hanging upside down

Important notice!
The PG fitting (9) must not be opened. Mechanical adjustment of the adjustment nut located below is prohibited and damages the valve!

Notice!
Due to the design principle, internal leakage is inherent to the valves, which may increase over the life cycle.
The tank line must not be allowed to run empty. With corresponding installation conditions, a preload valve (preload pressure approx. 2 bar) is to be installed.



Technical data (For applications outside these parameters, please consult us!)

general

Sizes	Size	6	10
Weight	kg	2.4	6.5
Installation position		Horizontal, must not be installed vertically	
Ambient temperature range	°C	–20 to +50	
Storage temperature range	°C	–20 to +80	
$MTTF_d$ values according to EN ISO 13849	Years	150 [1] (for more information see data sheet 08012)	

hydraulic (measured using HLP46, ϑ_{oil} = 40 °C ±5 °C)

Maximum operating pressure	– Port A, B, P	bar	Up to 315	
	– Port T	bar	Up to 210	
Rated flow $q_{V\ nom}$ at Δp = 10 bar		l/min	4, 8, 16, 32	25, 50, 75
Maximum admissible flow		l/min	90	180
Maximum admissible zero flow with p_e = 100 bar		l/min	≤ 0.3	≤ 0.6
Hydraulic fluid			See table below	
Hydraulic fluid temperature range		°C	–20 to +80 (preferably +40 to +50)	
Viscosity range		mm^2/s	20 to 380 (preferably 30 to 46)	
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Class 20/18/15 [1]	
Hysteresis		%	≤ 0.1	
Range of inversion		%	≤ 0.05	
Response sensitivity		%	≤ 0.05	
Zero shift upon change of hydraulic fluid temperature and operating pressure		%/10 K	< 0.15	
		%/100 bar	< 0.1	

[1] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components.
For the selection of the filters see www.boschrexroth.com/filter

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons		HL, HLP	NBR, FKM	DIN 51524
Flame-resistant	– containing water	HFC (Fuchs HYDROTHERM 46M, Petrofer Ultra Safe 620)	NBR	ISO 12922

☞ **Important information on hydraulic fluids!**

- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.)!
- The flash point of the process and operating medium used must be 40 K higher than the maximum solenoid surface temperature.
- **Flame-resistant – containing water**: Maximum pressure differential per control edge 175 bar. Pressure pre-loading at the tank port > 20 % of the pressure differential; otherwise, increased cavitation.

  Life cycle as compared to operation with mineral oil HL, HLP 50 % to 100 %.

Technical data (For applications outside these parameters, please consult us!)

electric

Supply voltage	Nominal voltage	VDC	24
	Lower limit value	VDC	19
	Upper limit value	VDC	35
Current consumption of the amplifier	I_{max}	A	2.0 plus load of switching outputs
	Impulse current	A	3.0 plus load of switching outputs
Command value input	Voltage input "B6"	V	±10 with Re = 100 kΩ
Command value output		V	±10
Duty cycle		%	100
Maximum coil temperature [1]		°C	Up to 150
Protection class according to DIN 40050			IP 65 with mounted and locked plug-in connectors

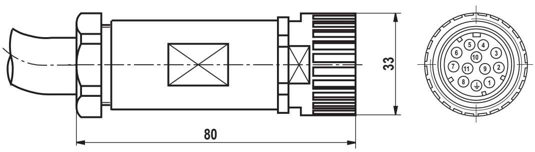
[1] Due to the temperatures occurring at the surfaces of the solenoid coils, the European standards ISO 13732-1 and EN ISO 4413 must be adhered to!

Notice!
Information on the environment simulation testing for the areas EMC (Electromagnetic compatibility), climate and mechanical load see RE 29048-U (declaration on environmental compatibility).64

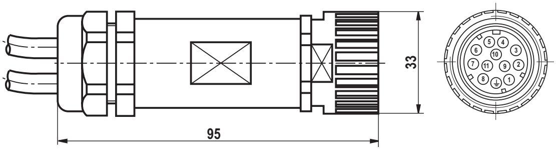
2

Electrical connection, mating connectors (dimensions in mm)

Mating connector according to DIN EN 175201-804 separate order under the material no. **R900752278** (plastic version) one cable duct with Ø 12 to 14 mm, pin assignment see below



Mating connector according to DIN EN 175201-804 separate order under the material no. **R900884671** (plastic version) two cable ducts with Ø 6 to 8 mm, pin assignment see below



Pin	Allocation interface B6	
1	24 VDC (u(t) = 19.0 V to 35 V), I_{max} = 2 A voltage supply	
2	0 V	
3	Enable input 8.5 VDC to 35 VDC	
4, 5	Differential amplifier input ±10 V command value	
6, 7	Differential amplifier input ±10 V actual value	
8	Power output stages signal output 0 V or U_B	
9	Control spool position P → B	24 VDC
10	Control spool position P → A	
11	Control spool position zero position	
PE	Connected to cooling element and valve housing	

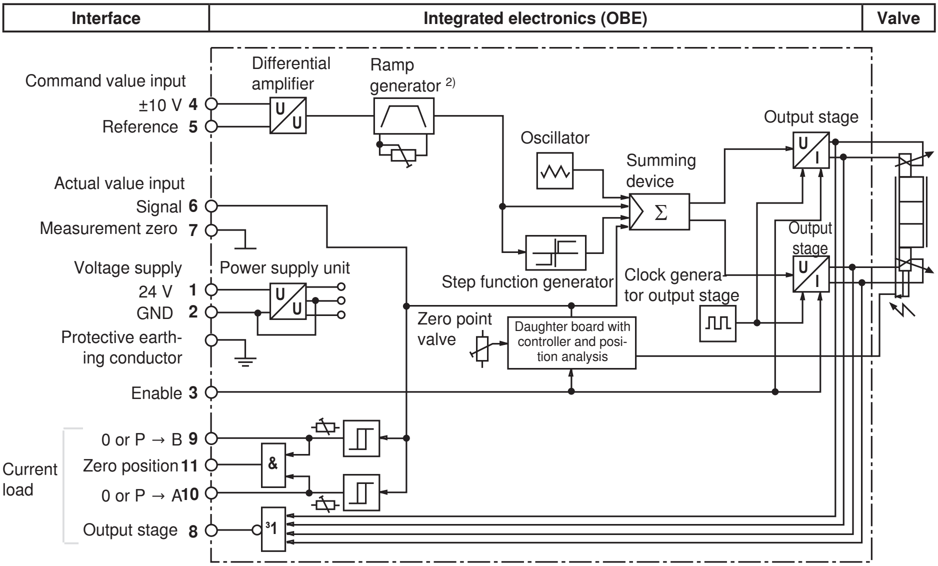
Command value: Positive command value 0 to +10 V at pin 4 and reference potential at pin 5 result in flow from P → A and B → T.
Negative command value 0 to –10 V at pin 4 and reference potential at pin 5 result in flow from P → B and A → T.

Actual value: Positive actual value 0 to +10 V at pin 6 and reference potential at pin 7 result in flow from P → A and B → T.
Negative actual value 0 to –10 V at pin 6 and reference potential at pin 7 result in flow from P → B and A → T.

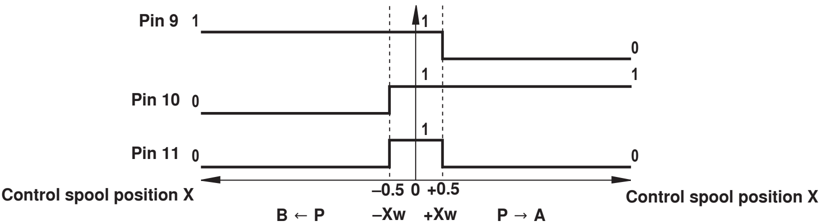
Connection cables: Recommendation: – Up to 25 m cable length type LiYCY 7 x 0.75 mm²
– Up to 50 m cable length type LiYCY 7 x 1.0 mm²

Integrated electronics

Block diagram



Logic switching statuses for control spool position monitoring



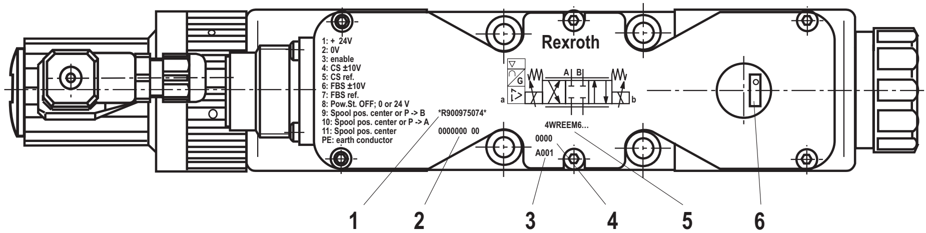
Logic signal linking

Control spool position	Direction of flow	Logic switching statuses		
		Pin 9	Pin 10	Pin 11
X < – Xw	B ← P	1	0	0
– Xw ≤ X ≤ Xw	-	1	1	1
X > Xw	P → A	0	1	0

0 ≙ 0 V
1 ≙ 24 VDC (19.0 V to 35 V)

Integrated electronics

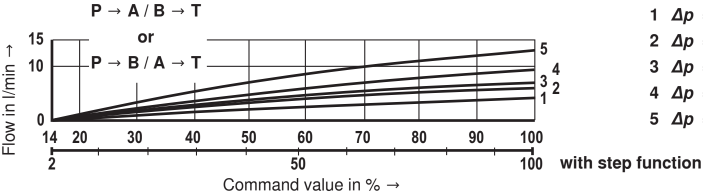
Marking and adjustment elements



1 Material no.
2 Production order number
3 Date of production
4 Serial number
5 Type designation
6 Setting the ramp time

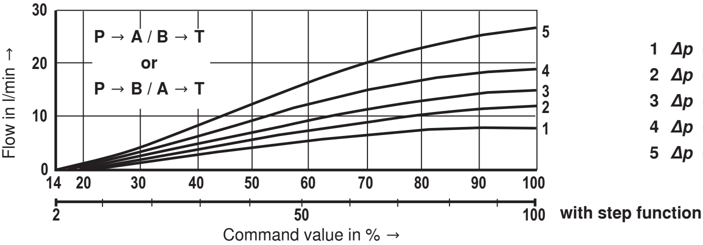
Characteristic curves: Size 6 (measured using HLP46, ϑ_{oil} = 40 °C ±5 °C, p = 100 bar)

4 l/min rated flow at 10 bar valve pressure differential



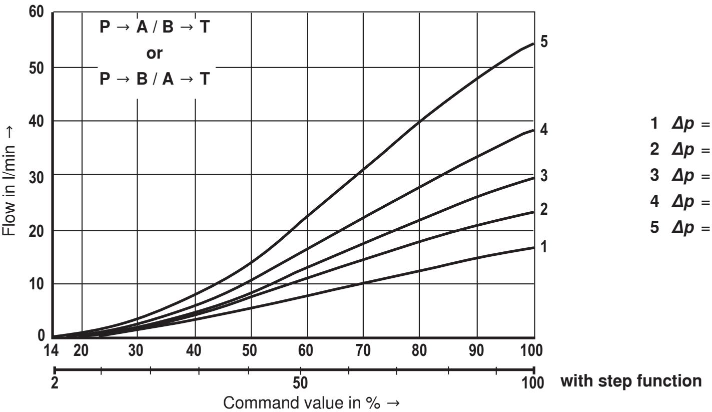
1 **Δp** = 10 bar constant
2 **Δp** = 20 bar constant
3 **Δp** = 30 bar constant
4 **Δp** = 50 bar constant
5 **Δp** = 100 bar constant

8 l/min rated flow at 10 bar valve pressure differential



1 **Δp** = 10 bar constant
2 **Δp** = 20 bar constant
3 **Δp** = 30 bar constant
4 **Δp** = 50 bar constant
5 **Δp** = 100 bar constant

16 l/min rated flow at 10 bar valve pressure differential

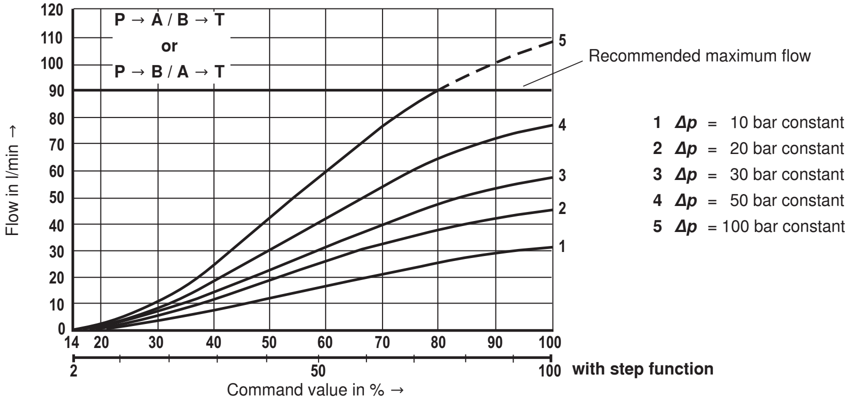


1 **Δp** = 10 bar constant
2 **Δp** = 20 bar constant
3 **Δp** = 30 bar constant
4 **Δp** = 50 bar constant
5 **Δp** = 100 bar constant

Δp = valve pressure differential (inlet pressure p_P minus load pressure p_L minus return flow pressure p_T)

Characteristic curves: Size 6 (measured using HLP46, ϑ_{oil} = 40 °C ±5 °C, p = 100 bar)

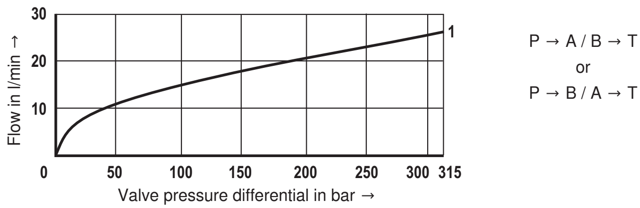
32 l/min rated flow at 10 bar valve pressure differential



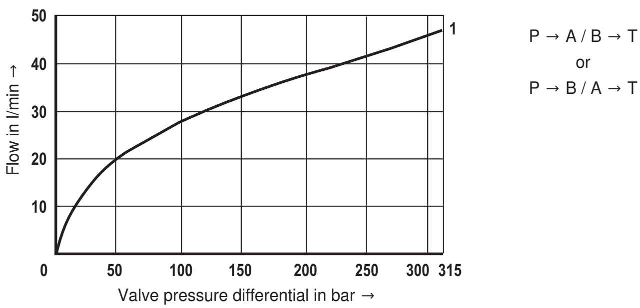
Δp = valve pressure differential (inlet pressure p_P minus load pressure p_L minus return flow pressure p_T)

Performance limit: Size 6 (measured using HLP46, ϑ_{oil} = 40 °C ±5 °C)

Rated flow 4 l/min



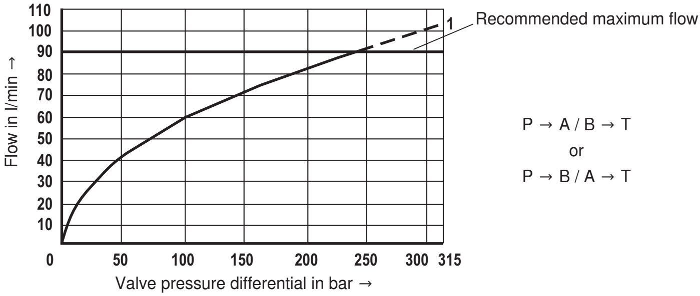
Rated flow 8 l/min



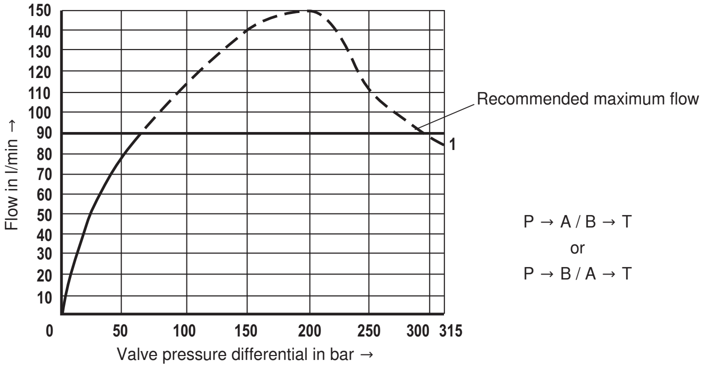
1 Command value = 100 %

Performance limit: Size 6 (measured using HLP46, ϑ_{oil} = 40 °C ±5 °C)

Rated flow 16 l/min

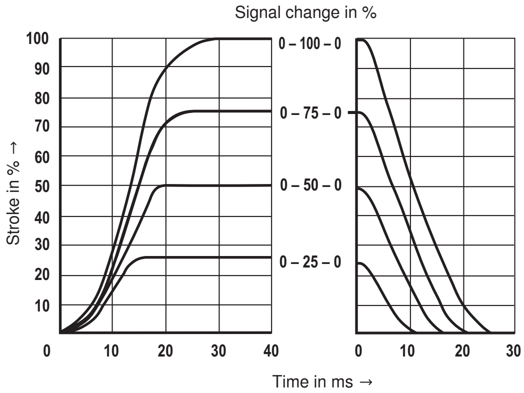


Rated flow 32 l/min

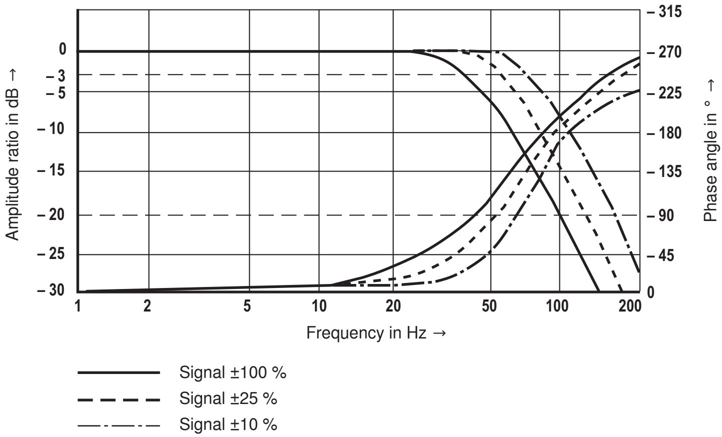


1 Command value = 100 %

Transition function with stepped electric input signals: Size 6
(measured using HLP46, ϑ_{oil} = 40 °C ±5 °C, p_s = 10 bar)

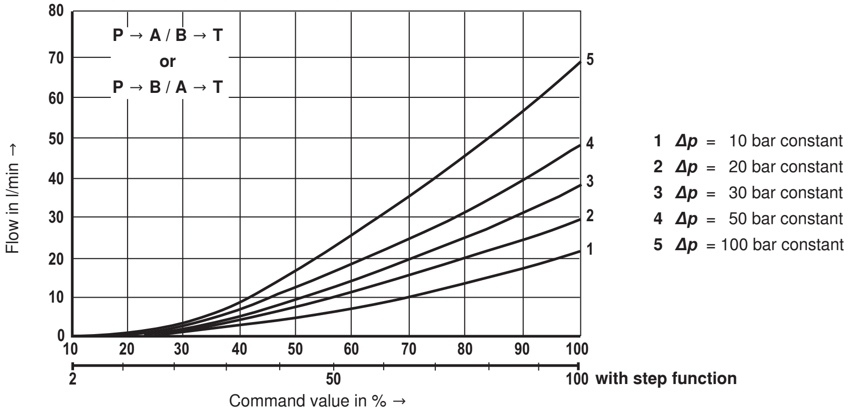


Frequency response characteristic curves: Size 6
(measured using HLP46, ϑ_{oil} = 40 °C ±5 °C, p_s = 10 bar)

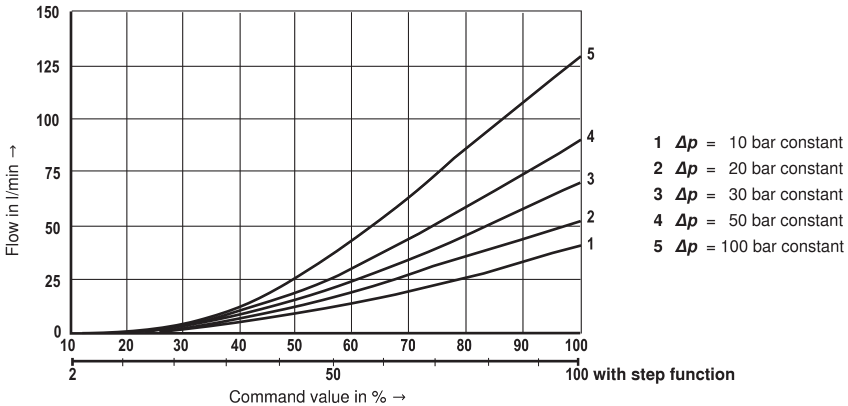


Characteristic curves: Size 10 (measured using HLP46, ϑ_{oil} = 40 °C ±5 °C, p = 100 bar)

25 l/min rated flow at 10 bar valve pressure differential



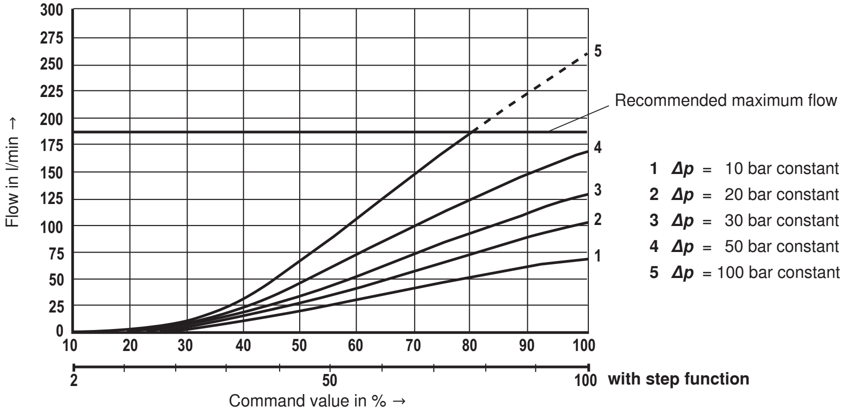
50 l/min rated flow at 10 bar valve pressure differential



Δp = valve pressure differential (inlet pressure p_P minus load pressure p_L minus return flow pressure p_T)

Characteristic curves: Size 10 (measured using HLP46, ϑ_{oil} = 40 °C ±5 °C, p = 100 bar)

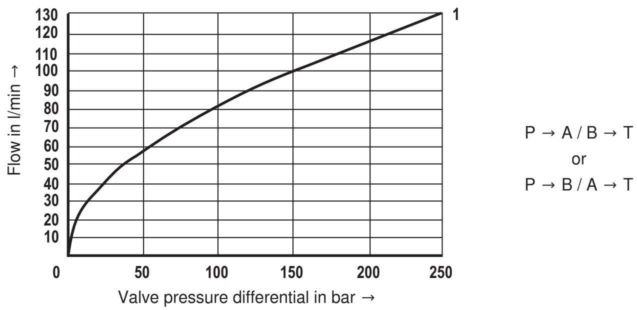
75 l/min rated flow at 10 bar valve pressure differential



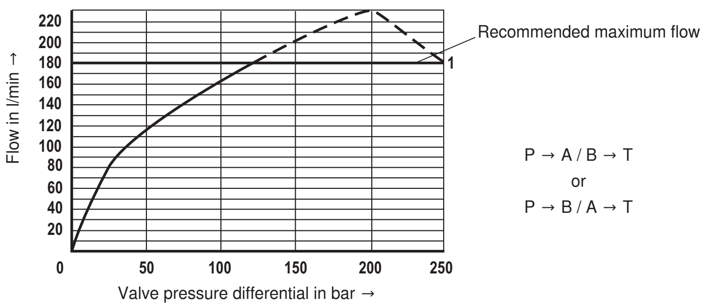
Δp = valve pressure differential (inlet pressure p_P minus load pressure p_L minus return flow pressure p_T)

Performance limit: Size 10 (measured using HLP46, ϑ_{oil} = 40 °C ±5 °C)

Rated flow 25 l/min



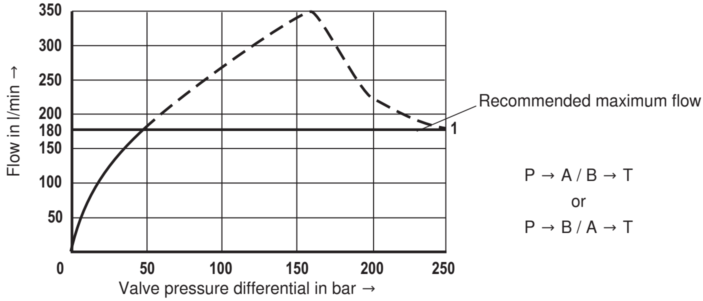
Rated flow 50 l/min



1 Command value = 100 %

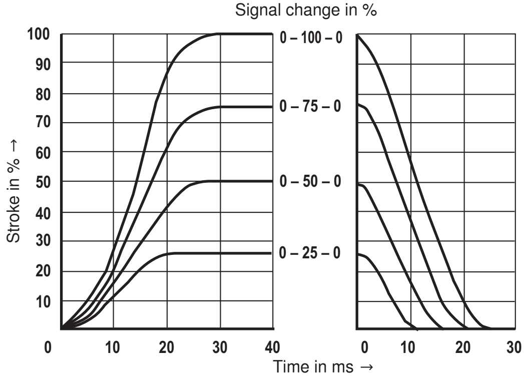
Performance limit: Size 10 (measured using HLP46, ϑ_{oil} = 40 °C ±5 °C)

Rated flow 75 l/min

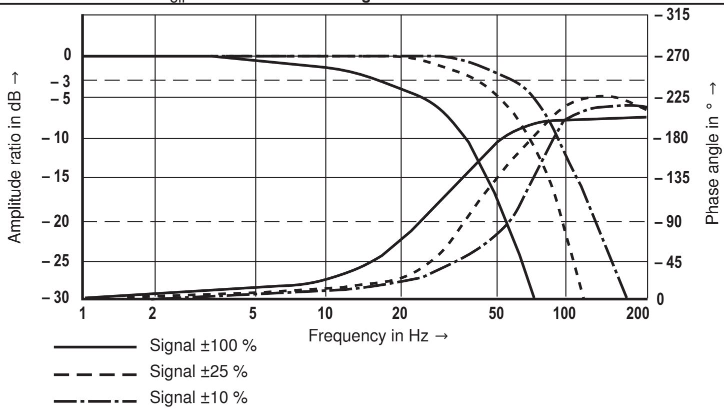


1 Command value = 100 %

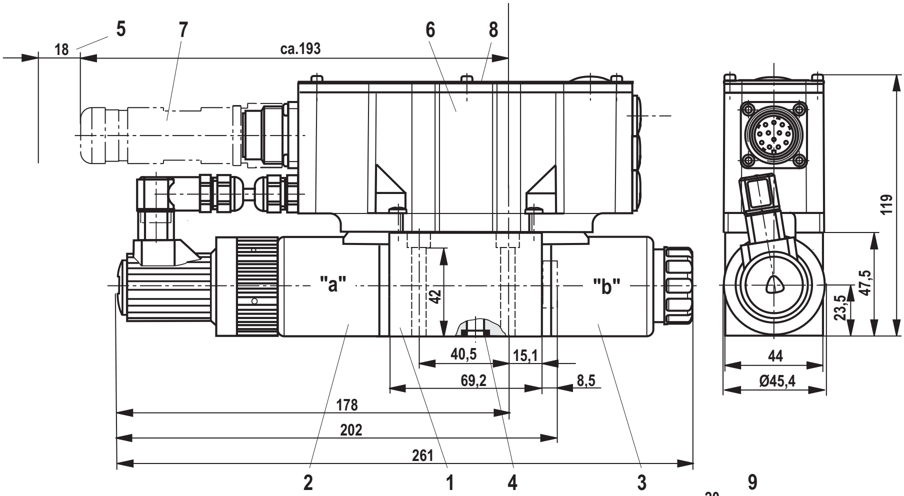
Transition function with stepped electric input signals: Size 10 (measured using HLP46, ϑ_{oil} = 40 °C ±5 °C, p_s = 10 bar)

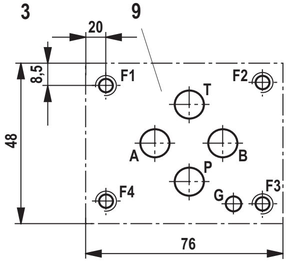


Frequency response characteristic curves: Size 10 (measured using HLP46, ϑ_{oil} = 40 °C ±5 °C, p_s = 10 bar)

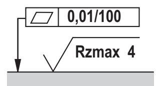


Dimensions: Size 6 (dimensions in mm)





1 Valve housing
2 Proportional solenoid "a" with inductive position transducer
3 Proportional solenoid "b"
4 R-ring 9.81 x 1.5 x 1.78 (ports P, A, B, T)
5 Space required to remove the mating connector
6 Integrated control electronics
7 Mating connector according to DIN EN 175201-804, order separately, see page 5
8 Name plate
9 Processed valve contact surface, porting pattern according to ISO 4401-03-02-0-05
Deviating from the standard:
– Ports P, A, B, T Ø8 mm
– Bore G can be eliminated, as there is no pin in the valve.



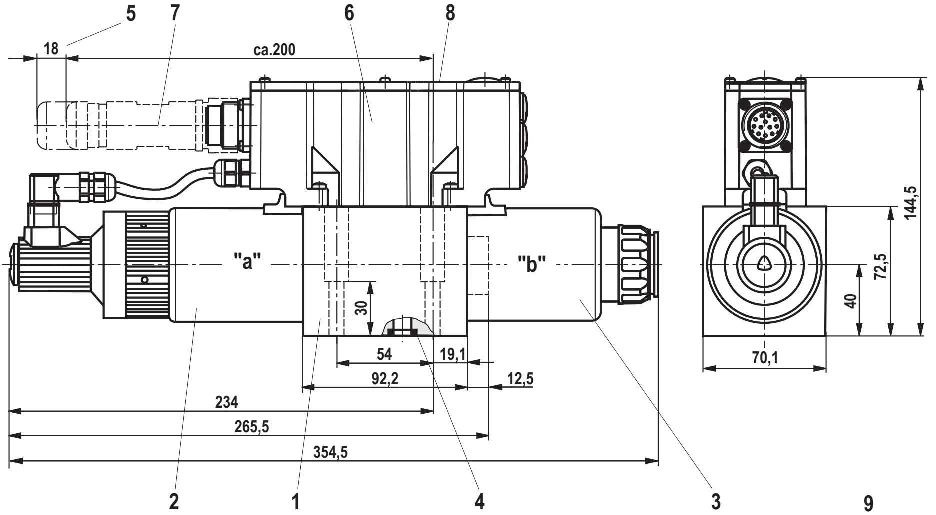
Required surface quality of the valve contact surface

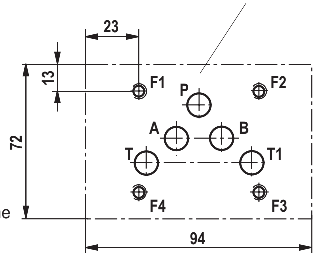
Notice!
The dimensions are nominal dimensions which are subject to tolerances.

2

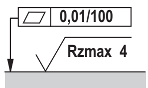
Subplates and valve mounting screws see page 16

Dimensions: Size 10 (dimensions in mm)





1 Valve housing
2 Proportional solenoid "a" with inductive position transducer
3 Proportional solenoid "b"
4 R-ring 13.0 x 1.6 x 2.0 (ports P, A, B, T, T1)
5 Space required to remove the mating connector
6 Integrated control electronics
7 Mating connector according to DIN EN 175201-804, order separately, see page 5
8 Name plate
9 Processed valve contact surface, porting pattern according to ISO 4401-05-04-0-05



Required surface quality of the valve contact surface

Hexagon socket head cap screws		Material number
Size 6	4x ISO 4762 - M5 x 50 - 10.9 Tightening torque M_A = 8,9 Nm ±10 %	
Size 10	4x ISO 4762 - M6 x 40 - 10.9 Tightening torque M_A = 15.5 Nm ±10 %	

Notice: The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure!

Subplates	Data sheet
Size 6	45052
Size 10	45054

Notice!

The dimensions are nominal dimensions which are subject to tolerances.

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
documentation@boschrexroth.de
www.boschrexroth.de

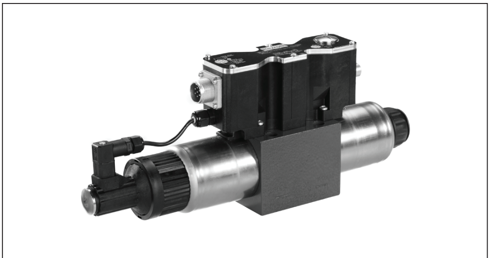
The Drive & Control Company

Rexroth
Bosch Group

4/3 proportional directional valve with integrated digital electronics and field bus interface (IFB-P)

Type 4WREF

RE 29048
Edition: 2013-02
Replaces: 12.12



- Sizes 6 and 10
- Component series 2X
- Maximum operating pressure 315 bar
- Maximum flow: 80 l/min (size 6)
- Maximum flow: 180 l/min (size 10)

Features

- Direct operated proportional directional valve with integrated digital electronics and field bus interface (Integrated Field Bus IFB-P)
- Operation by means of proportional solenoids with central thread and detachable coil
- Position-controlled valve control spool
- Analog interface for command and actual value
- Command value (flow) analog or via bus
- Design for CAN bus with CANopen protocol DS 408 or Profibus-DP
- Quick commissioning via PC and WIN-PED 6 commissioning software

Contents

Ordering code

01	02	03	04	05	06	07		08		09	10	11	12
4	**WRE**	**F**				**2X**	**/**	**V**	**–**	**24**			*****

01	4 main ports	**4**
02	Proportional directional valve	**WRE**
03	With integrated digital electronics and field bus interface	**F**
04	Size 6	**6**
	Size 10	**10**
05	Symbols e.g. E, E1, V etc.: possible design see page 3	

Rated flow for size 6

06	8 l/min	**08**
	16 l/min	**16**
	32 l/min	**32**

Rated flow for size 10

06	25 l/min	**25**
	50 l/min	**50**
	75 l/min	**75**
07	Component series 20 … 29 (20 … 29: Unchanged installation and connection dimensions)	**2X**
08	FKM seals	**V**
09	Supply voltage 24 V	**24**

Bus interface

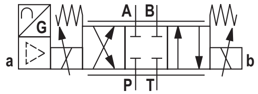
10	CANBus DS 408	**C**
	Profibus DP V0/V1	**P**

Electrical interface

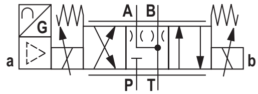
11	Command value ±10 V	**A1**
	Command value 4 to 20 mA	**F1**
12	Further details in the plain text	

Symbols

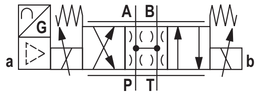
Type 4WREF...E...



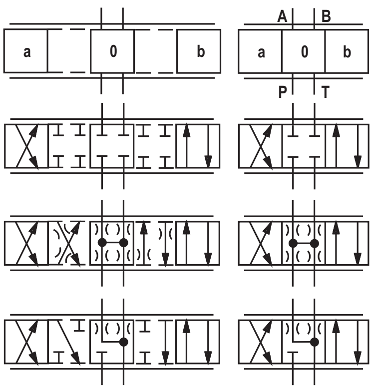
Type 4WREF...W...



Type 4WREF...V...



Control spool symbols



With symbols E1 and W1:

P → A: $\boldsymbol{q}_{\text{vmax}}$ B → T: $\boldsymbol{q}_{\text{v}}/2$

P → B: $\boldsymbol{q}_{\text{v}}/2$ A → T: $\boldsymbol{q}_{\text{vmax}}$

Function, section

Set-up

The valve basically consists of:

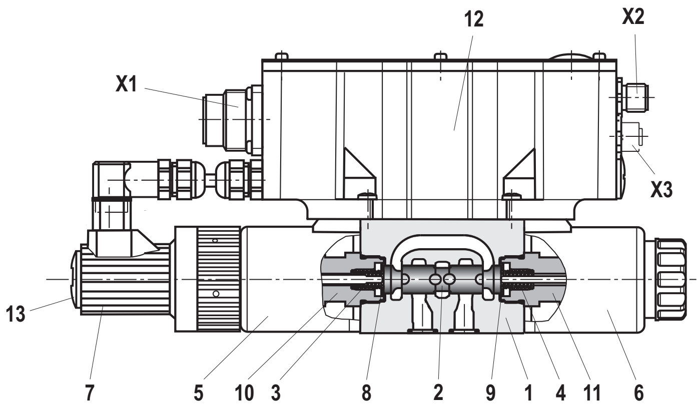
- Housing (1) with connection surface
- Control spool (2) with compression springs (3 and 4) and spring plates (8 and 9)
- Coils (5 and 6) and pole tubes (10 and 11) with central thread
- Position transducer (7)
- Integrated digital control electronics IFB-P (12)

Functional description

With de-energized solenoids (5 and 6), the control spool (2) is brought into the central position by the compression springs (3 and 4) between the spring plates (8 and 9) (with V control spool without spring plate). With V control spools, the mechanical zero position does not correspond to the hydraulic one.

Functions:

- Control of the valve spool position
- The command value can alternatively be specified via an analog interface (X1) or via the field bus interface (X2, X3).
- The actual value signals are provided via an analog interface (X1) and can additionally be read out via the field bus (X2, X3).
- The controller parameters are set via the field bus.



Notice! The PG fitting (13) must not be opened. Mechanical adjustment of the adjustment nut located below is prohibited and damages the valve!

Notice! Due to the design principle, internal leakage is inherent to the valves and may increase over the life cycle.
The tank line must not be allowed to run empty. With corresponding installation conditions, a preload valve is to be installed.

Function, section

The integrated digital electronics enables the following fault detection:
- Undervoltage
- Cable break in position transducer (7)
- Communication error
- Watchdog
- Cable break in command value input (only with current interface)

The following additional functions are available:
- Ramp generator
- Internal command value profile
- Enable function, digital
- Overlap compensation
- Zero point correction

WIN-PED PC program (version 6 or higher):
To implement the project planning task and to parameterize the IFB-P valves, the user may use the WIN-PED commissioning software.
- Parameterization
- Diagnosis
- Convenient data management on a PC

System requirements
- IBM PC or compatible system
- Windows 2000 or Windows XP
- RAM (recommendation: 256 MB)
- 150 MB of available hard disk capacity

Notice
The "WIN-PED" PC program is not included in the scope of delivery. It can be downloaded on the Internet free of charge! (See page 18)

2

Technical data
(for applications outside these parameters, please consult us!)

general			**Size 6**	**Size 10**
Installation position			Any, preferably horizontal	
Storage temperature range		°C	−20 ... +80	
Ambient temperature range		°C	−20 ... +50	
Weight without sandwich plate		kg	2.4	6.5
MTTFd values according to EN ISO 13849		Years	150 (for further details see data sheet 08012)	
Climate			Environmental audit according to EN 60068-2	

hydraulic (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)				
Maximum operating pressure	– Ports A, B and P	bar	Up to 315	
	– Port T	bar	Up to 210	
Rated flow q_{Vnom} with Δp = 10 bar		l/min	8	25
			16	50
			32	75
Maximum admissible flow		l/min	80	180
Hydraulic fluid			See table page 6	
Hydraulic fluid temperature range		°C	−20 ... +70, preferably +40 ... +50	
Viscosity range		mm²/s	20 to 380, preferably 30 to 46	
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Class 20/18/15 [1]	
Hysteresis (position control - valve control spool)		%	≤ 0.1	
Range of inversion (position control - valve control spool)		%	≤ 0.05	
Response sensitivity (position control - valve control spool)		%	≤ 0.05	
Zero shift valve control spool upon change of hydraulic fluid temperature and operating pressure		%/10K	< 0.15	
		%/100 bar	< 0.1	

[1] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components. For the selection of the filters, see www.boschrexroth.com/filter.

Technical data
(for applications outside these parameters, please consult us!)

Hydraulic fluid	**Classification**	**Suitable sealing materials**	**Standards**
Mineral oils and related hydrocarbons	HL, HLP	NBR, FKM	DIN 51524

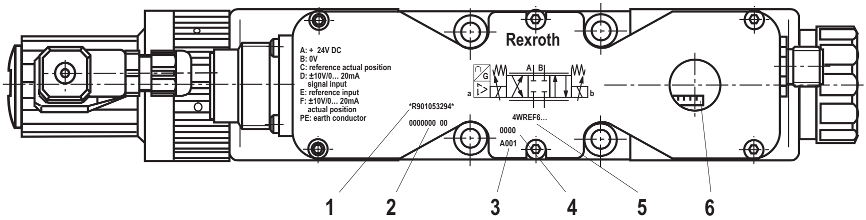
Important information on hydraulic fluids!
- For more information and data on the use of other hydraulic fluids, refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.)!
- The flash point of the hydraulic fluid used must be 40 K higher than the maximum solenoid surface temperature.

electric			
Duty cycle [1]		%	100
Supply voltage	– Nominal voltage	VDC	24
	– Lower limit value	VDC	19.4
	– Upper limit value	VDC	35
	– Maximum admissible residual ripple	Vpp	2
Total current consumption	– I_{max}	A	2
	– Impulse current	A	3
Command and actual value signals	– Voltage "A1"	V	±10
	– Current "F1"	mA	4 to 20
Converter resolution (command/actual value signals)		Bit	10
Maximum coil temperature [2]		°C	Up to 150
Protection class of the valve according to EN 60529			IP 65 with mounted and locked plug-in connectors
EMC (electromagnetic compatibility)			Interference resistance prEN 50082-2:1994 Interference emission EN 50081-1:1992

[1] Connect the valve to the supply voltage only when this is required for the functional processes of the machine.

[2] Due to the temperatures occurring at the surfaces of the solenoid coils, the European standards ISO 13732-1 and EN ISO 4413 must be adhered to.

Integrated electronics (IFB-P), marking and adjustment elements



1 Material number
2 Production order number
3 Date of production
4 Serial number
5 Type designation
6 DIL switch for address and baud rate setting (position B0 on the right)

2

Electrical connection and allocation

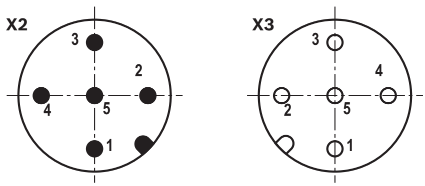
Connector pin assignment X1, 6-pole + PE according to DIN EN 175201-804

Pin	Signal	Interface A1 pin assignment	Interface F1 pin assignment
A	Supply voltage	24 VDC ($u(t)$ = 19.4 to 35 V); I_{max} = 2 A	
B		0 V	
C	Reference potential actual value	Reference potential actual value	
D	Differential amplifier input	±10 V command value; R_e > 50 kΩ	4 to 20 mA command value; R_e = 100 Ω
E		Reference potential command value	
F	Measuring output	±10 V actual valve control spool value (limit load 5 mA)	4 to 20 mA actual valve control spool value (load resistance maximum 300 Ω)
PE		Protective earthing conductor (directly connected to cooling element and valve housing)	

Connector pin assignment for CAN bus "X2"/"X3" (coding A), M12, 5-pole, pins/socket

Pin	Assignment
1	n. c.
2	n. c.
3	CAN_GND
4	CAN_H
5	CAN_L

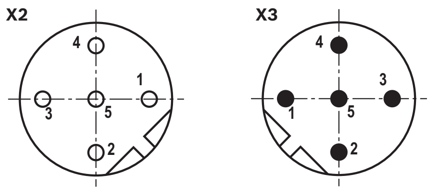
Transmission rate kbit/s 20 to 1000
Bus address 1 to 127
CAN-specific settings:
Baud rate and identifier can be set via the bus system and/or the DIL switches.



Connector pin assignment for Profibus DP "X2"/"X3" (coding B), M12, 5-pole, socket/pins

Pin	Assignment
1	+5 V
2	RxD/TxD-N (A line)
3	D GND
4	RxD/TxD-P (B line)
5	Shield

Transmission rate MBaud up to 12
Bus address 1 to 126
Setting via DIL switch.
The +5 V voltage of the IFB-P serves to supply an external bus terminator (as required).



Integrated electronics (IFB-P), settings for CANopen and Profibus DP

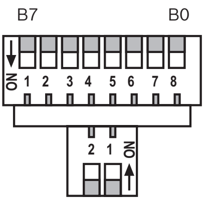
CANopen

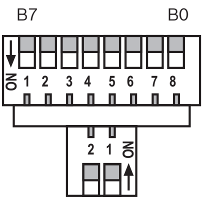
B7	B6	B5	B4	B3	B2	B1	B0	HEX	Baud rate: B7, B6	Address range: B5 to B0
0	0	0	0	0	0	0	0	00 [1]	Standard 20 kBaud or re-programmed	1 = Standard or re-programmed
0	0	0	0	0	0	0	1	01		
				to				to	20 kBaud	1 to 63
0	0	1	1	1	1	1	1	3F		
0	1	0	0	0	0	0	0	40	125 kBaud	1 = Standard or re-programmed
0	1	0	0	0	0	0	1	41		
				to				to	125 kBaud	1 to 63
0	1	1	1	1	1	1	1	7F		
1	0	0	0	0	0	0	0	80	250 kBaud	1 = Standard or re-programmed
1	0	0	0	0	0	0	1	81		
				to				to	250 kBaud	1 to 63
1	0	1	1	1	1	1	1	BF		
1	1	0	0	0	0	0	0	C0	500 kBaud	1 = Standard or re-programmed
1	1	0	0	0	0	0	1	C1		
				to				to	500 kBaud	1 to 62
1	1	1	1	1	1	1	0	FE		
1	1	1	1	1	1	1	1	FF	250 kBaud	Monitor mode/programming mode 1 = fixed

Profibus DP

B7	B6	B5	B4	B3	B2	B1	B0	HEX	Address range
0	0	0	0	0	0	0	0	00 [1]	125 = Standard or re-programmed
0	0	0	0	0	0	0	1	01	
				to				to	1 to 126 with parameter channel
0	1	1	1	1	1	1	0	7E	
1	0	0	0	0	0	0	0	80	
				to				to	1 to 126 with parameter channel
1	1	1	1	1	1	1	0	FE	
1	1	1	1	1	1	1	1	FF	Monitor operation address 125

[1] Factory setting



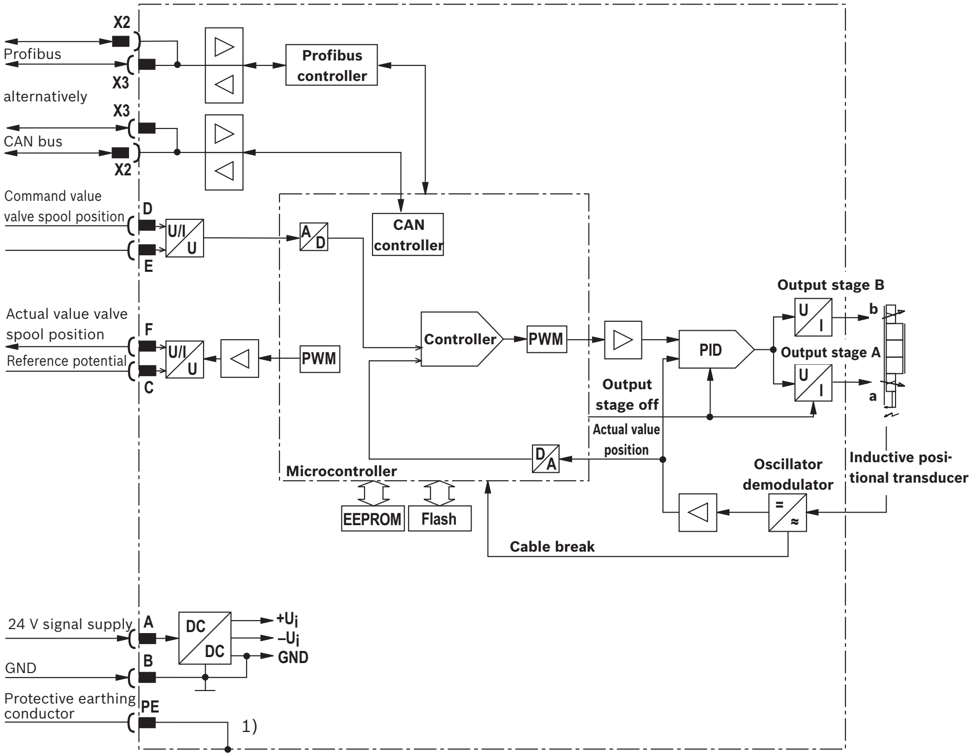


Connection of the bus terminator using the two lower switches (only with Profibus):

Left figure: Bus terminator not connected

Right figure: Bus terminator connected (both switches to "ON")

Integrated electronics (IFB-P), block diagram



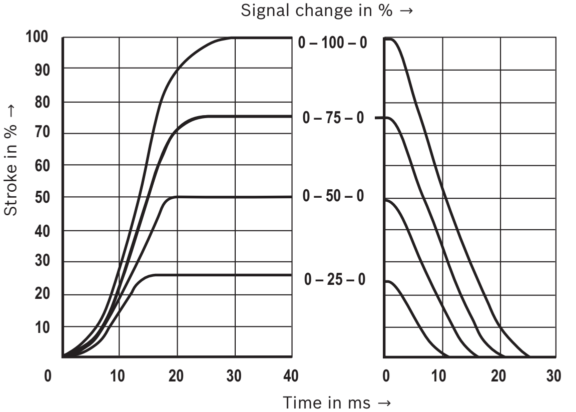
1) The protective earthing conductor (PE) is connected to cooling element and valve housing.

Command value	Positive command value 0 to +10 V (or 12 to 20 mA) at pin D and reference potential at pin E result in flow from P → A and B → T. Negative command value 0 to –10 V (or 12 to 4 mA) at pin D and reference potential at pin E result in flow from P → B and A → T.
Actual value	Positive actual value 0 to +10 V (or 12 to 20 mA) at pin F and reference potential at pin C result in flow from P → A and B → T.
Connection line	Recommendation: Up to 25 m line length type LiYCY 7 x 0.75 mm² Up to 50 m line lenght type LiYCY 7 x 1.00 mm² External diameter see sketch of mating connector

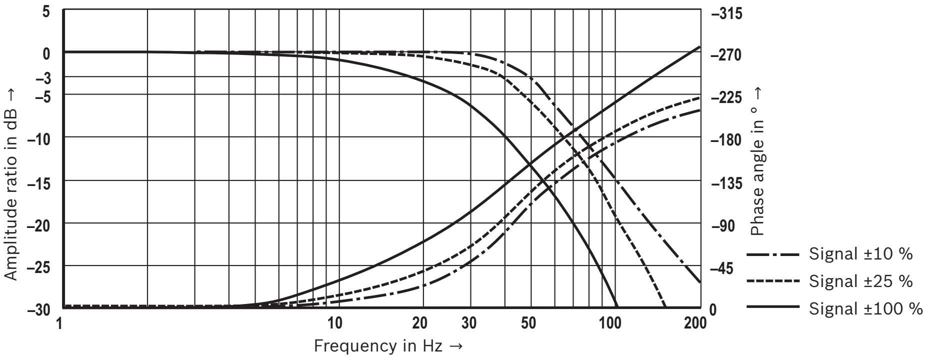
Characteristic curves size 6

(measured with HLP46, ϑ_{oil} = 40 ±5 °C) and p_s = 10 bar

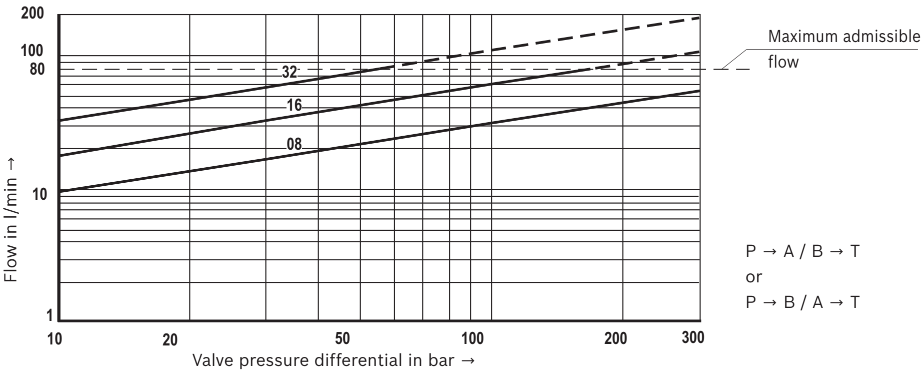
Transition function with stepped electric input signals (4/3 valve version; V control spool)



Frequency response (with V control spool)

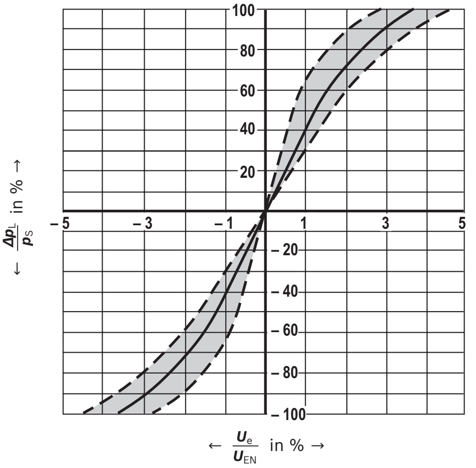


Flow/load function with maximum valve opening (with V control spool)

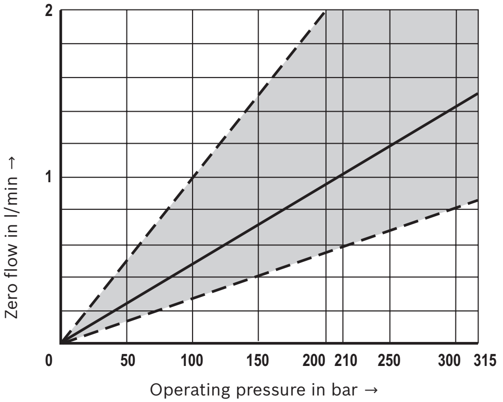


Characteristic curves size 6
(measured with HLP46, ϑ_{oil} = 40 ±5 °C) and p_s = 10 bar

Pressure/signal characteristic curve (V control spool), p_s = 100 bar



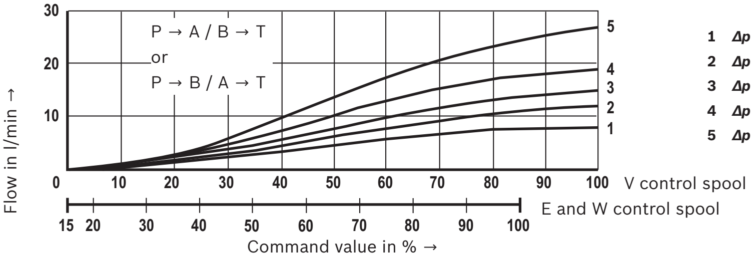
Zero flow (with central control spool position - V control spool)



Characteristic curves size 6

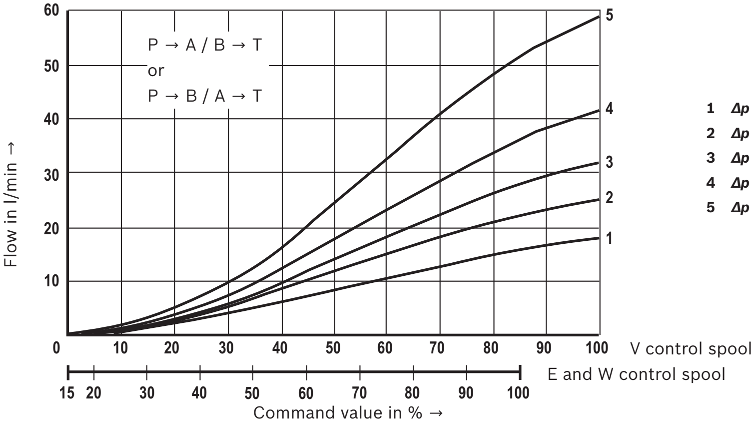
(measured with HLP46, ϑ_{oil} = 40 ±5 °C and p = 100 bar)

8 l/min rated flow



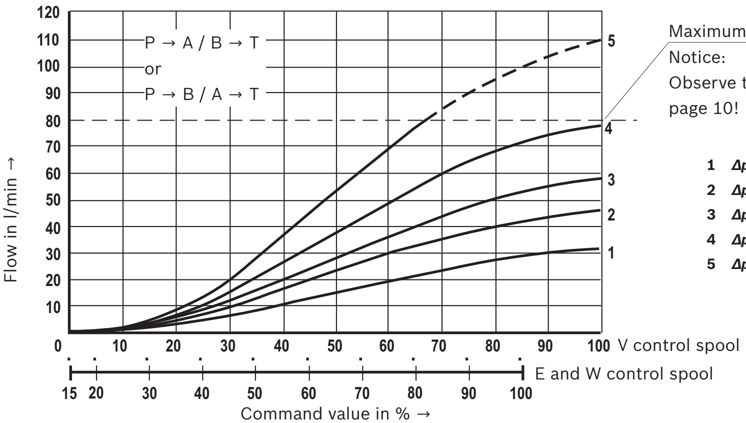
1 Δp = 10 bar constant
2 Δp = 20 bar constant
3 Δp = 30 bar constant
4 Δp = 50 bar constant
5 Δp = 100 bar constant

16 l/min rated flow



1 Δp = 10 bar constant
2 Δp = 20 bar constant
3 Δp = 30 bar constant
4 Δp = 50 bar constant
5 Δp = 100 bar constant

32 l/min rated flow



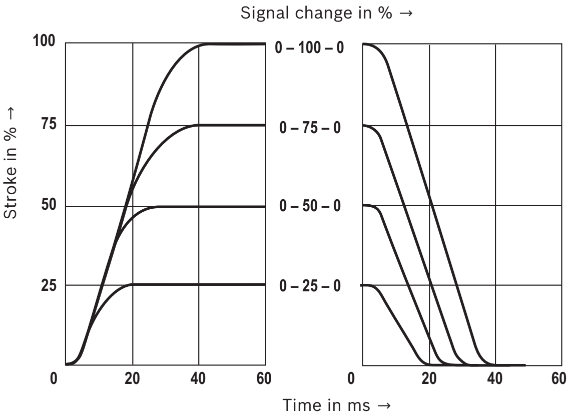
Maximum admissible flow
Notice:
Observe the flow/load function on page 10!

1 Δp = 10 bar constant
2 Δp = 20 bar constant
3 Δp = 30 bar constant
4 Δp = 50 bar constant
5 Δp = 100 bar constant

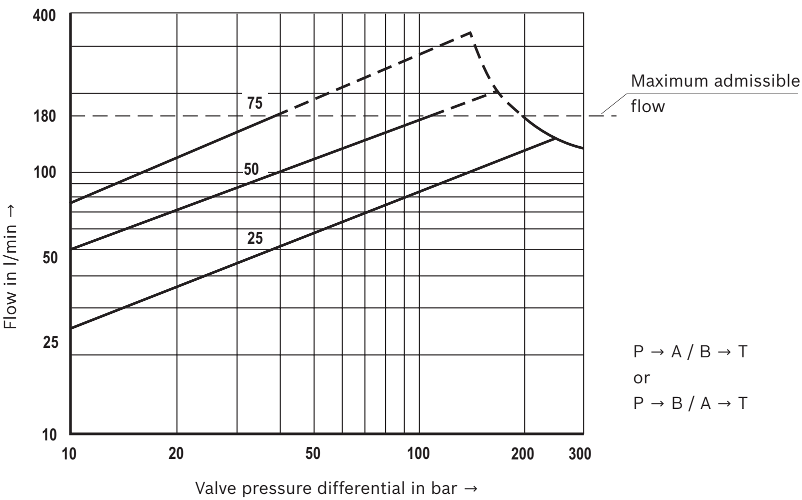
Characteristic curves size 10

(measured with HLP46, ϑ_{oil} = 40 ±5 °C) and p_s = 10 bar

Transition function with stepped electric input signals (4/3 valve version; V control spool)



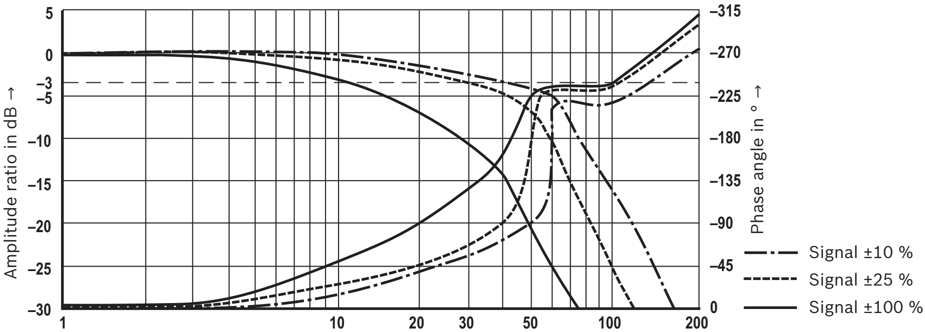
Flow/load function with maximum valve opening (with V control spool)



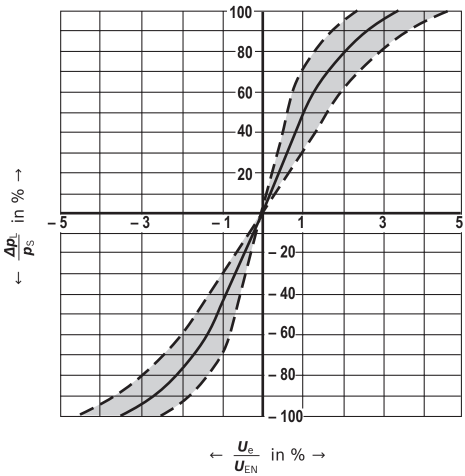
Characteristic curves size 10

(measured with HLP46, ϑ_{oil} = 40 ±5 °C) and p_s = 10 bar

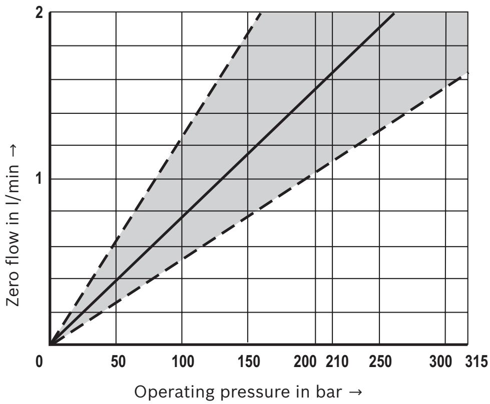
Frequency response (with V control spool)



Pressure/signal characteristic curve (V control spool), p_s = 100 bar



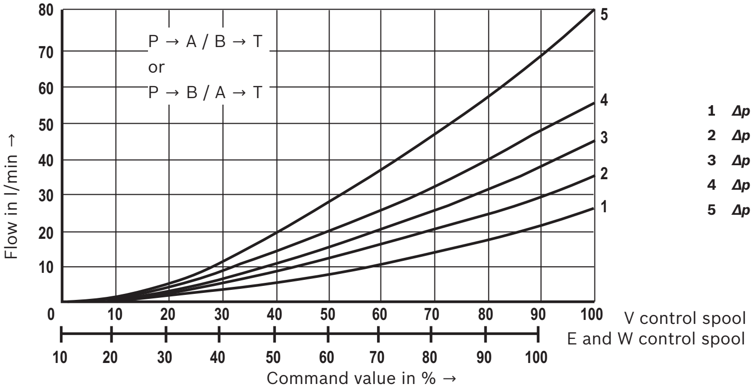
Zero flow (with central control spool position - V control spool)



Characteristic curves size 10

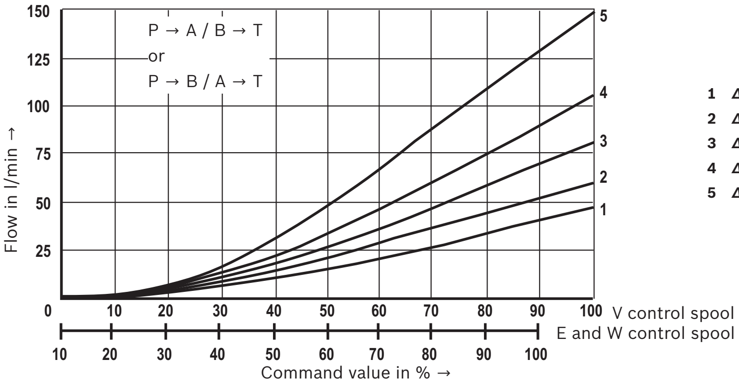
(measured with HLP46, ϑ_{oil} = 40 ±5 °C and ***p*** = 100 bar)

25 l/min rated flow



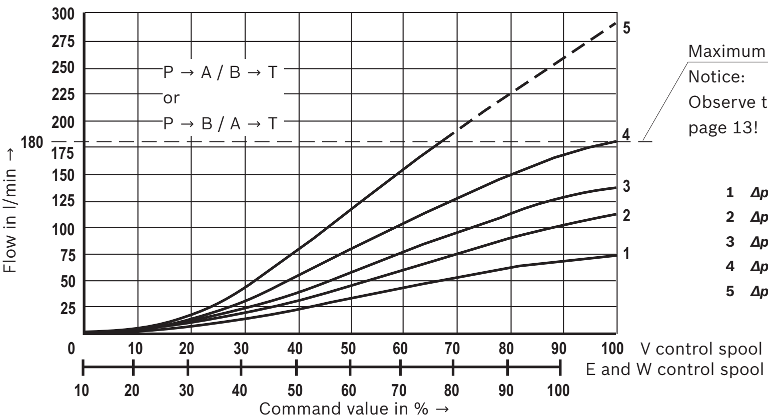
1 ***Δp*** = 10 bar constant
2 ***Δp*** = 20 bar constant
3 ***Δp*** = 30 bar constant
4 ***Δp*** = 50 bar constant
5 ***Δp*** = 100 bar constant

50 l/min rated flow



1 ***Δp*** = 10 bar constant
2 ***Δp*** = 20 bar constant
3 ***Δp*** = 30 bar constant
4 ***Δp*** = 50 bar constant
5 ***Δp*** = 100 bar constant

75 l/min rated flow

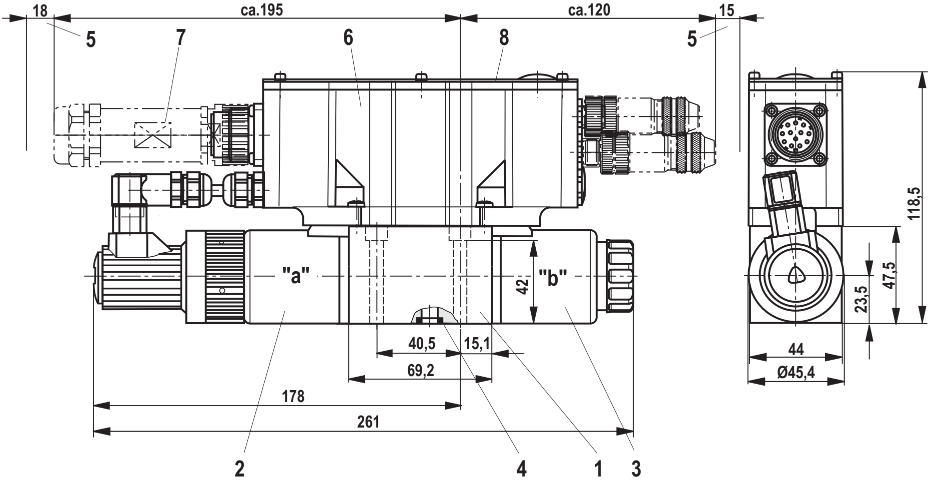


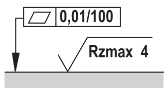
Maximum admissible flow

Notice:
Observe the flow/load function on page 13!

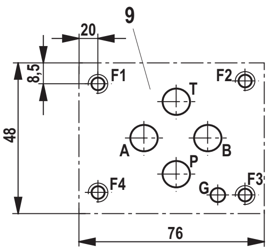
1 ***Δp*** = 10 bar constant
2 ***Δp*** = 20 bar constant
3 ***Δp*** = 30 bar constant
4 ***Δp*** = 50 bar constant
5 ***Δp*** = 100 bar constant

Unit dimension for size 6:
(dimensions in mm)





Required surface quality of the valve connection surface

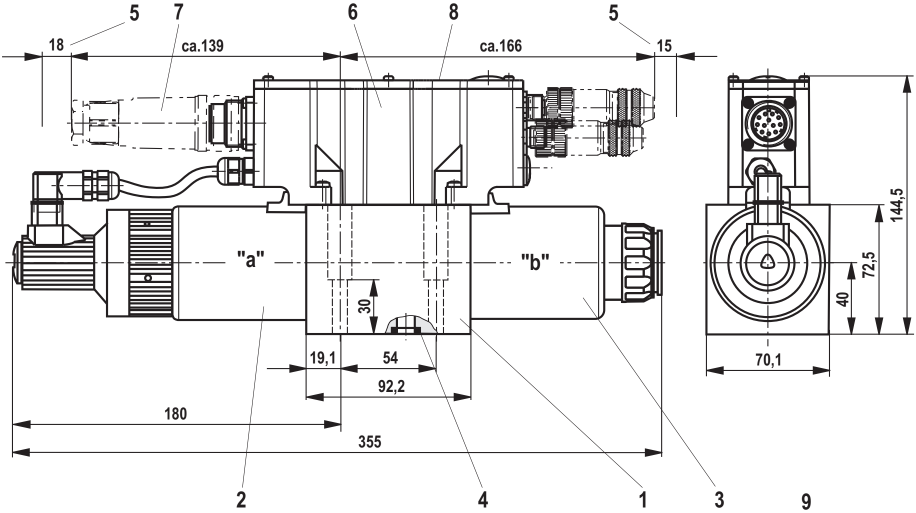


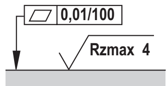
1 Valve housing
2 Proportional solenoid "a" with inductive position transducer
3 Proportional solenoid "b"
4 R-ring 9.81 x 1.5 x 1.78 for ports P, T, A and B
5 Space required to remove the mating connectors
6 Integrated digital control electronics
7 Mating connector according to DIN EN 175201-804; separate order, see page 19
8 Name plate
9 Machined valve contact surface, porting pattern according to ISO 4401-03-02-0-05
Deviating from the standard:
Ports P, A, B, T Ø8 mm
Bore G may not be required since there is no pin in the valve.

Notice!
The dimensions are nominal dimensions and subject to tolerances.

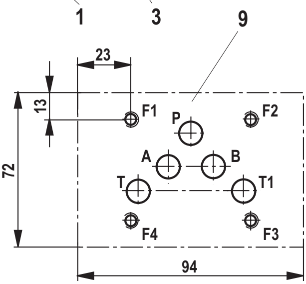
For valve mounting screws and **subplates,** see page 18.

Unit dimension for size 10:
(dimensions in mm)





Required surface quality of
the valve connection surface



2

1 Valve housing
2 Proportional solenoid "a" with inductive position transducer
3 Proportional solenoid "b"
4 R-ring 13.0 x 1.6 x 2.0 for ports P, T, T1, A and B
5 Space required to remove the mating connectors
6 Integrated digital control electronics
7 Mating connector according to DIN EN 175201-804;
separate order, see page 19
8 Name plate
9 Machined valve contact surface,
porting pattern according to ISO 4401-05-04-0-05

Notice!
The dimensions are nominal dimensions and subject to tolerances.

For valve mounting screws and **subplates,** see page 18.

Unit dimensions

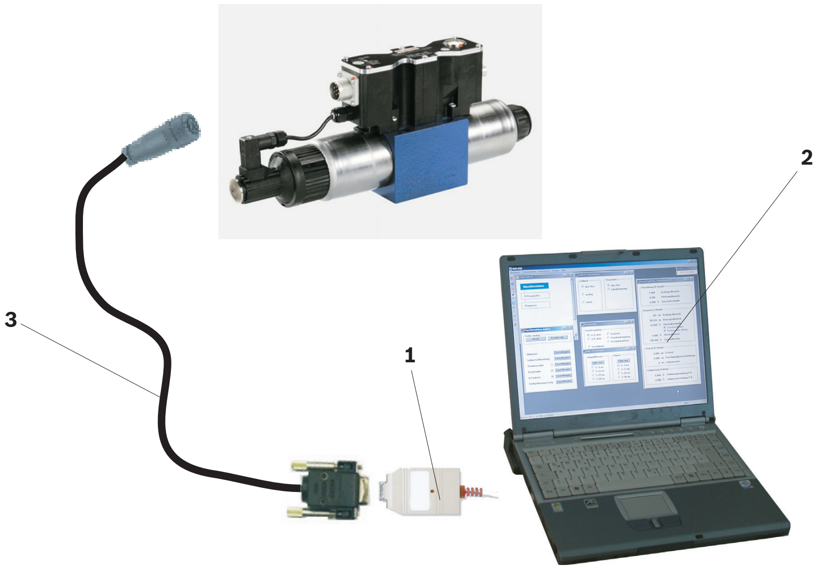
Hexagon socket head cap screws		**Material number**
Size 6	4x ISO 4762 - M5 x 50 - 10.9-flZn-240h-L Tightening torque M_A = 7 Nm ± 10 % or 4x ISO 4762 - M5 x 50 - 10.9 Tightening torque M_A = 8.9 Nm ± 10 %	R913000064
Size 10	4x ISO 4762 - M6 x 40 - 10.9-flZn-240h-L Tightening torqueM_A = 12.5 Nm ± 10 % or 4x ISO 4762 - M6x 40 - 10.9 Tightening torque M_A = 15.5 Nm ± 10 %	R913000058

Notice: The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure!

Subplates	**Data sheet**
Size 6	45052
Size 10	45054

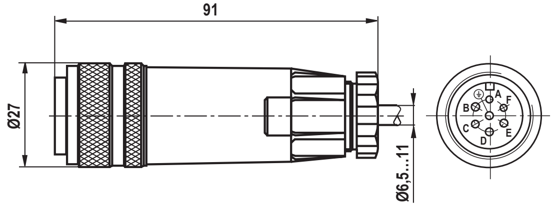
Accessories (not included in the scope of delivery)

	The following is required for the parameterization via PC:	**CANopen**	**Profibus DP**
1	Interface converter (USB)	VT-ZKO-USB/CA-1-1X/V0/0 Mat. no. R901071963	VT-ZKO-USB/P-1-1X/V0/0 Mat. no. R901071962
2	Commissioning software	WIN-PED 6 Download from www.boschrexroth.de/IAC	
3	Connection cable, 3 m	D-Sub / M12, coding A Mat. no. R900751271	D-Sub / M12, coding B Mat. no. R901078053

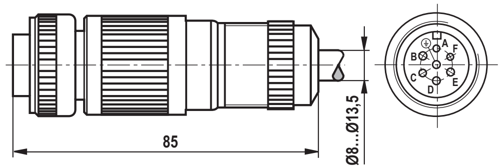


Accessories, port X1 (not included in the scope of delivery)

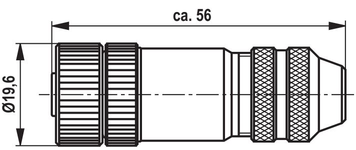
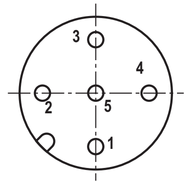
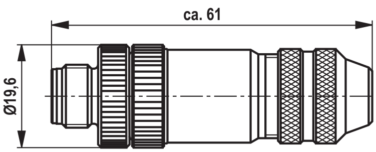
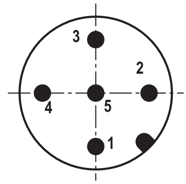
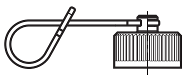
Mating connector for X1	Version	Material number
Mating connector according to DIN EN 175201-804 (6-pole)	Mating connector (plastic)	R900021267
	Mating connector (angular design)	R900217845



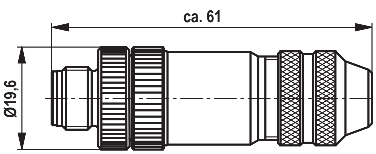
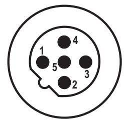
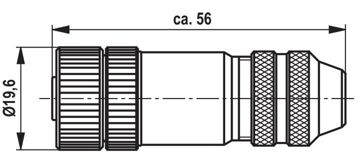
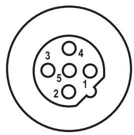
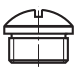
Mating connector for X1	Version	Material number
Mating connector according to DIN EN 175201-804 (6-pole)	Mating connector (metal)	R900223890



Accessories, CAN bus (A coding) (not included in the scope of delivery)

Description	View, dimensions	Pole pattern, order details
X2 Round connector, 5-pole, M12, can be assembled Straight mating connector in metal design		 Mat. no. R901076910 (cable diameter 6 to 8 mm)
X3 Round connector, 5-pole, M12, can be assembled Straight line connector in metal design		 Mat. no. R901076906 (cable diameter 6 to 8 mm)
M12 cap Dust protection (only for pins)		Mat. no. R901075564

Accessories, Profibus (B coding) (not included in the scope of delivery)

Description	View, dimensions	Pole pattern, order details
X2 Round connector, 5-pole, M12, can be assembled Straight line connector in metal design		 Mat. no. R901075545 (cable diameter 6 to 8 mm)
X3 Round connector, 5-pole, M12, can be assembled Straight mating connector in metal design		 Mat. no. R901075550 (cable diameter 6 to 8 mm)
M12 protective cap (only for socket)		Mat. no. R901075563

Project planning/maintenance instructions/additional information

Product documentation for IFB-P
- Data sheet 29048 (this data sheet)
- Operating manual 29015-B
- CAN bus protocol description data sheet 29015-01-Z
- Profibus protocol description data sheet 29015-02-Z
- General information on the maintenance and commissioning of hydraulic components 07800/07900
- General operating instructions: Hydraulic valves for industrial applications 07600-B

Commissioning software and documentation on the internet: www.boschrexroth.com/IAC

Maintenance instructions:
- The devices have been tested in the plant and are supplied with default settings.
- Only complete units can be repaired. Repaired devices are returned with default settings. User-specific settings will not be applied. The machine end-user will have to retransfer the corresponding user parameters.

Notices:
- Connect the valve to the supply voltage only when this is required for the functional processes of the machine.
- Do not use electrical signals provided via control electronics (e.g. "No error" signal) for switching safety-relevant machine functions (see also EN ISO 13849 "Safety of machinery – safety-related parts of control systems").
- If electro-magnetic interference is to be anticipated, suitable measures must be taken to ensure the function (depending on the application, e.g. shielding, filtration)!
- For more information, refer to the operating instructions and the WIN-PED online help.

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
documentation@boschrexroth.de
www.boschrexroth.de

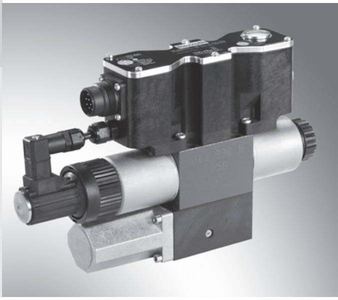
Electric Drives and Controls | Hydraulics | Linear Motion and Assembly Technologies | Pneumatics | Service

Rexroth
Bosch Group

4/3-proportional directional valve direct operated, with *pQ* functionality

RE 29050/03.13 1/26
Replaces: 12.12

Type 4WREQ



Size 6 and 10
Component series 2X
Maximum operating pressure 315 bar
Maximum flow 180 l/min

Table of contents

Features

- Direct operated proportional directional valve with integrated digital control electronics for the pressure, force and flow control (Integrated Axis Controller IAC-P)
- Completely adjusted unit consisting of valve, pressure sensor(s) (optional), digital control electronics and field bus connection
- Operation by means of proportional solenoids with central thread and detachable coil
- Valve spool position-controlled
- Integrated pressure sensor plate (optional)
- For subplate mounting: Porting pattern according to ISO 4401
- Analog interfaces for command and actual values
- Design for CAN bus with CANopen protocol DS 408 or PROFIBUS-DP V0/V1
- Quick commissioning via PC and commissioning software WIN-PED 6

Information on available spare parts:
www.boschrexroth.com/spc

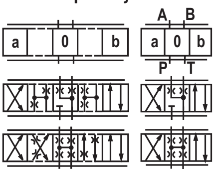
Ordering code

4WRE	Q			–	2X	/	V		–	24				*

With integrated digital electronics and ***pQ*** functionality **= Q**

Size 6 **= 6**
Size 10 **= 10**

Control spool symbols



= Q5-

= V

Rated flow [1]

Size 6

8 l/min **= 08**
16 l/min **= 16**
32 l/min **= 32**

Size 10

25 l/min **= 25**
50 l/min **= 50**
75 l/min **= 75**

Component series 20 to 29 **= 2X**
(20 to 29: Unchanged installation and connection dimensions)

Seal material
FKM seals **= V**

Pressure rating with internal sensors
100 bar [2] **= 4**
160 bar [2] **= 5**
250 bar [2] **= 8**
400 bar [3] **= B**
External sensor **= 0**

Position of the pressure sensors
0 = External sensor
Internal sensor in the channel
A = A
B = B
C = A + B
F = P + A + B

Application	Ordering code
Q control	F
p control only in A	A
p control only in B	B
p control in A + B or ***Δp*** control	C

Supply voltage
24 = Direct voltage 24 V

Bus interface
C = CANBus DS 408
P = PROFIBUS-DP V0/V1

Electronics interface [5]
A6 = ±10 VDC
F6 = 4 to 20 mA

Sensor interface with external pressure sensor [4]
2 = 4 to 20 mA
3 = 0 to 10 V
4 = 0 to 5 V
9 = 0.5 to 5 V
0 = Without external sensor interface

Further details in the plain text

1) See flow characteristic curves from page 12.

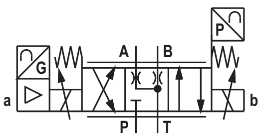
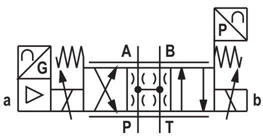
2) The selected pressure rating limits the maximum valve pressure.

3) Note: Maximum valve pressure is 315 bar.

4) If internal pressure sensors are used, no external pressure sensor can be connected.

5) With command value input "A6", only the sensor interfaces "3", "4" or "9" are possible.
With command value input "F6", only the sensor interface "2" is possible.

Symbols

Type 4WREQ.**Q5**-...	Type 4WREQ.**V**...
	

Set-up, function, section (valve with integrated sensors)

Set-up

The valve basically consists of:

- Housing (1) and pressure sensor plate (12) with connection surface
- Control spool (2) with compression springs (3 and 4) and spring plate (8 and 9)
- Coils (5 and 6) and pole tubes (14 and 15) with central thread
- Position transducer (7)
- Integrated pressure sensors (10)
- Integrated digital control electronics IAC-P (11)

Functional description

- With de-energized solenoids (5 and 6), the control spool (2) is brought into the central position by compression springs (3 and 4) between the spring plates (8 and 9) (with V spool valve without spring plate). With V spool valves, the mechanical zero position does not correspond to the hydraulic one.
- Depending on the valve type, the following functions result (some of them can be combined):
  - Flow control (***Q***)
  - Flow control (***Q***)
  - Pressure control in A and/or B (***p***)
  - Force control (***p***)
  - Substitutional control ***p/Q***
- The command value can alternatively be specified via an analog interface (X1) or via the field bus interface (X2, X3).
- The actual value signals are provided via an analog interface (X1) and can additionally be read out via the field bus (X2, X3).
- The controller parameters are set via the field bus
- Separate supply voltage for bus/controller and power part (output stage) for safety reasons

The digital integrated control electronics enables the following fault detection:

- Cable break pressure sensor (10)
- Undervoltage
- Cable break position transducer (7)
- Communication errors
- Watchdog
- Cable break command value inputs (only with current interface)

The following additional functions are available:

- Ramp generator
- Internal command value profile
- Enable function analog/digital
- Error output 24 V

PC program WIN-PED 6

To implement the project planning task and to parameterize the IAC-P valves, the user may use the commissioning software WIN-PED 6.

- Parameterization
- Diagnosis
- Comfortable data administration on the PC

System requirements

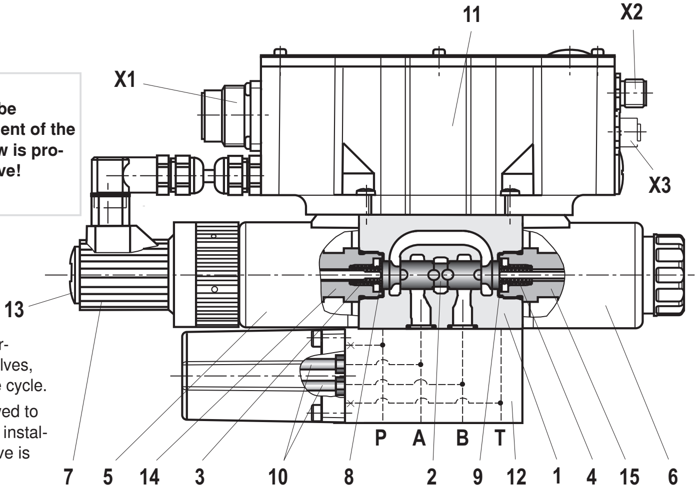
- IBM PC or compatible system
- Windows 2000 or Windows XP
- RAM (recommendation 256 MB)
- 150 MB of available hard disk capacity

Notice

- The "WIN-PED 6" PC program is not included in the scope of delivery. It can be downloaded on the Internet free of charge! (see page 26)

Important notice!

The PG fitting (13) must not be opened. Mechanical adjustment of the adjustment nut located below is prohibited and damages the valve!



Notice!

Due to the design principle, internal leakage is inherent to the valves, which may increase over the life cycle.

The tank line must not be allowed to run empty. With corresponding installation conditions, a preload valve is to be installed.

2

Set-up, function, section (valve for external sensor)

Set-up

The valve basically consists of:

- Housing (1) with connection surface
- Control spool (2) with compression springs (3 and 4) and spring plate (8 and 9)
- Coils (5 and 6) and pole tubes (14 and 15) with central thread
- Position transducer (7)
- Integrated digital control electronics IAC-P (11)
- Port (X4) for an external pressure sensor (12)

Functional description

- With de-energized solenoids (5 and 6), the control spool (2) is brought into the central position by compression springs (3 and 4) between the spring plates (8 and 9) (with V spool valve without spring plate). With V spool valves, the mechanical zero position does not correspond to the hydraulic one.
- Functions:
  - Flow control (***Q***)
  - Pressure control (***p***)
  - Substitutional control ***p/Q***
- The command value can alternatively be specified via an analog interface (X1) or via the field bus interface (X2, X3).
- The actual value signals are provided via an analog interface (X1) and can additionally be read out via the field bus (X2, X3).
- The controller parameters are set via the field bus
- Separate supply voltage for bus/controller and power part (output stage) for safety reasons

The digital integrated control electronics enables the following fault detection:

- Cable break pressure sensor (depending on sensor interface)
- Undervoltage
- Cable break position transducer (7)
- Communication errors
- Watchdog
- Cable break command value inputs (only with current interface)

The following additional functions are available:

- Ramp generator
- Internal command value profile
- Enable function analog / digital
- Error output 24 V

PC program WIN-PED 6

To implement the project planning task and to parameterize the IAC-P valves, the user may use the commissioning software WIN-PED 6.

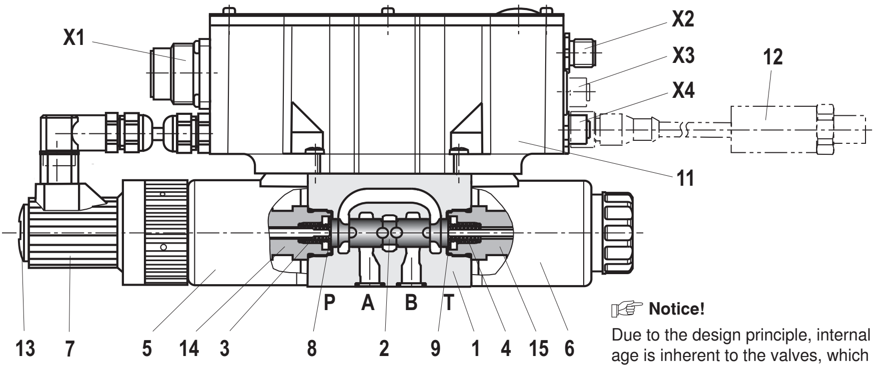
- Parameterization
- Diagnosis
- Comfortable data administration on the PC

System requirements

- IBM PC or compatible system
- Windows 2000 or Windows XP
- RAM (recommendation 256 MB)
- 150 MB of available hard disk capacity

Notice

- The "WIN-PED 6" PC program is not included in the scope of delivery. It can be downloaded on the Internet free of charge! (see page 24)



☞ **Important notice!**

The PG fitting (13) must not be opened. Mechanical adjustment of the adjustment nut located below is prohibited and damages the valve!

☞ **Notice!**

Due to the design principle, internal leakage is inherent to the valves, which may increase over the life cycle.

The tank line must not be allowed to run empty. With corresponding installation conditions, a preload valve is to be installed.

Technical data (For applications outside these parameters, please consult us!)

general

Sizes		6	10
Weight with sandwich plate (3 sensors)	kg	3.6	8.5
Weight without sandwich plate	kg	2.4	6.5
Installation position		Any, preferably horizontal	
Ambient temperature range	°C	–20 to +50	
Storage temperature range	°C	–20 to +80	

hydraulic (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Operating pressure [1]		100 bar	bar	Up to 100	
Ports P, A, B	with sensor	160 bar	bar	Up to 160	
		250 bar	bar	Up to 250	
		400 bar	bar	Up to 315	
Port T	with sensor	100 bar	bar	Up to 100	
		160 bar	bar	Up to 160	
		250 bar	bar	Up to 210	
		400 bar	bar	Up to 210	
Rated flow $q_{V\ nom}$ with Δp = 10 bar			l/min	8, 16, 32	25, 50, 75
Maximum admissible flow			l/min	80	180
Hydraulic fluid				See table below	
Hydraulic fluid temperature range			°C	–20 to +70, preferably +40 to +50	
Viscosity range			mm²/s	20 to 380, preferably 30 to 46	
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)				Class 20/18/15 [2]	
Hysteresis			%	≤ 0.1	
Range of inversion			%	≤ 0.05	
Response sensitivity			%	≤ 0.05	
Zero shift upon change of hydraulic fluid temperature and operating pressure			%/10 K	< 0.15	
			%/100 bar	< 0.1	

[1] Operating pressure, determined by valve and sensor

[2] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components.
For the selection of the filters see www.boschrexroth.com/filter

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons		HL, HLP	NBR, FKM	DIN 51524
Flame-resistant	– containing water	HFC (Fuchs HYDROTHERM 46M, Petrofer Ultra Safe 620)	NBR	ISO 12922

Important information on hydraulic fluids!

- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.)!
- The flash point of the process and operating medium used must be 40 K higher than the maximum solenoid surface temperature.
- **Flame-resistant – containing water**: Maximum pressure differential per control edge 175 bar. Pressure pre-loading at the tank port > 20 % of the pressure differential; otherwise, increased cavitation.
  Life cycle as compared to operation with mineral oil HL, HLP 50 % to 100 %.

2

Technical data (For applications outside these parameters, please consult us!)

electric

Supply voltage	Nominal voltage	VDC	24
	Lower limit value	VDC	19.4
	Upper limit value	VDC	35
	Maximum admissible residual ripple	Vss	2
Current consumption	I_{max}	A	2
	Impulse current	A	3
Command and actual value signals	Voltage "A6" U_Q	V	±10
	U_p	V	0 to 10
	Current "F6" I_Q and I_p	mA	4 to 20
Converter resolution (command/actual value signals)		Bit	10
Duty cycle [1)]		%	100
Maximum coil temperature [2)]		°C	Up to 150
Protection class of the valve according to EN 60529:1991+A1:2000			IP 65 with mounted and locked plug-in connectors

[1)] Connect the valve to the supply voltage only when this is required for the functional sequence of the machine.

[2)] Due to the temperatures occurring at the surfaces of the solenoid coils, the European standards ISO 13732-1 and EN ISO 4413 need to be adhered to.

Sensor technology

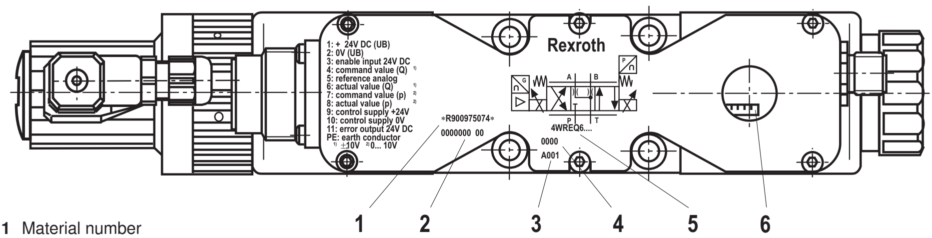
Measurement range	p_N	bar	**100**	**160**	**250**	**400**
Overload protection	p_{max}	bar	200	320	500	800
Bursting pressure	p	bar	400	640	1000	1600
Compensation error						
Zero point			< 0.25 % of the end value			
End value			< 0.5 %			
Temperature coefficients in the nominal temperature range						
Largest TK of the zero point			< 0.2 % / 10 K			
Largest TK of the range			< 0.2 % / 10 K			
Characteristic curve deviation			< 0.2 %			
Hysteresis			< 0.1 %			
Repeatability			< 0.05 %			
Long-term drift (1 year) with reference conditions			< 0.2 %			

With external pressure sensors, the accuracy of the pressure control depends on the accuracy class of the sensor used.

Notice!

Information on the environment simulation testing for the areas EMC (Electromagnetic compatibility), climate and mechanical load see RE 29050-U (declaration on environmental compatibility).

Control electronics (IAC-P), marking and adjustment elements



1 Material number
2 Production order number
3 Date of production
4 Serial number
5 Type designation, e.g. 4WREQ…-2X/…
6 DIL switch for address and baud rate setting (position B0 right), see page 10

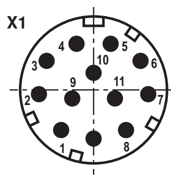
Control electronics (IAC-P), Electrical connections and allocation

Connector pin assignment X1, 11-pin + PE according to DIN EN 175201-804

Pin	No. and/or litz wire color [1]	Allocation interface A6	Allocation interface F6
1	1	24 VDC (u(t) = 19.4 V to 35 V), I_{max} = 1.7 A (for output stage)	
2	2	0 V ≙ load zero, reference for pins 1 and 9	
3	White	Enable input 9 to 35 V ≙ enable on	
4	Yellow	±10 V command value ***Q*** R_e > 50 kΩ	4 to 20 mA command value ***Q*** R_e = 100 Ω
5	Green	Reference for command values ***Q*** and ***p***	
6	Purple	±10 V actual value ***Q*** (limit load 5 mA)	4 to 20 mA actual value ***Q*** (load resistance max. 300 Ω)
7	Pink	0 to 10 V command value ***p*** R_e > 50 kΩ	4 to 20 mA command value ***p*** R_e = 100 Ω
8	Red	0 to 10 V actual value ***p*** (limit load 5 mA)	4 to 20 mA actual value ***p*** (load resistance max. 300 Ω)
9	Brown	Control voltage, level as pin 1, I_{max} = 0.3 A (for signal part and bus)	
10	Black	0 V reference potential for pins 3, 6, 8 and 11 (in the valve connected to pin 2)	
11	Blue	Error output 24 V (19.4 V to 35 V), 200 mA max. load	
PE	Green-yellow	Connected to cooling element and valve housing	

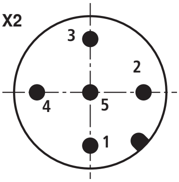
Connect shield to PE only on the supply side!

[1] Litz wire colors of the connection lines for mating connector with cable set (see accessories)

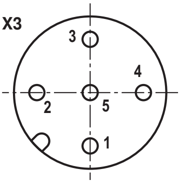


Control electronics (IAC-P), electrical connections and allocation

X2



X3



Connector pin assignment for CAN bus "X2"/"X3" (coding A), M12, 5-pin, pins/sockets

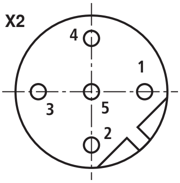
Pin	Allocation
1	n. c.
2	n. c.
3	CAN_GND
4	CAN_H
5	CAN_L

Transmission rate kbit/s	20 to 1000
Bus address	1 to 127

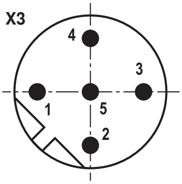
CAN-specific settings:

Baud rate and identifier can be set via the bus system and/or the DIL switches.

X2



X3



Connector pin assignment for PROFIBUS-DP, "X2"/"X3" (coding B), M12, 5-pin, socket/pins

Pin	Allocation
1	+5 V
2	RxD/TxD-N (A line)
3	D GND
4	RxD/TxD-P (B line)
5	Shield

Transmission rate	up to 12 MBaud
Bus address	1 to 126

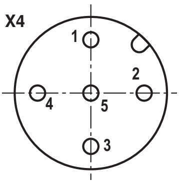
Setting via DIL switches

The +5 V voltage of the IAC-P is available for an external terminating resistor.

External pressure sensor port "X4" (coding A), M12, 5-pin, socket

Pin	Allocation of voltage interface	Allocation of current interface
1	Supply 24 VDC	Supply 24 VDC
2	Signal (0...+5 V)	Signal (4...20 mA)
3	Zero 0 V (GND)	Zero 0 V (GND)
4	n. c.	n. c.
5	n. c.	n. c.

X4



Notice:

We recommend connecting the shields on both sides over the metallic housings of the plug-in connectors.
Using connector pins will affect the shielding effect!
Internal screens are not required.

Control electronics (IAC-P), settings for CANopen and PROFIBUS-DP

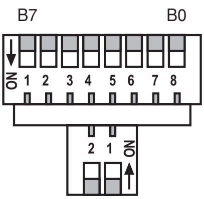
CANopen

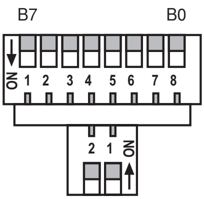
B7	B6	B5	B4	B3	B2	B1	B0	HEX	Baud rate: B7, B6	Address range: B5 to B0
0	0	0	0	0	0	0	0	00 [1)]	Standard 20 kBaud or re-programmed	1 = standard or re-programmed
0	0	0	0	0	0	0	1	01	20 kBaud	1 to 63
					to			to		
0	0	1	1	1	1	1	1	3F		
0	1	0	0	0	0	0	0	40	125 kBaud	1 = standard or re-programmed
0	1	0	0	0	0	0	1	41	125 kBaud	1 to 63
					to			to		
0	1	1	1	1	1	1	1	7F		
1	0	0	0	0	0	0	0	80	250 kBaud	1 = standard or re-programmed
1	0	0	0	0	0	0	1	81	250 kBaud	1 to 63
					to			to		
1	0	1	1	1	1	1	1	BF		
1	1	0	0	0	0	0	0	C0	500 kBaud	1 = standard or re-programmed
1	1	0	0	0	0	0	1	C1	500 kBaud	1 to 62
					to			to		
1	1	1	1	1	1	1	0	FE		
1	1	1	1	1	1	1	1	FF	250 kBaud	Monitor modus/ programming mode 1 = fixed

PROFIBUS-DP

B7	B6	B5	B4	B3	B2	B1	B0	HEX	Address range
0	0	0	0	0	0	0	0	00 [1)]	125 = standard or re-programmed
0	0	0	0	0	0	0	1	01	1 to 126 with parameter channel
					to			to	
0	1	1	1	1	1	1	0	7E	
1	0	0	0	0	0	0	0	80	1 to 126 without parameter channel
					to			to	
1	1	1	1	1	1	1	0	FE	
1	1	1	1	1	1	1	1	FF	Monitor operation address 125

[1)] Factory setting



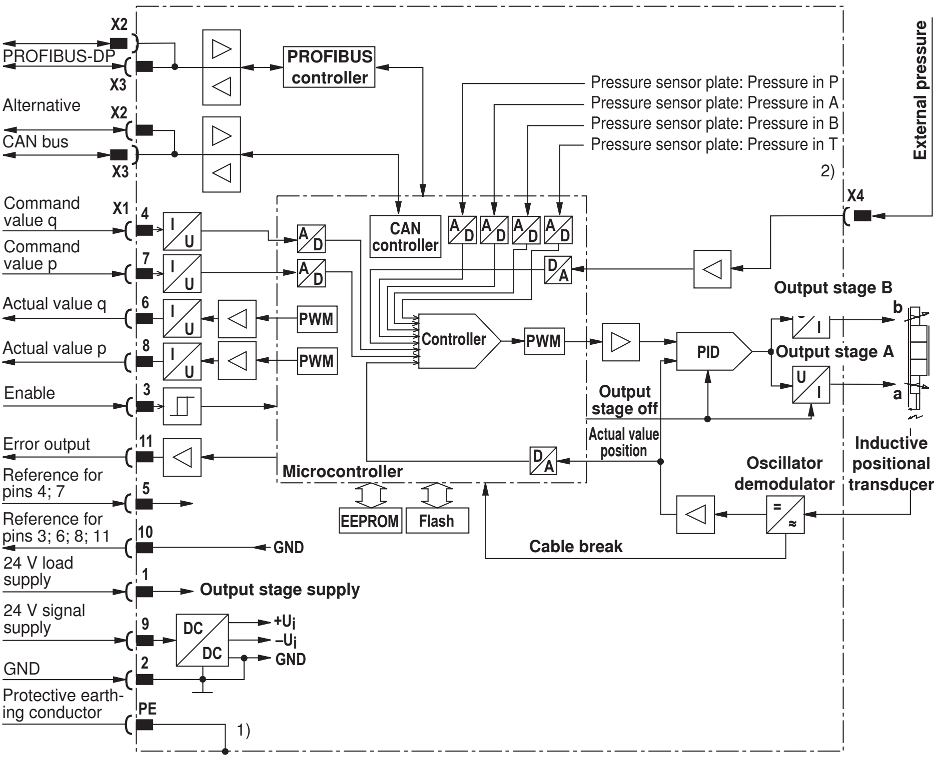


Connection of the bus terminator with the two lower switches (only with PROFIBUS-DP):

Left figure: Bus terminator not connected
Right figure: Bus terminator connected (both switches to "ON")

2

Control electronics (IAC-P), block diagram



Command value: Positive command value 0 to +10 V (or 12 to 20 mA) at pin 4 and reference potential at pin 5 result in flow from P → A and B → T.

Negative command value 0 to –10 V (or 12 to 4 mA) at pin 4 and reference potential at pin 5 result in flow from P → B and A → T.

Actual value: Positive actual value 0 to +10 V (or 12 to 20 mA) at pin 6 and reference potential at pin 10 result in flow from P → A and B → T.

Negative actual value 0 to –10 V (or 12 to 4 mA) at pin 6 and reference potential at pin 10 result in flow from P → B and A → T.

Connection line: Recommendation:
– Up to 25 m line length for pins 1; 2 and PE: 0.75 mm^2, otherwise 0.25 mm^2
– Up to 50 m line length for pins 1; 2 and PE: 1.00 mm^2

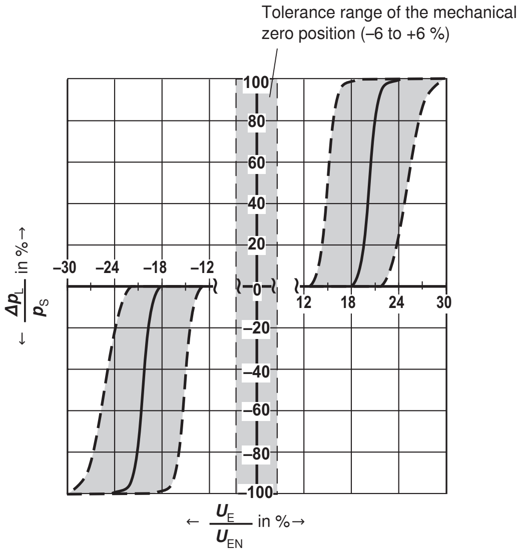
External diameter see sketch of mating connector

1) The protective earthing conductor (PE) is connected to cooling element and valve housing

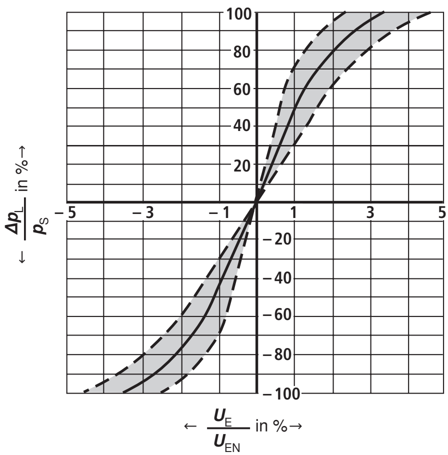
2) Pressure transducer in P, A, B and T depending on ordering code or an external pressure sensor via the 5-pin M12 mating connector X4

Characteristic curves: Size 6 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Pressure signal characteristic curve (Q5 control spool), p_s = 100 bar

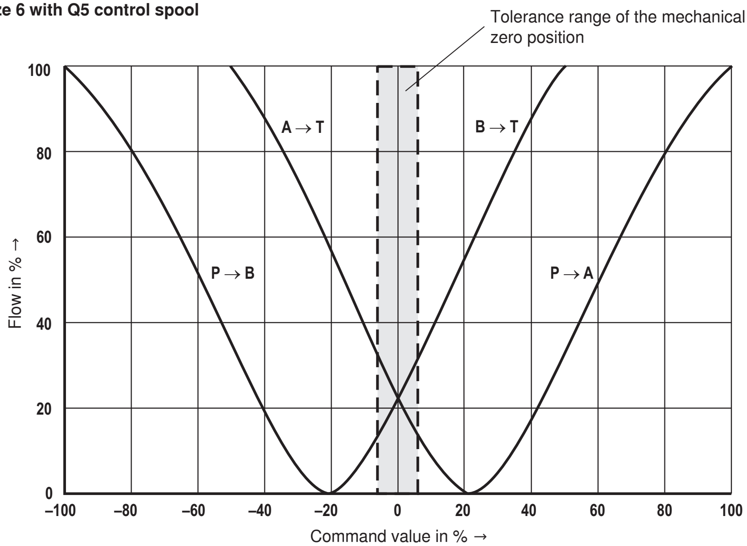


Pressure signal characteristic curve (V control spool), p_s = 100 bar

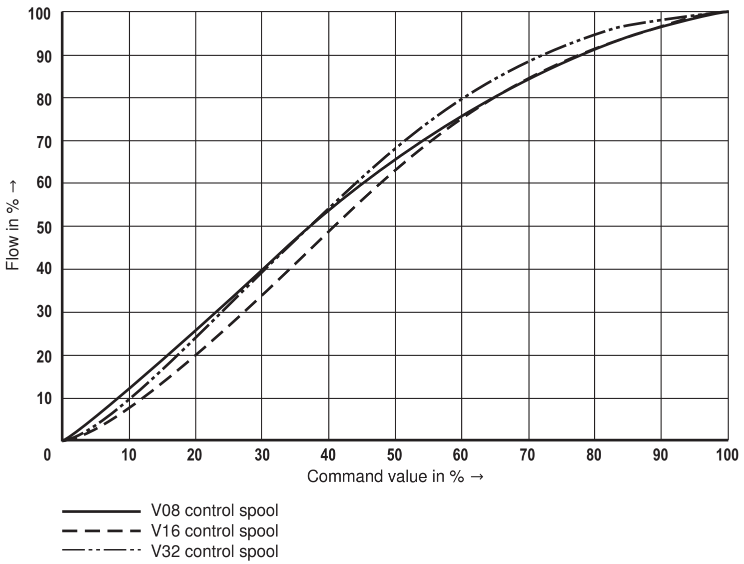


Characteristic curves: Size 6 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Flow, size 6 with Q5 control spool

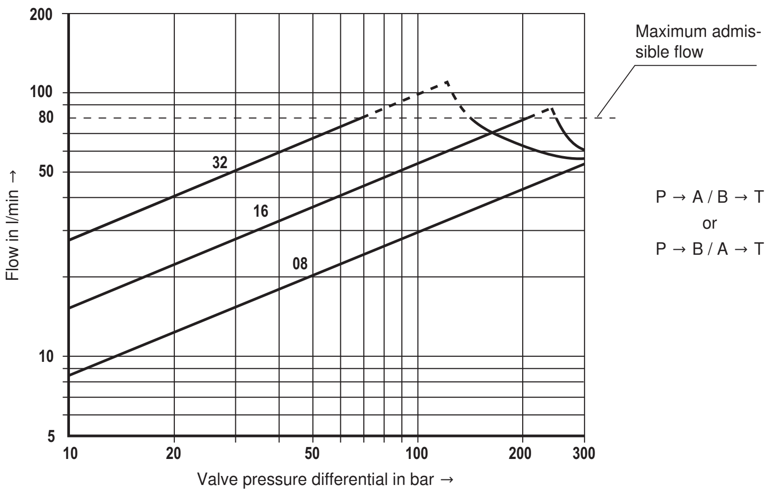


Flow, size 6 with V control spool

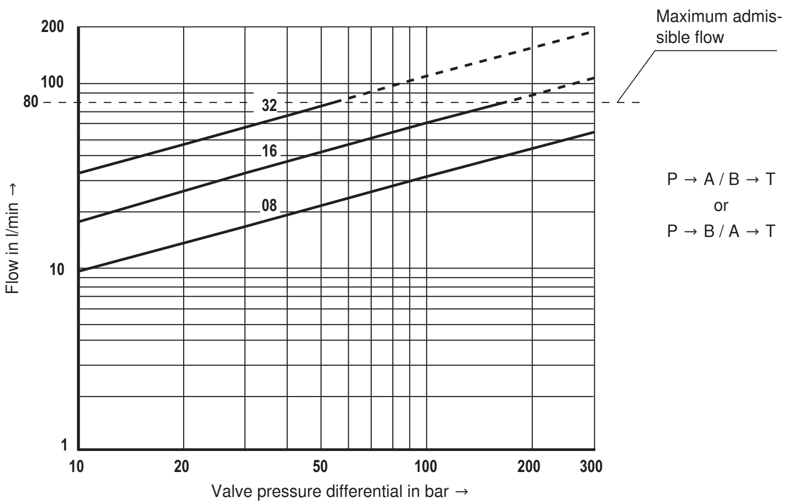


Characteristic curves: Size 6 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Flow/load function size 6 with Q5 control spool with maximum valve opening

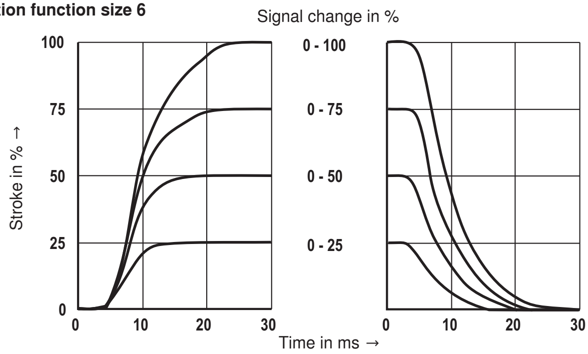


Flow/load function size 6 with V control spool with maximum valve opening

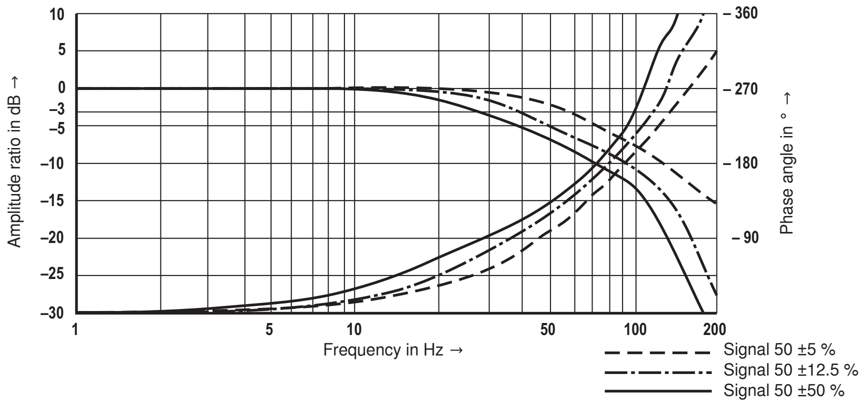


Characteristic curves: Size 6 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

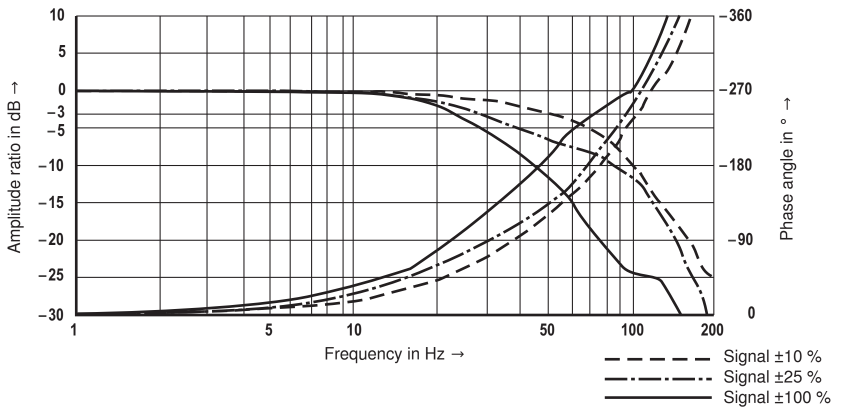
Transition function size 6



Frequency response size 6 with Q5 control spool, p_s = 10 bar

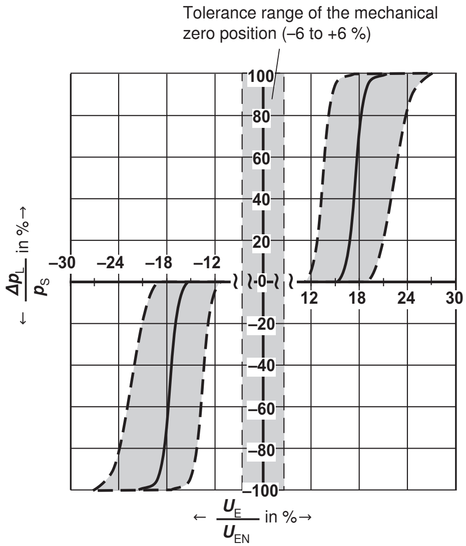


Frequency response size 6 with V control spool, p_s = 10 bar

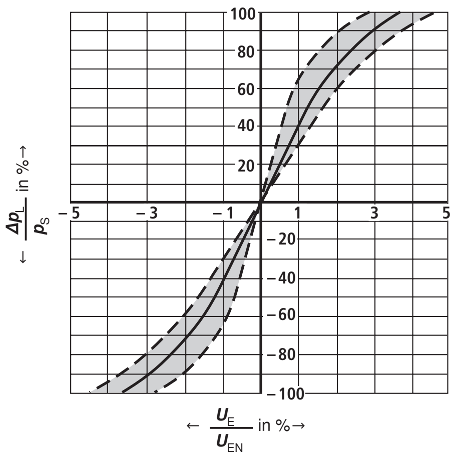


Characteristic curves: Size 10 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Pressure signal characteristic curve (Q5 control spool), p_s = 100 bar

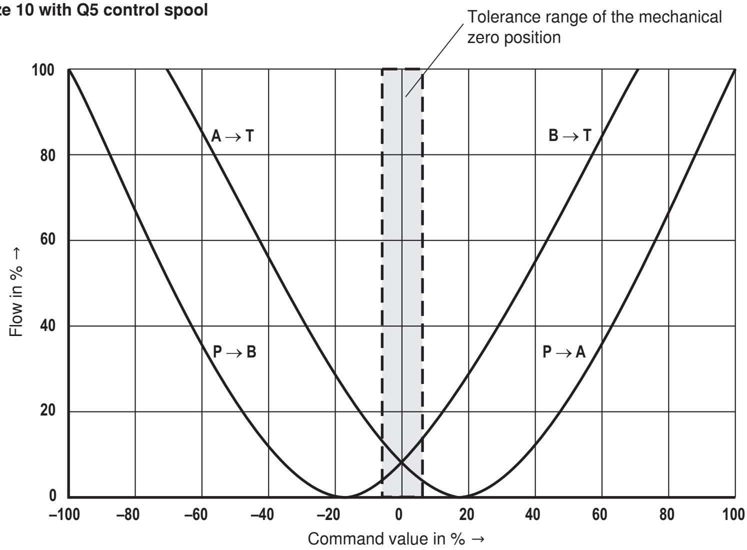


Pressure signal characteristic curve (V control spool), p_s = 100 bar

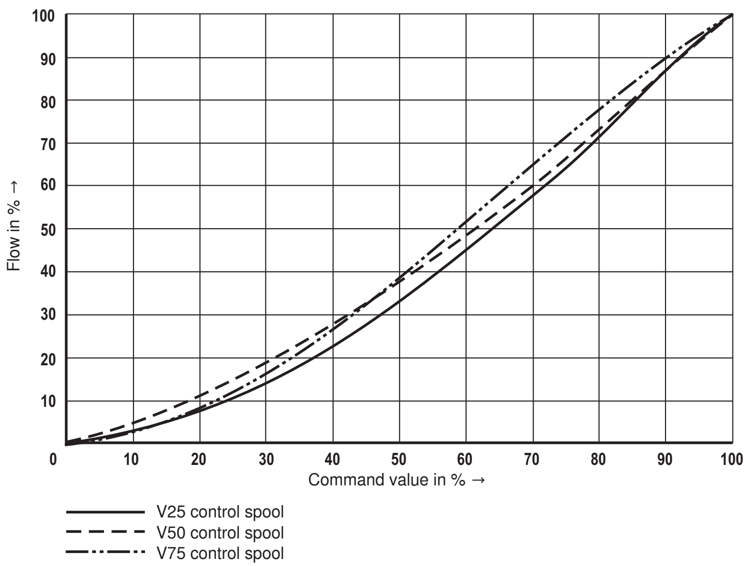


Characteristic curves: Size 10 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Flow, size 10 with Q5 control spool

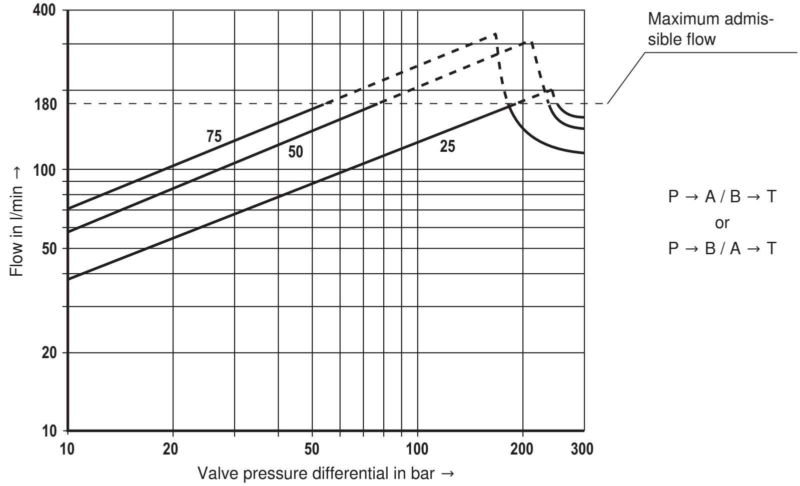


Flow, size 10 with V control spool

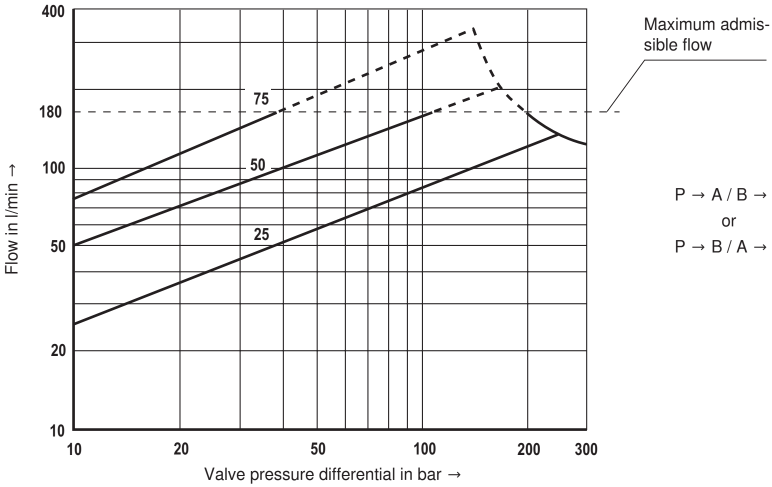


Characteristic curves: Size 10 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Flow/load function size 10 with Q5 control spool with maximum valve opening

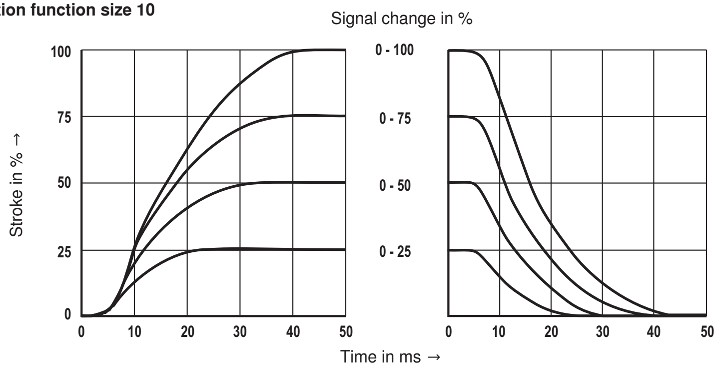


Flow/load function size 10 with V control spool with maximum valve opening

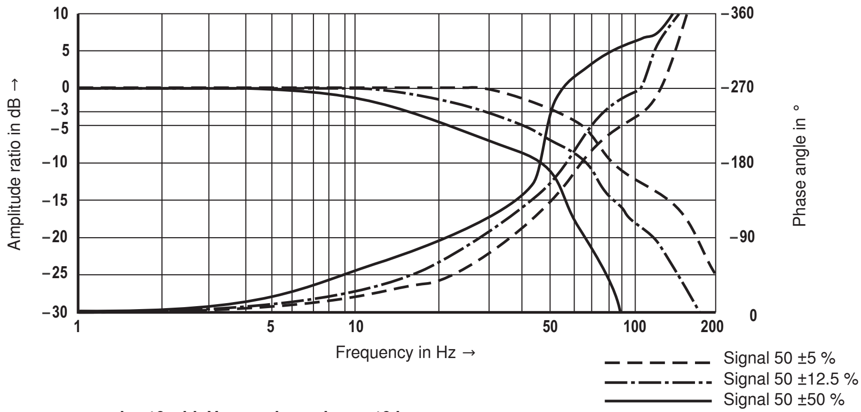


Characteristic curves: Size 10 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

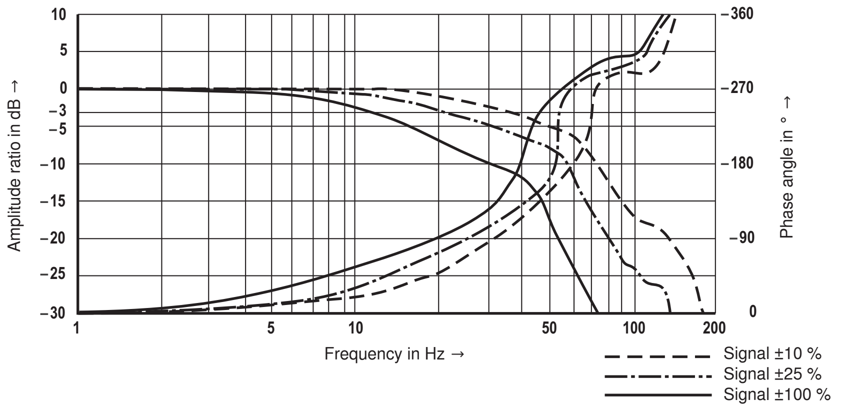
Transition function size 10



Frequency response size 10 with Q5 control spool, p_s = 10 bar

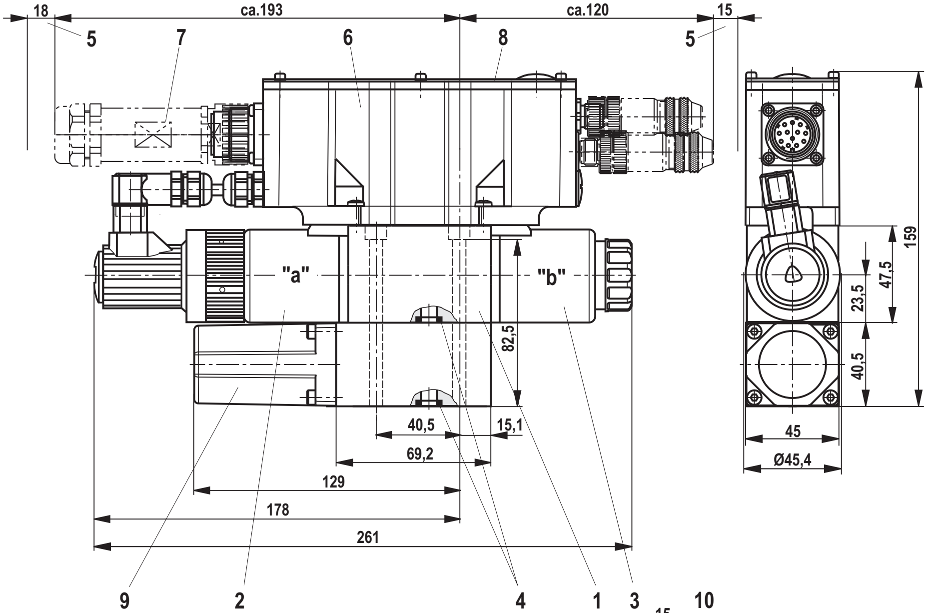


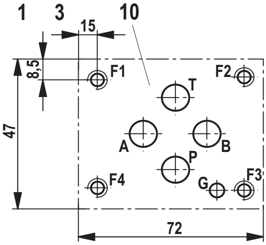
Frequency response size 10 with V control spool, p_s = 10 bar

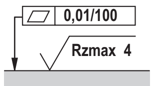


Dimensions: Size 6 (dimensions in mm)

Type 4WREQ with integrated pressure sensors







Required surface quality of the valve contact surface

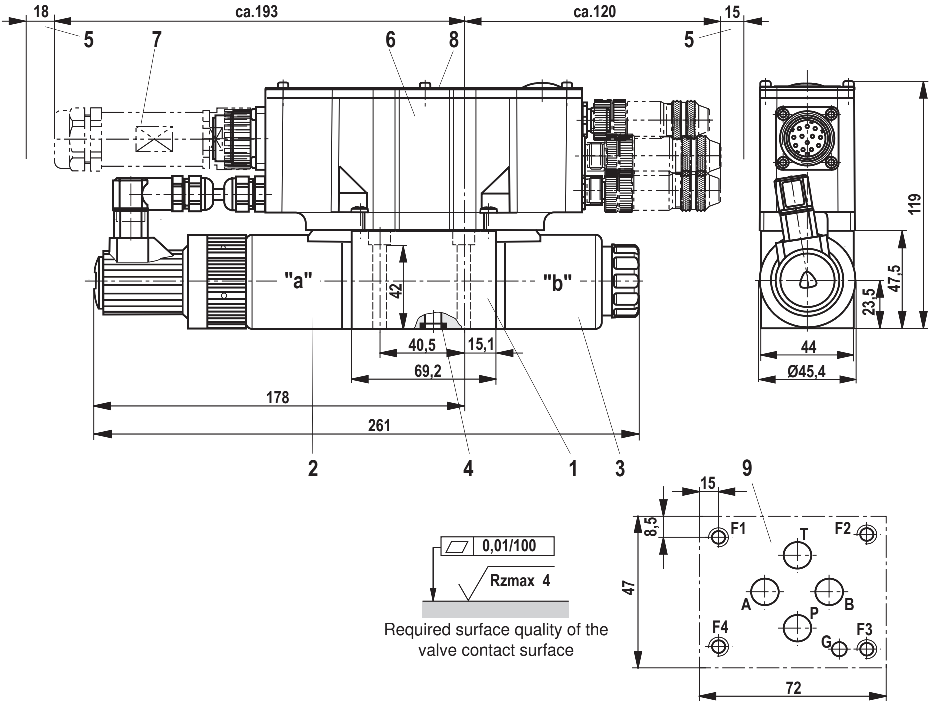
1 Valve housing
2 Proportional solenoid "a" with inductive position transducer
3 Proportional solenoid "b"
4 R-ring 9.81 x 1.5 x 1.78 (ports P, A, B, T)
5 Space required to remove the mating connector
6 Integrated digital control electronics
7 Mating connector according to DIN EN 175201-804; separate order, see page 25
8 Name plate
9 Integrated pressure transducer
10 Processed valve contact surface, porting pattern according to ISO 4401-03-02-0-05
Deviating from the standard:
– Ports P, A, B, T Ø 8 mm
– Bore G can be omitted as the valve does not have a pin.

Notice!
The dimensions are nominal dimensions which are subject to tolerances.

Subplates and valve mounting screws see page 23

Dimensions: Size 6 (dimensions in mm)

Type 4WREQ for external pressure sensor



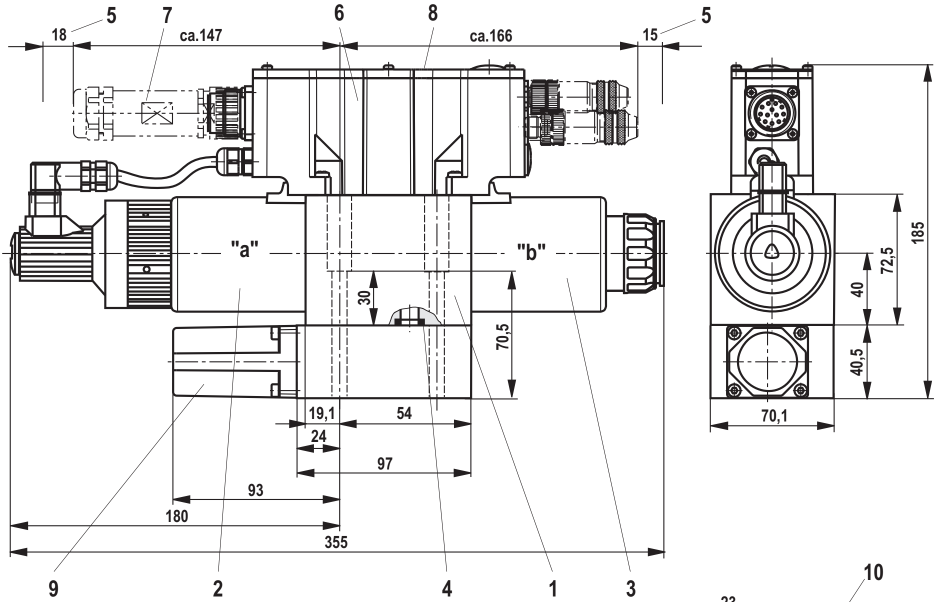
1 Valve housing
2 Proportional solenoid "a" with inductive position transducer
3 Proportional solenoid "b"
4 R-ring 9.81 x 1.5 x 1.78 (ports P, A, B, T)
5 Space required to remove the mating connector
6 Integrated digital control electronics
7 Mating connector according to DIN EN 175201-804; separate order, see page 25
8 Name plate
9 Processed valve contact surface, porting pattern according to ISO 4401-03-02-0-05
Deviating from the standard:
– Ports P, A, B, T Ø 8 mm
– Bore G can be omitted as the valve does not have a pin.

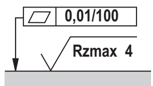
Notice!
The dimensions are nominal dimensions which are subject to tolerances.

Subplates and valve mounting screws see page 23

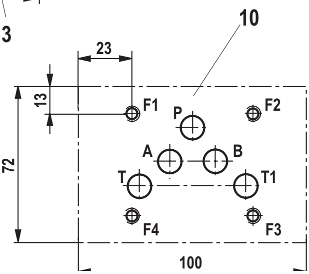
Dimensions: Size 10 (dimensions in mm)

Type 4WREQ with integrated pressure sensors





Required surface quality of the valve contact surface



2

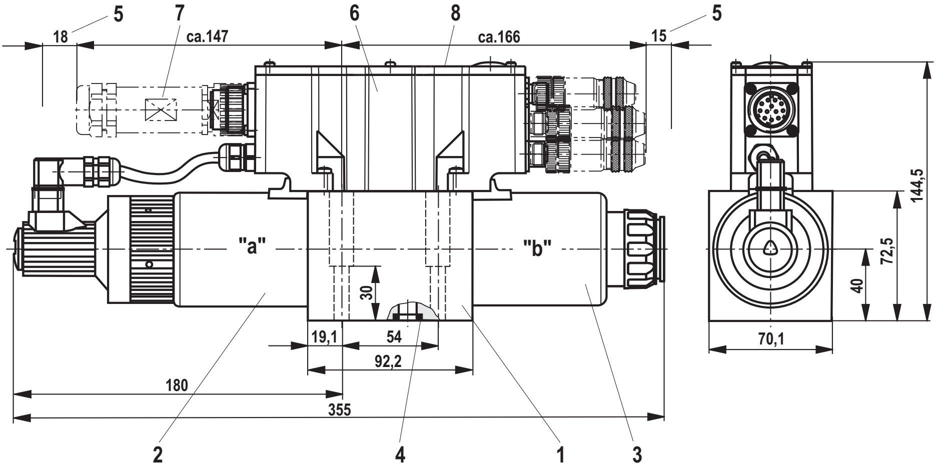
1 Valve housing
2 Proportional solenoid "a" with inductive position transducer
3 Proportional solenoid "b"
4 R-ring 13.0 x 1.6 x 2.0 (ports P, A, B, T1, T2)
5 Space required to remove the mating connector
6 Integrated digital control electronics
7 Mating connector according to DIN EN 175201-804; separate order, see page 25
8 Name plate
9 Integrated pressure transducer
10 Processed valve contact surface, porting pattern according to ISO 4401-05-04-0-05

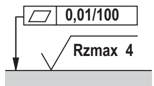
Notice!
The dimensions are nominal dimensions which are subject to tolerances.

Subplates and valve mounting screws see page 23

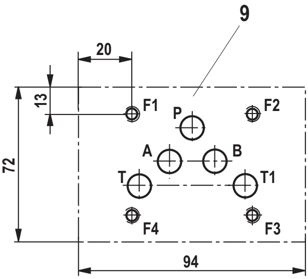
Dimensions: Size 10 (dimensions in mm)

Type 4WREQ for external pressure sensor





Required surface quality of the valve contact surface



1 Valve housing
2 Proportional solenoid "a" with inductive position transducer
3 Proportional solenoid "b"
4 R-ring 13.0 x 1.6 x 2.0 (ports A, B, P, T, T1)
5 Space required to remove the mating connector
6 Integrated digital control electronics
7 Mating connector according to DIN EN 175201-804; separate order, see page 25
8 Name plate
9 Processed valve contact surface, porting pattern according to ISO 4401-05-04-0-05

Notice!
The dimensions are nominal dimensions which are subject to tolerances.

Subplates and valve mounting screws see page 23

Dimensions

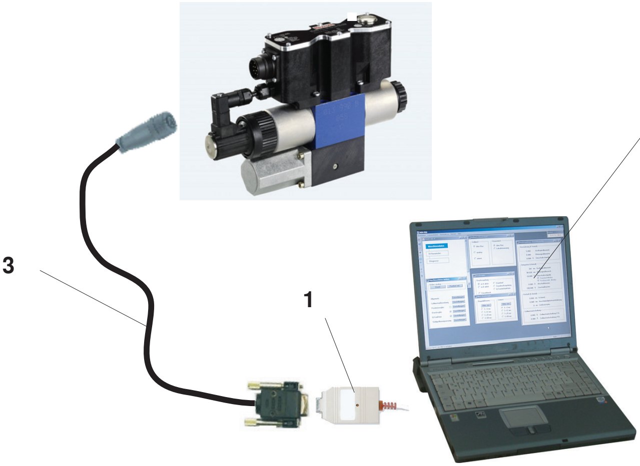
Hexagon socket head cap screws		**Material number**
Size 6 with integrated pressure sensors	4x ISO 4762 - M5 x 90 - 10.9-flZn-240h-L Tightening torque M_A = 7 Nm ±10 %	R913000222
Size 6 with external pressure sensor	4x ISO 4762 - M5 x 50 - 10.9-flZn-240h-L Tightening torque M_A = 7 Nm ±10 % or 4x ISO 4762 - M5 x 50 - 10.9 Tightening torque M_A = 8.9 Nm ±10 %	R913000064
Size 10 with integrated pressure sensors	4x ISO 4762 - M6 x 80 - 10.9-flZn-240h-L Tightening torque M_A = 12.5 Nm ±10 % or 4x ISO 4762 - M6 x 80 - 10.9 Tightening torque M_A = 15.5 Nm ±10 %	R913000512
Size 10 with external pressure sensor	4x ISO 4762 - M6 x 40 - 10.9-flZn-240h-L Tightening torque M_A = 12.5 Nm ±10 % or 4x ISO 4762 - M6 x 40 - 10.9 Tightening torque M_A = 15.5 Nm ±10 %	R913000058

Notice: The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure!

Subplates	**Data sheet**
Size 6	45052
Size 10	45054

Accessories (not included in the scope of delivery)

The following is required for the parameterization with PC:		CANopen	PROFIBUS-DP
1	Interface converter (USB)	VT-ZKO-USB/CA-1-1X/V0/0 Mat.no. **R901071963**	VT-ZKO-USB/P-1-1X/V0/0 Mat.no. **R901071962**
2	Commissioning software	WIN-PED 6 Download from www.boschrexroth.de\IAC	
3	Connection cable, 3 m	D-Sub / M12, coding A Mat.no. **R900751271**	D-Sub / M12, coding B Mat.no. **R901078053**

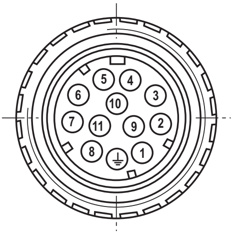


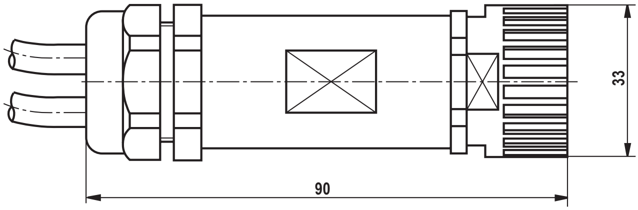
Accessories, port X1 (not included in the scope of delivery)

Mating connector for X1

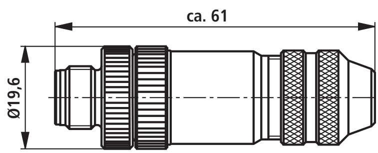
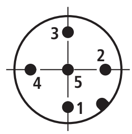
Mating connector according to DIN EN 175201 - 804 (11-pin + PE), plastic variant

- Mating connector without cable (assembly kit) Material no. **R900884671**
- Mating connector with cable set 2 x 5 m 12-pin Material no. **R900032356**
- Mating connector with cable set 2 x 20 m 12-pin Material no. **R900860399**

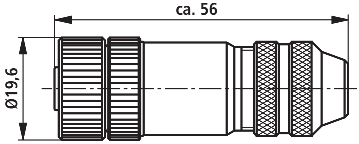
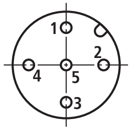
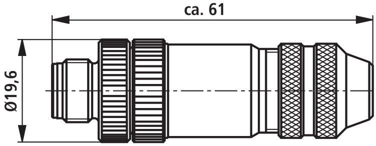
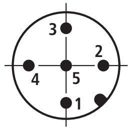
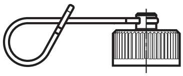




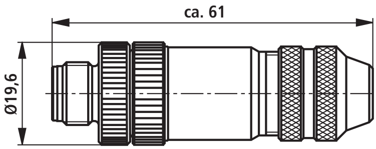
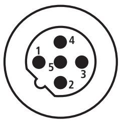
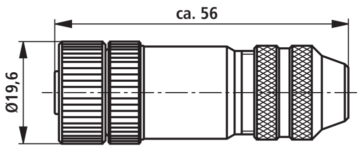
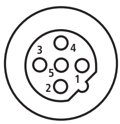
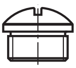
Accessories, sensor connection (not included in the scope of delivery)

Description	View, dimensions	Pole pattern, order details
X4 (analog sensor) Plug-in connector, 5-pin, M12, pin, A coding, straight line connector in metal design		 Mat no.: **R901075542** (cable diameter 4 to 6 mm)

Accessories, CAN bus (A coding) (not included in the scope of delivery)

Description	View, dimensions	Pole pattern, order details
X2 Round plug-in connector, can be assembled, 5-pin, M12 Straight mating connector in metal design.		 Mat no.: **R901076910** (line diameter 6 to 8 mm)
X3 Round plug-in connector, can be assembled, 5-pin, M12 Straight line connector in metal design.		 Mat no.: **R901076906** (line diameter 6 to 8 mm)
M12 cap Dust protection only for line connector.		Mat no.: **R901075564**

Accessories, PROFIBUS (B coding) (not included in the scope of delivery)

Description	View, dimensions	Pole pattern, order details
X2 Round plug-in connector, can be assembled, 5-pin, M12 Straight line connector in metal design.		 Mat no.: **R901075545** (line diameter 6 to 8 mm)
X3 Round plug-in connector, can be assembled, 5-pin, M12 Straight mating connector in metal design.		 Mat no.: **R901075550** (line diameter 6 to 8 mm)
M12 protective cap (only for mating connector)		Mat no.: **R901075563**

Project planning/maintenance instructions/additional information

Product documentation for IAC-P

- **Product information data sheet 29015-P**
- **Technical data sheet** (this data sheet)
- **Operating manual 29015-B**
- **CAN bus protocol description data sheet 29015-01-Z**
  PROFIBUS protocol description data sheet 29015-02-Z
- **General information on the maintenance and commissioning of hydraulic components**
  Data sheet 07800/07900

Commissioning software WIN-PED 6 and documentation on the Internet: www.boschrexroth.com/IAC

Maintenance instructions:

- The devices have been tested in the factory and are supplied with default settings.
- Only complete devices can be repaired. Repaired devices are returned with default settings. User-specific settings are not accepted. The machine end-user will have to retransfer the corresponding user parameters.

Notices:

- Connect the valve to the supply voltage only when this is required for the functional sequence of the machine.
- Do not use electrical signals led out via control electronics (e.g. "No error" signal) for switching safety-relevant machine functions (In this connection also refer to EN ISO 13849 "Safety of machinery - Safety-related parts of control systems").
- If electro-magnetic interference must be expected, take appropriate measures to ensure the function (depending on the application, e.g. shielding, filtering)!

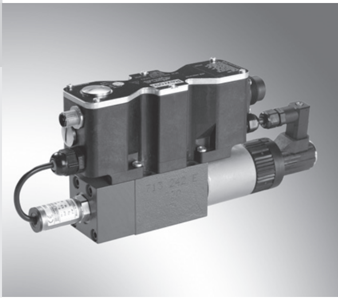
Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
documentation@boschrexroth.de
www.boschrexroth.de

Rexroth
Bosch Group

Proportional directional valve, direct operated, with *pQ* functionality

RE 29014/03.13
Replaces: 12.12

Type STW 0195, type STW 0196



STW 0195: Size 6
Component series 2X

STW 0196: Size 10
Component series 1X

Table of contents

Contents	Page

Information on available spare parts:
www.boschrexroth.com/spc

Features

- Direct operated 3-way proportional valve with integrated IAC-P digital control electronics, for controlling a pressure in port A
- Completely adjusted unit consisting of position-controlled valve, pressure sensor and field bus connection
- Operation via a proportional solenoid with central thread and detachable coil
- Valve spool, position-controlled
- Integrated pressure sensor plate (optional)
- For subplate mounting: Porting pattern according to ISO 4401
- Analog interfaces for command and actual values
- Design for CAN bus with CANopen protocol DS 408 or Profibus DP
- Separate connectors for power supply and bus connection
- Quick commissioning via PC and WINPED commissioning software

Ordering code

STW	0195	– 2X /		V	– 24			– *

With integrated digital electronics and ***pQ*** functionality; size 6

Component series 20 to 29 **= 2X**
(20 to 29: Unchanged installation and connection dimensions)

Rated flow

P → A 10 l/min, A → T 20 l/min **= 1**
P → A 20 l/min, A → T 20 l/min **= 2**

Seal material

FKM seals **= V**

Pressure rating of the integrated pressure sensor

3 = Nominal pressure 50 bar
5 = Nominal pressure 160 bar
8 = Nominal pressure 250 bar

Supply voltage

24 = Direct voltage 24 V

Bus interface

C = CANBus DS - 408
P = Profibus DP V0/V1

Interface A6 or F6

A6 = ±10 VDC
F6 = 4 to 20 mA

Further details in plain text

STW	0196	– 1X /	1	V	– 24			– *

With integrated digital electronics and ***pQ*** functionality; size 10

Component series 10 to 19 **= 1X**
(10 to 19: Unchanged installation and connection dimensions)

Rated flow

P → A 65 l/min,
A → T 60 l/min,
B → T 60 l/min **= 1**

Seal material

FKM seals **= V**

Pressure rating of the integrated pressure sensor

3 = Nominal pressure 50 bar
5 = Nominal pressure 160 bar
8 = Nominal pressure 250 bar

Supply voltage

24 = Direct voltage 24 V

Bus interface

C = CANBus DS - 408
P = Profibus DP V0/V1

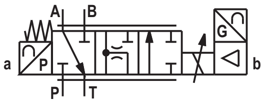
Interface A6 or F6

A6 = ±10 VDC
F6 = 4 to 20 mA

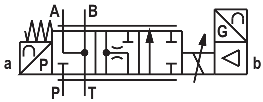
Further details in plain text

Symbols

Type STW0195...



Type STW0196...



Set-up, function, section

Set-up

The IAC-P valve basically consists of:

– Housing (1) with connection surface
– Control spool (2) with compression spring (3)
– Solenoid and pole tube (4) with central thread
– Position transducer (5)
– Pressure sensor (6)
– Integrated IAC-P digital control electronics (7) with bus connection (X2) and central connector (X1).

Functional description

– If solenoids (4) are not operated, spool position A → T (with type STW 0196-1X/1 additionally B → T)
– Functions:
  • Flow control (***Q***)
  • Pressure control (***p***)
  • Substitutional closed-loop control ***p/Q***
– The command value can alternatively be specified via an analog interface (X1) or via the field bus interface (X2, X3).
– The actual value signals are provided via an analog interface (X1) and can additionally be read out via the field bus (X2, X3).
– The controller parameters are set via the field bus (X2, X3).
– Separate supply voltage for bus/controller and power part (output stage) for safety reasons.

The digital integrated control electronics enables the following fault detection: (diagnosis)

– Cable break of pressure sensor supply line (6)
– Undervoltage
– Cable break of position transducer (5)
– Communication error
– Watchdog
– Cable break of command value inputs

The following additional functions are available:

– Pressure ramp
– Internal command value profile
– Enable function analog/digital
– Error output 24 V

WINPED PC program

To implement the project planning task and to parameterize the IAC-P valves, the user may use the WINPED commissioning software (see accessories).

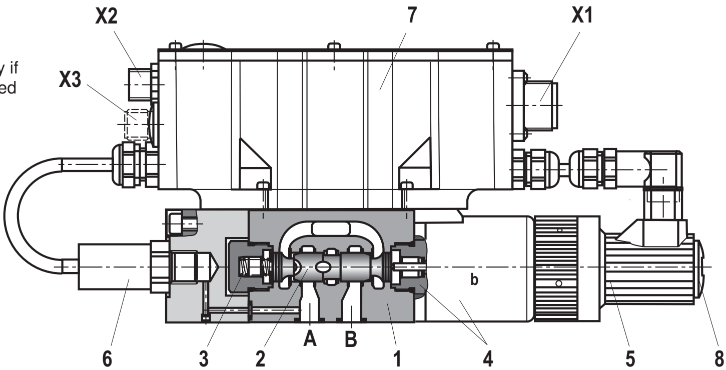
- Parameterization
- Diagnosis
- Comfortable data management on a PC
- PC operating systems: Windows 2000 or Windows XP

2

$Q_{command}$	***Q*** control	***p*** closed-loop control
< 12 mA	**A → T**	**Inactive**
> 12 mA	**Substitutional closed-loop control: (A → T or P → A) Q control ($Q_{command}$) with pressure limitation ($p_{command}$) if pressure limitation is active, the following applies: $Q_{actual} \leq Q_{command}$**	

Functional section of STW 0195–2X

X3 exists only if Profibus is used



Notice!

Due to the design principle, internal leakage is inherent to the valves, which may increase over the life cycle.

The tank line must not be allowed to run empty. With corresponding installation conditions, a preload valve is to be installed.

Important notice!

The PG fitting (8) must not be opened. Mechanical adjustment of the adjustment nut located below is prohibited and damages the valve!

Technical data (For applications outside these parameters, please consult us.)

general

Valve type			STW195	STW196
Weight		kg	2.4	6.5
Installation position			Any, preferably horizontal	
Ambient temperature range		°C	–20 … +50	
Storage temperature range		°C	–20 … +80	

hydraulic (measured using HLP 46; ϑ_{oil} = 40 °C ±5 °C and p = 100 bar)

Operating pressure [1)] Ports P, A, B with sensor	50 bar	bar	50			
	160 bar	bar	160			
	250 bar	bar	250			
Port T with sensor	50 bar	bar	50			
	160 bar	bar	160			
	250 bar	bar	210			
Rated flow $q_{V\ rated}$ at Δp = 5 bar (see also flow characteristic curve from page 10 onwards)	From P → A	l/min	Spool **1**	Spool **2**	65	
			10	20		
	From A → T	l/min	20	20	A → T, B → T	60
Maximum flow			See characteristic curves performance limit from page 11 onwards			
Hydraulic fluid			See table below			
Hydraulic fluid temperature range (at the valve's working ports)		°C	–20 to +80, preferably +40 to +50			
Viscosity range		mm²/s	20 to 380, preferably 30 to 46			
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Class 20/18/15 [2)]			
Hysteresis		%	≤ 0.1			
Range of inversion		%	≤ 0.05			
Response sensitivity		%	≤ 0.05			
Zero shift		%10 K	≤ 0.15			
		%100 bar	≤ 0.1			

1) Operating pressure, dependent on valve and sensor

2) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components.
For the selection of the filters see www.boschrexroth.com/filter

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons		HL, HLP	NBR, FKM	DIN 51524
Flame-resistant	– containing water	HFC (Fuchs HYDROTHERM 46M, Petrofer Ultra Safe 620)	NBR	ISO 12922

Important information on hydraulic fluids!

- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.)!
- The flash point of the process and operating medium used must be 40 K greater than the maximum solenoid surface temperature.
- **Flame-resistant – containing water**: Maximum pressure differential per control edge 175 bar. Pressure pre-loading at the tank port > 20 % of the pressure differential; otherwise, increased cavitation.

  Life cycle as compared to operation with mineral oil HL, HLP 50 % to 100 %

Technical data (For applications outside these parameters, please consult us.)

electric

Supply voltage	Nominal voltage	VDC	24
	Lower limit value	VDC	19.4
	Upper limit value	VDC	35
Maximum admissible residual ripple		Vpp	2
Current consumption	I_{max}	A	2
	Pulse current	A	3
Command value signals		mA	4 to 20 or via CAN bus
Duty cycle [1)]		%	100
Maximum coil temperature [2)]		°C	Up to 150
Protection class of the valve according to EN 60529			IP 65 with mating connector correctly mounted and locked

[1)] Connect the valve to the supply voltage only when this is required for the functional sequence of the machine.

[2)] Due to the temperatures occurring at the surfaces of the solenoid coils, the European standards ISO 13732-1 and EN ISO 4413 need to be adhered to.

Sensor technology

Valve type			STW 195 (size 6) and STW 196 (size 10)		
Measurement range	p_N	bar	**50**	**160**	**250**
Overload protection	p_{max}	bar	120	320	500
Bursting pressure	p	bar	550	800	1200
Compensation error	Zero point		< 0.15 % of full scale		
	End value		< 0.3 %		
Temperature coefficient in nominal temperature range					
Greatest temperature coefficient of zero point			< 0.2 % / 10 K		
Greatest temperature coefficient of the range			< 0.2 % / 10 K		
Characteristic curve deviation			< 0.2 %		
Hysteresis			< 0.1 %		
Repetition accuracy			< 0.05 %		
Setting time (10 - 90 %)		t	< 2 ms		
Long-term drift (1 year) at reference conditions			< 0.2 %		
Conformity			CE according to EMC directive 89/336/EEC, 93/68/EEC, 93/44/EEC		

Electrical connections, allocation

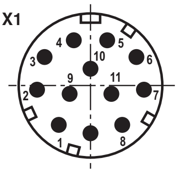
Connector allocation X1, 11-pole + PE according to DIN EN 175201-804

Pin	No. and/or litz wire color [1]	Interface A6 allocation	Interface F6 allocation
1	1	24 VDC (u(t) = 19.4 V … 35 V), I_{max} = 1.7 A (for output stage)	
2	2	0 V ≙ load zero, reference for pins 1 and 9	
3	White	Enable input 9 ... 35 V ≙ enable on	
4	Yellow	±10 V command value ***Q*** R_e > 50 kΩ	4...20 mA command value ***Q*** R_e = 100 Ω
5	Green	Reference for command values ***Q*** and ***p***	
6	Purple	±10 V actual value ***Q***	4...20 mA actual value ***Q*** (load resistance max. 300 Ω)
7	Pink	0 … 10 V command value ***p*** R_e > 50 kΩ	4...20 mA command value ***p*** R_e = 100 Ω
8	Red	0 … 10 V actual value ***p***	4...20 mA actual value ***p*** (load resistance max. 300 Ω)
9	Brown	Control voltage, level same as pin 1, I_{max} = 0.3 A (for signal part and bus)	
10	Black	0 V reference potential for pins 3, 6, 8 and 11 (connected with pin 2 in valve)	
11	Blue	Error output 24 V (19.4 V … 35 V), 200 mA max. load	
PE	Green-yellow	Connected to cooling element and valve housing	

Connect shield on PE only on the supply side!

[1] Litz wire colors of connection line
for mating connector with cable set (see accessories)

X1



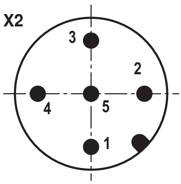
Connector allocation X2, CAN bus, (coding A), M12 x 1, 5-pole, pins

Pin	Allocation
1	n.c.
2	n.c.
3	CAN_GND
4	CAN_H
5	CAN_L

Transmission rate kbit/s 20 to 1000
Bus address 1 to 127

CAN-specific settings:
Baud rate and identifier must be set via the bus system.

X2



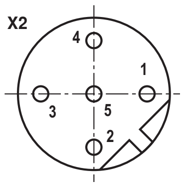
Connector allocation for Profibus DP, "X2"/"X3" (coding B), M12 x 1, 5-pole, socket/pins

Pin	Allocation
1	+5 V
2	RxD/TxD-N (A line)
3	D GND
4	RxD/TxD-P (B line)
5	Shield

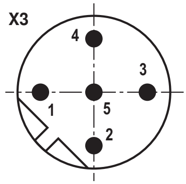
Transmission rate up to 12 MBaud
Bus address 1 to 126
Setting via DIL switch

The +5 V voltage of the IAC-P is available for an external terminating resistor.

X2



X3

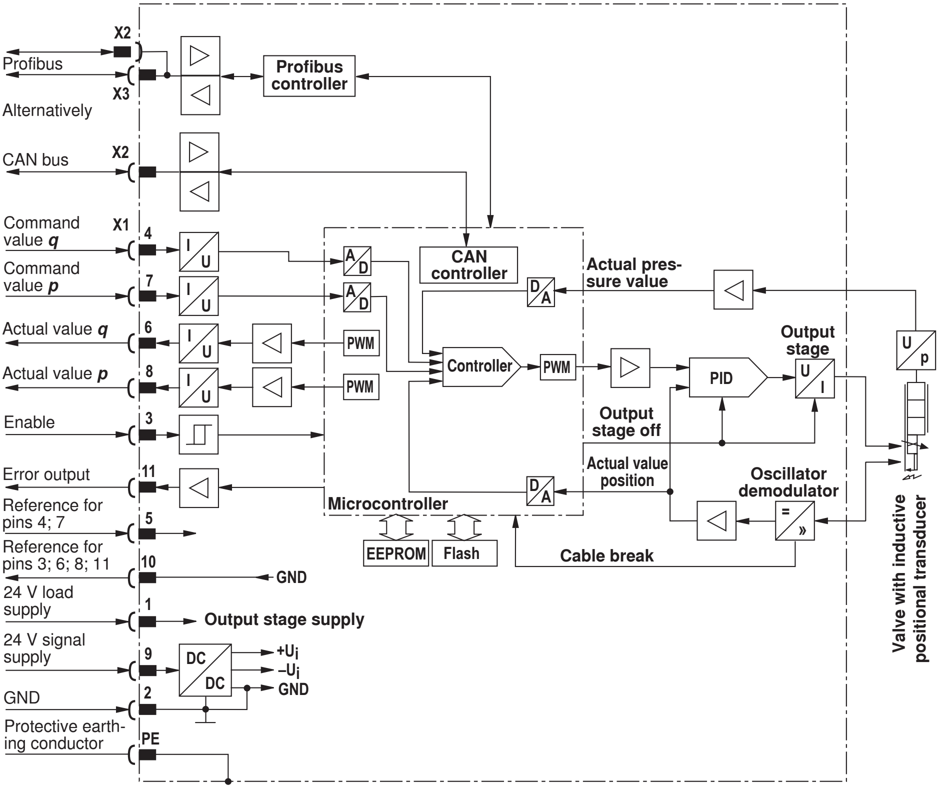


Notice:

We recommend connecting the shields on both sides via the metal housings of the plug-in connectors.
Using connector pins will affect the shielding effect!
Internal screens are not required.

Electrical connections, allocation

Block diagram, integrated control electronics



Command value: Command value 12 to 20 mA at pin 4 and reference potential at pin 5 result in flow from P → A.
Command value 4 to 12 mA at pin 4 and reference potential at pin 5 result in flow from A → T.

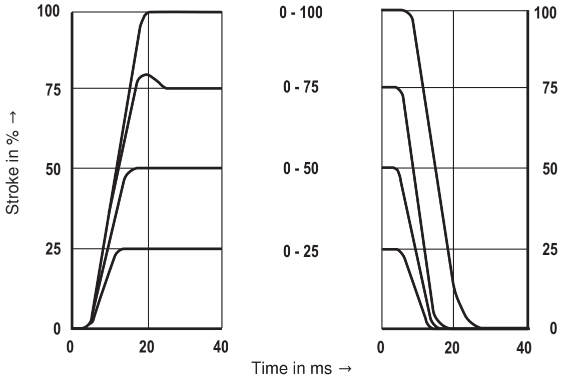
Actual value: Actual value 12 to 20 mA at pin 6 and reference potential at pin 10 result in flow from P → A.
Actual value 4 to 12 mA at pin 6 and reference potential at pin 10 result in flow from A → T.

Connection line: Recommendation: – Up to 25 m line length for pins 1; 2 and PE: 0.75 mm^2, otherwise 0.25 mm^2
– Up to 50 m line length for pins 1; 2 and PE: 1.00 mm^2

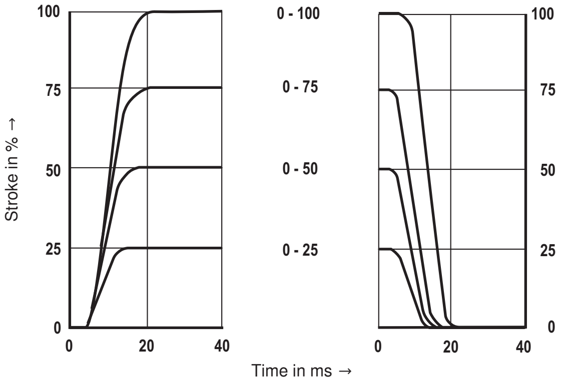
External diameter see sketch of mating connector

Characteristic curves: Type STW 0195-2X/1...

Transition function of type STW 0195-2X/1..., A → T

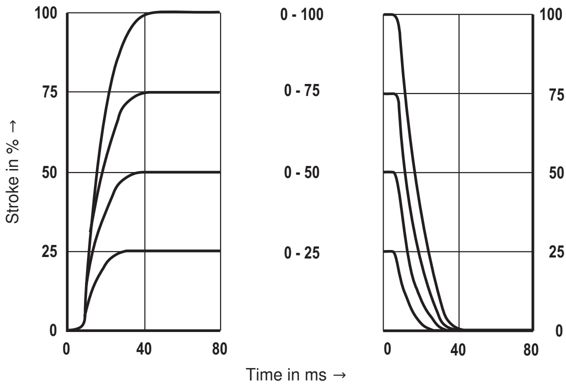


Transition function of type STW 0195-2X/1..., P → A

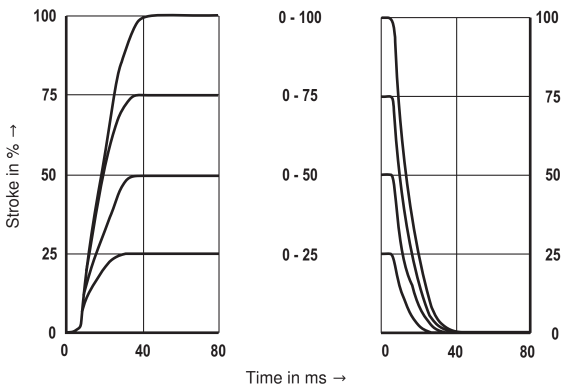


Characteristic curves: Type STW 0196-1X/1...

Transition function of type STW 0196-1X/1..., A → T, B → T

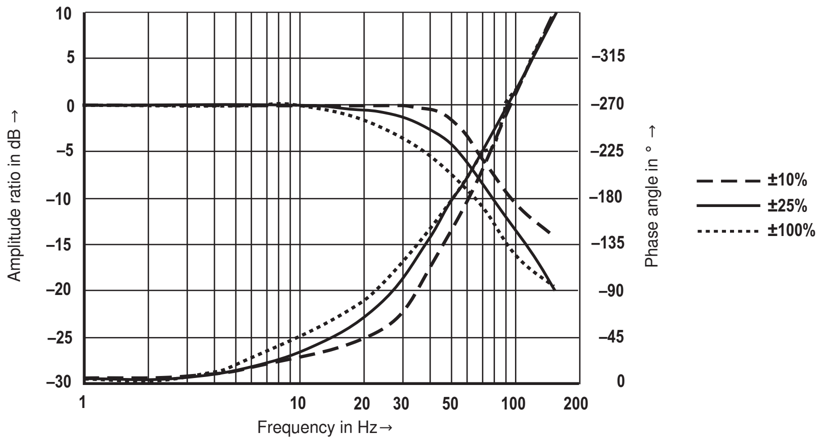


Transition function of type STW 0196-1X/1..., P → A

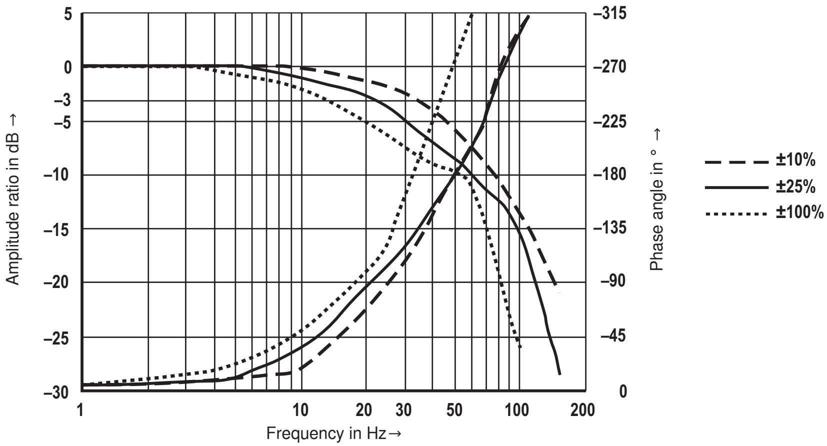


Characteristic curves: Type STW 0195-2X/1... and type STW 0196-1X/1...

Frequency response of type STW 0195-2X/1...

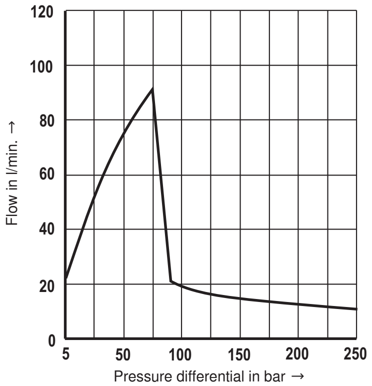


Frequency response of type STW 0196-1X/1...

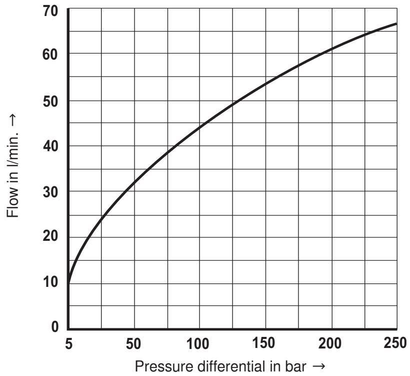


Characteristic curves: Type STW 0195-2X/1...

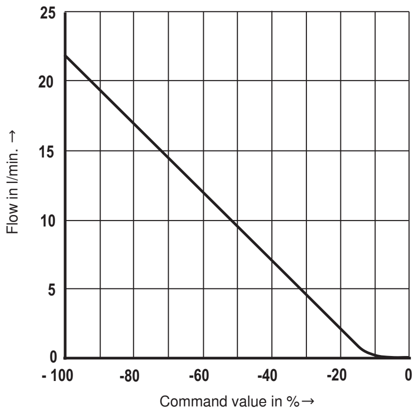
Performance limit A → T, position-controlled



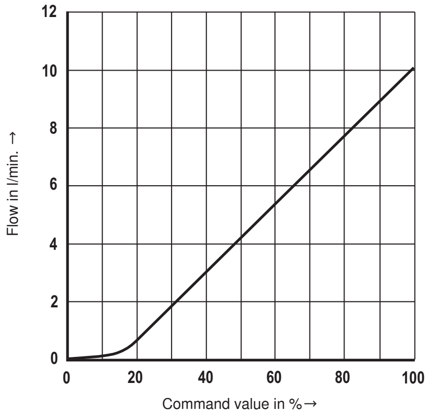
Performance limit P → A, position-controlled



Flow characteristic curve A → T, *Δp* = 5 bar

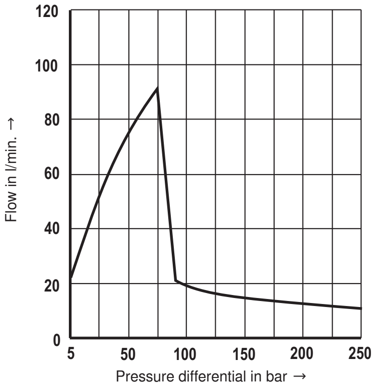


Flow characteristic curve P → A, *Δp* = 5 bar

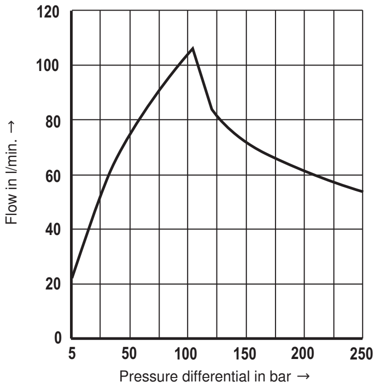


Characteristic curves: Type STW 0195-2X/2...

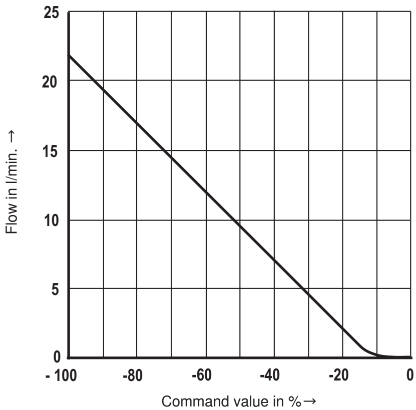
Performance limit A → T, position-controlled



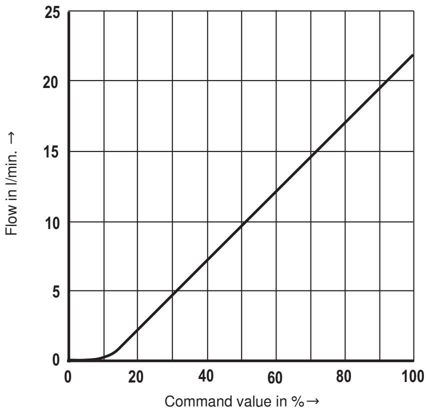
Performance limit P → A, position-controlled



Flow characteristic curve A → T, *Δp* = 5 bar

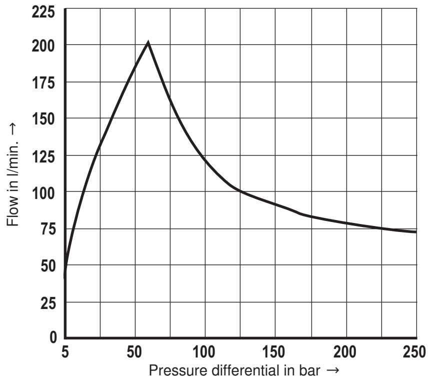


Flow characteristic curve P → A, *Δp* = 5 bar

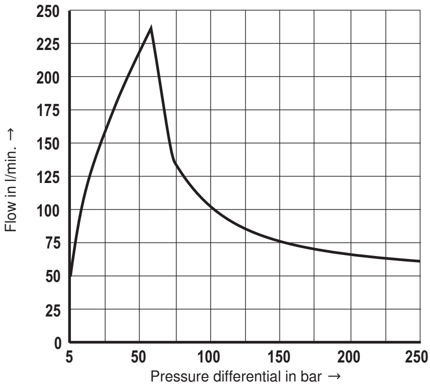


Characteristic curves: Type STW 0196-1X/1...

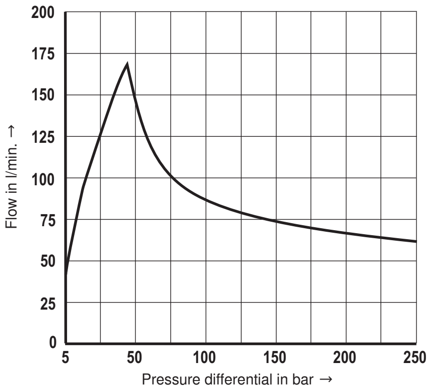
Performance limit A → T, position-controlled



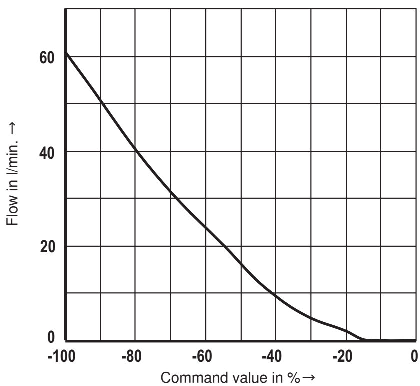
Performance limit P → A, position-controlled



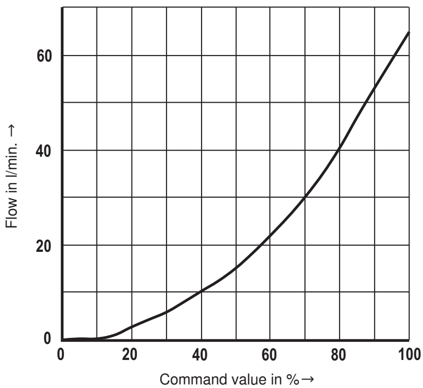
Performance limit B → T, position-controlled



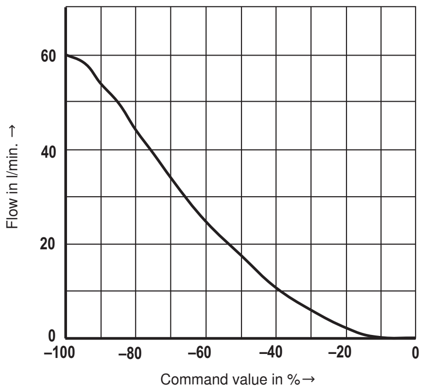
Flow characteristic curve A → T, *Δp* = 5 bar



Flow characteristic curve P → A, *Δp* = 5 bar

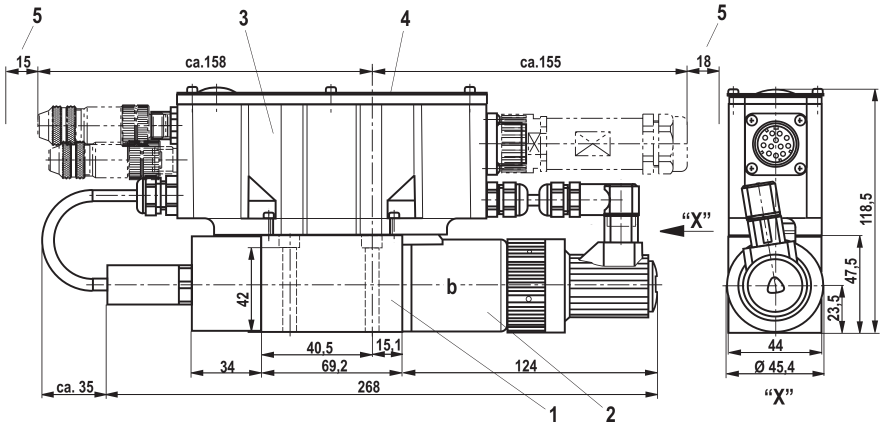


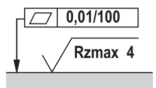
Flow characteristic curve B → T, *Δp* = 5 bar



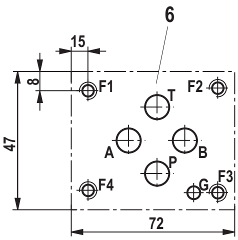
2

Dimensions: Type STW 0195-2X/1... (dimensions in mm)





Required surface quality of the valve contact surface



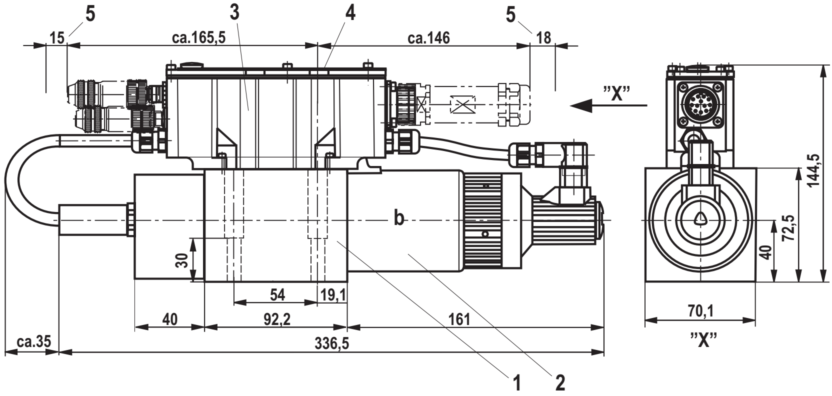
Notice!
The dimensions are nominal dimensions which are subject to tolerances.

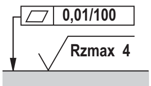
1. Valve housing
2. Proportional solenoid "b" with inductive position transducer
3. Integrated digital control electronics
4. Name plate
5. Space required to remove the connector
6. Machined valve contact surface, porting pattern according to ISO 4401-03-02-0-05

   Deviating from the standard:
   - Ports P, A, B and T with Ø 8 mm
   - Bore B may not be required since there is no pin in the valve.

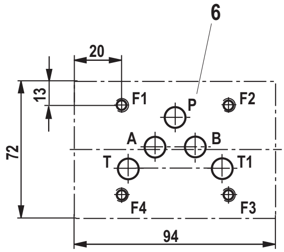
Subplates and valve mounting screws see page 16

Dimensions: Type STW 0196-1X/1... (dimensions in mm)





Required surface quality of the valve contact surface



Notice!
The dimensions are nominal dimensions which are subject to tolerances.

- **1** Valve housing
- **2** Proportional solenoid "b" with inductive position transducer
- **3** Integrated digital control electronics
- **4** Name plate
- **5** Machined valve contact surface, porting pattern according to ISO 4401-05-04-0-05

  Deviating from the standard:
  – Port T1 exists additionally

Subplates and valve mounting screws see page 16

Dimensions

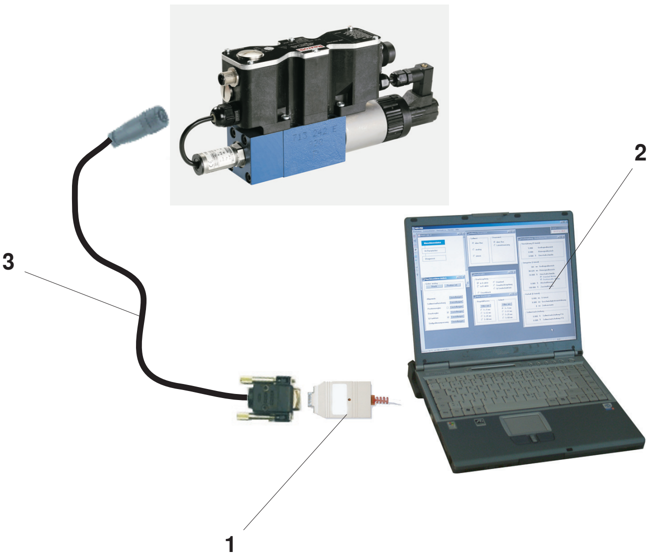
Hexagon socket head cap screws		Material number
Type STW0195	4x ISO 4762 - M5 x 50 - 10.9-flZn-240h-L Tightening torque M_A = 7 Nm ±10 % or 4x ISO 4762 - M5 x 50 Tightening torque M_A = 8.9 Nm ±10 %	R913000064
Type STW0196	4x ISO 4762 - M6 x 40 - 10.9-flZn-240h-L Tightening torque M_A = 12.5 Nm ±10 % or 4x ISO 4762 - M6 x 40 - 10.9 Tightening torque M_A = 15.5 Nm ±10 %	R913000058

Notice: The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure!

Subplates	Data sheet
Type STW0195	45052
Type STW0196	45054

Accessories (not included in the scope of delivery)

The following is required for the parameterization with PC:		CANopen	Profibus DP
1	Interface converter (USB)	VT-ZKO-USB/CA-1-1X/V0/0 Mat.no. **R901071963**	VT-ZKO-USB/P-1-1X/V0/0 Mat.no. **R901071962**
2	Commissioning software	WINPED Download via www.boschrexroth.de\IAC	
3	Connection cable, 3 m	D-Sub / M12, coding A Mat.no. **R900751271**	D-Sub / M12, coding B Mat.no. **R901078053**

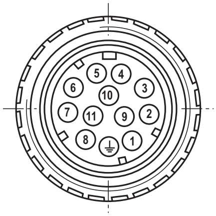


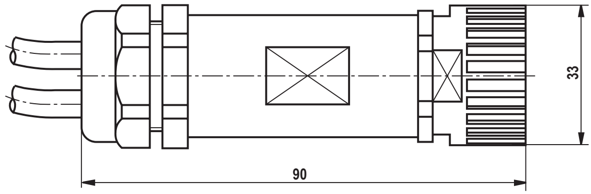
Accessories, port X1 (not included in the scope of delivery)

Mating connector for X1

Mating connector according to DIN EN17520-804 (11-pole + PE), plastic variant

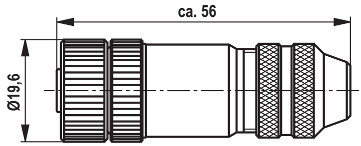
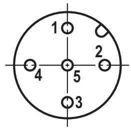
- Mating connector without cable (assembly kit) Material no. **R900884671**
- Mating connector with cable set 2 x 5 m 12-pole Material no. **R900032356**
- Mating connector with cable set 2 x 20 m 12-pole Material no. **R900860399**



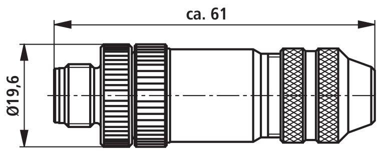
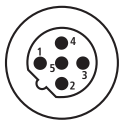
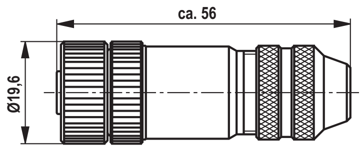
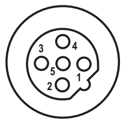
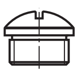


2

Accessories, CAN bus (A coding) (not included in scope of delivery)

Description	View, dimensions	Pole pattern, order details
X2 Round connector, can be assembled, 5-pole, M12x1 Straight mating connector in metal design.		 Mat no.: **R901076910** (line diameter 6 - 8 mm)

Accessories, Profibus (B coding) (not included in scope of delivery)

Description	View, dimensions	Pole pattern, order details
X2 Round connector, can be assembled, 5-pole, M12x1 Straight line connector in metal design.		 Mat no.: **R901075545** (line diameter 6 - 8 mm)
X3 Round connector, can be assembled, 5-pole, M12x1 Straight mating connector in metal design.		 Mat no.: **R901075550** (line diameter 6 - 8 mm)
M12 protective cap (for mating connector only)		Mat no.: **R901075563**

Project planning/maintenance instructions/additional information

Product documentation for types STW0195 and STW0196

- **Technical data sheet 29014** (this data sheet)
- **Operating manual 29015-B**
- **CAN bus protocol description, data sheet 29015-01-Z**
  Profibus protocol description, data sheet 29015-02-Z
- **General information regarding the maintenance and commissioning of hydraulic components data sheet 07800/07900**

WINPED commissioning software and documentation on the Internet: www.boschrexroth.com/IAC

Maintenance instructions:
- The devices have been tested in the factory and are supplied with default settings.
- Only complete devices can be repaired. Repaired devices are returned with default settings. User-specific settings are not accepted. The machine end-user will have to retransfer the corresponding user parameters.

Notes:
- Connect the valve to the supply voltage only when this is required for the functional sequence of the machine.
- Do not use electrical signals led out of control electronics (e.g. "No error" signal) for switching safety-relevant machine functions (See also EN ISO 13849 "Safety of machinery – safety-related parts of control systems").
- If electro-magnetic interference must be expected, take appropriate measures to ensure the function (depending on the application, e.g. shielding, filtration)!

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
documentation@boschrexroth.de
www.boschrexroth.de

The Drive & Control Company

Rexroth
Bosch Group

4/3 proportional directional spool valve, direct operated, with solenoid actuation

Type VEPS..43

RE 18162
Edition: 2013-01
Replaces: 05.12

H7900

- Frame size 10
- Component series 0
- Maximum operating pressure 350 bar
- Maximum flow 25 l/min

Features

- Mounting cavity R/UNF10-04-0-06
- Direct operated proportional directional spool valve with solenoid actuation for controlling the flow size
- Wet-pin DC solenoids
- Rotatable solenoid coil
- Manual override, optional

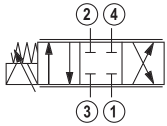
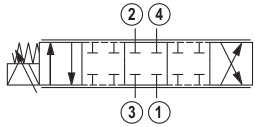
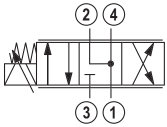
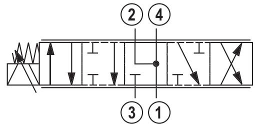
Contents

Ordering code (valve without coil) 1)

01		02		03	04	05		06	07	08	09	10	11	12
VEPS	**–**	**10A**	**–**	**43**				**OD14**		**78**	**KP2**		**0**	**0**

01	Proportional directional spool valve, direct operated, electrically operated	**VEPS**
02	Frame size 10	**10A**
03	4/3 directional design	**43**

Symbols

04			**10**
			**20**

05	**Without** manual override	**0**
	With pull/push manual override	**-M1**
06	4/3 proportional directional spool valves, direct operated, with solenoid actuation	**OD14**

Symbols

07	See item 04	**10**
		20
08	Frame size 10: R/UNF 10-04-0-06, see page 15	**78**
09	Proportional valve with 2 coils	**KP2**
10	**Without** manual override	**0**
	With pull/push manual override	**1**
11	Standard version	**0**
12	Revision status	**0**

Valve types (without coil) 1)

	Without manual override **"0"**			**With** pull/push manual override **"-M1", "1"**		
Symbol	**Type**		**Material no.**	**Type**		**Material no.**
10	VEPS-10A-4310	OD141078KP2000	R901271834	VEPS-10A-4310-M1	OD141078KP2100	R901300077
20	VEPS-10A-4320	OD142078KP2000	R901271837	VEPS-10A-4320-M1	OD142078KP2100	R901300083

Available coils (separate order) 1)

	Material no. for coil with connector 2)		
Direct voltage DC 3)	**"K4"** 03pol (2+PE) DIN EN 175301-803	**"K40"** 02pol K40 DT 04-2PA, make Deutsch	**"C4"** 02pol C4/Z30 AMP Junior-Timer
12 V	R901002932	R901003055	R901003044
24 V / 1200 mA	R901002319	R901003053	R901003026
24 V / 800 mA	R901049962	R901050010	R901049963

1) Complete valves with mounted coil on request.
2) Mating connectors, separate order, see data sheet 08006.
3) Other voltages upon request.

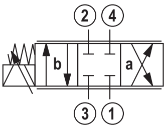
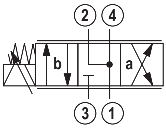
Function, section, symbols

General

The 4/3 proportional directional spool valves are direct operated, pressure-compensated cartridge valves. They regulate the flow proportionally to the input signal in a continuous form from the main port ③ to ② or ③ to ④.
The valve basically consists of:
Pole tube (1), socket (2), a control spool (5) as well as a return spring (4).

Function

In the de-energized condition, the control spool (5) is held in the initial position by the return spring (4). By energizing the solenoid (3), the control spool (5) is adjusted directly - proportional to the electrical input signal - and connects the main ports ③ with ② or ③ with ④. The symbols are realized by different spools ("10" and "20"). In case of de-excitation of the solenoid (3), the return spring (4) returns the control spool (5) into its initial position. Main ports ②, ③ and ④ can be permanently pressurized with an operating pressure of 350 bar. The ports have a fixed pin assignment (see symbols). At port ① there must be a maximum pressure of 250 bar.
The manual override (6) allows for the switching of the valve without solenoid energization.

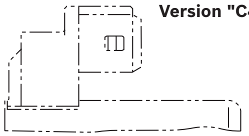
Symbol "10"	Symbol "20"
	

⚠ Attention!
If the valve is not installed or installed in a system that is not completely bled, the valve must not be energized as otherwise, the entering air has a very negative effect on the valve‘s dynamic behavior.

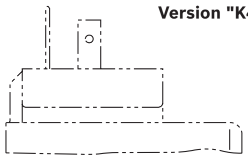
① = Main port 1 (T)
② = Main port 2 (A)
③ = Main port 3 (P)
④ = Main port 4 (B)

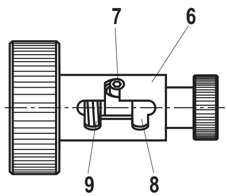
7 Initial position
8 Spool position "a"
9 Spool position "b"

Version "C4"

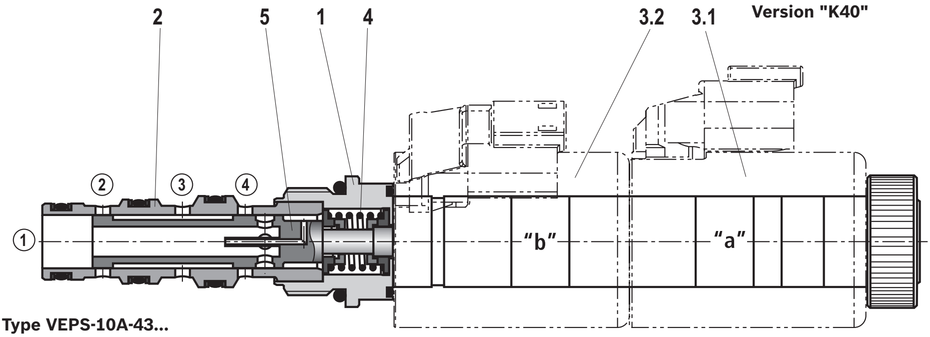


Version "K4"





Version "K40"



Type VEPS-10A-43...

Technical data

(For applications outside these parameters, please consult us!)

general			
Weight	– Valve	kg	0.35
	– Coil	kg	0.25 each
Installation position			Any - if it is ensured that no air can collect upstream the valve. Otherwise, we recommend suspended installation of the valve.
Ambient temperature range		°C	–40 to +120 (see page 12 and 13)
Storage temperature range		°C	–20 to +80

Environmental audits

Salt spray test according to DIN 50021	h	720
Surface protection DC solenoids		Coating according to DIN 50962-Fe//ZnNi with thick film passivation

hydraulic			
Maximum operating pressure	– Connection ②, ③, ④	bar	350
	– Connection ①	bar	250
Maximum flow		l/min	25
Step response	0 to 100 %; 100 to 0 %	ms	< 180 (with p_S = 10 bar)
Leakage		ml/min	< 60 per control edge (with Δp = 100 bar; HLP46, ϑ_{oil} = 40 °C)
Hydraulic fluid			See table below
Hydraulic fluid temperature range		°C	–40 to +100 (preferably +40 to +50)
Viscosity range		mm²/s	5 to 400 (preferably 10 to 100)
Maximum permitted degree of contamination of the hydraulic fluid - cleanliness class according to ISO 4406 (c)			Class 20/18/15 [1]
Hysteresis [2]			≤ 5
Range of inversion [2]			≤ 2
Response sensitivity [2]			≤ 1
Load cycles			2 million [3]

Hydraulic fluid		**Classification**	**Suitable sealing materials**	**Standards**
Mineral oils		HL, HLP	FKM	DIN 51524
Bio-degradable	– Insoluble in water	HEES	FKM	VDMA 24568
	– Soluble in water	HEPG	FKM	

Important information on hydraulic fluids!

- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!
- The flash point of the hydraulic fluids used must be 40 K higher than the maximum solenoid surface temperature.
- **Bio-degradable:** When using bio-degradable hydraulic fluids that are simultaneously zinc-solving, zinc may accumulate in the fluid.

1) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components. For the selection of the filters see www.boschrexroth.com/filter.

2) Measured with analog amplifier type RA2-1/10; see data sheet 95230

3) Rexroth standard test condition (HLP46; ϑ_{oil} = 40 °C ±5 °C)

2

Technical data
(For applications outside these parameters, please consult us!)

electric					
Voltage type			Direct voltage		
Supply voltages [4]		V	12 DC	24 DC	24 DC
Maximum solenoid current		A	1760 mA	1200 mA	800 mA
Coil resistance	– Cold value at 20 °C	Ω	2.3	4.8	11.5
	– Max. hot value	Ω	3.8	7.9	18.5
Duty cycle		%	see characteristic curve page 12 and 13 [5]		
Maximum coil temperature [6]		°C	150		
Protection class according to VDE 0470-1 (DIN EN 60529) DIN 40050-9	– Version "K4"		IP 65 with mating connector mounted and locked		
	– Version "C4"		IP 66 with mating connector mounted and locked		
			IP 69K with Rexroth mating connector (material no. R901022127)		
	– Version "K40"		IP 69K with mating connector mounted and locked		
			Plug-in proportional amplifier type VT-SSPA1...		Data sheet 30116
			Analog amplifier type RA...		Data sheet 95230
Recommended dither frequency (PMW)		Hz	120		
Design according to VDE 0580					

4) Other voltages upon request.

5) In case of use in altitudes > 2000 m a.s.l., we recommend consulting the manufacturer.

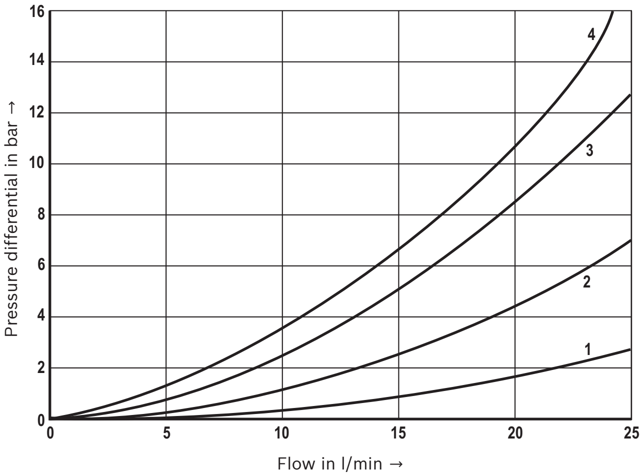
6) Due to the surface temperatures of the solenoid coils, the standards ISO 13732-1 and ISO 4413 need to be adhered to!

When establishing the electrical connection, the protective earthing conductor (PE ⏚) has to be connected properly.

2

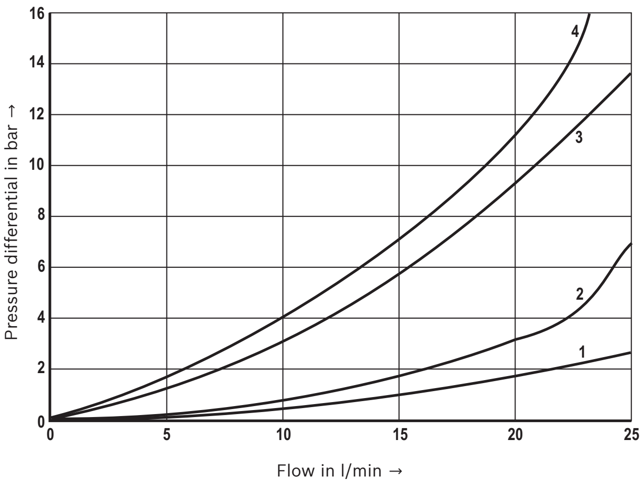
Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C and 24 V coil)

Δp-q_V characteristic curves – Symbol "10"



1	② → ①
2	④ → ①
3	③ → ④
4	③ → ②

Δp-q_V characteristic curves – Symbol "20"

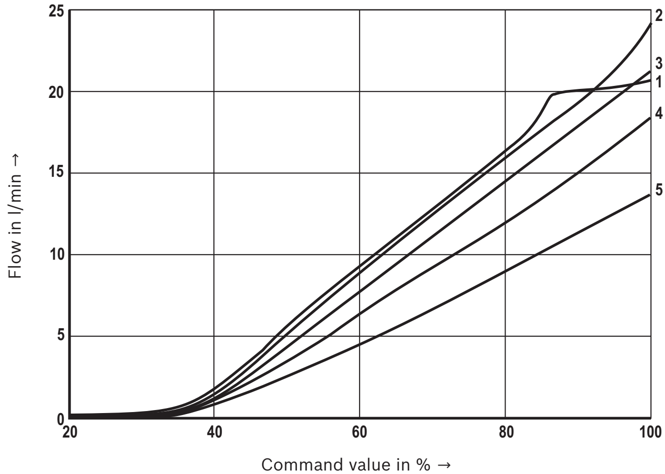


1	② → ①
2	④ → ①
3	③ → ④
4	③ → ②

Characteristic curves

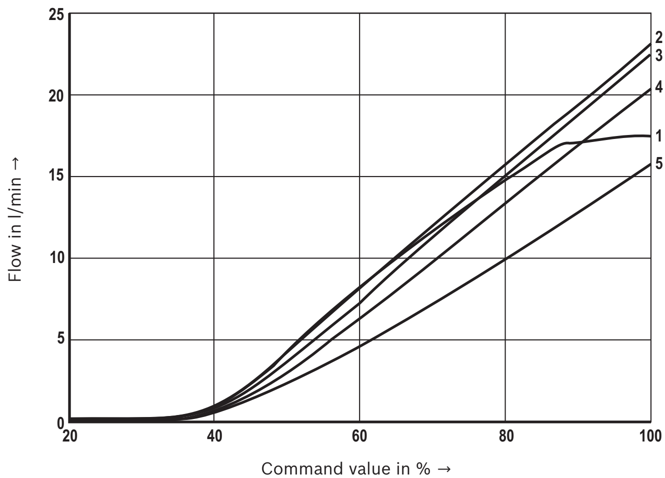
(measured with HLP46, ϑ_{oil} = 40 ±5 °C and 24 V coil)

Direction of flow ③ → ②
Symbol "10"



1 **Δp** = 10 bar constant
2 **Δp** = 20 bar constant
3 **Δp** = 30 bar constant
4 **Δp** = 50 bar constant
5 **Δp** = 100 bar constant

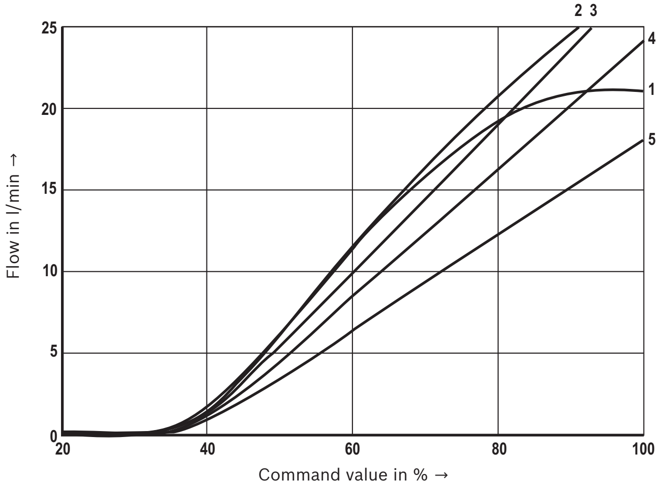
Direction of flow ③ → ④
Symbol "10"



1 **Δp** = 10 bar constant
2 **Δp** = 20 bar constant
3 **Δp** = 30 bar constant
4 **Δp** = 50 bar constant
5 **Δp** = 100 bar constant

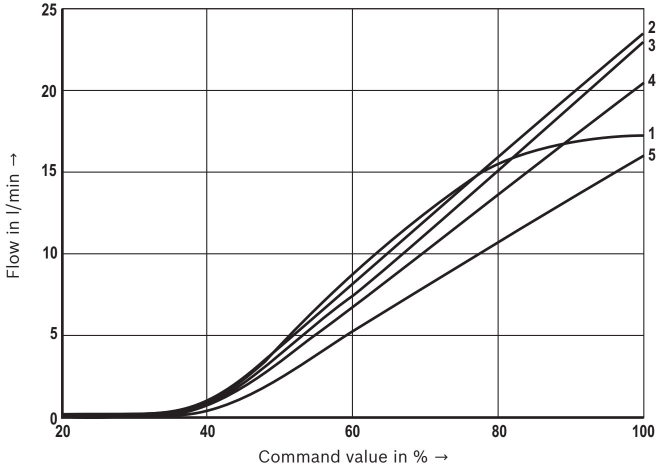
Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C and 24 V coil)

Direction of flow ③ → ②
Symbol "20"



1 **Δp** = 10 bar constant
2 **Δp** = 20 bar constant
3 **Δp** = 30 bar constant
4 **Δp** = 50 bar constant
5 **Δp** = 100 bar constant

Direction of flow ③ → ④
Symbol "20"



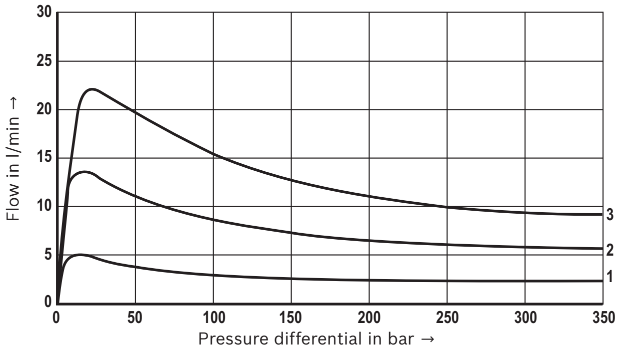
1 **Δp** = 10 bar constant
2 **Δp** = 20 bar constant
3 **Δp** = 30 bar constant
4 **Δp** = 50 bar constant
5 **Δp** = 100 bar constant

Limits of performance

(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Direction of flow ③ → ② / ④ → ①

Symbol "10"



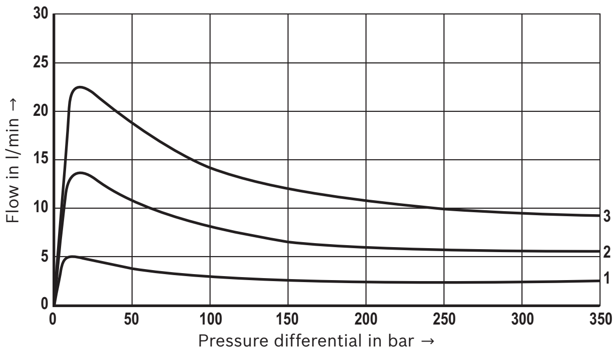
1 Command value = 50 %

2 Command value = 75 %

3 Command value = 100 %

Direction of flow ③ → ④ / ② → ①

Symbol "10"



1 Command value = 50 %

2 Command value = 75 %

3 Command value = 100 %

⚠ Attention!

The specified performance limits are valid for operation with two directions of flow (e.g. from ③ to ② and simultaneous return flow from ④ to ①).

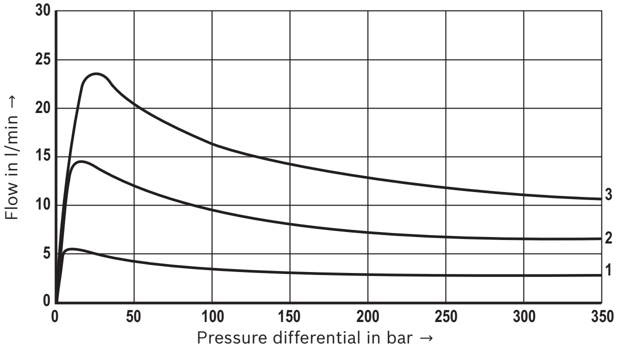
Due to the current forces acting within the valves, the permissible performance limit may be considerably lower with only one direction of flow (e.g. from ③ to ② and blocked port ④)!

In such applications, please consult us!

The performance limit was determined without tank preloading.

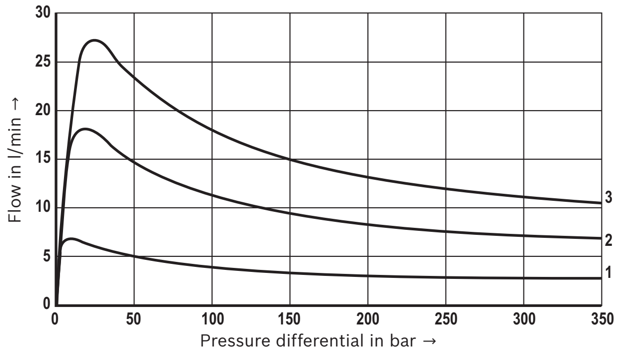
Limits of performance
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Direction of flow ③ → ② / ④ → ①
Symbol "20"



1 Command value = 50 %
2 Command value = 75 %
3 Command value = 100 %

Direction of flow ③ → ④ / ② → ①
Symbol "20"



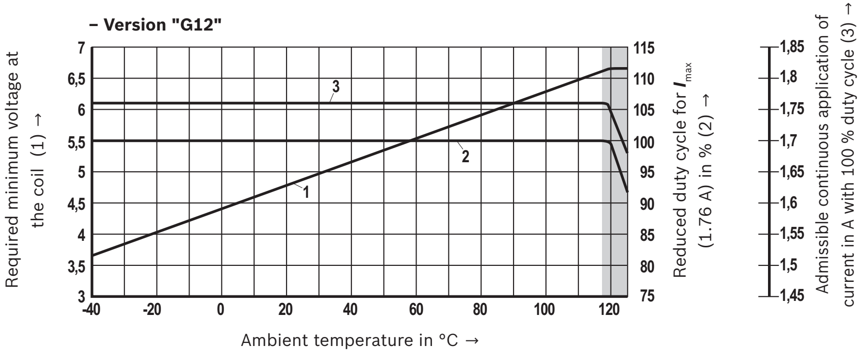
1 Command value = 50 %
2 Command value = 75 %
3 Command value = 100 %

⚠ **Attention!**
The specified performance limits are valid for operation with two directions of flow (e.g. from ③ to ② and simultaneous return flow from ④ to ①).
Due to the current forces acting within the valves, the permissible performance limit may be considerably lower with only one direction of flow (e.g. from ③ to ② and blocked port ④)!
In such applications, please consult us!
The performance limit was determined without tank preloading.

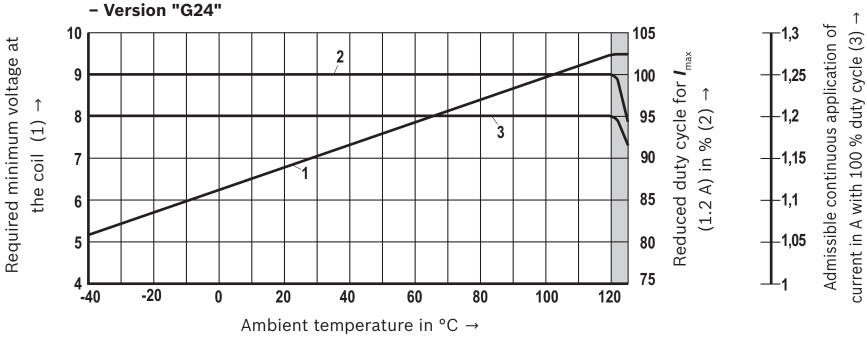
Minimum terminal voltage at the coil and relative duty cycle

Admissible working range against the ambient temperature

– Version "G12"



– Version "G24"

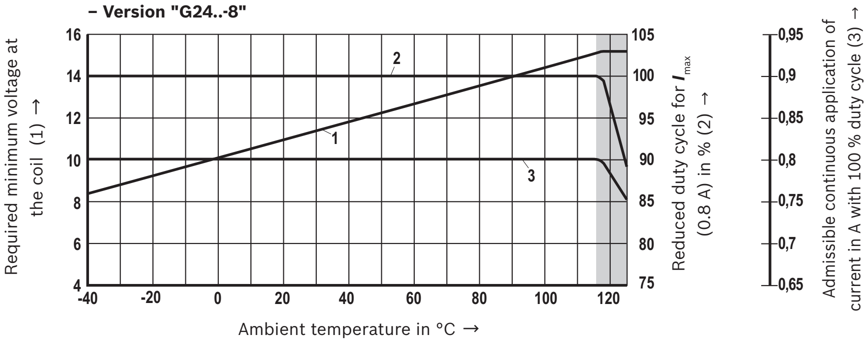


Limited valve performance

Notice!
The characteristic curves have been determined for coils with valve with medium test block size (80 x 80 x 80 mm), without flow in calm air.
Depending on the installation conditions (block size, flow, air circulation, etc.) there may be a better heat dissipation. Thus, the area of application is broadened.
In single cases, more unfavorable conditions may lead to limitations of the area of application.

Minimum terminal voltage at the coil and relative duty cycle

Admissible working range against the ambient temperature

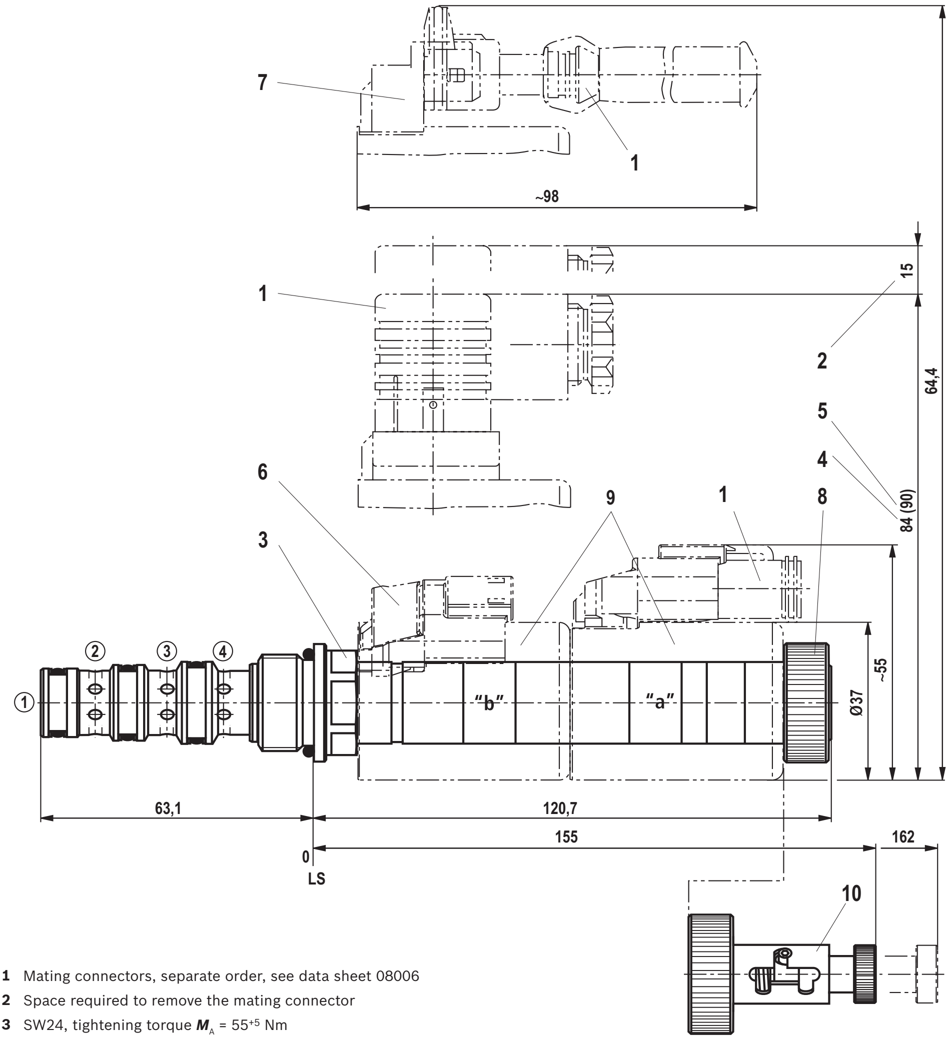


Limited valve performance

Notice!
The characteristic curves have been determined for coils with valve with medium test block size (80 x 80 x 80 mm), without flow in calm air.
Depending on the installation conditions (block size, flow, air circulation, etc.) there may be a better heat dissipation. Thus, the area of application is broadened.
In single cases, more unfavorable conditions may lead to limitations of the area of application.

2

Unit dimensions
(dimensions in mm)

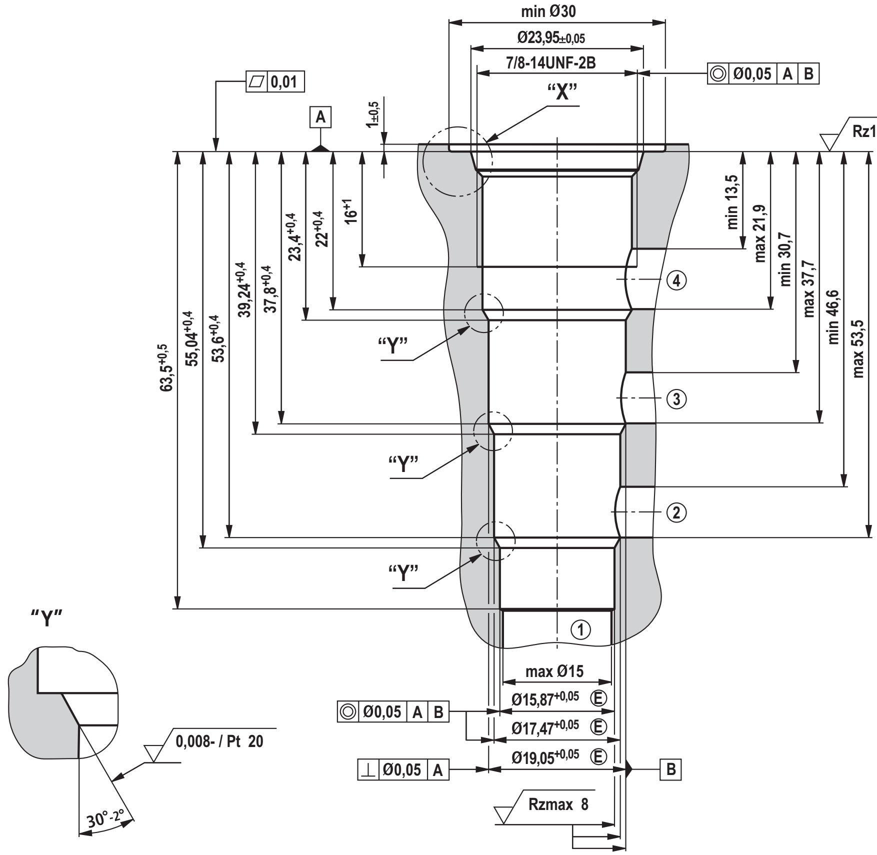


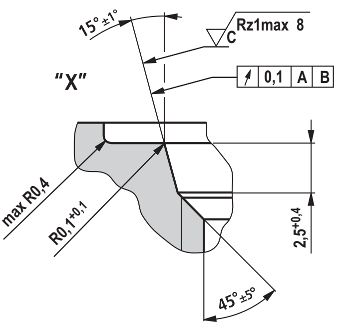
1 Mating connectors, separate order, see data sheet 08006
2 Space required to remove the mating connector
3 SW24, tightening torque M_A = 55^{+5} Nm
4 Dimension for "K4" mating connector, without circuitry
5 Dimension () for "K4" mating connector, with circuitry
6 Version "K40"
7 Version "C4"
8 Nut, tightening torque M_A = 5^{+1} Nm
9 Coil (separate order, see page 3)
10 Pull/push manual override "1"

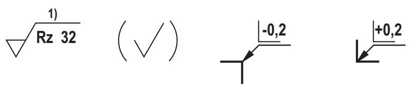
① = Main port 1 (T)
② = Main port 2 (A)
③ = Main port 3 (P)
④ = Main port 4 (B)

LS = Location Shoulder

Mounting cavity R/UNF-10-04-0-06; 4 main ports; thread 7/8-14UNF-2B
(dimensions in mm)





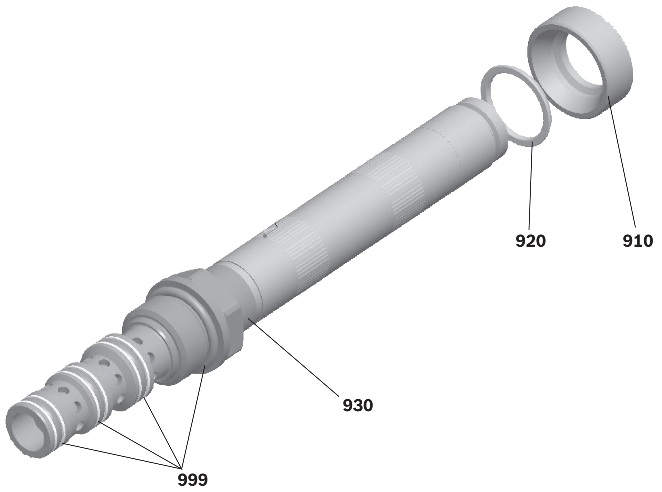


1) Visual inspection

① = Main port 1 (T)
② = Main port 2 (A)
③ = Main port 3 (P)
④ = Main port 4 (B)

LS = Location Shoulder
Tolerance for all angles ±0.5°
All seal ring insertion faces are rounded and free of burrs

Available individual components



Item	Denomination	Material no.
910	Nut	R901241052
920	O-ring for pole tube	R900007769
930	O-ring for pole tube	R913014944
999	Seal kit of the valve	R961005190

Coils, separate order, see page 3

More information

- Control electronics:
  - Plug-in proportional amplifier type VT-SSPA1... Data sheet 30116
  - Analog amplifier type RA... Data sheet 95230
- Selection of the filters www.boschrexroth.com/filter

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
documentation@boschrexroth.de
www.boschrexroth.de

2/2 proportional directional valve, direct operated

RE 18139-06/12.11 1/12
Replaces: 06.05

Type KKDS (High Performance)

Component size 1
Component series B
Maximum operating pressure 350 bar
Maximum flow 38 l/min

H6726

Table of contents

Features

– Cartridge valve
– Mounting cavity R/T-13A
– Direct operated proportional valve for controlling the flow size
– Operation by means of proportional solenoid with central thread and detachable coil
– Rotatable solenoid coil
– Free-flowing in both directions
– With concealed manual override, optional

– Control electronics:	Data sheet
• Plug-in proportional amplifier type VT-SSPA1…	30116
• Analog amplifier type RA…	95230

Information on available spare parts:
www.boschrexroth.com/spc

Ordering code

KKDS	R	1		B / H	C				V	*

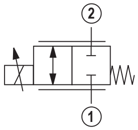
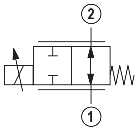
Proportional directional valve, direct operated

Maximum operating pressure 350 bar = **R**

Component size = **1**

2 main ports

Symbols

Symbol		
	normally closed	= **N**
	normally open	= **P**

Component series = **B**

High Performance and mounting cavity R/T-13A (see page 10) = **H**

C = Proportional solenoid, wet-pin

Supply voltage

G24 = Control electronics 24 V DC

G12 = Control electronics 12 V DC

N0 = **Without** manual override

N9 = **With** concealed manual override

Electrical connection [1)]

K4 = Without mating connector, with connector according to DIN EN 175301-803

K40 = Without mating connector, with connector DT 04-2PA (Deutsch plug)

C4 = Without mating connector, with connector AMP Junior-Timer

Seal material

V = FKM seals

Attention!

Observe compatibility of seals with hydraulic fluid used!

Further details in the plain text

[1)] Mating connectors, separate order, see data sheet 08006

Preferred types

Type	Material no.
KKDSR1NB/HCG24N0K4V	R901023172
KKDSR1PB/HCG24N0K4V	R901024015
KKDSR1NB/HCG12N0K4V	R901024009
KKDSR1PB/HCG12N0K4V	R901024034

Function, cross-sections, symbols

General

The 2/2 proportional directional valve is a direct operated cartridge spool valve. It steplessly controls the flow from main port ① to ② and from ② to ① in proportion to the input signal.

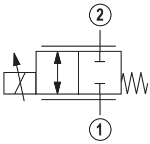
The valve basically consists of a bushing (6) with male thread for the mounting cavity, a socket (3), a control spool (5) with compression spring (8) as well as of a proportional solenoid (7) with central thread and removable coil.

Function (version **"N"** – normally closed)

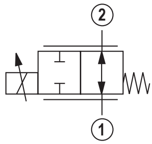
When the solenoid (7) is de-energized, the control spool (5) that is always pressure-compensated in relation to the actuating forces due to its constructive design, is held in the initial position by the compression spring (8) and blocks the flow between main port ① and ②. When the solenoid (7) is energized, the control spool (5) is adjusted directly – in proportion to the electrical input signal – and connects main port ① and ② via orifice-like cross-sections in the spool with progressive flow characteristics. When the solenoid (7) is de-energized, the compression spring (8) returns the control spool (5) to the initial position.

The manual override (4) allows for the switching of the valve without solenoid energization.

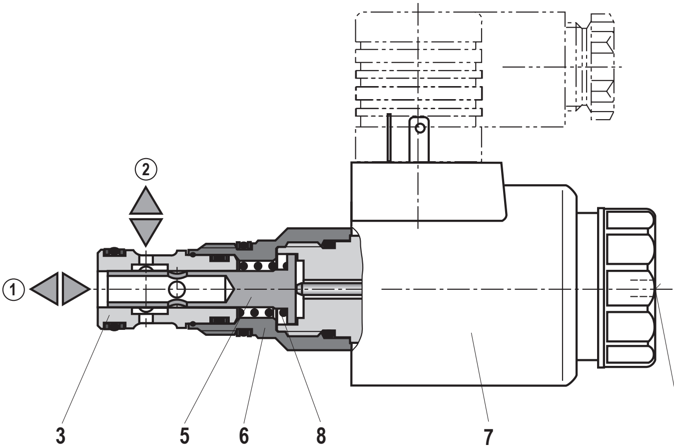
Symbol "N" – normally closed



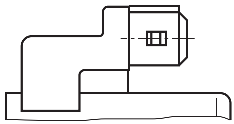
Symbol "P" – normally open



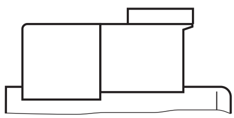
Version "K4"
(with mating connector)



Version "C4"



Version "K40"



Type KKDSR1NB/HC.N9K4V

Technical data (For applications outside these parameters, please consult us!)

general

Weight	kg	0.66
Installation position		Any - if it is ensured that no air can collect upstream of the valve. Otherwise, we recommend that the valve be mounted in a suspended position.
Ambient temperature range	°C	–40 to +100 (see minimum terminal voltage page 8)
Storage temperature range	°C	–20 to +80

Environmental audits

Salt spray test according to DIN 50021	h	720
Surface protection proportional solenoid		Coating according to DIN 50962-Fe//ZnNi with thick film passivation

hydraulic

Maximum operating pressure		bar	350
Maximum flow	– Symbol "N"	l/min	38 (①→ ②), 34 (② → ①); other flows upon request!
	– Symbol "P"	l/min	32 (①→ ②), 45 (② → ①)
Leakage		ml/min	< 30 (at Δ***p*** = 100 bar in ①; HLP46, ϑ_{oil} = 40 °C)
Step response	0 to 100 %; 100 to 0 %	ms	< 65 (at p_S = 10 bar)
Hydraulic fluid			See table page 5
Hydraulic fluid temperature range		°C	–40 to +100 (preferably +40 to +50)
Viscosity range		mm^2/s	5 to 400 (preferably 10 to 100)
Maximum admissible degree of contamination of the hydraulic fluid cleanliness class according to ISO 4406 (c)			Class 20/18/15 [1]
Hysteresis [2]		%	≤ 5
Range of inversion [2]		%	≤ 2
Response sensitivity [2]		%	≤ 1
Load cycles			2 million

[1] The cleanliness classes specified for the components must be complied with in hydraulic systems. An effective filtration prevents faults and at the same time increases the service life of the components.

For the selection of filters see www.boschrexroth.com/filter.

[2] Measured with analog amplifier type RA2-1/10, see data sheet 95230

Technical data (For applications outside these parameters, please consult us!)

hydraulic

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons		HL, HLP, HLPD, HVLP, HVLPD	FKM	DIN 51524
Environmentally compatible	– Insoluble in water	HEES	FKM	ISO 15380
		HEPR	FKM	
	– Soluble in water	HEPG	FKM	ISO 15380
Flame-resistant	– Water-free	HFDU, HFDR	FKM	ISO 12922
	– Water-containing	HFAS	FKM	ISO 12922

☞ **Important information on hydraulic fluids!**

- For more information and data on the use of other hydraulic fluids, refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!
- The flash point of the process and operating medium used must be 40 K higher than the maximum solenoid surface temperature.
- **Flame-resistant – water-containing**: Maximum pressure differential per control edge 175 bar, otherwise increased cavitation erosion!
  Tank pre-loading < 1 bar or > 20 % of the pressure differential. The pressure peaks should not exceed the maximum operating pressures!
- **Environmentally compatible:** When using environmentally compatible hydraulic fluids that are simultaneously zinc-solving, zinc may accumulate in the medium (700 mg zinc per pole tube).

2

electric

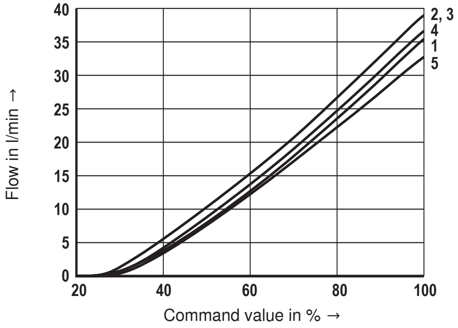
Voltage type			Direct voltage DC	
Supply voltage		V	12	24
Maximum solenoid current		A	1.8	1.2
Coil resistance	– Cold value at 20 °C	Ω	3.3	7.2
	– Max. hot value	Ω	5.0	10.8
Duty cycle		%	100 (see minimum terminal voltage page 8)	
Maximum coil temperature [3]		°C	150	
Protection class according to DIN EN 60529	– Version "K4"		IP 65 with mating connector mounted and locked	
	– Version "K40"		IP 69K with mating connector mounted and locked	
	– Version "C4"		IP 66 with mating connector mounted and locked	
			IP 69K with Rexroth mating connector (material no. R901022127)	
Control electronics (separate order)			– Plug-in proportional amplifier type VT-SSPA1…, see data sheet 30116 – Analog amplifier type RA ..., see data sheet 95230	
Design according to VDE 0580				

[3] Due to the surface temperatures of the solenoid coils, the standards ISO 13732-1 and EN 982 are to be observed!

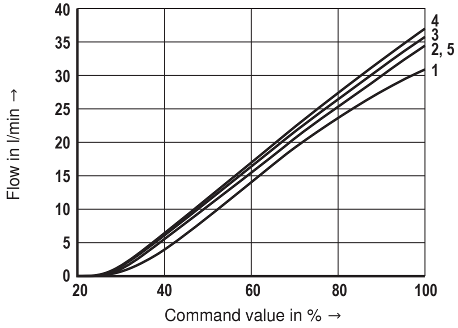
When establishing the electrical connection, the protective earthing conductor (PE ⏚) is to be connected properly.

Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

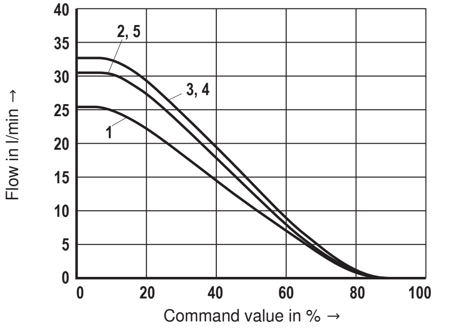
Direction of flow ① → ②
Symbol "N"



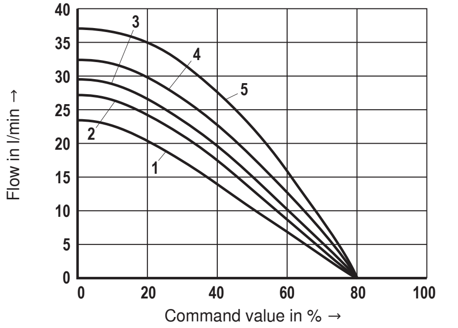
Direction of flow ② → ①
Symbol "N"



Direction of flow ① → ②
Symbol "P"



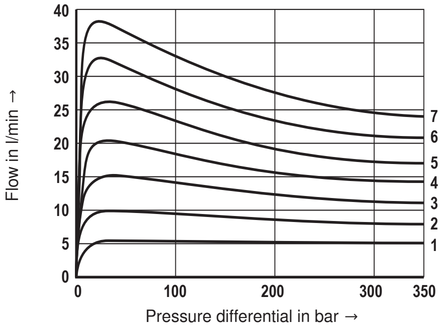
Direction of flow ② → ①
Symbol "P"



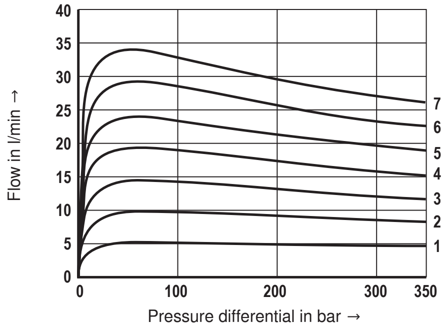
1 ***Δp*** = 10 bar constant
2 ***Δp*** = 20 bar constant
3 ***Δp*** = 30 bar constant
4 ***Δp*** = 50 bar constant
5 ***Δp*** = 100 bar constant

Performance limits (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

Direction of flow ① → ②
Symbol "N"

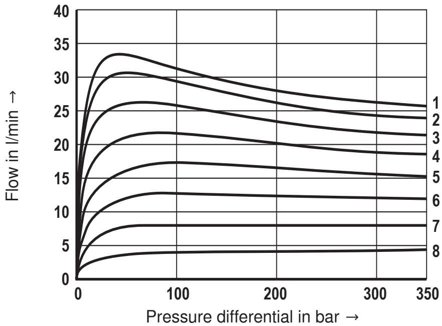


Direction of flow ② → ①
Symbol "N"

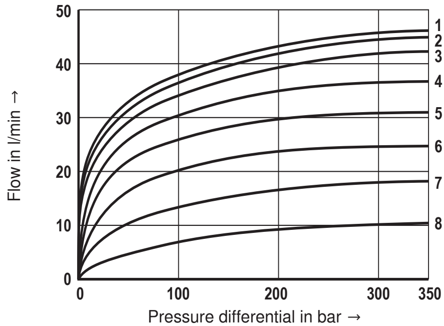


1 Command value = 40 %
2 Command value = 50 %
3 Command value = 60 %
4 Command value = 70 %
5 Command value = 80 %
6 Command value = 90 %
7 Command value = 100 %

Direction of flow ① → ②
Symbol "P"



Direction of flow ② → ①
Symbol "P"

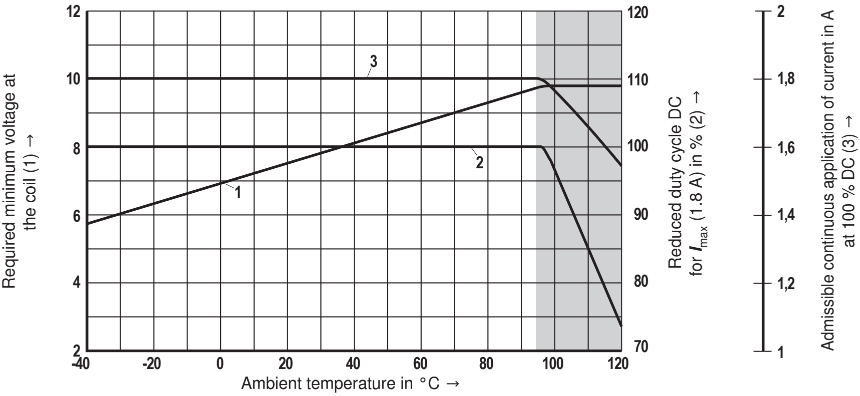


1 Command value = 0 %
2 Command value = 10 %
3 Command value = 20 %
4 Command value = 30 %
5 Command value = 40 %
6 Command value = 50 %
7 Command value = 60 %
8 Command value = 70 %

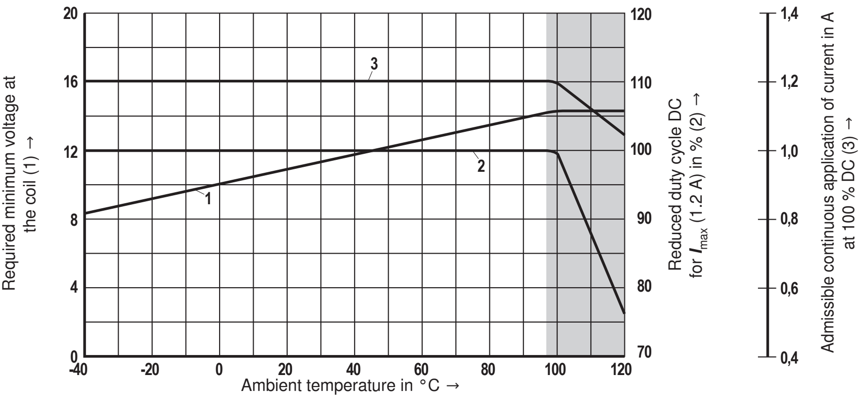
Minimum terminal voltage at the coil and relative duty cycle

Admissible working range depending on the ambient temperature

– **Version "G12"**



– **Version "G24"**



Limited valve performance

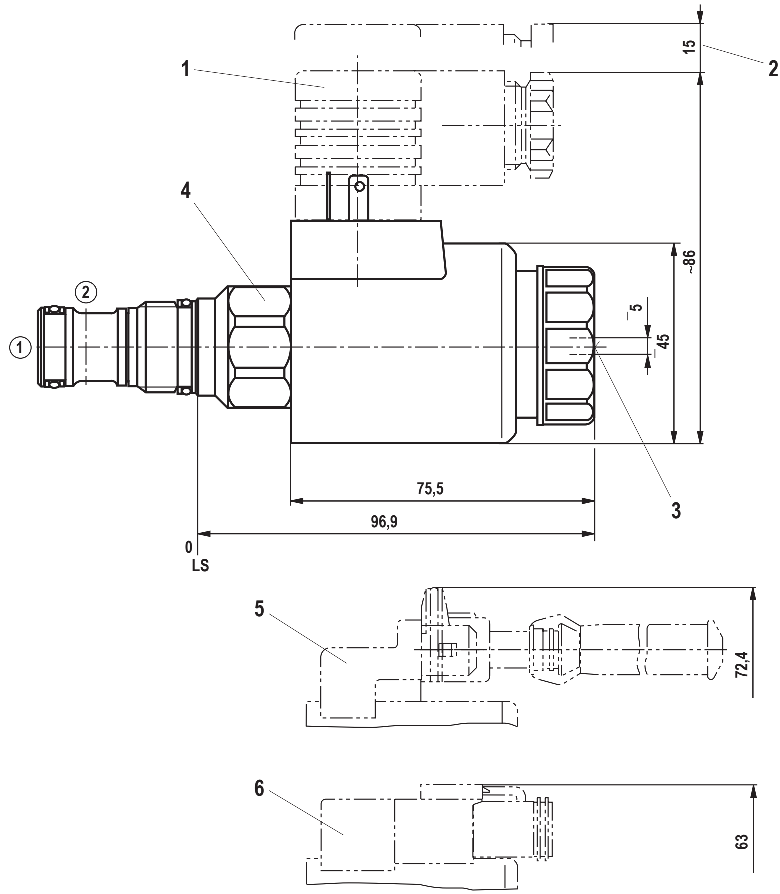
Notice!

The characteristic curves have been determined for coils with valve and medium test block size (80 x 80 x 80 mm), without flow in calm air.

Depending on the installation conditions (block size, flow, air circulation, etc.), there may be a better heat dissipation. This results in an increased area of application.

In single cases, more unfavorable conditions may lead to limitations of the area of application.

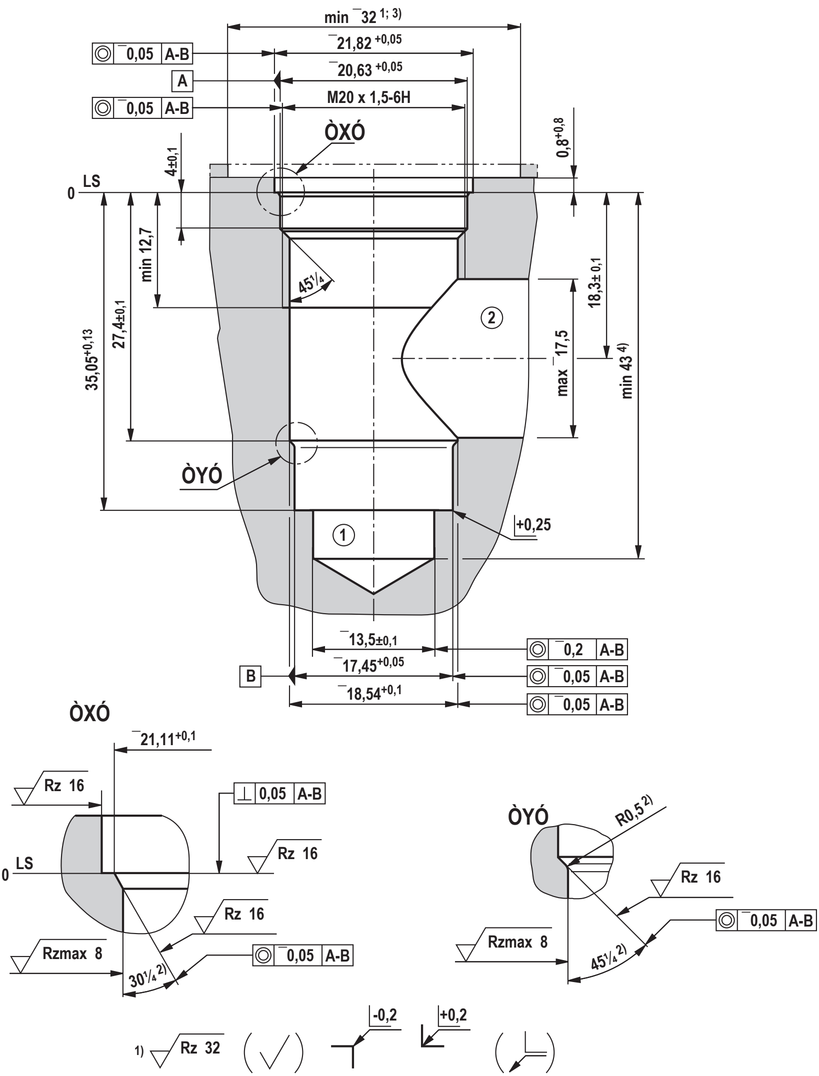
Unit dimensions (dimensions in mm)



① = Main port 1
② = Main port 2
LS = Location Shoulder

1 Mating connector without circuitry for connector "K4" (separate order, see data sheet 08006)
2 Space required for removing the mating connector
3 Concealed manual override "N9"
4 SW27, tightening torque M_A = 45 to 50 Nm
5 Mating connector for connector "C4" (separate order, see data sheet 08006)
6 Mating connector for connector "K40" (separate order, see data sheet 08006)

Mounting cavity R/T-13A¹⁾; 2 main ports; thread M20 x 1.5 (dimensions in mm)



1) Differing from T-13A

2) All seal ring insertion faces are rounded and free of burrs

3) With counterbore

4) Depth for moving parts

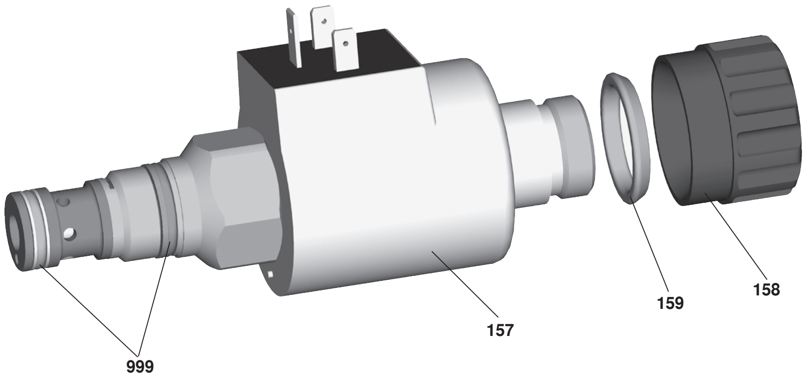
① = Main port 1

② = Main port 2

LS = Location Shoulder

Tolerance for all angles ±0.5°

Available individual components



Item	Denomination		Direct voltage	Material no.
157	Coil for individual connection	Version "K4"	12 V	R901022180
			24 V	R901022174
		Version "K40"	12 V	R901272648
			24 V	R901272647
		Version "C4"	12 V	R901022680
			24 V	R901022683
158	Nut			R900029574
159	O-ring for pole tube			R900071532
999	Seal kit of the valve			R900733593

Notes

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

Rexroth
Bosch Group

2/2 proportional directional valve, direct operated

RE 18139-09/12.11 1/10
Replaces: 04.09

Type KKDS (High Performance)

Component size 2
Component series A
Maximum operating pressure 350 bar
Maximum flow 58 l/min

H7568

Table of contents

Features

- Cartridge valve
- Mounting cavity R/T-5A
- Direct operated proportional valve for controlling the flow size
- Operation by means of proportional solenoid with central thread and detachable coil
- Rotatable solenoid coil
- With concealed manual override, optional

– Control electronics:	Data sheet
• Proportional plug-in amplifier type VT-SSPA1…	30116
• Analog amplifier type RA…	95230

Information on available spare parts:
www.boschrexroth.com/spc

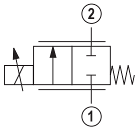
Ordering code

KKDS	R	2	N	A /	H	C				V	*

Proportional directional valve, direct operated

Maximum operating pressure 350 bar = **R**

Component size = **2**

2 main ports			
Symbol		Normally closed	= **N**

Component series = **A**

High Performance and mounting cavity R/T-5A (see page 9) = **H**

Proportional solenoid, wet-pin = **C**

[1] Mating connectors, separate order, see data sheet 08006

Further details in the plain text

Seal material

V = FKM seals

Attention!

Observe compatibility of seals with hydraulic fluid used!

Electrical connection [1]

K4 = Without mating connector, with connector according to DIN EN 175301-803

K40 = Without mating connector, with connector DT 04-2PA (Deutsch plug)

C4 = Without mating connector, with connector AMP Junior-Timer

N0 = **Without** manual override

N9 = **With** concealed manual override

Supply voltage

G24 = Control electronics DC 24 V

G12 = Control electronics DC 12 V

Preferred types

Type	Material no.
KKDSR2NA/HCG24N9K4V	R901074596
KKDSR2NA/HCG12N9K4V	R901036359
KKDSR2NA/HCG24N9C4V	R901055340

Function, section, symbol

General

The 2/2 proportional directional valve is a direct operated cartridge spool valve. It regulates the flow proportionally to the input signal in a continuous form from main port ① to ②.

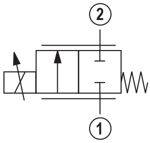
The valve basically comprises of a bushing (6) with male thread for the mounting cavity, socket (3), control spool (5) with compression spring (8) as well as proportional solenoid (7) with central thread and removable coil.

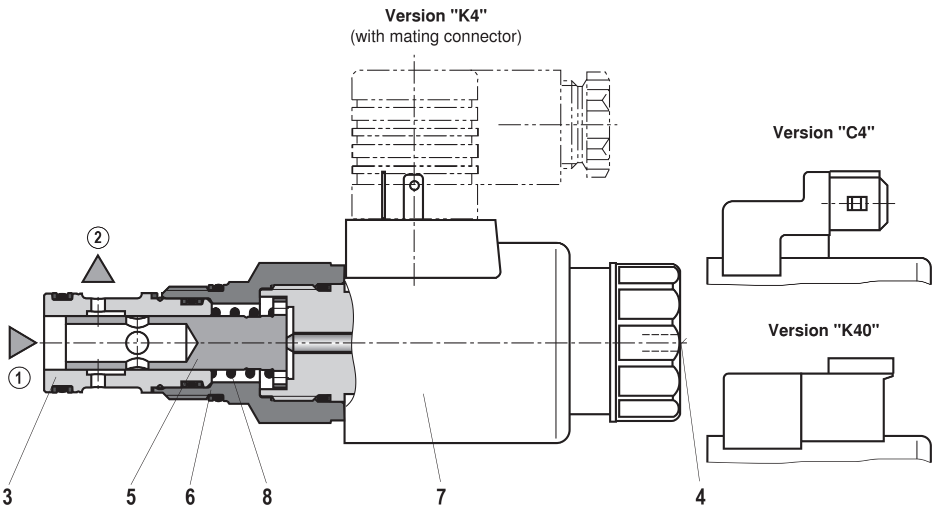
Function

With de-energized solenoid (7), the control spool (5) that is always pressure-compensated to the actuating forces due to its constructive design is held in the initial position by the compression spring (8) and blocks the flow between main port ① and ②. By energizing the solenoid (7), the control spool (5) is directly adjusted – proportional to the electric input signal – and, via orifice-like cross-sections with progressive flow characteristic in the spool, connects the main ports ① and ②. Upon de-excitation of the solenoid (7), the control spool (5) is brought back into the initial position by the compression spring (8).

The manual override (4) allows for the switching of the valve without solenoid energization.

Symbol





Type KKDSR2NA/HC.N9K4V

Technical data (For applications outside these parameters, please consult us!)

general

Weight		kg	0.84
Installation position			Any – if it is ensured that no air can collect upstream the valve. Otherwise, we recommend suspended installation of the valve.
Ambient temperature range		°C	–40 to +100 (see Minimum terminal voltage page 7)
Storage temperature range		°C	–20 to +80

Environmental audits

Salt spray test according to DIN 50021		h	720
Surface protection Proportional solenoid			Coating according to DIN 50962-Fe//ZnNi with thick layer passivation

hydraulic

Maximum operating pressure		bar	350
Maximum flow		l/min	58
Leakage		ml/min	< 60 (with $\Delta \boldsymbol{p}$ = 100 bar in ①; HLP46, ϑ_{oil} = 40 °C)
Step response	0 to 100 %; 100 to 0 %	ms	< 180 (with $\boldsymbol{p}_S$ = 10 bar)
Hydraulic fluid			See table page 5
Hydraulic fluid temperature range		°C	–40 to +100 (preferably +40 to +50)
Viscosity range		mm^2/s	5 to 400 (preferably 10 to 100)
Maximum permitted degree of contamination of the hydraulic fluid - cleanliness class according to ISO 4406 (c)			Class 20/18/15 [1]
Hysteresis [2]		%	≤ 5
Range of inversion [2]		%	≤ 2
Response sensitivity [2]		%	≤ 1
Load cycles			10 million

[1] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components.

For the selection of the filters see www.boschrexroth.com/filter.

[2] Measured with analog amplifier type RA2-1/10, see data sheet 95230.

Technical data (For applications outside these parameters, please consult us!)

hydraulic

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons		HL, HLP, HLPD, HVLP, HVLPD	FKM	DIN 51524
Environmentally compatible	– Insoluble in water	HEES	FKM	ISO 15380
		HEPR	FKM	
	– Soluble in water	HEPG	FKM	ISO 15380
Flame-resistant	– Water-free	HFDU, HFDR	FKM	ISO 12922
	– Water-containing	HFAS	FKM	ISO 12922

☞ **Important information on hydraulic fluids!**

- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!
- The flash point of the process and operating medium used must be 40 K higher than the maximum solenoid surface temperature.
- **Flame-resistant – water-containing:** Maximum pressure differential per control edge 175 bar, otherwise, increased cavitation erosion!
  Tank pre-loading < 1 bar or > 20 % of the pressure differential. Pressure peaks should not exceed maximum operating pressures!
- **Environmentally compatible:** When using environmentally compatible hydraulic fluids that are simultaneously zinc-solving, zinc may accumulate in the medium (700 mg zinc per pole tube).

electric

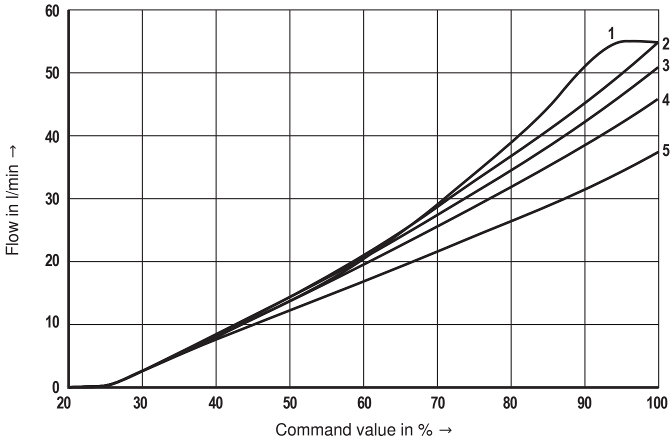
Voltage type			Direct voltage (DC)	
Supply voltage		V	12	24
Maximum solenoid current		A	1.8	1.2
Coil resistance	– Cold value at 20 °C	Ω	3.3	7.2
	– Max. hot value	Ω	5.8	13.0
Switch-on duration		%	100 (see minimum terminal voltage page 7)	
Maximum coil temperature [3]		°C	150	
Protection class according to DIN EN 60529	– Version "K4"		IP 65 with mating connector mounted and locked	
	– Version "K40"		IP 69K with mating connector mounted and locked	
	– Version "C4"		IP 66 with mating connector mounted and locked	
			IP 69K with Rexroth mating connector (Material no. R901022127)	
Control electronics (separate order)			– Proportional plug-in amplifier type VT-SSPA1…, see data sheet 30116 – Analog amplifier type RA..., see data sheet 95230	
Design according to VDE 0580				

[3] Due to the surface temperatures of the solenoid coils, the standards ISO 13732-1 and EN 982 need to be adhered to!

In the electrical connection, the protective earthing conductor (PE ⏚) must be connected properly.

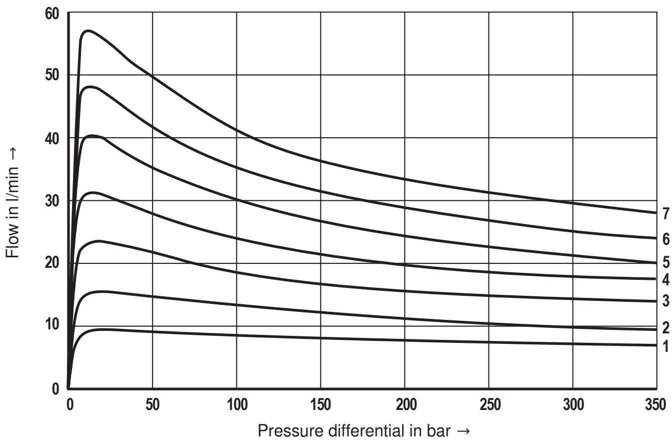
2

Characteristic curves (measured with HLP46, ϑ_{oil} = 40 ± 5 °C)



1 ***Δp*** = 10 bar constant
2 ***Δp*** = 20 bar constant
3 ***Δp*** = 30 bar constant
4 ***Δp*** = 50 bar constant
5 ***Δp*** = 100 bar constant

Limits of performance (measured with HLP46, ϑ_{oil} = 40 ± 5 °C)

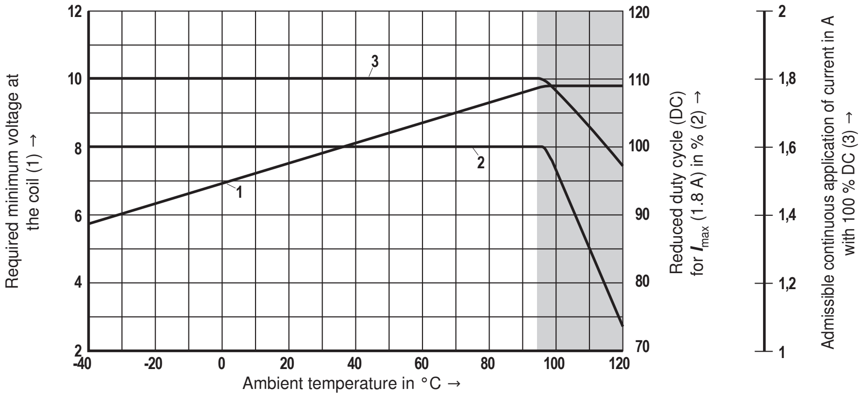


1 Command value = 40 %
2 Command value = 50 %
3 Command value = 60 %
4 Command value = 70 %
5 Command value = 80 %
6 Command value = 90 %
7 Command value = 100 %

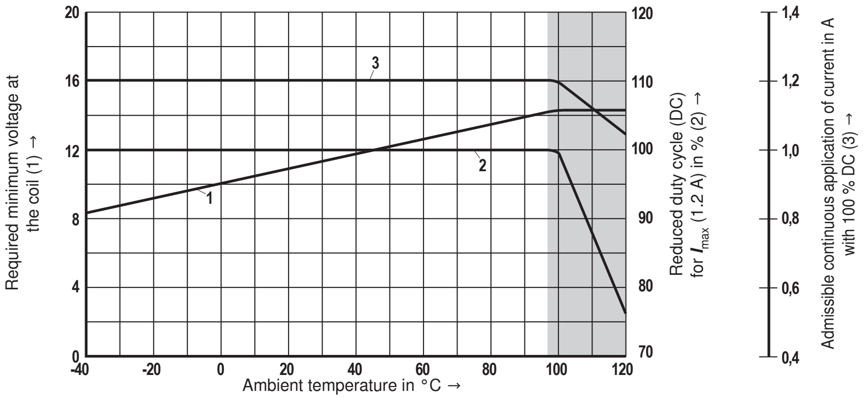
Minimum terminal voltage at the coil and relative duty cycle

Admissible working range against the ambient temperature

– Version "G12"



– Version "G24"



Limited valve performance

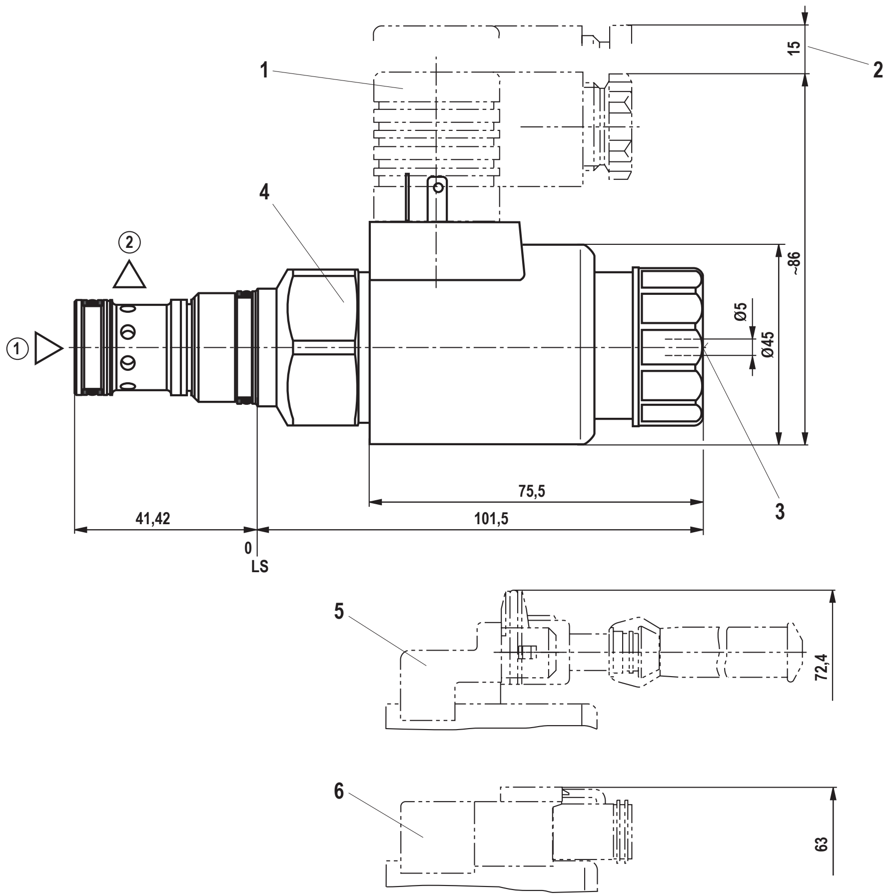
Notice!

The characteristic curves have been determined for coils with valve with medium test block size (80 x 80 x 80 mm), without flow in calm air.

Depending on the installation conditions (block size, flow, air circulation, etc.) there may be a better heat dissipation. This increases the area of application.

In single cases, more unfavorable conditions may lead to limitations of the range of application.

Unit dimensions (dimensions in mm)



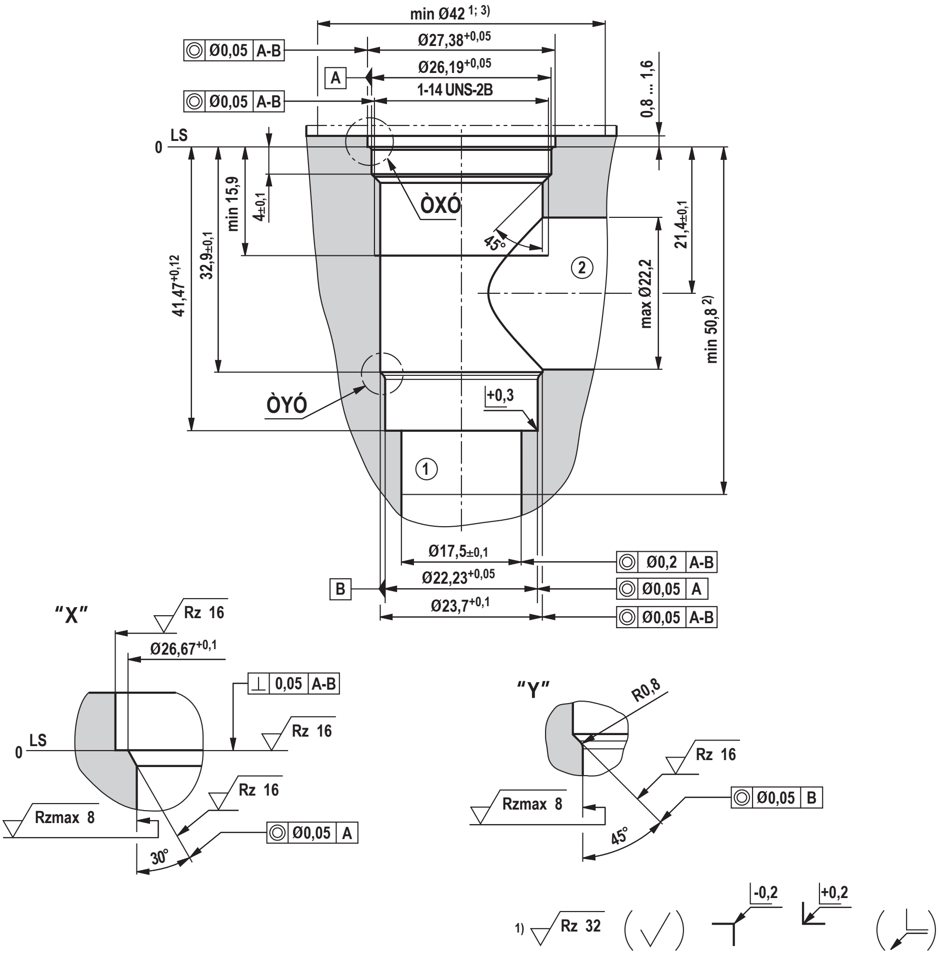
① = Main port 1

② = Main port 2

LS = Location Shoulder

- **1** Mating connector without circuitry for connector "K4" (separate order, see data sheet 08006)
- **2** Space required for removing the mating connector
- **3** Concealed manual override "N9"
- **4** SW36, tightening torque M_A = 60 to 65 Nm
- **5** Mating connector for connector "C4" (separate order, see data sheet 08006)
- **6** Mating connector for connector "K40" (separate order, see data sheet 08006)

Mounting cavity R/T-5A[1]; 2 main ports; thread 1-14 UNS-2B (dimensions in mm)



① = Main port 1
② = Main port 2
LS = Location Shoulder

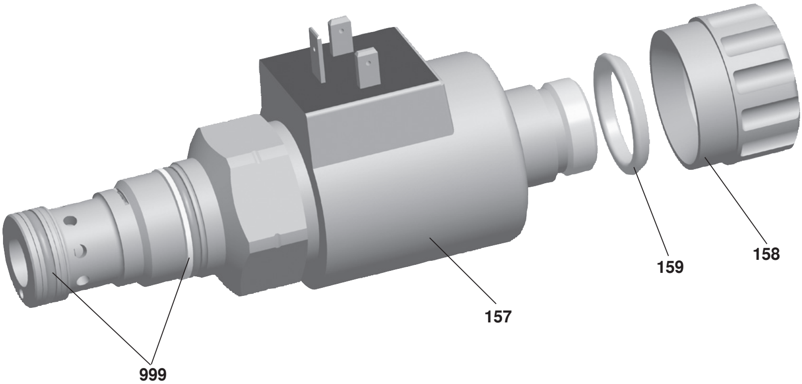
1) Differing from T-5A
2) Depth for moving parts
3) With counterbore

All seal ring insertion faces are rounded and free of burrs
Tolerance for all angles ±0.5°

Standards:

Workpiece edges	DIN ISO 13715
Form and position tolerance	DIN EN ISO 1101
General tolerances for metal-cutting procedures	DIN ISO 2768-mK
Tolerance	DIN ISO 8015
Surface quality	DIN EN ISO 1302

Available individual components



Item	Denomination		Direct voltage	Material no.
157	Coil for individual connection	Version "K4"	12 V	R901022180
			24 V	R901022174
		Version "K40"	12 V	R901272648
			24 V	R901272647
		Version "C4"	12 V	R901022680
			24 V	R901022683
158	Nut			R900029574
159	O-ring for pole tube			R900002507
999	Seal kit of the valve			R961004435

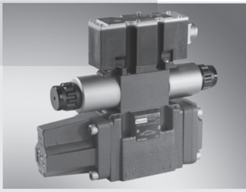
Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

4/2, 4/3, and 5/2, 5/3 proportional directional valve, pilot operated, without electrical position feedback without/with integrated electronics (OBE)

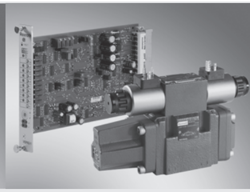
RE 29115/05.13
Replaces: 10.05

Type .WRZ..., .WRZE... and .WRH...

Sizes 10 to 52
Component series 7X
Maximum operating pressure 350 bar
Maximum flow 2800 l/min



Type 4WRZE 10 …-7X/...K31/...
with integrated electronics (OBE)



Type 4WRZ 10 …-7X/…K4/...
with the corresponding control electronics (separate order)

Table of contents

Contents	**Page**

Features

– Pilot operated, 2-stage proportional directional valve with integrated electronics (OBE) with type 4WRZE
– Control of flow direction and size
– Operation by means of proportional solenoids with central thread and detachable coil
– For subplate mounting:
  Porting pattern according to ISO 4401
– Manual override, optional
– Spring-centered control spool
– Control electronics
  • Type .WRZE…
    - Integrated electronics (OBE) with voltage or current input (A1 and/or F1)
  • Type .WRZ…
    - Digital or analog amplifier in Euro-card format
    - Analog amplifier in modular design

Information on available spare parts:
www.boschrexroth.com/spc

Ordering codes (types 4WRZ and 4WRH; sizes 10 to 32 subplate mounting; size 52 flange connection)

4WR_				–7X	/					

Hydraulic actuation	**= H**
Electro-hydraulic actuation	**= Z**
Type WRZ:	
For external electronics	**= no code**
With integrated electronics	**= E**
Size 10	**= 10**
Size 16	**= 16**
Size 25	**= 25**
Size 32	**= 32**
Size 52	**= 52**
For **control spool symbols,** see page 3	
Rated flow in l/min at valve pressure differential ***Δp*** = 10 bar	
Size 10	
25 l/min	**= 25**
50 l/min	**= 50**
85 l/min	**= 85**
Size 16	
100 l/min	**= 100**
125 l/min	**= 125**
150 l/min	**= 150**
180 l/min	**= 180**
Size 25	
220 l/min	**= 220**
325 l/min	**= 325**
Size 32	
360 l/min	**= 360**
520 l/min	**= 520**
Size 52	
1000 l/min	**= 1000**
Component series 70 to 79 (70 to 79: Unchanged installation and connection dimensions)	**= 7X**
For subplate mounting	**= no code**
For flange connection (size 52 only)	**= F**
Pilot control valve size 6	
Proportional solenoid with detachable coil	**= 6E** [1]
Supply voltage	
Direct voltage 24 V	**= G24** [1]
Without manual override	**= no code**
With concealed manual override	**= N9** [1, 2]
Without special type of protection	**= no code**
Seawater-resistant	**= J** [3]
Pilot oil supply and return	
External pilot oil supply, external pilot oil return	**= no code**
Internal pilot oil supply, external pilot oil return	**= E**
Internal pilot oil supply, internal pilot oil return	**= ET**
External pilot oil supply, internal pilot oil return (only possible without code for size 52 and type 4WRH)	**= T**

		*
		For further details, see the plain text
M =		NBR seals
V =		FKM seals
no code =		Without pressure reducing valve
D3 [1] **=**		With pressure reducing valve ZDR 6 DP0-4X/40YM-W80 (not adjustable)
		Electronics interface
A1 =		Command value ±10 V
F1 =		Command value 4 to 20 mA
no code =		For types WRZ and WRH
		Electrical connection type WRZ:
K4 [1, 4] **=**		**Without** mating connector, with connector according to DIN EN 175301-803
		Mating connector, separate order, see page 27
		Type WRZE:
K31 [1, 4] **=**		**Without** mating connector, with connector according to DIN EN 175201-804
		Mating connector, separate order, see page 27

[1] Not applicable with types 4WRH

[2] For version "J"→"N" instead of "N9"

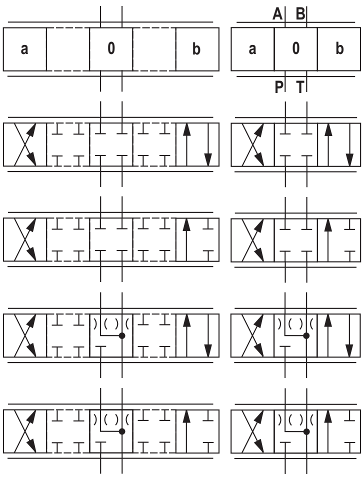
[3] For information on the seawater-resistant version, see data sheet 29115-M

[4] For version "J" = seawater-resistant **only** "K31"

2

Electric special types of protection available on request.

Control spool symbols

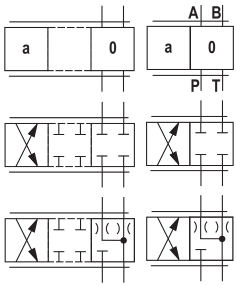


= E
E1-

= E3-

= W6-
W8-

= W9-



= EA [1]

= W6A [1]

[1] Not for type 4WRH

With symbols E1- and W8-:	P → A: q_V	B → T: $q_V/2$
	P → B: $q_V/2$	A → T: q_V
With symbols E3- and W9-:	P → A: q_V	B → T: Blocked
	P → B: $q_V/2$	A → T: q_V

(differential circuit, piston top at port A)

Notice: With symbols W6-, W8-, W9-, W6A, there is a connection from A → T and B → T with less than 2% of the respective nominal cross-section in switching position "0".

Ordering codes (types 4WRZ 52 and 4WRH 52; subplate mounting)

5WR_		52		1000 – 7X /									*

Hydraulic actuation = **H**
Electro-hydraulic actuation = **Z**

Type WRZ:
For external electronics = **no code**
With integrated electronics = **E**

Size 52 = **52**

For **control spool symbols,** see page 5

Rated flow in l/min at valve pressure differential ***Δp*** = 10 bar
1000 l/min = **1000**

Component series 70 to 79 = **7X**
(70 to 79: Unchanged installation and connection dimensions)

Pilot control valve size 6
Proportional solenoid with detachable coil = **6E** [1)]

Supply voltage
Direct voltage 24 V = **G24** [1)]

Without manual override = **no code**
With concealed manual override = **N9** [1, 2)]

Without special type of protection = **no code**
Seawater-resistant = **J** [3)]

Electrical connection type WRZ:
Without mating connector, with connector according to DIN EN 175301-803 = **K4** [1, 4]
Mating connector, separate order, see page 27
Type WRZE:
Without mating connector, with connector according to DIN EN 175201-804 = **K31** [1, 4]
Mating connector, separate order, see page 27

Electronics interface
Command value ±10 V = **A1**
Command value 4 to 20 mA = **F1**
For types WRZ and WRH = **no code**

Without pressure reducing valve = **no code**
With pressure reducing valve ZDR 6 DP0-4X/40YM-W80 (not adjustable) = **D3** [1)]

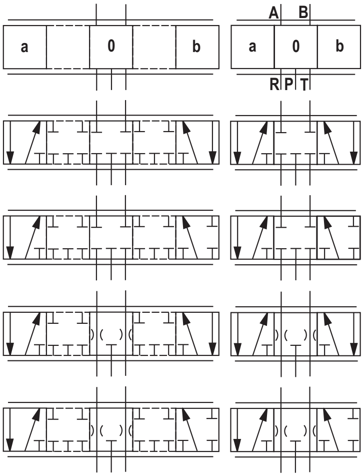
NBR seals = **M**
FKM seals = **V**

For further details, see the plain text

[1)] Not applicable with types 4WRH
[2)] For version "J"→"N" instead of "N9"
[3)] For information on the seawater-resistant version, see data sheet 29115-M
[4)] For version "J" = seawater-resistant **only** "K31"

Electric special types of protection available on request.

Control spool symbols

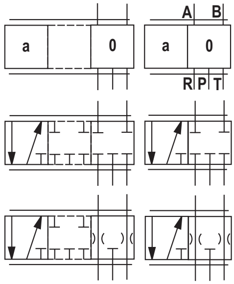


= E
E1-

= E3-

= W6-
W8-

= W9-



= EA [1)]

= W6A [1)]

[1)] Not for type 4WRH

With symbols E1- and W8-:	P → A: q_V	B → T: q_V/2
	P → B: q_V/2	A → R: q_V
With symbols E3- and W9-:	P → A: q_V	B → T: Blocked
	P → B: q_V/2	A → R: q_V

(differential circuit, piston top at port A)

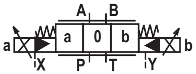
Notice:

- Only external pilot oil supply and return possible
- With control spool W6-, W8-, W9-, W6A, there is a connection from A → R and B → T with less than 2% of the respective nominal cross-section in switching position "0".

Symbols (simplified)

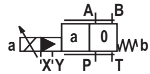
With electro-hydraulic actuation and for external electronics

Type 4WRZ…-7X./… and
type 4WRZ 52…-7XF/…

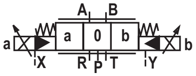


X = external
Y = external

Type 4WRZ…A-7X./… and
type 4WRZ 52 A…-7XF/…

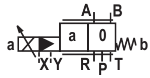


Type 5WRZ 52-7X./…

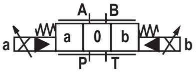


X = external
Y = external

Type 5WRZ 52 A-7X./…

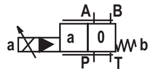


Type 4WRZ…-7X./…ET…



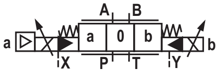
X = internal
Y = internal

Type 4WRZ.A…-7X./…ET…



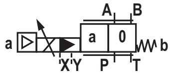
With electro-hydraulic actuation and for integrated electronics

Type 4WRZE…-7X./… and
type 4WRZE 52…-7XF/…

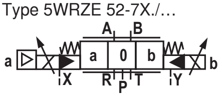


X = external
Y = external

Type 4WRZE…A-7X./… and
type 4WRZE 52 A…-7XF/…

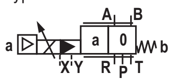


Type 5WRZE 52-7X./…

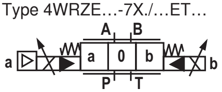


X = external
Y = external

Type 5WRZE 52 A-7X./…

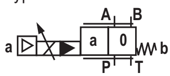


Type 4WRZE…-7X./…ET…



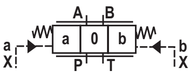
X = internal
Y = internal

Type 4WRZE.A…-7X./…ET…



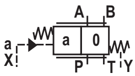
With hydraulic actuation

Type 4WRH…-7X./… and
type 4WRH 52…-7XF/…

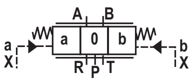


X = external
Y = external

Type 4WRH…A…-7X./… and
type 4WRH 52…-7XF/…

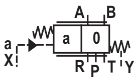


Type 5WRH 52…-7X.



X = external
Y = external

Type 5WRH 52 A…-7X./…



Function, section

Pilot control valve type 3DREP 6…

The pilot control valve is a 3-way pressure reducing valve that is actuated by a proportional solenoid. It converts an electrical input signal into a proportional pressure output signal and is used for all valves of the type 4WRZ... and 5WRZ...

The proportional solenoids are controllable, wet-pin DC solenoids with a central thread and a detachable coil. The solenoids are controlled by external electronics (type .WRZ...).

Set-up:

The valve basically consists of:
- Housing (1)
- Control spool (2) with pressure measuring spool (3 and 4)
- Solenoids (5 and 6) with central threads

Function:

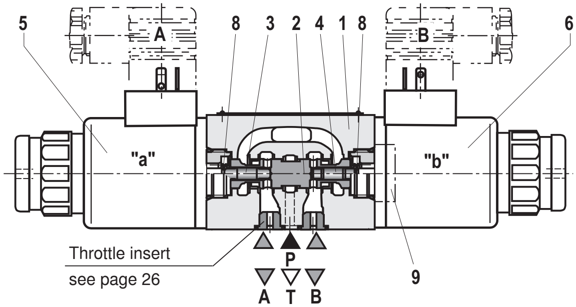
The pressure in A or B is set by means of the proportional solenoids. The amount of the pressure depends on the current. With de-energized solenoids (5, 6), the control spool (2) is held in the central position by means of the pressure springs (8). Ports A and B are connected with T so that the hydraulic fluid can flow to the tank without obstructions.

By energizing a proportional solenoid, e.g. solenoid "a" (5), the pressure measuring spool (3) and with it the control spool (2) are moved to the right. This opens the connection from P to B and A to T via orifice-type cross-sections with progressive flow characteristic. With the surface of the pressure measuring spool (4) the pressure that builds up in channel B acts on the control spool and against the solenoid force. The pressure measuring spool (4) is supported by solenoid "b". If the pressure exceeds the value set at solenoid "a", the control spool (2) is pushed back against the solenoid force and connects B with T until the set pressure is reached again. The pressure is proportional to the solenoid current.

When the solenoid is switched off, the control spool (2) is returned into the central position by the compression springs (8).

2

Type 3DREP 6…



Pilot control valve with two switching positions (type 3DREP 6…B…)

The operation of this valve version basically corresponds to the valve with 3 switching positions. However, this 2 spool position valve is only equipped with solenoid "a" (5). In the place of the second proportional solenoid there is a plug screw (9).

Information on type 3DREP 6:
Prevent the tank line from draining. If this is possible due to installation conditions, install a preload valve (with a preload pressure of approx. 2 bar).

Function, section

Pilot control valve type 3DREPE 6…

The pilot control valve is a 3-way pressure reducing valve that is actuated by a proportional solenoid. It converts an electrical input signal into a proportional pressure output signal and is used for all valves of the type 4WRZE... and 5WRZE...

The proportional solenoids are controllable, wet-pin DC solenoids with a central thread and a detachable coil. The solenoids are controlled by the integrated electronics (type .WRZE...).

Set-up:

The valve basically consists of:
- Housing (1)
- Control spool (2) with pressure measuring spool (3 and 4)
- Solenoids (5 and 6) with central threads
- Integrated electronics (7)

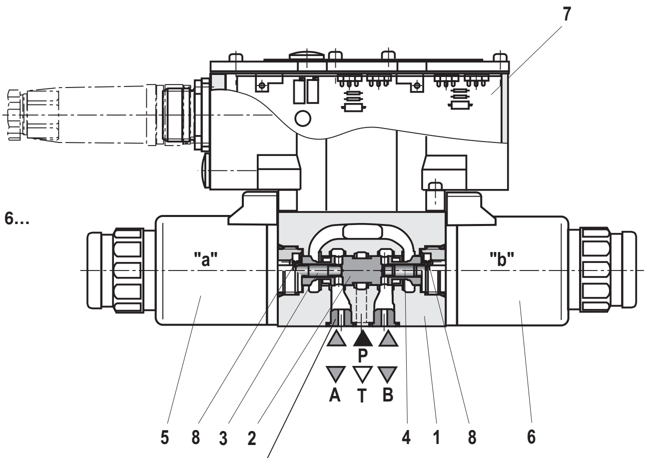
Function:

The pressure in A or B is set by means of the proportional solenoids. The amount of the pressure depends on the current. With de-energized solenoids (5, 6), the control spool (2) is held in the central position by means of the pressure springs (8). Ports A and B are connected with T so that the hydraulic fluid can flow to the tank without obstructions.

By energizing a proportional solenoid, e.g. solenoid "a" (5), the pressure measuring spool (3) and with it the control spool (2) are moved to the right. This opens the connection from P to B and A to T via orifice-type cross-sections with progressive flow characteristic. With the surface of the pressure measuring spool (4) the pressure that builds up in channel B acts on the control spool and against the solenoid force. The pressure measuring spool (4) is supported by solenoid "b". If the pressure exceeds the value set at solenoid "a", the control spool (2) is pushed back against the solenoid force and connects B with T until the set pressure is reached again. The pressure is proportional to the solenoid current.

When the solenoid is switched off, the control spool (2) is returned into the central position by the compression springs (8).

Type 3DREPE 6…



Throttle insert
see page 26

Function, section

Pilot operated proportional directional valves Types 4WRZ… and 5WRZ.52…

Valves of type 4WRZ... are pilot operated 4-way directional valves that are actuated by proportional solenoids. They control the flow direction and size.

Valves of type 5WRZ... are equipped with an additional port "R" (only size 52).

Set-up:

The valve basically consists of:
- Pilot control valve (9) with proportional solenoids (5 and 6)
- Main valve (10) with main control spool (11) and centering spring (12)

☞ **Notice!**

Due to the design principle, internal leakage is inherent to the valves, which may increase over the life cycle.

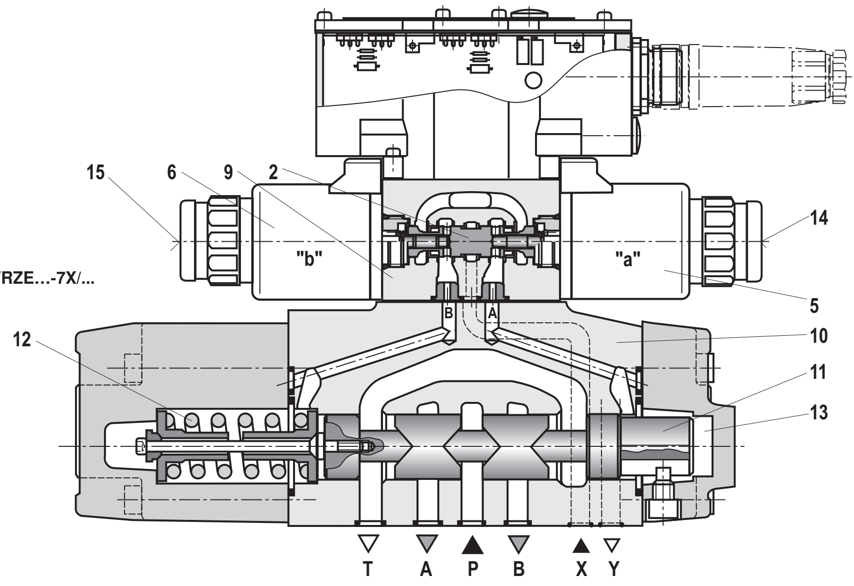
Function:
- With de-energized solenoids (5, 6), the main control spool (11) is held in the central position by means of the centering spring (12).
- The main control spool (11) is controlled by the pilot control valve (9); the main control spool is proportionally moved, e.g. by actuating solenoid "b" (6).
  - → The control spool (2) is moved to the right, pilot oil enters the pressure chamber (13) via the pilot control valve (9) and deflects the main control spool (11) according to the electric input signal.
  - → This opens the connection from P to B and A to T via orifice-type cross-sections with progressive flow characteristic.
- Pilot oil is internally supplied to the pilot control valve via port P or externally via port X.
- Switching the solenoid off (6)
  - → The control spool (2) and main control spool (11) are moved back into the central position.
- Depending on the switching position, flow occurs from P to A and B to T or P to B and A to T (R).

An optional manual override (14 and 15) can be used to move the control spool (2) without solenoid energization.

☞ **Notice:**
Inadvertent activation of the manual override may result in uncontrollable machine movements.

2

Type 4WRZE…-7X/...



Function, section

Externally pilot operated proportional directional valves Types 4WRH… and 5WRH.52…

Valves of the type .WRH... are pilot operated proportional directional valves for external actuation via pressure control valves.

Set-up:
The valve basically consists of:
- Main valve (10) with main control spool (11) and centering spring (12)
- Diversion plate (16)

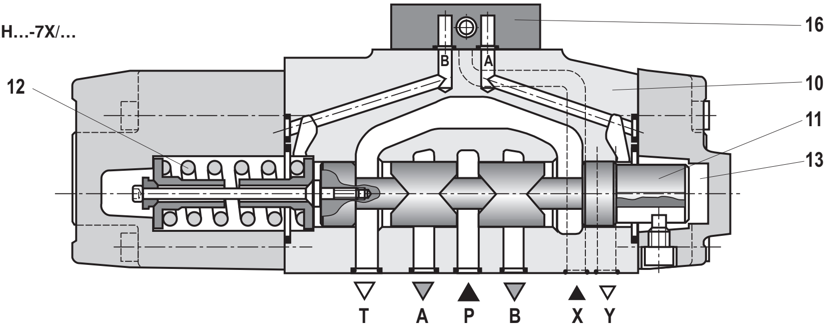
☞ **Notice!**

Due to the design principle, internal leakage is inherent to the valves, which may increase over the life cycle.

Function:
- The diversion plate (16) connects control port A that leads to the pressure chamber (13) with port Y and control port B with port X.
- If port X is pressurized, the main control spool (11) is moved to the right (P to B and A to T). If port Y is pressurized, the main control spool is moved to the left (P to A and B to T).

The pilot pressure at the main valve must not exceed 25 bar (16 bar with size 52)!

Type .WRH…-7X/…



Technical data (for applications outside these parameters, please consult us!)

general

Valve type				.WRZ	.WRZE	.WRH
Installation position				Any, preferably horizontal (for commissioning information, see data sheet 07800)		
Storage temperature range			°C	–20 to +80		
Ambient temperature range			°C	–20 to +70	–20 to +50	–20 to +70
Weight	– Subplate mounting	Size 10	kg	7.8	8.0	6.1
		Size 16	kg	11.9	12.1	9.7
		Size 25	kg	18.2	18.4	18.0
		Size 32	kg	42.2	42.2	41.5
		Size 52	kg	79.5	79.7	
	– Flange connection	Size 52	kg	77.5	77.7	
	– With "D3"		kg	+0.5 in addition		
Sine test according to DIN EN 60068-2-6:2008				10 cycles, 10...2000...10 Hz with logarithmic frequency changing speed of 1 oct./min., 5 to 57 Hz, amplitude 1.5 mm (p-p), 57 to 2000 Hz, amplitude 10 g, 3 axes		
Random test according to DIN EN 60068-2-64:2009				20…2000 Hz, amplitude 0.05 g^2/Hz (10 g_{RMS}) 3 axes, 30 min testing time per axis		
Shock test according to DIN EN 60068-2-27:2010				Half sine 15 g/11 ms, 3 times in positive/3 times in negative direction per axis, 3 axes		
Humid heat, cyclic according to DIN EN 60068-2-30:2006				Variant 2 +25 °C to +55 °C, 90% to 97% relative humidity, 2 cycles at 24 hours each		

Technical data (for applications outside these parameters, please consult us!)

hydraulic (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C and p = 100 bar)

Size		Size	10	16	25	32	52
Operating pressure							
– Pilot control valve	External pilot oil supply	bar	30 to 100				20 to 100
	Internal pilot oil supply	bar	100 to 315 only with "D3"	100 to 350 only with "D3"			–
– Main valve		bar	Up to 315	Up to 350	Up to 350	Up to 350	Up to 350
Return flow pressure	– Port T (port R) (external pilot oil return)	bar	Up to 315	Up to 250	Up to 250	Up to 150	Up to 250
	– Port T (internal pilot oil return)	bar	Up to 30	Up to 30	Up to 30	Up to 30	–
	– Port Y	bar	Up to 30	Up to 30	Up to 30	Up to 30	Up to 30
Flow of the main valve		l/min	Up to 170	Up to 460	Up to 870	Up to 1600	Up to 2800
Pilot flow at ports X and Y with stepped input signal 0 → 100%		l/min	3.5	5.5	7	15.9	7
Pilot volume for switching process 0 → 100%		cm^3	1.7	4.6	10	26.5	54.3
Hydraulic fluid			See table below				
Hydraulic fluid temperature range (at the valve working ports)		°C	–20 to +80 (preferably +40 to +50)				
Viscosity range		mm^2/s	20 to 380 (preferably 30 to 46)				
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)							
	– Pilot control valve		Class 18/16/13 [1)]				
	– Main valve		Class 20/18/15 [1)]				
Hysteresis		%	≤ 6				

1) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components.
For the selection of the filters, see www.boschrexroth.com/filter

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons		HL, HLP	NBR, FKM	DIN 51524
Flame-resistant	– containing water	HFC (Fuchs HYDROTHERM 46M, Petrofer Ultra Safe 620)	NBR	ISO 12922

Important information on hydraulic fluids!

- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.)!
- The flash point of the process and operating medium used must be 40 K greater than the maximum solenoid surface temperature.
- **Flame-resistant – containing water**: The maximum pressure differential per control edge is 175 bar. Pressure pre-loading at the tank port > 20% of the pressure differential; otherwise, increased cavitation.
- Life cycle as compared to operation with mineral oil HL, HLP 50% to 100%

Technical data (for applications outside these parameters, please consult us!)

electric

Valve type			.WRZ [1]	.WRZE
Voltage type			Direct voltage	
Command value overlap		%	15	
Maximum current		A	1.5	2.5
Solenoid coil resistance	– Cold value at 20 °C	Ω	4.8	2
	– Maximum hot value	Ω	7.2	3
Duty cycle		%	100	
Maximum coil temperature [3]		°C	150	
Protection class of the valve according to EN 60529			IP65 with mating connectors mounted and locked	

Control electronics

Type 4WRZ	Digital amplifier in Euro-card format [2]		VT-VSPD-1-2X/... according to data sheet 30523	
	Analog amplifier in Euro-card format [2] with 1 ramp time		VT-VSPA2-1-2X/V0/T1, according to data sheet 30110	
	Analog amplifier in Euro-card format [2] with 5 ramp times		VT-VSPA2-1-2X/V0/T5, according to data sheet 30110	
	Analog module amplifier [2]		VT-11118-1X/... according to data sheet 30218	
Type 4WRZE			Integrated in the valve, see page 14	
	Analog command value module [2]		VT- SWMA-1-1X/... according to data sheet 29902	
	Analog command value module [2]		VT-SWMAK-1-1X/... according to data sheet 29903	
	Digital command value card [2]		VT-HACD-1-1X/… according to data sheet 30143	
	Analog command value card [2]		VT-SWKA-1-1X/... according to data sheet 30255	
Current consumption	I_{max}	A	–	1.8
	– Impulse current	A	–	3
Command value signal	– Voltage input "A1"	V	–	±10
	– Current input "F1"	mA	–	4 to 20

[1] With Bosch Rexroth AG control electronics

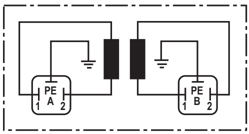
[2] Separate order

[3] Due to the temperatures occurring at the surfaces of the solenoid coils, the European standards ISO 13732-1 and EN 982 need to be adhered to.

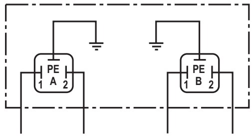
Electrical connection

For type .WRZ... (**for** external electronics – **not** with version **"J"** = seawater-resistant)
For mating connectors, see page 27

Connection at the connector

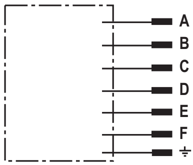


Connection to mating connector



to the amplifier to the amplifier

For type .WRZ... (**for** external electronics – with version **"J"** = seawater-resistant)
For mating connectors, see page 27



External electronics

Contact	Connection with
A	Solenoid A
B	Solenoid B
C	Solenoid A
D	Solenoid B
E	n.c.
F	n.c.
PE	Valve housing

For type .WRZE... (**with** integrated electronics (OBE) and with version **"J"** = seawater-resistant)
For mating connectors, see page 27

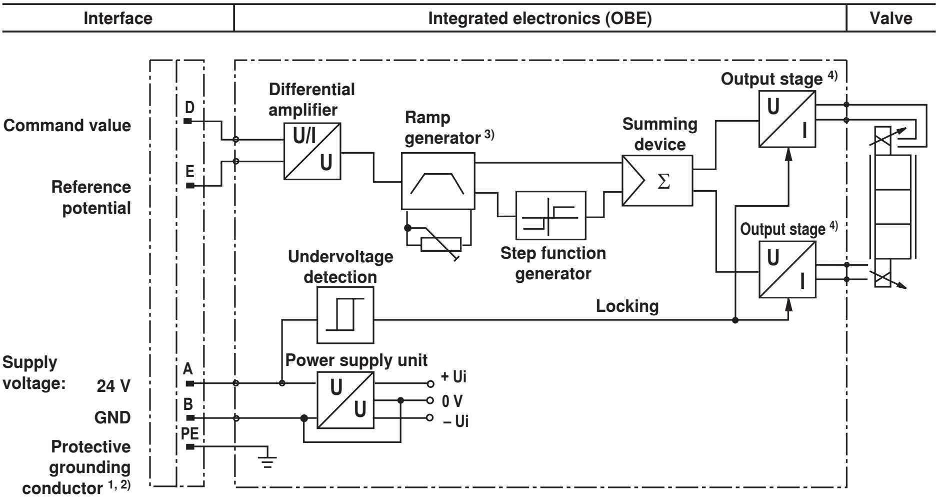
Connector pin assignment	Contact	Signal with A1	Signal at F1
Supply voltage	A	24 VDC (u(t) = 19.4 to 35 V); I_{max} = 2 A	
	B	0 V	
Reference (actual value)	C	Cannot be used [1)]	
Differential amplifier input	D	±10 V; R_e > 50 kΩ	4 to 20 mA; R_e > 100 Ω
(Command value)	E	Command value reference potential	
	F	Cannot be used [1)]	
Protective grounding conductor	PE	Connected to cooling element and valve housing	

[1)] Contacts C and F must not be connected!

Command value: A positive command value (0 to 10 V or 12 to 20 mA) at D and a reference potential at E result in a flow from P to A and B to T.
A negative command value (0 to –10 V or 12 to 4 mA) at D and a reference potential at E result in a flow from P to B and A to T.
If the valve and the solenoid are on side "a" (control spool variants EA and W6A), a positive command value at D and a reference potential at E result in flow from P to B and A to T.

Connection cable: Recommendation: – Up to 25 m cable length, type LiYCY 5 x 0.75 mm²
– Up to 50 m 25 m cable length, type LiYCY 5 x 1.0 mm²
External diameter 6.5 to 11 mm
Only install the shield on the supply side on the protective grounding conductor.

Block diagram of the integrated electronics (OBE) for type WRZE

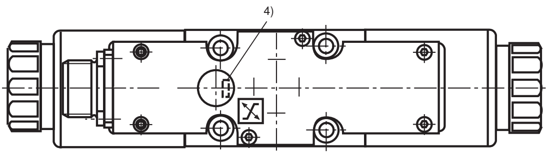


[1] Port PE is connected to the cooling element and the valve housing

[2] The protective grounding conductor is screwed to the valve housing and cover

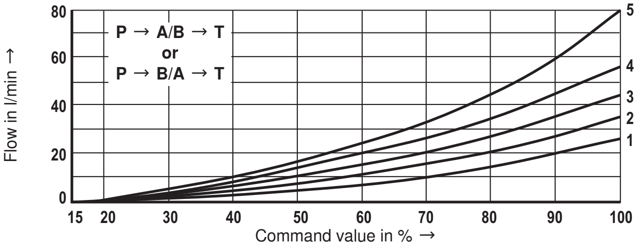
[3] Ramp can be set from 0 to 2.5 s from the outside, identical for T_{up} and T_{down}

[4] The output stages are current-controlled



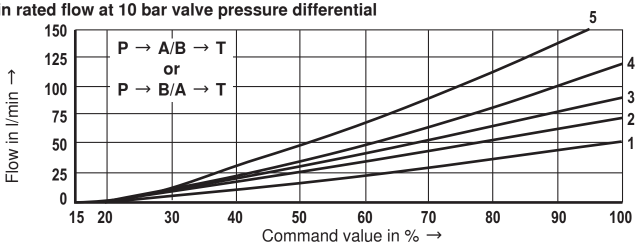
Characteristic curves size 10 (control spool "E, W6-, EA, W6A" as well as HLP46, ϑ_{oil} = 40 °C ±5 °C and p = 100 bar)

25 l/min rated flow at 10 bar valve pressure differential



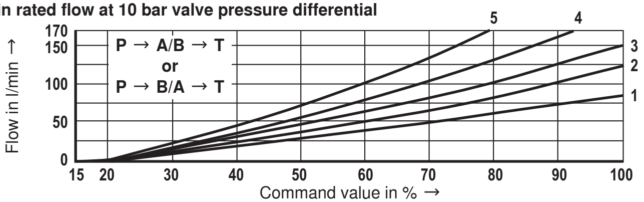
1 **Δp** = 10 bar, constant
2 **Δp** = 20 bar, constant
3 **Δp** = 30 bar, constant
4 **Δp** = 50 bar, constant
5 **Δp** = 100 bar, constant

50 l/min rated flow at 10 bar valve pressure differential



1 **Δp** = 10 bar, constant
2 **Δp** = 20 bar, constant
3 **Δp** = 30 bar, constant
4 **Δp** = 50 bar, constant
5 **Δp** = 100 bar, constant

85 l/min rated flow at 10 bar valve pressure differential



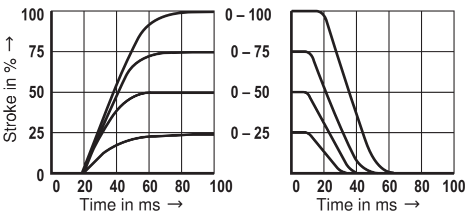
1 **Δp** = 10 bar, constant
2 **Δp** = 20 bar, constant
3 **Δp** = 30 bar, constant
4 **Δp** = 50 bar, constant
5 **Δp** = 100 bar, constant

Δp = valve pressure differential according to DIN 24311 (inlet pressure p_P minus load pressure p_L minus return flow pressure p_T)

Transition functions with stepped, electric input signals, measured at p_{St} = 50 bar

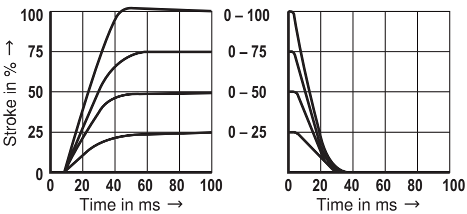
Type 4WRZ...

Signal change in %



Type 4WRZE...

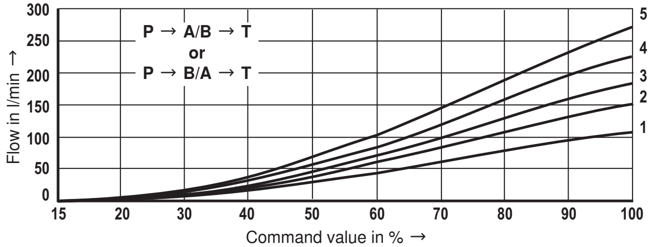
Signal change in %



2

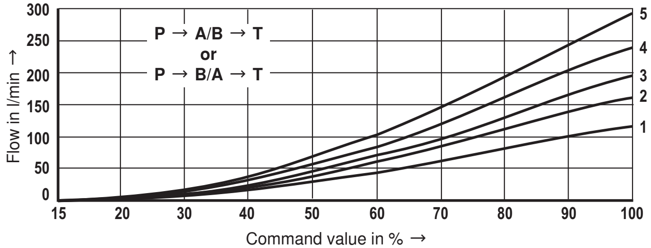
Characteristic curves size 16 (control spool "E, W6-, EA, W6A" as well as HLP46, ϑ_{oil} = 40 °C ±5 °C and p = 100 bar)

100 l/min rated flow at 10 bar valve pressure differential



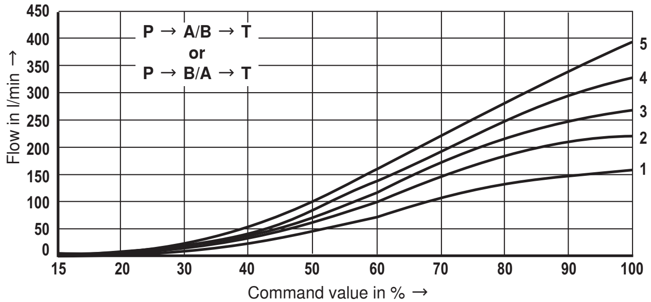
1 Δp = 10 bar, constant
2 Δp = 20 bar, constant
3 Δp = 30 bar, constant
4 Δp = 50 bar, constant
5 Δp = 100 bar, constant

125 l/min rated flow at 10 bar valve pressure differential



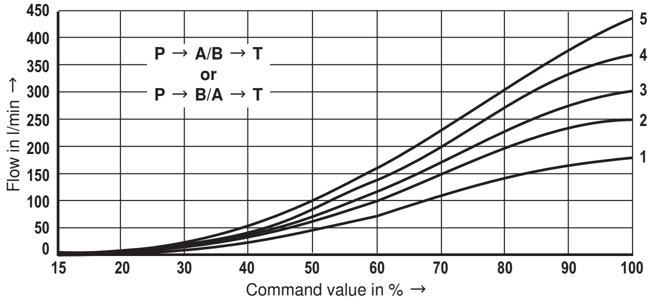
1 Δp = 10 bar, constant
2 Δp = 20 bar, constant
3 Δp = 30 bar, constant
4 Δp = 50 bar, constant
5 Δp = 100 bar, constant

150 l/min rated flow at 10 bar valve pressure differential



1 Δp = 10 bar, constant
2 Δp = 20 bar, constant
3 Δp = 30 bar, constant
4 Δp = 50 bar, constant
5 Δp = 100 bar, constant

180 l/min rated flow at 10 bar valve pressure differential



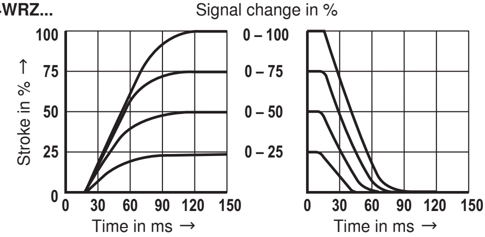
1 Δp = 10 bar, constant
2 Δp = 20 bar, constant
3 Δp = 30 bar, constant
4 Δp = 50 bar, constant
5 Δp = 100 bar, constant

Δp = valve pressure differential according to DIN 24311 (inlet pressure p_P minus load pressure p_L minus return flow pressure p_T)

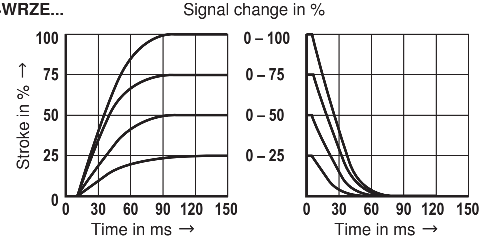
Characteristic curves size 16 (control spool "E, W6-, EA, W6A" as well as HLP46, ϑ_{oil} = 40 °C ±5 °C and p = 100 bar)

Transition functions with stepped, electric input signals, measured at p_{St} = 50 bar

Type 4WRZ...

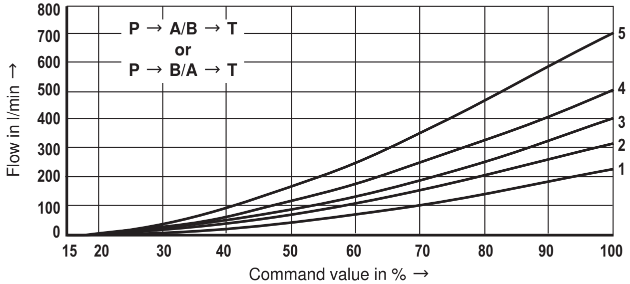


Type 4WRZE...



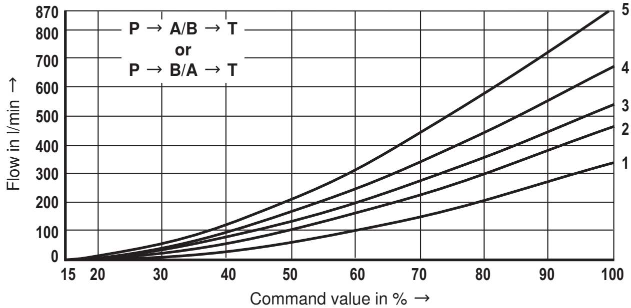
Characteristic curves size 25 (control spool "E, W6-, EA, W6A" as well as HLP46, ϑ_{oil} = 40 °C ±5 °C and p = 100 bar)

220 l/min rated flow at 10 bar valve pressure differential



1 ***Δp*** = 10 bar, constant
2 ***Δp*** = 20 bar, constant
3 ***Δp*** = 30 bar, constant
4 ***Δp*** = 50 bar, constant
5 ***Δp*** = 100 bar, constant

325 l/min rated flow at 10 bar valve pressure differential

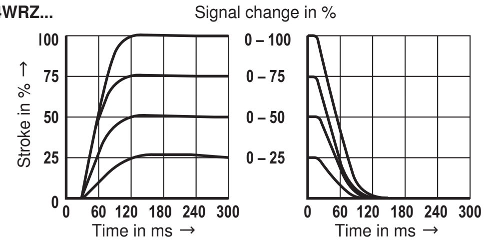


1 ***Δp*** = 10 bar, constant
2 ***Δp*** = 20 bar, constant
3 ***Δp*** = 30 bar, constant
4 ***Δp*** = 50 bar, constant
5 ***Δp*** = 100 bar, constant

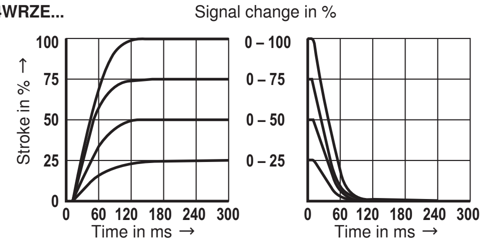
Δp = valve pressure differential according to DIN 24311 (inlet pressure p_P minus load pressure p_L minus return flow pressure p_T)

Transition functions with stepped, electric input signals, measured at p_{St} = 50 bar

Type 4WRZ...

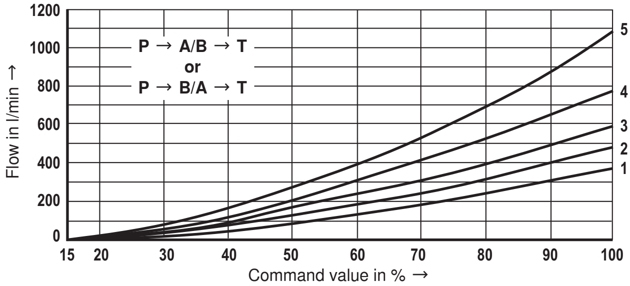


Type 4WRZE...



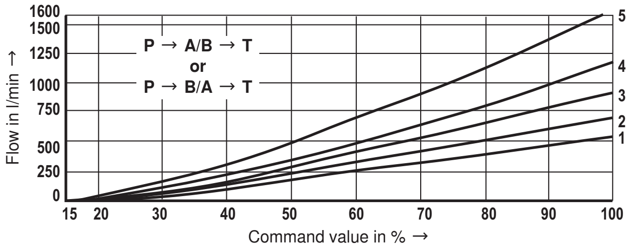
Characteristic curves size 32 (control spool "E, W6-, EA, W6A" as well as HLP46, ϑ_{oil} = 40 °C ±5 °C and *p* = 100 bar)

360 l/min rated flow at 10 bar valve pressure differential



1 **Δp** = 10 bar, constant
2 **Δp** = 20 bar, constant
3 **Δp** = 30 bar, constant
4 **Δp** = 50 bar, constant
5 **Δp** = 100 bar, constant

520 l/min rated flow at 10 bar valve pressure differential



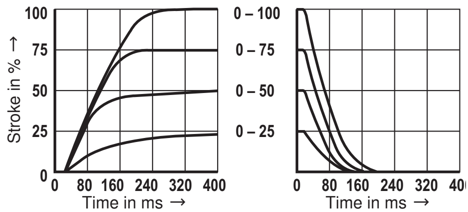
1 **Δp** = 10 bar, constant
2 **Δp** = 20 bar, constant
3 **Δp** = 30 bar, constant
4 **Δp** = 50 bar, constant
5 **Δp** = 100 bar, constant

Δp = valve pressure differential according to DIN 24311 (inlet pressure $\boldsymbol{p}_P$ minus load pressure $\boldsymbol{p}_L$ minus return flow pressure $\boldsymbol{p}_T$)

Transition functions with stepped, electric input signals, measured at p_{St} = 50 bar

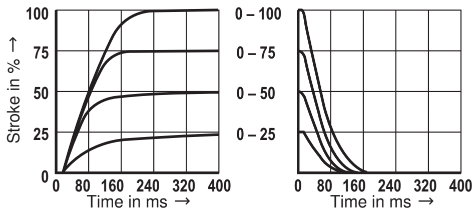
Type 4WRZ...

Signal change in %



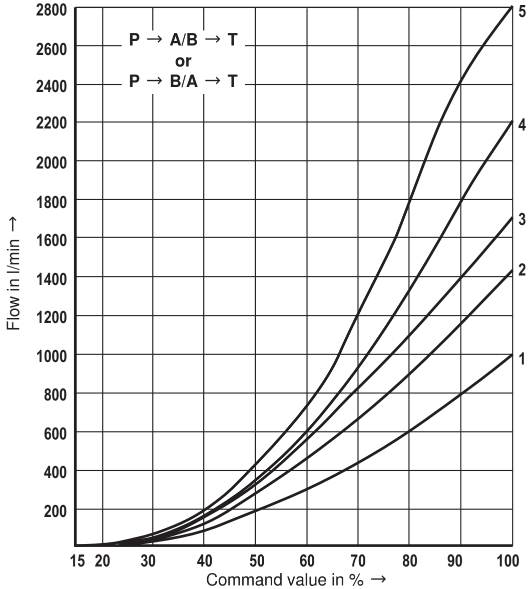
Type 4WRZE...

Signal change in %



Characteristic curves size 52 (control spool "E, W6-, EA, W6A" as well as HLP46, ϑ_{oil} = 40 °C ±5 °C and p = 100 bar)

1000 l/min rated flow at 10 bar valve pressure differential

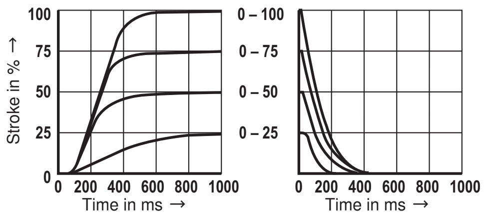


1 ***Δp*** = 10 bar, constant
2 ***Δp*** = 20 bar, constant
3 ***Δp*** = 30 bar, constant
4 ***Δp*** = 50 bar, constant
5 ***Δp*** = 100 bar, constant

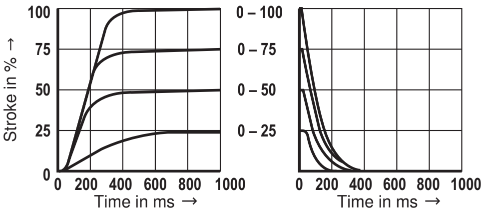
Δp = valve pressure differential according to DIN 24311 (inlet pressure p_P minus load pressure p_L minus return flow pressure p_T)

Transition functions with stepped, electric input signals, measured at p_{St} = 50 bar

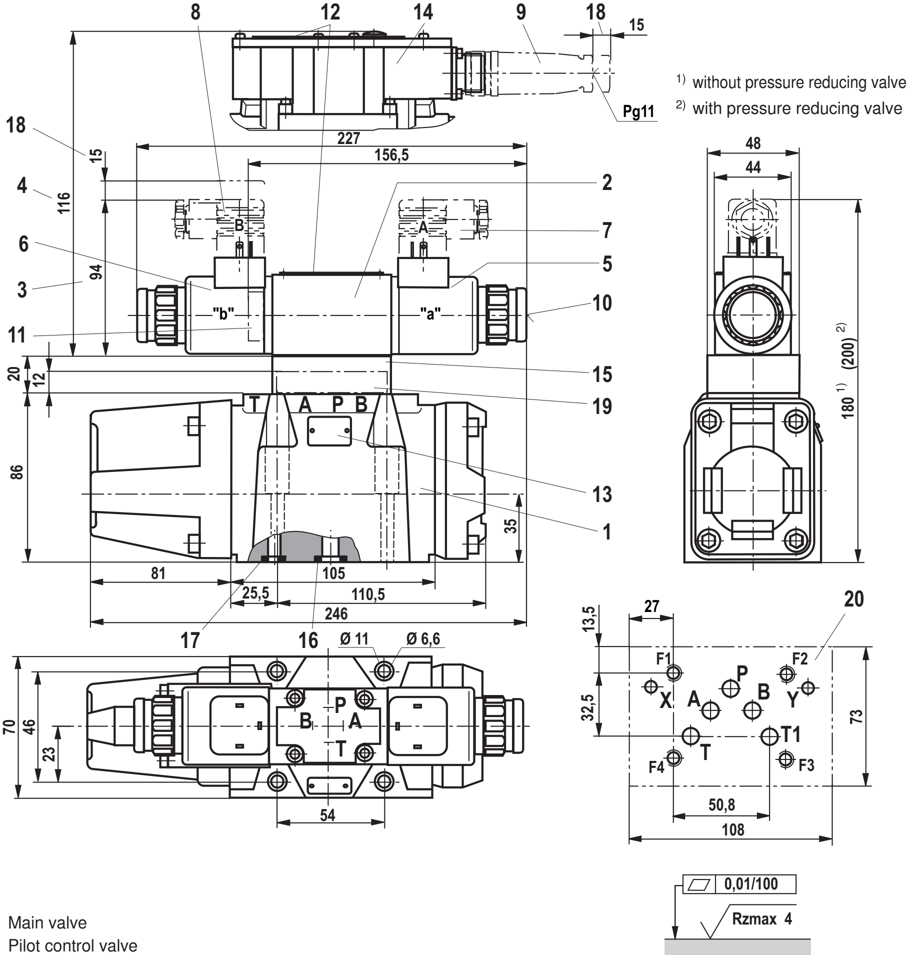
Type .WRZ… Signal change in %



Type .WRZE… Signal change in %



Dimensions: Size 10 (dimensions in mm)

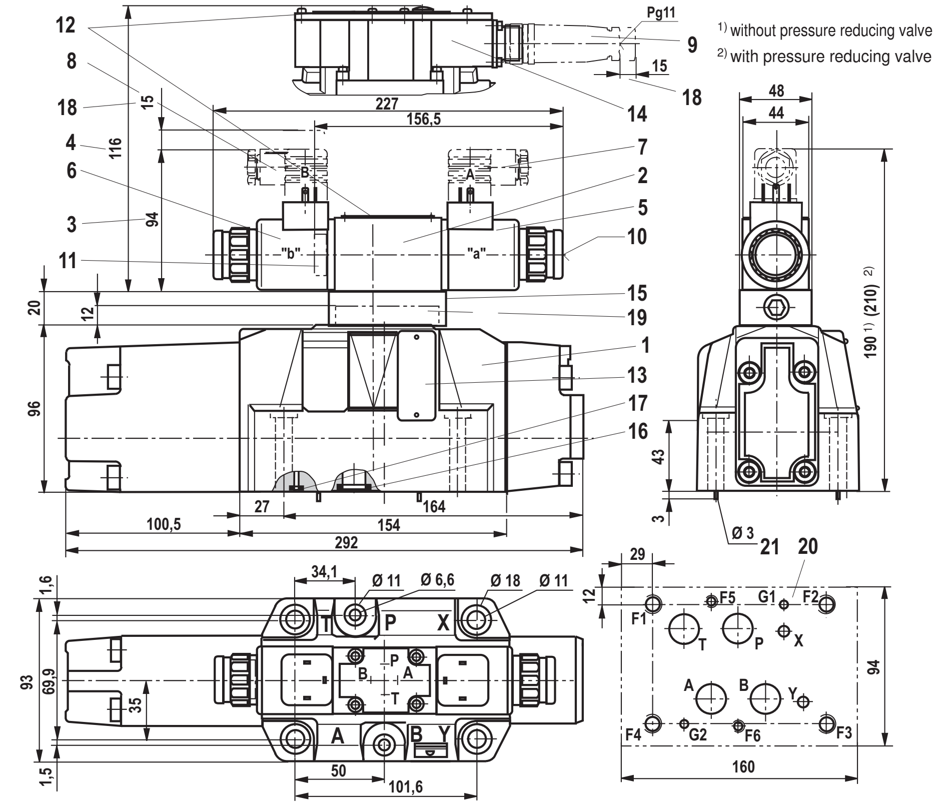


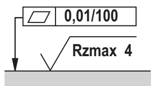
Required surface quality of the valve contact surface

- **1** Main valve
- **2** Pilot control valve
- **3** Dimension for version "4WRZ..." (**not** seawater-resistant)
- **4** Dimension for version "4WRZE..."
- **5** Proportional solenoid "a"
- **6** Proportional solenoid "b"
- **7** Mating connector "A", separate order, see page 27
- **8** Mating connector "B", separate order, see page 27
- **9** Mating connector, separate order, see page 27
- **10** Concealed manual override "N9"
- **11** Plug screw for valves with one solenoid
- **12** Name plate for pilot control valve
- **13** Name plate for main valve
- **14** Integrated electronics (OBE)
- **15** Pressure reducing valve "D3"
- **16** Identical seal rings for ports A, B, P, T, and T1
- **17** Identical seal rings for ports X and Y
- **18** Space required to remove the mating connector
- **19** Diversion plate (type 4WRH...)
- **20** Machined installation surface, porting pattern according to ISO 4401-05-05-0-05, ports X and Y as required

For subplates and valve mounting screws, see page 27

Dimensions: Size 16 (dimensions in mm)



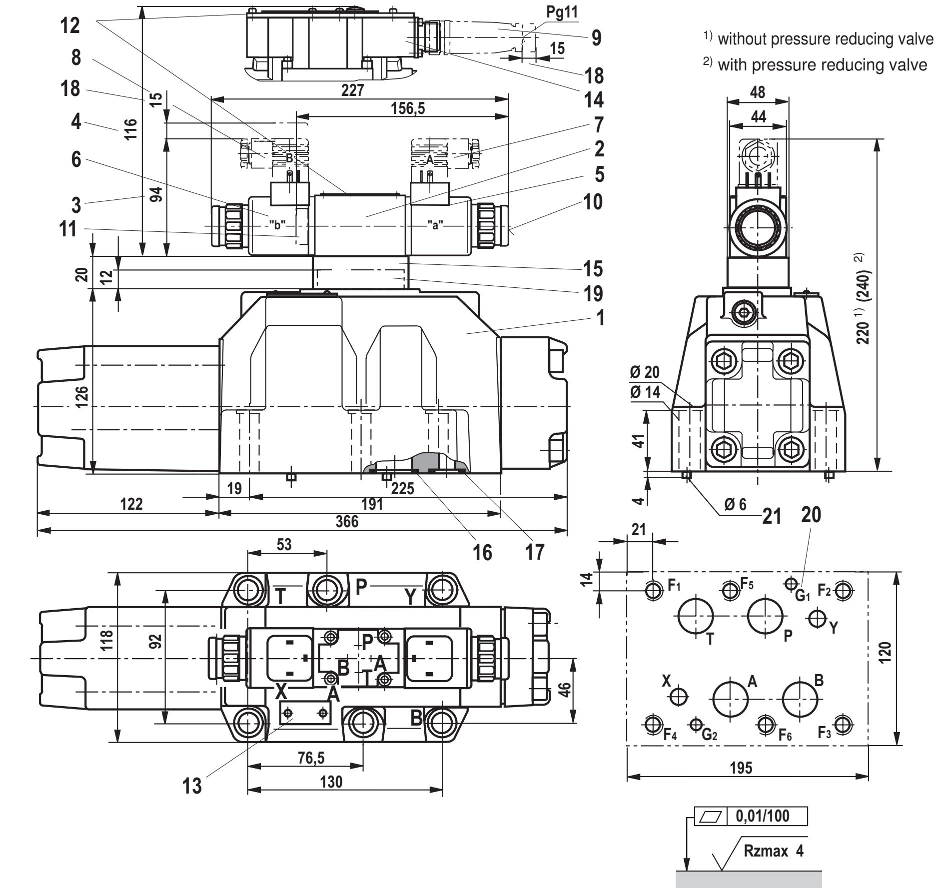


Required surface quality of the valve contact surface

1 Main valve
2 Pilot control valve
3 Dimension for version "4WRZ..." (**not** seawater-resistant)
4 Dimension for version "4WRZE..."
5 Proportional solenoid "a"
6 Proportional solenoid "b"
7 Mating connector "A", separate order, see page 27
8 Mating connector "B", separate order, see page 27
9 Mating connector, separate order, see page 27
10 Concealed manual override "N9"
11 Plug screw for valves with one solenoid
12 Name plate for pilot control valve
13 Name plate for main valve
14 Integrated electronics (OBE)
15 Pressure reducing valve "D3"
16 Identical seal rings for ports A, B, P, and T
17 Identical seal rings for ports X and Y
18 Space required to remove the mating connector
19 Diversion plate (type 4WRH...)
20 Machined installation surface, porting pattern according to ISO 4401-07-07-0-05, ports X and Y as required deviating from the standard: Ports A, B, P, T Ø20 mm.
21 Locking pin

For subplates and valve mounting screws, see page 27

Dimensions: Size 25 (dimensions in mm)

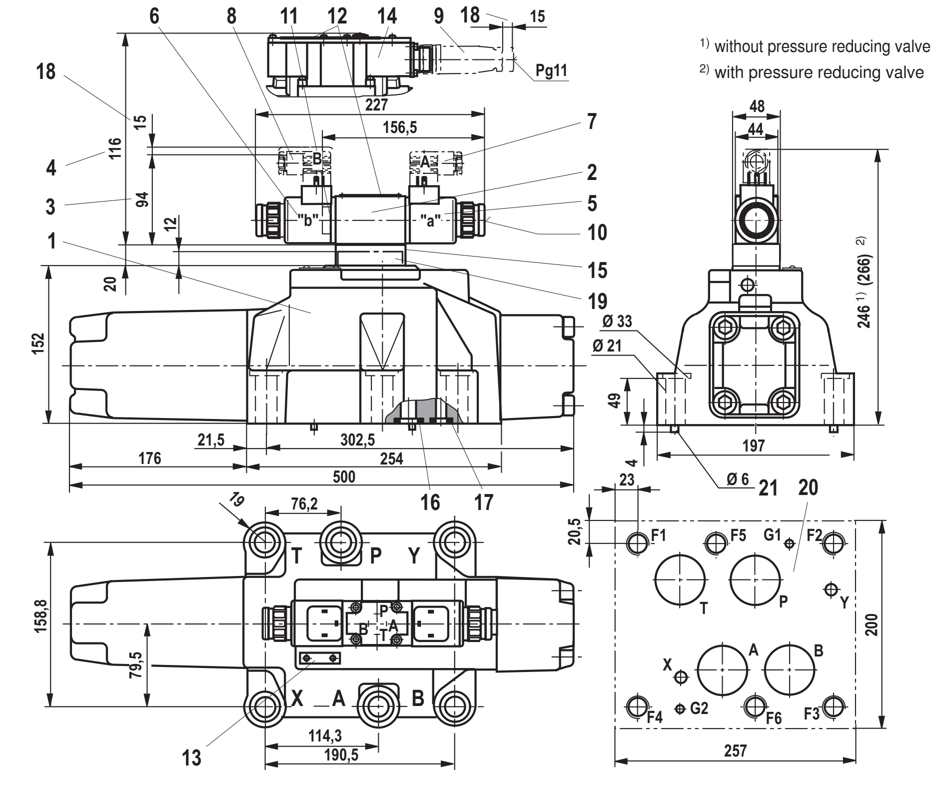


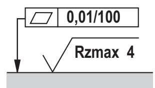
Required surface quality of the valve contact surface

1 Main valve
2 Pilot control valve
3 Dimension for version "4WRZ..." (**not** seawater-resistant)
4 Dimension for version "4WRZE..."
5 Proportional solenoid "a"
6 Proportional solenoid "b"
7 Mating connector "A", separate order, see page 27
8 Mating connector "B", separate order, see page 27
9 Mating connector, separate order, see page 27
10 Concealed manual override "N9"
11 Plug screw for valves with one solenoid
12 Name plate for pilot control valve
13 Name plate for main valve
14 Integrated electronics (OBE)
15 Pressure reducing valve "D3"
16 Identical seal rings for ports A, B, P, and T
17 Identical seal rings for ports X and Y
18 Space required for removing the mating connector
19 Diversion plate (type 4WRH...)
20 Machined installation surface, porting pattern according to ISO 4401-08-08-0-05, ports X and Y as required
21 Locking pin

For subplates and valve mounting screws, see page 27

Dimensions: Size 32 (dimensions in mm)



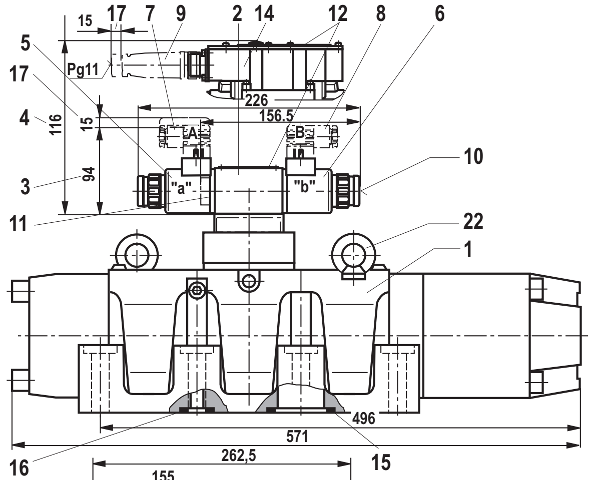


Required surface quality of the valve contact surface

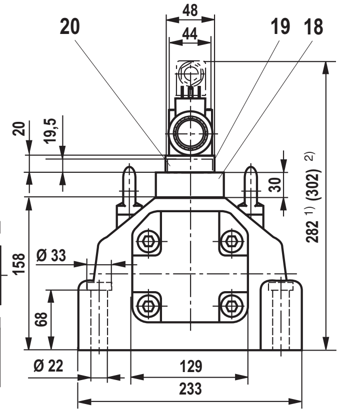
1 Main valve
2 Pilot control valve
3 Dimension for version "4WRZ..." (**not** seawater-resistant)
4 Dimension for version "4WRZE..."
5 Proportional solenoid "a"
6 Proportional solenoid "b"
7 Mating connector "A", separate order, see page 27
8 Mating connector "B", separate order, see page 27
9 Mating connector, separate order, see page 27
10 Concealed manual override "N9"
11 Plug screw for valves with one solenoid
12 Name plate for pilot control valve
13 Name plate for main valve
14 Integrated electronics (OBE)
15 Pressure reducing valve "D3"
16 Identical seal rings for ports A, B, P, and T
17 Identical seal rings for ports X and Y
18 Space required for removing the mating connector
19 Diversion plate (type 4WRH...)
20 Machined installation surface, porting pattern according to ISO 4401-10-09-0-05, ports X and Y as required deviating from the standard:
– Ports A, B, T and P Ø38 mm.
21 Locking pin

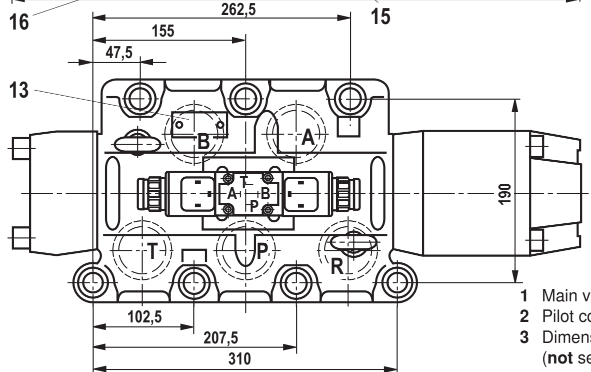
For subplates and valve mounting screws, see page 27

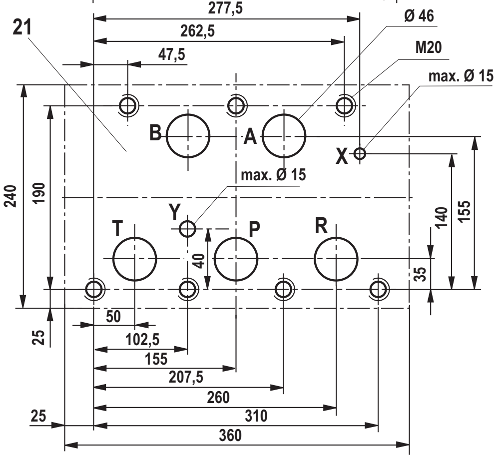
Dimensions: Subplate mounting size 52 (dimensions in mm)

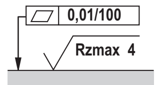


1) without pressure reducing valve
2) with pressure reducing valve









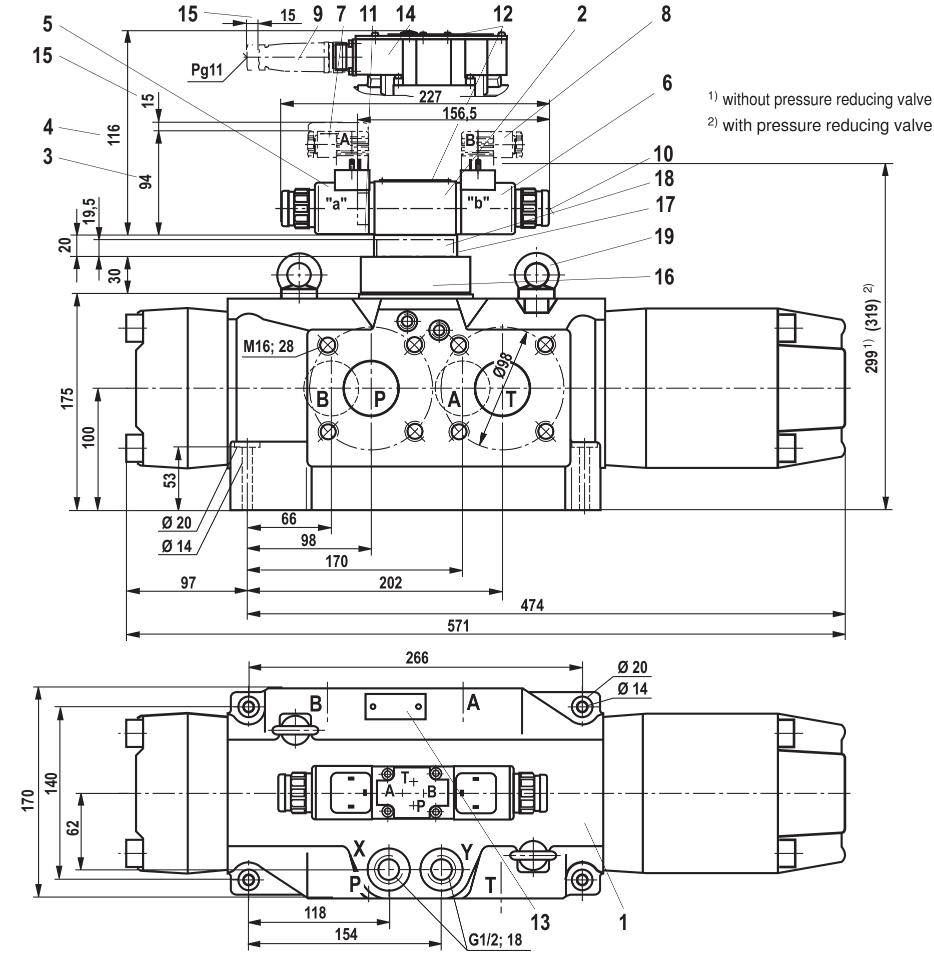
Required surface quality of the valve contact surface

1. Main valve
2. Pilot control valve
3. Dimension for version "4WRZ..." (**not** seawater-resistant)
4. Dimension for version "4WRZE..."
5. Proportional solenoid "a"
6. Proportional solenoid "b"
7. Mating connector "A"
8. Mating connector "B"
9. Mating connector, separate order, see page 27
10. Concealed manual override "N9"
11. Plug screw for valves with one solenoid
12. Name plate for pilot control valve
13. Name plate for main valve
14. Integrated electronics (OBE)
15. Identical seal rings for ports A, B, P, T, and R
16. Identical seal rings for ports X, Y, and L
17. Space required to remove the mating connector
18. Adapter plate
19. Pressure reducing valve "D3"
20. Diversion plate (type 4WRH...)
21. Machined installation surface, porting pattern, ports X and Y as required
22. Transport aid

For subplates and valve mounting screws, see page 27

2

Dimensions: Flange connection size 52 (dimensions in mm)



1 Main valve
2 Pilot control valve
3 Dimension for version "4WRZ..." (**not** seawater-resistant)
4 Dimension for version "4WRZE..."
5 Proportional solenoid "a"
6 Proportional solenoid "b"
7 Mating connector "A", separate order, see page 27
8 Mating connector "B", separate order, see page 27
9 Mating connector, separate order, see page 27
10 Concealed manual override "N9"
11 Plug screw for valves with one solenoid
12 Name plate for pilot control valve
13 Name plate for main valve
14 Integrated electronics (OBE)
15 Space required to remove the mating connector
16 Adapter plate
17 Pressure reducing valve "D3"
18 Diversion plate (type 4WRH...)
19 Transport aid

For subplates and valve mounting screws, see page 27

Accessories (not included in the scope of delivery)

Mating connectors			Material number
Mating connector for 4WRZ	DIN EN 175301-803	Solenoid "a", grey	R901017010
		Solenoid "b", black	R901017011
Mating connector for 4WRZE and 4WRZE...J...	DIN EN 175201-804		e.g. R900021267 (plastic)
			e.g. R900223890 (metal)

Hexagon socket head cap screws		Material number
Size 10	4x ISO 4762 - M6 x 45 - 10.9-flZn-240h-L Tightening torque M_A = 13.5 Nm ±10% or 4x ISO 4762 - M6 x 45 - 10.9 Tightening torque M_A = 15.5 Nm ±10%	R913000258
Size 16	2x ISO 4762 - M6 x 60 - 10.9-flZn-240h-L Tightening torque M_A = 12.2 Nm ±10% 4x ISO 4762 - M10 x 60 - 10.9-flZn-240h-L Tightening torque M_A = 58 Nm ±20% or 2x ISO 4762 - M6 x 60 - 10.9 Tightening torque M_A = 15.5 Nm ±10% 4x ISO 4762 - M10 x 60 - 10.9 Tightening torque M_A = 75 Nm ±20%	R913000115 R913000116
Size 25	6x ISO 4762 - M12 x 60 - 10.9-flZn-240h-L Tightening torque M_A = 100 Nm ±20% or 6x ISO 4762 - M12 x 60 - 10.9 Tightening torque M_A = 130 Nm ±20%	R913000121
Size 32	6x ISO 4762 - M20 x 80 - 10.9-flZn-240h-L Tightening torque M_A = 340 Nm ±20% or 6x ISO 4762 - M20 x 80 - 10.9 Tightening torque M_A = 430 Nm ±20%	R901035246
Size 52 (5WRZ52)	With a steel installation surface: 7x ISO 4762 - M20 x 90 - 10.9-flZn-240h-L Tightening torque M_A = 465 Nm ±20% With a cast iron installation surface: 7x ISO 4762 - M20 x 100 - 10.9-flZn-240h-L Tightening torque M_A = 465 Nm ±20% or With a steel installation surface: 7x ISO 4762 - M20 x 90 - 10.9 Tightening torque M_A = 610 Nm ±20% With a cast iron installation surface: 7x ISO 4762 - M20 x 100 - 10.9 Tightening torque M_A = 610 Nm ±20%	R913000397 R913000386
Size 52 (4WRZ52)	4x ISO 4762 - M12 x 70 - 10.9-flZn-240h-L Tightening torque M_A = 100 Nm ±20% or 4x ISO 4762 - M12 x 70 - 10.9 Tightening torque M_A = 130 Nm ±20%	R913000515

Subplates/connection flanges	Data sheet
Size 10	45054
Size 16	45056
Size 25	45058
Size 32	45060
Size 52	45501

When using type 4WRZ..., use the following throttle inserts in channel A and B of the pilot control valve:

Throttle insert	Ø in mm	Material number
Size 10	1.8	R900158510
Size 16	2.0	R900158547
Size 25	2.8	R900157948
Size 32	-	-
Size 52	-	-

2

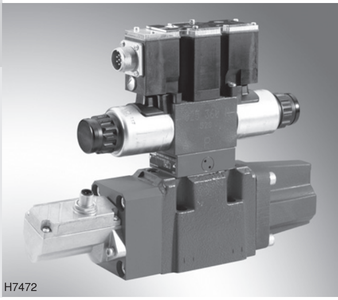
Notes

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
documentation@boschrexroth.de
www.boschrexroth.de

4/2, 4/3 proportional directional valve, pilot operated, w/o electric position feedback without/with integrated electronics (OBE), with spool position indicator

RE 29117/05.13
Replaces: 06.08

Types 4WRZ(E)M and 4WRHM



H7472

Sizes 10 to 25
Component series 1X
Maximum operating pressure 350 bar
Maximum flow 870 l/min

Table of contents

Features

- Pilot operated, 2-stage proportional directional valves with integrated electronics (OBE) with type 4WRZE
- Spool position indicator
- In combination with a contact shut-off, the valve complies with the requirements for safety-related components of a control according to category 1, EN ISO 13849-1:2006
- Suitable for use in safety-related parts of controls according to category 4, EN ISO 13849-1:2006
- Control of flow direction and size
- Operation by means of proportional solenoids with central thread and detachable coil
- Subplate mounting, porting pattern according to ISO 4401
- Manual override, optional
- Spring-centered control spool

Information on available spare parts:
www.boschrexroth.com/spc

Ordering codes

4WR			M			–1X/					/			*

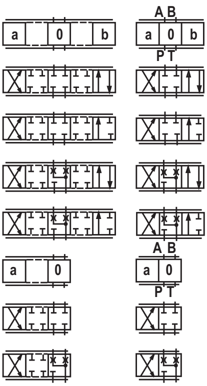
Hydraulic actuation = **H**
Electro-hydraulic actuation = **Z**

Only with WRZ:
With external electronics = **no code**
With integrated electronics = **E**

Monitoring the switching position = **M**

Size 10 = **10**
Size 16 = **16**
Size 25 = **25**
Size 32, see data sheet 29118

Control spool symbols



= **E**
E1-
= **E3-**
= **W6-**
W8-
= **W9-**
= **EA** [1)]
= **W6A** [1)]

With symbols E1- and W8-:
P → A: q_V B → T: $q_V/2$
P → B: $q_V/2$ A → T: q_V

With symbols E3- and W9-:
P → A: q_V B → T: Blocked
P → B: $q_V/2$ A → T: q_V
(differential circuit, piston top at port A)

Notice:
With spools W6-, W8-, W9-, W6A, there is a connection from A → T and B → T with less than 2% of the respective nominal cross-section in switching position "0".

Rated flow in l/min at valve pressure differential Δp = 10 bar

25 =	**50 =**	**85 =**		Size 10
100 =	**125 =**	**150 =**	**180 =**	Size 16
220 =	**325 =**			Size 25

1X = Component series 10 to 19
(10 to 19: Unchanged installation and connection dimensions)

6E [1)] **=** Pilot control valve size 6, proportional solenoid with detachable coil

Supply voltage of the electronics
G24 [1)] **=** 24 V direct voltage (standard version)

no code = Without manual override
N9 [1)] **=** With concealed manual override

Pilot oil supply and return
no code = External pilot oil supply, external pilot oil return
E [1)] **=** Internal pilot oil supply, external pilot oil return
ET [1)] **=** Internal pilot oil supply, internal pilot oil return
T [1)] **=** External pilot oil supply, internal pilot oil return

Electrical connection for WRZM:
K4 = Without mating connector with connector according to DIN EN 175301-803
Mating connector – separate order, see page 19
for WRZEM:
K31 = Without mating connector with connector according to DIN EN 175201 804
Mating connector – separate order, see page 19

Electronics interface for 4WRZEM:
A1 = Command value input ±10 V
F1 = Command value input 4 to 20 mA
no code = For WRZM and WRHM

no code = Without pressure reducing valve
D3 [1)] **=** With pressure reducing valve ZDR 6 DP0-4X/40YM-W80 (not adjustable)

M = NBR seals
V = FKM seals

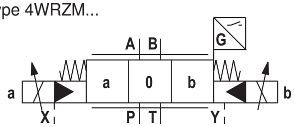
For further details, see the plain text

[1)] Not applicable to 4WRH

Symbols (simplified)

With electro-hydraulic actuation and for external electronics

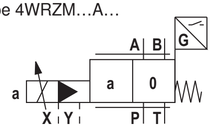
Type 4WRZM...



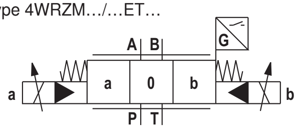
Pilot oil supply

X = external
Y = external

Type 4WRZM…A…

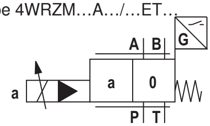


Type 4WRZM…/…ET…



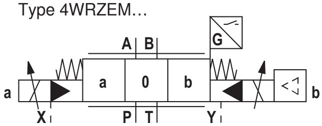
X = internal
Y = internal

Type 4WRZM…A…/…ET…



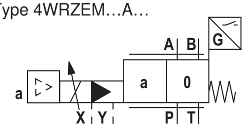
With electro-hydraulic actuation and integrated electronics

Type 4WRZEM…

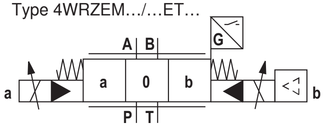


X = external
Y = external

Type 4WRZEM…A…

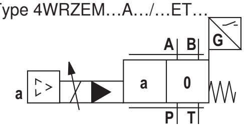


Type 4WRZEM…/…ET…



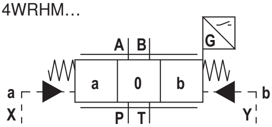
X = internal
Y = internal

Type 4WRZEM…A…/…ET…

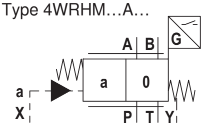


With hydraulic actuation

Type 4WRHM…



Type 4WRHM…A…



Pilot oil supply

Type 4WRZ(E)M… and type 4WRHM… **Extern pilot oil supply**
External pilot oil return

With this version, the pilot oil is supplied from a separate pilot circuit (externally).

The pilot oil return is not conducted into the T channel of the main valve, but is directed separately to the tank via port Y (externally).

Type 4WRZ(E)M…E… **Internal pilot oil supply**
External pilot oil return

With this version, the pilot oil is supplied from the P channel of the main valve (internally).

The pilot oil return is not conducted into the T channel of the main valve, but is directed separately to the tank via port Y (externally). Close port X in the subplate.

Type 4WRZ(E)M…ET… **Internal pilot oil supply**
Internal pilot oil return

With this version, the pilot oil is supplied from the P channel of the main valve (internally).

The pilot oil is returned directly to the T channel of the main valve (internally).

Close ports X and Y in the subplate.

Type 4WRZ(E)M…T… **External pilot oil supply**
Internal pilot oil return

With this version, the pilot oil is supplied from a separate pilot circuit (externally).

The pilot oil is returned directly to the T channel of the main valve (internally).

Close port Y in the subplate.

Function, section

Pilot control valve for 4WRZ(E)M… (type 3DREP(E)6…)

The pilot control valve is a 3-way pressure reducing valve that is actuated by a proportional solenoid. It converts an electrical input signal into a proportional pressure output signal.

The proportional solenoids are controllable, wet-pin DC solenoids with a central thread and a detachable coil. The solenoids can either be controlled by external electronics (type 4WRZM...) or by integrated electronics (type 4WRZEM...).

Set-up:

The pilot control valve basically consists of:

- Housing (1)
- Control spool (2) with pressure measuring spool (3 and 4)
- Solenoids (5 and 6) with central thread
- Optionally with Integrated electronics (7)

Function:

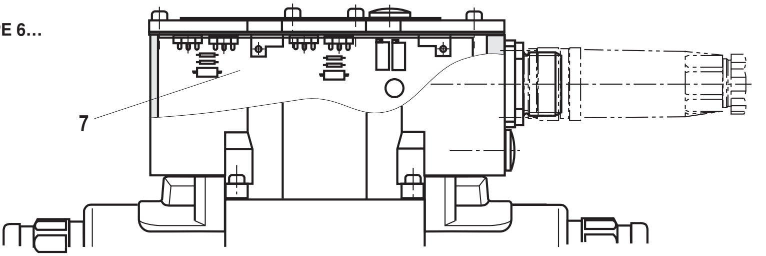
The pressure in A or B is set by means of the proportional solenoids. The amount of the pressure depends on the current.

With de-energized solenoids (5, 6), the control spool (2) is held in the central position by means of the pressure springs (8). Ports A and B are connected with T so that the hydraulic fluid can flow to the tank without obstructions.

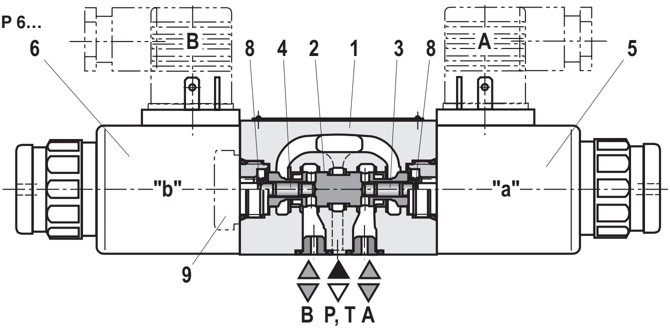
By energizing a proportional solenoid, e.g. solenoid "a" (5), the pressure measuring spool (3) and with it the control spool (2) are moved to the right. This opens the connection from P to B and A to T via orifice-type cross-sections with progressive flow characteristic. With the surface of the pressure measuring spool (4) the pressure that builds up in channel B acts on the control spool and against the solenoid force. The pressure measuring spool (4) is supported by solenoid "b". If the pressure exceeds the value set at solenoid "a", the control spool (2) is pushed back against the solenoid force and connects B with T until the set pressure is reached again. The pressure is proportional to the solenoid current.

When the solenoid is switched off, the control spool (2) is returned into the central position by the compression springs (8).

Type 3DREPE 6…



Type 3DREP 6…



Pilot control valve for 4WRZ(E)M…A… with two switching positions (type 3DREP(E)6…B…)

The operation of this valve version basically corresponds to the valve with 3 switching positions. However, this 2 spool position valve is only equipped with solenoid "a" (5).

In the place of the second proportional solenoid there is a plug screw (9).

Function, section

Electro-hydraulically actuated proportional directional valves Type 4WRZ(E)M…

Valves of type 4WRZ(E)M… are pilot operated proportional directional valves with spool position indicator.

They control the flow direction and size.

They are actuated by the proportional solenoids of the pilot control valve (see description on page 4).

Set-up:

The valve basically consists of:

- Pilot control valve (10) with proportional solenoids (5) and (6)
- Main valve (11) with main control spool (12), valve spring (13) and position indicator (14)

Function:

- With de-energized solenoids (5) and (6), the main control spool (12) is held in the central position by the valve spring (13).
- By energizing a proportional solenoid, e.g. solenoid "b" (6) the control spool (2) is moved to the right. Pilot oil enters the pressure chamber (15). The generated pressure moves the main control spool (12) proportionally to the electric input signal against the valve spring (13). This opens the connection from P to A and B to T via orifice-type cross-sections with progressive flow characteristic.
- Depending on the type, pilot oil is internally supplied to the pilot control valve via port P or externally via port X.
- When the solenoid (6) is switched off, the control spool (2) is returned into the central position by the compression springs (8). This unloads the pressure chamber (15) towards the tank and the main control spool (12) is returned to the central position by the valve spring (13).
- Depending on the type, the pilot oil is returned internally from the pilot control valve to the tank via port T or externally via port Y.
- An optional manual override (16 and 17) allows the control spool (2) and with it the main control spool (12) to be moved. **Inadvertent activation of the manual override may result in uncontrollable machine movements!**

Notice:

The tank line must not be allowed to run empty. If this is possible due to the installation conditions, install a preload valve (with a preload pressure of approx. 2 bar).

Spool position indicator:

The switching positions of the main control spool are detected by the inductive position switch (14) and displayed via two switching outputs with a preset logic. If the preset switching points are exceeded, the deviation from the zero position is displayed within the control spool overlap (see page 12).

The switching signals can be used in a superior control for monitoring purposes.

The electrical connection is implemented separately via a 4-pole connector M12x1 with two pins for signal output and two pins for voltage supply.

Area of application:

The valve may be used in machines with high safety requirements, e.g. hydraulic press control systems.

In combination with a contact shut-off, the valve complies with the requirements for safety-related components of a control according to category 1, EN ISO 13849-1:2006. The "emergency stop" command or an error detected by the machine control has to result in cutting the valve supply voltage.

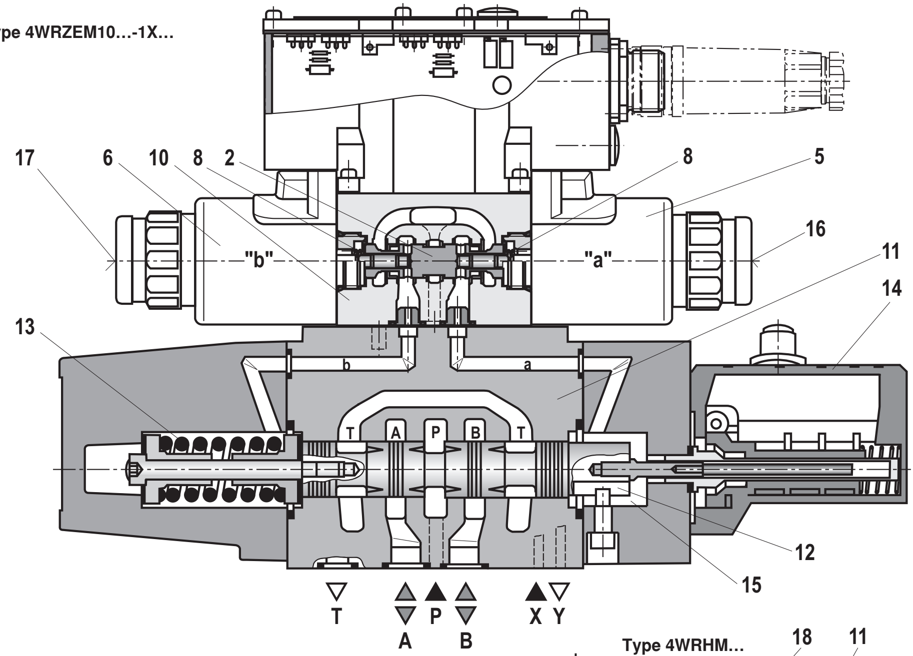
For the valve design the basic and well-tried safety principles according to ISO 13849-2:2003, tables C1 and C2 were used.

The valves are suitable for use in safety-related parts of controls according to category 4, EN ISO 13849-1:2006. This requires the entire control to meet the requirements of category 4, EN ISO 13849-1:2006 as well as the respective requirements of the applicable standards.

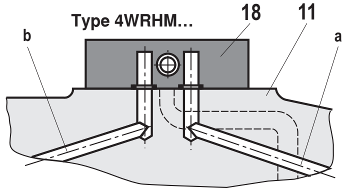
Please note chapter "Safety instructions" on page 20!

Function, section (continued)

Type 4WRZEM10…-1X…



Type 4WRHM…



Hydraulically actuated proportional directional valves Type 4WRHM…

Valves of type 4WRHM… are pilot operated proportional directional valves with spool position indicator. They control the flow direction and size. Actuation is carried out hydraulically via external pressure control valves.

Set-up:

The valve basically consists of:

- Main valve (11) with main control spool (12), valve spring (13) and position switch (14)
- Diversion plate (18)

Function:

- The diversion plate (18) connects control channel (a) that leads to the pressure chamber (15) with port Y and control channel (b) with port X.
- When ports X and Y are pressurized, the main control spool (12) can be moved proportionally in both directions.
- At a pressure of approx. 5 bar the connection from P-A/ B-T and/or P-B/A-T is opened. At 25 bar the maximum opening cross-section is reached.

The pilot pressure at X and Y must not exceed 25 bar.

Area of application:

The valve may be used in machines with high safety requirements, e.g. hydraulic press control systems.

The valve corresponds to the requirements for safety-related control parts according to category 1, EN ISO 13849-1:2006. The "emergency stop" command or an error detected by the machine control has to result in unloading the control ports X and Y.

For the valve design the basic and well-tried safety principles according to ISO 13849-2:2003, tables C1 and C2 were used.

The valves are suitable for use in safety-related parts of controls according to category 4, EN ISO 13849-1:2006. This requires the entire control to meet the requirements of category 4, EN ISO 13849-1:2006 as well as the respective requirements of the applicable standards.

Please note chapter "Safety instructions" on page 20!

Technical data (for applications outside these parameters, please consult us!)

general

Valve type			4WRZM	4WRZEM	4WRHM
Installation position			Any, preferably horizontal (for commissioning information, see data sheet 07800)		
Storage temperature range		°C	–20 to +80		
Ambient temperature range	Size 10/16/25	°C	–20 to +50	–20 to +50	
Weight	Size 10	kg	8.2	9.0	6.5
	Size 16	kg	13.0	13.7	10.1
	Size 25	kg	20.2	20.9	18.4
	With "D3"	kg	+0.5 in addition		
Sine test according to DIN EN 60068-2-6:2008			10 cycles, 10...2000...10 Hz with logarithmic frequency changing speed of 1 oct./min., 5 to 57 Hz, amplitude 1.5 mm (p-p), 57 to 2000 Hz, amplitude 10 g, 3 axes		
Random test according to DIN EN 60068-2-64:2009			20…2000 Hz, amplitude 0.05 g^2/Hz (10 g_{RMS}) 3 axes, 30 min testing time per axis		
Shock test according to DIN EN 60068-2-27:2010			Half sine 15 g/11 ms, 3 times in positive/3 times in negative direction per axis, 3 axes		
Humid heat, cyclic according to DIN EN 60068-2-30:2006			Variant 2 +25 °C to +55 °C, 90% to 97% relative humidity, 2 cycles at 24 hours		

hydraulic

Size		Size	10	16	25
Operating pressure					
Pilot control valve WRZ(E)	– External pilot oil supply	bar	30 to 100		
	– Internal pilot oil supply	bar	100 to 315 only with "D3"	100 to 350 only with "D3"	
Control WRH	– Ports X and Y	bar	25 maximum (cracking pressure approx. 5 bar)		
Main valve	– Ports P, A, B	bar	Up to 315	Up to 350	Up to 350
Return flow pressure	– Port T (external pilot oil return)	bar	Up to 315	Up to 250	Up to 250
	– Port T (internal pilot oil return)	bar	Up to 30	Up to 30	Up to 30
	– Port Y	bar	Up to 30	Up to 30	Up to 30
Flow of the main valve		l/min	Up to 170	Up to 460	Up to 870
Pilot flow at ports X and Y with stepped input signal 0 → 100%		l/min	3.5	5.5	7
Pilot volume for switching process 0 → 100%		cm^3	1.7	4.6	10
Hydraulic fluid			See table on page 8		
Hydraulic fluid temperature range		°C	–20 to +80 (preferably +40 to +50)		
Viscosity range		mm^2/s	20 to 380 (preferably 30 to 46)		
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)					
	– Pilot control valve		Class 18/16/13 [1)]		
	– Main valve		Class 20/18/15 [1)]		
Hysteresis		%	≤ 6		

[1)] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components.
For the selection of the filters see www.boschrexroth.com/filter

Technical data (for applications outside these parameters, please consult us!)

Hydraulic fluid		**Classification**	**Suitable sealing materials**	**Standards**
Mineral oils and related hydrocarbons		HL, HLP	NBR, FKM	DIN 51524
Flame-resistant	– containing water	HFC (Fuchs HYDROTHERM 46M, Petrofer Ultra Safe 620)	NBR	ISO 12922

☞ **Important information on hydraulic fluids!**
- For more information and data on the use of other hydraulic fluids, refer to data sheet 90220 or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.)!
- The flash point of the process and operating medium used must be 40 K greater than the maximum solenoid surface temperature.
- **Flame-resistant – containing water**: The maximum pressure differential per control edge is 175 bar. Pressure pre-loading at the tank port >20% of the pressure differential; otherwise, increased cavitation.
- Life cycle as compared to operation with mineral oil HL, HLP 50% to 100%

electric

Valve type			**4WRZM** [1]	**4WRZEM**
Voltage type			Direct voltage	
Command value overlap		%	20	
Maximum solenoid current		A	1.5	2.5
Solenoid coil resistance	Cold value at 20 °C	Ω	4.8	2
	Maximum hot value	Ω	7.2	3
Duty cycle		%	100	
Maximum coil temperature [3]		°C	150	
Electrical connection			With connector according to DIN EN 175301-803 Mating connector according to DIN EN 175301-803 [2], see page 19	With connector according to DIN EN 175201-804 Mating connector according to DIN EN 175201-804 [2], see page 19
Protection class of the valve according to EN 60529			IP65 with mating connectors mounted and locked	

[1] With Rexroth control electronics

[2] Separate order

[3] Due to the temperatures occurring at the surfaces of the solenoid coils, the European standards ISO 13732-1 and DIN EN 982 need to be adhered to.

Technical data (for applications outside these parameters, please consult us!)

Control electronics

Integrated electronics (OBE) with type 4WRZEM			–	Integrated in the valve, see page 10
Current consumption	I_{max}	A	–	1.8
	– Impulse current	A	–	3.0
Command value signal	– Voltage input "A1"	V	–	±10
	– Current input "F1"	mA	–	4 to 20
Suitable command value preparation for type WRZEM				
Analog command value card [1]			VT-SWKA-1-1X/… according to data sheet RE 30255	
Digital command value card [1]			VT-HACD-1-1X/… according to data sheet RE 30143	
Analog command value modules [1]			VT-SWMA-1-1X/… according to data sheet RE 29902	
			VT-SWMAK-1-1X/… according to data sheet RE 29903	
External electronics for type 4WRZM				
Analog amplifier in Euro-card format [1]	with 1 ramp time		VT- VSPA2-1-2X/V0/T1 according to data sheet RE 30110	
	with 5 ramp times		VT- VSPA2-1-2X/V0/T5 according to data sheet RE 30110	
Digital amplifier in Euro-card format [1]			VT-VSPD-1-2X/… according to data sheet RE 30523	
Analog amplifier in modular design [1]			VT 11118-1X/… according to data sheet RE 30218	

[1] Separate order

electric, spool position indicator (see page 11)

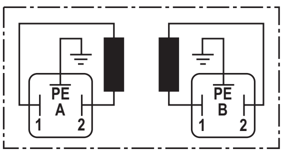
Principle		Inductive position switch
Switching point		Within positive valve overlap
Supply voltage	VDC	24 ± 4.8
Residual ripple		< 10%
Current consumption, without load current	mA	≤ 40
Reverse polarity protection		Installed, max. 300 V
Outputs		Reverse polarity protected, positive switching and short-circuit-proof
Protection class		IP 65 according to EN 60529 with installed connectors
Duty cycle		100%
Electrical connection		M12x1, 4-pole; assignment according to DIN EN 60947-5-2; mating connector, see page 19 (separate order)

Electrical connection (dimensions in mm)

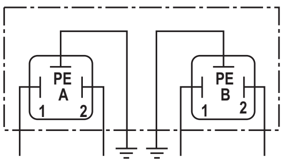
Type 4WRZM… for external electronics

For mating connectors, see page 19

Connector pin assignment



Mating connector pin assignment



Electrical connection (dimensions in mm)

Type 4WRZEM…, with integrated electronics (OBE)

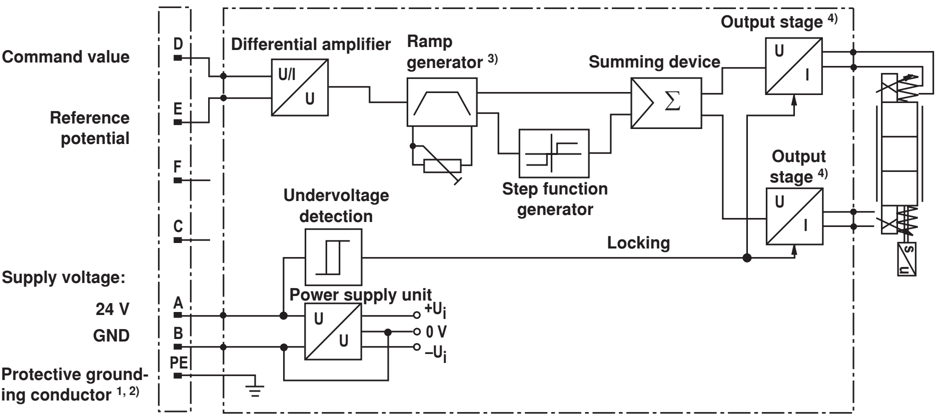
For mating connectors, see page 19

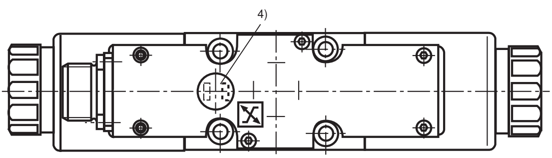
Connector pin assignment	Contact	Signal with A1	Signal at F1
Supply voltage	A	24 VDC ($\boldsymbol{u}$(t) = 19.4 to 35 V); $\boldsymbol{I}_{max}$ = 2 A	
	B	0 V	
Reference (actual value)	C	Cannot be used 1)	
Differential amplifier input	D	±10 V; $\boldsymbol{R}_e$ > 50 kΩ	4 to 20 mA; $\boldsymbol{R}_e$ > 100 Ω
(Command value)	E	Command value reference potential	
	F	Cannot be used 1)	
Protective grounding conductor	PE	Connected to cooling element and valve housing	

1) Contacts C and F must not be connected!

Mode of operation: A positive command value (0 to 10 V or 12 to 20 mA) at D and a reference potential at E result in a flow from P to A and B to T.
A negative command value (0 to –10 V or 12 to 4 mA) at D and a reference potential at E result in a flow from P to B and A to T.
If the valve and the solenoid are on side a (control spool variants **EA** and **W6A**), a reference potential at E and a positive command value at D (0 to 10 V or 4 to 20 mA) result in flow from P to B and A to T.

Block diagram of the integrated electronics





1) Port PE is connected to the cooling element and the valve housing

2) The protective grounding conductor is connected to the valve housing and cover

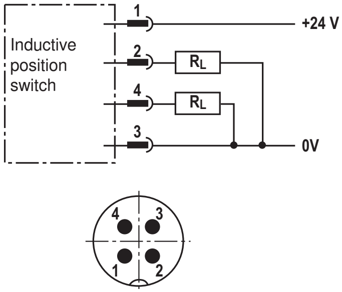
3) Ramp can be set from 0 to 2.5 s from the outside, identical for T_{up} and T_{down}

4) The output stages are current-controlled

Electrical connection (dimensions in mm)

Type 4WRZM… , 4WRZEM…, spool position indicator

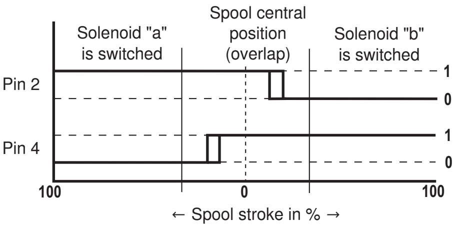
Connector pin assignment



	Pin	Signal	Mating connector wire color
Supply voltage	1	U_B = +24 V ± 4.8 V	Brown
Switching output 1	2	Switching status 0 (open): < 1.8 VDC Switching status 1 (closed): > U_B – 2.5 V (Limit load I_{max} = 250 mA)	White
Weight	3	0 V	Blue
Switching output 2	4	Switching status 0 (open): < 1.8 V DC Switching status 1 (closed): > U_B – 2.5 V (Limit load I_{max} = 250 mA)	Black

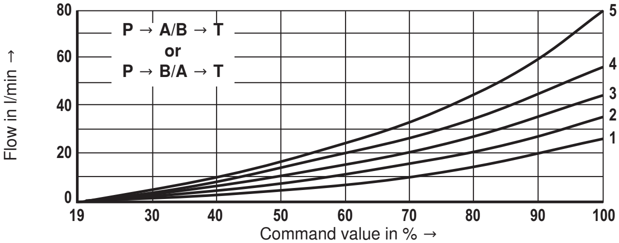
Notice: The position switch has no ground contact. Therefore, the use of protective extra-low voltage sources according to PELV (IEC64) is mandatory.

Switching logic



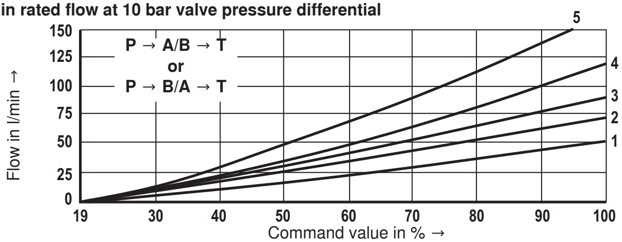
Characteristic curves size 10 (control spool "E, W6-, EA, W6A" as well as HLP46, ϑ_{oil} = 40 °C ±5 °C and p = 100 bar)

25 l/min rated flow at 10 bar valve pressure differential



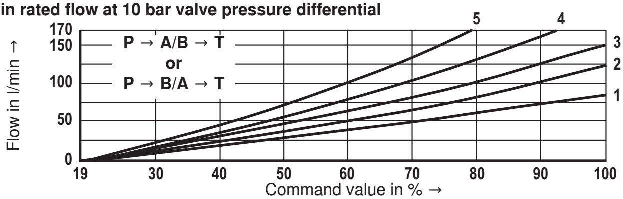
1 ***Δp*** = 10 bar, constant
2 ***Δp*** = 20 bar, constant
3 ***Δp*** = 30 bar, constant
4 ***Δp*** = 50 bar, constant
5 ***Δp*** = 100 bar, constant

50 l/min rated flow at 10 bar valve pressure differential



1 ***Δp*** = 10 bar, constant
2 ***Δp*** = 20 bar, constant
3 ***Δp*** = 30 bar, constant
4 ***Δp*** = 50 bar, constant
5 ***Δp*** = 100 bar, constant

85 l/min rated flow at 10 bar valve pressure differential

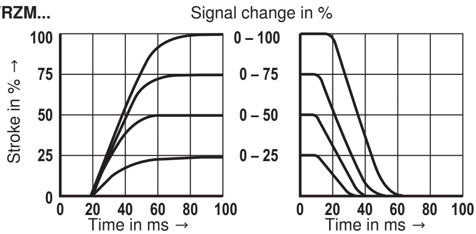


1 ***Δp*** = 10 bar, constant
2 ***Δp*** = 20 bar, constant
3 ***Δp*** = 30 bar, constant
4 ***Δp*** = 50 bar, constant
5 ***Δp*** = 100 bar, constant

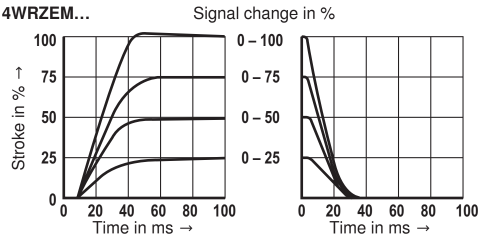
Δp = valve pressure differential according to DIN 24311 (inlet pressure p_P minus load pressure p_L minus return flow pressure p_T)

Transition functions with stepped, electric input signals, measured at p_{St} = 50 bar

Type 4WRZM...

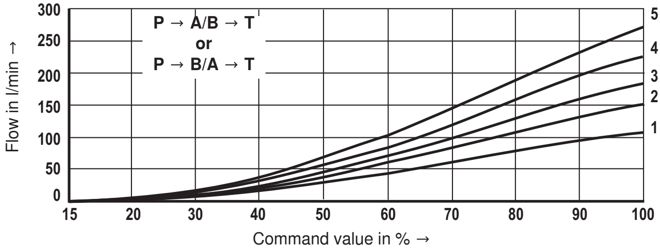


Type 4WRZEM...



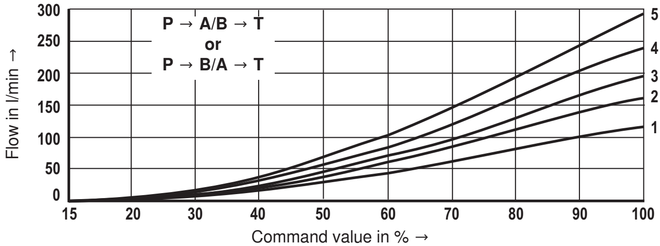
Characteristic curves size 16 (control spool "E, W6-, EA, W6A" as well as HLP46, ϑ_{oil} = 40 °C ±5 °C and p = 100 bar)

100 l/min rated flow at 10 bar valve pressure differential



1 **Δp** = 10 bar, constant
2 **Δp** = 20 bar, constant
3 **Δp** = 30 bar, constant
4 **Δp** = 50 bar, constant
5 **Δp** = 100 bar, constant

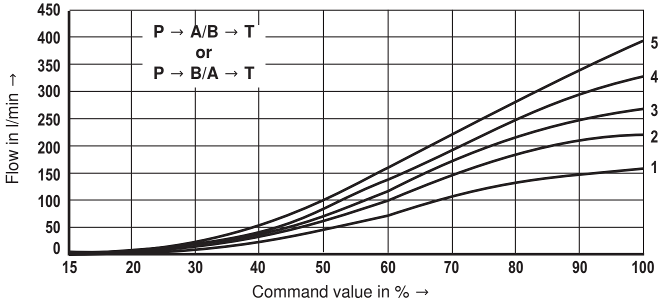
125 l/min rated flow at 10 bar valve pressure differential



1 **Δp** = 10 bar, constant
2 **Δp** = 20 bar, constant
3 **Δp** = 30 bar, constant
4 **Δp** = 50 bar, constant
5 **Δp** = 100 bar, constant

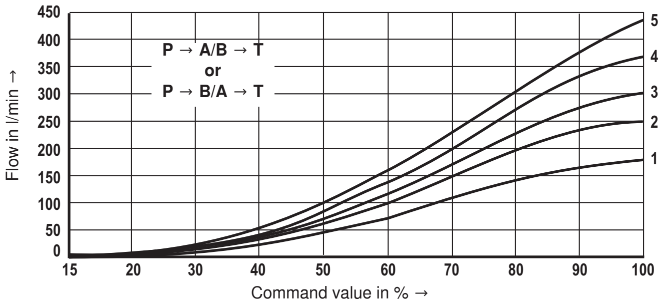
2

150 l/min rated flow at 10 bar valve pressure differential



1 **Δp** = 10 bar, constant
2 **Δp** = 20 bar, constant
3 **Δp** = 30 bar, constant
4 **Δp** = 50 bar, constant
5 **Δp** = 100 bar, constant

180 l/min rated flow at 10 bar valve pressure differential



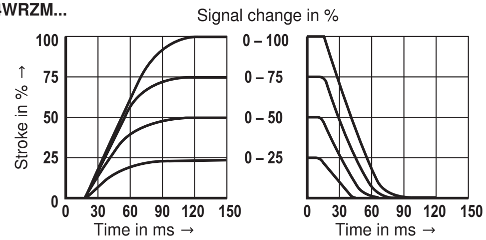
1 **Δp** = 10 bar, constant
2 **Δp** = 20 bar, constant
3 **Δp** = 30 bar, constant
4 **Δp** = 50 bar, constant
5 **Δp** = 100 bar, constant

Δp = valve pressure differential according to DIN 24311 (inlet pressure p_P minus load pressure p_L minus return flow pressure p_T)

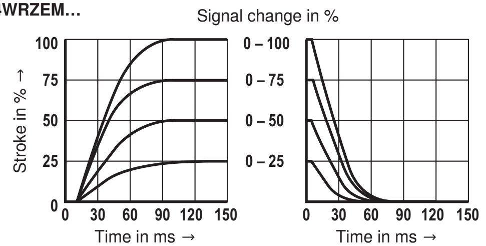
Characteristic curves size 16 (control spool "E, W6-, EA, W6A" as well as HLP46, ϑ_{oil} = 40 °C ±5 °C and p = 100 bar)

Transition functions with stepped, electric input signals, measured at p_{St} = 50 bar

Type 4WRZM...

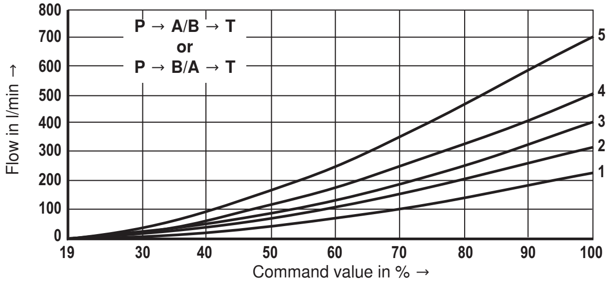


Type 4WRZEM…



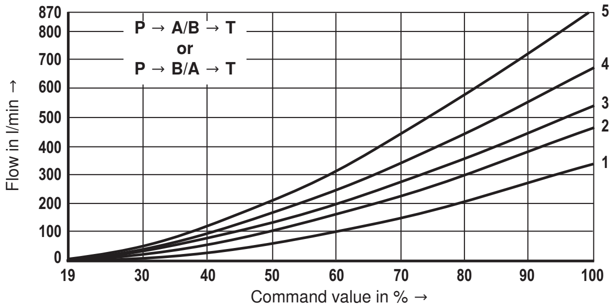
Characteristic curves size 25 (control spools "E, W6-, EA, W6A" as well as HLP46, ϑ_{oil} = 40 °C ±5 °C and p = 100 bar)

220 l/min rated flow at 10 bar valve pressure differential



1 **Δp** = 10 bar, constant
2 **Δp** = 20 bar, constant
3 **Δp** = 30 bar, constant
4 **Δp** = 50 bar, constant
5 **Δp** = 100 bar, constant

325 l/min rated flow at 10 bar valve pressure differential

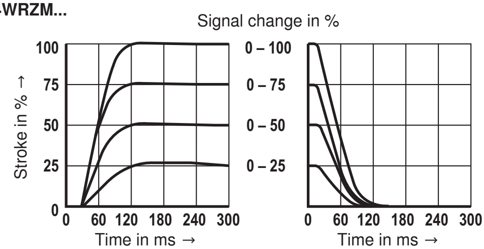


1 **Δp** = 10 bar, constant
2 **Δp** = 20 bar, constant
3 **Δp** = 30 bar, constant
4 **Δp** = 50 bar, constant
5 **Δp** = 100 bar, constant

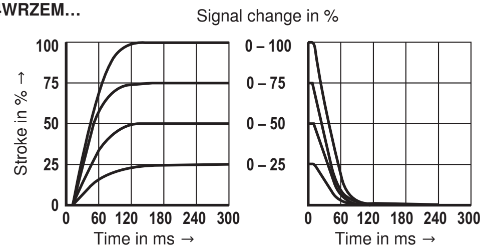
Δp = valve pressure differential according to DIN 24311 (inlet pressure p_P minus load pressure p_L minus return flow pressure p_T)

Transition functions with stepped, electric input signals, measured at p_{St} = 50 bar

Type 4WRZM...

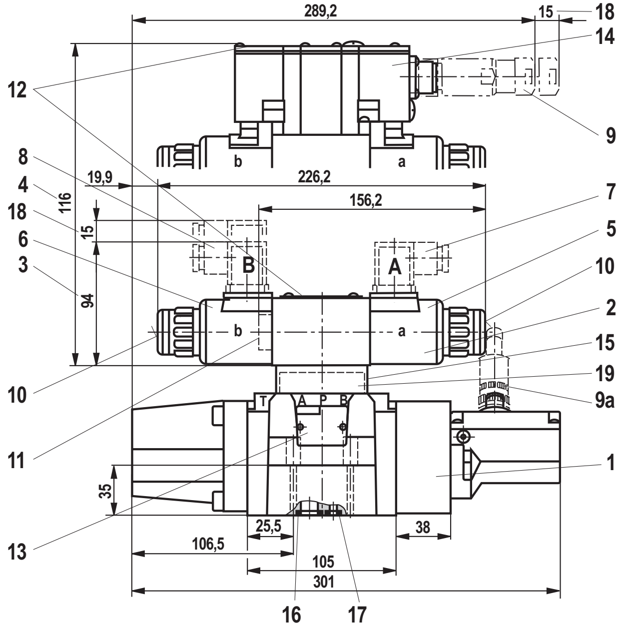


Type 4WRZEM…

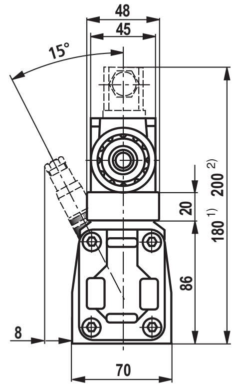


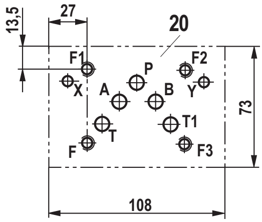
2

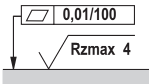
Dimensions: Size 10 (dimensions in mm)



¹⁾ without pressure reducing valve
²⁾ with pressure reducing valve







Required surface quality of the valve contact surface

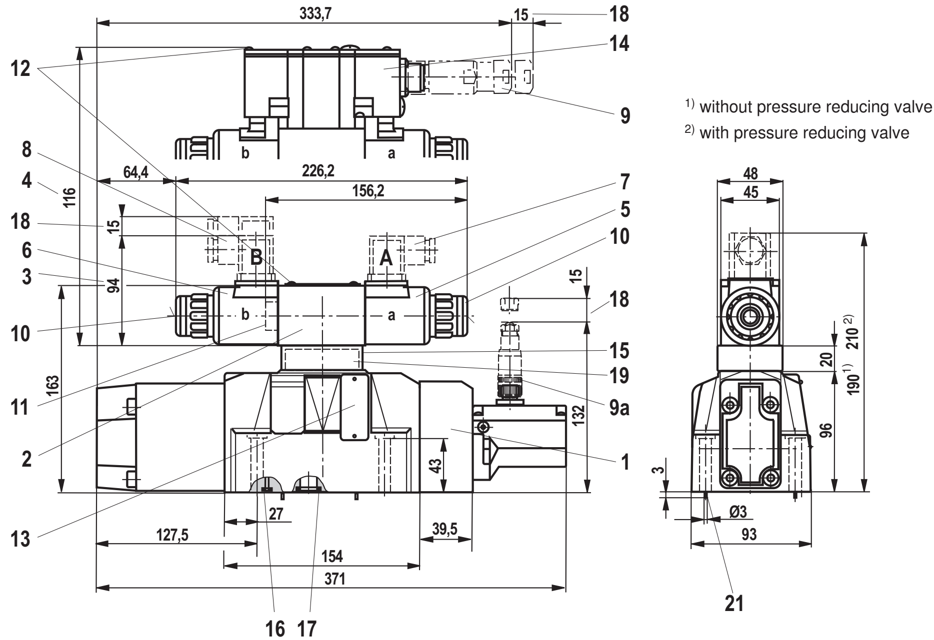
1. Main valve
2. Pilot control valve
3. Dimension for version "4WRZM..."
4. Dimension for version "4WRZEM..."
5. Proportional solenoid "a"
6. Proportional solenoid "b"
7. Mating connector "A", separate order, see page 19
8. Mating connector "B", separate order, see page 19
9. Mating connector, separate order, see page 19

9a Mating connector, separate order, see page 19

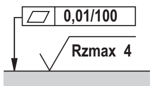
10. Concealed manual override "N9"
11. Plug screw for valves with one solenoid
12. Name plate for pilot control valve
13. Name plate for main valve
14. Integrated electronics (OBE)
15. Pressure reducing valve "D3"
16. Identical seal rings for ports A, B, P, T, and T1
17. Identical seal rings for ports X and Y
18. Space required for removing the mating connector
19. Diversion plate (type 4WRHM...)
20. Machined installation surface, porting pattern according to ISO 4401-05-05-0-05, ports X and Y as required

For subplates and valve mounting screws, see page 19

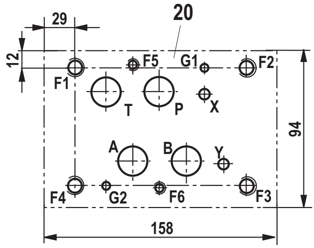
Dimensions: Size 16 (dimensions in mm)



1) without pressure reducing valve
2) with pressure reducing valve



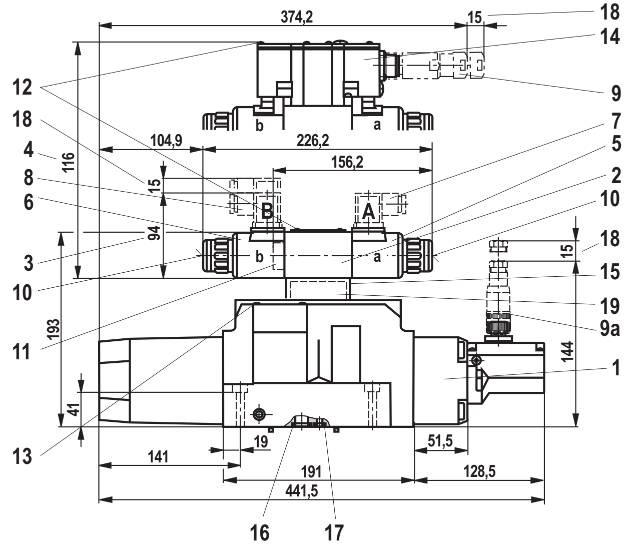
Required surface quality of the valve contact surface



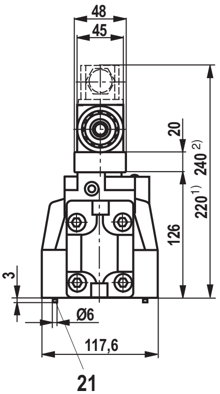
1 Main valve
2 Pilot control valve
3 Dimension for version "4WRZM..."
4 Dimension for version "4WRZEM..."
5 Proportional solenoid "a"
6 Proportional solenoid "b"
7 Mating connector "A", separate order, see page 19
8 Mating connector "B", separate order, see page 19
9 Mating connector, separate order, see page 19
9a Mating connector, separate order, see page 19
10 Concealed manual override "N9"
11 Plug screw for valves with one solenoid
12 Name plate for pilot control valve
13 Name plate for main valve
14 Integrated electronics (OBE)
15 Pressure reducing valve "D3"
16 Identical seal rings for ports A, B, P, and T
17 Identical seal rings for ports X and Y
18 Space required for removing the mating connector
19 Diversion plate (type 4WRHM...)
20 Machined installation surface, porting pattern according to ISO 4401-07-07-0-05,
ports X and Y as required
Deviating from the standard: Ports A, B, P, and T = Ø20 mm
21 Locking pin

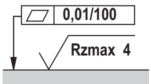
For subplates and valve mounting screws, see page 19

Dimensions: Size 25 (dimensions in mm)

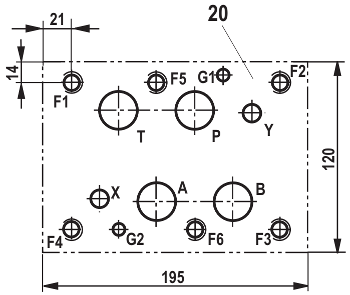


1) without pressure reducing valve
2) with pressure reducing valve





Required surface quality of the valve contact surface



1 Main valve
2 Pilot control valve
3 Dimension for version "4WRZM..."
4 Dimension for version "4WRZEM..."
5 Proportional solenoid "a"
6 Proportional solenoid "b"
7 Mating connector "A", separate order, see page 19
8 Mating connector "B", separate order, see page 19
9 Mating connector, separate order, see page 19
9a Mating connector, separate order, see page 19
10 Concealed manual override "N9"
11 Plug screw for valves with one solenoid
12 Name plate for pilot control valve
13 Name plate for main valve
14 Integrated electronics (OBE)
15 Pressure reducing valve "D3"
16 Identical seal rings for ports A, B, P, and T
17 Identical seal rings for ports X and Y
18 Space required for removing the mating connector
19 Diversion plate (type 4WRHM...)
20 Machined installation surface, porting pattern according to ISO 4401-08-08-0-05
21 Locking pin

For subplates and valve mounting screws, see page 19

Dimensions

Hexagon socket head cap screws		Material number
Size 10	4x ISO 4762 - M6 x 45 - 10.9-flZn-240h-L Tightening torque M_A = 13.5 Nm ±10% or 4x ISO 4762 - M6 x 45 - 10.9 Tightening torque M_A = 15.5 Nm ±10%	R913000258
Size 16	2x ISO 4762 - M6 x 60 - 10.9-flZn-240h-L Tightening torque M_A = 12.2 Nm ±10% 4x ISO 4762 - M10 x 60 - 10.9-flZn-240h-L Tightening torque M_A = 58 Nm ±20% or 2x ISO 4762 - M6 x 60 - 10.9 Tightening torque M_A = 15.5 Nm ±10% 4x ISO 4762 - M10 x 60 - 10.9 Tightening torque M_A = 75 Nm ±20%	R913000115 R913000116
Size 25	6x ISO 4762 - M12 x 60 - 10.9-flZn-240h-L Tightening torque M_A = 100 Nm ±20% or 6x ISO 4762 - M12 x 60 - 10.9 Tightening torque M_A = 130 Nm ±20%	R913000121

Notice: The tightening torque of the hexagon socket head cap screws refers to maximum operating pressure.

Subplates	Data sheet
Size 10	45054
Size 16	45056
Size 25	45058

Accessories (not included in the scope of delivery)

Mating connectors		Material number
Mating connector for 4WRZM	DIN EN 175201-803, see data sheet 08006	Solenoid a, gray, R901017010
		Solenoid b, black, R901017011
Mating connector for 4WRZEM	DIN EN 175201-804, see data sheet 08006	e.g. R900021267 (plastic)
		e.g. R900223890 (metal)
Mating connector for spool position indicator	IEC 60947-5-2, see data sheet 08006	e.g. R900031155 (M12x1 with screw connection)
		e.g. R900082899 (M12x1 with screw connection, angled, rotatable 4x90°)

2

Safety instructions

Instructions on project planning, installation and commissioning

- When implementing safety-related controls comply with the applicable industry-specific standards and regulations.
- Due to the flexible use of valves in systems, the user has to check and ensure that the product characteristics comply with all functional and safety requirements of the overall system.
- Make sure that there are no switching shocks and that the valve spool does not vibrate.
- Valves with spool position indicators may only be installed, adjusted, commissioned and maintained by specialists trained in hydraulics and electronics.
  Improper work at safety-related parts of controls may result in personal injury and damage to property!

The following applies to all work carried out at the valve:

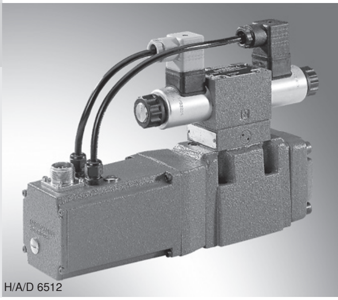
- Valves with spool position indicators must not be disassembled.
- Parts of the valves must not be exchanged.
- Integrated throttles must not be removed or modified.
- The spool position indicator may only be adjusted by the valve manufacturer.

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
documentation@boschrexroth.de
www.boschrexroth.de

Proportional directional valves, pilot operated, with electrical position feedback and integrated electronics (OBE)

RE 29075/05.13
Replaces: 08.04

Type 4WRKE


H/A/D 6512

Size 10 to 35
Component series 3X
Maximum operating pressure 350 bar
Maximum flow 3,000 l/min

Table of contents

Features

– Pilot operated 2-stage proportional directional valve with electrical position feedback of the main control spool and integrated electronics (OBE)
– Control of flow direction and size of a flow
– Operation by means of proportional solenoids
– Subplate mounting:
Porting pattern according to ISO 4401
– Electrical position feedback
– Spring-centered main control spool
– Pilot control valve:
Single-stage proportional directional valve
– Main stage with position control

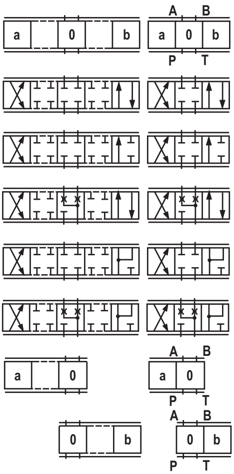
Ordering code

4WRKE				–3X/6E	G24		K31/		D3		*

Electrically operated 2-stage proportional directional valve in 4-way version with integrated electronics

Size 10	**= 10**
Size 16	**= 16**
Size 25	**= 25**
Size 27	**= 27**
Size 32	**= 32**
Size 35	**= 35**

Symbols



= E
= E1-
= E3-
= W6-
= W8-
= R
= R3-
= EA [1)]
= W6A
= EB [1)]
= W6B

With symbol E1-, W8-:
P → A : q_V B → T: $q_V/2$
P → B: $q_V/2$ A → T: q_V

With symbol R; R3:
P → A : q_V B → P: $q_V/2$
P → B : $q_V/2$ A → T: q_V

Notice:

In the zero position, spools W6-, W8- and R3- have a connection from A to T and B to T with approx. 2% of the relevant nominal cross-section.

Rated flow

25 = [2)]	or	**50 =** [3)]	or	**100 =**			Size 10
125 = [3)]	or	**150 =** [3)]	or	**200 =**	or	**220 =**	Size 16
220 = [3)]	or	**350 =**					Size 25
500 =							Size 27
400 =	or	**600 =**					Size 32
1000 =							Size 35

Characteristic curve form

L = Linear
P = Linear with fine control range

3X = Component series 30 to 39
(30 to 39: Unchanged installation and connection dimensions)

6E = Proportional solenoid with detachable coil

Supply voltage

G24 = Direct voltage 24 V

Pilot oil supply and drain

no code = Pilot oil supply external, pilot oil drain external
E = Pilot oil supply internal, pilot oil drain external
ET = Pilot oil supply internal, pilot oil drain internal
T = Pilot oil supply external, pilot oil drain internal

Electrical connection

K31 = **Without** mating connector with connector according to DIN EN 175201-804
Mating connector – separate order see page 21

Electronics interface

C1 = Command value/ actual value ±10 mA
A1 = [4)] Command value/ actual value ±10 V
F1 = Command value/ actual value 4 to 20 mA

D3 = With pressure reducing valve ZDR 6 DP0-4X/40YM-W80 (non-adjustable)

M = NBR seals
V = FKM seals

Further details in the plain text

[1)] **Examples:** Spool with spool position "a" (P → B) ordering code ..**EA**.. or **W6A**
Spool with spool position "b" (P → A) ordering code ..**EB**.. or **W6B**

[2)] Only E and W6- available with characteristic curve form **L** (linear)

[3)] Only E1- and W8- available with characteristic curve form **L** (linear)

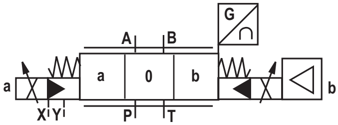
[4)] When replacing the component series 2X with component series 3X the electronics interface is to be defined with **A5** (enable signal at pin C)

Symbols

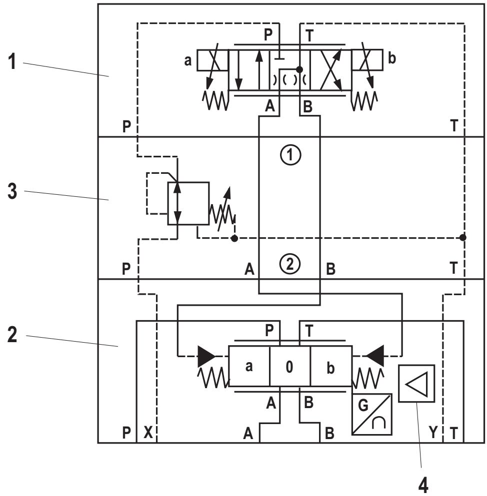
Simplified

Example:

Pilot oil supply external
Pilot oil drain external



Detailed



Example:

1 Pilot control valve type 4WRAP 6…

2 Main valve

3 Pressure reducing valve
type ZDR 6 DP0-4X/40YM-W80

4 Integrated electronics (OBE)

Function, section

Pilot control valve type 4WRAP 6 W7.3X/G24… (1st stage)

The pilot control valve is a direct operated proportional valve. The control edge dimensions have been optimized for use as a pilot control valve for proportional directional valves type 4WRKE.

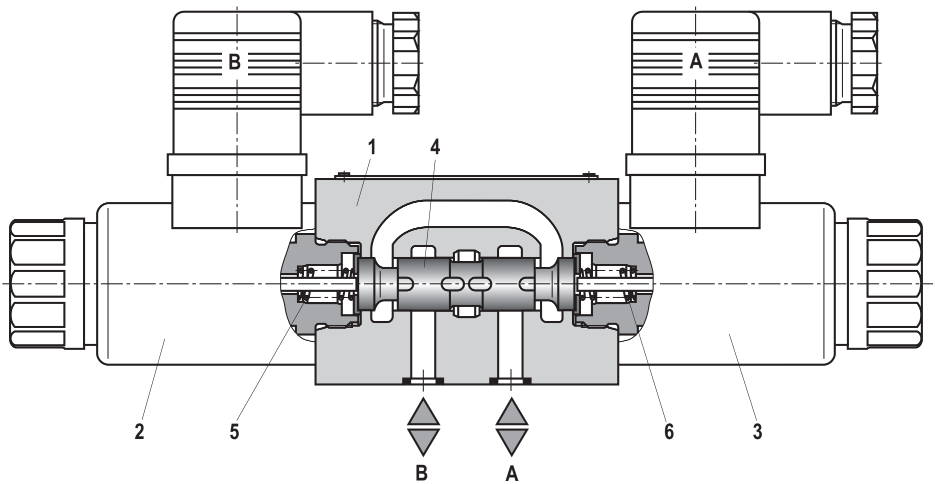
The proportional solenoids are pressure-tight, wet-pin AC solenoids with detachable coils. They transfer electric current proportionally into mechanical force. An increase of the current strength results in a correspondingly higher magnetic force. The set magnetic force remains the same during the total control stroke.

The pilot control valve mainly consists of the housing (1), the proportional solenoid (2 and 3), the valve control spool (4) and springs (5 and 6).

In a non-actuated state both actuators are connected to the tank. If one of the two solenoids (2 or 3) is excited, the magnetic force will move the valve control spool (4) towards the spring (5 or 6).

After having overcome the overlap area, the connection of one of the two actuators is blocked and the connection to the pressroom is made. There is a flow from P to the control chamber of the main stage.

Type 4WRAP 6 W7.3X/G24…



Function, section, valve particularities

Valves of type 4WRKE are 2-stage proportional directional valves.

They control the of flow direction and size.

The main stage is position-controlled so that the control spool position is independent from flow forces also in the case of bigger flows.

The valves mainly consist of the pilot control valve (1), the housing (8), the main control spool (7), the covers (5 and 6), the centering spring (4), the inductive position transducer (9) and the pressure reducing valve (3).

If there is no input signal, the main control spool (7) will be kept in the central position by the centering spring (4). Both control chambers in the covers (5 and 6) are connected to the tank via the valve control spool (2).

The main control spool (7) is connected to suitable control electronics via the inductive position transducer (9). Both the change of position of the main control spool (7) and the change of the command value at the junction summing of the amplifier create a differential voltage.

During the comparison of command and actual value a possible control deviation is determined via the electronics and the proportional solenoid of the pilot control valve (1) is supplied with current.

The current induces a force in the solenoid which operates the control spool via a plunger in a row. The flow which has been released via the control cross sections causes an adjustment of the main control spool.

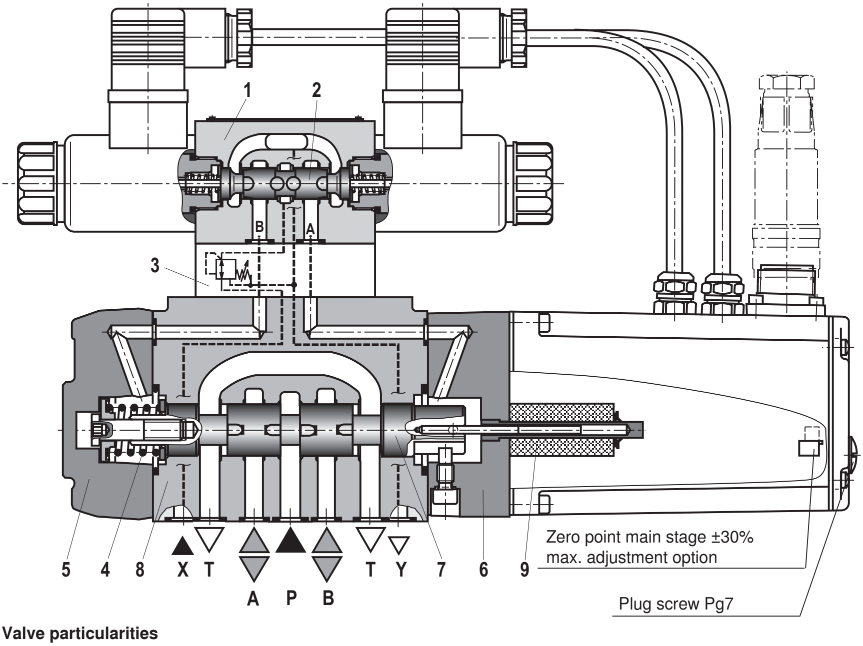
The main control spool (7) with the core of the inductive position transducer (9) attached to it is displaced until the actual value corresponds to the command value. In a controlled state the main control spool (7) is balanced and kept in this control position.

The control spool stroke and the control opening change proportionally to the command value.

The control electronics are integrated in the valve. By adjusting valve and electronics, the deviation in series production of the devices is kept low.

The tank lines must not be allowed to run empty; a preload valve is to be installed in the case of a corresponding installation condition (counterbalance pressure approx. 2 bar).

2



Valve particularities

- The 2nd stage is mainly built up from components of our proportional valves.
- The zero point adjustment at **"zero point main stage"** is made at the factory and can be adjusted in a range of ±30% of the nominal stroke via a potentiometer in the control electronics. Access in the integrated control electronics by removing a plug screw on the front side of the cover housing.
- When the pilot control valve or the control electronics are exchanged, they are to be re-adjusted. All adjustments may be implemented by instructed experts only.

☞ **Notice!**

Changes in the zero point may result in damage to the system and may only be implemented by instructed specialists!

Technical data (for applications outside these parameters, please consult us!)

general

Sizes	Size	10	16	25	27	32	35
Installation position and commissioning information		Preferably horizontal, see RE 07800					
Storage temperature range	°C	–20 to +80					
Ambient temperature range	°C	–20 to +50					
Weight	kg	8.7	11.2	16.8	17	31.5	34
Sine test according to DIN EN 60068-2-6:2008 [1]		10 cycles, 10...2,000..10 Hz with logarithmic frequency changing speed of 1 oct./min, 5 to 57 Hz, amplitude 1.5 mm (p-p), 57 to 2,000 Hz, amplitude 10 g, 3 axes					
Random test according to DIN EN 60068-2-64:2009 [1]		20…2,000 Hz, amplitude 0.05 g^2/Hz (10 g_{RMS}) 3 axes, testing time 30 min per axis					
Shock test according to DIN EN 60068-2-27:2010 [1]		Half sine 15 g / 11 ms, 3 times in positive and 3 times in negative direction per axis, 3 axes					
Humid heat, cyclic according to DIN EN 60068-2-30:2006		Variant 2 +25 °C to +55 °C, 90% to 97% relative humidity, 2 cycles with 24 hours each					

1) The information on mechanical load applies to the fastening level of the integrated valve electronics.

hydraulic (measured at p = 100 bar with HLP46 at 40 °C ± 5 °C)

				10	16	25	27	32	35
Operating pressure	Pilot control valve	Pilot oil supply	bar	25 to 315					
	Main valve, connection P, A, B		bar	Up to 315	Up to 350	Up to 350	Up to 210	Up to 350	Up to 350
Return flow pressure	Connection T	Pilot oil drain, internal	bar	Static < 10 (pilot control valve)					
		Pilot oil drain, external	bar	Up to 315	Up to 250	Up to 250	Up to 210	Up to 250	Up to 250
	Connection Y		bar	Static < 10 (pilot control valve)					
Rated flow q_{Vnom} ±10% with Δp = 10 bar Δp = valve pressure differential			l/min	– 25 50 100	125 150 200 220	– – 220 350	– – – 500	– – 400 600	– – – 1000
Recommended maximum flow			l/min	170	460	870	1000	1600	3000
Pilot oil flow at port X and/or Y with stepped input signal from 0 to 100% (315 bar)			l/min	4.1	8.5	11.7	11.7	13.0	13.0
Hydraulic fluid				See table page 7					
Maximum admissible degree of contamination of the hydraulic fluid - cleanliness class according to ISO 4406 (c)				Pilot control valve: Class 17/15/12 [1] Main stage: Class 20/18/15 [1]					
Hydraulic fluid temperature range			°C	–20 to +80, preferably +40 to +50					
Viscosity range			mm^2/s	20 to 380, preferably 30 to 45					
Hysteresis			%	≤ 1					
Response sensitivity			%	≤ 0.5					

1) The cleanliness classes stated for the components need to be maintained in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.
For the selection of the filters see www.boschrexroth.com/filter

Technical data (for applications outside these parameters, please consult us!))

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons		HL, HLP	NBR, FKM	DIN 51524
Flame-resistant	– containing water	HFC (Fuchs HYDROTHERM 46M, Petrofer Ultra Safe 620)	NBR	ISO 12922
Phosphoric acid ester		HFD-R	FKM	

Important information on hydraulic fluids!
- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.)!
- The flash point of the process and operating medium used must be 40 K greater than the maximum solenoid surface temperature.
- **Flame-resistant – containing water**: Maximum pressure differential per control edge 175 bar. Pressure pre-loading at the tank port > 20% of the pressure differential; otherwise, increased cavitation.
- Life cycle as compared to operation with mineral oil HL, HLP 50% to 100%

2

electrical

Voltage type		Direct voltage
Signal type		Analog
Maximum power	W	72 (average = 24 W)
Electrical connection		Mating connector according to DIN EN 175201-804
Protection class of the valve according to EN 60529		IP65 with mating connector mounted and locked
Control electronics		Integrated in the valve, see page 8

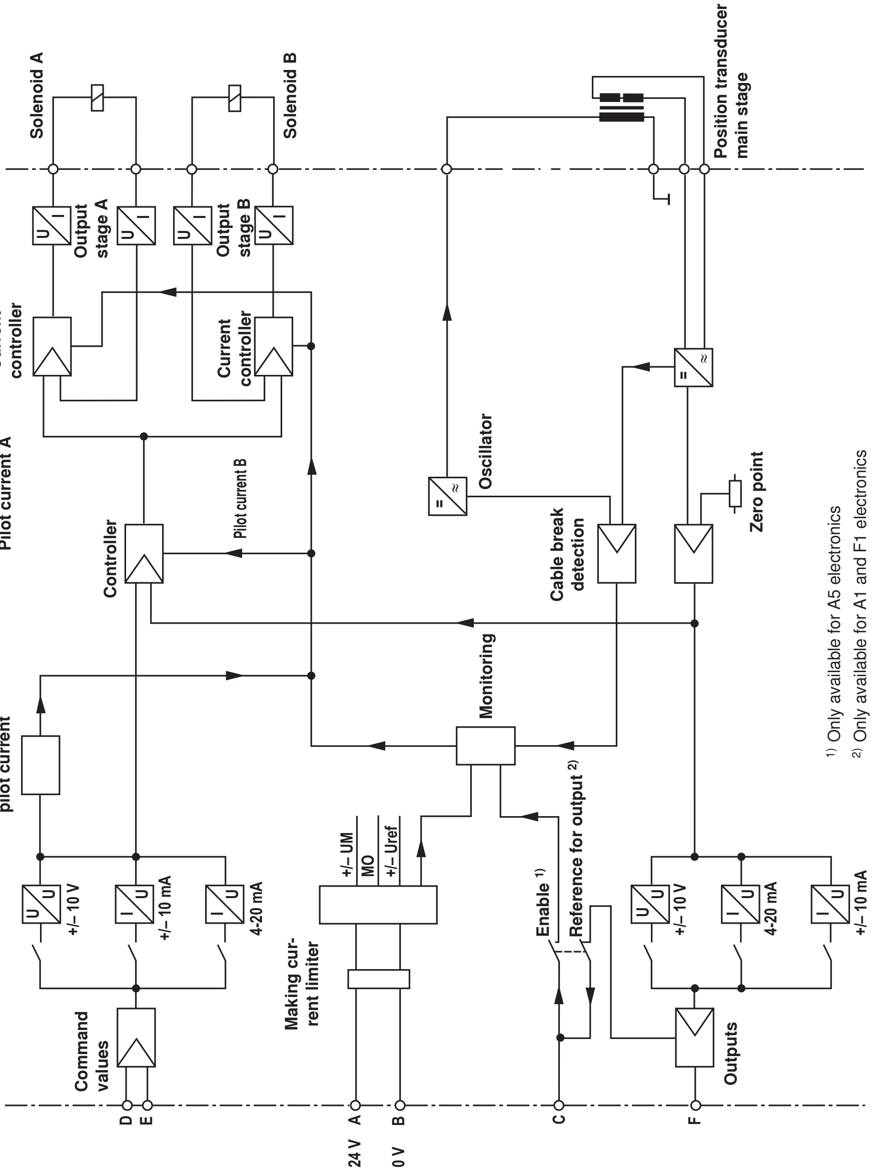
Connector pin assignment	Contact	Signal with A1	Signal with F1	Signal with A5
Supply voltage	A	24 VDC (18 to 35 VDC); I_{max} = 1.5 A; impulse load ≤ 3 A		
	B	0 V		
Reference (actual value)	C	Reference potential for actual value (contact "F")		Enable 4 to 24 V
Differential amplifier input	D	±10 V	4 to 20 mA	±10 V
(Command value)	E	0 V reference potential to pin D		0 V reference potential for pin D and F
Measuring output (actual value)	F	±10 V	4 to 20 mA	±10 V
	PE	Connected to cooling element and valve housing		

Command value: Reference potential at E and positive command value at D result in flow from P → A and B → T.
Reference potential at E and negative command value at D result in flow from P → B and A → T.

Connection cable: Recommendation: – Up to 25 m line length: Type LiYCY 7 x 0.75 mm²
– Up to 50 m line length: Type LiYCY 7 x 1.0 mm²
Only connect the shield to PE on the supply side.

Notice: **Electric signals taken out via valve electronics (e.g. actual value) must not be used for switching off safety-relevant machine functions!**

Block diagram of the integrated electronics (OBE)

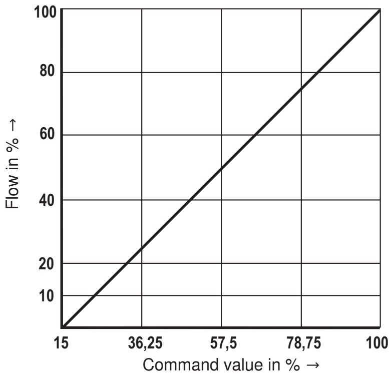


Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

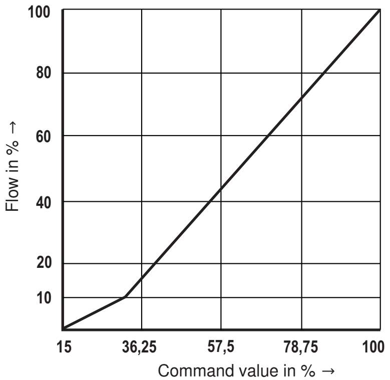
Flow command value function with e.g.
P → A / B → T 10 bar valve pressure differential or
P → A or A → T 5 bar per control edge

Control spool E, W, and R

Control spool with characteristic curve **L**

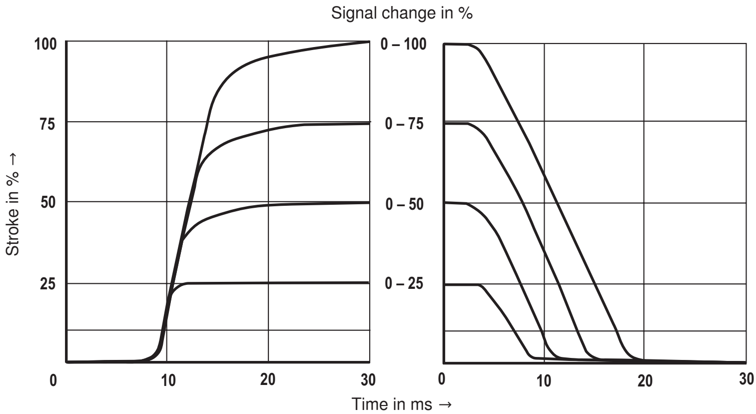


Control spool with characteristic curve **P**



Characteristic curves: Size 10 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

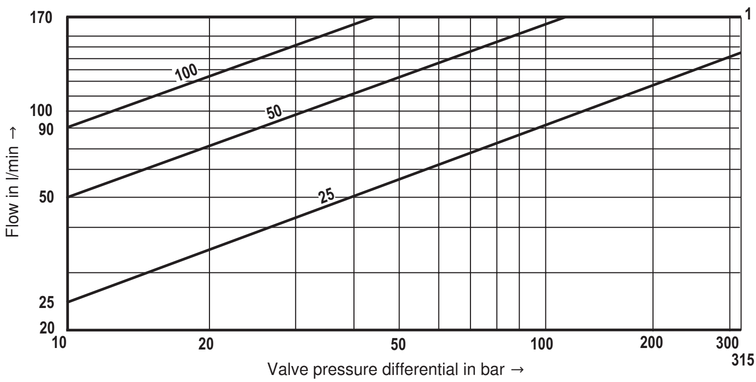
Transition function with stepped electric input signals



Measured with p_S = 100 bar

Flow/load function with maximum valve opening

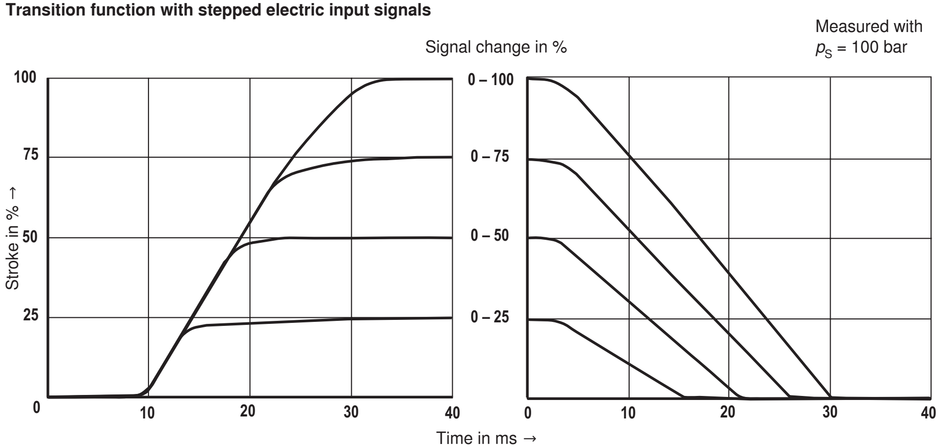
(tolerance ±10%)



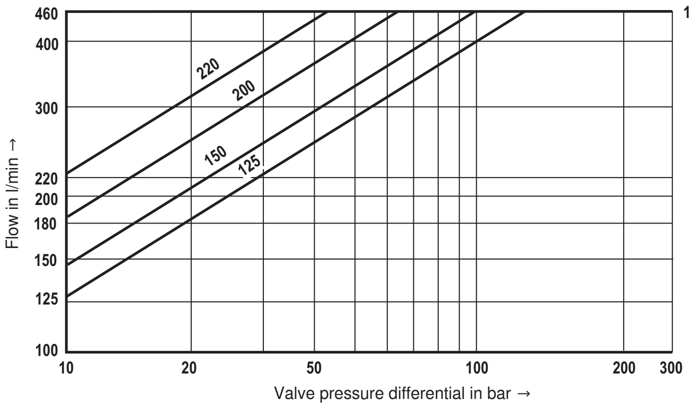
1 = Recommended flow limitation (flow velocity 30 m/s) in the valve connection bores

Characteristic curves: Size 16 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Transition function with stepped electric input signals



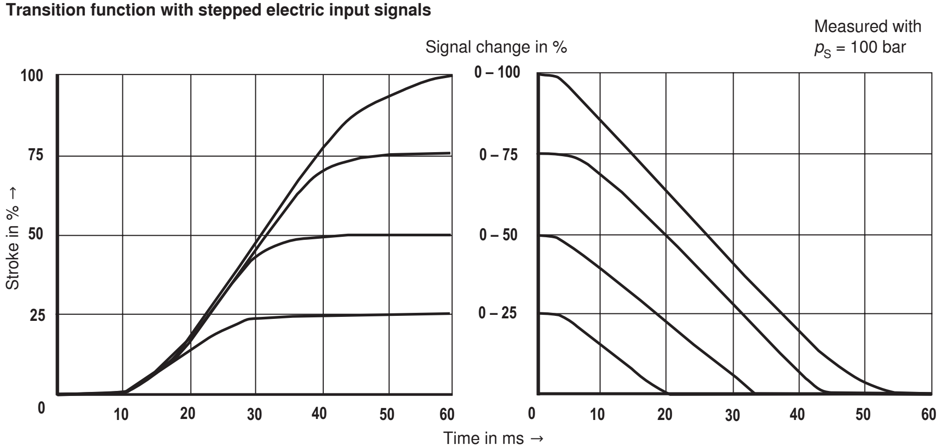
Flow/load function with maximum valve opening
(tolerance ±10%)



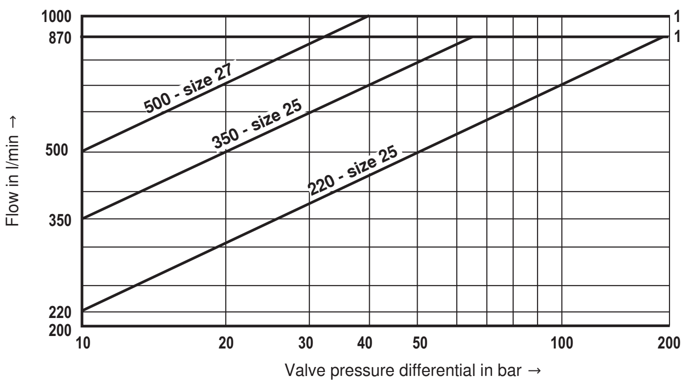
1 = Recommended flow limitation (flow velocity 30 m/s) in the valve connection bores

Characteristic curves: Size 25 and 27 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Transition function with stepped electric input signals



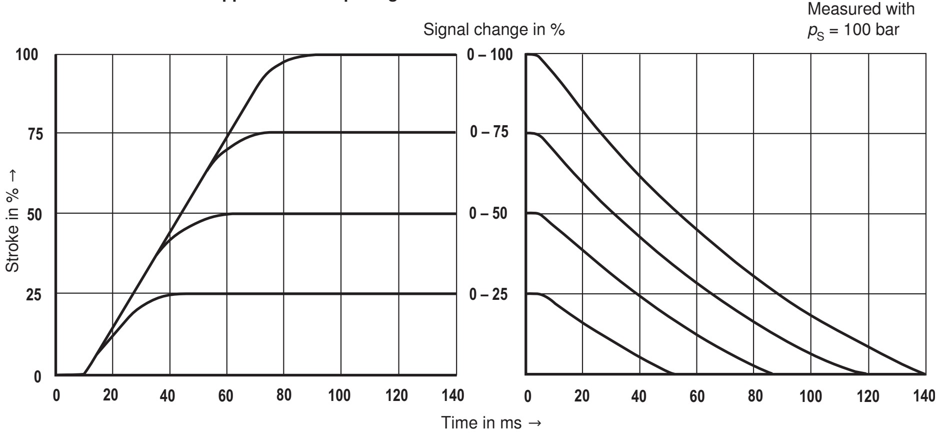
Flow/load function with maximum valve opening
(tolerance ±10%)



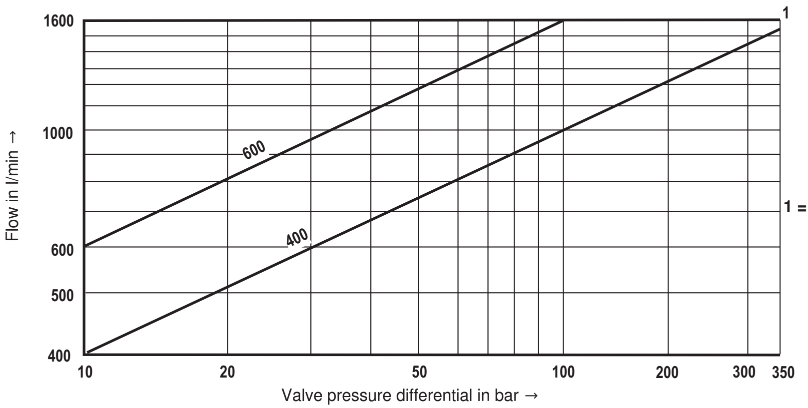
1 = Recommended flow limitation (flow velocity 30 m/s) in the valve connection bores

Characteristic curves: Size 32 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Transition function with stepped electric input signals



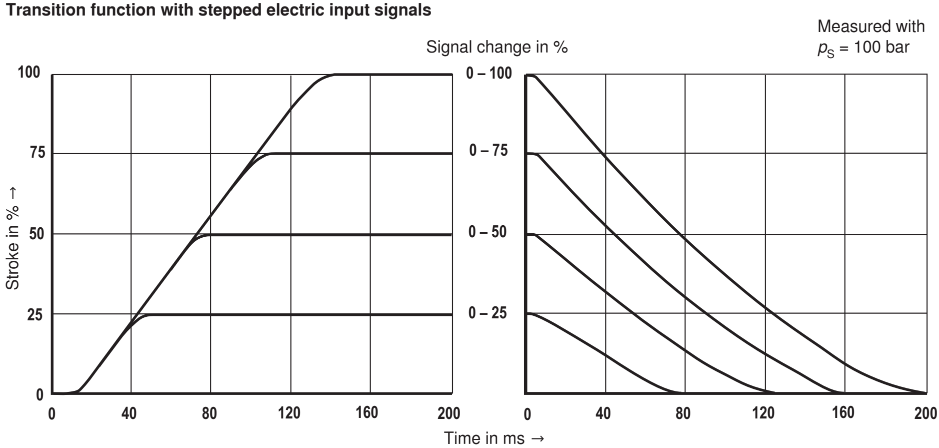
Flow/load function with maximum valve opening
(tolerance ±10%)



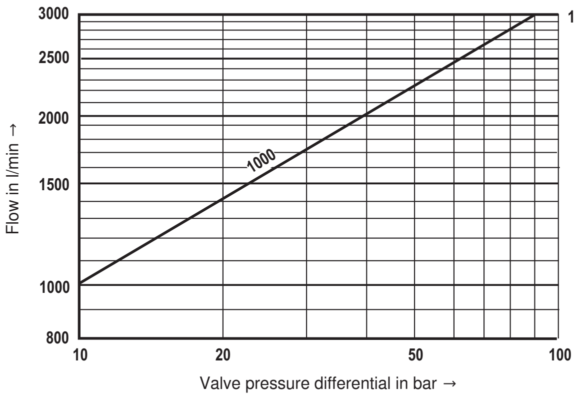
1 = Recommended flow limitation (flow velocity 30 m/s) in the valve connection bores

Characteristic curves: Size 35 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Transition function with stepped electric input signals

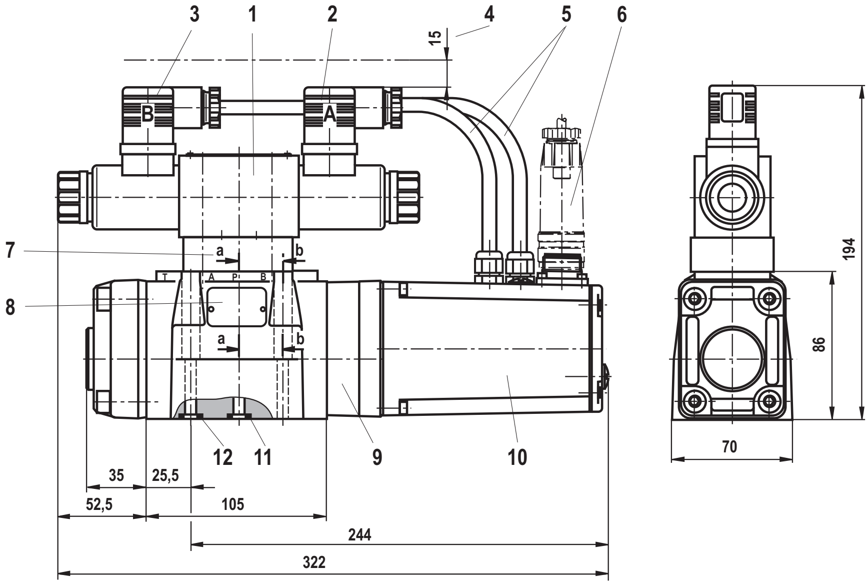


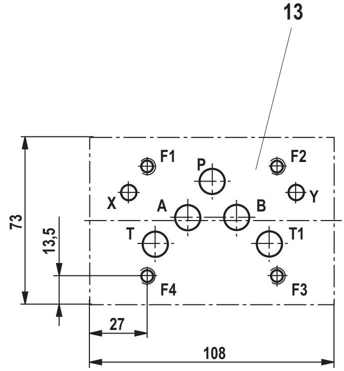
Flow/load function with maximum valve opening
(tolerance ±10%)

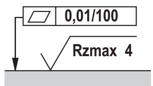


1 = Recommended flow limitation (flow velocity 30 m/s) in the valve connection bores

Dimensions: Size 10 (dimensions in mm)





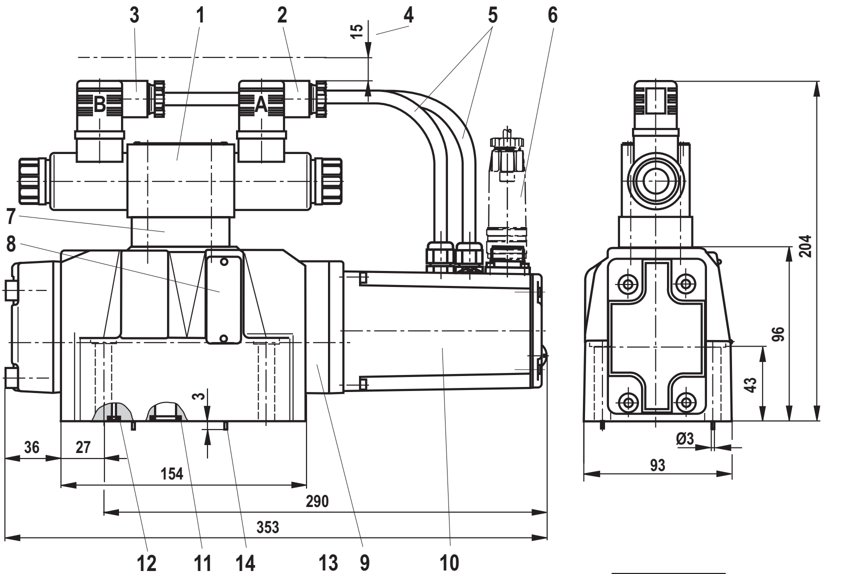


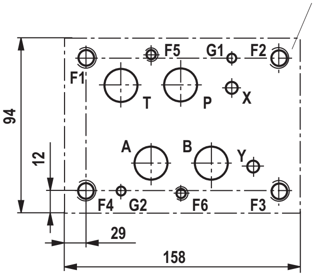
Required surface quality of the valve contact surface

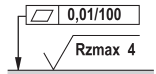
1 Pilot control valve
2 Mating connector "A", color gray
3 Mating connector "B", color black
4 Space required for connection cable and to remove the mating connector
5 Wiring
6 Mating connector, separate order, see page 21
7 Pressure reducing valve
8 Name plate
9 Main valve
10 Integrated electronics (OBE)
11 Identical seal rings for connection A, B, P, T
12 Identical seal rings for connection X, Y
13 Processed valve contact surface, porting pattern according to ISO 4401-05-05-0-05 (connection X, Y, as required)

Subplates and valve mounting screws see page 21

Dimensions: Size 16 (dimensions in mm)







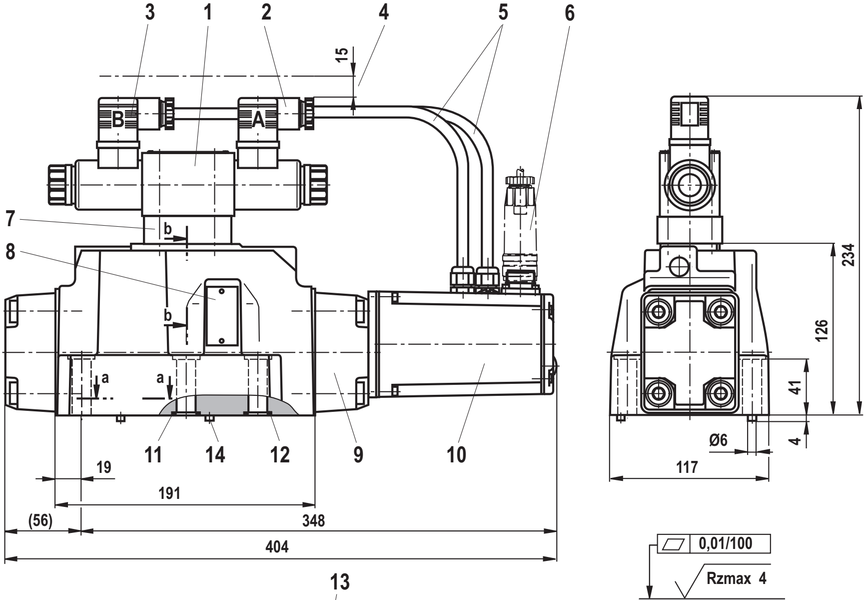
Required surface quality of the valve contact surface

1 Pilot control valve
2 Mating connector "A", color gray
3 Mating connector "B", color black
4 Space required for connection cable and to remove the mating connector
5 Wiring
6 Mating connector, separate order, see page 21
7 Pressure reducing valve
8 Name plate
9 Main valve
10 Integrated electronics (OBE)
11 Identical seal rings for connection A, B, P, T
12 Identical seal rings for connection X, Y
13 Processed valve contact surface, porting pattern according to ISO 4401-07-07-0-05 (connection X, Y as required) deviating from the standard:
- Connection A, B, T and P Ø 20mm

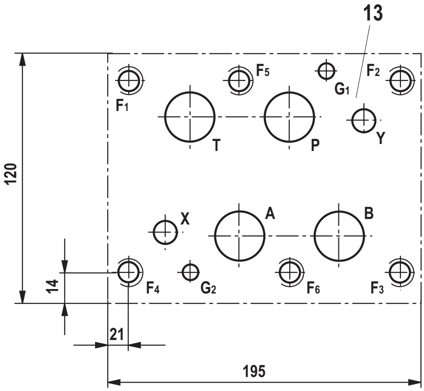
14 Locking pin

Subplates and valve mounting screws see page 21

Dimensions: Size 25 (dimensions in mm)



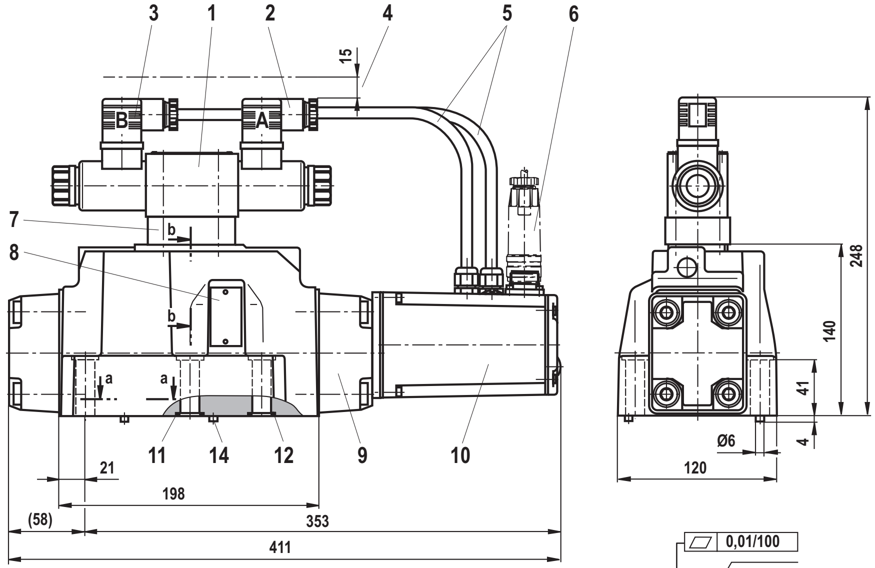
Required surface quality of the valve contact surface

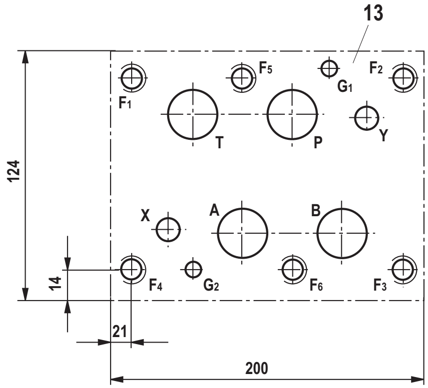


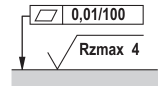
1 Pilot control valve
2 Mating connector "A", color gray
3 Mating connector "B", color black
4 Space required for connection cable and to remove the mating connector
5 Wiring
6 Mating connector, separate order, see page 21
7 Pressure reducing valve
8 Name plate
9 Main valve
10 Integrated electronics (OBE)
11 Identical seal rings for connection A, B, P, T
12 Identical seal rings for connection X, Y
13 Processed valve contact surface, porting pattern according to ISO 4401-08-08-0-05 (connection X, Y, as required)
14 Locking pin

Subplates and valve mounting screws see page 21

Dimensions: Size 27 (dimensions in mm)







Required surface quality of the valve contact surface

1 Pilot control valve

2 Mating connector "A", color gray

3 Mating connector "B", color black

4 Space required for connection cable and to remove the mating connector

5 Wiring

6 Mating connector, separate order, see page 21

7 Pressure reducing valve

8 Name plate

9 Main valve

10 Integrated electronics (OBE)

11 Identical seal rings for connection A, B, P, T

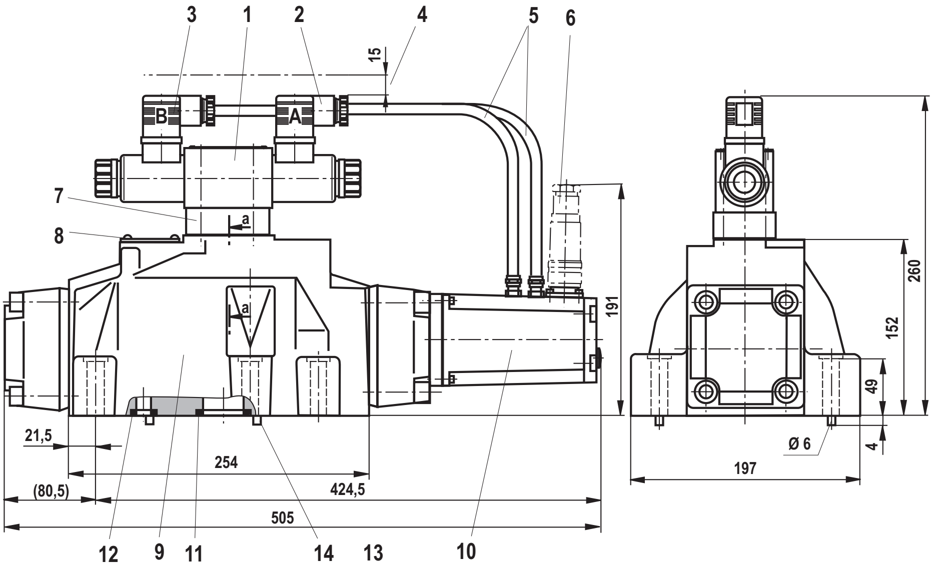
12 Identical seal rings for connection X, Y

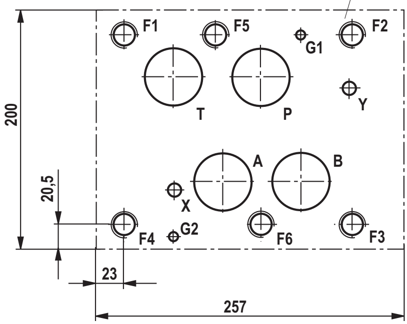
13 Processed valve contact surface, porting pattern according to ISO 4401-08-08-0-05 (connection X, Y as required) deviating from the standard:
- Connection A, B, T and P Ø 32 mm

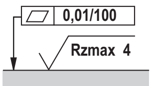
14 Locking pin

Subplates and valve mounting screws see page 21

Dimensions: Size 32 (dimensions in mm)







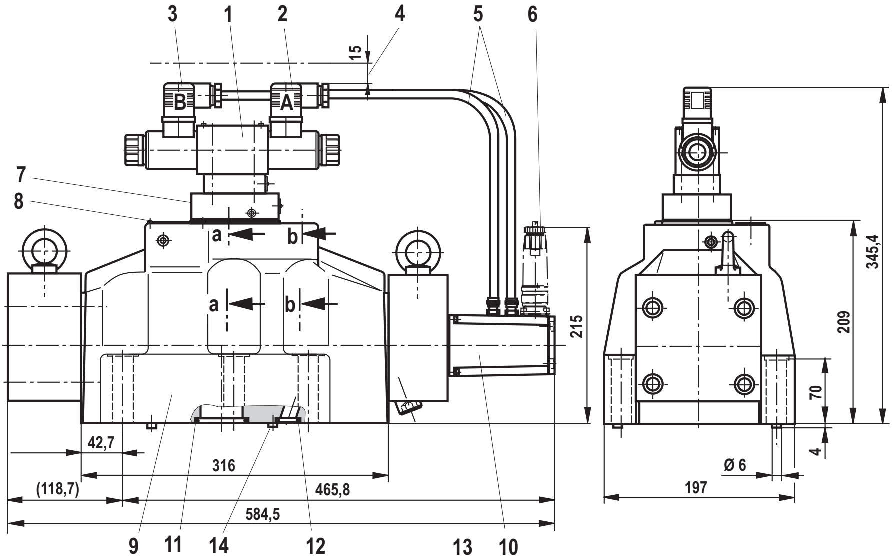
Required surface quality of the valve contact surface

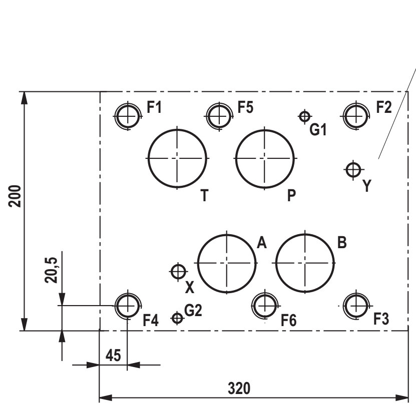
1 Pilot control valve
2 Mating connector "A", color gray
3 Mating connector "B", color black
4 Space required for connection cable and to remove the mating connector
5 Wiring
6 Mating connector, separate order, see page 21
7 Pressure reducing valve
8 Name plate
9 Main valve
10 Integrated electronics (OBE)
11 Identical seal rings for connection A, B, P, T
12 Identical seal rings for connection X, Y
13 Processed valve contact surface, porting pattern according to ISO 4401-10-09-0-05 (connection X, Y as required) deviating from the standard:
- Connection, B, T and P Ø 38 mm

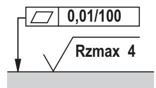
14 Locking pin

Subplates and valve mounting screws see page 21

Dimensions: Size 35 (dimensions in mm)







Required surface quality of the valve contact surface

1 Pilot control valve
2 Mating connector "A", color gray
3 Mating connector "B", color black
4 Space required for connection cable and to remove the mating connector
5 Wiring
6 Mating connector, separate order, see page 21
7 Pressure reducing valve
8 Name plate
9 Main valve
10 Integrated electronics (OBE)
11 Identical seal rings for connection A, B, P, T
12 Identical seal rings for connection X, Y
13 Processed valve contact surface, porting pattern according to ISO 4401-10-09-0-05 (connection X, Y as required) deviating from the standard:
- Connection A, B, T and P Ø 50 mm
14 Locating pins

Subplates and valve mounting screws see page 21

Dimensions

Hexagon socket head cap screws		Material number
Size 10	4x ISO 4762 - M6 x 45 - 10.9-flZn-240h-L Tightening torque M_A = 13.5 Nm ±10% or 4x ISO 4762 - M6 x 45 - 10.9 Tightening torque M_A = 15.5 Nm ±10%	R913000258
Size 16	2x ISO 4762 - M6 x 60 - 10.9-flZn-240h-L Tightening torque M_A = 12.2 Nm ±10% 4x ISO 4762 - M10 x 60 - 10.9-flZn-240h-L Tightening torque M_A = 58 Nm ±20% or 2x ISO 4762 - M6 x 60 - 10.9 Tightening torque M_A = 15.5 Nm ±10% 4x ISO 4762 - M10 x 60 - 10.9 Tightening torque M_A = 75 Nm ±20%	R913000115 R913000116
Sizes 25 and 27	6x ISO 4762 - M12 x 60 - 10.9-flZn-240h-L Tightening torque M_A = 100 Nm ±20% or 6x ISO 4762 - M12 x 60 - 10.9 Tightening torque M_A = 130 Nm ±20%	R913000121
Size 32	6x ISO 4762 - M20 x 80 - 10.9-flZn-240h-L Tightening torque M_A = 340 Nm ±20% or 6x ISO 4762 - M20 x 80 - 10.9 Tightening torque M_A = 430 Nm ±20%	R901035246
Size 35	6x ISO 4762 - M20 x 100 - 10.9-flZn-240h-L Tightening torque M_A = 465 Nm ±20% or 6x ISO 4762 - M20 x 100 - 10.9 Tightening torque M_A = 610 Nm ±20%	R913000386

Notice: The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure!

Subplates	Data sheet
Size 10	45054
Size 16	45056
Sizes 25 and 27	45058
Sizes 32 and 35	45060

Accessories (not included in the scope of delivery)

Mating connectors		Material number
Mating connector for high-response valve	DIN EN 175201-804, see data sheet 08006	e.g. R900021267 (plastic)
		e.g. R900223890 (metal)

2

Notes

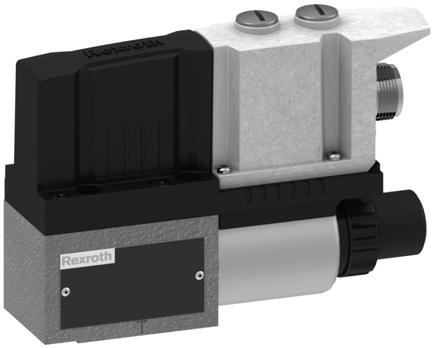
Bosch Rexroth AG
Industrial Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
documentation@boschrexroth.de
www.boschrexroth.de

Proportional pressure valves

Pressure-controlled directly operated proportional pressure relief valve with integrated electronics (OBE)

Type DBETA

RE 29262
Edition: 2013-04



- Size 6
- Component series 6X
- Maximum operating pressure 500 bar
- Maximum flow: 5 l/min

Features

- Pressure-controlled, directly operated proportional valve for pressure relief (pilot valve)
- For subplate mounting:
  Porting pattern according to ISO 4401
- Integrated pressure sensor
- Actual pressure value can be read via analog output
- Pressure controller can be adjusted to the system volume (easy setting via DIL switch)
- Linear command value pressure characteristic curve
- Virtually flow-independent pressure control
- CE conformity according to EMC Directive 2004/108/EC

Contents

Ordering code

01		02		03	04	05	06	07	08	09
DBETA	**–**	**6X**	**/**			**G24**	**K31**			*****

01	Proportional pressure relief valve, pressure-controlled with integrated electronics (OBE)	**DBETA**

02	Component series 60 to 69 (60 to 69: Unchanged installation and connection dimensions)	**6X**

03	Pressure measurement in channel B	**B**
	Pressure measurement in channel P	**P**

Maximum set pressure

04	Up to 50 bar	**50**
	Up to 100 bar	**100**
	Up to 200 bar	**200**
	Up to 350 bar	**350**
	Up to 500 bar	**500** [1]

[1] Only possible in version "M".

Supply voltage of the integrated electronics (OBE)

05	24 V DC voltage	**G24**

Electrical connection

06	Connector DIN EN 175201-804	**K31**

Electronics interface

07	Command value 0 to 10 V	**A1**
	Command value 4 to 20 mA	**F1**

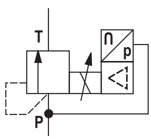
Seal material

08	NBR seals	**M**
	FKM seals	**V**
	Attention: Observe compatibility of seals with hydraulic fluid used! (Other seals upon request)	

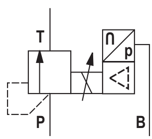
09	Further details in the plain text	

Symbols

Version P



Version B



Function, section

General information

DBETA proportional pressure relief valves are used for pressure relief. Operation is effected by means of a proportional solenoid. The pressure is regulated by the pressure sensor and the valve electronics. By means of these valves, the system pressure to be limited can be continuously adjusted and controlled depending on the electric command value.

The valves mainly consist of the housing (1), the valve seat (3), the valve poppet (4), the proportional solenoid (2), the integrated electronics (7) and the pressure sensor (8).

Basic principle

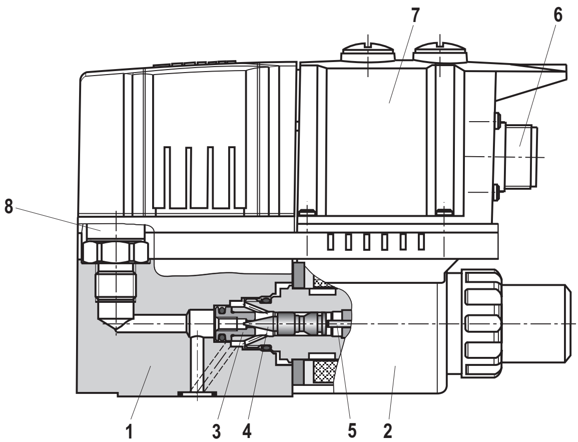
The supply voltage and the command value are applied to the connector (6). Depending on the command value the electronics converts the input signal into current. The proportional solenoid converts the electric current into mechanical force that acts directly on the valve poppet (4) via the armature plunger (5). The valve poppet (4) counteracts the hydraulic force in channel P. When the hydraulic force at the valve poppet (4) equals the solenoid force, the set pressure is reached. By increasing/reducing cross-section P to T, the pressure is maintained at the set level.

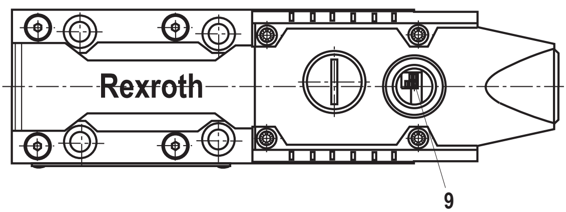
The pressure sensor (8) captures the pressure in channel P and/or B and the integrated electronics (7) controls the pressure independently of the flow.

Connector (6) provides the pressure in channel P and/or B as an analog actual value (0 to 10 V and/or 4 to 20 mA). If the command value is zero, the control electronics only applies the minimum control current to the proportional solenoid (2) and the minimum set pressure is applied.

With the DIL switch (9) the integrated pressure controller can be adjusted to various (line) volumes (see table on page 7).

Type: DBETA-6X/P...





Technical data
(for applications outside these parameters, please consult us!)

general		
Weight	kg	1.9
Mounting orientation		Any
Ambient temperature range	°C	–20 ... +60
Sine test according to DIN EN 60068-2-6		10...2000...10 Hz / maximum of 10 g / 10 cycles
Noise test according to DIN EN 60068-2-64		20...2000 Hz / 10 g_{RMS} / 30 g peak / 24h
Transport shock according to DIN EN 60068-2-27		15 g / 11ms
Maximum relative moisture at 25 to 55 °C	%	97

hydraulic			**Version P**	**Version B**
Maximum operating pressure for pressure rating 200, 350 and 500 bar [1)]	– Port P, A, B	bar	500	
Maximum operating pressure for pressure rating 100 bar [1)]	– Port A	bar	500	
	– Port P	bar	300	500
	– Port B	bar	500	300
Maximum operating pressure for pressure rating 50 bar [1)]	– Port A	bar	500	
	– Port P	bar	125	500
	– Port B	bar	500	125
Return flow pressure	– Port T	bar	Ideally at zero pressure to the tank [2)]	
Maximum set pressure	– Pressure rating 50 bar	bar	50	
	– Pressure rating 100 bar	bar	100	
	– Pressure rating 200 bar	bar	200	
	– Pressure rating 350 bar	bar	350	
	– Pressure rating 500 bar	bar	500	
Minimum set pressure (at command value 0 V and/or 4 mA)		bar	See characteristic curves page 8	
Maximum flow [3)]		l/min	5	
Minimum line volume		ml	20	
Hydraulic fluid			See table page 5	
Hydraulic fluid temperature range		°C	–15 ... +80 (FKM seals) –20 ... +80 (NBR seals)	
Viscosity range		mm^2/s	20 ... 380, preferably 30 to 46	
Maximum permitted degree of contamination of the hydraulic fluid Cleanliness class according to ISO 4406 (c)			Class 20/18/15 [4)]	
Hysteresis		%	< 1 of the maximum set pressure [5)]	
Range of inversion		%	< 0,25 of the maximum set pressure [5)]	
Response sensitivity		%	< 0,25 of the maximum set pressure [5)]	
Linearity		%	±1 of the maximum set pressure [5)]	
Step response (Tu + Tg) Line volume < 20 cm^3; **Q** = 0.8 l/min	10 % → 90 %	ms	123 (depending on the system)	
	90 % → 10 %	ms	94 (depending on the system)	

1) The summated pressure of all ports must not exceed 1030 bar, e.g. port P 500 bar + port B 500 bar + port T 30 bar + port A 0 bar = 1030 bar

2) Tank preloading of 30 bar in addition.
Attention: The tank preloading is added to the set pressure.
A short-time static pressure of 300 bar is admissible.

3) Recommended operation range **Q** > 0,5 l/min.

4) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components. For the selection of the filters see www.boschrexroth.com/filter

5) Accuracies apply for flow > 0.1 l/min and command value > 10 %.

Technical data
(for applications outside these parameters, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils		HL, HLP	NBR, FKM	DIN 51524
Bio-degradable	– insoluble in water	HEES	FKM	VDMA 24568
Flame-resistant	– water-free	HFDU	FKM	ISO 12922
	– containing water	HFC (Fuchs Hydrotherm 46M, Petrofer Ultra Safe 620)	NBR	ISO 12922

☞ **Important information on hydraulic fluids!**
- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.)!
- The flash point of the hydraulic fluid used must be 40 K higher than the maximum solenoid surface temperature.
- **Flame-resistant – containing water**:
  - The maximum pressure differential per control edge is 210 bar, otherwise, increased cavitation erosion.
  - Life cycle as compared to operation with mineral oil HLP 30 to 100 %.
  - Maximum fluid temperature 60 °C.
- **Bio-degradable:** When using bio-degradable hydraulic fluids that are simultaneously zinc-solving, zinc may accumulate in the fluid (700 mg zinc per pole tube).

3

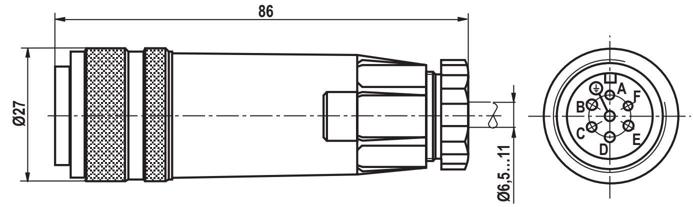
electric			
Minimum solenoid current		mA	≤ 100
Maximum solenoid current		mA	1600 ± 10 %
Switch-on duration		%	100
Supply voltage	– Nominal voltage	VDC	24
	– Lower limit value	VDC	18
	– Upper limit value	VDC	36
Current consumption		A	≤ 1.5 (I_{max} 2 A is possible)
Required fuse protection		A	2, time-lag
Inputs Pressure command value	– Voltage	V	0 to 10
	– Current	mA	4 to 20
Outputs Actual pressure value	– Voltage	V	0 to 10 ≙ 0 to 100 % of nominal pressure
	– Current	mA	4 to 20 ≙ 0 to 100 % of nominal pressure
Protection class of the valve according to EN 60529			IP 65 with mating connector mounted and locked
Conformity			CE according to EMC Directive 2004/108/EC Tested according to EN 61000-6-2 and EN 61000-6-3

Electrical connection (dimensions in mm)

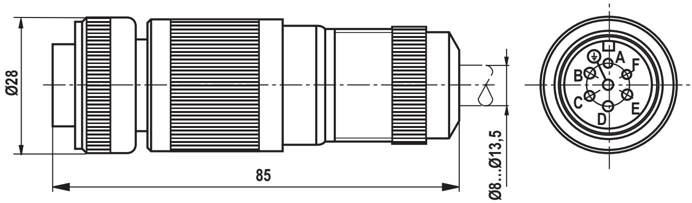
Connector pin assignment	Contact	Allocation interface "A1"	Allocation interface "F1"
Supply voltage	A	24 VDC (u(t) = 18 V to 36 V); I_{max} ≤ 2.0 A	
	B	0 V	
Reference potential actual value	C	Reference potential for contact F; at R_i (countersink) < 50 kΩ connect (star-like) to ground ⊥ on the control side	Reference contact F
Differential amplifier input	D	0 to 10 V; R_E > 100 kΩ	4 to 20 mA; R_E = 100 Ω
	E	Reference potential command value	
Actual pressure value	F	0 to +10 V actual value; I_{max} = 5 mA	4 to 20 mA; maximum load resistance 600 Ω
Protective ground	PE	Connected to solenoid and valve housing	

Mating connectors according to DIN EN 175201-804, solder contacts for line cross-section 0.5 to 1.5 mm²

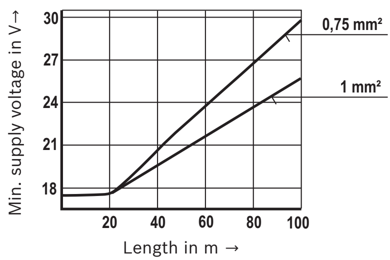
Plastic version,
material no. **R900021267**
(separate order)



Metal version,
material no. **R900223890**
(separate order)



Connection cable [1)]
– Recommendation 6-wire, 0.75 or 1 mm² plus protective grounding conductor and screening
– Only connect the screening to PE on the supply side
– Maximum admissible length = 100 m
The minimum supply voltage at the power supply unit depends on the length of the supply line (see diagram).



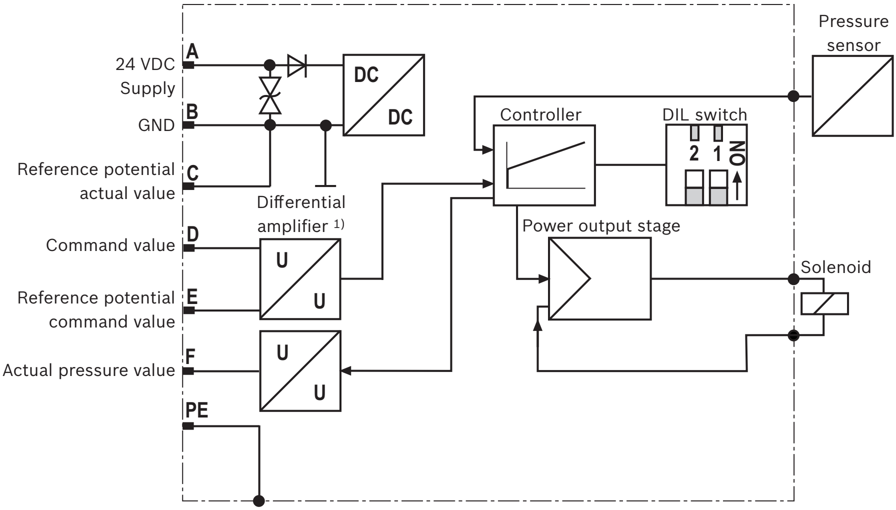
1) To comply with the provisions of EMC directive 2004/108/EC the metal version mating connector (R900223890) and a screened cable are required.

Integrated electronics (OBE)

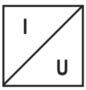
Function

The electronics are supplied with voltage via ports A and B. The command value is applied to the differential amplifier ports D and E.
The actual pressure value is captured by the integrated pressure sensor. The pressure command value is processed in the controller and compared to the actual pressure value. The power output stage processes the control output of the controller and controls the solenoid current.
The actual pressure value is reported at port F (reference port C).
With the DIL switch, the controller characteristics can be adjusted to certain line volumes (see table "DIL switch position").

Block diagram



1) For variant "F1":



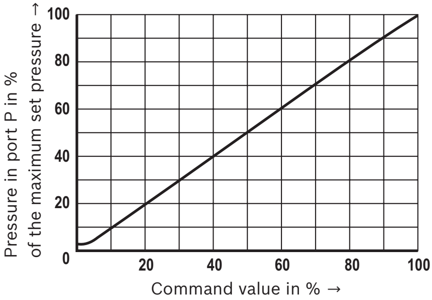
DIL switch position

Switch position		Volume in ml
2	1	
Off	Off	20
Off	On	170
On	Off	330
On	On	500

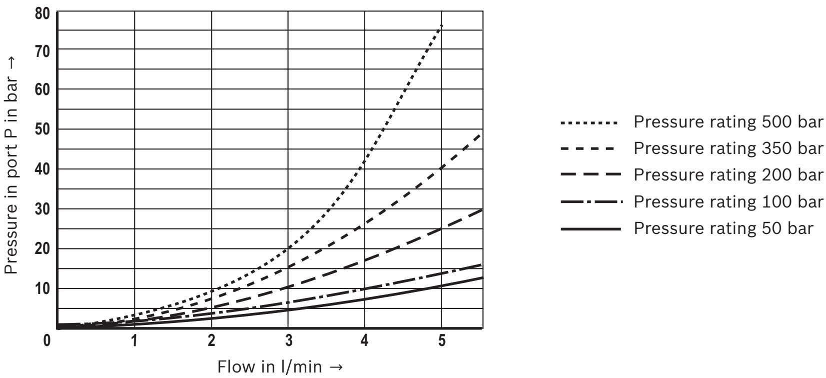
☞ **Notice!** If the pressure sensor fails, the valve switches to controlled operation. Port PIN F reports 0 V and/or 4 mA.

Characteristic curves
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

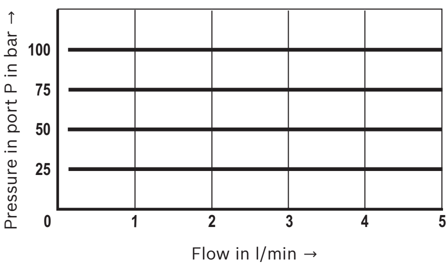
Pressure in port P depending on the command value (flow = 0.8 l/min)



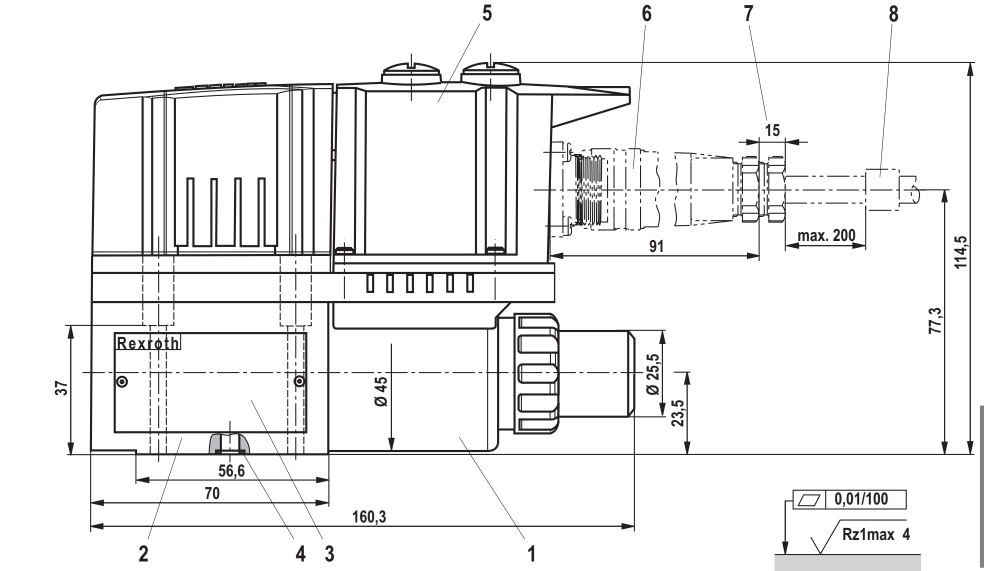
Minimum set pressure in port P with command value 0 V and/or 4 mA depending on the flow
(return flow pressure = 0 bar)



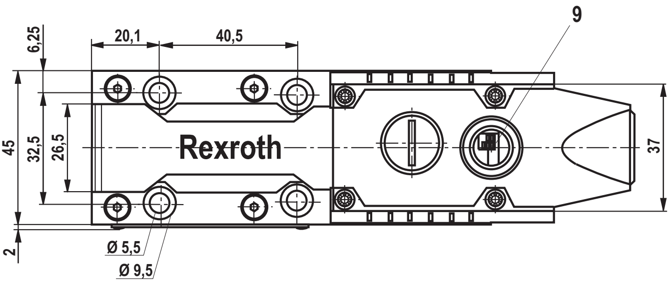
Pressure in port P depending on the flow (applies to all pressure ratings)

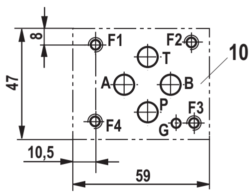


Dimensions:
(dimensions in mm)



Required surface quality of the valve connection surface





1 Proportional solenoid
2 Valve housing
3 Name plate
4 Identical seal rings for ports P, T, A and B
5 Integrated electronics (OBE)
6 Mating connector
7 Space required for removing the mating connector
8 Cable fastening
9 DIL switch for adjustment to various line volumes (see page 7)
10 Valve connection surface,
porting pattern according to ISO 4401-03-02-0-05
Deviating from the standard:
"A" channel not drilled, blind counterbore with sealing
"B" channel not drilled, blind counterbore with sealing (with version "P")
Locating pin not included in the scope of delivery

Notice!
The dimensions are nominal dimensions which are subject to tolerances.

For valve mounting screws and **subplates,** see page 10.

Dimensions

Hexagon socket head cap screws		**Material number**
Size 6	4x ISO 4762 - M5 x 45 - 10.9-flZn-240h-L Tightening torque M_A = 6 Nm ± 10 %	R913000140

Notice: The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure!

Subplates (only admissible up to 350 bar)	**Data sheet**	**Material number**
G 341/01 (G1/4) G 341/60 (G3/8)	45052 45052	R900424447 R901027119

Accessories (not included in the scope of delivery)

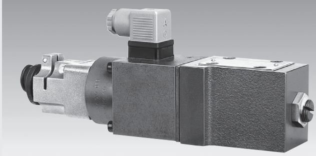
Mating connectors (details see page 6)	**Data sheet**	**Material number**
Mating connectors according to DIN EN 175201-804	08006	R900021267 (plastic) R900223890 (metal)

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
documentation@boschrexroth.de
www.boschrexroth.de

Proportional pressure relief valve with position feedback (Lvdt AC/AC)

RE 29150/07.05

Type DBETBX



Nominal size 6
Unit series 1X
Maximum working pressure P 315 bar, T 2 bar
Nominal flow rate Q_{nom} 1 l/min

List of contents

Features

- Directly operated valves with position feedback for limiting system pressure
- Adjustable through the position of the armature against the compression spring
- Position-controlled at a high magnetic force, minimal hysteresis $<0.3\,\%$, see Technical data and Characteristic curve
- Pressure limitation to a safe level even with faulty electronics (solenoid current $I > I_{max}$)
- For subplate attachment, mounting hole configuration to ISO 4401-03-02-0-94
  Subplates as per catalog sheet RE 45053
  (order separately)
- Plug-in connector for solenoid to DIN 43650-AM2 and plug-in connector for position transducer, included in scope of delivery
- Data for the external trigger electronics
  - $U_B = 24\ V_{nom}$ DC
  - Adjustment of valve curve Np and gain
  - With and without ramp generator
  - Europe card format, setpoint 0...+10 V
    (order separately)

Ordering data

DBETB	X	– 1X /		G24 – 37	Z4	M	*

Proportional pressure relief valve with position control and inductive position transducer on the cone

Mounting hole configuration to ISO 4401-03-02-0-94 **= X**

Unit series 10 to 19 (10 to 19: installation and connection dimensions unchanged) **= 1X**

Max. pressure stage

up to 28 bar	**= 28**
up to 80 bar	**= 80**
up to 180 bar	**= 180**
up to 250 bar	**= 250**
up to 315 bar	**= 315**

Voltage supply of trigger electronics 24 V DC **= G24**

Solenoid type (current)
37 = Solenoid current 3.7 A max.

Electrical connection
Z4 = Unit plug to DIN 43650-AM2
Plug-in connector included in scope of delivery

M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

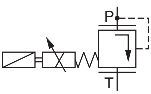
Further information in plain text
2 = Sealed seat adjustment[1)]

Preferred types

Type	Material Number
DBETBX–1X/28G24–37Z4M	0 811 402 013
DBETBX–1X/80G24–37Z4M2 [1)]	0 811 402 007
DBETBX–1X/180G24–37Z4M	0 811 402 003
DBETBX–1X/250G24–37Z4M2 [1)]	0 811 402 001
DBETBX–1X/315G24–37Z4M	0 811 402 004

Symbol

For external trigger electronics



Function, sectional diagram

General

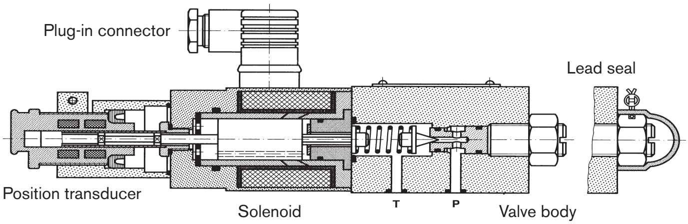
Type DBETBX proportional pressure relief valves are remote-controlled (pilot) valves in conical seat design. They are used to limit system pressure.
The valves are actuated by means of a position-controlled proportional solenoid.
With these valves, the system pressure that needs to be limited can be infinitely adjusted in relation to the position of the solenoid by means of external trigger electronics.

Basic principle

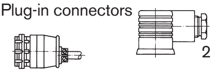
To adjust the system pressure, a setpoint is set in the trigger electronics. Based on this setpoint, the electronics control the position of the armature on the compression spring by means of the signal from the position transducer.
The position control ensures extremely low hysteresis: the position is maintained even in the event of external disturbances.
An “additional” spring between the cone and the seat contributes to stability and a minimal residual pressure.
The spring force acting on the cone and the pressure in the valve seat balance one another at a constant oil flow (0.7...1 l/min).
The “p_{max}” pressure stage is determined by the cone and seating bore configuration.

Pressure limitation for maximum safety

If a fault occurs in the electronics, so that the solenoid current (I_{max}) would exceed its specified level in an uncontrolled manner, the pressure cannot rise above the level determined by the maximum spring force.



Accessories

Type			Material Number
(4 x) ISO 4762-M5x50-10.9	Cheese-head bolts		2 910 151 174
Europe card 	VT-VRPA1-537-10/V0/PV	RE 30052	0 811 405 097
Europe card 	VT-VRPA1-537-10/V0/PV-RTP	RE 30054	0 811 405 102
Europe card 	VT-VRPA1-537-10/V0/PV-RTS	RE 30056	0 811 405 179
Plug-in connectors  2P+PE	Plug-in connector 2P+PE (M16x1.5) for the solenoid and plug-in connector for the position transducer, included in scope of delivery, see also RE 08008.		

Testing and service equipment

Test box type VT-PE-TB1, see RE 30063
Test adapter for Europe cards type VT-PA-3, see RE 30070

Technical data

General					
Construction		Poppet valve			
Actuation		Proportional solenoid with position control, external amplifier			
Connection type		Subplate, mounting hole configuration NG6 (ISO 4401-03-02-0-94)			
Mounting position		Horizontal, vertical with solenoid at top			
Ambient temperature range	°C	−20...+50			
Weight	kg	4.5			
Vibration resistance, test condition		Max. 25 g, shaken in 3 dimensions (24 h)			

Hydraulic (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)						
Pressure fluid		Hydraulic oil to DIN 51524...535, other fluids after prior consultation				
Viscosity range recommended	mm^2/s	20...100				
max. permitted	mm^2/s	10...800				
Pressure fluid temperature range	°C	−20...+80				
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)		Class 18/16/13 [1]				
Direction of flow		See symbol				
Max. set pressure (at Q = 1 l/min)	bar	28	80	180	250	315
Minimum pressure (at Q = 1 l/min)	bar	1.5	3	4	5	6
		Note: At Q_{max} = 3 l/min the pressure levels stated here increase				
Max. mechanical pressure limitation level, e.g. when solenoid current $I > I_{max}$	bar	<29	<85	<186	<258	<325
Max. working pressure (at Q = 1 l/min)	bar	Port P: 315				
Max. pressure	bar	Port T: $\leqq$ 2				

Electrical		
Cyclic duration factor	%	100
Degree of protection		IP 65 to DIN 40050 and IEC 14434/5
Solenoid connection		Unit plug DIN 43650/ISO 4400, M16 x 1.5 (2P+PE)
Position transducer connection		Special plug
Max. solenoid current	I_{max}	3.7
Coil resistance R_{20}	Ω	2.5
Max. power consumption at 100 % load and operating temperature	VA	60

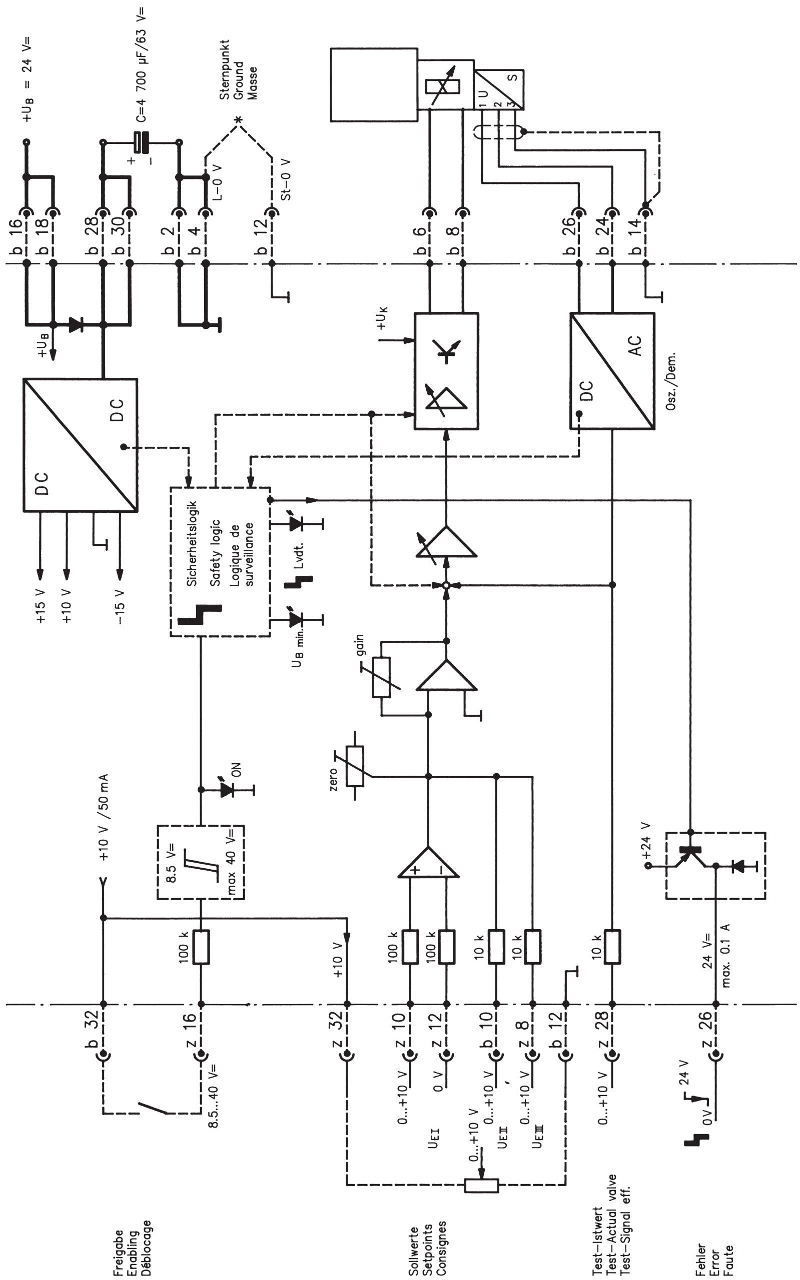
Static/Dynamic [2]		
Hysteresis	%	≤ 0.3
Range of inversion	%	≤ 0.2
Manufacturing tolerance for Q_{max}	%	≈ 6
Response time 100 % signal change	ms	On <45 / Off <25

[1] The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of components.
For a selection of filters, see catalog sheets RE 50070, RE 50076 and RE 50081.

[2] All characteristic values ascertained using amplifier 0 811 405 097 for the position-controlled 3.7 A solenoid.

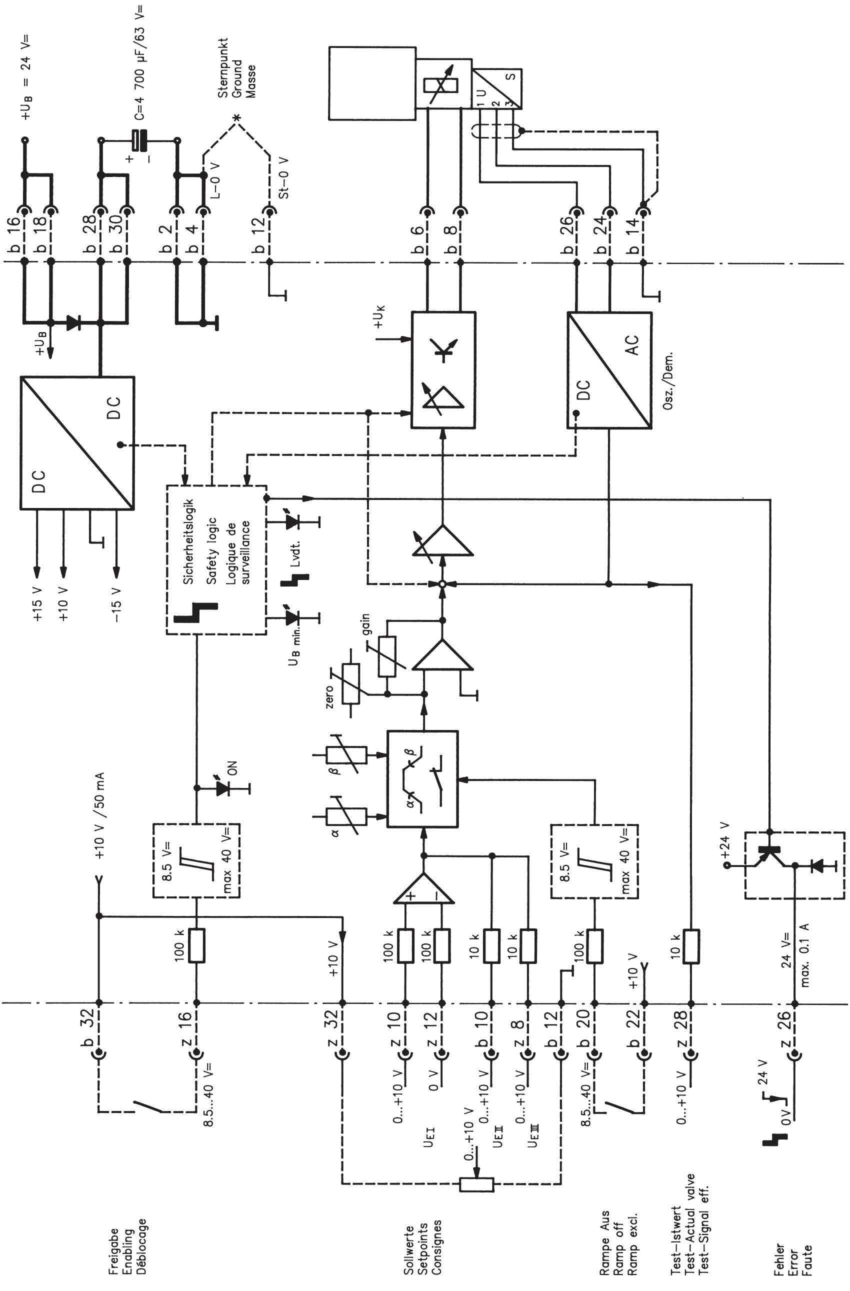
Valve with external trigger electronics (europe card without ramp, RE 30052)

Circuit diagram/pin assignment



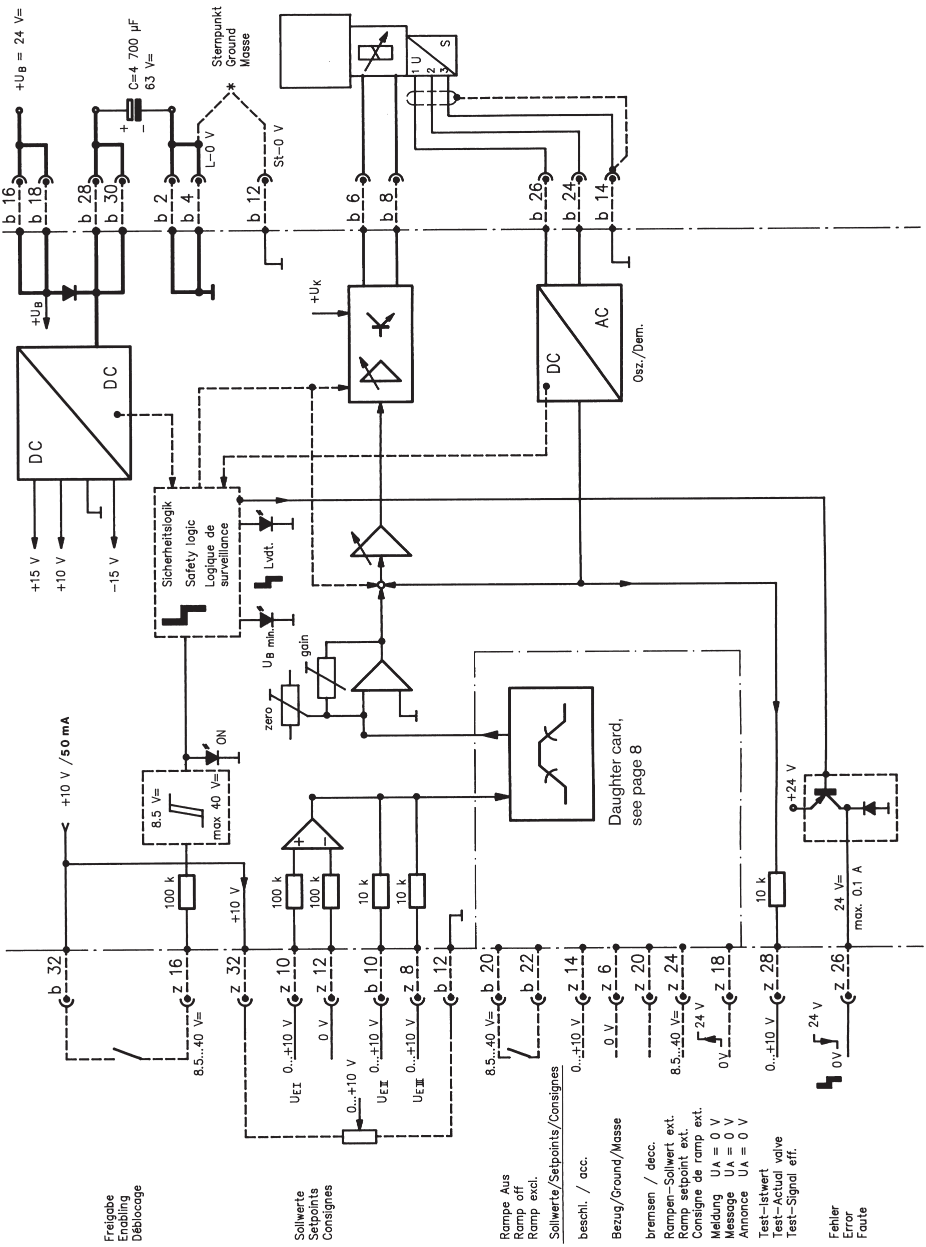
Valve with external trigger electronics (europe card with ramp, RE 30054)

Circuit diagram/pin assignment



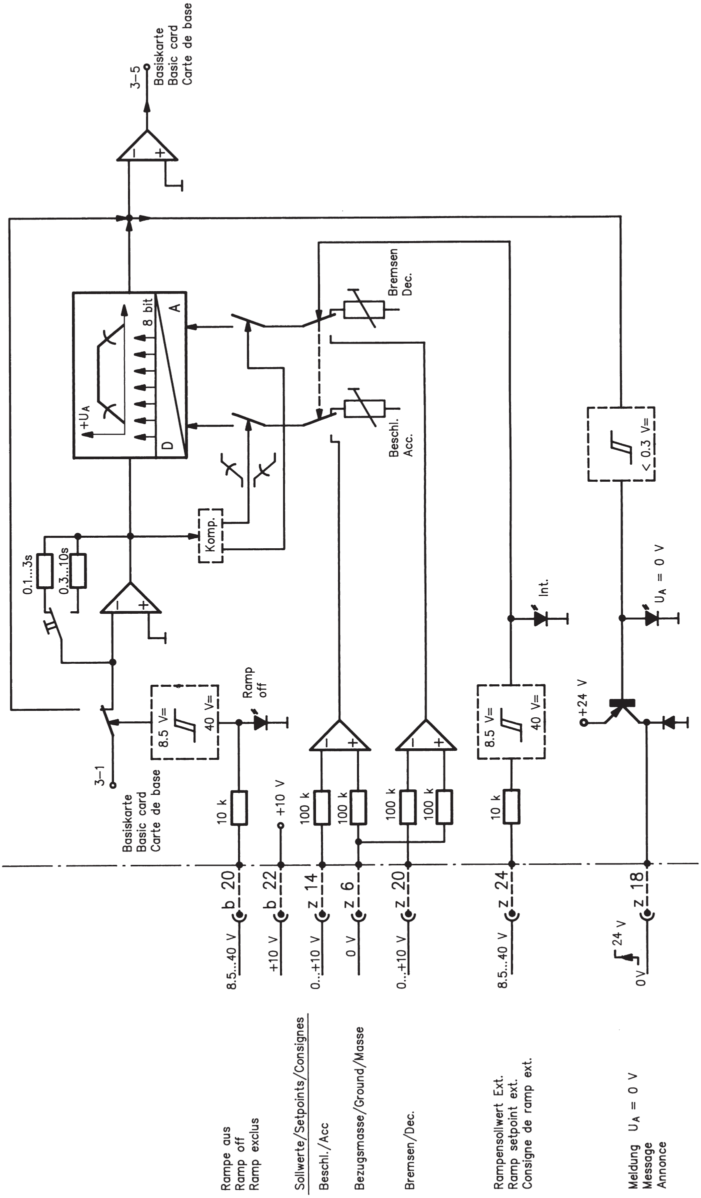
Valve with external trigger electronics (europe card with ramp, RE 30056)

Circuit diagram/pin assignment



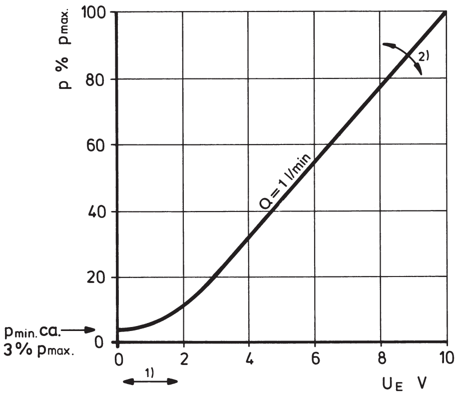
Valve with external trigger electronics (europe card with ramp, RE 30056)

Circuit diagram/pin assignment **Daughter card**



Characteristic curve (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Pressure in port P as a function of the setpoint
Nominal flow rate = 1 l/min

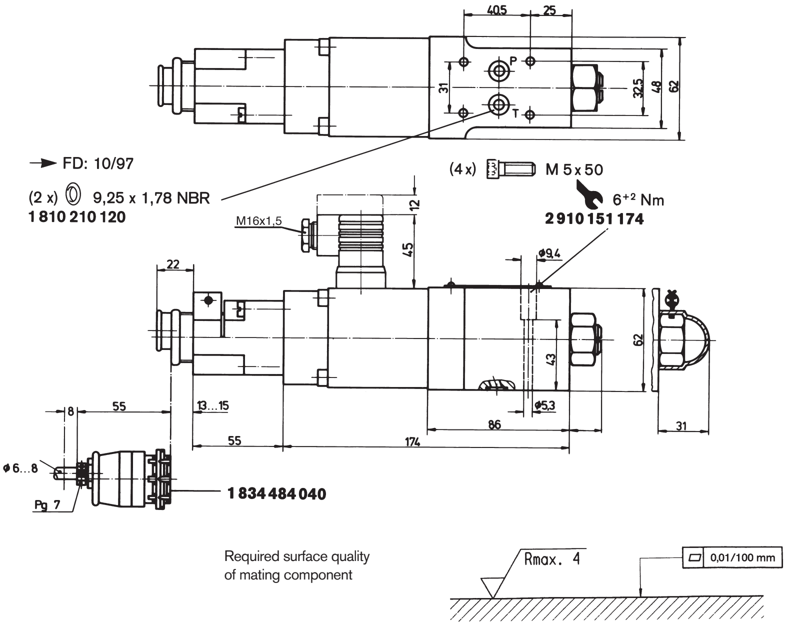


Valve amplifier

[1] Zero adjustment

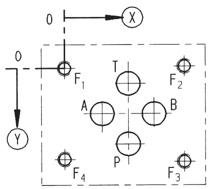
[2] Sensitivity adjustment

Unit dimensions (nominal dimensions in mm)



Mounting hole configuration: NG6 (ISO 4401-03-02-0-94)
For subplates, see catalog sheet RE 45053

1) Deviates from standard
2) Thread depth:
Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

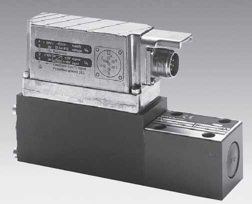


	P	A	T	B	F_1	F_2	F_3	F_4
X	21.5	12.5	21.5	30.2	0	40.5	40.5	0
Y	25.9	15.5	5.1	15.5	0	–0.75	31.75	31
Ø	8 1)	8 1)	8 1)	8 1)	M5 2)	M5 2)	M5 2)	M5 2)

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Telefon +49 (0) 93 52 / 18-0
Telefax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

Proportional pressure relief valve with on-board electronics (OBE) and position feedback

Type DBETBEX



Nominal size 6
Unit series 1X
Maximum working pressure P 315 bar, T 250 bar
Nominal flow rate Q_{nom} 1 l/min

List of contents

Contents	Page

Features

- Directly operated valves with position feedback and on-board electronics for limiting system pressure
- Adjustable through the position of the armature against the compression spring
- Position-controlled, minimal hysteresis $<0.2\,\%$, rapid response times, see Technical data
- Pressure limitation to a safe level even with faulty electronics (solenoid current $I > I_{max}$)
- For subplate attachment, mounting hole configuration to ISO 4401-03-02-0-94. Subplates as per catalog sheet RE 45053 (order separately)
- Plug-in connector to DIN 43563-AM6, see catalog sheet RE 08008 (order separately)
- Data for the on-board trigger electronics
  - Complies with CE, EMC directives EN 61000-6-2: 2002-08 and EN 61000-6-3: 2002-08
  - $U_B = 24\ V_{nom}$ DC
  - Electrical connection 6P+PE
  - Signal actuation
    - Standard 0...+10 V (A1)
    - Version 4...20 mA (F1)
  - Valve curve calibrated at the factory

Ordering data

DBETB	E	X	–1X/		G24	K31		M	*

Proportional pressure relief valve with inductive position transducer on the cone

With on-board electronics = **E**

Mounting hole configuration to ISO 4401-03-02-0-94 = **X**

Unit series 10 to 19 (10 to 19: installation and connection dimensions unchanged) = **1X**

Max. pressure stage

up to 80 bar = **80**
up to 180 bar = **180**
up to 250 bar = **250**
up to 315 bar = **315**

Voltage supply of trigger electronics 24 V DC = **G24**

K31 = **Electrical connection**
without plug-in connector,
with unit plug to DIN 43563-AM6
Order plug-in connector separately

Interface for trigger electronics
A1 = Setpoint input 0...+10 V
F1 = Setpoint input 4...20 mA

M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

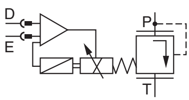
Further information in plain text

Preferred types

Type ....A1 (0...+10 V)	**Material Number**	**Type ....F1 (4...20 mA)**	**Material Number**
DBETBEX–1X/80G24K31A1M	0 811 402 072	DBETBEX–1X/80G24K31F1M	0 811 402 140
DBETBEX–1X/180G24K31A1M	0 811 402 071	DBETBEX–1X/180G24K31F1M	0 811 402 075
DBETBEX–1X/250G24K31A1M	0 811 402 073	DBETBEX–1X/315G24K31F1M	0 811 402 141
DBETBEX–1X/315G24K31A1M	0 811 402 070		

Symbol

For on-board electronics



Function, sectional diagram

General

Type DBETBEX proportional pressure relief valves are remote-controlled (pilot) valves in conical seat design. They are used to limit system pressure.
The valves are actuated by means of a proportional solenoid with on-board electronics.
With these valves, rapid response times with low hysteresis can be achieved.

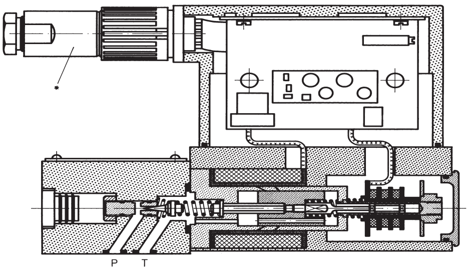
Basic principle

To adjust the system pressure, a setpoint is set in the trigger electronics. Based on this setpoint, the electronics control the position of the armature on the conical seat and on the compression spring.
The position control ensures extremely low hysteresis. The magnetic force determines the spring force until a new position is reached.

Pressure limitation for maximum safety

If a fault occurs in the electronics, so that the solenoid current (I_{max}) would exceed its specified level in an uncontrolled manner, the pressure cannot rise above the level determined by the maximum spring force.

EN 61000-6-2: 2002-08
EN 61000-6-3: 2002-08



Valve body Proportional solenoid with position transducer

Accessories

Type			Material Number
(4 x) ISO 4762-M5x30-10.9	Cheese-head bolts		2 910 151 166
* 	Plug-in connectors 2P+PE, see also RE 08008.	KS	1 834 482 022
		KS	1 834 482 026
		MS	1 834 482 023
		MS	1 834 482 024
		KS 90°	1 834 484 252

Testing and service equipment

Test box type VT-PE-TB3, see RE 30065
Measuring adapter 6P+PE type VT-PA-2, see RE 30068

Technical data

General

Construction		Poppet valve
Actuation		Proportional solenoid with position control and OBE
Connection type		Subplate, mounting hole configuration NG6 (ISO 4401-03-02-0-94)
Mounting position		Optional
Ambient temperature range	°C	–20...+50
Weight	kg	2.7
Vibration resistance, test condition		Max. 25 g, shaken in 3 dimensions (24 h)

Hydraulic (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Pressure fluid		Hydraulic oil to DIN 51524...535, other fluids after prior consultation			
Viscosity range recommended	mm^2/s	20...100			
Viscosity range max. permitted	mm^2/s	10...800			
Pressure fluid temperature range	°C	–20...+70			
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)		Class 18/16/13 [1)]			
Direction of flow		See symbol			
Max. set pressure (at $Q = 1$ l/min)	bar	80	180	250	315
Minimum pressure (at $Q = 1$ l/min)	bar	3	4	5	8
		Note: At $Q_{max} = 1.5$ l/min the pressure levels stated here increase			
Max. mechanical pressure limitation level, e.g. when solenoid current $I > I_{max}$	bar	<85	<186	<258	<325
Max. working pressure (at $Q = 1$ l/min)	bar	Port P: 315			
Max. pressure	bar	Port T: 250			

Static/Dynamic

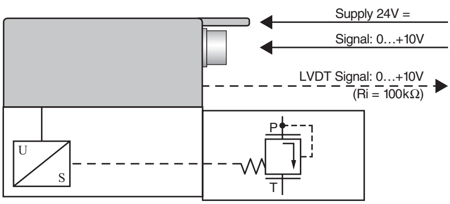
Hysteresis	%	≦ 0.2
Range of inversion	%	≦ 0.1
Manufacturing tolerance	%	≦ ±5
Response time 100 % signal change	ms	30
Response time 10 % signal change	ms	10
Thermal drift		<1 % at $\Delta T = 40\,°C$
Conformity		CE EN 61000-6-2: 2002-08 EN 61000-6-3: 2002-08

[1)] The purity classes stated for the components must be complied with in hydraulic systems.
Effective filtration prevents problems and also extends the service life of components.
For a selection of filters, see catalog sheets RE 50070, RE 50076 and RE 50081.

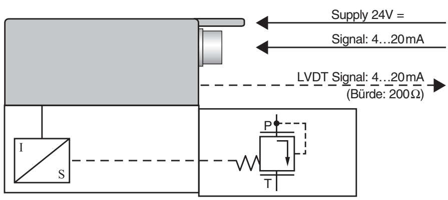
Technical data

Electrical, trigger electronics integrated in valve		
Cyclic duration factor	%	100
Degree of protection		IP 65 to DIN 40050 and IEC 14434/5
Connection		Plug-in connector 6P+PE, DIN 43563
Supply voltage Terminal A: Terminal B: 0 V		24 V DC Min. 21 V DC/max. 40 V DC Ripple max. 2 V DC
Power consumption		Solenoid ⍁ 45 mm = 40 VA max.
External fuse		2.5 A_F
Input, “standard” version Terminal D: U_E Terminal E:	A1	Differential amplifier, R_i = 100 kΩ 0...+10 V 0 V
Input, “mA signal” version Terminal D: I_{D-E} Terminal E: I_{D-E}	F1	Burden, R_{sh} = 200 Ω 4...20 mA Current loop I_{D-E} feedback
Max. voltage to differential inputs over 0 V		D → B } max. 18 V DC E → B
Test signal, “standard” version Terminal F: U_{Test} Terminal C:	A1	LVDT 0...+10 V Reference 0 V
Test signal, “mA signal” version Terminal F: I_{F-C} Terminal C: I_{F-C}	F1	LVDT signal 4...20 mA at external load 200...500 Ω max. 4...20 mA output Current loop I_{F-C} feedback
Safety earth conductor and shield		See pin assignment (installation in conformity with CE)
Recommended cable		See pin assignment up to 20 m 7 x 0.75 mm² up to 40 m 7 x 1 mm²
Calibration		Calibrated at the factory, see valve curve

Version A1:
Standard

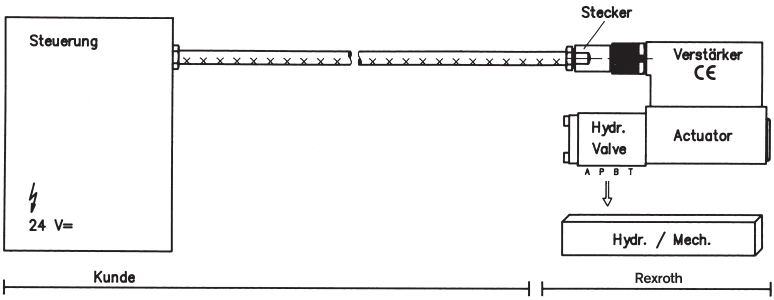


Version F1:
mA signal



Connection

For electrical data, see page 5
and Operating Instructions **1 819 929 083**



Technical notes for the cable

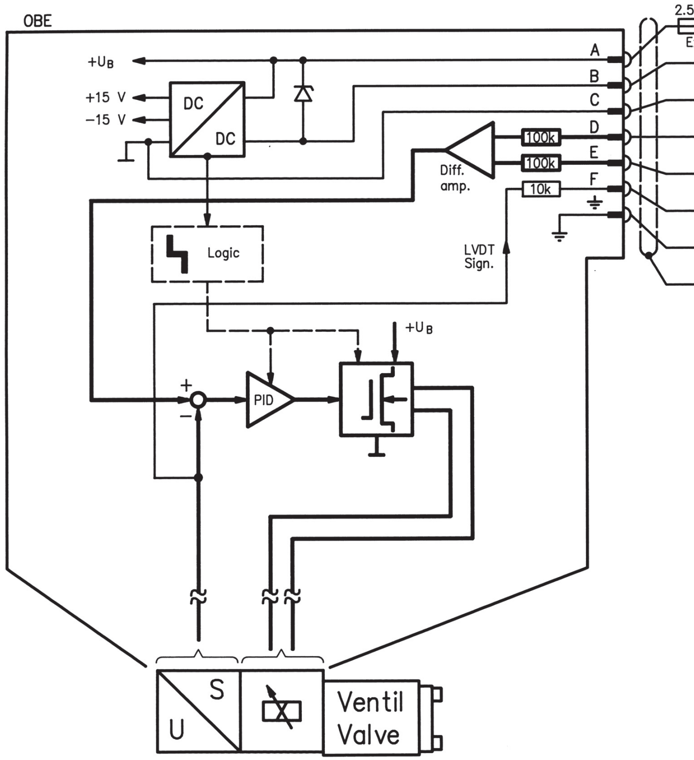
Version:	– Multi-wire cable – Extra-finely stranded wire to VDE 0295, Class 6 – Safety earth conductor, green/yellow – Cu-braided shield
Type:	– e.g. Ölflex-FD 855 CP (from Lappkabel company)
No. of wires:	– Determined by type of valve, plug type and signal assignment
Cable Ø:	– 0.75 mm² up to 20 m long – 1.0 mm² up to 40 m long
Outside Ø:	– 9.4...11.8 mm – Pg11 – 12.7...13.5 mm – Pg16

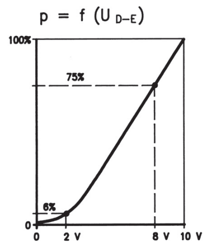
Important

Voltage supply 24 V DC nom,
if voltage drops below 18 V DC, rapid shutdown resembling "Enable OFF" takes place internally.
In addition, with the "mA signal" version:
$I_{D-E} \geqq 3$ mA – valve is active
$I_{D-E} \leqq 2$ mA – valve is deactivated.
Electrical signals emitted via the trigger electronics (e.g. actual values) must not be used to shut down safety-relevant machine functions!
(See also European Standard, "Technical Safety Requirements for Fluid-Powered Systems and Components – Hydraulics", EN 982.)

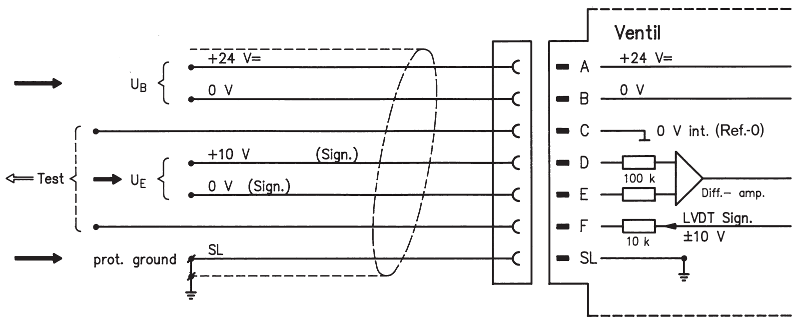
On-board trigger electronics

Circuit diagram/pin assignment
Version A1: U_{D-E} 0...+10 V



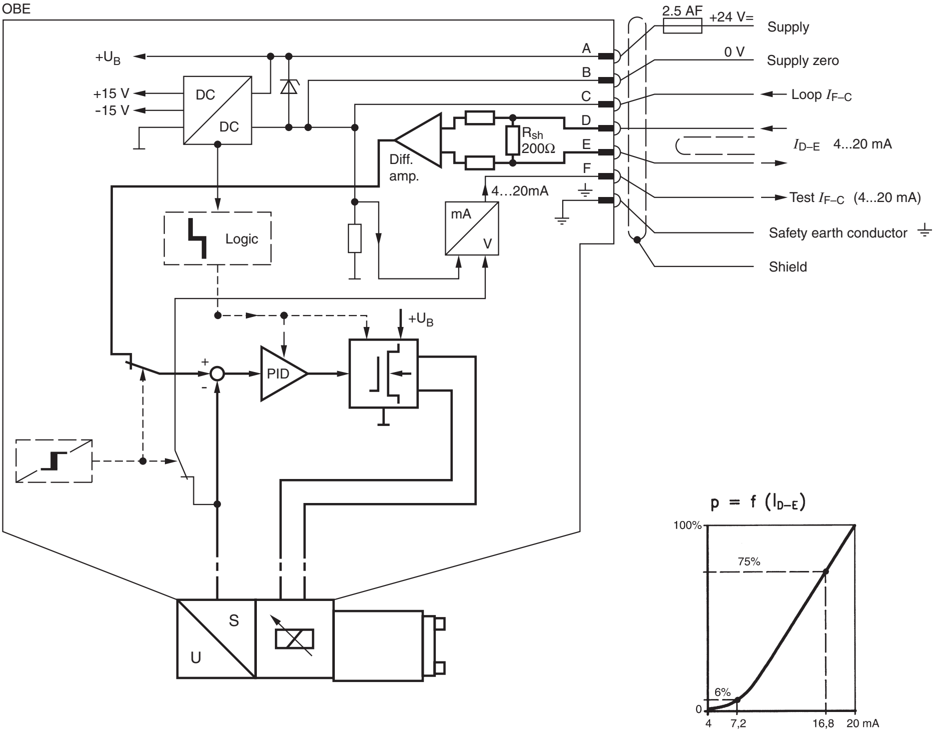


Pin assignment
Version A1: U_{D-E} 0...+10 V
(R_i = 100 kΩ)

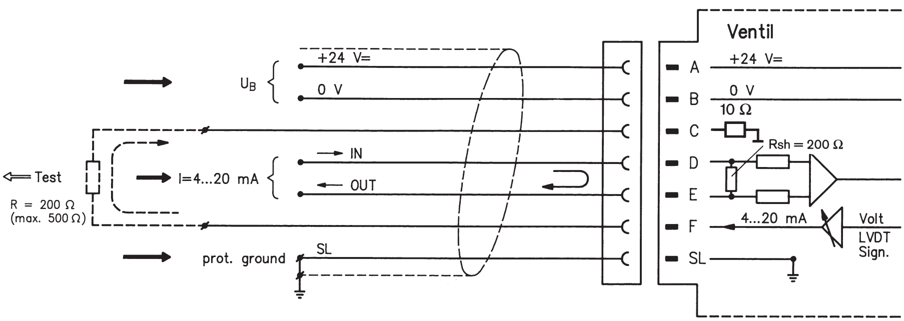


On-board trigger electronics

Circuit diagram/pin assignment
Version F1: I_{D-E} 4...20 mA

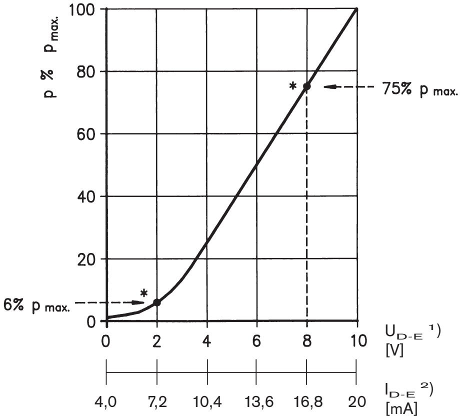


Pin assignment
Version F1: I_{D-E} 4...20 mA
($R_{sh} = 200$ kΩ)



Characteristic curve (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Pressure in port P as a function of the setpoint
Nominal flow rate = 1 l/min

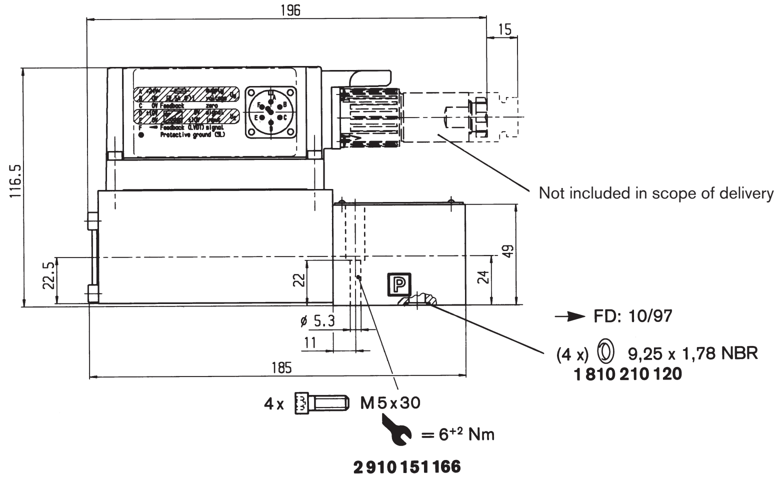


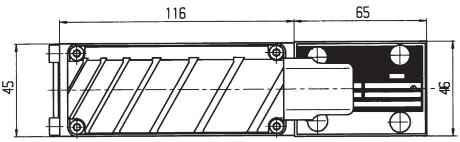
* Factory setting at $Q = 1$ l/min
±2 % manufacturing tolerance

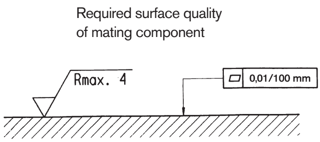
1) Version: $U_{D-E} = 0...+10$ V

2) Version: $I_{D-E} = 4...20$ mA

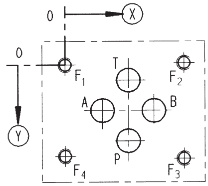
Unit dimensions (nominal dimensions in mm)







Mounting hole configuration: NG6 (ISO 4401-03-02-0-94)
For subplates, see catalog sheet RE 45053



1) Deviates from standard

2) Thread depth:
Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

	P	A	T	B	F_1	F_2	F_3	F_4
X	21.5	12.5	21.5	30.2	0	40.5	40.5	0
Y	25.9	15.5	5.1	15.5	0	–0.75	31.75	31
Ø	8 1)	8 1)	8 1)	8 1)	M5 2)	M5 2)	M5 2)	M5 2)

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Telefon +49 (0) 93 52 / 18-0
Telefax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

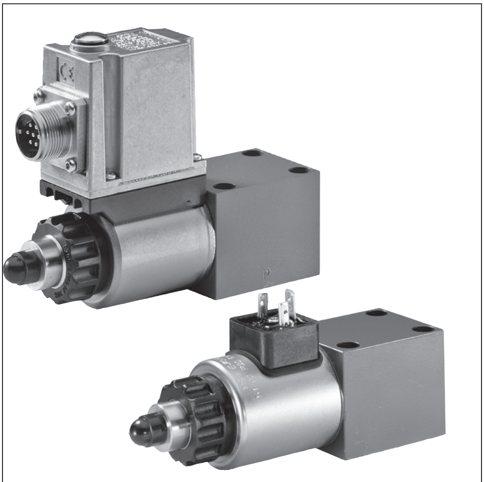
The Drive & Control Company

Rexroth
Bosch Group

Proportional pressure relief valve, directly operated, without/with integrated electronics (OBE)

Type DBET and DBETE

RE 29162
Edition: 2013-06
Replaces: 04.13



- Size 6
- Component series 6X
- Maximum operating pressure 420 bar
- Maximum flow: 2 l/min

Features

- Directly operated valves for limiting a system pressure
- Operation by means of proportional solenoid
- Proportional solenoid with central thread and detachable coil
- For subplate mounting:
  Porting pattern according to ISO 4401
- Integrated electronics (OBE) with type DBETE:
  Little manufacturing tolerance of the command value pressure characteristic curve
- External control electronics with type DBET:
  Amplifier with modular design, Euro-card format and as plug-in amplifier, individually adjustable upwards and downwards ramp, fine adjustment of the command value pressure characteristic curve is possible

Contents

Ordering code

01	02		03		04	05	06	07	08	09	10	11
DBET		**–**	**6X**	**/**			**G24**					*****

01	Proportional pressure relief valve	**DBET**

02	For external control electronics	**no code**
	With integrated electronics	**E**

03	Component series 60 to 69 (60 to 69: Unchanged installation and connection dimensions)	**6X**

Maximum pressure rating

04	Up to 50 bar	**50**
	Up to 100 bar	**100**
	Up to 200 bar	**200**
	Up to 315 bar	**315**
	Up to 350 bar	**350**
	Up to 420 bar	**420**

05	Pilot oil return internal	**no code**
	Pilot oil return, external	**Y**

Supply voltage of the integrated electronics (OBE)

06	24 V DC voltage	**G24**

07	1600 mA coil	**no code**
	800 mA coil (only possible for DBET-6X (external control electronics))	**–8** 1)

Electrical connection

08	**For type DBET:**	
	Without mating connector; connector DIN EN 175301-803	**K4** 2)
	For type DBETE:	
	Without mating connector; connector DIN EN 175201-804	**K31** 2)

Electronics interface

09	Command value 0 to 10 V	**A1**
	Command value 4 to 20 mA	**F1**
	with DBET	**no code**

Seal material

10	NBR seals	**M**
	FKM seals	**V**
	Attention: Observe compatibility of seals with hydraulic fluid used! (Other seals upon request)	

11	Further details in the plain text	

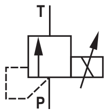
1) Replacement for series 5X (for comparison, see characteristic curve on page 9). All hydraulic characteristics specified in the data sheet refer to the version with a 1600 mA coil.

2) Mating connectors, separate order, see pages 7 and 14.

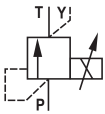
Symbols

For external control electronics (type DBET)

Pilot oil return internal

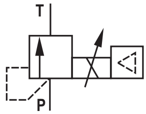


Pilot oil return, external (Y)

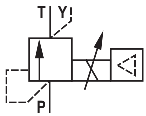


With integrated electronics (type DBETE)

Pilot oil return internal



Pilot oil return, external (Y)



Function, section

General information

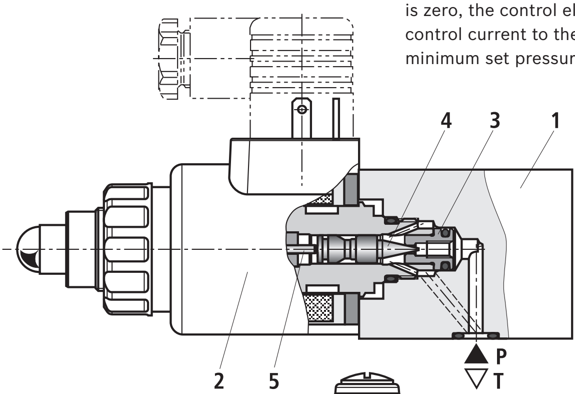
Type DBET proportional pressure relief valves are remote control valves with seat design and are used to limit a system pressure. Operation by means of a proportional solenoid with central thread and detachable coil. The interior of the solenoid is connected to port T or Y and is filled with the hydraulic fluid. Depending on the electric command value, these valves can be used to smoothly set the system pressure to be limited.

The valves mainly consist of the housing (1), the proportional solenoid (2), the valve seat (3) and the valve poppet (4).

Basic principle

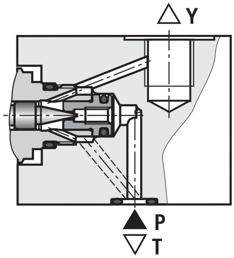
For the setting of the system pressure, a command value is specified at the control electronics. Depending on the command value, the electronics actuate the solenoid with electric current. The proportional solenoid converts the electric current into mechanical force that acts on the valve poppet (4) via the armature plunger (5). The valve poppet (4) presses on the valve seat (3) and interrupts the connection between port P and T or Y. If the hydraulic force on the valve poppet (4) equals the solenoid force, the valve controls the set pressure by lifting the valve poppet (4) off the valve seat (3) and thus enabling hydraulic fluid to flow from port P to T or Y. If the command value is zero, the control electronics only applies the minimum control current to the proportional solenoid (2) and the minimum set pressure is applied.

Type DBET

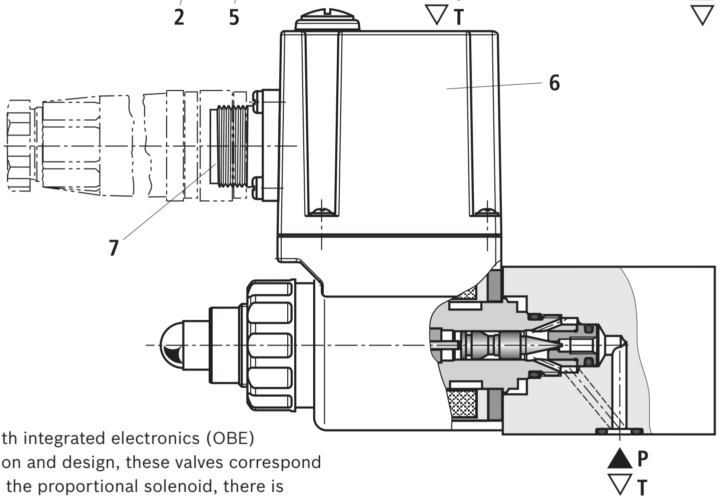


Type DBET...Y

Pilot oil return, external



Type DBETE



Type DBETE – with integrated electronics (OBE)

In terms of function and design, these valves correspond to type DBET. On the proportional solenoid, there is a housing (6) with the control electronics.

Supply and command value voltage are applied at the connector (7). At the factory, the command value pressure characteristic curve is adjusted with little manufacturing tolerance.

For more information on the control electronics, see page 8.

Technical data
(for applications outside these parameters, please consult us.)

general			
Weight	– Type DBET	kg	2.0
	– Type DBETE	kg	2.15
Mounting orientation			Any
Ambient temperature range		°C	–20 to +70 (DBET) –20 to +50 (DBETE)

hydraulic			
Maximum operating pressure	– Port P	bar	420
Maximum set pressure	– Pressure rating 50 bar	bar	50
	– Pressure rating 100 bar	bar	100
	– Pressure rating 200 bar	bar	200
	– Pressure rating 315 bar	bar	315
	– Pressure rating 350 bar	bar	350
	– Pressure rating 420 bar	bar	420
Minimum set pressure (at command value 0 V or 4 mA)		bar	See characteristic curves on page 11
Return flow pressure	Port T and/or Y	bar	Separately at zero pressure to the tank
Maximum flow		l/min	2 [1]
Hydraulic fluid [1]			See table on page 6
Hydraulic fluid temperature range		°C	–20 to +80
Viscosity range		mm^2/s	20 to 380, preferably 30 to 46
Maximum permitted degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Class 20/18/15 [2]
Hysteresis		%	< 4 of the maximum set pressure
Range of inversion		%	< 0.5 of the maximum set pressure
Response sensitivity		%	< 0.5 of the maximum set pressure
Linearity (flow 0.8 l/min)		%	±3 of the maximum set pressure
Manufacturing tolerance of the command value pressure characteristic curve, related to 0.8 l/min; pressure increasing	at command value 20 %	%	< ±1.5 of the maximum set pressure [3]
	at command value 100 %	%	< ±5 of the maximum set pressure (type DBET) [4] < ±1.5 of the maximum set pressure (type DBETE)
Step response (Tu + Tg) 0 → 100 % or 100 % → 0 line volume < 20 cm^3; ***Q*** = 0.8 l/min		ms	80 (depending on the system)

1) Observe flow limitation for pressure ratings 315, 350 and 420 bar (page 10).

2) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components.
For the selection of the filters, see www.boschrexroth.com/filter.

3) Zero point calibration at the factory.

4) Possible comparison of the external control electronics.

3

Technical data
(for applications outside these parameters, please consult us.)

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils		HL, HLP	NBR, FKM	DIN 51524
Bio-degradable	– Insoluble in water	HEES	FKM	VDMA 24568
Flame-resistant	– Water-free	HFDU	FKM	ISO 12922
	– Containing water	HFC (Fuchs Hydrotherm 46M, Petrofer Ultra Safe 620)	NBR	ISO 12922

Important information on hydraulic fluids!
- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.)!
- The flash point of the hydraulic fluid used must be 40 K higher than the maximum solenoid surface temperature.

- **Flame-resistant – containing water:**
  - The maximum pressure differential per control edge is 210 bar. Otherwise, there is increased cavitation erosion.
  - Life cycle as compared to operation with mineral oil HLP 30 to 100 %
  - Maximum fluid temperature 60 °C
- **Bio-degradable:** When using bio-degradable hydraulic fluids that are zinc-solving, zinc may accumulate in the fluid (700 mg zinc per pole tube).

electric			G24	G24-8
Minimum solenoid current		mA	≤ 100	≤ 100
Maximum solenoid current		mA	1600 ± 10 %	800 ± 5 %
Solenoid coil resistance	– Cold value at 20 °C	Ω	5,5	20,6
	– Maximum hot value	Ω	8,05	33
Switch-on duration		%	100	100

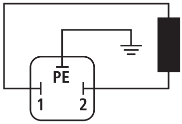
electric, integrated electronics (OBE)			
Supply voltage	– Nominal voltage	VDC	24
	– Lower limit value	VDC	21
	– Upper limit value	VDC	35
Current consumption		A	≤ 1,5
Required fuse protection		A	2, slow-blowing
Inputs	– Voltage	V	0 to 10
	– Current	mA	4 to 20
Output	– Actual current value	mV	1 mV ≙ 1 mA
Protection class of the valve according to EN 60529			IP 65 with mating connector mounted and locked

Notice!
Information on the environment simulation testing for the areas EMC (electromagnetic compatibility), climate and mechanical load, see data sheet 29162-U (declaration on environmental compatibility).

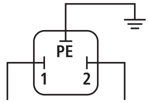
Electrical connection (dimensions in mm)

Type DBET

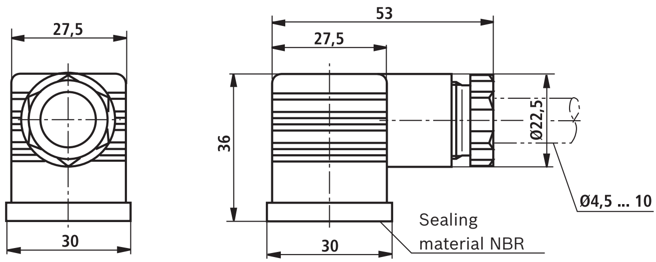
Connection at the connector



Connection at mating connector



Mating connector (black) according to DIN EN 175301-803, material no. **R901017011** (separate order)



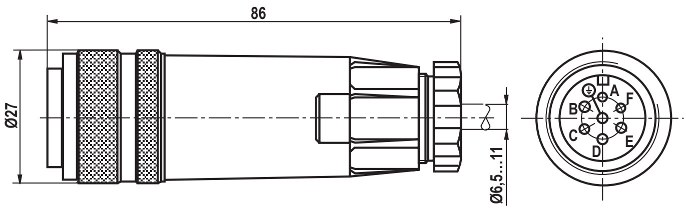
3

Type DBETE

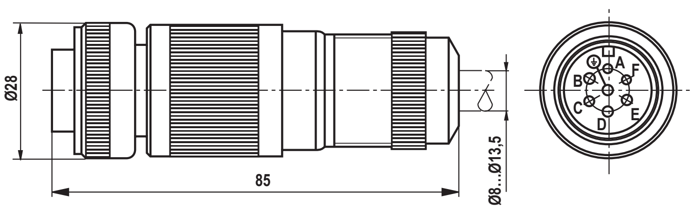
Connector pin assignment	Contact	Allocation interface "A1"	Allocation interface "F1"
Supply voltage	A	24 VDC (u(t) = 21 V to 35 V); I_{max} ≤ 1.5 A	
	B	0 V	
Reference potential actual value	C	Reference contact F; 0 V	Reference contact F; 0 V
Differential amplifier input	D	0 to 10 V; R_E = 100 kΩ	4 to 20 mA; R_E = 100 Ω
	E	Reference potential command value	
Measuring output (actual value)	F	0 to 1.6 V actual value (1 mV ≙ 1 mA) Load resistance > 10 kΩ	
Protective ground	PE	Connected to solenoid and valve housing	

Mating connectors according to DIN EN 175201-804, solder contacts for line cross-section 0.5 to 1.5 mm²

Plastic version,
material no. **R900021267**
(separate order)



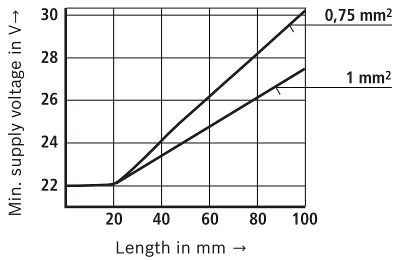
Metal version,
material no. **R900223890**
(separate order)



Electrical connection

Connection cable for type DBETE
– Recommendation 6-wire, 0.75 or 1 mm² plus protective grounding conductor and screening
– Only connect the screening to PE on the supply side
– Maximum admissible length = 100 m

The minimum supply voltage at the power supply unit depends on the length of the supply line (see diagram).



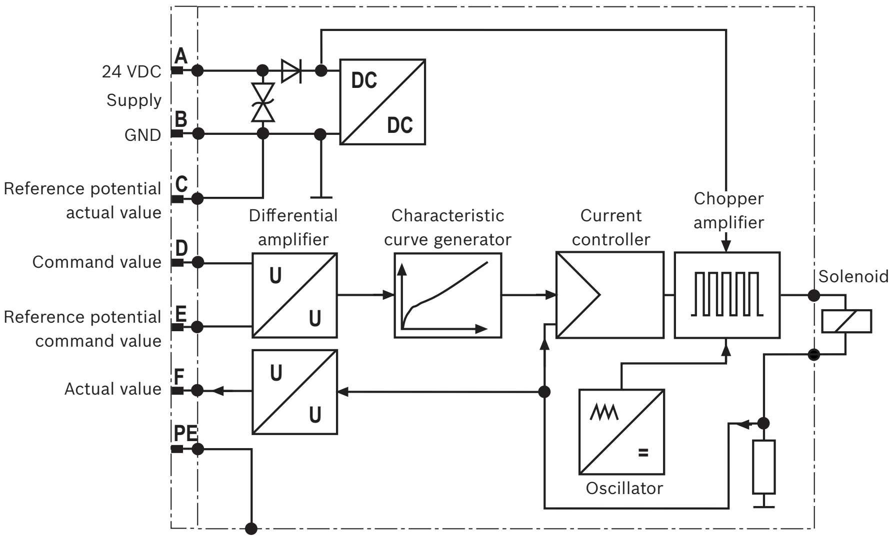
Integrated integrated (OBE) with type DBETE

Function

The electronics are supplied with voltage via ports A and B. The command value is applied to the differential amplifier ports D and E.
Via the characteristic curve generator, the command value solenoid current characteristic curve is adjusted to the valve so that non-linearities in the hydraulic system are compensated and thus, a linear command value pressure characteristic curve is created.
The current controller controls the solenoid current independently of the solenoid coil resistance.

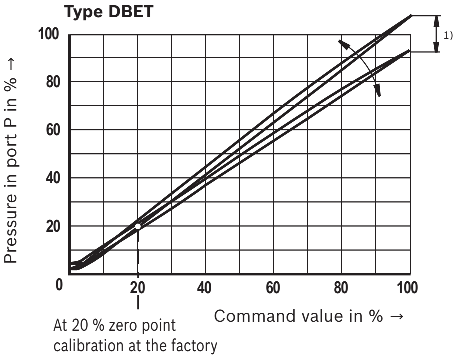
The power stage of the electronics for controlling the proportional solenoid is a chopper amplifier with a cycle frequency of approx. 180 Hz to 400 Hz. The output signal is pulse-width modulated (PWM).
In order to check the solenoid current, a voltage can be measured at the connector between pin F(+) and pin C(–) that is proportional to the solenoid current. **1 mV** corresponds to **1 mA** solenoid current.

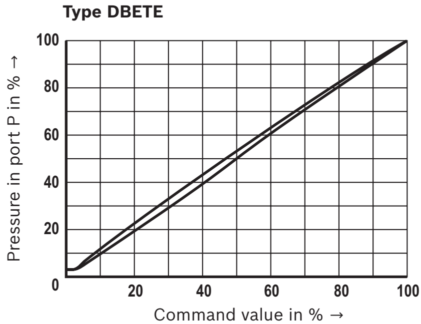
Block diagram



Characteristic curves
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

Pressure in port P depending on the command value (flow = 0.8 l/min)

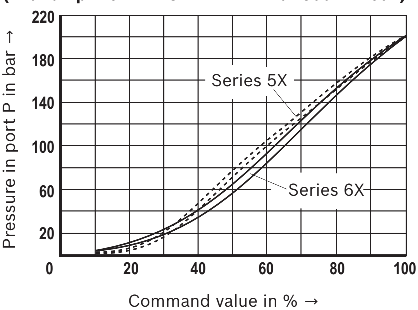




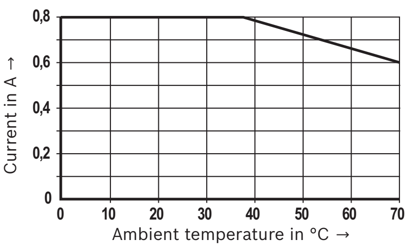
[1] With valve type DBET, the manufacturing tolerance at the **external amplifier** (type and data sheet, see page 14) can be changed using the command value attenuator potentiometer "**Gw**". The digital amplifier is set using the parameter "Limit".
In this context, the control current according to the technical data must not be exceeded.
In order that several valves can be adjusted to the same characteristic curve, do not set the pressure higher than the maximum set pressure of the pressure rating with command value 100 %.

Pressure in port P depending on the command value

Comparison DBET series 5X-6X / pressure rating 200 bar (with amplifier VT-VSPA1-1-1X with 800 mA coil)



Current drop as ambient temperature rises, 24 V and 100 % duty cycle

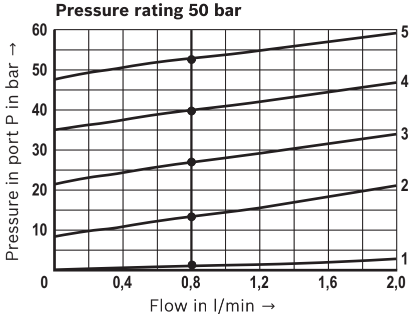


Note!
At increased temperature, the solenoid current drops, which results in a corresponding deviation of the set pressure.

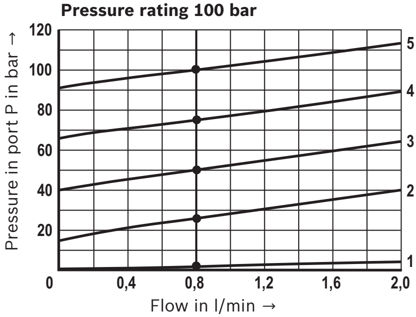
Characteristic curves
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

Pressure in port P depending on the flow

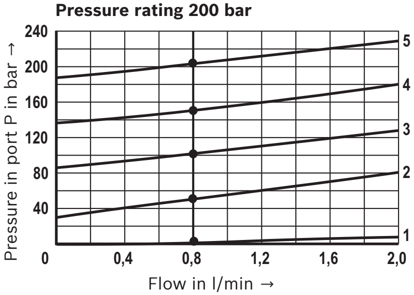
Pressure rating 50 bar



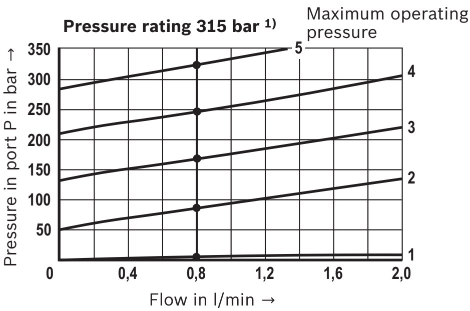
Pressure rating 100 bar



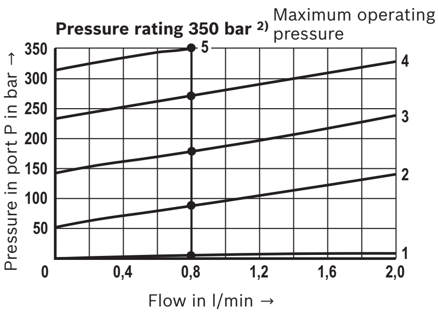
Pressure rating 200 bar



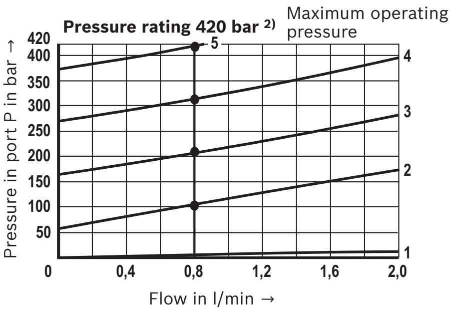
Pressure rating 315 bar [1)]



Pressure rating 350 bar [2)]



Pressure rating 420 bar [2)]



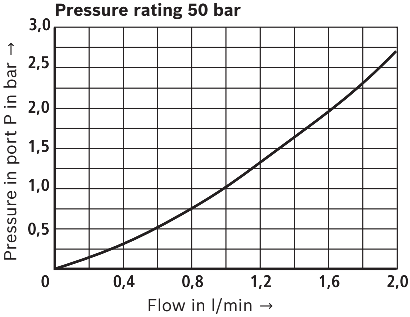
Applicable for all pressure ratings:
Curve **1** at 0 % of the command value
Curve **2** at 25 % of the command value
Curve **3** at 50 % of the command value
Curve **4** at 75 % of the command value
Curve **5** at 100 % of the command value [1; 2)]
The characteristic curves were measured without counter pressure in port T. ($\boldsymbol{p}_T$ = 0 bar)

1) In the case of characteristic curve 5, the command value may not exceed the maximum flow of 1.4 l/min
2) In the case of characteristic curve 5, the command value may not exceed the maximum flow of 0.8 l/min

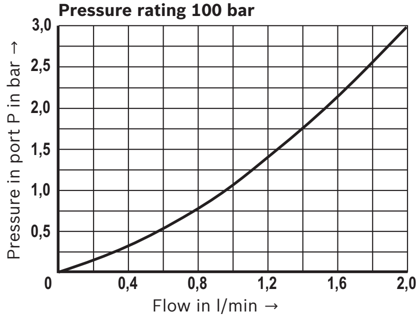
Characteristic curves
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

Minimum set pressure in port P with command value 0 V and/or 4 mA depending on the flow

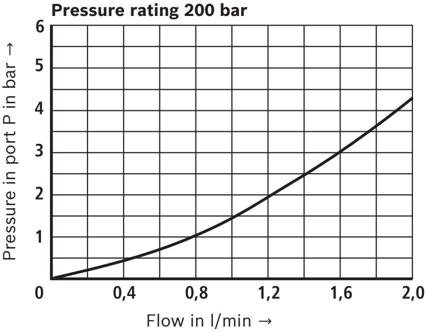
Pressure rating 50 bar



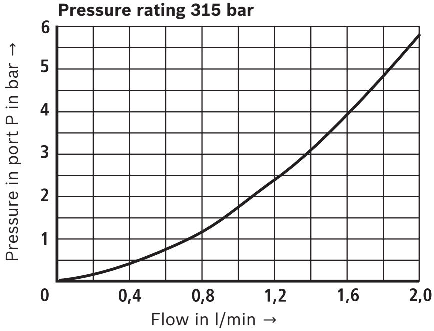
Pressure rating 100 bar



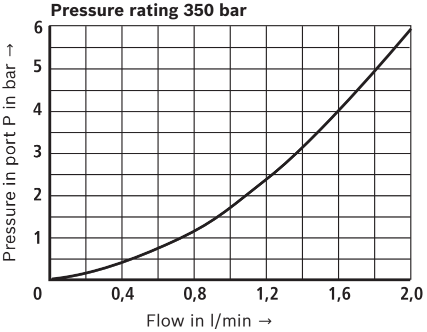
Pressure rating 200 bar



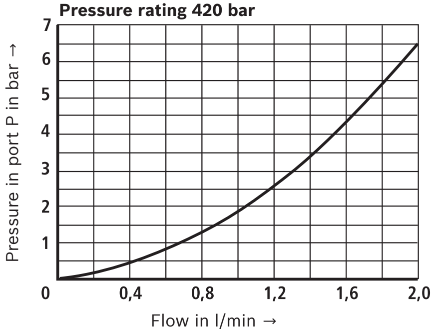
Pressure rating 315 bar



Pressure rating 350 bar



Pressure rating 420 bar

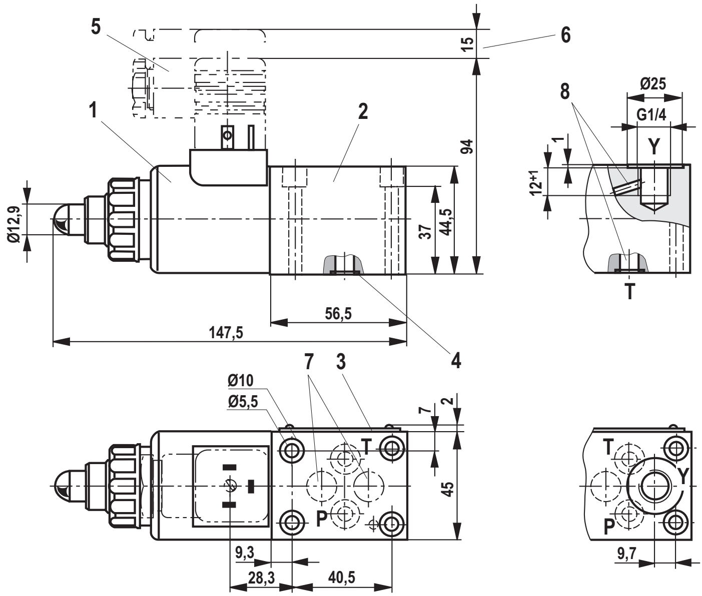


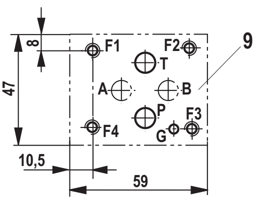
Notice

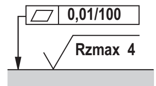
The characteristic curves were measured without counter pressure in port T. ($\boldsymbol{p}_T$ = 0 bar)
Minimum control current ≤ 100 mA
(This current is reached with a command value of 0 V and/or 4 mA.)

3

Dimensions: Type DBET
(dimensions in mm)





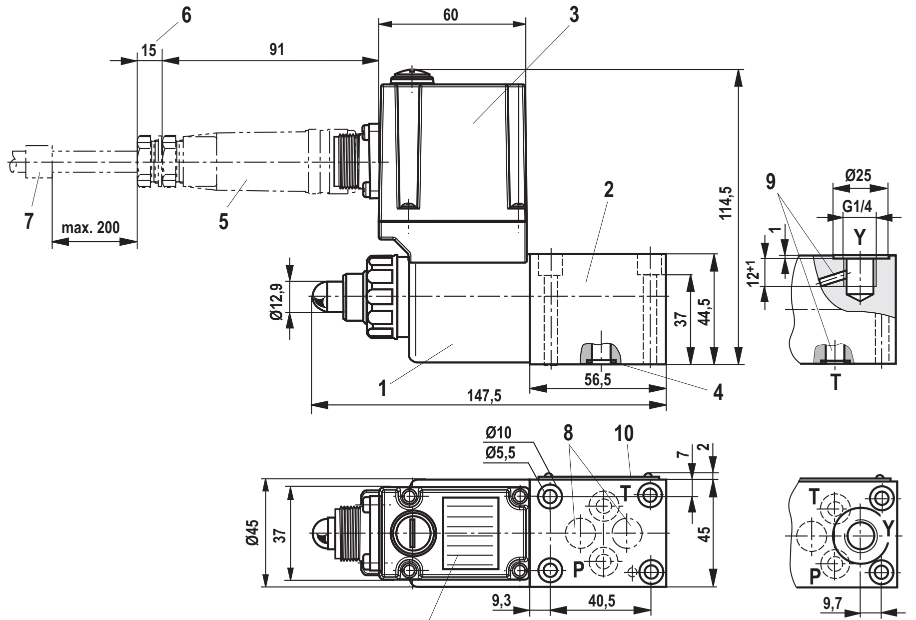


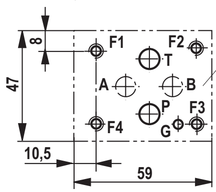
Required surface quality of the valve contact surface

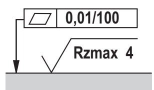
1 Proportional solenoid
2 Valve housing
3 Name plate
4 Identical seal rings for ports P, T, A and B
5 Mating connector according to DIN EN 175301-803
6 Space required for removing the mating connector
7 Blind counterbores A and B
8 With version ..Y.. (external pilot oil return) port Y is internally connected to port T. Port T is not plugged.
9 Machined valve contact surface, porting pattern according to ISO 4401-03-02-0-05 Deviating from the standard: "A" and "B" channels not drilled locating pin not included in the scope of delivery

For valve mounting screws and **subplates,** see page 14.

Dimensions: Type DBETE
(dimensions in mm)







Required surface quality of the valve contact surface

1 Proportional solenoid
2 Valve housing
3 Integrated electronics (OBE)
4 Identical seal rings for ports P, T, A and B
5 Mating connectors according to DIN EN 175301-804
6 Space required for removing the mating connector
7 Cable fastening
8 Blind counterbores A and B
9 With version ..Y.. (external pilot oil return) port Y is internally connected to port T. Port T is not plugged.
10 Name plate
11 Block diagram of the integrated electronics (OBE)
12 Machined valve contact surface, porting pattern according to ISO 4401-03-02-0-05 Deviating from the standard: "A" and "B" channels not drilled locating pin not included in the scope of delivery

For valve mounting screws and **subplates,** see page 14.

3

Dimensions

Hexagon socket head cap screws		Material number
Size 6	4x ISO 4762 - M5 x 45 - 10.9-flZn-240h-L Tightening torque M_A = 7 Nm ± 10 %	R913000140

Notice: The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure!

Subplates	Data sheet	Material number
G 341/01 (G1/4) G 341/60 (G3/8)	45052 45052	R900424447 R901027119

Accessories (not included in the scope of delivery)

External control for type DBET	Data sheet	Material number
VT-MSPA1-1-1X/V0/... in modular design (analog) VT-VSPD-1-2X/V0/.-0-1 in euro-card format (digital) VT-VSPA1-2-1X/V0/...in euro-card format (analog) VT-SSPA1-1-1X/V0/0-24 as a plug-in amplifier (analog) Limitations: No linearization of the command value pressure characteristic curve, higher hysteresis and range of inversion	30223 30523 30115 30265	

External control for type DBET ...G24-8...	Data sheet	Material number
VT-2000-5X/... in euro-card format VT-MSPA1-1-30 with modular design	29904 30224	

Mating connectors (details see page 7)	Data sheet	Material number
For type DBET: Mating connectors according to DIN EN 175301-803 For type DBETE: Mating connectors according to DIN EN 175201-804	08006 08006	R901017011 R900021267 (plastic) R900223890 (metal)

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
documentation@boschrexroth.de
www.boschrexroth.de

Proportional pressure relief valve, direct operated, increasing characteristic curve

RE 18139-04/06.12 1/14
Replaces: 11.11

Type KBPS.8A (High Performance)

Component size 8
Component series A
Maximum operating pressure 420 bar
Maximum flow 2 l/min

H7071

Table of contents

Features

– Cartridge valve
– Mounting cavity R/T-8A
– Direct operated proportional valve for limiting a system pressure
– Suitable for mobile and industrial applications
– Operation by means of proportional solenoid with central thread and detachable coil
– Fine adjustment of the command value pressure characteristic curve possible from the outside at the control electronics
– In case of power failure, minimum set pressure

– Control electronics:	Data sheet
• Plug-in proportional amplifier type VT-SSPA1…	30116
• Analog amplifier type RA…	95230
• BODAS controller type RC…	95200

Information on available spare parts:
www.boschrexroth.com/spc

Ordering code

KBPS		8	A	A /	H	C			V		*

Proportional pressure relief valve, direct operated (pilot control valve)

Pressure rating

up to 30 bar = **B**
up to 50 bar = **C**
up to 100 bar = **F**
up to 150 bar = **H**
up to 210 bar = **L**
up to 250 bar = **N**
up to 315 bar = **P**
up to 350 bar = **R**
up to 420 bar = **T**

Component size 8 = **8**

Minimum pressure with command value = 0 = **A**

Component series = **A**

High Performance and mounting cavity R/T-8A (see page 13) = **H**

Proportional solenoid, wet-pin = **C**

Supply voltage

G12 = Control electronics 12 V DC
G24 = Control electronics 24 V DC

Electrical connection [1)]

K4 = Without mating connector, with connector according to DIN EN 175301-803
K40 = Without mating connector, with connector DT 04-2PA (Deutsch plug)
C4 = Without mating connector, with connector AMP Junior-Timer

Seal material

V = FKM seals
Attention!
Observe compatibility of the seals with the hydraulic fluid used!

no code = Standard
-8 = Coil 800 mA (see page 5)

Further details in the plain text

[1)] Mating connectors, separate order, see data sheet 08006.

Preferred types

Type	Material number
KBPSC8AA/HCG24K4V	R901049804
KBPSF8AA/HCG24K4V	R901049817
KBPSL8AA/HCG24K4V	R901027408
KBPSN8AA/HCG24K4V	R901049877
KBPSP8AA/HCG24K4V	R901047007
KBPSR8AA/HCG24K4V	R901049860
KBPST8AA/HCG24K40V	R901045871
KBPSL8AA/HCG24K4V-8	R901053398
KBPSP8AA/HCG24C4V-8	R901132980
KBPSR8AA/HCG24C4V-8	R901128882

Function, section, symbol

General

Valves of type KBPS.8A are direct operated proportional pressure relief valves (pilot control valves) in seat design and are used to limit a system pressure. They basically comprise of the pule tube (3), the solenoid coil (4), the valve seat (5) and the valve poppet (6).

With command value 0 or in case of power failure, the minimum pressure is set. Operation by means of a proportional solenoid with central thread and detachable coil. The solenoid's interior is connected to the main port ② and filled with hydraulic fluid. Depending on the electric command value, these valves can be used to continuously set the system pressure to be limited.

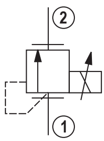
Basic principle

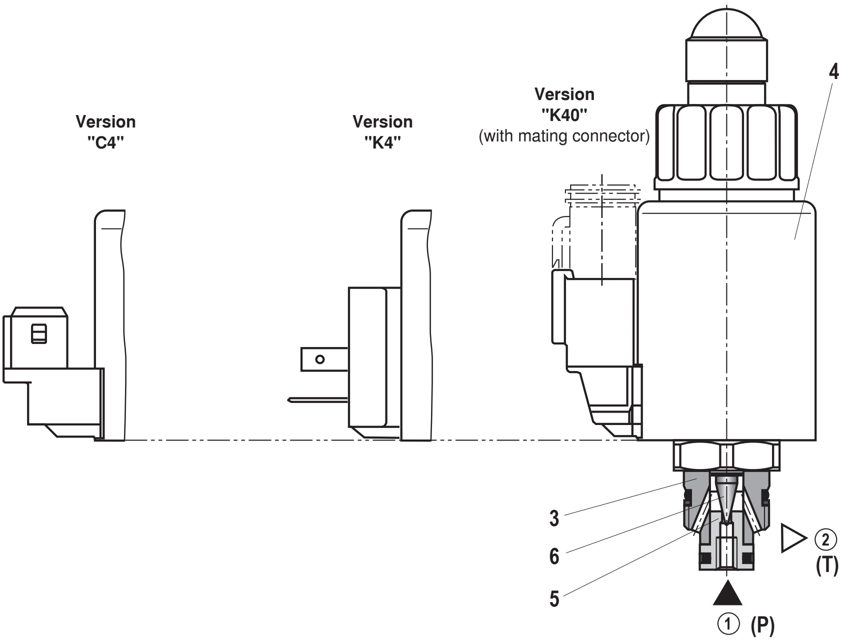
For the setting of the system pressure, a command value is specified at the control electronics. Depending on the command value, the electronics necessary for operation actuate the solenoid with electric current. The proportional solenoid converts the electric current into mechanical force that acts on the valve poppet (6) via the armature plunger. The valve poppet (6) pushes onto the valve seat (5) and blocks the connection between main port ① and ②. If the hydraulic force on the valve poppet (6) corresponds to the solenoid force, the valve controls the set pressure by lifting the valve poppet (6) off the valve seat (5) and thus enabling hydraulic fluid flow from main port ① to ②. If the command value is zero, the minimum pressure is set.

☞ **Notice!**

Occurring tank pressures (main port ②) are added up to the set values in the main port ①.

Symbol





3

Technical data (For applications outside these parameters, please consult us!)

general

Weight	kg	0.45
Installation position		Any - if it is ensured that no air can collect upstream the valve. Otherwise, we recommend suspended installation of the valve.
Ambient temperature range	°C	–20 to +120
Storage temperature range	°C	–20 to +80

Environmental audits:

Vibration test according to DIN EN 60068-2 / IEC 60068-2 /2 axes (X/Z)		
DIN EN 60068-2-6: 05/96	Vibrations, sine-shaped	10 cycles (5 Hz to 2000 Hz back to 5 Hz) with logarithmic frequency changing speed of 1 octave/min, 5 to 57 Hz, amplitude 1.5 mm (p-p), 57 to 2000 Hz, amplitude 10 g
IEC 60068-2-64: 05/93	Vibrations (random) and broadband noise	20 to 2000 Hz, amplitude 0.05 g^2/Hz (10 g RMS/30 g peak), testing time 30 min
DIN EN 60068-2-27: 03/95	Shocking	Half sine 15 g / 11 ms, 3 x in positive, 3 x in negative direction (a total of 6 individual shocks)
DIN EN 60068-2-29: 03/95	Bump test	Half sine 25 g / 6 ms, 1000 x in positive, 1000 x in negative direction (a total of 2000 individual shocks)
Indication per axis		
Climatic test according to EN 60068-2 / IEC 60068-2 (environmental test):		
DIN EN 60068-2-1: 03/95	Storage temperature	–40 °C, duration 16 h
DIN EN 60068-2-2: 08/94		+110 °C, duration 16 h
DIN EN 60068-2-1: 03/95	Cold test	2 cycles –25 °C, duration 2 h
DIN EN 60068-2-2: 08/94	Dry heating test	2 cycles +120 °C, duration 2 h
IEC 60068-2-30: 1985	Humid heat, cyclic	Variant 2/ +25 °C to +55 °C 93 % to 97 % relative humidity, 2 cycles à 24 h
Salt spray test: 720 h according to DIN 50021		
→ Coating generally not necessary. If paint is applied nevertheless, the reduced heat dissipation capacity is to be observed.		

hydraulic

Maximum operating pressure [1] (Main port ①)	bar	420
Maximum admissible return flow pressure (main port ②)	bar	210
Maximum set pressure [2]		See command value pressure characteristic curves page 6
Minimum set pressure with command value 0		See characteristic curves page 8 and 9
Maximum flow	l/min	2 (see characteristic curves page 6 and 7)
Hydraulic fluid		See page 5
Hydraulic fluid temperature range	°C	–20 to +80
Viscosity range	mm^2/s	15 to 380
Maximum permitted degree of contamination of the hydraulic fluid - cleanliness class according to ISO 4406 (c)		Class 20/18/15 [3]

1) **Attention!** The maximum operating pressure is the total of set pressure and return flow pressure!

2) If the valve is installed in a mounting cavity made of non-magnetically conductive material, the maximum set pressure is < 3 % lower.
Attention! The valves are set in the factory. In case of subsequent adjustment, the warranty will become invalid!

3) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components.
For the selection of the filters see www.boschrexroth.com/filter.

Technical data (For applications outside these parameters, please consult us!)

hydraulic

Hysteresis 4)			< 5 % of the max. set pressure
Range of inversion 4)			< 0.5 % of the max. set pressure
Response sensitivity 4)			< 0.5 % of the max. set pressure
Manufacturing tolerance of the command value pressure characteristic curve	– Command value 100 %		< 5 % of the max. set pressure
	– Command value 0		< 2 % of the max. set pressure
Step response (T_u + T_g) 0 → 100 % and/or 100 % → 0		ms	70 (depending on the system)

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils		HL, HLP	FKM	DIN 51524
Bio-degradable	– Insoluble in water	HEES	FKM	VDMA 24568
	– Soluble in water	HEPG	FKM	

Important information on hydraulic fluids!
- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!
- The flash point of the hydraulic fluids used must be 40 K higher than the maximum solenoid surface temperature.
- **Bio-degradable:** When using bio-degradable hydraulic fluids that are simultaneously zinc-solving, zinc may accumulate in the fluid.

3

electric

Supply voltage		V	12 DC	24 DC	"-8" / 24 DC
Maximum control current		mA	1760	1200	800
Coil resistance	– Cold value at 20 °C	Ω	2.3	4.8	11.5
	– max. hot value	Ω	3.8	7.9	18.9
Switch-on duration		%	100 5)		
Maximum coil temperature 6)		°C	150		
Protection class according to DIN EN 60529	– Version "K4"		IP 65 with mating connector mounted and locked		
	– Version "K40"		IP 69K with mating connector mounted and locked		
	– Version "C4"		IP 66 with mating connector mounted and locked		
			IP 69K with Rexroth mating connector (Material no. R901022127)		
Control electronics (separate order)			– Plug-in proportional amplifier type VT-SSPA1…, see data sheet 30116 – Analog amplifier type RA…, see data sheet 95230 – BODAS controller type RC…, see data sheet 95200		
Design according to VDE 0580					

4) Measured with analog amplifier type RA2-1/10, see data sheet 95230

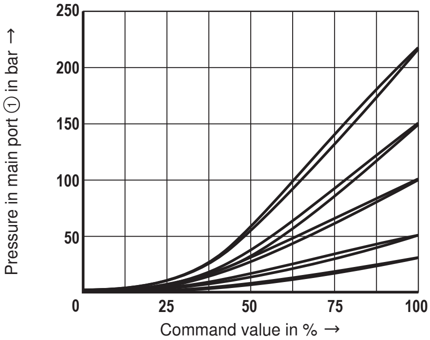
5) In case of use more than 2000 m a.s.l., please consult us.

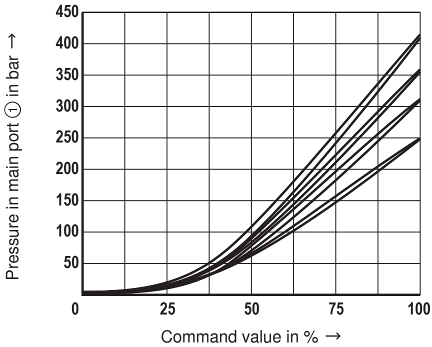
6) Due to the surface temperatures of the solenoid coils, the standards ISO 13732-1 and EN 982 need to be adhered to!

In the electrical connection, the protective earthing conductor (PE ⏚) must be connectedproperly.

Characteristic curves (measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C and 24 V coil)

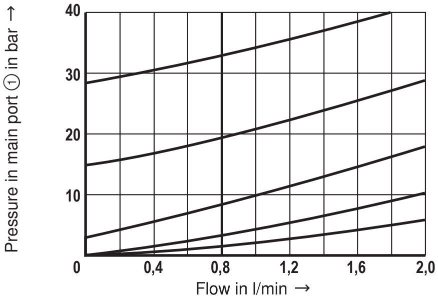
Pressure in the main port ① depending on the command value. Flow = 0.8 l/min



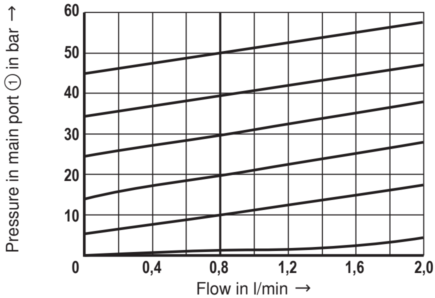


Pressure in the main port ① depending on the flow.
(The characteristic curve was measure without counter pressure in main port ②.)

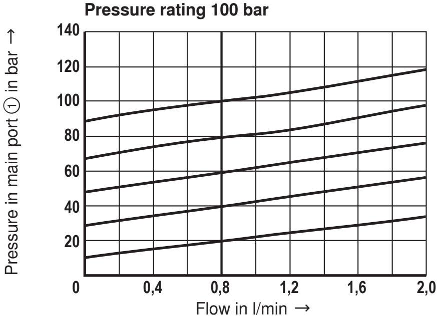
Pressure rating 30 bar



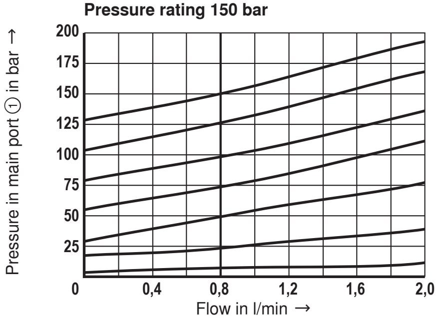
Pressure rating 50 bar



Pressure rating 100 bar

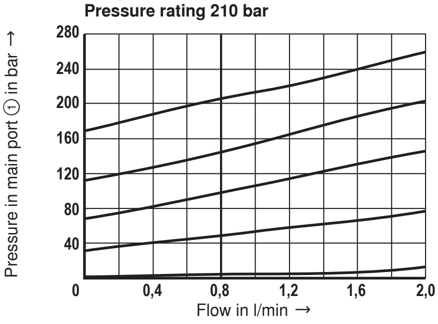


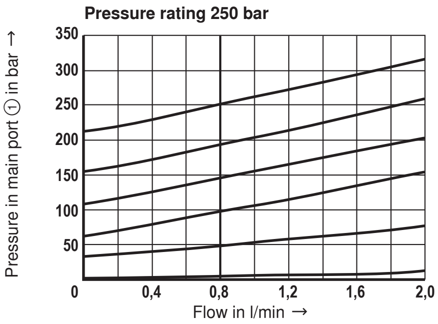
Pressure rating 150 bar

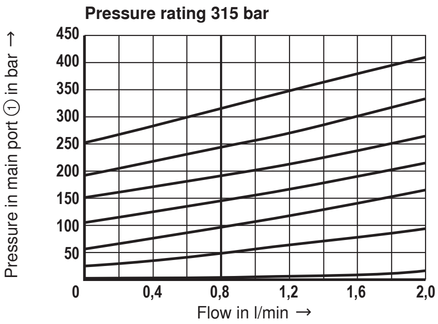


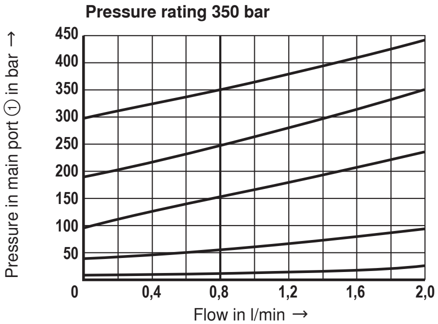
Characteristic curves (measures with HLP46, ϑ_{Oil} = 40 °C ± 5 °C and 24 V coil)

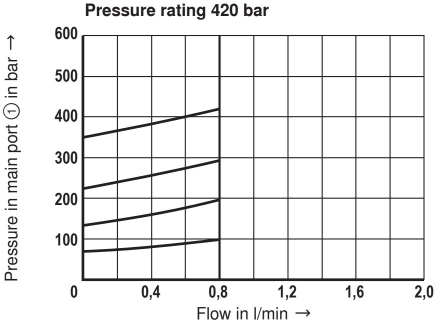
Pressure in the main port ① depending on the flow.
(The characteristic curve was measure without counter pressure in main port ②.)





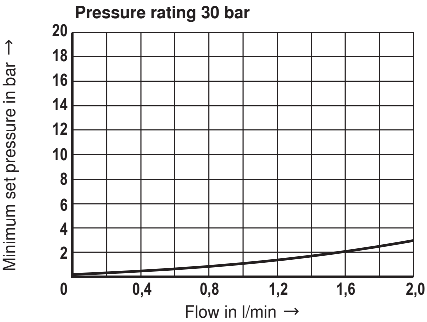


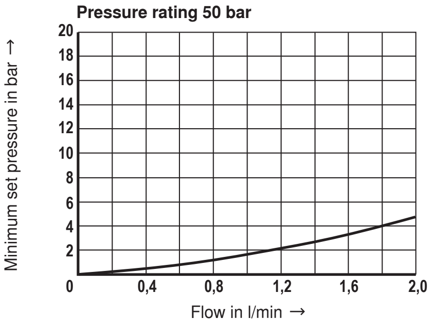


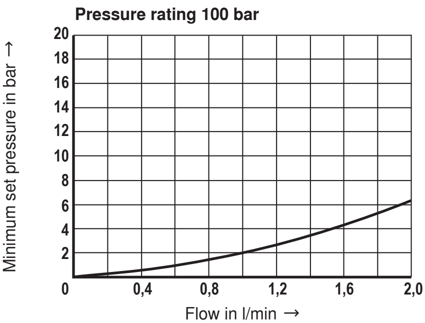


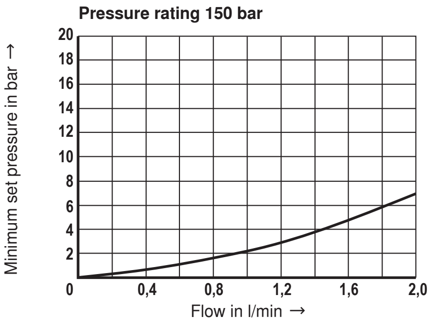
Characteristic curves (measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C and 24 V coil)

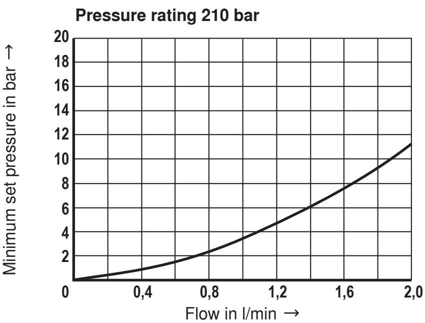
Minimum set pressure in main port ① with command value 0.
(The characteristic curve was measure without counter pressure in main port ②.)

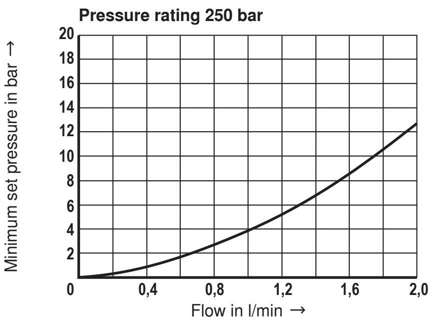






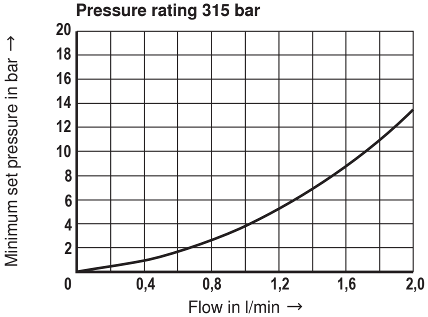


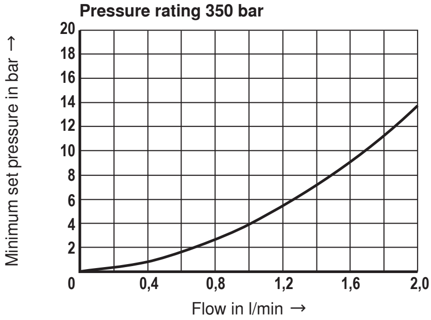


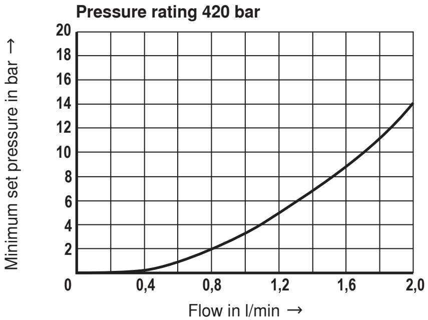


Characteristic curves (measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C and 24 V coil)

Minimum set pressure in main port ① with command value 0.
(The characteristic curve was measure without counter pressure in main port ②.)



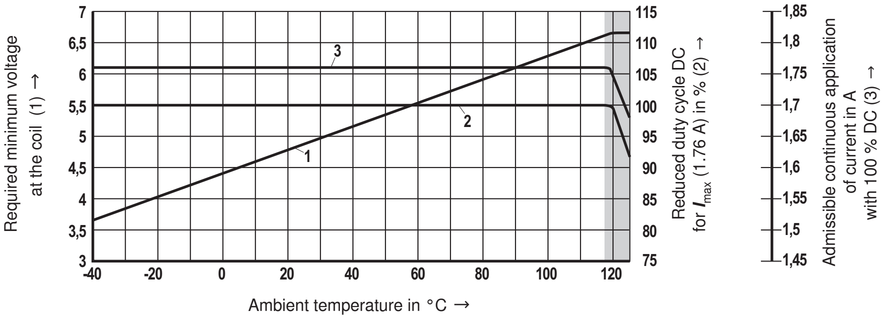




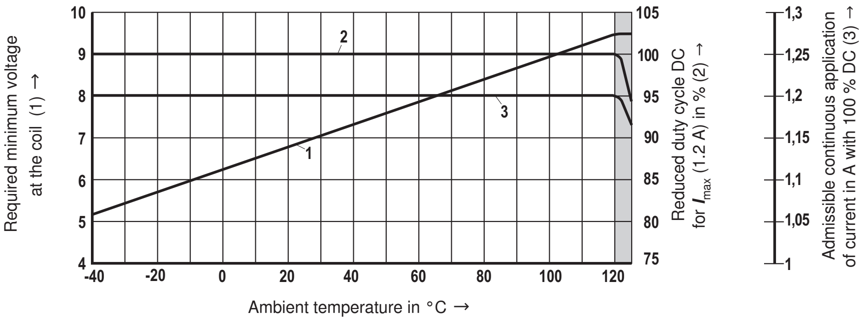
Minimum terminal voltage at the coil and relative duty cycle

Admissible working range against the ambient temperature

– **Version "G12"**



– **Version "G24"**



Limited valve performance

☞ **Notice!**

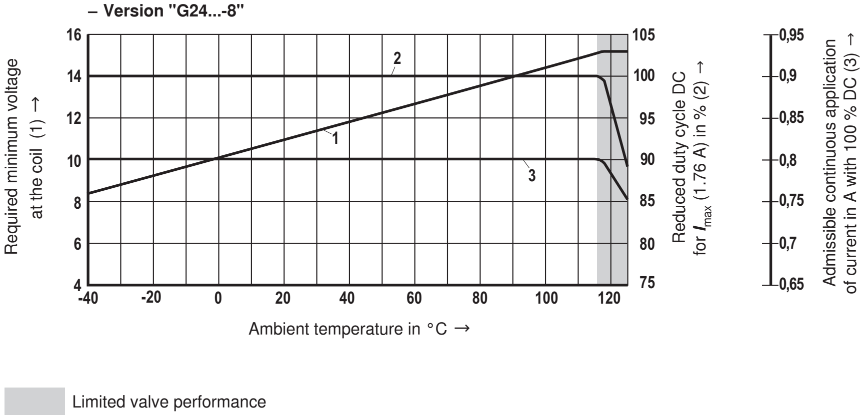
The characteristic curves have been determined for coils with valve with medium test block size (80 x 80 x 80 mm), without flow in calm air.

Depending on the installation conditions (block size, flow, air circulation, etc.) there may be a better heat dissipation. Thus, the area of application is broadened.

In single cases, more unfavorable conditions may lead to limitations of the area of application.

Minimum terminal voltage at the coil and relative duty cycle

Admissible working range against the ambient temperature



3

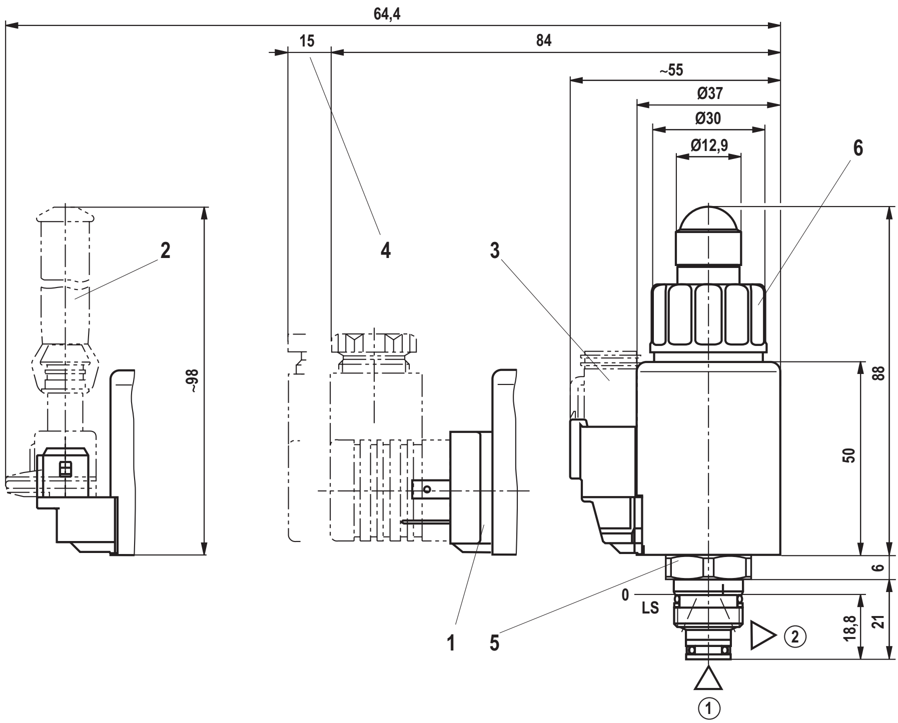
Notice!

The characteristic curves have been determined for coils with valve with medium test block size (80 x 80 x 80 mm), without flow in calm air.

Depending on the installation conditions (block size, flow, air circulation, etc.) there may be a better heat dissipation. Thus, the area of application is broadened.

In single cases, more unfavorable conditions may lead to limitations of the area of application.

Unit dimensions (dimensions in mm)



① = Main port 1

② = Main port 2

LS = Location Shoulder

1 Mating connector for connector "K4" (separate order, see data sheet 08006)

2 Mating connector for connector "C4" (separate order, see data sheet 08006)

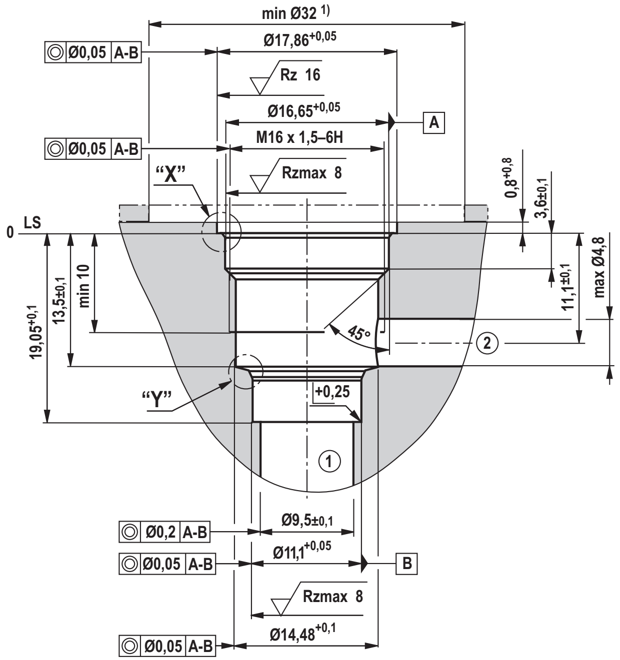
3 Mating connector for connector "K40" (separate order, see data sheet 08006)

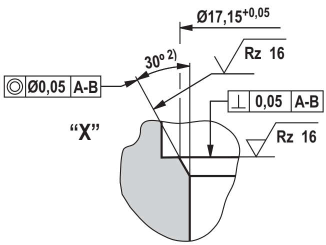
4 Space required to remove the mating connector

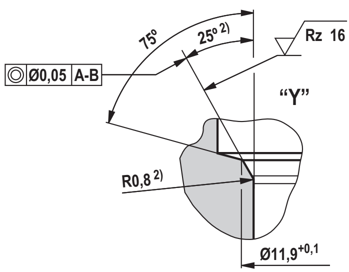
5 Hexagon SW22 for screwing in the pole tube; tightening torque M_A = 40^{+6} Nm

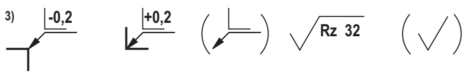
6 Solenoid nut, tightening torque M_A = 5^{+1} Nm

Mounting cavity R/T-8A; 2 main ports; thread M16 x 1.5-6H (dimensions in mm)









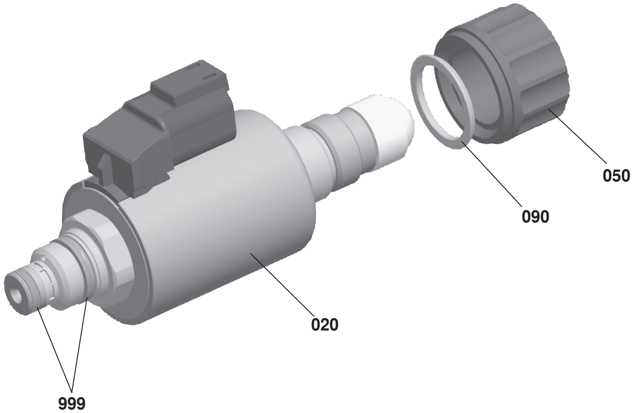
1) With counterbore, deviating from T-8A
2) All seal ring insertion faces are rounded and free of burrs
3) Deviating from T-8A

① = Main port 1
② = Main port 2
LS = Location Shoulder

Tolerance for all angles ±0.5°

3

Available individual components



Item	Denomination		Direct voltage	Material no.
020	Coil for individual connection [1]	Version "K4"	12 V	R901002932
			24 V	R901002319
			24 V / 800 mA	R901049962
		Version "K40"	12 V	R901003055
			24 V	R901003053
			24 V / 800 mA	R901050010
		Version "C4"	12 V	R901003044
			24 V	R901003026
			24 V / 800 mA	R901049963
050	Nut			R900992146
090	Seal ring for pole tube			R900007769
998	Seal kit of the valve			R961000376

[1] ☞ **Notice!**
After exchange of the solenoid coil, the pressure set in the factory may change by ±5 %.

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
documentation@boschrexroth.de
www.boschrexroth.de

Proportional pressure relief valve, direct operated, decreasing characteristic curve

RE 18139-05/07.12 1/14
Replaces: 11.11

Type KBPS.8B (High Performance)

Component size 8
Component series A
Maximum operating pressure 420 bar
Maximum flow 2 l/min

Table of contents

Information on available spare parts:
www.boschrexroth.com/spc

Features

- Cartridge valve
- Mounting cavity R/T-8A
- Direct operated proportional valve for limiting a system pressure
- Suitable for mobile and industrial applications
- Operation by means of proportional solenoid with central thread and detachable coil
- Fine adjustment of the command value pressure characteristic curve possible from the outside at the control electronics
- Set to the maximum pressure via the adjustment screw
- In case of power failure, maximum set pressure

– Control electronics:	Data sheet
• Plug-in proportional amplifier type VT-SSPA1…	30116
• Analog amplifier type RA…	95230
• BODAS control unit type RC…	95200

Ordering code

KBPS		8	B	A /	H	C			V		*

Proportional pressure relief valve, direct operated (pilot control valve)

Pressure rating

up to 30 bar	**= B**
up to 50 bar	**= C**
up to 100 bar	**= F**
up to 150 bar	**= H**
up to 210 bar	**= L**
up to 250 bar	**= N**
up to 315 bar	**= P**
up to 350 bar	**= R**
up to 420 bar	**= T**

Component size 8 **= 8**

Maximum pressure with command value = 0 **= B**

Component series **= A**

High Performance and mounting cavity R/T-8A (see page 13) **= H**

Proportional solenoid, wet-pin **= C**

Supply voltage

G12 = Control electronics 12 V DC
G24 = Control electronics 24 V DC

Electrical connection [1)]

K4 = Without mating connector, with connector according to DIN EN 175301-803
K40 = Without mating connector, with connector DT 04-2PA (Deutsch plug)
C4 = Without mating connector, with connector AMP Junior-Timer

Seal material

V = FKM seals
Attention!
Observe compatibility of the seals with the hydraulic fluid used!

no code = Standard
-8 = Coil 800 mA (see page 5)

Further details in the plain text

[1)] Mating connectors, separate order, see data sheet 08006.

Preferred types

Type	Material number
KBPSB8BA/HCG24C4V-8	R901144800
KBPSL8BA/HCG24C4V-8	R901120007
KBPSR8BA/HCG24C4V	R901018607
KBPSL8BA/HCG12C4V	R901056361
KBPSL8BA/HCG24C4V	R901018602
KBPSL8BA/HCG12K40V	R901064385
KBPSN8BA/HCG24K40V	R901016229
KBPSP8BA/HCG24K40V	R901026207
KBPSR8BA/HCG24K40V	R901188705
KBPSP8BA/HCG24K4V	R901018593

Function, section, symbol

General

Valves of type KBPS.8B are direct operated proportional pressure relief valves (pilot control valves) in seat design and are used to limit a system pressure. They basically comprise of the pole tube (3), the solenoid coil (4), the valve seat (5) and the valve poppet (6).

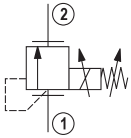
With command value 0 or in case of power failure, the maximum pressure is set. Operation by means of a proportional solenoid with central thread and detachable coil. The solenoid‘s interior is connected to the main port ② and filled with hydraulic fluid. Depending on the electric command value, these valves can be used to continuously set the system pressure to be limited.

Basic principle

In the factory, the valves are mechanically set to the maximum pressure. For the proportional reduction of the system pressure, a command value is specified at the control electronics. Depending on the command value, the electronics actuate the solenoid with electric current.

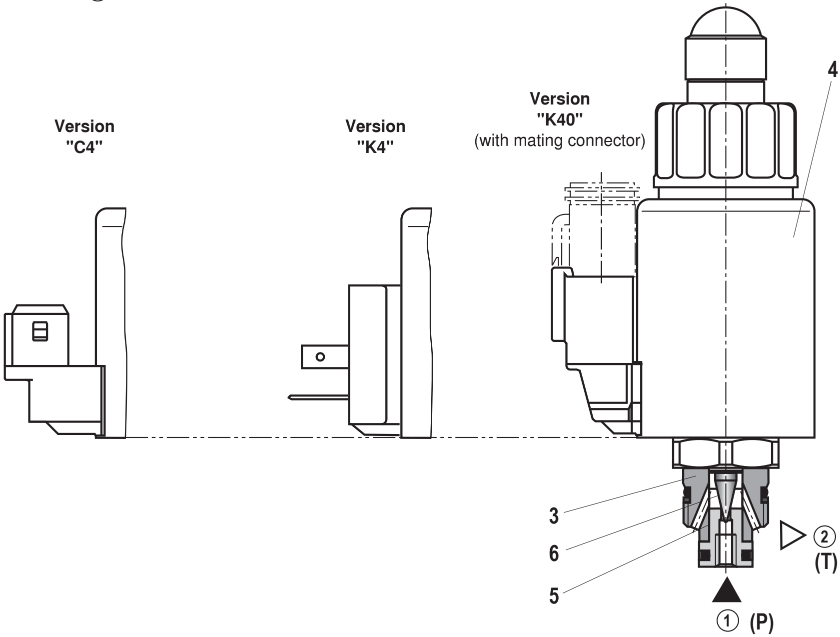
The proportional solenoid converts the electric current into mechanical force that acts against the setting spring via the armature and thus reduces the force on the valve poppet (6). The valve poppet (6) pushes onto the valve seat (5) and blocks the connection between main port ① and ②. If the hydraulic force on the valve poppet (6) corresponds to the force difference between setting spring and solenoid force, the valve controls the set pressure by lifting the valve poppet (6) off the valve seat and thus enabling hydraulic fluid flow from main port ① to ②. If the command value is zero, the maximum pressure is set.

Symbol



Notice!

Occurring tank pressures (main port ②) are added up to the set values in the main port ①.



Technical data (For applications outside these parameters, please consult us!)

general

Weight	kg	0.45
Installation position		Any - if it is ensured that no air can collect upstream the valve. Otherwise, we recommend suspended installation of the valve.
Ambient temperature range	°C	–20 to +120
Storage temperature range	°C	–20 to +80

Environmental audits:

Vibration test according to DIN EN 60068-2 / IEC 60068-2 /2 axes (X/Z)		
DIN EN 60068-2-6: 05/96	Vibrations, sine-shaped	10 cycles (5 Hz to 2000 Hz back to 5 Hz) with logarithmic frequency changing speed of 1 octave/min, 5 to 57 Hz, amplitude 1.5 mm (p-p), 57 to 2000 Hz, amplitude 10 g
IEC 60068-2-64: 05/93	Vibrations (random) and broadband noise	20 to 2000 Hz, amplitude 0.05 g^2/Hz (10 g RMS/30 g peak), testing time 30 min
DIN EN 60068-2-27: 03/95	Shocking	Half sine 15 g / 11 ms, 3 x in positive, 3 x in negative direction (a total of 6 individual shocks)
DIN EN 60068-2-29: 03/95	Bump test	Half sine 25 g / 6 ms, 1000 x in positive, 1000 x in negative direction (a total of 2000 individual shocks)
Indication per axis		
Climatic test according to EN 60068-2 / IEC 60068-2 (environmental test):		
DIN EN 60068-2-1: 03/95	Storage temperature	–40 °C, duration 16 h
DIN EN 60068-2-2: 08/94		+110 °C, duration 16 h
DIN EN 60068-2-1: 03/95	Cold test	2 cycles –25 °C, duration 2 h
DIN EN 60068-2-2: 08/94	Dry heating test	2 cycles +120 °C, duration 2 h
IEC 60068-2-30: 1985	Humid heat, cyclic	Variant 2/ +25 °C to +55 °C 93 % to 97 % relative humidity, 2 cycles à 24 h
Salt spray test: 720 h according to DIN 50021		
→ Coating generally not necessary. If paint is applied nevertheless, the reduced heat dissipation capacity is to be observed.		

hydraulic

Maximum operating pressure [1] (main port ①)	bar	420
Maximum admissible return flow pressure (main port ②)	bar	210
Maximum set pressure [2]		See command value pressure characteristic curves page 6
Minimum set pressure with command value max [3]		See characteristic curves page 8 and 9
Maximum flow	l/min	2 (see characteristic curves page 6 and 7)
Hydraulic fluid		See page 5
Hydraulic fluid temperature range	°C	–20 to +80
Viscosity range	mm^2/s	15 to 380
Maximum permitted degree of contamination of the hydraulic fluid - cleanliness class according to ISO 4406 (c)		Class 20/18/15 [4]

[1] **Attention!** The maximum operating pressure is the total of set pressure and return flow pressure!

[2] **Attention!** The valves are set in the factory. In case of subsequent adjustment, the warranty will become invalid!

[3] If the valve is installed in a mounting cavity made of non-magnetically conductive material, the minimum set pressure is slightly higher.

[4] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components.

For the selection of the filters see www.boschrexroth.com/filter.

Technical data (For applications outside these parameters, please consult us!)

hydraulic

Hysteresis 5)			< 4 % of the max. set pressure
Range of inversion 5)			< 0.5 % of the max. set pressure
Response sensitivity 5)			< 0.5 % of the max. set pressure
Manufacturing tolerance of the command value pressure characteristic curve	– Command value 100 %		< 2 % of the max. set pressure
	– Command value 0		< 5 % of the max. set pressure
Step response (T_u + T_g) 0 → 100 % and/or 100 % → 0		ms	70 (depending on the system)

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils		HL, HLP	FKM	DIN 51524
Bio-degradable	– Insoluble in water	HEES	FKM	VDMA 24568
	– Soluble in water	HEPG	FKM	

Important information on hydraulic fluids!

- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!
- The flash point of the hydraulic fluids used must be 40 K higher than the maximum solenoid surface temperature.
- **Bio-degradable:** When using bio-degradable hydraulic fluids that are simultaneously zinc-solving, zinc may accumulate in the fluid.

3

electric

Supply voltage		V	12 DC	24 DC	"-8" / 24 DC
Maximum control current		mA	1760	1200	800
Coil resistance	– Cold value at 20 °C	Ω	2.3	4.8	11.5
	– max. hot value	Ω	3.8	7.9	18.9
Switch-on duration		%	100 6)		
Maximum coil temperature 7)		°C	150		
Protection class according to DIN EN 60529	– Version "K4"		IP 65 with mating connector mounted and locked		
	– Version "K40"		IP 69K with mating connector mounted and locked		
	– Version "C4"		IP 66 with mating connector mounted and locked		
			IP 69K with Rexroth mating connector (material no. R901022127)		
Control electronics (separate order)			– Plug-in proportional amplifier type VT-SSPA1…, see data sheet 30116 – Analog amplifier type RA…, see data sheet 95230 – BODAS control unit type RC…, see data sheet 95200		
Design according to VDE 0580					

5) Measured with analog amplifier type RA1-1/10, see data sheet 95230

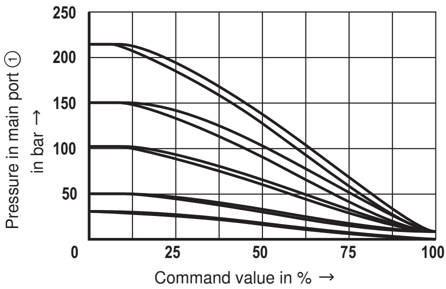
6) In case of use more than 2000 m a.s.l., please consult us.

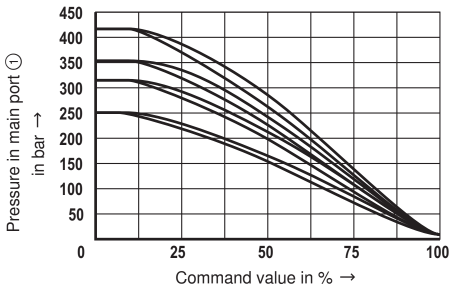
7) Due to the surface temperatures of the solenoid coils, the standards ISO 13732-1 and EN 982 need to be adhered to!

In the electrical connection, the protective earthing conductor (PE ⏚) must be connected properly.

Characteristic curves (measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C and 24 V coil)

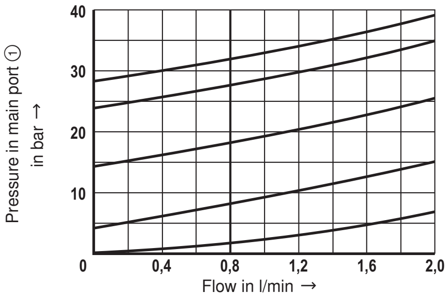
Pressure in main port ① depending on the command value. Flow = 0.8 l/min



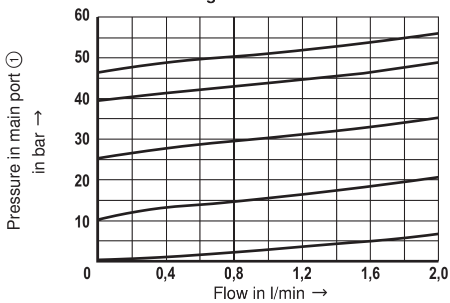


Pressure in main port ① depending on the flow.
(The characteristic curve was measure without counter pressure in main port ②.)

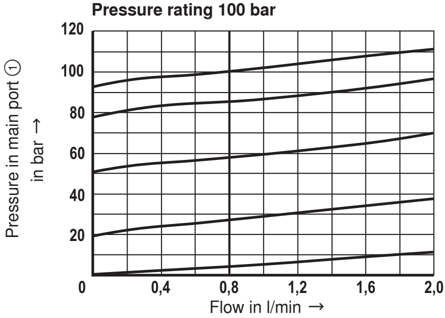
Pressure rating 30 bar



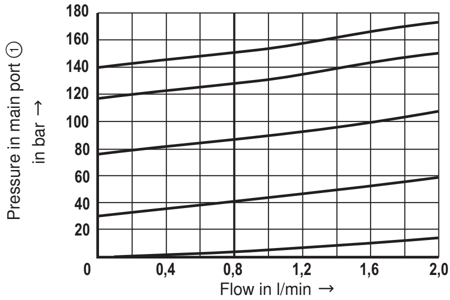
Pressure rating 50 bar



Pressure rating 100 bar



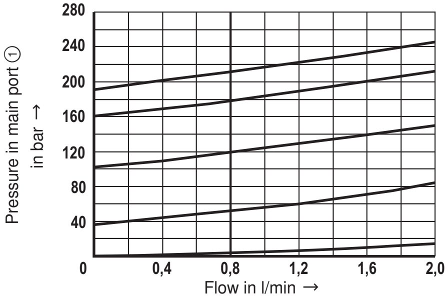
Pressure rating 150 bar



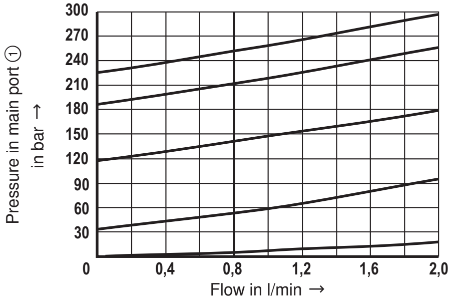
Characteristic curves (measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C and 24 V coil)

Pressure in main port ① depending on the flow.
(The characteristic curve was measure without counter pressure in main port ②.)

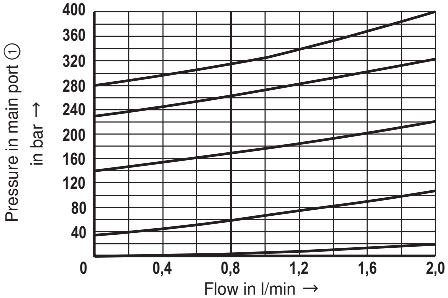
Pressure rating 210 bar



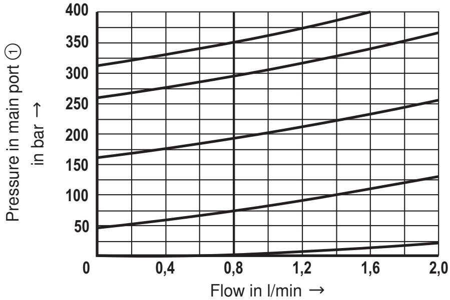
Pressure rating 250 bar



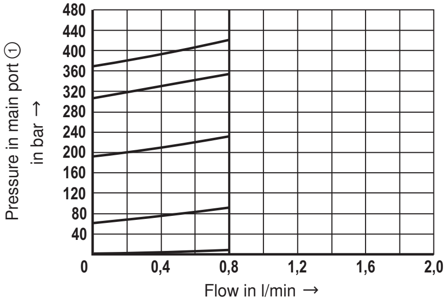
Pressure rating 315 bar



Pressure rating 350 bar



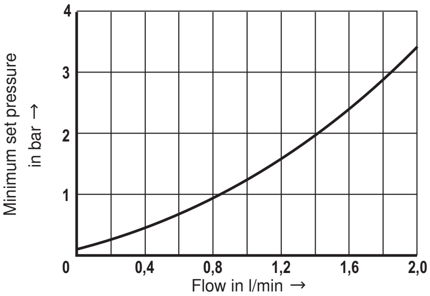
Pressure rating 420 bar



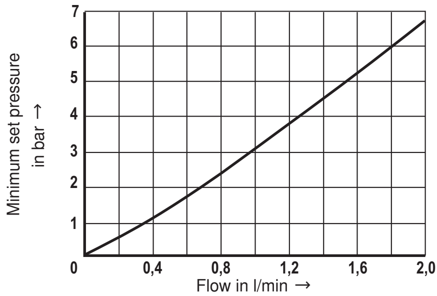
Characteristic curves (measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C and 24 V coil)

Minimum set pressure in main port ① with command value 100 %.
(The characteristic curve was measure without counter pressure in main port ②.)

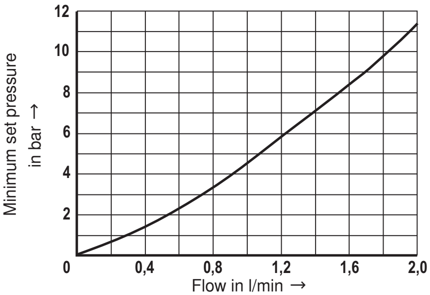
Pressure rating 30 bar



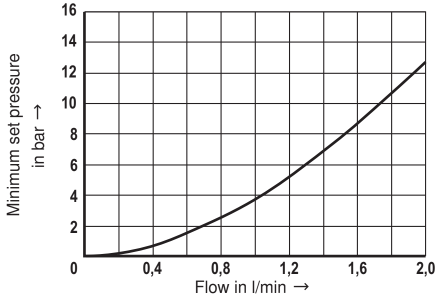
Pressure rating 50 bar



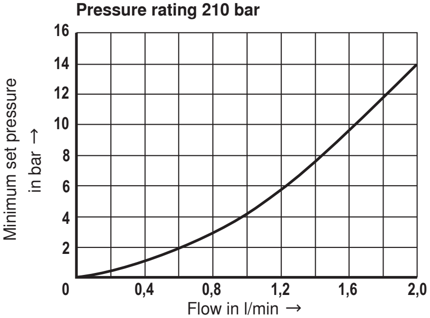
Pressure rating 100 bar



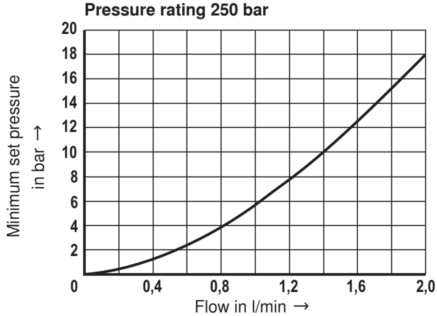
Pressure rating 150 bar



Pressure rating 210 bar

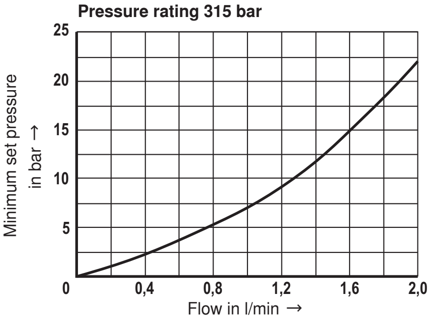


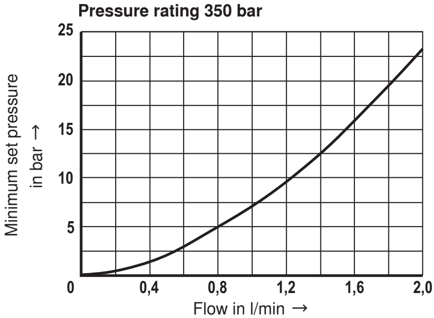
Pressure rating 250 bar

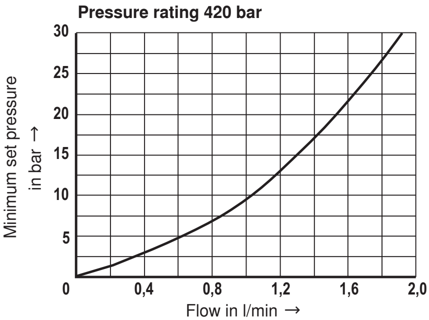


Characteristic curves (measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C and 24 V coil)

Minimum set pressure in main port ① with command value 100 %.
(The characteristic curve was measure without counter pressure in main port ②.)



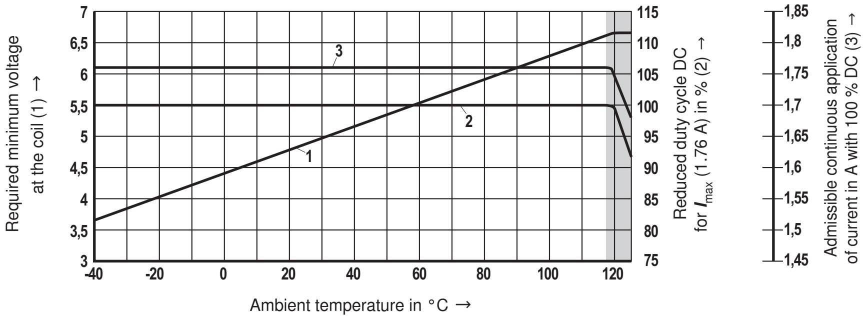




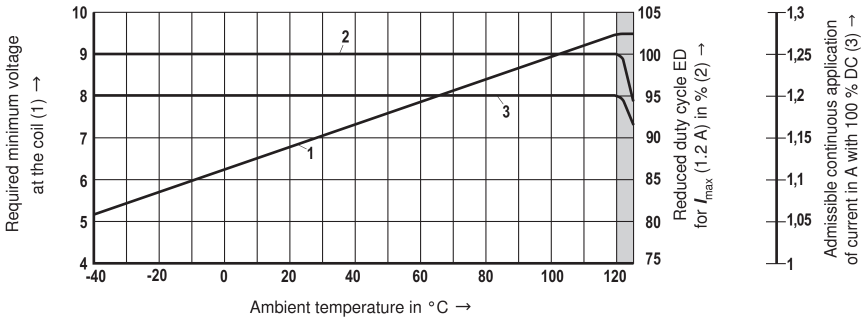
Minimum terminal voltage at the coil and relative duty cycle

Admissible working range against the ambient temperature

– Version "G12"



– Version "G24"



Limited valve performance

☞ **Notice!**

The characteristic curves have been determined for coils with valve with medium test block size (80 x 80 x 80 mm), without flow in calm air.

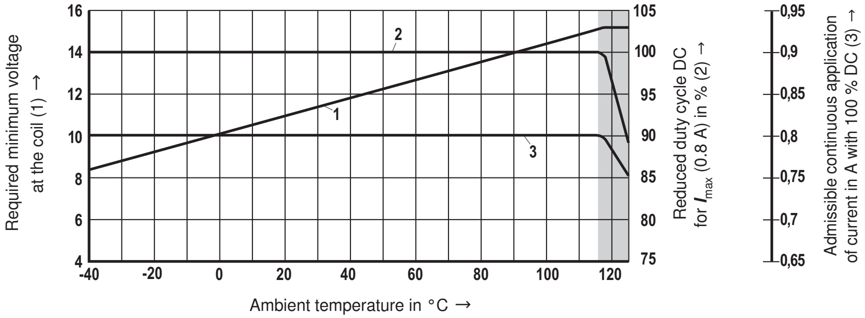
Depending on the installation conditions (block size, flow, air circulation, etc.) there may be a better heat dissipation. Thus, the area of application is broadened.

In single cases, more unfavorable conditions may lead to limitations of the area of application.

Minimum terminal voltage at the coil and relative duty cycle

Admissible working range against the ambient temperature

– Version "G24...-8"



Limited valve performance

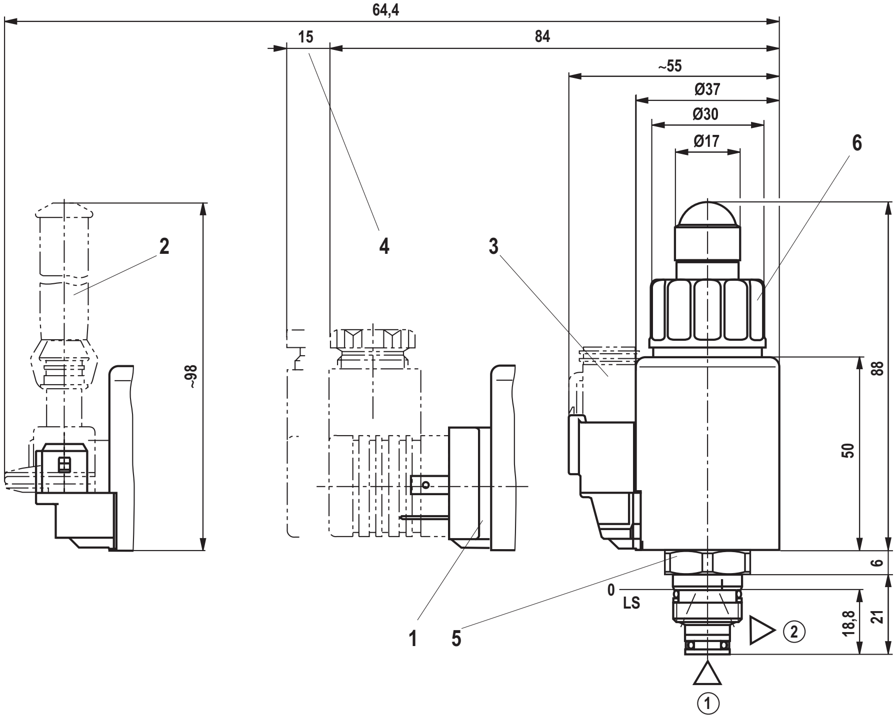
☞ **Notice!**

The characteristic curves have been determined for coils with valve with medium test block size (80 x 80 x 80 mm), without flow in calm air.

Depending on the installation conditions (block size, flow, air circulation, etc.) there may be a better heat dissipation. Thus, the area of application is broadened.

In single cases, more unfavorable conditions may lead to limitations of the area of application.

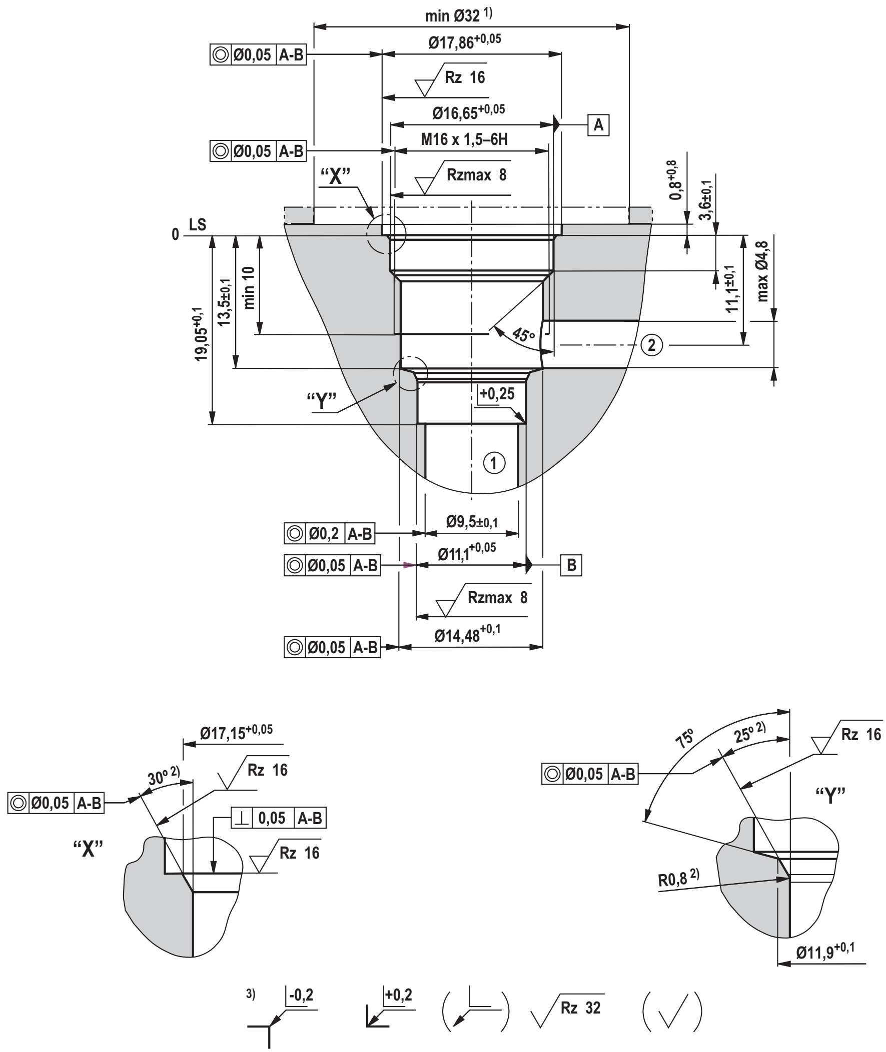
Unit dimensions (dimensions in mm)



① = main port 1
② = main port 2
LS = Location Shoulder

1 Mating connector for connector "K4" (separate order, see data sheet 08006)
2 Mating connector for connector "C4" (separate order, see data sheet 08006)
3 Mating connector for connector "K40" (separate order, see data sheet 08006)
4 Space required to remove the mating connector
5 Hexagon SW22 for screwing in the pole tube; tightening torque $M_A = 40^{+6}$ Nm
6 Solenoid nut, tightening torque $M_A = 5^{+1}$ Nm

Mounting cavity R/T-8A; 2 main ports; thread M16 x 1.5-6H (dimensions in mm)



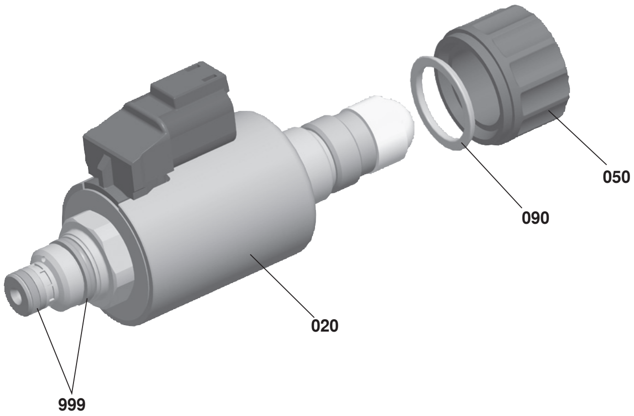
1) With counterbore, deviating from T-8A
2) All seal ring insertion faces are rounded and free of burrs
3) Deviating from T-8A

① = main port 1
② = main port 2
LS = Location Shoulder

Tolerance for all angles ±0.5°

3

Available individual components



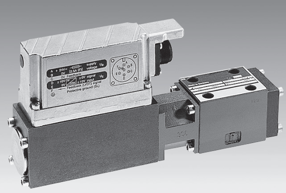
Item	Denomination		Direct voltage	Material no.
020	Coil for individual connection 1)	Version "K4"	12 V	R901002932
			24 V	R901002319
			24 V / 800 mA	R901049962
		Version "K40"	12 V	R901003055
			24 V	R901003053
			24 V / 800 mA	R901050010
		Version "C4"	12 V	R901003044
			24 V	R901003026
			24 V / 800 mA	R901049963
050	Nut			R900992146
090	Seal ring for pole tube			R900007769
998	Seal kit of the valve			R961000376

1) ☞ **Notice!**
After exchange of the solenoid coil, the pressure set in the factory may change by ±5 %.

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
documentation@boschrexroth.de
www.boschrexroth.de

Proportional pressure relief valve, pilot operated, with on-board electronics (OBE) and position feedback

Type DBEBE6X



Nominal size 6
Unit series 1X
Maximum working pressure P 315 bar, T 250 bar
Maximum flow rate 40 l/min

List of Contents

Contents	**Page**

Features

– Pilot operated valves with position feedback and on-board electronics for limiting system pressure (pilot oil internal only)
– Adjustable through the position of the armature against the compression spring
– Position-controlled, minimal hysteresis <1%, rapid response times, see Technical Data
– Pressure limitation to a safe level even with faulty electronics (solenoid current $I > I_{max}$)
– For subplate attachment, mounting hole configuration to ISO 4401-03-02-0-94. Subplates as per catalog sheet RE 45053 (order separately)
– Plug-in connector to DIN 43563-AM6, see catalog sheet RE 08008 (order separately)
– Data for the on-board trigger electronics
  • Complies with CE, EMC directives EN 61000-6-2: 2002-08 and EN 61000-6-3: 2002-08
  • U_B = 24 V_{nom}DC
  • Electrical connection 6P+PE
  • Signal actuation
    – Standard 0...+10 V (A1)
    – Version 4...20 mA (F1)
  • Valve curve calibrated at the factory

Ordering data

DBEB	E	6	X	–1X	/		G24	K31		M	*

Proportional pressure relief valve with inductive position transducer on the cone

With on-board electronics **= E**

Nominal size **= 6**

Mounting hole configuration to ISO 4401-03-02-0-94 **= X**

Unit series 10 to 19 (10 to 19: installation and connection dimensions unchanged) **= 1X**

Max. pressure stage
up to 80 bar **= 80**
up to 180 bar **= 180**
up to 315 bar **= 315**

Voltage supply of trigger electronics 24 V DC **= G24**

K31 = **Electrical connection**
without plug-in connector,
with unit plug to DIN 43563-AM6
Order plug-in connector separately

Interface for trigger electronics
A1 = Setpoint input 0...+10 V
F1 = Setpoint input 4...20 mA

M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

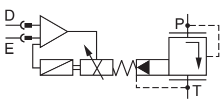
Further information in plain text

Preferred types

Type ....A1 (0...+10 V)	Material Number	Type ....F1 (4...20 mA)	Material Number
DBEBE6X–1X/80G24K31A1M	0 811 402 078	DBEBE6X–1X/80G24K31F1M	0 811 402 084
DBEBE6X–1X/180G24K31A1M	0 811 402 077	DBEBE6X–1X/180G24K31F1M	0 811 402 079
DBEBE6X–1X/315G24K31A1M	0 811 402 076		

Symbol

For on-board electronics



Function, sectional diagram

General

Type DBEBE6X proportional pressure relief valves are pilot valves that are used to limit system pressure. The valves are actuated by means of a position-controlled proportional solenoid with on-board electronics.
With these valves, rapid response times with low hysteresis can be achieved.

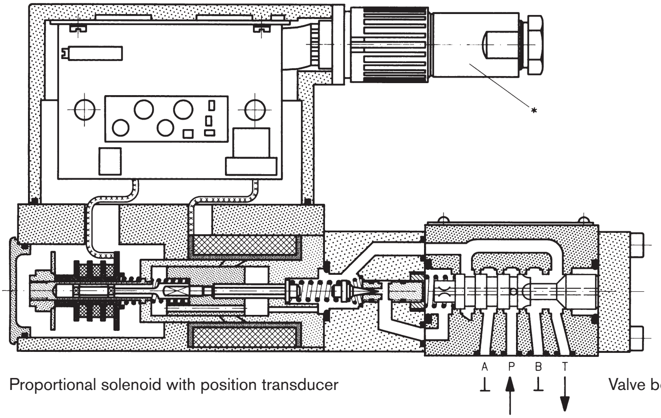
CE EN 61000-6-2: 2002-08
EN 61000-6-3: 2002-08

Basic principle

To adjust the system pressure, a setpoint is set in the trigger electronics. Based on this setpoint, the electronics control the position-controlled solenoid.
The proportional solenoid maintains its position against a spring force, which is proportionate to the system pressure.
The pilot stage is supplied with pilot oil through a bore hole at <0.6 l/min. The "p_{max}" pressure stage is determined by the cone and seating bore configuration.

Pressure limitation for maximum safety

If a fault occurs in the electronics, so that the solenoid current (I_{max}) would exceed its specified level in an uncontrolled manner, the pressure cannot rise above the level determined by the maximum spring force.



Proportional solenoid with position transducer

Valve body

Accessories

Type			Material Number
(4 x) ISO 4762-M5x30-10.9	Cheese-head bolts		2 910 151 166
* 	Plug-in connectors 6P+PE, see also RE 08008	KS	1 834 482 022
		KS	1 834 482 026
		MS	1 834 482 023
		MS	1 834 482 024
		KS 90°	1 834 484 252

Testing and service equipment

Test box type VT-PE-TB3, see RE 30065
Measuring adapter 6P+PE type VT-PA-2, see RE 30068

3

Technical data

General

Construction	Pilot stage	Poppet valve
	Main stage	Spool valve
Actuation		Proportional solenoid with position control and OBE
Connection type		Subplate, mounting hole configuration NG6 (ISO 4401-03-02-0-94)
Mounting position		Optional
Ambient temperature range	°C	–20...+50
Weight	kg	3.4
Vibration resistance, test condition		Max. 25 g, shaken in 3 dimensions (24 h)

Hydraulic (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Pressure fluid		Hydraulic oil to DIN 51524...535, other fluids after prior consultation		
Viscosity range	recommended mm^2/s	20...100		
	max. permitted mm^2/s	10...800		
Pressure fluid temperature range	°C	–20...+70		
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)		Class 18/16/13 [1]		
Direction of flow		See symbol		
Max. set pressure (at $Q = 1$ l/min)	bar	80	180	315
Minimum pressure (at $Q = 1$ l/min)	bar	7	8	10
Max. mechanical pressure limitation level, e.g. when solenoid current $I > I_{max}$	bar	<90	<190	<325
Max. working pressure	bar	Port P: 315		
Max. pressure	bar	Port T: 250		
Pilot oil flow	l/min	approx. 0.6		
Max. flow	l/min	40		

Static/Dynamic

Hysteresis	%	≦ 1	
Manufacturing tolerance	%	≦ ±5	
Response time 100 % signal change	ms	70	Response time at: $Q = 10$ l/min (values depend on the dead volume)
10 % signal change	ms	15	
Thermal drift		<1 % at $\Delta T = 40\,°C$	
Conformity		CE EN 61000-6-2: 2002-08 EN 61000-6-3: 2002-08	

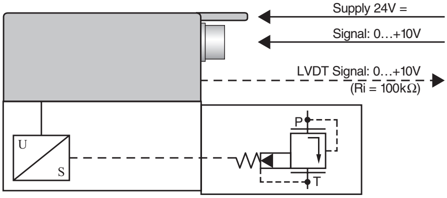
[1] The purity classes stated for the components must be complied with in hydraulic systems.
Effective filtration prevents problems and also extends the service life of components.
For a selection of filters, see catalog sheets RE 50070, RE 50076 and RE 50081.

Technical data

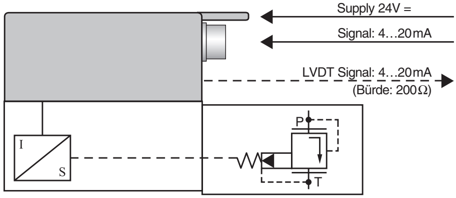
Electrical, trigger electronics integrated in valve		
Cyclic duration factor	%	100
Degree of protection		IP 65 to DIN 40050 and IEC 14434/5
Connection		Plug-in connector 6P+PE, DIN 43563
Supply voltage Terminal A: Terminal B: 0 V		24 V DC_{nom} Min. 21 V DC/max. 40 V DC Ripple max. 2 V DC
Power consumption		Solenoid ⧄ 45 mm = 40 VA max.
External fuse		2.5 A_F
Input, “standard” version Terminal D: U_E Terminal E:	A1	Differential amplifier, R_i = 100 kΩ 0...+10 V 0 V
Input, “mA signal” version Terminal D: I_{D-E} Terminal E: I_{D-E}	F1	Burden, R_{sh} = 200 Ω 4...20 mA Current loop I_{D-E} feedback
Max. voltage to differential inputs over 0 V		D → B, E → B } max. 18 V DC
Test signal, “standard” version Terminal F: U_{Test} Terminal C:	A1	LVDT 0...+10 V Reference 0 V
Test signal, “mA signal” version Terminal F: I_{F-C} Terminal C: I_{F-C}	F1	LVDT signal 4...20 mA at external load 200...500 Ω max. 4...20 mA output Current loop I_{F-C} feedback
Safety earth conductor and shield		See pin assignment (installation in conformity with CE)
Recommended cable		See pin assignment up to 20 m 7 x 0.75 mm^2 up to 40 m 7 x 1 mm^2
Calibration		Calibrated at the factory, see valve curve

3

Version A1:
Standard

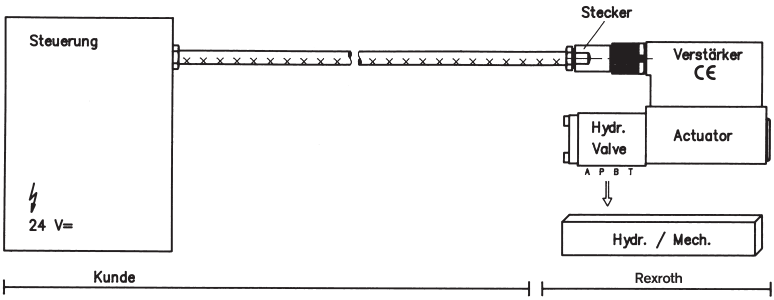


Version F1:
mA signal



Connection

For electrical data, see page 5 and
Operating Instructions **1 819 929 083**



Technical notes for the cable

Version:
- Multi-wire cable
- Extra-finely stranded wire to VDE 0295, Class 6
- Safety earth conductor, green/yellow
- Cu braided shield

Type:
- e.g. Ölflex-FD 855 CP (from Lappkabel company)

No. of wires:
- Determined by type of valve, plug type and signal assignment

Cable Ø:
- 0.75 mm^2 up to 20 m long
- 1.0 mm^2 up to 40 m long

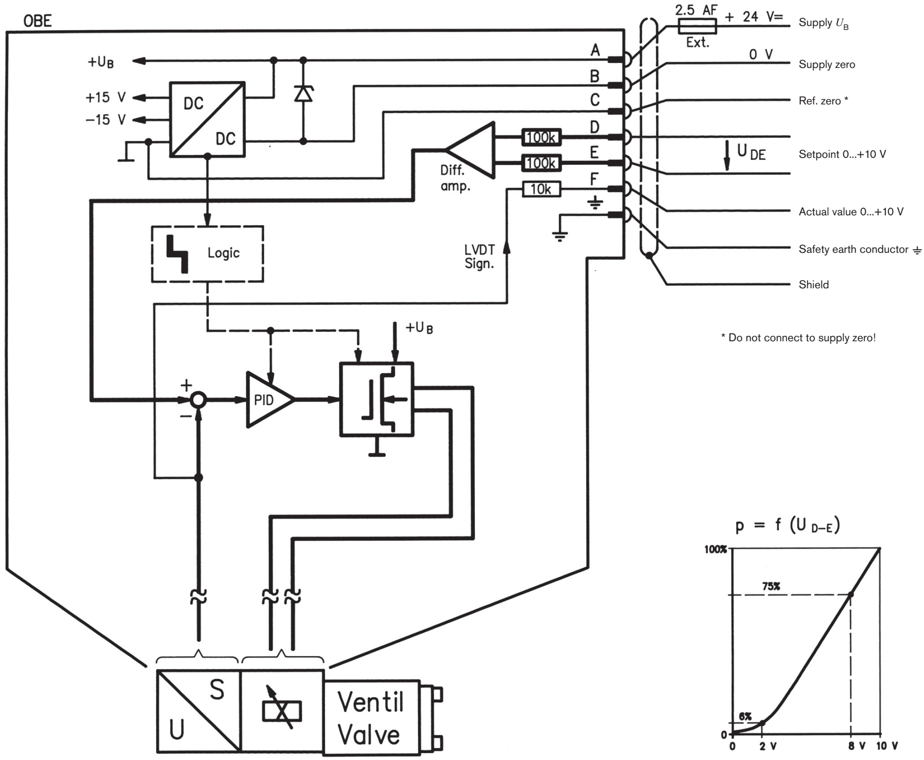
Outside Ø:
- 9.4...11.8 mm – Pg11
- 12.7...13.5 mm – Pg16

Important

Power supply 24 V DC nom,
if voltage drops below 18 V DC, rapid shutdown resembling "Enable OFF" takes place internally.
In addition, with the "mA signal" version:
$I_{D-E} \geqq 3$ mA – valve is active
$I_{D-E} \leqq 2$ mA – valve is deactivated.
Electrical signals emitted via the trigger electronics (e.g. actual values) must not be used to shut down safety-relevant machine functions!
(See also European Standard, "Technical Safety Requirements for Fluid-Powered Systems and Components – Hydraulics", EN 982).

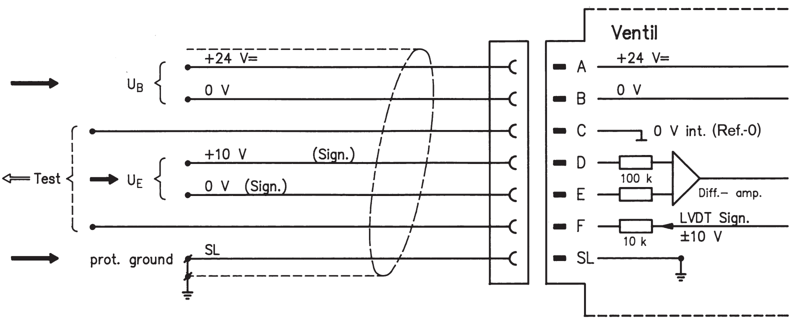
On-board trigger electronics

Circuit diagram/pin assignment
Version A1: U_{D-E} 0...+10 V



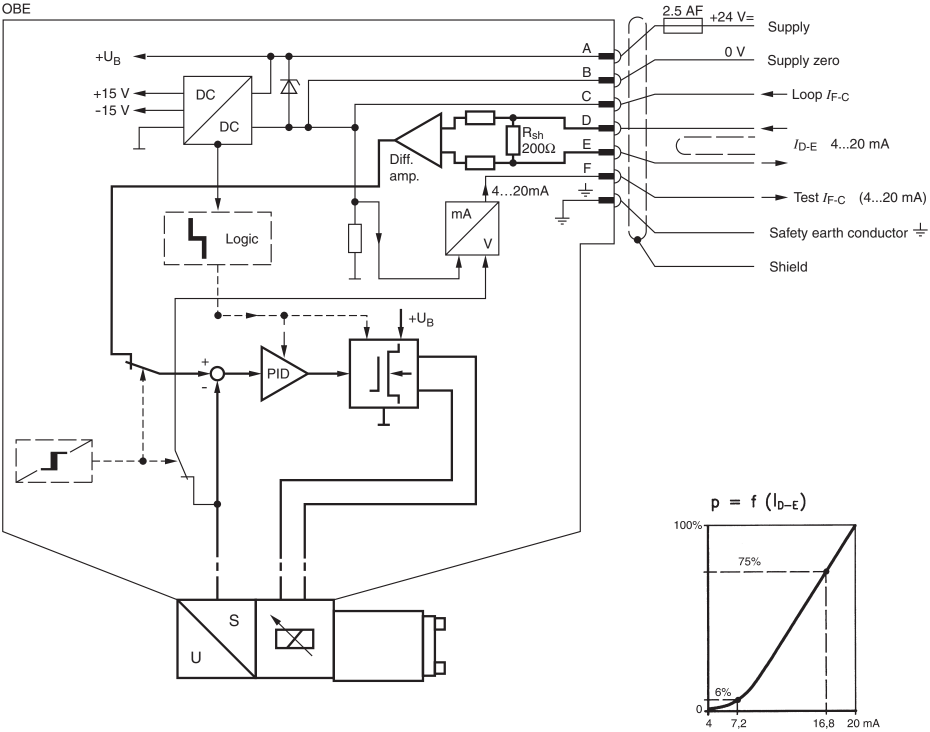
* Do not connect to supply zero!

Pin assignment
Version A1: U_{D-E} 0...+10 V
(R_i = 100 kΩ)

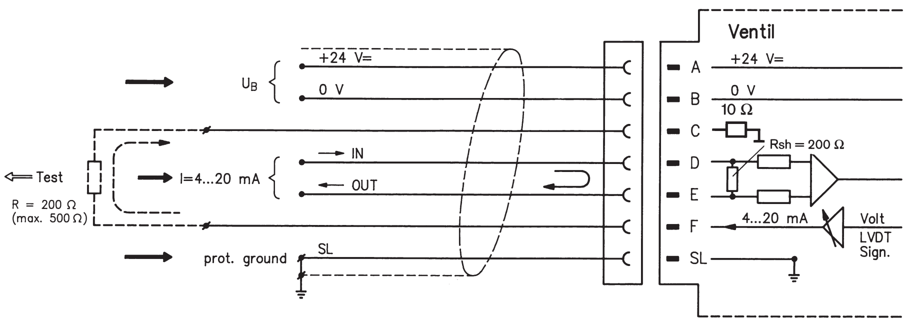


On-board trigger electronics

Circuit diagram/pin assignment
Version F1: I_{D-E} 4...20 mA

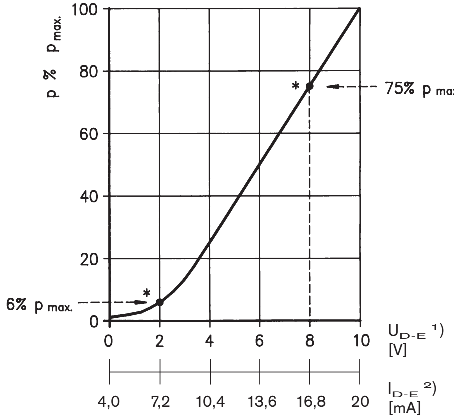


Pin assignment 6P+PE
Version F1: I_{D-E} 4...20 mA
(R_{sh} = 200 kΩ)



Characteristic curves (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Pressure in port P as a function of the setpoint

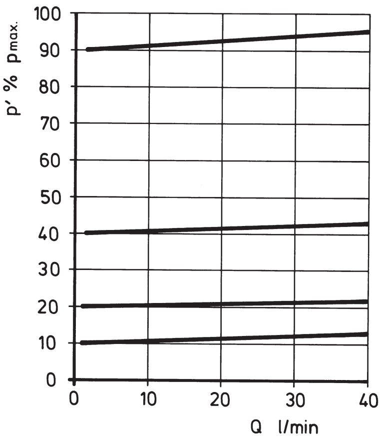


* Factory setting at $Q = 1$ l/min
±5 % manufacturing tolerance

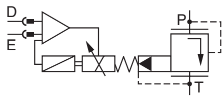
1) Version: $U_{D-E} = 0...+10$ V

2) Version: $I_{D-E} = 4...20$ mA

Pressure in port P proportionate to the maximum flow rate of the main stage

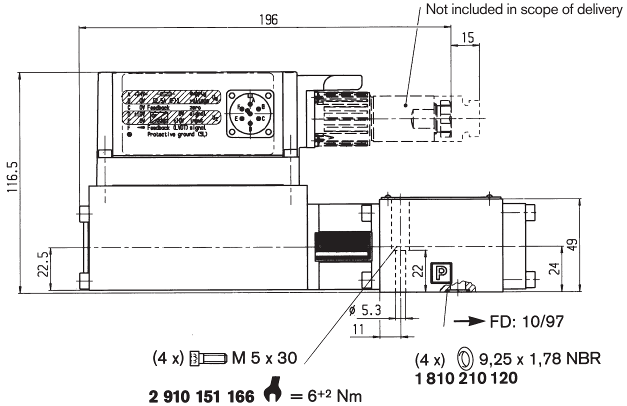


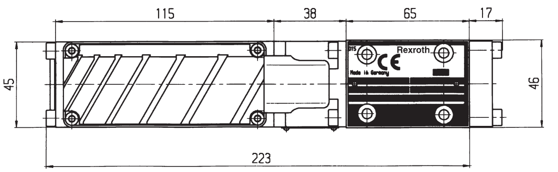
Set pressure
$p' = f\,(Q_{P-T})$



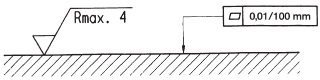
3

Unit dimensions (nominal dimensions in mm)

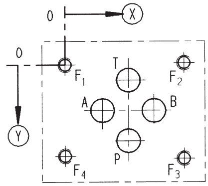




Required surface quality
of mating component



Mounting hole configuration: NG6 (ISO 4401-03-02-0-94)
For subplates see catalog sheet RE 45053



[1] Deviates from standard
[2] Thread depth:
Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

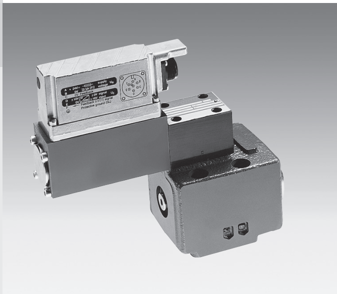
	P	A	T	B	F_1	F_2	F_3	F_4
X	21.5	12.5	21.5	30.2	0	40.5	40.5	0
Y	25.9	15.5	5.1	15.5	0	–0.75	31.75	31
Ø	8 [1]	8 [1]	8 [1]	8 [1]	M5 [2]	M5 [2]	M5 [2]	M5 [2]

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Telefon +49 (0) 93 52 / 18-0
Telefax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

Proportional pressure relief valve, pilot operated, with on-board electronics (OBE) and position feedback

RE 29163/07.05 1/12

Type DBEBE10Z



Nominal size 10
Unit series 1X
Maximum working pressure A, B, X 315 bar, Y 2 bar
Maximum flow rate Q_{nom} 120 l/min

List of Contents

Features

- Pilot operated valves with position feedback and on-board electronics for limiting system pressure (pilot oil internal only)
- Adjustable through the position of the armature against the compression spring
- With position control, minimal hysteresis < 1 %, rapid response times, see Technical Data
- Pressure limitation to a safe level even with faulty electronics (solenoid current $I > I_{max}$)
- For subplate attachment, mounting hole configuration to ISO 5781-AG-06-2-A
  Subplates as per catalog sheet RE 45055
  (order separately)
- Plug-in connector to DIN 43563-AM6, see catalog sheet RE 08008 (order separately)
- Data for the on-board trigger electronics
  Complies with CE, EMC directives EN 61000-6-2: 2002-08 and EN 61000-6-3: 2002-08
  • U_B = 24 V_{nom} DC
  • Electrical connection 6P+PE
  • Signal actuation
    – Standard 0...+10 V (A1)
    – Version 4...20 mA (F1)
  • Valve curve calibrated at the factory

Ordering data

DBEB	E	10	Z	–1X/		XY	G24	K31	A1	M	*

Proportional pressure relief valve with inductive position transducer on the cone

With on-board electronics **= E**

Nominal size **= 10**

Mounting hole configuration to ISO 5781-AG-06-2-A **= Z**

Unit series 10 to 19 (10 to 19: installation and connection dimensions unchanged) **= 1X**

Max. pressure stage
up to 180 bar **= 180**
up to 315 bar **= 315**

Relief port X
Pilot oil port Y **= XY**

* Variant "F1" (4...20 mA version) available on request

Further information in plain text

M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

Interface for trigger electronics*
A1 = Setpoint input 0...+10 V

K31 = **Electrical connection**
without plug-in connector, with unit plug to DIN 43563-AM6
Order plug-in connector separately

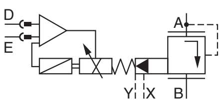
G24 = Voltage supply of trigger electronics 24 V DC

Preferred types

Type....A1 (0... +10 V)	Material Number
DBEBE10Z–1X/180XYG24K31A1M	0 811 402 115
DBEBE10Z–1X/315XYG24K31A1M	0 811 402 116

Symbol

For on-board electronics



Function, sectional diagram

General

Type DBEBE10Z proportional pressure relief valves are pilot operated and are used to limit system pressure.
They are actuated by means of a position-controlled proportional solenoid with on-board electronics.
The valve body contains a logic element (poppet valve) of the "normally closed" type. This is pilot operated and is in conical seat design.

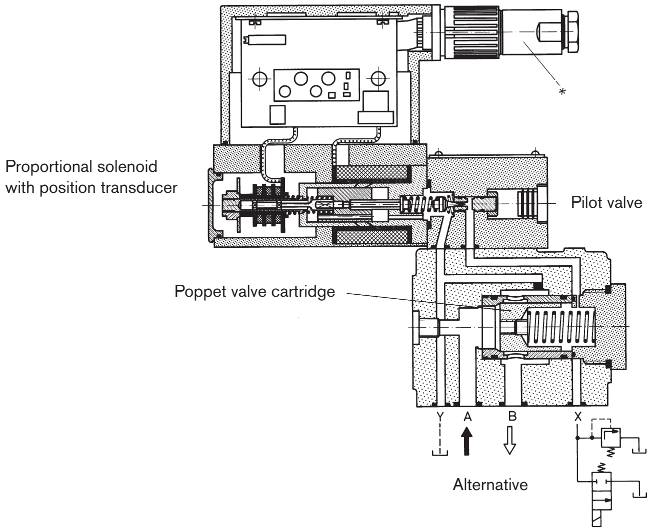
CE EN 61000-6-2: 2002-08
EN 61000-6-3: 2002-08

Basic principle

To adjust the system pressure, a setpoint is set in the trigger electronics. Based on this setpoint, the electronics control the position-controlled solenoid.
The proportional solenoid maintains its position against a spring force, which is proportionate to the system pressure. The pilot stage is supplied with pilot oil at a flow rate of <0.8 l/min through a bore. The "p_{max}" pressure stage is determined by the cone and seating bore configuration.

Pressure limitation for maximum safety

If a fault occurs in the electronics, so that the solenoid current (I_{max}) would exceed its specified level in an uncontrolled manner, the pressure cannot rise above the level determined by the maximum spring force.



Accessories

Type			Material Number
(4 x) ISO 4762-M10x80-10.9	Cheese-head bolts		2 910 151 309
* 	Plug-in connectors 6P+PE, see also RE 08008	KS	1 834 482 022
		KS	1 834 482 026
		MS	1 834 482 023
		MS	1 834 482 024
		KS 90°	1 834 484 252

Testing and service equipment

Test box type VT-PE-TB3, see RE 30065
Measuring adapter 6P+PE type VT-PA-2, see RE 30068

Technical data

General

Construction	Pilot stage		Poppet valve
	Main stage		Pressure relief valve
	Valve cartridge		Poppet valve, normally closed, with pilot oil bore
Actuation			Proportional solenoid with position control and OBE
Connection type			Subplate, mounting hole configuration NG10 (ISO 5781-AG-06-2-A)
Mounting position			Optional
Ambient temperature range		°C	–20...+50
Weight		kg	7.8
Vibration resistance, test condition			Max. 25 g, shaken in 3 dimensions (24 h)

Hydraulic (measured with HLP 46, ϑ_{oil} = 40 °C ±5 °C)

Pressure fluid			Hydraulic oil to DIN 51524...535, other fluids after prior consultation	
Viscosity range,	recommended	mm²/s	20...100	
	max. permitted	mm²/s	10...800	
Pressure fluid temperature range		°C	–20...+70	
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)			Class 18/16/13 [1]	
Direction of flow			See symbol	
Max. set pressure (at Q_{min} = 1 l/min)		bar	180	315
Minimum pressure (at Q_{min} = 1 l/min)		bar	6	8
Max. mechanical pressure limitation level, e.g. when solenoid current $I > I_{max}$		bar	<190	<325
Max. working pressure		bar	Port A, B: 315	
			Port Y: ≤ 2 external pilot oil drain	
			Port X: 315 relief port	
Internal pilot oil flow		l/min	≤ 0.8	
Max. flow		l/min	120 for Q_{max}, see Characteristic Curves	

Static/Dynamic

Hysteresis	%	≦ 1
Manufacturing tolerance for p_{max}	%	≦ ±5, see Characteristic Curves
Response time 100 % signal change	ms	≈ 80 dependent on dead volume or system volume
Thermal drift		<1 % at ΔT = 40 °C
Conformity		CE EN 61000-6-2: 2002-08 EN 61000-6-3: 2002-08

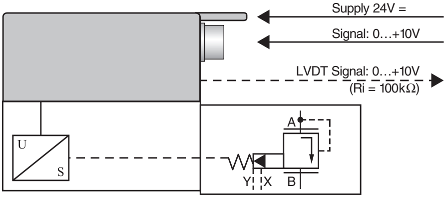
[1] The purity classes stated for the components must be complied with in hydraulic systems.
Effective filtration prevents problems and also extends the service life of components.
For a selection of filters, see catalog sheets RE 50070, RE 50076 and RE 50081.

Technical data

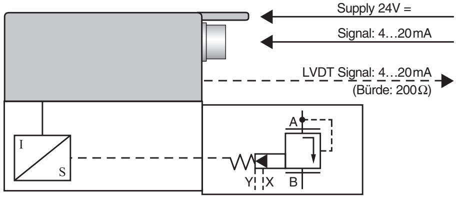
Electrical, trigger electronics integrated in valve		
Cyclic duration factor	%	100 %
Degree of protection		IP 65 to DIN 40050 and IEC 14434/5
Connection		Plug-in connector 6P+PE, DIN 43563
Supply voltage Terminal A: Terminal B: 0 V		24 V DC_{nom} Min. 21 V DC/max. 40 V DC Ripple max. 2 V DC
Power consumption		Solenoid ⧄ 45 mm = 40 VA max.
External fuse		2.5 A_F
Input, “standard” version Terminal D: U_E Terminal E:	A1	Differential amplifier, R_i = 100 kΩ 0...+10 V 0 V
Input, “mA signal” version Terminal D: $I_{D–E}$ Terminal E: $I_{D–E}$	F1*	Burden, R_{sh} = 200 Ω 4...20 mA Current loop $I_{D–E}$ feedback
Max. voltage to differential inputs over 0 V		D → B, E → B } max. 18 V DC
Test signal, “standard” version Terminal F: U_{Test} Terminal C:	A1	LVDT 0...+10 V Reference 0 V
Test signal, “mA signal” version Terminal F: $I_{F–C}$ Terminal C: $I_{F–C}$	F1*	LVDT signal 4...20 mA at external load 200...500 Ω max. 4...20 mA output Current loop $I_{F–C}$ feedback
Safety earth conductor and shield		See pin assignment (installation in conformity with CE)
Recommended cable		See pin assignment up to 20 m 7 x 0.75 mm^2 up to 40 m 7 x 1 mm^2
Calibration		Calibrated at the factory, see valve curve

* Variant “F1” (4...20 mA version) available on request

Version A1: Standard



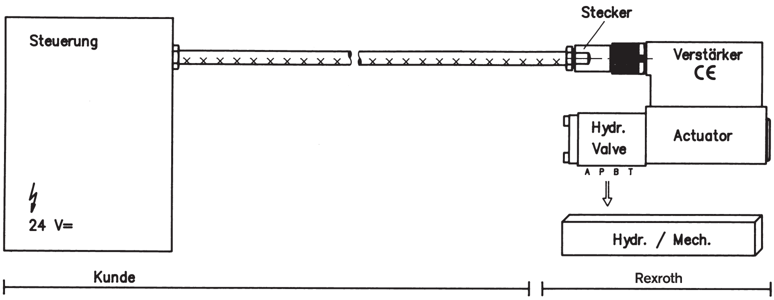
* Version F1: mA signal



3

Connection

For electrical data, see page 5 and
Operating Instructions **1 819 929 083**



Technical notes for the cable

Version: – Multi-wire cable
– Extra-finely stranded wire to VDE 0295, Class 6
– Safety earth conductor, green/yellow
– Cu braided shield

Type: – e. g. Ölflex-FD 855 CP (from Lappkabel company)

No. of wires: – Determined by type of valve, plug type and signal assignment

Cable Ø: – 0.75 mm² up to 20 m long
– 1.0 mm² up to 40 m long

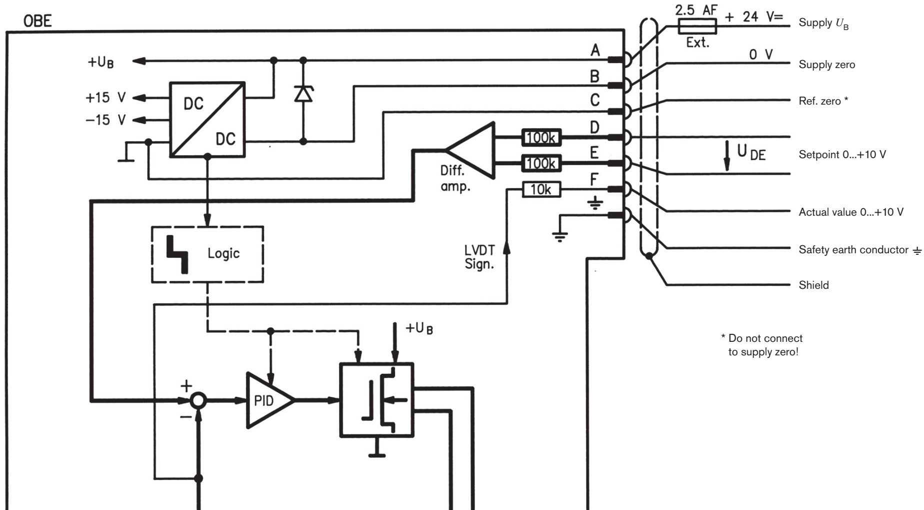
Outside Ø: – 9.4...11.8 mm – Pg11
– 12.7...13.5 mm – Pg16

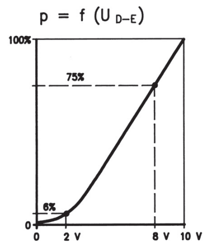
Important

Power supply 24 V DC nom.,
if voltage drops below 18 V DC, rapid shutdown resembling "Enable OFF" takes place internally.
In addition, with the "mA signal" version:
$I_{D-E} \geqq 3$ mA – valve is active
$I_{D-E} \leqq 2$ mA – valve is deactivated.
Electrical signals emitted via the trigger electronics (e.g. actual values) must not be used to shut down safety-relevant machine functions!
(See also European Standard, "Technical Safety Requirements for Fluid-Powered Systems and Components – Hydraulics", EN 982.

On-board trigger electronics

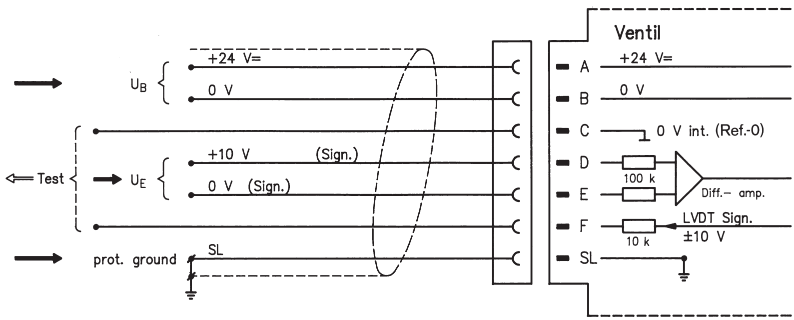
Circuit diagram/pin assignment
Version A1: U_{D-E} 0...+10 V





3

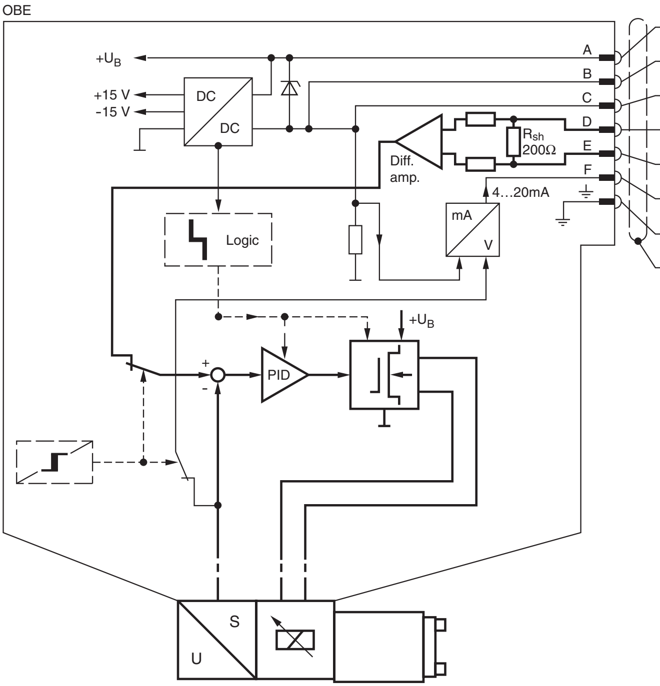
Pin assignment
Version A1: U_{D-E} 0...+10 V
(R_i = 100 kΩ)

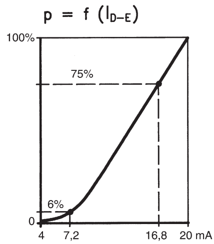


On-board trigger electronics

Circuit diagram/pin assignment

Version F1: I_{D-E} 4...20 mA

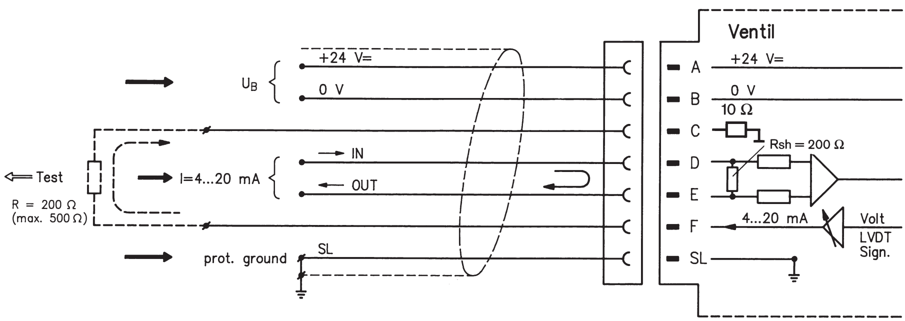




Pin assignment 6P+PE

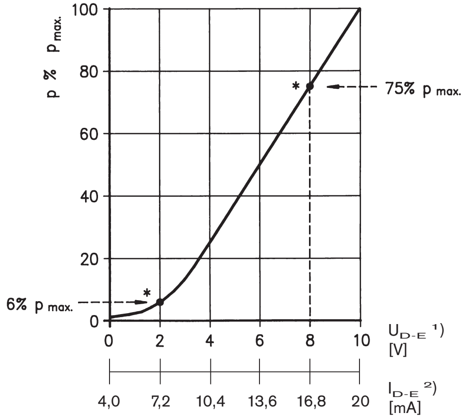
Version F1: I_{D-E} 4...20 mA

(R_{sh} = 200 kΩ)



Characteristic curves (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Pressure in port A as a function of the setpoint



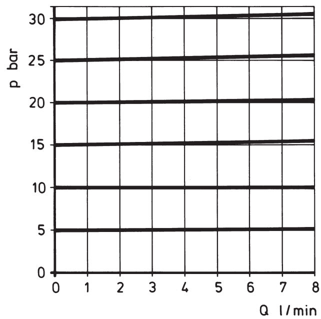
* Factory setting at $Q = 1$ l/min ±5 % manufacturing tolerance

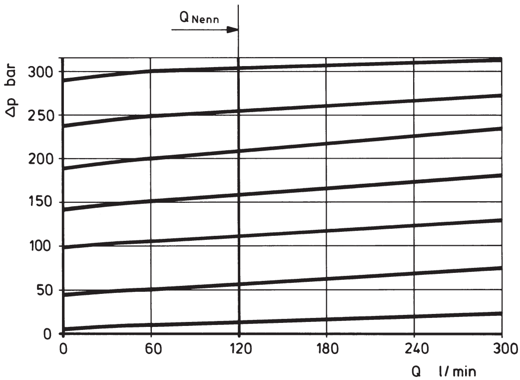
1) Version: $U_{D-E} = 0...+10$ V

2) Version: $I_{D-E} = 4...20$ mA

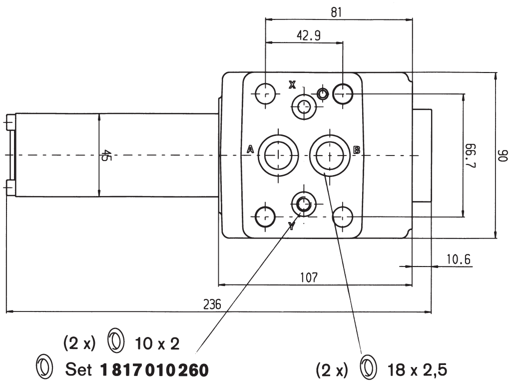
Pressure in port A as a function of the main stage nominal flow rate

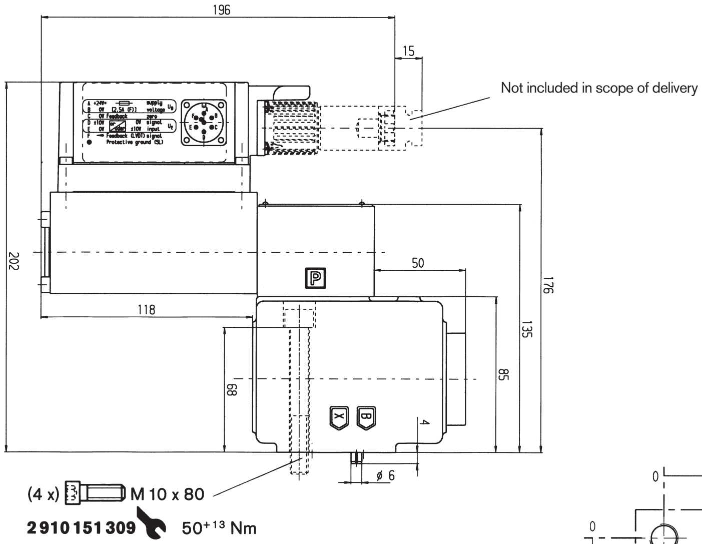
$p = f\,(Q)$

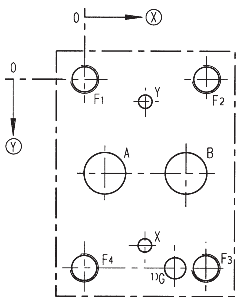




Unit dimensions (nominal dimensions in mm)

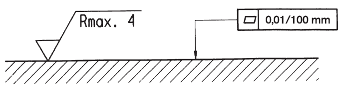






Mounting hole configuration: NG10 (ISO 5781-AG-06-2-A)
For subplates see catalog sheet RE 45055

Required surface quality
of mating component



1) Deviates from standard
2) Thread depth:
Ferrous metal 1.5 x Ø*
Non-ferrous 2 x Ø
* NG10 min.10.5 mm

	A	B	X	Y	G	F_1	F_2	F_3	F_4
X	7.2	35.8	21.4	21.4	31.8	0	42.9	42.9	0
Y	33.35	33.35	58.7	7,9	66.7	0	0	66.7	66.7
∅	14.7	14.7	4.8	4,8	7.5	M10 2)	M10 2)	M10 2)	M10 2)

Notes

Notes

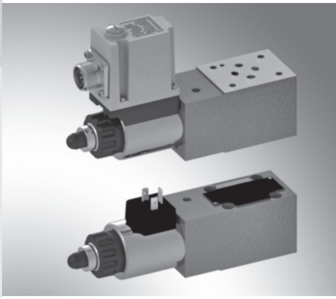
Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Telefon +49 (0) 93 52 / 18-0
Telefax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

Rexroth
Bosch Group

Proportional pressure relief valve, pilot operated

RE 29258/11.11 1/20
Replaces: RE 29158

Types (Z)DBE and (Z)DBEE



Size 6
Component series 2X
Maximum operating pressure 350 bar
Maximum flow 30 l/min

Table of contents

Contents	Page

Features

- Pilot operated valve for limiting a system pressure
- Operation by means of proportional solenoids
- Proportional solenoid with rotatable and detachable coil
- For subplate mounting or sandwich plate design:
  Porting pattern according to ISO 4401-03-02-0-05
  and DIN 24340
- Valve and control electronics from a single source
- External control electronics for types DBE and ZDBE
- Linear command value pressure characteristic curve
- Types DBEE and ZDBEE with integrated electronics (OBE):
  • Low manufacturing tolerance of the command value pressure characteristic curve

Information on available spare parts:
www.boschrexroth.com/spc

Ordering code

	DBE		6		2 – 2X /			G24				*

Subplate mounting = **no code**
Sandwich plate = **Z**

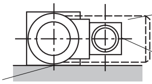
Proportional pressure relief valve

for external control electronics = **no code**
with integrated electronics (OBE) = **E**

Size 6 = **6**

Subplate mounting = **no code**
Pressure limitation in channel P = **VP**

Preferred position of mating connector = **2**



The mating connector can be brought to the desired position after the nut was loosened (see page 17, 18).

[1)] Valve mounting face (seal ring recesses in the housing)

Component series 20 to 29 = **2X**
(20 to 29: Unchanged installation and connection dimensions)

Maximum setting pressure

Pressure rating 25 bar	**= 25**
Pressure rating 50 bar	**= 50**
Pressure rating 100 bar	**= 100**
Pressure rating 200 bar	**= 200**
Pressure rating 315 bar	**= 315**
Pressure rating 350 bar	**= 350**

no code = Pilot oil return, internal (recommendation: Subplate mounting up to Q_{Vmax} =15 l/min)
Y = Pilot oil return, external (only possible with subplate mounting)

Supply voltage
G24 = +24 V direct voltage

Electrical connection
for DBE; ZDBE:
K4 = **without** mating connector, with connector according to DIN EN 175301-803
Mating connector – separate order see page 8
for DBEE; ZDBEE:
K31 = **without** mating connector, with connector according to DIN EN 175201-804
Mating connector – separate order see page 8

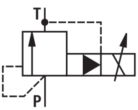
Interface electronics
A1 = Command value 0 to 10 V
F1 = Command value 4 to 20 mA
no code = for (Z)DBE

Seal material
M = NBR seals
V = FKM seals

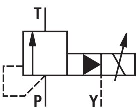
Further details in plain text

Symbols (for sandwich plate symbol: 1 = component side, 2 = plate side)

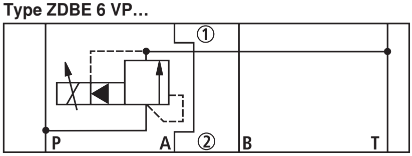
Type DBE 6…



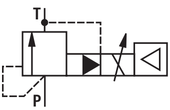
Type DBE 6…Y..



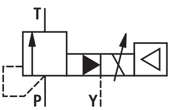
Type ZDBE 6 VP…



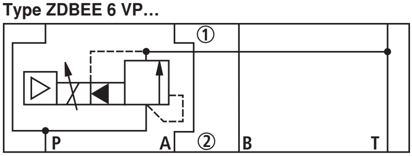
Type DBEE 6…



Type DBEE 6…Y..



Type ZDBEE 6 VP…



Function, cross-section

Types DBE and ZDBE

The pilot operated proportional pressure relief valves of the types DBE and ZDBE are operated by means of a proportional solenoid. These valves are used to limit a system pressure. With these valves it is possible to steplessly adjust the system pressure to be limited depending on the electrical command value.

These valves basically consist of a pilot control stage and a main stage.

The pilot control stage consists of a proportional solenoid (1), the poppet (2) and the valve seat (3). The main stage consists of a housing (4) and the main spool cartridge assembly (5). The proportional solenoid proportionally converts the electrical current into a mechanical force. An increase in the current intensity causes a corresponding rise in the magnetic force. The system pressure is adjusted by means of the proportional solenoid (1) depending on the command value. Pressure applied by the system in port P acts on the right hand side of the main spool cartridge assembly (5). At the same time, the system pressure acts via the pilot line (7), which is provided with an nozzle (6), on the spring-loaded side of the spool.

Via the valve seat in the pilot line (3), the pressure at the poppet (2) in the spring chamber acts against the force of the proportional solenoid (1).

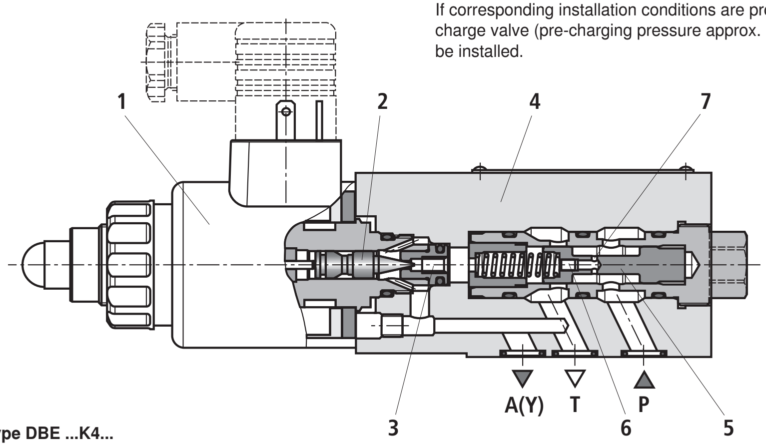
Once the pressure has reached the pre-set value, the poppet (3) is lifted from the seat. The pilot oil can now (depending on the model) drain externally via port A (Y) or internally into the tank, which results in a limitation of the pressure on the spring-loaded side of the main spool (5). If the system pressure continues to rise slightly, the higher pressure on the right hand side of the spool will push the spool to the left into the control position P to T.

At a minimum control current (corresponds to a command value of zero), the minimum setting pressure will be set.

Notice!

– The tank lines should be prevented from running empty. If corresponding installation conditions are provided, a precharge valve (pre-charging pressure approx. 1 bar) is to be installed.

3



Type DBE ...K4...

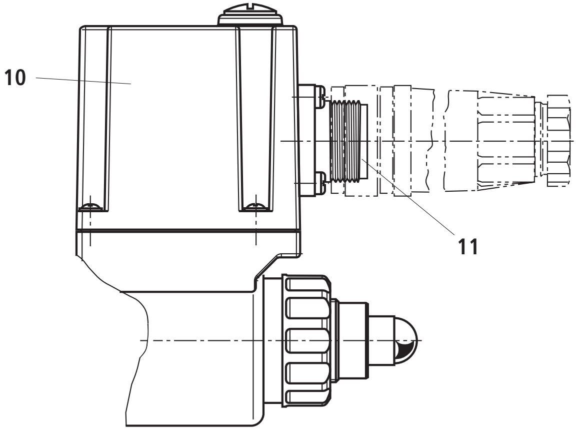
Function, cross-section

Type (Z)DBEE – with integrated electronics (OBE)

In terms of function and design, these valves correspond to type (Z)DBE. An additional housing (10) is fitted on the proportional solenoid which accommodates the control electronics.

Supply and command value voltage are applied at the connector (11).
In the factory, the command value pressure characteristic curve is adjusted with little manufacturing tolerance.

For more information on the control electronics, see page 9.



Type (Z)DBEE…-2X/…YG24K31...

Technical data (For applications outside these parameters, please consult us!)

general

Weight	– DBE and ZDBE	kg	2.4
	– DBEE and ZDBEE	kg	2.5
Installation position			Any
Storage temperature range		°C	–20 to +80
Ambient temperature range	– DBE and ZDBE	°C	–20 to +70
	– DBEE and ZDBEE	°C	–20 to +50

hydraulic (measured with HLP 46; ϑ_{oil} = 40 °C ± 5 °C)

Maximum operating pressure	– Port P; P1 – P2 A1 – A2; B1 – B2	bar	350
	– Port T	bar	50
Maximum setting pressure	– Pressure rating 25 bar	bar	25
	– Pressure rating 50 bar	bar	50
	– Pressure rating 100 bar	bar	100
	– Pressure rating 200 bar	bar	200
	– Pressure rating 315 bar	bar	315
	– Pressure rating 350 bar	bar	350
Minimum setting pressure at command value 0		bar	See characteristic curves on page 14 and 15
Return flow pressure in port A; with external pilot oil return (Y)			Separately at zero pressure to the tank
Pilot flow		l/min	0.6 to 1.2
Maximum flow		l/min	30
Hydraulic fluid			See table page 6
Hydraulic fluid temperature range		°C	–20 to +80
Viscosity range		mm^2/s	15 to 380
Maximum admissible degree of contamination of the hydraulic fluid cleanliness class according to ISO 4406 (c)			Class 20/18/15 [1)]
Hysteresis		%	±3 of the maximum setting pressure
Repeatability		%	< ±2 of the maximum setting pressure
Linearity		%	±3.5 of the maximum setting pressure
Manufacturing tolerance of the command value pressure characteristic curve, related to the hysteresis characteristic curve, pressure increasing	– DBE and ZDBE	%	±5 of the maximum setting pressure
	– DBEE and ZDBEE	%	±1.5 of the maximum setting pressure
Step response $T_u + T_g$ at Q_V = 5 l/min	10 % → 90 %	ms	130 Depending on system
	90 % → 10 %	ms	110 Depending on system

[1)] The cleanliness classes specified for the components must be complied with in hydraulic systems. An effective filtration prevents faults and at the same time increases the service life of the components.

For the selection of the filters see www.boschrexroth.com/filter.

3

Technical data (For applications outside these parameters, please consult us!)

hydraulic

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons		HL, HLP	NBR, FKM	DIN 51524
Environmentally compatible	– Insoluble in water	HEES	FKM	ISO 15380
		HEPR	FKM	
	– Soluble in water	HEPG	FKM	ISO 15380
Flame-resistant	– Water-free	HFDU, HFDR	FKM	ISO 12922
	– Water-containing	HFC Fuchs Hydrotherm 46M Petrofer Ultra Safe 620	NBR	ISO 12922

☞ **Important information on hydraulic fluids!**

- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- The flash point of the process and operating medium used must be 40 K higher than the maximum solenoid surface temperature.
- **Flame-resistant – water-containing**:
  Maximum pressure differential 210 bar, otherwise increased cavitation erosion! The pressure peaks should not exceed the maximum operating pressures!
  Service life as compared to HLP 30 - 100 %
  Maximum fluid temperature 60 °C

electric

Minimum solenoid current		mA	≤ 100
Maximum solenoid current		mA	1600 ± 10 %
Solenoid coil resistance	Cold value at 20 °C	Ω	5.5
	Maximum hot value	Ω	8.05
Duty cycle		%	100

electrical, integrated electronics (OBE)

Supply voltage	Nominal voltage	VDC	24
	Lower limit value	VDC	21
	Upper limit value	VDC	35
Current consumption		A	≤ 1.5
Required fuse protection		A	2, time-lag
Inputs	Voltage	V	0 to 10
	Current	mA	4 to 20
Output	Actual current value	mV	1 mV ≙ 1 mA
Protection class of the valve according to EN 60529			IP 65 with mating connector mounted and locked

Accessories (not included in scope of delivery)

Proportional amplifier for type (Z)DBE		**Material number**
VT-MSPA1-11-1X/ in modular design VT-VSPD-2 in eurocard format VT-MSPA1-11-1X/ in eurocard format VT-SSPA1-1-1X plug-in amplifier	according to data sheet 30223 according to data sheet 30523 according to data sheet 30100 according to data sheet 30116	

Mating connector for type (Z)DBE		**Material number**
Mating connector (black)	according to DIN EN 175301-803	R901017011

Mating connector for type (Z)DBEE		**Material number**
Mating connector	according to DIN EN 175201-804	e.g. R900021267 (plastic)
		e.g. R900223890 (metal)

Hexagon socket head cap screws		**Material number**
Type DBE(E)	4x ISO 4762 - M5 x 50 - 10.9-flZn-240h-L (friction coefficient μ_{total} = 0.09 to 0.14) Tightening torque M_A = 7 Nm ±10 %	
Type ZDBE(E)	4x ISO 4762 - M5 - 10.9-flZn-240h-L (friction coefficient μ_{total} = 0.09 to 0.14) Tightening torque M_A = 7 Nm ±10 %	

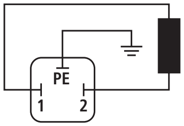
Notice: The tightening torque of the hexagon head cap screws refers to the maximum admissible operating pressure!

Subplates	**Data sheet**
Size 6	45052

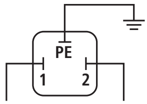
Electrical connection (dimensions in mm)

(Z)DBE

Connection to connector

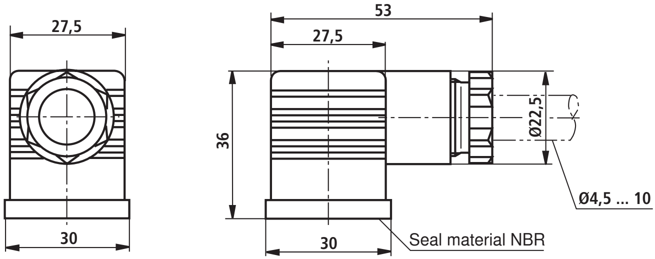


Connection to mating connector



to the amplifier

Mating connector (black)
according to DIN EN 175301-803
Material no. **R901017011**
(separate order)

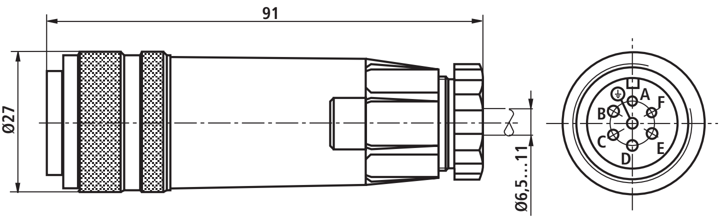


(Z)DBEE

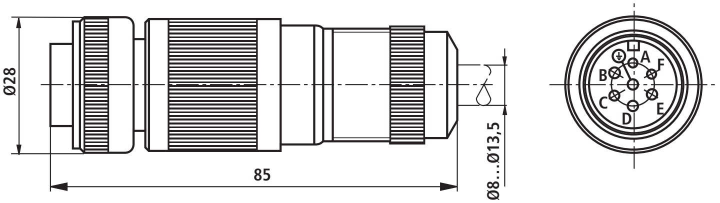
Device connector allocation	Contact	Assignment interface "A1"	Assignment interface "F1"
Supply voltage	A	24 VDC (u(t) = 21 V to 35 V); $I_{max} \leq 1.5$ A	
	B	0 V	
Reference potential actual value	C	Reference contact F; 0 V	Reference contact F; 0 V
Differential amplifier input	D	0 to 10 V; R_E = 100 kΩ	4 to 20 mA; R_E = 100 Ω
	E	Reference potential command value	
Measuring output (actual value)	F	0 to 1.6 V actual value (1 mV ≙ 1 mA) Load resistance > 10 kΩ	
	PE	Connected to solenoid and valve housing	

Mating connectors according to DIN EN 175201-804, solder contacts for line cross-section 0.5 to 1.5 mm²

Plastic version,
material no. **R900021267,**
(separate order)



Metal version,
material no. **R900223890,**
(separate order)

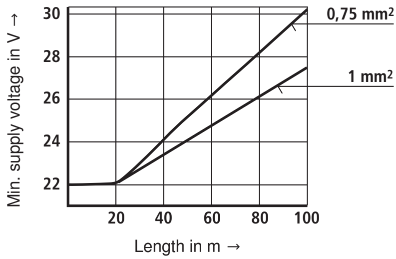


Electrical connection

Connection cable for (Z)DBEE

– Recommendation: 6-wire, 0.75 or 1 mm^2 plus protective earthing conductor and screening
– Only connect the screening to PE on the supply side
– Max. admissible length 100 m

The minimum supply voltage at the power supply unit depends on the length of the supply line (see diagram).



Integrated electronics (OBE) for type (Z)DBEE

Function

The electronics are supplied with voltage via ports A and B. The command value is applied to the differential amplifier ports D and E.

Via the characteristic curve generator, the command value solenoid current characteristic curve is adjusted to the valve so that non-linearities in the hydraulic system are compensated for and a linear command value pressure characteristic curve is created.

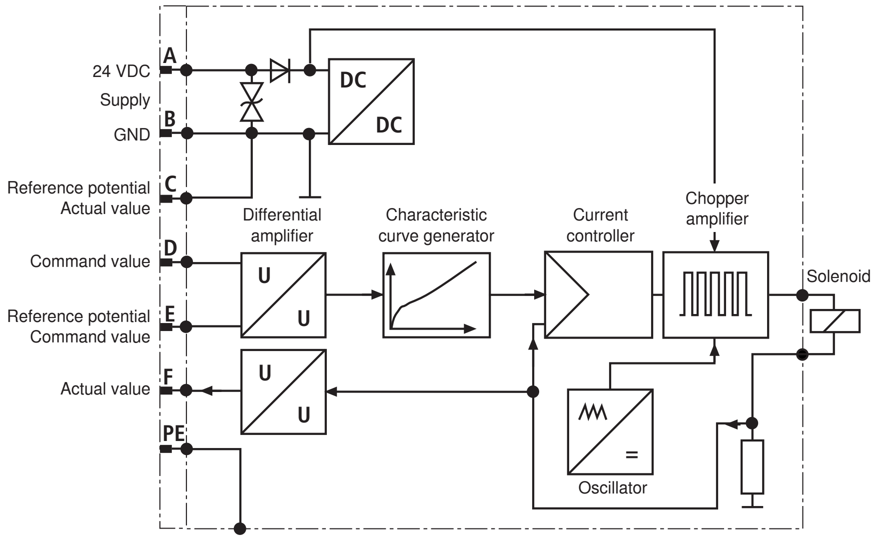
The current controller controls the solenoid current independent of the solenoid coil resistance.

The power section of the electronics for controlling the proportional solenoid is a chopper amplifier with a cycle frequency of approx. 180 Hz to 400 Hz. The output signal is pulse-width modulated (PWM).

For checking the solenoid current, a voltage can be measured between pin F(+) and pin C(–) that is proportional to the solenoid current. **1 mV** corresponds to a solenoid current of **1 mA**.

3

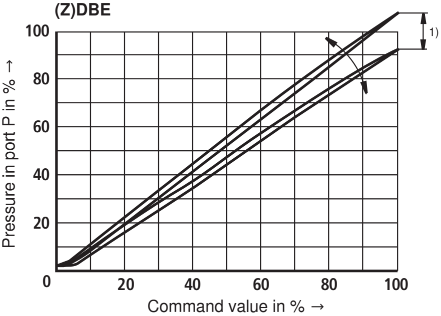
Block diagram



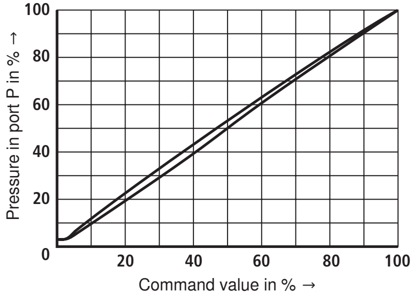
Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

Pressure in port P depending on the command value (Q_V = 5 l/min)

(Z)DBE



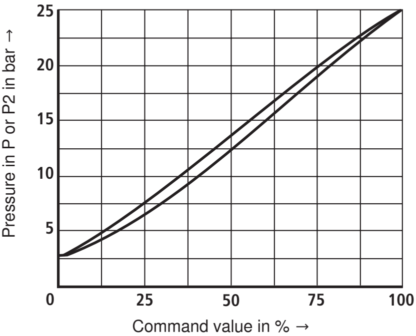
(Z)DBEE



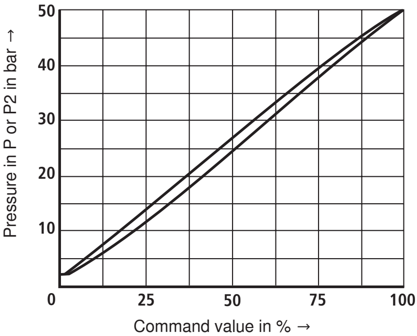
[1)] On valve DRE(M), the manufacturing tolerance can be adjusted at the **external analog amplifier** (for type and data sheet see page 7) using the command value attenuator potentiometer **"Gw"**. The digital amplifier can be set by means of the parameter "limit".
Here, the control current according to the technical data must not be exceeded.
In order to match several valves to the same characteristic curve, at a command value of 100 %, the pressure must not exceed the maximum setting pressure of the relevant pressure rating at no valve.

Pressure in port P or P2 depending on the command value (Q_V = 5 l/min)

Pressure rating 25 bar ("y" external and internal)

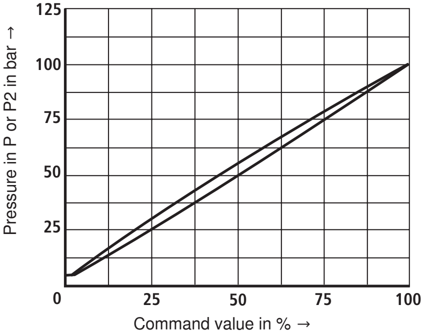


Pressure rating 50 bar ("y" external and internal)

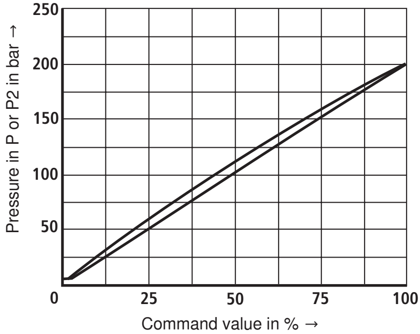


Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

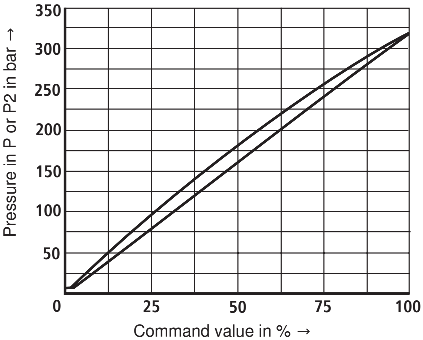
Pressure rating 100 bar ("y" external and internal)



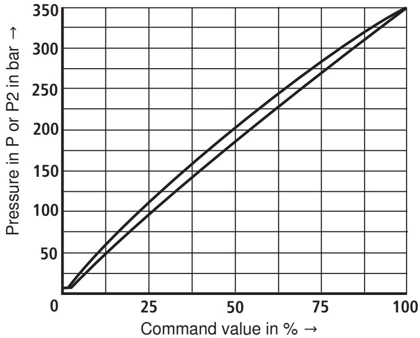
Pressure rating 200 bar ("y" external and internal)



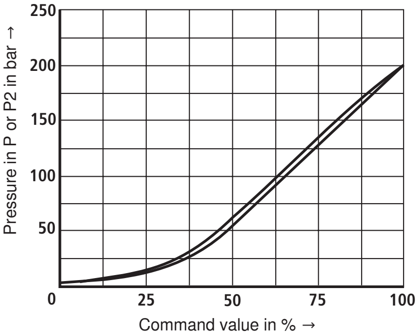
Pressure rating 315 bar ("y" external and internal)



Pressure rating 350 bar ("y" external and internal)

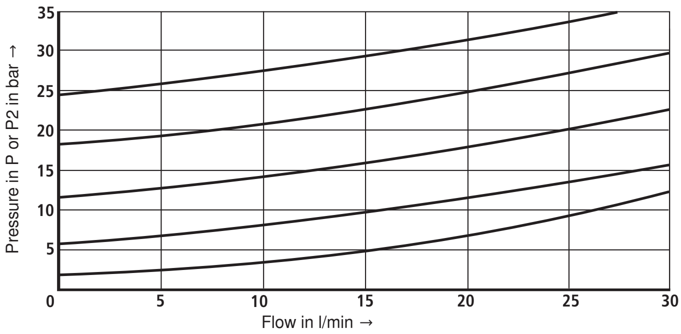


Pressure rating 200 bar (with VT-SSPA1) plug-in amplifier

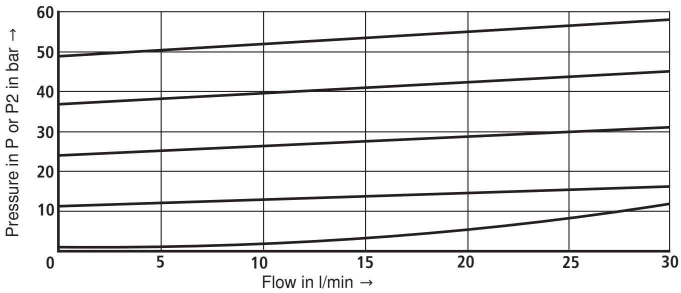


Characteristic curves (measured with HLP 46; ϑ_{oil} = 40 °C ± 5 °C)

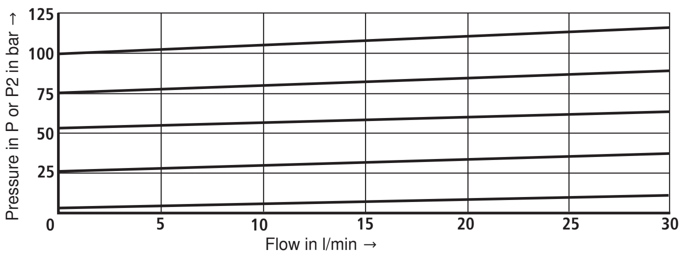
Pressure in channel P or P2 depending on the flow Q_v
Pressure rating 25 bar



Pressure rating 50 bar

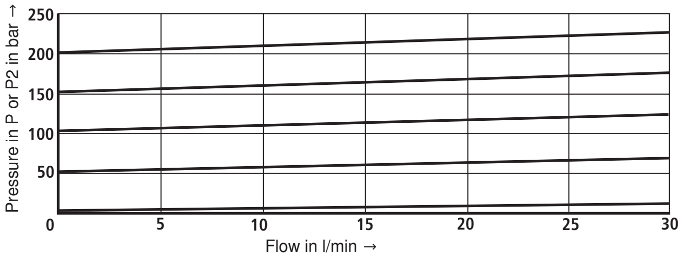


Pressure rating 100 bar

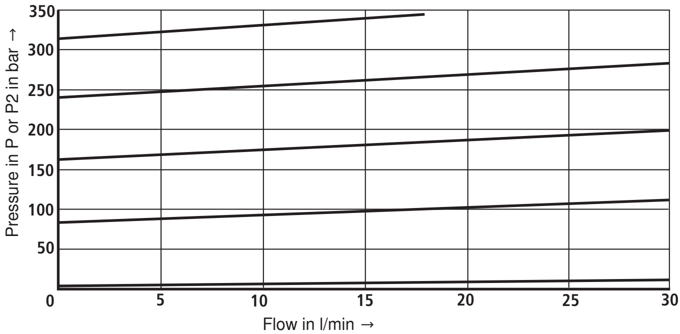


Characteristic curves (measured with HLP 46; ϑ_{oil} = 40 °C ± 5 °C)

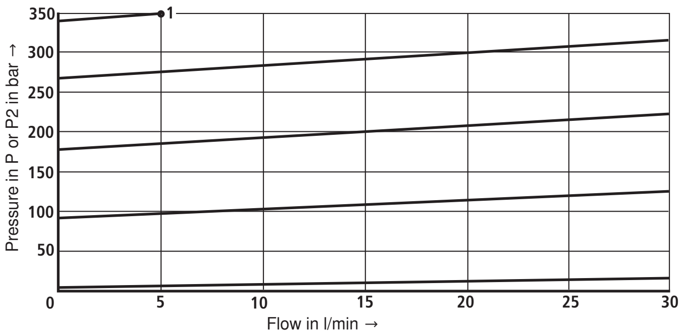
Pressure rating 200 bar



Pressure rating 315 bar



Pressure rating 350 bar [1)]



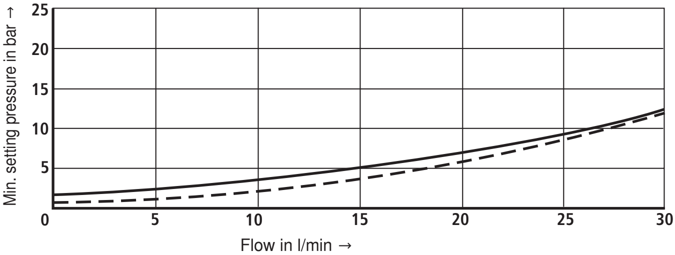
1) In case of characteristic curve 1, the command value may not exceed the maximum flow of 5 l/min

The characteristic curves were measured without counter pressure in port A (external pilot oil return) and T (internal pilot oil return). With internal pilot oil return, the pressure in P or P2 increases by the output pressure present in port T.

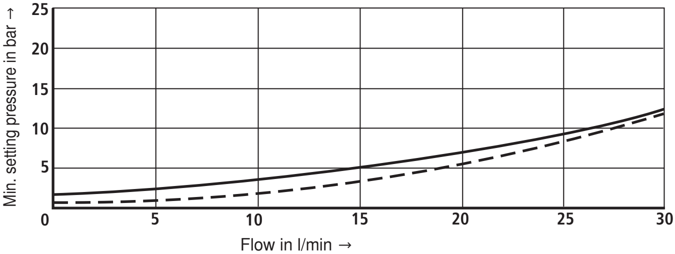
Characteristic curves (measured with HLP 46; ϑ_{oil} = 40 °C ± 5 °C)

Min. setting pressure in port P or P2 or at command value 0.

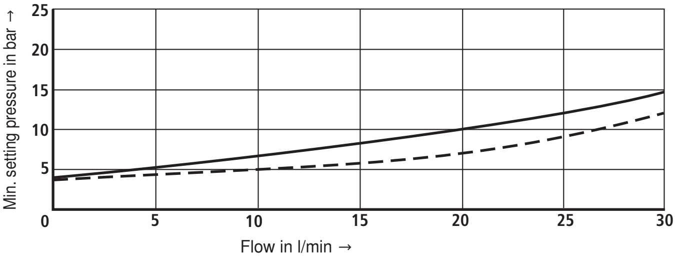
Pressure rating 25 bar



Pressure rating 50 bar



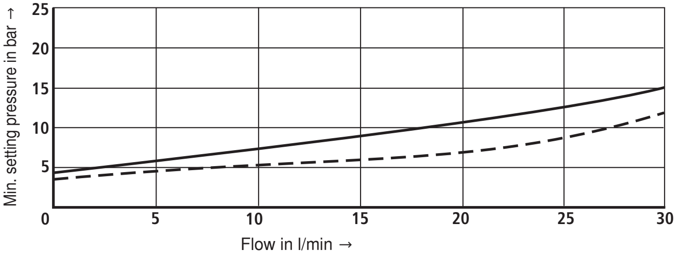
Pressure rating 100 bar



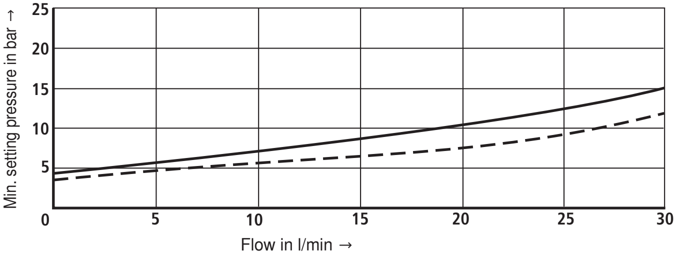
Pilot oil return ——— Internal – – – External

Characteristic curves (measured with HLP 46; ϑ_{oil} = 40 °C ± 5 °C)

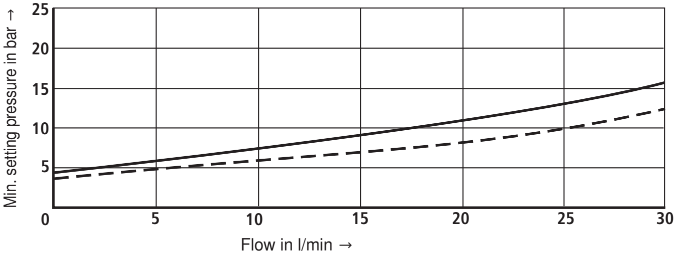
Pressure rating 200 bar



Pressure rating 315 bar



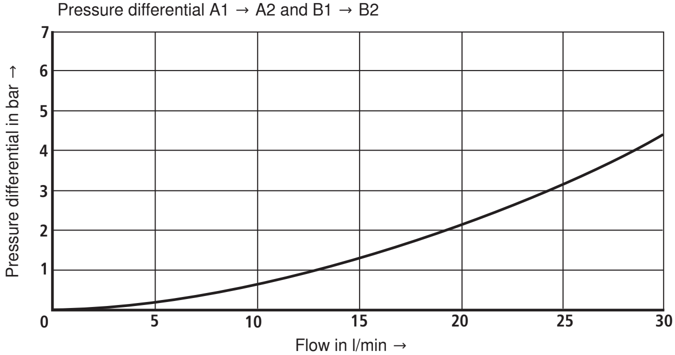
Pressure rating 350 bar

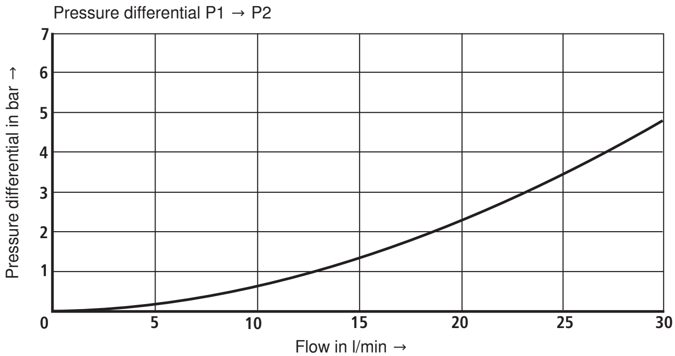


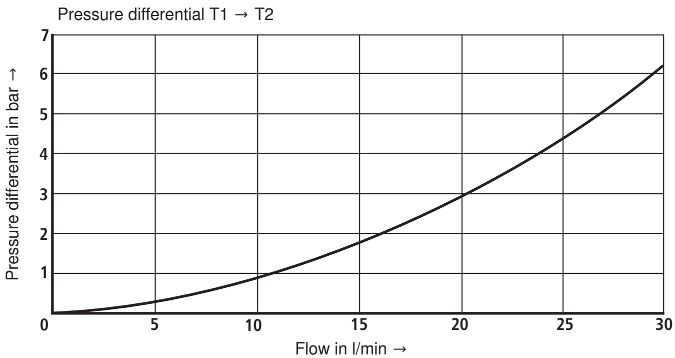
Pilot oil return ——— Internal – – – External

The characteristic curves were measured without counter pressure in port A (external pilot oil return) and T (internal pilot oil return). With internal pilot oil return, the pressure in P or P2 increases by the output pressure present in port T.

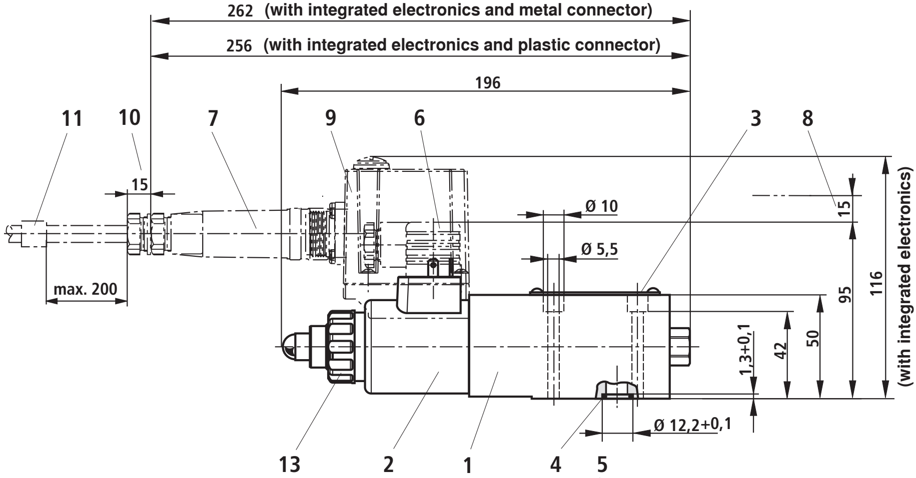
Characteristic curves (measured with HLP 46; ϑ_{oil} = 40 °C ± 5 °C)

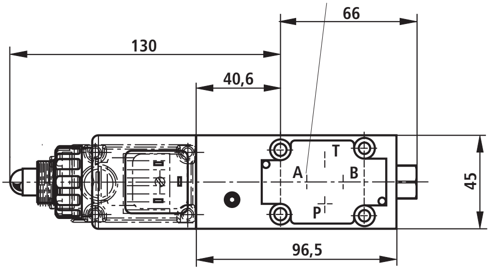


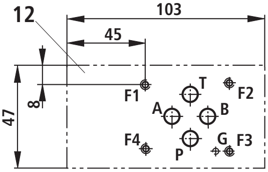


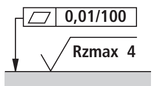


Unit dimensions: Types DBE and DBEE (dimensions in mm)









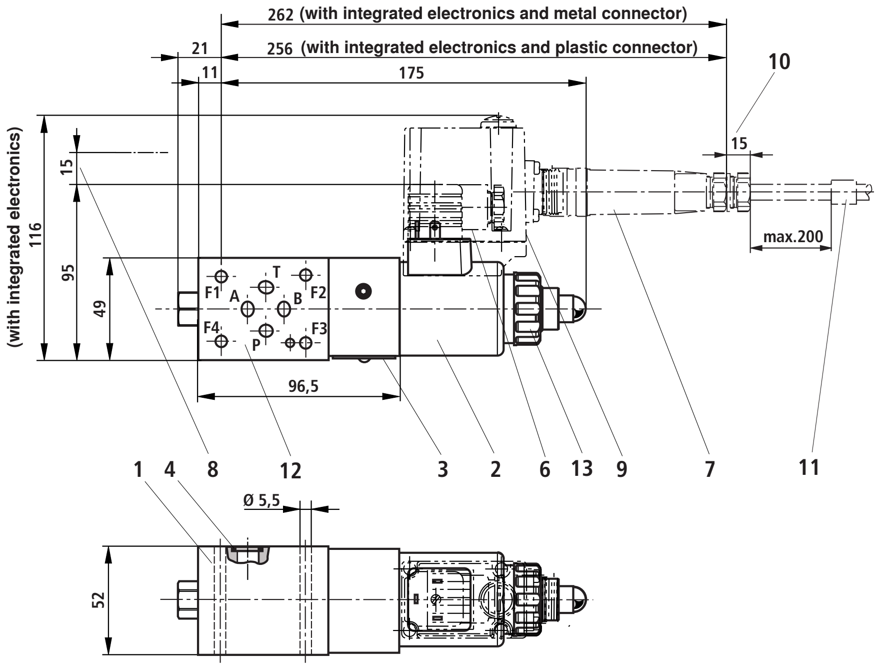
Required surface quality of the valve contact surface

1. Valve housing
2. Proportional solenoid
3. Name plate
4. Identical seal rings for ports A, B, P, and T
5. With version Y, pilot oil return external via port A (Y)
6. Mating connector according to DIN EN 175301-803
7. Mating connector according to DIN EN 175201-804
8. Space required for removing the mating connector
9. Integrated electronics (OBE)
10. Space required for removing the mating connector
11. Cable fastening
12. Machined installation surface, porting pattern according to DIN 24340 (**without** locating hole) and ISO 4401-03-02-0-05 (**with** locating hole)
13. O-ring and plastic nut SW 32 for coil fixation
    The nut can be loosened by rotating it anticlockwise (1 turn). The solenoid coil can then be rotated to the required position before fixing it again by tightening the nut.
    Tightening torque: 4+1 Nm.

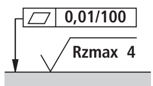
Tolerances according to:
- General tolerances ISO 2768-mK
- Tolerancing principle ISO 8015

Subplates and valve mounting screws see page 7

Unit dimensions: Types ZDBE and ZDBEE (dimensions in mm)



1 **1** Valve housing
- **2** Proportional solenoid
- **3** Name plate
- **4** Identical seal rings for ports A, B, P, and T
- **6** Mating connector for type ZDBE (separate order, see page 6)
- **7** Mating connector for type ZDBEE (separate order see page 6)
- **8** Space required for removing the mating connector
- **9** Integrated electronics (OBE)
- **10** Space required for removing the mating connector
- **11** Cable fastening
- **12** Machined installation surface, porting pattern according to DIN 24340 (**without** locating hole) and ISO 4401-03-02-0-05 (**with** locating hole)
- **13** O-ring and plastic nut SW 32 for coil fixation
  The nut can be loosened by rotating it anticlockwise (1 turn). The solenoid coil can then be rotated to the required position before fixing it again by tightening the nut.
  Tightening torque: 4+1 Nm.



Required surface quality of the valve contact surface

Tolerances according to: – General tolerances ISO 2768-mK
– Tolerancing principle ISO 8015

Subplates and valve mounting screws see page 7

Notes

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

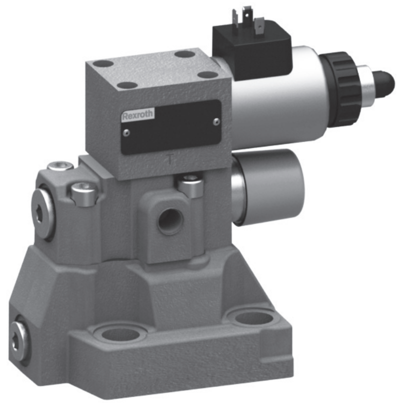
The Drive & Control Company

Rexroth
Bosch Group

Proportional pressure relief valve, pilot operated

Type DBEM and DBEME

RE 29361
Edition: 2012-12
Replaces: 29160, 29142



Similar figure

- Size 10 to 32
- Component series 7X
- Maximum operating pressure 350 bar
- Maximum flow: 700 l/min

Features

- Pilot operated valves for limiting a system pressure
- Operation by means of proportional solenoid
- For subplate mounting and threaded connection: Porting pattern according to ISO 6264
- Maximum pressure limitation
- Valve and control electronics from a single source
- Integrated electronics (OBE) with type DBEME: Little manufacturing tolerance of the command value pressure characteristic curve
- External control electronics with type DBEM (separate order)

Contents

Ordering code

01	02	03	04		05		06	07	08	09	10	11	12	13
DBE	**M**			**–**	**7X**	**/**			**G24**					*****

01	Proportional pressure relief valve	**DBE**
02	**With** maximum pressure limitation	**M** [1]
03	For external control electronics	**no code**
	With integrated electronics (OBE)	**E**

Size

04	Size 10	**10**
	Size 25	**20**
	Size 32	**30**
05	Component series 70 to 79 (70 to 79: Unchanged installation and connection dimensions)	**7X**

Pressure rating [2]

06	Up to 50 bar	**50**
	Up to 100 bar	**100**
	Up to 200 bar	**200**
	Up to 315 bar	**315**
	Up to 350 bar	**350**
07	Pilot oil return external	**Y**
	Unloading port X, pilot oil return external	**XY**

Supply voltage

08	24 V DC voltage	**G24**
09	1600 mA coil	**no code**
	800 mA coil	**–8** [3]

[1] The maximum pressure limitation only serves as protection against overpressure in case of an error in the pilot valve (e.g. in case of contamination or overcurrent).

[2] Special version DBEME-SO699 in size 10 and 20 available up to pressure rating 500 bar.

[3] Replacement for series 3X and series 5X SO1 (comparison see characteristic curve page 12). All characteristics (hydraulic and electric) specified in the data sheet refer to the version with 1600 mA coil.

Ordering code

01	02	03	04		05		06	07	08	09	10	11	12	13
DBE	M			–	7X	/			G24					*

Electrical connection

10	**For type DBEM:**	
	Without mating connector; connector DIN EN 175301-803	**K4** [4]
	For type DBEME:	
	Without mating connector; connector DIN EN 175201-804	**K31** [4]

Electronics interface

11	Command value 0 to 10 V	**A1**
	Command value 4 to 20 mA	**F1**
	With DBEM	**no code**

Seal material

12	NBR seals	**M**
	FKM seals	**V**
	Attention: Observe compatibility of seals with hydraulic fluid used!	

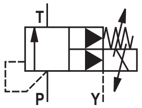
13	Further details in the plain text	

[4] Mating connectors, separate order, see page 8 and 16

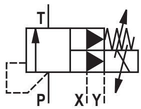
Symbols

For external control electronics:

Type DBEM...-7X/...Y...

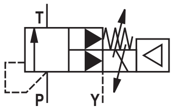


Type DBEM...-7X/...XY...

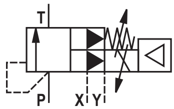


With integrated electronics:

Type DBEME...-7X/...Y...

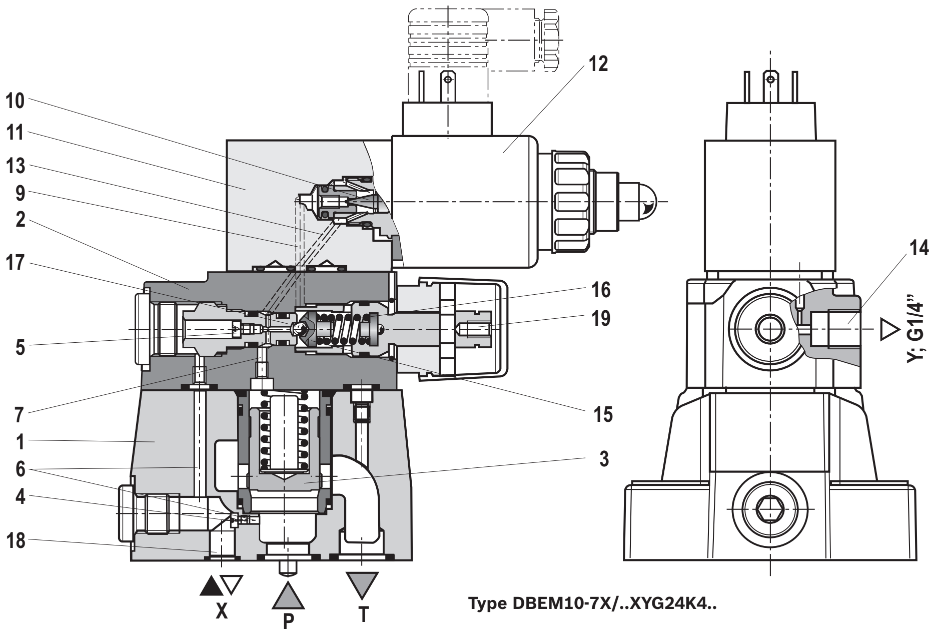


Type DBEME...-7X/...XY...



Function, section

Valves of type DBEM are pilot operated pressure relief valves. They are used to limit the operating pressure in hydraulic systems. By means of these valves, the pressure to be limited can be continuously adjusted depending on the electric command value.
These valves basically consist of the housing (1) with main spool insert (3), the sandwich plate valve with maximum pressure limitation (2) and the proportional pilot control valve (11).
Type DBEM…
The pressure applied to channel P acts on the main spool (3). At the same time, the pressure at port P is applied to the spring loaded side of the main spool (3) via the control lines (6, 7) provided with nozzles (4, 5). Via the connection bore (9), the pressure is simultaneously applied to the poppet (10) of the proportional pilot control valve (11). The hydraulic force at the pilot poppet (10) acts against the command value-dependent force of the proportional solenoid (12).
If the hydraulic force exceeds the solenoid force, the pilot poppet is opened (10). The pilot oil can now flow via the control line (13) into port Y (14) and to the tank; thus, a pressure drop results at the main spool (3) over the control lines (6, 7). The connection from port P to T is released. The main spool (3) controls the set operating pressure at port P.
As hydraulic protection against inadmissibly high pressures, a spring-loaded pressure relief valve (2) has been integrated. This maximum pressure limitation is pre-set to the relevant pressure rating (see table page 6). In the operating range of the valve, the poppet (15) is held on the valve seat (17) by the spring (16) and is thus closed. If the pressure in the spring chamber of the main spool (3) exceeds the maximum admissible set pressure of the valve, the poppet (15) is pressed against the compression spring (16) and the connection into the spring chamber is opened. Via port Y (14), the pilot oil flows into the tank. Due to the control lines (6, 7), a pressure drop occurs at the main spool (3). The connection from port P to T is released. The main spool (3) controls the set maximum operating pressure in port P. Via the adjustment element (19), the pre-set pressure can be reduced, if necessary. Port Y (14) must be externally piped to the tank. The connection to the tank should be pressureless. Via port X (18), the valve may be unloaded or the maximum pressure may be limited.



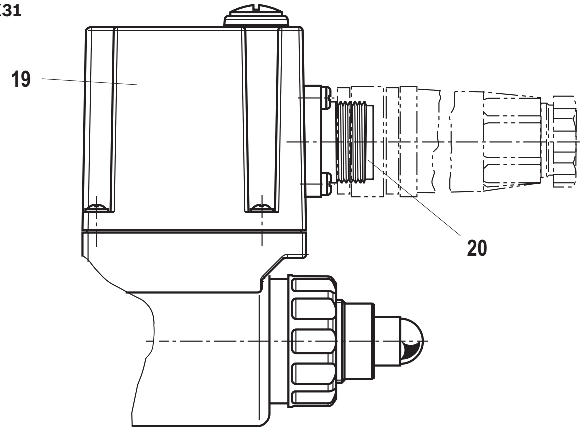
Type DBEM10-7X/..XYG24K4..

Function, section

Type DBEME – with integrated electronics (OBE)
In terms of function and design, these valves correspond to type DBEM. On the proportional solenoid, there is moreover a housing (19) with the control electronics.
Supply and command value voltage are applied to the connector (20).
In the factory, the command value pressure characteristic curve is adjusted with little manufacturing tolerance.

For more information on the control electronics, see page 9.

Type DBEME...-7X/...YG24K31



Technical data

(For applications outside these parameters, please consult us!)

general			**Size 10**	**Size 25**	**Size 32**
Weight	– Type DBEM	kg	4.5	5.3	6.4
	– Type DBEME	kg	4.7	5.5	6.6
Installation position			Any		
Storage temperature range		°C	–20 to +80		
Ambient temperature range	– Type DBEM	°C	–20 to +70		
	– Type DBEME	°C	–20 to +50		

hydraulic (measured with HLP46, ϑ_{Oil} = 40 ±5 °C)			**Size 10**	**Size 25**	**Size 32**
Maximum operating pressure	– Port P and X	bar	350		
	– Port T	bar	315		
	– Port Y	bar	Separately and to the tank at zero pressure		
Maximum set pressure	– Pressure rating 50 bar	bar	50		
	– Pressure rating 100 bar	bar	100		
	– Pressure rating 200 bar	bar	200		
	– Pressure rating 315 bar	bar	315		
	– Pressure rating 350 bar	bar	350		
Minimum set pressure with command value zero		bar	See characteristic curve page 10		
Maximum pressure limitation, set upon delivery			If necessary, the value may be reduced		
	– Pressure rating 50 bar	bar	to 75 bar		
	– Pressure rating 100 bar	bar	to 135 bar		
	– Pressure rating 200 bar	bar	to 240 bar		
	– Pressure rating 315 bar	bar	to 350 bar		
	– Pressure rating 350 bar	bar	to 390 bar		
Maximum flow		l/min	275	550	700
Pilot flow		l/min	0.4 to 1	0.4 to 1.5	0.4 to 1.5
Hydraulic fluid			See table page 7		
Hydraulic fluid temperature range		°C	–20 to +80		
Viscosity range		mm^2/s	15 to 380		
Maximum permitted degree of contamination of the hydraulic fluid - cleanliness class according to ISO 4406 (c)			Class 20/18/15 [1)]		
Hysteresis (see command value pressure characteristic curve)		%	≤ 5 of the maximum set pressure		
Linearity		%	±3.5 of the maximum set pressure		
Manufacturing tolerance of the command value pressure characteristic curve, related to the hysteresis characteristic curve; pressure increasing	– Type DBEM	%	±5 of the maximum set pressure		
	– Type DBEME	%	±1.5 of the maximum set pressure		
Step response $T_u + T_g$	10 % → 90 %	ms	~100	Measured with standing hydraulic fluid column, 0.2 liters at port A	
	90 % → 10 %	ms	~100		
Step response $T_u + T_g$	10 % → 90 %	ms	~200	Measured with standing hydraulic fluid column, 5 liters at port A	
	90 % → 10 %	ms	~200		

1) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components.
For the selection of the filters see www.boschrexroth.com/filter.

Technical data
(For applications outside these parameters, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons		HL, HLP	NBR, FKM	DIN 51524
Bio-degradable	– Insoluble in water	HETG	NBR, FKM	VDMA 24568
		HEES	FKM	
	– Soluble in water	HEPG	FKM	VDMA 24568
Flame-resistant	– Water-free	HFDU, HFDR	FKM	ISO 12922
	– Containing water	HFC	NBR	ISO 12922

Important information on hydraulic fluids!
- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.)!
- The flash point of the hydraulic fluid used must be 40 K higher than the maximum solenoid surface temperature.
- **Flame-resistant – containing water**: Maximum pressure differential per control edge 210 bar, otherwise, increased cavitation erosion. Life cycle as compared to HLP 30 to 100 %
  Fluid temperature maximum 60 °C
- **Bio-degradable:** When using bio-degradable hydraulic fluids that are simultaneously zinc-solving, zinc may accumulate in the fluid (per pole tube 700 mg zinc).

electric			G24	G24-8
Minimum solenoid current		mA	≤ 100	≤ 100
Maximum solenoid current		mA	1600 ± 10 %	800 ± 5 %
Solenoid coil resistance	– Cold value at 20 °C	Ω	5.5	20.6
	– Maximum hot value	Ω	8.05	33
Duty cycle		%	100	100

electrical, integrated electronics (OBE)			
Supply voltage	– Nominal voltage	VDC	24
	– Lower limit	VDC	21
	– Upper limit	VDC	35
Current consumption		A	≤ 1.5
Required fuse protection		A	2, time-lag
Inputs	– Voltage	V	0 to 10
	– Current	mA	4 to 20
Output	– Actual current value	mV	1 mV ≙ 1 mA
Protection class of the valve according to EN 60529			IP 65 with mating connector mounted and locked

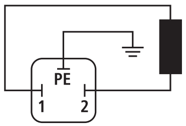
Caution!
At an ambient temperature of 70 °C and a duty cycle of 100 % with max. current, the coil reaches temperatures of up to 170 °C. Contact with the coil may lead to burns.

Notice!
Information on the environment simulation testing for the areas EMC (electromagnetic compatibility), see declaration on environmental compatibility data sheet 29162-U.

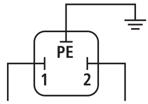
Electrical connection
(dimensions in mm)

Type DBEM

Connection at the connector

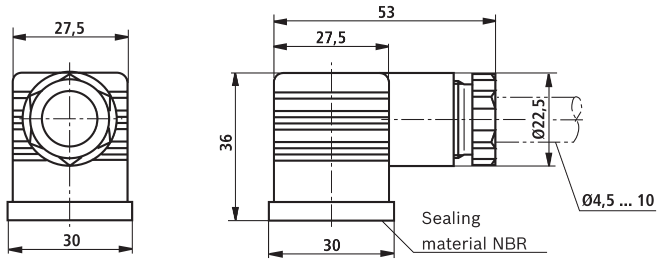


Connection at mating connector



to the amplifier

Mating connector (black) according to DIN EN 175301-803
Material no. **R901017011**
(separate order)

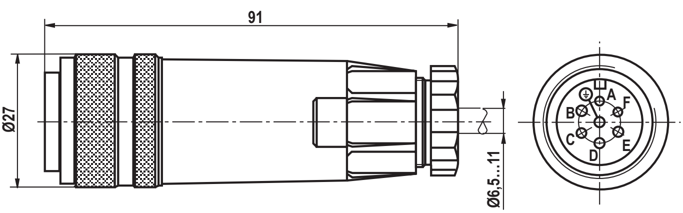


Type DBEME

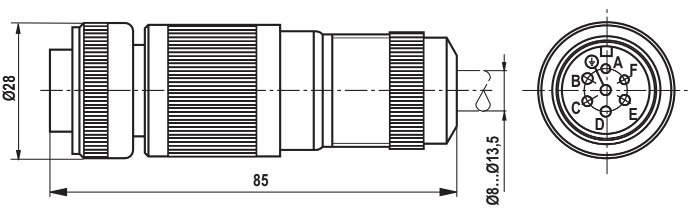
Device connector allocation	Contact	Allocation interface "A1"	Allocation interface "F1"
Supply voltage	A	24 VDC (u(t) = 21 V to 35 V); I_{max} ≤ 1.5 A	
	B	0 V	
Reference potential actual value	C	Reference contact F; 0 V	Reference contact F; 0 V
Differential amplifier input	D	0 to 10 V; R_E = 100 kΩ	4 to 20 mA; R_E = 100 Ω
	E	Reference potential command value	
Measuring output (actual value)	F	0 to 1.6 V actual value (1 mV ≙ 1 mA) load resistance > 10 kΩ	
Protective earth	PE	Connected to solenoid and valve housing	

Mating connectors according to DIN EN 175201-804, solder contacts for line cross-section 0.5 to 1.5 mm²

Plastic version,
material no. **R900021267**
(separate order)



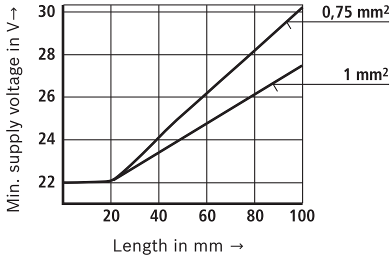
Metal version,
material no. **R900223890**
(separate order)



Electrical connection

Connection cable for type DBEME
– Recommendation 6-wire, 0.75 or 1 mm² plus protective earthing conductor and screening
– Only connect the screening to PE on the supply side
– Maximum admissible length 100 m

The minimum supply voltage at the power supply unit depends on the length of the supply line (see diagram).



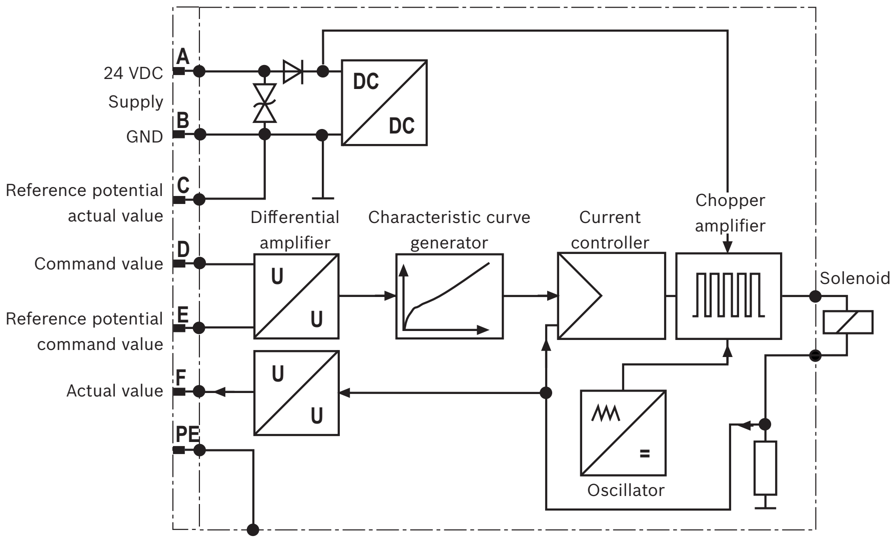
Integrated electronics (OBE) for type DBEME

Function

The electronics are supplied with voltage via ports A and B. The command value is applied to the differential amplifier ports D and E.
Via the characteristic curve generator, the command value solenoid current characteristic curve is adjusted to the valve so that non-linearities in the hydraulic system are compensated for and a linear command value pressure characteristic curve is created.
The current controller controls the solenoid current independent of the solenoid coil resistance.
The power stage of the electronics for controlling the proportional solenoid is a chopper amplifier with a cycle frequency of approx. 180 Hz to 400 Hz. The output signal is pulse-width modulated (PWM).
For checking the solenoid current, a voltage can be measured at the connector between pin F(+) and pin C(–) that is proportional to the solenoid current. **1 mV** corresponds to **1 mA** solenoid current

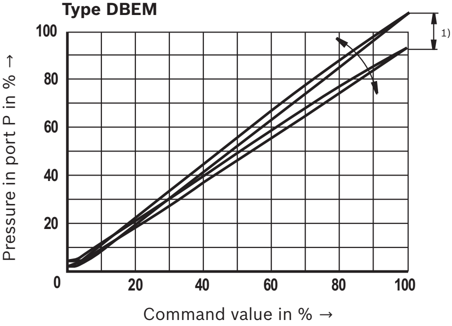
3

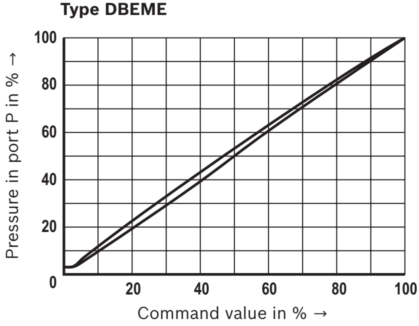
Block diagram



Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

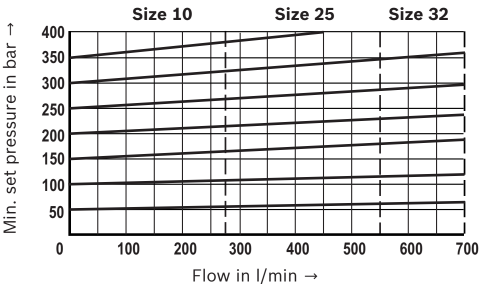
Pressure in port P depending on the command value (flow = 24 l/min)



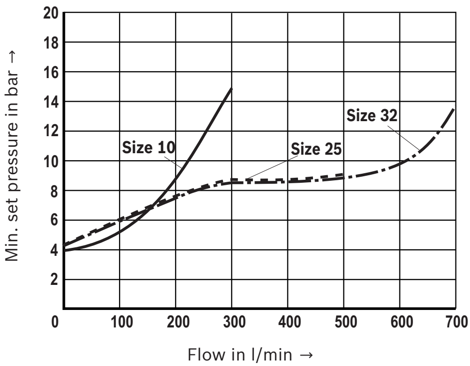


1) With valve type DBEM, the manufacturing tolerance at the **external amplifier** (type and data sheet see page 16) can be changed using the command value attenuator potentiometer "**Gw**". The digital amplifier is set using the parameter "Limit".
In this connection, the control current according to the technical data must not be exceeded.
In order to be able to adjust several valves to the same characteristic curve, don't set the pressure higher than the maximum set pressure of the pressure rating with command value 100 %.

Set pressure depending on the flow



Min. set pressure with command value 0



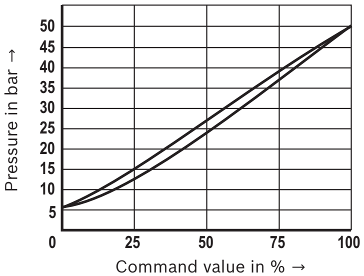
The characteristic curves apply to output pressure in T or Y = 0 bar in the total flow range.

Notice: So that the minimum set pressure is achieved, the pilot current must not exceed 100 mA.

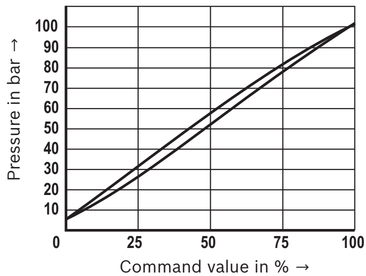
Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Command value pressure characteristic curves (measured with a flow of 24 l/min and with amplifier VT-MSPA1-1)

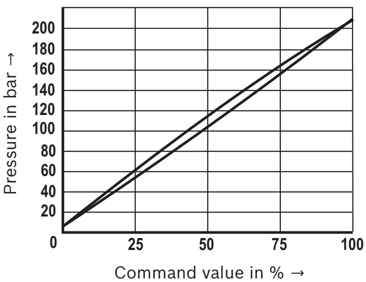
Pressure rating 50 bar



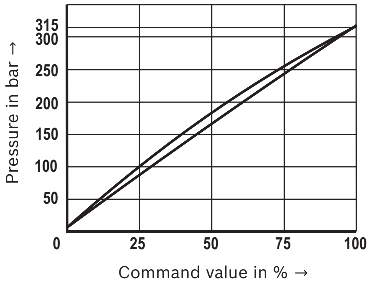
Pressure rating 100 bar



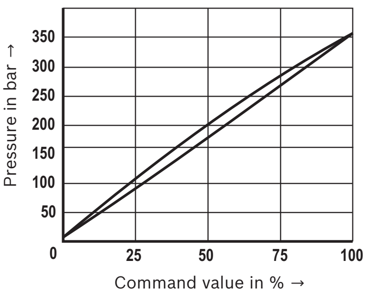
Pressure rating 200 bar



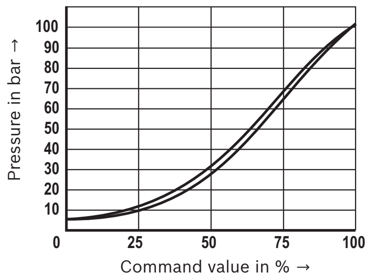
Pressure rating 315 bar



Pressure rating 350 bar

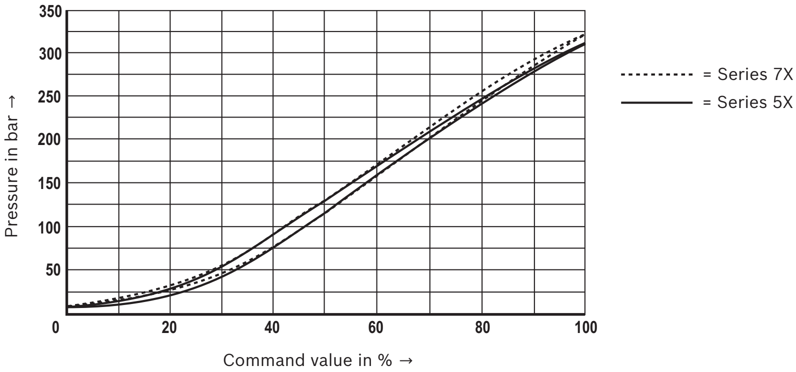


Pressure rating 100 bar (with amplifier VT-VSPA1-1)

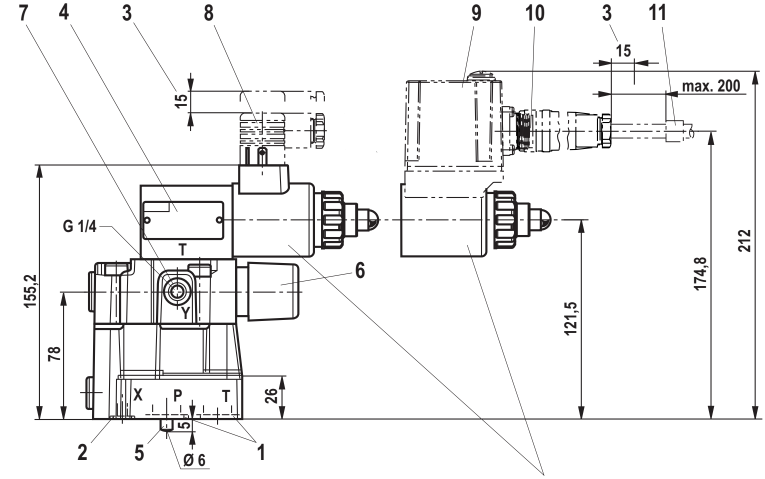


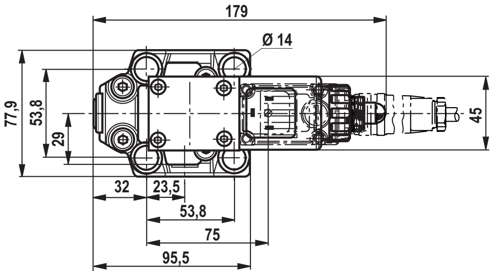
Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Comparison series 5X and 7X using the pressure rating 315 bar as example (with amplifier VT-SSPA1-1-1X with 800 mA coil)



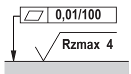
Device dimensions: Type DBEM(E) 10
(dimensions in mm)





Coil and electronics freely rotatable!

O-ring and plastic nut for coil fixation. The nut can be loosened by rotating it counterclockwise (1 turn). Afterwards, the solenoid coil can be rotated in any desired position. Subsequent fixation applying 5 ±1 Nm.



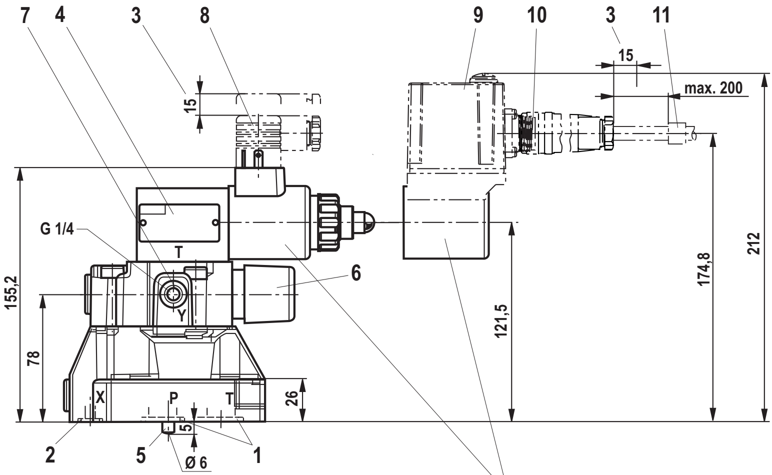
Required surface quality of the valve contact surface

1 Seal rings for ports P and T
2 Seal ring for ports X
3 Space required to remove the mating connector
4 Name plate
5 Locating pin
6 Maximum pressure limitation
7 External pilot oil return,
separately and to the tank at zero pressure
8 Mating connector for type DBEM
9 Integrated electronics (OBE)
10 Mating connector for type DBEME
11 Cable fastening

Notice!
The dimensions are nominal dimensions which are subject to tolerances.

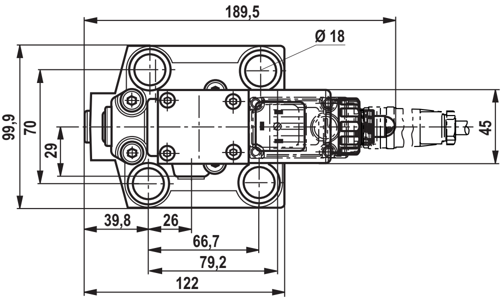
Valve mounting screws and **subplates** see page 16.

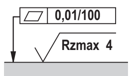
Device dimensions: Type DBEM(E) 25
(dimensions in mm)



Coil and electronics freely rotatable!

O-ring and plastic nut for coil fixation. The nut can be loosened by rotating it counterclockwise (1 turn). Afterwards, the solenoid coil can be rotated in any desired position. Subsequent fixation applying 5 ±1 Nm.





Required surface quality of the valve contact surface

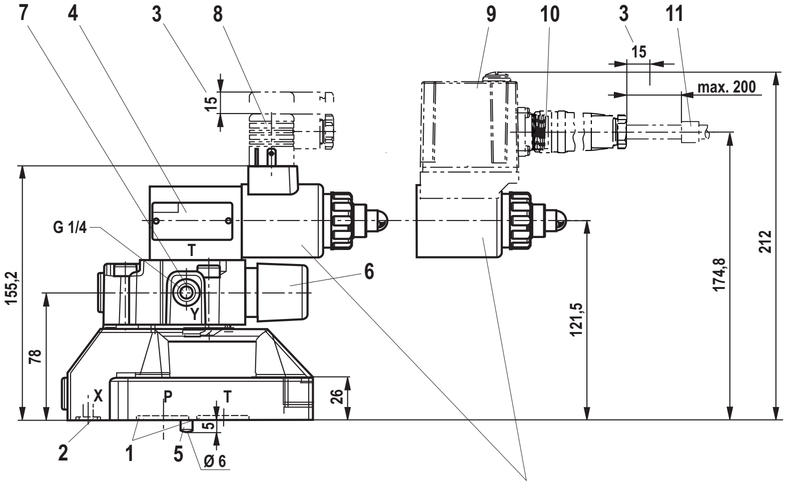
1 Seal rings for ports P and T
2 Seal ring for ports X
3 Space required to remove the mating connector
4 Name plate
5 Locating pin
6 Maximum pressure limitation
7 External pilot oil return, separately and to the tank at zero pressure
8 Mating connector for type DBEM
9 Integrated electronics (OBE)
10 Mating connector for type DBEME
11 Cable fastening

Notice!
The dimensions are nominal dimensions which are subject to tolerances.

Valve mounting screws and **subplates** see page 16.

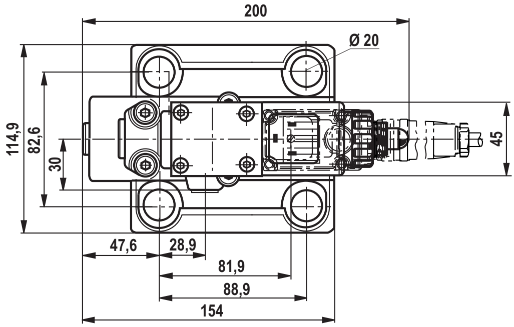
Device dimensions: Type DBEM(E) 32

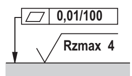
(dimensions in mm)



Coil and electronics freely rotatable!

O-ring and plastic nut for coil fixation. The nut can be loosened by rotating it counterclockwise (1 turn). Afterwards, the solenoid coil can be rotated in any desired position. Subsequent fixation applying 5 ±1 Nm.





Required surface quality of the valve contact surface

1 Seal rings for ports P and T
2 Seal ring for ports X
3 Space required to remove the mating connector
4 Name plate
5 Locating pin
6 Maximum pressure limitation
7 External pilot oil return, separately and to the tank at zero pressure
8 Mating connector for type DBEM
9 Integrated electronics (OBE)
10 Mating connector for type DBEME
11 Cable fastening

Notice!
The dimensions are nominal dimensions which are subject to tolerances.

Valve mounting screws and **subplates** see page 16.

Device dimensions

Hexagon socket head cap screws (separate order)		**Material number**
Size 10	4x ISO 4762 - M12 x 50 - 10.9-flZn-240h-L Friction coefficient μ_{total} = 0.09 to 0.14; Tightening torque M_A = 75 Nm ±10 %	R913000283
Size 25	4x ISO 4762 - M16 x 50 - 10.9-flZn-240h-L Friction coefficient μ_{total} = 0.09 to 0.14; Tightening torque M_A = 185 Nm ±10 %	R913000378
Size 32	4x ISO 4762 - M18 x 50 - 10.9-flZn-240h-L Friction coefficient μ_{total} = 0.09 to 0.14; Tightening torque M_A = 248 Nm ±10 %	R900002245

Notice: For reasons of stability, exclusively these valve mounting screws may be used. The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure!

Subplates	**Data sheet**	**Material number**
Size 10, 25, 32	45064	

Accessories
(not included in the delivery)

External control for type DBEM (only standard version G24)	**Data sheet**	**Material number**
VT-MSPA1-1-1X/V0/... in modular design (analog) VT-VSPD-1-2X/V0/.-0-1 in Euro-card format (digital) VT-VSPA1-2-1X/V0/...in Euro-card format (analog) VT-SSPA1-1-1X/V0/0-24 as plug-in amplifier	30223 30523 30115 30116	

Additionally (800 mA version G24-8)	**Data sheet**	**Material number**
VT-2000-5X/X/V0/... in Euro-card format VT-MSPA1-30 in modular design (analog)	29904 30224	

Mating connectors (details see page 7)	**Data sheet**	**Material number**
For type DBEM: Mating connectors according to DIN EN 175301-803 For type DBEME: Mating connectors according to DIN EN 175201-804	08006 08006	R901017011 R900021267 (plastic) R900223890 (metal)

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
documentation@boschrexroth.de
www.boschrexroth.de

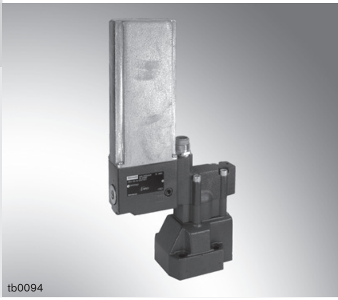
Rexroth
Bosch Group

Pressure relief valve with DC motor operation, pilot operated

RE 29139/06.07
Replaces: 01.00

Type DBG

Size 8 to 32
Component series 1X
Maximum operating pressure 315 bar
Maximum flow 600 l/min



tb0094

Table of contents

Information on available spare parts:
www.boschrexroth.com/spc

Features

- Operation by DC motor with reducing gear
- For subplate mounting:
  Porting pattern to ISO 6264-AR-06-2-A (size 10),
  ISO 6264-AS-08-2-A (size 25),
  ISO 6264-AT-10-2-A (size 32)
- For threaded connection
- For block installation
- 5 pressure ratings
- With actual value potentiometer or limit switch
- Self-locking in the event of a power failure
  (system pressure constant on variant with limit switch)

Further information:

Subplates according to RE 45064

Ordering code

DBG			–1X /				*

Pressure relief valve with DC motor operation

Pilot operated valve (complete)	**= No code**
Pilot valve **without** main spool insert (do **not** enter valve size)	**= C**
Pilot valve **with** main spool insert (enter valve size 30)	**= C**
Separate pilot valve as remote control valve (do **not** enter valve size)	**= T**

Size	Ordering code	
	Subplate mounting "No code"	Threaded connection "G"
8	–	= **8** (G3/8)
10	**= 10**	= **10** (G1/2)
16	–	= **15** (G3/4)
20	–	= **20** (G1)
25	**= 20**	= **25** (G1 1/4)
32	**= 30**	= **30** (G1 1/2)

For subplate mounting and block installation	**= No code**
For threaded connection	**= G**

1X = Component series 10 to 19
(10 to 19: unchanged installation and connection dimensions)

Pressure rating, max

50 =		Set pressure up to 50 bar
100 =		Set pressure up to 100 bar
200 =		Set pressure up to 200 bar
315 =		Set pressure up to 315 bar
400 =	(DBGT only)	Set pressure up to 400 bar

Pilot oil flow

No code =	Internal pilot oil supply / drain
X =	External pilot oil supply Internal pilot oil drain
Y =	Internal pilot oil supply External pilot oil drain
XY =	External pilot oil supply / drain

Seal material

No code =	NBR seals
V =	FKM seals

(other seals on request)

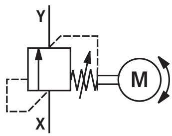
⚠ **Attention!**
Observe compatibility of seals with hydraulic fluid used!

E1 =	Limit switch
P2 =	Actual value potentiometer

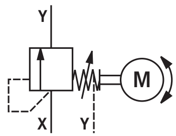
Further details in clear text

Symbols

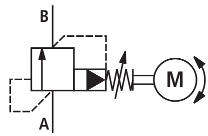
DBG C/T–1X/..



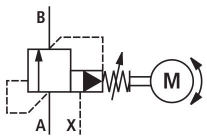
DBGC–1X/..Y..



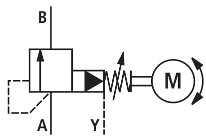
DBG..–1X/..
DBG..G–1X/..



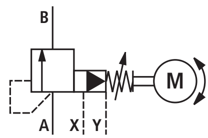
DBG..–1X/..X..
DBG..G–1X/..X..



DBG..–1X/..Y..
DBGC 30–1X/..
DBG..G–1X/..Y..



DBG..–1X/..XY..
DBG..G–1X/..XY..



Function, section

Pressure control valves of type DBG are pilot operated pressure relief valves.

They are used to limit a system pressure.

The pressure relief valves of this series basically consist of a pilot valve with electric motor as pressure adjustment element and a main valve with main spool insert.

The system pressure is adjusted by means of a DC motor (16) with reducing gear (17). The output shaft of reducing gear (17) rotates cam (14), which changes the tension of spring (8) via spring plate (15) and thus causes a change in pressure.

The pressure present in channel A acts on main spool (1.1). At the same time, the pressure is applied via pilot ports (4) and (5), which are fitted with orifices (2.1, 2.2) and (3), to the spring-loaded side of main spool (1.1) and to pilot poppet (6) in pilot valve (7).

When the system pressure rises above the value set on spring (8), pilot poppet (6) opens. The signal required for this is provided internally – on type DBG..–1X/.. via pilot lines (12) and (4) from channel A; or externally – on type DBG..–1X/..X (XY) via port (13) and pilot line (4). Pilot oil now flows through orifice (2.1), pilot line (4), orifice (2.2) and pilot poppet (6) into the spring chamber, from which it is fed to the tank either internally – on type DBG..–1X/.. via pilot line (10), or externally – on type DBG..–1X/..Y (XY) via pilot line (11)

In the closing direction, compression spring (1.2) acts on main spool (1.1), i.e. a pressure differential occurs between the '"A" side and the spring-loaded side of main spool (1.1). The pilot oil flow is determined by the cross-section of orifices (2.1, 2.2) and the pressure differential across main spool (1.1). When the pressure in "A" has risen by the pressure differential across main spool (1.1) when compared with the cracking pressure of pilot poppet (6), main spool (1.1) opens the connection from "A" to "B".

The oil now flows from channel "A" to channel "B" while maintaining the set operating pressure.

Actual value potentiometer (18) feeds back the position of cam (14).

Optionally, electrical limit switches can be installed instead of actual value potentiometer (18) for limiting the min. and max. pressure.

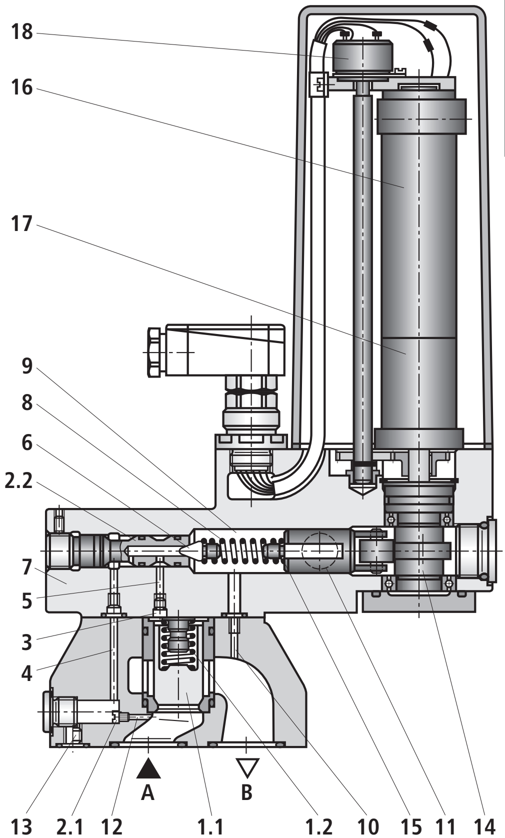
For the variant with limit switch, the min. adjustment time for the pressure range from p_{min} to p_{max} is 12 seconds. The adjustment time of 12 seconds allows gradual reaching of the required pressure in the inching mode.

For the variant with actual value potentiometer the min. adjustment time for the pressure range from p_{min} to p_{max} is 0.65 seconds.

In conjunction with the associated amplifier type VT-VRM1-1 a program control can be realised.

With the help of 2 additional pressure switches, the min. and max. pressures can be limited.

With the variant with limit switch, the pressure setting on the valve is maintained in the event of a power failure (cable break, fuse failure, short-circuit, etc.).



Technical data (for applications outside these parameters, please consult us!)

General

Size			Size	8	10	16	20	25	32
Weight	– Subplate mounting	DBG...	kg	–	7.4	–	–	8.1	9.4
	– Threaded connection	DBG..G	kg	8.5	8.5	8.5	8.3	9.8	9.5
	– Block installation	DBGC 30..	kg	5.4					
	– Pilot valve without main spool insert	DBGC...	kg	5.1					
	– Remote control valve	DBGT	kg	5.1					
Installation position				Optional					
Ambient temperature range			°C	–20 to +50					

Hydraulic

Maximum operating pressure	– Ports A, X	bar	315					
	– Port B	bar	10 (with internal pilot oil drain)					
			315 (with external pilot oil drain)					
Max. backpressure	– Port Y	bar	10					
Max. set pressure		bar	50; 100; 200; 315; 400 1)					
Min. set pressure			Depending on q_V (see Characteristic curves on pages 6 and 7)					
Maximum flow	– Subplate mounting	l/min	–	200	–	–	400	600
	– Threaded connection	l/min	100	200	200	400	400	600
	– DBGT	l/min	12					
Pilot oil flow		l/min	1					
Hydraulic fluid			Mineral oil (HL, HLP) to DIN 51524 2); fast bio-degradable hydraulic fluids to VDMT 24568 (see also RE 90221); HETG (rape seed oil) 2); HEPG (polyglycols) 3); HEES (synthetic esters) 3); other hydraulic fluids on request					
Hydraulic fluid temperature range		°C	–20 to +70					
Viscosity range		mm²/s	2.8 to 380					
Permissible max. degree of contamination of the hydraulic fluid - cleanliness class to ISO 4406 (c)			Class 20/18/15 4)					

Electrical, drive motor

Type of voltage			DC voltage
Supply voltage		V–	24
Rated power	– With limit switch	W	18
	– With actual value potentiometer	W	24
Electrical connection			Mating connector DIN 43651, 6-pin + PE
Type of protection to EN 60529			IP 65 with mating connector mounted and locked

1) Pressure rating of 400 bar only with variant DBGT

2) Suitable for NBR **and** FKM seals

3) Suitable **only** for FKM seals

4) The cleanliness classes specified for components must be adhered to in hydraulic systems.

Effective filtration prevents malfunction and, at the same time, prolongs the service life of components.
For the selection of filters, see data sheets RE 50070, RE 50076, RE 50081, RE 50086 and RE 50088.

Technical data (for applications outside these parameters, please consult us!)

Adjustment with limit switch in the inching mode: Ordering code "E1"

Adjustment time, p_{min} to p_{max}		s	12				
Limit switch variant:	– Micro-switch		30 V; 2 A DC				
	– Electric load		250 V; 5 A AC				
Pressure lag:	– Pressure rating	bar	50	100	200	315	400
	– Without short-circuit bridge	bar	1	2.5	5	7.5	10
	– With short-circuit bridge	bar	0.5	1	1.5	2	2.5

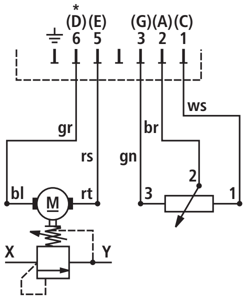
Adjustment with actual value potentiometer for cam position feedback function: Ordering code "P2"

Adjustment time, p_{min} to p_{max}		s	0.65				
Potentiometer	– Resistance	kΩ	5				
	– Power	W	1.75				
Adjustment hysteresis: Start-up pressure – deviation > 10 bar from nominal pressure							
	– Pressure rating	bar	50	100	200	315	400
	– Hysteresis	bar	< 0.5	< 1	< 2.5	< 4	< 5
Adjustment hysteresis: Start-up pressure – deviation > 20 bar from nominal pressure							
	– Pressure rating	bar	50	100	200	315	400
	– Hysteresis	bar	< 0.3	< 0.5	< 1	< 1.5	< 2
Repeatability		bar	< 0.5	< 1	< 1.3	< 1.7	< 2
Amplifier							
Electrical amplifier			VT-VRM1-1, component series 1X – see RE 30405-D				

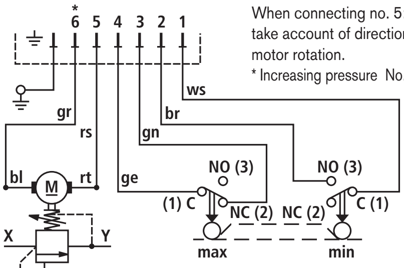
3

Electrical connection

Plug connection on DBG valve with actual value potentiometer	Plug connection on DBG valve with limit switch



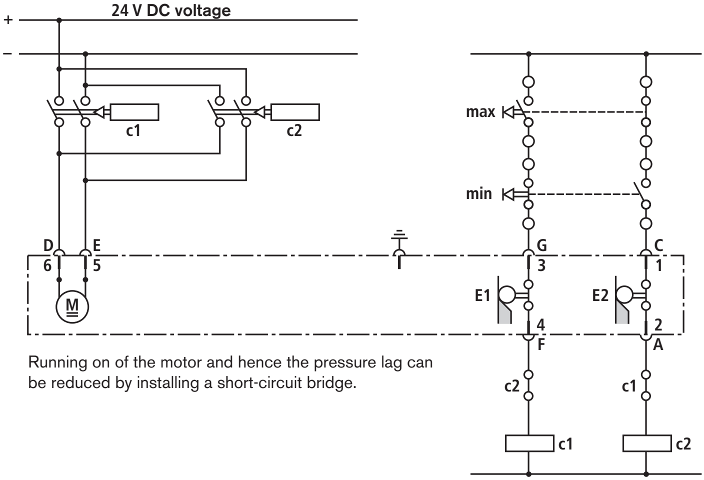
When connecting no. 5; 6 take account of direction of motor rotation.
* Increasing pressure No. 6 "+"



When connecting no. 5; 6 take account of direction of motor rotation.
* Increasing pressure No. 6 "+"

Initial position: Minimum position

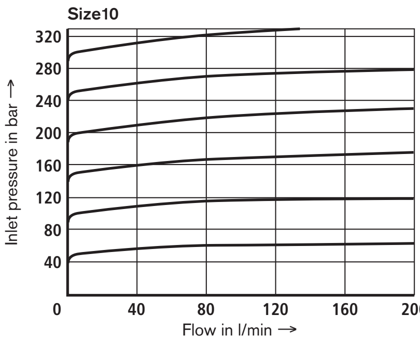
Circuit example: DBG valve with limit switch

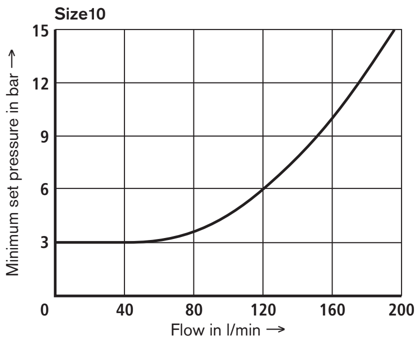


Running on of the motor and hence the pressure lag can be reduced by installing a short-circuit bridge.

Characteristic curves (measured at $\nu = 36\ mm^2/s$ and $\vartheta_{oil} = 50\ °C$)

The characteristic curves were measured with external, pressureless pilot oil drain. With internal pilot oil drain, the inlet pressure increases by the output pressure present in port B.

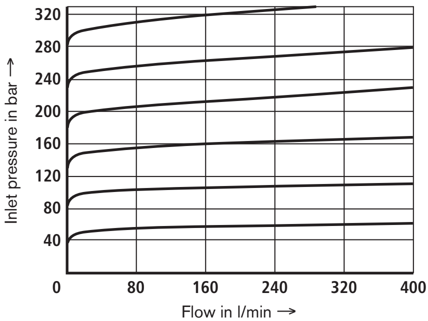




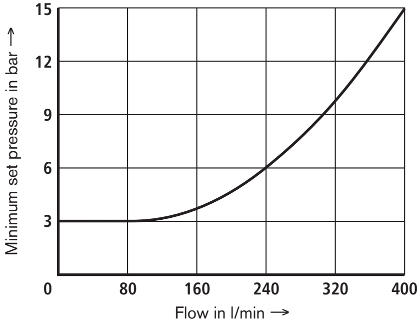
Characteristic curves (measured at $\nu = 36\ mm^2/s$ and $\vartheta_{oil} = 50\ °C$)

The characteristic curves were measured with external, pressureless pilot oil drain. With internal pilot oil drain, the inlet pressure increases by the outlet pressure present in port B.

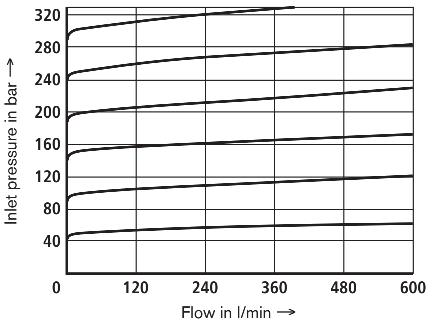
Size 25



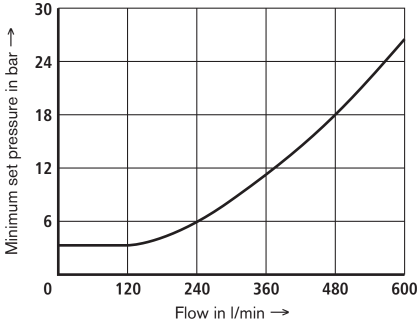
Size 25



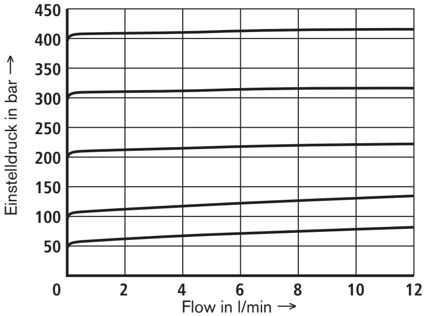
Size 32



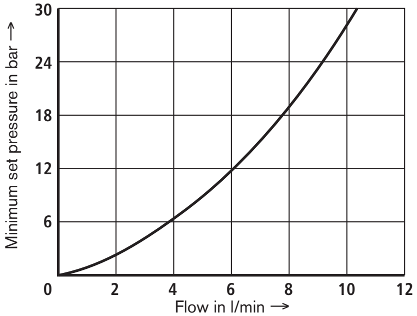
Size 32



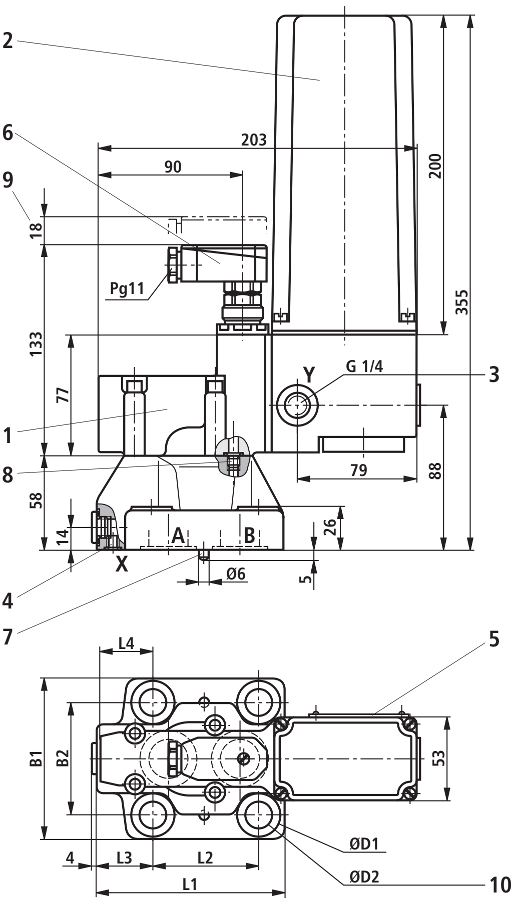
DBGT../400 Pressure rating 400 bar



DBGT../400 Pressure rating 400 bar



Unit dimensions: Subplate mounting (dimensions in mm)



1 Pilot valve
2 DC motor
3 Port "Y"
for external pilot oil drain
4 Port "X"
for external pilot oil supply
5 Nameplate
6 Mating connector (included in scope of supply)
7 Locating pin
8 Not required with internal pilot oil drain
9 Space required to remove mating connector
10 Valve mounting bore

Subplates to data sheet RE 45064
(separate order)

– Size 10	G 545/01	(G3/8)
	G 546/01	(G1/2)
– Size 25	G 408/01	(G3/4)
	G 409/01	(G1)
– Size 32	G 410/01	(G1 1/4)
	G 411/01	(G1 1/2)

Valve fixing screws (separate order)

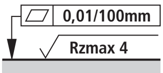
For strength reasons, only the following valve fixing screws may be used:

– Size 10
4 hexagon socket head cap screws ISO 4762 - M12 x 50 - 10.9-flZn-240h-L to VDA 235-101
Friction coefficient μ_{total} = 0.09 to 0.14,
tightening torque M_T = 75 Nm ± 10%,
Material no. **R913000283**

– Size 25
4 hexagon socket head cap screws ISO 4762 - M16 x 50 - 10.9-flZn-240h-L to VDA 235-101
Friction coefficient μ_{total} = 0.09 to 0.14,
tightening torque M_T = 185 Nm ± 10%,
Material no. **R913000378**

– Size 32
4 hexagon socket head cap screws ISO 4762 - M18 x 50 - 10.9-flZn-240h-L to VDA 235-101
Friction coefficient μ_{total} = 0.09 to 0.14,
tightening torque M_T = 248 Nm ± 10%,
Material no. **R900002245**

The tightening torques given are guidelines when screws of the specificied friction coefficients and a torque wrench (tolerance ±10 %) are used.

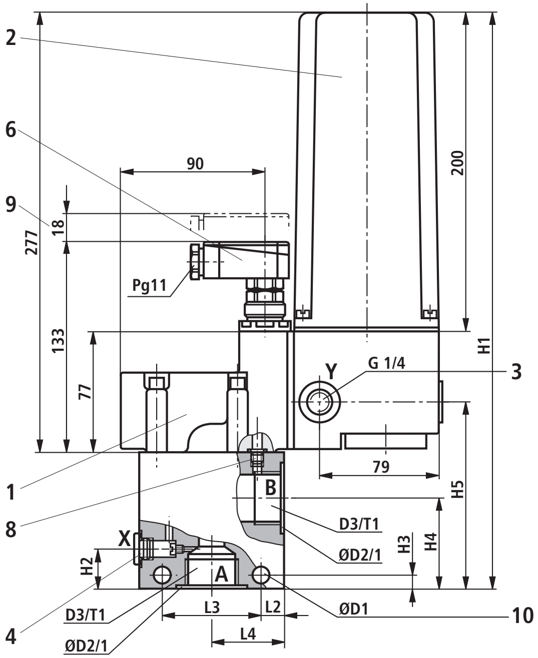


Required surface quality of valve mounting face

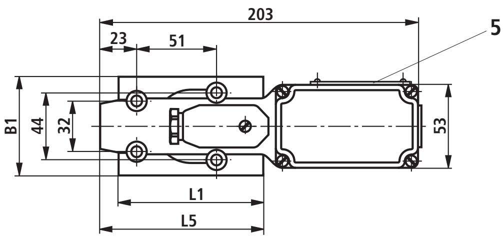
Tolerances according to:
– General tolerances ISO 2768-mK

Size	B1	B2	ØD1	ØD2	L1	L2	L3	L4	O-ring - port X	O-ring - ports A, B
10	78	54	20	14	90	54	23.5	37	9.25 x 1.78	17.12 x 2.62
25	100	69.8	26	18	117	66.7	34	34	9.25 x 1.78	28.17 x 3.53
32	115	82.5	30	20	148	89	41.5	31.5	9.25 x 1.78	34.52 x 3.53

Unit dimensions: Threaded connection (dimensions in mm)



1 Pilot valve
2 DC motor
3 Port "Y" for external pilot oil drain
4 Port "X" for remote control
5 Nameplate
6 Mating connector (included in scope of supply)
8 Not required with internal pilot oil drain
9 Space required to remove mating connector
10 Valve mounting bore

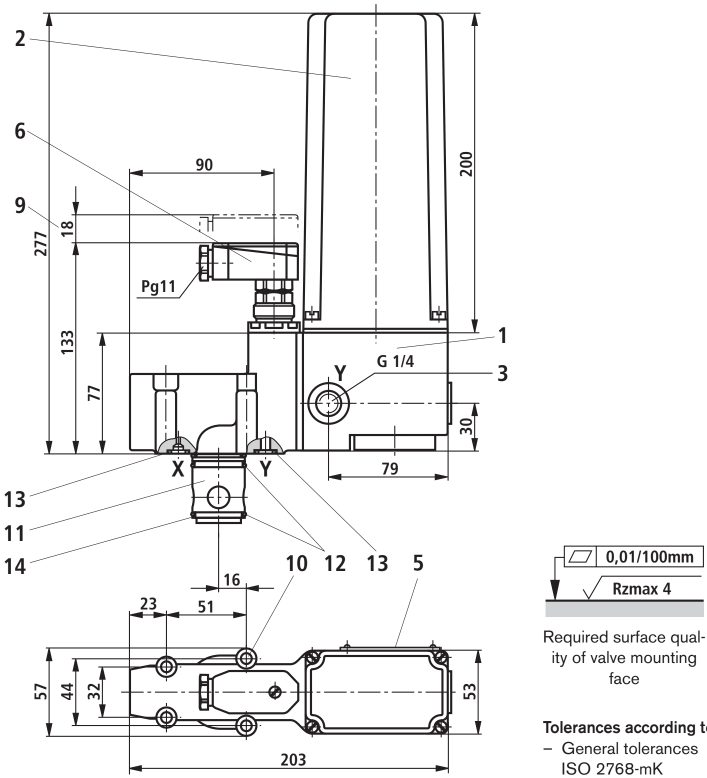


Tolerances according to:
– General tolerances ISO 2768-mK

<table>
<tr><th>Size</th><th>B1</th><th>ØD1</th><th>ØD2</th><th>D3</th><th>H1</th><th>H2</th><th>H3</th><th>H4</th><th>H5</th><th>L1</th><th>L2</th><th>L3</th><th>L4</th><th>L5</th><th>T1</th></tr>
<tr><td>8</td><td rowspan="4">63</td><td rowspan="4">9</td><td>28</td><td>G3/8</td><td rowspan="4">362</td><td rowspan="4">27</td><td rowspan="4">10</td><td rowspan="3">62</td><td rowspan="4">115</td><td rowspan="4">85</td><td rowspan="4">14</td><td rowspan="4">62</td><td rowspan="4">45</td><td rowspan="4">100</td><td>12</td></tr>
<tr><td>10</td><td>34</td><td>G1/2</td><td>14</td></tr>
<tr><td>16</td><td>42</td><td>G3/4</td><td>16</td></tr>
<tr><td>20</td><td>47</td><td>G1</td><td>57</td><td>18</td></tr>
<tr><td>25</td><td rowspan="2">70</td><td rowspan="2">11</td><td>56</td><td>G1 1/4</td><td rowspan="2">375</td><td rowspan="2">42</td><td rowspan="2">13</td><td rowspan="2">66</td><td rowspan="2">128</td><td rowspan="2">100</td><td rowspan="2">18</td><td rowspan="2">72</td><td rowspan="2">54</td><td rowspan="2">109</td><td>20</td></tr>
<tr><td>32</td><td>61</td><td>G1 1/2</td><td>22</td></tr>
</table>

3

Unit dimensions: Block installation (dimensions in mm)



Required surface quality of valve mounting face

Tolerances according to:
- General tolerances ISO 2768-mK

1 Pilot valve
2 DC motor
3 Port “Y“ for external pilot oil drain
5 Nameplate
6 Mating connector (included in scope of supply)
9 Space required to remove mating connector
10 Valve mounting bores
11 Main spool insert
12 O-ring 27.3 x 2.4
13 O-ring 9.25 x 1.78
14 Back-up ring 32/28.4 x 0.8

Valve fixing screws (separate order)

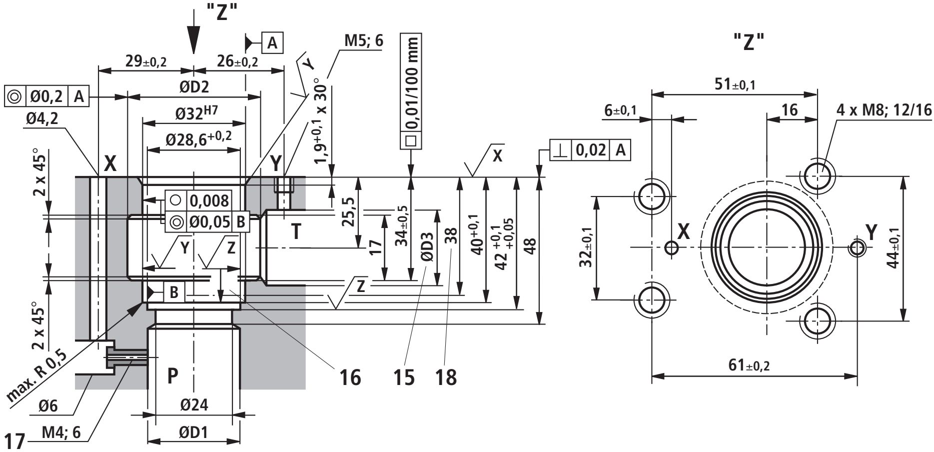
For strength reasons, only the following valve fixing screws may be used:

– Size10, 32
  4 hexagon socket head cap screws ISO 4762 - M8 x 50 - 10.9-flZn-240h-L to VDA 235-101
  Friction coefficient μ_{total} = 0.09 to 0.14,
  tightening torque M_T = 31 Nm ± 10%,
  Material no. **R913000543**

The tightening torques given are guidelines when screws of the specificied friction coefficients and a torque wrench (tolerance ±10 %) are used.

Unit dimensions: Block installation (dimensions in mm)

Mounting cavity



Tolerances according to:
– General tolerances ISO 2768-mK

√X = √Rzmax 4 √Y = √Rzmax 8 √Z = √Rz 16

Size	ØD1	ØD2	ØD3
10	10	40	10
32	32	45	32

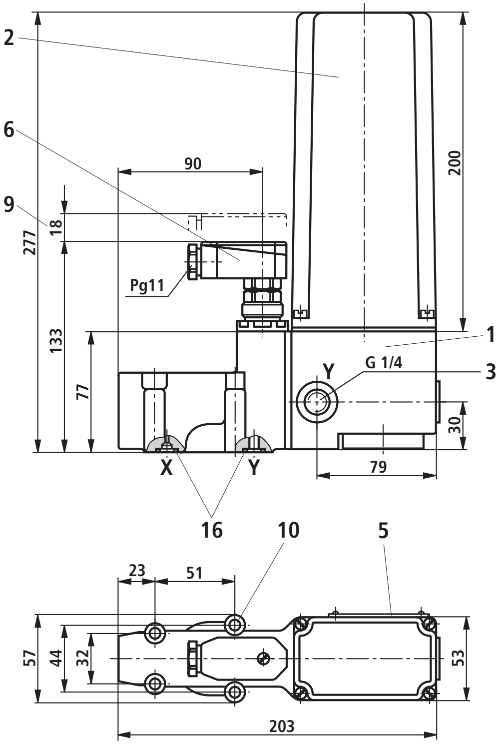
15 Bore ØD3 can intersect ØD2 at any point. However, care must be taken that connection bore X and the mounting bore are not damaged.

16 The back-up ring and the O-ring must be inserted in this bore before the main spool is installed.

17 Mounting kit includes orifice and main spool insert

18 Depth of fit

Unit dimensions: As remote control valve type DBGT (dimensions in mm)



1 Pilot valve
2 DC motor
3 Port “Y“ for external pilot oil drain
5 Nameplate
6 Mating connector (included in scope of supply)
9 Space required to remove mating connector
10 Valve mounting bores
16 O-ring 9.25 x 1,78

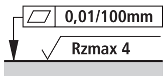
Subplates to data sheet RE 45064
(separate order)
G 51/01 (G1/4)

Valve fixing screws
(separate order)

For strength reasons, only the following valve fixing screws may be used:

4 hexagon socket head cap screws ISO 4762 - M8 x 50 - 10.9-flZn-240h-L to VDA 235-101
Friction coefficient μ_{total} = 0.09 to 0.14,
Tightening torque M_T = 31 Nm ± 10%,
Material no. **R913000543**

The tightening torques given are guidelines when screws of the specificied friction coefficients and a torque wrench (tolerance ±10 %) are used.



Required surface quality of valve mounting face

Tolerances according to:
– General tolerances ISO 2768-mK

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

The Drive & Control Company

Rexroth
Bosch Group

Proportional pressure relief valve, pilot operated, increasing characteristic curve

Type KBVS.1A

RE 18160
Edition: 2012-05

H7893

- Component size 1
- Component series A
- Maximum operating pressure 420 bar
- Maximum flow 80 l/min

Features

- Cartridge valve
- Mounting cavity R/UNF10-01-0-06
- Pilot operated proportional valve for system pressure limitation
- Suitable for mobile and industrial applications
- Operation by means of proportional solenoid with central thread and detachable coil
- Rotatable solenoid coil
- Via an adjustment screw, the valve is set to maximum pressure
- In case of power failure, the minimum pressure is set
- Fine adjustment of the command value pressure characteristic curve possible from the outside at the control electronics

Contents

Ordering code

01	02	03	04	05		06	07	08	09	10	11	12
KBVS		**1**	**A**	**A**	**/**	**F**	**C**			**V**		*****

01	Proportional pressure relief valve, pilot operated	**KBVS**

Pressure rating

02	Up to 50 bar	**C**
	Up to 100 bar	**F**
	Up to 150 bar	**H**
	Up to 210 bar	**L**
	Up to 250 bar	**N**
	Up to 315 bar	**P**
	Up to 350 bar	**R**
	Up to 420 bar	**T**

03	Component size 1	**1**
04	With a command value = 0, the minimum pressure is set	**A**
05	Component series	**A**
06	High Performance and mounting cavity R/UNF-10-01-0-06 (see page 11)	**F**
07	Proportional solenoid, wet-pin	**C**

Supply voltage

08	Control electronics 12 V DC	**G12**
	Control electronics 24 V DC	**G24**

Electrical connection

09	**Without** mating connector, with connector according to DIN EN 175301-803	**K4**
	Without mating connector, with connector DT 04-2PA (Deutsch connector)	**K40**
	Without mating connector, with connector AMP Junior-Timer	**C4**

Seal material

10	FKM seals	**V**
	(other seals upon request) Attention! Observe compatibility of seals with hydraulic fluid used!	

11	Standard version	**no code**
	Coil 800 mA (see page 6)	**-8**
12	Further details in the plain text	*****

1) Mating connectors, separate order, see data sheet 08006.

Valve types

Type	Material no.	Type	Material no.
KBVSC1AA/FCG24K40V	R901290550	KBVSN1AA/FCG24K40V	R901290569
KBVSF1AA/FCG24K40V	R901290561	KBVSP1AA/FCG24K40V	R901290570
KBVSH1AA/FCG24K40V	R901290562	KBVSR1AA/FCG24K40V	R901290580
KBVSL1AA/FCG24K40V	R901290567	KBVST1AA/FCG24K40V	R901290585

Function, symbol

General

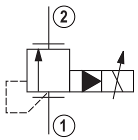
Valves of type KBVS are pilot operated proportional pressure relief valves in spool design and are used to limit the pressure in hydraulic systems. They mainly consist of the screwed-in proportional pilot control valve (1) and the main valve (2).
These valves can be used for infinitely adjusting the pressure to be limited depending on the command value. With command value 0 or in case of power failure, the minimum pressure is set.

Function

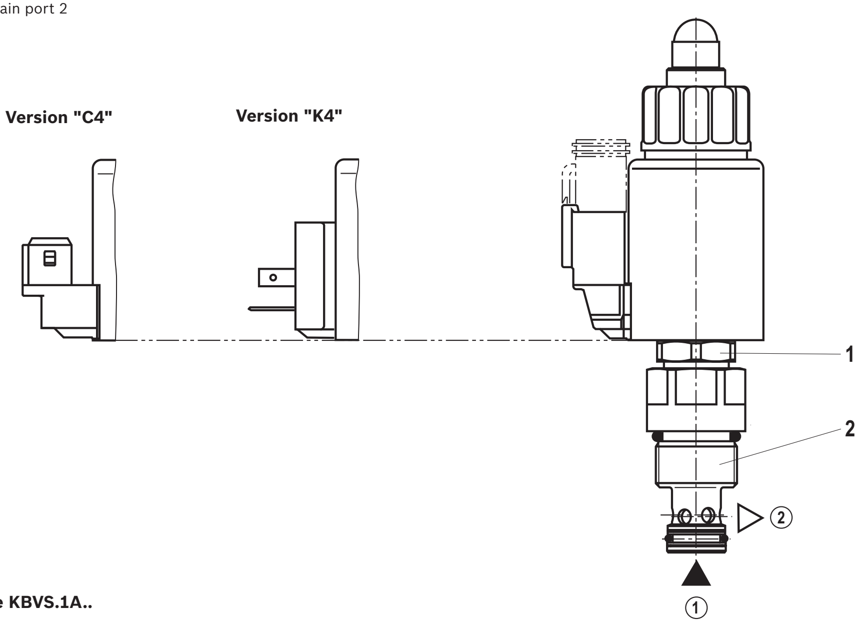
For the proportional increase in the system pressure, a command value is specified at the control electronics. The electronics control the solenoid coil with electric current depending on the command value, which via the pilot control valve (1) and the main valve (2) causes the actual pressure adjustment in main port ①.
($\boldsymbol{p}_{max}$ = command value max; $\boldsymbol{p}_{min}$ = command value 0)

Notice!
Occurring tank pressures (main port ②) are added up to the set values in main port ①.

Symbol



① = Main port 1
② = Main port 2



Type KBVS.1A..

Technical data (For applications outside these parameters, please consult us!)

general		
Weight	kg	0.75
Installation position		Any - if it is ensured that no air can collect upstream the valve. Otherwise, we recommend suspended installation of the valve.
Ambient temperature range	°C	–40 to +120 (see page 8 and 9)
Storage temperature	°C	–20 to +80

Environmental audits

Vibration test according to DIN EN 60068-2 / IEC 60068-2 /2 axes (X/Y)		
DIN EN 60068-2-6: 05/96	Vibrations, sine-shaped	10 cycles (5 Hz to 2000 Hz back to 5 Hz) with logarithmic frequency changing speed of 1 octave/min, 5 to 57 Hz, amplitude 1.6 mm (p-p), 57 to 2000 Hz, amplitude 10 g
IEC 60068-2-64: 05/93	Vibrations (random) and broad-band noise	20 to 2000 Hz, amplitude 0.1 g^2/Hz (14 g RMS/30 g peak), testing time 24 h
DIN EN 60068-2-27: 03/95	Shocking	Half-sine 15 g / 11 ms; 3 x in positive, 3 x in negative direction (a total of 6 single shocks)
DIN EN 60068-2-29: 03/95	Bump test	Half-sine 15 g / 11 ms; 1000 x in positive, 1000 x in negative direction (a total of 2000 single shocks)
Indication per axis		
Climatic test according to EN 60068-2 / IEC 60068-2 (environmental audit)		
DIN EN 60068-2-1: 03/95	Storage temperature	–40 °C, duration 16 h
DIN EN 60068-2-2: 08/94		+110 °C, duration 16 h
DIN EN 60068-2-1: 03/95	Cold test	2 cycles –25 °C, duration 2 h
DIN EN 60068-2-2: 08/94	Dry heating test	2 cycles +120 °C, duration 2 h
IEC 60068-2-30: 1985	Humid heat, cyclic	Variant 2/ +25 °C to +55 °C 93 % to 97 % relative humidity, 2 cycles à 24 h
Salt spray test according to DIN 50021	h	720

→ Coating generally not necessary. If paint is applied nevertheless, the reduced heat dissipation capacity is to be observed.

Technical data (For applications outside these parameters, please consult us!)

hydraulic			
Maximum operating pressure [1]	– Main port ①	bar	420
Maximum admissibler return flow pressure	– Main port ②	bar	210
Maximum set pressure [2]			See command value pressure characteristic curves page 7
Maximum set pressure with command value 0			See characteristic curves page 7
Maximum flow		l/min	80
Pilot oil		l/min	< 0.8
Leakage		ml/min	< 200 (with Δp = 250 bar; closed pilot control valve and HLP46, ϑ_{oil} = 40 °C)
Hydraulic fluid			See table below
Hydraulic fluid temperature range		°C	–40 to +80
Viscosity range		mm²/s	5 to 400 (preferably 10 to 100)
Maximum permitted degree of contamination of the hydraulic fluid - cleanliness class according to ISO 4406 (c)			Class 20/18/15 [3]
Load cycles			10 million
Hysteresis [4]			< 4 % of the max. set pressure
Turnover voltage [4]			< 0.5 % of the max. set pressure
Response sensitivity [4]			< 0.5 % of the max. set pressure
Manufacturing tolerance of the command value pressure characteristic curve	– Command value 100 %		< 5 % of the max. set pressure
	– Command value 0		< 2 % of the max. set pressure
Step response (T_u + T_g) 0 → 100 % and/or 100 % → 0		ms	100 (depending on the system)

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils		HL, HLP	FKM	DIN 51524
Bio-degradable	– Insoluble in water	HEES	FKM	VDMA 24568
	– Soluble in water	HEPG	FKM	

Important information on hydraulic fluids!
- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!
- The flash point of the hydraulic fluids used must be 40 K higher than the maximum solenoid surface temperature.
- **Bio-degradable:** When using bio-degradable hydraulic fluids that are simultaneously zinc-solving, zinc may accumulate in the fluid.

[1] The maximum operating pressure is added up from the set pressure and the return flow pressure!

[2] The valves are factory-set. In case of subsequent adjustment, the warranty will become invalid!

[3] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components. For the selection of the filters see www.boschrexroth.com/filter.

[4] Measured with analog amplifier type RA2-1/10, see data sheet 95230 (PWM = 300 Hz).

3

Technical data (For applications outside these parameters, please consult us!)

electric					
Voltage type			Direct voltage		
Supply voltages		V	12 DC	24 DC	"-8" / 24 DC
Maximum solenoid current		mA	1760	1200	800
Coil resistance	– Cold value at 20 °C	Ω	2.3	4.8	11.5
	– Max. hot value	Ω	3.8	7.9	18.9
Duty cycle		%	See characteristic curve page 8 and 9 [5)]		
Maximum coil temperature [6)]		°C	150		
Protection class according to VDE 0470-1 (DIN EN 60529) DIN 40050-9	– Version "K4"		IP 65 with mating connector mounted and locked		
	– Version "C4"		IP 66 with mating connector mounted and locked		
			IP 69K with Rexroth mating connector (material no. R901022127)		
	– Version "K40"		IP 69K with mating connector mounted and locked		
Control electronics (separate order)			Plug-in proportional amplifier type VT-SSPA1...		Data sheet 30116
			Analog amplifier type RA...		Data sheet 95230
			BODAS control unit type RC...		Data sheet 95200
Recommended dither frequency (PMW)		Hz	300		
Design according to VDE 0580					

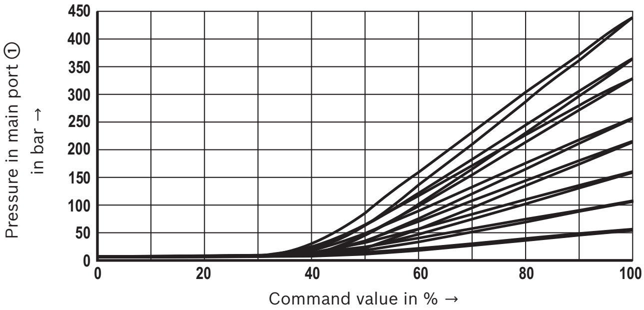
5) In case of use in altitudes > 2000 m a.s.l., we recommend consulting the manufacturer.

6) Due to the surface temperatures of the solenoid coils, the standards ISO 13732-1 and ISO 4413 need to be adhered to!

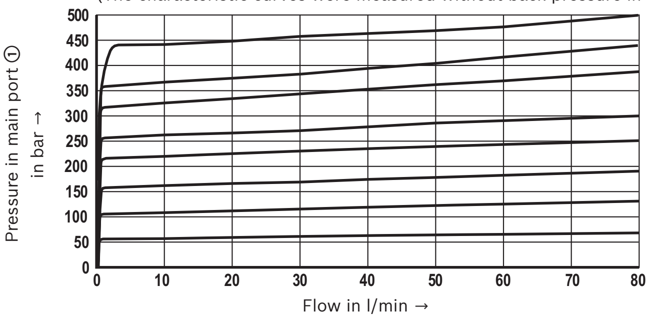
When establishing the electrical connection, the protective earthing conductor (PE ⏚) has to be connected properly.

Characteristic curves (measured with HLP46, ϑ_{oil} = 40 ±5 °C and 24 V coil)

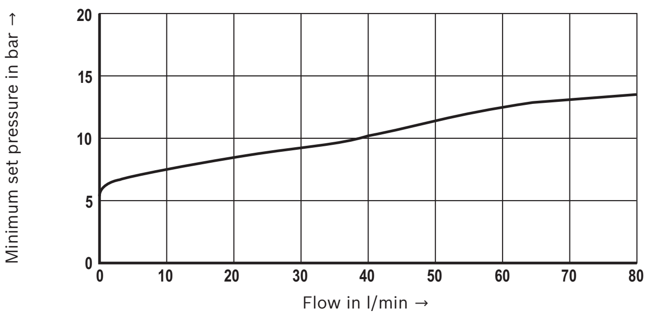
Pressure in main port ① depending on the command value; flow = 10 l/min



Pressure in main port ① depending on the flow.
(The characteristic curves were measured without back pressure in main port ②)



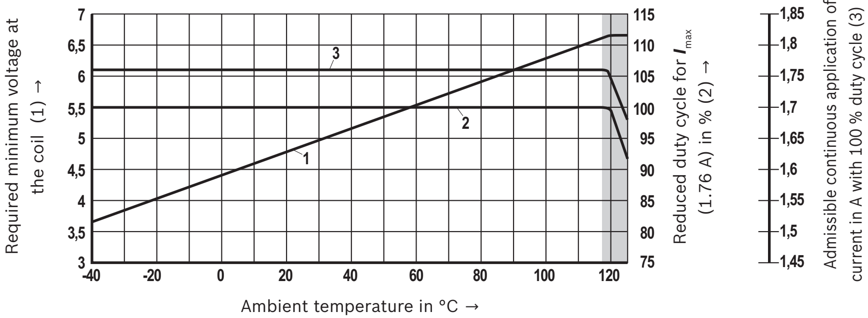
Minimum set pressure in the main port ① depending on the flow.
(The characteristic curves were measured without back pressure in main port ②)



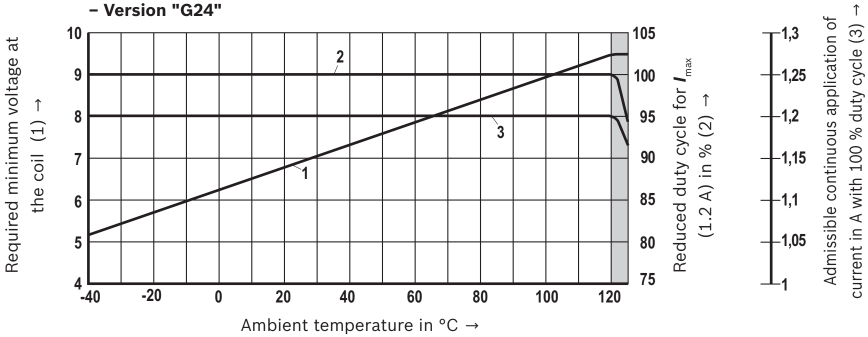
Minimum terminal voltage at the coil and relative duty cycle

Admissible working range depending on the ambient temperature

– Version "G12"



– Version "G24"

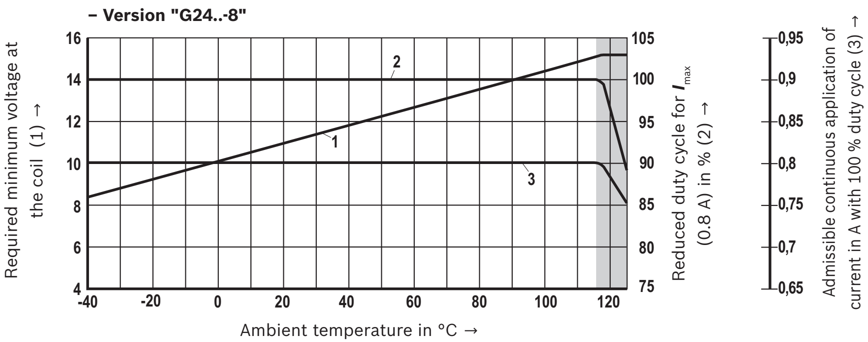


Limited valve performance

Notice!
The characteristic curves have been determined for coils with valve with medium test block size (80 x 80 x 80 mm), without flow in calm air.
Depending on the installation conditions (block size, flow, air circulation, etc.) there may be a better heat dissipation. Thus, the area of application is broadened.
In single cases, more unfavorable conditions may lead to limitations of the area of application.

Minimum terminal voltage at the coil and relative duty cycle

Admissible working range depending on the ambient temperature

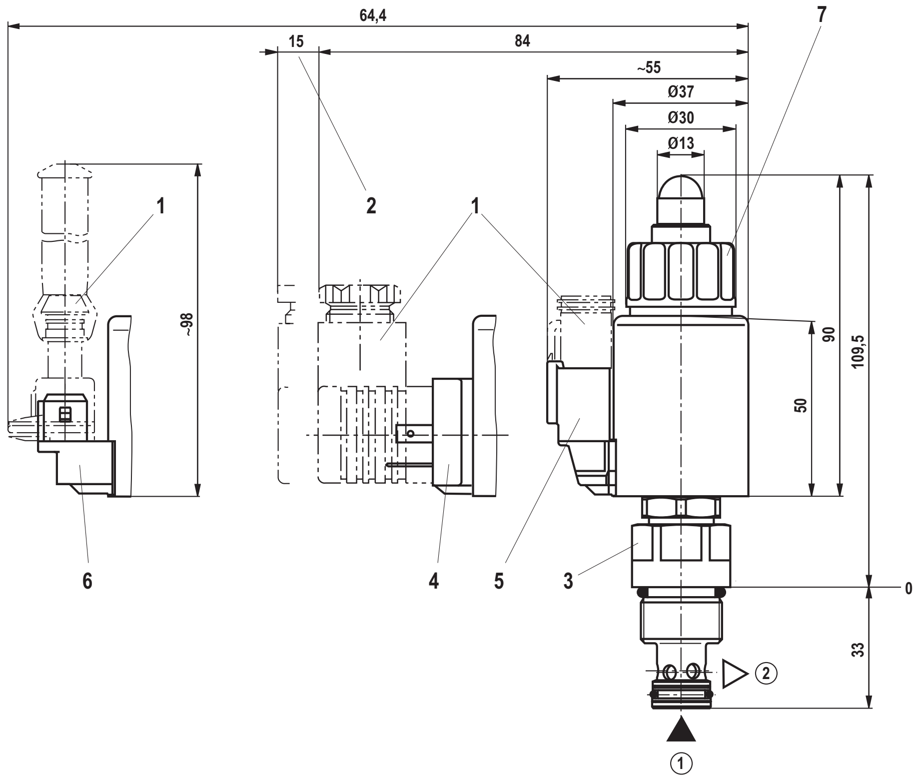


Limited valve performance

Notice!
The characteristic curves have been determined for coils with valve with medium test block size (80 x 80 x 80 mm), without flow in calm air.
Depending on the installation conditions (block size, flow, air circulation, etc.) there may be a better heat dissipation. Thus, the area of application is broadened.
In single cases, more unfavorable conditions may lead to limitations of the area of application.

3

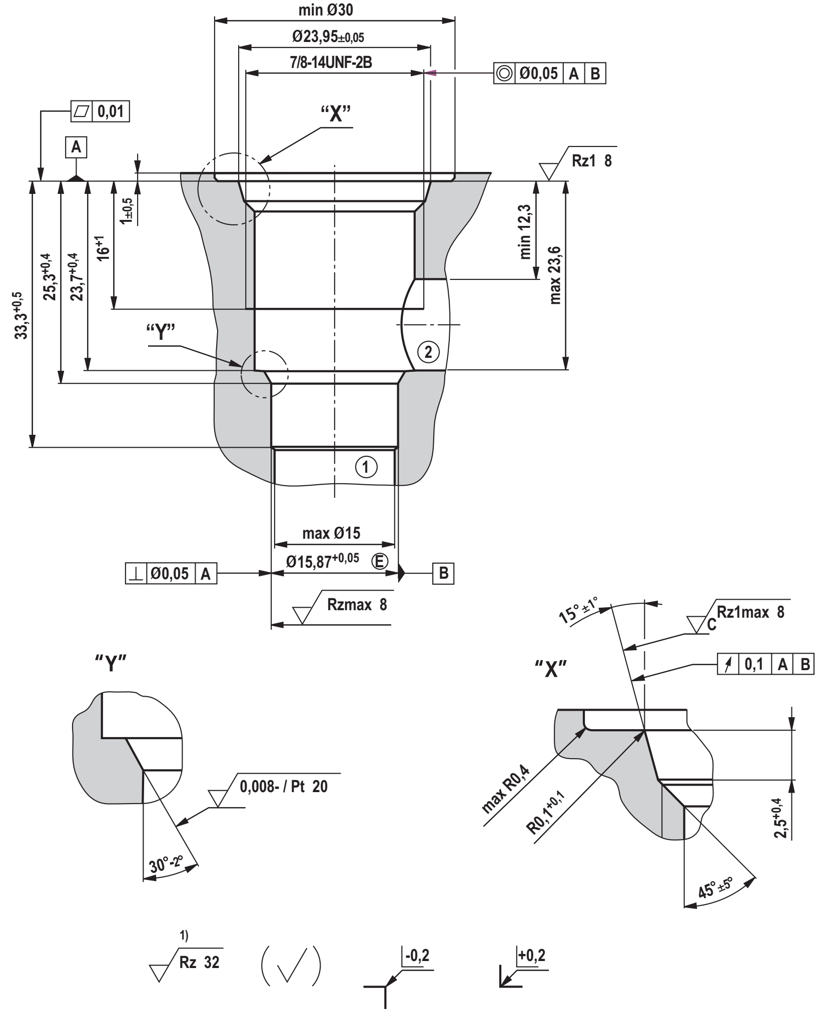
Unit dimensions (dimensions in mm)



1 Mating connectors, separate order, see data sheet 08006
2 Space required to remove the mating connector
3 SW24, tightening torque $\boldsymbol{M}_A$ = 55^{+5} Nm
4 Version "K4"
5 Version "K40"
6 Version "C4"
7 Nut, tightening torque $\boldsymbol{M}_A$ = 5^{+1} Nm

① = Main port 1
② = Main port 2

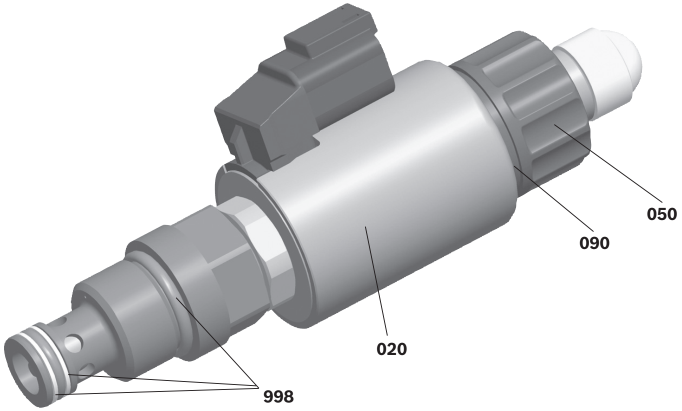
Mounting cavity R/UNF-10-01-0-06; 2 main ports; thread 7/8-14UNF-2B (dimensions in mm)



1) Visual inspection

① = Main port 1
② = Main port 2

Available individual components



Item	Denomination		Direct voltage	Material no.
020	Coil for individual connection [1]	K4	12 V 24 V / 1200 mA 24 V / 800 mA	R901002932 R901002319 R901049962
		K40	12 V 24 V / 1200 mA 24 V / 800 mA	R901003055 R901003053 R901050010
		C4	12 V 24 V / 1200 mA 24 V / 800 mA	R901003044 R901003026 R901049963
050	Nut			R900992146
090	Seal ring for pole tube			R900007769
998	Seal kit of the valve			R901006735

[1] After exchange of the solenoid coil, the pressure set in the factory may change by ±5 %.

More information

- Control electronics:
  - Plug-in proportional amplifier type VT-SSPA1... — Data sheet 30116
  - Analog amplifier type RA... — Data sheet 95230
  - BODAS control unit type RC... — Data sheet 95200
- Selection of the filters — www.boschrexroth.com/filter

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
documentation@boschrexroth.de
www.boschrexroth.de

The Drive & Control Company

Rexroth
Bosch Group

Proportional pressure relief valve, pilot operated, decreasing characteristic curve

RE 18152
Edition: 2012-07
Replaces: 05.12

Type KBVS.1B

H7893

- Component size 1
- Component series A
- Maximum operating pressure 420 bar
- Maximum flow 80 l/min

Features

- Cartridge valve
- Mounting cavity R/UNF10-01-0-06
- Pilot operated proportional valve for system pressure limitation
- Suitable for mobile and industrial applications
- Operation by means of proportional solenoid with central thread and detachable coil
- Rotatable solenoid coil
- Via an adjustment screw, the valve is set to maximum pressure
- In case of power failure, the maximum pressure set results
- Fine adjustment of the command value pressure characteristic curve possible from the outside at the control electronics

Contents

Ordering code (valve without coil) 1)

01	02	03	04	05		06	07	08	09	10	11	12
KBVS		**1**	**B**	**A**	**/**	**F**	**C**			**V**		*****

01	Proportional pressure relief valve, pilot operated	**KBVS**

Pressure rating

02	Up to 50 bar	**C**
	Up to 100 bar	**F**
	Up to 150 bar	**H**
	Up to 210 bar	**L**
	Up to 250 bar	**N**
	Up to 315 bar	**P**
	Up to 350 bar	**R**
	Up to 420 bar	**T**

03	Component size 1	**1**
04	With a command value = 0, the maximum pressure is set	**B**
05	Component series	**A**
06	High Performance and mounting cavity R/UNF-10-01-0-06 (see page 11)	**F**

Seal material

10	FKM seals	**V**
	(other seals upon request) Attention! Observe compatibility of seals with hydraulic fluid used!	
12	Further details in the plain text	*****

Valve types (without coil) 1)

Type	**Material no.**	**Type**	**Material no.**
KBVSC1BA/FV	R901325098	KBVSN1BA/FV	R901325107
KBVSF1BA/FV	R901325099	KBVSP1BA/FV	R901325109
KBVSH1BA/FV	R901325102	KBVSR1BA/FV	R901325111
KBVSL1BA/FV	R901325105	KBVST1BA/FV	R901325112

Available coils (separate order) 1)

	Material no. for coil with connector 2)		
Direct voltage DC 3)	**"K4"** 03pol (2+PE) DIN EN 175301-803	**"K40"** 02pol K40 DT 04-2PA, make Deutsch	**"C4"** 02pol C4/Z30 AMP Junior-Timer
12 V	R901002932	R901003055	R901003044
24 V / 1200 mA	R901002319	R901003053	R901003026
24 V / 800 mA	R901049962	R901050010	R901049963

1) Complete valves with mounted coil upon request
2) Mating connectors, separate order, see data sheet 08006.
3) Other voltages upon request.

Function, symbol

General

Valves of type KBVS are pilot operated proportional pressure relief valves in spool design and are used to limit the pressure in hydraulic systems. They mainly consist of the screwed-in proportional pilot control valve (1) and the main valve (2).
These valves can be used for infinitely adjusting the pressure to be limited depending on the command value. With command value 0 or in case of power failure, the maximum pressure is set (fail-safe characteristics).

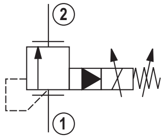
Function

In the factory, the valves are mechanically set to the maximum pressure. For the proportional reduction of the system pressure, a command value is specified at the control electronics. The electronics control the solenoid coil with electric current depending on the command value, which via the pilot control valve (1) and the main valve (2) causes the actual pressure adjustment in main port ①.
($\boldsymbol{p}_{max}$ = command value 0; $\boldsymbol{p}_{min}$ = command value max)

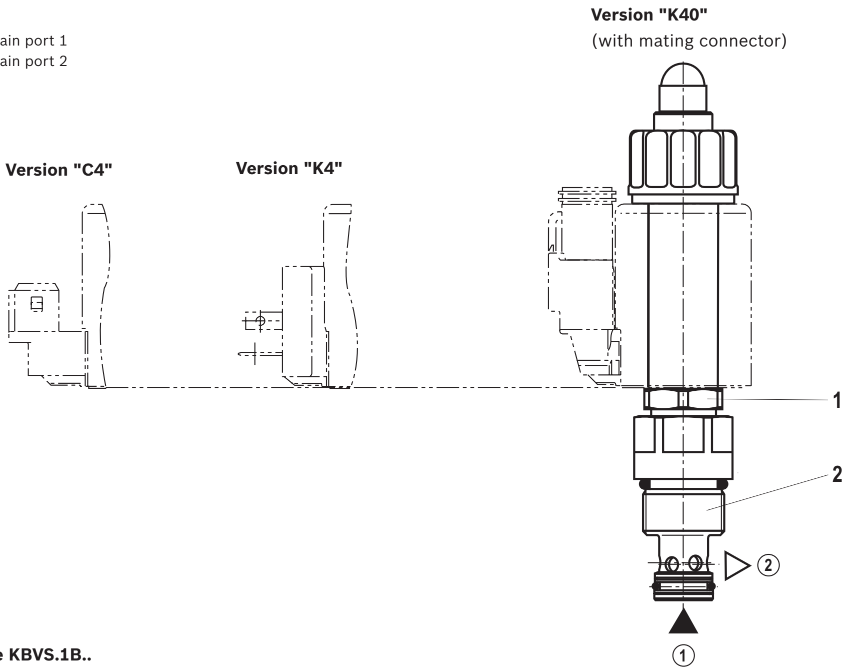
☞ **Notice!**
Occurring tank pressures (main port ②) are added up to the set values in main port ①.

3

Symbol



① = Main port 1
② = Main port 2



Type KBVS.1B..

Technical data (For applications outside these parameters, please consult us!)

general		
Weight	kg	0.75
Installation position		Any - if it is ensured that no air can collect upstream the valve. Otherwise, we recommend suspended installation of the valve.
Ambient temperature range	°C	–40 to +120 (see page 8 and 9)
Storage temperature	°C	–20 to +80

Environmental audits

Vibration test according to DIN EN 60068-2 / IEC 60068-2 /2 axes (X/Y)		
DIN EN 60068-2-6: 05/96	Vibrations, sine-shaped	10 cycles (5 Hz to 2000 Hz back to 5 Hz) with logarithmic frequency changing speed of 1 octave/min, 5 to 57 Hz, amplitude 1.6 mm (p-p), 57 to 2000 Hz, amplitude 10 g
IEC 60068-2-64: 05/93	Vibrations (random) and broad-band noise	20 to 2000 Hz, amplitude 0.1 g^2/Hz (14 g RMS/30 g peak), testing time 24 h
DIN EN 60068-2-27: 03/95	Shocking	Half-sine 15 g / 11 ms; 3 x in positive, 3 x in negative direction (a total of 6 single shocks)
DIN EN 60068-2-29: 03/95	Bump test	Half-sine 15 g / 11 ms; 1000 x in positive, 1000 x in negative direction (a total of 2000 single shocks)
Indication per axis		
Climatic test according to EN 60068-2 / IEC 60068-2 (environmental audit)		
DIN EN 60068-2-1: 03/95	Storage temperature	–40 °C, duration 16 h
DIN EN 60068-2-2: 08/94		+110 °C, duration 16 h
DIN EN 60068-2-1: 03/95	Cold test	2 cycles –25 °C, duration 2 h
DIN EN 60068-2-2: 08/94	Dry heating test	2 cycles +120 °C, duration 2 h
IEC 60068-2-30: 1985	Humid heat, cyclic	Variant 2/ +25 °C to +55 °C 93 % to 97 % relative humidity, 2 cycles à 24 h
Salt spray test according to DIN 50021	h	720

→ Coating generally not necessary. If paint is applied nevertheless, the reduced heat dissipation capacity is to be observed.

Technical data (For applications outside these parameters, please consult us!)

hydraulic			
Maximum operating pressure [1]	– Main port ①	bar	420
Maximum admissible return flow pressure	– Main port ②	bar	210
Maximum set pressure [2]			See command value pressure characteristic curves page 7
Maximum set pressure with command value 0			See characteristic curves page 7
Maximum flow		l/min	80
Pilot oil		l/min	< 0.8
Leakage		ml/min	< 200 (with Δp = 250 bar; closed pilot control valve and HLP46, ϑ_{oil} = 40 °C)
Hydraulic fluid			See table below
Hydraulic fluid temperature range		°C	–40 to +80
Viscosity range		mm²/s	5 to 400 (preferably 10 to 100)
Maximum permitted degree of contamination of the hydraulic fluid - cleanliness class according to ISO 4406 (c)			Class 20/18/15 [3]
Load cycles			10 million
Hysteresis [4]			< 4 % of the max. set pressure
Turnover voltage [4]			< 0.5 % of the max. set pressure
Response sensitivity [4]			< 0.5 % of the max. set pressure
Manufacturing tolerance of the command value pressure characteristic curve	– Command value 100 %		< 2 % of the max. set pressure
	– Command value 0		< 5 % of the max. set pressure
Step response (T_u + T_g) 0 → 100 % and/or 100 % → 0		ms	100 (depending on the system)

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils		HL, HLP	FKM	DIN 51524
Bio-degradable	– Insoluble in water	HEES	FKM	VDMA 24568
	– Soluble in water	HEPG	FKM	

Important information on hydraulic fluids!
- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!
- The flash point of the hydraulic fluids used must be 40 K higher than the maximum solenoid surface temperature.
- **Bio-degradable:** When using bio-degradable hydraulic fluids that are simultaneously zinc-solving, zinc may accumulate in the fluid.

1) The maximum operating pressure is added up from the set pressure and the return flow pressure!

2) The valves are factory-set. In case of subsequent adjustment, the warranty will become invalid!

3) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components. For the selection of the filters see www.boschrexroth.com/filter.

4) Measured with analog amplifier type RA2-1/10, see data sheet 95230 (PWM = 300 Hz).

3

Technical data (For applications outside these parameters, please consult us!)

electric					
Voltage type			Direct voltage		
Supply voltages		V	12 DC	24 DC	"-8" / 24 DC
Maximum solenoid current		mA	1760	1200	800
Coil resistance	– Cold value at 20 °C	Ω	2.3	4.8	11.5
	– Max. hot value	Ω	3.8	7.9	18.9
Duty cycle		%	See characteristic curve page 8 and 9 [5)]		
Maximum coil temperature [6)]		°C	150		
Protection class according to VDE 0470-1 (DIN EN 60529) DIN 40050-9	– Version "K4"		IP 65 with mating connector mounted and locked		
	– Version "C4"		IP 66 with mating connector mounted and locked		
			IP 69K with Rexroth mating connector (material no. R901022127)		
	– Version "K40"		IP 69K with mating connector mounted and locked		
Control electronics (separate order)			Plug-in proportional amplifier type VT-SSPA1...		Data sheet 30116
			Analog amplifier type RA...		Data sheet 95230
			BODAS control unit type RC...		Data sheet 95200
Recommended dither frequency (PMW)		Hz	300		
Design according to VDE 0580					

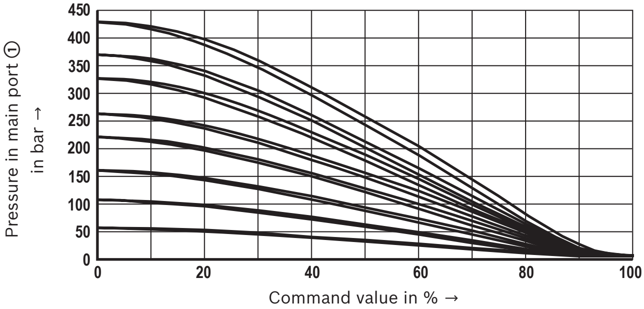
5) In case of use in altitudes > 2000 m a.s.l., we recommend consulting the manufacturer.

6) Due to the surface temperatures of the solenoid coils, the standards ISO 13732-1 and ISO 4413 need to be adhered to!

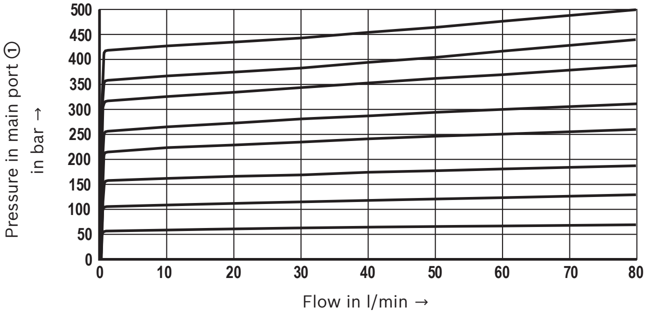
When establishing the electrical connection, the protective earthing conductor (PE ⏚) has to be connected properly.

Characteristic curves (measured with HLP46, ϑ_{oil} = 40 ±5 °C and 24 V coil)

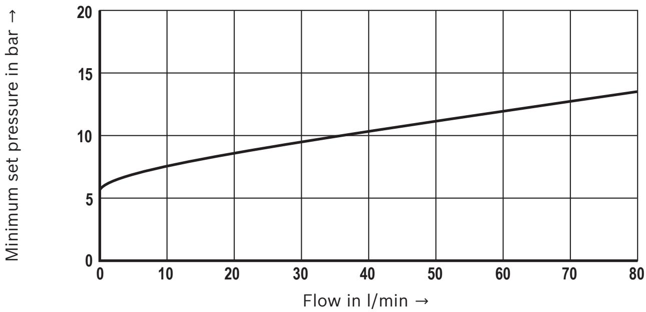
Pressure in main port ① depending on the command value; flow = 10 l/min



Pressure in main port ① depending on the flow.
(The characteristic curves were measured without back pressure in main port ②)

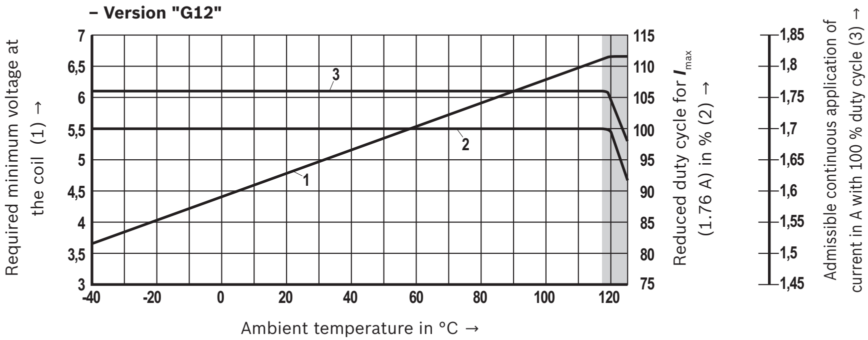


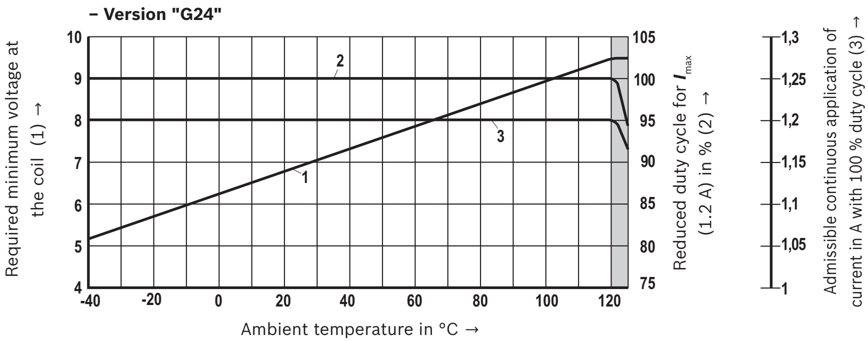
Minimum set pressure in the main port ① depending on the flow.
(The characteristic curves were measured without back pressure in main port ②)



Minimum terminal voltage at the coil and relative duty cycle

Admissible working range depending on the ambient temperature



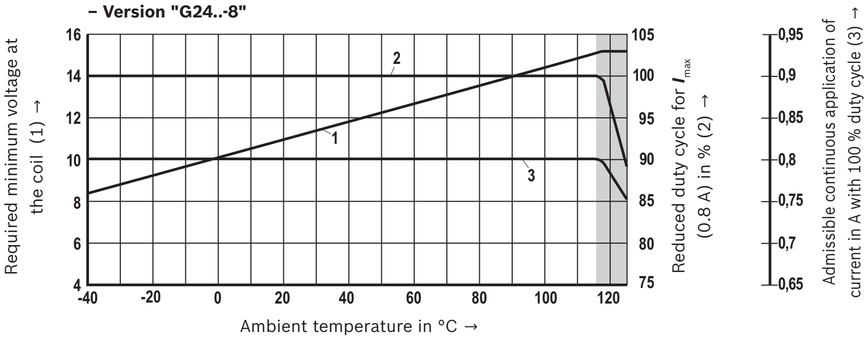


Limited valve performance

Notice!
The characteristic curves have been determined for coils with valve with medium test block size (80 x 80 x 80 mm), without flow in calm air.
Depending on the installation conditions (block size, flow, air circulation, etc.) there may be a better heat dissipation. Thus, the area of application is broadened.
In single cases, more unfavorable conditions may lead to limitations of the area of application.

Minimum terminal voltage at the coil and relative duty cycle

Admissible working range depending on the ambient temperature

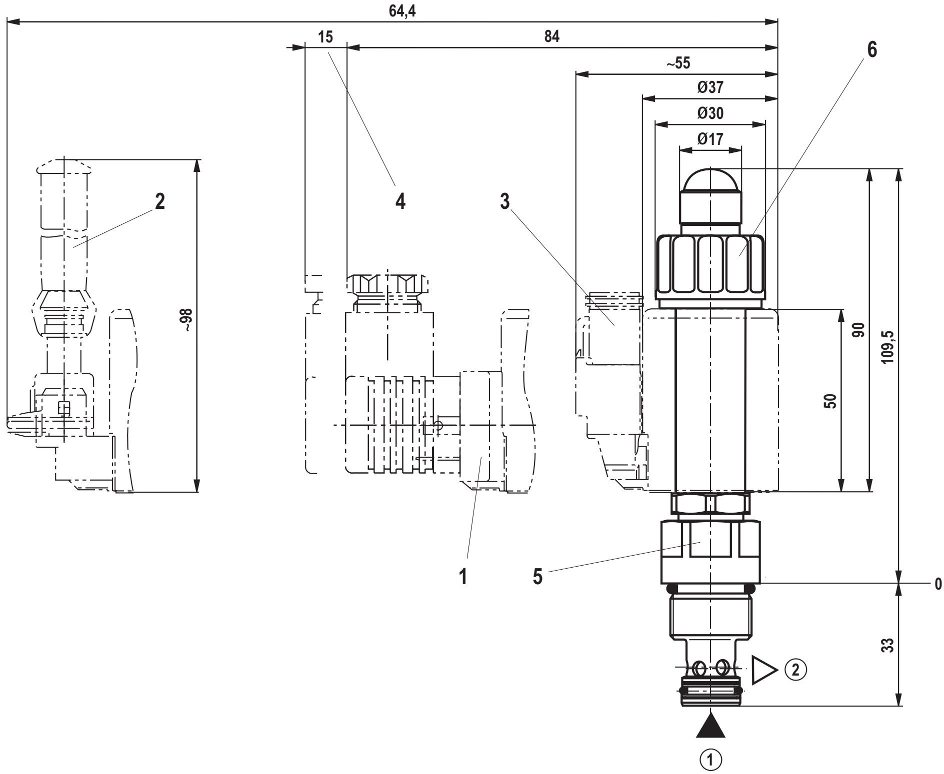


Limited valve performance

Notice!
The characteristic curves have been determined for coils with valve with medium test block size (80 x 80 x 80 mm), without flow in calm air.
Depending on the installation conditions (block size, flow, air circulation, etc.) there may be a better heat dissipation. Thus, the area of application is broadened.
In single cases, more unfavorable conditions may lead to limitations of the area of application.

3

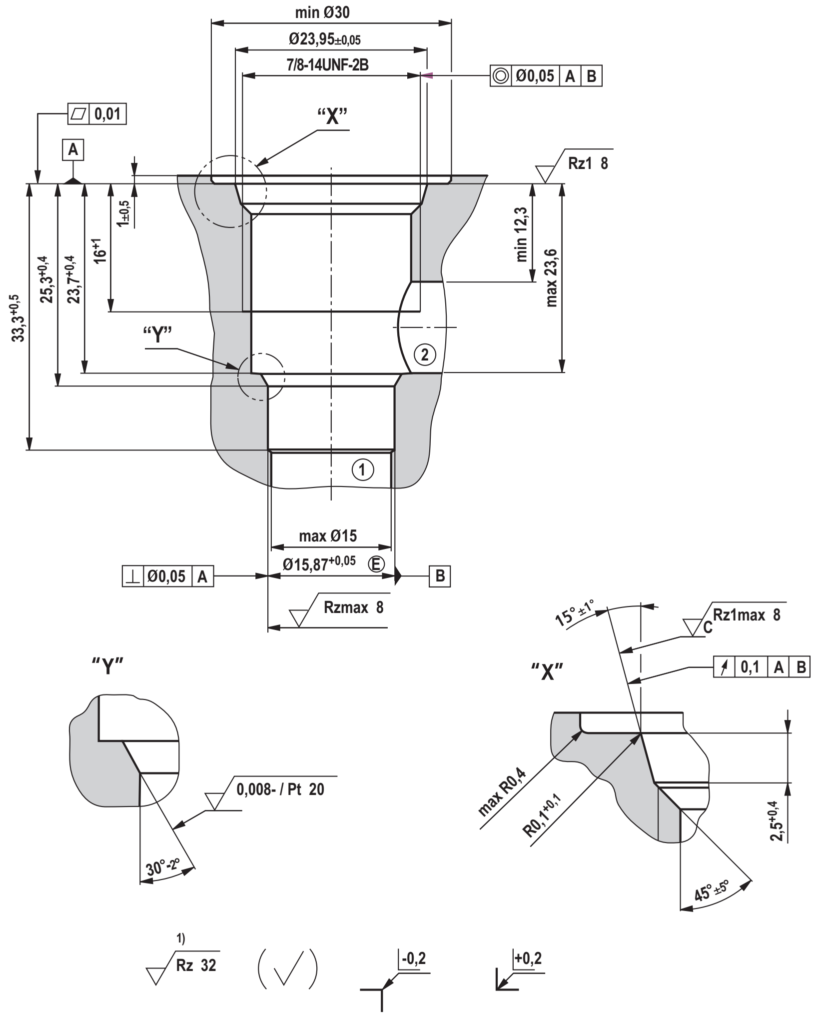
Unit dimensions (dimensions in mm)



1 Mating connectors, separate order, see data sheet 08006
2 Space required to remove the mating connector
3 SW24, tightening torque $\boldsymbol{M}_A = 55^{+5}$ Nm
4 Version "K4"
5 Version "K40"
6 Version "C4"
7 Nut, tightening torque $\boldsymbol{M}_A = 5^{+1}$ Nm

① = Main port 1
② = Main port 2

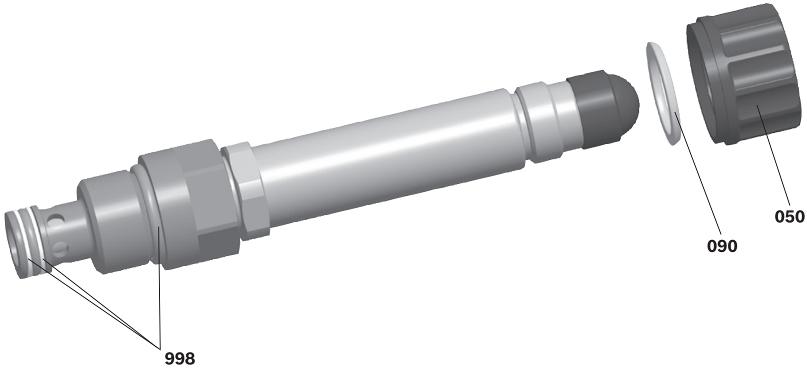
Mounting cavity R/UNF-10-01-0-06; 2 main ports; thread 7/8-14UNF-2B (dimensions in mm)



1) Visual inspection

① = Main port 1
② = Main port 2

Available individual components



Item	Denomination	Material no.
050	Nut	R900992146
090	Seal ring for pole tube	R900007769
998	Seal kit of the valve	R901006735

Coils, separate order, see page 2

More information

- Control electronics:
  - Plug-in proportional amplifier type VT-SSPA1... Data sheet 30116
  - Analog amplifier type RA... Data sheet 95230
  - BODAS control unit type RC... Data sheet 95200
- Selection of the filters www.boschrexroth.com/filter

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
documentation@boschrexroth.de
www.boschrexroth.de

Proportional pressure relief valve, pilot-operated, rising characteristic curve

RE 18139-08/07.12 1/12
Replaces: 09.07

Type KBVS.3A (High-Performance)

Component size 3
Component series A
Maximum operating pressure 350 bar
Maximum flow 200 l/min

H7139

Overview of contents

Features

- Mounting cavity R/ISO 7789-33-01-0-98
- Pilot-operated valve for limiting a system pressure
- Suitable for mobile and industrial applications
- Operation by proportional solenoid
- Proportional solenoid with central thread and detachable coil
- Cartridge valve
- Control electronics: plug-in amplifier VT-SSPA1...
- Fine balancing of the command value/pressure characteristic curves possible externally on the control electronics
- In the event of a power failure, the minimum pressure becomes effective

Information on available spare parts:
www.boschrexroth.com/spc

Ordering code

KBVS		3	A	A /	L	C			V		*

Pilot-operated proportional pressure relief valve

Pressure stage

up to 50 bar	**= C**
up to 100 bar	**= F**
up to 150 bar	**= H**
up to 210 bar	**= L**
up to 250 bar	**= N**
up to 315 bar	**= P**
up to 350 bar	**= R**

Component size 3 **= 3**

At command value = 0 the pressure is set **= A**

Component series **= A**

L = High-Performance and mounting cavity R/ISO 7789 [2]

C = Proportional solenoid, wet pin

Supply voltage

G12 = Control electronics 12 V DC

G24 = Control electronics 24 V DC

Electrical connection [1]

K4 = Component plug 03-pin (2+PE) K4, DIN EN 175301-803

K40 = Component plug 02-pin K40 DT 04-2PA, make: Deutsch

C4 = Cable plug 02-pin C4/Z30 type: Junior-Timer

Seal material

V = FKM seals

⚠ Caution!
Observe compatibility of seals with the hydraulic fluid used!

no code = Standard

-8 = Coil 800 mA (see page 5)

Further details in clear text

[1] Cable sockets (separate order), see RE 08006

[2] See page 10

Preferred types

Type	Material number
KBVSC3AA/LCG24K4V	R901061858
KBVSF3AA/LCG24K4V	R901061859
KBVSH3AA/LCG24K4V	R901061869
KBVSL3AA/LCG24K4V	R901061873
KBVSN3AA/LCG24K4V	R901061874
KBVSP3AA/LCG24K4V	R901061875
KBVSR3AA/LCG24K4V	R901061877

Function, Symbol

General

Valves of the KBVS type are pilot-operated proportional pressure relief valves of poppet design and used for limiting the pressure in hydraulic systems. They basically consist of a screwed-in proportional pilot valve (1) and the main valve (2).

These valves can be used for infinitely adusting the pressure to be limited in dependence upon the command value. At command value 0 or in the event of a power failure, the minimum pressure is set.

Basic principle

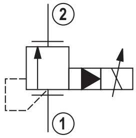
For the proportional increase in the system pressure, a command value is selected on the control electronics. The electronics controls the solenoid coil with electric current in dependence upon the command value, which causes the actual pressure adjustment in main port 1 via pilot valve (1) and main valve (2).

($\boldsymbol{p}_{max}$ = command value max; $\boldsymbol{p}_{min}$ = command value 0)
Internal pilot oil supply and drain.

☞ **Note!**

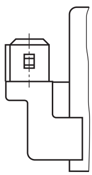
Any tank pressures (main port 2) add to the set value in main port 1.

Symbol

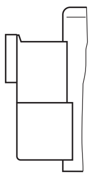


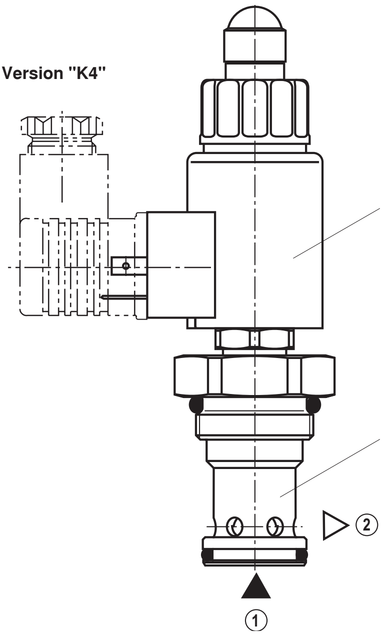
Version "K4"

Version "C4"



Version "K40"





Technical data (for applications outside these parameters, please consult us!)

general

Weight	kg	0,7
Installation orientation		Optional, if it can be ensured that no air can collect up-stream of the valve. Otherwise, we recommend that the valve be mounted in a suspended position.
Ambient temperature range	°C	–20 to +120
Storage temperature range	°C	–20 to +80

Environmental tests:

Vibration test according to DIN EN 60068-2 / IEC 60068-2 /2 axes (X/Z)		
DIN EN 60068-2-6: 05/96	Vibration, sinusoidal	10 cycles at 5 to 2000 to 5 Hz with a logarithmic frequency change rate of 1 Oct./min, 5 to 57 Hz, amplitude 1.5 mm (p-p), 57 to 2000 Hz, amplitude 10 g
IEC 60068-2-64: 05/93	Vibration (random) and broadband noise	20 to 2000 Hz, amplitude 0.05 g^2/Hz (10 g RMS/30 g peak), testing time 30 min
DIN EN 60068-2-27: 03/95	Shock test	Half sine 15 g / 11 ms; 3 x in pos., 3 x in neg. direction (6 individual shocks in total)
DIN EN 60068-2-29: 03/95	Bump test	Half sine 25 g / 6 ms; 1000 x in pos., 1000 x in neg. direction (2000 individual shocks in total)
Details per axis		
Climatic test according to DIN EN 60068-2 / IEC 60068-2 (environmental testing):		
DIN EN 60068-2-1: 03/95	Storage temperature	–40 °C, dwell time 16 h
DIN EN 60068-2-2: 08/94		+110 °C, dwell time 16 h
DIN EN 60068-2-1: 03/95	Cold test	2 cycles at –25 °C, dwell time 2 h
DIN EN 60068-2-2: 08/94	Dry heat test	2 cycles at +120 °C, dwell time 2 h
IEC 60068-2-30: 1985	Damp heat, cyclical	Variant 2/ +25 °C to +55 °C 93 % to 97 % relative humidity, 2 cycles, 24 h each
Salt spray test: 720 h according to DIN 50021		

→ Finish painting generally not required. Should you nevertheless wish to apply a finish coat, observe the reduced heat dissipation capacity.

hydraulic

Max. operating pressure [1] (main port 1)	bar	350
Max. permissible return flow pressure (main port 2)	bar	210
Maximum set pressure [2]		See command value/pressure characteristic curves on page 6
Minimum set pressure at command value 0		See charateristic curves on page 6
Maximum flow	l/min	200 (with pressure stage 350 bar max. 100 l/min)
Hydraulic fluid		see page 5
Hydraulic fluid temperature range	°C	–20 to +80
Viscosity range	mm^2/s	15 to 380
Max. permissible degree of contamination of the hydraulic fluid - cleanliness class acc. to ISO 4406 (c)		Class 20/18/15 [3]

[1] ⚠ **Caution!** The maximum operating pressure is added up from the set pressure and the return flow pressure!

[2] ⚠ **Caution!** The valves are factory-set. In the case of subsequent re-adjustment, the warranty will become void!

[3] The cleanliness class stated for the components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and, at the same time, increases the service life of components.

For the selection of filters, see www.boschrexroth.com/filter

Technical data (for applications outside these parameters, please consult us!)

hydraulic

Hysteresis			< 6 % of max. set pressure
Range of inversion			< 0,5 % of max. set pressure
Response sensitivity			< 0,5 % of max. set pressure
Tolerance of the command value/pressure characteristic curve	– Command value 100 %		< 5 % of max. set pressure
	– Command value 0		< 2 % of max. set pressure
Step response (T_u + T_g) 0 → 100 % or 100 % → 0		ms	100 (depends on system)

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils		HL, HLP	FKM	DIN 51524
Bio-degradable	– Insoluble in water	HEES	FKM	VDMA 24568
	– Soluble in water	HEPG	FKM	

Important information on hydraulic fluids!
- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!
- The flash point of the hydraulic fluids used must be 40 K higher than the maximum solenoid surface temperature.
- **Bio-degradable:** When using bio-degradable hydraulic fluids that are simultaneously zinc-solving, zinc may accumulate in the fluid.

electrical

Supply voltage		V	12 DC	24 DC	"-8" / 24 DC
Maximum control current		mA	max. nominal current 1760 mA	max. nominal current 1200 mA	max. nominal current 800 mA
Coil resistance	– Cold value at 20 °C	Ω	2,3	4,8	11,5
	– Max. hot value	Ω	3,8	7,9	18,9
Duty cycle		%	100 [4]		
Maximum coil temperature [5]		°C	150		
Type of protection acc. to VDE 0470-1 (DIN EN 60529), DIN 40050-9	– Version "K4"		IP 65 with cable socket mounted and locked		
	– Version "C4"		IP 66 with cable socket mounted and locked		
			IP 69K with Rexroth cable socket (material no. R901022127)		
	– Version "K40"		IP 69K with cable socket mounted and locked		
Control electronics [6]			Plug-in amplifier VT-SSPA1 (300 Hz)		
Rating according to VDE 0580					

[4] In the case of use at heights > 2000 m above MSL we recommend that you consult the manufacturer.

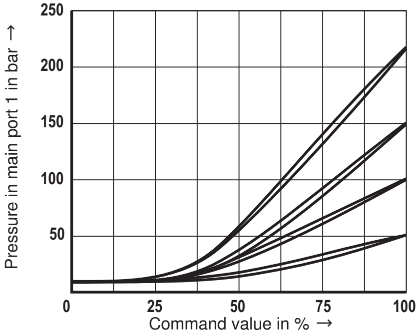
[5] Due to the surface temperatures occurring on solenoid coils, the European standards ISO 13732-1 and EN 982 must be observed!

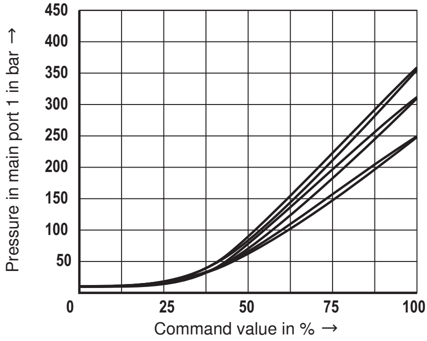
[6] Separate order, see RE 30116

3

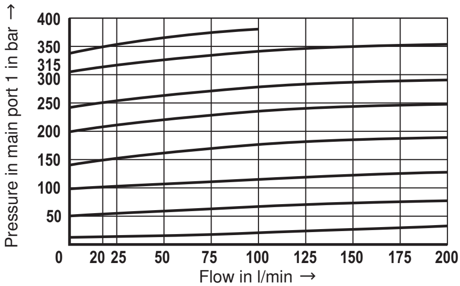
Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C and 24 V coil)

Pressure in main port 1 in dependence on command value. Flow = 20 l/min



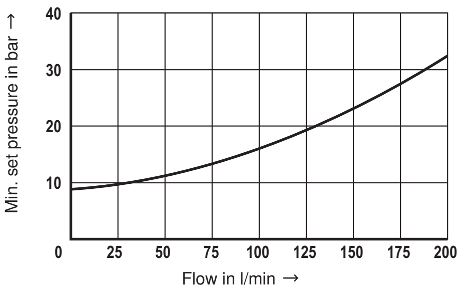


Pressure in main port 1 in dependence on flow.
(The characteristic curves were measured without backpressure in main port 2.)

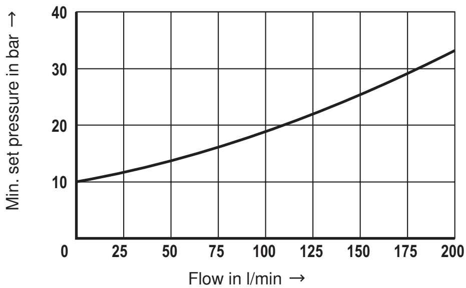


Minimum set pressure in main port 1 at command value 0.
(The characteristic curves were measured without backpressure in main port 2.)

Pressure stage 50 to 250 bar



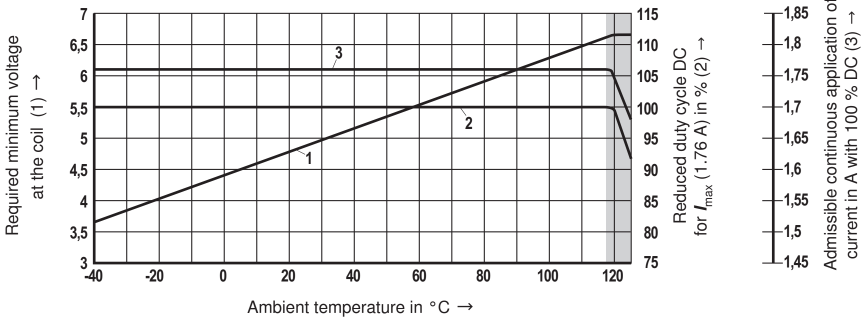
Pressure stage 315 to 350 bar



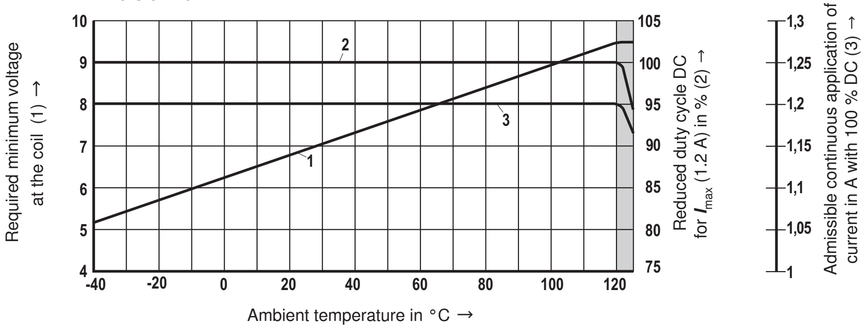
Minimum terminal voltage at the coil and relative duty cycle

Admissible working range against the ambient temperature

– Version "G12"



– Version "G24"



Limited valve performance

Notice!

The characteristic curves have been determined for coils with valve with medium test block size (80 x 80 x 80 mm), without flow in calm air.

Depending on the installation conditions (block size, flow, air circulation, etc.) there may be a better heat dissipation. Thus, the area of application is broadened.

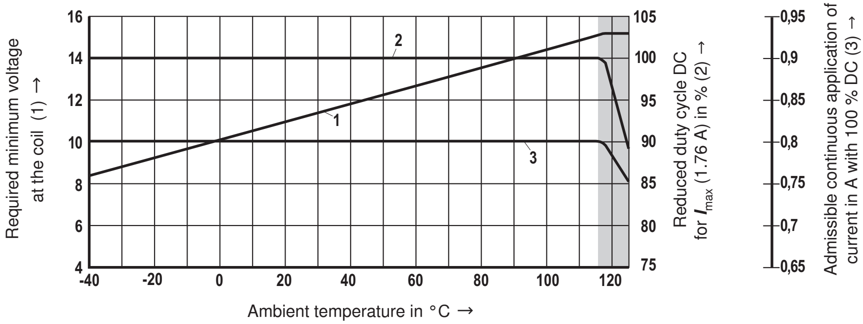
In single cases, more unfavorable conditions may lead to limitations of the area of application.

3

Minimum terminal voltage at the coil and relative duty cycle

Admissible working range against the ambient temperature

– **Version "G24...-8"**



Limited valve performance

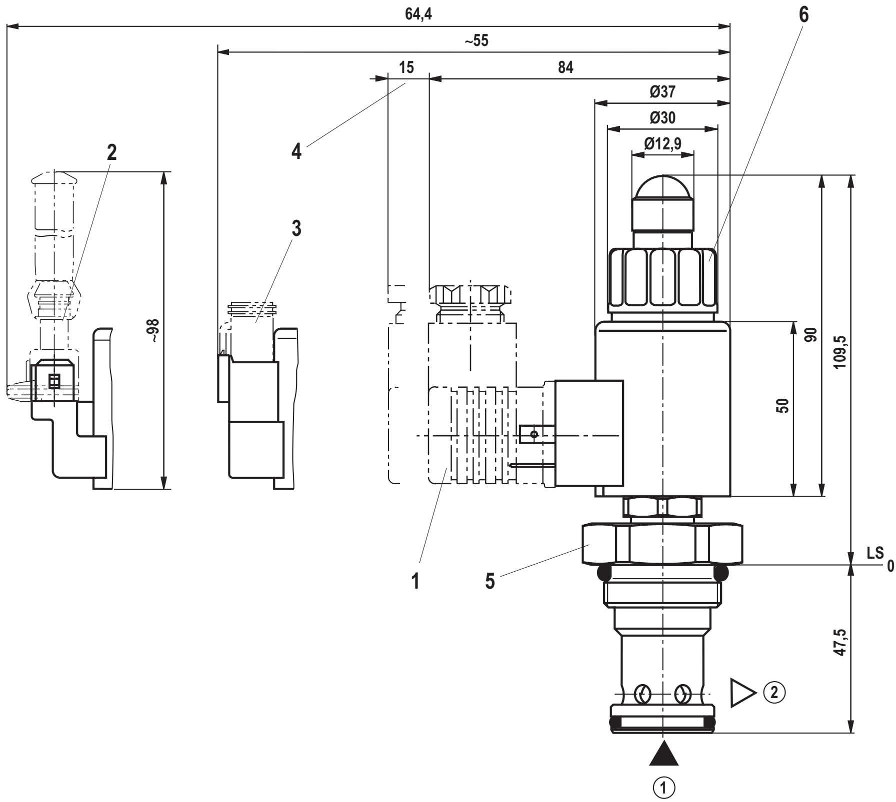
☞ **Notice!**

The characteristic curves have been determined for coils with valve with medium test block size (80 x 80 x 80 mm), without flow in calm air.

Depending on the installation conditions (block size, flow, air circulation, etc.) there may be a better heat dissipation. Thus, the area of application is broadened.

In single cases, more unfavorable conditions may lead to limitations of the area of application.

Unit dimensions (dimensions in mm)



① = Main port 1

② = Main port 2

LS = Location shoulder

1 Cable socket for component plug "K4" (separate order, see RE 08006)

2 Cable socket for component plug "C4" (separate order, see RE 08006)

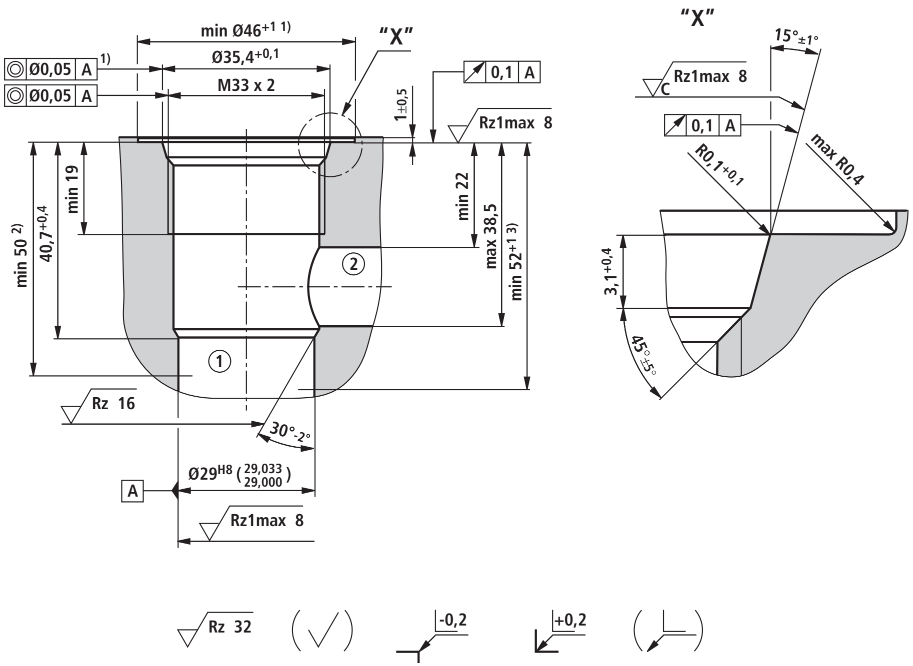
3 Cable socket for component plug "K40" (separate order, see RE 08006)

4 Space required to remove the plug-in connector

5 Hexagon SW41;
– Tightening torque $M_A = 100^{+20}$ Nm (< 250 bar)
– Tightening torque $M_A = 120^{+20}$ Nm (> 250 bar)

6 Solenoid nut, tightening torque $M_A = 5^{+1}$ Nm

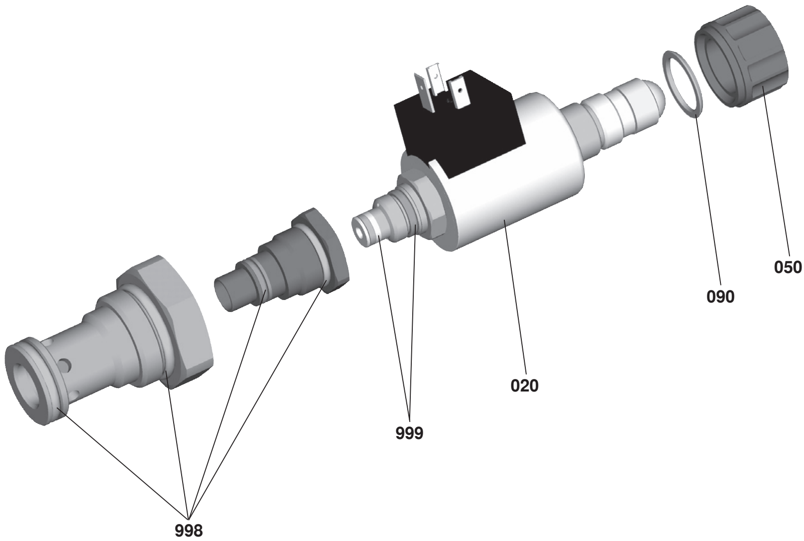
Mounting cavity R/ISO 7789-33-01-0-98; 2 main ports; thread M33 x 2
(dimensions in mm)



1) Different from ISO 7789-33-01-0-98
2) Depth of fit
3) Optional

① = Main port 1
② = Main port 2
LS = Location shoulder

Available individual components



Item	Designation		DC	Material no.
020	Coil for individual connection [1]	Version K4	12 V	R901002932
			24 V	R901002319
			24 V / 800 mA	R901049962
		Version K40	12 V	R901003055
			24 V	R901003053
			24 V / 800 mA	R901050010
		Version C4	12 V	R901003044
			24 V	R901003026
			24 V / 800 mA	R901049963
050	Nut			R900992146
090	Seal ring for pressure tube			R900007769
998	Main stage seal kit			R961001025
999	Pilot valve seal kit			R961000376

[1] ☞ **Note!**
After the solenoid coil was replaced, the factory-set pressure may change by ±5 %.

Notes

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
documentation@boschrexroth.de
www.boschrexroth.de

Proportional pressure relief valve, pilot-operated, falling characteristic curve

RE 18139-07/07.12 1/12
Replaces: 06.08

Type KBVS.3B (High-Performance)

H7139

Component size 3
Component series A
Maximum operating pressure 350 bar
Maximum flow 200 l/min

Overview of contents

Contents	Page
Features	1
Ordering code	2
Preferred types	2
Function, symbol	3
Technical data	4, 5
Characteristic curves	6
Minimum terminal voltage at the coil and relative duty cycle	7,8
Unit dimensions	9
Mounting cavity	10
Available individual components	11

Features

- Mounting cavity R/ISO 7789-33-01-0-98
- Pilot-operated valve for limiting a system pressure
- Suitable for mobile and industrial applications
- Operation by proportional solenoid
- Proportional solenoid with central thread and detachable coil
- Cartridge valve
- Control electronics: plug-in amplifier VT-SSPA1..
- Fine balancing of the command value/pressure characteristic curves possible externally on the control electronics
- Valves are adjusted to max. pressure by means of an adjustment screw
- In the event of a power failure, the maximum set pressure becomes effective

Information on available spare parts:
www.boschrexroth.com/spc

Ordering code

KBVS		3	B	A	/	L	C			V		*

Pilot-operated proportional pressure relief valve

Pressure stage

up to 50 bar	**= C**
up to 100 bar	**= F**
up to 150 bar	**= H**
up to 210 bar	**= L**
up to 250 bar	**= N**
up to 315 bar	**= P**
up to 350 bar	**= R**

Component size 3 **= 3**

At command value = 0 the maximum pressure is set **= B**

Component series **= A**

L = High-Performance and mounting cavity R/ISO 7789 [2)]

C = Proportional solenoid, wet pin

Supply voltage

G12 = Control electronics 12 V DC

G24 = Control electronics 24 V DC

Electrical connection [1)]

K4 = Component plug 03-pin (2+PE) K4, DIN EN 175301-803

K40 = Component plug 02-pin K40 DT 04-2PA, make: Deutsch

C4 = Cable plug 02-pin C4/Z30 type: Junior-Timer

Seal material

V = FKM seals

⚠ Caution! Observie compatibility of seals with the hydraulic fluid used!

no code = Standard

-8 = Coil 800 mA (see page 5)

Further details in clear text

[1)] Cable sockets (separate order), see RE 08006

[2)] See page 10

Preferred types

Type	Material number
KBVSC3BA/LCG24K4V	R901042645
KBVSF3BA/LCG24K4V	R901042649
KBVSH3BA/LCG24K4V	R901047841
KBVSL3BA/LCG24K4V	R901032852
KBVSN3BA/LCG24K4V	R901041058
KBVSP3BA/LCG24K4V	R901042652
KBVSR3BA/LCG24K4V	R901022444

Function, Symbol

General

Valves of the KBVS type are pilot-operated proportional pressure relief valves of poppet design and used for limiting the pressure in hydraulic systems. They basically consist of a screwed-in proportional pilot valve (1) and the main valve (2).

These valves can be used for infinitely adusting the pressure to be limited in dependence upon the command value. At command value 0 or in the event of a power failure, the maximum pressure is set (fail-safe characteristics).

Basic principle

The mechanics of the valve is factory-set to the maximum pressure. A command value for the proportional reduction of the system pressure is selected on the control electronics. The electronics controls the solenoid coil with electric current in dependence upon the command value, which causes the actual pressure adjustment in main port ① via pilot valve (1) and main valve (2).

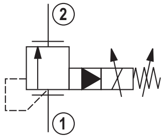
($\boldsymbol{p}_{max}$ = command value 0; $\boldsymbol{p}_{min}$ = command value max.)

Internal pilot oil supply and drain.

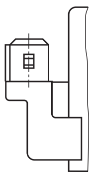
Note!

Any tank pressures (main port ②) add to the set value in main port ①.

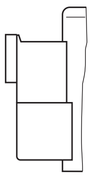
Symbol



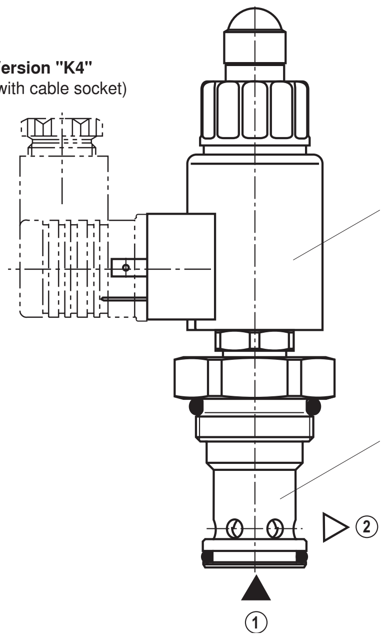
Version "C4"



Version "K40"



Version "K4"
(with cable socket)



Technical data (for applications outside these parameters, please consult us!)

general

Weight	kg	0,7
Installation orientation		Optional, if it can be ensured that no air can collect upstream of the valve. Otherwise, we recommend that the valve be mounted in a suspended position.
Ambient temperature range	°C	–20 to +120 (–40 to +110 for fan drives)
Storage temperature range	°C	–20 to +80

Environmental tests:

Vibration test according to DIN EN 60068-2 / IEC 60068-2 /2 axes (X/Z)		
DIN EN 60068-2-6: 05/96	Vibration, sinusoidal	10 cycles at 5 to 2000 to 5 Hz with a logarithmic frequency change rate of 1 Oct./min, 5 to 57 Hz, amplitude 1.5 mm (p-p), 57 to 2000 Hz, amplitude 10 g
IEC 60068-2-64: 05/93	Vibration (random) and broadband noise	20 to 2000 Hz, amplitude 0.05 g^2/Hz (10 g RMS/30 g peak), testing time 30 min
DIN EN 60068-2-27: 03/95	Shock test	Half sine 15 g / 11 ms; 3 x in pos., 3 x in neg. direction (6 individual shocks in total)
DIN EN 60068-2-29: 03/95	Bump test	Half sine 25 g / 6 ms; 1000 x in pos., 1000 x in neg. direction (2000 individual shocks in total)
Details per axis		
Climatic test according to DIN EN 60068-2 / IEC 60068-2 (environmental testing):		
DIN EN 60068-2-1: 03/95	Storage temperature	–40 °C, dwell time 16 h
DIN EN 60068-2-2: 08/94		+110 °C, dwell time 16 h
DIN EN 60068-2-1: 03/95	Cold test	2 cycles at –25 °C, dwell time 2 h
DIN EN 60068-2-2: 08/94	Dry heat test	2 cycles at +120 °C, dwell time 2 h
IEC 60068-2-30: 1985	Damp heat, cyclical	Variant 2/ +25 °C to +55 °C 93 % to 97 % relative humidity, 2 cycles, 24 h each
Salt spray test: 720 h according to DIN 50021		

→ Finish painting generally not required. Should you nevertheless wish to apply a finish coat, observe the reduced heat dissipation capacity.

hydraulic

Max. operating pressure [1] (main port ①)	bar	350
Max. permissible return flow pressure (main port ②)	bar	210
Maximum set pressure [2]		See command value/pressure characteristic curves on page 6
Minimum set pressure at max. command value		See charateristic curves on page 6
Maximum flow	l/min	200 (with pressure stage 350 bar max. 100 l/min)
Hydraulic fluid		See page 5
Hydraulic fluid temperature range	°C	–20 to +80 (–20 to +110 for fan drives)
Viscosity range	mm^2/s	12 to 800
Max. permissible degree of contamination of the hydraulic fluid - cleanliness class acc. to ISO 4406 (c)		Class 20/18/15 [3]

1) ⚠ **Caution!** The maximum operating pressure is added up from the set pressure and the return flow pressure!

2) ⚠ **Caution!** The valves are factory-set. In the case of subsequent re-adjustment, the warranty will become void!

3) The cleanliness class stated for the components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and, at the same time, increases the service life of components.

For the selection of filters, see www.boschrexroth.com/filter

Technical data (for applications outside these parameters, please consult us!)

hydraulic

Hysteresis			< 4 % of max. set pressure
Range of inversion			< 0.5 % of max. set pressure
Response sensitivity			< 0.5 % of max. set pressure
Tolerance of the command value/pressure characteristic curve	– Command value 100 %		< 2 % of max. set pressure
	– Command value 0		< 5 % of max. set pressure
Step response (T_u + T_g) 0 → 100 % or 100 % → 0		ms	100 (depends on system)

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils		HL, HLP	FKM	DIN 51524
Bio-degradable	– Insoluble in water	HEES	FKM	VDMA 24568
	– Soluble in water	HEPG	FKM	

Important information on hydraulic fluids!
- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!
- The flash point of the hydraulic fluids used must be 40 K higher than the maximum solenoid surface temperature.
- **Bio-degradable:** When using bio-degradable hydraulic fluids that are simultaneously zinc-solving, zinc may accumulate in the fluid.

electrical

Supply voltage		V	12 DC	24 DC	"-8" / 24 DC
Maximum control current		mA	max. nominal current 1760 mA	max. nominal current 1200 mA	max. nominal current 800 mA
Coil resistance	– Cold value at 20 °C	Ω	2,3	4,8	11,5
	– Max. hot value	Ω	3,8	7,9	18,9
Duty cycle		%	100 [4]		
Maximum coil temperature [5]		°C	150		
Type of protection acc. to VDE 0470-1 (DIN EN 60529), DIN 40050-9	– Version "K4"		IP 65 with cable socket mounted and locked		
	– Version "C4"		IP 66 with cable socket mounted and locked		
			IP 69K with Rexroth cable socket (material no. R901022127)		
	– Version "K40"		IP 69K with cable socket mounted and locked		
Control electronics [6]			Plug-in amplifier VT-SSPA1		
Rating according to VDE 0580					

[4] In the case of use at heights > 2000 m above MSL we recommend that you consult the manufacturer.

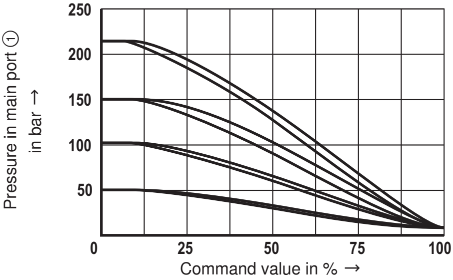
[5] Due to the surface temperatures occurring on solenoid coils, the European standards ISO 13732-1 and EN 982 must be observed!

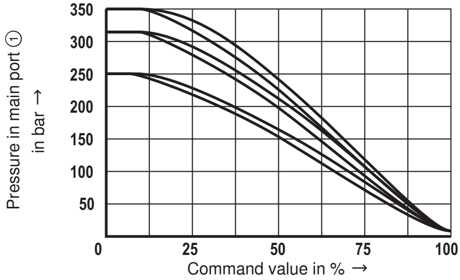
[6] Separate order, see RE 30116

3

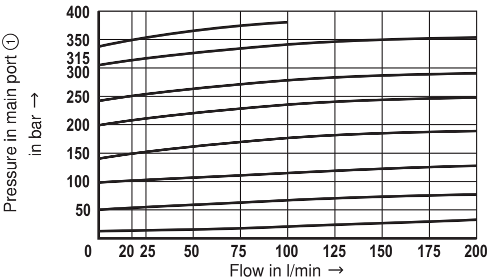
Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C and 24 V coil)

Pressure in main port ① in dependence on command value. Flow = 20 l/min



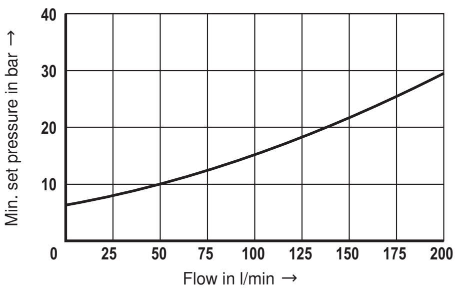


Pressure in main port ① in dependence on flow.
(The characteristic curves were measured without backpressure in main port ②.)

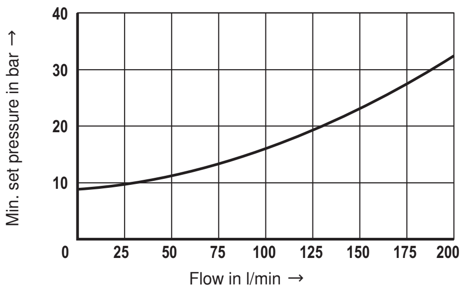


Minimum set pressure in main port ① at command value 100 %.
(The characteristic curves were measured without backpressure in main port ②.)

Pressure stage 50 to 250 bar



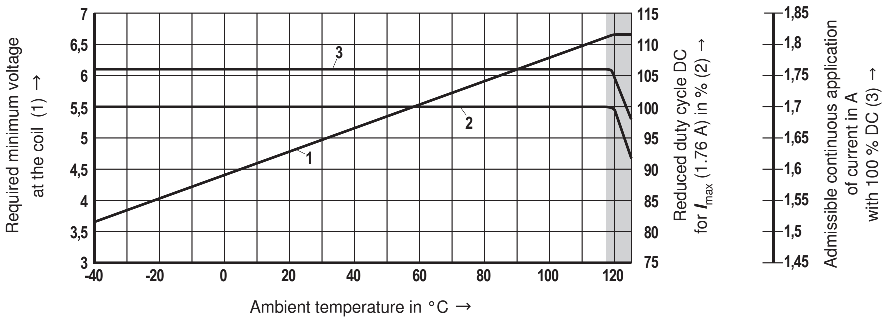
Pressure stage 315 and 350 bar



Minimum terminal voltage at the coil and relative duty cycle

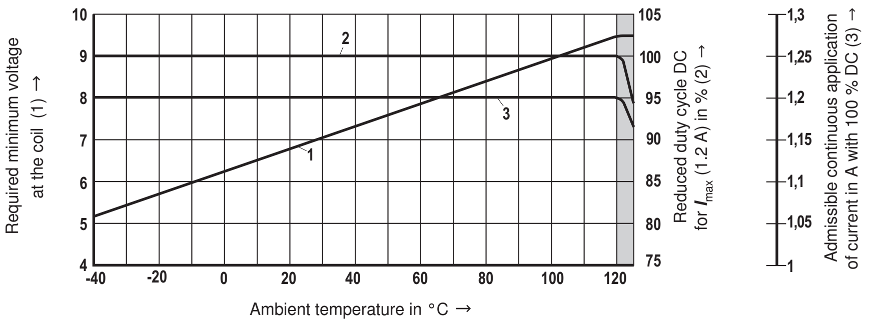
Admissible working range against the ambient temperature

– Version "G12"



3

– Version "G24"



Limited valve performance

☞ **Notice!**

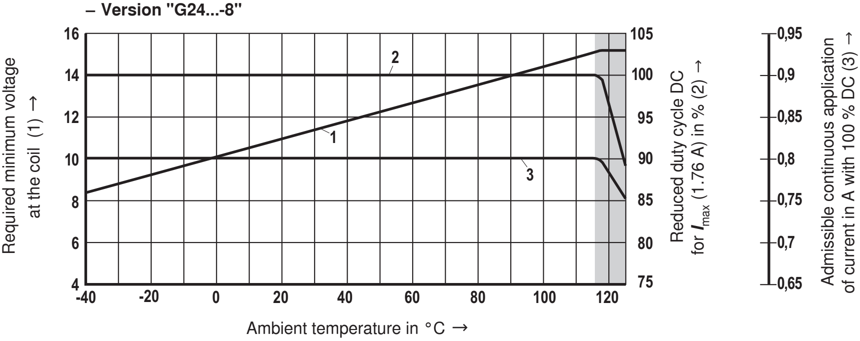
The characteristic curves have been determined for coils with valve with medium test block size (80 x 80 x 80 mm), without flow in calm air.

Depending on the installation conditions (block size, flow, air circulation, etc.) there may be a better heat dissipation. Thus, the area of application is broadened.

In single cases, more unfavorable conditions may lead to limitations of the area of application.

Minimum terminal voltage at the coil and relative duty cycle

Admissible working range against the ambient temperature



Limited valve performance

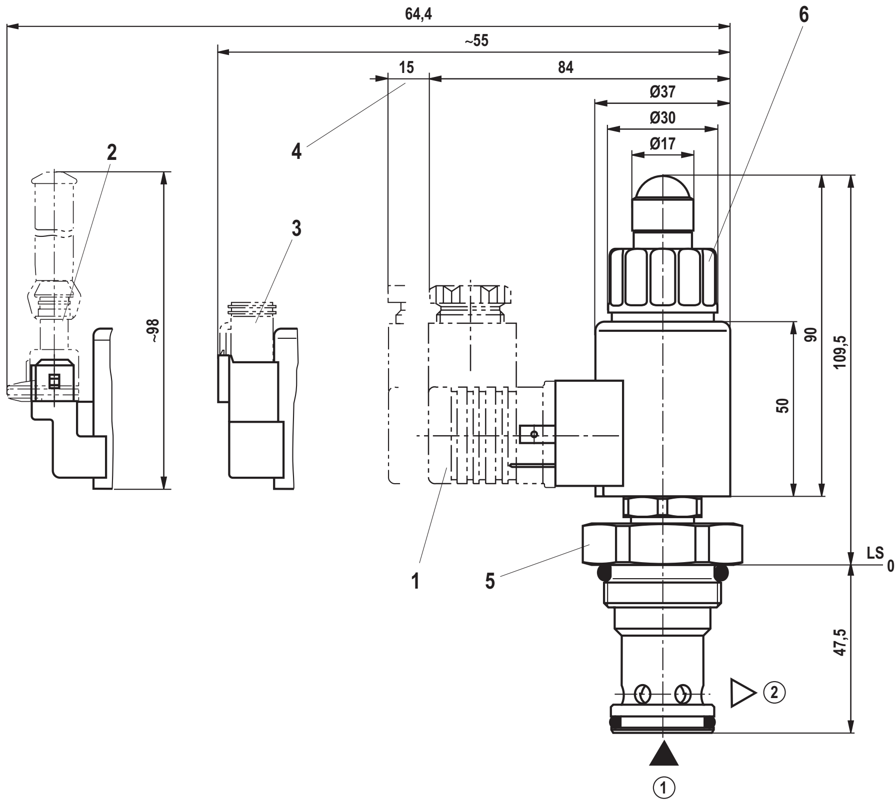
☞ **Notice!**

The characteristic curves have been determined for coils with valve with medium test block size (80 x 80 x 80 mm), without flow in calm air.

Depending on the installation conditions (block size, flow, air circulation, etc.) there may be a better heat dissipation. Thus, the area of application is broadened.

In single cases, more unfavorable conditions may lead to limitations of the area of application.

Unit dimensions (dimensions in mm)



① = Main port 1

② = Main port 2

LS = Location shoulder

1 Cable socket for component plug "K4" (separate order, see RE 08006)

2 Cable socket for component plug "C4" (separate order, see RE 08006)

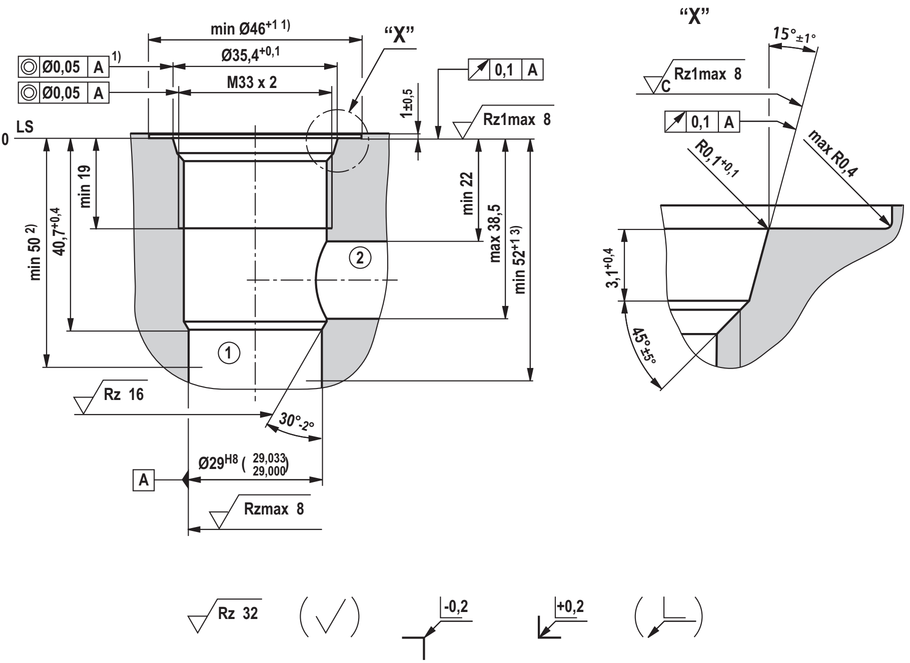
3 Cable socket for component plug "K40" (separate order, see RE 08006)

4 Space required to remove the plug-in connector

5 Hexagon SW41;
– Tightening torque $M_A = 100^{+20}$ Nm (< 250 bar)
– Tightening torque $M_A = 120^{+20}$ Nm (> 250 bar)

6 Solenoid nut, tightening torque $M_A = 5^{+1}$ Nm

Mounting cavity R/ISO 7789-33-01-0-98; 2 main ports; thread M33 x 2
(dimensions in mm)



1) Different from ISO 7789-33-01-0-98

2) Depth of fit

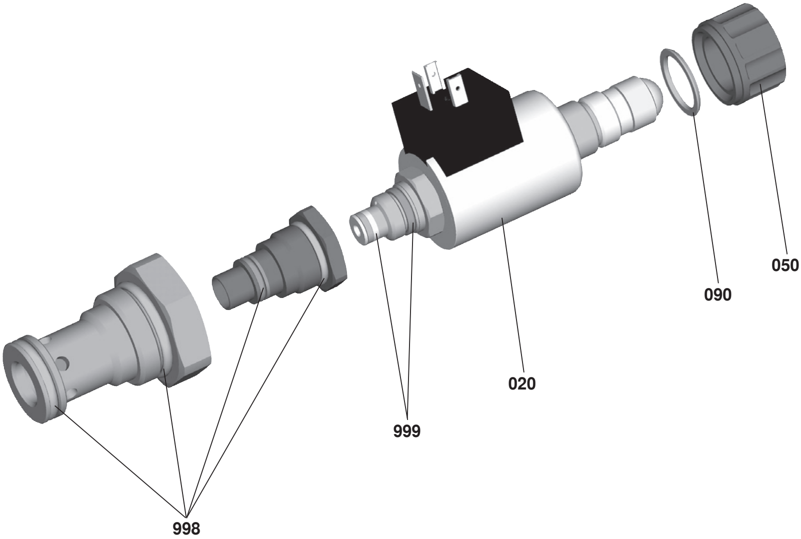
3) Optional

① = Main port 1

② = Main port 2

LS = Location shoulder

Available individual components



Item	Designation		DC	Material no.
020	Coil for individual connection [1]	Version K4	12 V 24 V 24 V / 800 mA	R901002932 R901002319 R901049962
		Version K40	12 V 24 V 24 V / 800 mA	R901003055 R901003053 R901050010
		Version C4	12 V 24 V 24 V / 800 mA	R901003044 R901003026 R901049963
050	Nut			R900992146
090	Seal ring for pressure tube			R900007769
998	Main stage seal kit			R961001025
999	Pilot valve seal kit			R961000376

[1] **Note!**
After the solenoid coil was replaced, the factory-set pressure may change by ±5 %.

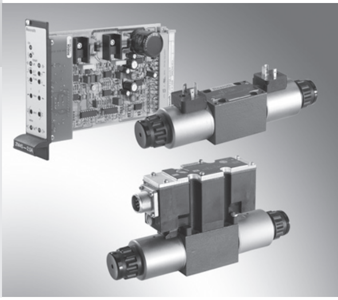
Notes

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
documentation@boschrexroth.de
www.boschrexroth.de

Proportional pressure reducing valve, in 3-way version

RE 29184/06.11
Replaces: 12.02

Type 3DREP and 3DREPE



Size 6
Component series 2X
Maximum operating pressure 100 bar
Maximum flow 15 l/min

Table of contents

Contents	Page

Features

- Direct operated proportional valves for controlling a pressure and the direction of a flow
- Operation by means of proportional solenoids with central thread and detachable coil
- Subplate mounting:
  Porting pattern according to ISO 4401
- Manual override, optional
- Spring-centered control spool
- Type 3DREPE with integrated control electronics
- External control electronics for type 3DREP:
  - Analog amplifiers type VT-VSPA2-1-2X/… in Eurocard format (separate order), see page 5
  - Digital amplifier type VT-VSPD-1-1X/… in Eurocard format (separate order), see page 5
  - Electric amplifier type VT 11118 in modular design (separate order), see page 5

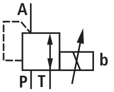
Ordering code

3DREP		6	–2X/		E	G24			/		*

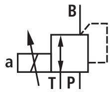
For **external** control electronics = **No code**
With **integrated** control electronics = **E**

Size
Size 6 = **6**

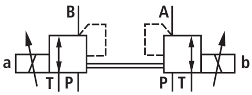
Symbols (simplified)



= **A**



= **B**



= **C**

Component series 20 to 29 = **2X**
(20 to 29: Unchanged installation and connection dimensions)

Pressure rating
16 bar = **16**
25 bar = **25**
45 bar = **45**

E = Proportional solenoid with detachable coil

Supply voltage
G24 = +24 V direct voltage

No code = Without manual override
N9 = [3] With concealed manual override

No code = Without special type of protection
J = [2] Sea water-resistant

Electrical connection for DREP
K4 = [1] **Without** mating connectors, with connector according to DIN EN 175 301-803
Mating connectors - separate order see page 7

For DREPE
K31 = [1] **Without** mating connectors, with connector according to DIN EN 175 301-804
Mating connectors - separate order see page 7

No code = For DREP
For DREPE
A1 = Command value/actual value ±10 V
F1 = Command value/actual value 4 to 20 mA

Seal material
M = NBR seals
V = FKM seals

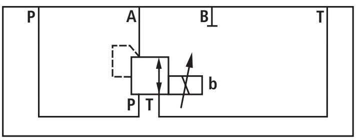
Further details in the plain text

[1] With version "J" = sea water-resistant only specify "K31"
[2] Only with version 3DREP6
[3] With version "J" = "N" instead of "N9"

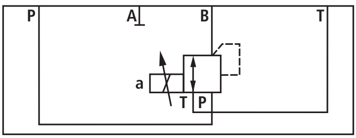
Electric special types of protection on request!

Symbols

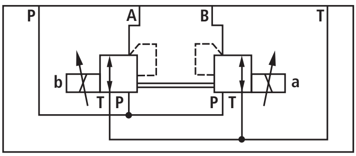
Type 3DREP..6 **A** 2X/..E (detailed)



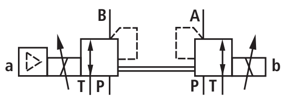
Type 3DREP..6 **B** 2X/..E (detailed)



Type 3DREP..6 **C** 2X/..E (detailed)



Example of valve with integrated control electronics
Type 3DREP**E**..6 **C** 2X/..E (simplified)



Function, section

The 3-way pressure reducing valve type 3 DREP 6.. is direct operated by proportional solenoids. It is used to convert an electric input signal into a proportional pressure output signal. The proportional solenoids are controllable wet-pin DC solenoids with central thread and detachable coil. The solenoids are optionally actuated by external control electronics (type 3DREP) or by the internal control electronics (type 3DREPE).

Set-up:

The valve basically consists of:

– Housing (1) with connection surface
– Control spool (2) with pressure measuring spool (3, 4)
– Solenoids (5, 6) with central thread
– Optionally integrated control electronics (7)

Function:

The pressure in A or B is set by means of the proportional solenoids. The amount of the pressure depends on the current. With de-energized solenoids (5, 6), the control spool (2) is held in the central position by means of the pressure springs (8). Ports A and B are connected with T so that the hydraulic fluid can flow off to the tank without obstructions.

By energizing a proportional solenoid e.g. solenoid "a" (5), the pressure measuring spool (3) and with it the control spool (2) are moved to the right. This opens the connection from P to B and A to T via orifice-type cross-sections with progressive flow characteristic. The pressure that builds up in channel B acts with the surface of the pressure measuring spool (4) on the control spool and against the solenoid force. The pressure measuring spool (4) is supported by the solenoid "b". If the pressure exceeds the value set at solenoid "a", the control spool (2) is pushed back against the solenoid force and connects B with T until the set pressure is achieved again. The pressure is proportional to the solenoid current.

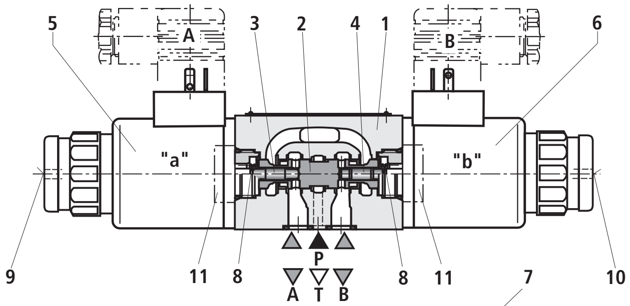
After shut-down of the solenoid, the control spool (2) is returned into the central position by the compression springs (8). An optional hand override (9, 10) allows for the displacement of the control spool (2) without solenoid energization.

☞ **Note:**

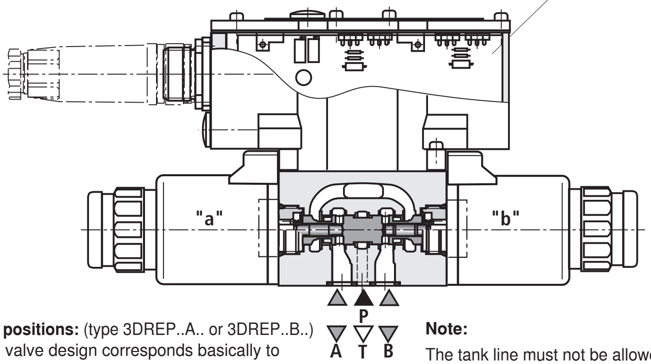
The unwanted activation of the hand override may lead to uncontrolled machine movements!

3

Type 3DREP 6..



Type 3DREPE 6..



Valve with 2 spool positions: (type 3DREP..A.. or 3DREP..B..)
The function of this valve design corresponds basically to the valve with 3 spool positions. The 2 spool position valves are, however, only equipped with solenoid "a" (5) or solenoid "b" (6). Instead of the 2nd proportional solenoid, there is a plug screw (11).

Note:

The tank line must not be allowed to run empty. With corresponding installation conditions, a pre-charge valve (pre-charging pressure approx. 2 bar) must be installed.

Technical data (For applications outside these parameters, please consult us!)

general

Valve type		3DREP	3DREPE
Weight	kg	2.0	2.2
Installation position		Any, preferably horizontal	
Storage temperature range	°C	–20 to +80	
Ambient temperature range	°C	–20 to +70	–20 to +50

hydraulic (measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Operating pressure range	Port P	bar	20 to 100 for pressure rating 16
		bar	30 to 100 for pressure rating 25
		bar	50 to 100 for pressure rating 45
	Port T	bar	0 to 30
Maximum flow		l/min	15 (Δp = 50 bar)
Hydraulic fluid			See table below
Hydraulic fluid temperature range (at the valve working ports)		°C	–20 to +80, preferably +40 to +50
Viscosity range		mm^2/s	20 to 380, preferably 30 to 46
Maximum admissible degree of contamination of the hydraulic fluid cleanliness class according to ISO 4406 (c)			Class 17/15/12 [1)]
Hysteresis		%	≤ 5
Repeatability		%	≤ 1
Response sensitivity		%	≤ 0.5
Range of inversion		%	≤ 1

[1)] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components.

For the selection of the filters see www.boschrexroth.com/filter

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons		HL, HLP	NBR, FKM	DIN 51524
Flame-resistant	– Water-containing	HFC	NBR	ISO 12922

☞ **Important information on hydraulic fluids!**

- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!
- The flash point of the process and operating medium used must be 40 K higher than the maximum solenoid surface temperature.
- **Flame-resistant – water-containing**: Maximum pressure differential per control edge 175 bar, otherwise, increased cavitation erosion!
  Tank pre-loading < 1 bar or > 20 % of the pressure differential. The pressure peaks should not exceed the maximum operating pressures!

Technical data (For applications outside these parameters, please consult us!)

electric

Valve type			3DREP	3DREPE
Voltage type			Direct voltage	
Type of signal			Analog	
Command value signal	Voltage input "A1"	V	-	±10
	Current input "F1"	mA		4 to 20
Maximum current per solenoid		A	1.5	2.5
Solenoid coil resistance	Cold value at 20 °C	Ω	5.2	2.15
	Maximum hot value	Ω	7.6	3.3
Duty cycle		%	100	
Maximum coil temperature [1]		°C	up to 150	
Protection class according DIN EN 60529/VDE 0470 part 1			IP 65 with mating connector mounted and locked	

[1] Due to the temperatures occurring at the surfaces of the solenoid coils, the European standards ISO 13732-1 and EN 982 need to be adhered to!

Control electronics

For 3DREP	Digital amplifier in Eurocard format [1]		VT-VSPD-1-2X/... according to data sheet 30523
	Analog amplifier in Eurocard format [1]		VT-VSPA2-1-2X/… according to data sheet 30110
	Analog module amplifier [1]		VT11118-1X/... according to data sheet 30218
For 3DREPE			Integrated in the valve, see page 8
	Analog command value module		VT- SWMA-1-1X/... according to data sheet 29902
	Analog command value module		VT-SWMKA-1-1X/... according to data sheet 29903
	Digital command value card		VT-HACD-1-1X/… according to data sheet 30143
	Analog command value card		VT-SWKA-1-1X/... according to data sheet 30255
Supply voltage 3DREPE, 3DREP [2]	Nominal voltage	VDC	24
	Lower limit value	V	19
	Upper limit value	V	35
Current consumption of the amplifier	I_{max}	A	1.8
	Maximum impulse current	A	3

[1] Separate order

[2] With Bosch Rexroth AG control electronics

Note: Information on the **environment simulation testing** for the areas EMC (electromagnetic compatibility), climate and mechanical load see RE 29055-U (declaration on environmental compatibility).

Block diagram of the integrated electronics (OBE) for type 3DREPE

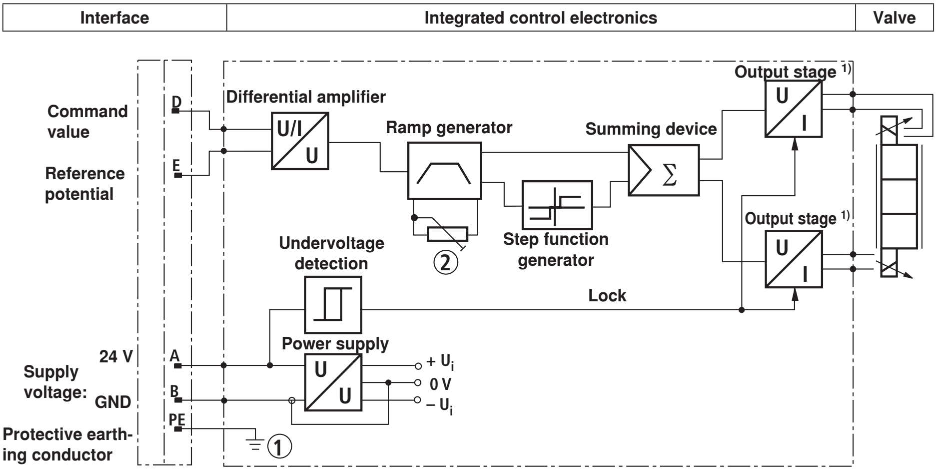
Device connector allocation	Contact	Signal with A1	Signal with F1
Supply voltage	A	24 VDC (u(t) = 19.4 to 35 V); I_{max} = 2 A	
	B	0 V	
Reference (actual value)	C	Cannot be used [1]	
Differential amplifier input	D	±10 V; R_e > 50 kΩ	4 to 20 mA; R_e > 100 Ω
(command value)	E	Reference potential command value	
	F	Cannot be used [1]	
	PE	Connected to cooling element and valve housing	

[1] Slots C and F must not be connected!

Command value: Reference potential at E and positive command value (or 12 to 20 mA) at D result in pressure in A.
Reference potential at E and negative command value (or 12 to 4 mA) at D result in pressure in B.
With valves with 1 solenoid on side b (design A):
Reference potential at E and positive command value at D (4 to 20 mA) result in pressure in A.
With valves with 1 solenoid on side a (design B):
Reference potential at E and positive command value at D (4 to 20 mA) result in pressure in B.

Connection cable: Recommendation:
– Up to 25 m line length: Type LiYCY 5 x 0.75 mm²
– Up to 50 m line length: Type LiYCY 5 x 1.0 mm²

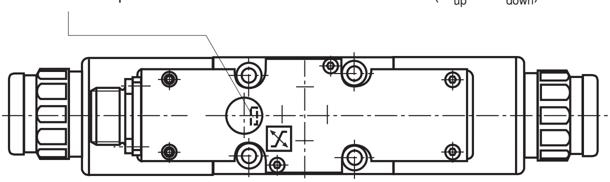
External diameter 6.5 to 11 mm
Connect shield on PE only on the supply side.



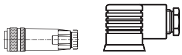
[1] Output stages current-controlled

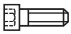
1 Protective earthing conductor screwed to valve housing and cover

2 Ramp can be set from 0 to 5 s from the outside ($T_{up} \triangleq T_{down}$)



Accessories (not included in scope of delivery)

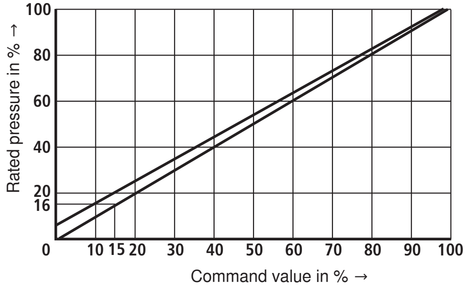
Mating connectors			**Material number**
Mating connector for **3DREP**	DIN EN 175301-803	Solenoid **a**, color gray Solenoid **b**, color black	R900074683 R900074684
Mating connector for **3DREPE** and **3DREPE...J...**	DIN EN 175201-804		e.g. R900021267 (plastic) e.g. R900223890 (metal) e.g. R900217845 (plastic 90°)
Mating connector for **3DREP...J...**	DIN EN 175201-804		R900021267 (plastic)

Hexagon socket head cap screws		**Material number**
Size 6	4 x ISO 4762 - M5 x 50 - 10.9 Tightening torque $\boldsymbol{M}_A$ = 8.9 Nm ±10 %	

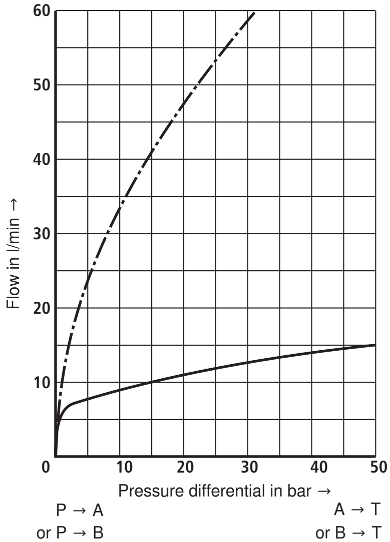
Subplates	**Data sheet**
Size 6	45052

Characteristic curves (measured with HLP 46, ϑ_{oil} = 40 °C ± 5 °C and p = 100 bar)

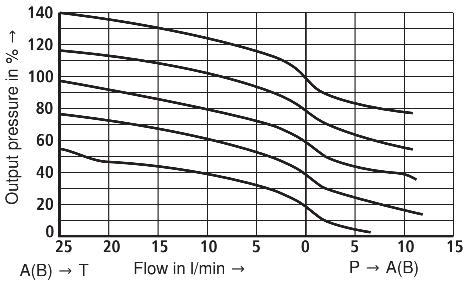
Pressure rating 16, 25 and 45 bar



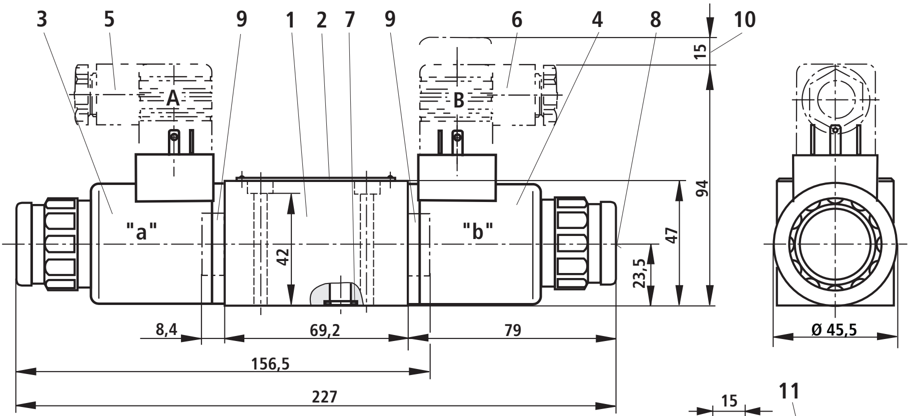
Pressure rating 16, 25 and 45 bar

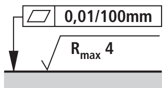


Pressure/flow dependency



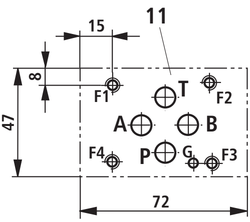
Unit dimensions: Type 3DREP (dimensions in mm)





Required surface quality of the valve mounting face

General tolerances according to ISO 2768-mK

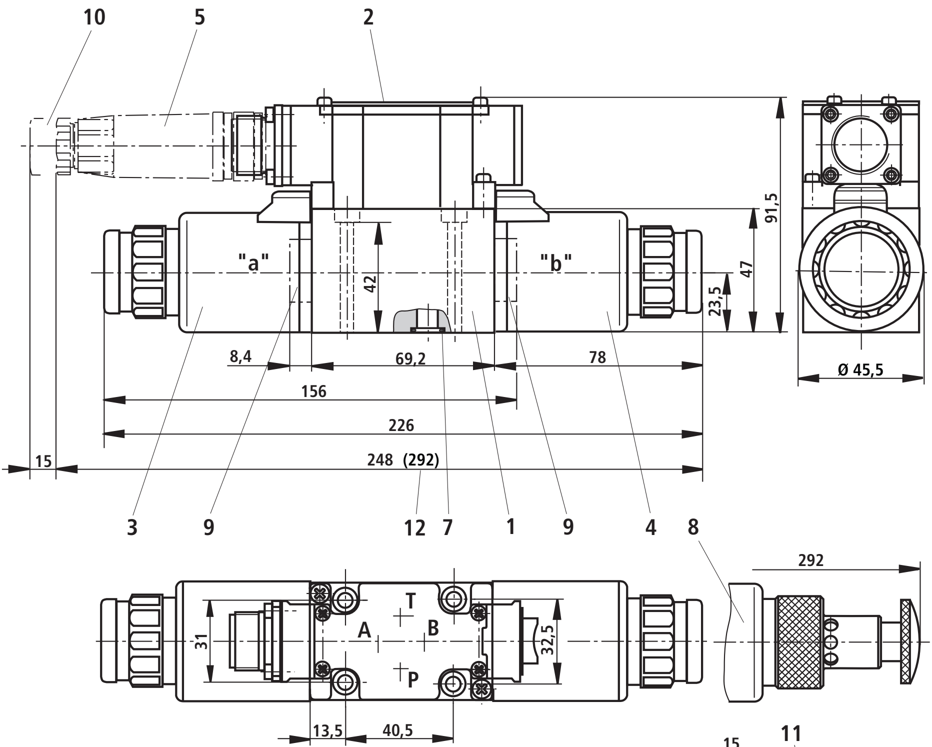


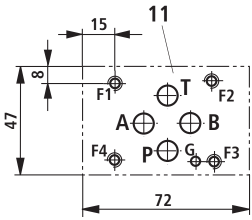
3

1 Valve housing
2 Name plate
3 Proportional solenoid "a"
4 Proportional solenoid "b"
5 Mating connector "A", color gray (order separately, see page 5)
6 Mating connector "B", color black (order separately, see page 5)
7 Identical seal rings for ports A, B, P, and T
8 Concealed manual override "N9"
9 Plug screw for valves with 1 solenoid (version "A" or "B")
10 Space required for removing the mating connector
11 Machined valve mounting face, porting pattern according to ISO 4401-03-02-0-05

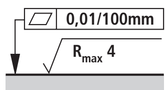
Subplates and valve mounting screws see page 7.

Unit dimensions: Type 3DREP...J - sea water-resistant (dimensions in mm)





1 Valve housing
2 Name plate
3 Proportional solenoid "a"
4 Proportional solenoid "b"
5 Mating connector (order separately, see page 5)
7 Identical seal rings for ports A, B, P, and T
8 Concealed manual override "N"
9 Plug screw for valves with 1 solenoid (version "A" or "B")
10 Space required for removing the mating connector
11 Machined valve mounting face, porting pattern according to ISO 4401-03-02-0-05
12 Dimension for version "N"

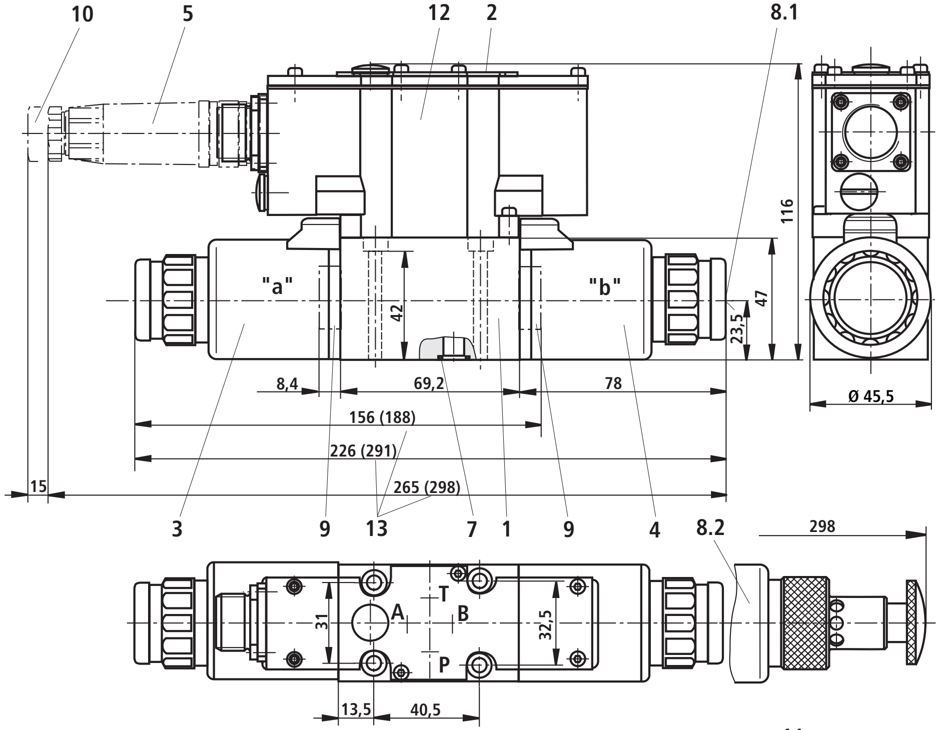


Required surface quality of the valve mounting face

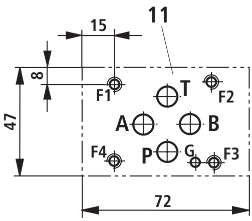
General tolerances according to ISO 2768-mK

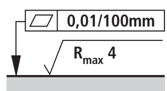
Subplates and valve mounting screws see page 7

Unit dimensions: Type 3DREPE and 3DREPE...J - sea water-resistant (dimensions in mm)



1	Valve housing
2	Name plate
3	Proportional solenoid "a"
4	Proportional solenoid "b"
5	Mating connector (order separately, see page 5)
7	Identical seal rings for ports A, B, P, and T
8.1	Concealed manual override "N9"
8.2	Manual override "N" for sea water-resistant version "J"
9	Plug screw for valves with 1 solenoid (version "A" or "B")
10	Space required for removing the mating connector
11	Machined valve mounting face, porting pattern according to ISO 4401-03-02-0-05
12	Integrated control electronics
13	Dimension ( ) for sea water-resistant version "J"





Required surface quality of the valve mounting face

General tolerances according to ISO 2768-mK

Subplates and valve mounting screws see page 7

3

Throttle insert

When using a proportional directional valve type 4WRZ..., the following throttle inserts are to be used in channel A and B:

Size	**10**	**16**	**25**	**32**	**52**
Ø in mm	1.8	2.0	2.8	–	–
Material no.	R900158510	R900158547	R900158548	–	–

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

Proportional pressure reducing valve, pilot operated

RE 29175/01.12
Replaces: 11.09

Type DRE(E) and ZDRE(E)

Size 6
Component series 1X
Maximum operating pressure 210 bar
Maximum flow 30 l/min

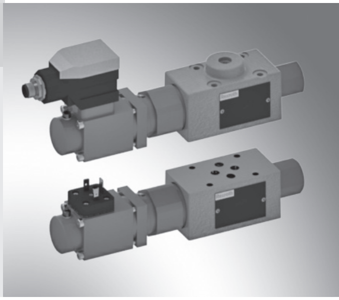


Table of contents

Information on available spare parts:
www.boschrexroth.com/spc

Features

– Pilot-operated valve for reducing the pressure in ports A and P1 with pressure limitation
– Operation by means of proportional solenoids
– For subplate mounting or sandwich plate design: Porting pattern according to ISO 4401-03-02-0-05
– Little manufacturing tolerance of the command value pressure characteristic curve due to electrical adjustment in case of operation with external control electronics
– Minimum set pressure in ports A or P1, see page 12
– Types DREE and ZDREE with integrated electronics (OBE)
– CE : With types DREE and ZDREE, the EMC directive 2004/108/EC is satisfied
  • EN61000-6-2:2011
  • EN61000-6-3:2011

Ordering code

	DRE		6		– 1X /		M	G24	

Subplate mounting = no code
Sandwich plate = Z

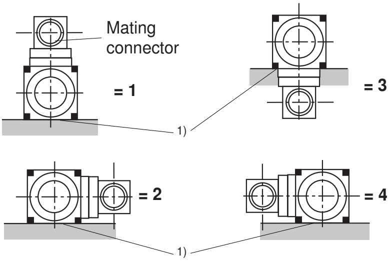
Proportional pressure reducing valve = DRE

For external control electronics = no code
With integrated electronics (OBE) = E

Size 6 = 6

Pressure reduction in channel A (subplate mounting) = no code
Pressure reduction in channel P1 (sandwich plate) = VP

Position of the mating connector (omitted in case of subplate mounting)



1) Valve mounting face
(seal ring recesses in the housing)

Component series 10 to 19 = 1X
(10 to 19: Unchanged installation and connection dimensions)

Pressure rating
50 bar = 50
100 bar = 100
210 bar = 210

Without check valve = M

Supply voltage
Direct voltage 24 V = G24

With manual override = N9
Without manual override = no code

			*

Further details in the plain text

Seal material
M = NBR seals
V = FKM seals

Interface electronics
A1 = Command value 0 to 10 V
F1 = Command value 4 to 20 mA
no code = Type (Z)DRE

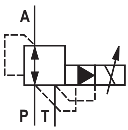
Electrical connection type DRE; ZDRE:
K4 = **Without** mating connector, with connector according to DIN EN 175301-803
Mating connector, separate order, see page 18

Type DREE; ZDREE:
K24 = **Without** mating connector, with connector M12
Cable set, separate order, see page 18

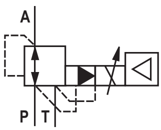
3

Symbols (1 = component side, 2 = plate side)

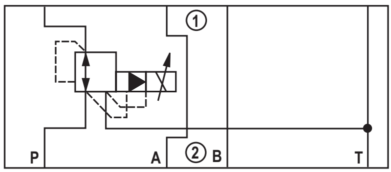
Type DRE 6…



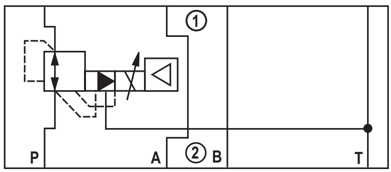
Type DREE 6…



Type ZDRE 6 VP…



Type ZDREE 6 VP…



Function, section

Valves of type DRE and ZDRE are electrically pilot operated 3-way pressure reducing valves with pressure limitation of the actuator.

They are used for reducing a system pressure.

Technical structure:

The valve consists of three main assemblies:

- Pilot control valve (1)
- Proportional solenoid (2)
- Main valve (3) with main control spool (4)

Function:

Type DRE

General function:

- Command value-dependent setting of the pressure to be reduced in channel A via the proportional solenoid (2).
- In the depressurized port P, the spring (17) holds the main control spool (4) in initial position.
- Thus, opening the connection from A to T and blocking of the connection from P to A.
- Pressure connection from port P to the ring channel (5).
- Pilot oil flows from the bore (6) to port T, via the flow controller (7), the nozzle (8) to the pilot control valve (1), the throttle gap (9) to the longitudinal groove (10) and the bores (11, 12).

Pressure reduction:

- Build-up of the pilot control pressure in the control chamber (16) as function of the command value.
- Movement of the main control spool (4) to the right, hydraulic fluid flows from P to A.
- Actuator pressure pending in port A to the spring chamber (15) via channel (13) and nozzle (14).
- Increase in the pressure in port A to the set pressure of the pilot control valve (1) leads to the movement of the main control spool (4) to the left. Pressure in port A is almost identical with the set pressure at the pilot control valve (1).

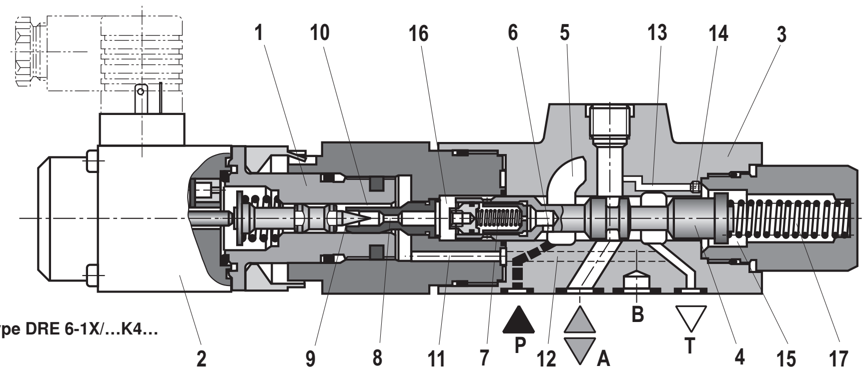
Pressure limitation:

- If the pressure in port A exceeds the set pressure of the pilot control valve (1), the main control spool (4) is moved further to the left.
- Thus, opening of the connection from A to T and limitation of the pressure pending in port A to the set command value.

Type ZDRE

In principle, the function of this valve corresponds to the function of type DRE 6.

The pressure is, however, reduced in channel P1.



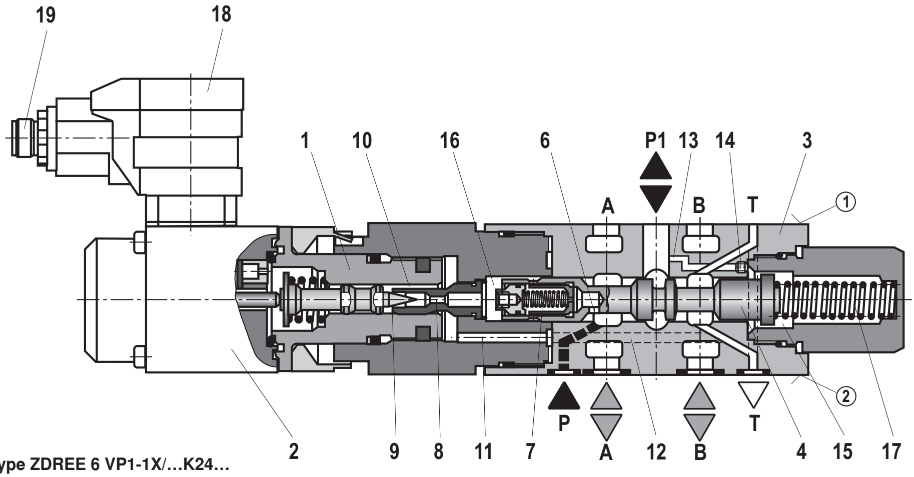
Type DRE 6-1X/…K4…

Function, section

Type (Z)DREE – with integrated electronics (OBE)

With regard to function and structure, these types correspond to type (Z)DRE. On the proportional solenoid (2), there is moreover a housing (18) with the control electronics.

Supply and command value voltage and/or command value current are applied to the connector (19).
In the factory, the command value pressure characteristic curve is adjusted with little manufacturing tolerance.



Type ZDREE 6 VP1-1X/…K24…
① = component side
② = plate side

Technical data (For applications outside these parameters, please consult us!)

general

Weight	– Type (Z)DRE 6	kg	2.0
	– Type (Z)DREE 6	kg	2.1
Installation position			Any
Storage temperature range		°C	–20 to +80
Ambient temperature range		°C	–20 to +70

hydraulic (measured with HLP 46; ϑ_{Oil} = 40 °C ± 5 °C)

Maximum operating pressure	– Port P or P2	bar	315	
	– Port P1, A, and B	bar	210	
	– Port T	bar	Separately and to the tank at zero pressure	
Maximum set pressure in channels P1 and A	– Pressure rating 50 bar	bar	50	
	– Pressure rating 100 bar	bar	100	
	– Pressure rating 210 bar	bar	210	
Minimum set pressure with command value 0 in channels P1 and A		bar	See characteristic curves page 12	
Pilot flow		l/min	0.65	
Maximum flow		l/min	30	
Hydraulic fluid			See table page 7	
Maximum admissible degree of contamination of the hydraulic fluid cleanliness class according to ISO 4406 (c)			Class 20/18/15 [1)]	
Hydraulic fluid temperature range		°C	–20 to +80	
Viscosity range		mm^2/s	15 to 380	
Hysteresis		%	±2.5 of the maximum set pressure	
Repeatability		%	< ±2 of the maximum set pressure	
Linearity	– Type (Z)DRE 6	%	±3.5 of the maximum set pressure	
Manufacturing tolerance of the command value pressure characteristic curve, related to the hysteresis characteristic curve, pressure increasing	– Type (Z)DRE 6	%	±2 of the maximum set pressure	
	– Type (Z)DREE 6	%	±3 of the maximum set pressure	
Step response $T_u + T_g$	10 % → 90 %	ms	~150	Measured with 1 liter standing hydraulic fluid column
	90 % → 10 %	ms	~150	

[1)] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components.

For the selection of the filters see www.boschrexroth.com/filter.

Technical data (For applications outside these parameters, please consult us!)

hydraulic

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons		HL, HLP	NBR, FKM	DIN 51524
Environmentally compatible	– Insoluble in water	HETG	NBR, FKM	ISO 15380
		HEES	FKM	
	– Soluble in water	HEPG	FKM	ISO 15380
Flame-resistant	– Water-free	HFDU, HFDR	FKM	ISO 12922
	– Water-containing	HFC Fuchs Hydrotherm 464 Petrofer Ultra Safe 620	NBR	ISO 12922

Important information on hydraulic fluids!

– For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!

– The flash point of the process and operating medium used must be at least 40 K higher than the maximum solenoid surface temperature.

– There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!

– **Flame-resistant - containing water:**
  - Maximum operating pressure 210 bar
  - Maximum hydraulic fluid temperature 60 °C
  - Expected service life as compared to HLP hydraulic oil 30 % to 100 %

3

electric

Supply voltage		V	24 direct voltage
Minimum control current		mA	100
Maximum control current		mA	1600
Solenoid coil resistance	– Cold value at 20 °C	Ω	5
	– Maximum hot value	Ω	7.5
Switch-on duration		%	100
Protection class of the valve according to EN 60529			IP 65 with mating connector mounted and locked

electrical, integrated electronics (OBE)

Supply voltage	Nominal voltage	VDC	24
	Lower limit value	VDC	21
	Upper limit value	VDC	35
Current consumption		A	≤ 1.5
Required fuse protection		A	2.0 time-lag
Inputs	Voltage	V	0 to 10
	Current	mA	4 to 20
Output	Actual current value	mV	1 mV ≙ 1 mA
Protection class of the valve according to EN 60529			IP 65 with mating connector mounted and locked
Electromagnetic compatibility			EN 61000-6-2: 2011-06; EN 61000-6-3: 2011-09

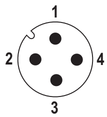
Electrical connection (dimensions in mm)

Type (Z)DREE

Device connector allocation	Contact	Assignment interface "A1"	Assignment interface "F1"
Supply voltage	1	24 VDC (u(t) = 21 V to 35 V); $I_{max} \leq 1.5$ A	
Command value input	2	0 to 10 V; R_E = 20 kΩ	4 to 20 mA; R_E = 100 Ω
Ground	3	0 V	
	4	Reference potential command value	

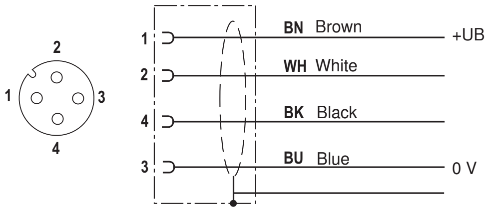
M12 plug-in connector port

Connector at the amplifier



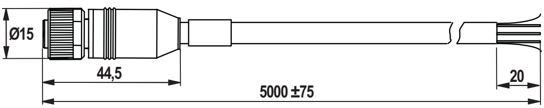
Mating connector and wire colors with pre-assembled cable set

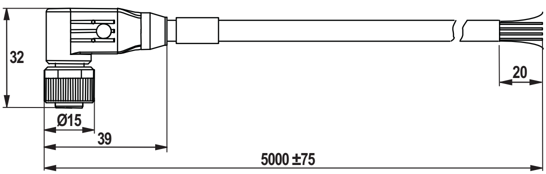
Please order the cable set separately, see page 18



The connection for protective earthing conductor is omitted

Connection cross-section:
4 x 0.75 mm² shielded
(connect shield in the control cabinet)

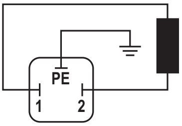




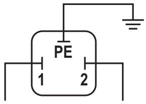
Electrical connection (dimensions in mm)

Type (Z)DRE

Connection at connector



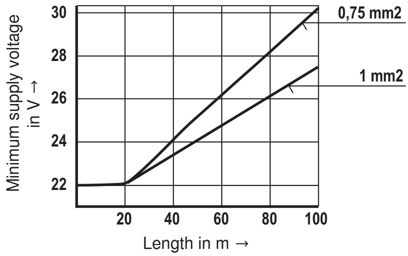
Connection at mating connector



Connection cable for type (Z)DRE

- Recommendation 6-wire, 0.75 or 1 mm² plus protective earthing conductor and shielding
- Only connect the screening to PE on the supply side
- Maximum admissible length 100 m

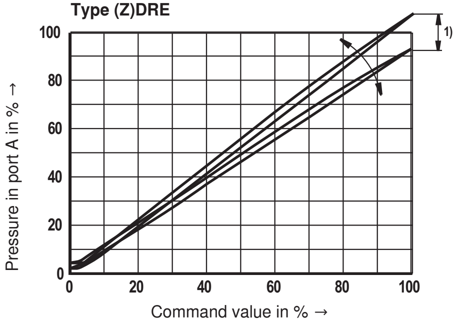
The minimum supply voltage at the power supply unit depends on the length of the supply line (see diagram).



3

Characteristic curves (measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C)

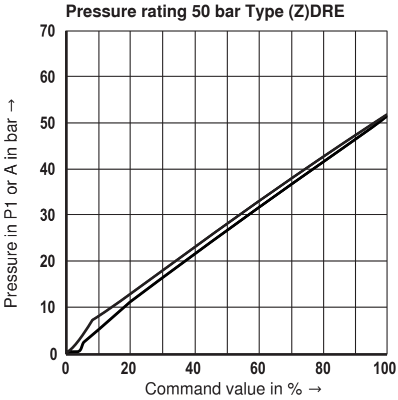
Pressure in port A depending on the command value (manufacturing tolerance)
without flow

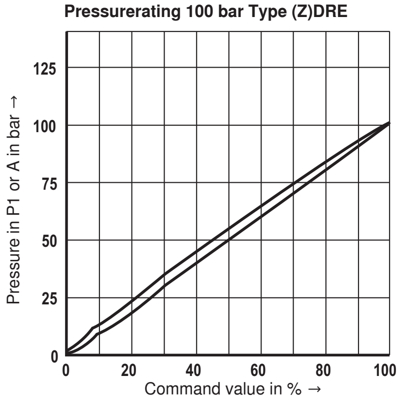


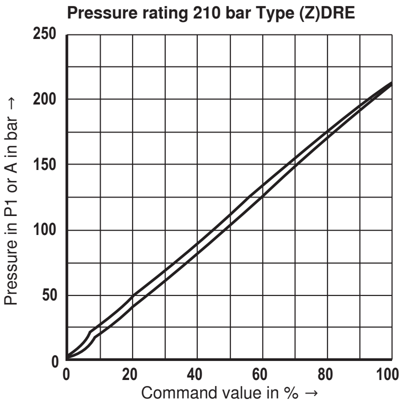
[1)] With type (Z)DRE, the manufacturing tolerance at the **external amplifier** (type and data sheet see page 7) can be adjusted using the command value attenuator potentiometer "**Gw**". With the digital amplifier, the setting is made using the "**Limit**" parameter.
In this connection, the control current according to the technical data must not be exceeded!
In order to be able to adjust several valves to the same characteristic curve, the pressure must - with a command value of 100 % - at no valve exceed the maximum set pressure of the relevant pressure rating.

Characteristic curves: Type (Z)DRE (measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C)

Type (Z)DRE: Pressure in port P1 or A depending on the command value

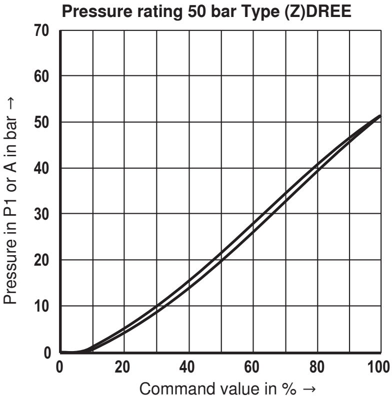


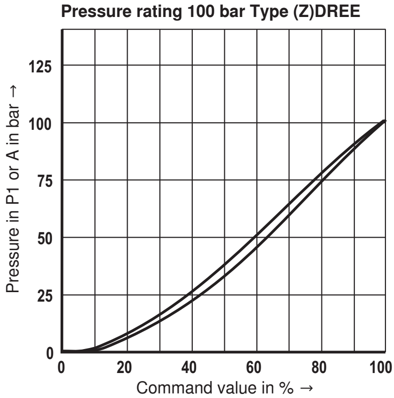


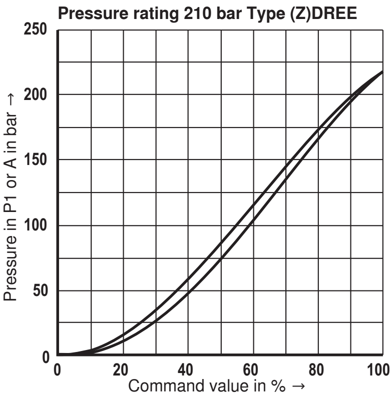


Characteristic curves: Type (Z)DREE (measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C)

Type (Z)DRE(E): Pressure in port P1 or A depending on the command value





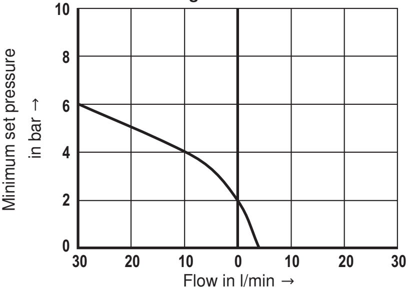


3

Characteristic curves (measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C)

Minimum set pressure in port P1 or A with command value 0 V (without counter pressure in channel T)

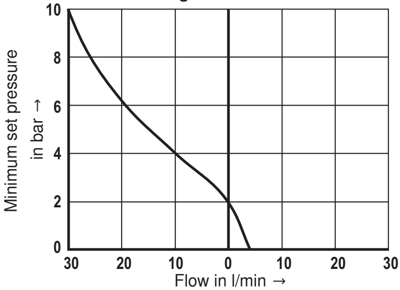
Pressure rating 50 bar



Type DRE A → T Type DRE P → A

Type ZDRE P1 → T Type ZDRE P → P1

Pressure rating 100 bar / 210 bar

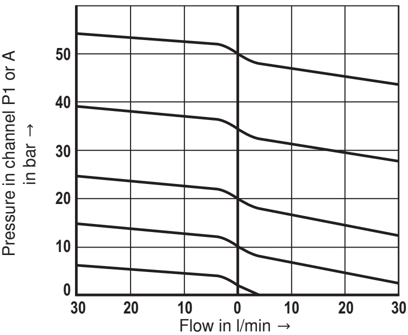


Type DRE A → T Type DRE P → A

Type ZDRE P1 → T Type ZDRE P → P1

Pressure in channel P1 or A – flow

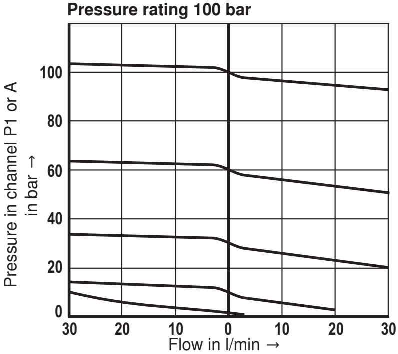
Pressure rating 50 bar



Type DRE A → T Type DRE P → A

Type ZDRE P1 → T Type ZDRE P → P1

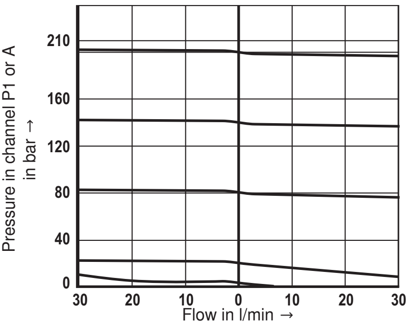
Pressure rating 100 bar



Type DRE A → T Type DRE P → A

Type ZDRE P1 → T Type ZDRE P → P1

Pressure rating 210 bar

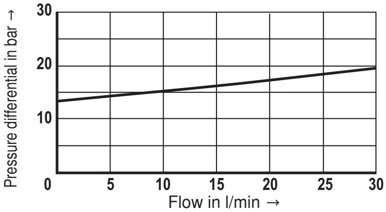


Type DRE A → T Type DRE P → A

Type ZDRE P1 → T Type ZDRE P → P1

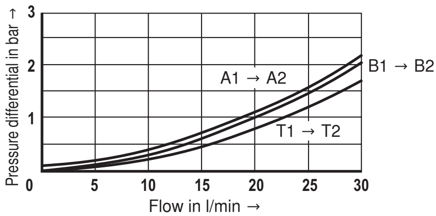
Characteristic curves (measured with HLP46, ϑ_{Oil} = 40 °C ± 5 °C)

***Δp*-*q*$_V$ characteristic curves**



Type DRE(E) P → A

Type ZDRE(E) P2 → P1

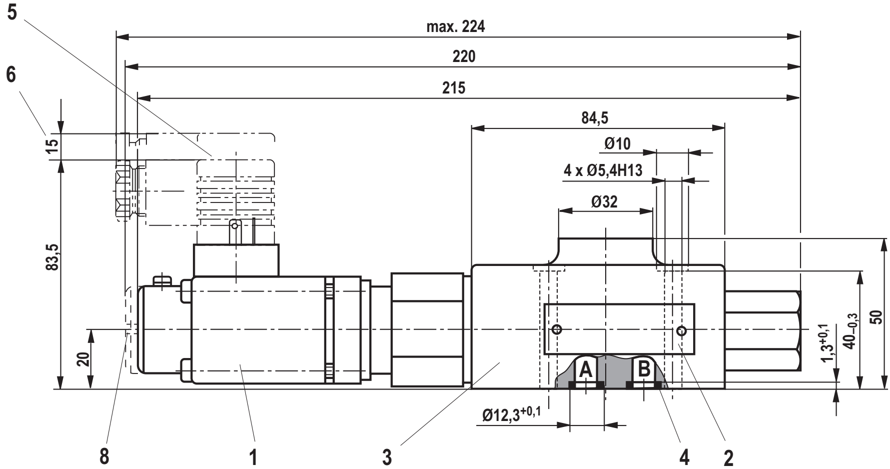


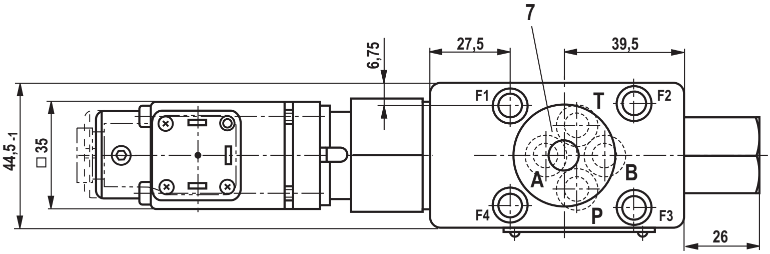
☞ **Notice!**

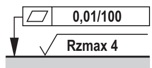
The shown Δ*p* value corresponds to the minimum pressure available in port P (P2) minus the maximum pressure to be controlled in port A(P1).

3

Unit dimensions: Type DRE (dimensions in mm)





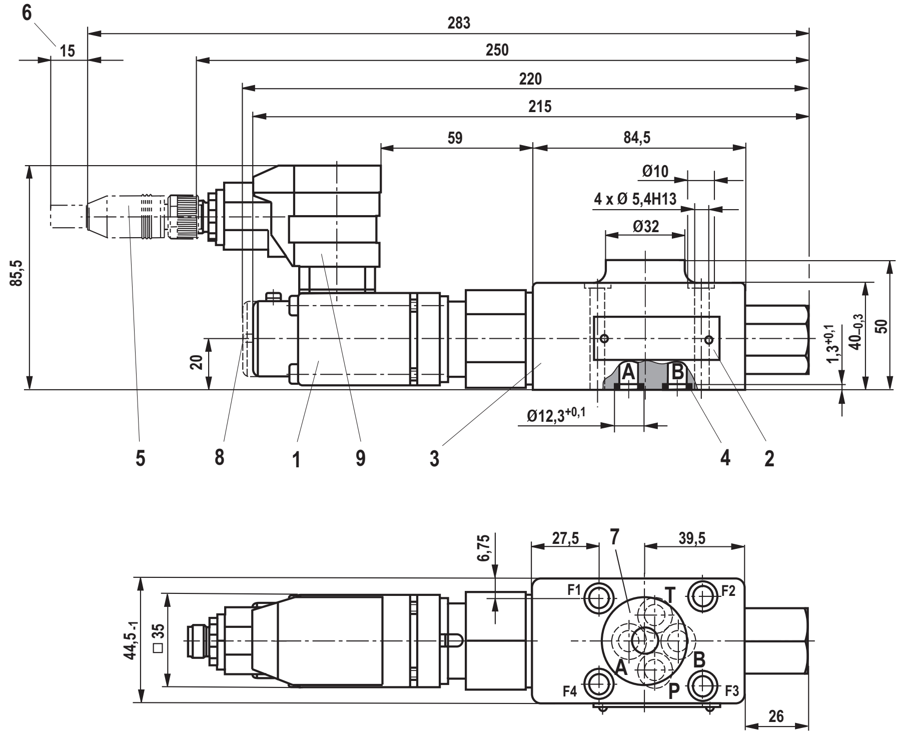


Required surface quality of the valve contact surface

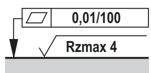
1 Proportional solenoid **without** manual override
2 Name plate
3 Valve housing
4 Identical seal rings for ports A, B, P, and T
5 Mating connector, separate order, see page 18
6 Space required to remove the mating connector
7 Porting pattern according to ISO 4401-03-02-0-05
8 Proportional solenoid **with** manual override

Subplates and valve mounting screws see page 18

Unit dimensions: Type DREE (dimensions in mm)



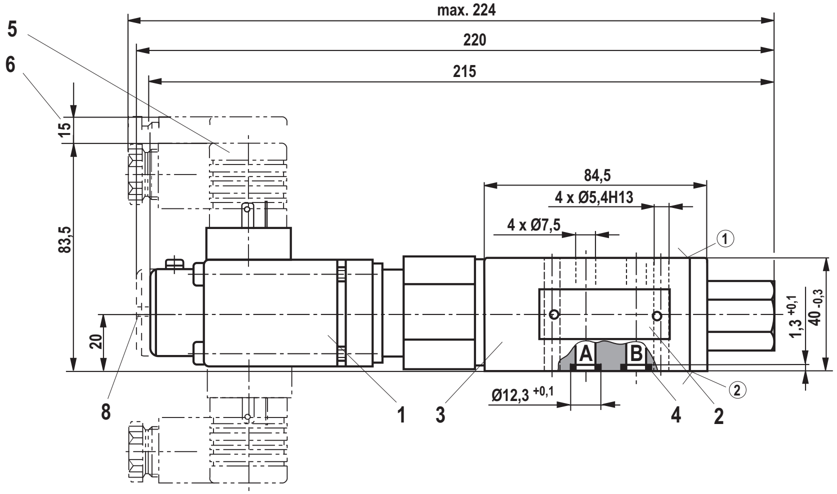
1 Proportional solenoid **without** manual override
2 Name plate
3 Valve housing
4 Identical seal rings for ports A, B, P, and T
5 Mating connector, separate order, see page 18
6 Space required to remove the mating connector
7 Porting pattern according to ISO 4401-03-02-0-05
8 Proportional solenoid **with** manual override
9 Integrated electronics (OBE)

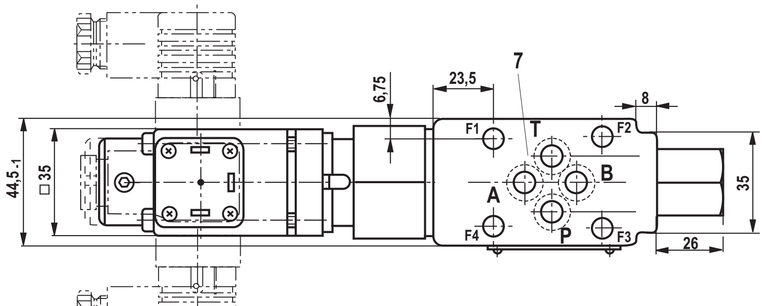


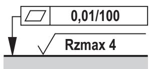
Required surface quality of the valve contact surface

Subplates and valve mounting screws see page 18

Unit dimensions: Type ZDRE (dimensions in mm)





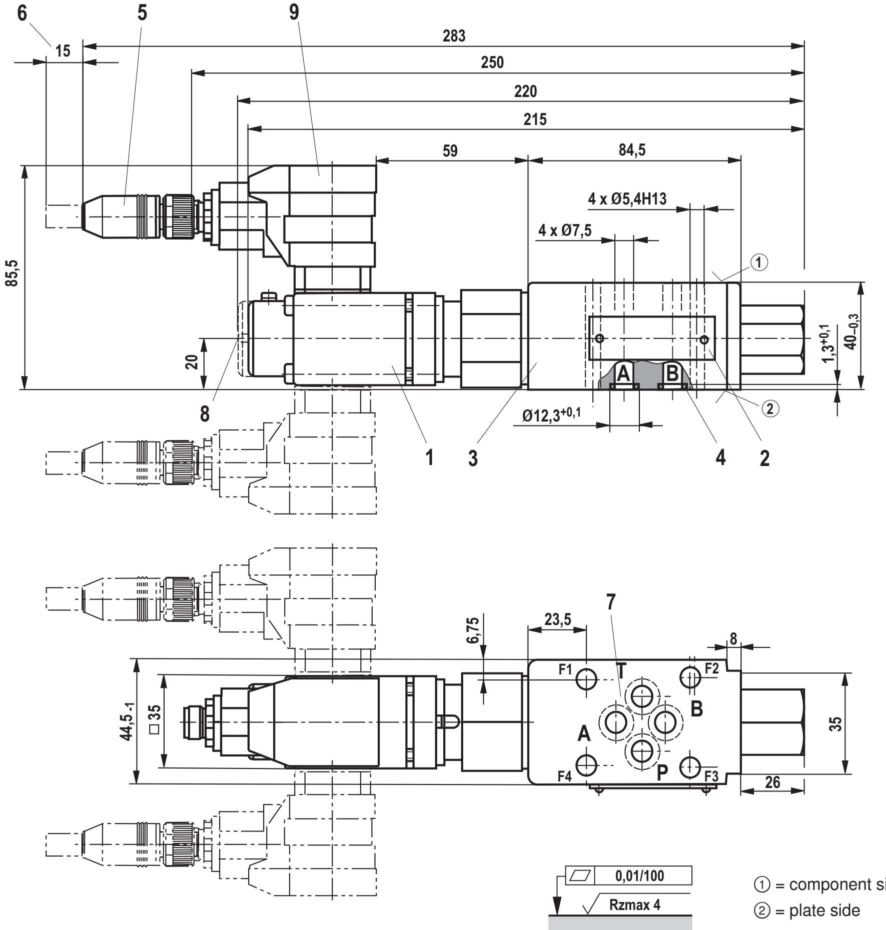


Required surface quality of the valve contact surface

① = component side
② = plate side

Item explanations see type DRE page 14, subplates and valve mounting screws see page 18

Unit dimensions: Type ZDREE (dimensions in mm)



① = component side
② = plate side

Required surface quality of the valve contact surface

Item explanations see type DREE page 15, subplates and valve mounting screws see page 18

Unit dimensions

Hexagon socket head cap screws		**Material number**
Type DRE(E)	4x ISO 4762 - M5 x 50 - 10.9-flZn-240h-L (Friction coefficient μ_{total} = 0.09 to 0.14) Tightening torque M_A = 7 Nm ±10 %	
Type ZDRE(E)	4x ISO 4762 - M5 - 10.9-flZn-240h-L (Friction coefficient μ_{total} = 0.09 to 0.14) Tightening torque M_A = 7 Nm ±10 %	

Notice: The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure!

Subplates	**Data sheet**
Size 6	45052

Accessories (not included in the scope of delivery)

Proportional amplifier for type (Z)DRE	**Data sheet**	**Material number**
VT-MSPA1-10 in modular design	30223	R901142355
VT-VSPD-1 in Euro-card format	30523	R901077287
VT-VSPA1-10 in Euro-card format	30100	R901152628

Mating connector for type (Z)DRE	**Data sheet**	**Material number**
Mating connector (black) DIN EN 175301-803	08006	R901017011

Cable sets for type (Z)DREE		**Material number**
Cable set VT-SSPA1-1X/M12/1/V00	assembled cable with straight mating connector	R901241656
Cable set VT-SSPA1-1X/M12/2/V00	assembled cable with angular mating connector	R901241651

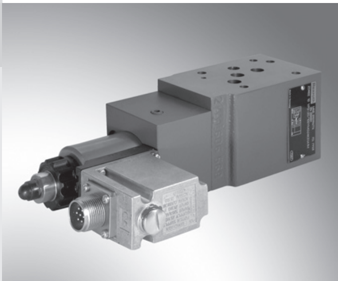
Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

Proportional pressure reducing valve, pilot operated

RE 29279/12.10
Replaces: 01.09

Types ZDRE; ZDREE

Size 10
Component series 2X
Maximum pressure setting 315 bar
Maximum flow 80 l/min



TB0220

Table of contents

Features

– Pilot operated valve for reducing a system pressure
– Actuation by proportional solenoid, which can be rotated
– Sandwich plate design
– Porting pattern to DIN 24340-A and ISO 4401
– 4 pressure ratings
– Valve and control electronics from a single source
– External control electronics for type ZDRE
– Linear command value/pressure characteristic curve
– Integrated electronics (OBE) with type ZDREE, with low manufacturing tolerance of the command value/pressure characteristic curve

Information on available spare parts:
www.boschrexroth.com/spc

Ordering code

Z	DRE		10	VP	2	–2X /		M	G24				*

Sandwich plate = **Z**

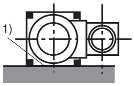
Proportional pressure reducing valve = **DRE**

For external electronics = **No code**
With integrated electronics = **E**

Size 10 = **10**

Pressure reduction in channel P1 = **VP**

Preferred position of mating connector = **2**



The mating connector can be brought to the desired position after the nut was loosened
(see page 13)

[1] Valve contact face
(O-ring recesses in the housing)

Component series 20 to 29 = **2X**
(20 to 29: unchanged installation and connection dimensions)

Pressure rating

Up to 50 bar	= **50**
Up to 100 bar	= **100**
Up to 200 bar	= **200**
Up to 315 bar	= **315**

Pilot oil supply/drain

Y = Pilot oil supply for directional valve from port P2, external pilot oil drain for directional valve and ZDRE

XY = External pilot oil supply for directional valve, external pilot oil drain for directional valve and ZDRE

L = Pilot oil supply for directional valve from P2, internal pilot oil drain for directional valve and external for ZDRE

XL = Pilot oil supply from P2 to X is plugged (direct operated directional valve needs **no** pilot oil), pilot oil drain of directional valve is plugged (direct operated directional valve needs **no** pilot oil drain), external pilot oil drain for ZDRE

Note: If no pilot oil supply is provided on the subplate, use sandwich plate HSZ 10 B097-3X/M01 for the supply.

M = Without check valve

Supply voltage of control electronics

G24 = DC voltage 24 V

Electrical connection

for ZDRE

K4 = **Without** mating connector, with component plug to DIN EN 175301-803

for ZDREE

K31 = **Without** mating connector, with component plug to DIN EN 175201-804

Electronics interface

A1 = Command value 0 to 10 V
F1 = Command value 4 to 20 mA
No code = For ZDRE

Seal material

M = NBR seals,
V = FKM seals

Further details in clear text

Accessories (not included in scope of supply)

– Sandwich plate with X and Y port
(for details, see page 3)
Type HSZ 10 B097-3X/M01
Material no.: **R900320785**

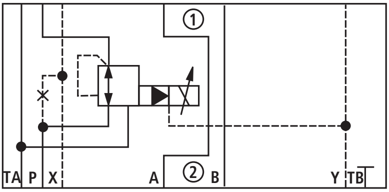
– Subplates to data sheet RE 45054
  • G 535/01 (G3/4), Material no. **R900476061**
  • G 536/01 (G1), Material no. **R900476059**

– External control for type ZDRE:
  • Analog amplifier VT-MSPA1-11-1X/V0 of modular design to data sheet RE 30223
  • Digital amplifier VT-VSPD-1-2X/V0/.-0-1 of Euro-card format to data sheet RE 30523
  • Analog amplifier VT-VSPA1-11-1X/V0/0 of Euro-card format to data sheet RE 30100

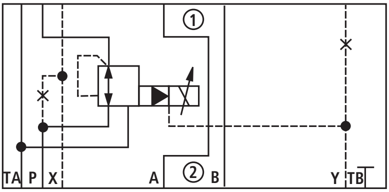
– Mating connectors (for details, see page 8)
  • For ZDRE: to DIN EN 175301-803, Material no. **R901017011**
  • For ZDREE: to DIN EN 175201-804, Material no. **R900021267** or **R900223890**

Symbols (① = component side, ② = plate side)

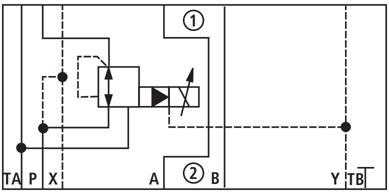
Type ZDRE



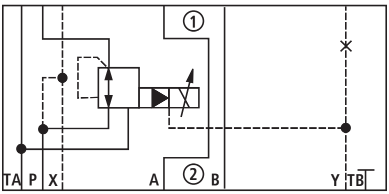
Type ZDRE10VP…**XY**



Type ZDRE10VP…**XL**

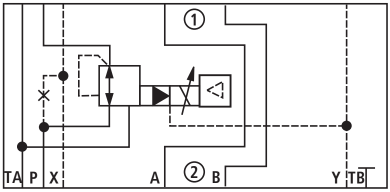


Type ZDRE10VP…**Y**

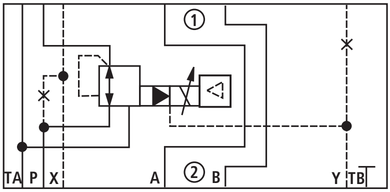


Type ZDRE10VP…**L**

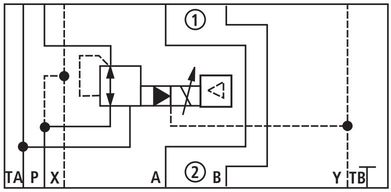
Type ZDREE



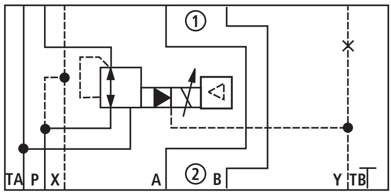
Type ZDREE10VP…**XY**



Type ZDREE10VP…**XL**

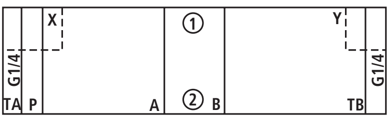


Type ZDREE10VP…**Y**



Type ZDREE10VP…**L**

Type sandwich plate HSZ



Sandwich plate HSZ 10 B097-3X/M01

- Dimensions (length x width x height): 100 x 70 x 30 mm
- Weight: 2.5 kg
- Size of ports X and Y: G1/4
- Dimensional sheet no.: R900262648

3

Function, section

Type ZDRE

Valves of type ZDRE... are pilot operated pressure reducing valves of sandwich plate design in 3-way variant, i.e. with pressure limitation of the actuator pressure.

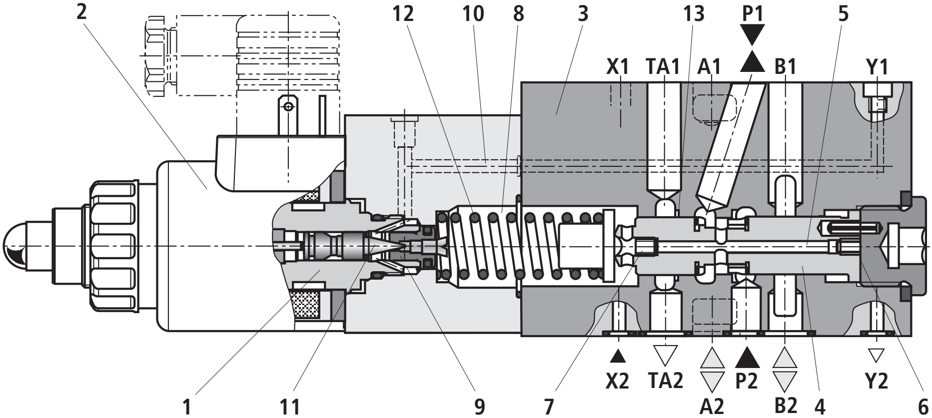
They are used for reducing a system pressure.

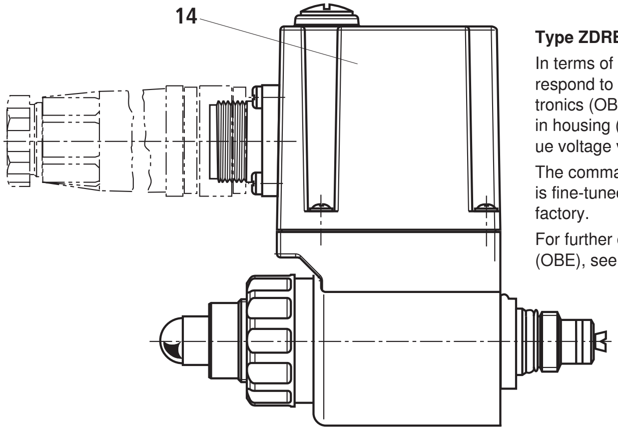
They basically consist of pilot part (1) with proportional solenoid (2), main valve (3) and control spool (4). The pressure in channel P1 is adjusted in dependence on the command value via proportional solenoid (2).

In the rest position, i.e. when no pressure is present in channel P2, control spool (4) opens the connection from channel P2 to P1.

The pressure in channel P1 acts via bore (5) onto spool area (6). The pilot oil for the pilot valve is taken from channel P1 and flows via bore (5), orifice (7), to spring chamber (8). From there, it is fed via valve seat (9), bore (10) and Y-line back to the tank.

The pressure required in channel P1 is pre-selected on the associated amplifier. The proportional solenoid moves valve poppet (11) towards valve seat (9) and increases the pressure in spring chamber (8). Thus, the pressure in both chambers (6) and (8) is balanced, and compression spring (12) pushes spool (4) to the right in the opening direction P2 to P1. As soon as actuator pressure P1 has increased to the value set on the pilot valve, valve poppet (11) opens and limits the pressure in spring chamber (8). Control spool (4) now moves to the left to the control position. When actuator pressure P1 exceeds the value set on the pilot valve, the control spool is pushed further to the left. It closes the connection from P2 to P1 and opens the connection P1 to tank TA1 at control land (13) until this pressure falls again to the set value.





Type ZDREE – with integrated electronics (OBE)

In terms of function and structure, these valves correspond to type ZDRE, except for the integrated electronics (OBE). The electronics (OBE) accommodated in housing (14) receives its supply and command value voltage via the mating connector.

The command value/pressure characteristic curve is fine-tuned with low manufacturing tolerance in the factory.

For further details on the integrated electronics (OBE), see page 9.

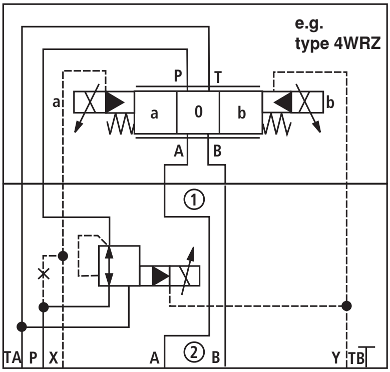
Pilot oil supply for directional valve mounted above

Notes

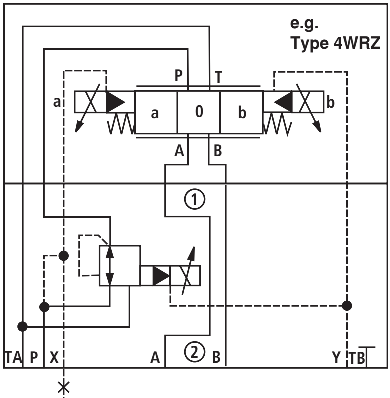
- On the **direct operated** directional valve, the seals for ports X and Y are missing on the connection faces of the housing. To prevent hydraulic fluid from flowing out, the pilot oil supply from P2 to X and the pilot oil drain between the directional valve and the ZDRE(E) must be plugged (variant XL).
- Leakage through the spool clearance from P to B can result in pressure building up in channel B!
- A **pilot operated** proportional directional valve in conjunction with the ZDRE(E) must have an **external pilot oil supply**.

On variants XY and XL the connection between P2 and X is plugged.

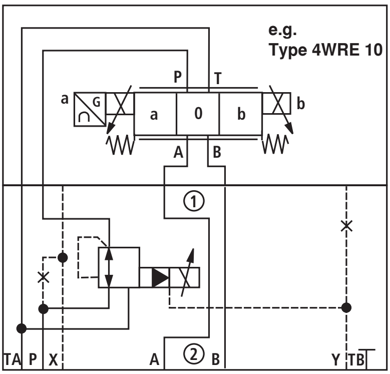
On variants Y and L port X must be plugged on the subplate.



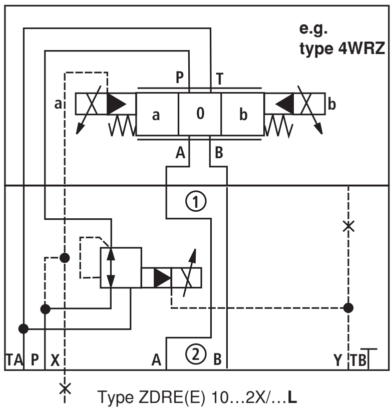
Type ZDRE(E) 10…2X/…**XY**



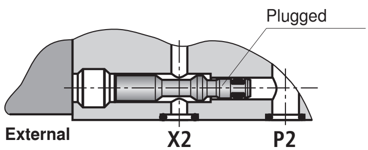
Type ZDRE(E) 10…2X/…**Y**

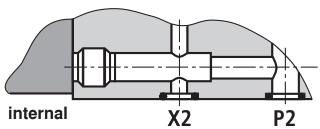


Type ZDRE(E) 10…2X/…**XL**



Type ZDRE(E) 10…2X/…**L**





Technical data (for applications outside these parameters, please consult us!)

General

Weight	ZDRE	kg	5.1
	ZDREE	kg	5.2
Installation orientation			Preferred orientation of the proportional solenoid: pointing downwards or horizontal
Storage temperature range		°C	–20 to +80
Ambient temperature range	ZDRE	°C	–20 to +70
	ZDREE	°C	–20 to +50

Hydraulic (measured with HLP 46; ϑ_{oil} = 40 °C ± 5 °C)

Maximum operating pressure	Port P1	bar	315	The pressure in an P2 must be about 20 bar higher than the required set pressure, which is to be achieved in P1.
	Ports P2; A; B; X	bar	350	
	Port T	bar	250	
	Port Y or L		Line separately and at zero pressure to tank	
Maximum set pressure in port P1	Pressure rating 50 bar	bar	50	
	Pressure rating 100 bar	bar	100	
	Pressure rating 200 bar	bar	200	
	Pressure rating 315 bar	bar	315	
Min. set pressure in channel P1 with zero command value		bar	See $p_{E\ min}$-q_v characteristic curve on page 12	
Permissible max. flow		l/min	80	
Pilot flow		l/min	0.6 to 0.9	
Hydraulic fluid			Mineral oil (HL, HLP) to DIN 51524, further hydraulic fluids on request	
Hydraulic fluid temperature range		°C	–20 to +80	
Viscosity range		mm^2/s	15 to 380	
Permissible max. degree of contamination of the hydraulic fluid - cleanliness class to ISO 4406 (c)			Class 20/18/15 [1]	
Hysteresis		%	±3 of maximum set pressure	
Repeatability		%	< ±2 of maximum set pressure	
Linearity		%	±3.5 of maximum set pressure	
Manufacturing tolerance of command value/pressure characteristic curve, referred to hysteresis characteristic curve	ZDRE [2]	%	±5 of set max. pressure	
	ZDREE [3]	%	±1.5 of set max. pressure	
Step response $T_u + T_g$	10 → 90%	ms	~160	Measured with 5 liters of a standing hydraulic fluid column in port P1
	90 → 10%	ms	~160	

[1] The cleanliness classes specified for components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and, at the same time, prolongs the service life of components.
For the selection of filters, see data sheets RE 50070, RE 50076, RE 50081, RE 50086 and RE 50088.

[2] For details, see page 10

[3] Adjustment in the factory

Technical data (for applications outside these parameters, please consult us!)

Electrical

Minimum solenoid current		mA	100
Maximum solenoid current		mA	1600 ± 10 %
Solenoid coil resistance	Cold value at 20 °C	Ω	5.5
	Max. warm value	Ω	8.05
Duty cycle		%	100

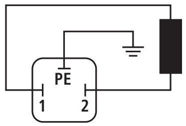
Electrical, integrated electronics (OBE)

Supply voltage	Nominal voltage	VDC	24
	Lower limit value	VDC	21
	Upper limit value	VDC	35
Current consumption		A	≤ 1.5
Required fuses		A	2, slow-blowing
Inputs	Voltage	V	0 to 10
	Current	mA	4 to 20
Output	Actual current value	mV	1 mV ≙ 1mA
Type of protection of the valve to EN 60529			IP 65 with mating connector mounted and locked

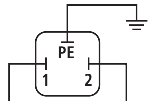
Electrical connection (dimensions in mm)

ZDRE

Connection to component plug

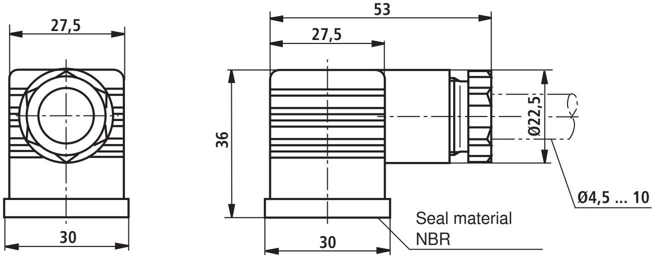


Connection to mating connector



to amplifier

Mating connector (black) to
DIN EN 175301-803
Material no. **R901017011**
(separate order)

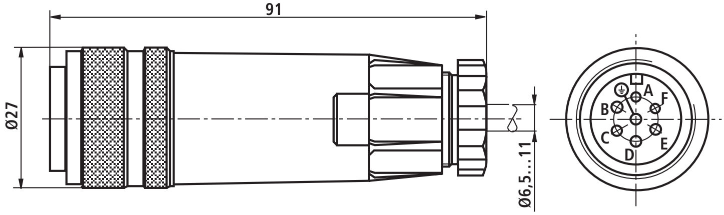


ZDREE

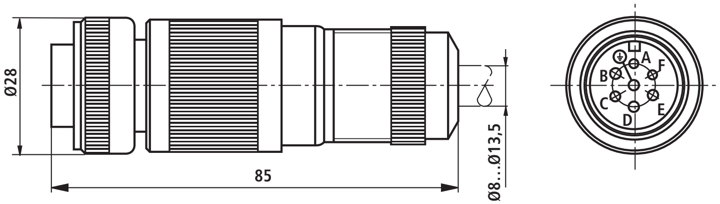
Component plug pinout	Contact	Pinout of interface "A1"	Pinout of interface "F1"
Supply voltage	A	24 VDC (u(t) = 21 V to 35 V); $I_{max} \leq$ 1.5 A	
	B	0 V	
Actual value reference potential	C	Reference contact F; 0 V	Reference contact F; 0 V
Differential amplifier input	D	0 to 10 V; R_i = 100 kΩ	4 to 20 mA; R_i = 100 Ω
	E	Command value reference potential	
Measurement output (actual value)	F	0 to 1.6 V actual value (1 mV ≙ 1 mA) Load resistance > 10 kΩ	
	PE	Connected to solenoid and valve housing	

Mating connectors to DIN EN 175201-804, soldered contacts for cable cross-section 0.5 to 1.5 mm²

Plastic variant,
Material no. **R900021267,**
(separate order)



Metal variant,
Material no. **R900223890**
separate order

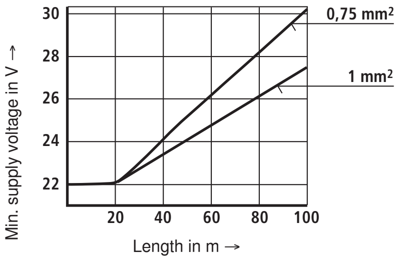


Electrical connection

Connection cable for ZDREE

- Recommendation: 6-wire, 0.75 or 1 mm^2 plus protective earth conductor and shield
- Connect shield only on the supply side to PE
- Permissible max. length 100 m

The minimum supply voltage on the power supply unit depends on the length of the supply cable (see diagram).



Integrated electronics (OBE) of type ZDREE

Function

Power supply to electronics via connections A and B. The command value is applied to differential amplifier connections D and E.

The characteristic curve generator adapts the command value/solenoid current characteristic curve to the valve so that non-linearities in the hydraulics are compensated for and a linear command value/pressure characteristic curve is obtained.

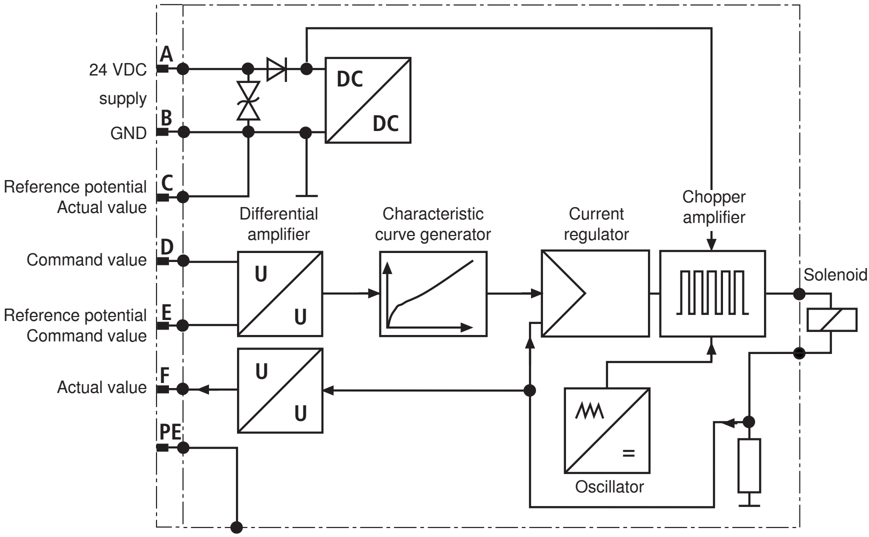
The current regulator regulates the solenoid current independently of the solenoid coil resistance.

A chopper amplifier with a clock frequency of ca. 180 Hz to 400 Hz forms the power output stage of the electronics for controlling the proportional solenoid. The output signal is pulse-width-modulated (PWM).

For testing the solenoid current, a voltage, which is proportional to the solenoid current, can be measured between pin F(+) and pin C(–) on the plug-in connector. **1 mV** corresponds to a solenoid current of **1 mA**.

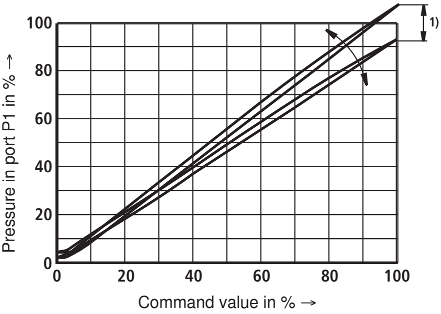
3

Block circuit diagram



Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

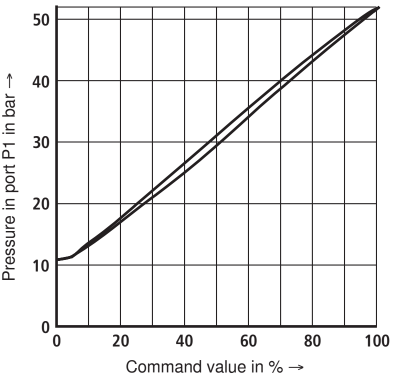
Reduced pressure in port P1 in dependence upon the command value (manufacturing tolerance)



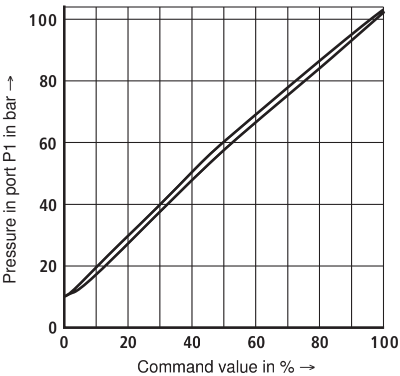
1) For valve ZDRE the tolerance can be modified on the **external amplifier** (for type and data sheet, see page 2) using command value attenuator potentiometer "**Gw**" . The digital amplifier can be adjusted by means of parameter "Limit".
Here, the control current specified in the technical data must not be exceeded.
In order that several valves can be matched to the same characteristic curves, the pressure at a command value of 100 % must not be set higher than the maximum pressure setting of the pressure rating.

Pressure in port P1 in dependence upon the command value (at flow 0 l/min)

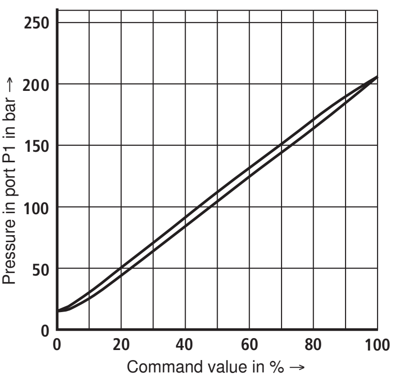
Pressure rating 50 bar



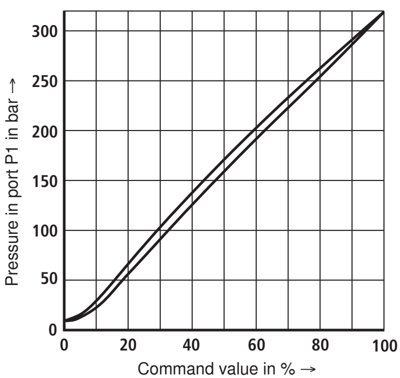
Pressure rating 100 bar



Pressure rating 200 bar

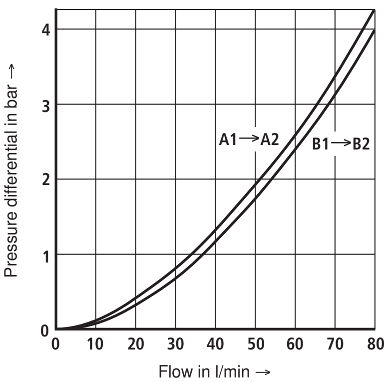


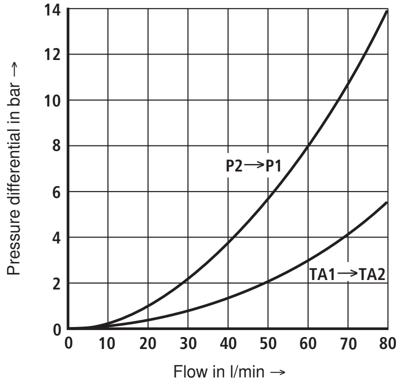
Pressure rating 315 bar



Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

Pressure differential in dependence upon the flow

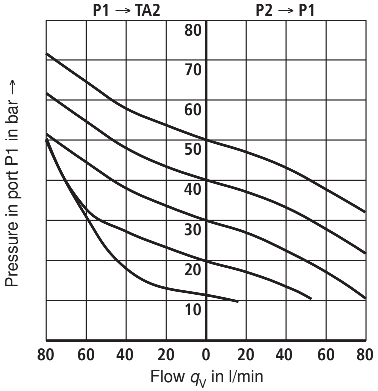




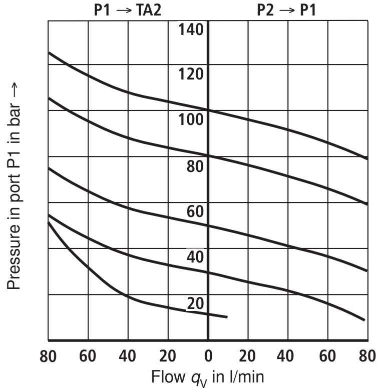
Characteristic curves (measured with HLP46, $\vartheta_{\mathbf{oil}}$ = 40 °C ± 5 °C)

Pressure in port P1 in dependence upon the flow

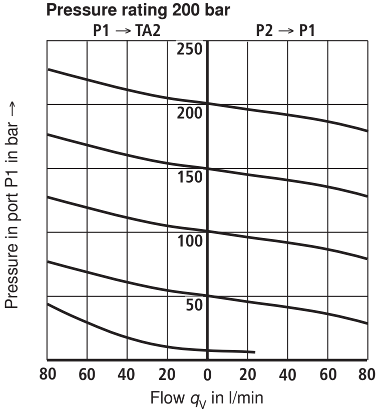
Pressure rating 50 bar



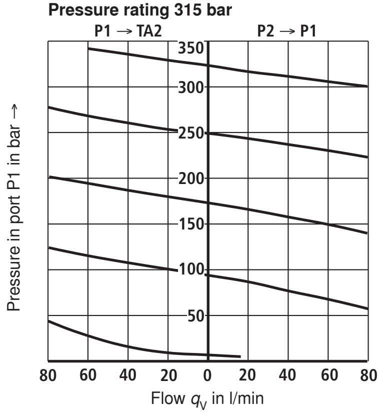
Pressure rating 100 bar



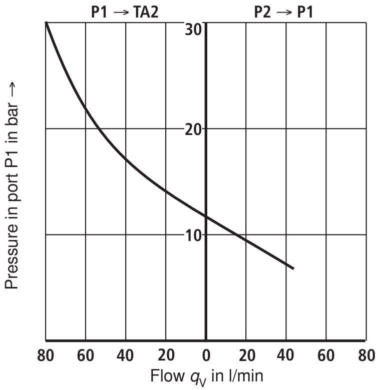
Pressure rating 200 bar



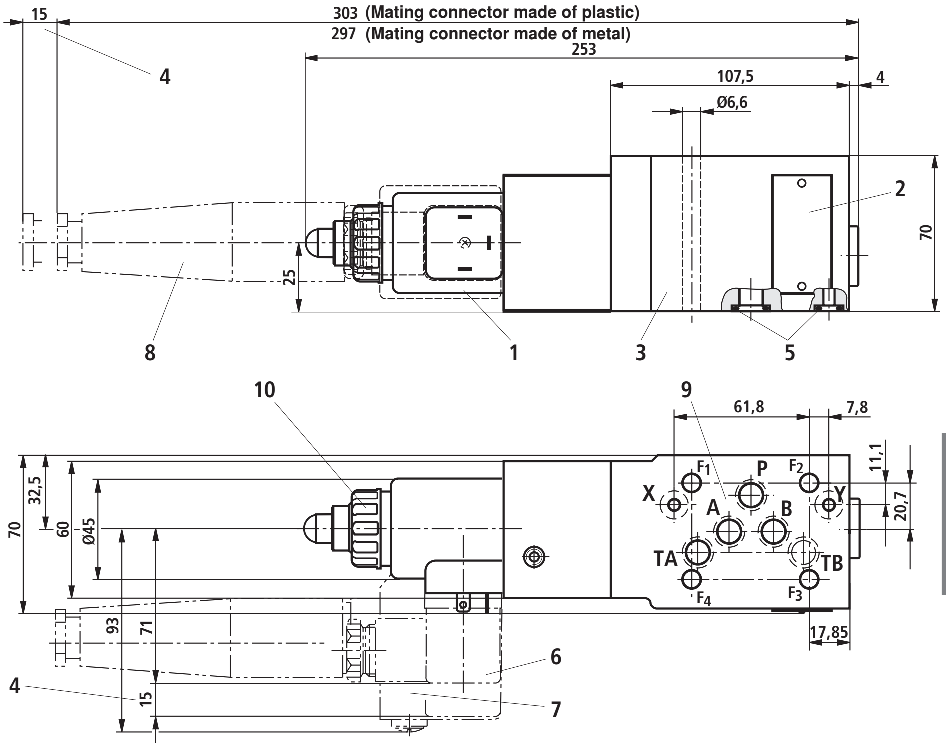
Pressure rating 315 bar



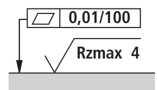
Min. set pressure in dependence upon the flow at zero command value



Unit dimensions (dimensions in mm)



1 Solenoid coil
2 Nameplate
3 Valve housing
4 Space required to remove mating connector
5 Identical seal rings for ports A2, B2, P2, TA2, TB2
Identical seal rings for ports X2, Y2
6 Mating connector for type ZDRE
(separate order)
7 Integrated electronics (type ZDREE) with component plug
8 Mating connector for type ZDREE,
plastic or metal variant,
(separate order)
9 Porting pattern to DIN 24340-A10
and ISO 4401-05-05-0-05 (X, Y as required)
10 O-ring and plastic nut A/F 32 for coil mounting
The nut can be loosened by turning it counter-clockwise (1 turn). The solenoid coil can then be rotated to the desired position and fixed by tightening the nut.
Tightening torque: 4+1 Nm



Required surface quality
of valve mounting face

Valve mounting screws

4 hexagon socket head cap screws ISO 4762-M6-10.9-flZn-240h-L
(Friction coefficient μ_{total} = 0.09 to 0.14);
tightening torque M_T = 12.5 Nm ± 10 %

or

4 hexagon socket head cap screws ISO 4762-M6-10.9
(Friction coefficient μ_{total} = 0.12 to 0.17);
tightening torque M_T = 15.5 Nm ± 10 %

Screw length as required

3

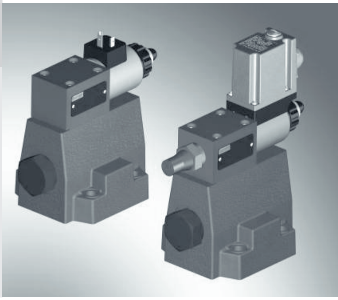
Notes

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

Proportional pressure reducing valve, pilot operated

RE 29276/03.11
Replaces: 01.10

Type DRE(M) and DRE(M)E



Sizes 10 and 25 1)
Component series 6X

Maximum operating pressure	315 bar
Maximum flow	300 l/min

Table of contents

1) Size 32 see data sheet RE 29278

Information on available spare parts:
www.boschrexroth.com/spc

Features

– Valve for reducing an operating pressure
– Operation by means of proportional solenoids
– Proportional solenoid with rotatable and detachable coil
– For subplate mounting:
  Porting pattern according to ISO 5781,
  Subplates according to data sheet RE 45062
  (separate order), see page 11
– Third path A to Y (Ø 7.5 mm)
– Minimum setting pressure 2 bar with command value zero
– Linearized command value-pressure characteristic curve
– Good transient response
– Optional check valve between A and B
– Maximum pressure limitation optional
– Type DRE(M)E with integrated electronics (OBE):
  • Little manufacturing tolerance of the command value-pressure characteristic curve

Ordering code

DRE			–6X/	Y		G24					*

without maximum pressure limitation = **no code**
with maximum pressure limitation [1)] = **M**

For external control electronics = **no code**
with integrated electronics (OBE) = **E**

Size 10 = **10**
Size 25 = **20**

Component series 60 to 69 = **6X**
(60 to 69: Unchanged installation and connection dimensions)

Pressure rating
50 bar = **50**
100 bar = **100**
200 bar = **200**
315 bar = **315**

Pilot oil return always external separately and at zero pressure to the tank = **Y**

with check valve between A and B = **no code**
without check valve = **M**

Supply voltage of the control electronics
G24 = Direct voltage 24 V

no code = 1600 mA design
- 8 = 800 mA design [2)]

Electrical connection
for DRE(M):
K4 = without mating connector, with connector according to DIN EN 175301-803
Mating connector - separate order see page 8
for DRE(M)E:
K31 = without mating connector, with connector according to DIN EN 175201-804
Mating connector - separate order see page 8

Interface electronics
A1 = Command value 0 to 10 V
F1 = Command value 4 to 20 mA
no code = with DRE

Seal material
M = NBR seals
V = FKM seals

Further details in the plain text

Accessories (not included in scope of delivery)

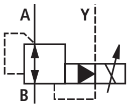
– External control for type DRE (only standard version G24 (1.6 A solenoid)):
  • Analog amplifier VT-MSPA1-11-1X/ in modular design according to data sheet RE 30223
  • Digital amplifier VT-VSPD-2 in Eurocard format according to data sheet RE 30523
  • Analog amplifier VT-VSPA1-11-1X/ in Eurocard format according to data sheet RE 30100
  • Proportional plug-in amplifier VT-SSPA1-1-1X plug-in amplifier according to data sheet RE 30116 connection M12 - 4-pole
– Mating connectors (details, see page 8)
  • For DRE(M): According to DIN EN 175301-803, Material no. **R901017011**
  • For DRE(M)E: According to DIN EN 175201-804, Material no. **R900021267** or **R900223890**

[1)] In case of an error (e.g. in case of contamination or overcurrent), the maximum pressure limitation prevents an inadmissibly high overpressure at the valve.

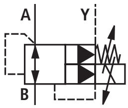
[2)] Replacement series 5X (Attention! External amplifiers only suitable for G24 = 1.6 A solenoid), see accessories.

Symbols

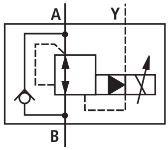
DRE -6X/...**YM**…



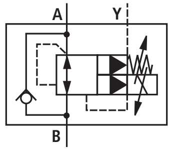
DREM -6X/...**YM**…



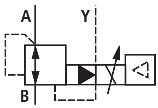
DRE -6X/...**Y**…



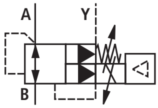
DREM -6X/...**Y**…



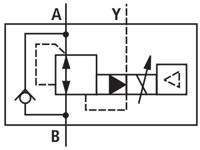
DREE -6X/...**YM**…



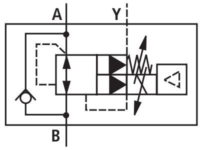
DREME -6X/...**YM**…



DREE -6X/...**Y**…



DREME -6X/...**Y**…



Function, section

Valves of type DRE(M) are pilot controlled pressure reducing valves. They are used for reducing an operating pressure.

These valves basically comprise of a pilot control valve (1) with proportional solenoid (2), main valve (3) with main spool insert (4), as well as an optional check valve (5).

Type DRE...

The pressure in channel A is set in a command value-dependent form via the proportional solenoid (2).

In rest position - no pressure in channel B -, the spring (17) holds the main spool (4) in its initial position. The connection from channel B to A is closed. A start-up jump is thus suppressed.

Via the bore (6), the pressure in channel A acts on the surface (7) of the main spool. The pilot oil is taken from channel B and flows via the bore (8) to the constant flow controller (9) keeping the pilot flow constant, independent of the pressure drop between channel A and B. From the constant flow controller (9), the pilot flow flows into the spring chamber (10), through the bores (11) and (12) via the valve seat (13) into the Y channel (14, 15, 16) and from there to the return.

The pressure required in channel A is preset at the related amplifier. The proportional solenoid moves the valve poppet (20) in the direction of the valve seat (13) and limits the pressure in the spring chamber (10) to the set value. If the pressure in channel A is lower than the specified command value, the higher pressure in the spring chamber (10) pushes the main spool to the right. The connection from B to A is opened.

If the set pressure in A is achieved, the forces at the main spool are balanced - the main spool is in control position.

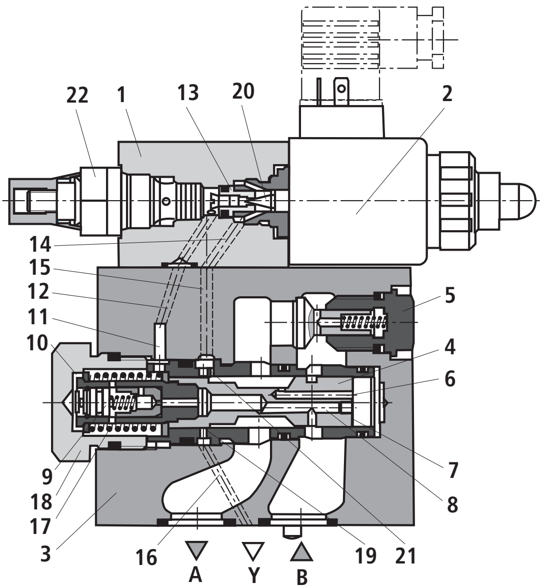
Pressure in channel A • Spool face (7) =
Pressure in the spring chamber (10) • Spool face – Spring force (17)

If in a standing hydraulic fluid column (e.g. cylinder piston to stop), the pressure in A is to be reduced, a lower command value is (e.g.) specified at the control electronics and thus, a lower pressure is pre-selected that is immediately applied to the spring chamber (10). The higher pressure in A at the face (7) of the main spool pushes the main spool against the plug screw (18) to stop. The connection A to B is blocked and A to Y is open. The force of spring (17) now acts against the hydraulic force at the face (7) of the main spool. In this main spool position, the hydraulic fluid can flow from channel A via the control edge (19) to Y into the return.

If the pressure in A has been reduced to the pressure in the spring chamber (10) plus Δp from spring (17), the main spool at the control edge A to Y closes the large control bores in the socket.

The remaining differential pressure of approx. 10 bar to the new command value pressure in A is only discharged via the fine control bore (21). This results in a good transient response without pressure undershoots.

For the free return flow from channel A to B, a check valve (5) can optionally be installed. A part of this flow from channel A simultaneously flows via the open control edge (19) of the main spool from A to Y into the return.



Type DREM…-6X/…YG24K4... (**with** check valve)

Type DREM...

For hydraulic protection against an inadmissibly high electric control current at the proportional solenoid, which imperatively results in increased pressures in port A, you can optionally install a spring-loaded pressure relief valve as maximum pressure limitation (22). The maximum pressure limitation is pre-set referred to the relevant pressure rating (table page 6).

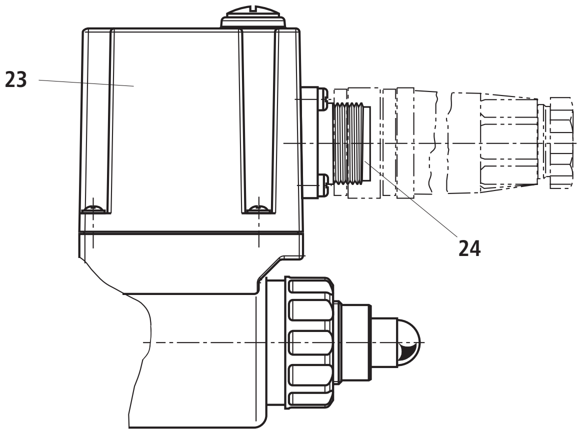
Function, section

Type DRE(M) – with integrated electronics (OBE)

With regard to function and structure, these types correspond to type DRE. On the proportional solenoid, there is moreover a housing (23) with the control electronics.

Supply and command value voltage are applied at the connector (24).
In the factory, the command value pressure characteristic curve is adjusted with little manufacturing tolerance.

For more information on the control electronics see page 8.



Type DRE(M)E…-6X/…YG24K31...

Technical Data (For applications outside these parameters, please consult us!)

general

Size		Size	10	25
Weight	– DRE and DREM	kg	4.7	6.0
	– DREE and DREME	kg	4.8	6.1
Installation position			Any	
Storage temperature range		°C	–20 to +80	
Ambient temperature range	– DRE(M)	°C	–20 to +70	
	– DRE(M)E	°C	–20 to +50	

hydraulic (measured with HLP 46, ϑ_{oil} = 40 °C ± 5 °C)

Size		Size	10	25
Max. operating pressure	– Port A and B	bar	315	
	– Port Y		Separately and to the tank at zero pressure (internal pipe Ø ≥ 5 mm; pipe length < 2500 mm)	
Max. setting pressure in channel A	– Pressure rating 50 bar	bar	50	
	– Pressure rating 100 bar	bar	100	
	– Pressure rating 200 bar	bar	200	
	– Pressure rating 315 bar	bar	315	
Min. setting pressure in channel A with command value zero		bar	2	
Maximum pressure limitation (fixedly set)			Set in the factory:	
	– Pressure rating 50 bar	bar	To 70 bar	
	– Pressure rating 100 bar	bar	To 130 bar	
	– Pressure rating 200 bar	bar	To 230 bar	
	– Pressure rating 315 bar	bar	To 350 bar	
Max. flow of the main valve		l/min	200	300
Pilot flow		l/min	0.8	
Hydraulic fluid			On mineral oil basis and related hydrocarbons (HL, HLP, HLPD, HLPP) according to DIN 51524 [1] Flame-resistant – water-free (HFDU(G), HFDU(E), HFDR) according to ISO12922 [2), 4)] Flame-resistant – containing water (HFC: Fuchs Hydrotherm 46M, Petrofer Ultra Safe 620) according to ISO12922 [3), 4)]	
Hydraulic fluid temperature range		°C	–20 to +80	
Viscosity range		mm^2/s	15 to 380	
Max. admissible degree of contamination of the hydraulic fluid Cleanliness class according to ISO 4406 (c)			Class 20/18/15 [5]	
Hysteresis		%	±3.5 of the max. setting pressure [6]	
Repeatability		%	< ±2 of the max. setting pressure [6]	
Linearity		%	±2 of the max. setting pressure [6]	
Manufacturing tolerance of the command value pressure characteristic curve, related to the hysteresis characteristic curve, pressure increasing	– DRE(M)	%	±3.5 of the max. setting pressure [6]	
	– DRE(M)E	%	±1.5 of the max. setting pressure [6]	
Step response $T_u + T_g$	10 → 90 %	ms	~130	Measured with standing hydraulic fluid column,
	90 → 10 %	ms	~160	1 liter at port A
Step response $T_u + T_g$	10 → 90 %	ms	~150	Measured with standing hydraulic fluid column,
	90 → 10 %	ms	~150	5 liters at port A

Foot notes see next page

Technical Data (For applications outside these parameters, please consult us!)

1) Suitable with NBR **and** FKM seals

2) Suitable **only** with FKM seals

3) Suitable **only** with NBR seals

4) When using flame-resistant hydraulic fluids HFC, the following limitations are to be observed:
– Max. operating pressure 210 bar
– Max. hydraulic fluid temperature 60 °C
– Expected service life 30...100 % as compared to HLP

5) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components.
For the selection of the filters see www.boschrexroth.com/filter

6) Does not apply to types "G24 - 8"

electric			"G24"	"G24-8"
Minimum solenoid current		mA	≤ 100	≤ 100
Maximum solenoid current		mA	1600 ± 10 %	800 ± 5 %
Solenoid coil resistance	Cold value at 20 °C	Ω	5.5	20.6
	Max. hot value	Ω	8	33
Duty cycle		%	100	100

electrical, integrated electronics (OBE)

Supply voltage	Nominal voltage	VDC	24
	Lower limit value	VDC	21
	Upper limit value	VDC	35
Current consumption		A	≤ 1.5
Required fuse protection		A	2, time-lag
Inputs	Voltage	V	0 to 10
	Current	mA	4 to 20
Output	Actual current value	mV	1 mV ≙ 1 mA
Protection class of the valve according to EN 60529			IP 65 with mating connector mounted and locked

Caution!

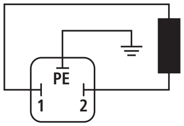
With an ambient temperature of 70 °C and a duty cycle of 100 % with max. current, the coil of the 800 mA solenoid reaches temperatures of up to 170 °C. In case of contact with the coil, this may lead to burns.

3

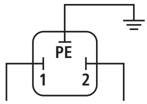
Electrical connection (dimensions in mm)

DRE(M)

Connection at connector

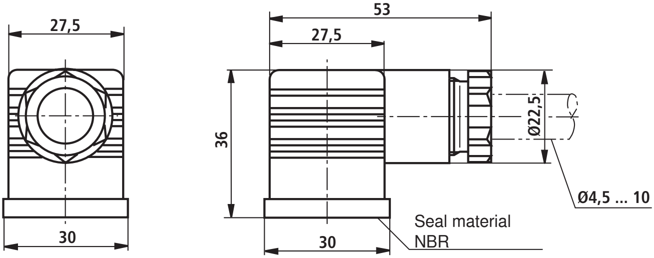


Connection at mating connector



To the amplifier

Mating connector (black) according to DIN EN 175301-803
Material no. **R901017011**
(separate order)

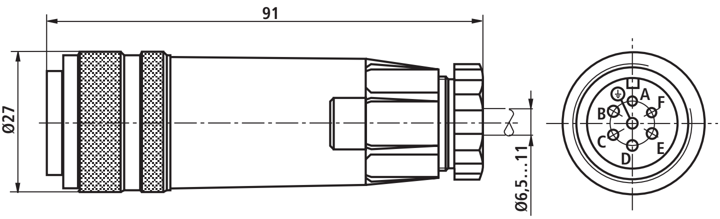


DRE(M)E

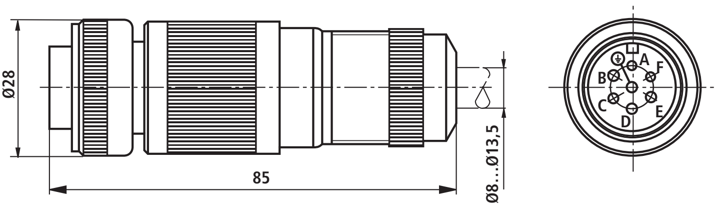
Device connector allocation	Contact	Allocation interface "A1"	Allocation interface "F1"
Supply voltage	A	24 VDC (u(t) = 21 V to 35 V); $I_{max} \leq 1.5$ A	
	B	0 V	
Reference potential actual value	C	Reference contact F; 0 V	Reference contact F; 0 V
Differential amplifier input	D	0 to 10 V; R_E = 100 kΩ	4 to 20 mA; R_E = 100 kΩ
	E	Reference potential command value	
Measuring output (actual value)	F	0 to 1.6 V actual value (1 mV ≙ 1 mA) Load resistance > 10 kΩ	
	PE	Connected to solenoid and valve housing	

Mating connectors according to DIN EN 175201-804, solder contacts for line cross-section 0.5 to 1.5 mm²

Plastic version,
material no. **R900021267,**
(separate order)



Metal version,
material no. **R900223890**
(separate order)

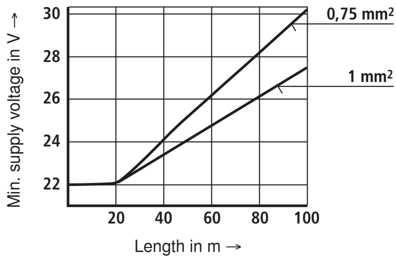


Electrical connection

Connection cable for DRE(M)E

- Recommendation 6-wire, 0.75 or 1 mm² plus protective earthing conductor and screening
- Only connect the screening to PE on the supply side
- Max. admissible length 100 m

The minimum supply voltage at the mains adapter depends on the length of the supply line (see diagram).



Integrated electronics (OBE) with type DRE(M)E

Function

The electronics are supplied with voltage via ports A and B. The command value is applied to the differential amplifier ports D and E.

Via the characteristic curve generator, the command value solenoid current characteristic curve is adjusted to the valve so that non-linearities in the hydraulic system are compensated and thus, a linear command value pressure characteristic curve is created.

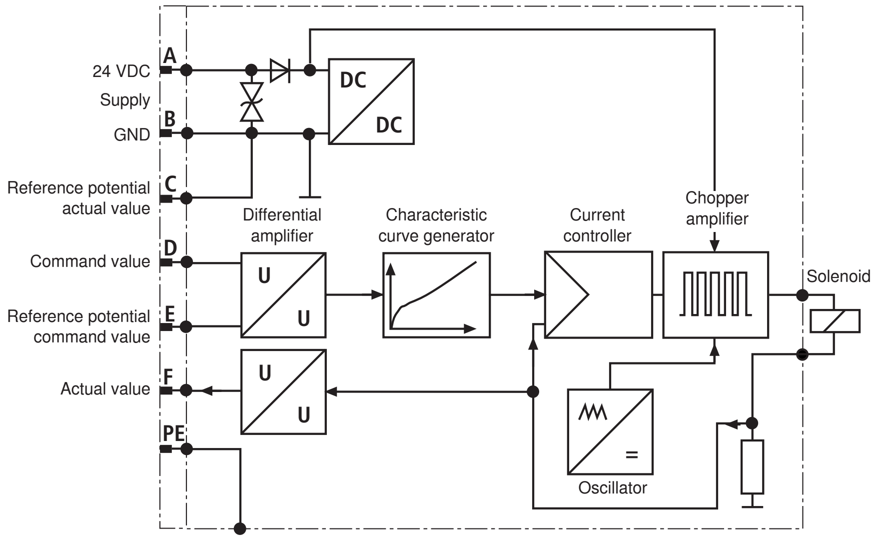
The current controller controls the solenoid current independent of the solenoid coil resistance.

The power section of the electronics for controlling the proportional solenoid is a chopper amplifier with a cycle frequence of approx. 180 Hz to 400 Hz. The output signal is pulse-width modulated (PWM).

For checking the solenoid current, a voltage can be measured between pin F(+) and pin C(–) that is proportional to the solenoid current. **1 mV** corresponds to **1 mA** solenoid current.

3

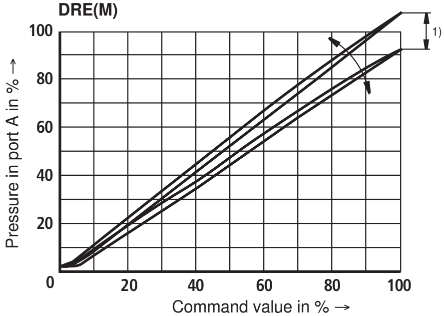
Block diagram



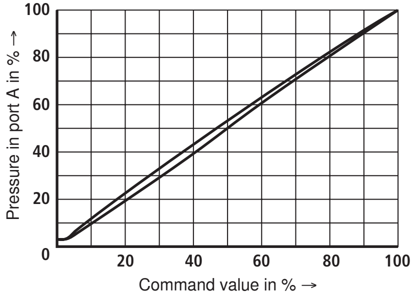
Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

Pressure in port A depending on the command value (flow = 0.8 l/min)

DRE(M)



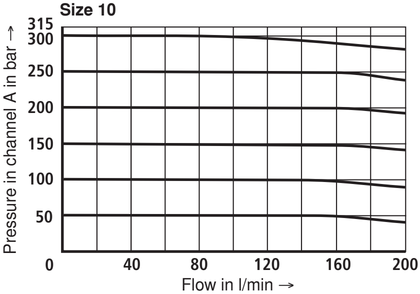
DRE(M)E



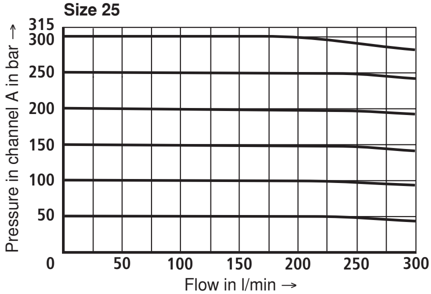
1) With valve DRE(M), the manufacturing tolerance at the **external amplifier** (type and data sheet see page 2) can be changed using the command value attenuator potentiometer "**Gw**". With the digital amplifier, the setting is made using the "Limit" parameter.
In this connection, the control current according to the technical data must not be exceeded.
In order to be able to adjust several valves to the same characteristic curve, the pressure must - with a command value of 100 % - at no valve not exceed the maximum setting pressure of the relevant pressure rating.

Pressure in channel A dependent on the flow q_v (characteristic curve with constant Δp)

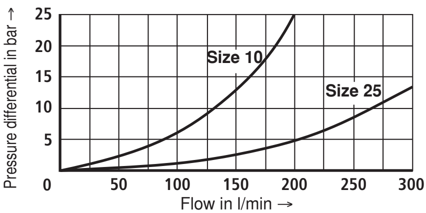
Size 10



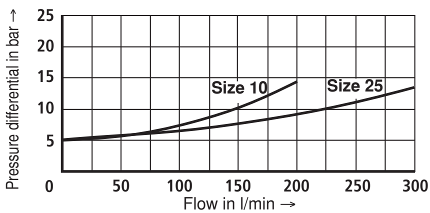
Size 25



Pressure differential via the check valve from A to B



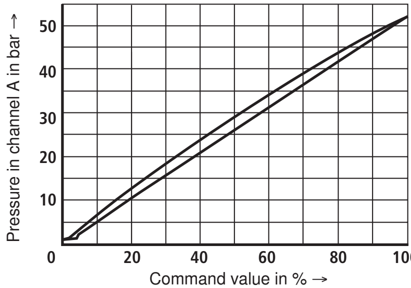
Pressure differential from B to A



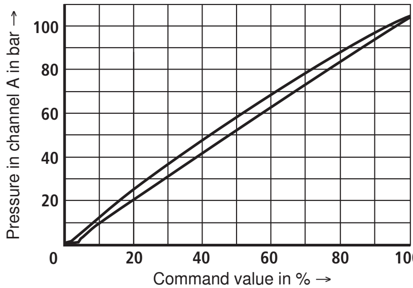
Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C and amplifier VT VSPA1-11-1X, 1600 mA coil...)

Pressure in channel A depending on the command value

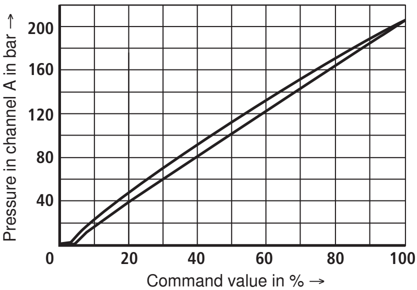
Pressure rating 50 bar



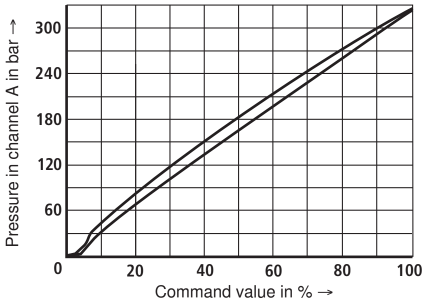
Pressure rating 100 bar



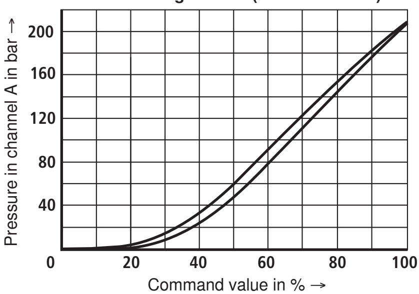
Pressure rating 200 bar



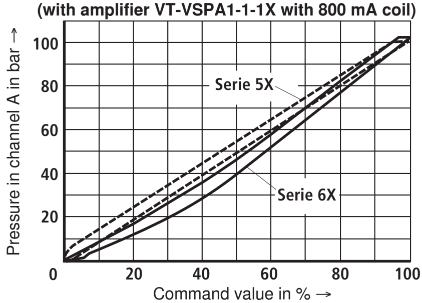
Pressure rating 315 bar



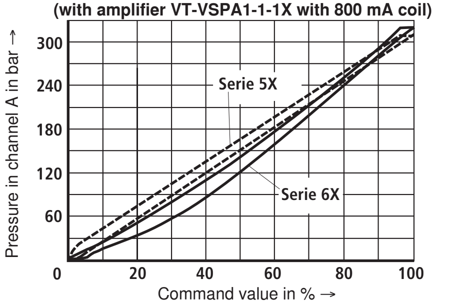
Pressure rating 200 bar (with VT-SSPA1)



Comparison series 5X-6X / pressure rating 100 bar (with amplifier VT-VSPA1-1-1X with 800 mA coil)

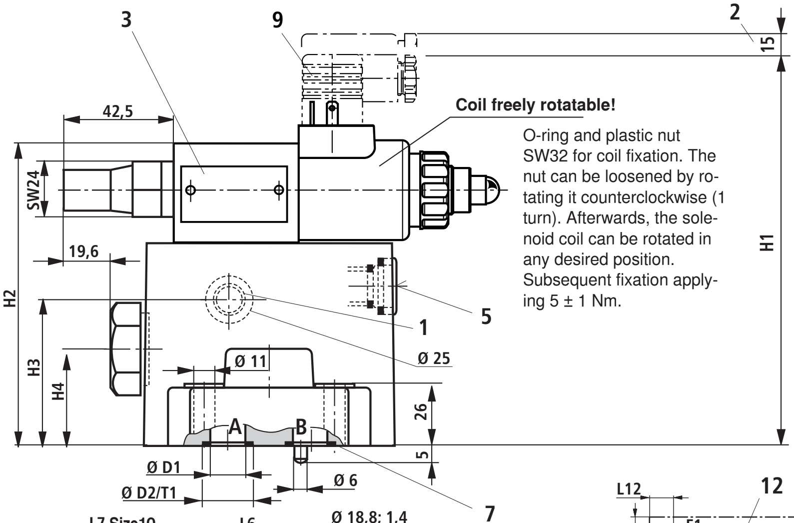


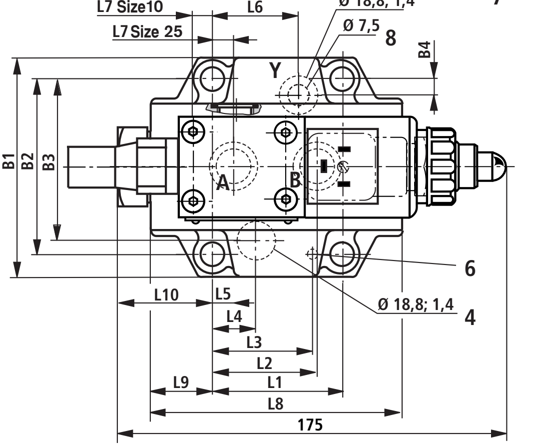
Comparison series 5X-6X / pressure rating 315 bar (with amplifier VT-VSPA1-1-1X with 800 mA coil)

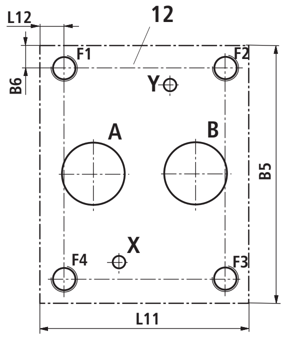


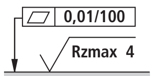
3

Unit dimensions type DRE(M) (dimensions in mm)









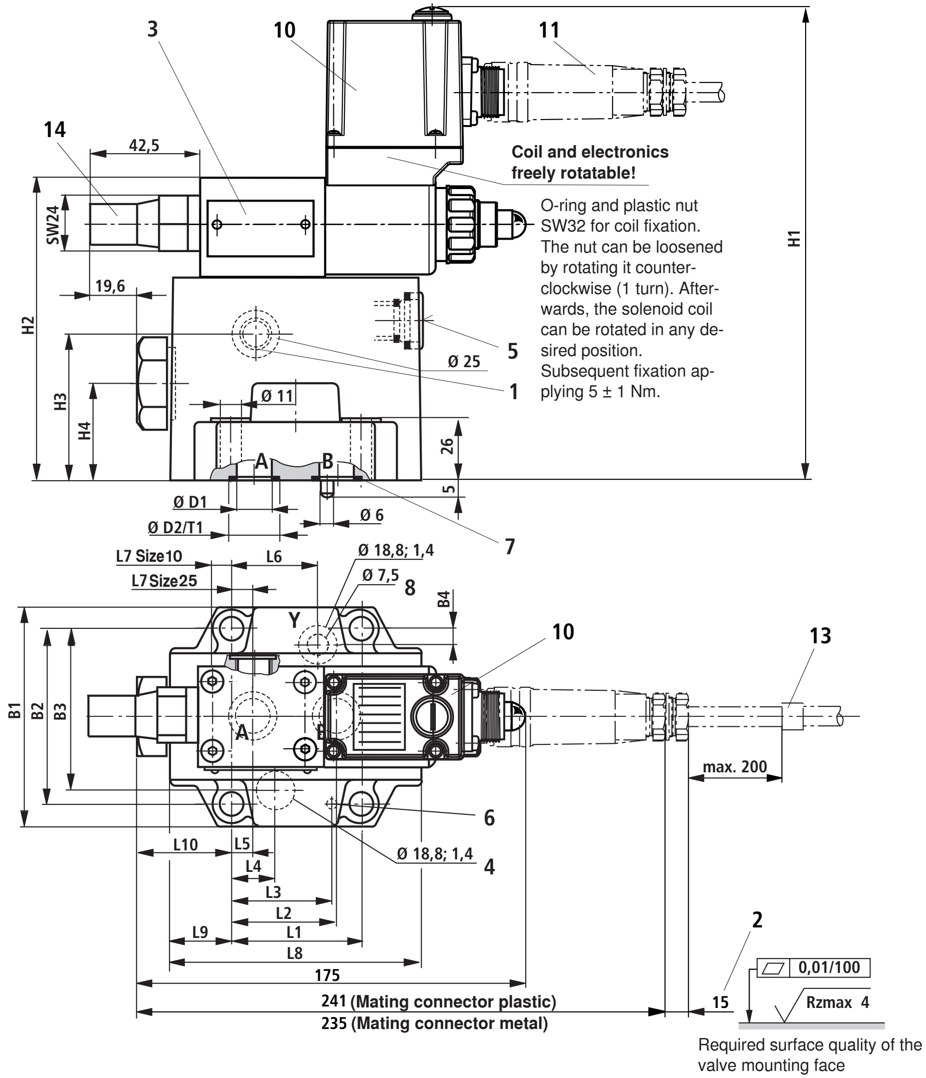
Required surface quality of the valve mounting face

Size	B1	B2	B3	B4	ØD1	ØD2^{H11}	H1	H2	H3	H4
10	85	66.7	58.8	7.9	15	21.8	171	123	58	36
25	102	79.4	73	6.4	25	34.8	185	137	64	44

Size	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	T1
10	42.9	35.8	31.8	21.5	7.2	21.5	5	116	44.5	59.5	2.0
25	60.3	49.2	44.5	20.6	11.1	39.7	12.2	116	27.3	42	2.9

Size	B5	B6	L11	L12
10	84	8.65	61	9.05
25	97	8.8	78	8.85

Unit dimensions type DRE(M)E (dimensions in mm)



Size	B1	B2	B3	B4	ØD1	ØD2^{H11}	H1	H2	H3	H4
10	85	66.7	58.8	7.9	15	21.8	192	123	58	36
25	102	79.4	73	6.4	25	34.8	206	137	64	44

Size	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	T1
10	42.9	35.8	31.8	21.5	7.2	21.5	5	116	44.5	59.5	2.0
25	60.3	49.2	44.5	20.6	11.1	39.7	12.2	116	27.3	42	2.9

Unit dimensions (continued)

1 Upon delivery, this port (G1/4) is closed. After removal of the blanking plug, an external and separate pilot oil return at zero pressure to the tank is, however, also possible here.
2 Space required for removing the mating connector
3 Name plate
4 Blind counterbore
5 Check valve, optional
6 Locating pin
7 Identical seal rings for ports A and B
Identical seal rings for port Y and blind counterbore (item 4)
8 Pilot oil return always external and separately at zero pressure to the tank, or optionally at item 1
9 Mating connector according to DIN EN 175301-803
10 Integrated electronics (OBE), type DRE(M)E with connector "K31"
11 Mating connector according to DIN EN 175201-804
12 Processed installation surface, porting pattern according to ISO 5781-06-07-0-00 (size 10)
ISO 5781-08-10-0-00 (size 25)
13 Cable fastening
14 Maximum pressure limitation with version DREM and DREME

Subplates according to data sheet RE 45062 and valve mounting screws must be ordered separately.

Subplates:
Size 10: G 460/01 (G 3/8)
G 461/01 (G 1/2)
Size 25: G 412/01 (G 3/4)
G 413/01 (G 1)

Valve mounting screws:
4 hexagon socket head cap screws
ISO 4762-M10x45-10.9-flZn-240h-L
(friction coefficient μ_{total} = 0.09 to 0.14,
Tightening torque M_A = 59 Nm ± 10 %

or

4 hexagon socket head cap screws ISO 4762-M10x45-10.9
(friction coefficient μ_{total} = 0.12 to 0.17)
Tightening torque M_A = 75 Nm ± 10 %

Notes

Notes

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

The Drive & Control Company

Rexroth
Bosch Group

Proportional pressure reducing valve, pilot operated

Type DRE(M) and DRE(M)E

RE 29278
Edition: 2012-12
Replaces: 11.11

- Size 32
- Component series 6X
- Maximum operating pressure 315 bar
- Maximum flow: 300 l/min

Features

- Valve for reducing an operating pressure
- Operation by means of proportional solenoid
- Proportional solenoid with rotatable and detachable coil
- For subplate mounting:
  Porting pattern according to ISO 5781
- Optional check valve between A and B
- Maximum pressure limitation optional
- Valve and control electronics from a single source
- Integrated electronics (OBE) with type DREME:
  Little manufacturing tolerance of the command value pressure characteristic curve
- External control electronics with type DRE and DREM (separate order)

Contents

Ordering code

01	02	03	04		05		06	07	08	09	10	11	12	13	14
DRE			30	–	6X	/		Y		G24					*

01	Proportional pressure reducing valve	**DRE**
02	**Without** maximum pressure limitation	**no code**
	With maximum pressure limitation	**M** 1)
03	For external control electronics	**no code**
	With integrated electronics (OBE)	**E**
Size		
04	Size 32	**30**
05	Component series 60 to 69 (60 to 69: Unchanged installation and connection dimensions)	**6X**
Pressure rating		
06	Up to 50 bar	**50**
	Up to 100 bar	**100**
	Up to 200 bar	**200**
	Up to 315 bar	**315**
07	Pilot oil return always external, separately and at zero pressure to the tank	**Y**
08	**With** check valve between A and B	**no code**
	Without check valve	**M**
Supply voltage		
09	24 V DC voltage	**G24**
10	1600 mA coil	**no code**
	800 mA coil	**–8** 2)

1) The maximum pressure limitation only serves as protection against overpressure in case of an error in the pilot valve (e.g. in case of contamination or over-current).

2) Replacement for series 4X (Attention! External amplifiers only suitable for G24 = 1.6 A solenoid), see accessories.

Ordering code

01	02	03	04		05		06	07	08	09	10	11	12	13	14
DRE			**30**	**–**	**6X**	**/**		**Y**		**G24**					*

Electrical connection

11	**For type DBEM:**	
	Without mating connector; connector DIN EN 175301-803	**K4** 3)
	For type DBEME:	
	Without mating connector; connector DIN EN 175201-804	**K31** 3)

Electronics interface

12	Command value 0 to 10 V	**A1**
	Command value 4 to 20 mA	**F1**
	With DBEM	**no code**

Seal material

13	NBR seals	**M**
	FKM seals	**V**
	Attention: Observe compatibility of seals with hydraulic fluid used!	

14	Further details in the plain text	

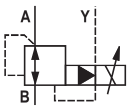
3) Mating connectors, separate order, see page 8 and 16

3

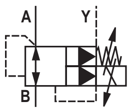
Symbols

For external control electronics:

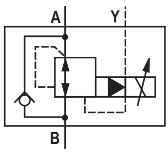
DRE 30-6X/...**YM**...



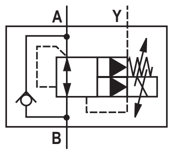
DREM 30-6X/...**YM**...



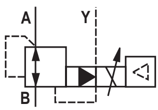
DRE 30-6X/...**Y**...



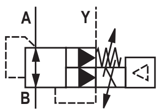
DREM 30-6X/...**Y**...



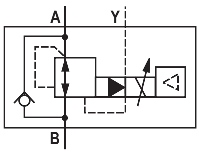
With integrated electronics:



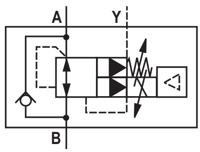
DREE 30-6X/...**YM**...



DREME 30-6X/...**YM**...



DREE 30-6X/...**Y**...



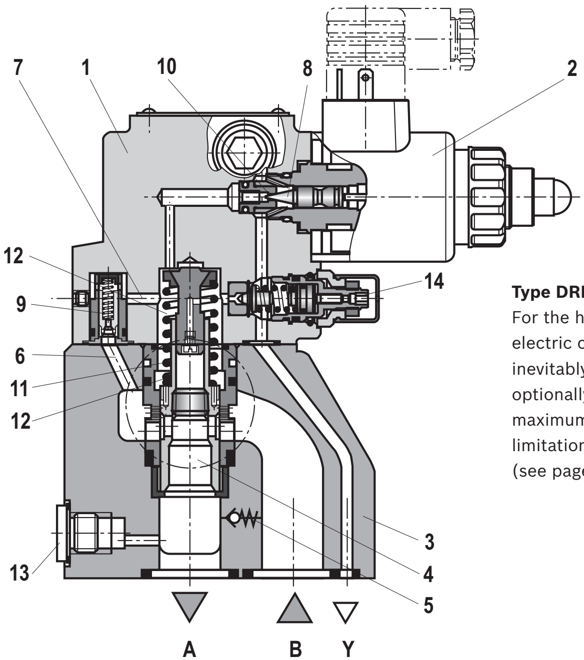
DREME 30-6X/...**Y**...

Function, section

Valves of type DRE(M) are pilot operated pressure reducing valves. They are used to reduce an operating pressure. These valves basically consist of a pilot control valve (1) with proportional solenoid (2), a main valve (3) with main spool insert (4), as well as an optional check valve (5).

Type DRE...

The pressure in channel A is set in a command value-dependent form via the proportional solenoid (2).
In rest position – no pressure in channel B –, the spring (11) holds the main spool (4) in its initial position. The connection from channel B to A is open.
The pressure in channel A acts on the bottom side of the main spool in closing direction and the pressure of the pilot control valve on the spring side of the main spool in the opening direction from channel B to A.
The pilot oil is taken from channel B and flows via the bore (6) to the fixed flow control (9) keeping the pilot flow constant, independent of the pressure drop between channel A and B. From the fixed flow control (9), the pilot flow flows through the bores (7) via the valve seat (10) by the valve poppet (8) into the Y channel to the tank.
The pressure required in channel A is preset at the related amplifier. The proportional solenoid pushes the valve poppet (8) in the direction of the valve seat (10) and limits the pressure in the spring chamber (12) to the set value. In the control position of the main spool (4), the hydraulic fluid flows from channel B to A and generates the pressure in channel A (setting of the pilot control valve plus spring (11)). If the set pressure in A is achieved, the forces at the main spool are balanced.
When the actuator connected to port A is not moving (e.g. cylinder piston at stop), and a lower pressure is set in channel A via the proportional solenoid (2), the main spool (4) closes the connection from B to A and at the same time opens the connection from channel A to the spring chamber (12) of the main spool (4). In this position, the compression volume in channel A can expand via the pilot control valve (1) and port Y.
For the free flow back from channel A to B, a check valve (5) can optionally be installed.
A pressure gauge connection (13) allows for the control of the reduced pressure in channel A.



Type DREM.30-4X/.YG24K4... (with check valve)

Type DREM...

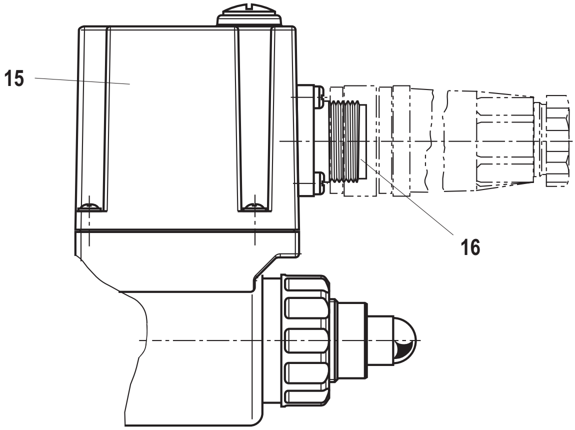
For the hydraulic protection against an inadmissible high electric control current at the proportional solenoid which inevitably results in excessive pressures in port A, you can optionally install a spring-loaded pressure relief valve as maximum pressure limitation (14). The maximum pressure limitation is pre-set, referred to the relevant pressure rating (see page 6).

Function, section

Type DRE(M)E – with integrated electronics (OBE)
With regard to function and set-up, these types correspond to type DRE. On the proportional solenoid, there is moreover a housing (15) with the control electronics.
Supply and command value voltage are applied to the connector (16).
In the factory, the command value pressure characteristic curve is adjusted with little manufacturing tolerance.

For more information on the control electronics, see page 9.

Type DRE(M)E...-6X/...YG24K31...



Technical data
(For applications outside these parameters, please consult us!)

general			
Weight	– Type DRE and DREM	kg	8.6
	– Type DREE and DREME	kg	8.7
Installation position			Any
Storage temperature range		°C	–20 to +80
Ambient temperature range	– Type DRE and DREM	°C	–20 to +70
	– Type DREE and DREME	°C	–20 to +50

hydraulic (measured with HLP46, ϑ_{oil} = 40 ± 5 °C)				
Maximum operating pressure	– Port A and B	bar	315	
	– Port Y	bar	Separately and to the tank at zero pressure	
Maximum set pressure in channel A	– Pressure rating 50 bar	bar	50	
	– Pressure rating 100 bar	bar	100	
	– Pressure rating 200 bar	bar	200	
	– Pressure rating 315 bar	bar	315	
Minimum set pressure in channel A with command value zero		bar	See characteristic curve page 14	
Maximum pressure limitation, fixedly set:			Set in the factory:	
	– Pressure rating 50 bar	bar	To 75 bar	
	– Pressure rating 100 bar	bar	To 130 bar	
	– Pressure rating 200 bar	bar	To 230 bar	
	– Pressure rating 315 bar	bar	To 350 bar	
Maximum flow of the main valve		l/min	300	
Pilot flow		l/min	1.0	
Hydraulic fluid			See table page 7	
Hydraulic fluid temperature range		°C	–20 to +70	
Viscosity range		mm^2/s	15 to 380	
Maximum admissible degree of contamination of the hydraulic fluid - cleanliness class according to ISO 4406 (c)			Class 20/18/15 [1]	
Hysteresis		%	±3 of the maximum set pressure [2]	
Repetition accuracy		%	< ±2 of the maximum set pressure [2]	
Linearity		%	±3.5 of the maximum set pressure [2]	
Manufacturing tolerance of the command value pressure characteristic curve, related to the hysteresis characteristic curve; pressure increasing	– Type DRE(M)	%	±5 of the maximum set pressure [2]	
	– Type DRE(M)E	%	±1.5 of the maximum set pressure	
Step response $\boldsymbol{T}_u$ + $\boldsymbol{T}_g$	10 % → 90 %	ms	~160	Measured with standing hydraulic fluid column, 1 liter at port A
	90 % → 10 %	ms	~250	
Step response $\boldsymbol{T}_u$ + $\boldsymbol{T}_g$	10 % → 90 %	ms	~250	Measured with standing hydraulic fluid column, 5 liters at port A
	90 % → 10 %	ms	~450	

[1] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components.
For the selection of the filters see www.boschrexroth.com/filter.

[2] Does not apply to types "G24-8"

Technical data
(For applications outside these parameters, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons		HL, HLP, HLPD, HLPP	NBR, FKM	DIN 51524
Flame-resistant	– water-free	HFDU, HFDR	FKM	ISO 12922
	– containing water	HFC Fuchs Hydrotherm 46M Petrofer Ultra Safe 620	NBR	ISO 12922

Important information on hydraulic fluids!
- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- The flash point of the hydraulic fluid used must be 40 K higher than the maximum solenoid surface temperature.
- **Flame-resistant – containing water**: Maximum pressure differential 210 bar, otherwise, increased cavitation erosion. The pressure peaks should not exceed the maximum operating pressures!
  Life cycle as compared to HLP 30 to 100 %
  Fluid temperature maximum 60 °C

electric			G24	G24-8
Minimum solenoid current		mA	≤ 100	≤ 100
Maximum solenoid current		mA	1600 ± 10 %	800 ± 5 %
Solenoid coil resistance	– Cold value at 20 °C	Ω	5.5	20.6
	– Maximum hot value	Ω	8.05	33
Duty cycle		%	100	100

electrical, integrated electronics (OBE)			
Supply voltage	– Nominal voltage	VDC	24
	– Lower limit	VDC	21
	– Upper limit	VDC	35
Current consumption		A	≤ 1.5
Required fuse protection		A	2, time-lag
Inputs	– Voltage	V	0 to 10
	– Current	mA	4 to 20
Output	– Actual current value	mV	1 mV ≙ 1 mA
Protection class of the valve according to EN 60529			IP 65 with mating connector mounted and locked

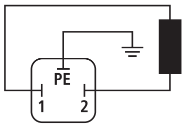
Caution!
At an ambient temperature of 70 °C and a duty cycle of 100 % with max. current, the coil of the 800 mA solenoid reaches temperatures of up to 170 °C. Contact with the coil may lead to burns.

3

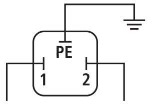
Electrical connection
(dimensions in mm)

Type DRE(M)

Connection at the connector

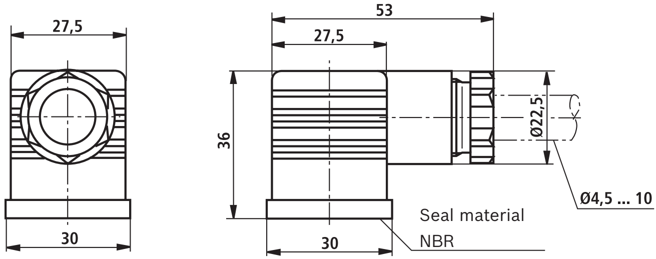


Connection at mating connector



to the amplifier

Mating connector (black)
according to DIN EN 175301-803
Material no. **R901017011**
(separate order)

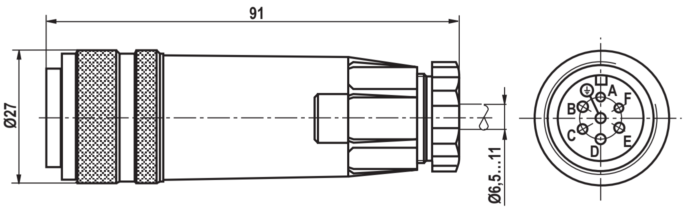


Type DRE(M)E

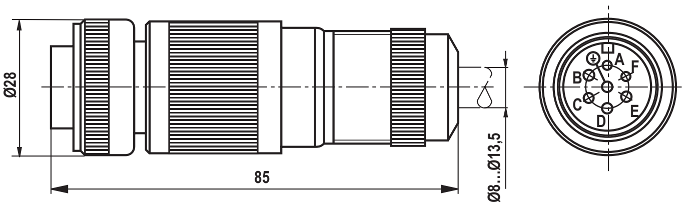
Device connector allocation	Contact	Allocation interface "A1"	Allocation interface "F1"
Supply voltage	A	24 VDC (u(t) = 21 V to 35 V); I_{max} ≤ 1.5 A	
	B	0 V	
Reference potential actual value	C	Reference contact F; 0 V	Reference contact F; 0 V
Differential amplifier input	D	0 to 10 V; R_E = 100 kΩ	4 to 20 mA; R_E = 100 Ω
	E	Reference potential command value	
Measuring output (actual value)	F	0 to 1.6 V actual value (1 mV ≙ 1 mA) Load resistance > 10 kΩ	
Protective earth	PE	Connected to solenoid and valve housing	

Mating connectors according to DIN EN 175201-804, solder contacts for line cross-section 0.5 to 1.5 mm²

Plastic version,
material no. **R900021267**
(separate order)



Metal version,
material no. **R900223890**
(separate order)

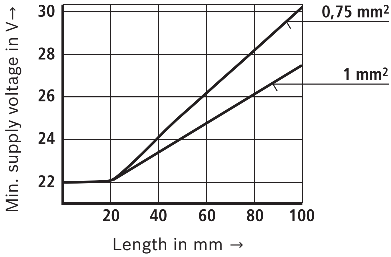


Electrical connection

Connection cable for type DRE(M)E

– Recommendation 6-wire, 0.75 or 1 mm² plus protective earthing conductor and screening
– Only connect the screening to PE on the supply side
– Maximum admissible length 100 m

The minimum supply voltage at the mains adapter depends on the length of the supply line (see diagram).



Integrated electronics (OBE) with type DRE(M)E

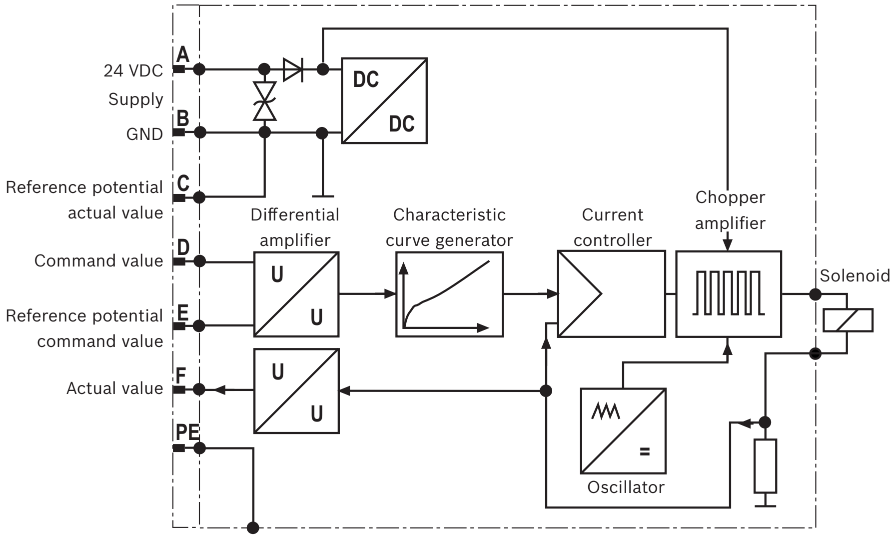
Function

The electronics are supplied with voltage via ports A and B. The command value is applied to the differential amplifier ports D and E.
Via the characteristic curve generator, the command value solenoid current characteristic curve is adjusted to the valve so that non-linearities in the hydraulics are compensated for and a linear command value pressure characteristic curve is created.
The current controller controls the solenoid current independent of the solenoid coil resistance.

The power stage of the electronics for controlling the proportional solenoid is a chopper amplifier with a cycle frequency of approx. 180 Hz to 400 Hz. The output signal is pulse-width modulated (PWM).
For checking the solenoid current, a voltage can be measured at the connector between pin F(+) and pin C(–) that is proportional to the solenoid current. **1 mV** corresponds to **1 mA** solenoid current.

3

Block diagram

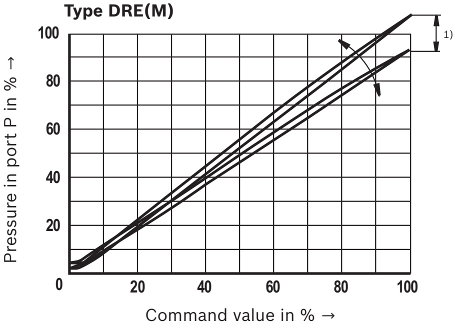


Characteristic curves

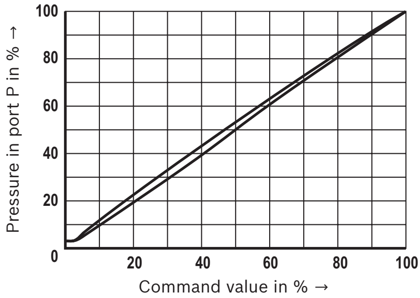
(measured with HLP46, ϑ_{oil} = 40 ± 5 °C)

Pressure in port P depending on the command value (flow = 0.8 l/min)

Type DRE(M)



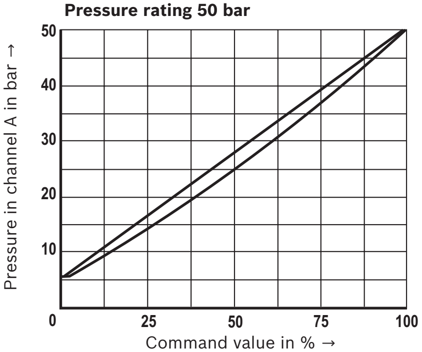
Type DRE(M)E



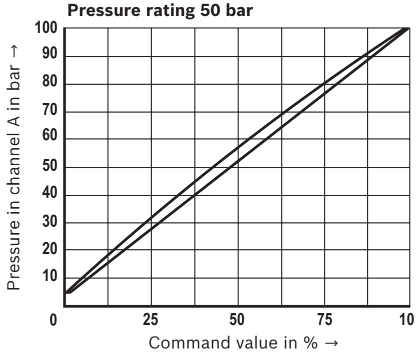
1) With valve type DRE(M), the manufacturing tolerance at the **external amplifier** (type and data sheet see page 16) can be changed using the command value attenuator potentiometer "**Gw**". The digital amplifier is set using the "Limit" parameter.
In this connection, the control current according to the technical data must not be exceeded.
In order to be able to adjust several valves to the same characteristic curve, do not set the pressure higher than the maximum set pressure of the pressure rating with command value 100 %.

Pressure in channel A depending on command value (measured with a flow of 0 l/min from B to A as well as related control electronics)

Pressure rating 50 bar



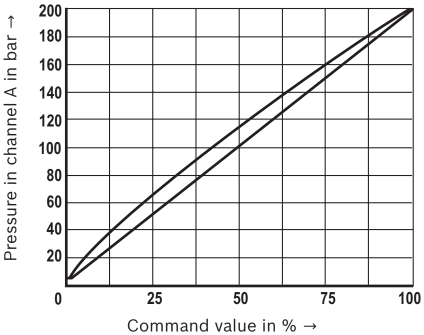
Pressure rating 50 bar



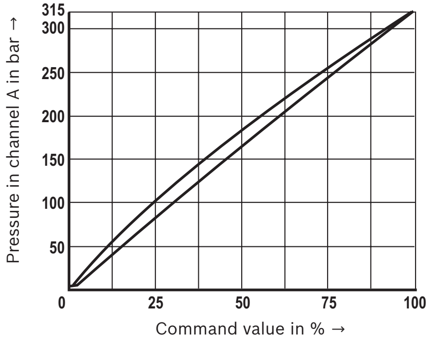
Characteristic curves

(measured with HLP46, ϑ_{oil} = 40 ± 5 °C)

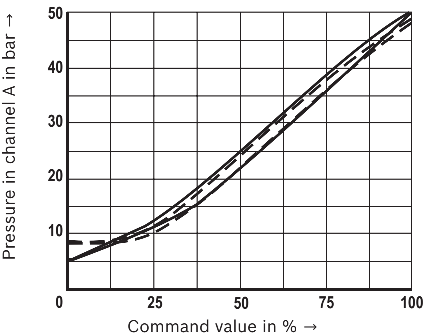
Pressure rating 200 bar



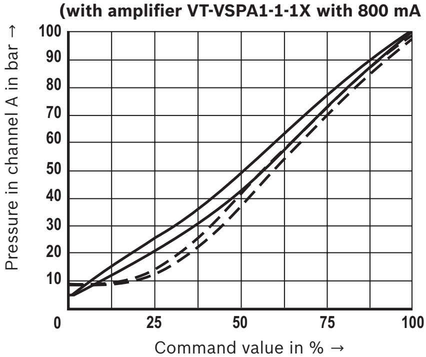
Pressure rating 315 bar



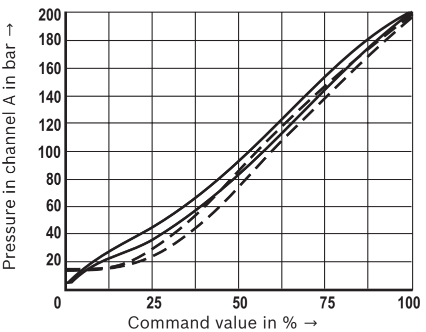
Comparison series 4X-6X / pressure rating 50 bar (with amplifier VT-VSPA1-1-1X with 800 mA coil)



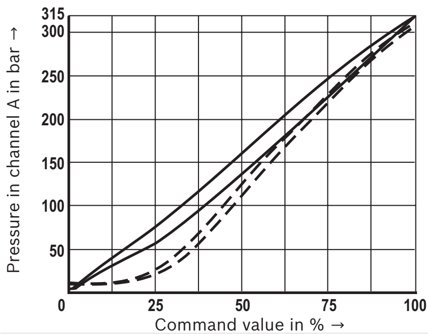
Comparison series 4X-6X / pressure rating 100 bar (with amplifier VT-VSPA1-1-1X with 800 mA coil)



Comparison series 4X-6X / pressure rating 200 bar (with amplifier VT-VSPA1-1-1X with 800 mA coil)



Comparison series 4X-6X / pressure rating 315 bar (with amplifier VT-VSPA1-1-1X with 800 mA coil)

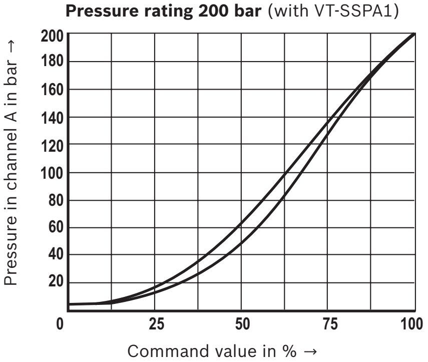


– – Series 4X

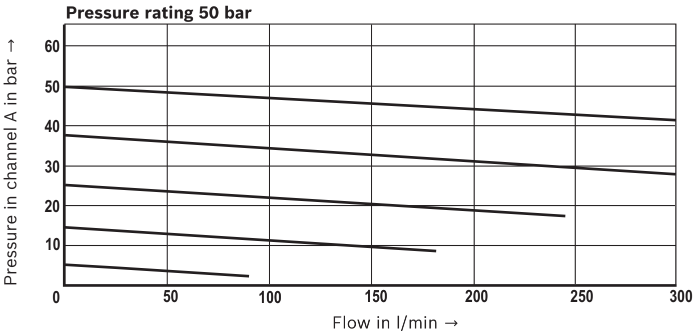
—— Series 6X 800 mA

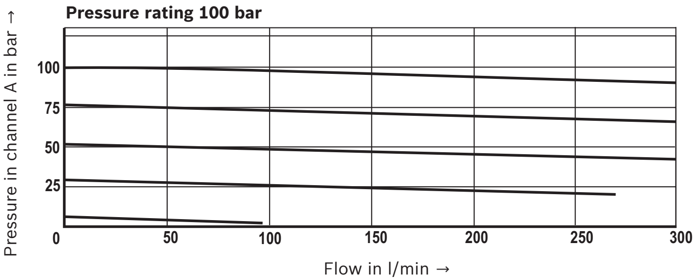
Notice!
In order to achieve the lowest settable pressure, the pilot current must not exceed 100 mA.

Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ± 5 °C)



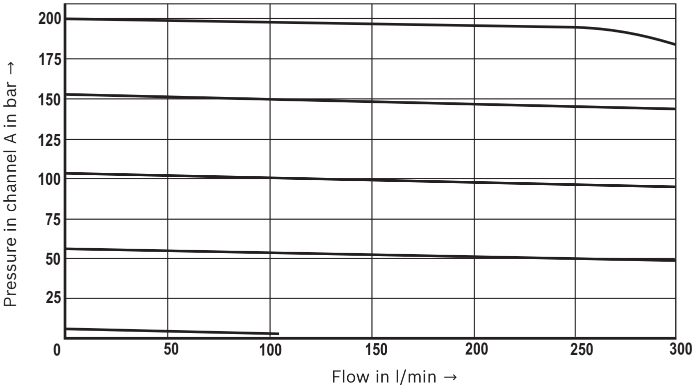
Pressure in channel A dependent on the flow Q_v



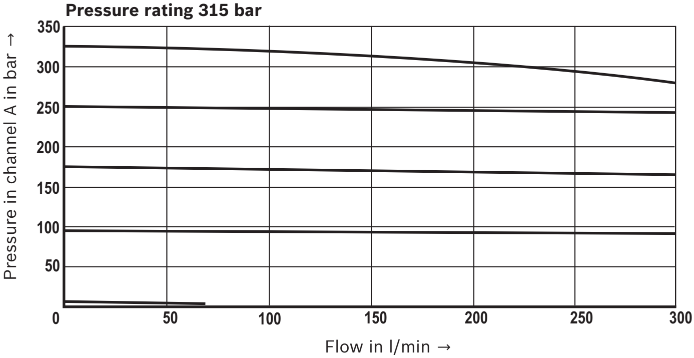


Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ± 5 °C)

Pressure rating 200 bar

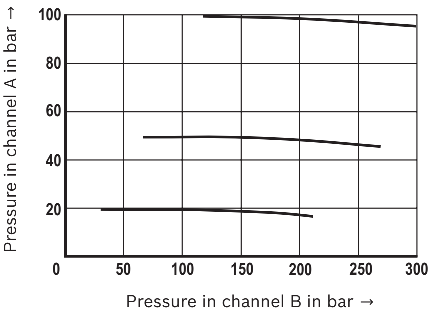


Pressure rating 315 bar

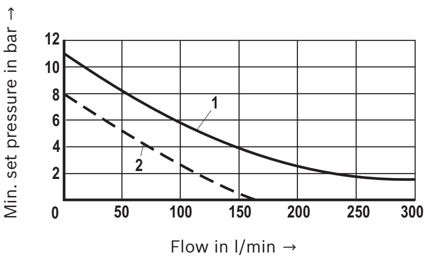


Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ± 5 °C)

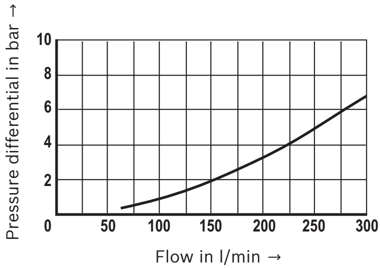
Pressure in channel A depending on pressure in channel B



p_{min}-Q_v characteristic curve



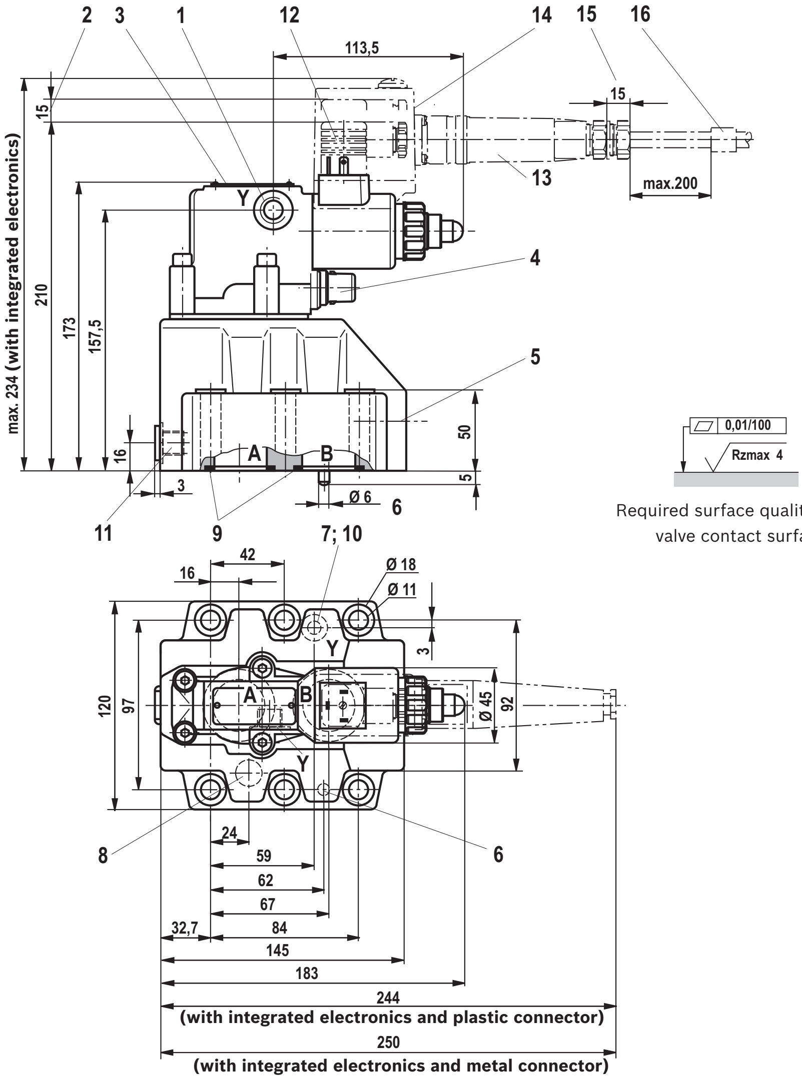
Pressure differential from A to B via the check valve



Characteristic curve 1: Same behavior of series 4X and 6X with p_{min} = 11 bar

Characteristic curve 2: Series 6X improved p_{min} = 8 bar, resulting in lower flow at p_{min}

Device dimensions
(dimensions in mm)



Required surface quality of the valve contact surface

Notice!
The dimensions are nominal dimensions which are subject to tolerances.

Item explanations, valve mounting screws and **subplates** see page 16.

Device dimensions

1 Upon delivery, this port (G 1/4) is closed. After removal of the blanking plug, an external and separate pilot oil return at zero pressure to the tank is, however, also possible here.
2 Space required to remove the mating connector
3 Name plate
4 Maximum pressure limitation with version DREM and DREME
5 Check valve, optional
6 Locating pin
7 Pilot oil return to the tank always external and at zero pressure
8 Blind counterbore
9 Identical seal rings for ports A and B
10 Identical seal rings for port Y and blind counterbore (item 8)
11 Pressure gauge connection G 1/4; 12 deep
12 Mating connector according to DIN EN 175301-803
13 Mating connector according to DIN EN 175201-804
14 Integrated electronics (OBE)
15 Space required to remove the mating connector
16 Cable fastening

Hexagon socket head cap screws (separate order)		**Material number**
Size 32	6x ISO 4762 - M10 x 70 - 10.9-flZn-240h-L Friction coefficient μ_{total} = 0.09 to 0.14; tightening torque M_A = 60 Nm ± 10 % or 6x ISO 4762 - M10 x 70 - 10.9 Friction coefficient μ_{total} = 0.12 to 0.17; tightening torque M_A = 75 Nm ± 10 %	R900002245

Notice: For reasons of stability, exclusively these valve mounting screws may be used. The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure!

Subplates	**Data sheet**	**Material number**
Size 32	45062	

Accessories
(not included in the scope of delivery)

External control for type DREM	**Data sheet**	**Material number**
VT-MSPA1-11-1X/ in modular design	30223	
VT-VSPD-2 in Euro-card format	30523	
VT-VSPA1-11-1X/ in Euro-card format	30100	
VT-SSPA1-1-1X/ as plug-in amplifier	30116	

Mating connectors (details see page 8)	**Data sheet**	**Material number**
For type DRE(M): Mating connectors according to DIN EN 175301-803	08006	R901017011
For type DRE(M)E: Mating connectors according to DIN EN 175201-804	08006	R900021267 (plastic) R900223890 (metal)

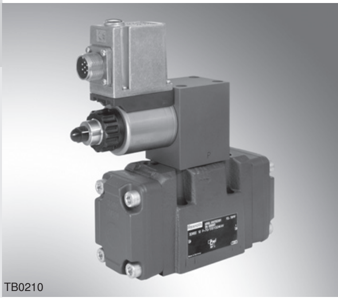
Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
documentation@boschrexroth.de
www.boschrexroth.de

Proportional pressure reducing valve, 3-way variant, pilot operated

RE 29286/01.10
Replaces: 02.08

Types 3DRE(M) and 3DRE(M)E

Sizes 10 and 16	
Component series 7X	
Maximum pressure setting	315 bar (size 10)
	250 bar (size 16)
Maximum flow	125 l/min (size 10)
	300 l/min (size 16)



TB0210

Table of contents

Features

– Pilot operated valve for reducing a pressure (P to A) and limiting a system pressure (A to T)
– Actuation by proportional solenoid
– Proportional solenoid with central thread and detachable coil
– For subplate mounting:
  Porting pattern to DIN 24340-A and ISO 4401
– Maximum pressure relief function optionally
– Valve and control electronics from a single source
– External control electronics for type 3DRE(M)
– Linear command value/pressure characteristic curve
– Integrated electronics (OBE) for type 3DRE(M)E with low manufacturing tolerance of the command value/pressure characteristic curve

Information on available spare parts:
www.boschrexroth.com/spc

Ordering code

3DRE				P – 7X /		G24			V	*

Without maximum pressure relief function = **No code**
With maximum pressure relief function = **M**

For external electronics = **No code**
With integrated electronics (OBE) = **E**

Size 10 = **10**
Size 16 = **16**

Subplate mounting = **P**

Component series 70 to 79 = **7X**
(70 to 79: unchanged installation and connection dimensions)

Pressure rating
50 bar = **50**
100 bar = **100**
200 bar = **200**
250 bar (size 16 only) = **250**
315 bar (size 10 only) = **315**

Pilot oil supply/drain
Internal pilot oil supply, external pilot oil drain = **Y**
External pilot oil supply, external pilot oil drain = **XY**

Supply voltage of control electronics
G24 = DC voltage 24 V

Electrical connection
for 3DRE, 3DREM:
K4 = **Without** mating connectors, with component plug to DIN EN 175301-803
for 3DREE, 3DREME
K31 = **Without** mating connector, with component plug to DIN EN 175201-804

Interface to electronics
A1 = Command value 0 to 10 V
F1 = Command value 4 to 20 mA
No code = For 3DRE

Seal material
V = FKM seals

Further details in clear text

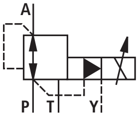
Accessories (not included in scope of supply)

– Subplates size 10 to data sheet RE 45054
  • G 535/01 (G3/4), Material no. **R900476061**
  • G 536/01 (G1), Material no. **R900476059**
– Subplates size 16 to data sheet RE 45056
  • G 172/01 (G3/4), Material no. **R900424410**
  • G 172/02 (M27 x 2), Material no. **R900424411**
  • G 174/01 (G1), Material no. **R900424413**
  • G 174/02 (M33 x 2), Material no. **R900424414**
  • G 174/08 (flange), Material no. **R900429264**
– External control for type 3DRE:
  • Analog amplifier VT-MSPA1-11-1X/V0/0 of modular design to data sheet RE 30223
  • Digital amplifier VT-VSPD-1-2X/V0/.-0-1 of Euro-card format to data sheet RE 30523
  • Analog amplifier VT-VSPA1-11-1X/V0/0 of Euro-card format to data sheet RE 30100
– Mating connectors (for details, see page 8)
  • For 3DRE: according to DIN EN 175301-803, Material no. **R901017011**
  • For 3DREE: according to DIN EN 175201-804, Material no. **R900021267** or **R900223890**

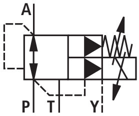
Symbols

Internal pilot oil supply
External pilot oil drain

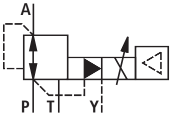
3DRE…**Y**…



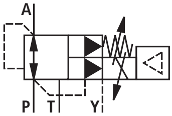
3DREM…**Y**…



3DREE…**Y**…

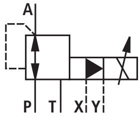


3DREME…**Y**…

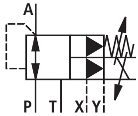


External pilot oil supply
External pilot oil drain

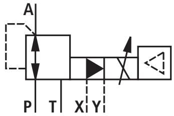
3DRE…**XY**…



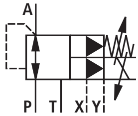
3DREM…**XY**…



3DREE…**XY**…



3DREME…**XY**…



Function, section

Valves of types 3DRE(M) and 3DRE(M)E are electrically pilot operated 3-way pressure reducing valves with actuator pressure relief function.

They are used to reduce a system pressure.

Technical structure

The valve consists of three main groups:

– Pilot valve (1), optionally with maximum pressure relief valve (15)

– Proportional solenoid (2)

– Main valve (3) with main spool (4)

Function

General function:

– Command value-related adjustment of the pressure to be reduced in port A by means of proportional solenoid (2).

– When no pressure is applied in port P, main spool (4) is held in the central position by springs (5) and (6).

– In this case, the connections from P to A and A to T are blocked.

– Pilot oil flows from bore (7) via flow controller (8), via pilot valve (1) to throttling gap (9), via line (10) to port Y. This connection must be directed to the tank at zero pressure.

Pressure reduction:

– Build-up of the pilot pressure in control chamber (11) as a function of the command value.

– Via orifice (12), pressure is built up in spring chamber (13), and main spool (4) is pushed to the right.
Hydraulic fluid flows from P to A.

– The actuator pressure in port A is present in spring chamber (14).

– When the pressure in port A increases to the value set on pilot valve (1), main spool (4) is pushed to the left. The pressure in port A is approximately the same as the pressure set on pilot valve (1).

Pressure relief function:

– When the pressure in port A exceeds the pressure set on pilot valve (1), main spool (4) is pushed further to the left.

– This causes the connection from A to T to open and the pressure applied in port A to be limited to the setpoint value.

Type 3DREM

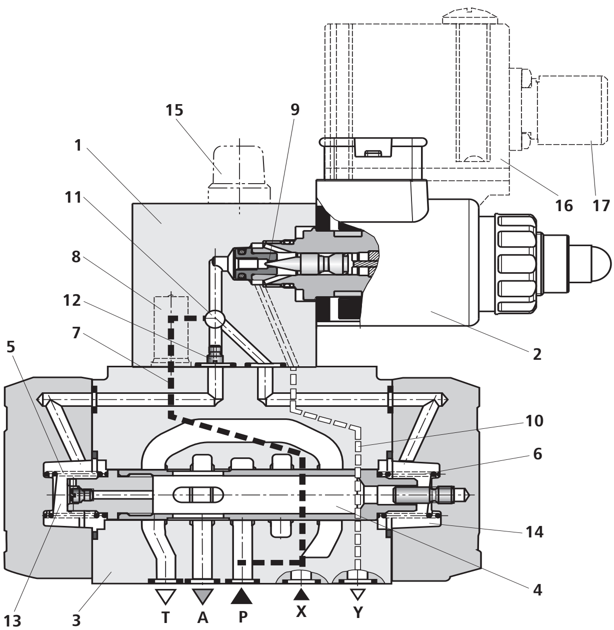
Optionally, the valve is available with an additional, spring-loaded pilot valve (15) for maximum pressure relief.

Types 3DREE and 3DREME – with integrated electronics (OBE)

In terms of function and design, these valves correspond to types 3DRE and 3DREM, except for the integrated electronics. The electronics accommodated in housing (16) receives its supply and command value voltage via mating connector (17).

The command value/pressure characteristic curve is adjusted in the factory with very low tolerances.

For further details about the integrated electronics, see page 7.



Technical data (for applications outside these parameters, please consult us!)

General

Size		Size	10	16
Weight	3DRE and 3DREM	kg	7.5	10.3
	3DREE and 3DREME	kg	7.6	10.4
Installation orientation			Optionally, preferably horizontal	
Storage temperature range		°C	–20 to +80	
Ambient temperature range	3DRE and 3DREM	°C	–20 to +70	
	3DREE and 3DREME	°C	–20 to +50	

Hydraulic (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

Size		Size	10	16
Maximum operating pressure	Ports P and X	bar	350	315
	Ports A and T	bar	315	250
	Port Y		Separately and at zero pressure to tank	
Maximum set pressure in channel A	Pressure rating 50 bar	bar	50	50
	Pressure rating 100 bar	bar	100	100
	Pressure rating 200 bar	bar	200	200
	Pressure rating 250 bar	bar	–	250
	Pressure rating 315 bar	bar	315	–
Min. set pressure in channel A without flow, at zero command value; see Characteristic curves on page 8		bar	< 5	< 4
Maximum pressure relief function (steplessly adjustable)			Pressure adjustment range:	Factory-set:
	Pressure rating 50 bar	bar	30 to 70	to 70 bar
	Pressure rating 100 bar	bar	50 to 130	to 130 bar
	Pressure rating 200 bar	bar	90 to 230	to 230 bar
	Pressure rating 315 bar (size 16 only)	bar	130 to 270	to 270 bar
	Pressure rating 315 bar (size 10 only)	bar	150 to 350	to 350 bar
Permissible max. flow		l/min	125	300
Pilot flow		l/min	1,1	
Hydraulic fluid			Mineral oil (HL, HLP) to DIN 51524, further hydraulic fluids on request!	
Hydraulic fluid temperature range		°C	–20 to +80	
Viscosity range		mm^2/s	15 to 380	
Permissible max. degree of contamination of the hydraulic fluid - cleanliness class to ISO 4406 (c)			Class 20/18/15 [1)]	
Hysteresis		%	± 3 of set max. pressure	
Repeatability		%	< ± 2 of set max. pressure	
Linearity		%	± 3.5 of set max. pressure	

[1)] The cleanliness classes specified for components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and, at the same time, prolongs the service life of components.

For the selection of filters, see data sheets RE 50070, RE 50076, RE 50081, RE 50086 and RE 50088.

3

Technical data (for applications outside these parameters, please consult us!)

Hydraulic (continued)

Manufacturing tolerance of command value/pressure characteristic curve, referred to hysteresis characteristic curve	3DRE(M)[1]	at 20% command value		< ±1.5% of set max. pressure
	3DRE(M)E[1]			
	3DRE(M)[2]	at 100% command value		< ±5% of set max. pressure
	3DRE(M)E[1]			< ±1.5% of set max. pressure
Switching time/step response Command value: 0 - 90 % and dead volume in A: 1 l		Tu + Tg	ms	< 140

[1] Matched in the factory

[2] For details, see page10

Electrical

Minimum solenoid current		mA	100
Maximum solenoid current		mA	1600 ± 10 %
Solenoid coil resistance	Cold value at 20 °C	Ω	5.5
	Max. warm value	Ω	8.05
Duty cycle		%	100

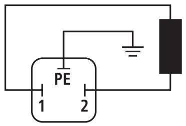
Electrical, integrated electronics (OBE)

Supply voltage	Nominal voltage	VDC	24
	Lower limit value	VDC	21
	Upper limit value	VDC	35
Current consumption		A	≤ 1.5
Required fuses		A	2, slow-blowing
Inputs	Voltage	V	0 to 10
	Current	mA	4 to 20
Output	Actual current value	mV	1 mV ≙ 1mA
Type of protection of the valve to EN 60529			IP 65 with mating connector mounted and locked

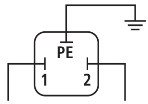
Electrical connection (dimensions in mm)

3DRE(M)

Connection to component plug

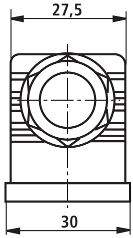


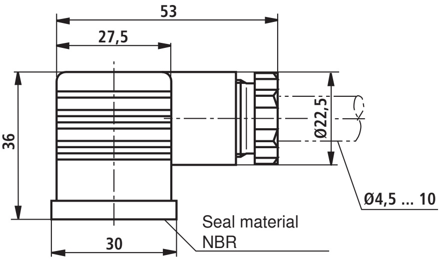
Connection to mating connector



To the amplifier

Mating connector (black) to
DIN EN 175301-803
Material no. **R901017011**
(separate order)



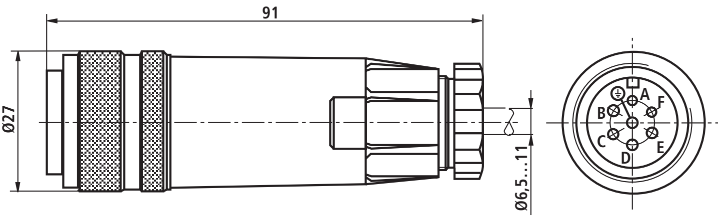


3DRE(M)E

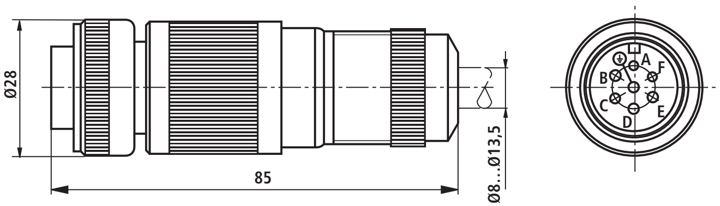
Component plug pinout	Contact	Pinout of interface "A1"	Pinout of interface "F1"
Supply voltage	A	24 VDC (u(t) = 21 V to 35 V); $I_{max} \leq 1.5$ A	
	B	0 V	
Actual value reference potential	C	Reference contact F; 0 V	Reference contact F; 0 V
Differential amplifier input	D	0 to 10 V; R_I = 100 kΩ	4 to 20 mA; R_I = 100 Ω
	E	Command value reference potential	
Measurement output (actual value)	F	0 to 1.6 V actual value (1 mV ≙ 1 mA) Load resistance > 10 kΩ	
	PE	Connected to solenoid and valve housing	

Mating connectors to DIN EN 175201-804, soldered contacts for cable cross-section 0.5 to 1.5 mm²

Plastic variant,
Material no. **R900021267,**
(separate order)



Metal variant,
Material no. **R900223890**
separate order

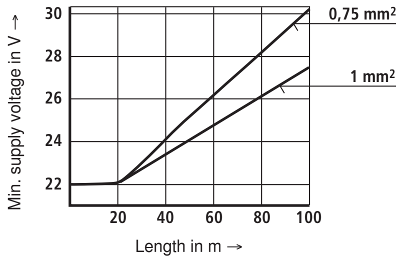


Electrical connection

Connection cable for 3DREE

- Recommendation: 6-wire, 0.75 or 1 mm^2 plus protective earth conductor and shield
- Connect shield to PE on the supply side only
- Permissible max. length 100 m

The minimum supply voltage at the power supply unit depends on the length of the supply cable (see diagram).



Integrated electronics (OBE) for type 3DRE(M)E

Function

The electronics is supplied with voltage via connections A and B. The command value is applied to differential amplifier connections D and E.

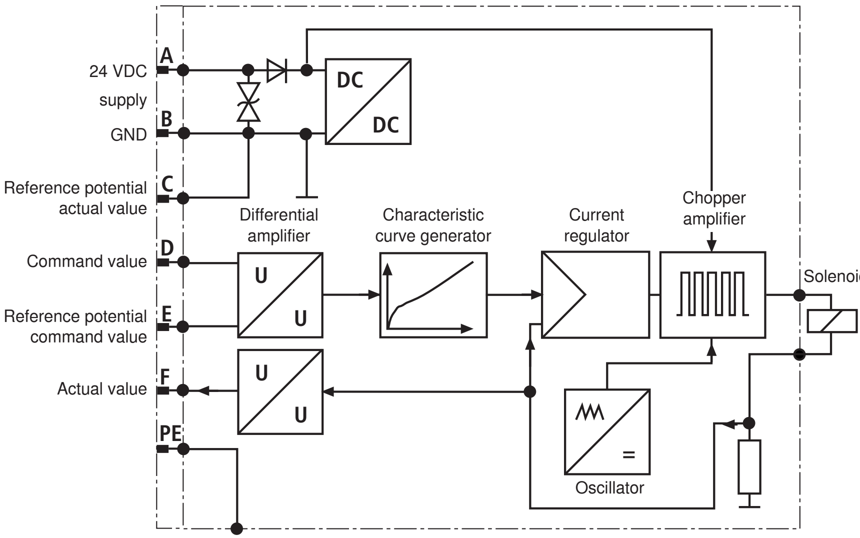
The characteristic curve generator adapts the command value/solenoid current characteristic curve to the valve so that non-linearities in the hydraulics are compensated for and a linear command value/pressure characteristic curve is obtained.

The current regulator regulates the solenoid current independently of the solenoid coil resistance.

A chopper amplifier with a clock frequency of approx. 180 Hz to 400 Hz forms the power stage of the electronics for activating the proportional solenoid. The output signal is pulse-width-modulated (PWM).

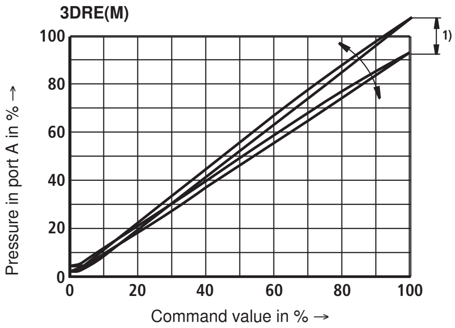
For checking the solenoid current, a voltage can be measured between Pin F(+) and Pin C(–), which is proportional to the solenoid current. **1 mV** corresponds to a solenoid current of **1 mA**.

Block circuit diagram



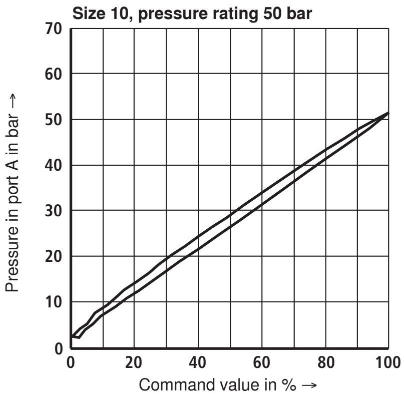
Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

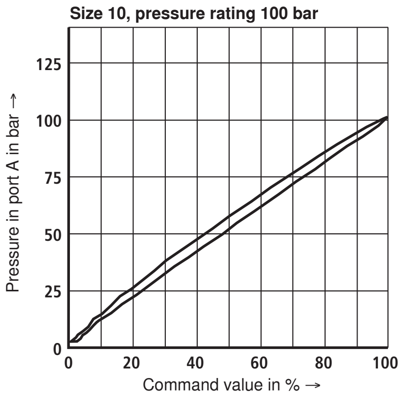
Pressure in port A in dependence upon the command value (manufacturing tolerance)
without flow

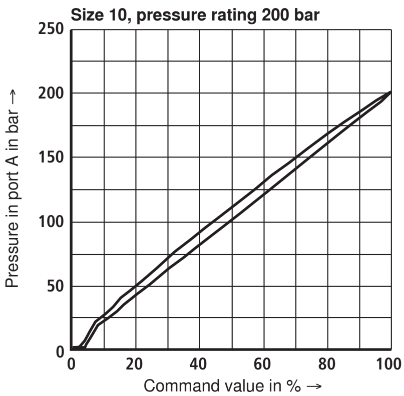


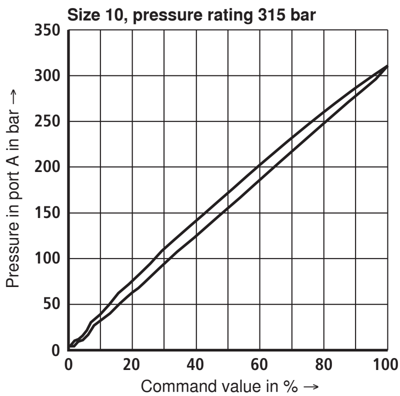
[1] For valve 3DRE(M) the manufacturing tolerance of the **external amplifier** (for type and data sheet, see page 2) can be modified with command value attenuator potentiometer "**Gw**". The digital amplifier is set with the parameter "Limit". The control current according to the technical data must, however, not be exceeded.
In order that several valves can be matched to the same characteristic curve, do not set the pressure higher than the maximum pressure setting of the relevant pressure rating at a command value of 100 %.

Pressure in port A in dependence upon the command value (at flow 0 l/min)



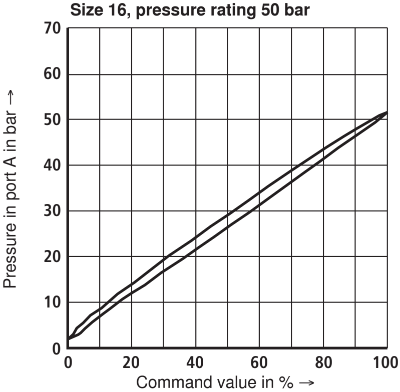


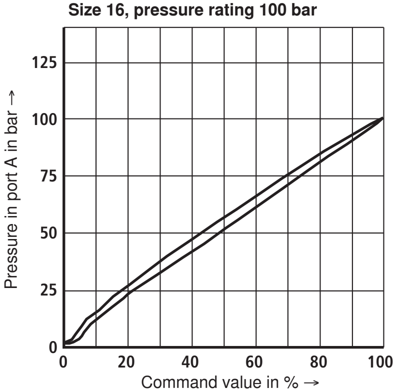


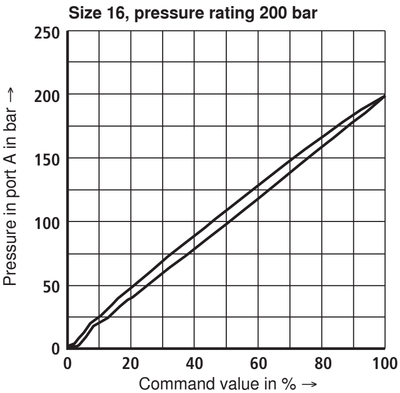


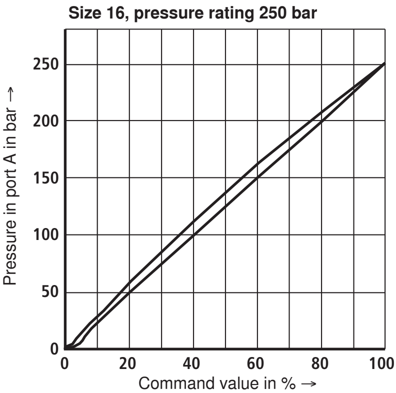
Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

Pressure in port A in dependence upon the command value (at flow 0 l/min)



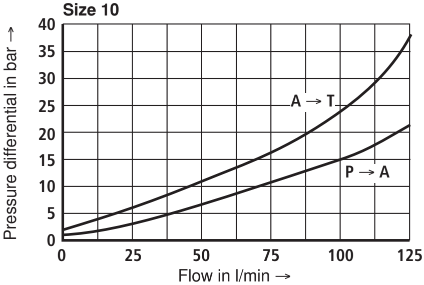


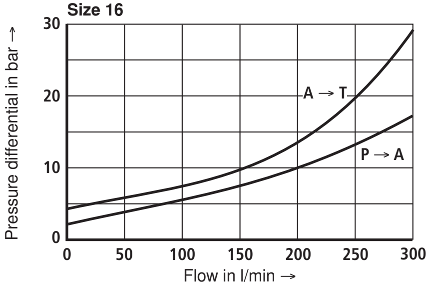




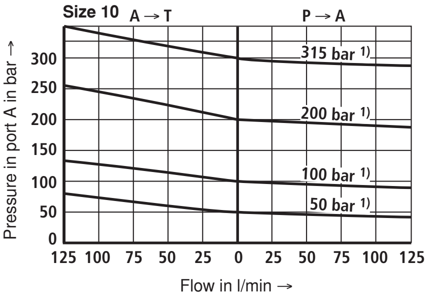
Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

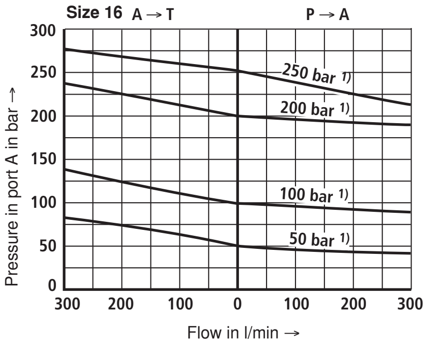
Pressure differential in dependence upon the flow





Pressure in port A in dependence upon the flow

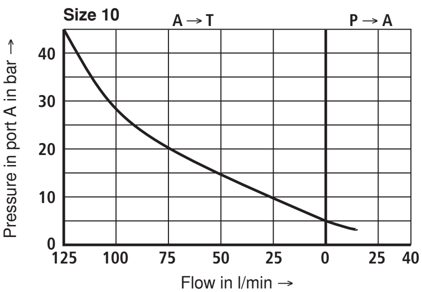


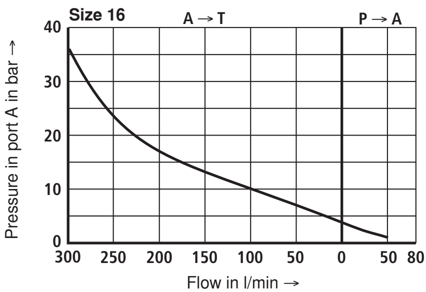


[1)] Pressure rating

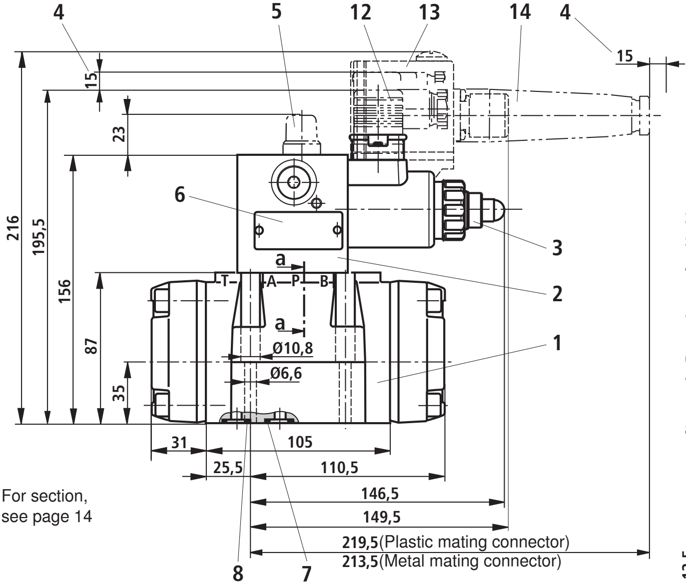
[1)] Pressure rating

Min. set pressure in dependence upon the flow at zero command value



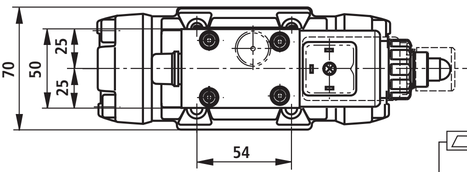


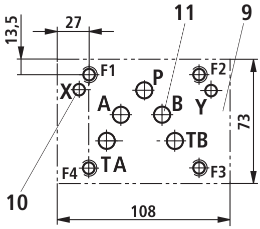
Unit dimensions of size 10 (dimensions in mm)

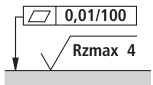


For section, see page 14

1 Main valve
2 Pilot valve
3 Proportional solenoid
4 Space required to remove mating connector
5 Maximum pressure relief function (type 3DREM…)
6 Nameplate
7 Identical seal rings for ports A, B, P, TA and TB
8 Identical seal rings for ports X and Y







Required surface quality of valve mounting face

9 Machined mounting surface, porting pattern to DIN 24340-A10 and ISO 4401-05-05-0-05
10 In the case of “internal“ pilot oil supply (variant Y), port X must be plugged in the subplate.
11 Port B must be plugged in the subplate
12 Mating connector for type 3DRE(M) (separate order)
13 Integrated electronics (type 3DREE, 3DREME) with component plug
14 Mating connector for type 3DRE(M)E, plastic or metal variant (separate order)

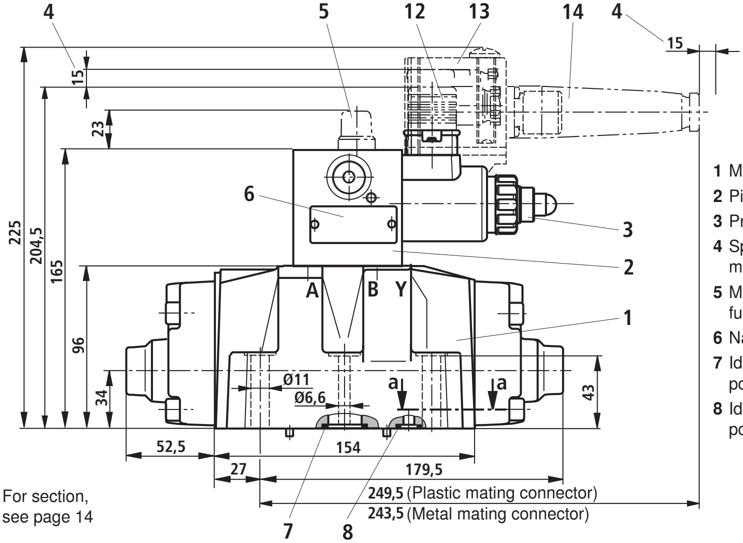
Valve mounting screws

4 hexagon socket head cap screws ISO 4762-M6x45-10.9-flZn-240h-L
(Friction coefficient μ_{total} = 0.09 to 0.14);
tightening torque M_T = 12.5 Nm ± 10 %

or

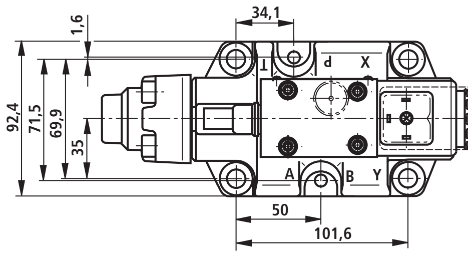
4 hexagon socket head cap screws ISO 4762-M6x45-10.9
(Friction coefficient μ_{total} = 0.12 to 0.17);
tightening torque M_T = 15.5 Nm ± 10 %

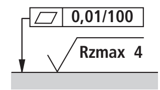
Unit dimensions of size 16 (dimensions in mm)



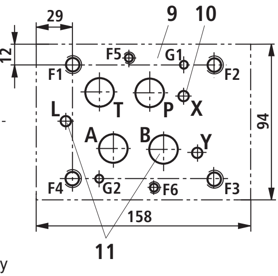
1 Main valve
2 Pilot valve
3 Proportional solenoid
4 Space required to remove mating connector
5 Maximum pressure relief function (type 3DREM…)
6 Nameplate
7 Identical seal rings for ports A, B, P and T
8 Identical seal rings for ports X and Y

For section, see page 14





Required surface quality of valve mounting face



9 Machined mounting surface, porting pattern to DIN 24340-A16 and ISO 4401-05-07-0-05
10 In the case of "internal" pilot oil supply (variant Y), port X must be plugged in the subplate.
11 Ports B and L must be plugged in the subplate)
12 Mating connector for type 3DRE(M) (separate order)
13 Integrated electronics (types 3DREE, 3DREME) with component plug
14 Mating connector for type 3DRE(M)E, plastic or metal variant (separate order)

Valve mounting screws

2 hexagon socket head cap screws ISO 4762-M6x60-10.9-flZn-240h-L
(Friction coefficient μ_{total} = 0.09 to 0.14)
tightening torque M_T = 12.2 Nm ± 10%
Material no. **R913000115**

4 hexagon socket head cap screws ISO 4762-M10x60-10.9-flZn-240h-L
(Friction coefficient μ_{total} = 0.09 to 0.14)
tightening torque M_T = 59 Nm ± 10%
Material no. **R913000116**

or

2 hexagon socket head cap screws ISO 4762-M6x60-10.9
(Friction coefficient μ_{total} = 0.12 to 0.17)
tightening torque M_T = 15.5 Nm ± 10%

4 hexagon socket head cap screws ISO 4762-M10x60-10.9
(Friction coefficient μ_{total} = 0.12 to 0.17)
tightening torque M_T = 75 Nm ± 10%

3

Pilot oil supply

Type 3DRE…-…/…XY **external pilot oil supply**
external pilot oil drain

With this variant, the pilot oil is supplied from a separate pilot circuit (external).

The pilot oil drain is not directed to the T channel of the main valve, but sepately to the tank via port Y (external).

Type 3DRE…-…/…Y… **internal pilot oil supply**
external pilot oil drain

With this variant, the pilot oil is supplied from the P channel of the main valve (internal).

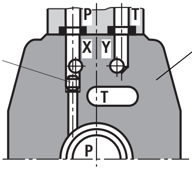
The pilot oil drain is not directed to the T channel of the main valve, but sepately to the tank via port Y (external).

Port X must be plugged in the subplate.

Item **1**: Plug screw M6 DIN 906-8.8 3A/F

Size 10 For the complete section, see page 12

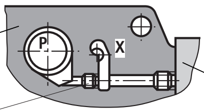
Section **a – a**



Pilot oil supply (section a – a)	external: **1** closed internal: **1** open
Pilot oil drain	external

Size 16 For the complete section, see page 13

Section **a – a**



Pilot oil supply (section a – a)	external: **1** closed internal: **1** open
Pilot oil drain	external

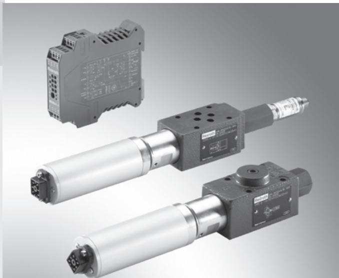
Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

Proportional pressure reducing valve with DC motor actuation

RE 29173/12.05 1/12
Replaces: 04.05
29174

Type (Z)DRS

Size 6
Component series 1X
Maximum operating pressure 210 bar
Maximum flow 30 l/min



H/A/D/7121/03

Table of contents

Features

– Pilot operated valve for pressure reduction in port A or P1 with pressure relief function
– Actuation by DC motor
– For subplate mounting or sandwich plate design: Position of ports to ISO 4401-03-02-0-94
– Self-locking DC motor → in the event of a supply voltage failure of fault message of the control electronics, the pressure setting is maintained
– Connect the tank port at zero pressure [1)]
– Controlling: Electrical amplifier type VT-MRMA1-1-1X/V0/0 (separate order), see page 6
– Position feedback
– Integrated pressure monitoring (optional)

[1)] Changes in the tank pressure result in changes in the set, reduced pressure.

Ordering code

	DRS	6	–1X/			M	G24	K32		G	*

- Subplate mounting = **no code**
- Sandwich plate design = **Z**
- Pressure reducing valve with DC motor actuation = **DRS**
- Size = **6**
- Pressure reduction in channel A (subplate mounting) = **no code**
- Pressure reduction in channel P1 (sandwich plate) = **VP**
- Component series 10 to 19 = **1X**
  (10 to 19: unchanged installation and connection dimensions)
- Pressure stage 50 bar = **50**
- Pressure stage 100 bar = **100**
- Pressure stage 210 bar = **210**
- Without pressure transducer on the component = **A**
- With pressure transducer on the component = **S**

M = Available only without check valve

Supply voltage of control electronics
G24 = 24 V DC voltage

Electrical connection
K32 = **Without** cable socket
With component plug type GO51FAVM
Cable socket – separate order, see page 6

Seal material
M = NBR seals
Suitable for mineral oil (HL, HLP) to DIN 51524
V = FKM seals
Observe compatibility of seal material with hydraulic fluid used!

G = With position feedback

Further details in clear text

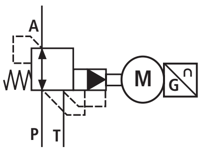
Standard types

Type DRS	Material number
DRS 6 –1X/50AMG24K32MG	R901025496
DRS 6 –1X/100AMG24K32MG	R901055990
DRS 6 –1X/210AMG24K32MG	R901055991

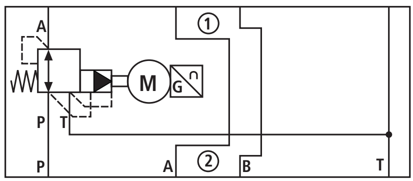
Type ZDRS	Material number
ZDRS 6 VP-1X/50AMG24K32MG	R901025495
ZDRS 6 VP-1X-/100AMG24K32MG	R900756973
ZDRS 6 VP-1X/210AMG24K32MG	R900777725

Symbols (1 = component side, 2 = plate side)

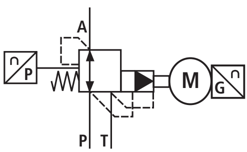
DRS 6...A... without pressure transducer



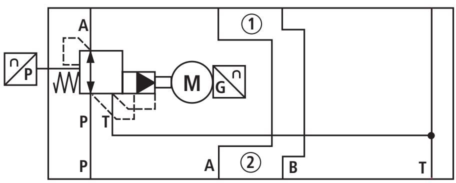
ZDRS 6...A... without pressure transducer



DRS 6...S... with pressure transducer



ZDRS 6...S... with pressure transducer



Function, section

Valves of types DRS and ZDRS are pilot operated 3-way pressure reducing valve with pressure relief function for the actuator.
They are used to reduce a system pressure.

Structure

The valves consist of three main assemblies:
- Pilot control valve (1)
- DC motor (2) with position feedback
- Main valve (3) with main spool (4)
- Optionally with or without pressure transducer (18)

Functional description, type DRS

- Adjustment of the pressure to be reduced in channel **A** via DC motor (2) in dependence upon the command value.
- When no pressure is applied in port **P,** spring (17) holds main spool (4) in the initial position → connection from port **A** to **T** is open, connection from port **P** to **A** is closed.
- Pressure connection from port **P** to ring channel (5); pilot oil flows through bore (6) via flow controller (7) into pilot control chamber (16); via orifice (8), throttling gap (9) into chamber (10) and through bores (11, 12) to port **T.**

Pressure reduction

- Pilot pressure builds up in pilot control chamber (16) as a function of the command value
- Main spool (4) is shifted to the right → hydraulic fluid flows from P to A
- The actuator pressure is applied in port A to spring chamber (15) via channel (13) and orifice (14)
- An increase in the pressure in port A to the set command pressure causes the main spool to be shifted to the right to the control position; the pressure in port A becomes virtually the same as the pressure set on pilot valve (1).

Pressure relief function - not available in the case of contamination

- When the pressure in port **A**(P1) exceeds the set command pressure, main spool (4) is shifted further to the left.
- This results in closing of the connection from **P** to **A**(P1), opening of the connection from P1 to **T** and limitation of the pressure applied in port **A**(P1) according to the set command value.

Pressure monitoring

In the case of valves with integrated pressure transducer, the latter is connected to the electronics and serves for sensing and monitoring the set pressure. Depending on the valve type, in channel A or P1. A further alternative is a valve without integrated pressure transducer, but with pressure measuring sandwich plate. See application example RE 62003 and RE 29260, sandwich plate with pressure transducer.

Type ZDRS

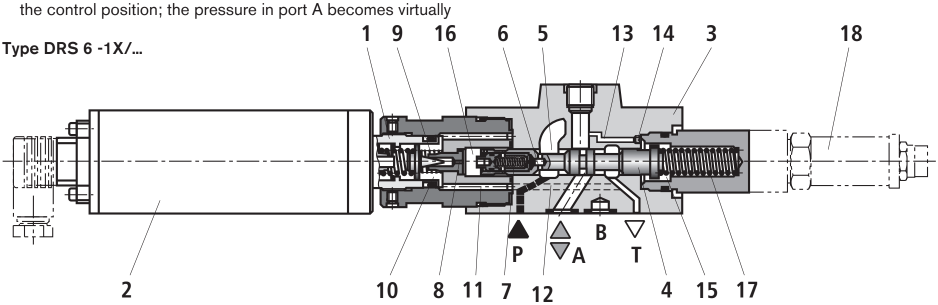
In principle, the function of this valve corresponds to that of type DRS. The pressure is, however, reduced in channel **P1**.

3

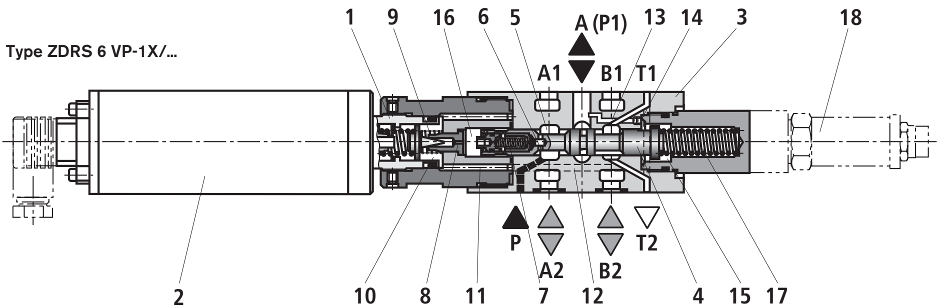
Note:

When the voltage supply of the control electronics is disconnected or fails, the DC motor remains at its current position and consequently, the pressure set last is maintained, provided that the hydraulic supply is available.

Type DRS 6 -1X/...



Type ZDRS 6 VP-1X/...



Overview of documentation

The present data sheet RE 29173 provides information about the pilot operated pressure reducing valve with DC motor actuation.

Overview of entire documentation	**Document no.**			
	German RD	**English RE .....**	**French RF .....**	**Spanish RS .....**
Analogue amplifier module Type VT-MRMA1-1-1X/V0/0	**30214**			
Declaration on environmental compatibility. Details about environmental testing in the fields of EMC (electromagnetic compatibility), climate and mechanical stress	**30214-U**			
Power supply unit type VT-NE30-1X	**29929**			
Pressure transducer with integrated electronics Type HM17-1X	**30269**			
Sandwich plate with pressure sensor type Z1SRD-1X	**29260**			
Proportional pressure reducing valve with DC motor actuation, type (Z)DRS, size 6, component series 1X	**29173**			
Application example	**62003**			

Technical data (for applications outside these parameters, please consult us!)

General

Installation orientation			Optional (preferably horizontal)
Weight	DRS	kg	1.6
	ZDRS	kg	1.5
Storage temperature range		°C	–20 to +80
Ambient temperature range		°C	–20 to +60

Hydraulic (measured at ν = 46 mm2/s, ϑ = 40 °C)

Max. operating pressure			
	Port P or P2	bar	250
	Ports P1, A and B	bar	210
	Port T	bar	Separately and at zero pressure to tank 1) (30 l/min flow possible)
Max. set pressure in channel P1 and A	Pressure stage 50 bar	bar	50
	Pressure stage 100 bar	bar	100
	Pressure stage 210 bar	bar	210
Min. pressure in channel P or P2		bar	Set pressure in channel A or channel P1 plus 20 bar
Min. set pressure at 0 command value in channel A or P1		bar	See characteristic curves on page 9 (max. 3 bar)
Max. permissible flow		l/min	30
Pilot flow		l/min	0.65
Hydraulic fluid			Mineral oil (HL, HLP) to DIN 51524 further hydraulic fluids on enquiry!
Max. permissible degree of contamination of the hydraulic fluid - cleanliness class to ISO 4406 (c)			Class 20/18/15 2)
Hydraulic fluid temperature range		°C	–20 to +80
Viscosity range		mm^2/s	15 to 280
Hysteresis		%	< 2 of settable max. pressure
Repeatability		%	< ± 1 of settable max. pressure
Linearity		%	< 2 of settable max. pressure
Response sensitivity		%	< 0.5 of settable max. pressure
Manufacturing tolerance of comm. value/pressure curve		%	< ± 6 of settable max. pressure 3)
Step response $T_u + T_g$	0% → 100%	ms	< 500] $T_u + T_g$ measured with static
	100% → 0%	ms	< 500] hydraulic fluid column of < 5 litres

1) Pressures > 10 bar can result in the destruction of the motor

2) The cleanliness classes specified for components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and, at the same time, prolongs the service life of components.

For the selection of filters, see data sheets: RE 50070, RE 50076, RE 50081, RE 50086 and RE 50088.

3) By matching of the zero point and the span in electronics type VT-MRMA1-1-1X/V0/0, the tolerance of the complete unit (valve + electronics) can be reduced.

3

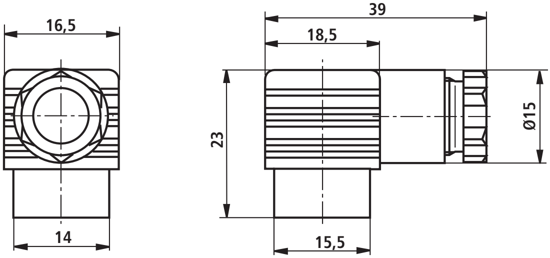
Technical data (for applications outside these parameters, please consult us!)

Electrical, valve			
Nominal voltage	U_N	V	18
Nominal current	I_N	A	0.5 ± 20%
Max. continuous current	I_{max}	A	0.5
Resistance	R	Ω	9.9
Winding temperature	ϑ_w	°C	≈ 20
	$\Delta\vartheta_{w\ perm.}$	K	100
Type of protection of the valve to EN 60529			IP 65 (with cable socket mounted and locked)
Electrical, control electronics			
Control electronics			Amplifier type VT-MRMA1-1-1X/V0/0 of modular design (separate order) to RE 30214 ⚠ **Caution!** **Valves of type (Z)DRS 6** must not be used for safety-relevant machine functions, since only the electrical part is safeguarded, but not the hydraulic part. This means that when the hydraulic pressure in P falls to 0 bar, then the actuator pressure (A) or secondary pressure (P1) inevitably becomes 0 bar as well.

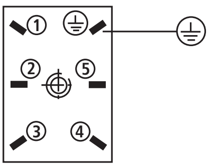
Note: For details with regard to **enviornment simulation testing** in the fields of EMC (electromagnetic compatibility), climate and mechanical stress, see RE 29173-U (declaration on environmental compability).

Electrical connection (nominal dimensions in mm)

Cable socket
Separate order stating material no. **R900021448** (plastic version)

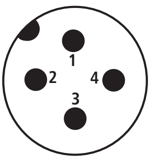


Version **(Z)DRS… 1X/…**



1 Position feedback +
2 Position feedback output
3 Position feedback –
4 Motor +
5 Motor –
PE = GND

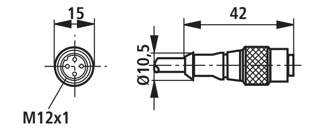
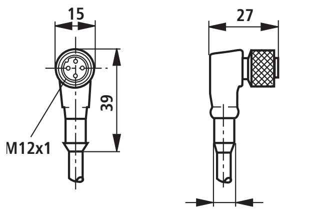
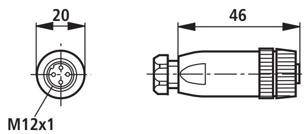
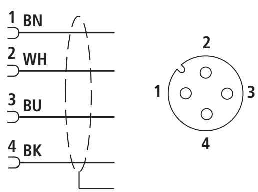
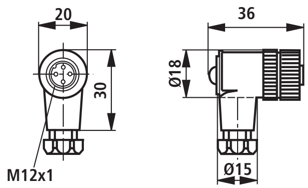
Pressure transducer version S
(4-pin M12 plug-in connector; viewed to contact side)



Voltage	**Current** (two-conductor system)
1 → auxiliary energy + (+ U_O)	**1** → auxiliary energy + (+ U_O)
2 → n.c.	**2** → n.c.
3 → auxiliary energy – (0V)	**3** → auxiliary energy – (0V)
4 → output signal	**4** → n.c.

Electrical connection (nominal dimensions in mm)

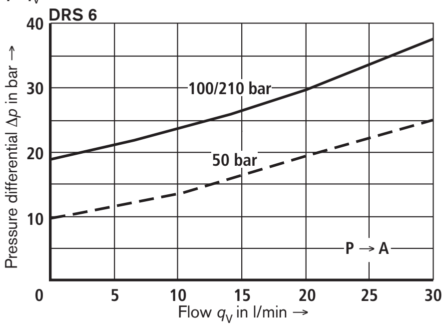
Cable sockets for pressure transducer

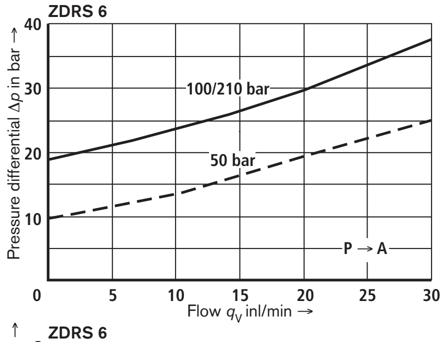
Technical data			Designation	Material no.
Current carrying capacity	4 A		04 POL (with 2 m cable)	R900773031
Temperature range	–25 to 90 °C		04 POL (with 5 m cable)	R900779498
Type of protection	IP 67			
Contacts	CuZn			
Contact surface	Gold-plated		04 POL (with 2 m cable)	R900779504
Housing	TPU		04 POL (with 5 m cable)	R900779503
Seal material	FKM			
Fitting	CuZn/Ni			
Wire cross-section	4 x 0.34 mm			
Sheath material	PUR			
Shield	Not connected on plug side		04 POL (without cable)[1]	R900773042
Sheath diameter	Ø 5.0 mm			
Sheath colour	Black			
Bending radius for dyn. applications	min. 50 mm			
			04 POL (without cable)[1]	R900779509

[1] Type of protection IP 68

Characteristic curves (measured at $\nu = 46$ mm²/s and $\vartheta = 40$ °C)

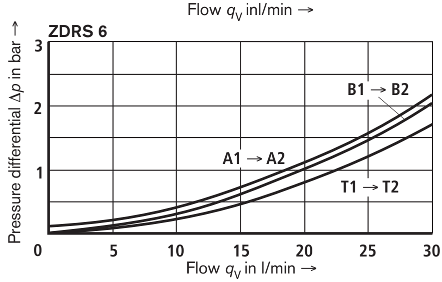
Δp-q_V characteristic curves





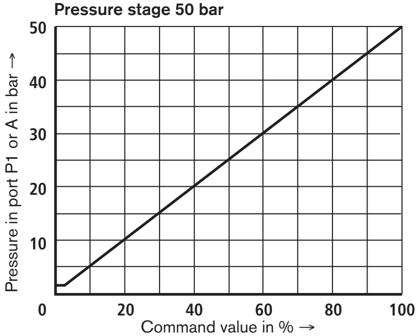
Note:

The Δp value indicated corresponds to the minimum pressure present in port P (P2) minus the maximum pressure to be controlled in port A (P1).

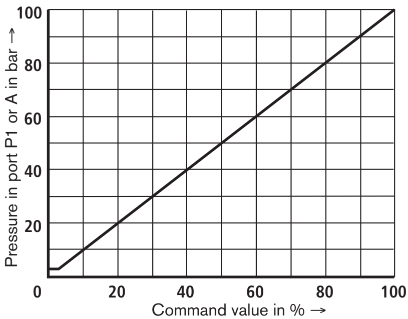


Pressure in port P1 or A in dependence upon command value

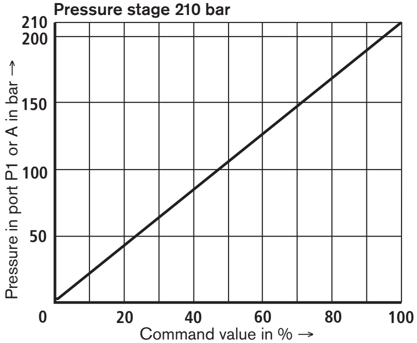
Pressure stage 50 bar



Pressure stage 100 bar



Pressure stage 210 bar



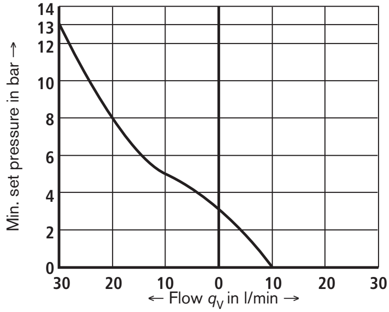
Characteristic curves (measured at $\nu = 46\ mm^2/s$ and $\vartheta = 40\ °C$)

Min. set pressure in port P1 or A at 0 V command value (without backpressure in channel T or T1)

Pressure stage 50 bar

DRS 6 A → T | DRS 6 P → A
ZDRS 6 P1 → T2 | ZDRS 6 P2 → P1

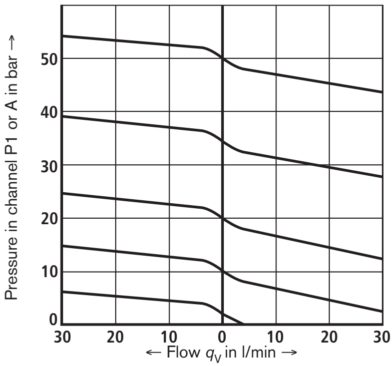
Pressure stages 100 bar and 210 bar



DRS 6 A → T | DRS 6 P → A
ZDRS 6 P1 → T2 | ZDRS 6 P2 → P1

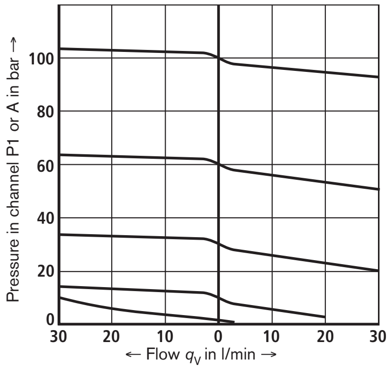
Pressure in port P1 or A in dependence upon the flow

Pressure stage 50 bar



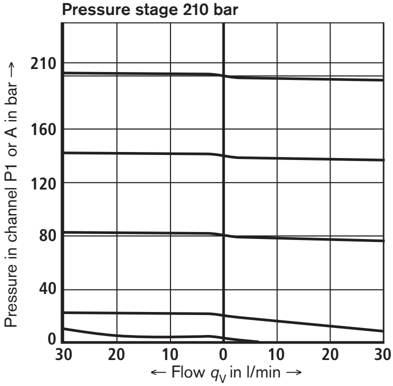
DRS 6 A → T | DRS 6 P → A
ZDRS 6 P1 → T2 | ZDRS 6 P2 → P1

Pressure stage 100 bar



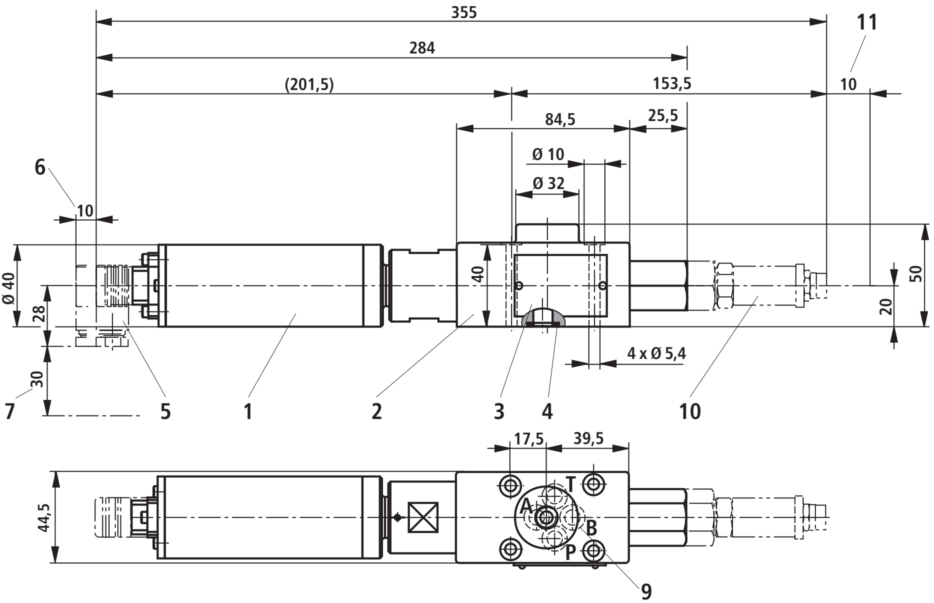
DRS 6 A → T | DRS 6 P → A
ZDRS 6 P1 → T2 | ZDRS 6 P2 → P1

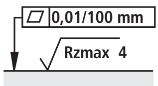
Pressure stage 210 bar



DRS 6 A → T | DRS 6 P → A
ZDRS 6 P1 → T2 | ZDRS 6 P2 → P1

Unit dimensions, type DRS 6 (nominal dimensions in mm)

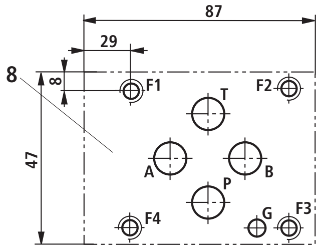




Required surface quality of mating surface

Tolerances:

– General tolerances ISO 2768-mK



1. DC motor
2. Valve housing
3. Nameplate
4. Identical seal rings for ports A, P, T and blind hole B
5. Cable socket, separate order, see pages 6 and 7
6. Space required to remove cable socket
7. Space required for connecting cable

   Note: The direction, in which the cable socket leads the cable away from the valve, can vary by 90° through 360°.
8. Position of ports to ISO 4401-03-02-0-94
   Deviating from standard:
   – Locating pin not provided for this valve
9. Blind hole (port B)
10. Pressure transducer for type DRS ...**S**
11. Space required to remove cable socket

Subplates to data sheet RE 45052 and valve fixing screws must be ordered separately.

Subplates: G 341/01 (G 1/4)
G 342/01 (G 3/8)
G 502/01 (G 1/2)

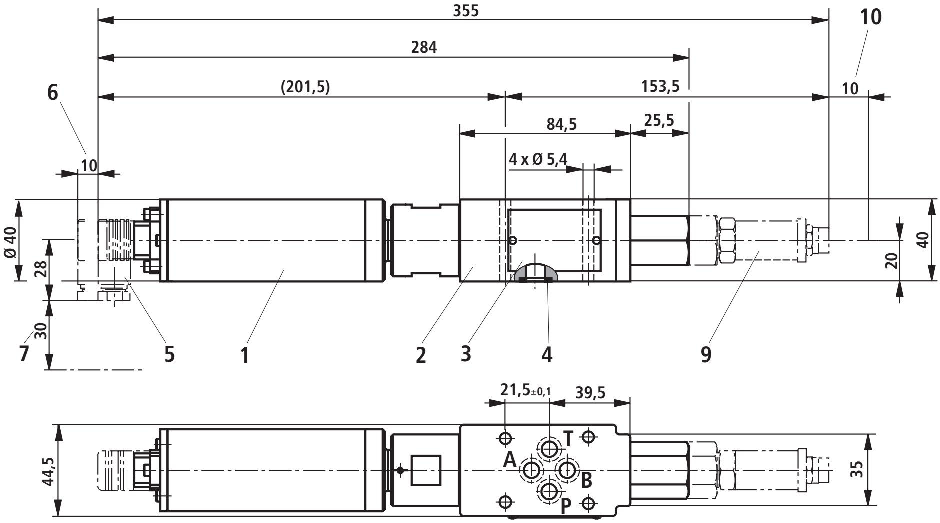
Valve fixing screws:

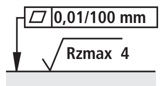
4 socket head cap screws ISO 4762 - M5 x 50 - 10.9-flZn-240h-L (friction coefficient μ_{total} = 0.09 to 0.14);
tightening torque M_T = 7 Nm ± 10%,
material no. **R913000064**

or

4 socket head cap screws ISO 4762 - M5 x 50 - 10.9
(friction coefficient μ_{total} = 0.12 to 0.17);
tightening torque M_T = 8.1 Nm ± 10%,

Unit dimensions, type ZDRS 6 (nominal dimensions in mm)

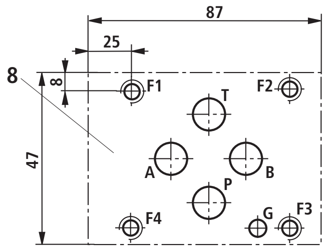




Required surface quality of mating surface

Tolerances:

– General tolerances ISO 2768-mK



1 DC motor

2 Valve housing

3 Nameplate

4 Identical seal rings for ports A, P, T and blind hole B

5 Cable socket, separate order, see pages 6 and 7

6 Space required to remove cable socket

7 Space required for connection cable

Note: The direction, in which the cable socket leads the cable away from the valve, can vary by 90° through 360°.

8 Position of ports to ISO 4401-03-02-0-94
Deviating from standard:
– Locating pin not provided for this valve

9 Pressure transducer for type ZDRS ...**S**

10 Space required to remove cable socket

Subplates to data sheet RE 45052 and valve fixing screws must be ordered separately.

Subplates:

G 341/01 (G 1/4)

G 342/01 (G 3/8)

G 502/01 (G 1/2)

Valve fixing screws:

4 socket head cap screws ISO 4762 - M5 - 10.9-flZn-240h-L
(friction coefficient μ_{total} = 0.09 to 0.14);
tightening torque M_T = 7 Nm ± 10%,
or

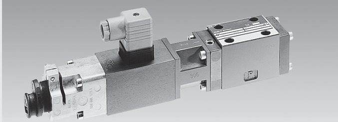
4 socket head cap screws ISO 4762 - M5 - 10.9
(friction coefficient μ_{total} = 0.12 to 0.17);
tightening torque M_T = 8.1 Nm ± 10%,

Notes

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

Proportional pressure reducing valve, pilot operated, with inductive position transducer

Type DREB6X



Nominal size 6
Unit series 1X
Maximum working pressure P 315 bar, T 250 bar
Maximum flow rate 40 l/min

List of Contents

Contents	Page

Features

– Pilot operated valves for reducing system pressure at the consumer (pilot oil internal only)
– 3-way version (P–A/A–T), $p_{min} = p_T$
– Adjustable through the position of the armature against the compression spring
– Position-controlled, minimal hysteresis < 1 %, rapid response times, see Technical data
– Pressure limitation to a safe level even with faulty electronics (solenoid current $I > I_{max}$)
– For subplate attachment, mounting hole configuration to ISO 4401-03-02-0-94
Subplates as per catalog sheet RE 45053 (order separately)
– Plug-in connector to DIN 43650-AM2 for the solenoid and plug-in connector for the position transducer, included in scope of delivery
– Data for the external trigger electronics
  • $U_B = 24\ V_{nom}$ DC
  • Adjustment of valve curve Np and gain with and without ramp generator
  • Europe card format, setpoint 0...+10 V (order separately)

Ordering data

DREB6	X	– 1X /		M	G24 – 25	Z4	M	*

Proportional 3-way pressure reducing valve with inductive position transducer, NG6, pilot operated: DREB6

Mounting hole configuration to ISO 4401-03-02-0-94 **= X**

Unit series 10 to 19 (10 to 19: installation and connection dimensions unchanged) **= 1X**

Max. pressure stage

up to 75 bar	**= 75**
up to 175 bar	**= 175**
up to 310 bar	**= 310**

Without non-return valve **= M**

Voltage supply of trigger electronics 24 V DC **= G24**

Solenoid type (current)

25 = Solenoid current 2.5 A max.

Z4 = **Electrical connection**
Unit plug to DIN 43650-AM2
Plug-in connector included in scope of delivery

M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

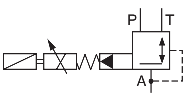
* Further information in plain text

Preferred types

Solenoid 2.5 A	
Type	**Material Number**
DREB6X–1X/75MG24–25Z4M	0 811 402 050
DREB6X–1X/175MG24–25Z4M	0 811 402 051
DREB6X–1X/310MG24–25Z4M	0 811 402 052

Symbol

For external trigger electronics



Function, sectional diagram

General

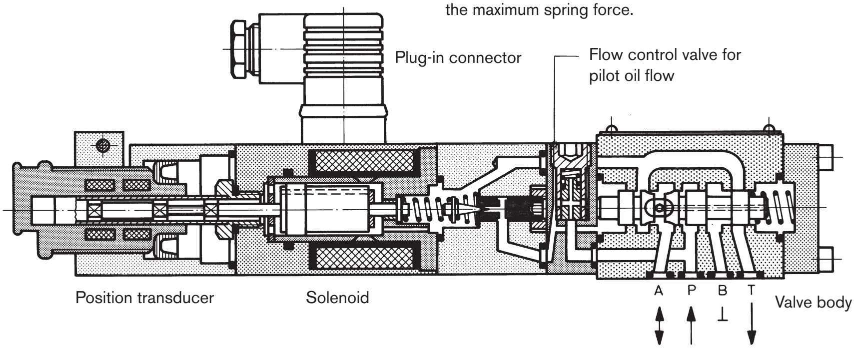
Type DREB6X proportional pressure reducing valves are pilot operated, with a 3-way main stage.
The pilot valve (pressure relief valve pilot stage) is supplied internally with a controlled flow of pilot oil via P.
The valves are actuated by a proportional solenoid, which is position-controlled against a spring. This ensures rapid response times and minimal hysteresis.
With these valves, the pressure in A (consumer) can be infinitely adjusted and reduced in relation to the solenoid current.

Basic principle

To adjust the system pressure in A, a setpoint is set in the trigger electronics. Based on this setpoint, the electronics control the solenoid coil with regulated PWM (pulse-width-modulated) current.
The proportional solenoid is positioned precisely on the spring characteristic curve. The pilot stage is supplied with oil from P at a flow rate of < 0.6 l/min via a flow control valve. The pilot pressure is compared with the consumer pressure (plus spring) in A and regulated (P–A/A–T).
The spring results in $p_{\mathrm{Amin}} = p$ in T.

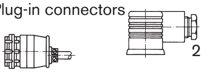
Pressure limitation for maximum safety

If a fault occurs in the electronics, so that the solenoid current ($I_{\max}$) would exceed its specified level in an uncontrolled manner, the pressure cannot rise above the level determined by the maximum spring force.



3

Accessories

Type			Material Number
(4 x) ISO 4762-M5x30-10.9	Cheese-head bolts		2 910 151 166
Europe card 	VT-VRPA1-527-10/V0/PV	RE 30052	0 811 405 096
Europe card 	VT-VRPA1-527-10/V0/PV-RTP	RE 30054	0 811 405 101
Europe card 	VT-VRPA1-527-10/V0/PV-RTS	RE 30056	0 811 405 176
Plug-in connectors  2P+PE	Plug-in connector 2P+PE (M16x1.5) for the solenoid and plug-in connector for the position transducer, included in scope of delivery, see also RE 08008		

Testing and service equipment

Test box type VT-PE-TB1, see RE 30063
Test adapter for Europe cards type VT-PA-3, see RE 30070

Technical data

General

Construction	Pilot stage		Poppet valve
	Main stage		Spool valve
Actuation			Proportional solenoid with position control, external amplifier
Connection type			Subplate, mounting hole configuration NG6 (ISO 4401-03-02-0-94)
Mounting position			Optional
Ambient temperature range		°C	–20...+50
Weight		kg	2.4
Vibration resistance, test condition			max. 25 g, shaken in 3 dimensions (24 h)

Hydraulic (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Pressure fluid			Hydraulic oil to DIN 51524...535, other fluids after prior consultation		
Viscosity range	recommended	mm^2/s	20...100		
	max. permitted	mm^2/s	10...800		
Pressure fluid temperature range		°C	–20...+80		
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)			Class 18/16/13 [1]		
Direction of flow			See symbol		
Max. set pressure in A (at $Q_{min} = 1$ l/min)		bar	75	175	310
Minimum pressure in A		bar	0 (relative) or pressure in T		
Min. inlet pressure in P		bar	$p_P = p_A + \geq 5$		
Max. working pressure		bar	Port P: 315		
Max. pressure		bar	Port T: 250 (B sealed)		
Internal pilot oil flow		l/min	approx. 0.6 (with closed-loop control)		
Max. flow		l/min	40		

Electrical

Cyclic duration factor	%	100
Degree of protection		IP 65 to DIN 40050 and IEC 14434/5
Solenoid connection		Unit plug DIN 43650/ISO 4400, M16 x 1.5 (2P+PE)
Position transducer connection		Special plug
Max. solenoid current	I_{max}	2.5 A
Coil resistance R_{20}	Ω	3
Max. power consumption at 100% load and operating temperature	VA	30

Static/Dynamic [2]

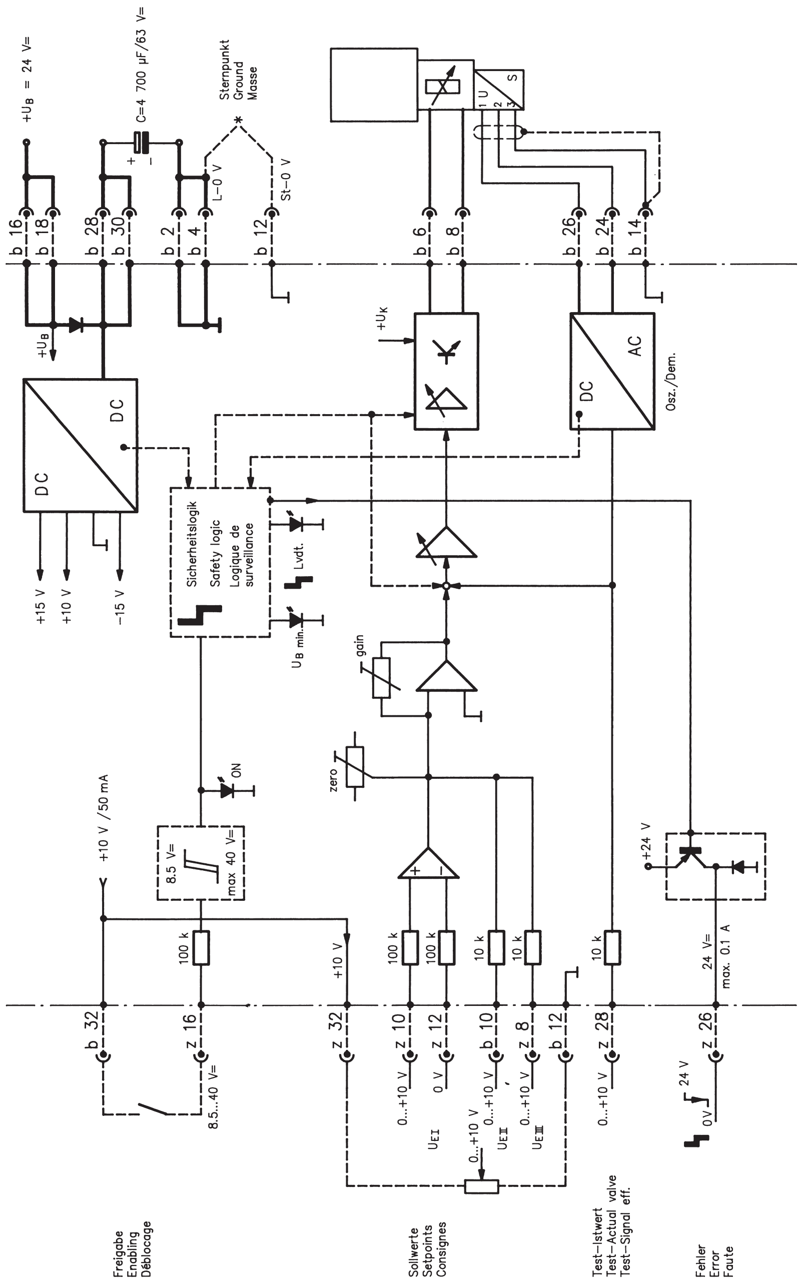
Hysteresis	%	≤ 1	
Manufacturing tolerance for p_{max}	%	≤ 10	
Response time 100 % signal change	ms	On <50	Response time at: $Q = 10$ l/min (values depend on the dead volume)
		Off <20	

[1] The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of components. For a selection of filters, see catalog sheets RE 50070, RE 50076 and RE 50081.

[2] All characteristic values ascertained using amplifier 0 811 405 096 (without ramp).

Valve with external trigger electronics (europe card without ramp, RE 30052)

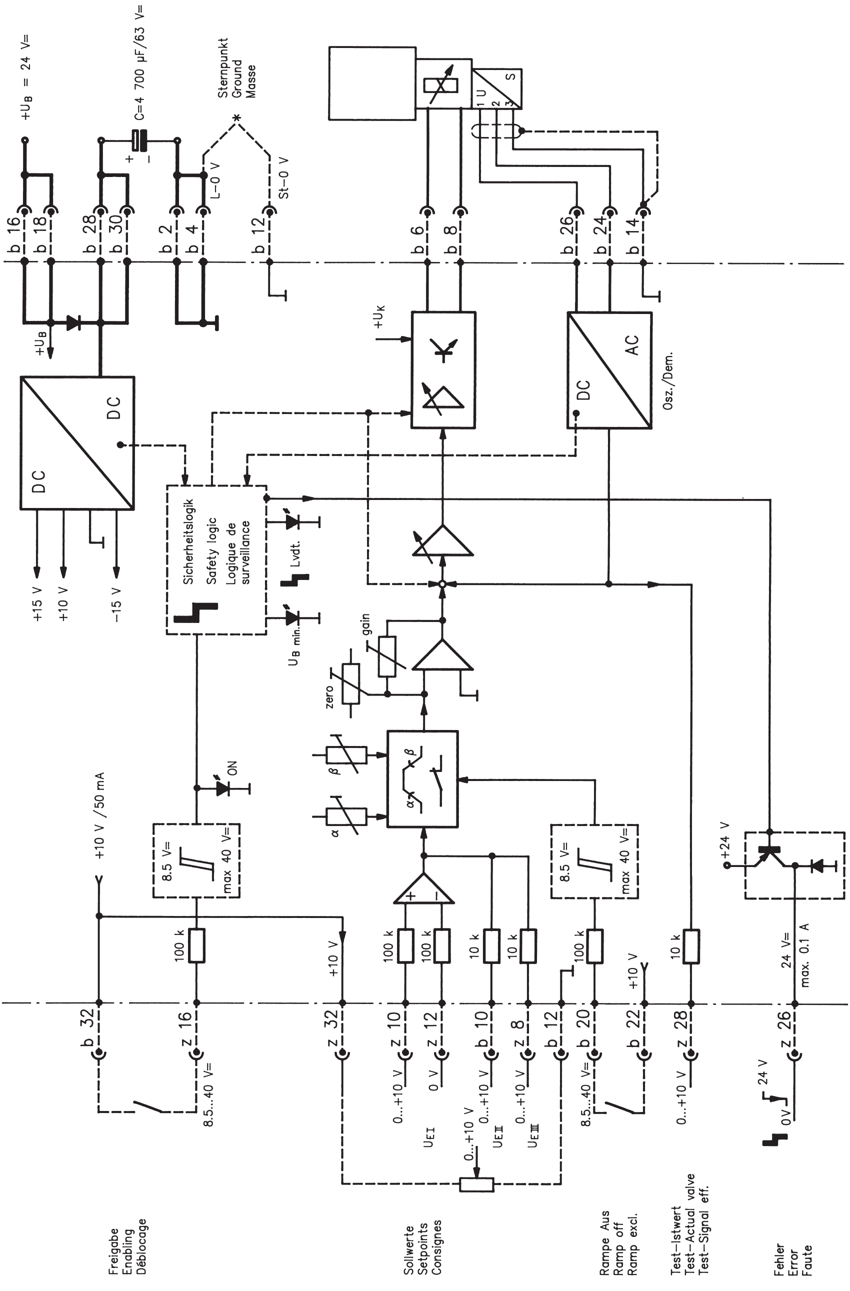
Circuit diagram/pin assignment



3

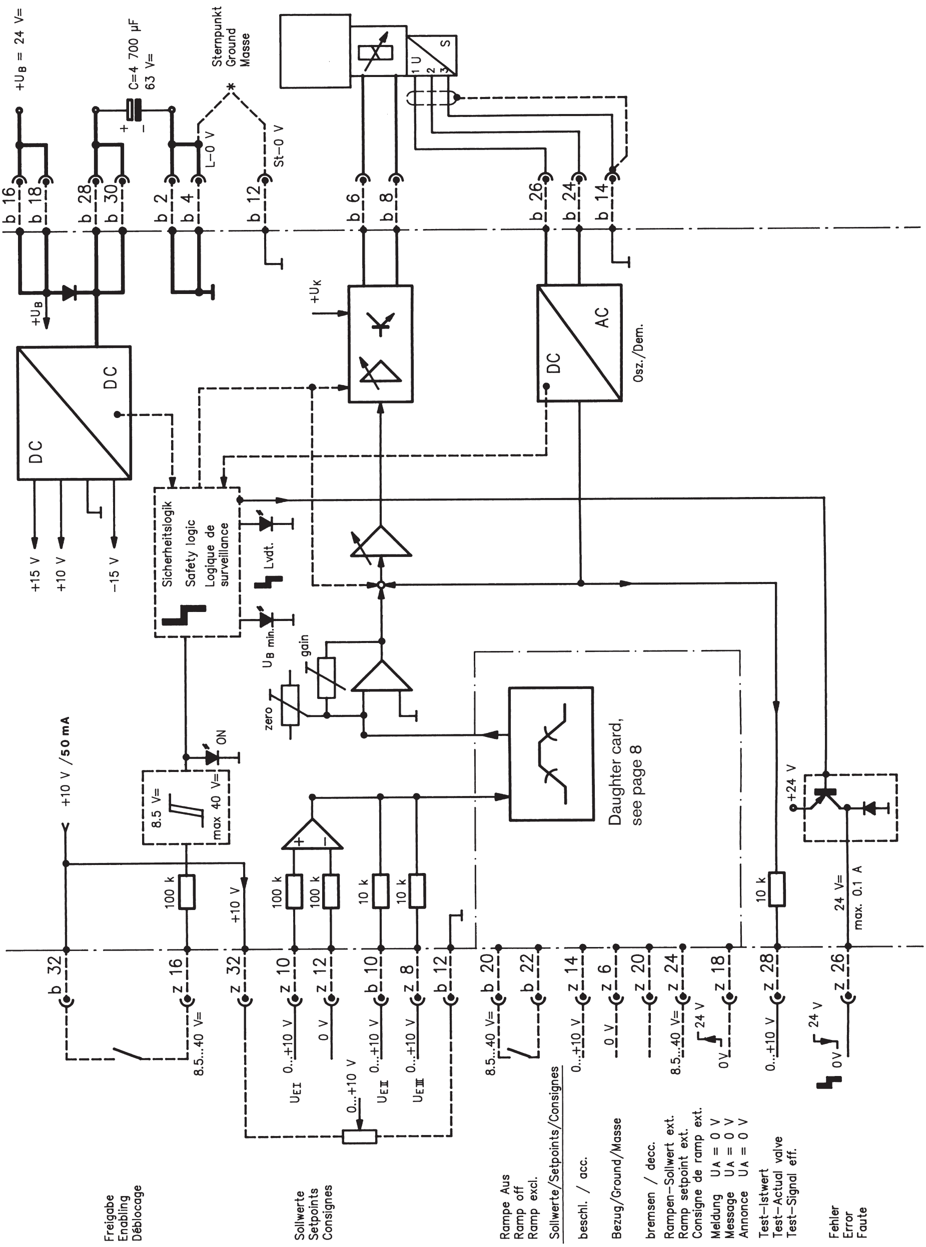
Valve with external trigger electronics (europe card without ramp, RE 30054)

Circuit diagram/pin assignment



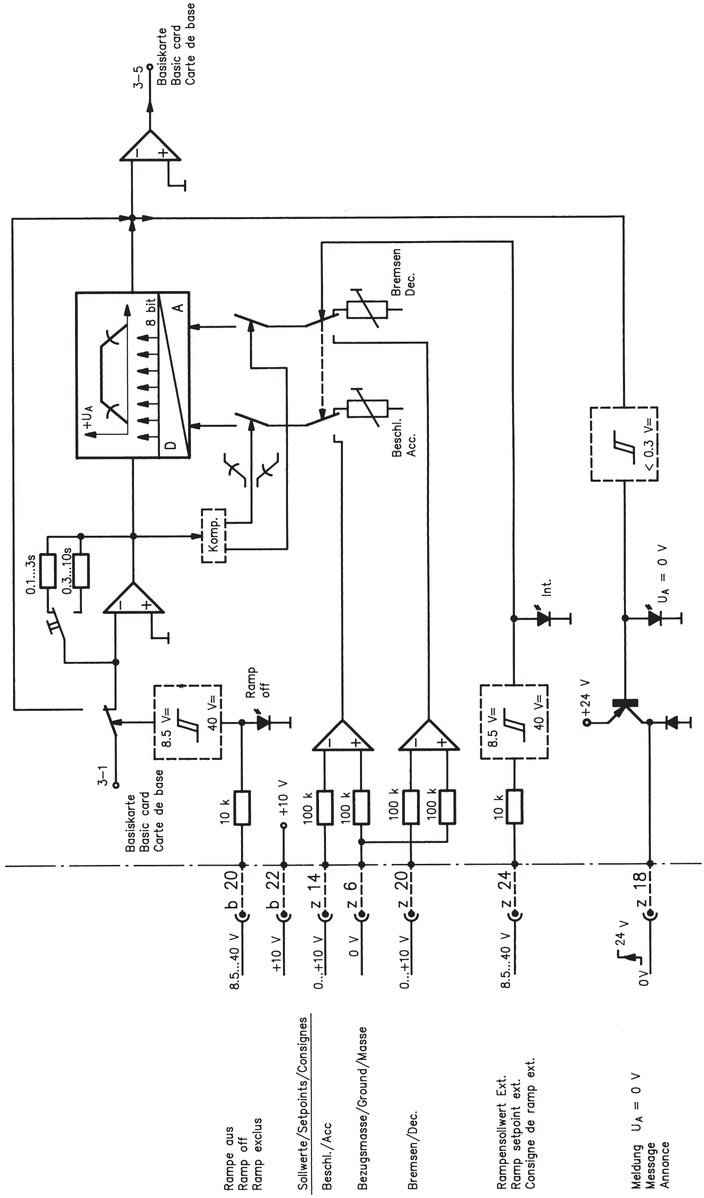
Valve with external trigger electronics (europe card without ramp, RE 30056)

Circuit diagram/pin assignment



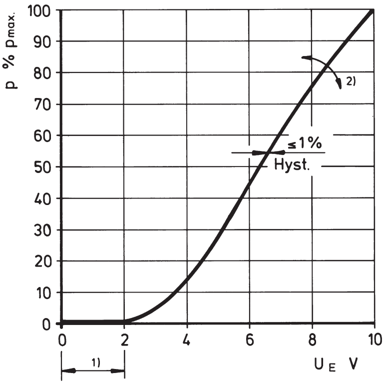
Valve with external trigger electronics (europe card without ramp, RE 30056)

Circuit diagram/pin assignment **Daughter card**



Characteristic curves (measured with HLP 46, $\vartheta_{oil} = 40°C \pm 5°C$)

Pressure in port A as a function of the setpoint



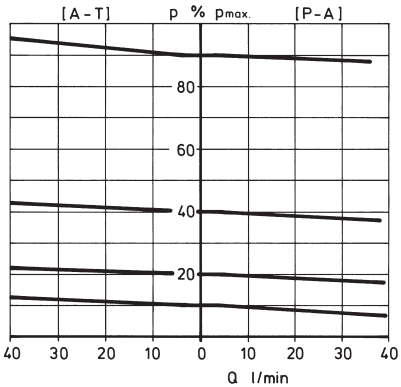
Valve amplifier

1) Zero adjustment

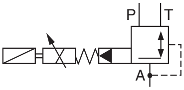
2) Sensitivity adjustment

3

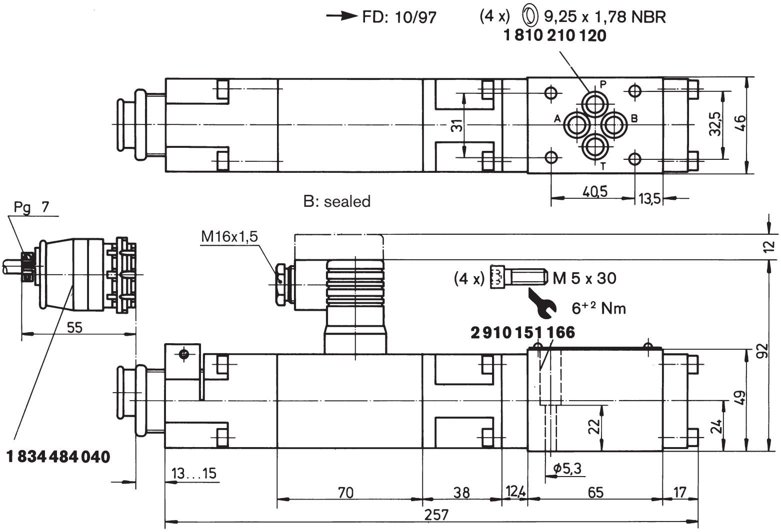
Pressure in port A proportionate to the maximum flow rate of the main stage

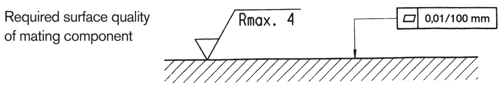


Set pressure
$p\% \, p_{max} = f\,(Q_{P-A}/Q_{A-T})$

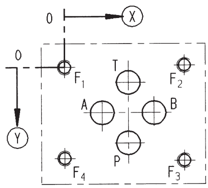


Unit dimensions (nominal dimensions in mm)





Mounting hole configuration: NG6 (ISO 4401-03-02-0-94)
For subplates, see catalog sheet RE 45053



1) Deviates from standard
2) Thread depth:
Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

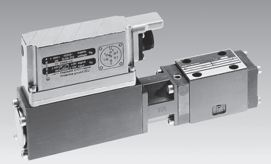
	P	A	T	B	F_1	F_2	F_3	F_4
X	21.5	12.5	21.5	30.2	0	40.5	40.5	0
Y	25.9	15.5	5.1	15.5	0	–0.75	31.75	31
Ø	8 1)	8 1)	8 1)	8 1)	M5 2)	M5 2)	M5 2)	M5 2)

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Telefon +49 (0) 93 52 / 18-0
Telefax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

Proportional pressure reducing valve, pilot operated, with on-board electronics (OBE) and position feedback

RE 29195/05.06
Replaces: 07.05

Type DREBE6X



Nominal size (NG) 6
Unit series 1X
Maximum working pressure P 315 bar, T 250 bar
Maximum flow rate 40 l/min

List of Contents

Contents	Page

Features

- Pilot operated valves with position feedback and on-board electronics for reducing system pressure in the consumer (pilot oil internal only)
- 3-way version (P–A/A–T), $p_{min} = p_T$
- Adjustable through the position of the armature against the compression spring
- Position-controlled, minimal hysteresis $< 1\,\%$, rapid response times, see Technical data
- Pressure limitation to a safe level even with faulty electronics (solenoid current $I > I_{max}$)
- For subplate attachment, mounting hole configuration to ISO 4401-03-02-0-05. Subplates as per catalog sheet RE 45053 (order separately)
- Plug-in connector to DIN 43563-AM6, see catalog sheet RE 08008 (order separately)
- Data for the on-board trigger electronics
  - Complies with CE, EMC directives EN 61000-6-2: 2002-08 and EN 61000-6-3: 2002-08
  - $U_B = 24\ V_{nom}$ DC
  - Electrical connection 6P+PE
  - Signal actuation
    - Standard 0...+ 10 V (A1)
    - Version 4...20 mA (F1)
  - Valve curve calibrated at the factory

Ordering data

DREB	E	6	X	–1X/		M	G24	K31		M	*

Proportional 3-way pressure reducing valve with inductive position transducer, pilot operated

With on-board electronics = **E**

Nominal size = **6**

Mounting hole configuration to ISO 4401-03-02-0-05 = **X**

Unit series 10 to 19 = **1X**
(10 to 19: installation and connection dimensions unchanged)

Max. pressure stage
up to 75 bar = **75**
up to 175 bar = **175**
up to 310 bar = **310**

Without non-return valve = **M**

Voltage supply of trigger electronics 24 V DC = **G24**

K31 = **Electrical connection**
without plug-in connector,
with unit plug to DIN 43563-AM6
Order plug-in connector separately

Interface for trigger electronics
A1 = Setpoint input 0...+10 V
F1 = Setpoint input 4...20 mA

M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

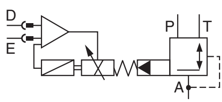
Further information in plain text

Preferred types

Type....A1 (0...+10 V)	Material Number	Type....F1 (4...20 mA)	Material Number
DREBE6X–1X/75MG24K31A1M	0 811 402 082	DREBE6X–1X/175MG24K31F1M	0 811 402 083
DREBE6X–1X/175MG24K31A1M	0 811 402 080	DREBE6X–1X/310MG24K31F1M	0 811 402 085
DREBE6X–1X/310MG24K31A1M	0 811 402 081		

Symbol

For on-board electronics



Function, sectional diagram

General

Type DREBE6X proportional pressure reducing valves are pilot operated with a 3-way main stage.
The pilot valve (pressure relief valve pilot stage) is supplied internally with a controlled flow of pilot oil via P.
The valves are actuated by means of a position-controlled proportional solenoid with on-board electronics.
With these valves, the pressure in A (consumer) can be infinitely adjusted and reduced in relation to the setpoint.

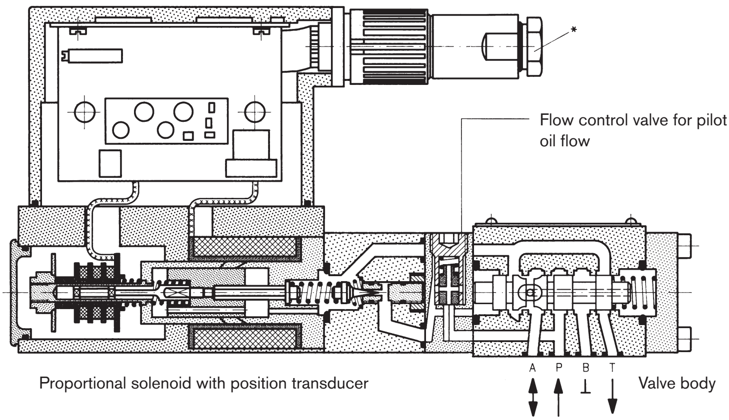
CE EN 61000-6-2: 2002-08
EN 61000-6-3: 2002-08

Basic principle

To adjust the system pressure in A, a setpoint is set in the trigger electronics. Based on this setpoint, the electronics control the position of the solenoid against the spring force. The proportional solenoid is positioned precisely on the spring characteristic curve. The pilot stage is supplied with oil from P at a flow rate of < 0.6 l/min via a flow control valve. The pilot pressure is compared with the consumer pressure (plus spring) in A and regulated.
The spring results in $p_{Amin} = p$ in T.

Pressure limitation for maximum safety

If a fault occurs in the electronics, so that the solenoid current (I_{max}) would exceed its specified level in an uncontrolled manner, the pressure cannot rise above the level determined by the maximum spring force.



Accessories

Type			Material Number
(4 x) ISO 4762-M5x30-10.9	Cheese-head bolts		2 910 151 166
* 	Plug-in connectors 6P+PE, see also RE 08008	KS	1 834 482 022
		KS	1 834 482 026
		MS	1 834 482 023
		MS	1 834 482 024
		KS 90°	1 834 484 252

Testing and service equipment

Test box type VT-PE-TB3, see RE 30065
Measuring adapter 6P+PE type VT-PA-2, see RE 30068

Technical data

General

Construction	Pilot stage	Poppet valve
	Main stage	Spool valve
Actuation		Proportional solenoid with position control and OBE
Connection type		Subplate, mounting hole configuration NG6 (ISO 4401-03-02-0-05)
Mounting position		Optional
Ambient temperature range	°C	–20...+50
Weight	kg	3.3
Vibration resistance, test condition		Max. 25 g, shaken in 3 dimensions (24 h)

Hydraulic (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Pressure fluid		Hydraulic oil to DIN 51524...535, other fluids after prior consultation		
Viscosity range	recommended mm²/s	20...100		
	max. permitted mm²/s	10...800		
Pressure fluid temperature range	°C	–20...+70		
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)		Class 18/16/13 [1]		
Direction of flow		See symbol		
Max. set pressure in A (at $Q_{min} = 1$ l/min)	bar	75	175	310
Minimum pressure in A	bar	0 (relative) or pressure in T		
Min. inlet pressure in P	bar	$p_P = p_A + \geq 5$		
Max. working pressure	bar	Port P: 315		
Max. pressure	bar	Port T: 250 (B sealed)		
Internal pilot oil flow	l/min	approx. 0.6 (with closed-loop control)		
Max. flow	l/min	40		

Static/Dynamic

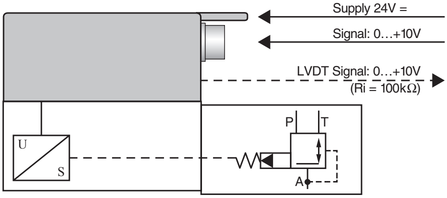
Hysteresis		%	≦1 of max. set pressure
Manufacturing tolerance		%	≦±5 of max. set pressure
Response time	100 % signal change	ms	50
	10 % signal change	ms	20
Thermal drift			<1% at $\Delta T = 40\,°C$
Conformity			CE EN 61000-6-2: 2002-08 EN 61000-6-3: 2002-08

[1] The purity classes stated for the components must be complied with in hydraulic systems.
Effective filtration prevents problems and also extends the service life of components.
For a selection of filters, see catalog sheets RE 50070, RE 50076 and RE 50081.

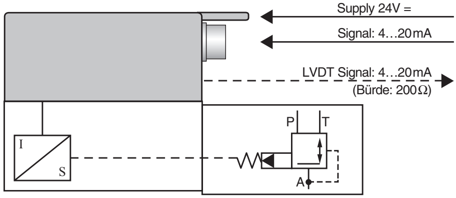
Technical data

Electrical, trigger electronics integrated in valve		
Cyclic duration factor	%	100
Degree of protection		IP 65 to DIN 40050 and IEC 14434/5
Connection		Plug-in connector 6P+PE, DIN 43563
Supply voltage Terminal A: Terminal B: 0 V		24 V DC_{nom} Min. 21 V DC/max. 40 V DC Ripple max. 2 V DC
Power consumption		Solenoid ⧄ 45 mm = 40 VA max.
External fuse		2.5 A_F
Input, “standard” version Terminal D: U_E Terminal E:	A1	Differential amplifier, R_i = 100 kΩ 0...+10 V 0 V
Input, “mA signal” version Terminal D: I_{D-E} Terminal E: I_{D-E}	F1	Burden, R_{sh} = 200 Ω 4...20 mA Current loop I_{D-E} feedback
Max. voltage to differential inputs over 0 V		D → B, E → B } max. 18 V DC
Test signal, “standard” version Terminal F: U_{Test} Terminal C:	A1	LVDT 0...+10 V Reference 0 V
Test signal, “mA signal” version Terminal F: I_{F-C} Terminal C: I_{F-C}	F1	LVDT signal 4...20 mA at external load 200...500 Ω max. 4...20 mA output Current loop I_{F-C} feedback
Safety earth conductor and shield		See pin assignment (installation in conformity with CE)
Recommended cable		See pin assignment up to 20 m 7 x 0.75 mm^2 up to 40 m 7 x 1 mm^2
Calibration		Calibrated at the factory, see valve curve

Version A1:
Standard

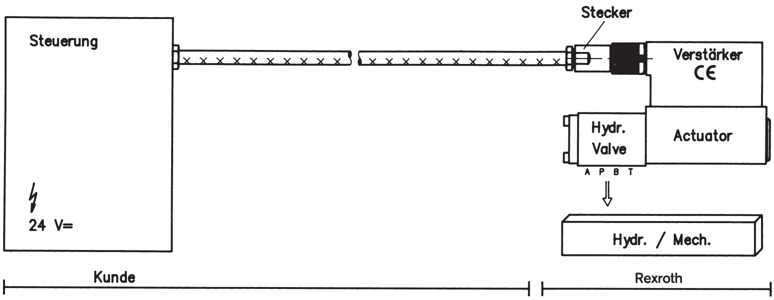


Version F1:
mA signal



Connection

For electrical data, see page 5 and
Operating Instructions **1 819 929 083**



Technical notes for the cable

Version:
- Multi-wire cable
- Extra-finely stranded wire to VDE 0295, Class 6
- Safety earth conductor, green/yellow
- Cu braided shield

Type:
- e.g. Ölflex-FD 855 CP (from Lappkabel company)

No. of wires:
- Determined by type of valve, plug type and signal assignment

Cable Ø:
- 0.75 mm^2 up to 20 m long
- 1.0 mm^2 up to 40 m long

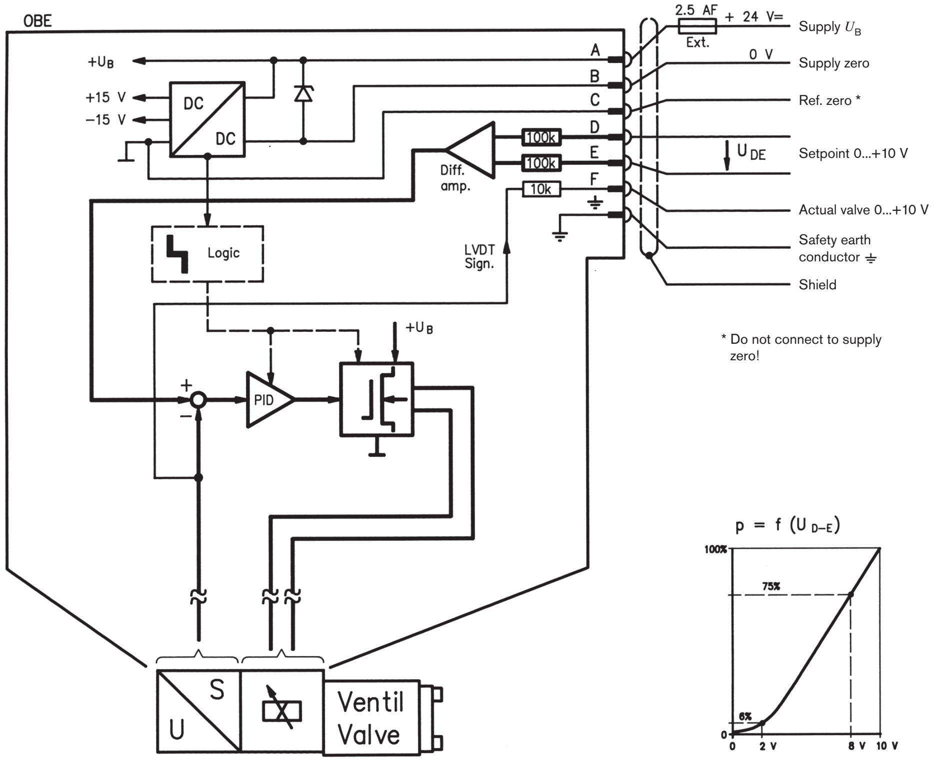
Outside Ø:
- 9.4...11 .8 mm – Pg 11
- 12.7...13.5 mm – Pg 16

Important

Voltage supply 24 V DC nom.,
if voltage drops below 18 V DC, rapid shutdown resembling "Enable OFF" takes place internally.
In addition, with the "mA signal" version:
$I_{D-E} \geqq 3$ mA – valve is active
$I_{D-E} \leqq 2$ mA – valve is deactivated.
Electrical signals emitted via the trigger electronics (e.g. actual values) must not be used to shut down safety-relevant machine functions!
(See also European Standard, "Technical Safety Requirements for Fluid-Powered Systems and Components – Hydraulics", EN 982.)

On-board trigger electronics

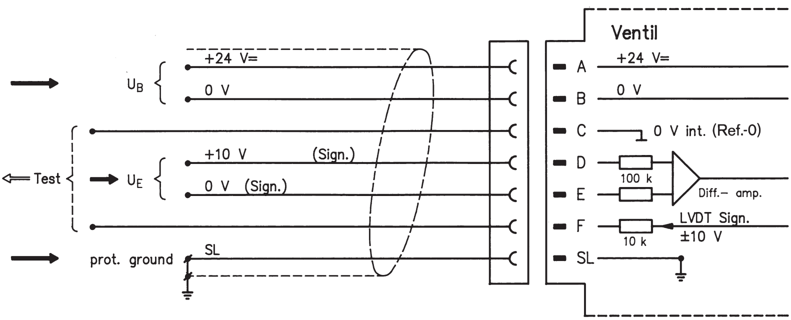
Circuit diagram/pin assignment
Version A1: U_{D-E} 0...+10 V



* Do not connect to supply zero!

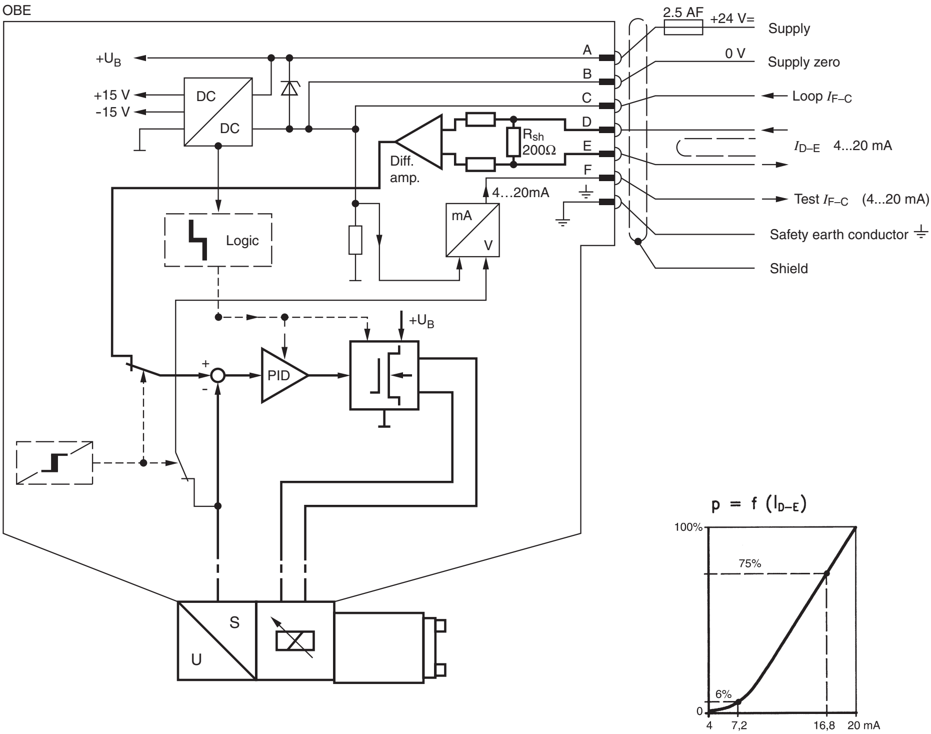
3

Pin assignment
Version A1: U_{D-E} 0...+10 V
(R_i = 100 kΩ)

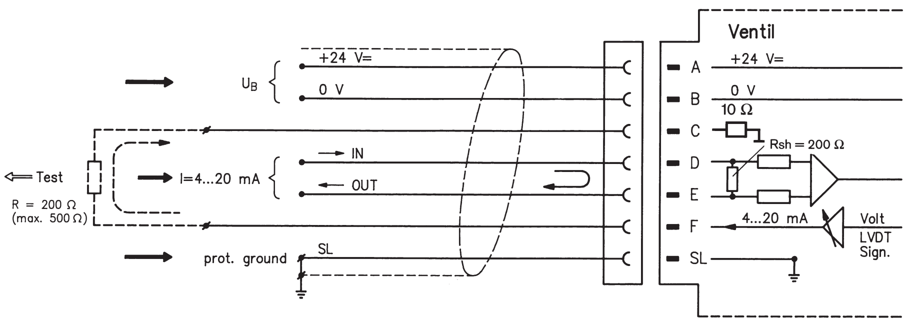


On-board trigger electronics

Circuit diagram/pin assignment
Version F1: I_{D-E} 4...20 mA

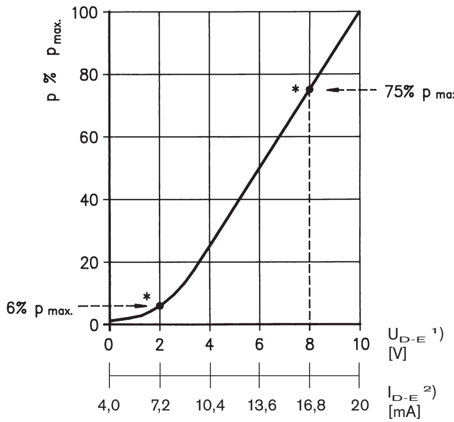


Pin assignment 6P+PE
Version F1: I_{D-E} 4...20 mA
(R_{sh} = 200 kΩ)



Characteristic curves (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Pressure in port A as a function of the setpoint



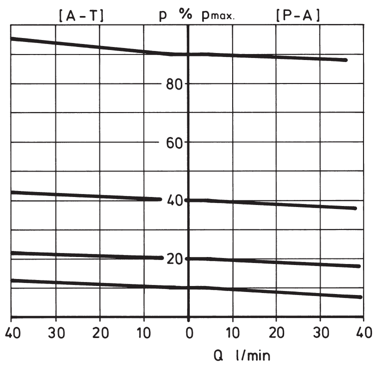
* Factory setting at $Q = 1$ l/min +5 % manufacturing tolerance (of max. set pressure)

1) Version: $U_{D-E} = 0...+10$ V

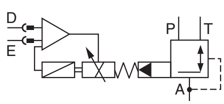
2) Version: $I_{D-E} = 4...20$ mA

3

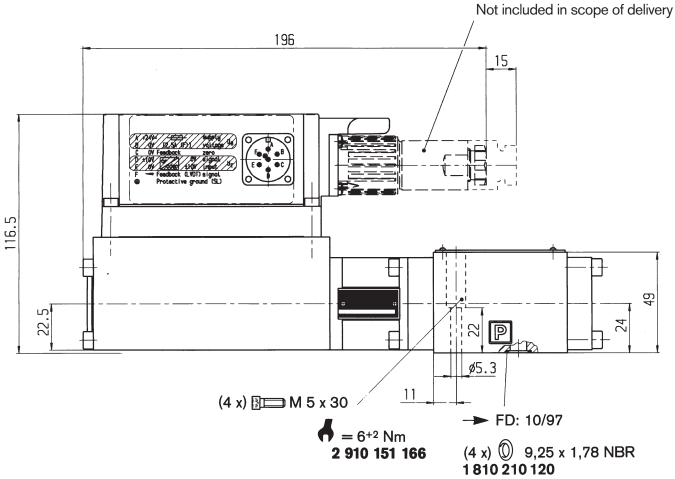
Pressure in port A proportionate to the maximum flow rate of the main stage

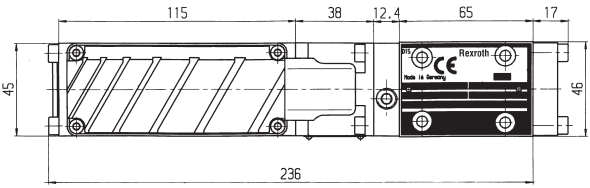


Set pressure
$p\,\%\,p_{max} = f\,(Q_{P-A}/Q_{A-T})$



Unit dimensions (nominal dimensions in mm)

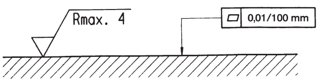


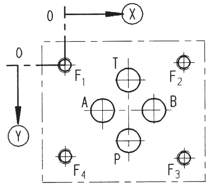


Mounting hole configuration: NG6
(ISO 4401-03-02-0-05)
For subplates, see catalog sheet RE 45053

[1)] Deviates from standard
[2)] Thread depth:
Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

Required surface quality of mating component



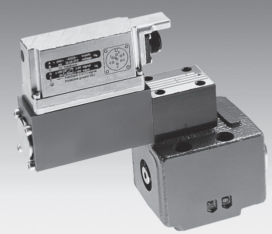


	P	A	T	B	F_1	F_2	F_3	F_4
X	21.5	12.5	21.5	30.2	0	40.5	40.5	0
Y	25.9	15.5	5.1	15.5	0	–0.75	31.75	31
Ø	8 [1)]	8 [1)]	8 [1)]	8 [1)]	M5 [2)]	M5 [2)]	M5 [2)]	M5 [2)]

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Telefon +49 (0) 93 52 / 18-0
Telefax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

Proportional pressure reducing valve, pilot operated, with on-board electronics (OBE) and position feedback

Type DREBE10Z



Nominal size 10
Unit series 1X
Maximum working pressure A, B, X 315 bar, Y 2 bar
Maximum flow rate Q_{nom} 120 l/min

List of contents

Contents	**Page**

Features

– Pilot operated valves with position feedback and on-board electronics for reducing system pressure (pilot oil internal only, with relief port X)
– Adjustable through the position of the armature against the compression spring
– With position control, minimal hysteresis <1%, rapid response times, see Technical Data
– Pressure limitation to a safe level even with faulty electronics (solenoid current $I > I_{max}$)
– For subplate attachment, mounting hole configuration to ISO 5781-AG-06-2-A
Subplates as per catalog sheet RE 45055 (order separately)
– Plug-in connector to DIN 43563-AM6, see catalog sheet RE 08008 (order separately)
– Data for the on-board trigger electronics
  • Complies with CE, EMC directives EN 61000-6-2: 2002-08 and EN 61000-6-3: 2002-08
  • U_B = 24 V_{nom} DC
  • Electrical connection 6P+PE
  • Signal actuation
    – Standard 0...+10 V (A1)
  • Valve curve calibrated at the factory

Ordering data

DREB	E	10	Z	–1X	/	XY	M	G24	K31	A1	M	*

Proportional pressure reducing valve with inductive position transducer on the cone

With on-board electronics = E

Nominal size = 10

Mounting hole configuration to ISO 5781-AG-06-2-A = Z

Unit series 10 to 19 (10 to 19: installation and connection dimensions unchanged) = 1X

Max. pressure stage

up to 180 bar = 180

up to 315 bar = 315

Relief port X
Pilot oil port Y = XY

* Variant “F1” (4...20 mA version) available on request

Further information in plain text

M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

Interface for trigger electronics*

A1 = Setpoint input 0...+10 V

K31 = **Electrical connection without** plug-in connector, with unit plug to DIN 43563-AM6
Order plug-in connector separately

G24 = Voltage supply of trigger electronics 24 V DC

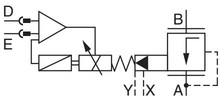
M = Without non-return valve

Preferred types

Type ....A1 (0...+10 V)	Material Number
DREBE10Z–1X/180XYMG24K31A1M	0 811 402 155
DREBE10Z–1X/315XYMG24K31A1M	0 811 402 152

Symbol

For on-board electronics



Function, sectional diagram

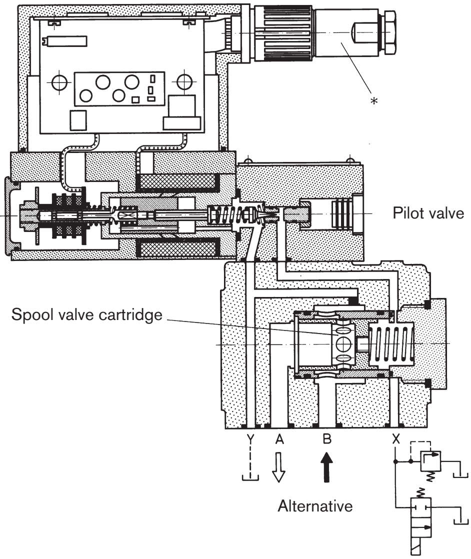
General

Type DREBE10Z proportional pressure reducing valves are pilot operated and are used to reduce system pressure.
They are actuated by means of a position-controlled proportional solenoid with on-board electronics.
The valve body contains a logic element (spool valve) of the "normally open" type. This is pilot operated and is in conical seat design.

Basic principle

To adjust the system pressure, a setpoint is set in the trigger electronics. Based on this setpoint, the electronics control the position-controlled solenoid.
The proportional solenoid maintains its position against a spring force, which is proportionate to the system pressure.
The pilot stage is supplied with pilot oil at a flow rate of < 0.8 l/min through a bore. The "p_{max}" pressure stage is determined by the cone and seating bore configuration.
Pressure limitation for maximum safety
If a fault occurs in the electronics, so that the solenoid current (I_{max}) would exceed its specified level in an uncontrolled manner, the pressure cannot rise above the level determined by the maximum spring force.

CE EN 61000-6-2: 2002-08
EN 61000-6-3: 2002-08



Accessories

Type			Material Number
(4 x) ISO 4762-M10x80-10.9	Cheese-head bolts		2 910 151 309
* 	Plug-in connectors 6P+PE, see also RE 08008	KS	1 834 482 022
		KS	1 834 482 026
		MS	1 834 482 023
		MS	1 834 482 024
		KS 90°	1 834 484 252

Testing and service equipment

Test box type VT-PE-TB3, see RE 30065
Measuring adapter 6P+PE type VT-PA-2, see RE 30068

Technical data

General		
Construction	Pilot stage	Poppet valve
	Main stage	Pressure reducing valve
	Valve cartridge	Spool valve, normally open
Actuation		Proportional solenoid with position control and OBE
Connection type		Subplate, mounting hole configuration NG10 (ISO 5781-AG-06-2-A)
Mounting position		Optional
Ambient temperature range	°C	–20...+50
Weight	kg	7.8
Vibration resistance, test condition		Max. 25 g, shaken in 3 dimensions (24 h)

Hydraulic (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)			
Pressure fluid		Hydraulic oil to DIN 51524...535, other fluids after prior consultation	
Viscosity range	recommended mm^2/s	20...100	
	max. permitted mm^2/s	10...800	
Pressure fluid temperature range	°C	–20...+70	
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)		Class 18/16/13 [1)]	
Direction of flow		See symbol	
Max. set pressure (at Q_{min} = 1 l/min)	bar	180	315
Minimum pressure (at Q_{min} = 1 l/min)	bar	6	8
Max. mechanical pressure limitation level, e.g. when solenoid current $I > I_{max}$	bar	$<$190	$<$325
Max. working pressure	bar	Port A, B: 315	
		Port Y: ≤ 2 external pilot oil drain	
		Port X: 315 relief port	
Internal pilot oil flow	l/min	≤ 0.8	
Max. flow	l/min	120 for Q_{max}, see Characteristic Curves	

Static/Dynamic		
Hysteresis	%	≦ 1
Manufacturing tolerance for p_{max}	%	≦ ±5, see Characteristic Curves
Response time 100 % signal change	ms	≈ 80 dependent on dead volume or system volume
Thermal drift		<1% at $\Delta T = 40\,°C$
Conformity		CE EN 61000-6-2: 2002-08 EN 61000-6-3: 2002-08

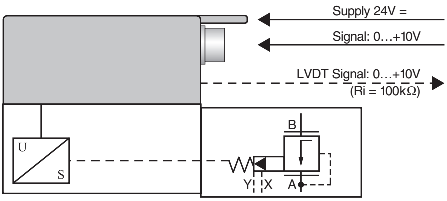
[1)] The purity classes stated for the components must be complied with in hydraulic systems.
Effective filtration prevents problems and also extends the service life of components.
For a selection of filters, see catalog sheets RE 50070, RE 50076 and RE 50081.

Technical data

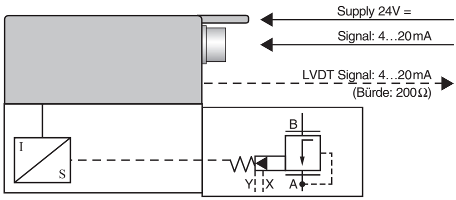
Electrical, trigger electronics integrated in valve		
Cyclic duration factor	%	100 %
Degree of protection		IP 65 to DIN 40050 and IEC 14434/5
Connection		Plug-in connector 6P+PE, DIN 43563
Supply voltage Terminal A: Terminal B: 0 V		24 V DC_{nom} Min. 21 V DC/max. 40 V DC Ripple max. 2 V DC
Power consumption		Solenoid ⌀ 45 mm = 40 VA max.
External fuse		2.5 A_F
Input, “standard” version Terminal D: U_E Terminal E:	A1	Differential amplifier, R_i = 100 kΩ 0...+10 V 0 V
Input, “mA signal” version Terminal D: I_{D-E} Terminal E: I_{D-E}	F1*	Burden, R_{sh} = 200 Ω 4...20 mA Current loop I_{D-E} feedback
Max. voltage to differential inputs over 0 V		$\left.\begin{array}{l} D \rightarrow B \\ E \rightarrow B \end{array}\right\}$ max. 18 V=
Test signal, “standard” version Terminal F: U_{Test} Terminal C:	A1	LVDT 0...+10 V Reference 0 V
Test signal, “mA signal” version Terminal F: I_{F-C} Terminal C: I_{F-C}	F1*	LVDT signal 4...20 mA at external load 200...500 Ω max. 4...20 mA output Current loop I_{F-C} feedback
Safety earth conductor and shield		See pin assignment (installation in conformity with CE)
Recommended cable		See pin assignment up to 20 m 7 x 0.75 mm² up to 40 m 7 x 1 mm²
Calibration		Calibrated at the factory, see valve curve

* Variant “F1” (4...20 mA version) available on request

Version A1: Standard

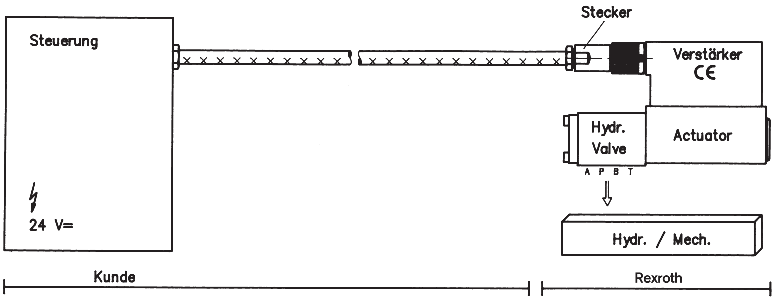


* Version F1: mA signal



Connection

For electrical data, see page 5 and
Operating Instructions **1 819 929 083**



Technical notes for the cable

Version:
- Multi-wire cable
- Extra-finely stranded wire to VDE 0295, Class 6
- Safety earth conductor, green/yellow
- Cu braided shield

Type:
- e.g. Ölflex-FD 855 CP (from Lappkabel company)

No. of wires:
- Determined by type of valve, plug type and signal assignment

Cable Ø:
- 0.75 mm² up to 20 m long
- 1.0 mm² up to 40 m long

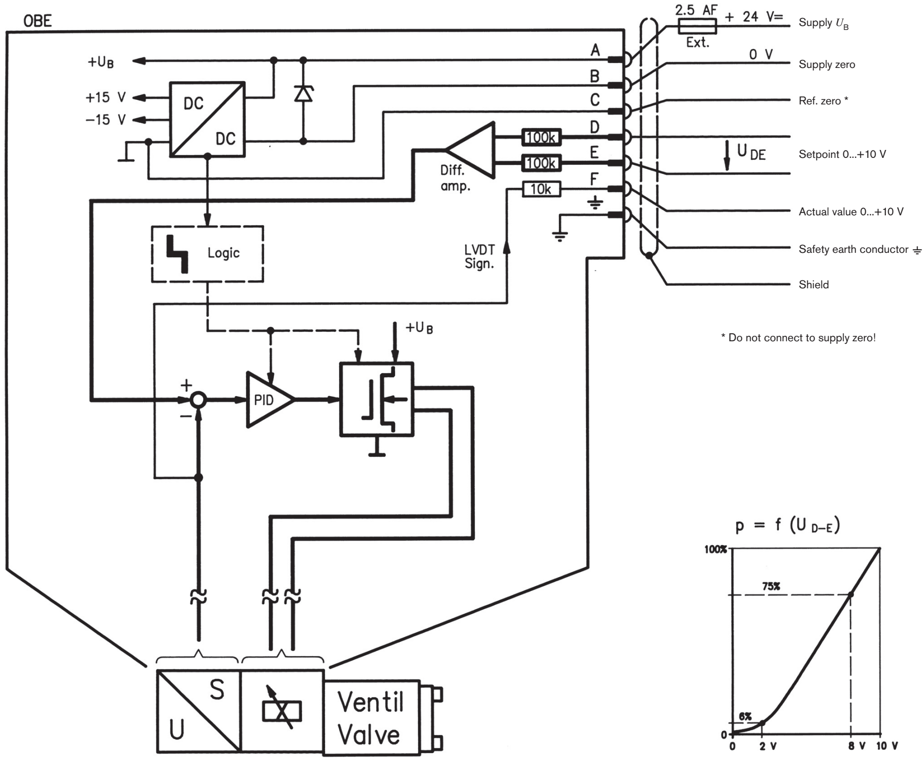
Outside Ø:
- 9.4...11.8 mm – Pg 11
- 12.7...13.5 mm – Pg 16

Important

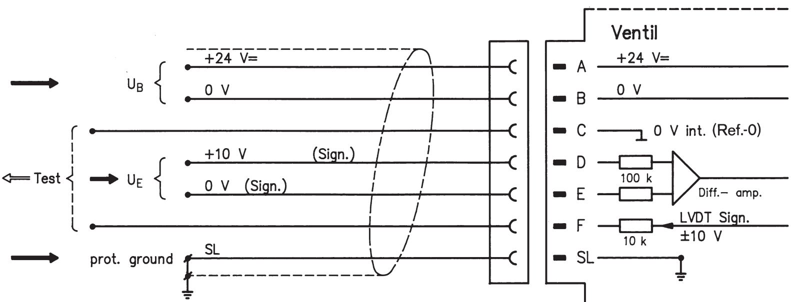
Power supply 24 V DC nom.,
if voltage drops below 18 V DC, rapid shutdown resembling "Enable OFF" takes place internally.
In addition, with the "mA signal" version:
$I_{D-E} \geqq 3$ mA – valve is active
$I_{D-E} \leqq 2$ mA – valve is deactivated.
Electrical signals emitted via the trigger electronics (e.g. actual values) must not be used to shut down safety-relevant machine functions!
(See also European Standard, "Technical Safety Requirements for Fluid-Powered Systems and Components – Hydraulics", EN 982).

On-board trigger electronics

Circuit diagram/pin assignment
Version A1: U_{D-E} 0...+10 V



Pin assignment
Version A1: U_{D-E} 0...+10 V
(R_i = 100 kΩ)

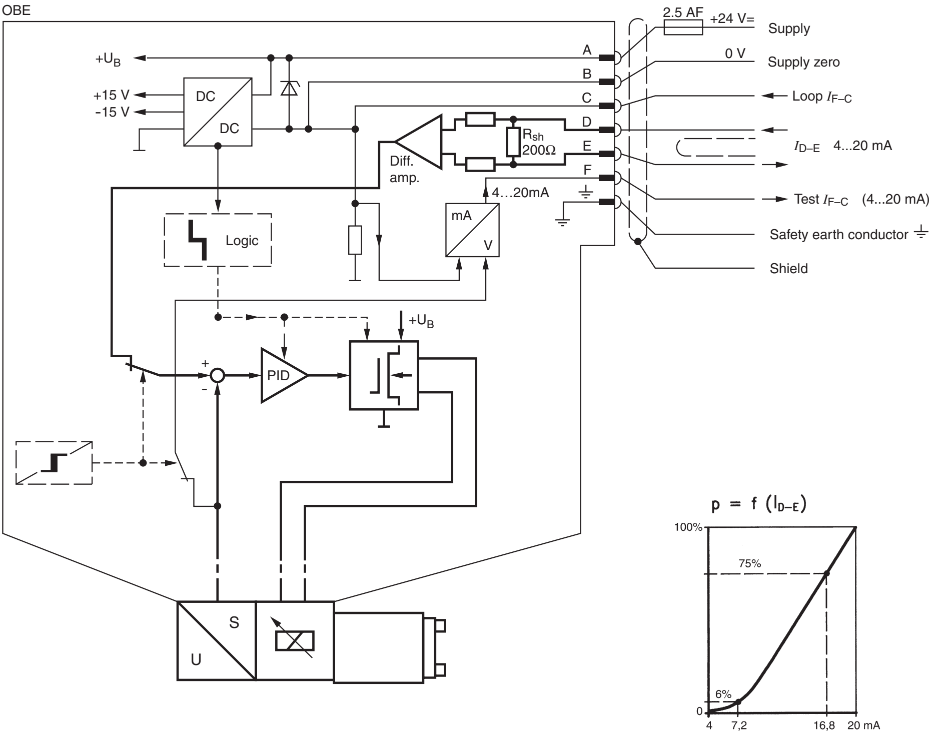


3

On-board trigger electronics

Circuit diagram/pin assignment

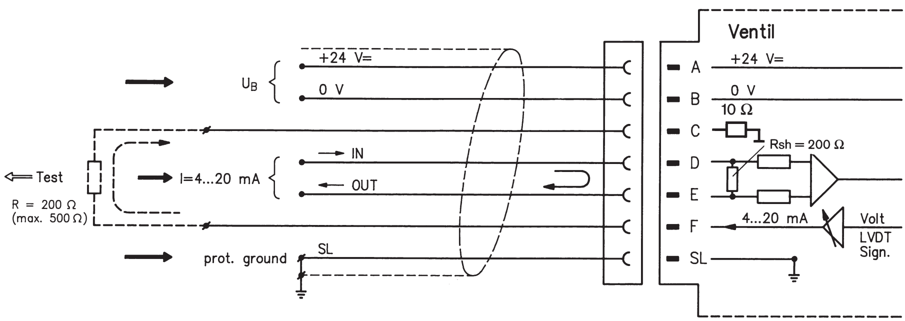
Version F1: I_{D-E} 4...20 mA



Pin assignment 6P+PE

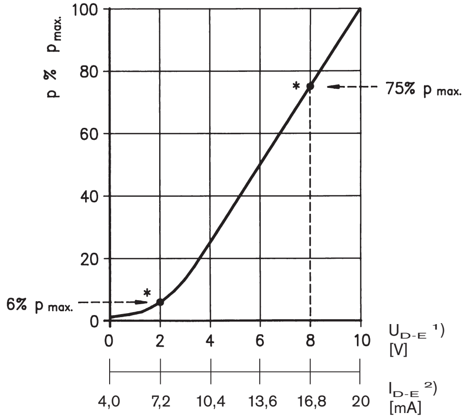
Version F1: I_{D-E} 4...20 mA

(R_{sh} = 200 kΩ)



Characteristic curves (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Pressure in port A as a function of the setpoint



* Factory setting at $Q = 1$ l/min
±5 % manufacturing tolerance

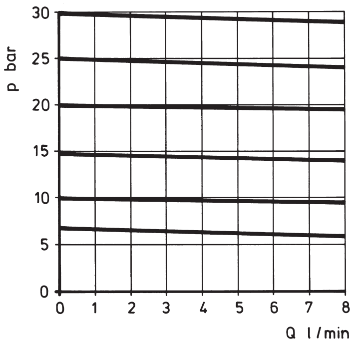
1) Version: $U_{D-E} = 0...+10$ V

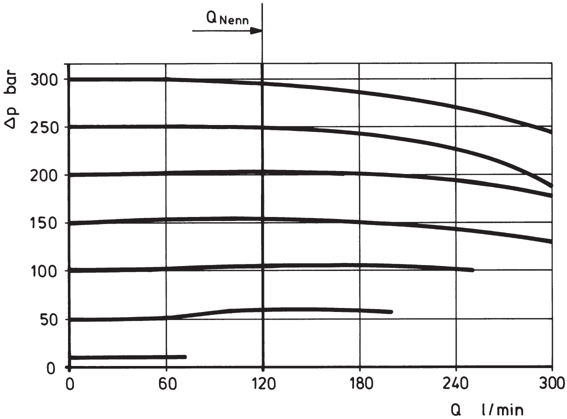
2) Version: $I_{D-E} = 4...20$ mA

3

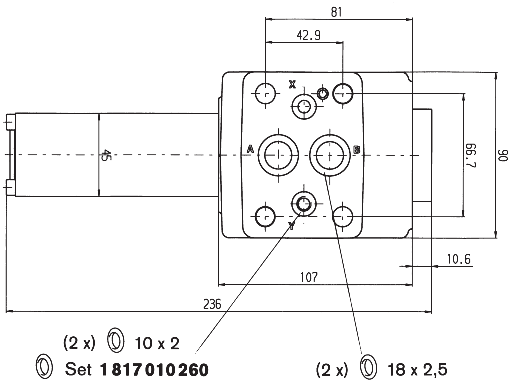
Pressure in port A as a function
of the main stage nominal flow rate

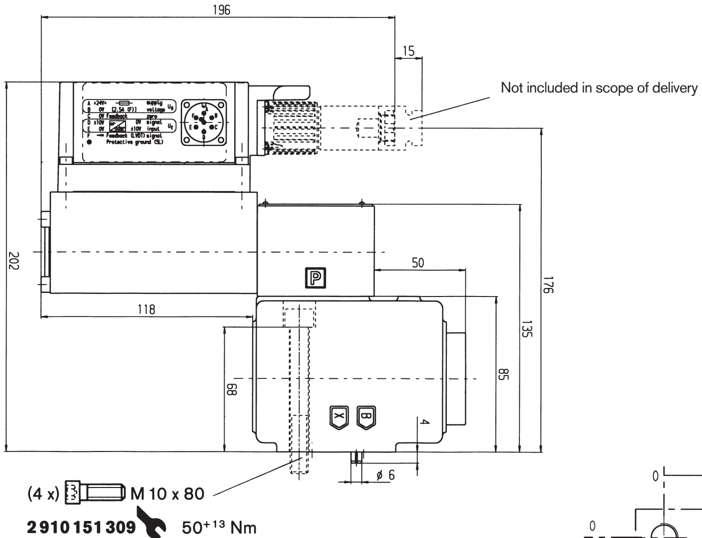
$p = f(Q)$

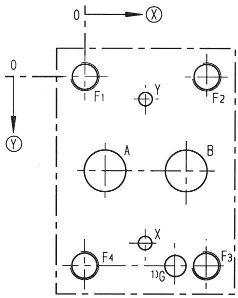




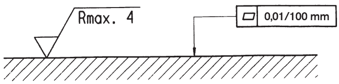
Unit dimensions (nominal dimensions in mm)







Mounting hole configuration: NG10 (ISO 5781-AG-06-2-A)
For subplates see catalog sheet RE 45055



1) Deviates from standard
2) Thread depth:
Ferrous metal 1.5 x Ø*
Non-ferrous 2 x Ø
* NG10 min. 10.5 mm

	A	B	X	Y	G	F_1	F_2	F_3	F_4
X	7,2	35,8	21,4	21,4	31,8	0	42,9	42,9	0
Y	33,35	33,35	58,7	7,9	66,7	0	0	66,7	66,7
∅	14,7	14,7	4,8	4,8	7,5	M10 2)	M10 2)	M10 2)	M10 2)

Notes

Notes

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Telefon +49 (0) 93 52 / 18-0
Telefax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

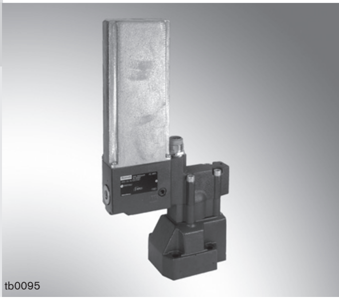
Rexroth
Bosch Group

Pressure reducing valve with DC motor operation, pilot operated

RE 29145/06.07
Replaces: 01.00

Type DRG

Size 8 to 32
Component series 1X
Maximum operating pressure 315 bar
Maximum flow 300 l/min



tb0095

Table of contents

Features

- Actuation by a DC motor with reducing gear
- For subplate mounting:
  Porting pattern to DIN 24340 Form D and ISO 5781
- For threaded connection
- For block installation
- 4 pressure ratings
- With actual value potentiometer or limit switch
- Check valve, optional
- Self-locking in the event of a power failure
  (with variant with position switch, system pressure remains constant)

Further information:
Subplates to RE 45062

Information on available spare parts:
www.boschrexroth.com/spc

Ordering code

DRG			–1X/		Y				*

Pressure reducing valve with DC motor operation

Pilot operated valve = **No code**
Pilot valve **without** main spool insert (do **not** enter size) = **C**
Pilot valve **with** main spool insert (enter size **10** or **32**) = **C**

Size	Ordering code	
	Subplate mounting "No code"	Threaded connection "G"
8	–	= **8** (G3/8)
10	= **10**	= **10** (G1/2)
16	–	= **15** (G3/4)
20	–	= **20** (G1)
25	= **20**	= **25** (G1 1/4)
32	= **30**	= **30** (G1 1/2)

For subplate mounting and block installation = **No code**
For threaded connection = **G**

Further details in clear text

E1 = Limit switch
P2 = Actual value potentiometer

Seal material
No code = NBR seals
V = FKM seals
(other seals on request)
⚠ **Attention!**
Observe compatibility of seals with hydraulic fluid used!

No code = **With** check valve
M = **Without** check valve

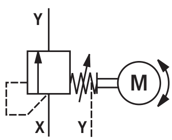
Pilot oil flow
Y = Pilot oil supply/drain see Symbols below

Pressure rating, max.
50 = Set pressure up to 50 bar
100 = Set pressure up to 100 bar
200 = Set pressure up to 200 bar
315 = Set pressure up to 315 bar

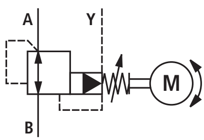
1X = Component series 10 to 19
(10 to 19: unchanged installation and connection dimensions)

Symbols

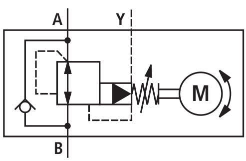
DRGC–1X/..Y



DRG..–1X/..Y..M
DRG..G–1X/..Y..
DRGC 10–1X/..Y.. and
DRGC 30–1X/..Y..



DRG..–1X/..Y



Function, section

Pressure control valves of type DRG are pilot operated pressure reducing valves.

They are used to reduce a system pressure.

Pressure reducing valves of this series basically consist of a pilot valve with electric motor with electric motor as pressure adjustment element, a main valve with main spool insert and an optional check valve.

The reduced pressure in A is adjusted by means of DC motor (16) with reducing gear (17). The output shaft of reducing gear (17) rotates cam (15), which changes the tension of spring (5) via spring plate (9) and thus causes a change in pressure.

The reduced pressure is present in port A, the inlet pressure in port B. The main fluid flow flows from B to A.

Actual value potentiometer (18) feeds back the position of cam (15).

Optionally, electrical limit switches can be installed instead of actual value potentiometer (18) for limiting the min. and max. pressure.

For the variant with limit switch, the min. adjustment time for the pressure range from p_{min} to p_{max} is 18 seconds.

The adjustment time of 18 seconds allows gradual reaching of the required pressure in the inching mode.

For the variant with actual value potentiometer the min. adjustment time for the pressure range from p_{min} to p_{max} is 1.3 seconds.

In conjunction with the associated amplifier type VT-VRM1-1 a program control can be realised.

With the help of 2 additional pressure switches, the min. and max. pressures can be limited.

With the variant with limit switch, the pressure setting on the valve is maintained in the event of a power failure (cable break, fuse failure, short-circuit, etc.).

Type DRG Sizes 8 and 10

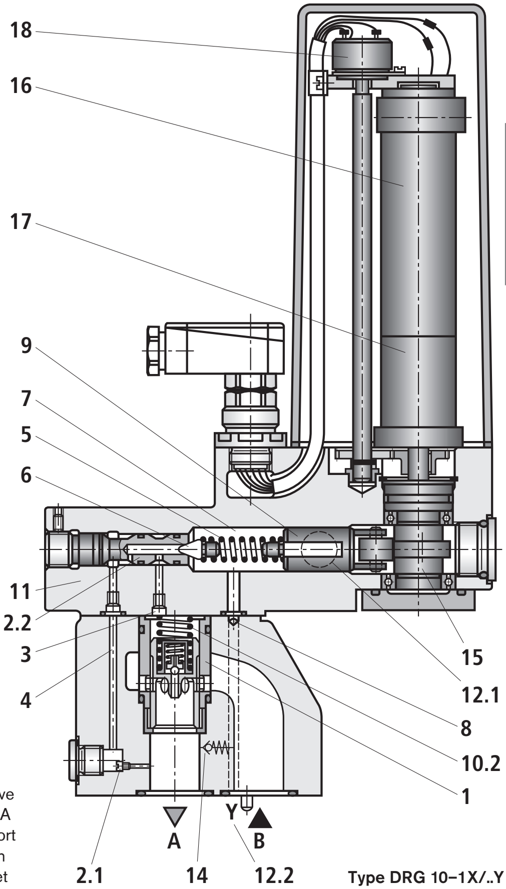
The reduced pressure in A is applied simultaneously to the spring-loaded side of main spool (1) via orifice (2.1), pilot line (4), orifice (2.2) and orifice (3).

The pressure on the spring-loaded side of main spool (1) is by the pressure differential of compression spring (10.2) lower than the pressure in A. In the opening direction, compression spring (10.2) acts on main spool (1). According to the opening cross-section of orifices (2.1; 2.2) and the pressure differential of compression spring (10.2), pilot oil flows through orifice (2.1), pilot line (4), orifice (2.2), poppet (6) into spring chamber (7) and further to the tank via Y (12.2) on the variant with subplate mounting or via (12.1) with the variant with threaded connection.

When the pressure in A rises above the value set on pilot valve (11), main spool (1) reduces the flow cross-section from B to A until the pressure set on pilot valve (11) is reached again in port A. Conversely, main spool (1) increases the flow cross-section from B to A, when the pressure in A is lower than the value set on pilot valve (11).

With a static oil column between A and the actuator, only the pilot oil flows via the main spool from B to A.
If, in this position, a lower pressure is set on pilot valve (11), main spool (1) interrupts the pilot oil supply from B to A until the oil volume isolated between A and the actuator has expanded to the lower pressure on pilot valve (11) via orifice (2.1), pilot line (4), orifice (2.2), poppet (6) and port Y.

A check valve (14) can optionally be installed to allow a free return flow from A to B.



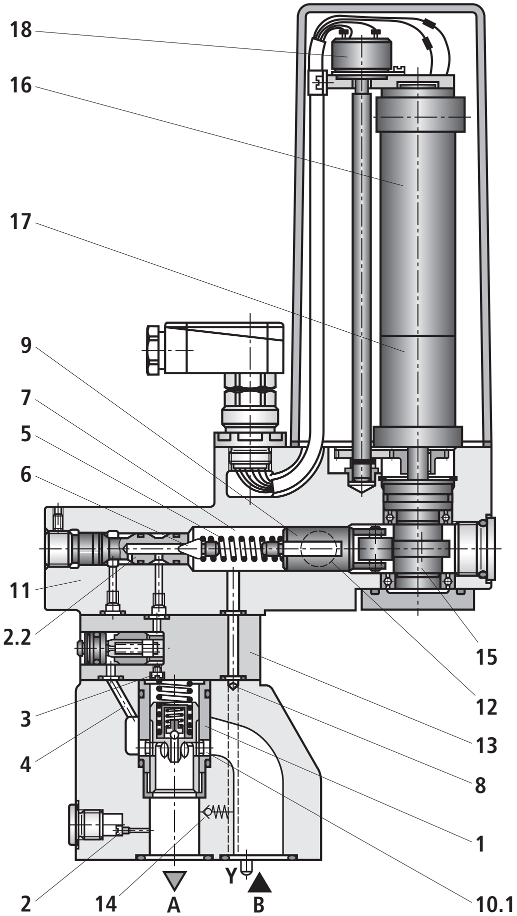
Type DRG 10–1X/..Y

Function, section

Type DRG sizes 16 to 32

Unlike with DRG 8 and DRG 10, with these valves, the pilot oil is taken from inlet pressure channel B. The flow regulator (13) holds the pilot oil flow constant.

If, with a static oil column between A and the actuator, a lower pressure is set on pilot valve (11), the oil column is unloaded via check valve (10.1), pilot line (4), poppet (6) and port Y.



Type DRG 20–1X/..Y

Technical data (for applications outside these parameters, please consult us!)

General

Size			Size	8	10	16	20	25	32
Weight	– Subplate mounting	DRG...	kg	–	7.8	–	–	10.0	12.8
	– Threaded connection	DRG..G	kg	8.4	8.4	9.5	9.5	10.4	10.4
	– Block installation	DRGC 10..	kg	5.5	–	–	–	–	6.1
		DRGC 30..	kg	5.5	–	–	–	–	6.1
	– Pilot valve without main spool insert	DRGC	kg	5.2	–	–	–	–	5.8
Installation position				Optional					
Ambient temperature range			°C	–20 to +50					

Hydraulic

Inlet pressure	– Port B	bar	up to 315				
Pressure rating		bar	50	100	200	315	400
Outlet pressure, can be regulated	– Port A	bar	up to 50	up to 100	up to 200	up to 315	up to 400
Minimum set pressure		bar	Depending on q_V (see Characteristic curves on page 8)				
Backpressure	– Port Y	bar	up to 10				

Size		Size	8	10	16	20	25	32
Maximum flow	– Subplate mounting	l/min	–	80	–	–	200	300
	– Threaded connection	l/min	80	80	200	200	200	300
Pilot oil flow		l/min	0.5		1.3			
Hydraulic fluid			Mineral oil (HL, HLP) to DIN 51524 [1]; fast bio-degradable hydraulic fluids to VDMT 24568 (see also RE 90221); HETG (rape seed oil) [1]; HEPG (polyglycols) [2]; HEES (synthetic esters) [2]; other hydraulic fluids on request					
Hydraulic fluid temperature range		°C	–20 to +70					
Viscosity range		mm^2/s	2.8 to 380					
Permissible max. degree of contamination of the hydraulic fluid - cleanliness class to ISO 4406 (c)			Class 20/18/15 [3]					

Electrical, drive motor

Type of voltage			DC voltage
Supply voltage		V–	24
Rated power	– With limit switch	W	18
	– With actual value potentiometer	W	24
Electrical connection			Mating connector DIN 43651, 6-pin + PE
Type of protection to EN 60529			IP 65 with mating connector mounted and locked

[1] Suitable for NBR **and** FKM seals

[2] Suitable **only** for FKM seals

[3] The cleanliness classes specified for components must be adhered to in hydraulic systems.

Effective filtration prevents malfunction and, at the same time, prolongs the service life of components.
For the selection of filters, see data sheets RE 50070, RE 50076, RE 50081, RE 50086 and RE 50088.

3

Technical data (for applications outside these parameters, please consult us!)

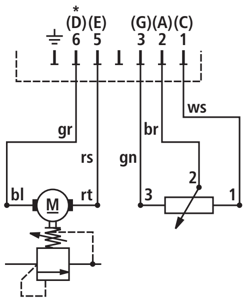
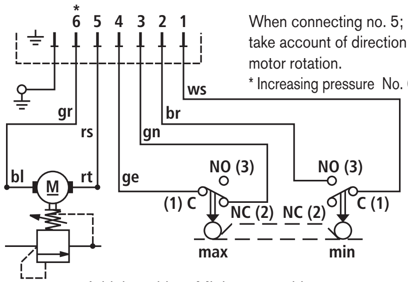
Adjustment with limit switch in inching mode: Ordering code "E1"

Adjustment time, p_{min} to p_{max}		s	18				
Position switch variant:	– Micro-switch		20 V; 2 A DC				
	– Electric load		250 V; 5 A AC				
Pressure lag:	– Pressure rating	bar	50	100	200	315	400
	– Without short-circuit bridge	bar	1	2.5	5	7.5	10
	– With short-circuit bridge	bar	0.5	1	1.5	2	2.5

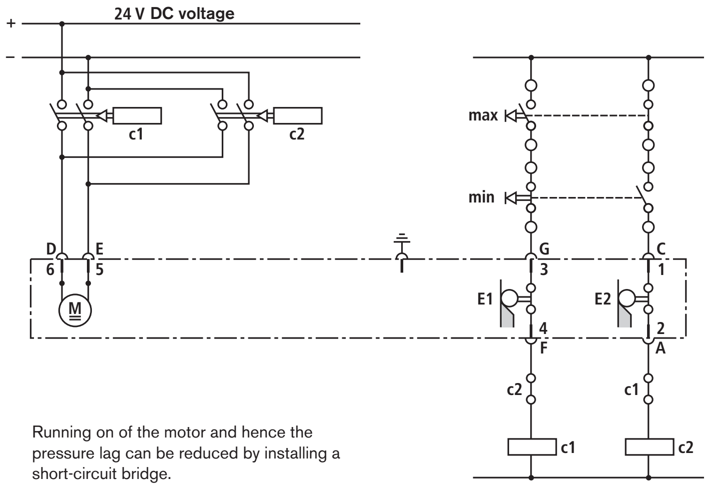
Adjustment with actual value potentiometer for cam position feedback function: Ordering code "P2"

Adjustment time, p_{min} to p_{max}		s	1.3				
Potentiometer	– Resistance	kΩ	5				
	– Power	W	1.75				
Adjustment hysteresis: Start-up pressure – deviation > 10 bar from nominal pressure							
	– Pressure rating	bar	50	100	200	315	400
	– Hysteresis	bar	< 0.5	< 1	< 2.5	< 4	< 5
Adjustment hysteresis: Start-up pressure – deviation > 20 bar from nominal pressure							
	– Pressure rating	bar	50	100	200	315	400
	– Hysteresis	bar	< 0.3	< 0.5	< 1	< 1.5	< 2
Repeatability		bar	< 0.5	< 1	< 1.3	< 1.7	< 2
Amplifier							
Electrical amplifier			VT-VRM1-1, component series 1X – see RE 30405-D				

Electrical connection

Plug connection on DRG valve with actual value potentiometer	Plug connection on DRG valve with limit switch
 When connecting no. 5; 6 take account of direction of motor rotation. * Increasing pressure No. 6 "+"	 When connecting no. 5; 6 take account of direction of motor rotation. * Increasing pressure No. 6 "+" Initial position: Minimum position

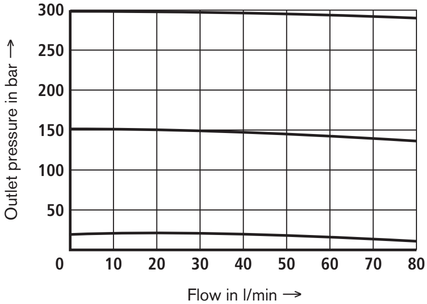
Circuit example: DRG valve with limit switch



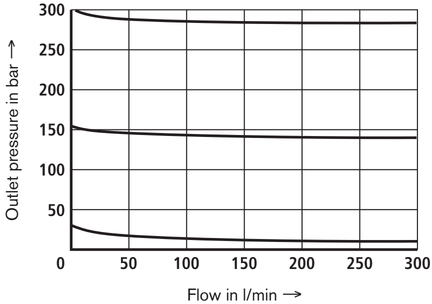
Running on of the motor and hence the pressure lag can be reduced by installing a short-circuit bridge.

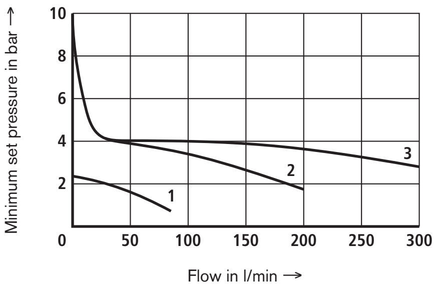
Characteristic curves (measured at $\nu = 41\ mm^2/s$ and $\vartheta_{oil} = 50\ °C$)

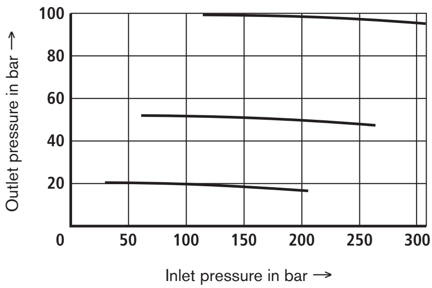
Sizes 8 and 10



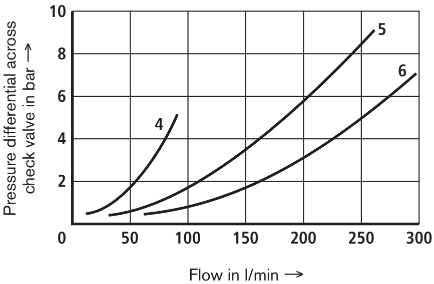
Sizes 16 to 32





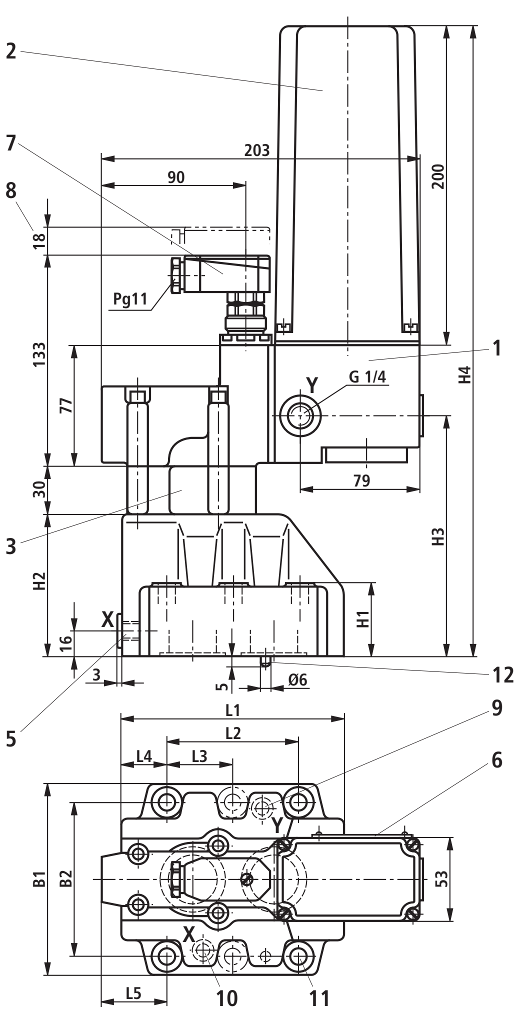


1 = DRG 8 and 10
2 = DRG 16 to 25
3 = DRG 30



4 = DRG 10
5 = DRG 20
6 = DRG 30

Unit dimensions: Subplate mounting (dimensions in mm)



1 Pilot valve
2 DC motor
3 Constant flow regulator (only with sizes 25 and 32)
5 Port "X" for remote control on size 10
Port M for pressure gauge on sizes 25 and 32
6 Nameplate
7 Mating connector (included in scope of supply)
8 Space required to remove mating connector
9 Port "Y"
10 Port "X" without function (blind hole)
11 4 valve mounting bores for sizes 10 and 25
6 valve mounting bores for size 32
12 Locating pin

Subplates to data sheet RE 45062
(separate order)

– Size 10	G 460/01	(G3/8)
	G 461/01	(G1/2)
– Size 25	G 412/01	(G3/4)
	G 413/01	(G1)
– Size 32	G 414/01	(G1 1/4)
	G 415/01	(G1 1/2)

Valve fixing screws (separate order)

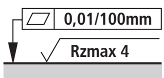
For strength reasons, only the following valve fixing screws may be used:

– Size 10
4 hexagon socket head cap screws ISO4762 - M10x50 - 10.9-flZn-240h-L to VDA 235-101
Friction coefficient μ_{total} = 0.09 to 0.14,
tightening torque M_T = 59 Nm ± 10%,
Material no. **R913000471**

– Size 25
4 hexagon socket head cap screws ISO4762 - M10x60 - 10.9-flZn-240h-L to VDA 235-101
Friction coefficient μ_{total} = 0.09 to 0.14,
tightening torque M_T = 59 Nm ± 10%,
Material no. **R913000116**

– Size 32
6 hexagon socket head cap screws ISO4762 - M10x70 - 10.9-flZn-240h-L to VDA 235-101
Friction coefficient μ_{total} = 0.09 to 0.14,
tightening torque M_T = 59 Nm ± 10%,
Material no. **R913000126**

The tightening torques given are guidelines when screws of the specificied friction coefficients and a torque wrench (tolerance ±10 %) are used.

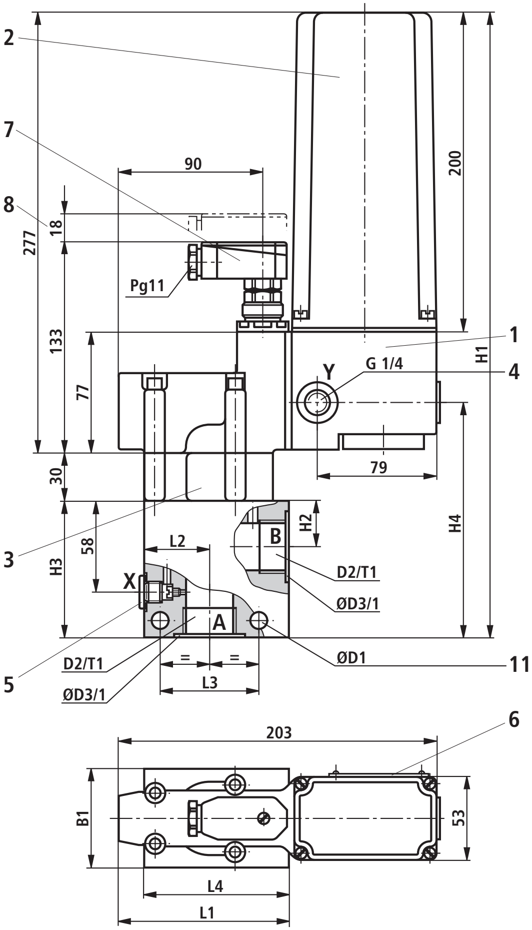


Required surface quality of valve mounting face

Tolerances according to:
– General tolerances ISO 2768-mK

Size	B1	B2	H1	H2	H3	H4	L1	L2	L3	L4	L5	O-ring Port Y	O-ring Port A, B
10	85	66.7	28	72	102	349	90	42.9	–	35.5	44.5	9.25 x 1.78	17.12 x 2.62
25	102	79.4	38	82	142	389	112	60.3	–	33.5	46.5	9.25 x 1.78	28.17 x 3.53
32	120	96.8	46	90	150	397	140	84.2	42.1	28	41.5	9.25 x 1.78	34.52 x 3.53

Unit dimensions: Threaded connection (dimensions in mm)



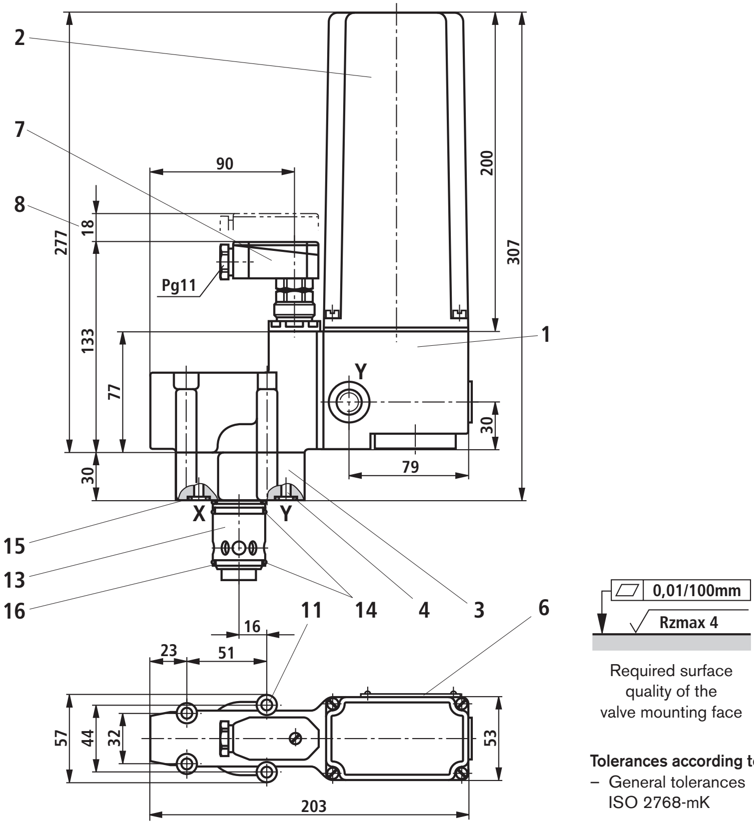
1 Pilot valve
2 DC motor
3 Constant flow regulator (only on sizes 16 to 32)
4 Port "Y" for external pilot oil drain
5 Port "X" for remote control on sizes 8 and 10
Port M for pressure gauge on sizes 16 to 32
6 Nameplate
7 Mating connector (included in scope of supply)
8 Space required to remove mating connector
11 Valve mounting bore

Note!
On this valve variant, no check valve is integrated in the valve to allow a free return flow from A to B.

Tolerances according to:
– General tolerances ISO 2768-mK

<table>
<tr><th>Size</th><th>B1</th><th>ØD1</th><th>D2</th><th>ØD3</th><th>H1</th><th>H2</th><th>H3</th><th>H4</th><th>L1</th><th>L2</th><th>L3</th><th>L4</th><th>T1</th></tr>
<tr><td>8</td><td rowspan="4">63</td><td rowspan="4">9</td><td>G3/8</td><td>28</td><td rowspan="2">362</td><td rowspan="3">23</td><td rowspan="4">75</td><td rowspan="2">115</td><td rowspan="4">108</td><td rowspan="4">40</td><td rowspan="4">62</td><td rowspan="4">90</td><td>12</td></tr>
<tr><td>10</td><td>G1/2</td><td>34</td><td>14</td></tr>
<tr><td>16</td><td>G3/4</td><td>42</td><td rowspan="2">392</td><td rowspan="2">145</td><td>16</td></tr>
<tr><td>20</td><td>G1</td><td>47</td><td>28</td><td>18</td></tr>
<tr><td>25</td><td rowspan="2">70</td><td rowspan="2">11</td><td>G1 1/4</td><td>56</td><td rowspan="2">405</td><td rowspan="2">34</td><td rowspan="2">85</td><td rowspan="2">158</td><td rowspan="2">111</td><td rowspan="2">46</td><td rowspan="2">72</td><td rowspan="2">99</td><td>20</td></tr>
<tr><td>32</td><td>G1 1/2</td><td>61</td><td>22</td></tr>
</table>

Unit dimensions: Block installation (dimensions in mm)



Required surface quality of the valve mounting face

Tolerances according to:
– General tolerances ISO 2768-mK

1 Pilot valve
2 DC motor
3 Constant flow regulator (only on size 32)
4 Port “Y“ for pilot oil drain
6 Nameplate
7 Mating connector (included in scope of supply)
8 Space required to remove mating connector
11 Valve mounting bores
13 Main spool insert
14 O-ring 27.3 x 2.4
15 O-ring 9.25 x 1.78
16 Back-up ring 32/28.4 x 0.8

Valve fixing screws (separate order)

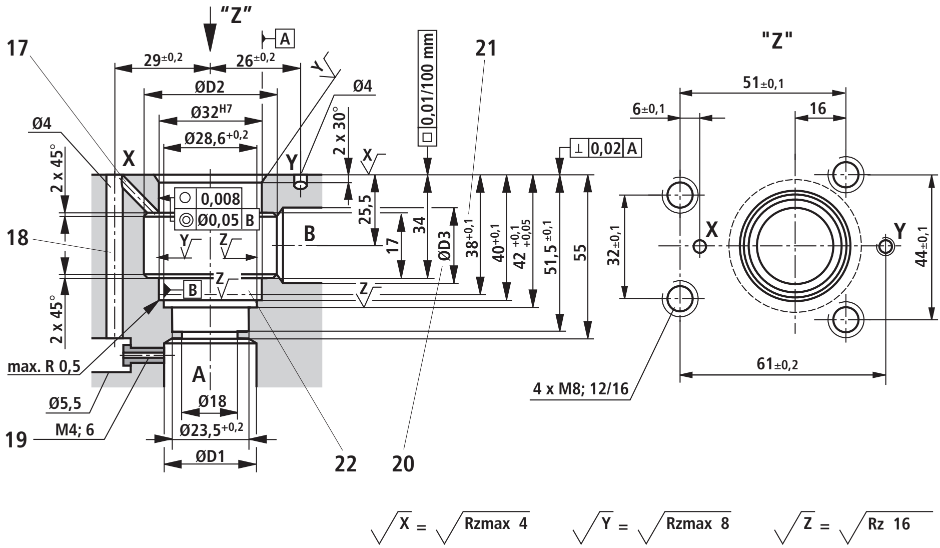
For strength reasons, only the following valve fixing screws may be used:

– Size10
4 hexagon socket head cap screws ISO4762 - M8x50 - 10.9-flZn-240h-L to VDA 235-101
Friction coefficient μ_{total} = 0.09 to 0.14,
tightening torque M_T = 31 Nm ± 10%,
Material no. **R913000543**

– Size 32
4 hexagon socket head cap screws ISO4762 - M8x80 - 10.9-flZn-240h-L to VDA 235-101
Friction coefficient μ_{total} = 0.09 to 0.14,
tightening torque M_T = 31 Nm ± 10%,
Material no. **R913000276**

The tightening torques given are guidelines when screws of the specificied friction coefficients and a torque wrench (tolerance ±10 %) are used.

Mounting cavity for block installation (dimensions in mm)



Size	ØD1	ØD2	Ø D3
10	10	40	10
32	32	45	32

17 Pilot oil tapping on size 32

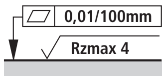
18 Pilot oil tapping on size10

19 Pilot oil tapping nozzle on size 10

20 Bore ØD3 can intersect ØD2 at any point. However, care must be taken that connection bore X and the fixing screws are not damaged.

21 Depth of fit

22 The back-up ring and the O-ring must be inserted in this bore before the main spool is installed



Required surface quality of valve mounting face

Tolerances according to:
– General tolerances ISO 2768-mK

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

Proportional flow valves

Designation	Type	Size	Component series	p_{max} in bar	Data sheet	Page
Proportional throttle valves						
Block installation, without/with integrated electronics	FE(E)	16	2X	315	29202	679
Block installation, without/with integrated electronics	FE(E)	25 ... 63	3X	315	29209	691
Proportional flow control valves						
Subplate mounting	2FRE	6	2X	210	29188	707
Subplate mounting	2FRE	10/16	4X	315	29190	719
Subplate mounting, without position control	3(2)FREX	6/10	1X	250	29219	731
Subplate mounting	3FREZ	6/10	1X	250	29220	747
Subplate mounting, with integrated electronics and inductive position transducer	3FREEZ	6/10	1X	250	29221	763
Block installation, with integrated pressure compensator	KUDSR	6	A	350	18702	777

4

2-way proportional throttle valve for block installation

RE 29202/07.05 1/12
Replaces: 03.00

Types FE; FEE

Size 16
Component series 2X
Maximum operating pressure 315 bar
Maximum flow 190 L/min bei $\Delta p = 10$ bar

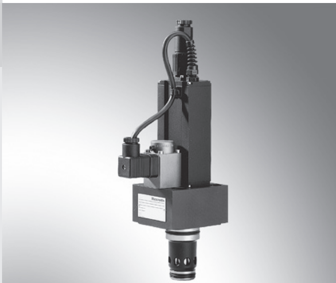

H4538

Table of contents

Information on available spare parts:
www.boschrexroth.com/spc

Features

– Pilot operated 2-way proportional throttle valve for block installation
– Installation dimensions to DIN ISO 7368-BA-06-2-A
– Electrically position-controlled orifice spool
– Direction of flow A to B
– In the event of a power failure or cable break (or withdrawal of the enable [1)]) the orifice spool moves automatically to the closed position and blocks the flow from A to B
– In conjunction with a pressure compensator, can be used for pressure-compensated flow control
– Type FE for external control electronics (separate order), see page 5
– Type FEE: completely matched unit with integrated electronics (OBE), optionally available with voltage or current interface

[1)] Type FEE only

Ordering code

FE		16	C –2X /				*

Electrically operated 2-way proportional throttle valve for block installation

For external control electronics = **No code**
With integrated electronics (OBE) = **E**

Size 16 = **16**

Kit = **C**

Component series 20 to 29 = **2X**
(20 to 29: unchanged installation and connection dimensions)

Flow characteristic "linear" [1)]
100 L/min = **100L**
190 L/min = **190L**

[1)] Nominal flow in L/min at Δp = 10 bar between ports A and B (see also hydraulic technical data on page 4)

Further details in clear text

Seal material
M = NBR seals, suitable for mineral oil (HL, HLP) to DIN 51524
V = FKM seals

Electronics interface (see page 7)
B1 = Command value input 0 to 10 V/ actual value output 0 to –10 V
G1 = Command value input 4 to 20 mA/ actual value output 4 to 20 mA
No code = For FE for external control electronics

Electrical connection
for FE:
K4 = **Without** cable sockets, with component plug to DIN EN 175301-803 for proportional solenoid and GSA20 made by Hirschmann for position transducer
Cable sockets – separate order, see page 6

for FEE:
K0 = **Without** cable socket, with component plug to DIN 43651, cable socket – separate order, see page 7

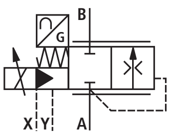
Standard type

Type	Material no.
FEE 16 C-2X/190LK0B1M	R900954413

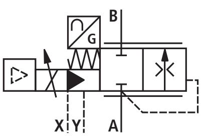
Symbols

Simplified

FE 16 C-2X/… [2)]



FEE 16 C-2X/… [2)]



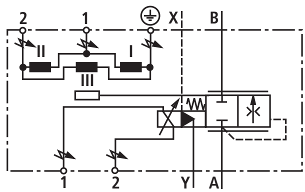
Direction of flow: A to B (X connected with A)

Note: Connect pilot oil port X with A or connect externally

Caution! In the case of external pilot oil supply at X, the pressure in X **must be** ≥ pressure in A!

Detailed (example of type FE)

FE 16 C-2X/…



[2)] **A** service port
B service port
X pilot oil supply
Y pilot oil drain

Function, section

Valves of type FE(E) are pilot operated 2-way proportional throttle valves for block installation for the infinitely variable control of a flow.

Technical structure:
The valve consists of four main assemblies:
- Cover (1) with mounting face for pilot oil ports.
- Main valve (2) with orifice spool (3).
- Pilot valve (4) with proportional solenoid (5).
- Integrated control electronics (6) (not provided for type FE) with position transducer (7).

General function:
- Command value-related closed-loop position control of orifice spool (3) and therefore defined opening of orifice (8).
- The flow depends on the Δp across orifice (8) and the position of orifice spool (3).
- Actual value acquisition of the position of orifice spool (3) by position transducer (7); command/actual value comparison in electronics (6); deviations are conditioned and passed on to proportional solenoid (5) of pilot valve (4) in the form of a control output for correcting the position of orifice spool (3).
- Area ratio of area (15) to area (12) = 1 : 1.
- Direction of flow A → B; connect X to A or connect externally.
- **Caution!** With external pilot oil supply, the pressure in X must be ≥ pressure in A to ensure proper functioning of the valve.
- A pilot oil by-pass via nozzle (16) increases vibration damping.
- When the enable is withdrawn, orifice spool (3) moves against mechanical limit stop (17) in the valve bushing (closed position) and blocks the flow A → B.
- The orifice spool position is already controlled at a command value of 0 V or 4 mA, with orifice (8) still being in the positive overlap position and closing A → B.
- For leakage across orifice spool (3) and pilot valve (4) at command 0 V or 4 mA and inactive enable, see Technical data on page 4.

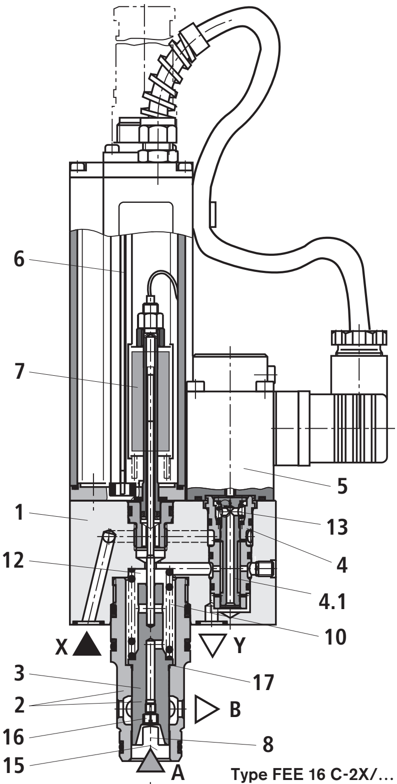
Function of opening orifice spool:
Flow A → B and A connected with X
- Proportional solenoid (5) shifts pilot spool (4.1) against spring (13) and opens the connection between control chamber (12) and Y; the pressure in control chamber (12) is reduced, and orifice spool (3) moved to the direction of opening by the pressure in A that acts on area (15).

Function of closing orifice spool:
Flow A → B and A connected with X
- Current reduced in proportional solenoid (5); spring (13) shifts pilot spool (4.1) against the proportional solenoid and opens the connection between X and control chamber (12); pressure builds up in control chamber (12); the pressure acting on the orifice spool area in control chamber (12) plus spring force (10) shift orifice spool (3) in the closing direction.

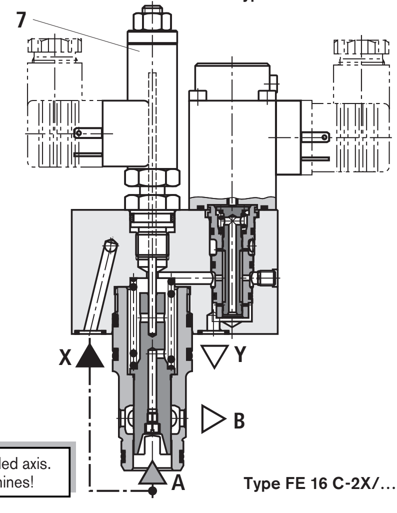
Flow control function:
- In conjunction with a pressure compensator, can be used for the pressure-compensated control of a flow.

Failure of the supply voltage:
- The integrated electronics de-energises the solenoid in the event of a supply voltage failure or cable break in position transducer (7).
- The spool is shifted to the closed position by the pressure applied to pilot port X plus spring force (10) and blocks the flow A → B.

⚠ **Caution:** A voltage supply failure results in a sudden standstill of the controlled axis. Accelerations that can occur in conjunction with this can cause damage to machines!



Type FEE 16 C-2X/…



Type FE 16 C-2X/…

Technical data (for applications outside these parameters, please consult us!)

General

Weight	– FE	kg	2.7
	– FEE	kg	2.9
Installation orientation			Optional
Storage temperature range		°C	– 20 to + 80
Ambient	– FE	°C	– 20 to + 70
temperature range	– FEE	°C	– 20 to + 50

Hydraulic (measured with HLP 46; $\vartheta_{oil} = 40\ °C \pm 5\ °C$)

Max. operating pressure	– Ports A, B	bar	315
Max. pilot pressure	– Port X	bar	315
Return flow pressure	– Port Y		At zero pressure to tank
Min. inlet pressure	– in A (direction of flow A → B)	bar	7
Max. flow q_{Vmax} of main valve at Δp 10 bar	Direction of flow A → B	L/min	190
Pilot oil volume for switching process from seated position	0 → 100%	cm^3	0.9
Max. pilot oil flow in port Y:	With stepped input signal	L/min	2.5
Direction of flow			A → B
Pilot oil port			Connect X to A or connect externally. ⚠ **Caution!** With external pilot oil supply, the pressure in X must be ≥ pressure in A.
Leakage fluid	– State: Command value 0 V or 4 mA		From A → B, see characteristic curve on page 9 Max. 0.4 L/min from A → X and across the nozzle in the main spool to Y at Δp 315 bar
	– State: Enable inactive (solenoid de-energised)		Max. 1.5 L/min from A → B at Δp 315 bar; max. 0.2 L/min from A → X and across the nozzle in the main spool to Y at Δp 315 bar
Hydraulic fluid			Mineral oil (HL, HLP) to DIN 51524; further hydraulic fluids on enquiry!
Hydraulic fluid temperature range		°C	– 20 to + 80
Viscosity range		mm^2/s	15 to 380
Max. permissible degree of contamination of the hydraulic fluid			
Cleanliness class	– Pilot valve		Class 17/15/12 [1]
to ISO 4406 (c)	– Main valve		Class 20/18/15/ [1]
Hysteresis		%	< 0.2
Response sensitivity		%	< 0.1
Range of inversion		%	< 0.15

[1] The cleanliness classes specified for components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and, at the same time, prolongs the service life of components.

For the selection of filters, see data sheets RE 50070, RE 50076, RE 50081, RE 50086 and RE 50088.

Technical data (for applications outside these parameters, please consult us!)

Type FE – external control electronics

Electrical, solenoid (pilot valve for type FE)

Type of voltage		V	24 DC
Nominal current		mA	1000
Coil resistance	– Cold value at 20 °C	Ω	12.7
	– Max. hot value	Ω	19.3
Duty cycle		%	100
Electrical connection			With component plug to DIN EN 175301-803
			Cable socket to DIN EN 175301-803 [1)]
Type of protection of the valve to EN 60529			IP65 with cable socket mounted and locked

Electrical, inductive position transducer (main stage)

Coil resistance	Total resistance of coils between		1 and 2	2 and ⏚	⏚ and 1
at 20 °C (see Symbols on page 2)		Ω	31.5	45.5	31.5
Inductance		mH	6 to 8		
Oscillator frequency		kHz	2.5		
Electrical connection			With component plug GSA20 made by Hirschmann		
			Cable socket GM209N (Pg9) made by Hirschmann [1)]		
Type of protection to EN 60529			IP65 with cable socket mounted and locked		
Electrical position measuring system			Differential throttle		

Control electronics (type FE only; separate order)

Amplifier in Euro-card format	analogue	VT-VRPA1-50-1X to data sheet RE 30117

4

Type FEE – integrated electronics (OBE)

Electrical

Duty cycle		%	100
Current consumption	– I_{max}	A	1.3
	– Pulse load	A	1.5
Electrical connection			With component plug to DIN 43651
			Cable socket to DIN 43651 11-pin + PE/Pg16 [2)]
Type of protection of the valve			IP65 with cable socket mounted and locked
Control electronics			Integrated in the valve (see page 8)

[1)] Separate order, see page 6

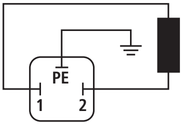
[2)] Separate order, see page 7

☞ **Note:** For details regarding **environment simulation testing** in the fields of EMC (electromagnetic compatibility), climate and mechanical stress, see RE 29202-U (declaration on environmental compatibility).

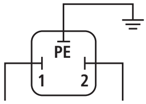
Electrical connection, cable sockets (nominal dimensions in mm)

Type FE – for external ontrol electronics

Connection to component plug

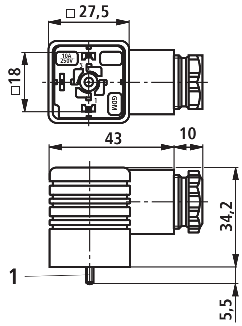


Connection to cable socket



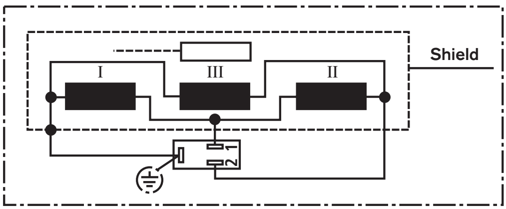
to amplifier

Cable socket to DIN EN 175301-803
Separate order stating material no. **R901017011**
(plastic version)

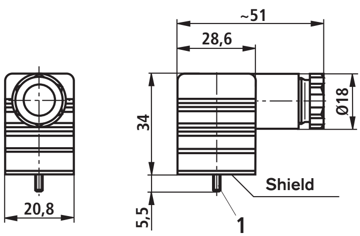


1 Fixing screw M3
Tightening torque $M_T = 0.5$ Nm

Inductive position transducer



Cable socket GM209N (Pg 9) made by Hirschmann
Separate order stating material no. **R900013674**
(plastic version)



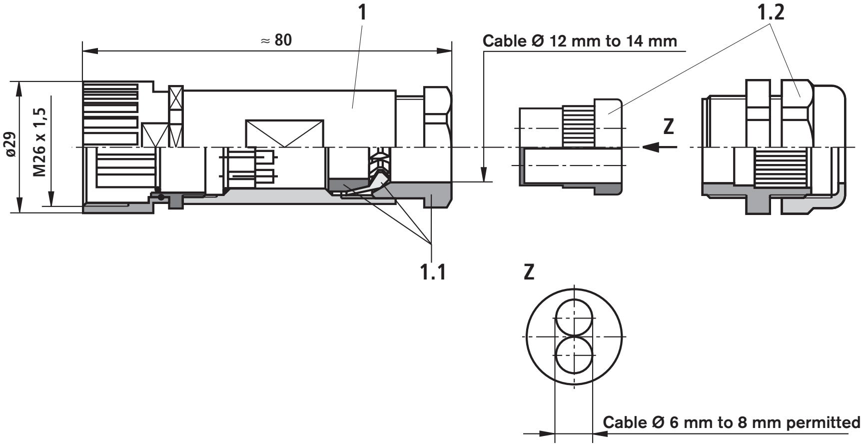
1 Fixing screw M3
Tightening torque $M_T = 0{,}5$ Nm

Electrical connection, cable sockets (nominal dimensions in mm)

Type FEE – with integrated electronics (OBE)

Cable socket to DIN 43651/11-pin + PE/Pg16
Separate order stating material no. **R900884671**
(plastic version)
Assembly consisting of items 1 and 1.1 or
items 1 and 1.2, type of protection IP65

Note:
– If **one** cable is used, combine item 1 with item 1.1
– If **two** cables are used, combine item 1 with item 1.2



Pin	Function	Conditions	
1	Operating voltage +UL	U_O = 24 VDC; $u_O(t)_{max}$ = 36 V; $u_O(t)_{min}$ = 21,6 V	
2	Ground L0		
3	Enable input / reference for pin 2	log 1 = 10 V to 36 V; log 0 = U < 8 V	
		Type **FEE…/…B1…**	Type **FEE…/…G1…**
		Voltage interface	Current interface
4	Command value input	0 V to + 10 V (R_i > 50 kΩ)	+ 4 mA to + 20 mA / load = 100 Ω
5	Command value input, reference		
6	Actual value output	0 V to – 10 V (I_{max} = 5 mA)	+ 4 mA to + 20 mA / load ≤ 500 Ω
7	Actual value output, reference		
8	free		
9	free		
10	free		
11	Ready for operation (output)	Valve not ready for operation:	U_{Pin11} < 8 V;
		Valve ready for operation:	U_{Pin11} = U_O – 3 V
		Reference – pin 2:	(I_{max} against 0 V; 50 mA);
PE	Protective conductor ⏚		

Recommended connecting cable – Up to 25 m → min. 0.75 mm² per wire
– Up to 50 m → min. 1.5 mm² per wire
– Connect shield to PE only on the supply side

Integrated electronics (OBE) bei Type FEE

Function

1. Making operation/disturbance characteristic:

After the supply voltage of 24 V was applied, the electronics is ready for operation, if the following conditions are fulfilled:

– Operating voltage $U_O > 18$ VDC
– The internal ± 7.5 V supply voltage is symmetrical
– The connection to the position transducer is not interrupted.
– The command value cable is not interrupted (only with 4 mA to 20 mA interface)

If one of these conditions is not fulfilled, the controller and the output stage are blocked and the signal "ready for operation" is set to < 8 V.

2. Normal operation

When the enable is inactive (< 8 V) and an optional command value is fed forward (0 to 10V or 4 to 20 mA) the orifice spool is in the seated position and blocks the flow from A to B.

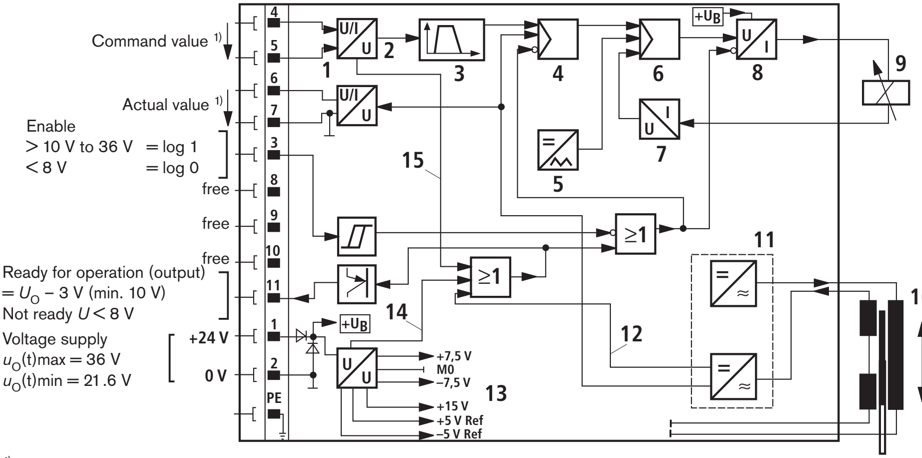
By applying a voltage > 10 V to the enable, the position controller for the orifice spool and the output stage for the pilot valve are switched on. At the same time, the position controller (PID) compares the actual value of the orifice spool position with the applied command value, and a control output is fed to the output stage, which changes the solenoid current until the orifice spool position corresponds to the command value.

The actual value of the orifice spool position is sensed by an inductive position transducer. The signal of the latter is rectified by the demodulator and fed back to the PID-controller.

The following output signals are available on the plug:

– Actual position value FEE.../...B1 (pin 6)
  • 0 V to – 10 V corresponds to 0 % to 100 % valve opening
  • Orifice spool at mechanical limit stop → actual value > 0.2 V
– Actual position value FEE.../...G1 (pin 6)
  • 4 mA to 20 mA corresponds to 0 % to 100 % valve opening
  • Orifice spool at mechanical limit stop → actual value < 3.65 mA
– Signal "ready for operation" (pin 11)
  • All conditions listed above are fulfilled → > 10 V
  • One of the conditions is not fulfilled → < 8V

Block circuit diagram / pin assignment of integrated electronics



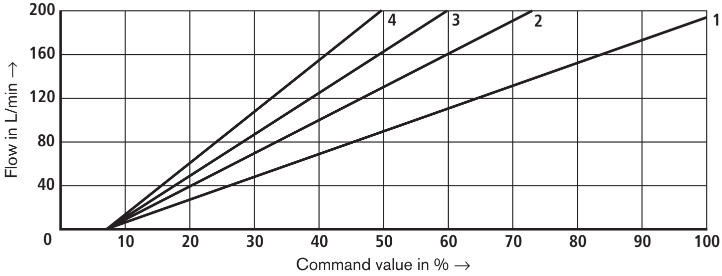
[1] With current version (4 mA to 20 mA), please observe:
Between connections 5 and 4, load = 100 Ω
Between connections 6 and 7, load ≤ 500 Ω

1 Input
2 Output
3 Fixed ramp
4 Position controller
5 Clock pulse
6 Current regulator
7 I/U converter
8 Output stage
9 Proportional solenoid
10 Position transducer
11 Oscillator / demodulator
12 Fault signal of position transducer
13 Power supply unit
14 Fault signal in the event of $+U_O$ undervoltage and asymmetry in the power supply unit
15 Cable break signal with current command value

Characteristic curves (measured with HLP 46 and $\vartheta_{oil} = 40\ °C \pm 5\ °C$)

Flow characteristic linear

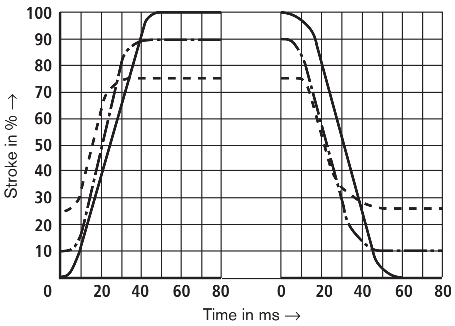
FE(E) 16 C…



1 $\Delta p =$ 10 bar
2 $\Delta p =$ 20 bar
3 $\Delta p =$ 30 bar
4 $\Delta p =$ 50 bar

Transient function with stepped command value change [1)]

FE(E) 16 C…



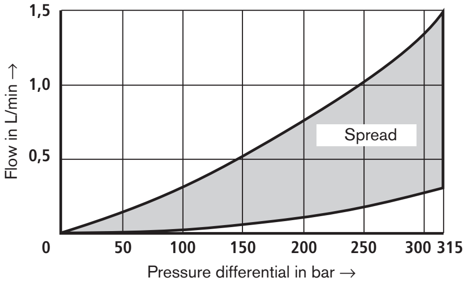
Step responses 0 – 100 – 0 % ———
10 – 90 – 10 % —·—
25 – 75 – 25 % – – –

[1)] Measurement conditions
Pressure in A = 50 bar
Command value change 0 → 100%
Pressure in A < 50 bar → actuating time extends
Pressure in A > 50 bar → actuating time shortens
Command value change 100 → 0%
No change in actuating time, if pressure in X = A

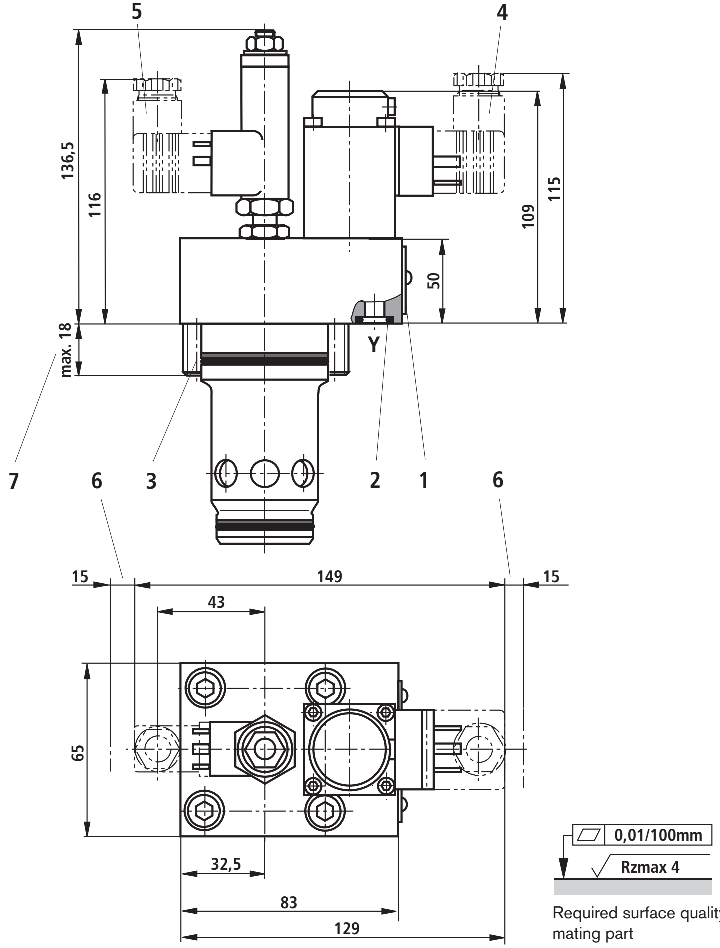
4

Leakage from A → B in dependence upon the pressure differential Δp (command value 0 V or 4 mA, resp.)

FE(E) 16 ../..190L..



Unit dimensions: Type FE (nominal dimensions in mm)

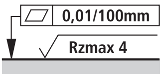


Required surface quality of mating part

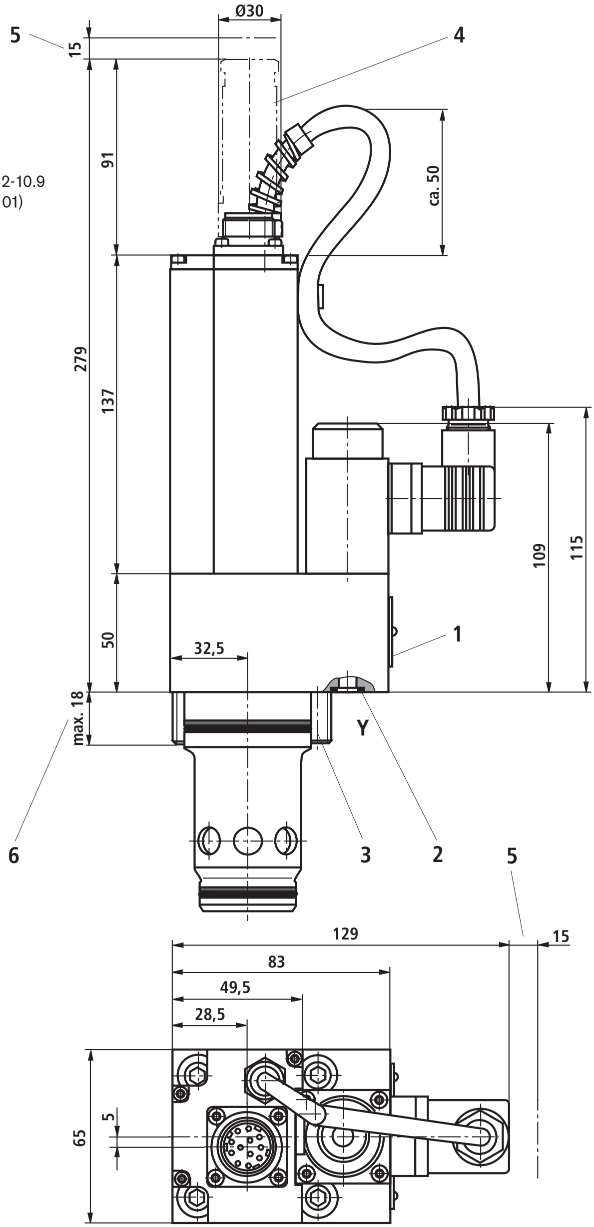
1 Nameplate
2 Identical seal rings for ports X and Y
3 Valve fixing screws
(included in the scope of supply)
4 socket head cap screws M8 x 35 to ISO 4762-10.9
(friction coefficient 0.09 ... 0.14 to VDA 235-101)
Tightening torque $M_T = 25$ Nm
4 Cable socket to DIN EN 175301-803
Separate order, see page 6
5 Cable socket GM209N (Pg 9) made by Hirschmann
Separate order, see page 6
6 Space required to remove cable socket
7 Screw-in length of valve fixing screws

Unit dimensions: Type FEE (nominal dimensions in mm)

1 Nameplate
2 Identical seal rings for ports X and Y
3 Valve fixing screws
(included in the scope of supply)
4 socket head cap screws M8 x 35 to ISO 4762-10.9
(friction coefficient 0.09 ... 0.14 to VDA 235-101)
Tightening torque M_T = 25 Nm
4 Cable socket to DIN 43651
11-pin + PE/Pg16
Separate order, see page 7
5 Space required to remove cable socket
6 Screw-in length of valve fixing screws



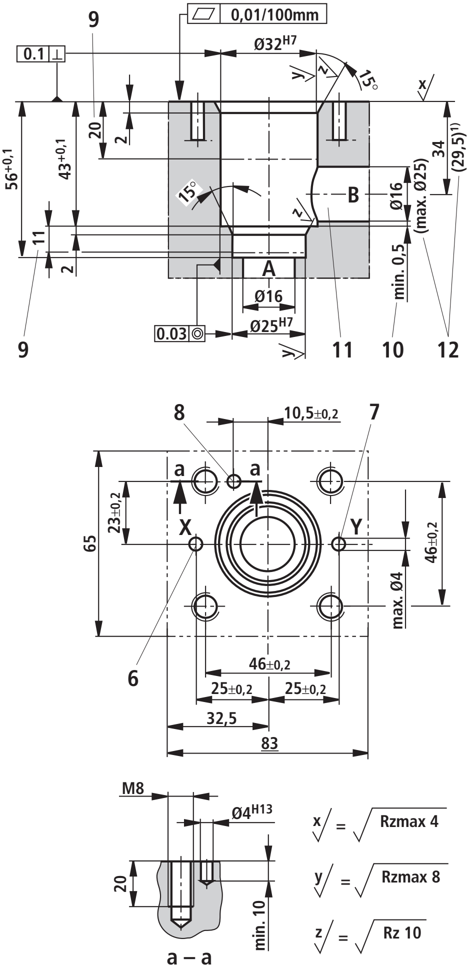
Required surface quality of mating part



Installation dimensions (nominal dimensions in mm)

Installation dimensions to DIN ISO 7368-BA-06-2-A

6 Port X
7 Port Y
8 Locating bore for locating pin
9 Depth of fit
10 Reference dimension
11 Port B can optionally be arranged around the central axis of port A. However, care must be taken that the fixing bores and pilot bores are not drilled.
12 In the case of a diameter of port B other than specified, the distance from the cover contact face to the centre of the bore must be calculated.



[1] Minimum distance (29.5 mm) with maximum diameter (Ø25 mm)

Tolerances to:
– General tolerances ISO 2768-mK

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

Rexroth
Bosch Group

2-way proportional throttle valve for block installation

RE 29209/04.07
Replaces: 07.05

Types FES; FESE

Sizes 25 to 63
Component series 3X
Maximum operating pressure 315 bar
Maximum flow 1800 l/min at Δp = 10 bar

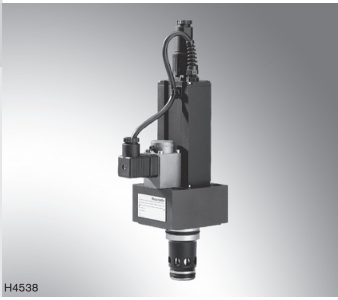

H4538

Table of contents

Features

– Pilot operated 2-way proportional throttle valve for block installation
– Installation dimensions to DIN ISO 7368
– Orifice spool electrically closed-loop position controlled
– Flow in both directions
– In the event of a power failure, cable break or withdrawal of the enable, the orifice spool automatically moves to the seated position and blocks the flow in both directions
– Can be used in conjunction with a pressure compensator for pressure-compensated flow control
– Type FES for external control electronics (separate order), see page 5
– Type FESE: completely matched unit with integrated electronics (OBE), optionally available with voltage or current interface

Information on available spare parts:
www.boschrexroth.com/spc

Ordering code

FES			C	A –3X/				*

For external control electronics = **No code**
With integrated electronics (OBE) = **E**

Size 25 = **25**
Size 32 = **32**
Size 40 = **40**
Size 50 = **50**
Size 63 = **63**

Kit = **C**

Direction of flow
A to B (X connected to A)
B to A (X connected to B) = **A**

Component series 30 to 39 = **3X**
(30 to 39: unchanged installation and connection dimensions)

Flow characteristics "linear" [1]
Size 25 up to 315 l/min = **315L**
Size 32 up to 450 l/min = **450L**
Size 40 up to 670 l/min = **670L**
Size 50 up to 1400 l/min = **1400L**
Size 63 up to 1800 l/min = **1800L**

[1] Nominal flow in L/min at Δp 10 bar between ports A and B (see also hydraulic technical data on page 4)

Further details in clear text

Seal material
M = NBR seals, suitable for mineral oil (HL, HLP) to DIN 51524
V = FKM seals

Electronics interface
(see page 7)
B1 = Command value input 0 to 10 V/ actual value output 0 to –10 V
G1 = Command value input 4 to 20 mA/ actual value output 4 to 20 mA
No code = For FES for external control electronics

Electrical connection
For FES:
K4 = Without cable sockets, with component plug to DIN EN 175301-803 for proportional solenoid and GSA20 made by Hirschmann for position transducer
Cable sockets – separate order, see page 6

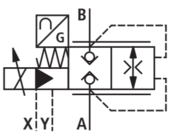
For FESE:
K0 = Without cable socket, with component plug to DIN 43651, cable socket – separate order, see page 7

Standard types

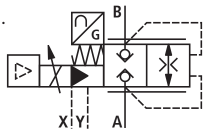
Type	Material no.
FESE 25 CA-3X/315LK0B1M	R900973604
FESE 32 CA-3X/450LK0B1M	R900973605
FESE 40 CA-3X/670LK0B1M	R900973607
FESE 50 CA-3X/1400LK0B1M	R900954504
FESE 63 CA-3X/1800LK0B1M	R900954505

Symbols

Simplified
FES .. CA-3X/…

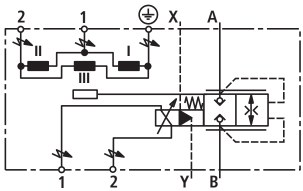


FESE .. CA-3X/…



Direction of flow: A to B (X connected with A)
B to A (X connected with B)

Detailed
(example of FES)
FES .. CA-3X/…



A = service port
B = service port
X = pilot oil supply
Y = pilot oil drain

Function, section

Valve types FES(E) are pilot operated 2-way proportional throttle valves for block installation for the infinitely variable control of a flow.

Technical structure:
The valve consists of four main assemblies:
– Cover (1) with mounting face for pilot oil ports.
– Main valve (2) with orifice spool (3).
– Pilot valve (4) with proportional solenoid (5).
– Integrated control electronics (6) (not provided for type FES) with position transducer (7).

General function:
– Command value-related closed-loop position control of orifice spool (3) and therefore defined opening of orifice (8).
– The flow depends on the Δp across orifice (8) and the position of orifice spool (3).
– Actual value acquisition of the position of orifice spool (3) by position transducer (7); command/actual value comparison in electronics (6); deviations are conditioned and passed on to proportional solenoid (5) of pilot valve (4) in the form of a control output for correcting the position of orifice spool (3).
– Area ratio of area (14) to area (15) = 2 : 1 for size 25; 32; 40, and 1.6 : 1 for size 50; 63.
– Direction of flow A → B (connect X with A);
direction of flow B → A (connect X with B);
external pilot oil supply via X possible.
– When the enable is withdrawn, orifice spool (3) moves onto valve seat (9) and closes the direction of flow A ↔ B leak-free. Spool seal (11) ensures the leak-free isolation of port B from control chamber (12); with internal pilot oil supply, take leakage oil from X via the pilot valve to Y into account!
– Orifice spool position is already controlled at a command value of 0 V or 4 mA, with orifice (8) still being in the positive overlap position.

Function of opening orifice spool:
(Assumption: flow A → B and A connected with X)
• Proportional solenoid (5) shifts pilot spool (4.1) against spring (13) and opens the connection between control chamber (12) and Y; the pressure in control chamber (12) is reduced and orifice spool (3) moved to the direction of opening by the pressure in A that acts on area (15) plus the pressure in B that acts on the annulus area (16).

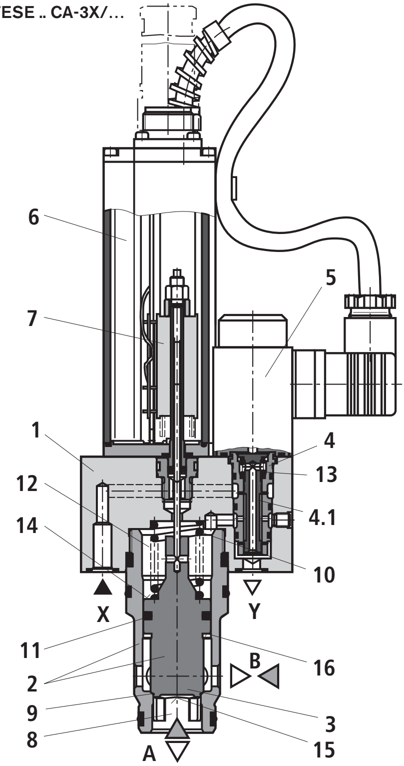
Function of closing orifice spool:
(Assumption: flow A → B and A connected with X)
• Current reduced in proportional solenoid (5); spring (13) shifts pilot spool (4.1) against the proportional solenoid and opens the connection between X and control chamber (12); the pressure acting on area (14) plus spring force (10) shift orifice spool (3) in the closing direction.

Flow control function:
• In conjunction with a pressure compensator, can be used for the pressure-compensated control of a flow.

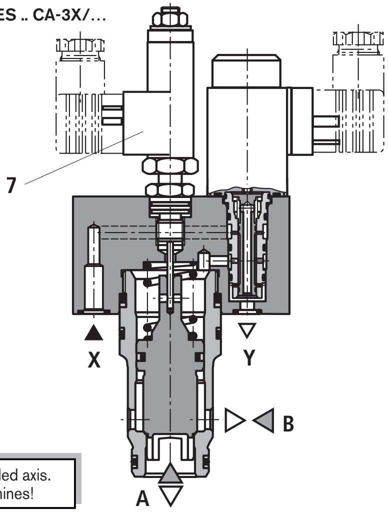
Failure of supply voltage:
• The integrated electronics de-energises the solenoid in the event of a supply voltage failure or cable break in position transducer (7).
• The spool is shifted to valve seat (9) by the pressure applied to pilot port X plus spring force (10) and blocks the flow A → B.

⚠ **Caution:** A voltage supply failure results in a sudden standstill of the controlled axis. Accelerations that can occur in conjunction with this can cause damage to machines!

Type FESE .. CA-3X/…



Type FES .. CA-3X/…



Technical data (for applications outside these parameters, please consult us!)

General

Size			25	32	40	50	63
Weight	– FES	kg	3.8	5.5	8.2	12.5	21
	– FESE	kg	4	5.7	8.4	12.7	21.2
Installation orientation			Optional				
Storage temperature range		°C	– 20 to + 80				
Ambient temperature range	– FES	°C	– 20 to + 70				
	– FESE	°C	– 20 to + 50				

Hydraulic (measured with HLP 46; $\vartheta_{oil} = 40\ °C \pm 5\ °C$)

Size			Size	25	32	40	50	63
Max. operating pressure	– Ports A, B		bar	315				
Max. pilot pressure	– Port X		bar	315				
Return flow pressure	– Port Y			At zero pressure to tank				
Min. inlet pressure	– in A (direction of flow A → B)		bar	12	15	15	20	20
	– in B (direction of flow B → A)		bar	15	20	20	25	25
Max. flow q_{Vmax} of main valve at Δp 10 bar	– Direction of flow A → B		l/min	360	480	680	1400	1800
	– Direction of flow B → A		l/min	330	460	585	1400	1800
Pilot oil volume for switching process from seated position → 100%			cm^3	3.9	7.6	12	23.4	52
Max. pilot oil volume in port Y:	– With stepped input signal		l/min	5.0	6.5	10	12	17
Pilot oil volume	at control position (0 to 100% command value) from X via pilot valve to Y		l/min	< 0.3 for all sizes				
Direction of flow	– Internal pilot oil supply	A → B		Connect A to X				
		B → A		Connect B to X				
	– External pilot oil supply	A → B		Pressure at X > pressure in A				
		B → A		Pressure at X > pressure in B				
Leakage fluid	– State:	Command value 0 V or 4 mA, from A → B / B → A in dependence on Δp		See characteristic curves on pages 9 to 14				
		from A → X / B → X via pilot control to Y at $p = 315$ bar		< 0.3 for all sizes				
	– State:	Enable inactive		A → B / B → A leak-free isolation				
		Solenoid de-energised ("fail-safe" position)		⚠ **Caution!** In the case of internal pilot oil supply, observe leakage from A or B to X via the pilot valve to Y. $q_V < 0.2$ l/min at $\Delta p = 315$ bar With external pilot oil supply to X, this fluid loss caused by leakage from A or B can be avoided. The external pressure at X must be ≥ the pressure in A with direction of flow A → B and ≥ the pressure in B with direction of flow B → A.				
Hydraulic fluid				Mineral oil (HL, HLP) to DIN 51524; further hydraulic fluids on enquiry!				
Hydraulic fluid temperature range			°C	– 20 to + 80				
Viscosity range			mm^2/s	15 to 380				
Max. permissible degree of contamination of the hydr. fluid Cleanliness class to ISO 4406 (c)	– Pilot valve			Class 17/15/12 [1)]				
	– Main valve			Class 20/18/15/ [1)]				
Hysteresis			%	< 0.2				
Response sensitivity			%	< 0.1				
Range of inversion			%	< 0.15				

Technical data (for applications outside these parameters, please consult us!)

Type FES – external control electronics

Electrical, solenoid (pilot valve)

Type of voltage		V	24 DC
Nominal current		mA	1000
Coil resistance	– Cold value at 20 °C	Ω	12.7
	– Max. hot value	Ω	19.3
Duty cycle		%	100
Electrical connection			With component plug to DIN EN 175301-803
			Cable socket to DIN EN 175301-803 [2]
Type of protection of the valve to EN 60529			IP65 with cable socket mounted and locked

Electrical, inductive position transducer (main stage; only for type FES)

Coil resistance	Total resistance of coils between		1 and 2	2 and ⏚	⏚ and 1
at 20 °C (see Symbols on page 2)		Ω	31.5	45.5	31.5
Inductance		mH	6 to 8		
Oscillator frequency		kHz	2.5		
Electrical connection			With component plug GSA20 made by Hirschmann		
			Cable socket GM209N (Pg9) made by Hirschmann [2]		
Type of protection to EN 60529			IP65 with cable socket mounted and locked		
Electrical position measuring system			Differential throttle		

Control electroncis (only for type FES; separate order)

Amplifier in Euro-card format		Size	25	32	40	50	63
	to data sheet RE 30117	analogue	VT-VRPA1-50	VT-VRPA1-51		VT-VRPA1-52	
Amplifier of modular design to data sheet RE 29756		analogue	VT 11037				

Type FESE – integrated electronics (OBE)

Electrical

Current consumption	– I_{max}	A	1.3
	– Pulse load	A	1.5
Duty cycle		%	100
Electrical connection			With component plug to DIN 43651
			Cable socket to DIN 43651 11-pin + PE/Pg16 [3]
Type of protection of the valve			IP65 with cable socket mounted and locked
Control electronics			Integrated in the valve (see page 8)

[1] The cleanliness classes specified for components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and, at the same time, prolongs the service life of components.
For the selection of filters, see data sheets RE 50070, RE 50076, RE 50081, RE 50086 and RE 50088.

[2] Separate order, see page 6

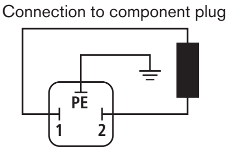
[3] Separate order, see page 7

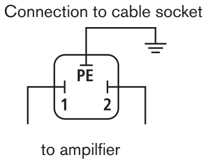
☞ **Note:** Details with regard to **environment simulation testing** in the fields of EMC (electromagnetic compatibility), climate and mechanical stress, see RE 29209-U (declaration on environmental compatibility).

4

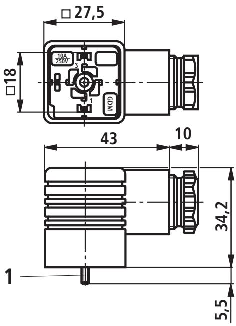
Electrical connection, cable sockets (nominal dimensions in mm)

Type FES – for external control electronics



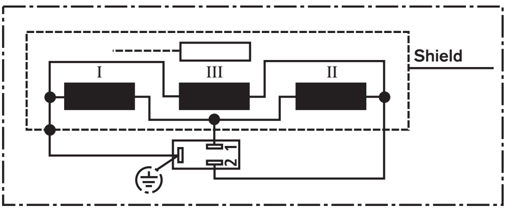


Cable socket to DIN EN 175301-803
Separate order stating material no. **R901017011**
(plastic version)

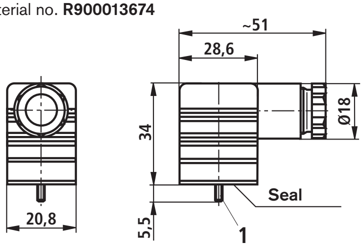


1 Fixing screw M3
Tightening torque $M_T = 0.5$ Nm

Inductive position transducer



Cable socket GM209N (Pg9) made by Hirschmann
Separate order stating material no. **R900013674**
(plastic version)



1 Fixing screw M3
Tightening torque $M_T = 0.5$ Nm

Electrical connection, cable sockets (nominal dimensions in mm)

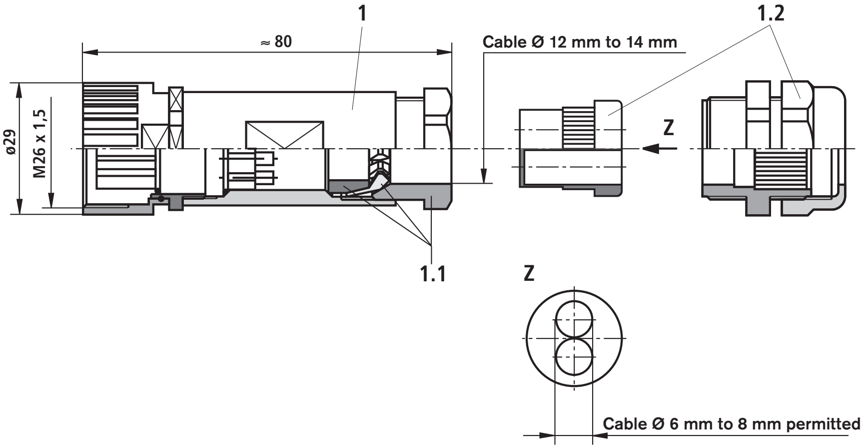
Type FESE – with integrated electronics (OBE)

Cable socket to DIN 43651/11-pin + PE/Pg16

Separate order stating material no. **R900884671** (plastic version)

Assembly consisting of items 1 and 1.1 or items 1 and 1.2, type of protection IP65

Note:
- If you use **one** cable, combine item 1 with item 1.1
- If you use **two** cables, combine item 1 with item 1.2



4

Pin	Function	Conditions	
1	Operating voltage +UL	U_O = 24 VDC; $u_O(t)_{max}$ = 36 V; $u_O(t)_{min}$ = 21.6 V	
2	Ground L0		
3	Enable input / reference for pin 2	log 1 = 10 V to 36 V; log 0 = U < 8 V	
		Type **FESE.../...B1...**	Type **FESE.../...G1...**
		Voltage interface	Current interface
4	Command value input	0 V to + 10 V (R_I > 50 kΩ)	+ 4 mA to + 20 mA / load = 100 Ω
5	Command value input, reference		
6	Actual value output	0 V to – 10 V (I_{max} = 5 mA)	+ 4 mA to + 20 mA / load ≤ 500 Ω
7	Actual value output, reference		
8	free		
9	free		
10	free		
11	Ready for operation (output)	Valve not ready for operation:	U_{Pin11} < 8 V;
		Valve not ready for operation:	U_{Pin11} = U_O – 3 V
		Reference – pin 2:	(I_{max} against 0 V; 50 mA);
PE	Protective conductor ⏚		

Recommended connecting cable
- Up to 25 m → min. 0.75 mm² per wire
- Up to 50 m → min. 1.5 mm² per wire
- Connect shield to PE only on the supply side

Integrated electronics (OBE) of type FESE

Function

1. Making operation/disturbance characteristic:

After the supply voltage of 24 V was applied, the electronics is ready for operation, if the following conditions are fulfilled:

- Operating voltage $U_O > 18$ VDC
- The internal ± 7.5 V supply voltage is symmetrical
- The connection to the position transducer is not interrupted.
- The command value cable is not interrupted (only with 4 mA to 20 mA interface)

If one of these conditions is not fulfilled, the controller and the output stage are blocked and the signal "ready for operation" is set to < 8 V.

2. Normal operation

When the enable is inactive (< 8 V) and an optional command value is fed forward (0 to 10V or 4 to 20 mA) the orifice spool is in the seated position and blocks the flow from A to B.

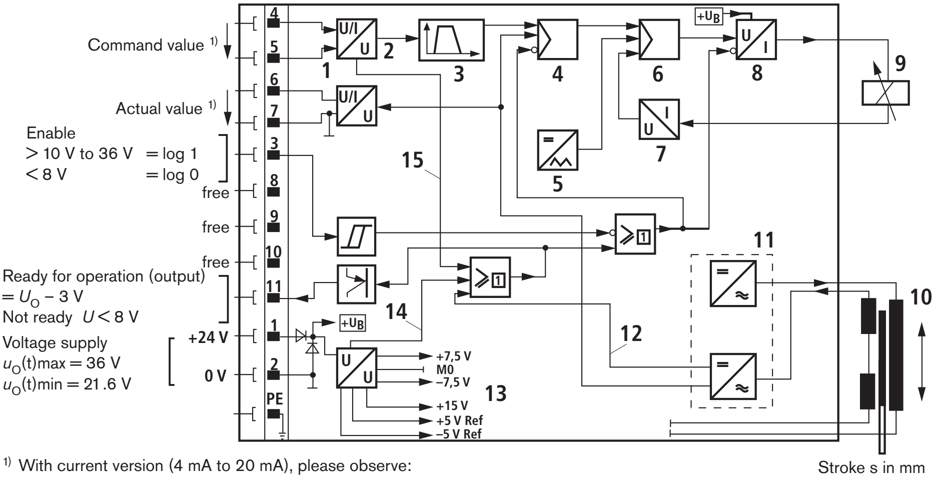
By applying a voltage > 10 V to the enable, the position controller for the orifice spool and the output stage for the pilot valve are switched on. At the same time, the position controller (PID) compares the actual value of the orifice spool position with the applied command value, and a control output is fed to the output stage, which changes the solenoid current until the orifice spool position corresponds to the command value.

The actual value of the orifice spool position is sensed by an inductive position transducer. The signal of the latter is rectified by the demodulator and fed back to the PID-controller.

The following output signals are available on the plug:

- Actual position value FESE.../...B1 (pin 6)
  - 0 V to – 10 V corresponds to 0 % to 100 % valve opening
  - Orifice spool in seated position → actual value > 0.8 V
- Actual position value FESE.../...G1 (pin 6)
  - 4 mA to 20 mA corresponds to 0 % to 100 % valve opening
  - Orifice spool in seated position → actual value < 2.7 mA
- Signal "ready for operation" (pin 11)
  - All conditions listed above are fulfilled → > 10 V
  - One of the conditions is not fulfilled → < 8V

Block circuit diagram / pin assignment of integrated electronics



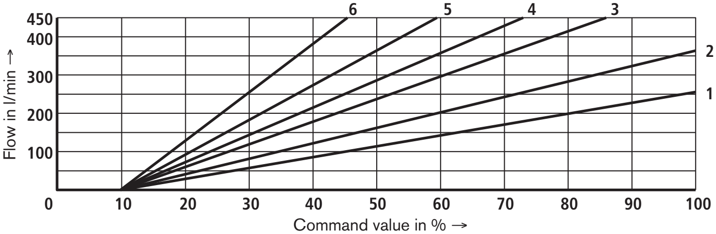
[1)] With current version (4 mA to 20 mA), please observe:
Between connections 5 and 4, load = 100 Ω
Between connections 6 and 7, load ≤ 500 Ω

1 Input
2 Output
3 Fixed ramp
4 Position controller
5 Clock pulse
6 Current regulator
7 I/U converter
8 Output stage
9 Proportional solenoid
10 Position transducer
11 Oscillator / demodulator
12 Fault signal of position transducer
13 Power supply unit
14 Error signal in the case of $+U_O$ undervoltage and asymmetry in the power supply unit
15 Cable break signal with current command value

Characteristic curves (measured with HLP 46 and $\vartheta_{oil} = 40\ °C \pm 5\ °C$) Size 25

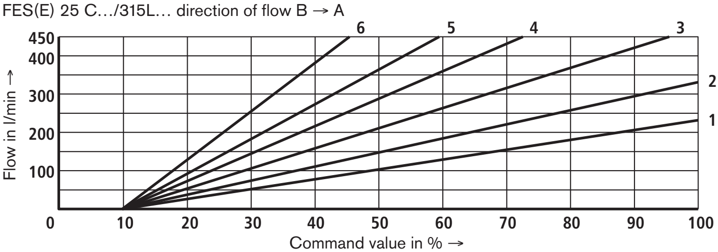
Flow characteristic linear

FES(E) 25 C.../315L... direction of flow A → B



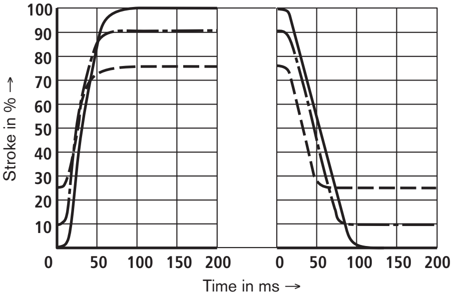
- **1** $\Delta p =$ 5 bar
- **2** $\Delta p =$ 10 bar
- **3** $\Delta p =$ 20 bar
- **4** $\Delta p =$ 30 bar
- **5** $\Delta p =$ 50 bar
- **6** $\Delta p =$ 100 bar

FES(E) 25 C.../315L... direction of flow B → A



- **1** $\Delta p =$ 5 bar
- **2** $\Delta p =$ 10 bar
- **3** $\Delta p =$ 20 bar
- **4** $\Delta p =$ 30 bar
- **5** $\Delta p =$ 50 bar
- **6** $\Delta p =$ 100 bar

Transient function in the case of stepped command value change [1)]



Step responses
0 – 100 – 0 %
10 – 90 – 10 %
25 – 75 – 25 %

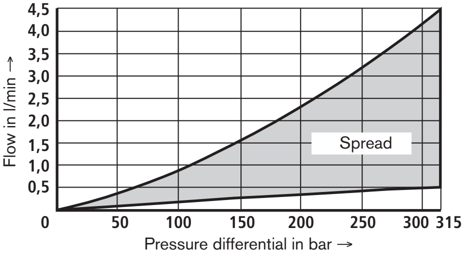
1) Measurement conditions

Pressure in A = 50 bar
Actuator in B closed ($p_A = p_B = 50$ bar)
Pressure in A < 50 bar → actuating time is extended
Pressure in A > 50 bar → actuating time is shortened
The area ratio of the orifice spool has an influence on the actuating time as follows:

→ Command value 0 → 100%: The actuating time becomes shorter, the higher the inlet pressure and the smaller the Δp across the valve.

→ Command value 100 → 0%: The actuating time becomes shorter, the higher the inlet pressure and the higher the Δp across the valve.

Leakage from A → B and B → A in dependence upon the pressure differential Δp (command value 0 V or 4 mA, resp.)

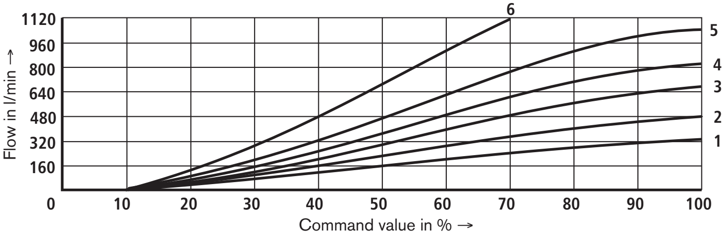


4

Characteristic curves (measured with HLP 46 and $\vartheta_{oil} = 40\ °C \pm 5\ °C$) Size 32

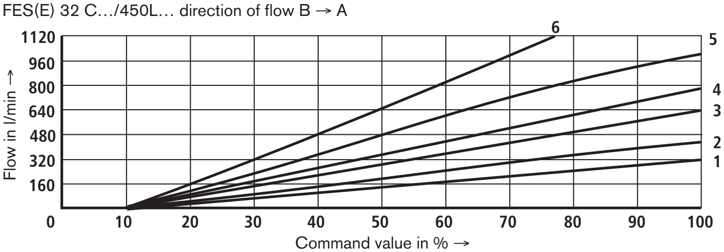
Flow characteristic linear

FES(E) 32 C…/450L… direction of flow A → B



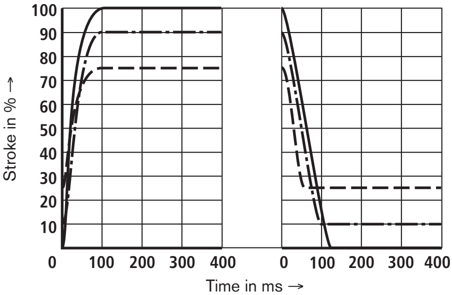
1 $\Delta p =$ 5 bar
2 $\Delta p =$ 10 bar
3 $\Delta p =$ 20 bar
4 $\Delta p =$ 30 bar
5 $\Delta p =$ 50 bar
6 $\Delta p =$ 100 bar

FES(E) 32 C…/450L… direction of flow B → A



1 $\Delta p =$ 5 bar
2 $\Delta p =$ 10 bar
3 $\Delta p =$ 20 bar
4 $\Delta p =$ 30 bar
5 $\Delta p =$ 50 bar
6 $\Delta p =$ 100 bar

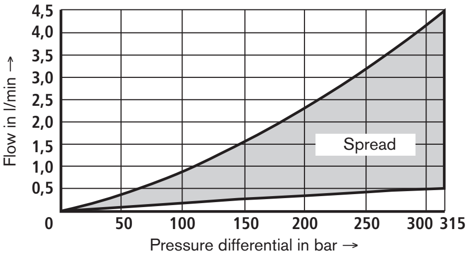
Transient function with stepped command value change [1)]



Step responses 0 – 100 – 0 % ———
10 – 90 – 10 % —·—·—
25 – 75 – 25 % – – – –

1) Measurement conditions
Pressure in A = 50 bar
Verbraucher in B geschlossen ($p_A = p_B = 50$ bar)
Pressure in A < 50 bar → actuating time is extended
Pressure in A > 50 bar → actuating time is shortened
The area ratio of the orifice spool has an influence on the actuating time as follows:
→ Command value 0 → 100%: The actuating time becomes shorter, the higher the inlet pressure and the smaller the Δp across the valve.
→ Command value 100 → 0%: The actuating time becomes shorter, the higher the inlet pressure and the higher the Δp across the valve.

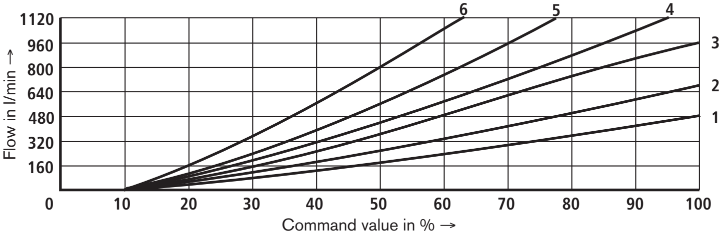
Leckage from A → B and B → A in dependence upon the pressure differential Δp (command value 0 V or 4 mA, resp.)



Characteristic curves (measured with HLP 46 and $\vartheta_{oil} = 40\ °C \pm 5\ °C$) Size 40

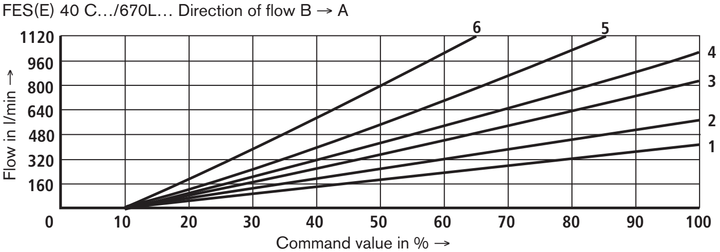
Flow characteristic linear

FES(E) 40 C.../670L... Direction of flow A → B



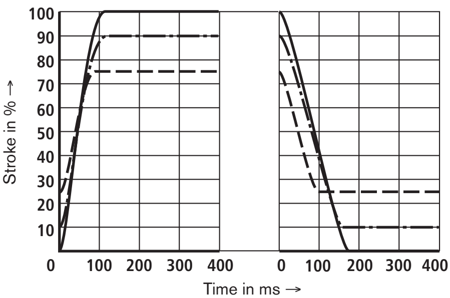
1 $\Delta p =$ 5 bar
2 $\Delta p =$ 10 bar
3 $\Delta p =$ 20 bar
4 $\Delta p =$ 30 bar
5 $\Delta p =$ 50 bar
6 $\Delta p =$ 100 bar

FES(E) 40 C.../670L... Direction of flow B → A



1 $\Delta p =$ 5 bar
2 $\Delta p =$ 10 bar
3 $\Delta p =$ 20 bar
4 $\Delta p =$ 30 bar
5 $\Delta p =$ 50 bar
6 $\Delta p =$ 100 bar

Transient function with stepped command value change [1]



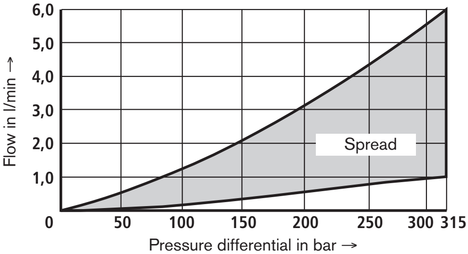
Step responses 0 – 100 – 0 % ————
10 – 90 – 10 % —·—·—
25 – 75 – 25 % – – – –

[1] Measurement conditions
Pressure in A = 50 bar
Verbraucher in B geschlossen ($p_A = p_B = 50$ bar)
Pressure in A < 50 bar → actuating time is extended
Pressure in A > 50 bar → actuating time is shortened
The area ratio of the orifice spool has an influence on the actuating time as follows:

→ Command value 0 → 100%: The actuating time becomes shorter, the higher the inlet pressure and the smaller the Δp across the valve.

→ Command value 100 → 0%: The actuating time becomes shorter, the higher the inlet pressure and the higher the Δp across the valve.

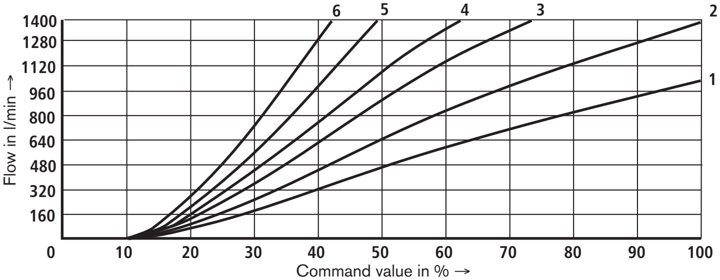
Leakage from A → B and B → A in dependence upon the pressure differential Δp (command value 0 V or 4 mA, resp.)



Characteristic curves (measured with HLP 46 and $\vartheta_{oil} = 40\ °C \pm 5\ °C$) Size 50

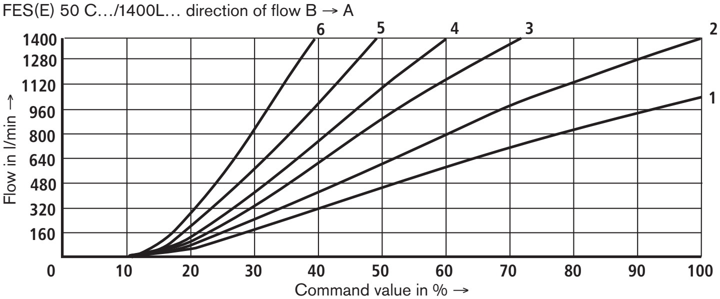
Flow characteristic linear [1)]

FES(E) 50 C…/1400L… direction of flow A → B



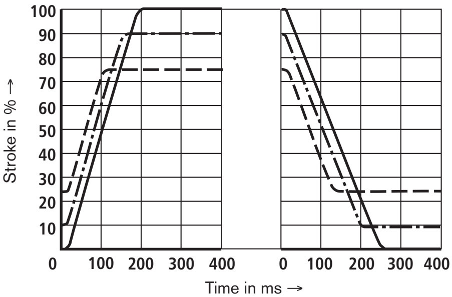
1 Δp = 5 bar
2 Δp = 10 bar
3 Δp = 20 bar
4 Δp = 30 bar
5 Δp = 50 bar
6 Δp = 100 bar

FES(E) 50 C…/1400L… direction of flow B → A



1 Δp = 5 bar
2 Δp = 10 bar
3 Δp = 20 bar
4 Δp = 30 bar
5 Δp = 50 bar
6 Δp = 100 bar

Transient function with stepped command value change [2)]



Step responses 0 – 100 – 0 % ———
10 – 90 – 10 % –·–·–
25 – 75 – 25 % – – – –

1) Flow values above 1200 l/min are no measured values!

2) Measurement conditions

Pressure in A = 50 bar
Verbraucher in B geschlossen ($p_A = p_B = 50$ bar)

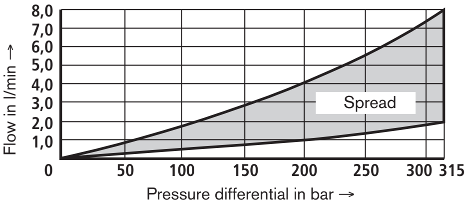
Pressure in A < 50 bar → actuating time is extended
Pressure in A > 50 bar → actuating time is shortened

The area ratio of the orifice spool has an influence on the actuating time as follows:

→ Command value 0 → 100%: The actuating time becomes shorter, the higher the inlet pressure and the smaller the Δp across the valve.

→ Command value 100 → 0%: The actuating time becomes shorter, the higher the inlet pressure and the higher the Δp across the valve.

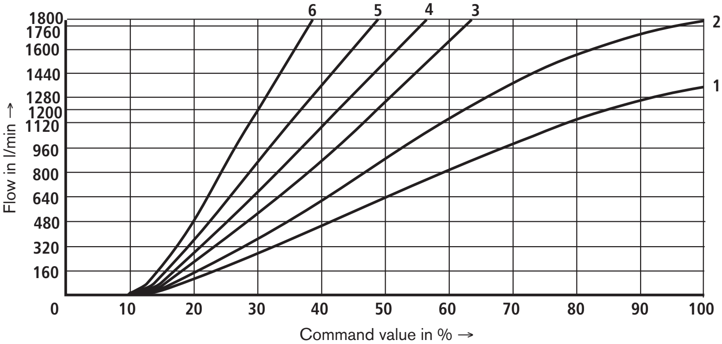
Leakage from A → B and B → A in dependence upon pressure differential Δp (command value 0 V or 4 mA, resp.)



Characteristic curves (measured with HLP 46 and $\vartheta_{oil} = 40\ °C \pm 5\ °C$) Size 63

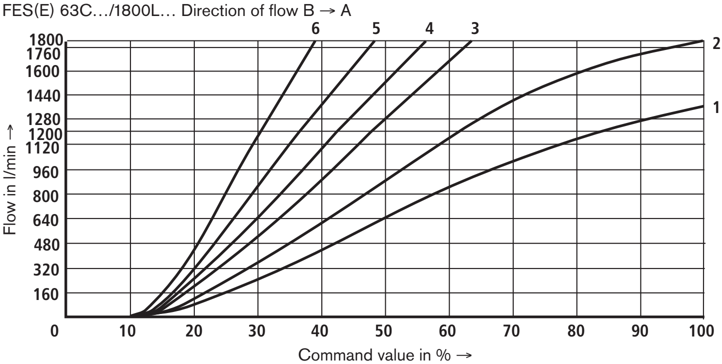
Flow characteristic linear [1)]

FES(E) 63 C…/1800L… direction of flow A → B



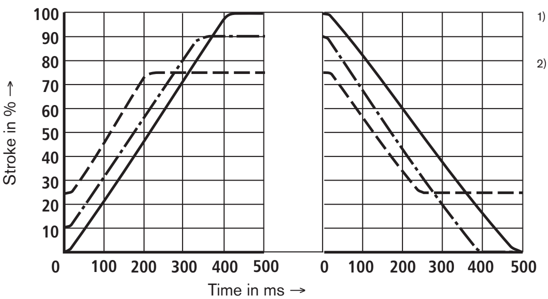
1 $\Delta p =$ 5 bar
2 $\Delta p =$ 10 bar
3 $\Delta p =$ 20 bar
4 $\Delta p =$ 30 bar
5 $\Delta p =$ 50 bar
6 $\Delta p =$ 100 bar

FES(E) 63C…/1800L… Direction of flow B → A



1 $\Delta p =$ 5 bar
2 $\Delta p =$ 10 bar
3 $\Delta p =$ 20 bar
4 $\Delta p =$ 30 bar
5 $\Delta p =$ 50 bar
6 $\Delta p =$ 100 bar

Transient function with stepped command value change [2)]



Step responses
0 – 100 – 0 %
10 – 90 – 10 %
25 – 75 – 25 %

[1)] Flow values above 1200 l/min are no measured values!

[2)] Measurement conditions

Pressure in A = 50 bar
Actuator in B closed ($p_A = p_B = 50$ bar)

Pressure in A < 50 bar → actuating time is extended
Pressure in A > 50 bar → actuating time is shortened

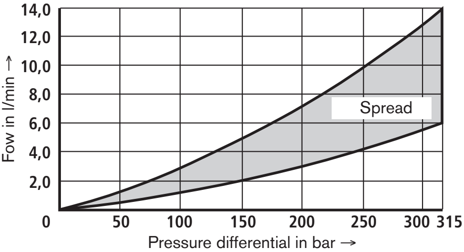
The area ratio of the orifice spool has an influence on the actuating time as follows:

→ Command value 0 → 100%: he actuating time becomes shorter, the higher the inlet pressure and the smaller the Δp across the valve.

→ Command value 100 → 0%: The actuating time becomes shorter, the higher the inlet pressure and the higher the Δp across the valve.

Characteristic curves (measured with HLP 46 and $\vartheta_{oil} = 40\ °C \pm 5\ °C$) Size 63

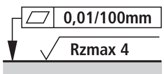
Leakage from A → B and B → A in dependence upon the pressure differential Δp (command value 0 V or 4 mA, resp.)

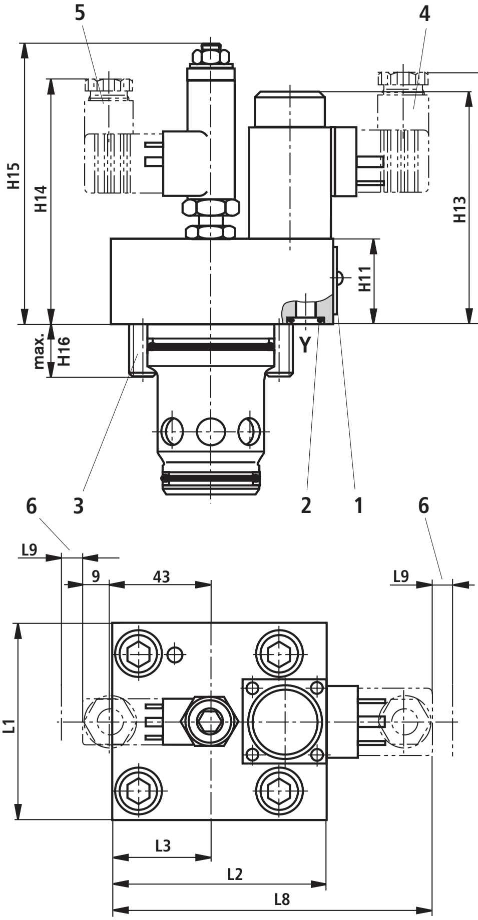


Unit dimensions: Type FES (nominal dimensions in mm)

Size	25	32	40	50	63
H11	51	63	62	73	90
H12	116	128	127	138	155
H13	110	122	121	132	149
H14	118	130	129	140	157
H15	137.5	149.5	148.5	159.5	176.5
H16	25	35	45	45	65
L1	85	102.5	126	140	180
L2	93.5	102.5	126	140	180
L3	42.5	51 .25	63	70	90
L8	139	150	169	184	219
L9	15	15	15	15	15

Required surface quality of mating part

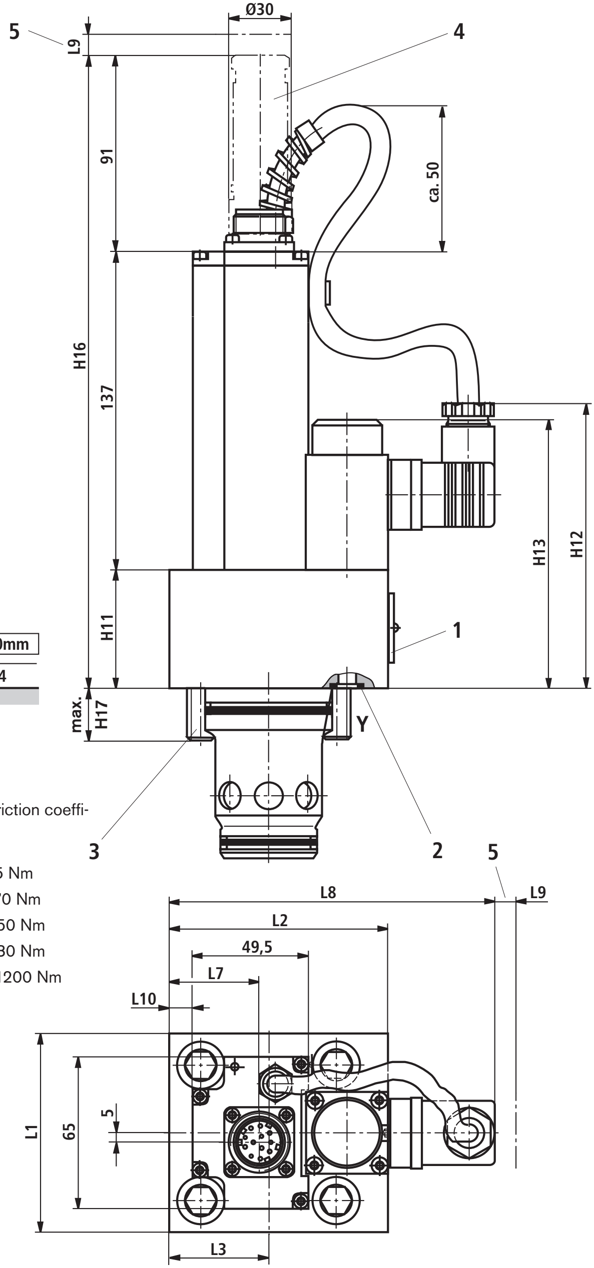




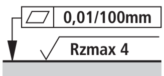
1 Nameplate
2 Identical seal rings for ports X and Y
3 4 off valve fixing screws to ISO 4762-10.9 (friction coefficient 0.09 ... 0.14 to VDA 235-101) are included in the scope of supply:
Size 25: M12 x 60, tightening torque $M_T = 75$ Nm
Size 32: M16 x 75, tightening torque $M_T = 170$ Nm
Size 40: M20 x 80, tightening torque $M_T = 350$ Nm
Size 50: M20 x 90, tightening torque $M_T = 380$ Nm
Size 63: M30 x 100, tightening torque $M_T = 1200$ Nm
4 Cable socket for proportional solenoid, separate order see, page 6
5 Cable socket for inductive position transducer, separate order, see page 6
6 Space required to remove cable socket

Unit dimensions: Type FESE (nominal dimensions in mm)

Size	25	32	40	50	63
H11	51	63	62	73	90
H12	116	128	127	138	155
H13	110	122	121	132	149
H16	279	291	290	301	318
H17	25	35	45	45	65
L1	85	102.5	126	140	180
L2	93.5	102.5	126	140	180
L3	42.5	51.25	63	70	90
L7	38.5	51.25	63	66	86
L8	139	150	169	184	219
L9	15	15	15	15	15
L10	10	18.75	30.5	37.5	57.5



Required surface quality of mating part



1 Nameplate

2 Identical seal rings for ports X and Y

3 4 off valve fixing screws to ISO 4762-10.9 (friction coefficient 0.09 ... 0.14 to VDA 235-101)
are included in the scope of supply:
Size 25: M12 x 60, tightening torque M_T = 75 Nm
Size 32: M16 x 75, tightening torque M_T = 170 Nm
Size 40: M20 x 80, tightening torque M_T = 350 Nm
Size 50: M20 x 90, tightening torque M_T = 380 Nm
Size 63: M30 x 100, tightening torque M_T = 1200 Nm

4 Cable socket
separate order, see page 7

5 Space required to remove cable socket

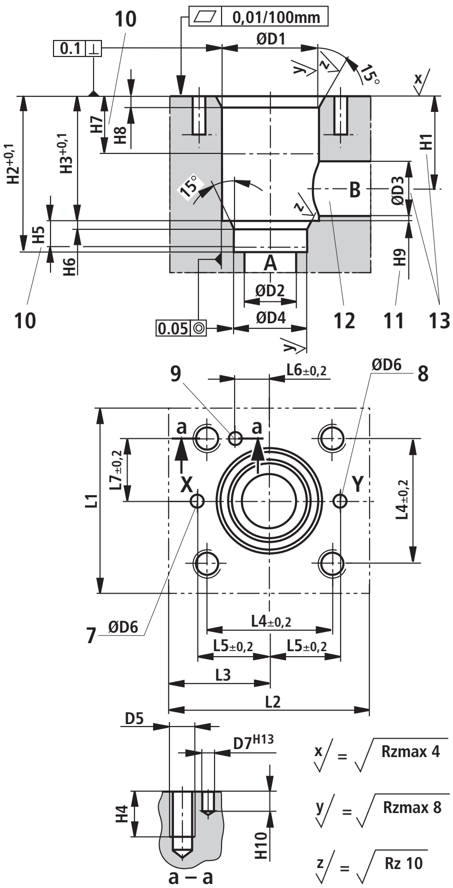
4

Installation dimensions (nominal dimensions in mm)

Installation dimensions to DIN ISO 7368					
Size	**25**	**32**	**40**	**50**	**63**
ØD1^{H8}	45	60	75	90	120
ØD2	25	32	40	50	63
ØD3	25	32	40	50	63
max. ØD3	32	40	50	63	80
ØD4^{H8}	34	45	55	68	90
D5	M12	M16	M20	M20	M30
max. ØD6	6	8	10	10	12
ØD7^{H13}	6	6	6	8	8
H1	44	52	64	72	95
H1 [1]	40.5	48	59	65.5	86.5
H2	72	85	105	122	155
H3	58	70	87	100	130
H4	25	35	45	45	65
H5	12	13	15	17	20
H6	2.5	2.5	3	3	4
H7	30	30	30	35	40
H8	2.5	2.5	3	4	4
min. H9, (ref. dimension)	1	1.5	2.5	2.5	3
min. H10	8	8	8	8	8
L1	85	102.5	126	140	180
L2	93.5	102.5	126	140	180
L3	42.5	51.25	63	70	90
L4	58	70	85	100	125
L5	33	41	50	58	75
L6	16	17	23	30	38
L7	29	35	42.5	50	62.5

[1] Bore centre at max. ØD3

Size	**Installation dimensions to DIN ISO 7368**
25	ISO 7368-BB-08-2-A
32	ISO 7368-BC-09-2-A
40	ISO 7368-BD-10-2-A
50	ISO 7368-BE-12-2-A
63	ISO 7368-BF-12-2-A



Tolerances to: General tolerances ISO 2768-mK

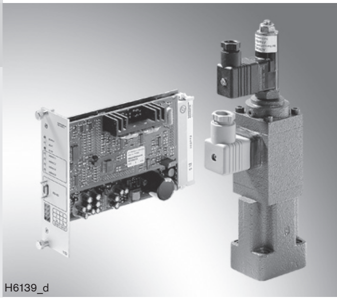
7 Port X
8 Port Y
9 Locating bore for locating pin
10 Depth of fit
11 Reference dimension
12 Port B can optionally arranged around the central axis of port A. However, care must be taken not to drill the fixing bores and the pilot bores.
13 In the case of a diameter for port B other than specified in the dimensional table, the distance from the cover contact face to the centre of the bore must be calculated.

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

Proportional flow control valve, 2-way version

RE 29188/02.07
Replaces: 02.06

Type 2FRE 6



H6139_d

Size 6
Component series 2X
Maximum operating pressure 210 bar
Maximum flow 25 l/min

Table of contents

Contents	**Page**

Information on available spare parts:
www.boschrexroth.com/spc

Features

– Valve with pressure compensator for the pressure-compensated control of a flow
– Actuation by means of proportional solenoid
– For subplate mounting:
Position of ports to ISO 4401-03-02-0-94
Subplates according to data sheet RE 45052
(separate order), see page 10
– With electrical closed-loop position control of the metering orifice
– The position transducer coil can be axially shifted, which simplifies zero point balancing of the metering orifice (electrical-hydraulic) without the need for intervening into the control electronics
– Low manufacturing tolerances of the valve and the electrical amplifier types VT-VRPA1-150-1X (analogue) and amplifier module types VT-MRPA1-150-1X (analogue), separate order, see page 6
– Flow control in both directions due to rectifier sandwich plate

Ordering code: Proportional flow control valve

2FRE	6		–2X/		K4		V	*

Size 6 = **6**

With external closing of the pressure compensator (suppression of start-up jump) = A

Without external closing of the pressure compensator = B

Component series 20 to 29 = **2X**
(20 to 29: unchanged installation and connection dimensions)

Nominal flow A → B /
Flow characteristics

Linear:	up to 1 l/min	=	**1L**
	up to 2 l/min	=	**2L**
	up to 8 l/min	=	**8L**
Progressive:	up to 3 l/min	=	**3Q**
	up to 6 l/min	=	**6Q**
	up to 10 l/min	=	**10Q**
	up to 16 l/min	=	**16Q**
	up to 25 l/min	=	**25Q**

Progressiv with rapid speed
Fine control range up to 2 l/min = **2QE**

K4 = **Electrical connection**
Without cable socket
with component socket to DIN EN 175301-803-A
for proportional solenoid and
GSA20 for position transducer
Cable sockets – separate order
see page 7

R = With check valve
M = Without check valve

V = FKM seals, suitable for mineral oil (HL, HLP) to DIN 51524

Further details in clear text

Standard types

Type	Material number
2FRE 6 B-2X/1LK4RV	R900947600
2FRE 6 B-2X/8LK4RV	R900934070
2FRE 6 B-2X/10QK4RV	R900949563
2FRE 6 B-2X/25QK4RV	R900937871
2FRE 6 B-2X/2QEK4RV	R900954501

Ordering code: Rectifier sandwich plate

Z4S	6	–1X/	V	*

Size 6 = **6**

Component series 10 to 19 = **1X**
(10 to 19: unchanged installation and connection dimensions)

FKM seals, suitable for mineral oil (HL, HLP) to DIN 51524 = **V**

Further details in clear text

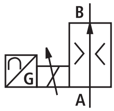
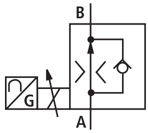
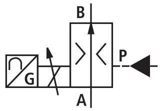
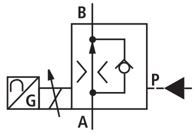
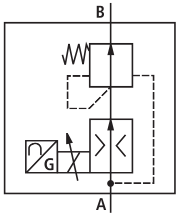
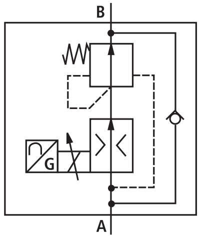
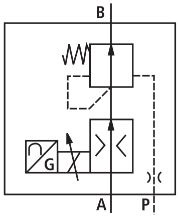
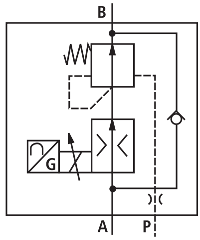
Type	Material number
Z4S 6-1X/V	R900489356

⚠ **Attention!**

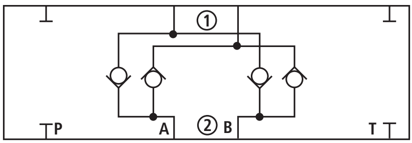
Rectifier sandwich plate type Z4S 6-1X/V can **not** be used in conjunction with a proportional flow control valve of type 2FRE 6 A-2X/… (with external closing of the pressure compensator).

Symbols

Proportional flow control valve (simplified, detailed)

	Type 2FRE 6 B-2X/…MV	Type 2FRE 6 B-2X/…RV	Type 2FRE 6 A-2X/…MV	Type 2FRE 6 A-2X/…RV
Simplified				
Detailed				

Rectifier sandwich plate (① = component side, ② = plate side)
Type Z4S 6-1X/V



Function, section

Proportional flow control valves of type 2FRE … feature a 2-way function. They can control a flow, which is determined by an electrical command value, with pressure and temperature compensation.

They basically consist of housing (1), proportional solenoid with inductive position transducer (2), metering orifice (3), pressure compensator (4) and optional check valve (5).

Proportional flow control valve type 2FRE 6 B-2X/.K4RV

(without external closing, with check valve)

The setting of the flow is determined by the setting (0 to 100 %) on the command value potentiometer. The selected command value causes metering orifice (3) to be adjusted via the amplifier and the proportional solenoid. The inductive position transducer senses the position of metering orifice (3). Any deviations from the command value are corrected by the closed-loop position control.

Pressure compensator (4) keeps the pressure differential across metering orifice (3) always at a constant value. This ensures load-compensation of the flow.

The low temperature drift is a result of the favourable design of the metering orifice.

At a command value of 0 % the metering orifice is closed.

In the event of a power failure or cable break on the inductive position transducer, the metering orifice closes.

Starting from a 0 % command value, a jump-free start-up is possible. The metering orifice can be opened and closed with a delay provided by two ramps in the electrical amplifier.

Check valve (5) allows the free return flow from B to A.

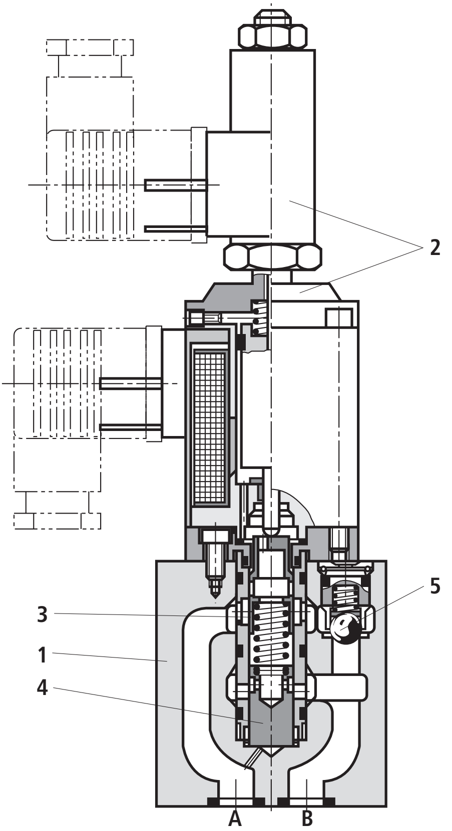
The supply and return flow to and from the actuator can be controlled with the help of an additional rectifier sandwich plate of type Z4S 6… under the proportional flow control valve.

Proportional flow control valve type 2FRE 6 A-2X/.K4MV

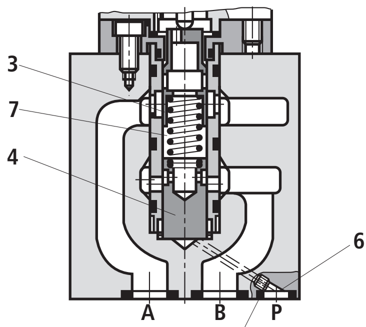
(with external closing, without check valve)

In principle, the function of this valve is the same as that of valve type 2FRE 6 B-2X/.K4RV.

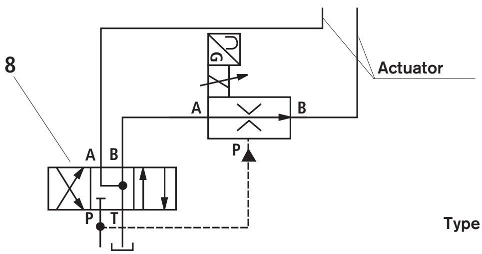
To suppress the start-up jump when metering orifice (3) is open (command value > 0 %), closing of pressure compensator (4) is provided via port P (6). There is no internal connection between port A and pressure compensator (4). The pressure in P upstream of directional valve (8) acts on pressure compensator (4) and holds it in the closed position against the force of spring (7). When directional valve (8) is switched from P to B, pressure compensator (4) moves from the closed position to the control position, thus preventing a start-up jump.



Type 2FRE 6 B-2X/.K4RV



Type 2FRE 6 A-2X/.K4MV



Technical data (for applications outside these parametes, please consult us!)

General

Weight	– Proportional flow control valve	kg	1,8
	– Rectifier sandwich plate	kg	0,9
Installation orientation			Optional
Storage temperature range		°C	–20 to +80
Ambient temperature range		°C	–20 to +50

Hydraulisch – proportional flow control valve (measured with HLP46 and at ϑ_{oil} = 40 °C ±5 °C)

Max. operating pressure in port A		bar	up to 210

Version			1L	2L	8L	3Q	6Q	10Q	16Q	25Q	2QE
Max. flow		l/min	1	2	8	3	6	10	16	25	25
Min. flow	– up to 100 bar	cm^3/min	25	25	50	15	25	50	70	100	15
	– up to 210 bar	cm^3/min	25	25	50	25	25	50	70	100	25
Max. leakage flow at 0 % command value Δp A → B (measured at $\nu = 41\ mm^2/s$ and $\vartheta = 50\ °C$)	50 bar	cm^3/min	4	4	6	4	4	6	7	10	4
	100 bar	cm^3/min	5	5	8	5	5	8	10	15	5
	210 bar	cm^3/min	7	7	12	7	7	12	15	22	7

Minimum pressure differential		bar	6 to 10
Pressure differential with free return flow B → A			see characteristic curve on page 9
Pressure/flow relationship: Inlet/outlet pressure			see characteristic curve on page 9
Dependence upon temperature Temperature drift, hydraulic and electrical			see characteristic curve on page 9
Hydraulics fluid			Mineral oil (HL, HLP) to DIN 51524 Further hydraulic fluids on enquiry!
Max. permissible degree of contamination of the hydraulic fluid – cleanliness class to ISO 4406 (c)			Class 20/18/15 [1)]
Hydraulic fluid temperature range		°C	–20 to +80
Viscosity range		mm^2/s	15 to 380
Hysteresis		%	$< \pm 1$ of q_{Vmax}
Repeatability		%	< 1 of q_{Vmax}
Manufacturing tolerances	– Valve 2FRE 6		≤ ± 3 % at 33 % command value ≤ ± 5 % at 100 % command value
	– Amplifier VT-VRPA1-150 (analogue)		Amplifier must be matched to the valve [2)]
	– Amplifier module VT-MRPA1-150 (analogue)		Amplifier must be matched to the valve [2)]

Hydraulic – rectifier sandwich plate

Operating pressure	bar	up to 210
Cracking pressure	bar	0,7
Nominal flow	l/min	25

[1)] The cleanliness classes specified for components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and, at the same time, prolongs the service life of components.

For the selection of filters, see data sheets RE 50070, RE 50076, RE 50081, RE 0086 and RE 50088.

[2)] Due to tolerances of the oscillator frequency (position transducer supply), amplifiers are subject to tolerances. When installing new systems or replacing an amplifier, the amplifier settings may have to be adjusted.

Technical data (for applications outside these parametes, please consult us!)

Electrical – proportional solenoid					
Type of voltage			DC		
Coil resistance	– Cold value at 20 °C	Ω	5.4		
	– Max. hot value	Ω	8.2		
Duty cycle		%	100		
Max. current per solenoid		A	1.5		
Electrical connection			With component plug to DIN EN 175301-803-A		
			Cable socket to DIN EN 175301-803-A [1]		
Type of protection to EN 60529			IP 65 [2] with cable socket mounted and locked		
Electrical – inductive position transducer					
Coil resistance	Total resistance of coil between		1 and 2	2 and ⏚	⏚ and 1
at 20 °C (see page 7)			31,5	45,5	31,5
Electrical connection			With component plug GSA20		
			Cable socket GM209N (Pg9) [1]		
Type of protection to EN 60529			IP 65 2) with cable socket mounted and locked		
Inductance		mH	6 to 8		
Oscillator frequency		kHz	2.5		
Electrical position measuring system			Differential throttle		
Nominal stroke		mm	3.5		
Control electronics (separate order)					
Associated amplifier in Euro-card format			Type VT-VRPA1-150-1X (analogue) to data sheet RE 30118		
Associated amplifier module			Type VT-MRPA1-150-1X (analogue) to data sheet RE 30221		

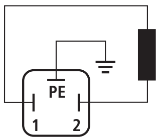
1) Separate order, see page 7

2) Due to the surface temperatures of solenoid coils, observe European standards DIN EN 563 and DIN EN 982!

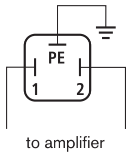
Electrical connection, cable sockets (nominal dimensions in mm)

Proportional solenoid

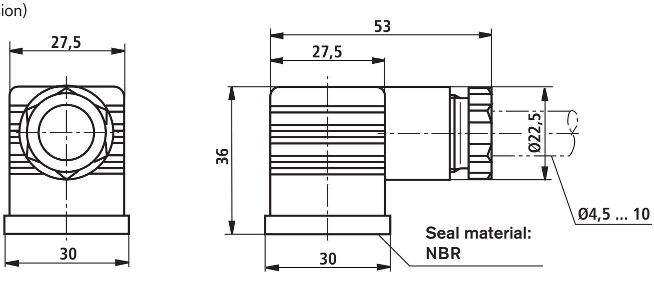
Connection to component plug

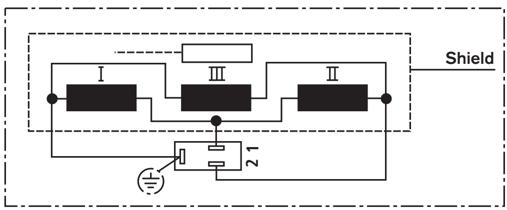


Connection to cable socket

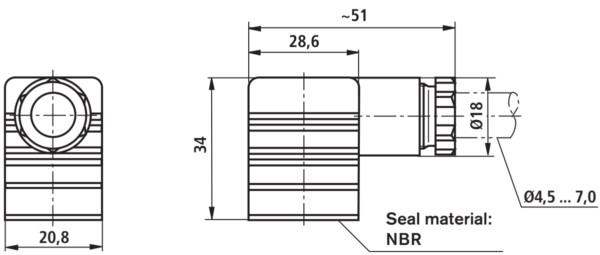


Cable socket to DIN EN 175301-803-A
Separate order stating material no. **R901017011**
(plastic version)





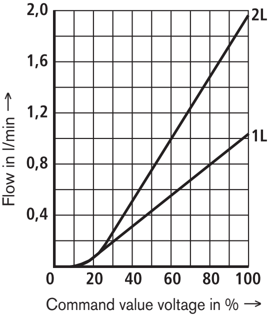
Cable socket Pg 9
Separate order stating material no. **R900013674**
(plastic version)

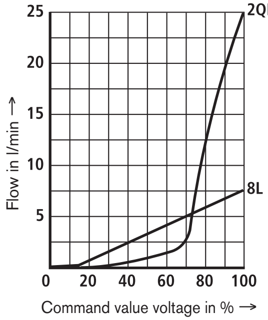


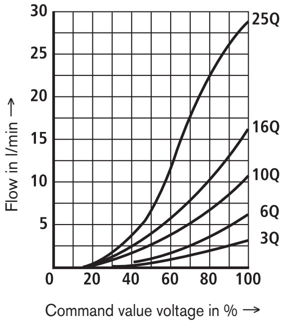
Characteristic curves (measured with HLP46 and at ϑ_{oil} = 40 °C ±5 °C)

Dependence of flow on command value voltage

(flow control from A → B); p_{nom} = 50 bar

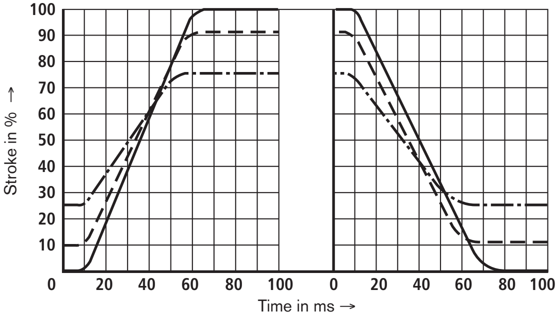




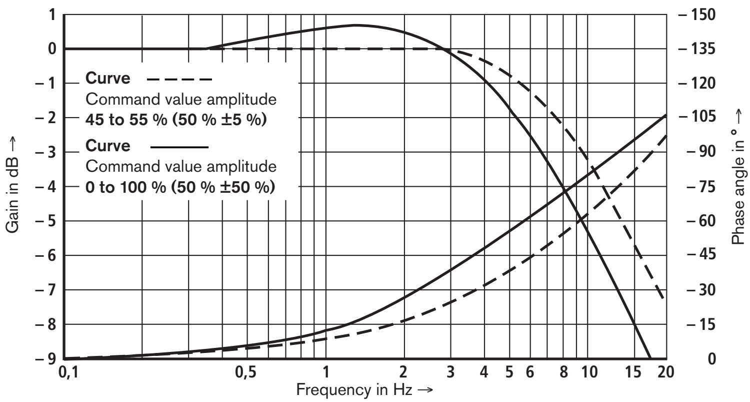


Transient function

at stepped command value change ; p_{nom} = 100 bar; valve type 25Q



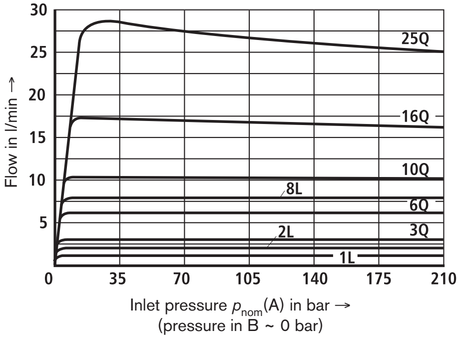
Frequency response characteristic curves; *pnom* = 100 bar; valve type 25Q

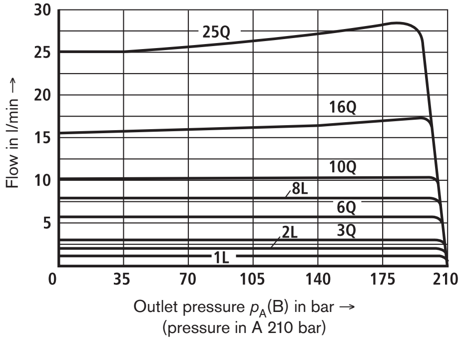


Characteristic curves (measured with HLP46 and at ϑ_{oil} = 40 °C ±5 °C)

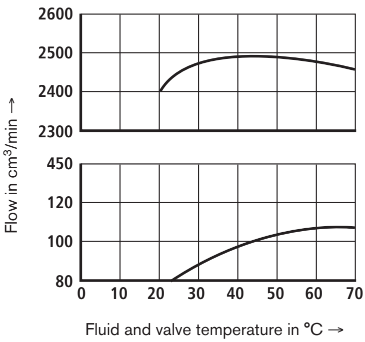
Proportional flow control valve

Pressure/flow relationship

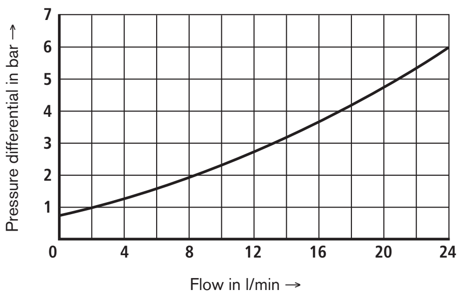




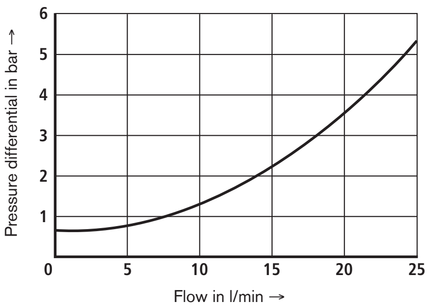
Dependence on temperature (flow characteristic 25Q – largest deviation) at Δp = 30 bar



Pressure differential across check valve B → A
Orifice closed

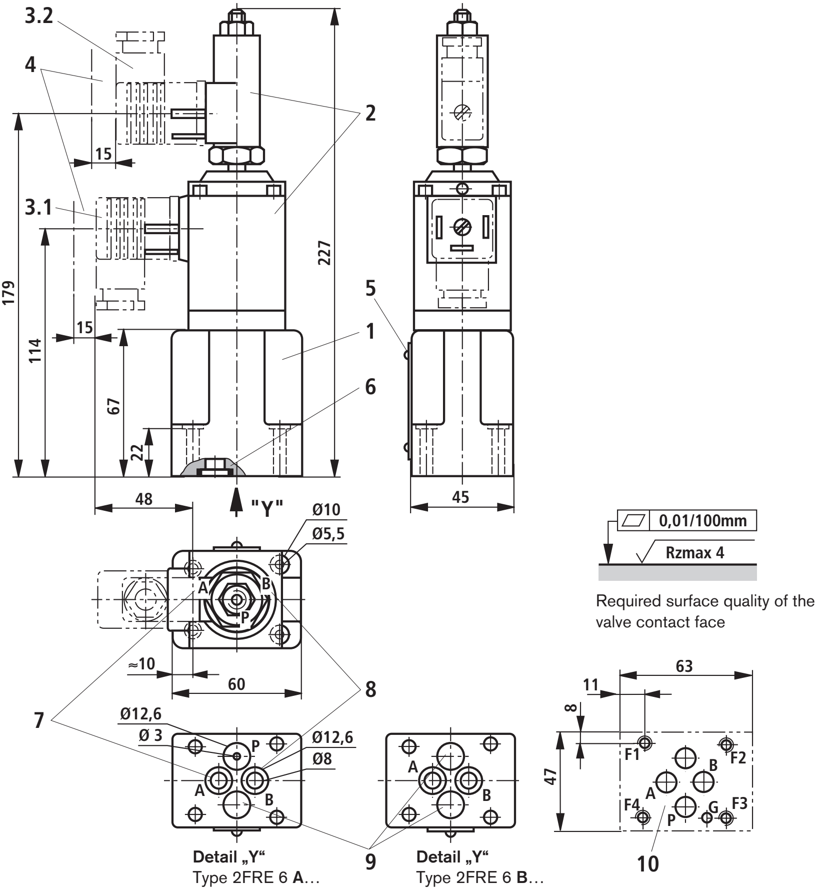


Rectifier sandwich plate
Δp-q_V characteristic curve



4

Unit dimensions: Proportional flow control valve (nominal dimensions in mm)



Detail „Y“
Type 2FRE 6 **A**…

Detail „Y“
Type 2FRE 6 **B**…

1 Valve housing
2 Proportional solenoid with indutive position transducer
3.1 Cable socket for proportional solenoid, separate order, see page 7
3.2 Cable socket for proportional solenoid, separate order, see page 7
4 Space required to remove cable socket
5 Nameplate
6 Identical seal rings for ports A, B, P and blind hole
7 Port A
8 Port B
9 Blind hole Ø 12.6 mm
10 Machined valve contact face, position of ports to ISO 4401 (**with** locating bore) (Code: 4401-03-02-0-94 – explanation to ISO 5783)

Tolerances to: – General tolerances to ISO 2768-mK

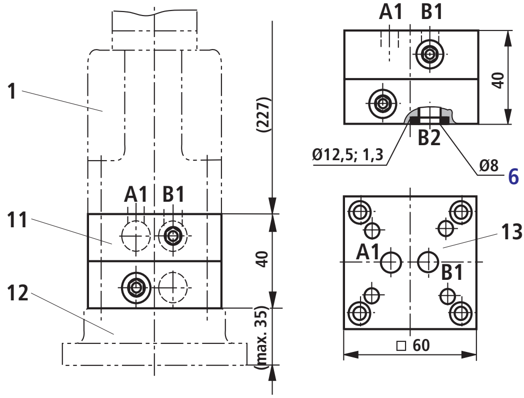
Subplates to data sheet RE 45052 and valve fixing screws must be ordered separately.

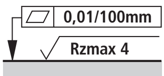
Subplates: G341/01 (G1/4)
G342/01 (G3/8)
G502/01 (G1/2)

Valve fixing screws (separate order)
The following valve fixing screws are recommended:

- **4 socket head cap screws to ISO 4762 - M5x30 - 10.9-flZn240h-L** (friction coefficient 0.09 to 0.14 to VDA 235-101); tightening torque M_T = 7 Nm ±10%, material no. **R913000316**
- **4 socket head cap screws to ISO 4762 - M5x30 - 10.9** (friction coefficient 0.08 to 0.16 to VDI 2230 – tempering, black) tightening torque M_T = 8.1 Nm ±10%

Unit dimensions: Rectifier sandwich plate (nominal dimensions in mm)





Required surface quality of valve contact face

4

1 Valve housing
6 Identical seal rings for ports A2 and B2
11 Rectifier sandwich plate
12 Subplate (separate order), see page 10
13 Valve contact face for 2FRE 6…

⚠ Attention!

Rectifier sandwich plate type Z4S 6-1X/V can **not** be used in conjunction with a proportional flow control valve of type 2FRE 6 A-2X/… (with external closing of the pressure compensator).

Tolerances to: – General tolerances ISO 2768-mK

Valve fixing screws (separate order)
The following valve fixing screws are recommended:

- **4 socket head cap screws to ISO 4762 - M5x70 - 10.9-flZn-240h-L** (friction coefficient 0.09 to 0.14 to VDA 235-101); tightening torque M_T = 7 Nm ±10%, material no. R913000325
- **4 socket head cap screws to ISO 4762 - M5x70 - 10.9** (friction coefficient 0.08 to 0.16 to VDI 2230 – tempering, black) tightening torque M_T = 8.1 Nm ±10%

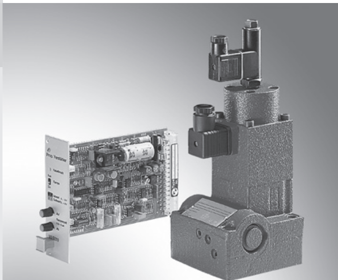
Notes

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

Proportional flow control valve, 2-way version

RE 29190/02.07
Replaces: 02.06

Type 2FRE



H5570_d

Sizes 10 and 16
Component series 4X
Maximum operating pressure 315 bar
Maximum flow 160 l/min

Table of contents

Features

– Valve with pressure compensator for the pressure-compensated control of a flow
– Actuation by means of proportional solenoid
– For subplate mounting:
  Porting pattern to ISO 6263, see page 10
  Subplates according to data sheet RE 45066 (separate order), see page 10
– With electrical closed-loop position control of the metering orifice
– The position transducer coil can be axially shifted, which simplifies zero point balancing of the metering orifice (electrical-hydraulic) without the need for intervening into the control electronics
– Low manufacturing tolerances of the valve and the electrical amplifier types VT-VRPA1-151-1X (analogue) and amplifier module Typ VT-MRPA1-151-1X (analogue), separate order, see page 5
– Flow control in both directions due to rectifier sandwich plate

Information on available spare parts:
www.boschrexroth.com/spc

Ordering code: Proportional flow control valve

2FRE	–4X/	B	K4		*

Size 10 = **10**
Size 16 = **16**

Component series 40 to 49 = **4X**
(40 to 49: unchanged installation and connection dimensions)

Further details in clear text

M = NBR seals, suitable for mineral oil (HL, HLP) to DIN 51524
V = FKM seals

Electrical connection
K4 = **Without** cable socket, with component plug to DIN EN 175301-803-A for proportional solenoid and GSA20 for position transducer
Cable sockets – separate order
see page 6

B = With pressure compensator stroke limiter

Nominal flow A → B / flow characteristics					
Size 10				Size 16	
Linear		Progressive with rapid speed (fine control rnge)		Linear	
Up to 10 l/min	**= 10L**	With rapid speed	**= 5QE**	Up to 80 l/min	**= 80L**
Up to 16 l/min	**= 16L**		**= 5Q**	Up to 100 l/min	**= 100L**
Up to 25 l/min	**= 25L**		**= 10Q**	Up to 125 l/min	**= 125L**
Up to 50 l/min	**= 50L**		**= 16Q**	Up to 160 l/min	**= 160L**
Up to 60 l/min	**= 60L**		**= 25Q**		

Standard types

Size 10

Type	material number
2FRE 10-4X/10LBK4M	R900915817
2FRE 10-4X/16LBK4M	R900915825
2FRE 10-4X/25LBK4M	R900915820
2FRE 10-4X/50LBK4M	R900915815

Size 16

Type	material number
2FRE 16-4X/100LBK4M	R900915819
2FRE 16-4X/160LBK4M	R900915814

Ordering code: Rectifier sandwich plate

Z4S	–2X/	*

Size 10 = **10**
Size 16 = **16**

Component series 20 to 29 = **2X**
(20 to 29: unchanged installation and connection dimensions)

Further details in clear text

No code = NBR seals, suitable for mineral oil (HL, HLP) to DIN 51524
V = FKM seals

Size 10

Type	material number
Z4S 10-2X/	R900413377
Z4S 10-2X/V	R900413379

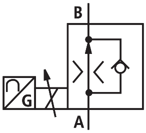
Size 16

Type	material number
Z4S 16-2X/	R900425901
Z4S 16-2X/V	R900427362

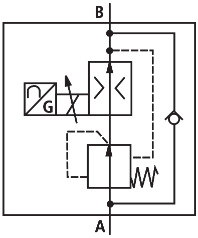
Symbols

Proportional flow control valve

Simplified

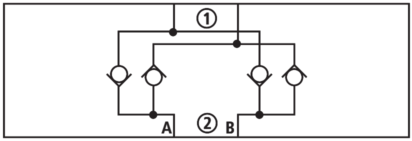


Detailed



Rectifier sandwich plate

① = component side, ② = plate side



Function, section

Proportional flow control valves of type 2FRE … feature a 2-way function. They can control a flow, which is determined by an electrical command value, in a pressure- and largely temperature-compensated way.

They basically consist of housing (1), proportional solenoid with inductive position transducer (2), metering orifice (3), pressure compensator (4), stroke limiter (5) and check valve (6).

The setting of the flow is determined by the setting (0 to 100 %) on the command value potentiometer. The selected command value causes metering orifice (3) to be adjusted via the amplifier and the proportional solenoid. The inductive position transducer senses the position of metering orifice (3). Any deviations from the command value are corrected by the closed-loop position control.

Pressure compensator (4) keeps the pressure differential across metering orifice (3) always at a constant value. This ensures pressure compensation of the flow.

If the current regulator is used only within a range, which is significantly smaller than the maximum nominal flow provided from the valve, the response time of pressure compensator (4) can be shortened by limiting the pressure compensator stroke. Thus, undesirable start-up jumps can be reduced.
If the grub screw of stroke limiter (5) is at the left-hand limit stop (turned out), the pressure compensator stroke is not limited.

The low temperature drift is a result of the favourable design of the metering orifice.

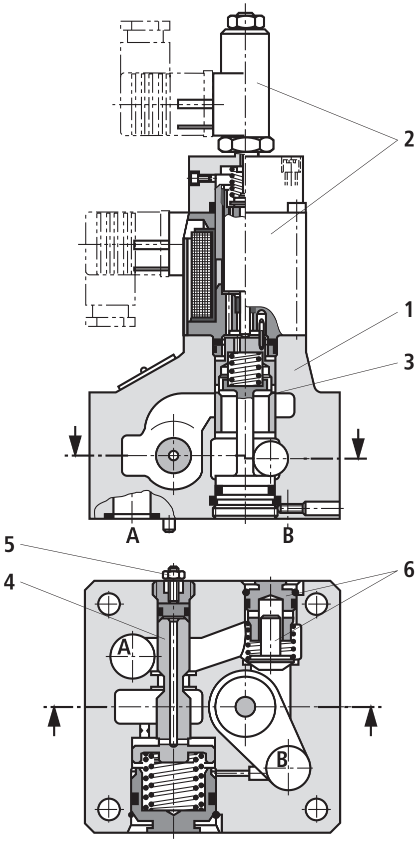
At a command value of 0 % the metering orifice is closed.

In the event of a power failure or cable break on the inductive position transducer, the metering orifice closes.

Starting from a 0 % command value, a jump-free start-up is possible. The metering orifice can be opened and closed with a delay provided by two ramps in the electrical amplifier.

Check valve (6) allows the free return flow from B to A.

The supply and return flow to and from the actuator can be controlled with the help of an additional rectifier sandwich plate of type Z4S… under the proportional flow control valve.



Technical data (for applications outside these parametes, please consult us!)

General

Size		Size	**10**	**16**
Weight	– Proportional flow control valve	kg	6.1	8.5
	– Rectifier sandwich plate	kg	3.2	9.3
Installation orientation			Optional	
Storage temperature range		°C	– 20 to + 80	
Ambient temperature range		°C	– 20 to + 70	

Hydraulic – proportional flow control valve (measured with HLP46 and at ϑ_{oil} = 40 °C ± 5 °C)

Size		Size	**10**					**16**			
Max. operating pressure	in port A	bar	Up to 315								
Max. flow	– Linear	l/min	10	16	25	50	60	80	100	125	160
	– Progressive with rapid speed	l/min	40					–			
Minimum pressure differential		bar	3 to 8					6 to 10			
Δp with free flow B → A		bar	see diagram on page 9								
Flow control											
Temperature drift	– Hydraulic + electrical Δq_V /°C	%	0.1 of q_{Vmax}								
	– Pressure-compensated (up to Δp = 315 bar)	%	± 2 of q_{Vmax}								
Hydraulic fluid			Mineral oil (HL, HLP) to DIN 51524 Further hydraulic fluids on enquiry!								
Hydraulic fluid temperature range		°C	– 20 to + 80								
Viscosity range		mm²/s	15 to 380								
Max. permissible degree of contamination of the hydraulic fluid - cleanliness class to ISO 4406 (c)			Class 20/18/15 [1)]								
Hysteresis		%	< ± 1 of q_{Vmax}								
Repeatability		%	< 1 of q_{Vmax}								
Manufacturing tolerance	Valve	%	≤ ± 2 at 33 % command value ≤ ± 5 at 100 % command value								
	– Amplifier VT-VRPA1-151 (analogue)	%	Amplifier must be matched to valve [2)]								
	– Amplifier module VT-MRPA1-151 (analogue)	%	Amplifier must be matched to valve [2)]								

Hydraulic – rectifier sandwich plate

Size	Size	**10**	**16**
Operating pressure	bar	Up to 315	
Cracking pressure	bar	1.5	
Nominal flow	l/min	60	160

[1)] The cleanliness classes specified for components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and, at the same time, prolongs the service life of components.

For the selection of filters, see data sheets RE 50070, RE 50076, RE 50081, RE 0086 and RE 50088.

[2)] Due to tolerances of the oscillator frequency (position transducer supply), amplifiers are subject to tolerances. When installing new systems or replacing an amplifier, the amplifier settings may have to be adjusted.

Technical data (for applications outside these parametes, please consult us!)

Electrical – proportional solenoid

Type of voltage			DC
Coil resistance	– Cold value at 20 °C	Ω	10
	– Max. hot value	Ω	13.9
Duty cycle		%	100
Max. current per solenoid		A	1.51
Electrical connection			With component plug to DIN EN 175301-803-A
			Cable socket to DIN EN 175301-803-A [1]
Type of protection to EN 60529			IP 65 [2], with cable socket mounted and locked

Electrical – inductive position transducer

Coil resistance	Total resistance of coils between		1 and 2	2 and ⏚	⏚ and 1
at 20 °C (see page 6)		Ω	31.5	45.5	31.5
Electrical connection			With component plug GSA20		
			Cable socket GM209N (Pg 9) [1]		
Inductance		mH	6 to 8		
Oscillator frequency		kHz	2.5		
Electrical position measuring system			Differential throttle		
Nominal stroke		mm	4		
Type of protection to EN 60529			IP 65 [2], with cable socket mounted and locked		

Control electronics (separate order)

Associated amplifier in Euro-card format	Type VT-VRPA1-151-1X (analogue) to data sheet RE 30118
Associated amplifier module	Type VT-MRPA1-151-1X (analogue) to data sheet RE 30221

[1] Separate order, see page 6

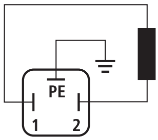
[2] Due to the surface temperatures of solenoid coils, observe European standards DIN EN563 and DIN EN982!

4

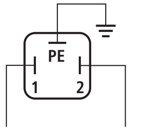
Electrical connection, cable sockets (nominal dimensions in mm)

Proportional solenoid

Connection to component plug

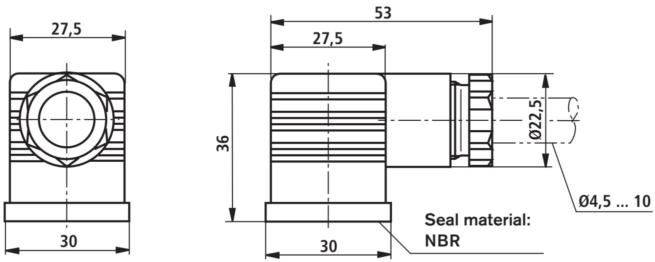


Connection to cable socket

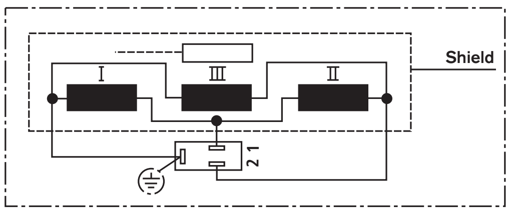


to amplifier

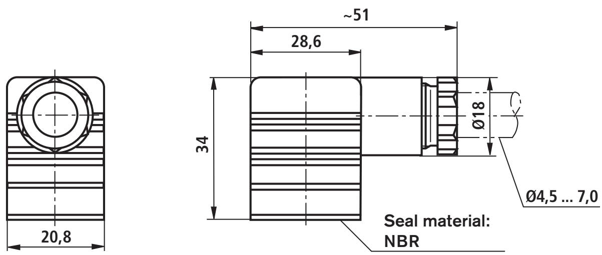
Cable socket to DIN EN 175301-803-A
Separate order stating material no. **R901017011**
(plastic version)



Inductive position transducer

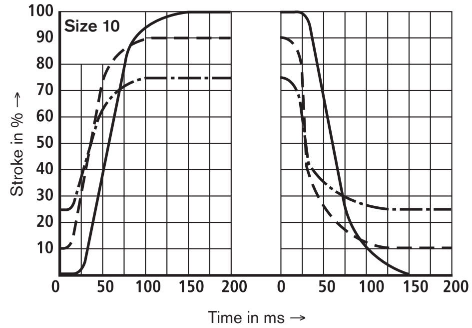


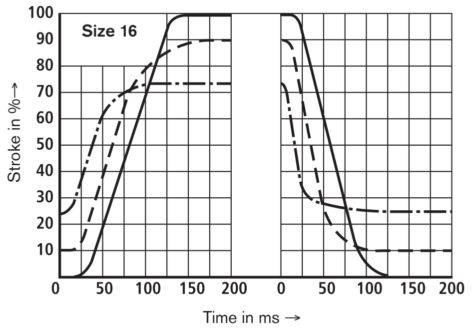
Cable socket Pg 9
Separate order stating material no. **R900013674**
(plastic version)



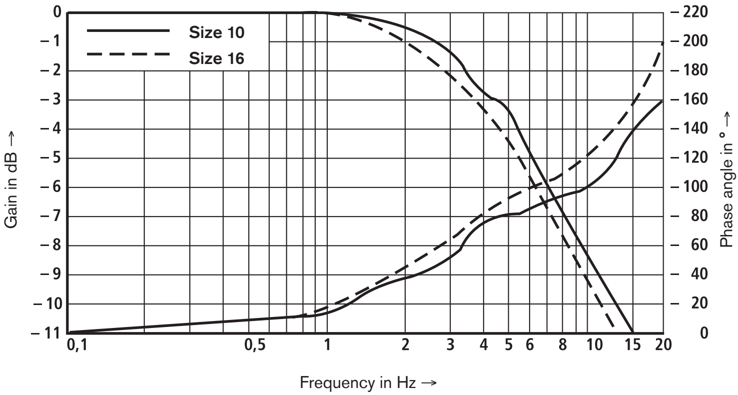
Characteristic curves (measured at $\nu = 41\ mm^2/s$ and $\vartheta = 50\ °C$; $p_{nom} = 50$ bar; Amplitude 0 → 100 %; size 10 type 60L / size 16 type 160L)

Transient function at stepped command value change



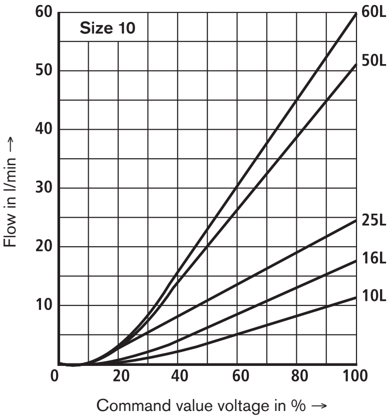


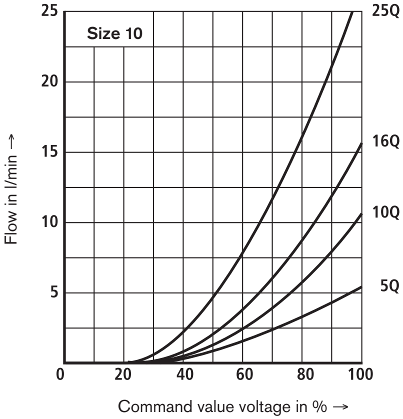
Frequency response characteristic curves

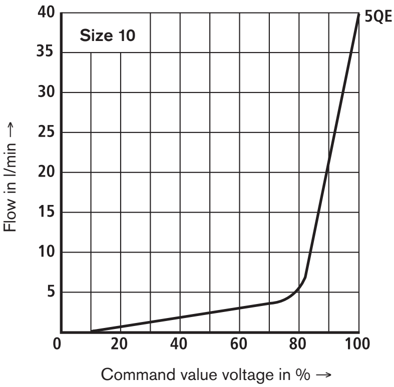


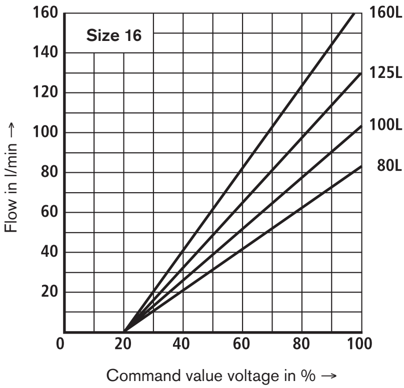
Characteristic curves (measured at $\nu = 41\ mm^2/s$ and $\vartheta = 50\ °C$)

Dependence of flow on command value voltage (flow control from A → B)



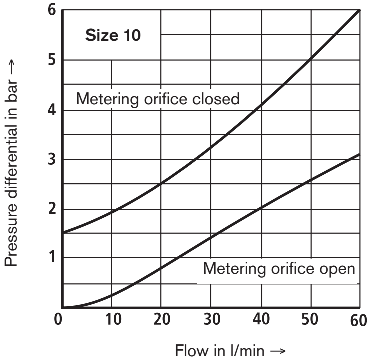


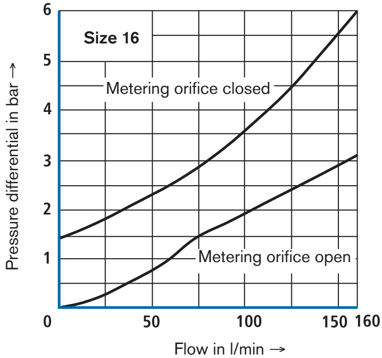




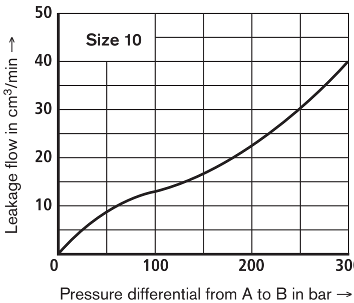
Characteristic curves (measured at $\nu = 41$ mm²/s and $\vartheta = 50$ °C)

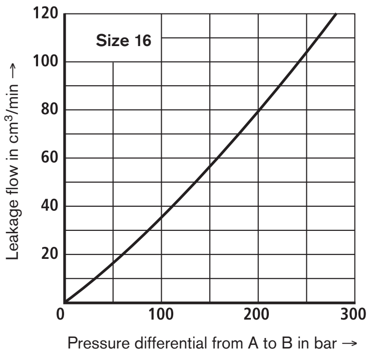
Pressure differential across check valve B → A





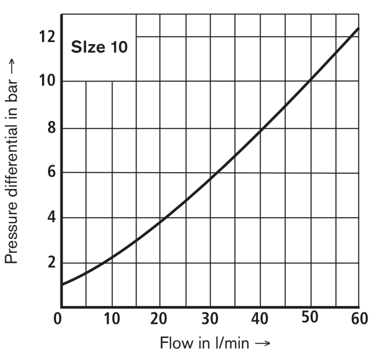
Leakage flow from A → B

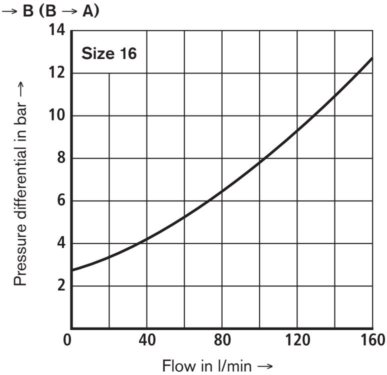




Rectifier sandwich plate

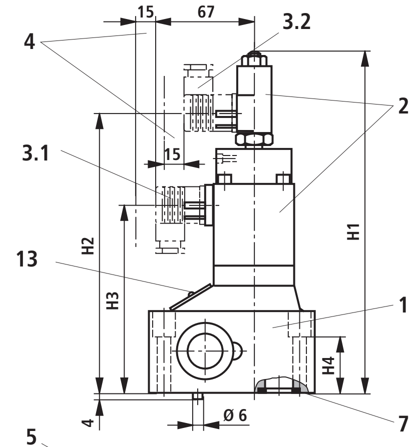
Pressure differential identical in both directions of flow
Flow from A → B (B → A)





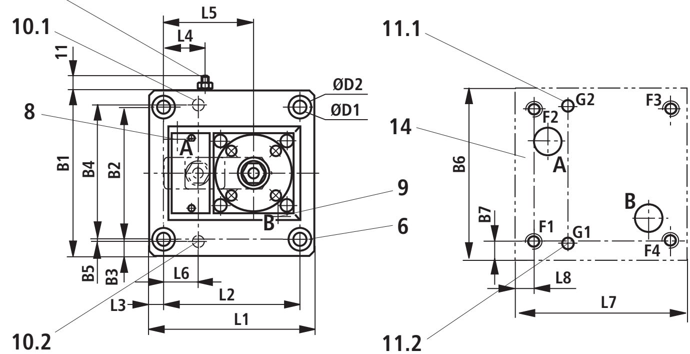
4

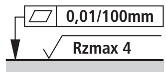
Unit dimensions: Proportional flow control valve (nominal dimensions in mm)



Size	10	16
B1	95	123.5
B2	76	101.5
B3	9.5	11
B4	79.4	102.4
B5	–	0.8
B6	97	126
B7	10.5	12
ØD1	9	11
ØD2	15	18
H1	245	255.5
H2	200	210
H3	210	140
H4	48	51

Size	10	16
L1	102.5	123.5
L2	82.5	101.5
L3	10	11
L4	24	31
L5	62.5	72.5
L6	23.8	28.6
L7	105	126
L8	11	12





Required surface quality of the valve contact face

Tolerances to: – General tolerances ISO 2768-mK

1 Valve housing
2 Proportional solenoid with inductive position transducer
3.1 Cable socket for proportional solenoid; separate order, see page 6
3.2 Cable socket for position transducer (separate order, see page 6)
4 Space required to remove cable socket
5 Setscrew of pressure compensator limiter, hexagon socket A/F 3, lock nut A/F 10
6 Valve fixing screws (separate order, see page 11)
7 Identical seal rings for ports A and B
8 Port A
9 Port B
10.1 Locating pin for sizes 10 and 16
10.2 Locating pin for size 16
11.1 Locating bore for locating pin for sizes 10 and 16
11.2 Locating bore for locating pin for size 16
13 Nameplate
14 Machined valve mounting face,
Size 10 - position of ports to ISO 6263-06-05-0-97
Size 16 - position of ports to ISO 6263-09-05-0-97

Subplates to data sheet RE 45066 and valve fixing screws must be ordered separately.

Subplates:	**Size 10**	**Size 16**
	G279/01 (G1/2)	G281/01 (G1)
	G280/01 (G3/4)	G282/01 (G1 1/4)

Unit dimensions: Valve fixing screws (separate order)

Without rectifier sandwich plate

Size 10
The following valve fixing screws are recommended:

4 socket head cap screws to ISO 4762 - M8 x 60 - 10.9-flZn-240h-L
(Friction coefficient 0.09 to 0.14 to VDA 235-101);
tightening torque M_T = 30 Nm ± 10%,
material no. **R913000217**

or

4 socket head cap screws to ISO 4762 - M8 x 60 - 10.9
(Friction coefficient 0.08 to 0.6 to VDI2230,
tempering, black);
tightening torque M_T = 34 Nm ± 10%

Size 16
The following valve fixing screws are recommended:

4 socket head cap screws to ISO 4762 - M10 x 70 - 10.9-flZn-240h-L
(Friction coefficient 0.09 to 0.14 to VDA 235-101);
tightening torque M_T = 64 Nm ± 10%,
material no. **R913000126**

or

4 socket head cap screws to ISO 4762 - M10 x 70 - 10.9
(Friction coefficient 0.08 to 0.16 to VDI 2230,
tempering, black);
tightening torque M_T = 75 Nm ± 10%,

With rectifier sandwich plate

Size 10
The following valve fixing screws are recommended:

4 socket head cap screws to ISO 4762 - M8 x 120 - 10.9-flZn-240h-L
(Friction coefficient 0.09 to 0.14 to VDA 235-101);
tightening torque M_T = 30 Nm ± 10%,
material no. **R913000423**

or

4 socket head cap screws to ISO 4762 - M8 x 120 - 10.9
(Friction coefficient 0.08 to 0.16 to VDI2230,
tempering, black);
tightening torque M_T = 34 Nm ± 10%

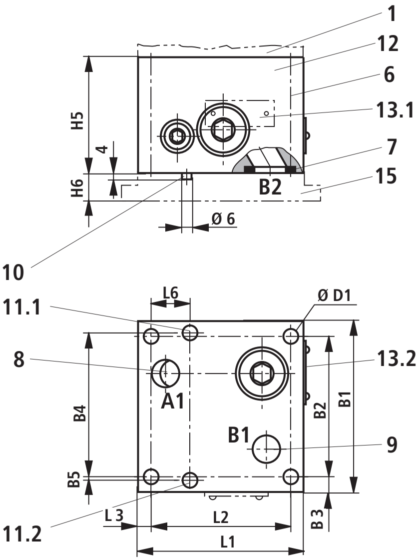
Size 16
The following valve fixing screws are recommended:

4 socket head cap screws to ISO 4762 - M10 x 160 - 10.9-flZn-240h-L
(Friction coefficient 0.09 to 0.14 to VDA 235-101);
tightening torque M_T = 64 Nm ± 10%,
material no. **R913000072**

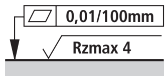
or

4 socket head cap screws to ISO 4762 - M10 x 160 - 10.9
(Friction coefficient 0.08 to 0.6 to VDI 2230,
tempering, black);
tightening torque M_T = 75 Nm ± 10%,

Unit dimensions: Rectifier sandwich plate (nominal dimensions in mm)



Size	10	16
B1	95	123.5
B2	76	101.5
B3	9.5	11
B4	79.4	102.4
B5	–	0.8
ØD1	9	11
H5	60	85
H6	30	40
L1	102.5	123.5
L2	82.5	101.5
L3	10	11
L6	23.8	28.6



Required surface quality of valve contact face

Tolerances to:
– General tolerances ISO 2768-mK

1 Valve housing
6 Valve fixing screws (separate order, see page 11)
7 Identical seal rings for A and B
8 Port A1 (A2)
9 Port B1 (B2)
10 Locating pin (position like items 11.1 and 11.2)
11.1 Locating bore for locating pin for sizes 10 and 16
11.2 Locating bore for locating pin for size 6
12 Rectifier sandwich plate
13.1 Nameplate (rectifier sandwich plate size 10)
13.2 Nameplate (rectifier sandwich plate size 16)
15 Subplate (separate order)

Subplates to data sheet RE 45066 and valve fixing screws must be ordered separately.

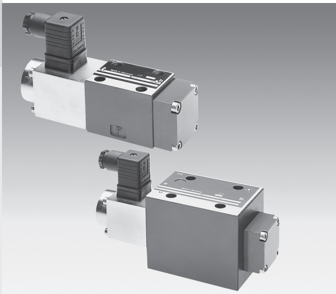
Subplates:	**Size 10**	**Size 16**
	G279/01 (G1/2)	G281/01 (G1)
	G280/01 (G3/4)	G282/01 (G1 1/4)

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone, +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

Proportional flow control valve, without position control

RE 29219/04.07
Replaces: 08.05

Type 3(2)FREX



Nominal size (NG) 6, 10
Unit series 1X
Maximum working pressure 250 bar
Nominal flow rate Q_{nom} 7.5...60 l/min

List of contents

Features

– Directly controlled flow control valves NG6 and NG10
– 2- or 3-way function is determined by how the hydraulic ports are assigned (residual flow runs through port P, 3rd way). Symbol "NO" (normally open) can only be implemented as a 2-way function
– Adjustable by means of the solenoid current, see Characteristic Curve, Technical Data and the selected valve electronics
– Solenoid version $I_{max} = 2.5$ A
– For subplate attachment, mounting hole configuration NG6 to ISO 4401-03-02-0-05, NG10 to ISO 4401-05-04-0-05
– Subplates as per catalog sheet, RE 45053 for NG6, RE 45055 for NG10 (order separately)
– Plug-in connector to DIN 43650-AM2 included in scope of delivery
– External trigger electronics with ramps and valve calibration in the following versions/designs (order separately)
  • Plug, setpoint 0...+10 V or 4...20 mA, RE 30264
  • Module, setpoint 0...+10 V, RE 30222
  • Europe card format, setpoint 0...+10 V, RE 30109

Ordering data

	FRE	X		B	–1X/		L		G24	–25		Z4	M	M

3-way = **3**
2-way = **2**

Proportional flow control valve, without position control

Without inductive position transducer = **X**

NG6 = **6**
NG10 = **10**

Without external closing fixture for pressure compensator = **B**

Unit series 10 to 19 = **1X**
(10 to 19: installation and connection dimensions unchanged)

Nominal flow rate
7.5 l/min at NG6 = **7.5**
15 l/min at NG6 = **15**
35 l/min at NG6 = **35**
60 l/min at NG10 = **60**
70 l/min at NG10 = **70**

Flow characteristic (L = linear) = **L**

Setpoint input +10 V, Q_{min} (NO) = **1**
Setpoint input +10 V, Q_{max} (NC) = **2**

G24 = Voltage supply of trigger electronics 24 V DC

Solenoid type (current)
25 = Solenoid current 2.5 A

N9 = Covered manual auxiliary override
N12 = Manual auxiliary override, screwable with counter nut

Z4 = **Electrical connection**
Unit plug to DIN 43650-AM2
Plug-in connector included in scope of delivery

M = Without non-return valve

M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

Preferred types

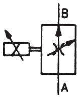
NG6 Solenoid 2.5 A		**NG10 Solenoid 2.5 A**	
Type	**Material Number**	**Type**	**Material Number**
FREX6B–1X/15L1G24–25N9Z4MM	0 811 403 123	FREX10B–1X/70L1G24–25N9Z4MM	0 811 403 013
FREX6B–1X/7,5L2G24–25N9Z4MM	0 811 403 112	FREX10B–1X/60L2G24–25N9Z4MM	0 811 403 010
FREX6B–1X/35L2G24–25N9Z4MM	0 811 403 113	FREX10B–1X/60L2G24–25N12Z4MM	0 811 403 011

Symbols

For external trigger electronics

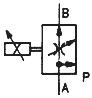
2-way, normally open

NO



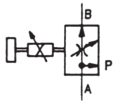
3-way, normally closed

NC



3-way, normally closed
with manual auxiliary override

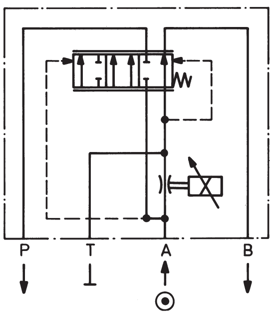
NC



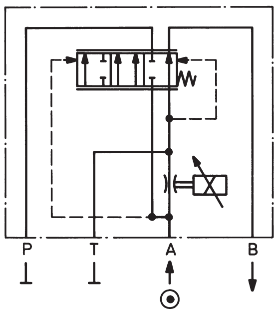
General
Flow control valves are directly actuated throttle valves with integrated pressure compensator.

Direction of flow
"3-way design" proportional flow control valves that are normally closed may be employed either as 2-way or 3-way flow control valves.

3-way flow control valve
A: Supply
B: Discharge
P: Residual flow, capacity up to 250 bar, or tank
T: Closed



2-way flow control valve
A: Supply
B: Discharge
P: } Closed
T: }



Note
Flow control valves with a normally open basic position may only be used as 2-way valves.

Function, sectional diagram

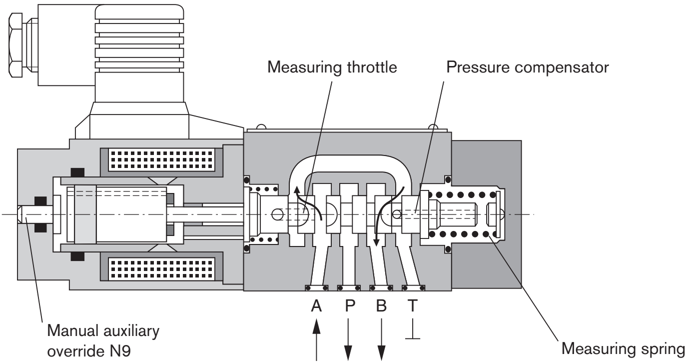
General

Type 3(2)FREX proportional flow control valves without position control are available in nominal sizes 6 and 10. They are actuated by means of a proportional solenoid. Hysteresis is < 5 %, the valve amplifier electronics are available in various designs.
The symbol "NO", normally open, can only be used as a 2-way flow control valve (type 2FREX).
The symbol "NC", normally closed, can be used as a 3 or a 2-way flow control valve.
The design of the valve body is such that, in the 3-way version, the residual flow runs through port P.
In the 2-way version, the flow runs from A to B (P and T are closed).

Basic principle

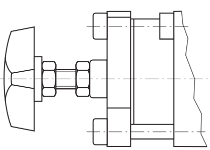
To adjust the oil flow rate, a setpoint is set in the trigger electronics. Based on this setpoint, the electronics control the solenoid coil with regulated PWM (pulse-width-modulated) current. The current is modulated with a dither, ensuring low hysteresis. The proportional solenoid converts the current to a mechanical force, with which an armature plunger acts on a spool to push against the spring. This then achieves a position that conforms to the characteristic curve of the spring. The valve opening is determined by the metering edges on the spool, and the integrated pressure compensator compares the pressure drop by means of a 4- or 8-bar measuring spring.
The pressure compensator with measuring spring regulates the pressure before the throttling edge according to the simplified formula:
"Load pressure plus force of measuring spring".
In this way, the pressure drop over the metering edge is maintained at a constant level.

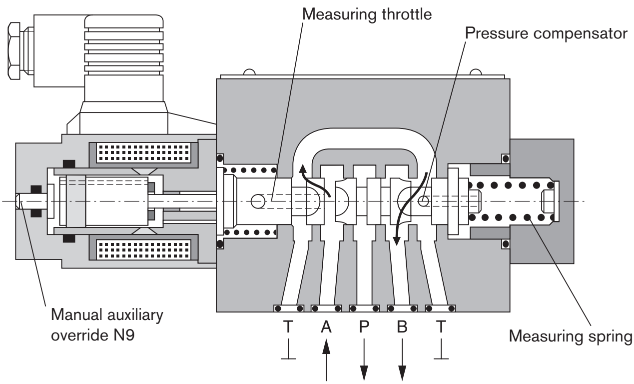
NG6



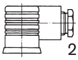
NG10

Manual auxiliary override N12





Accessories

Type				Material Number
(4x) ISO 4762-M5x30-10.9	Cheese-head bolts NG6			2 910 151 166
(4x) ISO 4762-M6x35-10.9	Cheese-head bolts NG10			2 910 151 207
Plug 	VT-SSPA1-525-20/V0	(2.5 A)	RE 30264	0 811 405 143
	VT-SSPA1-525-20/V0/I	(2.5 A)		0 811 405 145
Module 	VT-MSPA1-525-10/V0	(2.5 A)	RE 30222	0 811 405 127
Europe card 	VT-VSPA1-525-10/V0/RTP	(2.5 A)	RE 30109	0 811 405 079
Plug-in connector  2P+PE	Plug-in connector 2P+PE (M16x1.5) included in scope of delivery, see also RE 08008			

Testing and service equipment

Test box type VT-PE-TB1, see RE 30063
Current measuring adapter type VT-PA-5, see RE 30073

Technical data

General

Construction		Spool-type valve with integrated pressure compensator
Actuation		Proportional solenoid without position control, manual auxiliary override, external amplifier
Connection type		Subplate, mounting hole configuration NG6 (ISO 4401-03-02-0-05), NG10 (ISO 4401-05-04-0-05)
Mounting position		Optional
Ambient temperature range	°C	–20...+50
Weight	NG6 kg	2.0 (2.2 with manual auxiliary override)
	NG10 kg	5.8 (6.0 with manual auxiliary override)
Vibration resistance, test condition		Max. 25 g, shaken in 3 dimensions (24 h)

Hydraulic (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Pressure fluid		Hydraulic oil to DIN 51524...535, other fluids after prior consultation				
Viscosity range	recommended mm^2/s	20...100				
	max. permitted mm^2/s	10...800				
Pressure fluid temperature range	°C	–20...+80				
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)		Class 18/16/13 [1)]				
Direction of flow, see symbol		NG6			NG10	
Nominal flow rate Q_B with closed-loop control	l/min	7.5	15	35	60	70
Supply flow rate $Q_{A\,max}$	l/min	30	(NO)	40	65	(NO)
Minimum pressure drop $p_A > p_B$	bar	10	10	22	22	22
Max. working pressure	bar	Port A, B: 250 Port T: Closed Port P: Closed or residual flow 250 bar				

Electrical

Cyclic duration factor	%	100
Degree of protection		IP 65 to DIN 40050 and IEC 14434/5
Solenoid connection		Unit plug DIN 43650/ISO 4400, M16x1.5 (2P+PE)
Valve with solenoid type	A	2.5
Max. solenoid current I_{max}	A	2.5
Coil resistance R_{20}	Ω	3
Max. power consumption at 100 % load and operating temperature	VA	30

Static/Dynamic [2)]

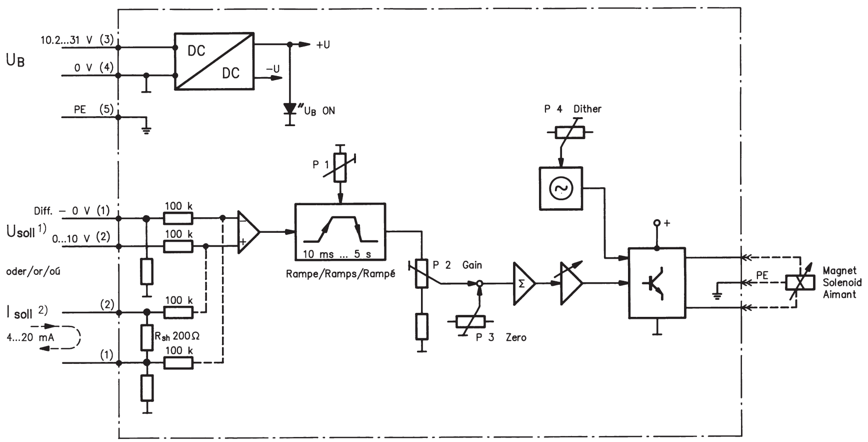
Hysteresis	%	≤ 5 from qv_{max}
Range of inversion	%	≤ 3 from qv_{max}
Manufacturing tolerance	%	≤ 20 from qv_{max}
Response time 100 % signal change	ms	On < 70
Correction time on max. load change (pressure compensator)		NG6 ≤ 30 NG10 ≤ 45

1) The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of components. For a selection of filters, see catalog sheets RE 50070, RE 50076 and RE 50081.

2) All characteristic values ascertained using amplifier 0 811 405 079 for the 2.5 A solenoid.

Valve with external trigger electronics (plug, RE 30264)

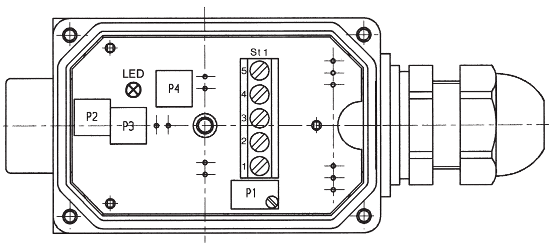
Circuit diagram/pin assignment



[1)] Version with 0...+10 V signal
[2)] Version with 4...20 mA signal

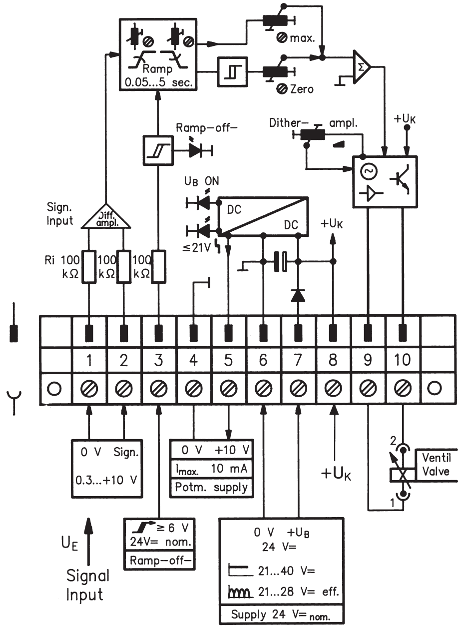
Connection/calibration

P1 – Ramp time
P2 – Sensitivity
P3 – Zero
P4 – Dither frequency
St1 – Terminal
LED – U_B display

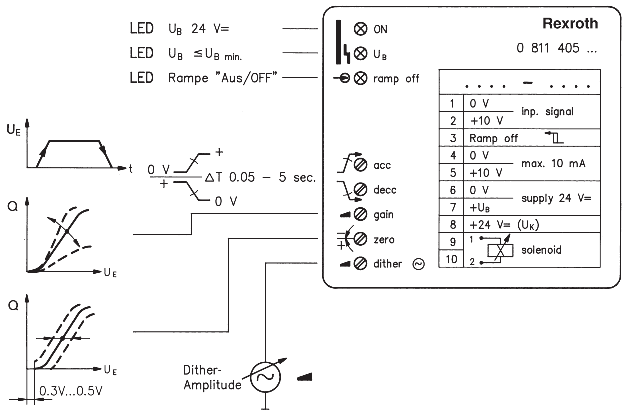


Valve with external trigger electronics (module, RE 30222)

Circuit diagram/pin assignment

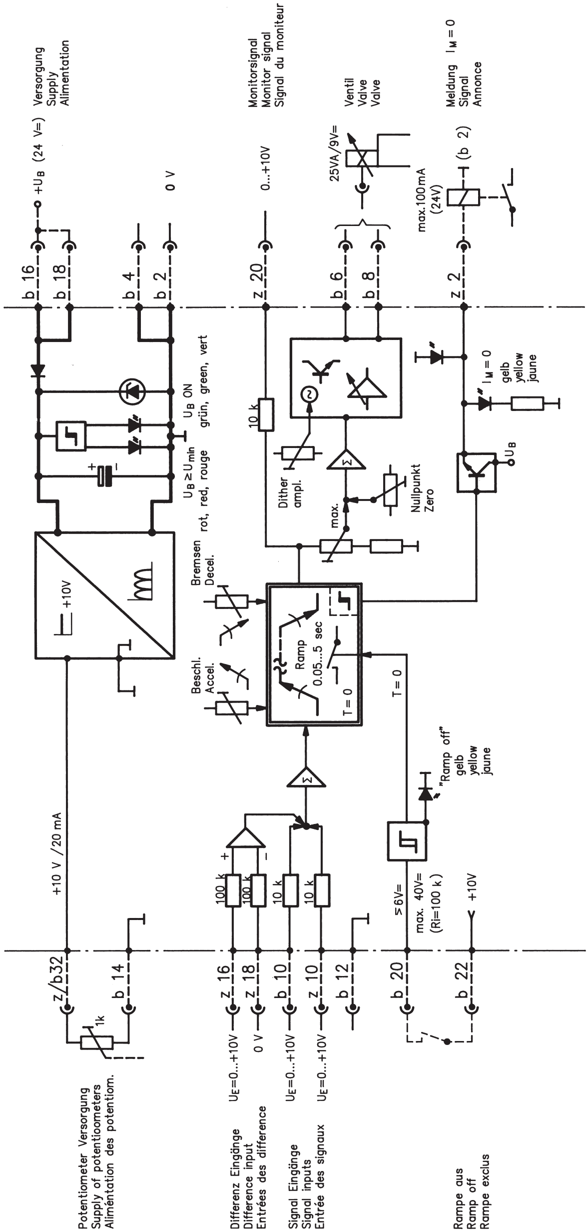


Front view/calibration



Valve with external trigger electronics (europe card, RE 30109)

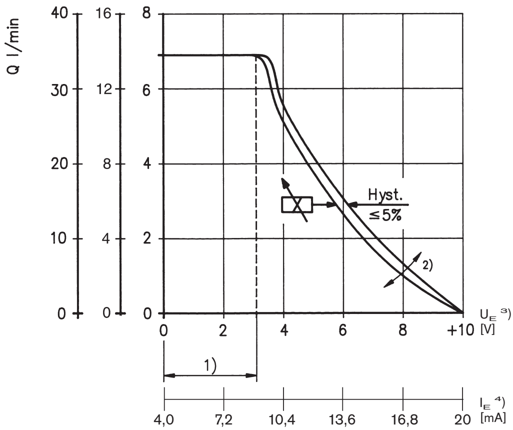
Circuit diagram/pin assignment



Characteristic curves NG6 (measured with HLP 46, $\vartheta_{oil} = 40°C \pm 5°C$)

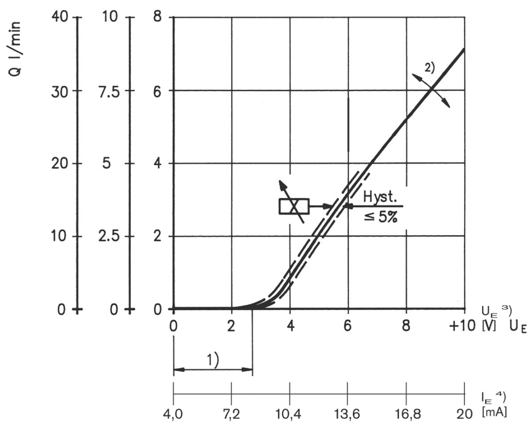
Q_{nom} = 7.5/15/35 l/min

Basic position open "NO"
(2-way version)



Q_{nom} = 7.5/15/35 l/min

Basic position closed "NC"
(3- or 2-way version)



Valve amplifier

1) Zero adjustment

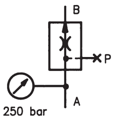
2) Sensitivity adjustment

3) Version: U_E = 0...+10 V

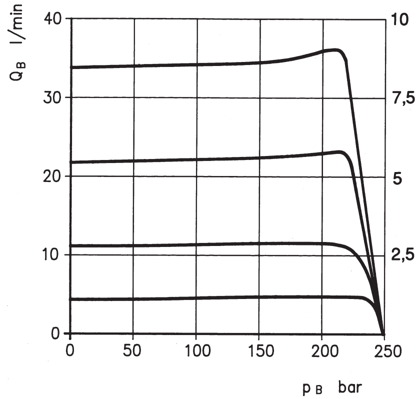
4) Version: I_E = 4...20 mA

Characteristic curves NG6 (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

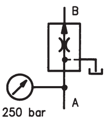
2-way version



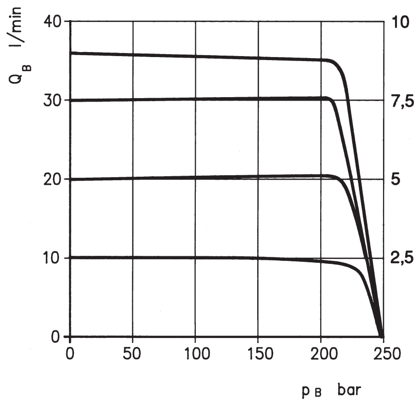
Q_{nom} = **7.5/15/35 l/min**



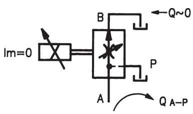
3-way version

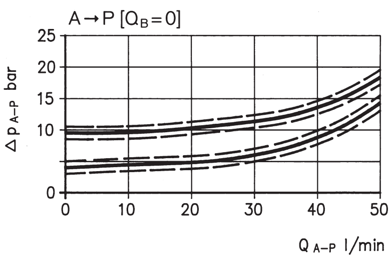


Q_{nom} = **7.5/15/35 l/min**



Residual flow “A–P”
(pressure drop)

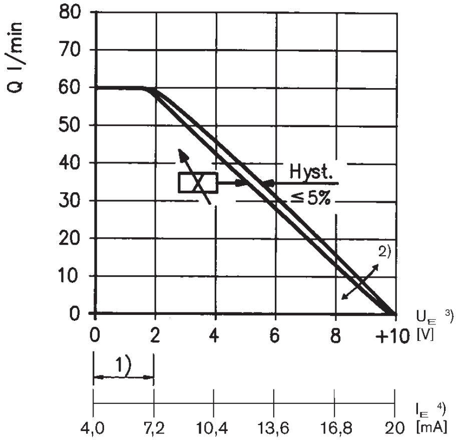




Characteristic curves NG10 (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

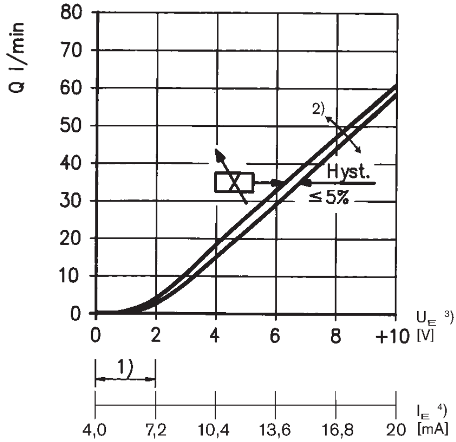
Q_{nom} = 60 (70) l/min

Basic position open "NO"
(2-way version)



Q_{nom} = 60 l/min

Basic position closed "NC"
(3- or 2-way version)



Valve amplifier

1) Zero adjustment

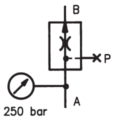
2) Sensitivity adjustment

3) Version: U_E = 0...+10 V

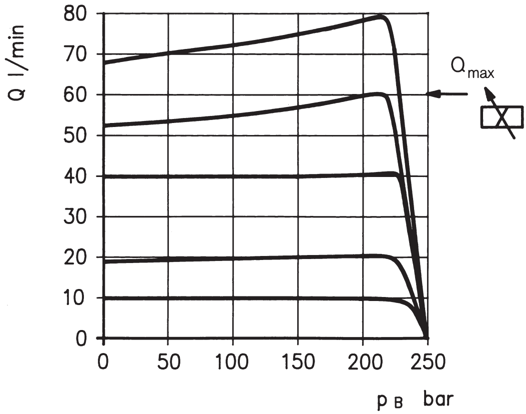
4) Version: I_E = 4...20 mA

Characteristic curves NG10 (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

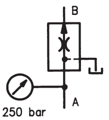
2-way version



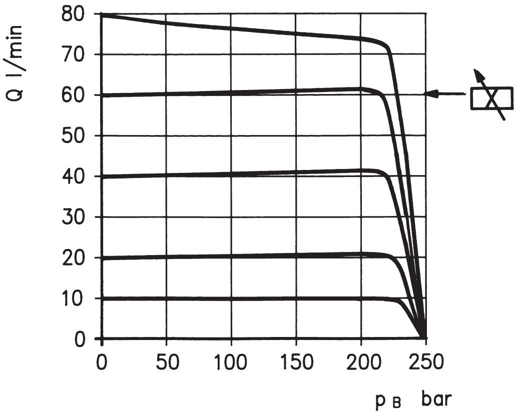
Q_{nom} **= 60 (70) l/min**



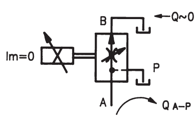
3-way version

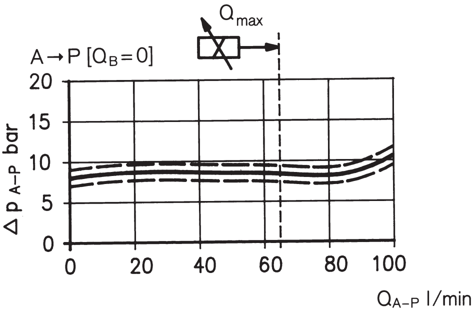


Q_{nom} **= 60 l/min**

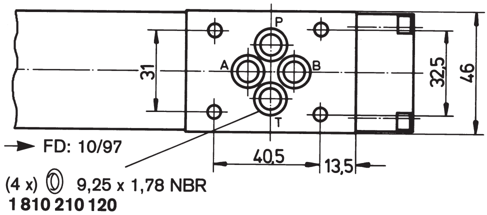


Residual flow "A–P"
(pressure drop)

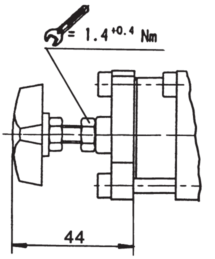


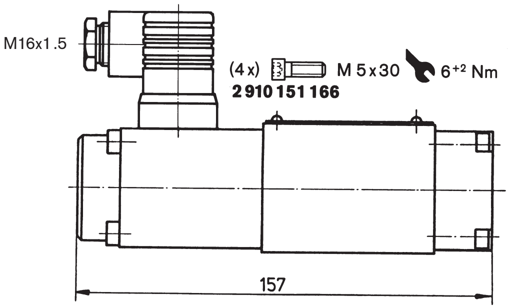


Unit dimensions NG6 (nominal dimensions in mm)

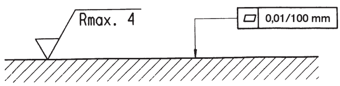


Manual auxiliary override N12

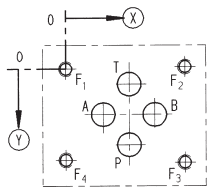




Required surface quality
of mating component



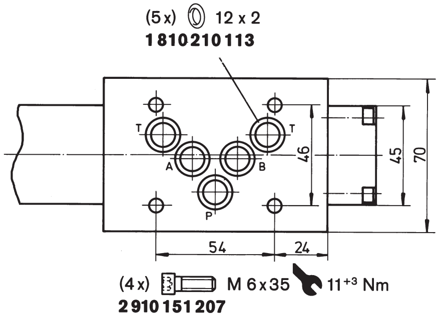
Mounting hole configuration: NG6 (ISO 4401-03-02-0-05)
For subplates, see catalog sheet RE 45053



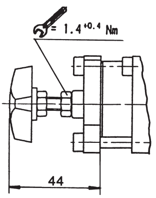
[1] Deviates from standard
[2] Thread depth:
Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

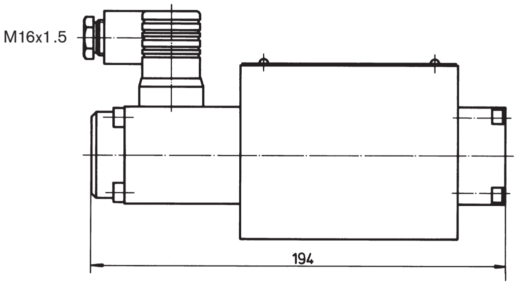
	P	A	T	B	F_1	F_2	F_3	F_4
X	21.5	12.5	21.5	30.2	0	40.5	40.5	0
Y	25.9	15.5	5.1	15.5	0	–0.75	31.75	31
Ø	8 [1]	8 [1]	8 [1]	8 [1]	M5 [2]	M5 [2]	M5 [2]	M5 [2]

Unit dimensions NG10 (nominal dimensions in mm)

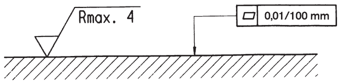


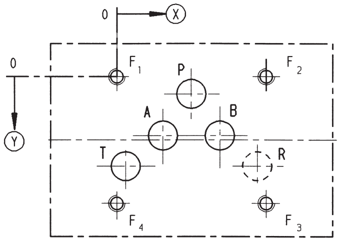
Manual auxiliary override N12





Required surface quality
of mating component





Mounting hole configuration: NG10 (ISO 4401-05-04-0-05)
For subplates, see catalog sheet RE 45055

1) Deviates from standard
2) Thread depth:
Ferrous metal 1.5 x Ø*
Non-ferrous 2 x Ø

* NG10 min. 10.5 mm

	P	A	T	B	F_1	F_2	F_3	F_4	R
X	27	16.7	3.2	37.3	0	54	54	0	50.8
Y	6.3	21.4	32.5	21.4	0	0	46	46	32.5
Ø	10.5 [1)]	10.5 [1)]	10.5 [1)]	10.5 [1)]	M6 [2)]	M6 [2)]	M6 [2)]	M6 [2)]	10.5 [1)]

Notes

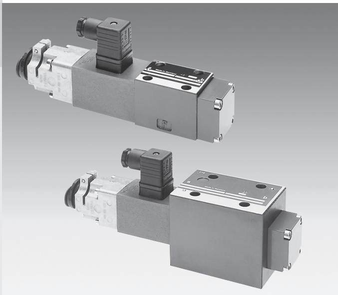
Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Telefon +49 (0) 93 52 / 18-0
Telefax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

Rexroth
Bosch Group

Proportional flow control valve, with inductive position transducer

RE 29220/08.05

Type 3FREZ



Nominal size 6, 10
Unit series 1X
Maximum working pressure 250 bar
Nominal flow rate Q_{nom} 2.6...80 l/min

Overview of Contents

Contents	Page

Features

- Directly controlled flow control valves NG6 and NG10
- With position control, minimal hysteresis < 1 %, see Technical Data
- The 3-way function is determined by how the hydraulic ports are assigned (residual flow runs through port P, 3rd way).
- Adjustable by means of the controlled solenoid position, the position transducer and the external valve electronics
- Solenoid version I_{max} = 2.7 A
- For subplate attachment, mounting hole configuration NG6 to ISO 4401-03-02-0-94, NG10 to ISO 4401-05-04-0-94
- Subplates as per catalog sheet, RE 45053 for NG6, RE 45055 for NG10 (order separately)
- Plug-in connector to DIN 43650-AM2 for the solenoid and plug-in connector for the position transducer, included in scope of delivery
- Data for the external trigger electronics
  - U_B = 24 V_{nom} DC
  - Adjustment of valve curve Np and gain with and without ramp generator
  - Europe card format, setpoint 0...+10 V (order separately)

Ordering data

3	FRE	Z		B	–1X/		L	2	G24–27	Z4	M	M	*

3-way **= 3**

Proportional flow control valve, with position control

With inductive position transducer **= Z**

NG6 **= 6**
NG10 **= 10**

Without external closing fixture for pressure compensator **= B**

Unit series 10 to 19 **= 1X**
(10 to 19: installation and connection dimensions unchanged)

Nennvolumenstrom
2.6 l/min (Δp = 4 bar pressure drop) **= 2.6**[1)]
10 l/min (Δp = 8 bar pressure drop) **= 10**
35 l/min (Δp = 8 bar pressure drop) **= 35**
80 l/min (Δp = 8 bar pressure drop) **= 80**

Flow characteristic (L = linear) **= L**

Setpoint input +10 V, Q = 0 l/min (NC) **= 2**

[1)] Recommended: p_{max} 100 bar

Further information in plain text

M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

M = Without non-return valve

Z4 = **Electrical connection**
Unit plug to DIN 43650-AM2
Plug-in connector included in scope of delivery

Solenoid type (current)
27 = Solenoid current max. 2.7 A

G24 = Voltage supply of trigger electronics 24 V DC

Preferred types

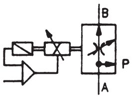
NG6 Solenoid 2.7 A		**NG10 Solenoid 2.7 A**	
Type	**Material Number**	**Type**	**Material Number**
3FREZ6B–1X/2.6L2G24–27Z4MZ	0 811 403 121	3FREZ10B–1X/80L2G24–27Z4MM	0 811 403 012
3FREZ6B–1X/10L2G24–27Z4MM	0 811 403 117		
3FREZ6B–1X/35L2G24–27Z4MM	0 811 403 114		

Symbols

For external trigger electronics

3-way, normally closed

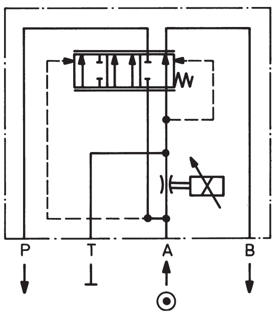
NC



General
Flow control valves are directly actuated throttle valves with integrated pressure compensator.

3-way flow control valve

A: Supply
B: Discharge
P: Residual flow, capacity up to 250 bar, or tank
T: Closed



Function, sectional diagram

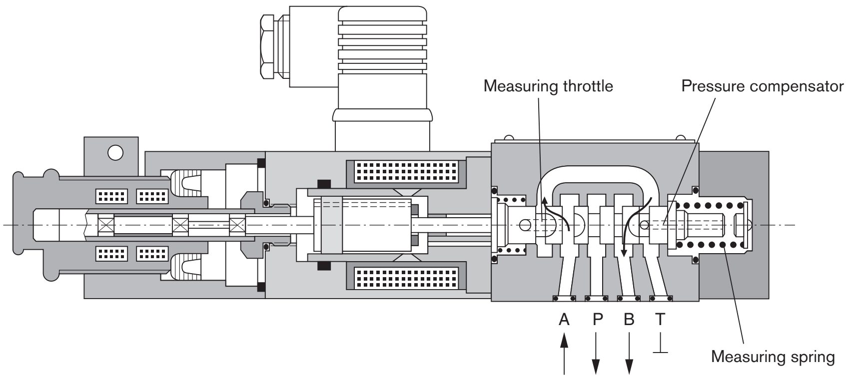
General

Type 3FREZ proportional flow control valves with position control are available in nominal sizes 6 and 10.
They are actuated by means of a proportional solenoid with inductive position transducer. Hysteresis is < 1 %. The valve amplifier electronics are available in the form of a Europe card.
The design of the valve body is such that the residual flow runs through port P.

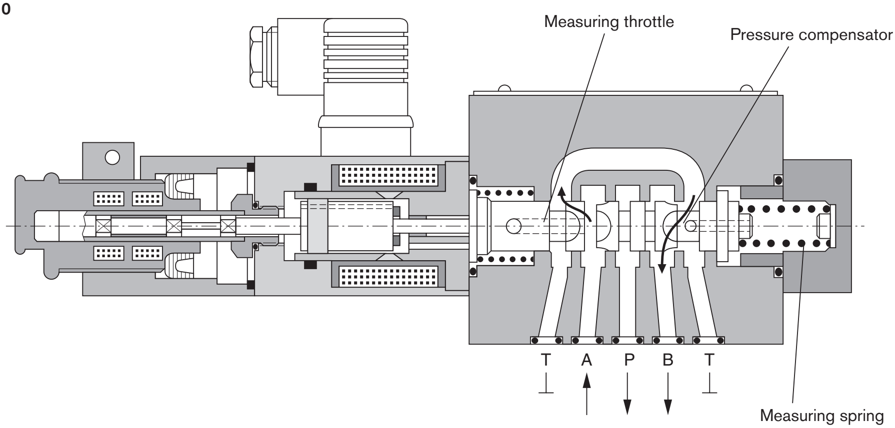
Basic principle

To adjust the oil flow rate from B, a setpoint is set in the trigger electronics. Based on this setpoint, the electronics control the solenoid coil as a function of the signal from the position transducer. The position control ensures very low hysteresis. The valve opening is determined by the metering edges on the spool, and the integrated pressure compensator compares the pressure drop by means of a 4 or 8-bar measuring spring. The pressure compensator with measuring spring regulates the pressure before the throttling edge according to the simplified formula: “Load pressure plus force of measuring spring”. In this way, the pressure drop over the metering edge is maintained at a constant level.

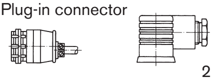
NG6



NG10



Accessories

Type			Material Number
(4x) ISO 4762-M5x30-10.9	Cheese-head bolts NG6		2 910 151 166
(4x) ISO 4762-M6x35-10.9	Cheese-head bolts NG10		2 910 151 207
Europe card 	VT-VRPA1-527-10/V0/QV	RE 30052	0 811 405 098
Europe card 	VT-VRPA1-527-10/V0/QV-RTP	RE 30054	0 811 405 103
Europe card 	VT-VRPA1-527-10/V0/QV-RTS	RE 30056	0 811 405 177
Plug-in connector  2P+PE	Plug-in connector 2P+PE (M16x1.5) for the solenoid and plug-in connector for the position transducer, included in scope of delivery, see also RE 08008.		

Testing and service equipment

Test box type VT-PE-TB1, see RE 30063
Test adapter for Europe cards type VT-PA-5, see RE 30070

Technical data

General

Construction		Spool-type valve with integrated pressure compensator
Actuation		Proportional solenoid with position control, external amplifier
Connection type		Subplate, mounting hole configuration NG6 (ISO 4401-03-02-0-94), NG10 (ISO 4401-05-04-0-94)
Mounting position		Optional
Ambient temperature range	°C	–20...+50
Weight	NG6 kg	2.2
	NG10 kg	6.0
Vibration resistance, test condition		Max. 25 g, shaken in 3 dimensions (24 h)

Hydraulic (measured with HLP 46, ϑ_{oil} = 40 °C ±5 °C)

Pressure fluid		Hydraulic oil to DIN 51524...535, other fluids after prior consultation			
Viscosity range, recommended	mm^2/s	20...100			
max. permitted	mm^2/s	10...800			
Pressure fluid temperature range	°C	–20...+80			
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)		Class 18/16/13 [1)]			
Direction of flow, see symbol		**NG6**			**NG10**
Nominal flow rate Q_B with closed-loop control	l/min	2.6	10	35	80
Pressure drop Δp	bar	4	8	8	8
Supply flow rate $Q_{A\,max}$	l/min	2.6	50	50	100
Minimum pressure drop $p_A > p_B$	bar	6	14	14	14
Max. working pressure	bar	Port A, B: 250 Port T: Closed Port P: Closed or residual flow 250 bar			

Electrical

Cyclic duration factor	%	100
Degree of protection		IP 65 to DIN 40050 and IEC 14434/5
Solenoid connection		Unit plug DIN 43650/ISO 4400, M16x1.5 (2P+PE)
Position transducer connection		Special plug
Valve with solenoid type	A	2.7
Max. solenoid current I_{max}	A	2.7
Coil resistance R_{20}	Ω	2.7
Max. power consumption at 100 % load and operating temperature	VA	40

Static/Dynamic [2)]

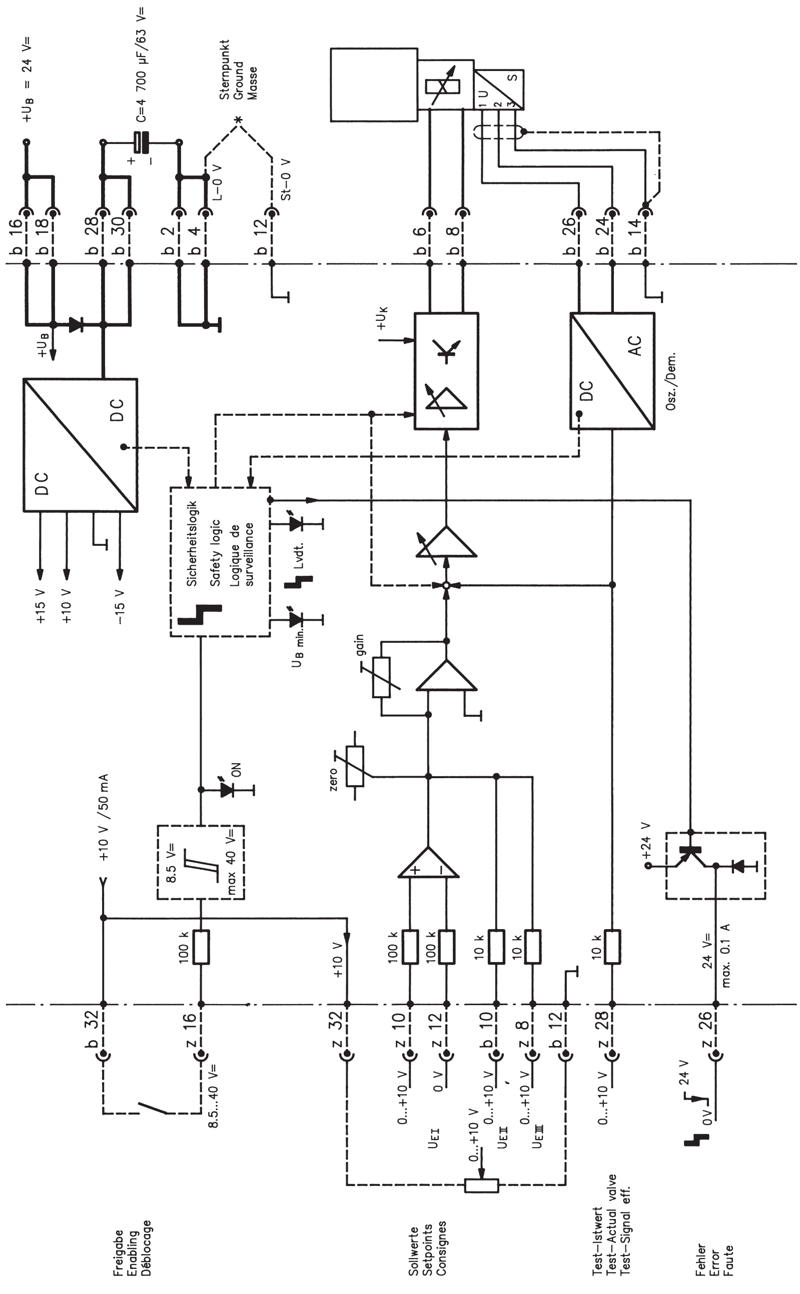
Hysteresis	%	$\leq$ 1
Range of inversion	%	$\leq$ 0.5
Manufacturing tolerance	%	$\leq$ 5
Resp. time 100 %/signal change 10 %	ms	$\leq$ 35/25
Correction time on max. load change (pressure compensator)	ms	NG6 $\leq$ 30 NG10 $\leq$ 45

[1)] The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of components. For a selection of filters, see catalog sheets RE 50070, RE 50076 and RE 50081.

[2)] All characteristic values ascertained using amplifier 0 811 405 098 for the 2.7 A solenoid.

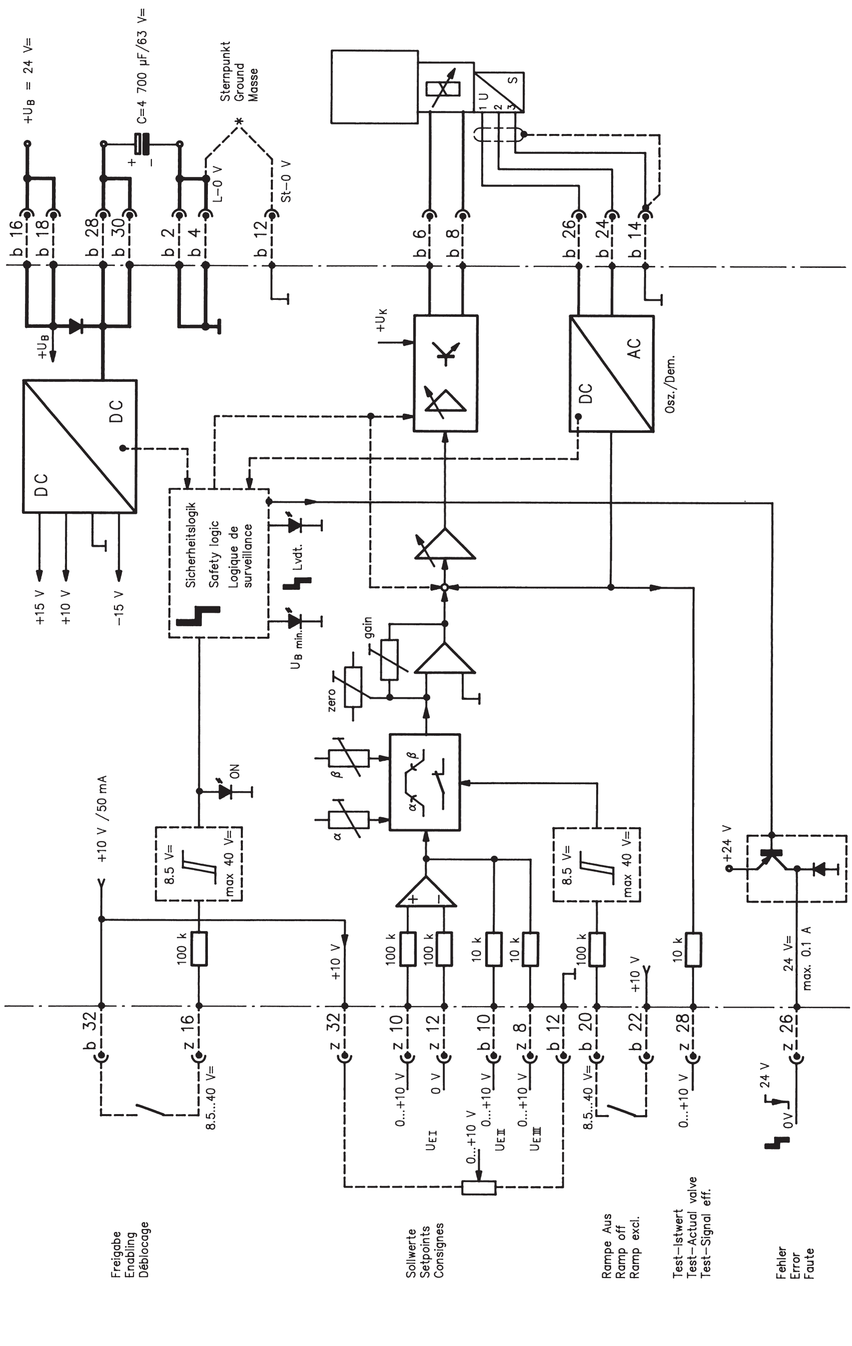
Valve with external trigger electronics (europe card without ramp, RE 30052)

Circuit diagram/pin assignment



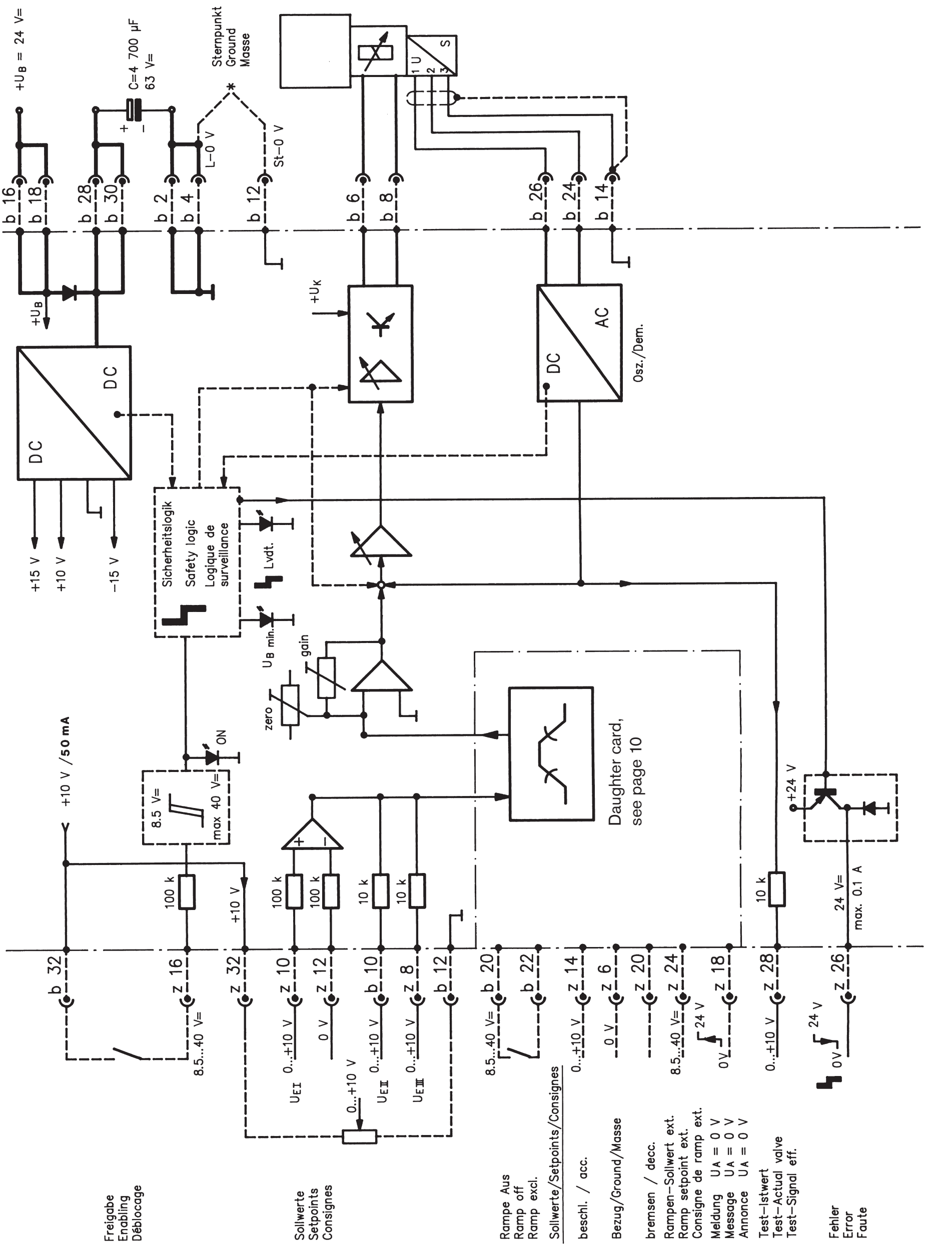
Valve with external trigger electronics (europe card with ramp, RE 30054)

Circuit diagram/pin assignment



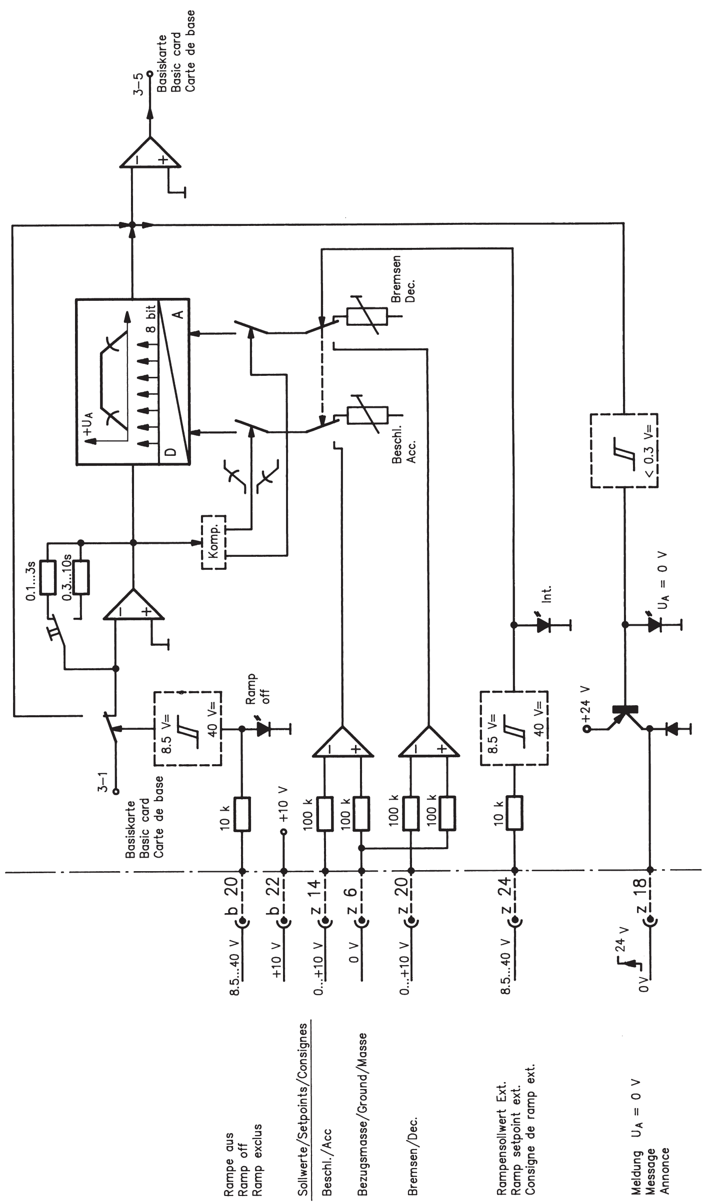
Valve with external trigger electronics (europe card with ramp, RE 30056)

Circuit diagram/pin assignment



Valve with external trigger electronics (europe card with ramp, RE 30056)

Circuit diagram/pin assignment **Daughter card**

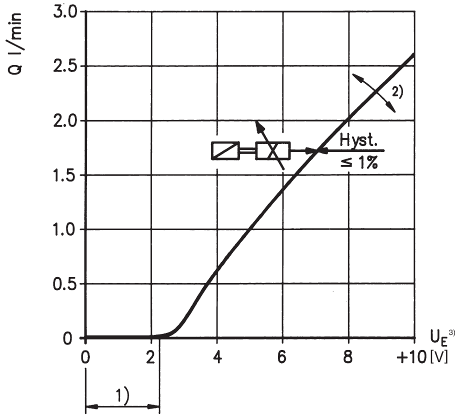


Characteristic curves NG6 (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Q_{nom} = 2.6 l/min, p_{max} = 100 bar

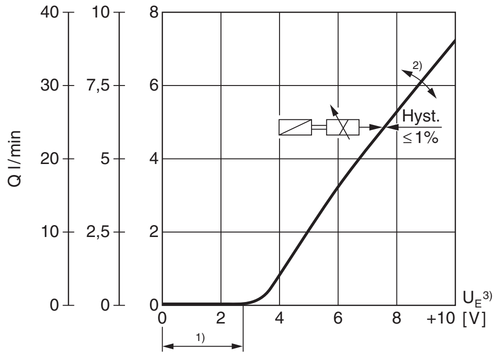
Special version for very low flow rates

Basic position closed “NC”



Q_{nom} = 10/35 l/min

Basic position closed “NC”



Valve amplifier

1) Zero adjustment

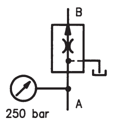
2) Sensitivity adjustment

3) Version: U_E = 0...+10 V

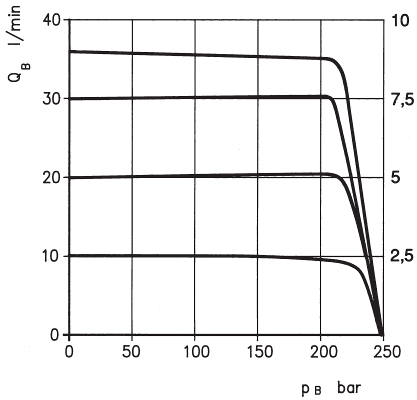
4

Characteristic curves NG6 (measured with HLP 46, $\vartheta_{oil} = 40°C \pm 5°C$)

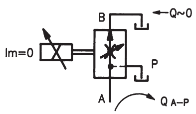
3-way version

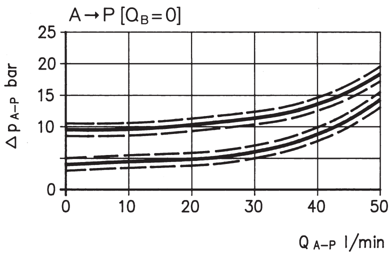


Q_{nom} **= 10/35 l/min**



Residual flow "A–P"
(pressure drop)

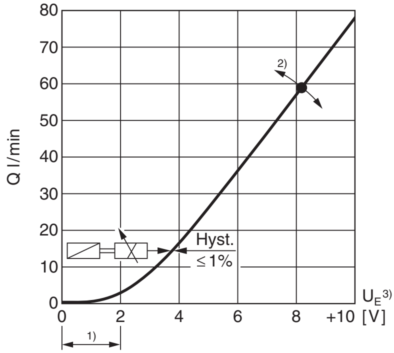




Characteristic curves NG10 (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Q_{nom} = 80 l/min

Basic position closed "NC"



Valve amplifier

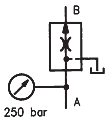
1) Zero adjustment

2) Sensitivity adjustment

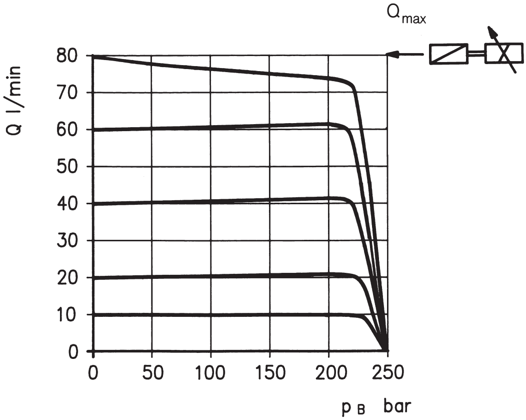
3) Version: U_E = 0...+10 V

Characteristic curves NG10 (measured with HLP 46, ϑ_{oil} = 40 °C ± 5 °C)

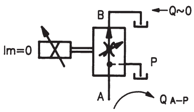
3-way version

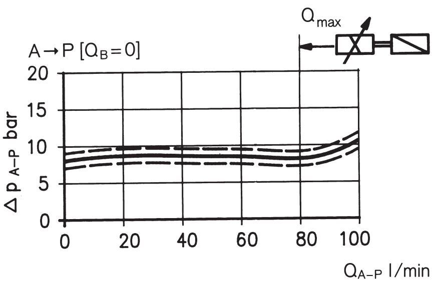


Q_{nom} = **80 l/min**

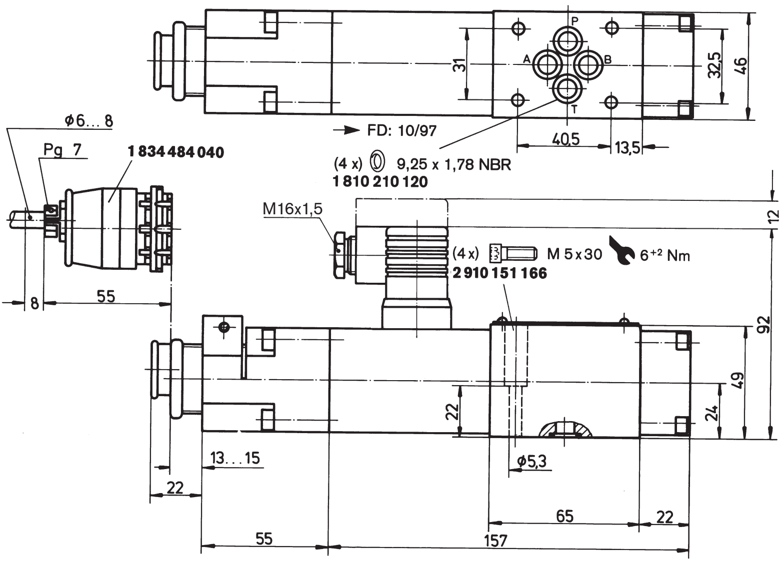


Residual flow "A–P"
(pressure drop)

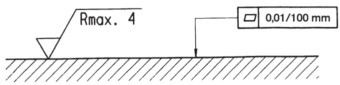




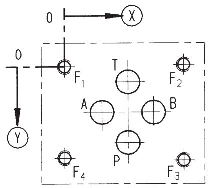
Unit dimensions NG6 (nominal dimensions in mm)



Required surface quality
of mating component



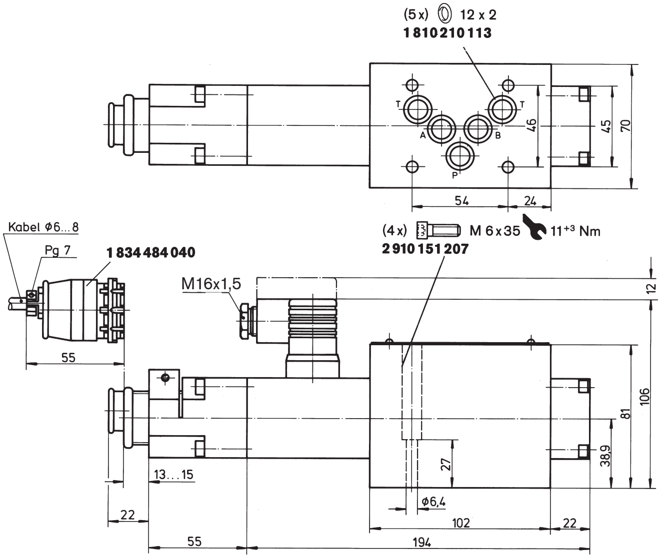
Mounting hole configuration: NG6 (ISO 4401-03-02-0-94)
For subplates see catalog sheet RE 45053



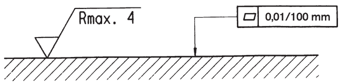
[1] Deviates from standard
[2] Thread depth:
Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

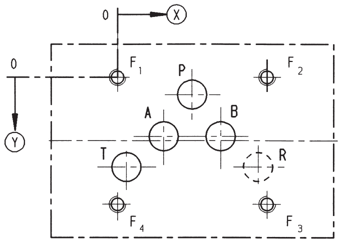
	P	A	T	B	F_1	F_2	F_3	F_4
X	21.5	12.5	21.5	30.2	0	40.5	40.5	0
Y	25.9	15.5	5.1	15.5	0	–0.75	31.75	31
Ø	8 [1]	8 [1]	8 [1]	8 [1]	M5 [2]	M5 [2]	M5 [2]	M5 [2]

Unit dimensions NG10 (nominal dimensions in mm)



Required surface quality of mating component





Mounting hole configuration: NG10 (ISO 4401-05-04-0-94)
For subplates see catalog sheet RE 45055

1) Deviates from standard
2) Thread depth:
Ferrous metal 1.5 x Ø*
Non-ferrous 2 x Ø

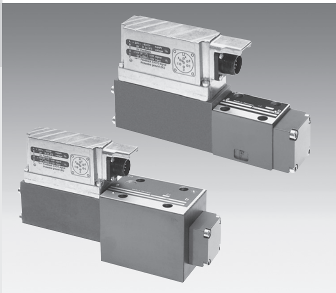
* NG10 min. 10.5 mm

	P	A	T	B	F_1	F_2	F_3	F_4	R
X	27	16.7	3.2	37.3	0	54	54	0	50.8
Y	6.3	21.4	32.5	21.4	0	0	46	46	32.5
Ø	10.5 1)	10.5 1)	10.5 1)	10.5 1)	M6 2)	M6 2)	M6 2)	M6 2)	10.5 1)

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Telefon +49 (0) 93 52 / 18-0
Telefax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

Proportional flow control valve, with on-board electronics (OBE) and inductive position transducer

Type 3FREEZ



Nominal size 6, 10
Unit series 1X
Maximum working pressure 250 bar
Nominal flow rate Q_{nom} 10...70 l/min

Overview of Contents

Features

– Directly controlled flow control valves NG6 and NG10 with on-board electronics and inductive position transducer
– With position control, minimal hysteresis < 1 %, see Technical Data
– The 3-way function is determined by how the hydraulic ports are assigned (residual flow runs through port P, 3rd way)
– Adjustable by means of the controlled solenoid position, the position transducer and the on-board electronics
– For subplate attachment, mounting hole configuration NG6 to ISO 4401-03-02-0-94, NG10 to ISO 4401-05-04-0-94
– Subplates as per catalog sheet, RE 45053 for NG6, RE 45055 for NG10 (order separately)
– Plug-in connector to DIN 43563-AM6, see catalog sheet RE 08008 (order separately)
– Data for the on-board trigger electronics
  • Complies with CE, EMC directives EN 61000-6-2: 2002-08 and EN 61000-6-3: 2002-08
  • U_B = 24 V_{nom} DC
  • Electrical connection 6P+PE
  • Signal actuation
    – Standard 0...+10 V (A1)
  • Valve curve calibrated at the factory

Ordering data

3	FRE	E	Z		B	–1X/		L	2	G24–K31	A1	M	M	*

3-way = **3**

Proportional flow control valve, with position control

With on-board electronics = **E**

With inductive position transducer = **Z**

NG6 = **6**
NG10 = **10**

Without external closing fixture for pressure compensator = **B**

Unit series 10 to 19 = **1X**
(10 to 19: installation and connection dimensions unchanged)

Nominal flow rate
10 l/min ($\Delta p = 8$ bar pressure drop) = **10**
35 l/min ($\Delta p = 8$ bar pressure drop) = **35**
70 l/min ($\Delta p = 8$ bar pressure drop) = **70**

Flow characteristic (L = linear) = **L**

Setpoint input +10 V, $Q = 0$ l/min (NC) = **2**

* Version “F1” (4...20 mA version) available on request

Further information in plain text

M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

M = Without non-return valve

Interface for trigger electronics*
A1 = Setpoint input 0...+10 V

K31 = **Electrical connection**
without plug-in connector, with unit plug to DIN 43563-AM6
Order plug-in connector separately

G24 = Voltage supply of trigger electronics 24 V DC

Preferred types

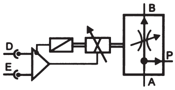
NG6		**NG10**	
Type	**Material Number**	**Type**	**Material Number**
3FREEZ6B–1X/10L2G24–K31A1MM	0 811 403 150	3FREEZ10B–1X/70L2G24–K31A1MM	0 811 403 019
3FREEZ6B–1X/35L2G24–K31A1MM	0 811 403 151		

Symbols

For on-board electronics

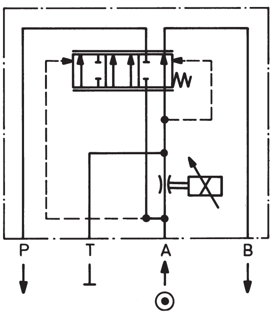
3-way, normally closed

NC



General
Flow control valves are directly actuated throttle valves with integrated pressure compensator.

3-way flow control valve
A: Supply
B: Discharge
P: Residual flow, capacity up to 250 bar, or tank
T: Closed



Function, sectional diagram

General

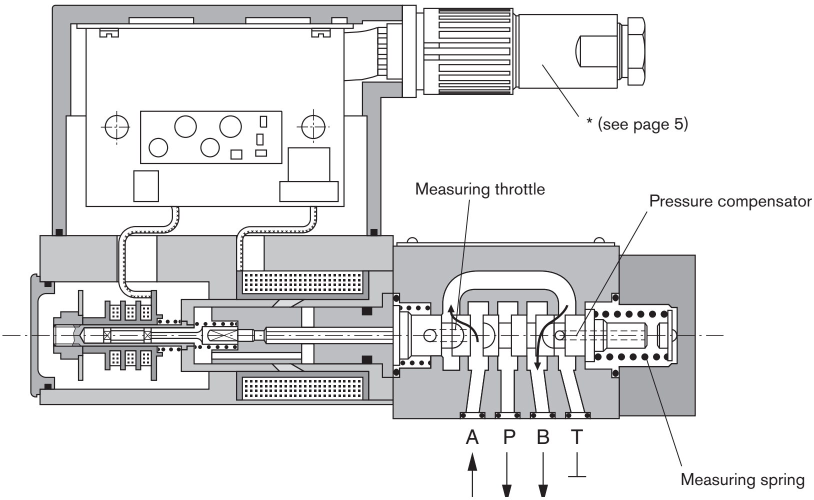
Type 3FREEZ proportional flow control valves with position control and on-board electronics are available in nominal sizes 6 and 10. They are actuated by means of a proportional solenoid with inductive position transducer. Hysteresis is < 1 %. The on-board electronics are calibrated at the factory and enable rapid response times. The design of the valve body is such that the residual flow runs through port P.

Basic principle

To adjust the oil flow rate from B, a setpoint is set in the trigger electronics. Based on this setpoint, the electronics control the solenoid coil as a function of the signal from the position transducer. The position control ensures very low hysteresis. The valve opening is determined by the metering edges on the spool, and the integrated pressure compensator compares the pressure drop by means of an 8-bar measuring spring. The pressure compensator with measuring spring regulates the pressure before the throttling edge according to the simplified formula: “Load pressure plus force of measuring spring”. In this way, the pressure drop over the metering edge is maintained at a constant level.

NG6

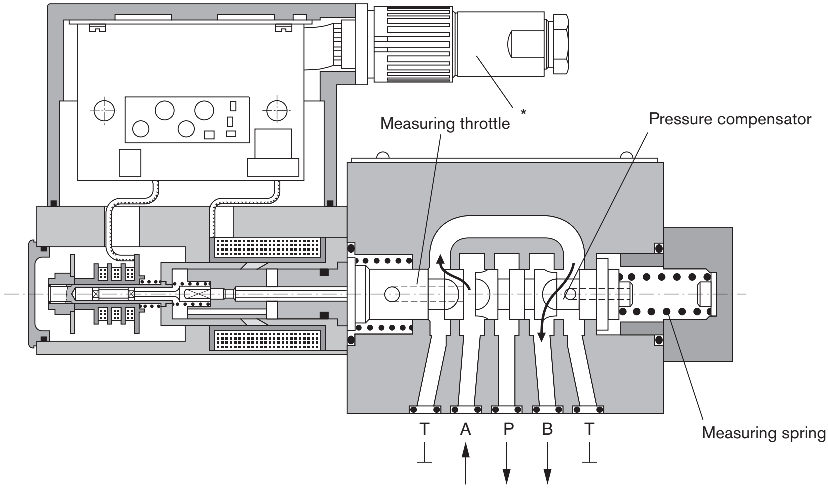
CE EN 61000-6-2: 2002-08
EN 61000-6-3: 2002-08



Function, sectional diagram

NG10

CE EN 61000-6-2: 2002-08
EN 61000-6-3: 2002-08



Accessories

Type			Material Number
(4x) ISO 4762-M5x30-10.9	Cheese-head bolts NG6		2 910 151 166
(4x) ISO 4762-M6x35-10.9	Cheese-head bolts NG10		2 910 151 207
* 	Plug-in connectors 6P+PE, see also RE 08008	KS	1 834 482 022
		KS	1 834 482 026
		MS	1 834 482 023
		MS	1 834 482 024
		KS 90°	1 834 484 252

Testing and service equipment

Test box type VT-PE-TB3, see RE 30065
Measuring adapter 6P+PE type VT-PA-2, see RE 30068

Technical data

General	
Construction	Spool-type valve with integrated pressure compensator
Actuation	Proportional solenoid with position control and on-board electronics OBE
Connection type	Subplate, mounting hole configuration NG6 (ISO 4401-03-02-0-94), NG10 (ISO 4401-05-04-0-94)
Mounting position	Optional
Ambient temperature range °C	−20...+50
Weight NG6 kg	3.1
NG10 kg	6.9
Vibration resistance, test condition	Max. 25 g, shaken in 3 dimensions (24 h)

Hydraulic (measured with HLP 46, ϑ_{oil} = 40 °C ±5 °C)			
Pressure fluid	Hydraulic oil to DIN 51524...535, other fluids after prior consultation		
Viscosity range, recommended mm²/s	20...100		
max. permitted mm²/s	10...800		
Pressure fluid temperature range °C	−20...+70		
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)	Class 18/16/13 [1]		
Direction of flow, see symbol	**NG6**		**NG10**
Nominal flow rate Q_B with closed-loop control l/min	10	35	70
Pressure drop Δp bar	8	8	8
Supply flow rate $Q_{A\ max}$ l/min	50	50	100
Minimum pressure drop $p_A > p_B$ bar	14	14	14
Max. working pressure bar	Port A, B: 250 Port T: Closed Port P: Closed or residual flow 250 bar		

Static/Dynamic		
Hysteresis %	≤ 1	≤ 1
Range of inversion %	≤ 0.5	≤ 0.5
Manufacturing tolerance %	≤ 5	≤ 5
Resp. time 100 %/signal change 10 % ms	25/25	35/25
Correction time on max. load change (pressure compensator) ms	≤ 30	≤ 45
Conformity	CE EN 61000-6-2: 2002-08 EN 61000-6-3: 2002-08	

[1] The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of components. For a selection of filters, see catalog sheets RE 50070, RE 50076 and RE 50081.

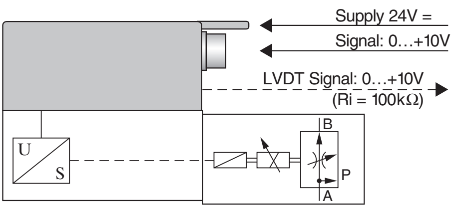
Technical data

Electrical, trigger electronics integrated in valve		
Cyclic duration factor	%	100
Degree of protection		IP 65 to DIN 40050 and IEC 14434/5
Connection		Plug-in connector 6P+PE, DIN 43563
Supply voltage Terminal A: Terminal B: 0 V		24 V DC_{nom} Min. 21 V DC/max. 40 V DC Ripple max. 2 V DC
Power consumption		Solenoid ⊠ 45 mm = 40 VA max.
External fuse		2.5 A_F
Input, "standard" version Terminal D: U_E Terminal E:	A1	Differential amplifier, R_i = 100 kΩ 0...+10 V 0 V
Input, "mA signal" version Terminal D: I_{D-E} Terminal E: I_{D-E}	F1*	Burden, R_{sh} = 200 Ω 4...20 mA Current loop I_{D-E} feedback
Max. voltage to differential inputs over 0 V		D → B E → B } max. 18 V DC
Test signal, "standard" version Terminal F: U_{Test} Terminal C:	A1	LVDT 0...+10 V Reference 0 V
Test signal, "mA signal" version Terminal F: I_{F-C} Terminal C: I_{F-C}	F1*	LVDT signal 4...20 mA at external load 200...500 Ω max. 4...20 mA output Current loop I_{F-C} feedback
Safety earth conductor and shield		See pin assignment (installation in conformity with CE)
Recommended cable		See pin assignment up to 20 m 7 x 0.75 mm^2 up to 40 m 7 x 1 mm^2
Calibration		Calibrated at the factory, see valve curve

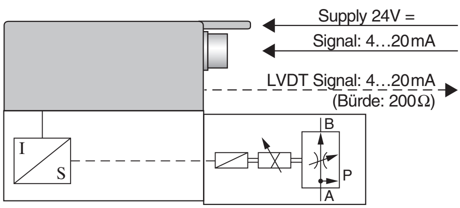
* Version "F1" (4...20 mA version) available on request

4

Version A1:
Standard

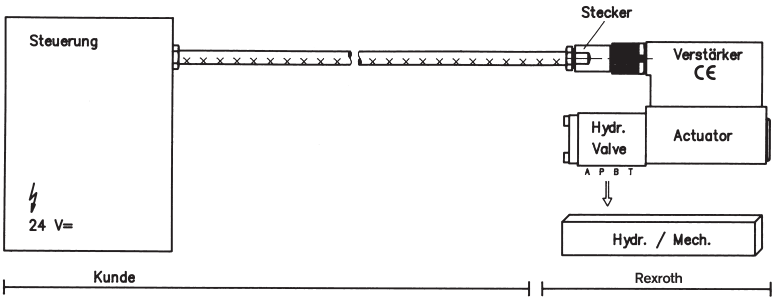


*** Version F1:**
mA Signal



Connection

For electrical data, see page 7 and
Operating Instructions **1 819 929 083**



Technical notes for the cable

Design:
- Multi-wire cable
- Extra-finely stranded wire to VDE 0295, Class 6
- Safety earth conductor, green/yellow
- Cu braided shield

Type:
- e.g. Ölflex-FD 855 CP (from Lappkabel company)

No. of wires:
- Determined by type of valve, plug type and signal assignment

Cable Ø:
- 0.75 mm^2 up to 20 m long
- 1.0 mm^2 up to 40 m long

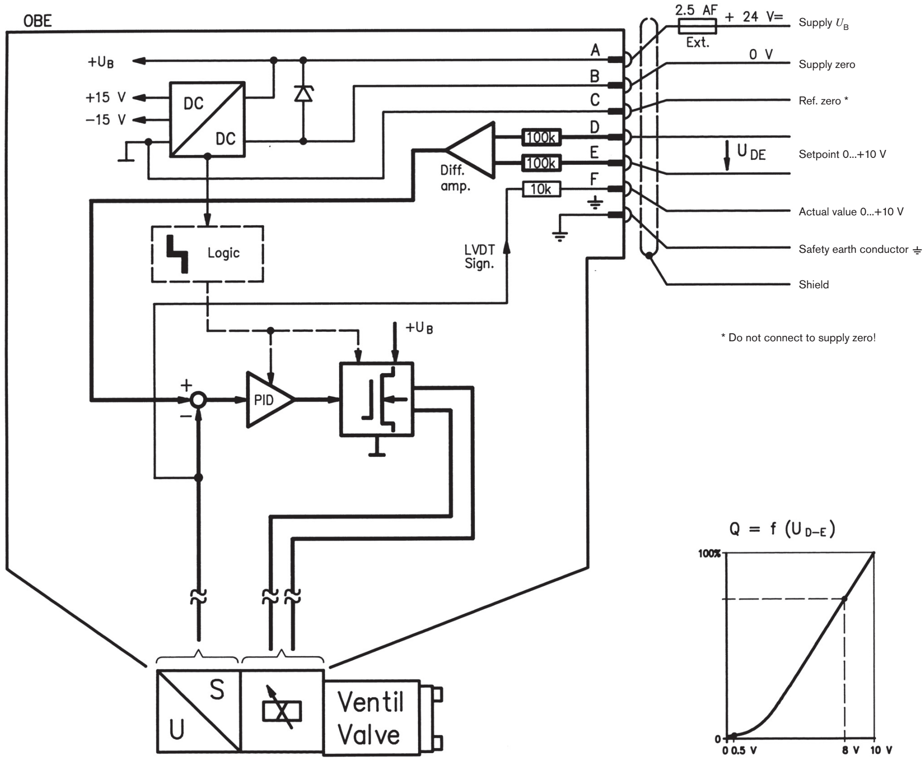
Outside Ø:
- 9.4...11.8 mm – Pg 11
- 12.7...13.5 mm – Pg 16

Important

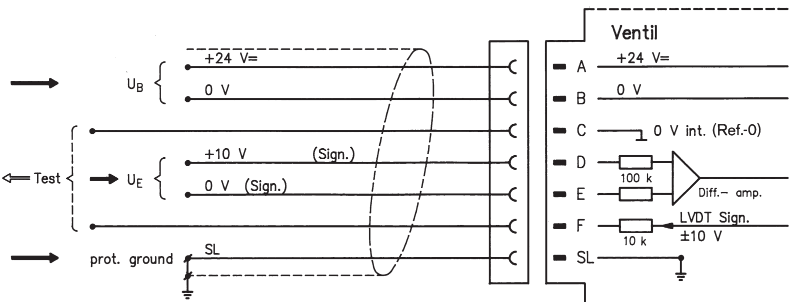
Power supply 24 V DC nom.,
if voltage drops below 18 V DC, rapid shutdown resembling "Enable OFF" takes place internally.
In addition, with the "mA signal" version:
$I_{D\text{-}E} \geqq 3$ mA – valve is active
$I_{D\text{-}E} \leqq 2$ mA – valve is deactivated.
Electrical signals (e.g. actual values) emitted via the trigger electronics must not be used to shut down safety-relevant machine functions!
(Also see European Standard, "Technical Safety Requirements for Fluid-Powered Systems and Components – Hydraulics", EN 982).

On-board trigger electronics

Circuit diagram/pin assignment
Version A1: $U_{D\text{-}E}$ 0...+10 V

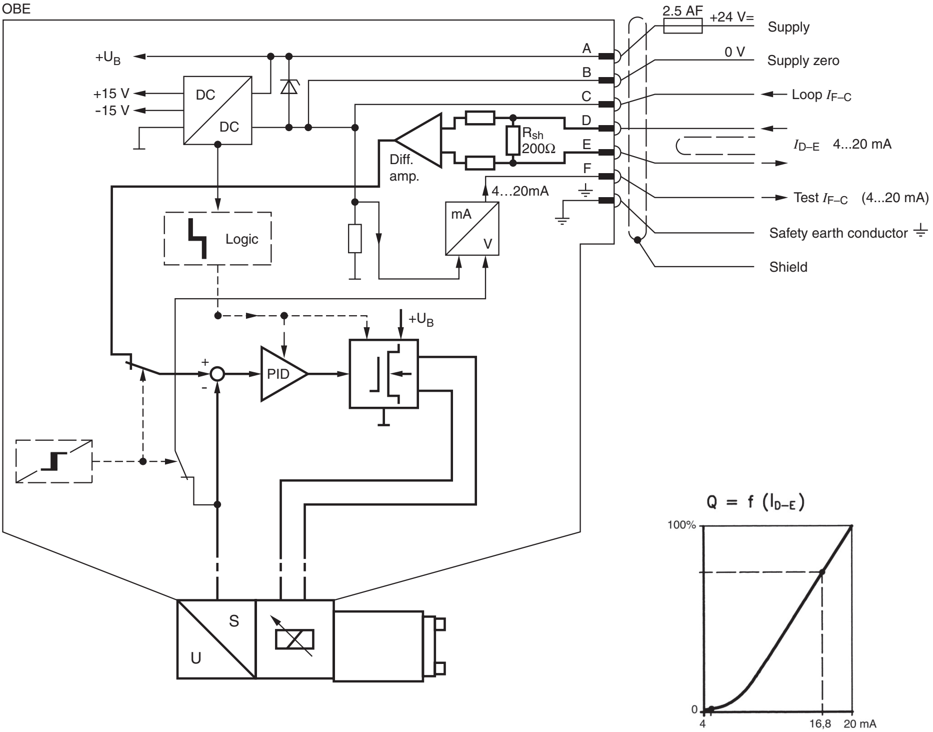


Pin assignment
Version A1: $U_{D\text{-}E}$ 0...+10 V
(R_i = 100 kΩ)

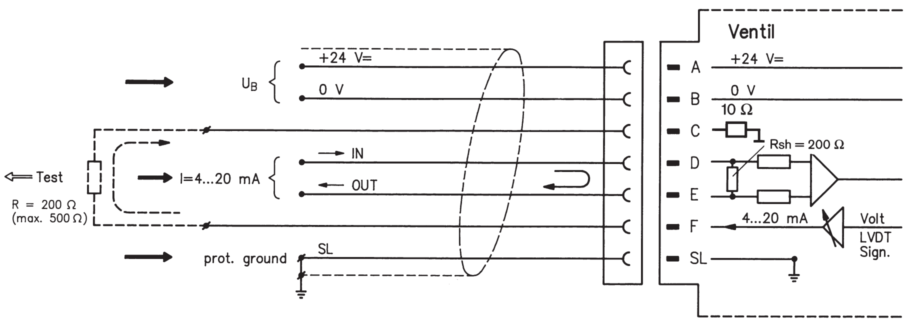


On-board trigger electronics

Circuit diagram/pin assignment
Version F1: $I_{D\text{-}E}$ 4...20 mA



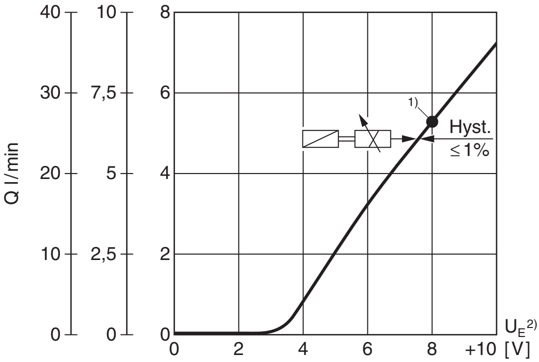
Pin assignment 6P+PE
Version F1: $I_{D\text{-}E}$ 4...20 mA
(R_{sh} = 200 kΩ)



Characteristic curves NG6 (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Q_{nom} = 10/35 l/min

Basic position closed "NC"

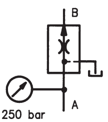


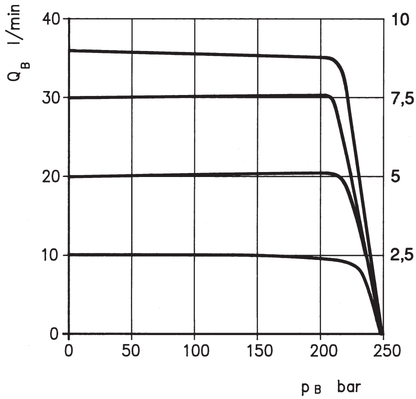
Valve amplifier

1) Factory setting – OBE
±5% manufacturing tolerance

2) Version: U_E = 0...+10 V

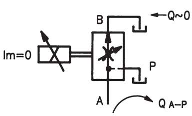
3-way version

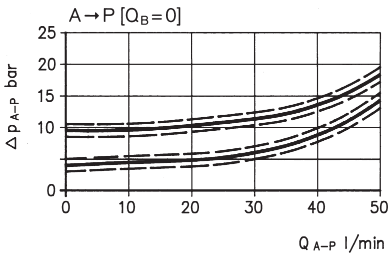




Q_{nom} = 10/35 l/min

Residual flow "A–P"
(pressure drop)

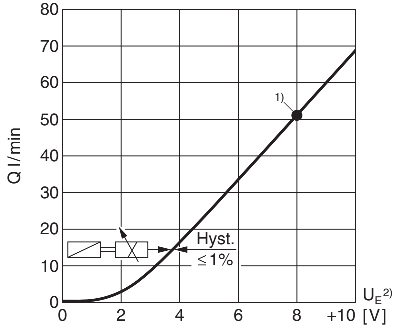




Characteristic curves NG10 (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

$Q_{nom.}$ **= 70 l/min**

Basic position closed “NC”

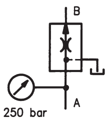


Valve amplifier

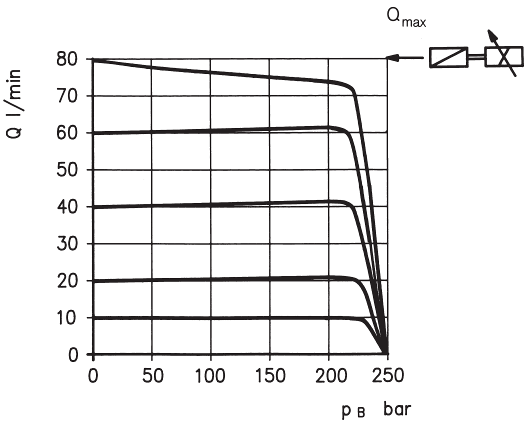
1) Factory setting – OBE
±5% manufacturing tolerance

2) Version: U_E = 0...+10 V

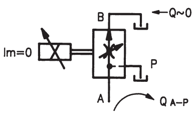
3-way version

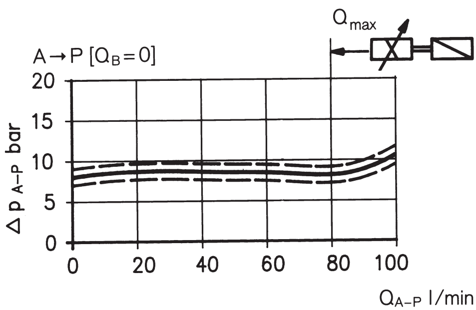


Q_{nom} **= 70 l/min**

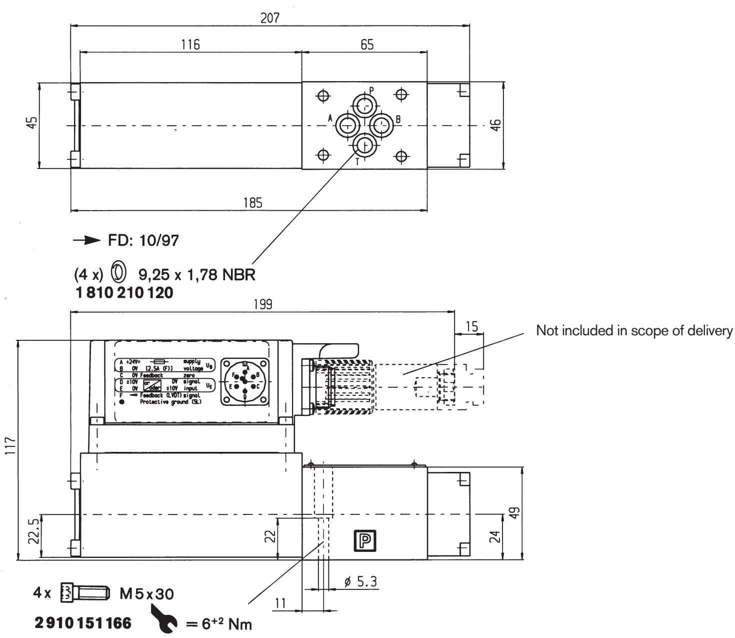


Residual flow “A-P”
(pressure drop)

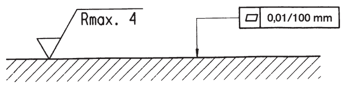




Unit dimensions NG6 (nominal dimensions in mm)

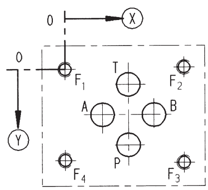


Required surface quality of mating component



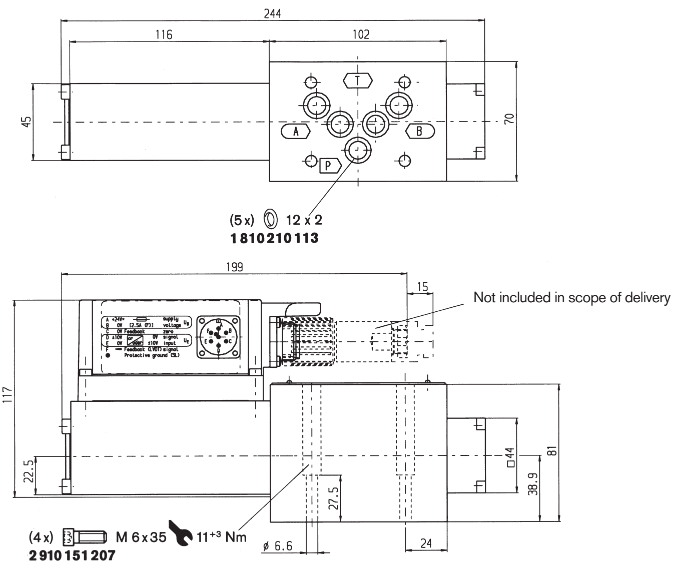
Mounting hole configuration: NG6 (ISO 4401-03-02-0-94)
For subplates see catalog sheet RE 45053

[1] Deviates from standard
[2] Thread depth:
Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

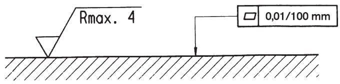


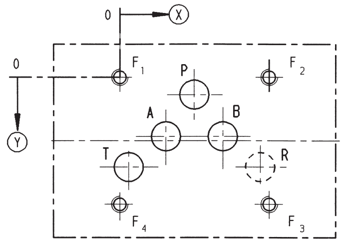
	P	A	T	B	F_1	F_2	F_3	F_4
X	21.5	12.5	21.5	30.2	0	40.5	40.5	0
Y	25.9	15.5	5.1	15.5	0	–0.75	31.75	31
Ø	8 [1]	8 [1]	8 [1]	8 [1]	M5 [2]	M5 [2]	M5 [2]	M5 [2]

Unit dimensions NG10 (nominal dimensions in mm)



Required surface quality of mating component





Mounting hole configuration: NG10 (ISO 4401-05-04-0-94)
For subplates see catalog sheet RE 45055

[1] Deviates from standard
[2] Thread depth:
Ferrous metal 1.5 x Ø*
Non-ferrous 2 x Ø

* NG10 min. 10.5 mm

	P	A	T	B	F_1	F_2	F_3	F_4	R
X	27	16.7	3.2	37.3	0	54	54	0	50.8
Y	6.3	21.4	32.5	21.4	0	0	46	46	32.5
Ø	10.5[1]	10.5[1]	10.5[1]	10.5[1]	M6[2]	M6[2]	M6[2]	M6[2]	10.5[1]

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Telefon +49 (0) 93 52 / 18-0
Telefax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

The Drive & Control Company Rexroth Bosch Group

Proportional flow control valve, with integrated pressure compensator

Type KUDSR

RE 18702
Edition: 2012-05
Replaces: 05.11

H7659

- Size 3
- Component series A
- Maximum operating pressure 350 bar
- Maximum flow 120 l/min

Features

- Mounting cavity R/UNF-16-03-0-06
- Direct operated proportional valve for controlling the flow size
- Operation by means of proportional solenoid with central thread and detachable coil
- Rotatable solenoid coil
- With concealed manual override
- Screwable manual override with star handle, optional

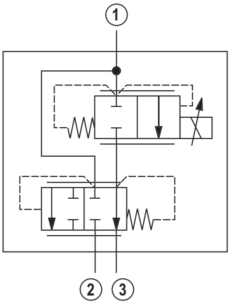
Contents

Ordering code (valve without coil) 1)

01	02	03	04	05		06	07	08	09
KUDS	**R**	**3**		**A**	**/**	**F**	**N9**	**V**	*****

01	Proportional flow control valve, with integrated pressure compensator, direct operated	**KUDS**
02	Maximum operating pressure 350 bar	**R**
03	Size 3	**3**

Symbol



04	Flow in the main port ③	
	80 l/min	**C**
	60 l/min	**C1**
	40 l/min	**C2**
05	Component series	**A**
06	High Performance and mounting cavity R/UNF-16-03-0-06, see page 13	**F**
07	**With** concealed manual override 2)	**N9**

Seal material

08	FKM seals	**V**
	(other seals upon request) Attention! Observe compatibility of seals with hydraulic fluid used!	
09	Further details in the plain text	*****

1) Complete valves with mounted coil on request.

2) Screwable manual override with star handle **"N14"** (separate order, material no. **R913009058**, see page 12).

Valve types (without coil) 1)

Type	**Material no.**
KUDSR3CA/FN9V	R901255657
KUDSR3C1A/FN9V	R901287409
KUDSR3C2A/FN9V	R901265879

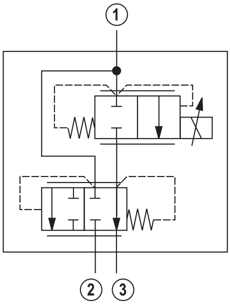
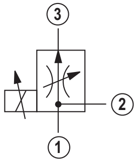
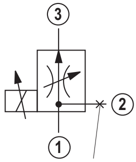
Available coils (separate order) [1]

	Material no. for coil with connector [3]		
Direct voltage DC [4]	**"K4"** 03pol (2+PE) DIN EN 175301-803	**"K40"** 02pol K40 DT 04-2PA, make Deutsch	**"C4"** 02pol C4/Z30 AMP Junior-Timer
12 V (1.8 A)	R901022180	R901272648	R901022680
24 V (1.2 A)	R901022174	R901272647	R901022683

[3] Mating connectors, separate order, see data sheet 08006.

[4] Other voltages upon request.

Symbols

Detailed	Simple	
		 By closing the main port ②, the valve can also be operated as 2-way flow control valve.

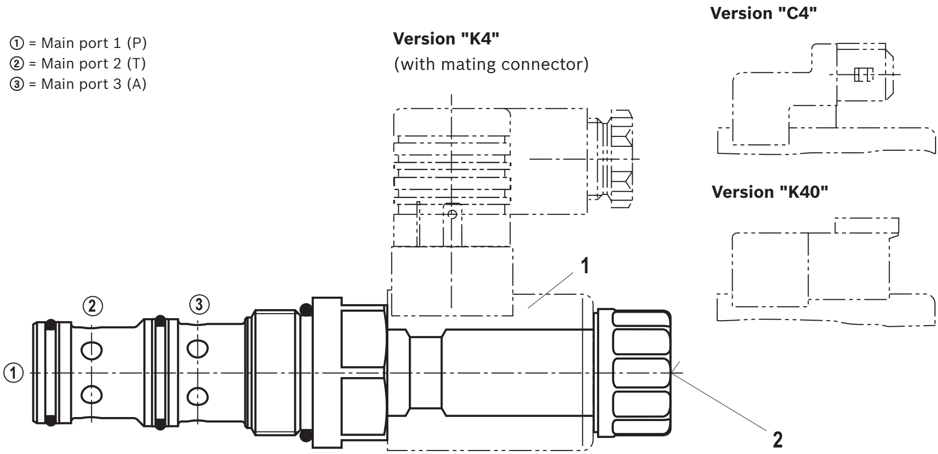
① = Main port 1 (P)
② = Main port 2 (T)
③ = Main port 3 (A)

Function

General
The proportional flow control valve is a direct operated cartridge valve in spool design with integrated pressure compensator. It regulates the flow proportionally to the input signal in a continuous form from the main port ① to ③. Superfluous residual flow is led to the tank or to another actuator via the port ②.
The valve basically comprises of housing, control spool, control spring, pressure compensator piston, orifice bush, pressure compensator spring as well as proportional solenoid (1) with central thread and detachable coil.

Function
With de-energized proportional solenoid (1), the control spool that is always pressure-compensated to the actuating forces due to its structural design is held in the initial position by the control spring and blocks the flow between main port ① and ③. By energizing the proportional solenoid (1), the control spool is adjusted directly proportional to the electrical input signal and, via orifice-like cross-sections (with progressive flow characteristic), connects the main ports ① and ③. Due to the integrated pressure compensator piston together with the pressure compensator spring, the pressure drop across the valve is kept constant, independent of the pressures at ①, ② and ③. In case of superfluous flow from ① the pressure compensator piston moves to the right and opens the connection ① to ②. In case of de-excitation of the proportional solenoid (1), the control spring returns the control piston into its initial position. The whole flow is now directly led from main port ① to main port ②.
The manual override (2) allows for the adjustment of the valve without solenoid energization.

① = Main port 1 (P)
② = Main port 2 (T)
③ = Main port 3 (A)



Type KUDSR3...

Technical data
(For applications outside these parameters, please consult us!)

general		
Weight	kg	0.97
Installation position		Any - if it is ensured that no air can collect upstream the valve. Otherwise, we recommend suspended installation of the valve.
Ambient temperature range	°C	see page 11
Storage temperature range	°C	–20 to +80

Environmental audits

Salt spray test according to DIN 50021	h	720
Surface protection DC solenoids		Coating according to DIN 50962-Fe//ZnNi with thick film passivation

hydraulic			
Maximum operating pressure	– Main port ①	bar	350
Bypass pressure	– Main port ②	bar	350 with q_{Vmax}
Prio pressure	– Main port ③	bar	330 with q_{Vmax}
Control pressure differential	– ① to ③	bar	12 to 15
Minimum pressure differential	– ① to ③	bar	> 10
Maximum flow	– Main port ①	l/min	120
Rated flow	– ① to ③	l/min	80 (regulated)
Leakage		ml/min	< 100 (with Δp = 100 bar in ①; HLP46, ϑ_{oil} = 40 °C)
Hydraulic fluid			See table below
Hydraulic fluid temperature range		°C	–40 to +100 (preferably +40 to +50)
Viscosity range		mm²/s	5 to 400 (preferably 10 to 100)
Maximum permitted degree of contamination of the hydraulic fluid - cleanliness class according to ISO 4406 (c)			Class 20/18/15 [1]
Load cycles		Million	10
Hysteresis [2]		%	≤ 5
Range of inversion [2]		%	≤ 2
Response sensitivity [2]		%	≤ 1

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils		HL, HLP	FKM	DIN 51524
Bio-degradable	– Insoluble in water	HEES	FKM	VDMA 24568
	– Soluble in water	HEPG	FKM	

Important information on hydraulic fluids!
- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!
- The flash point of the hydraulic fluids used must be 40 K higher than the maximum solenoid surface temperature.
- **Bio-degradable:** When using bio-degradable hydraulic fluids that are simultaneously zinc-solving, zinc may accumulate in the fluid.

1) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components.
For the selection of the filters see www.boschrexroth.com/filter.

2) Measured with analog amplifier type RA2-1/10 according to data sheet 95230 (PWM = 100 Hz).

4

Technical data
(For applications outside these parameters, please consult us!)

electric				
Voltage type			Direct voltage	
Supply voltages [3]		V	12 DC	24 DC
Maximum solenoid current		A	1.8	1.2
Coil resistance	– Cold value at 20 °C	Ω	3.3	7.2
	– Max. hot value	Ω	5.8	13.0
Duty cycle		%	See characteristic curve page 11	
Maximum coil temperature [4]		°C	150	
Protection class according to VDE 0470-1 (DIN EN 60529) DIN 40050-9	– Version "K4"		IP 65 with mating connector mounted and locked	
	– Version "C4"		IP 66 with mating connector mounted and locked	
			IP 69K with Rexroth mating connector (material no. R901022127)	
	– Version "K40"		IP 69K with mating connector mounted and locked	
Control electronics (separate order)			Analog amplifier module type VT-MSPA1...	Data sheet 30223
			Plug-in proportional amplifier type VT-SSPA1...	Data sheet 30116
			Analog amplifier type RA...	Data sheet 95230
			BODAS control unit type RC...	Data sheet 95200
Design according to VDE 0580				

[3] Other voltages upon request

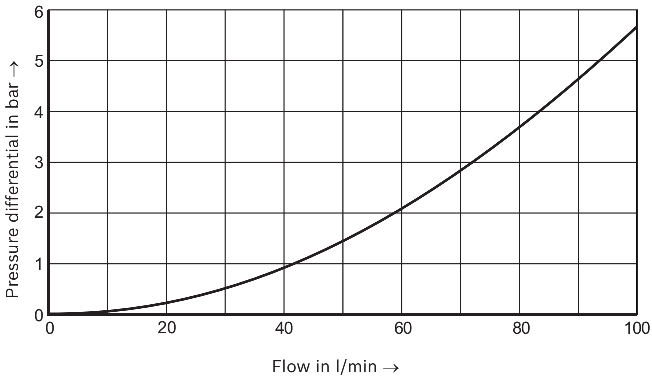
[4] Due to the surface temperatures of the solenoid coils, the standards ISO 13732-1 and ISO 4413 need to be adhered to!

When establishing the electrical connection, the protective earthing conductor (PE ⏚) has to be connected properly.

Characteristic curves

(measured with HLP46, ϑ_{oil} = 40 ± 5 °C and 24 V coil)

***Δp*-*q*$_V$ characteristic curve – Main port ① to ②** (③ open, orifice closed)

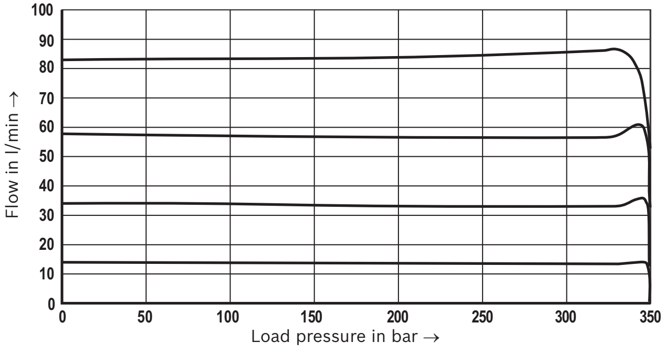


Characteristic curves: Version "C"

(measured with HLP46, ϑ_{oil} = 40 ± 5 °C and $q_{V①}$ = 80 l/min)

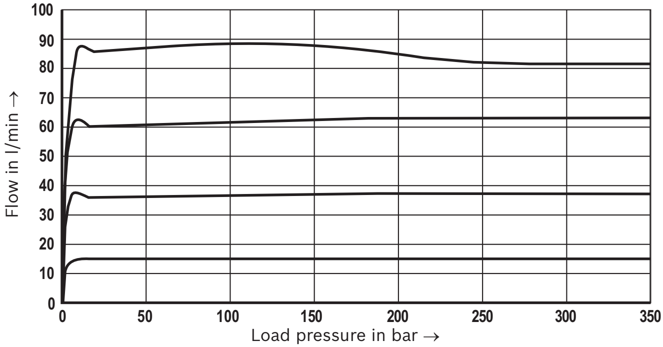
Regulated flow at the main port ③ across load pressure

3-way function (main port ② open to the tank)

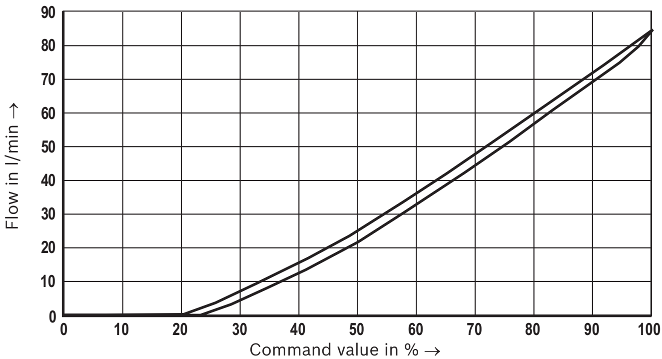


Regulated flow at the main port ③ across load pressure

2-way function (main port ② closed)



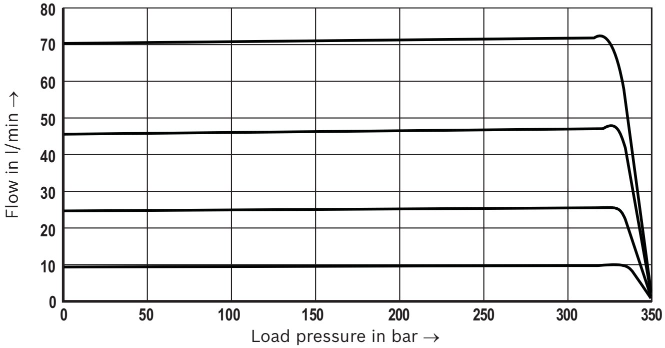
Flow at the main port ③ across command value



Characteristic curves: Version "C1"
(measured with HLP46, ϑ_{oil} = 40 ± 5 °C and $q_{V①}$ = 60 l/min)

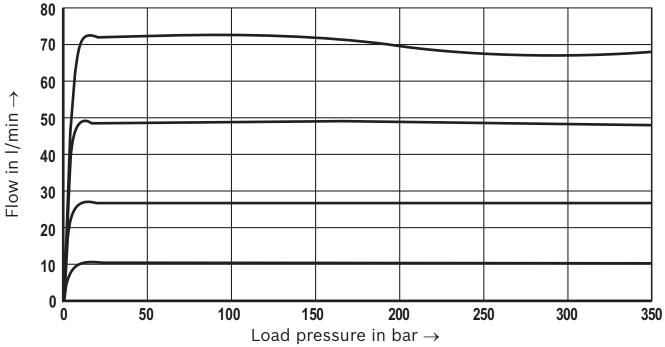
Regulated flow at the main port ③ across load pressure

3-way function (main port ② open to the tank)

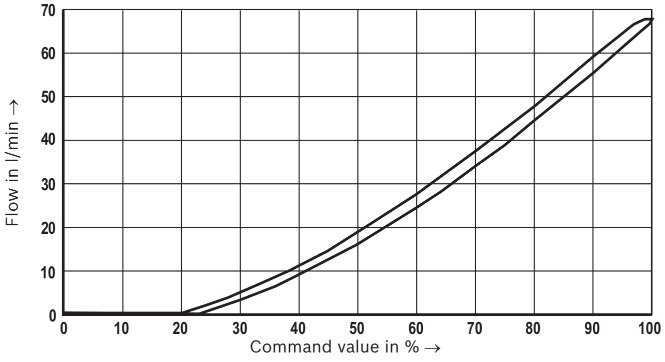


Regulated flow at the main port ③ across load pressure

2-way function (main port ② closed)

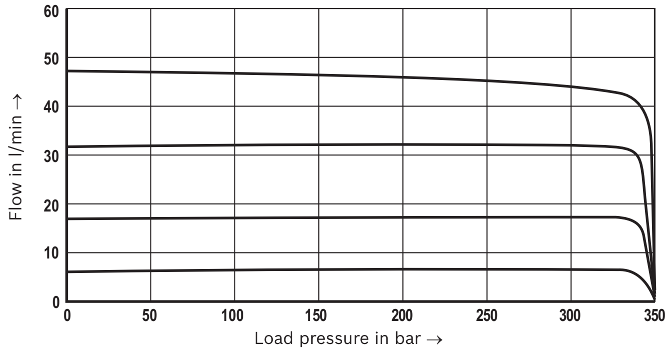


Flow at the main port ③ across command value

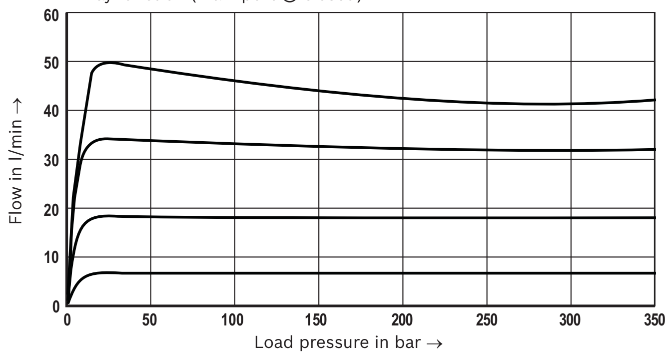


Characteristic curves: Version "C2"
(measured with HLP46, ϑ_{oil} = 40 ± 5 °C and $q_{V①}$ = 40 l/min)

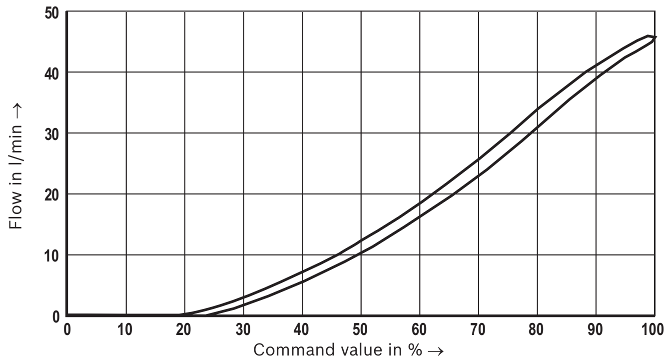
Regulated flow at the main port ③ across load pressure
3-way function (main port ② open to the tank)



Regulated flow at the main port ③ across load pressure
2-way function (main port ② closed)



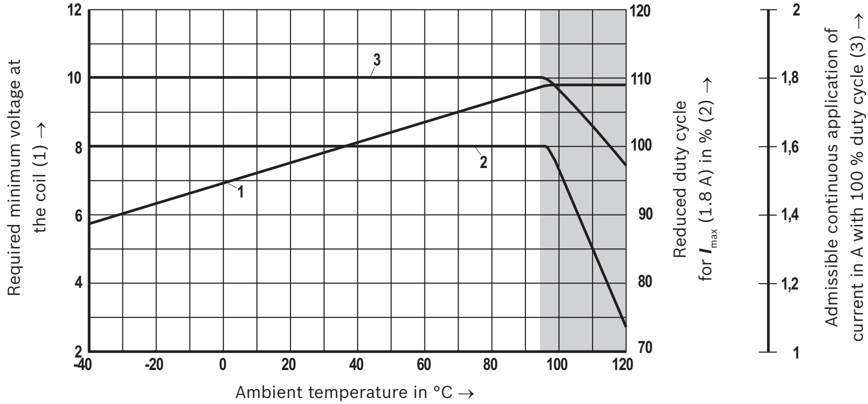
Flow at the main port ③ across command value



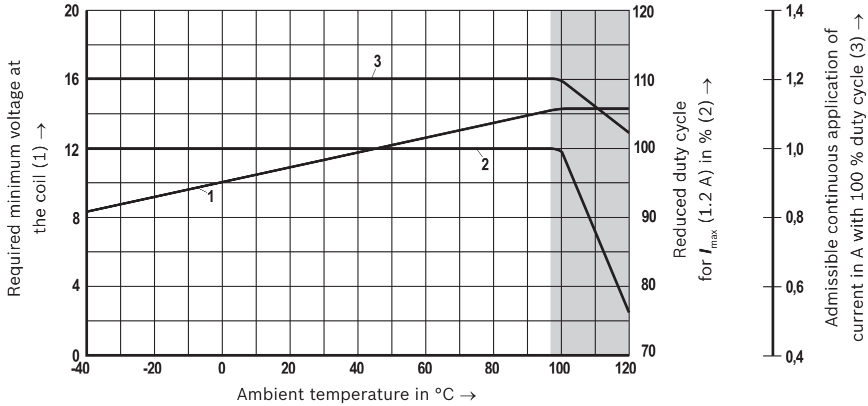
Minimum terminal voltage at the coil and relative duty cycle

Admissible working range against the ambient temperature

– Version "G12"



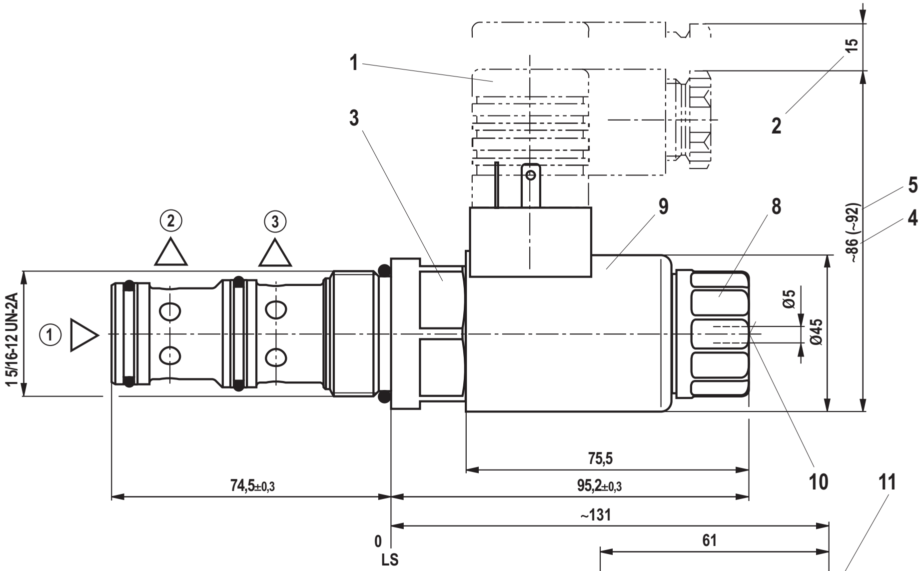
– Version "G24"

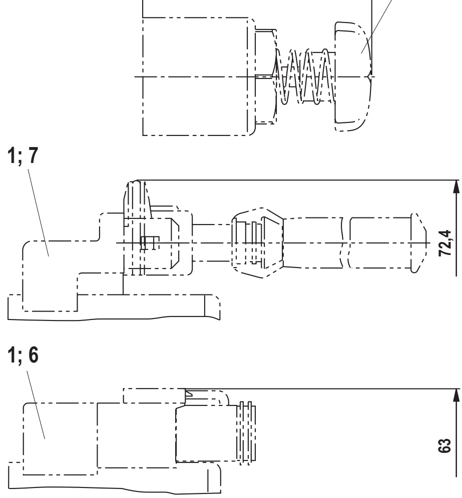


Limited valve performance

Notices!
The characteristic curves have been determined for coils with valve with medium test block size (80 x 80 x 80 mm), without flow in calm air.
Depending on the installation conditions (block size, flow, air circulation, etc.) there may be a better heat dissipation. Thus, the area of application is broadened.
In single cases, more unfavorable conditions may lead to limitations of the area of application.

Unit dimensions
(dimensions in mm)



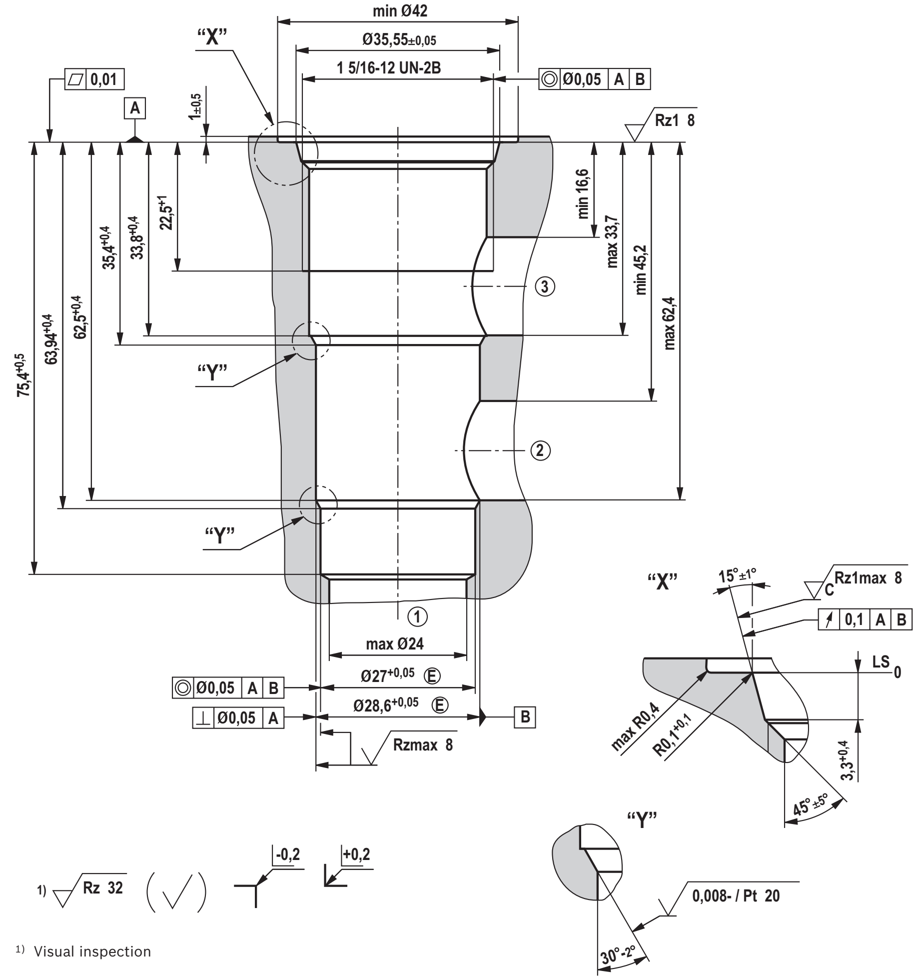


① = Main port 1 (P)
② = Main port 2 (T)
③ = Main port 3 (A)

LS = Location Shoulder

- **1** Mating connector without circuitry for connector "K4" (separate order, see data sheet 08006)
- **2** Space required to remove the mating connector
- **3** SW36, tightening torque $\boldsymbol{M}_A$ = 165^{+15} Nm
- **4** Dimension for "K4" mating connector, without circuitry
- **5** Dimension () for "K4" mating connector, with circuitry
- **6** Mating connector for connector "K40" (separate order, see data sheet 08006)
- **7** Mating connector for connector "C4" (separate order, see data sheet 08006)
- **8** Nut, tightening torque $\boldsymbol{M}_A$ = 5^{+2} Nm
- **9** Coil (separate order, see page 3)
- **10** Concealed manual override "N9"
- **11** Screwable manual override with star handle "N14" (separate order, see page 3)

Mounting cavity R/UNF16-03-0-06; 3 main ports; thread 1 5/16-12 UN-2B
(dimensions in mm)



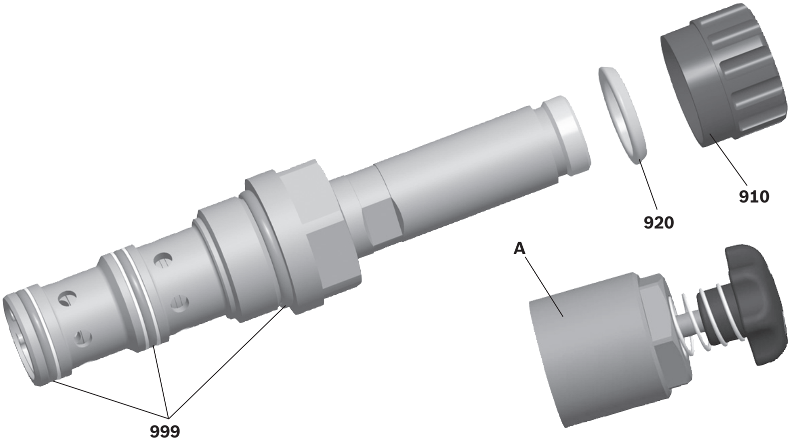
[1] Visual inspection

① = Main port 1 (P)
② = Main port 2 (T)
③ = Main port 3 (A)

LS = Location Shoulder

All seal ring insertion faces are rounded and free of burrs

Available individual components



Item	Denomination	Material no.
910	Nut	R900029574
920	O-ring for pole tube	R900002507
999	Seal kit of the valve	R961003236
A	Manual override "N14"	R913009058

Coils, separate order, see page 3.

More information

- Control electronics:
  - Analog amplifier module type VT-MSPA1... — Data sheet 30223
  - Plug-in proportional amplifier type VT-SSPA1... — Data sheet 30116
  - Analog amplifier type RA... — Data sheet 95230
  - BODAS control unit type RC... — Data sheet 95200
- Selection of the filters — www.boschrexroth.com/filter

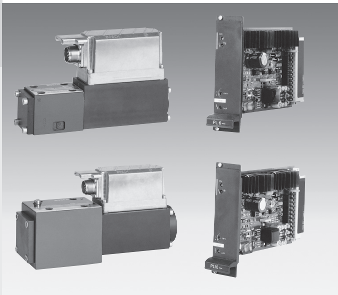
Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52/18-0
documentation@boschrexroth.de
www.boschrexroth.de

Directional control valves

Servo solenoid valves with electrical position feedback (Lvdt DC/DC) (ruggedized design)

RE 29026/07.08
Replaces: 01.05

Type 4WRPH



Nominal size (NG) 6, 10
Unit series 2X
Maximum working pressure P, A, B 315 bar, T 250 bar
Nominal flow rate 12...40 l/min (NG6), 50...100 l/min (NG10)

List of contents

Features

– Directly operated servo solenoid valve NG6, NG10, with control piston and sleeve in servo quality and sturdy design
– Actuated on one side, 4/4 fail-safe position when switched off
– “Ruggedized” design 40 *g* with central plug
– Suitable for the wood industry and in systems with difficult ambient conditions
– For subplate attachment, mounting hole configuration NG6 to ISO 4401-03-02-0-05 and NG10 to ISO 4401-05-04-0-05
– Subplates as per catalogue section NG6 RE 45053 and NG10 RE 45055 (order separately)

Ordering data

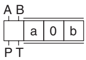
4WRP		H			B		–2X/G24	K0/	M –	750

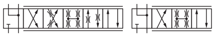
For **external** trigger electronics **= no design.**

Control piston/sleeve **= H**

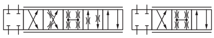
Nominal size 6 **= 6**
Nominal size 10 **= 10**

Symbols
4/4-way version





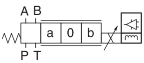
= C3, C5



= C4, C1

With symbols C5 and C1:[3)]
P → A: q_v B → T: $q_V/2$
P → B: $q_V/2$ A → T: q_v

Side of inductive position transducer



(Standard) **= B**

Nominal flow rate at 70 bar valve pressure difference

Nominal Size 6	**Nominal Size 10**
12 = 12 l/min	**50** = 50 l/min
15[1)] = 15 l/min	**100** = 100 l/min
24 = 24 l/min	
25[1)] = 25 l/min	
40 = 40 l/min	

Flow characteristic
L = Linear
P = Non-linear curve[2)]

2X = Unit series 20 to 29 (installation and connection dimensions unchanged)

Voltage supply of trigger electronics
G24 = +24 V DC

Electrical connection
K0 = **without** line socket, with plug to DIN 43563-AM6
Order line socket separately

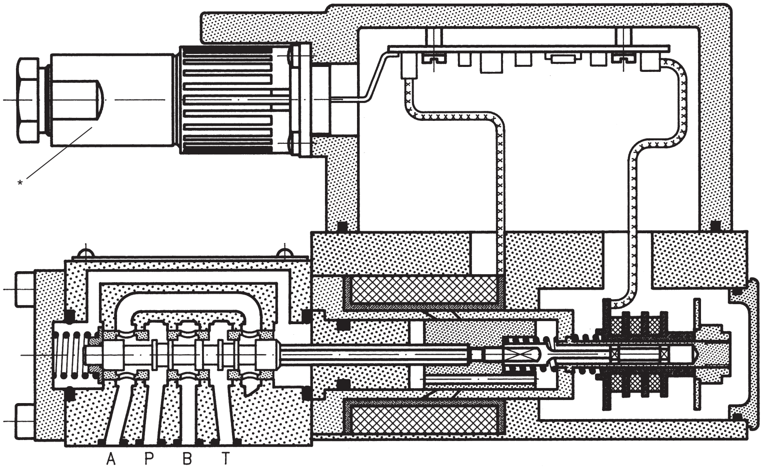
M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

750 = Ruggedized design

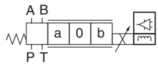
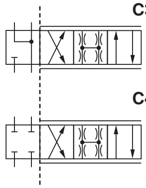
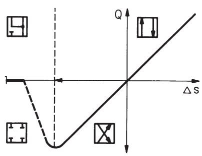
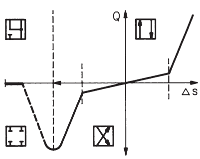
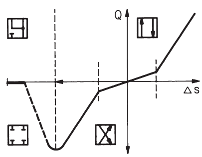
1) Only in connection with flow characteristic "p"
2) Kink 60% for NG6 with nominal flow rate "15" and "25", otherwise kink 40%
3) q_v 2:1 only with nominal flow rate ≧ 40 l/min

Function, Sectional diagram

Servo solenoid valve 4WRPH6...–750



Symbols

	Linear	p: kink 60 %	p: kink 40 %
C3, C5  **C4, C1**			
	C3, C4	C5, C1	C5, C1

Accessories

(4 x) M5 x 30 DIN 912–10.9	Fastening screws	**2 910 151 166**
	VT-VRRA1-527-20/V0, see RE 30041	**0 811 405 060**
	VT-VRRA1-527-20/V0/K60-AGC, see RE 30040	**0 811 405 066**
	VT-VRRA1-527-20/V0/K40-AGC, see RE 30040	**0 811 405 065**
*  6P + PE (Pg16)	Line socket not included in scope of delivery, see also RE 08008	**1 834 482 024**

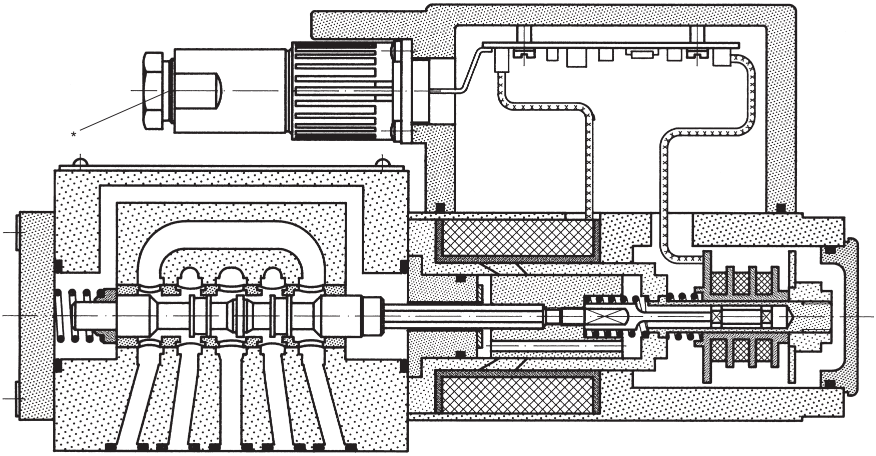
Testing and service equipment

– Test box type VT-PE-TB2, see RE 30064.

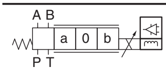
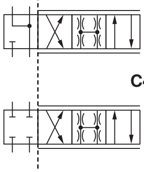
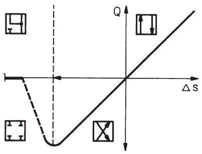
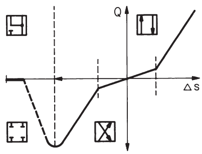
– Test adapter type VT-PA-3, see RE 30070.

Function, Sectional diagram

Servo solenoid valve 4WRPH 10...–750



Symbols

	Linear	p: kink 40 %
C3, C5  **C4, C1**		
	C3, C4	C5, C1

Accessories

(4 x) M6 x 40 DIN 912–10.9	Fastening screws	**2 910 151 209**
 	VT-VRRA1-537-20/V0, see RE 30041	**0 811 405 061**
	VT-VRRA1-537-20/V0/K40-AGC, see RE 30040	**0 811 405 067**
*  6P + PE (Pg16)	Line socket not includes in scope of delivery, see also RE 08008	**1 834 482 024**

Testing and service equipment

– Test box type VT-PE-TB2, see RE 30064.

– Test adapter type VT-PA-3, see RE 30070.

Technical data (Type 4WRPH 6)

General

Construction		Spool type valve, operated directly, with steel sleeve
Actuation		Proportional solenoid with position control, external amplifier
Type of mounting		Subplate, mounting hole configuration NG6 (ISO 4401-03-02-0-05)
Installation position		Optional
Ambient temperature range	°C	–20...+60
Weight	kg	2.5
Vibration resistance, test condition		Max. 40 g, shaken in 3 dimensions (24 h)

Hydraulic (measured with HLP 46, ϑ_{oil} = 40 °C ±5 °C)

Pressure fluid			Hydraulic oil to DIN 51524...535, other fluids after prior consultation			
Viscosity range	recommende	mm²/s	20...100			
	max. permitted	mm²/s	10...800			
Pressure fluid temperature range		°C	–20...+70			
Maximum permissible degree of contamination of pressure fluid Purity class to ISO 4406 (c)			Class 18/16/13 [1)]			
Flow direction			See symbol			
Nominal flow at Δp = 35 bar per notch [2)]		l/min	12	15	24	40
Max. working pressure		bar	Port P, A, B: 315			
Max. pressure		bar	Port T: 250			
Operating limits at Δp Pressure drop at valve		bar	315	315	315	160
Q_{Vnom}: > Q_N valves		bar	315	280	250	100
Leakage at 100 bar		cm³/min	< 300	–	< 500	< 900
		cm³/min	–	< 180	< 300	< 450

Electrical

Cyclic duration factor	%	100	
Power supply		24 V_{nom} (external amplifier)	
Degree of protection		IP 66 to DIN 40050, line socket 1 834 482 024, mounted	
Connectors for solenoid and position transducer		To DIN 43563-AM6 (line socket 1 834 482 024) Pg16 For pin assignment see block diagram on pages 7 and 8	
Max. solenoid current	A	2.7	
Coil resistance R_{20}	Ω	2.5	
Max. power consumption at 100 % load and operational temperature	VA	40	
Position transducer DC/DC technology		Supply: +15 V/35 mA –15 V/25 mA	Signal: 0...±10 V (R_L ≧ 10 kΩ)

Static/Dynamic

Hysteresis	%	≦ 0.2
Manufacturing tolerance for Q_{max}	%	< 10
Response time for signal change 0...100 %	ms	< 10
Thermal drift		Zero point displacement < 1 % at ΔT = 40 °C

1) The purity classes stated for the components must be complied with in hydraulic systems.
Effective filtration prevents problems and also extends the service life of components.
For a selection of filters, see catalogue sections RE 50070, RE 50076 and RE 50081.

2) Flow rate at a different Δp $\quad Q_x = Q_{nom} \cdot \sqrt{\frac{\Delta p_x}{35}}$

5

Technical data (Type 4WRPH 10)

General

Construction		Spool type valve, operated directly, with steel sleeve
Actuation		Proportional solenoid with position control, external amplifier
Type of mounting		Subplate, mounting hole configuration NG10 (ISO 4401-05-04-0-05)
Installation position		Optional
Ambient temperature range	°C	–20...+60
Weight	kg	7.0
Vibration resistance, test condition		Max. 40 g, shaken in 3 dimensions (24 h)

Hydraulic (measured with HLP 46, ϑ_{oil} = 40 °C ± 5 °C)

Pressure fluid		Hydraulic oil to DIN 51524...535, other fluids after prior consultation			
Viscosity range, recommended	mm^2/s	20...100			
Viscosity range, max. permitted	mm^2/s	10...800			
Pressure fluid temperature range	°C	–20...+70			
Maximum permissible degree of contamination of pressure fluid Purity class to ISO 4406 (c)		Class 18/16/13 [1]			
Flow direction		See symbol			
Nominal flow at Δp = 35 bar per notch [2]	l/min	50 (1:1)	50 (2:1)	100 (1:1)	100 (2:1)
Max. working pressure	bar	Port P, A, B: 315			
Max. pressure	bar	Port T: 250			
Operating limits at Δp Pressure drop at valve	bar	315	315	160	160
Q_{Vnom}: > Q_N Ventile	bar	250	250	100	100
Leakage at 100 bar	cm^3/min	< 1,200	< 1,200	< 1,500	< 1,000
	cm^3/min	< 600	< 500	< 600	< 600

Electrical

Cyclic duration factor	%	100	
Power supply		24 V_{nom} (external amplifier)	
Degree of protection		IP 66 to DIN 40050, line socket 1 834 482 024, mounted	
Connectors for solenoid and position transducer		To DIN 43563-AM6 (line socket 1 834 482 024) Pg16 For pin assignment see block diagram on pages 7 and 8	
Max. solenoid current	A	3.7	
Coil resistance R_{20}	Ω	2.4	
Max. power consumption at 100 % load and operational temperature	VA	60	
Position transducer DC/DC technology		Supply: +15 V/35 mA –15 V/25 mA	Signal: 0...±10 V ($R_L \geqq$ 10 kΩ)

Static/Dynamic

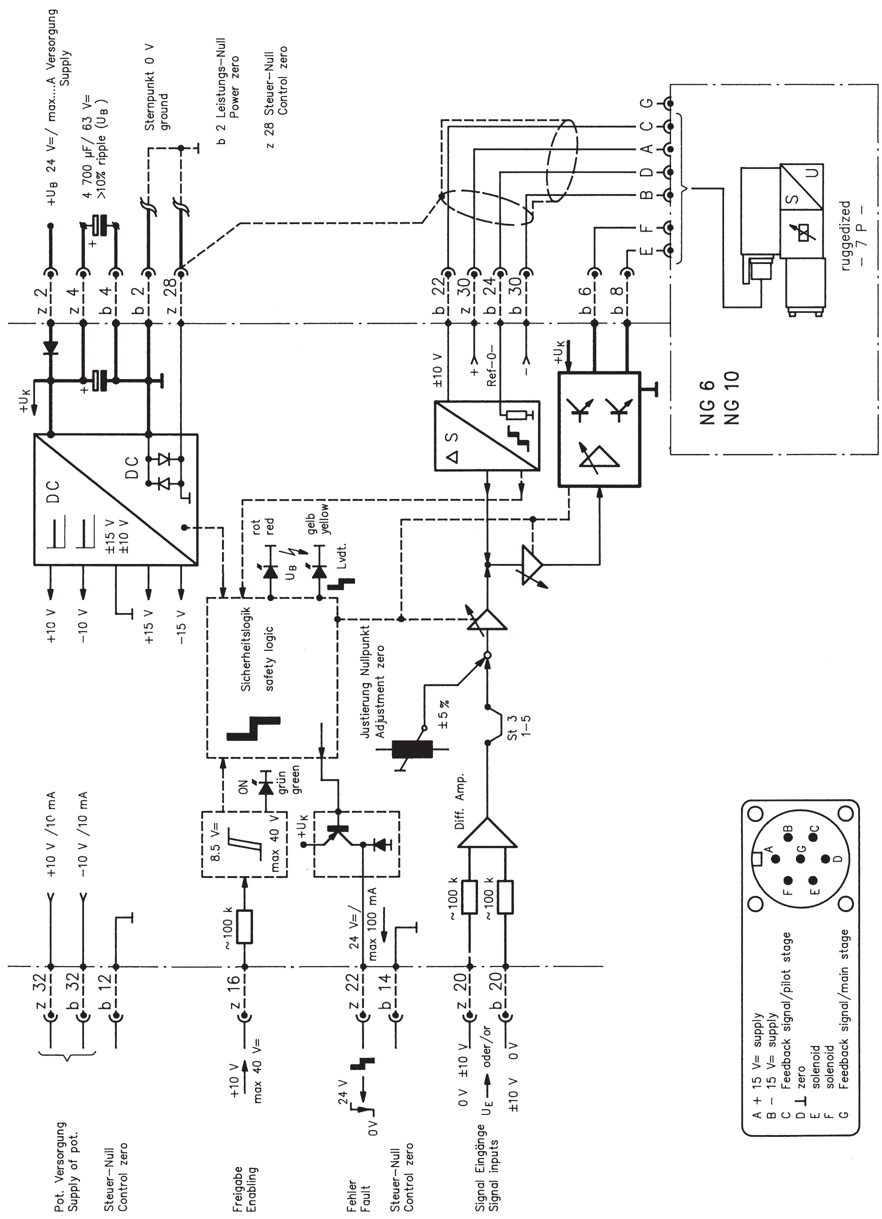
Hysteresis	%	≦ 0.2
Manufacturing tolerance for Q_{max}	%	< 10
Response time for signal change 0...100 %	ms	≦ 25
Thermal drift		Zero point displacement <1 % at ΔT = 40 °C

[1] The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of components. For a selection of filters, see catalogue sections RE 50070, RE 50076 and RE 50081.

[2] Flow rate at a different Δp $\quad Q_x = Q_{nom} \cdot \sqrt{\frac{\Delta p_x}{35}}$

Valve with external trigger electronics (standard linear curve: L)

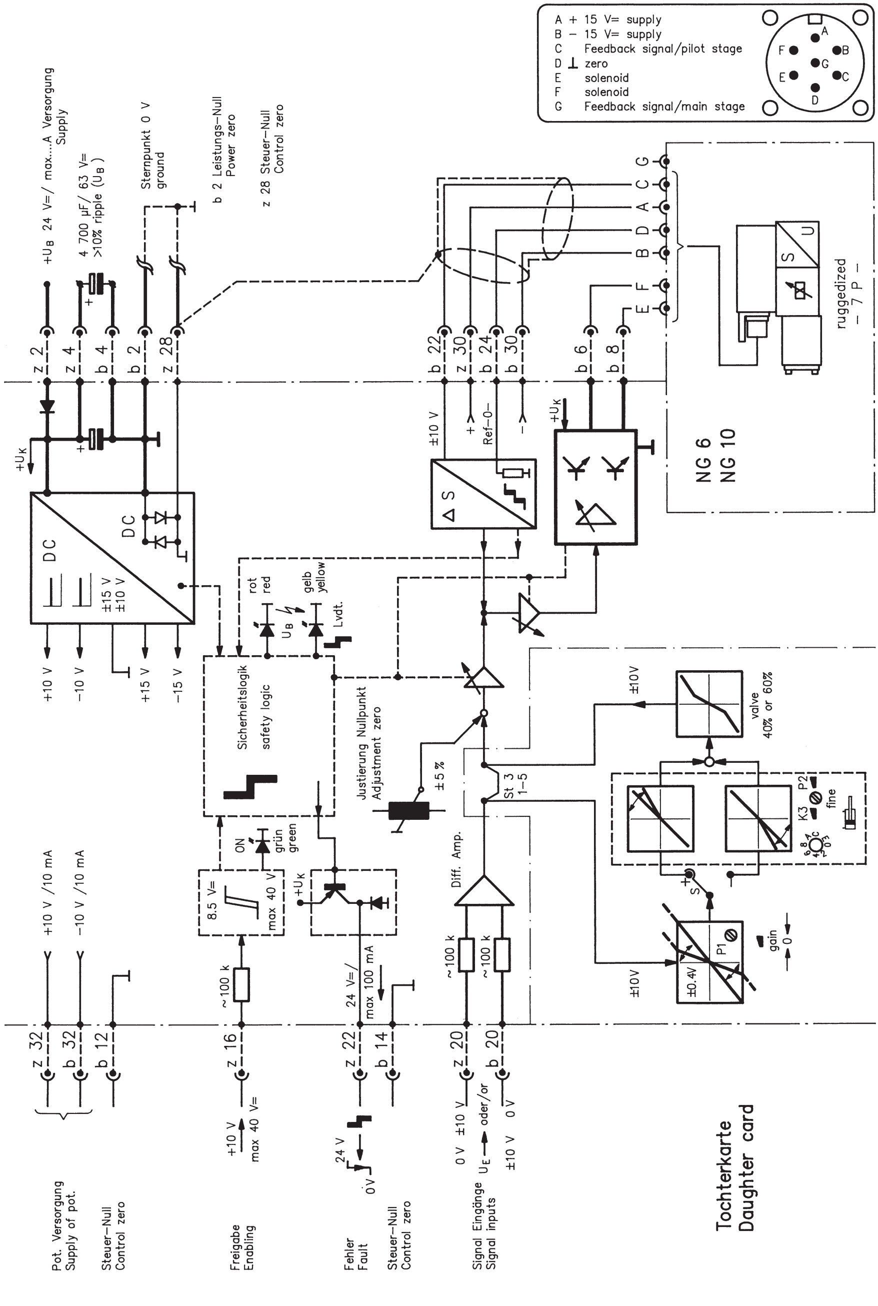
Block diagram/pin assignment



5

Valve with external trigger electronics (standard non-linear curve: P)

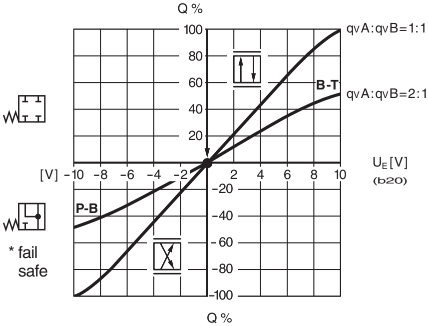
Block diagram/pin assignment



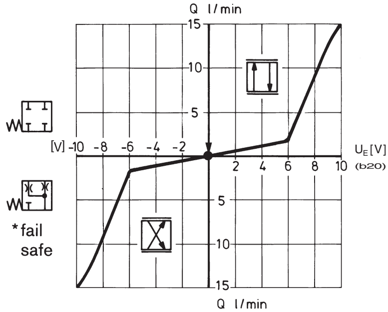
Performance curves (measured with HLP 46, ϑ_{oil} = 40 °C ±5 °C)

Flow rate/Signal function (with 70 bar pressure drop at valve)

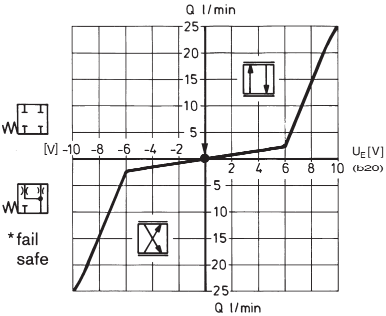
NG6, NG10
L: Linear 1:1 and 2:1



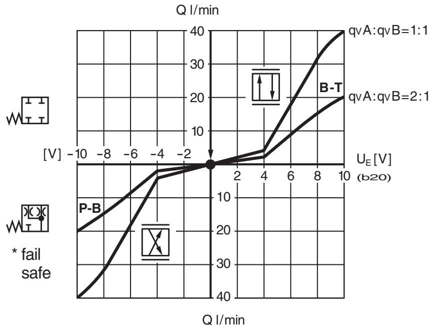
NG6
P: (kink 60 %)**



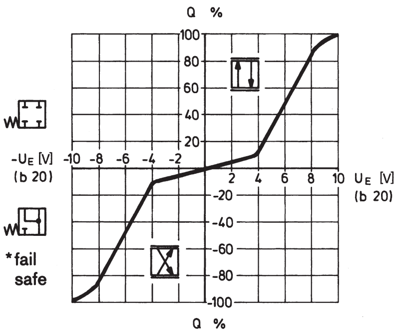
NG6
P: (kink 60 %)**



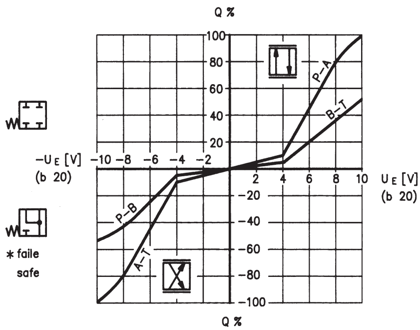
NG6
P: (kink 40 %) 1:1 and 2:1**



NG10
P: (kink 40 %)**



NG10
P: (kink 40 %) 1:1 and 2:1**

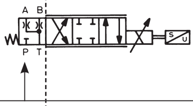
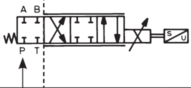


*Fail-safe, when enabling is not released.
**Q-kink = 10 % Q_N.

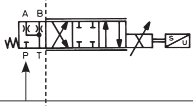
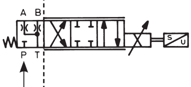
Performance curves (measured with HLP 46, ϑ_{oil} = 40 °C ±5 °C)

Fail-safe position

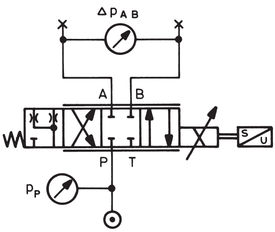
NG6 — **Fail-safe position**

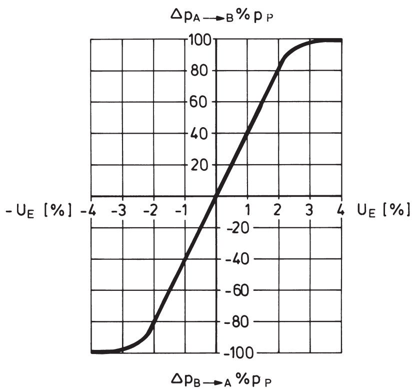
	Leakage at	100 bar	P–A P–B	50 cm^3/min 70 cm^3/min
	Flow at	Δp = 35 bar	A–T B–T	10...20 l/min 7...20 l/min
	Leakage at	100 bar	P–A P–B A–T B–T	50 cm^3/min 70 cm^3/min 70 cm^3/min 50 cm^3/min
 Fail-safe	p = 0 bar → 7 ms p = 100 bar → 10 ms	Enable off		

NG10 — **Fail-safe position**

	Leakage at	100 bar	P–A P–B	50 cm^3/min 70 cm^3/min
	Flow at	Δp = 35 bar Q_N 50/100 l/min	A–T B–T	10...100 l/min 10... 25 l/min
	Leakage at	100 bar	P–A P–B A–T B–T	50 cm^3/min 70 cm^3/min 70 cm^3/min 50 cm^3/min
 Fail-safe	p = 0 bar → 12 ms p = 100 bar → 16 ms	Enable off		

Pressure gain

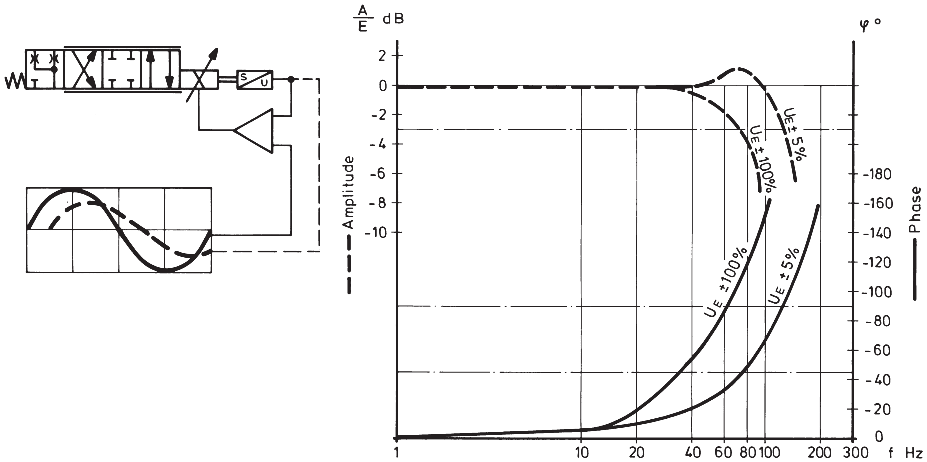




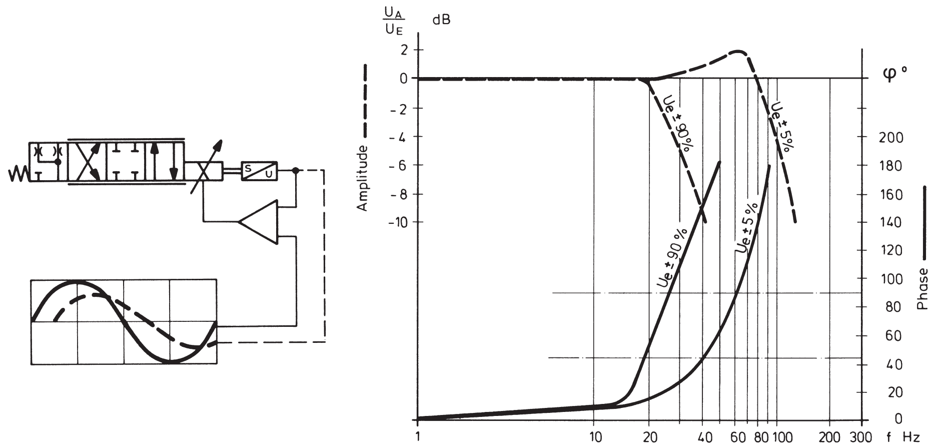
Performance curves (measured with HLP 46, ϑ_{oil} = 40 °C ±5 °C)

Bode diagram

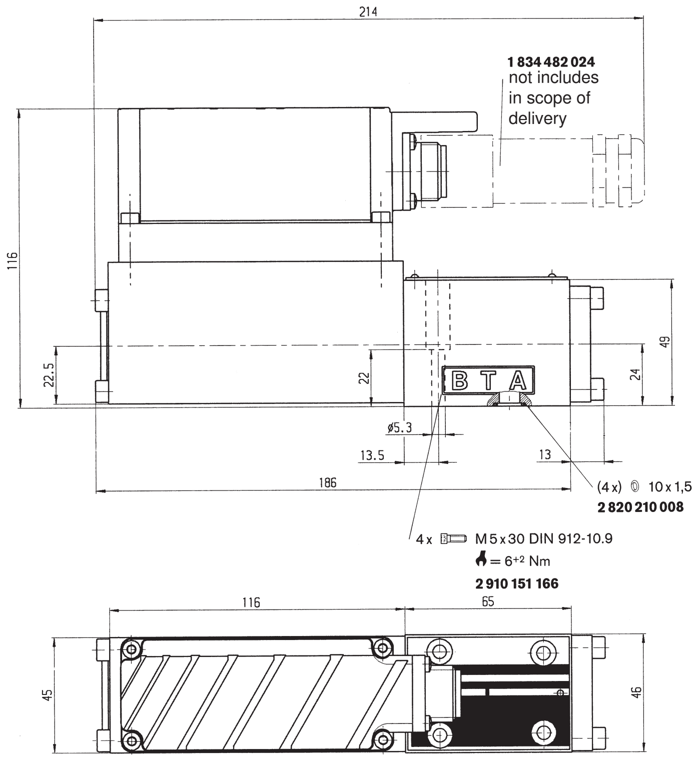
NG6



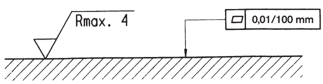
NG10



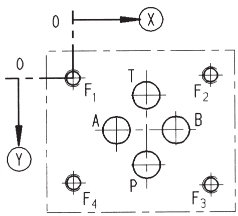
Unit dimensions for NG6 (in mm)



Required surface quality
of valve contact surface



Mounting hole configuration: NG6 (ISO 4401-03-02-0-05)
For subplates, see catalogue section RE 45053



1) Deviates from standard
2) Thread depth:
Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

	P	A	T	B	F_1	F_2	F_3	F_4
X	21.5	12.5	21.5	30.2	0	40.5	40.5	0
Y	25.9	15.5	5.1	15.5	0	–0.75	31.75	31
Ø	8 1)	8 1)	8 1)	8 1)	M5 2)	M5 2)	M5 2)	M5 2)

Notes

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Telefon +49 (0) 93 52 / 18-0
Telefax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

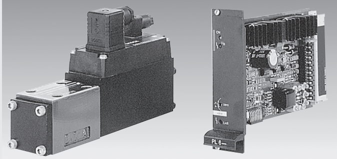
Notes

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Telefon +49 (0) 93 52 / 18-0
Telefax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

Servo solenoid valves with electrical position feedback (Lvdt DC/DC ±10 V)

RE 29028/01.05 1/10
Replaces: 09.03

Type 4WRPH 6



Size 6
Unit series 2X
Maximum working pressure P, A, B 315 bar, T 250 bar
Nominal flow rate 2...40 l/min (Δp 70 bar)

List of contents

Features

- Directly operated servo solenoid valve NG6, with control piston and sleeve in servo quality
- Actuated on one side, 4/4 fail-safe position when switched off
- Control solenoid with integral position feedback and electronics for position transducer (Lvdt DC/DC)
- Suitable for electrohydraulic controllers in production and testing systems
- For subplate attachment, mounting hole configuration to ISO 4401-03-02-0-94
- Subplates as per catalogue section RE 45053 (order separately)
- Line sockets to DIN 43560-AM2
  Solenoid 2P+PE/M16 x 1.5, position transducer 4P/Pg7 in scope of delivery, see catalogue section RE 08008
- External trigger electronics (order separately)
  - Electric amplifier for standard curve "L"
    0 811 405 060, see catalogue section RE 30041
  - Electric amplifier for non-linear curve "P"
    40 % – 0 811 405 065 and 60 % – 0 811 405 066, see catalogue section RE 30040

Variants on request

- For standard applications
- Special symbols for plastic machines
- Sturdy "ruggedized" version for applications up to 40 g, valve with metal cap and central plug (7P).

Ordering data and scope of delivery

4WRP		H	6		B		–2X/G24	Z4/ M	*

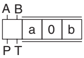
For **external** trigger eletronics **= no desig.**

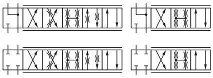
Control piston/sleeve **= H**

Size 6 **= 6**

Symbols

4/4-way version





= C3, C5

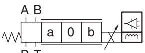
= C4, C1

With symbols C5 and C1: [3]

P → A: q_v B → T: $q_v/2$

P → B: $q_v/2$ A → T: q_v

Side of inductive position tranducer



(Standard) **= B**

[1] Only in connection with flow characteristic “p”

[2] Kink 60 % for NG6 with nominal flow rate “15” and “25”, otherwise kink 40 %

[3] q_v 2:1 only with nominal flow rate = 40 l/min

Further information in plain text

M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

Electronical connection

Z4 = with line socket, with plug to DIN 43560-AM2

Line socket in scope of delivery

Voltage supply of trigger electronics

G24 = +24 V DC

2X = Unit series 20 to 29 (installation and connection dimensions unchanged)

Flow characteristic

L = Linear

P = Non-linear curve [2]

Nominal flow rate at 70 bar valve pressure difference (35 bar /metering notch)

Size 6

02 = 2 l/min

04 = 4 l/min

12 = 12 l/min

15 [1] = 15 l/min

24 = 24 l/min

25 [1] = 25 l/min

40 [3] = 40 l/min

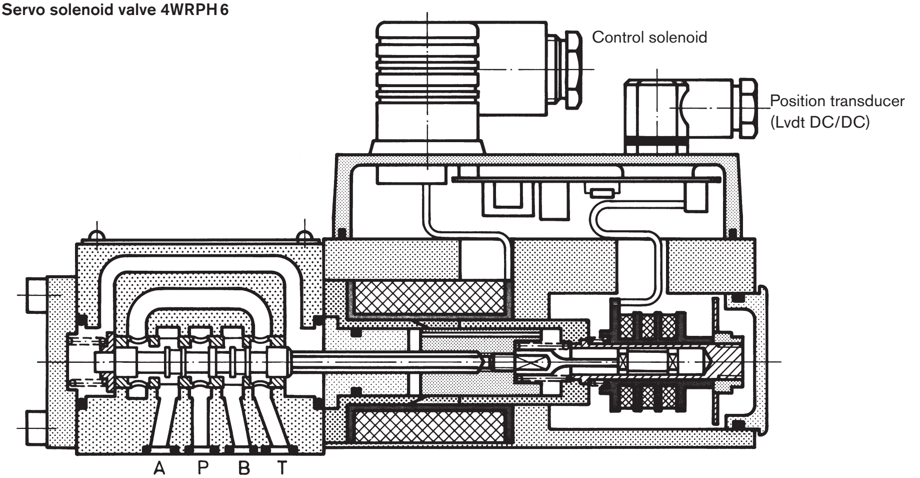
Preferred types (available at short notice)

Type 4WRPH 6	Material no.
C3/C5	
4WRPH 6 C3B02L –2X/G24Z4 /M	**0 811 404 041**
4WRPH 6 C3B04L –2X/G24Z4 /M	**0 811 404 033**
4WRPH 6 C3B12L –2X/G24Z4 /M	**0 811 404 034**
4WRPH 6 C3B24L –2X/G24Z4 /M	**0 811 404 035**
4WRPH 6 C3B40L –2X/G24Z4 /M	**0 811 404 036**
4WRPH 6 C5B40L –2X/G24Z4 /M	**0 811 404 510**
4WRPH 6 C3B15P –2X/G24Z4 /M	**0 811 404 047**
4WRPH 6 C3B25P –2X/G24Z4 /M	**0 811 404 043**
4WRPH 6 C3B40P –2X/G24Z4 /M	**0 811 404 044**
4WRPH 6 C5B40P –2X/G24Z4 /M	**0 811 404 511**

Type 4WRPH 6	Material no.
C1/C4	
4WRPH 6 C4B02L –2X/G24Z4 /M	**0 811 404 512**
4WRPH 6 C4B04L –2X/G24Z4 /M	**0 811 404 160**
4WRPH 6 C4B12L –2X/G24Z4 /M	**0 811 404 037**
4WRPH 6 C4B24L –2X/G24Z4 /M	**0 811 404 038**
4WRPH 6 C4B40L –2X/G24Z4 /M	**0 811 404 039**
4WRPH 6 C1B40L –2X/G24Z4 /M	**0 811 404 513**
4WRPH 6 C4B15P –2X/G24Z4 /M	**0 811 404 048**
4WRPH 6 C4B25P –2X/G24Z4 /M	**0 811 404 045**
4WRPH 6 C4B40P –2X/G24Z4 /M	**0 811 404 046**
4WRPH 6 C1B40P –2X/G24Z4 /M	**0 811 404 162**

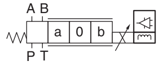
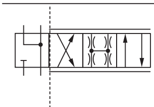
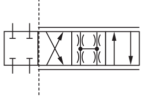
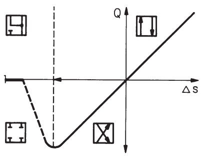
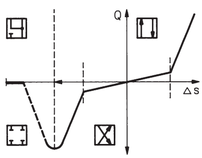
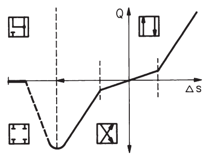
Function, sectional diagram

Servo solenoid valve 4WRPH 6

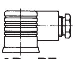
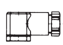


Valve body Control solenoid with position transducer

Symbols

	Linear	p: kink 60 % [q_n 15,25 l/min]	p: kink 40 % [q_n 40 l/min]
C3, C5  **C4, C1** 			
	C3, C5, C4, C1		
	Standard = 1:1, from q_n 40 l/min also 2:1		

Accessories, not included in scope of delivery

(4 x) M5 x 30 DIN 912–10.9	Fastening screws	**2 910 151 166**
 	VT-VRRA1-527-20 / V0, see RE 30041	**0 811 405 060**
	VT-VRRA1-527-20 / V0 / K60-AGC, see RE 30040	**0 811 405 066**
	VT-VRRA1-527-20 / V0 / K40-AGC, see RE 30040	**0 811 405 065**
 2P + PE  4P	2P + PE (M16 x 1.5) and 4P (Pg7) included in scope of delivery, see also RE 08008	

Application
– Valve amplifier with pressure compensator (p/Q), see RE 30058.

Testing and service equipment

– Test box type VT-PE-TB2, see RE 30064.
– Test adapter type VT-PA-3, see RE 30070.

Technical Data

General

Construction		Spool type valve, operated directly, with steel sleeve
Actuation		Proportional solenoid with position control, external amplifier
Type of mounting		Subplate, mounting hole configuration NG6 (ISO 4401-03-02-0-94)
Installation position		Optional
Ambient temperature range	°C	–20 … +50
Weight	kg	2.3
Vibration resistance, test condition		Max. 25 g, shaken in 3 dimensions (24 h)

Hydraulic (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Pressure fluid		Hydraulic oil to DIN 51524 … 535, other fluids after prior consultation					
Viscosity range recommended	mm²/s	20 … 100					
Viscosity range max. permitted	mm²/s	10 … 800					
Pressure fluid temperature range	°C	–20 … +80					
Maximum permissible degree of contamination of pressure fluid Purity class to ISO 4406 (c)		Class 18/16/13[1)]					
Flow direction		See symbol					
Nominal flow at $\Delta p = 35$ bar per notch[2)]	l/min	2	4	12	15	24	40
Max. working pressure	bar	Port P, A, B: 315					
Max. pressure	bar	Port T: 250					
Operating limits at Δp Pressure drop at valve $q_{Vnom}: > q_N$ valves	bar	315	315	315	315	315	160
	bar	315	315	315	280	250	100
Leakage at 100 bar	cm³/min	<150	<180	<300	–	<500	<900
	cm³/min	–	–	–	<180	<300	< 450

Electrical

Cyclic duration factor	%	100 ED
Power supply		24 V_{nom} (external amplifier)
Degree of protection		IP 65 to DIN 40050
Solenoid connector		Connector DIN 43650/ISO 4400 M16 x 1.5 (2P + PE)
Position transducer connector		Special Connector Pg7 (4P)
Max. solenoid current	A	2.7
Coil restistance R_{20}	Ω	2.5
Max. power consumption at 100 % load and operational temperature	VA	40
Position transducer DC/DC technology		Supply: +15 V/35 mA, –15 V/35 mA; Signal: 0...±10 V ($R_L \geqq 10$ kΩ)

Static/Dynamic

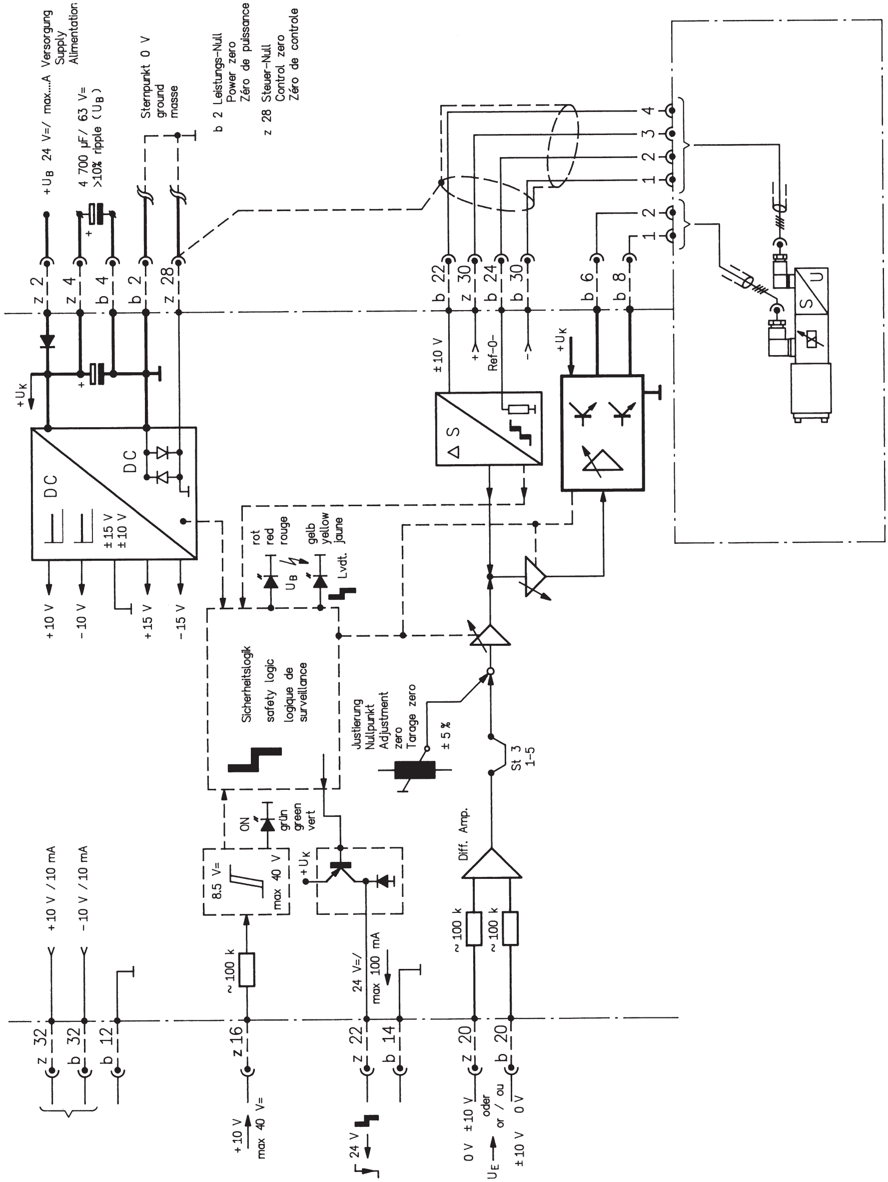
Hysteresis	%	$\leqq 0.2$
Manufacturing tolerance for $q_{max.}$	%	< 10
Response time for signal change 0 … 100 %	ms	< 10
Thermal drift		Zero point displacement <1 % at $\Delta T = 40\,°C$

1) The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of components. For a selection of filters, see catalogue sections RE 50070, RE 50076 and RE 50081.

2) Flow rate at a different Δp $$q_x = q_{nom} \cdot \sqrt{\frac{\Delta p_x}{35}}$$

Valve with external trigger electronics (standard linear curve: L)

Block diagram/pin assignment

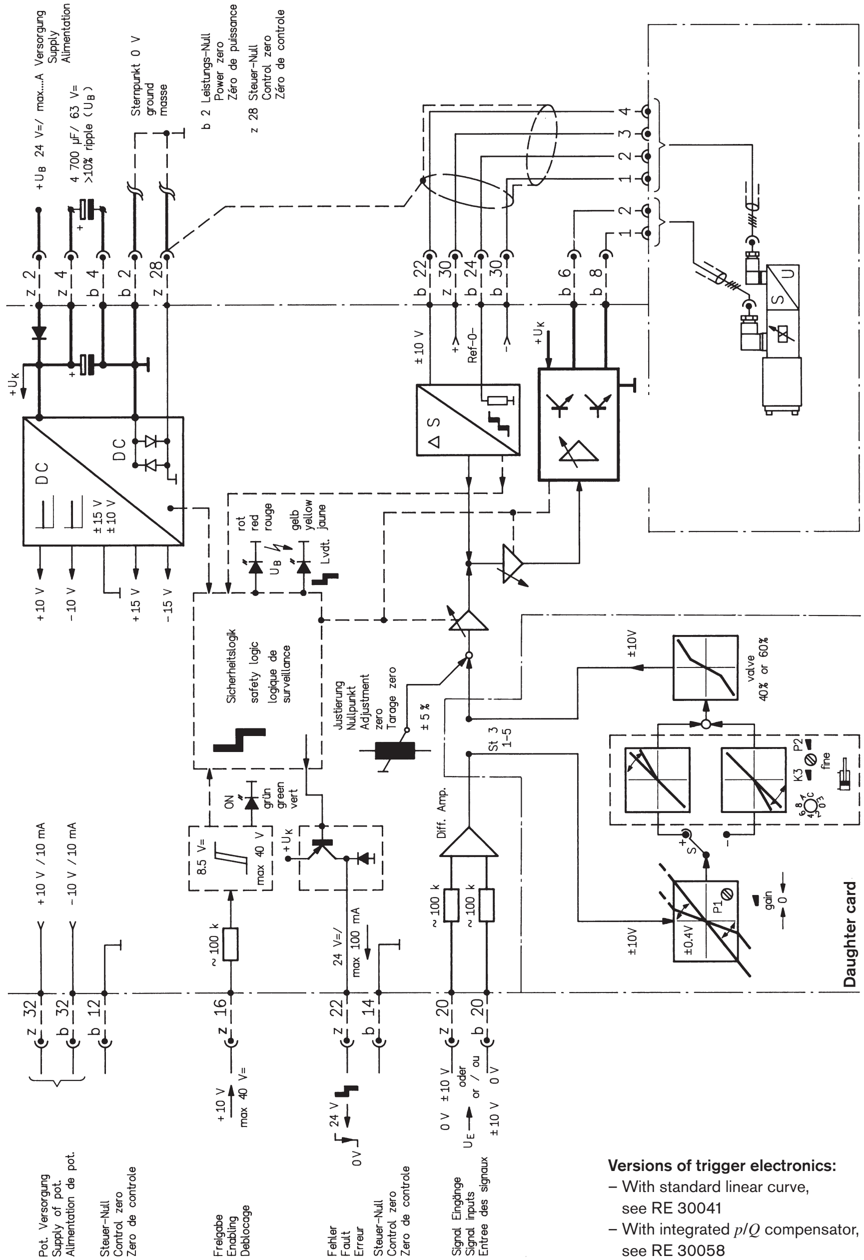


Versions of trigger electronics:
- With non-linear curve and surface area compensation, see RE 30040
- With integrated p/Q compensator, see RE 30058

5

Valve with external trigger electronics (non-linear curve: P)

Block diagram/pin assignment



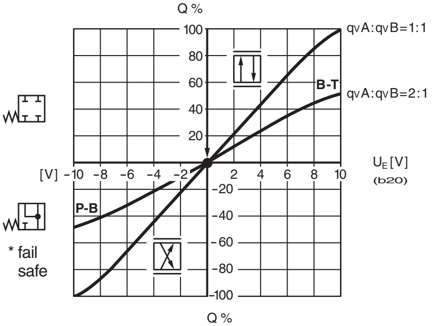
Versions of trigger electronics:

- With standard linear curve, see RE 30041
- With integrated *p*/*Q* compensator, see RE 30058

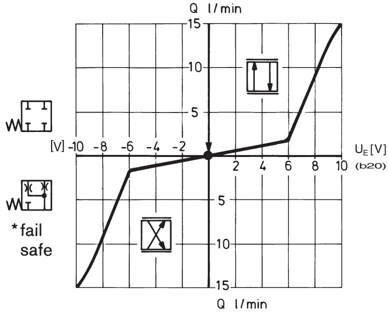
Performance curves (measured with HLP46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Flow rate/Signal function $Q = f\,(U_E)$

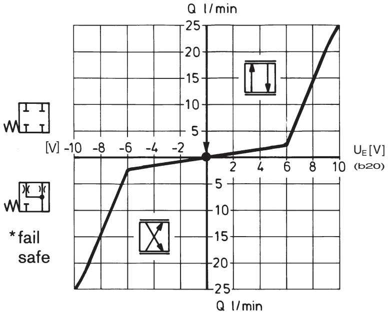
L: Linear



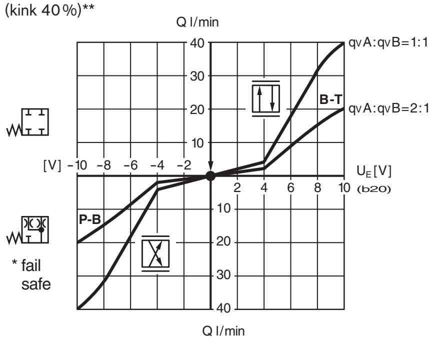
P: (kink 60 %)**



P: (kink 60 %)

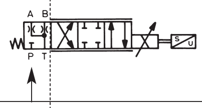
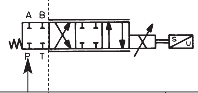


P: (kink 40 %)**



*Fail-safe when enabling is not released.
**Q-kink = 10 % Q_N.

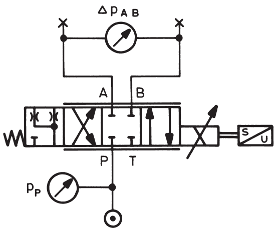
Fail-safe position

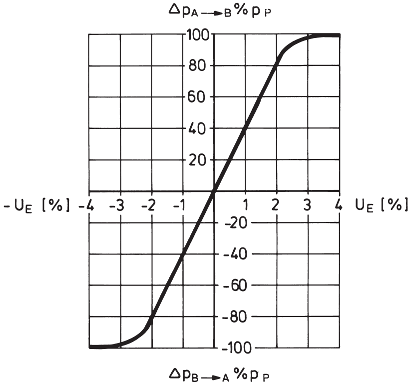
	Leakage at	100 bar	P–A P–B	50 cm³/min 70 cm³/min
	Flow rate at	Δp = 35 bar	A–T B–T	10 … 20 l/min 7 … 20 l/min
	Leakage at	100 bar	P–A P–B A–T B–T	50 cm³/min 70 cm³/min 70 cm³/min 50 cm³/min

Fail-safe	p = 0 bar → 7 ms	Enable off
	p = 100 bar → 10 ms	

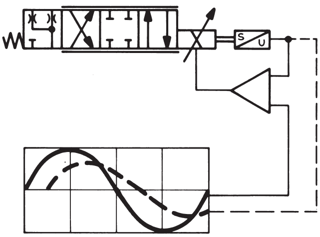
Performance curves (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

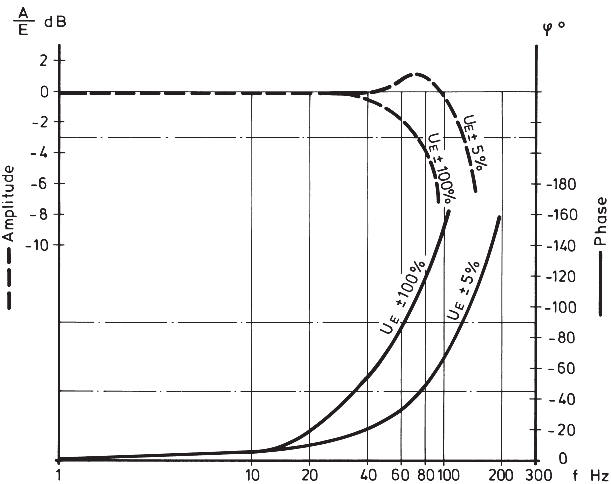
Pressure gain



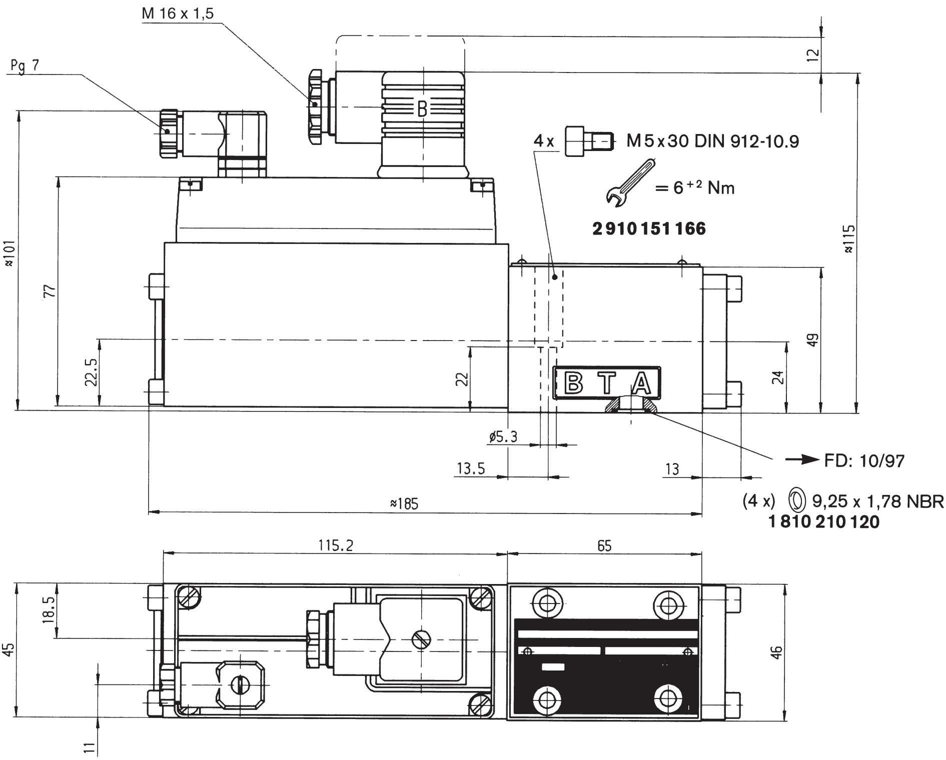


Bode diagram

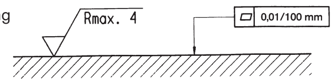




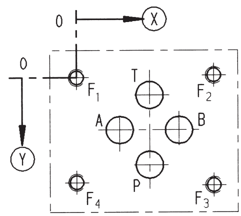
Unit dimensions (nominal dimensions in mm)



Required surface quality of mating component



Mounting hole configuration: NG6 (ISO 4401-03-02-0-94)
For subplates, see catalogue section RE 45053



1) Deviates from standard
2) Thread depth:
Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

	P	A	T	B	F_1	F_2	F_3	F_4
Ⓧ	21.5	12.5	21.5	30.2	0	40.5	40.5	0
Ⓨ	25.9	15.5	5.1	15.5	0	–0.75	31.75	31
∅	8 1)	8 1)	8 1)	8 1)	M5 2)	M5 2)	M5 2)	M5 2)

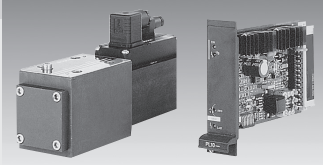
Notes

Bosch Rexroth AG
Industrial Hydraulics
Zum Eisengießer 1
D-97816 Lohr am Main, Germany
Telefon +49 (0) 93 52 / 18-0
Telefax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

Servo solenoid valves with electrical position feedback (Lvdt DC/DC ±10 V)

RE 29032/01.05
Replaces: 09.03

Type 4WRPH 10



Size 10
Unit series 2X
Maximum working pressure P, A, B 315 bar, T 250 bar
Nominal flow rate 50...100 l/min (Δp 70 bar)

List of contents

Features

– Directly operated servo solenoid valve NG10, with control piston and sleeve in servo quality
– Actuated on one side, 4/4 fail-safe position when switched off
– Control solenoid with integral position feedback and electronics for position transducer (Lvdt DC/DC)
– Suitable for electrohydraulic controllers in production and testing systems
– For subplate attachment, mounting hole configuration to ISO 4401-05-04-0-94
– Subplates as per catalogue section RE 45055 (order separately)
– Line sockets to DIN 43560-AM2
Solenoid 2P+PE/M16 x 1.5, position transducer 4P/Pg7 in scope of delivery, see catalogue section RE 08008
– External trigger electronics (order separately)
 ● Electric amplifier for standard curve "L"
 0 811 405 061, see catalogue section RE 30041
 ● Electric amplifier for non-linear curve "P"
 40 % – 0 811 405 067, see catalogue section RE 30040

Variants on request

– For standard applications
– Special symbols for plastic injection-moulding machines
– Sturdy "ruggedized" version for applications up to 40 g, valve with metal cap and central plug (7P).

Ordering data and scope of delivery

4WRP		H	10		B			– 2X	/ G24	Z4 / M	*

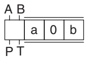
For **external** trigger electronics = **no desig.**

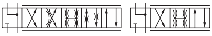
Control piston/sleeve = **H**

Size 10 = **10**

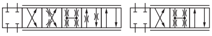
Symbols

4/4-way version





= **C3, C5**



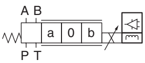
= **C4, C1**

With symbols C5 and C1:

P → A: q_v B → T: $q_v/2$

P → B: $q_v/2$ A → T: q_v

Side of inductive position transducer



(Standard) = **B**

Further information in plain text

M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

Electrical connection

Z4 = with line socket, with plug to DIN 43560-AM2

Line socket included in scope of delivery

Voltage supply of trigger electronics

G24 = +24 V DC

2X = Unit series 20 to 29 (installation and connection dimensions unchanged)

Flow characteristic

L = Linear

P = Non-linear curve

Nominal flow rate at 70 bar valve pressure difference (35 bar/metering notch)

Size 10

50 = 50 l/min

100 = 100 l/min

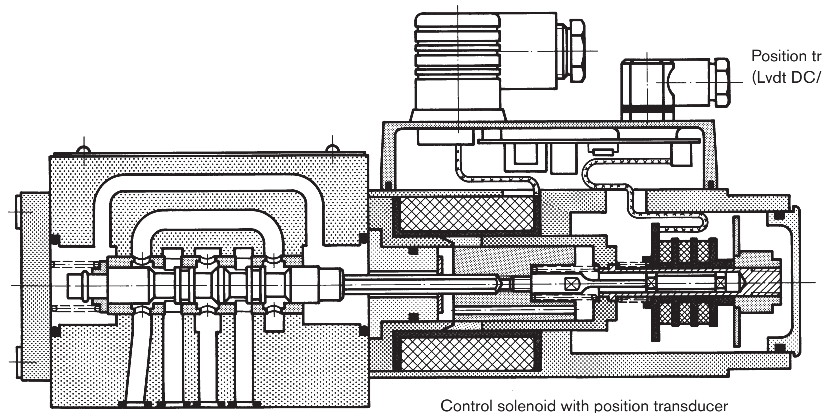
Preferred types (available at short notice)

Type 4WRPH 10	Material No.
C3/C5	
4WRPH 10 C3B50L –2X/G24Z4 /M	**0 811 404 058**
4WRPH 10 C3B100L –2X/G24Z4 /M	**0 811 404 059**
4WRPH 10 C5B100L –2X/G24Z4 /M	**0 811 404 077**
4WRPH 10 C3B50P –2X/G24Z4 /M	**0 811 404 062**
4WRPH 10 C3B100P –2X/G24Z4 /M	**0 811 404 063**
4WRPH 10 C5B100P –2X/G24Z4 /M	**0 811 404 079**

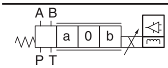
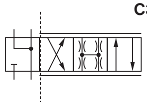
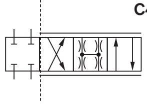
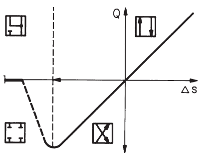
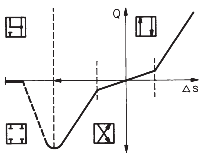
Type 4WRPH 10	Material No.
C1/C4	
4WRPH 10 C4B50L –2X/G24Z4 /M	**0 811 404 060**
4WRPH 10 C4B100L –2X/G24Z4 /M	**0 811 404 061**
4WRPH 10 C1B100L –2X/G24Z4 /M	**0 811 404 076**
4WRPH 10 C4B50P –2X/G24Z4 /M	**0 811 404 064**
4WRPH 10 C4B100P –2X/G24Z4 /M	**0 811 404 065**
4WRPH 10 C1B50P –2X/G24Z4 /M	**0 811 404 067**
4WRPH 10 C1B100P –2X/G24Z4 /M	**0 811 404 078**

Function, sectional diagram

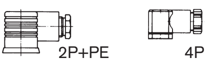
Servo solenoid valve 4WRPH 10



Symbols

	Linear	p: kink 40 %
C3, C5  C4, C1 		
	C3, C4, C5, C1	

Accessories, not included in scope of delivery

(4 x) M6 x 40 DIN 912–10.9	Fastening screws	**2 910 151 209**
	VT-VRRA1-537-20 / V0, see RE 30041	**0 811 405 061**
	VT-VRRA1-537-20 / V0 / K40-AGC, see RE 30040	**0 811 405 067**
 2P+PE 4P	Line sockets 2P+PE (M16 x 1.5) and 4P (Pg7) included in scope of delivery, see also RE 08008	

Application
– Valve amplifier with pressure compensator (p/Q), see RE 30058.

Testing and service equipment

– Test box type VT-PE-TB2, see RE 30064.
– Test adapter type VT-PA-3, see RE 30070.

Technical data

General

Construction		Spool type valve, operated directly, with steel sleeve
Actuation		Proportional solenoid with position control, external amplifier
Type of mounting		Subplate, mounting hole configuration NG10 (ISO 4401-05-04-0-94)
Installation position		Optional
Ambient temperature range	°C	–20 … +50
Weight	kg	6.8
Vibration resistance, test condition		Max. 25 g, shaken in 3 dimensions (24 h)

Hydraulic (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Pressure fluid		Hydraulic oil to DIN 51524 … 535, other fluids after prior consultation			
Viscosity range recommended	mm²/s	20 … 100			
Viscosity range max. permitted	mm²/s	10 … 800			
Pressure fluid temperature range	°C	–20 … +80			
Maximum permissible degree of contamination of pressure fluid Purity class to ISO 4406 (c)		Class 18/16/13 [1]			
Flow direction		See symbol			
Nominal flow at $\Delta p = 35$ bar per notch [2]	l/min	50 (1:1)	50 (2:1)	100 (1:1)	100 (2:1)
Max. working pressure	bar	Port P, A, B: 315			
Max. pressure	bar	Port T: 250			
Operating limits at Δp Pressure drop at valve	bar	315	315	160	160
q_{Vnom}: $> q_N$ valves	bar	250	250	100	100
Leakage at 100 bar	cm³/min	<1200	<1200	<1500	<1000
	cm³/min	<600	<500	<600	<600

Electrical

Cyclic duration factor	%	100	
Power supply		24 V_{nom} (external amplifier)	
Degree of protection		IP 65 to DIN 40050	
Solenoid connector		Connector DIN 43650/ISO 4400 M16 x 1.5 (2P+PE)	
Position transducer connector		Connector Pg7 (4P)	
Max. solenoid current	A	3.7	
Coil resistance R_{20}	Ω	2.4	
Max. power consumption at 100 % load and operational temperature	VA	60	
Position transducer DC/DC technology		Supply: +15 V/35 mA –15 V/25 mA	Signal: 0...±10 V ($R_L \geqq 10$ kΩ)

Static/Dynamic

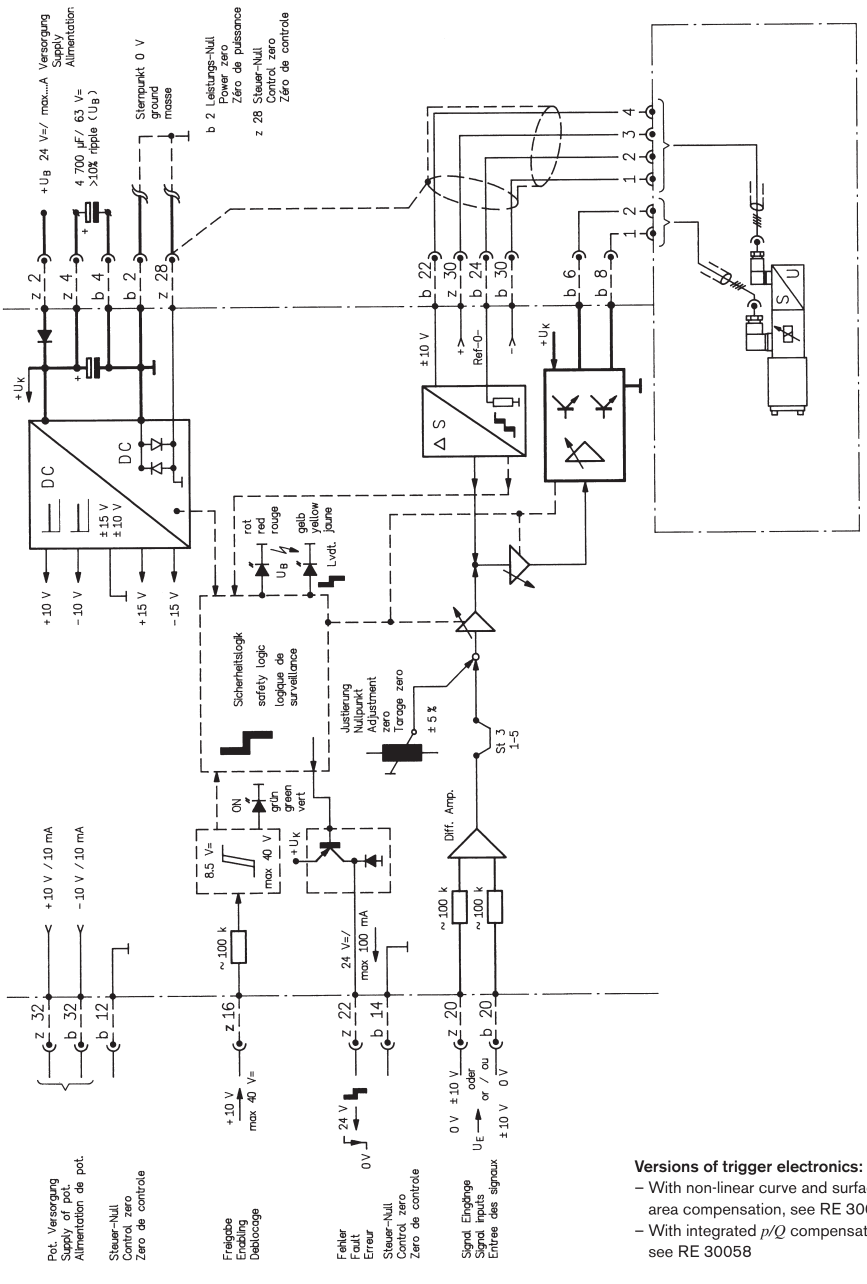
Hysteresis	%	$\leqq 0.2$
Manufacturing tolerance for $q_{max.}$	%	< 10
Response time for signal change 0 … 100 %	ms	< 25
Thermal drift		Zero point displacement <1 % at $\Delta T = 40\,°C$

[1] The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of components. For a selection of filters, see catalogue sections RE 50070, RE 50076 and RE 50081.

[2] Flow rate at a different Δp $\quad q_x = q_{nom} \cdot \sqrt{\dfrac{\Delta p_x}{35}}$

Valve with external trigger electronics (standard linear curve: L)

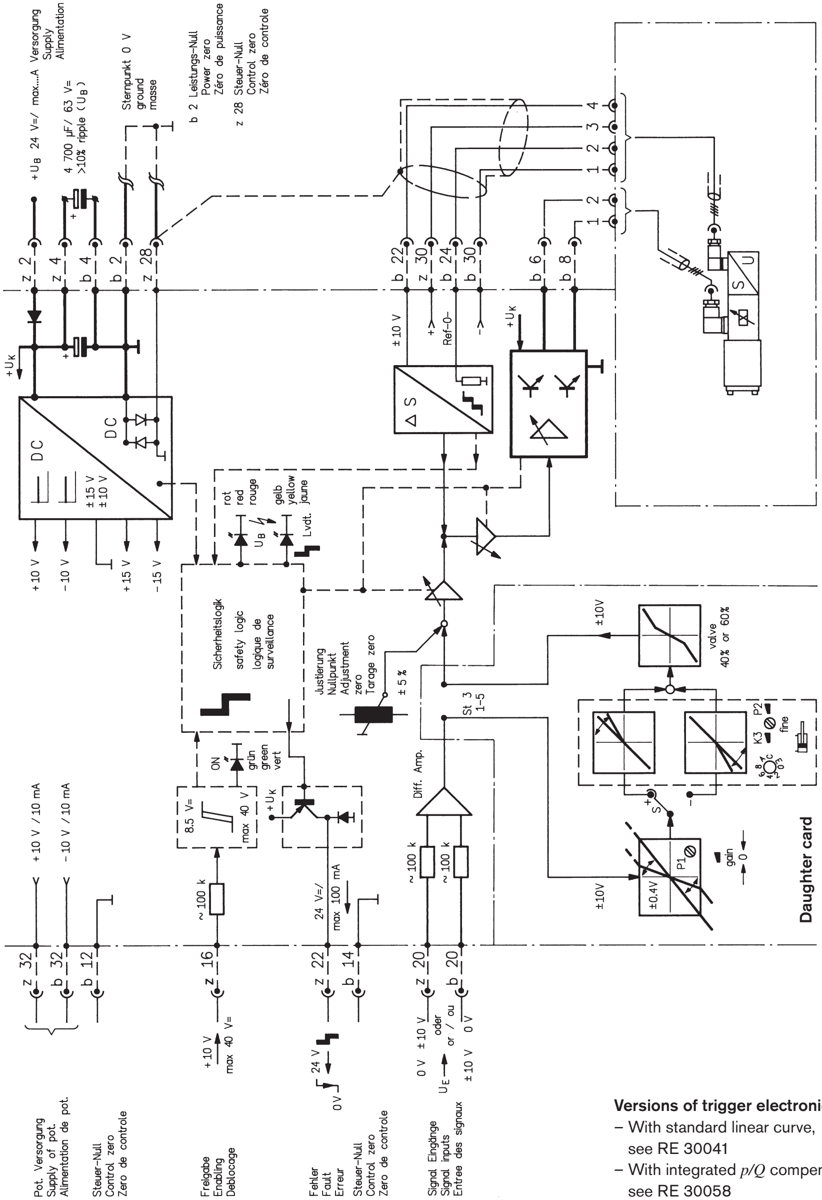
Block diagram/pin assignment



Versions of trigger electronics:
- With non-linear curve and surface area compensation, see RE 30040
- With integrated *p/Q* compensator, see RE 30058

Valve with external trigger electronics (standard non-linear curve: P)

Block diagram/pin assignment



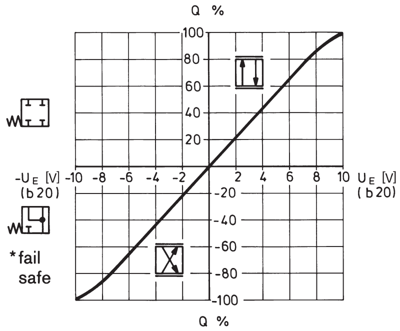
Versions of trigger electronics:

- With standard linear curve, see RE 30041
- With integrated *p/Q* compensator, see RE 30058

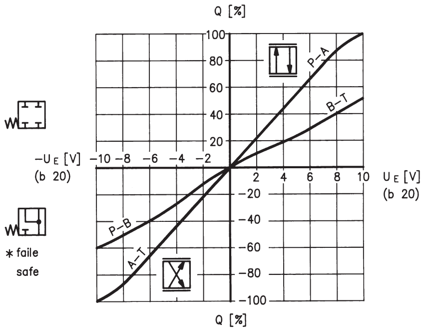
Performance curves (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Flow rate/Signal function $Q = f(U_E)$

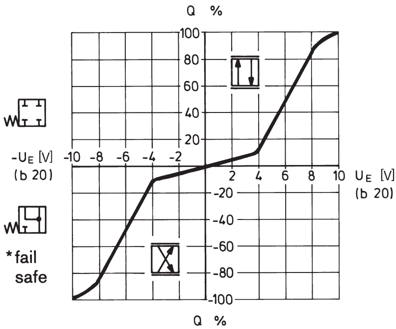
L: Linear



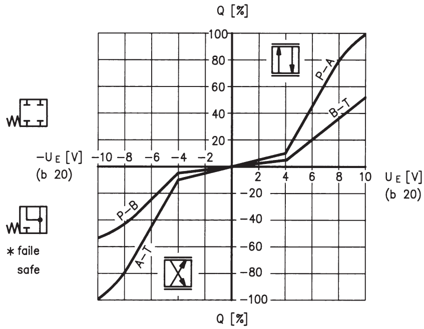
L: (linear) 2:1



P: (kink 40 %)**

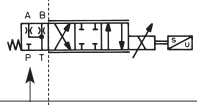
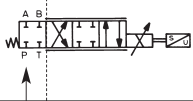
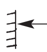


P: (kink 40 %) 2:1**



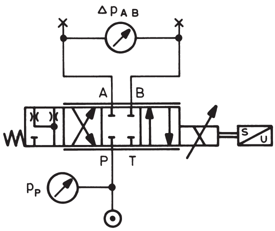
*Fail-safe when enabling is not released.
**Q_N-kink = 10 % Q_N.

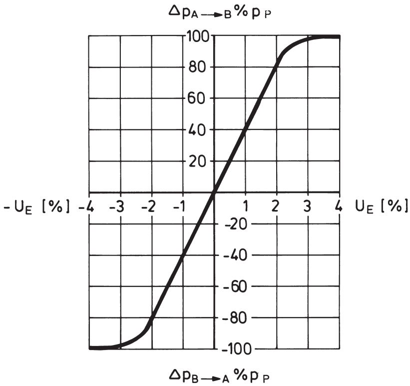
Fail-safe position

	Leakage at	100 bar	P–A P–B	50 cm^3/min 70 cm^3/min
	Flow at	Δp = 35 bar q_N 50/100 l/min	A–T B–T	10 … 100 l/min 10 … 25 l/min
	Leakage at	100 bar	P–A P–B A–T B–T	50 cm^3/min 70 cm^3/min 70 cm^3/min 50 cm^3/min
 Fail-safe	p = 0 bar → 12 ms p = 100 bar → 16 ms	Enable off		

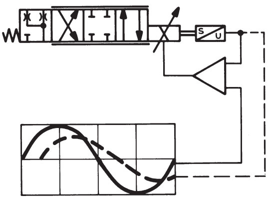
Performance curves (measured with HLP46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

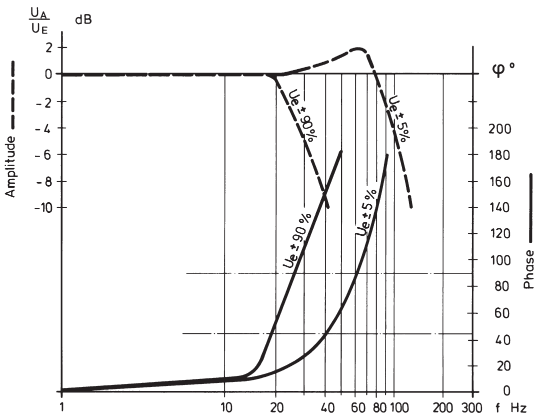
Pressure gain



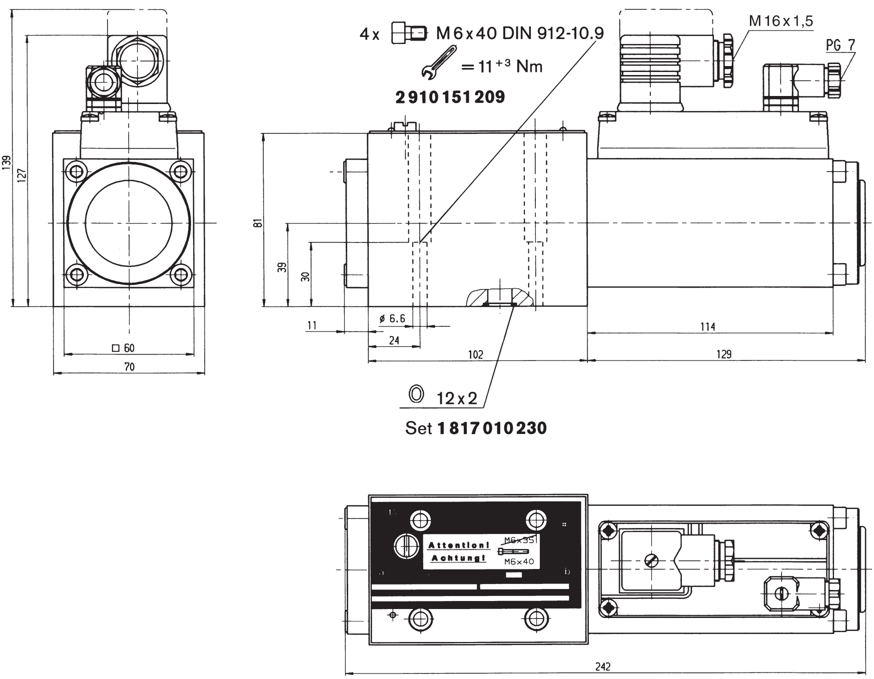


Bode diagram

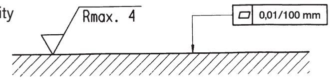




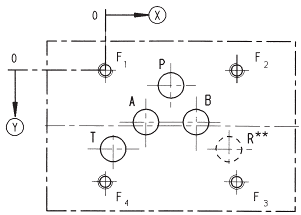
Unit dimensions (nominal dimensions in mm)



Required surface quality
of mating component



Mounting hole configuration: NG10
(ISO 4401-05-04-0-94)
For subplates, see catalogue section
RE 45055



[1] Deviates from standard
[2] Thread depth:
Ferrous metal 1.5 x Ø*
Non-ferrous 2 x Ø
* (NG10 min. 10.5 mm)

** 5/3 – NG10
R = P_2

	P	A	T	B	F_1	F_2	F_3	F_4	R
Ⓧ	27	16.7	3.2	37.3	0	54	54	0	50.8
Ⓨ	6.3	21.4	32.5	21.4	0	0	46	46	32.5
Ø	10.5 [1]	10.5 [1]	10.5 [1]	10.5 [1]	M6 [2]	M6 [2]	M6 [2]	M6 [2]	10.5 [1]

Notes

Bosch Rexroth AG
Industrial Hydraulics
Zum Eisengießer 1
D-97816 Lohr am Main, Germany
Telefon +49 (0) 93 52 / 18-0
Telefax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

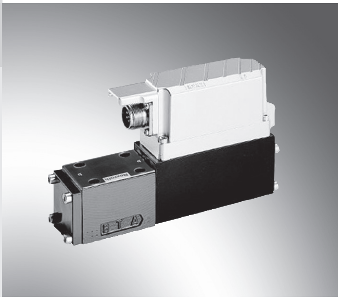
Rexroth
Bosch Group

4/4-way servo solenoid directional control valves, directly operated, with electrical position feedback and on-board electronics (OBE)

RE 29035/10.10
Replaces: 05.10

Type 4WRPEH6

Size 6
Unit series 2X
Maximum working pressure P, A, B 315 bar, T 250 bar
Nominal flow 2...40 l/min (Δ*p* 70 bar)



Type 4WRPEH6

List of contents

Features

- Directly operated servo solenoid directional control valve, with control piston and sleeve in servo quality
- Actuated on one side, 4/4 fail-safe position when switched off
- Electrical position feedback and on-board electronics (OBE), calibrated at the factory
- Electrical connection 6P+PE
  Signal input differential amplifier with interface A1 ±10 V or interface F1 4...20 mA (*R*sh = 200 Ω)
- Used in electrohydraulic controllers in production and testing systems

For information regarding the available spare parts see:
www.boschrexroth.com/spc

Ordering data

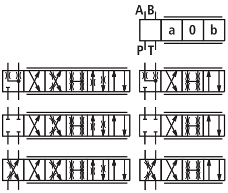
4WRP	E	H	6		B		–2X/	G24	K0/		M	*

With **on-board** electronics = **E**

Control piston/sleeve = **H**

Size = **6**

Control spool symbols
4/4-way version



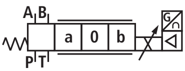
= **C3, C5**

= **C4, C1**

= **C**

With C5 and C1: 3)
P → A: Q_v B → T: $Q_v/2$
P → B: $Q_v/2$ A → T: Q_v

Assembly side of inductive position transducer



(Standard) = **B**

Further information in plain text

Seal material
M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

Interface for trigger electronics
A1 = Setpoint input ±10 V
F1 = Setpoint input 4…20 mA

Electrical connection
K0 = **without** plug-in connector, with plug to DIN 43563-AM6
Order plug-in connector separately

Voltage supply of trigger electronics
G24 = +24 V DC

2X = Unit series 20 to 29 (installation and connection dimensions unchanged)

Flow characteristic
L = Linear
P = Non-linear curve 2)

Nominal flow rate
at 70 bar valve pressure difference (35 bar per metering notch)
02 = 2 l/min 4)
04 = 4 l/min
12 = 12 l/min 5)
15 = 15 l/min 1)
24 = 24 l/min 5)
25 = 25 l/min 1)
40 = 40 l/min 3)

1) Only in connection with flow characteristic “P”
2) Kink 60 % for NG6 with nominal flow rate “15” and “25”, otherwise kink 40 %
3) Q_v 2:1 only with nominal flow rate = 40 l/min
4) Not in connection with flow characteristic “P”
5) Only in connection with flow characteristic “L”

Function, sectional diagram

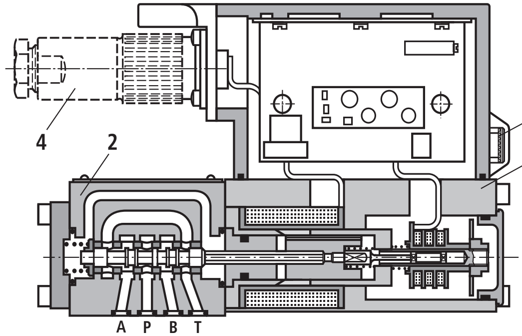
General

In the field of integrated electronics, the specified command value is compared with the actual position value. In case of deviations from the standard, the lifting solenoid is activated. Due to the changed magnetic force, the lifting solenoid adjusts the control valve against the spring.
Lifting/control cross-section are adjusted proportionally to the command value. In case of a command value provision of 0 V, the electronics adjusts the control valve against the spring to center position. In deactivated condition, the spring is unloaded to a maximum and the valve is in fail-safe position.

Switch-off behavior

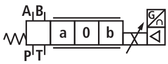
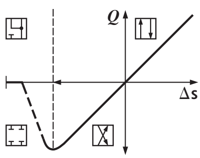
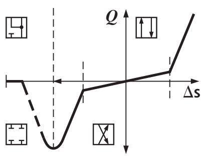
If the electronics is switched off, the valve immediately moves to the secured basic position (fail safe).

In this process, the P-B/A-T position is passed which might cause movements at the controlled component. This must be taken into account when designing the plant.



1 Control solenoid with position transducer
2 Valve body
3 Plug for possible 2nd stage
4 Plug in connector

Symbols

	L: Linear	P: kink
 C3, C5  C4, C1  C		

Testing and service equipment

– Service case type VT-VETSY-1 with test device, see data sheet 29685
– Measuring adapter 6P+PE type VT-PA-2, see data sheet 30068

Technical data

General

Construction		Spool-type valve, directly operated, with steel sleeve
Actuation		Control solenoid with position control, OBE
Type of mounting		Subplate, mounting hole configuration (ISO 4401-03-02-0-05)
Installation position		Optional
Ambient temperature range	°C	–20...+50
Weight	kg	2.7
Vibration resistance, test condition		Max. 25 *g*, shaken in 3 dimensions (24 h)

Hydraulic (measured with HLP 46, ϑ_{oil} = 40 °C ±5 °C)

Pressure fluid			Hydraulic oil to DIN 51524...535, other fluids after prior consultation						
Viscosity range	recommended	mm^2/s	20...100						
	max. permitted	mm^2/s	10...800						
Pressure fluid temperature range		°C	–20...+70						
Maximum permissible degree of contamination of pressure fluid Purity class to ISO 4406 (c)			Class 18/16/13 [1]						
Direction of flow			See symbol						
Nominal flow at Δp = 35 bar per notch [2]		l/min	2	4	12	15	24	40
Max. working pressure	Ports P, A, B	bar	315						
	Port T	bar	250						
Operating limits at Δp Pressure drop at valve	C, C3, C5	bar	315	315	315	315	315	160
Q_{Vnom}: > Q_N valves	C4, C1	bar	315	315	315	280	250	100
Max. recommended nominal flow at 100 bar	Linear characteristic curve L	cm^3/min	< 150	< 180	< 300	–	< 500	< 900
	Inflected characteristic curve P	cm^3/min	–	–	–	< 180	< 300	< 450

Fail-safe position

C Flow at Δp = 35 bar per notch	l/min	2	4	10	13	18	20
C3, C5 Zero flow at 100 bar	cm^3/min	50 P–A					
	cm^3/min	70 P–B					
C3, C5 Flow at Δp = 35 bar per notch	l/min	10...20 A–T					
	l/min	7...20 B–T					
C4, C1 Zero flow at 100 bar	cm^3/min	50 P–A					
	cm^3/min	70 P–B					
	cm^3/min	70 A–T					
	cm^3/min	50 B–T					
Fail-safe position reached	0 bar	7 ms					
	100 bar	10 ms					

Static/Dynamic

Hysteresis	%	≦ 0,2
Manufacturing tolerance for Q_{max}	%	< 10
Response time for signal change 0...100 %	ms	≦ 10
Thermal drift		Zero point displacement < 1 % at ΔT = 40 °C
Zero adjustment		Factory-set ±1 %

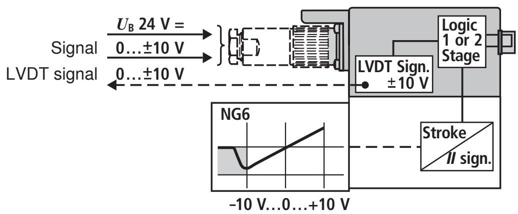
[1] The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of components. For a selection of filters, see www.boschrexroth.com/filter.

[2] Flow rate at a different Δp $Q_x = Q_{nom} \cdot \sqrt{\frac{\Delta p_x}{35}}$

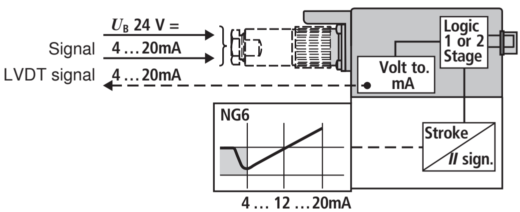
Technical data

Electrical, trigger electronics integrated in the valve		
Cyclic duration factor	%	100
Degree of protection		IP 65 to DIN 40050 and IEC 14434/5
Connection		Plug-in connector 6P+PE, DIN 43563
Power supply Terminal A: Terminal B: 0 V		24 V DC_{nom} Min. 21 V DC/max. 40 V DC Ripple max. 2 V DC
Max. power consumption		40 VA
External fuse		2.5 A_F
Input, version A1 Terminal D: U_E Terminal E:		Differential amplifier, R_i = 100 kΩ 0...±10 V 0 V
Input, version F1 Terminal D: $I_{D–E}$ Terminal E: $I_{D–E}$		Burden, *R*sh = 200 Ω 4...(12)...20 mA Current loop $I_{D–E}$ feedback
Max. differential input voltage at 0 V		D → B E → B } max. 18 V=
Test signal, version A1 Terminal F: U_{Test} Terminal C:		LVDT 0...+10 V Reference 0 V
Test signal, version F1 Terminal F: $I_{F–C}$ Terminal C: $I_{F–C}$		LVDT signal 4...20 mA at external load 200...500 Ω max. 4...20 mA output Current loop $I_{F–C}$ feedback
Protective conductor and screen		See pin assignment (CE-compliant installation)
Calibration		Calibrated at the factory, see characteristic curve of the valve
Electromagnetic compatibility tested according to		EN 61000-6-2: 2005-08 EN 61000-6-3: 2007-01

Version A1:
Standard



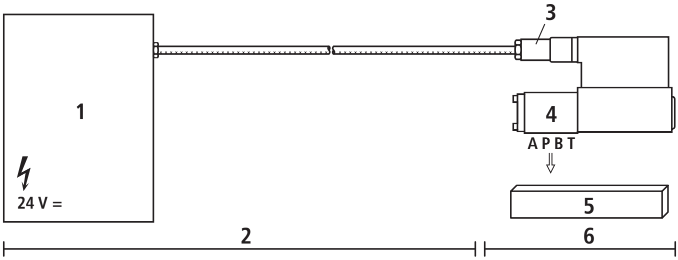
Version F1:
mA signal



5

Electric connection

For electrical data, see page 5



1 Control
2 Provided by customer
3 Plug-in connector
4 Valve
5 Connecting surface
6 Provided by Rexroth

Technical notes on the cable

Version: – Multi-wire cable
– Extra-finely stranded wire to VDE 0295, Class 6
– Protective conductor, green/yellow
– Cu braided screen

Types: – e.g. Ölflex-FD 855 CP (from Lappkabel company)

No. of wires: – Determined by type of valve, plug types and signal assignment

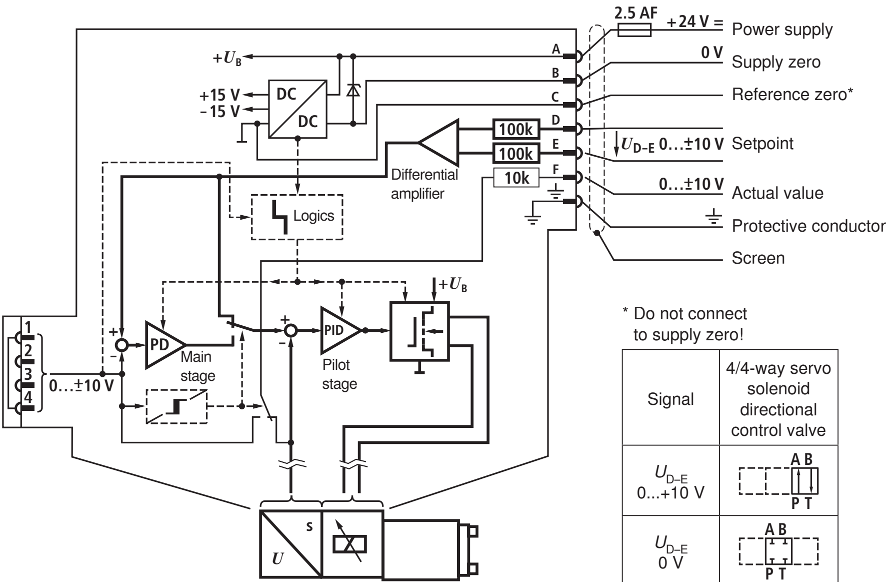
Cable Ø: – 0.75 mm^2 to 20 m length
1.0 mm^2 to 40 m length

Outside Ø: – 9.4...11.8 mm – Pg11
12.7...13.5 mm – Pg16

Note
Voltage supply 24 V DC_{nom},
if voltage drops below 18 V DC, rapid shutdown resembling "Enable OFF" takes place internally.
In addition, with F1 version:
$I_{D-E} \geqq 3$ mA – valve is active
$I_{D-E} \leqq 2$ mA – valve is deactivated.
Electrical signals emitted via the trigger electronics (e.g. actual values) must not be used to shut down safety-relevant machine functions! (See European Standard, "Technical Safety Requirements for Fluid-Powered Systems and Components – Hydraulics", EN 982.)

On-board electronics

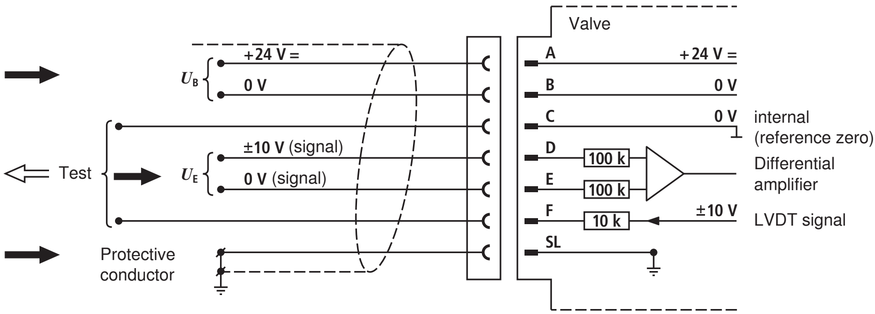
Block diagram/pin assignment
Version A1: U_{D-E} ±10 V



* Do not connect to supply zero!

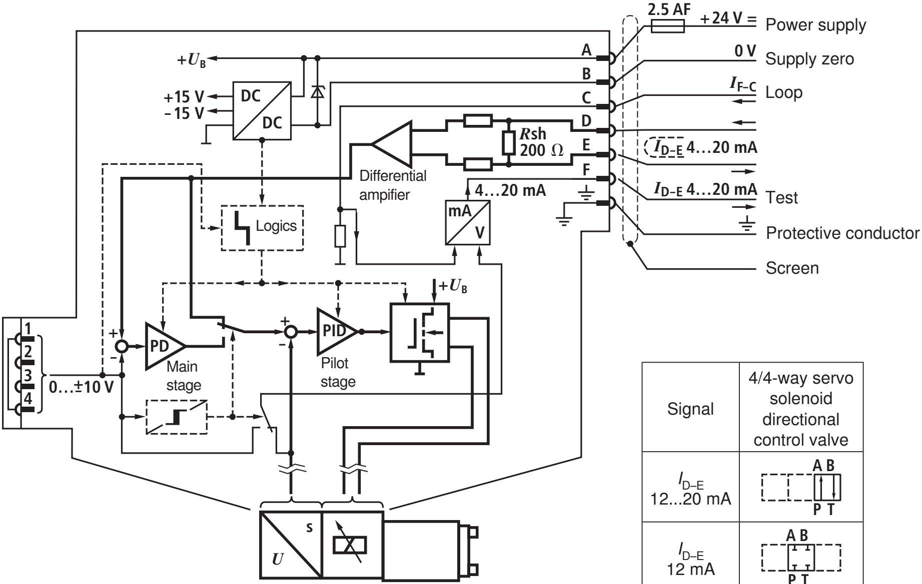
Signal	4/4-way servo solenoid directional control valve
U_{D-E} 0...+10 V	A B / P T
U_{D-E} 0 V	A B / P T
U_{D-E} 0...–10 V	A B / P T

Pin assignment 6P+PE
Version A1: U_{D-E} ±10 V
(R_i = 100 kΩ)



On-board electronics

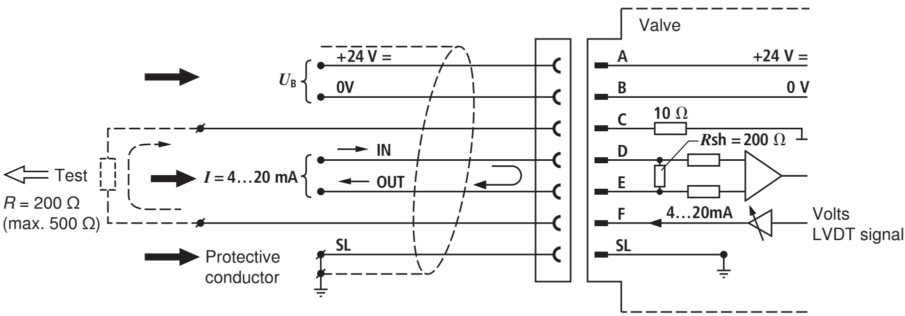
Block diagram/pin assignment
Version F1: I_{D-E} 4...12...20 mA



Signal	4/4-way servo solenoid directional control valve
I_{D-E} 12...20 mA	A B P T
I_{D-E} 12 mA	A B P T
I_{D-E} 4...12 mA	A B P T

$I_{D-E} \leqq 2$ mA: valve inactive

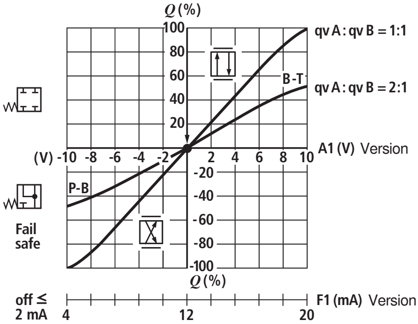
Pin assignment 6P+PE
Version F1: I_{D-E} 4...12...20 mA
(Rsh = 200 Ω)



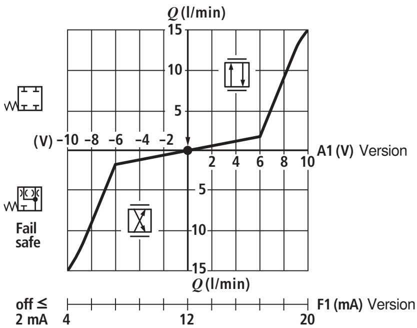
Characteristic curves (measured with HLP 46, ϑ_{oil} = 40 °C ± 5 °C)

Flow rate – signal function $Q = f\,(U_{D-E})$
$Q = f\,(I_{D-E})$

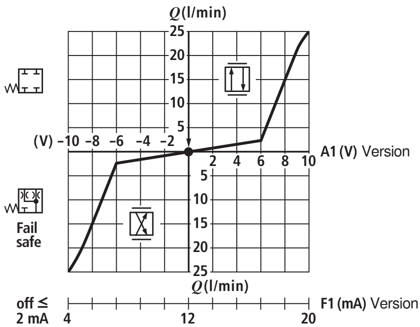
Flow characteristic
L: Linear



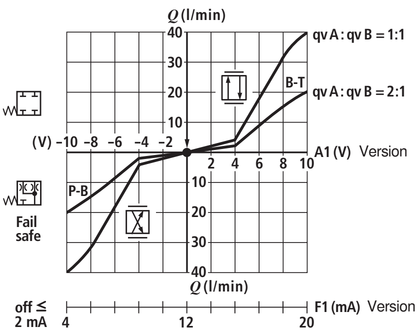
Flow characteristic
P: (kink 60 %) 15 l/min



Flow characteristic
P: (kink 60 %) 25 l/min



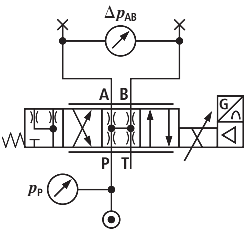
Flow characteristic
P: (kink 40 %) 40 l/min

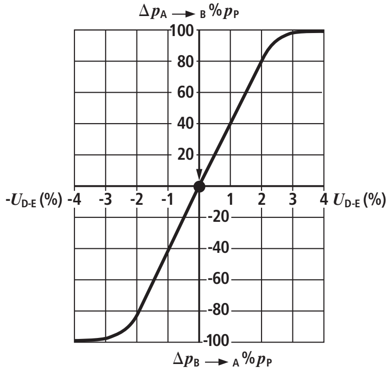


5

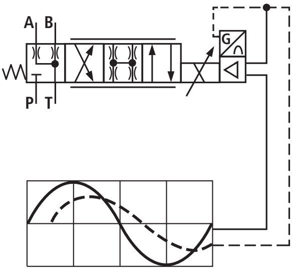
Characteristic curves (measured with HLP 46, ϑ_{oil} = 40 °C ± 5 °C)

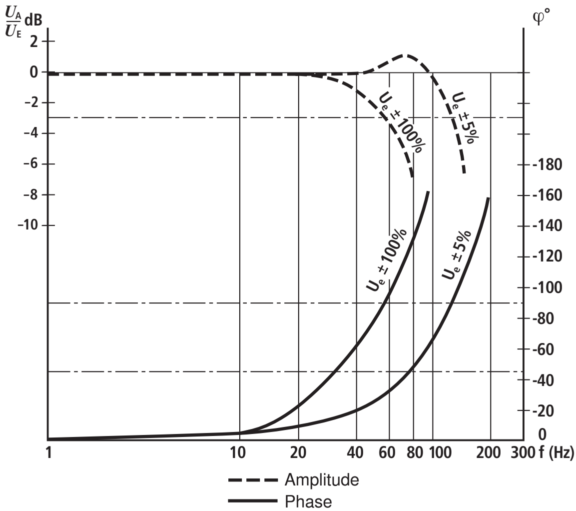
Pressure gain



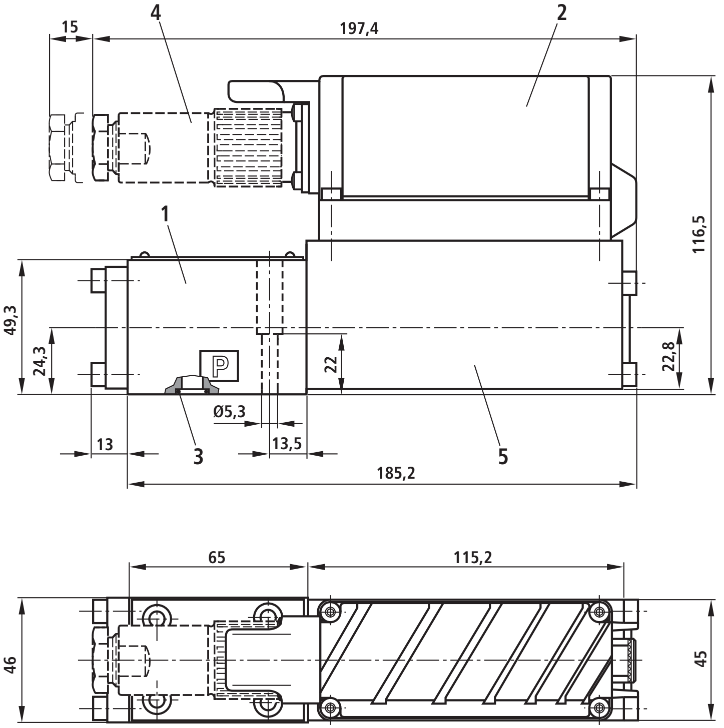


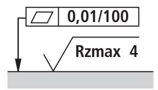
Bode diagram





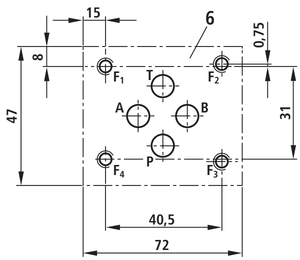
Unit dimensions (dimensions in mm)





Required surface quality
of valve mounting face

5



1 Valve housing

2 On-board electronics

3 O-rings ∅ 9.25 x 1.78 (ports P, A, B, T)

4 Plug-in connector not included in scope of delivery, see data sheet 08008 (order separately)

5 Control solenoid with position transducer

6 Machined valve contact surface, mounting hole configuration to ISO 4401-03-02-0-05
Deviates from standard:
Ports P, A, B, T ∅ 8 mm
Minimum thread depth: Ferrous metal 1.5 x ∅
Non-ferrous 2 x ∅

Subplates, see data sheet 45053 (order separately)

Valve fastening bolts (order separately)
The following valve fastening bolts are recommended:
4 cheese-head bolts ISO 4762-M5x30-10.9-N67F82170
(galvanized in accordance with Bosch standard N67F82170)
Tightening torque M_A = 6 +2 Nm
Material no. **2910151166**
or
4 cheese-head bolts ISO 4762-M5x30-10.9
(coefficient of friction μ_{total} = 0.12–0.17)
Tightening torque M_A = 8.9 Nm ±10 %

Notes

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Telefon +49 (0) 93 52 / 18-0
Telefax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

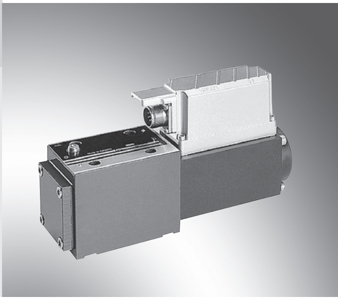
Rexroth
Bosch Group

4/4 controlled directional valve, directly operated, with electric position feedback and integrated electronics (OBE)

RE 29037/03.10
Replaces: 10.05

Type 4WRPEH10

Size 10
Component series 2X
Maximum operating pressure P, A, B 315 bar, T 250 bar
Rated flow 50...100 l/min (Δ*p* 70 bar)



Type 4WRPEH10

Table of contents

Contents	Page

Features

- Directly actuated controlled directional valve, with control spool and sleeve in servo quality
- Single-side operated, 4/4 fail-safe position in deactivated state
- Electric position feedback and integrated electronics (OBE), calibrated in the factory
- Electric port 6P+PE
  Signal input of differential amplifier with interface A1 ±10 V or interface F1 4...20 mA (R_{sh} = 200 Ω)
- Used for electro-hydraulic control systems in production and test plants

Information on available spare parts:
www.boschrexroth.com/spc

Ordering code

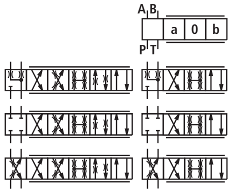
4WRP	E	H	10		B		– 2X /	G24	K0 /		M	*

With **integrated** electronics = **E**

Control piston/sleeve = **H**

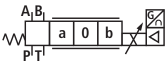
Size = **10**

Control spool symbol
4/4 way design



With symbols C5 and C1:
P → A: q_V B → T: $q_V/2$
P → B: $q_V/2$ A → T: q_V

Installation side of the inductive position transducer



(standard) = **B**

Rated flow
at 70 bar valve pressure difference (35 bar/control edge)
50 = 50 l/min
100 = 100 l/min

Flow characteristics
L = Linear
P = Inflected characteristic curve

2X = Component series 20 to 29 (identical installation and connection dimensions)

Supply voltage of the control electronics
G24 = +24 V direct current

Electric port
K0 = Without mating connector, With connector according to DIN 43563-AM6
Mating connector– separate order

Interface of the control electronics
A1 = Command value input ±10 V
F1 = Command value input 4...20 mA

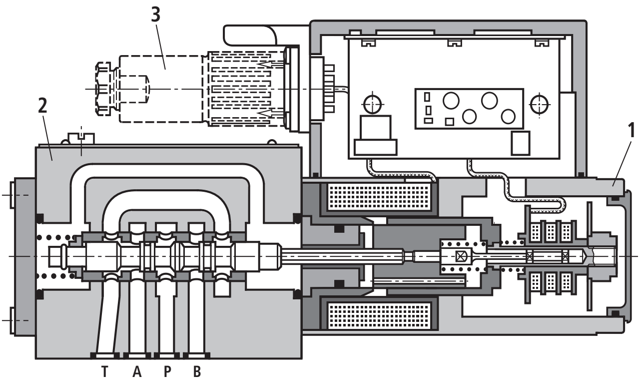
Seal material
M = NBR seals, suitable for mineral oils (HL, HLP) according to DIN 51524

Further details in the plain text

Function, section

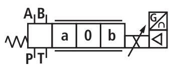
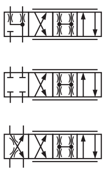
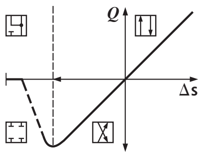
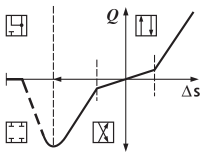
General
In the field of integrated electronics, the specified command value is compared with the actual position value. In case of deviations from the standard, the lifting solenoid is activated. Due to the changed magnetic force, the lifting solenoid adjusts the control valve against the spring.
Lifting/control cross-section are adjusted proportionally to the command value. In case of a command value provision of 0 V, the electronics adjusts the control valve against the spring to center position. In deactivated condition, the spring is unloaded to a maximum and the valve is in fail-safe position.

Switch-off behavior
If the electronics is switched off, the valve immediately moves to the secured basic position (fail safe).
In this process, the P-B/A-T position is passed which might cause movements at the controlled component. This must be taken into account when designing the plant.



1 Control solenoid with position transducer
2 Valve bodies
3 Mating connectors

Symbols

	L: Linear	P: Inflection 40 %
 C3, C5 C4, C1 C		

Test and service device

– Service case Type VT-VETSY-1 with test device, see RE 29685
– Measuring adapter 6P+PE Type VT-PA-2, see RE 30068

Technical data

general						
Type			Gate valve, directly operated, with steel sleeve			
Actuation			Proportional solenoid with position control, OBE			
Type of connection			Plate port, porting pattern (ISO 4401-05-04-0-05)			
Installation position			Any			
Ambient temperature range		°C	–20...+50			
Weight		kg	7,1			
Vibration resistance, test condition			Max. 25 *g*, space vibration test in all directions (24 h)			
hydraulic (measured with HLP 46, ϑ_{oil} = 40 °C ± 5 °C)						
Hydraulic fluid			Hydraulic oil according to DIN 51524…535, other media upon request			
Viscosity range	Recommended	mm^2/s	20...100			
	Max admissible	mm^2/s	10...800			
Hydraulic fluid temperature range		°C	–20...+70			
Maximum admissible degree of contamination of the hydraulic fluid cleanliness class according to ISO 4406 (c)			Class 18/16/13 [1]			
Flow direction			According to symbol			
Rated flow at Δp = 35 bar per edge [2]		l/min	50 (1:1)	50 (2:1)	100 (1:1)	100 (2:1)
Max operating pressure	Port P, A, B	bar	315			
	Orifice T	bar	250			
Limitation of use Δp pressure loss at the valve	C, C3, C5	bar	315	315	160	160
Q_{Vnom}: > Q_N valves	C4, C1	bar	250	250	100	100
Zero flow at 100 bar	Linear characteristic curve L	cm^3/min	< 1200	< 1200	< 1500	< 1000
	Inflected characteristic curve P	cm^3/min	< 600	< 500	< 600	< 600
Fail-safe position						
C Flow at Δp = 35 bar per edge		l/min	50	50	100	100
C3, C5		cm^3/min	50 P–A			
Zero flow at 100 bar		cm^3/min	70 P–B			
C3, C5		l/min	110...100 A–T			
Flow at Δp = 35 bar per edge		l/min	10...25 B–T			
C4, C1		cm^3/min	50 P–A			
Zero flow at 100 bar		cm^3/min	70 P–B			
		cm^3/min	70 A–T			
		cm^3/min	50 B–T			
Reaching the fail-safe position		0 bar	12 ms			
		100 bar	16 ms			

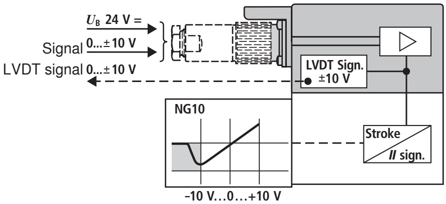
[1] In hydraulic systems, the cleanliness classes indicated for components must be observed.
Effective filtration prevents faults and at the same time increases the service life of the components.
For the choice of filters, see technical data sheets RE 50070, RE 50076 and RE 50081.

[2] Flow at different Δp $Q_x = Q_{nom} \cdot \sqrt{\frac{\Delta p_x}{35}}$

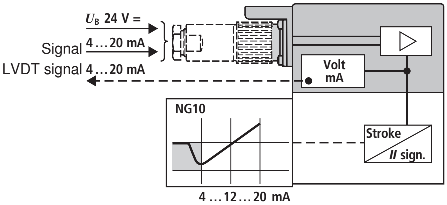
Technical data

static / **dynamic**		
Hysteresis	%	≦ 0,2
Manufacturing tolerance q_{max}	%	< 10
Actuating time for signal step 0...100 %	ms	≦ 25
Temperature drift		Zero shift < 1 % at ΔT = 40 °C
Zero compensation		ex factory ±1 %
electric, control electronics integrated in the valve		
Relative duty cycle	%	100 ED
Protection class		IP 65 according to DIN 40050 and IEC 14434/5
Port		Mating connector 6P+PE, DIN 43563
Supply voltage Terminal A: Terminal B: 0 V		24 V = $_{nom}$ min. 21 V = / max. 40 V = Ripple max. 2 V =
Max. power consumption		60 VA
Fuse protection, external		2.5 A_F
Input, version A1 Terminal D: U_E Terminal E:		Differential amplifier, R_i = 100 kΩ 0...±10 V 0 V
Input, version F1 Terminal D: I_{D-E} Terminal E: I_{D-E}		Load, R_{sh} = 200 Ω 4...(12)...20 mA Current loop I_{D-E} feedback
Max. voltage of the differential inputs almost 0 V		D → B, E → B } max. 18 V =
Test signal, version A1 Terminal F: U_{test} Terminal C:		LVDT 0...±10 V Reference 0 V
Test signal, version F1 Terminal F: I_{F-C} Terminal C: I_{F-C}		LVDT signal 4...20 mA, at external load 200...500 Ω max. 4...20 mA output Current loop I_{F-C} feedback
Protective earthing conductor and shielding		See pin assignment (CE-compliant installation)
Adjustment		Calibrated in the factory, see characteristic curve of the valve
Electromagnetic compatibility tested according to		EN 61000-6-2: 2005-08 EN 61000-6-3: 2007-01

Version A1:
Standard

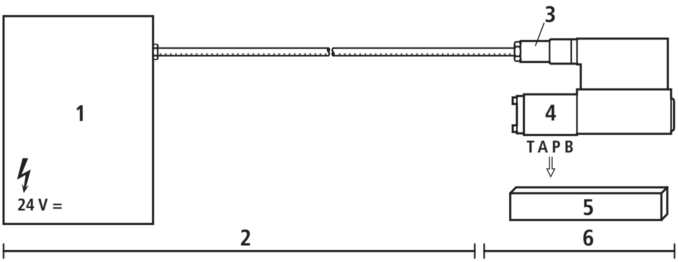


Version F1:
mA signal



Electrical connection

Electrical data, see page 5



1 Control
2 On the customer side
3 Mating connector
4 Valve
5 Contact surface
6 On Rexroth side

Technical notes with regard to cable

Version:
– Multi-core wire
– Litz wire structure, extra fine wire according to VDE 0295, class 6
– Protective earthing conductor, green-yellow
– Cu shielding braid

Type:
– e.g. Oilflex-FD 855 CP (Company Lappkabel)

Number of wires:
– Determined by the valve type, connector type and signal configuration

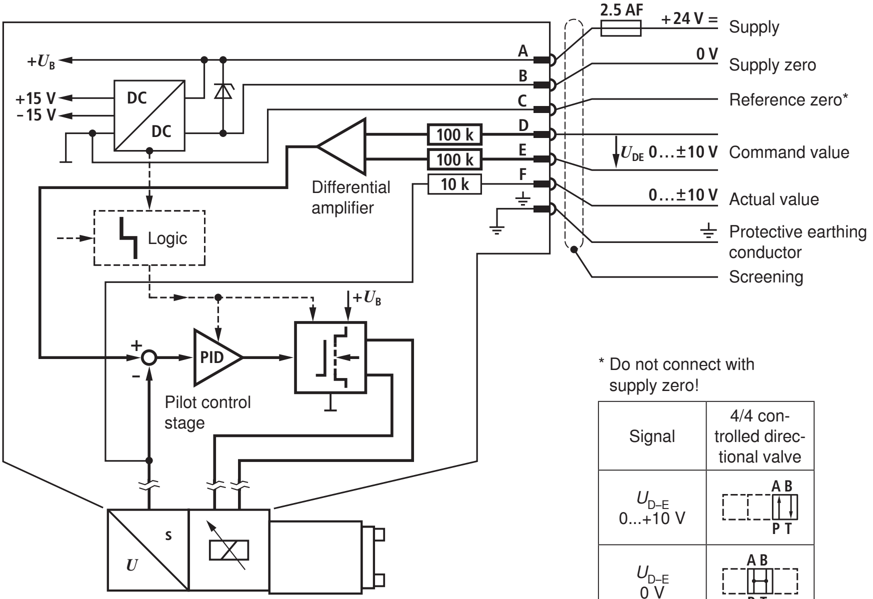
Line Ø:
– 0.75 mm² to 20 m of length
1.0 mm² to 40 m of length

OuterØ:
– 9.4...11.8 mm – Pg11
12.7...13.5 mm – Pg16

Note
Supply voltage 24 V = $_{nom}$,
if the value falls below 18 V = an internal fast switch-off is effected which can be compared with “Release OFF”.
Additionally for version F1:
$I_{D-E} \geqq 3$ mA – valve is active
$I_{D-E} \leqq 2$ mA – valve is deactivated.
Electric signals taken out via control electronics (e.g. actual value) may not be used for the switch-off of safety-relevant machine functions! (See also the European standard “Safety requirements for fluid power systems and their components - Hydraulics”, EN 982.)

Integrated electronics

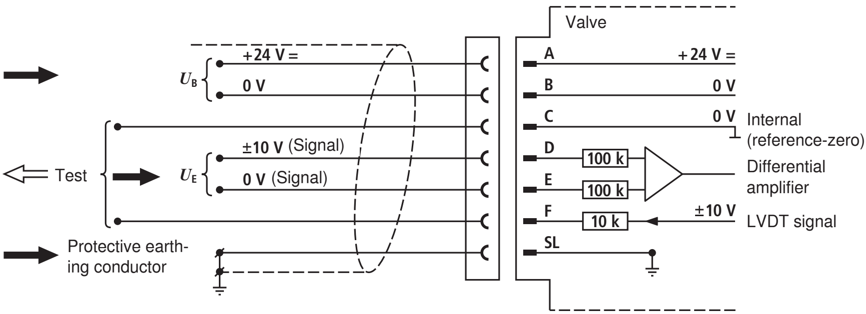
Block diagram/Pinout
Version A1: U_{D-E} ±10 V



* Do not connect with supply zero!

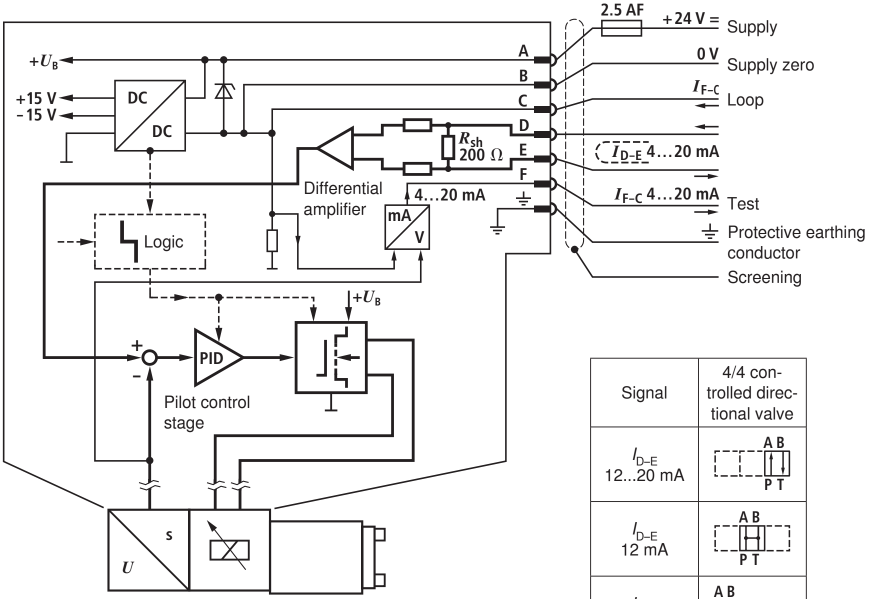
Signal	4/4 controlled directional valve
U_{D-E} 0...+10 V	A B P T
U_{D-E} 0 V	A B P T
U_{D-E} 0...–10 V	A B P T

Pin assignment 6P+PE
Version A1: U_{D-E} ±10 V
(R_i = 100 kΩ)



Integrated electronics

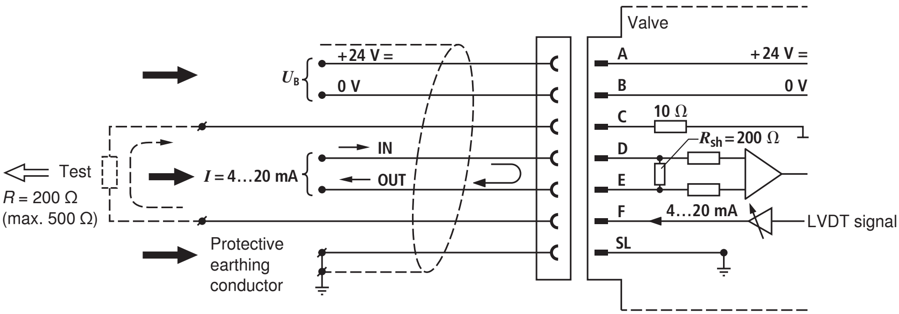
Block diagram/Pinout
Version F1: I_{D-E} 4...12...20 mA



Signal	4/4 controlled directional valve
I_{D-E} 12...20 mA	A B P T
I_{D-E} 12 mA	A B P T
I_{D-E} 4..0.12 mA	A B P T

$I_{D-E} \leqq 2$ mA: Valve inactive

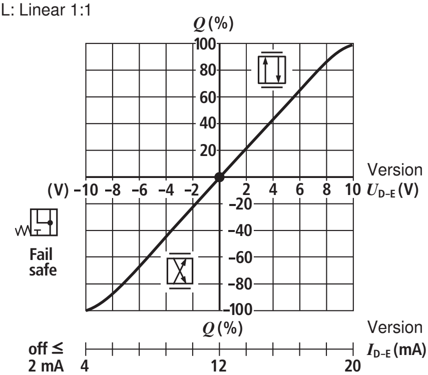
Pin assignment 6P+PE
Version F1: I_{D-E} 4...12...20 mA
(R_{sh} = 200 Ω)



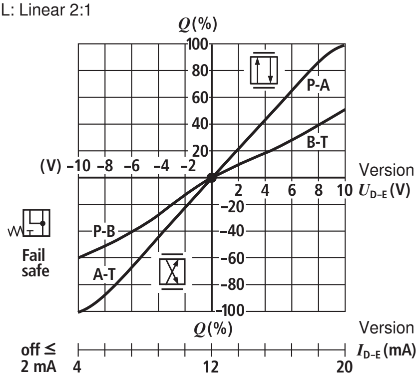
Characteristic curves (measured with HLP 46, ϑ_{oil} = 40 °C ± 5 °C)

Flow – signal function $Q = f(U_{D-E})$
$Q = f(I_{D-E})$

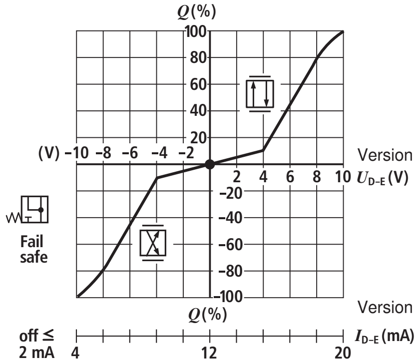
Flow characteristics
L: Linear 1:1



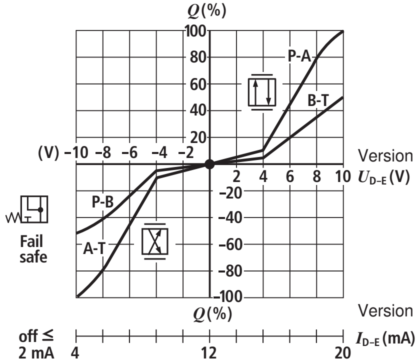
Flow characteristics
L: Linear 2:1



Flow characteristics
P: (Inflection 40%) 1:1



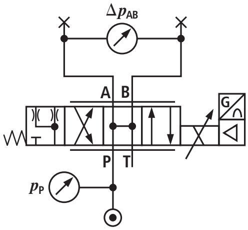
Flow characteristics
P: (Inflection 40%) 2:1

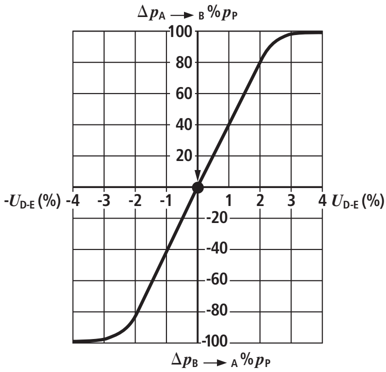


5

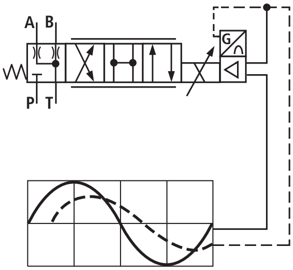
Characteristic curves (measured with HLP 46, ϑ_{oil} = 40 °C ± 5 °C)

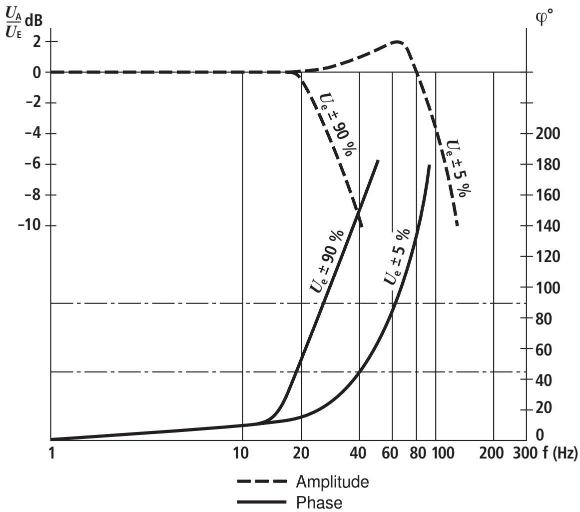
Pressure gain



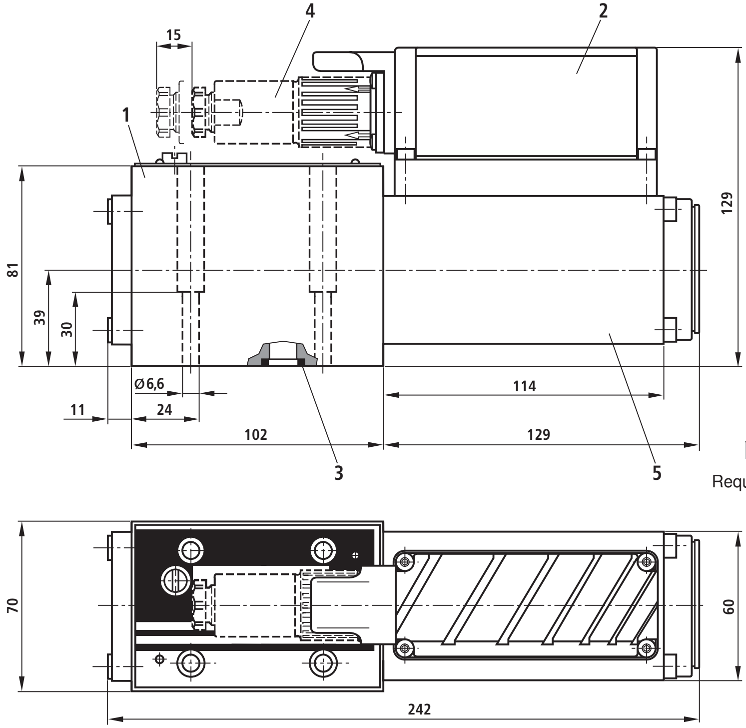


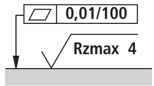
Bode diagram



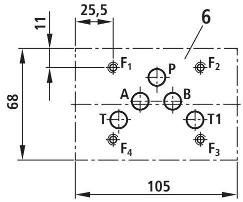


Unit dimensions (dimensions in mm)





Required surface quality of the valve mounting face



1 Valve housing
2 Integrated electronics
3 O-rings Ø 12 x 2 (ports P, A, B, T, T1)
4 Mating connector
see technical data sheet RE 08008
(separate order)
5 Control solenoids with position transducer
6 Machined valve mounting face, porting pattern according to ISO 4401-05-04-0-05
Deviating from the standard:
Ports P, A, B, T, T1 Ø 10.5 mm

Subplates, see technical data sheet RE 45055 (separate order)

Valve mounting screws (separate order)
The following valve mounting screws are recommended:
4 hexagon socket head cap screws
ISO 4762-M6x40-10.9-N67F82170
(galvanized according to N67F82170)
Tightening torque M_A = 11+3 Nm
Mat. no. 2910151209
or
4 hexagon socket head cap screws ISO 4762-M6x40-10.9
(friction rate μ_{total} = 0.12–0.17)

5

Notes

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

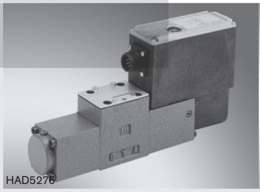
Rexroth
Bosch Group

4/3 directional high-response control valves, direct operated, with integrated control electronics (OBE)

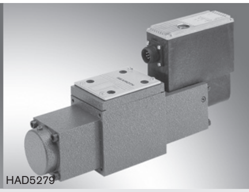
RE 29067/11.05
Replaces: 02.03

Type 4WRSE

Sizes 6 and 10
Series 3X
Maximum operating pressure 315 bar
Maximum flow 180 l/min



Type 4WRSE 6 -...-3X/... with integrated control electronics (OBE)



Type 4WRSE 10 -...-3X/... with integrated control electronics (OBE)

Table of contents

Features

– Direct operated directional high-response control valve with integrated control electronics (OBE) for controlling the direction and magnitude of a flow
– Suitable for position and velocity control
– Actuation by control solenoids
– Electrical position feedback
– High response sensitivity and low hysteresis
– Integrated control electronics (OBE) with interface ±10 V or 4 … 20 mA
– For subplate mounting:
  Porting pattern to DIN 24340 form A and ISO 4401
  Subplates to data sheets RE 45052 and RE 45054 (separate order), see pages 12 and 13

Ordering code

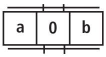
4WRS	E					–3X/G24	K0/		V	*

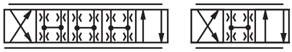
Integrated control electronics (OBE) = E

Without sleeve = No code

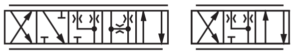
Size 6 = 6
Size 10 = 10

Spool symbols





= V, V1-



= Q2-

With symbol V1-:

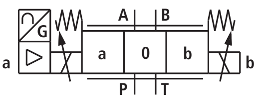
P → A: q_V B → T: $q_V/2$
P → B: $q_V/2$ A → T: q_V

With symbol Q2-:

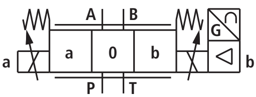
P → A: q_V B → T: q_V
P → B: $q_V/3$ A → T: q_V

Note:
Spools V and V1 have an overlap of –1.0 % … +1.0 %.

Side of inductive position transducer



= No code (standard)



= C

Further details in clear text

Seal material

V = FKM seals, suitable for mineral oils (HL, HLP) to DIN 51524 and phosphate ester (HFD-R)

Interface of control electronics

A1 = Command value input ±10 V
F1 = Command value input 4 … 20 mA

Electrical connection

K0 = With component plug to DIN EN 175201-804
Without cable socket
Cable socket – separate order, see page 5

Supply voltage of control electronics

G24 = 24 V DC

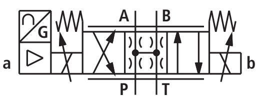
3X = Component series 30 … 39 (30 … 39: unchanged installation and connection dimensions)

Nominal flow at 10 bar valve pressure differential

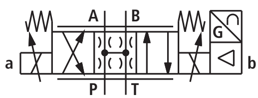
	Size 6
04 =	4 l/min (only with symbol V)
10 =	10 l/min
20 =	20 l/min
35 =	35 l/min
	Size 10
25 =	25 l/min
50 =	50 l/min
80 =	75 l/min

Symbols

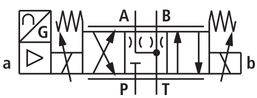
Type 4WRSE..**V** (standard)



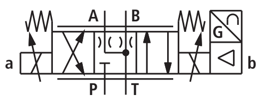
Type 4WRSE..**VC**



Type 4WRSE..**Q2** (standard)



Type 4WRSE..**Q2C**



Standard types

Size 6

Type	Material number
4WRSE 6 V04-3X/G24K0/A1V	R900938307
4WRSE 6 V1-10-3X/G24K0/A1V	R900909078
4WRSE 6 V1-20-3X/G24K0/A1V	R900906155
4WRSE 6 V1-35-3X/G24K0/A1V	R900904794
4WRSE 6 V10-3X/G24K0/A1V	R900558830
4WRSE 6 V20-3X/G24K0/A1V	R900576060
4WRSE 6 V35-3X/G24K0/A1V	R900579447

Size 10

Type	Material number
4WRSE 10 Q2-50-3X/G24K0/A1V	R900916872
4WRSE 10 V1-80-3X/G24K0/A1V	R900556812
4WRSE 10 V1-25-3X/G24K0/A1V	R900922997
4WRSE 10 V1-50-3X/G24K0/A1V	R900579140
4WRSE 10 V25-3X/G24K0/A1V	R900579637
4WRSE 10 V50-3X/G24K0/A1V	R900579943
4WRSE 10 V80-3X/G24K0/A1V	R900579286

Function, section

These 4/3 directional high-response valves are direct operated components of sandwich plate design. They are actuated by control solenoids. The solenoids are controlled by integrated control electronics (OBE).

Structure:

The valve basically consists of:

– Housing (1) with connection face
– Control spool (2) with compression springs (3 and 4)
– Solenoids (5 and 6)
– Position transducer (7)
– Integrated control electronics (OBE) (8)
– Zero point adjustment (9) accessible via Pg9 cover

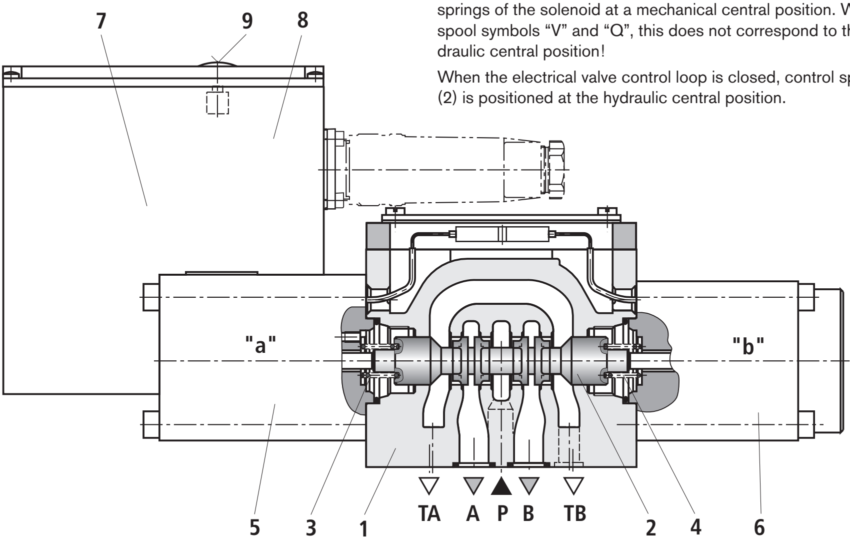
Functional description:

– When solenoids (5 and 6) are de-energised, control spool (2) is held by compression springs (3 and 4) in the central position
– Direct operation of control spool (2) through energisation of the control solenoid
  e.g. controlling of solenoid "b" (6)
  - Control spool (2) is pushed to the left in proportion to the electrical input signal
  - Connection open from P → A and B → T via orifice-like cross-sections with linear flow characteristics
– De-energisation of solenoid (6)
  Control spool (2) is returned by compression spring (3) to the central position

In the de-energised state, control spool (2) is held by the return springs of the solenoid at a mechanical central position. With spool symbols “V” and “Q”, this does not correspond to the hydraulic central position!

When the electrical valve control loop is closed, control spool (2) is positioned at the hydraulic central position.

Type 4WRSE 10 V...



Technical data (for applications outside these parameters, please consult us!)

General

Sizes		**Size 6**	**Size 10**
Weight	kg	3.0	7.3
Installation orientation		Optional, preferably horizontal	
Ambient temperature range	°C	–20 … +50	
Storage temperature range	°C	–20 … +80	

Hydraulic (measured with HLP46, $\vartheta_{oil} = 40$ °C ± 5 °C and $p = 100$ bar)

Operating pressure	Ports P, A, B	bar	up to 315	up to 315
	Port T	bar	up to 315	up to 315
Nominal flow $q_{V\,nom}$ ±10 % at $\Delta p = 10$ bar		l/min	4	25
			10	50
(Δp = valve pressure differential)			20	75
			35	–
Max. permissible flow		l/min	80	180
Hydraulic fluid			Mineral oil (HL, HLP) to DIN 51524 and phosphate ester (HFD-R), further hydraulic fluids on enquiry	
Hydraulic fluid temperature range		°C	–20 … +80	
Viscosity range		mm²/s	20 … 380, preferably 30 … 46	
Max. permissible degree of contamination of the hydraulic fluid - cleanliness class to ISO 4406 (c)			Class 18/16/13 [1)]	
Hysteresis		%	≤ 0.05	
Range of inversion		%	≤ 0.03	
Response sensitivity		%	≤ 0.03	
Zero point balancing		%	≤ 1	
Zero point drift with change in:			**Size 6**	**Size 10**
	Hydraulic fluid temperature	%/10 K	< 0.1	< 0.1
	Operating pressure	%/100 bar	< 0.5	< 0.3

Electrical

Operating voltage	Nominal value (limits)	VDC	24	(19.4 … 35)
Current consumption	Size 6	A	max. 2	Impulse load: 4 A
	Size 10	A	max. 2.8	Impulse load: 4 A
Interface “A1“	Command value signal	V	±10	$R_i > 50$ kΩ
	Actual value signal	V	±10	$I_{max} = 2$ mA
Interface “F1“	Command value signal	mA	4 … 20	$R_e > 100$ Ω
	Actual value signal	mA	4 … 20	max. load resistance 500 Ω
Duty cycle		%	100	
Coil temperature [1)]		°C	up to 150	
Type of protection of valve to EN 60529			IP 65 with cable socket correctly mounted and locked	

1) Due to the surface temperatures of solenoid coils, observe European standards EN 563 and EN 982!

Note: For details with regard to environment simulation testing in the fields of EMC (electromagnetic compatibility), climate and mechanical stress, see RE 29067-U (declaration on environmental compatibility).

Electrical connection

Component plug pin assignment	Contact	Signal: Interface A1	Signal: Interface F1
Supply voltage	A	24 VDC (19.4 … 35 VDC), I_{max} = 2 A (size 6), I_{max} = 2.8 A (size 10), impulse load: 4 A	
	B	0 V	
Actual value reference potential	C	Connect reference potential for contact F to ⊥ on the control side (star-shape)	Reference potential for contact F
Comand value signal	D	±10 V, R_i > 50 kΩ	4 … 20 mA, R_i > 100 Ω
	E	Reference potential for contact D	
Actual value	F	±10 V I_{max} = 2 mA	4 … 20 mA, max. load resistance 500 Ω
Protective conductor	PE	Connected to heat sink and valve body	

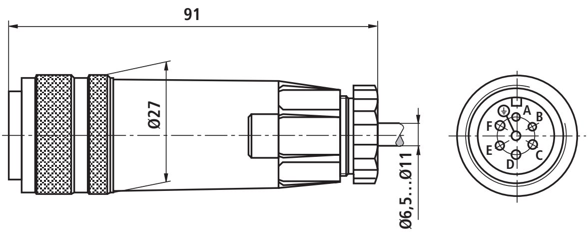
Command value: Positive command value at D (interface A1) or 12 ... 20 mA (interface F1) and reference potential at E causes a flow from P → A and B → T.
Negative command value at D (interface A1) or 12 ... 4 mA (interface F1) and reference potential at E causes a flow from P → B and A → T.

Actual value: Interface A1: Positive signal at F and reference potential at C means flow from P → A.
Interface F1: 12 ... 20 mA means flow from P → A.

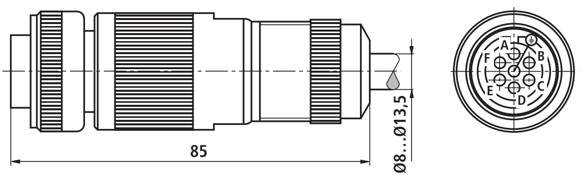
Connecting cable: Recommendation: – up to 25 m cable length: Type LiYCY 7 x 0.75 mm²
– up to 50 m cable length: Type LiYCY 7 x 1.0 mm²
Outer diameter 6.5 … 11 mm or 8 … 13.5 mm, respectively
Connect shield to ⊥ only on the supply side.

Cable sockets

Cable socket (plastic version)
to DIN EN 175201-804
Separate order,
material no. **R900021267**



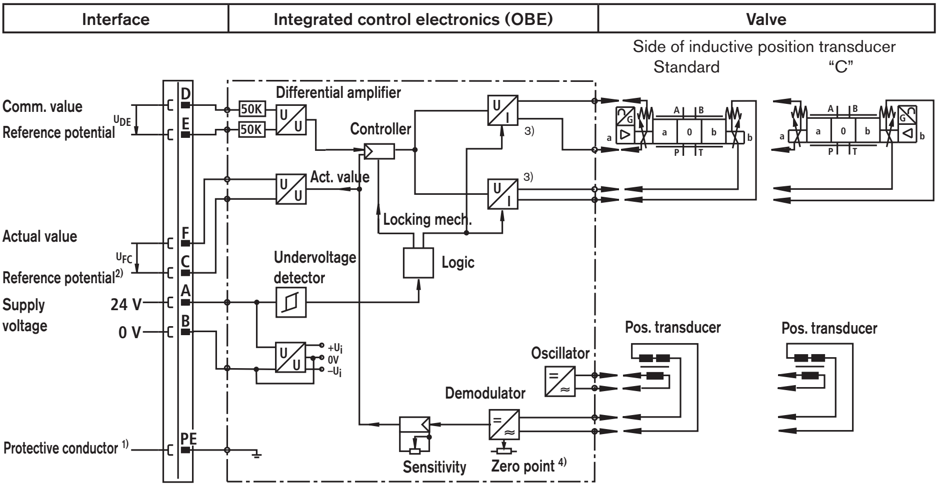
Cable socket (metal version)
to DIN EN 175201-804
Separate order,
material no. **R900223890**



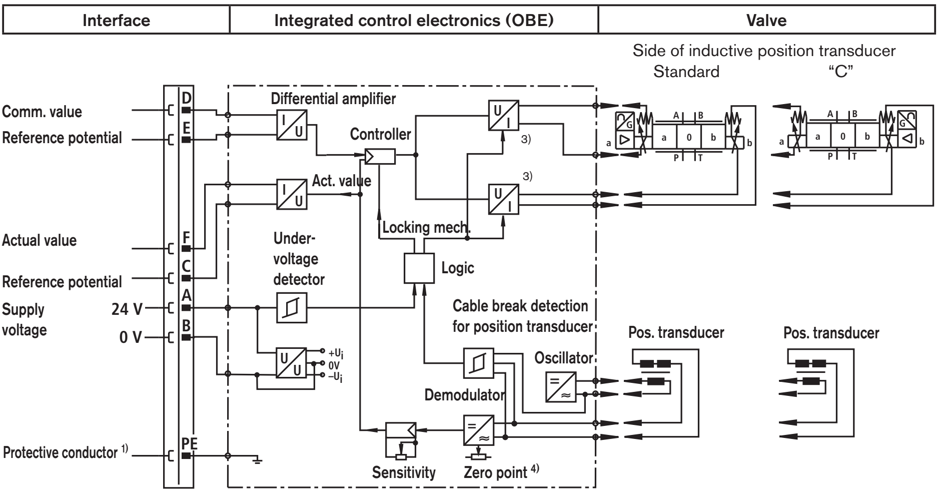
Integrated control electronics (OBE)

Block circuit diagram / pin assignment of integrated control electronics (OBE)

Interface A1



Interface F1



Note:

Electrical signals brought out via control electronics (e.g. actual value) must not be used for switching off safety-relevant machine functions! (See also European standard EN 982, "Safety requirements for fluid power systems and components - hydraulics")

1) PE connection connected to heat sink and valve body

2) Connect pin C to ⊥ on the control side

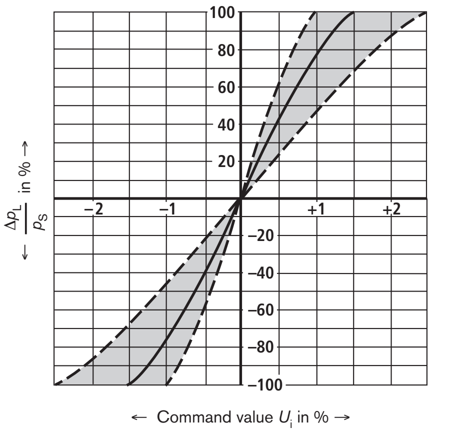
3) Output stage current regulated

4) Zero point externally adjustable

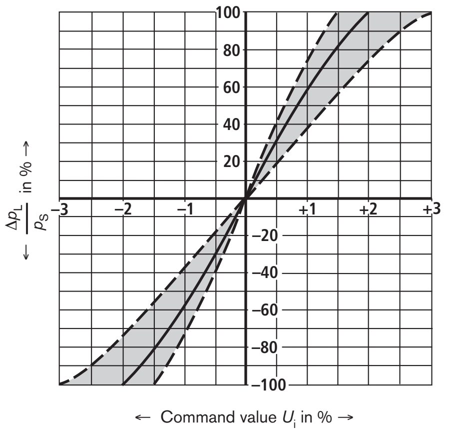
Characteristic curves (measured with HLP46, $\vartheta_{oil} = 40\ °C \pm 5\ °C$)

Pressure/signal characteristic curves (V spool) $p_S = 100$ bar

Size 6
Type 4WRSE 6 V…

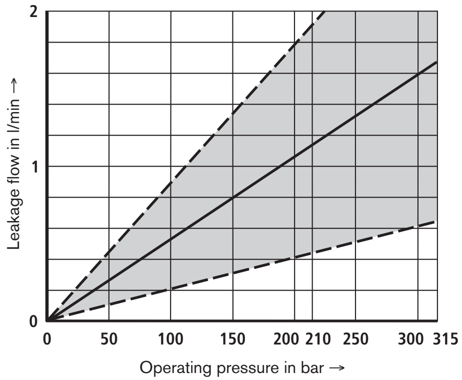


Size 10
Type 4WRSE 10 V…

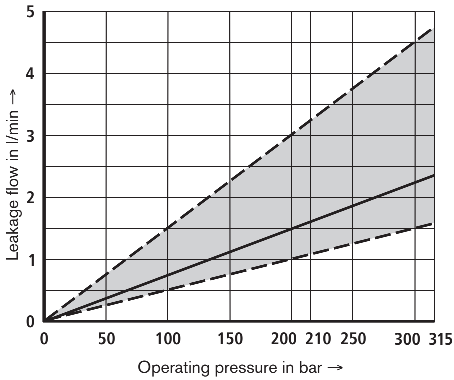


Typical leakage flow

Size 6
Type 4WRSE 6 V.35…



Size 10
Type 4WRSE 10 V.80…

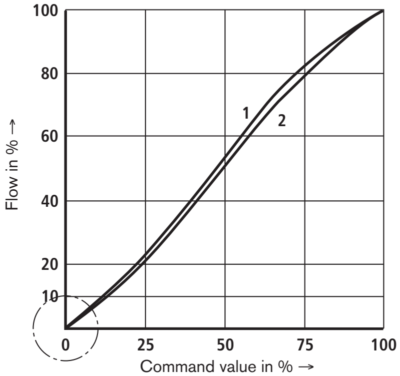


5

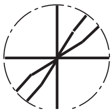
Characteristic curves of size 6 (measured with HLP46, $\vartheta_{oil} = 40\ °C \pm 5\ °C$)

Typical flow characteristic curve (V, V1 spool)

at 10 bar valve pressure differential or 5 bar per control land



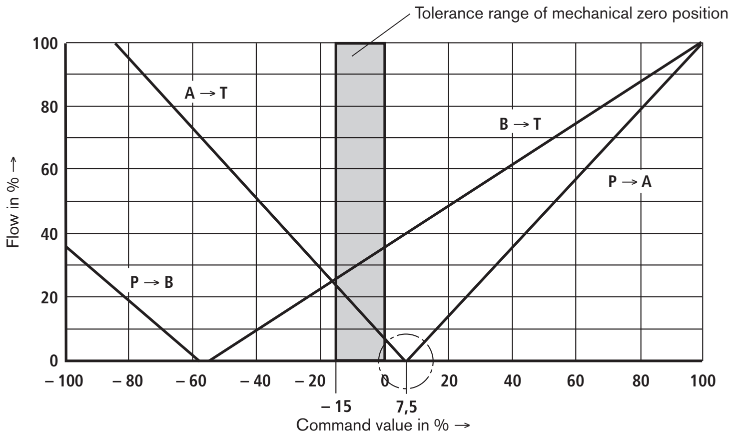
1 = Nominal flow 35 l/min
2 = Nominal flow 10 l/min
Spool … 20 between characteristic curves 1 and 2

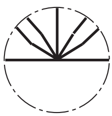


Zero point passage depending on manufacturing tolerance
Valve overlap –1 % … +1 %

Typical flow characteristic curve (Q2 spool)

at 10 bar valve pressure differential or 5 bar per control land

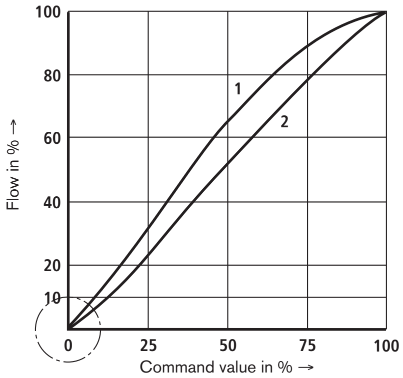




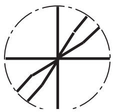
Characteristic curves of size 10 (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

Typical flow characteristic curve (V, V1 spool)

at 10 bar valve pressure differential or 5 bar per control land



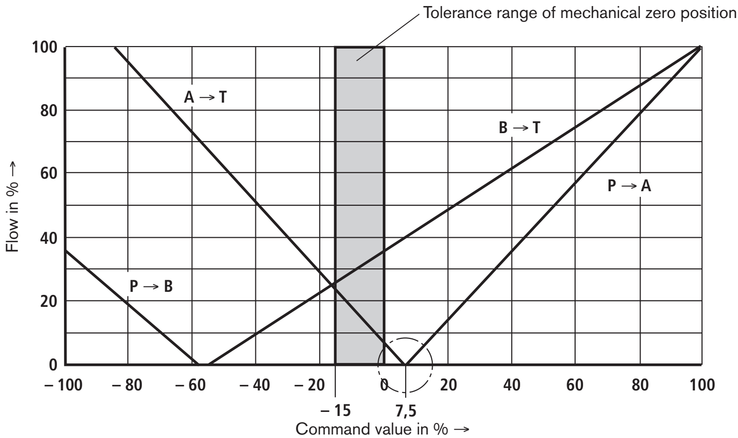
1 = Nominal flow 75 l/min
2 = Nominal flow 25 l/min
Spool … 50 between characteristic curves 1 and 2



Zero point passage depending on manufacturing tolerance
Valve overlap –1 % … +1 %

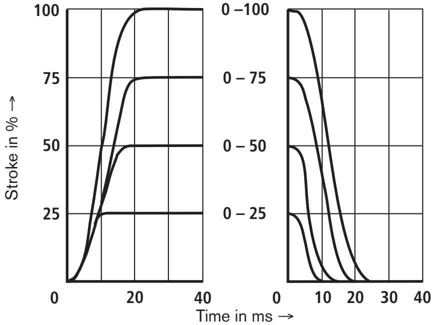
Typical flow characteristic curve (Q2 spool)

at 10 bar valve pressure differential or 5 bar per control land



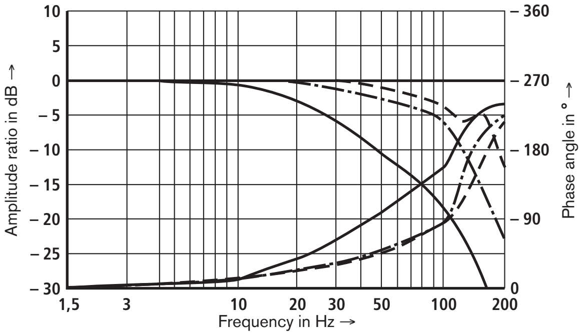
Characteristic curves of size 6 (measured with HLP46, $\vartheta_{oil} = 40\ °C \pm 5\ °C$)

Transient function with stepped electrical input signals



Measured at:
$p_S = 10$ bar
$\nu = 46\ mm^2/s$
$\vartheta = 40\ °C$

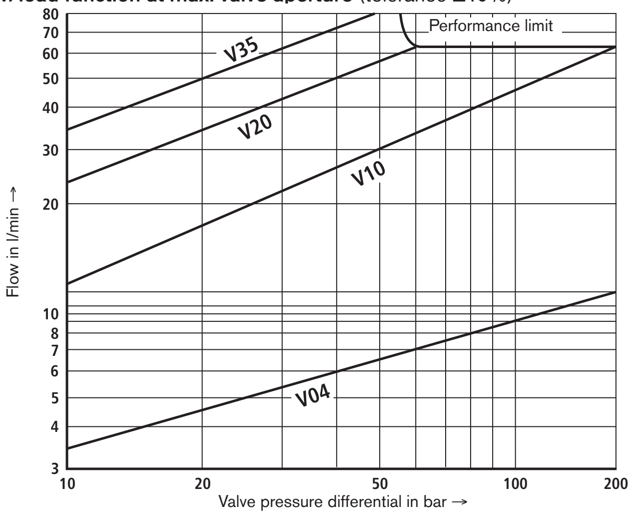
Frequency response characteristic curves



Measured at:
$p_S = 10$ bar
$\nu = 46\ mm^2/s$
$\vartheta = 40\ °C$

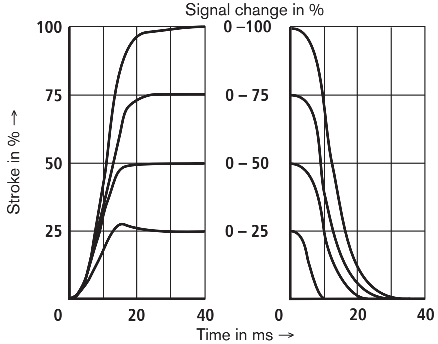
Signal ±10 %
Signal ±25 %
Signal ±100 %

Flow/load function at max. valve aperture (tolerance ±10%)



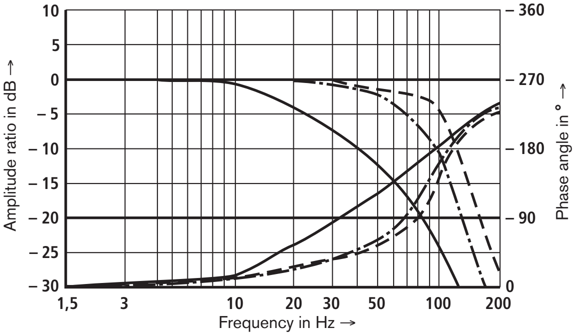
Characteristic curves of size 10 (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

Transient function with stepped electrical input signals



Measured at:
p_S = 10 bar
ν = 46 mm²/s
ϑ = 40 °C

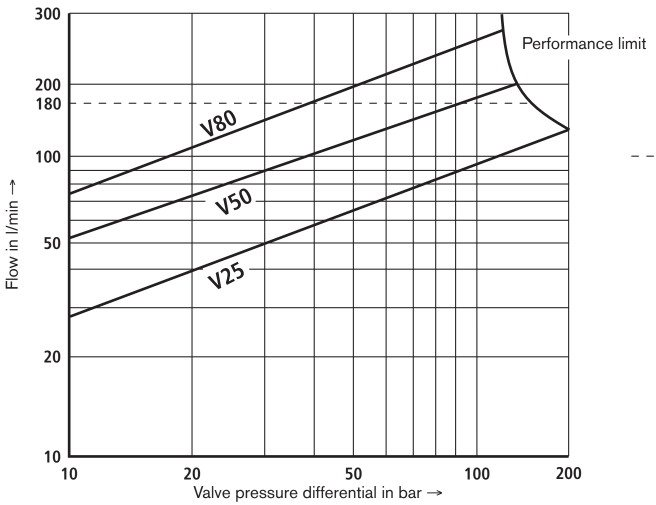
Frequency response characteristic curves



Measured at:
p_S = 10 bar
ν = 46 mm²/s
ϑ = 40 °C

Signal ±10 %
Signal ±25 %
Signal ± 100 %

Flow/load function at max. valve aperture (tolerance ±10%)

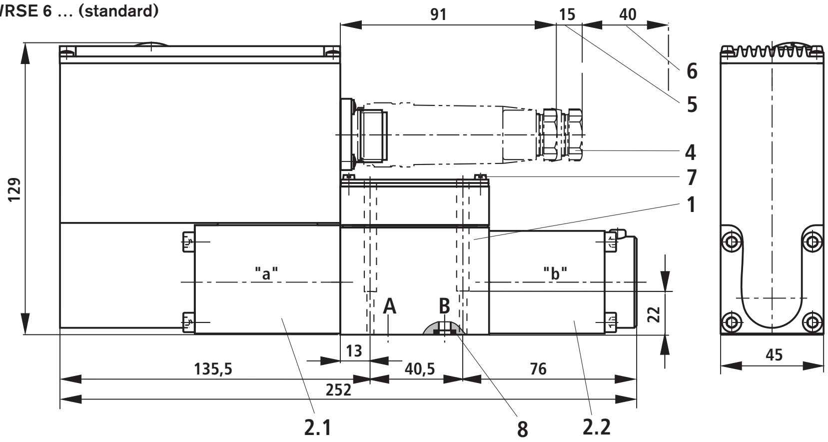


Recommended flow limitation
q_V = 180 l/min

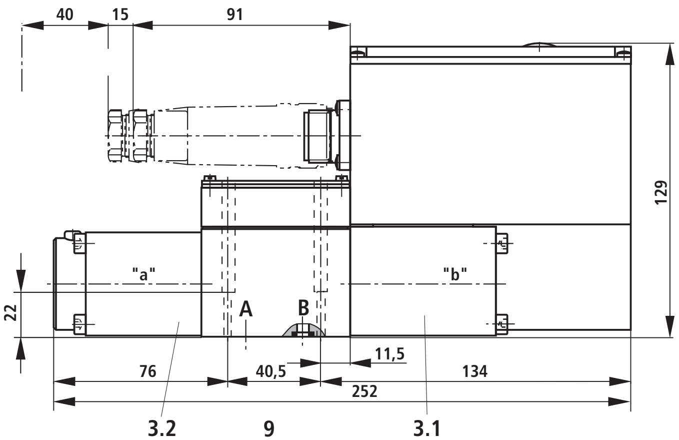
5

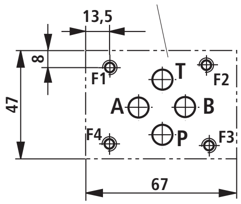
Unit dimensions of size 6 (nominal dimensions in mm)

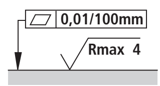
Type 4WRSE 6 … (standard)



Type 4WRSE 6 C…







Required surface quality of mating part

1 Valve housing
2.1 Control solenoid "a" with inductive position transducer
2.2 Control solenoid "b"
3.1 Control solenoid "b" with inductive position transducer
3.2 Control solenoid "a"
4 Cable socket to DIN EN 175201-804 (separate order, see page 5)
5 Space required to remove cable socket
6 Additional space required for bending radius of connecting cable
7 Nameplate
8 R-ring 9.81 x 1.5 x 1.78 (ports P, A, B, T)
9 Machined valve mounting face, position of ports to DIN 24340 form A6 and ISO 4401-03-02-0-94 without locating bore

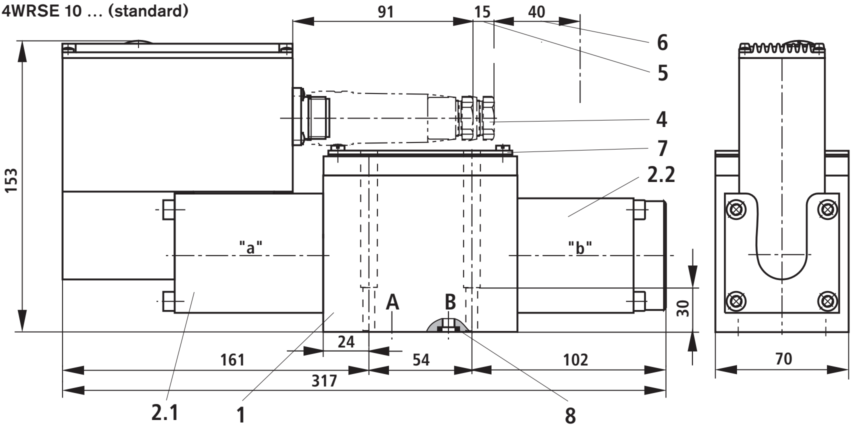
Subplates to data sheet RE 45052 and valve fixing screws must be ordered separately.

Subplates: G 341/01 (G1/4)
G 342/01 (G3/8)
G 502/01 (G1/2)

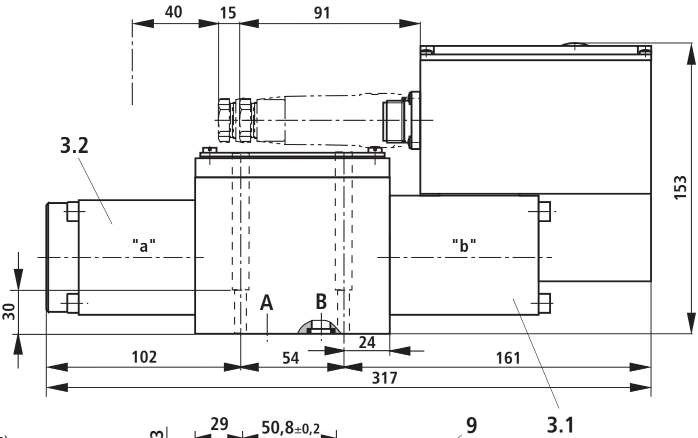
4 hexagon socket head cap screws
ISO 4762 – M5x30-10.9-flZn-240h-L
(friction coefficient total = 0.09 to 0.14)
Tightening torque M_T = 7 Nm ± 10%
material no. R913000316 (separate order)

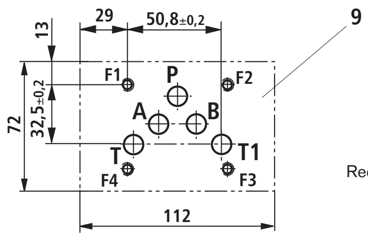
Unit dimensions of size 10 (nominal dimensions in mm)

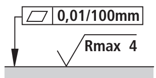
Type 4WRSE 10 … (standard)



Type 4WRSE 10 C…







Required surface quality of mating part

- **1** Valve housing
- **2.1** Control solenoid "a" with inductive position transducer
- **2.2** Control solenoid "b"
- **3.1** Control solenoid "b" with inductive position transducer
- **3.2** Control solenoid "a"
- **4** Cable socket to DIN EN 175201-804 (separate order, see page 5)
- **5** Space required to remove cable socket
- **6** Additional space required for bending radius of connecting cable
- **7** Nameplate
- **8** R-ring 13.0 x 1.6 x 2.0 (ports A, B, P, T)
- **9** Machined valve mounting face, position of ports to DIN 24340 form A10 and ISO 4401-05-04-0-94

Subplates to data sheet RE 45054 and valve fixing screws must be ordered separately.

Subplates: G 66/01 (G3/8)
G 67/01 (G1/2)
G 534/01 (G3/4)

4 hexagon socket head cap screws
ISO 4762 – M6x40-10.9-flZn-240h-L
(friction coefficient total = 0.09 to 0.14)
Tightening torque M_T = 12.5 Nm ± 10%
material no. R913000058 (separate order)

Notes

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

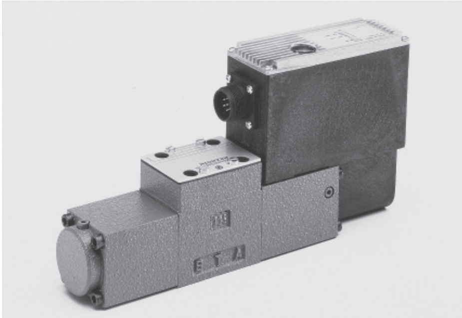
RE 29 069/02.03

Replaces: 12.99

4/3 and 4/4 high response directional control valves, direct operated, with electrical position feedback Type 4WRSEH

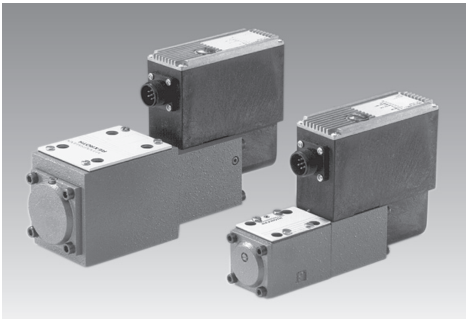
Nominal sizes 6 and 10
Series 3X
Maximum operating pressure 315 bar
Maximum flow 80 L/min (NS 6)
Maximum flow 180 L/min (NS 10)

H/A 5276/95



Type 4WRSEH 6 **V**…D-3X/… (4/3 high response directional control valve)

H/A 5544/96



Types 4WRSEH 10 **C.B**…D-3X/… and 4WRSEH 6 **C.B**…D-3X/… (4/4 high response directional control valve)

Overview of contents

Features

– Direct operated high response directional control valve for the control of the size and direction of a flow
– Valve spool and bush are of servo quality
– Suitable for closed loop, position, speed and pressure control
– Operated via high response solenoids
– With fail-safe position for the 4/4 high response directional control valve
– Electrical position feedback
– High response sensitivity and low hysteresis
– Integrated control electronics with interface A1 or F1
– For subplate mounting:
Porting pattern to DIN 24 340 form A, ISO 4401 and CETOP-RP 121 H
Subplates to catalogue sheets RE 45 052 and RE 45 054 (separate order), see pages 14 to 17

Ordering details

4WRS	E	H						–3X /	G24	K0 /		V	*

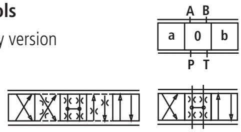
With **integrated** control electronics = **E**

Control spool/bush = **H**

Nominal size 6 = **6**
Nominal size 10 = **10**

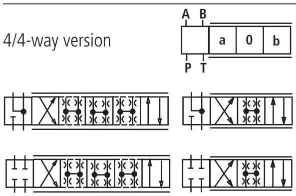
Symbols

4/3-way version



= **V**

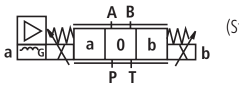
4/4-way version



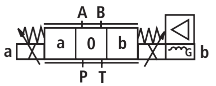
= **C3**

= **C4**

Inductive position transducer location with spool symbol „V“

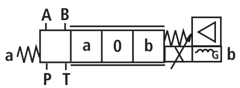


(Standard) = **No code**

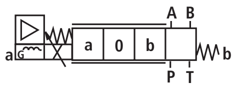


= **C**

Inductive position transducer location with spool symbols „C3“ and „C4“



(Standard) = **B**



= **No code**

Nominal flow at a 70 bar pressure differential

Nominal size 6

04 = [3)] 4 L/min
12 = 12 L/min
24 = 24 L/min
40 = [2)] 40 L/min
50 = [1)] 50 L/min

Nominal size 10

50 = 50 L/min
100 = 100 L/min

Flow characteristics

L = Linear
P = Inflected characteristic curve 40 %

Spool overlap [4)]

E = 0...0.5% negative
D = 0...0.5% positive

3X = Series 30 to 39
(30 to 39: unchanged installation and connection dimensions)

Control electronics power supply

G24 = + 24 V DC

Electrical connections

K0 = With component plug to E DIN 43 563-AM6
Without plug-in connector,
Plug-in connector – separate order, see page 6

Control electronics interface

A1 = Command value input ± 10 V
F1 = Command value input 4 to 20 mA

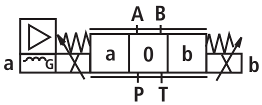
V = FKM seals, suitable for mineral oils (HL, HLP) to DIN 51 524 and phosphate ester (HFD-R)

Further details in clear text

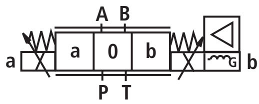
1) Only with „V“ in conjunction with flow characteristic „L“
2) Only with „C“ and „V“ in conjunction with flow characteristic „P“
3) Only in conjunction with flow characteristic „L“
4) The spool overlap in % relates to the nominal stroke of the control spool. We recommend, for closed loop applications, the D overlap. Further spool overlaps on request!

Symbols

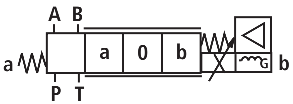
Type 4WRSEH.V…-3X…



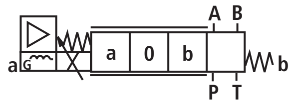
Type 4WRSEH.V**C**…-3X/…



Type 4WRSEH.C.**B**…-3X/…



Type 4WRSEH.C…-3X/…



Function, section

The 4/3 and 4/4 high response directional control valves are designed as direct operated units of subplate mounting design. They are operated by high response solenoids. The solenoids are controlled via the integrated control electronics.

Design:

The valve basically comprises of:

- Housing (1) with mounting surface
- Control spool (2) in bush (3) with compression springs (4 and 5)
- Solenoids (6 and 7)
- Position transducer (8)
- Integrated control electronics (9)
- Zero point adjustment accessible (10) via Pg9

Functional description:
4/3-way version

- With solenoids (6 and 7), de-energised the control spool (2) is held in its mechanical centre position by the compression springs (4 and 5)
- Direct operation of the control spool (2) by the energisation of one of the high response solenoids

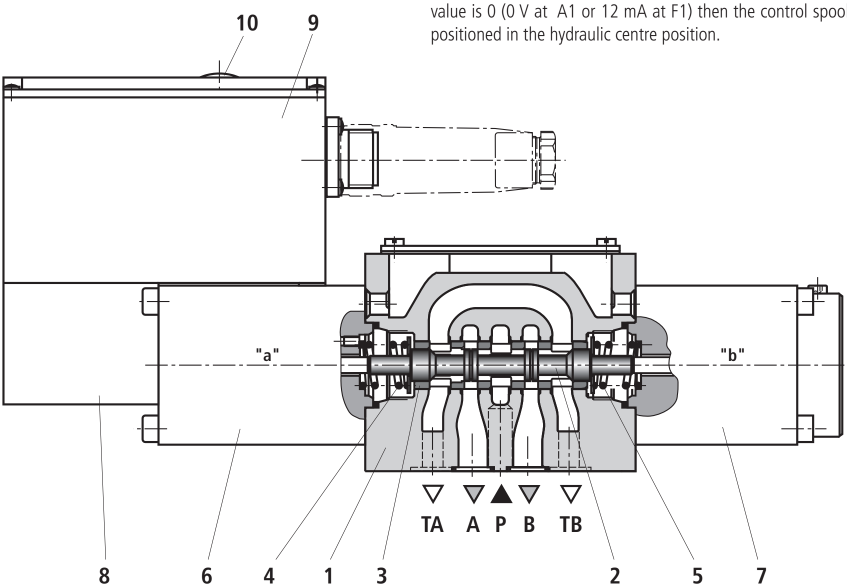
  E.g. control of solenoid "b" (7)

  → Moves the control spool (2) to the left in proportion to the electrical input signal

  → Connection from P to A and B to T via orifice type cross-sections with linear or inflected flow characteristics
- By de-energising the solenoid (7) → control spool (2) is returned to its centre position via the compression spring (4)

In the de-energised condition the control spool (2) is held in a mechanical centre position via the control springs. This does not relate to the hydraulic centre position!

By closing the electrical valve closed loop circuit and the command value is 0 (0 V at A1 or 12 mA at F1) then the control spool (2) is positioned in the hydraulic centre position.



Type 4WRSEH 10 V…–3X/…

Function, section

4/4-way version

The function of these valves is basically the same as the 4/3-way version. However, when the solenoid is de-energised the control spool is moved into a fail-safe position via a compression spring.

The 4/4 high response directional control valves are designed as direct operated units of subplate mounting design. They are operated by high response solenoids. The solenoids are controlled via the integrated control electronics.

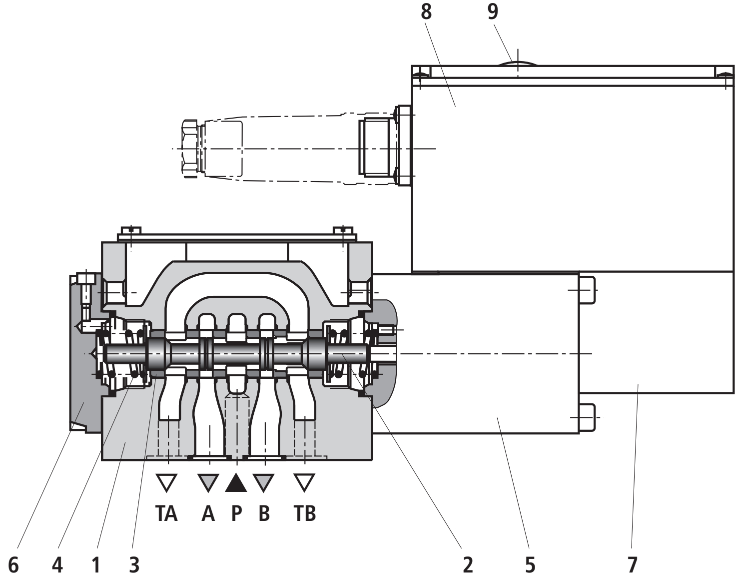
Design:

The valve basically comprises of:

– Housing (1) with mounting surface
– Control spool (2) in bush (3) with compression springs (4)
– Solenoid (5) and cover (6)
– Position transducer (7)
– Integrated control electronics (8)
– Zero point adjustment accessible (9) via the Pg9

Functional description:

– With the solenoid (5) de-energised, a fail-safe position for the control spool (2) via compression spring (4) results
– Direct operation of the control spool (2) by the energisation of the high response solenoid (5)
  E.g. control of the solenoid
  → Moves the control spool (2) in proportion to the electrical input signal
  → Connection from P to A and B to T via orifice type cross-sections with linear or inflected flow characteristics
– By de-energising the solenoid (5) → the control spool (2) is moved back into the fail-safe condition via the compression spring (4)



Type 4WRSEH 10 VC…–3X/…

Technical data (for applications outside these applications, please consult us!)

General

General			NS 6	NS 10
Installation			Optional, preferably horizontal	
Storage temperature range		°C	– 20 to + 80	
Ambient temperature range		°C	– 20 to + 50	
Weight	Valve with 1 solenoid	kg	2.3	6.0
	Valve with 2 solenoids	kg	3.0	7.3

Hydrualic (measured at $p = 100$ bar, $\nu = 46\ mm^2/s$ and $\vartheta = 40\ °C$)

			NS 6				NS 10	
Operating pressure	Ports A, B, P	bar	up to 315				up to 315	
	Port T	bar	up to 315				up to 210	
Application limits C3, C4	Nominal flow	L/min	04	12	24	40	50	100
[1] The details for C4 are	Application limit Δp with symbol C3	bar	315	315	315	160	250	150
only preliminary details!	Application limit Δp with symbol C4 [1]	bar	315	315	200	100	150	100
Nominal flow $q_{V\ nom}$ ± 10 % at $\Delta p = 70$ bar		L/min	4				50	
Δp = valve pressure differential							12 100	
			24				–	
			50 (with V spool with flow „L“); 40 (with C and V spools with flow characteristic „P“)				–	
Max. permissble flow		L/min	80				180	
Pressure fluid			Mineral oil (HL, HLP) to DIN 51 524 and phosphate ester (HFD-R), further pressure fluids on request					
Degree of contamination			Maximum permissible degree of pressure fluid contamination to NAS 1638				A filter with a minimum retention rate of $\beta_x \geq 75$ is recommended	
			Class 7				x = 10	
Pressure fluid temperature range		°C	– 20 to + 80					
Viscosity range		mm^2/s	20 to 380, preferably 30 to 46					
Hysteresis		%	< 0.05					
Reversal span		%	< 0.03					
Response sensitivity		%	< 0.03					

Electrical

Valve protection to DIN 40 050			IP 65	
Voltage type			DC	
Signal type			analogue	
Zero point alignment		%	≤ 1	
Zero point displacement with changes to:			**NS 6**	**NS 10**
	Pressure fluid temperature	%/10 K	< 0.15	< 0.1
	Operating pressure	%/100 bar	< 0.05	< 0.05
Electrical connection			With component plug to E DIN 43 563 AM6	
[2] separate order, see page 6			Plug-in connector to E DIN 43 563-BF6-3/Pg11 [2]	
Control electronics			VT 13070 (integrated into the valve, see page 7)	

Note: For details regarding the **environmental simulation test** covering EMC (electro-magnetic compatibility), climate and mechanical loading see RE 29 069-U (declaration regarding environmental compatibility).

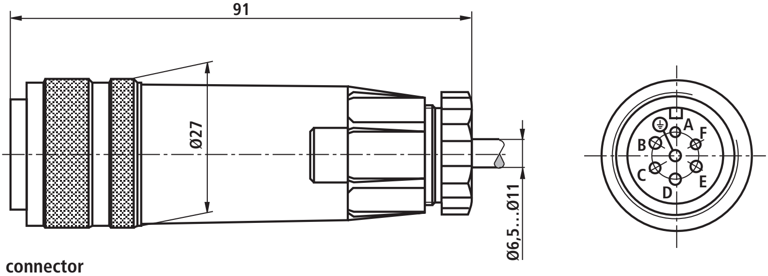
5

Electrical connections, plug-in connector

Plug-in connector

Plug-in connector to E DIN 43 563-BF6-3/Pg11
Separate order under material No. **00021267** (plastic version)

For pin allocation see block circuit diagram on page 7

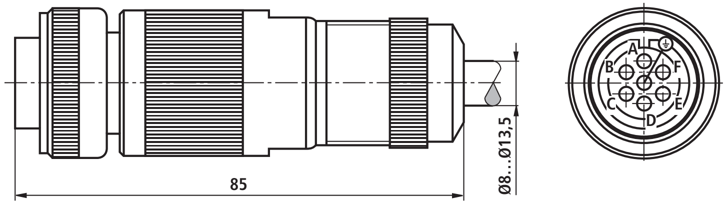


Plug-in connector

Plug-in connector to E DIN 43 563-BF6-3-Pg13.5

Separate order under material No. **000223890** (metal version)

For pin allocation see block circuit diagram on page 7



Component plug allocation

	Contact	Signal
Supply voltage	A	24 VDC (u(t) = 19.4 V to 35 V); I_{max} = 2 A (NS 6) I_{max} = 2.8 A (NS 10); impulse load= 4 A
	B	0 V
Ref. (actual value)	C	Ref. potential for actual value (contact F); A1: $R_e > 50$ kΩ F1: $R_e < 10$ Ω
Differential amplifier input	D	A1: ± 10 V command value, $R_e > 50$ kΩ or F1: 4...20 mA, $R_e > 100$ Ω
(command value)	E	0 V ref. potentional
Measurement output (act. value)	F	± 10 V actual value (limiting load 2 mA); or F1: 4...20 mA, max. load impedance 500 Ω
	PE	Connected with cooling body and valve housing

Actual value: Interface A1: A positive signal at F and the reference potential at C results in a flow from P to A.
Note for A1: Connect pin C on the control side (star form) with ⊥.
Interface F1: 12...20 mA results in a flow from P to A.

Command value: A positive command value at D (interface A1) or 12...20 mA (interface F1) and the reference potential at E results in a flow from P to A and B to T.
A negative command value at D (interface A1) or 12...4 mA (interface F1) and the reference potential at E results in a flow from P to B and A to T.

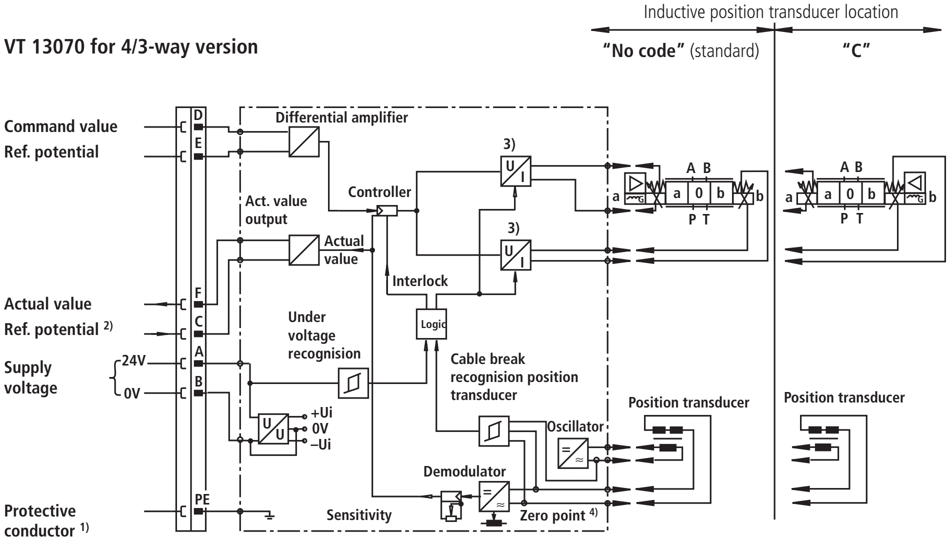
Connection cable: Recommended: – up to 25 m cable length type LiYCY 7 x 0.75 mm^2
– up to 50 m cable length type LiYCY 7 x 1.0 mm^2
Outside diameter 6.5 to 11 mm
Only connect the screen to ⊥ on the supply side.

Integrated control electronics VT 13070

Block circuit diagram / connection allocation for the integrated control electronics

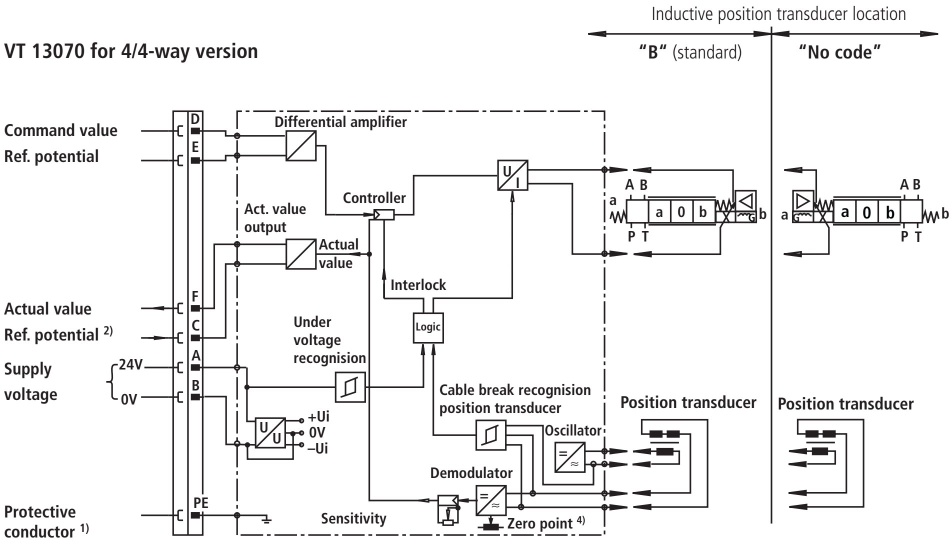
Interface	Integrated control electronics	Valve

VT 13070 for 4/3-way version



Interface	Integrated control electronics	Valve

VT 13070 for 4/4-way version



1) Connection PE is connected with the cooling body and the valve housing

2) **Note for A1:** Connect pin C on the control side to ⊥

3) Output stage, current controller

4) Zero point externally adjustable

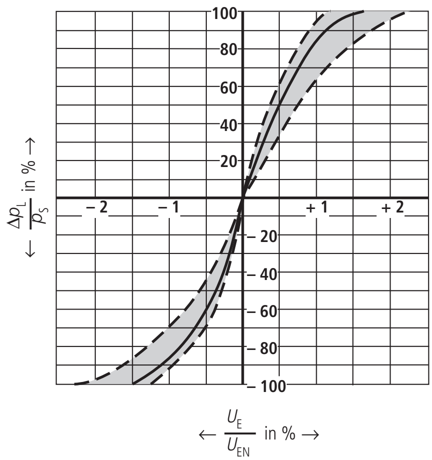
Note: **Electrical signal (e.g. actual value) taken via valve electronics must not be used to switch off the machine safety functions!**
(This is in accordance with the regulations to the European standard "Safety requirements of fluid technology systems and components – hydraulics", EN 982!)

5

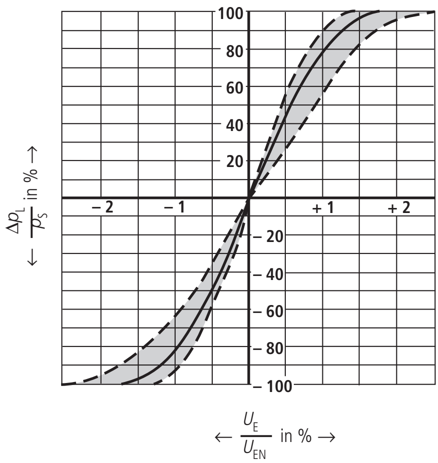
Characteristic curves (measured at ν = 46 mm^2/s and ϑ = 40 °C) NS 6 and 10

Pressure-signal-characteristic curve p_S = 100 bar

NS 6 Type 4WRSEH 6 … L.-3X/…

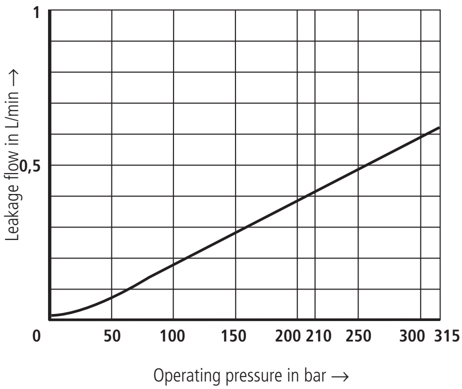


NS 10 Type 4WRSEH 10 … L.-3X/…

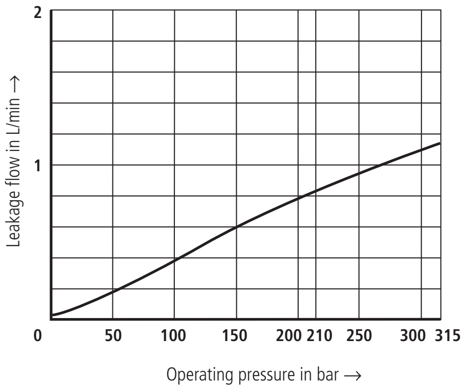


Leakage flow (typical)

NS 6 Type 4WRSEH 6 V50 L.-3X/…

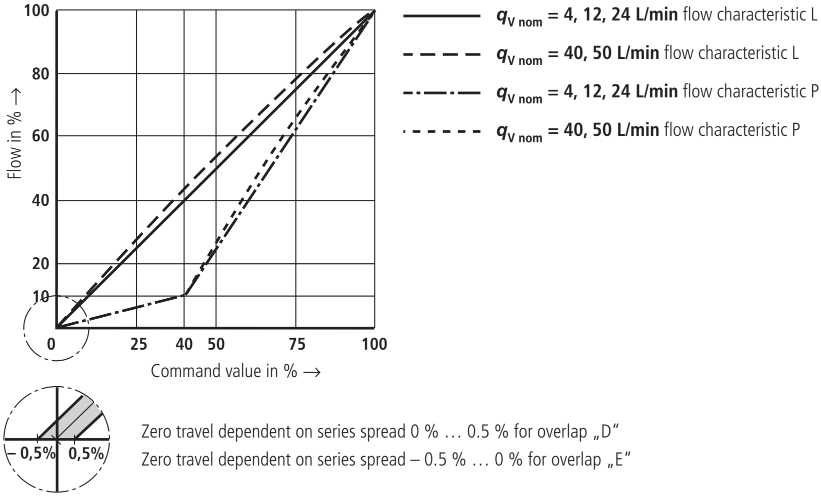


NS 10 Type 4WRSEH 10 V100 L.-3X/…



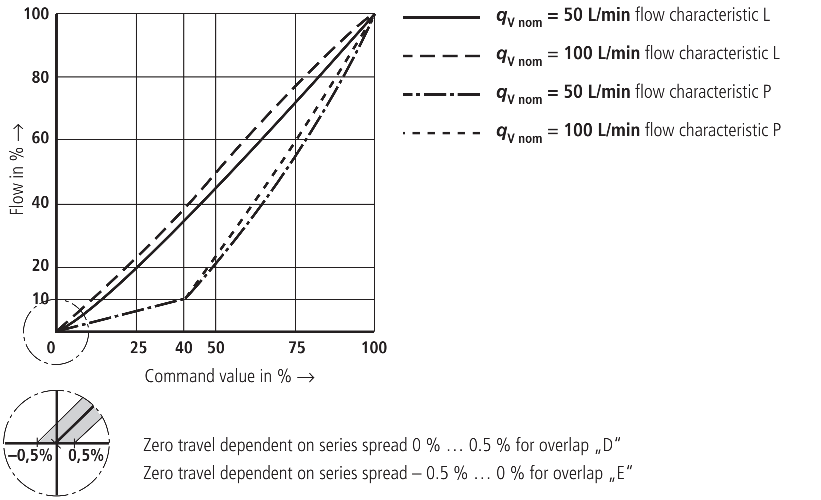
Characteristic curves (typical flow characteristic curve at 70 bar valve pressure differential or 35 bar per control land)

NS 6



Zero travel dependent on series spread 0 % … 0.5 % for overlap „D“
Zero travel dependent on series spread – 0.5 % … 0 % for overlap „E“

NS 10

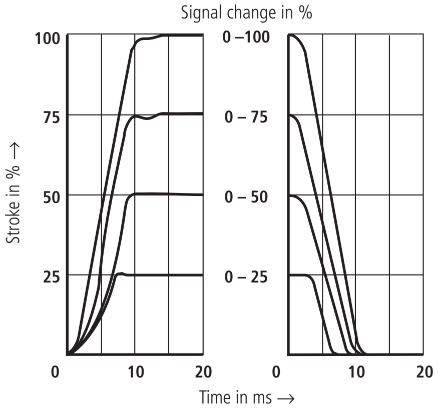


Zero travel dependent on series spread 0 % … 0.5 % for overlap „D“
Zero travel dependent on series spread – 0.5 % … 0 % for overlap „E“

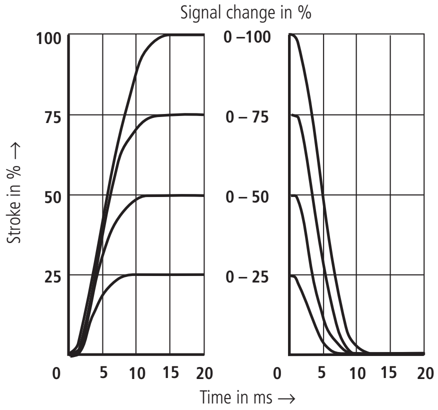
Characteristic curves (measured at: p_S = 10 bar; ν = 46 mm²/s; ϑ = 40 °C) **NS6**

Transient function with a jump form of electrical input signal

4/3-way version

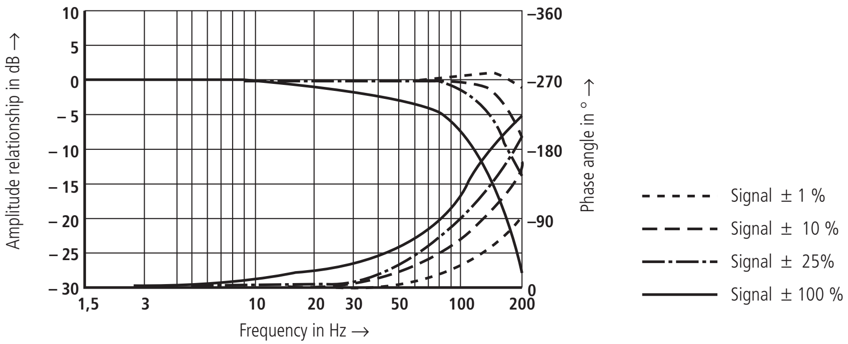


4/4-way version

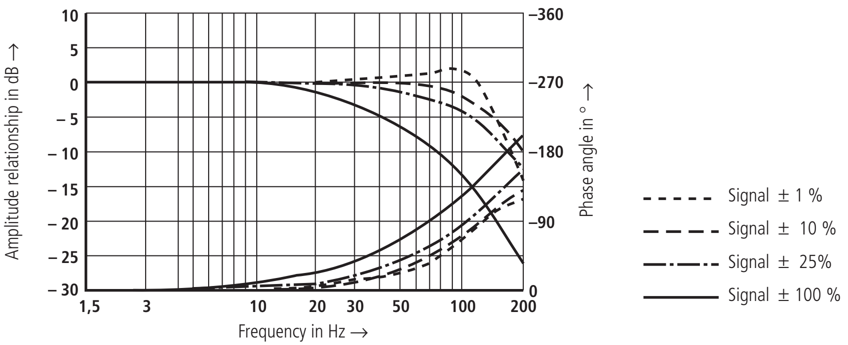


Frequency response characteristic curves

4/3-way version



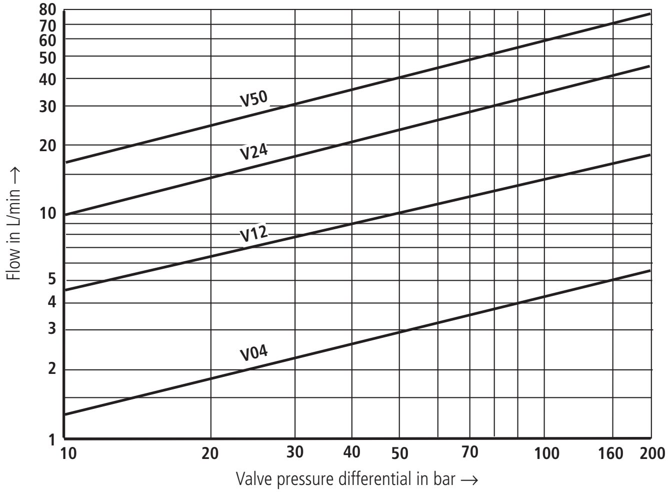
4/4-way version



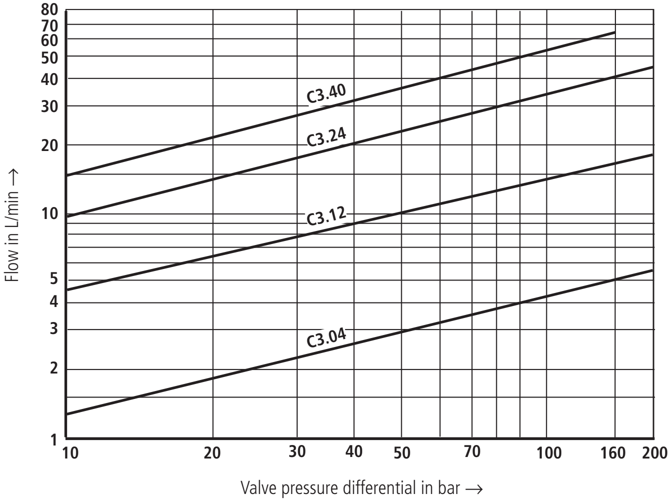
Characteristic curves (measured at: p_S = 10 bar; ν = 46 mm²/s; ϑ = 40 °C) NS6

Flow-load function at the max. valve opening (tolerance ± 10%)

4/3-way version



4/4-way version

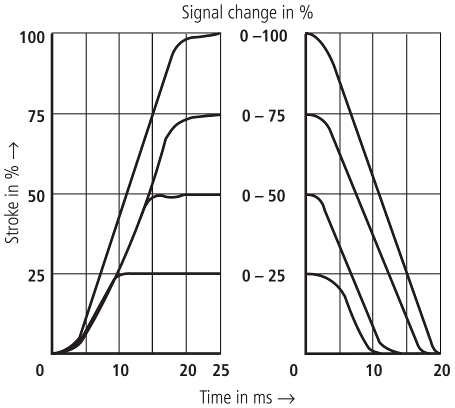


5

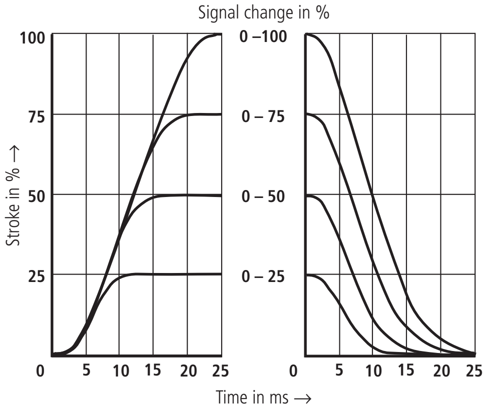
Characteristic curves (measured at: p_S = 10 bar; ν = 46 mm²/s; ϑ = 40 °C) **NS10**

Transient function with a jump form of electrical input signal

4/3-way version

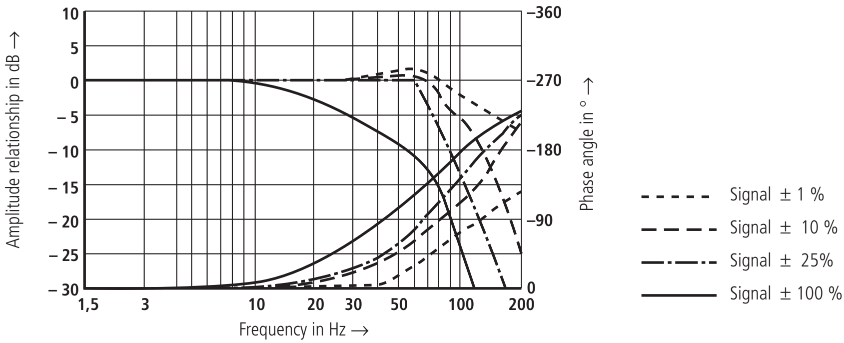


4/4-way version

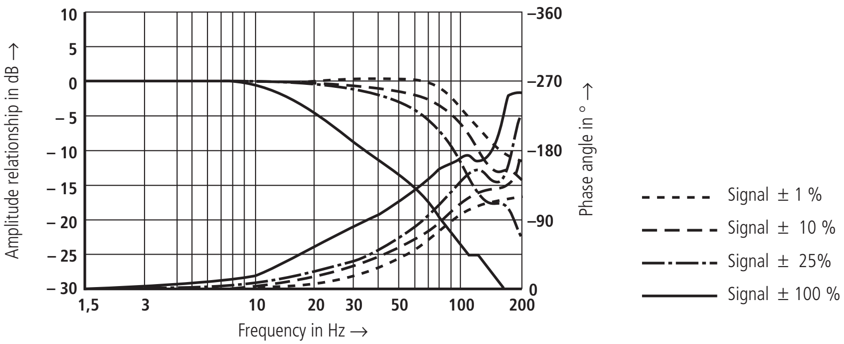


Frequency response characteristic curves

4/3-way version



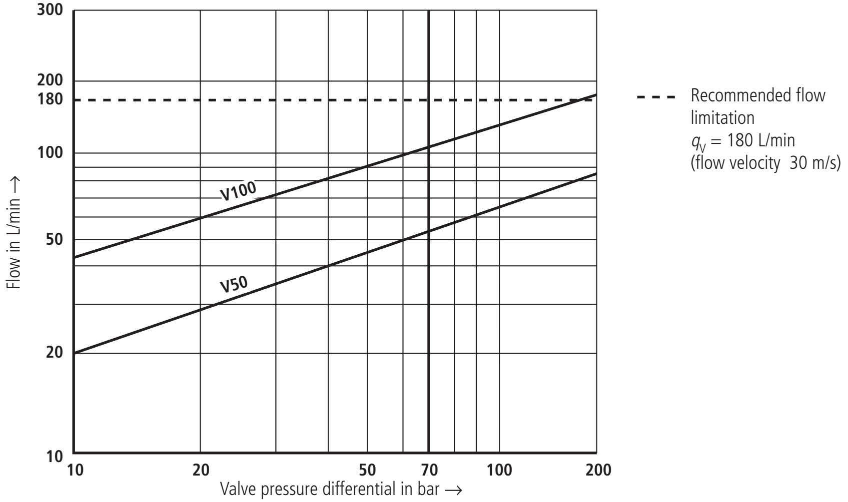
4/4-way version



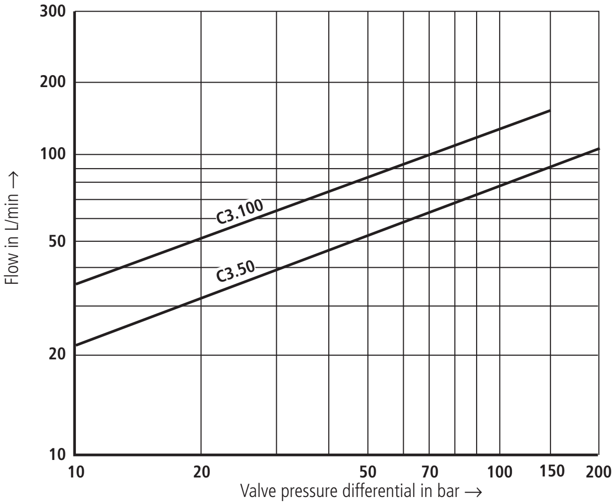
Characteristic curves (measured at: p_S = 10 bar; ν = 46 mm²/s; ϑ = 40 °C) NS10

Flow-load function at the max. valve opening (tolerance ± 10%)

4/3-way version



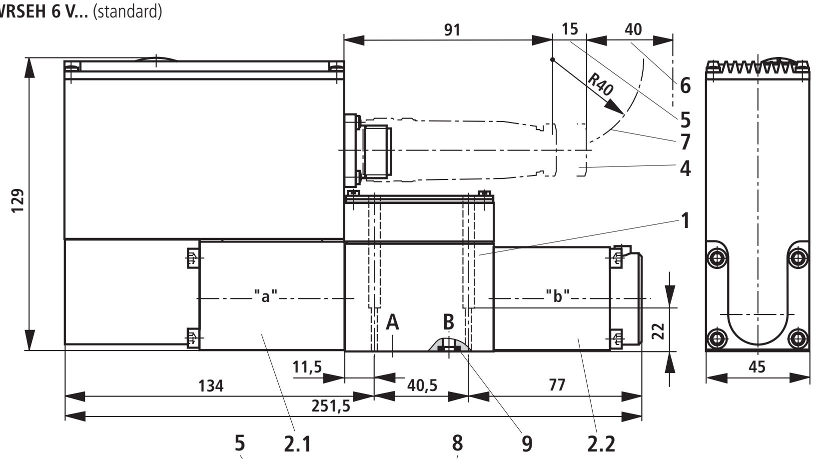
4/4-way version



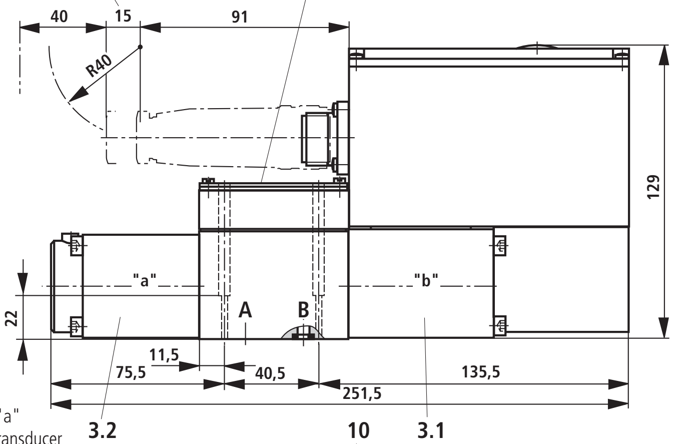
Unit dimensions: NS 6

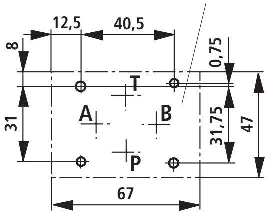
(Dimensions in mm)

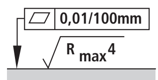
Type 4WRSEH 6 V... (standard)



Type 4WRSEH 6 VC..







Required surface finish of mating piece

1 Valve housing
2.1 High response solenoid "a" with inductive position transducer
2.2 High response solenoid "b"
3.1 High response solenoid "b" with inductive position transducer
3.2 High response solenoid "a"
4 Plug-in connector to E DIN 43 563 BF6-3/Pg11 (separate order, see page 6)
5 Space required to remove the plug-in connector
6 Space requed for the cable bend radius when removing the plug-in connector
7 Cable bend radius
8 Name plate
9 R-ring 9.81 x 1.5 x 1.78 (ports A, B, P, T)
10 Machined valve mounting surface, position of ports to DIN 24 340 form A, ISO 4401 and CETOP-RP 121 H

Subplates to catalogue sheet RE 45 052 and valve fixing screws must be ordered separately.

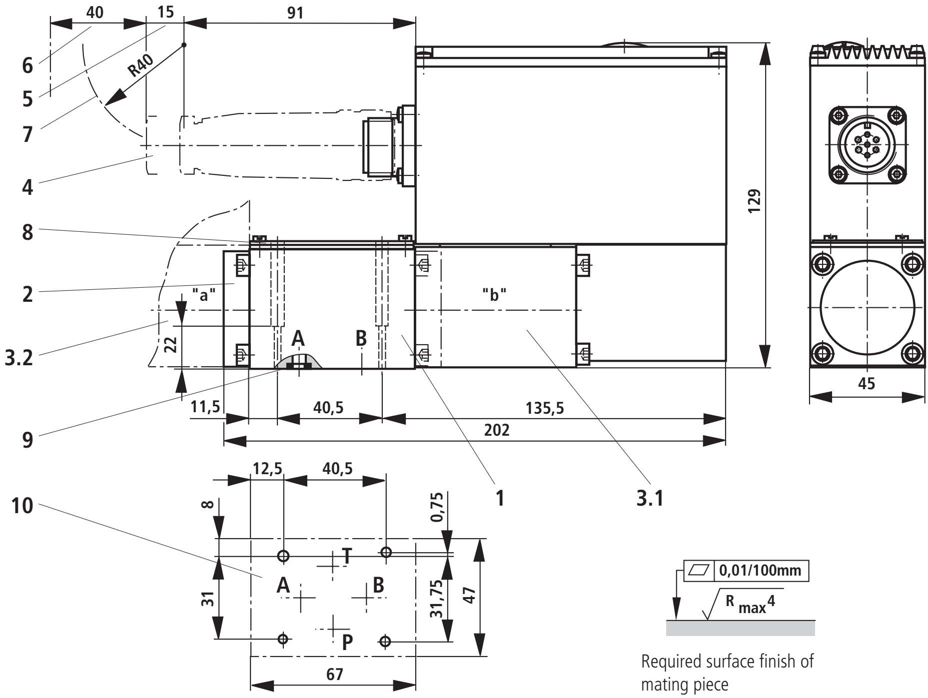
Subplates: G 341/01 (G 1/4)
G 342/01 (G 3/8)
G 502/01 (G 1/2)

Valve fixing screws:
4 off M5 x 30 DIN 912-10.9; M_A = 7.1 Nm

Unit dimensions: NS 6

(Dimensions in mm)

Type 4WRSEH 6 C.B...



Required surface finish of mating piece

1 Valve housing

2 Cover

3.1 High response solenoid „b“ with inductive position transducer

3.2 High response solenoid „a“ with inductive position transducer

4 Plug-in connector to E DIN 43 563 BF6-3/Pg11 (separate order, see page 6)

5 Space required to remove the plug-in connector

6 Space required for the cable bend radius when removing the plug-in connector

7 Cable bend radius

8 Name plate

9 R-ring 9.81 x 1.5 x 1.78 (ports A, B, P, T)

10 Machined valve mounting surface, position of ports to DIN 24 340 form A, ISO 4401 and CETOP-RP 121 H

Subplates to catalogue sheet RE 45 052 and valve fixing screws must be ordered separately.

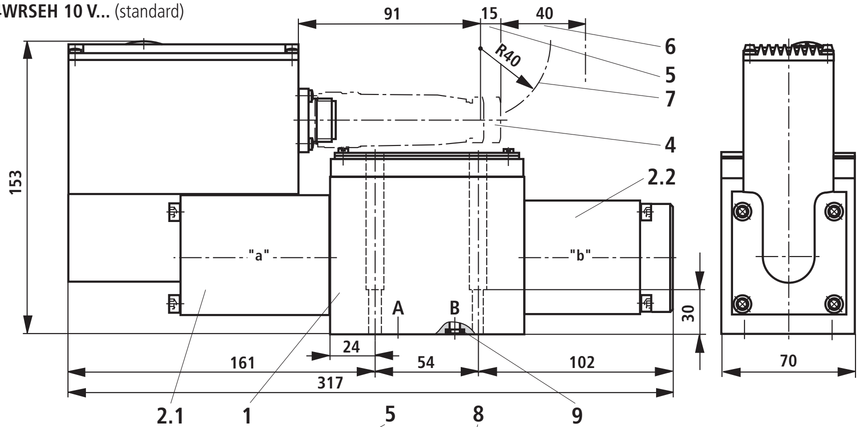
Subplates: G 341/01 (G 1/4)
G 342/01 (G 3/8)
G 502/01 (G 1/2)

Valve fixing screws:
4 off M5 x 30 DIN 912-10.9; M_A = 7.1 Nm

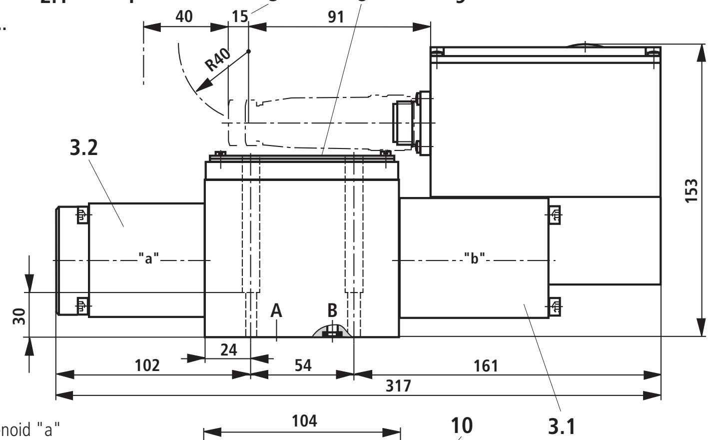
Unit dimensions: NS 10

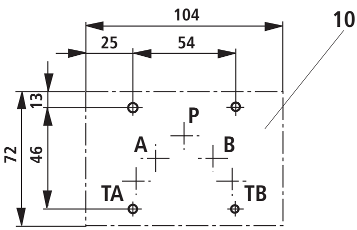
(Dimensions in mm)

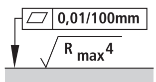
Type 4WRSEH 10 V... (standard)



Type 4WRSEH 10 .VC..







Required surface finish of mating piece

1 Valve housing
2.1 High response solenoid "a" with inductive position transducer
2.2 High response solenoid "b"
3.1 High response solenoid "b" with inductive position transducer
3.2 High response solenoid "a"
4 Plug-in connector to E DIN 43 563-BF6-3/Pg11 (separate order, see page 6)
5 Space required to remove the plug-in connector
6 Space required for the cable bend radius when removing the plug-in connector
7 Cable bend radius
8 Name plate
9 R-ring 13.0 x 1.6 x 2.0 (ports A, B, P, T)
10 Machined valve mounting surface, position of ports to DIN 24 340 form A, ISO 4401 and CETOP-RP 121 H

Subplates to catalogue sheet RE 45 054 and valve fixing screws must be ordered separately.

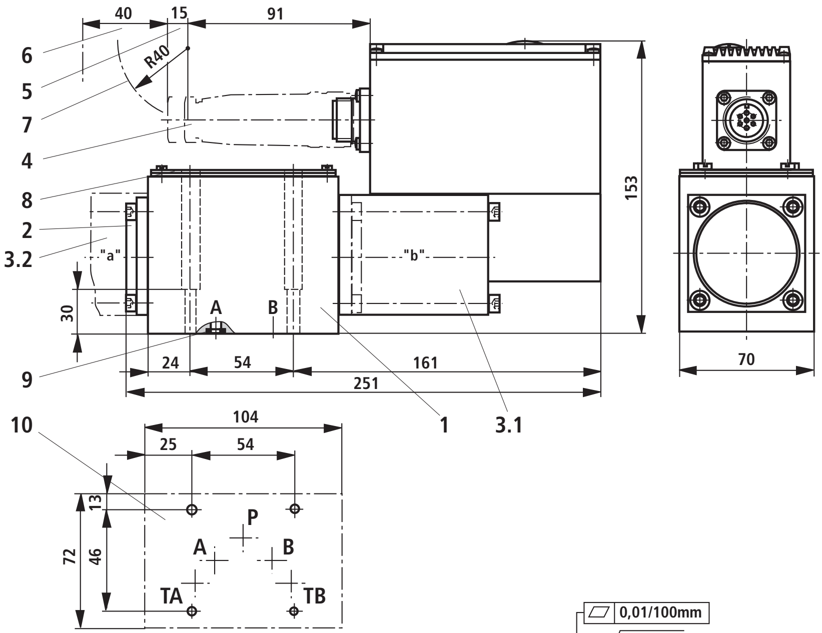
Subplates: G 66/01 (G 3/8); G 67/01 (G 1/2)
G 534/01 (G 3/4)

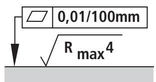
Valve fixing screws:
4 off M6 x 40 DIN 912-10.9; M_A = 12.2 Nm

Unit dimensions: NS 10

(Dimensions in mm)

Type 4WRSEH 10 C.B...





Required surface finish of mating piece

1 Valve housing
2 Cover
3.1 High response solenoid „b“ with inductive position transducer
3.2 High response solenoid „a“ with inductive position transducer
4 Plug-in connector to E DIN 43 563-BF6-3/Pg11 (separate order, see page 6)
5 Space required to remove the plug-in connector
6 Space required for the cable bend radius when removing the plug-in connector
7 Cable bend radius
8 Name plate
9 R-ring 13.0 x 1.6 x 2.0 (ports A, B, P, T)
10 Machined valve mounting surface, position of ports to DIN 24 340 form A, ISO 4401 and CETOP-RP 121 H

Subplates to catalogue sheet RE 45 054 and valve fixing screws must be ordered separately.

Subplates: G 66/01 (G 3/8); G 67/01 (G 1/2)
G 534/01 (G 3/4)

Valve fixing screws:
4 off M6 x 40 DIN 912-10.9; M_A = 12.2 Nm

Notes

Bosch Rexroth AG
Industrial Hydraulics

D-97813 Lohr am Main
Zum Eisengießer 1 • D-97816 Lohr am Main
Telefon 0 93 52 / 18-0
Telefax 0 93 52 / 18-23 58 • Telex 6 89 418-0
eMail documentation@boschrexroth.de
Internet www.boschrexroth.de

Bosch Rexroth Limited

Cromwell Road, St Neots,
Cambs, PE19 2ES
Tel: 0 14 80/22 32 56
Fax: 0 14 80/21 90 52
eMail: info@boschrexroth.co.uk

Electric Drives and Controls | Hydraulics | Linear Motion and Assembly Technologies | Pneumatics | Service

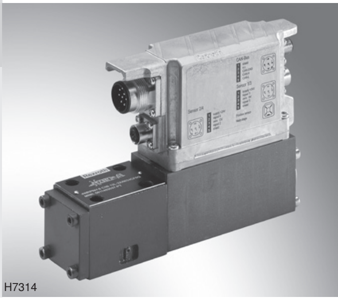
Rexroth
Bosch Group

High-response valve with integrated digital axis controller (IAC-R) and field bus interface

RE 29191/09.10
Replaces: 06.05

Type 4WRPNH.../24C...
Type 4WRPNH.../24P...

Size 6 and 10
Component series 2X
Maximum operating pressure 315 bar
Maximum flow 100 l/min (Δp = 70 bar)



H7314

Table of contents

Features

– Direct operated high-response valves size 6 and size 10 with control spool and sleeve in servo quality
– Single-side operated, 4/4 fail-safe position in deactivated state
– Integrated digital axis control functionality (IAC-R) for:
  • Flow control
  • Position control
  • Pressure control
  • p/Q function
  • Substitutional position/pressure and position/force control
  • NC functionality (stand-alone operation possible)
– Analog and digital interfaces for command and actual values
  •4 x analog sensors (+/–10 V or 4..20 mA) or
  •1 x length measurement system (1Vss or SSI) and 2 analog sensors
– Command value provision/actual value response analog (current or voltage) or via field bus
– Analog/digital inputs/outputs configurable
– Field bus connection
  •CAN bus with CANopen protocol DS408
  •Profibus-DP V0/V1
– Quick commissioning via PC and commissioning software

Ordering code

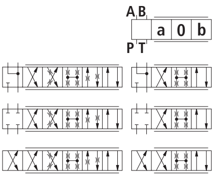
4WRP	N	H			B		– 2X /	M /	24				*

with integrated digital axis controller and NC functionality **= N**

Control spools / sleeve **= H**

Size 6 **= 6**
Size 10 **= 10**

Spool symbols
4/4-directional design



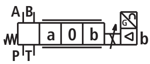
= C3, C5

= C4, C1

= C

With symbols C5 and C1:
P → A: q_v B → T: $q_v/2$
P → B: $q_v/2$ A → T: q_v

Mounting side of the inductive position transducer



(standard) **= B**

Rated flow at 70 bar valve pressure differential (35 bar / control edge)

Size 6
2 l/min **= 02**
4 l/min **= 04**
12 l/min [8] **= 12**
15 l/min [1] **= 15**
24 l/min [8] **= 24**
25 l/min [1] **= 25**
40 l/min [2] **= 40**

Size 10
50 l/min **= 50**
100 l/min **= 100**

Flow characteristics
Linear **= L**
Inflected characteristic curve [3] **= P**

Further details in the plain text

Sensor interfaces [4]
A = X4, M12-5, ±10 V
X7, M12-5, ±10 V
B = X4, M12-5, ±10 V
X7, M23-12, SSI [5]
C = X4, M12-5, ±10 V
X7, M23-12, 1 Vss [6]
G = X4, M12-5, 4...20 mA
X7, M12-5, 4...20 mA
H = X4, M12-5, 4...20 mA
X7, M23-12, SSI [5]

Command value inputs
A6 = ±10 VDC
F6 = 4...20 mA

Field bus interface
C = CANopen [7]
P = Profibus DP V0/V1

24 = Supply voltage 24 V

Seal material
M = NBR seals suitable for mineral oils (HL; HLP) according to DIN 51524

2X = Component series 20 to 29 (20 to 29: Identical installation and connection dimensions)

1) Only in connection with flow characteristics **"P"**
2) q_v 2:1 only with rated flow = 40 l/min
3) Inflection 60 % at size 6 with rated flow **"15"** and **"25"**, otherwise inflection 40 %
4) For sensor interfaces **"A"**, **"B"** or **"C"** only command value input **"A6"** is possible.
For sensor interface **"G"** and **"H"** only command value input **"F6"** is possible.
5) Gray code or binary
6) Adjustable interpolation
7) Field bus interface CANopen with sensor interface **"B"**, **"C"**, **"G"** or **"H"** only upon request
8) Only in connection with flow characteristics **"L"**

Note:

Ordering codes for and technical information on the control valve with integrated digital axis controller (IAC-R) and clock-synchronized PROFIBUS DP/V2 (PROFIdrive profile) can be seen on data sheet 29291.

Standard types

Size 6 with CANopen

Material no.	Type
R901124262	4WRPNH 6 C4 B40P-2X/M/24CA6A
R901131590	4WRPNH 6 C4 B15P-2X/M/24CA6A
0811403540	4WRPNH 6 C3 B24L-2X/M/24CF6G
0811403548	4WRPNH 6 C4 B40L-2X/M/24CA6A
0811403541	4WRPNH 6 C3 B04L-2X/M/24CA6A

Size 10 with CANopen

Material no.	Type
R901125645	4WRPNH 10 C3 B100P-2X/M/24CA6A
0811403361	4WRPNH 10 C3 B100L-2X/M/24CA6A
R901243764	4WRPNH 10 C3 B100L-2X/M/24CA6B
R901243769	4WRPNH 10 C3 B100P-2X/M/24CA6B

Size 6 with Profibus DP

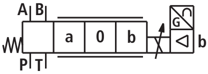
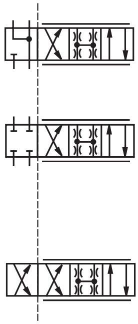
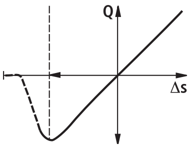
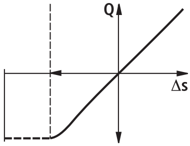
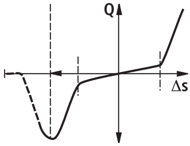
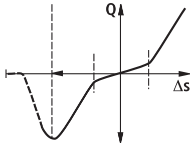
Material no.	Type
0811403552	4WRPNH 6 C3 B04L-2X/M/24PA6A
0811403575	4WRPNH 6 C3 B40L-2X/M/24PA6B
0811403550	4WRPNH 6 C3 B40L-2X/M/24PA6A
0811403573	4WRPNH 6 C3 B25P-2X/M/24PA6B
0811403559	4WRPNH 6 C3 B04L-2X/M/24PF6G
0811403531	4WRPNH 6 C3 B40L-2X/M/24PF6G
R901224758	4WRPNH 6 C1 B24L-2X/M/24PF6G

Size 10 with Profibus DP

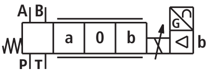
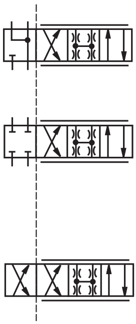
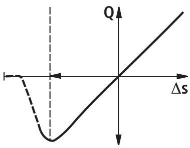
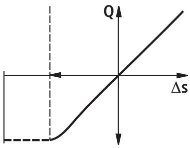
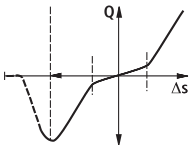
Material no.	Type
0811403358	4WRPNH 10 C3 B100L-2X/M/24PF6G
0811403359	4WRPNH 10 C4 B100L-2X/M/24PF6G
R901232766	4WRPNH 10 C4 B100P-2X/M/24PF6G

Symbols

Size 6

	Linear	*p*: Inflection 60 % [q_n 15.25 l/min]	*p*: Inflection 40 % [q_n 40 l/min]
 C3, C5 C4, C1 C	 C3, C5, C4, C1  C	 C3, C5, C4, C1	
	Standard = 1:1, from q_n = 40 l/min also 2:1		

Size 10

	Linear	*p*: Inflection 40 %
 C3, C5 C4, C1 C	 C3, C5, C4, C1  C	 C3, C5, C4, C1

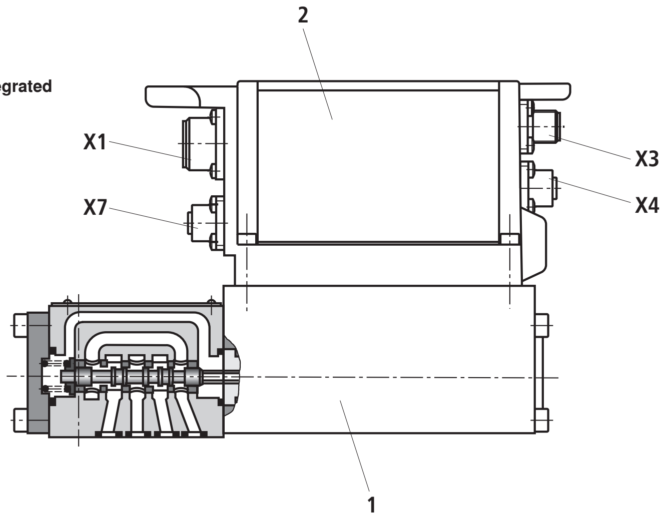
Function, section

Structure

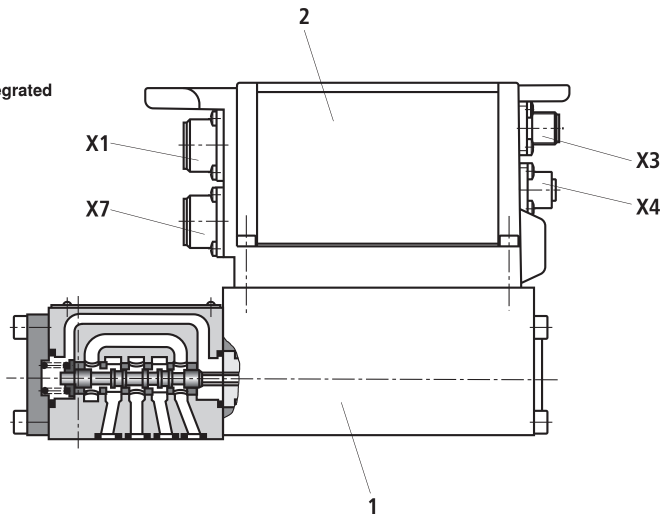
The IAC-R valve mainly consists of:

- Direct operated high-response valve (1) with control spool in servo quality
- Integrated digital axis controller (2) with analog and digital sensor interfaces and field bus connection (X3)

High-response valve with integrated axis controller with analog interfaces (X1, X4, X7)



High-response valve with integrated axis controller with analog interfaces (X1, X4) and digital sensor interface (X7)



Function, section

Functional description

The **IAC-**R valve (**I**ntegrated **A**xis **C**ontroller on the basis of high-response valves) is a digital high-response valve with integrated axis controller with the following functionalities:

– Flow control
– Position control
– Pressure control
– p/Q function
– Substitutional position/pressure and position/force control
– NC functionality

– The command value can alternatively be provided via an analog interface (X1) or via the field bus interface (X3)
– The actual value signals are provided via an analog interface (X1) and can additionally be read out via the field bus (X3).
– The controller parameters are set via the field bus.
– Separate supply voltage for bus/controller and power part (output stage) for safety reasons

PC program WinHPT

To implement the project planning task and to parameterize the IAC-R valves, the user may use the commissioning software WinHPT (see accessories).

– Parameterization
– Programming of NC functionality
– Diagnosis
– Comfortable data management on a PC
– PC operating systems: Windows 2000 or Windows XP

The digital integrated control electronics enables the following fault detection:

– Cable break sensors
– Undervoltage
– Temperature of the integrated electronics
– Communication errors
– Watchdog

The following additional functions are available:

– Ramp generator
– Internal command value profile
– Release function analog/digital
– Error output 24 V (e.g. as switching signal to PLC/logic and further valves), max. 1.8 A
– Control output adjustment
  • Deadband compensation
  • Zero point correction
  • Valve inflection compensation
  • Friction compensation
  • Direction-dependent gain

Technical Data (For applications outside these parameters, please consult us!)

general			Size 6	Size 10
Type			Gate valve, directly operated, with steel sleeve	
Actuation			Proportional solenoid with position control, OBE	
Type of connection			Plate connection, porting pattern according to ISO 4401	
Installation position			Any	
Ambient temperature range		°C	–20 … +50	
Weight		kg	2.7	7.5

hydraulic (measured with HLP46, $\vartheta_{ÖL}$ = 40 °C ± 5 °C)			
Hydraulic fluid			Hydraulic oil according to DIN 51524…535, other media upon request
Viscosity range	Recommended	mm^2/s	20 … 100
	Max admissible	mm^2/s	10 … 800
Hydraulic fluid temperature range		°C	–20 … +60
Maximum permitted degree of contamination of the hydraulic fluid cleanliness class according to ISO 4406 (c)			Class 18/16/13 [1)]
Direction of flow			According to symbol

hydraulic, size 6								
Rated flow at Δp = 35 bar per edge [2)]		l/min	2	4	12	15	24/25	40
Max. operating pressure	Ports P, A, B	bar	315					
	Port T	bar	250					
Limitation of use with regard to the transition to failsafe	Spool symbols C3, C5	bar	315	315	315	315	315	160
	Spool symbols C1, C4	bar	315	315	315	280	250	100
Leakage oil at 100 bar	Linear characteristic curve L	cm^3/min	< 150	< 180	< 300	-	< 500	< 900
	Inflected characteristic curve P	cm^3/min	-	-	-	< 180	< 300	< 450

hydraulic, size 10						
Rated flow at Δp = 35 bar per edge [2)]		l/min	50 (1:1)	50 (2:1)	100 (1:1)	100 (2:1)
Max. operating pressure	Ports P, A, B	bar	315			
	Port T	bar	250			
Limitation of use with regard to the transition to failsafe	Spool symbols C3, C5		315	315	160	160
	Spool symbols C1, C4		250	250	100	100
Leakage oil at 100 bar	Linear characteristic curve L	cm^3/min	< 1200	< 1200	< 1500	< 1500
	Inflected characteristic curve P	cm^3/min	< 600	< 500	< 600	< 600

static / **dynamic**		Size 6	Size 10
Hysteresis	%	≤ 0.2	
Manufacturing tolerance q_{max}	%	< 10	
Actuating time for signal step 0 … 100 %	ms	≤ 10	25
Temperature drift		Zero shift < 1 % at Δϑ = 40 °C	
Zero compensation		ex factory ±1 %	
Conformity		CE according to EMC directive 2004/108/EC	

The footnotes are explained on the following page.

5

Technical Data (For applications outside these parameters, please consult us!)

electric			
Relative duty cycle		%	100 (continuous operation)
Protection class according to EN 60529			IP 65 with mounted and locked plug-in connectors
Supply voltage	Nominal voltage	VDC	24
	Lower limit value	VDC	21
	Upper limit value	VDC	36
	Max admissible residual ripple	Vss	2 (at supply voltage of 23 V … 34 V)
Power consumption	Size 6	W	Max. 40
	Size 10	W	Max. 60
AD/DA resolution		Analog inputs Analog outputs	12 bit 10 bit
Protective earthing conductor and shielding			See pin assignment (CE-compliant installation)
Adjustment			Calibrated ex factory, see valve characteristic curve

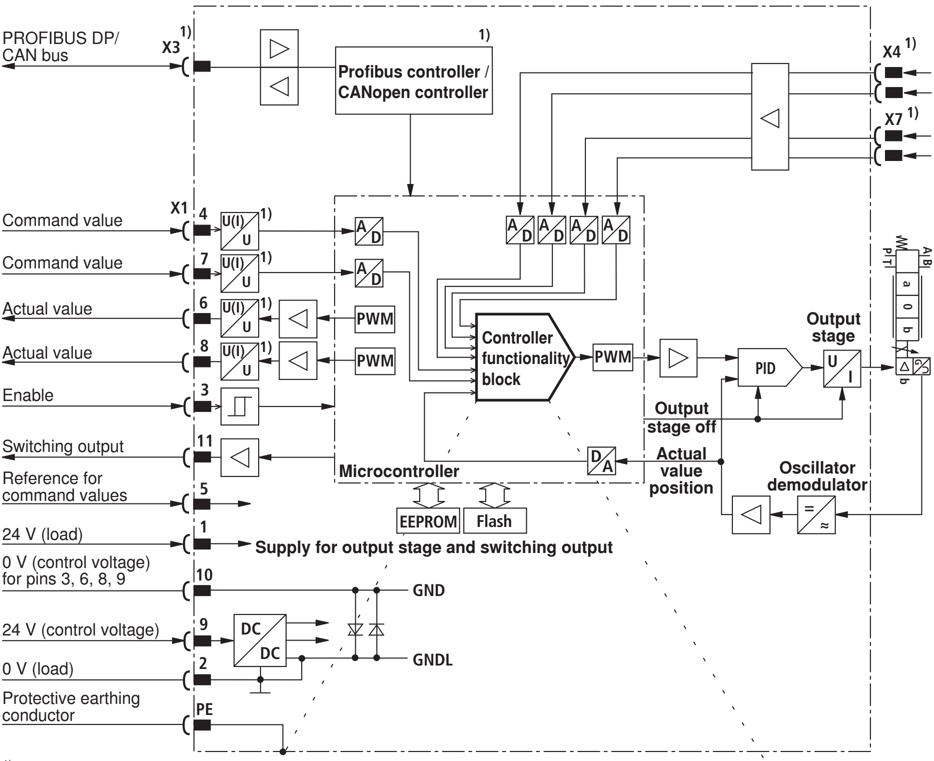
1) The cleanliness classes specified for the components must be adhered to in hydraulic systems.

Effective filtration prevents faults and at the same time increases the service life of the components.

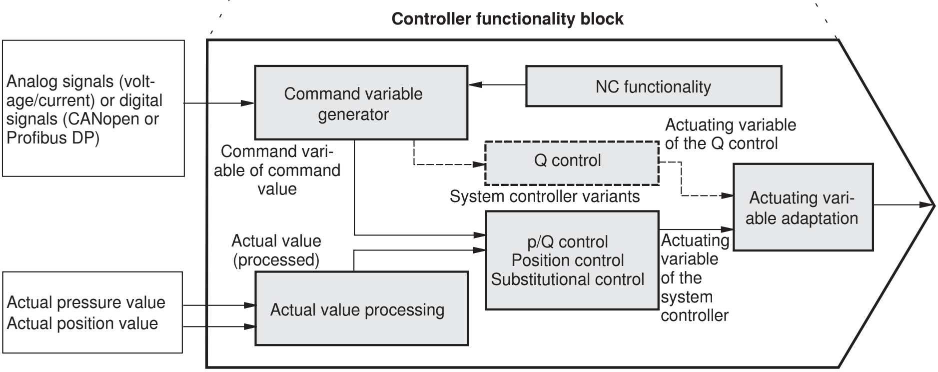
For the selection of the filters see www.boschrexroth.de/filter.

2) Flow at different Δp: $q_x = q_{nom} \cdot \sqrt{\frac{\Delta p_x}{35}}$

Block diagram/controller functionality



[1)] According to ordering code



These variables must be parameterized.

Electrical connections, assignment

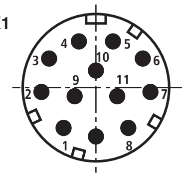
Unit connector pin assignment X1, 11-pole + PE according to EN 175201-804

Pin	Core marking [1)]	Assignment of interface A6	Assignment of interface F6
1	1	24 VDC (supply for output stage and power switching signal)	
2	2	0 V ≙ load zero (for output stage)	
3	3	Release input 8.5 … 24 VDC = function, R_e ~10 kΩ	
4	4	Command value ±10 V; R_e ~130 kΩ or dig. Input (from PLC) [2)]	4 … 20 mA command value; R_e = 200 Ω or dig. Input (from PLC) [2)]
5	5	Reference for command values	
6	6	±10 V actual value or dig. Output (to PLC) [2)]	4 … 20 mA actual value, load resistance ~330 Ω or dig. Output (to PLC) [2)]
7	7	Command value ±10 V; R_e ~130 kΩ or dig. Input (from PLC) [2)]	4 … 20 mA command value; R_e = 200 Ω or dig. Input (from PLC) [2)]
8	8	±10 V actual value or dig. Output (to PLC) [2)]	4 … 20 mA actual value, load resistance ~330 Ω or dig. Output (to PLC) [2)]
9	9	24 VDC (control voltage for signal part and bus)	
10	10	0 V reference potential for pin 3, 6, 8 and 9	
11	11	Switching output 24 V (error signal or power switching signal) max 1.8 A	
PE	Green-yellow	Protective earthing conductor (connected directly to metal housing)	

[1)] Core marking of the connection lines for line socket with cable set (see accessories)

[2)] Selection via commissioning software

X1



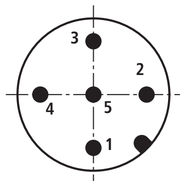
Unit connector pin assignment for CAN bus "X3" (code A), M12, 5-pole, pins

Pin	Assignment
1	n.c.
2	n.c.
3	CAN_GND
4	CAN_H
5	CAN_L

External screen on both sides of the metallic housing of the plug-in connection.

Internal screens are not required.

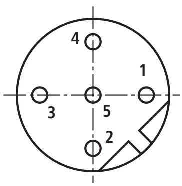
Transmission rate kbit/s	20 to 1000
Bus address	1 to 127



Unit connector pin assignment for Profibus DP "X3" (code B), M12, 5-pole, socket

Pin	Assignment
1	VP
2	RxD/TxD-N (A line)
3	D GND
4	RxD/TxD-P (B line)
5	Shield

Transmission rate	up to 12 MBaud
Bus address	1 to 126



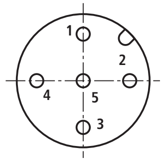
The galvanically separated voltage +5 V (pin 1 - VP) at the socket allows for passive termination of the profibus.

Electrical connections, assignment

Analog sensor interfaces, connection "X4" and "X7" (code A), M12, 5-pole, socket

Pin	Assignment of voltage interface	Assignment of current interface
1	Supply 24 VDC	Supply 24 VDC
2	Signal 3 (X4) / 4 (X7), (–10 … +10 V)	Signal 3 (X4) / 4 (X7), (4 … 20 mA)
3	Zero 0 V	Zero 0 V [1]
4	Signal 1 (X4) / 2 (X7), (–10 … +10 V)	Signal 1 (X4) / 2 (X7), (4 … 20 mA)
5	Shield	Shield

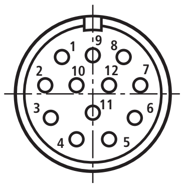
[1] Do not connect to 2-wire pressure transducer



Attention: The analog sensor interfaces at the connections X4 and X7 are not coded.
Danger of confusing the same! The user has to ensure proper wiring!

Digital sensor interface 1Vss or SSI measurement system "X7", M23, 12-pole, socket

Pin	Assignment 1Vss	Assignment SSI
1	$\overline{B}$	0 V
2	Sense +5 V [1]	Data
3	R	Clock
4	$\overline{R}$	n.c.
5	A	n.c.
6	$\overline{A}$	n.c.
7	n.c.	n.c.
8	B	n.c.
9	n.c.	24 V
10	0 V [1]	$\overline{\text{Data}}$
11	Sense 0 V [1]	$\overline{\text{Clock}}$
12	+5 V [1]	n.c.



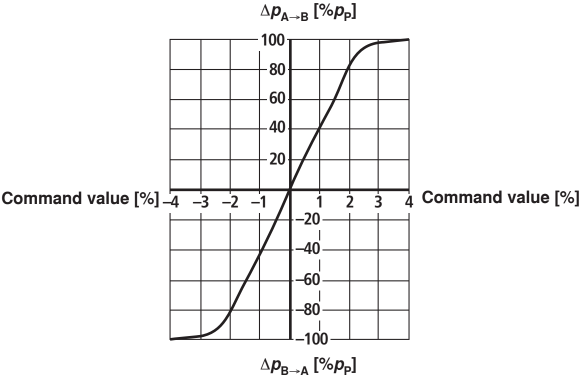
Note:
The sense signal is not analyzed.

[1] **Recommendation**:
Connect the voltages +5 V (pin 12) and +5 V-Sense (pin 2), as well as 0 V (pin 10) and 0 V-Sense (pin 11) for transducer supply.

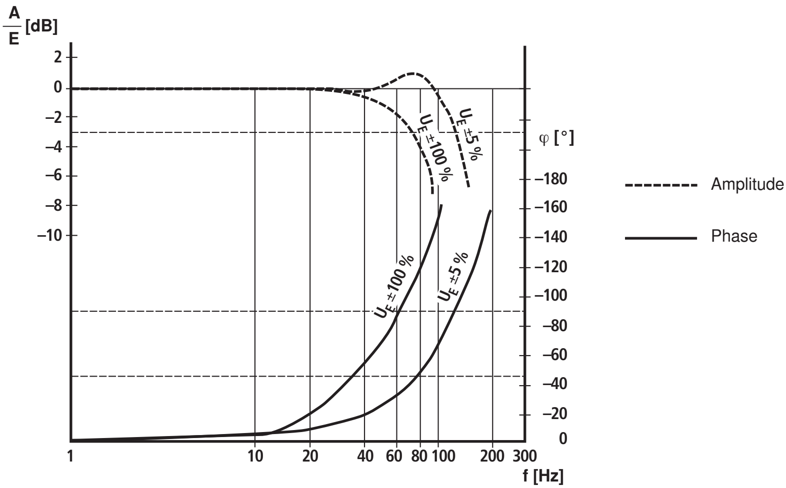
Note:
We recommend connecting the screens on both sides over the metallic housings of the plug-and-socket-connectors.
Using connector pins will affect the effectiveness of the screen!
Internal screens are not required.

Characteristic curves size 6 (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

Pressure gain



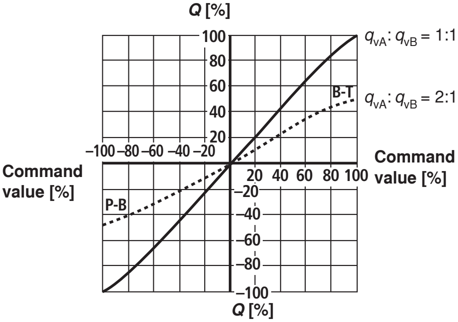
Bode diagram



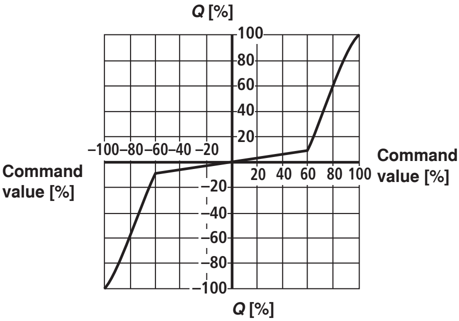
Characteristic curves size 6 (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

Flow - signal function

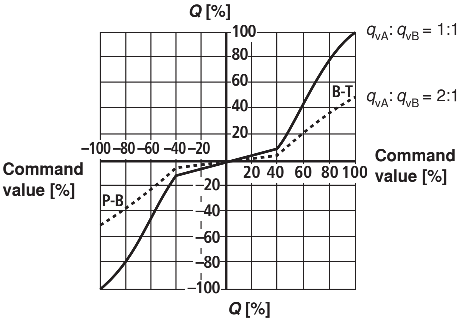
L: Linear



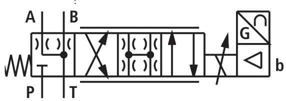
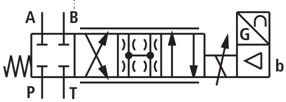
P: Inflection 60 %



P: Inflection 40 %



Fail-safe position

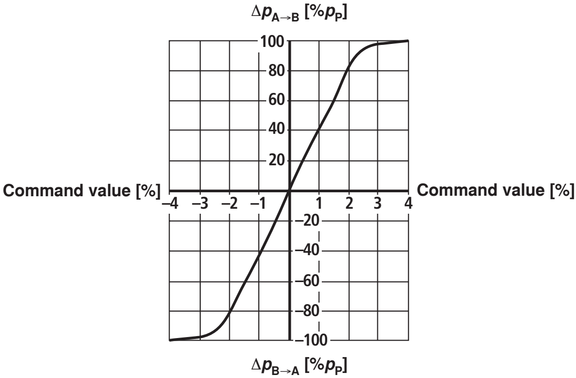
	Leakage oil at	100 bar	P → A	50 cm^3/min
			P → B	70 cm^3/min
	Flow at	Δp = 35 bar	A → T	10 ... 20 l/min
			B → T	7 ... 20 l/min
	Leakage oil at	100 bar	P → A	50 cm^3/min
			P → B	70 cm^3/min
			A → T	70 cm^3/min
			B → T	50 cm^3/min

Fail-safe	p = 0 bar => 7 ms	Enable "off" or internal shut-off in case of error
	p = 100 bar => 10 ms	U_B ≤ 18 V or I ≤ 2 mA (at 4…20 mA signal)

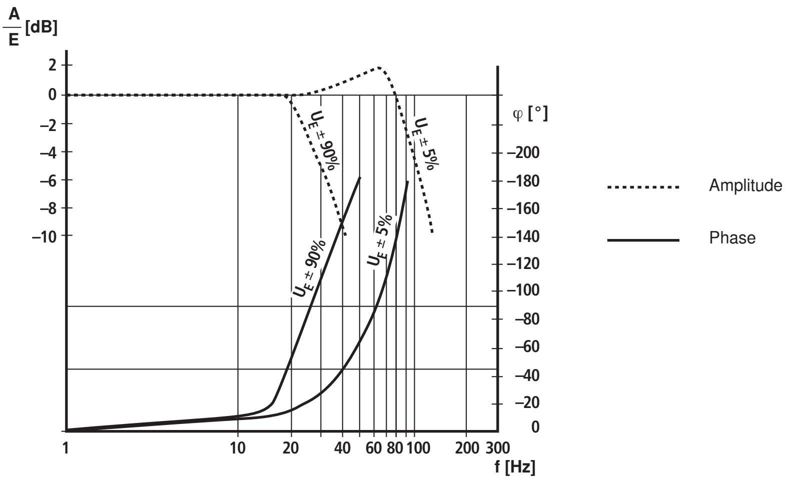
5

Characteristic curves size 10 (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

Pressure gain



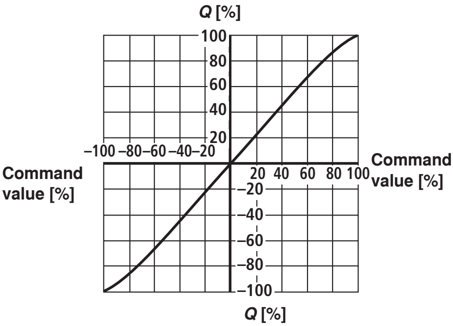
Bode diagram



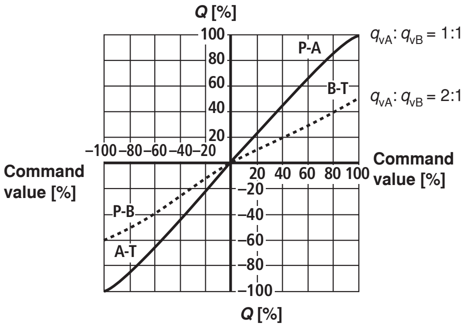
Characteristic curves size 10 (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

Flow - signal function

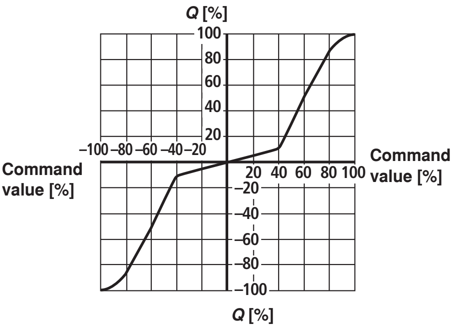
L: Linear 1:1



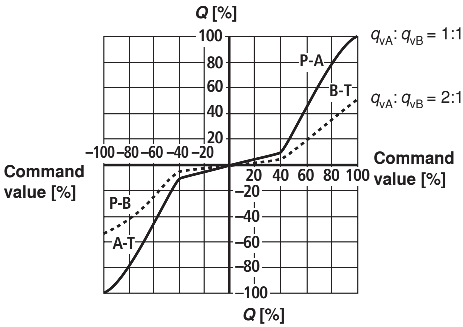
L: Linear 2:1



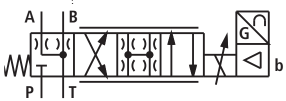
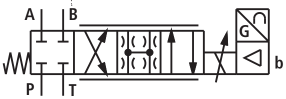
P: Inflection 40 % 1:1



P: Inflection 40 % 2:1



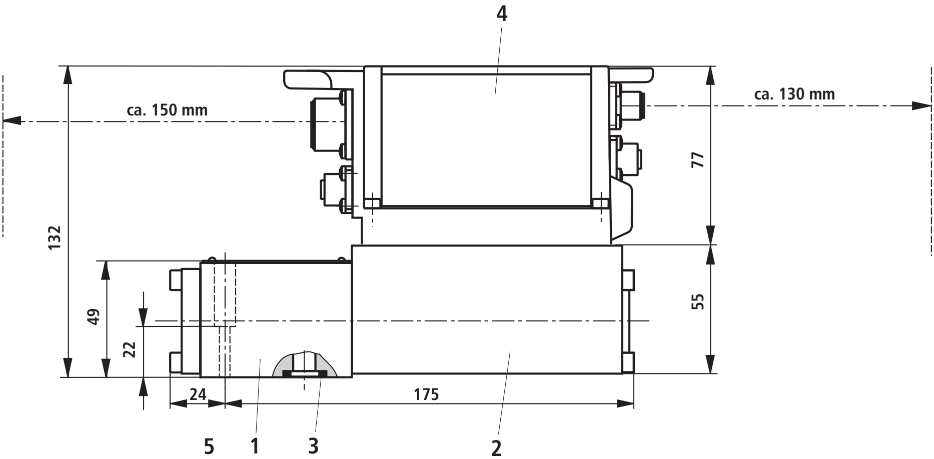
Fail-safe position

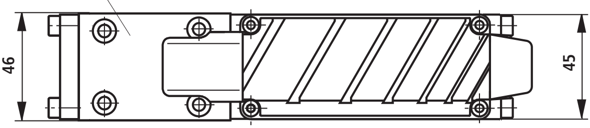
	Leakage oil at	100 bar	P → A	50 cm^3/min
			P → B	70 cm^3/min
	Flow at	Δp = 35 bar	A → T	10 ... 20 l/min
		q_n = 50/100 l/min	B → T	7 ... 20 l/min
	Leakage oil at	100 bar	P → A	50 cm^3/min
			P → B	70 cm^3/min
			A → T	70 cm^3/min
			B → T	50 cm^3/min

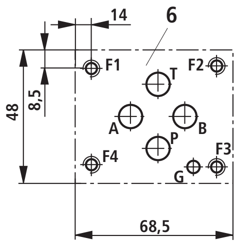
Fail-safe	p = 0 bar => 12 ms	Enable "off" or internal shut-off in case of error
	p = 100 bar => 16 ms	$U_B \leq$ 18 V or $I \leq$ 2 mA (at 4…20 mA signal)

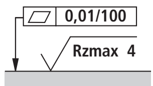
5

Unit dimensions size 6 (dimensions in mm)









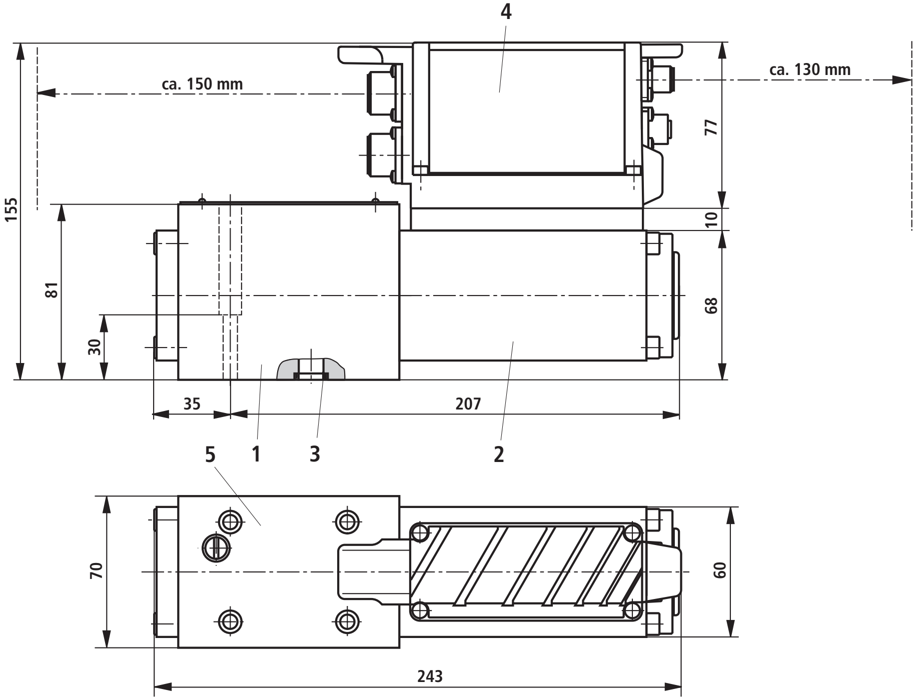
Required surface quality of the valve mounting face

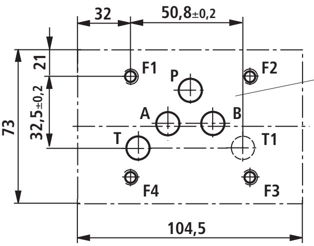
- **1** Valve housing
- **2** Control solenoid with position transducer
- **3** O-ring 9.25 x 1.78 (ports P, A, B, T)
- **4** Integrated digital control electronics
- **5** Name plate
- **6** Machined valve mounting face, porting pattern according to ISO 4401-03-02-0-05

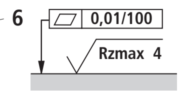
Valve mounting screws
(not included in scope of delivery)
4 units of hexagon socket head cap screws according to ISO4762-M5x30-10.9-N67F 821 70
(galvanized according to Bosch standard N67F 821 70)
M_A = 6+2 Nm

Mat. no. **2910151166**

Unit dimensions size 10 (dimensions in mm)







Required surface quality of the valve mounting face

5

1 Valve housing

2 Control solenoid with position transducer

3 O-ring 12.0 x 2.0 (ports P, A, B, T, T1)

4 Integrated digital control electronics

5 Name plate

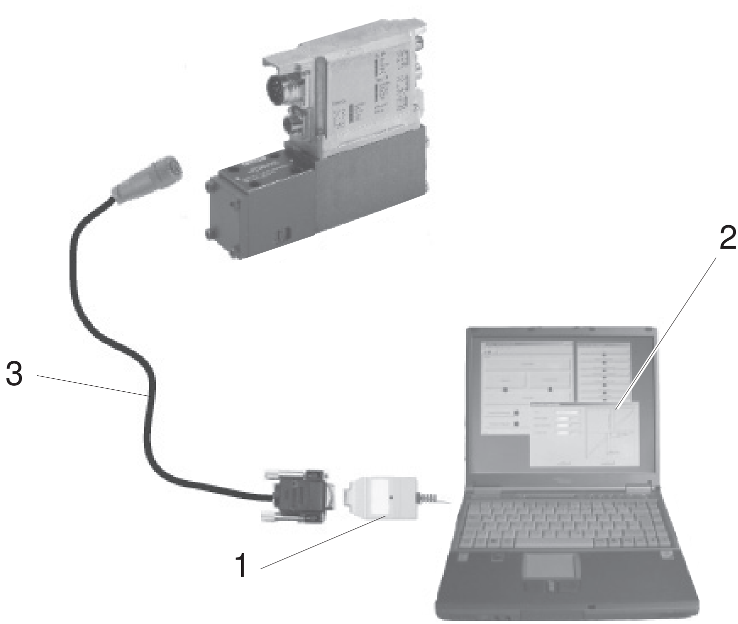
6 Machined valve mounting face, porting pattern according to ISO 4401-05-04-0-05

Deviating from the standard:
– Port T1 is provided additionally

Valve mounting screws
(not included in scope of delivery)
4 units of hexagon socket head cap screws according to ISO4762-M6x40-10.9-N67F 821 70
(galvanized according to Bosch standard N67F 821 70)
M_A = 11+3 Nm
Mat. no. **2910151209**

Accessories for parameterization (not included in scope of delivery)

The following is required for the parameterization with PC:	CANopen	Profibus DP
1 Interface converter (USB)	VT-ZKO-USB/CA-1-1X/V0/0 Mat. no. **R901071963**	VT-ZKO-USB/P-1-1X/V0/0 Mat. no. **R901071962**
2 Start-up software	WinHPT Download from www.boschrexroth.com/IAC	
3 Connecting cable, 3 m	D-Sub / M12 (coding A), Mat. no. **R900751271**	D-Sub / M12 (coding B), Mat. no. **R901078053**

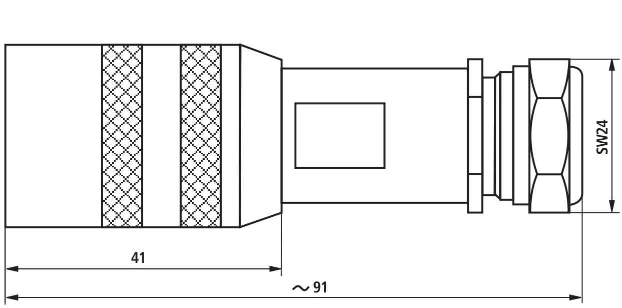


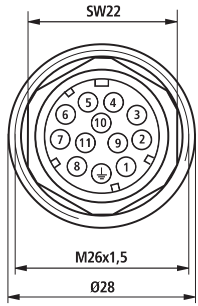
Accessories, port X1 (not included in scope of delivery)

Mating connector for X1

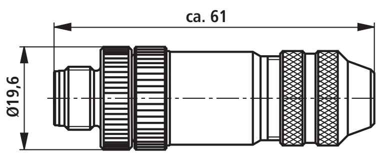
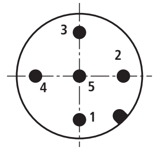
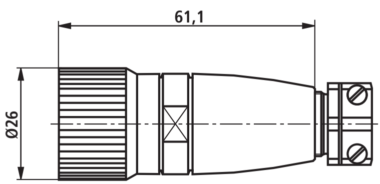
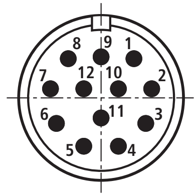
Mating connector according to EN 175201-804 (12-pole, metal design)

- Mating connector (construction set) for a cable diameter of 12-15 mm — Material no. **R901268000**
- Mating connector with 5 m cable, 12 x 0.75 mm² with cable shield, assembled — Material no. **R901272854**
- Mating connector with 20 m cable, 12 x 0.75 mm² with cable shield, assembled — Material no. **R901272852**



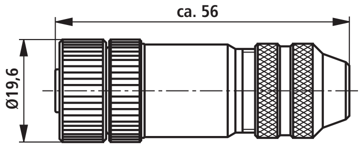
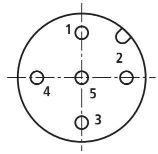
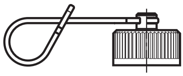


Accessories, sensor connections (not included in scope of delivery)

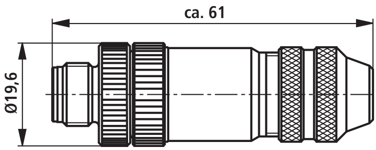
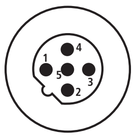
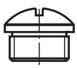
Description	View, dimensions	Pole image, order details
X4, X7 (analog sensors) Plug-in connector, 5-pole, M12 x 1, pins, A coding, metal design		 Mat. no.: **R901075542** (cable diameter 4 … 6 mm)
X7 (digital sensors, 1 Vss and SSI) Plug-in connector, 12-pole, M23, pins, soldered joint, metal design with cap nut		 Mat. no.: **R901076284** (cable diameter up to 10.5 mm)

5

Accessories, CAN bus (A coding) (not included in scope of delivery)

Description	View, Dimensions	Pole image, order details
X3 Round plug-in connector, processible, 5-pole, M12 x 1 Straight mating connector from metal.		 Mat. no.: **R901076910** (cable diameter 6-8 mm)
M12 cap Dust protection		Mat. no.: **R901075564**

Accessories, profibus (B code) (not included in scope of delivery)

Description	View, Dimensions	Pole image, order details
X3 Round plug-in connector, processible, 5-pole, M12 x 1 Straight line coupling plug from metal.		 Mat. no.: **R901075545** (cable diameter 6-8 mm)
Further profibus participants can be connected e.g. with a Y cable (can be ordered at HARTING, Mat. no. TB61042030039).		
M12 protective cap		Mat. no.: **R901075563**

Project Planning / Maintenance Instructions / Additional Information

Product documentation for IAC-R

Data sheet 29191 (this data sheet)

Declaration on environmental compatibility 29191-U

Operator's manual
CANopen 29090-B-01
Profibus 29090-B-02

General information on the maintenance and commissioning of hydraulic components
07800 / 07900

Commissioning software and documentation on the Internet: www.boschrexroth.com/IAC

Maintenance instructions:
- The devices have been tested in the plant and are supplied with default settings.
- Only complete units can be repaired. Repaired devices are returned with default settings.
  User-specific settings are not maintained. The operator will have to retransfer the corresponding user parameters.

Notes:
- Connect the valve to the supply voltage only when this is required for the functional processes of the machine.
- Electric signals taken out via control electronics (e.g. signal "ready for operation") may not be used for the actuation of safety-relevant machine functions! (See also the European standard "Safety requirements for fluid power systems and their components - Hydraulics", EN 982.)
- If electromagnetic interference is to be anticipated, suitable measures must be taken to ensure the function (depending on the application, e.g. shielding, filtration)!

Notes

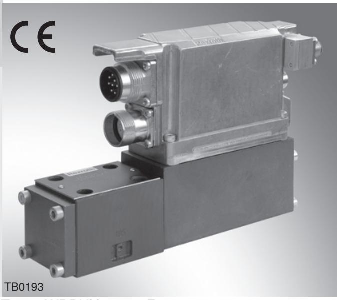
Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

High-response valve with integrated digital axis controller (IAC-R) and clock-synchronized PROFIBUS DP/V2 (PROFIdrive profile)

RE 29291/06.13
Replaces: 02.11

Type 4WRPNH.../24F..

Size 6 and 10
Component series 2X
Maximum operating pressure 315 bar
Maximum flow 100 l/min (Δp = 70 bar)



Type 4WRPNH 6 .../24F..

Table of contents

Features

– Direct operated high-response valves size 6 and size 10 with servo performance type control spool and sleeve
– Single-side operated, 4/4 fail-safe position in deactivated state
– Integrated digital axis control functionality (IAC-R) for:
  • position control with underlying velocity control
  • DSC functionality
– Analog sensor interfaces for
  • current and voltage
– Digital sensor interfaces for
  • 1 x length measurement system 1Vpp or
  • 1 x length measurement system SSI or
  • 1 x length measurement system EnDat 2.2
– Clock-synchronous command value provision according to PROFIdrive profile V4.0
  • telegram 5 or 105
– PROFIBUS DP/V1, DP/V2
– Quick commissioning via PC and commissioning software WinHPT from version 2.1

Ordering code

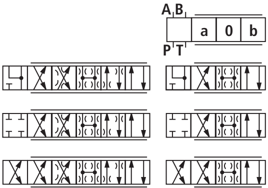
4WRP	N	H			B		–2X /	M /	24	F			*

With integrated digital axis controller for NC control systems **= N**

Control spool / sleeve **= H**

Size 6 **= 6**
Size 10 **= 10**

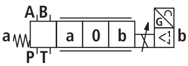
Spool symbols
4/4 directional design



= C3, C5
= C4, C1
= C

With symbols C5 and C1:
P → A: q_v B → T: q_v / 2
P → B: q_v / 2 A → T: q_v

Mounting side of the inductive position transducer



(standard) **= B**

Rated flow at 70 bar valve pressure differential (35 bar / control edge)

Size 6
2 l/min [1] **= 02**
4 l/min **= 04**
12 l/min [5] **= 12**
15 l/min [2] **= 15**
24 l/min [5] **= 24**
25 l/min [2] **= 25**
40 l/min [3] **= 40**

Size 10
50 l/min **= 50**
100 l/min **= 100**

Flow characteristics
Linear **= L**
Inflected characteristic curve [4] **= P**

Further details in clear text

Sensor interfaces
A = X4, M12-5, ±10 V
X7, M12-5, ±10 V
B = X4, M12-5, ±10 V
X7, M23-12, SSI
C = X4, M12-5, ±10 V
X7, M23-12, 1 Vpp
G = X4, M12-5, 4-20 mA
X7, M12-5, 4-20 mA
T = X4, M12-5, ±10V
X7, M12-8, EnDat 2.2

Electronics interface
A6 = ±10 VDC
F6 = 4 to 20 mA

Drive bus
F = PROFIBUS DP/V2
PROFIdrive profile

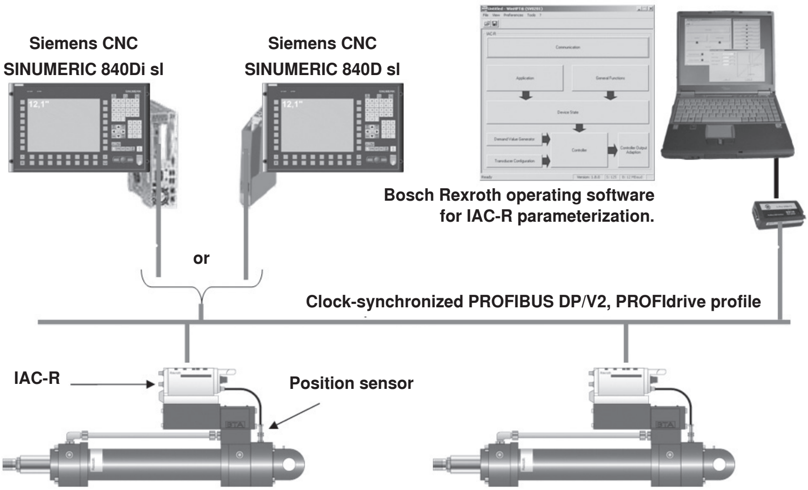
24 = Supply voltage 24 V

Seal material
M = NBR gaskets suitable for mineral oils (HL; HLP) according to DIN 51524

2X = Component series 20 to 29 (20 to 29: unchanged mounting and connection dimensions)

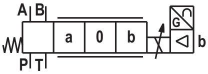
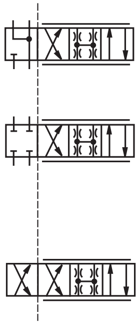
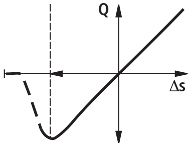
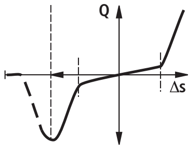
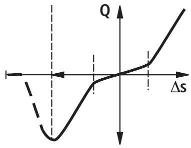
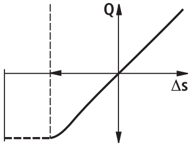
[1] Rated flow 2 l/min not with flow characteristics **"P"**
[2] Only in connection with flow characteristics **"P"**
[3] q_V 2:1 only with rated flow = 40 l/min
[4] Inflection 60% at size 6 with rated flow **"15"** and **"25"**, otherwise inflection 40%
[5] Only in connection with flow characteristics **"L"**

System overview



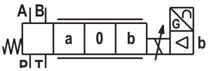
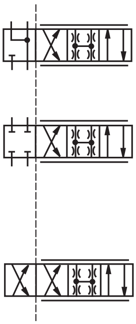
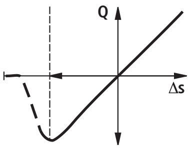
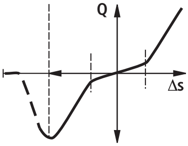
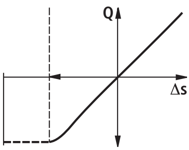
Symbols

Size 6

<table>
<tr><td></td><td>Linear</td><td>p: Inflection 60 %
[q_n 15.25 l/min]</td><td>p: Inflection 40 %
[q_n 40 l/min]</td></tr>
<tr><td rowspan="3">
C3, C5
C4, C1
C</td><td>
C3, C5, C4, C1</td><td rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td>
C</td></tr>
<tr><td colspan="3">Standard = 1:1, from q_n = 40 l/min also 2:1</td></tr>
</table>

C3, C5, C4, C1 (applies to both inflection diagrams)

Size 10

<table>
<tr><td></td><td>Linear</td><td>p: Inflection 40 %</td></tr>
<tr><td rowspan="2">
C3, C5
C4, C1
C</td><td>
C3, C5, C4, C1</td><td rowspan="2">
C3, C5, C4, C1</td></tr>
<tr><td>
C</td></tr>
</table>

Function, section

Construction

The IAC-R valve mainly consists of:
- Direct operated high-response valve (1) with servo performance type control spool
- Integrated digital axis controller (2) with analog (X4/X7) or digital (X7) sensor interface
- PROFIBUS interface (X3) with functionality according to DP/V1 with clock synchronization according to DP/V2

Functional description

The IAC-R valve is a digital high-response valve with integrated axis controller with the following functionalities:
- Position control
- DSC functionality
- Analog (X4/X7) or digital (X7) sensor interface
- Clock-synchronous command value specification according to PROFIdrive profile V4.0
  • telegram 5 or 105
- The controller parameters are set via the PROFIdrive parameter protocol.
- Separate supply voltage for bus/controller and power part (output stage) for safety reasons.

PC program WinHPT

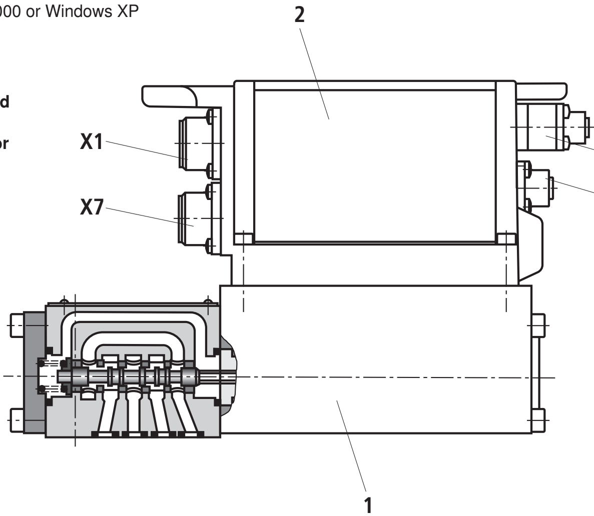
To implement the project planning task and to parameterize the IAC-R valves, the user may use the commissioning software WinHPT (see accessories).
- Parameterization
- Diagnosis
- Comfortable data management on a PC
- PC operating systems: Windows 2000 or Windows XP

The digital integrated control electronics enables the following fault detection:
- Cable rupture of sensorics system
- Undervoltage
- Temperature of the integrated electronics
- Communication fault
- Watchdog
- Synchronous monitoring

The following additional functions are available:

- Fault output 24 V or control of an isolator valve
- Control output adjustment
  • deadband compensation
  • zero offset
  • valve inflection compensation
  • friction compensation
  • direction-dependent gain
- PIDT1 controller
- State controller
- Automatic/semi-automatic drive measurement for simple controller optimization

High-response valve with integrated axis controller and analog (X4/X7) or digital (X7) sensor interface



Technical data (For applications outside these parameters, please consult us!)

General			Size 6			Size 10		
Type			Spool valve, directly operated, with steel sleeve					
Actuation			Proportional solenoid with position control, OBE					
Type of connection			Subplate mounting, porting pattern according to ISO 4401					
Installation position			any					
Ambient temperature range		°C	–20 … +50					
Weight		kg	2.7			7.5		
hydraulic (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)								
Hydraulic fluid			Hydraulic oil according to DIN 51524…535, other media upon request					
Viscosity range	recommended	mm^2/s	20 … 100					
	max admissible	mm^2/s	10 … 800					
Hydraulic fluid temperature range		°C	–20 … +60					
Maximum admissible degree of contamination of the hydraulic fluid – cleanliness class according to ISO 4406 (c)			Class 18/16/13 [1)]					
Flow direction			according to symbol					
Hydraulic, size 6								
Rated flow at Δp = 35 bar per edge [2)]		l/min	2	4	12	15	24/25	40
Max operating pressure	Ports P, A, B	bar	315					
	Port T	bar	250					
Limitations of use Δp pressure drop across valve q_{Vnom}: > $q_{N\ valves}$	Spool symbols C, C3, C5	bar	315	315	315	315	315	160
	Spool symbols C1, C4	bar	315	315	315	280	250	100
Leakage oil at 100 bar	linear characteristic curve L	cm^3/min	< 150	< 180	< 300	–	< 500	< 900
	inflected characteristic curve P	cm^3/min	–	–	–	< 180	< 300	< 450
Hydraulic, size 10								
Rated flow at Δp = 35 bar per edge [2)]		l/min	50 (1:1)	50 (2:1)	100 (1:1)	100 (2:1)		
Max. operating pressure	Ports P, A, B	bar	315					
	Port T	bar	250					
Limitations of use Δp pressure loss at valve q_{Vnom}: > $q_{N\ valves}$	Spool symbols C, C3, C5	bar	315	315	160	160		
	Spool symbols C1, C4	bar	250	250	100	100		
Leakage oil at 100 bar	linear characteristic curve L	cm^3/min	< 1200	< 1200	< 1500	< 1500		
	inflected characteristic curve P	cm^3/min	< 600	< 500	< 600	< 600		
Static / dynamic			Size 6			Size 10		
Hysteresis		%	≤ 0.2					
Manufacturing tolerance		%	< 10					
Acutating time for signal step 0 … 100 %		ms	≤ 10			25		
Temperature drift			Zero point drift < 1% at $\Delta\vartheta$ = 40 °C					
Zero point calibration			ex factory ±1 %					
Conformity			CE according to EMC directive 2004/108/EC					

The footnotes are explained on the following page.

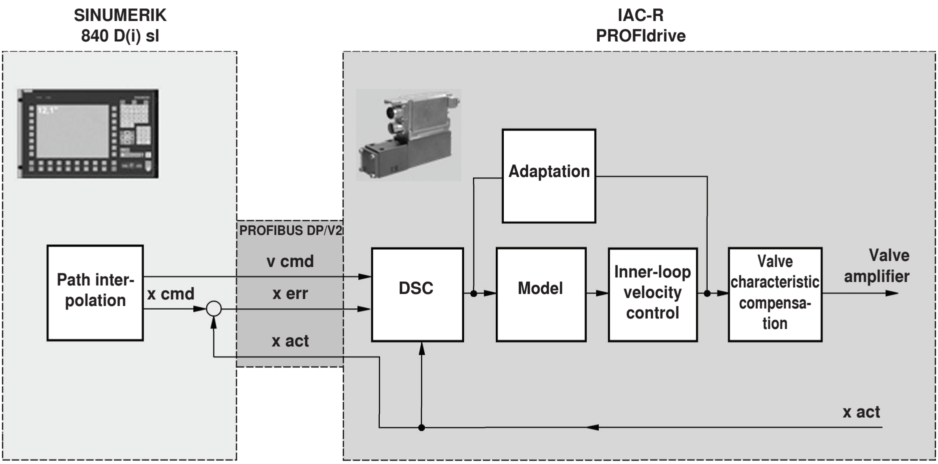
Technical data (For applications outside these parameters, please consult us!)

Electrical			
Relative duty cycle		%	100 (continuous operation)
Protection class			IP 65 according to EN 60529 with mounted and locked line connectors
Supply voltage	Nominal voltage	VDC	24
	Lower limit value	VDC	21
	Upper limit value	VDC	36
	Max. admissible residual ripple	Vpp	2 (at supply voltage of 23 V … 34 V)
Power consumption	Size 6	W	max. 40
	Size 10	W	max. 60
Protective earthing conductor and shielding			see pin assignment (CE-compliant installation)
Adjustment			Calibrated ex factory, see valve characteristic curve

[1] The cleanliness classes stated for the components need to be maintained in hydraulic systems.
Effective filtration prevents faults and at the same time increases the service life of the components.
For selecting the filters, see www.boschrexroth.de/filter

[2] Flow at different Δ*p*: $q_x = q_{nom} \cdot \sqrt{\frac{\Delta p_x}{35}}$

Block diagram of the controller functionality



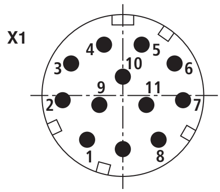
Electrical connections, assignment

Unit connector assignment X1, 11-pin + PE according to DIN EN 175201-804

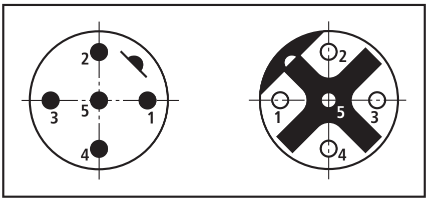
Pin	No. or Litz wire color[1)]	Assignment interface A6/F6
1	1	24 VDC (supply for output stage and power switching signal)
2	2	0 V ≙ load zero (for output stage)
3	white	reserved
4	yellow	reserved
5	green	reserved
6	purple	reserved
7	pink	reserved
8	red	reserved
9	brown	24 VDC (supply for signal part and bus)
10	black	0 V reference potential for pin 9 (supply for signal part and bus)
11	blue	Switching output 24 V (error signal or power switching signal) max 1.8 A
PE	green-yellow	Protective earthing conductor (connected directly to metal housing)

Connect shield on PE only on the supply side!

1) Litz wire colors of the connection lines for line socket (see accessories)



Unit connector assignment for PROFIBUS DP "X3" (code B), M12, 5-pin, socket / pins



Pin	Pinout of plug	Pinout of socket
1	n.c.	VP
2	RxD/TxD-N (A line)	RxD/TxD-N (A line)
3	DGND	DGND
4	RxD/TxD-P (B line)	RxD/TxD-P (B line)
5 1)	Shield	Shield

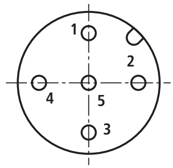
1) We recommend connecting the shield on both sides via the metallic housing of the plug-and-socket-connectors. Using pin 5 will have adverse effects on the effectiveness of the shield!

The unit socket and the unit plug are equivalent as PROFIBUS connections.
The electrically isolated voltage +5 V (pin 1 - VP) at the socket allows for passive termination of the PROFIBUS.

Electrical connections, assignment

Analog sensor interfaces, connection "X4" and "X7" (code A), M12, 5-pin, socket

Pin	Pinout Voltage interface	Pinout Current interface
1	Supply 24 VDC	Supply 24 VDC
2	Signal 3 (X4) / 4 (X7), (–10 … +10 V)	Signal 3 (X4) / 4 (X7), (4 … 20 mA)
3	Zero 0 V	Zero 0V
4	Signal 1 (X4) / 2 (X7), (–10 … +10 V)	Signal 1 (X4) / 2 (X7), (4 … 20 mA)
5	Shield	Shield

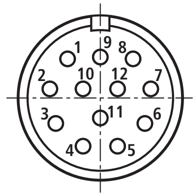


Note:

The analog sensor interfaces at the connections X4 and X7 are not coded. Danger of confusing the same! The user has to ensure proper wiring!

Digital sensor interface 1Vpp or SSI measurement system "X7", M23, 12-pin, socket

Pin	Pinout 1Vpp	Pinout SSI
1	$\overline{\text{B}}$	0 V
2	sense +5 V [1)]	Data
3	R	Clock
4	$\overline{\text{R}}$	n.c.
5	A	n.c.
6	$\overline{\text{A}}$	n.c.
7	n.c.	n.c.
8	B	n.c.
9	n.c.	24 V
10	0 V [1)]	$\overline{\text{Data}}$
11	Sense 0 V [1)]	$\overline{\text{Clock}}$
12	+5 V [1)]	n.c.

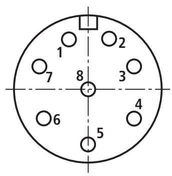


Note:

The sense signal is not evaluated.

Digitale Sensorschnittstelle EnDat 2.2 Messsystem „X7", M12, 8-polig, Buchse

Pin	Belegung EnDat 2.2
1	0 V [2)]
2	+5 V [2)]
3	Data
4	$\overline{\text{Data}}$
5	0V [2)]
6	$\overline{\text{Clock}}$
7	Clock
8	supply +5 V [2)]



Note:

We recommend connecting the shields on both sides via the metallic housings of the plug-and-socket-connectors.
Using connector pins will affect the effectiveness of the screen!
Internal shields are not required.

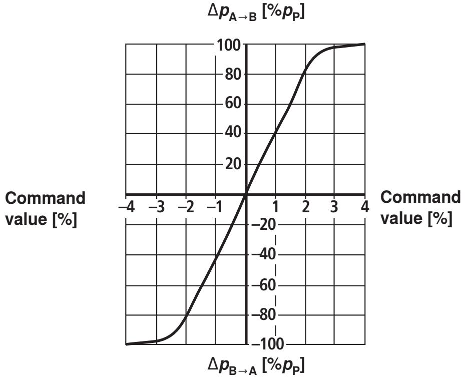
1) **Recommendation**: Connect the voltages +5 V (pin 12) and +5 V-Sense (pin 2), as well as 0 V (pin 10) and 0 V-Sense (pin 11) for transducer supply.

2) **Recommendation**: Connect the voltages +5 V (pin 2 and 8) as well as 0 V (pin 1 and 5) for transducer supply.

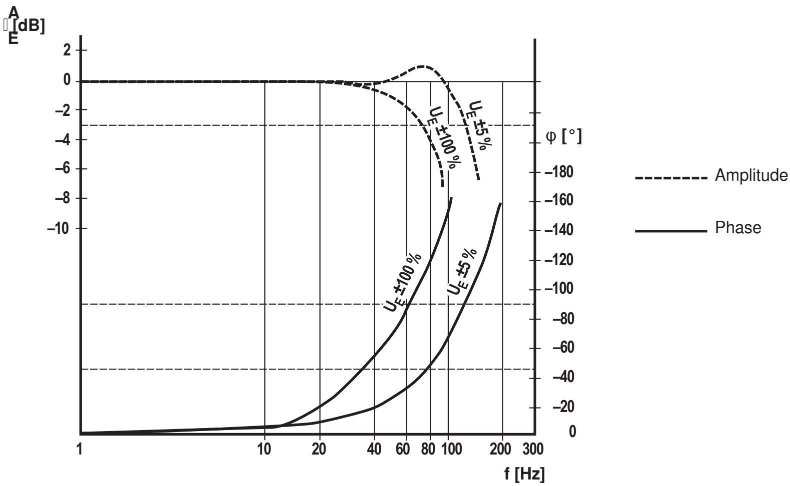
5

Characteristic curves size 6 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Pressure gain



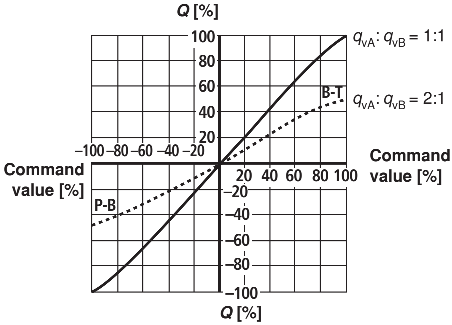
Bode diagram



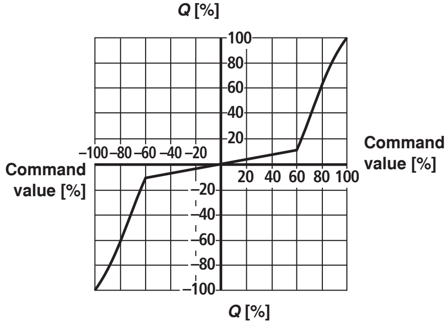
Characteristic curves size 6 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Flow - signal function

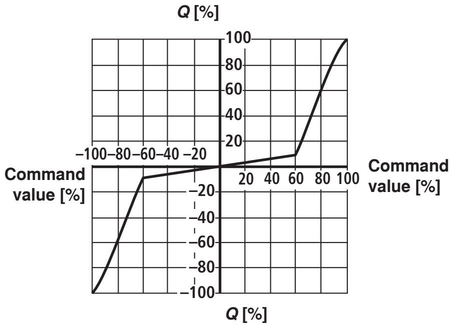
L: Linear



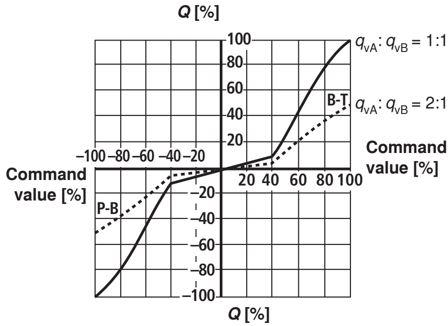
P: Inflection 60 %



P: Inflection 60 %

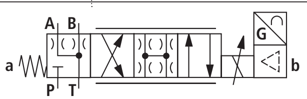


P: Inflection 40 %

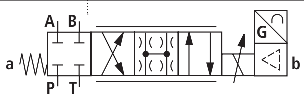


Note:
Ex factory the inflection-compensation is activated at the valve electronics. In order that the P-characteristic curve appears linear.

Fail-safe position



Leakage oil at	100 bar	P → A	50 cm³/min
		P → B	70 cm³/min
Flow at	Δp = 35 bar	A → T	10 ... 20 l/min
		B → T	7 ... 20 l/min

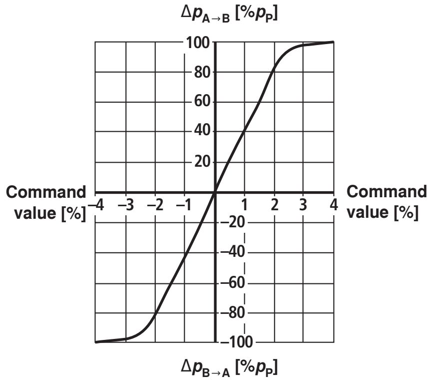


Leakage oil at	100 bar	P → A	50 cm³/min
		P → B	70 cm³/min
		A → T	70 cm³/min
		B → T	50 cm³/min

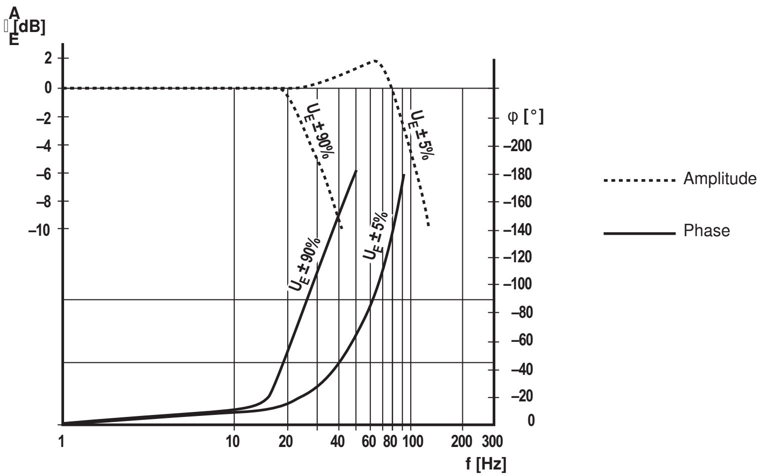
Fail-safe	p = 0 bar => 7 ms	Shut-down U_B (output stage) X1 / pin 1+2
	p = 100 bar => 10 ms	

Characteristic curves size 10 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Pressure gain



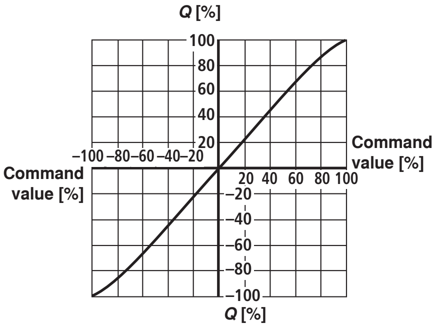
Bode diagram



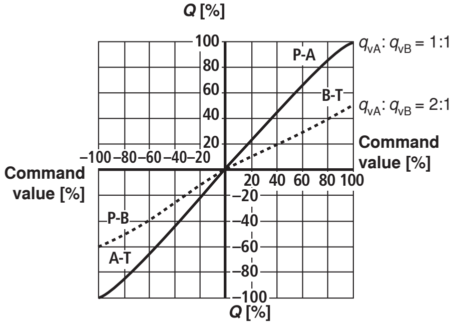
Characteristic curves size 10 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Flow - signal function

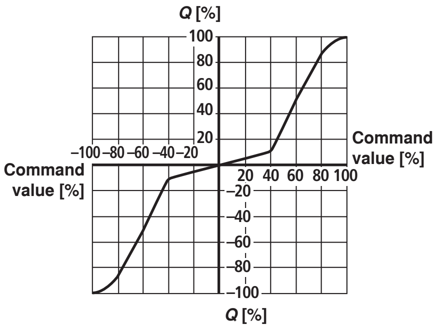
L: Linear 1:1



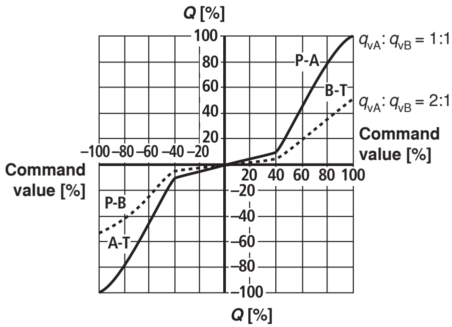
L: Linear 2:1



P: Inflection 40% 1:1



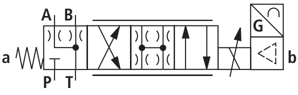
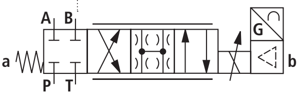
P: Inflection 40% 2:1



Note:

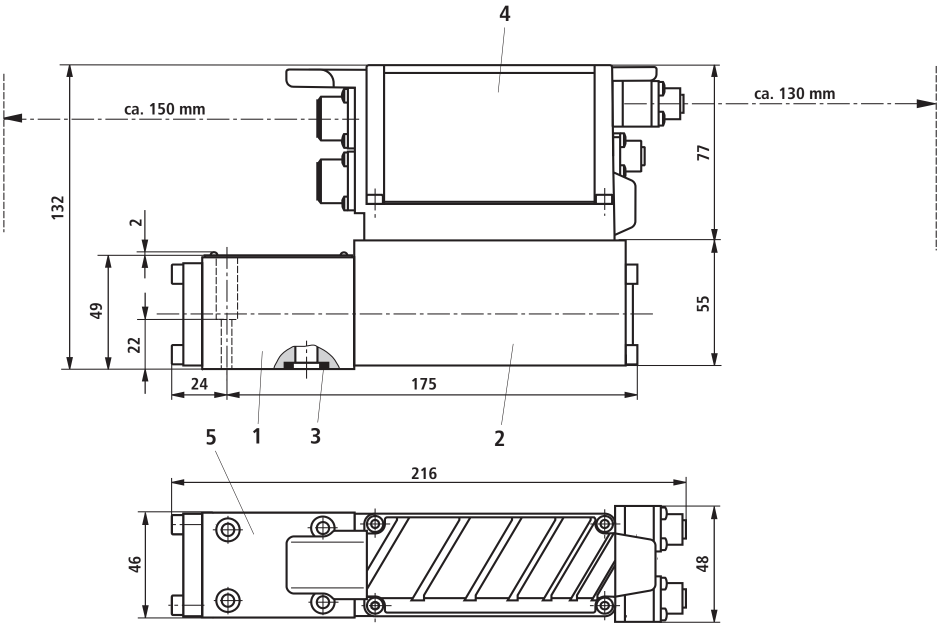
Ex factory the inflection-compensation is activated at the valve electronics. In order that the P-characteristic curve appears linear.

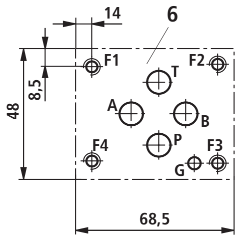
Fail-safe position

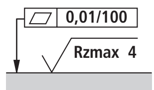
	Leakage oil at	100 bar	P → A	50 cm³/min
			P → B	70 cm³/min
	Flow at	Δp = 35 bar	A → T	10 ... 20 l/min
		q_n = 50/100 l/min	B → T	7 ... 20 l/min
	Leakage oil at	100 bar	P → A	50 cm³/min
			P → B	70 cm³/min
			A → T	70 cm³/min
			B → T	50 cm³/min

Fail-safe	p = 0 bar => 12 ms	Shut-down U_B (output stage) X1 / pin 1+2
	p = 100 bar => 16 ms	

Unit dimensions size 6 (dimensions in mm)







Required surface quality
of the valve contact surface

1 Valve housing

2 Control solenoid with position transducer

3 Identical seal rings for ports P, A, B, T

4 Integrated digital control electronics

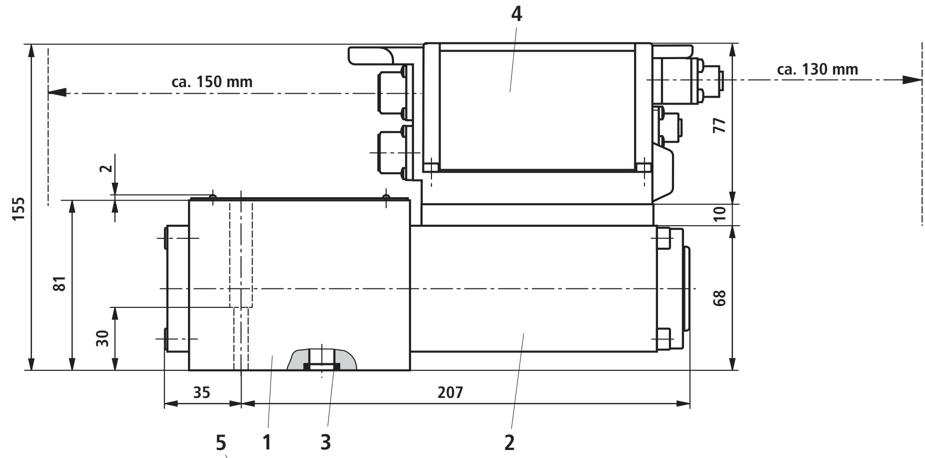
5 Nameplate

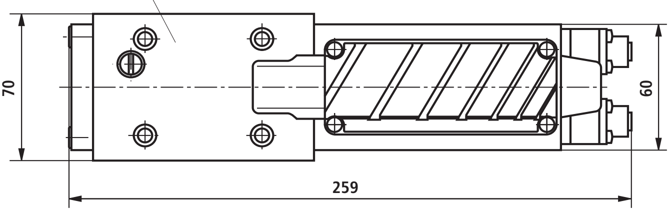
6 Machined valve contact surface, position of the ports according to ISO 4401-03-02-0-05

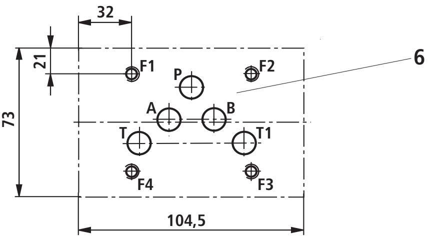
Valve mounting screws
(not included in scope of delivery):

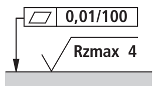
4 units of hexagon socket head cap screws according to ISO4762-M5x30-10.9-N67F 821 70
(galvanized according to Bosch standard N67F 821 70)
M_T = 6 +2 Nm
material no. **2910151166**

Unit dimensions size 10 (dimensions in mm)









Required surface quality
of the valve contact surface

1 Valve housing

2 Control solenoid with position transducer

3 Identical seal rings for ports P, A, B, T, T1

4 Integrated digital control electronics

5 Nameplate

6 Machined valve contact surface, position of the ports according to ISO 4401-05-04-0-05

Deviating from the standard:
– port T1 exists additionally

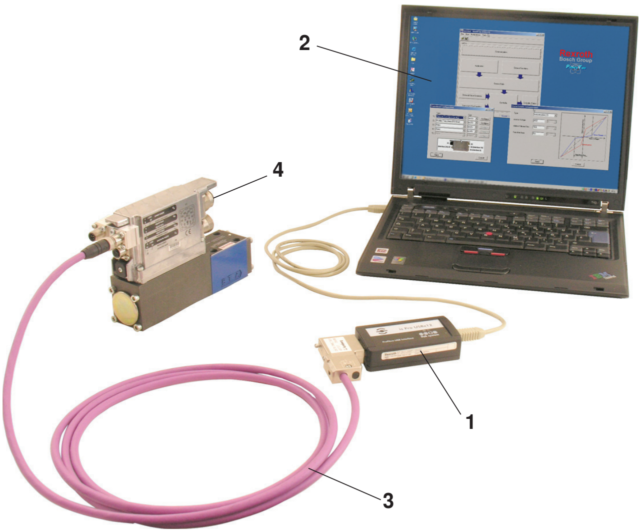
Valve mounting screws
(not included in scope of delivery):

4 units of hexagon socket head cap screws according to ISO4762-M6x40-10.9-N67F 821 70
(galvanized according to Bosch standard N67F 821 70)
M_T = 11 +3 Nm
material no. **2910151209**

5

Accessories for parameterization (not included in scope of delivery)

For parameterization using the PC, the following is required:	PROFIBUS DP (code B)
1 Interface converter (USB-PROFIBUS DP)	VT-ZKO-USB/P-1-1X/V0/0 Mat.no. **R901071962**
2 Start-up software	WinHPT (from version 2.1) Download at www.boschrexroth.com/IAC
3 Connecting cable, 3 m	D-Sub/M12, Mat.no. **R901078053**
4 24 V supply voltage	Mating connector for X1 (see below)

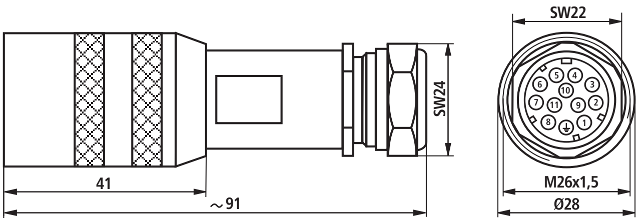


Accessories, port X1 (not included in the scope of delivery)

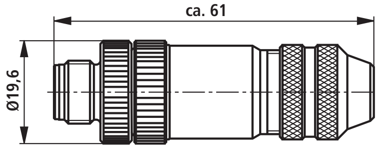
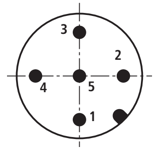
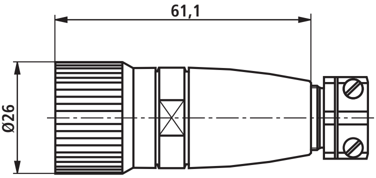
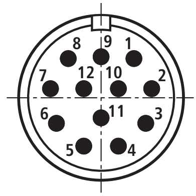
Mating connector for X1

Mating connector according to EN 175201-804 (12-pole, metal design)

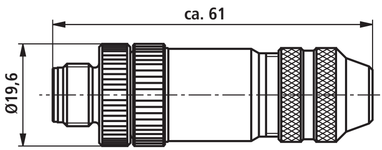
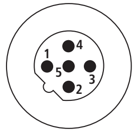
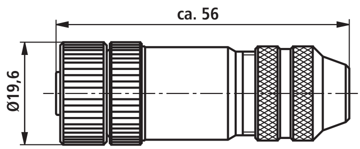
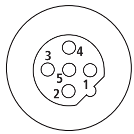
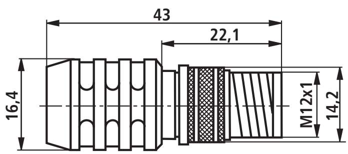
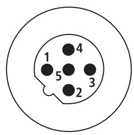
- Mating connector (construction set) for a cable diameter of 12-15 mm, Material no. **R901268000**
- Mating connector with 5 m cable, 12 x 0.75 mm² with cable shield, assembled, Material no. **R901272854**
- Mating connector with 20 m cable, 12 x 0.75 mm² with cable shield, assembled, Material no. **R901272852**



Accessories, sensor connections (not included in scope of delivery)

Description	View, dimensions	Pin pattern, order details
X4, X7 (analog sensors) Plug-in connector, 5-pole, M12 x 1, pins, A coding, metal design		 Mat. no.: **R901075542** (cable diameter 4 … 6 mm)
X7 (digital sensors, 1 Vpp and SSI) Plug-in connector, 12-pole, M23, pins, soldered joint, metal design with cap nut		 Mat. no.: **R901076284** (cable diameter up to 10.5 mm)

Accessories, PROFIBUS (B code) (not included in scope of delivery)

Description	Detail, dimensions	Pin pattern, order details
X3 Round connector, to be wired by user, 5-pin, M12 x 1 Straight line connector in metal design		 Material no.: **R901075545** (cable diameter 6 - 8 mm)
X3 Round connector, to be wired by user, 5-pin, M12 x 1 Straight mating connector from metal		 Material no.: **R901075550** (cable diameter 6 - 8 mm)
PROFIBUS terminating resistor Round plug-in connector, 5-pin, M12 x 1		 Material no.: **R901078086**

Project planning / maintenance instructions / additional information

Product documentation for IAC-R with clock-synchronized PROFIBUS DP/V2 (PROFIdrive profile)

- **Data sheet 29291** (this data sheet)
- **Declaration on environmental compatibility 29191-U**
- **Operating instructions 29291-B**
- **General Information on the Maintenance and Start-up of Hydraulic Components 07800 / 07900**

Commissioning software and documentation on the internet: www.boschrexroth.com/IAC

Mainenance notes:
– The devices have been tested in the factory and are supplied with default settings.
– Only complete units can be repaired. The repaired units will be supplied with default settings and current firmware. User-specific settings are not maintained. The operator will have to retransfer the corresponding user parameters.

Notes:
– Connect the valve to the supply voltage only when this is required for the functional processes of the machine.
– Electric signals brought out via control electronics (e.g. signal "ready for operation") may not be used for the actuation of safety-relevant machine functions! (see also the European standard "Safety requirements for fluid power systems and their components - Hydraulics", EN 982.)
– If electromagnetic interference must be expected, take appropriate measures to safeguard the function (depending on the application, e.g. shielding, filtering)!

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
documentation@boschrexroth.de
www.boschrexroth.de

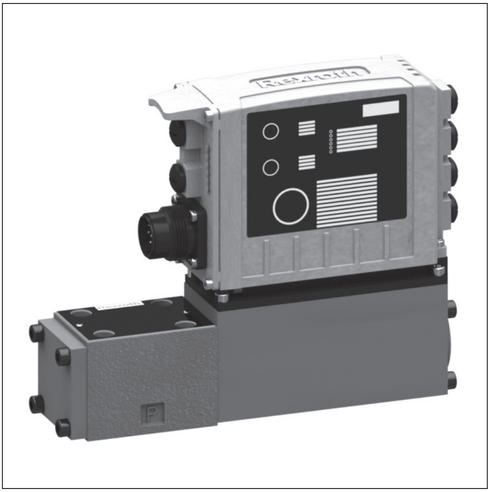
The Drive & Control Company

Rexroth
Bosch Group

High-response valve with integrated digital axis controller (IAC-Multi-Ethernet)

Type 4WRPDH

RE 29391
Edition: 2013-03



- Sizes 6 and 10
- Component series 2X
- Maximum operating pressure 315 bar
- Maximum flow 100 l/min

CE

Features

- Direct operated servo quality high-response valves
- Integrated digital axis control functionality (IAC-Multi-Ethernet)
- Best-in-class hydraulic controller
- Bus connection/service interface
  (sercos, EtherCAT, EtherNet/IP, PROFINET RT)
- Actual value detection:
  2 x configurable analog sensors (current/voltage)
  1 x linear position measurement system
  (SSI, EnDat 2.2 or 1Vss)
- Internal safety function
  (can be used up to category 4/PL e according to EN 13849-1)
- CE conformity according to EMC Directive 2004/108/EC

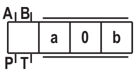
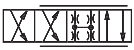
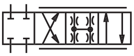
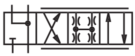
Contents

Ordering code

01	02	03	04	05	06	07	08	09	10		11		12	13	14	15	16
4	**WRP**	**D**	**H**			**B**			**2X**	**/**		**/**	**24**		**D6**		

01	4 main ports	**4**
02	High-response valve	**WRP**
03	With integrated digital axis controller	**D**
04	Control spool/bushing	**H**
05	Size 6	**6**
	Size 10	**10**

Control spool symbols (possible designs, characteristic curves see page 4)

06	Symbol	Characteristic curve L	Characteristic curve P			
			Inflection 60 % (size 6 only)	Inflection 40 %		
		●	●	●		**C**
			●	●	Rated flow 40 l/min or higher	**C1** [1)]
		●	●	●		**C4**
		●	●	●		**C3**
			●	●	Rated flow 40 l/min or higher	**C5** [1)]

● = available

[1)] With symbols C1 and C5:
P → A: $\boldsymbol{q}_\text{v}$ B → T: $\boldsymbol{q}_\text{v}/2$
P → B: $\boldsymbol{q}_\text{v}/2$ A → T: $\boldsymbol{q}_\text{v}$

07	Installation side of the inductive position transducer	**B**

Rated flow of size 6 with 70 bar valve pressure differential (35 bar/control edge)

		Characteristic curve L	Characteristic curve P		
08	2 l/min	●			**02**
	4 l/min	●	●		**04**
	12 l/min	●			**12**
	15 l/min		●		**15**
	24 l/min	●			**24**
	25 l/min		●		**25**
	40 l/min	●	●		**40**

● = available

Rated flow of size 10 with 70 bar valve pressure differential (35 bar/control edge)

08	50 l/min	**50**
	100 l/min	**100**

Flow characteristics

09	Linear	**L**
	Inflected characteristic curve (inflection 60 % for size 6 with rated flows "**15**" and "**25**", otherwise inflection 40 %)	**P**

Ordering code

01	02	03	04	05	06	07	08	09	10		11		12	13	14	15	16
4	**WRP**	**D**	**H**			**B**			**2X**	**/**		**/**	**24**		**D6**		

10	Component series 20 … 29 (20 … 29: Unchanged installation and connection dimensions)	**2X**

Seal material

11	NBR seals	**M**
	FKM seals	**V**

12	Supply voltage 24 V	**24**

Field bus interface

13	EtherNET/IP	**E**
	PROFINET RT	**N**
	Sercos	**S**
	EtherCAT (CANopen profile)	**T**

Electrical interface

14	±10 VDC or 4 … 20 mA	**D6**

Sensor interfaces

15	0 … 10 V/4 … 20 mA/EnDat 2.2	**S**
	0 … 10 V/4 … 20 mA/SSI	**T**
	0 … 10 V/4 … 20 mA/1Vss	**U**

16	Further details in the plain text	

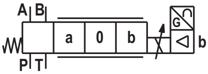
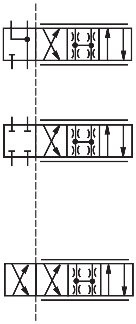
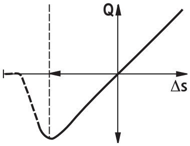
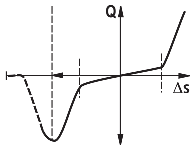
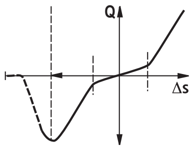
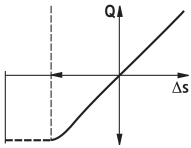
☞ **Notice!** For ordering codes and technical information regarding high-response valves with integrated digital axis controller and additional bus profiles, please refer to:
- Data sheet 29191: CANopen, Profibus DP V0/V1
- Data sheet 29291: Profibus DP/V2 (PROFIdrive profile)

☞ **Important notice!** Control spool versions that have been approved for the safety function:
- C
- C1
- C3
- C4
- C5

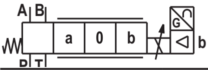
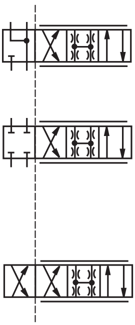
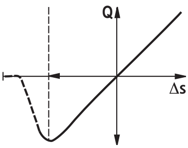
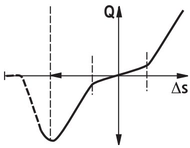
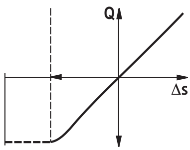
5

Symbols

Size 6

<table>
<tr><td></td><td>Linear</td><td>P: Inflection 60 %
[q_n = 15.25 l/min]</td><td>P: Inflection 40 %
[q_n = 40 l/min]</td></tr>
<tr><td rowspan="3">
C3, C5
C4, C1
C</td><td>
C3, C4</td><td rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td>
C</td></tr>
<tr><td></td><td colspan="2">C3, C5, C4, C1</td></tr>
<tr><td></td><td colspan="3">Standard = 1:1, from q_n = 40 l//min also 2:1</td></tr>
</table>

Size 10

<table>
<tr><td></td><td>Linear</td><td>P: Inflection 40 %</td></tr>
<tr><td rowspan="2">
C3, C5
C4, C1
C</td><td>
C3, C4</td><td rowspan="2">
C3, C5, C4, C1</td></tr>
<tr><td>
C</td></tr>
</table>

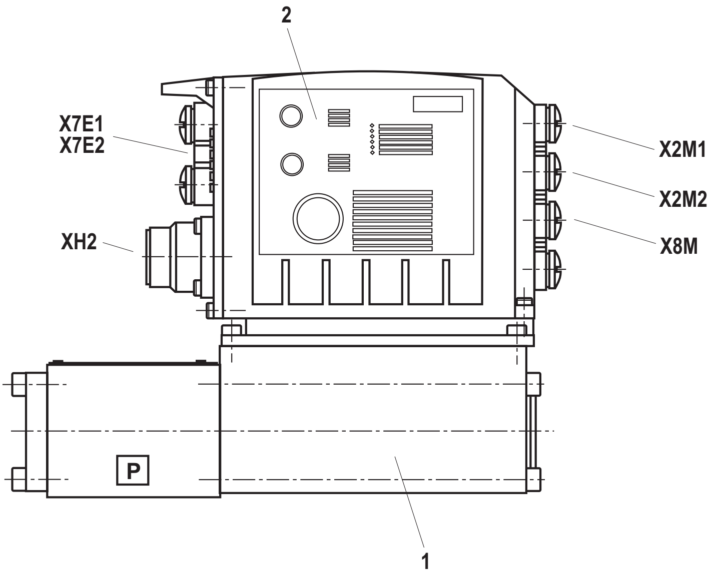
Function, section

Design

The high-response valve with IAC-Multi-Ethernet electronics mainly consists of:

- Direct operated high-response valve (1) with control spool and bushing in servo quality
- Integrated digital axis controller (2) with:
  - Analog/digital interface (XH2)
  - Ethernet interfaces (X7E1, X7E2)
  - Analog sensor interfaces (X2M1, X2M2)
  - Digital sensor interface (X8M)

High-response valve with integrated axis controller, analog interfaces (X2M1, X2M2), digital interfaces (XH2, X8M) and Ethernet interfaces (X7E1, X7E2)



Function, section

Functional description

The **IAC-Multi-Ethernet** valve (**I**ntegrated **A**xis **C**ontroller based on high-response valves) is a digital high-response valve with integrated axis controller and the following functionalities:

- ▶ Position control
- ▶ Pressure control
- ▶ Force control
- ▶ Override control (position/pressure)

This enables, amongst others, the following operating modes:

- ▶ Valve direct control
- ▶ Drive-controlled position control
- ▶ Drive-controlled positioning
- ▶ Positioning block operation

- ▶ The command values are specified via the Ethernet interface (X7E1 or X7E2) or, alternatively, via the analog/digital interface (XH2)
- ▶ The feedback information of the actual value signals to the superior control system is provided optionally either via the Ethernet interface (X7E1 or X7E2) or the analog/digital interface (XH2)
- ▶ The control parameters are set via the Ethernet interface (X7E1 or X7E2)

Safety function

The integrated control electronics of the valve enables the additional switch-off of a channel according to EN 13849-1 in the direction "P" to "A" (depending on the application, the fail-safe position must be adhered to).
For this purpose, a suitable control system must be provided to perform the plausibility check between the direction-dependent valve signals "enable input" and "enable acknowledgement" (signal fed back by the valve).
It is not possible to switch off direction "P" to "B" in a safety-relevant manner according to EN 13849-1 (depending on valve type).

Monitoring

The digital control electronics enables comprehensive monitoring functions/fault detection including:

- ▶ Undervoltage
- ▶ Communication error
- ▶ Cable break for analog sensor inputs and digital position measurement system
- ▶ Short-circuit monitoring for analog/digital outputs
- ▶ Monitoring of the microcontroller (watchdog)
- ▶ Temperature of the integrated electronics

IndraWorks PC program

To implement the project planning task and to parameterize the IAC-Multi-Ethernet valves, the user may use the IndraWorks engineering tool (see accessories).

- ▶ Project planning
- ▶ Parameterization
- ▶ Commissioning
- ▶ Diagnosis
- ▶ Comfortable management of all data on a PC
- ▶ PC operating systems: Windows XP (SP3), Windows 7

Technical data
(for applications outside these parameters, please consult us!)

general		**Size 6**	**Size 10**
Design		Spool valve, direct operated, with steel sleeve,	
Operation		Proportional solenoid with position control, OBE	
Type of connection		Plate connection, porting pattern according to ISO 4401	
Installation position		Any	
Ambient temperature range	°C	–20 ... +60	
Storage temperature range	°C	–10 ... +50	
Sine test according to DIN EN 60068-2-6		10...2000 Hz / maximum of 10 g / 10 cycles / 3 axis	
Random test according to DIN EN 60068-2-64		20...2000 Hz / 10 g_{RMS} / 30 g peak / 30 min / 3 axis	
Transport shock according to DIN EN 60068-2-27		15 g / 11 ms / 3 axis	
Weight	kg	3.2	7.2
Maximum relative humidity (non-condensing)	%	97	

hydraulic			
Hydraulic fluid			See table page 8
Viscosity range	– recommended	mm^2/s	20 ... 100
	– maximum admissible	mm^2/s	10 ... 800
Hydraulic fluid temperature range		°C	–20 ... +60
Maximum admissible degree of contamination of the hydraulic fluid Cleanliness class according to ISO 4406 (c)			Class 18/16/13 [1]
Direction of flow			According to symbol

hydraulic, size 6								
Rated flow at ***Δp*** = 35 bar per edge [2]		l/min	2	4	12	15	24/25	40
Maximum operating pressure	– Ports A, B, P	bar	315					
	– Port T	bar	250					
Limitation of use with regard to the transition to failsafe	– Spool symbols C3, C5	bar	315	315	315	315	315	160
	– Spool symbols C1, C4	bar	315	315	315	280	250	100
Zero flow at 100 bar	– Linear characteristic curve L	cm^3/min	< 150	< 180	< 300	-	< 500	< 900
	– Inflected characteristic curve P	cm^3/min	-	-	-	< 180	< 300	< 450

hydraulic, size 10						
rated flow at ***Δp*** = 35 bar per edge [2]		l/min	50 (1:1)	50 (2:1)	100 (1:1)	100 (2:1)
Maximum operating pressure	– Ports A, B, P	bar	315			
	– Port T	bar	250			
Limitation of use with regard to the transition to failsafe	– Spool symbols C3, C5	bar	315	315	160	160
	– Spool symbols C1, C4	bar	250	250	100	100
Zero flow at 100 bar	– Linear characteristic curve L	cm^3/min	< 1200	< 1200	< 1500	< 1500
	– Inflected characteristic curve P	cm^3/min	< 600	< 500	< 600	< 600

[1] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components. For the selection of the filters, see www.boschrexroth.com/filter.

[2] Flow with different ***Δp:***

$$q_x = q_{rated} \cdot \sqrt{\frac{\Delta p_x}{35}}$$

5

Technical data

(for applications outside these parameters, please consult us!)

static/dynamic			
Hysteresis	%	≤ 0.2	
Manufacturing tolerance q_{max}	%	< 10	
Actuating time for signal step 0 ... 100 %	ms	≤ 10	25
Temperature drift		Zero shift < 1 % with $\Delta\vartheta$ = 40 °C	
Zero compensation		Ex factory ±1 %	

Hydraulic fluid		**Classification**	**Suitable sealing materials**	**Standards**
Mineral oils and related hydrocarbons		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524
Bio-degradable	– insoluble in water	HETG	NBR, FKM	VDMA 24568
		HEES	FKM	
	– soluble in water	HEPG	FKM	VDMA 24568
Flame-resistant	– water-free	HFDU, HFDR	FKM	ISO 12922
	– containing water	HFC	NBR	ISO 12922

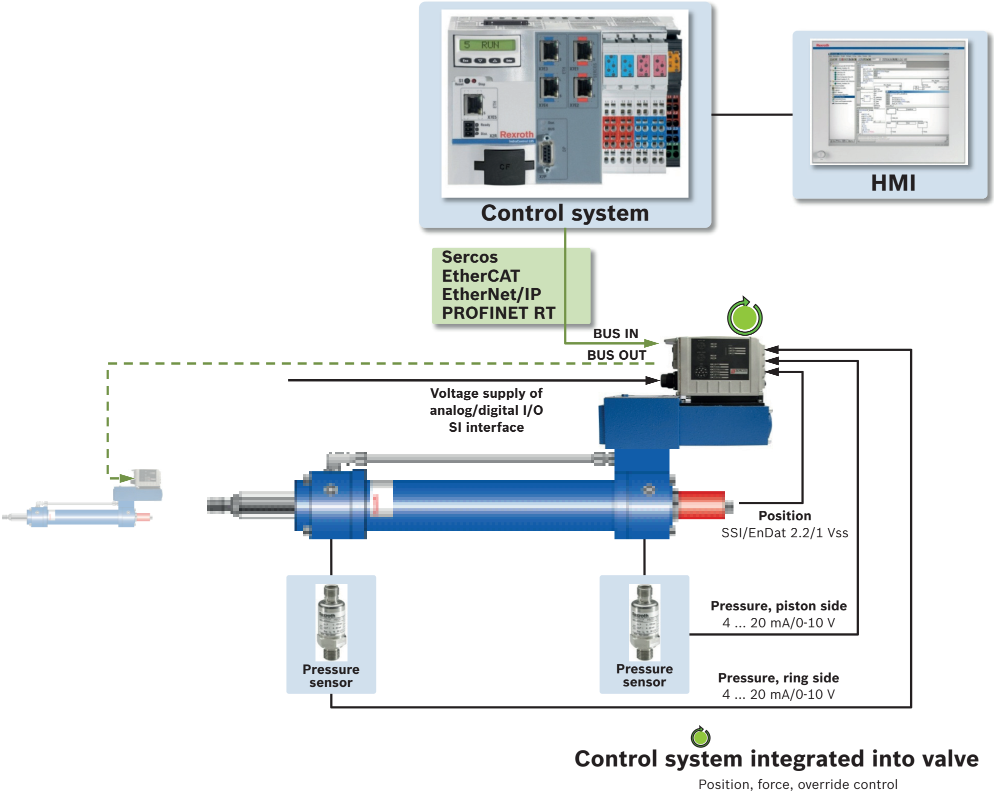
Important information on hydraulic fluids!

- For more information and data on the use of other hydraulic fluids, refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.)!
- The flash point of the hydraulic fluid used must be 40 K higher than the maximum solenoid surface temperature.
- **Flame-resistant – containing water**: Maximum pressure differential per control edge 50 bar. Pressure pre-loading at the tank port > 20 % of the pressure differential; otherwise, increased cavitation. The pressure peaks should not exceed the maximum operating pressures!
  – If HFDU is used, data sheet 90222 must be complied with!

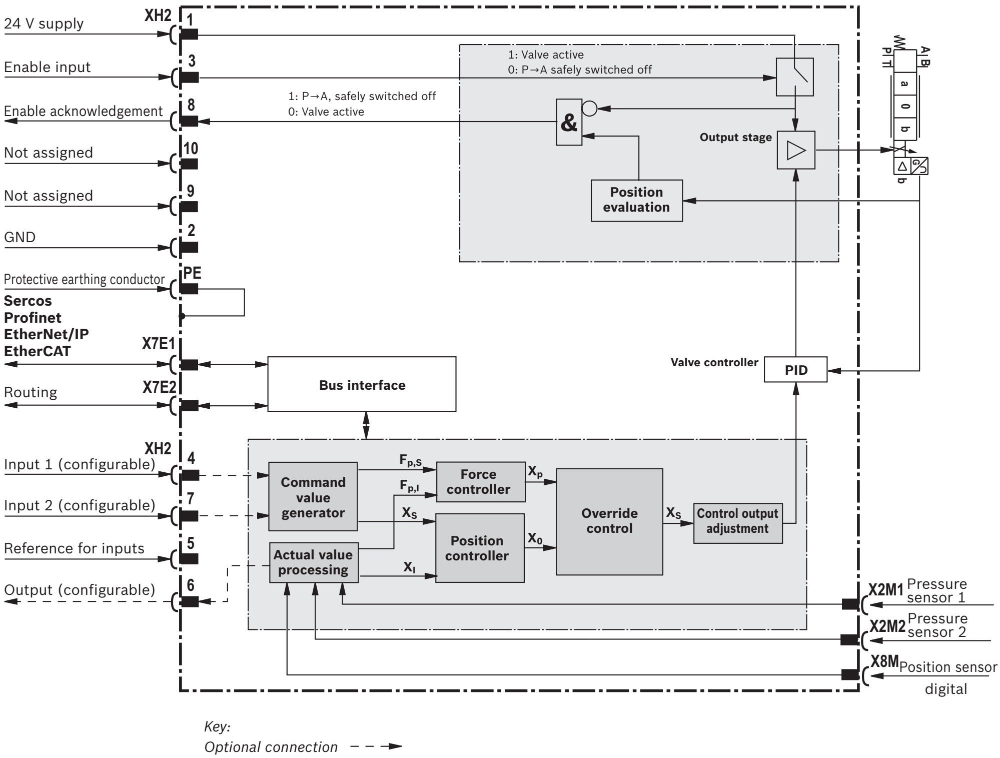
electrical, integrated electronics (OBE)			
Relative duty cycle		%	100 (continuous operation)
Protection class according to EN 60529			IP 65 with mounted and locked plug-in connectors
Supply voltage [1]	– Nominal voltage	VDC	24
	– Lower limit value	VDC	18
	– Upper limit value	VDC	36
	– Maximum admissible residual ripple	Vpp	2.5 (Comply with absolute supply voltage limit values!)
Power consumption	– Size 6	W	Maximum of 40
	– Size 10	W	Maximum of 60
AD/DA resolution	– Analog inputs		12 bit
	– Analog output		10 bit
Protective earthing conductor and screening			See pin assignment (CE-compliant installation)
Required fuse protection, external		A	4, time-lag
Adjustment			Calibrated at plant, see valve characteristic curve
Conformity			CE according to EMC Directive 2004/108/EC tested according to EN 61000-6-2 and EN 61000-6-3

[1] Supply voltage is used directly for sensor connections X2M1, X2M2 and X8M (no internal voltage limitation)

Representation of the axis controller in the system network



Block diagram/controller function block



Detailed description of the safety function:
After the signal at the enable input has been removed, the output stage, and thus the solenoid of the valve, are internally separated from the available supply voltage. The enable acknowlegement will only be activated after the safe valve control spool position has been achieved.

For a more detailed description of the safety function, please refer to the 29391-B operating instructions as well.

Electrical connections, assignment

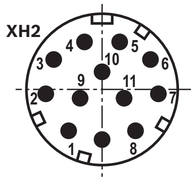
Connector pin assignment XH2, 11-pole + PE according to EN 175201-804

Pin	Core marking 1)	Interface D6 assignment
1	1	24 V DC supply voltage
2	2	GND
3	3	Enable input, output stage 24 V DC
4	4	Command value 1(4 ...20 mA/±10 V) 2)
5	5	Reference for command values
6	6	Actual value (4 ...20 mA/±10 V) 2, 3)
7	7	Command value 2(4 ...20 mA/±10 V) 2)
8	8	Enable acknowledgement, output stage 24 V DC
9	9	Not assigned
10	10	Not assigned
11	11	Switching output 24 V (error signal or power switching signal) max 1.5 A
PE	green-yellow	Protective earthing conductor (connected directly to metal housing)

1) Core marking of the connection lines for mating connector with cable set (see accessories)

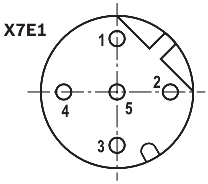
2) Selection via commissioning software

3) For diagnostic purposes, precise actual value response via Ethernet interface



Connector pin assignment for Ethernet interface "X7E1" and "X7E2" (coding D), M12, 4-pole, socket

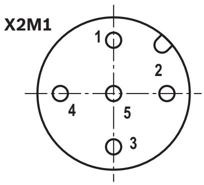
Pin	Assignment
1	TxD +
2	RxD +
3	TxD –
4	RxD –
5	Not assigned



5

Analog configurable sensor interfaces, connections "X2M1", "X2M2" (coding A), M12, 5-pole, socket

Pin	Assignment
1	+24 V voltage output (sensor supply) 1)
2	Sensor signal input current (4 ... 20 mA) 2)
3	GND
4	Sensor signal input voltage (0 ... 10 V) 2)
5	Negative differential amplifier input to pin 4 (optional)



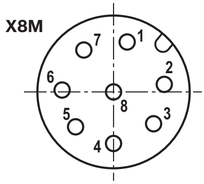
1) Maximum load capacity 50 mA, voltage output same as voltage supply connected to input XH2!

2) Only one signal input per interface, configurable

Electrical connections, assignment

Digital sensor interface SSI, EnDat 2.2 or 1 Vpp measurement system "X8M", M12, 8-pole, socket

Pin	SSI pin assignment [1]	EnDat 2.2 pin assignment [1)2)]	1Vpp pin assignment
1	GND	GND	GND
2	+24 V	+5 V	+5 V
3	Data +	Data +	A +
4	Data –	Data –	A –
5	GND	GND	B +
6	Clock –	Clock –	B –
7	Clock +	Clock +	R +
8	+24 V	+5 V	R –



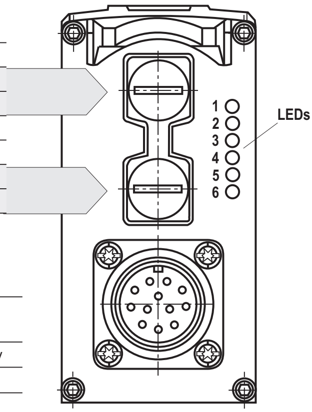
1) Pins 2, 8 and 1, 5 each with same assignment

2) Supported resolution ≥ 10 nm

Notice!
- Maximum load capacity at pin 2 (encoder supply): 50 mA (SSI), 250 mA (EnDat 2.2, 1 Vpp)
- We recommend connecting the screens on both sides over the metallic housings of the plug-in connectors. Using connector pins will affect the shielding effect! Internal screens are not required.

LED displays

LED	Interface	Sercos	EtherNET/IP	EtherCAT	PROFINET
1	X7E1	Activity	Activity	Not used	Activity
2		Link	Link	Link/activity	Link
3	Electronics module	S	Network status	Network status	Network status
4		Module status	Module status	Module status	Module status
5	X7E2	Activity	Activity	Not used	Activity
6		Link	Link	Link/activity	Link



Displays of the Status LEDs

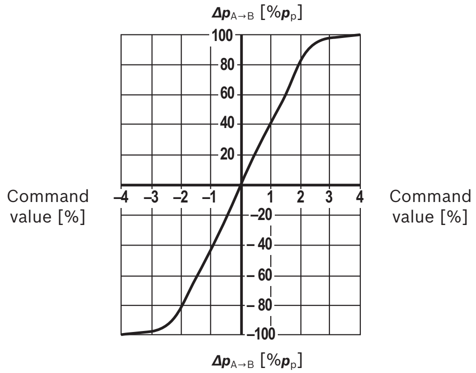
Module status LED (LED 4)	Display status
Off	No voltage supply
Green-red, flashing	Self-test
Green, flashing	Standby
Green	Operation
Red, flashing	Warning
Red	Error

Network status LED (LED 3)	Display status
Off	No voltage supply
Green	Operation

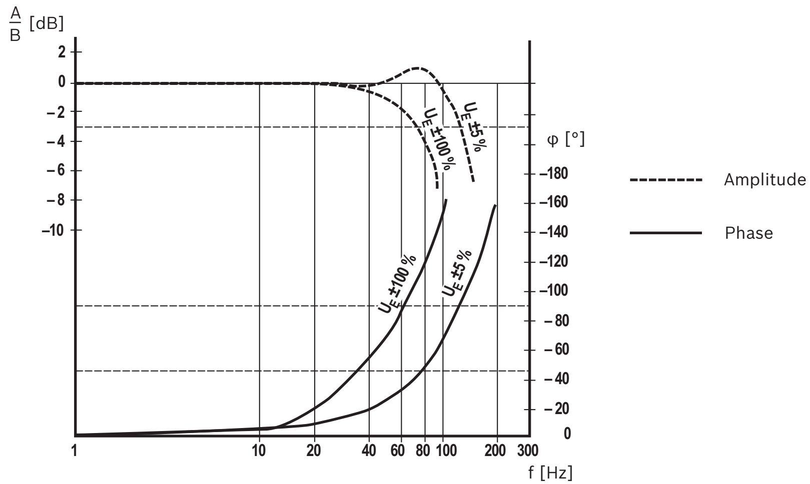
Notice!
- LEDs 1, 2, 5 and 6 refer to interfaces "X7E1" and "X7E2"
  - Link: Cable plugged in, connection established (permanently lit)
  - Activity: Data sent/received (flashing)
- Module status LEDs 3 and 4 refer to the electronics module
- For a detailed description of the diagnosis LEDs, please refer to the functional description Rexroth HydraulicDrive HDS-xx.

Characteristic curves size 6
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Pressure amplification



Bode diagram

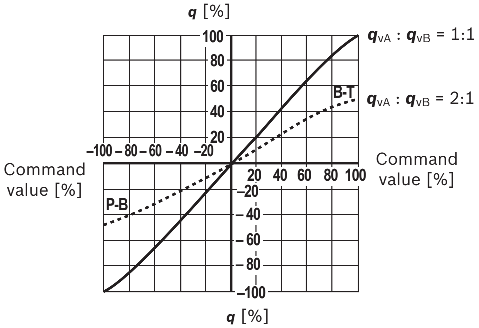


5

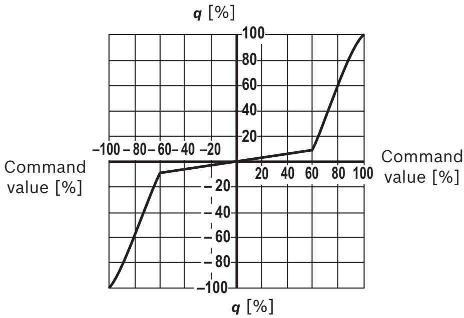
Characteristic curves size 6
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/signal function

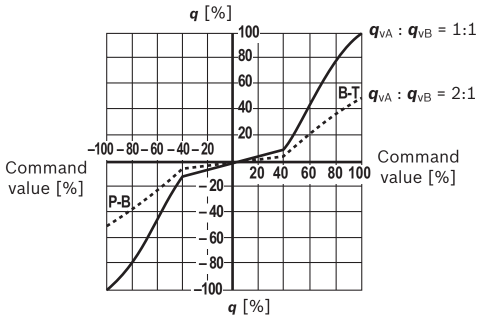
L: Linear



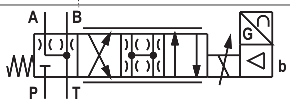
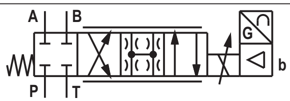
P: Inflection 60 %



P: Inflection 40 %



Fail-safe position

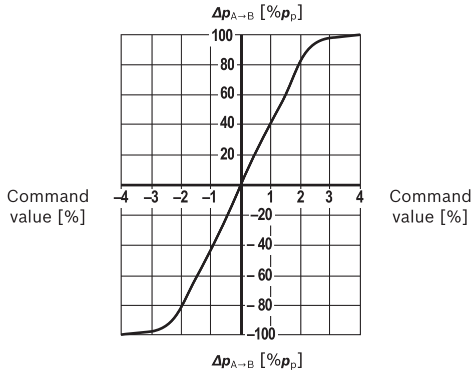
	Zero flow at	100 bar	P→A	50 cm³/min
			P→B	70 cm³/min
	Flow at	***Δp*** = 35 bar	A→T	10 ... 20 l/min
			B→T	7 ... 20 l/min
	Zero flow at	100 bar	P→A	50 cm³/min
			P→B	70 cm³/min
			A→T	70 cm³/min
			B→T	50 cm³/min

Fail-safe	***p*** = 0 bar => 7 ms	Enable "off" or internal shut-off if an error has occurred
	p = 100 bar => 10 ms	U_B ≤ 18 V or ***I*** ≤ 2 mA (with 4 ... 20 mA signal, cable break detection: Current threshold configurable)

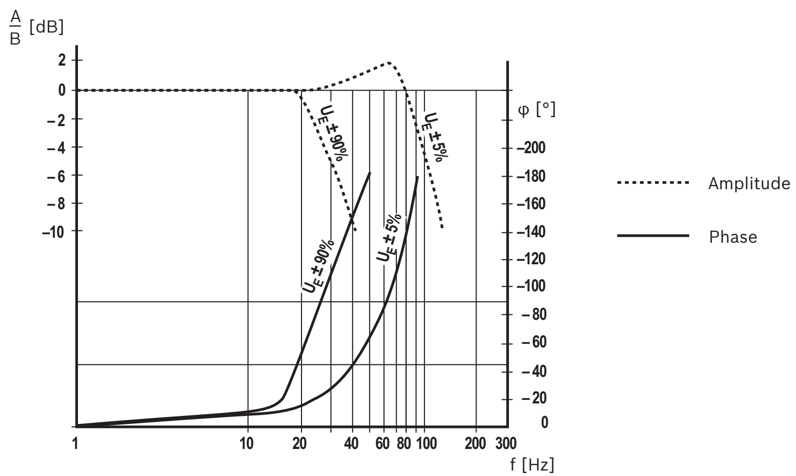
Characteristic curves size 10

(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Pressure amplification



Bode diagram

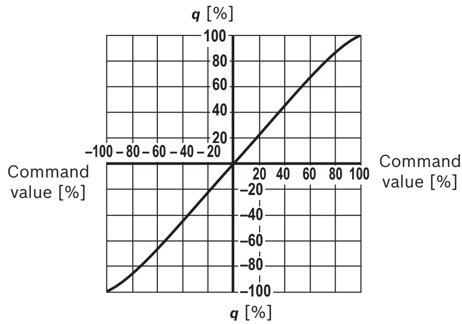


5

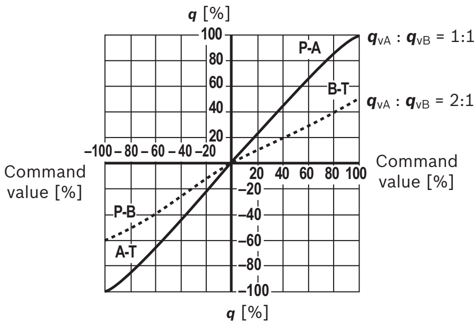
Characteristic curves size 10
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/signal function

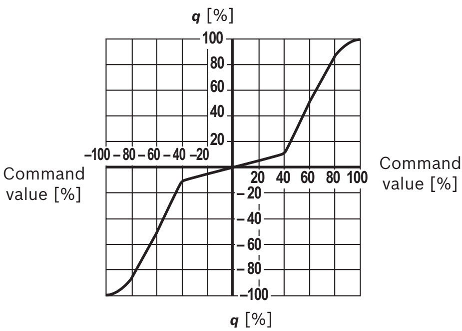
L: Linear 1:1



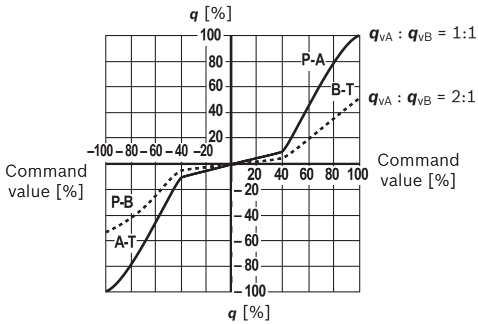
L: Linear 2:1



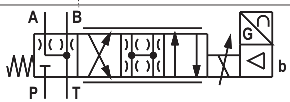
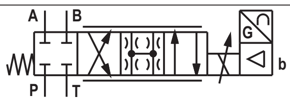
P: Inflection 40 % 1:1



P: Inflection 40 % 2:1

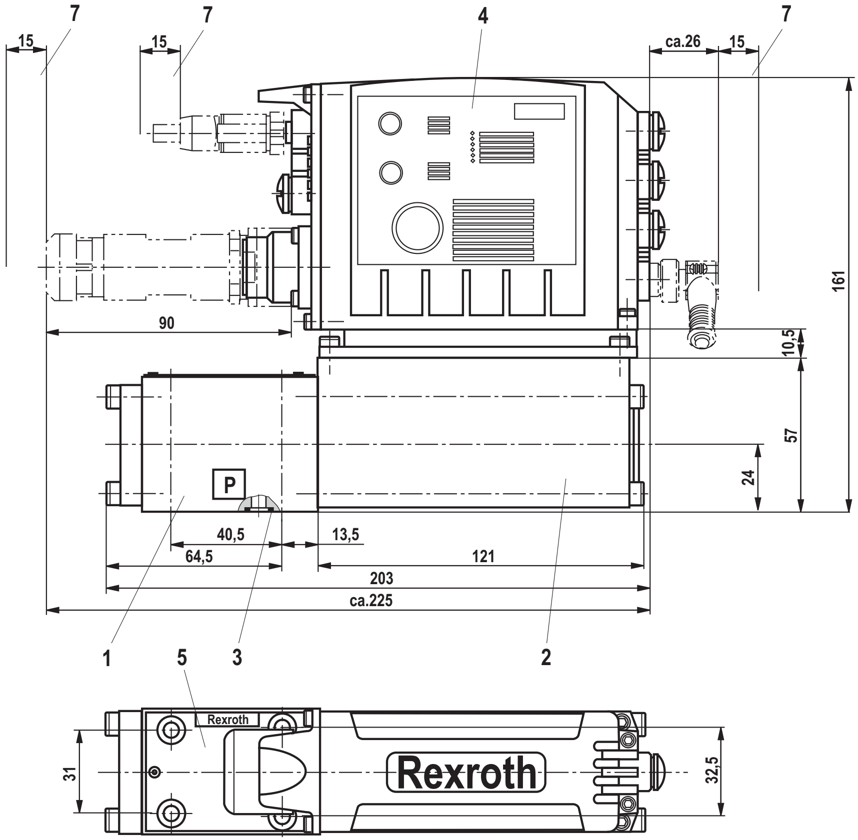


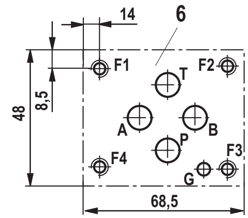
Fail-safe position

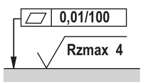
	Zero flow at	100 bar	P→A	50 cm³/min
			P→B	70 cm³/min
	Flow at	Δp = 35 bar	A→T	10 ... 20 l/min
		q_n = 50/100 l/min	B→T	7 ... 20 l/min
	Zero flow at	100 bar	P→A	50 cm³/min
			P→B	70 cm³/min
			A→T	70 cm³/min
			B→T	50 cm³/min

Fail-safe	p = 0 bar => 12 ms	Enable "off" or internal shut-off if an error has occurred
	p = 100 bar => 16 ms	U_B ≤ 18 V or I ≤ 2 mA (with 4 ... 20 mA signal, cable break detection: Current threshold configurable)

Dimensions, size 6 (dimensions in mm)







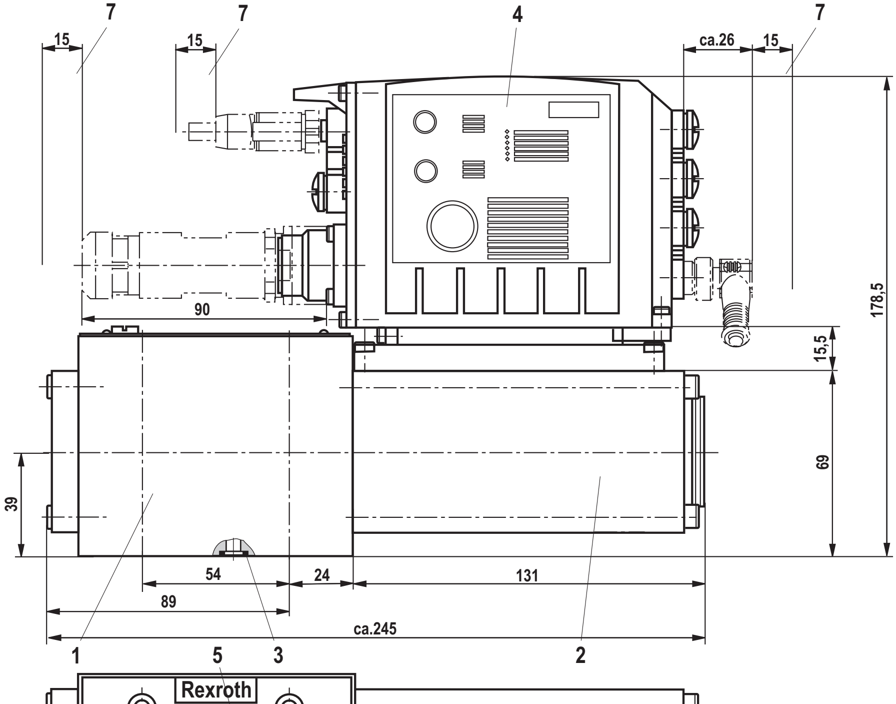
Required surface quality of the valve contact surface

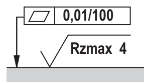
1 Valve housing
2 Control solenoid with position transducer
3 Identical seal rings, 9.25 x 1.78, for ports A, B, P, T
4 Integrated digital control electronics
5 Name plate
6 Machined valve contact surface, porting pattern according to ISO 4401-03-02-0-05
7 Space required for removing the mating connectors

Notice!
The dimensions are nominal dimensions and subject to tolerances.

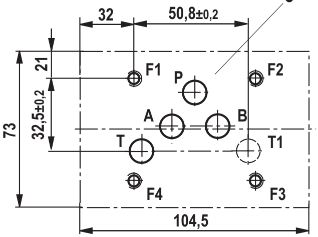
Valve mounting screws (separate order)
4 hexagon socket head cap screws, metric,
ISO 4762 - M5 x 30 - 10.9-N67F 821 70
Tightening torque M_A = 6 + 2 Nm
Material no. 2910151166

Dimensions, size 10 (dimensions in mm)





Required surface quality of the valve contact surface



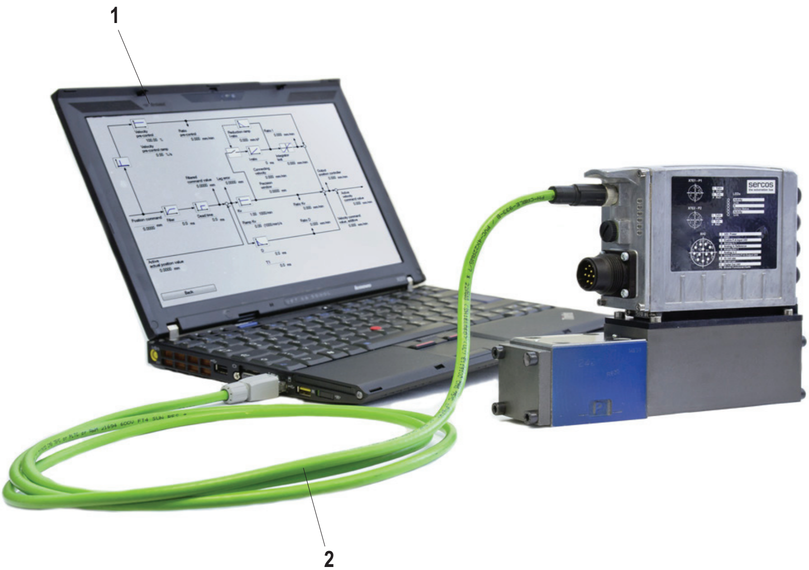
Notice!
The dimensions are nominal dimensions and subject to tolerances.

1 Valve housing
2 Control solenoid with position transducer
3 Identical seal rings, 12.0 x 2, for ports A, B, P, T, T1
4 Integrated digital control electronics
5 Name plate
6 Machined valve contact surface, porting pattern according to ISO 4401-05-04-0-05
Deviating from the standard:
Port T1 is additionally available
7 Space required for removing the mating connectors

Valve mounting screws (separate order)
4 hexagon socket head cap screws, metric, ISO 4762 - M6 x 40 - 10.9-N67F 821 70
Tightening torque $\boldsymbol{M}_A$ = 11 + 3 Nm
Material no. 2910151209

Accessories for parameterization (not included in scope of delivery)

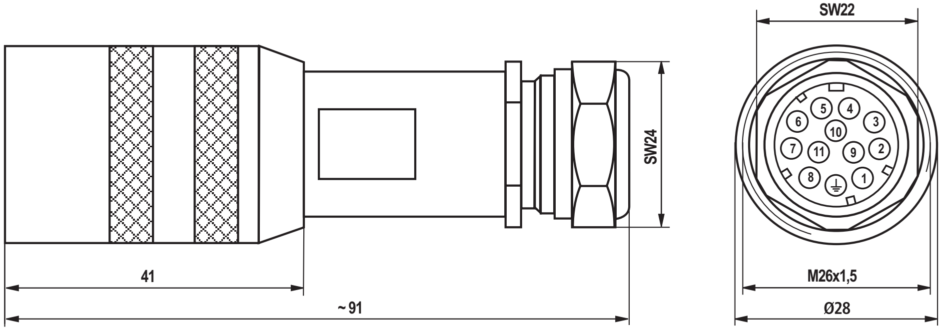
For parameterization via PC, the following is required:	
1 Commissioning software	IndraWorks Indraworks D Indraworks DS, download from www.boschrexroth.com/IAC
2 Connection cable, 3 m	Shielded, M12 on RJ45, length can be freely chosen Mat. no. R911172135, type designation to be specified additionally RKB0044/xxx.x (length in meters)



5

Accessories, port XH2 (not included in the scope of delivery)

Mating connector for XH2	Design	Material number
Mating connector according to DIN EN 175201-804 (12-pole, metal design)	Mating connector (assembly kit) for cable diameters of 12-15 mm	R901268000
	Mating connector with 5 m cable, 12 x 0.75 mm² with cable shield, assembled	R901272854
	Mating connector with 20 m cable, 12 x 0.75 mm² with cable shield, assembled	R901272852



Accessories, sensor connections X2M1 and X2M2 (not included in the scope of delivery)

Cable set for X2M1, X2M2 (Analog sensors)	Design	Material number
Cable set for connecting Bosch Rexroth pressure sensors HM20, shielded, 5-pole, A coding, PUR/PVC, straight connector M12, on straight socket M12, line cross-section 0.34 mm²	Length 1.0 m	R901111712
	Length 2.0 m	R901111713

Accessories, sensor connection X8M (not included in the scope of delivery)

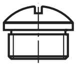
Cable set for X8M (SSI, 1Vss only) [1]	Design	Material number
Shielded, 8-pole, A coding, straight connector M12, on free line end, line cross-section 0.25 mm²	Length 10.0 m	R913002642

[1] **Recommendation**: If an EnDat 2.2 sensor is used, please refer to the sensor manufacturer Heidenhain with respect to a cable set.

Accessories, Ethernet connections X7E1 and X7E2 (not included in the scope of delivery)

Cable set for X7E1, X7E2 (Ethernet interface)	**Design**	**Material number**
Cable set, shielded, 4-pole, D coding, straight connector M12, on straight connector M12, line cross-section 0.25 mm^2	Length xx.x m	R911172111 (type designation RKB0040/xx.x to be specified additionally)
Cable set, shielded, 4-pole, straight connector M12, on straight connector RJ45, line cross-section 0.25 mm^2	Length xx.x m	R911172135 (type designation RKB0044/xx.x to be specified additionally)

Miscellaneous accessories (not included in scope of delivery)

Protective cap	**Design**	**Material number**
Protective cap M12		R901075563

5

Project planning/maintenance instructions/additional information

Product documentation for IAC-Multi-Ethernet

- Data sheet 29391 (this data sheet)
- Operating instructions 29391-B
- CE declaration of conformity (available from Bosch Rexroth upon request)
- Operation of IAC-Multi-Ethernet electronics (xx: Software version):
  – Functional description Rexroth HydraulicDrive HDS-xx
  – Parameter description Rexroth HydraulicDrive HDS-xx
  – Diagnosis description Rexroth HydraulicDrive HDS-xx
- General information on the maintenance and commissioning of hydraulic components 07800/07900
- General operating instructions: Hydraulic valves for industrial applications 07600-B

Product family

- 4-way analog valve, direct operated, sizes 6 and 10, with integrated electronics (see data sheets 29035 and 29037)
- 4-way bus valve, direct operated, sizes 6 and 10, in CANopen or Profibus version (see data sheet 29191)

Commissioning software and documentation on the internet: www.boschrexroth.com/IAC

Maintenance instructions:

- The devices have been tested in the plant and are supplied with default settings.
- Only complete units can be repaired. Repaired devices are returned with default settings. User-specific settings will not be applied. The machine end-user will have to retransfer the corresponding user parameters.

Notes:

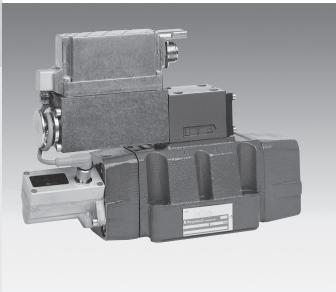
- The supply voltage must be permanently connected, as otherwise bus communication is not possible.
- If electromagnetic interference is to be anticipated, suitable measures must be taken to ensure the function (depending on the application, e.g. shielding, filtration)!

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
documentation@boschrexroth.de
www.boschrexroth.de

4/3-way servo solenoid directional control valves with electrical position feedback (Lvdt DC/DC) (ruggedized design)

RE 29084/01.09
Replaces: 01.05

Type 4WRL10...25



Sizes (NG) 10, 16, 25
Unit series 3X
Maximum working pressure P, A, B 350 bar
Nominal flow rate 55...370 l/min (Δ*p* 10 bar)

List of contents

Contents	Page
Features	1
Ordering data	2
Symbols, accessories	3
Function, sectional diagram	4
Control oil supply	5
Technical data	6 and 7
Valve with external trigger electronics	8 and 9
Characteristics curves	10 and 11
Unit dimensions	12 to 14

For information regarding the available spare parts see:
www.boschrexroth.com/spc

Features

– Pilot operated 4/3-way servo solenoid directional control valves NG10 to NG25
– Pilot valve NG6, with control piston and sleeve in servo quality and sturdy design, actuated on one side, 4/4 fail-safe position when switched off
– Position transducer (Lvdt DC/DC) with metal cap
– Main stage in servo quality with position feedback
– Flow characteristic
  • M = Progressive with fine metering notch
  • P = Non-linear curve
  • L = Linear
– For subplate attachment, mounting hole configuration NG10 to ISO 4401-05-05-0-05, NG16 to ISO 4401-07-07-0-05 and NG25 to ISO 4401-08-08-0-05
– Subplates as per Technical Data Sheet, NG10 RE 45055, NG16 RE 45057 and NG25 RE 45059 (order separately)
– Plug-in connectors to DIN 43563-AM6, see Technical Data Sheet RE 08008 (order separately)
– External trigger electronics (order separately)
  • Electric amplifier for standard curves “M” and “L”
  • Electric amplifier for non-linear curve “P”

Ordering data

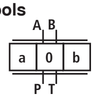
4WRL					–3X/ G24		K0/ M – 750

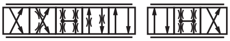
For **external** trigger electronics **= no desig.**

NG10	**= 10**
NG16	**= 16**
NG25	**= 25**

Control spool symbols

4/3-way version





= V, V1

With symbol V1:
P → A: q_v B → T: $q_v/2$
P → B: $q_v/2$ A → T: q_v

[1] Q_N: Flow characteristic "M" or "L"
[2] Q_N: Flow characteristic "P"

Nominal flow rate
at 10 bar valve pressure difference
(5 bar per metering notch)

	NG10
40 =	40 l/min [2]
55 =	55 l/min [1]
70 =	70 l/min [2]
85 =	85 l/min [1]
	NG16
90 =	90 l/min [2]
120 =	120 l/min [1]
150 =	150 l/min [2]
200 =	200 l/min [1]
	NG25
300 =	300 l/min [2]
370 =	370 l/min [1]

Flow characteristic

M =	Progressive with linear fine metering
P =	Non-linear curve [2], linear (kink at 40 %)
L =	Linear

3X = Unit series 30 to 39 (installation and connection dimensions unchanged)

Power supply of trigger electronics
G24 = +24 V DC

Control oil inlet "x" control oil outlet "y"

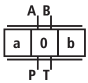
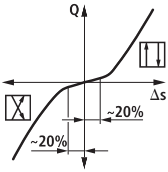
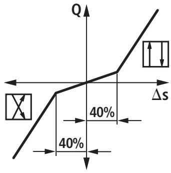
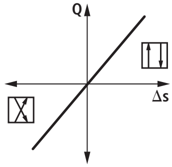
No designation =	"x" = external, "y" = external
E =	"x" = internal, "y" = external
ET =	"x" = internal, "y" = internal
T =	"x" = external, "y" = internal

Electrical connection
K0 = **without** plug-in connector, with plug to DIN 43563-AM6
Order plug-in connector separately

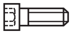
M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

750 = Ruggedized design

Symbols

	M: Progressive with fine metering	P: Non-linear, linear (40%)	L: Linear
			

Accessories, not included in delivery

Fastening bolts 	NG10	4 x ISO 4762-M6 x 40-10.9-N67F821 70	**2 910 151 209**
	NG16	2 x ISO 4762-M6 x 45-10.9-N67F821 70	**2 910 151 211**
		4 x ISO 4762-M10 x 50-10.9-N67F821 70	**2 910 151 301**
	NG25	6 x ISO 4762-M12 x 60-10.9-N67F821 70	**2 910 151 354**
	VT-VRRA1-527-20/V0/2STV, see RE 30045		**0 811 405 063**
	VT-VRRA1-527-20/V0/K40-AGC-2STV, see RE 30043		**0 811 405 068**
 6P+PE (Pg16)	Plug-in connector not included in delivery, also see RE 08008		**1 834 482 024**

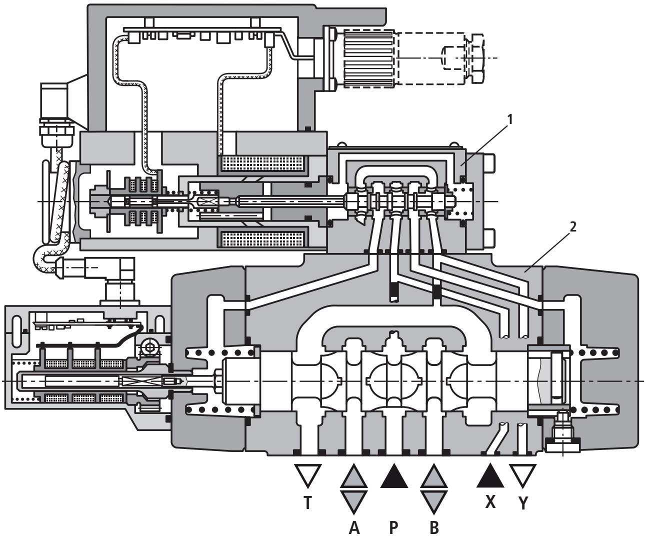
Testing and service equipment

– Test box type VT-PE-TB2, see RE 30064
– Test adapter type VT-PA-3, see RE 30070

Function, sectional diagram

Construction

The valve consists of two main assemblies:
– Pilot valve (1) with control spool and sleeve, return springs, control solenoid and inductive position transducer
– Main stage (2) with centering springs and position feedback



Functional description

When the control solenoid is not actuated, the control spool is held by springs in the fail-safe position, and the main stage spool remains in spring-centered mid position at 1...6% of the stroke in the direction P-B/A-T.
In the on-board electronics, the pre-defined setpoint is compared with the actual value for the position of the main stage control spool. In the event of an error signal, the control solenoid is actuated, and the pilot spool is moved as the magnetic force changes. The flow released through the control cross-sections causes the main control spool to move. The stroke/control cross-section of the main control spool is controlled proportionately to the setpoint. If the input setpoint is 0 V, the electronics move the main stage control spool to mid position.
The control oil is conveyed to the pilot valve either internally via port P or externally via port X. The oil returns to the tank internally via port T or externally via port Y.

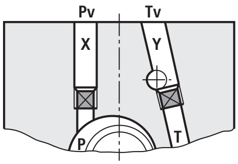
Power failure

In the event of a power failure or an open circuit, the on-board electronics cut off the electricity to the control solenoid and the pilot spool moves to the “fail-safe” position, relieving the control oil chambers of the main stage. The main stage control spool is held by springs in mid position.

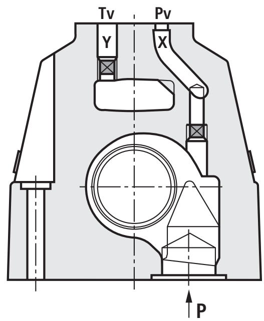
Control oil supply

The pilot valve can be supplied
both via ports X and Y (externally)
and via the main flow channels P and T.

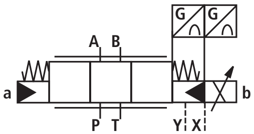
NG10, 25



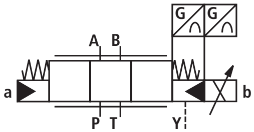
NG16



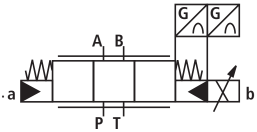
Type...–3X...



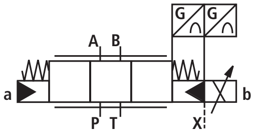
Type...–3X...E...



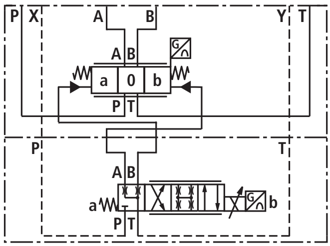
Type...–3X...ET...



Type...–3X...T...



Symbol in detail
(external control oil inlet and outlet)



Main valve

Pilot valve

No designation = “x” = external “y” = external
E = “x” = internal “y” = external
ET = “x” = internal “y” = internal
T = “x” = external “y” = internal

Important

Hydraulic symbols are largely derived from the symbols of the switching valves. 4/3-way servo solenoid directional control valves (pilot operated) do not have a closed mid position when switched off! They only perform their function in an active, closed control loop, even if the pilot valve features a fail-safe 4th position.
See technical data for details on “switch-off behavior”.

Technical data

General

Construction		Spool type valve, pilot operated		
Actuation		Servo solenoid directional control valve NG6, with position controller for pilot valve and main stage, external electric amplifier		
Type of mounting		Subplate, mounting hole configuration NG10...25 to ISO 4401-...		
Installation position		Optional		
Ambient temperature range	°C	–20...+60		
Weight	kg	**NG10** 8.6	**NG16** 10.3	**NG25** 18.3
Vibration resistance, test condition		Max. 40 *g*, shaken in 3 dimensions (24 h)		

Hydraulic (measured with HLP 46, ϑ_{oil} = 40 °C ±5 °C)

Pressure fluid			Hydraulic oil to DIN 51524...535, other fluids after prior consultation		
Viscosity range	recommended	mm^2/s	20...100		
	max. permitted	mm^2/s	10...800		
Pressure fluid temperature range		°C	–20...+70		
Maximum permissible degree of contamination of pressure fluid Purity class to ISO 4406 (c)			Class 18/16/13 [1]		
Flow direction			See symbol		
Nominal flow at Δp = 5 bar per notch [4]			**NG10**	**NG16**	**NG25**
		l/min	40 [3], 55 [1], 70 [2], 85 [3]	90 [2], 120 [3], 150 [2], 200 [3]	300 [2], 370 [3]
Max. working pressure	Ports P, A, B	bar	350		
Max. pressure	Ports T, X, Y	bar	250		
Min. control oil pressure in “pilot stage”		bar	10		
Q_{max}		l/min	170	450	900
Q_N pilot valve		l/min	4	12	24
Leakage of pilot valve at 100 bar		cm^3/min	< 180	< 300	< 500
Leakage of main stage at 100 bar		cm^3/min	< 400 / < 600	< 1000	< 1000

Static/Dynamic

Hysteresis		%	,0.1 scarcely measurable		
Manufacturing tolerance for Q_{max}		%	%10		
Response time for signal change (at X = 100 bar)	0...100%		25	40	45
	0...10%		15	18	20
Response time for signal change (at X = 10 bar)	0...100%		85	90	150
	0...10%		50	40	80
Switch-off behavior			After electrical switch-off: pilot valve in “fail-safe” Main stage moves to spring-centered “mid position”: 1...6% P-B/A-T		
Thermal drift			Zero point displacement <1% at ΔT = 40 °C		
Zero adjustment			Adjustable ±5% via valve amplifier		

1) The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of components. For a selection of filters, see Technical Data Sheets RE 50070, RE 50076 and RE 50081.

2) Characteristic curve: P (non-linear).

3) Characteristic curve: M or L

4) Flow rate at a different Δp $Q_x = Q_{nom} \cdot \sqrt{\frac{\Delta p_x}{5}}$

Technical data

Electrical

Cyclic duration factor	%	100 ED	
Power supply		24 V DC_{nom} (external electric amplifier)	
Degree of protection		IP 65 to DIN 40050, plug-in connector 1 834 482 024 correctly fitted	
Solenoid and position transducer connector		To DIN 43563-AM6 (plug-in connector 1 834 482 024) Pg16 For pin assignment, see block diagram on pages 8 and 9	
Max. solenoid current	A	2.7	
Coil resistance R_{20}	Ω	2.5	
Max. power consumption at 100% load and operating temperature	VA	40	
Position transducer DC/DC technology		Supply: +15 V/35 mA –15 V/25 mA	Signal: 0...±10 V (R_L ≥10 kΩ)

All characteristics only in connection with valve amplifier 0 811 405 063

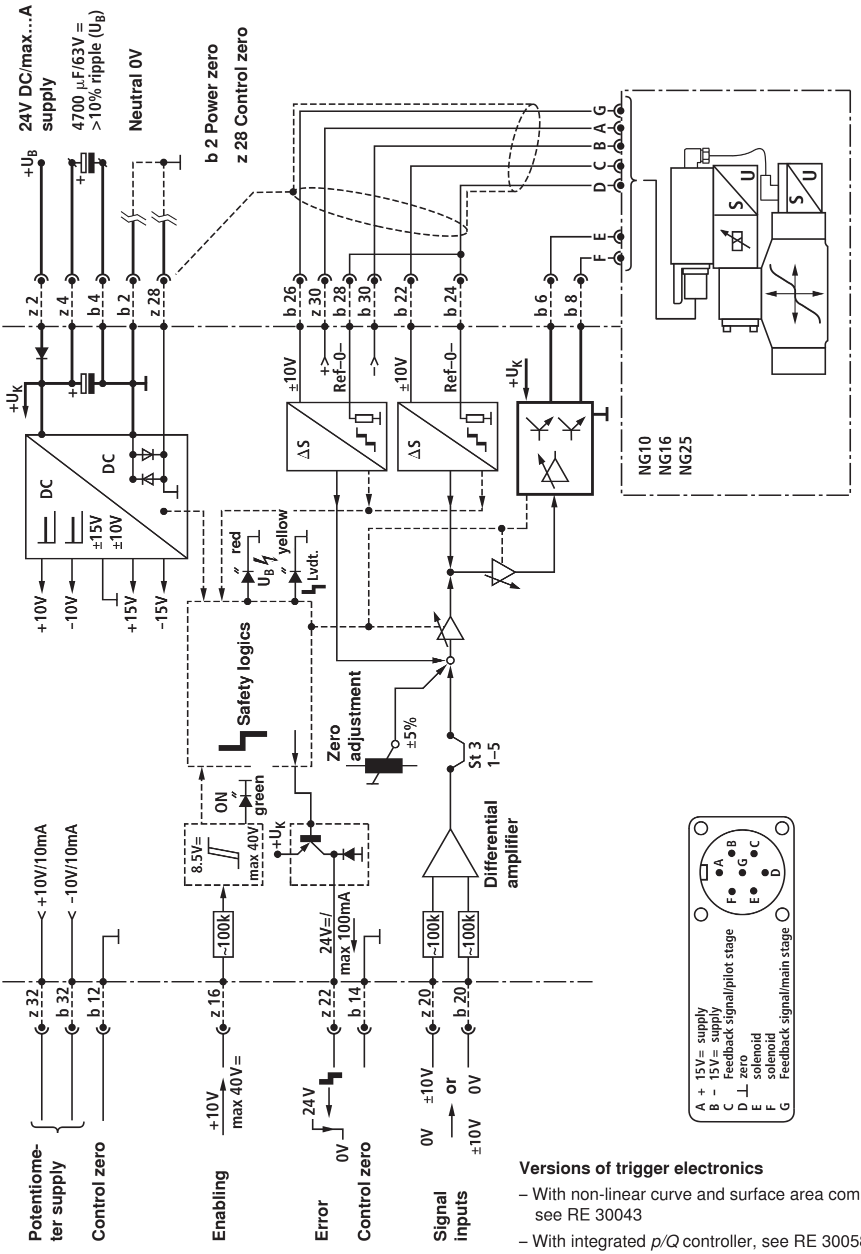
Important

Pilot operated 4/3-way servo solenoid directional control valves only perform their function in an active closed control loop and do not have a “fail-safe” position when switched off. For this reason, many applications require the use of “external check valves”, which must be taken into account during the On/Off switching sequence.

5

Valve with external trigger electronics (standard linear curve: M, L)

Block diagram/pin assignment



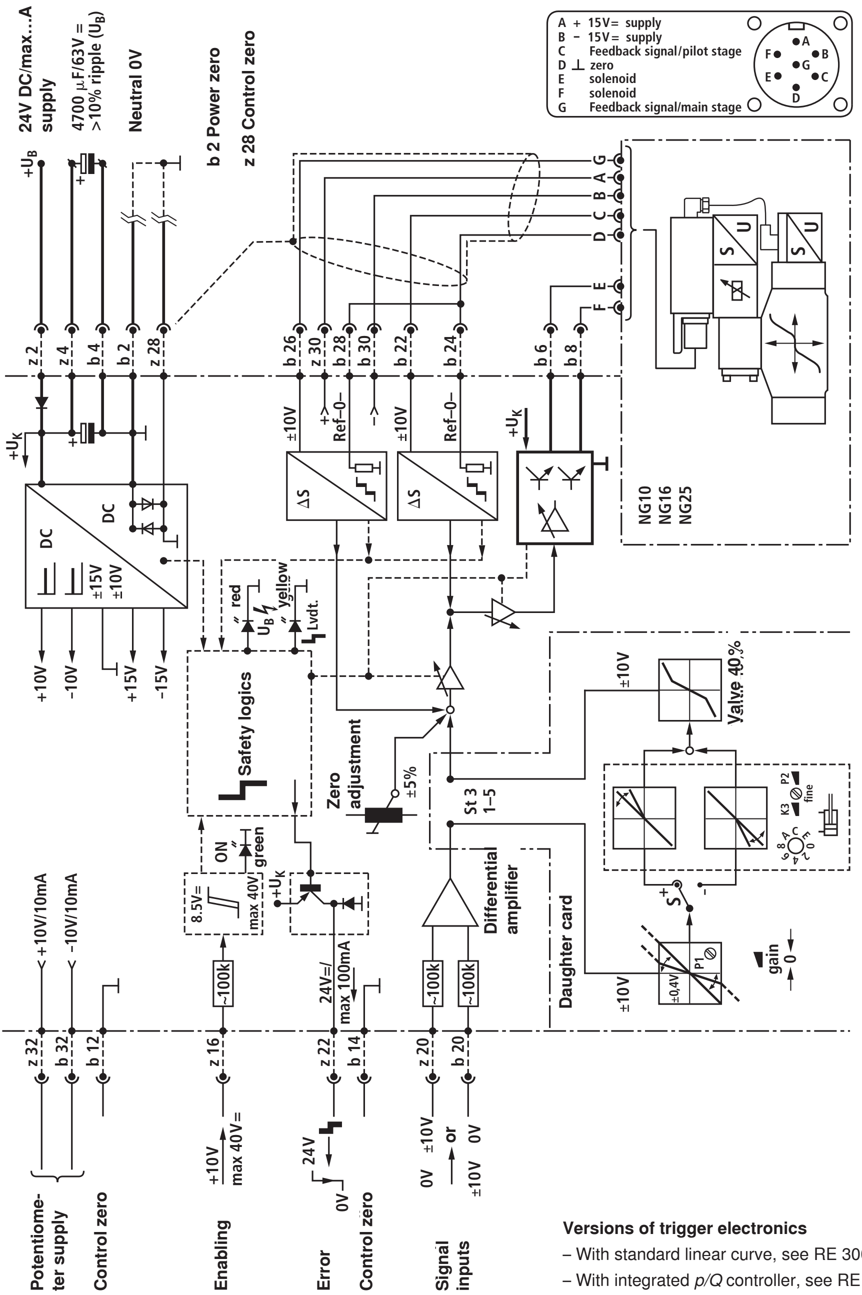
Versions of trigger electronics

– With non-linear curve and surface area compensation, see RE 30043

– With integrated *p/Q* controller, see RE 30058

Valve with external trigger electronics (non-linear curve: P)

Block diagram/pin assignment



Versions of trigger electronics

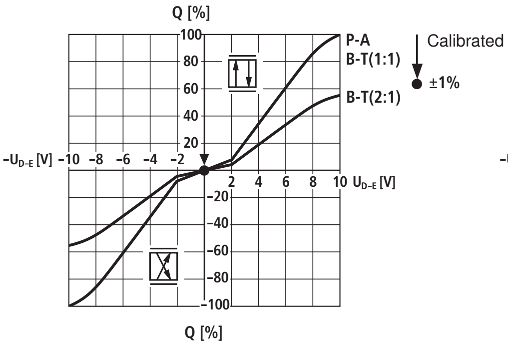
– With standard linear curve, see RE 30045

– With integrated *p/Q* controller, see RE 30058

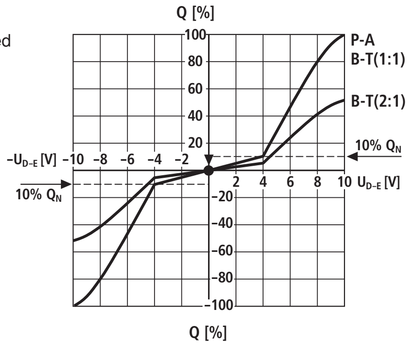
Characteristic curves (measured with HLP 46, ϑ_{oil} = 40 °C ± 5 °C)

Flow rate – signal function $Q = f(U_E)$

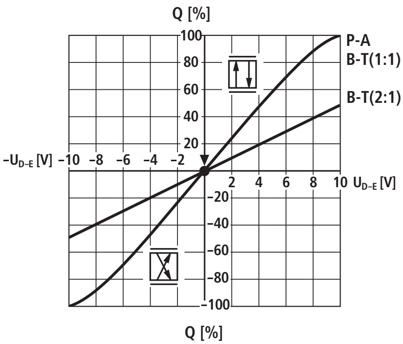
Flow characteristic M



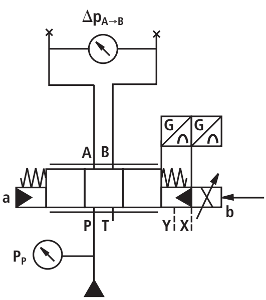
Flow characteristic P

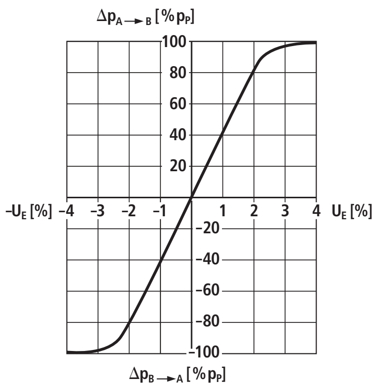


Flow characteristic L



Pressure gain

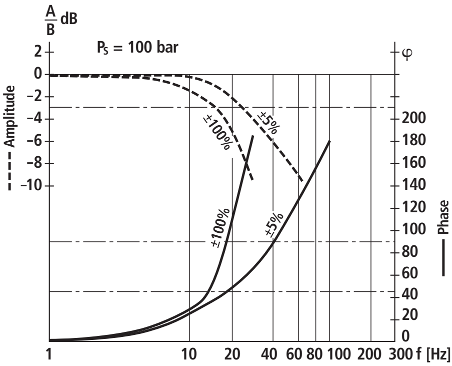




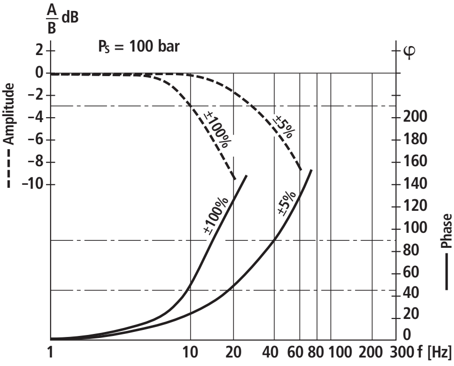
Characteristic curves (measured with HLP 46, ϑ_{oil} = 40 °C ± 5 °C)

Bode diagram

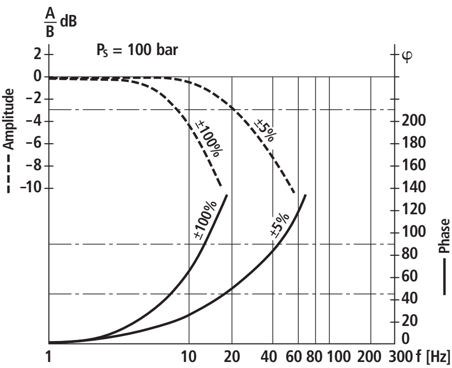
NG10



NG16

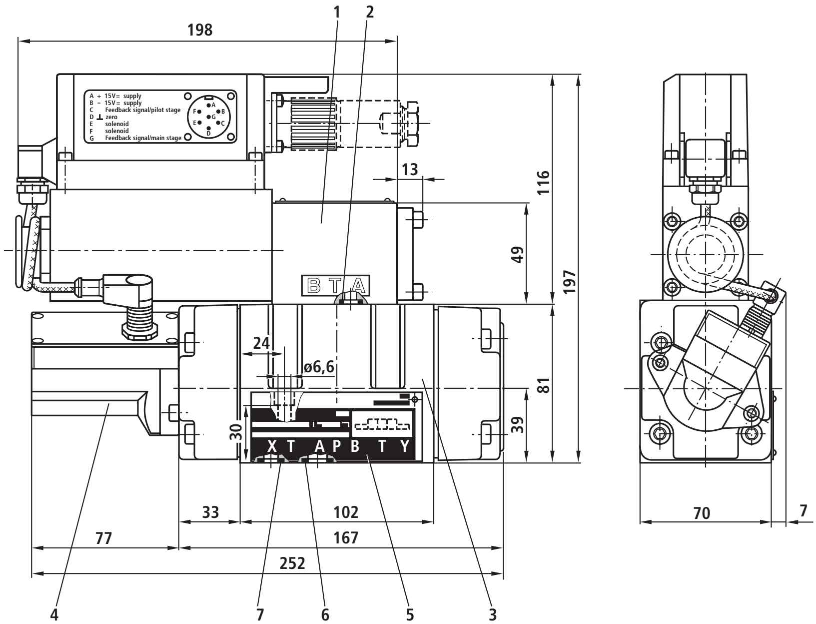


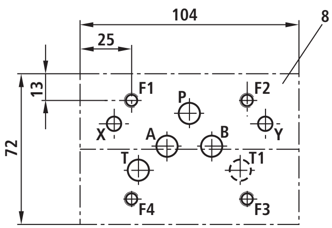
NG25

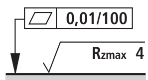


5

Unit dimensions NG10 (nominal dimensions in mm)







Required surface quality
of mating component

1 Pilot valve
2 O-ring 9.25 x 1.78 (ports P, A, B, T)
3 Main valve
4 Inductive position transducer (main valve)
5 Nameplate
6 O-ring 12 x 2 (ports P, A, B, T, T1)
7 O-ring 10 x 2 (ports X, Y)

8 Machined valve contact surface, mounting hole configuration according to ISO 4401-05-05-0-05
Deviates from standard:
Ports P, A, B, T, T1 Ø10.5 mm
Minimum thread depth: Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

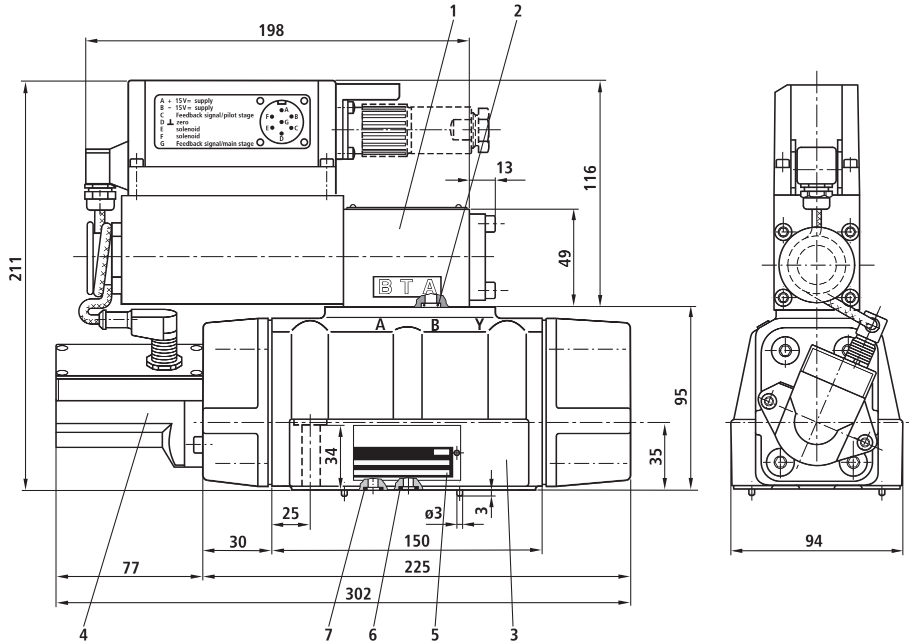
Subplates, see Technical Data Sheet RE 45055

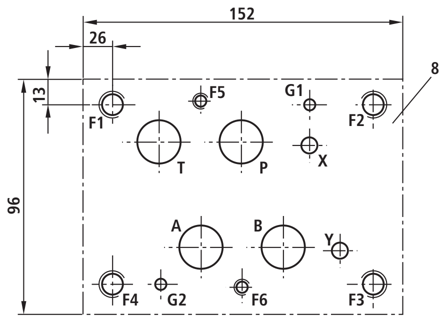
Valve fastening bolts (order separately)
The following valve fastening bolts are recommended:

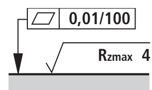
4 cheese-head bolts ISO 4762-M6x40-10.9-N67F821 70
(galvanized in accordance with Bosch standard N67F821 70)
Tightening torque M_A = 11+3 Nm

Material no. **2910151209**

Unit dimensions NG16 (nominal dimensions in mm)







Required surface quality
of mating component

8 Machined valve contact surface, mounting hole configuration according to ISO 4401-07-07-0-05
Deviates from standard:
Ports P, A, B, T Ø 20 mm
Minimum thread depth: Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

Subplates, see Technical Data Sheet RE 45057

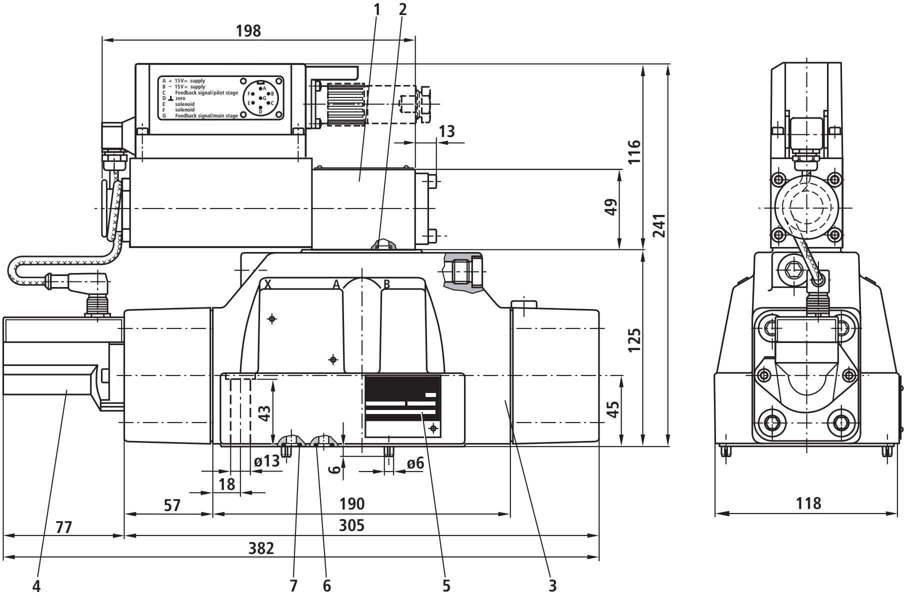
Valve fastening bolts (order separately)
The following valve fastening bolts are recommended:

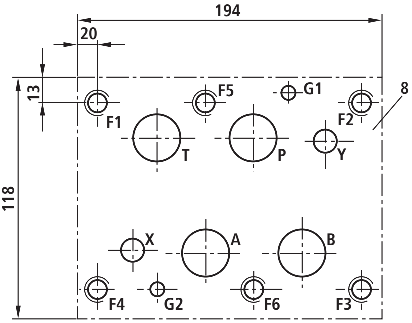
2 cheese-head bolts ISO 4762-M6x45-10.9-N67F821 70
(galvanized in accordance with Bosch standard N67F821 70)
Tightening torque M_A = 11+3 Nm
Material no. **2910151211**

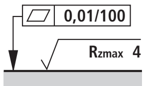
4 cheese-head bolts ISO 4762-M10x50-10.9-N67F821 70
(galvanized in accordance with Bosch standard N67F821 70)
Tightening torque M_A = 50+10 Nm
Material no. **2910151301**

1 Pilot valve
2 O-ring 9.25 x 1.78 (ports P, A, B, T)
3 Main valve
4 Inductive position transducer (main valve)
5 Nameplate
6 O-ring 23 x 2,5 (ports P, A, B, T)
7 O-ring 9 x 2 (ports X, Y)

Unit dimensions NG25 (nominal dimensions in mm)







Required surface quality of mating component

1 Pilot valve
2 O-ring 9.25 x 1.78 (ports P, A, B, T)
3 Main valve
4 Inductive position transducer (main valve)
5 Nameplate
6 O-ring 28 x 3 (ports P, A, B, T)
7 O-ring 15 x 2,5 (ports X, Y)

8 Machined valve contact surface, mounting hole configuration according to ISO 4401-08-08-0-05
Deviates from standard:
NG25: Ports P, A, B, T Ø 25 mm
Minimum thread depth: Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

Subplates, see Technical Data Sheet RE 45059

Valve fastening bolts (order separately)
The following valve fastening bolts are recommended:

6 cheese-head bolts ISO 4762-M12x60-10.9-N67F821 70
(galvanized in accordance with Bosch standard N67F821 70)
Tightening torque M_A = 90+30 Nm
Material no. **2910151354**

Notes

5

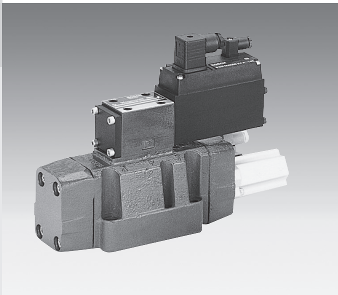
Notes

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Telefon +49 (0) 93 52 / 18-0
Telefax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

4/3-way servo solenoid directional control valves, pilot operated, with electrical position feedback (Lvdt DC/DC ±10V)

RE 29086/01.09
Replaces: 01.05

Type 4WRL 10...35, symbols V/V1



Sizes (NG) 10, 16, 25, 27, 35
Unit series 3X
Maximum working pressure P, A, B 350 bar (NG27: 280 bar)
Nominal flow rate 55...1000 l/min (Δp = 10 bar)

List of contents

For information regarding the available spare parts see:
www.boschrexroth.com/spc

Features

- Pilot operated 4/3-way servo solenoid directional control valves NG10 to NG35
- Pilot valve NG6, with control piston and sleeve in servo quality, actuated on one side, 4/4 fail-safe position when switched off
- Control solenoid with electrical position feedback and electronics for position transducer (Lvdt DC/DC)
- Main stage in servo quality with position feedback
- Flow characteristic
  - M = Progressive with fine metering notch
  - P = Non-linear curve
  - L = Linear
- For subplate attachment, mounting hole configuration NG10 to ISO 4401-05-05-0-05, NG16 to ISO 4401-07-07-0-05, NG25/27 to ISO 4401-08-08-0-05 and NG35 to ISO 4401-10-09-0-05
- Subplates as per Technical Data Sheet, NG10 RE 45055, NG16 RE 45057, NG25/27 RE 45059 and NG35 RE 45060 (order separately)
- Plug-in connectors to DIN 43560-AM2 Solenoid 2P+PE/M16 x 1.5, position transducer 4P/Pg7 included in delivery, see Technical Data Sheet RE 08008
- External trigger electronics (order separately)
  - Electric amplifier for standard curve "M" and "L"
  - Electric amplifier for non-linear curve "P"

Ordering data

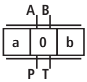
4WRL					–3X / G24		Z4 / M	*

For **external** trigger electronics **= no desig.**

NG10	**= 10**
NG16	**= 16**
NG25	**= 25**
NG27 [1)]	**= 27**
NG35 [2)]	**= 35**

Control spool symbols

4/3-way version



= V, V1

With symbol V1:
P → A: q_V B → T: $q_V/2$
P → B: $q_V/2$ A → T: q_V

Nominal flow rate
at 10 bar valve pressure difference
(5 bar per metering notch)

NG10	
55 l/min [4)]	**= 55**
70 l/min [3)]	**= 70**
85 l/min [4)]	**= 85**
NG16	
100 l/min [3)]	**= 55**
120 l/min [4)]	**= 70**
150 l/min [3)]	**= 85**
200 l/min [4)]	**= 200**
NG25	
300 l/min [3)]	**= 300**
370 l/min [4)]	**= 370**
NG27	
430 l/min [1) 4)]	**= 430**
NG35	
1000 l/min [2) 4)]	**= 1000**

Flow characteristic

M =	Progressive with linear fine metering
P =	Non-linear curve, linear (kink at 40 %)
L =	Linear

3X = Unit series 30 to 39 (installation and connection dimensions unchanged)

Power supply of trigger electronics
G24 = +24 V DC

Control oil inlet "x"
control oil return "y"

no desig. =	"x" = external, "y" = external
E =	"x" = internal, "y" = external
ET =	"x" = internal, "y" = internal
T =	"x" = external, "y" = internal

Electrical connection
Z4 = **with** plug-in connector, with plug to DIN 43560-AM2
Plug-in connector included in delivery

M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

Further information in plain text

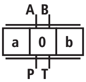
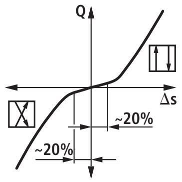
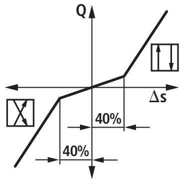
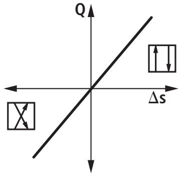
[1)] NG27 is a high-flow version of NG25, ports P, A, B and T have ∅ 32 mm in the main stage. Contrary to standard ISO 4401-08-08-0-05, ports P, A, B and T may be drilled to max. ∅ 30 mm in the control block. These valves therefore offer higher flow rates $Q_A : Q_B$

[2)] NG35 is a high-flow version of NG32, ports P, A, B and T have ∅ 50 mm in the main stage. Contrary to standard ISO 4401-10-09-0-05, ports P, A, B and T may be drilled to max. ∅ 48 mm in the control block. These valves therefore offer higher flow rates $Q_A : Q_B$

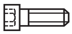
[3)] Q_N: Flow characteristic "P"

[4)] Q_N: Flow characteristic "M" or "L"

Symbols

	M: Progressive with fine metering	P: Non-linear, linear (40%)	L: Linear
			

Accessories, not included in delivery

Valve fastening bolts 	NG10	4 x ISO 4762-M6 x 40-10.9-N67F821 70	**2 910 151 209**
	NG16	2 x ISO 4762-M6 x 45-10.9-N67F821 70	**2 910 151 211**
		4 x ISO 4762-M10 x 50-10.9-N67F821 70	**2 910 151 301**
	NG25/27	6 x ISO 4762-M12 x 60-10.9-N67F821 70	**2 910 151 354**
	NG35	6 x ISO 4762-M20 x 90-10.9-N67F821 70	**2 910 151 532**
	VT-VRRA1-527-20/V0/2STV, see RE 30045		**0 811 405 063**
	VT-VRRA1-527-20/V0/K40-AGC-2STV, see RE30043		**0 811 405 068**
 2P+PE 4P	2P+PE (M16 x 1.5) and 4P (Pg7) included in delivery, also see RE 08008		

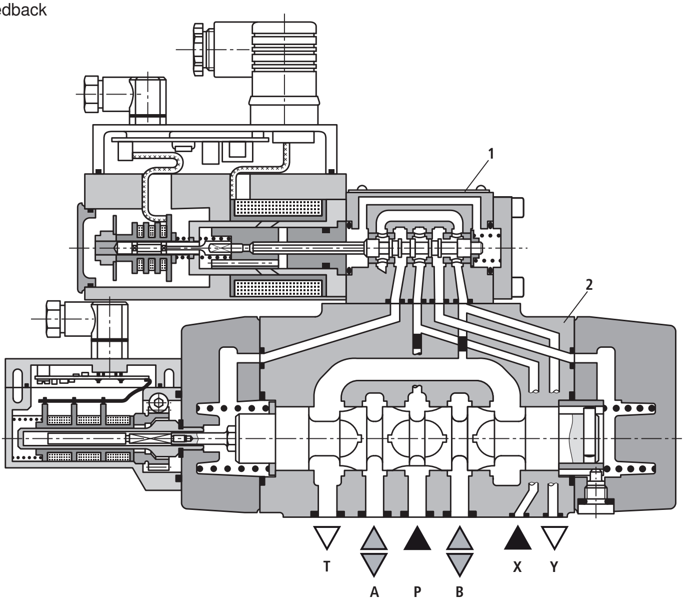
Testing and service equipment

– Test box type VT-PE-TB2, see RE 30064
– Test adapter type VT-PA-3, see RE 30070

Function, sectional diagram

Construction

The valve consists of two main assemblies:
– Pilot valve (1) with control spool and sleeve, return springs, control solenoid and inductive position transducer
– Main stage (2) with centering springs and position feedback



Functional description

When the control solenoid is not actuated, the control spool is held by springs in the fail-safe position, and the main stage spool remains in spring-centered mid position at 1…6% of the stroke in the direction P-B/A-T.
In the on-board electronics, the pre-defined setpoint is compared with the actual value for the position of the main stage control spool. In the event of an error signal, the control solenoid is actuated, and the pilot spool is moved as the magnetic force changes. The flow released through the control cross-sections causes the main control spool to move. The stroke/control cross-section of the main control spool is controlled proportionately to the setpoint. If the input setpoint is 0 V, the electronics move the main stage control spool to mid position. The control oil is conveyed to the pilot valve either internally via port P or externally via port X. The oil returns to the tank internally via port T or externally via port Y.

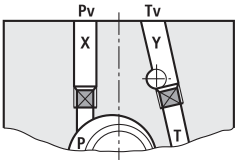
Power failure

In the event of a power failure or an open circuit, the on-board electronics cut off the electricity to the control solenoid and the pilot spool moves to the fail-safe position, relieving the control oil chambers of the main stage. The main stage control spool is held by springs in mid position.

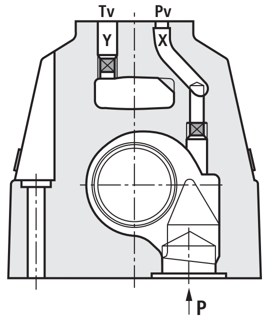
Control oil supply

The pilot valve can be supplied both via ports X and Y (externally) and via the main flow channels P and T.

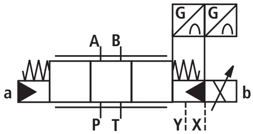
NG10, 25, 27, 35



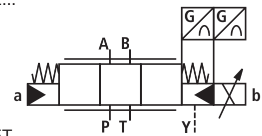
NG16



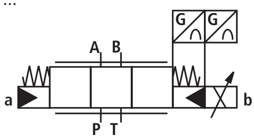
Type...–3X...



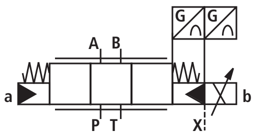
Type...–3X...E...



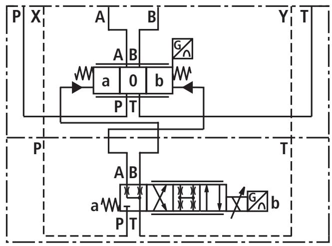
Type...–3X...ET...



Type...–3X...T...



Symbol in detail
(external control oil inlet and outlet)



Main valve

Pilot valve

No designation =	"x" = external	"y" = external
E =	"x" = internal	"y" = external
ET =	"x" = internal	"y" = internal
T =	"x" = external	"y" = internal

Important

Hydraulic symbols are largely derived from the symbols of the switching valves. 4/3-way servo solenoid directional control valves (pilot operated) do not have a closed mid position when switched off! They only perform their function in an active, closed control loop, even if the pilot valve features a fail-safe 4th position. See technical data for details on "switch-off behavior".

Technical data

General

Construction		Spool type valve, pilot operated				
Actuation		Servo solenoid directional control valve NG6, with position controller for pilot valve and main stage, external electric amplifier				
Type of mounting		Subplate, mounting hole configuration NG10...35 to ISO 4401-...				
Installation position		Optional				
Ambient temperature range	°C	–20...+50				
Weight	kg	**NG10** 8.35	**NG16** 10	**NG25** 18	**NG27** 18	**NG35** 80
Vibration resistance, test condition		Max. 25 *g*, shaken in 3 dimensions (24 h)				

Hydraulic (measured with HLP 46, ϑ_{oil} = 40 °C ±5 °C)

Pressure fluid			Hydraulic oil to DIN 51524...535, other fluids after prior consultation				
Viscosity range	recommended	mm²/s	20...100				
	max. permitted	mm²/s	10...800				
Pressure fluid temperature range		°C	–20...+80				
Maximum permissible degree of contamination of pressure fluid Purity class to ISO 4406 (c)			Class 18/16/13 [1]				
Flow direction			See symbol				
			NG10	**NG16**	**NG25**	**NG27**	**NG35**
Nominal flow at Δp = 5 bar per notch [2]		l/min	55 70 85	100 120 150 200	300 370	430	1000
Max. working pressure	Ports P, A, B External control oil inlet	bar	350	350	350	280	350
	Ports P, A, B Internal control oil inlet	bar	250				
	Ports T, X, Y	bar	250				
Min. control oil pressure in “pilot stage”		bar	10				
Q_{max}		l/min	170	450	900	1000	3500
Q_N pilot valve		l/min	4	12	24	24	40
Leakage of pilot valve at 100 bar		cm³/min	< 180	< 300	< 500	< 500	< 900
Leakage of main stage at 100 bar		cm³/min	< 400 < 600	< 1000	< 1000	< 1000	< 6000

Static/Dynamic

Hysteresis		%	< 0.1, scarcely measurable				
Manufacturing tolerance for Q_{max}		%	≦ 10				
Response time for signal change (at X = 100 bar)	0...100 %		25	40	45	45	130
	0...10 %		15	18	20	20	60
Response time for signal change (at X = 10 bar)	0...100 %		85	90	150	150	500
	0...10 %		50	40	80	80	200
Switch-off behavior			After electrical switch-off: pilot valve in fail-safe Main stage moves to spring-centered “mid position”: 1…6 % P-B/A-T				
Thermal drift			Zero point displacement < 1 % at ΔT = 40 °C				
Zero adjustment			Adjustable ±5 % via valve amplifier				

[1] The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of components. For a selection of filters, see Technical Data Sheets RE 50070, RE 50076 and RE 50081.

[2] Flow rate at a different Δp $\quad Q_x = Q_{nom} \cdot \sqrt{\frac{\Delta p_x}{5}}$

Technical data

Electrical			
Cyclic duration factor	%	100 ED	
Power supply		24 V DC_{nom} (external electric amplifier)	
Degree of protection		IP 65 to DIN 40050	
Solenoid connector		Connector DIN 43560/ISO 4400 M16x1.5 (2P+PE)	
Position transducer connector		Connector Pg7 (4P)	
Max. solenoid current	A	2.7	
Coil resistance R_{20}	Ω	2.5	
Max. power consumption at 100 % load and operating temperature	VA	40	
Position transducer DC/DC technology		Supply: +15 V/35 mA –15 V/25 mA	Signal: 0...±10 V (R_L ≧ 10 kΩ)

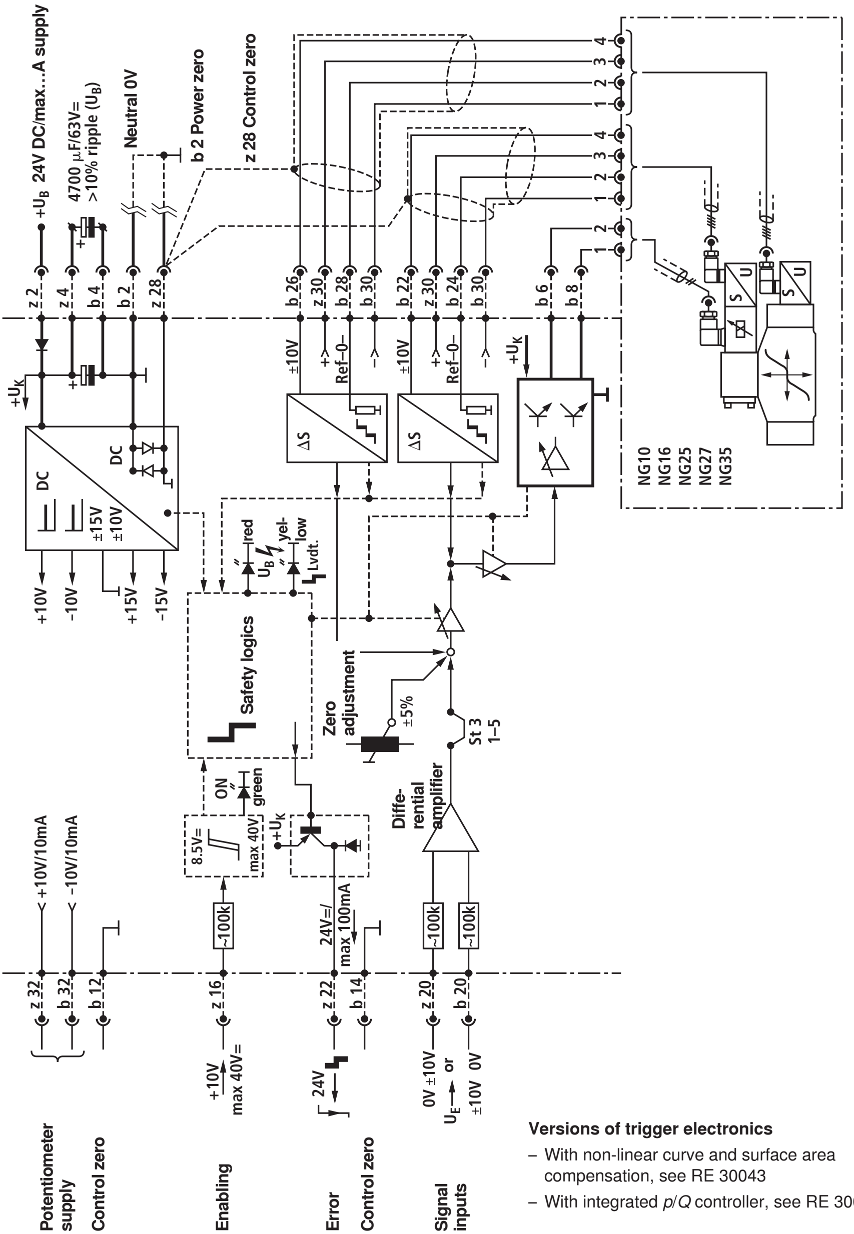
All characteristics only in connection with valve amplifier 0 811 405 063

Important

Pilot operated 4/3-way servo solenoid directional control valves only perform their function in an active closed control loop and do not have a fail-safe position when switched off. For this reason, many applications require the use of “external check valves”, which must be taken into account during the On/Off switching sequence.

Valve with external trigger electronics (standard linear curve: M, L)

Block diagram/pin assignment

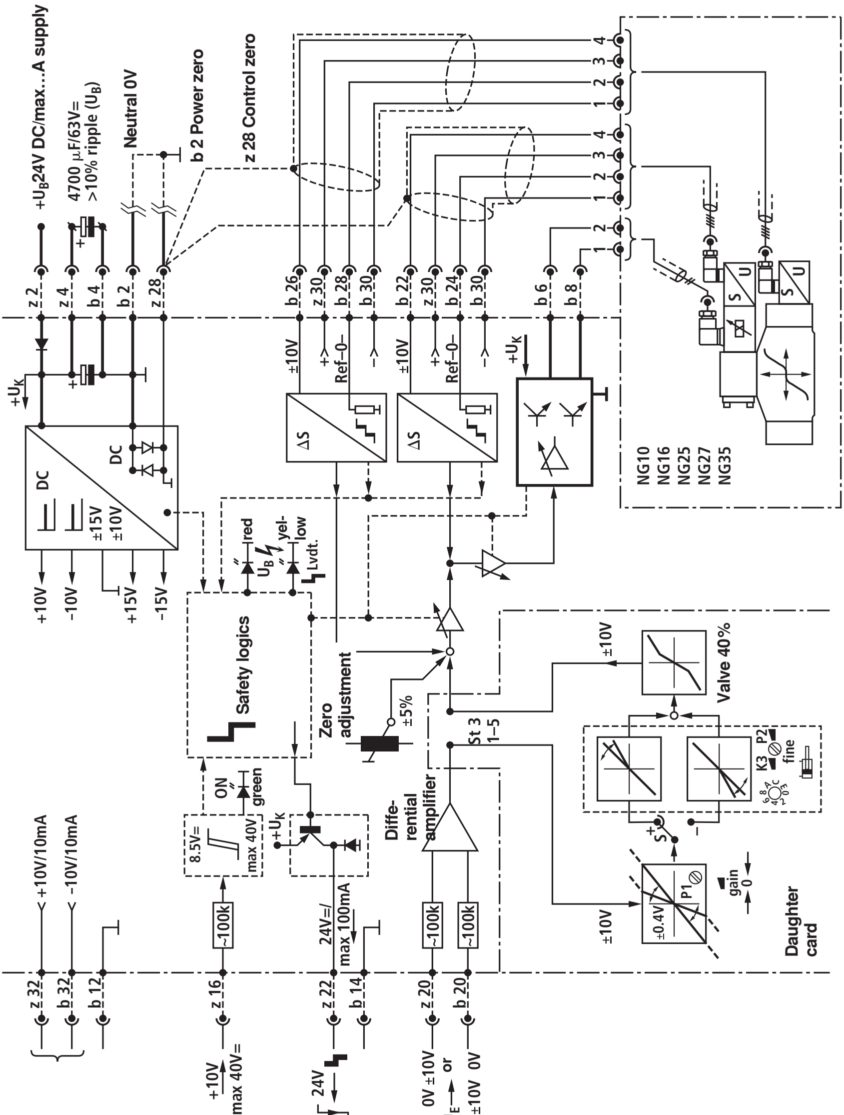


Versions of trigger electronics

- With non-linear curve and surface area compensation, see RE 30043
- With integrated *p*/*Q* controller, see RE 30058

Valve with external trigger electronics (non-linear curve: P)

Block diagram/pin assignment



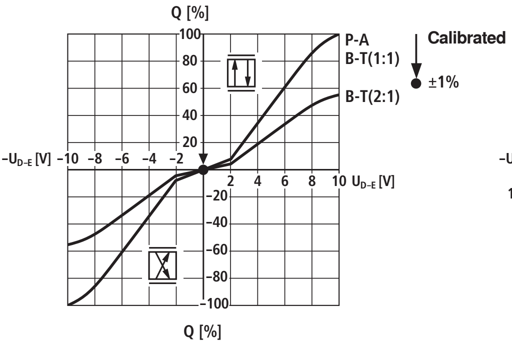
Versions of trigger electronics

- With standard linear curve, see RE 30045
- With integrated *p/Q* controller, see RE 30058

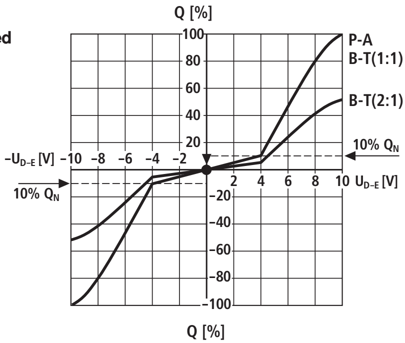
Characteristic curves (measured with HLP 46, ϑ_{oil} = 40 °C ± 5 °C)

Flow rate – signal function ***Q*** **= f (*U*$_E$)**

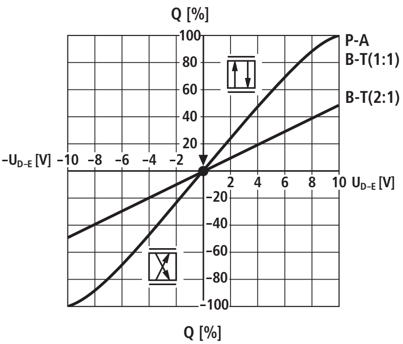
Flow characteristic M



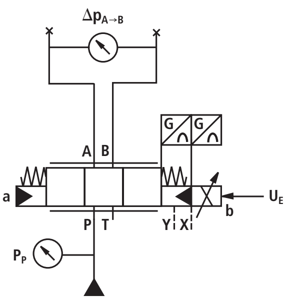
Flow characteristic P

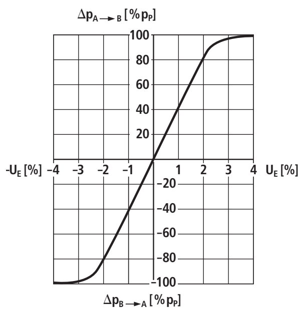


Flow characteristic L



Pressure gain

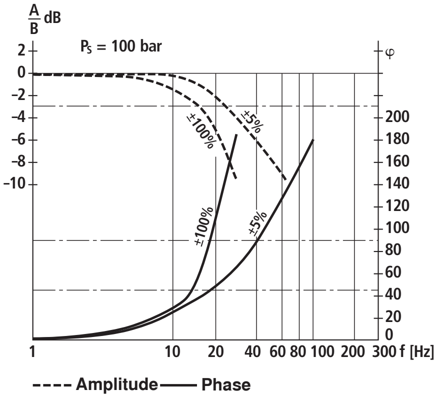




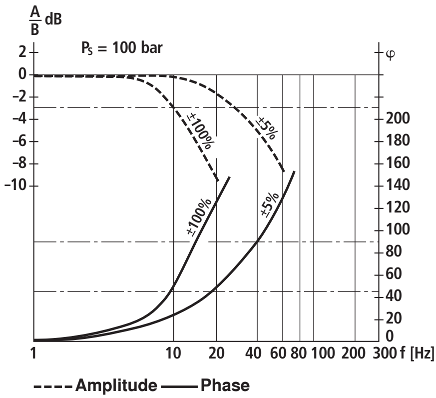
Characteristic curves (measured with HLP 46, ϑ_{oil} = 40 °C ± 5 °C)

Bode diagram

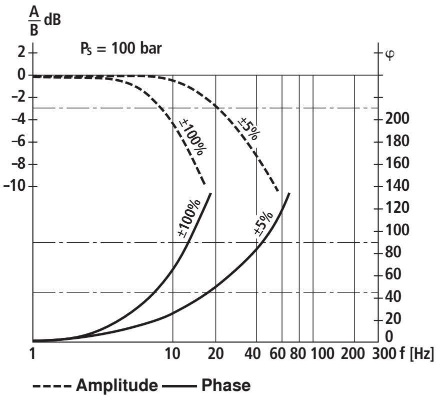
NG10



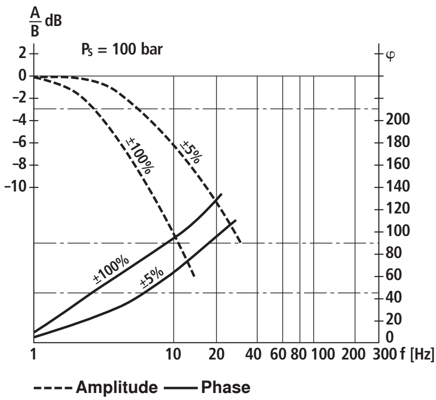
NG16



NG25/27

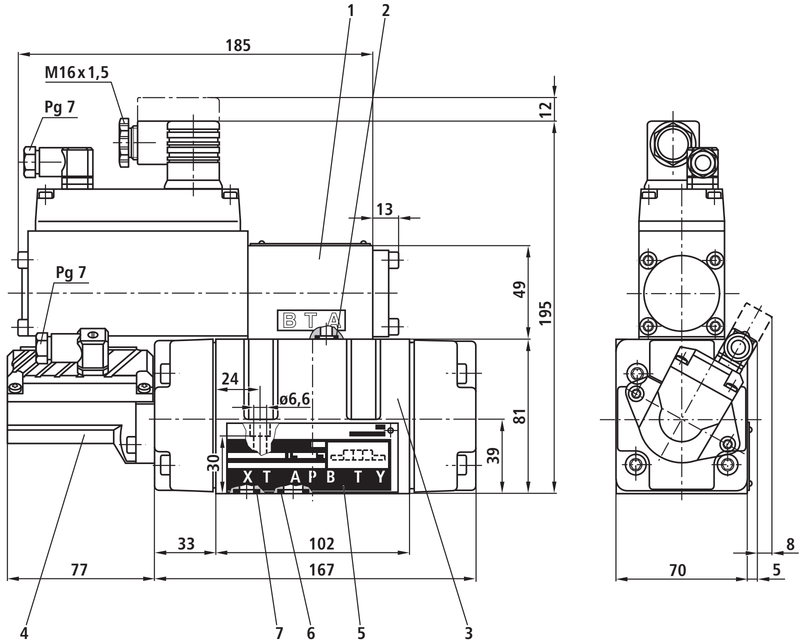


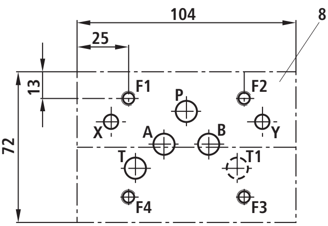
NG35

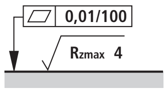


5

Unit dimensions NG10 (nominal dimensions in mm)







Required surface quality
of mating component

1 Pilot valve
2 O-ring 9.25 x 1.78 (ports P, A, B, T)
3 Main valve
4 Inductive position transducer (main valve)
5 Nameplate
6 O-ring 12 x 2 (ports P, A, B, T, T1)
7 O-ring 10 x 2 (ports X, Y)

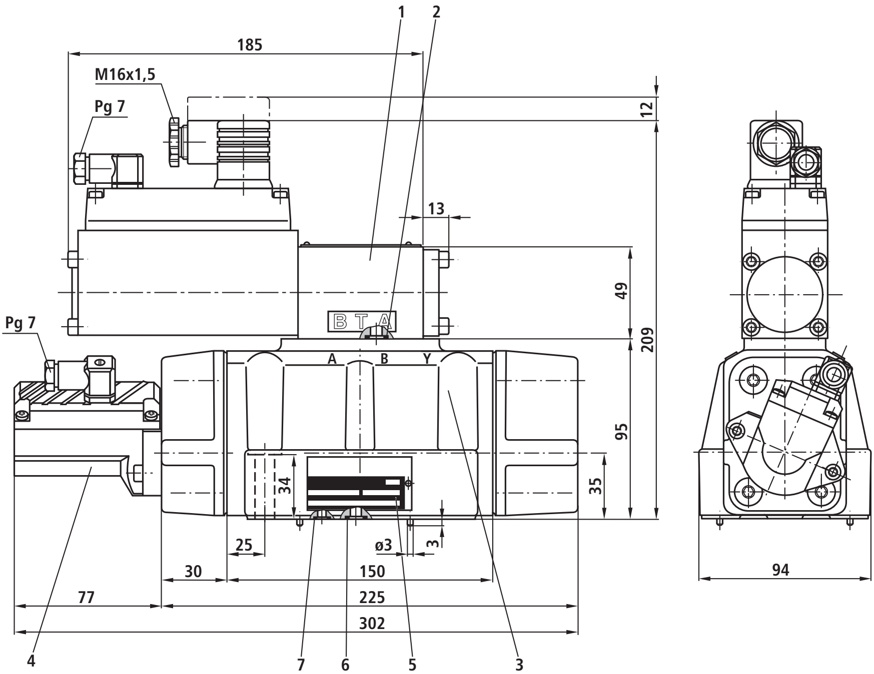
8 Machined valve contact surface, mounting hole configuration according to ISO 4401-05-05-0-05
Deviates from standard:
Ports P, A, B, T, T1 Ø 10.5 mm
Minimum thread depth: Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

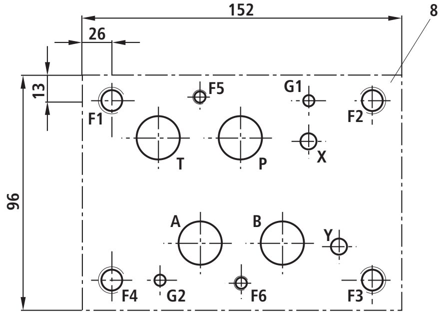
Subplates, see Technical Data Sheet RE 45055

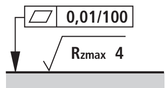
Valve fastening bolts (order separately)
The following valve fastening bolts are recommended:

4 cheese-head bolts ISO 4762-M6x40-10.9-N67F821 70
(galvanized in accordance with Bosch standard N67F821 70)
Tightening torque M_A = 11+3 Nm
Material no. **2910151209**

Unit dimensions NG16 (nominal dimensions in mm)







Required surface quality
of mating component

8 Machined valve contact surface, mounting hole configuration according to ISO 4401-07-07-0-05
Deviates from standard:
Ports P, A, B, T Ø 20 mm
Minimum thread depth: Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

Subplates, see Technical Data Sheet RE 45057

Valve fastening bolts (order separately)
The following valve fastening bolts are recommended:

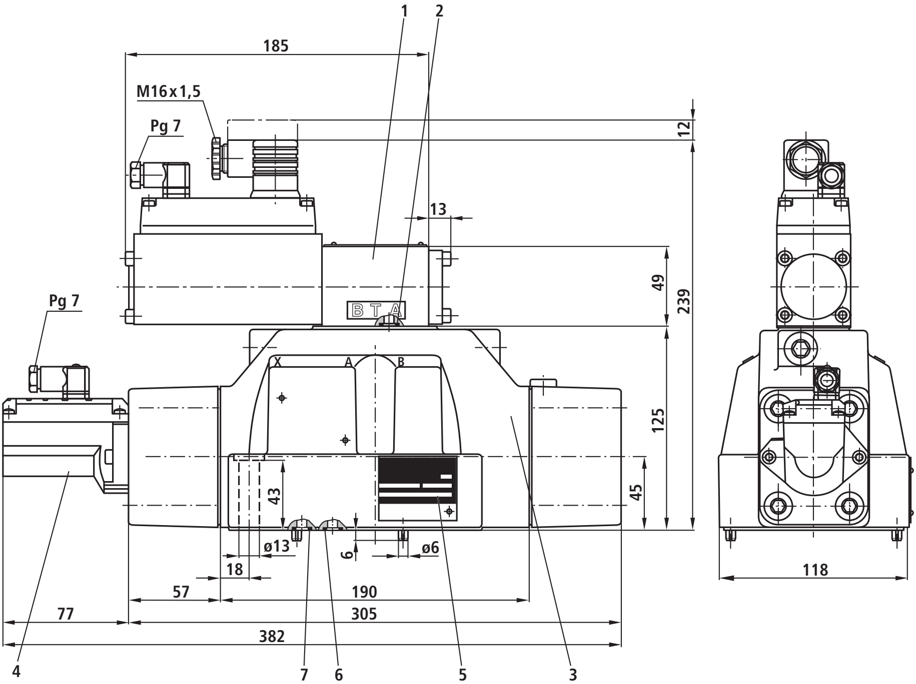
2 cheese-head bolts ISO 4762-M6x45-10.9-N67F821 70
(galvanized in accordance with Bosch standard N67F821 70)
Tightening torque M_A = 11+3 Nm
Material no. **2910151211**

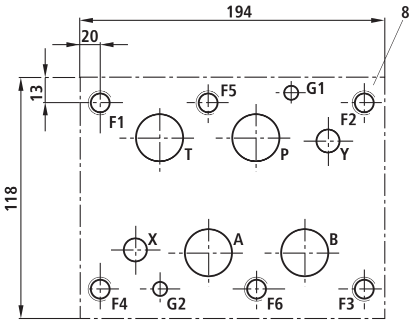
4 cheese-head bolts ISO 4762-M10x50-10.9-N67F821 70
(galvanized in accordance with Bosch standard N67F821 70)
Tightening torque M_A = 50+10 Nm
Material no. **2910151301**

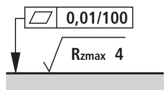
1 Pilot valve
2 O-ring 9.25 x 1.78 (ports P, A, B, T)
3 Main valve
4 Inductive position transducer (main valve)
5 Nameplate
6 O-ring 23 x 2.5 (ports P, A, B, T)
7 O-ring 9 x 2 (ports X, Y)

5

Unit dimensions NG25/27 (nominal dimensions in mm)







Required surface quality
of mating component

1 Pilot valve

2 O-ring 9.25 x 1.78 (ports P, A, B, T)

3 Main valve

4 Inductive position transducer (main valve)

5 Nameplate

6 O-ring (ports P, A, B, T)
NG25: 28 x 3
NG27: 34.6 x 2.62

7 O-ring 15 x 2.5 (ports X, Y)

8 Machined valve contact surface, mounting hole configuration according to ISO 4401-08-08-0-05
Deviates from standard:
NG25: Ports P, A, B, T Ø 25 mm
NG27: Ports P, A, B, T Ø 32 mm
Minimum thread depth: Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

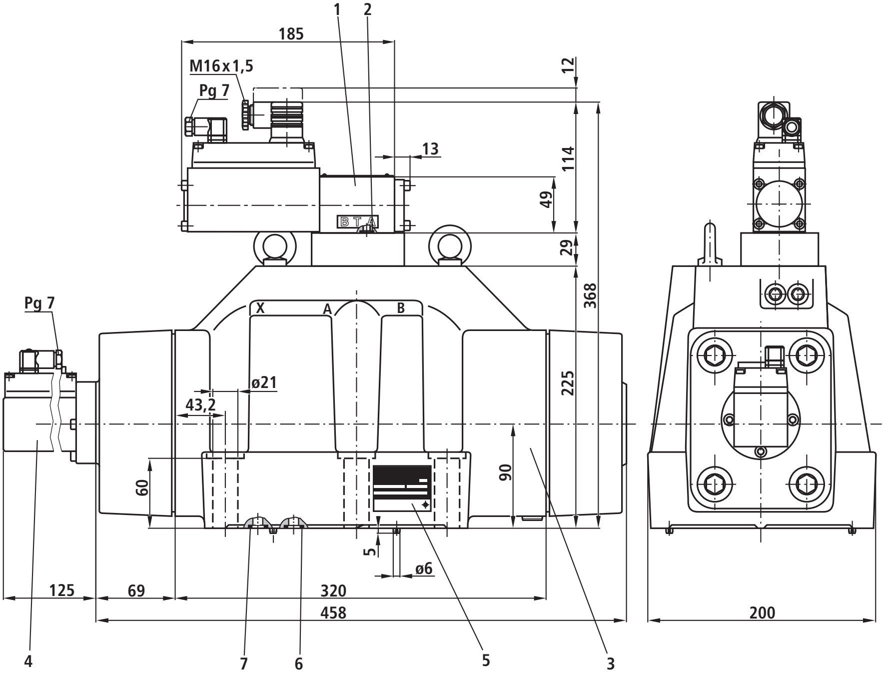
Subplates, see Technical Data Sheet RE 45059

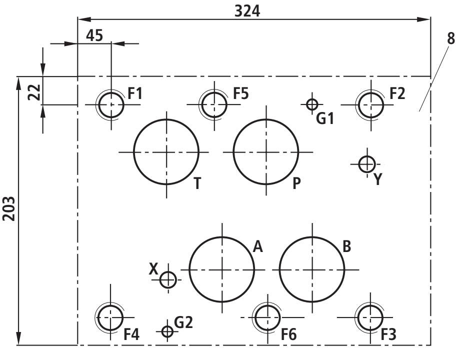
Valve fastening bolts (order separately)
The following valve fastening bolts are recommended:

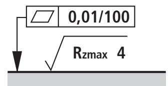
6 cheese-head bolts ISO 4762-M12x60-10.9-N67F821 70
(galvanized in accordance with Bosch standard N67F821 70)
Tightening torque NG25 M_A = 90+30 Nm,
NG27 M_A = 90±15 Nm

Material no. **2910151354**

Unit dimensions NG35 (nominal dimensions in mm)







Required surface quality of mating component

5

1 Pilot valve
2 O-ring 9.25 x 1.78 (ports P, A, B, T)
3 Main valve
4 Inductive position transducer (main valve)
5 Nameplate
6 O-ring 53.57 x 3.53 (ports P, A, B, T)
7 O-ring 15 x 2.5 (ports X, Y)

8 Machined valve contact surface, mounting hole configuration according to ISO 4401-10-09-0-05
Deviates from standard:
Ports P, A, B, T Ø 48 mm
Minimum thread depth: Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

Subplates, see Technical Data Sheet RE 45060

Valve fastening bolts (order separately)
The following valve fastening bolts are recommended:

6 cheese-head bolts ISO 4762-M20x90-10.9-N67F821 70
(galvanized in accordance with Bosch standard N67F821 70)
Tightening torque M_A = 450+110 Nm
Material no. **2910151532**

Notes

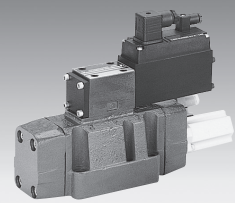
Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Telefon +49 (0) 93 52 / 18-0
Telefax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

Rexroth
Bosch Group

4/3-way servo solenoid directional control valves, pilot operated, with electrical position feedback (Lvdt DC/DC ±10V)

RE 29087/01.09
Replaces: 01.05

Type 4WRL 10...35, symbols E./W.



Sizes (NG) 10, 16, 25, 27, 35
Unit series 3X
Maximum working pressure P, A, B 350 bar (NG27: 280 bar)
Nominal flow rate 80...1100 l/min (Δp = 10 bar)

List of contents

For information regarding the available spare parts see:
www.boschrexroth.com/spc

Features

- Pilot operated 4/3-way servo solenoid directional control valves NG10 to NG35, with approx. 20 % overlap
- Pilot valve NG6, with control piston and sleeve in servo quality, actuated on one side, 4/4 fail-safe position when switched off
- Control solenoid with electrical position feedback and electronics for position transducer (Lvdt DC/DC)
- Main stage with position feedback
- Spool with linear travel, with anti-rotation element
- Flow characteristic
  • S = Progressive
  • NG16, 25 and 27 with load tap C1/C2
- For subplate attachment, mounting hole configuration NG10 to ISO 4401-05-05-0-05, NG16 to ISO 4401-07-07-0-05, NG25/27 to ISO 4401-08-08-0-05 and NG35 to ISO 4401-10-09-0-05
- Subplates as per Technical Data Sheet, NG10 RE 45055, NG16 RE 45057, NG25/27 RE 45059 and NG35 RE 45060 (order separately)
- Plug-in connectors to DIN 43560-AM2
  Solenoid 2P+PE/M16 x 1.5, position transducer 4P/Pg7 included in delivery, see Technical Data Sheet RE 08008
- External trigger electronics (order separately)
  • Electric amplifier for standard curve without ramps
  • Electric amplifier with ramps and dead-band compensation

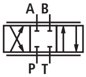
Ordering data

4WRL						S	–	3X	/	G24		Z4	/	M	*

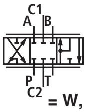
For **external** trigger electronics **= no desig.**

NG10	**= 10**
NG16	**= 16**
NG25	**= 25**
NG27 [1]	**= 27**
NG35 [2]	**= 35**

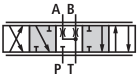
Control spool symbols **= E, E1**

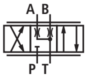


= E (Z), E1 (Z)

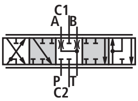


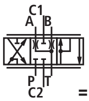
= W, W1



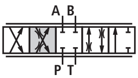


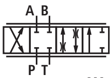
= W (Z), W1 (Z)



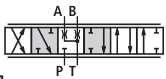


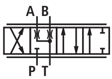
= E4





= W4





Transitional symbols

With symbol
E1, E1(Z), E4, W1, W1(Z), W4:
P → A: q_V B → T: $q_V/2$
P → B: $q_V/2$ A → T: q_V

With load tap C1/C2 (NG16, 25, 27) **= Z**

Nominal flow rate at 10 bar valve pressure difference (5 bar per metering notch)

	NG10
80 =	80 l/min
	NG16
110 =	110 l/min
180 =	180 l/min
	NG25
350 =	350 l/min
	NG27
430 =	430 l/min [1]
	NG35
1100 =	1100 l/min [2]

S = **Flow characteristic** Progressive

3X = Unit series 30 to 39 (installation and connection dimensions unchanged)

G24 = **Power supply of trigger electronics** +24 V DC

Control oil inlet "x" control oil return "y"

No desig. =	"x" = external, "y" = external
E =	"x" = internal, "y" = external
ET =	"x" = internal, "y" = internal
T =	"x" = external, "y" = internal

Z4 = **Electrical connection with** plug-in connector, with plug to DIN 43560-AM2
Plug-in connector included in delivery

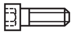
M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

***** Further information in plain text

[1] NG27 is a high-flow version of NG25, ports P, A, B and T have ∅ 32 mm in the main stage. Contrary to standard ISO 4401-08-08-0-05, ports P, A, B and T may be drilled to max. ∅30 mm in the control block. These valves therefore offer higher flow rates $Q_A : Q_B$

[2] NG35 is a high-flow version of NG32, ports P, A, B and T have ∅ 50 mm in the main stage. Contrary to standard ISO 4401-10-09-0-05, ports P, A, B and T may be drilled to max. ∅48 mm in the control block. These valves therefore offer higher flow rates $Q_A : Q_B$

Accessories, not included in delivery

Fastening bolts 	NG10	4 x ISO 4762-M6 x 40-10.9-N67F821 70	**2 910 151 209**
	NG16	2 x ISO 4762-M6 x 45-10.9-N67F821 70	**2 910 151 211**
		4 x ISO 4762-M10 x 50-10.9-N67F821 70	**2 910 151 301**
	NG25/27	6 x ISO 4762-M12 x 60-10.9-N67F821 70	**2 910 151 354**
	NG35	6 x ISO 4762-M20 x 90-10.9-N67F821 70	**2 910 151 532**
	VT-VRRA1-527-20/V0/2STV, see RE 30045		**0 811 405 063**
	VT-VRRA1-527-20/V0/RTS-2STV, see RE 30044		**0 811 405 073**
 2P+PE 4P	2P+PE (M16 x 1.5) and 4P (Pg7) included in delivery, also see RE 08008		

Testing and service equipment

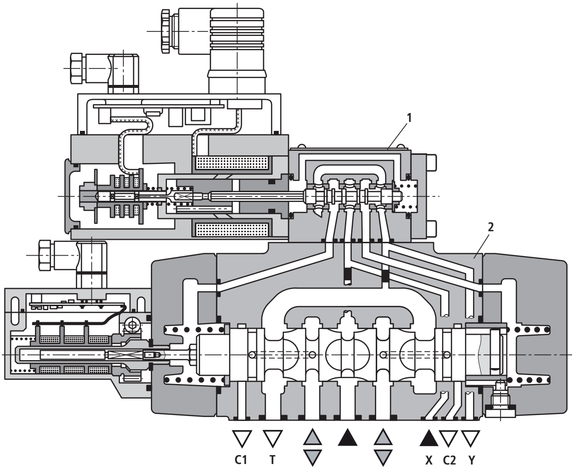
– Test box type VT-PE-TB2, see RE 30064

– Test adapter type VT-PA-3, see RE 30070

Function, sectional diagram

Construction

The valve consists of two main assemblies:
- Pilot valve (1) with control spool and sleeve, return springs, control solenoid and inductive position transducer
- Main stage (2) with centering springs and position feedback



Functional description

When the control solenoid is not actuated, the control spool is held by springs in the fail-safe position, and the main stage spool remains in spring-centered mid position.
In the on-board electronics, the pre-defined setpoint is compared with the actual value for the position of the main stage control spool. In the event of an error signal, the control solenoid is actuated, and the pilot spool is moved as the magnetic force changes. The flow released through the control cross-sections causes the main control spool to move. If the input setpoint is 0 V, the main stage control spool is spring-centered in overlapped mid position. The control oil is conveyed to the pilot valve either internally via port P or externally via port X. The oil returns to the tank internally via port T or externally via port Y.

Power failure

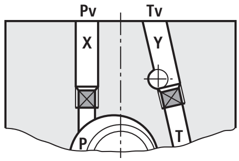
In the event of a power failure or an open circuit, the on-board electronics cut off the electricity to the control solenoid and the pilot spool moves to the fail-safe position, relieving the control oil chambers of the main stage. The main stage control spool is spring-centered in mid position.

5

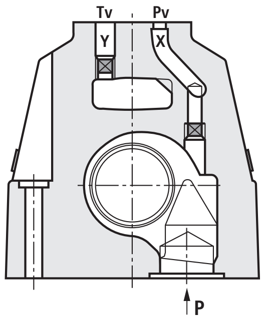
Control oil supply

The pilot valve can be supplied both via ports X and Y (externally) and via the main flow channels P and T.

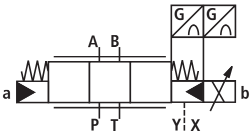
NG10, 25, 27, 35



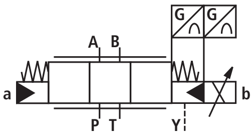
NG16



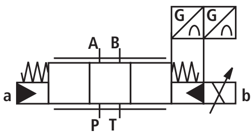
Type...–3X...



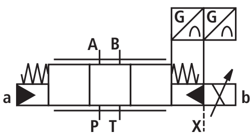
Type...–3X...E...



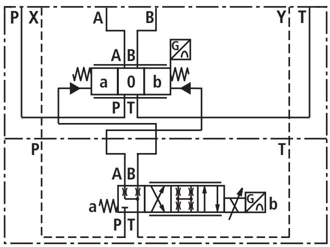
Type...–3X...ET...



Type...–3X...T...



Symbol in detail
(external control oil inlet and outlet)



Main valve

Pilot valve

No designation =	“x” = external	“y” = external
E =	“x” = internal	“y” = external
ET =	“x” = internal	“y” = internal
T =	“x” = external	“y” = internal

Technical data

General

Construction		Spool type valve, pilot operated				
Actuation		Servo solenoid directional control valve NG6, with position controller for pilot valve and main stage, external electric amplifier				
Type of mounting		Subplate, mounting hole configuration NG10...35 to ISO 4401-...				
Installation position		Optional				
Ambient temperature range	°C	–20...+50				
Weight	kg	**NG10** 8.35	**NG16** 10	**NG25** 18	**NG27** 18	**NG35** 80
Vibration resistance, test condition		Max. 25 *g*, shaken in 3 dimensions (24 h)				

Hydraulic (measured with HLP 46, ϑ_{oil} = 40 °C ±5 °C)

Pressure fluid		Hydraulic oil to DIN 51524...535, other fluids after prior consultation				
Viscosity range recommended	mm^2/s	20...100				
Viscosity range max. permitted	mm^2/s	10...800				
Pressure fluid temperature range	°C	–20...+80				
Maximum permissible degree of contamination of pressure fluid Purity class to ISO 4406 (c)		Class 18/16/13 [1]				
Flow direction		See symbol				
Nominal flow at		**NG10**	**NG16**	**NG25**	**NG27**	**NG35**
Δp = 5 bar per notch [2]	l/min	80	180	350	430	1100
Max. working pressure: Ports P, A, B (external control oil inlet)	bar	350	350	350	280	350
Max. working pressure: Ports P, A, B, X	bar	280				
Max. working pressure: Ports T, Y	bar	250				
Min. control oil pressure in “pilot stage”	bar	8				
Q_{max}	l/min	170	450	900	1000	3000
Q_N pilot valve (inlet) Δp = 35 bar	l/min	2	4	12	12	40
Leakage of pilot valve at X = 100 bar	cm^3/min	<150	<180	<350	<500	<1100
Leakage of main stage control spool symbols “E” at P = 100 bar	l/min	<0.25	<0.4	<0.6	<0.6	<1.1

Static/Dynamic

Overlap in mid position		≈ 18...22 % of spool stroke, electrically adjustable for $U_{D–E}$ ±0.5 V with 0 811 404 073				
Spool stroke, main stage	± mm	4	7	10	10	12.5
Control oil volume of main stage 100 %	cm^3	1.1	4.3	11.3	11.3	41.5
Control oil requirement 0...100 %, (at X = 100 bar)	l/min	2.2	4.7	11.7	11.7	15.6
Hysteresis	%	<0.1 scarcely measurable				
Manufacturing tolerance		See flow curves, adjustable with 0 811 404 073				
Response time for 0...100 %, (at X = 100 bar)	ms	<40	<80	<80	<80	<130
Response time for 0...100 %, (at X = 10 bar)	ms	<150	<250	<250	<250	<500
Switch-off behavior		After electrical switch-off (pilot valve in fail-safe) Main stage moves to spring-centered overlapped mid position				
Thermal drift		<1 % at ΔT = 40 °C				

1) The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of components. For a selection of filters, see Technical Data Sheets RE 50070, RE 50076 and RE 50081.

2) Flow rate at a different Δp $Q_x = Q_{nom} \cdot \sqrt{\frac{\Delta p_x}{5}}$

5

Technical data

Electrical			
Cyclic duration factor	%	100 ED	
Power supply		24 V DC_{nom} (external electric amplifier)	
Degree of protection		IP 65 to DIN 40050	
Solenoid connector		Connector DIN 43560/ISO 4400 M16 x 1.5 (2P+PE)	
Position transducer connector		Connector Pg7 (4P)	
Max. solenoid current	A	2.7	
Coil resistance R_{20}	Ω	2.5	
Max. power consumption at 100% load and operating temperature	VA	40	
Position transducer DC/DC technology		Supply: +15 V/35 mA –15 V/25 mA	Signal: 0...±10 V (R_L ≧10 kΩ)

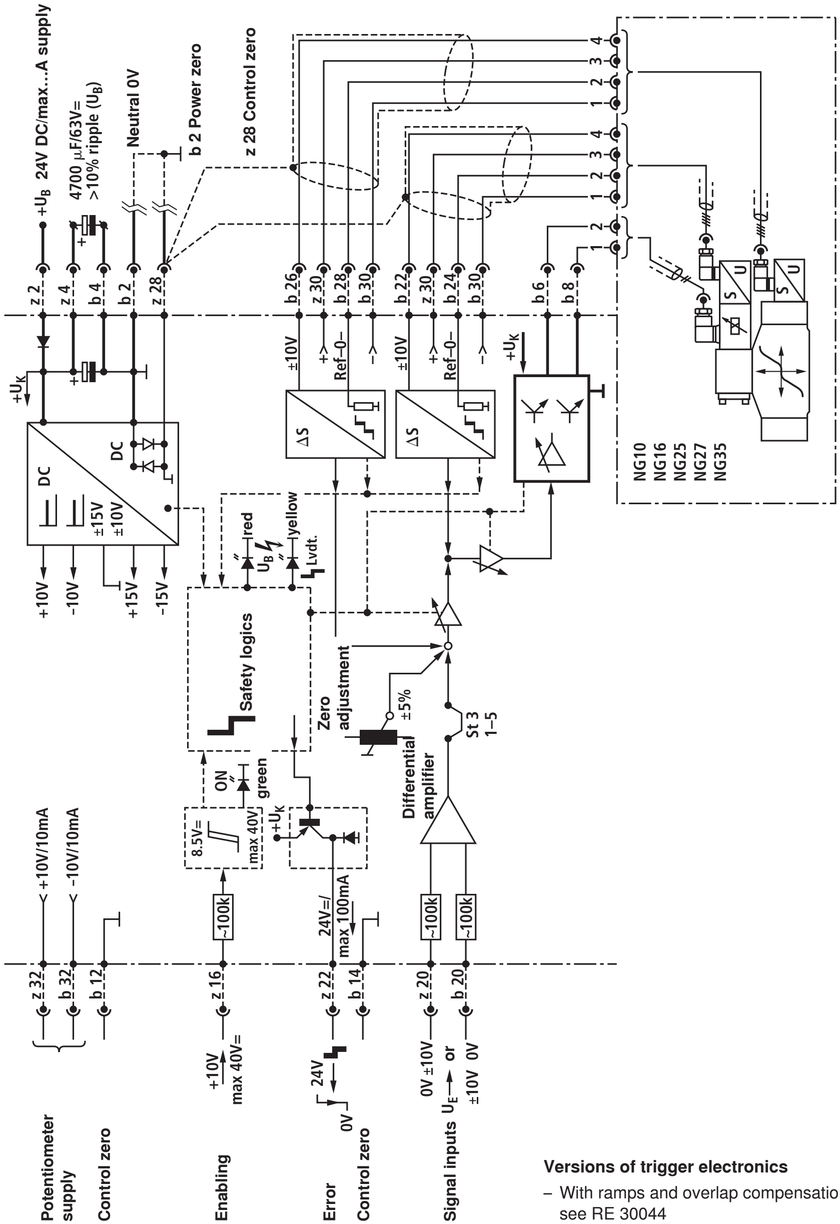
All characteristics only in connection with valve amplifier 0 811 405 063

Important

Pilot operated 4/3-way servo solenoid directional control valves with positive overlap function in open or closed-loop-controlled axes and have approx. 20% overlap when switched off. This condition does not constitute an active fail-safe position.
For this reason, many applications require the use of “external check valves”, which must be taken into account during the On/Off switching sequence.

Valve with external trigger electronics (standard: without ramps, overlap compensation)

Block diagram/pin assignment

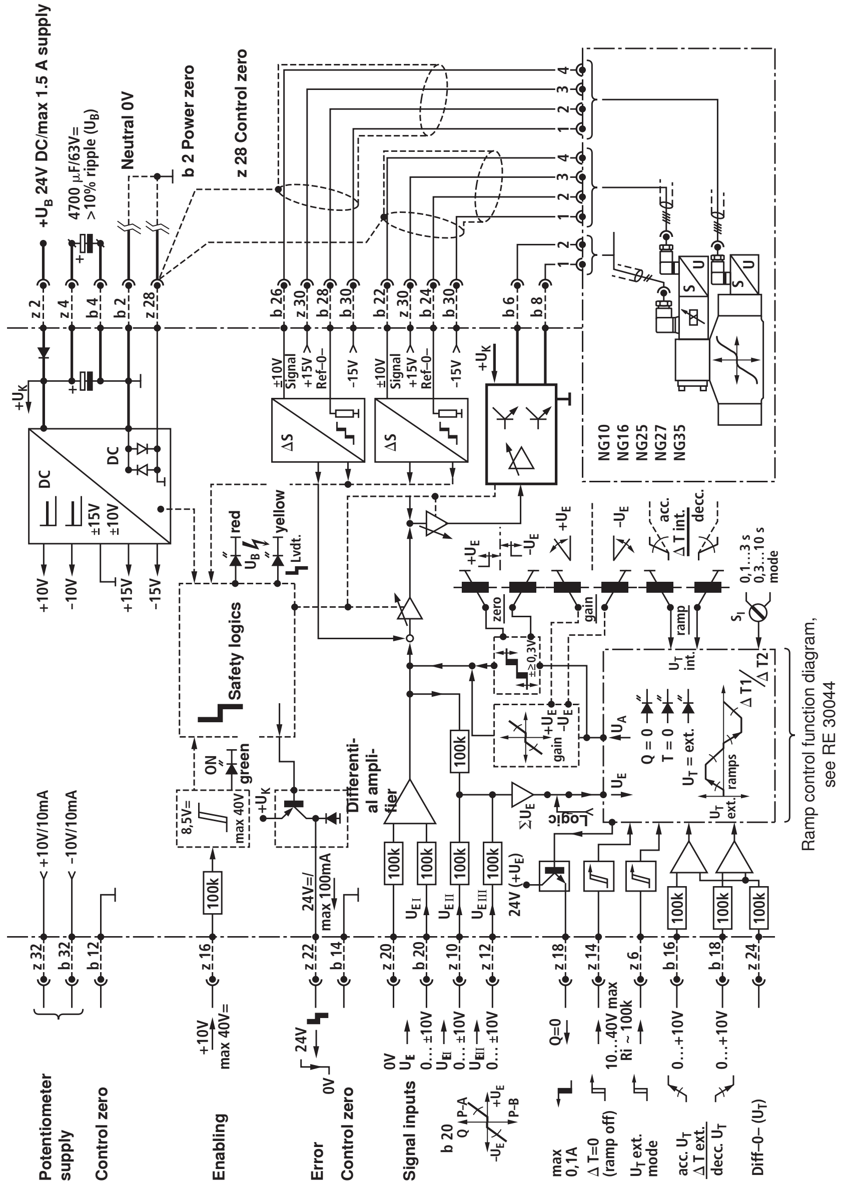


Versions of trigger electronics

– With ramps and overlap compensation, see RE 30044

Valve with external trigger electronics (standard: with ramps, overlap compensation)

Block diagram/pin assignment



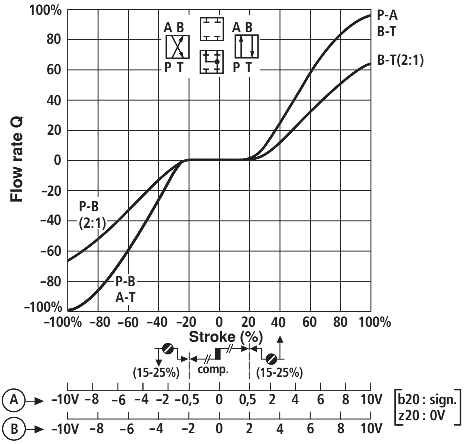
Versions of trigger electronics

– With standard linear curve,
  see RE 30045

Characteristic curves (measured with HLP 46, ϑ_{oil} = 40 °C ±5 °C)

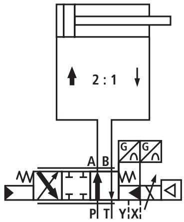
Flow rate – signal function
Q = f (U_E)

Symbol E(Z), W(Z) ($Q_A : Q_B$ = 1 : 1)
E1(Z), W1(Z) ($Q_A : Q_B$ = 2 : 1)



Control spool with asymmetric metering notches

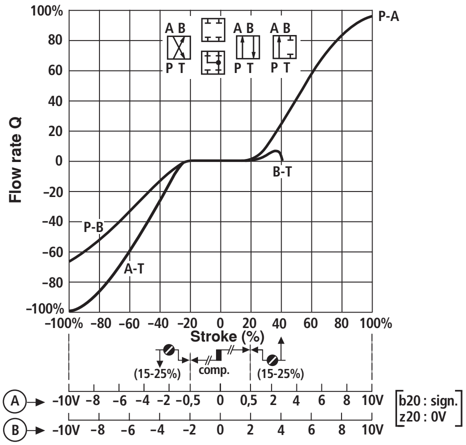
Control spools with asymmetric metering notches are available in a ratio of 2:1 for the purpose of adaptation to differential cylinders.



Flow in mid position, "leakage oil pressure relief"

With symbol "E", leakage oil in the two work chambers A and B of the control piston gives rise to a build-up of pressure in A or B, which then causes a connecting cylinder to drift out of position.
In many cases, the "W" symbol is a better solution. With a setpoint of "0", the control piston moves into the overlapped mid position. In this mid position, pressure is then relieved from ports A and B with 1% +0.5% Q_N to T. This also supports the function of external check valves.

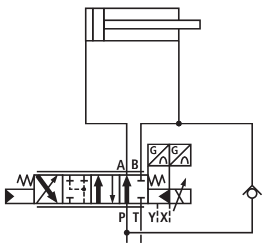
Symbol E4, W4 ($Q_A : Q_B$ = 2 : 1)



Control spools in a differential circuit

In order to produce differential circuits, valve spools with a 4th position are available. It is sufficient to install a non-return valve in the consumer lines.

In addition, a control spool (symbol) with internal B-P connection is employed for certain branch-oriented solutions. However, we recommend that you consult the BRH Application Center with regard to these special symbols, as a simulation or knowledge of this type of system is usually required.



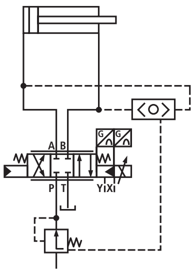
Amplifier	A with ramp	**0 811 405 073** – RE 30044
	B without ramp	**0 811 405 063** – RE 30045

Characteristic curves (measured with HLP 46, ϑ_{oil} = 40 °C ± 5 °C)

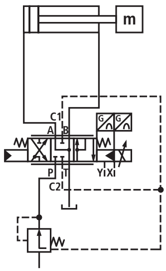
Load tap C1/C2
To compensate for fluctuations in the load or supply pressure, 4/3-way servo solenoid directional control valves are combined with pressure compensators. The load is tapped via a shuttle valve for the NG10 and 35, and via two additional ports C1 and C2 for the NG16, 25 and 27 (“4WRL” and “4WRLE” only).

The pressure compensator therefore always receives the correct pressure signal even in the event of negative load. When using pressure compensators, an external control oil supply should always be selected.

NG10, 35



NG16, 25, 27

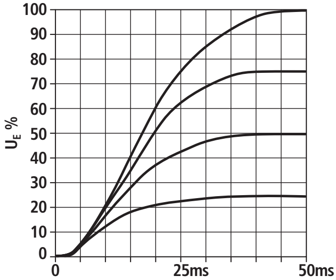


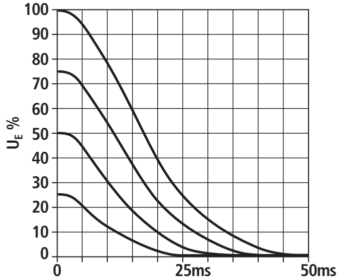
Characteristic curves (measured with HLP 46, ϑ_{oil} = 40 °C ± 5 °C)

Response time (at X = 100 bar)

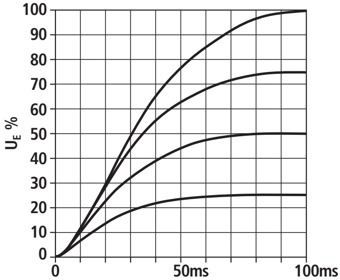
	Open	Close

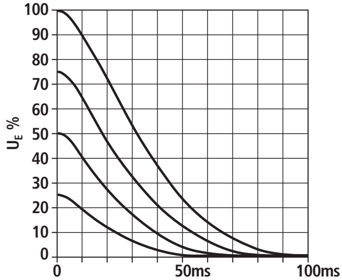
NG10



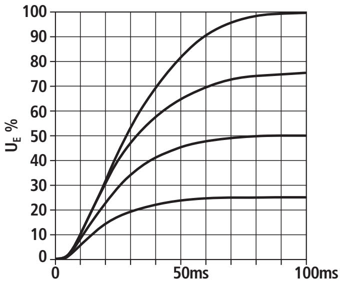


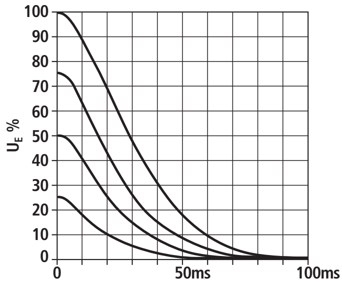
NG16



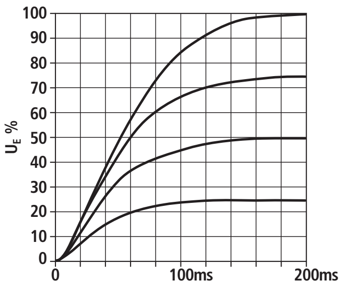


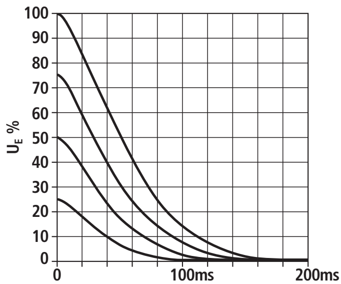
NG25/27





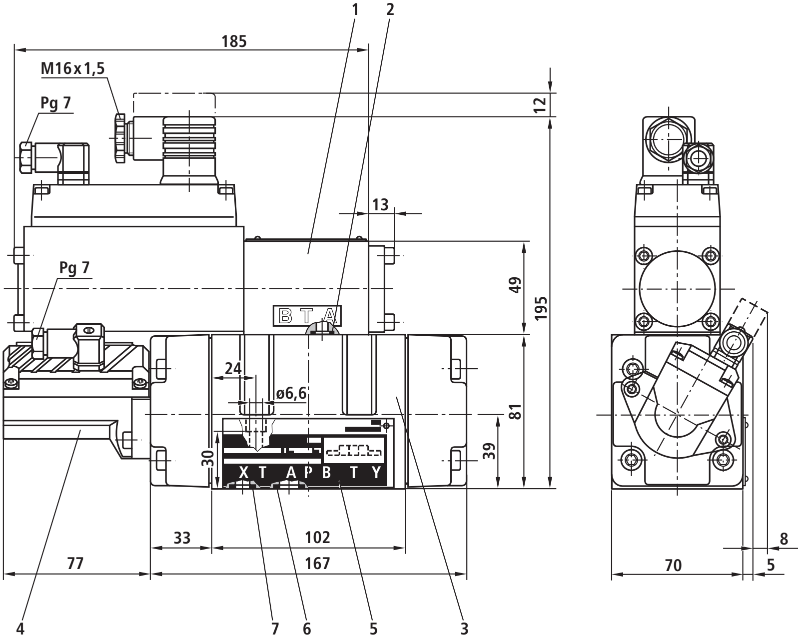
NG35

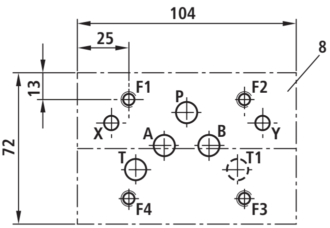


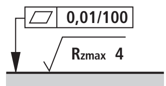


5

Unit dimensions NG10 (nominal dimensions in mm)







Required surface quality
of mating component

1 Pilot valve
2 O-ring 9.25 x 1.78 (ports P, A, B, T)
3 Main valve
4 Inductive position transducer (main valve)
5 Nameplate
6 O-ring 12 x 2 (ports P, A, B, T, T1)
7 O-ring 10 x 2 (ports X, Y)

8 Machined valve contact surface, mounting hole configuration according to ISO 4401-05-05-0-05
Deviates from standard:
Ports P, A, B, T, T1 Ø10.5 mm
Minimum thread depth: Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

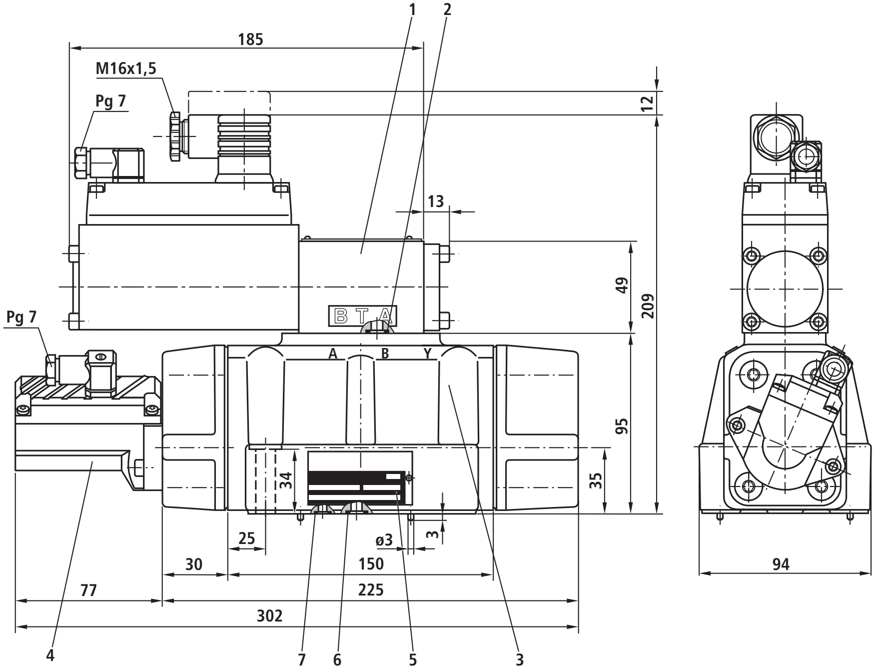
Subplates, see Technical Data Sheet RE 45055

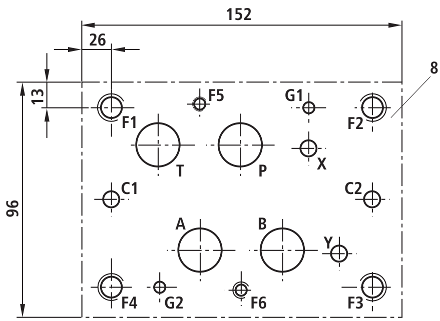
Valve fastening bolts (order separately)
The following valve fastening bolts are recommended:

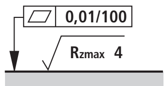
4 cheese-head bolts ISO 4762-M6x40-10.9-N67F821 70
(galvanized in accordance with Bosch standard N67F821 70)
Tightening torque M_A = 11+3 Nm

Material no. **2910151209**

Unit dimensions NG16 (nominal dimensions in mm)







Required surface quality of mating component

8 Machined valve contact surface, mounting hole configuration according to ISO 4401-07-07-0-05

Deviates from standard:
Ports P, A, B, T Ø 20 mm
Minimum thread depth: Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

Subplates, see Technical Data Sheet RE 45057

Valve fastening bolts (order separately)
The following valve fastening bolts are recommended:

2 cheese-head bolts ISO 4762-M6x45-10.9-N67F821 70
(galvanized in accordance with Bosch standard N67F821 70)
Tightening torque M_A = 11+3 Nm

Material no. **2910151211**

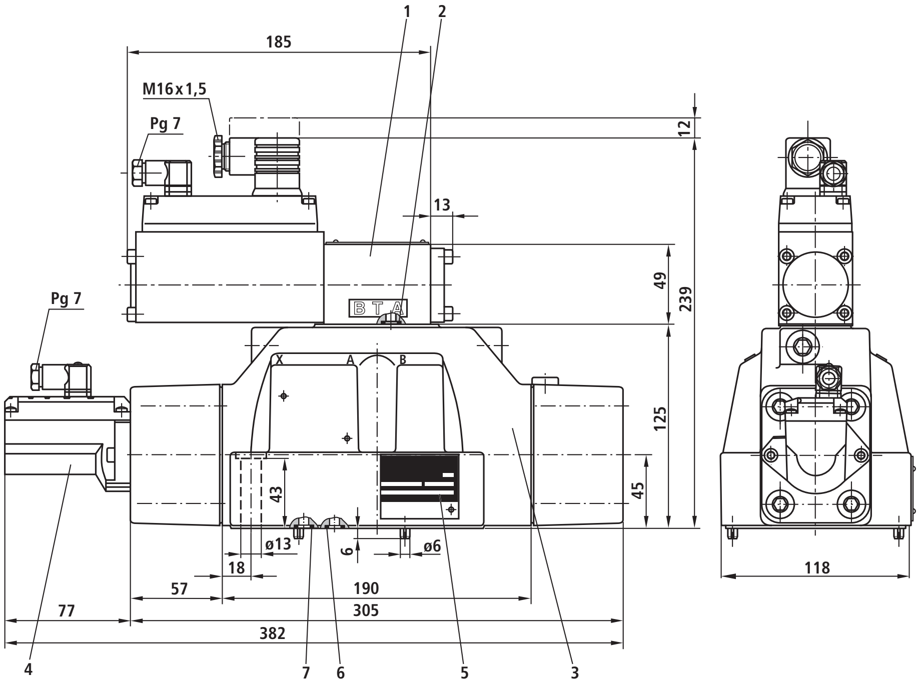
4 cheese-head bolts ISO 4762-M10x50-10.9-N67F821 70
(galvanized in accordance with Bosch standard N67F821 70)
Tightening torque M_A = 50+10 Nm

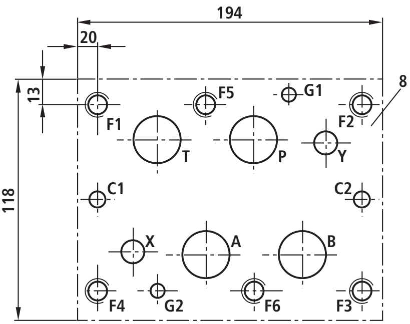
Material no. **2910151301**

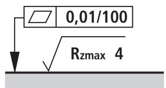
1 Pilot valve
2 O-ring 9.25 x 1.78 (ports P, A, B, T)
3 Main valve
4 Inductive position transducer (main valve)
5 Nameplate
6 O-ring 23 x 2.5 (ports P, A, B, T)
7 O-ring 9 x 2 (ports X, Y, C1, C2)

5

Unit dimensions NG25/27 (nominal dimensions in mm)







Required surface quality of mating component

1 Pilot valve

2 O-ring 9.25 x 1.78 (ports P, A, B, T)

3 Main valve

4 Inductive position transducer (main valve)

5 Nameplate

6 O-ring (ports P, A, B, T)
NG25: 28 x 3
NG27: 34.6 x 2.62

7 O-ring 15 x 2.5 (ports X, Y, C1, C2)

8 Machined valve contact surface, mounting hole configuration according to ISO 4401-08-08-0-05
Deviates from standard:
NG25: Ports P, A, B, T Ø 25 mm
NG27: Ports P, A, B, T Ø 32 mm
Minimum thread depth: Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

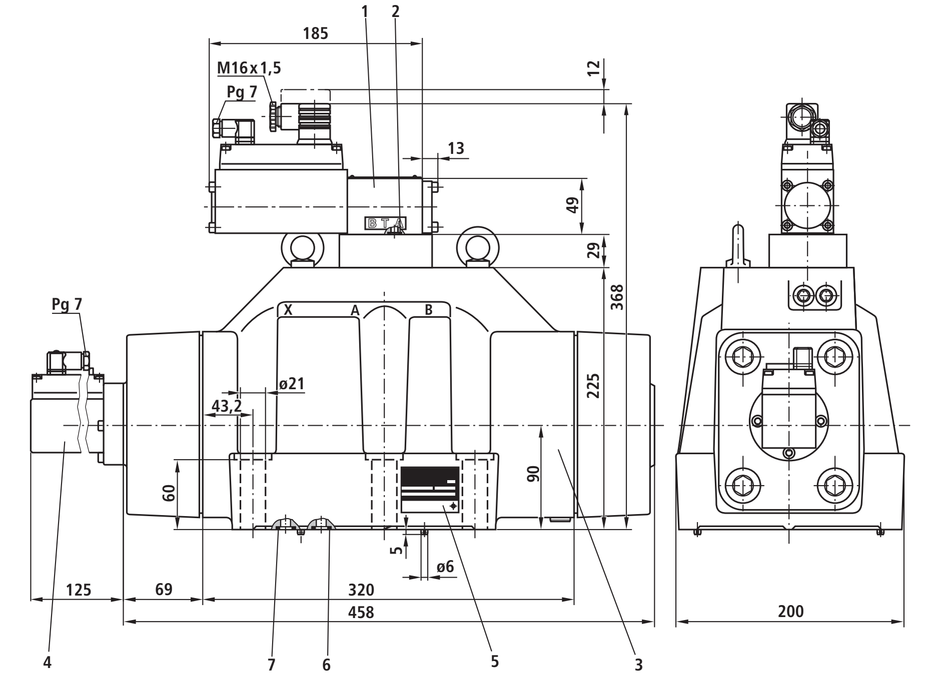
Subplates, see Technical Data Sheet RE 45059

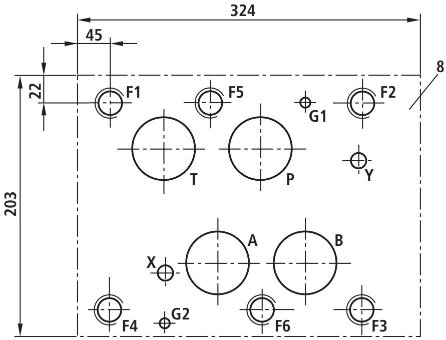
Valve fastening bolts (order separately)
The following valve fastening bolts are recommended:

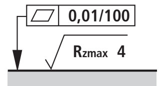
6 cheese-head bolts ISO 4762-M12x60-10.9-N67F821 70
(galvanized in accordance with Bosch standard N67F821 70)
Tightening torque NG25 M_A = 90+30 Nm,
NG27 M_A = 90±15 Nm

Material no. **2910151354**

Unit dimensions NG35 (nominal dimensions in mm)







Required surface quality
of mating component

5

1 Pilot valve

2 O-ring 9.25 x 1.78 (ports P, A, B, T)

3 Main valve

4 Inductive position transducer (main valve)

5 Nameplate

6 O-ring 53.57 x 3.53 (ports P, A, B, T)

7 O-ring 15 x 2.5 (ports X, Y)

8 Machined valve contact surface, mounting hole configuration according to ISO 4401-10-09-0-05
Deviates from standard:
Ports P, A, B, T Ø 48 mm
Minimum thread depth: Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

Subplates, see Technical Data Sheet RE 45060

Valve fastening bolts (order separately)
The following valve fastening bolts are recommended:

6 cheese-head bolts ISO 4762-M20x90-10.9-N67F821 70
(galvanized in accordance with Bosch standard N67F821 70)
Tightening torque M_A = 450+110 Nm
Material no. **2910151532**

Notes

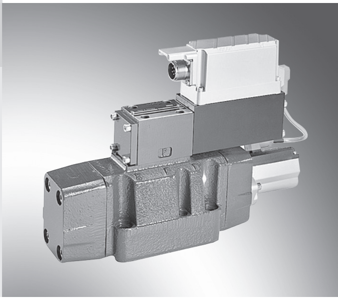
Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Telefon +49 (0) 93 52 / 18-0
Telefax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

4/3-way servo solenoid directional control valves, pilot operated, with electrical position feedback and on-board electronics (OBE)

RE 29088/10.10
Replaces: 01.09

Type 4WRLE 10...35, symbols V/V1

Sizes (NG) 10, 16, 25, 27, 35
Unit series 3X
Maximum working pressure P, A, B 350 bar (NG27: 280 bar)
Nominal flow 40…1000 l/min (Δp = 10 bar)



Type 4WRLE 10...35

List of contents

Contents	**Page**

Features

– Pilot operated 4/3-way servo solenoid directional control valves NG10 to NG35
– Pilot valve NG6, with control piston and sleeve in servo quality, actuated on one side, 4/4 fail-safe position when switched off
– Control solenoid with electric position feedback and on-board electronics (OBE), calibrated at the factory
– Main stage in servo quality with position feedback
– Flow characteristic
  • M = Progressive with fine metering notch
  • P = Non-linear curve
  • L = Linear
– Electrical connection 6P+PE
  Signal input of differential amplifier with interface A1 ±10 V, or interface F1 4...20 mA (*R*sh = 200 Ω)

For information regarding the available spare parts see:
www.boschrexroth.com/spc

Ordering data

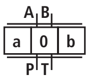
4WRL	E				–3X/	G24		K0/		M	*

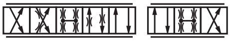
With **on-board** electronics **= E**

Sizes **= 10**
= 16
= 25
= 27 [1]
= 35 [2]

Control spool symbols

4/3-way version





= V, V1

With V1:

P → A: Q_v B → T: $Q_v/2$
P → B: $Q_v/2$ A → T: Q_v

Nominal flow rate
at 10 bar valve pressure difference
(5 bar per metering notch)

NG10	
40 l/min [3]	**= 40**
55 l/min [4]	**= 55**
70 l/min [3]	**= 70**
85 l/min [4]	**= 85**
NG16	
90 l/min [3]	**= 90**
120 l/min [4]	**= 120**
150 l/min [3]	**= 150**
200 l/min [4]	**= 200**
NG25	
300 l/min [3]	**= 300**
370 l/min [4]	**= 370**
NG27	
430 l/min [1] [4]	**= 430**
NG35	
1000 l/min [2] [4]	**= 1000**

Further information in plain text

Seal material
M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

Interface for trigger electronics
A1 = Setpoint input ±10 V
F1 = Setpoint input 4…20 mA

Electrical connection
K0 = **without** plug-in connector, with plug to DIN 43563-AM6
Order plug-in connector separately

Control oil inlet "x" control oil return "y"

No desig. =	"x" = external	"y" = external
E =	"x" = internal	"y" = external
ET =	"x" = internal	"y" = internal
T =	"x" = external	"y" = internal

Power supply of trigger electronics
G24 = +24 V DC

3X = Unit series 30 to 39 (installation and connection dimensions unchanged)

Flow characteristic
M = Progressive with linear fine metering
P = Non-linear curve, linear (kink at 40 %)
L = Linear

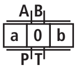
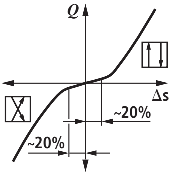
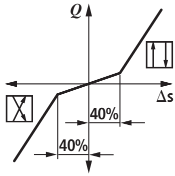
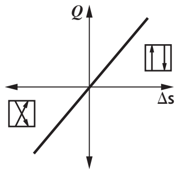
[1] NG27 is a high-flow version of NG25, ports P, A, B and T have ∅ 32 mm in the main stage. Contrary to standard ISO 4401-08-08-0-05, ports P, A, B and T may be drilled to max. ∅ 30 mm in the control block. These valves therefore offer higher flow rates $Q_A : Q_B$

[2] NG35 is a high-flow version of NG32, ports P, A, B and T have ∅ 50 mm in the main stage. Contrary to standard ISO 4401-10-09-0-05, ports P, A, B and T may be drilled to max. ∅ 48 mm in the control block. These valves therefore offer higher flow rates $Q_A : Q_B$

[3] Q_N: Flow characteristic "P"

[4] Q_N: Flow characteristic "M" or "L"

Symbols

	M: Progressive with fine metering	P: Non-linear, linear (40 %)	L: Linear
			

Testing and service equipment

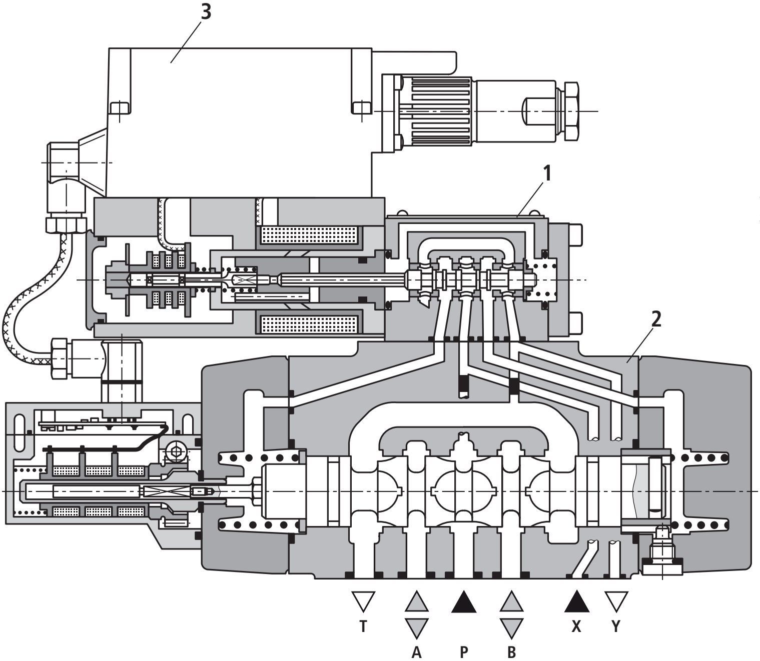
- Service case type VT-VETSY-1 with test device, see data sheet 29685
- Measuring adapter 6P+PE type VT-PA-2, see data sheet 30068

Function, sectional diagram

Construction

The valve consists of three main assemblies:

– Pilot valve (1) with control spool and sleeve, return springs, control solenoid and inductive position transducer
– Main stage (2) with centering springs and position feedback
– On-board trigger electronics (3)



1 Pilot valve
2 Main stage
3 Trigger electronics

Functional description

When the control solenoid is not actuated, the control spool is held by springs in the fail-safe position, and the main stage spool remains in spring-centered offset position at 1…6% of the stroke in the direction P-B/A-T.
In the on-board electronics, the pre-defined setpoint is compared with the actual value for the position of the main stage control spool. In the event of an error signal, the control solenoid is actuated, and the pilot spool is moved as the magnetic force changes. The flow released through the control cross-sections causes the main control spool to move. The stroke/control cross-section of the main control spool is controlled proportionately to the setpoint. If the input setpoint is 0 V, the electronics move the main stage control spool to mid position.
The control oil is conveyed to the pilot valve either internally via port P or externally via port X. The oil returns to the tank internally via port T or externally via port Y.

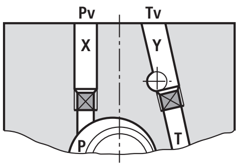
Power failure

In the event of a power failure or an open circuit, the on-board electronics cut off the electricity to the control solenoid and the pilot spool moves to the fail-safe position, relieving the control oil chambers of the main stage.
The main stage control spool is held by springs in the offset position.

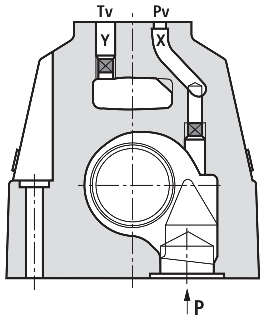
Control oil supply

The pilot valve can be supplied both via ports X and Y (externally) and via the main flow channels P and T.

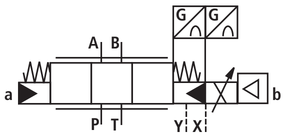
NG10, 25, 27, 35



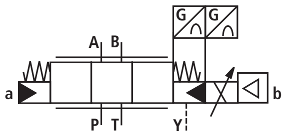
NG16



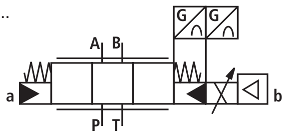
Type...–3X...



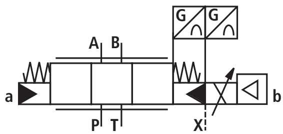
Type...–3X...E...



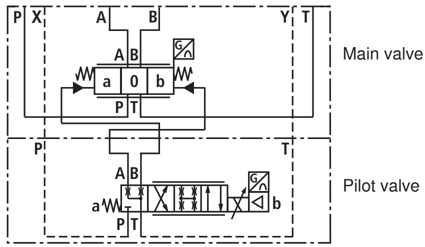
Type...–3X...ET...



Type...–3X...T...



Symbol in detail
(external control oil inlet and outlet)



No designation =	“x” = external	“y” = external
E =	“x” = internal	“y” = external
ET =	“x” = internal	“y” = internal
T =	“x” = external	“y” = internal

Important

Hydraulic symbols are largely derived from the symbols of the switching valves. 4/3-way servo solenoid directional control valves (pilot operated) do not have a closed mid position when switched off! They only perform their function in an active, closed control loop, even if the pilot valve features a fail-safe 4th position. See technical data for details on “switch-off behavior”.

5

Technical data

General

Construction		Spool type valve, pilot operated				
Actuation		Servo solenoid directional control valve NG6 OBE, with position controller for pilot valve and main stage				
Type of mounting		Subplate, mounting hole configuration NG10...35 to ISO 4401-...				
Installation position		Optional				
Ambient temperature range	°C	–20...+50				
Weight	kg	**NG10** 8.7	**NG16** 10.6	**NG25** 18.4	**NG27** 18.4	**NG35** 81
Vibration resistance, test condition		Max. 25 *g*, shaken in 3 dimensions (24 h)				

Hydraulic (measured with HLP 46, ϑ_{oil} = 40 °C ±5 °C)

Pressure fluid		Hydraulic oil to DIN 51524…535, other fluids after prior consultation				
Viscosity range recommended	mm^2/s	20...100				
Viscosity range max. permitted	mm^2/s	10...800				
Pressure fluid temperature range	°C	–20...+70				
Maximum permissible degree of contamination of pressure fluid Purity class to ISO 4406 (c)		Class 18/16/13 [1]				
Flow direction		See symbol				
		NG10	**NG16**	**NG25**	**NG27**	**NG35**
Nominal flow at Δp = 5 bar per notch [2]	l/min	40 / 55 / 70 / 85	90 / 120 / 150 / 200	300 / 370	430	1000
Max. working pressure: Ports P, A, B External control oil inlet	bar	350	350	350	280	350
Max. working pressure: Ports P, A, B Internal control oil inlet	bar	250				
Max. working pressure: Ports T, X, Y	bar	250				
Min. control oil pressure in “pilot stage”	bar	10				
Q_{max}	l/min	170	450	900	1000	3500
Q_N pilot valve	l/min	4	12	24	24	40
Nominal flow of pilot valve at 100 bar	cm^3/min	<180	<300	<500	<500	<900
Nominal flow of main stage at 100 bar	cm^3/min	<400 / <600	<1000	<1000	<1000	<6000

Static/Dynamic

Hysteresis	%	<0.1, scarcely measurable				
Manufacturing tolerance for Q_{max}	%	≦10				
Response time for signal change (at X = 100 bar)	0...100 %	25	26	32	32	90
	0...10 %	14	15	18	18	40
Response time for signal change (at X = 10 bar)	0...100 %	85	80	120	120	350
	0...10 %	50	30	50	50	150
Switch-off behavior		After electrical switch-off: Pilot valve in fail-safe Main stage moves to spring-centered “offset position”: 1…6% P-B/A-T				
Thermal drift		Zero point displacement <1 % at ΔT = 40 °C				
Zero adjustment		Factory-set ±1 %				

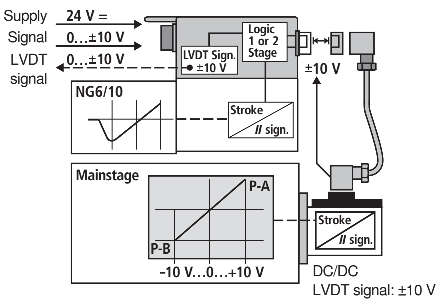
[1] The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of components. For a selection of filters, see www.boschrexroth.com/filter.

[2] Flow rate at a different Δp $Q_x = Q_{nom} \cdot \sqrt{\frac{\Delta p_x}{35}}$

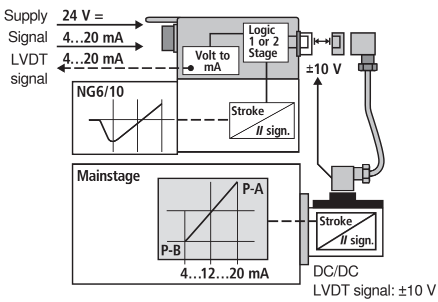
Technical data

Electric pilot valve NG6, trigger electronics integrated in the valve		
Cyclic duration factor	%	100 ED
Degree of protection		IP 65 to DIN 40050 and IEC 14434/5
Connection		Plug-in connector 6P+PE, DIN 43563
Power supply Terminal A: Terminal B: 0 V		24 V DC_{nom} min. 21 V DC/max. 40 V DC Ripple max. 2 V DC
Max. power consumption		40 VA
External fuse		2,5 A_F
Input, “Standard” version Terminal D: U_E Terminal E:		Differential amplifier, R_i = 100 kΩ 0... ±10 V 0 V
Input, “mA signal” version Terminal D: $I_{D–E}$ Terminal E: $I_{D–E}$		Burden, Rsh = 200 Ω 4...(12)...20 mA Current loop $I_{D–E}$ feedback
Max. differential input voltage at 0 V		D → B E → B } max. 18 V DC
Test signal, “Standard” version Terminal F: U_{Test} Terminal C:		LVDT 0...±10 V Reference 0 V
Test signal, “mA signal” version Terminal F: $I_{F–C}$ Terminal C: $I_{F–C}$		LVDT signal 4...20 mA at external load 200...500 Ω max. 4...20 mA output Current loop $I_{F–C}$ feedback
Protective conductor and screen		See pin assignment (CE-compliant installation)
Calibration		Calibrated at the factory, see valve characteristic curve
Electromagnetic compatibility tested according to		EN 61000-6-2: 2005-08 EN 61000-6-3: 2007-01

Version A1: Standard



Version F1: mA signal

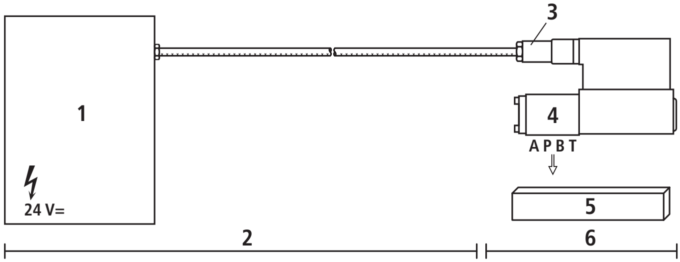


Important

Pilot operated 4/3-way servo solenoid directional control valves only perform their function in an active closed control loop and do not have a fail-safe position when switched off. For this reason, many applications require the use of “external check valves”, which must be taken into account during the On/Off switching sequence.

Electric connection

For electrical data, see page 7



1 Control
2 Provided by customer
3 Plug-in connector
4 Valve
5 Connecting surface
6 Provided by Rexroth

Technical notes on the cable

Version: – Multi-wire cable
– Extra-finely stranded wire to VDE 0295, Class 6
– Protective conductor, green/yellow
– Cu braided screen

Types: – e.g. Ölflex-FD 855 CP (from Lappkabel company)

No. of wires: – Determined by type of valve, plug types and signal assignment

Cable Ø: – 0.75 mm² to 20 m length
1.0 mm² to 40 m length

Outside Ø: – 9.4...11.8 mm – Pg11
12.7...13.5 mm – Pg16

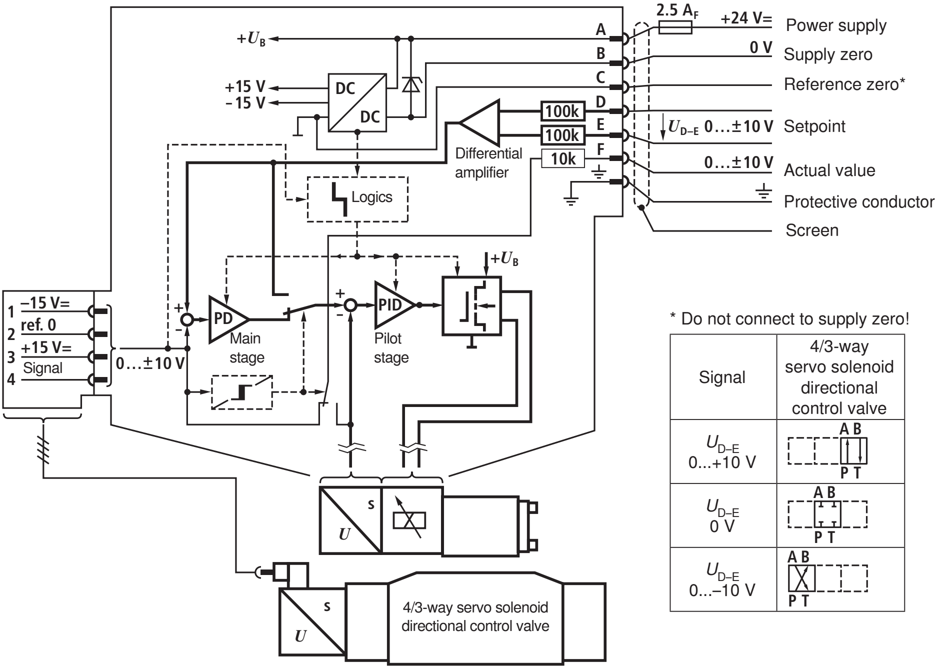
Note
Voltage supply 24 V $DC_{nom.}$,
if voltage drops below 18 V DC, rapid shutdown resembling "Enable OFF" takes place internally.
In addition, with the "mA signal" version:
$I_{D-E} \geqq 3\,mA$ – valve is active
$I_{D-E} \leqq 2\,mA$ – valve is deactivated.
Electrical signals emitted via the trigger electronics (e.g. actual values) must not be used to shut down safety-relevant machine functions!

(See European Standard, "Technical Safety Requirements for Fluid-Powered Systems and Components – Hydraulics", EN 982.)

On-board electronics

Block diagram/pin assignment

Version A1: U_{D-E} ±10 V

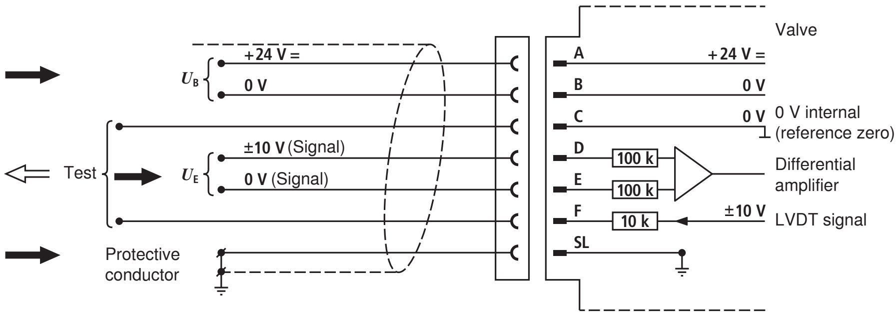


* Do not connect to supply zero!

Signal	4/3-way servo solenoid directional control valve
U_{D-E} 0...+10 V	A B / P T
U_{D-E} 0 V	A B / P T
U_{D-E} 0...–10 V	A B / P T

Pin assignment 6P+PE

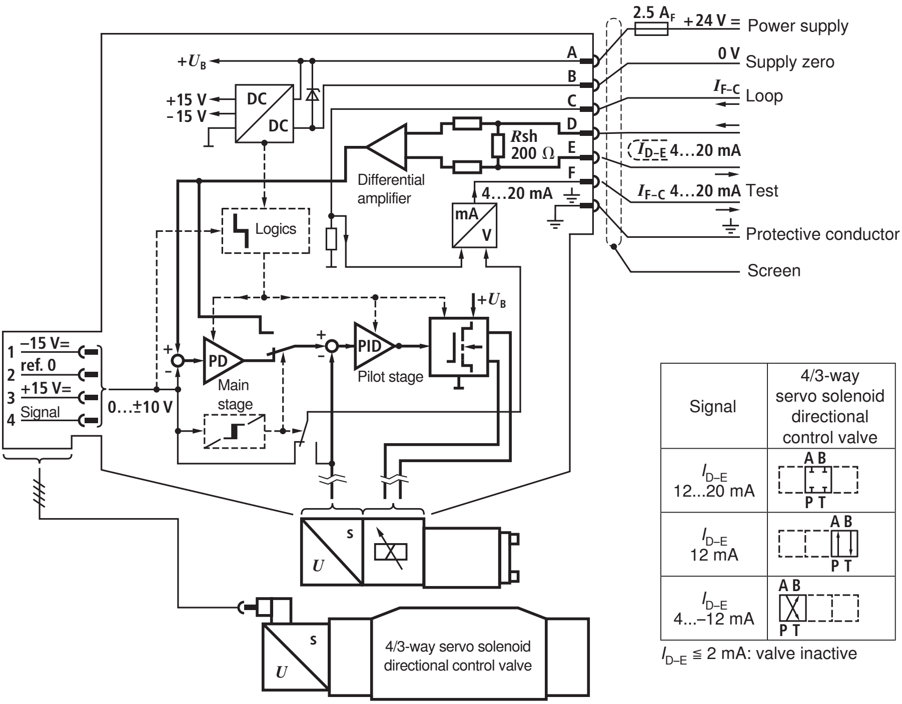
Version A1: U_{D-E} ±10 V
(R_i = 100 kΩ)



On-board electronics

Block diagram/pin assignment

Version F1: I_{D-E} 4...12...20 mA

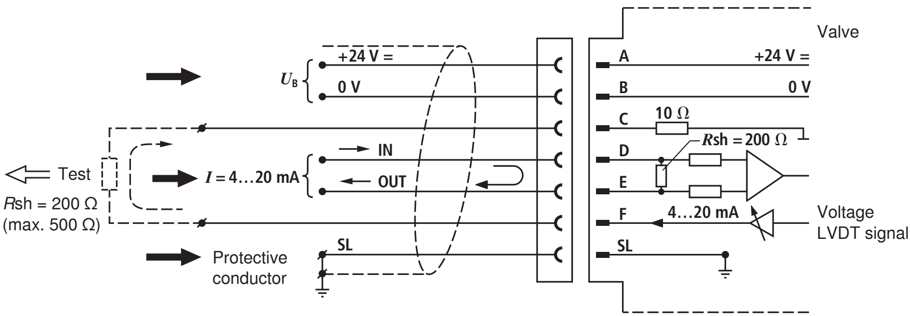


Signal	4/3-way servo solenoid directional control valve
I_{D-E} 12...20 mA	A B P T
I_{D-E} 12 mA	A B P T
I_{D-E} 4...–12 mA	A B P T

I_{D-E} ≦ 2 mA: valve inactive

Pin assignment 6P+PE

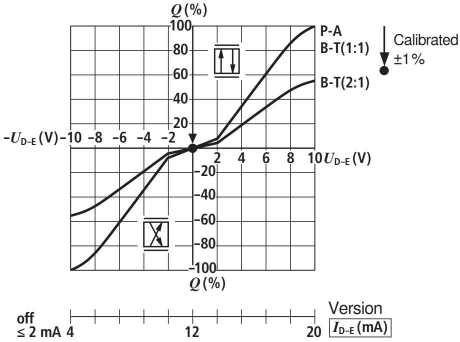
Version F1: I_{D-E} 4...12...20 mA
(Rsh = 200 Ω)



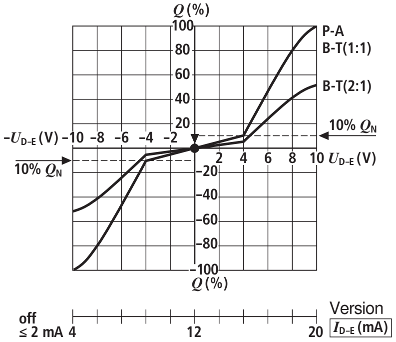
Characteristic curves (measured with HLP 46, ϑ_{oil} = 40 °C ± 5 °C)

Flow rate – signal function $Q = f(U_{D-E})$
$Q = f(I_{D-E})$

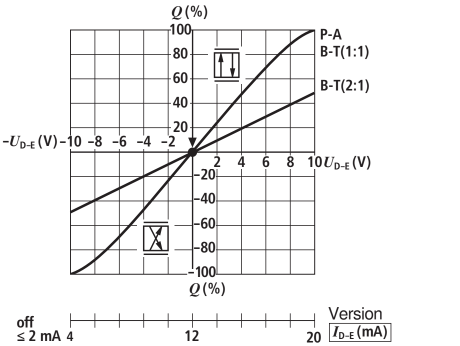
Flow characteristic M



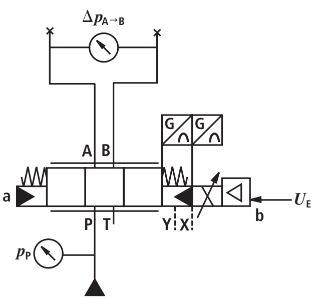
Flow characteristic P

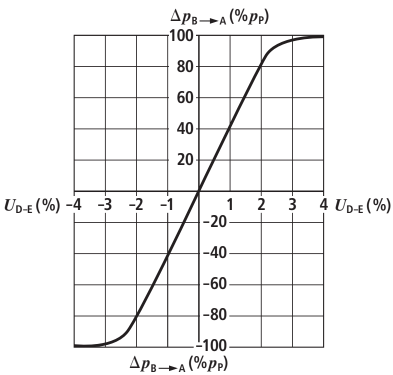


Flow characteristic L



Pressure gain

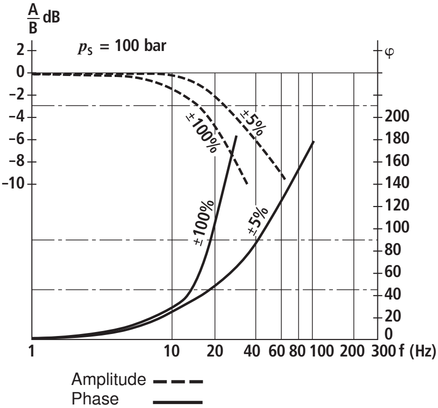




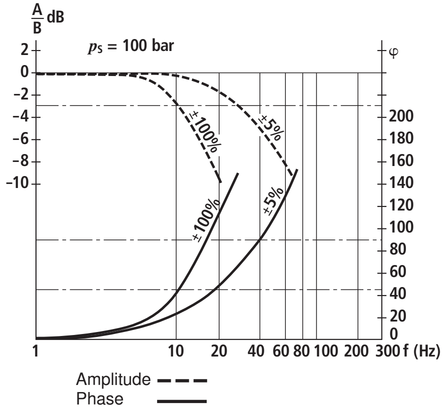
Characteristic curves (measured with HLP 46, ϑ_{oil} = 40 °C ± 5 °C)

Bode diagram

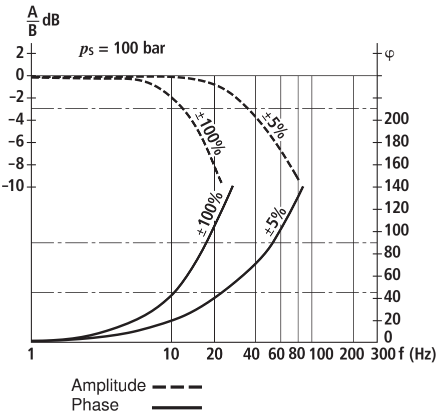
NG10



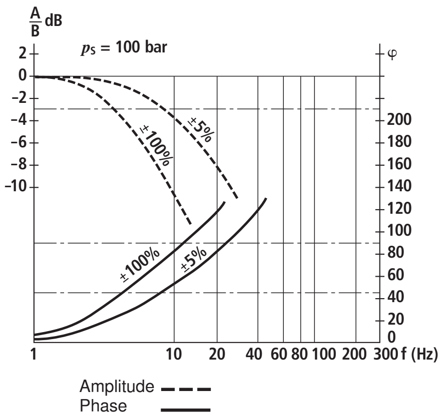
NG16



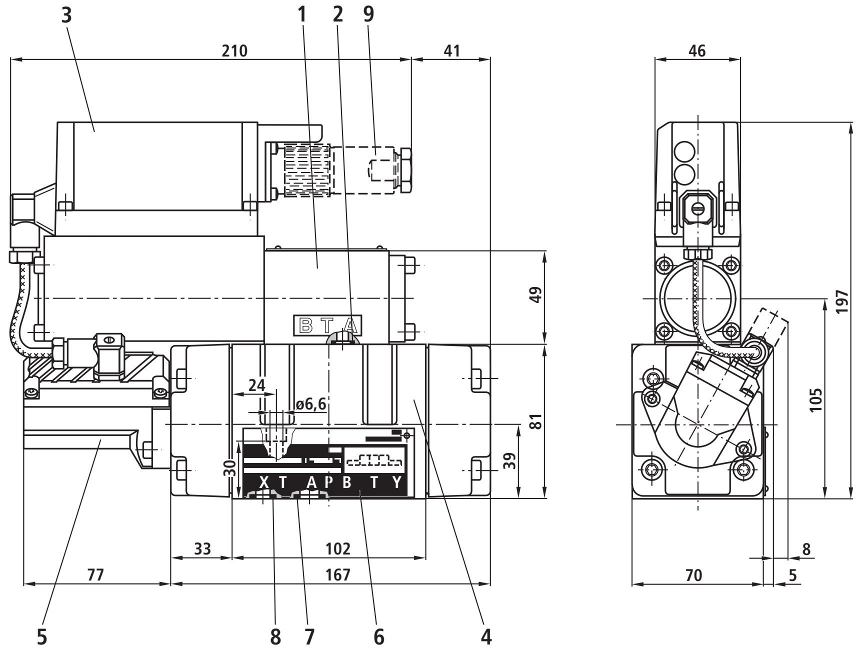
NG25/27

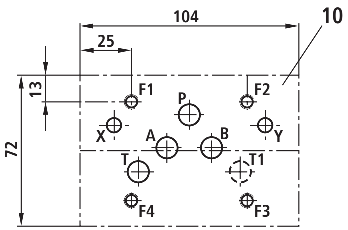


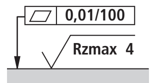
NG35



Unit dimensions NG10 (dimensions in mm)







Required surface quality of valve mounting face

1 Pilot valve
2 O-ring 9.25 x 1.78 (ports P, A, B, T)
3 On-board electronics
4 Main valve
5 Inductive position transducer (main valve)
6 Nameplate
7 O-ring 12 x 2 (ports P, A, B, T, T1)
8 O-ring 10 x 2 (ports X, Y)
9 Plug-in connector not included in delivery, see data sheet 08008 (order separately)

10 Machined valve contact surface, mounting hole configuration according to ISO 4401-05-05-0-05
Deviates from standard:
Ports P, A, B, T, T1 ∅ 10.5 mm
Minimum thread depth: Ferrous metal 1.5 x ∅
Non-ferrous 2 x ∅

Subplates, see data sheet 45055 (order separately)

Valve fastening bolts (order separately)
The following valve fastening bolts are recommended:

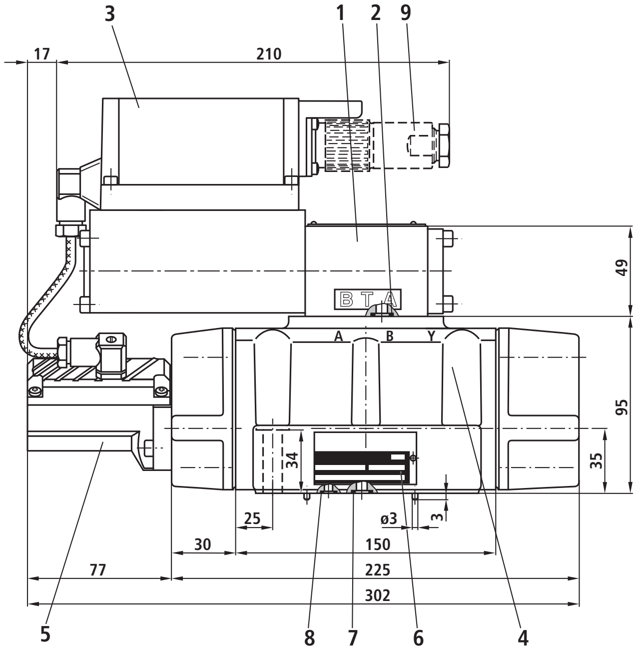
4 cheese-head bolts ISO 4762-M6x40-10.9-N67F821 70
(galvanized in accordance with Bosch standard N67F821 70)

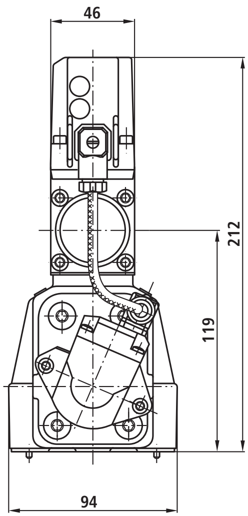
Tightening torque M_A = 11+3 Nm

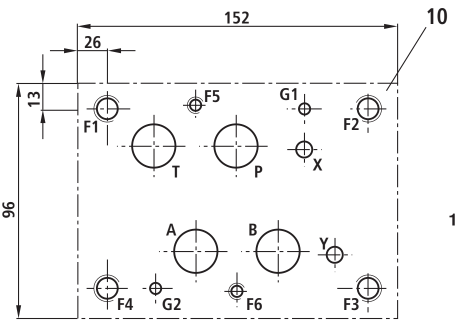
Material no. **2910151209**

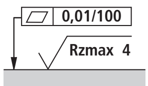
5

Unit dimensions NG16 (dimensions in mm)









Required surface quality of valve mounting face

1 Pilot valve

2 O-ring 9.25 x 1.78 (ports P, A, B, T)

3 On-board electronics

4 Main valve

5 Inductive position transducer (main valve)

6 Nameplate

7 O-ring 23 x 2.5 (ports P, A, B, T)

8 O-ring 9 x 2 (ports X, Y)

9 Plug-in connector not included in delivery, see data sheet 08008 (order separately)

10 Machined valve contact surface, mounting hole configuration according to ISO 4401-07-07-0-05

Deviates from standard:
Ports P, A, B, T ∅ 20 mm
Minimum thread depth: Ferrous metal 1.5 x ∅
Non-ferrous 2 x ∅

Subplates, see data sheet 45057 (order separately)

Valve fastening bolts (order separately)
The following valve fastening bolts are recommended:

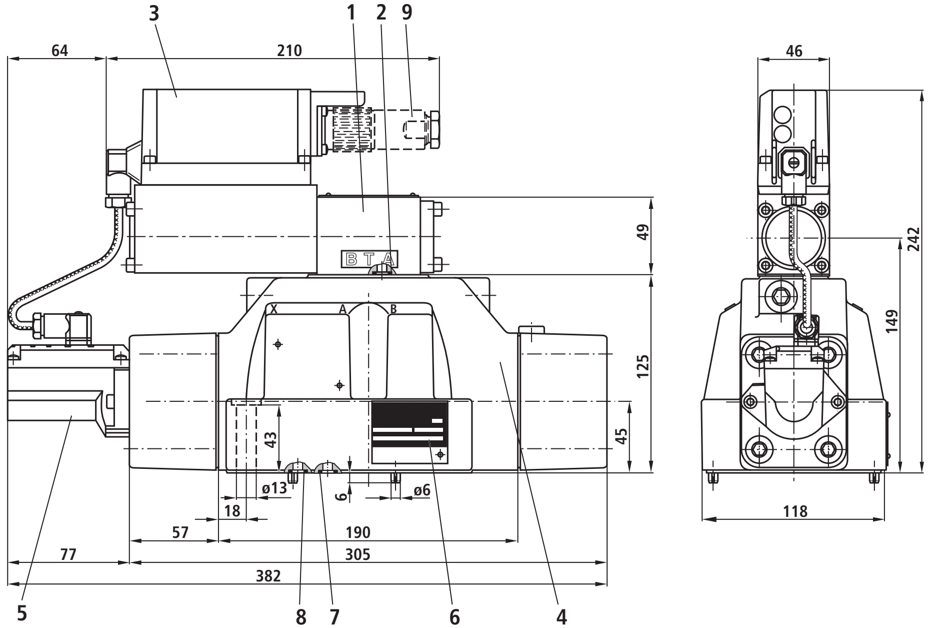
2 cheese-head bolts ISO 4762-M6x45-10.9-N67F821 70
(galvanized in accordance with Bosch standard N67F821 70)
Tightening torque M_A = 11+3 Nm

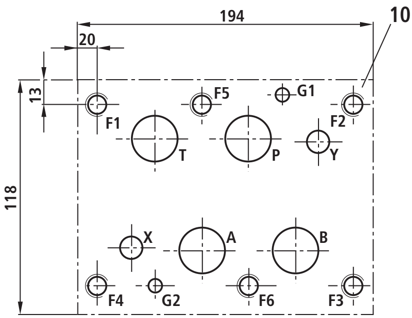
Material no. **2910151211**

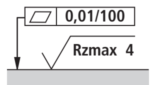
4 cheese-head bolts ISO 4762-M10x50-10.9-N67F821 70
(galvanized in accordance with Bosch standard N67F821 70)
Tightening torque M_A = 50+10 Nm

Material no. **2910151301**

Unit dimensions NG25/27 (dimensions in mm)







Required surface quality of valve mounting face

1 Pilot valve

2 O-ring 9.25 x 1.78 (ports P, A, B, T)

3 On-board electronics

4 Main valve

5 Inductive position transducer (main valve)

6 Nameplate

7 O-ring (ports P, A, B, T)
NG25: 28 x 3
NG27: 34.6 x 2.62

8 O-ring 15 x 2.5 (ports X, Y)

9 Plug-in connector not included in delivery, see data sheet 08008 (order separately)

10 Machined valve contact surface, mounting hole configuration according to ISO 4401-08-08-0-05
Deviates from standard:
NG25: Ports P, A, B, T ∅ 25 mm
NG27: Ports P, A, B, T ∅ 32 mm
Minimum thread depth: Ferrous metal 1.5 x ∅
Non-ferrous 2 x ∅

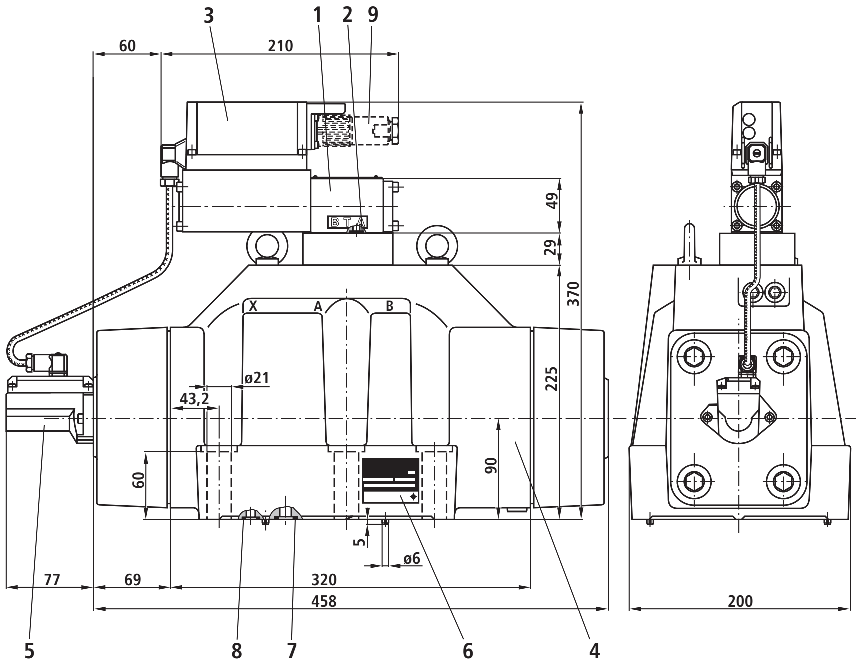
Subplates, see data sheet 45059 (order separately)

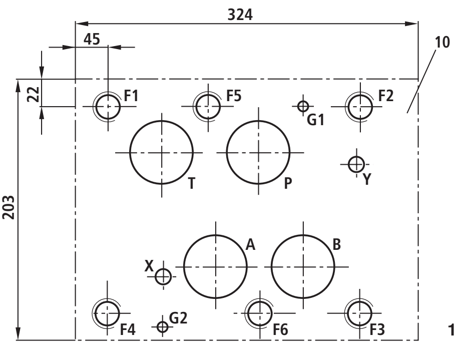
Valve fastening bolts (order separately)
The following valve fastening bolts are recommended:

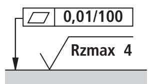
6 cheese-head bolts ISO 4762-M12x60-10.9-N67F821 70
(galvanized in accordance with Bosch standard N67F821 70)
Tightening torque NG25 M_A = 90+30 Nm,
NG27 M_A = 90±15 Nm

Material no. **2910151354**

Unit dimensions NG35 (dimensions in mm)







Required surface quality of valve mounting face

1 Pilot valve
2 O-ring 9.25 x 1.78 (ports P, A, B, T)
3 On-board electronics
4 Main valve
5 Inductive position transducer (main valve)
6 Nameplate
7 O-ring 53.57 x 3.53 (ports P, A, B, T)
8 O-ring 15 x 2.5 (ports X, Y)
9 Plug-in connector not included in delivery, see data sheet 08008 (order separately)

10 Machined valve contact surface, mounting hole configuration according to ISO 4401-10-09-0-05
Deviates from standard:
Ports P, A, B, T ∅ 48 mm
Minimum thread depth: Ferrous metal 1.5 x ∅
Non-ferrous 2 x ∅

Subplates, see data sheet 45060 (order separately)

Valve fastening bolts (order separately)
The following valve fastening bolts are recommended:

6 cheese-head bolts ISO 4762-M20x90-10.9-N67F821 70
(galvanized in accordance with Bosch standard N67F821 70)
Tightening torque M_A = 450+110 Nm
Material no. **2910151532**

Notes

Notes

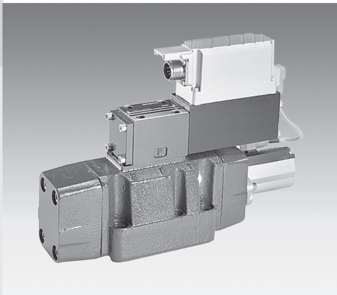
Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Telefon +49 (0) 93 52 / 18-0
Telefax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

Rexroth
Bosch Group

4/3-way servo solenoid directional control valves, pilot operated, with electrical position feedback and on-board electronics

RE 29089/01.09
Replaces: 01.05

Type 4WRLE 10...35, symbols E./W.



Sizes (NG) 10, 16, 25, 27, 35
Unit series 3X
Maximum working pressure P, A, B 350 bar (NG27: 280 bar)
Nominal flow rate 50...1100 l/min (Δp = 10 bar)

List of contents

For information regarding the available spare parts see: www.boschrexroth.com/spc

Features

- Pilot operated 4/3-way servo solenoid directional control valves NG10 to NG35, with approx. 20 % overlap
- Pilot valve NG6, with control piston and sleeve in servo quality, actuated on one side, 4/4 fail-safe position when switched off
- Control solenoid with electrical position feedback and on-board electronics (OBE), calibrated at the factory
- Main stage with position feedback
- Electronically calibrated and compensated overlap
- Spool with linear travel, with anti-rotation element
- Flow characteristic
  - S = Progressive
  - NG16, 25 and 27 with load tap C1/C2
- For subplate attachment, mounting hole configuration NG10 to ISO 4401-05-05-0-05, NG16 to ISO 4401-07-07-0-05, NG25/27 to ISO 4401-08-08-0-05 and NG35 to ISO 4401-10-09-0-05
- Subplates as per Technical Data Sheet, NG10 RE 45055, NG16 RE 45057, NG25/27 RE 45059 and NG35 RE 45060 (order separately)
- Plug-in connectors to DIN 43563-AM6, see Technical Data Sheet RE 08008 (order separately)

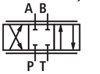
Ordering data

4WRL	E					S	J	–3X/	G24		K0/	A1	M	*

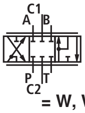
With **on-board** electronics = **E**

NG10 = **10**
NG16 = **16**
NG25 = **25**
NG27 [1)] = **27**
NG35 [2)] = **35**

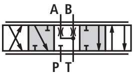
Control spool symbols = **E, E1**

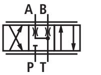


= **E (Z), E1 (Z)**

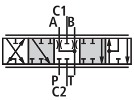


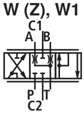
= **W, W1**



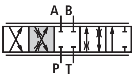


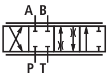
= **W (Z), W1 (Z)**



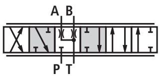


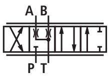
= **E4**





= **W4**





▢ Transitional symbols

With symbol E1, E1(Z), E4, W1(Z), W4:
P → A: q_V B → T: $q_V/2$
P → B: $q_V/2$ A → T: q_V

With load tap C1/C2
(NG16, 25, 27) = **Z**

Nominal flow rate at 10 bar valve pressure difference (5 bar per metering notch)

	NG10
50 =	50 l/min
80 =	80 l/min
	NG16
180 =	180 l/min
	NG25
350 =	350 l/min
	NG27
430 =	430 l/min [1)]
	NG35
1100 =	1100 l/min [2)]

Flow characteristic
S = Progressive

J = **Overlap compensation signal**
See characteristic curve range: +0.5 V

3X = Unit series 30 to 39
(installation and connection dimensions unchanged)

Voltage supply of trigger electronics
G24 = +24 V DC

Control oil supply "x", control oil return "y"
No desig. = "x" = external, "y" = external
E = "x" = internal, "y" = external
ET = "x" = internal, "y" = internal
T = "x" = external, "y" = internal

Electrical connection
K0 = **without** plug-in connector, with plug to DIN 43563-AM6
Order plug-in connector separately

Interface for trigger electronics
A1 = Setpoint input ±10 V

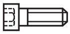
M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

Further information in plain text

1) NG27 is a high-flow version of NG25, ports P, A, B and T have ∅ 32 mm in the main stage. Contrary to standard ISO 4401-08-08-0-05, ports P, A, B and T may be drilled to max. ∅ 30 mm in the control block. These valves therefore offer higher flow rates $Q_A : Q_B$

2) NG35 is a high-flow version of NG32, ports P, A, B and T have ∅ 50 mm in the main stage. Contrary to standard ISO 4401-10-09-0-05, ports P, A, B and T may be drilled to max. ∅ 48 mm in the control block. These valves therefore offer higher flow rates $Q_A : Q_B$

Accessories, not included in delivery

Fastening bolts 	NG10	4 x ISO 4762-M6 x 40-10.9-N67F821 70	**2 910 151 209**
	NG16	2 x ISO 4762-M6 x 45-10.9-N67F821 70	**2 910 151 211**
		4 x ISO 4762-M10 x 50-10.9-N67F821 70	**2 910 151 301**
	NG25/27	6 x ISO 4762-M12 x 60-10.9-N67F821 70	**2 910 151 354**
	NG35	6 x ISO 4762-M20 x 90-10.9-N67F821 70	**2 910 151 532**
	Plug-in connectors 6P+PE, also see RE 08008	KS	**1 834 482 022**
		KS	**1 834 482 026**
		MS	**1 834 482 023**
		MS	**1 834 482 024**
		KS 90°	**1 834 484 252**

Testing and service equipment

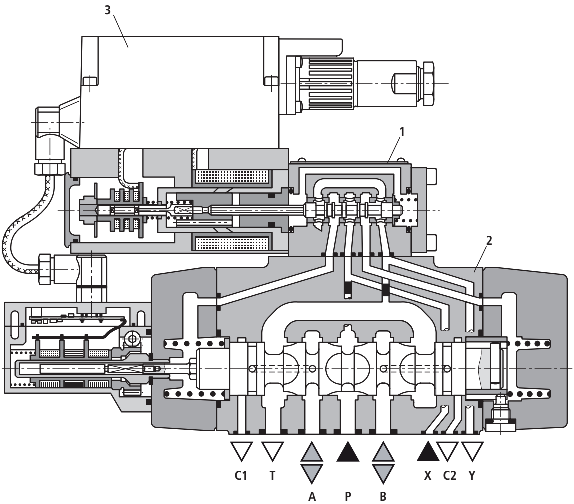
– Test box type VT-PE-TB3, see RE 30065

– Test adapter 6P+PE type VT-PA-2, see RE 30068

Function, sectional diagram

Construction

The valve consists of three main assemblies:
- Pilot valve (1) with control spool and sleeve, return springs, control solenoid and inductive position transducer
- Main stage (2) with centering springs and position feedback
- On-board trigger electronics (3)



Functional description

When the control solenoid is not actuated, the control spool is held by springs in the fail-safe position, and the main stage spool remains in its spring-centered mid position.
In the on-board electronics, the pre-defined setpoint is compared with the actual value for the position of the main stage control spool. In the event of an error signal, the control solenoid is actuated, and the pilot spool is moved as the magnetic force changes. The flow released through the control cross-sections causes the main control spool to move. The spool stroke is controlled proportionately to the setpoint of 0.5...10 V between 20...100 %. If the input setpoint is < ± 0.5 V, the control spool is held in the spring-centered, overlapped mid position.

The control oil is conveyed to the pilot valve either internally via port P or externally via port X. The oil returns to the tank internally via port T or externally via port Y.

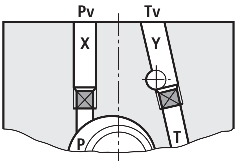
Power failure

In the event of a power failure or an open circuit, the on-board electronics cut off the electricity to the control solenoid and the pilot spool moves to the fail-safe position, relieving the control oil chambers of the main stage. The main stage control spool is held by springs in mid position.

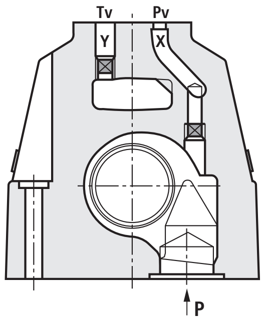
Control oil supply

The pilot valve can be supplied both via ports X and Y (externally) and via the main flow channels P and T.

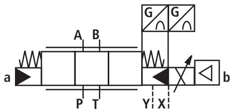
NG10, 25, 27, 35



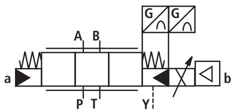
NG16



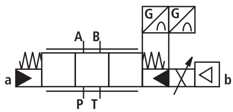
Type...–3X...



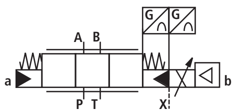
Type...–3X...E...



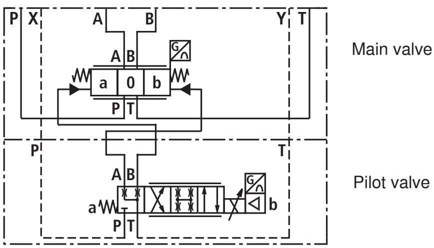
Type...–3X...ET...



Type...–3X...T...



Symbol in detail
(external control oil inlet and outlet)



No designation =	“x” = external	“y” = external
E =	“x” = internal	“y” = external
ET =	“x” = internal	“y” = internal
T =	“x” = external	“y” = internal

Technical data

General						
Construction		Spool type valve, pilot operated				
Actuation		Servo solenoid directional control valve NG6, with position controller for pilot valve and main stage				
Type of mounting		Subplate, mounting hole configuration NG10...35 to ISO 4401-...				
Installation position		Optional				
Ambient temperature range	°C	–20...+50				
Weight	kg	**NG10** 8.7	**NG16** 10.6	**NG25** 18.4	**NG27** 18.4	**NG35** 81
Vibration resistance, test condition		Max. 25 *g*, shaken in 3 dimensions (24 h)				

Hydraulic (measured with HLP 46, ϑ_{oil} = 40 °C ±5 °C)						
Pressure fluid		Hydraulic oil to DIN 51524...535, other fluids after prior consultation				
Viscosity range recommended	mm^2/s	20...100				
Viscosity range max. permitted	mm^2/s	10...800				
Pressure fluid temperature range	°C	–20...+70				
Maximum permissible degree of contamination of pressure fluid Purity class to ISO 4406 (c)		Class 18/16/13 [1)]				
Flow direction		See symbol				
Nominal flow at		**NG10**	**NG16**	**NG25**	**NG27**	**NG35**
Δp = 5 bar per notch [2)]	l/min	50, 80	180	350	430	1100
Max. working pressure: Ports P, A, B (external control oil inlet)	bar	350	350	350	280	350
Max. working pressure: Ports P, A, B, X	bar	280				
Max. working pressure: Ports T, Y	bar	250				
Min. control oil pressure in “pilot stage”	bar	8				
Q_{max}	l/min	170	450	900	1000	3500
Q_N pilot valve (inlet) Δp = 35 bar	l/min	2	4	12	12	40
Leakage of pilot valve at X = 100 bar	cm^3/min	<150	<180	<350	<500	<1100
Leakage of main stage control spool symbols “E” at P = 100 bar	l/min	<0.25	<0.4	<0.6	<0.6	<1.1

Static/Dynamic						
Overlap in mid position		ª18...22 % of spool stroke, electrically compensated for U_{D-E} ±0.5 V				
Spool stroke, main stage	± mm	4	7	10	10	12,5
Control oil volume of main stage 100 %	cm^3	1.1	4.3	11.3	11.3	41.5
Control oil requirement 0...100 %, (at X = 100 bar)	l/min	2.2	4.7	11.7	11.7	15.6
Hysteresis	%	<0.1, scarcely measurable				
Manufacturing tolerance	%	< ±5 (Q_{max})				
Response time for 0...100 %, (at X = 100 bar)	ms	<40	<80	<80	<80	<130
Response time for 0...100 %, (at X = 10 bar)	ms	<150	<250	<250	<250	<500
Switch-off behavior		After electrical switch-off (pilot valve in fail-safe) Main stage moves to spring-centered overlapped mid position				
Thermal drift		<1 % at ΔT = 40 °C				
Calibration		At the factory ±1 %, see flow curve				
Electromagnetic compatibility		EN 61000-6-2: 2002-08 EN 61000-6-3: 2002-08				

[1)] The purity classes stated for the components must be complied with in hydraulic systems.
Effective filtration prevents problems and also extends the service life of components.
For a selection of filters, see Technical Data Sheets RE 50070, RE 50076 and RE 50081.

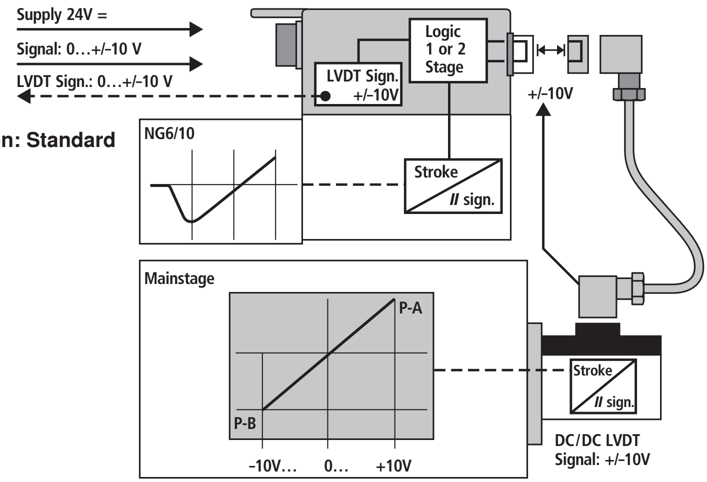
[2)] Flow rate at a different Δp $Q_x = Q_{nom} \cdot \sqrt{\frac{\Delta p_x}{5}}$

5

Technical data

Electric pilot valve NG6, trigger electronics integrated in the valve		
Cyclic duration factor	%	100 ED
Degree of protection		IP 65 to DIN 40050 and IEC 14434/5
Connection		Plug-in connector 6P+PE, DIN 43563
Power supply Terminal A: Terminal B: 0 V		24 V DC_{nom} min. 21 V DC/max. 40 V DC Ripple max. 2 V DC
Power consumption		Solenoid Ø45 mm = 40 VA max.
External fuse		2,5 A_F
Input, “Standard” version Terminal D: U_E Terminal E:		Differential amplifier, R_i = 100 kΩ 0...±10 V 0 V
Max. differential input voltage at 0 V		D → B E → B max. 18 V DC
Test signal, “Standard” version Terminal F: U_{Test} Terminal C:		LVDT 0...±10 V Reference 0 V
Protective conductor and screen		See pin assignment
Recommended cable		See pin assignment up to 20 m 7 x 0.75 mm^2 up to 40 m 7 x 1 mm^2
Calibration		Overlap and P–A at +8 V, calibrated at the factory, see valve characteristic curve

Version: Standard

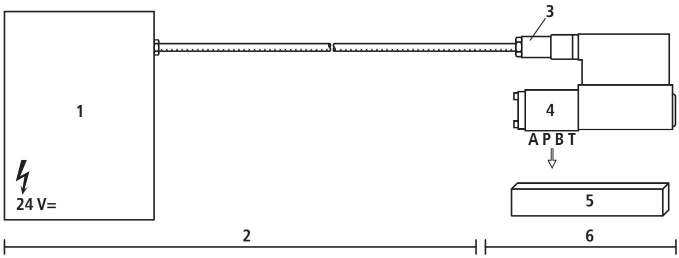


Important

Pilot operated 4/3-way servo solenoid directional control valves with positive overlap perform their function in open or closed-loop-controlled axes and have approx. 20 % overlap when switched off.
This condition does not constitute an active fail-safe position. For this reason, many applications require the use of “external check valves” or certain sandwich-mounted valves, which must be taken into account during the On/Off switching sequence.

Connection

For electrical data, see page 6



1 Control
2 Provided by customer
3 Plug-in connector
4 Valve
5 Connecting surface
6 Provided by Rexroth

Technical notes on the cable

Version: – Multi-wire cable
– Extra-finely stranded wire to VDE 0295, Class 6
– Protective conductor, green/yellow
– Cu braided screen

Types: – e.g. Ölflex-FD 855 CP (from Lappkabel company)

No. of wires: – Determined by type of valve, plug type and signal assignment

Cable Ø: – 0.75 mm² to 20 m length
– 1.0 mm² to 40 m length

Outside Ø: – 9.4...11.8 mm – Pg11
– 12.7...13.5 mm – Pg16

Important

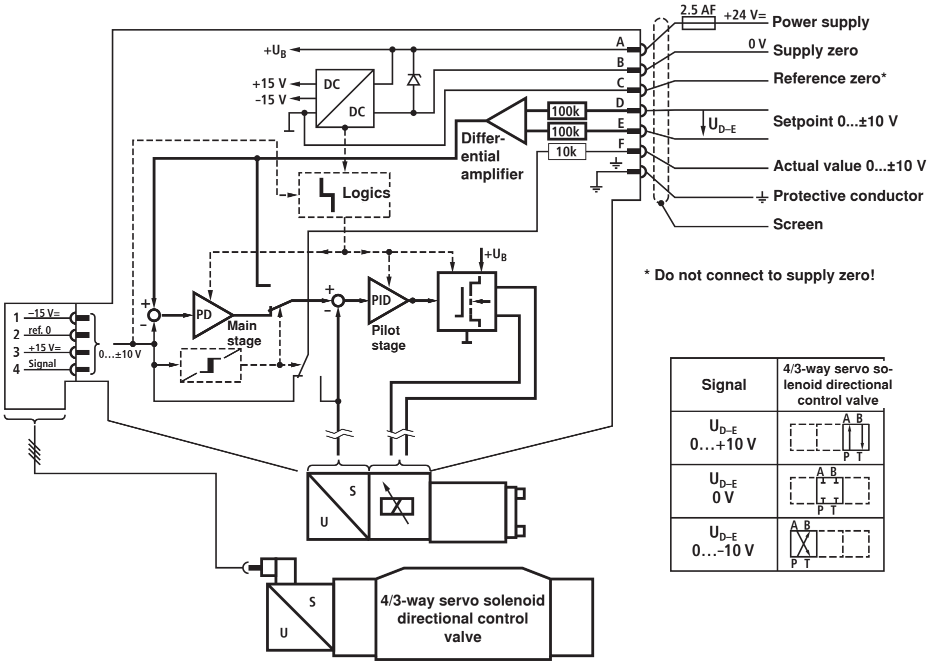
Voltage supply 24 V $DC_{nom.}$,
if voltage drops below 18 V DC, rapid shutdown resembling "Enable OFF" takes place internally.
In addition, with the "mA signal" version:
$I_{D-E} \geqq 3\,mA$ – valve is active
$I_{D-E} \leqq 2\,mA$ – valve is deactivated.
Electrical signals emitted via the trigger electronics (e.g. actual values) must not be used to shut down safety-relevant machine functions! (See European Standard, "Technical Safety Requirements for Fluid-Powered Systems and Components – Hydraulics", EN 982.)

5

On-board electronics

Block diagram/pin assignment

Version A1: U_{D-E} ±10 V

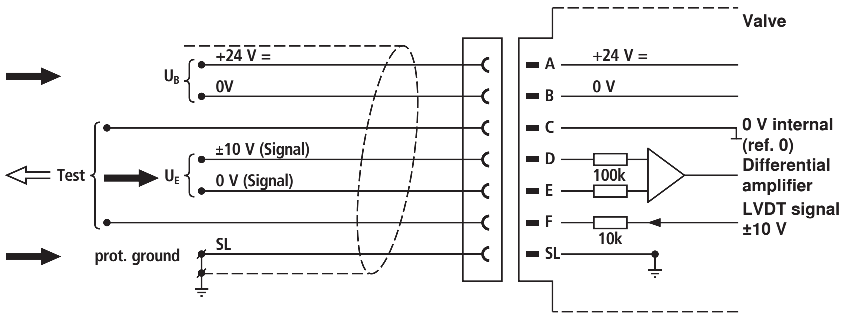


* Do not connect to supply zero!

Signal	4/3-way servo solenoid directional control valve
U_{D-E} 0…+10 V	A B P T
U_{D-E} 0 V	A B P T
U_{D-E} 0…–10 V	A B P T

Pin assignment 6P+PE

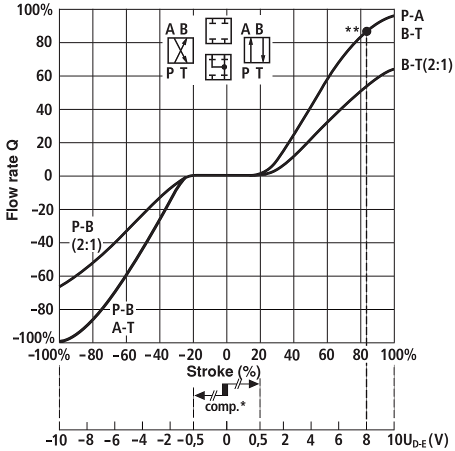
Version A1: U_{D-E} ±10 V
(R_i = 100 kΩ)



Characteristic curves (measured with HLP 46, ϑ_{oil} = 40 °C ±5 °C)

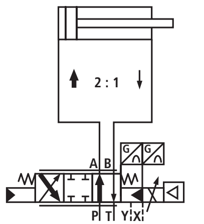
Flow rate – signal function
***Q* = f (*U*$_{D–E}$)**

Symbol E(Z), W(Z) ($Q_A : Q_B$ = 1 : 1)
E1(Z), W1(Z) ($Q_A : Q_B$ = 2 : 1)



Control spool with asymmetric metering notches

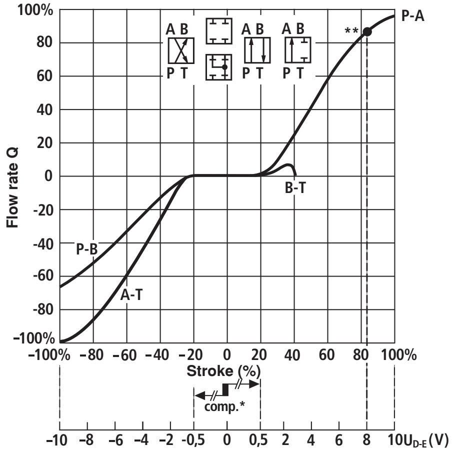
Control spools with asymmetric metering notches are available in a ratio of 2:1 for the purpose of adaptation to differential cylinders.



Flow in mid position, "leakage oil pressure relief"

With symbol "E", leakage oil in the two work chambers A and B of the control piston gives rise to a build-up of pressure in A or B, which then causes a connecting cylinder to drift out of position.
In many cases, the "W" symbol is a better solution. With a setpoint of "0", the control piston moves into the overlapped mid position. In this mid position, pressure is then relieved from ports A and B with 1 % ±0.5 % Q_N to T.
This also supports the function of external check valves.

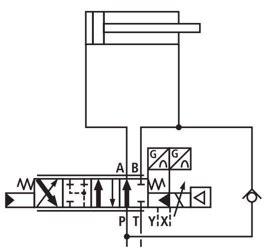
Symbol E4, W4 ($Q_A : Q_B$ = 2 : 1)



Control spools in a differential circuit

In order to produce differential circuits, valve spools with a 4th position are available.
It is sufficient to install a check valve in the consumer lines.

In addition, a control spool (symbol) with internal B-P connection is employed for certain branch-oriented solutions. However, we recommend that you consult the BRH Application Center with regard to these special symbols, as a simulation or knowledge of this type of system is usually required.



5

* Comp. $U_{D–E}$ ±0.5 V factory setting ±1 %
** $Q_{P–A}$ at +8 V [$U_{D–E}$] manufacturing tolerance Q_{max} ≦ ±5 %

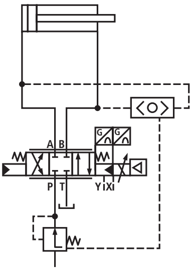
Characteristic curves (measured with HLP 46, ϑ_{oil} = 40 °C ±5 °C)

Load tap C1/C2

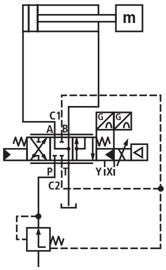
To compensate for fluctuations in the load or supply pressure, 4/3-way servo solenoid directional control valves are combined with pressure compensators. The load is tapped via a shuttle valve for the NG10 and 35, and via two additional ports C1 and C2 for the NG16, 25 and 27.

The pressure compensator therefore always receives the correct pressure signal even in the event of negative load. When using pressure compensators, an external control oil supply should always be selected.

NG10, 35



NG16, 25, 27



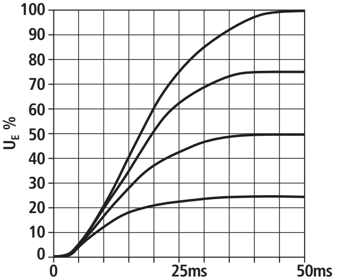
Characteristic curves (measured with HLP 46, ϑ_{oil} = 40 °C ± 5 °C)

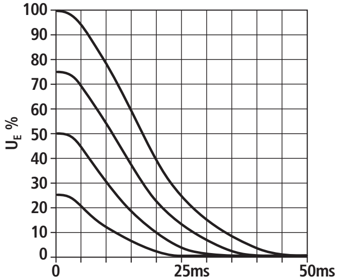
Response time (at X = 100 bar)

Open

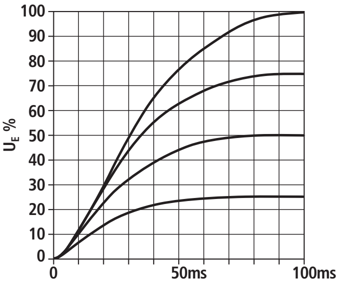
Close

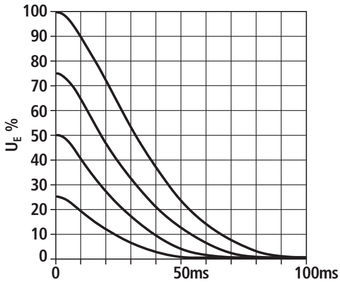
NG10



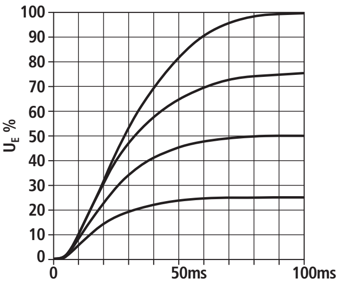


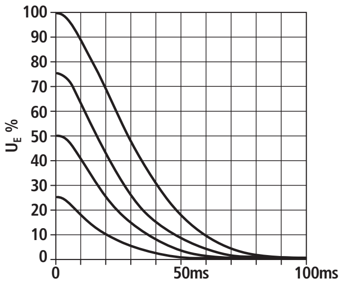
NG16



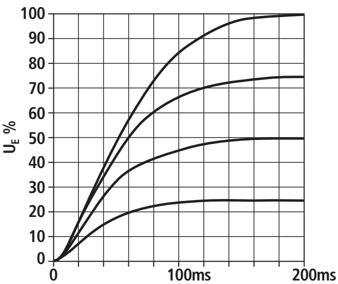


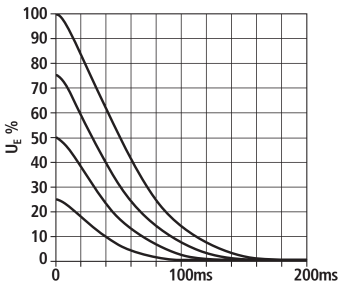
NG25/27



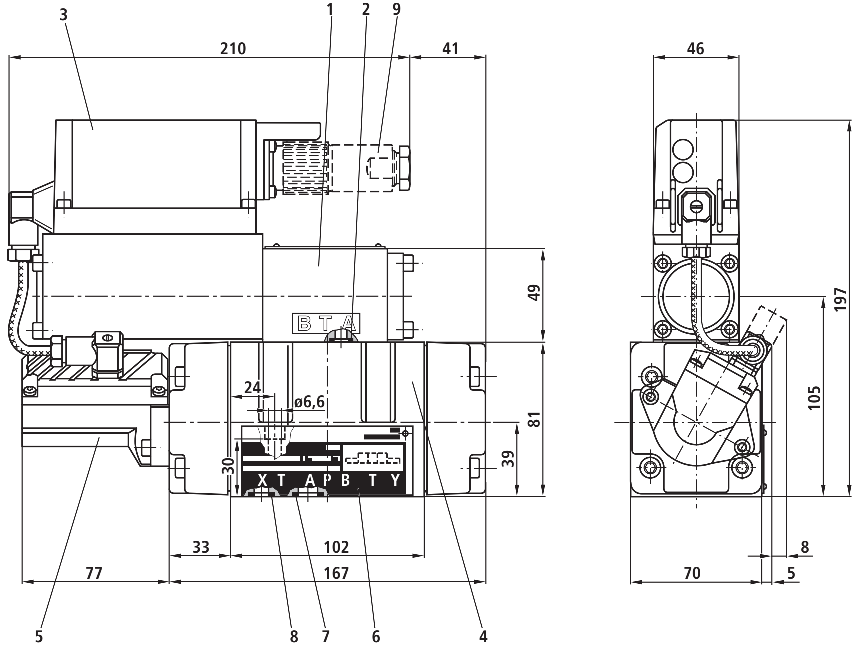


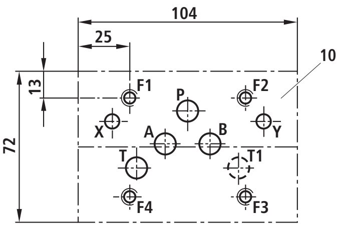
NG35

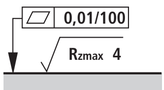




Unit dimensions NG10 (nominal dimensions in mm)







Required surface quality
of mating component

1 Pilot valve

2 O-ring 9.25 x 1.78 (ports P, A, B, T)

3 On-board electronics

4 Main valve

5 Inductive position transducer (main valve)

6 Nameplate

7 O-ring 12 x 2 (ports P, A, B, T, T1)

8 O-ring 10 x 2 (ports X, Y)

9 Plug-in connector not included in delivery (order separately)

10 Machined valve contact surface, mounting hole configuration according to ISO 4401-05-05-0-05

Deviates from standard:
Ports P, A, B, T, T1 Ø 10,5 mm
Minimum thread depth: Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

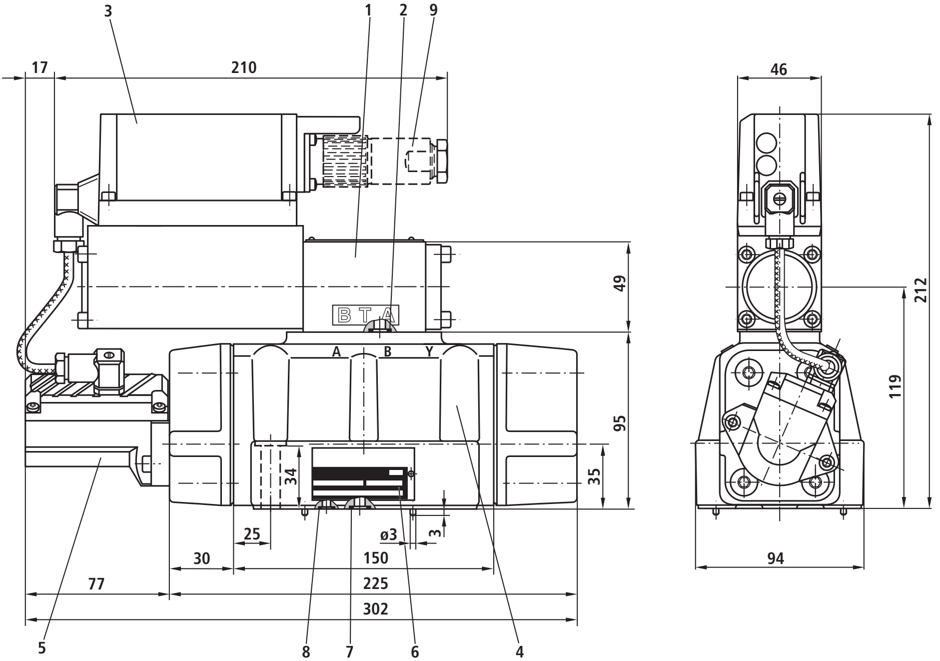
Subplates, see Technical Data Sheet RE 45055

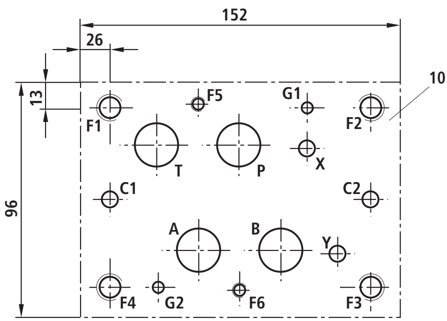
Valve fastening bolts (order separately)
The following valve fastening bolts are recommended:

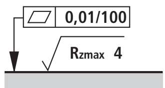
4 cheese-head bolts ISO 4762-M6x40-10.9-N67F821 70
(galvanized in accordance with Bosch standard N67F821 70)
Tightening torque M_A = 11+3 Nm

Material no. **2910151209**

Unit dimensions NG16 (nominal dimensions in mm)







Required surface quality of mating component

1 Pilot valve
2 O-ring 9.25 x 1.78 (ports P, A, B, T)
3 On-board electronics
4 Main valve
5 Inductive position transducer (main valve)
6 Nameplate
7 O-ring 23 x 2.5 (ports P, A, B, T)
8 O-ring 9 x 2 (ports X, Y, C1, C2)
9 Plug-in connector not included in delivery (order separately)

10 Machined valve contact surface, mounting hole configuration according to ISO 4401-07-07-0-05
Deviates from standard:
Ports P, A, B, T Ø 20 mm
Minimum thread depth: Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

Subplates, see Technical Data Sheet RE 45057

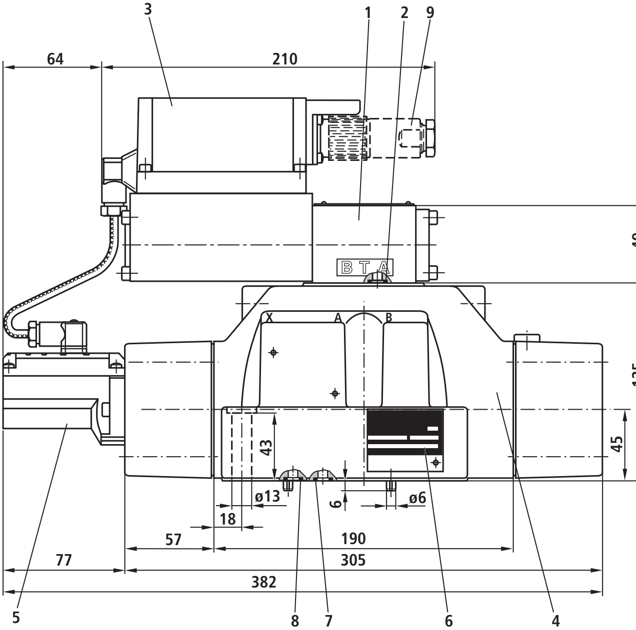
Valve fastening bolts (order separately)
The following valve fastening bolts are recommended:

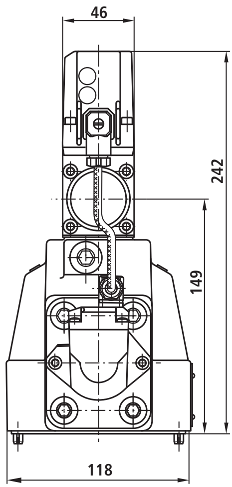
2 cheese-head bolts ISO 4762-M6x45-10.9-N67F821 70
(galvanized in accordance with Bosch standard N67F821 70)
Tightening torque M_A = 11+3 Nm
Material no. **2910151211**

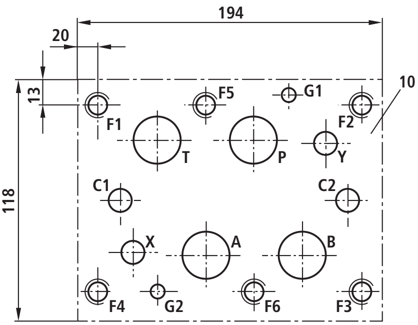
4 cheese-head bolts ISO 4762-M10x50-10.9-N67F821 70
(galvanized in accordance with Bosch standard N67F821 70)
Tightening torque M_A = 50+10 Nm
Material no. **2910151301**

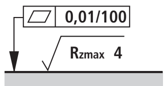
5

Unit dimensions NG25/27 (nominal dimensions in mm)









Required surface quality
of mating component

1 Pilot valve
2 O-ring 9.25 x 1.78 (ports P, A, B, T)
3 On-board electronics
4 Main valve
5 Inductive position transducer (main valve)
6 Nameplate
7 O-ring (ports P, A, B, T)
NG25: 28 x 3
NG27: 34.6 x 2.62
8 O-ring 15 x 2.5 (ports X, Y, C1, C2)
9 Plug-in connector not included in delivery (order separately)

10 Machined valve contact surface, mounting hole configuration according to ISO 4401-08-08-0-05
Deviates from standard:
NG25: Ports P, A, B, T Ø 25 mm
NG27: Ports P, A, B, T Ø 32 mm
Minimum thread depth: Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

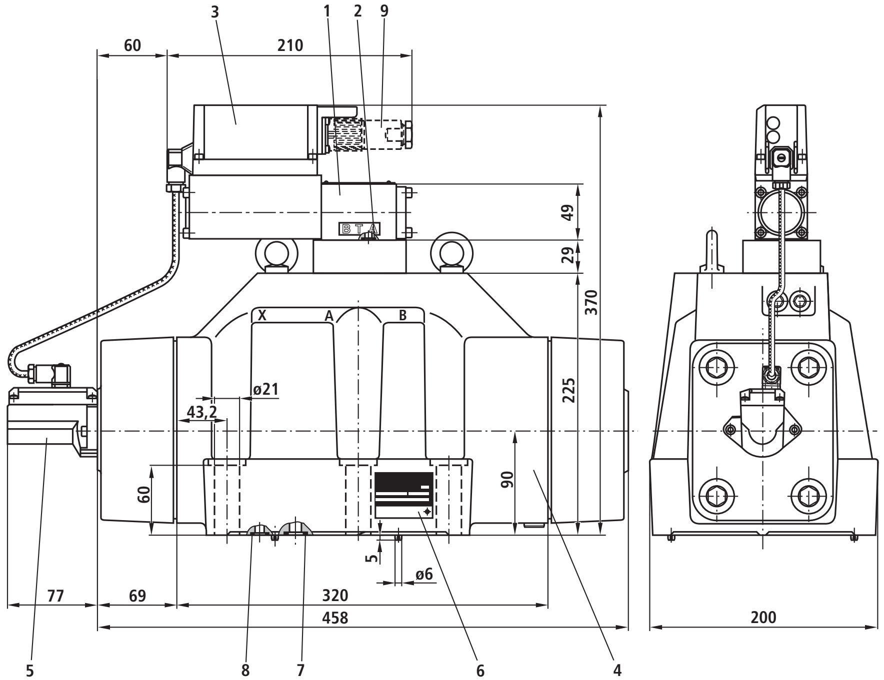
Subplates, see Technical Data Sheet RE 45059

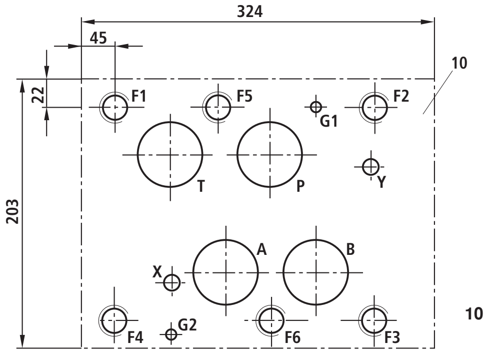
Valve fastening bolts (order separately)
The following valve fastening bolts are recommended:

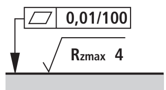
6 cheese-head bolts ISO 4762-M12x60-10.9-N67F821 70
(galvanized in accordance with Bosch standard N67F821 70)
Tightening torque NG25 M_A = 90+30 Nm,
NG27 M_A = 90±15 Nm

Material no. **2910151354**

Unit dimensions NG35 (nominal dimensions in mm)







Required surface quality of mating component

5

1 Pilot valve

2 O-ring 9.25 x 1.78 (ports P, A, B, T)

3 On-board electronics

4 Main valve

5 Inductive position transducer (main valve)

6 Nameplate

7 O-ring 53.57 x 3.53 (ports P, A, B, T)

8 O-ring 15 x 2.5 (ports X, Y)

9 Plug-in connector not included in delivery (order separately)

10 Machined valve contact surface, mounting hole configuration according to ISO 4401-10-09-0-05
Deviates from standard:
Ports P, A, B, T Ø 48 mm
Minimum thread depth: Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø

Subplates, see Technical Data Sheet RE 45060

Valve fastening bolts (order separately)
The following valve fastening bolts are recommended:

6 cheese-head bolts ISO 4762-M20x90-10.9-N67F821 70
(galvanized in accordance with Bosch standard N67F821 70)
Tightening torque M_A = 450+110 Nm

Material no. **2910151532**

Notes

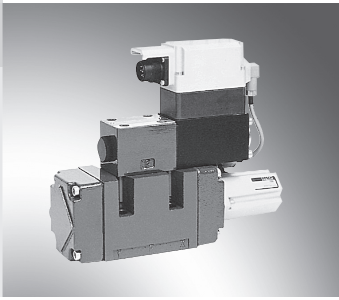
Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Telefon +49 (0) 93 52 / 18-0
Telefax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

4/3 directional control valve, pilot operated, with electric position feedback and integrated electronics (OBE)

RE 29077/03.10
Replaces: 01.09

Type 4WRVE 10...27, symbols V, V1

Sizes 10, 16, 25, 27
Component series 2X
Maximum operating pressure P, A, B 350 bar (size 27: 280 bar)
Rated flow 40...430 l/min (Δp = 10 bar)



Type 4WRVE 10

Table of contents

Information on available spare parts:
www.boschrexroth.com/spc

Features

– Pilot operated high-response 4/3 directional control valve size 10 to size 27, with control spool and bushing in servo quality
– Integrated electronics (OBE) with position controller for pilot control and main stage, calibrated in the factory
– Main stage in servo quality with position feedback
– Flow characteristics
  • M = progressive with fine control edge
  • P = inflected characteristic curve
  • L = linear
– Electric port 11P+PE
  Differential amplifier signal input with interface B5 ±10 V

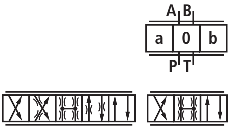
Ordering code

4WRV	E				–2X/	G24		K0/	B5	M	*

with **integrated** electronics **= E**

Size **= 10**
= 16
= 25
= 27 1)

Control spool symbols
4/3 directional design



= V, V1

For V1:
P → A: q_V B → T: $q_V/2$
P → B: $q_V/2$ A → T: q_V

Rated flow
at 10 bar valve pressure differential
(5 bar/control edge)

Size 10
40 l/min 2) **= 40**
55 l/min 3) **= 55**
70 l/min 2) **= 70**
85 l/min 3) **= 85**

Size 16
90 l/min 2) **= 90**
120 l/min 3) **= 120**
150 l/min 2) **= 150**
200 l/min 3) **= 200**

Size 25
300 l/min 2) **= 300**
370 l/min 3) **= 370**

Size 27
430 l/min 1) 3) **= 430**

1) Size 27 is the high-flow version of size 25, the connection bores P, A, B, T are designed with Ø32 mm in the main stage. In the manifold, ports P, A, B, T can be drilled with max. Ø30 mm in deviation from standard ISO 4401-08-08-0-05. Thus, the valves allow for higher flow values $Q_A : Q_B$

2) Q_N: Flow characteristics "P"

3) Q_N: Flow characteristics "M" or "L"

Further details in the plain text

Seal material
M = NBR seals suitable for mineral oils (HL, HLP) according to DIN 51524

Interface of the control electronics
B5 = Command value input ±10 V

Electrical connection
K0 = **without** mating connector, with unit connector according to DIN 43563-AM6
Mating connector – separate order

Pilot oil supply "x", pilot oil return "y"

No code =	"x" = external,	"y" =external
E =	"x" = internal,	"y" =external
ET =	"x" = internal,	"y" = internal
T =	"x" = external,	"y" = internal

Supply voltage of the electronics
G24 = +24 V direct current

2X = Component series 20 to 29
(unchanged installation and connection dimensions)

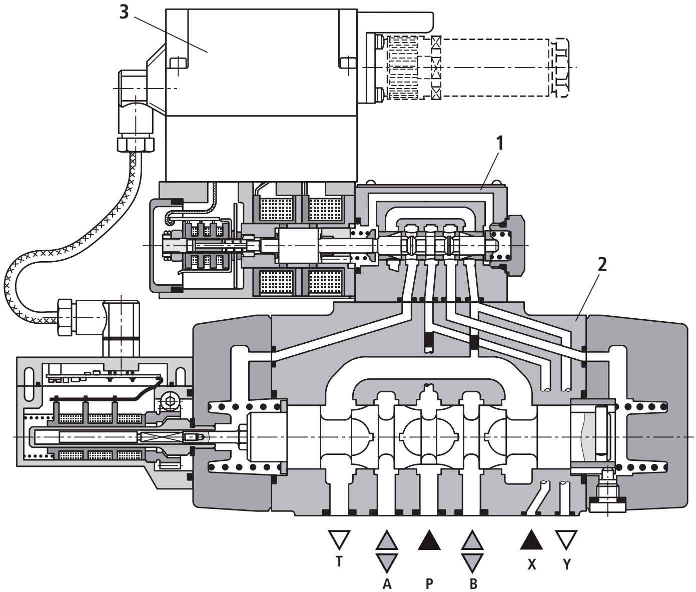
Flow characteristics
M = Progressive with linear fine control (up to 20 %)
P = Inflected characteristic curve, linear (inflection at 40 %)
L = Linear

Function, section

Structure

The valve consists of 3 main assemblies:

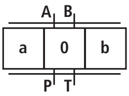
– Pilot control valve (1) with control spool and bushing, return springs, double stroke solenoid and inductive position transducer
– Main stage (2) with centering springs and position feedback
– Integrated control electronics (3)

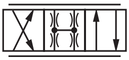


Functional description

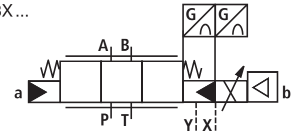
In the integrated electronics, the specified command value is compared with the actual position value of the main stage control spool. In case of control deviations, the double stroke solenoid is activated which adjusts the pilot control spool due to the changed magnetic force. The flow released through the control cross-sections causes the displacement of the main control spool, the stroke/control cross-section of which is controlled proportionally to the command value. If the command value is 0 V, the electronic controls the control spool of the main stage in the center position.
The pilot control valve is supplied with the pilot oil either internally through port P or externally through port X. The return to the tank can be implemented internally via port T or externally via port Y.
If deactivated or in case of no release, the pilot control valve is undefined in P-B/A-T (preferred) or P-A/B-T, the main stage can be completely controlled.

Symbols

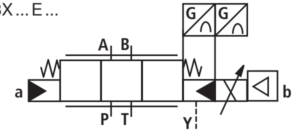




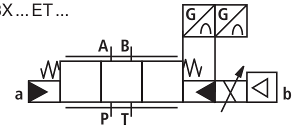
Type ... –3X ...



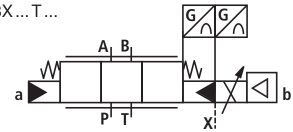
Type ... –3X ... E ...



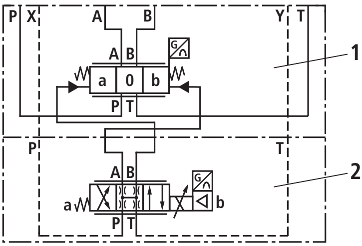
Type ... –3X ... ET ...



Type ... –3X ... T ...



Symbol, detailed
(pilot oil supply and pilot oil drain external)



1 Main valve
2 Pilot control valve

Test and service devices

– Type VT-VETSY-1 service case with test device, see RE 29685
– Measuring adapter 11P+PE type VT-PA-1, see RE 30067

Technical data

general						
Type			Spool valve, pilot operated			
Actuation			Directional control valve size 6 - OBE, with position controller for pilot control valve and main stage			
Type of connection			Subplate mounting, porting pattern according to ISO 4401-...			
Installation position			Any			
Ambient temperature range		°C	–20...+50			
Weight		kg	**Size 10** 8.0	**Size 16** 10.4	**Size 25** 18.2	**Size 27** 18.2
Vibration resistance, test condition			Max. 25 *g*, room vibration test in all directions (24 h)			
hydraulic (measured with HLP 46, ϑ_{oil} = 40 °C ±5 °C)						
Hydraulic fluid			Hydraulic oil according to DIN 51524…535, other media upon request			
Viscosity range	recommended	mm²/s	20...100			
	max admissible	mm²/s	10...800			
Hydraulic fluid temperature range		°C	–20...+65			
Maximum admissible degree of contamination of the hydraulic fluid cleanliness class according to ISO 4406 (c)			Class 18/16/13 [1)]			
Flow direction			According to symbol			
Rated flow at Δp = 5 bar per edge [2)]			**Size 10**	**Size 16**	**Size 25**	**Size 27**
		l/min	40, 55, 70, 85	90, 120, 150, 200	300, 370	430
Max. operating pressure	Ports P, A, B external pilot oil supply	bar	350	350	350	350
	Ports P, A, B internal pilot oil supply	bar	250			
	Ports T, X, Y	bar	250			
Min. pilot oil pressure "pilot control stage"		bar	10			
Q_{max}		l/min	170	450	900	1000
Q_N pilot control valve		l/min	8	24	40	40
Zero flow pilot control valve at 100 bar		cm³/min	<180	<300	<500	<500
Zero flow main stage at 100 bar		cm³/min	<400, <600	<1000	<1000	<1000
static / dynamic						
Hysteresis		%	<0.1 hardly measurable			
Manufacturing tolerance Q_{max}		%	< 10			
Actuating time for signal step (at X = 100 bar)	0...100%		12	15	23	23
	0...10%		6	7	10	10
Actuating time for signal step (at X = 10 bar)	0...100%		40	50	90	90
	0...10%		20	20	30	30
Switch-off behavior			after electrical shut-off: Pilot control valve not defined in P-B/A-T or P-A/B-T, main stage can be completely controlled (PB/AT or PA/BT)			
Temperature drift			Zero shift <1% at ΔT = 40 °C			
Zero compensation			ex factory ±1%			

1) The cleanliness classes specified for the components must be complied with in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components. For the selection of the filters, see technical data sheets RE 50070, RE 50076 and RE 50081.

2) Flow with different Δp $Q_x = Q_{nom} \cdot \sqrt{\frac{\Delta p_x}{5}}$

5

Technical data

electric, control electronics integrated in the valve			
Relative duty cycle	%	100 ED, max. power consumption 30 VA (24 V=)	
Protection class		IP 65 according to DIN 40050	
Port		Plug-in connector, 11P+PE	Data
Supply 24 V=$_{nom}$ 1)	2)	$\boxed{1}$ $\boxed{2}$	+24 V=$_{nom}$, fuse protection 2.5 A_F (output stages) 0 V power ground
	3)	$\boxed{9}$ $\boxed{10}$	+24 V=$_{nom}$ Signal part 0 V Signal ground
Input signal ±10 V	4)	$\boxed{4}$ $\boxed{5}$	U_{IN} $\overline{U_{IN}}$ } Differential amplifier, R_i = 100 kΩ
Actual value signal (LVDT)		$\boxed{6}$ $\boxed{7}$	±10 V=, R_a = 1 kΩ 0 V, reference point
Release input		$\boxed{3}$	>8.5 V to 24 V=$_{nom}$ (max. 40 V=) R_i = 10 kΩ
Messages	5)	$\boxed{8}$ $\boxed{11}$	Acknowledgement release +24 V= Error message: no error +24 V=
Protective earthing conductor		⏚	Connect only if 24 V = system transformer does not comply with standard VDE 0551
Electromagnetic compatibility tested according to		EN 61000-6-2: 2005-08 EN 61000-6-3: 2007-01	

1) 24 V=$_{nom}$ – min. 21 V=
– max. 40 V=

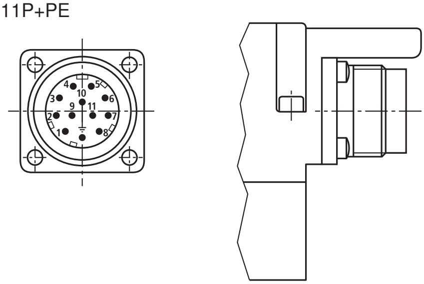
2) U_B (pin 1) = output stage supply
– valve "OFF" <13.4 V=
– valve "ON" >16.8 V=
no error message (pin 11)

3) U_S (pin 9) = electronics supply
– valve "OFF" <16.8 V=
error message (pin 11)
– valve "ON" >19.5 V=
no error message (pin 11)

4) inputs: voltage resistant up to max. 50 V

5) Messages are loadable with max. 20 mA and short-circuit proof against ground

11P+PE

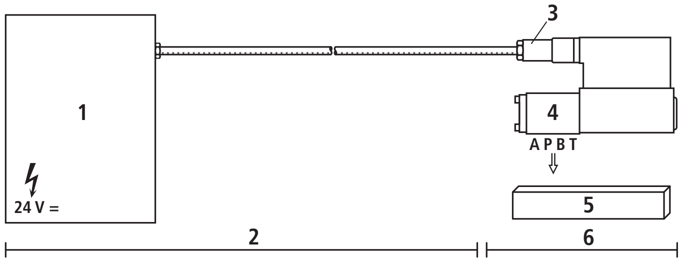


Note

Pilot operated 4/3 directional control valves fulfill their function only in active closed control loops and do not have a secured basic position when deactivated. Therefore, "additional isolator valves" are required in many applications and must be taken into account for the On/Off series.

Electrical connection

Electric data, see page 6



1 Control
2 Provided by the customer
3 Mating connector
4 Valve
5 Contact surface
6 Provided by Rexroth

Technical notes for the cable

Version:
- Multi-wire cable
- Litz wire structure, very fine wires according to VDE 0295, class 6
- Protective earthing conductor, green-yellow
- Cu shield braid

Type:
- e.g. Oilflex-FD 855 CP (company Lappkabel)

Number of wires:
- Depends on the valve type, connector type and signal assignment

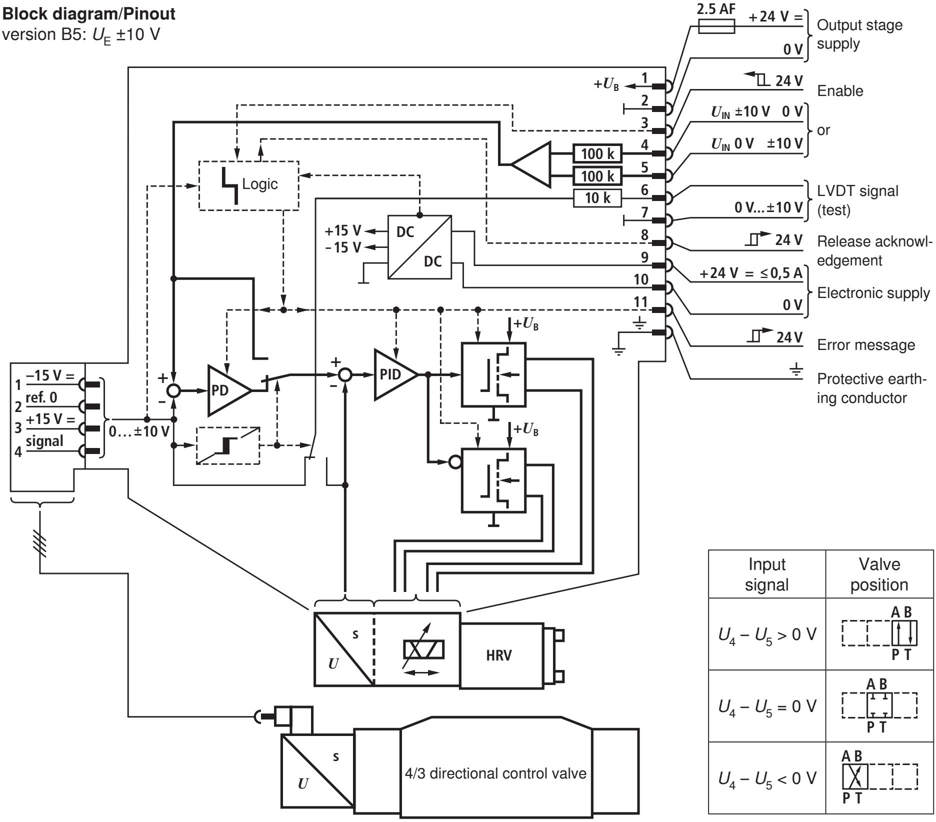
Line Ø:
- 0.75 mm^2 up to a length of 20 m
  1.0 mm^2 up to a length of 40 m

Outer Ø:
- 9.4...11.8 mm – Pg11
  12.7...13.5 mm – Pg16

Note
Electric signals taken out via control electronics (e.g. actual value) must not be used for the deactivation of safety-relevant machine functions!
(See also the European standard "Safety requirements for fluid power systems and their components - Hydraulics", EN 982!)

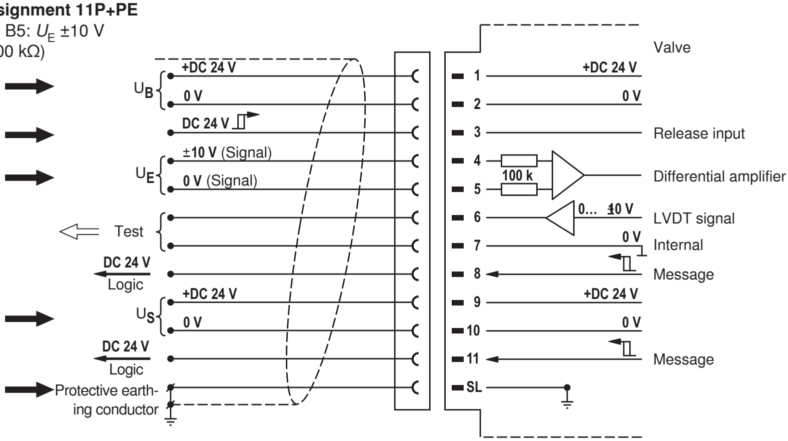
Integrated electronics

Block diagram/Pinout
version B5: U_E ±10 V



Input signal	Valve position
$U_4 - U_5 > 0$ V	A B / P T
$U_4 - U_5 = 0$ V	A B / P T
$U_4 - U_5 < 0$ V	A B / P T

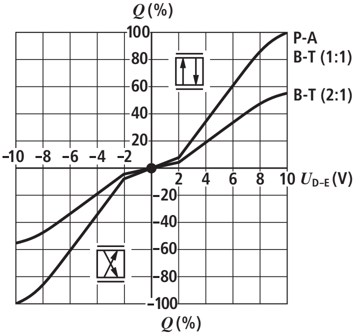
Pin assignment 11P+PE
version B5: U_E ±10 V
(R_i = 100 kΩ)



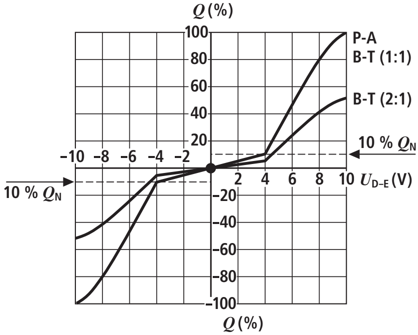
Characteristic curves (measured with HLP 46, ϑ_{Oil} = 40 °C ±5 °C)

Flow – signal function $Q = f\ (U_E)$

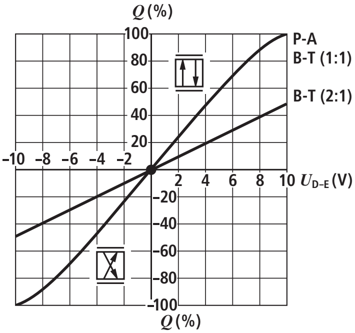
Flow characteristics M



Flow characteristics P



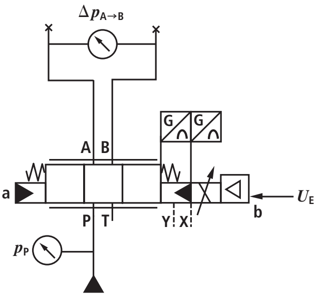
Flow characteristics L

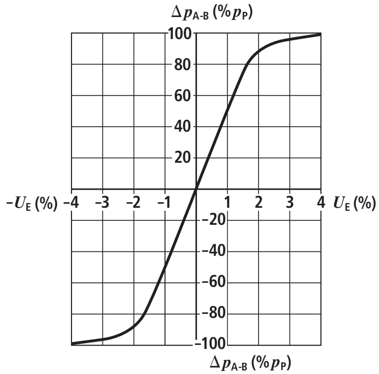


5

Characteristic curves (measured with HLP 46, ϑ_{Oil} = 40 °C ±5 °C)

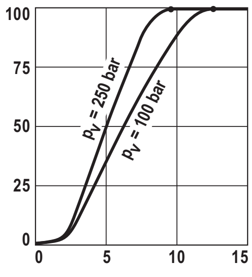
Pressure gain $\Delta = f\,(U_E)$



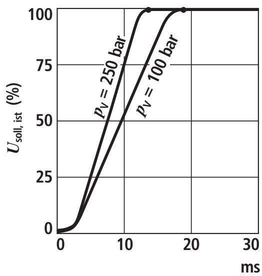


Step function 0 → 100 %

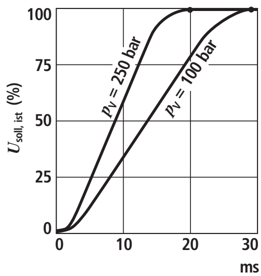
Size 10



Size 16



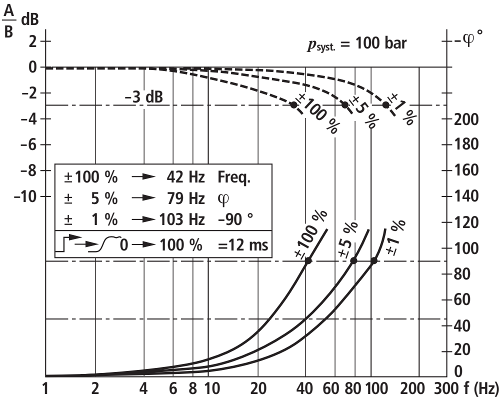
Size 25/27



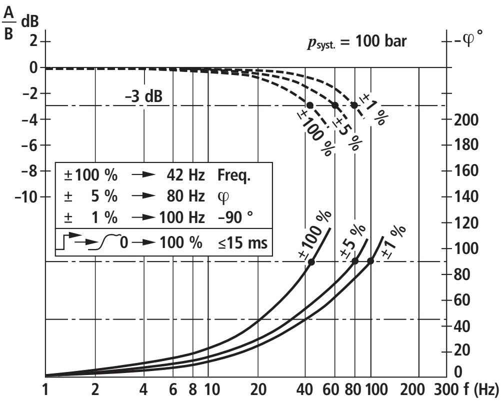
Characteristic curves (measured with HLP 46, ϑ_{Oil} = 40 °C ±5 °C)

Bode diagram

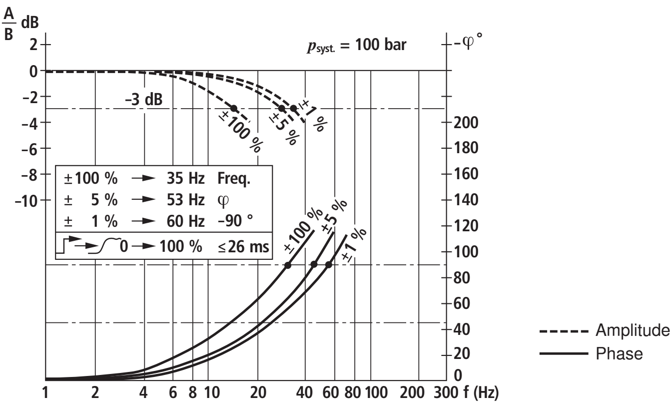
Size 10



Size 16

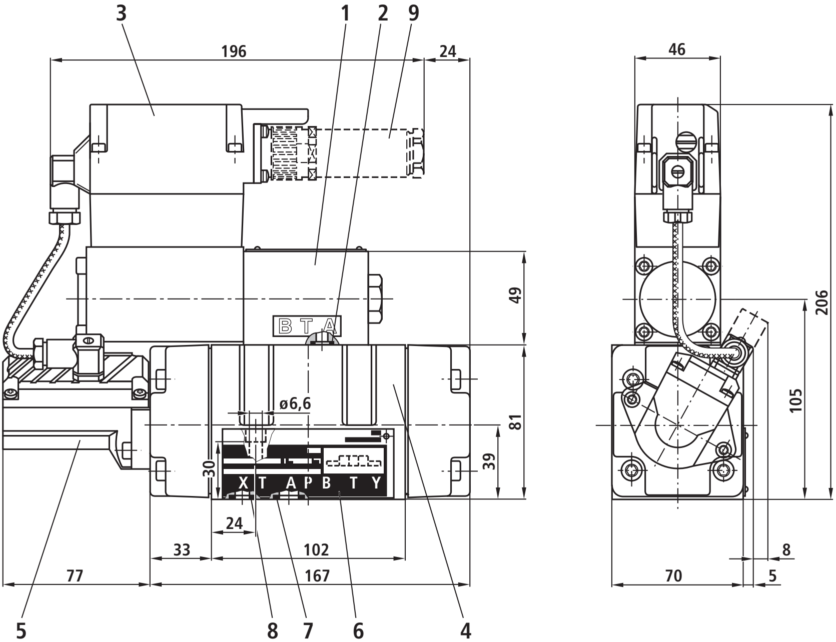


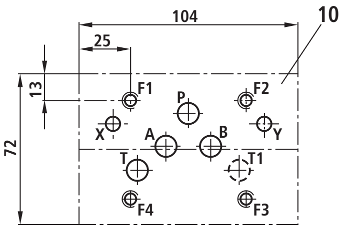
Size 25/27

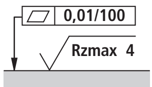


5

Unit dimensions size 10 (dimensions in mm)







Required surface quality
of the valve mounting face

1 Pilot control valve
2 O-ring 9.25x1.78 (ports P, A, B, T)
3 Integrated electronics
4 Main valve
5 Inductive position transducer (main valve)
6 Name plate
7 O-ring 12x2 (ports P, A, B, T, T1)
8 O-ring 10x2 (ports X, Y)
9 Mating connector not included in the scope of delivery, see technical data sheet RE 08008 (separate order)

10 Machined valve mounting face, porting pattern according to ISO 4401-05-05-0-05

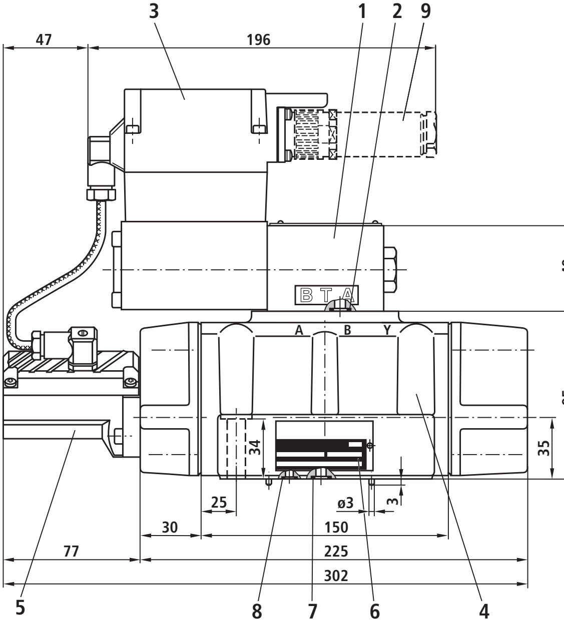
Deviating from the standard:
ports P, A, B, T, T1 Ø 10.5 mm

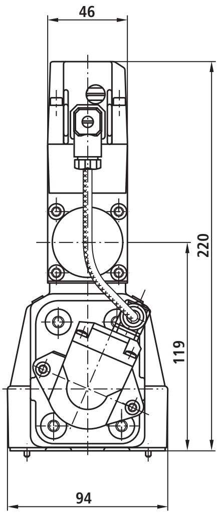
Subplates, see technical data sheet RE 45055 (separate order)

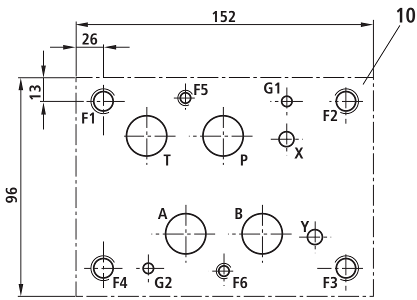
Valve mounting screws (separate order)
The following valve mounting screws are recommended:

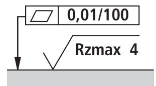
4 hexagon socket head cap screws
ISO 4762-M6x40-10.9-N67F821 70
(galvanized according to Bosch standard N67F821 70)
tightening torque M_A = 11+3 Nm
Mat. no. 2910151209

Unit dimensions size 16 (dimensions in mm)









Required surface quality of the valve mounting face

1 Pilot control valve
2 O-ring 9.25x1.78 (ports P, A, B, T)
3 Integrated electronics
4 Main valve
5 Inductive position transducer (main valve)
6 Name plate
7 O-ring 23x2.5 (ports P, A, B, T)
8 O-ring 9x2 (ports X, Y)
9 Mating connector not included in the scope of delivery, see technical data sheet RE 08008 (separate order)

10 Machined valve mounting face, porting pattern according to ISO 4401-07-07-0-05
Deviating from the standard: ports P, A, B, T Ø 20 mm

Subplates, see technical data sheet RE 45057 (separate order)

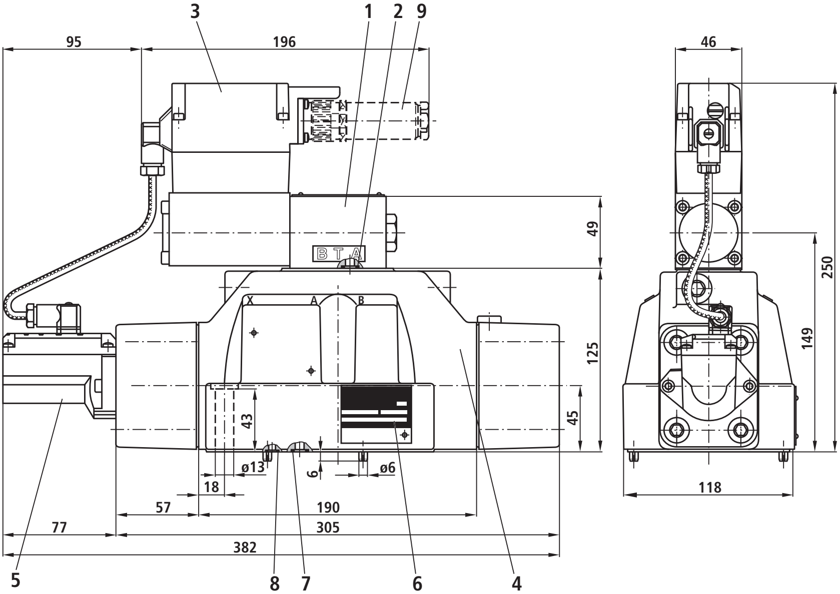
Valve mounting screws (separate order)
The following valve mounting screws are recommended:

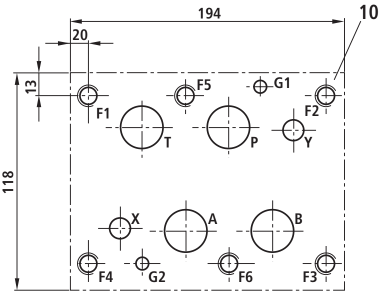
2 hexagon socket head cap screws
ISO 4762-M6x45-10.9-N67F821 70
(galvanized according to Bosch standard N67F821 70)
tightening torque M_A = 11+3 Nm
Mat. no. 2910151211

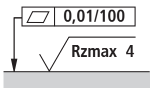
4 hexagon socket head cap screws
ISO 4762-M6x40-10.9-N67F821 70
(galvanized according to Bosch standard N67F821 70)
tightening torque M_A = 50+10 Nm
Mat. no. 2910151301

5

Unit dimensions size 25/27 (dimensions in mm)







Required surface quality
of the valve mounting face

1 Pilot control valve
2 O-ring 9.25x1.78 (ports P, A, B, T)
3 Integrated electronics
4 Main valve
5 Inductive position transducer (main valve)
6 Name plate
7 O-ring (ports P, A, B, T)
Size 25: 28x3
Size 27: 34.6x2.62
8 O-ring 15x2.5 (ports X, Y)
9 Mating connector not included in the scope of delivery, see technical data sheet RE 08008 (separate order)
10 Machined valve mounting face, porting pattern according to ISO 4401-08-08-0-05
Deviating from the standard:
size 25: Ports P, A, B, T Ø 25 mm
size 27: Ports P, A, B, T Ø 32 mm

Subplates, see technical data sheet RE 45059 (separate order)

Valve mounting screws (separate order)
The following valve mounting screws are recommended:

6 hexagon socket head cap screws
ISO 4762-M12x60-10.9-N67F821 70
(galvanized according to Bosch standard N67F821 70)
tightening torquesize 25 M_A = 90+30 Nm,
size 27 M_A = 90±15 Nm

Mat. no. 2910151354

Notes

Notes

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

Rexroth
Bosch Group

RE 29 070/02.03

Replaces: 12.98

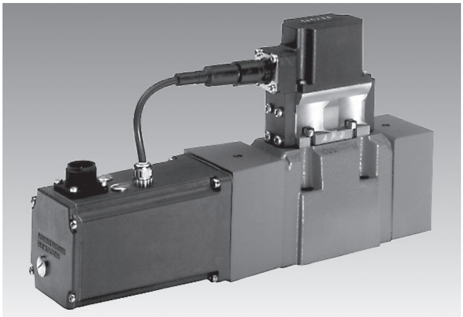
4/3-way fast response valve Type 4WRGE

Nom. size 10 – max. operating pressure 315 bar

Nom. sizes 16, 25 – max. operating pressure 350 bar

Series 1X

Maximum flow 870 L/min



H/A 5268/95

Type 4WRGE 10…L-1X/315G24..K31...

Overview of contents

Features

– Pilot operated 2-stage fast response valve with electrical closed loop position control of main spool and integrated open and closed loop control electronics

– Suitable for closed loop position, speed, pressure and force closed loop control, with simultaneous high demands on the dynamics in the small signal range and on the response sensitivity

– Pilot control valve:
Single-stage servo valve to the orifice/flapper principle

– Position acquisition of main spool via an inductive position transducer

– High response sensitivity and low hysteresis

– Easily exchangeable filter element

– Integrated control electronics using SMD technology, output stage in thick layer hybrid technology, external zero point correction possible

– For subplate mounting:
Porting pattern to DIN 24 340 form A
Subplates to catalogue sheets RE 45 054 to 45 058 (separate order), see pages 13 to 15

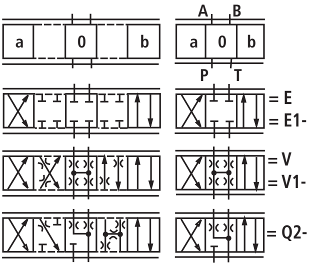
Ordering details

4WRGE				L	– 1X /	315	G24		K31/			*

Electrically operated 2-stage fast response directional control valve of 4-way design with servo valve pilot control and integrated control electronics

Nominal size 10	**= 10**
Nominal size 16	**= 16**
Nominal size 25	**= 25**

Symbols



With symbol E1-, V1-:

P → A: q_V B → T: $q_V/2$

P → B: $q_V/2$ A → T: q_V

Note:

With the spools E and E1 there is an overlap of 15 % in the zero position, with the spools V and V1 an overlap from 0 to 0.5 %.

Further details in clear text

M = [1] NBR seals
V = FKM seals

No code = Without sandwich plate directional valve
WG152 = With sandwich plate directional valve 24 V with component plug DIN 43 650-AM2, **Without** plug-in connector
Plug-in connector – separate order, see page 6

A1 = Command value input ± 10 VDC
C1 = Command value input ± 10 mA

Electrical connections

K31 = With component plug to E DIN 43 563-AM6-3, **Without** plug-in connector, Plug-in connector – separate order, see page 6

Pilot oil supply and drain

No code = Pilot oil supply, external, Pilot oil drain, external
E = Pilot oil supply, internal, Pilot oil drain, external
ET = Pilot oil supply, internal, Pilot oil drain, internal
T = Pilot oil supply, external, Pilot oil drain, internal

G24 = Supply voltage 24VDC

Pilot pressure

315 = 10 to 315 bar

1X = Series 10 to 19
(10 to 19: unchanged installation and connection dimensions)

Characteristic curve form

L = Linear

Nominal flow in L/min at 10 bar valve pressure differential

50 =	or	**100 =**	with nominal size 10
125 =	or	**200 =**	with nominal size 16
250 =	or	**350 =**	with nominal size 25

[1] Suitable for mineral oil to DIN 51 524

Preferred types

NS 10

Material no.	Type
00954120	4WRGE 10 V50L-1X/315G24ETK31/A1M
00954151	4WRGE 10 V50L-1X/315G24K31/A1M
00954152	4WRGE 10 V1-50L-1X/315G24K31/A1M
00916455	4WRGE 10 V1-50L-1X/315G24ETK31/A1M
00954153	4WRGE 10 V1-100L-1X/315G24K31/A1M

NS 16

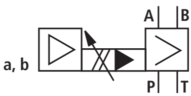
Material no.	Type
00954154	4WRGE 16 V125L-1X/315G24ETK31/A1M
00954155	4WRGE 16 V200L-1X/315G24ETK31/A1M
00954156	4WRGE 16 V200L-1X/315G24K31/A1M
00954157	4WRGE 16 V1-200L-1X/315G24ETK31/A1M
00954158	4WRGE 16 V1-200L-1X/315G24K31/A1M

NS 25

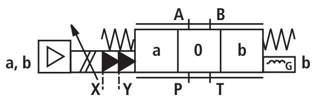
Material no.	Type
00954159	4WRGE 25 V250L-1X/315G24ETK31/A1M
00954160	4WRGE 25 V350L-1X/315G24ETK31/A1M
00954161	4WRGE 25 V350L-1X/315G24K31/A1M
00954162	4WRGE 25 V1-350L-1X/315G24ETK31/A1M
00954163	4WRGE 25 V1-350L-1X/315G24K31/A1M

Symbols

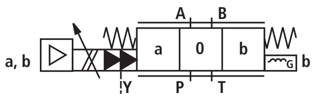
General



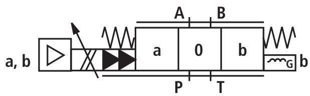
Type 4WRGE…-1X/…



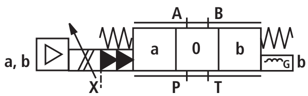
Type 4WRGE…-1X/…E…



Type 4WRGE…-1X/…ET…



Type 4WRGE…-1X/…T…



5

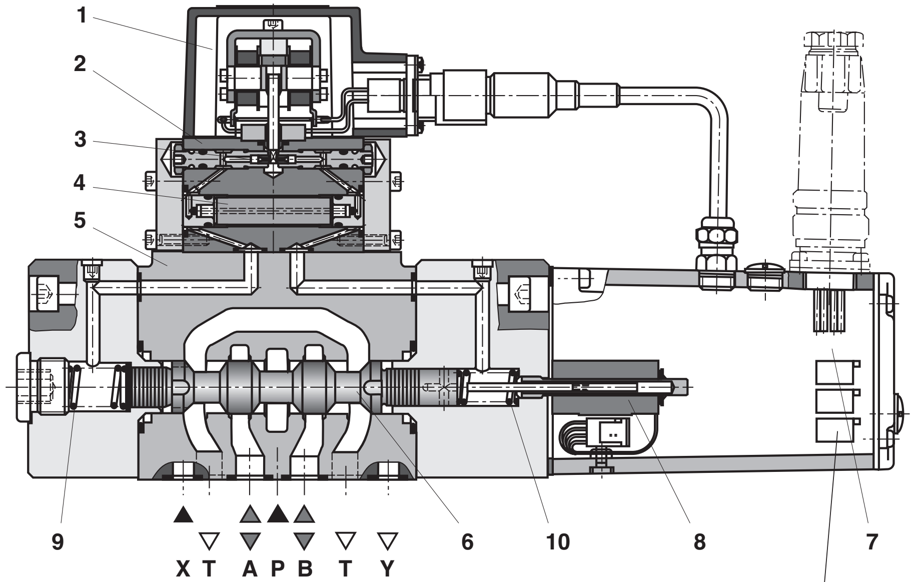
Function, section

The 4/3-way fast response valve is designed for subplate mounting with closed loop position control and integrated control electronics. It infinitely controls the flow proportional to the input signal from P to B and A to T or from P to A and B to T.

Design:

The valve consists of 4 main component groups:

– Low-friction pilot control valve (1) with a 2-gap torque motor; valve housing (2) with orifices (3) and filter (4)
– Housing of main stage (5) with spring centered spool (6)
– Control electronics (7) with amplifier for the control of the pilot control valve (1) and for closed loop position control of the main spool (6)
– Inductive position transducer (8) for position acquisition of the main spool



Type 4WRGE 10…-1X/…K31…

R316 Position transducer zero point

Functional description:

– Actuation of pilot control valve via a command value of 0 to ± 10 V or from 0 to ± 10 mA
– Comparison of the command/actual value in the control electronics → with control deviation the torque motor is operated and the flapper plate is deflected according to the control amplitude.
– Unbalancing of the pilot pressures via the variable and fixed orifices
  → movement of main spool (6)
– Reaching the position of the main spool according to the command value signal → control deviation is reduced to virtually 0 V → control process is completed
– Pilot oil supply to pilot control valve internally via port P or externally via port X. Pilot oil drain internally via port T or externally via Y to tank

⚠ Attention!

When the supply voltage fails but operating pressure remains available, the main spool (6) moves into an undefined position. The occuring accelerations may cause damage to the machinery.

By using a sandwich plate directional valve (see pages 12 to 14) both pilot lines in the main stage are short circuited when a power failure occurs.

With spool types E, E1 and Q2 the centering springs (9, 10) centre the main spool (6), V and V1 spools are moved into the preferred direction of P to B and A to T within a tolerance range of 1 % to 11 % of the spool stroke. When the operating pressure fails and sandwich plate directional valves are not used the same characteristics apply.

Technical data (for applications outside these parameters, please consult us!)

General			**NS 10**	**NS 16**	**NS 25**
Installation			optional, preferably horizontal (commissioning guidelines see RE 07 700)		
Ambient temperature range		°C	– 20 to + 50		
Storage temperature range		°C	– 20 to + 80		
Weight		kg	8.0	9.8	18.0

Hydraulic (measured at p = 100 bar, ν = 32 mm²/s, ϑ = 40°C)

Oper. pressure: Pilot control valve, pilot oil supply		bar	10 to 315		
Main valve, ports P, A, B		bar	up to 315	up to 350	up to 350
Return pressure: Port T	Pilot oil drain, internal	bar	pressure peaks < 100 permissible		
	Pilot oil drain, external	bar	up to 315	up to 250	up to 250
Port Y		bar	pressure peaks < 100 permissible		
Nominal flow $q_{V\ nom}$ ± 10 % at Δp = 10 bar [1] [1] Δp = valve pressure differential		L/min	50 100	125 200	250 350
Flow of main spool (max. permissible)		L/min	170	460	870
Stroke of main spool (2-stage)		mm	± 3.5	± 3.5	± 3.5
Pilot flow at ports X or Y with a jump form of input signal from 0 to 100 %		L/min	2.0	2.0	2.0
Pressure fluid			mineral oil (HL, HLP) to DIN 51 524 further pressure fluids on request!		
Filter rating of the pilot control valve			100 µm absolute		
Degree of contamination			max. permissible degree of contamination of the pressure fluid is to NAS 1638	A filter with a minimum retention rate of β_X = 75 is recommended	
	Pilot control valve		class 7	x = 5	
	Main valve		class 9	x = 15	
Pressure fluid temperature range		°C	– 20 to 80; preferrably 40 to 50		
Viscosity range		mm²/s	20 to 380; preferrably 30 to 45		
Hysteresis		%	≤ 0.05		
Response sensitivity		%	≤ 0.02		
Reversal span		%	≤ 0.04		

Electrical

Voltage type		DC		
Signal type		analogue		
Zero balance	%	≤ 2		
Zero deflection with alteration of:				
Pressure fluid temperature	%/10 K	< 0.2	< 0.2	< 0.3
Operating pressure	%/100 bar	< 0.02	< 0.04	< 0.04
Return pressure 0 to 10 % from p	%	< 0.01	< 0.02	< 0.02
Valve protection to DIN 40 050		IP 65		
Control electronics		VT 13037 (integrated in valve, see page 7)		

Note: For details regarding the **environmental simualtion test** covering EMC (electro-magnetic compatibility), climate and mechanical loading see RE 29 070-U (declaration regarding environmental compatibility).

5

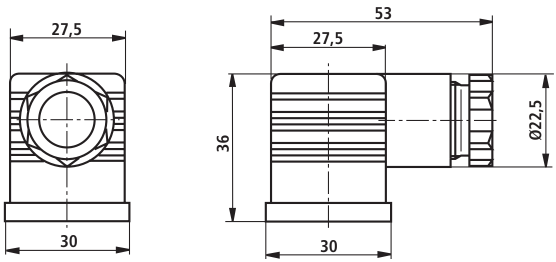
Electrical connections

Sandwich plate directional valve WG 152

Plug-in connector to DIN 43 650 -AF2/Pg11

Separate order under material no. **00074684**

(plastic version)

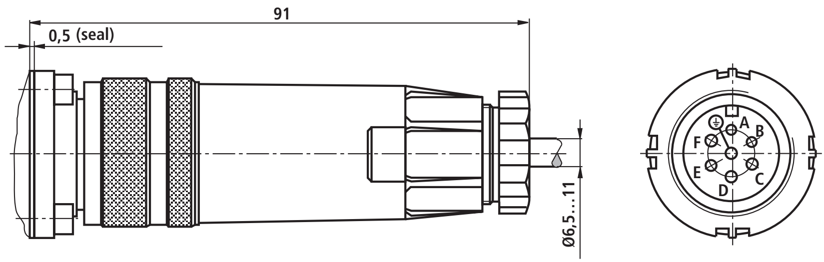


Plug-in connector to E DIN 43 563-BF6-3/Pg11

Separate order under material no. **00021267**

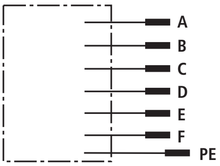
(plastic version)

For pin allocation see block circuit diagram on page 7



Integrated control electronics

Pin allocation, component plug



Integrated control electronics (see below)

	Pin	Signal [1]
Supply voltage	A B	24 VDC (19 to 35 VDC) GND
	C	n.c.
Differential amplifier input	D E	com. value (± 10 V or ± 10 mA) ref. potential [2]
Measurement output	F	act. value (± 10 V or ± 10 mA) against 0 V [3]
Earth	PE	connected to valve housing

[1] Supply voltage + 24 VDC ± 25 %; full bridge rectification with smoothing capacitor 2200 µF; I_{max} = 230 mA

[2] Current input ± 10 mA → input resistance 100 Ω

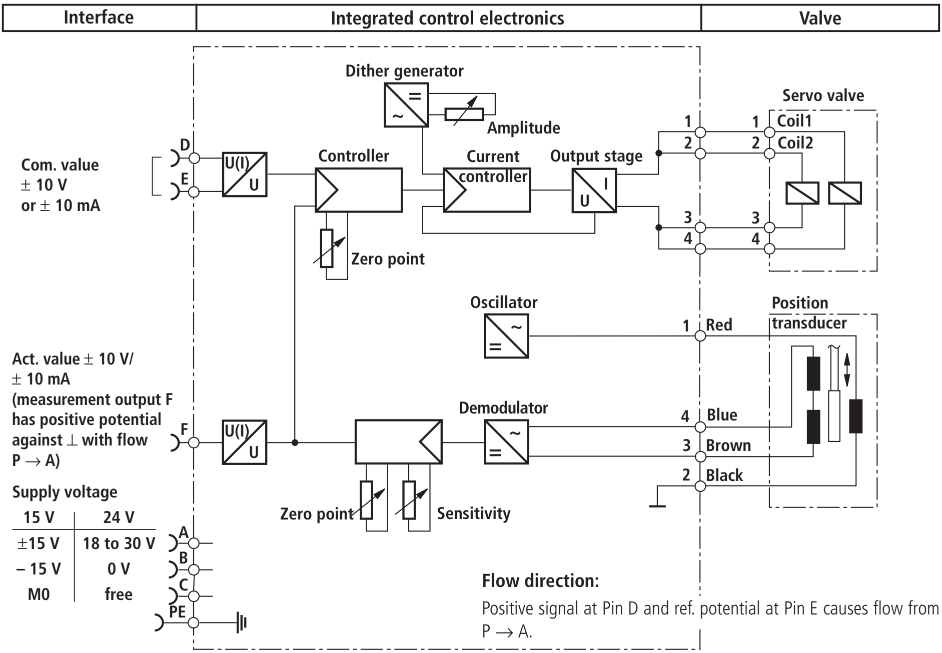
[3] ± 10 mA → max. load resistance 1 kΩ

Command value: Reference potential at E and positive command value at D causes flow from P to A and B to T.
Reference potential at E and negative command value at D causes flow from P to B and A to T.

Connection cable: Recomeded: – up to 25 m cable length type LiYCY 5 x 0.75 mm²
– up to 50 m cable length type LiYCY 5 x 1.0 mm²
External diameter 6.5 to 11 mm
Connect screen to PE on supply side only.

Note: Electrical signals (e.g. actual value) which are transmitted by the valve electronics must not be used to switch off safety related machinery functions! (Please note the „Safety requirements for fluid power operated machinery and parts – hydraulics" according to European standard EN 982!)

Block circuit diagram / Terminal allocation of the integrated control electronics type VT13037



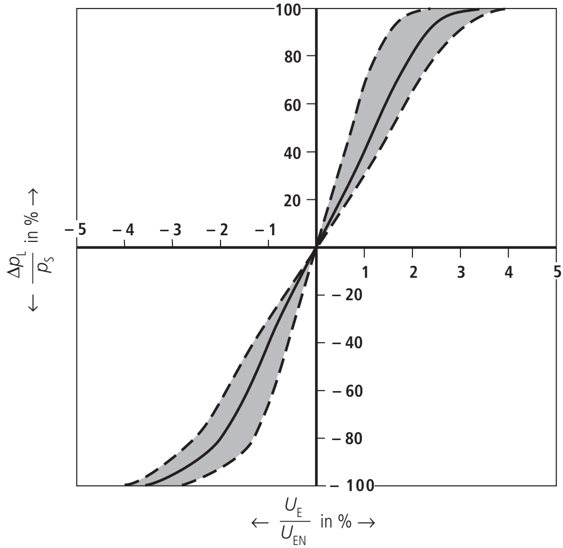
Flow direction:

Positive signal at Pin D and ref. potential at Pin E causes flow from P → A.

5

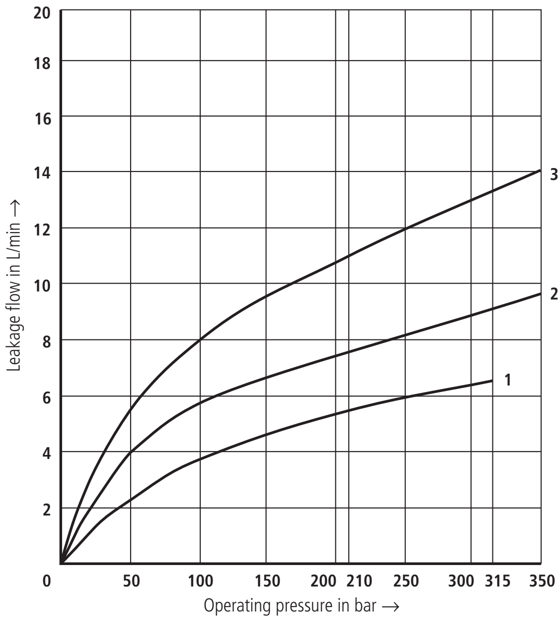
Characteristic curves (measured at ν = 32 mm²/s and ϑ = 40 °C) **All nominal sizes**

Pressure-signal-characteristic curve (V spool)



Characteristic curve measured with a pilot control pressure p_s = 210 bar

Leakage flow 4WRGE…V with pilot control valve in centre position of main spool

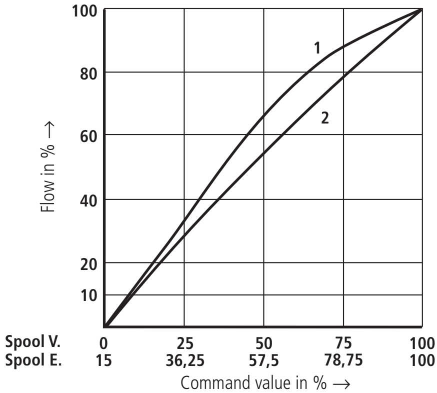


1 = Nominal size 10 (100 L/min)
2 = Nominal size 16 (200 L/min)
3 = Nominal size 25 (350 L/min)

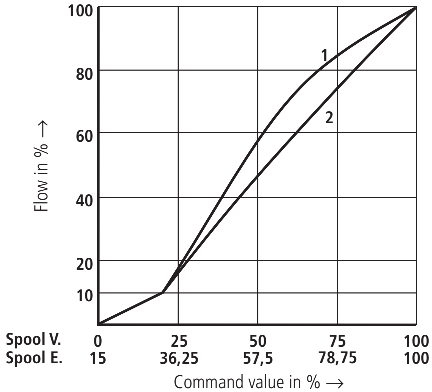
Characteristic curves (measured at Δp = 10 bar or 5 bar per control land)

Spool symbols E. and V.

Spool with characteristic curve **L**

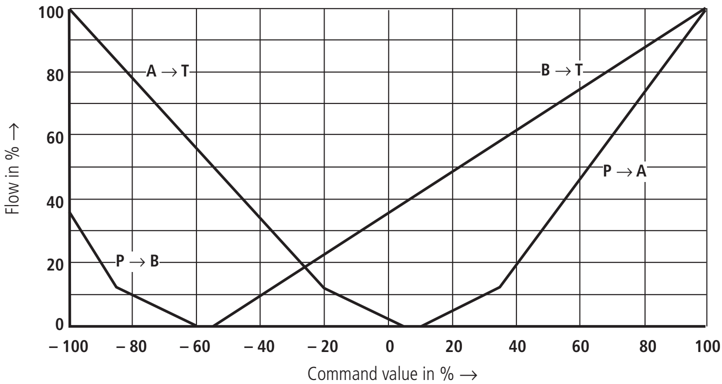


Spool with characteristic curve **P**



1 = Larger nominal flow
2 = Smaller nominal flow

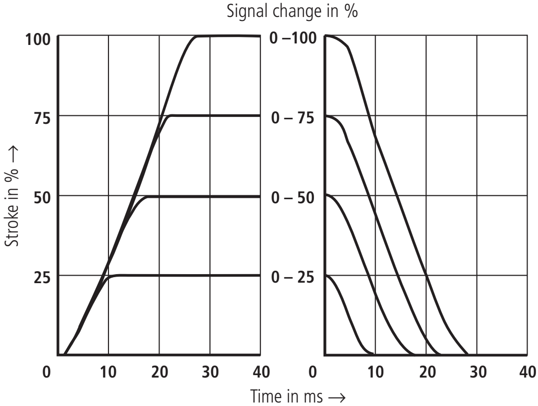
Spool symbol Q2-



5

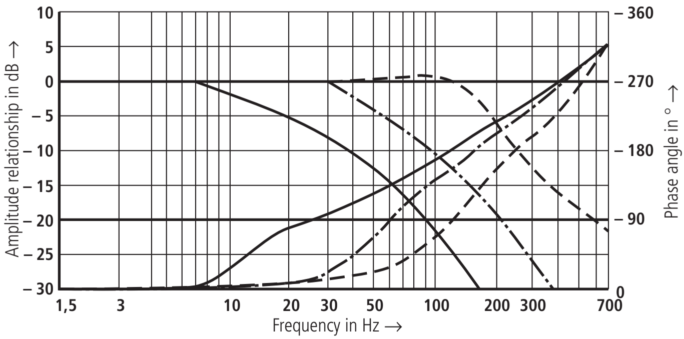
Characteristic curves (measured at ν = 32 mm²/s and ϑ = 40 °C) NS 10

Transient function with a jump form of electrical input signal



Characteristic curve measured with a pilot control pressure p_s = 210 bar

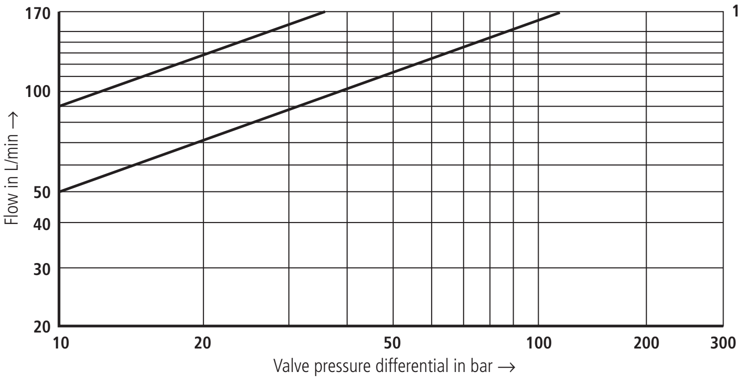
Frequency response characteristic curves



Characteristic curve measured with a pilot control pressure p_s = 210 bar

Signal ± 10 %
Signal ± 25 %
Signal ± 100 %

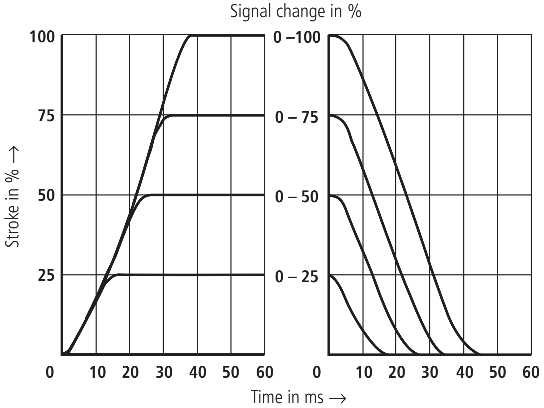
Flow/load function at max. valve opening (tolerance ± 10 %)



1 = Recommended flow limitation

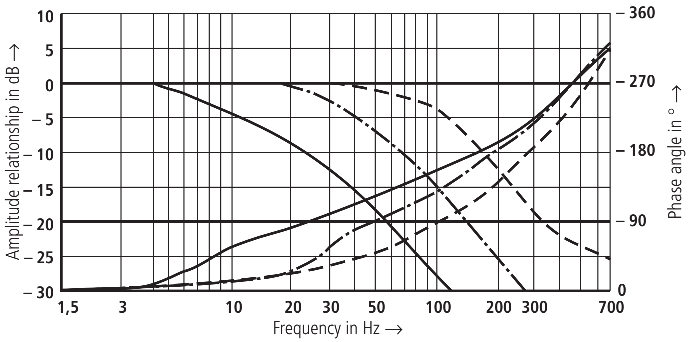
Characteristic curves (measured at $\nu = 32$ mm²/s and $\vartheta = 40$ °C)

Transient function with a jump form of input signal



Characteristic curve measured with a pilot control pressure p_s = 210 bar

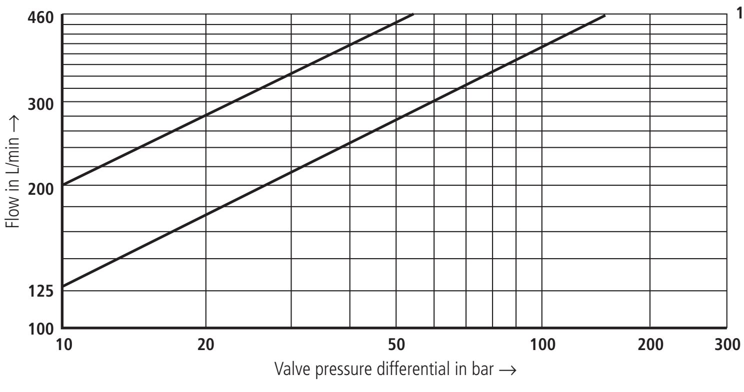
Frequency response characteristic curves



Characteristic curve measured with a pilot control pressure p_s = 210 bar

Signal ± 10 %
Signal ± 25 %
Signal ± 100 %

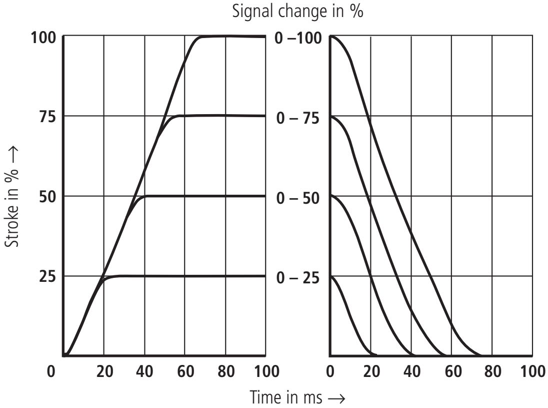
Flow/load function at max. valve opening (tolerance ± 10 %)



1 = Recommended flow limitation

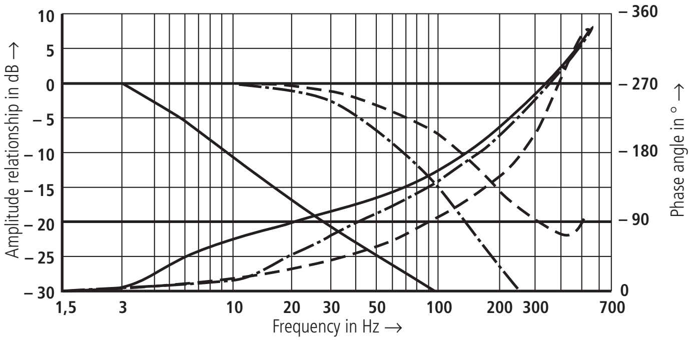
Characteristic curves (measured at $\nu = 32\ mm^2/s$ and $\vartheta = 40\ °C$) NG 25

Transient function with a jump form of electrical input signal



Characteristic curve measured with a pilot control pressure p_s = 210 bar

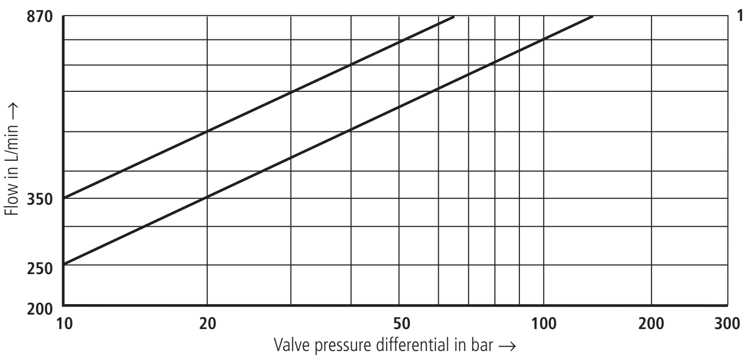
Frequency response characteristic curves



Characteristic curve measured with a pilot control pressure p_s = 210 bar

Signal ± 10 %
Signal ± 25 %
Signal ± 100 %

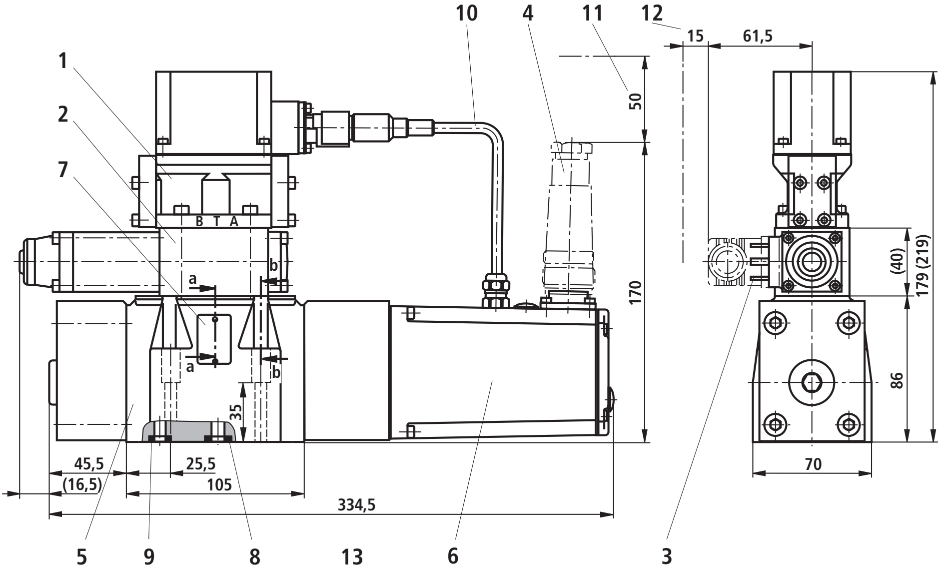
Flow/load function at max. valve opening (tolerance ± 10 %)

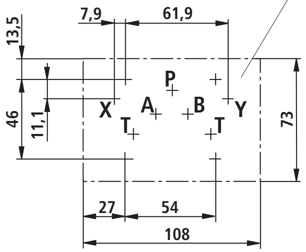


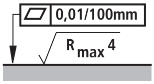
1 = Recommended flow limitation

Unit dimensions: NS 10

(Dimensions in mm)







Required surface finish of mating piece

1 Pilot control valve

2 Sandwich plate directional control valve (only included with ordering detail "…WG152")

3 Plug-in connector to DIN 43 650-AF2/Pg11 (separate order, see page 6)

4 Plug-in connector to E DIN 43 563-BF6-3/Pg11 (separate order, see page 6)

5 Main valve

6 Control electronics and inductive position transducer

7 Name plate

8 R-ring 13 x 1.6 x 2 (ports A, B, P, T)

9 R-ring 11.18 x 1.6 x 1.78 (ports X, Y)

10 Connection cable

11 Space required for connection cable and removal of plug-in connector

12 Space required to remove plug-in connector

13 Valve mounting surface, porting pattern to DIN 24 340 form A (ports X, Y on request)

Subplates to catalogue sheet RE 45 054 and valve fixing screws must be ordered separately.

Subplates: G 534/01 (G 3/4)
G 535/01 (G 3/4) with ports X and Y
G 536/01 (G 1) with ports X and Y

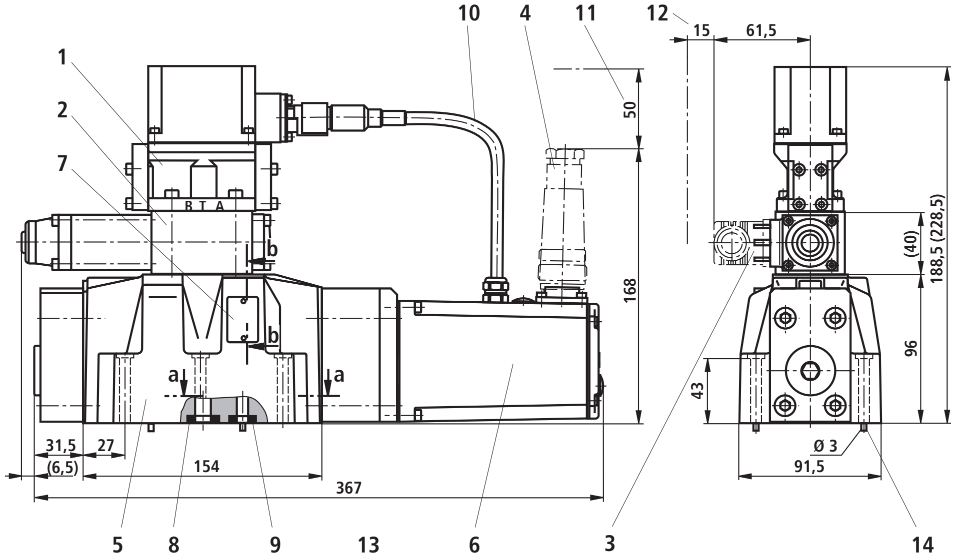
Valve fixing screws:
4 off M6 x 45 DIN 912-10.9; M_A = 15.5 Nm

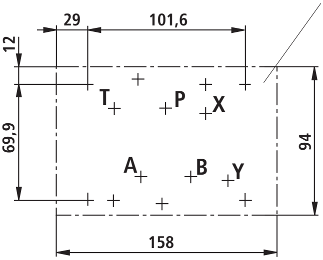
For section details see page 16.

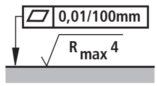
5

Unit dimensions: NS 16

(Dimensions in mm)







Required surface finish of mating piece

1 Pilot control valve

2 Sandwich plate directional control valve (only included with ordering detail "…WG152")

3 Plug-in connector to DIN 43 650-AF2/Pg11 (separate order, see page 6)

4 Plug-in connector to E DIN 43 563-BF6-3/Pg11 (separate order, see page 6)

5 Main valve

6 Control electronics and inductive position transducer

7 Name plate

8 R-ring 22.53 x 2.3 x 2.62 (ports A, B, P, T)

9 R-ring 10 x 2 x 2 (ports X, Y)

10 Connection cable

11 Space required for connection cable and removal of plug-in connector

12 Space required to remove plug-in connector

13 Valve mounting surface, porting pattern to DIN 24 340 form A (ports X, Y on request)

14 Locating pin (2 off)

Subplates to catalogue sheet RE 45 054 and valve fixing screws must be ordered separately.

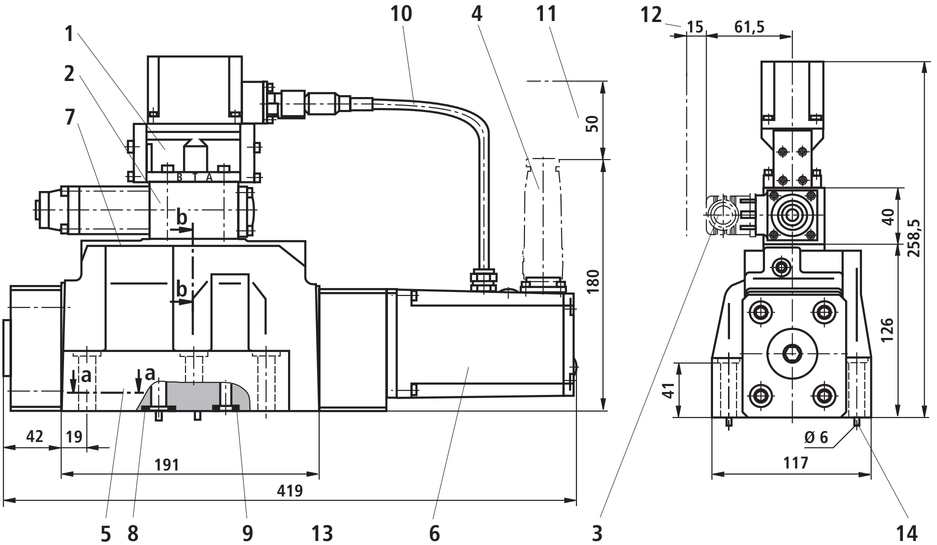
Subplates: G 172/01 (G 3/4)
G 172/02 (M27 x 2)
G 174/01 (G 1)
G 174/02 (M33 x 2)

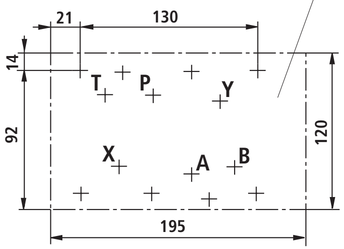
Valve fixing screws:
2 off M6 x 60 DIN 912-10.9; M_A = 15.5 Nm
4 off M10 x 60 DIN 912-10.9; M_A = 75 Nm

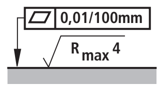
For section details see page 16.

Unit dimensions: NS 25

(Dimensions in mm)







Required surface finish of mating peice

1 Pilot control valve

2 Sandwich plate directional control valve (only included with ordering detail "…WG152")

3 Plug-in connector DIN 43 650-AF2/Pg11 (separate order, see page 6)

4 Plug-in connector to E DIN 43 563-BF6-3/Pg11 (separate order, see page 6)

5 Main valve

6 Control electronics and inductive position transducer

7 Name plate

8 R-ring 27.8 x 2.6 x 3 (ports A, B, P, T)

9 R-ring 19 x 3 x 3 (ports X, Y)

10 Connection cable

11 Space required for connection cable and removal of plug-in connector

12 Space required to remove plug-in connector

13 Valve mounting surface, porting pattern to DIN 24 340 form A (ports X, Y on request)

14 Locating pin (2 off)

Subplates to catalogue sheet RE 45 054 and valve fixing screws must be ordered separately.

Subplates:	G 151/01 (G 1)
	G 154/01 (G 1 1/4)
	G 156/01 (G 1 1/2)

Valve fixing screws:
6 off M12 x 60 DIN 912-10.9; M_A = 130 Nm

For section details see page 16.

5

Pilot oil supply

Type 4WRGE…-1X/… **Pilot oil supply, external**
Pilot oil drain, external

With this version the pilot oil supply is from a separate pilot pressure circuit (external).
The pilot oil drain is not into the T port of the main valve but separately into the tank via port Y (external).

Type 4WRGE…-1X/…E… **Pilot oil supply, internal**
Pilot oil drain, external

With this version the pilot oil supply is from the P port of the main valve (internal).
The pilot oil drain is not into the T port of the main valve but separately into the tank via port Y (external).
Port X must be plugged in the subplate.

Type 4WRGE…-1X/…ET… **Pilot oil supply, internal**
Pilot oil drain, internal

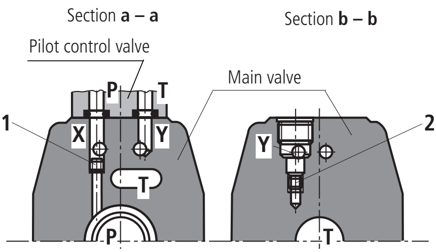
With this version the pilot oil supply is from the P port of the main valve (internal).
The pilot oil drain is directly into the T port of the main valve (internal).
Ports X and Y must be plugged in the subplate.

Type 4WRGE…-1X/…T… **Pilot oil supply, external**
Pilot oil drain, internal

With this version the pilot oil supply is from a separate pilot pressure circuit (external).
The pilot oil drain is directly into the T port of the main valve (internal).
Port Y must be plugged in the subplate.

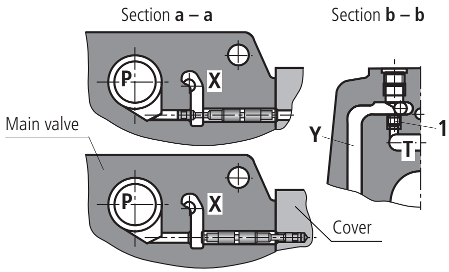
Positions **1** and **2**: Plug M6 DIN 906-8.8 A/F 3

NS 10 For section diagram see page 12



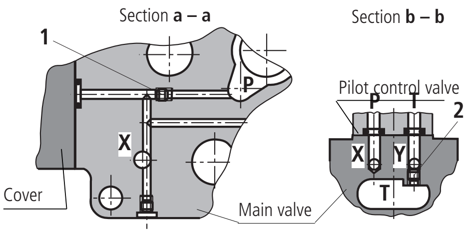
Pilot oil supply	external:	**1**	closed
(section a – a)	internal:	**1**	open
Pilot oil drain	external:	**2**	closed
(section b – b)	internal:	**2**	open

NS 16 For section diagram see page 13



Pilot oil supply	external:	**P**	closed
(section a – a)	internal:	**P**	open
Pilot oil drain	external:	**1**	closed
(section b – b)	internal:	**1**	open

NS 25 For section diagram see page 14



Pilot oil supply	external:	**1**	closed
(section a – a)	internal:	**1**	open
pilot oil drain	external:	**2**	closed
(section b – b)	internal:	**2**	open

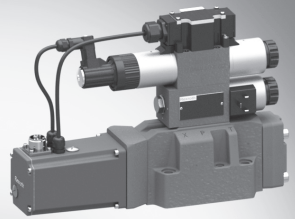
Bosch Rexroth AG
Industrial Hydraulics
D-97813 Lohr am Main
Zum Eisengießer 1 • D-97816 Lohr am Main
Telefon 0 93 52 / 18-0
Telefax 0 93 52 / 18-23 58 • Telex 6 89 418-0
eMail documentation@boschrexroth.de
Internet www.boschrexroth.de

Bosch Rexroth Limited
Cromwell Road, St Neots,
Cambs, PE19 2ES
Tel: 0 14 80/22 32 56
Fax: 0 14 80/21 90 52
E-mail: info@boschrexroth.co.uk

4/3 directional control valves, pilot operated, with electrical position feedback and integrated electronics (OBE)

RE 29083/05.13
Replaces: 09.12

Type 4WRTE



Size 10 to 35
Component series 4X
Maximum operating pressure 350 bar

Table of contents

Features

– Pilot operated 2-stage directional control valve with electrical position feedback of the main control spool and integrated electronics (OBE)
– Suitable for the position, velocity, pressure and force control
– Control of flow direction and size
– Pilot control valve:
Direct operated, position-controlled, with pressure feed back of the pilot pressures
– Main stage:
Self-centering, position-controlled
– Subplate mounting:
Porting pattern according to ISO 4401

Information on available spare parts:
www.boschrexroth.com/spc

Ordering code

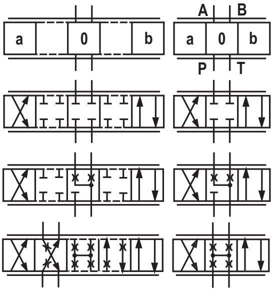
4WRTE				–4X / 6E	G24		K31 /		*

2-stage directional control valve with electrical position feedback and integrated electronics (OBE)

Size

Size 10	**= 10**
Size 16	**= 16**
Size 25	**= 25**
Size 27	**= 27**
Size 32	**= 32**
Size 35	**= 35**

Control spool symbols



= E
= E1

= W6
= W8

= V
= V1

Control spool symbols E1-, W8-, V1-:

P → A : q_V B → T: $q_V/2$
P → B: $q_V/2$ A → T: q_V

Rated flow at valve pressure differential Δp = 10 bar

Size 10

25 l/min [1]	**= 25**
50 l/min [2]	**= 50**
90 l/min	**= 100**

Size 16

125 l/min [3]	**= 125**
150 l/min [4]	**= 150**
180 l/min	**= 200**
220 l/min	**= 220**

Size 25

220 l/min	**= 220**
350 l/min	**= 350**

Size 27

500 l/min	**= 500**

Size 32

400 l/min	**= 400**
600 l/min	**= 600**

Size 35

1000 l/min	**= 1000**

Flow characteristics

L = Linear
P = Linear with fine control range

4X = Component series 40 to 49
(40 to 49: Unchanged installation and connection dimensions)

Pilot control valve

6E = Size 6
Proportional solenoid with detachable coil

Supply voltage

G24 = Direct voltage 24 V

Pilot oil supply and return

no code =	Pilot oil supply external Pilot oil return external
E =	Pilot oil supply internal Pilot oil return external
T =	Pilot oil supply external Pilot oil return internal
ET =	Pilot oil supply internal Pilot oil return internal

Electrical connection

K31 = **Without** mating connector with connector according to DIN EN 175201-804
Mating connector – separate order, see page 21

Electronics interface

A1 = [5] Command value/actual value ±10 V
F1 = Command value/actual value 4 to 20 mA

Seal material

M = NBR seals
V = FKM seals

Further details in the plain text

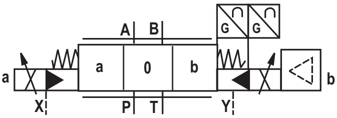
[1] E, W6-, W8-, V only available with flow characteristics **L** (linear)
[2] E1-, W8-, V1- only available with flow characteristics **L** (linear)
[3] V1-125 only available with flow characteristics **L** (linear)
[4] V1-150 only available with flow characteristics **L** (linear)
[5] When replacing the component series 3X by component series 4X, the electronics interface is to be defined with **A5** (enable signal at pin C).

Symbols

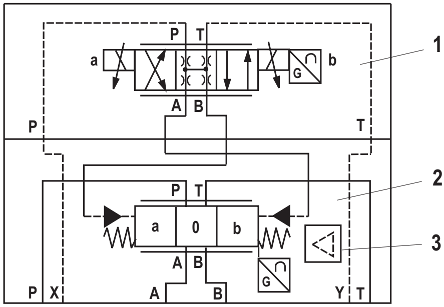
Simplified

Example:

Pilot oil supply external
Pilot oil return external



Detailed



1 Pilot control valve
2 Main valve
3 Integrated electronics (OBE)

Function, section

The 4/3 directional control valve is designed for subplate mounting, with position control and integrated electronics.

Set-up:

The valve consists of 3 main assemblies:

- Housing (1) with main stage control spool (2)
- Integrated electronics with inductive position transducer (3) of the main stage
- Pilot control valve (4) with control spool/socket unit (5), inductive position transducer (6) and pressure feed back for central position of the main stage control spool (2)

Function:

- With de-energized proportional solenoids (7; 8) central position of the main stage control spool (2) due to centering spring (9) and pressure feed back
- Control of the main stage control spool (2) via the pilot control valve (4)
  → the main stage control spool is positioned in a controlled manner
- Controlling the control spool of the pilot control valve (4) by changing the solenoid force of the proportional solenoids (7; 8)
- Connection of the command and actual values in the integrated electronics
- Pilot oil supply to the pilot control valve internally via port P or externally via port X
  Pilot oil return internally via port T or externally via Y to the tank
- With a command value of 0 V, the electronics control the main stage control spool (2) in central position.

Failure of supply voltage:

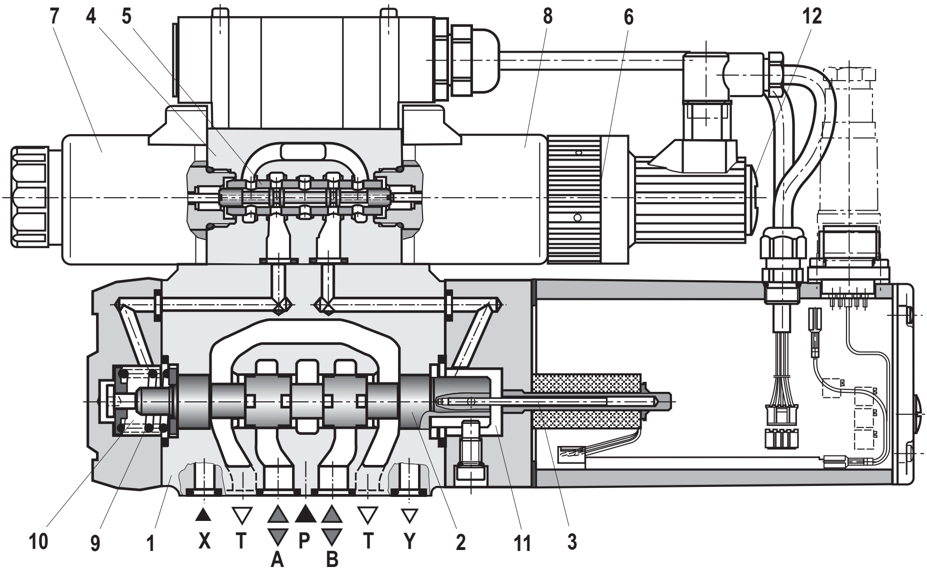
- Integrated electronics de-energizes the solenoid in case of supply voltage failure or cable break
- Automatic pressure control on the same level in the control chambers (10 and 11) by the pilot control valve
- In case of pressure supply failure, centering of the main stage control spool by centering spring (9)
- Central position of the main stage control spool (2)

Attention:

Failure of the supply voltage will lead to an abrupt standstill of the control axis. The accelerations occurring in this connection may cause machine damage.
With control spool symbols E, E1-, W6- and W8-, the centering spring (9) brings the main stage control spool (2) into the central position, V and V1 control spools are switched into the preferred direction P to B and A to T in the tolerance range from 1% to a maximum of 11% of the control spool stroke.

☞ **Important notice!**

The PG fitting (12) must not be opened. Mechanical adjustment of the adjustment nut located below is prohibited and damages the valve!



The zero point has been adjusted in the factory.

If the pilot control valve or the electronics is exchanged, the zero point has to be adjusted once again by instructed specialists.

☞ **Notice!**

Changes in the zero point may result in damage to the system and may only be implemented by instructed specialists!

Technical data (for applications outside these parameters, please consult us!)

general

Sizes	Size	10	16	25	27	32	35
Weight	kg	8.7	11.2	16.8	17	31.5	34
Installation position and commissioning information		Preferably horizontal, see data sheet 07700					
Ambient temperature range	°C	–20 to +50					
Storage temperature range	°C	–20 to +80					
$MTTF_d$ values according to EN ISO 13849	Years	150 [1)] (for more information see data sheet 08012)					
Sine test according to DIN EN 60068-2-6:2008		10 cycles, 10…2000.. 10 Hz with logarithmic frequency changing speed of 1 octave/min, 5 to 57 Hz, amplitude 1.5 mm (p-p), 57 to 2000 Hz, amplitude 10 g, 3 axes					
Random test according to DIN EN 60068-2-64:2009		20…2000 Hz, amplitude 0.05 g^2/Hz (10 g_{RMS}) 3 axes, testing time 30 min per axis					
Shock test according to DIN EN 60068-2-27:2010		Half-sine 15 g / 11 ms, 3 times in positive and 3 times in negative direction per axis, 3 axes					
Humid heat, cyclic according to DIN EN 60068-2-30:2006		Variant 2 +25 °C to +55 °C, 90% to 97% relative humidity, 2 cycles of 24 hours each					

hydraulic (measured with HLP 46, ϑ_{oil} = 40 °C ±5 °C)

Maximum operating pressure – Pilot control valve, Pilot oil supply [2)]	bar	25 to 315					
Maximum operating pressure – Main valve, port P, A, B	bar	315	350	350	210	350	350
Maximum return flow pressure – Port T, Pilot oil return, internal	bar	Static < 10					
Maximum return flow pressure – Port T, Pilot oil return, external	bar	315	250	250	210	250	250
Maximum return flow pressure – Port Y	bar	Static < 10					
Rated flow q_{Vnom} ±10% at Δp = 10 bar Δp = valve pressure differential in bar	l/min	– 25 50 100	125 150 200 220	– – 220 350	– – – 500	– – 400 600	– – – 1000
Recommended maximum flow	l/min	170	460	870	1000	1600	3000
Pilot oil flow at port X and/or Y with stepped input signal from 0 to 100% (315 bar)	l/min	7	14	20	20	27	29
Hydraulic fluid		See table page 6					
Hydraulic fluid temperature range (at the valve working ports)	°C	–20 to +80, preferably +40 to +80					
Viscosity range	mm^2/s	20 to 380, preferably 30 to 45					
Maximum admissible degree of contamination of the hydraulic fluid - cleanliness class according to ISO 4406 (c)		Pilot control valve: Class 18/16/13 [3)] Main stage: Class 20/18/15 [3)]					
Hysteresis	%	≤ 0.1					
Response sensitivity	%	≤ 0.05					
Zero point calibration (ex works) [4)]	%	≤ 1					

1) With control spool types E, E1, W6 and W8: In longitudinal control spool direction, there is sufficient positive overlap without shock/vibration load; observe the installation orientation with regard to the main direction of acceleration!

2) For perfect system behavior, we recommend an external pilot oil supply for pressures above 210 bar.

3) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components.
For the selection of the filters see www.boschrexroth.com/filter

4) Related to the pressure-signal characteristic curve (control spool V)

5

Technical data (for applications outside these parameters, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons		HL, HLP	NBR, FKM	DIN 51524
Flame-resistant	– containing water	HFC (Fuchs HYDROTHERM 46M, Petrofer Ultra Safe 620)	NBR	ISO 12922

Important information on hydraulic fluids!

- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.)!
- The flash point of the process and operating medium used must be 40 K higher than the maximum solenoid surface temperature.
- **Flame-resistant – containing water**: Maximum pressure differential per control edge 175 bar. Pressure pre-loading at the tank port >20% of the pressure differential; otherwise, increased cavitation.
- Life cycle as compared to operation with mineral oil HL, HLP 50% to 100%

electric

Voltage type		Direct voltage
Duty cycle	%	100
Maximum coil temperature [1]	°C	150
Maximum power	W	72 (average = 24 W)
Electrical connection		With connector according to DIN EN 175201-804
Protection class of the valve according to EN 60529		IP65 with mating connector mounted and locked

[1] Due to the temperatures occurring at the surfaces of the solenoid coils, the European standards ISO 13732-1 and EN ISO 4413 need to be adhered to!

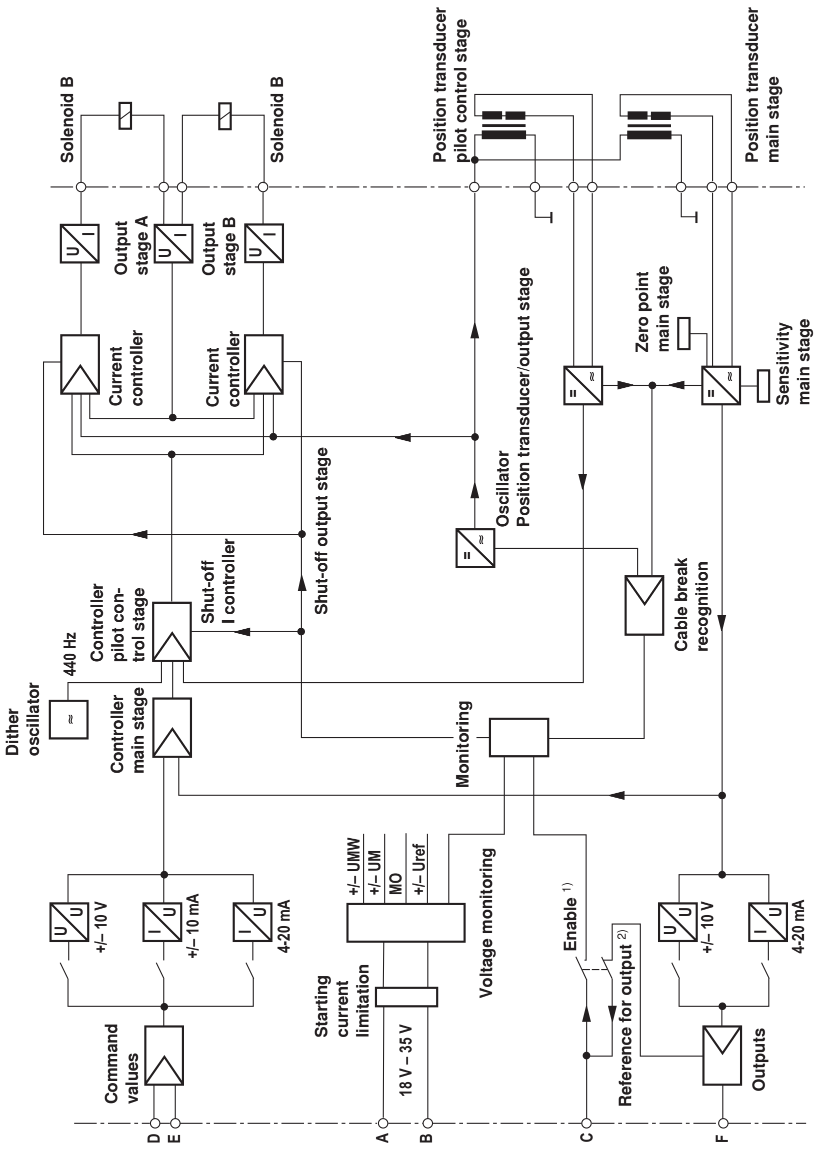
Connector pin assignment	Contact	Signal with A1	Signal with F1	Signal with A5
Supply voltage	A	24 VDC (18 to 35 VDC); I_{max} = 3 A; impulse load = 4 A		
	B	0 V		
Reference (actual value)	C	Reference potential for actual value (contact "F")		Enable 4 to 24 V
Differential amplifier input	D	±10 V	4 to 20 mA	±10 V
(Command value)	E	0 V reference potential (contact "D")		0 V reference potential for pin D and F
Measuring output (actual value)	F	±10 V	4 to 20 mA	±10 V
	PE	Connected to cooling element and valve housing		

Command value: Reference potential at E and positive command value at D result in flow from P → A and B → T.
Reference potential at E and negative command value at D result in flow from P → B and A → T.

Connection cable: Recommendation: – Up to 25 m line length: Type LiYCY 7 x 0.75 mm²
– Up to 50 m line length: Type LiYCY 7 x 1.0 mm²
Only connect the shield to PE on the supply side.

Notice: **Electric signals taken out via valve electronics (e.g. actual value) must not be used for switching off safety-relevant machine functions!**

Block diagram of the integrated electronics (OBE) type VT 13060-3X/...

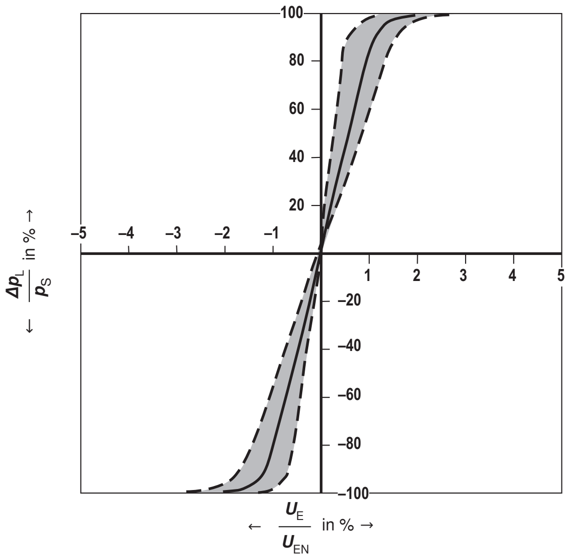


1) Only with electronics interface "A5"

2) Only with electronics interfaces "A1" and "F1"

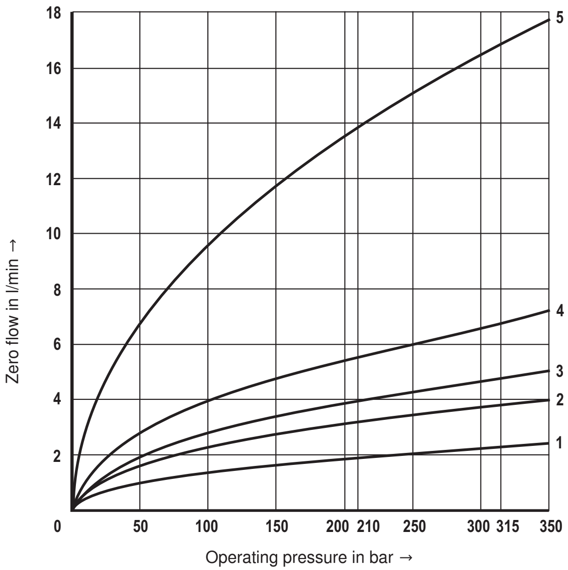
Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C and p = 100 bar)

Pressure-signal characteristic curve (control spool V)



Pilot pressure p_S = 100 bar

Zero flow of the main stage (control spool V) with pilot control valve



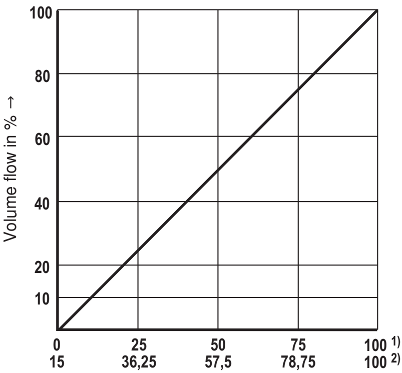
1 Size 10
2 Size 16
3 Sizes 25, 27
4 Size 32
5 Size 35

Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Flow command value function at e.g.
P → A / B → T 10 bar valve pressure differential or
P → A or A → T 5 bar per control edge

Control spool E, W, and V

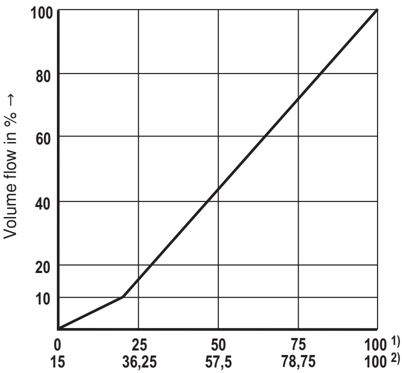
Control spool with characteristic curve **L**



Command value in % →

1) Positive overlap 0 to 0.5% with control spool **V**
2) Positive overlap 15% with control spools **E** and **W**

Control spool with characteristic curve **P**

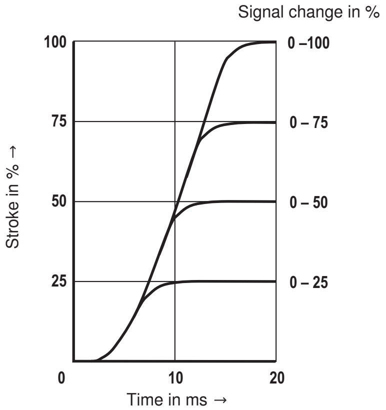


Command value in % →

1) Positive overlap 0 to 0.5% with control spool **V**
2) Positive overlap 15% with control spools **E** and **W**

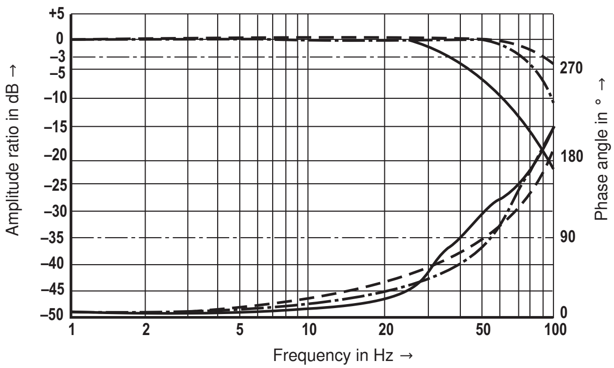
Characteristic curves: Size 10 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Transition function with stepped electric input signals



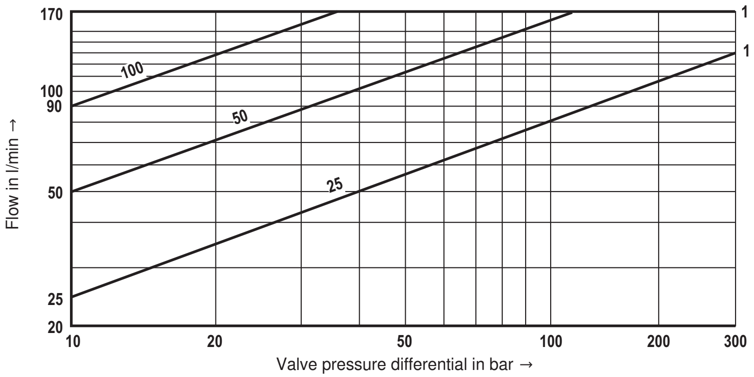
Measured with:
– Pilot control valve port X = 100 bar
– Main valve port P = 10 bar

Frequency response characteristic curves



Measured with:
– Pilot control valve port X = 100 bar
– Main valve port P = 10 bar

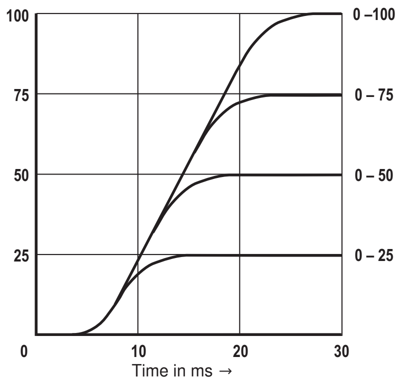
Flow/load function with maximum valve opening (tolerance ±10%)



1 Recommended flow limitation (flow velocity 30 m/s)

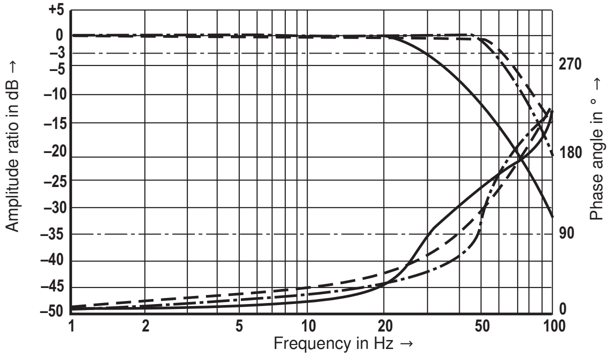
Characteristic curves: Size 16 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Transition function with stepped electric input signals



Measured with:
- Pilot control valve port X = 100 bar
- Main valve port P = 10 bar

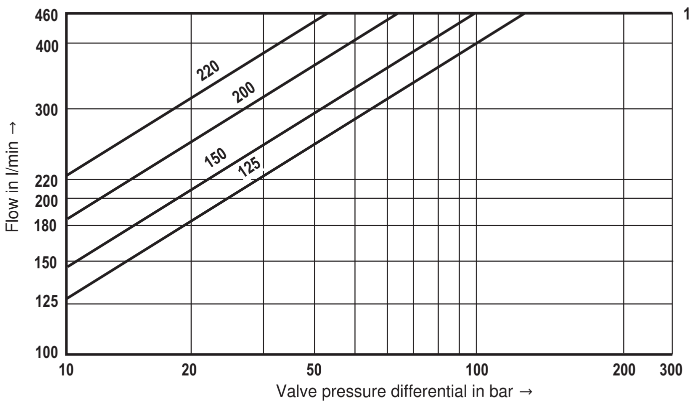
Frequency response characteristic curves



Measured with:
- Pilot control valve port X = 100 bar
- Main valve port P = 10 bar

Signal ±5%
Signal ±25%
Signal ±100%

Flow/load function with maximum valve opening (tolerance ±10%)

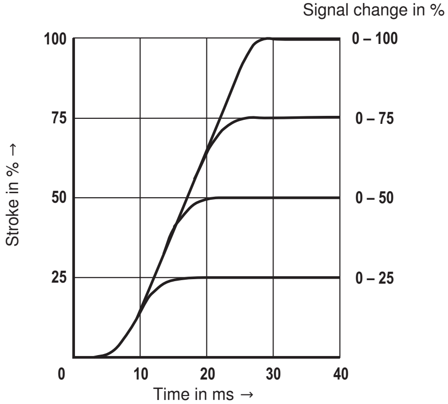


1 Recommended flow limitation (flow velocity 30 m/s)

5

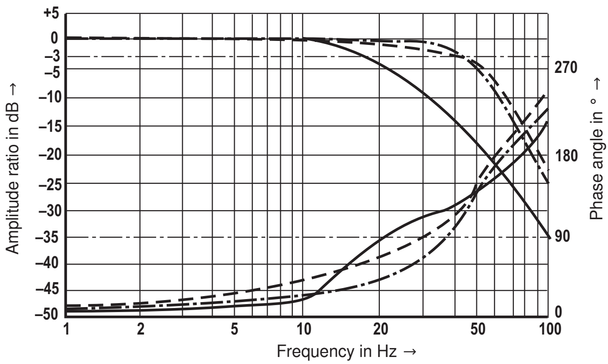
Characteristic curves: Sizes 25 and 27 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Transition function with stepped electric input signals



Measured with:
- Pilot control valve port X = 100 bar
- Main valve port P = 10 bar

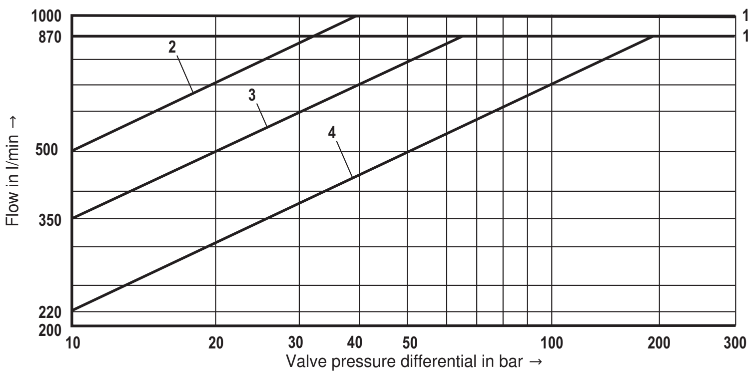
Frequency response characteristic curves



Measured with:
- Pilot control valve port X = 100 bar
- Main valve port P = 10 bar

Signal ±5%
Signal ±25%
Signal ±100%

Flow/load function with maximum valve opening (tolerance ±10%)

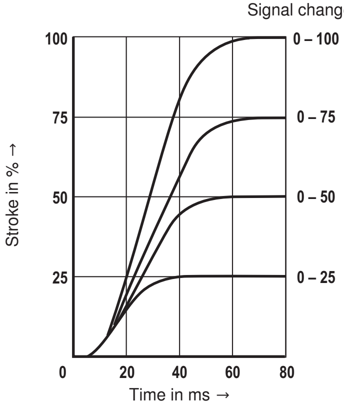


1 Recommended flow limitation (flow velocity 30 m/s)

2 500 - size 27
3 350 - size 25
4 220 - size 25

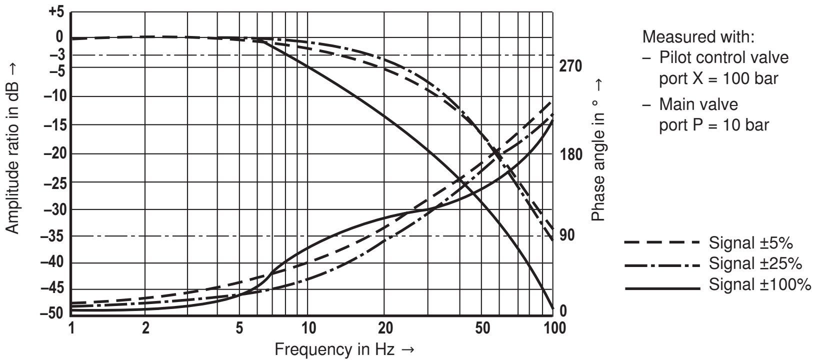
Characteristic curves: Size 32 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Transition function with stepped electric input signals



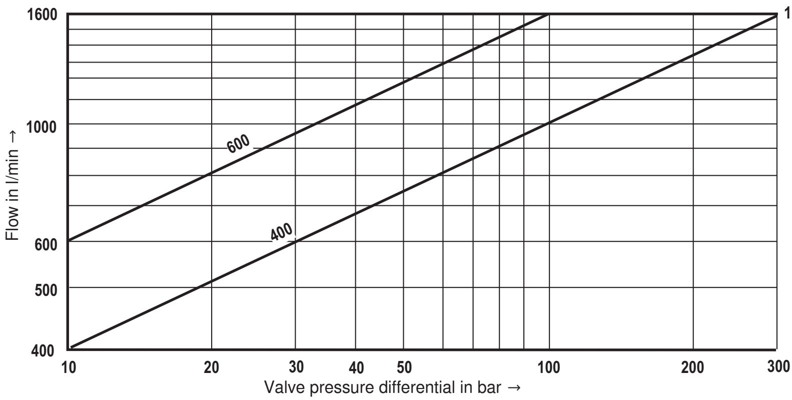
Measured with:
– Pilot control valve port X = 100 bar
– Main valve port P = 10 bar

Frequency response characteristic curves



Measured with:
– Pilot control valve port X = 100 bar
– Main valve port P = 10 bar

Flow/load function with maximum valve opening (tolerance ±10%)

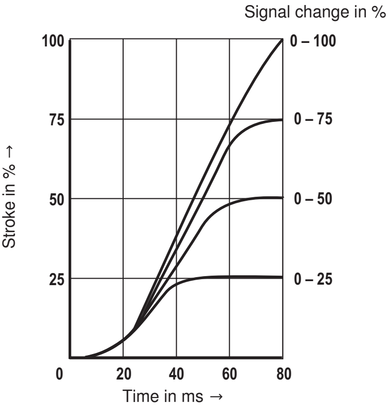


1 Recommended flow limitation (flow velocity 30 m/s)

5

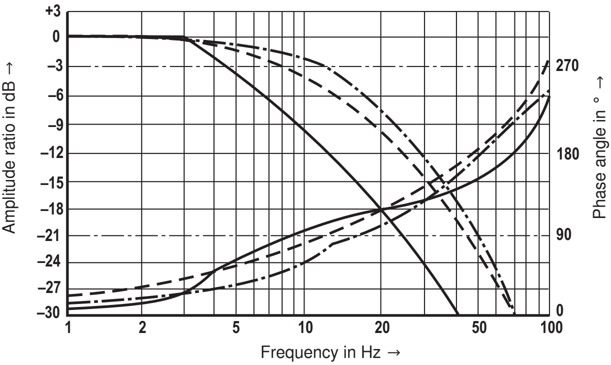
Characteristic curves: Size 35 (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)

Transition function with stepped electric input signals



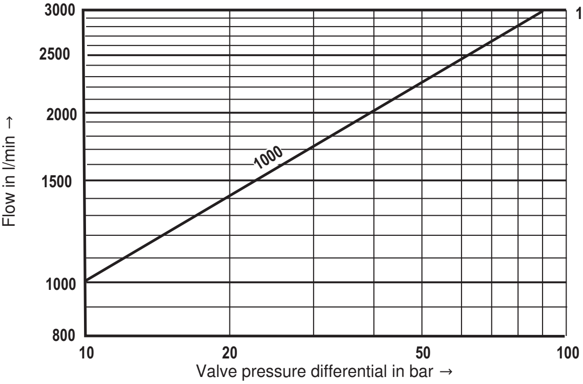
Measured with:
- Pilot control valve port X = 100 bar
- Main valve port P = 10 bar

Frequency response characteristic curves



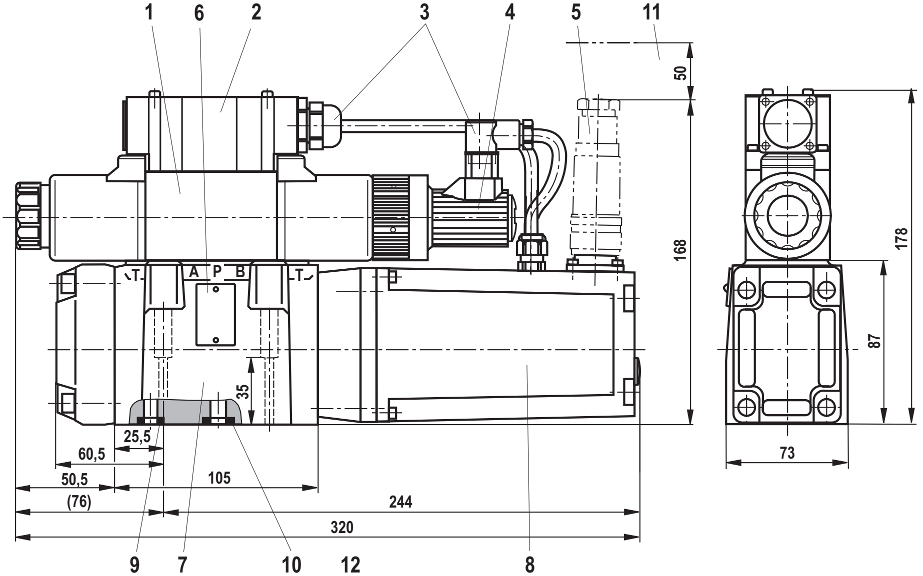
Measured with:
- Pilot control valve port X = 100 bar
- Main valve port P = 10 bar

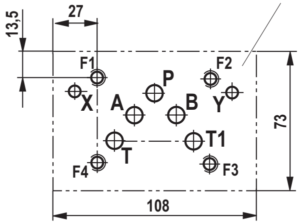
Flow/load function with maximum valve opening (tolerance ±10%)

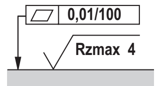


1 Recommended flow limitation (flow velocity 30 m/s)

Dimensions: Size 10 (dimensions in mm)







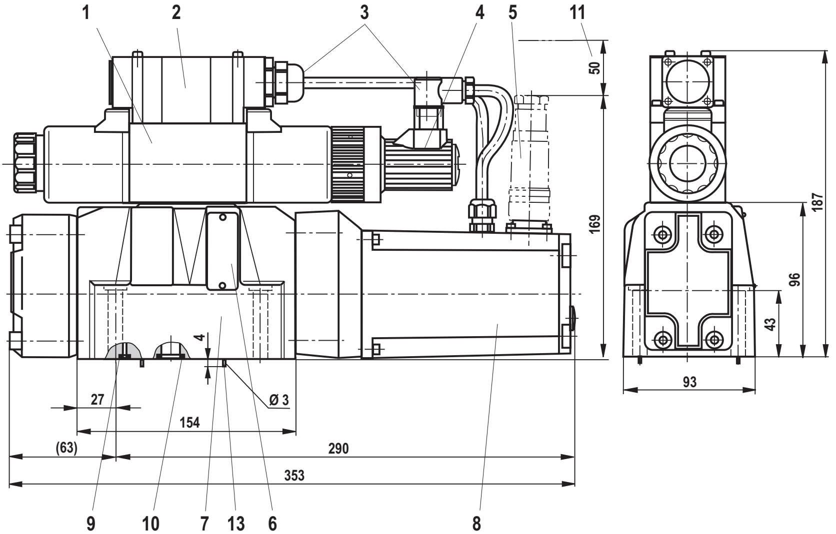
Required surface quality of the valve contact surface

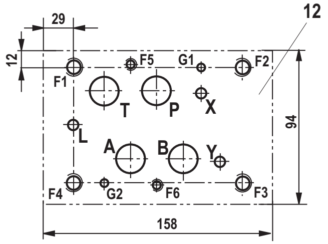
5

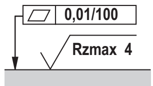
1 Pilot control valve
2 Electrical connection
3 Wiring and mating connector
4 Inductive position transducer (pilot control valve)
5 Mating connector 6-pole + PE (separate order, see page 21)
6 Name plate
7 Main valve
8 Integrated electronics (OBE) and inductive position transducer (main valve)
9 Identical seal rings for ports X, Y
10 Identical seal rings for ports A, B, P, T, T1
11 Space required for connection cable and to remove the mating connector
12 Machined valve contact surface, porting pattern according to ISO 4401-05-05-0-05 (ports X, Y as required)

Subplates and valve mounting screws see page 21.

Dimensions: Size 16 (dimensions in mm)







Required surface quality of the valve contact surface

1 Pilot control valve

2 Electrical connection

3 Wiring and mating connector

4 Inductive position transducer (pilot control valve)

5 Mating connector 6-pole + PE (separate order, see page 21)

6 Name plate

7 Main valve

8 Integrated electronics (OBE) and inductive position transducer (main valve)

9 Identical seal rings for ports X, Y

10 Identical seal rings for ports A, B, P, T, T1

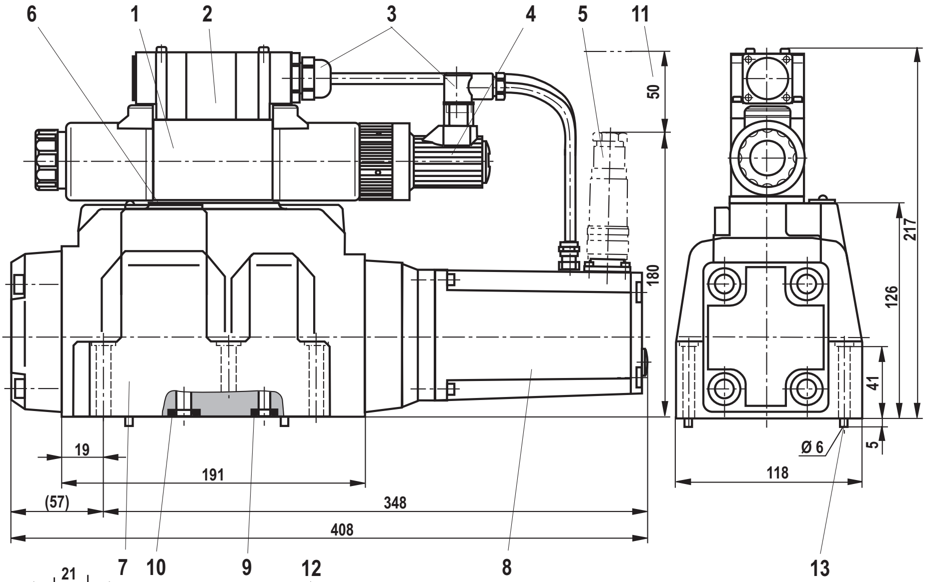
11 Space required for connection cable and to remove the mating connector

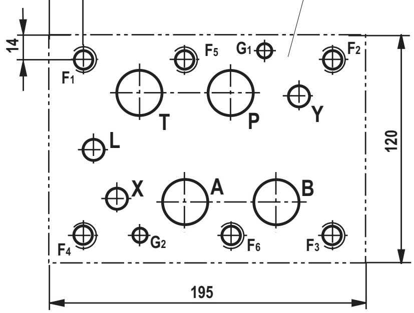
12 Machined valve contact surface,
porting pattern according to ISO 4401-07-07-0-05
(ports X, Y as required)
Deviating from the standard:
– Ports A, B, P T Ø 20 mm

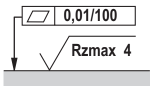
13 Locking pin

Subplates and valve mounting screws see page 21.

Dimensions Size 25 (dimensions in mm)







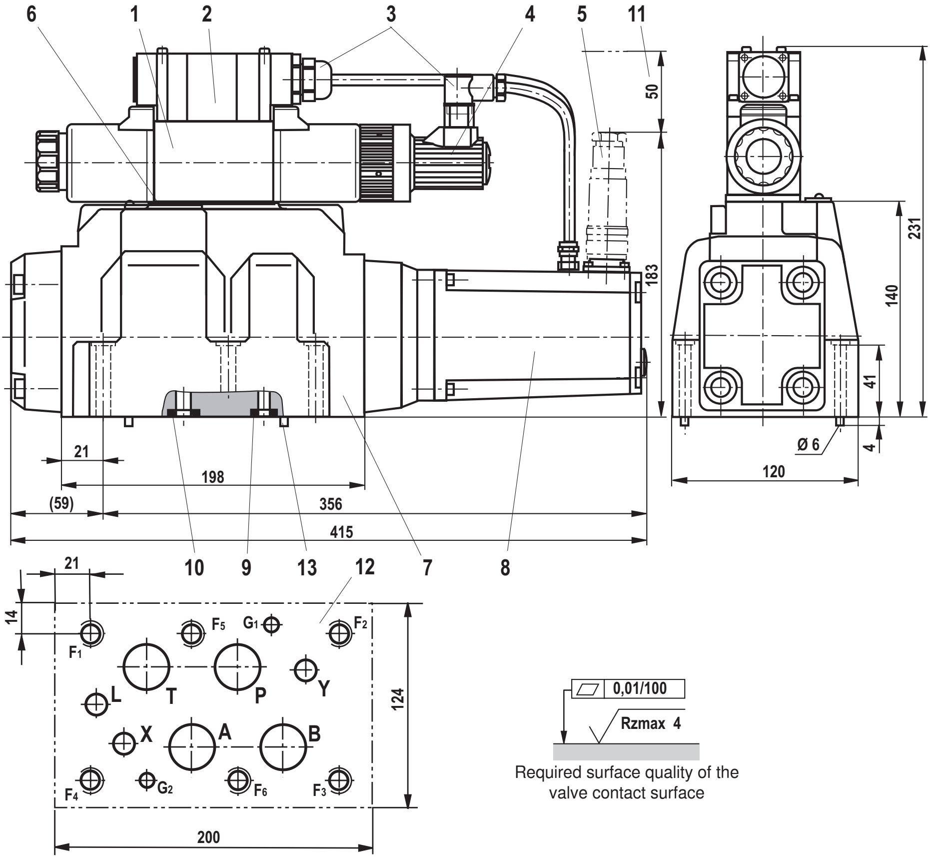
Required surface quality of the valve contact surface

5

1 Pilot control valve
2 Electrical connection
3 Wiring and mating connector
4 Inductive position transducer (pilot control valve)
5 Mating connector 6-pole + PE (separate order, see page 21)
6 Name plate
7 Main valve
8 Integrated electronics (OBE) and inductive position transducer (main valve)
9 Identical seal rings for ports X, Y, and L
10 Identical seal rings for ports A, B, P, T
11 Space required for connection cable and to remove the mating connector
12 Machined valve contact surface, porting pattern according to ISO 4401-08-08-0-05 (ports X, Y and L as required)
13 Locking pin

Subplates and valve mounting screws see page 21.

Dimensions Size 27 (dimensions in mm)

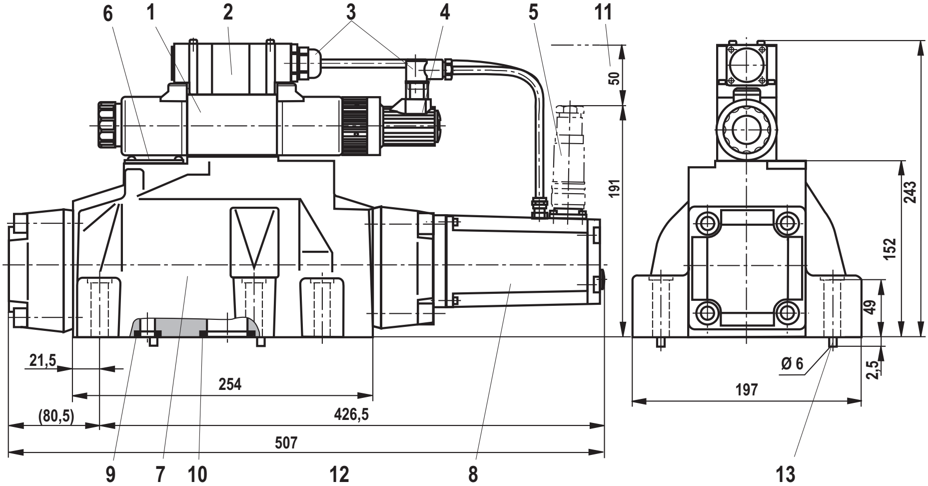


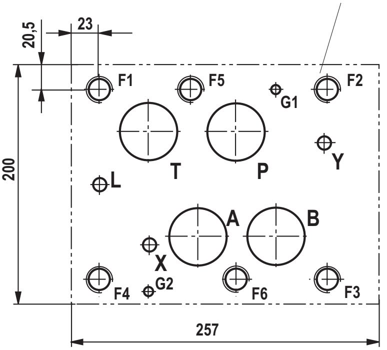
Required surface quality of the valve contact surface

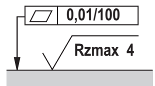
1 Pilot control valve
2 Electrical connection
3 Wiring and mating connector
4 Inductive position transducer (pilot control valve)
5 Mating connector 6-pole + PE (separate order, see page 21)
6 Name plate
7 Main valve
8 Integrated electronics (OBE) and inductive position transducer (main valve)
9 Identical seal rings for ports X, Y, and L
10 Identical seal rings for ports A, B, P, T
11 Space required for connection cable and to remove the mating connector
12 Machined valve contact surface, porting pattern according to ISO 4401-08-08-0-05 (ports X, Y, and L as required)
Deviating from the standard:
– Ports A, B, T and P Ø 32 mm
13 Locking pin

Subplates and valve mounting screws see page 21.

Dimensions Size 32 (dimensions in mm)





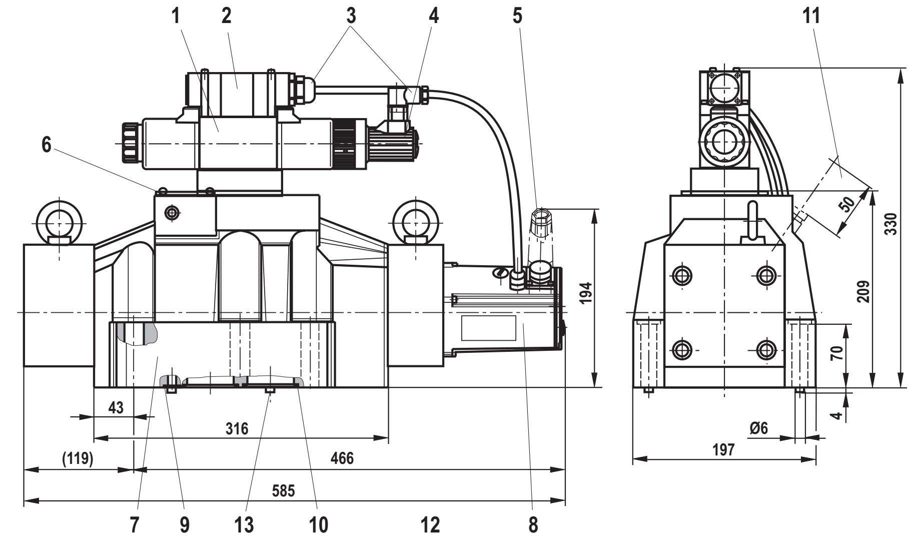


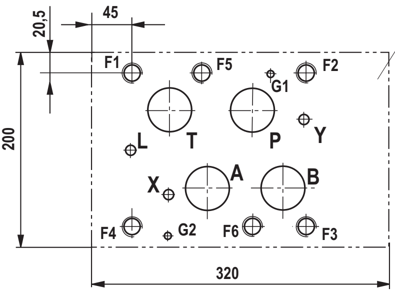
Required surface quality of the valve contact surface

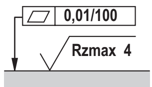
1 Pilot control valve
2 Electrical connection
3 Wiring and mating connector
4 Inductive position transducer (pilot control valve)
5 Mating connector 6-pole + PE (separate order, see page 21)
6 Name plate
7 Main valve
8 Integrated electronics (OBE) and inductive position transducer (main valve)
9 Identical seal rings for ports X, Y, and L
10 Identical seal rings for ports A, B, P, T
11 Space required for connection cable and to remove the mating connector
12 Machined valve contact surface, porting pattern according to ISO 4401-10-09-0-05 (ports X, Y, and L as required)
Deviating from the standard:
– Ports A, B, T and P Ø 38 mm
13 Locking pin

Subplates and valve mounting screws see page 21.

Dimensions Size 35 (dimensions in mm)







Required surface quality of the valve contact surface

1 Pilot control valve
2 Electrical connection
3 Wiring and mating connector
4 Inductive position transducer (pilot control valve)
5 Mating connector 6-pole + PE (separate order, see page 21)
6 Name plate
7 Main valve
8 Integrated electronics (OBE) and inductive position transducer (main valve)
9 Identical seal rings for ports X, Y, and L
10 Identical seal rings for ports A, B, P, T
11 Space required for connection cable and to remove the mating connector
12 Machined valve contact surface, porting pattern according to ISO 4401-10-09-0-05 (ports X, Y, and L as required)
Deviating from the standard:
– Ports A, B, T and P Ø 50 mm
13 Locking pin

Subplates and valve mounting screws see page 21.

Dimensions

Hexagon socket head cap screws		Material number
Size 10	4x ISO 4762 - M6 x 45 - 10.9-flZn-240h-L Tightening torque M_A = 13.5 Nm ±10% or 4x ISO 4762 - M6 x 45 - 10.9 Tightening torque M_A = 15.5 Nm ±10%	R913000258
Size 16	2x ISO 4762 - M6 x 60 - 10.9-flZn-240h-L Tightening torque M_A = 12.2 Nm ±10% 4x ISO 4762 - M10 x 60 - 10.9-flZn-240h-L Tightening torque M_A = 58 Nm ±20% or 2x ISO 4762 - M6 x 60 - 10.9 Tightening torque M_A = 15.5 Nm ±10% 4x ISO 4762 - M10 x 60 - 10.9 Tightening torque M_A = 75 Nm ±20%	R913000115 R913000116
Sizes 25 and 27	6x ISO 4762 - M12 x 60 - 10.9-flZn-240h-L Tightening torque M_A = 100 Nm ±20% or 6x ISO 4762 - M12 x 60 - 10.9 Tightening torque M_A = 130 Nm ±20%	R913000121
Size 32	6x ISO 4762 - M20 x 80 - 10.9-flZn-240h-L Tightening torque M_A = 340 Nm ±20% or 6x ISO 4762 - M20 x 80 - 10.9 Tightening torque M_A = 430 Nm ±20%	R901035246
Size 35	6x ISO 4762 - M20 x 100 - 10.9-flZn-240h-L Tightening torque M_A = 465 Nm ±20% or 6x ISO 4762 - M20 x 100 - 10.9 Tightening torque M_A = 610 Nm ±20%	R913000386

Notice: The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure!

Subplates	Data sheet
Size 10	45054
Size 16	45056
Sizes 25 and 27	45058
Sizes 32 and 35	45060

5

Accessories (not included in the scope of delivery)

Mating connectors		Material number
Mating connector for high-response valve	DIN EN 175201-804, see data sheet 08006	e.g. R900021267 (plastic)
		e.g. R900223890 (metal)

Notes

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
documentation@boschrexroth.de
www.boschrexroth.de

The Drive & Control Company Rexroth Bosch Group

4/3 directional high-response valves, pilot operated, with electrical position feedback and integrated electronics (OBE)

Type 4WRDE

RE 29093
Edition: 2012-11
Replaces: 09.07

- Size 10 to 35
- Component series 5X
- Maximum operating pressure 350 bar
- Maximum flow: 3000 l/min

Features

- Pilot operated 3-stage directional control valve with electrical position feedback of the main control spool and integrated electronics (OBE)
- Position sensing of the main control spool by means of an inductive position transducer
- 2-stage pilot control valve type 4WS2EM 6-2X/...
- Particularly suitable for position, velocity, pressure and force control where there are at the same time high requirements on the dynamics and the response sensitivity
- Subplate mounting:
  Porting pattern according to ISO 4401

Contents

Ordering code

01	02	03	04	05	06		07		08	09	10	11		12	13	14	15
4	**WRDE**					**–**	**5X**	**/**	**6L**	**24**		**K9**	**/**			**R**	*****

01	4 main ports	**4**
02	High-response valve	**WRDE**
03	Size 10	**10**
	Size 16	**16**
	Size 25	**25**
	Size 27	**27**
	Size 32	**32**
	Size 35	**35**
04	Symbols e.g. E, E1, W etc; possible design see page 4	

Rated flow size 10 with 10 bar valve pressure differential

05	25 l/min	**25** [1]
	50 l/min	**50**
	90 l/min	**100**

Rated flow size 16 with 10 bar valve pressure differential

05	125 l/min	**125**
	200 l/min	**200**

Rated flow size 25 with 10 bar valve pressure differential

05	220 l/min	**220**
	350 l/min	**350**

Rated flow size 27 with 10 bar valve pressure differential

05	500 l/min	**500**

Rated flow size 32 with 10 bar valve pressure differential

05	400 l/min	**400**
	600 l/min	**600**

Rated flow size 35 with 10 bar valve pressure differential

05	1000 l/min	**1000**

Flow characteristics

06	Linear	**L**
	Linear with fine control range	**P**
07	Component series 50 ... 59 (50 ... 59: Unchanged installation and connection dimensions)	**5X**

Pilot control valve

08	Servo valve control size 6 (data sheet 29564)	**6L**
09	Direct voltage 24 V	**24**

[1] Only available with E, W and V control spool variant and with characteristic curve form L (linear)

Ordering code

01	02	03	04	05	06		07		08	09	10	11		12	13	14	15
4	**WRDE**					**–**	**5X**	**/**	**6L**	**24**		**K9**	**/**			**R**	*****

Pilot oil supply and return

10	Pilot oil supply external, pilot oil return external	**no code**
	Pilot oil supply internal, pilot oil return external	**E**
	Pilot oil supply internal, pilot oil return internal	**ET**
	Pilot oil supply external, pilot oil return internal	**T**

Electrical connection

11	**Without** mating connector, with connector	**K9** [1)]

12	**Without** directional sandwich plate valve	**no code**
	With directional sandwich plate valve 24 V = mating connector Z4	**WG152** [1)]

Seal material

13	NBR seals	**M**
	FKM seals	**V**

14	R rings	**R**

15	Further details in the plain text	

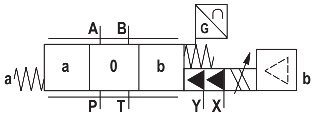
[1)] Mating connectors, separate order, see page 21

5

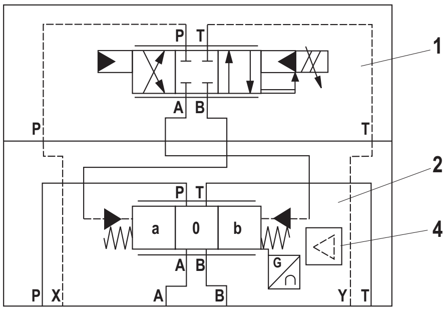
Symbols

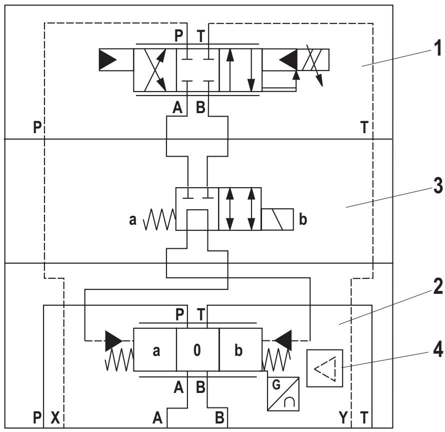
Simplified

Example:
Pilot oil supply external
pilot oil return external



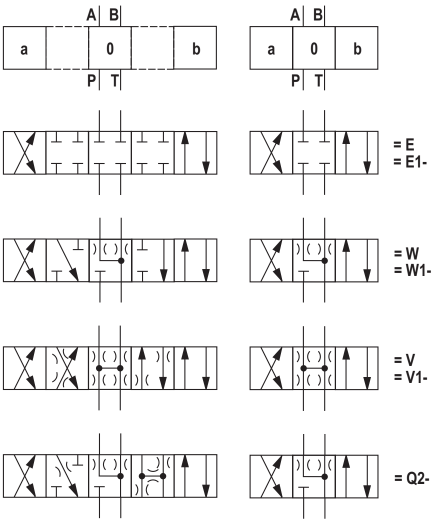
Detailed





1 Pilot control valve
2 Main valve
3 Directional sandwich plate valve
4 Integrated electronics (OBE)

Control spool symbols



With control spool symbol E1-, W1- and V1-:

P→A:	q_{Vmax}	B→T:	$q_V/2$
P→B:	$q_V/2$	A→T:	q_{Vmax}

Notice!
In the zero position, control spools W and W1- have a connection from A to T and B to T with approx.3 % of the relevant nominal cross-section.

Function, section

Valves of type 4WRDE are 3-stage directional control valves. They control the quantity and direction of a flow and are mainly used in control loops for different tasks.
They consist of the following assemblies:

- The 2-stage pilot control valve consisting of the control motor (1) and a hydraulic amplifier (5) designed as nozzle flapper plate valve and the control spool socket unit (6) as flow amplifier stage for actuating the 3rd stage (7).
- The 3rd stage (7) for flow control.
- An inductive position transducer (8) the core (9) of which is attached to the control spool (10) of the 3rd stage.

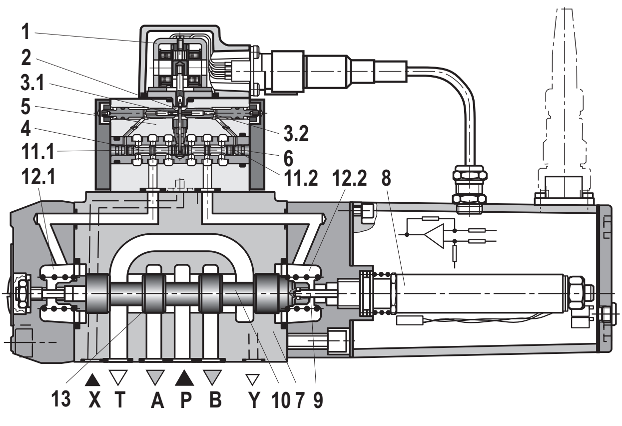
The position of the control spool (10) is measured by an inductive position transducer (8). The signal linking of the valve control loop, the supply of the position measurement system and the control of the pilot control valve are carried out via control electronics integrated in the valve.
The voltage difference created by the command/actual value comparison is amplified in the control electronics and supplied to the 1st stage of the valve as control deviation. This signal deflects the flapper plate (2) between the two control nozzles (3.1, 3.2). This creates a pressure difference between the two control chambers (11.1, 11.2). The control spool (4) is moved and releases a corresponding flow into the control chamber (12.1 or 12.2). The control spool (10) with the core (9) of the inductive position transducer (8) attached to it is displaced until the actual value corresponds to the command value. In the compensated condition, the control spool (10) is held in the position specified by the command value.

The control spool stroke is proportional to the command value. For the control of the flow, a corresponding control opening results, depending on the position of the control spool (10) to the control edges (13), to which the flow is proportional. The valve dynamics is optimized via the electric gain. The control electronics is integrated in the valve (oscillator, demodulator).

Valve particularities

- The 3rd stage is basically set-up of modules of our proportional valves.
- With V control spools, the control edges of control spools and housings are ground in to each other.
- When the pilot control valve or the control electronics is exchanged, they are to be re-adjusted. All adjustments may be implemented by instructed experts only.
- The pilot control valve may only be maintained by Bosch Rexroth employees. An exception to this is the replacement of the filter and the sealing according to the accessories list. It has to be ensured that during the assembly, the sealing is properly seated and the plug screw is tightened.
  The tightening torque for the plug screw is 30 Nm.

☞ **Notice!**
Changes in the zero point may result in damage to the system and may only be implemented by instructed specialists!



Technical data
(For applications outside these parameters, please consult us!)

general		**Size 10**	**Size 16**	**Size 25**	**Size 27**	**Size 32**	**Size 35**
Weight	kg	6.8	8.9	15.2	15.5	35.2	71
Installation position and commissioning information		Preferably horizontal, see data sheet 07700					
Storage temperature range	°C	−20 … +80					
Ambient temperature range	°C	−20 … +60					

hydraulic (measured with HLP46, ϑ_{Oil}= 40 ±5 °C)									
Maximum operating pressure	– Port A, B, P	Pilot oil supply external [1]	bar	350	350	350	250	350	350
	– Port X		bar	25 to 250			25 to 210	25 to 250	
	– Port A, B, P	Pilot oil supply internal	bar	25 to 250			25 to 210	25 to 250	
Maximum return flow pressure	– Port T	Pilot oil supply internal	bar	Pressure peaks < 100 admissible					
		Pilot oil supply external	bar	315	250	250	210	250	250
	– Port Y	Pilot oil supply internal	bar	Pressure peaks < 100 admissible					
Rated flow q_{Vnom} ±10 % with valve pressure differential Δp = 10 bar [2]			l/min	25 50 90	– 125 200	– 220 350	– – 500	– 400 600	– – 1000
Recommended maximum flow			l/min	170	460	870	1000	1600	3000
Pilot oil flow at port X or Y with stepped input signal from 0 to 100 % (250 bar)			l/min	8.8	13.5	17.4	17.4	32.5	45.3
Hydraulic fluid				See table page 6					
Hydraulic fluid temperature range (at the valve working ports)			°C	−20 … +80; preferably +40 … +50					
Viscosity range			mm²/s	20 … 380					
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)				Pilot control valve: Class 18/16/13 [3] Main stage: Class 20/18/15 [3]					
Hysteresis			%	≤ 0.2					
Response sensitivity			%	≤ 0.1					
Zero point calibration (ex works) [4]			%	≤ 1					
Zero shift upon change of:									
– Hydraulic fluid temperature			%/20 °K	≤ 0.7					
– Operating pressure			%/100 bar	≤ 0.5					
– Return flow pressure 0 to 10 % of p			%	≤ 0.2					

1) For a perfect system behavior, we recommend an external pilot oil supply for pressures above 210 bar.

2) q_{Vnom} = rated flow (complete valve) in l/min with a V control spool.

3) The cleanliness classes stated for the components need to be maintained in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components.
For the selection of the filters see www.boschrexroth.com/filter.

4) Related to the pressure-signal characteristic curve (control spool V).

Technical data
(For applications outside these parameters, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons		HL, HLP	NBR, FKM	DIN 51524
Flame-resistant	– containing water	HFC (Fuchs HYDROTHERM 46M, Petrofer Ultra Safe 620)	NBR	ISO 12922

☞ **Important information on hydraulic fluids!**
- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.)!
- The flash point of the hydraulic fluid used must be 40 K higher than the maximum solenoid surface temperature.
- **Flame-resistant – containing water**: Maximum pressure differential per control edge 175 bar. Pressure pre-loading at the tank port > 20 % of the pressure differential; otherwise, increased cavitation.
  – Life cycle as compared to operation with mineral oil HL, HLP 50 % to 100 %

electric	
Voltage type	Direct voltage
Type of signal	Analog
Protection class according to EN 60529	IP 65 with mating connector mounted and locked
Control electronics	Integrated in the valve

Electrical connections, allocation

Contact	Signal	Device connector allocation
A	24 VDC (20 to 28 VDC); full bridge rectification smoothened with 2200 µF; I_{max} = 270 mA	Supply voltage
B	0 V	
C	4 to 24 VDC	Enable [1] (activates the valve control loop)
D	±10 V [2; 3]	Differential amplifier input (command value)
E		
F	±10 V (to contact "B")	Actual value

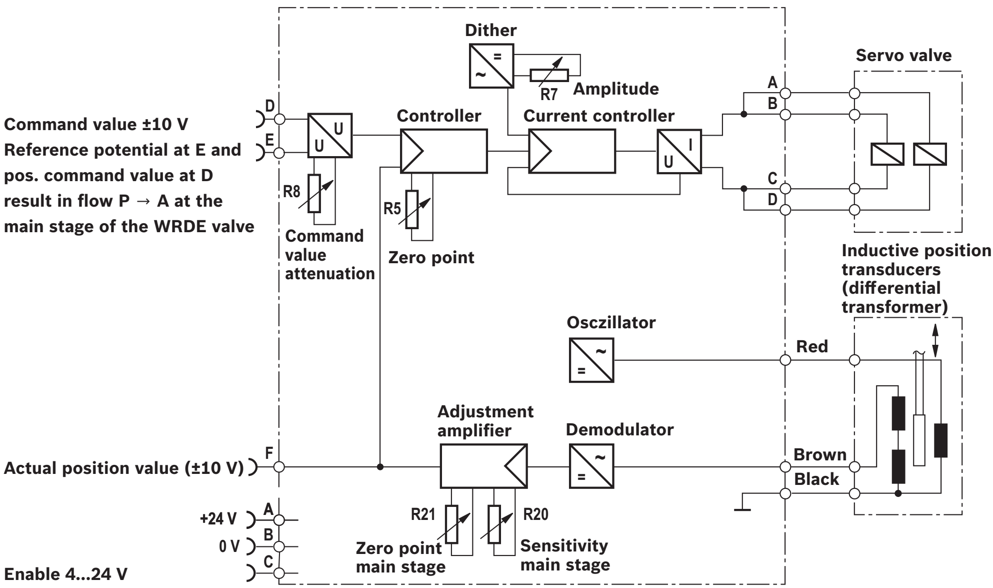
5

[1] With pending hydraulic pressure and **deactivated enable**, the control spool of the main stage is moved into end position and the cylinder axis leaves its position at **maximum velocity**. If a WG152 directional sandwich plate valve is used between pilot control valve and main stage, the control chambers are unloaded from the pilot control valve to the main control spool and the control spool of the main stage is centered in central position or in a preferred position by springs. Consequently, the cylinder axis leaves its position at **minimum velocity**.

[2] Positive command value at D vis-à-vis E results in flow from P to A at the main stage!

[3] Current input ±10 mA as option, input resistance 1 kΩ; in the ordering code, extend the type by "– 280".

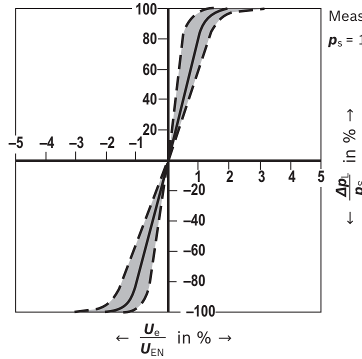
Block diagram of the integrated electronics (OBE)



Notice!
Electric signals taken out via control electronics (e.g. actual value or enable) must not be used for switching off safety-relevant machine functions!

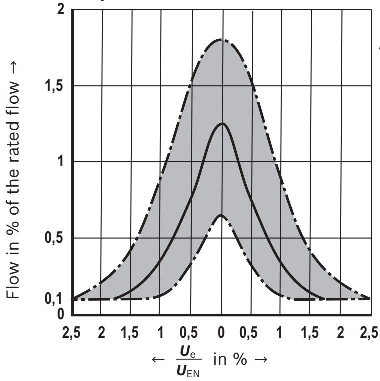
Characteristic curves (measured with v = 32 mm²/s and ϑ_{Oil} = 40 ±5 °C)

Pressure-signal characteristic curve (control spool V)



Measured with
p_s = 100 bar

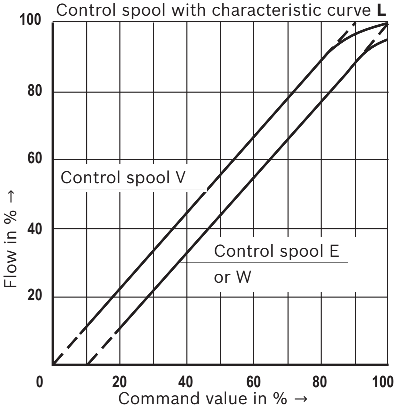
Zero flow of the main stage (control spool V) without pilot control valve



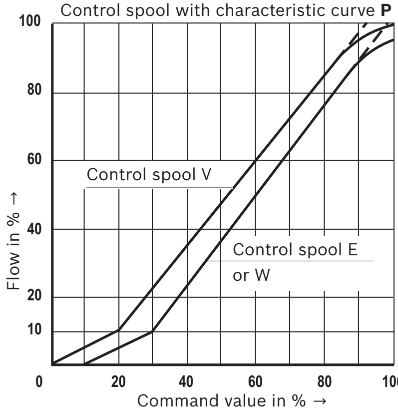
Measured with
p_s = 100 bar

Flow command value function e.g. with
P → A / B → T 10 bar valve pressure differential or
P → A or A → T 5 bar per control edge

Control spool with characteristic curve **L**

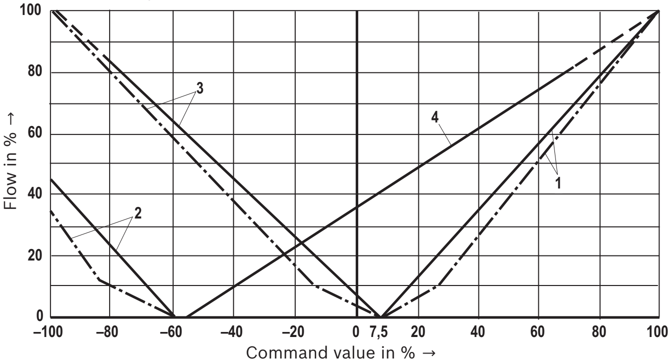


Control spool with characteristic curve **P**



Control spool **Q2-...P** —·—·

Control spool **Q2-...L** ——

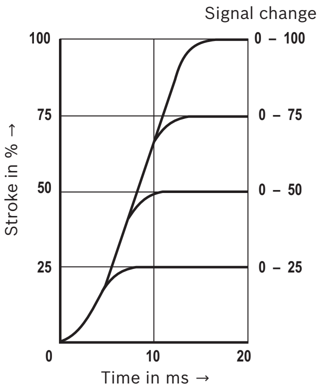


1 P → A
2 P → B
3 A → T
4 B → T

Characteristic curves size 10

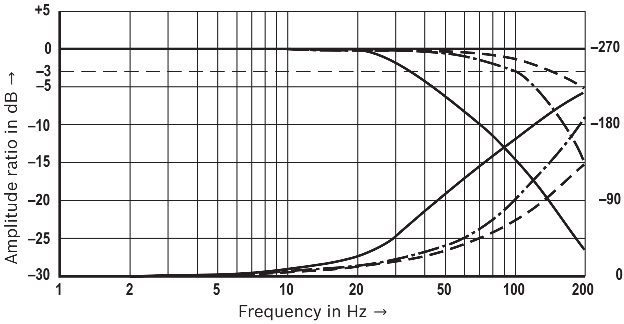
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

Transition function with stepped electric input signals



Measured with:
- Pilot control valve
  Port "X" = 140 bar
- Main stage
  Port "P" = 10 bar

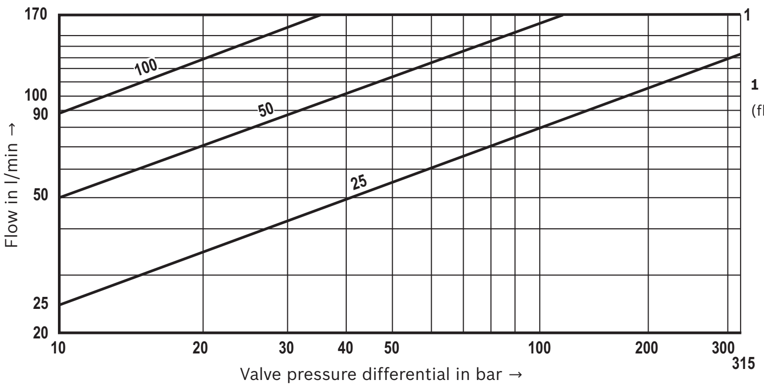
Frequency response characteristic curves



Measured with:
- Pilot control valve
  Port "X" = 140 bar
- Main stage
  Port "P" = 10 bar

Signal ±100 %
Signal ±25 %
Signal ±5 %

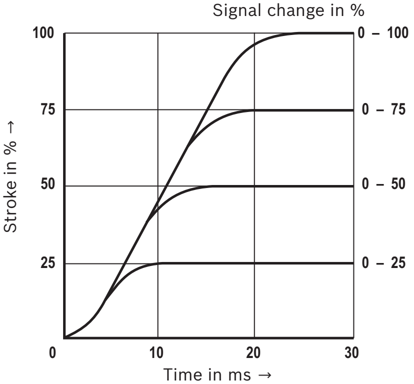
Flow/load function with maximum valve opening (tolerance ±10 %)



1 = recommended flow limitation (flow velocity 30 m/s)

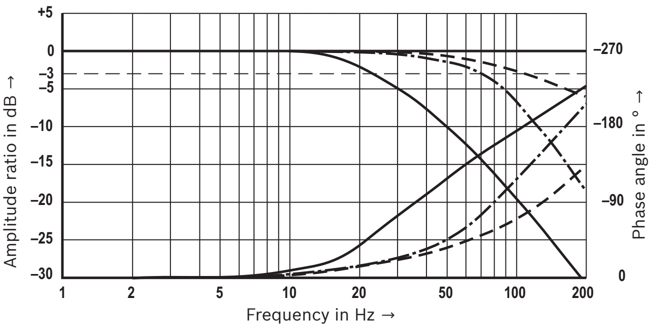
Characteristic curves size 16
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

Transition function with stepped electric input signals



Measured with:
- Pilot control valve
  Port "X" = 140 bar
- Main stage
  Port "P" = 10 bar

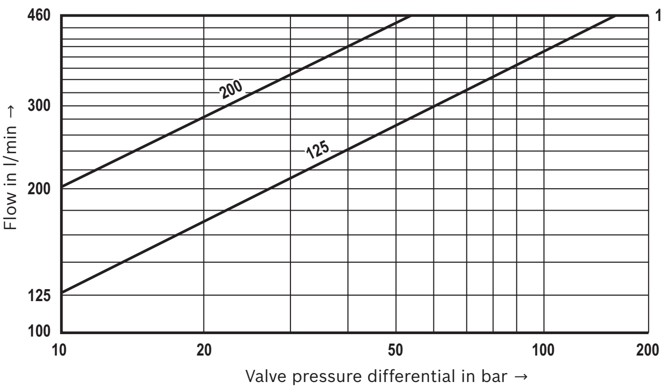
Frequency response characteristic curves



Measured with:
- Pilot control valve
  Port "X" = 140 bar
- Main stage
  Port "P" = 10 bar

Signal ±100 %
Signal ±25 %
Signal ±5 %

Flow/load function with maximum valve opening (tolerance ±10 %)

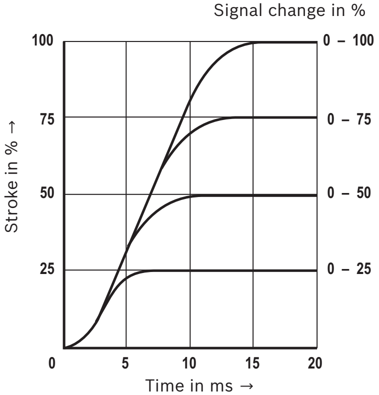


1 = recommended flow limitation
(flow velocity 30 m/s)

Characteristic curves size 25 and 27

(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

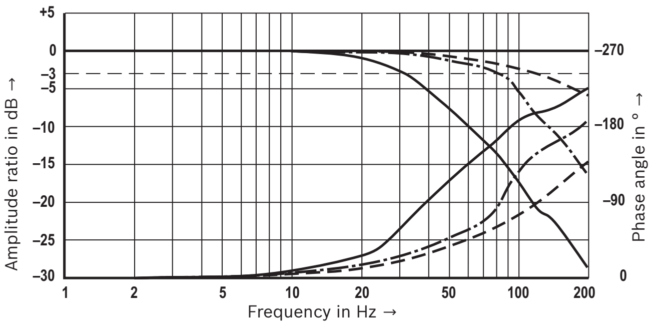
Transition function with stepped electric input signals



Measured with:

- Pilot control valve
  Port "X" = 140 bar
- Main stage
  Port "P" = 10 bar

Frequency response characteristic curves



Measured with:

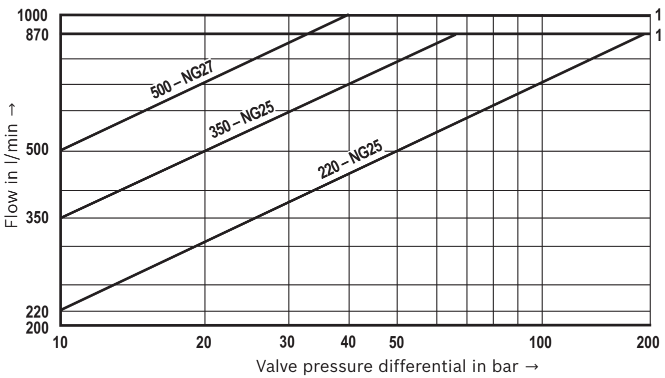
- Pilot control valve
  Port "X" = 140 bar
- Main stage
  Port "P" = 10 bar

Signal ±100 %

Signal ±25 %

Signal ±5 %

Flow/load function with maximum valve opening (tolerance ±10 %)

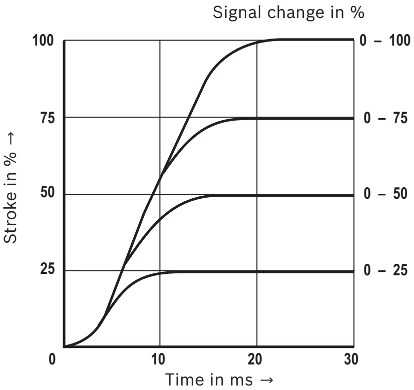


1 = recommended flow limitation (flow velocity 30 m/s)

Characteristic curves size 32

(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

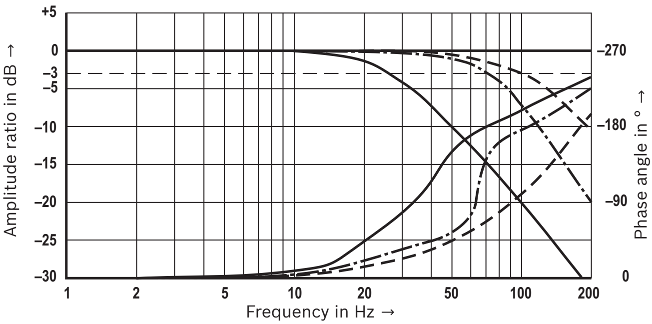
Transition function with stepped electric input signals



Measured with:

- Pilot control valve
  Port "X" = 140 bar
- Main stage
  Port "P" = 10 bar

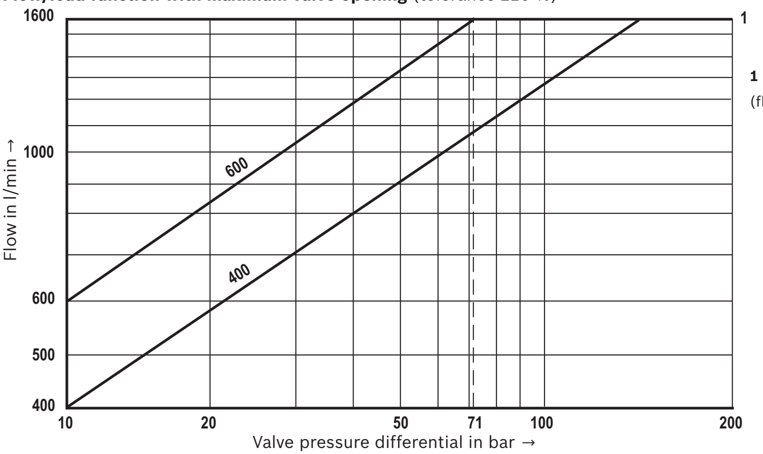
Frequency response characteristic curves



Measured with:

- Pilot control valve
  Port "X" = 140 bar
- Main stage
  Port "P" = 10 bar

Flow/load function with maximum valve opening (tolerance ±10 %)

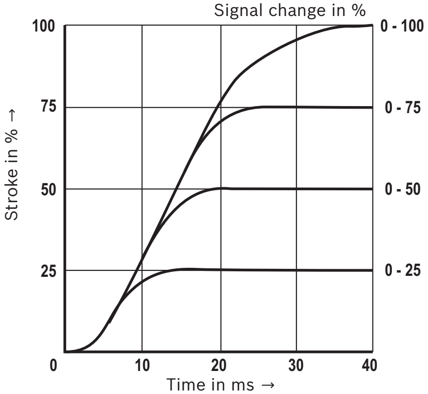


1 = recommended flow limitation (flow velocity 30 m/s)

5

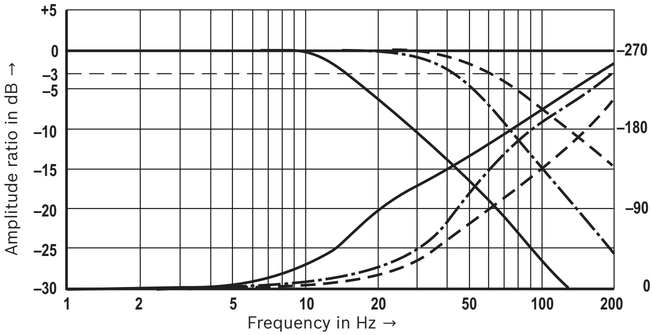
Characteristic curves size 35
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

Transition function with stepped electric input signals



Measured with:
- Pilot control valve
  Port "X" = 140 bar
- Main stage
  Port "P" = 10 bar

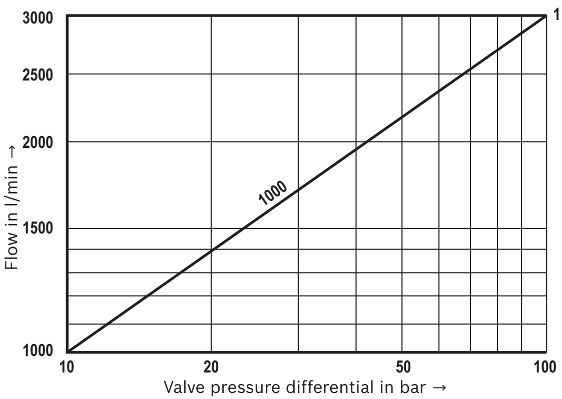
Frequency response characteristic curves



Measured with:
- Pilot control valve
  Port "X" = 140 bar
- Main stage
  Port "P" = 10 bar

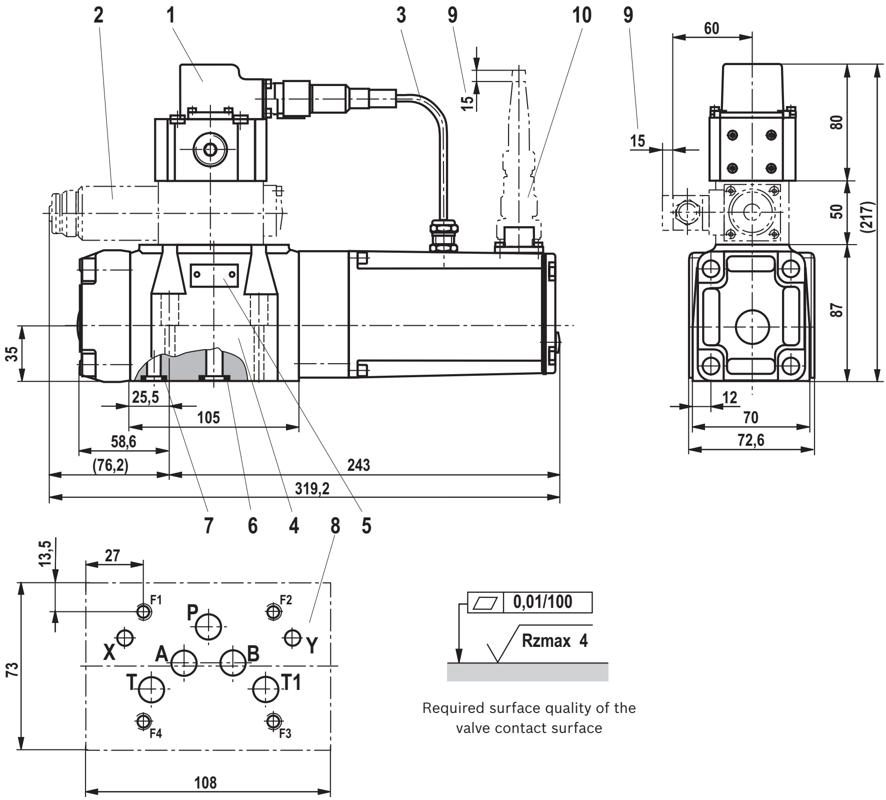
Signal ±100 %
Signal ±25 %
Signal ±5 %

Flow/load function with maximum valve opening (tolerance ±10 %)



1 = recommended flow limitation
(flow velocity 30 m/s)

Device dimensions size 10 (dimensions in mm)



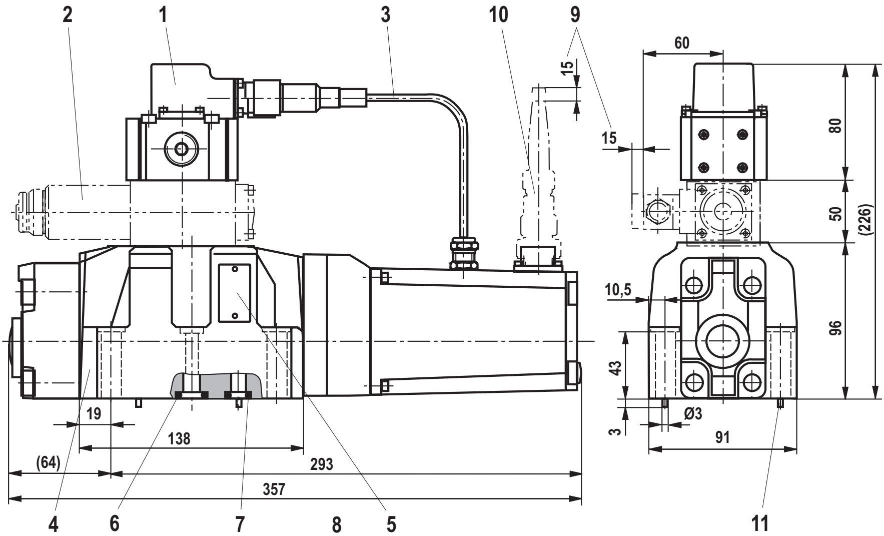
Required surface quality of the valve contact surface

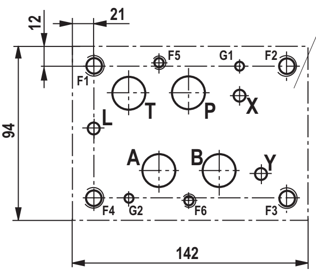
1 Pilot control valve
2 Directional sandwich plate valve (only contained with version "...WG152")
3 Cabling
4 Main stage
5 Name plate
6 Identical seal rings for ports A, B, P, T and T1
7 Identical seal rings for ports X and Y
8 Machined valve contact surface, porting pattern according to ISO 4401-05-05-0-05 (ports X and Y as required)
9 Space required to remove the mating connectors
10 Mating connector, separate order, see page 21

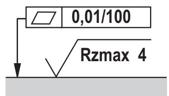
Notice!
The dimensions are nominal dimensions which may be subject to tolerance deviations.

Valve mounting screws and subplates see page 21

Device dimensions size 16 (dimensions in mm)







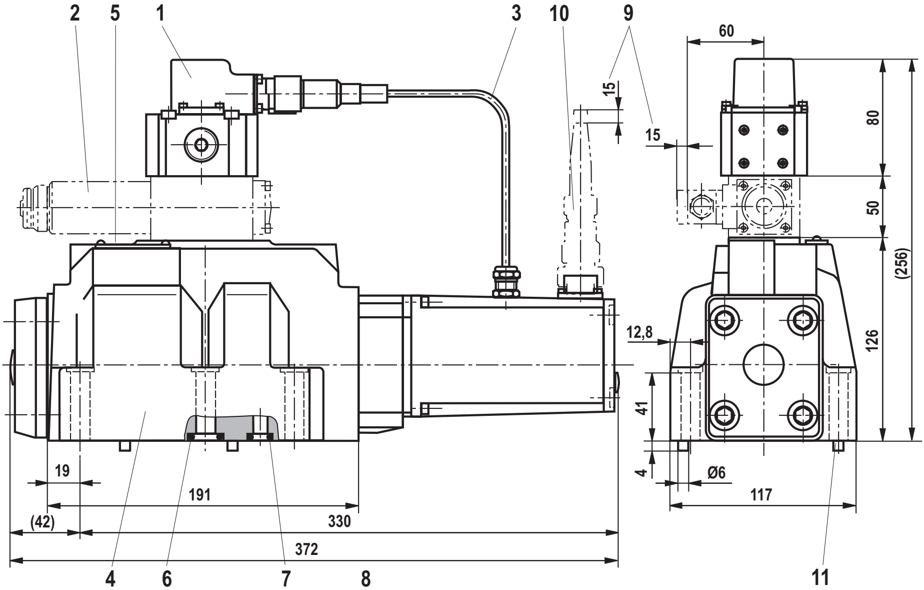
Required surface quality of the valve contact surface

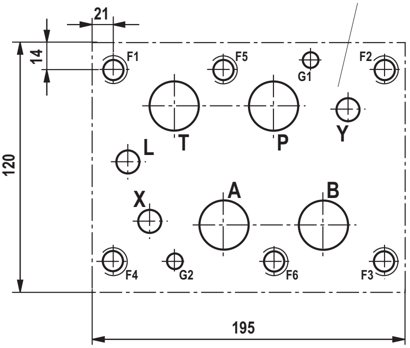
- **1** Pilot control valve
- **2** Directional sandwich plate valve (only contained with version "...WG152")
- **3** Cabling
- **4** Main stage
- **5** Name plate
- **6** Identical seal rings for ports A, B, P, T
- **7** Identical seal rings for ports X, Y, and L
- **8** Machined valve contact surface, porting pattern according to ISO 4401-07-07-0-05 (ports X and Y as required)
- **9** Space required to remove the mating connectors
- **10** Mating connector, separate order, see page 21
- **11** Locking pin

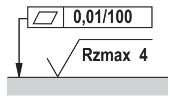
Notice!
The dimensions are nominal dimensions which may be subject to tolerance deviations.

Valve mounting screws and subplates see page 21

Device dimensions size 25 (dimensions in mm)







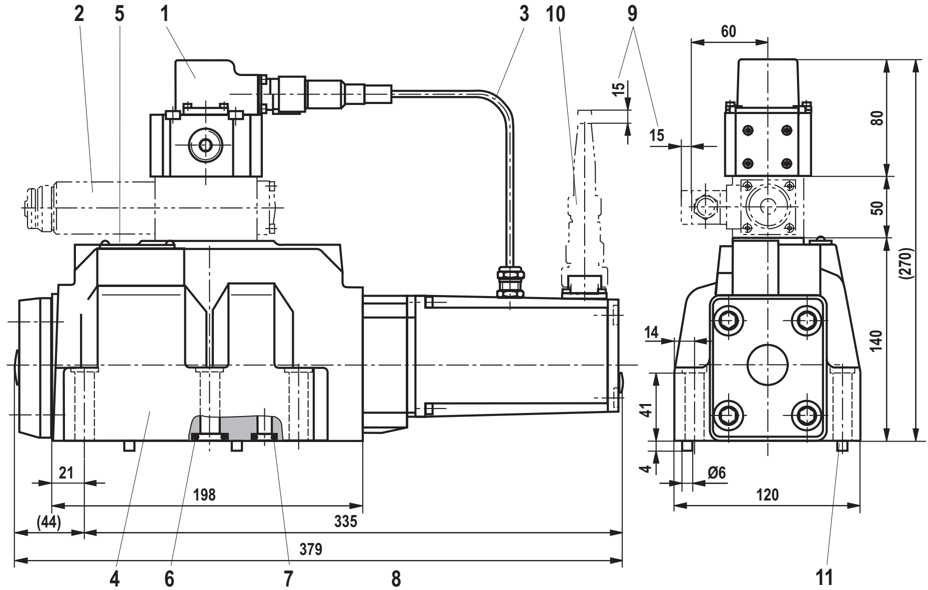
Required surface quality of the valve contact surface

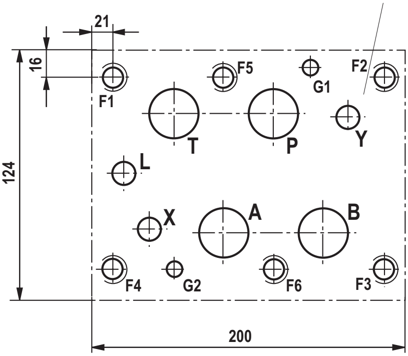
1 Pilot control valve
2 Directional sandwich plate valve (only contained with version "...WG152")
3 Cabling
4 Main stage
5 Name plate
6 Identical seal rings for ports A, B, P, T
7 Identical seal rings for ports X, Y, and L
8 Machined valve contact surface, porting pattern according to ISO 4401-08-08-0-05 (ports X and Y as required)
9 Space required to remove the mating connectors
10 Mating connector, separate order, see page 21
11 Locking pin

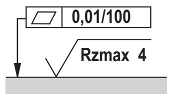
Notice!
The dimensions are nominal dimensions which may be subject to tolerance deviations.

Valve mounting screws and subplates see page 21

Device dimensions size 27 (dimensions in mm)







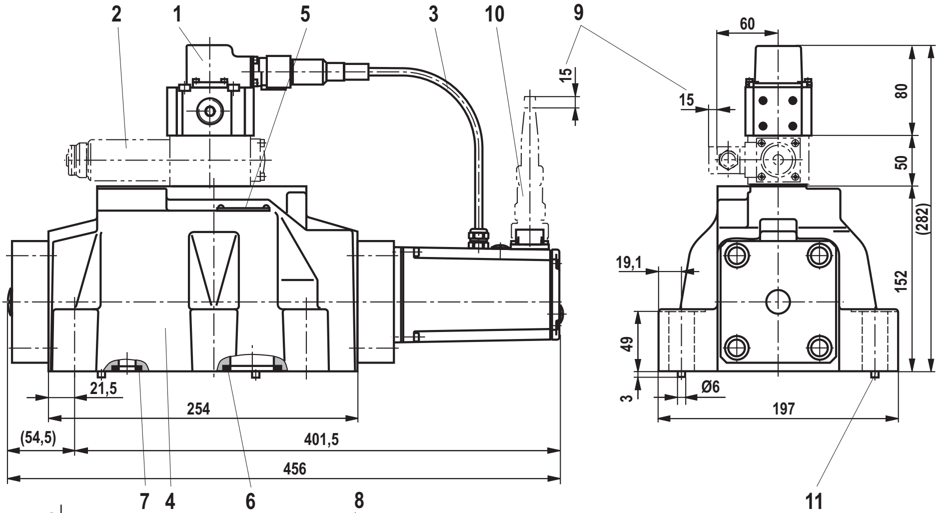
Required surface quality of the valve contact surface

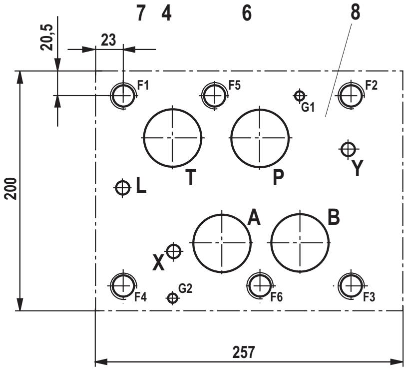
1. Pilot control valve
2. Directional sandwich plate valve (only contained with version "...WG152")
3. Cabling
4. Main stage
5. Name plate
6. Identical seal rings for ports A, B, P, T
7. Identical seal rings for ports X, Y, and L
8. Machined valve contact surface, porting pattern according to ISO 4401-08-07-0-05 (ports X and Y as required)
9. Space required to remove the mating connectors
10. Mating connector, separate order, see page 21
11. Locking pin

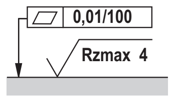
> **Notice!**
> The dimensions are nominal dimensions which may be subject to tolerance deviations.

Valve mounting screws and subplates see page 21

Device dimensions size 32 (dimensions in mm)







Required surface quality of the valve contact surface

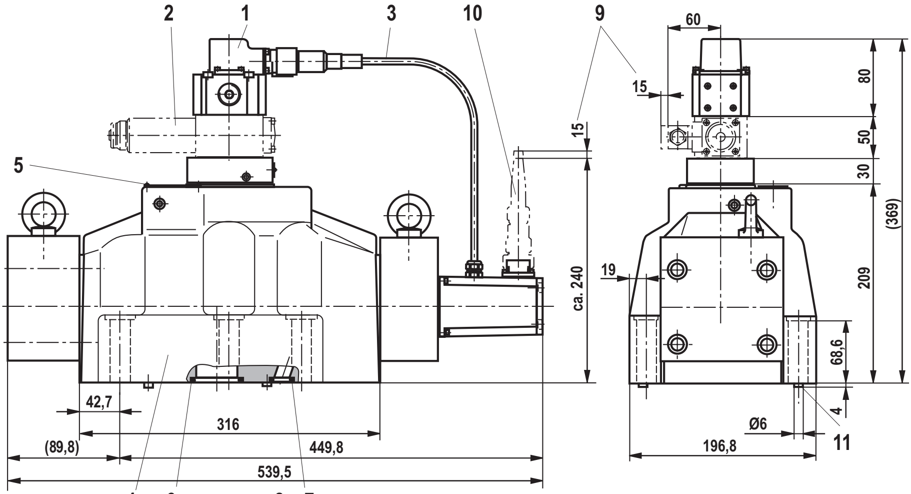
5

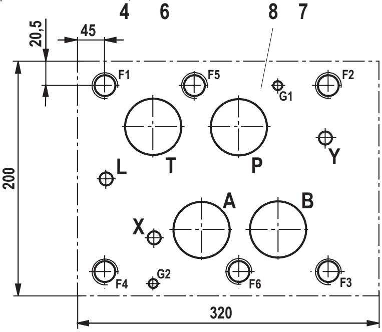
1 Pilot control valve
2 Directional sandwich plate valve (only contained with version "...WG152")
3 Cabling
4 Main stage
5 Name plate
6 Identical seal rings for ports A, B, P, T
7 Identical seal rings for ports X, Y, and L
8 Machined valve contact surface, porting pattern according to ISO 4401-10-09-0-05 (ports X and Y as required)
9 Space required to remove the mating connectors
10 Mating connector, separate order, see page 21
11 Locking pin

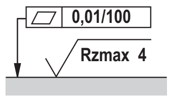
Notice!
The dimensions are nominal dimensions which may be subject to tolerance deviations.

Valve mounting screws and subplates see page 21

Device dimensions size 35 (dimensions in mm)







Required surface quality of the valve contact surface

1 Pilot control valve
2 Directional sandwich plate valve (only contained with version "...WG152")
3 Cabling
4 Main stage
5 Name plate
6 Identical seal rings for ports A, B, P, T
7 Identical seal rings for ports X, Y, and L
8 Machined valve contact surface, porting pattern according to ISO 4401-10-09-0-05 (ports X and Y as required)
9 Space required to remove the mating connectors
10 Mating connector, separate order, see page 21
11 Locking pin

Notice!
The dimensions are nominal dimensions which may be subject to tolerance deviations.

Valve mounting screws and subplates see page 21

Device dimensions

Hexagon socket head cap screws (separate order)		**Material number**
Size 10	4x ISO 4762 - M6 x 45 - 10.9-flZn-240h-L Tightening torque $\boldsymbol{M_A}$ = 13.5 Nm ±10 %	R913000258
Size 16	2x ISO 4762 - M6 x 60 - 10.9-flZn-240h-L Tightening torque $\boldsymbol{M_A}$ = 12.2 Nm ±10 % 4x ISO 4762 - M10 x 60 - 10.9-flZn-240h-L Tightening torque $\boldsymbol{M_A}$ = 58 Nm ±20 %	R913000115 R913000116
Sizes 25 and 27	6x ISO 4762 - M12 x 60 - 10.9-flZn-240h-L Tightening torque $\boldsymbol{M_A}$ = 100 Nm ±20 %	R913000121
Size 32	6x ISO 4762 - M20 x 80 - 10.9-flZn-240h-L Tightening torque $\boldsymbol{M_A}$ = 340 Nm ±20 %	R901035246
Size 35	6x ISO 4762 - M20 x 100 - 10.9-flZn-240h-L Tightening torque $\boldsymbol{M_A}$ = 360 Nm ±20 %	R913000386

Notice: For reasons of stability, exclusively the following valve mounting screws may be used: The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure!

Subplates	**Data sheet**
Size 10	45054
Size 16	45056
Sizes 25 and 27	45058
Size 32	45060

Accessories (not included in the scope of delivery)

Mating connectors (details see page 7)	**Data sheet**	**Material number**
For high-response valve: Mating connector according to DIN EN 175201-804	08006	e.g. R900021267 (plastic) e.g. R900223890 (metal)
compatible with VG95328 size 14-6S		e.g. R900013159 (plastic)
For sandwich plate: Mating connector according to DIN EN 175301-803, ISO 4400		e.g. R901017011 (plastic)

Miscellaneous	**Material number**
Filter element and seal	R961001949

5

Notes

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
documentation@boschrexroth.de
www.boschrexroth.de

Rexroth
Bosch Group

2- and 3-way high response cartridge valve

RE 29137/10.05
Replaces: 08.03

Type .WRCE.../P

Nominal sizes 32, 40 and 50
Component series 2X
Maximum operating pressure 420 bar
Maximum flow 4500 L/min

Type 3WRCE...-2X/P

Type 2WRCE...-2X/P

Overview of contents

[1] Not for new applications!

For information regarding the available spare parts see:
www.boschrexroth.com/spc

Features

– Pilot operated 2-stage valve, of cartridge design
– Suitable for closed loop, position, pressure, force and speed
– Pilot control valve (pilot):
  Direct operated proportional valve NS6 with electrical feedback, trimmed, closes the 2WRCE main stage in the event of a power failure and when pilot pressure is applied, opens the 3WRCE main stage from A to T
– Main stage: closed loop position controlled
– Integrated control and closed loop control electronics (OBE)
– Manifold mounting:
  Cavity to DIN ISO 7368 for 2WRCE
– Typical applications:
  • Presses
  • Dye casting machines
  • Nibbling axis

For further information see:
– Pilot control valve, similar
  • Type 4WREE 6 to RE 29061

Note
For further variants of type .WRCE…/S with servo pilot control see RE 29136

Ordering details: type 2WRCE

2	WRCE		S		–2X/	P	G24	K31/			*

2/2-way directional valve	= 2
Electrically operated high response cartrdige valve With integrated electronics (OBE)	= WRCE
Nominal size 32	= 32
Nominal size 40	= 40
Nominal size 50	= 50
Poppet spool	= S
Nominal flow in l/min with a 5 bar valve pressure differential	
NS32: 650 l/min linear	= 650
480 l/min with a fine control range **only** ...S480R...	= 480
NS40: 1000 l/min linear **only** ...S1000L...	= 1000
700 l/min with a fine control range **only** ...S700R...	= 700
NG50: 1600 l/min linear **only** ...S1600L...	= 1600
1100 l/min with a fine control range **only** ...S1100R...	= 1100
Characteristic curve form	
Linear	= L
Linear with a progressive fine control range	= R
Component series 20 to 29 (20 to 29 unchanged installation and connection dimensions)	= 2X
Pilot control valve (pilot)	
Proportional valve	= P
Supply voltage 24 VDC	= G24
Electrically connections	
Without plug-in connection, with component plug to DIN EN 175201-804 (separate order, see page 12)	= K31
Electronic interfaces	
Command value 0 ...+10 V, actual value +0.5 ...+10 V	= A1
Command value 0 ...+10 mA, actual valve +0.5 ...+10 mA	= C1
Sandwich plate isolator valve	
Without isolator valve	= No code
With isolator valve:	
A de-energised isolator valve actively closes the 2WRCE using the applied pilot pressure	= WK15
A de-energised isolator valve actively opens the 2WRCE using the applied pilot pressure	= WL15
Seal material	
NBR seals, suitable for mineral oil HL and HLP to DIN 51524	= M
FKM seals	= V
Further details in clear text	*

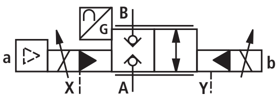
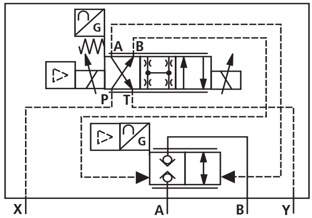
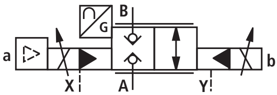
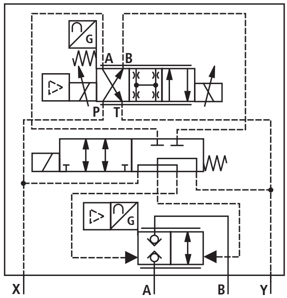
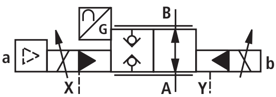
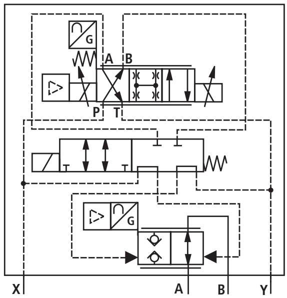
Ordering details: type 3WRCE – not for new applications!

3	WRCE				–2X /	P	G24	K31 /			*

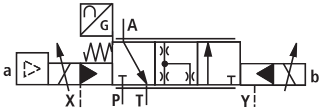
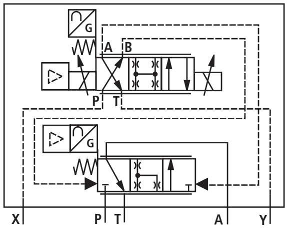
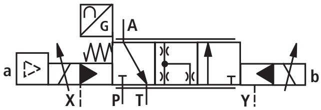
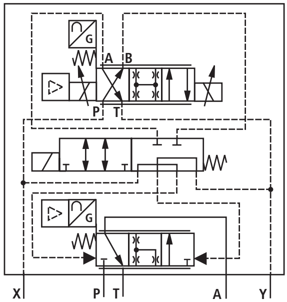
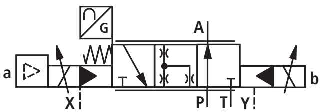
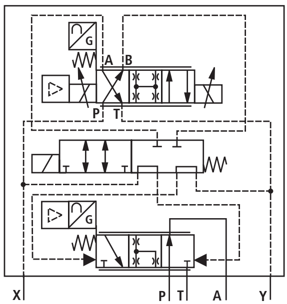
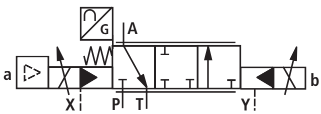
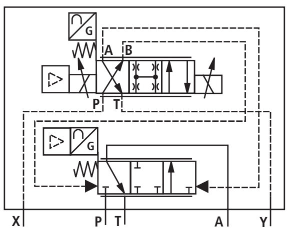
3/2-way directional valve	= 3
Electrically operated high response control valve for manifold mounting With integrated electronics (OBE)	= WRCE
Nominal size 32	= 32
Nominal size 40	= 40
Nominal size 50	= 50
Sliding spool, zero overlap (+0.5...+1.5 %)	= V
Sliding spool, with 10…13 % positive overlap	= E
Nominal flow in l/min with a 5 bar valve pressure differential	
NS32: 290 l/min linear **only** ...V290L...	= 290
NS32: 250 l/min with a fine control range **only** ...E250P...	= 250
NS40: 460 l/min linear **only** ...V460L...	= 460
NS40: 410 l/min with a fine control range **only** ...E410P...	= 410
NS50: 720 l/min linear **only** ...V720L...	= 720
NS50: 620 l/min with a fine control range **only** ...E620P...	= 620
Characteristic curve form	
Linear	= L
Linear with a linear fine control range	= P
Component series 20 to 29 (20 to 29 unchanged installation and connection dimensions)	= 2X
Pilot control valve (pilot)	
Proportional valve	= P
Supply voltage 24 VDC	= G24
Electrical connections	
Without plug-in connector, with component plug to DIN EN 175201-804 (separate order, see page 12)	= K31
Electronic interfaces	
Command value ± 10 V, actual value ± 10 V	= A1
Command value ± 10 mA, actual value ± 10 mA	= C1
Sandwich plate isolator valve	
Without isolator valve	= No code
With isolator valve:	
A de-energised isolator valve actively opens the 3WRCE, using the applied pilot pressures from A to T	= WK15
A de-energised isolator valve actively opens the 3WRCE, using the applied pilot pressures from P to A	= WL15
24 VDC power supply, plug-in connector separate order, see page 12 (without circuitry)	
Seal material	
NBR seals, suitable for mineral oil HL and HLP to DIN 51524	= M
FKM seals	= V
Further details in clear text	*

5

Symbols: type 2WRCE

Simplified	Detailed
2WRCE..-2X/P...	**2WRCE..-2X/P...**
	
2WRCE..-2X/P...WK15...	**2WRCE..-2X/P...WK15...**
	
2WRCE..-2X/P...WL15...	**2WRCE..-2X/P...WL15...**
	

Symbols: type 3WRCE – not for new applications!

Simplified	Detailed
3WRCE..V...-2X/P... 	3WRCE..V...-2X/P... 
3WRCE..V...-2X/P...WK15... 	3WRCE..V...-2X/P...WK15... 
3WRCE..V...-2X/P...WL15... 	3WRCE..V...-2X/P...WL15... 
3WRCE..E...-2X/P... 	3WRCE..E...-2X/P... 

Design, function and section: type 2WRCE

The type 2WRCE...-2X/P... valves are 2-stage high response control valves.

They control the size and direction of a flow and are mainly used in closed loop control circuits.

Design

They comprise of the following assemblies:

– The single stage proportional pilot control valve (1), (pilot), with two solenoids as electro-mechanical converters and a spool that is connected to the integrated pilot electronics (6.2) via an electrical feedback

– The second stage (2) for flow control

– An inductive position transducer (3) whose core (4) is fixed to the spool (5) of the third stage

– And integrated closed loop control electronics (6.1).

Function

Within the integrated control electronics (OBE) the command and actual values are compared and the pilot control valve solenoids are controlled via a current proportional to the closed loop control deviation.

The pilot control valve assumes a proportional control position and controls the flows into or from control chambers A (7) and B (8) that actuate the main spool (5) by means of the closed loop valve control until the system deviation is 0.

The stroke of the main spool is thus controlled in proportion to the command value. It must be noted here that the flow also depends on the valve pressure drop.

Special valve features

Flow can pass through the valve from A to B or from B to A.

The poppet opens or closes at a command value of 5 %. In the case of smaller command values, the closed loop valve control tries to correct the spool position, thus pressing it onto the seat up at a pressure to the maximum pilot pressure and closing the connection leak-free.

The stated valve dynamics are only valid within the closed loop control range of the valve. In the case of command value step changes from the seated position to small opening values additional time delays occur.

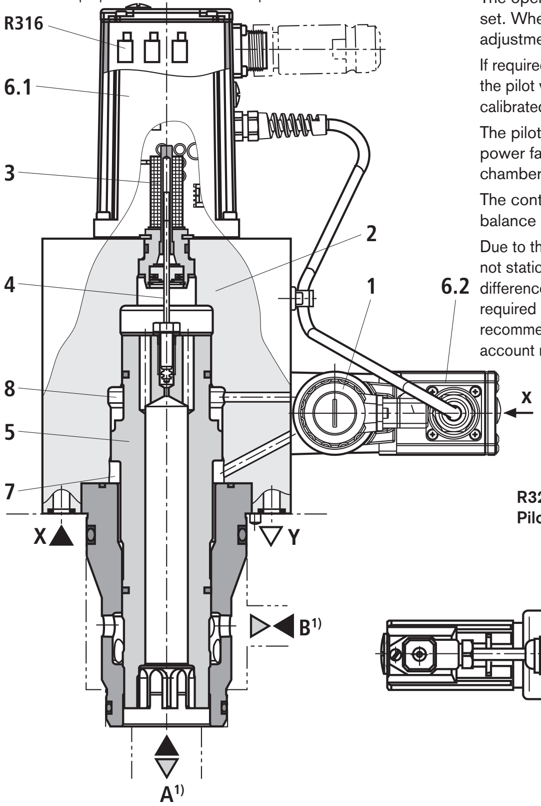
The opening point of 5 % (= 0.5 V or 0.5 mA) is factory preset. When the pilot valve or the controller are replaced, adjustments are usually not required.

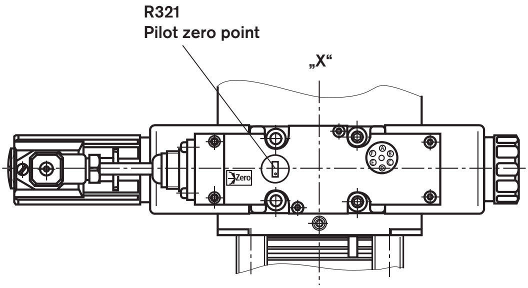
If required, the pilot zero point can be adjusted via the R321 after the pilot was replaced, or the zero point of the entire valve calibrated via the R316 after the controller was replaced.

The pilot valve has an internal setting so that in the case of a power failure the pilot pressure is connected to control chamber B (8), i.e. the main stage closes.

The control electronics have an offset setting in order to balance out the pilot trimming.

Due to the diameter differences of the seat area, the spools are not statically pressure compensated. In order to balance the force difference, with spool type S...L 6 % of the system pressure is required as pilot pressure, with spool type S...R 22 %. The recommended minimum pilot pressure is obtained by taking into account reserves required for the flow forces and dynamics.





1) Preferably port B should be connected to the actuator.

Design, function and section: type 3WRCE – not for new applicatons!

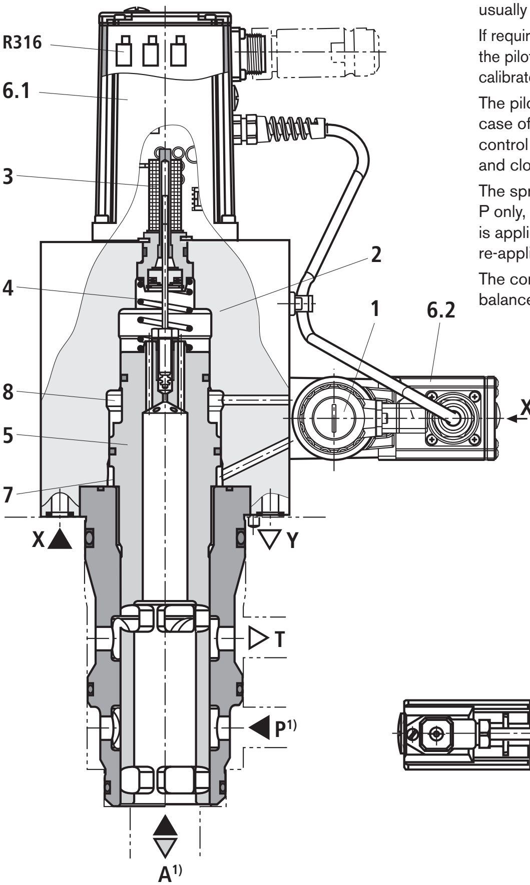
The type 3WRCE...-2X/P... valves are 2-stage high response control valves.

They control the size and direction of a flow and are mainly used in closed loop control circuits.

Design

They comprise of the following assemblies:

- The single stage proportional pilot control valve (1), (pilot), with two solenoids as electro-mechanical converters and a spool that is connected to the integrated pilot electronics (6.2) via an electrical feedback
- The second stage (2) for flow control
- An inductive position transducer (3) whose core (4) is fixed to the spool (5) of the second stage
- And integrated control electronics (6.1).



1) Please use the variant with P and A exchanged. Please consult us!

Function

Within the integrated control electronics (OBE) the command and actual values are compared and the pilot control valve solenoids are controlled via a current proportional to the closed loop control deviation.

The pilot control valve assumes a proportional control position and controls the flows into or from control chambers A (7) and B (8) that actuate the main spool (5) by means of the closed loop valve control until the system deviation is 0.

The stroke of the main spool is thus controlled in proportion to the command value. It must be noted here that the flow also depends on the valve pressure drop.

Special valve features

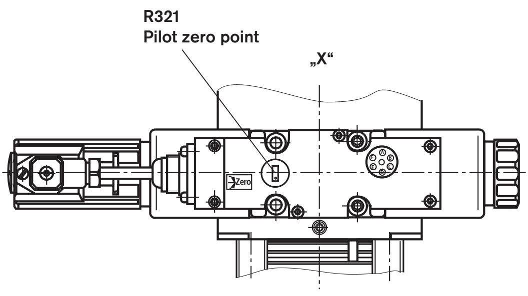
The opening point of 0 % (V spools) is factory pre-set. When the pilot valve or the controller are replaced, adjustments are usually not required.

If required, the pilot zero point can be adjusted via the R321 after the pilot was replaced, or the zero point of the entire valve calibrated via the R316 after the controller was replaced.

The pilot control valve has an internal setting so that in the case of a power failure the pilot pressure is connected to control chamber B (8), i.e. the main stage opens from A to T, and closes the connection from P to A.

The spring behind the main spool moves the spool to position P only, after the connection to A is closed, when no pressure is applied (e.g. before installation or when the pressures are re-applied after a tool change).

The control electronics have an offset setting in order to balance out the pilot trimming.



Technical data: type 2WRCE (for applications outside these parameters, please consult us!)

General

Nominal size	NS	**32**	**40**	**50**
Weight	kg	12.5	19.9	26.8
Weight with isolator valves ...../...WK or .../...WL...	kg	13.7	21.1	28
Pilot control valve nominal size (pilot)	NS	6	6	6
Installation; commissioning		Optional, preferably horizontal; to RE 07700		
Storage temperature range	°C	–20 to +80		
Ambient temperature range	°C	–20 to +50		

Hydraulic (measured with HLP32, $\vartheta_{oil} = 40\ °C \pm 5\ °C$)

Nominal size	NS	**32**	**40**	**50**
Max. operating pressures				
– Main stage, ports A, B	bar	420		
– Pilot control valve, port X	bar	315		
– Pilot control valve, port Y	bar	210		
Minimum control pressure in % of the system pressure				
– For spool version S...L	%	15		
– For spool version S...R	%	45		
Nominal flow q_{Vnom} +10 % at $\Delta p = 5$ bar – Version ...S...L (linear)	l/min	650	1000	1600
– Version ...S...R (linear with a progressive fine control range)	l/min	480	700	1100
Max. flow – For spool ...S...L	l/min	1500	2200	3500
Max. flow – For spool ...S...R	l/min	2000	3000	4500
Control oil flow at X and Y with a stepped form of input signal from 0 to 100 % (315 bar)	l/min	37	45	60
Zero flow of the proportional pilot stage in relation to the pressure in pipe X	l/min	$q_{Lmin} = 0{,}0026 \frac{L}{min\ bar} \cdot p_x$ [bar] $q_{Lmax} = 0{,}0095 \frac{L}{min\ bar} \cdot p_x$ [bar]		
Control oil flow	cm^3	4.52	8.48	17.3
Pressure fluid		Mineral oil (HL, HLP) to DIN 51524, other pressure fluids on request		
Pressure fluid temperature range	°C	–20 to +80; preferably +40 to +50		
Viscosity range	mm^2/s	20 to 380; preferably 30 to 45		
Max. permissible degree of pressure fluid contamination Cleanliness class to ISO 4406 (c) – Pilot control valve + main valve		Class 20/18/15 [1)]		
Hysteresis	%	≤ 0.2		
Reversal span	%	≤ 0.1		
Response sensitivity	%	≤ 0.1		
Closing time with: – Pilot control valve	ms	≤ 200		
(with control pressure of 40 to 315 bar) – Sandwich plate isolator valve	ms	≤ 200		

1) The cleanliness class stated for the components must be adhered to in hydraulic systems. Effective filtration prevents faults from occurring and at the same time increases the component service life. For the selection of filters see data sheets:
RE 50070, RE 50076, RE 50081; RE 50086 and RE 50088

Technical data: type 2WRCE (for applications outside these parameters, please consult us!)

Electrical

Nominal size	NS	32	40	50
Voltage type		DC		
Signal type		Analogue		
Opening point calibration	%	≤ 1		
Zero displacement with a change in:				
– Pressure fluid temperature	%/10 K	≤ 0.3	≤ 0.3	≤ 0.3
– Control pressure in X	%/100 bar	≤ 0.7	≤ 0.7	≤ 0.7
– Return pressure in Y	%/bar	≤ 0.3	≤ 0.3	≤ 0.3
Valve protection to EN 60529		IP65 with mounted and fixed plug-in connector		

Note!
for details regarding the enviromental siumulation test covering EMC (electro-magnetic compatibility), climate and mechanical loading see RE 29137-U (declaration regarding environmental compatibility).

Integrated electronics (OBE) type VT 13037

Block circuit diagram, see page 11

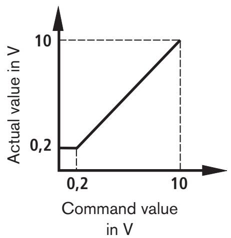
Nominal command value range for the 2WRCE:
0 to +10 V (mA) ≙ 0 to 100 %

Within the command value range of 0 to +0.5 V, the actual value remains constant at 0.5 V.

With a slow command value change from +0.5 V to +10 V, the actual value follows the command value within ±0.15 V.

With command values over +10 V, the command value follows up to approx. +12 V.

With a command value jump to +10 V, the actual value can briefly reach values of approx. +10.5 V.



5

Technical data: type 3WRCE [1] (for applications outside these parameters, please consult us!)

General

Nominal size	NS	**32**	**40**	**50**
Weight	kg	12.8	20.2	28
Weight with isolator valves ...../...WK or .../...WL...	kg	14	21.4	29.2
Pilot control valve nominal size (pilot)	NS	6	6	6
Installation; commissioning		Optional, preferably horizontal; to RE 07700		
Storage temperature range	°C	–20 to +80		
Ambient temperature range	°C	–20 to +50		

Hydraulic (measured with HLP32, $\vartheta_{oil} = 40$ °C ± 5 °C)

Nominal size	NS	**32**	**40**	**50**
Max. operating pressures				
– Main stage, ports A, B, T	bar	315		
– Pilot control valve, port X	bar	315		
– Pilot control valve, port Y	bar	210		
Nominal flow q_{Vnom} +10 % at $\Delta p = 5$ bar – Version ...V...L (linear)	l/min	290	460	720
Max. flow	l/min	900	1400	2200
Control oil flow at X and Y with a stepped form of input signal from 0 to 100 % (315 bar)	l/min	20	35	55
Max. zero flow of the main stage at $p_p = 300$ bar	l/min	4	6	8
Zero flow of the proportional pilot stage in relation to the pressure in pipe X	l/min	$q_{Lmin} = 0{,}0026 \frac{L}{\text{min bar}} \cdot p_x$ [bar] $q_{Lmax} = 0{,}0095 \frac{L}{\text{min bar}} \cdot p_x$ [bar]		
Control oil flow	cm^3	± 2.26	± 4.24	± 8.65
Pressure fluid		Mineral oil (HL, HLP) to DIN 51524, other pressure fluids on request		
Pressure fluid temperature range	°C	–20 to +80; preferably +40 … +50		
Viscosity range	mm^2/s	20 to 380; preferably 30 to 45		
Max. permissible degree of pressure fluid contamination Cleanliness class to ISO 4406 (c) – Pilot control valve + main valve		Class 20/18/15 [2]		
Hysteresis	%	≤ 0,2		
Reversal span	%	≤ 0,1		
Response sensitivity	%	≤ 0,1		
Closing time with: – Pilot control valve	ms	≤ 200		
(for control pressures from 40 to 315 bar) – Sandwich plate isolator valve	ms	≤ 200		

[1] Not for new applications!

[2] The cleanliness class stated for the components must be adhered to in hydraulic systems. Effective filtration prevents faults from occurring and at the same time increases the component service life. for the selection of filters see data sheets:
RE 50070, RE 50076, RE 50081; RE 50086 and RE 50088

Technical data: type 3WRCE [1)] (for applications outside these parameters, please consult us!)

Electrical

Nominal size	NS	32	40	50
Voltage type		DC		
Signal type		Analogue		
Opening point calibration	%	≤ 1		
Zero displacement with a change in:				
– Pressure fluid temperature	%/10 K	≤ 0.3	≤ 0.3	≤ 0.3
– Control pressure in X	%/100 bar	≤ 0.7	≤ 0.7	≤ 0.7
– Return pressure in Y	%/bar	≤ 0.3	≤ 0.3	≤ 0.3
Valve protection to EN 60529		IP65 with mounted and fixed plug-in connector		

1) Not for new applications!

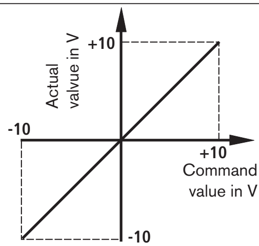
Integrated electronics (OBE) type VT 13037

Nominal current value range for the 3WRCE:
0 to ±10 V (mA) ≙ 0 to ±100 %

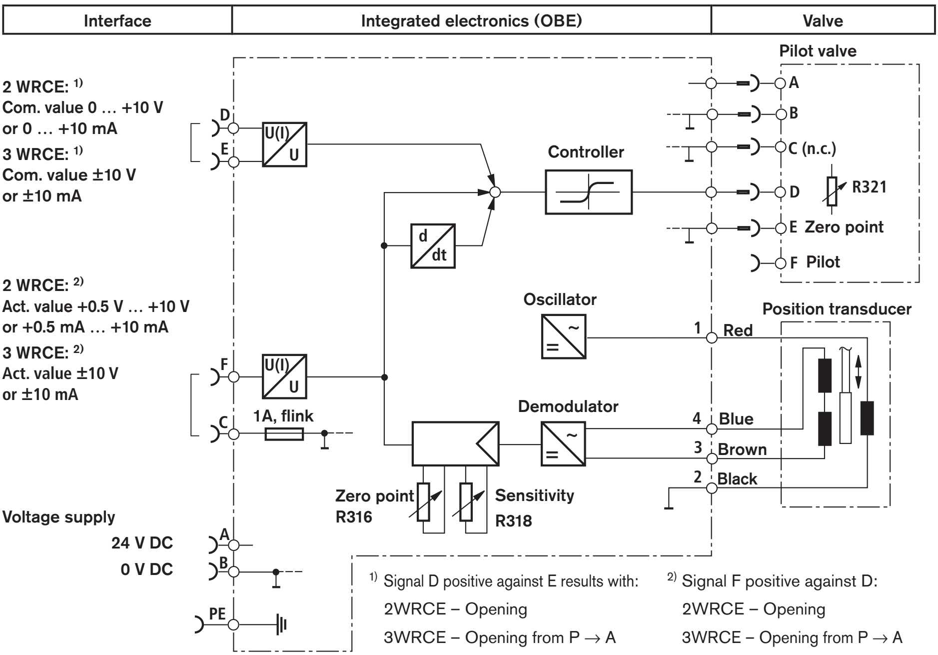
With a slow command value change from 0 V to ±10 V, the actual value follows the command value within ±0,15 V.

With command values over ±10 V, the command value follows up to approx. ±13 V.

With a command value jump to ±10 V, the actual value can briefly each values of approx. ±10,5 V.



Block circuit diagram (OBE) type VT13037



1) Signal D positive against E results with:
2WRCE – Opening
3WRCE – Opening from P → A

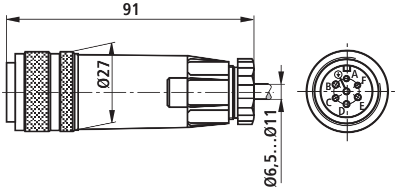
2) Signal F positive against D:
2WRCE – Opening
3WRCE – Opening from P → A

5

Electrical connections, plug-in connectors

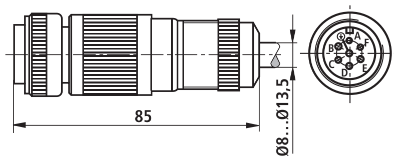
Plug-in connector

Plug-in connector to DIN EN 175201-804
Separate order under Material No. **R900021267**
(plastic version)



Plug-in connector

Plug-in connector to DIN EN 175201-804
Separate order under Material No. **R9000223890**
(metal version)

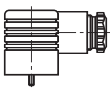
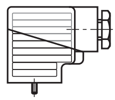


Component plug allocation	Pin	Electronic interface A1 allocation		Electronic interface C1 allocation	
		2WRCE	3WRCE	2 WRCE	3WRCE
Voltage supply	A	24 VDC nominal (18 ... 30 V; $I_{average}$ = 1 A, I_{peak} = 3 A)			
	B	0 VDC			
Measurement zero	C	Reference to in F			
Differential command	D	0 ... +10 V	0 ... ±10 V	0 ... +10 mA	0 ... ±10 mA
value input	E	Input resistance >100 kΩ	Input resistance >100 kΩ	Load 100 Ω	Load 100 Ω
Actual valve Reference is contact C [1]	F	+0,5 ... +10 V Max. 10 mA	0 ... ±10 V Max. 10 mA	+0,5 ... +10 mA Load max. 1 kΩ	0 ... ±10 mA Load max. 1 kΩ
Earth	PE	Connected to the valve housing Do not connect when the valve is already earthed via the system			

[1] The command and acutal values have the same polarity. If fuse „1A flink“ fails, then the actual value can also be measured between F and B.

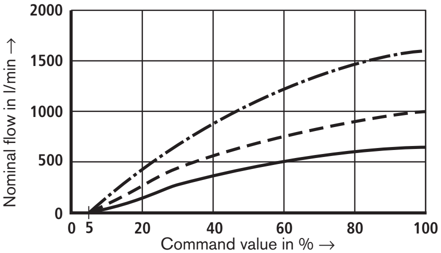
Note: **Electrical signals (e.g. actual value) taken via valve electronics must not be used to switch off the machine safety functions!**
(Also see the European Standard „Safety requirement for fluid power systems and components – Hydraulics“, EN 982!)

Plug-in connectors for isolator valves to DIN EN 175301-803 for component plug „K4“

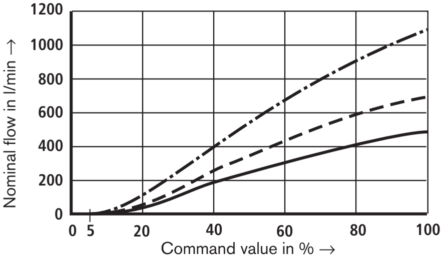
Further plug-in connectors see RE 08006					
		Material No.			
Valve side	**Colour**	Without circuitry	With indicator light 12 … 240 V	With rectifier 12 … 240 V	With indicator light and Z-diode protective circuitry 24 V
a	Grey	**R901017010**	–	–	–
a/b	Black	–	**R901017022**	**R901017025**	**R901017026**

Characteristic curves (measured with HLP32, $\vartheta_{oil} = 40\ °C \pm 5\ °C$)

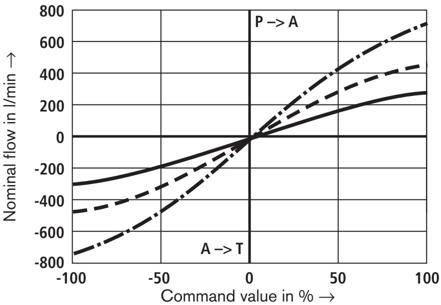
Nominal flow with a 5 bar valve pressure differential A → B = B → A



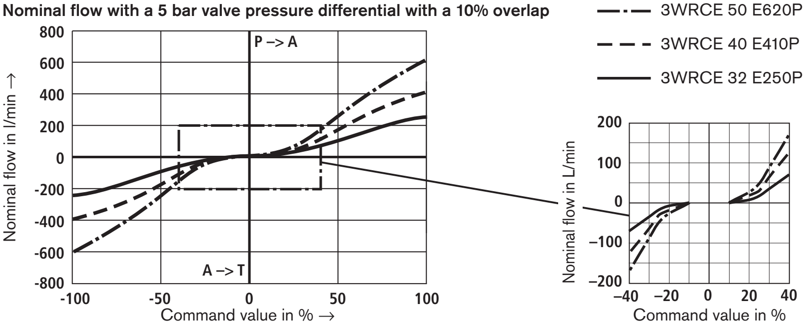
Nominal flow with a 5 bar valve pressure differential A → B = B → A



Nominal flow with a 5 bar valve pressure differential

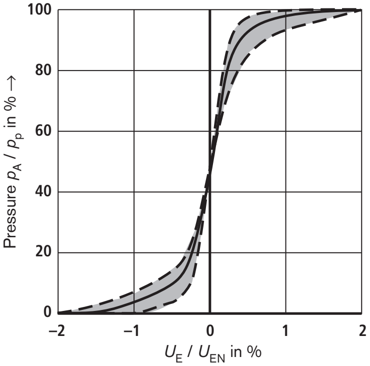


Nominal flow with a 5 bar valve pressure differential with a 10% overlap



Characteristic curves (measured with HLP32, $\vartheta_{oil} = 40\ °C \pm 5\ °C$)

Pressure-signal function for the 3WRCE...V... limiting and average value characteristic curves

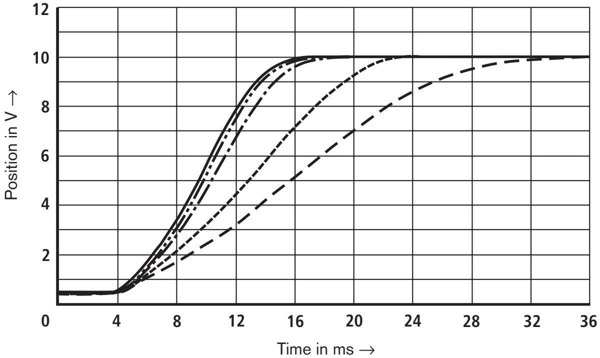


Characteristic curves (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

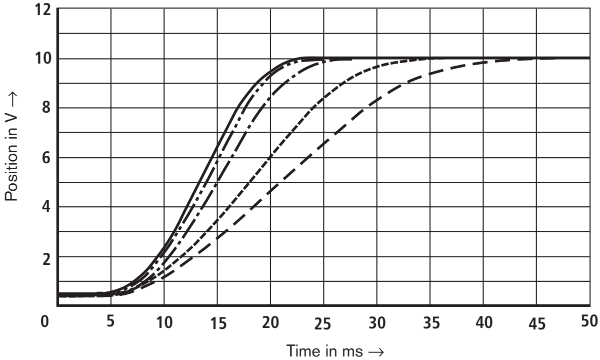
Transient function

— — — 40 bar, ------ 70 bar, —·— 140 bar, —··— 210 bar, ——— 315 bar

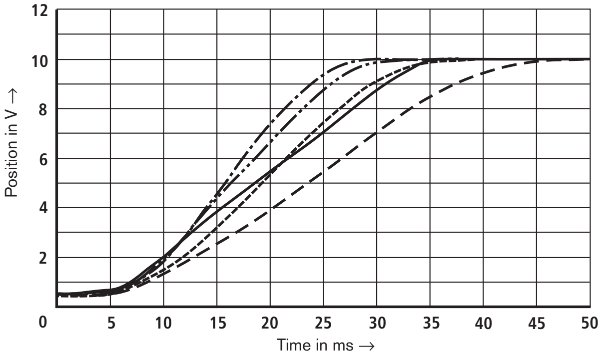
2WRCE 32...



2WRCE 40...



2WRCE 50...

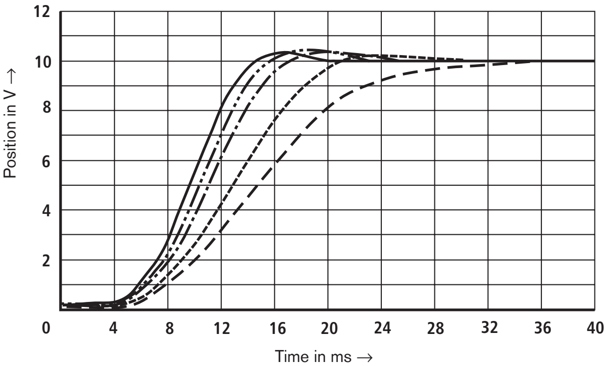


Characteristic curves (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

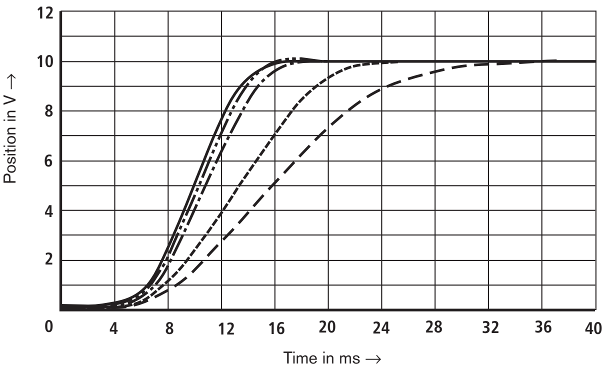
Transient function

– – – 40 bar, ------ 70 bar, —·— 140 bar, —··— 210 bar, —— 315 bar

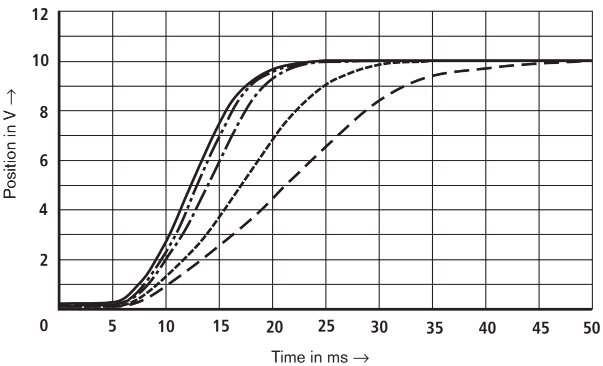
3WRCE 32…



3WRCE 40…



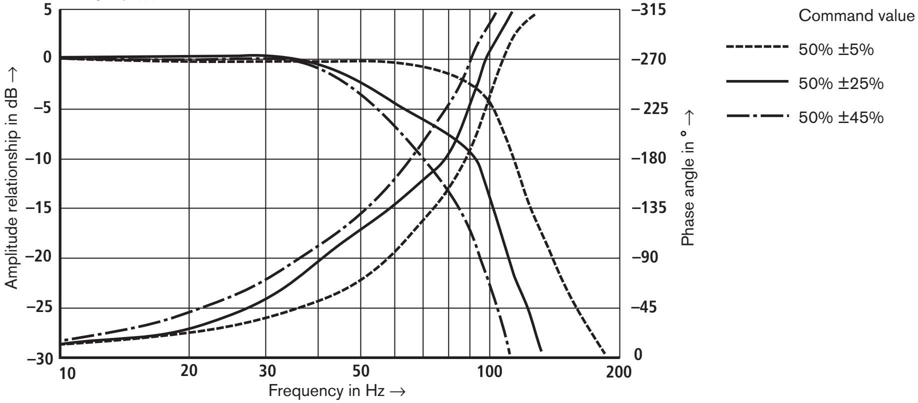
3WRCE 50…



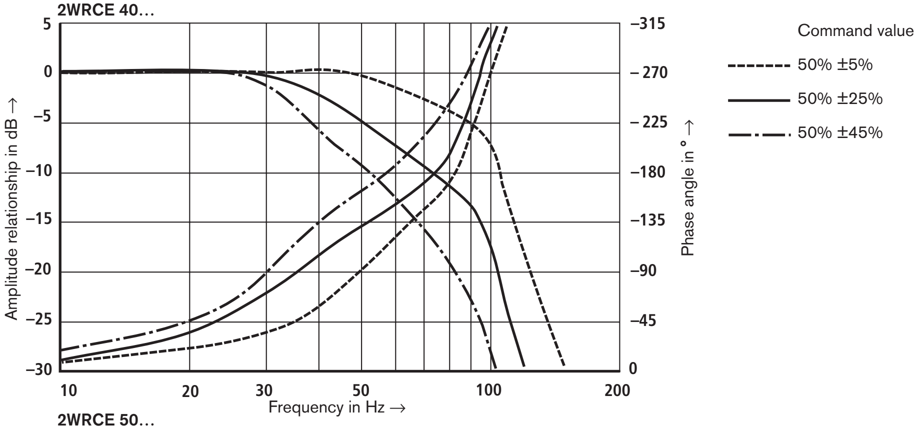
Characteristic curves (measured with HLP32, $\vartheta_{oil} = 40\ °C \pm 5\ °C$)

Frequency response at p_{st} = 315 bar

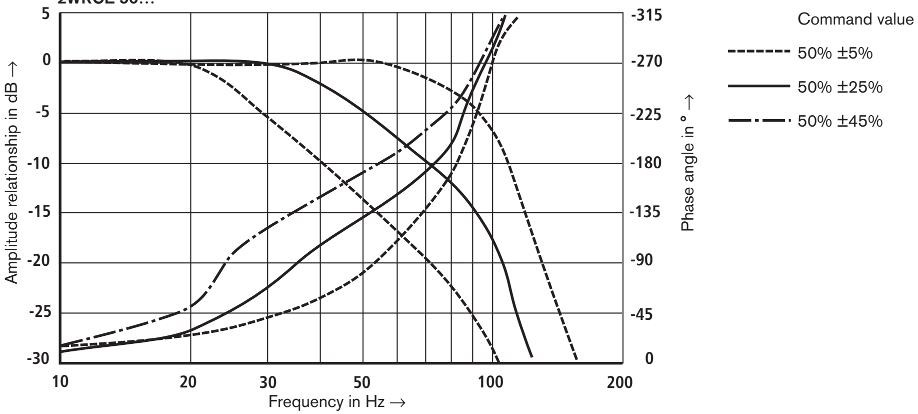
2WRCE 32...



2WRCE 40...



2WRCE 50...

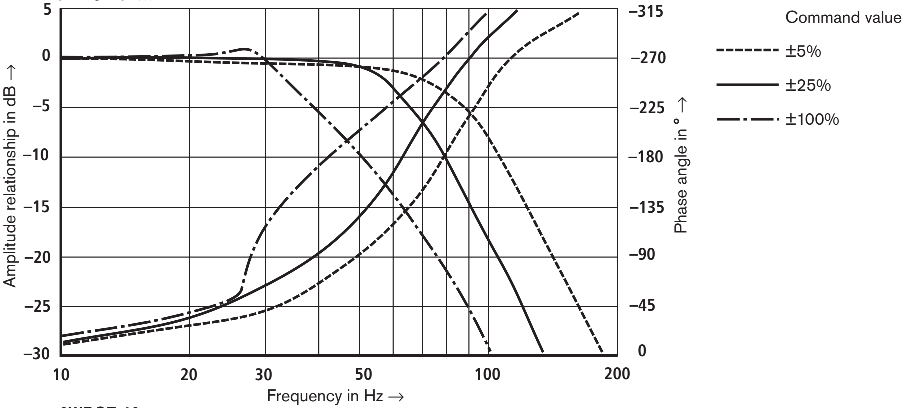


5

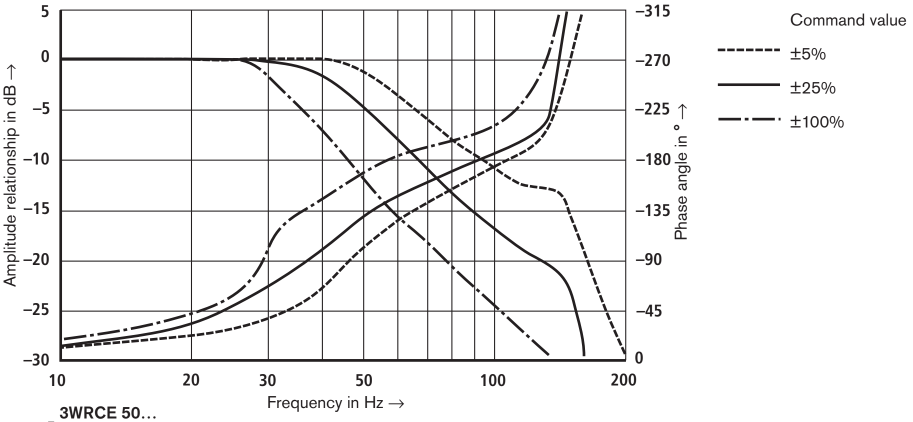
Characteristic curves (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

Frequency response at p_{st} = 315 bar

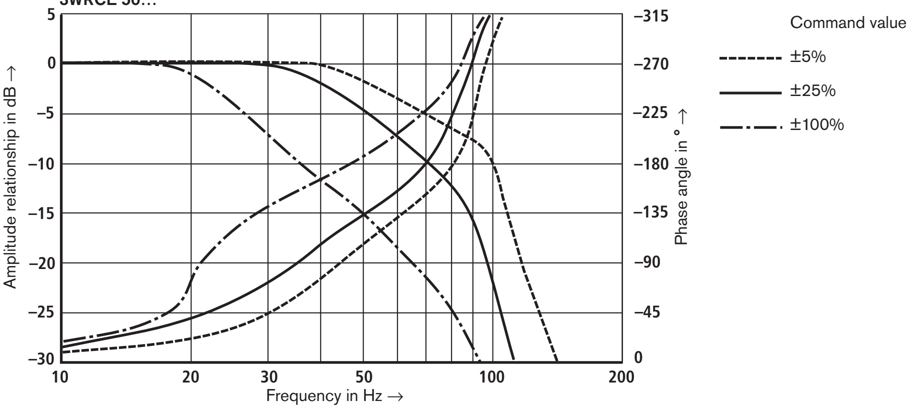
3WRCE 32...



3WRCE 40...



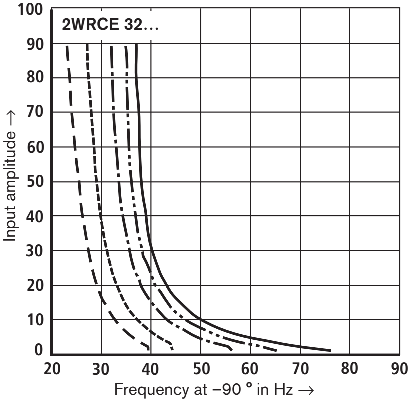
3WRCE 50...

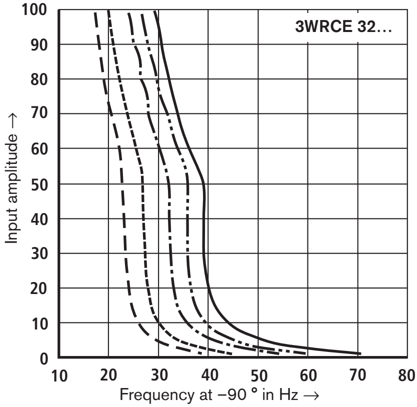


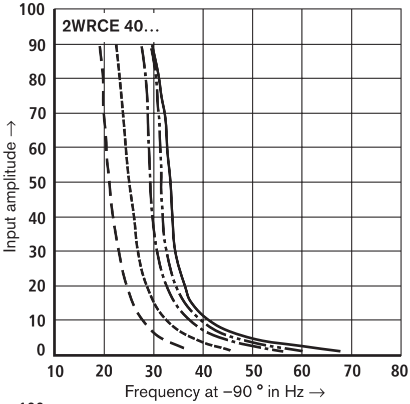
Characteristic curves (measured with HLP32, $\vartheta_{oil} = 40\ °C \pm 5\ °C$)

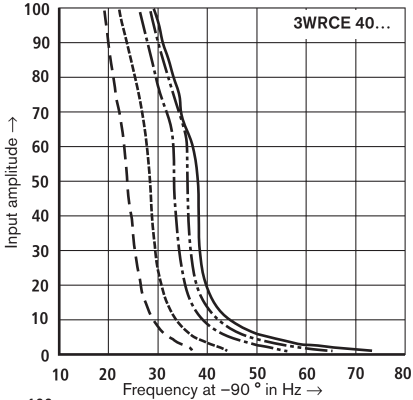
The relationship of the frequency *f* at –90° of the operating pressure and the input amplitude

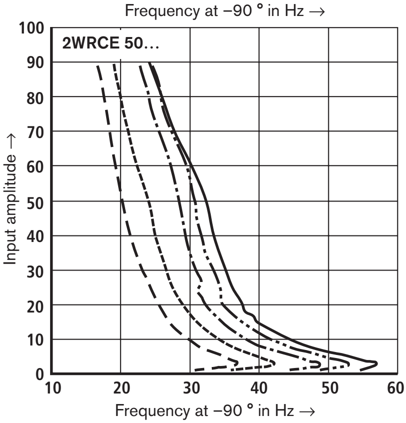
— — — $p_{st} = 40$ bar
- - - - $p_{st} = 70$ bar
—·— $p_{st} = 140$ bar
—··— $p_{st} = 210$ bar
——— $p_{st} = 315$ bar

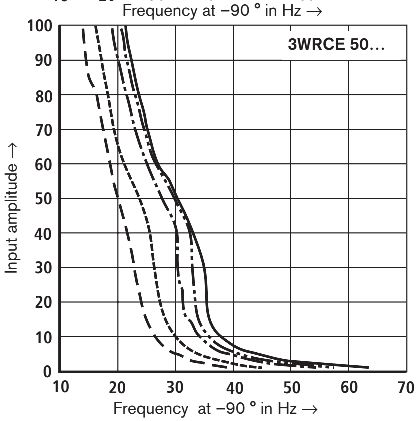






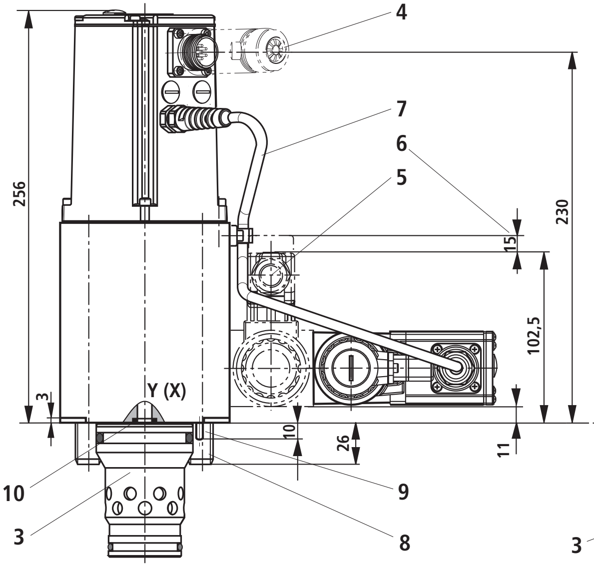






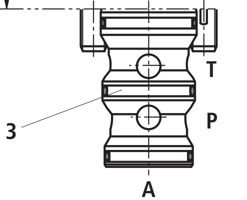
Unit dimensions: types 2WRCE and 3WRCE [1]), NS32 (nominal dimensions in mm)

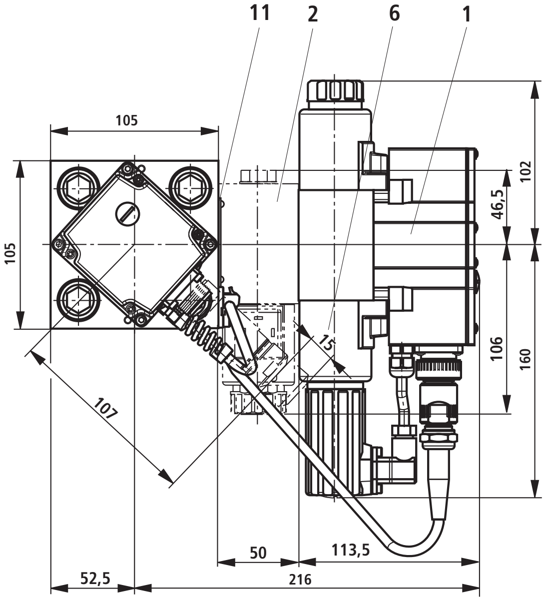
2WRCE 32



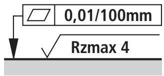
3WRCE 32... [1])

(the missing dimensions are the same as the 2WRCE 32...)





Required surface finish of the valve mounting surface

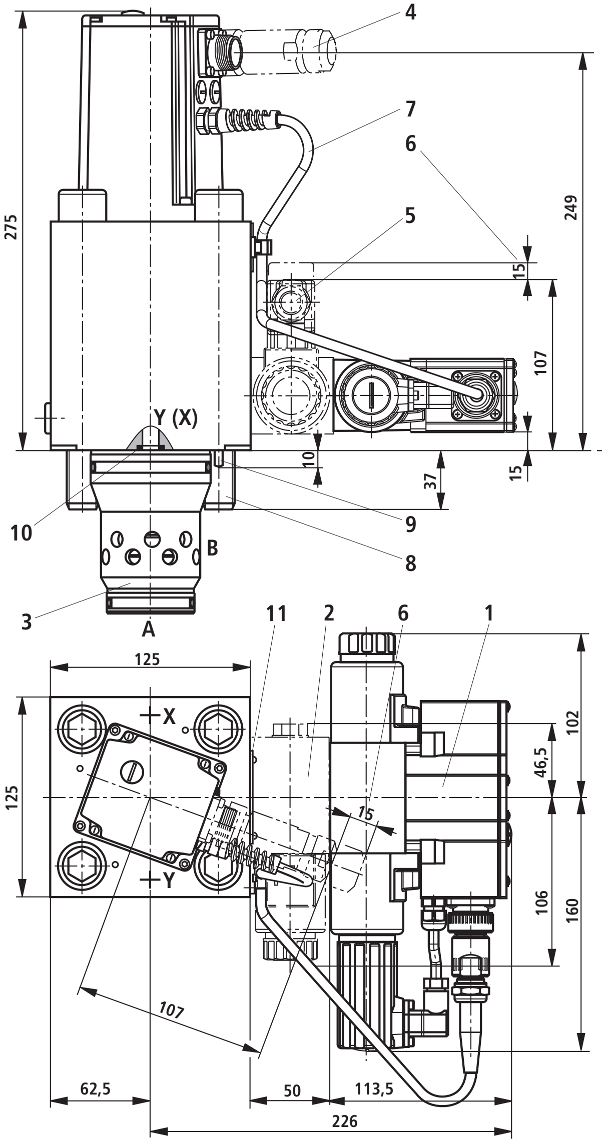


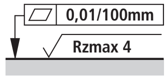
1 Pilot control valve (proportional valve NS6)
2 Sandwich plate isolator valve (only with versions „WK15“ and „WL15“)
3 Bush
4 Plug-in connector to DIN EN 175201-804 (separate order, see page 12)
5 Plug-in connector to DIN EN 175301-803 (separate order, see page 12)
6 Space required to remove the plug-in connector
7 Cabling
8 Valve fixing screws (are included within the scope of supply) 4 S.H.C.S. ISO 4762 - M16 x 100-10.9 (friction co-efficient $\mu_{total} = 0.09$ to 0.14 Tightening torque for a tightening factor of: 1.6 : 280 Nm (display or signaling type of torque wrench)
9 Locating pin hole
10 Identical seal rings for ports X and Y
11 Name plate

[1]) Not for new applications!

Unit dimensions: types 2WRCE and 3WRCE [1], NS40 (nominal dimensions in mm)

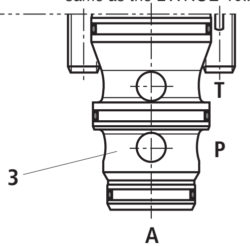
2WRCE 40





Required surface finish of the valve mounting surface

3WRCE 40... [1]
(the missing dimensions are the same as the 2WRCE 40...)



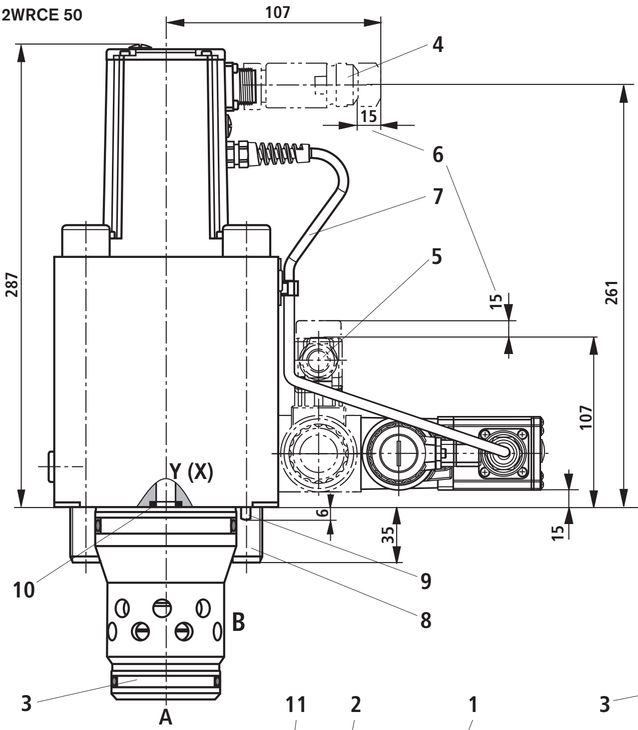
1 Pilot control valve (proportional valve NS6)
2 Sandwich plate isolator valve (only with versions „WK15“ and „WL15“)
3 Bush
4 Plug-in connector to DIN EN 175201-804 (separate order, see page 12)
5 Plug-in connector to DIN EN 175301-803 (separate order, see page 12)
6 Space required to remove the plug-in connector
7 Cabling
8 Valve fixing screws
(are included within the scope of supply)
4 S.H.C.S. ISO 4762 -
M20 x 180-10.9
(friction co-efficient μ_{total} = 0.09 to 0.14
Tightening torque for a tightening factor of: 1.6 : 560 Nm (display or signaling type of torque wrench)
9 Locating pin hole
10 Identical seal rings for ports X and Y
11 Name plate

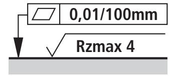
5

[1] Not for new applications!

Unit dimensions: types 2WRCE and 3WRCE [1)], NS50 (nominal dimensions in mm)

2WRCE 50



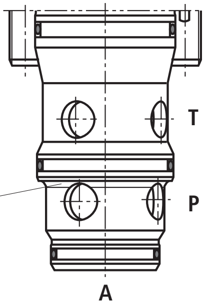


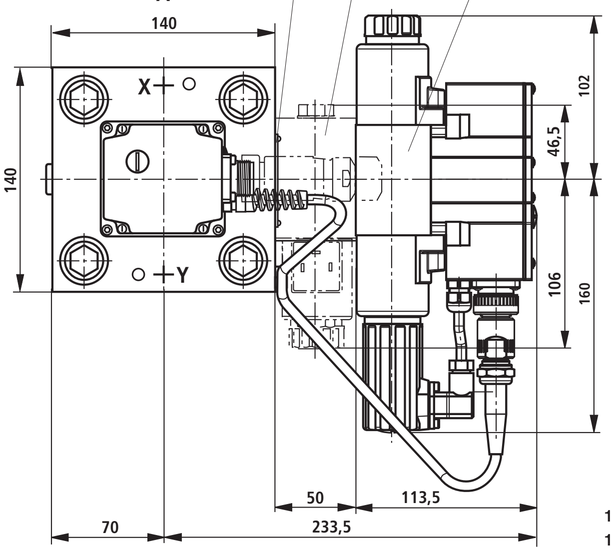
Required surface finish of the valve mounting surface

3WRCE 50... [1)]

(the missing dimensions are the same as the 2WRCE 50...)

[1)] Not for new applications!

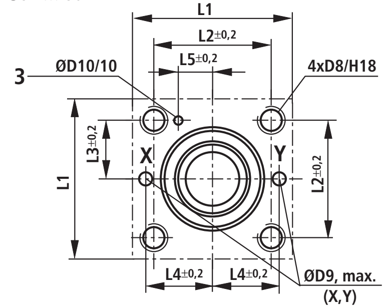




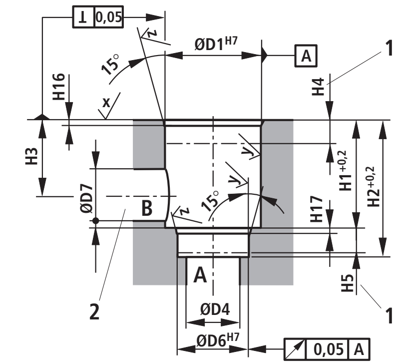
1 Pilot control valve (proportional valve NS6)
2 Sandwich plate isolator valve (only with versions WK15 and WL15)
3 Bush
4 Plug-in connectors to DIN EN 175201-804 (separate order, see page 12)
5 Plug-in connectors to DIN EN 175301-803 (separate order, see page 12)
6 Space required to remove the plug-in connector
7 Cabling
8 Valve fixing screws (are included within the scope of supply) 4 S.H.C.S. ISO 4762 - M20 x 190-10.9 (friction co-efficient μ_{total} = 0.09 to 0.14 tightening torque for a tightening factor of: 1 .6 : 560 Nm (display or signaling type of torque wrench)
9 Locating pin hole
10 Identical seal rings for ports X and Y
11 Name plate

Installation dimensions to DIN ISO 7368 (nominal dimensions in mm)

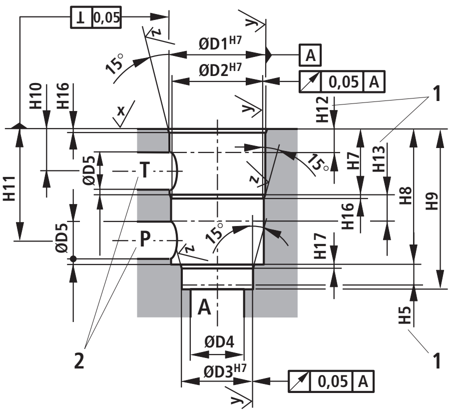
NS32 … 50



Cavity for type 2WRCE to DIN ISO 7368



Cavity for type 3WRCE



NS	32	40	50
ØD1^{H7}	60	75	90
ØD2^{H7}	58	73	87
ØD3^{H7}	55	55	68
ØD4	32	40	50
ØD5	24	30	35
ØD6^{H7}	45	55	68
ØD7	32	40	50
D8	M16	M20	M20
max. ØD9	8	10	10
ØD10	6	6	8
H1	70	87	100
H2	85	105	122
H3	52	64	72
H4	30	30	35
H5	13	15	17
H7	43,5	54	87
H8	85	105	143
H9	100	125	165
H10	30	36	66
H11	70,5	87	122
H12	18	21	48
H13	15	18	18
H16	2,5	3	4
H17	2,5	3	3
H18	35	45	45
L1	105	125	140
L2	70	85	100
L3	35	42,5	50
L4	41	50	58
L5	17	23	30

$\sqrt{}^{x}$ = $\sqrt{R_{max}\ 4}$

$\sqrt{}^{y}$ = $\sqrt{R_{max}\ 8}$

$\sqrt{}^{z}$ = $\sqrt{R_z\ 10}$

Tolerances to: – General tolerances ISO 2768-mK

1 Depth of fit, min. dim.

2 Ports P, T or B may be moved about the central axis of port A. However adequate spacing in relation to the fixing holes and control oil holes must be taken into account.

3 Locating pin hole

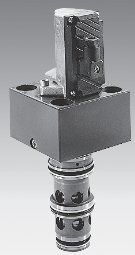
Notes

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Telefon +49 (0) 93 52 / 18-0
Telefax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

Rexroth
Bosch Group

3-way servo solenoid valves, cartridge type, pilot operated, with inductive position transducer

Type 3WRCB 25...50



Nominal size (NG) 25, 32, 50
Unit series 1X
Maximum working pressure P, A, T, X, Z 315 bar
Nominal flow rate Q_{nom} 65...750 l/min

Overview of Contents

Different versions on request
– For standard applications
– Special symbols for plastics machines
– Valve electronics (OBE) with 11P+PE interface possible

Features

– Pilot operated servo solenoid valves NG25 to NG50
– Design: cartridge type, 3/2-way symbol
  Metering edges P–A / A–T
– Control spool with anti-rotation element and metering edges in servo quality
– Pressure-tight up to 315 bar
– Pilot line A–X generally required
– Dynamic return (B–Z) possible with the NG25 and NG50
– With inductive position transducer, position-controlled by the external pilot valve and the valve electronics
– Pilot valve mounted externally on valve block
– Hysteresis <0.1 %, scarcely measurable
– Flow characteristic
  • M = progressive with fine metering edge
– Plug-in connector for inductive position transducer (4P) included in scope of delivery
– Employed in electrohydraulic closed-loop controllers in production and testing systems
– Choice of pilot control:
  • 4WRPEH6... with on-board electronics, see RE 29035
  • 4WRPH6... with external electronics, see RE 29028 and RE 30045

Ordering data

3WRCB	H		V			M	–	1X	/	Z	M

3/2-way cartridge servo solenoid valve

Hydraulically actuated = **H**

NG25 = **25**
NG32 = **32**
NG50 = **50**

Piston with zero overlap = **V**

Ratio of positioning surface area on piston
1:1 = **no code**
1:1.5 = **F**

Nominal flow rate l/min (with 5 bar pressure drop at valve)
NG25
65 l/min = **65**
190 l/min = **190**
NG32
380 l/min = **380**
NG50
300 l/min = **300**
750 l/min = **750**

M = Non-linear characteristic
Progressive with linear fine metering range

1X = Unit series 10 to 19
(10 to 19: installation and connection dimensions unchanged)

Z = Additional control oil port*

M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

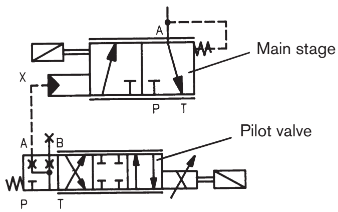
* Not possible for NG32

Preferred types

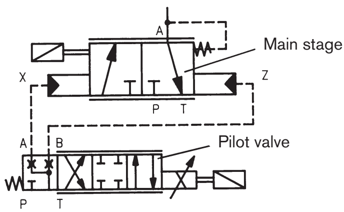
Type	Material Number
NG25	
3WRCBH25VF65M–1X/ZM	0 811 402 513
3WRCBH25VF190M–1X/ZM	0 811 402 514
NG32	
3WRCBH32V380M–1X/M	0 811 402 611
NG50	
3WRCBH50VF750M–1X/ZM	0 811 402 639
3WRCBH50VF300M–1X/ZM	0 811 402 640

Note
You can find an overview of and further information on the pilot valves and accessories on pages 5 and 6.

Symbols and control oil supply

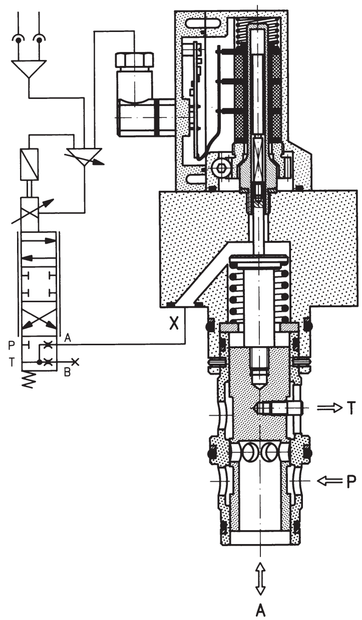


A ⟷ X

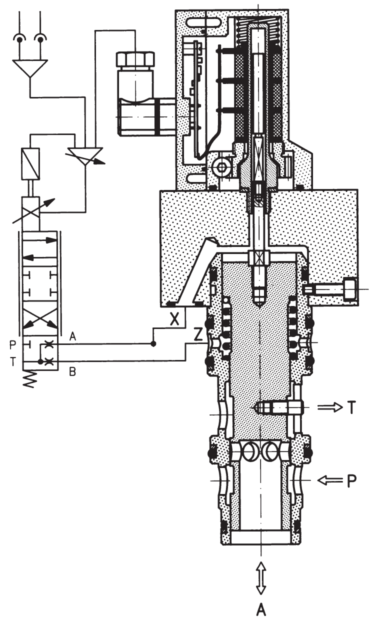


A ⟷ X / B ⟷ Z

NG32, with A–X



NG25, 50 with A–X and B–Z



Function, sectional diagram

General

3/2-way cartridge servo solenoid valves are pilot operated main stages with two metering edges, P–A / A–T.
At the transition, fine metering edges ensure minimum oil leakage with high, linear pressure gain. The spool position is deflected by the control oil of the pilot valve. If X is relieved of pressure, the load pressure in A and the internal spring cause the spool to return (symbol A–T). The position of the spool is detected by an inductive position transducer, and its signal together with the valve electronics allows closed-loop position control by an NG6 pilot servo solenoid valve.
Hysteresis is <0.1 % and thus scarcely measurable. The design of these valves is extremely compact, and is frequently employed in the plastics branch in injection molding cylinders.
Pressure relief takes place by way of the metering edge A–T.
The NG25 and NG50 valves also offer a port Z, which enables a faster return when there is little load in A. For this purpose, the pilot valve must be connected to A–X and B–Z.

Basic principle

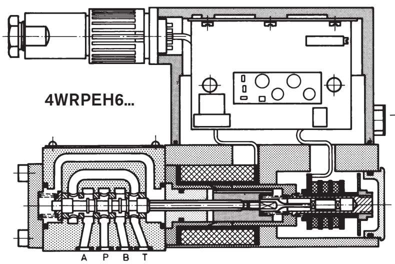
Pilot operated 3/2-way cartridge servo solenoid valves have metering edges in servo quality, see characteristic curves. The spool position is measured by an inductive position transducer and processed by the external position control.
The following components are required for the external position control:
– Pilot valve 4WRP(E)H 6
– Valve electronics, internal (OBE) or external
– Valve block (provided by customer).
The switching of control oil in the valve block and the electrical connection together form the basis of the pilot operated valve function for closed-loop control tasks in the system.
This is mostly a process for speed and pressure control. The system's process controllers form the valve signal for the control loop.

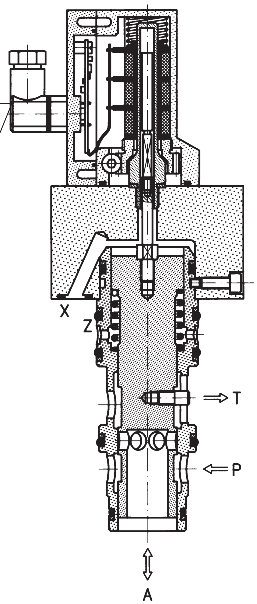
Pilot valve

with on-board electronics (OBE)

Main stage

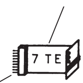
3/2-way cartridge servo solenoid valve 3WRCB 25…50

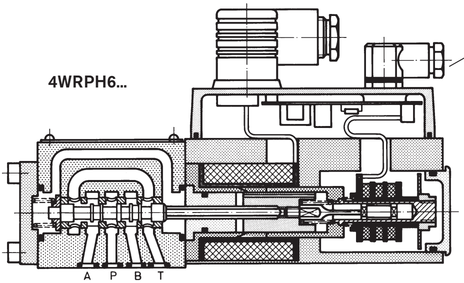




or with external electronics

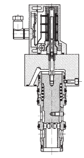
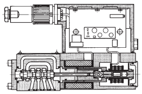
Valve amplifier



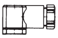


Overview

3WRCB25...50 with on-board electronics (OBE)

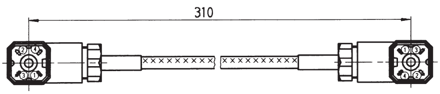
Main stage			Pilot valve			
3WRCB25...50	**NG**	**Material Number**	**4WRPEH6...**	Q_N l/min	**Material Number** Signal ± 10 V	**Material Number** Signal 4...20 mA
	25	0 811 402 513		12	0 811 404 601	0 811 404 632
		0 811 402 514				
	32	0 811 402 611		24	0 811 404 602	0 811 404 633
	50	0 811 402 639		40	0 811 404 603	0 811 404 634
		0 811 402 640				

Accessories

Type			Material Number
 PG7	Plug-in connector 4P for 3WRCB25...50		Included in scope of delivery
(4x) ISO 4762	Cheese-head bolts for 3WRCB25...50		
	Cable for connecting main stage to pilot valve, see below		1 834 463 005
(4x) ISO 4762	Cheese-head bolts M5x30 for 4WRPEH6...		2 910 151 166
	Plug-in connector 6P+PE for 4WRPEH6..., see also RE 08008	KS – PG11	1 834 482 022
		KS – PG11	1 834 482 026
		MS – PG11	1 834 482 023
		MS – PG16	1 834 482 024
		KS – PG11 – 90°	1 834 484 252

Cable for main stage and pilot valve (4WRPEH6...)

This cable is used to connect the main stage to the pilot valve.



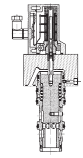
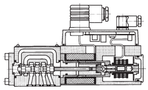
	Cable for connecting main stage to pilot valve	**Material Number**
		1 834 463 005

Testing and service equipment

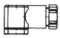
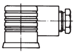
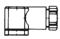
Test box type VT-PE-TB3, see RE 30065
Measuring adapter 6P+PE type VT-PA-2, see RE 30068

Overview

3WRCB25...50 with external electronics

Main stage			**Pilot valve**		
3WRCB25...50	**NG**	**Material Number**	**4WRPH6...**	Q_N l/min	**Material Number** Signal ± 10 V
	25	0 811 402 513		12	0 811 404 034
		0 811 402 514			
	32	0 811 402 611		24	0 811 404 035
	50	0 811 402 639		40	0 811 404 036
		0 811 402 640			

Accessories

Type		**Material Number**
 PG7	Plug-in connector 4P for 3WRCB25...50	Included in scope of delivery
(4x) ISO 4762	Cheese-head bolts for 3WRCB25...50	
  M16x1,5 PG7	Plug-in connector 4P and 2P+PE for 4WRPH6...	
(4x) ISO 4762	Cheese-head bolts M5x30 for 4WRPH6...	2 910 151 166
 Europe card	VT-VRRA1-527-20/V0/2STV, see RE 30045	0 811 405 063

Testing and service equipment

Test box type VT-PE-TB2, see RE 30064
Test adapter type VT-PA-3, see RE 30070

Technical data

General

Construction		3/2-way cartridge servo solenoid valve, pilot operated main stage
Actuation		Servo solenoid valve NG6, on the block as a separate pilot valve
Type of mounting		Cartridge type, see installation dimensions
Installation position		Horizontal, or position transducer facing downwards
Ambient temperature range	°C	–20...+50
Vibration resistance, test condition		Max. 25 g, shaken in 3 dimensions (24 h)

Hydraulic (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Pressure fluid		Hydraulic oil to DIN 51524...535, other fluids after prior consultation				
Viscosity range recommended	mm^2/s	20...100				
max. permitted	mm^2/s	10...800				
Pressure fluid temperature range	°C	–20...+80				
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)		Class 18/16/13 [1]				
Direction of flow		See symbols				
		NG25		**NG32**	**NG50**	
Nominal flow rate at Δp = 5 bar per edge [2]	l/min	65	190	380	300	750
Max. working pressure	bar	Port P, A, T, X, Z: 315				
Q_{max}	l/min	200	570	1000	900	2250
Q_N pilot valve	l/min	12		24	40	
Leakage Pilot valve at 100 bar	cm^3/min	<300		<500	<900	
Leakage Main stage at100 bar	cm^3/min	<350	<350	<500	<500	<600
Control oil flow p = 100 bar and at max. dynamics	l/min	8		16	28	
Control oil pressure "pilot stage"	bar	min. = p_A + 4				

All above characteristics valid only in connection with valve 4WRPEH6..., see page 5.

[1] The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of components. For a selection of filters, see catalog sheets RE 50070, RE 50076 and RE 50081.

[2] Flow at a different Δp

$$Q_x = Q_{nom} \cdot \sqrt{\frac{\Delta p_x}{5}}$$

Important

Information on Q_{nom}/Q_{max} only applies if installation dimensions are complied with.

Technical data

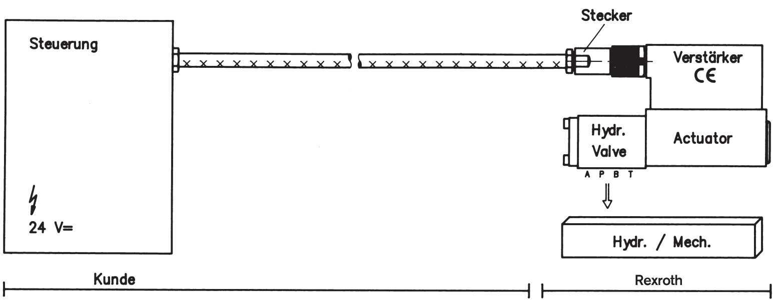
Static/Dynamic				
Hysteresis	%	$<$ 0.1, scarcely measurable		
Manufacturing tolerance	%	$\leq$ 10		
		NG25	NG32	NG50
Response time for signal change 0...100 % ($p_X = 100$ bar/$p_A = 50$ bar) A–X	ms	33	28	60
Response time for signal change 0...100 % ($p_X = 100$ bar/$p_A = 50$ bar) A–X/B–Z	ms	27	–	50
Switch-off behavior		After electrical switch-off: pilot valve in “fail-safe”, main stage moves to “A–T” symbol position		
Thermal drift		Zero drift $<$ 1 % at $\Delta T = 40$ °C		
Zero calibration		Adjustable by ±5 % on valve amplifier, pilot valve with OBE factory-set		

Electrical		
Position transducer DC/DC technology	Supply: +15 V/35 mA −15 V/25 mA	Signal: 0...±10 V ($R_L \geqq 10$ kΩ)

All above characteristics valid only in connection with valve 4WRPEH6..., see page 5.

Connection

For electrical data, see page 7 and
Operating Instructions **1 819 929 083**



Technical notes for the cable

Design:
- Multi-wire cable
- Extra-finely stranded wire to VDE 0295, Class 6
- Safety earth conductor, green/yellow
- Cu braided shield

Type:
- e.g. Ölflex-FD 855 CP (from Lappkabel company)

No. of wires:
- Determined by type of valve, plug type and signal assignment

Cable Ø:
- 0.75 mm² up to 20 m long
- 1.0 mm² up to 40 m long

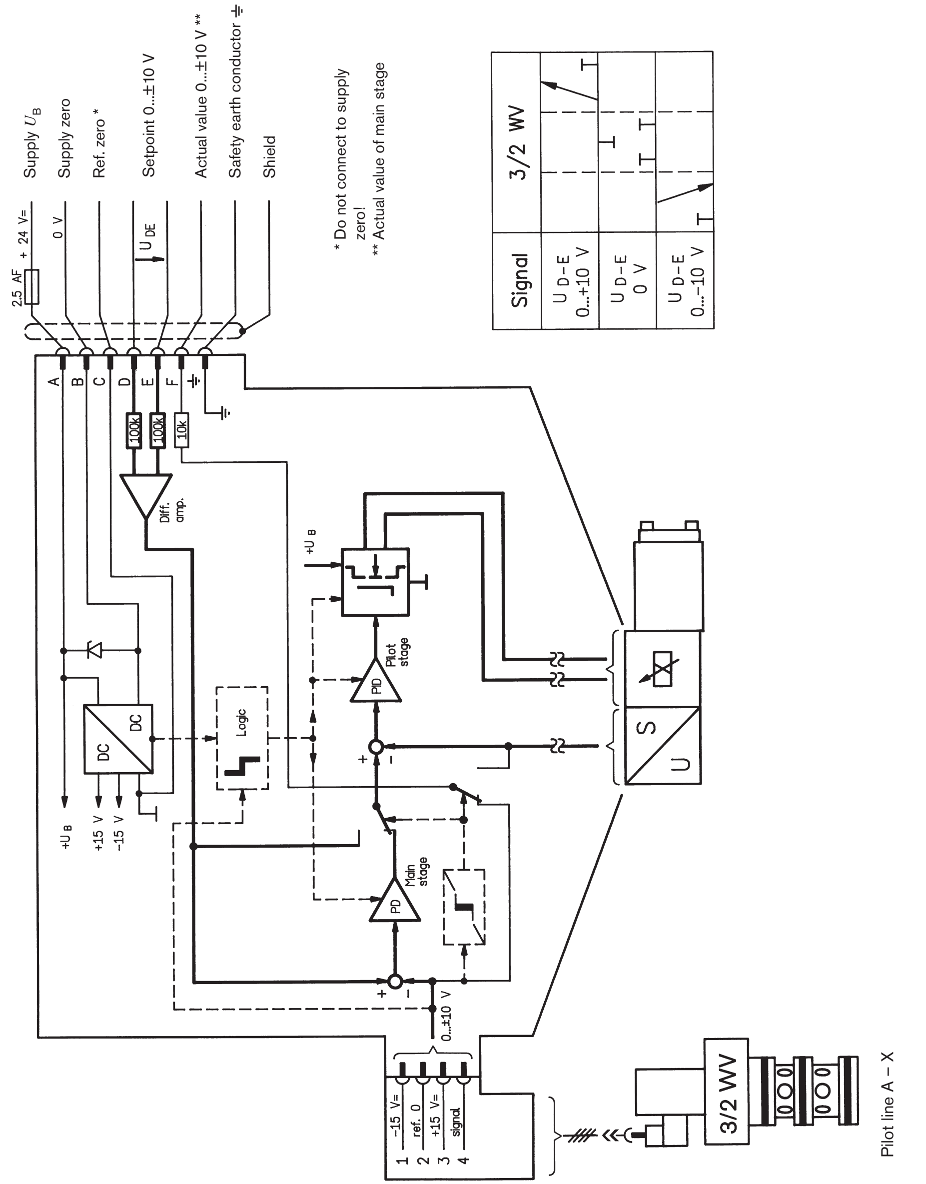
Outside Ø:
- 9.4...11.8 mm – Pg11
- 12.7...13.5 mm – Pg16

Important

Power supply 24 V DC nom.,
if voltage drops below 18 V DC, rapid shutdown resembling “Enable OFF” takes place internally.
In addition, with the “mA signal” version:
$I_{D-E} \geqq 3$ mA – valve is active
$I_{D-E} \leqq 2$ mA – valve is deactivated.
Electrical signals (e.g. actual values) emitted via the trigger electronics must not be used to shut down safety-relevant machine functions!
(Also see European Standard, “Technical Safety Requirements for Fluid-Powered Systems and Components – Hydraulics”, EN 982.)

On-board trigger electronics

Circuit diagram/pin assignment
Version A1: U_{D-E} 0...±10 V

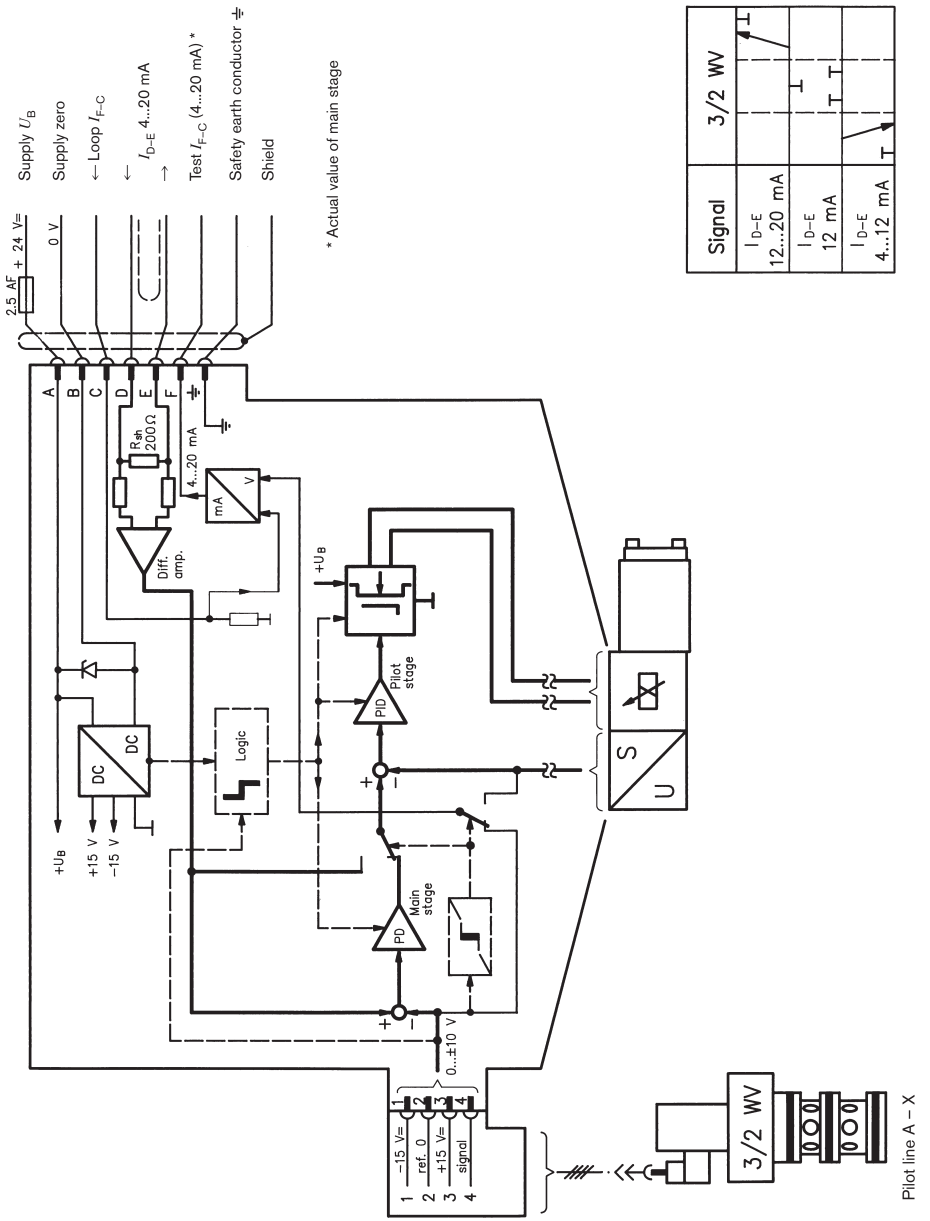


5

On-board trigger electronics

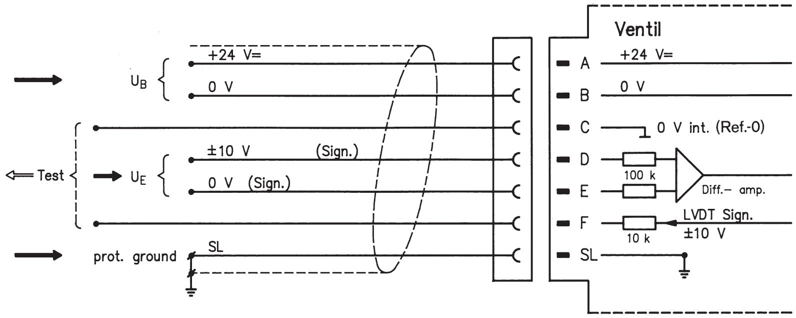
Circuit diagram/pin assignment

Version F1: I_{D-E} 4...20 mA

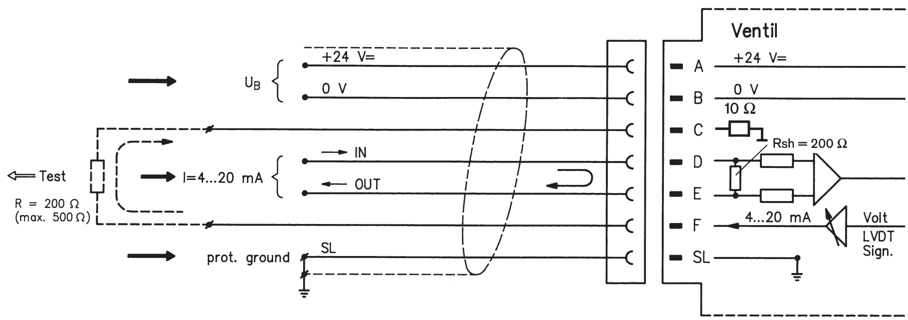


On-board trigger electronics

Pin assignment 6P+PE
Version A1: U_{D-E} 0...±10 V
(R_i = 100 kΩ)



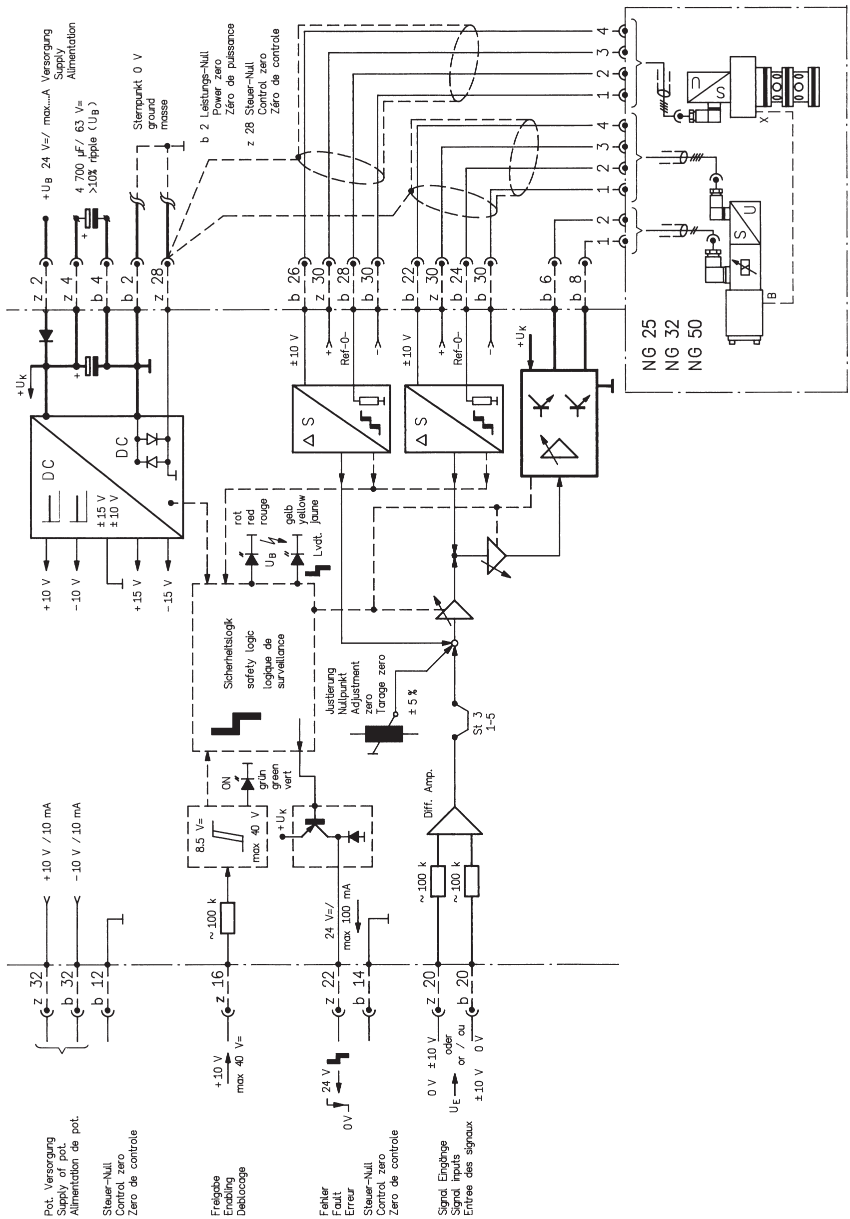
Pin assignment 6P+PE
Version F1: I_{D-E} 4...20 mA
(R_{sh} = 200 Ω)



5

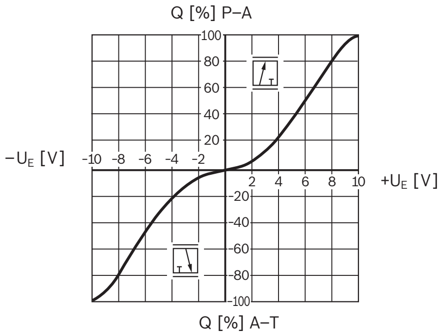
Valve with external trigger electronics (Europe card, RE 30045)

Circuit diagram/pin assignment

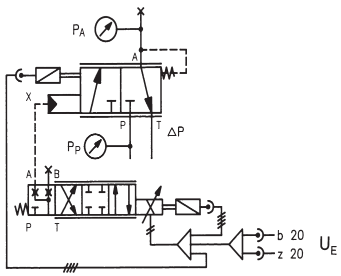


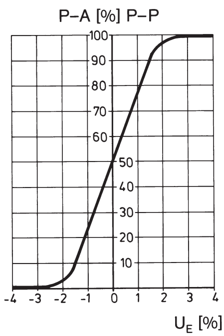
Characteristic curves (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Flow rate/signal function



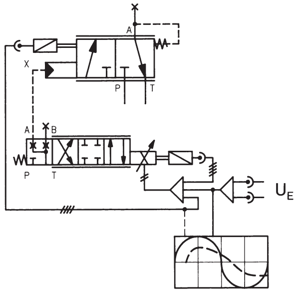
Pressure gain



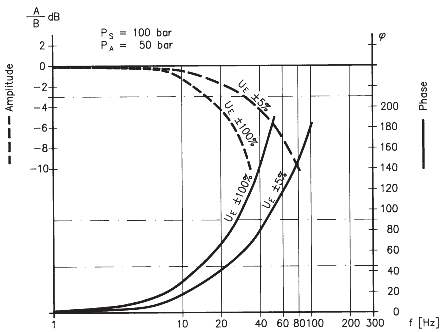


Characteristic curves (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

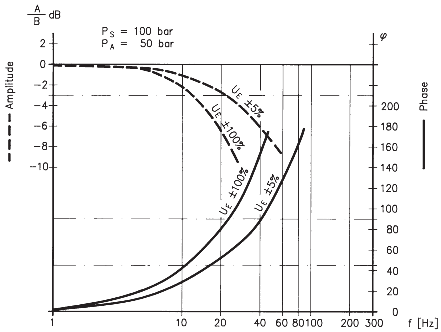
Bode diagram



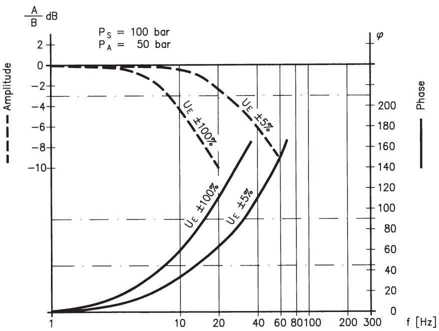
NG25



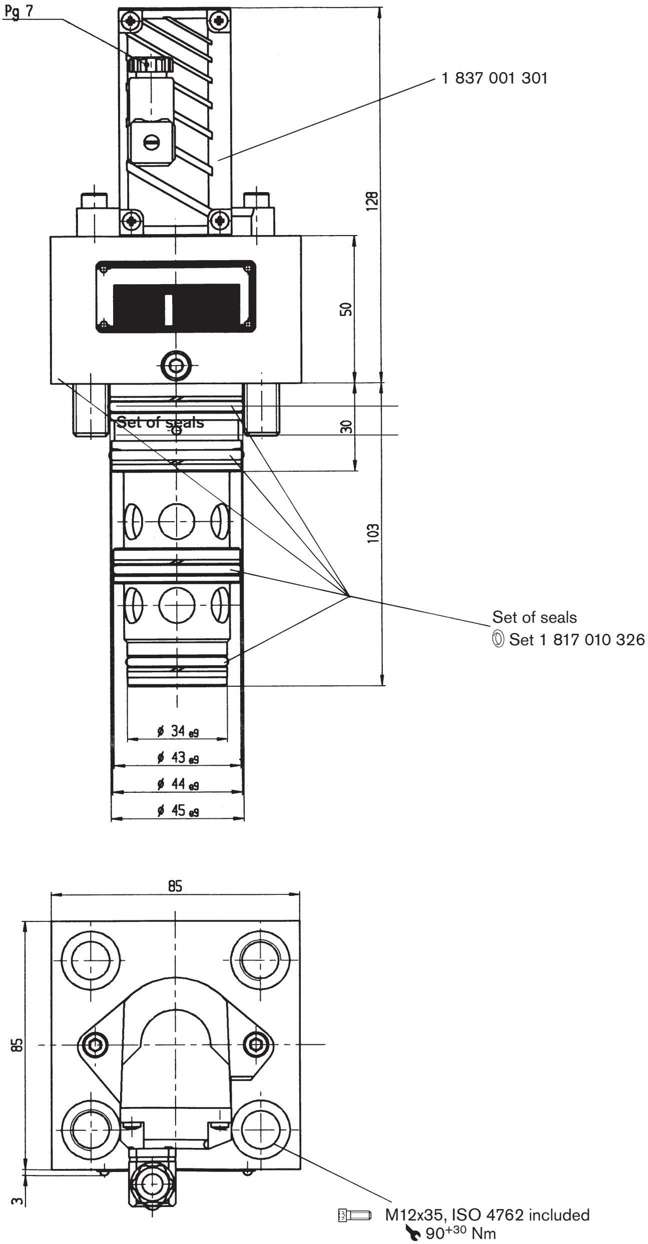
NG32



NG50



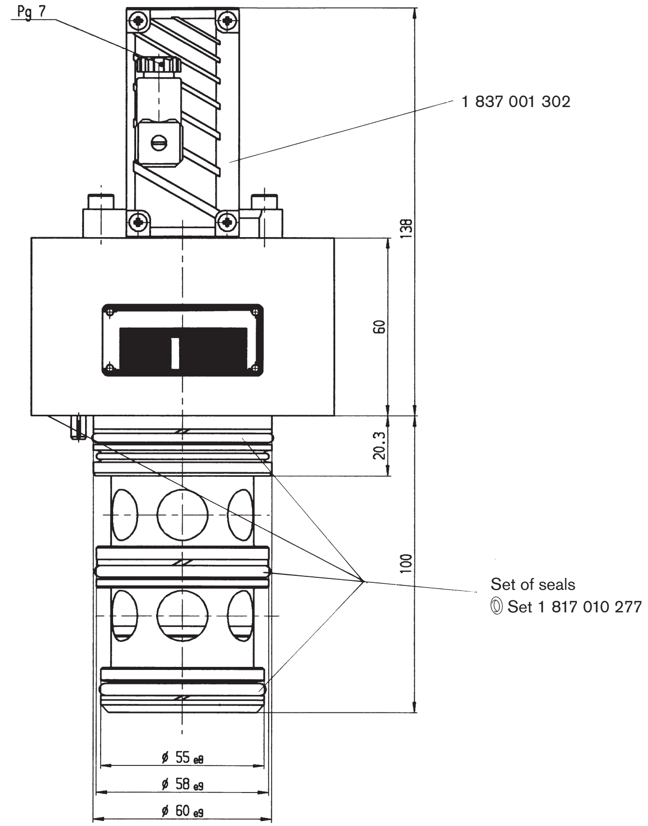
Unit dimensions NG25 (nominal dimensions in mm)

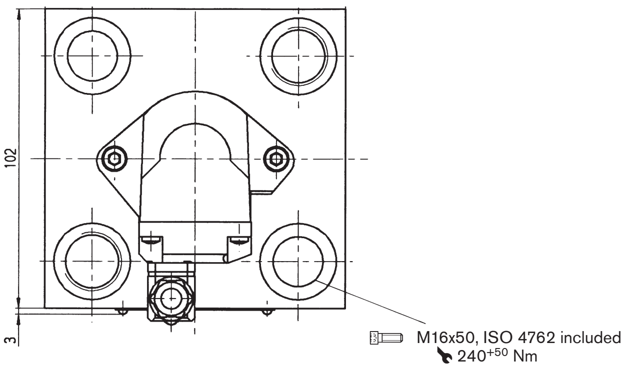


See installation dimensions on page 18

5

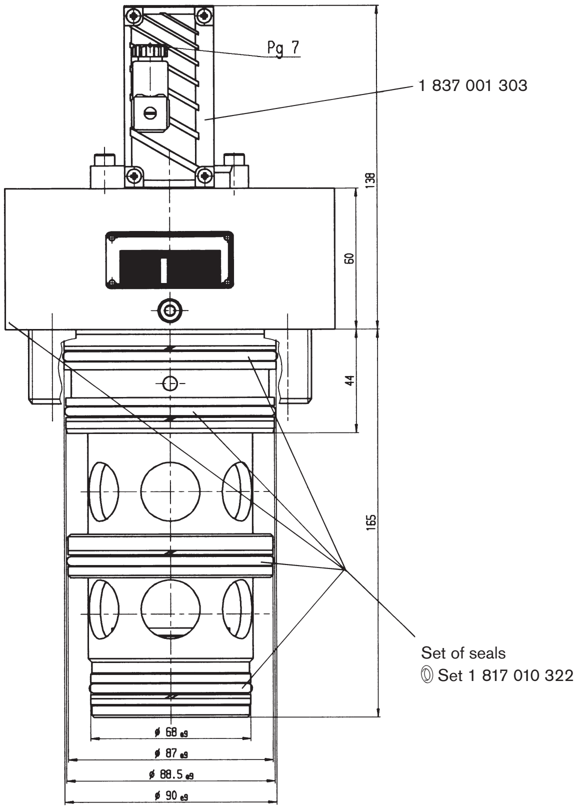
Unit dimensions NG32 (nominal dimensions in mm)

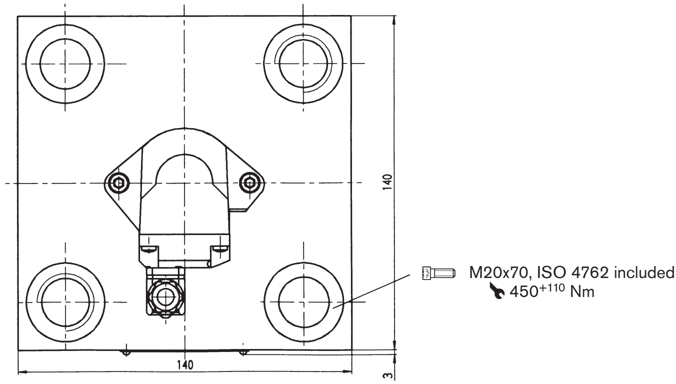




See installation dimensions on page 19

Unit dimensions NG50 (nominal dimensions in mm)

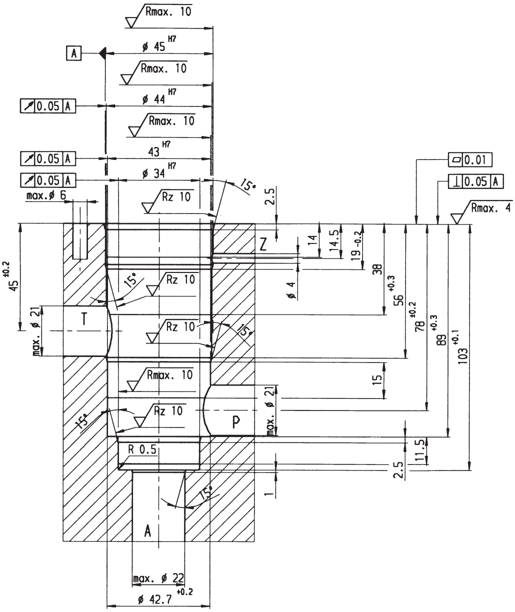




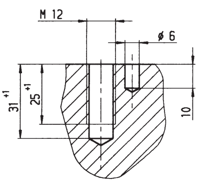
See installation dimensions on page 20

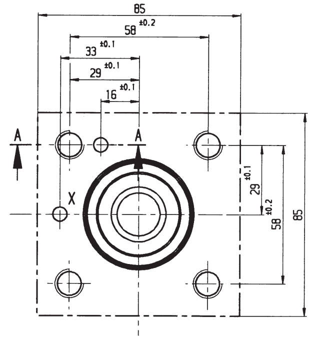
Installation dimensions NG25 (nominal dimensions in mm)

A ⟷ X / B ⟷ Z



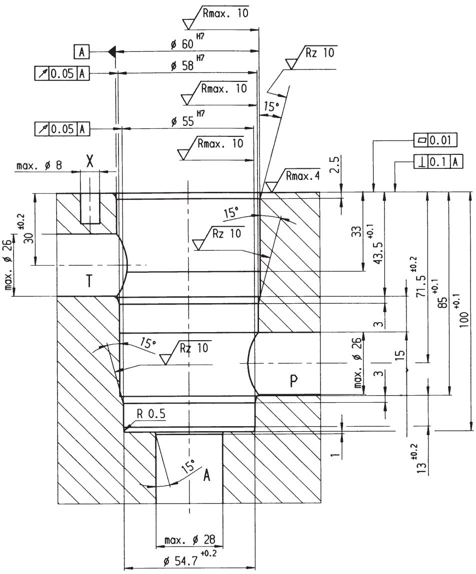
A–A



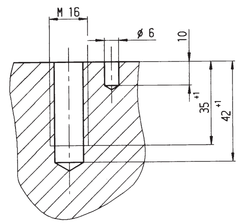


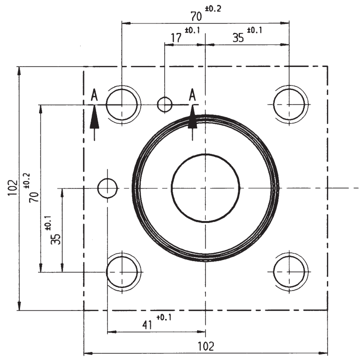
Installation dimensions NG32 (nominal dimensions in mm)

A ⟷ X



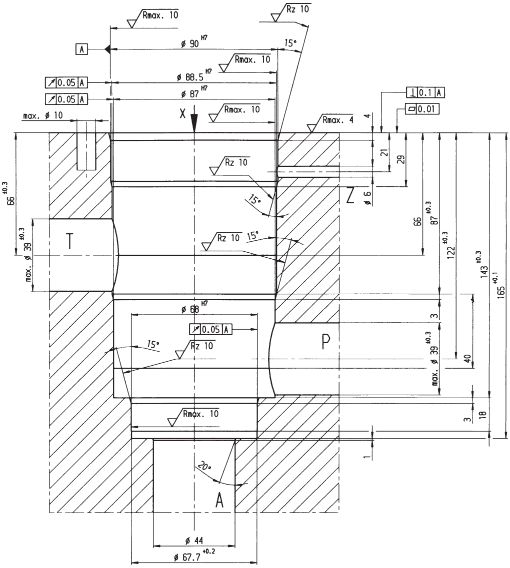
A – A



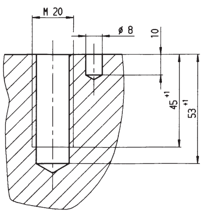


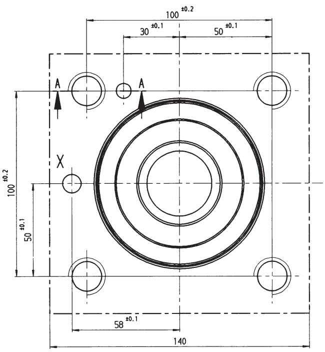
Installation dimensions NG50 (nominal dimensions in mm)

A ⟷ X / B ⟷ Z



A – A



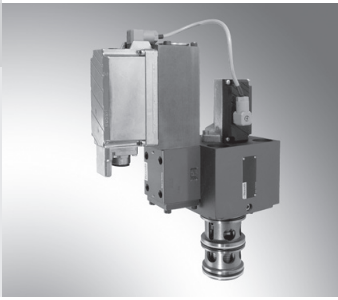


Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Telefon +49 (0) 93 52 / 18-0
Telefax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

3/3 directional high-response valve (cartridge valve) with integrated control electronics

RE 29222/02.09
Replaces: 29218

Type 3WRCBEE



Sizes 25, 32 and 50
Component series 1X
Maximum operating pressure 315 bar
Maximum flow 2,250 l/min

Table of contents

Contents	Pages

Information on available spare parts:
www.boschrexroth.com/spc

Features

- Pilot operated 3/3 directional high-response valve sizes 25, 32 and 50
- Design: Block installation, 3/3 directional symbol control edges P > A or A > T
- Mounting cavity, see page 14
- Control spool with anti-rotation feature and control edges in servo-performance quality
- Pressure-resistant up to 315 bar
- With inductive position transducer on main spool and pilot valve
- Position-controlled with integrated electronics OBE.
- These valves serve for closed-loop control of the magnitude and direction of the flow.
- Completely adjusted unit
- Flow characteristics
  M = Progressive with fine control edge
- In case of an error in the OBE and pilot pressure applied the main spool is opened in direction A towards T. P to A is blocked then.

Ordering code

3WRCB	EE					M	– 1X /	G24	K31 /		M	*

3/3 high-response cartridge valve

Integrated pilot and OBE

Size 25	**= 25**
Size 32	**= 32**
Size 50	**= 50**
Spool with zero overlap	**= V**

Actuating area ratio at the spool [1)]

1:1	(Size 50)	**= No code**
1:1.5	(Size 25, size 32)	**= F**

Nominal flow l/min (at 5 bar valve pressure drop)

Size 25	
190 l/min	**= 190**
Size 32	
380 l/min	**= 380**
Size 50	
750 l/min	**= 750**

Characteristic curve inflected **= M**
Progressive with linear fine control range

1X = Component series 10 to 19
(10 to 19: unchanged mounting and connection dimensions)

G24 = Voltage supply OBE 24V

Electrical connection
K31 = Without mating connector, individual connection with connector according to DIN EN 175201-804

Electronics interface
A1 = ±10 V DC
F1 = 4 to 20 mA

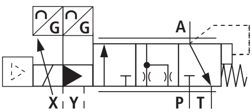
M = NBR seals suitable for mineral oils (HL, HLP) according to DIN 51524 [2)]

Further details in the clear text

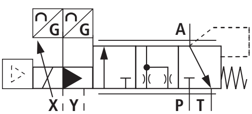
[1)] Determined in the factory
[2)] Other seal materials upon request

Symbols

Simplified

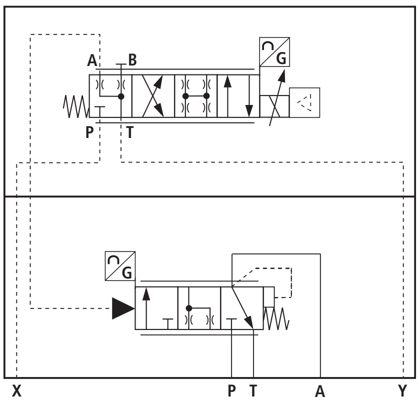


with area ratio



without area ratio

Detailed



Pilot valve
4WRPEH6

Main stage
In preferred position with de-energized pilot valve (example with area ratio)

Function, section

The 3/3 directional high-response valve is designed as cartridge valve with integrated control electronics for the stepless closed-loop control of a flow from P to A and A to T.

Technical design

The valve consists of the following assemblies

- Cover (1) with connection faces,
- Main spool (7) with control edges,
- Bushing (2),
- Pilot control valve (3) with paired spool/bushing unit and inductive position transducer (6).
- Integrated control electronics (4) with inductive position transducer (12) of the main spool.

Function

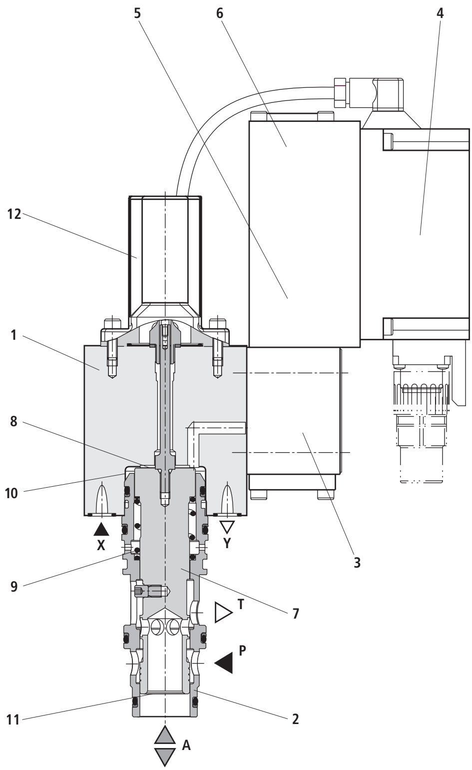
- Actuation of the main spool (7) using the pilot control valve (3); pressure build-up in the control chamber (10) acts on area (8) – the pressure in port A acting on area (11) and the spring force (9) act in the opposite direction
- The spool of the pilot control valve is controlled by means ofproportional solenoid (5) against the force of the spring in the pilot control valve.
- Linking of command values (4) and actual values (12 and 6) in the microcontroller of the integrated control electronics (4)
- Pilot oil supply X to the pilot control valve port P; pilot oil drain via Y to the tank
- At command value 0 V or 12 mA the electronics controls the main spool (7) in central position, thus pressure in A approx. P system/2
- Area ratio of area (11) to area (8) at:
  Size 25 = 1 : 1.5
  Size 32 = 1 : 1.5
  Size 50 = 1 : 1

Failure of supply voltage

- The integrated control electronics de-energizes the solenoid when the supply voltage fails or the cable is ruptured
- Depressurization of spool area (8) via pilot control valve (3) to Y to the tank.
- Due to spring force (9) and pressure in port A on area (11) the main spool (7) opens the connection A to T and closes from P to A

Important note:

Failure of the supply voltage results in the closed control loop stopping abruptly. The accelerations occurring at this point may lead to machine damages.



Section example size 25

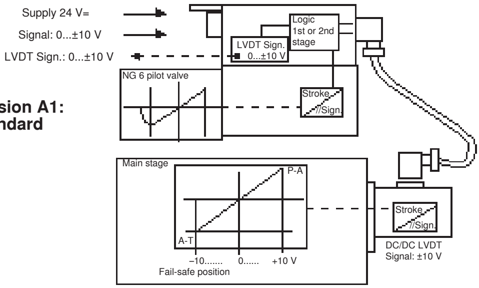
Technical data (For applications outside these parameters, please consult us!)

general					
Size			**25**	**32**	**50**
Weight		kg	11.8	16.2	23.2
Installation position			Any (when the valve is installed on a consumer, you should avoid the main spool being arranged parallel to the acceleration respectively deceleration direction of the consumer!)		
Ambient temperature range		°C	–20 to +50		
Storage temperature range		°C	–20 to +80		
hydraulic					
Max. operating pressure		bar	up to 315		
Return flow pressure		bar	up to 30		
Nominal flow $q_{V\ nom}$ at Δp = 5 bar		l/min	190	380	750
Max. admissible flow		l/min	600	1,000	2,250
Max. zero flow in control position (at p = 315 bar)		l/min	1.5	2.5	3.5
Pilot flow in X or Y for minimum actuating time (command value –100% to +100%)		l/min	12	16	30
Leakage in spring-centered position (–100% command value) at max. operating pressure		l/min	0.2	0.4	0.8
Area ratio of main spool			1 : 1.5	1 : 1.5	1 : 1
Main spool spring			Δp = 2.5 bar (relating to the spool area at port A)		
Hydraulic fluid			Mineral oil (HL, HLP) according to DIN 51 524		
Hydraulic fluid temperature range		°C	–20 to +80		
Viscosity range		mm^2/s	15 to 380		
Cleanliness class according to ISO code	Pilot valve		Maximum admissible degree of contamination of the hydraulic fluid according to ISO 4406 (c) [1] class 18/16/13		
	Main valve		Maximum admissible degree of contamination of the hydraulic fluid according to ISO 4406 (c) [1] class 18/20/15		
Hysteresis		%	< 0.1		
Response sensitivity		%	< 0.1		
electrical					
Supply voltage DC	Nominal voltage	V	24		
	Lower limit value	V	21		
	Upper limit value	V	35		
Current consumption	I_{max}	A	1.8		
	Impulse load	A	3		
Duty cycle		%	100		
Protection class according to DIN 40050			IP 65 with mating connector mounted and locked		
Thermal drift of the main spool		%/10K	0.16	0.34	0.02
Control electronics			Integrated in the valve, see pages 6 and 7		

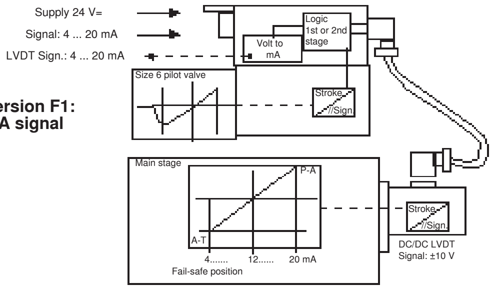
[1] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Efficient filtration prevents malfunctions and at the same time prolongs the service life of components.
For the selection of filters, see data sheets RE 50070, RE 50076, and RE 50081.

Electrical connection

Version A1: Standard



Version F1: mA signal

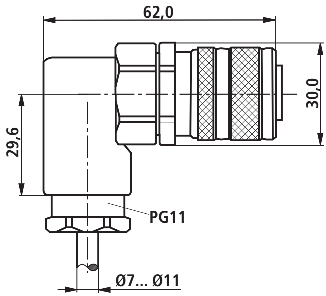


Mating connector 6P+PE / PG11 according to DIN EN 175201-804

See data sheet RE 08008

Separate order with material no. 1834484252

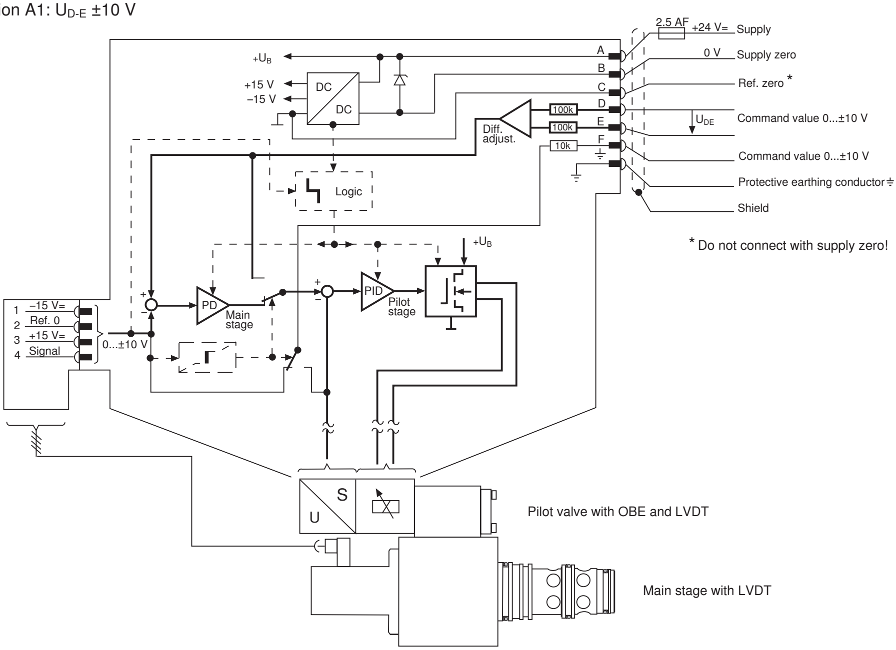
Pinout, see pages 6 and 7



Integral control electronics

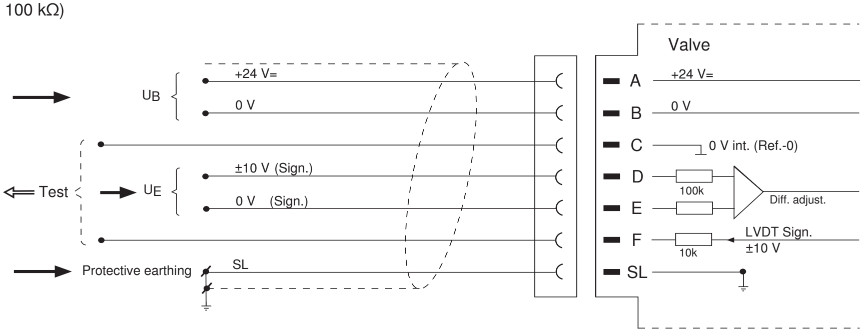
Block circuit diagram / pinout

Version A1: U_{D-E} ±10 V



Pinout 6P+PE

Version A1: U_{D-E} ±10 V
(R_i = 100 kΩ)

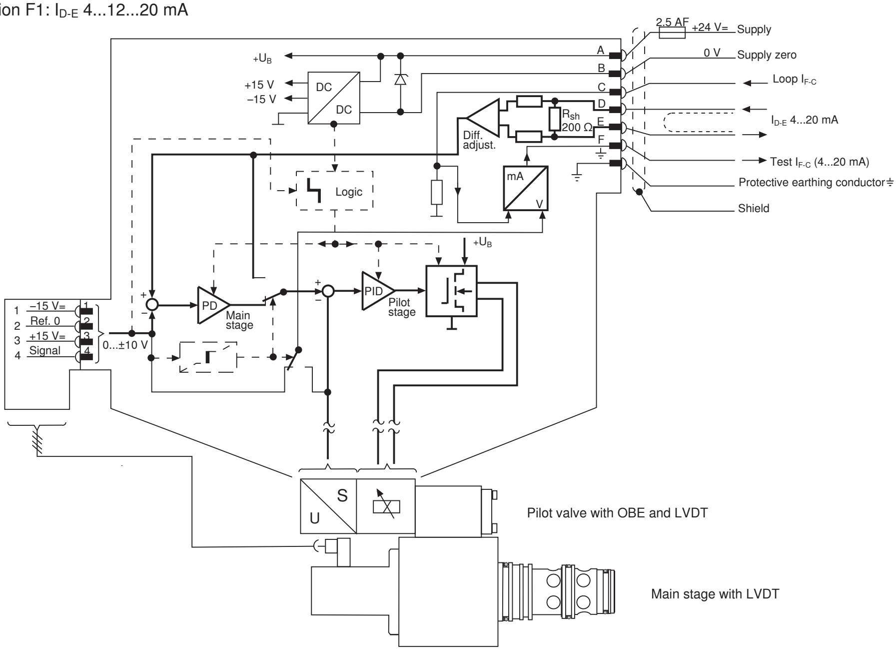


Recommendation connecting cable:
- up to 25 m min 0.75 mm² per wire
- up to 50 m min 1.5 mm² per wire
- with shield braid (connect shield to supply zero of the mains adapter on one side)
- max. external diameter 7 to 11 mm

Integral control electronics

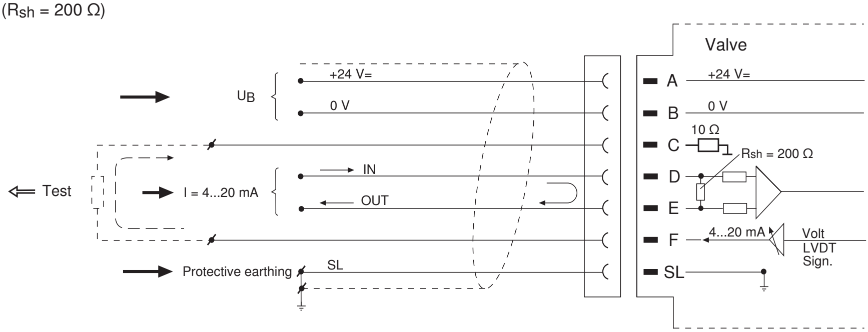
Block circuit diagram / pinout

Version F1: $I_{D\text{-}E}$ 4...12...20 mA



Pinout 6P+PE

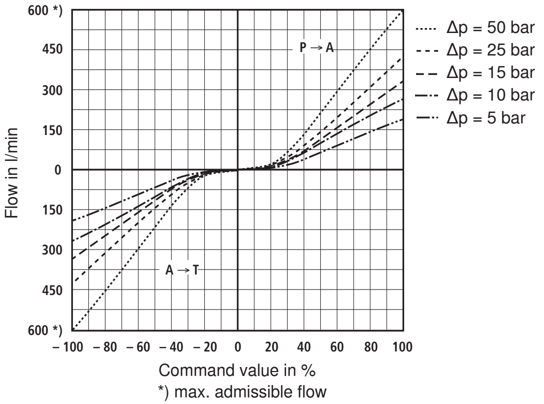
Version F1: $I_{D\text{-}E}$ 4...12...20 mA
(R_{sh} = 200 Ω)



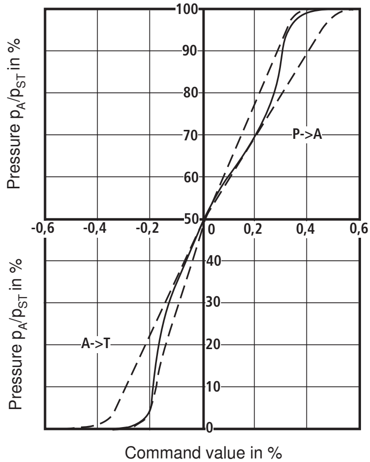
Recommendation connecting cable: - up to 25 m min 0.75 mm² per wire
- up to 50 m min 1.5 mm² per wire
- with shield braid (connect shield to supply zero of the mains adapter on one side)
- max. external diameter 7 to 11 mm

Characteristic curves size 25 (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

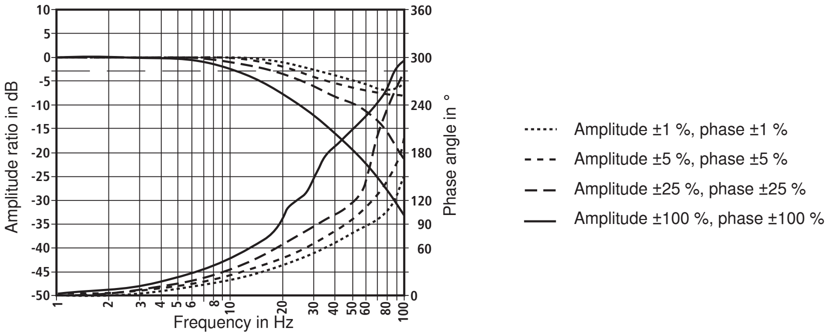
Nominal flow for Q_N = 190 l/min at Dp 5 bar



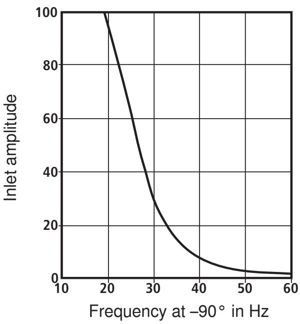
Pressure/signal function



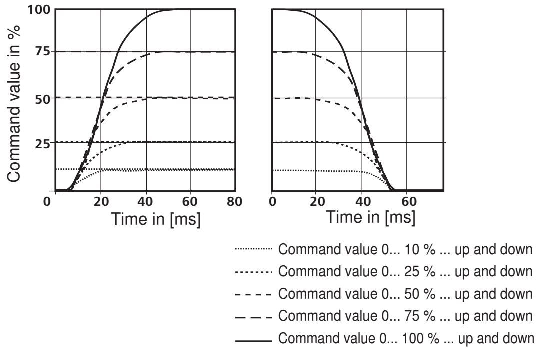
Frequency response at p_{St}/p_A = 100 bar/50 bar



Dependency of the frequency response at –90° and p_{St}/p_A = 100 bar/50 bar

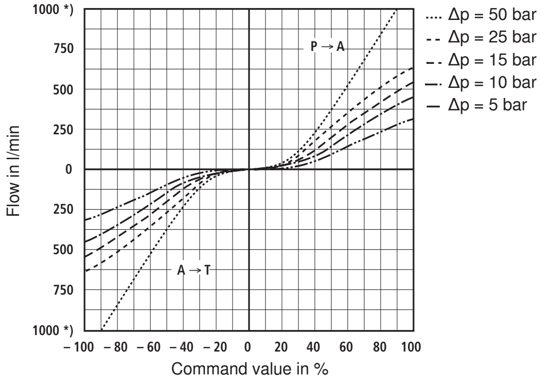


Transition function with stepped, electrical input signal measured at p_{St}/p_A = 100 bar/50 bar



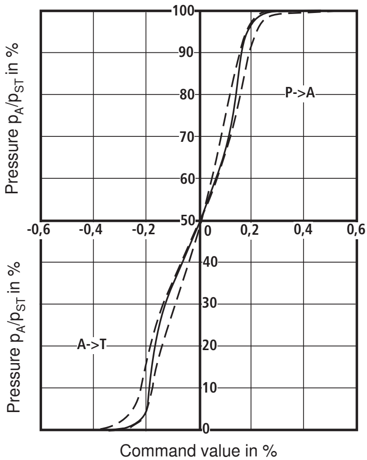
Characteristic curves size 32 (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

Nominal flow for Q_N = 380 l/min at Dp 5 bar

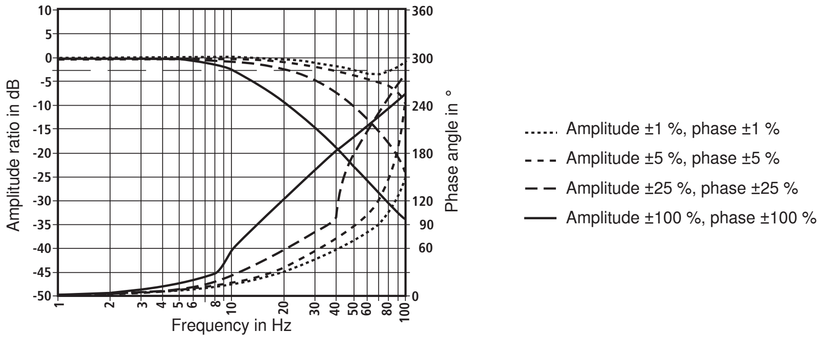


*) max. admissible flow

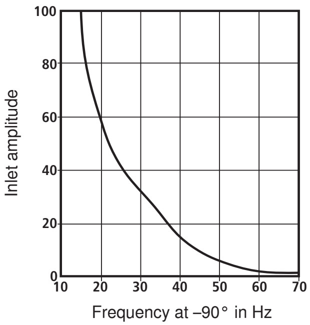
Pressure/signal function



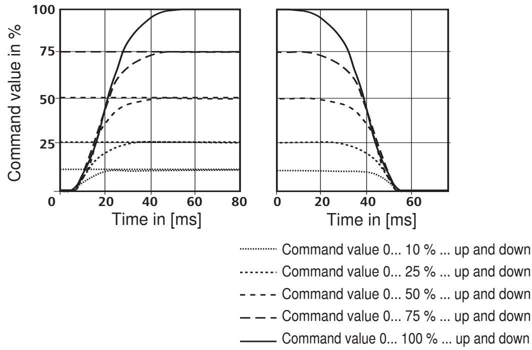
Frequency response at p_{St}/p_A = 100 bar/50 bar



Dependency of the frequency response at –90° and p_{St}/p_A = 100 bar/50 bar



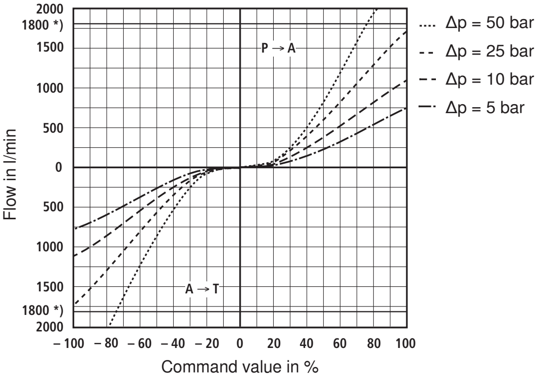
Transition function with stepped, electrical input signal measured at p_{St}/p_A = 100 bar/50 bar



5

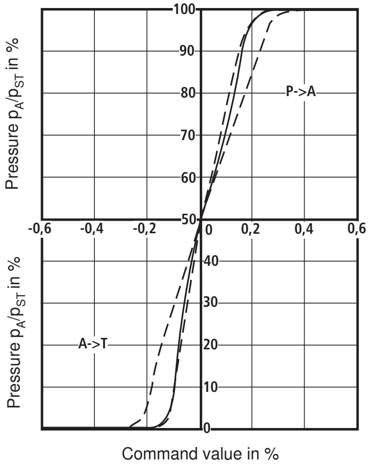
Characteristic curves size 50 (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

Nominal flow for Q_N = 750 l/min at Dp 5 bar

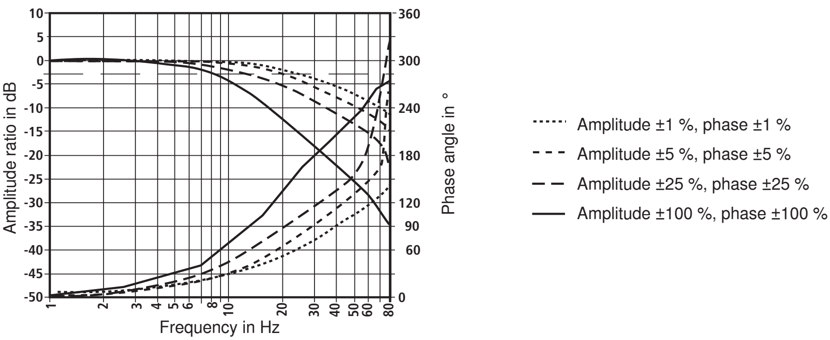


*) max. admissible flow

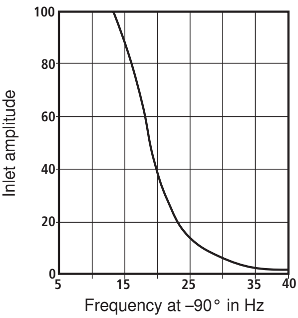
Pressure/signal function



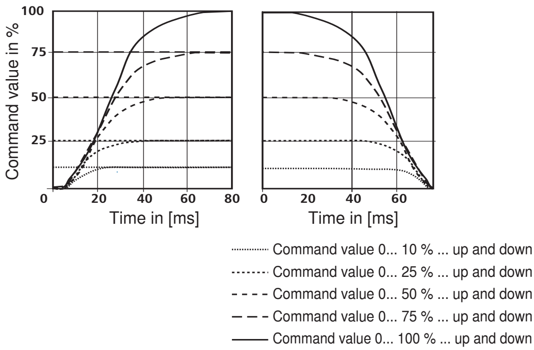
Frequency response at p_{St}/p_A = 100 bar/50 bar



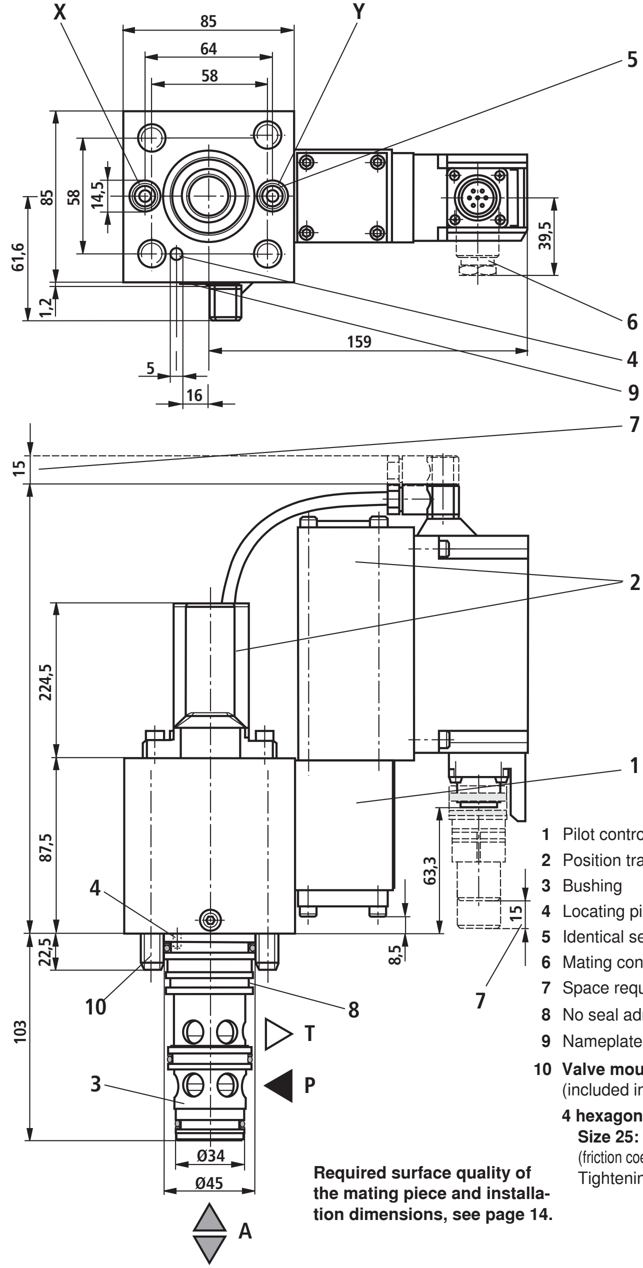
Dependency of the frequency response at –90° and p_{St}/p_A = 100 bar/50 bar



Transition function with stepped, electrical input signal measured at p_{St}/p_A = 100 bar/50 bar



Unit dimensions: Size 25 (dimensions in mm)



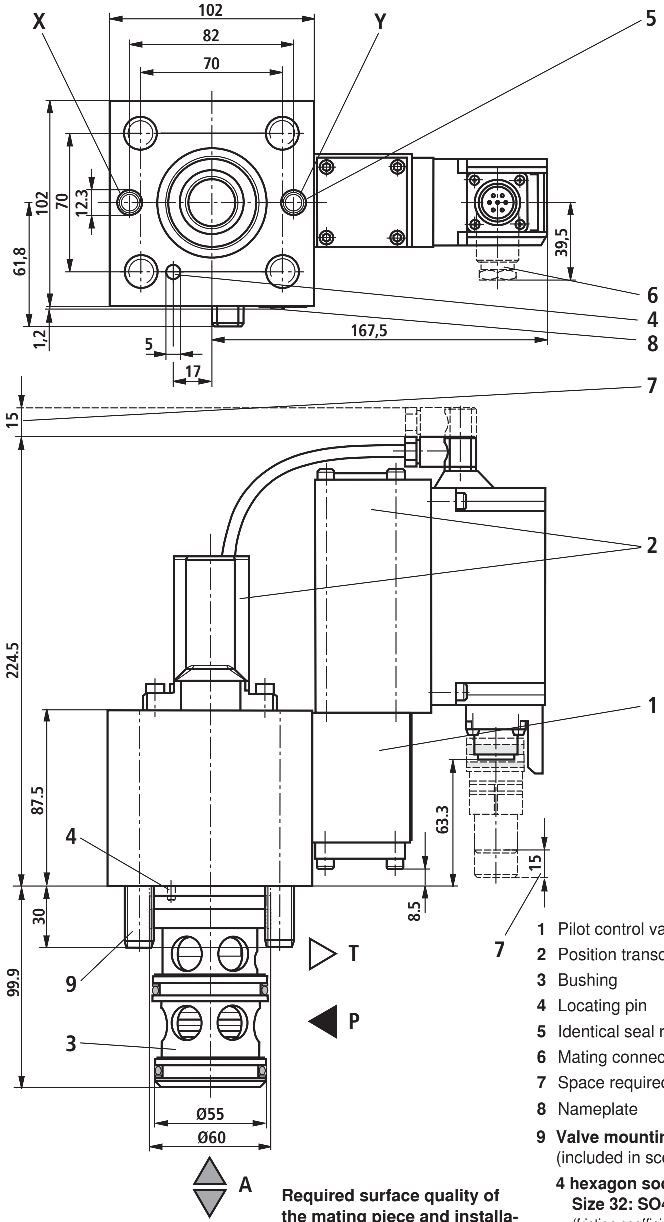
1 Pilot control valve with OBE
2 Position transducer pilot and main stage
3 Bushing
4 Locating pin
5 Identical seal rings for ports X and Y
6 Mating connector (order separately, see page 5)
7 Space required for removing the mating connector
8 No seal admissible
9 Nameplate
10 **Valve mounting screws**
(included in scope of delivery)

4 hexagon socket head cap screws
Size 25: ISO4762-M12x35-10.9-flZn-240h-L
(friction coefficient 0.09 to 0.14 according to VDA 235-101)
Tightening torque M_T = 110 Nm ±10%

Required surface quality of the mating piece and installation dimensions, see page 14.

5

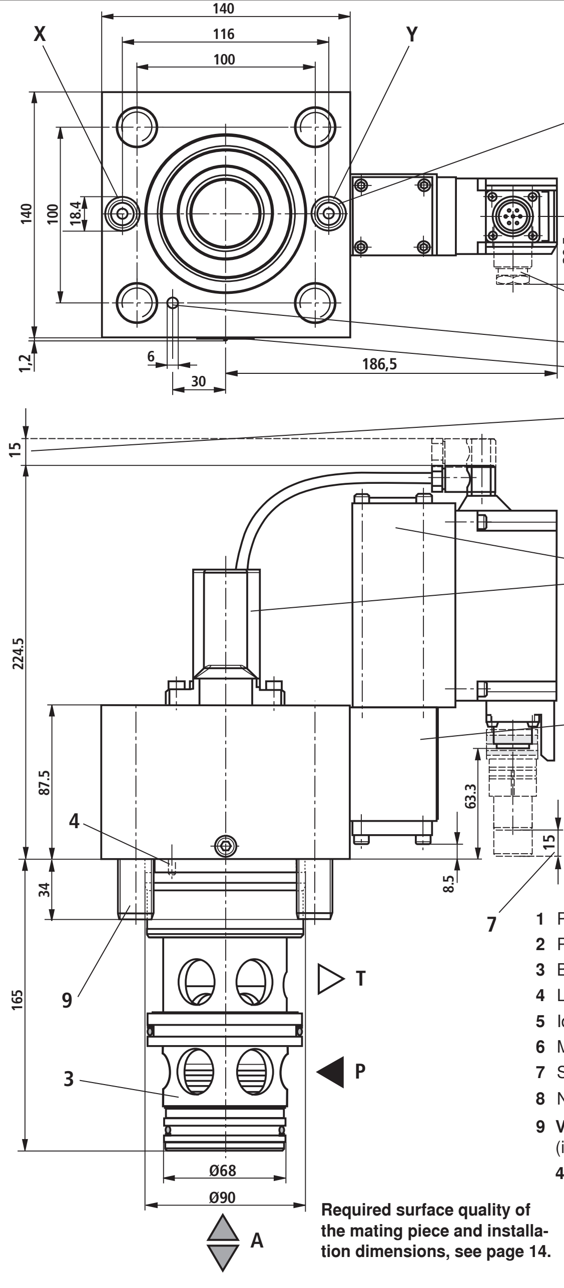
Unit dimensions: Size 32 (dimensions in mm)



Required surface quality of the mating piece and installation dimensions, see page 14.

1 Pilot control valve with OBE
2 Position transducer pilot and main stage
3 Bushing
4 Locating pin
5 Identical seal rings for ports X and Y
6 Mating connector (order separately, see page 5)
7 Space required for removing the mating connector
8 Nameplate
9 **Valve mounting screws**
(included in scope of delivery)
4 hexagon socket head cap screws
Size 32: SO4762-M16x50-10.9-flZn-240h-L
(friction coefficient 0.09 to 0.14 according to VDA 235-101)
Tightening torque M_T = 270 Nm ±10%

Unit dimensions: Size 50 (dimensions in mm)



1 Pilot control valve with OBE
2 Position transducer pilot and main stage
3 Bushing
4 Locating pin
5 Identical seal rings for ports X and Y
6 Mating connector (order separately, see page 5)
7 Space required for removing the mating connector
8 Nameplate
9 **Valve mounting screws**
(included in scope of delivery)

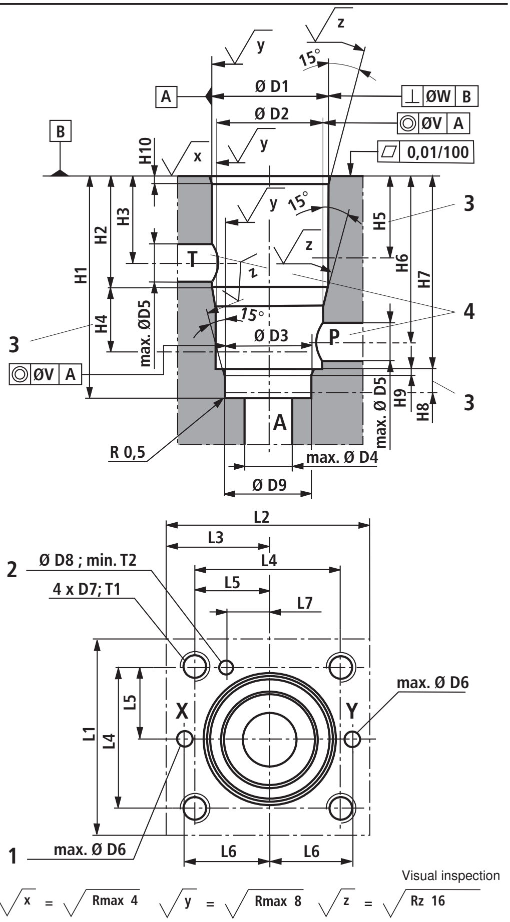
4 hexagon socket head cap screws
Size 50: ISO4762-M20x70-10.9-flZn-240h-L
(friction coefficient 0.09 to 0.14 according to VDA 235-101)
Tightening torque M_T = 540 Nm ±10%

Required surface quality of the mating piece and installation dimensions, see page 14.

5

Mounting cavity (dimensions in mm)

Size	25	32	50
L1	85	102	140
L2	85	102	140
L3	42,5	51	70
L4±0.2	58	70	100
L5±0.1	29	35	50
L6±0.2	33	41	58
L7±0.2	16	17	30
H1+0.1	103	100	165
H2	56	43.5	87
H3	45	30	66
H4	15	16	40
H5	25	18	66
H6±0.3	78	70.5	122
H7+0.3	89	85	143
H8	11.5	13.5	18
H9	2.5	3	3
H10	2.5	2.5	4
ØD1H7Ⓔ	45	60	90
ØD2H7Ⓔ	43	58	87
ØD3H7Ⓔ	34	55	68
max. ØD4	20	30	35
max. ØD5	20	24	35
max. ØD6	6	8	10
D7	M12	M16	M20
ØD8H13	6	6	8
ØD9+0.2	33.7	54.7	67.7
T1	25	35	45
min T2	10	10	10
V	0.03	0.03	0.03
W	0.05	0.1	0.1



Tolerance ISO 8015
General tolerances ISO 2768-mK

1 Connect port X with port P or externally

2 Boring for locating pin

3 Depth of fit

4 Ports P and T can be positioned around the central axis of port A. Mounting and pilot bores must not be damaged in doing so.

Notes

Notes

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

2- and 3-way high-response cartridge valve

RE 29136/12.04
Replaces: 05.03

Type .WRCE.../S

Sizes 32, 40 and 50
Component series 2X
Maximum operating pressure 420 bar
Maximum flow 4500 L/min

Type 2WRCE...-2X/S

Type 3WRCE...-2X/S

Table of contents

Features

- Pilot operated 3-stage high-response valve
- Suitable for closed-loop controlling of position, pressure, force and velocity
- Pilot control valve:
  2-stage servo-valve of size 6 or 10 with mechanical feedback, trimmed; closes the 2WRCE main stage and opens the 3WRCE main stage from A to T in the event of a power failure when pilot pressure is applied
- Main stage: closed-loop position controlled
- Integrated open and closed-loop control electronics (OBE)
- Block installation:
  Mounting cavity to DIN ISO 7368 for 2WRCE
- Typical applications:
  - Presses
  - Die-casting machines
  - Punching axes

Further information:
– Pilot control valve

• Servo-valve of size 6	RE 29564
• Servo-valve of size 10	RE 29583

Note
Type .WRCE…/P with proportional pilot valve, see RE 29137

Ordering code: Type 2WRCE

2	WRCE		S		–2X /	S		K31 /			*

2/2 directional valve	= 2
Electrically operated cartridge type high-response valve with integrated electronics (OBE)	= WRCE
Size 32	= 32
Size 40	= 40
Size 50	= 50
Poppet	= S
Nominal flow in L/min at 5 bar valve pressure drop	
Size 32: 650 L/min linear, ...S650L... only	= 650
480 L/min with fine control range, ...S480R... only	= 480
Size 40: 1000 L/min linear, ...S1000L... only	= 1000
700 L/min with fine control range, ...S700R... only	= 700
Size 50: 1600 L/min linear, ...S1600L... only	= 1600
1100 L/min with fine control range,...S1100R... only	= 1100
Characteristic curve shape	
Linear	= L
Linear, with progressive fine control range	= R
Component series 20 to 29 (20 to 29: unchanged installation and connection dimensions)	= 2X
Pilot control valve	
Servo-valve	= S
Supply voltage 24VDC	= G24
Supply voltage ± 15VDC	= G15
Electrical connection	
Without cable socket, with component plug to DIN EN 175201-804 (separate order, see page 12)	= K31
Interfaces	
Command value 0 ...+10 V, actual value 0.5 ...+10 V	= A1
Command value 0 ...+10 mA, actual value 0.5 ...+10 mA	= C1
Sandwich plate shut-off valve	
Without shut-off valve	= No code
With shut-off valve	
De-energised shut-off valve actively closes 2WRCE when pilot pressure is applied	= WK15
De-energised shut-off valve actively opens 2WRCE when pilot pressure is applied	= WL15
Voltage supply 24 VDC, cable socket separate order, see page 12	
Seals	
NBR seals, suitable for mineral oil HL and HLP to DIN 51524	= M
FKM seals	= V
Further details in clear text	

Preferred types:

Type 2WRCE	Material no.
2WRCE 32 S650L-2X/SG24K31/A1M	R900768408
2WRCE 40 S1000L-2X/SG24K31/A1M	R900768412
2WRCE 50 S1600L-2X/SG24K31/A1M	R900770094

Ordering code: 3WRCE

3	WRCE				–2X / S		K31 /			*

3/2 directional valve = **3**

Electrically operated cartridge type high-response valve with integrated electronics (OBE) = **WRCE**

Size 32 = **32**
Size 40 = **40**
Size 50 = **50**

Sliding spool, zero overlap (+0.5...+1.5%) = **V**
Sliding spool, with 10…13 % pos. overlap = **E**

Nominal flow in L/min at 5 bar valve pressure drop

Size 32: 290 L/min linear, ...V290L... only = **290**
250 L/min with fine control range, ...E250P... only = **250**

Size 40 460 L/min linear, ...V460L... only = **460**
410 L/min with fine control range, ...E410P... only = **410**

Size 50 720 L/min linear, ...V720L... only = **720**
620 L/min with fine control range, ...E620P... only = **620**

Characteristic curve shape
Linear = **L**
Linear with linear fine control range = **P**

Component series 20 to 29 = **2X**
(20 to 29: unchanged installation and connection dimensions)

Pilot control valve
Servo-valve = **S**

Supply voltage 24VDC = **G24**
Supply voltage ± 15VDC = **G15**

Electrical connection
Without cable socket, with component plug to DIN EN 175201-804 = **K31**
(separate order, see 12)

Interfaces
Command value ± 10 V, actual value ± 10 V = **A1**
Command value ± 10 mA, actual value ± 10 mA = **C1**

Sandwich plate shut-off valve
Without shut-off valve = **No code**
With shut-off valve
De-energised shut-off valve actively opens 3WRCE from A to T when pilot pressure is applied = **WK15**
De-energised shut-off valve actively opens 3WRCE from P to A when pilot pressure is applied = **WL15**
Voltage supply 24 VDC, cable socket separate order, see page 12 (without connections)

Seals
NBR seals, suitable for mineral oils HL and HLP to DIN 51524 = **M**
FKM seals = **V**

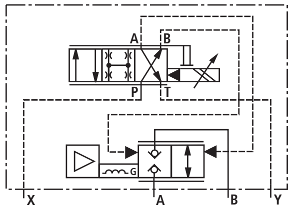
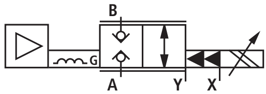
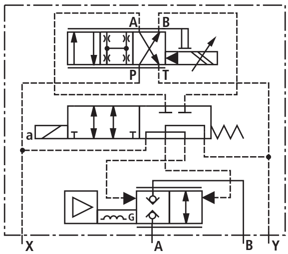
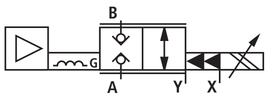
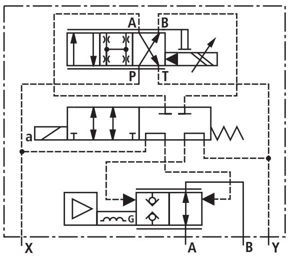
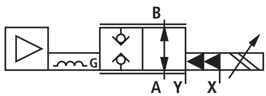
Further details in clear text

Preferred types:

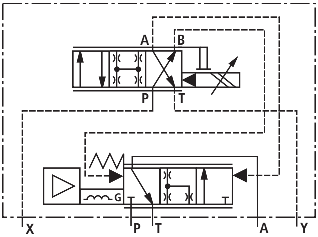
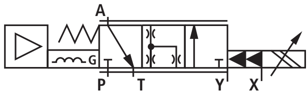
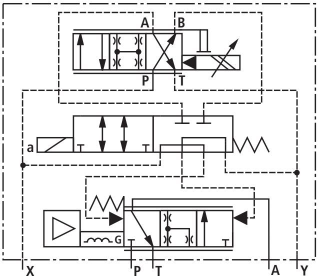
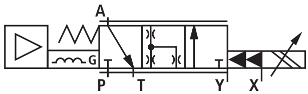
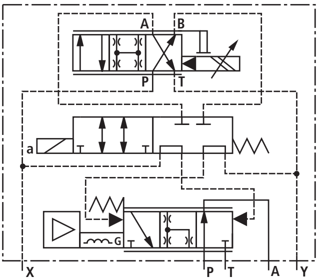
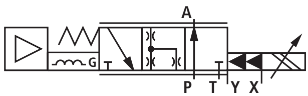
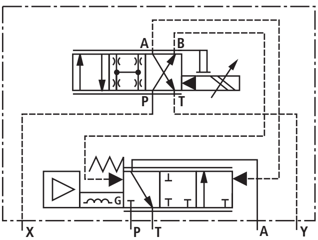
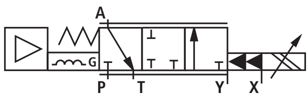
Type 3WRCE	Material no.
3WRCE 32 V290L-2X/SG24K31/A1M	**R900768414**
3WRCE 40 V460L-2X/SG24K31/A1M	**R900759110**
3WRCE 50 V720L-2X/SG24K31/A1M	**R900768415**

5

Symbols: 2WRCE

Detailed	Simplified
2WRCE..-2X/S...	**2WRCE..-2X/S...**
	
2WRCE..-2X/S...WK...	**2WRCE..-2X/S...WK...**
	
2WRCE..-2X/S...WL...	**2WRCE..-2X/S...WL...**
	

Symbols: 3WRCE

Detailed	Simplified
3WRCE..V...-2X/S... 	3WRCE..V...-2X/S... 
3WRCE..V...-2X/S...WK... 	3WRCE..V...-2X/S...WK... 
3WRCE..V...-2X/S...WL... 	3WRCE..V...-2X/S...WL... 
3WRCE..E...-2X/S... 	3WRCE..E...-2X/S... 

Structure, function and section: 2WRCE

Valves of type 2WRCE...-2X/S... are 3-stage high-response valves.

They control the amount and direction of a flow and are mainly used in closed control loops.

Structure

They consist of the following assemblies:

- 2-stage pilot control valve (1)
  - with dry torque motor
  - low-friction nozzle-flapper plate amplifier and
  - mechanical feedback of the spool position
- one main stage (2) for flow control
- an inductive position transducer (3) whose core (4) is mounted to the spool (5) of the third stage
- and integrated closed-loop control electronics (6).

Function

The integrated electronics compares command values and actual values and controls the torque motor of the pilot control valve by providing a current that is proportional to the system deviation.

The pilot control valve moves to a proportional control position and controls the flows to or from control chambers A (7) and B (8), which actuate the main spool (5) via the closed valve control loop until the system deviation becomes 0.

The stroke of the main spool is therefore controlled proportionally to the command value. Here, it must be noted that the flow also depends on the valve pressure drop.

Special valve features:

Fluid can flow through the valve from A to B or from B to A.

The spool closes or opens at a command value of 5 % . In the case of smaller command values, the valve control loop tries to correct the position of the spool and consequently presses it onto the seat at up to the full pilot pressure, thus closing the connection leak-free.

The specified valve dynamics are only valid within the closed-loop control range of the valve. In the case of command value step-changes from the seated position to small opening values, additional delay times occur.

The cracking point of 5 % (= 0.5 V or 0.5 mA) is factory-set. When the pilot control valve or the control electronics are replaced, the cracking point can be re-adjusted by means of zero balancing potentiometer R316, which is accessible via a plug screw.

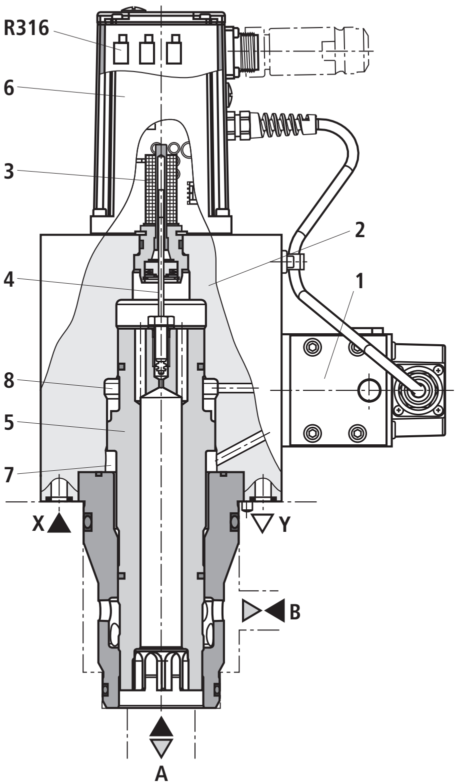
Except for zero point balancing of the controller, no adjustments are permitted on the closed-loop control electronics (= controller or open-loop control electronics) or pilot control valve in the case of a replacement.

On the pilot control valve, only the filter element may be changed (see RE 29564 for size 6 or RE 29583 for size 10).

The pilot valve is adjusted so that in the event of a power failure, it directs the pilot pressure to control chamber B (8), i.e. closes the main stage.

The control electronics is provided with an offset in order to compensate for the trimming of the pilot control valve (pilot trimming).

Due to differences in the diameter in the area around the seat, the spools are not statically pressure-compensated. To balance the difference in force, 6 % of the system pressure is required as pilot pressure for spool S...L, and 22 % for S...R 22 %. This results in the recommended minimum control pressure with reserves for flow force and dynamics.



Structure, function and section: 3WRCE

Valves of type 3WRCE...-2X/S... are 3-stage high-response valves.

They control the amount and direction of a flow and are mainly used in closed control loops.

Structure

They consist of the following assemblies:

– 2-stage pilot control valve (1)
  • with dry torque motor
  • low-friction nozzle-flapper plate amplifier and
  • mechanical feedback of the spool position
– a main stage (2) for flow control
– an inductive position transducer (3), whose core (4) is mounted to the spool (5) of the third stage
– and integrated closed-loop control electronics (6).

Function

The integrated electronics compares command values and actual values and controls the torque motor of the pilot control valve by providing a current that is proportional to the system deviation.

The pilot control valve moves to a proprtional control position and controls the flows to or from control chambers A (7) and B (8), which actuate the main spool (5) via the closed valve control loop until the system deviation becomes 0.

The stroke of the main spool is therefore controlled proportionally to the command value. Here, it must be noted that the flow also depends on the valve pressure drop.

Special valve features

The cracking point of 0 % (V-spool) is factory-set. When the pilot control valve or the control electronics are replaced, the cracking point can be re-adjusted by means of zero balancing potentiometer R316, which is accessible via a plug screw.

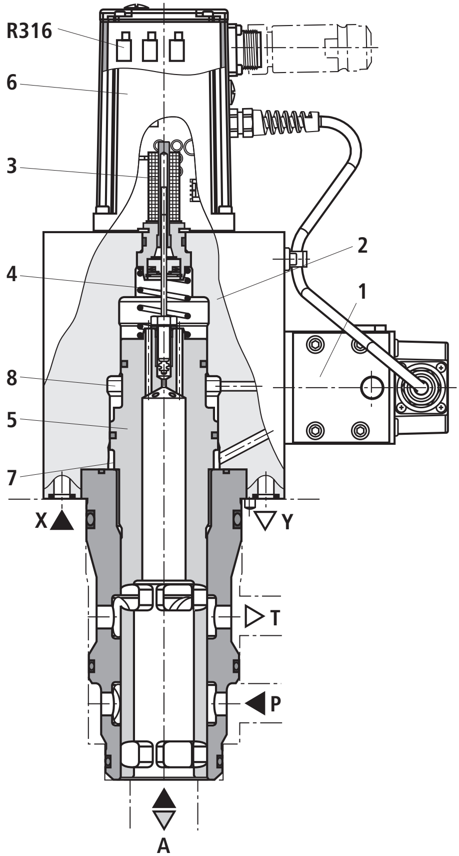
Except for zero point balancing, no adjustments are permitted on the closed-loop control electronics (= controller or open-loop control electronics) or pilot control valve in the case of a replacement.

On the pilot control valve, only the filter element may be changed (see RE 29564 for size 6 or RE 29583 for size 10).

The pilot control valve is adjusted so that in the event of a power failure the pilot pressure is applied to control chamber B (8), i.e. the main stage opens from A to T or closes the connection from P to A.

The spring behind the main spool only shifts the spool to the position, at which P to A is closed, when no pressure is applied (before installation; before re-application of pressures, e.g. after a tool change).

The control electronics is provided with an offset in order to compensate for trimming of the pilot control valve (pilot trimming).



Technical data: 2WRCE (for applications outside these parameters, please consult us!)

General

Sizes	Size	**32**	**40**	**50**
Installation position; commissioning		Optional, preferably horizontal; according to RE 07700		
Storage temperature range	°C	−20 ... +80		
Ambient temperature range	°C	−20 ... +60		
Weight	kg	11.2	21.1	28
Weight with shut-off valve ...../...WK or .../...WL...	kg	12.4	24.8	31.7
Size of the pilot control valve	Size	6	10	10

Hydraulic (measured with HLP32, $\vartheta_{oil} = 40\ °C \pm 5\ °C$)

Max. operating pressures					
Main stage ports A, B		bar	420		
Pilot control valve port X		bar	315		
Pilot control valve port Y		bar	Pressure peaks <100, steady-state <10		
Minimum pilot pressure in % of system pressure					
with spool of version S...L		%	15		
with spool of version S...R		%	45		
Nominal flow q_{Vnom} +10 % at $\Delta p = 5$ bar					
Version ...S...L (linear)		L/min	650	1000	1600
Version ...S...R (linear with progressive fine control range)		L/min	480	700	1100
Max. flow	with spool ...S...L	L/min	1500	2200	3500
	with spool ...S...R	L/min	2000	3000	4500
Pilot flow to X and Y with step-like input signal from 0 to 100 % (315 bar)		L/min	38	56	80
Zero flow of the servo pilot stage in dependence on pressure in X		L/min	$\sqrt{\frac{p_x}{70\ \text{bar}}} \cdot 0.5$	$\sqrt{\frac{p_x}{70\ \text{bar}}} \cdot 1.2$	
Pilot oil flow		cm^3	4.52	8.48	17.3
Nominal stroke		mm	10	12	15
Hydraulic fluid			Mineral oil (HL, HLP) to DIN 51524, further hydraulic fluids on enquiry		
Hydraulic fluid temperature range		°C	−20 … +80; preferably +40 … +50		
Viscosity range		mm^2/s	20 … 380; preferably 30 … 45		
Max. permissible degree of contamination of the hydraulic fluid according to ISO 4406 (c)					
Cleanliness class to ISO code	Pilot control valve		Class 18/16/13 [1)]		
	Main valve		Class 20/18/15 [1)]		
Hysteresis		%	≤ 0.2		
Range of inversion		%	≤ 0.1		
Response sensitivity		%	≤ 0.1		
Closing time when using	pilot trimming	ms	≤ 550		
(for pilot pressures from 40 to 315 bar)	sandwich plate shut-off valve	ms	≤ 200		

[1)] The cleanliness classes specified for components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and at the same time increases the service life of components. For the selection of filters, see data sheets: RE 50070, RE 50076, RE 50081; RE 50086 and RE 50088

Technical data: 2WRCE (for applications outside these parameters, please consult us!)

Electrical

Sizes	Size	32	40	50
Type of protection of the valve to EN 60529		IP65 with cable socket mounted and locked		
Type of voltage		DC voltage		
Type of signal		Analogue		
Cracking point balancing	%	≤ 1		
Zero drift in the case of changes in:				
Hydraulic fluid temperature	%/10 K	≤ 0.3	≤ 0.3	≤ 0.3
Pilot pressure in X	%/100 bar	≤ 0.7	≤ 0.7	≤ 0.7
Return line pressure in Y 0 to 10% of p_X	%/bar	≤ 0.3	≤ 0.3	≤ 0.3

Note!

For details regarding environment simulation testing in the fields of EMC (electromagnetic compatibility), climate and mechanical stress, see RE 29136-U (declaration on environmental compatibility).

Integrated electronics (OBE) of type VT 13037

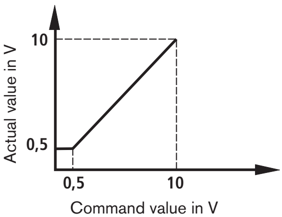
Nominal command value range for 2WRCE:
0 to +10 V (mA) ≙ 0 to 100 %

Within the command value range from 0 to +0.5 V the actual value remains constant at 0.5 V.

In the case of slow changes in the command value from +0.5 V to +10 V the actual value follows the command value within ±0.1 V.

With command values above +10 V the actual value follows up to approx. +12 V.

In the case of a command value step-change to +10 V, the actual value can briefly take values up to approx. +10.5 V.



5

Technical data: 3WRCE (for applications outside these parameters, please consult us!)

General

Sizes	Size	**32**	**40**	**50**
Installation position; commissioning		Optional, preferably horizontal; according to RE 07700		
Storage temperature range	°C	−20 ... +80		
Ambient temperature range	°C	−20 ... +60		
Weight	kg	11.5	18.9	29.2
Weight with shut-off valve ...../...WK or .../...WL...	kg	12.7	20.1	32.9
Size of the pilot control valve	Size	6	6	10

Hydraulic (measured with HLP32, $\vartheta_{oil} = 40\ °C \pm 5\ °C$)

Max. operating pressures				
Main stage ports P, A, T	bar	315		
Pilot control valve port X	bar	315		
Pilot control valve port Y	bar	Pressure peaks <100, steady-state <10		
Nominal flow q_{Vnom} +10 % at $\Delta p = 5$ bar				
Version ...V...L (linear)	L/min	290	460	720
Max. flow	L/min	900	1400	2200
Pilot flow to X and Y with step-like input signal from 0 to 100 % (315 bar)	L/min	27	42	65
Max. zero flow of the main stage , $p_p = 300$ bar	L/min	4	6	8
Zero flow of the servo pilot stage in dependence upon the pressure in X	L/min	$\sqrt{\frac{p_x}{70\ \text{bar}}} \cdot 0.5$		$\sqrt{\frac{p_x}{70\ \text{bar}}} \cdot 1.2$
Pilot flow	cm³	±2.26	±4.24	±8.65
Nominal stroke	mm	±5	±6	±7.5
Hydraulic fluid		Mineral oil (HL, HLP) to DIN 51524		
Hydraulic fluid temperature range	°C	−20 … +80; preferably +40 … +50		
Viscosity range	mm²/s	20 … 380; preferably 30 … 45		
Max. permissible degree of contamination of the hydraulic fluid to ISO 4406 (c)				
Cleanliness class to ISO code – Pilot control valve		Class 18/16/13 [1)]		
Cleanliness class to ISO code – Main valve		Class 20/18/15 [1)]		
Hysteresis	%	≤ 0.2		
Range of inversion	%	≤ 0.1		
Response sensitivity	%	≤ 0.1		
Closing time from 100% opening down to zero flow using pilot trimming	ms	≤ 500		
Sandwich plate shut-off valve (for pilot pressures from 40... 315 bar)	ms	≤ 200		

[1)] The cleanliness classes specified for components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and at the same time increases the service life of components. For the selection of filters, see data sheets: RE 50070, RE 50076, RE 50081; RE 50086 and RE 50088

Technical data: 3WRCE (for applications outside these parameters, please consult us!)

Electrical

Sizes	Size	32	40	50
Type of protection of the valve to EN 60529		IP65 with cable socked mounted and locked		
Type of voltage		DC voltage		
Type of signal		Analogue		
Zero balancing	%	≤ 1		
Zero drift in the case of changes in:				
Hydraulic fluid temperature	%/10 K	≤ 0.3	≤ 0.3	≤ 0.3
Pliot pressure in X	%/100 bar	≤ 0.7	≤ 0.7	≤ 0.7
Return line pressure in Y (0 to 10% of p_x)	%/bar	≤ 0.3	≤ 0.3	≤ 0.3

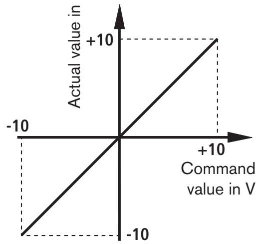
Integrated electronics (OBE) type VT 13037

Nominal command value range for 3WRCE:
0 to ±10 V (mA) ≙ 0 to ±100 %

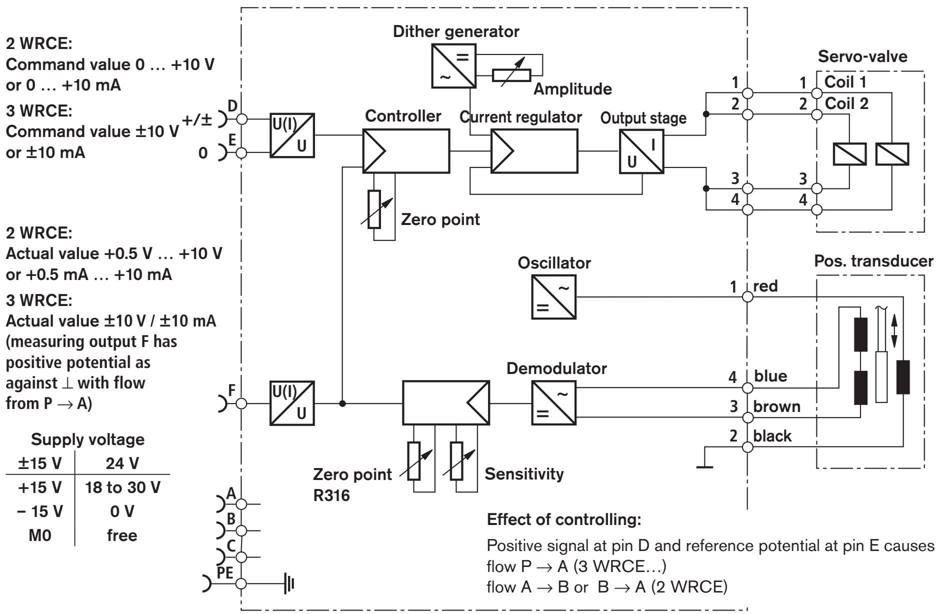
In the case of slow changes in the command value from 0 V to ±10 V the actual value follows the command value within ±0.1 V.

With command values above ±10 V the actual values follows up to approx. ±13 V.

With a command value step-change to ±10 V, the actual value can briefly take values up to approx. ±10.5 V.



Block circuit diagram of integrated electronics (OBE) type VT13037



Supply voltage	
±15 V	24 V
+15 V	18 to 30 V
– 15 V	0 V
M0	free

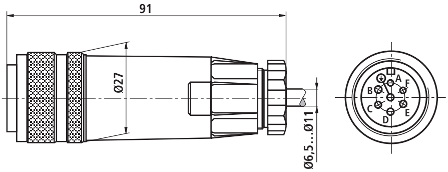
Effect of controlling:

Positive signal at pin D and reference potential at pin E causes
flow P → A (3 WRCE…)
flow A → B or B → A (2 WRCE)

Electrical connection, cable sockets

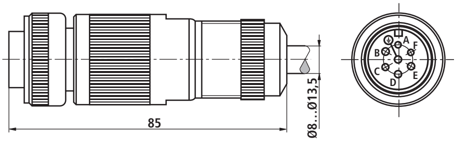
Cable socket

Cable socket to DIN EN 175201-804
separate order stating material no. **R900021267**
(plastic version)



Cable socket

Cable socket to DIN EN 175201-804
separate order stating material no. **R9000223890**
(metal version)



Component plug pin assignment	Pin	Pin assignment of interface A1 (Voltage supply "G15" in brackets)		Pin assignment of interface C1	
		2WRCE	3WRCE	2 WRCE	3WRCE
Supply voltage	A	+24 VDC (+15 VDC)		+24 VDC (+15 VDC)	
	B	0 VDC (–15 VDC)		0 VDC (–15 VDC)	
M0 at ±15V "G15"	C	n.c. (reference to pins A, B)		n.c. (reference to pins A, B)	
Differential command value	D	0 ... +10 V	0 ... ±10 V	0 ... +10 mA	0 ... ±10 mA
input	E				
Actual value Reference for "G24" is pin B Reference for "G15" is pin C	F	+0.5 ... +10 V	0 ... ±10 V	+0.5 ... +10 mA	0 ... ±10 mA
Protective ground	PE	Connected to valve housing		Connected to valve housing	

Do not connect PE, if the valve is already grounded via the system.

Supply voltage: +24 VDC ±6 V; full-bridge rectification with smoothing capacitor 2200 µF = I_{max} = 230 mA
±15 VDC ±0.45 V; stabilised and smoothed; I_{max} = 180 mA

Command value current: 0 … +10 mA or ±10 mA → input resistance 100 Ω

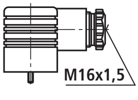
Actual value current: 0.5 mA … +10 mA or ±10 mA → max. load resistance 1 kΩ
Command value and actual value have the same polarity

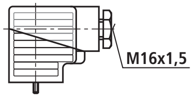
Note: **Electrical signals brought out via control electronics (e.g. actual value) must not be used for switching off safety-relevant machine functions!**

(See also European standard "Safety requirements for fluid power systems and components – hydraulics", EN 982!)

Cable sockets for shut-off valve to DIN EN 175301-803 for component plug "K4"

For further cable sockets, see RE 08006

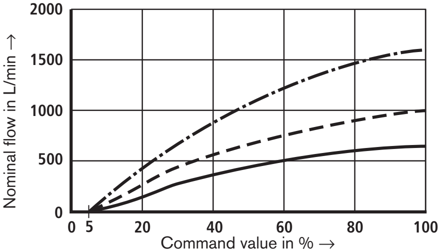




Valve side	Colour	Material no Without circuitry	With lamp 12 … 240 V	With rectifier 12 … 240 V	With lamp and Z-diode protective circuitry 24 V
a	grey	**R901017010**	–	–	–
a/b	black	–	**R901017022**	**R901017025**	**R901017026**

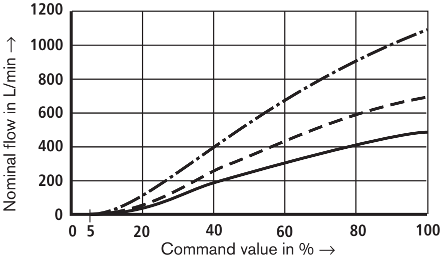
Characteristic curves (measured with HLP32, $\vartheta_{oil} = 40\ °C \pm 5\ °C$)

Nominal flow at 5 bar valve pressure differential A → B = B → A



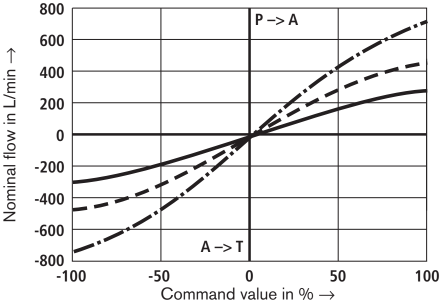
2WRCE 50 S1600L
2WRCE 40 S1000L
2WRCE 32 S650L

Nominal flow at 5 bar valve pressure differential A → B = B → A



2WRCE 50 S1100R
2WRCE 40 S700R
2WRCE 32 S480R

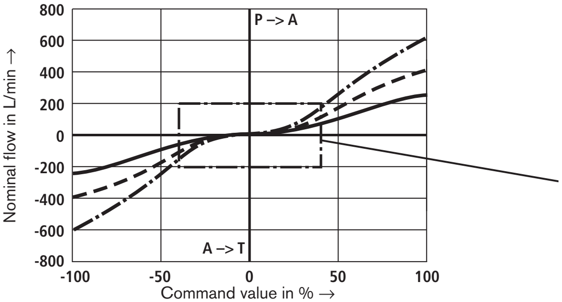
Nominal flow at 5 bar valve pressure differential

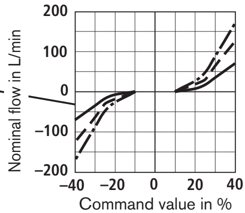


3WRCE 50 V720L
3WRCE 40 V460L
3WRCE 32 V290L
(overlap +0.5...+1.5%)

Nominal flow at 5 bar valve pressure differential with 10% overlap

3WRCE 50 E620P
3WRCE 40 E250P
3WRCE 32 E410P

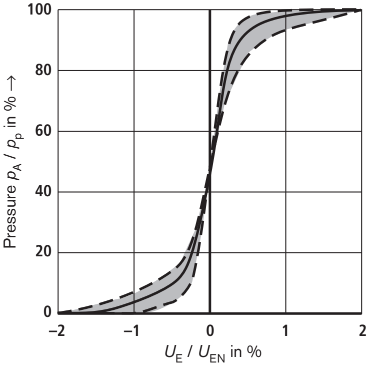




5

Characteristic curves (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

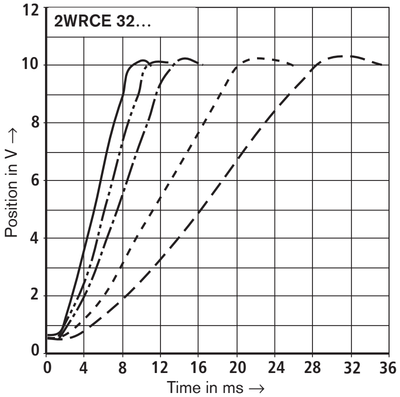
Pressure/signal function with 3WRCE...V... limit and average value curves

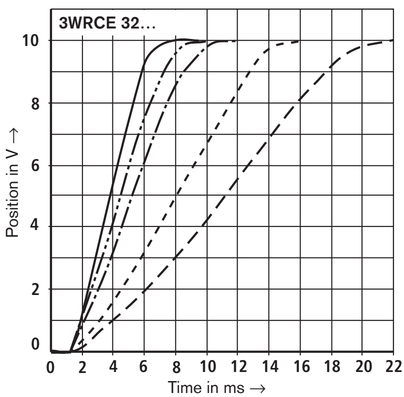


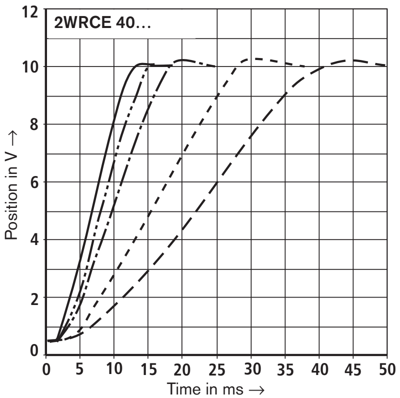
Characteristic curves (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

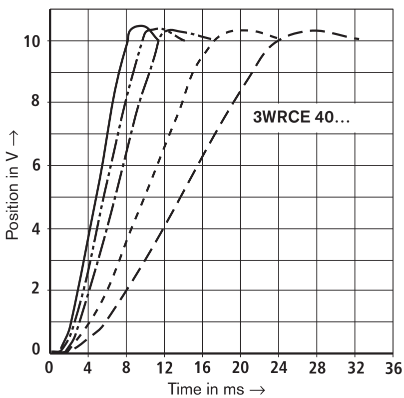
Transient function

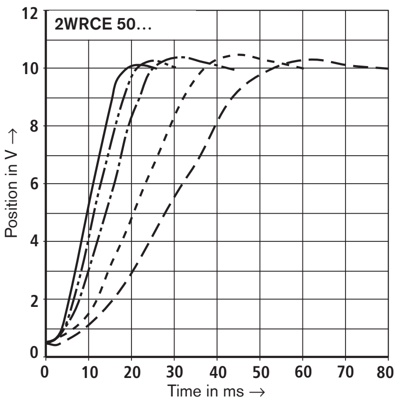
— — — 40 bar, ------ 70 bar, —·— 140 bar, —··— 210 bar, —— 315 bar

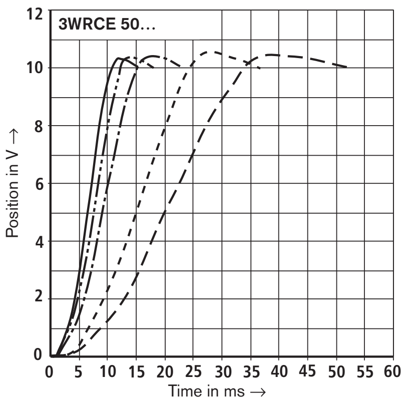








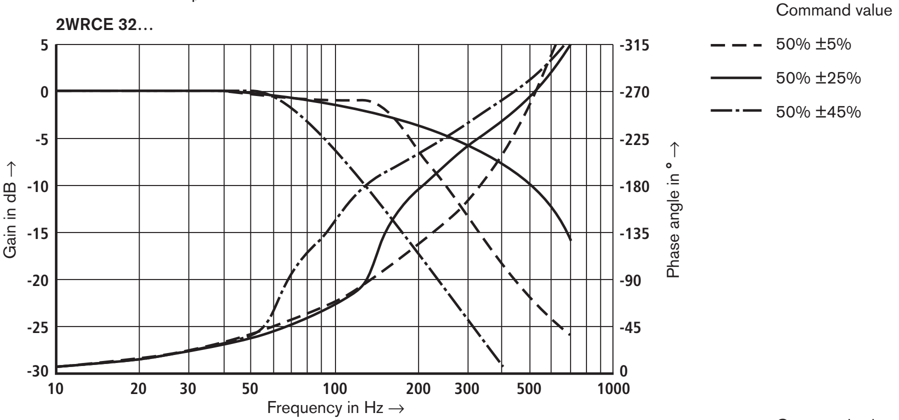




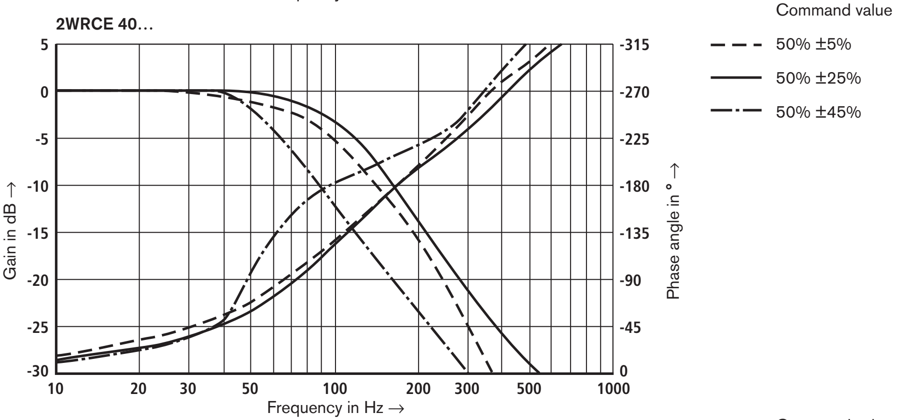
Characteristic curves (measured with HLP32, $\vartheta_{oil} = 40\ °C \pm 5\ °C$)

Frequency response at p_p = 315 bar

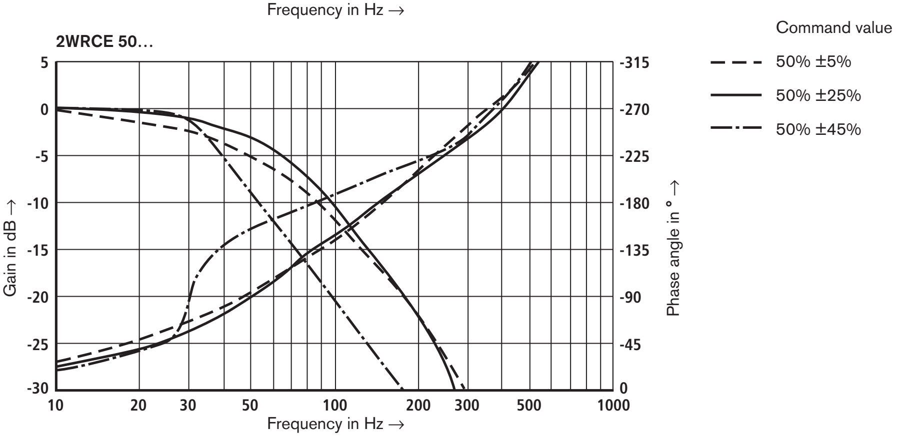
2WRCE 32…



2WRCE 40…



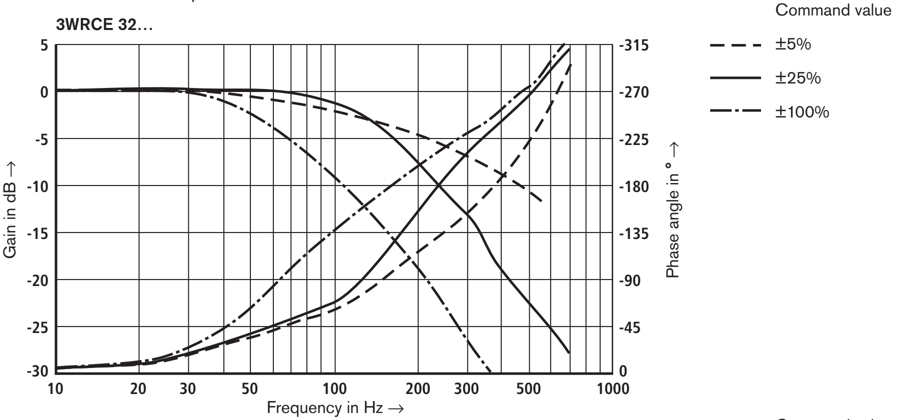
2WRCE 50…



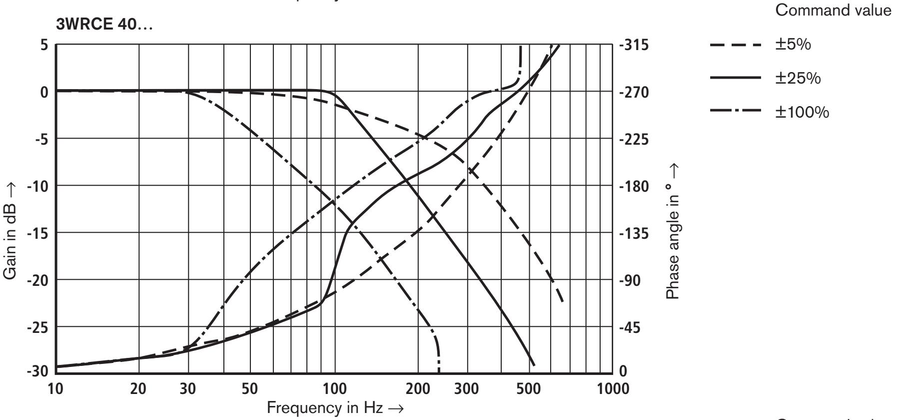
Characteristic curves (measured with HLP32, $\vartheta_{oil} = 40\ °C \pm 5\ °C$)

Frequency response at p_p = 315 bar

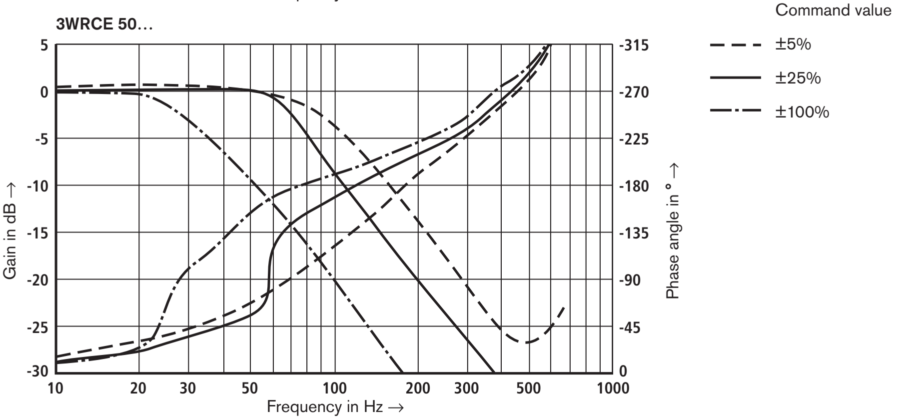
3WRCE 32…



3WRCE 40…



3WRCE 50…

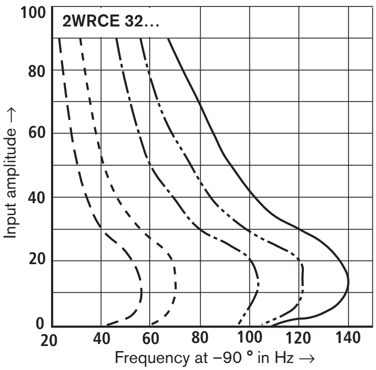


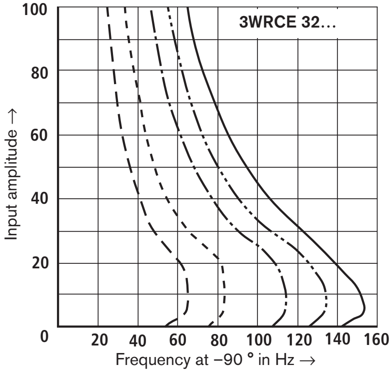
5

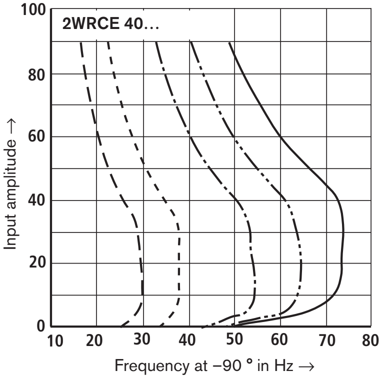
Characteristic curves (measured with HLP32, $\vartheta_{oil} = 40\ °C \pm 5\ °C$)

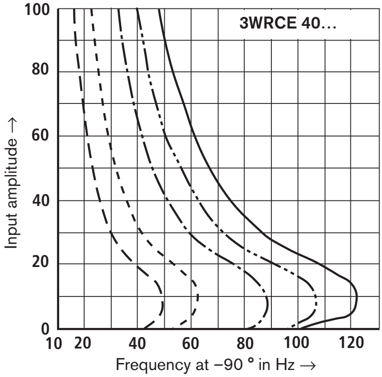
Dependence of frequency *f* at –90° on operating pressure and input amplitude

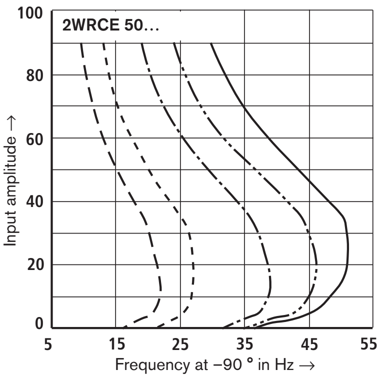
p_{st} = 40 bar
p_{st} = 70 bar
p_{st} = 140 bar
p_{st} = 210 bar
p_{st} = 315 bar

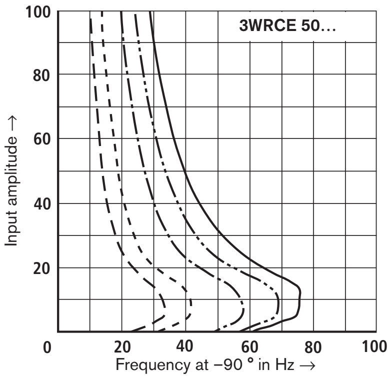






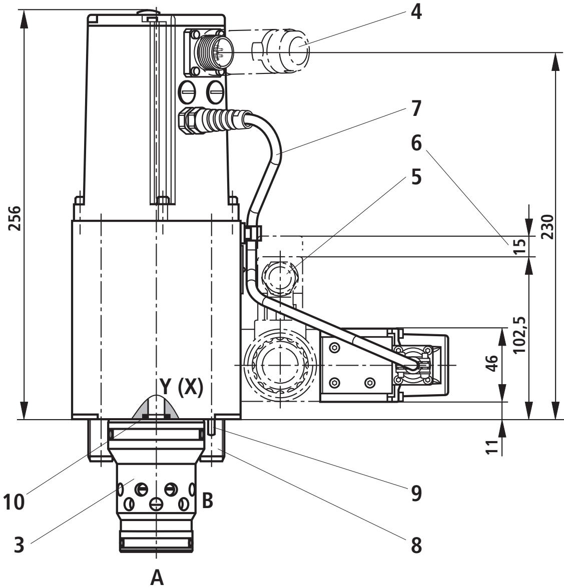




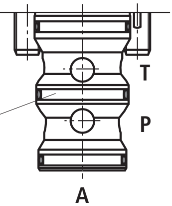


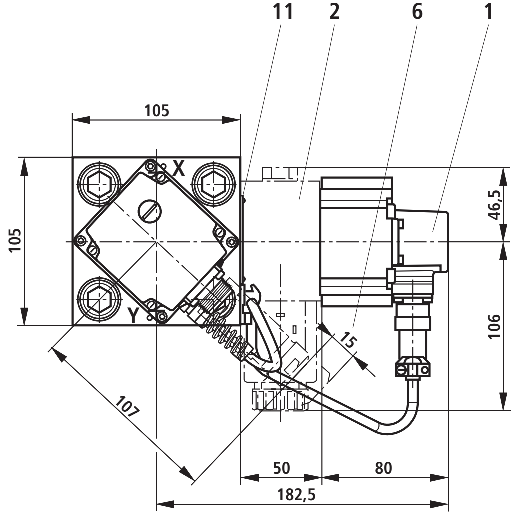
Unit dimensions: 2WRCE and 3WRCE, size 32 (nominal dimensions in mm)

2WRCE 32



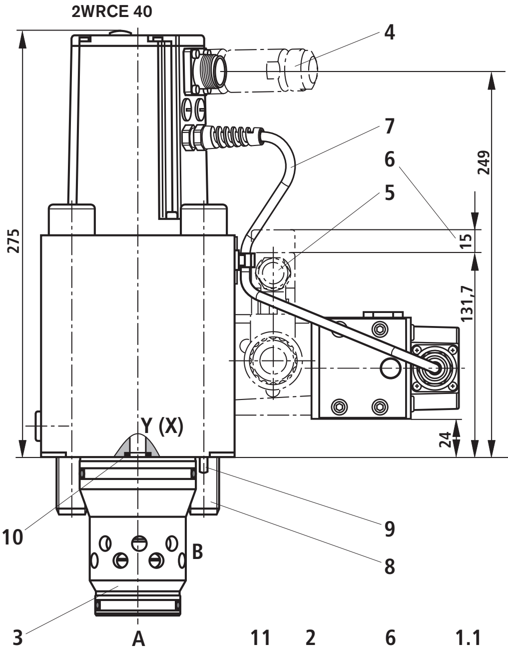
3WRCE 32...
(other dimensions like 2WRCE 32...)



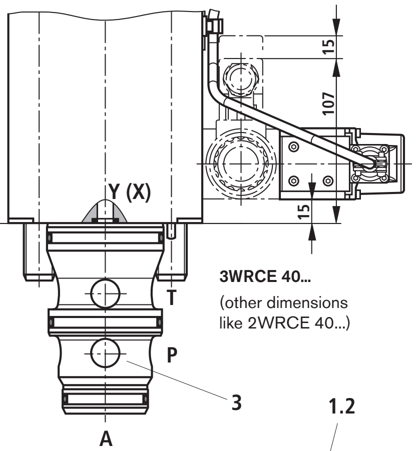


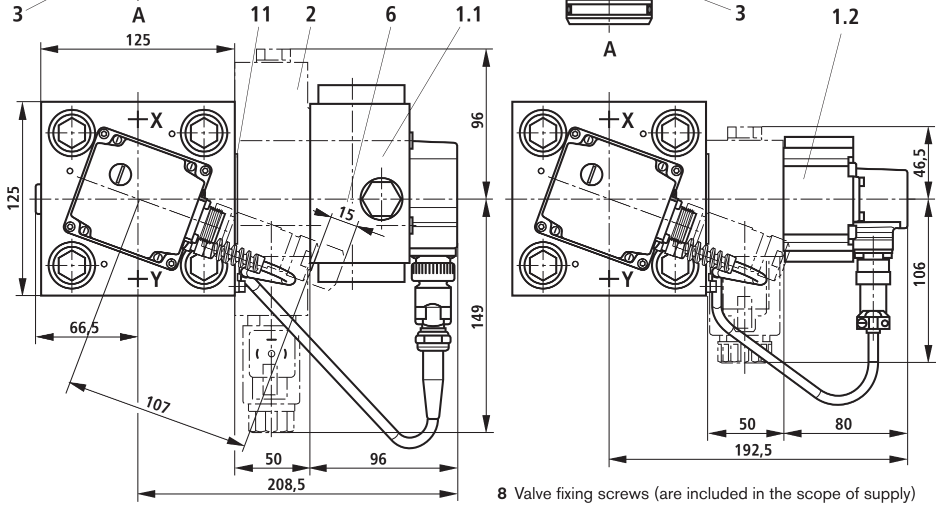
1 Pilot control valve (servo-valve of size 6)
2 Sandwich plate shut-off valve
(with versions “WK15“ and “WL15“ only)
3 Sleeve
4 Cable socket to DIN EN 175201-804
(separate order, see page 12)
5 Cable socket to DIN EN 175301-803
(separate order, see page 12)
6 Space required to remove cable socket
7 Cabling
8 Valve fixing screws (are included in the scope of supply) 4 off M16 x 100-10.9 DIN 912;
tightening torque for tightening factor 1.6 : 280 Nm
(indicator or signalling torque wrench)
9 Locating pin
10 Identical seal rings for ports X and Y
11 Nameplate

Unit dimensions: 2WRCE and 3WRCE, size 40 (nominal dimensions in mm)



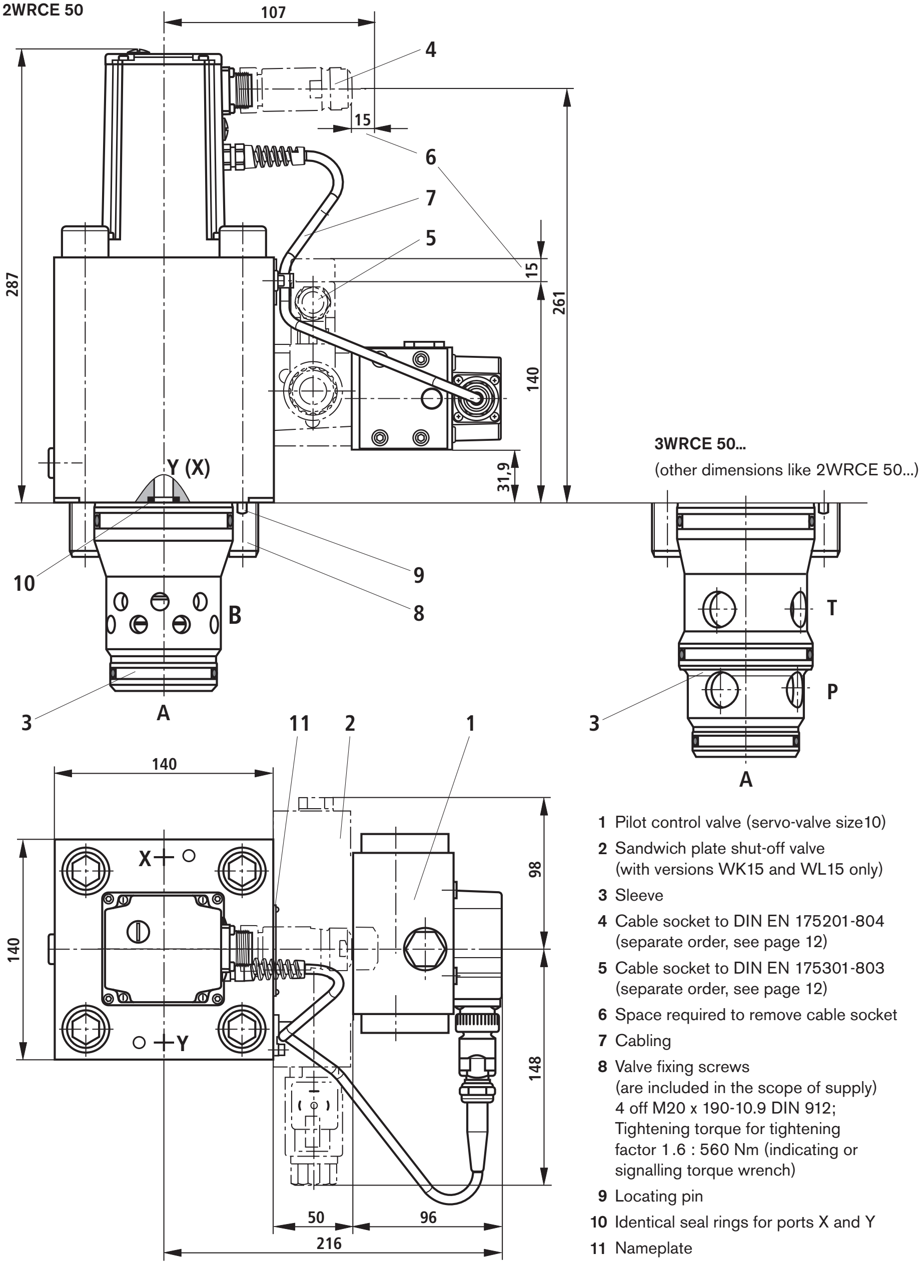
1.1 Pilot control valve (servo-valve size 10)
1.2 Pilot control valve (servo-valve size 6)
2 Sandwich plate shut-off valve (with versions "WK15" and "WL15" only)
3 Sleeve
4 Cable socket to DIN EN 175201-804 (separate order, see page 12)





5 Cable socket to DIN EN 175301-803 (separate order, see page 12)
6 Space required to remove cable socket
7 Cabling
8 Valve fixing screws (are included in the scope of supply) 4 off M20 x 180-10.9 DIN 912; tightening factor 1.6 : 560 Nm (indicating or signalling torque wrench)
9 Locating pin
10 Identical seal rings for ports X and Y
11 Nameplate

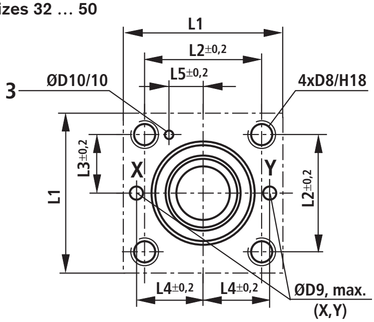
Unit dimensions: 2WRCE and 3WRCE, size 50 (nominal dimensions in mm)



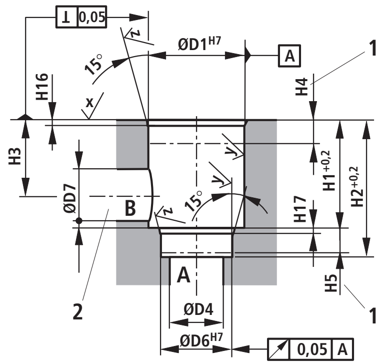
1 Pilot control valve (servo-valve size10)
2 Sandwich plate shut-off valve (with versions WK15 and WL15 only)
3 Sleeve
4 Cable socket to DIN EN 175201-804 (separate order, see page 12)
5 Cable socket to DIN EN 175301-803 (separate order, see page 12)
6 Space required to remove cable socket
7 Cabling
8 Valve fixing screws (are included in the scope of supply) 4 off M20 x 190-10.9 DIN 912; Tightening torque for tightening factor 1.6 : 560 Nm (indicating or signalling torque wrench)
9 Locating pin
10 Identical seal rings for ports X and Y
11 Nameplate

Mounting cavity to DIN ISO 7368 (nominal dimensions in mm)

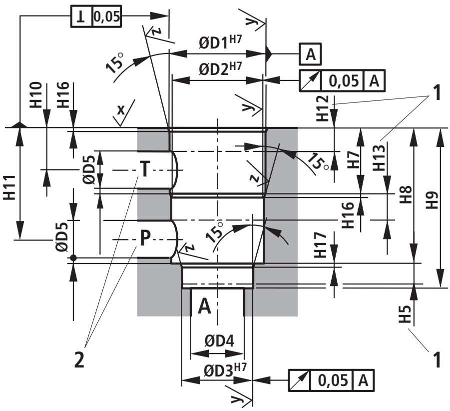
Sizes 32 … 50



Mounting cavity for type 2WRCE to DIN ISO 7368



Mounting cavity for type 3WRCE



Size	32	40	50
$ØD1^{H7}$	60	75	90
$ØD2^{H7}$	58	73	87
$ØD3^{H7}$	55	55	68
ØD4	32	40	50
ØD5	24	30	35
$ØD6^{H7}$	45	55	68
ØD7	32	40	50
D8	M16	M20	M20
max. ØD9	8	10	10
ØD10	6	6	8
H1	70	87	100
H2	85	105	122
H3	52	64	72
H4	30	30	35
H5	13	15	17
H7	43.5	54	87
H8	85	105	143
H9	100	125	165
H10	30	36	66
H11	70.5	87	122
H12	18	21	48
H13	15	18	18
H16	2.5	3	4
H17	2,5	3	3
H18	35	45	45
L1	105	125	140
L2	70	85	100
L3	35	42.5	50
L4	41	50	58
L5	17	23	30

$\sqrt{x} = \sqrt{R_{max\ 4}}$

$\sqrt{y} = \sqrt{R_{max\ 8}}$

$\sqrt{z} = \sqrt{R_z\ 10}$

1 Depth of fit, min. dimension

2 Ports P, T or B can be arranged around the central axis of port A. Provide sufficient distance to fixing holes and pilot bores.

3 Bore for locating pin

General tolerances to DIN ISO 2768 mK, toleration to DIN 7167

Notes

Notes

Bosch Rexroth AG
Industrial Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Telephone +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

2- and 3-way high response cartridge valves

RE 29135/06.13
Replaces: 10.05

Types .WRC.../S; .WRCE.../S

Type 2WRCE...-1X/S

Type 3WRCE...-1X/S

Nominal sizes 63 to 160
Component series 1X
Maximum operating pressure 420 bar
Maximum flow 50000 L/min

Overview of contents

[1)] Not for new applications!

For information regarding the available spare parts see:
www.boschrexroth.com/spc

Features

- High response control valve of cartridge design
- Controlled by means of a servo directional valve
- Feedback of the control spool position by means of an inductive positional transducer
- 2-way control element of poppet design
- 3-way control element of spool design
- Typical applications,
  Open or closed loop control of large flows, e.g.:
  • Forging manipulators
  • Press cylinders
  • Pressure casting machines
- Control electronics:
  Integrated or to component type separate order, see page 11

For further information regarding pilot operated valves and external control electronics see:

• Servo directional valves NS6	Data sheet 29564
• Servo directional valves NS10	Data sheet 29583
• Servo directional valves NS16	Data sheet 29591
• Amplifier type VT-SR...	Data sheet 29931

Ordering details: type 2WRC(E)

2	WRC				–1X /	S	/	*

2/2-way directional valve = **2**

Electrically operated high response cartridge valve = **WRC**

For external control electronics = **No code**
With integrated electonics (OBE) = **E**

Nominal size 63 = **63**
Nominal size 80 = **80**
Nominal size 100 = **100**
Nominal size 125 = **125**
Nominal size 160 = **160**

Designation of the spool characteristic curves
2-way function
Spool with:
– Standard poppet seat (linear) = **K001**
– Dual gain flow (linear fine control range) = **D001**
– Control window (progressive fine control range) = **S001**

Further details in clear text

Seal material
M = NBR seal (suitable for mineral oil HL and HLP to DIN 51524)
V = FKM seals

Supply voltage
No code = For .WRC (external control electronics)
for .WRCE:
G24 = Supply voltage +24 VDC
G15 = Supply voltage +15 VDC

Pilot valve
S = Servo directional valve

1X = Component series 10 to 19
(10 to 19 unchanged installation and connection dimensions)

Ordering details: type 3WRC(E) – Not for new applications!

3	WRC				–1X /	S	/	*

3/2-way directional valve = **3**

Electrically operated high response control valve for manifold mounting = **WRC**

For external control electronics = **No code**
With integrated electronics (OBE) = **E**

Nominal size 63 = **63**
Nominal size 80 = **80**
Nominal size 100 = **100**

Designation of the spool characteristic curves
3-way function
Spools with:
– 0 to 0.5% positive overlap (linear) = **L006**
– 0 to 0.5% negative overlap (linear fine control range) = **V001**
– 10% positive overlap (linear fine control range) = **E001**

Further details in clear text

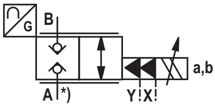
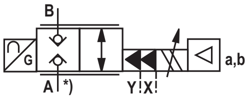
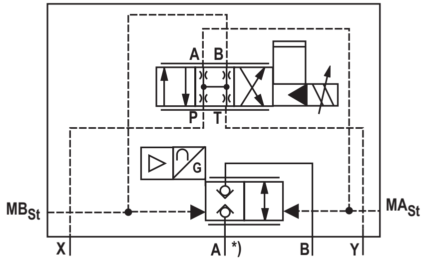
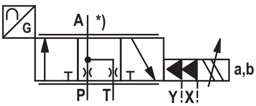
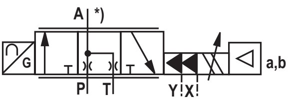
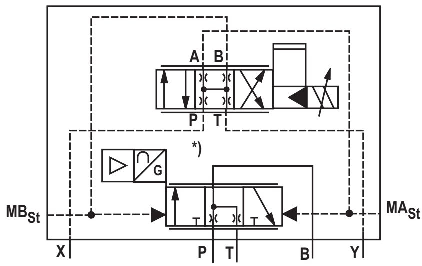
Seal material
M = NBR seals (suitable for mineral oil HL and HLP to DIN 51524)
V = FKM seals

Supply voltage
No code = For .WRC (external control electronics)
For .WRCE:
G24 = Supply voltage +24 VDC
G15 = Supply voltage +15 VDC

Pilot valve
S = Servo directional valve

1X = Component series 10 to 19
(10 to 19 unchanged installation and connection dimensions)

Symbols

Simplified: main stage with pilot control valve	Detailed: main stage with pilot control valve
2-way function **2WRC** 	
2WRCE – with integrated electronics (OBE) 	**2WRCE** – with integrated electronics (OBE) 
3-way function (spool overlap L and V) **3WRC** 	
3WRCE – with integrated electronics (OBE) 	**3WRCE** – with integrated electronics (OBE) 

Design, function and section: type 2WRC(E)

The valve types 2WRC(E) are 3-stage high response valves.

They control the rate and direction of a flow and are primarily used in closed loop control circuits.

Design

They comprise of the following sub-assemblies:

- A pilot control valve (1) as a 2-stage servo directional valve (pilot)
  - With a dry torque motor
  - Low friction jet / flapper amplifier and
  - Mechanical feedback of the spool position
- A main control spool (2) for flow control
- An inductive position transducer (3) whose core (4) is attached to the spool (2) of the third stage
- And integrated control electronics (5) for 2WRCE or separate electronics for the 2WRC version.

Function

Within the integrated control electronics (OBE) the command and actual values are compared and the pilot control valve solenoids are controlled via a currrent proportional the closed loop control deviation.

The pilot control valve asumes a proportional control position and controls the flows into or from control chambers A (6) and B (7), that actuate the main spool (2) by means of the closed loop control valve until the system deviation is 0.

The stroke of the main spool is thus controlled in proportion to the command value. It must be noted herethat the flow also depends on the valve pressure drop.

Valve features

Flow can be passed through the valve from A to B or from B to A.

The poppet spool closes or opens with a command value of approx. 2 %. With smaller command values the valve's closed loop control circuit trys to correct the spool position and thereby presses the spool, with up to the full system pressure, onto its seat and closes the connection leak-free.

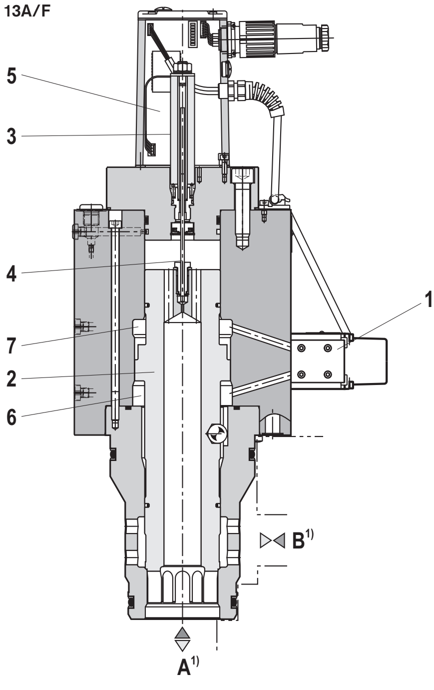
The stated switching times are only valid for the closed loop control range of the valve. With command value jumps from the seat to small opening values, additional delay times occur.

The 2 % opening point (= 0.2 V) is factory pre-set. When replacing the pilot control valve or control electronics the opening point can be calibrated by adjusting the position transducer (3) by using the 13A/F nut.

When carrying out an exchange **no** adjustments to the control electronics and pilot control valve (= closed loop controller, controller or control electronics), other than the zero calibration at the position controller may be carried out.

Only the filter element can be replaced on the pilot control valve (see data sheet „Servo directional valve")

Due to the diameter differences in the seat area, the spools are not pressure balanced. To compensate for the force differences for spool „K001" 6 %, and for spools „D001" and „S001" 22 % of the system pressure is required as the control pressure, and then by adding reserves for flow forces and dynamics, the recommended minimum control pressure can be obtained (see technical data).



[1)] Preferably port B should be connected to the actuator.

⚠ **Attention:** A loss of power at the pilot control valve results in the spool being in an undefined position (2). For preventive measures see data sheet 29135-1 „Preferred settings on the 2WRCE"

Design, function and section: type 3WRC(E) [1)]

The valve types 3WRC(E) are 3-stage 3-way high response valves.

They control the rate and direction of a flow and are primarily used in closed loop control circuits.

Design

They comprise of the following sub-assemblies:

– A pilot control valve (1) as a 2-stage servo directional valve (pilot)
  • With a dry torque motor
  • Low friction jet / flapper amplifier and
  • Mechanical feedback of the spool position
– A main control spool (2) for flow control
– An inductive position transducer (3) whose core (4) is attached to the spool (2) of the third stage
– And integrated control electronics (5) for 3WRCE or separate electronics for the 3WRC version.

Function

Within the integrated or external electronics, the command and actual values are compared, and accordingly the associated control deviation controls, the pilot valve torque motor via a proportional current.

The pilot control valve assumes a proprtional control position and controls the pilot control flows in/out of the control chambers A (6) and B (7), that controls the main spool (2) via the closed loop circuit until the control deviation is 0.

The stroke of the main spool is thereby closed loop controlled in proportion to the command value. It has, however to be taken into account that the flow is also dependent on the pressure drop.

⚠ **Attention:** A loss of power at the pilot control valve results in the spool being in an undefined position (2). for preventative measures see data sheet 29135-1 „Preferred setting on the 3WRCE“

[1)] Not for new applications!

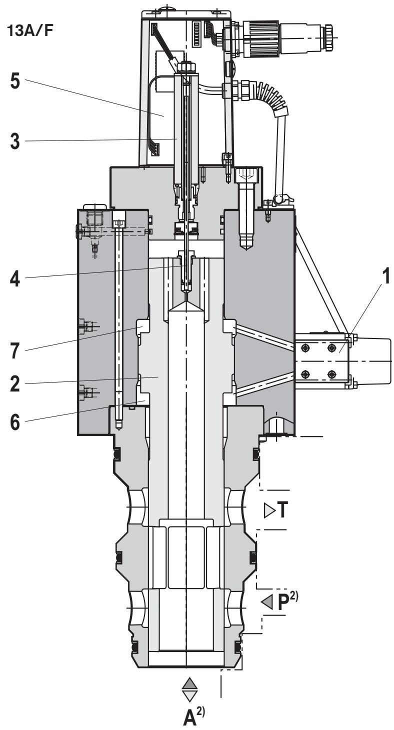
[2)] Please use the variant with P and A exchanged. Please consult us!

Valve features

The 0 % opening point (L006 and V001 spools) is factory pre-set. When replacing the pilot control valve or the control electronics the opening point can be calibrated by adjusting the position transducer (3) by using the 13A/F nut.

When carrying out an exchange **no** adjustments to the control electronics and pilot control valve (= closed loop controller, controller or control electronics) may be carried out other than the zero calibration at the position controller.

Only the filter element can be replaced on the pilot control valve (see data sheet „Servo directional valves“).



5

Technical data: type 2WRC(E) (for applications outside these parameters, please consult us!)

General

Nominal size	NS	**63**	**80**	**100**	**125**	**160**
Weight	kg	56	114	198	357	635
Pilot control valve nominal size (pilot)	NS	6	10	10	16	16
Installation; commissioning guidelines		Optional, preferably horizontal; to data sheet 07700				
Storage temperature range		−20 to +80				
Ambient temperature range	°C	−20 to +60 for WRCE −20 to +70 for WRC				

Hydraulic (measured with HLP32, $\vartheta_{oil} = 40$ °C ±5 °C)

Nominal size	NS	**63**	**80**	**100**	**125**	**160**
Max. operating pressure						
– Main stage, ports A, B	bar	420				
– Pilot control valve, port X	bar	315				
– Pilot control valve, port Y	bar	Pressure peaks <100, static <10				
Min. control pressure in % of the system pressure						
– For spool „K001“	%	15				
– For spools „D001“ and „S001“	%	45				
Nominal flow q_{Vnom} −10 % at $\Delta p = 5$ bar						
– For spool „K001“	l/min	2600	4100	6300	10100	17000
– For spool „D001“	l/min	2300	3600	5800	9200	15000
– For spool „S001“	l/min	1800	3000	5200	7800	13300
Max. flow						
– For spools „K001“ and „D001“	l/min	5500	9000	14000	22000	35000
– For spool „S001“	l/min	8000	13000	20000	30000	50000
Switching time at 200 bar (315 bar)						
– Stroke 50%	ms	37(30)	32(25)	45(35)	50(40)	70(60)
– Stroke 100%	ms	70(60)	50(40)	75(60)	90(70)	120(100)
Pilot oil flow at X and Y with a stepped form of input signal from 0 to 100 % (315 bar)	l/min	42	135	165	320	430
Zero flow of the servo pilot stage in relationship to pressure in line X		$\sqrt{\frac{p_x}{70\text{ bar}}} \bullet 0{,}5$	$\sqrt{\frac{p_x}{70\text{ bar}}} \bullet 1{,}5$		$\sqrt{\frac{p_x}{70\text{ bar}}} \bullet 3{,}5$	
Control flow	cm^3	36,3	67,9	132,5	313,4	565,5

Technical data: type 2WRC(E) (for applications outside these parameters, please consult us!)

Hydraulic (measured with HLP32, ϑ_{oil} = 40 °C ±5 °C)

Nominal size		NS	63	80	100	125	160
Pressure fluid			Mineral oil (HL, HLP) to DIN 51524, other pressure fluids on request				
Pressure fluid temperature range		°C	–20 to +80; preferably +40 to +50				
Viscosity range		mm²/s	20 to 380; preferably 30 to 45				
Max. permissible degree of pressure fluid contamination Cleanliness class to ISO 4406 (c)	– Pilot control valve		Class 18/16/13 [1]				
	– Main valve		Class 20/18/15 [1]				
Hysteresis		%	≤ 0.5				
Reversal error		%	≤ 0.2				
Response sensitivity		%	≤ 0.2				

Electrical

Voltage type			DC
Signal type			Analogue
Opening point calibration, see page 8		%	≤ 1
Zero point drift with a change in:	– Pressure fluid temperature	%/10 K	≤ 0.3
	– Control pressure in X	%/100 bar	≤ 0.7
	– Return pressure in Y 0 to 10 % from p_x	%/bar	≤ 0.3
Valve protection to EN 60529			IP65 with mounted and fixed plug-in connector

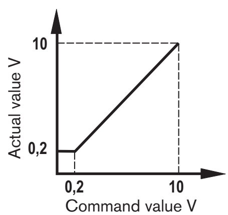
[1] The cleanliness classes stated for the components need to be maintained in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.
For the selection of the filters see www.boschrexroth.com/filter

5

Control electronics

Control electronics	– 2WRCE	Integrated in the valve, see page 11
	– 2WRC	External control electronics, see data sheet 29931

Nominal command value range for 2WRCE:
0 to +10 V ≙ 0 to 100 %
In the command value range 0 to 0.2 V the actual value stays constant at 0.2 V.
With a slow command value change from 0.2 V to 10 V, the actual value follows the command value within ±0.1 V.
With command value jumps greater than 10 V, then the actual value can briefly reach valves of approx. 10.5 V.



Technical data: type 3WRC(E) [1] (for applications outside these parameters, please consult us!)

General

Nominal size	NS	**63**	**80**	**100**
Weight	kg	57	116	200
Pilot control valve nominal size (pilot)	NS	6	10	10
Installation; commissioning guidelines		Optional, preferably horizontal; to data sheet 07700		
Storage temperature range		–20 to +80		
Ambient temperature range	°C	–20 to +60 to WRCE –20 to +70 to WRC		

Hydraulic (measured with HLP32, $\vartheta_{oil} = 40$ °C ±5 °C)

Nominal size	NS	**63**	**80**	**100**
Max. operating pressure				
– Main stage, ports P, A, T	bar	315		
– Pilot control valve, port X	bar	315		
– Pilot control valve, port Y	bar	Pressure peaks <100, static <10		
Nominal flow q_{Vnom} +10 % at $\Delta p = 5$ bar				
– For spool „L006“	l/min	1200	1850	2800
– For spool „V001“	l/min	1250	1900	2700
– For spool „E001“	l/min	1180	1820	2750
Max. flow				
– For spool L…, V…, E…,	l/min	3500	5600	8500
Switching time at 200 bar (315 bar)				
– Stroke 50%	ms	20(17)	18(13)	25(20)
– Stroke 100%	ms	37(30)	32(25)	40(35)
Pilot oil flow at X and Y with a stepped form of input signal from 0 to 100 % (315 bar)	l/min	42	130	170
Zero flow of the servo pilot stage in relationship to pressure in line X		$\sqrt{\frac{p_x}{70\ \text{bar}}} \cdot 0{,}5$	$\sqrt{\frac{p_x}{70\ \text{bar}}} \cdot 1{,}5$	
Control flow	cm^3	±18,1	±33,9	±66,2
Pressure fluid		Mineral oil (HL, HLP) to DIN 51524, other pressure fluids on request		
Pressure fluid temperature range	°C	–20 to +80; preferably +40 to +50		
Viscosity range	mm^2/s	20 to 380; preferably 30 to 45		
Max. permissible degree of pressure fluid contamination				
Cleanliness class to ISO 4406 (c) – Pilot control valve		Class 18/16/13 [2]		
Cleanliness class to ISO 4406 (c) – Main valve		Class 20/18/15 [2]		
Hysteresis	%	≤ 0.5		
Reversal error	%	≤ 0.2		
Response sensitivity	%	≤ 0.2		

[1] Not for new applications!

[2] The cleanliness classes stated for the components need to be maintained in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.
For the selection of the filters see www.boschrexroth.com/filter

Technical data: type 3WRC(E)[1] (for applications outside these parameters, please consult us!)

Electrical

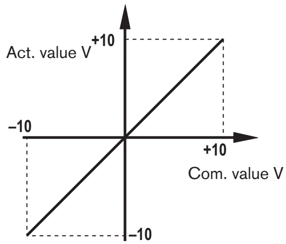
Voltage type		DC
Signal type		Analogue
Zero calibration	%	≤ 1
Zero point drift with change in:		
– Pressure fluid temperature	%/10 K	≤ 0.3
– Control pressure in X	%/100 bar	≤ 0.7
– Return pressure in Y 0 to 10 % from p_x	%/bar	≤ 0.3
Valve protection to EN 60529		IP65 with mounted and fixed plug-in connector

Control electronics

Control electronics	– 3WRCE	Integrated in the valve, see page 11
	– 3WRC	External control electronics, see data sheet 29931

[1] Not for new applications!

Nominal command value range for 3WRCE:
0 to ±10 V $\hat{=}$ 0 to ±100 %
With a slow command value change from 0 V to ±10 V, the actual value follows the command value within ±0.1 V.
With command value greater than ±10 V, then the actual value can briefly reach values of approx. ±10.5 V.



Electrical connections

The plug-in connectors are included within the scope of supply.

Component plug allocation with integrated electronics (OBE)

Component plug allocation	Pin	Allocation with a G24 supply voltage		Allocation with a G15 supply voltage	
		2WRCE	3WRCE	2WRCE	3WRCE
Supply voltage	A	+ 24 VDC		+ 15 VDC	
	B	0 VDC		– 15 VDC	
	C	Enable (+ 24 V) [2]		Reference to A, B	
Differential com. value input	D	0 ... +10 V	0 ... ±10 V	0 ... +10 V	0 ... ±10 V
	E	R_e = >100 kΩ	R_e = >100 kΩ	R_e = >100 kΩ	R_e = >100 kΩ
Actual valve	F	+0,2 ... +10 V	0 ... ±10 V	+0,2 ... +10 V	0 ... ±10 V
		Reference is pin B	Reference is pin B	Reference is pin C	Reference is pin C
Earth	PE	Connected with the valve housing		Connected with the valve housing	

[2] Without enable = SO37 (–37 attached to the type code)

Do not connect PE when the valve is already earthed via the system.

Supply voltage: +24 VDC ±6 V; full bridge rectification with a smoothing capaciter 2200 µF; I_{max} = 230 mA
±15 VDC ±0,45 V; stabilised and smoothed; I_{max} = 180 mA

The command and actual values have the same polarity

D positive against E → main spool for the 2WRCE opens

D positive against E → main spool for the 3WRCE moves in direction P to A open

Note: **Electrical signals generated via control electronics (e.g. actual valve) must not be used for switching safety-relevant machine functions!**

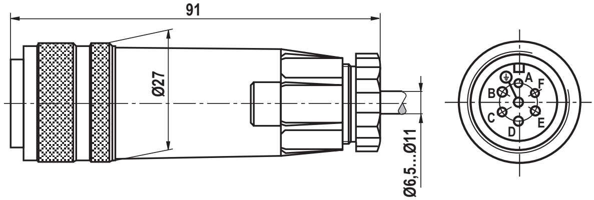
(Also see the European Standard „Safety requirement for fluid power systems and components – Hydraulics“, EN 982!)

5

Electrical connection, plug-in connector for the integrated electronics or main stage of the external control electronics

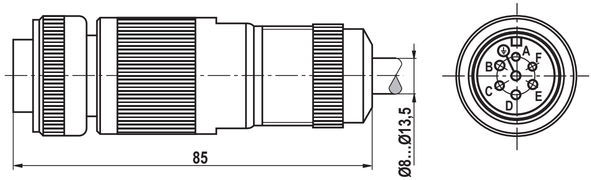
Plug-in connector (within the scope of supply)

Plug-in connector to DIN EN 175201-804
Separate order under Material No. **R900021267**
(plastic version)



Plug-in connector (separat order)

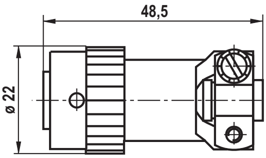
Plug-in connector to DIN EN 175201-804
Separate order under Material No. **R9000223890**
(metal version)



Plug-in connector for pilot control valve NS6 (NS63)

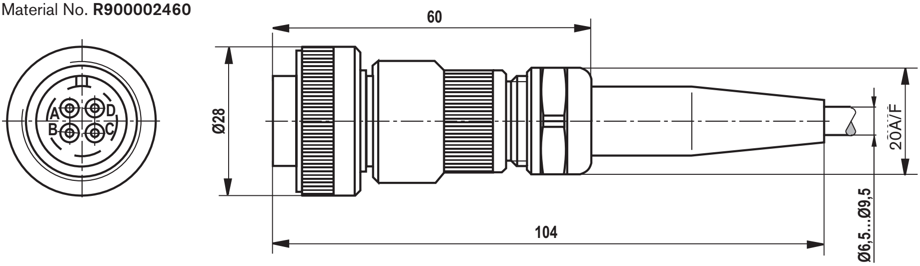
Plug-in connector to VG 95 328
Separate order under Material No. **R900005414**

Connection cable: 4 or 6 core, 0,75 mm^2, screened
(e.g. cable type LiYCY 4 or 6 x 0.75 mm^2),
to DIN VDE 0812
Outer diameter 5 to 8.5 mm



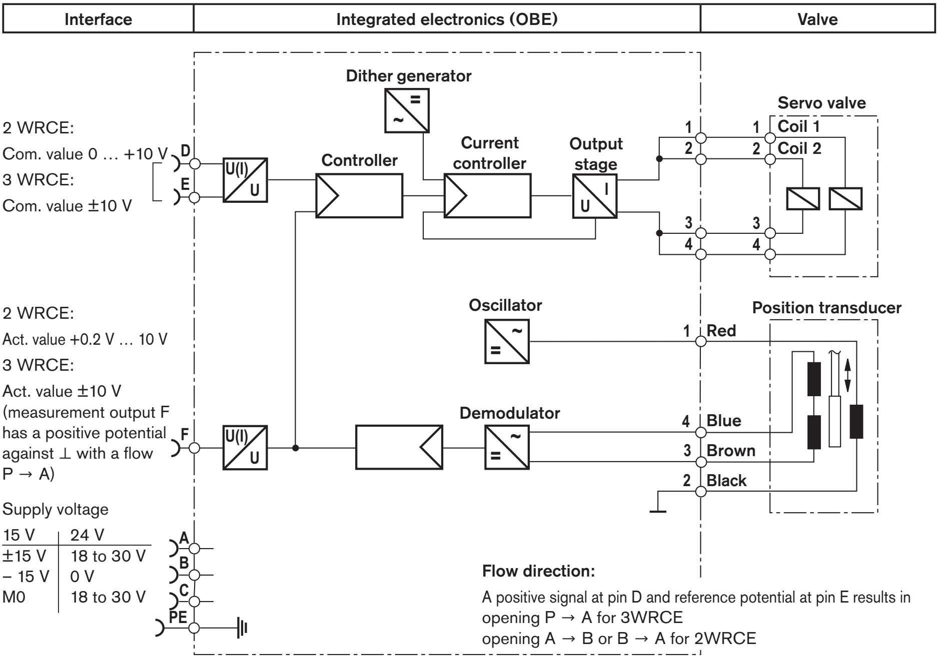
Plug-in connector for pilot control valves NS10 and 16 (NS80, 100, 125, 160)

Plug-in connector version **K8** (external control electronics)
to VG 095 342 – separate order under
Material No. **R900002460**



Integrated electronics (OBE) type VT13037 for valve type .WRCE

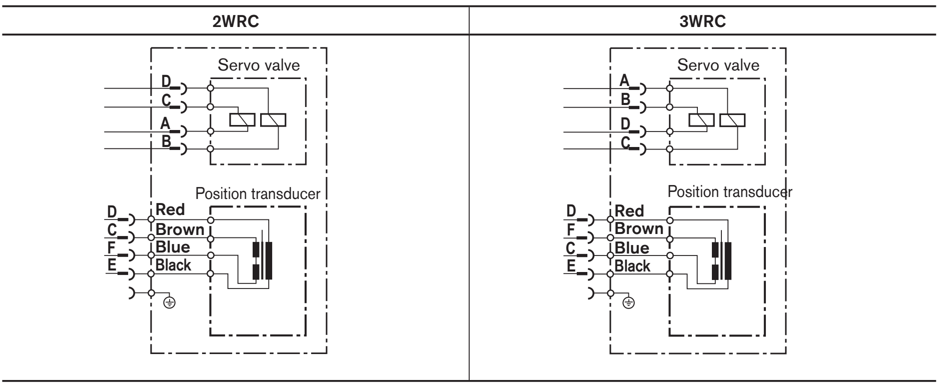
Block circuit diagram / pin allocation



5

External control electronics

Pin allocation

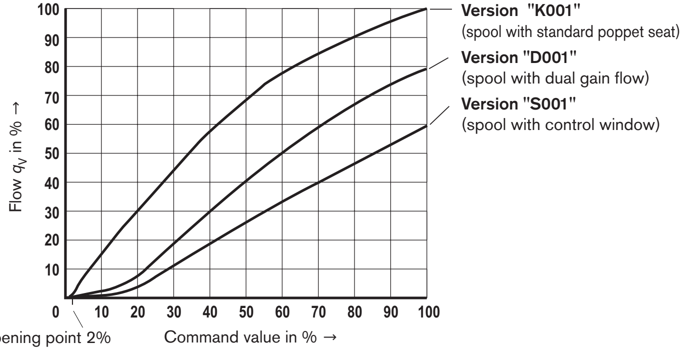


Characteristic curves (measured with HLP32 $\vartheta_{oil} = 40\ °C \pm 5\ °C$)

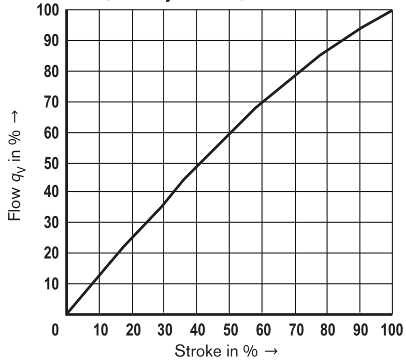
A $\Delta p = 5$ bar relates to a 100% flow value of the nominal flow of the associated table.

For other valve pressure differentials, the following applies: $q = q_{vnom} \cdot \sqrt{\dfrac{\Delta p}{\Delta p_{nom}}}$

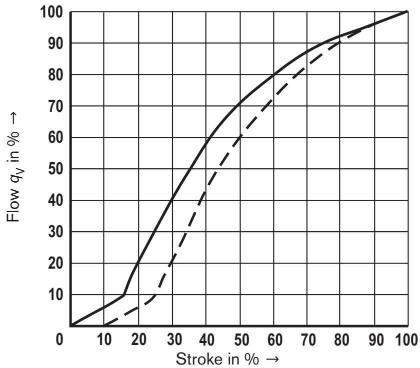
Type 2 WRC.../...
(2/2-way function)



Type 3 WRC.../... (3/2-way function)

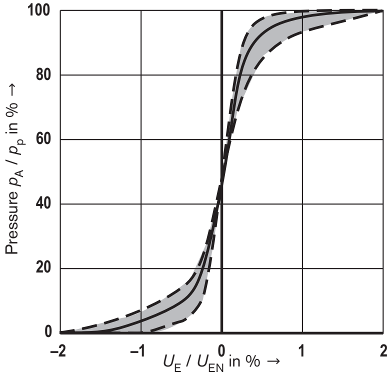


Version "L006"



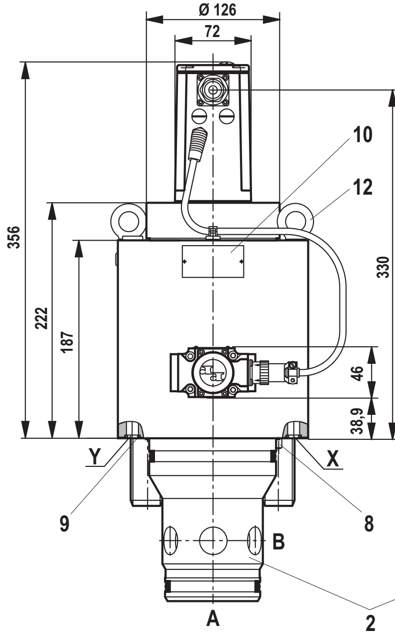
Version "V001"
Version "E001"

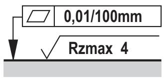
Pressure-signal function for 3WRC(E)…V and L…-limiting and average value characteristic curves



Unit dimensions: 2WRC(E) and 3WRC(E) 1), NS63 (nominal dimensions in mm)

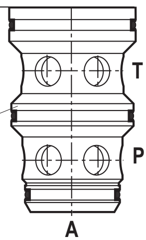
2WRC(E) 63

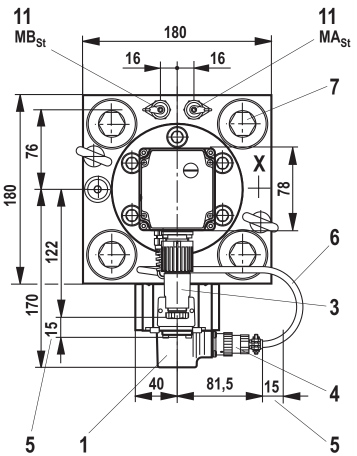




Required surface finish of the valve mounting surface

3WRC(E) 63 1)
(the missing dimensions are the same as the 2WRC(E) 63...)



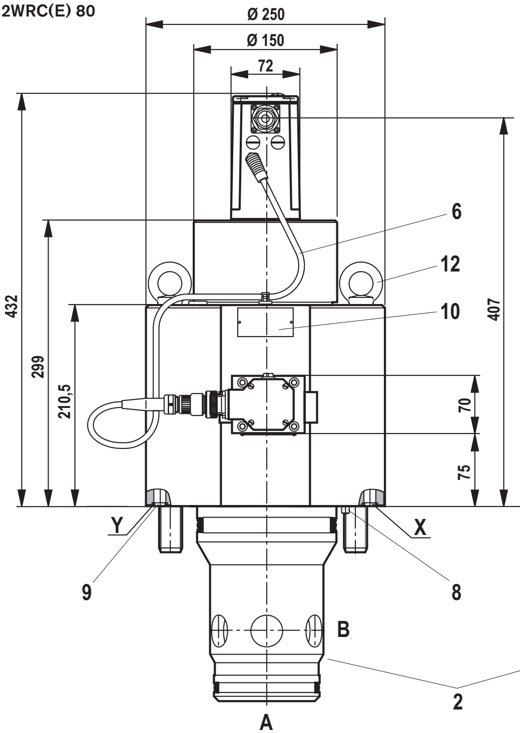


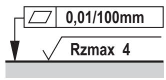
1 Pilot control valve (servo directional valve NS6)
2 Bush
3 Plug-in connector (Material No. **R900021267**) included within the scope of supply
4 Plug-in connector (Material No. **R900005414**) included within the scope of supply
5 Space required to remove the plug-in connector
6 Cabling (only for WRCE)
7 Valve fixing screws (are included within the scope of supply) 4 S.H.C.S. ISO 4762 – M30 x 220-10.9; Tightening torque for a tightening factor of 1.6 : 1900 Nm
8 Locating pin hole
9 Identical seal rings for ports X and Y
10 Name plate
11 Test points for control pressures, screwed coupling G1/4
12 Transport aid

1) Not for new applications!

Unit dimensions: 2WRC(E) and 3WRC(E) [1)], NS80 (nominal dimensions in mm)

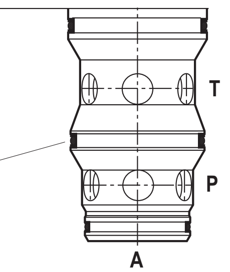
2WRC(E) 80

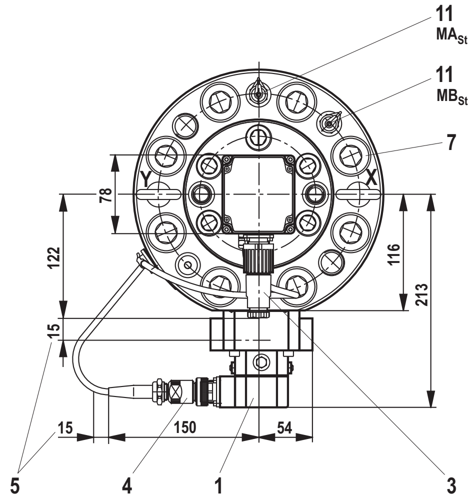




Required surface finish of the valve mounting surface

3WRC(E) 80 [1)]
(the missing dimensions are the same as the 2WRC(E) 80...)



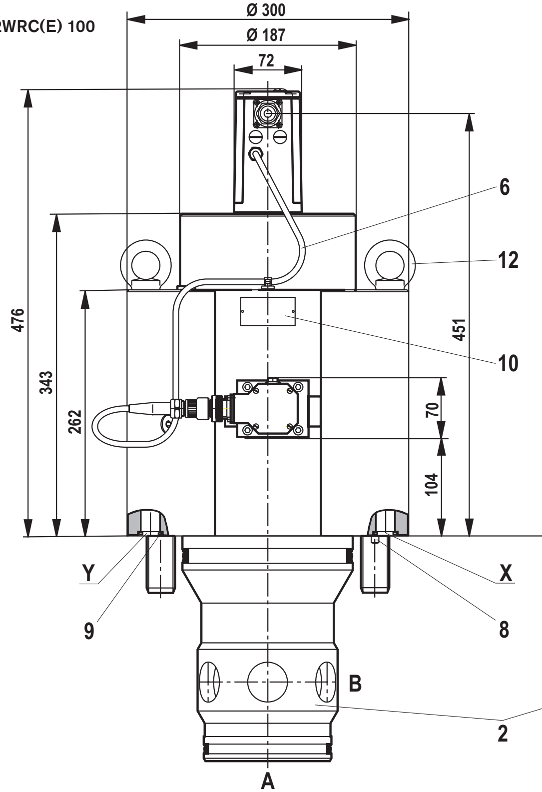


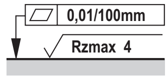
1 Pilot control valve (servo directional valve NS10)
2 Bush
3 Plug-in connector (Material No. **R900021267**) included within the scope of supply
4 Plug-in connector (Material No. **R900002460**) included within the scope of supply
5 Space required to remove the plug-in connector
6 Cabling (only for WRCE)
7 Valve fixing screws
(are included within the scope of supply)
8 S.H.C.S. ISO 4762 – M24 x 220-10.9;
Tightening torque for a tightening factor of 1.6 : 960 Nm
8 Locating pin hole
9 Identical seal rings for ports X and Y
10 Name plate
11 Test points for control pressure, G1/4 screwed coupling
12 Transport aid

[1)] Not for new applications!

Unit dimensions: 2WRC(E) and 3WRC(E) [1)], NS100 (nominal dimensions in mm)

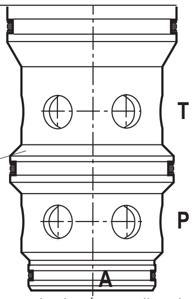
2WRC(E) 100

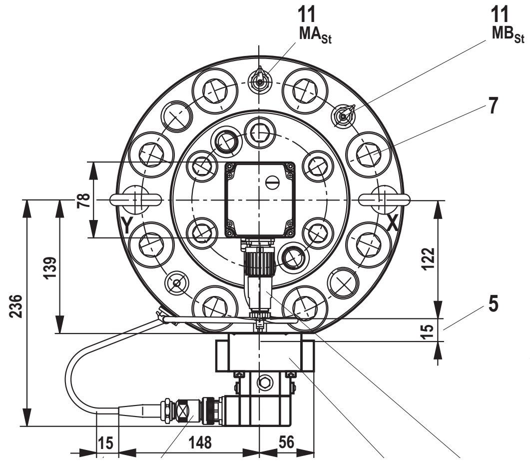




Required surface finish of the valve mounting surface

3WRC(E) 100 [1)]
(the missing dimensions are the same as for 2WRC(E) 100...)





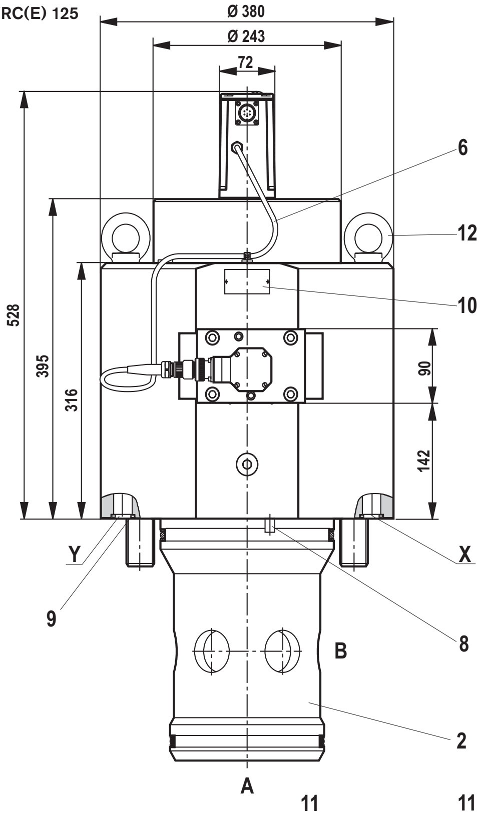
1 Pilot control valve (servo directional valve NS10)
2 Bush
3 Plug-in connector (Material No. **R900021267**) included within the scope of supply
4 Plug-in connector (Material No. **R900002460**) included within the scope of supply
5 Space required to remove the plug-in connector
6 Cabling (only for WRCE)
7 Valve fixing scews (are included within the scope of supply) 8 S.H.C.S. ISO 4762 – M30 x 280-10.9; Tightening torque for a tightening factor of 1.6 : 1900 Nm
8 Locating pin hole
9 Identical seal rings for ports X and Y
10 Name plate
11 Test points for control pressures, G1/4 screwed coupling
12 Transport aid

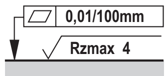
[1)] Not for new applications!

5

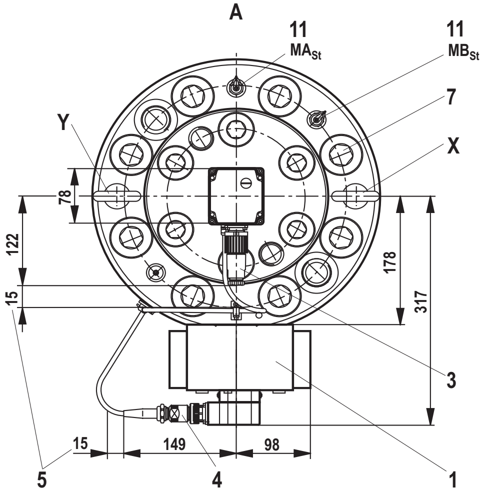
Unit dimensions: 2WRC(E), NS125 (nominal dimensions in mm)

2WRC(E) 125





Required surface finish of the valve mounting surface

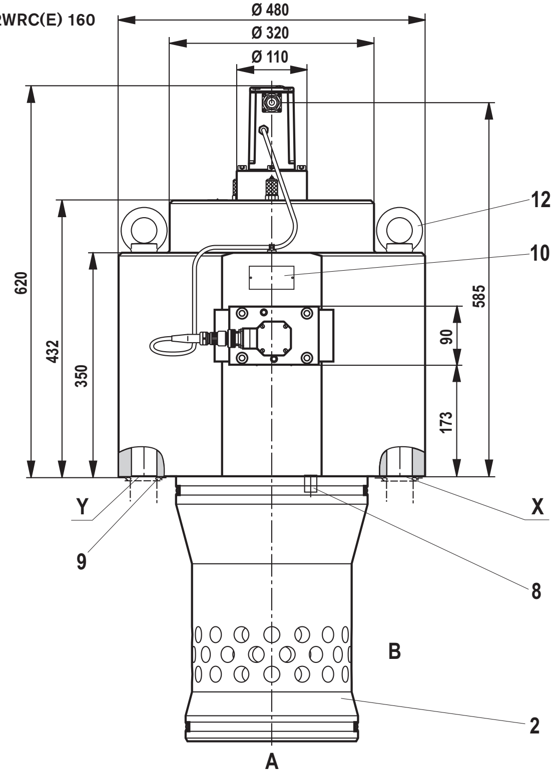


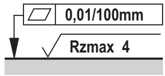
1 Pilot control valve (servo directional valve NS16)
2 Bush
3 Plug-in connector (Material No. **R900021267**) included within the scope of supply
4 Plug-in connector (Material No. **R900002460**) included within the scope of supply
5 Space required to remove the plug-in connector
6 Cabling (only for WRCE)
7 Valve fixing screws (are included within the scope of supply) 8 S.H.C.S. ISO 4762 – M36 x 300-10.9; Tightening torque for a tightening factor of 1.6 : 3300 Nm
8 Locating pin hole
9 Identical seal rings for ports X and Y
10 Name plate
11 Test points for control pressures, G1/4 screwed coupling
12 Transport aid

1) Not for new applications!

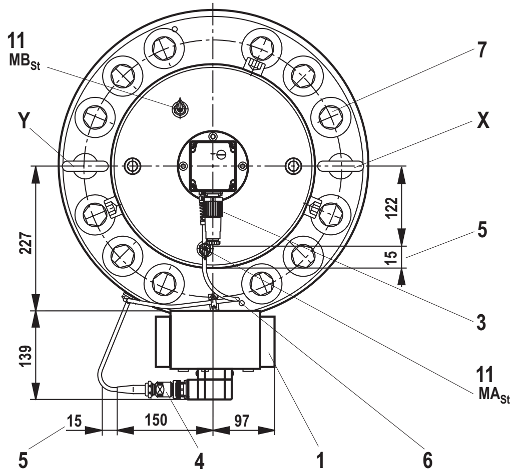
Unit dimensions: 2WRC(E), NS160 (nominal dimensions in mm)

2WRC(E) 160





Required surface finish of the valve mounting surface



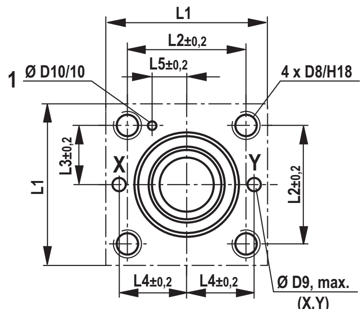
1) Not for new applications!

1 Pilot control valve (servo directional valve NS16)
2 Bush
3 Plug-in connector (Material No. **R900021267**) included within the scope of material
4 Plug-in connector (Material No. **R900002460**) included within the scope of material
5 Space required to remove the plug-in connector
6 Cabling (only for WRCE)
7 Valve fixing screws (are included within the scope of material) 12 S.H.C.S. ISO 4762 – M42 x 420-10.9; Tightening torque for a tightening factor of 1.6 : 5000 Nm
8 Locating pin hole
9 Identical seal rings for ports X and Y
10 Name plate
11 Test points for control pressures, G1/4 screwed coupling
12 Transport aid

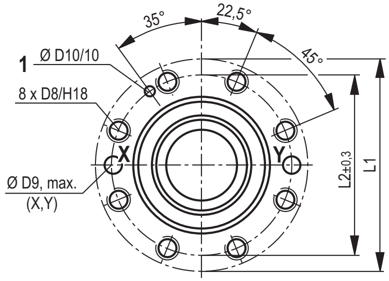
5

Installation dimensions to DIN ISO 7368 – except for NS125 and 160 (nom. dimensions in mm)

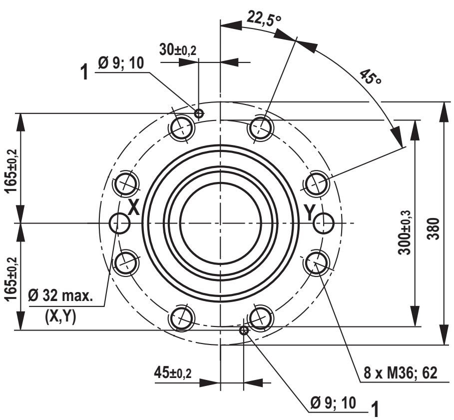
NS63



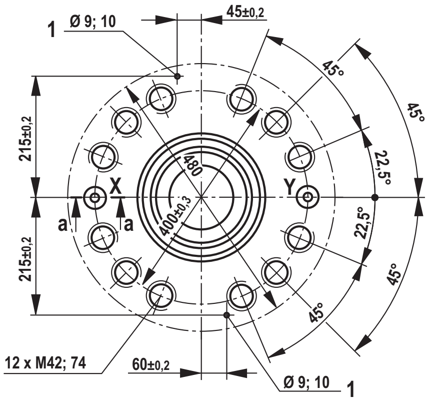
NS80, 100



NS125



NS160

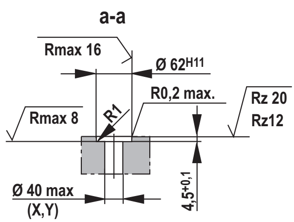


1 Locating pin hole

Tolerances to:
– General tolerances ISO 2768-mK

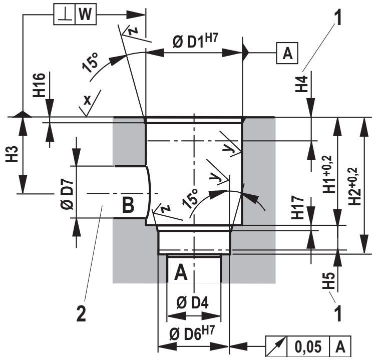
NS	63	80	100
D8	M30	M24	M30
max. ØD9	12	16	20
ØD10	8	10	10
L1	180	250	300
L2	125	200	245
L3	62,5	–	–
L4	75	–	–
L5	38	–	–

Counterbore for ports X and Y in the manifold, only for NS160

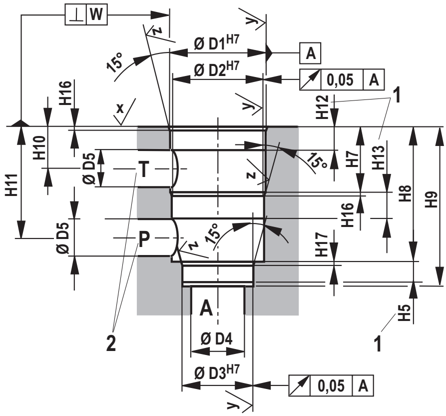


Installation dimensions to DIN ISO 7368 – except for NS125 and 160 (nom. dimensions in mm)

Cavity for type 2WRC…
to DIN ISO 7368



Cavity for type 3WRC…



$\overset{x}{\surd} = \sqrt{\text{Rmax } 4}$

$\overset{y}{\surd} = \sqrt{\text{Rmax } 8}$

$\overset{z}{\surd} = \sqrt{\text{Rz } 10}$

1 Depth of fit, minimum dimensions

2 Ports P, T or B can be arranged about the centre axis of port A. However care must be taken to ensure that the fixing and control bores are not damaged.

Tolerances to:
– General tolerances ISO 2768-mK

NS	63	80	100	125	160
ØD1^{H7}	120	145	180	225	300
ØD2^{H7}	116	140	174	220	290
ØD3^{H7}	90	110	135	200	270
ØD4	63	80	100	max.150	max.200
ØD5	48	60	75	95	120
ØD6^{H7}	90	110	135	200	270
ØD7	63	80	100	125	200
H1	130	175	210	257	370
H2	155	205	245	300	425
H3	95	130	155	192	268
H4	40	40	50	40	50
H5	20	25	29	31	45
H7	85	125	155	195	245
H8	165	215	270	335	420
H9	195	245	305	380	480
H10	57	90	112	140	175
H11	137	180	225	280	350
H12	33	60	75	93	115
H13	28	25	32	37	45
H16	4	5	5	5,5	5,5
H17	4	5	5	7	8
H18	65	50	63	–	–
W	0,05	0,1	0,2	0,2	0,2

Notes

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Telefon +49 (0) 93 52 / 18-0
documentation@boschrexroth.de
www.boschrexroth.de

Directional servo valves

Designation	Type	Size	Component series	p_{max} in bar	Data sheet	Page
Directional servo valves						
Subplate mounting	4WS(E)2EM	6	2X	315	29564	1209
Subplate mounting	4WS(E)2E.	10	5X	315	29583	1221
Subplate mounting	4WS(E)2E.	16	2X	210/315	29591	1241
Subplate mounting	4WSE3E	16	2X	350	29620	1257
Subplate mounting	4WSE3E	25	3X	350	29621	1271
Subplate mounting	4WSE3E	32	5X	315	29622	1285

4-way directional servo-valve

RE 29564/09.10
Replaces: 01.07

1/12

Type 4WS.2E

Size 6
Component series 2X
Maximum operating pressure 315 bar
Maximum flow 48 l/min

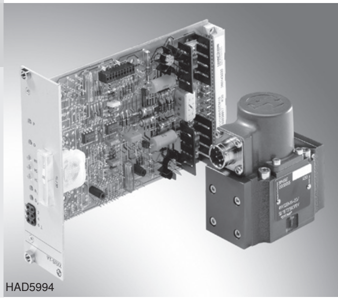


Table of contents

Information on available spare parts:
www.boschrexroth.com/spc

Features

- Valve for controlling position, force, direction or velocity
- 2-stage servo-valve with mechanical feedback
- 1st stage as a nozzle-flapper plate amplifier
- For subplate mounting, porting pattern to ISO 4401-03-02-0-05
  Subplates according to data sheet RE 45052 (separate order)
- Dry torque motor, no contamination of the solenoid gaps through the hydraulic fluid
- Can also be used as 3-way version
- Wear-free spool return element
- Controlling
  - External control electronics in Euro-card format or of modular design (separate order), see page 6
  - or control electronics integrated in the valve (OBE)
- Valve and integrated control electronics are adjusted and tested
- Pressure chambers on the control bush with gap seal, no seal ring wear
- Filter for 1st stage freely accessible from outside, see pages 9 and 10

Ordering code

	6 – 2X /		B		ET		K17		V	*

Electrically operated 2-stage servo-valve of 4-way design with mechanical feedback
For **external** control electronics = **4WS2EM**
With **integrated** control electronics (OBE) = **4WSE2EM**

Size 6 = **6**

Component series 20 to 29 = **2X**
(20 to 29: unchanged installation and connection dimensions)

Nominal flow 1)

2 l/min	= **2**
5 l/min	= **5**
10 l/min	= **10**
15 l/min	= **15**
20 l/min	= **20**
25 l/min	= **25**

(Observe tolerance field of the flow/signal function, see page 7)

Valves for **external** control electronics 2)
Coil no. 11 (30 mA/85 Ω x per coil) = **11**
Valves with **integrated** control electronics
Controlling:
Command value ±10 mA = **8**
Command value ±10 V = **9**

ET = Internal pilot oil supply and drain 3)

Inlet pressure range 4)
210 = 10 to 210 bar
315 = 10 to 315 bar

Electrical connection
K17 = **Without** mating connector, with male connector
Mating connector – separate order, see page 6

Spool overlap 5)
D = 0 to 0.5 % positive
E = 0 to 0.5 % negative

Seal material
V = FKM seals, suitable for mineral oil (HL, HLP) to DIN 51524 6)

Further details in clear text

1) **Nominal flow**
The nominal flow refers to a 100 % command value signal at a 70 bar valve pressure differential (35 bar per control land).
The valve pressure differential must be observed as reference variable. Differing valves cause a change in the flow. It must be noted that the nominal flow tolerance is ±10 % (see flow/signal function on page 7).

2) **Electrical control data**
Valves for **external** control electronics: The actuating signal must be provided by a current-regulated output stage. For servo amplifiers, see page 6.
Valves with **integrated** control electronics: With integrated control electronics, the command value can be provided as voltage (ordering code "9") or, in the case of large distances of > 25 m between the control and the valve, as current (ordering code "8").

3) **Pilot oil**
This valve is only available with internal pilot oil supply and drain.

4) **Inlet pressure range**
The system pressure should be as constant as possible. With regard to dynamics, the frequency relationship must be taken into account within the permissible pressure of 10 to 210 bar or 10 to 315 bar.

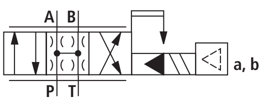
5) **Spool overlap**
The spool overlap in % is referred to the nominal stroke of the control spool.
Further spool overlaps on request.

6) **Seal material**
If you require another seal material, please consult us.

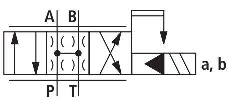
7) **Details in clear text**
Here, you can specify special requirements. These will be verified in the factory after receipt of your order and the type designation supplemented with an assigned number.

Symbols

Valves with OBE
(Example: 4WS**E**2EM 6-2X…ET…)



Valves without OBE
(Example: 4WS2EM 6-2X…ET…)



Function, section

4WS(E)2EM 6-2X/…

Valves of this type are electrically operated, 2-stage directional servo-valves with porting pattern to ISO 4401-03-02-0-05. They are mainly used for the closed-loop control of position, force, pressure or velocity.

These valves consist of an electromechanical converter (torque motor) (1), a hydraulic amplifier (nozzle flapper plate principle) (2) and a control spool (3) in a bush (2nd stage), which is connected to the torque motor via a mechanical feedback.

As a result of an electrical input signal applied at coils (4) of the torque motor, a force is generated by a permanent magnet that acts on armature (5), which generates a torque in conjunction with a bending tube (6). This causes flapper plate (7), which is connected by a pin to the bending tube (6), to be moved from the central position between the two control nozzles (8), and a pressure differential occurs across the front faces of the control spool (3). The pressure differential causes a change in the position of the spool, which results in the connection of the pressure port with an actuator port and, at the same time, in the connection of the other actuator port with the return flow port.

The control spool is connected with the flapper plate or the torque motor with the help of a bending spring (mechanical feedback) (9). The position of the spool is changed until the torque fed back by the bending tube and the electromagnetic torque of the torque motor are balanced, and the pressure differential across the nozzle flapper plate system becomes zero.

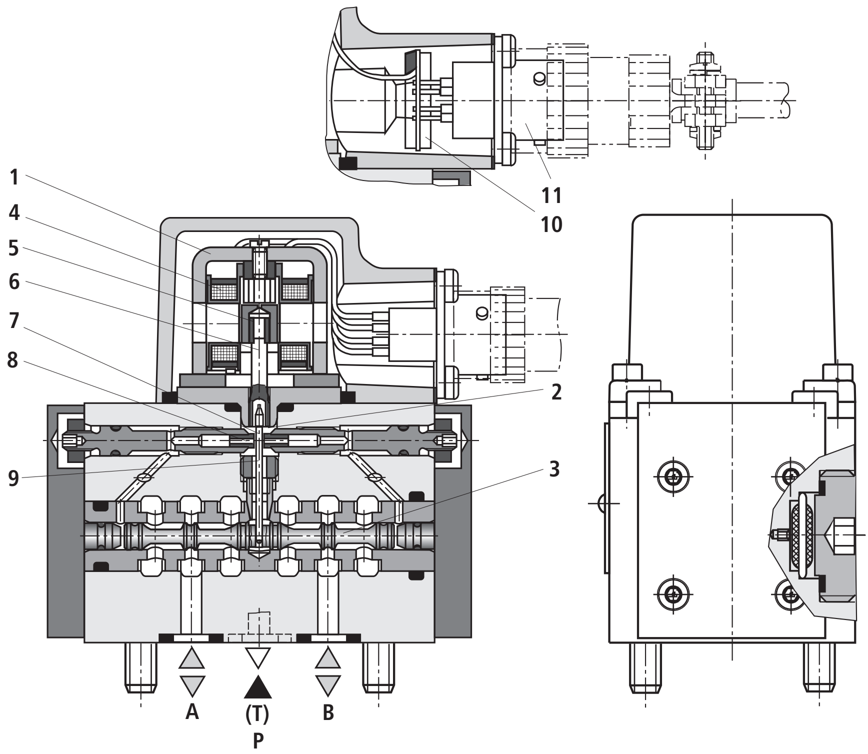
The stroke of the control spool and hence the flow through the servo-valve is therefore controlled in proportion to the electrical input signal. It must be noted that the flow depends on the valve pressure drop.

Type 4WS2EM 6-2X/… for external control electronics

For controlling the valve, an external control electronic control (servo-amplifier) is used, which amplifies an analogue input signal (command value) to a level required for the output signal to provide a current-regulated control of the servo-valve.

Type 4WSE2EM 6-2X/… with OBE

For the amplification of the analogue input signal, a control electrics (10), which is matched specifically to this valve type, is integrated in the valve. It is mounted to the male connector (11) in the cap of the torque motor.



6

Technical data (for applications outside these parameters, please consult us!)

General

Weight		kg	1.1
Porting pattern			ISO 4401-03-02-0-05
Installation orientation			Optional (Make sure that during start-up of the system, the valve is supplied with sufficient pressure ≥ 10 bar!)
Storage temperature range		°C	–20 to +80
Ambient temperature range		°C	–20 to +60, valve with OBE
			–30 to +100, valve without OBE

Hydraulic

Operating pressure	– Ports A, B, P	bar	10 to 210 or 10 to 315
Return flow pressure	– Port T	bar	Pressure peaks < 100, steady-state < 10
Zero flow $q_{V,L}$ 1) with spool overlap E measured without dither signal		l/min	$\sqrt{p_P/70\text{ bar}} \cdot (0.4\text{ l/min} + 0.02 \cdot q_{Vnom})$ 2); 3)
Nominal flows q_{Vnom} ± 10 % at valve pressure differential Δp = 70 bar		l/min	2; 5; 10; 15; 20; 25
Max. possible control spool stroke with mechanical end position (in the event of a failure) referred to nominal stroke		%	120 to 170
Hydraulic fluid			Mineral oil (HL, HLP) to DIN 51524; other hydraulic fluids on request
Hydraulic fluid temperature range preferably +40 to +50 °C		°C	–30 to +80, for valve with OBE
			–30 to +100, for valves without OBE
Viscosity range		mm^2/s	15 to 380, preferably 30 to 45
Permissible max. degree of contamination of the hydraulic fluid - cleanliness class to ISO 4406 (c)			Class 18/16/13 4)
Feedback system			Mechanical
Hysteresis (dither-optimised)		%	≤ 1.5
Range of inversion (dither-optimised)		%	≤ 0.2
Response sensitivity (dither-optimised)		%	≤ 0.2
Pressure intensification at 1 % spool stroke change (from hydraulic zero point)		% of p_P 3)	≥ 50
Zero balancing current over the entire operating pressure range		%	≤ 3, long term ≤ 5
Zero drift in the case of a change in:			
	Hydraulic fluid temperature	% / 20 °C	≤ 1
	Ambient temperature	% / 20 °C	≤ 1
	Operating temperature 80 to 120 % of p_P 3)	% / 100 bar	≤ 2
	Return flow pressure 80 to 10 % of p_P 3)	% / bar	≤ 1

1) $q_{V,L}$ = nominal flow in l/min

2) q_{Vnom} = nominal flow in l/min

3) p_P = operating pressure in bar

4) The cleanliness classes specified for components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and, at the same time, prolongs the service life of components.

For the selection of filters, see www.boschrexroth.com/filter

Technical data (for applications outside these parameters, please consult us!)

Electrical

Type of protection to EN 60529			IP 65 with mating connector correctly mounted and locked
Type of signal			Analogue
Nominal current per coil		mA	30
Resistance per coil		Ω	85
Inductivity at 60 Hz and 100 % nominal current	Series connection	H	1.0
	Parallel connection	H	0.25
In case of actuating using non-Rexroth amplifiers, we recommend a superimposed dither signal			

External control electronics

Servo-amplifier (separate order)	Euro-card format	analogue	Type VT-SR2-1X/.-60 according to data sheet RE 29980
	Modular design	analogue	Type VT 11021 according to data sheet RE 29743
The coils of the valve may only be connected to these amplifiers in a parallel connection!			

Note! For details with regard to **environment simulation testing** in the fields of EMC (electromagnetic compatibility), climate and mechanical stress, see RE 29564-U (declaration on environmental compatibility).

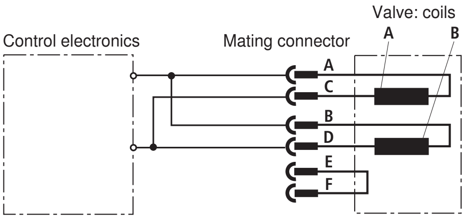
Available accessories

Service case with test unit for servo, proportional and high-response valves with integrated electronics, type VT-VETSY-1 according to data sheet RE 29685.

Service case with test unit for servo-valves for external electronics, type VT-SVTSY-1 according to data sheet RE 29681.

Electrical connection, external control electronics (example of parallel circuit)

Type 4WS2EM 6-2X/…



The coils are connected in parallel in the mating connector or on the amplifier (see figure).

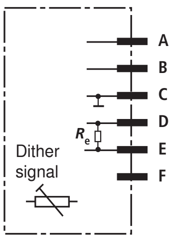
For a serial connection, contacts B and C must be connected.

Bridge E-F can be used for the electrical recognition of the correct connection of the male connector or for cable break detection.

Electrical controlling from A (+) to D (–) results in a direction of flow from P → A and B → T. Reverse electrical controlling results in a direction of flow from P → B and A → T.

Electrical connection, integrated control electronics

Type 4WSE2EM 6-2X/…



	Pin assignment of mating connector	Current control Control "**8**"	Voltage control Control "**9**"
Supply voltage (tolerance ±3 %, residual ripple content < 1 %) Current consumption	A	+15 V, max. 150 mA	+15 V max. 150 mA
	B	–15 V, max. 150 mA	–15 V max. 150 mA
	C	⊥	⊥
Commmand value	D	±10 mA R_i = 1 kΩ	±10 V R_i ≥ 8 kΩ I_i = 1i2 mA
Commmand value reference	E		
	F	Not assigned	

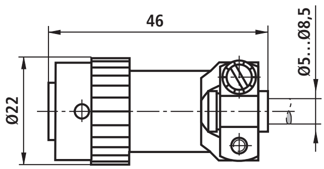
Command value at mating connector connection D = positive against mating connector connection E results in a direction of flow from P → A and B → T.

Command value at mating connector connection D = negative against mating connector connection E results in a direction of flow from P → B and A → T.

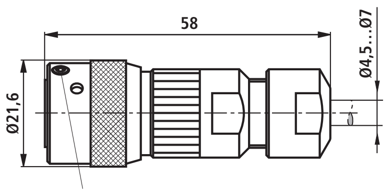
Note: **Electrical signals brought out via control electronics must not be used for switching off safety-relevant machine functions!**
(See also European standard EN 982, “Safety requirements for fluid power systems and their components – hydraulics“).

Electrical connection, mating connector

Plug-in connector,
separate order stating Material no. **R900005414**



Plug-in connector,
separate order stating Material no. **R901043330**

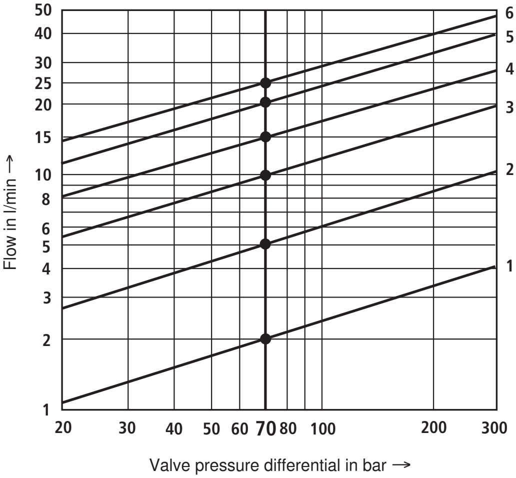


Connection cable:

4- or 6-wire, 0.75 mm^2, shielded, with litz wires to DIN VDE 0812 (e.g. cable type LIYCY 4 or 6 x 0.75 mm^2)

Characteristic curves (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

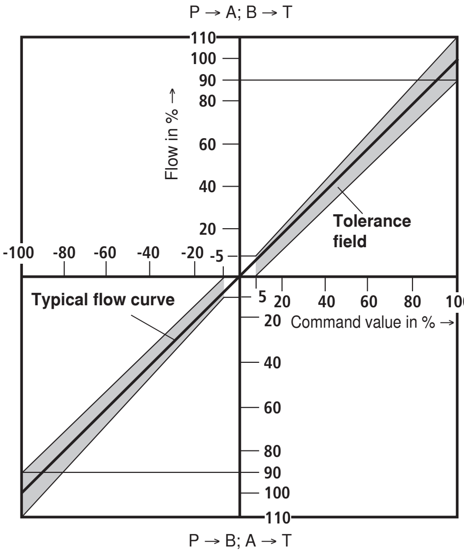
Flow/load function (tolerance ±10 %) at 100 % command value signal



Ordering code	Nominal flow	Curve
2	2 l/min	1
5	5 l/min	2
10	10 l/min	3
15	15 l/min	4
20	20 l/min	5
25	25 l/min	6

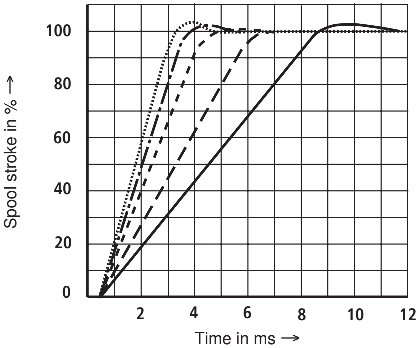
Δp = Valve pressure differential (inlet pressure p_P minus load pressure p_L minus return flow pressure p_T)

Tolerance field of flow/signal function at constant valve pressure differential Δp



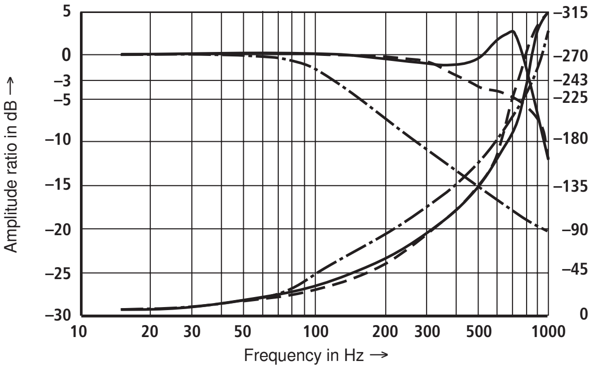
Characteristic curves (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

Transient function with pressure stage 315 bar



Measured at pilot pressure:
- 40 bar (solid line)
- 70 bar (long dashes)
- 140 bar (short dashes)
- 210 bar (dash-dot)
- 315 bar (dotted)

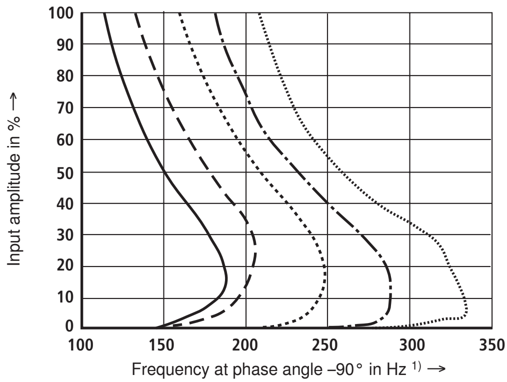
Frequency response with pressure stage 315 bar



Command value signal:
- ±5% (solid line)
- ±25% (dashed)
- ±100% (dash-dot)

Measured at pilot pressure p_{ST} = 315 bar

Dependence of frequency at –90° on operating pressure *p* and input amplitude



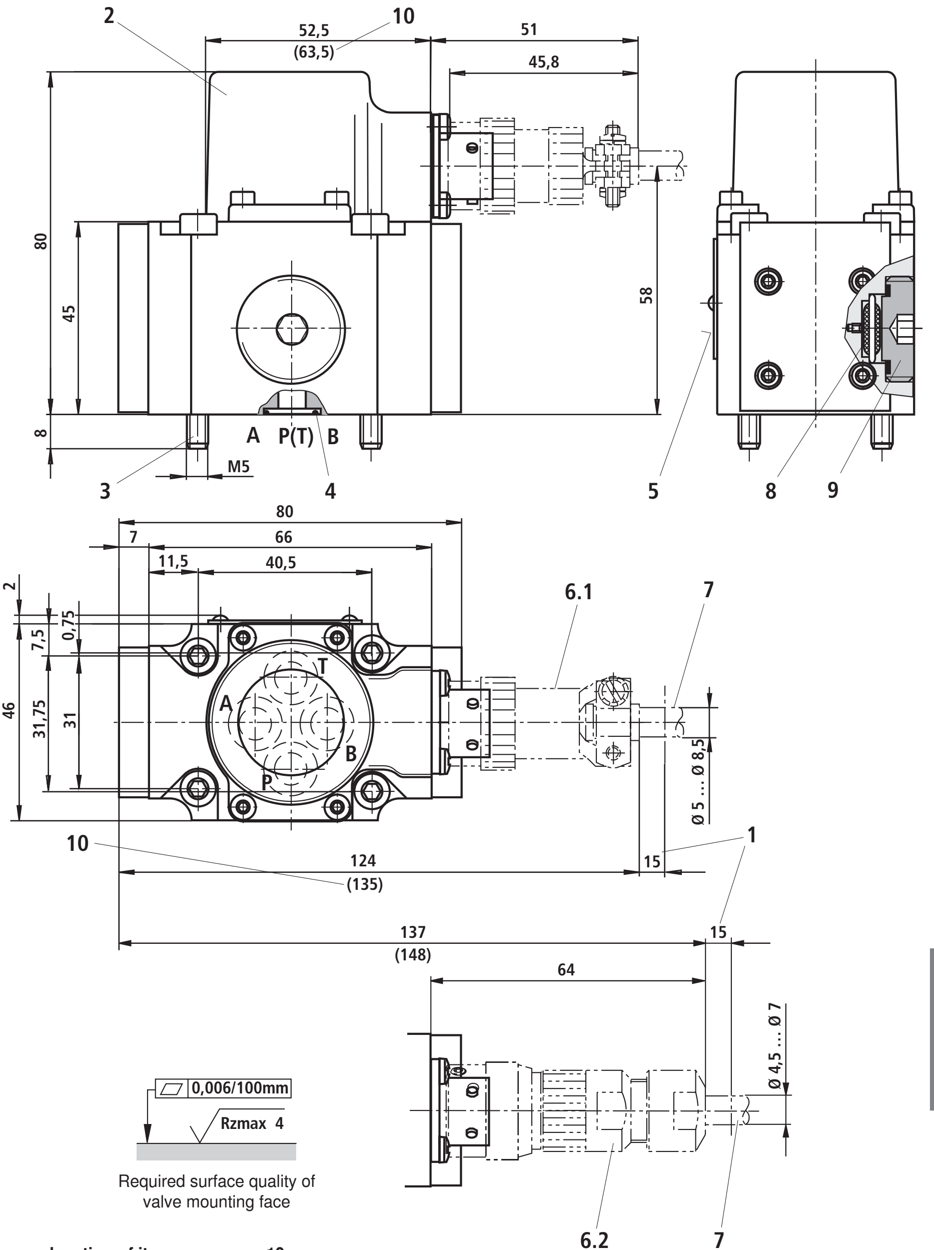
- 40 bar (solid line)
- 70 bar (long dashes)
- 140 bar (short dashes)
- 210 bar (dash-dot)
- 315 bar (dotted)

The output signal corresponds to the spool stroke with flow and without load pressure

[1] Correction factors at q_{Vnom}:

25 l/min	1.00
20 l/min	1.00
15 l/min	0.95
10 l/min	0.90
5 l/min	0.85
2 l/min	0.80

Unit dimensions: Types 4WS2EM 6 and 4WSE2EM 6 (nominal dimensions in mm)



Required surface quality of valve mounting face

For explanation of items, see page 10

Unit dimensions: Explanation of items

1 Space required to remove mating connector; in addition, take account of the bending radius of the connection cable

2 Cap

3 Valve mounting screws (included in the scope of supply)
For reasons of strength, use exclusively the following valve mounting screws:
4 hexagon socket head cap screws (4 A/F)
ISO 4762-M5 x 50-10.9-flZn-240h-L
(friction coefficient 0.09 – 0.4 to VDA 235-101)
M_T = 9.3 Nm

4 Identical seal rings for P, A, B and T

5 Nameplate

6.1 Mating connector, Material no. **R900005414** (separate order, see page 6)

6.2 Mating connector, Material no. **R901043330** (separate order, see page 6)

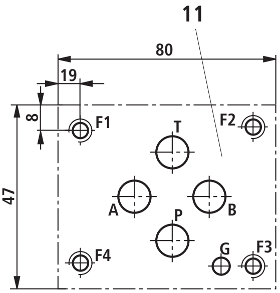
7 Connection cable; further information on page 6

8 Filter

9 Plug screw (6 A/F)
Tighten to M_T = 30 Nm after filter change

10 Dimensions in ( ) for valve with integrated control electronics (OBE)

11 Machined valve mounting face
Porting pattern according to ISO 4401-03-02-0-05
Deviating from standard:
– Locating pin (G) not provided



Subplates according to data sheet RE 45052 (separate order)

G 341/01	(G1/4)
G 342/01	(G3/8)
G 502/01	(G1/2)

Flushing plate with porting pattern to ISO 4401-03-02-0-05 (nominal dimensions in mm)

Symbol

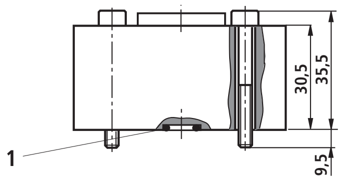
with FKM seals, Material no. **R900936049**, weight: 0.6 kg

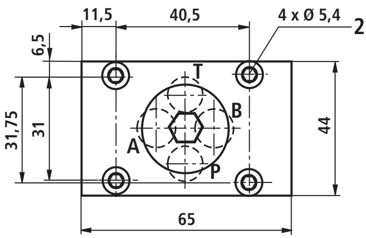
1 4 off R-rings 9.81 x 1.5 x 1.78

2 Mounting screws
(included in the scope of supply)

For strength reasons, use exclusively the following valve mounting screws:

4 hexagon socket head cap screws
ISO 4762-M5 x 40-10.9-flZn-240h-L
(friction coefficient 0.09-0.14 – to VDA 235-101)
M_T = 7 Nm ±10 %





To ensure the proper operation of servo-valves, it is indispensable to flush the system before commissioning.

The following equation provides a guideline for the flushing time per system:

$$t \geq \frac{V}{q_V} \cdot 5$$

t	=	flushing time in h
V	=	tank capacity in l
q_V	=	pump flow in l/min

When topping up more than 10 % of the tank capacity, repeat the flushing process.

Better than the use of a flushing plate is a directional valve with connection to ISO 4401-03-02-0-05. This valve can also be used for flushing the actuator ports. See also data sheet RE 07700.

6

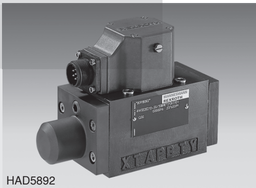
Notes

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

Directional servo-valve in 4-way design

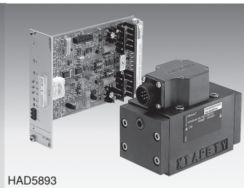
RE 29583/05.11
Replaces: 07.03

Type 4WS.2E...



HAD5892

Type 4WSE2ED 10-5X/...B...K31EV



HAD5893

Type 4WS2EM 10-5X/...B...K31EV

Size 10
Component series 5X
Maximum operating pressure 315 bar
Maximum flow 180 l/min

Table of contents

Information on available spare parts:
www.boschrexroth.com/spc

Features

- Valve to control position, force, pressure or velocity
- 2-stage servo valve with mechanical or mechanical and electric return
- 1st stage as nozzle flapper plate amplifier
- Subplate mounting:
  Porting pattern according to ISO 4401
- Dry control motor, no pollution of the solenoid gaps by the hydraulic fluid
- Can also be used as 3-way version
- Wear-free control spool return element
- Control
  • External control electronics in Eurocard format or in modular design (separate order), see page 8
  • Or control electronics integrated in the valve (OBE)
- Valve and integrated control electronics are adjusted and tested
- Control spool with flow force compensation
- Control sleeve centrically fixed; thus low susceptibility to temperature and pressure
- Pressure chambers at the control sleeve with gap seal, no wear of the seal ring
- Filter for 1st stage externally accessible, see pages 16, 17 and 18

Ordering code

		10 – 5X /	B				K31	E	V	*

Directional servo-valve in 4-way design for **external** control electronics = **4WS2E**
with **integrated** control electronics = **4WSE2E**

Mechanical return = **M**
Mechanical and electric return = **D**
(only available with integrated electronics)

Size 10 = **10**

Component series 50 to 59 = **5X**
(50 to 59: Unchanged installation and connection dimensions)

Rated flow 1)
with valve pressure differential Δ***p*** = 70 bar

5 l/min	= **5**
10 l/min	= **10**
20 l/min	= **20**
30 l/min	= **30**
45 l/min	= **45**
60 l/min	= **60**
75 l/min	= **75**
90 l/min	= **90**

Further details in the plain text 7)

V = FKM seals 6)
suitable for mineral oil (HL, HLP) according to DIN 51524

Spool overlap 5)
E = 0 to 0.5 % negative

Electrical connection
K31 = **Without** mating connector with connector according to EN 175201-804
Mating connector - separate order
see page 7

Inlet pressure range 4)
210 = 10 to 210 bar
315 = 10 to 315 bar

Pilot oil supply and return 3)
– = Supply external, return external
E = Supply internal, return external
T = Supply external, return internal
ET = Supply internal, return internal

Valves for **external** control electronics: 2)
11 = Coil no. 11 (30 mA / 85 Ω per coil)

Valves with **integrated** control electronics:

	Command value	Actual value (only available with 4WSE2ED…)
9 =	±10 V	±10 V
13 =	±10 mA	±10 mA

Rated flow 1)

The rated flow refers to a 100 % command value signal at 70 bar valve pressure differential (35 bar per control edge). The valve pressure differential must be regarded as reference. Other values result in the flow being changed.

A possible rated flow tolerance of ±10 % must be taken into account (see flow signal function page 9).

Electrical control data 2)

Valves for **external** control electronics:
The actuating signal must be formed by a current-controlled output stage. Servo amplifier see page 7.

Valves with **integrated** control electronics:
With the integrated electronics, the command value can be fed in as voltage (ordering code "9") or - with larger distances (> 25 m between control and valve) as current (ordering code "13").

Pilot oil 3)

Care should be taken that the pilot pressure is as constant as possible. An external pilot control via port X is thus often advantageous. The valve can be operated with a higher pressure at X than at P in order to influence the dynamics in a positive form.

The ports X and Y are also pressurized in case of "Internal" pilot oil supply.

Inlet pressure range 4)

Care should be taken that the system pressure is as constant as possible.

Pilot pressure range: 10 to 210 bar or 10 to 315 bar

With regard to the dynamics, the frequency response dependency must be observed within the admissible pressure range.

Spool overlap 5)

The spool overlap in % refers to the nominal stroke of the control spool.

Other control spool overlaps upon request!

Seal material 6)

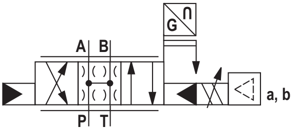
If you need any other sealing material, please contact us!

Details in the plain text 7)

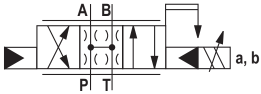
Here, special requests are to be specified in the plain text. After receipt of the order, they are checked by the plant and the type designation is amended with a related number.

Symbols

Valves with electric and mechanical return, with OBE
(example: 4WS**E**2ED 10-5X…ET…)



Valves with mechanical return, without OBE
(example: 4WS2EM 10-5X…ET…)



Function, section

4WS(E)2EM10-5X/...

Valves of type 4WS(E)2EM10-5X/... are electrically operated, 2-stage directional servo-valves. They are mainly used to control position, force and velocity.

These valves consist of an electro-mechanical converter (torque motor) (1), a hydraulic amplifier (nozzle flapper plate principle) (2) and a control spool (3) in a sleeve (2nd stage), which is connected to the torque motor via a mechanical return.

An electrical input signal at the coils (4) of the torque motor generates a force by means of a permanent magnet which acts on the armature (5), and in connection with a torque tube (6) results in a torque. This causes the flapper plate (7) which is connected to the torque tube (6) via a pin to move from the central position between the two control nozzles (8), and a pressure differential is created across the front faces of the control spool. This pressure differential results in the control spool changing its position, which results in the pressure port being connected to one actuator port and, at the same time, the other actuator port being connected to the return flow port.

The control spool is connected to the flapper plate or the torque motor by means of a bending spring (mechanical return) (9). The position of the control spool is changed until the feedback torque across the bending spring and the electromagnetic torque of the torque motor are balanced and the pressure differential at the nozzle flapper plate system becomes zero.

The stroke of the control spool and consequently the flow of the servo valve are controlled in proportion to the electrical input signal. It must be noted that the flow depends on the valve pressure drop.

External control electronics, type 4WS2EM10-5X/... (separate order)

External control electronics (servo amplifier) serve the actuation of the valve, amplifying an analog input signal (command value) so that with the output signal, the servo valve is actuated in a flow-controlled form.

Integrated control electronics, type 4WSE2EM10-5X/... and 4WSE2ED10-5X/...

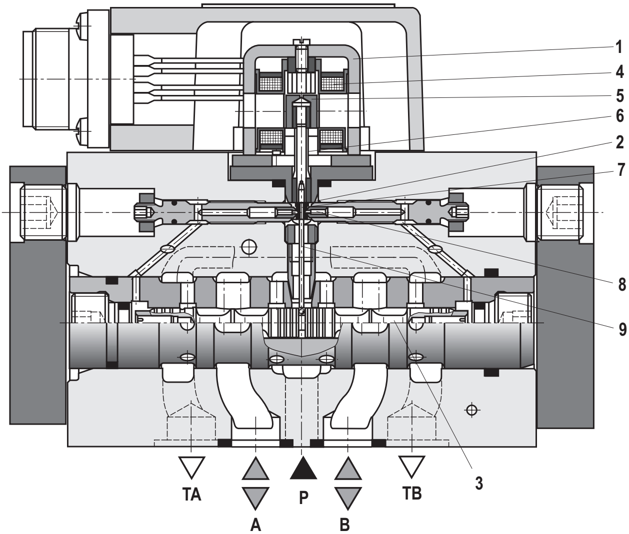
To amplify the analog input signal, control electronics (10) especially adjusted to this valve type are integrated. They are located in the torque motor cover cap. The valve zero point can be adjusted by means of an externally accessible potentiometer.

4WSE2ED10-5X/...

In addition to the mechanical control by the return spring, valves of this types are equipped with the electric spool position detection and control. The control spool position is determined by an inductive position transducer (11). The position transducer signal is compared to the command value by integrated control electronics (10). Any possible control deviation is amplified electrically and fed to the torque motor as control signal. With the additional electric return, higher dynamical values can be achieved by the electric controller gain in the small signal range than with the purely mechanical version. The additionally available mechanical return ensures that in case the electric voltage supply fails, the valve spool is positioned in the zero range.

The valve is only available with integrated control electronics. The valve zero point can be adjusted by means of an externally accessible potentiometer.

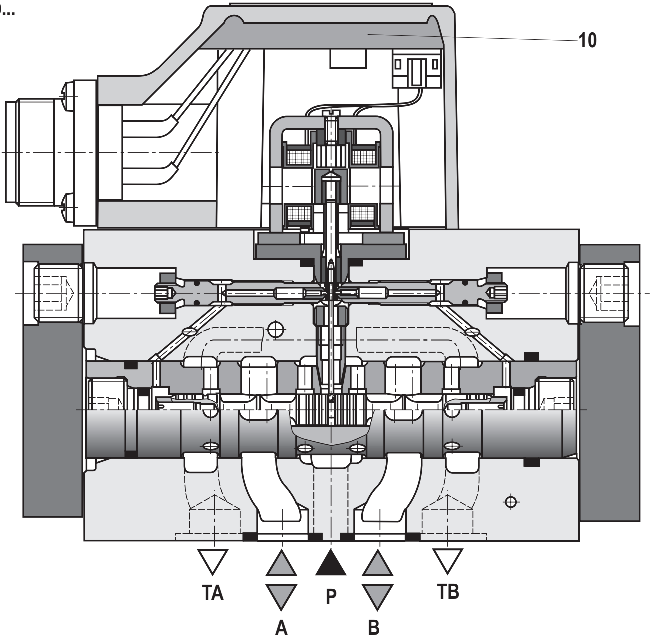
Note:
Changes in the zero point may result in damage to the system and may only be implemented by instructed specialists.



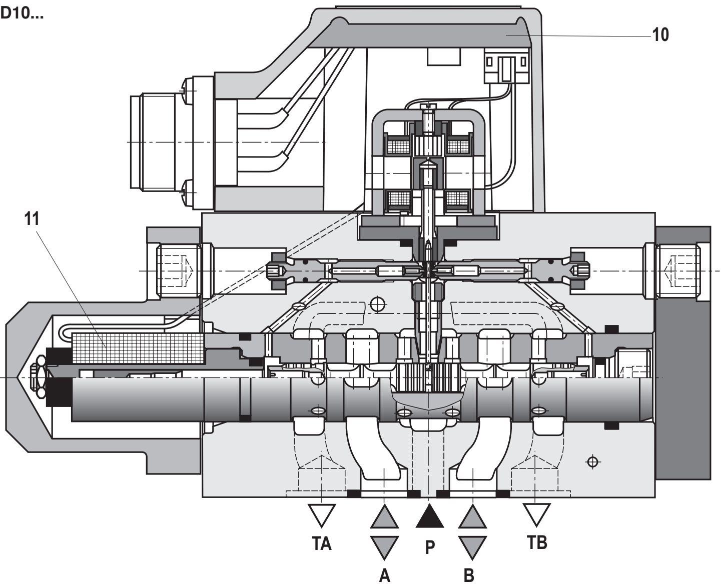
Type 4WS2EM10...

Section

Type 4WSE2EM10...



Type 4WSE2ED10...



Technical data (For applications outside these parameters, please consult us!)

general

Weight	with mechanical return	kg	3.56
	with mechanical and electric return and integrated control electronics	kg	3.65
Installation position			Optional, if it is ensured that during start-up of the system the pilot control is supplied with sufficient pressure (≥ 10 bar).
Storage temperature range		°C	–20 to +80
Ambient temperature range		°C	–20 to +60 valve with OBE
			–30 to +100 valve without OBE

hydraulic (measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Operating pressure	Pilot control stage, pilot oil supply	bar	10 to 210 or 10 to 315								
	Main valve, port P, A, B	bar	Up to 315								
Return flow pressure	Port T										
	Pilot oil return internal	bar	Pressure peaks < 100 permitted, static < 10								
	Pilot oil return external	bar	Up to 315								
	Port Y	bar	Pressure peaks < 100 permitted, static < 10								
Hydraulic fluid			See table page 7								
Hydraulic fluid temperature range		°C	–15 to +80, preferably +40 to +50								
Viscosity range		mm^2/s	15 to 380, preferably 30 to 45								
Maximum admissible degree of contamination of the hydraulic fluid cleanliness class according to ISO 4406 (c)			Class 18/16/13 [1]								
Zero flow $Q_{V,L}$ [2] measured without dither signal		l/min	$\sqrt{\frac{p_P^{4)}}{70\ \text{bar}}} \cdot 0.7\ \frac{\text{l}}{\text{min}}$	$\sqrt{\frac{p_P^{4)}}{70\ \text{bar}}} \cdot 0.9\ \frac{\text{l}}{\text{min}}$	$\sqrt{\frac{p_P^{4)}}{70\ \text{bar}}} \cdot 1.2\ \frac{\text{l}}{\text{min}}$			$\sqrt{\frac{p_P^{4)}}{70\ \text{bar}}} \cdot 1.5\ \frac{\text{l}}{\text{min}}$		$\sqrt{\frac{p_P^{4)}}{70\ \text{bar}}} \cdot 1.7\ \frac{\text{l}}{\text{min}}$		
Rated flow $Q_{v\ rated}$ [3], tolerance ±10 % with valve differential pressure Δp = 70 bar		l/min	5	10	20	30	45	60	75	90	
Maximum control spool stroke possible with mechanical end position (in case of error) related to nominal stroke		%	120 to 170				120 to 150				
Pressure gain with 1 % spool stroke change (from the hydraulic zero point)		% of p_P [4]	≥ 30					≥ 60		≥ 80	
Return system			Mechanical "M"					Mechanical and electric "D"			
Hysteresis (dither-optimized)		%	≤ 1.5					≤ 0.8			
Range of inversion (dither-optimized)		%	≤ 0.3					≤ 0.2			
Response sensitivity (dither-optimized)		%	≤ 0.2					≤ 0.1			
Zero adjustment flow over the entire operating pressure range		%	≤ 3, long-term ≤ 5					≤ 2			
Zero shift upon change of:											
	Hydraulic fluid temperature	% / 20 °C	≤ 1					≤ 2			
	Ambient temperature	% / 20 °C	≤ 1					≤ 2			
	Operating pressure 80 to 120 % of p_P [4]	% / 100 bar	≤ 2					≤ 2			
	Return flow pressure 0 to 10 % p_P [4]	% / bar	≤ 1					≤ 1			

[1] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components.

For the selection of the filters see www.boschrexroth.com/filter

[2] $Q_{V,L}$ = Zero flow in l/min

[3] $Q_{V\ rated}$ = Rated flow (complete valve) in l/min

[4] p_P = Operating pressure in bar

Technical Data (For applications outside these parameters, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons		HL, HLP	NBR, FKM	DIN 51524
Flame-resistant	– Water-containing	HFC	NBR	ISO 12922

☞ **Important information on hydraulic fluids!**

- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!
- The flash point of the process and operating medium used must be 40 K higher than the maximum solenoid surface temperature.
- **Flame-resistant – water-containing**: Maximum pressure difference per control edge 175 bar, otherwise, increased cavitation erosion!
  Tank pre-loading < 1 bar or > 20 % of the pressure difference. The pressure peaks should not exceed the maximum operating pressures!

electric

Return system			Mechanical "M"	Mechanical and electric "D"
Protection class of the valve according to EN 60529			IP 65 with mating connector mounted and locked	
Type of signal			Analog	
Rated current per coil		mA	30	
Resistance per coil		Ω	85	
Inductivity with 60 Hz and 100 % rated current	Connection in series	H	1.0	
	Connection in parallel	H	0.25	
In case of actuation using non-Rexroth amplifiers, we recommend a superimposed dither signal				

electric, external control electronics (only version "M")

Amplifier (separate order)	Eurocard format	Analog	Type VT-SR2-1X/... according to data sheet 29980
	Modular design	Analog	Type VT 11021 according to data sheet 29743

Important: Information on the **environment simulation testing** for the areas EMC (electromagnetic compatibility), climate and mechanical load see data sheet 29583-U (declaration on environmental compatibility).

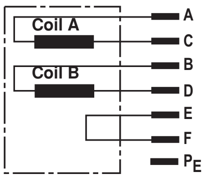
Available accessories

Service case with test device for continuous valves with integrated electronics type VT-VETSY-1 according to data sheet 29685.

Service case with test device for servo valves for external electronics type VT-SVTSY-1 according to data sheet 29681.

Electrical connection, external control electronics

Type 4WS2EM 10-5X...



The electrical connection can be designed as parallel or serial connection. For reasons of operational safety and the resulting lower coil inductivity, we recommend the connection in parallel.

The E-F bridge can be used for the electrical determination of the correct connection of the plug-in connector and/or for the identification of cable break.

Connection in parallel:
In the mating connector, connect contact A with B and C with D.

Connection in series:
In the mating connector, connect contact B with C.

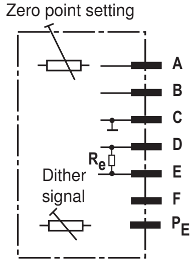
Electrical control from A (+) to D (–) results in the flow direction P to A and B to T. Inverted electrical control results in the flow direction P to B and A to T.

E → F = bridge

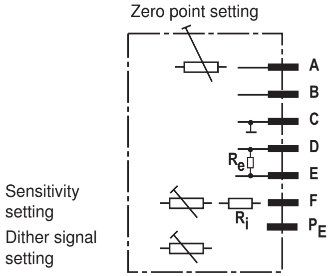
6

Electrical connection, integrated control electronics

Type 4WSE2EM 10-5X...



Type 4WSE2ED 10-5X...



	Mating connector assignment	Current control Control "**13**"	Voltage control Control "**9**"
Supply voltage	A	+15 V	+15 V
	B	–15 V	–15 V
	C	⊥	⊥
Command value	D	±10 mA	±10 V
	E	R_e = 100 Ω	R_e ≥ 50 kΩ
Measuring output for control spool	F [1]	±10 mA [2] Load max. 1 kΩ	+10 V against ⊥ [2] R_i ≈ 4.7 kΩ

[1] In valves with mechanical return, part F is not used.
[2] With nominal spool stroke

Current consumption at the mating connector port	A	Max. 150 mA	Max. 150 mA
	B		
	D	0 to ±10 mA	≤ 0.2 mA
	E		

Supply voltage: ±15 V ±3 %, residual ripple < 1 %

Command value: Command value at the mating connector port D = positive against mating connector port E results in flow from P to A and B to T.
Measuring output F has positive signal against ⊥.

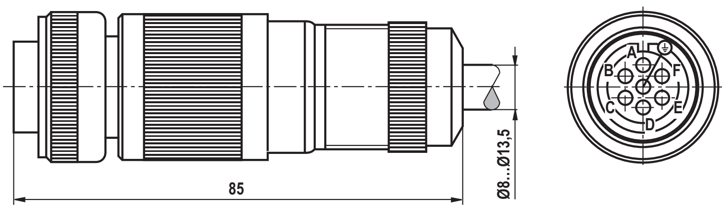
Command value at the mating connector port D = negative against mating connector port E results in flow from P to B and A to T.
Measuring output F has negative signal against ⊥.

Measuring output: The voltage or current signal is proportional to the control spool stroke.

Important: Electric signals taken out via control electronics (e.g. actual value) must not be used for switching off safety-relevant machine functions!

Electrical connection, mating connector

Mating connector according to DIN EN 175.201-804
separate order under Material no. **R900223890**
(metal version)

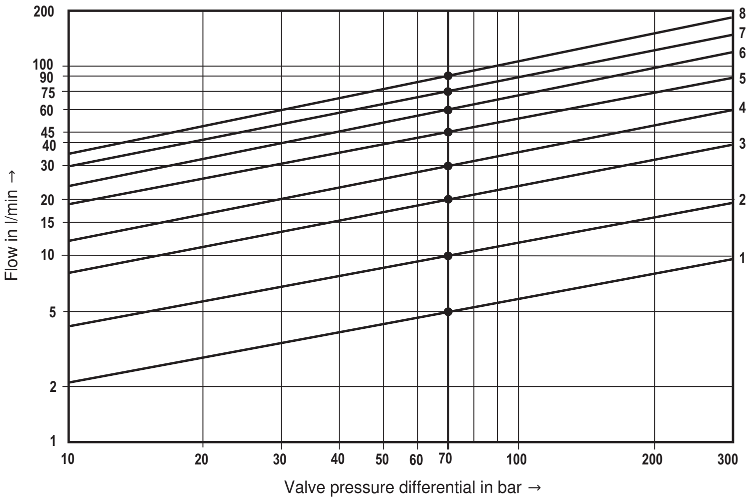


Characteristic curves (measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Flow/load function (tolerance ±10 %)
with 100 % command value signal

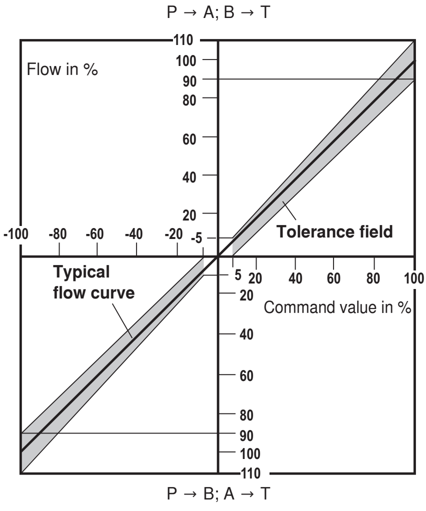
Rated flow

5 l/min	=	Curve **1**	45 l/min	=	Curve **5**
10 l/min	=	Curve **2**	60 l/min	=	Curve **6**
20 l/min	=	Curve **3**	75 l/min	=	Curve **7**
30 l/min	=	Curve **4**	90 l/min	=	Curve **8**



$\Delta \boldsymbol{p}$ = Valve pressure differential (inlet pressure $\boldsymbol{p}_P$ minus load pressure $\boldsymbol{p}_L$ and minus return flow pressure $\boldsymbol{p}_T$)

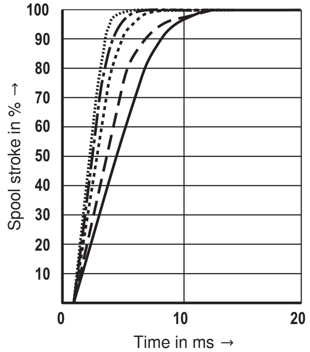
Tolerance field of the flow command value function
at constant valve pressure differential



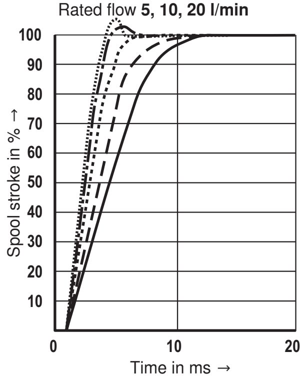
Characteristic curves: Type 4WS.2EM 10 and 4WSE2ED 10 (measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Transition function with pressure rating 315 bar, step response without flow

4WS.2EM 10
Rated flow **5, 10, 20 l/min**



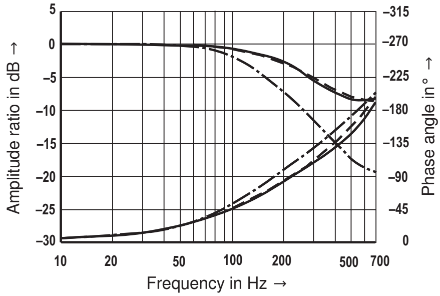
4WSE2ED 10
Rated flow **5, 10, 20 l/min**



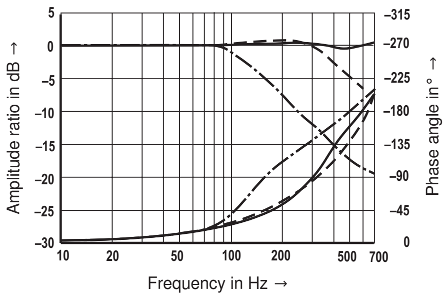
40 bar 70 bar 140 bar 210 bar 315 bar

Frequency response with pressure rating 315 bar, stroke frequency without flow

4WS.2EM 10
Rated flow **5, 10, 20 l/min**



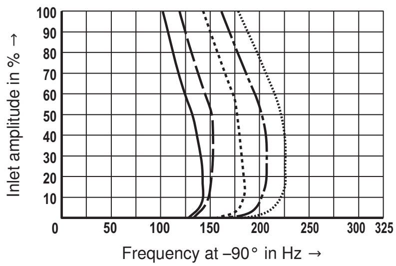
4WSE2ED 10
Rated flow **5, 10, 20 l/min**



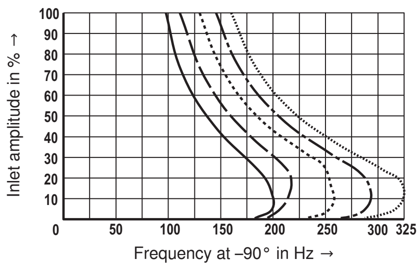
5 % 25 % 100 %

Dependency of the frequency *f* at –90° on the operating pressure *p* and the inlet amplitude

4WS.2EM 10
Rated flow **5, 10, 20 l/min**



4WSE2ED 10
Rated flow **5, 10, 20 l/min**

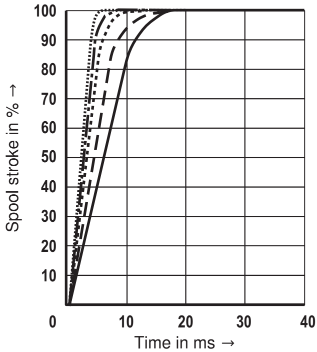


40 bar 70 bar 140 bar 210 bar 315 bar

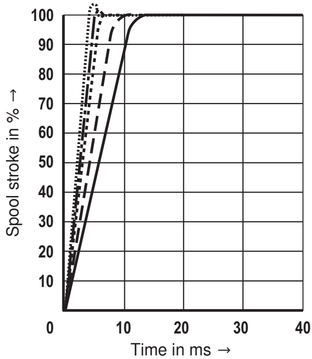
Characteristic curves: Type 4WS.2EM 10 and 4WSE2ED 10 (measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Transition function with pressure rating 315 bar, step response without flow

4WS.2EM 10
Rated flow **30 l/min**



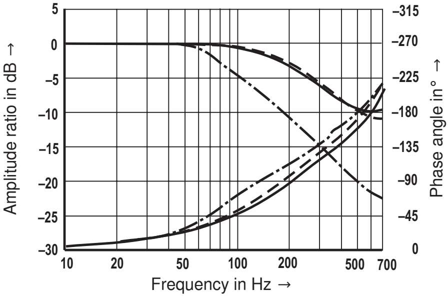
4WSE2ED 10
Rated flow **30 l/min**



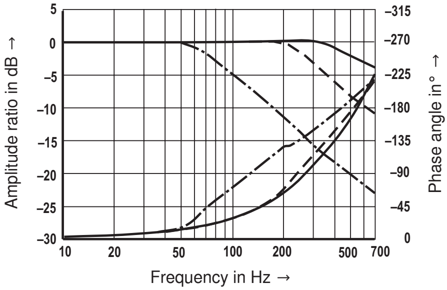
40 bar — 70 bar — 140 bar — 210 bar — 315 bar

Frequency response with pressure rating 315 bar, stroke frequency without flow

4WS.2EM 10
Rated flow **30 l/min**



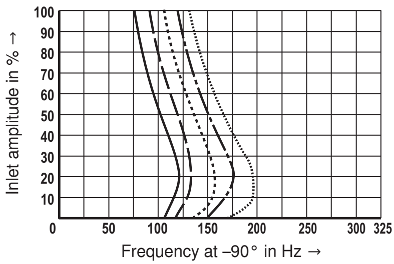
4WSE2ED 10
Rated flow **30 l/min**



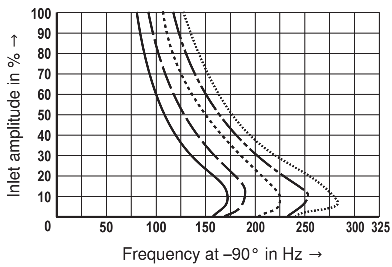
5 % — 25 % — 100 %

Dependency of the frequency *f* at –90° on the operating pressure *p* and the inlet amplitude

4WS.2EM 10
Rated flow **30 l/min**



4WSE2ED 10
Rated flow **30 l/min**

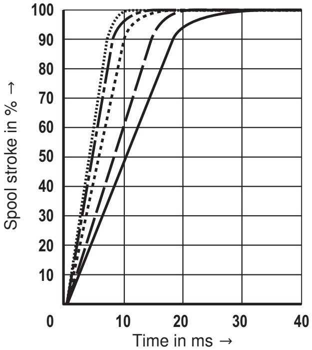


40 bar — 70 bar — 140 bar — 210 bar — 315 bar

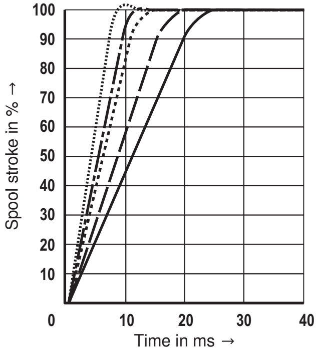
Characteristic curves: Type 4WS.2EM 10 and 4WSE2ED 10 (measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Transition function with pressure rating 315 bar, step response without flow

4WS.2EM 10
Rated flow **45 l/min**



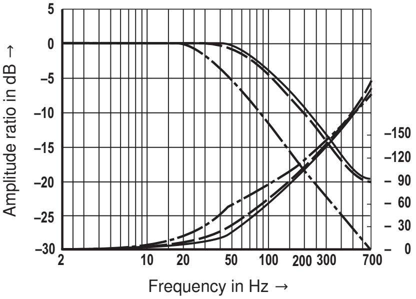
4WSE2ED 10
Rated flow **45 l/min**



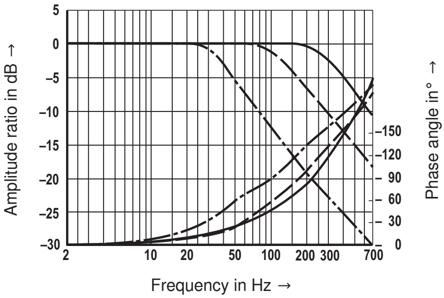
40 bar — 70 bar — 140 bar — 210 bar — 315 bar

Frequency response with pressure rating 315 bar, stroke frequency without flow

4WS.2EM 10
Rated flow **45 l/min**



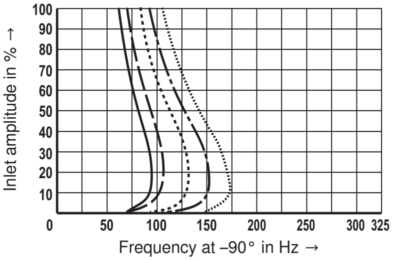
4WSE2ED 10
Rated flow **45 l/min**



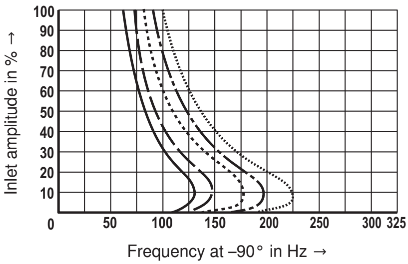
5 % — 25 % — 100 %

Dependency of the frequency *f* at –90° on the operating pressure *p* and the inlet amplitude

4WS.2EM 10
Rated flow **45 l/min**



4WSE2ED 10
Rated flow **45 l/min**

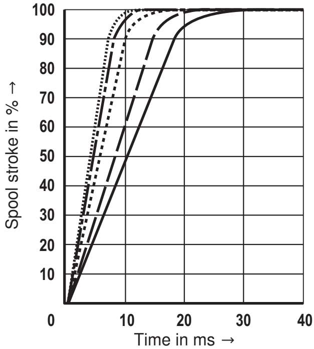


40 bar — 70 bar — 140 bar — 210 bar — 315 bar

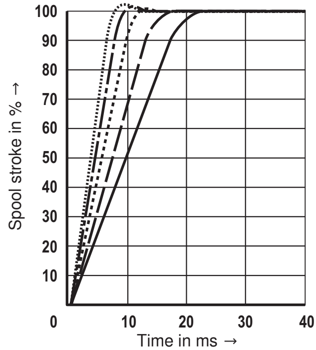
Characteristic curves: Type 4WS.2EM 10 and 4WSE2ED 10 (measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Transition function with pressure rating 315 bar, step response without flow

4WS.2EM 10
Rated flow **60 l/min**



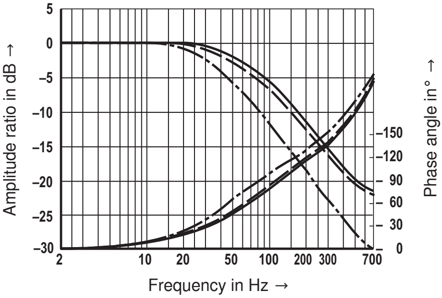
4WSE2ED 10
Rated flow **60 l/min**



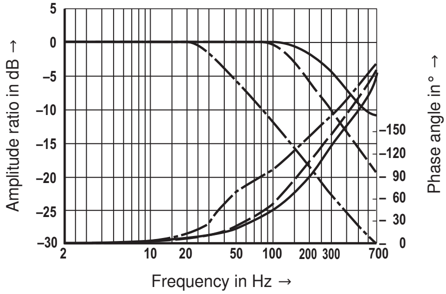
—— 40 bar — — — 70 bar .... 140 bar —·— 210 bar .... 315 bar

Frequency response with pressure rating 315 bar, stroke frequency without flow

4WS.2EM 10
Rated flow **60 l/min**



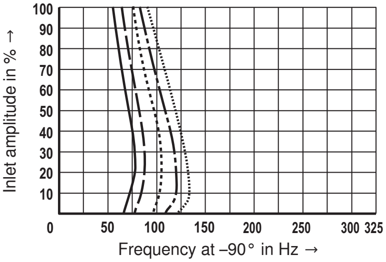
4WSE2ED 10
Rated flow **60 l/min**



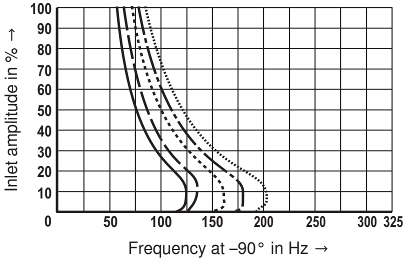
—— 5 % — — — 25 % —·— 100 %

Dependency of the frequency *f* at –90° on the operating pressure *p* and the inlet amplitude

4WS.2EM 10
Rated flow **60 l/min**



4WSE2ED 10
Rated flow **60 l/min**



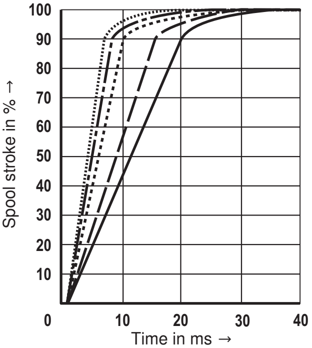
—— 40 bar — — — 70 bar .... 140 bar —·— 210 bar .... 315 bar

6

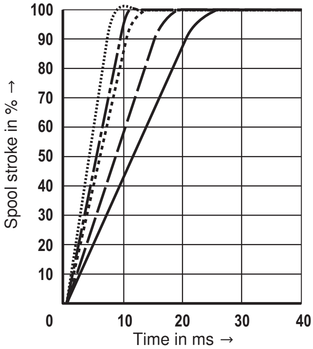
Characteristic curves: Type 4WS.2EM 10 and 4WSE2ED 10 (measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Transition function with pressure rating 315 bar, step response without flow

4WS.2EM 10
Rated flow **75 l/min**



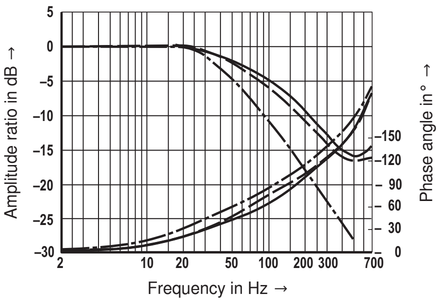
4WSE2ED 10
Rated flow **75 l/min**



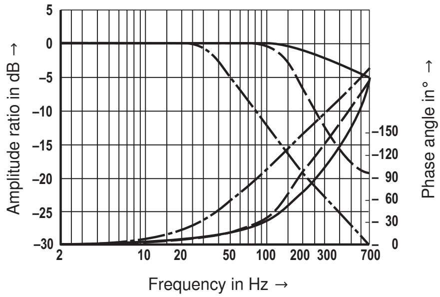
40 bar 70 bar 140 bar 210 bar 315 bar

Frequency response with pressure rating 315 bar, stroke frequency without flow

4WS.2EM 10
Rated flow **75 l/min**



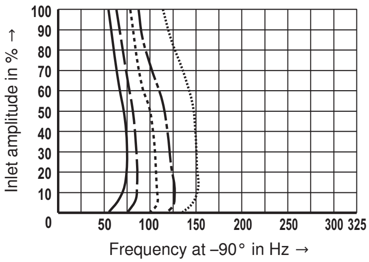
4WSE2ED 10
Rated flow **75 l/min**



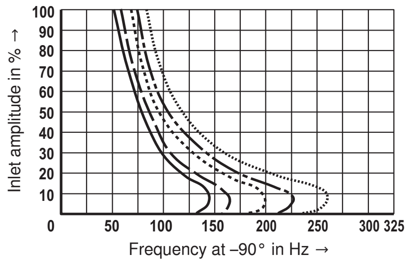
5 % 25 % 100 %

Dependency of the frequency *f* at –90° on the operating pressure *p* and the inlet amplitude

4WS.2EM 10
Rated flow **75 l/min**



4WSE2ED 10
Rated flow **75 l/min**

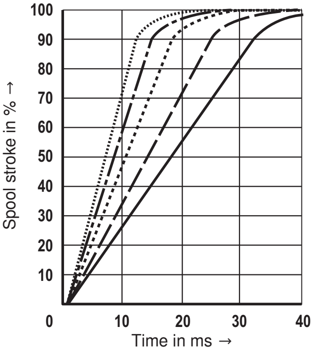


40 bar 70 bar 140 bar 210 bar 315 bar

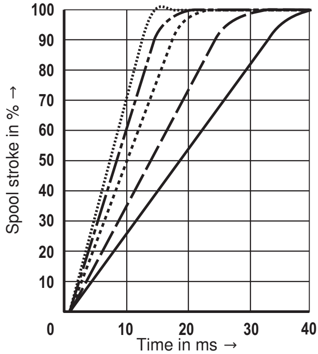
Characteristic curves: Type 4WS.2EM 10 and 4WSE2ED 10 (measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Transition function with pressure rating 315 bar, step response without flow

4WS.2EM 10
Rated flow **90 l/min**



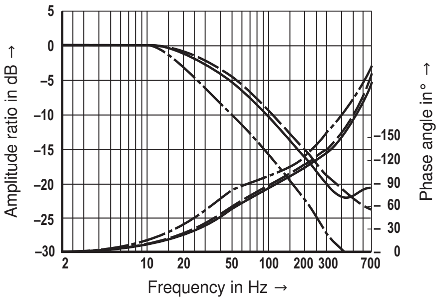
4WSE2ED 10
Rated flow **90 l/min**



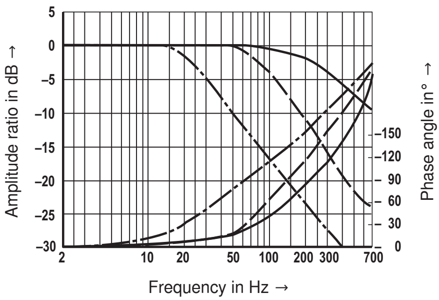
40 bar — 70 bar — 140 bar — 210 bar — 315 bar

Frequency response with pressure rating 315 bar, stroke frequency without flow

4WS.2EM 10
Rated flow **90 l/min**



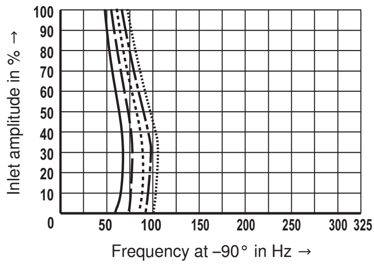
4WSE2ED 10
Rated flow **90 l/min**



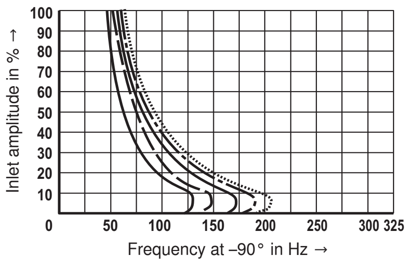
5 % — 25 % — 100 %

Dependency of the frequency *f* at –90° on the operating pressure *p* and the inlet amplitude

4WS.2EM 10
Rated flow **90 l/min**



4WSE2ED 10
Rated flow **90 l/min**

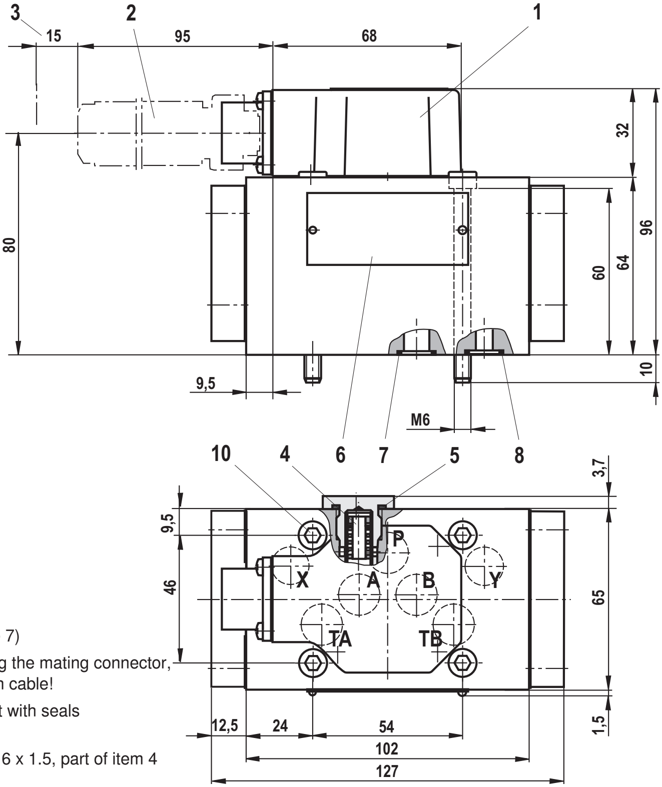


40 bar — 70 bar — 140 bar — 210 bar — 315 bar

6

Unit dimensions: Type 4WS2EM 10 (dimensions in mm)

Mechanical return / external control electronics, type 4WS2EM 10-5X/…



1 Cap

2 Mating connector
(order separately, see page 7)

3 Space required for removing the mating connector, also take care of connection cable!

4 Exchangeable filter element with seals
Material no.: **R961001950**

5 Profile seal for filter screw 16 x 1.5, part of item 4

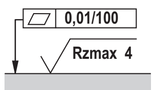
6 Name plate

7 Identical seal rings for ports A, B, P, TA and TB

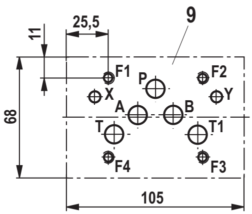
8 Identical seal rings for ports X and Y
Ports X and Y are also pressurized in case of "internal" pilot oil supply.

9 Processed valve mounting faces, porting pattern according to ISO 4401-05-05-0-05
Port T1 is optional and is recommended for reducing the pressure drop from B → T with rated flows > 45 l/min.

10 Valve mounting screws
For reasons of stability, exclusively the following valve mounting screws may be used:
4 hexagon socket head cap screws ISO 4762-M6x70-10.9-flZn-240h-L (friction coefficient 0.09 – 0.14 according to VDA 235-101) (included in the delivery)



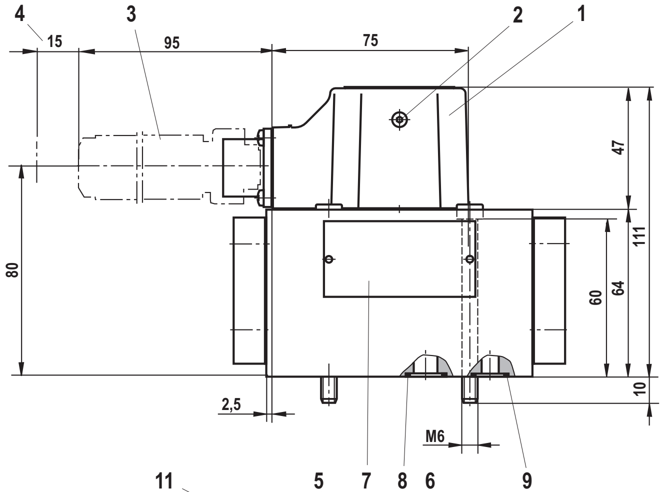
Required surface quality of the counterpart

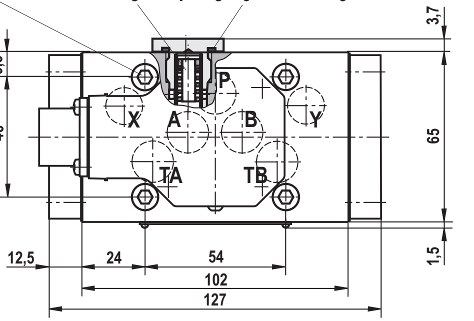


Subplates according to data sheet 45054 must be ordered separately.

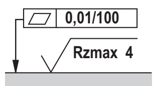
Unit dimensions: Type 4WSE2EM 10 (dimensions in mm)

Mechanical return / integrated control electronics, type 4WSE2EM 10-5X/…

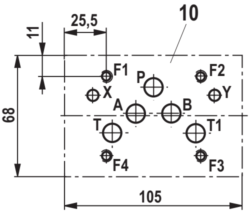




1 Cap **with** integrated control electronics
2 Electric zero point setting:
After removal of the SW2.5 plug screw, the zero point can be corrected using a potentiometer
3 Mating connector (order separately, see page 7)
4 Space required for removing the mating connector, also take care of connection cable!
5 Exchangeable filter element with seals
Material no.: **R961001950**
6 Profile seal for filter screw 16 x 1.5, part of item 5
7 Name plate
8 Identical seal rings for ports A, B, P, TA and TB
9 Identical seal rings for ports X and Y
Ports X and Y are also pressurized in case of "internal" pilot oil supply.
10 Processed valve mounting faces, porting pattern according to ISO 4401-05-05-0-05
Port T1 is optional and is recommended for reducing the pressure drop from B → T with rated flows > 45 l/min.
11 Valve mounting screws
For reasons of stability, exclusively the following valve mounting screws may be used:
4 hexagon socket head cap screws
ISO 4762-M6x70-10.9-flZn-240h-L
(friction coefficient 0.09 – 0.14 according to VDA 235-101) (included in the delivery)



Required surface quality of the counterpart

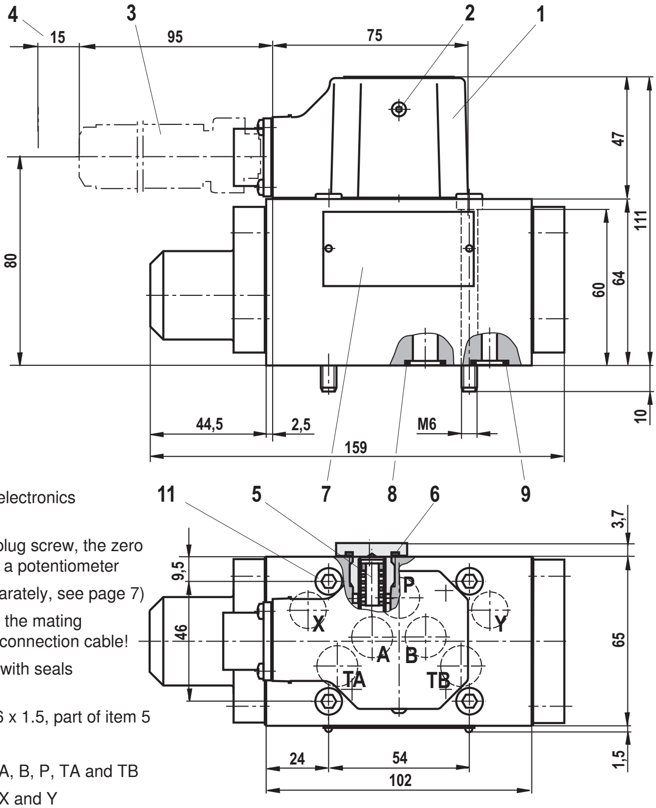


Subplates according to data sheet 45054 must be ordered separately.

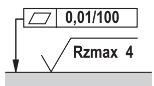
6

Unit dimensions: Type 4WSE2ED 10 (dimensions in mm)

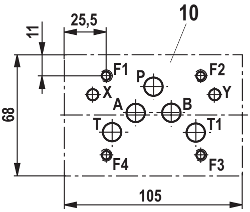
Electric and mechanical return / integrated control electronics, type 4WSE2ED 10-5X/…



1 Cap **with** integrated control electronics
2 Electric zero point setting:
After removal of the SW2.5 plug screw, the zero point can be corrected using a potentiometer
3 Mating connector (order separately, see page 7)
4 Space required for removing the mating connector, also take care of connection cable!
5 Exchangeable filter element with seals
Material no.: **R961001950**
6 Profile seal for filter screw 16 x 1.5, part of item 5
7 Name plate
8 Identical seal rings for ports A, B, P, TA and TB
9 Identical seal rings for ports X and Y
Ports X and Y are also pressurized in case of "internal" pilot oil supply.
10 Processed valve mounting faces, porting pattern according to ISO 4401-05-05-0-05
Port T1 is optional and is recommended for reducing the pressure drop from B → T with rated flows > 45 l/min.
11 Valve mounting screws
For reasons of stability, exclusively the following valve mounting screws may be used:
4 hexagon socket head cap screws ISO 4762-M6x70-10.9-flZn-240h-L (friction coefficient 0.09 – 0.14 according to VDA 235-101) (included in the delivery)



Required surface quality of the counterpart

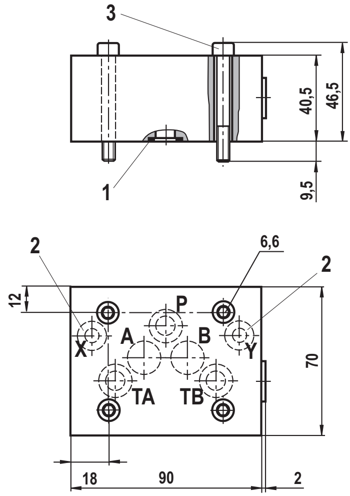


Subplates according to data sheet 45054 must be ordered separately.

Flushing plate with porting pattern according to ISO 4401-05-05-0-05 (dimensions in mm)

Symbol

with FKM seals,
Material no. **R900912450**, weight: 2 kg



1 R-ring 13 x 1.6 x 2 (A, B, P, TA and TB)

2 R-ring 11.18 x 1.6 x 1.78 (X, Y)

3 Mounting screws
For reasons of stability, exclusively the following mounting screws may be used:
4 hexagon socket head cap screws
ISO 4762-M6x50-10.9-flZn-240h-L
(friction coefficient 0.09 - 0.14 according to VDA 235-101) (included in the delivery)

To ensure proper operation of the servo-valves, it is necessary to flush the system before commissioning.

The following values are guidelines for the flushing time per system:

$$t \geq \frac{V}{Q_V} \cdot 5$$

t = Flushing time in h

V = Tank capacity in l

Q_V = Pump flow in l/min

When topping up more than 10 % of the tank capacity, flushing must be repeated.

The use of a directional valve with port in accordance with ISO 4401-05-05-0-05 is suited better than a flushing plate. This valve can also be used for flushing the actuator ports. Also refer to catalog sheet RE 07700.

Notes

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

Rexroth
Bosch Group

RE 29 591/06.02

Replaces: 03.93

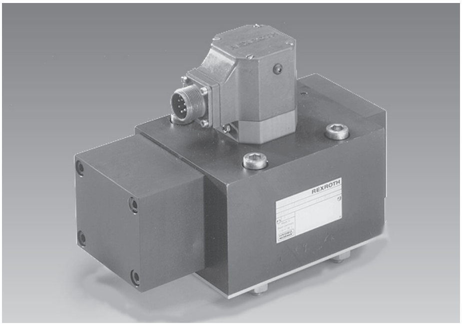
4-way directional servo valve
Type 4WS.2E…

Nominal size 16

Series 2X

Maximum operating pressure 210/315 bar

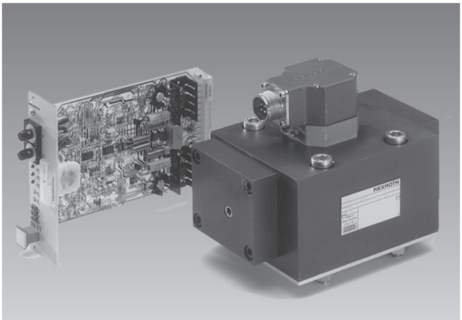
Maximum flow 320 L/min



H/A 3013

Type 4WSE2ED 16-2X/…B… with mechanical and electrical feedback and integrated control electronics

Overview of contents



H/A/3012

Type 4WS2EM 16-2X/…B… with mechanical feedback and associated external control electronics (separate order)

Features

- Valve for closed loop position, force and speed control
- Two stage servo valve with mechanical or mechanical and electrical feedback
- 1st stage as an orifice-flapper plate amplifier
- For subplate mounting, porting pattern to DIN 24 340 form A16 with port X, subplates to catalogue sheet RE 45 054 (separate order)
- Dry torque motor, no contamination of the solenoid gap by the pressure fluid
- Can also be used as a 3-way version
- Wear-free spool return element
- Three control variations
- Control:
  - External control electronics in eurocard format (separate order), see page 7
  - Or with the control electronics integrated into the valve
- The valves with integrated control electronics are calibrated and tested
- The pilot oil supply, internal/external, can be changed without dismantling the valve
- The control sleeve can be replaced
- Filter for the 1st stage is accessible from the outside by means of a plug

Ordering details

		16 –2X /	B					E	V	*

Electrically operated
2-stage
4-way servo valve

For **external** control electronics = **4WS2E**

With **integrated** control electronics = **4WSE2E**

Mechanical feedback = **M**

Mechanical and electrical feedback (only with integrated electronics) = **D**

Nominal size 16 = **16**

Series 20 to 29 = **2X**
(20 to 29: unchanged installation and connection dimensions)

Nominal flow ❶
At a valve pressure differential Δp = 70 bar
100 L/min = **100**
150 L/min = **150**
200 L/min = **200**
(the tolerance of the flow/signal function on page 9 has to be taken into account!)

Coil or control data ❷
Valves for **external** control electronics
Coil No. 12 (50 mA/85 Ω per coil) = **12**
Valves with **integrated** electronics
Control: Command value ± 10 mA/1 kΩ = **8**
Command value ± 10 V/≥ 50 kΩ = **9**

❸ **Pilot oil supply and drain**
ET = Internal supply and drain (standard)
T = External supply, internal drain

❹ **Input pressure range for the 1st stage**
210 = 10 to 210 bar
315 = 10 to 315 bar

Electrical connection
Valve for **external** control electronics:
K8 = **Without** plug-in connector with component plug for a 4-pin plug-in connector to VG 095 342
Valve with **integrated** control electronics:
K9 = **Without** plug-in connector with component plug for a 6-pin plug-in connector to E DIN 43 563-AM6-3
Plug-in connector – separate order

❺ **Spool overlap**
E = 0 to 0.5 % negative

❻ **V =** FKM seals

❼ Further details in clear text

❶ Nominal flow
The nominal flow refers to a 100 % command value signal at a 70 bar valve pressure differential (35 bar per control land). This valve pressure differential is to be considered as a reference value. Other values cause a change in the flow.
Please take into account a possible nominal flow tolerance of ± 10 % (see flow/load function on page 9).

❷ Electrical control data
Valves for **external** control electronics: The positioning signal must be generated by a current regulated output stage. See page 7 for servo amplifiers.
Valves with **integrated** control electronics: The command value can be applied as a voltage (ordering detail „9“) or for longer distances (> 25 m between the control and the valve) as a current (ordering detail „8“).

❸ Input pressure for the pilot control
The pilot pressure must be maintained as constant as possible. Therefore an external pilot control via port X is often advantageous.

The dynamic response of the valve may be influenced using a higher pressure at X than at P.

❹ Input pressure range
The system pressure must be maintained as constant as possible.

Pilot pressure range: 10 to 210 bar or 10 to 315 bar

With referance to the dynamics, within the permissible pressure range the frequency relationship must be taken into account.

❺ Spool overlap
The spool overlap in % refers to the control spool nominal stroke.

Other spool overlaps on request!

❻ Seal material
If other seal materials are required please consult us!

❼ Details in clear text
Special requirments are to be specified in clear text. After receipt of the order they will be checked by the factory and the type code will be completed with an associated number.

Test unit

Test unit (battery operated, optionally with a power supply) to catalogue sheet RE 29 681
Attention:
– Only for valves with external control electronics

Test unit for proportional and servo valves with integrated control electronics
Type VT-VET-1, series 1X to catalogue sheet RE 29 685.

The test unit is used for the control and functional testing of proportional and servo valves with integrated electronics. It is suitable for testing valves with an operating voltage of ± 15 V or 24 V.
The following operating modes are possible:
– External operation → Linking the operating voltage and the command value from the control cabinet to the valve
– Internal/external operation → Command value is applied by the test unit; the operating voltage via the control cabinet
– Internal operation → Operating voltage via a seperate power supply; the command value is applied by the test unit
– Command value is applied via a BNC socket → Optional operating voltage

Preferred types (readily available)

Valves for external control electronics, mechanical feedback

Material No.	Type 4WS2EM
00769978	4WS2EM 16-2X/100B12ET315K8EV
00716550	4WS2EM 16-2X/150B12ET315K8EV
00960575	4WS2EM 16-2X/200B12ET315K8EV

Valves with integrated control electronics, mechanical feedback

Material No	Type 4WSE2EM
00769976	4WSE2EM 16-2X/100B9ET315K9EV
00769980	4WSE2EM 16-2X/150B9ET315K9EV
00769981	4WSE2EM 16-2X/200B9ET315K9EV

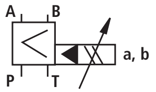
Valves with integrated control electronics, mechanical and electrical feedback

Material No.	Type 4WSE2ED
00769983	4WSE2ED 16-2X/100B9ET315K9EV
00769982	4WSE2ED 16-2X/150B9ET315K9EV
00769984	4WSE2ED 16-2X/200B9ET315K9EV

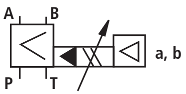
Symbols

Simplified

Valves for external control electronics

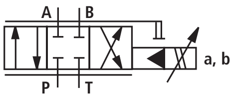


Valves with integrated control electronics

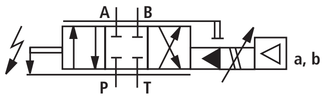


Detailed

Mechanical feedback



Electrical and mechanical feedback



6

Function, section

4WS(E)2EM 16-2X/...

The valve types 4WS(E)2EM... are electrically actuated, 2-stage servo directional valves with a porting pattern to DIN 24 340 form A16. They are primarily used for the closed loop control of position, force and velocity.

These valves comprise of an electro-mechanical convertor (torque motor) (1), a hydraulic amplifier (flapper jet principle) (2) and a control spool (3) in a sleeve (2nd stage), that is connected to the torque motor via a mechanical feedback.

Via an electrical input signal at the coils (4) of the torque motor, a force is generated via a permanent magnet at the armature (5) that, in conjunction with a torque tube, (6) generates a torque. Due to this the flapper plate (7), which is connected with the torque tube (6) via a rod, is moved out of the central position between the control orifices (8) a pressure differential now results which acts on the front face of the control spool. This pressure differential causes the spool to move, whereby the pressure connection is connected to an actuator connection and at the same time the other actuator connection is connected to the return connection.

The control spool is connected via a feedback spring (mechanical feedback) (9) to the flapper plate and torque motor. The control spool continues to change position until the torque feedback, via the feedback spring and the electro-magnetic torque of the torque motor are balanced, and the pressure differential at the flapper jet system becomes zero.

The stroke of the control spool and thus the flow through the pilot control valve is closed loop controlled in proportion to the electrical input signal. It has, however to be taken into account that the flow is dependent on the valve pressure differential.

External control electronics, type 4WS2EM 16-2X/...
(separate order)

External control electronics, (servo amplifier), are used to control the valve, they so amplifiy the analogue input signal (command value) that the controlled current output signal is capable of driving the valve.

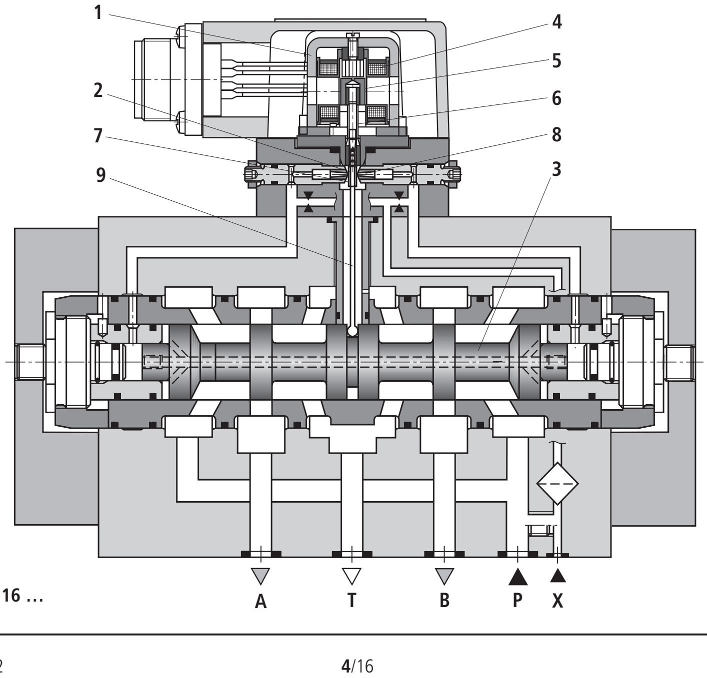
Integrated control electronics, types 4WSE2EM16-2X/... and 4WSE2ED 16-2X/...

For the amplification of the analogue input signal control electronics (10), which are specially matched to the valve, are integrated into the valve. They are built into the torque motor cover plate. The valve zero point can be adjusted by a potentiometer which is externally accessible.

4WSE2ED 16-2X/...

This type of valve is fitted with, in addition to the mechanical closed loop control via a feedback spring, an electrical spool position acquisition and control system. The spool position is obtained via an inductive position transducer (11). The position transducer signal is compared with the command value via the integrated control electronics (10). Any possible control deviation is electrically amplified and then passed onto the torque motor as a control signal. With the additional electrical feedback it is possible to obtain higher dynamic values in the small signal range than the purely mechanical version due to the electrical closed loop amplification. The mechanical feedback ensures that, in the case of failure of the electrical power supply, the spool is positioned in the zero range.

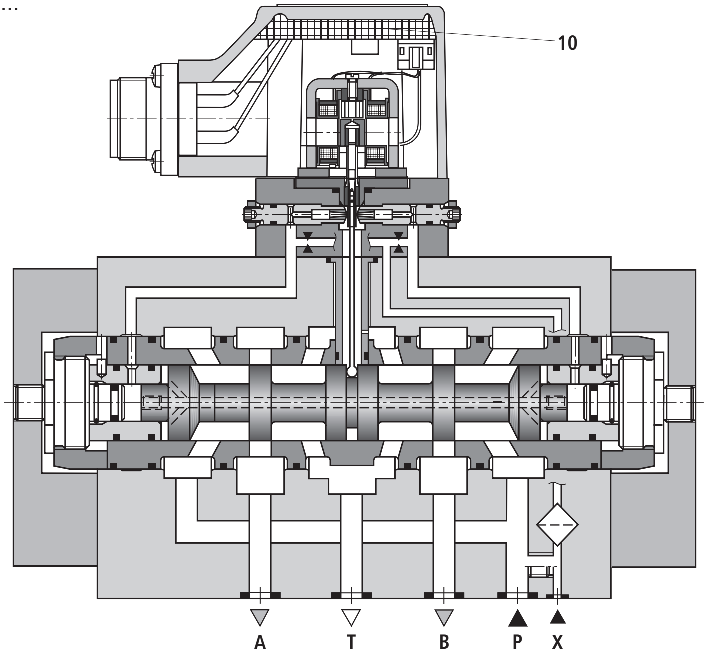
The valve is only available with integrated control electronics. The valve zero point can be adjusted by an externally accessible potentiometer.



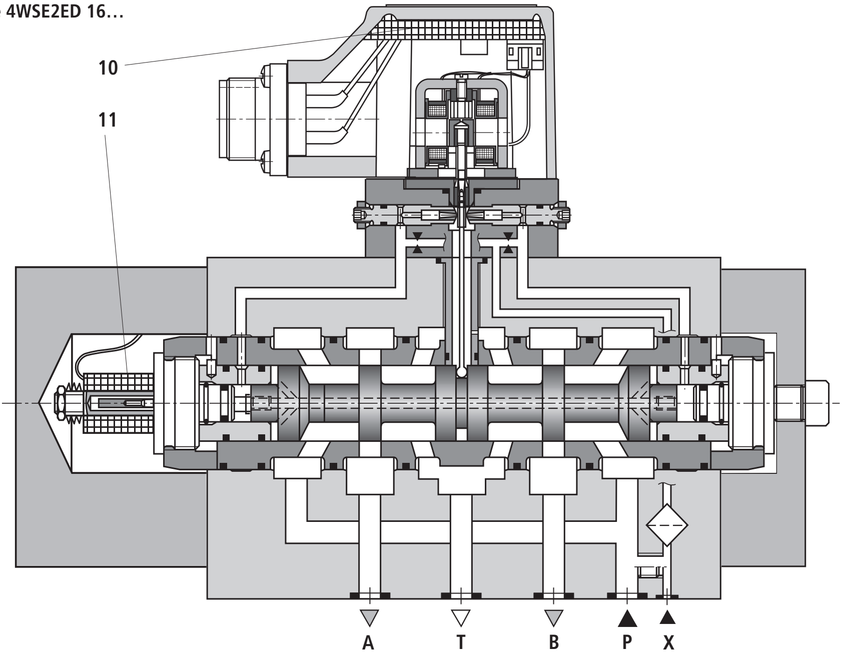
Type 4WS2EM 16 …

Section

Type 4WSE2EM 16…



Type 4WSE2ED 16…



Technical data (for applications outside these applications, please consult us!)

General

Porting pattern		DIN 24 340 form A16
Installation		Optional, it has however to be ensured that, when the system is started, the pilot control is supplied with an adequate pressure (≥ 10 bar)!
Storage temperature range	°C	–20 to +80
Ambient temperature range	°C	–30 to +70, valve for external control electronics
		–20 to +60, valve with integrated control electronics
Weight – With mechanical feedback	kg	10.0
Weight – With mechanical and electrical feedback and integrated control electronics	kg	11.0

Hydraulic (measured with a viscosity of $\nu = 32\ \text{mm}^2/\text{s}$ and $\vartheta = 40\ °\text{C}$)

Operating pressure (ports A, B, P, X)	bar	10 to 210 or 10 to 315		
Return pressure, port T	bar	Pressure peaks < 100, static < 10		
Pressure fluid		Mineral oil (HL, HLP) to DIN 51 524, other pressure fluids on request!		
Pressure fluid temperature range	°C	–20 to +80; preferably +40 to +50		
Viscosity range	mm^2/s	15 to 380; preferably 30 to 45		
Degree of contamination		Maximum permissible degree of contamination of the pressure fluid	A filter with a minimum retention rate of $\beta_X \geq 75$ is recommended without bypass valve and fitted as close as possible in front of the servo valve	
		Class 7	x = 5	
Zero flow $q_{V,L}$ [1] (spool overlap "E") measured without a dither signal	L/min	$\leq \sqrt{\frac{p}{70}} \bullet 3.5$ L/min [2]		
Nominal flow $q_{V\,nom} \pm 10\ \%$ [3] at a valve pressure differential $\Delta p = 70$ bar [4]	L/min	100	150	200
Pressure gain (spool overlap „E") at 1% change in stroke (starting from the hyd. zero point)	% von p	≥ 65	≥ 80	≥ 90
Control spool stroke	mm	0.6	0.9	1.2
Control spool area	mm^2	78		
Feedback system		Mechanical (M)	Mechanical and electrical (D)	
Hysteresis (dither optimised)	%	≤ 1.5	≤ 0.5	
Reversal range (dither optimised)	%	≤ 0.3	≤ 0.2	
Response sensitivity (dither optimised)	%	≤ 0.2	≤ 0.1	
Zero balance	in % von I_{nom}	≤ 3	≤ 2	
Zero offset at change in:				
Pressure fluid temperature	%/20 °K	≤ 1.5	≤ 1.2	
Ambient temperature	%/20 °K	≤ 1	≤ 0.5	
Operating pressure	%/100 bar	≤ 2	≤ 1	
Return pressure 0 to 10 % of p	%	≤ 1	≤ 0.5	

[1] $q_{V,L}$ = Zero flow in L/min
[2] p = Operating pressure in bar
[3] $q_{V\,nom}$ = Nominal flow (complete valve) in L/min
[4] Δp = Valve pressure differential in bar

Technical data (for applications outside these parameters, please consult us!)

Electrical

Feedback system		Mechanical (M)	Mechanical and electrical (D)
Valve protection to EN 60 529		IP65	
Signal type		Analogue	
Nominal current per coil	mA	50	–
Resistance per coil	Ω	85	–
Inductivity at 60 Hz and 100% nominal current: Series circuit	H	0.96	–
Parallel circuit	H	0.24	–
Recommended dither signal: f = 400 Hz		The amplitude value is dependent on the hydraulic system: a max. 5 % vom of the nominal current	

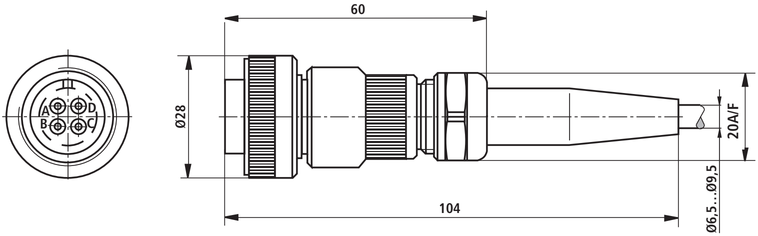
Electrical, external control electronics

Amplifier in (separate order) eurocard format	Type VT-SR2, to catalogue sheet RE 29 980

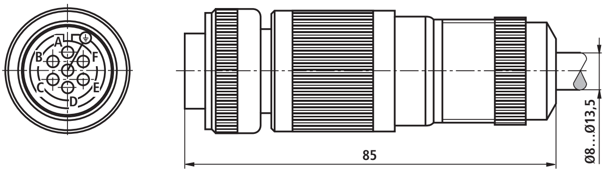
Note: For details regarding the **environmental simulation test** covering EMC (electro-magnetic compatibility), climate and mechanical loading see RE 29 591-U (declaration regarding environmental compatibility).

Plug-in connector

Plug-in connector version **K8** (external control electronics) to VG 095 342 – separate order under Material No. **00002460**



Plug-in connector version **K9** to E DIN 43 563-BF6-3/Pg11 separate order under Material No. **00223890** (metal version)



Coil electrical connections in the component plug (for valves with external control electronics)

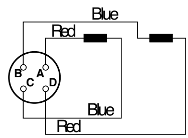
The electrical connections can be either in parallel or series. Due to operational safety considerations and the low spool inductivity, we recommend a parallel circuit.

Parallel circuit: In the plug connect contacts A with B and C with D.

Series circuit: In the plug connect contacts B with C.

Electrical control from A (+) to D (–) results in a flow direction from P to A and B to T. Reversed electrical control results in a flow direction of P to B and A to T.

4 WS 2 EM 16-2X/...

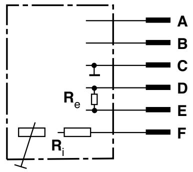


Connection cable:
4-core, 0.75 mm², screened (e.g. cable type LiYCY 4x0.75mm²)
Outside diameter 6.5 to 9.5 mm
Only connect the screen to the supply side.

6

Terminal connections 4 WSE2E .16. (valves with integrated control electronics)

Integrated control electronics



Zero point adjustment

	Terminal connections	Current input signal Control "**8**"	Voltage input signal Control "**9**"
Supply voltage (± 3 %)	A	+ 15 V	+ 15 V
	B	– 15 V	– 15 V
	C	⊥	⊥
Command value	D E	± 10 mA; R_e = 1 kΩ	± 10 V R_e ≥ 50 kΩ
Measuring output for the control spool	F [1]	Nom. stroke corresponds to approx. ± 10 V with respect to ⊥ ; R_i = 1 kΩ	

Current consumption at plug terminal	A B	Max. 150 mA	Max. 150 mA
	D E	± 10 mA	≤ 0.2 mA

[1] For valves without electrical feedback terminal F is not connected.

Supply voltage: ± 15 V ± 3 %, residual ripple < 1 %

Command value: A command value at plug connection D = negative with respect to the plug connection E results in a flow from P to B and A to T.

Measurement output F has a negative signal with respect to ⊥ .

A command value at plug connection D = positive with respect to the plug connection E results in a flow from P to A and B to T.

Measurement output F has a positive signal with respect to ⊥ .

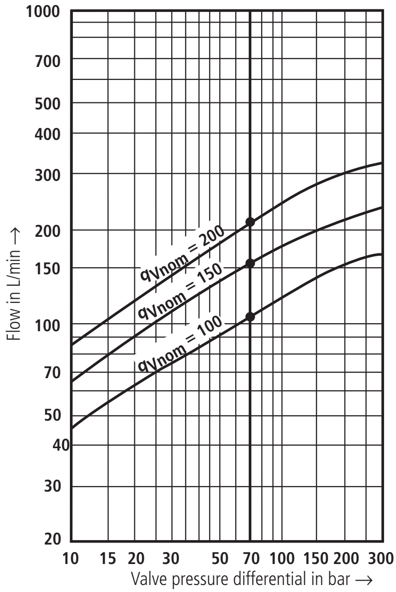
Measurement output: The voltage signal U_F is proportional to the spool stroke.

Note: **Electrical signals (e. g. actual value) taken via valve electronics must not be used to switch off the machine safety functions!**

(Also see European standard "Safety requirements of fluid technology systems and components – hydraulics", prEN 982 !)

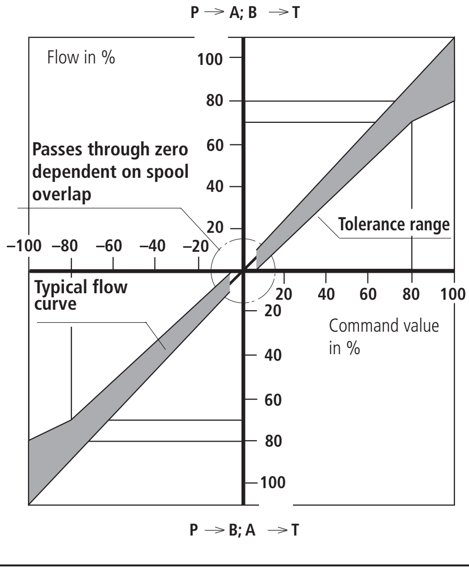
Characteristic curves (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

Flow/load function (tolerance ± 10 %)
at 100 % command value signal



Δp = Valve pressure differential (input pressure minus the return pressure and minus the load pressure)

Tolerance range of flow/signal function
at constant valve pressue differential



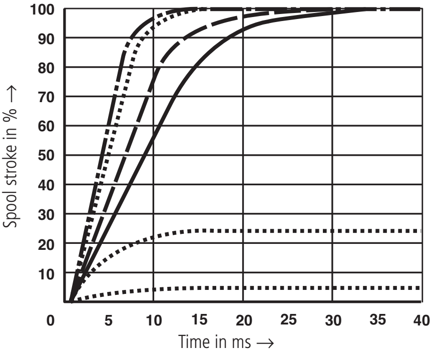
6

Characteristic curves: type 4WS.2EM 16 (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

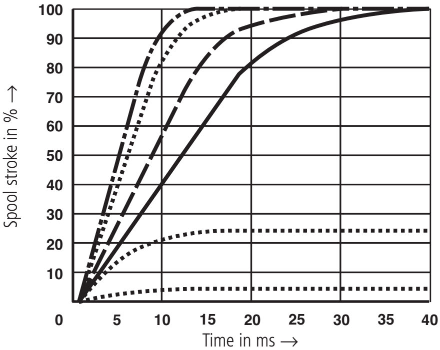
Transient function with a 315 bar pressure stage

Stop response without flow

Nominal flow **100 L/min**



Nominal flow **150 L/min**

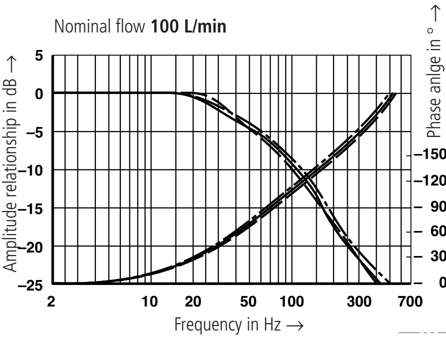


40 bar — 70 bar — 140 bar — 210 and 315 bar

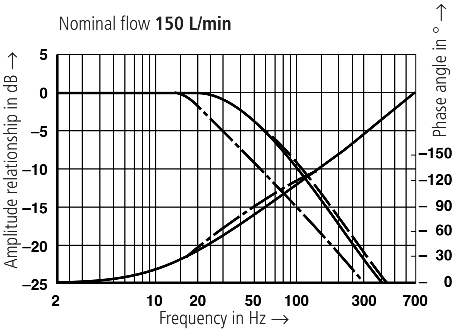
Frequency response with a 315 bar pressure stage, *p* = 315 bar

Stroke frequency response without flow

Nominal flow **100 L/min**



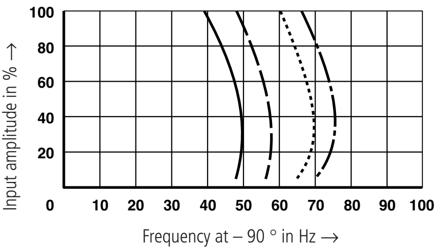
Nominal flow **150 L/min**



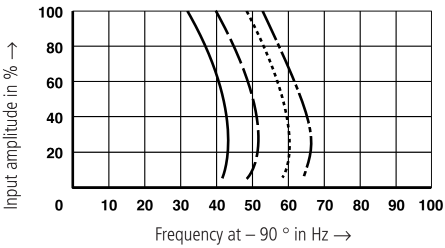
5 % — 25 % — 100 %

Relationship of the corner frequency to the operating pressure *p*

Nominal flow **100 L/min**



Nominal flow **150 L/min**

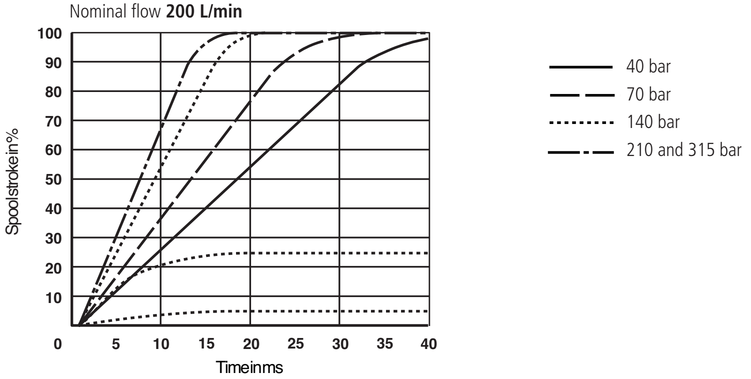


40 bar — 70 bar — 140 bar — 210 and 315 bar

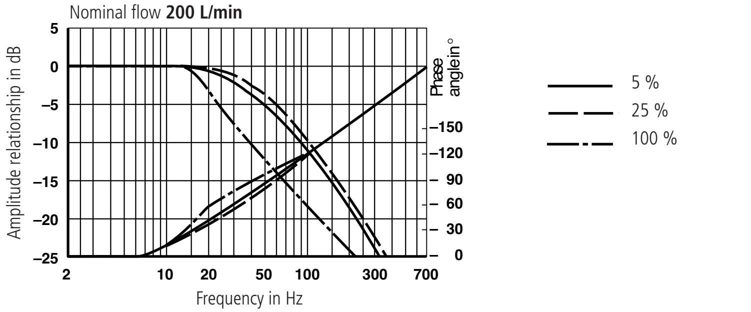
Output signal ≙ spool stroke without flow

Characteristic curves: type 4WS.2EM 16 (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

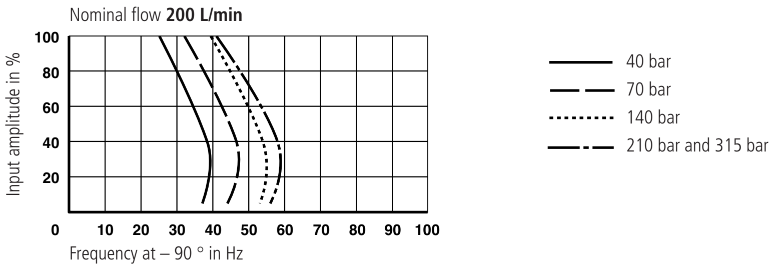
Transient function with a 315 bar pressure stage Step response without flow



Frequency response with a 315 bar pressure stage, *p* = 315 bar Stroke requency response without flow



Relationship of the corner frequency to the operating pressure *p*



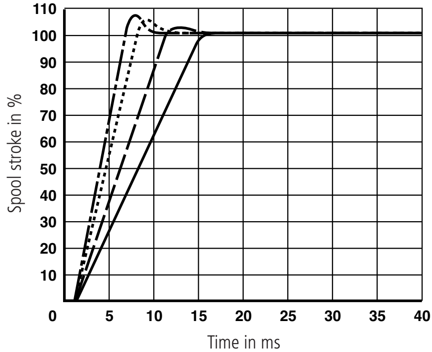
Output signal ≙ spool stroke without flow

6

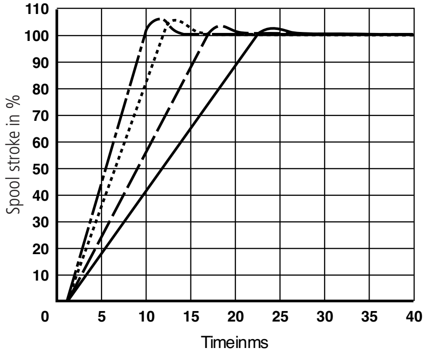
Characteristic curves: type 4WSE2ED 16 (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

Transient function with a 315 bar pressure stage Step response without flow

Nominal flow **100 L/min**



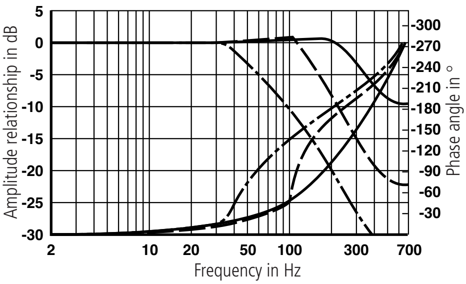
Nominal flow **150 L/min**



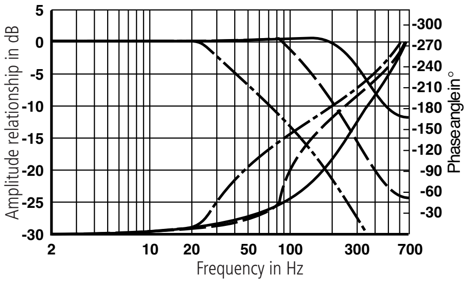
40 bar — 70 bar — 140 bar — 210 bar and 315 bar

Frequency response with a 315 bar pressure stage, *p* = 315 bar Stroke requency response without flow

Nominal flow **100 L/min**



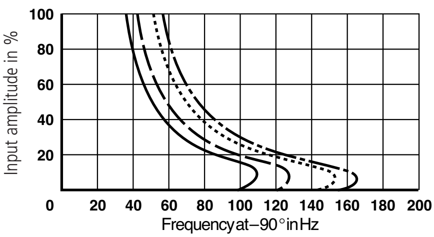
Nominal flow **150 L/min**



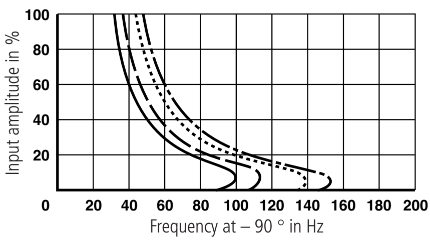
5 % — 25 % — 100 %

Relationship of the corner frequency to the operating pressure *p*

Nominal flow **100 L/min**



Nominal flow **150 L/min**

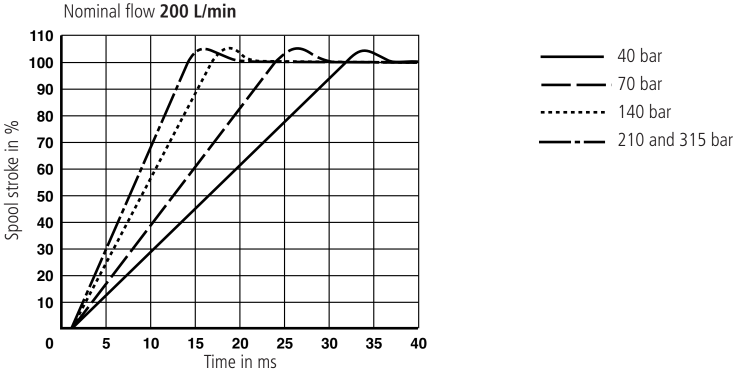


40 bar — 70 bar — 140 bar — 210 bar and 315 bar

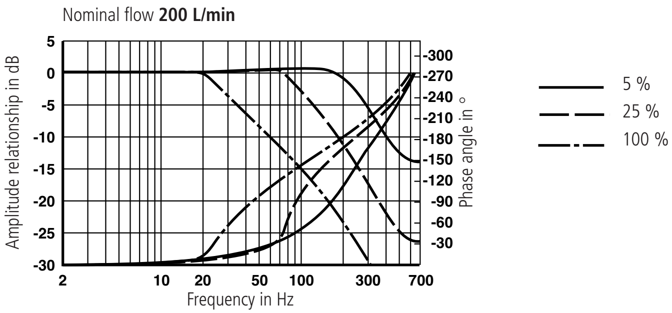
Output signal ≙ spool stroke without flow

Characteristic curves: type 4WSE2ED 16 (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

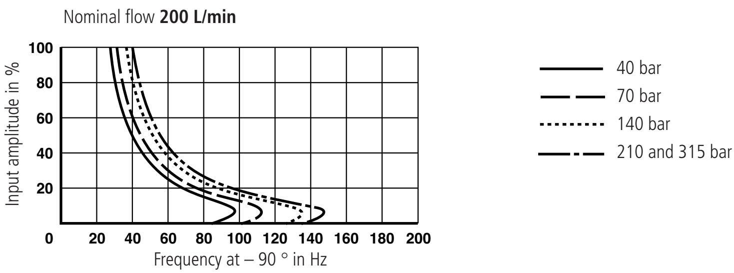
Transient function with a 315 bar pressure stage Step response without flow



Frequency response with a 315 bar pressure stage, *p* = 315 bar Stroke frequency response without flow



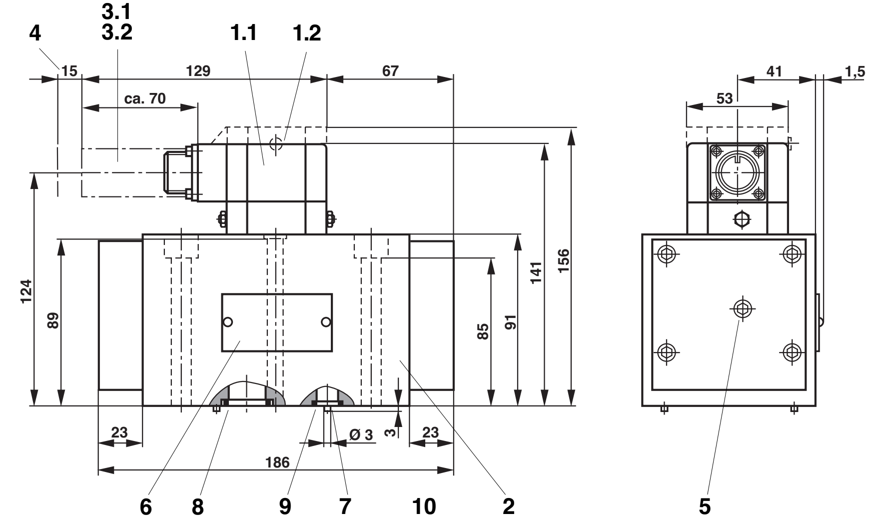
Relationship of the corner frequency to the operating pressure *p*

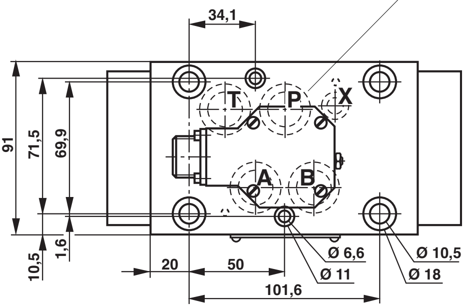


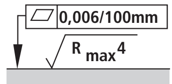
Output signal ≙ spool stroke without flow

6

Unit dimensions: type 4WS.2EM 16 (dimensions in mm)







Required surface finish of the mating piece

1.1 Pilot control (1st stage) **without** integrated control electronics (4 WS 2 EM 16)

1.2 Pilot control (1st stage) **with** integrated control electronics (4 WSE 2 EM 16)
Electrical zero point setting:
Having removed the plug (2.5A/F) the zero point may be corrected via the potentiometer.

2 2nd stage

3.1 **Without integrated electronics:**
4-pin plug-in connector compatible with VG 095 342

3.2 **With integrated electronics:**
6-pin plug-in connector compatible with VG 095 342

4 Space required to remove the plug-in connector, take the connection cable into account!

5 For setting the hydraulic zero point on both sides 5A/F internal hexagon

6 Name plate

7 Locating pin (2 off)

8 Identical seal rings for ports A, B, P and T

9 Seal ring for port X

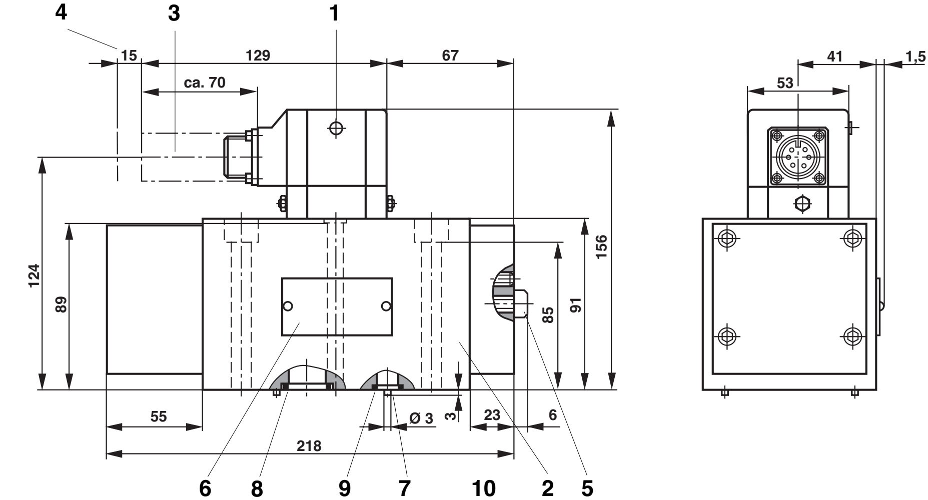
10 Porting pattern to DIN 24 340, form A 16

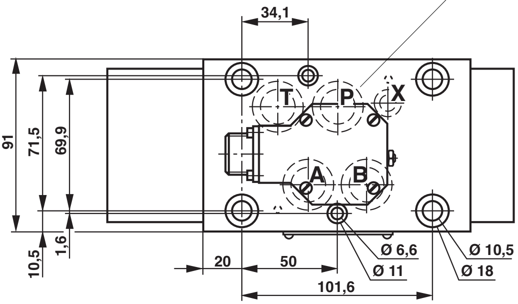
Subplates G 172/01 (G 3/4)
G 174/01 (G 1); G 174/08 (flange)
to catalogue sheet RE 45 056 must be ordered separately.

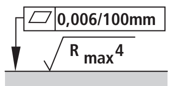
Valve fixing screws are included within the scope of supply.

4 off M10 x 100 DIN 912-10.9; M_A = 75 Nm
2 off M6 x 100 DIN 912-10.9; M_A = 15.5 Nm

Unit dimensions: type 4WSE2ED 16 (dimensions in mm)







Required surface finish of the mating piece

1 Pilot control (1st stage) with integrated control electronics
Electrical zero point setting:
Having removed the plug (2.5A/F) the zero pont may be corrected via the potentiometer.

2 2nd stage

3 6-pin plug-in connector compatible to VG 095 342

4 Space required to remove the plug-in connector, take the connection cable into account!

5 Setting of hydraulic zero point via two screws 5A/F and 3A/F internal hexagon

6 Name plate

7 Locating pin (2 off)

8 Identical seal rings for ports A, B, P and T

9 Seal ring for port X

10 Porting pattern to DIN 24 340, form A 16

Subplates G 172/01 (G 3/4)
G 174/01 (G 1); G 174/08 (flange)
to catalogue sheet RE 45 056 must be ordered separately.

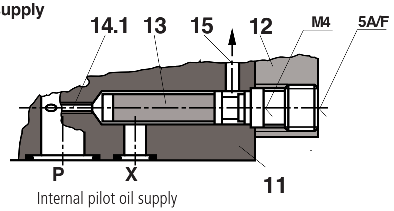
Valve fixing screws are included within the scope of supply.

4 off M10 x 100 DIN 912-10.9; M_A = 75 Nm
2 off M6 x 100 DIN 912-10.9; M_A = 15.5 Nm

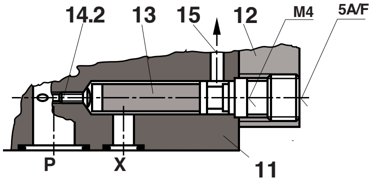
6

Pilot oil supply (pilot oil drain usually internal)

Pilot oil supply



Internal pilot oil supply
(version **"ET"**)



External pilot oil supply
(version **"T"**)

11 Main valve

12 Cover

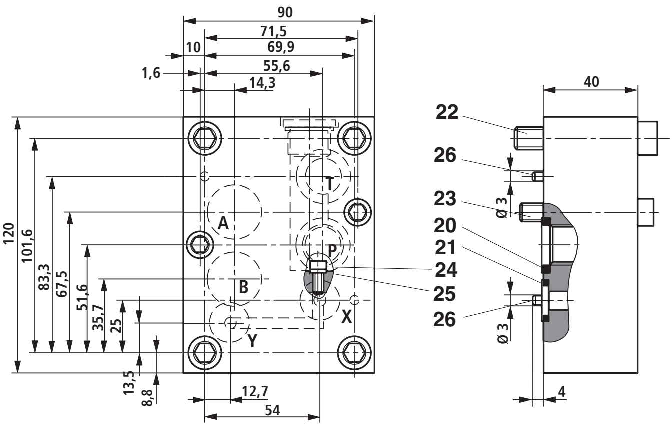
13 Filter
Material No. **00649157**

14.1 Open

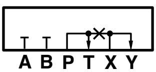
14.2 Closed
plug M6 x 10 DIN 906

15 For 1st stage

Flushing plate (dimensions in mm)



Symbol



With NBR seals
Material No. 00308493

20 Identical seal rings for ports A, B, P, T

21 Identical seal rings for ports X, Y

22 4 off S.H.C.S. M10 x 50 DIN 912–8.8
(are included within the scope supply); M_A = 51 Nm

23 2 off S.H.C.S. M6 x 50 DIN 912–8.8
(are included within the scope supply); M_A = 10,4 Nm

24 1 off S.H.C.S. M6 x 10 DIN 912–8.8
(are included within the scope supply)

25 Seal ring

26 Locating pin (2 off)

In order to ensure that the servo valves functions correctly it is always necessary to flush the system before commissioning
As a guideline for the flushing time per system the following may be used:

$$\boxed{t \geq \frac{V}{q_V} \cdot 5}$$

t = Flushing time in hours
V = Tank contents in litres
q_V = Pump flow in litres per minute

If the tank is subsequently filled with more than 10 % of the tank contents then the flushing process must be repeated.

A directional valve with a porting pattern to DIN 24 340 form A 16 is more suitable than a flushing plate. The actuator lines can also be flushed using this valve.

Bosch Rexroth AG
Industrial Hydraulics
D-97813 Lohr am Main
Zum Eisengießer 1 • D-97816 Lohr am Main
Telefon 0 93 52 / 18-0
Telefax 0 93 52 / 18-23 58 • Telex 6 89 418-0
eMail documentation@boschrexroth.de
Internet www.boschrexroth.de

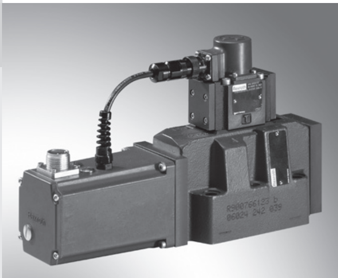
Bosch Rexroth Limited
Cromwell Road, St Neots,
Cambs, PE19 2ES
Tel: 0 14 80/22 32 56
Fax: 0 14 80/21 90 52
E-mail: info@boschrexroth.co.uk

Directional servo-valve in 4-way version

RE 29620/03.12
Replaces: 04.08

Type 4WSE3E 16

Size 16
Component series 2X
Maximum operating pressure 350 bar
Maximum flow 570 l/min



H7359

Table of contents

Information on available spare parts:
www.boschrexroth.com/spc

Features

- Valve for position, force, pressure or velocity control
- 3-stage servo-valve with electrical position control of the control spool of the 3rd stage, position sensing of the control spool by means of an inductive position transducer
- High dynamics 2-stage pilot control valve of size 6
- 1st stage as nozzle flapper plate amplifier
- Filter for 1st stage externally accessible and replaceable
- Subplate mounting:
  Porting pattern according to ISO 4401
- Can also be used as 3-way version
- Valve and integrated control electronics are adjusted and tested in the factory
- Optimized valve control loop
- High response sensitivity, very low hysteresis and zero point drift
- Internal or external pilot oil supply and return
- Gap seals at pressure chambers of the control sleeve, no wear of O-ring

Ordering code

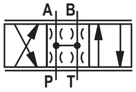
4WSE3E	16				– 2X /			/	K31		*

3-stage servo-valve

Size

Size 16 **= 16**

Control spool symbol 1)



= V
= V1

Control spool position in de-energized state

Not defined **= no code**
100 % P → A / B → T **= P**

Rated flow 2)

105 l/min **= 100**
150 l/min **= 150**
200 l/min **= 200**
260 l/min **= 300**

Control spool overlap 3)

0 to 0.5 % positive **= D**
0 to 0.5 % negative **= E**

Component series 20 to 29 **= 2X**
(20 to 29: Unchanged installation and connection dimensions)

Seal material 4)

FKM seals **= V**
NBR seals **= M**

Pilot flow 5)

XY = Pilot oil supply external, return external
XT = Pilot oil supply external, return internal
PY = Pilot oil supply internal, return external
PT = Pilot oil supply internal, return internal

Pressure rating 6)

7 = 210 bar
9 = 315 bar

Supply voltage

15 = ±15 V
24 = +24 V
See page 6

Electrical connection

K31 = 6+PE
Without mating connector

Electronics interface command/actual value

A1 = 0 to 10 V
C1 = 0 to 10 mA
F1* = 4 to 20 mA

Further details in the plain text

* Only with +24 V supply voltage

1) **Control spool symbols**
with control spool symbol V
P → A: $q_{V\,max}$ B → T: $q_{V\,max}$
P → B: $q_{V\,max}$ A → T: $q_{V\,max}$
with control spool symbol V1
P → A: $q_{V\,max}$ B → T: $q_V / 2$
P → B: $q_V / 2$ A → T: $q_{V\,max}$

2) **Rated flow**
The rated flow refers to a 100 % command value signal at 70 bar valve pressure differential (35 bar per control edge). The valve pressure differential must be regarded as reference. Other values result in the flow being changed.
A possible rated flow tolerance of ±10 % and a saturation influence must be taken into account (see flow/signal function page 8).

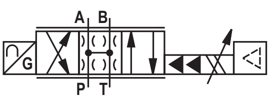
3) **Control spool overlap**
The control spool overlap in % is referred to the nominal stroke of the control spool.
(Other control spool overlaps upon request.)

4) **Seal material**
See notices on page 5

5) **Pilot oil**
Care should be taken that the pilot pressure is as constant as possible. An external pilot control via port X is thus often advantageous.

6) **Inlet pressure range**
Care should be taken that the inlet pressure is as constant as possible. Minimum control pressure ≥ 10 bar.
Up to a pilot pressure of 210 bar, pressure rating 7 is to be selected. From a pilot pressure greater than 210 bar, pressure rating 9 is to be selected.
With regard to the dynamics, the frequency response dependency must be observed within the admissible pressure range.
At an inlet pressure > 40 bar, the control pressure must not be less than 60 % of the inlet pressure as otherwise the current forces at the control spool of the 3rd stage will impair the controllability.
At an inlet pressure ≤ 40 bar working with a control pressure above port X (external supply) is in any case advantageous.

Symbol



Function, section

The valves of type 4WSE3E 16 are electrically operated, 3-stage directional servo-valves. They are mainly used for position, force or pressure and velocity controls.

These valves consist of a 2-stage pilot control valve of type 4WS2EM 6 (1), a main stage with a main control spool in a sleeve (2), an inductive position transducer (3), and the integrated control electronics (4).

The pilot control valve (1) consists of an electro-mechanical transformer (torque motor), a hydraulic amplifier (nozzle flapper plate principle) and a pilot control spool in a sleeve, which is connected to the torque motor via a mechanical feedback.

Electric currents in the coils of the torque motor generate a force by means of a permanent magnet which acts on the armature, and in connection with a torque tube results in a torque. This causes the flapper plate which is connected to the torque tube via a pin to move from the central position between the two control nozzles, and a pressure differential is created across the front sides of the pilot control spool. The pressure differential results in the control spool changing its position, which results in the pressure port being connected to one actuator port and, at the same time, the other actuator port being connected to the return flow port.

The pilot control spool is connected to the flapper plate or the torque motor by means of a bending spring (mechanical feedback).

The position of the control spool is changed until the flapper plate position and hence the pressure differential across the nozzle flapper plate system becomes zero due to the feedback torque, which acts via the bending spring against the electro-magnetic torque of the torque motor.

In doing so, the stroke of the pilot control spool and hence the flow of the pilot control valve is controlled proportionally to the electrical input signal (see data sheet 29564).

In the main stage, the main control spool (2) is operated by the pilot control valve and its position is sensed by an inductive position transducer (3). The position transducer signal is compared to the command value by integrated control electronics (4). Any possible control deviation is amplified electrically and fed to the pilot control valve as control signal. The pilot control valve starts to move and the main control spool is re-positioned.

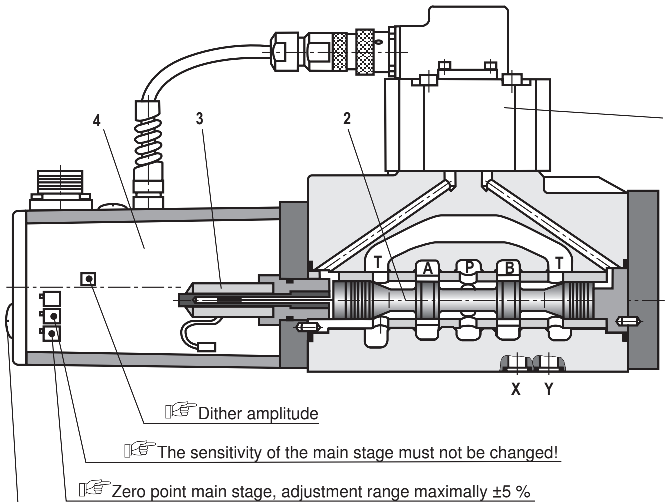
The stroke of the main control spool and consequently the flow of the servo-valve are controlled in proportion to the command value. It must be noted that the flow depends on the valve pressure differential.

The valve zero point can be adjusted by means of an externally accessible potentiometer.

The valves are factory-set with a dither default setting with the constant frequency of 400 Hz.

☞ **Notice!**

Changes in the zero point and/or the dither amplitude may result in damage to the system and may only be implemented by instructed specialists.



The pilot control valve may only be maintained by Bosch Rexroth employees. An exception to this is the replacement of the filter element – see data sheet 29564.

Technical data (For applications outside these parameters, please consult us!)

general

Weight	kg	9.5
Installation position		Any, if it is ensured that the pilot control is supplied with sufficient pressure (> 10 bar) during start-up of the system. In case of insufficient pressure supply, the control spool of the servo-valve can take any position. This may result in channel P being connected to the actuator and the build-up of pressure being delayed. This may be prevented by providing an external pressure supply at port X.
Storage temperature range	°C	–20 to +80
Ambient temperature range	°C	–20 to +60

hydraulic (measured with HLP 32, ϑ_{Oil} = 40 °C ± 5 °C)

Maximum operating pressure	Pilot control stage, pilot oil supply X		bar	10 to 210 and/or 10 to 315 (see page 2, pressure rating)
	Main valve, port P, A, B	Pilot oil supply internal	bar	315
	Main valve, port P, A, B	Pilot oil supply external	bar	350
Maximum return flow pressure	Pilot control stage, port Y		bar	Pressure peaks < 100 admissible, static < 10
	Main valve, port T	Pilot oil return internal	bar	Pressure peaks < 100 admissible, static < 10
		Pilot oil return external	bar	250
Zero flow				See page 9 (characteristic curves)
Rated flow $\boldsymbol{q}_{Vnom}$ ±10 % with $\boldsymbol{\Delta p}$ = 70 bar			l/min	105, 150, 200, 260
Hydraulic fluid				See table page 5
Hydraulic fluid temperature range			°C	–20 to +80; preferably +40 to +50
Viscosity range			mm²/s	15 to 380; preferably 30 to 45
Maximum admissible degree of contamination of the hydraulic fluid cleanliness class according to ISO 4406 (c)			Pilot control valve	Class 18/16/13 [1]
			Main stage	Class 20/18/15 [1]
Hysteresis			%	≤ 0.10
Range of inversion			%	≤ 0.05
Response sensitivity			%	≤ 0.05
Pressure gain				≥ 90 % of $\boldsymbol{p}_P$ [2] with 1 % change in the control spool stroke (from hydraulic zero point)
Zero shift upon change of:	Hydraulic fluid temperature		% / 10 K	≤ 0.3
	Ambient temperature		% / 10 K	≤ 0.3
	Operating pressure		% / 100 bar	≤ 0.3
	Return flow pressure 0 to 10 % of $\boldsymbol{p}_P$		% / 100 bar	≤ 0.3

[1] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components.
For the selection of the filters see www.boschrexroth.com/filter

[2] $\boldsymbol{p}_P$ = Inlet pressure/operating pressure

☞ **Notice!**
For information on the **environment simulation testing** for the areas EMC (electromagnetic compatibility), climate and mechanical load, see data sheet 29620-U.

Technical data (For applications outside these parameters, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons		HL, HLP	NBR, FKM	DIN 51524
Flame-resistant	– containing water	HFC Fuchs Hydrotherm 46M Petrofer Ultra Safe 620	NBR	ISO 12922

☞ **Important information on hydraulic fluids!**

- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!
- **Flame-resistant – containing water**:
  Maximum pressure differential per control edge 210 bar, otherwise, increased cavitation erosion!
  Tank pre-loading < 1 bar or > 20 % of the pressure differential of the tank edge. The pressure peaks should not exceed the maximum operating pressures!
  Maximum fluid temperature 60 °C

Technical data (For applications outside these parameters, please consult us!)

electric

Protection class according to EN 60529	IP 65 with mating connector mounted and locked
Type of signal	Analog

Electronics interface		**A1**	**C1**	**F1**
	Pin			
Current consumption at the mating connector	A	< ±150 mA with ±15 V < 200 mA with 24 V		< 200 mA with 24 V
	B			
	D	0 to ±0.05 mA	0 to ±10 mA	4 to 20 mA
	E			

Device connector allocation	**Pin**	**Supply voltage 15**		**Supply voltage 24**		
Interface		A1	C1	A1	C1	F1
Supply voltage	A	+15 VDC		+24 VDC		
	B	–15 VDC		0 VDC		
M0	C	0 VDC / reference to pins A, B		Not used		
Differential command value input	D E	0 to ±10 V R_e >100 kΩ	0 to ±10 mA R_e = 100 Ω	0 to ±10 V R_e >100 kΩ	0 to ±10 mA R_e = 100 Ω	4 to 20 mA R_e = 100 Ω
Actual value Reference with +24 V is pin B Reference with ±15 V is pin C	F	0 to ±10 V R_i ≈ 1 kΩ	0 to ±10 mA Load max. 1 kΩ	0 to ±10 V R_i ≈ 1 kΩ	0 to ±10 mA Load max. 1 kΩ	4 to 20 mA Load max. 500 Ω
Protective earth	PE	Connected to valve housing				

☞ **One end of the shield must be connected to the control!**

Supply voltage: ±15 V ±3 %, residual ripple < 1 %
+24 VDC / 18 V to 35 V; full bridge rectification with smoothing capacitor
2200 µF = I_{max} = 230 mA

Command value: **A1, C1:**
Reference potential at E and positive command value at D result in flow from P → A and B → T.
Reference potential at E and negative command value at D result in flow from P → B and A → T.
F1:
Reference potential at E and signal 12 to 20 mA at D result in flow from P → A and B → T.
Reference potential at E and signal 12 to 4 mA at D result in flow from P → B and A → T.

Actual value / measuring output: The voltage / current signal is proportional to the control spool stroke and has the same sign as the command value.

Connection cable: Recommendation: – up to 25 m line length: Type LiYCY 7 x 0.75 mm^2
– up to 50 m line length: Type LiYCY 7 x 1.0 mm^2
Only connect the shield to ⊥ on the supply side.

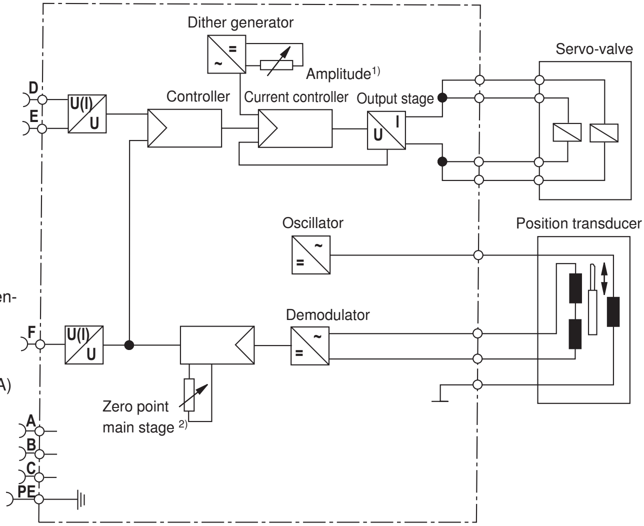
Notice: **Electric signals taken out via valve electronics (e.g. actual value) must not be used for switching off safety-relevant machine functions!**

Block diagram of the integrated electronics (OBE)

Interface | Integrated electronics (OBE) | Valve

Differential command value input
±10 V or ±10 mA or 4 to 20 mA

Actual value ±10 V / ±10 mA
(measuring output F has positive potential against ⊥ with flow P → A)
Actual value 4 to 20 mA
(measuring output F is larger than 12 mA against ⊥ with flow P → A)



Supply voltage

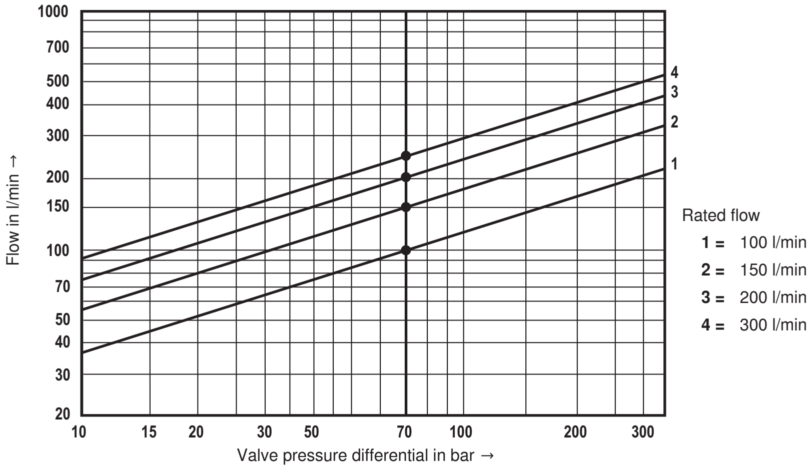
	±15 V	24 V
A	+15 V	18 V to 35 V
B	–15 V	0 V
C	⊥ M0	n.c.

1) 2)

☞ **Changes in the zero point and/or the dither amplitude may result in damage to the system and may only be implemented by instructed specialists.**

Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

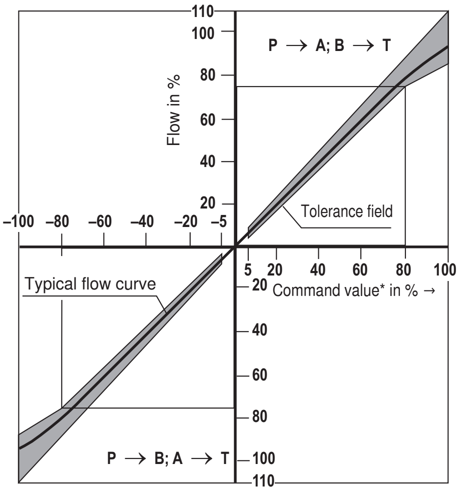
Flow/load function (tolerance ±10 %) with 100 % command value signal



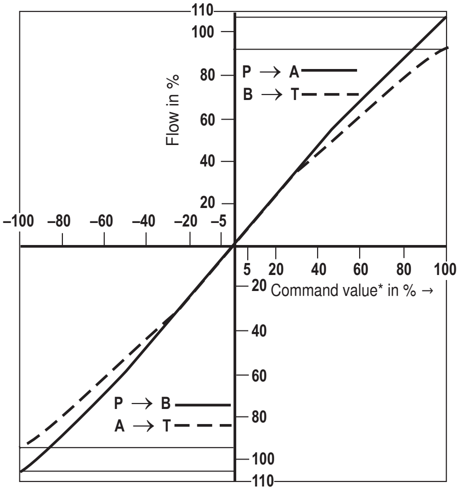
Δp = Valve pressure differential (inlet pressure $\boldsymbol{p}_P$ minus load pressure $\boldsymbol{p}_L$ minus return flow pressure $\boldsymbol{p}_T$)

Tolerance field of the flow/signal function at constant valve pressure differential

Summated edge $\boldsymbol{\Delta p}_V$ = 70 bar



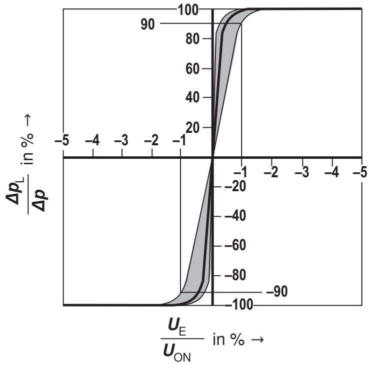
Single edge $\boldsymbol{\Delta p}_V$ = 35 bar (tolerance ±5 %)



* With interface F1, the negative command value axis corresponds to 4 to 12 mA, the positive command value axis to 12 to 20 mA

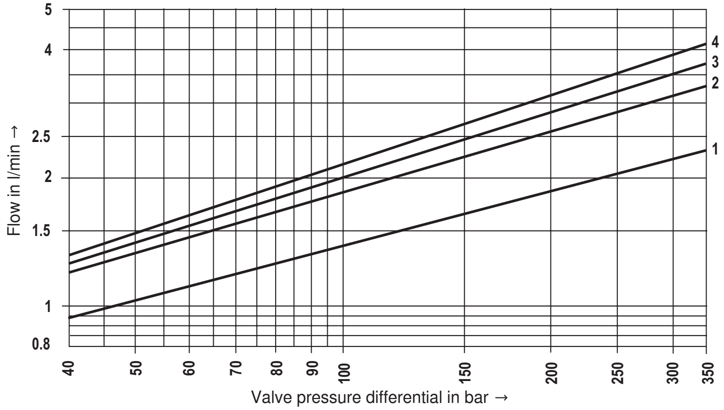
Characteristic curves (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

Pressure signal characteristic curve



Measured at
280 bar operating pressure

Zero flow total with "D" overlap (pilot control valve and main stage)
Tolerance ±20 %



1 = 100 l/min
2 = 150 l/min
3 = 200 l/min
4 = 300 l/min

Zero flow Data valid for overlap "E"	Pilot control valve L1	l/min	$\leq \sqrt{\frac{p_P}{70\text{ bar}}} \cdot 0.5$
	Overall valve q_V	l/min	$\leq \sqrt{\frac{p_P}{70\text{ bar}}} \cdot 0.015 \cdot q_{Vnom}$

q_{Vnom} Rated flow (overall valve) in l/min
105, 150, 200, 260

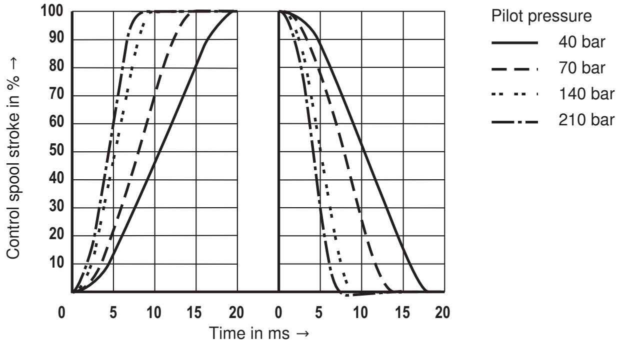
p_P Operating pressure in bar

Δp Valve pressure differential in bar

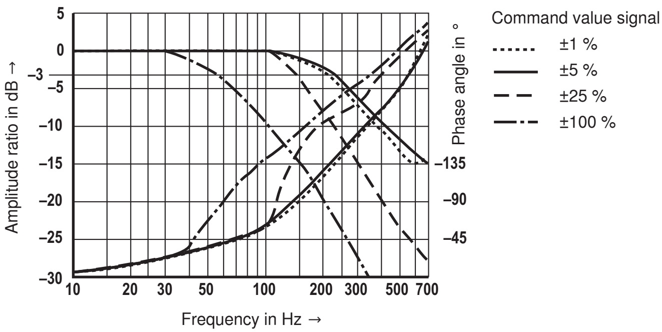
q_V 100, 150, 200, 300 l/min

Characteristic curves (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

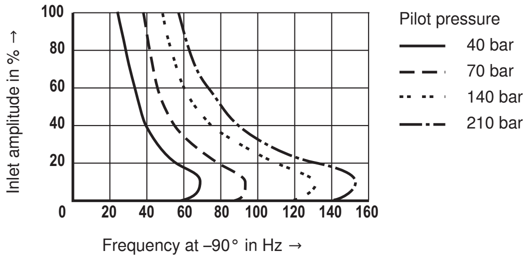
Transition function – measured with 210 bar pressure rating



Frequency response at p_P = 210 bar – measured with 210 bar pressure rating

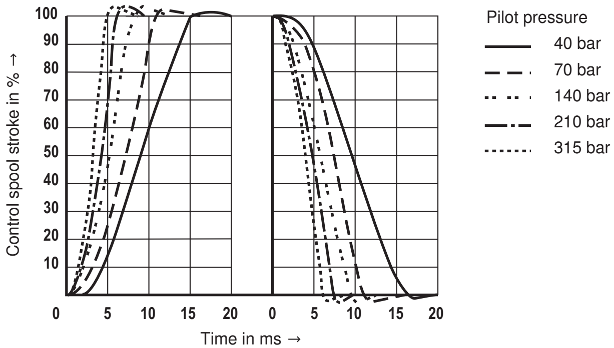


Dependence of the –90° frequency on the pilot pressure – measured with 210 bar pressure rating

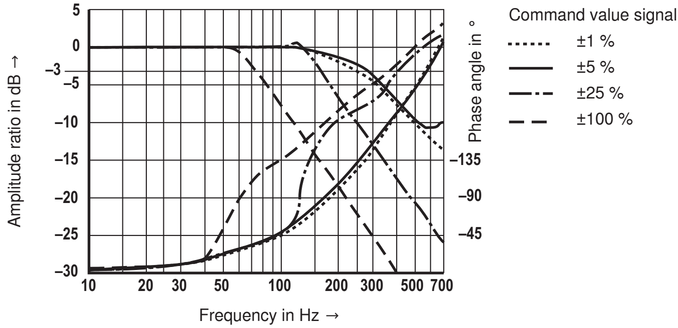


Characteristic curves (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

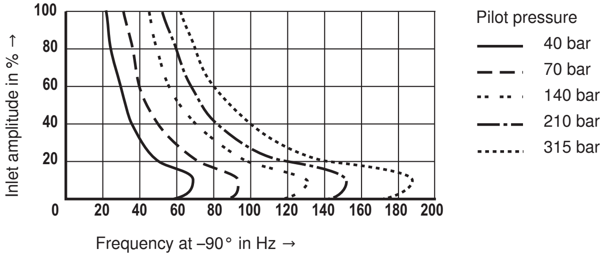
Transition function – measured with 315 bar pressure rating



Frequency response at p_P = 315 bar – measured with 315 bar pressure rating

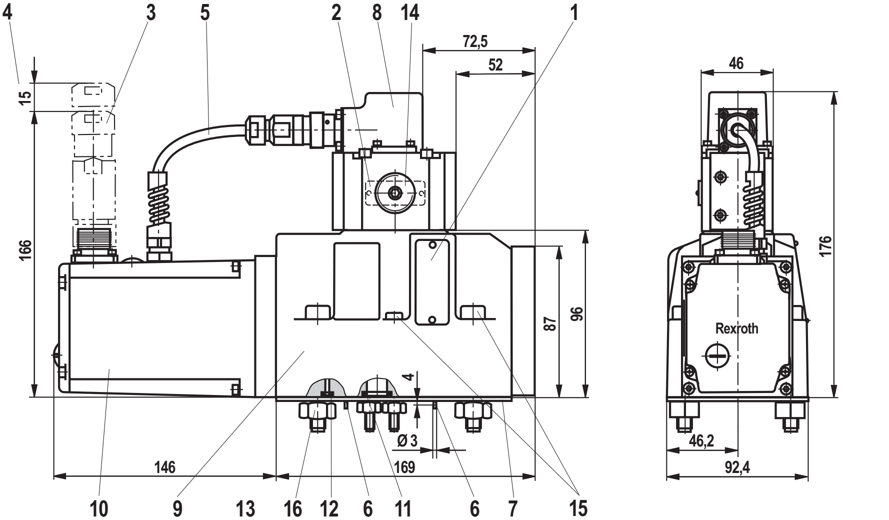


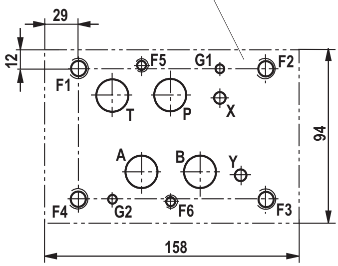
Dependence of the –90° frequency on the pilot pressure – measured with 315 bar pressure rating

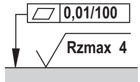


Output signal corresponds to control spool stroke without flow

Unit dimensions: Type 4WSE3E 16 (dimensions in mm)







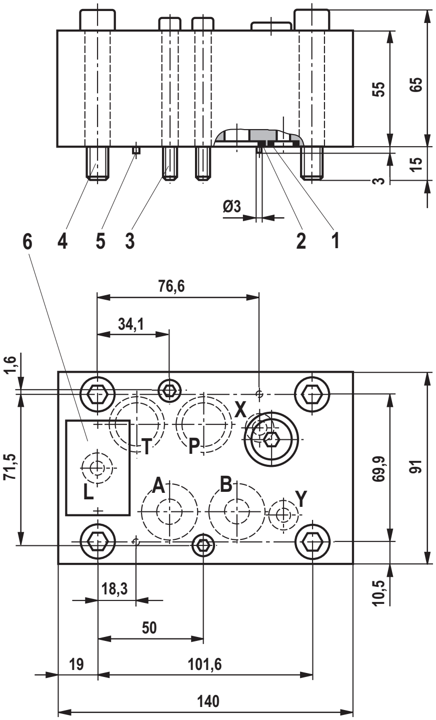
Required surface quality of the valve mounting face

1 Name plate – overall valve
2 Name plate – pilot control valve
3 Mating connector according to EN 175201-804, separate order, see page 13
4 Space required to remove the mating connector, take connection cable into account!
5 PVC cable not resistant when in contact with HFD-R fluid
6 Locating pin (2 units) G1 and G2
7 Cover plate (for transport only)
8 Pilot control valve (2-stage)
9 Main stage (3rd stage)
10 Integrated control electronics
11 Identical seal rings for ports A, B, P, and T
12 Identical seal rings for ports X and Y
The ports X and Y are also pressurized in the case of "internal" pilot oil supply
13 Machined valve mounting face, porting pattern according to ISO 4401-07-07-0-05
14 Exchangeable filter element with seal, material no. **R961000194**
15 Valve mounting screws
16 Hexagon nuts (for transport only)

Hexagon socket head cap screws (included in the delivery)		**Material number**
Size 16	2x ISO 4762 - M6 x 60 - 10.9-flZn-240h-L Tightening torque M_A = 12.5 Nm ±10 %	R913000115
	4x ISO 4762 - M10 x 60 - 10.9-flZn-240h-L Tightening torque M_A = 58 Nm ±10 %	R913000116

Notice: The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure!

Flushing plate with porting pattern according to ISO 4401-07-07-0-05 (dimensions in mm)



1 R-ring 10 x 2 x 2 (L, X, Y) included in scope of delivery

2 R-ring 22.53 x 2.30 x 2.62 (P, T, A, B) included in scope of delivery

3 2 hexagon socket head cap screws (included in the scope of delivery)
ISO4762-M6x70-10.9flZn-240h-L
(friction coefficient 0.09 to 0.14 according to VDA 235-101)
M_A = 15.5 Nm ±20 %
Material no. **R913000282**

4 4 hexagon socket head cap screws (included in the scope of delivery)
ISO4762-M10x70-10.9flZn-240h-L
(friction coefficient 0.09 to 0.14 according to VDA 235-101)
M_A = 75 Nm ±20 %
Material no. **R913000126**

5 2 locating pins 3 x 8 - A2C DIN EN 28741

6 Name plate

To ensure proper functioning of the servo-valves, it is necessary to flush the system before commissioning.

The following values are guidelines for the flushing time per system:

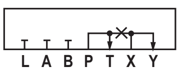
$$t \geq \frac{V}{q_V} \cdot 5$$

t = Flushing time in hours
V = Tank capacity in liters
q_V = Pump flow in liters per minute

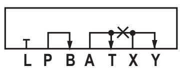
When topping up more than 10 % of the tank capacity, the flushing procedure must be repeated.

The use of a directional valve with port in accordance with ISO 4401-07-07-0-05 is better suited than a flushing plate. With this valve, you can also flush the actuator ports.

Symbols



with FKM seals,
material no. **R900904218**
Weight: 4.75 kg



with FKM seals,
material no. **R900959376**
(without fig.)
Weight: 4.5 kg

Accessories (not included in the scope of delivery)

Mating connectors		**Material number**
Mating connector for servo-valve	DIN EN 175201-804, see data sheet 08006	R900223890 (metal)

Subplates	**Data sheet**
Size 16	45056

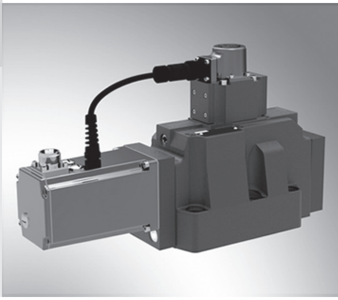
Notes

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
documentation@boschrexroth.de
www.boschrexroth.de

Directional servo-valve in 4-way version

RE 29621/03.12
Replaces: 05.09

Type 4WSE3E 25



Size 25
Component series 3X
Maximum operating pressure 350 bar
Maximum flow 1020 l/min

Table of contents

Information on available spare parts:
www.boschrexroth.com/spc

Features

– Valve for position, force, pressure or velocity control
– 3-stage servo-valve with electrical position control of the control spool of the 3rd stage, position sensing of the control spool by means of an inductive position transducer
– High dynamics 2-stage pilot control valve of size 6
– 1st stage as nozzle flapper plate amplifier
– Filter for 1st stage externally accessible and replaceable
– Subplate mounting: Porting pattern according to ISO 4401
– Can also be used as 3-way version
– Valve and integrated control electronics are adjusted and tested in the factory
– Optimized valve control loop
– High response sensitivity, very low hysteresis and zero point drift
– Internal or external pilot oil supply and return
– Gap seals at pressure chambers of the control sleeve, no wear of O-ring

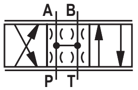
Ordering code

4WSE3E	25					3X /		/	K31		*

3-stage servo-valve

Size
Size 25 **= 25**

Control spool symbol [1]



= V
= V1

Control spool position in de-energized state
Not defined **= no code**
100 % P → A / B → T **= P**

Rated flow [2]
210 l/min **= 200**
300 l/min **= 300**
380 l/min **= 400**
450 l/min **= 500**

Control spool overlap [3]
0 to 0.5 % positive **= D**
0 to 0.5 % negative **= E**

Component series 30 to 39 **= 3X**
(30 to 39: Unchanged installation and connection dimensions)

Seal material [4]
FKM seals **= V**
NBR seals **= M**

Further details in the plain text

Electronics interface command/actual value
A1 = 0 to 10 V
C1 = 0 to 10 mA
F**1*** **=** 4 to 20 mA

Electrical connection
K31 = 6+PE
Without mating connector

Supply voltage
15 = ±15 V
24 = +24 V
See page 6

Pressure rating [6]
7 = 210 bar
9 = 315 bar

Pilot flow [5]
XY = Pilot oil supply external, return external
XT = Pilot oil supply external, return internal
PY = Pilot oil supply internal, return external
PT = Pilot oil supply internal, return internal

* Only with +24 V supply voltage

[1] **Control spool symbols**
with control spool symbol V
P → A; $\boldsymbol{q}_{V\,max}$ B → T; $\boldsymbol{q}_{V\,max}$
P → B; $\boldsymbol{q}_{V\,max}$ A → T; $\boldsymbol{q}_{V\,max}$
with control spool symbol V1
P → A; $\boldsymbol{q}_{V\,max}$ B → T; $\boldsymbol{q}_{V}$ / 2
P → B; $\boldsymbol{q}_{V}$ / 2 A → T; $\boldsymbol{q}_{V\,max}$

[2] **Rated flow**
The rated flow refers to a 100 % command value signal at 70 bar valve pressure differential (35 bar per control edge). The valve pressure differential must be regarded as reference. Other values result in the flow being changed. A possible rated flow tolerance of ±10 % and a saturation influence must be taken into account (see flow/signal function page 8).

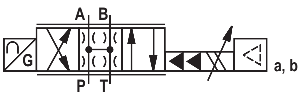
[3] **Control spool overlap**
The control spool overlap in % is referred to the nominal stroke of the control spool.
(Other control spool overlaps upon request.)

[4] **Seal material**
See notice on page 5

[5] **Pilot oil**
Care should be taken that the pilot pressure is as constant as possible. An external pilot control via port X is thus often advantageous.

[6] **Inlet pressure range**
Care should be taken that the inlet pressure is as constant as possible. Minimum pilot pressure ≥ 10 bar.
Up to a pilot pressure of 210 bar, pressure rating 7 is to be selected. From a pilot pressure greater than 210 bar, pressure rating 9 is to be selected.
With regard to the dynamics, the frequency response dependency must be observed within the admissible pressure range.
At an inlet pressure > 40 bar, the pilot pressure must not be less than 60 % of the inlet pressure as otherwise the current forces at the control spool of the 3rd stage will impair the controllability.
At an inlet pressure ≤ 40 bar, working with a pilot pressure above port X (external supply) is in any case advantageous.

Symbol



Function, section

Valves of type 4WSE3E 25 are electrically operated, 3-stage directional servo-valves. They are mainly used for position, force or pressure and velocity controls.

These valves consist of a 2-stage pilot control valve of type 4WS2EM 6 (1), a main stage with a main control spool in a sleeve (2), an inductive position transducer (3), and integrated control electronics (4).

The pilot control valve (1) consists of an electro-mechanical transformer (torque motor), a hydraulic amplifier (nozzle flapper plate principle) and a pilot control spool in a sleeve, which is connected to the torque motor via a mechanical feedback.

Electric currents in the coils of the torque motor generate a force by means of a permanent magnet which acts on the armature, and in connection with a torque tube results in a torque. This causes the flapper plate which is connected to the torque tube via a pin to move from the central position between the two control nozzles, and a pressure differential is created across the front sides of the pilot control spool. The pressure differential results in the control spool changing its position, which results in the pressure port being connected to one actuator port and, at the same time, the other actuator port being connected to the return flow port.

The pilot control spool is connected to the flapper plate or the torque motor by means of a bending spring (mechanical feedback).

The position of the control spool is changed until the flapper plate position and hence the pressure differential across the nozzle flapper plate system becomes zero due to the feedback torque, which acts via the bending spring against the electro-magnetic torque of the torque motor.

In doing so, the stroke of the pilot control spool and hence the flow of the pilot control valve is controlled proportionally to the electrical input signal (see data sheet 29564).

In the main stage, the main control spool (2) is operated by the pilot control valve and its position is sensed by an inductive position transducer (3). The position transducer signal is compared to the command value by integrated control electronics (4). Any possible control deviation is amplified electrically and fed to the pilot control valve as control signal. The pilot control valve starts to move and the main control spool is re-positioned.

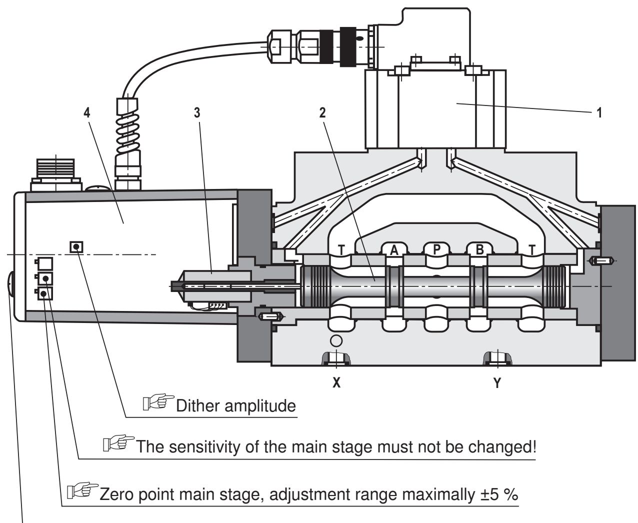
The stroke of the main control spool and consequently the flow of the servo-valve are controlled in proportion to the command value. It must be noted that the flow depends on the valve pressure differential.

The valve zero point can be adjusted by means of an externally accessible potentiometer.

The valves are factory-set with a dither default setting with the constant frequency of 400 Hz.

☞ **Notice!**

Changes in the zero point and/or the dither amplitude may result in damage to the system and may only be implemented by instructed specialists.



Plug screw Pg7

The pilot control valve may only be maintained by Bosch Rexroth employees. An exception to this is the replacement of the filter element – see data sheet 29564.

Technical data (For applications outside these parameters, please consult us!)

general

Weight	kg	16
Installation position		Any, if it is ensured that the pilot control is supplied with sufficient pressure (> 10 bar) during start-up of the system. In case of insufficient pressure supply, the control spool of the servo-valve can take any position. This may result in channel P being connected to the actuator and the build-up of pressure being delayed. This may be prevented by providing an external pressure supply at port X.
Storage temperature range	°C	–20 to +80
Ambient temperature range	°C	–20 to +60

hydraulic (measured with HLP 32, ϑ_{Oil} = 40 °C ± 5 °C)

Maximum operating pressure	Pilot control stage, pilot oil supply X		bar	10 to 210 and/or 10 to 315 (see page 2, pressure rating)
	Main valve, port P, A, B	Pilot oil supply internal	bar	315
	Main valve, port P, A, B	Pilot oil supply external	bar	350
Maximum return flow pressure	Pilot control stage, port Y		bar	Pressure peaks < 100 admissible, static < 10
	Main valve, port T	Pilot oil return internal	bar	Pressure peaks < 100 admissible, static < 10
		Pilot oil return external	bar	250
Leakage flow				See page 9 (characteristic curves)
Rated flow q_{Vnom} ±10 % with Δp = 70 bar			l/min	210, 300, 380, 450
Hydraulic fluid				See table page 5
Hydraulic fluid temperature range			°C	–20 to +80; preferably +40 to +50
Viscosity range			mm²/s	15 to 380; preferably 30 to 45
Maximum admissible degree of contamination of the hydraulic fluid cleanliness class according to ISO 4406 (c)			Pilot control valve	Class 18/16/13 [1)]
			Main stage	Class 20/18/15 [1)]
Hysteresis			%	≤ 0.10
Range of inversion			%	≤ 0.05
Response sensitivity			%	≤ 0.05
Pressure gain				≥ 90 % of p_P [2)] with 1 % change in the control spool stroke (from hydraulic zero point)
Zero shift upon change of:	Hydraulic fluid temperature		% / 10 K	≤ 0.3
	Ambient temperature		% / 10 K	≤ 0.3
	Operating pressure		% / 100 bar	≤ 0.3
	Return flow pressure 0 to 10 % of p_P		% / 100 bar	≤ 0.3

1) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components.
For the selection of the filters see www.boschrexroth.com/filter

2) p_P = Inlet pressure/operating pressure

Notice!
For information on the **environment simulation testing** for the areas EMC (electromagnetic compatibility), climate and mechanical load, see data sheet 29620-U.

Technical data (For applications outside these parameters, please consult us!)

Hydraulic fluid	Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons	HL, HLP	NBR, FKM	DIN 51524
Flame-resistant – containing water	HFC Fuchs Hydrotherm 46M Petrofer Ultra Safe 620	NBR	ISO 12922

☞ **Important information on hydraulic fluids!**

– For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!

– There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!

– **Flame-resistant – containing water**:

Maximum pressure differential per control edge 210 bar, otherwise, increased cavitation erosion!
Tank pre-loading < 1 bar or > 20 % of the pressure differential of the tank edge. The pressure peaks should not exceed the maximum operating pressures!

Maximum fluid temperature 60 °C

Technical data (For applications outside these parameters, please consult us!)

electric

Protection class according to EN 60529	IP 65 with mating connector mounted and locked
Type of signal	Analog

Electronics interface		**A1**	**C1**	**F1**
	Pin			
Current consumption at the mating connector	A	< ±150 mA with ±15 V		< 200 mA with 24 V
	B	< 200 mA with 24 V		
	D	0 to ±0.05 mA	0 to ±10 mA	4 to 20 mA
	E			

Device connector allocation	**Pin**	**Supply voltage 15**		**Supply voltage 24**		
Interface		A1	C1	A1	C1	F1
Supply voltage	A	+15 VDC		+24 VDC		
	B	–15 VDC		0 VDC		
M0	C	0 VDC / reference to pins A, B		Not used		
Differential command value input	D	0 to ±10 V	0 to ±10 mA	0 to ±10 V	0 to ±10 mA	4 to 20 mA
	E	R_e >100 kΩ	R_e = 100 Ω	R_e >100 kΩ	R_e = 100 Ω	R_e = 100 Ω
Actual value Reference with +24 V is pin B Reference with ±15 V is pin C	F	0 to ±10 V R_i ≈ 1 kΩ	0 to ±10 mA Load max. 1 kΩ	0 to ±10 V R_i ≈ 1 kΩ	0 to ±10 mA Load max. 1 kΩ	4 to 20 mA Load max. 500 Ω
Protective earth	PE	Connected to valve housing				

☞ **One end of the shield must be connected to the control!**

Supply voltage: ±15 V ±3 %, residual ripple < 1 %
+24 VDC / 18 V to 35 V; full bridge rectification with smoothing capacitor
2200 μF = I_{max} = 230 mA

Command value: **A1, C1:**
Reference potential at E and positive command value at D result in flow from P → A and B → T.
Reference potential at E and negative command value at D result in flow from P → B and A → T.
F1:
Reference potential at E and signal 12 to 20 mA at D result in flow from P → A and B → T.
Reference potential at E and signal 12 to 4 mA at D result in flow from P → B and A → T.

Actual value / measuring output: The voltage / current signal is proportional to the control spool stroke and has the same sign as the command value.

Connection cable: Recommendation: – up to 25 m line length: Type LiYCY 7 x 0.75 mm^2
– up to 50 m line length: Type LiYCY 7 x 1.0 mm^2
Only connect the shield to ⊥ on the supply side.

Notice: **Electric signals taken out via valve electronics (e.g. actual value) must not be used for switching off safety-relevant machine functions!**

Block diagram of the integrated electronics (OBE)

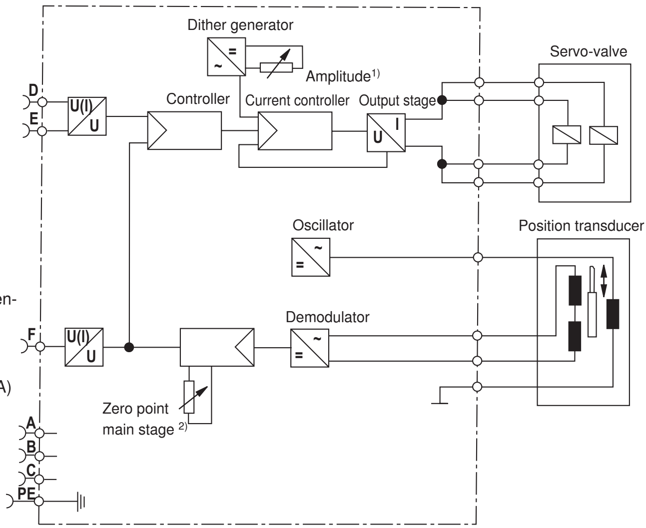
Interface — Integrated electronics (OBE) — Valve

Differential command value input
±10 V or ±10 mA or 4 to 20 mA

Actual value ±10 V /±10 mA
(measuring output F has positive potential against ⊥ with flow P → A)
Actual value 4 to 20 mA
(measuring output F is larger than 12 mA against ⊥ with flow P → A)

Supply voltage

	±15 V	24 V
A	+15 V	18 V to 35 V
B	–15 V	0 V
C	⊥ M0	n.c.

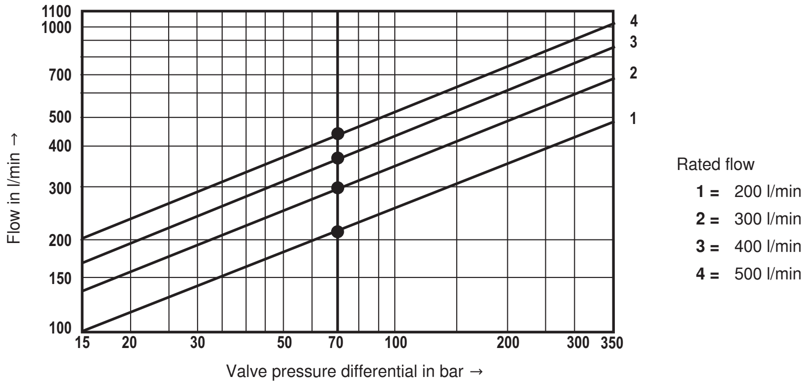


1) 2)

☞ **Changes in the zero point and/or the dither amplitude may result in damage to the system and may only be implemented by instructed specialists.**

Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

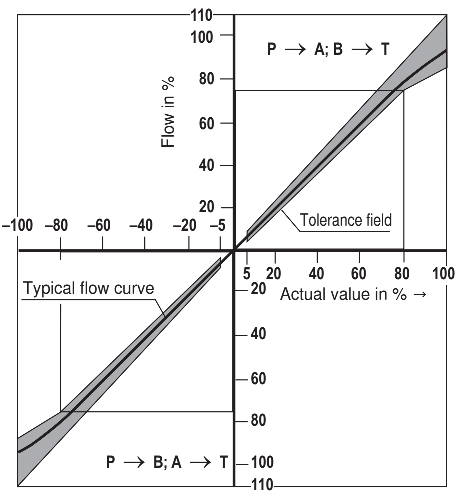
Flow/load function (tolerance ±10 %) with 100 % command value signal



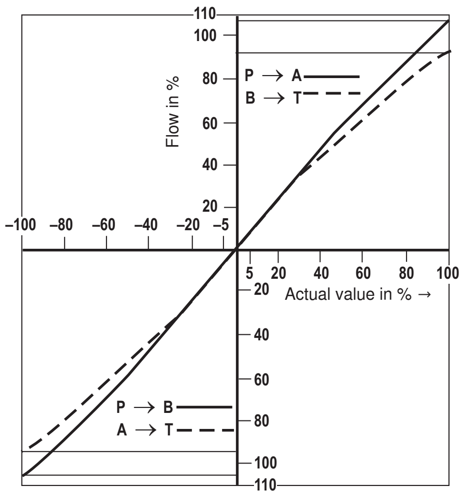
Δp = Valve pressure differential (inlet pressure p_P minus load pressure p_L minus return flow pressure p_T)

Tolerance field of the flow/signal function at constant valve pressure differential

Summated edge Δp_V = 70 bar



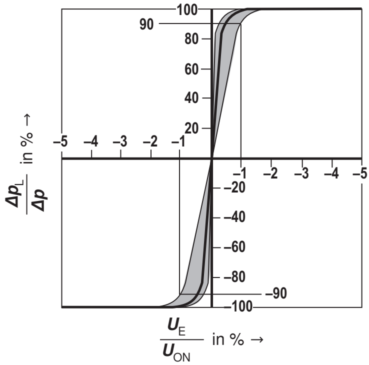
Single edge Δp_V = 35 bar (tolerance ±5 %)



* With interface F1, the negative command value axis corresponds to 4 to 12 mA, the positive command value axis to 12 to 20 mA

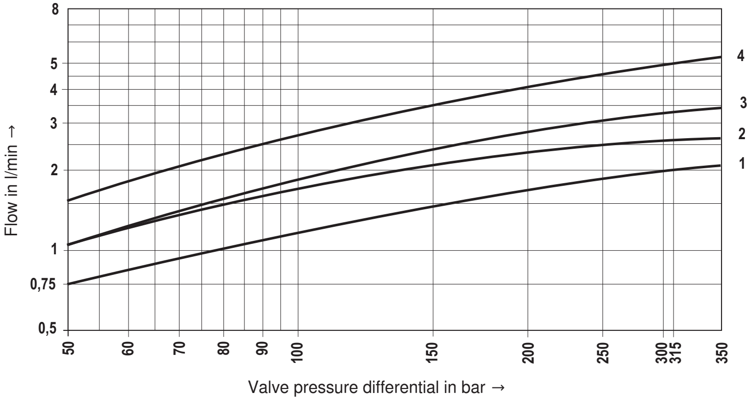
Characteristic curves (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

Pressure signal characteristic curve



Measured at
280 bar operating pressure

Zero flow total with "D" overlap (pilot control valve and main stage)
Tolerance ±20 %



1 = 200 l/min
2 = 300 l/min
3 = 400 l/min
4 = 500 l/min

Zero flow Data valid for overlap "E"	Pilot control valve L1	l/min	$\leq \sqrt{\frac{p_P}{70\text{ bar}}} \cdot 0.55$
	Overall valve q_V	l/min	$\leq \sqrt{\frac{p_p}{70\text{ bar}}} \cdot 0.015 \cdot q_{Vnom}$

q_{Vnom} Rated flow (overall valve) in l/min
210, 300, 380, 450

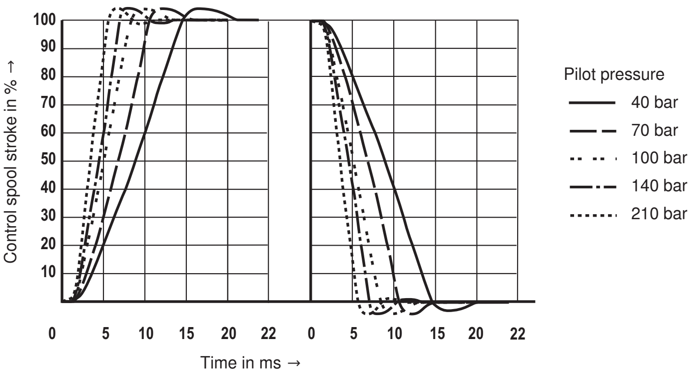
p_P Operating pressure in bar

Δp Valve pressure differential in bar

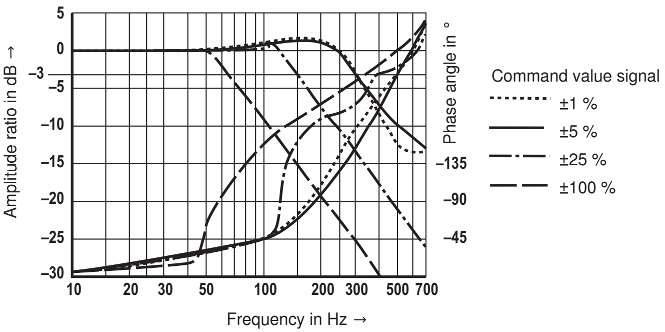
q_V 200, 300, 400, 500 l/min

Characteristic curves (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

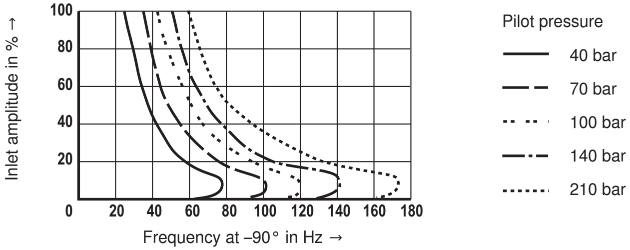
Transition function – measured with 210 bar pressure rating



Frequency response at p_P = 210 bar – measured with 210 bar pressure rating

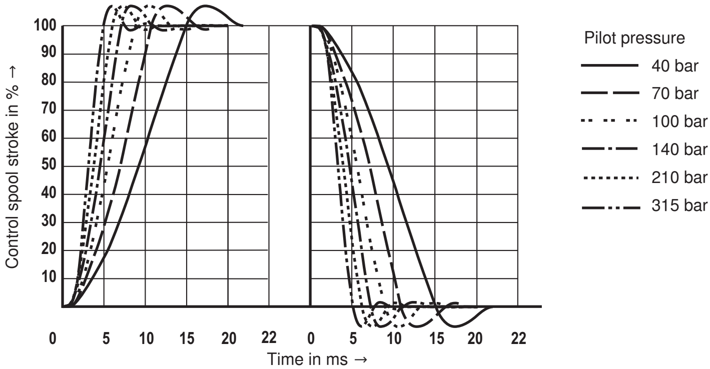


Dependence of the –90° frequency on the pilot pressure – measured with 210 bar pressure rating

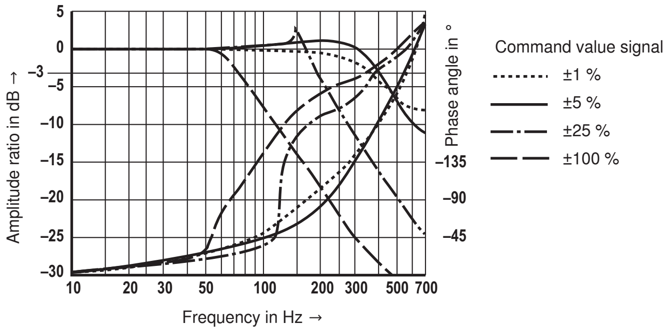


Characteristic curves (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

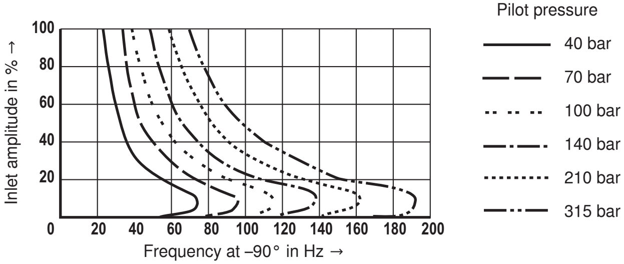
Transition function – measured with 315 bar pressure rating



Frequency response at p_P = 315 bar – measured with 315 bar pressure rating

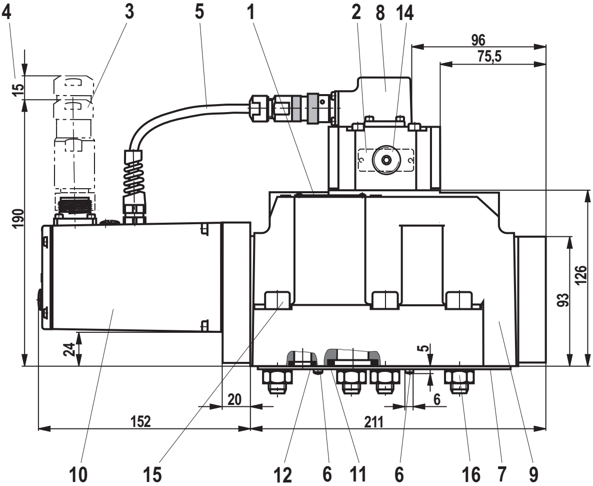


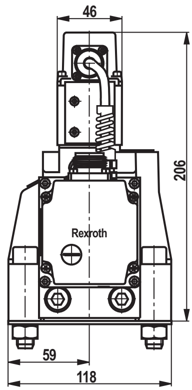
Dependence of the –90° frequency on the pilot pressure – measured with 315 bar pressure rating

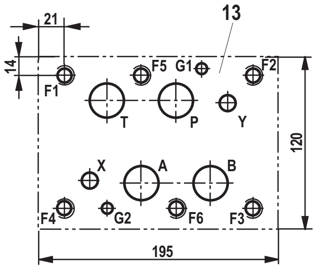


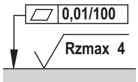
6

Unit dimensions: Type 4WSE3E 25 (dimensions in mm)









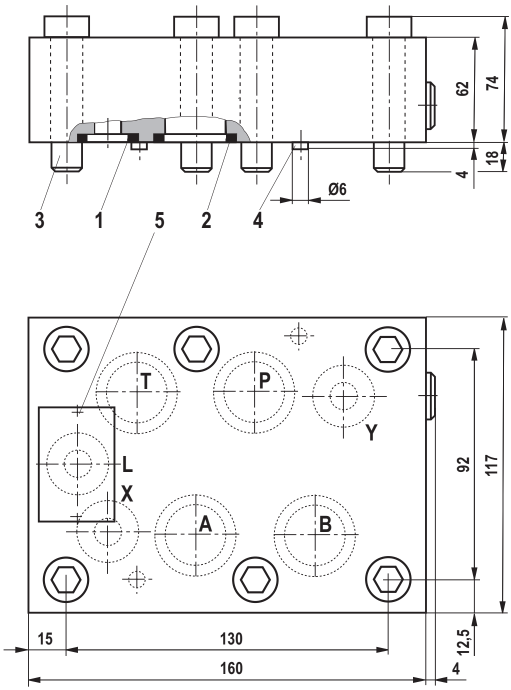
Required surface quality of the valve mounting face

1. **1** Name plate – overall valve
2. **2** Name plate – pilot control valve
3. **3** Mating connector according to EN 175201-804, separate order, see page 13
4. **4** Space required to remove the mating connector, take connection cable into account!
5. **5** PVC cable not resistant when in contact with HFD-R fluid
6. **6** Locating pin (2 units) G1 and G2
7. **7** Cover plate (for transport only)
8. **8** Pilot control valve (2-stage)
9. **9** Main stage (3rd stage)
10. **10** Integrated control electronics
11. **11** Identical seal rings for ports A, B, P, and T
12. **12** Identical seal rings for ports X and Y
    The ports X and Y are also pressurized in the case of "internal" pilot oil supply
13. **13** Machined valve mounting face, porting pattern according to ISO 4401-08-08-0-05
14. **14** Exchangeable filter element with seal, material no. **R961000194**
15. **15** Valve mounting screws
16. **16** Hexagon nuts (for transport only)

Hexagon socket head cap screws (included in the scope of delivery)		**Material number**
Size 25	6x ISO 4762 - M12 x 60 - 10.9-flZn-240h-L Tightening torque M_A = 100 Nm ±10 %	R913000121

Notice: The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure!

Flushing plate with porting pattern according to ISO 4401-08-08-0-05 (dimensions in mm)



1 R-ring 19x3x3 (X, Y) included in scope of delivery

2 R-ring 27.8x2.6x3 (P, T, A, B) included in scope of delivery

3 6 hexagon socket head cap screws (included in scope of delivery)
ISO4762-M12x80-10.9
(friction coefficient 0.09 to 0.14 according to VDA 235-101)
M_A = 100 Nm
Material no. **R913000413**

4 2 locating pins ISO8741 - 6X12-ST

5 Name plate

To ensure proper functioning of the servo-valves, it is necessary to flush the system before commissioning.

The following values are guidelines for the flushing time per system:

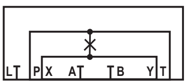
$$t \geq \frac{V}{q_V} \cdot 5$$

t = Flushing time in hours
V = Tank capacity in liters
q_V = Pump flow in liters per minute

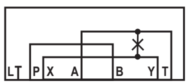
When topping up more than 10 % of the tank capacity, the flushing procedure must be repeated.

The use of a directional valve with port in accordance with ISO 4401-08-08-0-05 is better suited than a flushing plate. With this valve, you can also flush the actuator ports.

Symbols



with FKM seals,
Material no. **R900959384**
Weight: 8.4 kg



with FKM seals,
Material no. **R900959377**
(without fig.)
Weight: 8.4 kg

6

Accessories (not included in the scope of delivery)

Mating connectors		Material number
Mating connector for servo-valve	DIN EN 175201-804, see data sheet 08006	R900223890 (metal)

Subplates	Data sheet
Size 25	45058

Notes

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
documentation@boschrexroth.de
www.boschrexroth.de

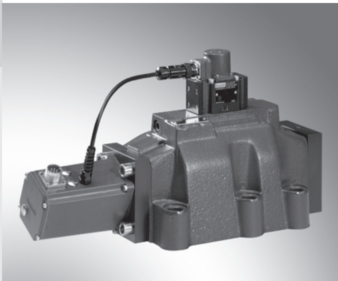
Rexroth
Bosch Group

Directional servo-valve in 4-way version

RE 29622/03.12
Replaces: 05.09

Type 4WSE3E 32

Size 32
Component series 5X
Maximum operating pressure 315 bar
Maximum flow 1800 l/min



H7357

Table of contents

Features

– Valve for position, force, pressure or velocity control
– 3-stage servo-valve with electrical position control of the control spool of the 3rd stage, position sensing of the control spool by means of an inductive position transducer
– High dynamics 2-stage pilot control valve of size 6
– 1st stage as nozzle flapper plate amplifier
– Filter for 1st stage externally accessible and replaceable
– Subplate mounting:
Porting pattern according to ISO 4401
– Can also be used as 3-way version
– Valve and integrated control electronics are adjusted and tested in the factory
– Optimized valve control loop
– High response sensitivity, very low hysteresis and zero point drift
– Internal or external pilot oil supply and return
– Gap seals at pressure chambers of the control sleeve, no O-ring wear

Information on available spare parts:
www.boschrexroth.com/spc

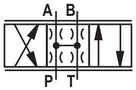
Ordering code

4WSE3E	32					5X	/				/		K31		*

3-stage servo-valve

Size
Size 32 **= 32**

Control spool symbol 1)



= V
= V1

Control spool position in de-energized state
Not defined **= no code**
100 % P → A / B → T **= P**

Rated flow 2)
500 l/min **= 500**
670 l/min **= 700**
890 l/min **= 1000**

Control spool overlap 3)
0 to 0.5 % positive **= D**
0 to 0.5 % negative **= E**

Component series 50 to 59 **= 5X**
(50 to 59: Unchanged installation and connection dimensions)

Seal material 4)
FKM seals **= V**
NBR seals **= M**

Further details in the plain text

Electronics interface command/actual value
A1 = 0 to 10 V
C1 = 0 to 10 mA
F**1*** = 4 to 20 mA

Electrical connection
K31 = 6+PE
Without mating connector

Supply voltage
15 = ±15 V
24 = +24 V
See page 6

Pressure rating 6)
7 = 210 bar
9 = 315 bar

Pilot flow 5)
XY = Pilot oil supply external, return external
XT = Pilot oil supply external, return internal
PY = Pilot oil supply internal, return external
PT = Pilot oil supply internal, return internal

* Only with +24 V supply voltage

1) **Control spool symbols**
with control spool symbol V
P → A; $q_{V\,max}$ B → T; $q_{V\,max}$
P → B; $q_{V\,max}$ A → T; $q_{V\,max}$
with control spool symbol V1
P → A; $q_{V\,max}$ B → T; q_V / 2
P → B; q_V / 2 A → T; $q_{V\,max}$

2) **Rated flow**
The rated flow refers to a 100 % command value signal at 70 bar valve pressure differential (35 bar per control edge). The valve pressure differential must be regarded as reference. Other values result in the flow being changed. A possible rated flow tolerance of ±10 % and saturation influence must be taken into account (see flow/signal function page 8).

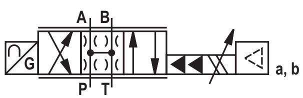
3) **Control spool overlap**
The control spool overlap in % is referred to the nominal stroke of the control spool.
(Other control spool overlaps upon request.)

4) **Seal material**
See notices on page 5

5) **Pilot oil**
Care should be taken that the pilot pressure is as constant as possible. An external pilot control via port X is thus often advantageous.

6) **Inlet pressure range**
Care should be taken that the inlet pressure is as constant as possible. Minimum control pressure ≥ 10 bar.
Up to a pilot pressure of 210 bar, pressure rating 7 is to be selected. From a pilot pressure greater than 210 bar, pressure rating 9 is to be selected.
With regard to the dynamics, the frequency response dependency must be observed within the admissible pressure range.
At an inlet pressure > 40 bar, the pilot pressure must not be less than 60 % of the inlet pressure as otherwise the current forces at the control spool of the 3rd stage will impair the controllability.
At an inlet pressure ≤ 40 bar, working with a pilot pressure above port X (external supply) is in any case advantageous.

Symbol



Function, section

Valves of type 4WSE3E 32 are electrically operated, 3-stage directional servo-valves. They are mainly used for position, force or pressure and velocity controls.

These valves consist of a 2-stage pilot control valve of type 4WS2EM 6 (1), a main stage with a main control spool in a sleeve (2), an inductive position transducer (3), and integrated control electronics (4).

The pilot control valve (1) consists of an electro-mechanical converter (torque motor), a hydraulic amplifier (nozzle flapper plate principle) and a pilot control spool in a sleeve, which is connected to the torque motor via a mechanical feedback.

Electric currents in the coils of the torque motor generate a force by means of a permanent magnet which acts on the armature, and in connection with a torque tube results in a torque. This causes the flapper plate which is connected to the torque tube via a pin to move from the central position between the two control nozzles, and a pressure differential is created across the front sides of the pilot control spool. The pressure differential results in the control spool changing its position, which results in the pressure port being connected to one actuator port and, at the same time, the other actuator port being connected to the return flow port.

The pilot control spool is connected to the flapper plate or the torque motor by means of a bending spring (mechanical feedback).

The position of the control spool is changed until the flapper plate position and hence the pressure differential across the nozzle flapper plate system becomes zero due to the feedback torque, which acts via the bending spring against the electro-magnetic torque of the torque motor.

In doing so, the stroke of the pilot control spool and hence the flow of the pilot control valve is controlled proportionally to the electrical input signal (see data sheet 29564).

In the main stage, the main control spool (2) is operated by the pilot control valve and its position is sensed by an inductive position transducer (3). The position transducer signal is compared to the command value by integrated control electronics (4). Any possible control deviation is amplified electrically and fed to the pilot control valve as control signal. The pilot control valve starts to move and the main control spool is re-positioned.

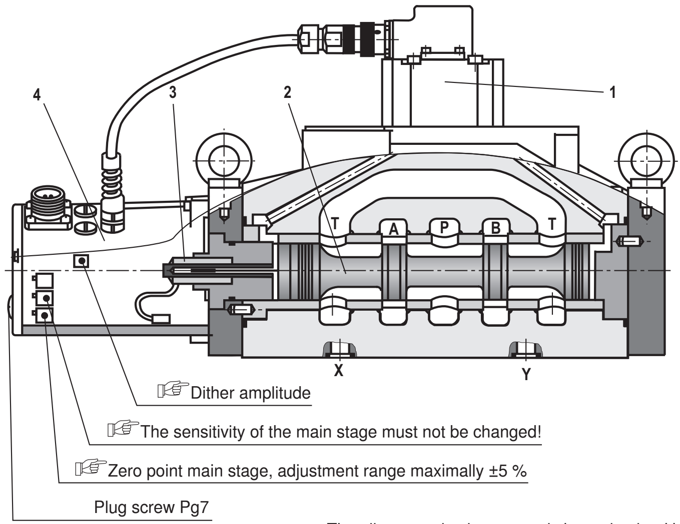
The stroke of the main control spool and consequently the flow of the servo-valve are controlled in proportion to the command value. It must be noted that the flow depends on the valve pressure differential.

The valve zero point can be adjusted by means of an externally accessible potentiometer.

The valves are factory-set with a dither default setting with the constant frequency of 400 Hz.

☞ **Notice!**

Changes in the zero point and/or the dither amplitude may result in damage to the system and may only be implemented by instructed specialists.



The pilot control valve may only be maintained by Bosch Rexroth employees. An exception to this is the replacement of the filter element – see data sheet 29564.

Technical data (For applications outside these parameters, please consult us!)

general

Weight	kg	35
Installation position		Any, if it is ensured that the pilot control is supplied with sufficient pressure (> 10 bar) during start-up of the system. In case of insufficient pressure supply, the control spool of the servo-valve can take any position. This may result in channel P being connected to the actuator and the build-up of pressure being delayed. This may be prevented by providing an external pressure supply at port X.
Storage temperature range	°C	–20 to +80
Ambient temperature range	°C	–20 to +60

hydraulic (measured with HLP 32, ϑ_{Oil} = 40 °C ± 5 °C)

Maximum operating pressure	Pilot control stage, pilot oil supply X		bar	10 to 210 or 10 to 315 (see page 2, pressure rating)
	Main valve, port P, A, B	Pilot oil supply internal	bar	315
	Main valve, port P, A, B	Pilot oil supply external	bar	315
Maximum return flow pressure	Pilot control stage, port Y		bar	Pressure peaks < 100 admissible, static < 10
	Main valve, port T	Pilot oil return internal	bar	Pressure peaks < 100 admissible, static < 10
		Pilot oil return external	bar	250
Zero flow				See page 9 (characteristic curves)
Rated flow q_{Vnom} ±10 % at Δp = 70 bar			l/min	500, 670, 890
Hydraulic fluid				See table page 5
Hydraulic fluid temperature range			°C	–20 to +80; preferably +40 to +50
Viscosity range			mm²/s	15 to 380; preferably 30 to 45
Maximum admissible degree of contamination of the hydraulic fluid cleanliness class according to ISO 4406 (c)			Pilot control valve	Class 18/16/13 [1]
			Main stage	Class 20/18/15 [1]
Hysteresis			%	≤ 0.10
Range of inversion			%	≤ 0.05
Response sensitivity			%	≤ 0.05
Pressure gain				≥ 90 % of p_P [2] with 1 % change in control spool stroke (from hydraulic zero point)
Zero shift upon change of:	Hydraulic fluid temperature		% / 10 K	≤ 0.3
	Ambient temperature		% / 10 K	≤ 0.3
	Operating pressure		% / 100 bar	≤ 0.3
	Return flow pressure 0 to 10 % of p_P		% / 100 bar	≤ 0.3

[1] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components.
For the selection of the filters see www.boschrexroth.com/filter

[2] p_P = Inlet pressure/operating pressure

☞ **Notice!**
For information on the **environment simulation testing** for the areas EMC (electromagnetic compatibility), climate and mechanical load, see data sheet 29620-U.

Technical data (For applications outside these parameters, please consult us!)

Hydraulic fluid	Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons	HL, HLP	NBR, FKM	DIN 51524
Flame-resistant – containing water	HFC Fuchs Hydrotherm 46M Petrofer Ultra Safe 620	NBR	ISO 12922

☞ **Important information on hydraulic fluids!**

- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!
- **Flame-resistant – containing water**:
  Maximum pressure differential per control edge 210 bar, otherwise, increased cavitation erosion!
  Tank pre-loading < 1 bar or > 20 % of the pressure differential of the tank edge. The pressure peaks should not exceed the maximum operating pressures!
  Maximum fluid temperature 60 °C

Technical data (For applications outside these parameters, please consult us!)

electric

Protection class according to EN 60529	IP 65 with mating connector mounted and locked
Type of signal	Analog

<table>
<tr><th colspan="2">Electronics interface</th><th>A1</th><th>C1</th><th>F1</th></tr>
<tr><td rowspan="5">Current consumption at the mating connector</td><td>Pin</td><td colspan="3"></td></tr>
<tr><td>A</td><td colspan="2" rowspan="2">< ±150 mA at ±15 V
< 200 mA at 24 V</td><td rowspan="2">< 200 mA at 24 V</td></tr>
<tr><td>B</td></tr>
<tr><td>D</td><td rowspan="2">0 to ±0.05 mA</td><td rowspan="2">0 to ±10 mA</td><td rowspan="2">4 to 20 mA</td></tr>
<tr><td>E</td></tr>
</table>

<table>
<tr><th>Device connector allocation</th><th>Pin</th><th colspan="2">Supply voltage 15</th><th colspan="3">Supply voltage 24</th></tr>
<tr><td>Interface</td><td></td><td>A1</td><td>C1</td><td>A1</td><td>C1</td><td>F1</td></tr>
<tr><td rowspan="2">Supply voltage</td><td>A</td><td colspan="2">+15 VDC</td><td colspan="3">+24 VDC</td></tr>
<tr><td>B</td><td colspan="2">–15 VDC</td><td colspan="3">0 VDC</td></tr>
<tr><td>M0</td><td>C</td><td colspan="2">0 VDC / reference to pins A, B</td><td colspan="3">Not used</td></tr>
<tr><td rowspan="2">Differential command value input</td><td>D</td><td>0 to ±10 V</td><td>0 to ±10 mA</td><td>0 to ±10 V</td><td>0 to ±10 mA</td><td>4 to 20 mA</td></tr>
<tr><td>E</td><td>R_e >100 kΩ</td><td>R_e = 100 Ω</td><td>R_e >100 kΩ</td><td>R_e = 100 Ω</td><td>R_e = 100 Ω</td></tr>
<tr><td>Actual value
The reference with +24 V is pin B
The reference with ±15 V is pin C</td><td>F</td><td>0 to ±10 V
R_i ≈ 1 kΩ</td><td>0 to ±10 mA
Load max. 1 kΩ</td><td>0 to ±10 V
R_i ≈ 1 kΩ</td><td>0 to ±10 mA
Load max. 1 kΩ</td><td>4 to 20 mA
Load max. 500 Ω</td></tr>
<tr><td>Protective earth</td><td>PE</td><td colspan="5">Connected to valve housing</td></tr>
</table>

☞ **One end of the shield must be connected to the control!**

Supply voltage: ±15 V ±3 %, residual ripple < 1 %
+24 VDC / 18 V to 35 V; full bridge rectification with smoothing capacitor
2200 µF = I_{max} = 230 mA

Command value: **A1, C1:**
Reference potential at E and positive command value at D result in flow from P → A and B → T.
Reference potential at E and negative command value at D result in flow from P → B and A → T.
F1:
Reference potential at E and signal 12 to 20 mA at D result in flow from P → A and B → T.
Reference potential at E and signal 12 to 4 mA at D result in flow from P → B and A → T.

Actual value / measuring output: The voltage / current signal is proportional to the control spool stroke and has the same sign as the command value.

Connection cable: Recommendation: – up to 25 m line length: Type LiYCY 7 x 0.75 mm²
– up to 50 m line length: Type LiYCY 7 x 1.0 mm²
Only connect the shield to ⊥ on the supply side.

Notice: **Electric signals taken out via valve electronics (e.g. actual value) must not be used for switching off safety-relevant machine functions!**

Block diagram of the integrated electronics (OBE)

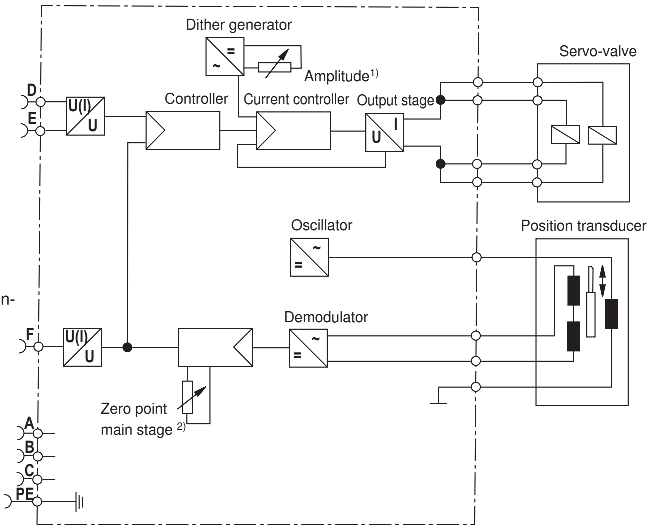
Interface

Differential command value input
±10 V or ±10 mA or 4 to 20 mA

Actual value ±10 V / ±10 mA
(measuring output F has positive potential against ⊥ with flow P → A)
Actual value 4 to 20 mA
(measuring output F is greater 12 mA against ⊥ with flow P → A)

Supply voltage

	±15 V	24 V
A	+15 V	18 V to 35 V
B	–15 V	0 V
C	⊥ M0	n.c.

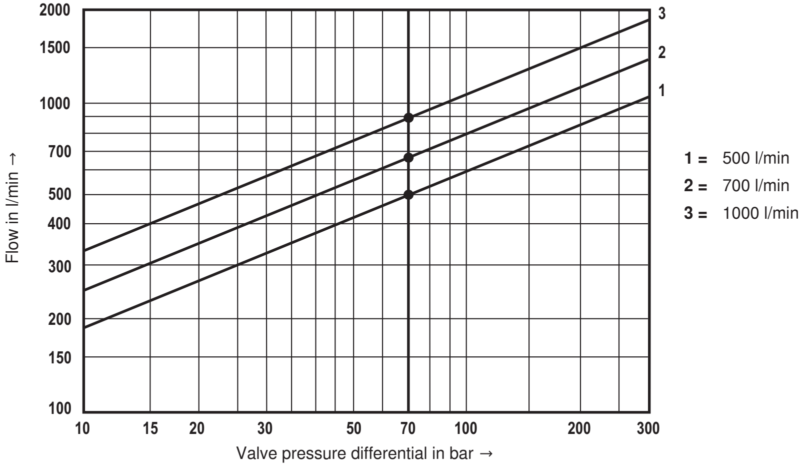


1) 2)

☞ **Changes in the zero point and/or the dither amplitude may result in damage to the system and may only be implemented by instructed specialists.**

Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

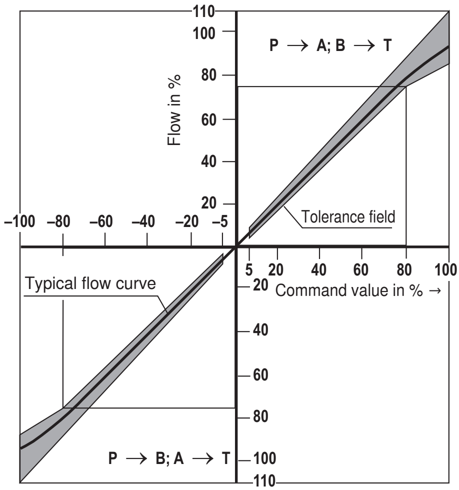
Flow/load function (tolerance ±10 %) with 100 % command value signal



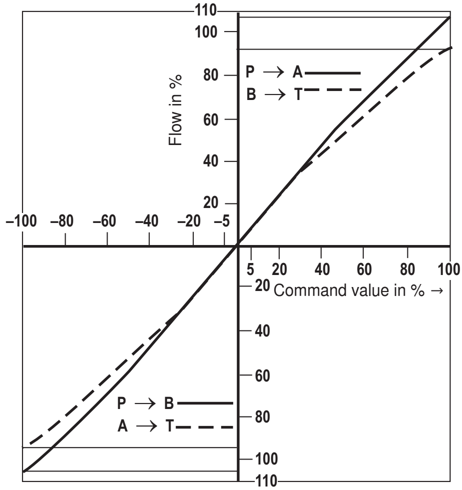
Δp = Valve pressure differential (inlet pressure p_P minus load pressure p_L minus return flow pressure p_T)

Tolerance field of the flow/signal function with constant valve pressure differential

Summated edge Δp_V = 70 bar



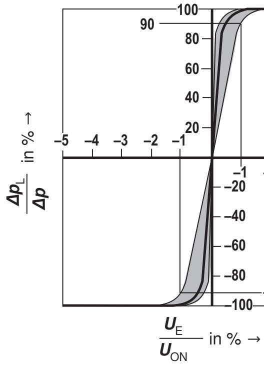
Single edge Δp_V = 35 bar (tolerance ±5 %)



* With interface F1, the negative command value axis corresponds to 4 to 12 mA, the positive command value axis to 12 to 20 mA

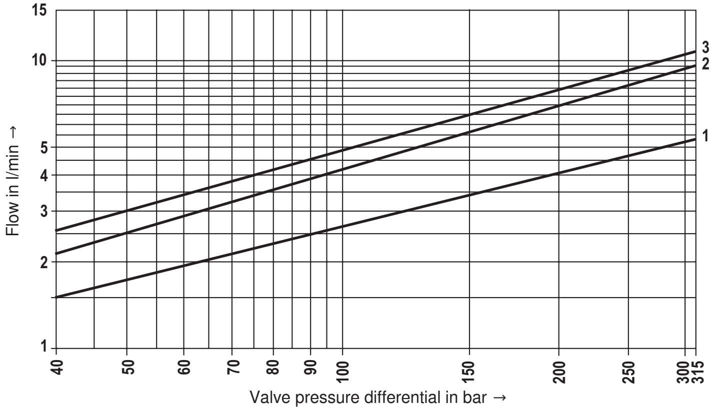
Characteristic curves (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

Pressure signal characteristic curve



Measured at
280 bar operating pressure

Leakage flow total with "D" overlap (pilot control valve and main stage)
Tolerance ±20 %



1 = 500 l/min
2 = 700 l/min
3 = 1000 l/min

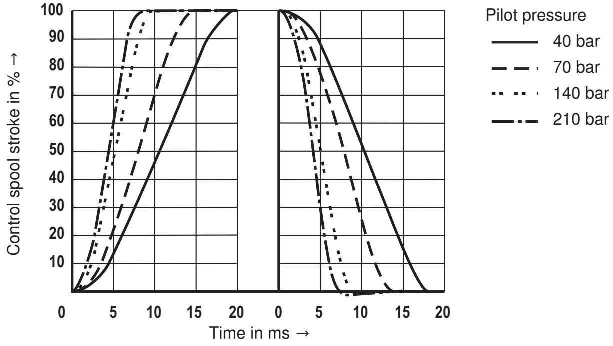
Zero flow Data valid for overlap "E"	Pilot control valve L1	l/min	$\leq \sqrt{\frac{p_P}{70\text{ bar}}} \cdot 0.8$
	Overall valve q_V	l/min	$\leq \sqrt{\frac{p_P}{70\text{ bar}}} \cdot 0.015 \cdot q_{Vnom}$

q_{Vnom} Rated flow (overall valve) in l/min 500, 670, 890
p_P Operating pressure in bar
Δp Valve pressure differential in bar
q_V 500, 700, 1000 l/min

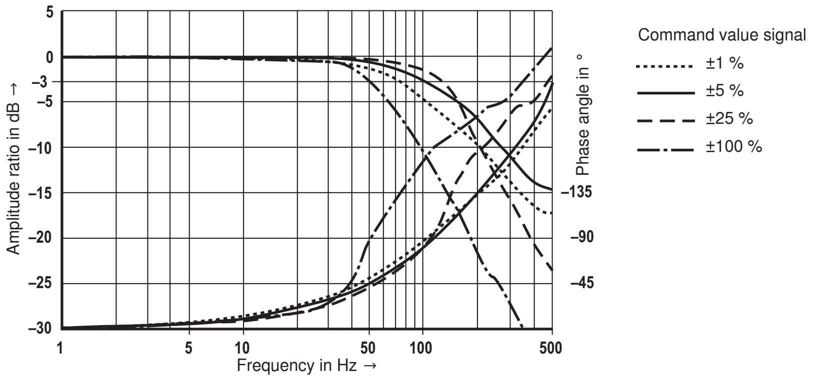
6

Characteristic curves (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

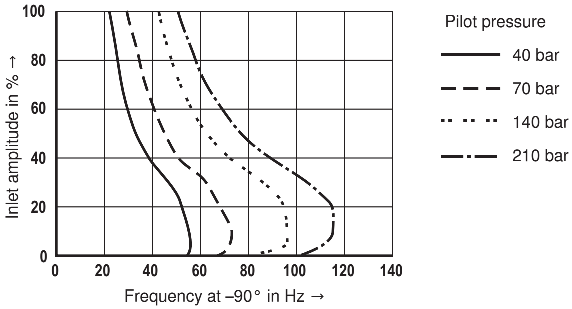
Transition function – measured with 210 bar pressure rating



Frequency response at p_P = 210 bar – measured with 210 bar pressure rating

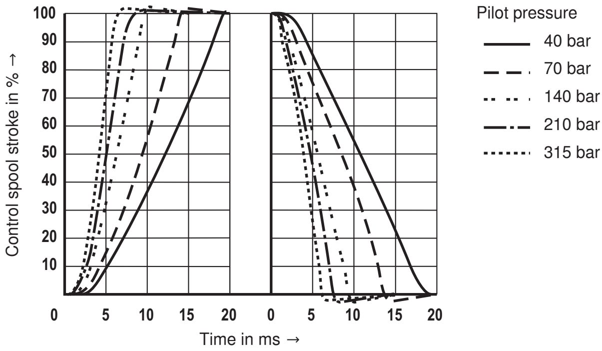


Dependence of the –90° frequency of the pilot pressure – measured with 210 bar pressure rating

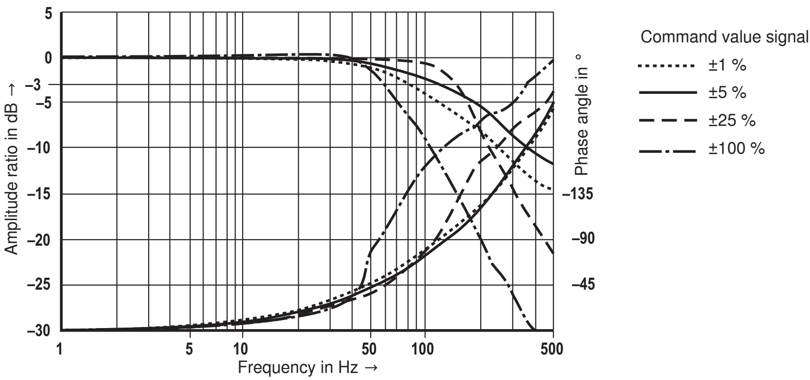


Characteristic curves (measured with HLP32, ϑ_{oil} = 40 °C ± 5 °C)

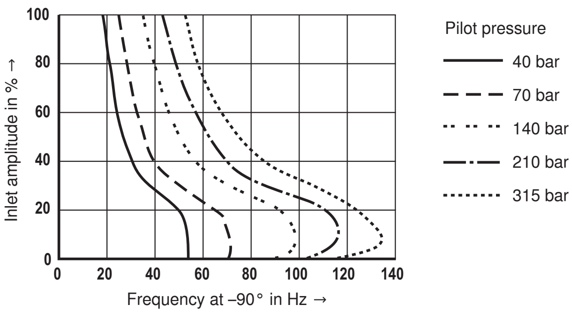
Transition function – measured with 315 bar pressure rating



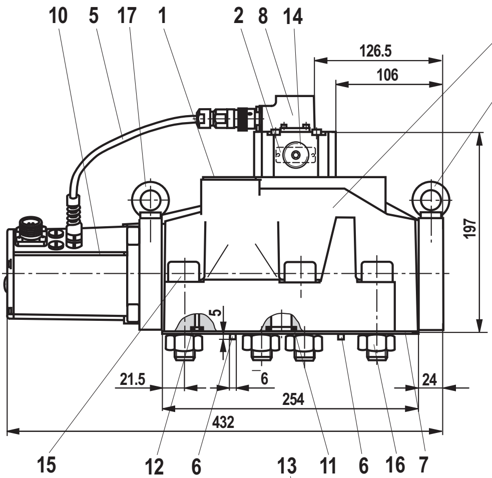
Frequency response at p_P = 315 bar – measured with 315 bar pressure rating

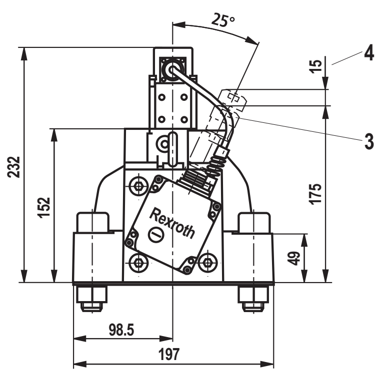


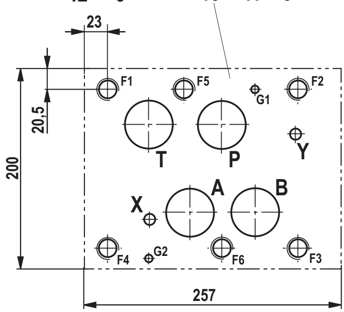
Dependence of the –90° frequency of the pilot pressure – measured with 315 bar pressure rating

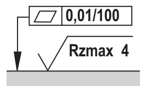


Unit dimensions: Type 4WSE3E 32 (dimensions in mm)









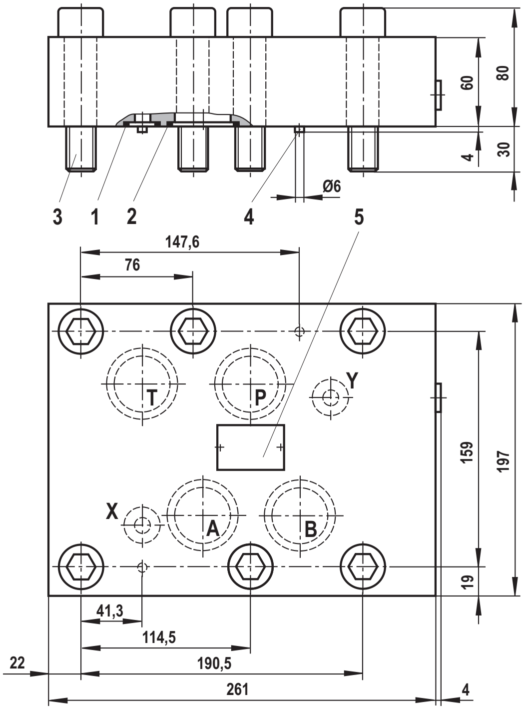
Required surface quality of the valve mounting face

1 Name plate – overall valve
2 Name plate – pilot control valve
3 Mating connector according to EN 175201-804, separate order, see page 13
4 Space required to remove the mating connector, take connection cable into account!
5 PVC cable not resistant when in contact with HFD-R fluid
6 Locating pin (2x) G1 and G2
7 Cover plate (for transport only)
8 Pilot control valve (2-stage)
9 Main stage (3rd stage)
10 Integrated control electronics
11 Identical seal rings for ports A, B, P, and T
12 Identical seal rings for ports X and Y
The ports X and Y are also pressurized in the case of "internal" pilot oil supply
13 Machined valve mounting face, porting pattern according to ISO 4401-10-09-0-05
14 Exchangeable filter element with seal, material no. **R961000194**
15 Valve mounting screws
16 Hexagon nuts (for transport only)
17 Ring bolts (for transport only)

Hexagon socket head cap screws (included in the scope of delivery)		**Material number**
Size 32	6x ISO 4762 - M20 x 80 - 10.9-flZn-240h-L Tightening torque M_A = 340 Nm ±10 %	R901035246

Notice: This tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure!

Flushing plate with porting pattern according to ISO 4401-10-09-0-05 (dimensions in mm)



1 R-ring 19x3x3 (X, Y) included in scope of delivery

2 R-ring 42.5x3x3 (P, T, A, B) included in scope of delivery

3 6 hexagon socket head cap screws (included in scope of delivery)
ISO4762-M20x90-10.9flZn-240h-L
(friction coefficient 0.09 to 0.14 according to VDA 235-101)
M_A = 340 Nm
Material no. **R913000397**

4 2 locating pins 6x12-6.8 DIN EN 28741

5 Name plate

To ensure proper operation of the servo-valves, it is necessary to flush the system before commissioning.

The following values are guidelines for the flushing time per system:

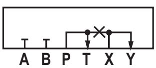
$$t \geq \frac{V}{q_V} \cdot 5$$

t = Flushing time in hours
V = Tank capacity in liters
q_V = Pump flow in liters per minute

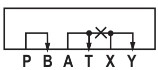
When topping up more than 10 % of the tank capacity, the flushing procedure must be repeated.

The use of a directional valve with port in accordance with ISO 4401-10-09-0-05 is better suited than a flushing plate. With this valve, you can also flush the actuator ports.

Symbols



with FKM seals
Material no. **R900550597**
Weight: 22.3 kg



with FKM seals
Material no. **R900959396**
(without fig.)
Weight: 22.3 kg

6

Accessories (not included in the scope of delivery)

Mating connectors		**Material number**
Mating connector for servo-valve	DIN EN 175201-804, see data sheet 08006	R900223890 (metal)

Subplates	**Data sheet**
Size 32	45060

Notes

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
documentation@boschrexroth.de
www.boschrexroth.de

Proportional servo valve accessories

Designation	Type	Size	Component series	p_{max} in bar	Data sheet	Page
Supply pressure compensator						
Sandwich plate design	ZDC	6	1X	250	29231	1301
Sandwich plate design	ZDC	10 … 32	2X	350	29224	1307

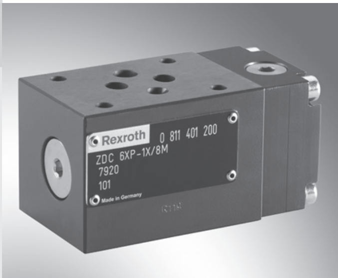
Electric Drives and Controls | Hydraulics | Linear Motion and Assembly Technologies | Pneumatics | Service

Rexroth
Bosch Group

Supply pressure compensator, direct operated

Type ZDC

Size 6
Component series 1X
Maximum operating pressure 250 bar
Maximum flow 35 l/min



H7870

Table of contents

Features

– Sandwich plate valve
– Porting pattern according to DIN 24340 form A
– Load compensation in channel P → A or P → B by installed shuttle valve
– 2-way version "P"
– Flow control in case of interaction with proportional directional valve

Information on available spare parts:
www.boschrexroth.com/spc

Ordering code

Z	DC	6	X	P	–1X	/		M		*

Sandwich plate valve = Z
Supply pressure compensator = DC
Size 6 = 6
Porting pattern according to DIN 24340 form A = X
Load compensation in channel P = P
Load compensation in channel A = A
Component series 10 to 19 = 1X
(10 to 19: Unchanged installation and connection dimensions)

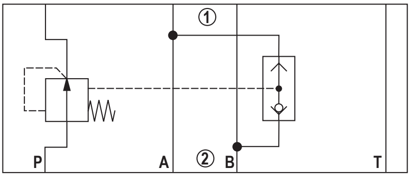
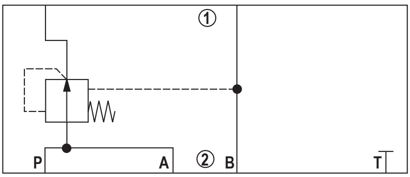
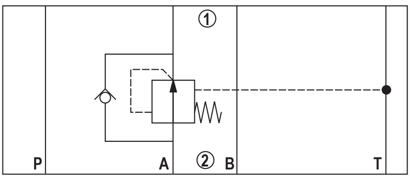
Pressure differential
8 = 8 bar
14 = 14 bar
25 = 25 bar

Seal material
M = NBR seals
(other seals upon request)
Attention!
Observe compatibility of seals with hydraulic fluid used!

No code = No special version
Possible special versions see below

Further details in the plain text

Preferred types and standard units are contained in the EPS (standard price list).

Symbols (① = component side, ② = plate side)	**Ordering code** **Load compensation in channel**	**Pressure differential**	**Special version**	**Material no.**
	P	8	–	0811401200
	P	14	–	0811401208
	P	25	-291 Special setting with directional valve type 4WRPE [1]; flow Δp 100 bar > 33 l/min	R901140492
	P	8	-287 Closed-loop control in P component-side; supply optionally A or P; pilot pressure from B	0811401201
	A	8	-292 Flow in A; pilot pressure from T	0811401202

[1] Material no. 0811404618

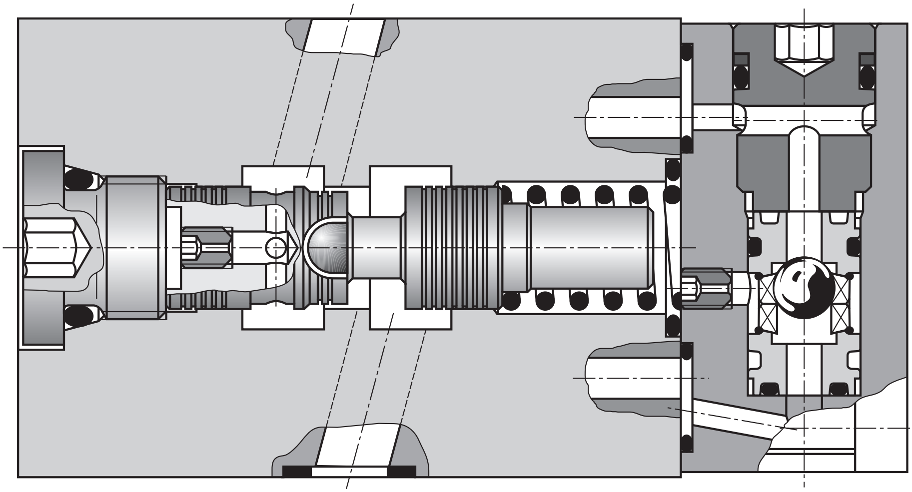
Function, section

Valves of type ZDC are direct operated supply pressure compensators in 2-way design.

As with all throttle cross-sections, the flow of proportional throttle valves and directional valves depends on the pressure differential Δ***p***.

The effect of a load-compensated, electrical flow control valve results from the combination of throttle valve (measurement throttle) and pressure compensator which keeps the pressure differential Δ***p*** at the measurement throttle constant. The pressure differential is determined by the pressure compensator spring and depending on the select design ranges between 8 and 25 bar

The combination of a proportional directional valve with a pressure compensator results in the effect of a flow control valve for 2 directions. The changing load pressure is to be scanned via a shuttle valve. If pulling loads result during deceleration of mass, backpressure valves are to be provided.



Technical data (For applications outside these parameters, please consult us!)

general

Weight	kg	1.5
Installation position		Any

hydraulic

Maximum operating pressure	bar	250
Maximum flow	l/min	35 (depending on the pressure differential)
Hydraulic fluid		See table below
Hydraulic fluid temperature range	°C	–20 to +70
Viscosity range	mm^2/s	15 to 380
Maximum permitted degree of contamination of the hydraulic fluid - cleanliness class according to ISO 4406 (c)		Class 20/18/15 [1)]

Hydraulic fluid	Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons	HL, HLP, HLPD, HVLP, HVLPD	NBR	DIN 51524

☞ **Important Information on hydraulic fluids!**

– For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!

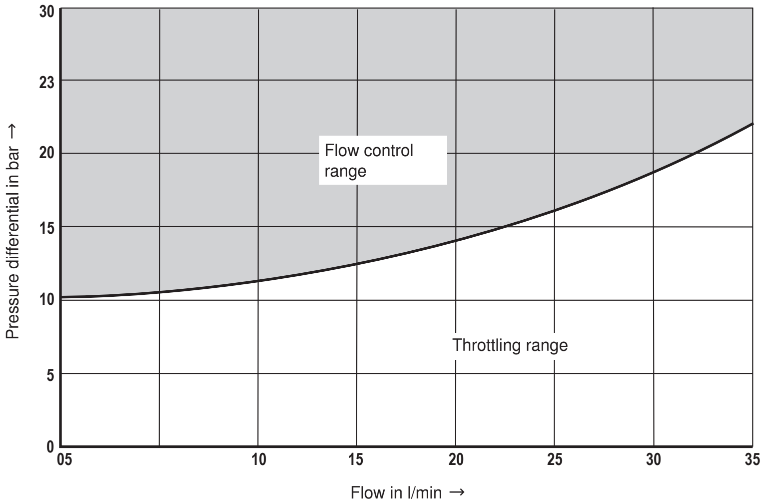
– There may be limitations regarding the technical valve data (temperature, pressure range, service life, maintenance intervals, etc.)!

[1)] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the service life of the components.

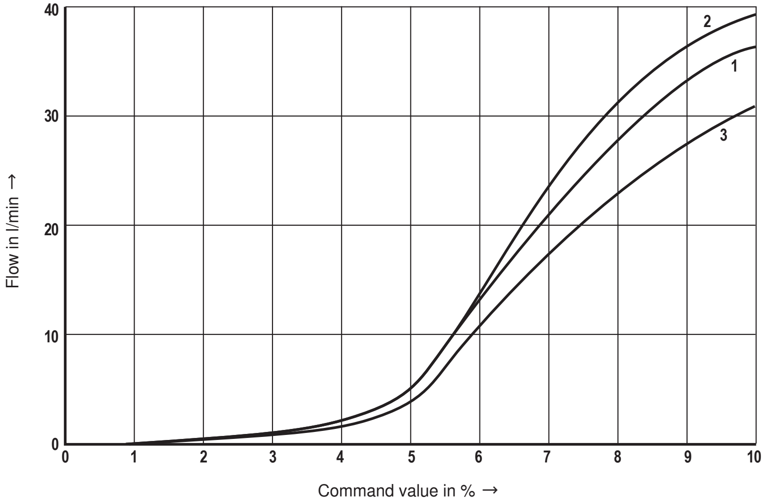
For selecting the filters, see www.boschrexroth.com/filter.

Characteristic curves (measured with HLP46 and ϑ_{oil} = 40 °C ± 5 °C)

Flow control P to A, P to B



Pressure differential $\Delta \boldsymbol{p}_{min} = \boldsymbol{p}_{Pump} - \boldsymbol{p}_{Load}$



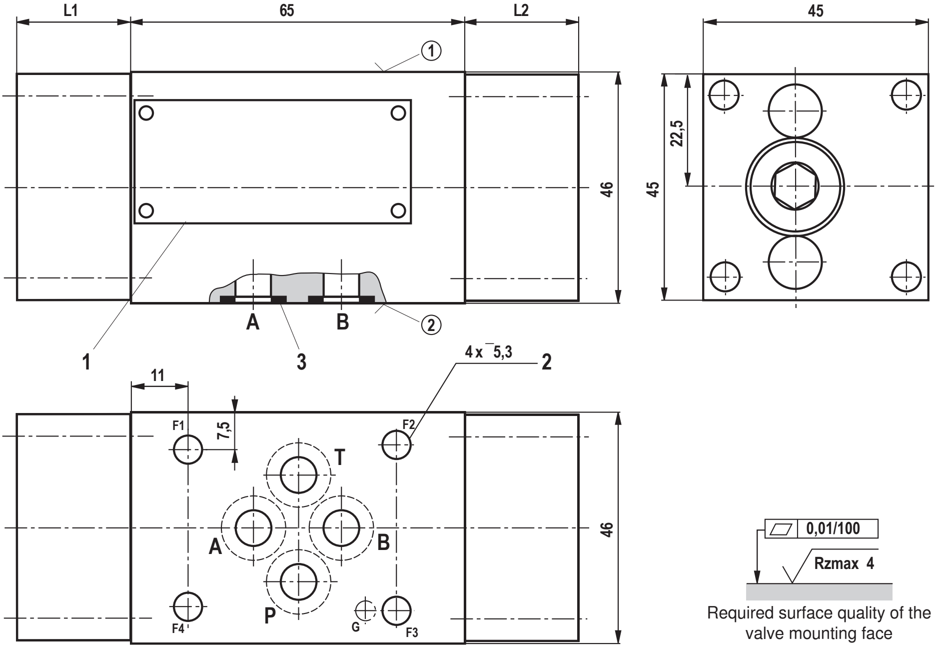
Characteristic curves measured with directional control valve type 4WRPE 6 ...

1 Version "8M"

2 Version "14M"

3 Version "25M-291"

Unit dimensions (dimensions in mm)



Required surface quality of the valve mounting face

① Component side – porting pattern according to DIN 24340 form A

② Plate side – porting pattern according to DIN 24340 form A

1 Name plate

2 Valve mounting bores

3 Identical seal rings for ports A, B, P, T

Valve mounting screws (separate order)

4 hexagon socket head cap screws ISO 4762 - M5 - 10.9

☞ **Notice!**

Length and tightening torque of the valve mounting screws must be calculated according to the components mounted under and over the sandwich plate valve.

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

Electric Drives and Controls | Hydraulics | Linear Motion and Assembly Technologies | Pneumatics | Service

Rexroth
Bosch Group

Meter-in pressure compensator, direct operated

RE 29224/11.07
Replaces: 02.03

Type ZDC

Sizes 10 to 32
Component series 2X
Maximum operating pressure 350 bar
Maximum flow 520 l/min

tb0217

Table of contents

Features

- Sandwich plate valve
- Porting pattern to ISO 4401
- Load compensation in channel P → A or P → B by integrated shuttle valve
- 2-way design “P“
- 3-way design “PT“ (sizes 10 to 25)
- Flow control in interaction with proportional directional valve

Information on available spare parts:
www.boschrexroth.com/spc

Ordering code

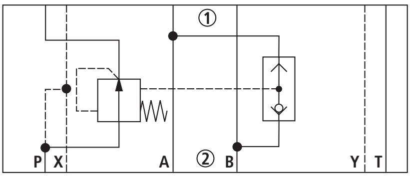
ZDC		–2X/			*

Size 10	= 10
Size 16	= 16
Size 25	= 25
Size 32 (variant "P" only)	= 32
2-way design (pressure reducing function)	= P
3-way design (pressure relief function)	= PT
Component series 20 to 29 (20 to 29: unchanged installation and connection dimensions)	= 2X
Pilot oil supply "internal"	= No code
Pilot oil supply "external	= X
Pilot oil supply external, port X on component side plugged (size 10 only)	= XL
No code =	Without special type of protection
J =	Seawater-resistant
Seal material	
M =	NBR seals
V =	FKM seals
	(other seals on request)
	⚠ Attention! Observe compatibility of seals with hydraulic fluid used!
	Further details in clear text

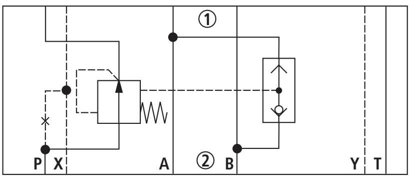
Standard types and components can be found in the EPS (standard price list).

Symbols: 2-way design "P" (① = component side, ② = plate side)

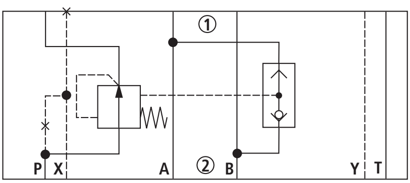
Pilot oil supply "internal"
Type ZDC . P-2X/…



Pilot oil supply "external"
Type ZDC . P-2X/**X**…

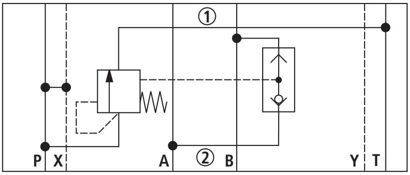


Pilot oil supply "external",
port X on component side plugged (size 10 only)
Type ZDC 10 P-2X/**XL**…

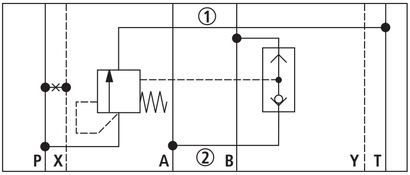


Symbols: 3-way design “PT“ (① = component side, ② = plate side)

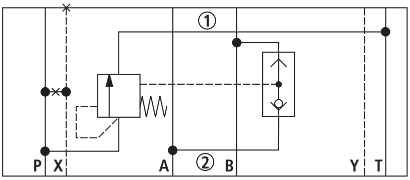
Pilot oil supply “internal“
Type ZDC . PT-2X/…



Pilot oil supply “external“
Type ZDC . PT-2X/**X**…



Pilot oil supply “external“,
port X on component side plugged (size 10 only)
Type ZDC 10 PT-2X/**XL**…



Function, section

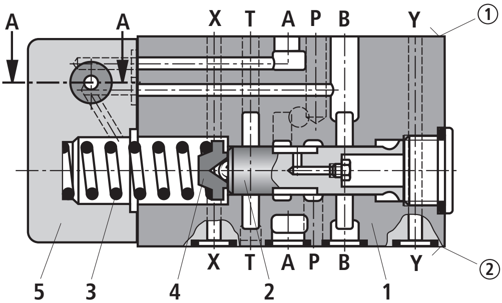
Valves of type ZDC are direct operated meter-in pressure compensators of 2- or 3-way design.

They are used for load compensation as meter-in pressure compensator in channel P.

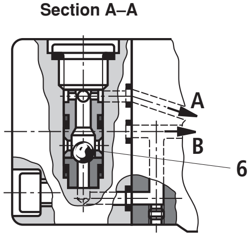
These valves basically consist of housing (1), control spool (2), compression spring (3) with spring plate (4), and cover (5) with integrated shuttle valve (6).

Compression spring (3) holds control spool (2) in the open position from P2 to P1, when pressure differential P1 → A1 or P1 → B1 is less than 10 bar.

When the pressure differential exceeds 10 bar, control spool (2) is pushed to the left until the pressure differential is restored.



Section A–A



Technical data (for applications outside these parameters, please consult us!)

General

Size	Size	**10**	**16**	**25**	**32**
Weight	kg	3.0	3.5	8.9	64.7
Installation position		Optional			

Hydraulic

Maximum operating pressure	– Ports A, B, P	bar	350
	– Port T	bar	250
	– Port X	bar	30 to 100
	– Port Y	bar	150; up to 30 bar in conjunction with pilot operated proportional directional valve

Maximum flow	l/min	85	150	325	520
Hydraulic fluid		Mineral oil (HL, HLP) to DIN 51524 [1]; fast bio-degradable hydraulic fluids to VDMA 24568 (see also RE 90221); HETG (rape seed oil) [1]; HEPG (polyglycols) [2]; HEES (synthetic esters) [2]; other hydraulic fluids on request			
Hydraulic fluid temperature range	°C	–20 to +70			
Viscosity range	mm^2/s	15 to 380			
Permissible max. degree of contamination of the hydraulic fluid - cleanliness class to ISO 4406 (c)		Class 20/18/15 [3]			

1) Suitable for NBR and FKM seals

2) Suitable only for FKM seals

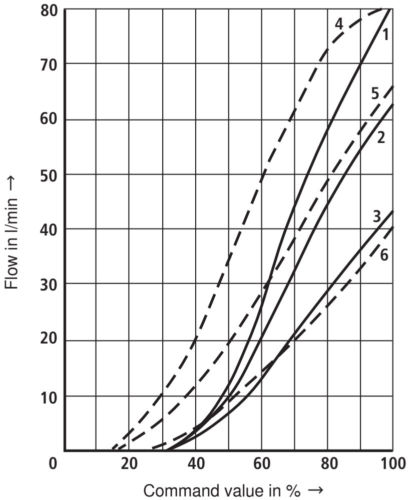
3) The cleanliness classes specified for components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and, at the same time, prolongs the service life of components.

For the selection of filters, see data sheets RE 50070, RE 50076, RE 50081, RE 50086, RE 50087 and RE 50088.

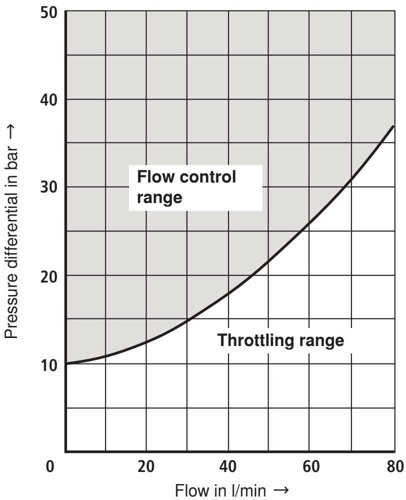
Characteristic curves (measured with HLP46 and ϑ_{oil} = 40 °C ±5 °C)

Flow control P to A, P to B

Size 10



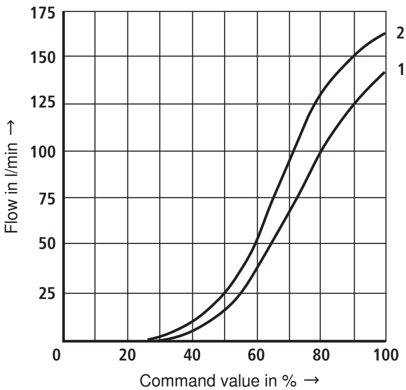
Size 10



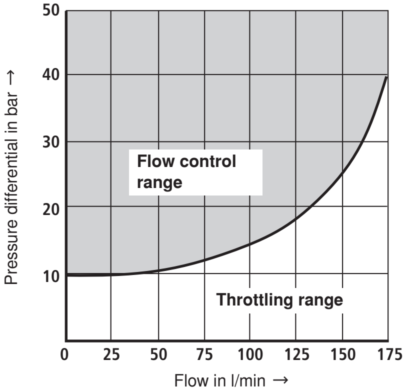
1 With type 4WRZ 10…85…
2 With type 4WRZ 10…50…
3 With type 4WRZ 10…25…
4 With type 4WRZ 10…64…
5 With type 4WRZ 10…32…
6 With type 4WRZ 10…16…

Pressure differential $\Delta p_{min} = p_{pump} - p_{load}$

Size 16



Size 16



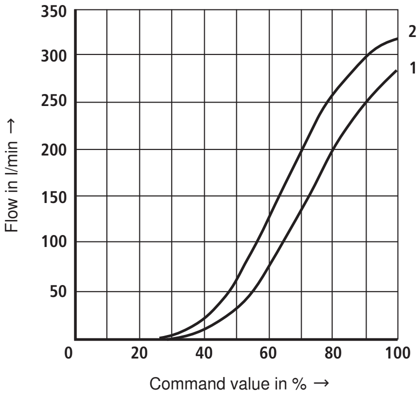
1 With type 4 WRZ 16…100…
2 With type 4 WRZ 16…150…

Pressure differential $\Delta p_{min} = p_{pump} - p_{load}$

Characteristic curves (measured with HLP46 and ϑ_{oil} = 40 °C ±5 °C)

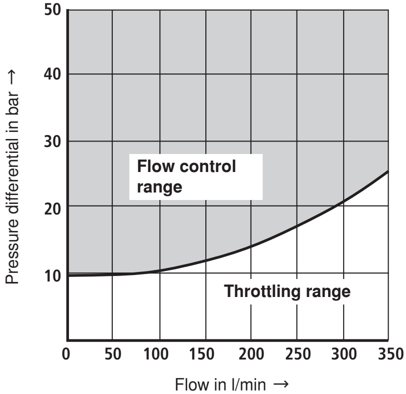
Flow control P to A, P to B

Size 25



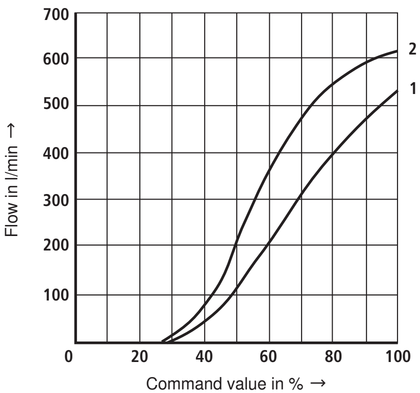
1 With type 4 WRZ 25…270…
2 With type 4 WRZ 25…325…

Size 25



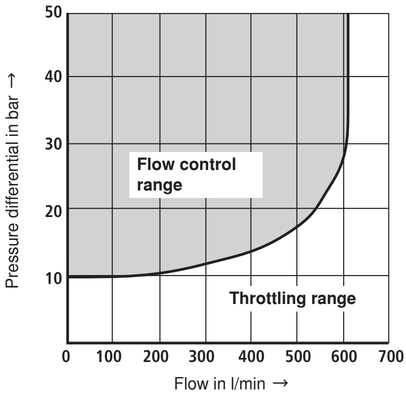
Pressure differential $\Delta \boldsymbol{p}_{min} = \boldsymbol{p}_{pump} - \boldsymbol{p}_{load}$

Size 32



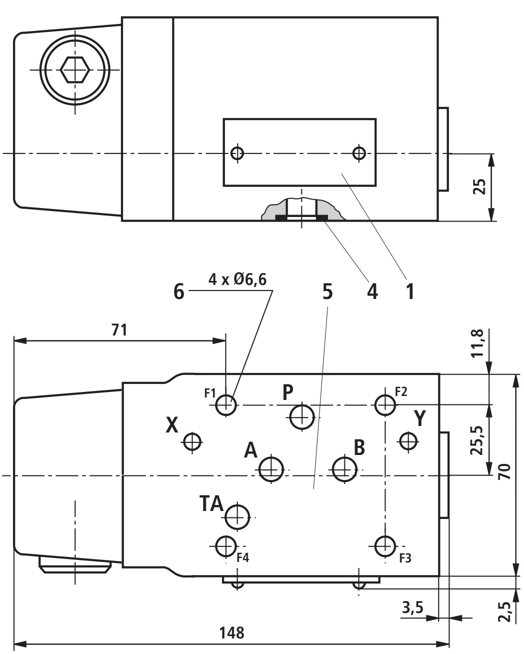
1 With type 4 WRZ 32…360…
2 With type 4 WRZ 32…520…

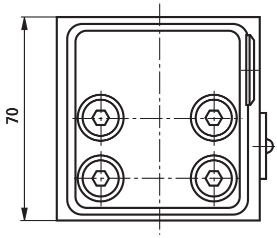
Size 32

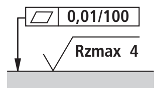


Pressure differential $\Delta \boldsymbol{p}_{min} = \boldsymbol{p}_{pump} - \boldsymbol{p}_{load}$

Unit dimensions: Size 10 (dimensions in mm)







Required surface quality of valve mounting face

1 Nameplate

4 Idential seal rings for ports A, B, P, T;
Idential seal rings for ports X, Y (plate side)

5 Porting pattern ISO 4401-05-05-0-05

6 Valve mounting screws (see on the right)

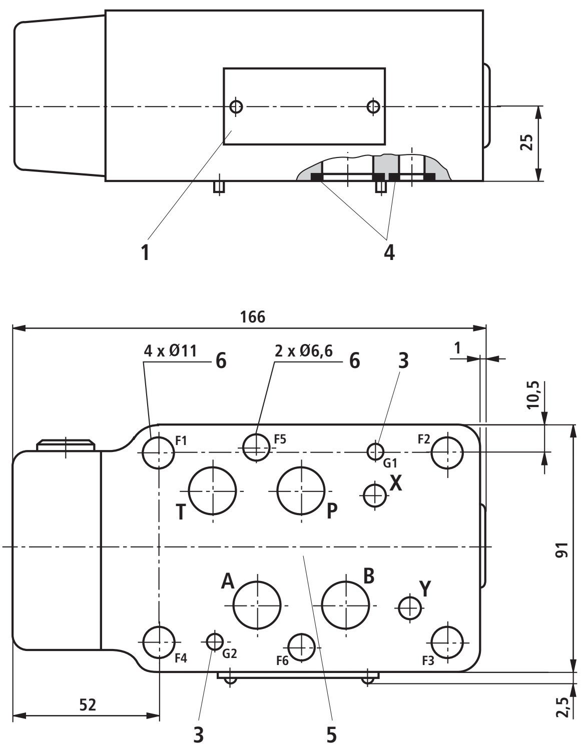
Valve mounting screws (separate order)

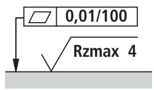
4 hexagon socket head cap screws ISO 4762 - M6 - 10.9

☞ **Note!**

The length and tightening torque of the valve mounting screws must be calculated in conjunction with the components mounted below and above the sandwich plate valve.

Unit dimensions: Size 16 (dimensions in mm)





Required surface quality of valve mounting face

1 Nameplate
2 Locating pin
3 Bore for locating pins
4 Idential seal rings for ports A, B, P, T;
  Idential seal rings for ports X, Y (plate side)
5 Porting pattern ISO 4401-07-07-0-05
6 Valve mounting screws (see on the right)

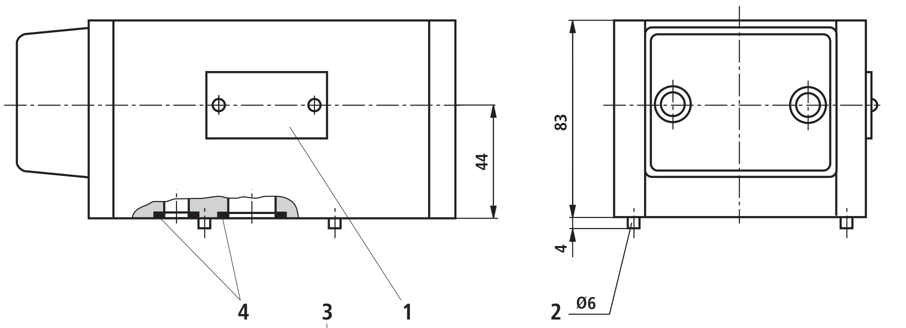
Valve mounting screws (separate order)

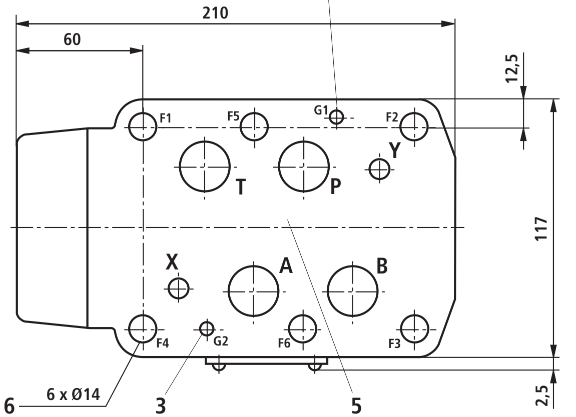
4 hexagon socket head cap screws ISO 4762 - M10 - 10.9
2 hexagon socket head cap screws ISO 4762 - M6 - 10.9

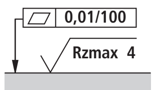
Note!

The length and tightening torque of the valve mounting screws must be calculated in conjunction with the components mounted below and above the sandwich plate valve.

Unit dimensions: Size 25 (dimensions in mm)







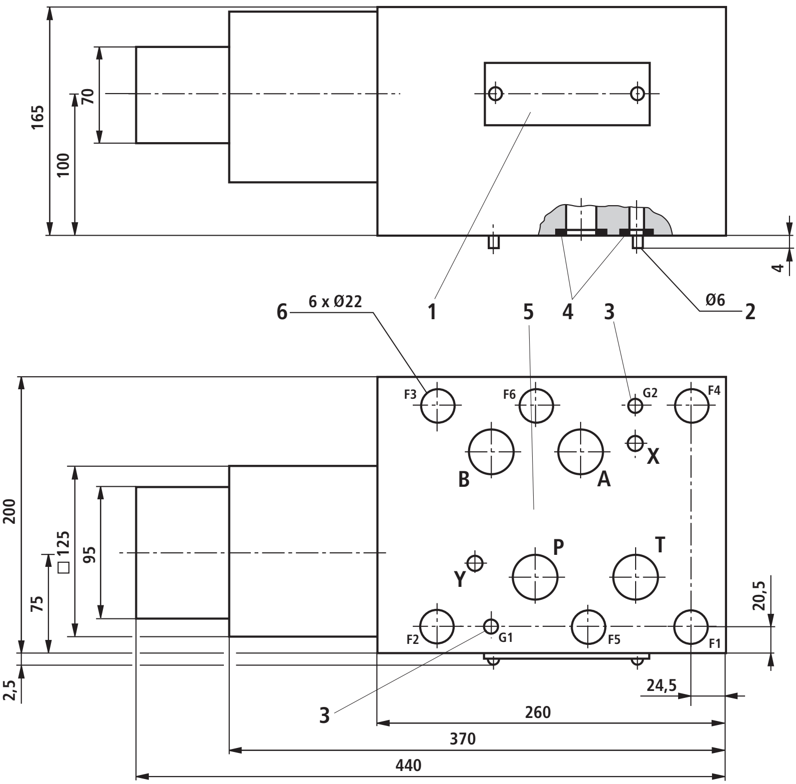
Required surface quality of valve mounting face

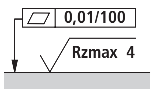
1 Nameplate
2 Locating pin
3 Bore for locating pins
4 Idential seal rings for ports A, B, P, T; Idential seal rings for ports X, Y (plate side)
5 Porting pattern ISO 4401-08-08-0-05
6 Valve mounting screws (see on the right)

Valve mounting screws (separate order)
6 hexagon socket head cap screws ISO 4762 - M12 - 10.9

☞ **Note!**
The length and tightening torque of the valve mounting screws must be calculated in conjunction with the components mounted below and above the sandwich plate valve.

Unit dimensions: Size 32 (dimensions in mm)





Required surface quality of valve mounting face

1 Nameplate
2 Locating pin
3 Bore for locating pins
4 Idential seal rings for ports A, B, P, T; Idential seal rings for ports X, Y (plate side)
5 Porting pattern ISO 4401-10-09-0-05
6 Valve mounting screws (see on the right)

Valve mounting screws (separate order)

6 hexagon socket head cap screws ISO 4762 - M20 - 10.9

☞ **Note!**

The length and tightening torque of the valve mounting screws must be calculated in conjunction with the components mounted below and above the sandwich plate valve.

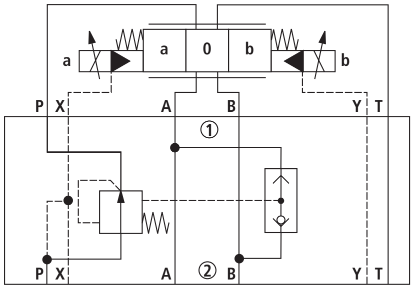
Pilot oil supply

⚠ **Attention!**

In conjunction with the meter-in pressure compensator the pilot operated proportional valve must be used in the variant with “**external pilot oil supply**“!

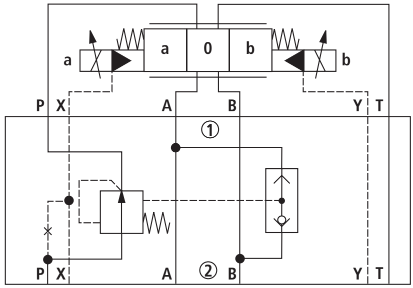
With **external** pilot oil supply the connection to channel P is closed. The pilot oil is taken from a separate control circuit. With **internal** pilot oil supply the connection to channel P is open. The pilot oil is taken from the throttle side of the pressure compensator (port X in the subplate is closed).

Type 4WRZ…



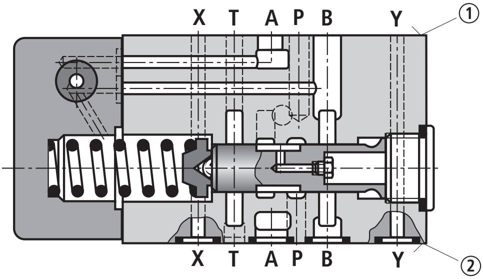
Type ZDC..P-2X/…

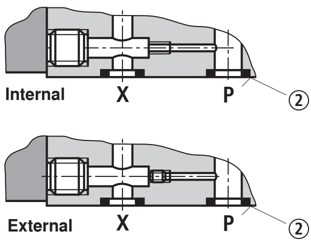
Type 4WRZ…



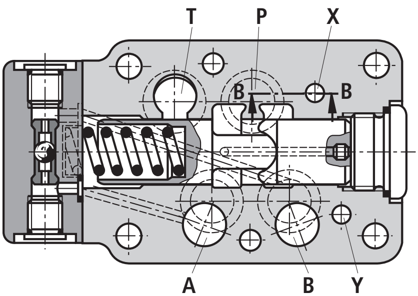
Type ZDC..P-2X/**X**…

Size 10

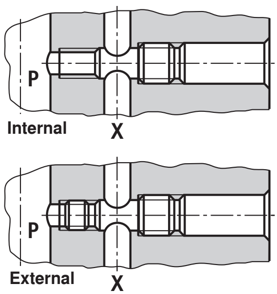




Size 16

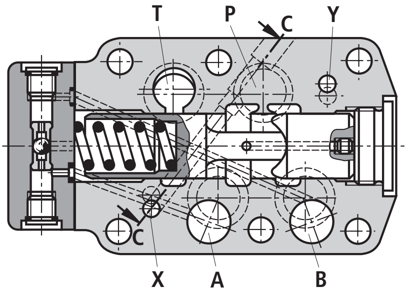


Section B–B

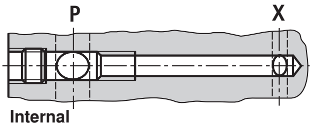


Pilot oil supply

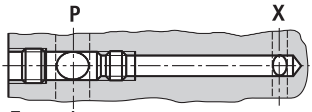
Size 25



Section C–C

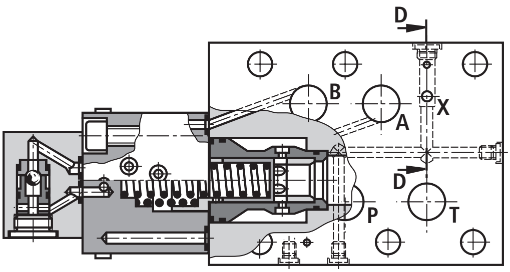


Internal

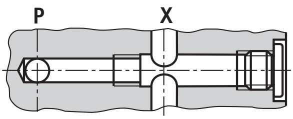


External

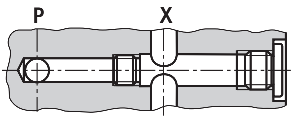
Size 32



Section D–D



Internal



External

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

The Drive & Control Company

Rexroth
Bosch Group

Bosch Rexroth AG
Zum Eisengießer 1
97816 Lohr, Germany
Phone +49(0)9352/18-0
Fax +49(0)9352/18-40
info@boschrexroth.de
www.boschrexroth.com

Find your local contact person here:
www.boschrexroth.com/contact

Document no.: RE 00112-05
Material no.: R999000306
Versions no.: 2013-08
Replaces: RE 00112-03_2008-11