

Electro-Hydraulic Proportional Valve Series

.5 to 132 gpm
3000, 3600, 4000, 5000 psi

Overview

Today's hydraulic systems demand high levels of automation, power efficiency, and energy efficiency, which is why the use of electro-hydraulic proportional valves is on the rise. Built-in electronic

components deliver outstanding response and fluid pressure that allows high output, as well as superior operation, and control. The NACHI Electrohydraulic Proportional Valve

Series includes the pressure control valves, flow control valves, and direction control valves that make it easy to meet these needs.

Features

1 Pressure Control Valve Series

- EPR Series:** Small-volume direct driver type pilot relief valve
- ER Series:** Large-volume balanced piston type relief valve
- EGB Series:** Large-volume balanced piston type pressure reducing valve with relief function

The pressure control section uses a poppet structure, which is virtually impervious to the effects of dirt in the operating fluid for outstanding pressure stability.

Flow Control Valve Series

- ES Series:** This 3-directional valve provides proportional flow control in accordance with **input current**.
- ESR Series:** With a built-in load sensing function, this 3-way valve is for use in low-energy circuits.

A force feedback mechanism is used for main spool positioning, and amplification is performed by the pilot spool. The result is superior response with small hysteresis

and outstanding flow rate reproduction.

3 Direction Flow Control Valve Series

- ESD Series:** This electro-hydraulic proportional valve provides both direction control and flow control functions. Mounting methods are the same as those for standard directional valves, which allows simple structuring and maintenance.

4 Modular Type Control Valve Series

- EOG-G01:** This reduction valve with relief function can be used in ganged configurations.
- EOF-G01:** This flow control valve combines a restrictor valve with a pressure compensation valve.

This dual configuration provides easy installation along with dramatically reduced space requirements.

5 Power Amplifiers

- EMA Series:** Amplifier type
 - EMC Series:** Controller type
- A **current-feedback** amplifier system is used to virtually eliminate **output current** fluctuation. The same power supply specifications apply to all types.

6 Compact Power Amplifiers

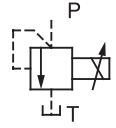
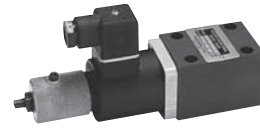
- EBA Series:** Amplifier type
- The highly efficient PWM control system of this new series ensures high reliability in a compact configuration.

7 Compact, Multi-function Power Amplifiers

- EDA Series:** Amplifier type
 - EDC Series:** Amplifier controller type
- A choice of inputs: 6-contact or DC 2 input/4-contact compensation valve.

Series List

Name	Maximum Working Pressure psi	Rated Flow Rate gpm								
		.26	.5	2.6	13.2	26.4	52.8	79.2	105	132
Electro-hydraulic Proportional Valve (EPR)	5000	01 — Size								
Electro-hydraulic Proportional Relief Valve (ER)	5000				03		06			
Electro-hydraulic Proportional Relief and Reducing Valve (EGB)	3600			03		06				
Electro-hydraulic Proportional Flow Control Valve (ES)	3000	02		03		06		10		
Load Sensitive Electro-hydraulic Proportional Relief and Flow Control Valve (ESR)	3600	03			06		10			
Electro-hydraulic Proportional Flow Control Valve (ESD)	3600	01		03		04		06		
Modular Type Electro-hydraulic Proportional Reducing Valve (EOG)	3600	01								
Modular Type Electro-hydraulic Flow Control Valve (EOF)	3000	01								
Power Amplifier (EMA) (EMC)		—————								
Compact Power Amplifier (EBA)		—————								
Compact, Multi-function Power Amplifier (EDA) (EDC)		—————								



Electro-Hydraulic Proportional Pilot Relief Valve

0.3 gpm
43 to 4000 psi

Features

This DC solenoid relief valve matches the attraction force of a DC solenoid with fluid pressure. When connected to a

small-volume hydraulic system or the poppet of a balanced piston type pressure control valve, this valve provides

continual pressure control in proportion to **input current**.

Specifications

Item	Model No.	EPR-G01-*-***-12
Rated Flow Rate gpm		0.3
Pressure Control Range psi		B: 43 to 360 1: 100 to 1000 2: 145 to 2000 3: 215 to 3000 4: 215 to 4000 5: 290 to 5000
Rated Current mA		800
Coil Resistance Ω		20 (68° F)
Hysteresis %		3 max. (Note)
Weight lbs		3.5

Note: Value when a Nachi-Fujikoshi special amplifier is used (with dithering).

Series List

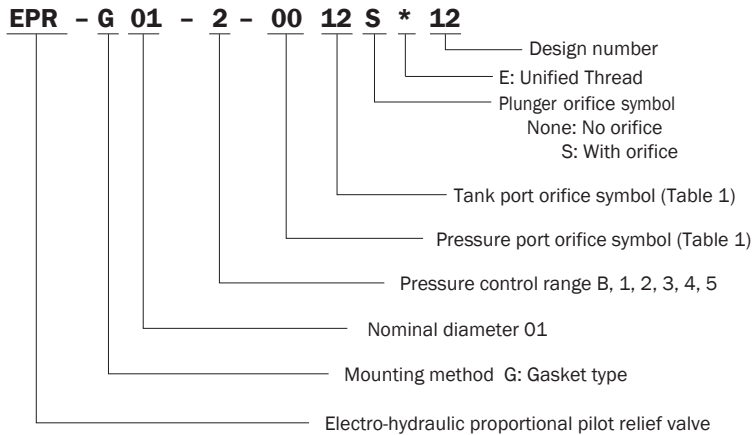


Table 1 Pressure Port and Tank Port Orifice Symbols

Orifice Symbol	00	08	09	10	11	12	13
Orifice Diameter	None	φ0.8	φ0.9	φ1.0	φ1.1	φ1.2	φ1.3

Note: The following are the standards for the orifice auxiliary symbols.

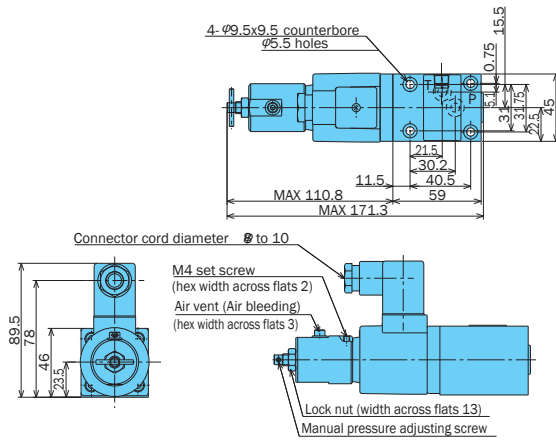
Pressure Control Range	Orifice Auxiliary Symbol
Type B, Type 1	0013S
Type 2, Type 3	0012S
Type 4	1212S
Type 5	1111S

• Handling

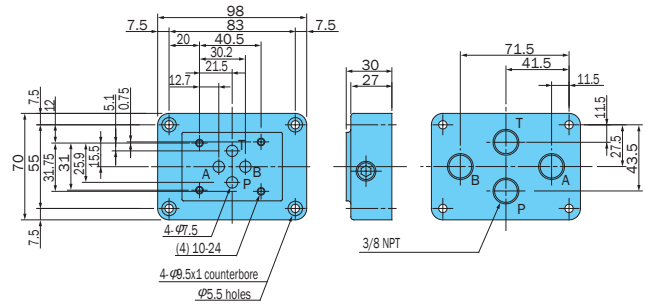
- Air Bleeding**
To enable proper pressure control, loosen the air vent when starting up the pump in order to bleed any air from the pump, and fill the inside of the solenoid with hydraulic operating fluid. The position of the air vent can change by loosening the M4 screw and rotating the cover.
- Mounting Method**
Mounting on a vertical surface causes minimum pressure to increase by 14 psi.
- Manual Pressure Adjusting Screw**
For the initial adjustment or when there is no **input current** to the valve due to an electrical problem or some other reason, valve pressure can be increased by rotating the manual adjustment screw clockwise (rightward). Normally, the manual adjusting screw should be rotated back fully to the left (counter-clockwise) and secured with the lock nut.
- Minimum Relief Flow Rate**
A small flow rate can cause setting pressure to become unstable. Use a flow rate of at least .18 in³/min.
- Load Capacity**
When using this valve to control direct circuit pressure, make sure the load volume (valve P port side volume) is at least 2.4 in³.
- Bundled Accessories (Valve Mounting Bolts)**
10-24 x 1 3/4" (four) Tightening torque: 3.6-7 ft lbs.
- Sub Plate**
When a sub plate is required, order using the following model number. MSA-01Y-E10 (See the next page for dimensions.)
- Use an operating fluid that conforms to the both of the following.**
Fluid Temperature: 4 °F to 140 °F
Viscosity: 12 to 400 centistokes. The recommended viscosity range is 15 to 60 centistokes.

Installation Dimension Drawings

EPR-G01



Sub Plate
MSA-01Y-E10

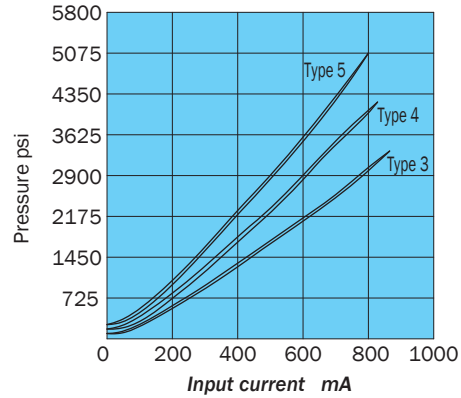
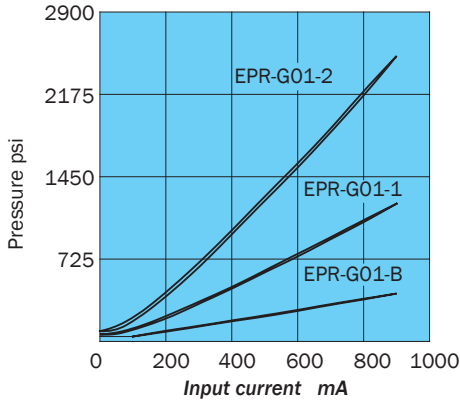


Note: Install the sub plate so the valve's P port is aligned with the sub plate's B port.
The gasket surface dimensions comply with the ISO standard shown below.
ISO 4401-03-02-0-94

Performance Curves

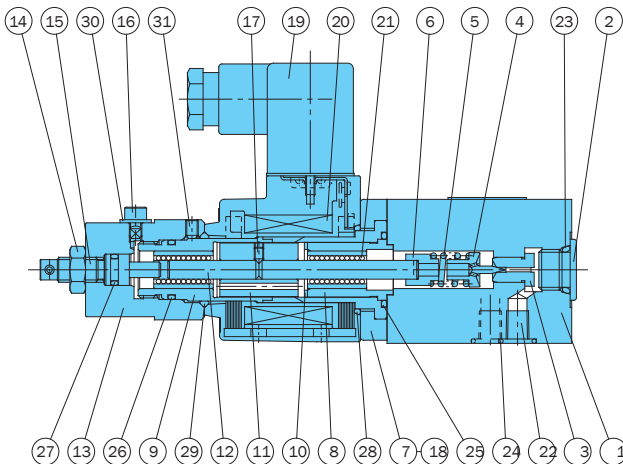
Hydraulic Operating Fluid Viscosity 32 centistokes

Input Current – Pressure Characteristics



Cross-sectional Drawing

EPR-G01-*.****-12



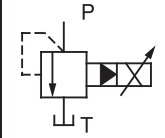
Part No.	Part Name	Part No.	Part Name	Part No.	Part Name
1	Body	12	Rod	22	Choke
2	Plug	13	Cover	23	O-ring
3	Seat	14	Nut	24	O-ring
4	Poppet	15	Screw	25	O-ring
5	Spring	16	Screw	26	O-ring
6	Retainer	17	Screw	27	O-ring
7	Cover	18	Screw	28	O-ring
8	Stopper	19	Connector	29	O-ring
9	Guide	20	Coil	30	Seal
10	Shim	21	Ball bush	31	Screw
11	Plunger				

Note: Coil model number JD64-D2

Seal Part List (Kit Model Number JPS-G01-1A)

Part No.	Part Name	Part Number	Q'ty
23	O-ring	1B-P11	1
24	O-ring	1B-P9	2
25	O-ring	1B-P22	1
26	O-ring	AS 568-016(Hs90)	1
27	O-ring	1B-P7	1
28	O-ring	S-25	1
29	O-ring	1A-P20	1
30	Seal	CW1000FO	1

Note: O-ring 1A/B-** refers to JIS B2401-1A/B.



Electro-Hydraulic Proportional Relief Valve

39 to 84.5 gpm
43 to 5075 psi

Features

This valve combines a compact, high-performance electro-hydraulic proportional pilot relief valve and balanced piston type relief valve to provide pressure control in proportion to **input current**.

Throughput volume and fluid temperature fluctuation has little effect on control pressure, so this valve provides open loop control of even complex pressures (forces).

• Handling

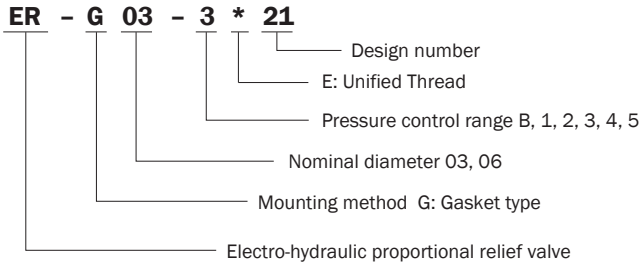
- 1 To enable proper pressure control, loosen the air vent when starting up the pump in order to bleed any air from the pump, and fill the inside of the solenoid with hydraulic operating fluid.
- 2 Manual Pressure Adjusting Screw
For the initial adjustment or when there is no input current to the valve due to an electrical problem or some other reason, valve pressure can be increased by rotating the manual adjustment screw clockwise (rightward). Normally, the manual adjusting screw should be rotated back fully to the left (counterclockwise) and secured with the lock nut.
- 3 Tank Port Back Pressure
Make sure that tank port back pressure is as small as possible; no greater than 29 psi.
- 4 Safety Valve Setting Pressure
The safety valve is set to maximum adjustment pressure plus 217 to 290 psi. When actually using the valve, adjust in accordance with actual pressure.
- 5 Bundled Accessories (Valve Mounting Bolts)

Specifications

Item	Model No.	ER-G03-*-21	ER-G06-*-21
Rated Flow Rate gpm		39	84
Pressure Control Range psi		B: 43 to 357 1: 100 to 1000 2: 143 to 2000 3: 214 to 3000 4: 214 to 3571 5: 286 to 5000	
Rated Current mA		800	
Coil Resistance Ω		20 (68° F)	
Hysteresis %		3 max. (Note 2)	
Minimum Relief Flow Rate gpm		1.3	2.1
Weight lbs		13.2	15.7

Note: 1. G03 type only Flow rate: 10.5 gpm
2. Value when a Nachi-Fujikoshi special amplifier is used (with dithering).

Understanding Model Numbers

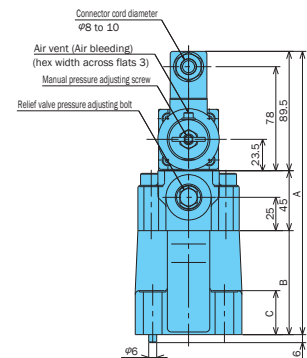
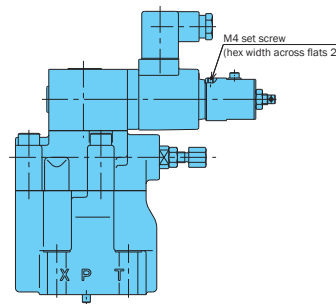
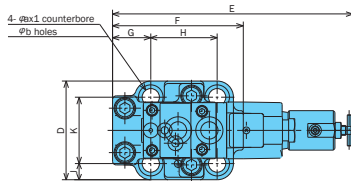


Model No.	Bolt Size	Q'ty	Tightening Torque ft lbs
ER-G03	1/2-13 x 2"	4	55 to 70
ER-G06	5/8-11 x 2 3/8"	4	140 to 170

- 6 Use an operating fluid that conforms to the both of the following.
Fluid Temperature: 4° F to 140° F
Viscosity: 12 to 400 centistokes. The recommended viscosity range is 15 to 60 centistokes.

Installation Dimension Drawings

ER-G**-*-21

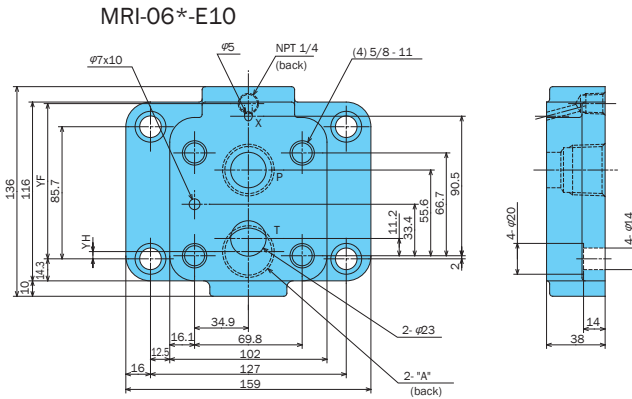
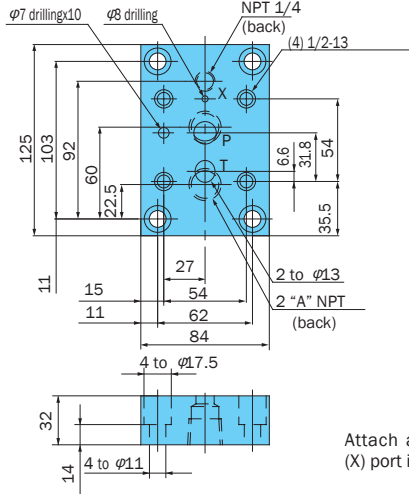


The gasket surface dimensions comply with the ISO standard shown below.
G03-ISO 6264-AR-06-2-A
G06-ISO 6264-AS-08-2-A

Model No.	A	B	C	D	E	F	G	H	J	K	a	b
ER-G03	212.5	78	33	80	194.8	106	31	53.8	13.1	53.8	20	14
ER-G06	217.5	83	37	100	203.8	119	37	66.7	15	70	26	17.5

Proportional Valves

Sub Plate (Maximum Operating Pressure: 3625 psi)
MRI-03*-E10 MRI-03X-E10 MRI-06*-E10



Attach a plug when the vent (X) port is not used.

Model No.	A NPT
MRI-03-E10	3/8
MRI-03X-E10	1/2
MRI-06-E10	3/4
MRI-06X-E10	1

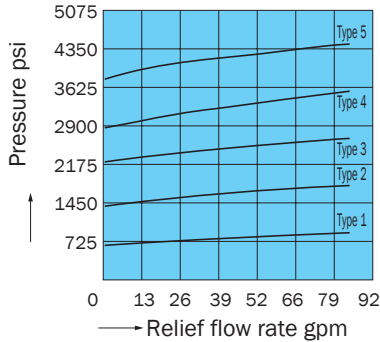
Model No.	YF	YH
MRI-06-E10	92.5	13.2
MRI-06X-E10	100.7	4.7

Performance Curves

Hydraulic Operating Fluid Viscosity 32 centistokes

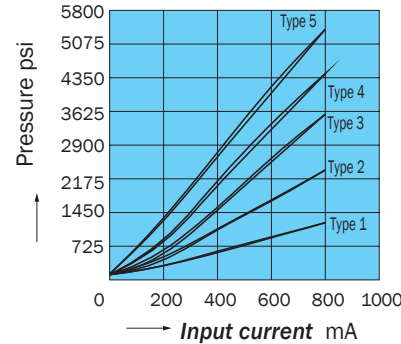
Flow Rate – Pressure Characteristics

ER-G06-*-E21



Input Current – Pressure Characteristics

ER-G06-*-E21



Cross-sectional Drawing

ER-G**-*-21

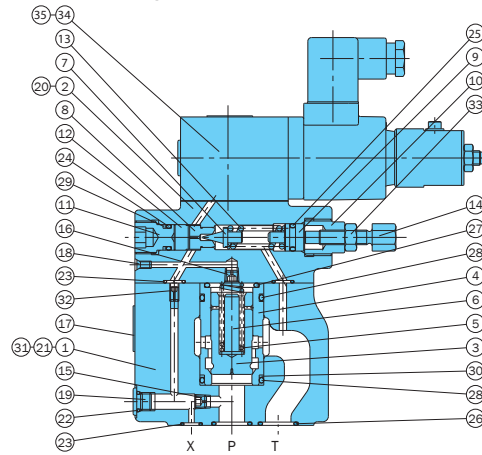
ER Valve Built-in Pilot Relief Valve List

Model No.	Built-in Pilot Relief Valve
ER-G03-B-21	EPR-G01-B-0011S-12
1	1-0011S-12
2	2-1313S-12
3	3-1212S-12
4	4-1111S-12
5	5-1010S-12
ER-G06-1-21	EPR-G01-1-0011S-12
2	2-1313S-12
3	3-1212S-12
4	4-1111S-12
5	5-1010S-12

Seal Part List (Kit Model Number JPS-G01-1A)

Part No.	Part Name	Nominal Diameter/Part Number		Q'ty
		G03	G06	
22	O-ring	1B-P8	1B-P8	1
23	O-ring	1B-P9	1B-P9	3
24	O-ring	1B-P10A	1B-P10A	1
25	O-ring	1A-P11	1A-P11	1
26	O-ring	1B-P18	1B-P28	2
27	O-ring	1B-G25	1B-P28	1
28	O-ring	1B-G30	1B-P32	2
29	Backup ring	T2-P10A	T2-P10A	1
30	Backup ring	T2-G30	T2-P32	1

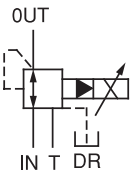
Note: 1. O-ring 1A/B-** refers to JIS B2401-1A/B.
2. For the ** part of the kit number, specify the valve size (G03, G06).
3. EPR-G01 pilot valve seal is available separately. See page G-3 for more information.



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

Electro-Hydraulic Proportional Reducing and Relief Valve

13.2 to 26.4 gpm
43.5 to 3625 psi



Features

This valve combines a compact, high-performance electro-hydraulic pilot relief valve, and a reducing and relief valve for low-pressure control of pressure within a hydraulic system in proportion to *input*

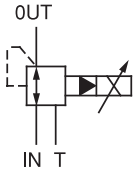
current.
Since this valve includes a relief function, OUT side pressure can be maintained at a virtually fixed level, even when the valve's OUT side is used as reaction force. This valve also provides outstanding response as pressure drops.

Specifications

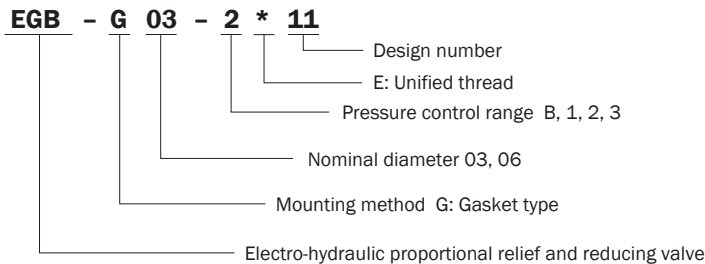
Item	Model No.	EGB-G03-*-11	EGB-G06-*-11
Maximum Operating Pressure psi		3625	
Maximum Flow Rate gpm		13.2	26.4
Pressure Control Range psi		B: 43 to 357 1: 100 to 1000 2: 129 to 2000 3: 214 to 3000	
Rated Current mA		800	
Coil Resistance Ω		20 (68° F)	
Hysteresis %		3 max. (Note 2)	
Weight lbs		12	17

Note: 1.G03 type only Rated flow rate: 5.2 gpm
2.Value when a Nachi-Fujikoshi special amplifier is used (with dithering).

- Handling
- 1 Air Bleeding
To enable proper pressure control, loosen the air vent when starting up the pump in order to bleed any air from the pump, and fill the inside of the solenoid with hydraulic operating fluid.
- 2 DR Port Piping
When configuring piping, ensure that the DR port (T port for the G06 size) is filled with operating fluid.
- 3 Manual Pressure Adjusting Screw
For the initial adjustment or when there is no input current to the valve due to an electrical problem or some other reason, valve pressure can be increased by rotating the manual adjustment screw clockwise (rightward). Normally, the manual adjusting screw should be rotated back fully to the left (counterclockwise) and secured with the lock nut.
- 4 Load Capacity
The G03 load capacity (valve OUT side volume) is at least .5 gpm, while the G06 load capacity is at least 1.3 gpm.
- 5 Bundled Accessories (Valve Mounting Bolts)



Understanding Model Numbers



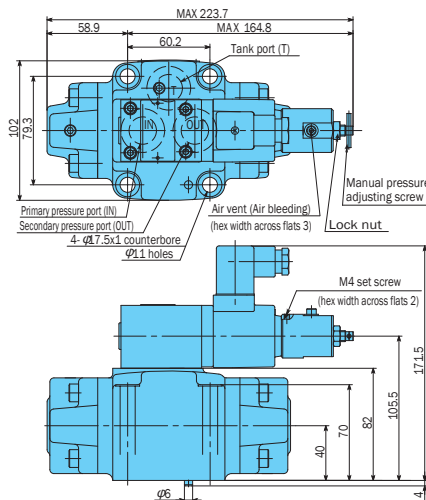
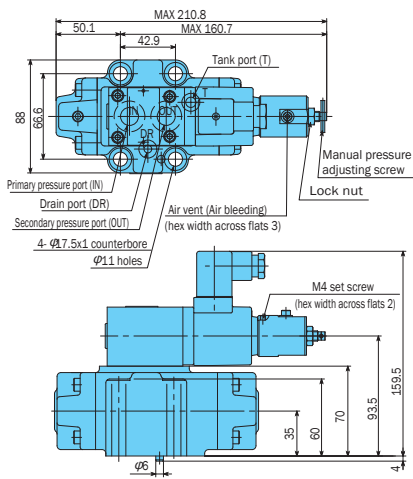
Model No.	Bolt Size	Q'ty	Tightening Torque ft lbs
EGB-G03	3/8-16 x 3"	4	33 to 40
EGB-G06	3/8-16 x 3 3/8"	4	33 to 40

- 6 Use an operating fluid that conforms to the both of the following.
Oil temperature: 4 to 140 °F
Viscosity: 12 to 400 centistokes. The recommended viscosity range is 15 to 60 centistokes.

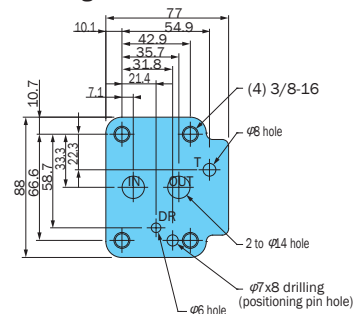
Installation Dimension Drawings

EGB-G03-*-11

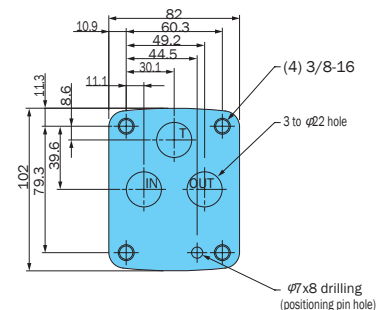
EGB-G06-*-11



Mounting Gasket Dimensions EGB-G03-*-11



Mounting Gasket Dimensions EGB-G06-*-11

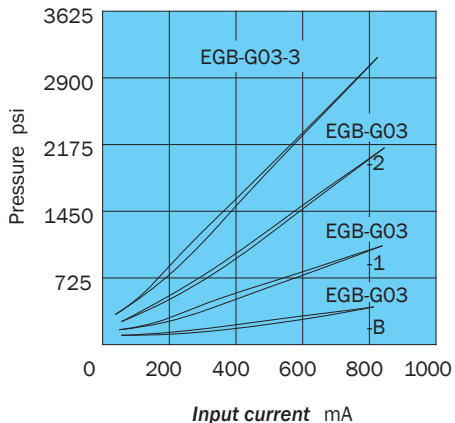


Performance Curves

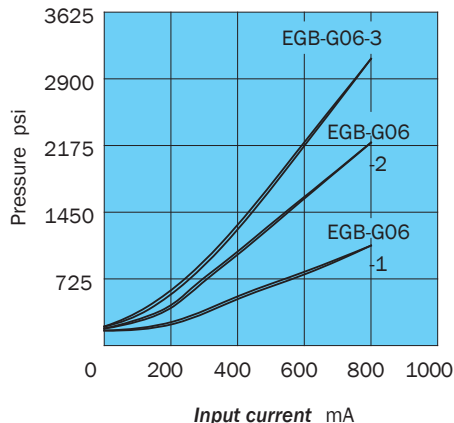
Hydraulic Operating Fluid Viscosity 32 centistokes

Input Current – Pressure Characteristics

EGB-G03

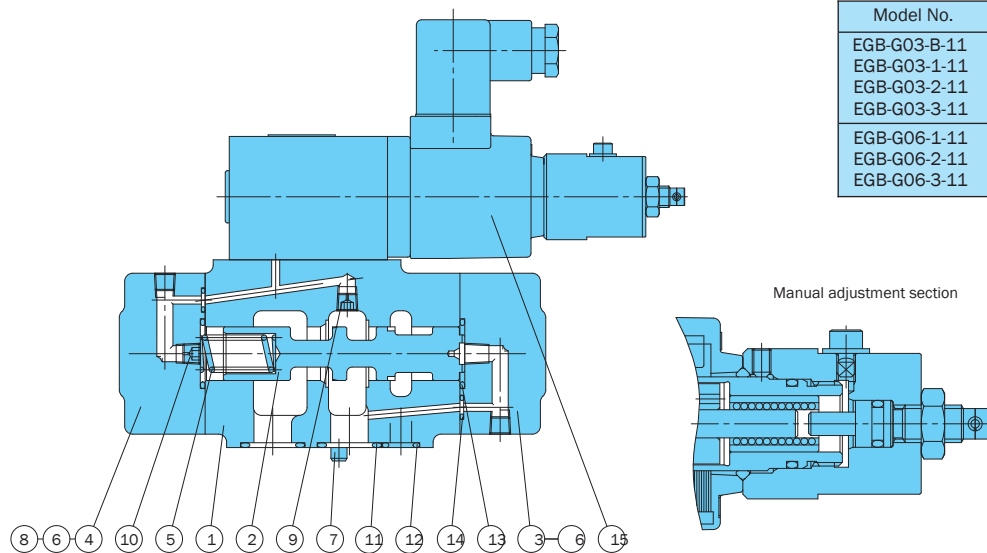


EGB-G06



Cross-sectional Drawing

EGB-G**-*-11



EGB Valve Built-in Pilot Relief Valve List

Model No.	Built-in Pilot Relief Valve
EGB-G03-B-11	EPR-G01-B-0000-12
EGB-G03-1-11	1-0013-12
EGB-G03-2-11	2-0012-12
EGB-G03-3-11	3-0011-12
EGB-G06-1-11	EPR-G01-1-0013-12
EGB-G06-2-11	2-0012-12
EGB-G06-3-11	3-0012-12

Seal Part List (Kit Model Number JGS-***)

Part No.	Part Name	EGB-G03-*-11		EGB-G06-*-11	
		Part Number	Q'ty	Part Number	Q'ty
11	O-ring	1B-P20	2	1B-P26	3
12	O-ring	1B-P10A	2	-	-
13	O-ring	1B-P22	2	1B-G30	2
14	O-ring	1B-P6	2	1B-P6	2

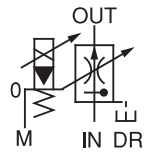
Note: 1.O-ring 1B-** refers to JIS B2401-1B-**.
 2.For the ** part of the kit number, specify the valve size (G03, G06).
 3.EPR-G01 pilot valve seal is available separately. See page G-3 for more information.

Part No.	Part Name
1	Body
2	Piston
3	Cover
4	Cover
5	Spring
6	Screw
7	Pin
8	Pin
9	Choke
10	Choke
11	O-ring
12	O-ring
13	O-ring
14	O-ring
15	Pilot relief valve

Note:
 Coil model number JD64-D2

Electro-Hydraulic Proportional Flow Control Valve

.5 to 132 gpm
3045 psi



Features

This valve controls actuator speed in response to the size of **input current**. Pressure and control fluid temperature fluctuation has little effect on setting

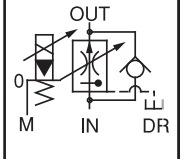
pressure which enables high-precision speed control. This valve is the perfect choice for actuator acceleration and deceleration control, and remote control.

Specifications

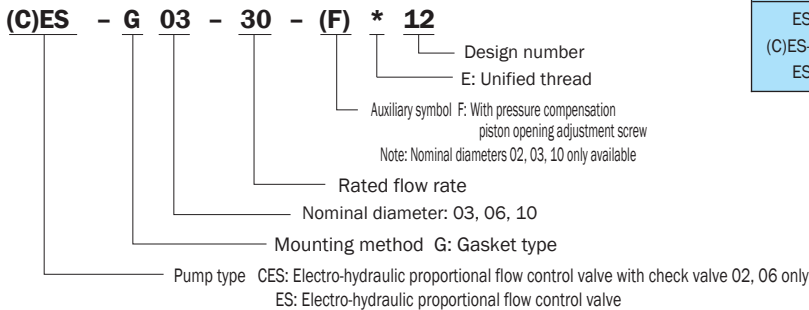
Item	Model No.	ES-G03-60 (F)-12 125	(C)ES-G06-250-11	ES-G10-500(F)-11
Maximum Operating Pressure psi		3045	3045	3045
Flow Rate Control Range gpm		.5 to 15.8	1.3 to 66	3.9 to 132
Minimum Allowable Valve Pressure Differential psi		145 (Note1)	217 (Note1)	(Note1)
Reverse Flow Rate gpm (With check valve only)		33 (Note3)	52	-
Hysteresis %		3 max. (Note 2)	3 max. (Note 2)	3 max. (Note 2)
Rated Current mA		800	800	800
Coil Resistance Ω		20 (68°F)	20 (68°F)	20 (68°F)
Weight lbs		28.6	55	121

Note: 1. Control valve inlet and outlet pressure differential required to obtain favorable pressure compensation.
2. Value when a Nachi-Fujikoshi special amplifier is used (with dithering).
3. ES-G03 does not have a built-in check valve, but a sub plate with check valve (Model No. MCF-03-D-22) is available for it.

- Handling
- 1 Air Bleeding
To enable proper pressure control, loosen the air vent when starting up the pump in order to bleed any air from the pump, and fill the inside of the solenoid with hydraulic operating fluid. The position of the air vent can change by loosening the M4 screw and rotating the cover.
- 2 Manual Flow Rate Adjusting Screw
For the initial adjustment or when there is no **input current** to the valve due to an electrical problem or some other reason, the flow rate can be increased by rotating the manual adjustment screw clockwise (rightward). Normally, this adjusting screw should be returned completely to its original position and secured with the lock nut.
- 3 Drain Port
Make sure that back pressure is no greater than 29 psi, and that his port is connected directly to the fluid tank at a point that is below the oil surface.
- 4 Bundled Accessories (Valve Mounting Bolts)



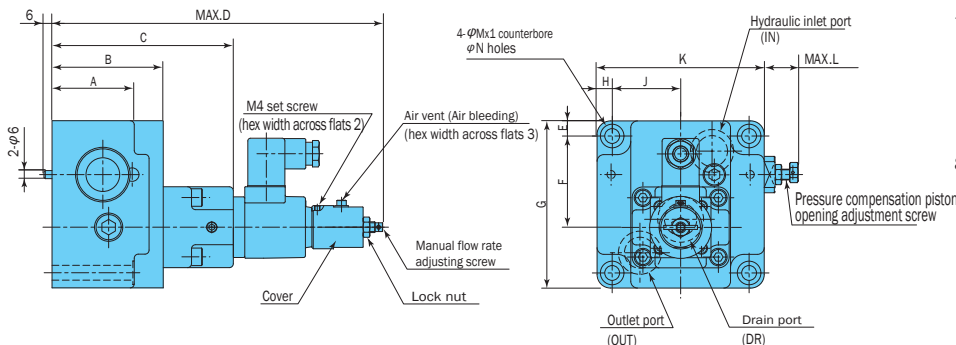
Understanding Model Numbers



Model No.	Bolt Size	Q'ty	Tightening Torque ft lbs
ES-G03	3/8-16 x 3"	4	33 to 40
(C)ES-G06	5/8-11 x 5 1/2"	4	140 to 170
ES-G10	3/4-10 x 6 1/4"	4	270 to 339

- 5 The loss coefficient and control valve can cause resonance when there is a great distance between the flow control valve and actuator (when the pipe internal volume is large). Be sure to keep the distance between the flow control valve and actuator as small as possible, and to avoid the use of flexible hose as much as possible.
- 6 Sub Plate
See the next page for more information about sub plates.
- 7 Use an operating fluid that conforms to the both of the following.
Oil temperature: 4 to 140 °F
Viscosity: -12 to 400 centistokes.
The recommended viscosity range is 15 to 60 centistokes.
- 8 Since this valve has a built-in pressure compensation valve, changing of the inertial load (using a high inertial oil motor, etc.) can create the risk of hunching under certain conditions. Contact your sales agent before changing the inertial load.
Note: Use a hex wrench that has a width across flats of 8 to adjust the aperture adjustment screw of nominal diameter 10.

Installation Dimension Drawings



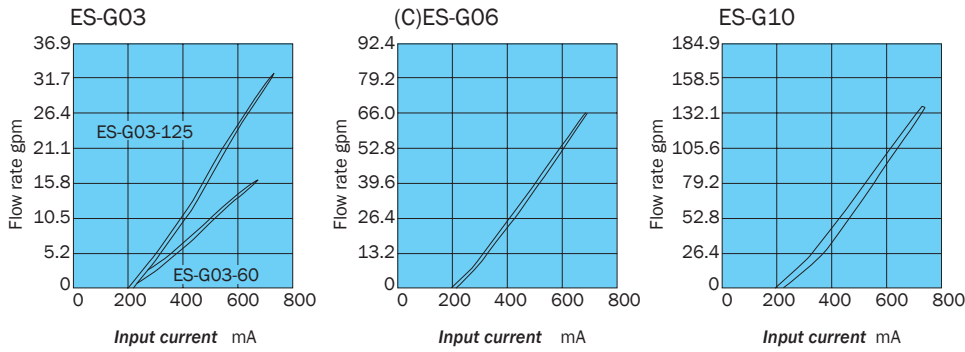
Model No.	A	B	C	D	E	F	G	H	J	K	L	M	N
ES-G03	61	82.5	134.5	245.3	11.2	67.8	124	11.2	50.8	124	26	17.5	11
(C)ES-G06	115	130	182	292.8	16.8	104.8	167	17	73	180	-	26	18
ES-G10	137	160	215	326.3	25	148	228	23.5	98.5	244	18	32	22

• The gasket surface dimensions comply with the ISO standard shown below.
(C) ES-G03 ...ISO 6263-07-09-97
(C) ES-G06 ...ISO 6263-08-13-97

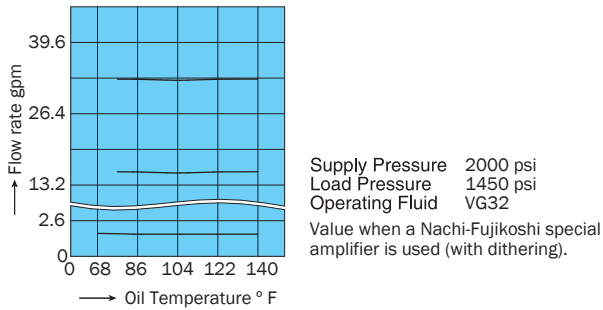
Performance Curves

Hydraulic Operating Fluid Viscosity Centistokes

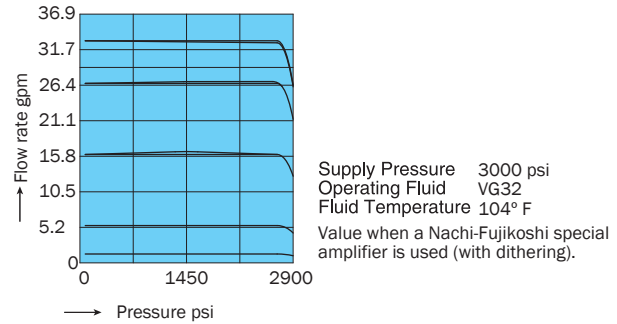
Input Current – Flow Rate Characteristics



Fluid Temperature – Control Flow Rate Characteristics

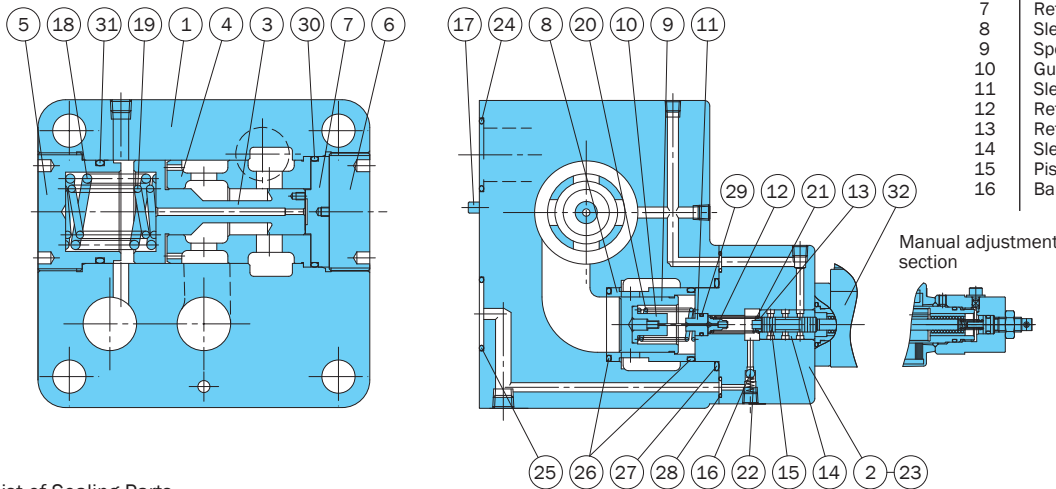


Pressure – Control Flow Rate Characteristics



Cross-sectional Drawing

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



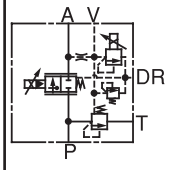
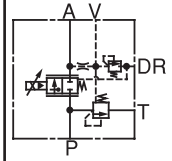
Part No.	Part Name	Part No.	Part Name
1	Body	17	Pin
2	Cover	18	Spring
3	Piston	19	Spring
4	Sleeve	20	Spring
5	Plug	21	Spring
6	Plug	22	Spring
7	Retainer	23	Spring
8	Sleeve	24	O-ring
9	Spool	25	O-ring
10	Guide	26	O-ring
11	Sleeve	27	O-ring
12	Retainer	28	O-ring
13	Retainer	29	O-ring
14	Sleeve	30	O-ring
15	Piston	31	O-ring
16	Ball	32	Proportional solenoid

List of Sealing Parts

Part No.	Part Name	ES-G03		(C)ES-G06		ES-G10	
		Part Number	Q'ty	Part Number	Q'ty	Part Number	Q'ty
24	O-ring	1B-P26	2	1B-G35	2	1B-P48	2
25	O-ring	1B-P28	1	1B-G35	1	1B-P48	1
26	O-ring	-	-	1B-G35	2	1B-G50	2
27	O-ring	1B-P29	1	1B-G45	1	1B-G60	1
28	O-ring	1B-P5	4	1B-P8	3	1B-P9	3
29	O-ring	1B-P9	1	1B-P9	1	1B-P9	1
30	O-ring	1B-P20	1	1B-G55	1	1B-G75	2
31	O-ring	1B-P38	1	1B-P50	1	1B-G75	1
Seal Kit Number		JFS-G03		JFS-G06		JFS-G10	

Note: O-ring 1B-** refers to JIS B2401-1B-**.

Proportional Valves



Load Response Electro-Hydraulic Proportional Relief and Flow Control Valve

.26 to 132 gpm
3625 psi

Features

The load sensing function of this meter in flow control valve makes it possible to control pump discharge pressure automatically in accordance with the size of the load

pressure. Using this valve suppresses wasteful pump pressure rises and makes it possible to configure an energy-efficient circuit.

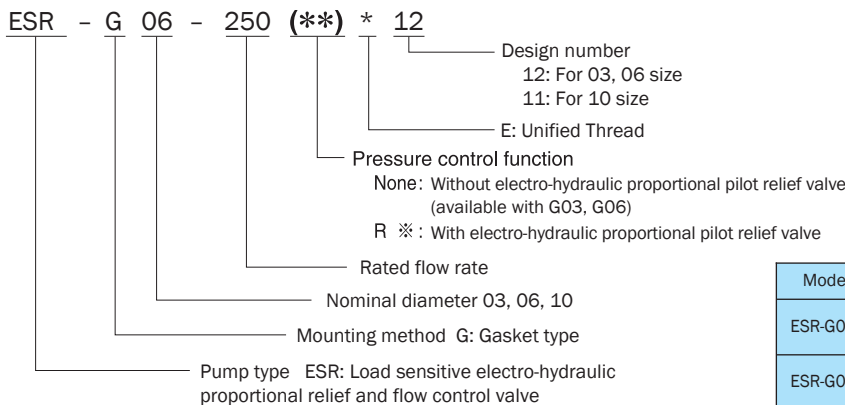
- Handling
 - 1 In order to ensure stable control, loosen the air vent and bleed air from the valve before starting operation.
 - 2 Manual Adjusting Screw
For the initial adjustment or when there is no input current to the valve due to an electrical problem or some other reason, pressure or flow rate can be increased by rotating the manual adjustment screw clockwise (rightward). Normally, this adjusting screw should be returned completely to its original position and secured with the lock nut.
 - 3 Drain Port
Minimum control pressure is increased by drain port back pressure, so be sure to connect the drain port directly to the fluid tank at a point that is below the oil surface.
 - 4 Safety Valve Setting Pressure
For a safety valve without an electro-hydraulic proportional pilot relief valve, safety valve pressure is set to minimum pressure (507 psi). In the case of a safety valve with an electrohydraulic proportional pilot relief valve, the safety valve setting pressure is set to the minimum adjustment pressure plus 217 psi. When actually using the valve, adjust in accordance with hydraulic circuit pressure.
 - 5 Minimum Relief Flow Rate During Pressure Control
Setting pressure can become unstable when the relief flow rate to the valve's T port is small. Because of this, use a relief flow rate of at least 2.6 gpm with a nominal diameter of .1", and a relief flow rate of at least 2.6 gpm with a nominal diameter of .39".
 - 6 Valve Mounting Orientation
When an electro-hydraulic proportional pilot relief valve main valve is mounted on a vertical surface with the pilot relief valve part facing downwards make it difficult to bleed air from the pilot relief valve. Because of this, you should not use this type of mounting orientation.
 - 7 Bundled Accessories (Valve Mounting Bolts)

Specifications

Item	Model No.	ESR-G03-125 (R*)-12	ESR-G06-250 (R*)-12	ESR-G10-500 R*-11
Maximum Operating Pressure psi		3625	3625	3625
Rated Flow Rate l/min (gpm)		125 (33)	250 (66)	500 (132)
Flow Rate Control System	Flow Rate Control Range gpm	.5 to 33	1.3 to 66	3.9 to 132
	Valve Differential Pressure psi	72 (Note1)	101 (Note1)	130 (Note1)
	Hysteresis %	3 max. (Note 2)	3 max. (Note 2)	3 max. (Note 2)
	Repeatability %	1	1	1
	Rated Current mA	800	800	800
	Coil Resistance Ω	20 (68°F)	20 (68°F)	20 (68°F)
Pressure Control System (Note 3)	Pressure Control Range psi	R1 174 to 1000 R2 203 to 2000 R3 232 to 3000 R4 232 to 3625	R1 174 to 1000 R2 203 to 2000 R3 232 to 3000 R4 232 to 3625	R1 174 to 1000 R2 203 to 2000 R3 232 to 3000 R4 232 to 3625
	Hysteresis %	3 max. (Note 2)	3 max. (Note 2)	3 max. (Note 2)
	Repeatability %	1	1	1
	Rated Current mA	800	800	800
	Coil Resistance Ω	20 (68°F)	20 (68°F)	20 (68°F)
Weight lbs		30.8	61.7	132

Note: 1.Indicates the pressure differential between the valve P port and A port.
2.Value when a Nachi-Fujikoshi special amplifier is used (with dithering).
3.These specifications apply to valves that include an electro-hydraulic proportional pilot relief valve (i.e. ESR-G06-250R2-11).
4.The maximum adjustment pressure is 3625 psi for a valve that does not include an electro-hydraulic proportional pilot relief valve.
Factory default is minimum output (507 psi max.) Set this value in accordance with the pressure of the hydraulic circuit being used.

Understanding Model Numbers

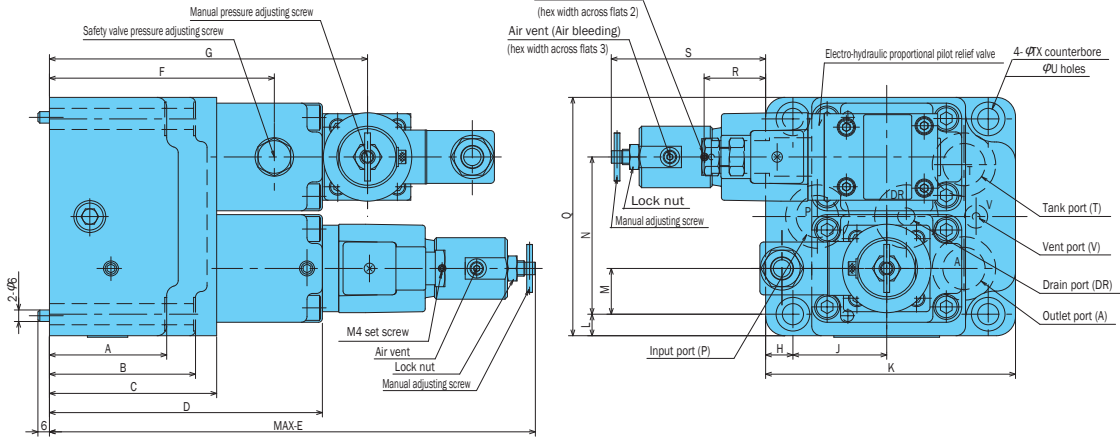


Model No.	Bolt Size	Q'ty	Tightening Torque ft lbs
ESR-G03	3/8-16 x 3 1/2	4	33 to 40
ESR-G06	5/8-11 x 5 1/4	4	140 to 173
ESR-G10	3/4-10 x 5	4	272 to 339

- 8 Sub Plate
See the next page for more information about sub plates.
- 9 Use an operating fluid that conforms to the both of the following. Oil temperature: -4 to 158°F
Viscosity: 12 to 400 centistokes. The recommended viscosity range is 15 to 60 centistokes.

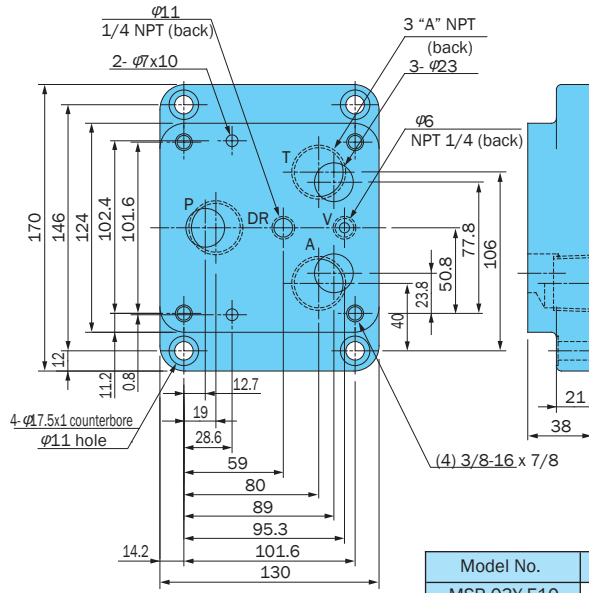
10 Since this valve has a built-in pressure compensation valve, changing of the inertial load (using a high inertial oil motor, etc.) can create the risk of hunching under certain conditions. Contact your sales agent before changing the inertial load.

Installation Dimension Drawings



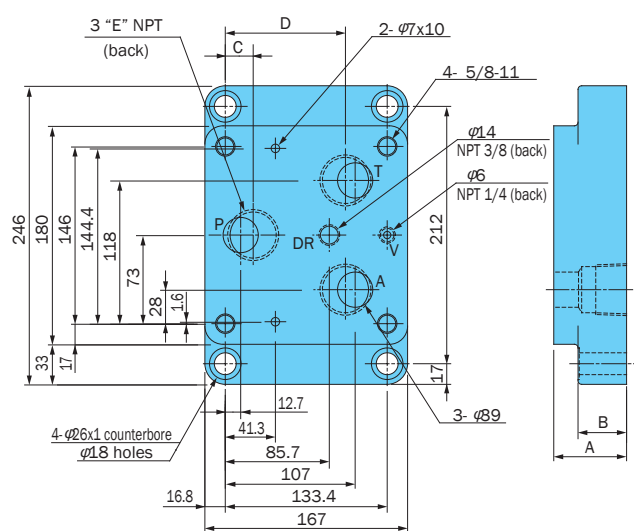
Model No.	A	B	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	T	U
ESR-G03	61	76	87	142	252.8	117	165.5	14.2	48.8	130	11.2	23.8	81.8	124	32	80.3	17.5	11
ESR-G06	76	110	120	172	282.8	154	195.5	16.8	57.2	167	17	28	118	180	21	68.3	26	18
ESR-G10	107	107	150	205	317.3	183	228.5	25	76	228	23.5	35	162	244	-3	35.3	32	22

Sub Plate
MSR-03*-E10



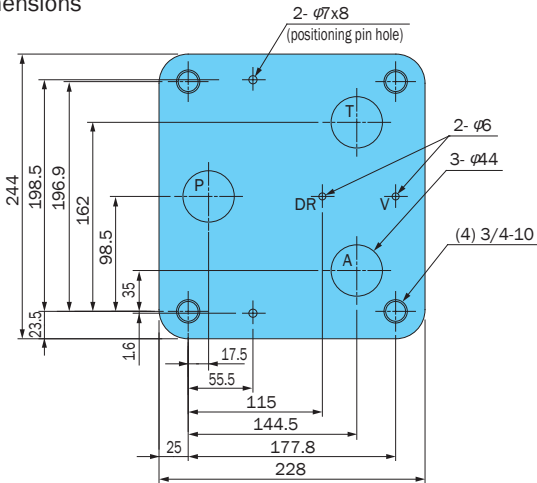
Model No.	A NPT
MSR-03Y-E10	3/4
MSR-03Z-E10	1

MSR-06*-E10



Model No.	A	B	C	D	E
MSR-06X-E10	95	25	16	107	1 NPT
MSR-06Y-E10	60	40	23	99	1 1/4 NPT

ESR-G10 Mounting Gasket Surface Dimensions

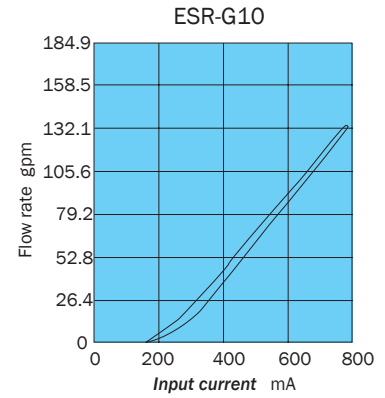
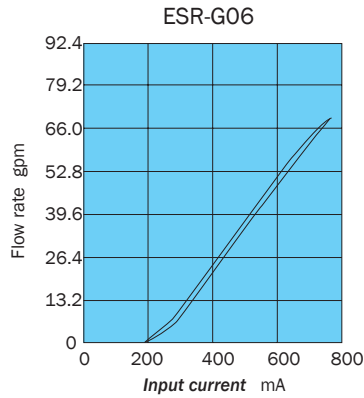
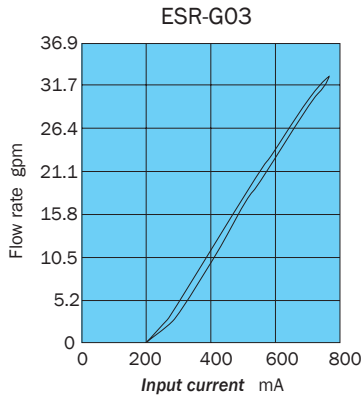


The gasket surface dimensions comply with the ISO standards shown below.
 ESR-G03-ISO 6263-07-11-97
 ESR-G06-ISO 6263-08-15-97

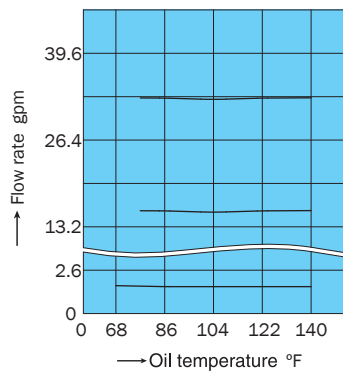
Performance Curves

Hydraulic Operating Fluid Viscosity 32 centistokes

Input Current – Flow Rate Characteristics

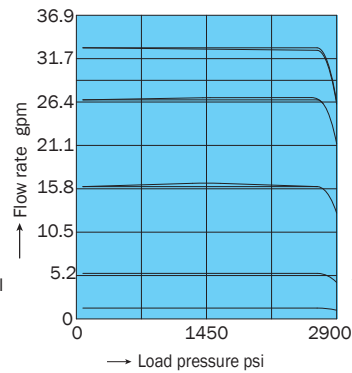


Fluid Temperature – Control Flow Rate Characteristics



Load Pressure: 1450 psi
Operating Fluid: VG32
Value when a Nachi-Fujikoshi special amplifier is used (with dithering).

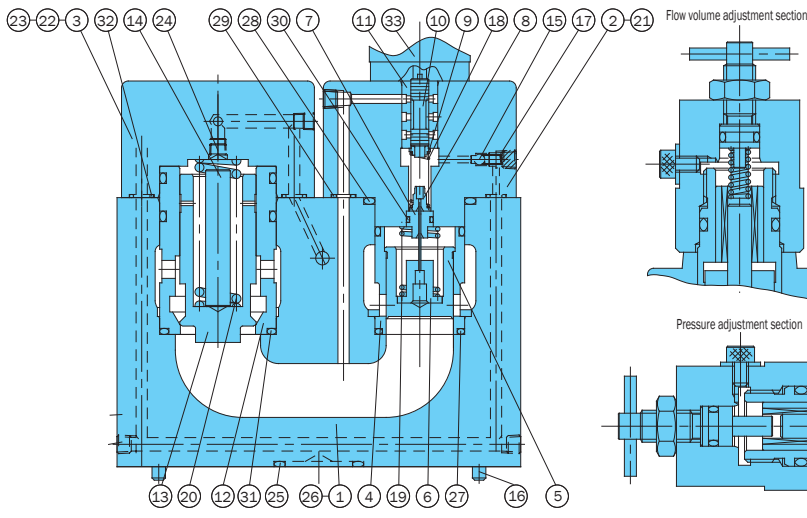
Pressure – Control Flow Rate Characteristics



Electro-hydraulic Proportional Pilot
Relief Valve Setting Pressure 3045 psi
Operating Fluid: VG32
Fluid Temperature: 104° F
Value when a Nachi-Fujikoshi special amplifier is used (with dithering).

Cross-sectional Drawing

ESR-G***-11, 12



Part No.	Part Name	Part No.	Part Name
1	Body	18	Spring
2	Cover (A)	19	Spring
3	Cover (B)	20	Spring
4	Sleeve	21	Screw
5	Spool	22	Screw
6	Guide	23	Safety valve
7	Sleeve	24	Choke
8	Retainer	25	O-ring
9	Retainer	26	O-ring
10	Piston	27	O-ring
11	Sleeve	28	O-ring
12	Sleeve	29	O-ring
13	Poppet	30	O-ring
14	Guide	31	O-ring
15	Ball	32	O-ring
16	Pin	33	Proportional solenoid
17	Spring		

Note: Coil model number JD64-D2

List of Sealing Parts

Part No.	Part Name	ESR-G03		ESR-G06		ESR-G10	
		Part Number	Q'ty	Part Number	Q'ty	Part Number	Q'ty
25	O-ring	1B-P26	4	1B-G35	4	1B-P48	4
26	O-ring	1B-P9	1	1B-P9	1	1B-P9	1
27	O-ring	1B-G25	2	1B-G35	2	1B-G50	2
28	O-ring	1B-G35	1	1B-G45	1	1B-G60	1
29	O-ring	1B-P6	3	1B-P8	3	1B-P9	3
30	O-ring	1B-P9	1	1B-P9	1	1B-P9	1
31	O-ring	1B-G35	3	1B-P46	3	1B-G65	3
32	O-ring	1B-P6	2	1B-P8	2	1B-P9	2
Seal Kit Number		JLS-G03R		JLS-G06R		JLS-G10R	

Note: 1.O-ring 1B-** refers to JIS B2401-1B-**. 2.EPR-G01 seal is available separately. See page G-3 for more information.



Electro-Hydraulic Proportional Flow and Directional Control Valve

2.6 to 132 gpm
3625 psi

Features

This valve uses a DC solenoid in a traditional 4-way solenoid valve to create a solenoid valve capable of both direction switching and high-speed control. The lineup consists of the direct system O1 size and the pilot system O3, O4, and O6 sizes.

Direction control is performed by supplying **input current** to one of the two proportional solenoid valves, and the size of the flow rate is controlled in accordance with the size of the **input current**. This type of valve can be used for remote control and shockless acceleration and deceleration control, and for simple configuration of hydraulic circuits.

Specifications

Model No.	ESD-G01-** 10 20 -12	ESD-G03-** 40- (**)-12 80	ESD-G04- **140(**)-12	ESD-G06- **250(**)-13
Maximum Operating Pressure psi	3625			
Rated Flow Rate l/min (gpm)	10/20 (2.6/5.2) (Note 1)	40/80 (10.5/21) (Note 1)	139 (36.9) (Note 1)	125/250 (66) (Note 1)
Maximum Flow Rate gpm	6.6 (Note 2)	26.4 (Note 2)	36.9 (Note 2)	66 (Note 2)
Pilot Pressure psi	-	At least 145 (Note 3)		
Pilot Flow Rate gpm	-	At least .5 (Note 4)	At least .79 (Note 4)	At least 1.3 (Note 4)
T Port Allowable Back Pressure psi	2.5 (25.5)	Internal Drain: 362 External Drain: 3045		
Rated Current mA	850			
Coil Resistance Ω	20 (68° F)			
Hysteresis %	5 max. (Note 5)			
Response Time s	0.04 (Note 6)	0.05 (Note 6)	0.08 (Note 6)	0.1 (Note 6)
Weight lbs	4.8	15.4	20.2	33

Note: 1. Value when pressure drop volume to P → A and P → B is ΔP = 145 psi
2. Indicates maximum throughput volume value between each port.
3. Indicates differential between the pilot port and tank port, or drain port.
4. Value when 0.1 second is assumed for the response time from zero to the rated flow volume.
5. Value when a Nachi-Fujikoshi special amplifier is used.
6. Response time is typical value for a supply pressure of 2030 psi and fluid temperature of 104° F (kinematic viscosity: 40 centistokes)

Understanding Model Numbers

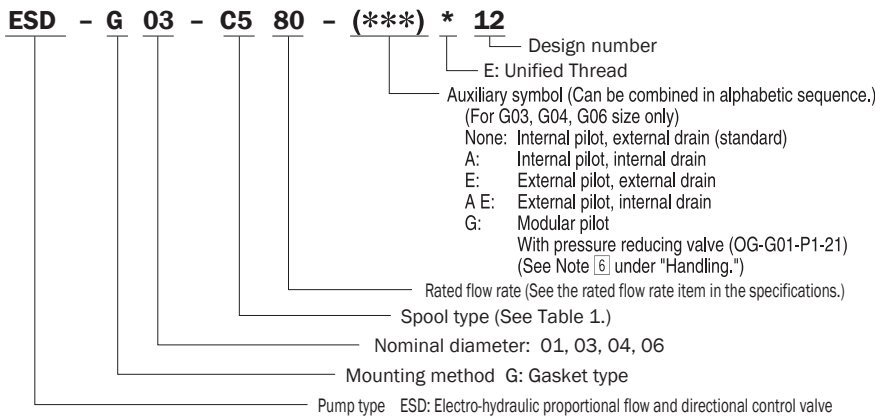


Table 1

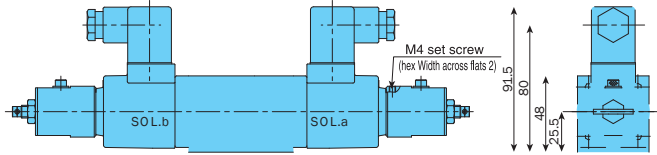
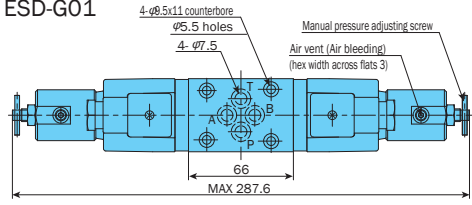
Spool Type	Hydraulic Circuit		
	ESD-G01	ESD-G03, G04	ESD-G06
C5			
C6S			

- Handling
 - 1 Air Bleeding
In order to ensure stable control, loosen the air vent and bleed air from the valve before starting operation. For details, see the user's guide.
 - 2 T Port Piping
When configuring piping, ensure that the T port (pilot valve T port for the G03, G04, and G06 sizes) is filled with operating fluid.
 - 3 Manual Adjusting Screw
For the initial adjustment or when there is no input current to the valve due to an electrical problem or some other reason, the valve can be operated and valve pressure can be increased by rotating the manual adjustment screw clockwise (rightward). Normally, the manual adjusting screw should be rotated back fully to the left (counterclockwise).
 - 4 Valve Mounting Orientation
Install the valve so the spool axis line is horizontal.
 - 5 Combining with a Pressure Compensation Valve
Use of the optional pressure compensation kit is recommended when higher precision flow rate control is required or in high-pressure applications. For details, see page G-20.
 - 6 If pilot pressure (ESD-G03, G04, G06) exceeds 1300 psi use a modular type P port reduction valve (OG-G01-P1-21) at a setting of 290 psi.
 - 7 On a system that requires large brake pressure during deceleration or a system that uses a vertical cylinder, equip a counter balance valve.
Use a single rod, if the rod exit is not slowed sufficiently, use a counter balance valve on the rod.
 - 8 Maintain hydraulic operating fluid contamination so it is at least Class 9. Use of a G01 modular filter (Absolute: 8μ m) is also helpful.

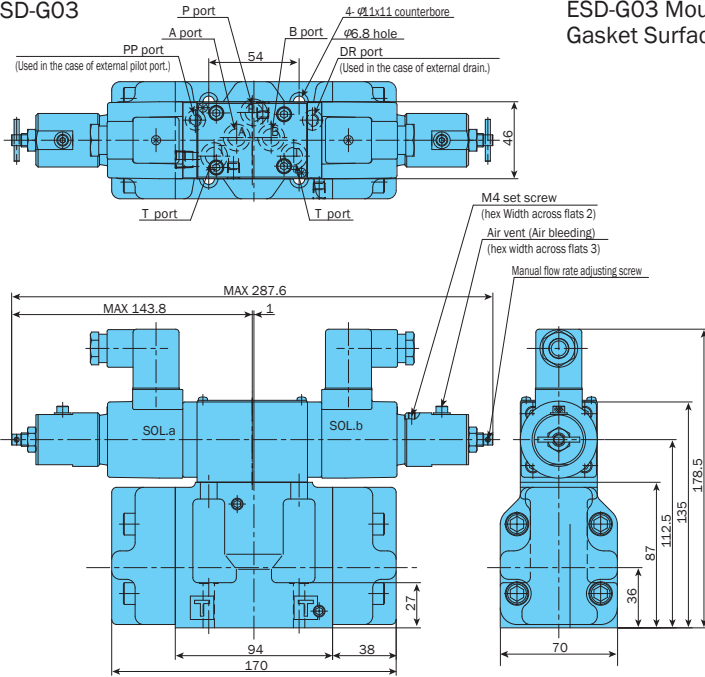
(Continued on next page)

Installation Dimension Drawings

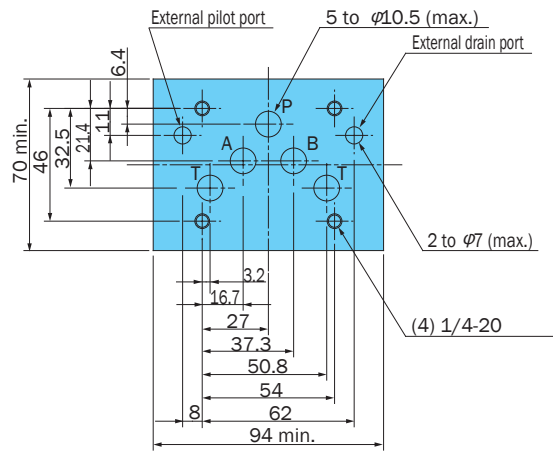
ESD-G01



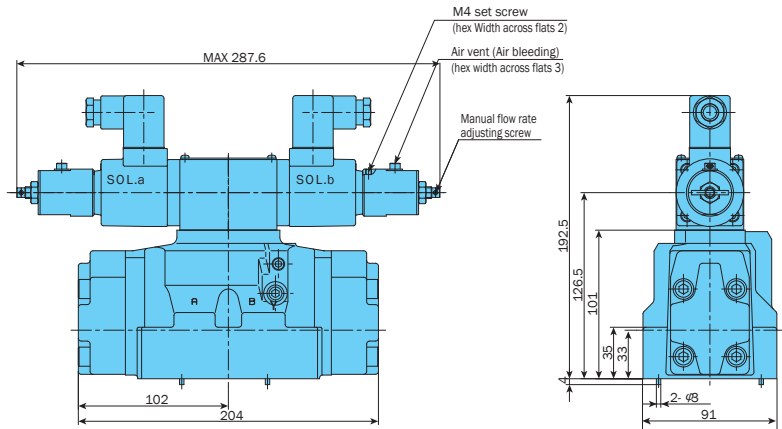
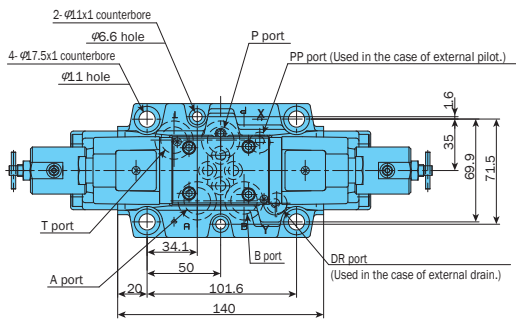
ESD-G03



ESD-G03 Mounting Gasket Surface Dimensions
Gasket Surface Mounting Dimensions (ISO4401-05-0-94)



ESD-G04



Bundled Accessories (Valve Mounting Bolts)

Model No.	Bolt Size	Q'ty	Tightening Torque ft lbs
ESD-G01	10-24 x 1 3/4	4	3.6 to 5 ft lbs
ESD-G03	1/4-20 x 1 3/8	4	7 to 9.5 ft lbs
ESD-G04	1/4-20 x 1 3/4	2	7 to 9.5 ft lbs
	3/8-16 x 2	4	33 to 40 ft lbs
ESD-G06	1/2-13 x 2 3/8	6	44 to 51 ft lbs

For information about sub plates, see MSA-01Y-E10 on page G-3.

Gasket Surface Dimensions (ISO 4401-03-02-0-94)

Use an operating fluid that conforms to both of the following.

Oil temperature: -4 to 158° F Viscosity: 12 to 400 centistokes. The recommended viscosity range is 15 to 60 centistokes.

- Auxiliary symbol G: Equipping a modular type pilot reduction valve increases the height by 1.57".
- The gasket surface dimensions comply with the ISO standards shown below.

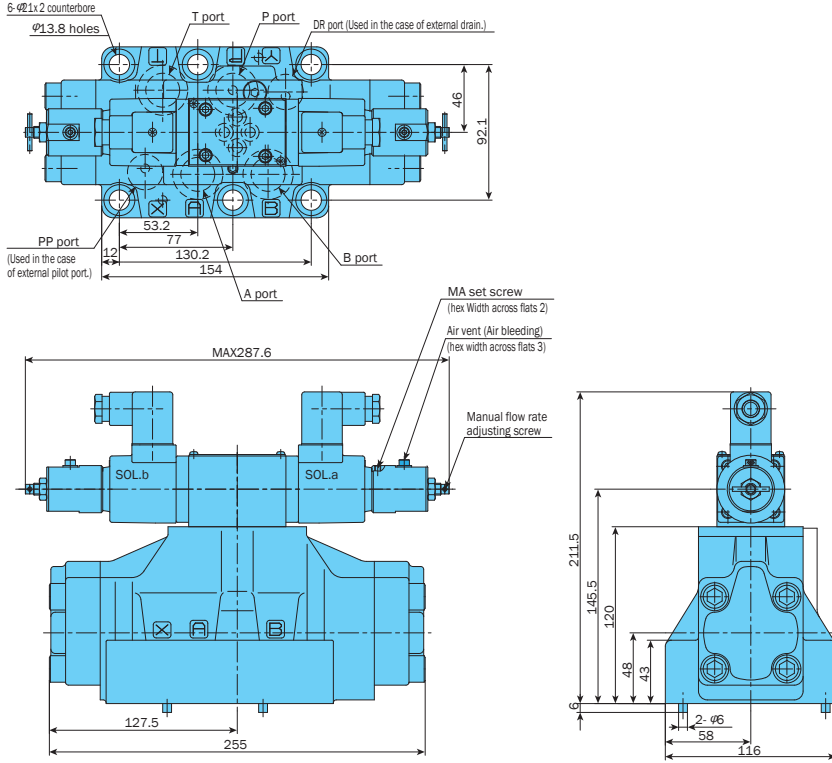
ESD-G04 - ISO 4401-07-06-0-94

ESD-G06 - ISO 4401-08-07-0-94

ESD-G10 - ISO 4401-10-08-0-94

Note: The coil cover has an M4 set screw. To change the air vent orientation, loosen the M4 screw and then rotate the cover. After bleeding air, tighten the cover and then secure it with the M4 screw.

ESD-G06



Performance Curves

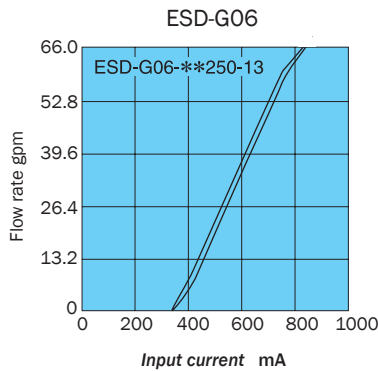
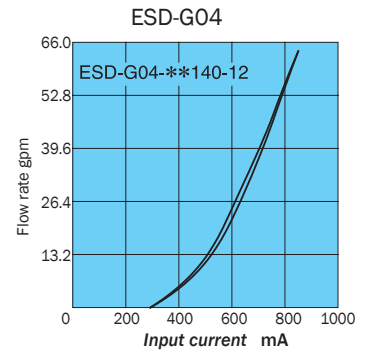
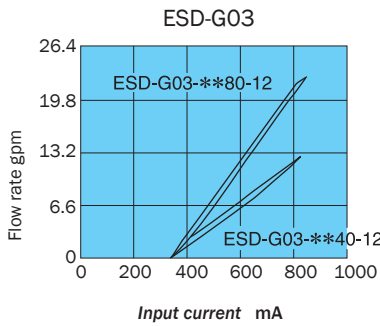
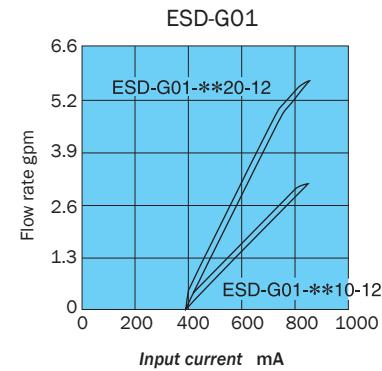
Hydraulic Operating Fluid Viscosity 32 centistokes

Input Current - Flow Rate Characteristics are characteristic when the P → A or P → B pressure drop is $\Delta P = 145$ psi.

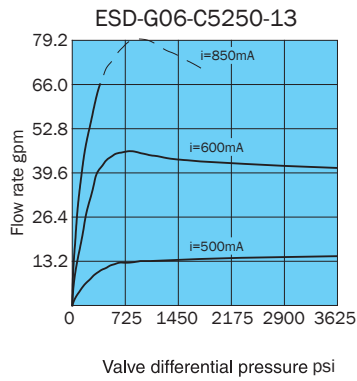
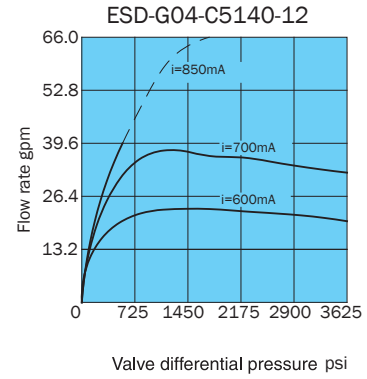
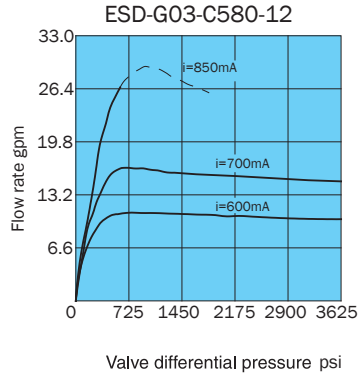
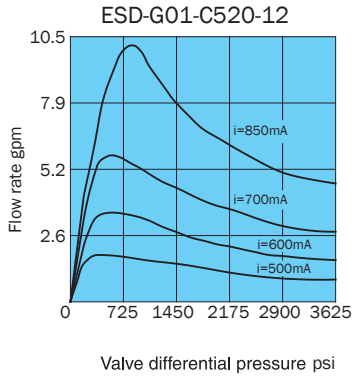
For Pressure - Flow Rate Characteristics, the horizontal shaft valve differential pressure indicates the pressure drop volume of the entire control valve

(between P, A, B, T), and flow rate is measured at the oil motor.

Input Current - Flow Rate Characteristics

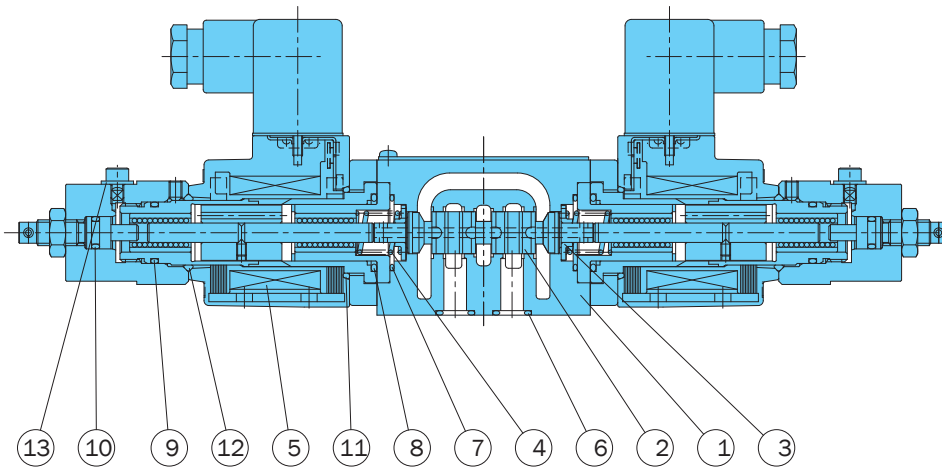


Pressure - Flow Rate Characteristics



Cross-sectional Drawing

ESD-G01-***-12



Part No.	Part Name
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	O-ring
12	O-ring
13	Seal

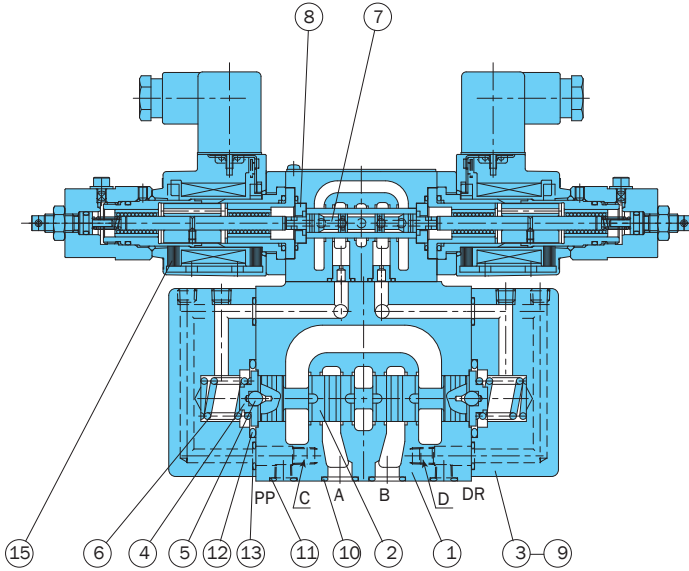
Note: Coil model number JD64-D2

Seal Part List (Kit Model Number JDS-G01-1A)

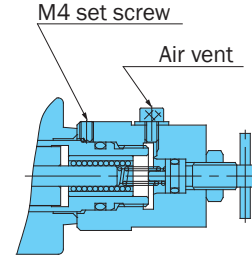
Part No.	Part Name	Part Number	Q'ty
6	O-ring	AS 568-012(Hs90)	4
7	O-ring	AS 568-019(Hs90)	2
8	O-ring	1B-P22	2
9	O-ring	AS 568-016(Hs90)	2
10	O-ring	1B-P7	2
11	O-ring	S-25	1
12	O-ring	1A-P20	1
13	Seal	CW1000F0	2

Note: O-ring 1A/B-** refers to JIS B2401-1A/B-**.

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



Manual adjustment section
(ESD-G03, G04, G06, G10)

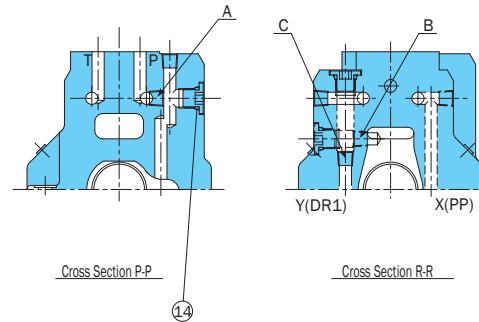
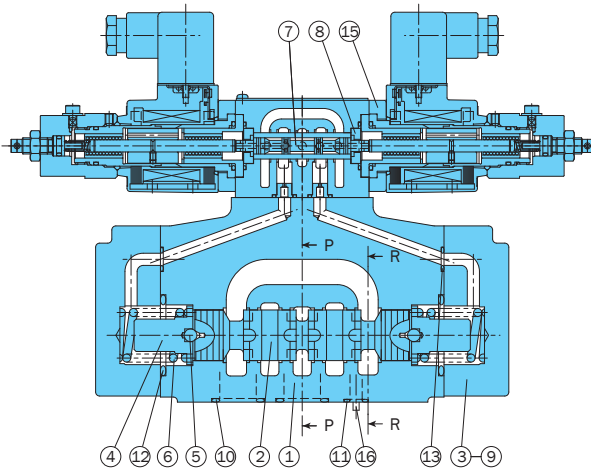


Note: The coil cover has an M4 set screw.
When changing the orientation of the air vent, loosen the M4 screw and rotate the cover. Retighten after bleeding the air.

Methods for Changing the Pilot/Drain System

After Change		Hexagon Socket Head Plug
Pilot	Internal	Change to PP port from C.
	External	Change from PP port to C.
Drain	Internal	Change from D to DR port.
	External	Change from DR port to D.

ESD-G04-***-(**)-12



Methods for Changing the Pilot/Drain System

After Change		Hexagon Socket Head Plug
Pilot	Internal	Remove from A
	External	Insert from A
Drain	Internal	Change from B to C
	External	Change from C to B

Note: A single hex head plug (NPTF 1/16) is required when changing to external pilot.
Hex Head Plug: TPUA-1/16

Part No.	Part Name
1	Body
2	Spool
3	Cover
4	Retainer
5	Ball
6	Spring
7	Pilot spool
8	Stopper
9	Screw
10	O-ring
11	O-ring
12	O-ring
13	O-ring
14	O-ring
15	Proportional solenoid

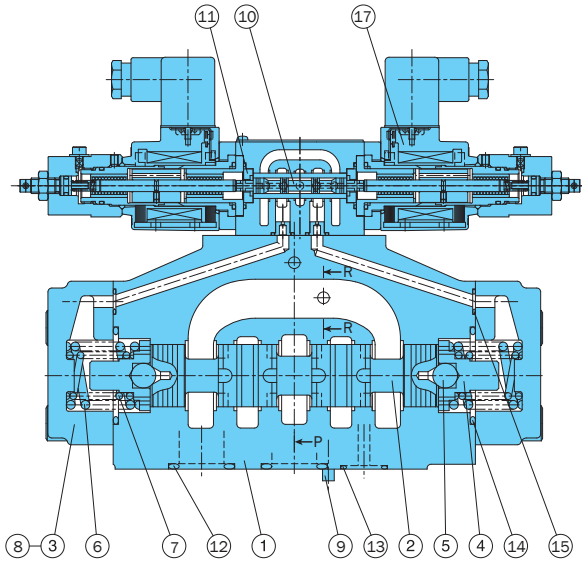
Note: Coil model number JD64-D2

Seal Part List (Kit Model Number JHS-***)

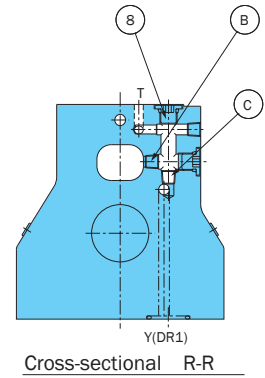
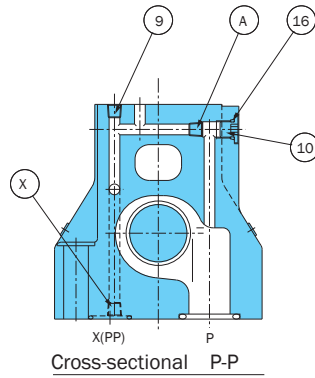
Part No.	Part Name	ESD-G03		ESD-G04	
		Part Number	Q'ty	Part Number	Q'ty
10	O-ring	1B-P12	5	1B-P22	4
11	O-ring	1B-P9	2	1B-P10A	2
12	O-ring	1B-P28	2	1B-P34	2
13	O-ring	1B-P9	6	1B-P9	2
14	O-ring	---	-	1B-P8	3
Kit Model No.		JHSG03		JHSG04	

Note: O-ring 1B-*** refers to JIS B 2401-1B-***.

ESD-G06-***-(***)-13



Pilot, Drain System Change



Changing the Pilot and Drain Connections

After Change		Hexagon Socket Head Plug
Pilot	Internal	Switch from A to x .
	External	Switch from x to A .
Drain	Internal	Switch from B to C .
	External	Switch from C to B .

Seal Part List (Kit Model Number JHS-G06)

Part No.	Part Name	Part Number	Q'ty
12	O-ring	1B-P28	4
13	O-ring	1B-P20	2
14	O-ring	1B-G45	2
15	O-ring	1B-P10	2
16	O-ring	1B-P8	3

Note: O-ring 1B-** refers to JIS B 2401-1B-**.

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



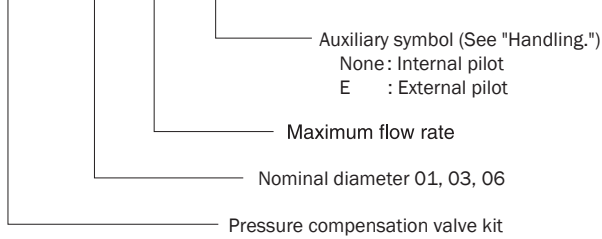
Pressure Compensation Valve Kit

Specifications

Item	Model No.	JHF-01027	JHF-03040(E)	JHF-03080(E)	JHF-06170(E)
Maximum Operating Pressure psi		3045	3625	3625	3045
Pressure Compensation Differential Pressure psi		145	87	203	116
Maximum Flow Rate ℓ/min (gpm)		27 (7.1)	40 (10.5)	80 (21.1)	170 (44.9)
Weight lbs		3.3	10.3	11.0	26.4

Understanding Model Numbers

JHF - 03 040 (E)



• Handling

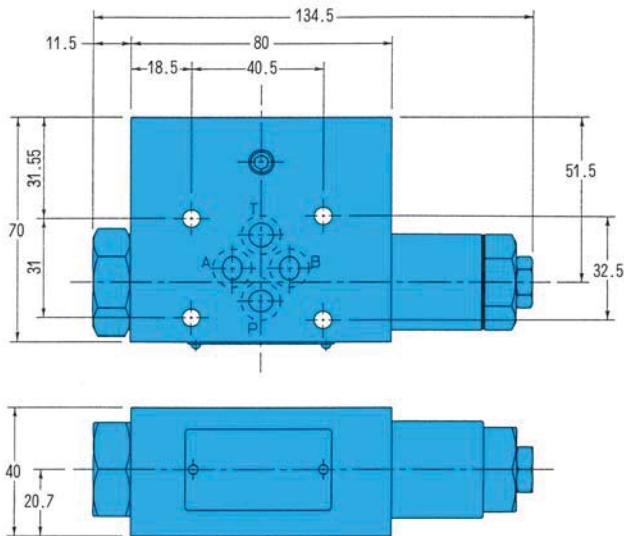
When using the pressure compensation kit, use an external pilot type for the ESD valve (G03, O6).

An internal pilot type pressure compensation valve kit is used when the pilot flow rate is supplied from the P port, without an external pilot port (Pp port) on the manifold. An

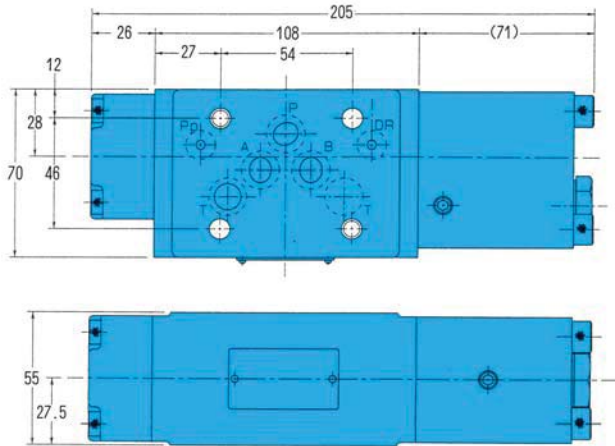
external pilot type pressure compensation valve kit is used when there is an external pilot port (Pp port) on the manifold.

Installation Dimension Drawings

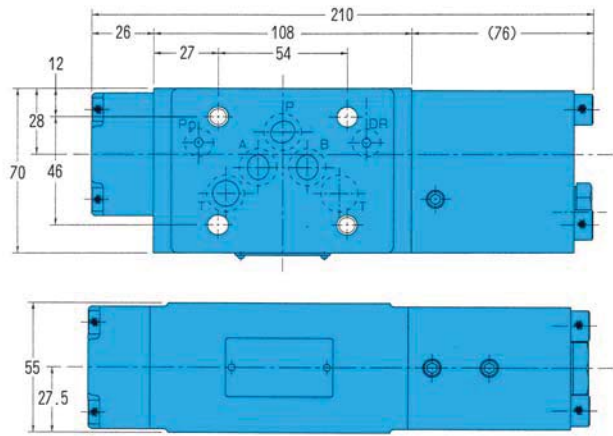
Pressure compensation valve kit
JHF-01027



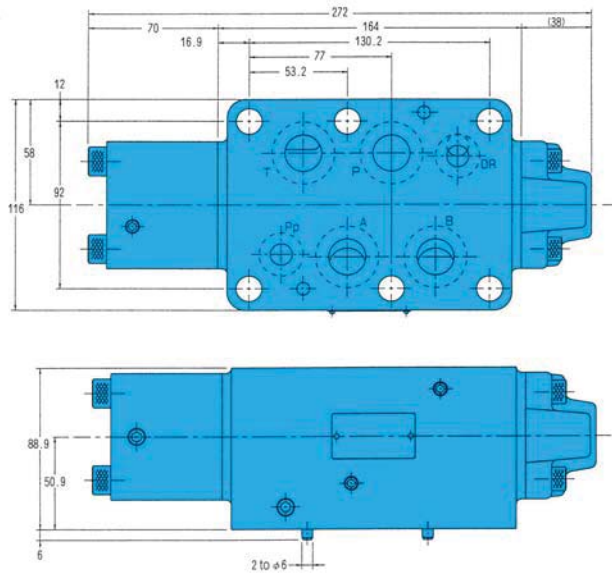
JHF-03040(E)



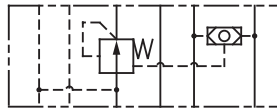
JHF-03080(E)



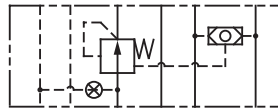
JHF-06170(E)



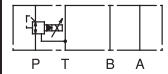
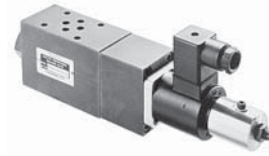
Note: Mounting bolts are not included with the pressure compensation kit. Use the valve mounting bolt lists on pages F-87 through F-89 to select mounting bolts.



Internal pilot



External pilot



Modular Type Electro-Hydraulic Proportional Reducing Valve

7.9 gpm
43.5 to 2030 psi

Features

This valve incorporates the ease-of-use principles of the modular valve into an electro-hydraulic proportional reducing valve to provide reduction

control of hydraulic system pressure in proportion to **input current**. This valve is perfect for a small-scale hydraulic system, such as those used

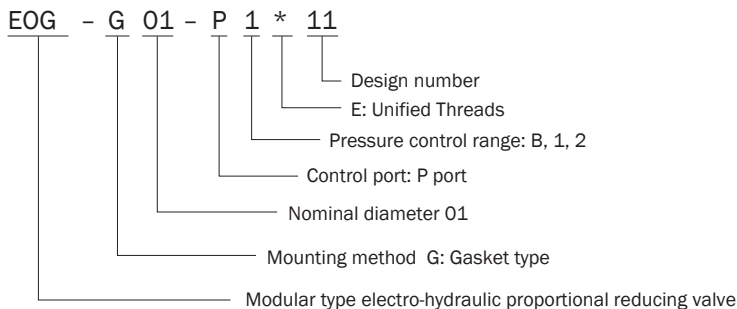
for continuous proportional control of lathe chuck pressure. A relief function ensures outstanding pressure response characteristics.

Specifications

Item	Model No.	EOG-G01-P*-11
Maximum Operating Pressure psi		3625
Maximum Flow Rate gpm		7.9
Pressure Control Range psi		B: 43.5 to 362 1: 58 to 1000 2: 87 to 2000
T Port Allowable Back Pressure psi		362
Rated Current mA		850
Coil Resistance Ω		20 (68° F)
Hysteresis %		3 max. (Note 1)
Weight lbs		7.9

Note: Value when a Nachi-Fujikoshi special amplifier is used (with dithering).

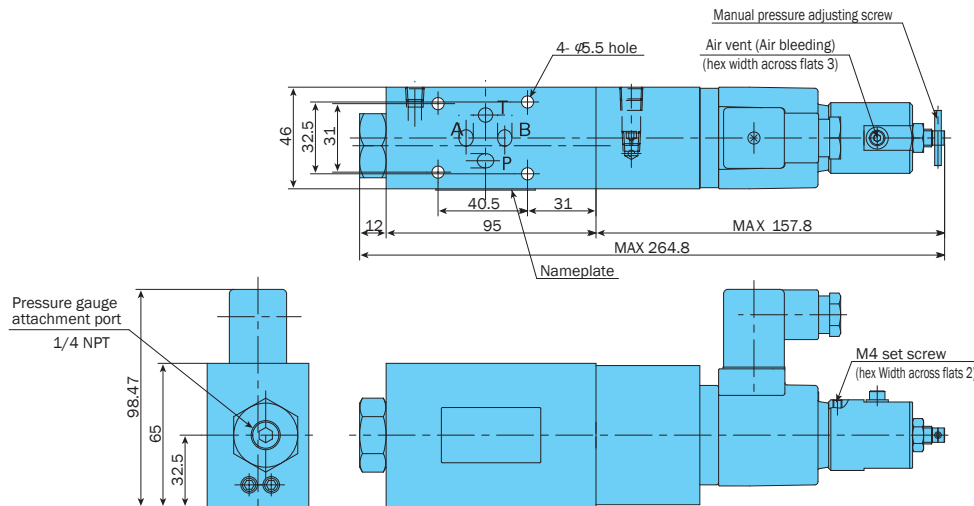
Understanding Model Numbers



- Handling
- 1 Air Bleeding
To enable proper pressure control, loosen the air vent when starting up the pump in order to bleed any air from the pump, and fill the inside of the solenoid with hydraulic operating fluid.
- 2 Manual Pressure Adjusting Screw
For the initial adjustment or when there is no input current to the valve due to an electrical problem or some other reason, valve pressure can be increased by rotating the manual adjustment screw clockwise (rightward). Normally, the manual adjusting screw should be rotated back fully to the left (counterclockwise) and secured with the lock nut.
- 3 Minimum Control Pressure
Since this valve has an internal drain system, T port back pressure has an effect on minimum control pressure.
- 4 Load Capacity
Make load capacity (valve OUT side capacity) at least .13 gpm.
- 5 Use an operating fluid that conforms to the both of the following.
Oil temperature: -4 to 158 °F
Viscosity: 12 to 400 centistokes
The recommended viscosity range is 15 to 60 centistokes.

Installation Dimension Drawings

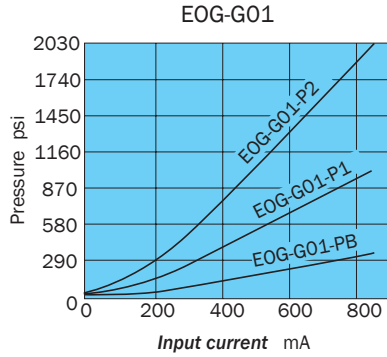
EOG-G01-P*-E11



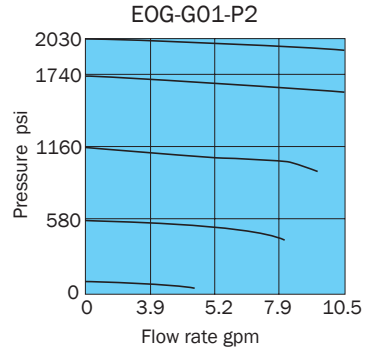
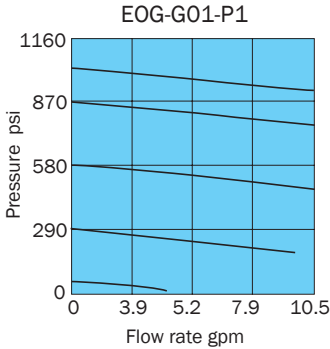
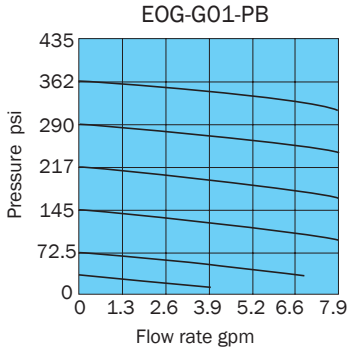
Performance Curves

Hydraulic Operating Fluid Viscosity 32 centistokes

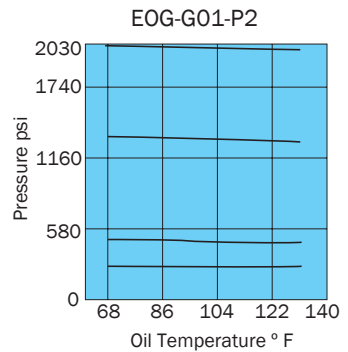
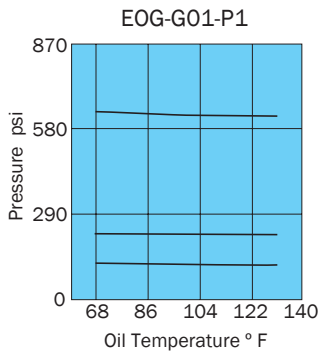
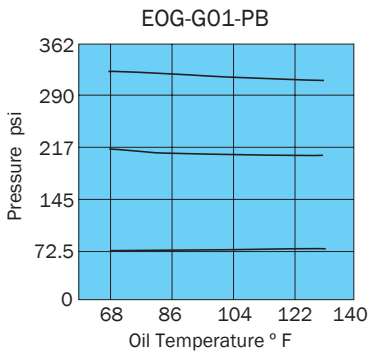
Input Current - Pressure Characteristics



Flow Rate - Pressure Characteristics

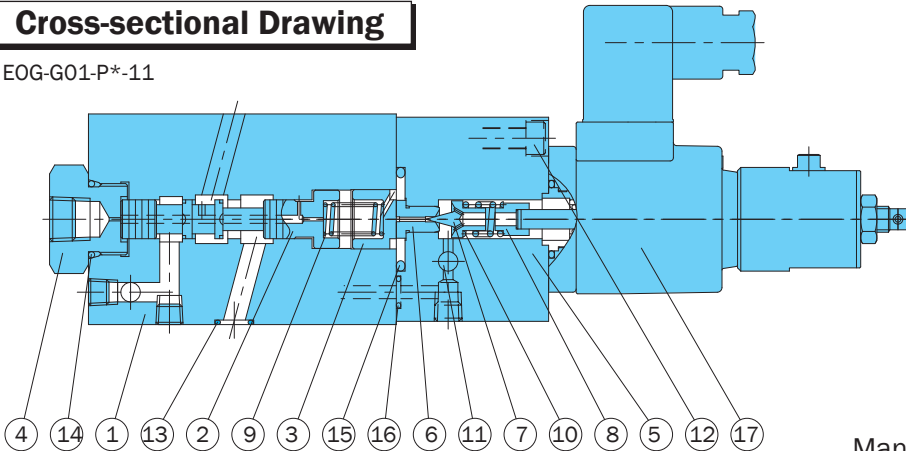


Fluid Temperature Characteristics



Cross-sectional Drawing

EOG-G01-P*-11



Part No.	Part Name	Part No.	Part Name
1	Body	10	Spring
2	Spool	11	Choke
3	Retainer	12	Screw
4	Plug	13	O-ring
5	Cover	14	O-ring
6	Seat	15	O-ring
7	Poppet	16	O-ring
8	Retainer	17	Proportional solenoid
9	Spring		

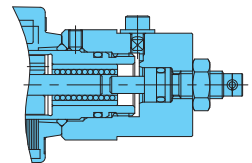
Note: Coil model number JD64-D2

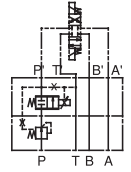
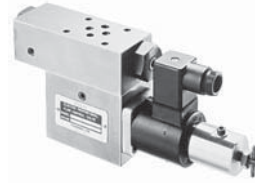
Seal Part List (Kit Model Number JBS-G01)

Part No.	Part Name	Part Number	Q'ty
13	O-ring	1B-P9	4
14	O-ring	1B-P20	1
15	O-ring	1B-P26	1
16	O-ring	1B-P7	1

Note: O-ring 1B-** refers to JIS B2401 1B-**.

Manual adjustment section





Modular Type Electro-Hydraulic Proportional Flow Control Valve

.07 to 6.6 gpm
3045 psi

Features

An electro-hydraulic proportional restrictor valve and pressure compensation valve are combined into a modular configuration, available as one of two types: the meter in control EOF-G01-P and meter out control EOF-G01-T.

The pressure fluctuations have little influence on the setting flow rate making this valve perfect for electro-hydraulic proportional control of small hydraulic systems used for machine tool APC and ATC high-speed shockless control, remote control, etc.

• Handling

1 Air Bleeding

To enable proper pressure control, loosen the air vent when starting up the pump in order to bleed any air from the pump, and fill the inside of the solenoid with hydraulic operating fluid. The position of the air vent can change by loosening the lock screw and rotating the cover.

2 Manual flow rate adjusting screw

For the initial adjustment or when there is no **input current** to the valve due to an electrical problem or some other reason, the flow rate can be adjusted by rotating the manual adjustment screw. Rotate clockwise (rightward) to increase flow rate.

Normally, this adjusting screw should be returned completely to its original position and secured with the lock nut.

3 T Port Back Pressure

Since this valve has an internal drain system, make sure that valve T port back pressure is no greater than 362 psi.

4 Use an operating fluid that conforms to the both of the following.

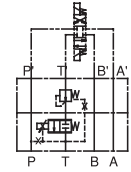
Oil temperature: -4 to 158 °F

Viscosity: 12 to 400 centistokes

The recommended viscosity range is 15 to 60 centistokes.

5 O-ring Plate Orientation

- The port nearest the nameplate surface is the P port.
- The port with a mounting pitch width of 31 (narrow pitch width) is the A port.
- The cutout on the O-ring plate is on the A port side.

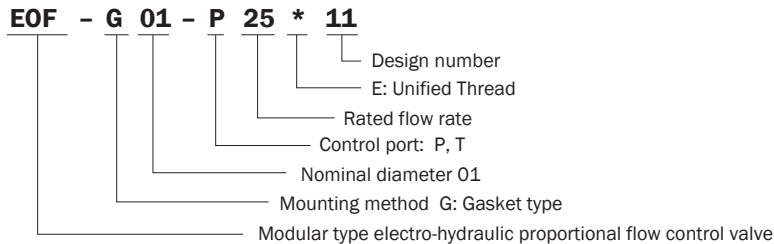


Specifications

Item	Model No.	EOF-G01- P T 25-11
Maximum Operating Pressure psi		3045
Flow Rate Control Range ℓ/min (gpm)		0.3 to 25 (.07 to 6.6)
Flow Rate Control Port		EOF-G01-P : P port EOF-G01-T : T Port
T Port Allowable Back Pressure psi		362 max.
Hysteresis %		3 max. (Note 1)
Response Speed S		0.05
Rated Current mA		800
Coil Resistance Ω		20 (68° F)
Weight lbs		8.1

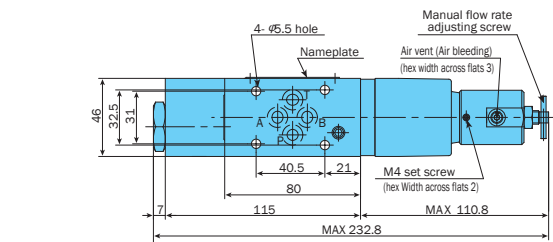
Note: Value when a Nachi-Fujikoshi special amplifier is used (with dithering).

Understanding Model Numbers

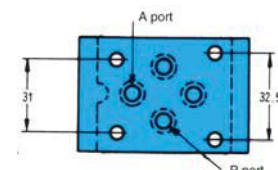
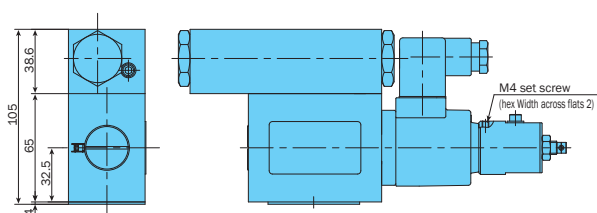
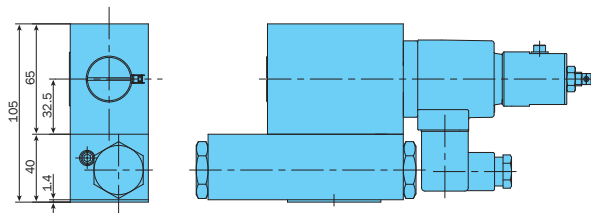
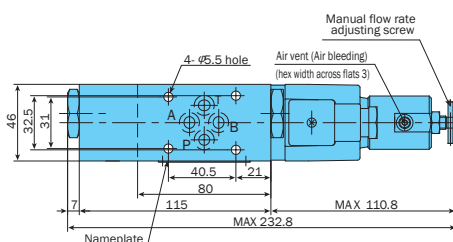


Installation Dimension Drawings

EOF-G01-P25-11



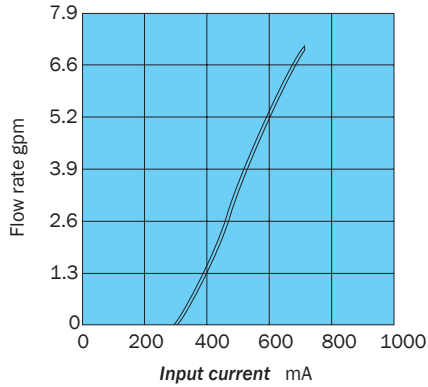
EOF-G01-T25-11



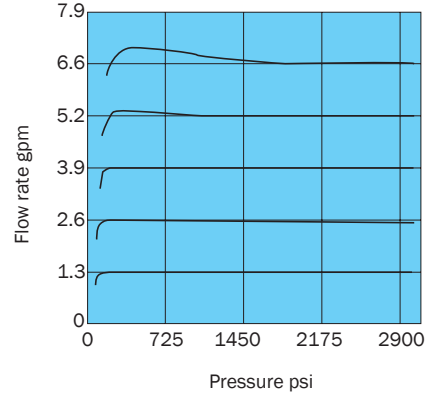
Performance Curves

Hydraulic Operating Fluid Viscosity 32 centistokes

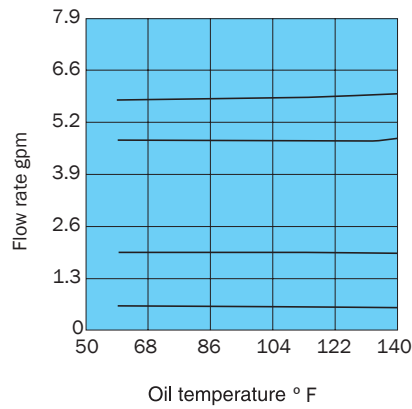
Input Current -
Flow Rate
Characteristics



Pressure -
Flow Rate
Characteristics

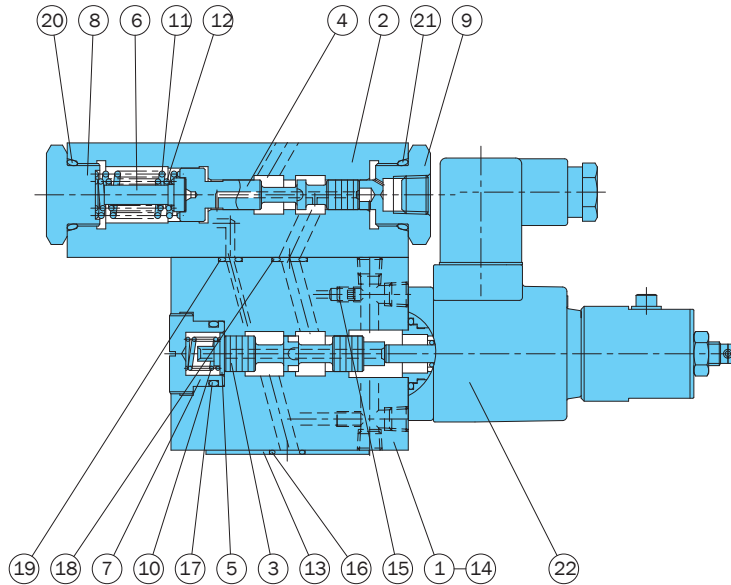


Fluid Temperature
Characteristics



Cross-sectional Drawing

EOF-G01-T25



Part No. Part Name

Part No.	Part Name
1	Body
2	Body
3	Spool
4	Piston
5	Retainer
6	Retainer
7	Plug
8	Plug
9	Plug
10	Spring
11	Spring
12	Spring
13	Plate
14	Screw
15	Screw
16	O-ring
17	O-ring
18	O-ring
19	O-ring
20	O-ring
21	O-ring
22	Proportional solenoid

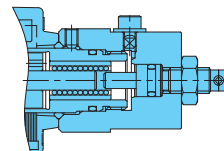
Note: Coil model number JD64-D2

Seal Part List (Kit Model Number JMS-G01)

Part No.	Part Name	Part Number	Q'ty
16	O-ring	1B-P9	4
17	O-ring	1B-P18	1
18	O-ring	1B-P9	4
19	O-ring	1B-P5	1
20	O-ring	1B-P20	1
21	O-ring	1B-P20	1

Note: 1B-** refers to JIS B2401-1B-**.

Manual adjustment section





Power Amplifier Series for Electro-Hydraulic Proportional Valve Drive

Overview

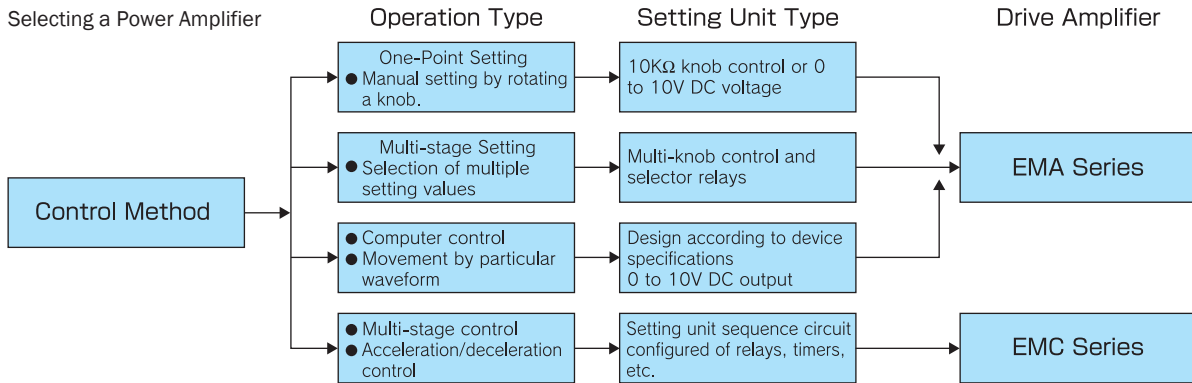
This special amplifier is for driving electrohydraulic proportional pressure control valves, electro-hydraulic proportional flow control valves, and electro-hydraulic proportional direction control valves. It comes in a choice of two different types: an amp type and a controller type.

Basically, the amp type converts 0 to 10V DC range command voltage to a **DC current** of in the range of 0 to 900mA, which is then supplied to the control valve. The control type performs multi-stage control of **output current** in accordance with the ON-OFF signal of external contacts.

Power Amplifier Types and Functions

Type	Model No.	Drive Control Valve	Functions
Amp Type	EMA-PD5-N-20	Pressure Control Valves Flow Control Valves Direction Control Valves	Three functions: open loop control, feedback control, and acceleration/deceleration control.
Controller Type	EMC-PC6-A-20	Same as above.	Built-in command voltage setting units (potentiometers) Setting unit selection is performed by relay contacts, limit switches, timer contacts, etc.

Selecting a Power Amplifier



Specifications

Item	Model No.	EMA-PD5-N-20	EMC-PC6-A-20
Function		Amp Type (Closed Loop)	Controller Type
Number of Inputs		5 DC inputs	-
Number of Channels		-	6
Maximum Output Current		900mA (20Ω solenoid)	900mA (20Ω solenoid)
Input voltage		0 to +10V DC	-
Feedback Voltage		0 to +10V DC	-
Input Impedance		At least 50kΩ	-
Externally Set Variable Resistance		10kΩ	-
Zero Adjust(NULL)		0 to 900mA	0 to 900mA
Time Lag (T-UP, DOWN)		0.3 to 3sec	-
Gain Adjustment (GAIN)		$\frac{900\text{mA}}{10V_{DC}}$ to $\frac{900\text{mA}}{1.5V}$	0 to $\frac{900\text{mA}}{80\% \text{ channel setting}}$
External power supply		+10V _{DC} (10mA)	-
External Contact Resistance		-	10Ω max. when closed
Dither (Internal, semi-fixed)		Level: 0 to 500mApp Frequency: 50 to 220Hz	Level: 0 to 500mApp Frequency: 50 to 220Hz
Channel Time Lag (TIME)		-	0.3 to 3 seconds Externally variable
Power Supply Voltage		AC100, 110, 200, 220V (±10%)50/60Hz	AC100, 110, 200, 220V (±10%)50/60Hz
Power Consumption		50VA	50VA
Allowable Ambient Temperature		32 to 122° F	32 to 122° F
Temperature Drift		0.2mA/°C max.	0.2mA/°C max.
Weight lbs		7.7	7.7

• Handling

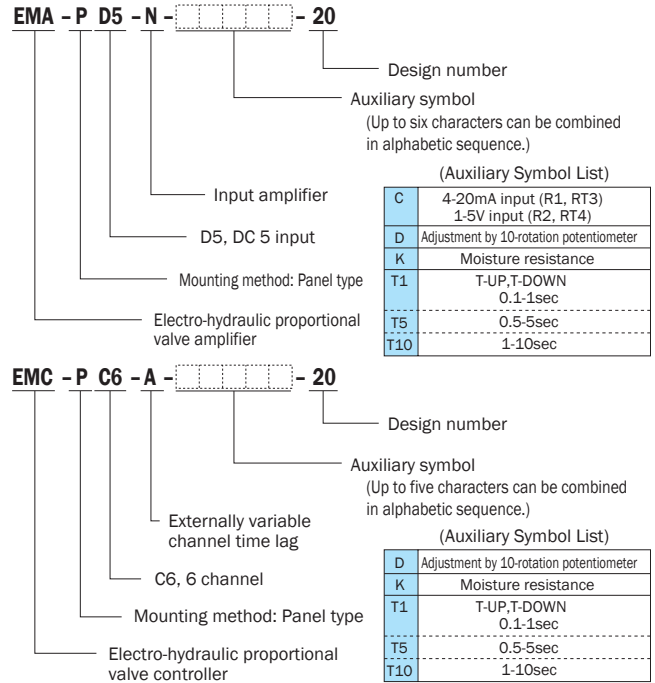
- 1 Power supply voltage can be either 110V or 230V.
- 2 When selecting a location, avoid areas subject to high temperatures and high

humidity, and select an area where there is little vibration and dust.

- 3 Use shielded wire for the analog signal and valve output signal wires.

- 4 When performing valve output signal line ON-OFF switching with a relay, connect a surge absorber or varistor parallel with the relay.

Understanding Model Numbers

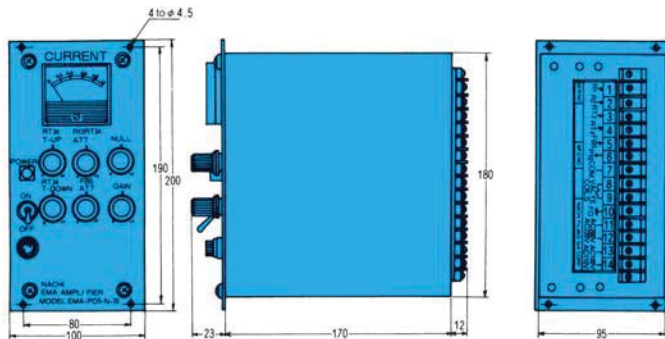
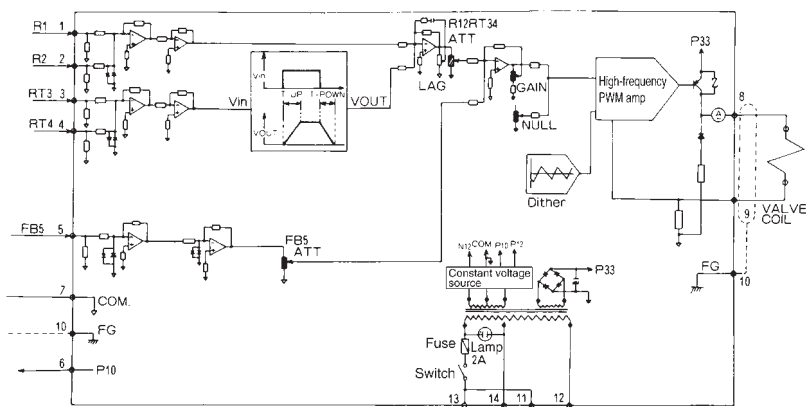


Note: T-UP, DOWN, and TIMER all become 0.3-3 sec when there is no signal for T1, T5, and T10.

Power Amplifier Series for Electro-Hydraulic Proportional Valve Drive

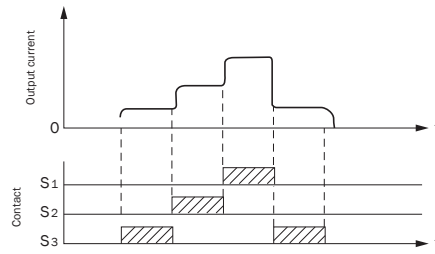
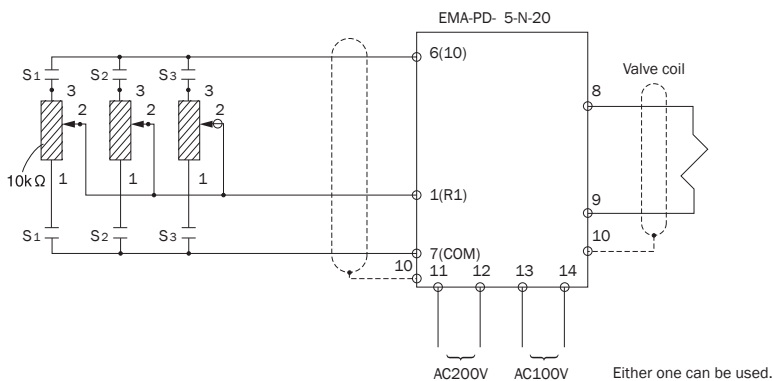
EMA-PD5-N-20

No.	Name	No.	Name
1	R1	8	Output terminal to
2	R2	9	VALVE COIL valve
3	RT3, delay input	10	FG, case ground
4	RT4, delay input	11	AC200, 220V
5	FB5, feedback input	12	AC100, 110V
6	P10, external power supply	13	
7	COM, signal land	14	



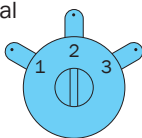
Application Examples

1. Multi-stage Setting Using Multiple Potentiometers

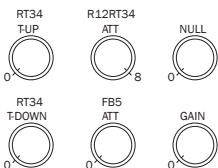


(1) Wiring the amp and external potentiometer

A potentiometer has three terminals numbered 1, 2, and 3.



(2) Setting the adjusting knobs
Terminals 2 (R2), 3 (RT3), and 4 (RT4) can also be used in place of terminal 1. An RT34T-UP and RT34T-DOWN acceleration/deceleration timer can also be used in the case of terminal 3 (RT3) and terminal 4 (RT4). In this case, the settings of the knobs on the front panel of the amp are normally as shown in the illustration below. The manual setting unit provides **output current** control in the range of 0 to 900mA as it is rotated from full counterclockwise to full clockwise.



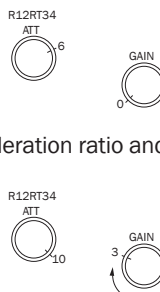
Wiring

- Amp terminal 7 (0V) Potentiometer terminal 1
- Amp terminal 6 (10V) Potentiometer terminal 3
- Amp terminal 1 (R1) Potentiometer terminal 2

With this wiring, rotating the potentiometer clockwise causes the **output current** to increase.

- If an output in the range of 0 to 600mA is desired even while the manual setting unit is rotated fully clockwise, restrict the setting of R12RT34ATT to 6.

- When the level deceleration ratio and other factors limit the effective use of the manual setting unit to only 150° of the 300°, use GAIN to adjust the **output current** to 900mA.



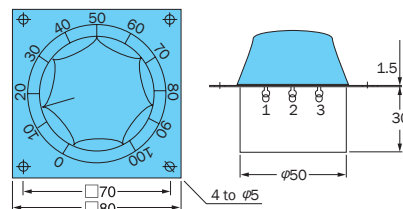
Note: 1. A range of 5KΩ to 10KΩ is recommended for external knobs and potentiometers.

2. In order to prevent **current** loss across terminals 6 and 7, insert relays between terminal 6 and the potentiometers and terminal 7 and the potentiometers.

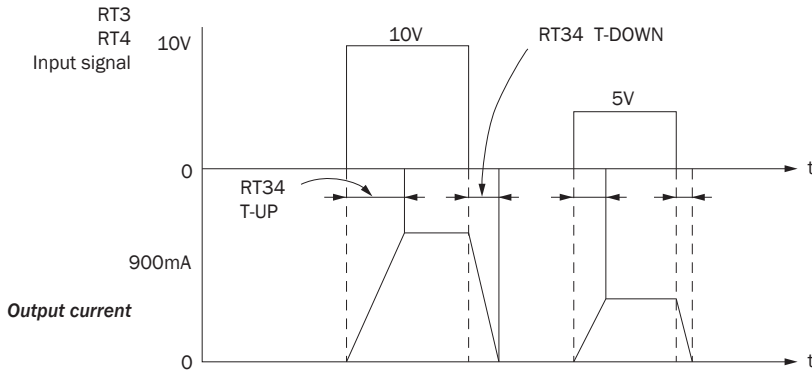
3. Do not enable more than one potentiometer at the same time.

(3) The following is available for the external setting knob.

Model No. F ZS-6350-101



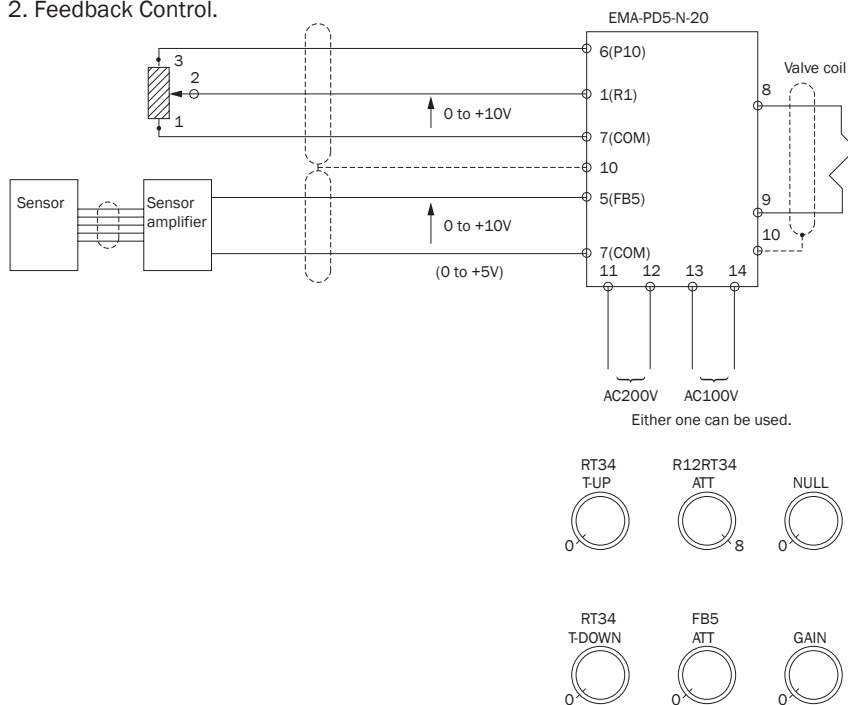
(4) Acceleration time adjustment (RT34T-UP) and deceleration time adjustment (RT34T-DOWN)



This circuit creates a fixed acceleration time lag in accordance with the voltage that added the input signal to terminals 3 and 4 (RT3, RT4). The time lag is adjustable in the range of 0.3 to 3 seconds, as standard. As shown in the diagram to the left, even when RT34T-UP is set to 3 seconds, the change to 5V during stepped input from 0 to 10V and stepped input from 0 to 5V takes 1.5 seconds, which is half the set time.

With the wiring shown to the left, **output current** is increased or decreased in accordance with the feedback signal of the sensor, which regulates pressure or the flow rate.

2. Feedback Control.



Note:
Using terminal 3 (RT3) and terminal 4 (RT4) in place of terminal 1 (R1) enables T-UP and T-DOWN, which allows feedback control without overshooting or undershooting, even when input signal voltage is stepped.

Adjustment Method
• Initially, set FB5ATT to 0 as shown in the illustration to the left, and check to see if open loop control is possible.
• Next, set FB2ATT to 2 and GAIN to 2, and input a feedback signal. Gradually rotate FB5ATT clockwise and increase gain.

Set the feedback gain to the level that is immediately before the point where vibration is generated in the control system. (FB5ATT, GAIN)

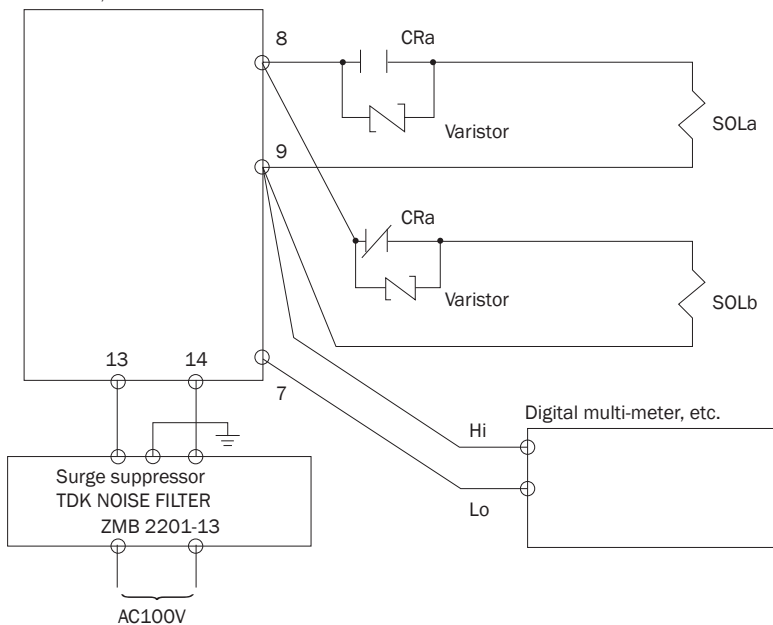
- Note:
- To measure **current**, measure the voltage at terminal 9, using terminal 7 as reference. The voltage across the 0.5Ω **current** detection resistor at 1A is 0.5V. Use a measurement device with an input impedance of at least 1MΩ.
 - Switch the terminal 8 line using a relay. Make sure that both relays are not on at the same time.
 - To absorb surge voltage, include 82V varistors in parallel with the relay contacts.

- Recommended Varistor
Tama Electric Co., Ltd. NV082D10
Matsushita ERZV10D820
- For relays, use OMRON LY type power relays or the equivalent.
 - Too much noise in the 110V AC or 230V AC power supply line can result in unstable **output current**. If this happens, equip a surge absorber on the power supply.

Recommended Model
TDK NOISE FILTER
ZMB2201-13

3. Direction Control Valve (ESD) Drive

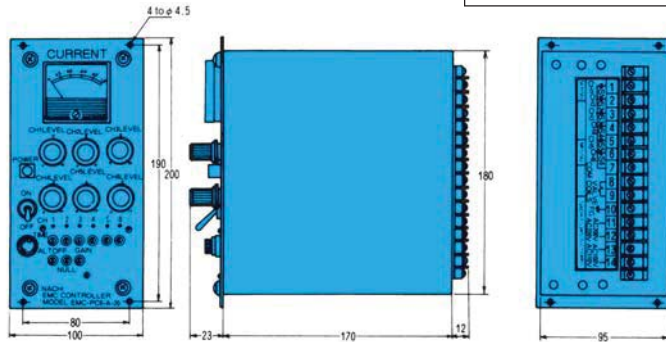
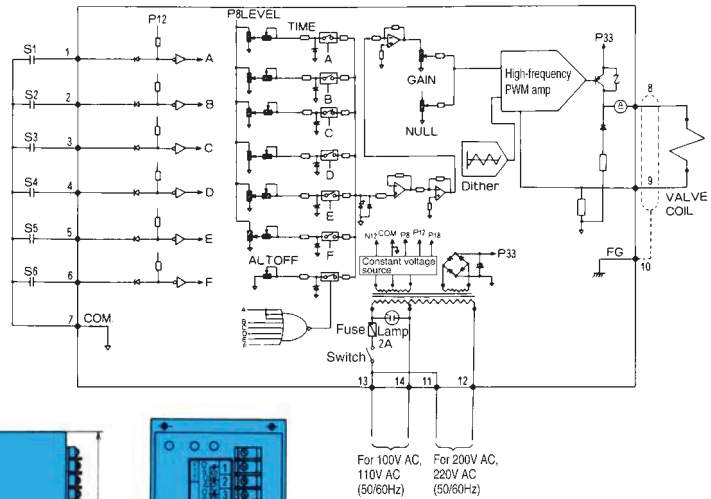
EMA-PD5-N-20, EMC-PC6-A-20



Power Amplifier Series for Electro-hydraulic Proportional Valve Drive

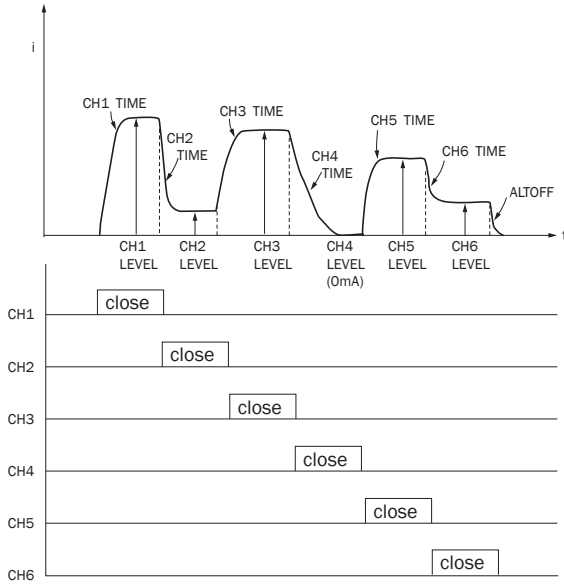
EMC-PC6-A-20

No.	Name	No.	Name
1	CH1 Input command contact	8	Output terminal to valve
2	CH2 "	9	VALVE COIL
3	CH3 "	10	FG, case ground
4	CH4 "	11	AC200 220V
5	CH5 "	12	AC100 110V
6	CH6 "	13	AC100 110V
7	Common COM input contact	14	



Note: When external contacts S1 through S6 are closed, use a non-voltage contact no greater than 10 Ω .

Application

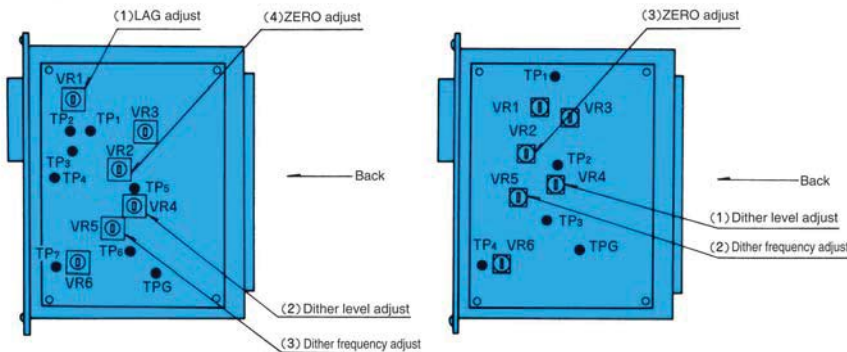


- LEDs are provided to indicate channel selection.
- The TIME knob of each channel adjusts the time until the selected channel's level is reached, as shown to the left. Make sure that the lap time (or time when channel is not selected) when changing the channel selection is 30msec maximum.
- Use independent external contacts. Even when external contacts are superimposed, output is not the sum of each channel, so use of superimposed external contacts is not supported.

Note: When replacing a Design Number 10 controller with a Design Number 20 controller, you must also change the sequence from superimposed external contacts to independent.

Dither Adjustment Method (Dither is set to load 400mA_{p-pm} 100Hz.)

- (1) EMA-PD-N-20 (2) EMC-PC6-A-20



Removing the left side panel when viewed from the front reveals the configuration shown in the illustrations to the left.

1. If piping or other items vibrate in response to the dither, raise the dither frequency by rotating the trimmer clockwise.
2. When repeat stability is poor and the hysteresis is large, increase the dither level by rotating clockwise. If this does not resolve the problem, lower the dither frequency by rotating the trimmer counterclockwise.
3. When repeatability is poor with the ES valve or ESD valve due to insufficient air bleeding within the guide, raise the dither frequency by rotating the tripper clockwise, as described in 1.



Small Type Power Amplifier Series for Electro-Hydraulic Proportional Valve Drive

Features

This power amplifier provides high efficiency and reliability in a compact configuration.

Lightweight, compact design – The configuration of this amplifier is 1/3 the weight and 1/2 the volume of existing models.

High efficiency – A PWM control system enables a highly efficient design with little heat generation.

High reliability – All functions are integrated onto a single circuit board for a highly reliable design with no internal wiring.

Specifications

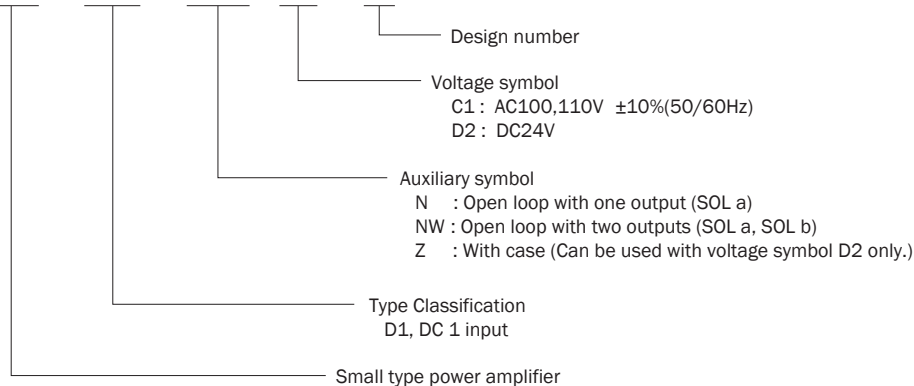
Item	Model No.	EBA-PD1-N-C1-10	EBA-PD1-NW-C1-10	EBA-PD1-N(Z)-D2-10	EBA-PD1-NW(Z)-D2-10
Function		Amp Type (Open Loop)	Amp Type (Open Loop)	Amp Type (Open Loop)	Amp Type (Open Loop)
Number of Inputs		1 DC inputs	1 DC inputs	1 DC inputs	1 DC inputs
Drive Solenoid		SOL a	SOL a, SOL b	SOL a	SOL a, SOL b
Maximum Output Current		900mA (20Ω solenoid)	900mA (20Ω solenoid)	900mA (20Ω solenoid)	900mA (20Ω solenoid)
Input voltage		0 to +10V DC	-10 to +10V DC	0 to +10V DC	-10 to +10V DC
Input Impedance		50kΩ	50kΩ	50kΩ	50kΩ
Externally Set Variable Resistance		10kΩ	10kΩ	10kΩ	10kΩ
Zero Adjust (NULL)		0 to 900mA	0 to 900mA	0 to 900mA	0 to 900mA
Gain Adjustment (GAIN)		0 to $\frac{900\text{mA}}{5\text{V input}}$	0 to $\frac{900\text{mA}}{5\text{V input}}$	0 to $\frac{900\text{mA}}{5\text{V input}}$	0 to $\frac{900\text{mA}}{5\text{V input}}$
External power supply		+5V DC (5mA)	+5V DC (5mA) -5V DC (5mA)	+5V DC (5mA)	+5V DC (5mA) -5V DC (5mA)
Dither Frequency (DITHER)		Variable: 80 to 220Hz	Variable: 80 to 220Hz	Variable: 80 to 220Hz	Variable: 80 to 220Hz
Time Lag (LAG)		Internally Variable: 0.05 to 2 seconds	Internally Variable: 0.05 to 2 seconds	Internally Variable: 0.05 to 2 seconds	Internally Variable: 0.05 to 2 seconds
Power Supply Voltage		AC100 · 110V ±10% (50/60Hz)	AC100 · 110V ±10% (50/60Hz)	DC24V (DC24 to 30V)	DC24V (DC24 to 30V)
Power Consumption		30VA	30VA	30VA	30VA
Allowable Ambient Temperature		32 to 122° F	32 to 122° F	32 to 122° F	32 to 122° F
Temperature Drift		0.2mA/°F max.	0.2mA/°F max.	0.2mA/°F max.	0.2mA/°F max.
Weight lbs		4.8	4.8	.3 (1.3 with Z)	3.0 (1.3 with Z)
Driven Valve		Pressure Control Valves Flow Control Valves	Direction Control Valve	Pressure Control Valves Flow Control Valves	Direction Control Valve

• Handling

- When selecting a location, avoid areas subject to high temperatures and high humidity, and select an area where there is little vibration and dust.
- Use shielded wire for the analog signal and valve output signal wires.
- The brightness of the LED changes in accordance with the size of the output current.

Understanding Model Numbers

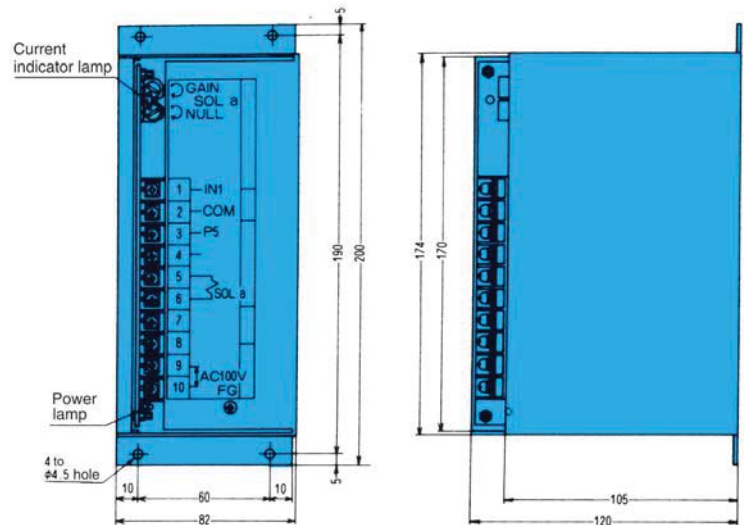
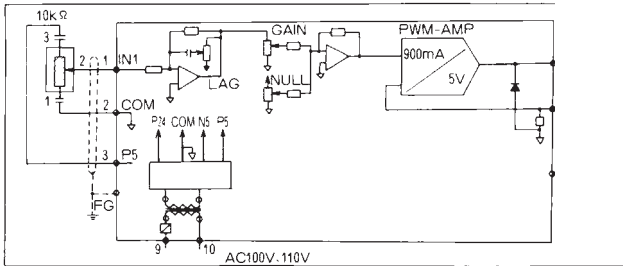
EBA - PD1 - NWZ - D2 - 10



Installation Dimension Drawings

EBA-PD1-N-C1-10

No.	Name	No.	Name
1	Input signal terminal IN1	5	Output terminal to
2	Input signal terminal COM	6	valve SOL a
3	External power supply P5	7	
		8	
		9	
		10	AC100 · 110V

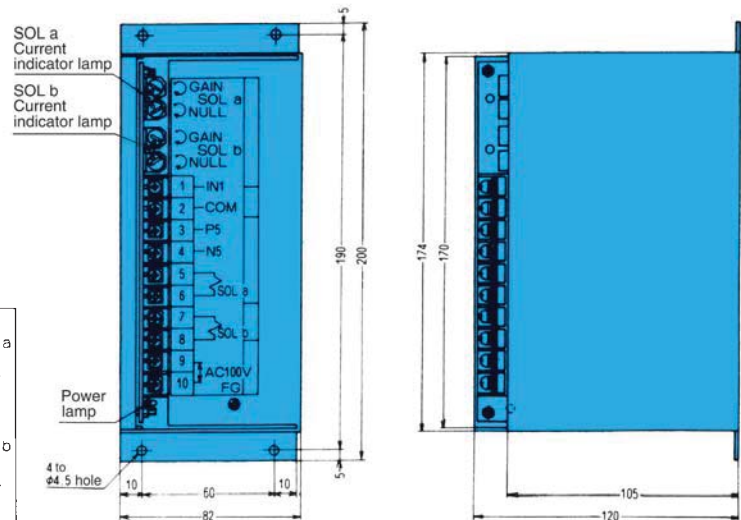
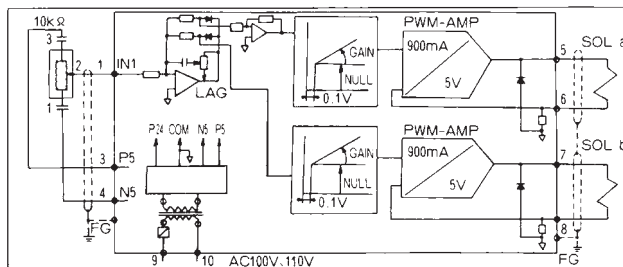


- With EBA-PD1-N (Z), **current** is supplied to the control valve in proportion to input signal voltage in the range of 0 to +10V.
- To measure **current**, measure the voltage at terminal 6, using terminal 2 as reference. The voltage across the 0.5Ω **current** detection resistor at 1A is 0.5V. Input impedance of the measurement device should be at least 1MΩ.

- With EBA-PD1-NW (Z), the polarity of the input voltage is determined, and current is supplied to SOLa when it's positive and to SOLb when it is negative.
- NULL and GAIN for SOL a and SOL b are enabled when each of their input signal voltage is ±0.1V or more.

EBA-PD1-NW-C1-10

No.	Name	No.	Name
1	Input signal terminal IN1	5	Output terminal to
2	Input signal terminal COM	6	valve SOL a
3	External power supply P5	7	Output terminal to
4	External power supply N5	8	valve SOL b
		9	
		10	AC100 · 110V

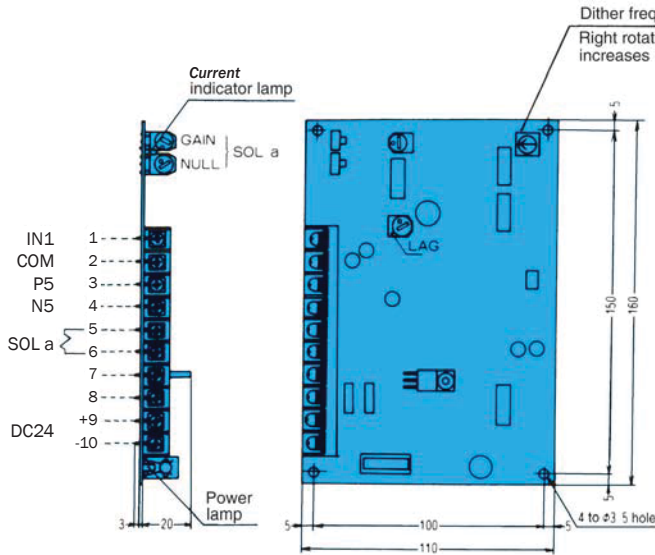
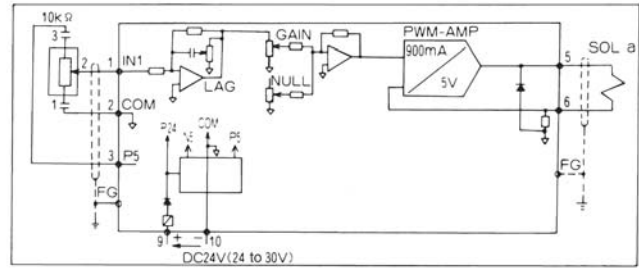


- To measure **current**, measure the voltage at SOLa terminal 6 and SOLb terminal 6, using terminal 2 as reference. The voltage across

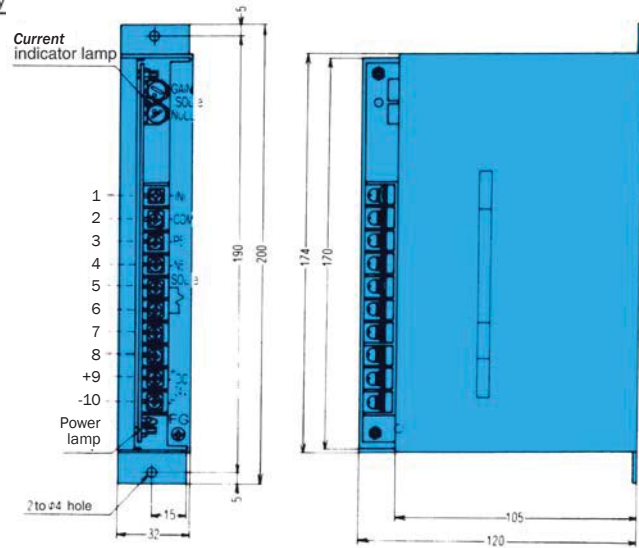
- the 0.5Ω **current** detection resistor at 1A is 0.5V. Input impedance of the measurement device should be at least 1MΩ.

EBA-PD1-N(Z)-D2-10

No.	Name	No.	Name
1	Input signal terminal IN1	5	Output terminal to valve SOL a
2	Input signal terminal COM	6	
3	External power supply P5	7	
		8	
		9	+ DC24V
		10	- DC24V



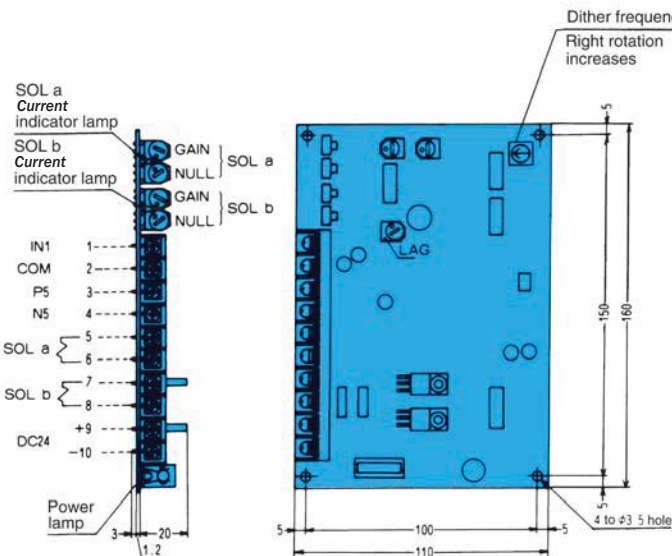
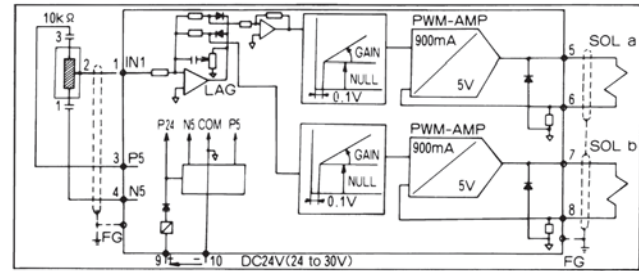
EBA-PD1-N-D2-10



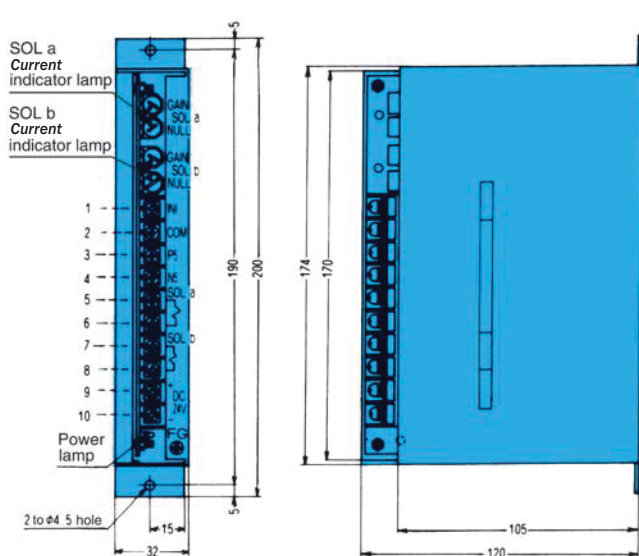
EBA-PD1-NZ-D2-10

EBA-PD1-NW(Z)-D2-10

No.	Name	No.	Name
1	Input signal terminal IN1	5	Output terminal to valve SOL a
2	Input signal terminal COM	6	
3	External power supply P5	7	Output terminal to valve SOL b
4	External power supply N5	8	
		9	+ DC24V
		10	- DC24V



EBA-PD1-NW-D2-10



EBA-PD1-NWZ-D2-10

Note: Use a 24V switching regulator with a capacitance of at least 1A.

Example

Manufacturer	Model No.	Capacity
COSEL	R25A-24	24V 1.1A
TDK	EAK24-1R3G	24V 1.3A
DENSEI-LAMBDA	EWS25-24	24V 1.2A

• General Precautions

1 Measuring **current** flow in the solenoid coil

As shown in the illustration below, disconnect the line supplying **current** to the solenoid coil, and then insert a 1A DC rated **current** meter or measure voltage across terminals 5 and 6. Solenoid coil resistance is 20Ω, so the relationship between voltage and **current** is as shown below. Note, however, that these values are not exact, because coil resistance changes with temperature.

Voltage (V)	Current (mA)
0	0
4	200
8	400
12	600
16	800

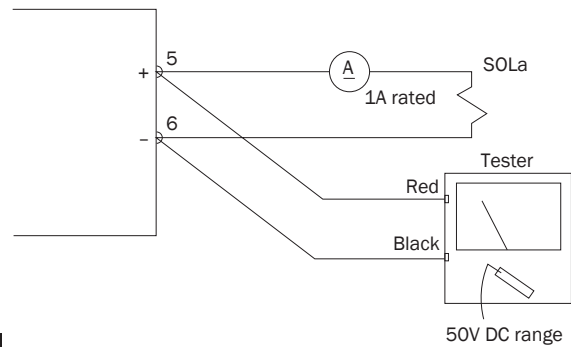
Measurements across terminals 7 and 8 can be performed the same as shown in the illustration below.

2 Never energize only the solenoid coil. The amp will not operate correctly if the iron coil is not inserted.

3 For connection between the amp/controller and solenoid coil, use a 2-conductor shielded wire with a conductor nominal cross-section area of 2.0mm². Type VCTF (Rated Voltage: 300V vinyl cab tire cord).

Wiring between the command voltage generator and amplifier should be VCTF 0.75m² 3-conductor wire.

Use a shield that conforms to JIS Class 3 grounding. If the ground line is unstable, do not connect the shield to anything.



Power Amplifier Operation and Terminology

• Zero Adjust (NULL)

This knob sets the lower limit of the operating pressure and flow rate. Rotating it clockwise increases the **output current**. This knob is also used for manual control while checking valve operation.

• Channel Time Lag (TIME)

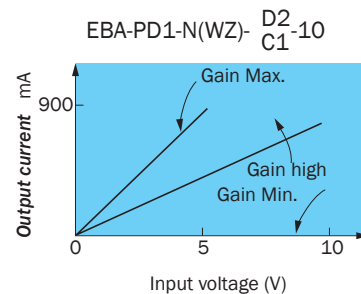
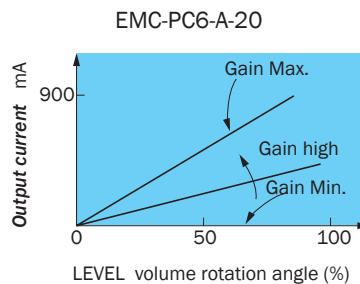
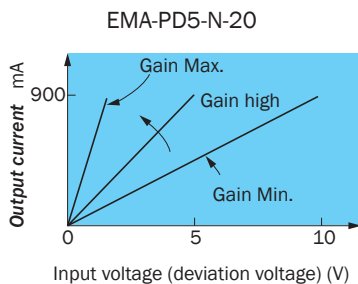
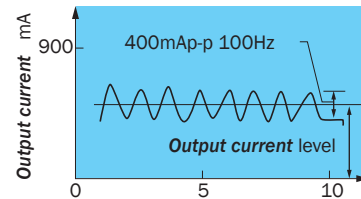
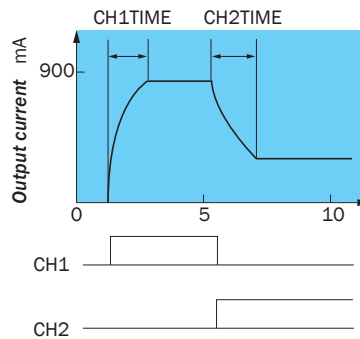
This knob adjusts the time it takes for a channel selected by external contact to reach its channel level. Rotating it clockwise increases the time lag.

• Dither

Dither plays a role in improving control valve hysteresis, response, stability, etc.

• Gain Adjust (GAIN)

This knob adjusts **output current** in proportion to input signal voltage or the channel level knob rotation angle. Rotating it clockwise increases gain.





Small Type Multi-Function Power Amplifier

Features

This compact, multi-function power amplifier uses advanced hybrid integrated circuits (HIC).

Compact design – Less than half the size of previous models.

High reliability – Circuit board configuration eliminates the need for wiring.

Multi-Function –

- Simultaneous driving of two valves
- Controller with built-in amplifier (EDC-PC6-AWZ-D2-20)
- Dither frequency selection function (From Designs 11, 20)

Specifications

Item	Model No.	EDA-PD1-NWZ-D2-11	EDC-PC6-AWZ-D2-20
Function		Amp Type	Amp/Controller Type
Input type		1 DC inputs	Contacts, 6 inputs, DC 2 inputs
Maximum Output Current		900mA (20Ω solenoid)	900mA (20Ω solenoid)
Input voltage		-10 to +10VDC	0 to +10VDC
Input Impedance		50kΩ	50kΩ
Externally Set Variable Resistance		10kΩ	10kΩ
Drive Solenoid		SOL a, SOL b	SOL 1, SOL 2
Zero Adjust (NULL)		0 to 900mA	0 to 900mA
Gain Adjust (GAIN)		0 to $\frac{900mA}{2.5V}$	0 to $\frac{900mA}{2.5V}$
External power supply		+5VDC(5mA) -5VDC(5mA)	+5VDC(10mA)
Time Lag (LAG)		0 to 2sec	0 to 2sec
Dither Frequency (DITHER)		80 to 250Hz	80 to 250Hz
Power Supply Voltage		DC24V (DC24 to 30V)	DC24V (DC24 to 30V)
Power Consumption		30VA	60VA
Allowable Ambient Temperature		32 to 122° F	32 to 122° F
Temperature Drift		0.2mA/°F max.	0.2mA/°F max.
Weight lbs		.6 lbs	.8 lbs
Driven Valve		Pressure, flow, direction control valves	Pressure, flow, direction control valves

• Handling

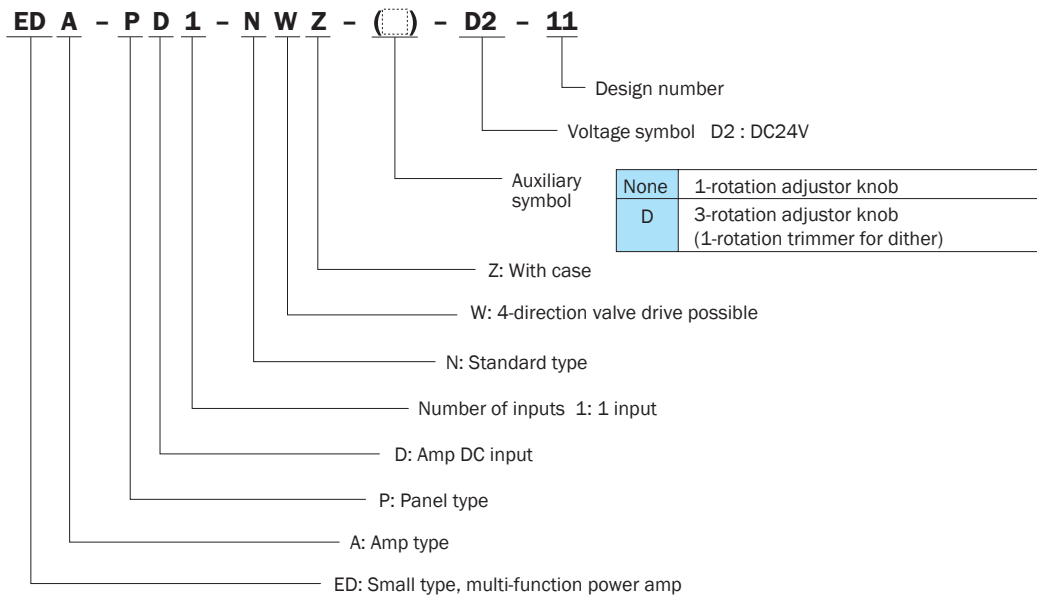
1 When selecting a location, avoid areas subject to high temperatures and high humidity, and select an area where there is little vibration and dust.

2 Use shielded wire for the analog signal and valve output signal wires. See page G-33 for general precautions.

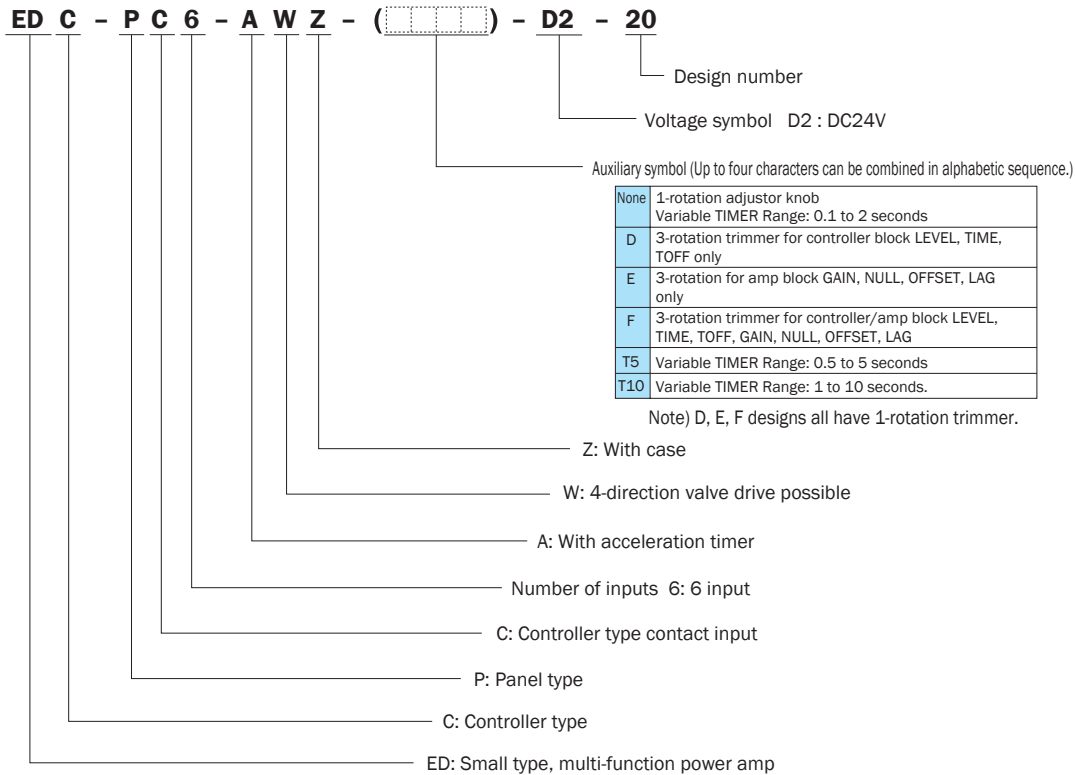
3 The brightness of the LED changes in accordance with the size of the **output current**.

Power Amplifier Operation and Terminology

(1) Amp Type



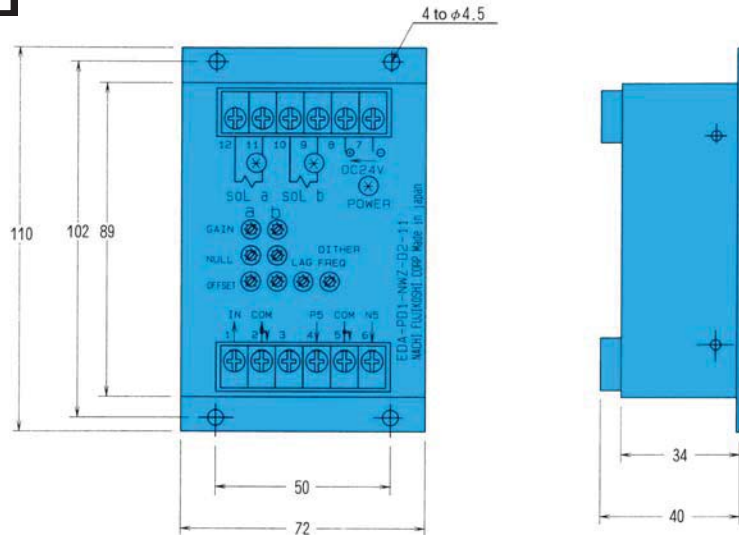
(2) Amp/Controller Type



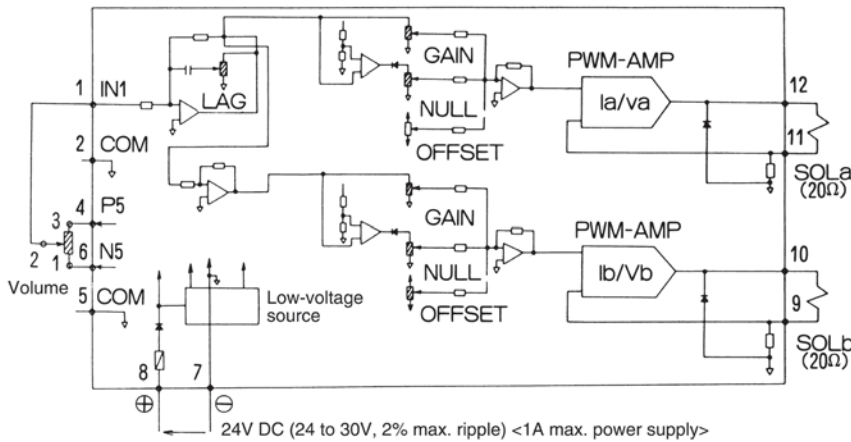
Power Amplifier Operation and Terminology

EDA-PD1-NWZ-D2-11

No.	Name	No.	Name
1	Input signal terminal IN1	7	- DC24V
2	Input signal terminal COM	8	+ DC24V
3		9	Output terminal to valve
4	External power supply P5	10	SOL b
5	Input signal terminal COM	11	Output terminal to valve
6	External power supply N5	12	SOL a



Block Diagram

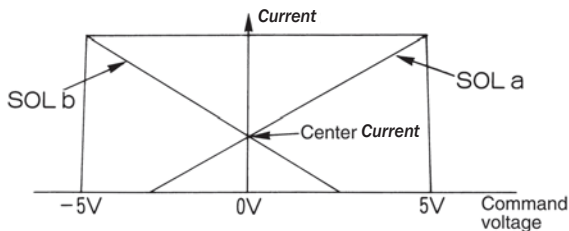


- **Current** is supplied to SOL a when input signal voltage polarity is positive, and to SOL b when negative. Either SOL a or SOL b can be driven at any one time.
- Push-pull drive is also supported.
- To measure **current**, measure the voltage at SOL a terminal 11 and SOL b terminal 9, using terminal 5 as reference. The voltage across the 0.5Ω **current** detection resistor at 1A is 0.5V. Use a measurement device with an input impedance of at least 1MΩ.
- To use SOL a only, connect terminal 1 of the knob to amp terminal 2, use an input voltage range of 0 to 5V. (ER, ES only)

Application Examples

Adjusting Push-pull Drive for a Special Proportional Valve (Special Specification Direction Control Valve)

- a) Overlap Type Proportional Valve ESD-G01-C5 $\frac{10}{20}$ -6333D:300mA (Center **Current**)
- b) Zero-Lap Type Proportional Valve ESD-G01-C5 $\frac{10}{20}$ -6586C:200mA (Center **Current**)



As shown in the figure to the left, push-pull control aims at increasing response at the zero point by simultaneously energizing both solenoids.

Adjustment Procedure

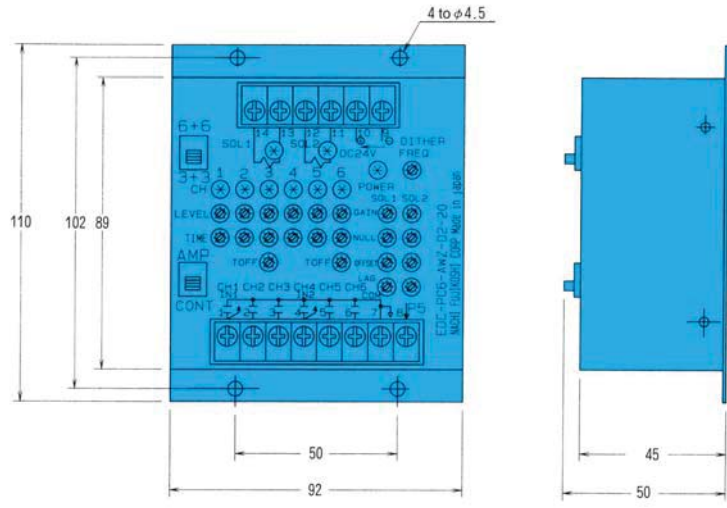
- 1 NULL, GAIN, OFFSET
Rotate all seven knobs counterclockwise as far as they will go.
- 2 Without any connection between terminals 1 and 2, use the OFFSET knob to simultaneously energize SOL a and SOL b as follows.
SOL a 300mA(200mA)
SOL b 300mA(200mA)
- 3 Next, apply +5V to terminal 1 (connecting 1 and 4), and set the SOL a GAIN knob to the following:
SOL a 850mA
SOL b 300mA
For the SOL b **current** here, SOL b GAIN should be fully rotated counterclockwise, and its setting should not be changed.

This completes the setting procedure.

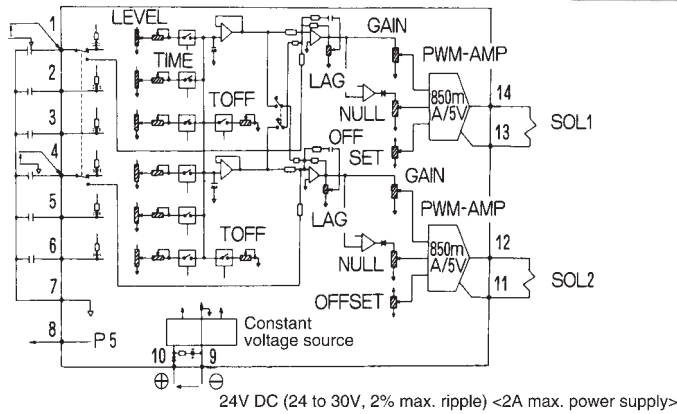
- The three LAG and NULL knobs should be left rotated fully counterclockwise. There is no need to change their settings.
- EDA-PD1-NWZ-D2-11 is configured with a feedback system, so it does not have a feedback gain adjustment function. In this case, use EDA-PD1-NWZ-D2-11 in combination with the EA-PD4-D10-*-10 NACHI servo amp.

EDC-PC6-AWZ-D2-20

No.	Name	No.	Name
1	CH1 select terminal	7	COM
	Input signal terminal	8	External power supply P5
2	CH2 select terminal	9	-
3	CH3 select terminal	10	+ DC24V
4	CH4 select terminal	11	Output terminal to
	Input signal terminal	12	valve SOL 2
5	CH5 select terminal	13	Output terminal to
6	CH6 select terminal	14	valve SOL 1



Block Diagram

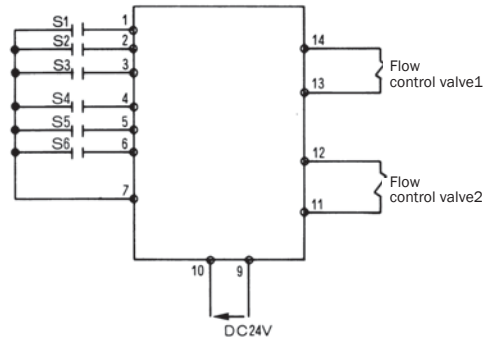


- Dual simultaneous output to SOL 1 and SOL 2 is supported.
- To measure **current**, measure the voltage at SOL a terminal 13 and SOL b terminal 1, using terminal 7 as reference. The voltage across the 0.5Ω current detection resistor at 1A is 0.5V. Use a measurement device with an input impedance of at least 1MΩ.

Application Examples

1) Switch Position

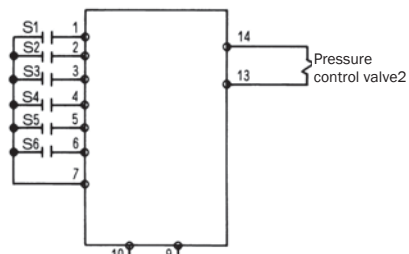
- CONT
- 3+3



- Simultaneous control using two flow control valves (3-speed)
As shown in the diagram to the left, flow control 1 speed is controlled with CH1 LEVEL when CH1 and CH2 are turned on at the same time. Next, flow control valve 2 speed is controlled by CH4 LEVEL, and simultaneous control is possible by adjusting flow control valve 1 speed in the same way. 3-speed synchronous control is possible by grouping CH1 through CH3 and CH4 through CH6.

2) Switch Position

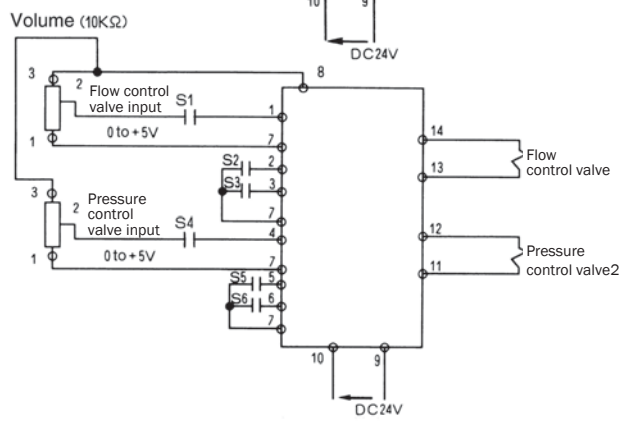
- CONT
- 6+6



- Pressure control valve 6-pressure control
As shown in the diagram to the left, this amplifier can be use as a 6-channel controller for a single pressure control valve. Minimum pressure at this time is in accordance with the setting of the OFFSET knob. The NULL knob cannot be used to configure settings unless a channel is selected.

3) Switch Position

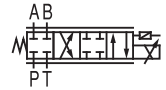
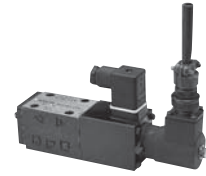
- AMP
- 3+3



- 2-output amplifier for simultaneous control of load-sensitive system pressure and flow rate
As shown in the diagram to the left, 0 to +5V input and channel CH2 or CH3 input are added together and output to the flow control valve. Likewise, 0 to +5V and CH5 or CH6 input is added together and output to the pressure control valve.

High-Response Proportional Flow Control Valve ESH-G01

2.6 to 13.2 gpm
4640 psi



Features

Frequency response equivalent to an electro-hydraulic servo valve. Direct spool by a high-output proportional solenoid. Differential transformer for accurate spool positioning with minor feedback.

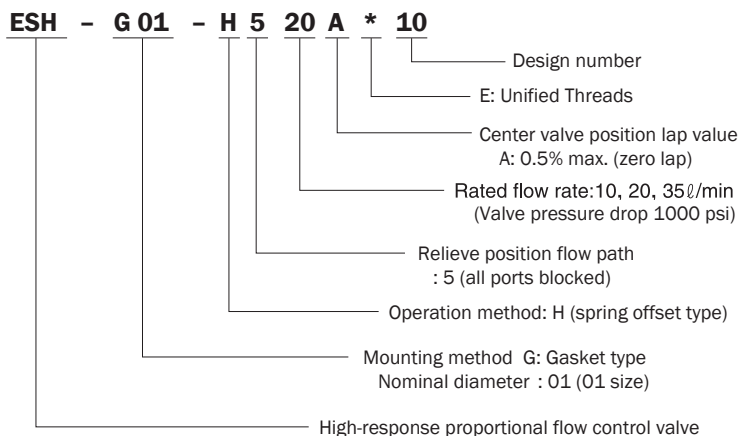
Recovery of all port block positions following amp power off or wiring disconnection (Failsafe Function). Steel spool and spring for long life.

Specifications

Model No.		ESH-G01-H510A-10	ESH-G01-H520A-10	ESH-G01-H540A-10
Item				
Maximum Operating Pressure P, A, B psi		4640		
T Port Allowable Back Pressure psi		362 max.		
Rated Flow Rate l/min (gpm) (Valve pressure drop 1000 psi)		10 (2.6)	20 (5.2)	40 (9.2)
Maximum Flow Rate gpm		5.8	9.2	13
Limit Valve Pressure Drop psi		4640	3045	2030
Hysteresis %		0.5 max.		
Step Response ms (0→100% Displacement)		16 max. (Note 1)		
Frequency Response Hz (90° Phase Delay ±10% Displacement)		At least 80 (Note 1)		
Center	Supply Pressure	0.5% max/FS (Δp=3625 psi)		
Drift	Fluid Temperature	1.5% max/FS (Δt=104°F)		
Filtration		Class NAS9 max.		
Operating Fluid Temperature Range ° F (Recommended Fluid Temperature Range ° F)		32 to 140° F (86 to 140° F)		
Water and Dust Resistance		IP53		
Weight lbs		5		

Note: 1. Step response is typical value for a supply pressure of 1000 psi and fluid temperature of 104° F (kinematic viscosity: 40 centistokes)

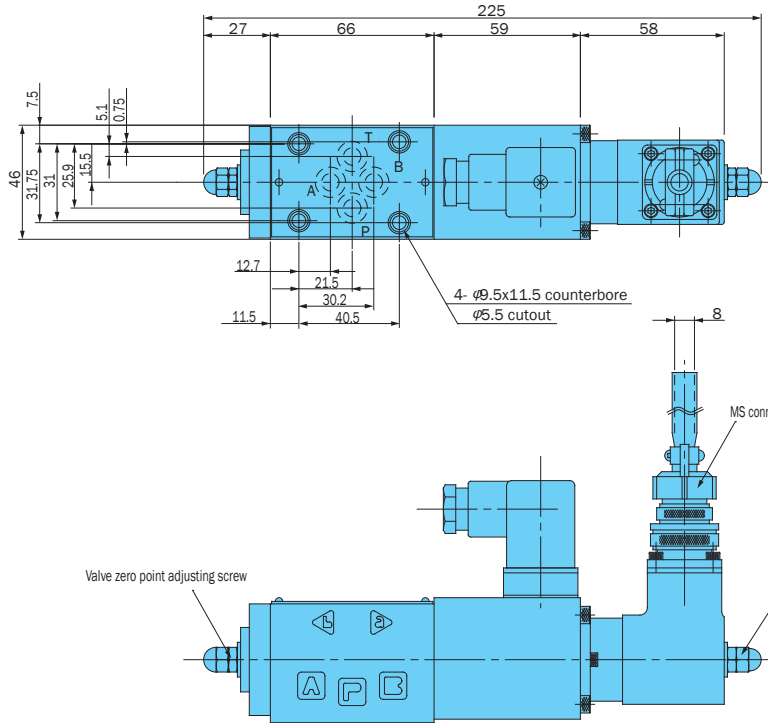
Understanding Model Numbers



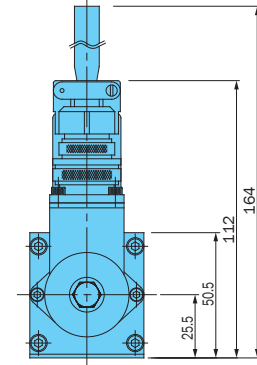
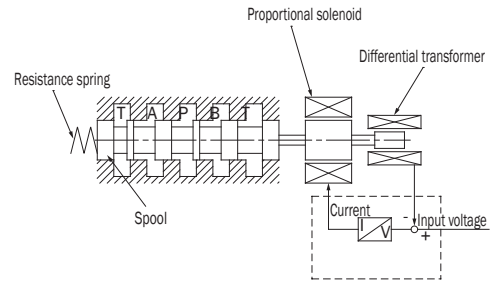
• Handling

- The amp and valve are adjusted to match at the factory, so be sure to use items that have the same MFG No.
- The differential transformer zero adjust screw and valve zero adjust screw are adjusted and fixed at the factory. Because of this, you should not touch the screws (sealed cap nuts).
- Install the valve so the spool axis line is horizontal.
- In the case of 3-port applications and for the direction that throughflow is most common, use of the following flow is recommended P→A→B→T. P→A limit differential pressure is greater than that of P→B.
- Be sure to perform sufficient flushing before a test run.
- Use steel piping for this valve and the main actuator, and keep piping as short as possible.
- There is no air bleeding.
- Mineral oil hydraulic operating fluid is standard. Use an R&O type and wear resistant type of ISO VG32, 46, or 68 or equivalent.
- Use an operating fluid that conforms to the both of the following.
Kinematic viscosity: 20 to 140 centistokes
Oil temperature: 86 to 140° F
- Filtration
Maintain hydraulic operating fluid contamination so it is at least NAS Class 9.
- Electrical wiring between the amp and valve should be no longer than 30 meters. For the solenoid valve use VCTF 2 mm², 2-conductor shielded wire, and for the differential transformer use VCTF 0.5 mm², 4-conductor shielded wire.
- After disassembling the valve, be sure to fill the inside of the guide with operating fluid before reassembling.
- Bundled Accessories (Valve Mounting Bolts)
(4) 10-24 x 1 3/4"
Tightening Torque: 3.5 to 5 ft lbs

Installation Dimension Drawings

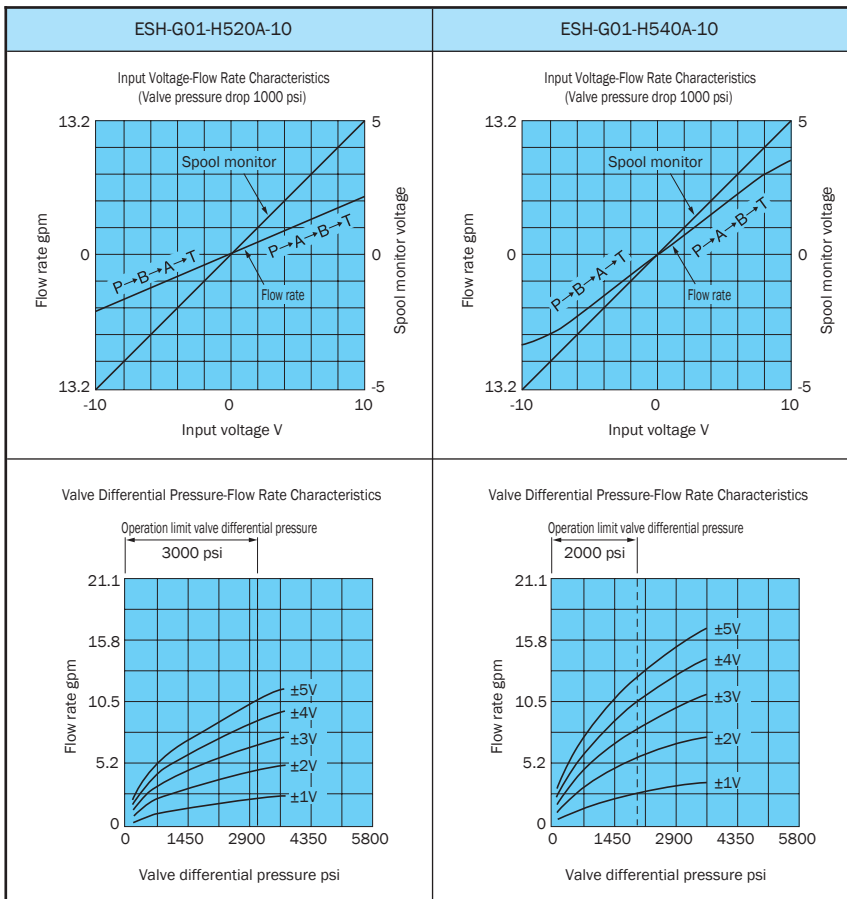


Operation Principle



The gasket mounting method conforms to ISO4401-AB-03-4-A.

Performance Curves



Note: $\pm 10V$ input amp factory default data.
Rotating the GAIN trimmer clockwise (rightward) increases the flow rate by up to 10%.

- Valve Pressure Drop and Rated Flow Rate
Valve Pressure Drop (ΔP_x)
 $= P_s - P_L - P_T$
 P_s : Valve supply pressure
 P_L : Load pressure
 P_T : T Port back pressure
The rated flow rate is the value when the above valve pressure drop is 1000 psi.

- Valve Pressure Drop and Control Flow Rate
The following is the maximum control flow rate when the size of the obtained valve pressure drop is ΔP_x ,

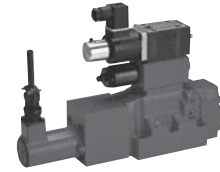
$$Q_x = Q_{rate} \times \sqrt{\frac{\Delta P_x}{7}}$$

Qrate : Rated flow rate
 $\Delta P_x = P_s - P_L - P_T$

- Calculation example
When ESH-G01-H520A-10 is used under the following conditions:
 $P_s = 102 \text{ kgf/cm}^2$ (1450 psi)
 $P_L = 61 \text{ kgf/cm}^2$ (870 psi)
 $P_T = 10 \text{ kgf/cm}^2$ (145 psi)
Maximum control flow rate Q_x is as shown below:

$$Q_x = Q_{rate} \times \sqrt{\frac{P_s - P_L - P_T}{7}}$$

$$= 20 \times \sqrt{\frac{10 - 6 - 1}{7}} = 13 \text{ l/min}$$



High-Response Proportional Flow Control Valve ESH-G03, 04, 06

21 to 158 gpm
4060 to 4640 psi

Features

- Main spool minor feedback for greatly increased hysteresis and repeatability.
- Response characteristics suitable to 20Hz and high precision acceleration control.
- Recovery of center position following amp power off or wiring disconnection (Failsafe Function).
- Single rod cylinder spool available for easy use.
- Built-in pilot pressure reducing valve for stable operation.

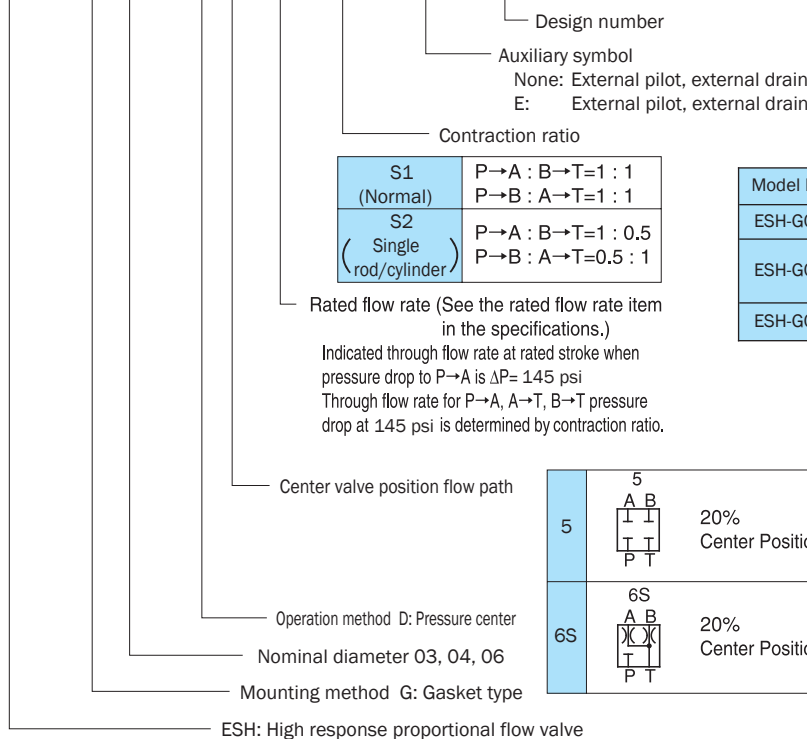
Specifications

Item	Model No.		ESH-G03- D*****-(*)-11	ESH-G04- D*****-(*)-11	ESH-G06- D*****-(*)-11
	Maximum Operating Pressure psi	P,A,B Ports	External Pilot	4060	4640
		Internal Pilo	3625	3625	3625
T Port			3045	3045	3045
Pp Port			3625	3625	3625
Minimum Pilot Pressure psi			217	217	217
Rated Flow Rate l/min (gpm) Rated stroke, P→A pressure drop, 145 psi			80 (21)	180 (47.5)	350 (92.5)
Maximum Flow Rate gpm			37	79.2	158
Pilot Pressure Reducing Valve Set Pressure psi			290	290	580
Hysteresis %			0.5 max.	0.5 max.	0.5 max.
Step Response ms (0 →100% displacement)			50(Note1)	50(Note1)	50(Note1)
Frequency Response Hz (±10% input, 90 ° phase delay)			20(Note1)	20(Note1)	20(Note1)
Pilot Flow Rate gpm			1	2.1	3.1
Y (DR1), L (DR2) allowable back pressure psi			29	29	29
Weight lbs			17.6	26.4	39.7

Note: 1. Step response is typical value for a supply pressure of 1000 psi and fluid temperature of 104° F (kinematic viscosity: 40 centistokes)

Understanding Model Numbers

ESH - G 04 - D 5 180 S1 - (*) - 11



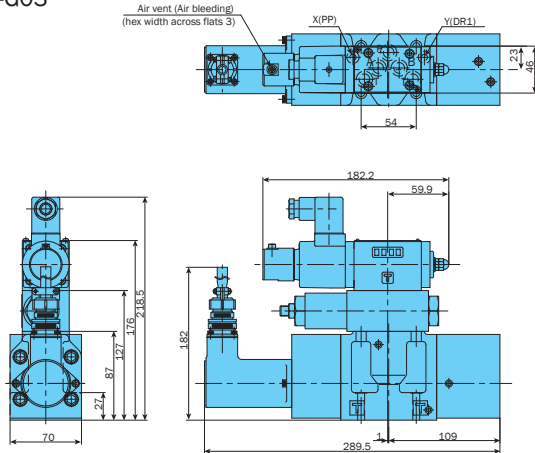
- Handling
- 1 Air Bleeding
In order to ensure stable control, loosen the air vent and bleed air from the valve before starting operation.
- 2 Y (DR1), L (DR2) Ports
Connect ports Y (DR1) and L (DR2) directly to the fluid tank so they are always supplied with operating fluid, in order to keep back pressure no greater than 29 psi.
- 3 L (DR2) Port
Since this valve is a pressure center type, G04 and G06 have an L (DR2) port. Be sure to connect this port directly to the fluid tank.
G03 has a Y (DR1) port only, and this is connected internally to L.
- 4 Valve Mounting Orientation
Install the valve so the spool axis line is horizontal.
- 5 Filtration
Maintain hydraulic operating fluid contamination so it is at least NAS Class 9.
- 6 The amp and valve are adjusted to match at the factory, so be sure to use items that have the same MFG No.
- 7 Oil-based operating fluid is standard. Use an R&O type and wear-resistant type of ISO VG32, 46, or 68 or equivalent.
- 8 Use an operating fluid that conforms to the both of the following.
Kinematic viscosity: 20 to 140 centistokes
Oil temperature: 86 to 140° F
- 9 Electrical wiring between the amp and valve should be no longer than 30 meters. For the solenoid valve use VCTF 2 mm2 2-conductor shielded wire, and for the differential transformer use VCTF 0.5 mm2 4-conductor shielded wire.
- 10 Bundled Accessories (Valve Mounting Bolts)

Model No.	Bolt Size	Q'ty	Tightening Torque ft lbs
ESH-G03	1/4-20 x 1 3/8"	4	7 to 9.5
ESH-G04	3/8-16 x 2"	4	33 to 40
	1/4-20 x 1 3/4"	2	7 to 9.5
ESH-G06	1/2-13 x 2 3/8"	6	44 to 51

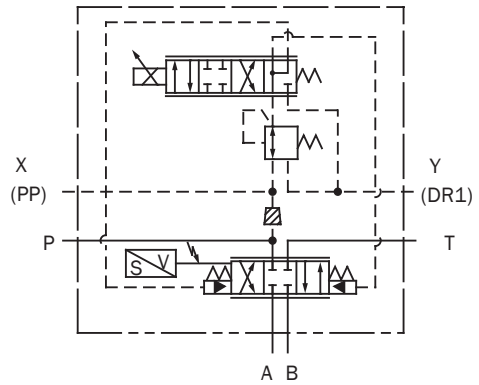
- 11 With G03 and G04, providing command in the range of 0 to +10V to the amp's RF input produces a flow of P→A→B→T. With G06, flow is P→B→A→T.
- 12 For G03 and G04, connect the ports and actuator to achieve a working of P→A→B→T. For G06, connect for a working of P→B→A→T.
- 13 Contact your agent for a contraction ratio S2 with the G06 size.

Installation Dimension Drawings

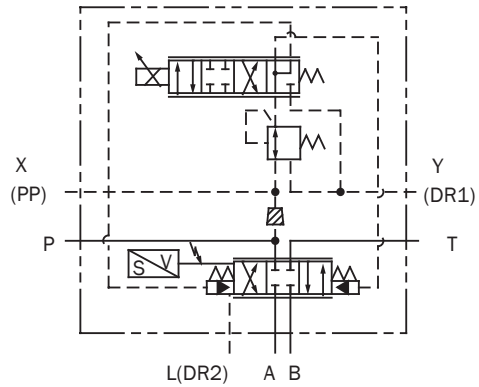
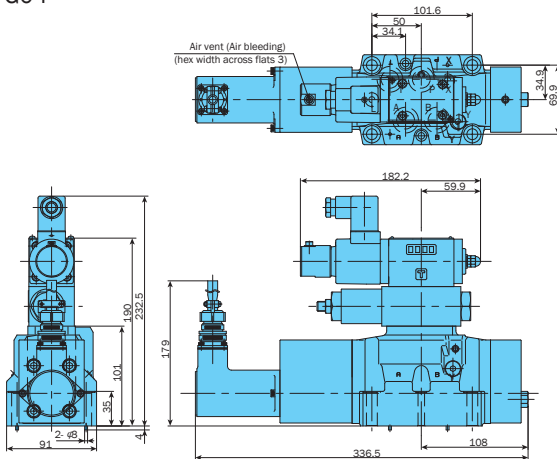
ESH-G03



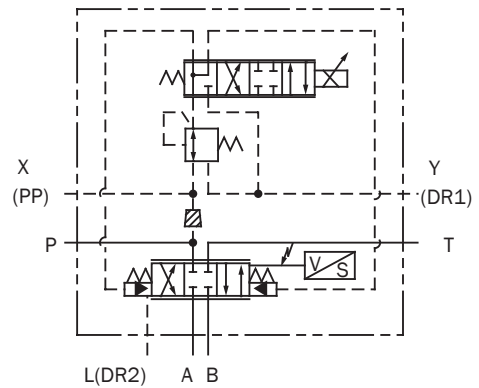
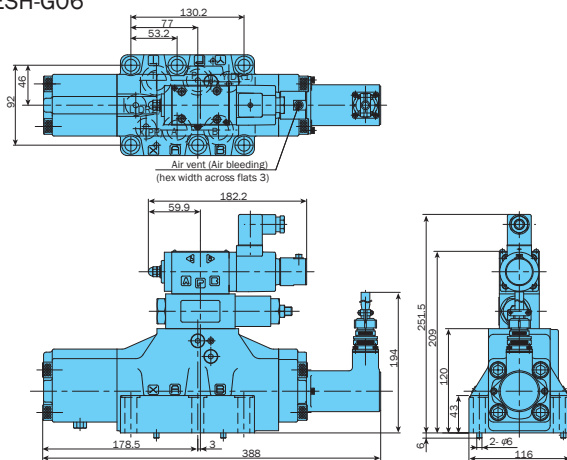
JIS Symbol




ESH-G04



ESH-G06



Note:
A stopper plug is needed for the  area if the pilot is external.

Gasket Surface Dimensions

For G03, see ESD-G03 gasket surface dimensions, and for G04 and G06, see DSS-G04, 06-**-20 gasket surface dimensions. Y (DR1) and L (DR2) are required. Gasket surface dimensions conform to the following.

G03: ISO 4401-03-02-0-94 (D05)

G04: ISO 4401-07-06-0-94 (D07)

G06: ISO 4401-08-07-0-94 (D08)



High-Speed Response Proportional Control Valve Amplifier EHA Series

Features

Coil current feedback and spool position feedback amplification for stable, high-speed spool positioning. Built in check connector ICS simplifies maintenance.

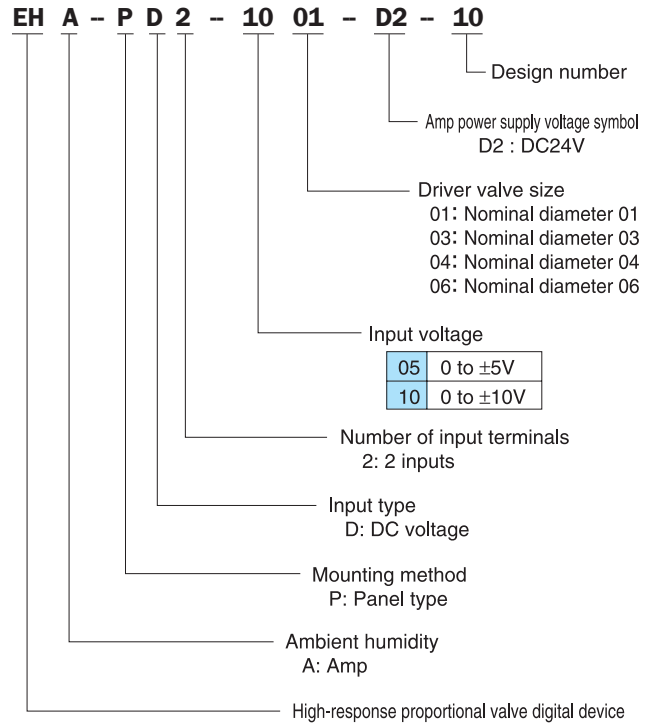
A single printed circuit board allows separation of connectors and the terminal box. Built-in differential transformer disconnect detection circuit drops **coil current** to 0mA

when disconnection occurs. Servo ready and servo ON interfaces. Power supply and **current** control switching system for improved efficiency.

Specifications

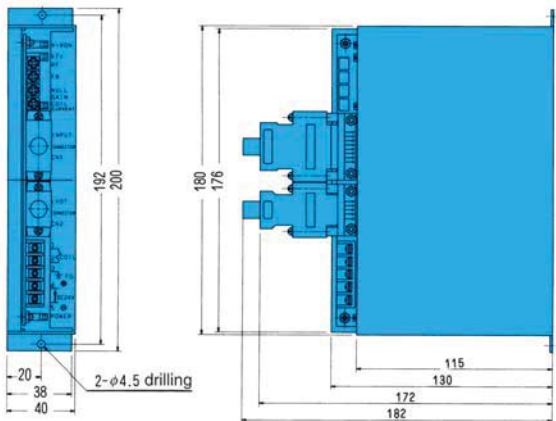
Power Supply Voltage	24V DC (22V DC to 28V DC) Lip Noise: 150mVp-p max.
Power Supply Capacity	At least 2.1A (COSEL R50A-24 equivalent switching regulator)
Ambient Temperature	32 to 122° F
Ambient Temperature	35 to 85% RH (non-condensation)
Input Signal Voltage	0 to ±5V DC or 0 to ±10V DC
Input Impedance	50kΩ
Power Consumption	2.1A maximum consumption current at 24V
Weight lbs	2
External Supply Voltage	+5V : (10mA maximum supply possible) -5V : (10mA maximum supply possible)
Drive Coil	2.5Ω; max. 2.7A or 5 Ω; max. 2.4A
Spool Displacement Measurement	Differential transformer (LVDT)
Servo ON	Application of 24V DC during valve operation
Ready	During normal valve operation: ON
Spool displacement monitor	0 to ±5V

Understanding Model Numbers

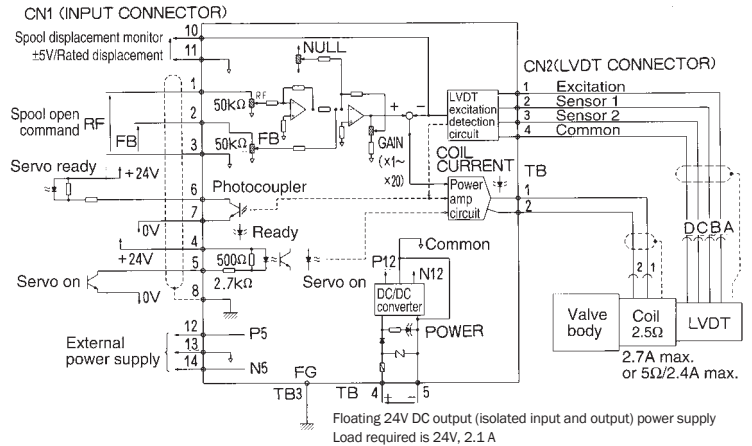


Note: Select an amp that matches the valve size.

Installation Dimension Drawings



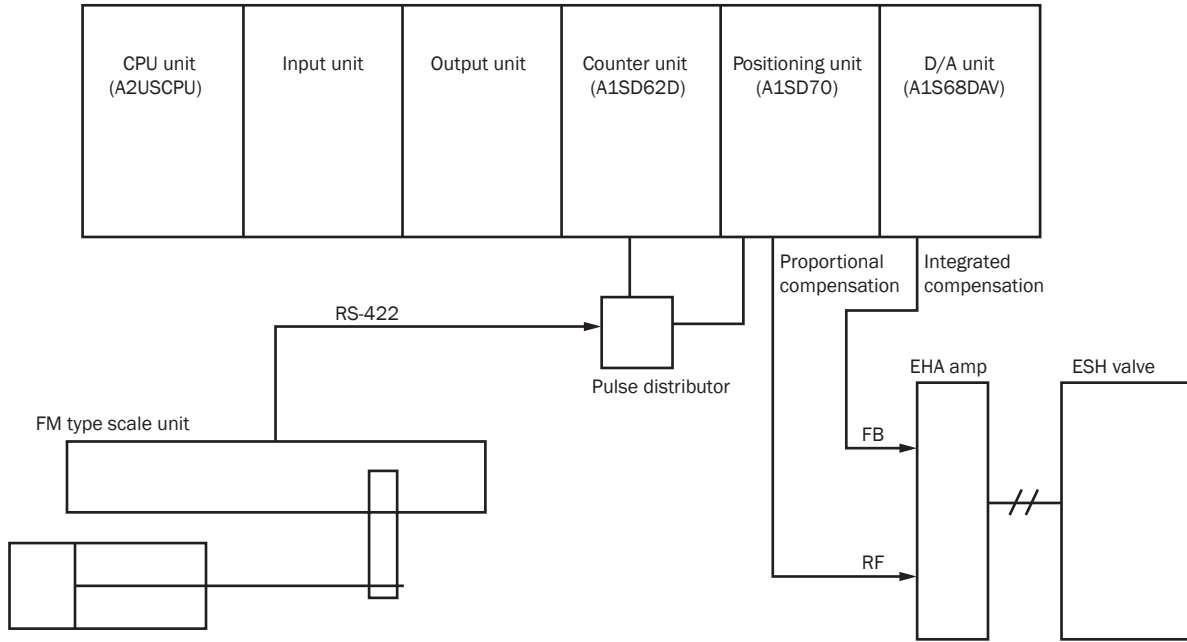
Block Diagram



Note:
Since G03, G04, and G05 are pilot operation types, there is an LVDT on the main spool, but connection is identical.

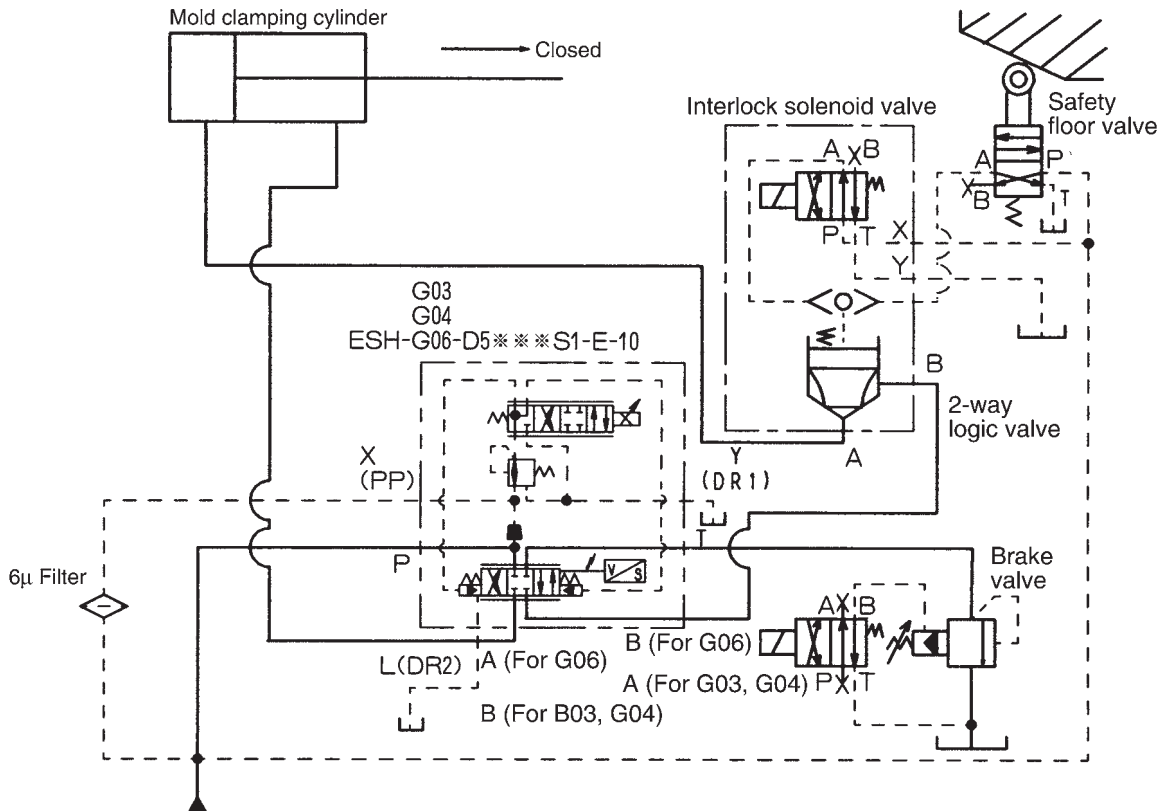
(1) Example Application in ESH-G01 Positioning Circuit

This is an ESH-G01 positioning circuit using a sequencer. Proportional control is performed by the positioning unit, while integral compensation is performed by the counter unit and D/A unit. The result is high-precision positioning.



(2) Example Application in ESH-G03, G04, G06 Molding Machine Mold Clamping Circuit

This hydraulic circuit is a basic application example. The actual application hydraulic circuit would require modification to match the machinery and to provide the necessary functions. Cut off flow to the cylinder with the safety door valve and interlock solenoid valve, in accordance with the logic valve.



Electro-Hydraulic Servo Valve Driver Amplifier

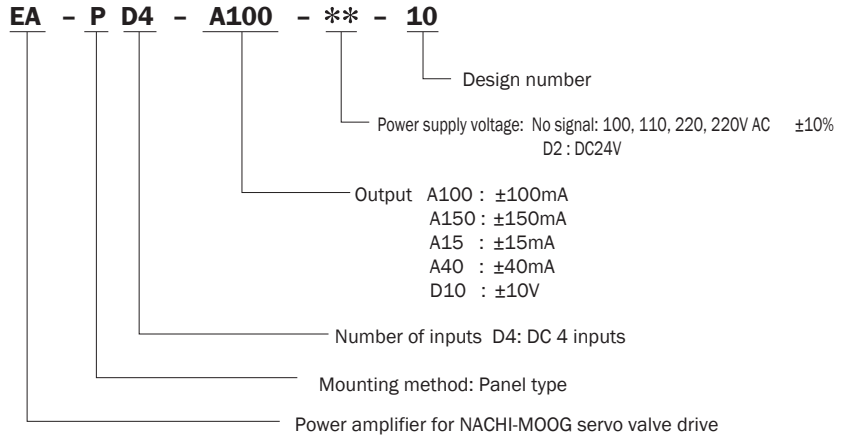
Features

- Compact design.
- Capable of driving virtually all NACHI-MOOG servo valve series.
- Power supply support for 24V DC in addition to 100V AC and 200V AC.

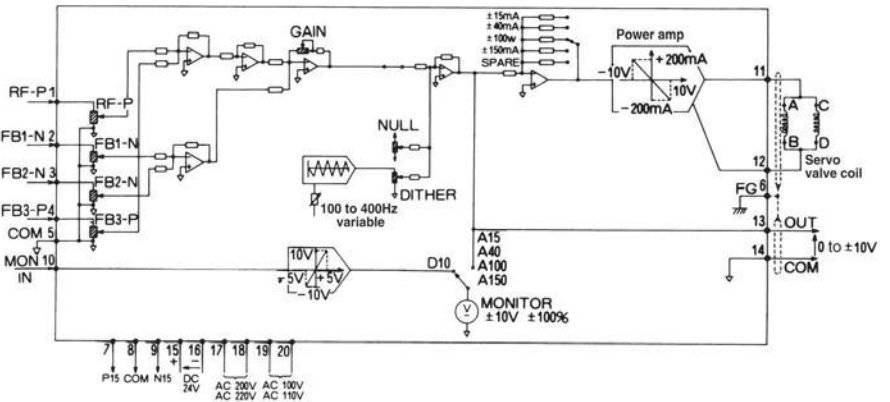
Specifications

Item	Description
Number of Inputs	4 (RF-P,FB1-N,FB2-N,FB3-P)
Input Voltage Range	±10VDC (Command Signal/ Feedback Signal)
Input Impedance	50kΩ
Gain Adjust (GAIN)	1 to 20 X/5 to 100 X switchable
Zero Adjust (NULL)	0 to ±20%
Frequency Characteristics	-3dB attenuation at 700Hz
Dither (DITHER)	100 to 400Hz variable (Factory default; 200Hz)
Power Supply Voltage	AC100, 110, 200, 220V (±10%) 50/60Hz
Power Consumption	20VA
External power supply	+15V (200mA) -15V (200mA)
Allowable Ambient Temperature	32 to 122° F
Temperature Drift	50μV/°C max.
Weight lbs	6.6
Servo Valve Coil Drive Current	± 15mA(100Ω) ± 40mA(40Ω) ±100mA(14Ω) ±150mA(14Ω) It is possible to switch the output voltage ±10V for the four types noted above. Resistance values in parentheses indicate resistance in the case of parallel wiring of the servo valve coil.

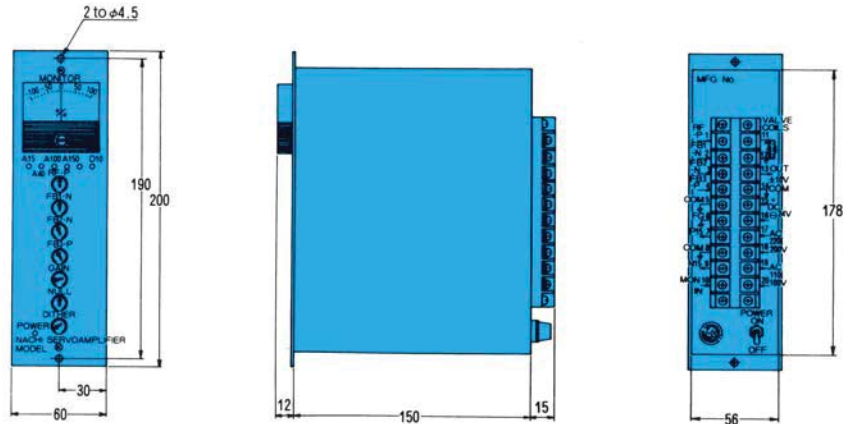
Understanding Model Numbers



Note: 24V DC only can be used in the case of power supply voltage signal D2. 100V, 200V AC cannot be used.



No.	Name	No.	Name
1	RF-P input	11	Control current
2	FB1-N feedback input	12	Output terminal
3	FB2-N feedback input	13	Control voltage
4	FB3-P feedback input	14	Output terminal
5	COM signal land	15	+
6	FG case ground	16	- DC24V
7	P15 external power supply	17	AC200, 220V
8	COM signal land	18	
9	N15 external power supply	19	
10	MON/IN monitor in	20	AC100, 110V

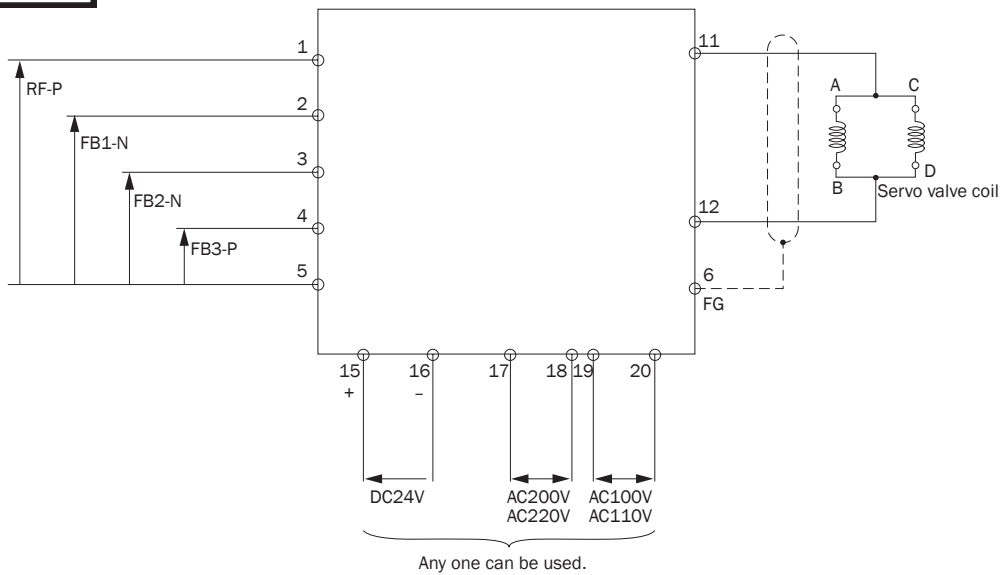


Installation Dimension Drawings

Servo Model Number	Rated Output	Applicable Servo Amplifier Model Number
EN-J631 Series	±100mA (parallel wiring)	EA-PD4-A100
EN-31 Series Center Flow 19.8 gpm Rated Models	±150mA (parallel wiring)	EA-PD4-A150
EN-J072-401, EN-J072-402, EN-J073-401, EN-J073-402, EN-J073-403, EN-J073-404, EN-J073-405, EN-J076-401, EN-J076-402, EN-J076-403, EN-J076-404, EN-J076-405	±15mA (parallel wiring)	EA-PD4-A15
EN-J072-403, EN-J770, EN-J073-406, EN-J076-406	±40mA (parallel wiring)	EA-PD4-A40
EN-J661 EN-J662 (Main Valve Position Detector or AmP Built In) EN-J663	±10V	EA-PD4-D10

Wiring Diagram

EN-J631, J072, J073,
J076, J770 Series



EN-J661, J662, J663 Series

