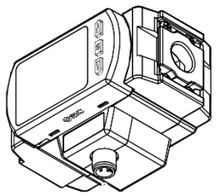
ORIGINAL INSTRUCTIONS

Instruction Manual
Digital Flow Switch – Modular type
PF3A7R5H / PF3A701H
PF3A702H / PF3A704H
PF3A708H



IO-Link

The intended use of the digital flow switch is to monitor and display flow information while connected to the IO-Link communication protocol.

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 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: Robotics - Safety requirements - Part 1: Industrial 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.

⚠ **Danger**	Danger indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
⚠ **Warning**	Warning indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
⚠ **Caution**	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.
- Special products (-X) might have specifications different from those shown in the specifications section. Contact SMC for specific drawings.

2 Specifications

Models			PF3A 7R5H	PF3A 701H	PF3A 702H	PF3A 704H	PF3A 708H
Applicable fluid			Air, N_2, Ar, CO_2				
Operating fluid temperature			0 to 50 °C				
Flow	Detection method		Heating sensor (branch flow)				
	Rated flow range (L/min)		5 to 500	10 to 1000	20 to 2000	40 to 4000	80 to 8000
	Set point range	Instantaneous flow (L/min)	5 to 750	10 to 1500	20 to 3000	40 to 6000	80 to 12000
		Accumulated flow (L)	0 to 9,999,999,990 (PF3A708H: 0 to 99,999,999,900)				
	Min. settable unit	Instantaneous flow (L/min)	1		2		5
		Accumulated flow (L)	10				100
	Accumulated volume per pulse (L/pulse)		1,10, 50,100	10,50,100,500		50,100,500, 1000	
	Pulse width		Variable at 50 to 100 ms / 10 ms step				
	Accumulated value hold		2 minutes or 5 minutes				
Pressure	Rated pressure range		0 to 1.0 MPa				
	Proof pressure		1.5 MPa				
	Pressure loss		Refer to the pressure loss graph				
	Pressure Characteristics		±5.0 % F.S. (0 to 1.0 MPa, 0.5 MPa standard)				
Electrical	Power supply voltage		24 VDC ±10% as switch output device 21.6 to 30 VDC as IO-Link device				
	Current consumption		150 mA or less				
	Protection		Polarity protection				
Accuracy	Display accuracy		±3.0 %F.S.				
	Analogue output accuracy		±3.0 %F.S.				
	Repeatability		±1.0 %F.S.				
	Temperature characteristics		±5.0 %F.S. (Ambient temp. 0 to 50 °C, 25 °C standard)				
	Impact when modular devices are connected		±5.0 %				
Switch output	Output type		NPN or PNP open collector output				
	Output mode		Select one of output (hysteresis or window comparator mode), output for accumulated flow, accumulated pulse output.				
	Switch operation		Normal or reversed output				
	Maximum load current		60 mA				
	Maximum applied voltage (NPN output)		28 VDC as switch output device 30 VDC as IO-Link device				
	Internal voltage drop (Residual voltage)		NPN: 1 V or less (load current 60 mA) PNP: 2 V or less (load current 60 mA)				
	Response time		Select from 1 s, 2 s, 5 s.				
	Hysteresis		Variable from 0				
	Protection		Over current protection				
Analogue Output	Output type		Voltage output: 1 to 5 V (0 to 10 V can be selected), Current output: 4 to 20 mA				
	Impedance	Voltage output	Output impedance approx. 1 kΩ				
		Current output	Max. load impedance 600 Ω Min. load impedance 50 Ω				
	Response time		Linked to response time of switch output (output with digital filter setting)				

2 Specifications (continued)

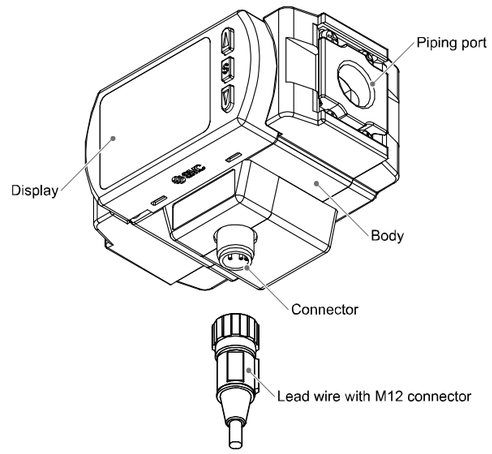
Models		PF3A 7R5H	PF3A 701H	PF3A 702H	PF3A 704H	PF3A 708H
Ext. input	Input type	Input with no voltage: 0.4 V or less				
	Input mode	Select from Reset Accumulated Value, Reset Peak and Reset Bottom values				
	Time for input	30 ms or more				
Display	Reference condition	Normal or Standard condition				
	Display type	Display method: LCD Number of displays: 2 (main display and sub display) Colour (main display): Red and green Display colour (sub display): Orange Display - main display: 5 digits, 7 segment Display - sub display: 6 digits, 7 segment				
	Operation LED	OUT LED: Red is ON when output is ON				
Environmental	Protection	IP65				
	Withstand voltage	1000 V AC for 1 minute between terminals and housing				
	Insulation resistance	50 MΩ between terminals and housing (with 500 VDC megger)				
	Operating temperature range	Operation: 0 to 50 °C, Storage: -10 to 60 °C (no condensation or freezing)				
	Operating humidity range	Operation, Storage: 35 to 85%RH (no condensation)				
Standards		CE / UKCA, UL (CSA)				
Piping specification		Modular (body size: 20)	Modular (body size: 30)	Modular (body size: 40)	Modular (body size: 50, 60)	
Material in contact with fluid		SUS304, Aluminium alloy, PPS, HNBR (Sensor: Pt, Au, Ni, Fe, lead glass (not RoHS compliant), Al_2O_3)				
Lead wire with connector		3 m				
Weight	Body	350 g	350 g	400 g	720 g	720 g
	Lead wire	90 g				

2.1 IO-Link specifications

IO-Link type	Device
IO-Link version	V1.1
Communication speed	COM2 (38.4 kbps)
Min. cycle time	3.3 ms
Process data length	Input Data: 4 bytes, Output Data: 0 byte
On request data communication	Available
Data storage function	Available
Event function	Available
Vendor ID	131 (0x0083)
Device ID	PF3A7R5H-xx-Lx-xxx 0X02E2 (738) PF3A7R5H-xx-L3x-xxx 0X02E3 (739) PF3A7R5H-xx-L4x-xxx 0X02E4 (740) PF3A701H-xx-Lx-xxx 0X018A (394) PF3A701H-xx-L3x-xxx 0X018B (395) PF3A701H-xx-L4x-xxx 0X018C (396) PF3A702H-xx-Lx-xxx 0X018D (397) PF3A702H-xx-L3x-xxx 0X018E (398) PF3A702H-xx-L4x-xxx 0X018F (399) PF3A704H-xx-Lx-xxx 0X02E5 (741) PF3A704H-xx-L3x-xxx 0X02E6 (742) PF3A704H-xx-L4x-xxx 0X02E7 (743) PF3A708H-xx-Lx-xxx 0X02E8 (744) PF3A708H-xx-L3x-xxx 0X02E9 (745) PF3A708H-xx-L4x-xxx 0X02EA (746)
IODD file	SMC-PF3A7*H-**-L*-***-yyyymmdd-IODD1.1

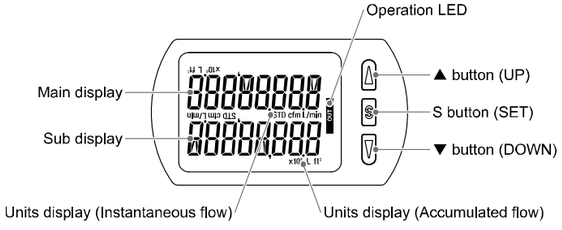
- The IODD configuration file can be downloaded from the SMC website (URL: https://www.smcworld.com).

3 Names of Individual parts

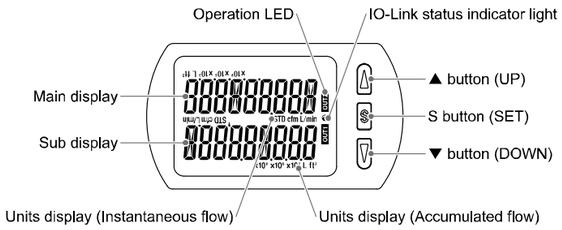


Element	Description
Display	See below
Connector	M12 4-pin connector for electrical connections.
Lead wire with M12 connector	Lead wire for power supply and outputs.
Piping port	For piping connections.
Body	The body of the product.

3.1 Display



- **IO-Link specification**



3 Names of Individual parts (continued)

Element	Description
Main display	Displays the instantaneous flow value and error codes. (2 colour display)
Operation LED	Indicates the output status of OUT. When the output is ON: Orange LED is ON. When the accumulated pulse output mode is selected, the output display will turn off.
Sub display	Displays the accumulated flow, set value, and peak/ bottom value when in measurement mode.
▲ button (UP)	Selects the mode and the display shown on the Sub display or increases the switch point.
S button (SET)	Press this button to change the mode and to set a value.
▼ button (DOWN)	Selects the mode and the display shown on the Sub display or decreases the switch point.
Units display (Instantaneous flow)	Indicates the flow measurement units currently selected.
Units display (Accumulated flow)	Indicates the flow measurement units currently selected.
IO-Link status indicator light	LED is ON when OUT1 is used in IO-Link mode. (LED is OFF in SIO mode)

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 pressure and temperature range.

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.

4.3 Mounting

- Never mount the product in a location where it will be used as a mechanical support.
- Mount the product so that the fluid flows in the direction indicated by the arrow on the side of the body.
- Avoid mounting the product with the display facing upward.
- Do not mount the product upside down.
- The monitor with integrated display can be rotated. Rotating the display with excessive force will damage the end stop.

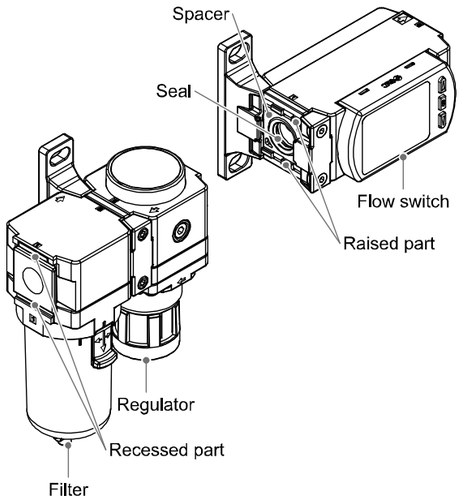
4 Installation (continued)

4.4 Piping

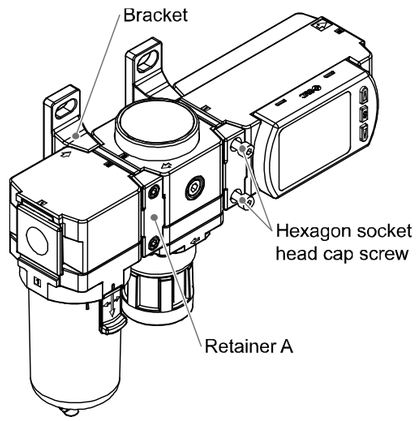
⚠ Caution

- Before connecting piping make sure to clean up chips, cutting oil, dust etc.
- When installing piping or fittings, ensure sealant material does not enter inside the port.
- Fit the raised part of the spacer to the recessed part (groove for the raised part) of the product.
- Temporarily tighten the retainer A with two hexagon socket head cap screws.
- Tighten the two hexagon socket head cap screws with a hexagonal wrench evenly.
- Refer to the table below for the screws tightening torque.

Applicable model	Hex wrench socket nominal size	Tightening torque
PF3A7R5H	2	0.36 ±0.036 N•m
PF3A701H	3	1.2 ±0.05 N•m
PF3A702H		
PF3A704H	4	2.0 ±0.1 N•m
PF3A708H		



4 Installation (continued)



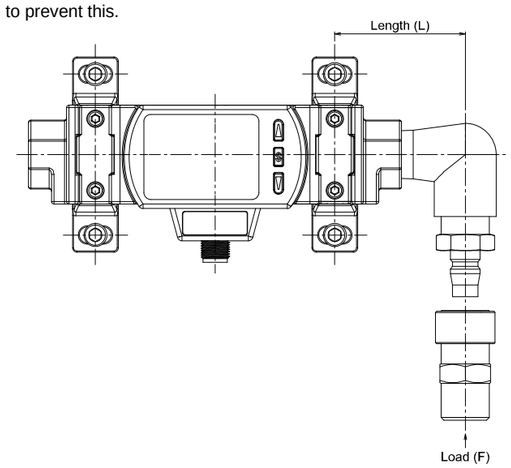
- The following options are required for coupling with modular F, R, and L combinations. They are separately prepared by the user.

Digital flow switch	Air combination	Spacer	Spacer with bracket	Pipe adapter
PF3A7R5H	AC20#-D	Y200-D	Y200T-D	E200-#02-D
PF3A701H	AC30#-D	Y300-D	Y300T-D	E300-#03-D
PF3A702H	AC40#-D	Y400-D	Y400T-D	E400-#04-D
PF3A704H	AC50#-D AC60#-D	Y600-D	Y600T-D	E600-#10-D
PF3A708H				

- Refer to the SMC website (URL: https://www.smcworld.com) for more details of options.

⚠ Caution

- Do not apply torsion or bending moment other than the weight of the product itself. External piping needs to be supported separately as it may cause damage. If a moment applied to the equipment is unavoidable during operation, the moment should be lower than the maximum moment shown below. Non-flexible piping like steel tube is susceptible to excessive moment load or vibration. Insert flexible tubes to prevent this.



Model	PF3A 7R5H	PF3A 701H	PF3A 702H	PF3A 704H	PF3A 708H
Maximum moment (M): N•m	14.5	16	19.5	45	

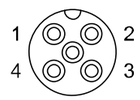
Max. moment (M) = Length (L) x Load (F)

4 Installation (continued)

4.5 Wiring

⚠ Caution

- **Do not perform wiring while the power supply is ON.**
- **Confirm proper insulation of wiring.**
- **Do not route wires and cables together with power or high voltage cables.**
  The product can malfunction due to interference of noise and surge voltage from power and high voltage cables. Route the wires of the product separately from power or high voltage cables.
- If a commercially available switching power supply is used, be sure to ground the frame ground (FG) terminal. If the product is connected to the commercially available switching power supply, switching noise will be superimposed and the product specifications will not be satisfied. 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 the series power supply.



Pin numbers of connector

When used as switch output device

No.	Name	Wire colour	Function
1	DC(+)	Brown	24 VDC
2	FUNC	White	Analogue output or External input
3	DC(-)	Blue	0 V
4	OUT	Black	Switch output

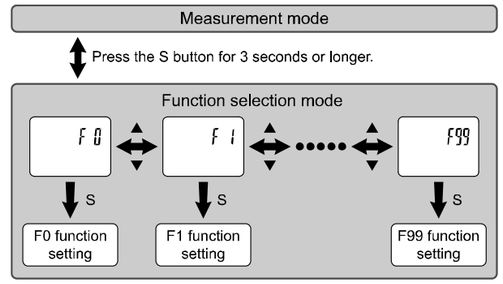
When used as IO-Link device

No.	Name	Wire colour	Function
1	DC(+)	Brown	21.6 to 30 VDC
2	N.C/Other	White	Not connected / Analogue output or External input
3	DC(-)	Blue	0 V
4	C/Q	Black	IO-Link data / Switch output (SIO)

5 Function Setting

5.1 Function selection mode

In measurement mode, press the SET button for 3 seconds or longer to display [F 0].
Press the UP or DOWN button to select the function to be changed.
Press and hold the SET button for 2 seconds or longer in function selection mode to return to measurement mode.



Refer to the SMC website (URL: https://www.smcworld.com) for more setting details.

5 Function Setting (continued)

5.1 Default settings

Function (Main display)		Default Settings (Right sub display)
(Main display)	(Left sub display)	
[F 0]	[FLU] Select fluid	[Air] Air, Nitrogen
	[rEF] Select display units	[Std] Standard condition
	[Uni] ([Unit]) Units selection	[L] L/min *1
	([norP]) Select NPN / PNP	([PnP]) PNP output
	([ioL]) IO-Link enable / disable	([on]) IO-Link enabled
[F 1]	[oUt] ([oUt1]) Output mode	[HYS] Hysteresis mode
	[ot] ([1ot]) Switch mode	[P] ([1_P]) Normal output
	[P] ([P_1]) Input switch operation	[250] 250 L/min (PF3A7R5H)
		[500] 500 L/min (PF3A701H)
		[1000] 1000 L/min (PF3A702H)
		[2000] 2000 L/min (PF3A704H)
		[4000] 4000 L/min (PF3A708H)
	[H] ([H_1]) Setting of Hysteresis	[25] 25 L/min (PF3A7R5H)
		[50] 50 L/min (PF3A701H)
		[100] 100 L/min (PF3A702H)
		[200] 200 L/min (PF3A704H)
		[400] 400 L/min (PF3A708H)
	([dt1]) Delay time setting	([0.00]) 0.00 s
	[CoL] Select display colour	[SoG] ([1SoG]) Green when ON, Red when OFF (OUT1)
([F 2]) *2	[oUt2] Output mode	[HYS] Hysteresis mode
	[2ot] Switch mode	[2_P] Normal output
	[P_2] Input switch operation	[250] 250 L/min (PF3A7R5H)
		[500] 500 L/min (PF3A701H)
		[1000] 1000 L/min (PF3A702H)
		[2000] 2000 L/min (PF3A704H)
		[4000] 4000 L/min (PF3A708H)
	[H_2] Setting of Hysteresis	[25] 25 L/min (PF3A7R5H)
		[50] 50 L/min (PF3A701H)
		[100] 100 L/min (PF3A702H)
		[200] 200 L/min (PF3A704H)
		[400] 400 L/min (PF3A708H)
	[dt2] Delay time setting	[0.00] 0.00 s
	[CoL] Select display colour	[1SoG] Green when ON, Red when OFF (OUT1)
[F 3]	[FiL] Select digital filter	[1.0] 1 second
[F 5]	[FnC] ([FUnC]) FUNC (analogue output / external input) *3	[oUt] ([AoUt]) Analogue output
[F10]	[SUb] Select sub display (Line name setting) *4	[dEF] Default setting
[F13]	[rEv] Select Reverse display	[oFF] Reverse display OFF
[F14]	[CUt] Zero cut-off setting	[1.0] 1%F.S. cut
[F30]	[SAv] ([SAvE]) Accumulated value hold	[oFF] Not stored
[F80]	[dSP] ([diSP]) Display OFF mode	[on] Display ON
[F81]	[Pin] Security code	[oFF] Not used
[F90]	[ALL] Setting of all functions	[oFF] Not used
[F96]	[Sin] ([S_in]) Check of input signal	[- - -] No input signal
[F98]	[tES] ([tESt]) Output check	[n] Normal output
[F99]	[ini] Reset to the default settings	[oFF] Not used

*: Items in brackets ( ) are IO-Link specifications.
*1: Setting is only possible for models with the units selection function.
*2: [F 2] The OUT2 setting can be set on the product screen, but since there is no OUT2 switch output function, it is not possible to output the ON/OFF signal to an external device.
*3: When the 1 switch output type (output specification symbol is L) is used, [F 5] is displayed as [---] and cannot be set.
1 to 5 V or 0 to 10 V can be selected when the analogue voltage output type is used. Analogue output free range function can be selected.
*4: When Line name is selected, a suitable line name can be input.

6 Other Settings

- **Flow switch setting and functions**
- **IO-Link functions**
- **Zero cut off function**

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

7 How to Order

Refer to the SMC website (URL: https://www.smcworld.com) for more How to Order details.

8 Outline Dimensions (mm)

Refer to the SMC website (URL: https://www.smcworld.com) for details of Outline dimensions..

9 Maintenance

9.1 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.
- Remove condensate periodically.
  If condensate enters the secondary side, it can cause operating failure of pneumatic equipment.
- Do not use solvents such as benzene, thinner etc. to clean the product. This may damage the surface of the body or erase the markings on the body.
  Use a soft cloth to remove stains.
  For heavy stains, use a damp cloth that has been soaked with diluted neutral detergent and fully squeezed, then wipe up the stains again with a dry cloth.
- 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.

10 Limitations of Use

10.1 Limited warranty and Disclaimer/Compliance Requirements
Refer to Handling Precautions for SMC Products.

11 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.

12 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.smc.eu (Europe)
SMC Corporation, 1-5-5, Kyobashi, Chuo-ku, Tokyo 104-0031, JAPAN
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