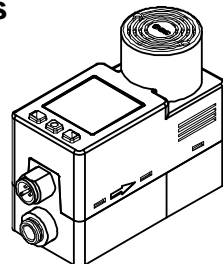




**Instruction Manual**  
**Digital Flow Controller for Air**  
**PFC7## series**



The intended use of the digital flow controller for air is to monitor and control flow and provide an output signal.

**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<sup>\*)</sup>, and other safety regulations.

<sup>\*)</sup> ISO 4414: Pneumatic fluid power — General rules and safety requirements for systems and their components.

ISO 4413: Hydraulic fluid power — General rules and safety requirements for systems and their components

IEC 60204-1: Safety of machinery - Electrical equipment of machines. Part 1: General requirements

ISO 10218-1: Robots and robotic devices - Safety requirements for industrial robots - Part 1: Robots

- 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.

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

**2 Specifications**

**2.1 General specifications**

Item	Specifications
Enclosure	IP40 (IEC 60529)
Operating temperature	Operating: 0 to 50 °C : Storage: -10 to 60 °C (no freezing or condensation)
Humidity range	35 to 85% R.H. (no condensation)
Withstand voltage	1000 VAC for 1 min. between terminals and housing
Insulation resistance	50 MΩ min (500 VDC Mega) between terminals and housing
Materials in contact with fluid	PPS, FKM, SUS, Brass, PTFE, Si, Au, GE4F

**2 Specifications (continued)**

**2.2 PFC7## specifications**

Model	PFC710	PFC725	PFC750	PFC711		
Fluid	Applicable fluids *1 (Air quality: JIS B8392-1 1.1.2 to 1.6.2, ISO8573-1 1.1.2 to 1.6.2)					
	Fluid temperature range 0 to 50 °C					
Flow	Detection method Heating type sensor					
	Rated control flow rate range *2	Dry air, N <sub>2</sub> , Ar	0.1 to 10 L/min	0.2 to 25 L/min	0.5 to 50 L/min	1 to 100 L/min
		CO <sub>2</sub>	0.1 to 5 L/min	0.2 to 12.5 L/min	0.5 to 25 L/min	1 to 50 L/min
	Set controlled flow rate range *2	Dry air, N <sub>2</sub> , Ar	0.04 to 10.3 L/min	0.1 to 25.8 L/min	0.2 to 51.5 L/min	0.4 to 103 L/min
		CO <sub>2</sub>	0.04 to 5.15 L/min	0.1 to 12.9 L/min	0.2 to 25.8 L/min	0.4 to 51.5 L/min
	Min. unit of set controlled flow rate	0.01 L/min	0.1 L/min			
	Set accumulated flow range	0.0 to 99,999,999.9 L	0 to 999,999,999 L			
	Min. unit of accumulated flow rate	0.1 L	1 L			
	Accumulated volume per pulse (Pulse width = 50 ms)	0.1 L / Pulse		1 L / Pulse		
	Accumulated value hold function	Select every 2 or 5 minutes (when the function is not set, power supply OFF reset)				
Control accuracy	±3% F.S.					
Analogue output accuracy *4	±3% F.S.					
Repeatability	±1% F.S.					
Temperature characteristics	±5% F.S. (0 to 50 °C, Reference: 25 °C)					
Pressure characteristics	±2% F.S. (Operating pressure range, reference operating pressure)					
Settling time	Reaches within ±3%F.S. of the commanded flow rate in 0.5 seconds or less (under reference conditions) *5		Reaches within ±3%F.S. of the commanded flow rate in 1 second or less (under reference conditions) *5			
	Control spec. method IO-Link, local setting, analogue input					
Operation when power supply is disconnected	Fully closed (Normally closed (N.C.))					
	Control *3					
Analogue input	Input type	1 to 5 V				
	Input impedance	1 MΩ approx.				
Current	Input type	4 to 20 mA				
	Input impedance	250 Ω or less				
Analogue output	Output type	Select 1 to 5 V or 0 to 10 V				
	Output impedance	1 kΩ approx.				
	Output type	4 to 20 mA				
	Load impedance	50 to 600 Ω				
Switch output	Output type	Select NPN or PNP open collector output				
	Output mode	Limit deviation tolerance mode, accumulated output, accumulated pulse output, error output, switch output off				
	Switch operation	Select normal or reversed output				
	Max. load current	80 mA				
	Max. applied voltage	30 VDC (NPN only)				
	Internal voltage drop (Residual voltage)	1.5 V or less (at 80 mA load current)				
	Delay time	5 ms or less, variable from 0 to 60 s / 0.01 s increments				
	Protection	Switch output power supply polarity protection, over current protection				

**2 Specifications (continued)**

Model	PFC710	PFC725	PFC750	PFC711	
Pressure	Operating pressure range *6	50 to 250 kPa	100 to 300 kPa	150 to 350 kPa	250 to 350 kPa
	Min. operating differential pressure *7	50 kPa	100 kPa	150 kPa	250 kPa
	Reference operating pressure *8	100 kPa	150 kPa	200 kPa	300 kPa
	Withstand pressure	1 MPa			
Electrical	Power supply voltage	24 VDC ±10%			
	Current consumption *9	200 mA or less			
Display	Protection	Power supply polarity protection			
	Reference condition *10	Select standard condition (STD) or normal condition (NOR)			
	Display mode	Instantaneous flow rate display (Main display) Select set control flow display or accumulated flow rate display (Sub display)			
	Units *11	Instantaneous flow	L/min, cfm		
Displayable range	Accumulated flow	L, ft <sup>3</sup>			
	Instantaneous flow	-0.5 to 10.5 L/min	-1.3 to 26.3 L/min	-2.5 to 52.5 L/min	-5 to 105 L/min
Min. display units	Accumulated flow	0 to 99,999,999.9 L	0 to 999,999,999 L		
	Instantaneous flow	0.01 L/min	0.1 L/min		
Display *12	Accumulated flow	0.1 L			1 L
	Instantaneous flow	LCD (The display screen can be rotated by 90, 180, and 270°)			
Mounting orientation	The controller cannot be mounted with the display facing down				
	Piping specification	C4 (φ4) / C6 (φ6)	C6 (φ6) / N7 (φ1/4") / C8 (φ8)		
Piping	Screw fitting	01 (Rc1/8) F1 (NPT1/8) N1 (G1/8)		02 (Rc1/4) F2 (NPT1/4) N2 (G1/4)	
	Product	With One-touch fitting	255 g approx.		
With Screw fitting		305 g approx.			
Weight	Lead wire	180 g approx.			
	Mounting Bracket	25 g approx.			

- \*1: Refer to the recommended pneumatic circuit.
- \*2: The operation may be unstable outside the rated control flow range.
- \*3: Applicable fluid: The specification value when dry air is shown. For gas types other than air, the value is for reference.
- \*4: For the analogue voltage, option 1, lead wire with M12 connector (3 m long), is used. If the lead wire is different, the accuracy may fluctuate depending on the wiring resistance.
- \*5: The reference conditions are as follows: pressure: reference operating pressure; temperature: 25°C; commanded flow rate: step change from 1% to 100%. In other conditions, the settling time may be delayed.
- \*6: The operating pressure range refers to the pressure that can be applied to the primary side of the product. This product cannot be used for negative pressure.
- \*7: The minimum operating differential pressure is the minimum differential pressure value (pressure difference between the primary and secondary sides) required for the product to operate normally. Do not mount a restrictor immediately on the secondary side of the product. Doing so may result in unstable control operation.
- \*8: Pressure on the secondary side of the product is open to atmosphere (0 kPa).
- \*9: Analogue output and switch output are not included. If there is no supply pressure, a consumption current beyond the product specifications may flow in the event of an error in control operation.
- \*10: Standard condition (STD): 20 °C, 101.3 kPa, 65% R.H. (The flow rate given in the specification is the value at the standard condition) Normal condition (NOR): 0 °C, 101.3 kPa, 0% R.H.
- \*11: This setting is only available for models with the units selection function. For models without the units selection function, the instantaneous flow is fixed to L/min and the accumulated flow (rate) is fixed to L.

**2 Specifications (continued)**

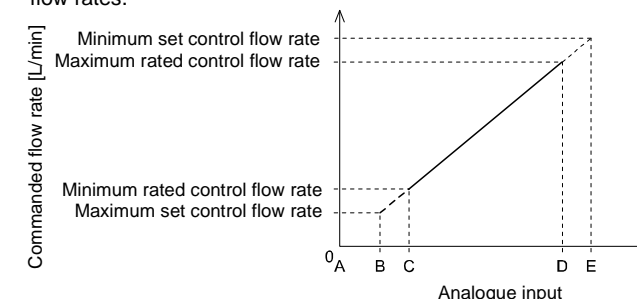
\*12: Typefaces included herein are solely developed by DvnaComware Taiwan Inc.  
\*13: SMC are working to improve quality. However, any products with tiny scratches, smear, dead-pixel, or variation in the display colour or brightness which does not affect the performance of the product, are verified as conforming products.

**2.3 Cable specifications (ZS-53-A, ZS-53-D)**

Conductor	Nominal cross section	AWG21
Insulator	Outside diameter	1.60 mm approx.
	Colours	Brown, White, Black, Blue
Sheath	Material	Oil resistant PVC
	Outer diameter	φ6

**2.4 Characteristics data**

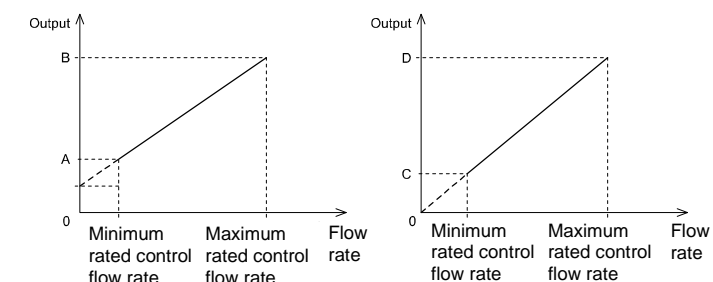
- Flow rate / Analogue input  
Analogue input values are converted into corresponding commanded flow rates.



	A	B	C		D	E
			PFC710 / 750 / 711	PFC725		
Voltage input	1 V	1.016 V	1.04 V	1.032 V	5 V	5.12 V
Current input	4 mA	4.064 mA	4.16 mA	4.128 mA	20 mA	20.48 mA

- Flow rate / Analogue output

Analogue output is output according to the controlled flow rate.



	0 L/min	A		B
		PFC710 / 750 / 711	PFC725	
Voltage output (1 to 5 V)	1 V	1.04 V	1.032 V	5 V
Current output	4 mA	4.16 mA	4.128 mA	20 mA

	0 L/min	C		D
		PFC710 / 750 / 711	PFC725	
Voltage output (0 to 10 V) *1	0 V	0.1 V	0.08 V	10 V

\*1: Set the current that flows from the connected equipment to the analogue output to 20 μA or less when selecting 0 to 10 V. When more than 20 μA current flows, the accuracy may not be satisfied below 0.5 V.

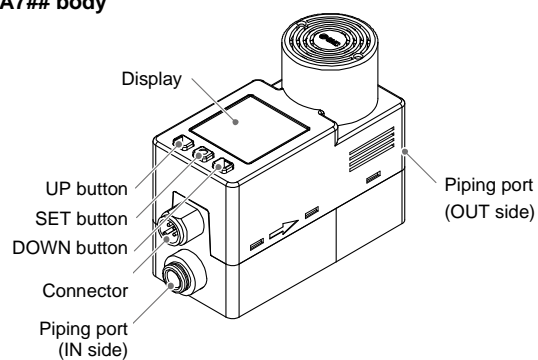
Model	Min. rated control flow rate	Max. rated control flow rate
PFC710	0.1 L/min	10.0 L/min
PFC725	0.2 L/min	25.0 L/min
PFC750	0.5 L/min	50.0 L/min
PFC711	1.0 L/min	100.0 L/min

**Warning**

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

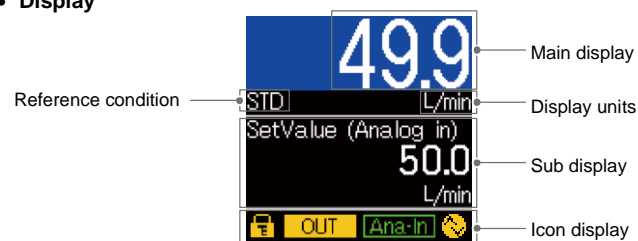
### 3 Name and function of parts

• **PFCA7## body**



Item	Description
Display	Refer to the details below.
Piping port	For piping connections. IN represents "inlet" and OUT represents "outlet".
Connector	For lead wire with M12 connection.
UP button DOWN button	Use these buttons to select the mode and the display shown on the Sub display, or increase or decrease the numerical value. The assignment of the UP and DOWN buttons changes depending on the display rotation angle.
SET button	Use this button to change the mode and to set a value.

• **Display**



Item	Description
Main display	Displays the flow rate value and the error codes.
Sub display	Displays the commanded flow rate, peak/bottom value, accumulated flow rate value, switch output / communication mode, and line names.
Reference condition	Indicates the reference condition currently selected.
Display units	Indicates the units currently selected.
Icon display	Displays the function status. See below.

• **Icon display**

Icon	Name	Description
	Key-lock	The icon is ON when the buttons are locked.
	OUT status	The icon LED is ON when the output is ON.
	Analogue input status	Red: Analogue input warning (less than -5%). Green: Analogue input normal. Yellow: Analogue input warning (above 110%).
	IO-Link status	Yellow: Communicating with IO-Link. White: Connecting to IO-Link (including communication disruption). Light is OFF: Not connected to IO-Link.

For more information about IO-Link communication status indication refer to the operation manual on the SMC website (URL: <https://www.smcworld.com>).

### 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 the product in a place where it could be splashed by oil or chemicals.
- Do not use in an area where electrical surges are generated.
- Do not use in an explosive atmosphere.
- Do not install in a location subject to vibration or impact in excess of the product specifications.
- Do not use the product in the presence of a magnetic field.
- Do not mount in a location exposed to radiant heat that would result in temperatures in excess of the product specifications.
- Do not use the product in an environment that is exposed to temperature cycles.
- Do not expose to direct sunlight. Use a suitable protective cover.

#### 4.3 Mounting

- Refer to the flow direction marked on the product before mounting.
- Never mount the product in a location that will be used as a foothold.
- Mount the bracket (SMC Part number ZS-40-L for side mounting or ZS-53-G for flow path mounting) to the product using screws supplied.
- The tightening torque of the bracket mounting screws must be 0.63 ±10% N•m.
- When the product is mounted using a bracket, use M3 screws (4 pcs.).
- Refer to the operation manual on the SMC website (URL: <https://www.smcworld.com>) for mounting dimensions.

#### 4.4 Piping

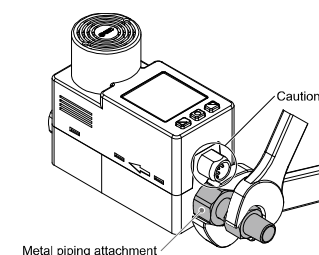
- The product should be flushed out by air blow to remove any dust left in the piping before connecting the piping.
- Do not mount the product with the display facing downward.
- Do not insert metal wires or other foreign matter into the piping ports. This can damage the sensor causing failure or malfunction.
- If there is a risk of foreign matter entering the fluid, install a filter or mist separator on the IN side (entry side) to avoid failure or malfunction.
- If the fluid flow on the IN side (entry side) of the product is unstable, correct measurement and flow rate control will not be possible. If a valve is used on the IN side (entry side) of the product, the flow may be disturbed due to the change of the effective area.
- Do not install a restrictor immediately on the product OUT side (outlet). Otherwise, the flow control action may be unstable.

**Caution**

- Before connecting piping make sure to clean up chips, cutting oil, dust etc.
- When installing piping or fittings, ensure sealant material (tape) does not enter inside the port.
- When connecting the piping, hold the specified part of the body with a spanner. Using a spanner on other parts may damage the product. Specifically, make sure that the spanner does not damage the connector.
- The required tightening torque of the fittings is given in the table below.

### 4 Installation (continued)

- If the tightening torque is exceeded, the product can be damaged. If the correct tightening torque is not applied, the fittings may become loose.
- Ensure there is no leakage after piping.



Nominal thread size	Required torque
Rc(NPT)1/8	7 to 9 N•m
Rc(NPT)1/4	12 to 14 N•m

Nominal thread size	Width across flats of attachment
Rc(NPT)1/8, Rc(NPT)1/4, G1/8	17 mm
G1/4	21 mm

### 5 Wiring

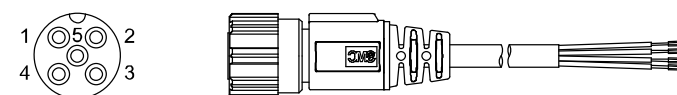
#### 5.1 Wiring

**Caution**

- Wiring should only be performed with the power supply turned OFF.
- Confirm proper insulation of wiring.
- Avoid repeatedly bending, stretching or applying a heavy object to the lead wire.
- 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.

- If a commercially available switching power supply is used, be sure to ground the frame ground (FG) terminal. If a commercially available switch-mode power supply is connected for use, switching noise will be superimposed and it will not be able to meet the product specifications. In that case, insert a noise filter such as a line noise filter/ferrite between the switching power supplies or change the switching power supply to a series power supply.

#### 5.2 M12 Connector Pin numbers (ZS-53-A, ZS-53-D)



- When used as a switch output device

Pin number	Wire colour	Name	Description
1	Brown	DC(+)	24 VDC
2	White	OUT2	Analogue output
3	Blue	DC(-)	0 V
4	Black	OUT1	Switch output
5	Grey	IN	Analogue input

- When used as an IO-Link device

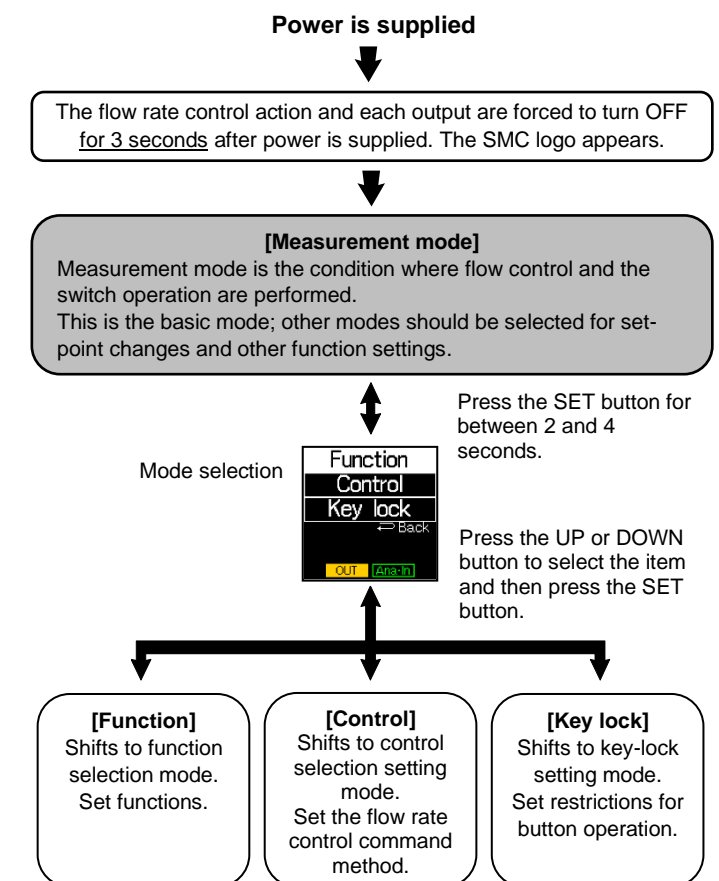
Pin number	Wire colour	Name	Description
1	Brown	DC(+)	24 VDC
2	White	NC	Not connected
3	Blue	DC(-)	0 V
4	Black	C/Q	Communication data (IO-Link)
5	Grey	NC	Not connected

### 5 Wiring (continued)

#### 5.3 Connecting

- Align the lead wire M12 connector (SMC part number ZS-53-A) with the connector key groove and insert vertically.
- Connection is complete when the knurled part is fully tightened. Check that the connection is not loose.

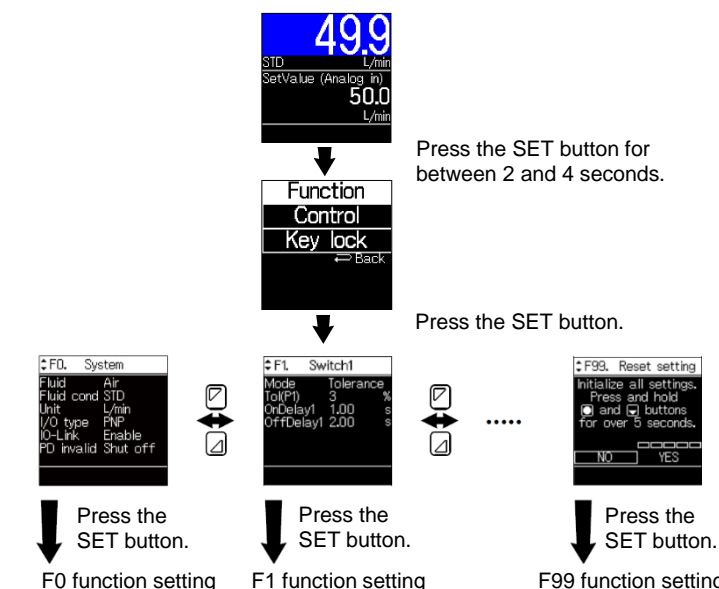
### 6 Outline of Settings



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

### 7 Function selection mode

- In this mode, each function setting can be changed separately.
- In measurement mode, press the SET button for between 2 and 4 seconds, then select [Function] to enter function selection mode.
- Press the UP or DOWN button to change the number and each function that you want to change can be selected.





## 7 Function selection mode (continued)

### When setting is complete:

Press the UP or DOWN button to select [Back], to return to function selection mode.

Press the SET button for at least 2 seconds to return to measurement mode.

### 7.1 Default settings

No	Function	Item	Default setting
[F0]	System settings	[Fluid] Fluid settings	[Air] Air
		[Fluid cond] Flow rate reference condition.	[STD] Standard condition
		[Unit] Flow rate display units.	[L/min] L/min (L)
		[I/O type] NPN or PNP output selection.	[PNP] PNP output
		[IO-Link] IO-Link enable/disable setting.	[Enable] Enable
[F1]	OUT1 settings	[PD invalid] Output PD setting during communication error.	[Shut off] Output PD: 0
		[Mode] Output mode selection	[Tolerance] Limit deviation tolerance mode
		[tol(P1)] Limit deviation tolerance setting	[ 3 %] 3% of rated control flow
		[OnDelay1] ON delay time setting	[0.00 s] 0 second
[F10]	Measurement setting	[Resolution] Display resolution setting	[Low] 100 resolution
		[Type] Analogue output switching setting	[1-5V] 1 to 5 V (Analogue voltage type). [4-20mA] 4 to 20 mA (Analogue current type).
[F22]	Analogue output settings	[Free span] Analogue free range setting	[10.00L/min] 10 L/min (For the PFCA710, the upper limit of the rated control flow.)
		[Save intvl] Accumulation storage setting	[No save] Not to hold
[F30]	Accumulated flow (rate) settings	[Disp mode] Accumulated display direction setting	[Increment] Addition direction
		[Auto shut] Automatic accumulation shut-off enable/disable	[Disable] Disable
		[Colour] Select measurement value display colour	[1onB,offR] ON: Blue; OFF: Red
[F80]	Display settings	[Display] Display OFF setting	[ON] Display ON
		[Rotation] Display rotation angle setting	[0deg] Rotation angle 0°
		[Brightness] Screen brightness setting	[100%] Brightness 100%
		[Line name] Line name display setting	[OFF] No line name displayed
[F81]	PIN code setting	Selection of PIN code	[OFF] Not used
[F91]	Device information	-	Information check (No settings)
[F96]	Input check	-	Input check (No settings)
[F98]	Output check	-	[Normal] Normal output
[F99]	Reset to factory default settings	-	[ oFF] Not to be reset

## 8 IO-Link Parameter settings

### 8.1 IODD file

IODD (I/O Device Description) is a definition file which provides all properties and parameters required for establishing functions and communication of the device.

- The IODD includes the main IODD file and a set of image files such as vendor logo, device picture and device icon.
- The IODD file for this product is as follows:

Product number	IODD file *
PFCA7*-*****	SMC-PFCA7*-*****-yyyymmdd-IODD1.1

\*: "\*" indicates the product model which corresponds to each IODD file.

\*: "yyyymmdd" indicates the date of creation of the file, with yyyy, mm, and dd representing the year, month, and date, respectively.

- The IODD file can be downloaded from the SMC website (URL: <https://www.smcworld.com>).

### 8.2 IO-Link specifications

IO-Link type	Device
IO-Link version	V1.1
Communication speed	COM2 (38.4 kbps)
Min. cycle time	5.5 ms
Process data length	Input Data: 8 bytes, Output Data: 2 bytes
On request data communication	Available
Data storage function	Available
Event function	Available

## 9 Other Settings

- Reset operation
- Zero clear function

For further details refer to the operation manual on the SMC website (URL: <https://www.smcworld.com>).

## 10 How to Order



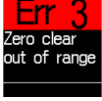




Refer to the operation manual or catalogue on the SMC website (URL: <https://www.smcworld.com>) for How to order information.

## 11 Outline Dimensions (mm)

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

## 12 Troubleshooting

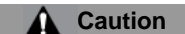
### 12.1 Error display

Error name	Error display	Description	Measures	Control operation during an error
System error (Err 0, 4, 6, 8, 16, 40, 82, 83)		An internal data error has occurred.	Turn off the power and check for any noise source, and then turn on the power again. If the failure cannot be solved, contact SMC.	Stop
Over current error (Err 1)		The switch output load current has exceeded 80 mA.	Remove the cause of the excessive current in the output.	Continuing
Zero clear error (Err 3)		During a zero clear operation, a flow rate exceeding ±5%F.S. is applied.	Perform the zero-clear operation again when the flow rate is not applied.	Continuing
Version does not match (Err 15)		The IO-Link version does not match with the master.	Align the master IO-Link version to the device.	Continuing
Control error (Err 50)		The controlled flow rate does not continuously reach the commanded flow rate for at least 5 seconds.	Use the product within the operating differential pressure and operating pressure range. Check to see if there is any air leakage from piping, etc. The controlled flow rate is restored by setting the commanded flow rate to zero. When [Local] is selected in control selection setting mode, the controlled flow rate is restored by pressing and holding the UP and DOWN button for 1 second or longer.	Stopped
Close error (Err 51)		Flow rate exceeding ±5% F.S. is applied when commanded flow rate is less than ±1% F.S.	Mount the product so that the fluid flow direction is the same as the arrow indicated on the side of the body.	Stopped
Abnormal power supply voltage (Err 60)		Power supply voltage is outside of the range 24 VDC±10%.	Supply a power supply voltage within the range 24 VDC±10%.	Stopped

Refer to the operation manual or catalogue on the SMC website (URL: <https://www.smcworld.com>) for Troubleshooting details.

## 13 Maintenance

### 13.1 General Maintenance



- 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 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 system before operating the product.

## 14 Limitations of Use

### 14.1 Limited warranty and Disclaimer/Compliance Requirements

Refer to Handling Precautions for SMC Products.

## 15 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.

## 16 Contacts

Refer to [www.smcworld.com](http://www.smcworld.com) or [www.smc.eu](http://www.smc.eu) for your local distributor / importer.

# SMC Corporation

URL : <https://www.smcworld.com> (Global) <https://www.smc.eu> (Europe)  
SMC Corporation, 4-14-1, Sotokanda, Chiyoda-ku, Tokyo 101-0021, Japan  
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