USE AND MAINTENANCE MANUAL

CAMOZZI
Automation

SERIES FSP02-FSP03
DIGITAL FLOW SENSOR

Contents

Introduction

1.1 Product Safety Instructions

This section indicate the levels of risks with the labels of Danger, Warning and Caution.

Danger indicates high level of risk, will lead to fatal or serious injuries if not avoided.

Warning indicates medium level of risk, it might cause death or serious injuries.

Caution indicates low level of risk, it might result in minor injuries, such as scald, electric shock, etc. and the product, equipment and machines might be damaged.

1.2 Precautions for use

Warning

- **Operate within the specified voltage.**
  Malfunction or damaged product, electric shock or fire may be resulted by exceeding the specified voltage range.
- **Do not exceed the maximum load current.**
  It may damage the product.
- **Do not use any load that generates surges.**
  Surge protection is present but applying surge voltage repeatedly will ultimately damage the product.
  When using with inductive load (such as relay or solenoid), please install a flyback diode across the load (polarity must be observed).
- **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 voltage – Internal voltage drop of sensor > Minimum operating voltage of load

- **Please follow the rated range of flow and pressure to avoid damage.**
- **Do not use flammable fluids and/or permeable fluids.**
  They may cause fire, explosion or corrosion.

1.3 Working fluid and working environment

- **Do not use in an explosive gas atmosphere.**
  The sensor does not have explosion-proof structure, fire, explosion or corrosion can result.
- **Do not use near a surge voltage generated area.**
  If product is nearby the device of surge voltage (e.g., lightning strikes, solenoid lifters, high frequency induction furnaces, motors, etc.), please take measures against the surge sources to prevent damage.
- **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 damaged 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.**

1.4 Wiring Precautions

- **Check wire color and terminal number when wiring.**
  Incorrect wiring can cause permanent damages to the sensor, check wire color and terminal number according to 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.
- **Please use a separate route for the product wiring and any power or high voltage wiring to avoid noise interruption.**
- **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.
- **Do not connect wire when the power is on.**
- **RS485 products must be connected the communication wire first.**
  Wiring for RS485 MODBUS : Please connect RS485 (B+) or (A-) before connecting power supply to avoid short circuit to damage to product.

1.5 Installation Precautions

- **Ensure the flow direction of the fluid.**
  Install the pipe by following the arrow indication that shows the air flow direction on the product.
- **Flush out all dirt and dust by air blow before connecting the piping to the sensor.**
- **Do not drop or hit.**
  When installation, do not drop, hit or apply excessive shock (100m/s2), permanent damage to the internal component of the sensor may occur.
- **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 set the products 10mm 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.

1.6 Other Precautions

- **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 changes.**
  During the initial flow and pressure setting, the product will switch the output according to the existing settings until the changes are complete.

Caution

1.7 Installation Precautions

- **Please follow the specified tightening torque.**
- **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.
- **When mounting without a bracket, please use P type self-tapping screw- M3 x L 6mm.**
- **Do not remove the fixed pin for the One-Touch Fitting.**
  To avoid losing the internal parts and cause malfunction.
- **Please do not replace fittings by yourself.**
- **While installing the FSP01-201 to the pipe, please apply air tube with I.D. 5 mm.**
  While installing the FSP01-010/500 to the pipe, please apply air tube with I.D. 4 mm.

1.8 Maintenance Precautions

- **The accuracy could change by 2 to 3% when the piping is removed or replaced.**
- **Do not touch terminals or connectors when power is on.**

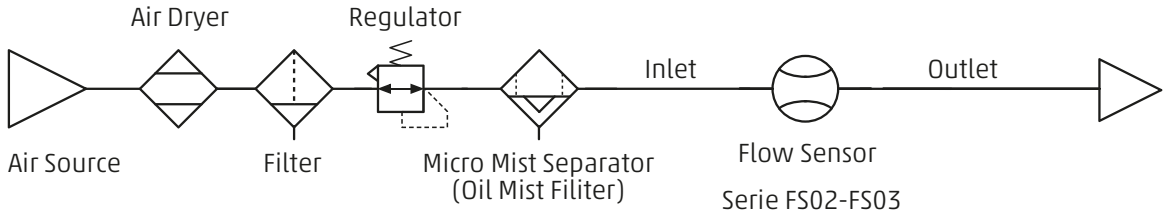
1.9 Disposal

- **Sensors at end-of-life must be disposed of in accordance with E-Waste regulations of the country/region, NOT disposed of with regular garbage.**

Warning

1.10 Fluid

- **Check the regulator and flow adjustment valve before introducing the fluid.**
- **On the inlet side, be sure to install an air filter below the filtration level of 10um.**
  The sensing element cannot measure properly if foreign matter adheres to it.
- **Recommended Equipments and Installation**



NOTE

Please install a throttle valve on the outlet side of the sensor to prevent errors caused by unstable flow.

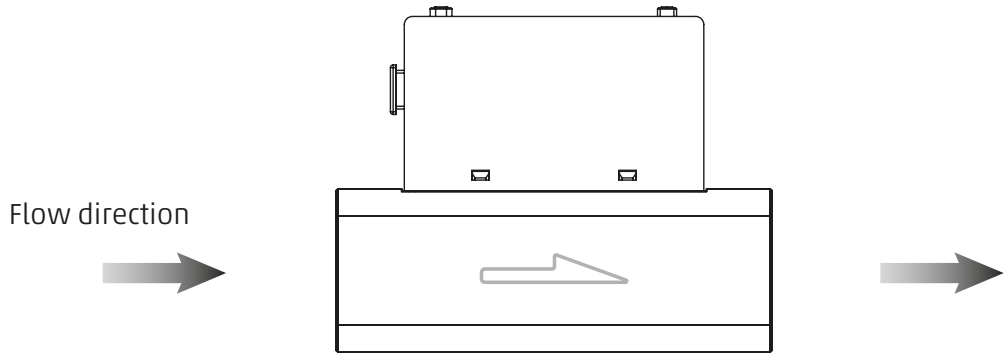
1.11 Disclaimer

- 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 responsibility of CAMOZZI AUTOMATION.
- Our warranty applies solely to our product, not to any other 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 that happened by using the product beyond the specified range of function stated in the catalog or the instruction manual.

Installation Instructions

2.1 Piping

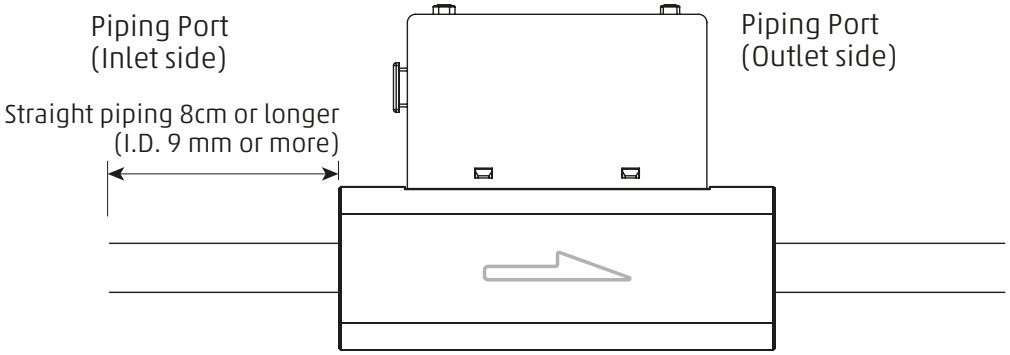
Install the pipe by following the arrow indication that shows the air flow direction on the product.



Use straight piping 8cm or longer (I.D.9 mm or more) to connect the Piping Port (Inlet side). If straight piping is not installed, the accuracy may vary by ± 2% F.S.
Avoid sudden changes in the piping size on the inlet side of the product.

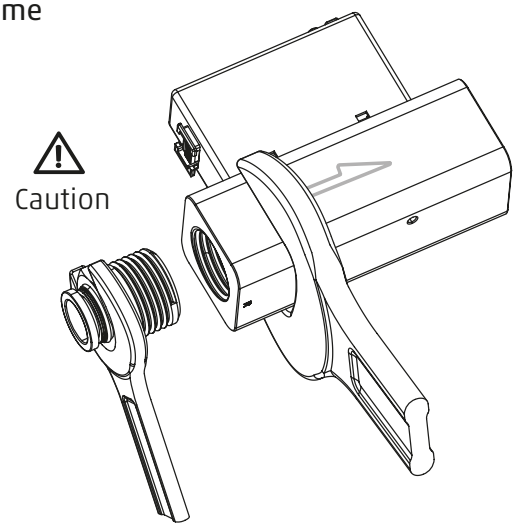
Do not release the outlet side piping of the product directly to the atmosphere without the piping connected.

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



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.
Please refer to the applicable torque below.



After installation completed, turn on the gas and power supply for proper operation and leaking test to confirm whether the installation is correct.

Piping Specification	Required Torque
G 1/2	28 ÷ 30 Nm
G 3/4	28 ÷ 30 Nm

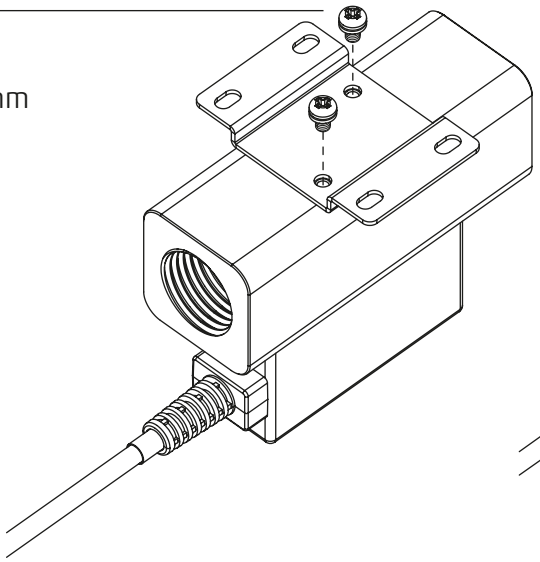
2.2 Mounting Bracket / Optional Parts

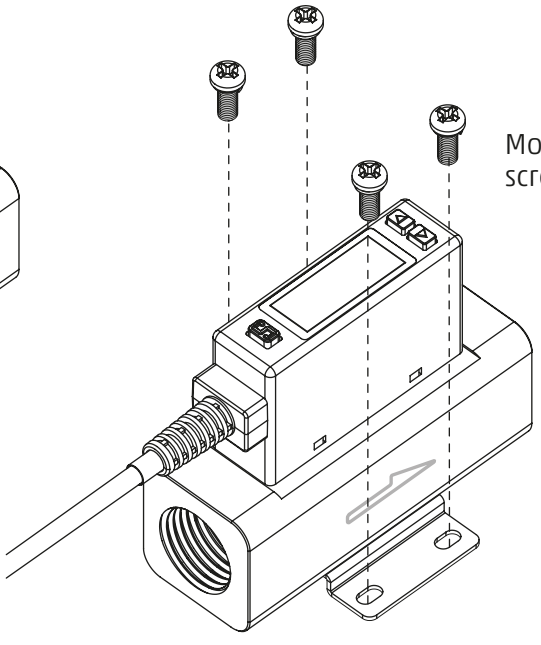
The LCD display may be difficult to see at certain angles.
The sensor can be installed horizontally or vertically, but the flow rates may change because of the installation way of the product or piping.

The tightening torque for screws should be under 0.3 ±0.1 N.m.

Mounting screw

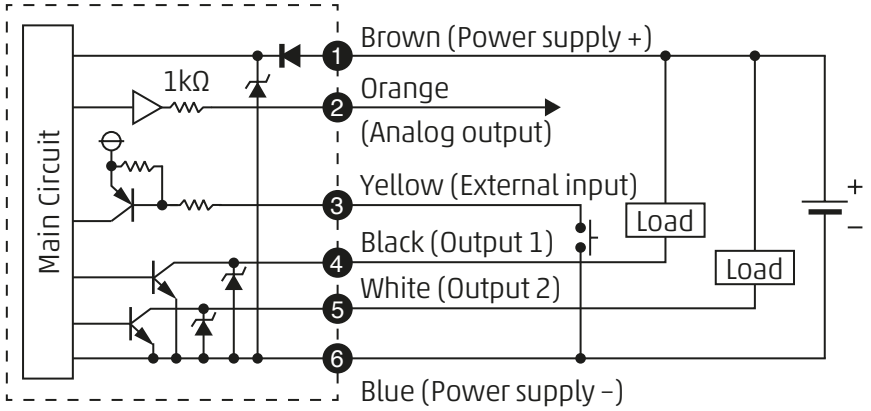
P Type
Size: 3.0
Length: 6mm



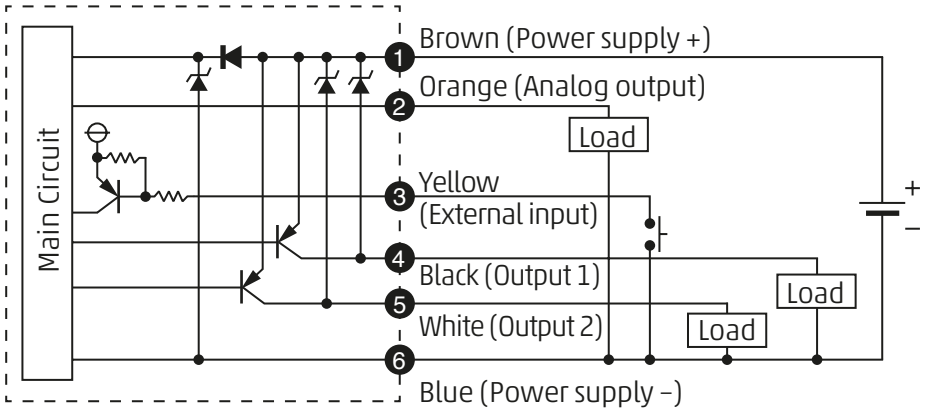


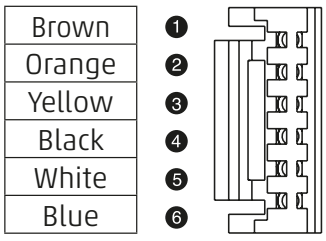
2.3 Wiring Diagrams

• PNP Output / Analog Voltage Output / External Input



• PNP Output / Analog Current Output / External Input

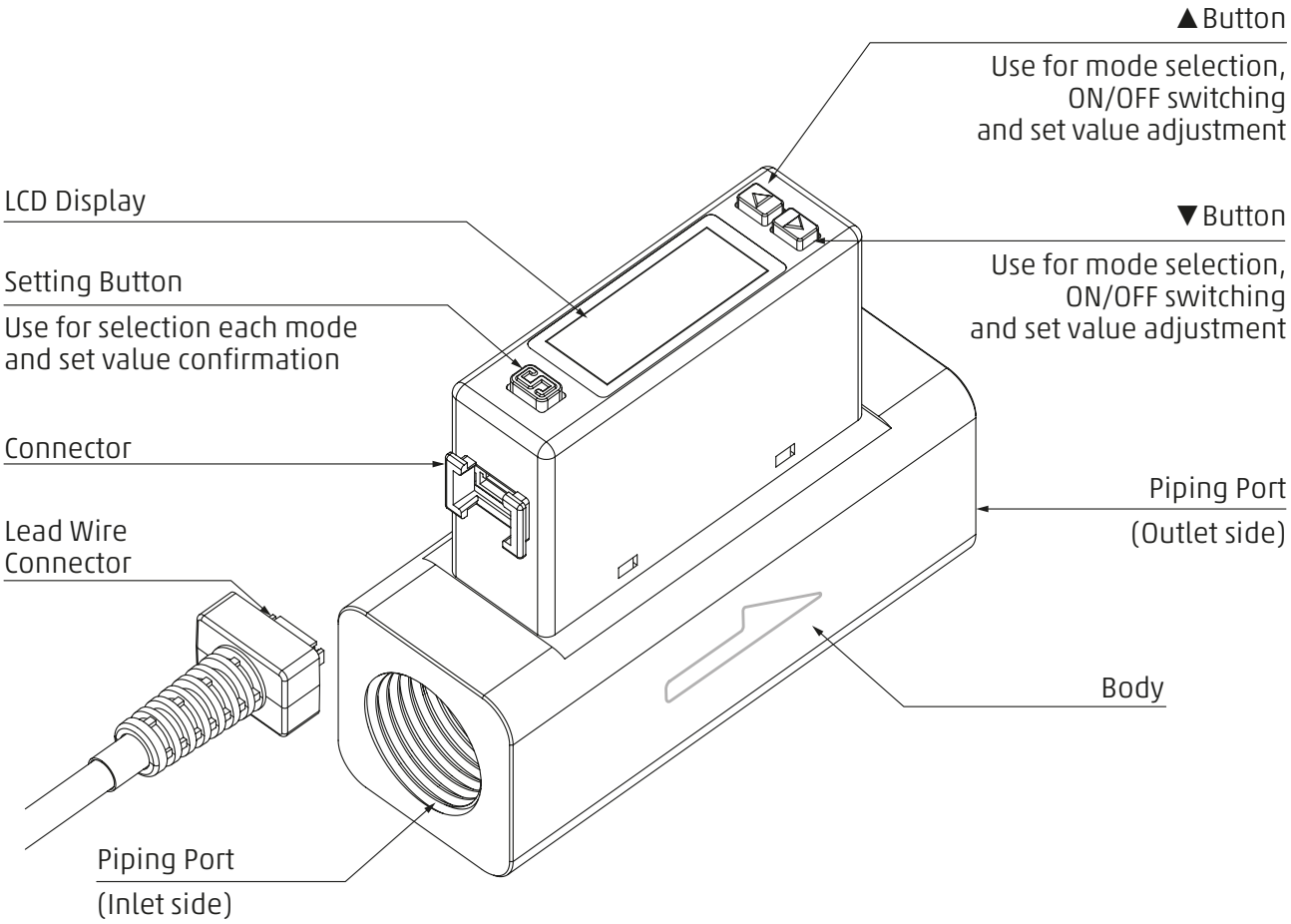


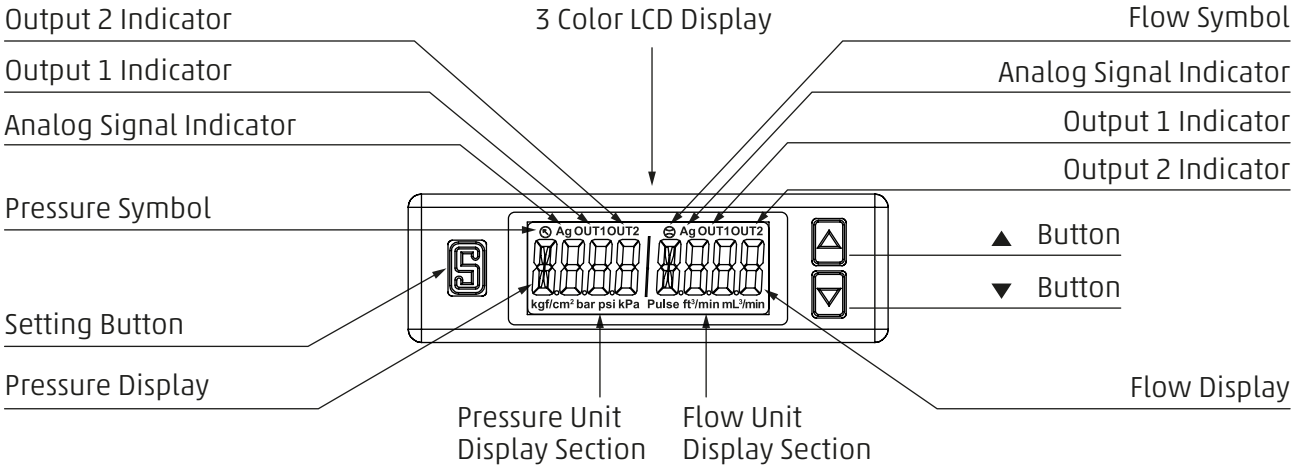


Pin N°	Line color	Content
1	Brown	Power supply (12÷24 VDC)
2	Orange	Analog voltage output: 1 ÷ 5V Analog current output: 4 ÷ 20mA
3	Yellow	External input
4	Black	Output 1 (Max. load current: 125mA)
5	White	Output 2 (Max. load current: 125mA)
6	Blue	0V (GND)

How to Use

3.1 Names and Functions of Individual Parts





3.2 Function Instruction

• Function Setting Mode

Function Code	Item	Default setting	Explanation
[F-01]	[oUt 1] OUT1 setting		Select Output 1 corresponding to flow sensor or pressure sensor Set the flow rate or pressure value to switch ON/OFF
	[oUt 1] OUT1 sensor correspondence	FLoU	
	[FLoU] OUT1 output mode	HYS	
	[oUt 1] OUT1 output type	no	
	[FL- 1] OUT1 set value input	50% of maximum measured flow rate 501: 250 L/min 102: 500 L/min 202: 1000 L/min	
	[FH- 1] OUT1 set value input	60% of maximum measured flow rate 501: 300 L/min 102: 600 L/min 202: 1200 L/min	
[F-02]	[oUt2] OUT2 setting		Select Output 2 corresponding to flow sensor or pressure sensor Set the flow rate or pressure value to switch ON/OFF
	[oUt2] OUT2 sensor correspondence	FLoU	
	[FLoU] OUT2 output mode	HYS	
	[oUt2] OUT2 output type	no	
	[FL-2] OUT2 set value input	50% of maximum measured flow rate 501: 250 L/min 102: 500 L/min 202: 1000 L/min	
	[FH-2] OUT2 set value input	60% of maximum measured flow rate 501: 300 L/min 102: 600 L/min 202: 1200 L/min	
[F-03]	[CLor] LCD Display setting		Select back light color and display mode
	[d iSP] LCD Display corresponding to output	oUt 1	
	[coL] LCD Display color setting	SoG	
[F-04]	[rESP] Flow/Pressure sensor selection	FLoU	Select the response time for analog output Pressure sensor: 2.5ms ~ 1500ms Flow sensor: 50ms ~ 1500ms
	[FLoU] Response time setting	800(ms)	
[F-05]	[UPdA] Flow/Pressure sensor selection	FLoU	Display refresh cycle can be set in 200ms, 500ms or 1000ms
	[UPdA] Display refresh time of flow sensor setting	500(ms)	
[F-06]	[Un it] Unit setting		Select the UNIT of pressure / flow sensor
	[FLoU] Flow unit setting	LPn	
	[PrES] Pressure unit setting	Un it	

• Function Setting Mode

Function Code	Item	Default setting	Explanation
[F-07]	[rEFE] Flow reference standard setting	Anr	Select the flow value is shown under standard (ANR) or normal condition (NOR)
[F-08]	[AnG] Analog output setting	FLoW	Select the analog corresponding to pressure or flow sensor
[F-09]	[EEPr] Accumulated value hold setting	oFF	To save the last accumulated flow value every 2 or 5 minutes
[F- 10]	[d iS] Flow sensor display mode setting		Select to display Instantaneous Flow or Accumulated Flow Mode
	[dSP] Flow sensor display mode setting	inS	
[F-80]	[SYn] Sync the value of flow analog output and display	oFF	Turn ON to synchronize the value of flow analog output and display
[F-9 1]	[ECo] Power-Save mode setting	no	Select if turn on power-save mode to reduce power consumption
[F-92]	[inP] External input setting	r_r	Select for Accumulated flow rate zero clear, Auto-Shift or Auto-Shift zero
[F-93]	[nbUS] Modbus RTU setting		Set ID number, baud rate and transmission format
	[id] ID number setting	1	
	[rAt] Baud rate setting	96 (9600 Bd)	
	[For] Transmission format setting	n8 1	
	[trA] Communications protocol setting	rtU	
[F-94]	[F inE] Fine adjustment Setting	oFF	The displayed value can be adjusted slightly
[F-95]	[FoUt] Forced output function		To force output ON/OFF to test the switch function
	[oUt 1] Forced output function	oFF	
	[oUt2] Forced output function	oFF	
[F-99]	[rESt] Reset to the default setting		Return to the factory default setting
	[rSt] Reset to the default setting	oFF	

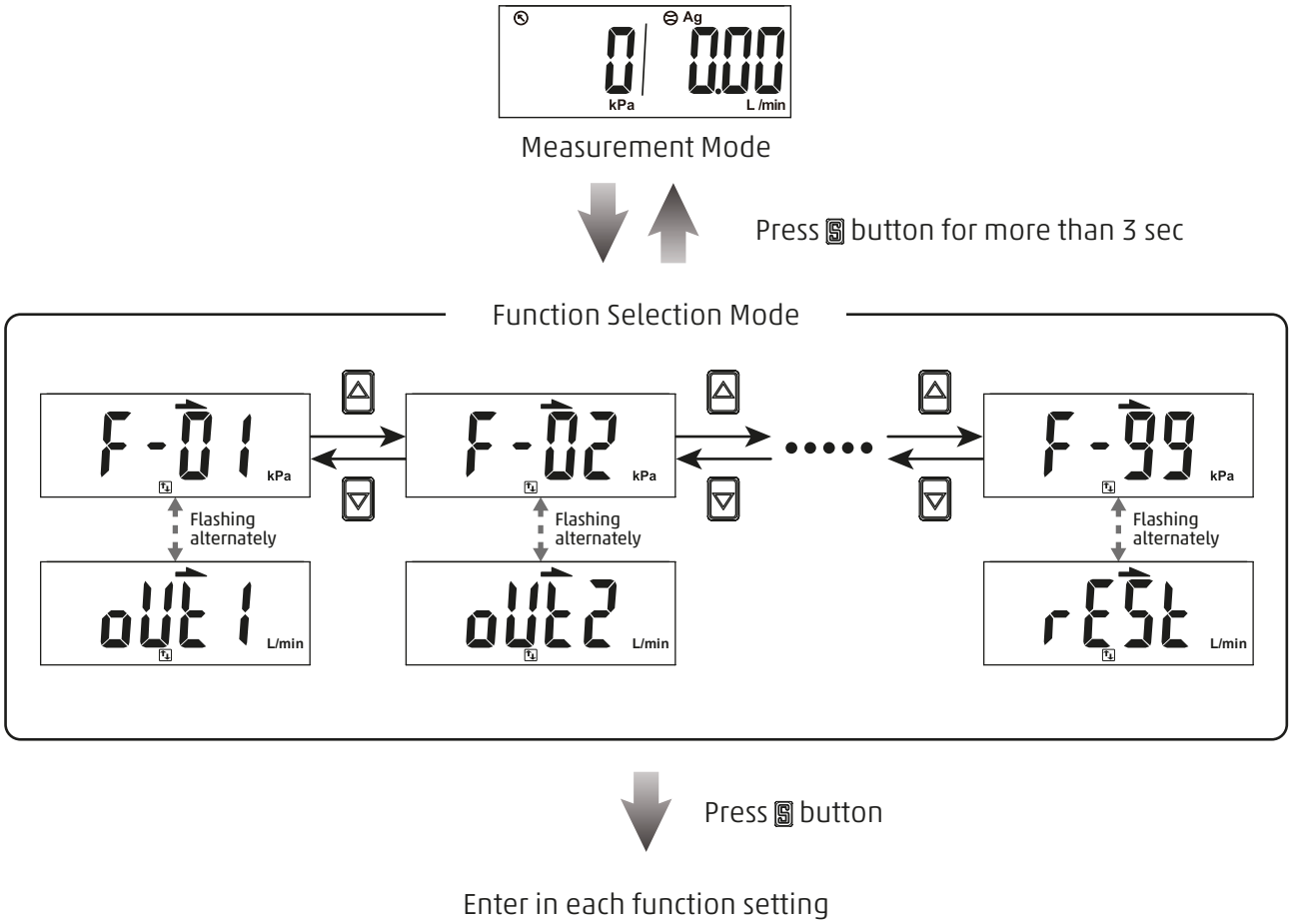
• Measurement Mode

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

3.3 Operation Instructions

• Function Selection Mode

At Measurement Mode, press S button for more than 3 sec. to display [F-01].
Press ▲ or ▼ button to select other setting functions.
Press S for 3 sec. at Function Setting Mode to return to Measurement Mode.

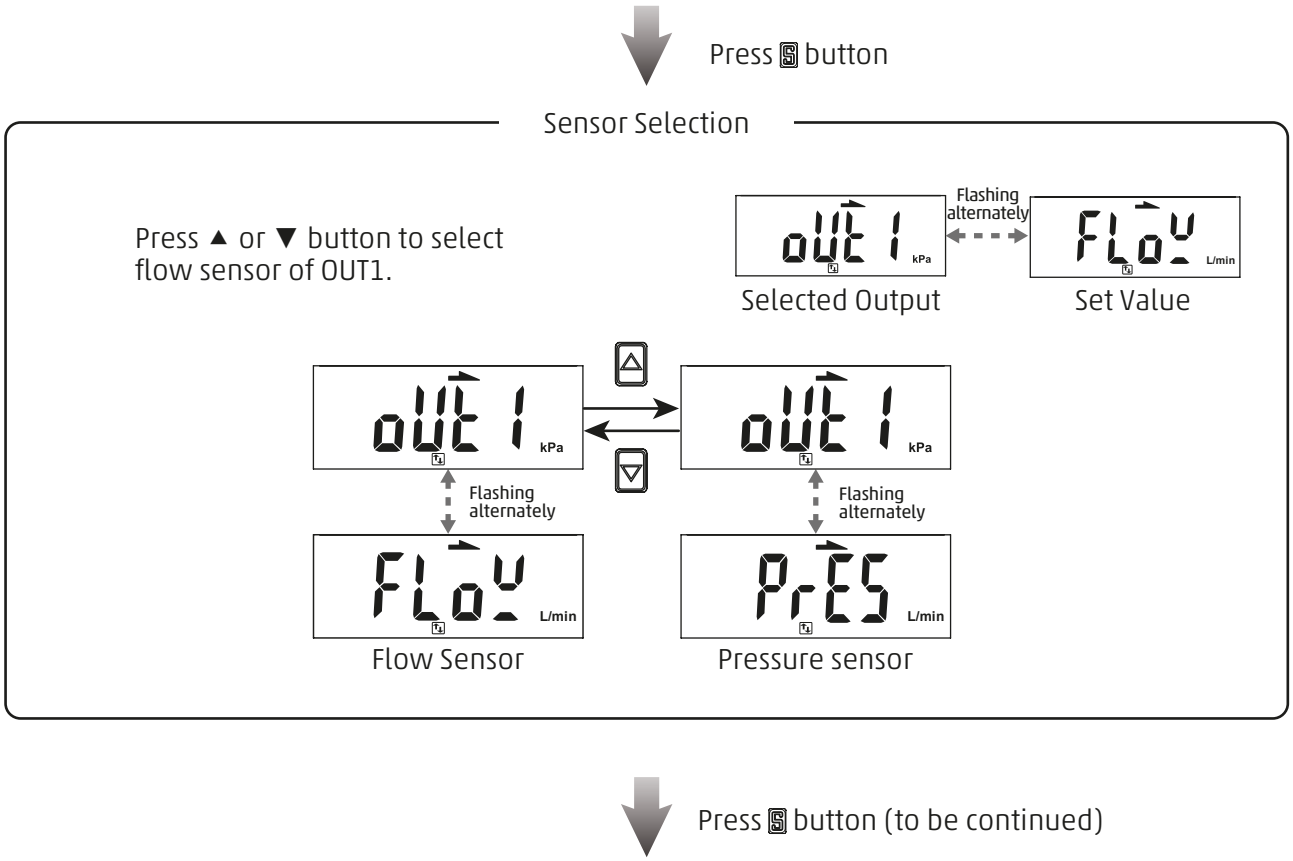


• **[F-01] OUT1 Setting**

Setting corresponding sensor and operating mode of OUT1.

1. Flow sensor setting

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



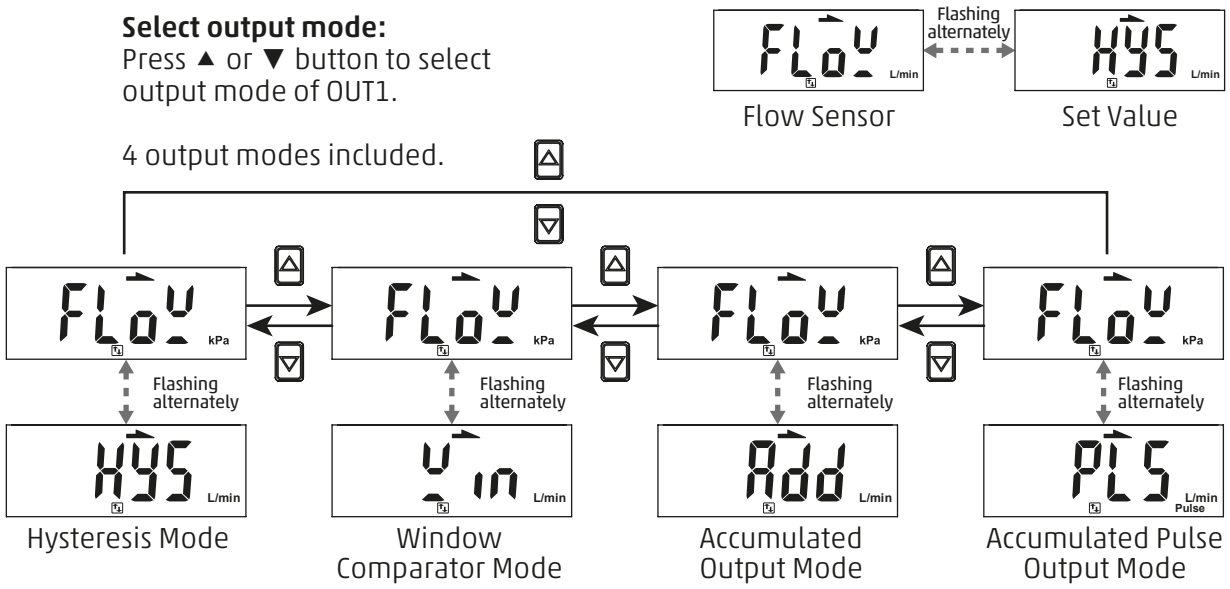
Press S button (to be continued)

Press S button

Output Mode Setting

Select output mode:
Press ▲ or ▼ button to select output mode of OUT1.

4 output modes included.

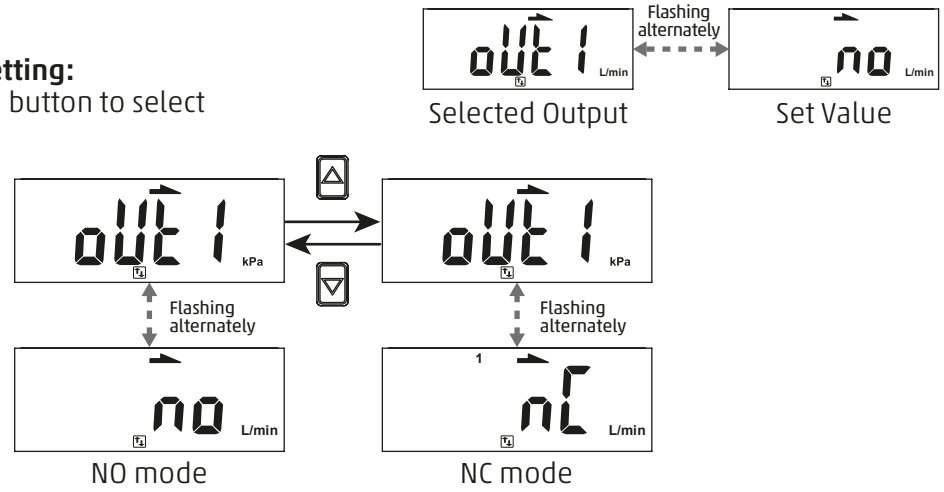


NOTE: Accumulated Pulse Mode is available in OUT1, but not in OUT 2.

Press S button

Output Type Setting

OUT1 type setting:
Press ▲ or ▼ button to select OUT1 type.



NOTE: Type setting will not display when Accumulated Pulse Output Mode is set.

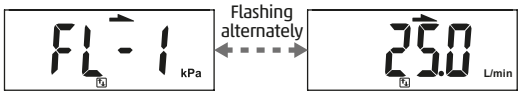
Press S button (to be continued)

Press button

Set Value Setting

OUT1 set value setting:
Press ▲ or ▼ button to adjust the set value.

Hysteresis Mode [HYS]:[FL-1]
Window Comparator Mode [Win]:[FL-1]
Accumlated Output Mode [Add]:[AdL1]



Selected Mode | Set Value

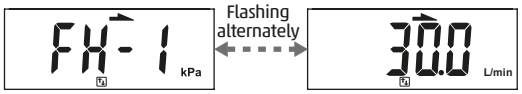
NOTE: Set value setting will not display when Accumulated Pulse Output is set.

Press button

Set Value Setting

OUT1 set value setting:
Press ▲ or ▼ button to adjust the set value.

Hysteresis Mode [HYS]:[FH-1]
Window Comparator Mode [Win]:[FH-1]
Accumlated Output Mode [Add]:[AdH1]



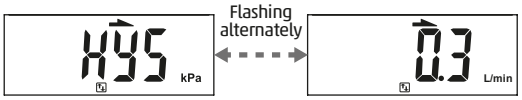
Selected Mode | Set Value

NOTE: Set value setting will not display when Accumulated Pulse Output is set.

Press button

Fixed Hysteresis Setting

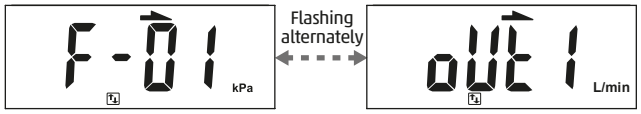
Fixed hysteresis setting:
Press ▲ or ▼ button to adjust fixed hysteresis value.



Fixed Hysteresis Mode | Set Value

NOTE: Fixed hysteresis setting is available when selecting Window Comparator Mode.

Press button to return to Function Selection Mode



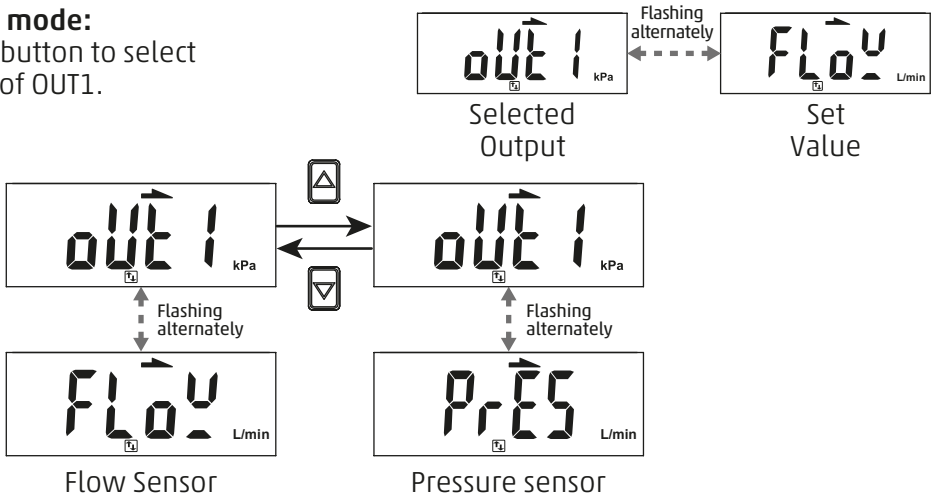
2. Pressure sensor setting

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

Press S button

Sensor Selection

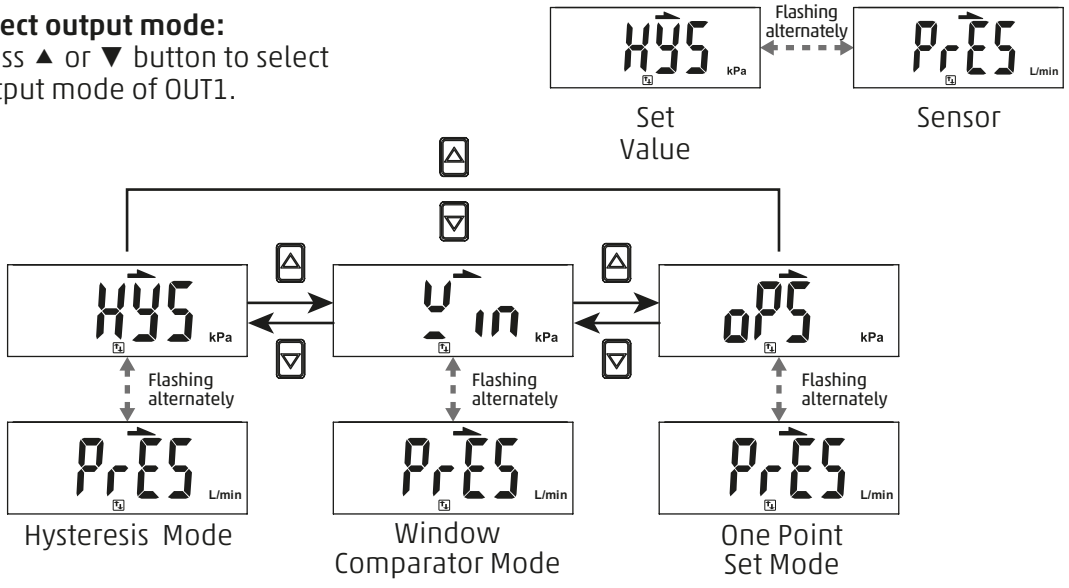
Select output mode:
Press ▲ or ▼ button to select output mode of OUT1.



Press S button

Output Mode Setting

Select output mode:
Press ▲ or ▼ button to select output mode of OUT1.

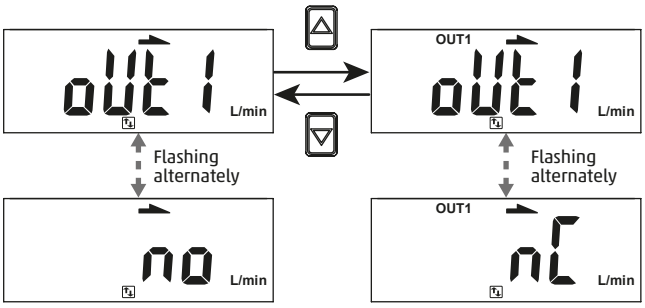


Press S button (to be continued)

Output Type Setting

OUT1 type setting:
Press ▲ or ▼ button to select OUT1 type.

Selected Output | Set Value

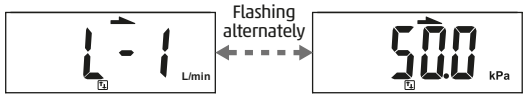


NO mode | NC mode

Press [S] button

Set Value Setting

OUT1 set value setting:
Press ▲ or ▼ button to adjust the set value.



Selected Mode | Set Value

Hysteresis Mode [HYS]:[L-1], [H-1]
Window Comparator Mode [WIn]:[L-1], [H-1]
Accumlated Output Mode [oPS]:[P-1]

Selected Mode | Set Value

Press [S] button (to be continued)

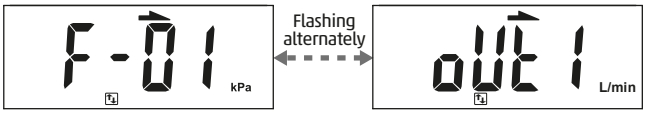
Fixed Hysteresis Setting

Fixed hysteresis setting:
Press ▲ or ▼ button to adjust fixed hysteresis value.

Fixed Hysteresis Mode | Set Value

NOTE: Fixed hysteresis setting will not display when Hysteresis Mode is set.

Press button to return to Function Selection Mode



- **[F-02] OUT2 Setting**

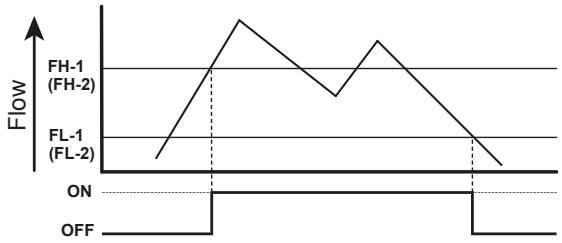
Setting corresponding sensor and operating mode of OUT2.

1. Press ▲ or ▼ button at function setting mode to start "OUT 2 Setting" [F-02] [oUt2]
2. Check the [F-01] for the same follow setting.

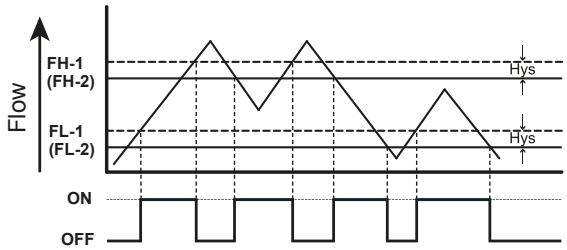
NOTE: The OUT2 Setting dose not have Accumulated Pulse Output Mode.

Normal Open Mode

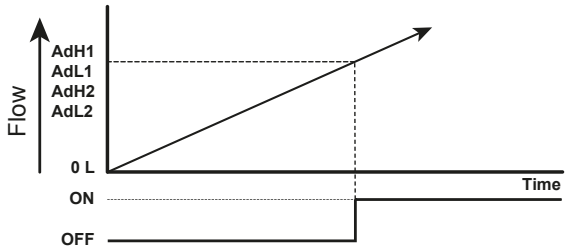
Hysteresis Mode



Window Comparator Mode

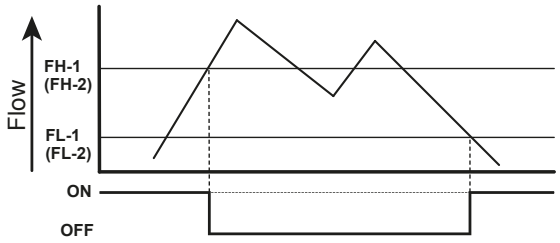


Accumulated Output Mode

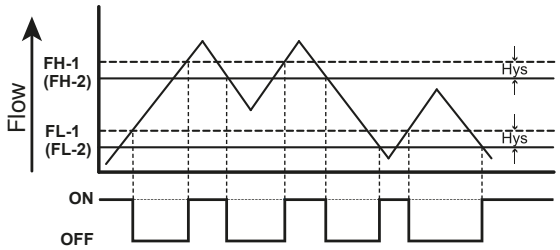


Normal Close Mode

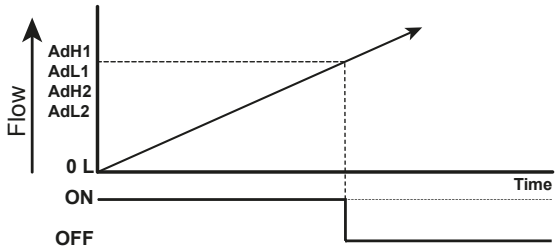
Hysteresis Mode



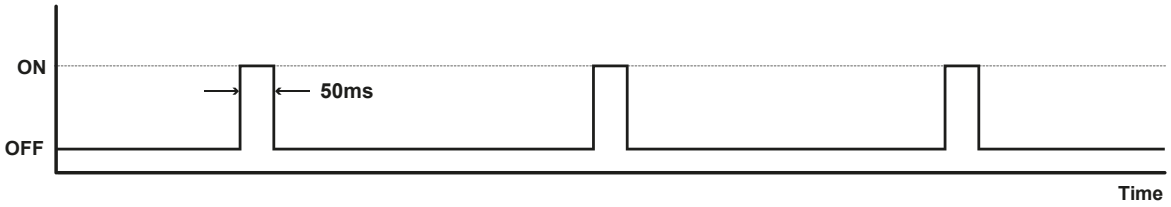
Window Comparator Mode



Accumulated Output Mode



Accumulated Pulse Output Mode



Flow Range	500L	1000L	2000L
Pulse Output Rate	5mL	10L	10L

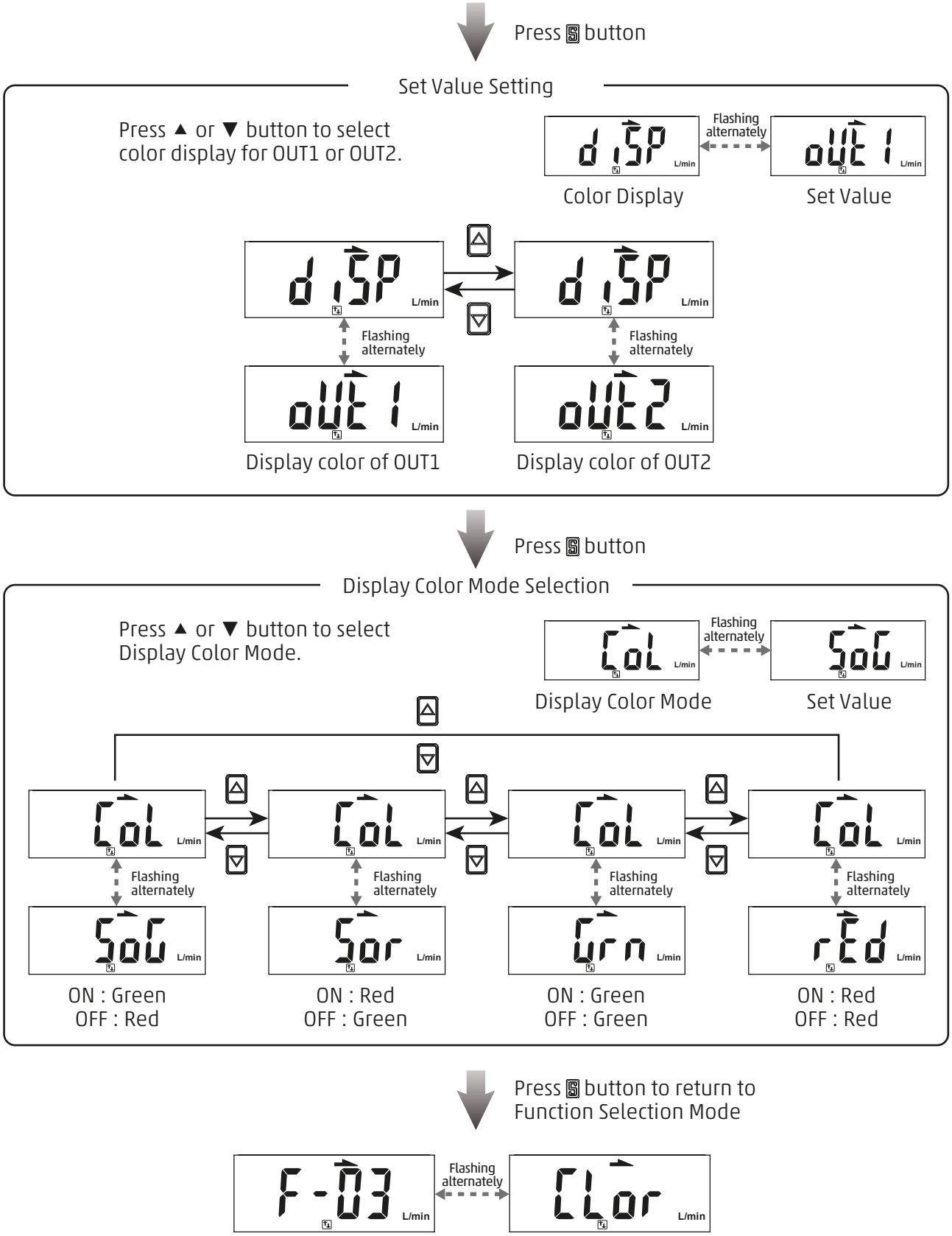
NOTE:

1. In case hysteresis is set at less than or equal to 2 digits, switch output may chatter if input detected fluctuates near the set point.
2. 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.

• **[F-03] LCD Display Color Setting**

4 LCD Display Color Modes of output value selection.

Press ▲ or ▼ button at Function Setting Mode to display [F-03] [CLor]

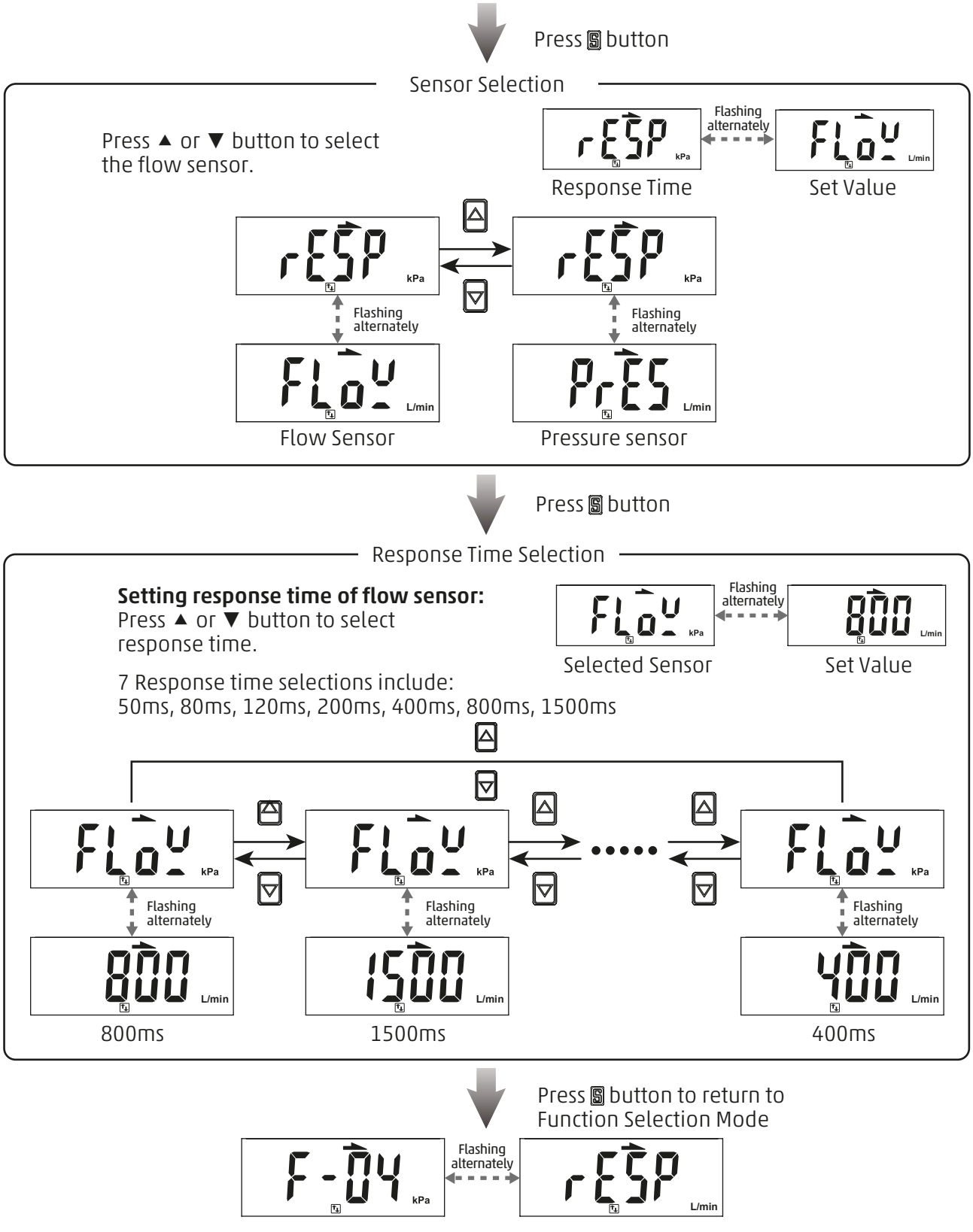


• **[F-04] Response Time Setting**

Select proper response time to avoid switch output chattering.

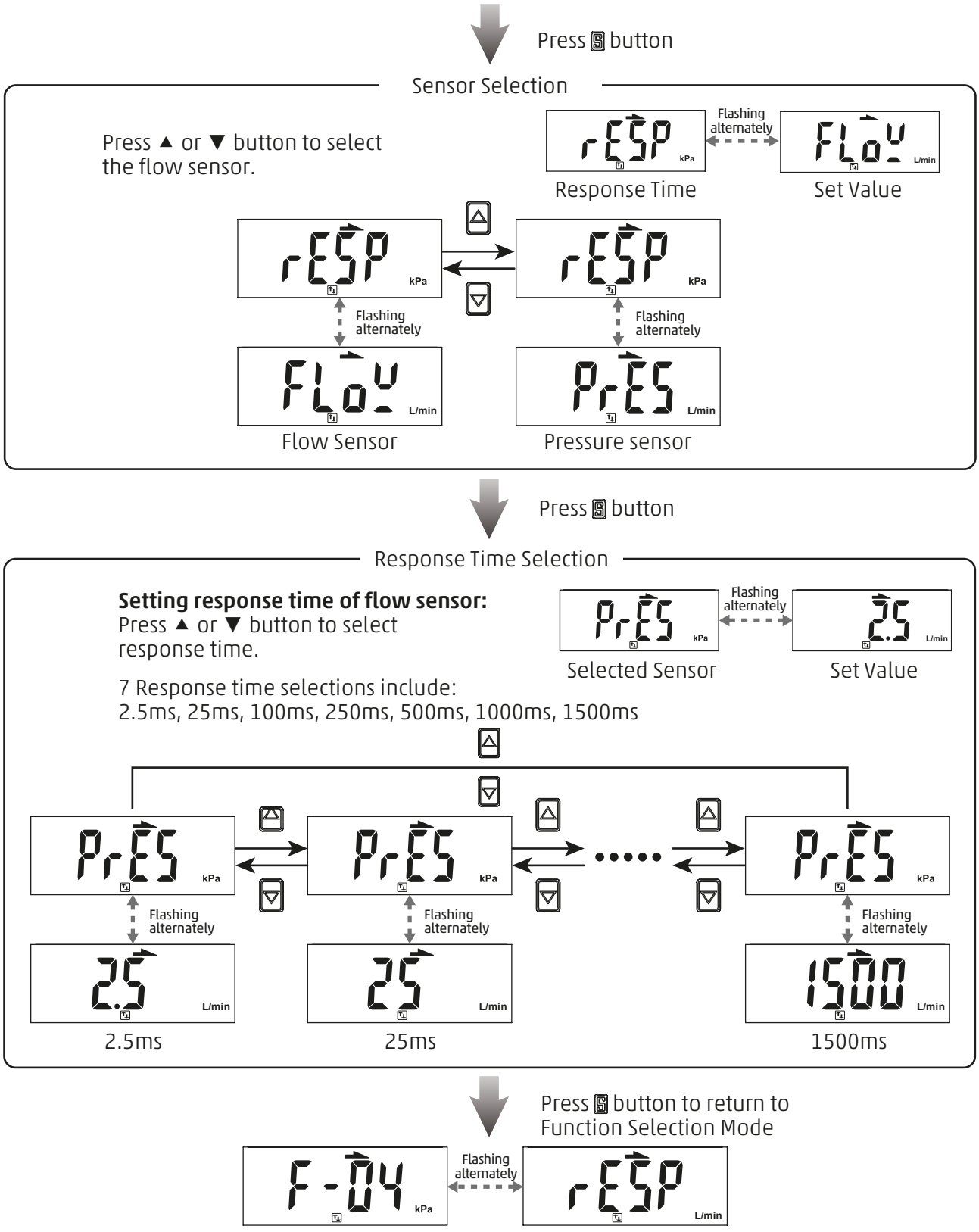
1. Flow sensor setting

Press ▲ or ▼ button at Function Selection Mode to display [F-04] [rESP]



2. Pressure sensor setting

Press ▲ or ▼ button at Function Setting Mode to display [F-04] [rESP]

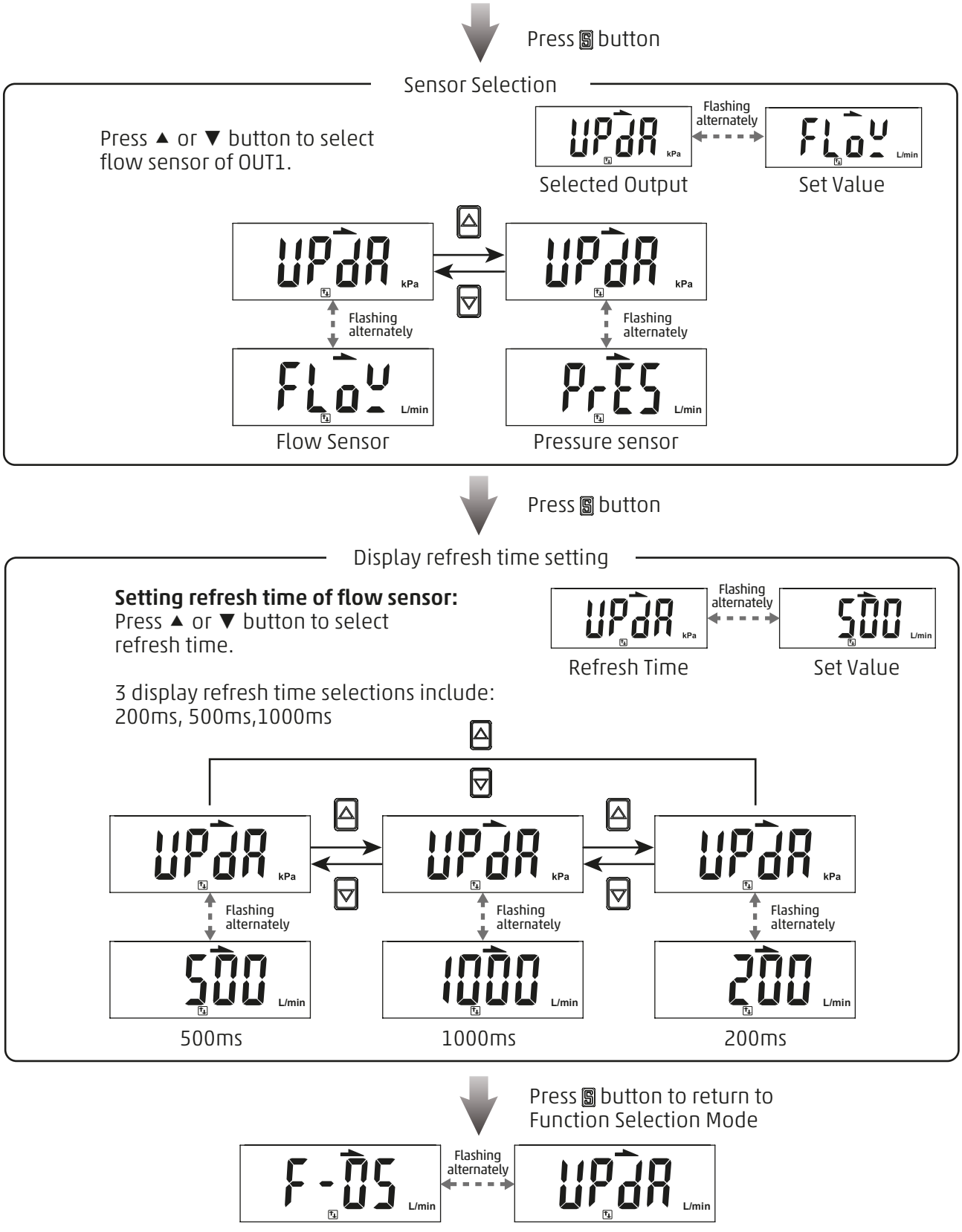


• **[F-05] Display Refresh Time Setting**

Select the proper display refresh time to reduce frequently changing value.

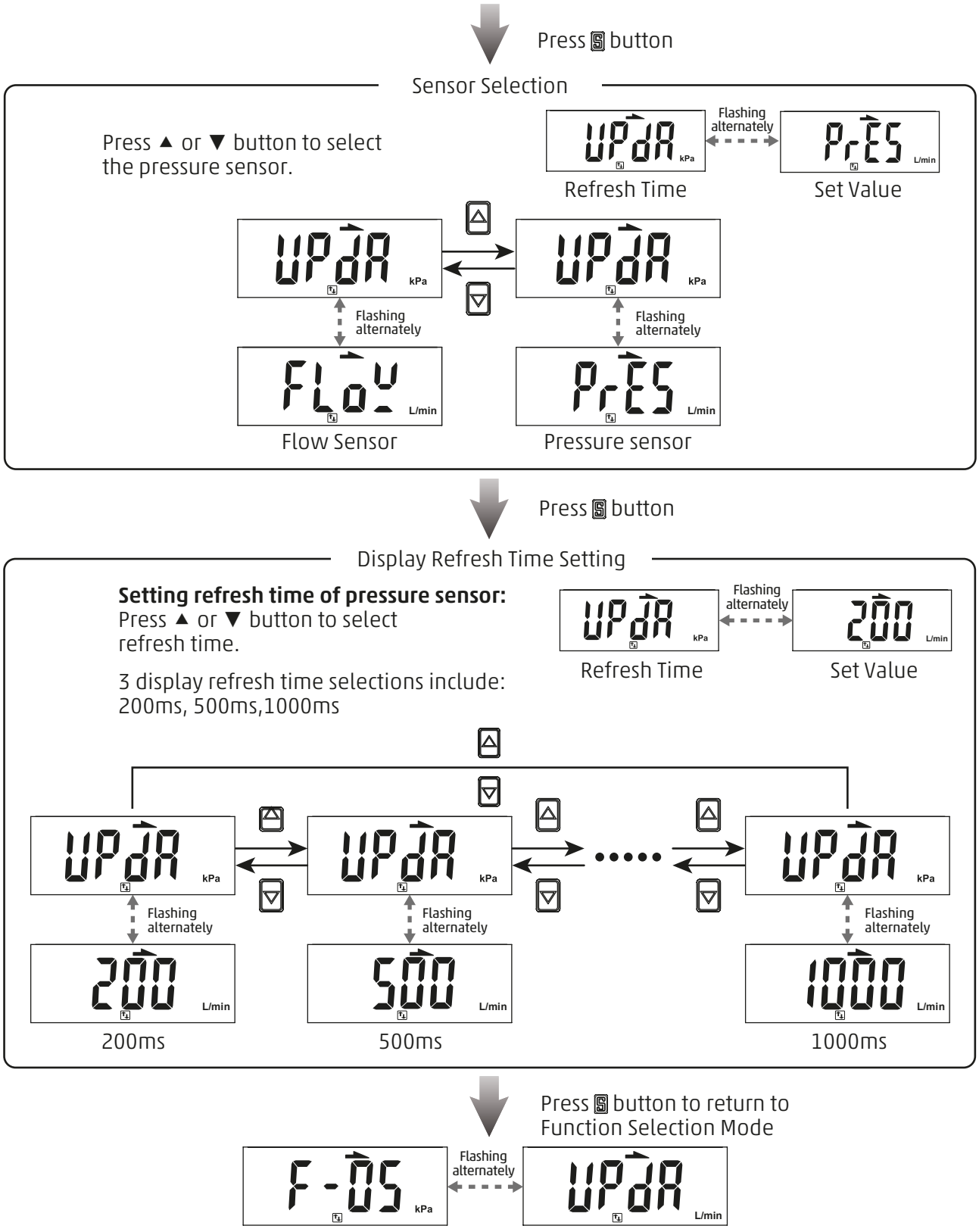
1. Flow sensor setting

Press ▲ or ▼ button at Function Setting Mode to display [F-05] [UPdA]



2. Setting display refresh time of pressure sensor

Press ▲ or ▼ button at Function Selection Mode to display [F-05] [UPdA]



• **[F-06] Unit Setting**

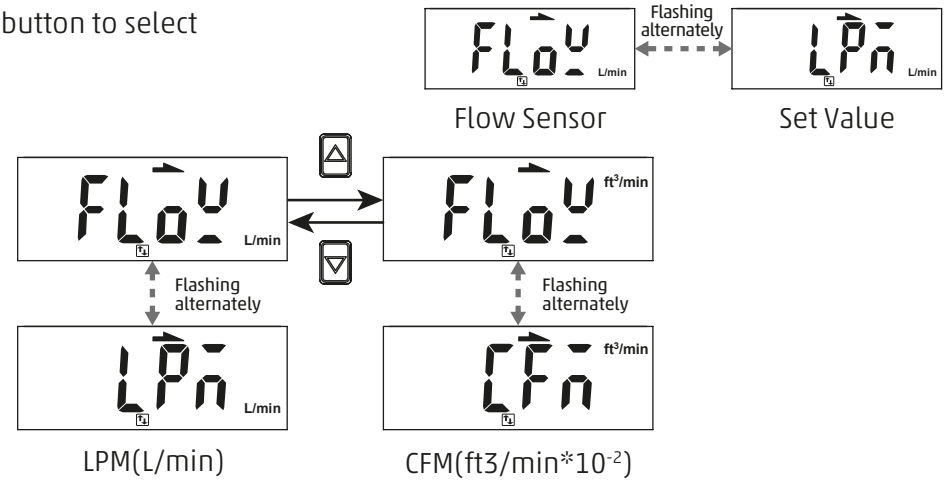
Select the flow unit of the sensor.

Press ▲ or ▼ button at Function Selection Mode to display [F-06] [Unit].

Press S button

Flow Unit Selection

Press ▲ or ▼ button to select flow unit.



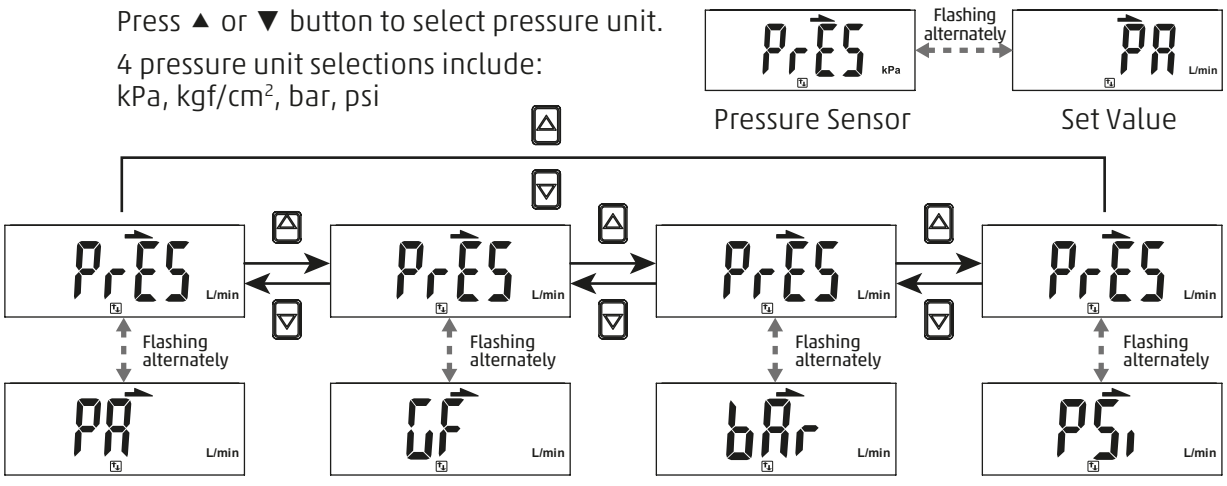
NOTE:
When the measured flow rate range is 500mL/min or 1000mL/min, the unit of LPM is selected to represent the unit in mL/min.

Press S button

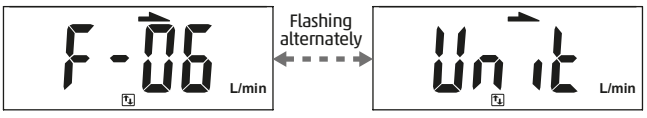
Pressure Unit Selection

Press ▲ or ▼ button to select pressure unit.

4 pressure unit selections include:
kPa, kgf/cm², bar, psi



Press S button to return to Function Selection Mode



• [F-07] Flow Reference Standard Setting

Select the flow value is shown under standard or normal condition.

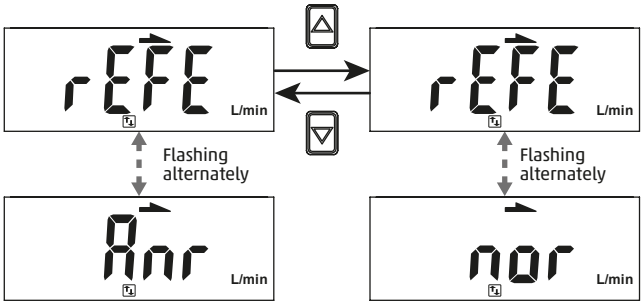
Press ▲ or ▼ button at Function Selection Mode to display [F-07] [rEFE].

Press S button

Flow Reference Standard Setting

Press ▲ or ▼ button to select the standard or normal condition.

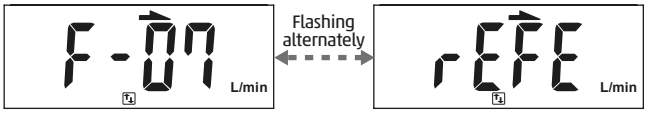
Flow Reference Set Value



LPM(L/min) CFM(ft3/min*10^{-2})

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).

Press S button to return to Function Selection Mode



• **[F-08] Analog Output Setting**

Select the analog output signal is for flow sensor or pressure sensor.

< Operation >

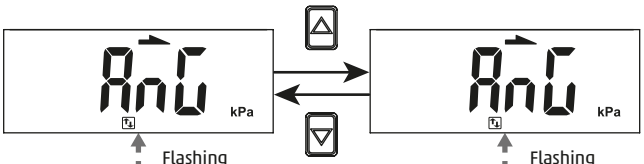
Press ▲ or ▼ button at Function Selection Mode to display [F-08] [AnG].

Press S button

Sensor Selection

Press ▲ or ▼ button to select the sensor of analog output.

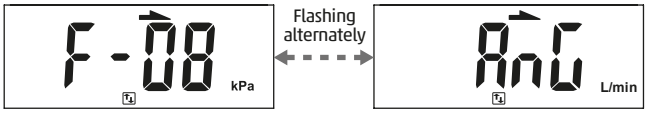
Analog Set Value



Flow sensor Pressure sensor

NOTE: This function is not available with RS485 (Output Specification -02 and -04).

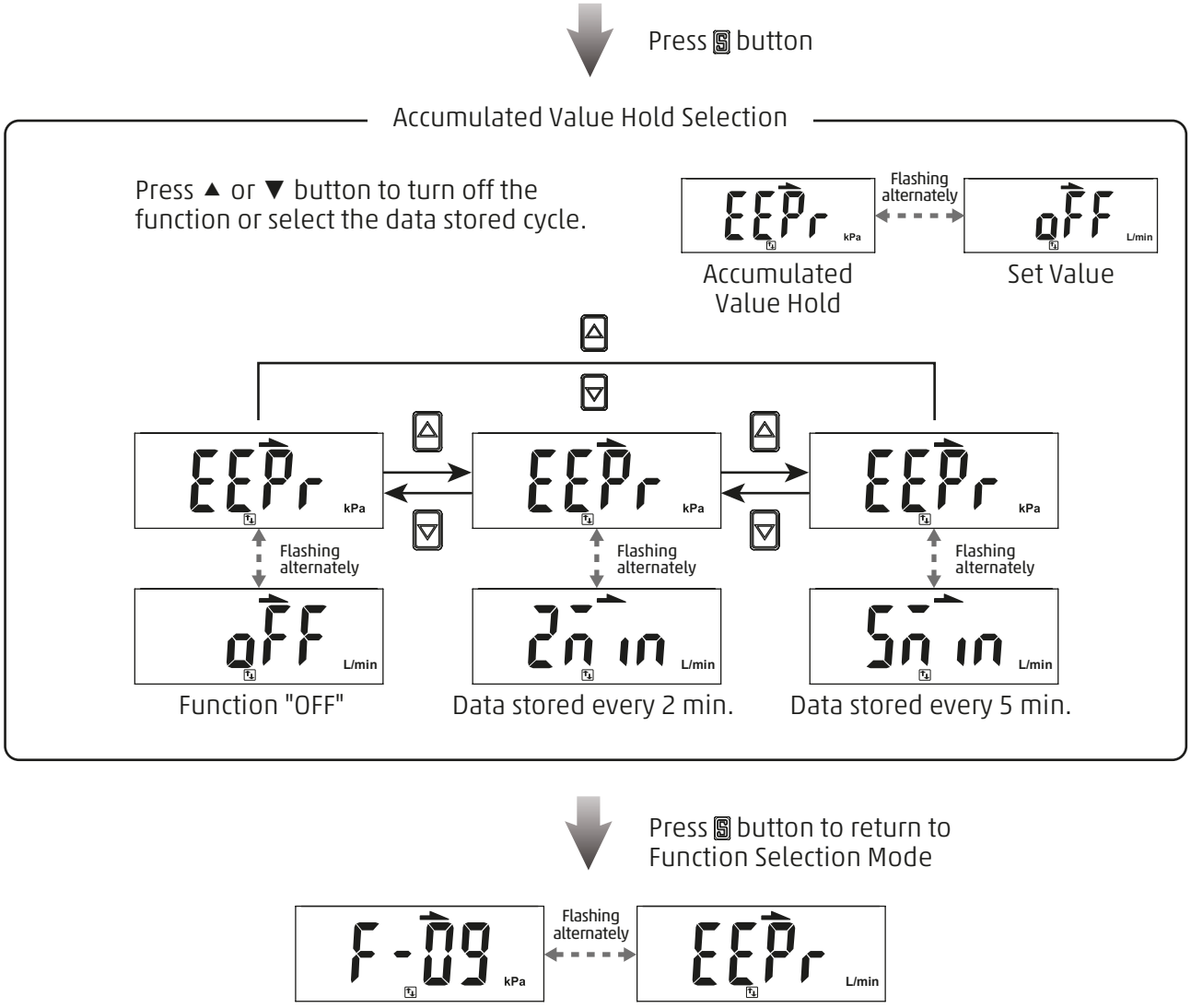
Press S button to return to Function Selection Mode



• **[F-09] Accumulated Value Hold Setting**

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.

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



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

• [F-010] Flow Sensor Display Mode Setting

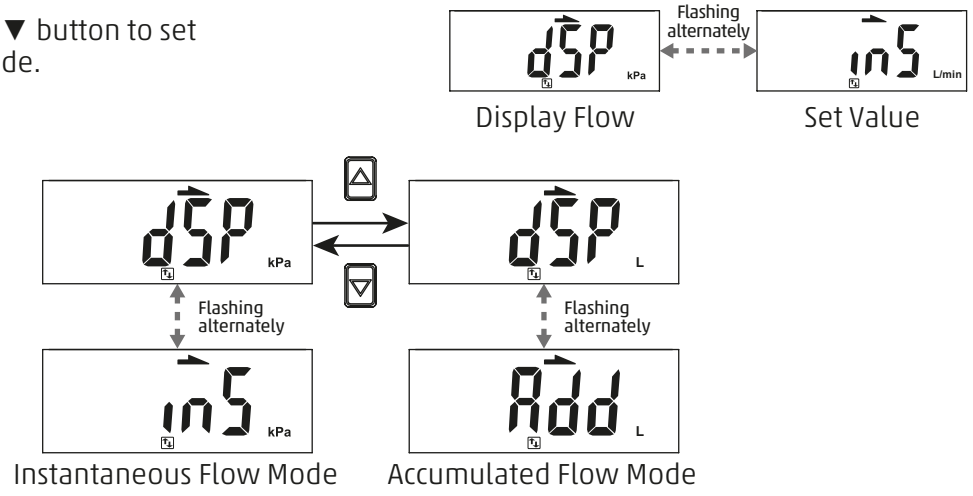
Select to display Instantaneous Flow or Accumulated Flow Mode.

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

Press S button

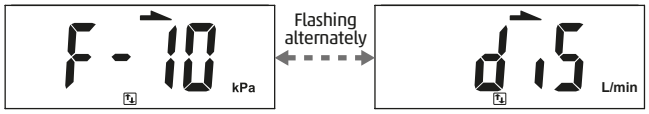
Display Mode Selection

Press ▲ or ▼ button to set display mode.



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.

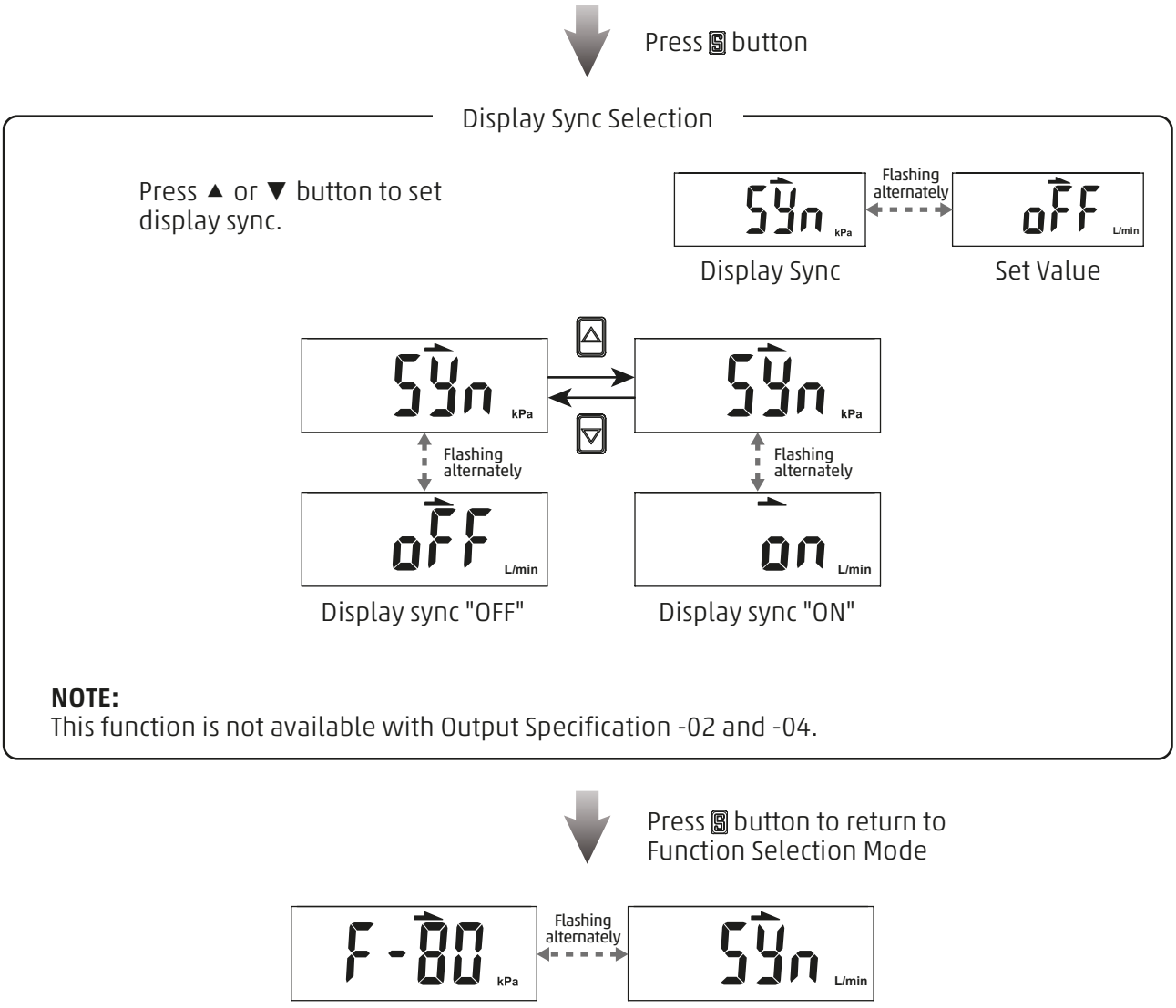
Press S button to return to Function Selection Mode



• [F-080] Sync the value of flow analog output and display

Turn ON to synchronize the value of flow analog output and display.

Press ▲ or ▼ button at Function Selection Mode to display [F-80] [Syn].



NOTE:
This function is not available with Output Specification -02 and -04.

• [F-91] Power-Save Mode Setting

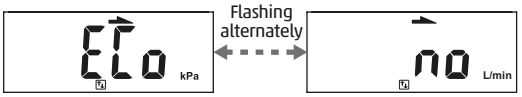
Select Power-Save Mode at Measurement Mode.
During the Power-Save Mode, the main display will turned off if no buttons is pressed in 30 sec., press any keys to leave the Power-Save Mode.

Press ▲ or ▼ button at Function Selection Mode to display [F-91] [ECo].

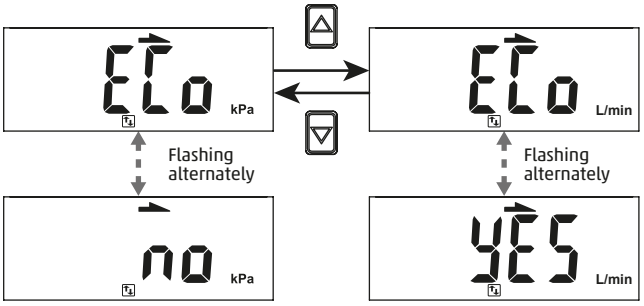
Press S button

Power-Save Mode Selection

Press ▲ or ▼ button to turn on the power-save mode.

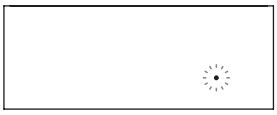


Power-Save Mode Set Value

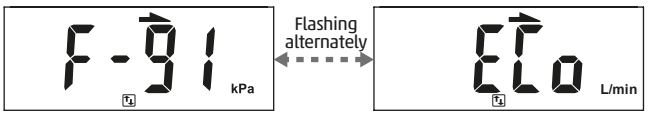


Power-save mode "OFF" Power-save "ON"

NOTE: During the Power-Save Mode, the decimal point will flash.



Press S button to return to Function Selection Mode



• [F-092] External Input Setting

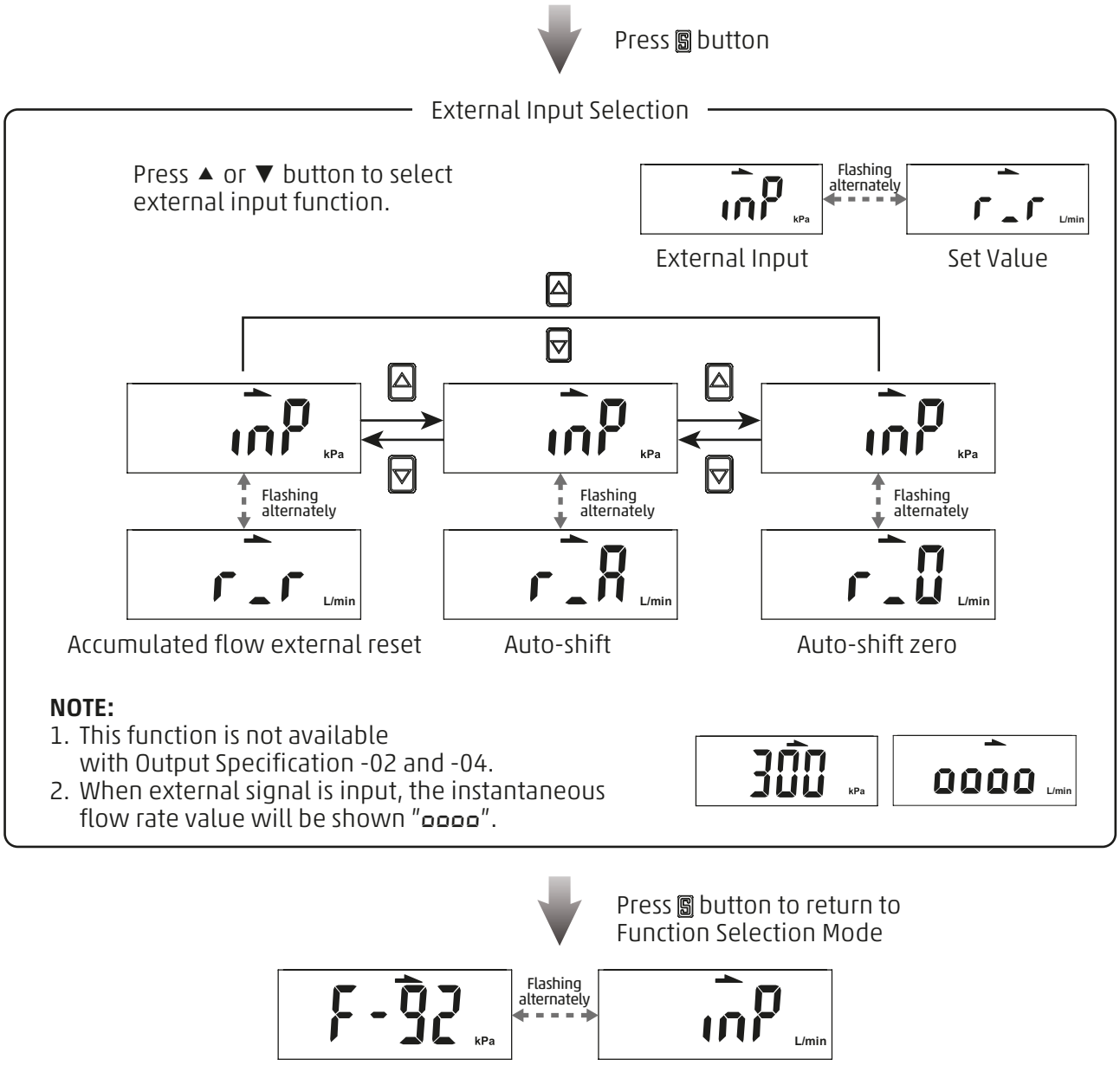
Accumulated flow external reset:The accumulated flow value will reset to "0" when an external input signal is applied.

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.

Press ▲ or ▼ button at Function Selection Mode to display [F-92] [inP].



• **[F-93] Modbus RTU Setting**

MODBUS transmission protocol can be set according to user requirements.

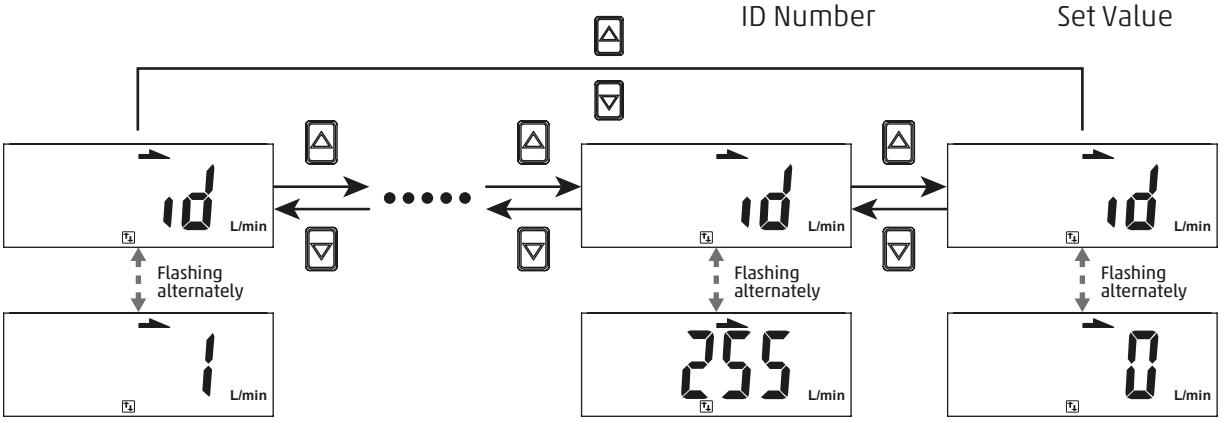
Press ▲ or ▼ button at Function Selection Mode to display [F-93] [nbUS].

Press S button

ID Number Setting

Press ▲ or ▼ button to set ID number.

ID Number Set Value



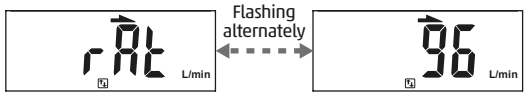
ID number 1 ID number 255 ID number 0

NOTE: This function only available for RS485 (Output Specification -02 and -04).

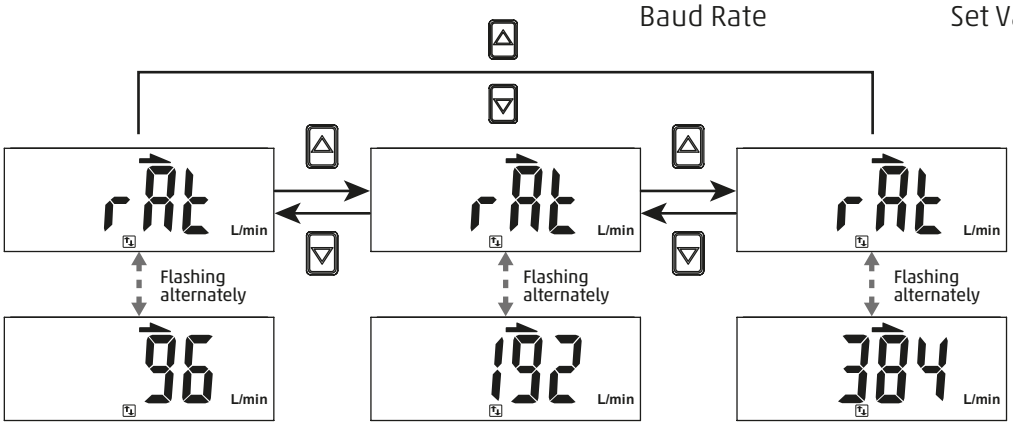
Press S button

Baud Rate Setting

Press ▲ or ▼ button to set baud rate.



Baud Rate Set Value



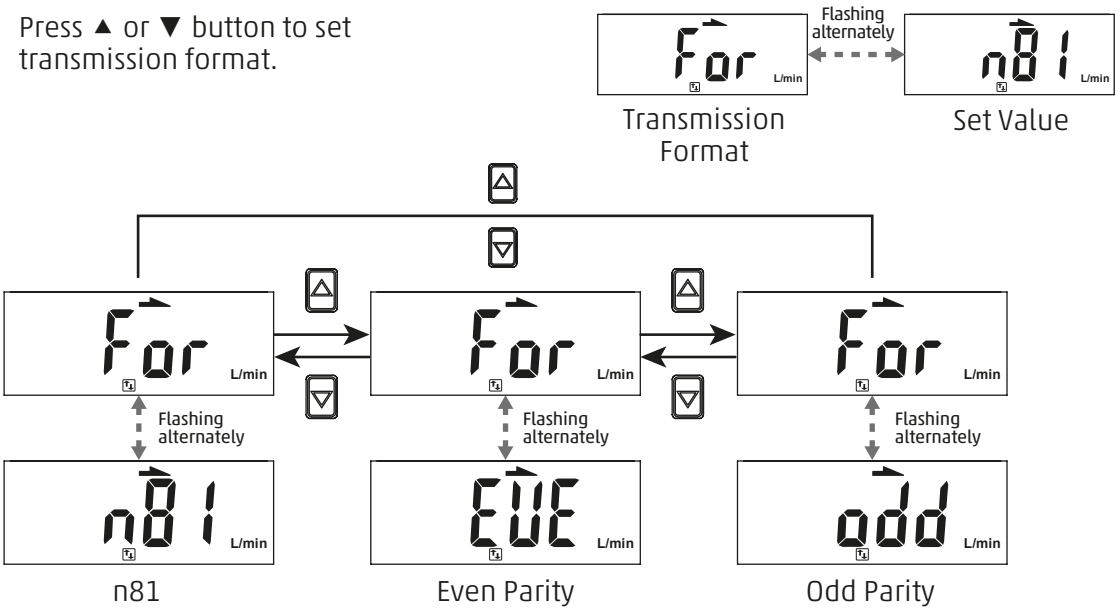
9600 Bd 19200 Bd 38400 Bd

NOTE: This function only available for RS485 (Output Specification -02 and -04).

Press button (to be continued)

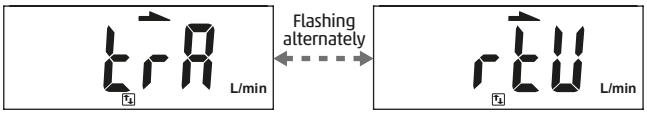
Transmission format setting

Press ▲ or ▼ button to set transmission format.



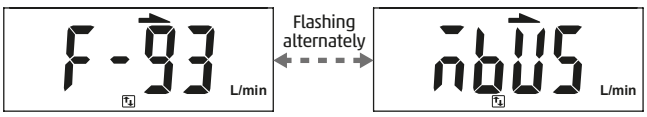
NOTE: This function only available for RS485 (Output Specification -02 and -04).

Press button



RTU mode

Press button to return to Function Selection Mode



• [F-94] Fine Adjustment Setting

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

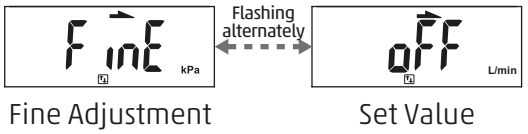
1. Fine adjustment of instantaneous flow value

Press ▲ or ▼ button at Function Selection Mode to display [F-94] [F inE].

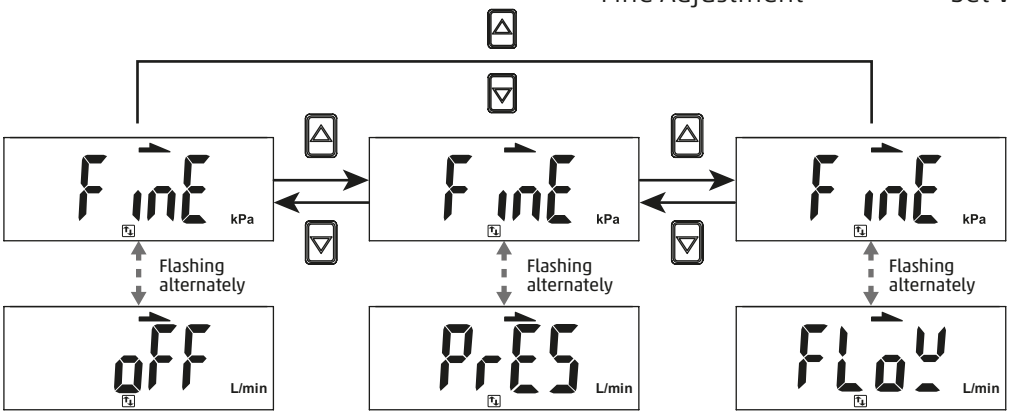
Press S button

Fine Adjustment Setting

Press ▲ or ▼ button to select fine adjustment OFF or to set fine adjustment instantaneous flow rate value or pressure value.



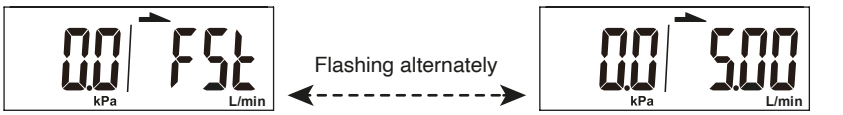
Fine Adjustment　　Set Value



Fine adjustment function off　　Fine adjustment of pressure value　　Fine adjustment of Instantaneous flow rate value

Fine Adjustment of Instantaneous Flow Rate Value

Press ▲ or ▼ button to set fine adjustment value.



Set Value　Fine adjustment setting　　Set Value　Instantaneous flow value

NOTE: Display will flashing between instantaneous flow value and "FST".

Press S button

Return to the measurement mode

2. Fine adjustment of pressure value

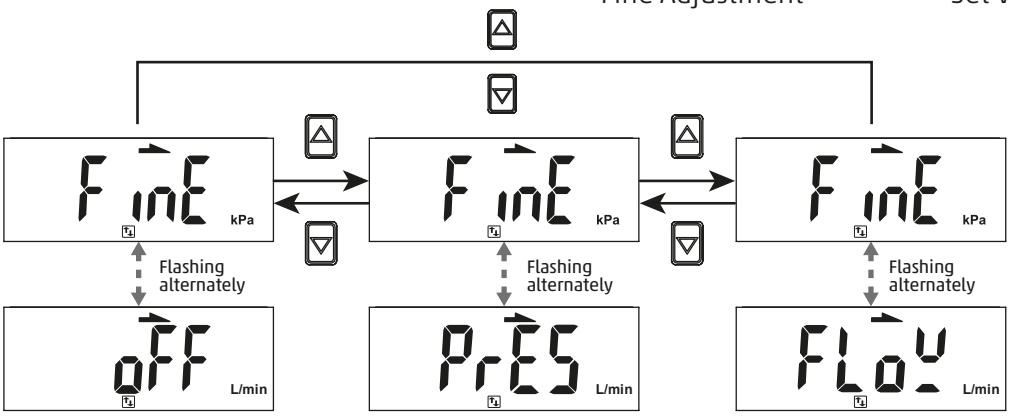
Press ▲ or ▼ button at Function Selection Mode to display [F-94] [F inE].

Press S button

Fine Adjustment Setting

Press ▲ or ▼ button to select fine adjustment function off or select fine adjustment of instantaneous flow value or pressure value.

Fine Adjustment — Set Value



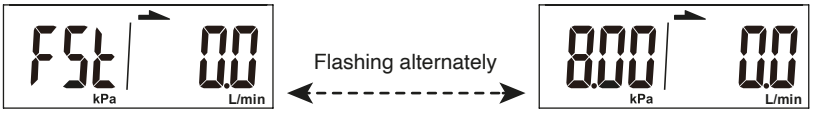
Fine adjustment function off

Fine adjustment of pressure value

Fine adjustment of Instantaneous flow rate value

Fine Adjustment of Pressure Value

Press ▲ or ▼ button to setting fine adjustment of display value



Fine adjustment setting — Set Value — Pressure Value — Set Value

NOTE: Display will flashing between pressure value and "FST".

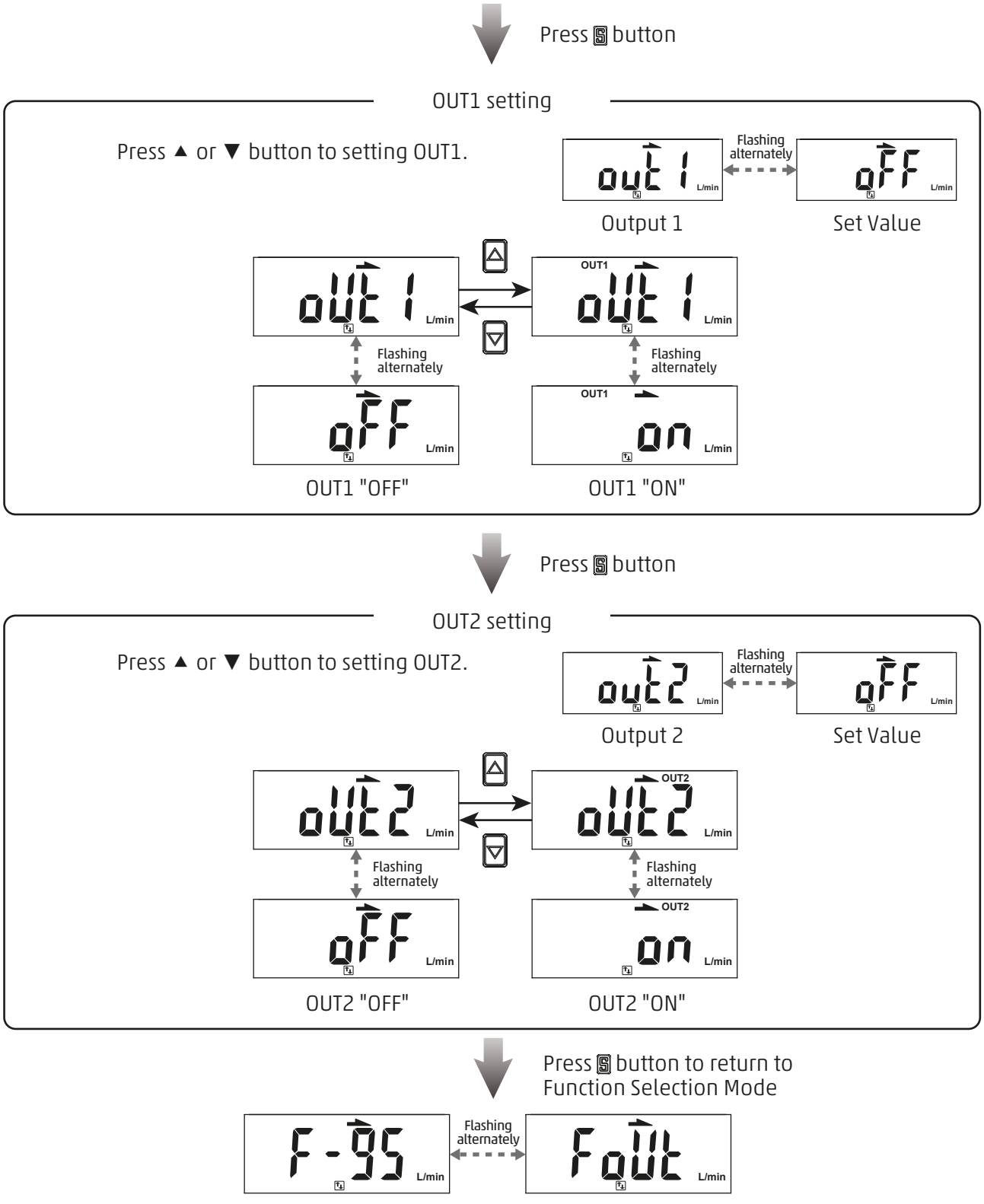
Press S button

Return to the measurement mode

• **[F-95] Forced Output Function**

To force output ON/OFF to test the switch function.

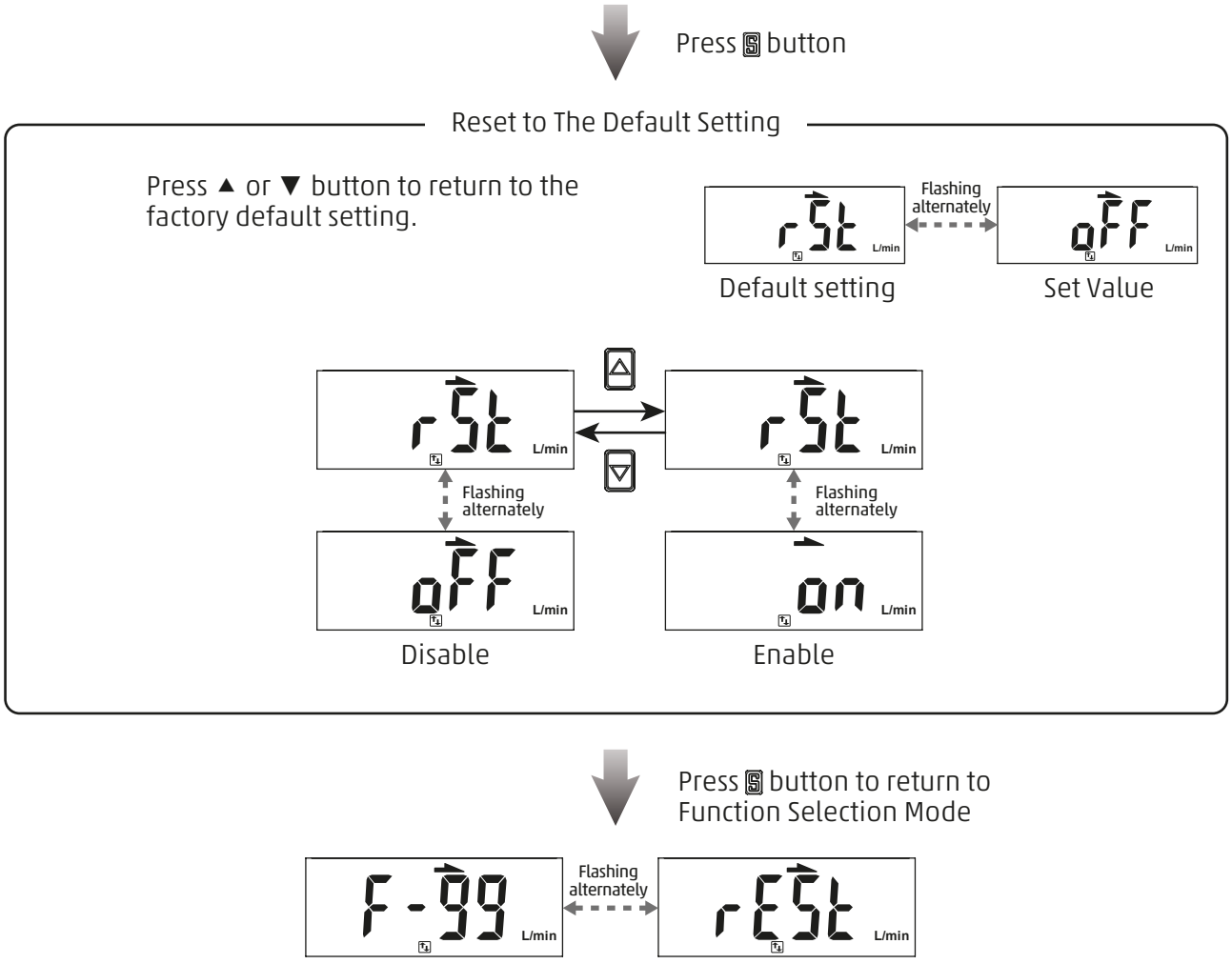
Press ▲ or ▼ button at Function Selection Mode to display [F-95] [FoUt].



• [F-99] Reset to the Default Setting

The factory default settings can be restored.

Press ▲ or ▼ button at Function Selection Mode to display [F-99] [rESt].



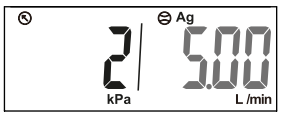
• Pressure Zero Adjustment Function

The displayed value can be adjusted to "0" when the measured flow is within ±5% F.S. of the zero point at the time of shipment from the factory.

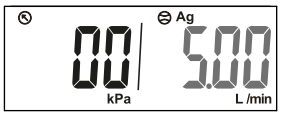
< Operation >

Press [S] and ▼ button simultaneously over 3 sec. at the measurement mode (not Accumulated flow value display mode) until display [00].
And release holding the button to return measurement mode.

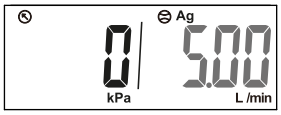
Measurement mode



Press [S] and ▲ button simultaneously over 3 sec.



To release holding the button to return measurement mode.



Pressure value return zero.

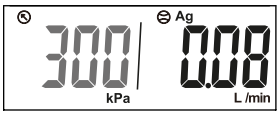
• Instantaneous Flow Zero Adjustment Function

The displayed value can be adjusted to "0" when the measured flow is within ±5% F.S. of the zero point at the time of shipment from the factory.

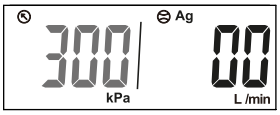
< Operation >

Press [S] and ▼ button simultaneously over 3 sec. at the measurement mode (not Accumulated flow value display mode) until display [00].
And release holding the button to return measurement mode.

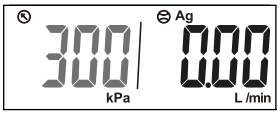
Measurement mode



Press [S] and ▲ button simultaneously over 3 sec.



To release holding the button to return measurement mode.



Instantaneous flow value return zero.

• **Reset Accumulated Flow Function**

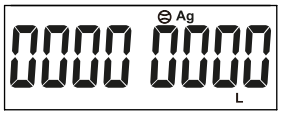
Accumulate flow value return to zero.

< Operation >

Press S and ▼ button simultaneously over 3 sec. at the measurement mode (Accumulated flow value mode) until display zero.
And release holding the button to return measurement mode.

Measurement mode

Press S and ▼ button simultaneously over 3 sec.



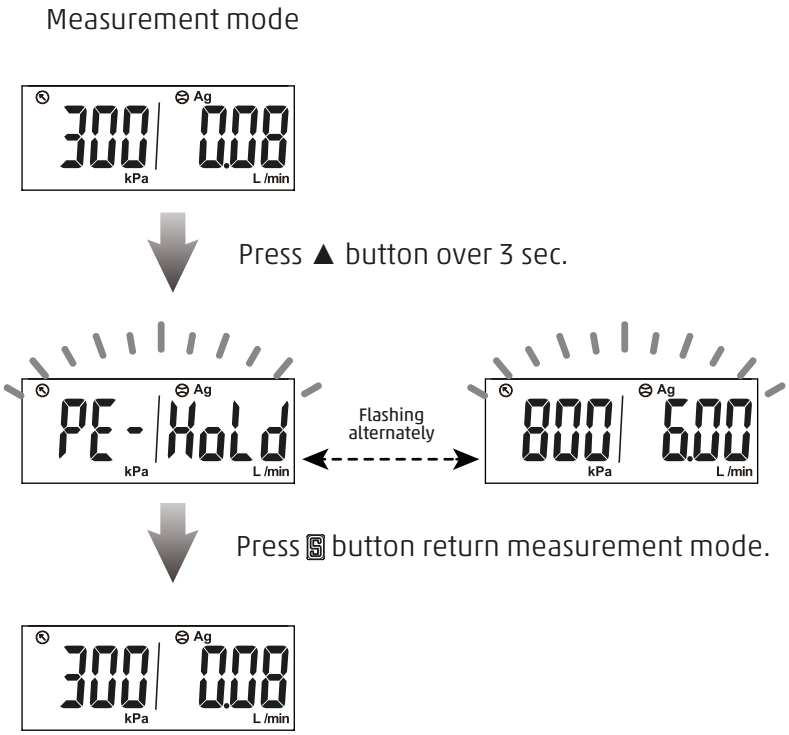
Accumulated value display zero.
To release holding the button to return measurement mode.

• **Peak Value Display**

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

< Operation >

Press ▲ button over 3 sec. at the measurement mode.
The maximum value will be displayed flashing, and is held.
Press S button return to the measurement mode.

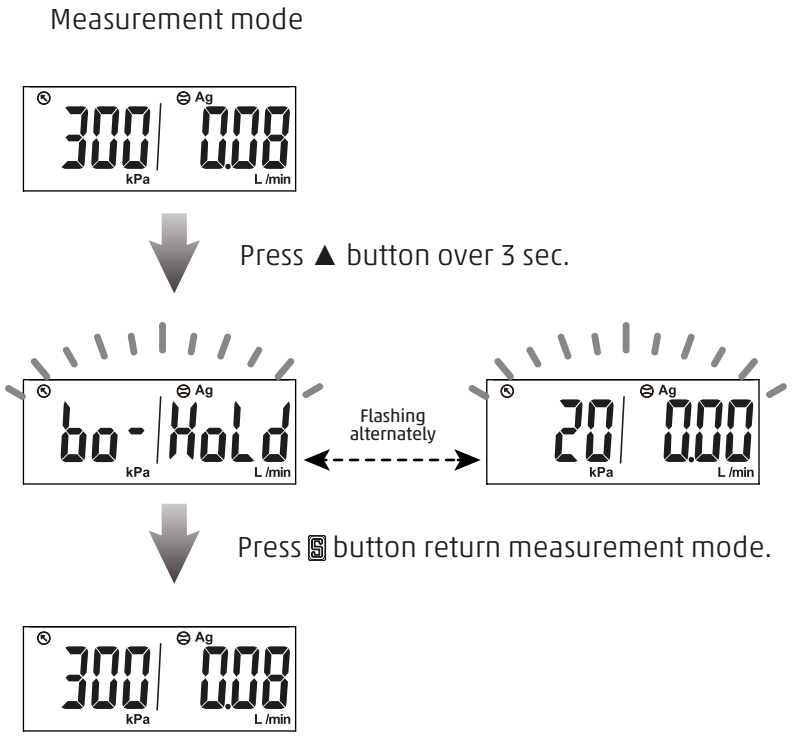


• Bottom Value Display

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

< Operation >

Press ▼ button over 3 sec. at the measurement mode.
The minimum value will be displayed flashing, and is held.
Press S button return to the measurement mode.



• 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.

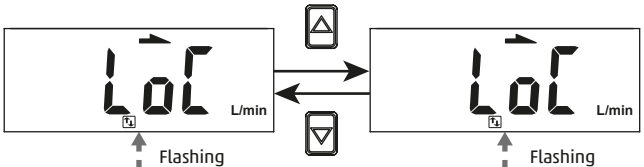
< Operation >

Press S button over 5 sec. at measurement mode
to select key lock/unlock setting.

Key Lock / Unlock Setting

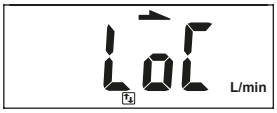
Press ▲ or ▼ button to select locking or unlocking of the key.

Lock Selected Mode



Unlock Lock

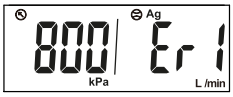
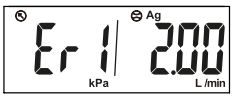
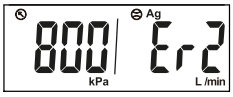
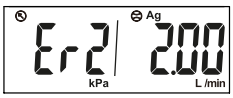
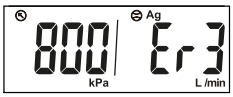
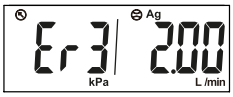
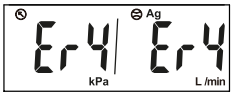
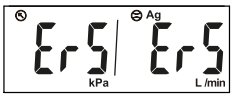
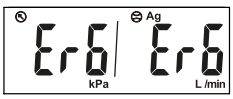
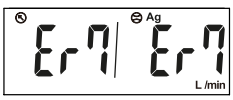
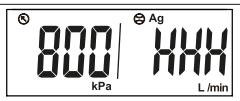
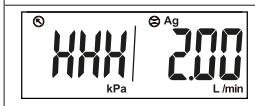
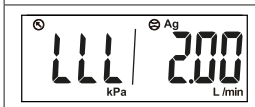
NOTE: If a button operation is performed while the key lock setting is ON, [LoC] will displayed.



Displayed for 1 sec.

Instruction

4.1 Error Code Instruction

Error Type	Error Code	Error Condition	Troubleshooting
OUT1 Excess Load Current Error		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.
			
OUT2 Excess Load Current Error		Output 2 load current is more than 125 mA.	
			
Zero Adjustment Error		The instant flow is over ±5% F.S. of the zero point.	Perform the zero clear function again under no flow conditions.
		The pressure value is over ±3% F.S. of the zero point.	Perform the zero clear function again under no pressure conditions
System Error		Memory error	Turn power off, and then restart. If error condition remains, please return to factory for inspection.
		Internal data error	
		Internal data error	
		System parameter error	
Applied Flow/Pressure Error		Turn power off, and then restart. If error condition remains, please return to factory for inspection.	Reduce the flow to the display range.
		The pressure has exceeded the upper limit of the pressure display range.	Reduce the pressure to the display range.
		The instant flow has exceeded the lower limit of the flow display range.	Ensure the flow is in the correct direction.
		The pressure has exceeded the lower limit of the pressure display range.	Increase the pressure to the display range.

Specifications

Model			**FS02-501***	**FS02-102***	**FS03-202***
Fluid			Dry air, N_2, Non-corrosive / Non-flammable gas		
Measured flow rate range			2 ÷ 500 L/min	5 ÷ 1000 L/min	10 ÷ 2000 L/min
Flow Direction			Unidirection		
Rated Pressure Range			-0,9 ÷ 10 bar		
Display					
			4 digital * 4 digital, 7 segment LCD display (Red / Green / Orange)		
Instant Flow Rate	Display Range		0 ÷ 525 L/min	0 ÷ 1050 L/min	0 ÷ 2100 L/min
	Minimum Setting Scale	LPM	1 L/min		
		CFM *1	1 ft^3/min		
Accumulated Flow	Display Range		99999999 L		
	Minimum Setting Scale *1		1 L/min		
			0 .1 ft^3/min		
Pressure Display	Display Range		-1 ÷ 10 bar		
	Minimum Setting Scale	kPa	1		
		kfg/cm^2	0.01		
		bar	0.01		
		psi	0.1		
Accuracy Flow					
Guaranteed Range			2 ÷ 100 % F.S.		
Indicator Accuracy			± 3% F.S. ± 1 digit *1		
Analog Output Accuracy			± 5% F.S. *1		
Repeatability			± 1% F.S. ± 1 digit (± 2% F.S. when response time is set to 50 ms) *2		
Linearity			± 3% F.S. *2		
Temp. Characteristic			± 5% F.S. (compare with *2)		
Pressure Characteristic			± 5% F.S. ± 1 digit *3		
Accuracy Pressure					
Guaranteed Range			0 ~ 100 % F.S.		
Indicator Accuracy			± 2% F.S. ± 1 digit *4		
Analog Output Accuracy			± 2.5% F.S. *4		
Repeatability			± 0.2% F.S. ± 1 digit *4		
Linearity			± 1% F.S. *4		
Temp. Characteristic			± 2% F.S. (compare with *4)		

>>

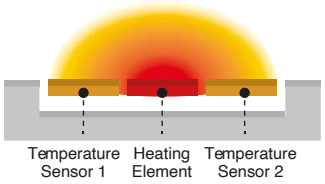
Specifications

Model	010	500	201
Switch Output			
	2NPN: open collector 2 outputs Max. Load Current: 125 mA Max. Supply Voltage: 28 V DC Voltage Drop: ≤ 1.5 V		2PNP: open collector 2 outputs Max. Load Current: 125 mA Max. Supply Voltage: 24 V DC Voltage Drop: ≤ 1.5 V
Response Time Flow	800 ms (50, 80, 120, 200, 400, 1500 ms selectable)		
Output mode Flow	Hysteresis Mode, Window Comparator Mode, Accumulated Output, Accumulated Pulse Output		
Response Time Pressure	2.5 ms (25 ms, 100 ms, 250 ms, 500 ms, 1000 ms, 1500 ms selectable)		
Output mode Pressure	One Point Set Mode, Hysteresis Mode, Window Comparator Mode		
Hysteresis	Adjustable		
Output Short Circuit Proterction	Yes		
Accumulated Pulse Output	5 L/pulse	10 L/Pulse	10 L/Pulse
	20 ft^3/pulse	40 ft^3/pulse	40 ft^3/pulse
Analog Output			
Voltage Output	Voltage Output Range: 1-5V *5 Output impedance: 1 kΩ		
Current Output	Current Output Range: 4-20mA *5 Output impedance: ≤ 300 Ω		
Response Time	Pressure: ≤ 50ms; Flow: ≤ 100ms		
External Input	Non-voltage input , ≤ 0.4 V, ≥ 30 ms		
Communication interface	RS-485 *6		
Power Supply Voltage	12 ÷ 24V DC ± 10 % - Ripple (P-P) ≤ 10 %		
Current Consumption	≤ 50 mA		
Environment			
Withstand Pressure	15 bar		
Enclosure	IP40		
Working Fluid Temp.	0 ÷ 50°C (No condensation or freezing)		
Ambient Temp. Range	Operation: 0 ÷ 50°C ; Storage: -10 ÷ 60°C (No condensation or freezing)		
Ambient Humidity Range	Operation / Storage: 35 ÷ 85 % R.H. (No condensation)		
Insulation Resistance	≥ 2 MΩ (50V DC, between case and lead wire)		
Withstand Voltage	250V AC 1-min (between case and lead wire)		
Vibration	Total amplitude 1.5 mm or 10 G, 10Hz - 55Hz - 10Hz scan for 1 minute, 2 hours each direction of X, Y and Z		
Shock	100 m/s^2 (10 G) , 3 times each in direction of X, Y and Z		
EMC	IEC 61000-6-2, IEC 61000-6-4		
Lead Wire	Ø4 Oil-resistance cable - 26 AWG (0.15 mm^2) - 6 cores		
Port Size	G 1/2"		G 1/2"
Weight (with 2 Meter Lead Wire)	250 gr		250 gr

NOTE:
*1: CONDITION : Inlet Pressure : 3 bar, Outlet Pressure : 1 atmospheric pressure, 25 °C
*2: CONDITION : Outlet Pressure : 1 atmospheric pressure, 25 °C
*3: 0 ÷ 10 bar, Outlet Pressure : 1 atmospheric pressure, 25 °C
*4: Outlet flow rate = 0 L/min, 25°C
*5: PWM output, corresponding to pressure sensor 0 ÷ 10 bar
*6: This function only available for Output Specification -02 and -04

Thermal Mass Flow Sensor Principles

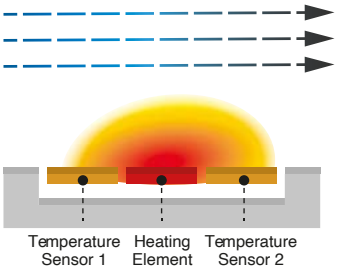
Symmetric Temperature Profile No Flow



(a):No Flow

In the absence of flow, the heat from the heater spreads evenly left and right, so the temperature distribution is like (a).

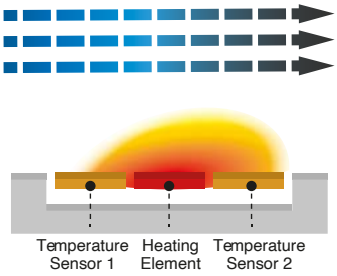
Skewed Temperature Profile Small Flow



(b):Small Flow

When flow begins, the inlet side is cooled by the flow, the outlet side is warmed by the heat of the inlet side of the heater, and the temperature distribution is like (b).

Skewed Temperature Profile Large Flow



(c):Large Flow

When the flow increases, it becomes a distribution like (C). Since the temperature distribution before and after the heater is proportional to the flow rate, the flow rate can be determined from the ratio.

Ordering Information

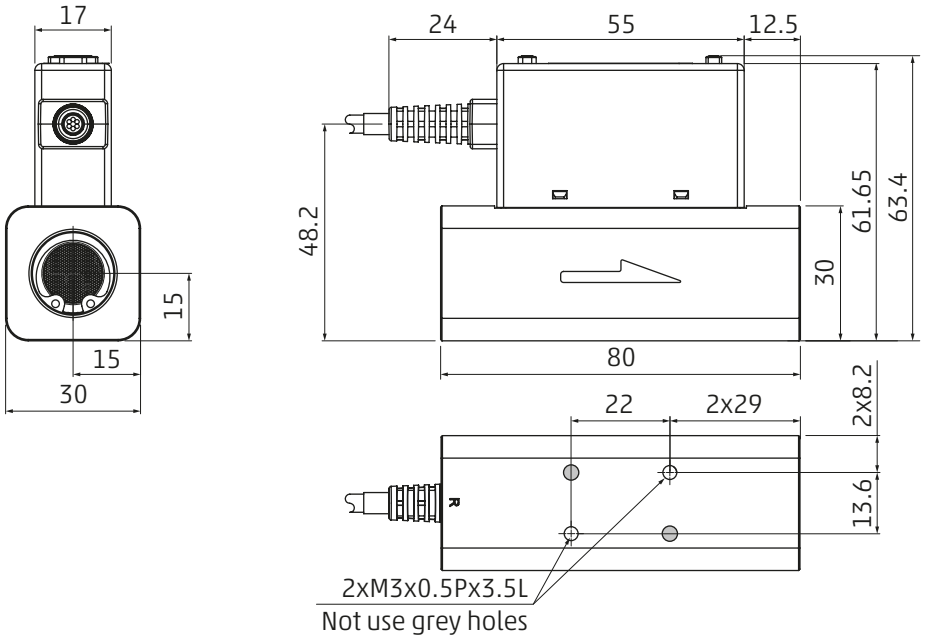
FSP02	**-**	**501**		**030**		**F9C**

FSP02	SERIES FSP02 FSP03
501	FLOW RATE RANGE 501 = 500 L/min, for Series FSP02 102 = 1000 L/min, for Series FSP02 202 = 2000 L/min, for Series FSP03
030	OUTPUT SPECIFICATIONS 030 = 2 PNP output + Analog output 1÷5V 031 = 2 PNP output + Analog output 4÷20mA
F9C	PORT SIZE F9C = G1/2", for Series FSP02 F12C = G3/4", for Series FSP03
	OPTIONAL PARTS FS-BT-27 = Mounting bracket, for Series FSP02 FS-BT-28 = Mounting bracket, for Series FSP03 GM6X-2 = Connector 2mt GM6X-5 = Connector 5mt

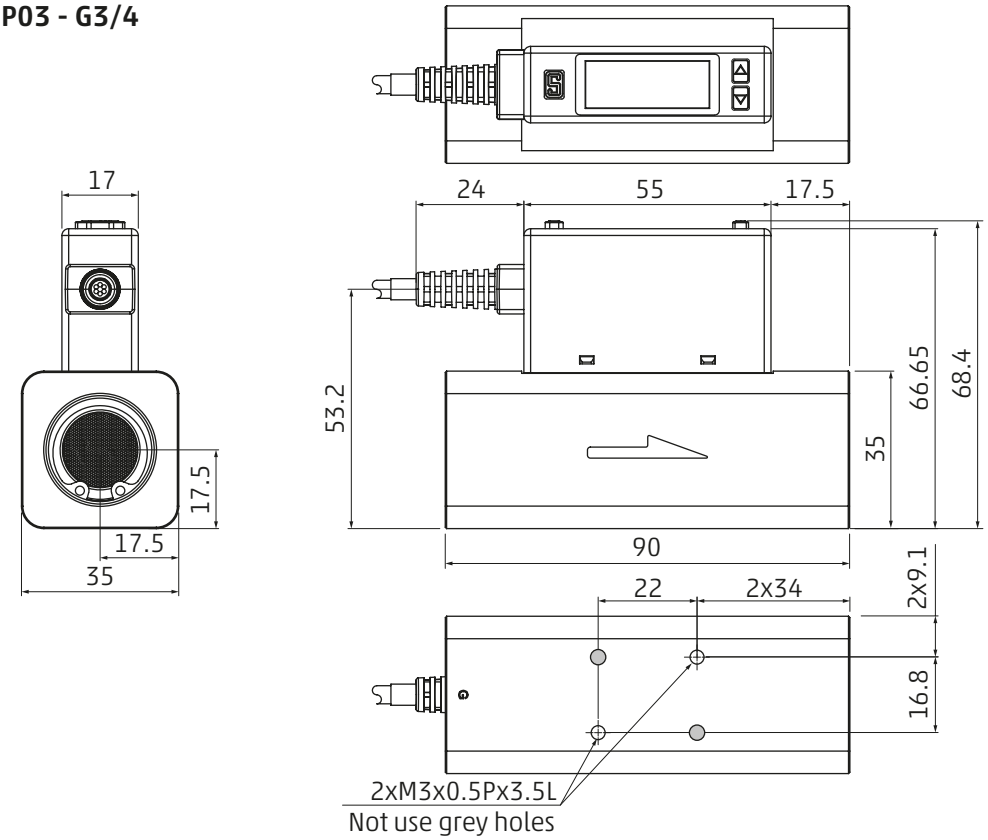
Dimensions

1 . Product

• FSP02 - G1/2

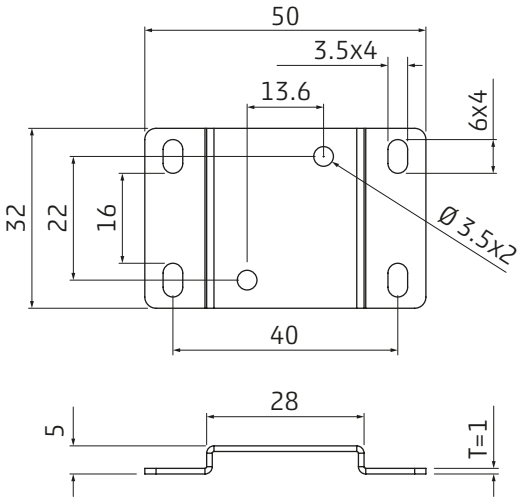


• FSP03 - G3/4

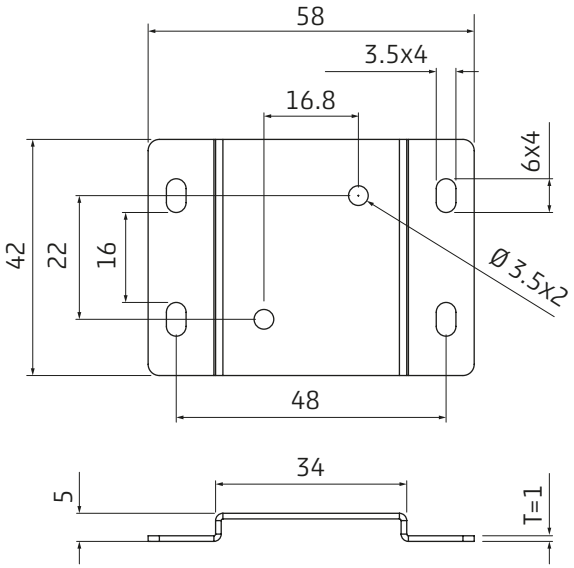


2 . Mounting Bracket

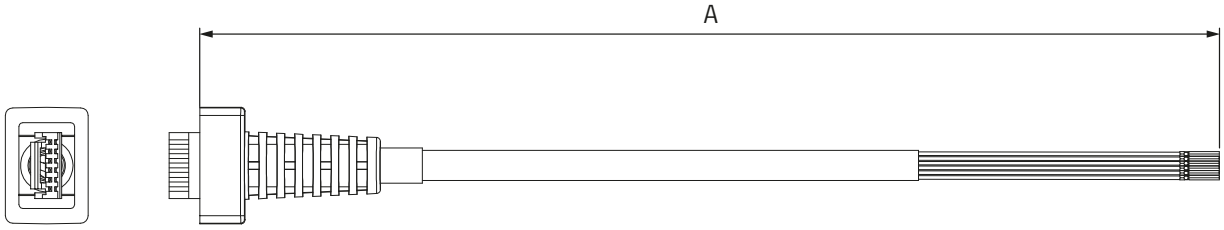
- **FSP02**



- **FSP03**



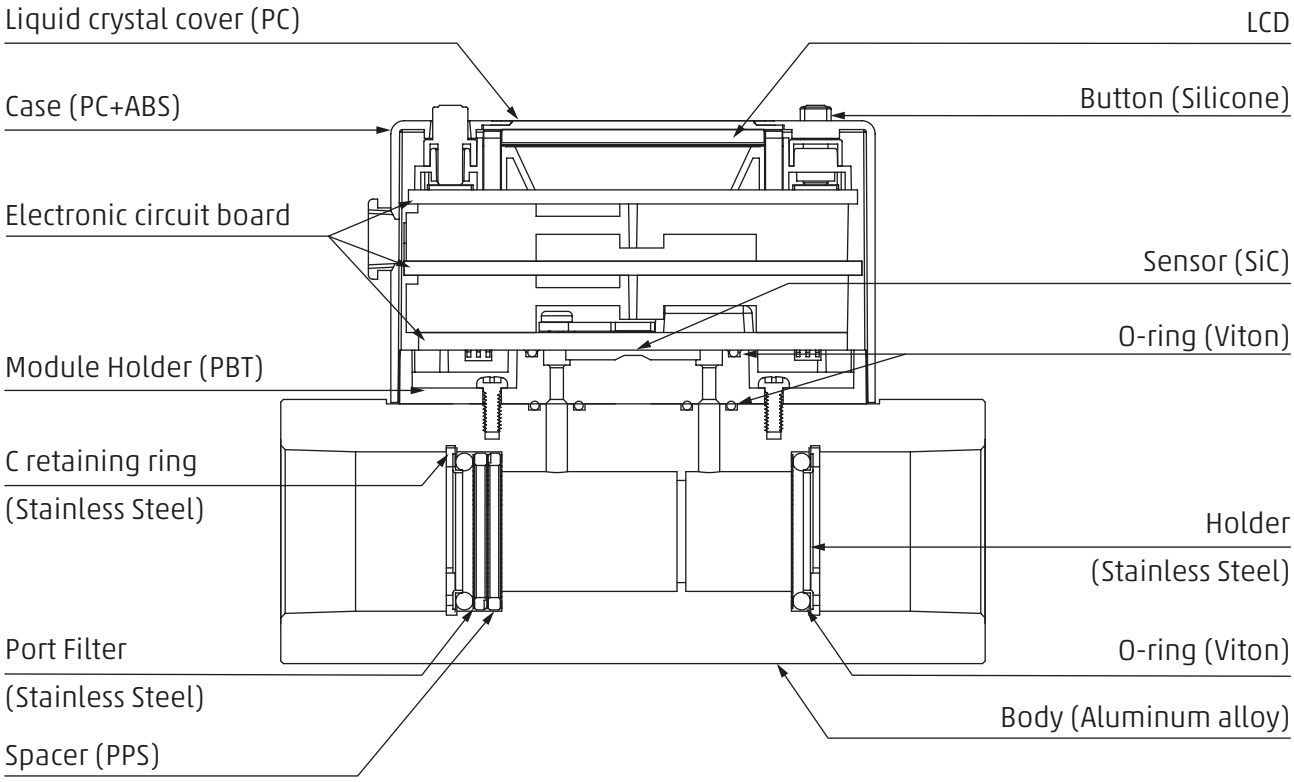
3. Cable



A	GM6X-2	GM6X-5
	2000mm	5000mm

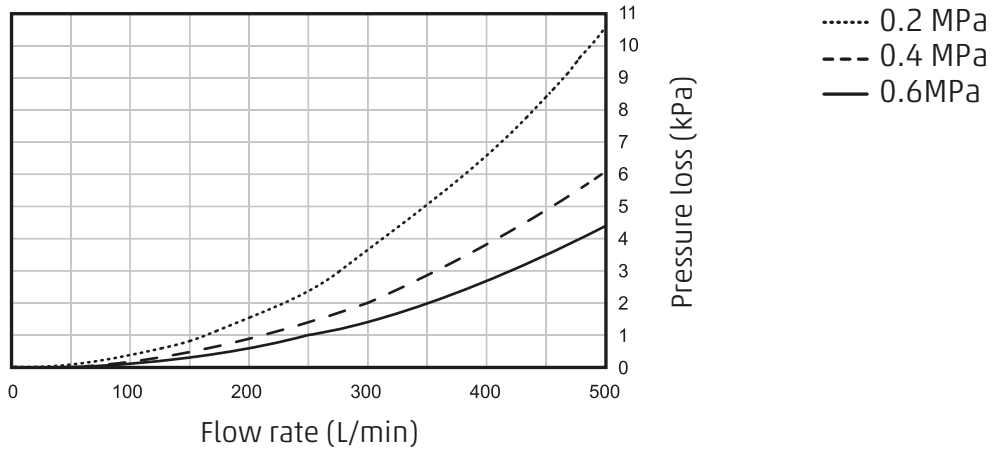
Construction

- **Ø6,Ø8**

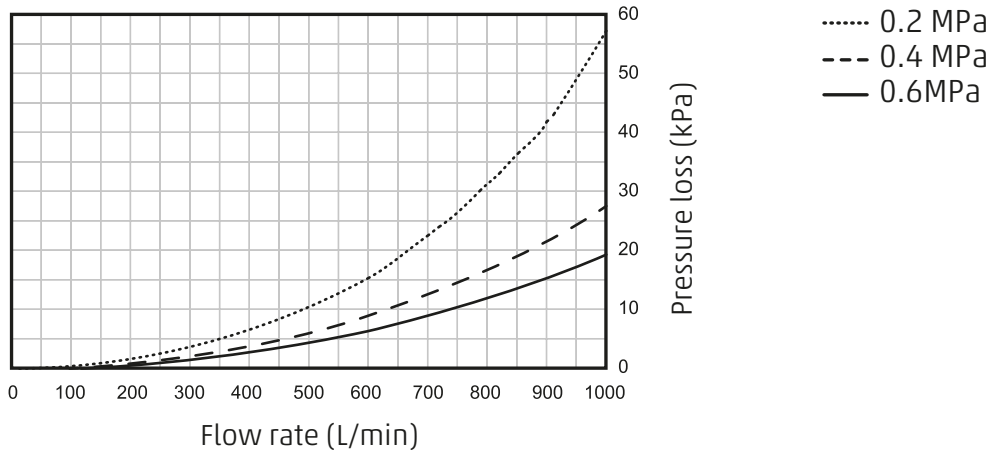


Pressure Loss Characteristics

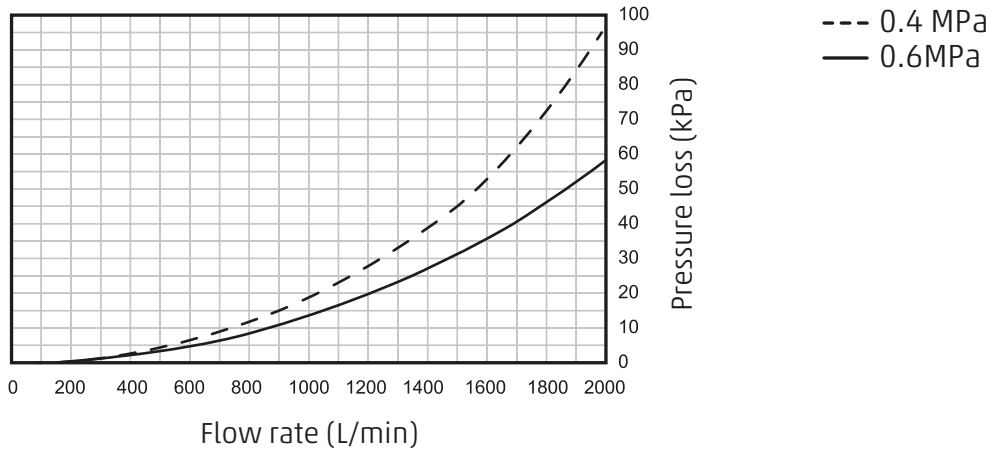
- **FSP02-501 (500 L/min)**



- **FSP02-102 (1000 L/min)**



- **FSP03-202 (2000 L/min)**



MIX COMUNICAZIONE - MI

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