



Installation & Maintenance Manual
Digital Flow Switch
Series PFM710 / 725 / 750 / 711



Safety Instructions

- This manual contains essential information for the protection of users and others from possible injury and/or equipment damage.
- Read this manual before using the product, to ensure correct handling, and read the manuals of related apparatus before use.
- Keep this manual in a safe place for future reference.
- These instructions indicate the level of potential hazard by label of "DANGER", "WARNING" or "CAUTION", followed by important safety information which must be carefully followed.
- To ensure safety of personnel and equipment the safety instructions in this manual and the product catalogue must be observed, along with other relevant safety practices.

	DANGER	In extreme conditions, there is a possible result of serious injury or loss of life.
	WARNING	If instructions are not followed there is a possibility of serious injury or loss of life.
	CAUTION	If instructions are not followed there is a possibility of injury or equipment damage.

Safety Instructions (continued)

- Connect wires and cables correctly, and do not connect while the power is ON.
- Do not route wires and cables together with power or high-voltage cables.
- Check the insulation of wires and cables.
- Take proper measures against noise, such as noise filters, when the product is incorporated in equipment or devices.
- Select the required protection (IP) rating according to the environment of operation.
- Take sufficient shielding measures when the product is to be used in the following conditions:
 - (1) where noise due to static electricity is generated.
 - (2) where electro-magnetic field strength is high.
 - (3) where radioactivity is present.
 - (4) where power lines are located.
- Do not use the product in a place where electric surges are generated.
- Use suitable surge protection when a surge generating load such as a solenoid valve are to be directly driven.
- Prevent any foreign matter from entering this product.
- Use the product within the specified ambient temperature range.
- Do not expose the product to any heat radiation.
- Do not clean the product with chemicals such as benzene or thinners.

Power Supply selection

A UL approved direct current (DC) power supply should be used with this product, as follows:

1. A limited voltage / current supply in accordance with UL508.

A circuit from which power is supplied by the secondary coil of a transformer according to the following:

Maximum voltage (no load): Less than 30Vrms (42.4V peak)

Maximum current: (1) Less than 8A (including when short circuited)

- (2) Limited by circuit protection (such as a fuse) with the following rating.

No load voltage (V peak)	Max. current (A)
0 bis 20 [V]	5.0
20 to 30 [V]	100 / peak voltage

2. A Class 2 power supply unit in accordance with UL1310, or a power supply circuit of maximum 30Vrms (42.4V peak) or less, using a Class 2 transformer in accordance with UL1585 as power source.

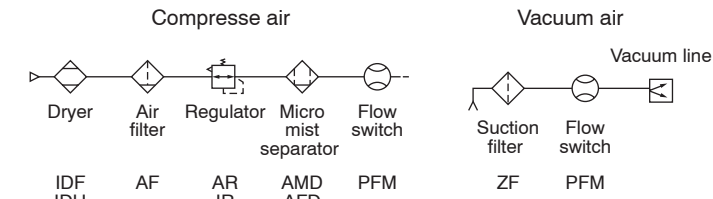
NOTE

Follow the instructions given below when handling the flow switch. Otherwise damage, failure or malfunction of the device may result.

- Make sure to operate the switch within the specified voltage range.
- Make sure the flow and operating pressure are within the specified limits.
- Data input to the flow switch is not deleted even if the power supply is disconnected.
- Confirm the pressure loss at the sensor according to the flow characteristic (Pressure loss) graph when designing piping.
- For piping of the flow switch, hold the piping with a spanner on the metal part of the piping (Piping attachment).
- Install or connect the flow switch so that the flow direction specified on the label matches with actual flow direction.
- Do not mount the body with the bottom facing upwards.
- Before piping the flow switch, ensure dust is eliminated from the piping by cleaning with a blast of air.
- Never mount a switch in a place that will be used as a foothold during piping.
- Use dry air which complies with the quality grade of ISO8573-1 1.1.2 to 1.6.2: 2001.
- Install a filter or mist separator to the inlet if contamination of the fluid is possible to avoid failure or malfunction. See recommended pneumatic circuit example.

NOTE

Recommended pneumatic circuit example



- Wire as short as possible to avoid the effect of noise and surge.
- Never use in the presence of explosive gases.
- Do not apply heat cycle to the flow switch.
- Avoid using switches in an environment where there is a likelihood of splashing or spraying of water, chemicals, or oil.
- Do not mount the flow switch where vibration (98m/s² or less) and impact (490m/s² or less) exist to avoid failure and malfunction.
- Operation under low temperature (5°C or less) leads to damage or failure if the fluid or air contains frozen moisture.
- Do not short circuit the load.
- Do not press set buttons with a sharp pointed object.
- Supply power when there is no flow.
- The flow switch will not operate for 3 sec. after the power is supplied.
- Flow switch measurement output at initial setting and flow setting is switched with conditions before setting.
- Maintenance and inspection should be performed periodically.
- Display analogue output may fluctuate by 2 to 3% for 10 min. after supplying power to the flow switch.
- Do not poke inside a piping port with a sharp object.
- The flow rate of the flow switch, which has a restrictor, may change if the needle turns due to vibration.
- The accuracy may fluctuate by 2 to 3% if a customer removes or replaces piping by themselves.

WARNING

- **Do not disassemble, modify (including change of printed circuit board) or repair the product.**

An injury or product failure may result.

- **Do not operate the product beyond the specification range.**

Fire, malfunction or equipment damage may result. Use the product only after confirming the specifications.

- **Do not use the product in the presence of flammable, explosive or corrosive gas.**

Fire, explosion or corrosion may result. This product does not have an explosion proof construction.

- **When using the product as part of an interlocking system:**

- 1) Provide a double interlocking system, for example a mechanical system.

- 2) Check the product regularly to ensure proper operation.

- **Before performing maintenance, be sure of the following:**

- 1) Turn off the power supply.
- 2) Stop the air supply, exhaust the residual pressure and verify the release of air from the system.

CAUTION

- **Always perform a system check after maintenance.**

Do not use the product if any error occurs.

Safety cannot be assured if caused by un-intentional malfunction.

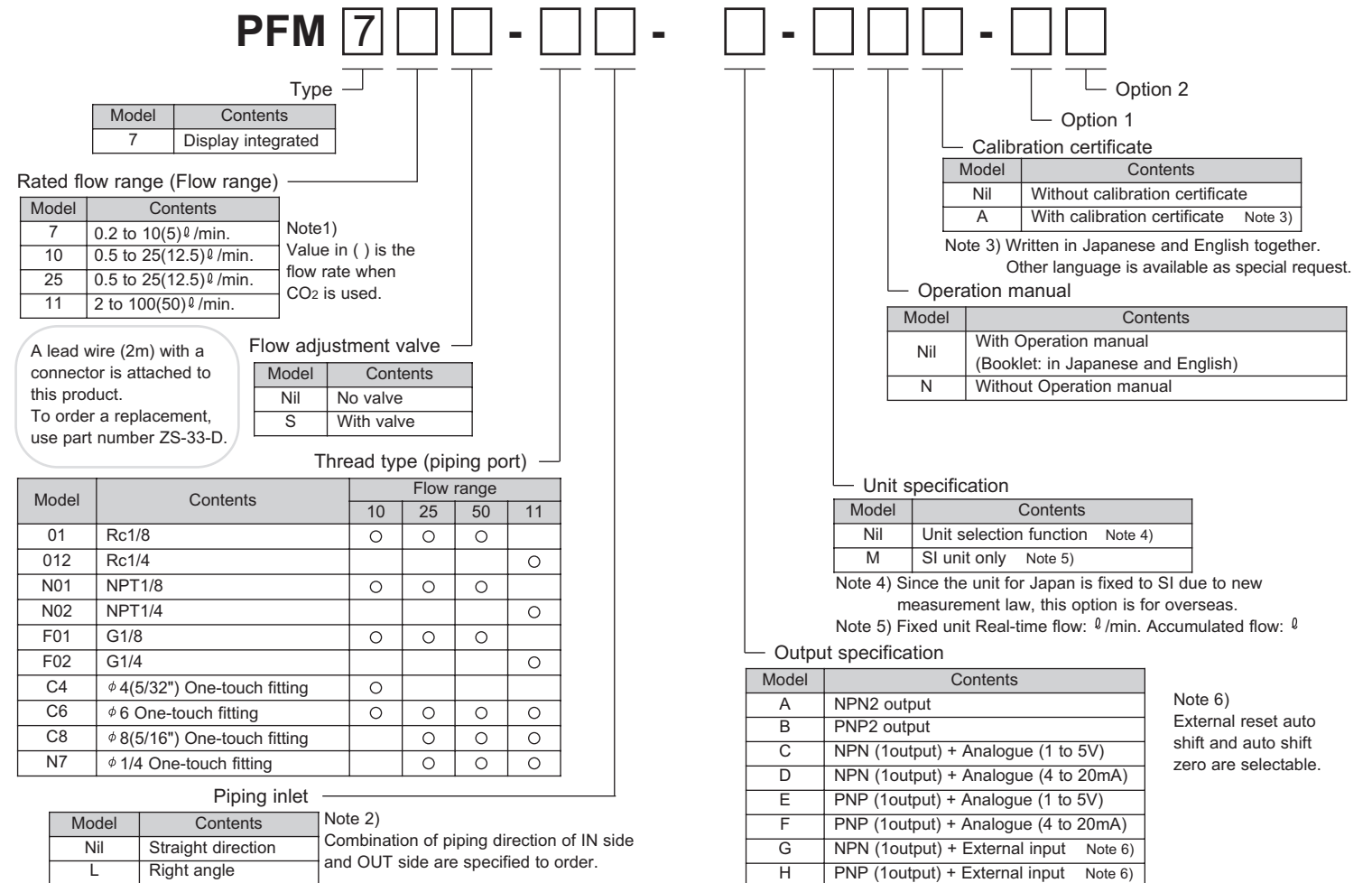
- **Provide grounding to ensure correct operation and to improve noise resistance of the product.**

This product should be individually grounded using a short cable.

- **Follow the instructions given below when handling the product. Failing to do so may result in product damage.**

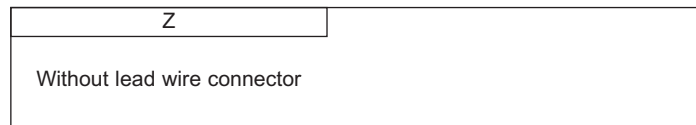
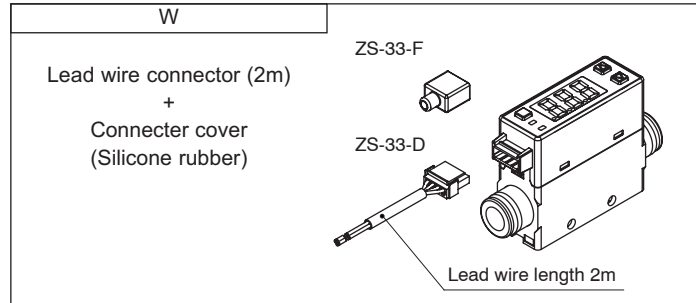
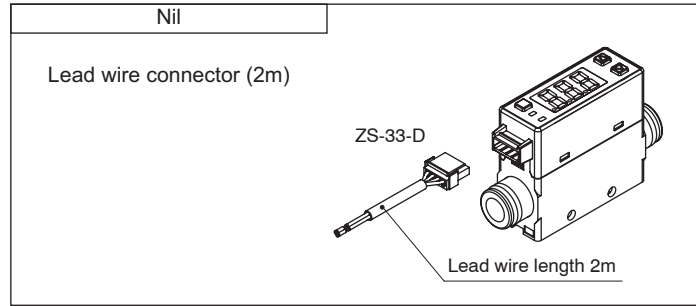
- Maintenance space should always be provided around the product.
- Do not remove labels from the product.
- Do not drop, hit or apply excessive shock to the product.
- Follow all specified tightening torques.
- Do not bend, apply tensile force, or apply force by placing heavy loads, on the cables.

Model Indication Method

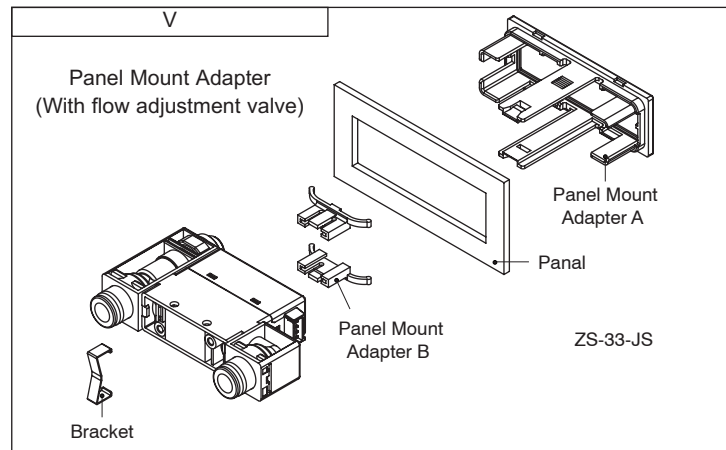
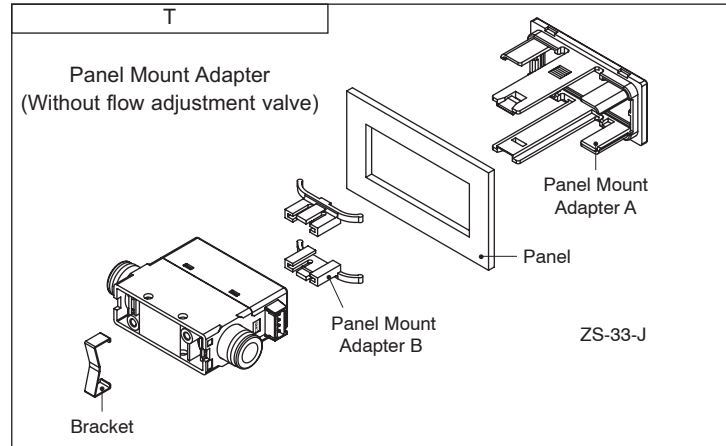


Model Indication Method (continued)

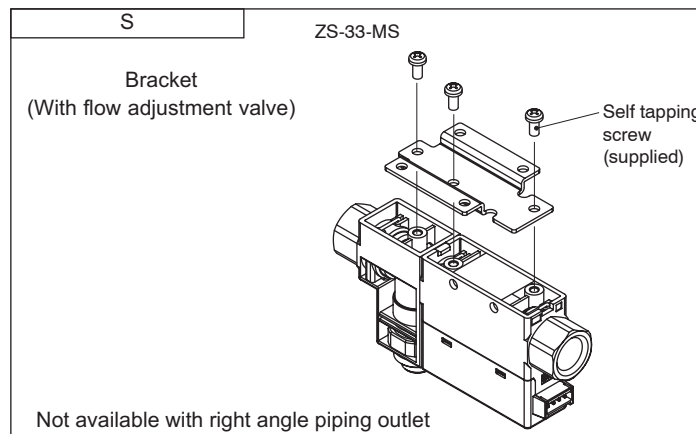
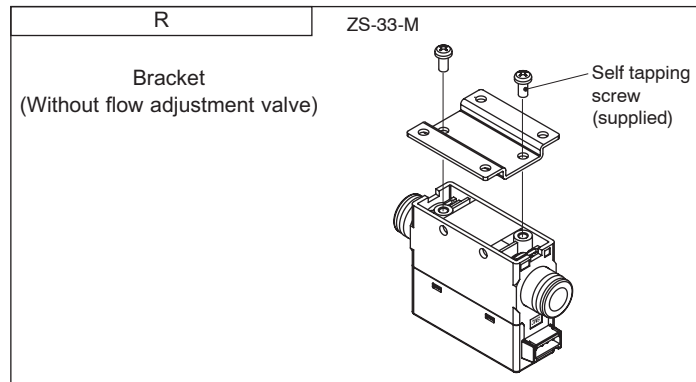
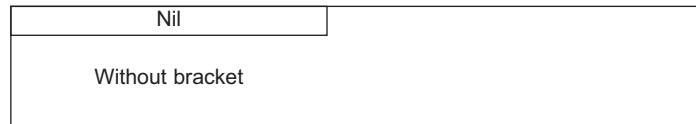
Option1



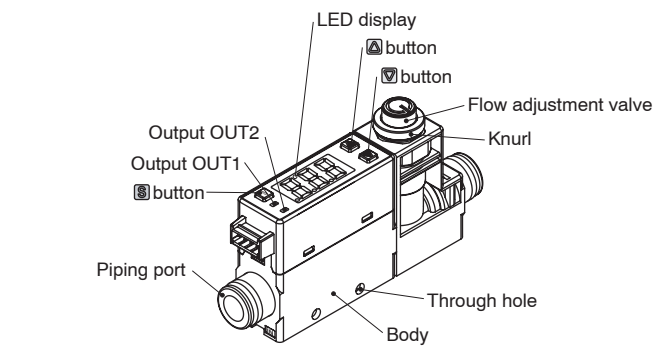
Option2



Option2



Names and Functions of Individual Parts



Output (OUT1) display (green): Lights when output OUT1 turns on. Flashes when an overcurrent error occurs.

Output (OUT2) display (red): Lights when output OUT2 turns on. Flashes when an overcurrent error occurs.

LED display panel: Displays flow value, set mode condition, and error code. Indication colour is selectable from red and green depending on output (OUT1) condition.

▲ button: Selects the mode and increases the mode or ON/OFF set value. Press this button to change to the peak display mode.

▼ button: Selects the mode and decreases the mode or ON/OFF set value. Press this button to change to the bottom display mode.

■ button: Press this button to change to each mode and to set a set value.

Reset: Press ▲ and ▼ buttons simultaneously to start reset function. This is to clear the condition when an abnormality occurs.

Body: Flow switch itself.

Flow adjustment valve: Orifice mechanism to adjust the flow.

Piping port: Connection port of piping.

Knurl: Used to fix the flow adjustment valve.

Through hole: Used to mount the flow switch on a DIN rail or a panel directly.

Specifications

Model	PFM710	PFM725	PFM750	PFM711
Measured fluid	Dry air, N ₂ , Ar, CO ₂ (Air quality class is JIS B8392-1 1.1.2 to 1.6.2, ISO8573-1 1.1.2 to 1.6.2)			
Rated flow range (measurement range)	Dry air, N ₂ , Ar 0.2 to 10 ^l /min.	0.5 to 25 ^l /min.	1 to 50 ^l /min.	2 to 100 ^l /min.
Possible display range (Note1)	Dry air, N ₂ , Ar 10.5 ^l /min.	26.3 ^l /min.	52.5 ^l /min.	105 ^l /min.
Settable range (Note1)	Dry air, N ₂ , Ar 0 to 10.5 ^l /min.	0 to 26.3 ^l /min.	0 to 52.5 ^l /min.	0 to 105 ^l /min.
Minimum set unit (Note 2)	0.01 ^l /min.	0.1 ^l /min.	0.1 ^l /min.	0.1 ^l /min.
Accumulated pulse flow rate exchange value	0.1 ^l /Pulse	0.1 ^l /Pulse	0.1 ^l /Pulse	0.1 ^l /Pulse
Display unit (Note 3)	Real-time flow rate ^l /min.		CFM x 10 ⁻²	
Accuracy	Display accuracy: ± 3%F.S. or less (Fluid: Dry air) Analogue output accuracy: ± 5%F.S. or less			
Repeatability	± 1%F.S. or less (Fluid: Dry air) Analogue output accuracy ± 3%F.S. or less			
Pressure characteristic	± 5%F.S. or less (0.35MPa reference)			
Temperature characteristics	± 2%F.S. (15 to 35°C) ± 5%F.S. (0 to 50°C)			
Operating pressure range	-70kPa to 750kPa			

Model	PFM710	PFM725	PFM750	PFM711
Enclosure	IP40			
Operating fluid temp.	0 to 50°C (No freezing or condensation)			
Operating temp. range	Operating: 0 to 50°C Stored: -10 to 60°C (No freezing or condensation)			
Operating humidity range	Operating, stored 35 to 85%R.H. (No condensation)			
Withstand voltage	1000VAC, 1 min. Between external terminals and case			
Insulation resistance	50MΩ or more (500VDC Mega) Between external terminals and case			
Vibration resistance	Without flow adjustment valve: 10 to 500Hz at whichever smaller 1.5mm amplitude or 98m/s ² acceleration in X, Y, Z directions for 2 hours each With flow adjustment valve: 10 to 150Hz at whichever smaller 1.5mm amplitude or 19.6m/s ² acceleration in X, Y, Z directions for 2 hours each			
Impact resistance	490m/s ² X,Y,Z directions 3 times for each			

Part No.	01	02	N01	N02	F01	F02	C4	C6	C8	N7
Port size	Rc 1/8	Rc 1/4	NPT 1/8	NPT 1/4	G 1/8	G 1/4	φ 4 (5/32") One-touch fitting	φ 6 One-touch fitting	φ 8 (5/16") One-touch fitting	φ 1/4 One-touch fitting

Proof pressure	1MPa
Accumulated flow range	Max.999999 ^l Note 4)
Switch output	NPN or PNP open collector output
Max. load current	80mA
Max. supply voltage	28VDC (NPN output)
Internal voltage drop	NPN output: 1V or less (at 80mA) PNP output: 1.5V or less (at 80mA)
Response time	1 sec. (50 msec., 0.5 sec., 2 sec. are selectable)
Output protection	Short circuit protection, excess current
Response time	1.5 sec. or less (Response 90%)
Analogue output (Note 5)	Voltage output: 1 to 5V Output impedance: 1kΩ
Current output	Output current: 4 to 20mA Max. load impedance: 600Ω Min. load impedance: 50Ω
Hysteresis mode (Note 6)	Variable
Window comparator mode	Variable
External input	No voltage input (Reed switch or solid state) Input 30 msec. or more
Display	3 digits 7 segment display 2 colour indication (Red/Green) Update cycle: 10 times/s
Indicator light	OUT1: ON when light is on (Green) OUT2: ON when light is on (Red)
Source voltage	24VDC ± 10%
Power consumption	55mA or less

Weight	Straight without flow adjustment valve	95g	125g	55g
	Right angle without flow adjustment valve	105g	135g	65g
	Straight with flow adjustment valve	135g	165g	95g
	Right angle with flow adjustment valve	145g	175g	105g
Fluid contact material	LCP, PBT, brass (electroless nickel plating), HNBR (+fluorine coating), FKM (+fluorine coating), silicone, Au, SUS304			

Note 1) If min. set unit (0.01^l/min.) is selected for 10^l/min. type, upper limit of the display is [9.99^l/min.]. If min. set unit (0.1^l/min.) is selected for 100^l/min. type, upper limit of the display is [99.9^l/min.].

Note 2) With PFM710, 0.01^l/min. and 0.1^l/min. are selectable. With PFM711, 0.1^l/min. and 1^l/min. are selectable. When CFM is selected as display unit, the minimum set unit cannot be changed. With ex-factory conditions, PFM710 is set at 0.1^l/min., and PFM711 is set at 1^l/min..

Note 3) <ANR> at ex-factory. <ANR> means standard condition at 20 centigrade, 1 atm. 65%R.H.. N^l/min. means reference condition at 0 centigrade, at 1 atm.. When equipped with unit change function. (For type without unit change function, the unit is fixed to SI (l/min. or l))

Note 4) Cleared by turning off the power. Possible to select the holding function (with interval of 2 min. or 5 min.). If 5 min. is selected, and when the life of memory element (electronic component) is 1 million cycles (energized for 24 hours/day), the life will be (5 min. x 1 million cycles = 5 million min. =) 9.5 years at the longest. When this function is used, calculate the life based on operating conditions and use within the life range.

Note 5) Response time is set at 1.5 sec. (90%) with ex-factory conditions. 100 msec. is selectable as well.

Note 6) With ex-factory conditions, the mode is hysteresis mode. Window comparator mode is selectable by button.

Installation

Installation

How to mount

Panel Mount mounting

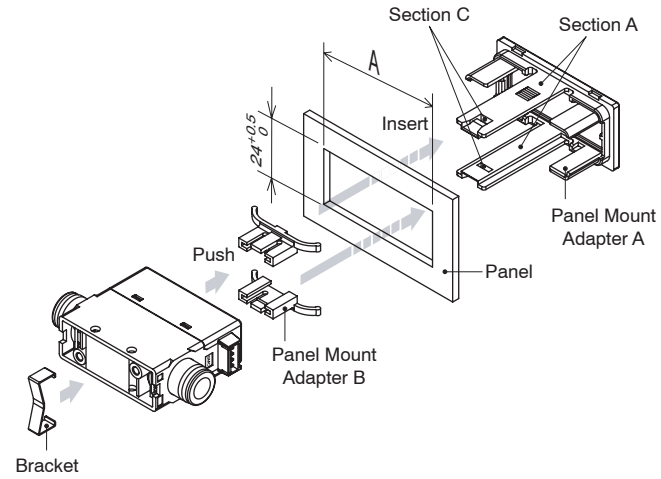
- Insert Panel Mount Adapter B supplied as an accessory into Section A of Panel Mount Adapter A.

Push Panel Mount Adapter B from behind till the display is fixed onto the panel.

The pin of Panel Mount Adapter B engages the notched part of Panel Adapter C to fix the display.

- The switch can be mounted on a panel with a thickness of 1 to 3.2mm.

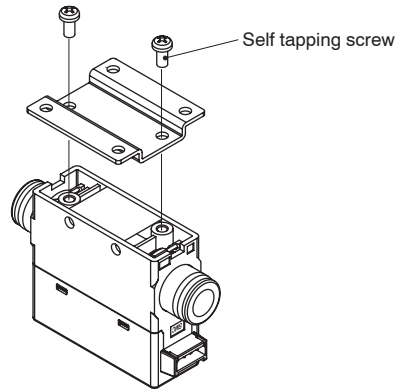
- See the illustration below for panel cut out dimensions.



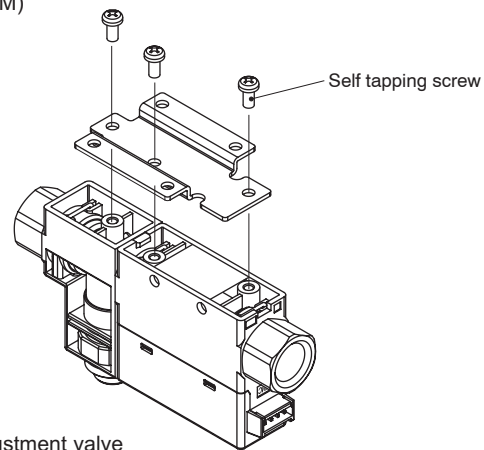
	Dimension A	Adaptor model
Without flow adjustment valve	54 ^{+0.5} ₀	ZS-33-J
With flow adjustment valve	74 ^{+0.5} ₀	ZS-33-JS

Bracket mounting

- Fasten the bracket mounting screws at a clamping torque of 0.5 ± 0.05N·m.



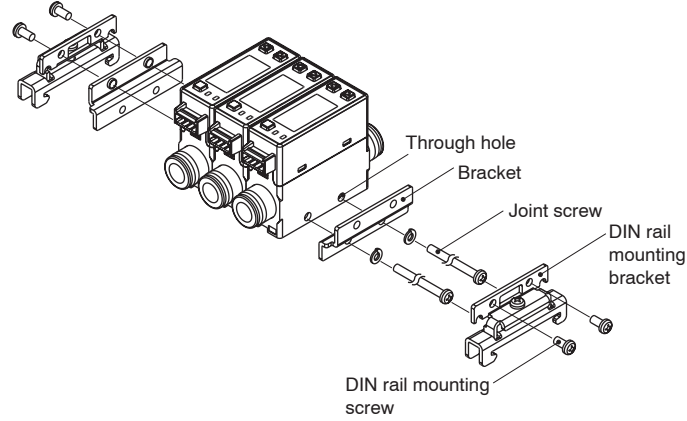
Without flow adjustment valve
(using ZS-33-M)



With flow adjustment valve
(using ZS-33-MS)

DIN rail mounting (using ZS-33-R)

- The tightening torque for DIN rail mounting screws and joint screws should be 0.4 ± 0.05N·m.



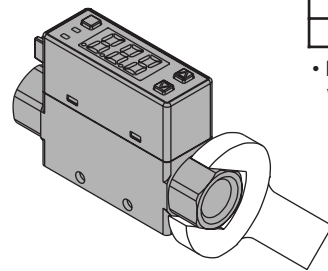
Note) Not applicable if the thread type is F02.

Piping

- Ensure tightening torque is correct when installing piping.
- Refer to the following table for the appropriate torque values.

Nominal size of screws	Appropriate torque N·m
Rc1/8	7 to 9
Rc1/4	12 to 14

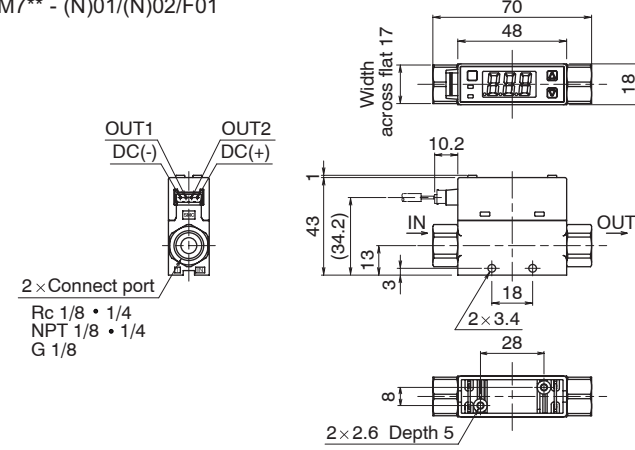
- Hold the metal part with the spanner when piping.



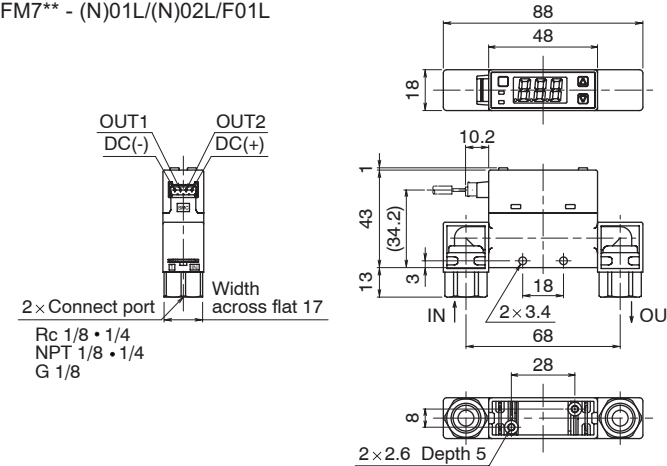
- For one-touch fitting, insert the piping to the end so that it cannot be pulled out.
- Inserting the piping with excessive force can cause damage.
- Ensure there is no leakage after piping.
- Use this flow switch within the specified operating pressure range and operating temperature range.
- Withstand pressure is 1.0MPa.

Outline with Dimensions (mm)

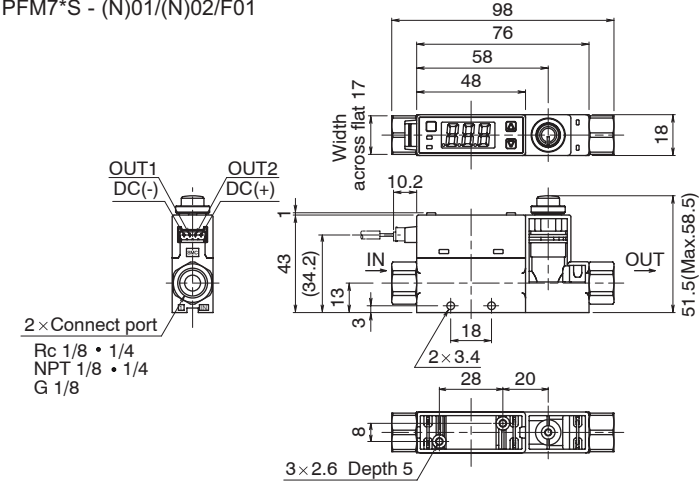
PFM7** - (N)01/(N)02/F01



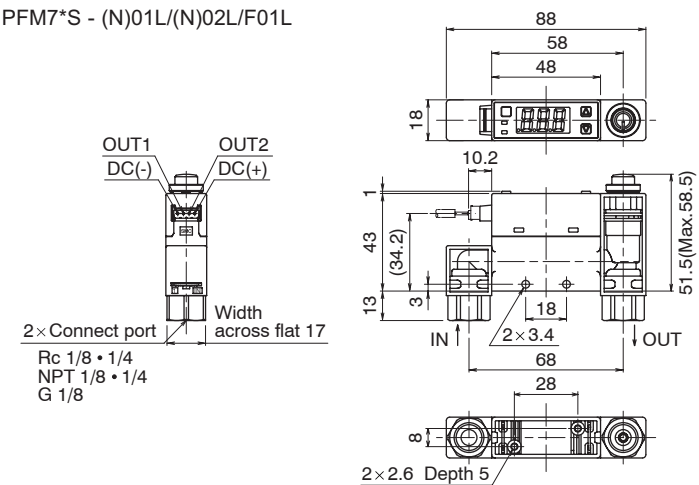
PFM7** - (N)01L/(N)02L/F01L



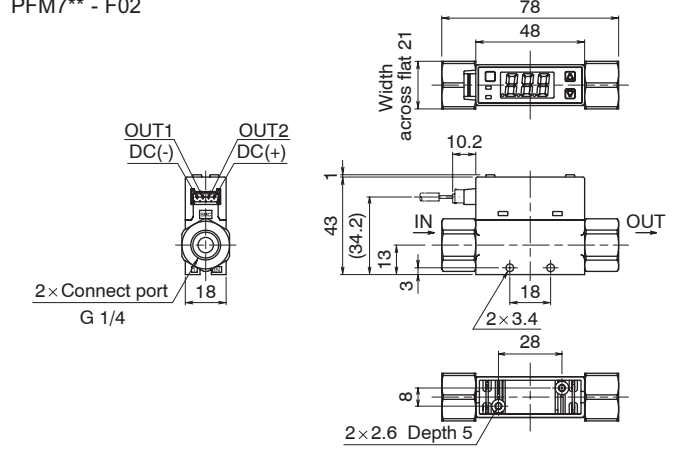
PFM7*S - (N)01/(N)02/F01



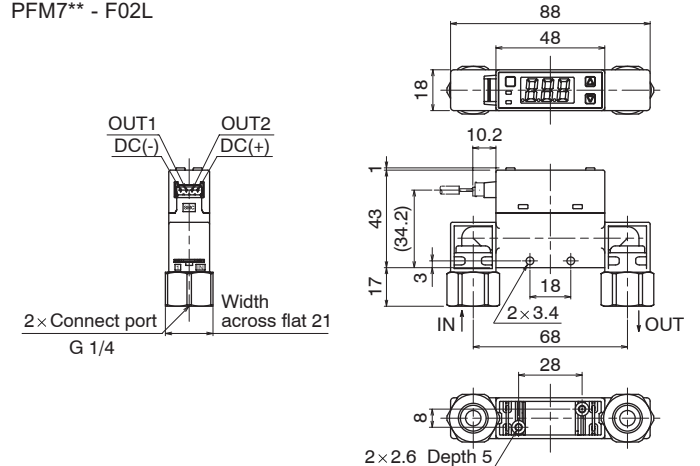
PFM7*S - (N)01L/(N)02L/F01L



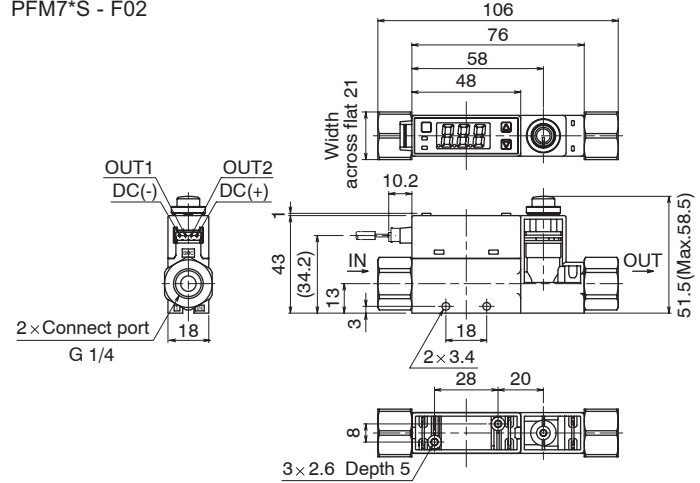
PFM7** - F02



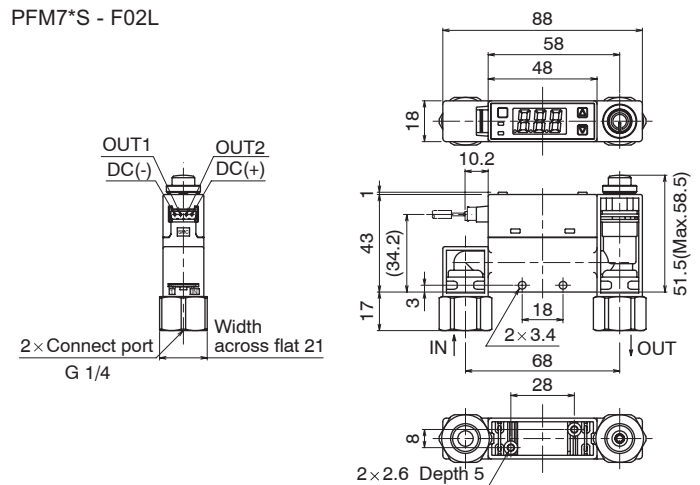
PFM7** - F02L



PFM7*S - F02

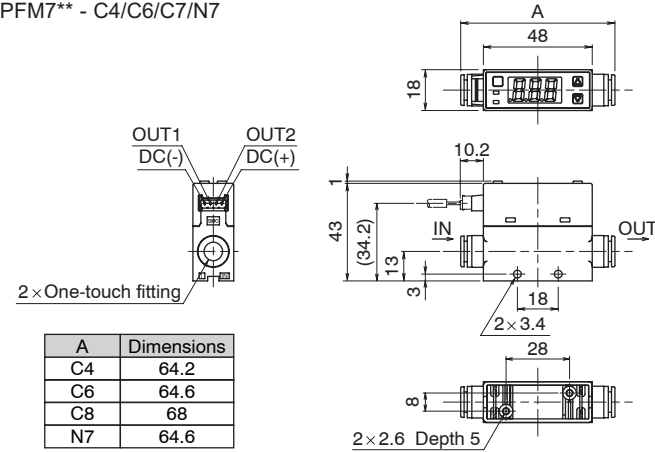


PFM7*S - F02L

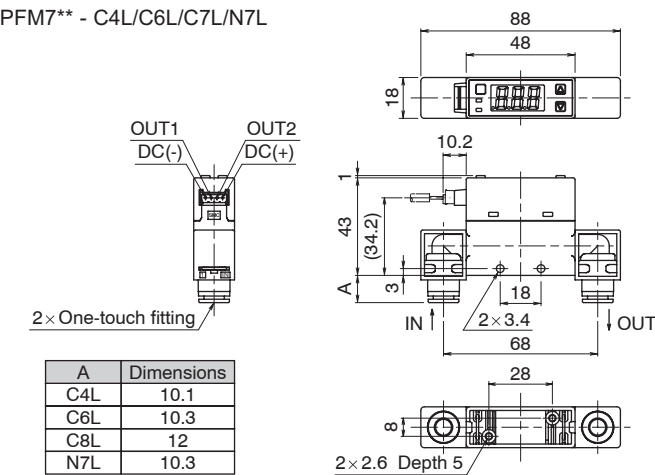


Outline with Dimensions (mm) (continued)

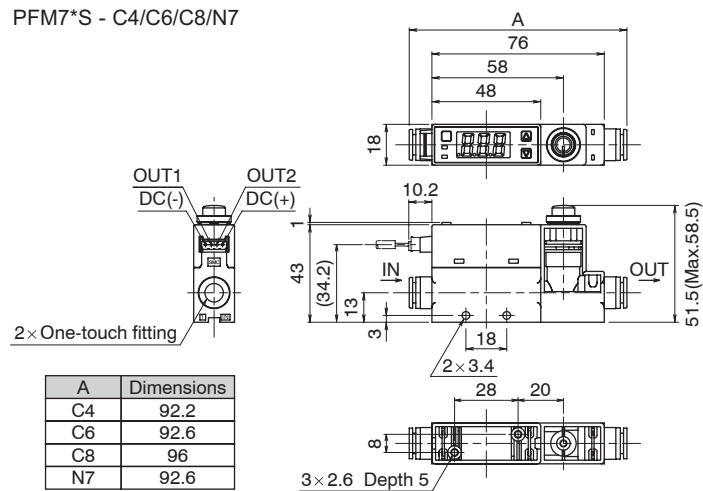
PFM7** - C4/C6/C7/N7



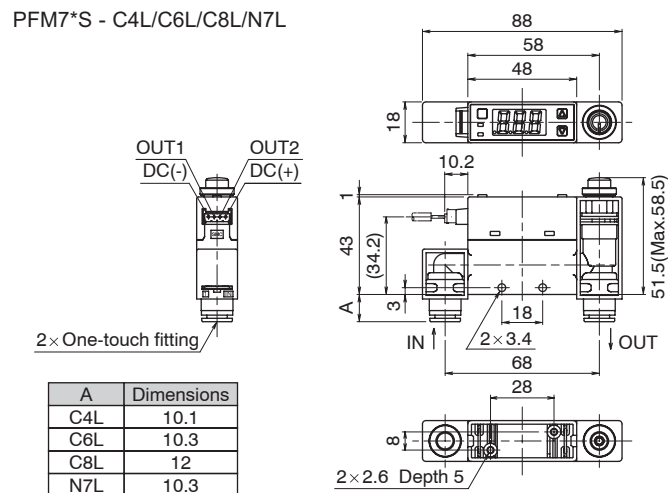
PFM7** - C4L/C6L/C7L/N7L



PFM7*S - C4/C6/C8/N7



PFM7*S - C4L/C6L/C8L/N7L



Internal Circuit and Wiring

Wiring

Connection

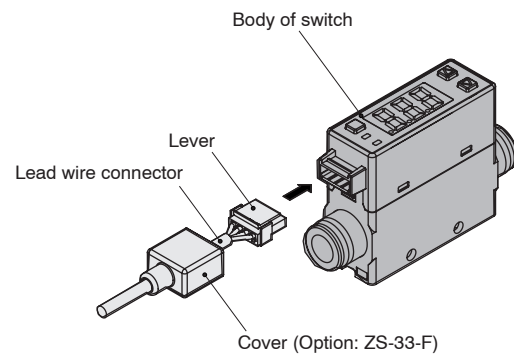
Make connection after turning the power off.

- Use a separate route when installing wire.
- Malfunction stemming from noise may occur if wire is installed in the same route as that of power or high-voltage cable.
- Be sure to ground terminal FG when using a switching regulator obtained on the market. If analogue output is performed connecting to a switching regulator (available on the market), switching noise will be superimposed and product specification can no longer be met. This can be prevented by inserting a noise filter, such as a line noise filter and a ferrite element, between the switching regulator and the pressure switch, or by using a series power supply instead of a switching regulator.

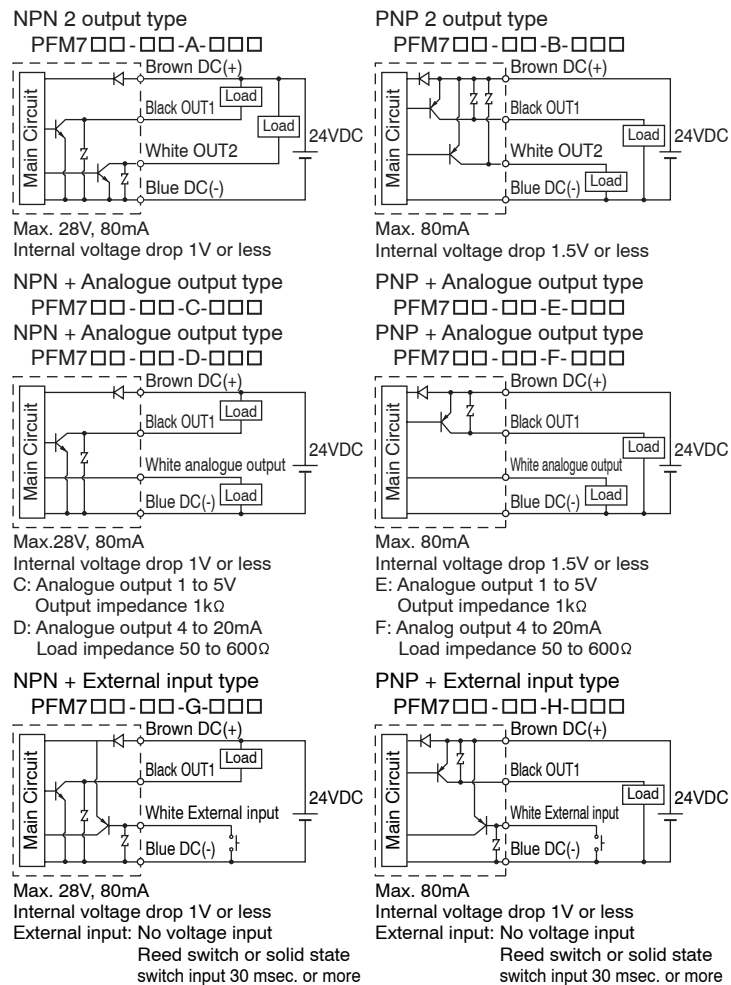
Connector

Connector Connecting / Disconnecting

- When connecting the connector, insert it straight onto the pin holding the lever and connector body between fingers and lock the connector by pushing the lever claw into the square groove in the body of the switch.
- When disconnecting the connector, push down the lever by thumb to disengage the lever claw from the square groove. Then pull the connector straight out.



Internal circuit and wiring example



Setting

Flow setting

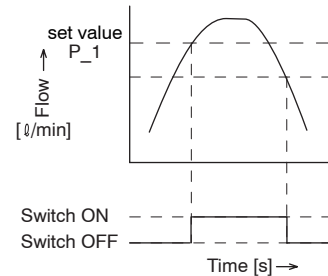
Set ON point and OFF point of the switch.

Operation

When the flow rate exceeds the setting point, the switch will be turned on. When the flow rate falls below the setting point by hysteresis or more, the switch will be turned off.

The switch is adjusted such that it will be turned on with the centre point of a flow rate setting range each product specification has.

If the operation shown below doesn't cause any problem, do not change the settings.



<Setting procedure> Note) The flow switch will also output during setting.

- 1 Press the button once in the measurement mode.



- 2 [P_1] and set value are displayed in turn.



- 3 Press the or button to change the set value. The button is for increase and the button is for decrease.

- Press the button once to increase by one figure and press it continuously to keep increasing the set figure.



- Press the button once to decrease by one figure and press it continuously to keep decreasing the set figure.



- 4 Press the button to finish the setting. If 2 outputs specification is selected, [P_2] is displayed. Continue setting work.

Zero clear of display
Display is reset to zero when and button are pressed simultaneously for 1 sec..
For initial use, implementation of zero clear is recommended.

Error Indication

Error indication function

This function is to display error location and content when a problem or an error occurs.

Error Name	Error Display	Error Content	Troubleshooting
Flow Error	XXX	Flow exceeds the upper limit of the flow display range.	Reduce the flow.
	LLL	-5% or more flow in the reverse direction.	Direct the flow to the proper direction.
Overcurrent Error	Er1	Load current of the switch output (OUT1) exceeds 80mA.	Turn off the power supply and eliminate the cause of excess current. Then supply the power again.
	Er2	Load current of the switch output (OUT2) exceeds 80mA.	Turn off the power supply and eliminate the cause of excess current. Then supply the power again.
System Error	Er0	Condition is that of before the adjustment at factory. Internal circuit may be damaged.	Stop operation immediately and contact SMC Sales office.
Zero clear error	Er3	System error. Failed to memorize the data, or internal circuit may be damaged.	Reset using reset function.
	Er4	If fluid flows during zero clear setting (pressing and buttons simultaneously below 1 sec.), "Er4" is indicated on the screen for 1 sec..	Please check that fluid doesn't flow at the time of zero clear setting.
Flow Error	999 Accumulated flow displayed	Accumulated flow range is exceeded.	Clear the accumulated flow. (If accumulated flow is not used, this is not a problem.)

If the above remedy does not recover the operation, the error needs to be investigated by SMC.

Contact

AUSTRIA	(43) 2262 62280	NETHERLANDS	(31) 20 531 8888
BELGIUM	(32) 3 355 1464	NORWAY	(47) 67 12 90 20
CZECH REP.	(420) 541 424 611	POLAND	(48) 22 211 9600
DENMARK	(45) 7025 2900	PORTUGAL	(351) 21 471 1880
FINLAND	(358) 207 513513	SLOVAKIA	(421) 2 444 56725
FRANCE	(33) 1 6476 1000	SLOVENIA	(386) 73 885 412
GERMANY	(49) 6103 4020	SPAIN	(34) 945 184 100
GREECE	(30) 210 271 7265	SWEDEN	(46) 8 603 1200
HUNGARY	(36) 23 511 390	SWITZERLAND	(41) 52 396 3131
IRELAND	(353) 1 403 9000	UNITED KINGDOM	(44) 1908 563888
ITALY	(39) 02 92711		

SMC Corporation

URL <http://www.smcworld.com> (Global) <http://www.smceu.com> (Europe)

Specifications are subject to change without prior notice from the manufacturer.
© SMC Corporation All Rights Reserved.