PF##-TF222-173EN

ORIGINAL INSTRUCTIONS

Instruction Manual
Digital Flow Monitor (4 channel)
PFG20# series

IO-Link

The intended use of the remote flow monitor is to monitor and display flow information provided from a digital flow sensor.

1 Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of “Caution,” “Warning” or “Danger.” They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC) *1), and other safety regulations.

*1) ISO 4414: Pneumatic fluid power - General rules relating to systems.
ISO 4413: Hydraulic fluid power - General rules relating to systems.
IEC 60204-1: Safety of machinery - Electrical equipment of machines. (Part 1: General requirements)
ISO 10218-1: Manipulating industrial robots -Safety. etc.

- Refer to product catalogue, Operation Manual and Handling Precautions for SMC Products for additional information.
- Keep this manual in a safe place for future reference.

⚠ **Caution**	Caution indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
⚠ **Warning**	Warning indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
⚠ **Danger**	Danger indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

⚠ Warning

- **Always ensure compliance with relevant safety laws and standards.**
- All work must be carried out in a safe manner by a qualified person in compliance with applicable national regulations.
- This product is class A equipment intended for use in an industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility in other environments due to conducted or radiated disturbances.
- Refer to the operation manual on the SMC website (URL: https://www.smcworld.com) for more safety instructions.

⚠ Warning

- Special products (-X) might have specifications different from those shown in the specifications section. Contact SMC for specific drawings.

2 Specifications

2.1 PFG20# (with PF2A5## sensor) for Air

Model			PFG20#				
Applicable sensor			PF2A 510	PF2A 550	PF2A 511	PF2A 521	PF2A 551
Flow		Rated flow range (L/min)	1 to 10	5 to 50	10 to 100	20 to 200	50 to 500
	Instantaneous	Display / set flow range (L/min)	0.5 to 11	2.5 to 55	5 to 110	10 to 220	25 to 550
		Min. setting / unit (L/min)	0.1	0.5	1.0	2.0	5.0
	Accumulated	Display / set flow range	0 to 999,999,999 L (0 to 9,999,999.9 x10^3 L for PF2A551)				
		Min. setting / display unit	1 L				10 L
		Pulse flow rate conversion (L/pulse)	0.1	0.5	1.0	2.0	5.0
	Units		L/min, cfm (according to setting range)				

2.2 PFG20# (with PF3W5## sensor) for Water

Model			PFG20#				
Applicable sensor			PF3W 504	PF3W 520	PF3W 540	PF3W 511	PF3W 525
Flow		Rated flow range (L/min)	0.5 to 4	2 to 16	5 to 40	10 to 100	50 to 250
	Instantaneous	Display / set flow range (L/min) *1)	0.35 to 4.50	1.7 to 18.0	3.5 to 45.0	7 to 112	20 to 280
		Min. setting / unit (L/min)	0.05	0.1	0.5	1.0	2.0
	Accumulated	Display / set flow range	0 to 999,999,999 L (0 to 99,999,999.9 L for PF3W504)				
		Min. setting / display unit	0.1 L	1 L			
		Pulse flow rate conversion	0.05 L	0.1 L	0.5 L	1 L	2 L
	Units		L/min, gal/min (according to setting range)				

2.3 PFG20# (with PF2D5## sensor) for Pure water / Chemical fluid

Model			PFG20#		
Applicable sensor			PF2D504	PF2D520	PF2D540
Flow		Rated flow range (L/min)	0.4 to 4	1.8 to 20	4 to 40
	Instantaneous	Display / set flow range (L/min) *1)	0.25 to 4.50	1.3 to 21.0	2.5 to 45.0
		Min. setting / unit (L/min)	0.05	0.1	0.5
	Accumulated	Display / set flow range	0 to 99,999,999.9 L	0 to 999,999,999 L	
		Min. setting / display unit	0.1 L	1 L	
		Pulse flow rate conversion	0.05 L	0.1 L	0.5 L
	Units		L/min, gal/min (according to setting range)		

∗1) Display will indicate 0.00 when the value is below the minimum display value.

2 Specifications (continued)

2.4 Common specifications

Item			Specification
Electrical	Supply voltage	Used as switch output device	12 to 24 VDC ±10%, ripple (p-p) 10% max.
		Used as IO-Link device	18 to 30 VDC, ripple (p-p) 10% *1
	Current consumption		55 mA or less
	Circuit protection		Polarity protection
	Supply voltage for sensor *1		Power supply voltage: −1.5 V
	Supply current for sensor *2		110 mA max. (however total power supply current for 4 inputs is 440 mA max.). 200 mA max. total power supply current when used as an IO-Link device.
Accuracy	Linearity		±5.0% F.S. max. *4
	Repeatability		±1.0% F.S. max. *4
	Temperature characteristics		±2.0% F.S. max. (25°C standard) *4
Switch Output (SIO mode)	Output type		NPN or PNP open collector (5 outputs)
	Output mode		Hysteresis, window comparator, accumulated output, accumulated pulse output, error output, output OFF
	Switch operation		Normal or reversed output
	Max. Load current		80 mA
	Maximum applied voltage (NPN)		30 VDC
	Internal volt drop (residual voltage)		1.5 V max. (Load current 80 mA)
	Delay time *3		5 ms max., 0 to 60 s / 0.01 s increments
	Response time *4		3 ms max.
	Hysteresis		Variable from zero *5
	Circuit protection		Over current protection
Sensor input	Input type		Voltage input: 1 to 5 VDC (impedance: 1 MΩ)
	No. of inputs		4 inputs
	Connection		e-CON connector
	Protection		Over voltage protection (up to 26.4 VDC)
Display	Display type		LCD
	No. of displays		3 (1 main display and 2 sub displays)
	Display colour		Main display: Red/Green, Sub display: Orange
	Number of display digits		Main display: 4 digits 7segment Sub display (left): 4 digits (partially 11-segments, 7-segments for other) Sub display (right): 5 digits (partially 11-segments, 7-segments for other)
	Operation LED		LED is ON when switch output is ON (OUT1, OUT2: Orange)
Digital filter *6			Variable from 0 to 30 s/0.01 s increments
Environment	Enclosure		Front: IP65 (panel mounting), Other: IP40
	Temperature range		Operation: 0 to 50°C, Storage: -10 to 60°C (no condensation)
	Humidity range		Operation, Storage: 35 to 85% R.H. (no condensation)
	Withstand voltage		1000 VAC, for 1 minute between terminals and housing
	Insulation resistance		50 MΩ or more (with 500 VDC mega) between terminals and housing
Product weight			51 g (excluding cables)

∗1: Check the range of the power supply voltage of the sensor to connect.
∗2: The product will be damaged when the DC (+) and DC (-) of the sensor input connector are short-circuited.
∗3: Value without digital filter (at 0 ms).
∗4: It is the value when combined with an applicable flow sensor.
∗5: If the applied flow fluctuates around the set value, the hysteresis must be set to a value more than the amount of fluctuation or chattering will occur.
∗6: The response time indicates when the set value is 90% in relation to the step input.
∗7: Any products with scratches, smears, or variations in the display colour or brightness, which does not affect the performance of the product, are verified as conforming products.

2 Specifications (continued)

2.5 Communication specifications (IO-Link mode)

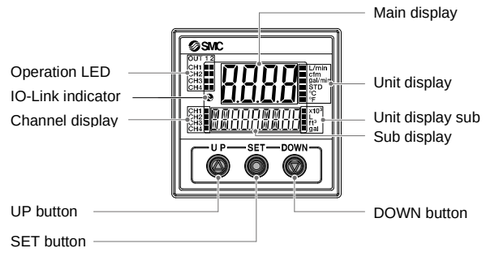
IO-Link type	Device
IO-Link version	V1.1
Communication speed	COM2 (38.4 kbps)
IODD configuration file *8	SMC-PFG200-yyyymmdd-IODD1.1
Min. cycle time	4.8 ms
Process data length	Input Data: 10 byte, Output Data: 0 byte
On request data communication	Available
Data storage function	Available
Event function	Available
Vendor ID	131 (0x0083)
Device ID	655 (0x00028F)

∗8: The IODD configuration file can be downloaded from the SMC website, (https://www.smcworld.com)

2.6 Cable specifications

Conductor area		0.15 mm^2 (AWG26)
Insulator	Outside diameter	0.9 mm
Sheath	Outer diameter	ϕ 4.8

3 Name and function of parts



Item	Description
Operation LED	LED is ON (Orange) when OUT is ON.
Main display	Displays (Red / Green) the current status of flow, setting mode, selected units and error codes.
UP button	Selects the channel and mode, and increases the ON/OFF set value.
SET button	Changes the mode and sets the set value.
DOWN button	Changes the sub display, selects the mode and decreases the ON/OFF set value.
Unit display	LED (Red / Green) indicates the selected units for instantaneous or accumulated flow.
Channel display	Indicates the channel selected (CH1 to CH4).
Sub display (left)	Displays (Orange) items.
Sub display (right)	Displays (Orange) set values and peak and bottom hold values.
IO-Link indicator	Indicates OUT1 output communication status (SIO mode, start-up mode, Pre-operation mode, operation mode) and the presence of communication data.

4 Installation

4.1 Installation

⚠ Warning

- Do not install the product unless the safety instructions have been read and understood.
- Use the product within the specified operating rated flow, operating pressure and temperature range.
- Tighten to the specified tightening torque.
  If the tightening torque is exceeded the mounting screws, brackets and the product can be broken. Insufficient torque can cause displacement of the product from its correct position.
- Do not drop, hit or apply excessive shock to the product.

4.2 Environment

⚠ Warning

- Do not use in an environment where corrosive gases, chemicals, salt water or steam are present.
- Do not use in an explosive atmosphere.
- Do not expose to direct sunlight. Use a suitable protective cover.
- Do not install in a location subject to vibration or impact in excess of the product's specifications.
- Do not mount in a location exposed to radiant heat that would result in temperatures in excess of the product's specifications.
- Do not use the product in areas subject to large temperature cycle.
- Do not operate close to a heat source, or in a location exposed to radiant heat.

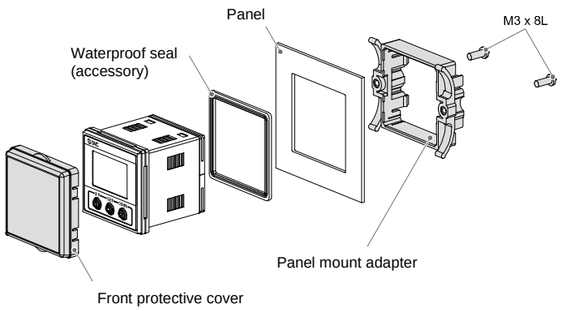
4.3 Mounting

- Never mount the product in a location that will be used as a foothold.
- Refer to the operation manual on the SMC website (URL: https://www.smcworld.com) for mounting dimensions.

4.4 Mounting with Panel mount adapter

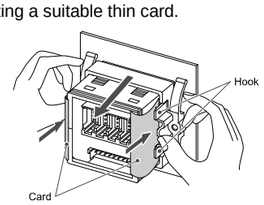
Mount the product as shown below. The panel mount adapter and the front cover can be rotated 90º for mounting.

- Fix the panel mount adapter to the monitor using the mounting screws (M3 x 8 L, 2 pcs.) supplied.
- The front protective cover for panel mounting satisfies IP65. However, if the panel mount adapter is not fixed securely or the instrument is not seated correctly, water might enter. After the product makes contact with the panel, the screws should be further tightened 1/4 to 1/2 turn.
- The self-tapping screws cannot be re-used.
- Suitable for panel thickness of 0.5 to 8 mm.
- Panel mount adapter (Part No.: ZS-26-B)
- Front protective cover (Part No.: ZS-26-01)
- Panel mount adapter + Front protective cover (Part No.: ZS-26-C)



Removing the panel mount adapter

- The monitor with panel mount adapter can be removed from the installation by removing 2 screws and releasing the hooks at the sides. The hooks can be released by inserting a suitable thin card.
- Pull the panel mount adapter to the front and remove the product.
- If the panel mount adapter is pulled with the hook engaged, the monitor or the panel mount adapter will be damaged.



5 Wiring

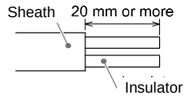
5.1 Wiring

⚠ Caution

- Wiring should only be performed with the power supply turned OFF.
- Confirm proper insulation of wiring.
- Use separate routes for the product wiring and any power or high voltage wiring. Otherwise, malfunction may result due to noise.
- Keep wiring as short as possible to prevent interference from electromagnetic noise and surge voltage.
- Ensure that the FG terminal is connected to ground when using a commercially available switch-mode power supply.
  Switching noise will be superimposed and the product specification can no longer be met. This can be prevented by inserting a noise filter, such as a line noise filter and ferrite core, between the switch-mode power supply and the product, or by using a series power supply instead of a switch-mode power supply.

5.2 Sensor Connector wiring

- Attaching the sensor wire.
  The sensor wire sheath should be stripped as shown.
  Do not cut the insulator.

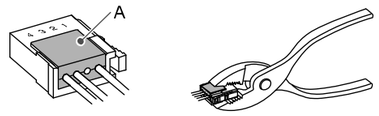


- Insert the corresponding wire colour shown in the table into the pin number printed on the sensor connector, to the bottom.

5.2.1 Sensor (e-CON) connector pin layout

Pin no.	PF2#5##		PF3W5##	
	Wire colour	Signal	Wire colour	Signal
1	Brown	DC (+)	Brown	DC (+)
2	N.C.	-	N.C.	-
3	Blue	DC (-)	Blue	DC (-)
4	White	Sensor input	Black	Sensor input

- Check that the above-mentioned wire preparation has been performed correctly, then part A shown in the figure is pushed in by hand to make temporary connection.



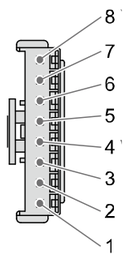
- Part A centre should be pressed straight in using a suitable tool, such as pliers. The e-CON connector cannot be re-used once it has been completely crimped.
- In case of connection failure or when a pin is mis-wired, always use a new e-CON connector.
- If the connector is not wired correctly [LLL] will be displayed.
- The wire colours are applicable for an SMC sensor lead wire.

5.2.2 Sensor (e-CON) connector details

SMC Part No.	Applicable sensor	Description
ZS-28-CA-4	Sensor connector for PF2A5##, PF2W5##, PF3W5##	Wire O.D.: ϕ1.15 to 1.35, Cover colour: Blue
ZS-28-CA-2	Sensor connector for PF2D5##	Wire O.D.: ϕ0.9 to 1.0, Cover colour: Red

5.3 Power and Output Connector pin layout

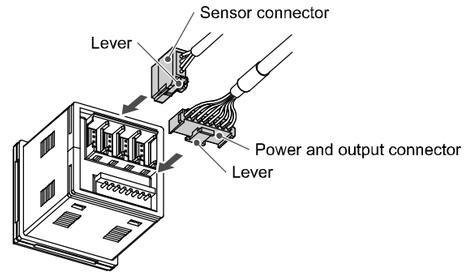
Pin no.	Wire colour	Description
1	Brown	DC(+) (L+)
2	Blue	DC(-) (L-)
3	Black	CH1_OUT1 (C/Q)
4	White	CH1_OUT2
5	Grey	CH2_OUT1
6	Red	CH3_OUT1
7	Green	CH4_OUT1
8	Yellow	FUNC (NC)



5 Wiring (continued)

5.4 Connecting / Disconnecting

- When mounting the connector, insert it straight into the socket, holding the lever and connector body, and push the connector until the lever hooks into the housing, and locks.
- When removing the connector, press down the lever to release the hook from the housing and pull the connector straight out.



6 Outline of Settings

Power is supplied

↓

The product code is displayed for approximately 3 sec. after power is supplied. Then, measurement mode is displayed.

↓

[Initial setting]
(Function selection mode [F 0]). Select the connected sensor, flow range, display units, and enable/disable IO-Link.

↓

[Measurement mode]
Detects the flow after power is supplied and indicates the display and switch operating status.
This is the basic mode; other modes should be selected for set-point changes and other function settings.
Channel selection: A channel can be selected by pressing the UP button. The display and settings are set for each channel.

Press SET button once	Press SET button for 1-3 s	Press SET button for 3-5 s	Press DOWN button once	
[3 step setting mode]	**[Simple setting mode]**	**[Function selection mode]**	**[Sub display setting]**	**[Other Settings]**

- The outputs will continue to operate during setting.
- If a button operation is not performed for a certain time during the setting, the display will flash. (This is to prevent the setting from remaining incomplete if, for instance, an operator were to leave during setting).
- 3 step setting mode, simple setting mode and function selection mode settings are reflected on each other.

Refer to the operation manual on the SMC website (URL: https://www.smcworld.com) for further Setting details.

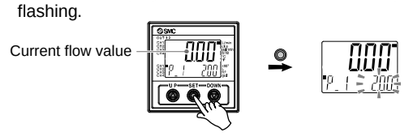
7 3 step Setting mode

In this mode, the set values can be input in just 3 steps.
Use this mode if the product is to be used straight away, after changing only the set values. (The current flow value is displayed on the main display).

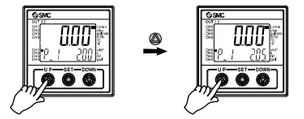
The set value (P_1 or n_1, P_2 or n_2) and hysteresis (H_1, H_2) can be changed.
After selecting the channel, set the items on the sub display (set value or hysteresis) with the DOWN button. When changing the set value, follow the operation below. The hysteresis setting can be changed in the same way.

7 3 step Setting mode (continued)

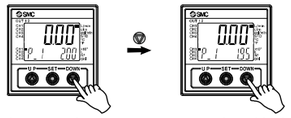
1. Press the SET button once when the item to be changed is displayed on the sub display. The set value on the sub display (right) will start flashing.



2. Press the UP or DOWN button to change the set value.
   Press the UP button once to increase by one digit, or press and hold to continuously increase.



- Press the DOWN button once to decrease by one digit, or press and hold to continuously decrease.



- When the UP and DOWN buttons are pressed and held simultaneously for 1 second or longer, the set value is displayed as [- - -], and the set value will be the same as the current flow value automatically (snap shot function Then it is possible to adjust the value by pressing the UP or DOWN button.

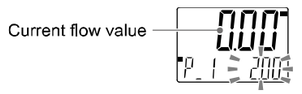
3. Press the SET button to finish the setting.

8 Simple Setting mode

In the simple setting mode, the set value, hysteresis and delay time can be changed while checking the current flow value (main display).

(1) After selecting the channel, press and hold the SET button for 1 to 3 seconds in measurement mode. [SEt] is displayed on the main display. When the button is released while in the [SEt] display, the current flow value is displayed on the main display, [P_1] or [n_1] is displayed on the sub display (left), and the set value is displayed on the sub display (right) (flashing).

(2) Change the set value using the UP or DOWN button, and press the SET button to set the value. Then, the setting moves to hysteresis setting (The snap shot function can be used).

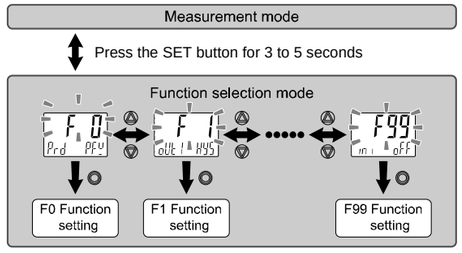


(3) Change the set value using UP or DOWN button, and press the SET button to set the value. Then, the setting moves to setting of OUT2.

(4) Press the SET button for less than 2 seconds to complete the OUT1 setting. [P_2] or [n_2] is displayed on the sub screen (left). Continue with the setting of OUT2.

9 Function selection mode

- After selecting the channel, in measurement mode, press the SET button for 3 to 5 seconds, to display [F 0].
- Select to display the function to be changed [F##].
- Press and hold the SET button for 2 seconds or longer in function selection mode to return to measurement mode.



- Some products do not have all of the functions. If a function is not available or selected due to configuration of other functions, [- - -] is displayed on the sub display (right).
- For the settings which are common to all channels, all channel indicators will turn on.

9.1 Default settings

The following are the default settings. If these are acceptable, keep these settings. To change a setting enter function selection mode.

9.1.1 [F 0] Setting

Item	Default setting
Connected product	PFW
Connected sensor	Flow
Connected sensor range	4 L range
Display units	L/min, L
Enable/disable IO-Link	IO-Link enabled

9.1.2 [F 1] Setting of OUT1

Item	Description	Default setting
Output mode	Select hysteresis mode, window comparator mode, accumulated output, accumulated pulse output, error output or switch output OFF.	Hysteresis mode
Output type	Select normal or reversed output.	Normal output
Flow setting	Set ON and OFF point of the switch output.	2.00 L/min
Hysteresis	Setting of hysteresis can prevent the switch output from chattering.	0.20 L/min
Delay time	Delay time of the switch output can be selected.	0.00 sec.
Display colour	Select the display colour. (Linked to OUT1)	Output ON: Green Output OFF: Red

9.1.3 [F 2] Setting of OUT2

Item	Description	Default setting
Output mode	Select hysteresis mode, window comparator mode, accumulated output, accumulated pulse output, error output or switch output OFF.	Hysteresis mode
Output type	Select normal or reversed output.	Normal output
Flow setting	Set ON and OFF point of the switch output.	2.00 L/min
Hysteresis	Setting of hysteresis can prevent the switch output from chattering.	0.20 L/min
Delay time	Delay time of the switch output can be selected.	0.00 sec.
Display colour	Select the display colour. (Linked to OUT1)	Output ON: Green Output OFF: Red

9 Function selection mode (continued)

9.2 Other parameter settings

Item	Default setting
[F 3] Digital filter	0.00 sec.
[F10] Sub display	dEF (Standard)
[F14] Zero cut-off	Available for PF2A only
[F20] External input	Accumulated value reset
[F30] Accumulated flow value hold	OFF
[F80] Power saving mode	OFF
[F81] Security code	OFF
[F90] Setting of all functions	OFF
[F95] Channel to channel copy function	OFF
[F96] Sensor input display	No configurable items
[F98] Output check	N/A (normal output)
[F99] Reset to default settings	OFF

10 Other functions

- **Channel scan function**
- **Snap shot function**
- **Peak / Bottom display function**
- **Key-lock function**

Refer to the operation manual on the SMC website (URL: https://www.smcworld.com) for setting these functions.

11 Troubleshooting

11.1 Error indication

Error	Error displayed	Description	Measures
Over current error	Er 1 (CH.※ oC.1) ∗2 Er 2 (CH.※ oC.2) ∗2	The switch output load current is 80 mA or more. ※ indicates channel with error.	Turn the power off and remove the cause of the over current. Then supply the power again.
Flow error	HHH	Flow has exceeded the upper limit of the set flow range.	Reset flow to a level within the set flow range. Check the sensor connection and wiring.
	LLL	Flow has exceeded the lower limit of the set flow range. Sensor is not connected or wired incorrectly.	
System error	Er 0 ∗1 Er 4 ∗1 Er 6 ∗1 Er 8 ∗1 Er40 ∗1 Er15	An internal data error has occurred.	Turn the power off and on again. If the failure cannot be solved, contact SMC.

∗1: The switch output will be OFF when an error is generated. An error is output when the error output is set (for products with the error output function).
∗2: When the set output has an over current error the switch output is OFF.

- If the error cannot be reset or other errors occur then please contact SMC.

12 How to Order

Refer to the operation manual or catalogue on the SMC website (URL: https://www.smcworld.com) for How to order information.

13 Outline Dimensions (mm)

Refer to the operation manual or catalogue on the SMC website (URL: https://www.smcworld.com) for Outline Dimensions.

14 Maintenance

14.1 General Maintenance

⚠ Caution

- Not following proper maintenance procedures could cause the product to malfunction and lead to equipment damage.
- If handled improperly, compressed air can be dangerous.
- Maintenance of pneumatic systems should be performed only by qualified personnel.
- Before performing maintenance, turn off the power supply and be sure to cut off the supply pressure. Confirm that the air is released to atmosphere.
- After installation and maintenance, apply operating pressure and power to the equipment and perform appropriate functional and leakage tests to make sure the equipment is installed correctly.
- If any electrical connections are disturbed during maintenance, ensure they are reconnected correctly and safety checks are carried out as required to ensure continued compliance with applicable national regulations.
- Do not make any modification to the product.
- Do not disassemble the product, unless required by installation or maintenance instructions.

- **How to reset the product after a power cut or when the power has been unexpectedly removed**
  The settings of the product are retained from before the power cut or de-energizing.
  The output condition also recovers to that before the power cut or de-energizing, but may change depending on the operating environment. Therefore, check the safety of the whole installation before operating the product. If the installation is using accurate control, wait until the product has warmed up (approximately 10 to 15 minutes)..

15 Limitations of Use

15.1 Limited warranty and Disclaimer/Compliance Requirements

Refer to Handling Precautions for SMC Products.

16 Product disposal

This product should not be disposed of as municipal waste. Check your local regulations and guidelines to dispose of this product correctly, in order to reduce the impact on human health and the environment.

17 Contacts

Refer to www.smcworld.com or www.smc.eu for your local distributor / importer.

SMC Corporation

URL : https://www.smcworld.com (Global) https://www.smceu.com (Europe)
SMC Corporation, 4-14-1, Sotokanda, Chiyoda-ku, Tokyo 101-0021, Japan
Specifications are subject to change without prior notice from the manufacturer.

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