NACHI

Proportional Control Valves

Photo	Туре	Series	Description	Main Specifications
	Pressure Control	EPR	Electro-Hydraulic Proportional Pilot Relief Valve	0.3gpm, 5000psi
	Pressure Control	ER	Electro-Hydraulic Proportional Relief Valve	39.7 - 84.6gpm, 5000psi
	Pressure Control	EGB	Electro-Hydraulic Proportional Reducing and Relief Valve	13.2 - 26.4gpm, 3000psi
	Flow Control	ES	Electro-Hydraulic Proportional Flow Control Valve	0.08 - 132.1gpm, 3000psi
	Flow & Directional Control	ESD	Electro-Hydraulic Proportional Directional and Flow Control Valve	6.6 - 66.1gpm, 3571psi
NA	Pressure Control	EOG	Modular Type Electro- Hydraulic Proportional Reducing Valve	7.9gpm, 3571psi
	Flow Control	EOF	Modular Type Electro- Hydraulic Proportional Reducing Valve	0.08 - 6.6gpm, 3000psi
	Amplifier	EDA/EDC	Small Type Amplifier Series for Electro- Hydraulic Proportional Valve	NA

NACHİ

EPR Series Electro-hydraulic Proportional Pilot Relief Valve (EPR)



Features

This is a direct acting type relief valve based on a balance between the attraction force of a DC solenoid and a hydraulic force. This valve can be utilized in a small capacity hydraulic system or connected to the vent-port of a balance piston type pressure control valve to perform continuous control of the pressure in proportion to the input current.

Specifications

Item	EPR-G01-*-***-*12	
Rated flow //min (gpm)	1.2 (0.3)	
Pressure adjusting range kgf/cm² (psi)	B: 3 ~ 25 (43 ~ 357) 1: 7 ~ 70 (100 ~ 1000) 2: 10 ~ 140 (143 ~ 2000) 3: 15 ~ 210 (214 ~ 3000) 4: 15 ~ 280 (214 ~ 4000) 5: 20 ~ 350 (286 ~ 5000)	
Rated current mA	800	
$\begin{tabular}{lllllllllllllllllllllllllllllllllll$	20 (20°C) (68°F)	
Hysteresis	3% or less Note 1).	
Weight kgf (lbs)	1.6 (3.5)	

Note 1). This is the hysteresis value when Nachi amplifier is provided for the valve. (With dither)

Understanding Model Numbers



Number of Pressure port and Tank port orifice

Number	00	08	09	10	11	12	13
Orifice size	None	ф0.8 (0.031)	ф0.9 (0.035)	ф1.0 (0.039)	φ1.1 (0.043)	ф1.2 (0.047)	ф1.3 (0.051)
Unit = mm (inch)						

Pressure range	Orifice number
B, 1 type	0013S
2, 3 type	0012S
4 type	1212S
5 type	1111S

Note) Standard size is as below.

Handling Air Bleeding

Loosen the air vent to bleed the air and fill the solenoid with oil at the start of operation to obtain good pressure control.

The position of the air vent can be changed by turning the cover.

2 Installation Method

The minimum pressure will become approximately 2kgf/cm² (29 psi) higher when this valve is attached on a vertical plane.

3 Manual Pressure Adjusting Screw When there is no input current supplied to the valve as in the case of initial adjustment or due to an electrical fault, the valve pressure can be controlled temporarily by turning the manual adjusting screw. In normal operation, this manual adjusting screw must be retracted completely and fixed with the lock nut.

4 Minimum Relief Flow

Since the setting pressure may become unstable in case of low flow rate, use this valve at a flow rate of 0.3 ℓ /min (0.08 gpm) or more.

5 Load Capacity When the circuit pressure is to be controlled directly by this valve, the

load capacity must be 40cc (2.4 in³) or more.

6 Mounting Bolts

M5 x 45 ℓ (E: 10-24 UNC-3A x 1³/₄"), Grade 12.9 tightening torque

- $= 50 \sim 70 \text{ kgf} \cdot \text{cm} (4 \sim 5 \text{ lbs} \cdot \text{ft})$
- 7 Subplate
 - When a subplate is required, specify the following type in the purchase order.
 - MSA-01Y-*10 (refer to dimensions in the figure below.)
- 8 Oil Temperature
- -20°C~70°C (-4°F~158°F)
- 9 Oil Viscosity
- 12~400 cSt
- 15~60 cSt is recommended.
- 10Gasket Dimension
- ISO 4401-03-02-0-94







27

28

0 ring

Seal

No.	Name of part	Number of part	Qty
23	0 ring	RO-P11-90	1
24	0 ring	R0-P9-90	2
25	0 ring	R0-P22-90	1
26	0 ring	R0-P16-90	1
27	0 ring	RO-P7-90	1
28	Seal	DS-1-4	1

NACHI

ER Series Electro-hydraulic Proportional Relief Valve (ER)





Features

This valve is a combination of the electro-hydraulic proportional pilot relief valve (EPR Series) and a balance piston type relief valve and is used to perform pressure control in proportion to the input current. Since the control pressure is affected very little by changes of flow rate or oil temperature, even complicated pressure (power) control can be performed by an open loop system.

Specifications

Item	ER-G03-*-*21	ER-G06-*-*21		
Rated flow <i>c</i> /min (gpm)	150 (39.7)	320 (84.6)		
Pressure adjusting range kgf/cm² (psi)	B: 3 ~ 2 1: 7 ~ 7 2: 10 ~ 3: 15 ~ 4: 15 ~ 5: 20 ~ 3	B: 3 ~ 25 (43 ~ 357) Note 1). 1: 7 ~ 70 (100 ~ 1000) 2: 10 ~ 140 (143 ~ 2000) 3: 15 ~ 210 (214 ~ 3000) 4: 15 ~ 250 (214 ~ 3571) 5: 20 ~ 350 (286 ~ 5000)		
Rated current mA		800		
Coil resistance Ω	20 (20	20 (20°C) (68°F)		
Hysteresis	3% or le	ess Note 2).		
Minimum relief flow //min (gpm)	5 (1.3)	8 (2.1)		
Weight kgf (lbs)	6.0 (13.2)	7.1 (15.7)		

Note 1). The G03 model only available. But the flow is restricted to 40 l/min (10.6 gpm).
 2). This is the hysteresis value when Nachi amplifier is provided for the valve. (With dither)

Understanding Model Numbers





(1.42)

(3.27

(8.56)

(3.94)

(8.01)

(1.46)

(2.63)

(0.59)

(4.69

Handling

- 1 Air Bleeding
 - Loosen the air vent to bleed the air thoroughly and fill oil in the solenoid at the start of operation to obtain good pressure control.
- ²Manual Pressure Adjusting Screw When there is no input current supplied to the valve as in the case of initial adjustment or due to an electrical fault, the valve pressure can be controlled temporarily by turning the manual adjusting screw. In normal operation, this manual adjust screw must be retracted completely and fixed with the locknut.
- 3 Tank Port Back-Pressure Use the valve with a tank port back-pressure which is as low as possible. 2 kgf/cm² (29 psi) or less is recommended.
- 4 Setting Pressure of Safety valve The safety valve is set for a pressure that is 15~20 kgf/cm² (214~286 psi) above the maximum adjusting pressure. Adjust this safety valve setting in accordance with the pressure to be actually used.
- 5 Mounting Bolts Grade = 12.9

Model	Bolt Size	Quantity	Tightening torque
ER-G03	M12 x 50¢ (E: 1/2-13 UNCx2")	4	750 ~ 950 kgf cm (55 ~ 69 lbs [.] ft)
ER-G06	M16 x 80¢ (E: 5/8-11 UNCx2 3/8")	4	1900 ~ 2350 kgf cm (138 ~ 170 lbs [.] ft)

6 Oil Temperature

-20°C~70°C (-4°F~158°F)

7 Oil Viscosity

b

.14

(0.55)

18

0.71

(0.98)

(2.76)

12~400 cSt

- 15~60 cSt is recommended.
- 8 Gasket Dimension
- G03 = ISO 6264-AR-06-2-A
- G06 = ISO 6264-AS-08-2-A

Subplate MRI-03*-E10



(26.4) (52.9) (79.3) Relief flow *l*/min (gpm)

200

300

100

0



Cross Section Drawing

ER-G**-*-*21

Combination with EPR Valve



Model	Pilot valve model]
ER-G03-B-21	EPR-G01-B-0011S-12	
1	1-0011S-12	
2	2-1313S-12	
3	3-1313S-12	
4	4-1212S-12	
5	5-1212S-12	
ER-G06-1-21	EPR-G01-1-0011S-12	No
2	2-1313S-12	1
3	3-1313S-12	, ,
4	4-1212S-12	2
5	5-1212S-12	3

List of Seals

Ne	Nome of next	Model / Nu	0+	
NO.	wame of part	ER-G03-*-*20	ER-G06-*-*20	uty
22	0 ring	RO-P8-90	RO-P8-90	2
23	0 ring	RO-P9-90	RO-P9-90	3
24	0 ring	RO-G10A-90	RO-G10A-90	1
25	0 ring	R0-P11	R0-P11	1
26	0 ring	R0-P18-90	RO-P28-90	2
27	0 ring	R0-G25-90	RO-P28-90	1
28	0-ring	RO-G30-90	RO-P32-90	2
29	Backup ring	RBO-P10A	RBO-P10A	1
30	Backup ring	RBO-G30	RB-P32	1

No.	Name of part	No.	Name of part
1	Body	19	Plug
2	Cover	20	Screw
3	Poppet	21	Pin
4	Sleeve	22	0-ring
5	Spring	23	0-ring
6	Spacer	24	0-ring
7	Poppet	25	0-ring
8	Seat	26	0-ring
9	Plunger	27	0-ring
10	Retainer	28	0-ring
11	Plug	29	Backup ring
12	Collar	30	Backup ring
113	Spring	31	Screw
14	Knob	32	Orifice
15	Orifice	33	Nut
16	Orifice	34	Pilot relief valve
17	Plate	35	Screw
18	Plug		

NACHİ

EGB Series Electro-hydraulic Proportional Reducing and Relief Valve





Features

This is a combination of the electrohydraulic proportional pilot relief valve (EPR Series) and a reducing valve with a relief and is used to perform pressure reducing control of the pressure in a hydraulic system in proportion to the input current. Since a relief function is provided, the outlet side pressure can be maintained practically constant even when a reaction force acts on the valve outlet side. Owing to this feature, the response performance are very good.

Specifications

Model	EGB-G03	EGB-G06	
Item	^-^11	^-^11	
Max. operating pressure kgf/cm ² (psi)	210 (3000)		
Rated flow l/min (gpm)	50 (13.2)	100 (26.4)	
Pressure adjusting range kgf/cm ² (psi)	B: 3 ~ 25 (43 ~ 357) Note (1) 1: 7 ~ 70 (100 ~ 1000)		
	$\begin{array}{c} 2. & 9 \\ 3: & 15 \\ \sim & 210 \\ (214 \\ \sim & 3000) \end{array}$		
Rated current (mA)	800		
Coil resistance (Ω)	20 (20°C) (68°F)		
Hysteresis	3% or less (Note 2)		
Weight kgf (Ibs)	5.5 (12)	7.8 (17)	
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Note 1) The G03 model is only available, but the flow is restricted to 20 µ/min (5.3 gpm). Note 2) This is the hysteresis value when NACHI's amplifier is provided for the valve. (With dither)







Handling

- 1 Air Bleeding
 - Loosen the air vent to bleed the air throughly and fill oil in the solenoid at the start of operation to obtain good pressure control.
- 2 DR Port Piping

Please take care in piping so that the DR port (in case of G06 size T port) is always filled up with oil.

- 3 Manual Pressure Adjusting Screw When there is no input current supplied to the valve as in the case of initial adjustment or due to an electrical fault, the valve pressure can be controlled temporarily by turning the manual adjusting screw. In normal operation, this manual adjusting screw must be retracted completely and fixed with the locknut.
- 4 Load Capacity
 - Use this valve with a load capacity (Valve outlet side capacity) or 5ℓ (305 in³) or more.
- 5 Mounting Bolts

Grade = 12.9				
	Model	Bolt Size	Quantity	Tightening torque
	EGB-G03	M10 x 75¢ (E: 3/8-16 UNCx3")	4	450 ~ 550 kgf · cm (33 ~ 40 lbs · ft)
	EGB-G06	M10 x 85¢ (E: 3/8-16 UNCx3-3/8")	4	450 ~ 550 kgf · cm (33 ~ 40 lbs · ft)

6 Oil temperature

- -20~70°C (-4°F~158°F)
- 7 Oil viscosity
- 12~400 cSt

15~60 cSt is recommended.

Installation Gasket Dimensions EGB-G03-*-*11





Cross Section Drawing

EGB-G**-*-*11



List of Seals

No. Nome of	Number	ER-G03-*-*	11	ER-G06-*-*11		
NO.	Name of part	Number of part	Q'ty	Number of part	Q'ty	
11	0 ring	RO-P20-90	2	RO-P26-90	3	
12	0 ring	RO-P10A-90	2			
13	0 ring	RO-P22-90	2	RO-G03-90	2	
14	0 ring	RO-P6-90	2	RO-P6-90	2	

Combination with EPR Valve

EGB-G06

EGB-606-3

EGB-G06-1

800

EGB-G06-2

EPR valve model
EPR-G01-B-0000-12
1-0013-12
2-0012-12
3-0011-12
EPR-G01-1-0013-12
2-0012-12
3-0012-12

1000

Manual pressure adjusting section

200

400

Input current mA

600

No.	Name of part
1	Body
2	Piston
3	Cover
4	Cover
5	Spring
6	Screw
7	Pin
8	Pin
9	Orifice
10	Orifice
11	0 ring
12	0 ring
13	0 ring
14	0 ring
15	Pilot relief valve

ΝΔΟΗί

EOG Series

Modular Type Electro-hydraulic Proportional Reducing Valve (EOG)





Features

This valve is the expansion of modular valve idea into electro-hydraulic proportional reducing valve, and it is used to perform pressure reducing control of the pressure in a hydraulic system in proportion to the input current.

This valve is most suited for small hydraulic systems, such as continuous proportional control of the lathe's work chuck pressure of machine tools. Since a relief function is provided, the response performance to the pressure is very good.

Specifications

Item	Model	EOG-G01-P*-*11
Max. operating pressure	kgf/cm² (psi)	250 (3571)
Rated flow	۷/min (gpm)	30 (7.9)
Pressure adjusting ranges	kgf/cm² (psi)	B: 3 ~ 25 (43 ~ 357) 1: 4 ~ 70 (58 ~ 1000) 2: 6 ~ 140 (86 ~ 2000)
Allowable back pressure of T-port	kgf/cm² (psi)	Less than 25 (357)
Rated current	(mA)	850
Coil resistance	(Ω)	20 (20°C) (68°F)
Hysteresis	(%)	Less than 3 Note (1)
Weight	kgf (Ibs)	3.6 (7.9)

Note 1) This is the hysteresis value when NACHI's amplifier is provided for the valve. (with dither)

Understanding Model Numbers



Installation Dimensions

mm (inch)

EOG-G01-P*



Handling

1 Air Bleeding

- Loosen the air vent to bleed the air throughly and fill oil in the solenoid at the start of operation to obtain good pressure control.
- Manual Pressure Adjusting Screw When there is no input current supplied to the valve as in the case of initial adjustment or due to an electrical fault, the valve pressure can be controlled temporarily by turning the manual adjusting screw. In normal operation, this manual adjusting screw must be retracted completely and fixed with the clocknut.
- 3T-Port Back Pressure Since this is the internal drain system, keep the valve T-port back pressure less than 25 kgf/cm² (357 psi).
- 4 Load capacity Please make load capacity (outside piping capacity) more than 0.5ℓ (0.13 gallon).
- 5Oil Temperature -20~70°C (-4°F~158°F)
- 6 Oil Viscosity
- 12~400 cSt
 - 15~60 cSt is recommended.
- 7 Gasket Dimension ISO 4401-03-02-0-94

Oil viscosity 32 cSt



NACH

ES Series Electro-hydraulic Proportional Flow Control Valve (ES)





Features

The actuator speed can be controlled optionally according to the input current

Since the setting flow rate is affected

or oil temperature, high accuracy speed control is possible. This valve is most suited for acceleration and

very little by changes of the pressure

deceleration control of the actuator and remote control.

Specifications

Model	(C)ES-G02	ES-G03	(C)ES-G06	ES-G10
Item	-10/30-(F)-*12	-60/125-(F)-*12	-250-*11	-500-(F)-*11
Max. operating pressure kgf/cm ² (psi)		210 (30	000)	
Metered flow range 2/min (gpm)	0.3~10 (0.08~2.6)/ 0.3~30 (0.08~7.9)	1~60 (0.3~15.9)/ 1~125 (0.3~33.0)	3~250 (0.8~66.1)	5~500 (1.3~132.1)
Min. required differential	10 (143)	13 (186)	15 (214)	20 (286)
pressure kgf/cm ² (psi)	(Note 1)	(Note 1)	(Note 1)	(Note 1)
Reverse free flow 2/min (gpm) (Only with check valve)	50 (13.2)	(125)(33.0) (Note 3)	200 (52.8)	
Hysteresis	3% or less (Note 2)	3% or less (Note 2)	3% or less (Note 2)	3% or less (Note 2)
Rated current (mA)		800		
Coil resistance (Ω) 20 (20°C) (68°F)				
Weight kgf (lbs)	8.5 (19)	13 (29)	25 (55)	55 (121)
Note 1) This is the differential pre	ssure between th	e valve inlet and o	utlet by which	a good

pressure compensation effect can be obtained.

Note 2) This is the hysteresis value when NACHI's amplifier is provided for the valve. (with dither) Note 3) Although the ES-G03 does not include a built-in check valve type, a check valve auxiliary plate (Model MCF-03-D-22) is available





CES: Electro-hydraulic Proportional Flow Control Valve with check valve. Only 02. and 06. ES: Electro-hydraulic Proportional Flow Control Valve



							mm	n (inch)					
Model	Α	В	C	D	E	F	G	н	J	K	L	M	N
(C)ES-G02	66	80	132	242.5	9.7	48	102	9.4	38.1	95	23	14	8.8
	(2.60)	(3.15)	(5.20)	(9.55)	(0.38)	(1.89)	(4.02)	(0.37)	(1.50)	(3.74)	(0.91)	(0.55)	(0.35)
ES-G03	61	82.5	134.5	245	11.2	67.8	124	11.2	50.8	124	26	17.5	11
	(2.40)	(3.25)	(5.30)	(9.65)	(0.44)	(2.67)	(4.88)	(0.44)	(2.00)	(4.88)	(1.02)	(0.69)	(0.43)
(C)ES-G06)	115 (4.53)	130 (5.12)	182 (7.17)	292.5 (11.52)	168.8 (0.66)	104.8 (4.13)	167 (6.57)	17 (0.67)	73 (2.87)	180 (7.09)	-	26 (1.02)	18 (0.71)
ES-G10	137	160	215	326	25	148	228	23.5	98.5	24.4	18	32	22
	(5.39)	(6.30)	(8.46)	(12.83)	(0.98)	(5.83)	(8.98)	(0.93)	(3.88)	(9.61)	(0.71)	(1.26)	(0.87)

Handling 1 Air Bleeding

Loosen the air vent and bleed the air thoroughly and fill oil in the solenoid at the start of operation to obtain stable flow control.

The position of the air vent be changed by turning the cover.

² Manual Flow Adjusting Screw

When there is no input current supplies to the valve as in the case of initial adjustment or due to an electrical fault, the flow can be adjusted by turning the manual adjusting screw. In normal operation, this adjusting screw must be retracted completely and fixed by the locknut.

3 Drain Port

Connect the drain port directly to the oil tank so that the back-pressure will be 2 kgf/cm2 (29 psi) or less.

4 Mounting Bolts

Grade = 12.9

Model	Bolt Size	Quantity	Tightening torque
(C)ES-G02	M8 x 80¢ (E: 5/16-18 UNCx3-1/8")	4	200 ~ 250 kgf · cm (15 ~ 18 lbs · ft)
ES-G03	M10 x 75¢	4	450 ~ 550 kgf · cm
	(E: 3/8-16 UNCx3")		(33 ~ 40 · lbs · ft)
(C)ES-G06	M16 x 1352 (E: 5/8-11 UNCx5-5/16")	4	1900 ~ 2350 kgf · cm (138 ~ 170 lbs · ft)
ES-G06	M20 x 160¢ (E: 3/4-10 UNCx6-5/16")	4	3700 ~ 4600 kgf · cm (268 ~ 333 lbs · ft)

5 If the distance between the flow control valve and the actuator is long (Piping volume is large.). resonance of the load system and the control valve may occur in some cases.

6 Subplate

Refer to page 8 for details.

- 7 Oil Temperature
- -20~70°C (-4°F~158°F)
- 8 Oil Viscosity
- 12~400 cSt
- 15~60 cSt is recommended.
- ⁹Gasket Dimension
 - (C)ES-G02 = ISO 6263-06-05-97
 - ES-G03 = ISO 6263-07-09-97
 - (C)ES-G06 = ISO 6263-08-13-97



No.

Name of part

Cross Section Drawings

ES-G**-*-*11(12)



1	Body	17	Pin
2	Cover	18	Spring
3	Piston	19	Spring
4	Sleeve	20	Spring
5	Plug	21	Spring
6	Plug	22	Spring
7	Retainer	23	Screw
8	Sleeve	24	0 ring
9	Spool	25	0 ring
10	Guide	26	0 ring
11	Sleeve	27	0 ring
12	Retainer	28	0 ring
13	Retainer	29	0 ring
14	Sleeve	30	0 ring
15	Piston	31	0 ring
16	Ball	32	Proportional solenoid

No.

Name of part



Manual flow adjusting section

(14) (15)

List of Seals

H

(25)

No	Nome of part	(C)ES-G02		ES-G03		(C)ES-G06		ES-G10	
INU.	Mane of part	Number of part	Q'ty	Number of part	Q'ty	Number of part	Q'ty	Number of part	Q'ty
24	0 ring	RO-P18-90	2	RO-P26-90	2	RO-G35-90	2	RO-P48-90	2
25	0 ring	RO-P24-90	1	RO-P28-90	1	RO-G35-90	1	R0-P48-90	1
26	0 ring	—	-		_	RO-G35-90	2	RO-G50-90	2
27	0 ring	RO-P29-90	1	RO-P29-90	1	RO-G45-90	1	RO-G60-90	1
28	0 ring	RO-P5-90	4	RO-P5-90	4	RO-P8-90	3	RO-P9-90	3
29	0 ring	RO-P9-90	1	RO-P9-90	1	RO-P9-90	1	RP-P9-90	1
30	0 ring	RO-P12-90	1	R0-P20-90	1	RO-G55-90	1	RO-G75-90	2
31	0 ring	R0-P30-90	1	R0-P38-90	1	R0-P50-90	1	BO-G75-90	1

Subplate for Electro-hydraulic Proportional Flow Control Valves (ES) MES-02*-(E)10 MES-03*-(E)10





Gasket Mounting Dimensions ES-G10

MES-06*-(E)10





Auxiliary Plate with Check Valve MCF-03-D-22



Mounting bolts M10x110ℓ(E:3/8-16 UNCx4 3/8") 4 pcs

ΝΔΟΗΪ

EOF Series

Modular Type Electro-hydraulic Proportional Flow Control Valve (EOF)



EOF-G01-725

Features

This valve was made by modulating the combination of the Electro-Hydraulic Throttle Valve plus Pressure Compensating Valve, and has 2 types; one is the Meter-In Control Valve (EOF-G01-P) and the other is Meter-Out Control Valve (EOF-G01-T).

Since the setting flow rate is affected very little by changes of the pressure or oil temperature, this valve is most suited for electro-proportionating the small oil hydraulic systems, such as the high speed shockless control or remote control of APC, ATC in the machine tools.

Specifications

ltem	Model	EOF-G01-P/T25-*11
Max. operating pressure	kgf/cm² (psi)	210 (3000)
Rated flow	۷/min (gpm)	0.3 ~ 25 (0.08 ~ 6.6)
Flow control port		EOF-G01-P: P-Port EOF-G01-T: T-Port
Allowable back-pressure of T-port	kgf/cm² (psi)	Less than 25 (357)
Hysteresis	(%)	Less than 3 Note (1)
Resistance time	(sec)	0.05
Rated current (mA)	(mA)	800
Coil resistance	(Ω)	20 (20°C) (68°F)
Weight	kaf (Ibs)	3.7 (8.2)

Note 1) This is the hysteresis value when NACHI's amplifier is provided for the valve. (with dither)

mm (inch)

EOF-G01-T25

Understanding Model Numbers



Installation Dimensions

EOF-G01-P25









Handling

- 1 Air Bleeding
- Loosen the air vent to bleed the air thoroughly and fill oil in the solenoid at the start of operation to obtain good flow control. The position of the air vent is changed by turning the cover.
- ²Manual Flow Adjusting Screw When there is no input current supplied to the valve as in the case of initial adjustment or due to an electrical fault, the flow can be adjusted by turning the Manual Adjusting Screw. In normal operation, this adjusting screw must be retracted completely and fixed by the locknut.
- 3T-Port Back-Pressure Since this is the internal drain system, keep the valve T-Port Back Pressure less than 25kgf/cm² (357 psi)
- 4 Oil Temperature
 - -20°C~70°C (-4°F~158°F)
- 5 Oil Viscosity
 - 12~400 cSt
 - 15~60 cSt is recommended.
- 6 Gasket Dimension ISO 4401-03-02-0-94





Note: Notch side is A port.

Input Current-Pressure Characteristics EOG-G01



Pressure-Flow Rate Characteristics EOG-G01



Oil Temperature Characteristics EOG-G01-PB





ΝΔCΗ

ESD Series Electro-hydraulic Proportional Directional and Flow Control Valve (ESD)



Features

This is electro-hydraulic proportional control valve which is composed of DC proportional solenoids in addition to the conventional 4-way solenoid valve to provide both directional control and flow control functions. The available sizes are 01 size of the direct acting system and the 03 and 06 sizes of the pilot system.

Directional control is performed by

applying an input current on one of the two proportional solenoids. And the flow volume is controlled by changing the magnitude of the input current

Remote control and shockless acceleration and deceleration control are possible and the hydraulic circuit can be simplified.

Specifications

Model	ESD-G01	ESD-G03	ESD-G06		
Item	-*-*- <mark>10</mark> -*12	-*-*- ⁴⁰ -(**)-*12	-*-*- <mark>125</mark> -(**)-*13		
Max. operating pressure kgf/cm ² (psi)		250 (3571)			
Rated flow ℓ/min (gpm)	10/20 (2.6/5.3) (Note 1)	40/80(10.6/21.1) (Note 1)	125/250(33.0/66.1) (Note 1)		
Max, flow ℓ/min (gpm)	25 (6.6) (Note 2)	100 (26.4) (Note 2)	250 (66.1) (Note 2)		
Pilot pressure kgf/cm ² (psi)	_	10 (143) or more (Note 3)			
Pilot flow &/min (gpm)	_	2(0.5) or more (Note 4)	5(1.3) or more (Note 4)		
Allowable back-pressure of T port kgf/cm ² (psi)	25 (357)	25 (357) 210 (3000	(Internal drain)) (External drain)		
Rated current (m/A)	850				
Coil resistance (Ω)	20 (20°C) (68°F)				
Hysteresis (%)	5 or less (Note 5)				
Response time (sec)	0.04 (Note 6)	0.05 (Note 6)	0.1 (Note 6)		
Weight kgf (lbs)	2.2 (4.9)	7 (15)	15 (33)		

Note 1) This is the value when the P→A or P→B pressure drop ΔP = 10 kgf/cm² (143 psi).
 Note 2) This value indicates the maximum flow between respective ports.
 Note 3) This value indicates the difference between the pilot port and tank port or between the pilot port and drain port.

Note 4) This is the value when the response time from zero to rated current is assumed to be 0.1 sec. (0.3 sec. in case of G10 size)

Note 5) This is the hysteresis when NACHI's amplifier is provided for the valve Note 6) Response time is measured at 140 kgf/cm² (2000 psi), Oil temp. 40°C (104°C),

Oil Viscosity 40cSt

Understanding Model Numbers





NOTE: ESD SERIES VALVES ARE METER IN / METER OUR DESIGN.

Handling

1 Air Bleeding

Loosen the air vent and bleed the air thoroughly at the start of operation to obtain stable control operation.

- 2 T-port Piping
- Provide piping so that the T-port (Pilot valve T-port in case of G03, G06) is always full of oil.
- 3 Manual Adjusting Screw

When there is no input current supplied to the valve in the case of initial adjustment or due to an electrical fault, the valve can be operated temporarily by turning the manual adjusting screw. In normal operation, the manual adjusting screw must be completely retracted to its original position.

4 Mounting Position of Valve

Mount the valve in proper position so that the spool axis will be horizontal.

- 5 Combination with Pressure Compensation Valve Combined use with a pressure compensation valve (option) is recommended when flow control of higher accuracy is required or when it is to be used at high pressure. NACHI'S pressure reducing type pressure compensation valves listed in the page PV-20 are available for this purpose.
- 6 Pilot Pressure (ESD-G03, G06)
- When the pilot pressure exceeds 90 kgf/cm² (1286 psi), use the modular type P-port pressure reducing valve (OG-G01-P1-21), and set pressure 20 kgf/cm² (286 psi).
- 7 Provide a counter balance valve in case of a system that requires a large brake force for declaration or system which uses a vertical type cylinder. 8 Mounting Bolt

Valve Model	Bolt Size	Quantity			
ESD-G01	M5x45ℓ (E: 10-24UNCx1 3/4")	4			
ESD-G03	M6x35ℓ (E:1/4-20UNCx1 3/8'')	4			
ESD-G06	M12x60l (E:1/2-13UNCx2 3/8'')	6			

9 Tightening Torque

Valve Model	Tightening Torque
ESD-G01	50 ~ 70 kgf-cm (3.6 ~ 5.1 lbs·ft)
ESD-G03	100 ~ 130 kgf-cm (7.2 ~ 9.4 lbs·ft)
ESD-G06	600 ~ 700 kgf-cm (43 ~ 51 lbs·ft)

10 Please maintain oil cleanliness class equal to NAS 9 or better.

11 Oil Temperature -20°C~70°C (-4°F~158°F)

12 Oil Viscosity

12~400 cSt

15~60 cSt is recommended.



ESD-G01



ESD-G03



ESD-G06



Gasket dimension ESD-G01 = ISO 4401-03-02-0-94 ESD-G03 = ISO 4401-05-0-94 ESD-G06 = ISO 4401-08-07-0-94

Refer to MSA-01Y-(E)10 on page 3 for details of subplate.

ESD-G03 Mounting Gasket Dimensions



Oil viscosity = 32 cSt

The input current - flow rate characteristics are the characteristics when the control valve pressure drop ΔP of P \rightarrow A or P \rightarrow B is 10 kgf/cm² (143 psi) ($\Delta P = 10$ kgf/cm² (143 psi)). The valve differential pressure represent-

ed by the abscissa in the pressure flow performance curve indicates the overall pressure drop of the control valve (pressure drop of B-A-B-T). The flow rate is measured by an oil motor.



Valve differential pressure kgf/cm² (psi)

Cross Section Drawings

ESD-G01-****-*12



No.	Name of part
1	Body
2	Spool
3	Retainer
4	Spring
5	Coil
6	O ring
7	O ring
8	O ring
9	O ring
10	O ring
11	Seal

List of Seals

No.	Name of part	Number of part	Qty
6	0 ring	R0-P9-90	4
7	O ring	R0A-019-90	2
8	0 ring	R0-P22-90	2
9	0 ring	R0-P16-90	2
10	O ring	R0-P7-90	2
11	Seal	DS-1-4	2

ESD-G03-****-(**)-*12



List of Seals

No.	Name of part	Number of part	Qty
10	0 ring	R0-P12-90	5
11	0 ring	R0-09-90	2
12	O ring	R0-P28-90	2
13	0 ring	R0-P9-90	6

- Note 1). There is a set screw on coil cover. Please loosen it when you change position of air vent.
 - Method of modifying pilot of drain (Standard = internal pilot, external drain)

 - drain)
 To modify the internal pilot to the external one, remove the hexagonal socket plug from PP and mount it on C.
 To modify the external drain to the internal drain type, remove the hexagonal socket head plug from D and mount it on DP. it on DR.

Cross Section Drawing

ESD-G06-****-*13



Note) There is a set screw on coil cover. Please loosen it when you change position of air vent.



Note) Method of modifying pilot or drain (Standard = internal pilot, external drain.)

- 1. To modify the external pilot type to the internal one, remove the hexagonal socket head plug from (A).
- 2. To modify the internal pilot type to the external one, mount the
- a. To modify the external drain type to the internal drain type, remove the hexagonal socket head plug from (B) and mount it on C.
- To modify the internal drain type to the external drain type, remove the hexagonal socket head plug from C and mount it on (B).

No.	Name of part	No.	Name of part
1	Body	10	Pin
2	Spool	11	Pilot spool
3	Cover	12	Stopper
4	Retainer	13	0 ring
5	Ball	14	O ring
6	Stopper	15	0 ring
7	Spring	16	0 ring
8	Spirng	17	0 ring
9	Screw	18	Proportional solenoid

		Number of part	
No.	Name of part	ESD-G06-*-*13	۵ty
13	0 ring	RO-P28-90	4
14	0 ring	RO-P20-90	2
15	0 ring	RO-G45-90	2
16	0 ring	RO-P10-90	2
17	0 ring	RO-P8-90	3

NACHI ESD Series Pressure Compensation Valve Kit

Specifications

ltem	Model	JHF-01027	JHF-03040(E)	JHF-03080(E)	JHF-06170(E)
Max. operating pressure	kgf/cm² (psi)	210 (3000)	250 (3571)	250 (3571)	210 (3000)
Differential pressure for comp	ensation kgf/cm² (psi)	10 (143)	6 (86)	14 (200)	8 (114)
Max. flow	ℓ/min(gpm)	27 (7.1)	40 (10.6)	80 (21.2)	170 (44.9)
Weight	kgf (lbs)	1.5 (3.3)	4.7 (10.4)	5.0 (11.0)	12 (26.5)

Understanding Model Numbers





Handling

1 Use external pilot style ESD valve for this Pressure Compensation Valve kit.

Internal pilot type Pressure Compensation Valve Kit is used when there is no pilot port on manifold, and you have to supply pilot flow from P port.

3 External pilot type Pressure Compensation Valve kit is used when there is external pilot port on manifold.

Cross Section Drawings

JHF-01027





JHF-03040(E)





JHF-03080(E)





JHF-06170(E)



PV-21

ΝΔΟΗί

EDA Series, **EDC Series**

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4-4 			B

Small Type Amplifier Series For Electro-Hydraulic Proportional Valve Drive

Features

These are compact and multi-function power amplifiers using high-technology of HIC (Hybrid IC).

- Compact and Space Saving Less than 1/2 of old model.
- High Reliability All functions are concentrated in a printed circuit board without any internal wiring.
- Multi function
 - This amplifier can operate 2 valves at a time.
 - Controller has also amplifier function. (EDC-PC6-AWZ-D2-20)
 - Dither frequency is adjustable.

Specifications

Items Models	EDA-PD1-NWZ-D2-11	EDC-PC6-AWZ-D2-20	
Function	Amp. type	Amp. / Controller type	
Input Number	1 DC input	2 DC input / 6 channel input	
Max. output current	900mA (20Ω solenoid)		
Input voltage	-10 ~ +10VDC	0 ~ +10VDC	
Input impedance	50kΩ	50kΩ	
External setting variable resistor	10kΩ	10kΩ	
Driven solenoid	SOL a, SOL b	SOL 1, SOL 2	
Zero point adjust (NULL)	0 ~ 900mA		
Gain adjust (GAIN)	0 ~ 900mA 2.5V	0 ~ <u>900mA</u> 2.5V	
External supply power	+5VDC (5mA) -5VDC (5mA)	+5VDC (10mA)	
Time lag (LAG)	0 ~ 2 sec		
Dither frequency (DITHER)	80 ~ 250 Hz		
Electric power source	DC24V (DC24 ~ 30V)		
Power consumption	30VA	60VA	
Permissible ambient temperature	0 ~ 50°C		
Temperature drift	0.2mA/°C		
Weight	0.3kg (0.7 lbs)	0.4kg (0.9 lbs)	
Driven valve	Pressure / Flow / Directional and flow control valve		

Handling

1 Select an installation place where the power amplifier will not be exposed to high temperature or high humidity and where there is minimal vibration and dust.

2 Use shielded wire for the analog signal and valve output signal lines.

3Luminous diode, which changes the brightness according to the volume of output current, is installed.

Understanding Model Numbers





(2) Amplifier/Controller type



Installation Dimensions

EDA-PD1-NWZ-D2-11

No.	Terminal	No.	Terminal
1	Input signal terminal IN 1	7	- DC041/
2	Input signal terminal COM	8	+ 0.241
3		9	Output terminal for valve
4	Power supply for	10	SOL B
	external use P5		
5	Input signal terminal COM	11	Output terminal for valve
6	Power supply for	12	SOL a
	external use N5		



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SOLD

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DC24V (24~30V, ripple 2% or less) (Max. 1A)

Block Diagram



· Amplifier supplies output to Sol. a when input voltage is plus, and

of solenoid coil: Measure the voltage between No. 5 and No. 11 terminal for Sol. a. Measure the voltage between No. 5

and No. 9 terminal for Sol. b. The current is 1A at 0.5V as the

resistance for current detecting is 0.5Ω.

Use tester with input impedance of $1M\Omega$ or more.

- If only Sol, a is used, connect No. 1 terminal of external potentiometer to No. 2 terminal, and make the input 0~5V. (ex. ER, ES valve)
- By Push-Pull control, the response at zero point can be improved by driving Sol. a and Sol. b one at a time.

Example of directions

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- 1. Push-Pull drive method for special proportional valve.
 - a) Over-lap type ESD valve ESD-G01-C5¹⁰₂₀-6333B···300mA (Center current) b) Zero-lap type ESD valve ESD-G01-C5¹⁰₂₀-6586A...200A (Center current)



Adjusting method:

- 1. Turn the volume of NULL, GAIN, OFFSET and LAG (total 7 volumes) to the end of counterclockwise.
- 2. Adjust output current by using OFFSET volume as below. (Terminal No. 1 and No. 2 must be
 - free.) Sol. a...300mA (200mA)

 - Sol. b...300mA (200mA)
- 3. Supply +5V to terminal (connect No. 1 and No. 4 terminal), and adjust the output current by using Sol. a GAIN volume as below. rSol. a…850mA ∫Sol. b…300mA

(Sol. b current does not change) 4. Supply -5V to No. 1 terminal

(connect No. 1 and No. 6 terminal), and adjust the output current by using Sol. b GAIN volume as below

sol. a…0mA

lSol. b…850mA

All settings are completed by this operation.

· LAG, NULL are not needed to adjust.

EDC-PC6-AWZ-D2-20

No.	Terminal	No.	Terminal
1	CH1 Selection terminal	7	COM
	Input signal terminal	8	Power supply for
2	CH2 Selection terminal		external use
3	CH3 Selection terminal	9	-
4	CH4 Selection terminal	10	+ DC24V
	Input signal terminal	11	Output terminal for valve
5	CH5 Selection terminal	12	SOL 2
6	CH6 Selection terminal	13	Output terminal for valve
		14	SOL 1



Block Diagram





1) Switch positions CONT





- Sol. 1 and Sol. 2 can be controlled individually one at a time.
- · Measuring method for the current of solenoid coil:

Measure the voltage between No. 7 and No. 13 terminal for Sol. 1.

Measure the voltage between No. 7 and No. 11 terminal for Sol. 2.

The current is 1A at 0.5V as the resistance for current detecting 0.5Ω.

Use tester with input impedance of $1M\Omega$ or more.

- · Synchronized control of two flow control valves (three speeds): As shown left, while turning on CH1 and CH4, control the speed of No. 1 valve with the LEVEL resistor of CH1 and control the speed of No. 2 valve with the LEVEL resistor CH4. Then, set the resistor so that the speed of No. 1 valve is equal to that of No. 2 valve. Combining CH1 to CH3 and CH4 to CH6 allows synchronized control in three speeds.
- · 6-CH controller mode with one pressure control valve:

As shown left, the module controller can be used as the 6-CH controller for one pressure control valve. Use the OFFSET resistor to set minimum pressure. The NULL resistor cannot be set when channels are not selected.

 Two output amplifiers for simultaneous pressure and flow control of power match system:

As shown left, input voltage of 0 to 5V is added to the sum of the output from CH2 or CH3, and output to flow control valve. Input voltage of 0 to 5V is added to the sum of the output from CH5 or CH6, and output to pressure control valve.

PV-34