

Controller for Proportional Control Valve KFPC1-F07-DN DC24V

User's Manual Ver. 2.0

Thank you for purchasing a Koganei product.
Read this manual carefully before use, and then use the product in the correct manner.

Note that product configurations, specifications, and internal mechanisms are subject to change without notice. Please be aware that, should such a change occur, there may be differences between the product and the contents of this manual.

Important

To operate the proportional control valve properly, always initialize settings before usage (For setting methods, please refer to 6. Initial settings in the instruction manual).



1. Introduction

1.1 Unpacking of the Package and Inspection

Check that all product parts are included, and that none have been damaged during shipping. The standard package contents are as follows:

- One controller body
- User's Manual

If anything is missing, or if damage is found, please contact Koganei.

1.2 General Precautions for Use and Safety

To ensure the correct operation and long service life of the unit, be sure to follow the operating instructions and installation conditions below, and be aware of the acceptable limits noted in the catalog.
Have installation and maintenance performed by a person with professional expertise.

- During operation, maintenance, and repair of the product, always observe accident prevention procedures and electrical equipment safety principles.
- Never disconnect piping or valves while the system is pressurized.
- Always switch off the power supply before engaging in work on the system.
- Adopt suitable procedures to avoid erratic operation and prevent unacceptable breakdowns.
- Always observe the above precautions. Koganei cannot assume responsibility for any actions taken in violation of these instructions.

Caution

This sign indicates information that must be followed. Failure to follow the information could result in risk to personal health or machine performance.

Important

This sign indicates additional important information, hints, or recommendations.

2. Function

2-1 The KFPC1 Controller offers optimum control of the Proportional Control Valve KFPV050 series and KFPV300 series.

Important

To ensure correct operation of the proportional control valve, always perform the initial settings before use.
Always use one controller per proportional control valve.
(For the initial settings, see "6. Initial Settings.")

2-2 Converts the external standard input signal into a pulse width modulation (PWM) signal, and uses that signal to continuously control the valve opening in the Proportional Control Valve KFPV050 series and KFPV300 series.

2-3 The standard input signal can be selected from a range of 4 to 20mA, or from 0 to 10V. To change the settings for the standard input signal, use DIP switch SW1.

2-4 The frequency of the PWM signal can be set to two levels.

2-5 A temperature compensation circuit is built into the unit.

2-6 Operating current for the proportional control valve depends on the pressure, etc. of the actual application. Two potentiometers, MIN and MAX, are used to adjust the current value I_1 at which the valve starts to open, and the current value I_2 at which the valve is fully open, to obtain the optimum initial settings for pressure and other conditions in each application (see Figure 1).

- Potentiometer MIN is for setting the current value I_1 for the valve starting to open.
- Potentiometer MAX is for setting the current value I_2 for the valve to fully open, or in other words, for the slope setting.

2-7 When setting I_1 and I_2 , the initial setting support circuit for generating the required minimum standard input signal (4mA or 0V) and the maximum standard input signal (20mA or 10V) is built into the unit. To change the minimum or maximum standard input signal, use slide switch SW2.

2-8 To enable the valve to be completely closed when the standard signal input is at less than 2% of the full scale, the unit has a zero point switch-off function that sets the operating current to zero. If this function is enabled, the valve is completely closed at less than 4.3mA, when using the standard input signal of 4 to 20mA, or at less than 0.2V when using the standard input signal of 0 to 10V (see Figure 1). To enable or disable this function, use DIP switch SW1.

Important

Always set the zero point switch-off function to disabled when performing the initial settings. Note, however, that if slide switch SW2 is used for the initial settings, the zero point switch-off function is automatically switched to disabled.

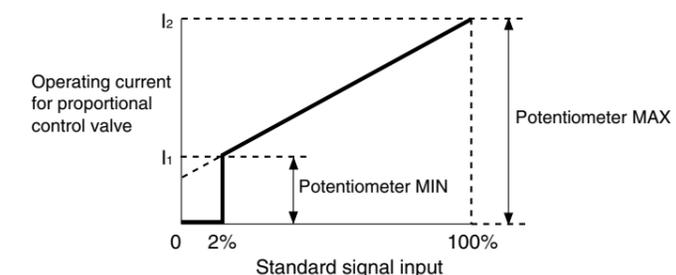


Figure 1

2-9 The RAMP response time can be adjusted in a range from 0 to 10 seconds by the potentiometer RAMP to ease steep changes in the standard signal input.

2-10 Current flowing to the proportional control valve's solenoid can be monitored in mV unit. If the current is 1mA, the output on the monitor shows 1mV.

2-11 An LED for indicating the operating condition of the proportional control valve is installed.
LED on: Current is flowing to the solenoid.
LED off: Input signal is less than 2%, or no current is flowing to the solenoid.

3. Specifications

Item	Model	KFPC1-F07-DN DC24V	
Mounting type		DIN rail mounting type	
Signal input		4~20mA	0~10V
Input impedance	Ω	220	1.2M
Power supply voltage		DC24V \pm 10%	
Valve control signal		PWM (pulse width modulation)	
Ambient temperature range (atmosphere)	$^{\circ}\text{C}$	0~50 (no condensation allowed)	
Maximum allowable load current	A	1.1	
Power consumption (for control circuit)	W	0.55	
Monitor signal		Directly proportional to the solenoid current, 1mV = 1mA	
RAMP response time	s	0~10	

Important

When using a DIN connector KFPZ-39 to connect the KFPC1 controller, keep the length of the cable between the proportional control valve and the controller to 50m or shorter. Cables longer than 50m cannot fully open the valve. Use a cable of 0.3SQ or larger.

Caution

Always shut off the power before handling the unit.
Do not let the cable ends become twisted.

4. Major Parts and Functions

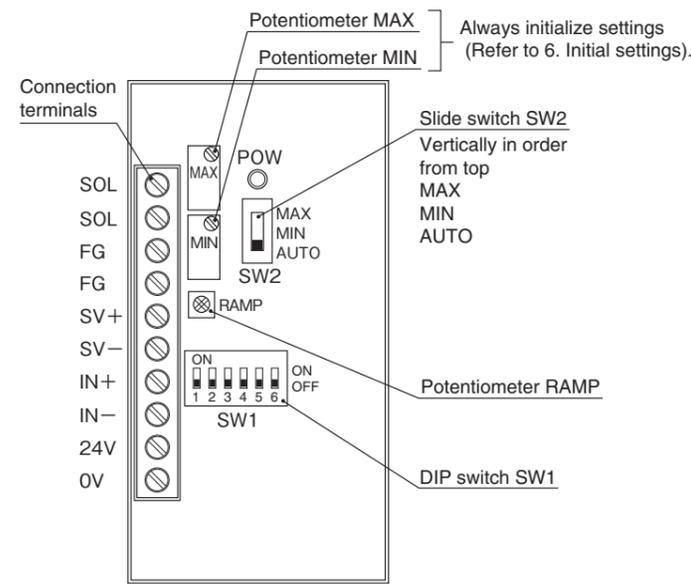


Figure 2

Connection terminals

SOL:	Valve actuation output (no polarity)
SOL:	Valve actuation output (no polarity)
FG:	Ground for valve
FG:	Frame ground for power
SV+:	Monitor output (+) ^{Note}
SV-:	Monitor output (-) ^{Note}
IN+:	Standard signal input (+)
IN-:	Standard signal input (-)
24V:	Power supply input (+)
0V:	Power supply input (-)

Note: When measuring monitor output from the upper surface of the screw by using testers etc, measured value may not be displayed if the screw is in loose condition.

Potentiometers

MAX:	Setting for current value I_2 at which the valve is fully open
MIN:	Setting for current value I_1 at which the valve starts to open
RAMP:	Setting for RAMP response time (0 to 10s)

LED indicator

POW: Lights up when current is flowing to the solenoid ^{Note}

Note: The indicator will not light up when the power is only supplied.

DIP switches

SW1	
1~3 (SIGNAL):	Selects standard signal input (4 to 20mA, or 0 to 10V)
4, 5 (PWM):	Switches between PWM frequencies
6 (ZERO):	Sets the zero point switch-off function

Slide switches

SW2	
MAX:	Input signal MAX
MIN:	Input signal MIN
AUTO:	Input signal AUTO (Operating mode)

5. Switch Settings

5-1 DIP Switch SW1 Settings

5-1-1 DIP switches (1, 2, 3): standard signal input settings
Sets the standard signal inputs to be used.
Perform the settings before switching on the power.

DIP switches (1, 2, 3)	Standard input signal
	0~10V
	4~20mA

Setting at shipping is 4 to 20mA.

5-1-2 DIP switches (4, 5): PWM frequency settings
Ordinarily, setting to a lower frequency reduces the hysteresis. However, if the control media tends to cause the system to vibrate in medium or high-pressure applications, use of a high frequency setting is recommended.

DIP switches (4, 5)	PWM frequency
	PWM frequency: Low
	PWM frequency: High

※ Setting at shipping.

5-1-3 DIP switch (6): Zero point switch-off function setting
Sets the zero point switch-off function to enabled or disabled.
When adjusting the current value (I_1) to open the valve, always set the zero point switch-off function to disabled.

DIP switch (6)	Zero point switch-off function
	Disabled
	Enabled

Setting at shipping for the zero point switch-off function is disabled.

5-2 Slide Switch SW2 (Initial Setting Switch)

Normal use is in the AUTO position (operation mode).
Use MIN and MAX when performing the initial settings, and switch between these two positions to set the conditions to forcibly input the MIN and MAX values for the respective standard signal input values.

Switch positions	Content
MAX (top)	Forced input of standard signal input MAX value
MIN (middle) ^{Note}	Forced input of standard signal input MIN value
AUTO (bottom)	Operation mode

Note: At the MIN (middle) position, the zero point switch-off function is automatically disabled.

Setting at shipping is

6. Initial Settings

Always perform the initial settings before operating the proportional control valve.
Complete all piping and wiring work, and then with media in a flowing state, follow the below procedures to set the controller to its initial settings. There are two methods available for the initial settings, as shown below.
Method 1: Use the switch SW2 inside the controller to perform the settings.
Method 2: Externally input a MIN value (4mA or 0V) and a MAX value (20mA or 10V) to the standard input signal, to perform the settings.

6-1 Method 1: Method Using Slide Switch SW2 Built Inside the Controller.

- 6-1-1 Rotate potentiometer RAMP as far as it will go in the counterclockwise direction to set the RAMP response time to zero seconds.
- 6-1-2 Set slide switch SW2 to the MIN position.
- 6-1-3 Use potentiometer MIN in the procedure below to set the current value I_1 at the position where the valve starts to open and the media starts to flow.
 - ① Rotate potentiometer MIN clockwise, and check that the valve is open and the media is flowing.
 - ② Then, rotate it counterclockwise until the valve closes and the media stops.
 - ③ Rotate it clockwise again, and stop when the media starts to flow. This is the I_1 setting position.
- 6-1-4 Set slide switch SW2 to the MAX position.
- 6-1-5 Use potentiometer MAX in the procedure below to set the current value I_2 at the position where the valve is fully open and the maximum flow rate is obtained.
 - ① Rotate potentiometer MAX counterclockwise, and check that the flow rate is decreasing.
 - ② Then, rotate it clockwise until the flow rate reaches its maximum and is no longer increasing.
 - ③ Rotate it counterclockwise again, and stop at the position where the flow rate starts to decrease. This is the I_2 setting position.

Important

- Since potentiometer MIN affects the maximum flow rate current value I_2 , adjust I_1 first. In addition, potentiometer MAX also has an effect on the minimum flow rate current value I_1 . As a result, adjustment of MIN and MAX needs to be repeated several times until a stable value is obtained.
- Caution should be exercised when setting the slide switch SW2 to MAX, because the valve opening may reach 100% in a stroke.

- 6-1-6 If necessary, use potentiometer RAMP to set the RAMP response time. The setting range is 0 to 10 seconds. Rotate all the way in the counterclockwise direction to set at zero seconds.
- 6-1-7 If necessary, set the zero point switch-off function. To enable it, set DIP switch SW1 No.6 to ON.
- 6-1-8 Set slide switch SW2 to AUTO, and return to operation mode. That completes the initial settings.

6-2 Method 2: Method for External Input of MIN Value (4mA or 0V) and MAX Value (20mA or 10V) to Standard Input Signal

- 6-2-1 Set the types of signals (4 to 20mA, or 0 to 10V) used for external input by DIP switch SW1. See "5-1-1 DIP switches (1, 2, 3): standard signal input settings." Perform these settings before switching on the power.
- 6-2-2 Check that slide switch SW2 is in AUTO position. If in a different position, set to AUTO.
- 6-2-3 Set the zero point switch-off function to disabled. To disable, set DIP switch SW1 No.6 to OFF.
- 6-2-4 Input the minimum value of the standard signal input (4mA or 0V).
- 6-2-5 Use potentiometer MIN to set the current value I_1 at the position where the valve starts to open and the media to flow.
<For the setting procedure, see 6-1-3 ①, ②, and ③.>
- 6-2-6 Input the maximum value for the standard input signal (20mA or 10V).

- 6-2-7 Use potentiometer MAX to set the current value I_2 at the position where the valve is fully open and the maximum flow rate is flowing.
<For the setting procedure, see 6-1-5 ①, ②, and ③.>
- 6-2-8 When the I_1 and I_2 settings are complete, switch off the standard input signal.
- 6-2-9 If necessary, use potentiometer RAMP to set the RAMP response time. The setting range is 0 to 10 seconds. Rotate all the way in the counterclockwise direction to set at zero seconds.
- 6-2-10 If necessary, set the zero point switch-off function. To enable it, set DIP switch SW1 No.6 to ON.
- 6-2-11 That completes the initial settings.

7. Reference Values for the Initial Settings

Setting values in the measurement conditions shown below, for the current value I_1 at which the valve starts to open, and the current value I_2 at which the valve is fully open, are described for reference in Table 5.

<Setting conditions>	Koganei measurement conditions
Media:	Air
Valve starts to open:	Primary (upstream side) pressure P1 = 0.1MPa Secondary (downstream side) P2 = 0MPa Pressure drop when media is flowing $\Delta P = 0.1\text{MPa}$ ($\Delta P = P1 - P2$)
Valve fully open:	(Primary (upstream side) pressure P1 = 0.1MPa, secondary (downstream side) P2 = 0MPa)

Check the current value I_1 at which the valve starts to open, and the current value I_2 at which the valve is fully open by reading out the monitor output (voltage value).
A monitor output of 1mV corresponds to the solenoid current of 1mA.

Table 5

Proportional control valve type		Valve starts to open (I_1 : Potentiometer MIN)	Valve fully open (I_2 : Potentiometer MAX)
KFPV 050	Orifice 2.0mm	195	260
	Orifice 3.0mm	190	260
	Orifice 4.0mm	175	270
KFPV 300	Orifice 4.0mm	440	650
	Orifice 6.0mm	400	720
	Orifice 8.0mm	410	770
	Orifice 10.0mm	400	780
	Orifice 12.0mm	320	710

Monitor signal connections:

Terminal SV+	Monitor output (+)
Terminal SV-	Monitor output (-)

Caution

In the proportional control valve, the current value I_1 at which the valve starts to open decreases as the primary pressure increases. In addition, the current value I_2 at which the valve is fully open decreases as the pressure drop increases. If the setting is at a higher value than the current value I_2 at which the valve is fully open in Table 5, there will not be any burning damage to the solenoid during normal use. The flow rate will not increase, however, and the linearity of flow characteristics will be damaged. Caution is needed when using continuous current for a fully open valve, however, since increased resistance due to a rising solenoid temperature could cause the temperature compensation circuit for stabilizing the current value to cease functioning.



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