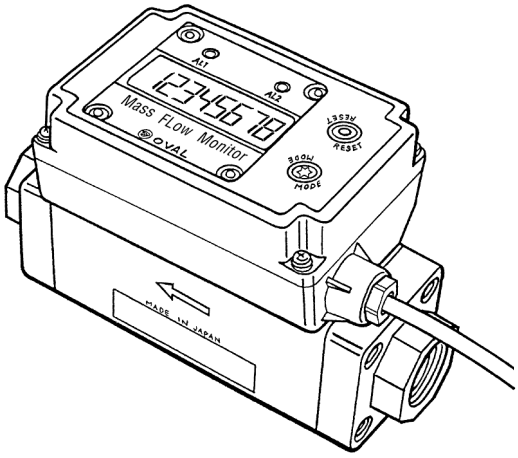
OVAL INSTRUCTIONS

Ins. No. S-193-12-E

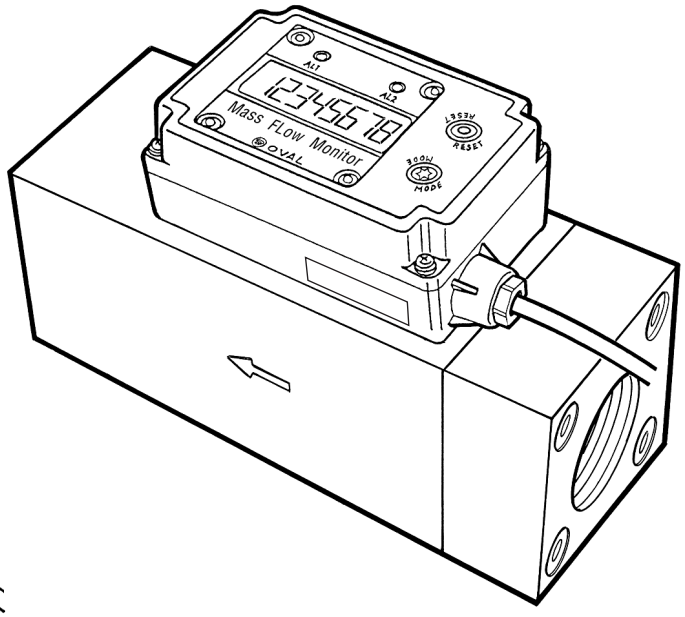
MASS FLOW MONITOR

CE

MODEL : TF10□□ – $\begin{matrix}P11\\A12\end{matrix}$ G – 11□A□



TF1015–P11G–11□A□
TF1020–P11G–11□A□



TF1025–A12G–11□A□
TF1040–A12G–11□A□
TF1050–A12G–11□A□

Every OVAL product is fabricated, tested, and inspected under stringent quality control before leaving our factory.

To derive maximum benefit from the product, we recommend you to be well familiar with the information and instructions given in this manual before you place it in service and retain this manual at the field location for ready reference.

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The indications **NOTE**, **CAUTION**, and **WARNING** shown throughout this manual are to draw your attention to specific items:

➡ NOTE

Notes are separated from the general text to bring user's attention to important information.

⚠ **CAUTION**

Caution statements call attention to user about hazards or unsafe practices that could result in minor personal injury or property damage.

⚠ **WARNING**

Warning statements call attention to user about hazards or unsafe practices that could result in serious personal injury or death.

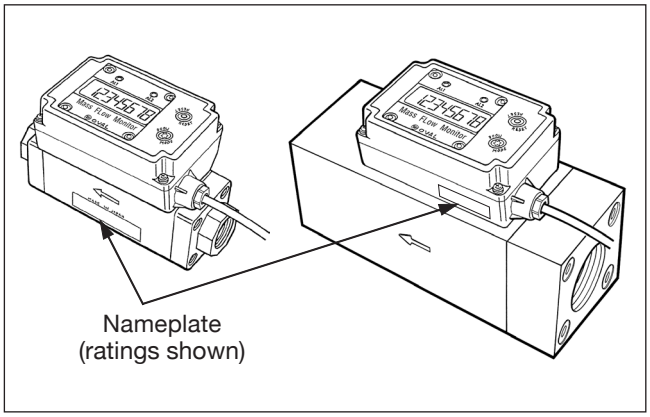
1. BEFORE YOU BIGIN

Every OVAL flowmeter is fully inspected at the factory before shipment. When this device is delivered, please make sure to check the appearance of the device to confirm that it is free from damage.
Please read this section carefully, as this section contains necessary precautions for handling. For matters other than those described in this section, please find relevant items from the Contents on page 2 to refer to them.
For any inquiries, call the sales office from which you purchased the product, or contact the nearest OVAL representative in our customer service network.

⚠CAUTION: When inquiring, please inform us of the product name, code (MODEL) and serial number, operating conditions, and other relevant information.

1.1 Confirming the Nameplate

Every OVAL flowmeter is assembled and adjusted according to individual specifications. Product code and ratings are stated on the nameplate on the side of the body. Make sure that, by referring to the GENERAL SPECIFICATIONS and PRODUCT CODE, the product you received is fully in compliance with your order.



1.2 Transportation Precautions

(1) To prevent unexpected problems, transport the flowmeter to the installation site using the original manufacturer's packaging for shipment.

(2) Treat with care not to give a strong impact or shock during transportation and keep away from rainwater.

1.3 Storage Precautions

Storing MASS FLOW MONITOR for long term before installation can result in unexpected and undesirable conditions.
When long-term storage is anticipated, take the following precautions:

(1) Your MASS FLOW MONITOR can best be stored in the manufacturer’s original packaging used for shipping if possible.

(2) Place of storage should conform to the following requirements:

- ★ **Location free from rain and water.**
- ★ **Location free from vibration and impact shocks.**
- ★ **At room temperature with minimal temperature and humidity variation (around 25°C and 65% R.H.).**

(3) Purge MASS FLOW MONITOR that has once been placed in service with clean air, N_2 gas, etc. to prevent the metered fluid from adhering to the meter, connection parts, piping inner walls, housing, etc. before storage. Protect the inlet and outlet to prevent dust from getting inside.

⚠CAUTION: 1. Do not use thinner, alcohol, or other solvents to clean the device.
2. Never use the cleaning solution to clean the inside of the flow path.

2. OPERATING CONDITIONS

These operating conditions are stated in Sections "5. INSTALLATION" and "9. GENERAL SPECIFICATIONS". Make sure to confirm them before operation.

⚠CAUTION: DO NOT install in a hazardous area since this device is a non-explosionproof product.

3. GENERAL

This instrument is a compact and lightweight thermal flowmeter that uses thermal resistor elements.
One of the two thermal resistor elements placed at right angles to the flow of the fluid detects the fluid temperature, and the other element is heated and controlled so that the temperature difference is constant. When the fluid (mass flow rate) flows and heat is taken from the heating side sensor, the power supply increases to keep the temperature difference constant.
The mass flow rate is calculated from the change in power (voltage, current).

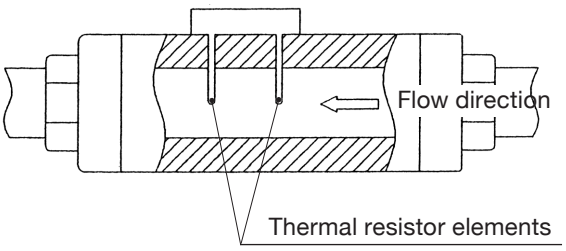


Fig. 3.1

3.1 Features

(1) It has a structure with no moving parts and has excellent durability.

(2) The main part is made of resin or aluminum, which is lightweight and compact.

(3) The fittings are made of robust metal.

(4) The backlit LCD display is easy to view even in dark places.

(5) The display's physical orientation is arbitrary, and the display can be changed in 90 ° steps in a direction that is easy to view.

⚠CAUTION: Please note that the direction of the display must be changed by opening the upper case of the transmitter.
For the change method, refer to Section "5.3 How to Change Display Orientation".

4. COMPONENT NAMES AND FUNCTIONS

4.1 Part Names

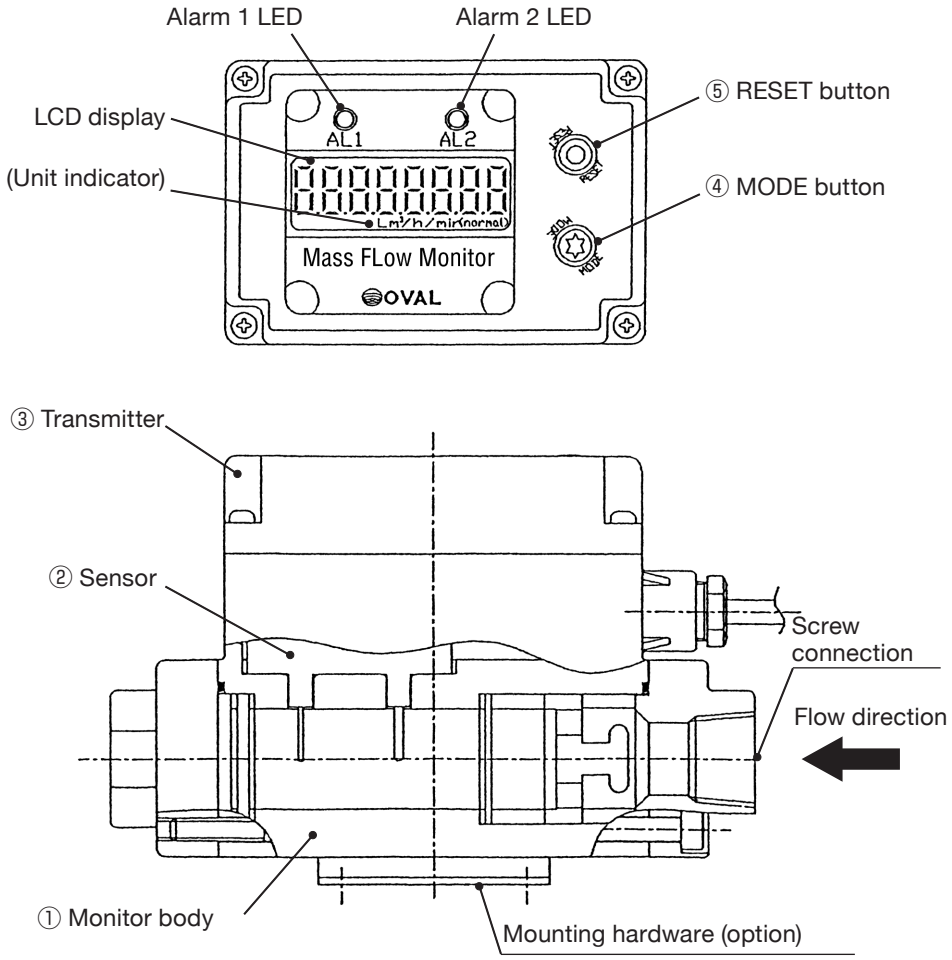


Fig. 4.1

4.2 Individual Functions

No.	Part Name	Description
①	**Body**	Consists of a measuring tube, straightener, and rectification mesh.
②	**Sensor**	Consists of two thermal resistor elements. Power supply (voltage and current) to one of the heat-resistive resistance elements changes to maintain the heat resistance at a constant level (approx. 30℃).
③	**Transmitter**	Changes in supply power (voltage and current) are transformed into a flowrate signal which can be monitored on a 8-digit LCD display in terms of instant flowrate and total flow.
④	**MODE button**	Changes display modes to the instant flowrate or total flow. (Refer to Sec. 8.1 for details.)
⑤	**RESET button**	Used to reset the "Resettable total flow" to zero.

⚠CAUTION: Do not disassemble the MASS FLOW MONITOR.
If the flow path is extremely dirty or if there is any abnormality in operation, please contact the place of purchase or our nearest service network. We do not guarantee the device which has been disassembled on your own.

5. INSTALLATION

5.1 Installation Location

MASS FLOW MONITOR is intended for indoor use.

Install in a location that meets the following conditions.

⚠CAUTION: <u>It cannot be installed in a hazardous area.</u>

(1) Location free from rain and water.

(2) Location with less temperature change.

(3) Location away from direct sunlight.

(4) Location free from vibrations or impact shocks.

(5) Location where the display can be easily read and maintenance can be conducted.

(6) Location with process conditions where the fluid pressure does not exceed the permissible pressure of 0.7 MPa.

5.2 Physical Orientation

There are no restrictions on the physical orientation of this instrument related to its accuracy. Make sure that the flow direction match with the inflow direction arrow on the side of the main unit.

➡NOTE: The display orientation can be changed in 90° steps to a direction that is easy to view. (Refer to Section 5.3)

5.3 How to Change Display Orientation

This work is performed by removing the transmitter. Please note the following condition.

(1) Perform in a clean environment before installing this unit to your piping.

(2) Avoid working in a humid or dusty environment.

(3) Be careful not to damage the parts of the board during work.
Tools used: Phillips screwdriver (for M3 and M2.6 pan head screws)
Changeable display direction: It can be changed in 90° steps as shown in the figure below.

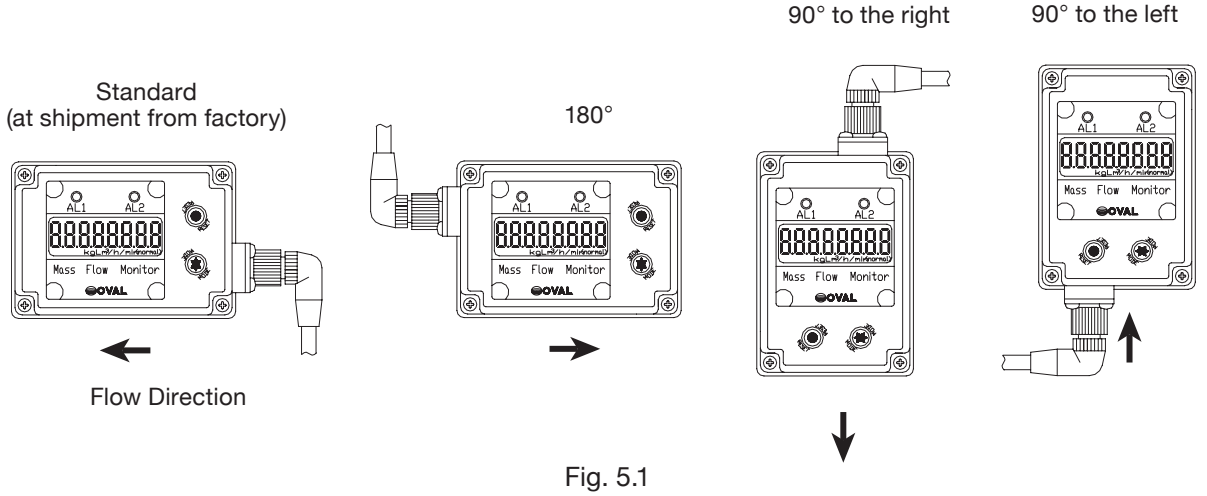


Fig. 5.1

How to Change Display Orientation

① If power is supplied, turn it off. (Make sure nothing is displayed on the LCD).

② Remove the set screws (3×14) at the four corners that hold the upper case of the transmitter, and slowly open the upper case. (Fig.5.2)
If the rotation is 180°, invert the upper case with the cable connected. (Fig.5.3)
Follow the procedure below to rotate 90° left or right.

③ Remove the four set screws (2.6×8) that secure the display board, and then remove the display board. (Fig.5.5)

➡ NOTE: Never remove the set screw of the amplifier board fixed to the lower case.

④ Take out the four spacers (white rings) attached to the boss that fix the display board. (Fig.5.6)

⑤ Remove the top panel, turn it around and set it in the upper case.

⑥ Put the removed spacer on each bosses.

⑦ Set the display board in the upper case so that it faces the top panel, and fix it with four set screws (2.6×8: tightening torque 45 cN·m). (Align the LED holes on the top panel with the LEDs on the display board)

⑧ Make sure that the O-ring of the lower case is fitted in the groove, and tighten the upper case evenly with four screws (3×14: tightening torque 60cN·m), being careful not to pinch the cable. (Fig.5.7).

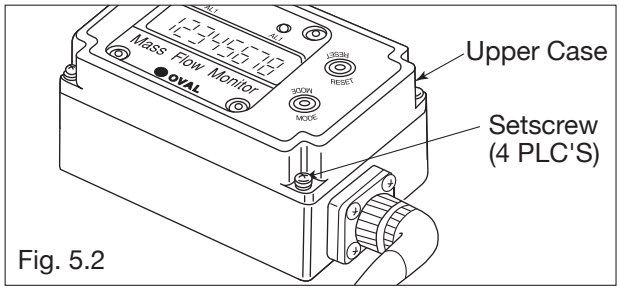


Fig. 5.2

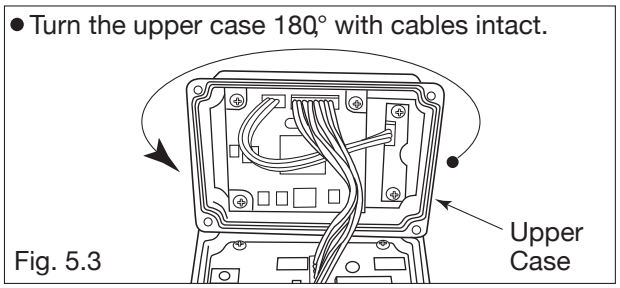


Fig. 5.3

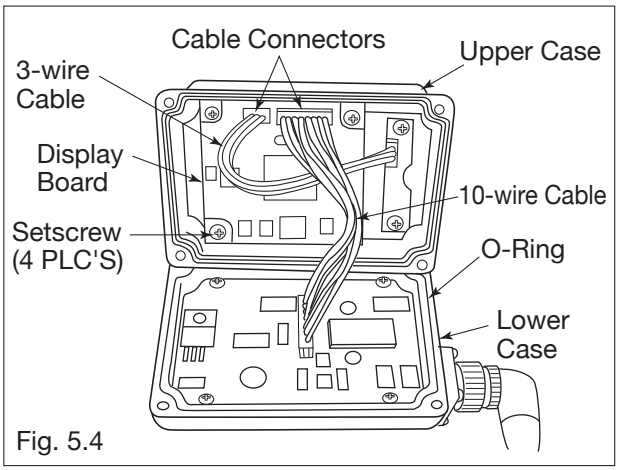


Fig. 5.4

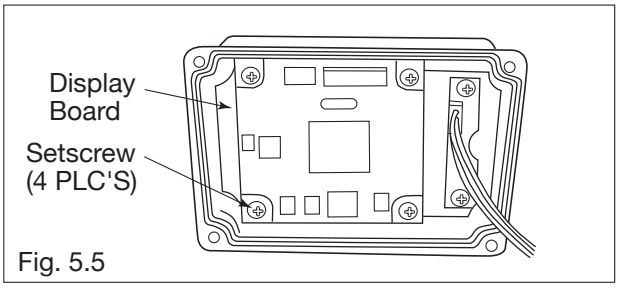


Fig. 5.5

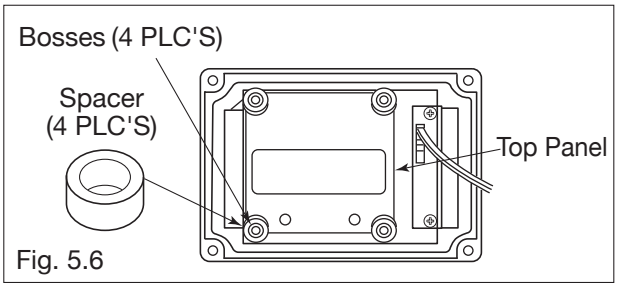


Fig. 5.6

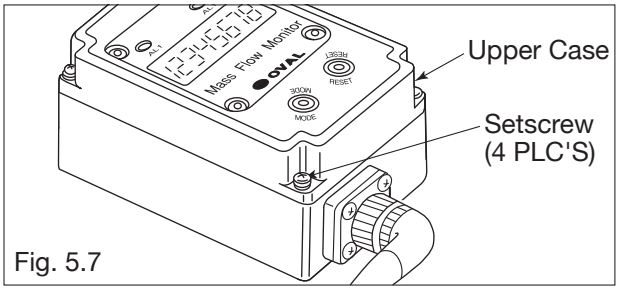


Fig. 5.7

5.4 Conditions Required for Metered Fluid

Since this instrument is a thermal flowmeter, accuracy may be lost if contaminated.

Therefore, if dust, oil, water, etc. are considered to be mixed in the measurement fluid, install a filter or drain separator on the upstream side.

5.5 Piping Procedure

(1) Piping Conditions

This instrument has built-in rectifier elements, and it is not affected by the difference in piping diameter.

However, install a straight pipe of about nipple length (3D or more) when piping an elbow on the inlet side.

If the elbow is directly piped, an error of about ±1% FS may occur.

There are no piping restrictions on the outlet side.

(2) Installation of mounting brackets (optional: for nominal diameters of 15 mm and 20 mm)

Tool used: Phillips head torque screwdriver for M3 pan head machine screw

Do not use any screws other than the attached special screws (tap tight screws 3×8).

Refer to "External Dimension" in Section 12 for the mounting location and mounting orientation.

Screw tightening torque: 60 ± 3cN·m

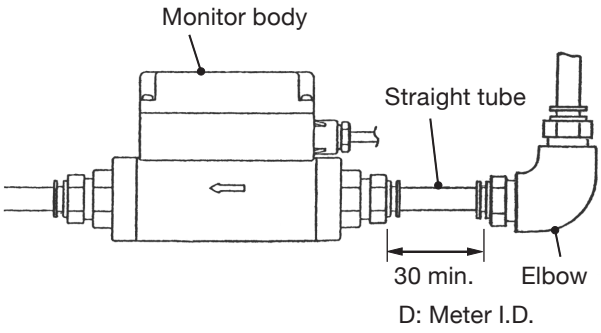


Fig. 5.8

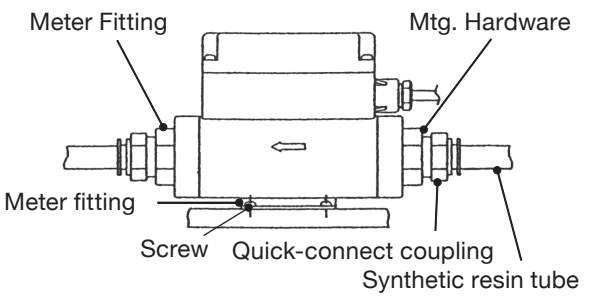


Fig. 5.9

⚠CAUTION: When using metal piping, there is a risk that the metal piping mounting part of the flow meter will be damaged due to piping stress, so do not use the mounting bracket and fix the metal piping part with U bolts or the like.

(3) Piping Procedure (for meter sizes 15mm and 20mm)

1. Since the connection part is made of aluminum, connect it so that excessive force or impact is not applied. Also, since the main body is made of resin, pipe it so that no force is applied to the main body. The tightening torque should be 30 ± 1 (N・m).

➡NOTE: When connecting to piping, fix the aluminum joint on the connecting side with a tool such as a spanner before piping. (Fig.5.9)

2. Be careful not to bring tools such as spanners into contact with the transmitter.
3. Do not connect the pipes while holding down the transmitter.
4. Considering the removal of the flowmeter, it is recommended to use union fittings upstream and downstream of the flowmeter.

⚠ WARNING

Negligence of the precautions above may result in damaged components.

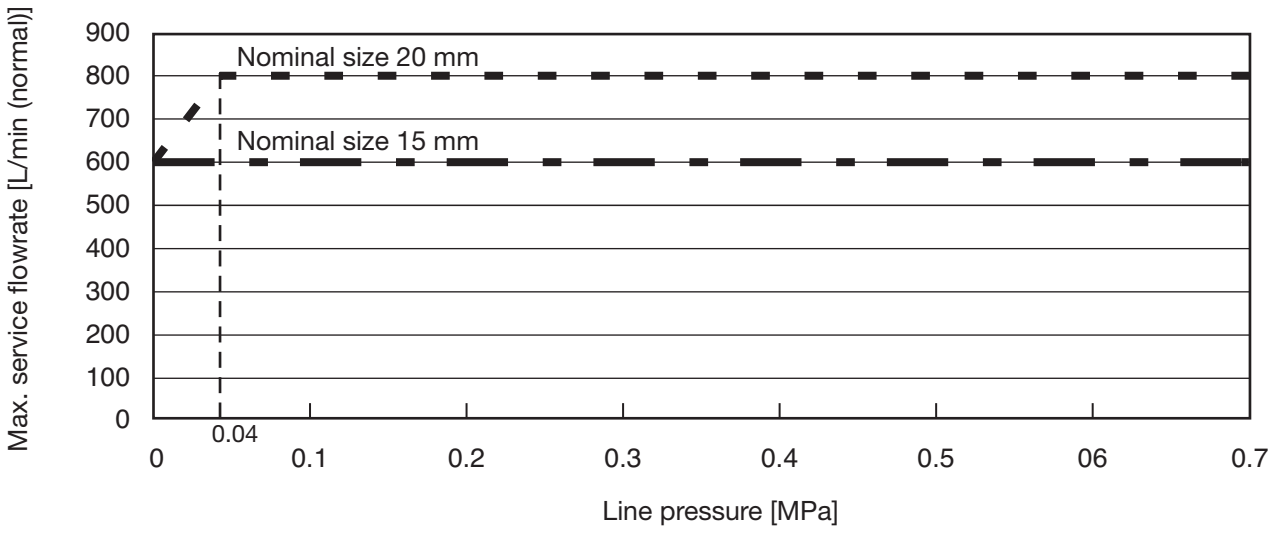
(4) Flushing

If it is expected that foreign matter will flow into the piping due to new piping, etc., flush the inside of the piping sufficiently before installing the instrument.

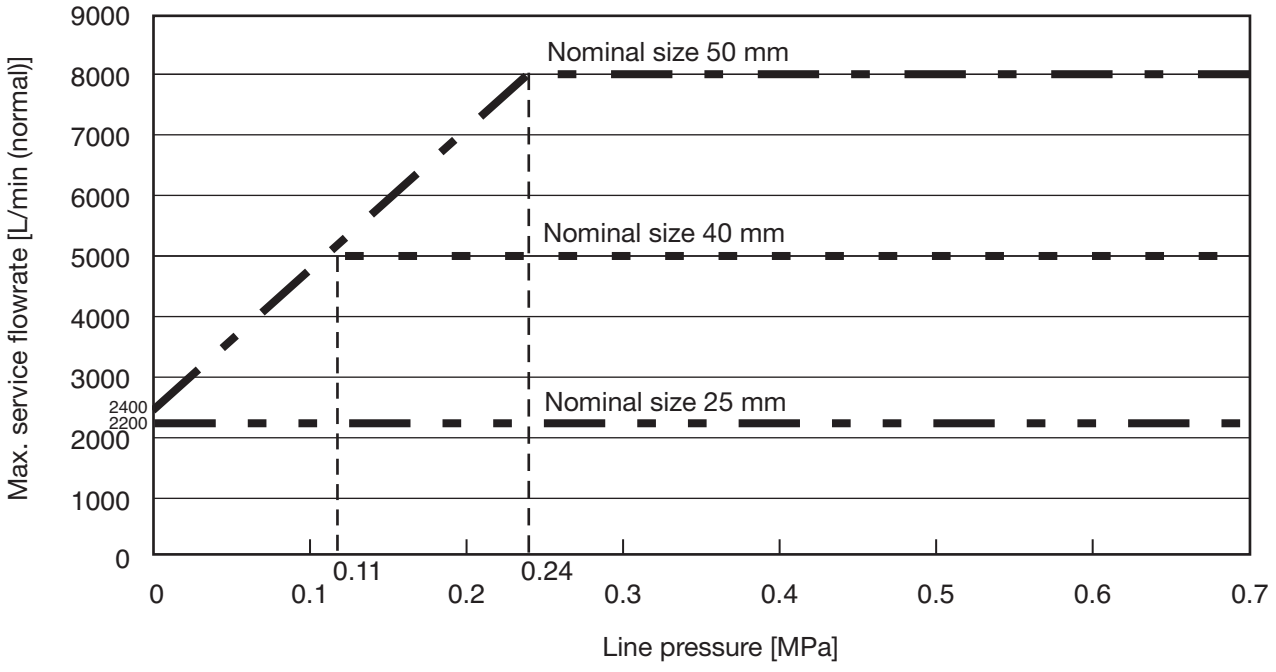
5.6 Maximum Service Flowrate

The maximum service flowrate varies with line pressure. Measurement continuation at larger service flowrates may possibly damage the sensor. Therefore, determine the maximum service flowrate from the following graphs and place the sensor in service within the rate so obtained.

■ Relationship between line pressure and maximum service flowrate (nominal sizes 15mm and 20mm)



■ Relationship between line pressure and maximum service flowrate (nominal sizes 25mm, 40 and 50mm)



6. WIRING CONNECTIONS

6.1 Wiring Specifications

Table 6.1

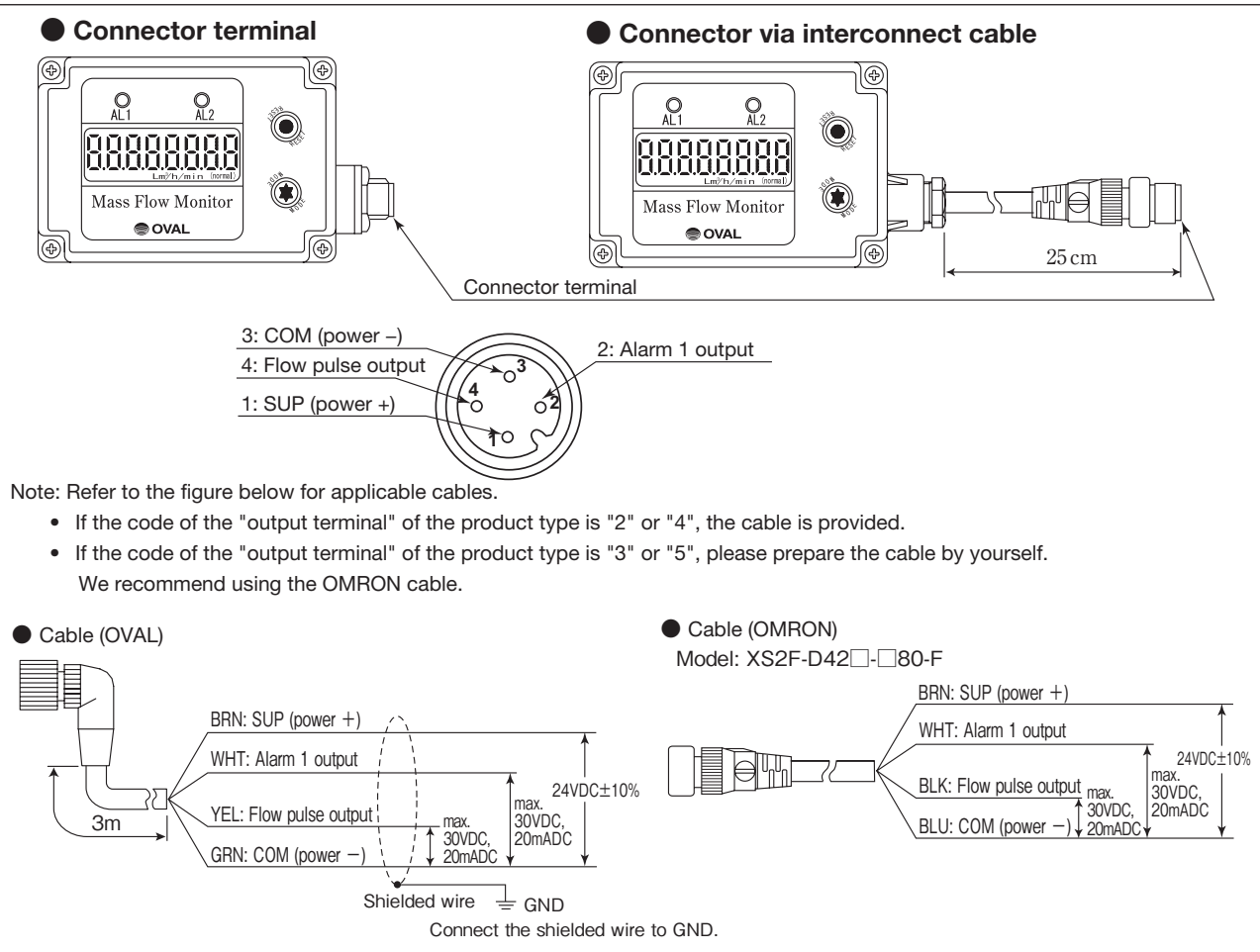
Item	Description
Transmission cable (Depends on your specification).	The following cables are supplied depending on the 15th digit of the product code. [1] : 5-core shielded cable 3m (finished outer diameter ϕ6.3mm) ... Fixed to this unit [2][4]: 4-core shielded cable 3m (finished outer diameter ϕ6.0mm, with 4-pin connector on one side of the cable) ... Attached to this unit
Alarm output	Open collector output Allowable current: 20mADC Max. voltage impression: 30VDC
Flow pulse output	Open collector output Allowable current: 20mADC Max. voltage impression: 30VDC
Flow analog output	4 to 20mA corresponding to 0 to F.S.
Supply Voltage	24VDC±10%

6.2 Wiring Diagram

➡NOTE: For the types and shapes of output terminals, refer to "Explanation of output terminals" on page 29.

⚠CAUTION: 1. Be careful not to make a mistake in the polarity of the power supply.
2. Be sure to ground the shielded wire to GND.

(1) Flow pulse output + single alarm point specifications (Fig. 6.1)

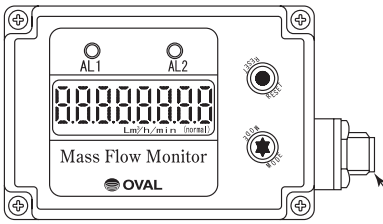


※ Refer to "Wiring Color Change due to Attached Cable Change" on the last page.

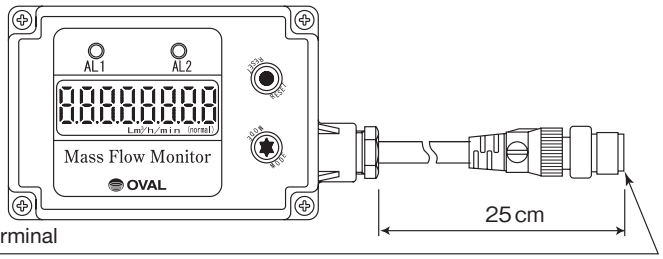
Fig. 6.1

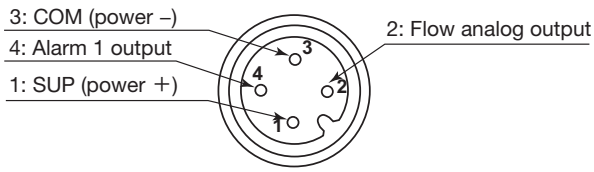
(2) Flow analog output + one alarm specifications (Fig. 6.2)

● **Connector terminal**



● **Connector via interconnect cable**

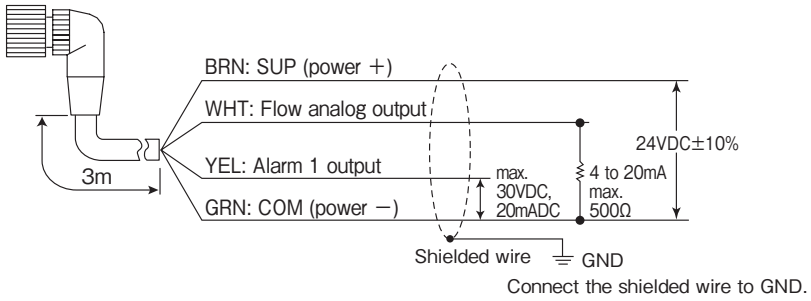




Note: Refer to the figure below for applicable cables.

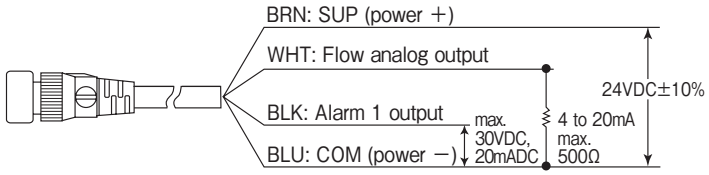
- If the code of the "output terminal" of the product type is "2" or "4", the cable is provided.
- If the code of the "output terminal" of the product type is "3" or "5", please prepare the cable by yourself. We recommend using the OMRON cable.

● Cable (OVAL)



● Cable (OMRON)

Model: XS2F-D42□-□80-F

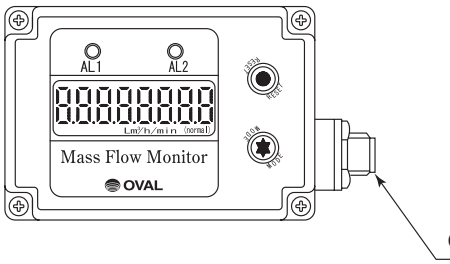


※ Refer to "Wiring Color Change due to Attached Cable Change" on the last page.

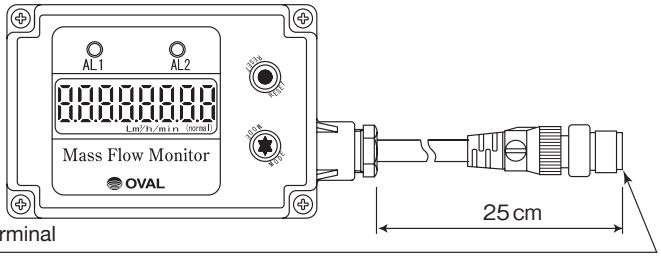
Fig. 6.2

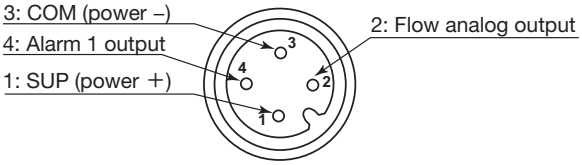
(3) Flow pulse output + flow analog output specifications (Fig. 6.3)

● **Connector terminal**



● **Connector via interconnect cable**





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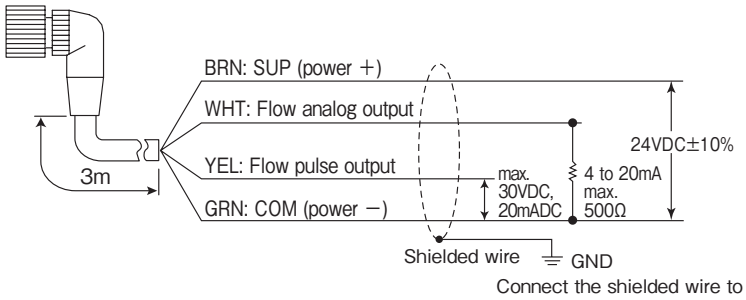
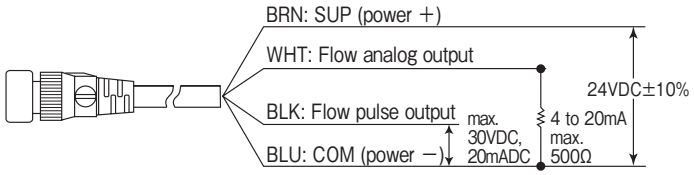
● Cable (OVAL)



● Cable (OMRON)
Model: XS2F-D42□-□80-F

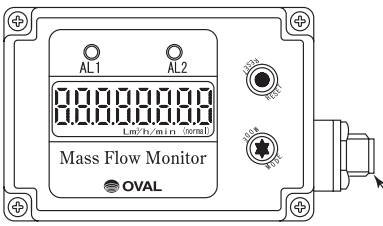


※ Refer to "Wiring Color Change due to Attached Cable Change" on the last page.

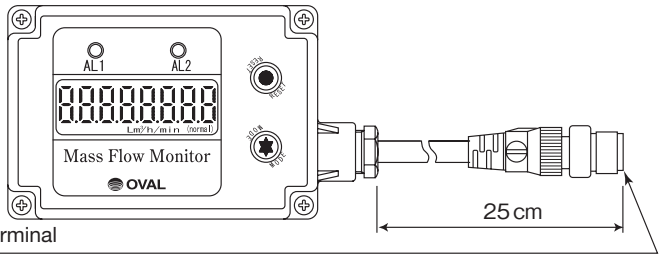
Fig. 6.3

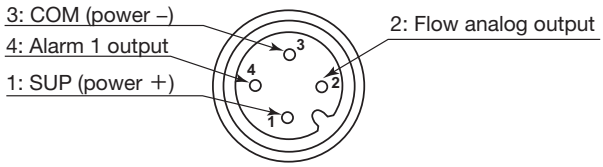
(4) Two alarm point specifications (Fig. 6.4)

● **Connector terminal**



● **Connector via interconnect cable**





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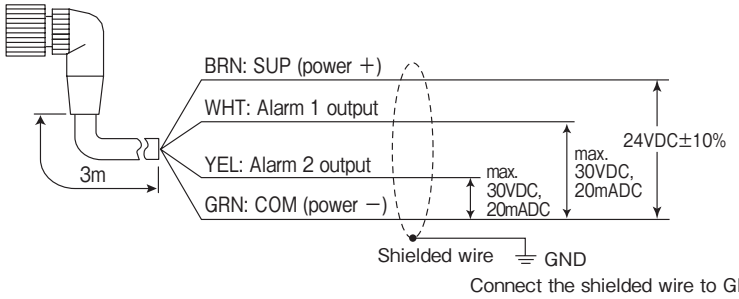
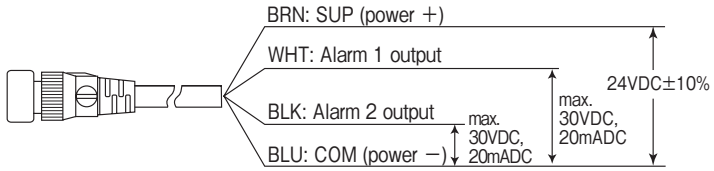
- If the code of the "output terminal" of the product type is "2" or "4", the cable is provided.
- If the code of the "output terminal" of the product type is "3" or "5", please prepare the cable by yourself. We recommend using the OMRON cable.

● Cable (OVAL)



● Cable (OMRON)
Model: XS2F-D42□-□80-F



※ Refer to "Wiring Color Change due to Attached Cable Change" on the last page.

Fig. 6.4

(5) Flow pulse output + two alarm points specifications (Fig. 6.5)

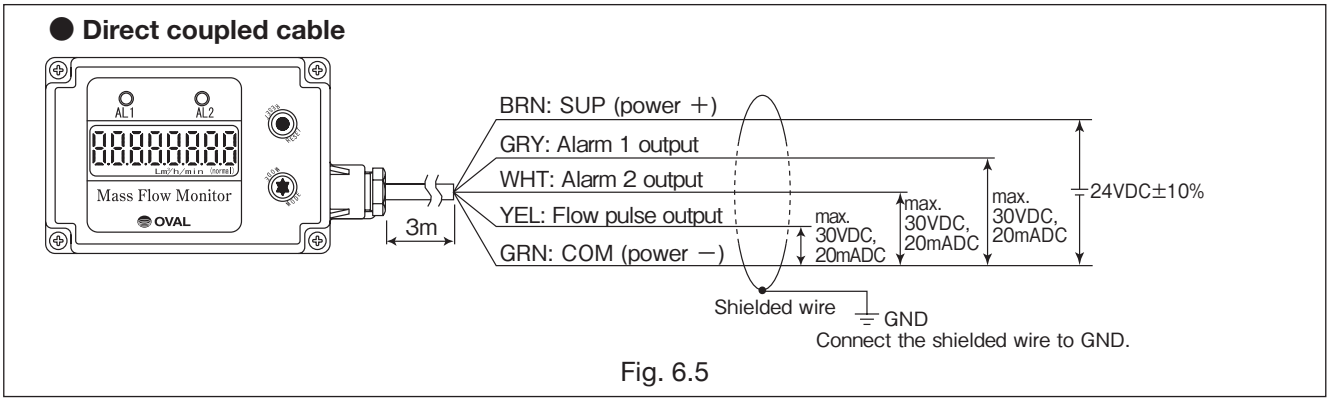


Fig. 6.5

(6) Flow pulse output + flow analog output + single alarm point specifications (Fig. 6.6)

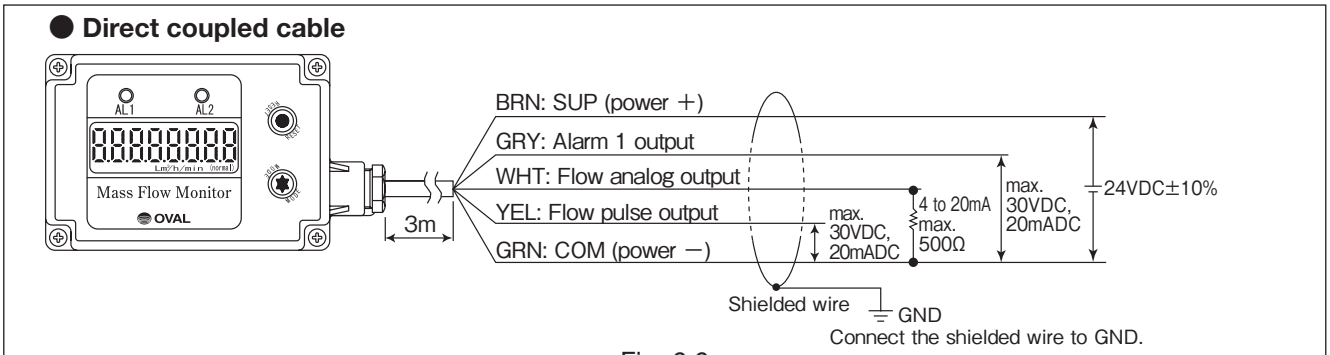


Fig. 6.6

⚠CAUTION: If the product code ⑮ is selected "less cable", the cable shown in the wiring diagram is not provided with the product.

6.3 Cable Specifications

The usable cable depends on the specifications of the product code ⑮ "Output terminal".
Refer to the table below.

product code ⑮	"Output Terminal" specifications ※1	Cable Specifications	State at shipment from factory
「1」	Cable coupled directly	[OVAL cable] 5-conductor shield cable Length: 3 m, O.D.: 6.3 mm	Directly coupled to the product body.
「2」	Connector via interconnect cable (cable provided)	[OVAL cable] 4-conductor shield cablewith connector Length: 3 m, O.D: 6 mm	Packed together with product body.
「4」	Connector terminal (cable provided)		
「3」	Connector via interconnect cable (no cable provided)	[Recommended cable] Manufacturer: OMRON Model: XS2F-D42□-□80-F Name: Cabled connector socket single side connector Length: As specified by the customer O.D.: 6 mm	The cable is not provided with the product, so please prepare the recommended cable shown on the left. (Please purchase directly from the cable manufacturer or supplier.)
「5」	Connector terminal (no cable provided)		

※1 For the types and shapes of output terminals, refer to the section "Explanation of output terminals".

7. OPERATION

(1) Check that the fluid conditions (pressure, temperature, etc.) and flowrate meet the rated specifications.
(2) After checking the wiring, turn on the power and check that the flow rate indication is 0.
(3) Make sure that there are no leaks in the piping, and gradually open the upstream valve.

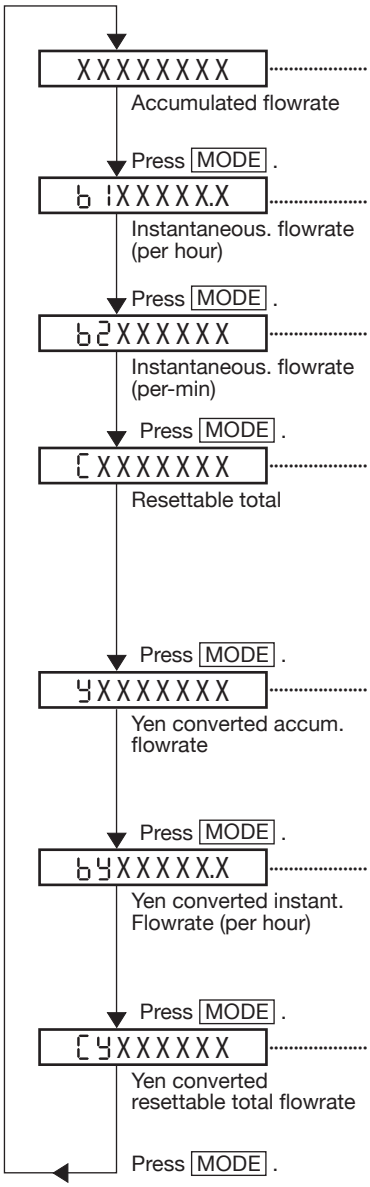
⚠CAUTION:
1. MASS FLOW MONITOR can measure immediately after the power is turned on, but the optimum accuracy will be obtained 30 minutes after the power is turned on.
2. Be careful not to increase the flow rate suddenly to prevent adverse effects on the equipment.

8. TRANSMITTER DISPLAY FUNCTIONS AND RECONFIGURATION

8.1 Viewing the Flow Variables

With this instrument, you can select and display any flow rate from 7 types of flowrate displays. Each flowrate display can be switched as shown in the figure below by pressing the "MODE" button on the display. Press the "MODE" button so that the flowrate you want to display is obtained.

(Immediately after the power is turned on, the flowrate is displayed before the power was turned off last time. The "X" in the figure is the value for each flowrate.)



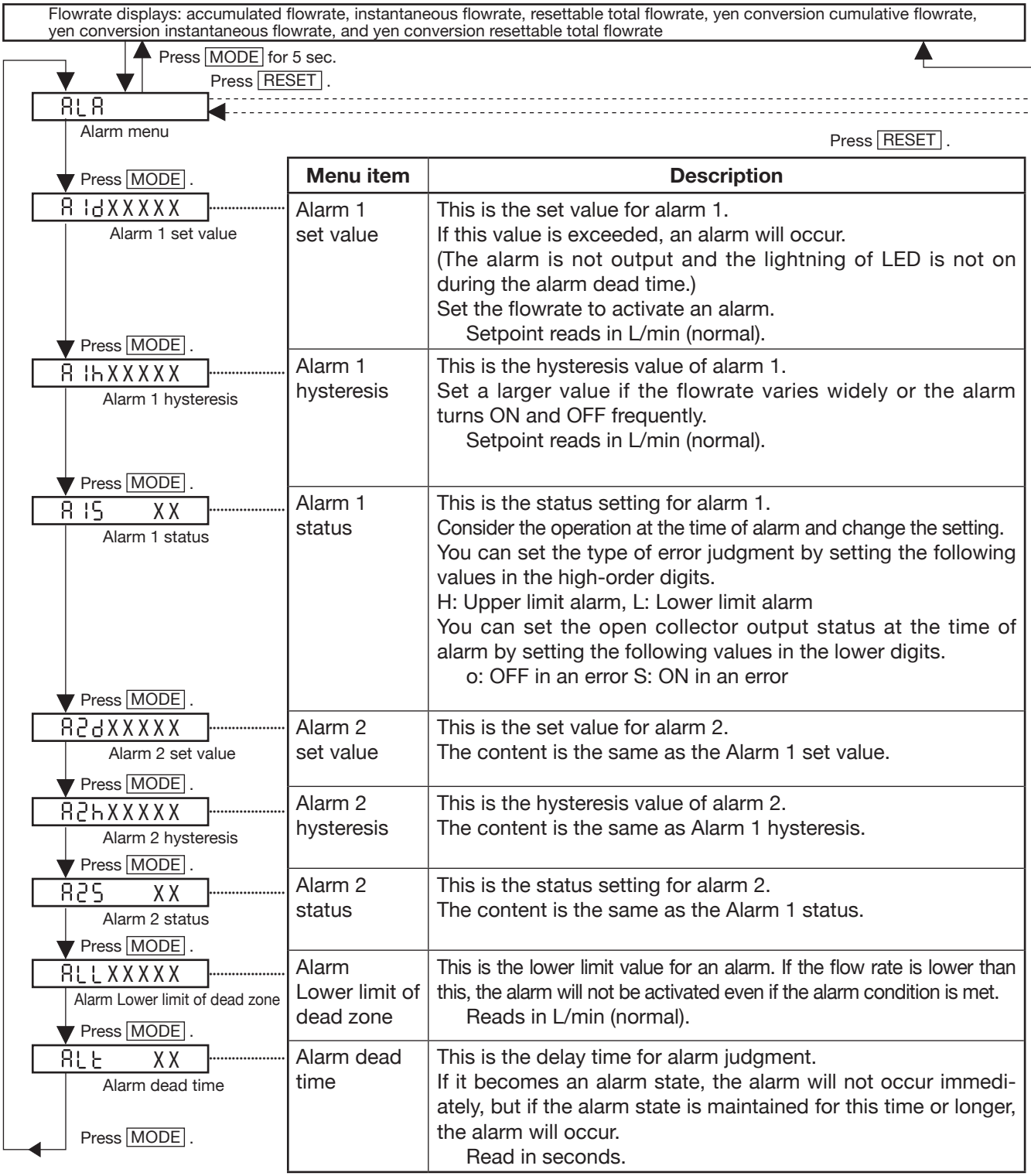
Menu item	Description
Accumulated flowrate	Displays the accumulated value of the flow rate that has flowed so far. (The accumulated value cannot be set to "0".) Reads in m^3 (normal).
Instantaneous flowrate (per hour)	Displays the instantaneous flowrate converted per hour. Reads in m^3/h (normal).
Instantaneous flowrate (per minutes)	Displays the instantaneous flowrate converted per minutes. Reads in L/min (normal).
Resettable total flowrate	Displays the integrated value of the flow rate that has flowed since the last reset. (By pressing the "RESET" button while the reset integration value is displayed, the reset integration value can be set to "0".) Reads in m^3 (normal).
Accumulated flowrate in terms of Yen ※1	This is the cumulative yen conversion value obtained by multiplying the flowrate by the yen conversion coefficient. Reads in Yen. (Unit of registration is not shown.)
Instantaneous flowrate in terms of Yen (hourly) ※1	This is the yen conversion instantaneous flow rate obtained by multiplying the flow rate by the yen conversion coefficient. Reads in Yen/h. (Only /h appears for the unit of registration.)
Resettable total flowrate in terms of Yen ※1	This is a yen conversion resettable integrated value obtained by multiplying the flow rate by the yen conversion coefficient. Reads in Yen. (Unit of registration is not shown.) The yen-converted integrated value of the flow rate that has flowed since the last reset is displayed. (By pressing the "RESET" button while the yen conversion resettable integration is displayed, you can set the yen conversion resettable integration value to "0".)

➡NOTE ※1:By setting the amount per 1 m^3 (normal) of fluid in the yen conversion coefficient, it is possible to display the yen conversion accumulated flowrate, the yen conversion instantaneous flow rate, and the yen conversion resettable flowrate.
(If "0" is set for the yen conversion coefficient, the yen conversion accumulated flowrate, the yen conversion instantaneous flow rate, and the yen conversion resettable flowrate will not be displayed.)

8.2 Parameter Display

The left side of the figure shows parameters related to alarms, and the right side shows other parameters and special functions.
You can change the parameter by displaying the parameter you want to change.

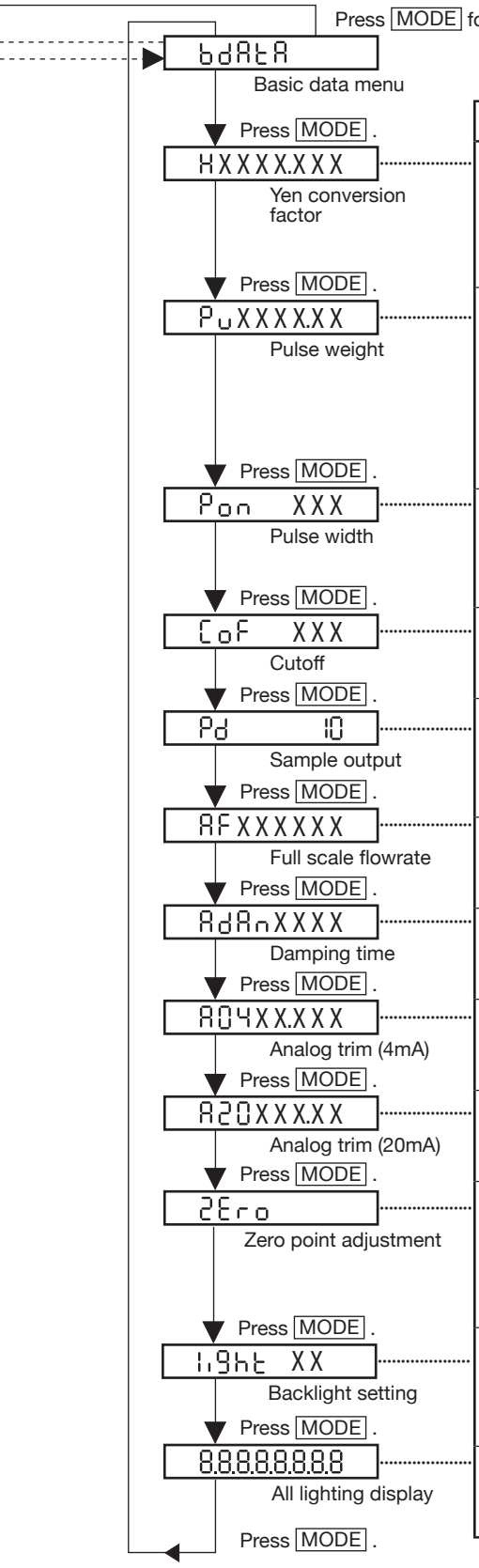
To return to the flow rate display state, press the "MODE" button for 5 seconds in either [ALA] or [bdAtA] display.



Menu item	Description
Alarm 1 set value	This is the set value for alarm 1. If this value is exceeded, an alarm will occur. (The alarm is not output and the lightning of LED is not on during the alarm dead time.) Set the flowrate to activate an alarm. Setpoint reads in L/min (normal).
Alarm 1 hysteresis	This is the hysteresis value of alarm 1. Set a larger value if the flowrate varies widely or the alarm turns ON and OFF frequently. Setpoint reads in L/min (normal).
Alarm 1 status	This is the status setting for alarm 1. Consider the operation at the time of alarm and change the setting. You can set the type of error judgment by setting the following values in the high-order digits. H: Upper limit alarm, L: Lower limit alarm You can set the open collector output status at the time of alarm by setting the following values in the lower digits. o: OFF in an error S: ON in an error
Alarm 2 set value	This is the set value for alarm 2. The content is the same as the Alarm 1 set value.
Alarm 2 hysteresis	This is the hysteresis value of alarm 2. The content is the same as Alarm 1 hysteresis.
Alarm 2 status	This is the status setting for alarm 2. The content is the same as the Alarm 1 status.
Alarm Lower limit of dead zone	This is the lower limit value for an alarm. If the flow rate is lower than this, the alarm will not be activated even if the alarm condition is met. Reads in L/min (normal).
Alarm dead time	This is the delay time for alarm judgment. If it becomes an alarm state, the alarm will not occur immediately, but if the alarm state is maintained for this time or longer, the alarm will occur. Read in seconds.

To display the parameters, press the “MODE” button for 5 seconds from the flowrate display state to display ALA. Subsequent operations can be displayed by pressing the "MODE" and "RESET" buttons according to the figure below.

(“X” in the figure will be the value with each setting.)



NOTES: 1. Refer to Section 8.3 for the parameter "changeable range" and factory default setting.
2. ※1: If your MASS FLOW MONITOR has no analog output function, this menu item will not be displayed.

Menu item	Description
Yen conversion factor	This is the set value for converting to yen. The yen-converted flowrate can be displayed by setting the amount per 1 m³ (normal) of fluid. Reads in Yen/m³ (normal). If the set value is "0", the yen conversion display is not performed.
Pulse weight	It is the value of the flowrate per output pulse. Reads in L (normal). When changing the settings, be careful to satisfy the following conditions. If this condition is not met, the pulse output will not be output normally. Max. service flowrate [L/min (normal)] / pulse weight [L(normal)] x (pulse "ON" [msec] + 1) / 60 < 1000
Pulse width	The value of the width of the output pulse. Reads in msec. If the same conditions as the pulse weight are not met, the pulse output will not be output normally.
Cutoff	This is the set value for the cut-off of the instantaneous flowrate. All flow rates lower than this value are set to "0". Reads in L/min (normal).
Sample output	10Hz pulse output is possible even during flow rate measurement. It can be used to check the connection with other systems. (For details on how to operate the sample output, refer to "8.6 Sample pulse output function".)
Analog Full scale flowrate ※1	Full-scale (20mA) flowrate value for analog output.
Analog Damping time ※1	This is the setting for the damping time of the analog output. (Due to the characteristics of the circuit, there is a time constant of about 1 second apart from the software settings.)
Analog trim (4mA) ※1	Adjust the analog output 4mA. (For details, refer to "8.7 Analog Output Adjustment".)
Analog trim (20mA) ※1	Adjusts the analog output of 20mA. (For details, refer to "8.7 Analog Output Adjustment".)
Zero point adjustment	You can adjust the zero point. Normally, the product is shipped after being calibrated, so do not perform this operation. The operation is "MODE" while pressing the "RESET" button at the time of this display. Press the button for at least 5 seconds.
Backlight setting	You can select the lighting mode of the backlight from four modes. On: Always lit, EC: Always lit at about half the brightness when on. OF: Always off, SL: Brightness is halved about 10 seconds after the button operation is completed.
All lighting display	Checks the lighting of the LCD display and LED lamp for alarm. Turns on all LCD displays and alarm LEDs. (Alarm output is generated as usual.)

8.3 Default Parameter Settings

The factory default parameters are set as shown in the table below.

Upper : Display content Middle: Unit of the set value Lower : Settable range	Factory default settings				
	Nominal size				
	15mm	20mm	25mm	40mm	50mm
Alarm 1 set value L/min (normal) 0 to 99999	50	65	200	400	650
Alarm 1 hysteresis L/min (normal) 0 to 99999	10	15	35	85	135
Alarm 1 status Ho, HS, Lo, LS	LS	LS	LS	LS	LS
Alarm 2 set value L/min (normal) 0 to 99999	600	800	2200	5000	8000
Alarm 2 hysteresis L/min (normal) 0 to 99999	10	15	35	85	135
Alarm 2 status Ho, HS, Lo, LS	HS	HS	HS	HS	HS
Alarm Lower limit of dead zone L/min (normal) 0 to 99999	10	15	35	85	135
Alarm dead time Seconds 0 to 99	3	3	3	3	3
Yen conversion factor Yen 1m^3 (normal) 0 to 999.999	2.000	2.000	2.000	2.000	2.000
Pulse weight L (normal) 0.01 to 9999.99	0.1	0.1	1.00	1.00	1.00
Pulse width msec 1 to 240	5	5	5	5	3
Cutoff ※1 L/min (normal) 0 to 99999	9	14	34	84	134
Analog full scale flowrate L/min (normal) 0 to 99999	600	800	2200	5000	8000
Analog Damping time sec 0 to 99	0	0	0	0	0
Backlight setting On, EC, OF, SL	On	On	On	On	On

➡ NOTES: ※1: Do not change the cutoff setting except in the following cases.

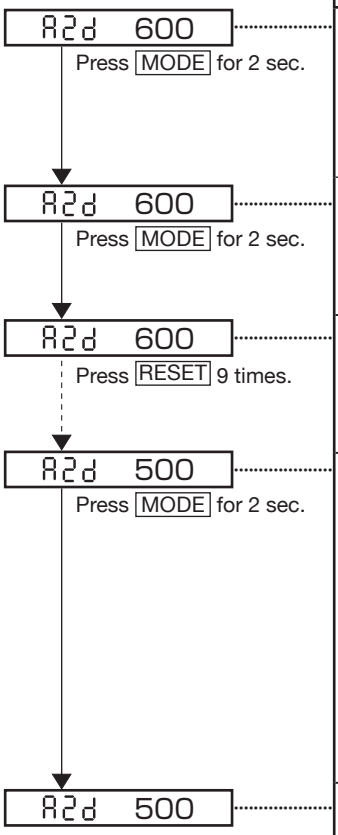
(1) If the output is generated even when the flow rate is stopped (*), set a cutoff value that is slightly larger than the output value at that time.

(2) Set the cutoff value smaller than the preferred flowrate, such as when you want to measure the flow rate in a smaller flow range than the cutoff value. Depending on the situation, the offset value at the zero point may increase the error in this area. If necessary, adjust the zero point in advance after the flow stops (*).
Zero point adjustment is performed with "ZEro" (zero point adjustment) in "8.2 Parameter display".

※ After the flow stops: it means that the valve on the downstream side of the instrument is fully closed and there is no leakage under the usage process conditions.

8.4 Parameter Reconfiguration

As an example, we will explain how to change the alarm 2 set value from 600 to 500.
For the display operation, refer to "8.2 Parameter Display".



Description
[Displays the alarm 2 set value.] Press the "MODE" button for 2 seconds or longer, and release the button when the display blinks. (It goes into write mode and the digit of the ones digit blinks.)
[The rightmost digit "0" blinks.] Press the "MODE" button twice to blink the hundreds digit. (Press the "MODE" button to shift the blinking position by one to the left.)
[The hundreds digit "6" blinks.] Press the "RESET" button 9 times to set the number to "5". (Press the "RESET" button to increment the blinking digit.)
[The number becomes "5" while the hundreds digit remains blinking.] The setting value is now "500". To save this value, press the "MODE" button for 2 seconds or longer, and release the button when the blinking display changes to lit. (Save the value and exit write mode.) If you want to exit the write mode without making any settings, press the "RESET" button for 2 seconds or longer, and release the button when the blinking display changes to lit. (Exit from write mode without saving the value.)
[The blinking display changes to lit.] The setting is completed.

8.5 Alarm Features

With this instrument, alarm 1 and alarm 2 can be set arbitrarily to monitor the flow rate. In addition, you can make detailed alarm settings by setting two parameters, "Alarm lower limit of dead zone" and "Alarm dead time". When setting the alarm, refer to this manual, set the parameters, and use the instrument effectively. An example of an alarm setting is also described, so please refer to it when you set parameters.

⚠CAUTION: If the alarm function is not necessary, set the alarm setting value to "0". (Alarm status can be either upper limit alarm or lower limit alarm.)

(1) Upper limit alarm setting

There are five parameters ① to ⑤ below for the upper limit alarm. Follow the instructions for each parameter to make the settings.

① Alarm set value

Set the flowrate [(L/min (normal)] for the upper limit alarm.

② Alarm hysteresis

The alarm is canceled under the following conditions.
Set an appropriate alarm hysteresis value [L / min (normal)].

Flowrate < Alarm set value - Alarm hysteresis

If the flowrate fluctuates greatly and the alarm turns ON and OFF frequently, set a slightly larger value.

③ Alarm status (upper digit)

Set "H" for the upper digit to set the upper limit alarm.

④ Alarm status (lower digit)

Set the output status at the time of alarm in the lower digit.

The alarm output is "ON" (Lo impedance) when "S" is set, and the alarm output is "OFF" (Hi impedance) when "o" is set.

⑤ Alarm dead time

Set the delay time [sec] from when the flow rate exceeds the alarm set value until when the alarm occurs. Note that the setting of this parameter is common to both alarms 1 and 2.

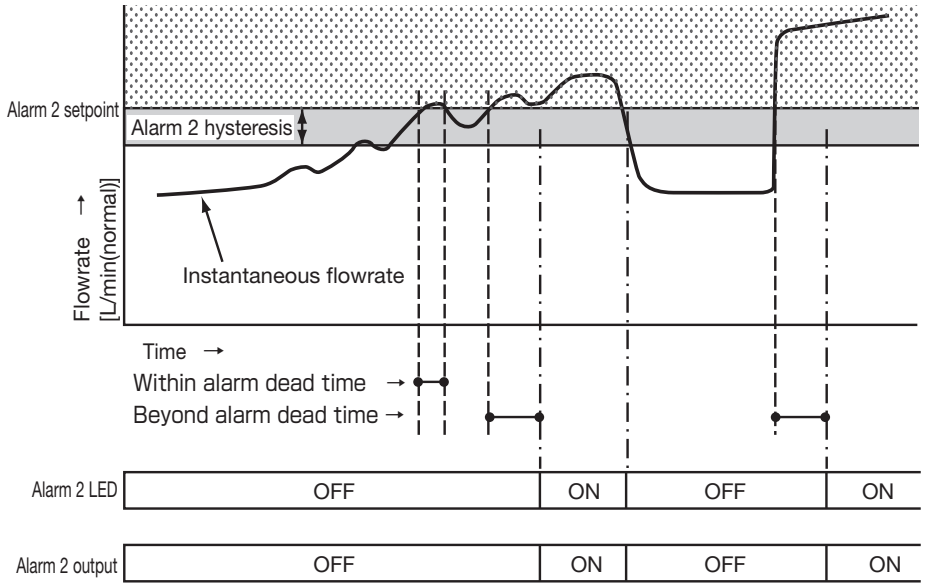
■ Upper limit alarm setting example

Shown below is an example of setting when alarm 2 is set as the upper limit alarm.

● Setting example 1 (When "alarm hysteresis" and "alarm dead time" exist)

・Alarm conditions: When the following condition continues beyond the alarm dead time.
Instantaneous flowrate ≧ Alarm set value

・Alarm cancel conditions: Instantaneous flowrate < Alarm set value - Alarm hysteresis



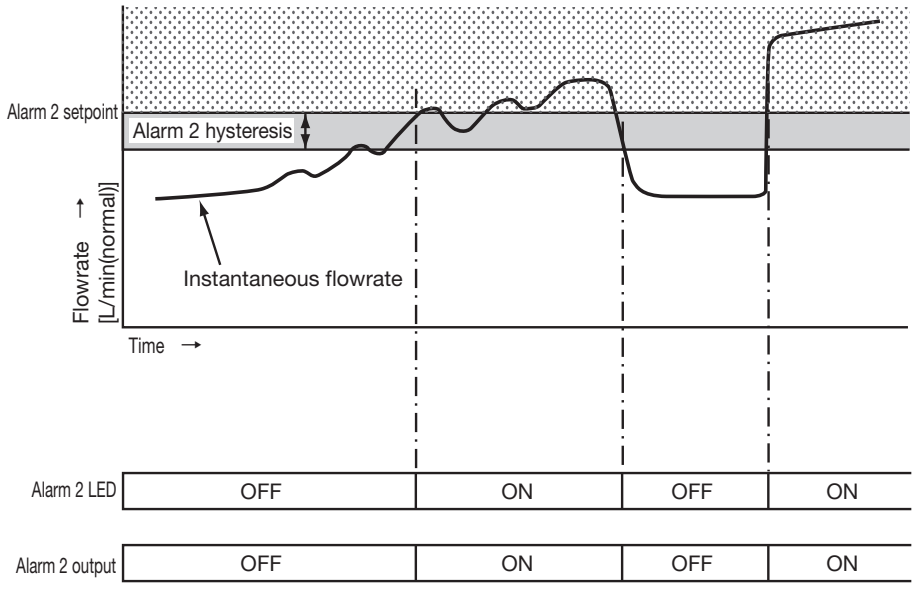
Parameter Name	Setting
Alarm 2 set value [L/min (normal)]	550
Alarm 2 hysteresis [L/min (normal)]	20
Alarm 2 status (higher digit)	H
Alarm 2 status (lower digit)	S
Alarm dead time [sec]	3

➡NOTES: If the alarm 2 status (lower digit) is set to "o", the "ON" and "OFF" of the alarm 2 output will be opposite to the above chart.

● Setting example 2 ("Alarm hysteresis" is setting, but "Alarm dead time" is "0")

・Alarm conditions : Instantaneous flowrate ≧ Alarm set value

・Alarm cancel conditions : Instantaneous flowrate < Alarm set value - Alarm hysteresis



Parameter Name	Setting
Alarm 2 set value [L/min (normal)]	550
Alarm 2 hysteresis [L/min (normal)]	20
Alarm 2 status (higher digit)	H
Alarm 2 status (lower digit)	S
Alarm dead time [sec]	0

➡NOTES: If the alarm 2 status (lower digit) is set to "o", the "ON" and "OFF" of the alarm 2 output will be opposite to the above chart.

(2) Lower limit alarm setting

There are six parameters ① to ⑥ below for the lower limit alarm. Follow the instructions for each parameter to make the settings.

⚠CAUTION: If the flowrate is "0", the alarm will not be generated.

① Alarm set value

Set the flowrate [(L/min (normal)] for the lower limit alarm.

② Alarm hysteresis

The alarm is canceled under the following conditions. Set an appropriate alarm hysteresis value [L / min (normal)].

Flowrate > Alarm set value + Alarm hysteresis

If the flowrate fluctuates greatly and the alarm turns ON and OFF frequently, set a slightly larger value.

③ Alarm status (upper digit)

Set "L" for the upper digit to set the lower limit alarm.

④ Alarm status (lower digit)

Set the output status at the time of alarm in the lower digit.

The alarm output is "ON" (Lo impedance) when "S" is set, and the alarm output is "OFF" (Hi impedance) when "o" is set.

⑤ Alarm lower limit of dead zone

Set the lower limit flow rate [L / min (normal)] for alarm.

For example, some devices, such as pressure reducing bleed valves, may see some leak even when the device is stopped on a line that uses large number of pneumatic devices.

In such a case, you can set the "Alarm lower limit of dead zone" so that the alarm will not be activated even if there is some leakage.

The lower limit alarm does not generate under the following conditions:

Flowrate ≦ Alarm lower limit of dead zone

Set a value slightly larger than the flowrate when the device is stopped.

⚠CAUTION: This instrument displays the flow rate below the cutoff value [L / min (normal)] as "0". The value of Alarm lower limit of dead zone must be larger than the cutoff value and smaller than the alarm set value.
If The value of the Alarm lower limit of dead zone is set larger than the alarm set value, the lower limit alarm setting will not work because alarm lower limit of the alarm dead zone setting is given priority.

⑥ Alarm dead time

Set the delay time [sec] from when the flow rate exceeds the alarm set value until when the alarm is activated. Normally, when the device is stopped, the alarm does not start because the flow rate is lower than the alarm lower limit of dead zone. Also, even when the device is operating, the alarm will not be activated because the flow rate is higher than the alarm set value. However, the alarm will be activated for a moment when the device changes from a stopped state to an operating state, or when it changes from an operating state to a stopped state.
To avoid this alarm activation, set this setting longer than the alarm state.
Please note that this parameter is common to alarms 1 and 2.

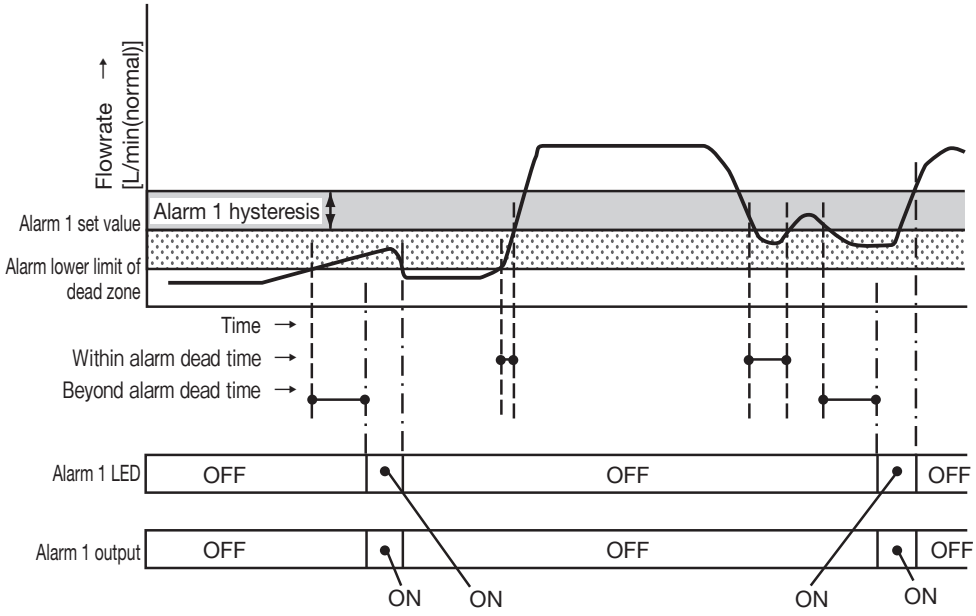
■ Lower limit alarm setting example

Shown below is an example of setting when alarm 1 is set as the lower limit alarm.

● Setting example 1 (When "alarm hysteresis" and "alarm dead time" exist)

・Alarm conditions : When the following condition continues beyond the alarm dead time.
Alarm lower limit of dead zone < Instantaneous flowrate <Alarm set value

・Alarm cancel conditions : Instantaneous flowrate ≦ Alarm lower limit of dead zone
or Instantaneous flowrate > Alarm set value + Alarm hysteresis



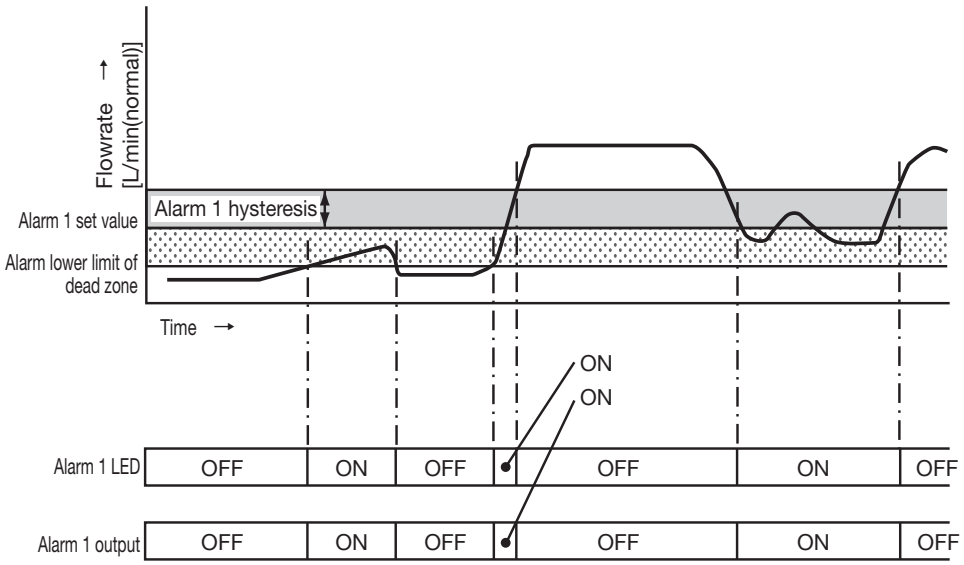
Parameter Name	Setting
Alarm 1 set value [L/min (normal)]	50
Alarm 1 hysteresis [L/min (normal)]	10
Alarm 1 status (upper digit)	L
Alarm 1 status (lower digit)	S
Alarm lower limit of dead zone [L/min (normal)]	20
Alarm dead time [sec]	3

➡NOTES: If the alarm 2 status (lower digit) is set to "o", the "ON" and "OFF" of the alarm 2 output will be opposite to the above chart.

● Setting example 2 ("Alarm hysteresis" is setting, but "Alarm dead time" is "0")

・Alarm conditions : Alarm lower limit of dead zone < Instantaneous flowrate <Alarm set value

・Alarm cancel conditions : Instantaneous flowrate ≦ Alarm lower limit of dead zone
or Instantaneous flowrate > Alarm set value + Alarm hysteresis



Parameter Name	Setting
Alarm 1 set value [L/min (normal)]	50
Alarm 1 hysteresis [L/min (normal)]	10
Alarm 1 status (upper digit)	L
Alarm 1 status (lower digit)	S
Alarm lower limit of dead zone [L/min (normal)]	20
Alarm dead time [sec]	0

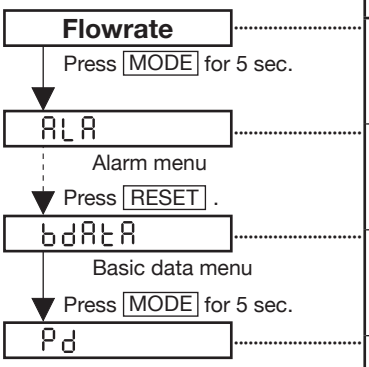
➡NOTES: If the alarm 2 status (lower digit) is set to "o", the "ON" and "OFF" of the alarm 2 output will be opposite to the above chart.

8.6 Sample Pulse Output

Sample pulse output is performed at a frequency of 10 Hz regardless of the state of the flow meter, and the integrated value of the number of pulses output at this time is displayed. This function makes it easy to connect the flowmeter to other systems and to check the operation.
The operation method is as follows.
("X" or "Y" in the figure will be the value with each setting.)

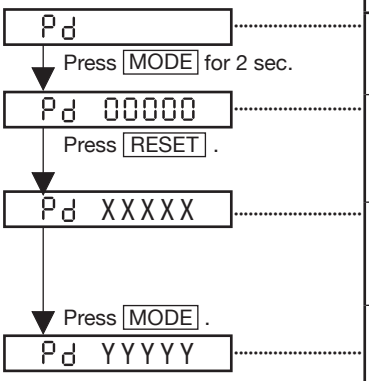
⚠CAUTION: When this operation is performed, the pulse output becomes a sample pulse output, and the pulse is output regardless of the actual flowrate. Do not perform this operation if the flowrate output is used for control data. The accuracy of the sample pulse is ± 1 count to the displayed value.

(1) Select Sample pulse output.



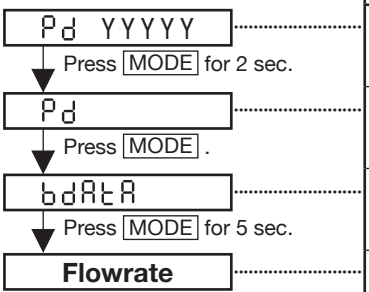
Description
The flowrate is displayed.
Press the "MODE" button for 5 seconds to display the alarm menu.
Press the "RESET" button once to display the basic data menu.
Press the "MODE" button 5 times to display the sample pulse output. The sample pulse output is displayed.

(2) Run sample pulse output.



Description
Sample pulse output is displayed.
Press the "MODE" button for 2 seconds to bring into sample pulse output standby status. [The display will show indication as shown in left figure at standby and pulse is not generated yet at this stage.]
When you press the "RESET" button, a 10Hz flow pulse output starts generating. (If you want to stop the sample pulse output, operate (3) End the sample pulse output.) ["XXXX" in the figure counts up by 1 for each flow rate pulse output.]
Press the "MODE" button to stop the sample pulse output. ["YYYY" in the figure is the number of pulses generated as sample pulses.] (To start generating the sample pulse again, press the "RESET" button. If you want to stop the sample pulse output, operate (3) End the sample pulse output.)

(3) End the sample pulse output



Description
The sample pulse output is stopped.
Press the "MODE" button for 2 seconds or longer to display the sample pulse output.
Press the "MODE" button 8 times to display the basic data menu.
Press the "MODE" button for 5 seconds or longer to display the flow rate. The flow rate will be displayed.

8.7 Analog Output Adjustment

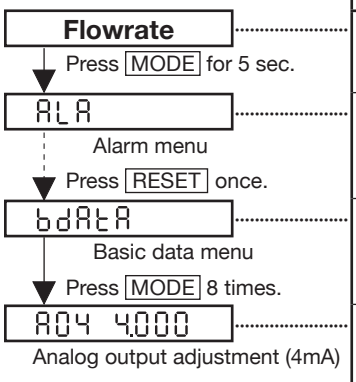
You can trim and adjust the analog output at this window.

➡ NOTES: 1. Output is accurately adjusted in the factory and normally requires no further adjustment. Analog adjustment consists of 4mA trim and 20mA trim. In the 4mA trim the current (4mA) is adjusted to 0 flow whereas the 20mA trim is adjusted to full scale flow.

2. Do not perform this adjustment on a model that has no analog output requirements.

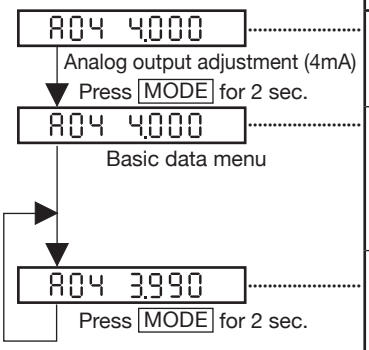
8.7.1 Analog Adjustment (4mA)

(1) Select Analog Adjustment (4mA).



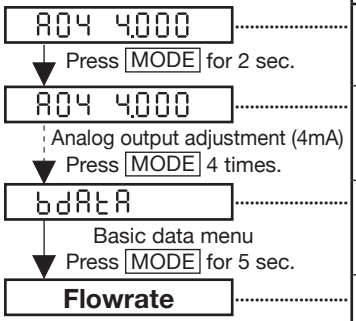
Description
The flowrate is displayed.
Press the "MODE" button for 5 seconds to display the alarm menu.
Press the "RESET" button once to display the basic data menu.
Press the "MODE" button 8 times. Analog output adjustment (4mA) will be displayed.

(2) Run Analog Adjustment (4mA).



Description
Analog output adjustment (4mA) is displayed.
Press the "MODE" button for 2 seconds to bring into analog adjustment (4mA) status. [The number (0) on the far right starts blinking.] If the analog output deviates from 4mA, perform the following operations. If there is no deviation, operate (3) End analog adjustment (4mA).
Set the reading value of the analog output ammeter as a numerical value. For example, if the ammeter reading is "3.990", set the value to "3.990". • By turning on the [MODE] switch, the setting digit (blinking part) can be shifted to the left digit • By turning on the [RESET] switch, the value of the blinking part increases by 1. If you press the "MODE" button for 2 seconds, the value will blink to "4.000", and the analog output adjusted based on the set value will be output from the transmitter. If the analog output deviation is still large, set the value again.

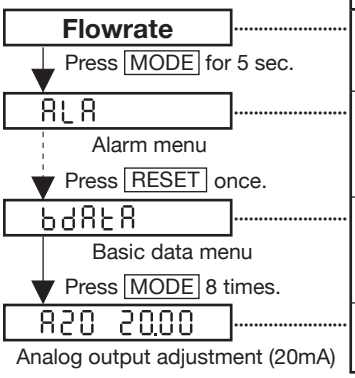
(3) End Analog Adjustment (4mA).



Description
The analog output (4mA) has been adjusted. [The number (0) on the far right is blinking.]
Press the "MODE" button for 2 seconds to display analog adjustment (4mA). [Blinks of the far right digit (0) will be stopped.]
Press the "MODE" button 5 times to display the basic data menu.
Press the "MODE" button for 5 seconds. The flow rate display will be displayed.

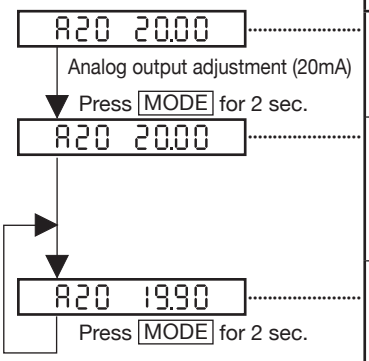
8.7.2 Analog Adjustment (20mA)

(1) Select Analog Adjustment (20mA).



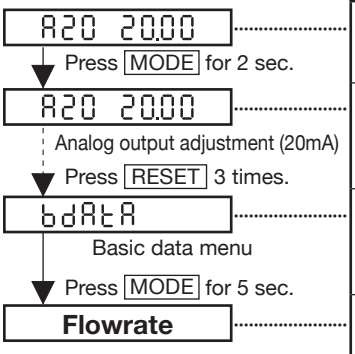
Description
The flowrate is displayed.
Press the "MODE" button for 5 seconds to display the alarm menu.
Press the "RESET" button once to display the basic data menu.
Press the "MODE" button 9 times. Analog output adjustment (20mA) will be displayed.

(2) Run Analog Adjustment (20mA).



Description
Analog output adjustment (20mA) is displayed.
Press the "MODE" button for 2 seconds to bring into analog adjustment (20mA) status. [The number (0) on the far right starts blinking.] If the analog output deviates from 20mA, perform the following operations. If there is no deviation, operate of (3) End analog adjustment (20mA).
Set the reading value of the analog output ammeter as a numerical value. For example, if the ammeter reading is "19.90", set the value to "19.90". • y turning on the [MODE] switch, the setting digit (blinking part) can be shifted to the left digit. • By turning on the [RESET] switch, the value of the blinking part increases by 1. If you press the "MODE" button for 2 seconds, the value will blink to "20.00", and the analog output adjusted based on the set value will be output from the transmitter. If the analog output deviation is still large, set the value again.

(3) End Analog Adjustment (20mA).



Description
The analog output (20mA) has been adjusted. [The number (0) on the far right is blinking.]
Press the "MODE" button for 2 seconds to display analog adjustment (20mA). [Blinks of the far right digit (0) will be stopped.]
Press the "MODE" button 4 times to display the basic data menu.
Press the "MODE" button for 5 seconds. The flow rate display will be displayed.

8.8 Error Messages

If an error occurs, an error message will be displayed alternately with the flow rate display.
It may be displayed when the power is turned on.

	Kind of error	Abnormal state	Coping process
out. Err. (Description)	Pulse output error	The pulse is not output correctly.	Check the following three values. • Pulse weight (parameter) • Pulse width (parameter) • Instantaneous flow rate display at error display Change the parameters so that the above values satisfy the following conditions. Flowrate with error message [L (normal)] /pulse weight [L/min (normal)] × (pulse "ON" duration [msec] + 1) /60 < 1000
AnA. Err. (Description)	Analog error	115% or more of analog full scale is flowing due to excessive flowrate.	Take the following actions. • Reduce the flowrate. • Increase the analog full scale (parameter) setting value.
PA. Err.1 (Description)	Setting error	The flowrate cannot be calculated.	Electrical part can be the cause. Please contact our sales / service network for further support.
PA. Err.2 (Description)	Accumulated total error	The accumulated flowrate data is an abnormal value.	Electrical part can be the cause. Please contact our sales / service network. (In case of temporary error, if you press the "RESET" button, the cumulative integrated value will be reset to "0", but you will be able to measure the flow rate as usual.)
Ain1 Err. (Description) Ain2 Err.	Sensor error	The flowrate cannot be measured correctly.	Sensor part can be the cause. Please contact our sales / service network for further support.

9. GENERAL SPECIFICATIONS

Item	Description				
Model	TF1015	TF1020	TF1025	TF1040	TF1050
Nominal Size	15mm	20mm	25mm	40mm	50mm
Acceptable Fluid	Compressed air and nitrogen				
Flow Range ※1	10 to 600 L/min (normal)	15 to 800L/min (normal)	35 to 2200L/min (normal)	85 to 5000L/min (normal)	135 to 8000L/min (normal)
Fluid Temperature	0 to 50℃				
Ambient Temperature	0 to 50℃				
Pressure Range	0 to 0.7MPa				
Major Parts Materials	Monitor body: PBT (Polybutylene Terephtalate)		Monitor body: A5052 (Machined, anodized)		
	Sensor: SUS316 Display: Mixed resin consisting PC (Polycarbonate) and PBT (polybuthylene terephthalate) Transmitter case: PBT (Polybutylene Terephtalate) O-rings: Viton				
Connection Rating	Rc1/2 (female)	Rc3/4 (female)	Rc1 (female)	Rc1・1/2 (female)	Rc2 (female)
Connector Material	ADC12 (Aluminum die cast, Alodine (trivalent))	A5052 (Aluminum machined and anodized)			
Display	7-segment 8-digit LCD (backlit, with unit display). The display can be rotated in 90° steps. • Instantaneous flow rate (m^3 / h (normal), L / min (normal)) • Resettable total flowrate, accumulated flowrate (m^3 (normal)) • Yen conversion (Instantaneous flow rate, Accumulated flowrate, Resettable total flowrate) Note: In the case of yen conversion, the unit of the numerical value is "yen".				
	LED × 2 places (Lights up in an alarmed condition).				
Output ※2	Flow pulse (Factored pulse, open collector output) (Pulse width adjustable from 1 to 240 msec) Alarm (2 points, open collector output) Flowrate analog 4 to 20mA, Max. load resistance 500 Ω				
Alarm	• 2 independent set points can be chosen (settings, hysteresis, or high/low alarms.) • The lowest limit of alarm can be set up. (Alarm can be cleared at around 0 flow.)				
Pressure Loss	10kPa max. (flowing at the max. flowrate above 0.3MPa)				
Response	Time constant 1.5 sec. max.				
Power	24 VDC ±10%, Max. 100 mA				
Cable	Refer to Section 6.2 Wiring Diagram.				
Physical Orientation	Horizontal or vertical				
Protection Grade	Non-explosionproof, indoor use, IP65				

➡NOTES: ※1. The unit (normal) indicates the value converted to 0℃ and 1 atm. The maximum flow rate is limited by the pressure inside the pipe as it may damage the sensor. Please refer to "5.6 Maximum service flowrate".

※2. You can select any two output points. (Refer to the product code for the combination.)

● Accuracy (all meter sizes)

	Flowrate below 40% of full scale	Flowrate 40% or more of full scale
Reproducibility	±0.8% of full scale or better	±2% of reading or better
Linearity	±2% of full scale or better	±5% of reading or better
Pressure characteristics	±0.12% of full scale/0.1 MPa or better	±0.3%/0.1 MPa of reading or better
Temperature characteristics	±0.1%/℃ of full scale	±0.2%/℃ of reading

10. APPLICABLE STANDARDS

Applicable EU Directive	EMC Directive: 2014/30/EU RoHS Directive: 2011/65/EU
Applicable EN standards, etc.	EMC Directive: EN61326-1: 2013 Class A RoHS Directive: EN50581: 2012

11. PRODUCT CODE

Table 11.1

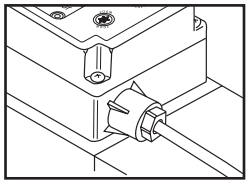
Item	Product Code ①②③④⑤⑥	–	⑦	⑧	⑨	⑩	–	⑪	⑫	⑬	⑭	⑮	Description
Model	T F												Mass flow monitor
Type	1												Standard type
Nominal size	0 1 5	-											15mm
	0 2 0	-											20mm
	0 2 5	-											25mm
	0 4 0	-											40mm
	0 5 0	-											50mm
Body material			A										Aluminum (for Nominal sizes 25mm, 40mm and 50mm)
			P										PBT (for Nominal sizes 15mm and 20mm)
Max. operating pressure				1									0.7MPa
Sensor design					1								Nominal sizes 15mm and 20mm
					2								Nominal sizes 25mm, 40mm and 50mm
Metered fluid						G	-						Compressed air and nitrogen
Connection rating (※1)								1					Rc thread (female)
Display									1				Totalizer and digital indicator
Output (※2)										1			Output × 2: Flow pulse + single alarm point
										2			Output × 2: Flow analog + single alarm point
										3			Output × 2: Flow pulse + flow analog
										4			Output × 2: Two alarm points
										5			Output × 3: Flow pulse + two alarm points
										7			Output × 3: Flow pulse + flow analog + single alarm point
Version											A		Standard

Output terminals		Nom. size (mm) 15	20	25	40	50
1	Direct coupled cable (output × 3, 5 conductor, 3 meters long)	○	○	○	○	○
2	Connector via cable (output × 2) Cable provided (4 conductor, 3 long)	○	○	×	×	×
3	Connector via cable (output × 2) No cable provided	○	○	×	×	×
4	Connector terminal (output × 3) Cable provided (4 conductor, 3 long)	×	×	○	○	○
5	Connector terminal (output × 3) No cable provided	×	×	○	○	○

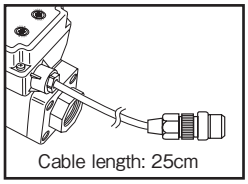
NOTES: ※1: 15mm: Rc1 /2, 20mm: Rc3/4, 25mm: Rcl, 40mm: Rc1-1 /2, 50mm: Rc2
※2: You can select 2-point output or 3-point output. The selection of "output terminal" is restricted depending on the number of output points.
※3: Product code for the mounting adapter (optional) for nominal diameters of 15 mm and 20 mm: TFB015

● Explanation of Output Terminal ▶

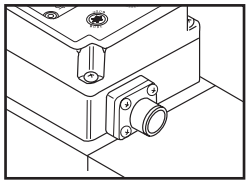
(Direct coupled cable)



(Connector via interconnect cable)



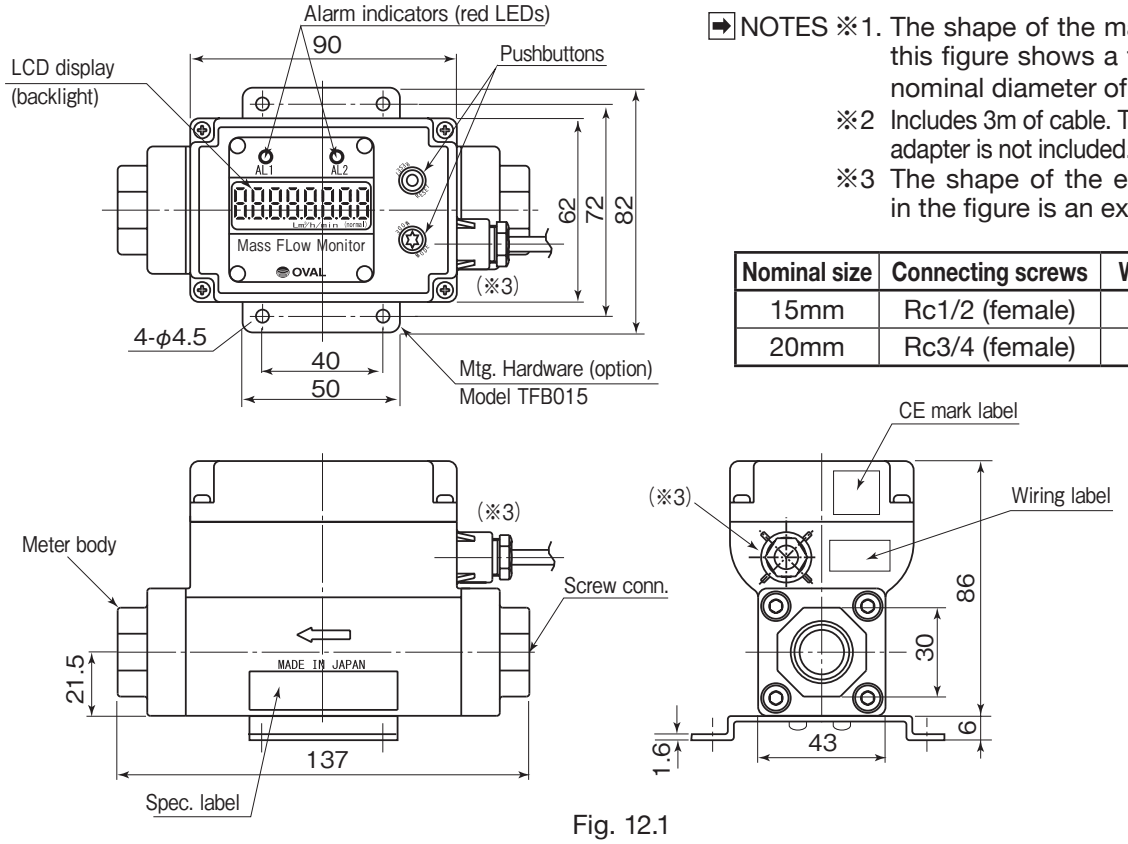
(Connector terminal)



12. OUTLINE DIMENSIONS

Nominal sizes: 15mm and 20mm (※1)

All dimensions in millimeters



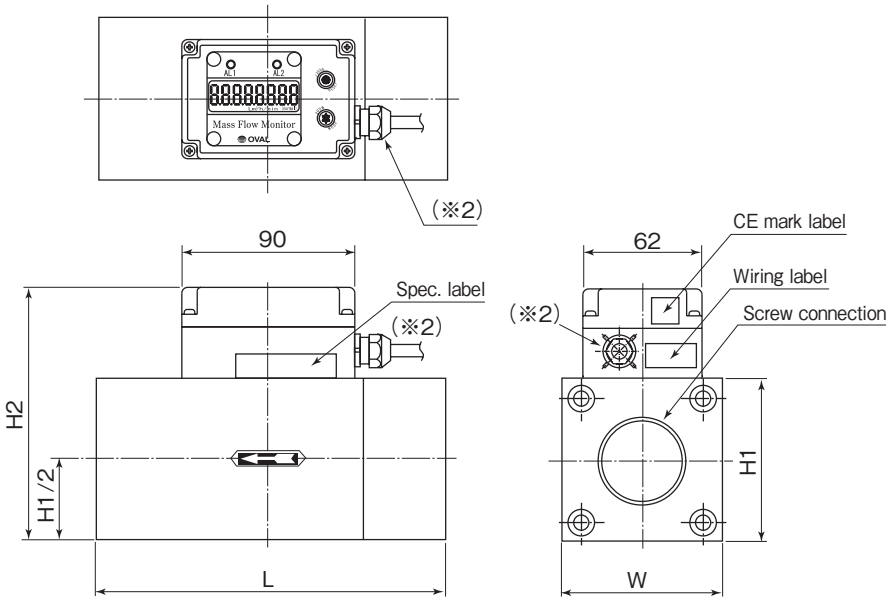
➡NOTES ※1. The shape of the main body in this figure shows a type with a nominal diameter of 15 mm.
※2 Includes 3m of cable. The mounting adapter is not included.
※3 The shape of the electric wire in the figure is an example.

Nominal size	Connecting screws	Weight (※2)
15mm	Rc1/2 (female)	750g
20mm	Rc3/4 (female)	760g

Fig. 12.1

Nominal sizes; 25, 40 and 50mm

All dimensions in millimeters



Nominal size	L	W	H1	H2	Connecting screws	Weight (※1)
25mm	180	66	59	106	Rc1 (female)	1620g
40mm	180	83	83	130	Rc1・1/2 (female)	2560g
50mm	200	83	83	130	Rc2 (female)	2620g

➡NOTES ※1. A cable of 3 meters long inclusive.
※2. The shape of the cable outlet in the figure is an example.

Fig. 12.2

Wiring Color Change due to Attached Cable Change

The transmission cable included with this product has been temporarily changed. Due to the change, there is a discrepancy between the cable wiring colors shown in the wiring diagram and the actual product.

Standard cable	Changed cable
	

● **Cable Wiring Color Replacement List**

Assignment	Standard cable	Changed cable
SUP (Power +)	Brown	Brown
Signal 1*	White	White
COM (Power –)	**Green**	**Blue**
Signal 2*	**Yellow**	**Black**

※ Signal 1 and Signal 2 are assigned differently depending on the specifications. Please check the wiring diagram.

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