

DIRECTIONAL FLOW CONTROL VALVE
WITH COMPACT AMPLIFIER INSTALLED

EPDG-1 INSTRUCTION MANUAL

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1. DIRECTIONAL FLOW CONTROL VALVE WITH COMPACT AMPLIFIER INSTALLED

1-1 Outline

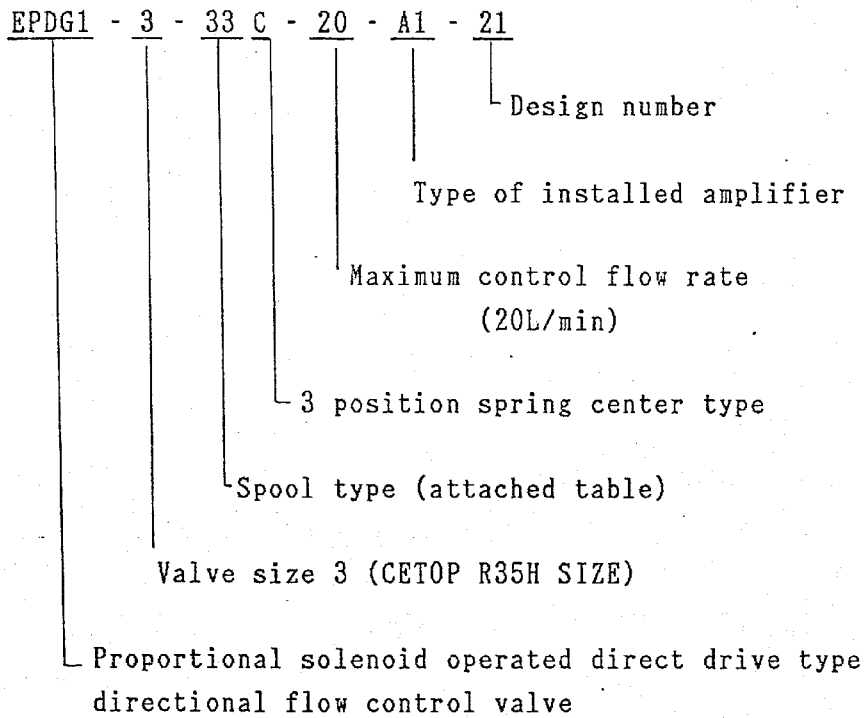
This is a directional flow control valve using the proportional solenoids for the electro-magnetic actuator.

This valve has a simple and solid construction, and a high response flow control is possible because the spool is directly driven by the proportional solenoid. The valve property difference can be made minimum by installation of the compact amplifier.

1-2 Features

- o The lag time adjusting function with the electric signal easily realizes the optimum shockless control of a machine which has been difficult to do till now.
- o The flow rate can be controlled by the external analog signal (electric voltage).
- o Two setting devices with three settings are built in for both directions of P-A and P-B. (A1 type.)
- o The setting is exchangeable only with the contact point signal. (Direct-control is possible with the sequencer etc.) (A1 type.)

1-3 Model Code



1-4 Composition

The valve is composed of the following units.

- 1) Proportional solenoid
- 2) Spool

Type	Hydraulic symbol
3 3	
2	

- 3) Installed compact amplifier
A1 Multifunction, with setting devices

1-5 Principle of Operation

The flow rate is controlled by the spool position which varies the area of the hydraulic path.

The spool position is fixed at the position where the driving force of the proportional solenoid in proportion to the current value is balanced with the spring force, then the flow rate is controlled by the current. Direction of P-A and P-B is defined by the a, b solenoid respectively. The influence of the load variation can be reduced by using the modular type pressure compensating valve.

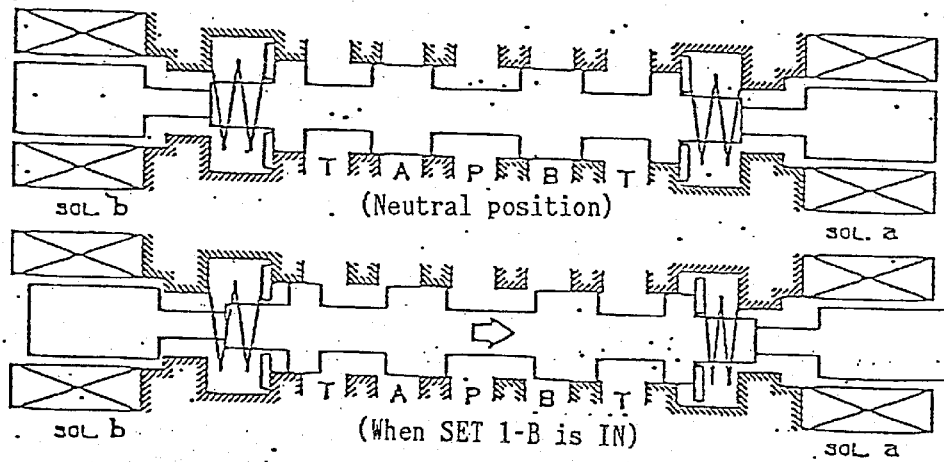
The valve property difference is made minimum at the factory, because the difference caused from the mechanical factor is absorbed by the electrical adjustment of the installed amplifier. (A1 type.)

1-6 Caution in Use

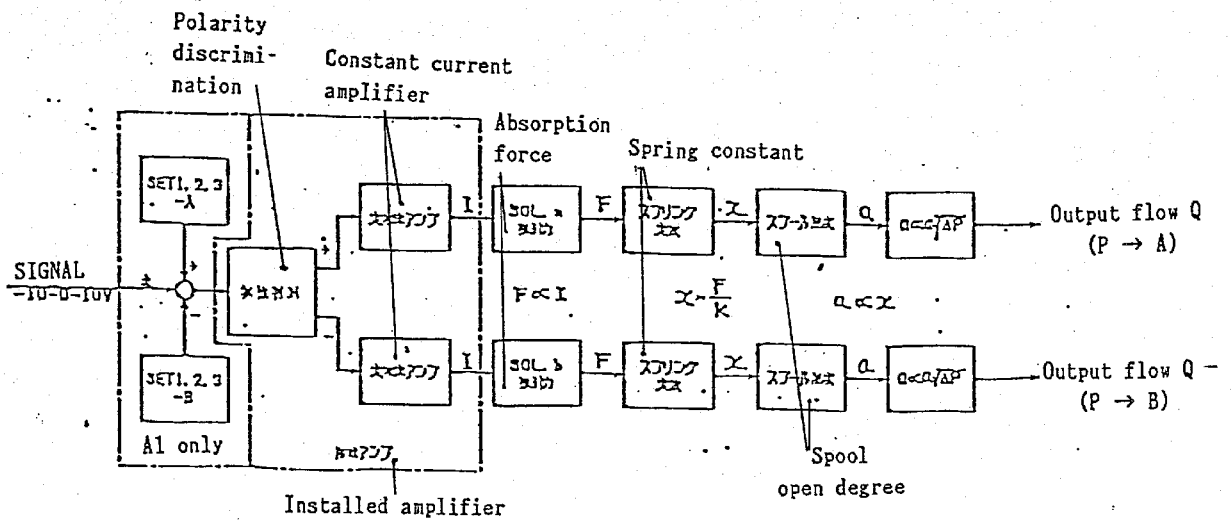
1. Install the valve so that the direction of the valve in length is made horizontal. Otherwise the characteristic is changed.
2. Install the valve with a proper torque. (Recommended torque: 0.8 kgf.m = 7.9 N.m)
3. Do not use the manual push rod unless emergency, as the flow rate is varied from the setting value.

With the back pressure of over 3 kg/cm², the condition returns to the original even when the manual rod is used. When the back pressure is less than 3 kg/cm², flow the current of 1A to the opposite solenoid and the condition nearly returns to the original.

Basic Construction



Basic Block Diagram



* ΔP is varied by the hydraulic oil source, load condition etc.
 (can be stabilized by using the pressure compensating valve)

o Modular type pressure compensating valve (relief type):

TGMHR-3-P-04-10

o Modular type pressure compensating valve (pressure reduction type):

TGMHX-3-P-04-10

o Modular type shuttle valve: TGMSH-3-AB-10

2. INSTALLED COMPACT AMPLIFIER

2-1 Features

- o The protection circuit is built in for opening or shortcircuit of the solenoid coil.
- o The solenoid current value (approx. 1V/1A) and the operating condition signal (normal 0V, abnormal +15 V) are output for the monitoring function.

2-2 Adjustment

Adjusting trimmers such as JUMP. A/B, MAX. A/B, OFF SET, DITHER have been adjusted at the factory. Do not use them usually.

- o JUMP.A/B (already adjusted):

Adjustment of dead zone of the proportional valve.

The special tool is required for the adjustment.

- o MAX.A/B (already adjusted):

Adjustment of maximum flow rate.

It has been adjusted so that the flow becomes 100% when the input voltage is +10 V or -10 V.

- o OFF SET (already adjusted):

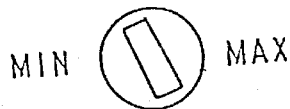
Adjustment of OFF SET

0 point has been calibrated.

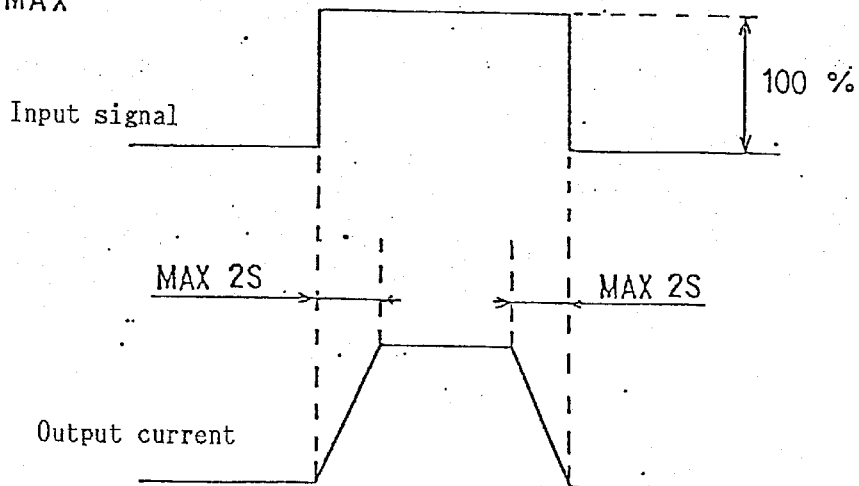
- o DITHER (already adjusted):

Adjustment of DITHER GAIN, which defines the amplitude of AC added to the output current.

- o SET.1A ~ 3A/1B ~ 3B: Adjustment by setting.
 - 1A, 2A, 3A 0 - 100% (P-A)
 - 1B, 2B, 3B 0 - 100% (P-B)
 Increases with CW rotation.



- o UP.A/B, DOWN.A/B: Adjustment of time slope.
 - Adjust these while observing the response of machine. These give the time slope of the output current for the input signal.
 - The rising time and the down time are increased by C.W rotation.



2-3 Operation

The desired flow rate is obtained by driving the solenoid a or b with the exchanging signals which are set by three setting devices of either side and total six devices.

The exchanging inputs are not basically overlap, and when overlapped, the output current corresponds to the averaged value of input settings. The time slope can be set by the trimmers of UP.A/B (rising up) and DOWN.A/B (down). The maximum adjusting value is 2 sec./100%.

2-4 Caution in Use

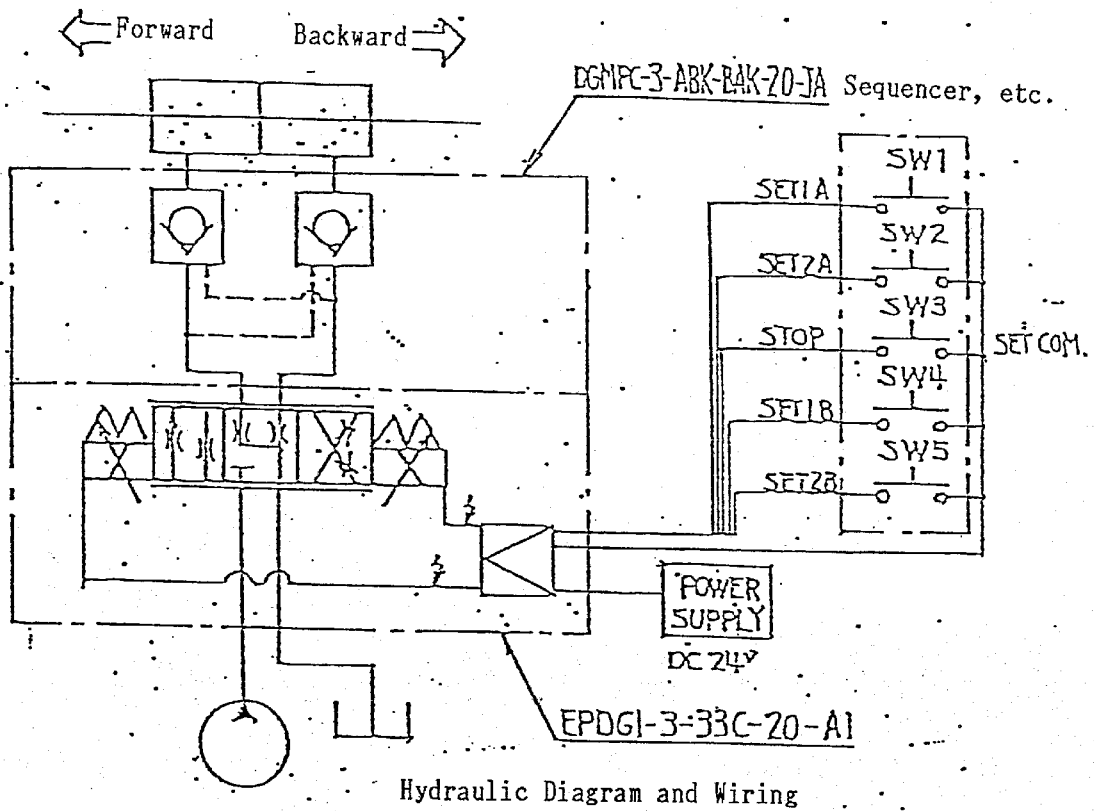
1. The contact point type or open collector type should be used for the inputs of exchanging setting and STOP. Do not apply the electric voltage.

When the open collector type is used, use the transistor the specifications of which are rated current of 20 mA or more, voltage resistance of 35 V or more and allowable leak current of 0.5 mA or less.

When a relay is used, use the relay of 5 mA or less of the minimum applicable load.

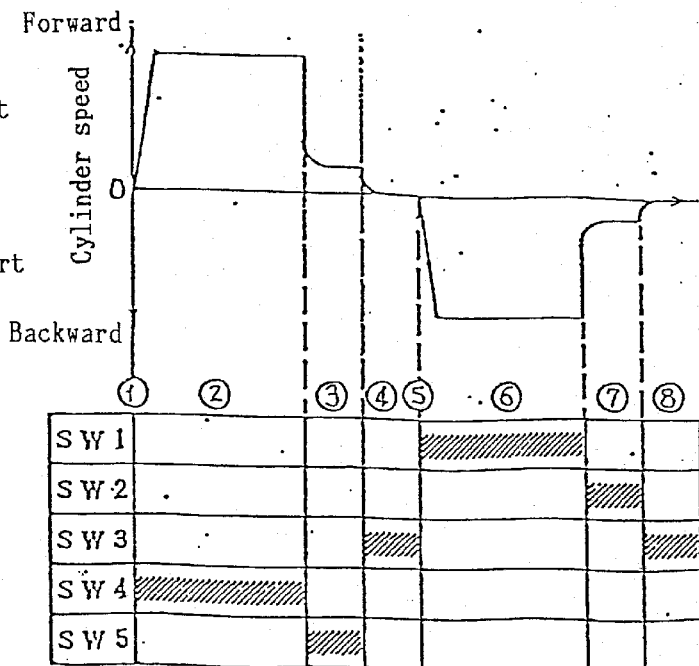
2. For adjustment of the trimmers, use the screw driver fitted to the slot of the trimmer, and do not apply excessive force, because the rotating parts of trimmer is made of resin.

3. EXAMPLE OF USE (A CYLINDER IS OPERATED BY THIS VALVE)



Cylinder movement

- ① Shockless forward movement start
- ② High speed forward movement
- ③ Low speed
- ④ Stop, holding
- ⑤ Shockless backward movement start
- ⑥ High speed backward movement
- ⑦ Low speed backward movement
- ⑧ Stop, holding



High speed forward movement:

The maximum flow rate is obtained by setting SET 1B VB at MAX. *1

Low speed forward movement:

Adjust SET 2B VR according to the requirements for stop position accuracy of machine, cycle time etc. In this sequence, adjust to decrease the flow rate because the setting flow rate is used in the decreasing side of the flow rate. When the decreasing is too excessive, increase the flow rate sufficiently once, and then decrease to the desired flow rate again. *2

Shockless forward movement start:

Adjust DELAY UP VR according to the machine shock and the cycle time etc. *3

High speed backward movement:

Adjust SET 1A VR in the same way as SET 1B VR.

Low speed backward movement:

Adjust SET 2A VR in the same way as SET 2B VR.

Shockless backward movement start:

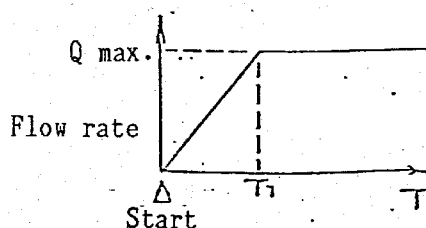
Adjust DELAY UP A VR in the same way as DELAY UP B VR.

Others:

Set DELAY DOWN A/B at MIN.

*1) The flow rate varies according to the conditions (differential pressure of the valve) such as the supply pressure, load pressure etc. Refer to the pressure difference vs flow curve.

- *2) This depends on the valve hysteresis. When this is used in the flow increasing side, adjust to increase the flow rate. And when the setting adjusted in this way is used both for flow increase and decreases, the decreased flow rate becomes a little higher than the setting flow rate. (maximum 7% of full scale.)
- *3) T1 can be adjusted in the range of 0.1 ~ 2 sec. as shown in the figure.



(Adjust DELAY lastly.)

Others)

STOP signal stops the output forcibly even when the setting signal is input, or the external signal is input and the flow rate is varying during DELAY.

This valve also has SET 3A and SET 3B. Use these according to the operation of machine.

Plural valves have to be used for these kind of operation till now, and this valve can do the same with only one. This valve can easily get the optimum condition of the machine which has been difficult to get in the shockless operation. In addition this valve has other merit such as the exchanging can be directly driven by the control signal (signal of a sequencer, etc.)

4. TROUBLE

The followings become cause of trouble.

Care should be taken on:

(1) Improper wiring

Make sure connection and wiring are correct before the power supply is switched on.

(2) Excessive high ambient temperature

The operating temperature limits are 0 - 60°C.

The storage temperature limits are -10 - 75°C.

(3) Condensation

The condensation should occur when the ambient temperature changes suddenly. (especially high → low).

The operation with condensation should cause the trouble.

(4) Drip proof construction

Although the valve and the installed amplifier have drip proof constructions, do not install at the place exposed to the water directly.

(5) Chemicals, etc.

Do not install at the place exposed to the chemicals of strong acid, strong alkali and organic solution (especially aromatic, chloric fatty acid).

It is not harmless to remove the soil with methanol, ethanol, thinner and trichloroethane etc. (for the amplifier box.)

The followings mean trouble. Replace, immediately. (The amplifier has been adjusted to match with the valve, then they should be replaced as a pair.)

- I) -15, +15 V between terminals No. ①, ⑮ are not output.
- II) 15V of ALM at terminal No. ⑪ is output.
(ALM IND is flickering.)
- III) The voltage between terminals No. ⑨, ⑤ can not be varied in the range of 0 - 1.3 V, when between the terminals No. ⑦ COM and ② B1 (or ③, ④, ⑫, ⑬, ⑭) is short-circuited and VR B1 (or B2, B3, A1, A2, A3) is rotated.

5. SPECIFICATIONS

(Hydraulic)

Maximum control flow rate	20 l/min
Hysteresis	7% F.S or less
Rated operating pressure	210 (kgf/cm ²)
Allowable tank pressure	140 (kgf/cm ²)
Proper oil temperature (ISO VG32)	40+5°C
Lowest operating oil temperature	0°C
Highest operating oil temperature	60°C

(Solenoid)

Coil resistance	13 ohm at 20°C
Rated current	1A at 20°C
Class of insulation	Class F

(Installed compact amplifier)

Power supply	DC 24V+10%
Output current	1A max.
Constant current control method	PWM
Max. variable range	0.04A/V - 0.1A/V
Dither	Triangle wave Approx. 110 Hz Pp 200 mA max.
Operating temperature limits	0 - 55°C
Operating humidity limits	30 - 90% RH
Storage temperature limits	-10 - 75°C

