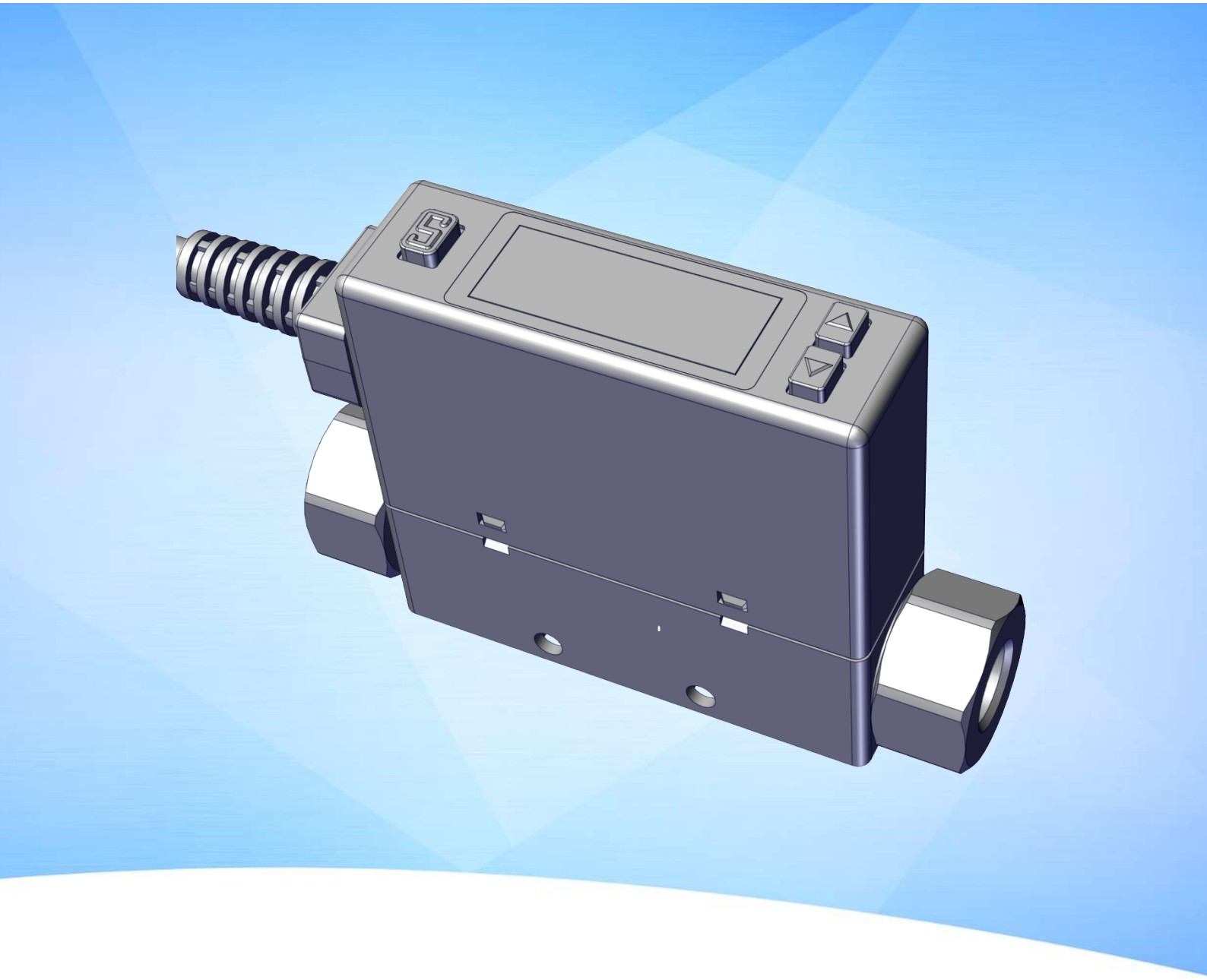

Assembly Instructions

Flow Sensor FS

WWW.SCHMALZ.COM

EN-US · 30.30.01.02533 · 02 · 12/22

Note

The Assembly instructions were originally written in German. Store in a safe place for future reference. Subject to technical changes without notice. No responsibility is taken for printing or other types of errors.

Published by

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www.schmalz.com/salesnetwork

Contents

1 Important Information

1.1 Note on Using this Document

J. Schmalz GmbH is generally referred to as Schmalz in this document.

The document contains important notes and information about the different operating phases of the product:

- Transport, storage, start of operations and decommissioning
- Safe operation, required maintenance, rectification of any faults

The document describes the product at the time of delivery by Schmalz and is aimed at:

- Installers who are trained in handling the product and can operate and install it
- Technically trained service personnel performing the maintenance work
- Technically trained persons who work on electrical equipment

1.2 The technical documentation is part of the product

1. For problem-free and safe operation, follow the instructions in the documents.
2. Keep the technical documentation in close proximity to the product. The documentation must be accessible to personnel at all times.
3. Pass on the technical documentation to subsequent users.

⇨ Failure to follow the instructions in these Assembly instructions may result in injuries!

⇨ Schmalz is not liable for damage or malfunctions that result from failure to heed these instructions.

If you still have questions after reading the technical documentation, contact Schmalz Service at:

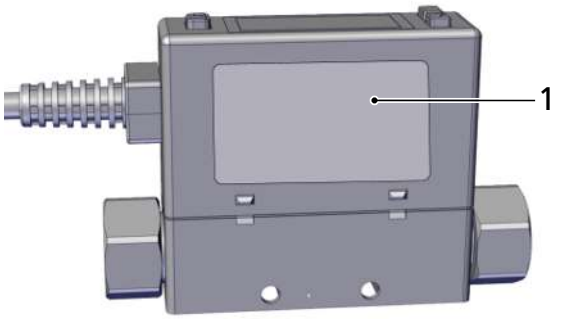
www.schmalz.com/services

1.3 Type Plate

The type plate (1) is printed to the Flow Sensor and must always be clearly legible.

It includes the following information:

- Name
- Part number
- Pressure Range
- Flow Range
- Wire Color and Function
- Lot No
- QR code
- CE label



1.4 Symbols

This symbol indicates useful and important information.

✓ This symbol represents a prerequisite that must be met prior to an operational step.

▸ This symbol represents an action to be performed.

⇨ This symbol represents the result of an action.

Actions that consist of more than one step are numbered:

1. First action to be performed.
2. Second action to be performed.

2 Fundamental Safety Instructions

2.1 Intended Use

The volume flow sensor is used for measuring and displaying the flow rate or pressure and outputs it proportionally as an electrical voltage from 1 to 5 V on an analog output.

This device has been designed, developed and constructed solely for industrial and commercial use. Private use is excluded.

The volume flow sensor is built in accordance with the latest standards of technology and is delivered in a safe operating condition. However, hazards may occur during use.

Intended use includes observing the technical data and the installation and operating instructions in this manual.

2.2 Non-Intended Use

Schmalz accepts no liability for damages caused by the use of the product for purposes other than those described under "Intended Use."

Non-intended use includes the following:

- Use in potentially explosive atmospheres

2.3 Personnel Qualification

Unqualified personnel cannot recognize dangers and are therefore exposed to higher risks!

1. Only instruct qualified personnel to perform the tasks described in these operating instructions.
2. The product may only be operated by persons who have undergone appropriate training.
3. Electrical work and installations may only be carried out by qualified electrical specialists.
4. Assembly and maintenance work must only be carried out by qualified personnel.

2.4 Warnings in This Document

Warnings warn against hazards that may occur when handling the product. The signal word indicates the level of danger.

Signal word	Meaning
⚠ WARNING	Indicates a medium-risk hazard that could result in death or serious injury if not avoided.
NOTE	Indicates a danger that leads to property damage.

2.5 Safety Instructions

⚠ WARNING

Use of flammable fluids and/or permeable fluids

They may cause fire, explosion or corrosion.

- ▸ Do not use flammable fluids and/or permeable fluids.

2.6 Modifications to the Product

Schmalz assumes no liability for consequences of modifications over which it has no control:

1. The product must be operated only in its original condition as delivered.
2. Use only original spare parts from Schmalz.
3. The product must be operated only in perfect condition.

3 Product Description

3.1 Designation code

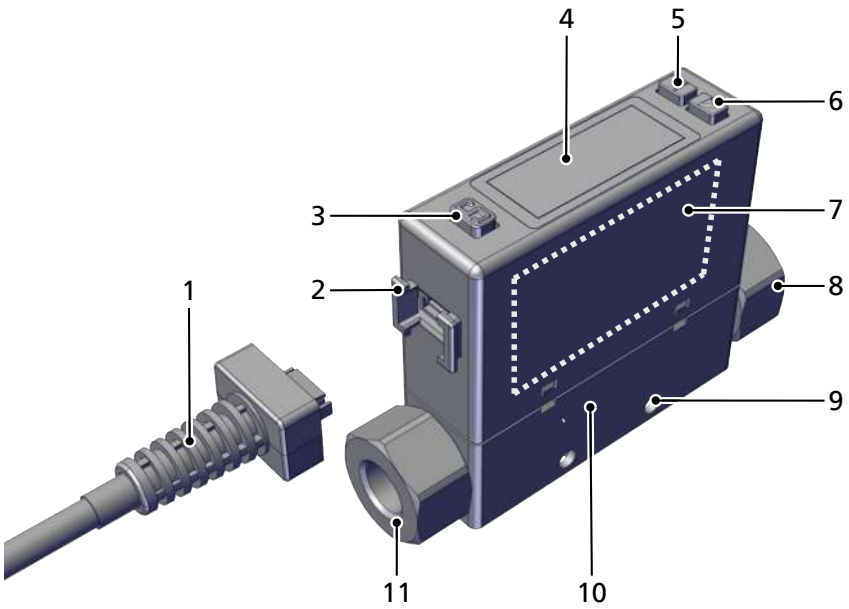
The breakdown of the item designation (e.g. FS-10-D-2PA-K) is as follows:

Feature	Variants
Type	FS
Recommended volume flow in the pressure measurement range	05: 5 l/min 10: 10 l/min 50: 50 l/min 100: 100 l/min 200: 200 l/min
Recommended volume flow in the vacuum measurement range	05: 5 l/min 10: 10 l/min 50: 50 l/min 100: 100 l/min 200: 100 l/min
Display	D
Output specification	2PA: 2x PNP + 1x 1 to 5 V
	2NA: 2x NPN + 1x 1 to 5 V
Electrical connection	K: Cable

3.2 Variants and Type Key

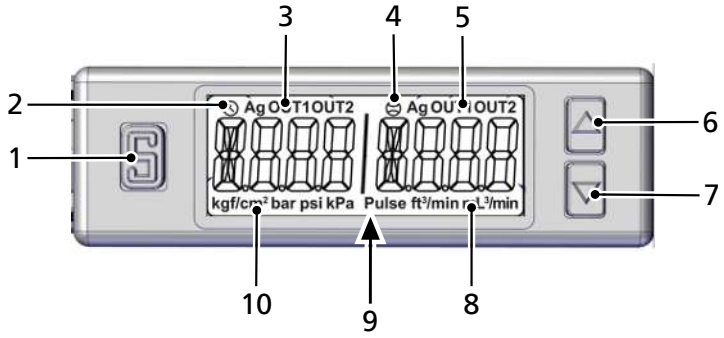
Part no. 10.06.04...	Designation	Size	Connection	Pneumatic connection
...00001	FS-5-D-2NA-K	0 ... 5 L/min	2 NPN output + Analog output 1 ~ 5 V	Thread G1/8“
...00002	FS-5-D-2PA-K	0 ... 5 L/min	2 PNP output + Analog output 1 ~ 5 V	Thread G1/8“
...00003	FS-10-D-2NA-K	0 ... 10 L/min	2 NPN output + Analog output 1 ~ 5 V	Thread G1/8“
...00004	FS-10-D-2PA-K	0 ... 10 L/min	2 PNP output + Analog output 1 ~ 5 V	Thread G1/8“
...00005	FS-50-D-2NA-K	0 ... 50 L/min	2 NPN output + Analog output 1 ~ 5 V	Thread G1/8“
...00006	FS-50-D-2PA-K	0 ... 50 L/min	2 PNP output + Analog output 1 ~ 5 V	Thread G1/8“
...00007	FS-100-D-2NA-K	0 ... 100 L/min	2 NPN output + Analog output 1 ~ 5 V	Thread G1/4“
...00008	FS-100-D-2PA-K	0 ... 100 L/min	2 PNP output + Analog output 1 ~ 5 V	Thread G1/4“
...00009	FS-200-D-2NA-K	0 ... 200 L/min	2 NPN output + Analog output 1 ~ 5 V	Thread G1/4“
...00010	FS-200-D-2PA-K	0 ... 200 L/min	2 PNP output + Analog output 1 ~ 5 V	Thread G1/4“

3.3 Design of the flow sensor



1	Lead Wire Connector	2	Connector
3	**SETTING BUTTON** Use for selection each mode and set value confirmation	4	LCD Display
5	**UP-BUTTON** Use for mode selection, ON/OFF switching and set value adjustment	6	**DOWN-BUTTON** Use for mode selection, ON/OFF switching and set value adjustment
7	Identification Plate	8	Piping Port (Outlet side)
9	Through-Hole Use to mount the product on a plate directly	10	Body
11	Piping Port (Inlet side)		

3.4 Display and Operating Element in Detail



1	**SETTING BUTTON**	2	Pressure Symbol
3	Indicator for Analog Signal, Output 1 and Output 2	4	Flow Symbol
5	Indicator for Analog Signal, Output 1 and Output 2	6	**UP-BUTTON**
7	**DOWN-BUTTON**	8	Flow Unit Display Section
9	3 Color LCD Display	10	Pressure Unit Display Section

Pressure definition with selected display unit depending on the vacuum switch version:

Selected unit	Display definition for variant VS-V...	Display definition for variant VS-P10...
kPa	0.1	—
MPa	—	0.001
kgf/cm^2	0.001	0.01
bar	0.001	0.01
psi	0.01	0.1
inHg	0.1	—
mmHg	1	—

3.5 Function Instuction

3.5.1 Function Setting Mode

Function code	Item	Factory setting	Explanation
[F-01]	[oUt 1] OUT1 setting	oUt 1	Selection of output 1 for flow sensor or pressure sensor. Setting for the flow rate or pressure value for activation and deactivation.
	[oUt 1] Selected sensor for OUT1	FLoY	
	[FLoY] OUT1 output mode	HYS	
	[oUt 1] OUT1 output type	no	
	[FL- 1] OUT1 setpoint input	50% of the maximum flow rate measured 005 : 250 ml/min ' 010 : 500 ml/min 050 : 2.50 l/min ' 100 : 5.00 l/min 500 : 25.0 l/min ' 101 : 50.0 l/min 201 : 100 l/min	
	[FH- 1] OUT1 set value input	60% of the maximum flow rate measured 005 : 300 ml/min ' 010 : 600 ml/min 050 : 3.00 l/min ' 100 : 6.00 l/min 500 : 30.0 l/min ' 101 : 60.0 l/min 201 : 120 l/min	
[F-02]	[oUt2] OUT2 setting	oUt 2	Selection of output 2 for flow sensor or pressure sensor. Setting for the flow rate or pressure value for activation and deactivation.
	[oUt2] selected sensor for OUT2	FLoY	
	[FLoY] OUT2 output mode	HYS	
	[oUt2] OUT2 output type	no	
	[FL-2] OUT2 setpoint input	50% of the maximum flow rate measured 005 : 250 ml/min ' 010 : 500 ml/min 050 : 2.50 l/min ' 100 : 5.00 l/min 500 : 25.0 l/min ' 101 : 50.0 l/min 201 : 100 l/min	
	[FH-2] OUT2 setpoint input	60% of the maximum flow rate measured 005 : 300 ml/min ' 010 : 600 ml/min 050 : 3.00 l/min ' 100 : 6.00 l/min 500 : 30.0 l/min ' 101 : 60.0 l/min 201 : 120 l/min	
[F-03]	[cLor] LCD display setting	cLor	Selection of the background lighting and display mode.
	[d iSP] LCD display for corresponding output	oUt 1	
	[d iSP] Color selection for LCD display	SoG	
[F-04]	[rESP] Selection of the response time	rESP	Selection of the response time for the analog output.

	[rESP] Selection of flow/pressure sensor	FLoY	Pressure sensor: 2.5 ms to 1500 ms 50 ms to 1500 ms flow sensor
	[FLoY] Selection of response time	800 (ms)	
[F-05]	[UPdA] Selection of the display refresh time	UPdA	The display refresh cycle can be set to 200 ms, 500 ms or 1000 ms.
	[UPdA] Selection of flow/pressure sensor	FLoY	
	[UPdA] Selection of the flow display refresh time	500 (ms)	
[F-06]	[Un it] Selection of the unit	Un it	Selection of the unit for the pressure/flow sensor.
	[FLoY] Selection of the unit for the flow rate	LPn	
	[PrES]	Un it	
[F-07]	[rEFE] Selection of the flow rate reference conditions	rEFE	Selection of the flow rate value displayed under standard (ANR) or norm (NOR) conditions.
	[rEFE] Selection of the flow rate reference conditions	Anr	
[F-08]	[AnG] Selection of the analog output	AnG	Selection of the analog output for the pressure or flow sensor.
	[FLoY] Selection of the analog output	FLoY	
[F-09]	[EEPr] Selection for storing the cumulative value	EEPr	Saving the last cumulative flow value every 2 or 5 minutes.
	[EEPr] Selection for storing the cumulative value	oFF	
[F-10]	[d is] Selection of the flow sensor display mode	d is	Setting for whether to display the current flow or the cumulative flow.
	[dSP] Selection of the flow sensor display mode	inS	
[F-80]	[SYn] Synchronize the value of the flow of the analog output and display	oFF	Select On to synchronize the value of the analog flow output and the display.
[F-91]	[Eco] Selection of energy saving mode	Eco	Set whether to enable energy saving mode to reduce power consumption.
	[Eco] Selection of energy saving mode	no	
[F-92]	[inP] Selection of the external input	inP	Selection of the zeroing of the cumulative flow, auto-shift or auto-shift with display zeroing.
	[inP] Selection of the external input	r_r	
[F-93]	[nbUS] Setting for Modbus RTU	nbUS	Setting the ID number, baud rate and transfer format.
	[id] ID number setting	1	

	[rAt] Baud rate setting	96 (9600 Bd)	
	[For] Transfer format setting	n8 1	
	[trA] Communication protocol setting	rtU	
[F-94]	[F inE] Fine adjustment	F inE	The displayed value can be easily adjusted.
	[F inE] Fine adjustment	oFF	
[F-95]	[FoUt] Forced output activation/deactivation	FoUt	For forced analog output activation/deactivation.
	[oUt 1] Forced output activation/deactivation	oFF	
	[oUt2] Forced output activation/deactivation	oFF	
[F-99]	[rESt] Reset the factory settings	rESt	Resets the device to the factory settings.
	[rSt] Reset the factory settings	oFF	

3.5.2 Measurement

Item	Explanation
Pressure display	Display pressure value.
Flow display	Display instantaneous flow rate.
Accumulated flow rate display	Display accumulated flow rate.
Pressure zero setting	The displayed pressure value can be adjusted to "0".
Instantaneous Flow rate zero setting	The displayed instantaneous flow rate value can be adjusted to "0".
Accumulated flow rate zero clear	The accumulated flow rate can be set to "0".
Peak value display	The maximum pressure or instantaneous flow can be detected when the power is supplied for a period.
Bottom value display	The minimum pressure or instantaneous flow can be detected when the power is supplied for a period.
Key lock/unlock mode	To prevent errors occurring due to unintentional changes of the set values.

4 Technical Data

4.1 General Parameters

Size			Unit	FS-5	FS-10	FS-50	FS-100	FS-200
Measuring medium				Dry air, N2, non-aggressive/non-flammable gases				
Sensor element	Flow rate	Recommended volume flow in the pressure measurement range		0 to 5 l/min	0 to 10 l/min	0 to 50 l/min	0 to 100 l/min	0 to 200 l/min
		Recommended volume flow in the vacuum measurement range		0 to 5 l/min	0 to 10 l/min	0 to 50 l/min	0 to 100 l/min	
		Direction of flow		unidirectional				
	Pressure	Nominal pressure range		–90 to 800 kPa				
Display				4-digit * 4-digit, 7-segment LCD display (red/green/orange)				
	Current volume flow	Display range		0 to 5.00 l/min	0 to 10.00 l/min	0 to 50.0 l/min	0 to 100 l/min	0 to 200 l/min
		Minimum setting scale	LPM	0.01 l/min		0.1 l/min		1 l/min
			CFM [1]	0.1 ft^3/min		1 ft^3/min		
	Cumulative volume flow	Display range		999999.99 l		9999999.9 l		99999999 l
		Minimum setting scale [1]		0.01 l		0.1 l		1 l
				0.1 ft^3		1 ft^3		
	Pressure display	Display range		–100 to 1000 kPa				
		Minimum setting scale	kPa	1				
			kgf/cm^2	0.01				
			bar	0.01				
			psi	0.1				
Accuracy	Flow rate	Guaranteed range		2 to 100% F.S.				
		Display accuracy		±3% F.S. ±1 digit [2]				
		Accuracy, analog output		±5% F.S. [2]				
		Repeatability		±1% F.S. ±1 digit [3]				
		Linearity		±3% F.S. [3]				
		Temperature characteristic		±2% F.S. (15 to 35° C) ; ±5% F.S. (0 to 15° C · 35 to 50° C) (see [3])				
		Pressure characteristic		±5% F.S. ±1 digit [4]				
	Pressure	Guaranteed range		0 to 100% F.S.				
		Display accuracy		±2% F.S. ±1 digit [5]				
		Accuracy, analog output		±2.5% F.S. [5]				
		Repeatability		±0.2% F.S. ±1 digit [5]				
		Linearity		±1% F.S. [5]				

Size			Unit	FS-5	FS-10	FS-50	FS-100	FS-200
		Temperature characteristic		±2% F.S. (see [5])				
Switching output				2NPN: 2 open collector outputs Max. load current: 125 mA Max. supply voltage: 28 V DC Voltage drop: ≤ 1.5 V 2PNP: 2 open collector outputs Max. load current: 125 mA Max. supply voltage: 24 V DC Voltage drop: ≤ 1.5 V				
	Response time		Flow rate	800 ms (50 ms, 80 ms, 120 ms, 200 ms, 400 ms, 1500 ms available)				
			Pressure	2.5 ms (25 ms, 100 ms, 250 ms, 500 ms, 1000 ms, 1500 ms available)				
	Output mode		Flow rate	Hysteresis mode, Window Comparator mode, cumulative output, cumulative pulse output				
			Pressure	One Point mode, Hysteresis mode, Window Comparator mode				
	Hysteresis			Adjustable				
	Short circuit protection on output			Yes				
	Cumulative pulse output [1]			0.05 l/pulse	0.1 l/pulse	0.5 l/pulse	1 l/pulse	2 l/pulse
				0.2 ft^3/pulse	0.4 ft^3/pulse	2 ft^3/pulse	4 ft^3/pulse	7 ft^3/pulse
Analog output	Voltage output			Voltage output range: 1 to 5 V [6] Output impedance: 1 kΩ				
	Current output			Voltage output range: 4 to 20 mA [6] Load impedance: ≤ 300 Ω				
	Response time			Pressure ≤ 50 ms; flow rate: ≤ 100 ms				
External input				Without voltage, input actuated with ground, < 0.4 V, ≥ 30 ms				
Communication interface				RS-485 [7]				
Electricity	Power supply			12 V to 24 V DC ±10% · Ripple (P-P) ≤ 10%				
	Current consumption			≤50 mA				
Environment	Compressive strength			1000 kPa				
	Housing			IP40				
	Medium temperature			0 to 50° C (no condensation, not freezing)				
	Ambient temperature range			Operation: 0 to 50° C; storage: –10 to 60° C (no condensation, not freezing)				
	Ambient humidity			Operation/storage: 35 to 85% R.H. (no condensation)				
	Insulation resistance			> 50 MΩ (DC 500 V, between housing and connection cable)				
	Withstand voltage			AC 1000 V for 1 min. (between housing and connection cable)				
	Vibration			Total amplitude 1.5 mm or 10 G, 10 Hz – 55 Hz – 10 Hz scan for 1 minute, two hours in all directions X, Y and Z				
	Shock strength			100 m/s^2 (10 G), 3 times each in the direction of X, Y and Z				
	EMC			IEC 61000-6-2, IEC 61000-6-4				

Size		Unit	FS-5	FS-10	FS-50	FS-100	FS-200
Connection cable			Oil-resistant Ø4 mm cable – 26 AWG (0.15 mm²), 6-pole				
Connection size for medium	1/8" internal thread		✓	✓	✓	—	—
	1/4" internal thread		—	—	—	✓	✓
Weight (with 2 meter connection cable)			approx. 107 g (1/8" internal thread); approx. 110.5 g (1/4" internal thread)				

Cumulative pulse output [1)]

NOTE:

[1)] CFM (ft^3/min * 10^{-2}) and ft^3 *10^{-2}.

[2)] OPERATION: Input pressure: 300 kPa, output pressure: atmospheric pressure, 25° C.

[3)] OPERATION: Output pressure: atmospheric pressure, 25° C.

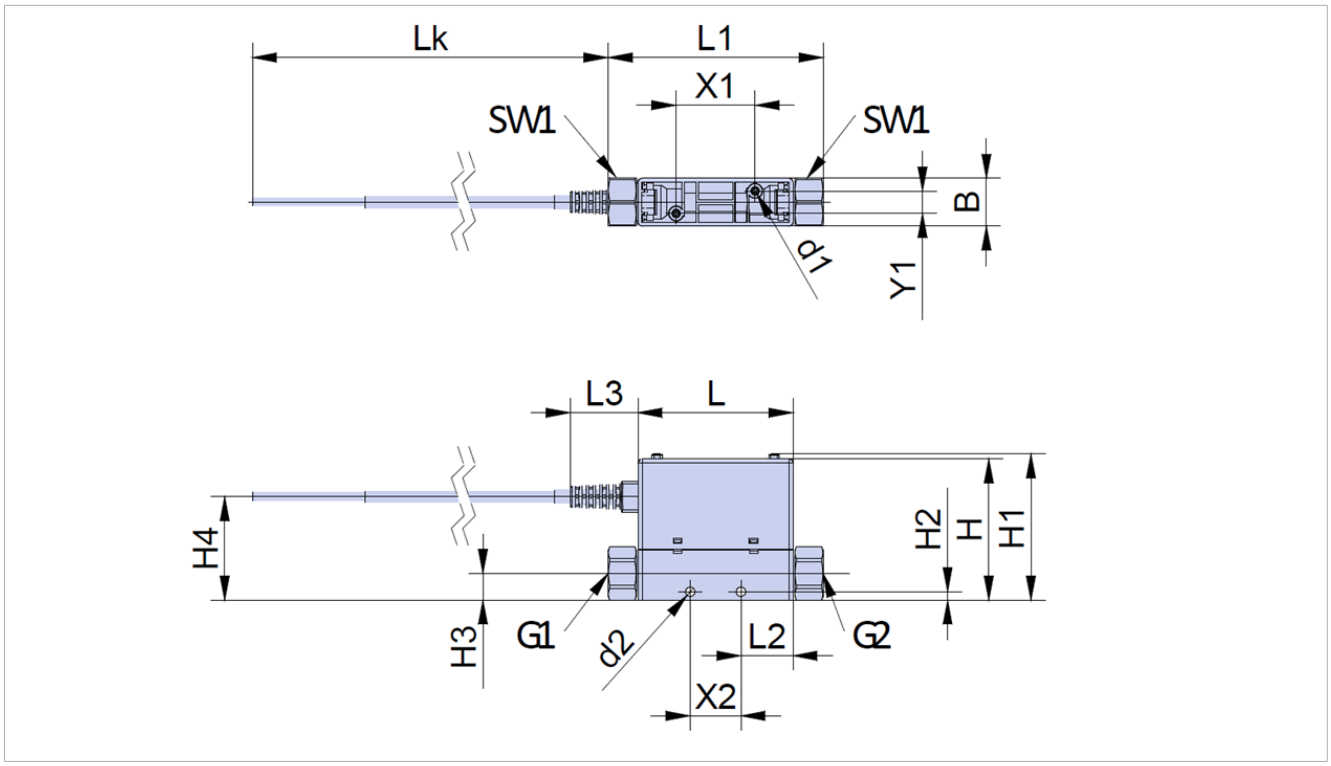
[4)] –90 to 800 kPa, output pressure: atmospheric pressure, 25° C.

[5)] Output flow rate = 0 l/min, 25° C.

[6)] PWM output, corresponding to pressure sensor 0 to 1000 kPa.

[7)] This function is only available for output specification -02 and -04.

4.2 Dimensions



Lk	SW1	L1	X1	d1	d2	Y1	B	H	H1
2.000	17	84,2	28	2,5	3	8	17	50	52

H2	H3	H4	L	L2	L3	G1	G2	X2
3	9,5	36,7	55	18,5	18,6	G1/8"-IG (until 50 l/min)	G1/8"-IG (until 50 l/min)	18

H2	H3	H4	L	L2	L3	G1	G2	X2
						or G1/4"-IG (from 100 l/ min)	or G1/4"-IG (from 100 l/ min)	

All data in mm.

5 Installation

5.1 Installation Instructions

- Do not use near a surge voltage generated area. Solenoid lifters, high frequency Induction furnaces and motors, etc. can generate high surge voltages, if using near the sensor will cause the internal circuit components to deteriorate and cause damages.
- Sensors can not withstand lightning strikes. The product is CE compliant, but can not resist surge voltage of lightning strikes, take measures to avoid lightening strikes in the system.
- Do not use in an environment where sensors could be splashed by water or oil. Enclosure rating is IP40, please avoid water or oil splashed environment to prevent adversely effects.
- Do not use in an environment subject to large temperature cycling. Internal components of the sensor will be affected adversely by large heating/cooling cycles other than ordinary changes in temperature.
- Do not mount the product in locations where it is exposed to radiant heat. This could result in damage and/or malfunction.
- Ensure the flow direction of the fluid. Follow the flow direction indicator for installation and piping.
- Flush out all dirt and dust by air blow before connect the piping to the sensor.
- When installation, do not drop, hit or apply excessive shock (100m/s^2). Internal damage can cause malfunction even if the housing appears to be undamaged.
- Do not install multiple products in close proximity. The heat generated from each product could cause the temperature to rise and change the characteristics of product or deterioration of the plastic parts. Please position the products 10 mm apart from each other.
- Hold the sensor body when installing. The tensile strength of the cable is 24.5 N and apply excessive pulling force can cause damage to the sensor.

NOTE

The pressure or flow rate exceeded the specified range

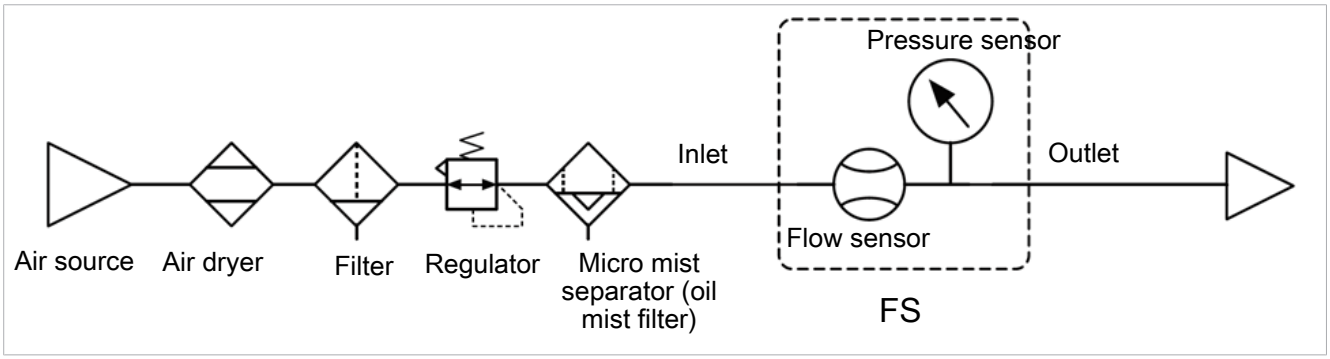
The sensing element may be damaged

- Check the regulator and flow adjustment valve before introducing the fluid.

The sensing element cannot measure properly if foreign matter adheres to it.

On the inlet side, be sure to install an air filter below the filtration level of 10 µm.

Recommended Equipments and Installation



When measuring the pressure of the inlet side, install a throttle valve or solenoid valve on the outlet side.

When measuring the pressure of the outlet side, install a throttle valve or solenoid valve on the inlet side.

5.2 Mounting Bracket / Optional Parts

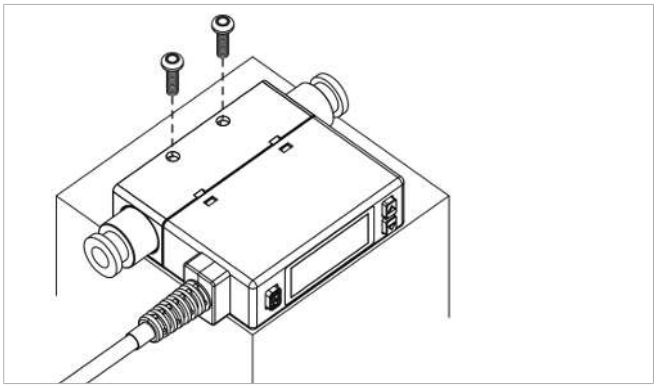
Do not mount the sensor in a place that will be used as a foothold. The product may damage if sit or step on it accidentally.

The LCD display may be difficult to see at certain angles.

The sensor can be installed horizontally or vertically, but the flow rates may change because of the installation way of the product or piping.

The tightening torque for screws should be under 0.5 ±0.1 Nm.

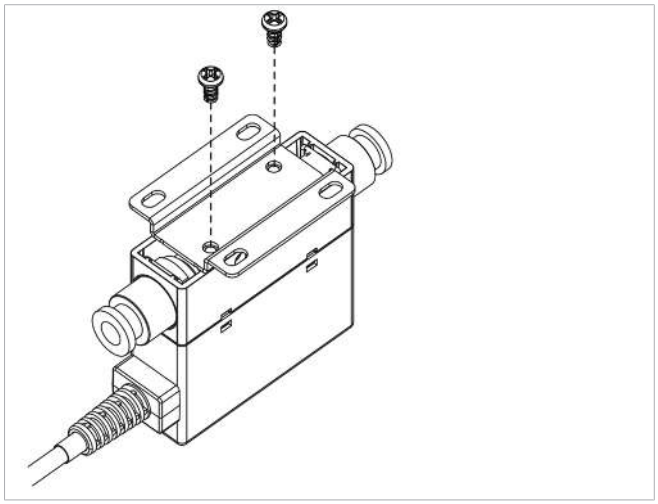
Horizontal mounting (by Through-Hole)



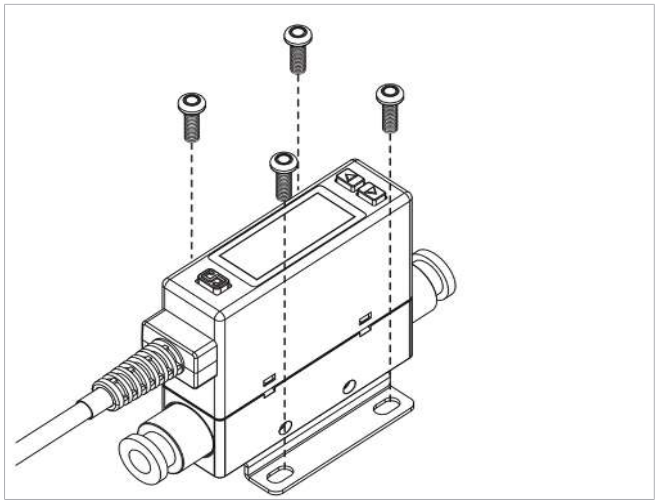
- Mounting screws

Bracket (no. 10.06.04.00011) mounting

1. Fix the bracket to the flow sensor. Self-Tapping-Screw: P Type, size M3.0, length L = 6 mm.

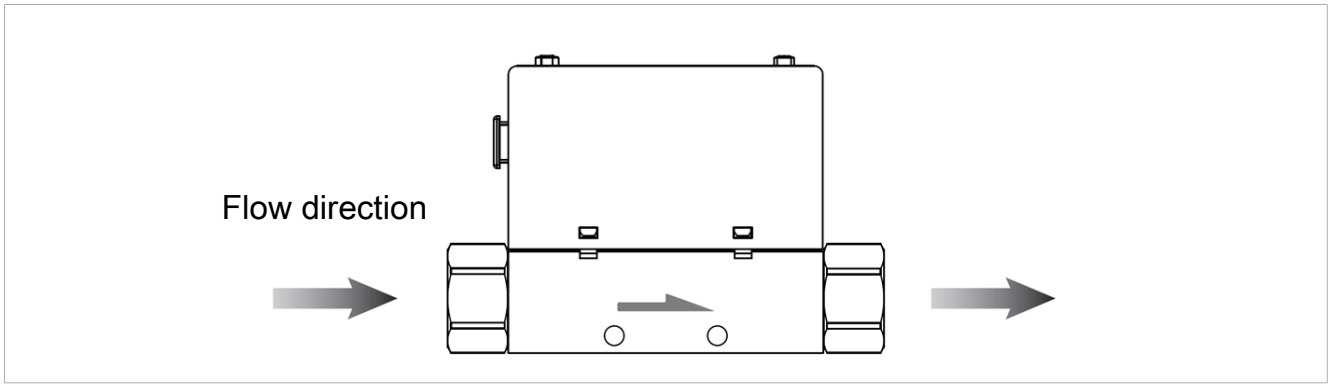


2. Mounting screws.



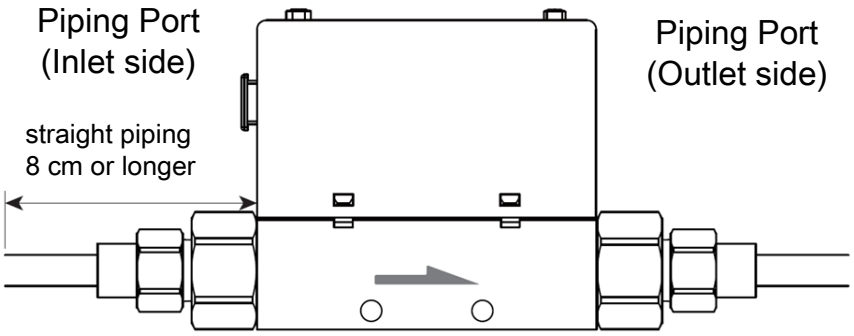
5.3 Piping

Install the pipe by following the arrow indication that shows the air flow direction on the product.



Use straight piping 8 cm or longer to connect the Piping Port (Inlet side). If straight piping is not installed, the accuracy may vary by ± 2% F.S..

Straight Piping: The pipe is without bending and the cross sectional areas of the pipe keeps the same.



Blow the air to flush out the foreign matters, dust and etc. before installing the pipe. Uncleaned air may cause malfunction or damage to the product.
When mounting the fitting, a wrench should be used on the metal part.
Using on other parts of the product with a wrench may damage the product.
If the tightening torque is exceeded, the product can be broken.
If the tightening torque is insufficient, the fitting may become loose and cause air leakage.
After installation completed, turn on the gas and power supply for proper operation and leaking test to confirme whether the installation is correct.

5.4 Electrical Connection

NOTE

Incorrect power supply

Destruction of the integrated electronics

- Operate the product using a power supply unit with protected extra-low voltage (PELV).
- The system must incorporate safe electrical cut-off of the power supply in compliance with EN60204.
- Do not connect or disconnect the connector under tension and/or when voltage is applied.

NOTE

Connect with the power turned on

Damage to the electronics and/or malfunction

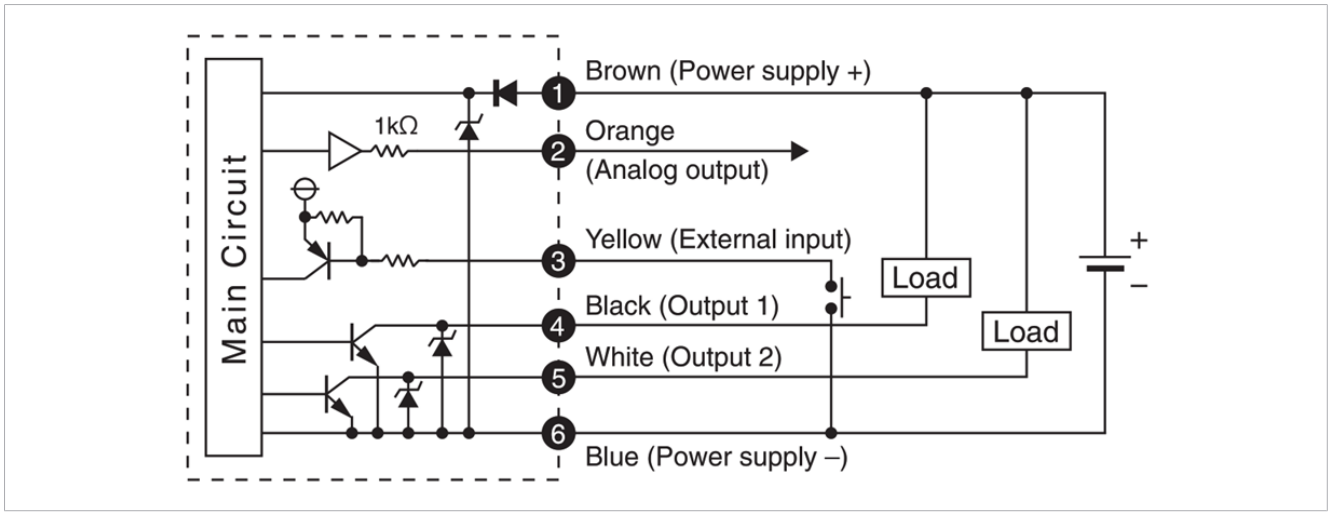
- Switch off the power supply before connecting cables!

The folw sensor is supplied with a 6-wire connection cable with open cable ends.

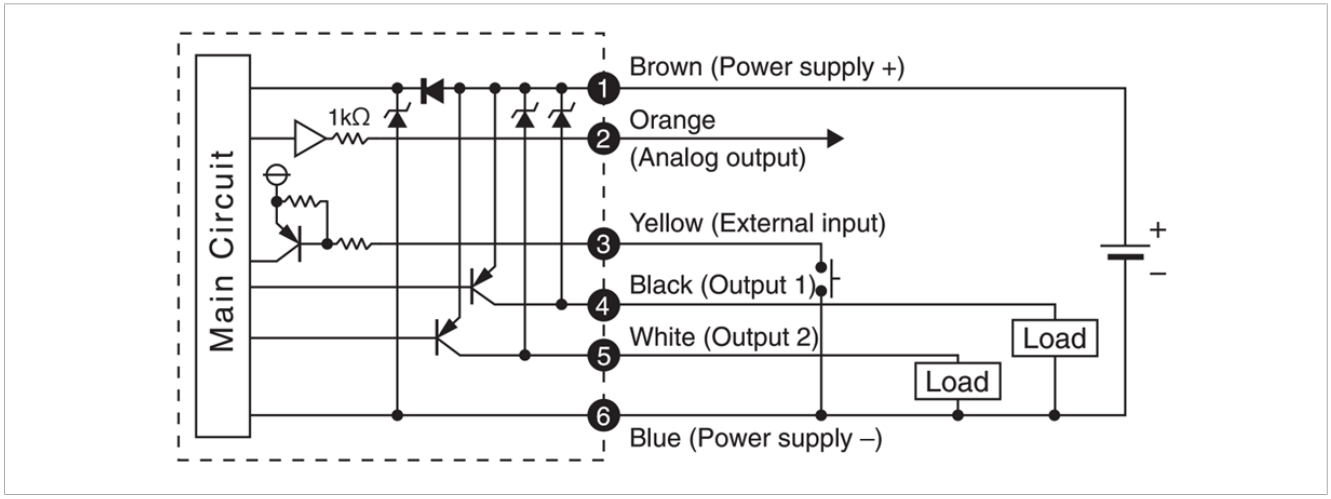
Integrate the folw sensor into your application in accordance with the electrical circuit diagram. The following points must be taken into account for this:

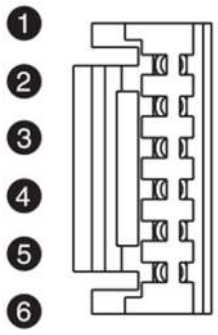
- Check wire color and terminal number when wiring. Incorrect wiring can cause permanent damages to the sensor, check wire color and terminal number against the manual before wiring.
- Avoid repeatedly bending or stretching the lead wire. It can cause damage to the sheath, or breakage of the wire.
- Confirm wiring insulation. Please avoid poor insulations (and interference from another circuit, poor insulation between terminals, etc.) it can lead to over current being applied to the product, causing damage.
- Do not route wires and cables together with power or high voltage cables. The product may malfunction due to interference or noise and surge voltage from power and high voltage cables.
- Do not short-circuit the load. When the load is short-circuited, an error will be displayed. But excess current may cause damage to the sensor.

• NPN Output / Analog Voltage Output / External Input



• PNP Output / Analog Voltage Output / External Input





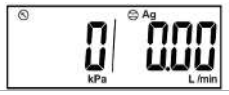
Pin No.	Line color	Content
1	Brown	Power supply (DC 12 to 24 V DC)
2	Orange	Analog voltage output: 1 ~ 5 V Analog current output: 4 ~ 20 mA
3	Yellow	External input
4	Black	Output 1 (Max. load current : 125 mA)
5	White	Output 2 (Max. load current : 125 mA)
6	Blue	0 V (GND)

6 Operation Instructions

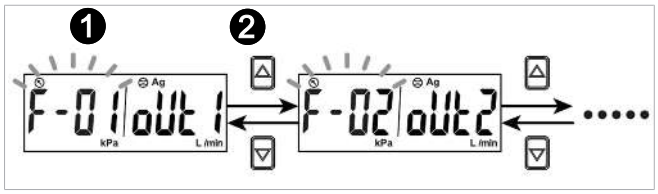
After power is supplied, the output will remain off until the display is turned on. Please operate the sensor after the value is shown.

Stop the control systems before perform setting chnages. During the initial flow and pressure setting, the product will swich the output according to the existing settings until the changes are complete.

6.1 Function Selection Mode



✓ At "Measurement Mode"



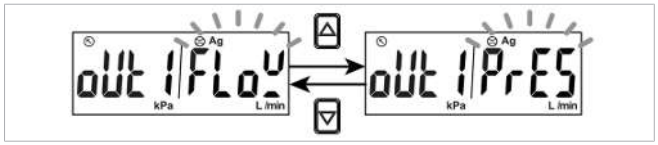
1. Press [S] button for more than 3 sec. to display [F-01] ❶. Press [▲] or [▼] button to select other setting functions ❷.
2. Press [S] for 3 sec. at "Function Setting Mode" to return to "Measurement Mode".
3. Or press [S] to enter in each function setting.

6.2 OUT1 Setting Selection

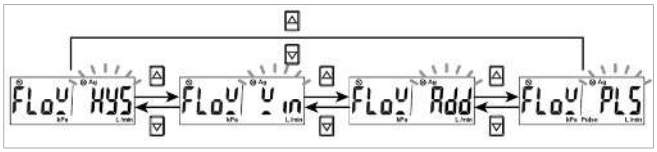
[F01] Setting corresponding sensor and operating mode of OUT1.

1. Flow sensor setting

1. Press [▲] or [▼] button at "Function Setting Mode" to display [F-01] [oUt1].
2. Press [S] button to switch to "Sensor Selection" (oUt1 - selected output).
3. Press [▲] or [▼] button to select flow sensor of OUT 1.
4. Press [S] button to switch to "Output Mode Setting"

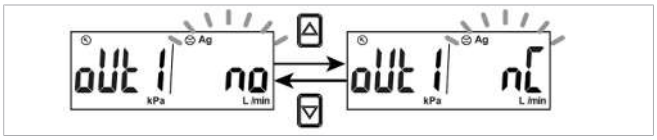


5. Press ▲ or ▼ button to select output mode of OUT1 (4 output modes included).
   HYS = Hysteresis Mode
   U in = Window Comparator Mode
   Add = Accumulated Output Mode
   PLS = Accumulated Pulse Output Mode
   NOTE: The Accumulated Pulse Output Mode can only be set in OUT 1, and OUT2 does not have this setting.



6. Press S button to switch to "Output Type Setting".

7. Press ▲ or ▼ button to select OUT1 type.
   no = NO mode (normally open mode)
   nc = NC mode (normally close mode)
   NOTE: Type setting will not display when Accumulated Pulse Output Mode is set.



8. Press S button to switch "Set Value Setting".

9. Press ▲ or ▼ button to adjust the set value.
   Hysteresis Mode [HYS]: [FL- 1] and [FH- 1]
   Window Comparator Mode [U in]: [FL- 1] and [FH- 1]
   Accumlated Output Mode [Add]: [AdL 1] and [AdH 1]
   NOTE: Set value setting will not display when Accumulated Pulse Output is set.

10. Press S button to switch to "Fixed Hysteresis Setting".

11. Press ▲ or ▼ button to adjust fixed hysteresis value.
    NOTE: Fixed hysteresis setting will not display when Hysteresis Mode, Accumulated Output Mode and Accumulated Pulse Output Mode is set.

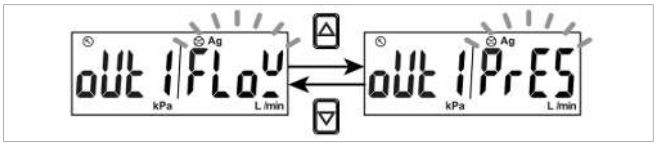
12. Press S button to return to "Function Selection Mode".

2. Pressure sensor setting

1. Press ▲ or ▼ button at "Function Setting Mode" to display [F-01] [oUt1].

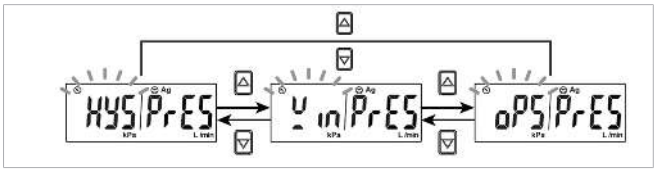
2. Press S button to switch to "Sensor Selection" (oUt1 - selected output).

3. Press ▲ or ▼ button to select pressure sensor of OUT 1.



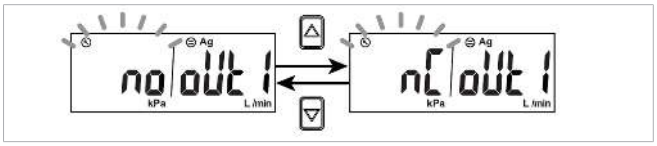
4. Press S button to switch to "Output Mode Setting"

5. Press ▲ or ▼ button to select output mode of OUT1 (3 output modes included).
   HYS = Hysteresis Mode
   WIn = Window Comparator Mode
   oPS = One Point Set Mode



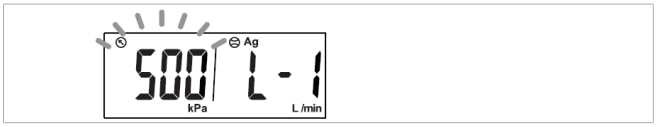
6. Press S button to switch to "Output Type Setting".

7. Press ▲ or ▼ button to select OUT1 type.
   nO = NO mode (normally open mode)
   nC = NC mode (normally close mode)
   NOTE: Type setting will not display when Accumulated Pulse Output Mode is set.



8. Press S button to switch "Set Value Setting".

9. Press ▲ or ▼ button to adjust the set value.
   Hysteresis Mode [HYS]: [L-1] and [H-1]
   Window Comparator Mode [WIn]: [L-1] and [H-1]
   One Point Set Mode [oPS]: [P-1]

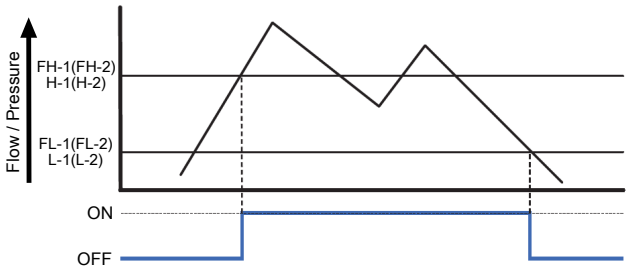
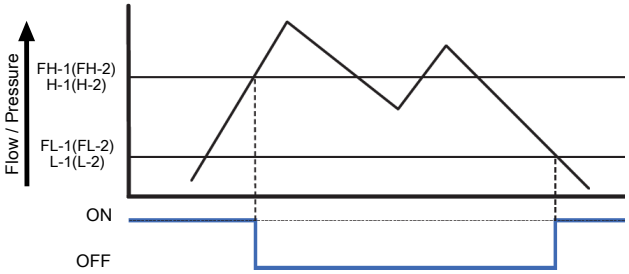
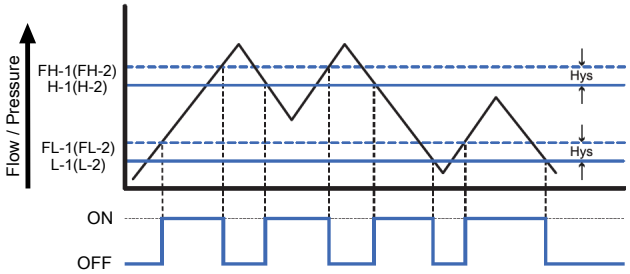
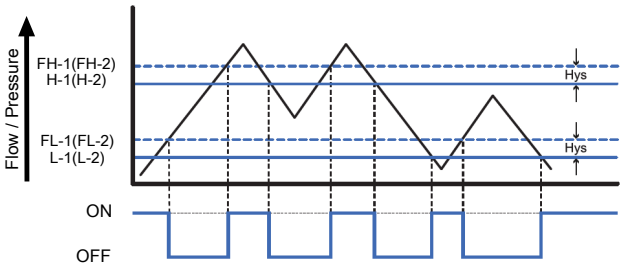
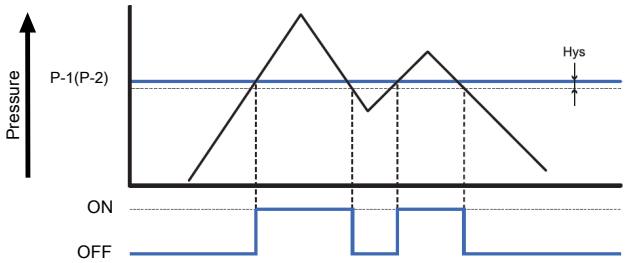
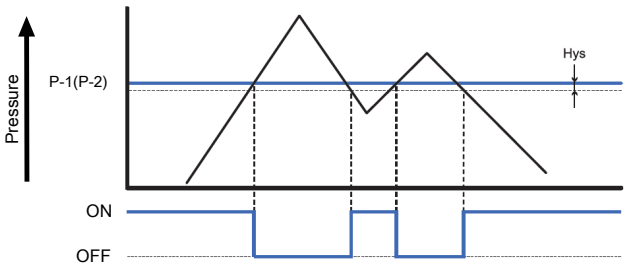
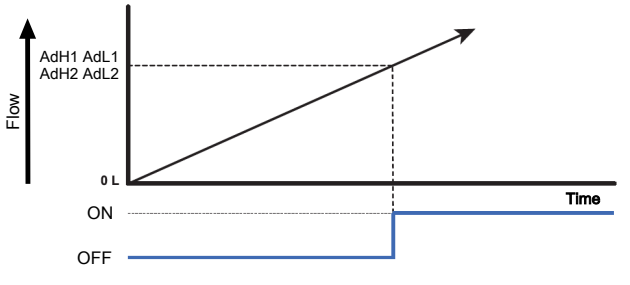
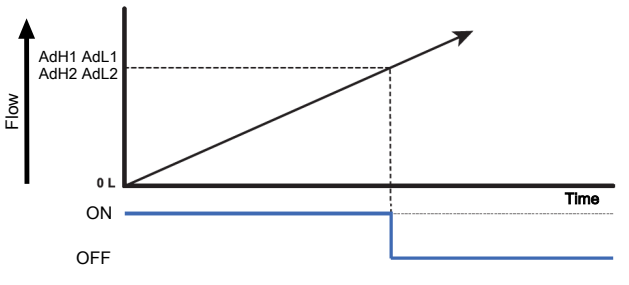


10. Press S button to switch to "Fixed Hysteresis Setting".

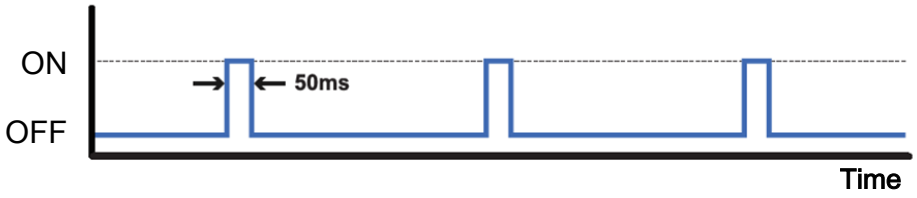
11. Press ▲ or ▼ button to adjust fixed hysteresis value.
    NOTE: Fixed hysteresis setting will not display when Hysteresis Mode is set.

12. Press S button to return to "Function Selection Mode".

Swiching logic

NO Mode	NC Mode
Hysteresis Mode	
	
Window Comparator Mode	
	
One Point Set Mode	
	
Accumulated Output Mode	
	

Accumulated Pulse Output Mode



Flow Range	500mL	1000mL	5L	10L	50L	100L	200L
Pulse Output Rate	5mL	10mL	0.05L	0.1L	0.5L	1L	2L

NOTE:

- In case hysteresis is set at less than or equal to 2 digits, switch output may chatter If Input pressure fluctuates near the set point.
- When using window comparator mode, the difference between two set points must be greater than the fixed hysteresis, otherwise will cause the switch output to malfunction.

6.3 OUT2 Setting Selection

[F02] Setting corresponding sensor and operating mode of OUT2.

1. Press ▲ or ▼ button at "Function Setting Mode" to display and start "OUT2 Setting" [F-02] [oUt2].
2. Check the [F-01] for the same follow setting.

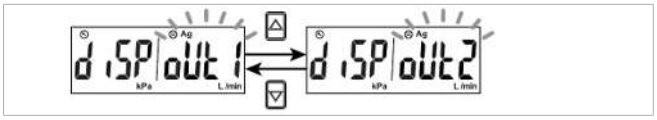
NOTE:

The OUT2 Setting dose not have Accumulated Pulse Output Mode.

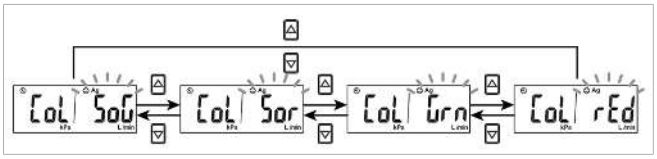
6.4 LCD Display Color Selection

[F-03] 4 LCD Display Color Modes of output value selection.

1. Press ▲ or ▼ button at "Function Selection Mode" to display [F-03] [cLor].
2. Press S button to switch to "Output Selection" (oUt 1 - selected output).
3. Press ▲ or ▼ button to select color display for OUT 1 or OUT2.



4. Press S button to switch to "Display Color Mode Selection".
5. Press ▲ or ▼ button to select "Display Color Mode".
   [SoG] => ON = Green and OFF = Red
   [Sor] => ON = Red and OFF = Green
   [Grn] => ON = Green and OFF = Green
   [rEd] => ON = Red and OFF = Red



6. Press [S] button to return to "Function Selection Mode".

6.5 Response Time Selection

[F-04] Select proper response time to avoid switch output chattering.

1. Flow sensor setting

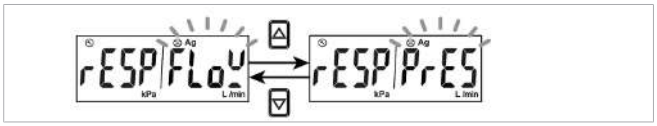
1. Press [▲] or [▼] button at "Function Selection Mode" to display [F-04] [rESP].
2. Press [S] button to switch to "Sensor Selection".
3. Press [▲] or [▼] button to select the flow sensor.

4. Press [S] button to switch to "Response Time Selection".
5. Setting response time of flow sensor: Press [▲] or [▼] button to select response time. 7 Response time selections include: 50ms, 80ms, 120ms, 200ms, 400ms, 800ms, 1500ms

6. Press [S] button to return to "Function Selection Mode".

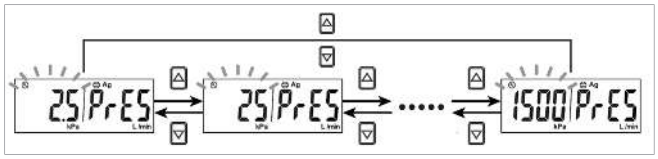
2. Pressure sensor setting

1. Press [▲] or [▼] button at "Function Selection Mode" to display [F-04] [rESP].
2. Press [S] button to switch to "Sensor Selection".
3. Press [▲] or [▼] button to select the pressure sensor.



4. Press [S] button to switch to "Response Time Selection".

5. Setting response time of pressure sensor: Press ▲ or ▼ button to select response time.
   7 Response time selections include:
   2.5ms, 25ms, 100ms, 250ms, 500ms, 1000ms, 1500ms



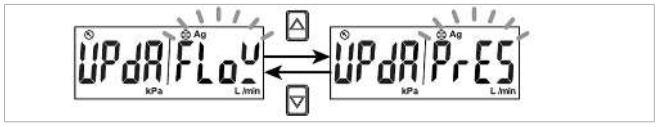
6. Press S button to return to "Function Selection Mode".

6.6 Display Refresh Time Selection

[F-05] Select the proper display refresh time to reduce frequently changing value.

1. Flow sensor setting

1. Press ▲ or ▼ button at "Function Selection Mode" to display [F-05] [UPdA].
2. Press S button to switch to "Sensor Selection".
3. Press ▲ or ▼ button to select the flow sensor.

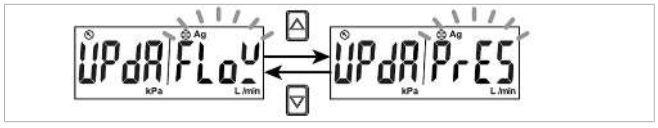


4. Press S button to switch to "Display Refresh Time Selection".
5. Setting refresh time of flow sensor: Press ▲ or ▼ button to select refresh time.
   3 display refresh time selections include:
   200ms, 500ms, 1000ms

6. Press S button to return to "Function Selection Mode".

2. Pressure sensor setting

1. Press ▲ or ▼ button at "Function Selection Mode" to display [F-05] [UPdA].
2. Press S button to switch to "Sensor Selection".
3. Press ▲ or ▼ button to select the pressure sensor.



4. Press [S] button to switch to "Display Refresh Time Selection".

5. Setting response time of pressure sensor: Press [▲] or [▼] button to select refresh time.
   3 display refresh time selections include:
   200ms, 500ms, 1000ms

6. Press [S] button to return to "Function Selection Mode".

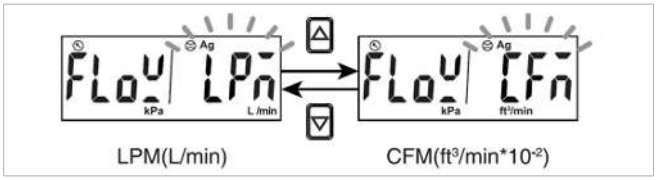
6.7 Unit Selection

[F-06] Select the flow unit and pressure unit of the sensor.

1. Press [▲] or [▼] button at "Function Selection Mode" to display [F-06] [Un it].

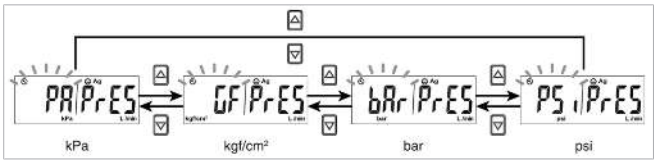
2. Press [S] button to switch to "Flow Unit Selection".

3. Press [▲] or [▼] button to select flow unit.
   2 flow unit selections include:
   LPM(L/min), CFM(ft^3/min*10^{-2})
   NOTE: When the measured flow rate range is 500mL/min or 10OOmL/min, the unit of LPM is selected to represent the unit in mL/min.



4. Press [S] button to switch to "Pressure Unit Selection".

5. Press [▲] or [▼] button to select pressure unit.
   4 pressure unit selections include:
   kPa, kgf/cm^2, bar, psi



6. Press [S] button to return to "Function Selection Mode".

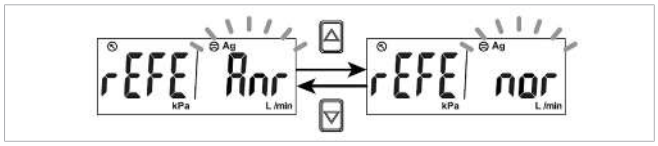
6.8 Flow Reference Standard Selection

[F-On] Select the flow value is shown under standard or normal condition.

1. Press [▲] or [▼] button at "Function Selection Mode" to display [F-On] [rEFE].

2. Press [S] button to switch to "Flow Reference Standard Selection"

3. Press ▲ or ▼ button to select the standard or normal condition.
   Standard conditon (ANR) = [Anr]
   Normal condition (NOR) = [nor]
   NOTE:
   1. Stardard condition (ANR): the display value is calculated under 20°C, 1atm.
   2. Normal condition (NOR): the display value is calculated under 0°C, 1atm.
   3. Flow rate in the specification is the value at standard condition (ANR).



4. Press S button to return to "Function Selection Mode".

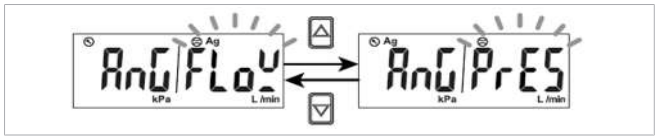
6.9 Analog Output Selection

[F-08] Select the analog output signal is for flow sensor or pressure sensor.

1. Press ▲ or ▼ button at "Function Selection Mode" to display [F-08] [AnG].

2. Press S button to switch to "Sensor Selection".

3. Press ▲ or ▼ button to select the sensor of analog output (flow sensor or pressure sensor).
   NOTE:
   1. This function is not available with Output Specification -02 and -04.



4. Press S button to return to "Function Selection Mode".

6.10 Accumulated Value Hold Selection

[F-09] The default setting is "OFF", the accumulated flow value is zeroed when the power supply is turned off.
Select this function to keep accumulated flow value to be stored in permanent memory and reload the recent saved accumulated value after power supply turns on.

1. Press ▲ or ▼ button at "Function Selection Mode" to display [F-09] [EEPr].

2. Press S button to switch to "Accumulated Value Hold Selection".

3. Press ▲ or ▼ button to turn off the function or select the data stored cycle.
   Function "OFF" = [oFF]
   Data stored every 2 min. = [2 in]
   Data stored every 5 min. = [5 in]

4. Press S button to return to "Function Selection Mode".

NOTE:
The maximum writable limit of the memory device is 1 million cycles. If the sensor is operated 24 hours per day, the durability is calculated as below:

- 5 minutes x 1 million cycles = 5 million minutes = 9.5 years
- 2 minutes x 1 million cycles = 2 million minutes = 3.8 years

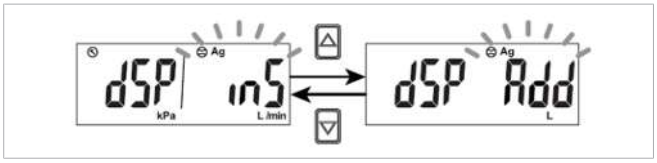
6.11 Flow Sensor Display Mode Selection

[F- 10] Select to display Instantaneous Flow or Accumulated Flow Mode.

1. Press ▲ or ▼ button at "Function Selection Mode" to display [F- 10] [d 15].

2. Press S button to switch to "Display Mode Selection".

3. Press ▲ or ▼ button to select display mode.
   Instantaneous Flow Mode = [in5]
   Accumulated Flow Mode = [Add]
   NOTE: When the measured flow rate range is 500mL/min or 1000mL/min, the accumulated flow is selected and the unit will become in mL/min.



4. Press S button to return to "Function Selection Mode".

6.12 Synchronizing the Flow Value Between the Analog Output and the Display

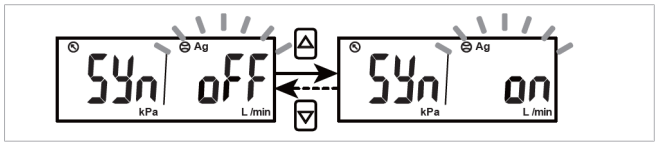
[F-80] Select to synchronize the flow value between the analog output and the display.

ⓘ This function is available only for the flow output.

1. In function selection mode, press ▲ or ▼ to display [F-80] [Syn].

2. Press the S button to switch to the display synchronization.

3. Press the ▲ or ▼ button to set the display synchronization.
   Display sync "OFF" = [oFF]
   Display sync "on" = [on]



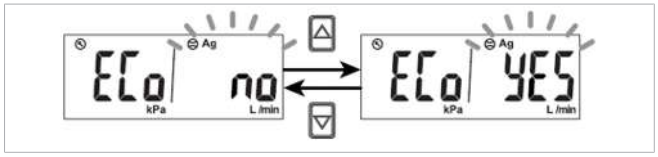
4. Press the S button to return to the function selection mode.

6.13 Power-Save Mode Selection

[F-9 I] Select Power-Save Mode at Measurement Mode.

During the Power-Save Mode, the main display will turned off if no buttons is pressed in 30 sec., press any keys to leave the Power-Save Mode.

1. Press ▲ or ▼ button at "Function Selection Mode" to display [F-9 I] [Eco].
2. Press S button to switch to "Power-Save Mode Selection".
3. Press ▲ or ▼ button to turn on the power-save mode.
   Power-save mode "OFF" = [no]
   Power-save mode "ON" = [YES]
   NOTE: During the Power-Save Mode, the decimal point will flash.



4. Press S button to return to "Function Selection Mode".

6.14 External Input Selection

[F-92] Accumulated flow external reset: The accumulated flow value will reset to "0" when an external input signal is applied.

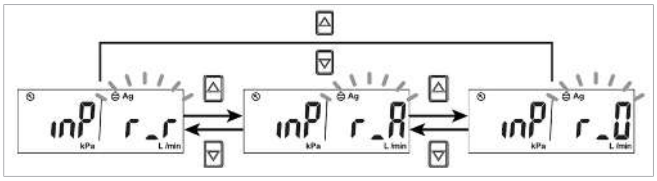
Auto-shift: The instantaneous flow rate will regard as the standard when the external input signal is applied. The switch output function operates relative to its change.

Auto-shift zero: The instantaneous flow rate is reset to zero to regard as standard when the external input signal is applied. The switch output function operates relative to its change.

This function is only for output 1 corresponding to flow sensor action point. When external signal is input, please connect the input wire to GND for 30 ms or more.

1. Press ▲ or ▼ button at "Function Selection Mode" to display [F-92] [inP].
2. Press S button to switch to "External Input Selection".

3. Press ▲ or ▼ button to select external input function.
   Accumulated flow external reset = [inP r_r]
   Auto-shift = [inP r_A]
   Auto-shift zero = [inP r_0]
   NOTE:
   1. This function is not available with Output Specification -02 and -04.
   2. When external signal is input, the instantaneous flow rate value will be shown [□□□□].



4. Press S button to return to "Function Selection Mode".

6.15 Fine Adjustment Setting

[F-94] This function is to fine adjust flow and pressure display values. Display values can be calibrated to within ±2.5% R.D.

1. Fine adjustment of instantaneous flow value

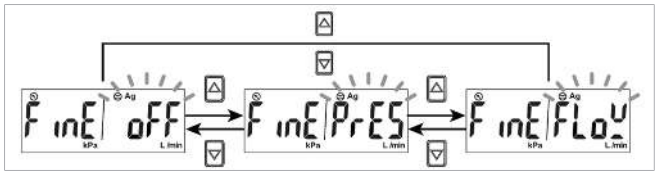
1. Press ▲ or ▼ button at "Function Selection Mode" to display [F-94] [F inE].
2. Press S button to switch to "Fine Adjustment Setting".
3. Press ▲ or ▼ button to select fine adjustment OFF or to set fine adjustment instantaneous flow rate value or pressure value.
   Fine adjustment function off = [□FF]
   Fine adjustment of pressure value = [PrES]
   Fine adjustment of Instantaneous flow rate value = [FLoW]

   ⇨ FLoW is displayed.
4. Press S button to select "Fine adjustment of Instantaneous flow rate value".
   ⇨ Display changes to [value] / [FSt] respectively [0.00] Flashing Alternately
5. Press ▲ or ▼ button to set fine adjustment value (left display).
   NOTE: Right display will flashing between [0.00] and [FSt].
6. Press S button to return to "Measurement Mode".

2. Fine adjustment of pressure value

1. Press ▲ or ▼ button at "Function Selection Mode" to display [F-94] [F inE].
2. Press S button to switch to "Fine Adjustment Setting".
3. Press ▲ or ▼ button to select fine adjustment OFF or to set fine adjustment instantaneous flow rate value or pressure value.
   Fine adjustment function off = [oFF]
   Fine adjustment of pressure value = [PrES]
   Fine adjustment of Instantaneous flow rate value = [FLoW]

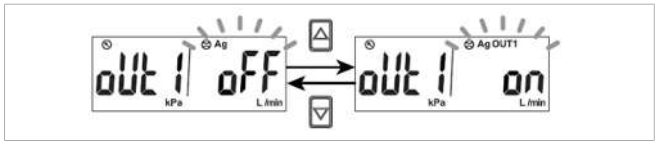
   ⇨ [PrES] is displayed.
4. Press S button to select "Fine Adjustment of Pressure Value".
   ⇨ Display changes to [FSt] respectively [0.00] Flashing Alternately / [value]
5. Press ▲ or ▼ button to setting fine adjustment of display value (right display).
   NOTE: Left display will flashing between [0.00] and [FSt].
6. Press S button to return to "Measurement Mode".

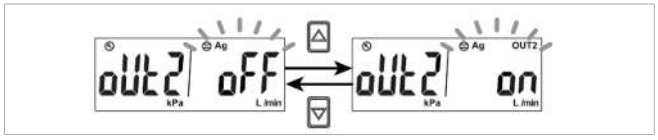


6.16 Forced Output Function

[F-95] To turn the analog ON/OFF forcibly.

1. Press ▲ or ▼ button at "Function Selection Mode" to display [F-95] [FoUt].
2. Press S button to switch to "OUT 1 setting".
3. Press ▲ or ▼ button to setting OUT 1.
   OUT1 OFF = [oFF]
   OUT1 ON = [on]
4. Press S button to return to "OUT2 setting".
5. Press ▲ or ▼ button to setting OUT 2.
   OUT2 OFF = [oFF]
   OUT2 ON = [on]



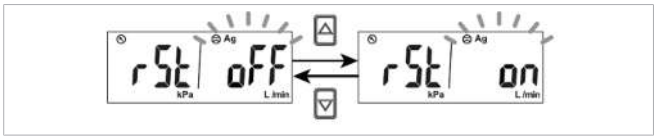


6. Press S button to return to "Function Selection Mode".

6.17 Reset to the Default Setting

[F-99] The factory default settings can be restored.

1. Press ▲ or ▼ button at "Function Selection Mode" to display [F-99] [rESt].
2. Press S button to switch to "Reset to The Default Setting".
3. Press ▲ or ▼ button to return to the factory default setting.
   Disable = [oFF]
   Enable = [on]



4. Press S button to return to "Function Selection Mode".

6.18 Pressure Zero Adjustment Function

The displayed value can be adjusted to "0" when the pressure is within ±3% of the zero point at the time of shipment from the factory.

✓ Sensor is at measurement mode.

1. Press S and ▲ simultaneously over 3 sec. until display [00].
2. Release holding the buttons to return measurement mode.

⇨ Pressure value return zero.

6.19 Instantaneous Flow Zero Adjustment Function

The displayed value can be adjusted to "0" when the measured flow is within ±10% F.S. of the zero point at the time of shipment from the factory.

✓ Sensor is at measurement mode.

1. Press S and ▼ simultaneously over 3 sec. until display [00].
2. Release holding the buttons to return measurement mode.

⇨ Instantaneous flow value return zero.

6.20 Reset Accumulated Flow Function

Accumulate flow value return to zero.

✓ Sensor is at measurement mode (Accumulated flow value mode).

1. Press ▲ and ▼ simultaneously over 3 sec. until display zero.

2. Release holding the buttons to return measurement mode.

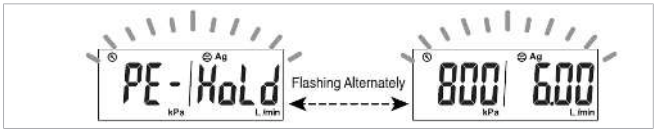
⇨ Accumulated value display zero.

6.21 Peak Value Display

The maximum pressure and instantaneous flow, from when the power was supplied to this moment, is detected and updated.

✓ Sensor is at measurement mode.

1. Press ▲ over 3 sec.



⇨ The maximum value will be displayed flashing, and is held.

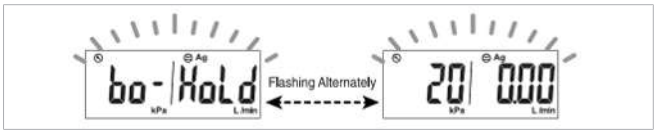
2. Press S button return to the measurement mode.

6.22 Bottom Value Display

The minimum pressure and instantaneous flow, from when the power was supplied to this moment, is detected and updated.

✓ Sensor is at measurement mode.

1. Press ▼ over 3 sec.



⇨ The minimum value will be displayed flashing, and is held.

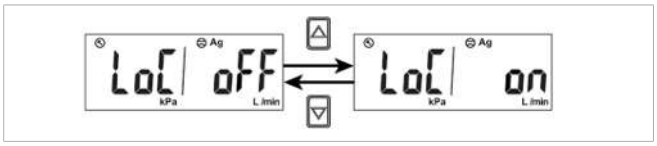
2. Press S button return to the measurement mode.

6.23 Key Lock / Unlock Mode

To prevent errors occurring due to unintentional changes of the set values. If a button operation is performed while the key lock setting is ON, [LOC] [ON] is displayed for 1 sec.

✓ Sensor is at measurement mode.

1. Press [S] button over 5 sec. to select "Key Lock/Unlock Setting".
2. Press [▲] or [▼] button to select locking or unlocking of the key.
   Unlock = [OFF]
   Lock = [ON]
   NOTE: If a button operation is performed while the key lock setting is ON, [LOC] [ON] will displayed.



⇨ Displayed for 1 sec.

7 Warranty

Our warranty applies solely to our product, not to any other ...

- damages and injuries which occur by earthquakes, fires, the acts by third party, other matters, acts intentionally, acts accidentally, misuse, or other abnormal conditions that are not the responsible of Schmalz.
- additional damages (the loses of business profits, business interruption, etc.) incurred due to using or misusing the product.

Our warranty excludes any injuries and damages happened by using the product beyond the specified range of catalog or/and not following the instruction manual.

8 Troubleshooting

8.1 Specific Internal Voltage drop

Observed the internal voltage drop.

When used at a specified voltage, if the sensor is functional but the load does not work, please check if the operating voltage of the load meets the following formula.

Power Supply — Internal voltage drop of sensor —> Minimum operating voltage of load

8.2 Error Code Instruction

Error Type	Error Code	Error Condition	Troubleshooting
0UT1 Excess Load Current Error	[800] [Er 1] / [Er 1] [2.00]	Output 1 load current is more than 125 mA	Turn power off and check the cause of overload current or lower the current load under 125 mA, then restart.
0UT2 Excess Load Current Error	[800] [Er2] / [Er2] [2.00]	Output 2 load current is more than 125 mA	
Zero Adjustment Error	[800] [Er3]	The instant flow is within ±10% F.S. of the zero point.	Perform the zero clear function again under no flow conditions.
	[Er3] [2.00]	The pressure value is over ±3% F.S. of the zero point.	Perform the zero clear function again under no pressure conditions.
System Error	[Er4] [Er4]	Memory error	Turn power off, and then restart. If error condition remains, please return to factory for inspection.
	[Er5] [Er5]	Internal data error	
	[Er6] [Er6]	Internal data error	
	[Er7] [Er7]	System parameter error	
Applied Flow/ Pressure Error	[800] [HHH]	The instant flow has exceeded the upper limit of the flow display range.	Reduce the flow to the display range.
	[HHH] [2.00]	The pressure has exceeded the upper limit of the pressure display range.	Reduce the pressure to the display range.
	[800] [LLL]	The instant flow has exceeded the lower limit of the flow display range.	Ensure the flow is in the correct direction.
	[LLL] [2.00]	The pressure has exceeded the lower limit of the pressure display range.	Reduce the pressure to the display range.

9 Maintenance Precautions

1. The accuracy could change by 2 to 3 % when the piping is removed or replaced.
2. Do not insert a stick or wire into the piping ports.
3. Do not touch the terminals or connectors when power is on.

10 Declarations of Conformity

10.1 EU Declaration of Conformity

The manufacturer Schmalz confirms that the product described in these instructions fulfills the following applicable EU directives:

2014/30/EU	Electromagnetic Compatibility
2011/65/EU	RoHS Directive

The following harmonized standards were applied:

EN 61000-6-2+AC	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments
EN 61000-6-4+A1	Electromagnetic compatibility - Part 6-4: Generic standards - Emission standard for industrial environments
EN IEC 63000	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

Additional technical standards and specifications were applied:

EN 61000-4-2	Electromagnetic Compatibility (EMC) – Part 4-2: Testing and measuring procedures
EN 61000-4-3	Electromagnetic Compatibility (EMC) – Part 4-3: Testing and measuring procedures
EN 61000-4-4	Electromagnetic Compatibility (EMC) – Part 4-4: Testing and measuring procedures
EN 61000-4-6	Electromagnetic Compatibility (EMC) – Part 4-6: Testing and measuring procedures
EN 61000-4-8	Electromagnetic Compatibility (EMC) – Part 4-8: Testing and measuring procedures

The EU Declaration of Conformity valid at the time of product delivery is delivered with product or made available online. The standards and directives cited here reflect the status at the time of publication of the operating and assembly instructions.

10.2 UKCA Conformity

The manufacturer Schmalz confirms that the product described in these operating instructions fulfills the following applicable UK regulations:

2016	Electromagnetic Compatibility Regulations
2012	The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations

The following designated standards were applied:

EN 61000-6-2+AC	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments
EN 61000-6-4+A1	Electromagnetic compatibility - Part 6-4: Generic standards - Emission standard for industrial environments
EN IEC 63000	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

Additional technical standards and specifications were applied:

EN 61000-4-2	Electromagnetic Compatibility (EMC) – Part 4-2: Testing and measuring procedures
EN 61000-4-3	Electromagnetic Compatibility (EMC) – Part 4-3: Testing and measuring procedures
EN 61000-4-4	Electromagnetic Compatibility (EMC) – Part 4-4: Testing and measuring procedures
EN 61000-4-6	Electromagnetic Compatibility (EMC) – Part 4-6: Testing and measuring procedures
EN 61000-4-8	Electromagnetic Compatibility (EMC) – Part 4-8: Testing and measuring procedures

The Declaration of Conformity (UKCA) valid at the time of product delivery is delivered with the product or made available online. The standards and directives cited here reflect the status at the time of publication of the operating and assembly instructions.

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