

20210401

Ultrasonic Flow Meter for Management of Fuel Gas

ATZTA UX/UZ

Model : UX15 UX25

Operation Manual



Instruction Manual for High-performance Ultrasonic Flowmeter for Fuel Gas UX15/25

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- **Attention**

Thank you for choosing our High-performance Ultrasonic Flowmeter for Fuel Gas UX15/25. Please be sure to read this manual to use the product safely and prevent accidents.

Please arrange for this manual to be delivered without fail to those who use the product. This manual is also necessary for maintenance of the product. Please keep this manual carefully until the product is discarded.










- **Product outline**

This product is a supersonic type flow meter for fuel gas, capable of measuring flow rate in a range from an atmospheric pressure to 100 kPa. To connect the product to the pipe, screw in a taper pipe thread.

○ **Important information**






This section provides precautions for safe and proper use of this product with the following pictograms.

Structure of warning indications







 Danger	Incorrect handling by ignoring the instructions of this symbol may lead to imminent danger of death or serious injury.
 Warning	Incorrect handling by ignoring the instructions of this symbol may lead to death or serious injury.
 Caution	Incorrect handling by ignoring the instructions of this symbol may lead to personal injury or physical damage (product failure, etc.).
	 Improper operation may result in an accident.
	 Prohibited acts.
	 Matters that must be strictly observed.

○ **For safe and proper use**

Precautions for use


 Danger	<ul style="list-style-type: none">  1. Do not use the product for applications that require safety, such as nuclear application, railroads, aircrafts, vehicles, and playground equipment.  2. Do not modify the product.  3. Do not use the product for foods, drinks, medical chemicals, etc. since it is not designed to sanitary specifications.  4. Do not use the product in the atmosphere of an inflammable gas, etc., because it is not designed for explosion-proof specifications. The meters do not conform to ATEX (explosion-proof) directive (2014/34/EU).
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Working environment and applicable fluid


 Caution	<ul style="list-style-type: none">  1. Do not flow any gas other than city gas (13A), propane, butane, and nitrogen through the product.  2. Observe the temperature and humidity ranges (-10 to +60°C, 90%RH or lower) and pressure range (atmospheric pressure to not more than 100 kPa) when using the product.  3. Avoid using the product or applying it to a fluid in an atmosphere containing a corrosive gas (chlorine, hydrogen sulfide, etc.).  4. This product does not have a complete waterproof structure (IP64). Do not install it at a place that may be submerged in water.  5. Install the product as far away from a noise source as possible. If it is installed near a noise source, use shielded lines for the cable connected to the flow meter. In such a case, ground the shielded line to FG other than the flow meter. 6. Installation of a sunshade is recommended if the product is exposed to direct sunlight. 7. When the product is used with propane or butane, use it under the conditions that avoid the oil mist condition due to reliquefaction, etc. Attachment of oil mist to the inner side of the flow meter may cause abnormality to flow rate measurement and result in failure of accurate measurement.
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	8. The product may not meet the accuracy of specifications in a pulsating environment. Installation in area with less pulsation is recommended.
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Cautions for operation


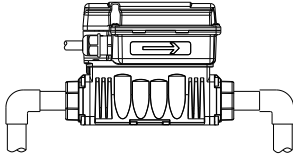
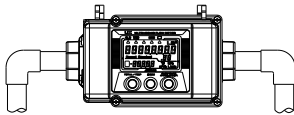
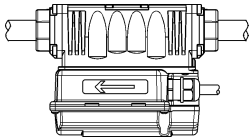
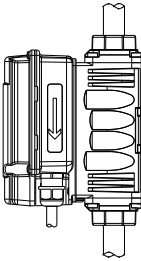
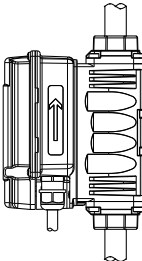
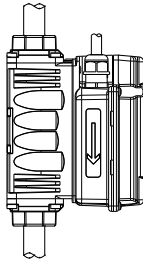
 Caution	1. This flow meter is not a specified measuring instrument defined by the Japanese Measurement Law.
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Storage



 Caution	<ul style="list-style-type: none"> ⊘ 1. Store the product at a place away from fire and not exposed to direct sunlight. ⊘ 2. Do not place any combustible material, inflammable substance, or heating unit around the product. ⓘ 3. Store the product at a place where ambient temperature is -20 to +70°C and no dew condensation occurs.
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Piping


 Warning	⊘ 1. Do not use the product as a foothold or climb on it.
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 Caution	<p>1. When installing the product to a new pipe, clean the pipe well before installation.</p> <p>2. Vertical piping is recommended when oil mist, dust, etc. are contained in a large amount. Note that when installing the product outdoors, it must not be installed with "display facing downward" or "cable inlet facing upward." Even when installing the product indoors, prevent water from coming into the product through the cable inlet.</p> <div style="display: flex; justify-content: space-around; align-items: flex-start; margin-top: 20px;"> <div style="text-align: center;"> <p>○ Correct</p>  </div> <div style="text-align: center;"> <p>○ Correct</p>  </div> <div style="text-align: center;"> <p>✗ Wrong</p>  </div> </div> <div style="display: flex; justify-content: space-around; align-items: flex-start; margin-top: 20px;"> <div style="text-align: center;"> <p>○ Correct</p>  </div> <div style="text-align: center;"> <p>○ Correct</p>  </div> <div style="text-align: center;"> <p>✗ Wrong</p>  </div> </div> <p>3. Do not install the product at a location where strong load, such as compressive force or tensile force, may be applied after installation.</p> <p>4. Install the product along with the flow direction indicated on the product.</p> <p>5. Do not drop the product, hit it, or apply excessive impact.</p>
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Wiring

 Danger	<ul style="list-style-type: none"> ⓘ 1. When performing wiring, follow the instructions in this Manual. ⓘ 2. Use the product within the rating. ⓧ Do not use the product at a voltage exceeding permissible load.
 Caution	<ol style="list-style-type: none"> 1. Do not array wiring together with power supply lines or power lines, etc. of other equipment. 2. For receiver instruments, electrical isolation from other others is recommended. 3. Do not pull forcibly the cables connected to the terminal Junction block. 4. Ensure that the tip of the cable connected to the terminal block is not soaked in water during wiring work, etc. ⓘ 5. When connecting the power supply to the terminal block, be careful not to short-circuit it. Use an external power supply having a short-circuit protecting function. ⓘ 6. Be sure to interrupt the supply of external power while performing wiring. ⓧ 7. Do not perform operation or wiring with wet hands. ⓘ 8. For the external power specification (24VDC, 100VAC), provide a power supply switch to the power system that supplies electricity to this product in order to prevent electrical shock in connection to the power supply terminal or removal. ⓘ 9. For the external power specification (24VDC), choose the 0V terminal when grounding the power source. Do not ground the 24V (+) terminal since the housing is electrically conduct with SG (0V) and short circuit occurs to the FG terminal of the user's device if the 24V (+) terminal is grounded. ⓧ 10. For the external power specification (100VAC), do not connect the earth wire of the cable to the flow meter. ⓧ 11. For the external power specification (24VDC, 100VAC), do not ground the plus of the analog output line. Since the housing is electrically conduct with SG (0V), if plus of the analog output line is grounded, a current loop that bypasses current output is formed and analog output is not correctly delivered.

Disassembly and inspection

 Caution	<ul style="list-style-type: none"> ⓧ 1. Do not disassemble the product. 2. When fluid flow is normal, the pilot lamp will blink. If it does not blink, please contact our branch or sales office nearby.
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Disposal

 Warning	<ul style="list-style-type: none"> ⓘ 1. Never dispose of this product through the normal disposal route since it has a built-in lithium ion battery.[Built-in battery type] ⓘ 2. Never throw the product into fire. Otherwise, it may catch fire or explode.
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1. Introduction

1-1. Confirmation of package contents

Upon delivery of the product, confirm that the following items are contained in the package.

Name	Quantity	Remarks
Ultrasonic flowmeter	1	
Instruction Manual (this document)	1	

1-2. Battery connection in the built-in battery specification

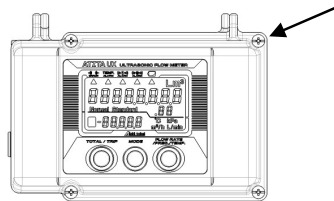
Battery is not connected upon shipping in the built-in battery specification. Connect the battery connector correctly as described below before use.

- Connection of battery connector

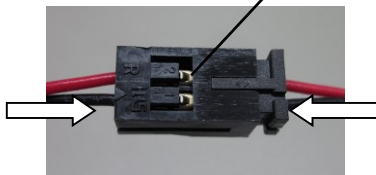
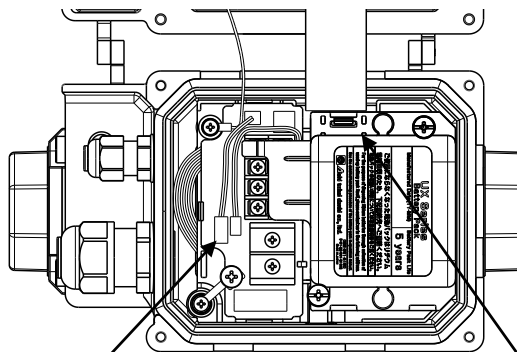
- 1) Loosen the screws of the display at 4 positions to open the cover.

(The screws are drop-out prevention screws, which cannot be removed from the cover.)

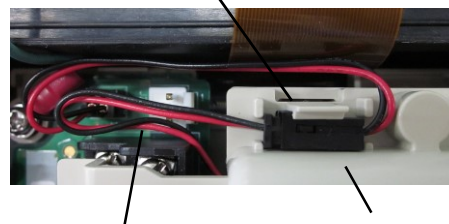
Thread (M4 x 4 positions)



- 2) Connect the battery connector and fix it to the hook of the battery pack.



Connect the battery connector.

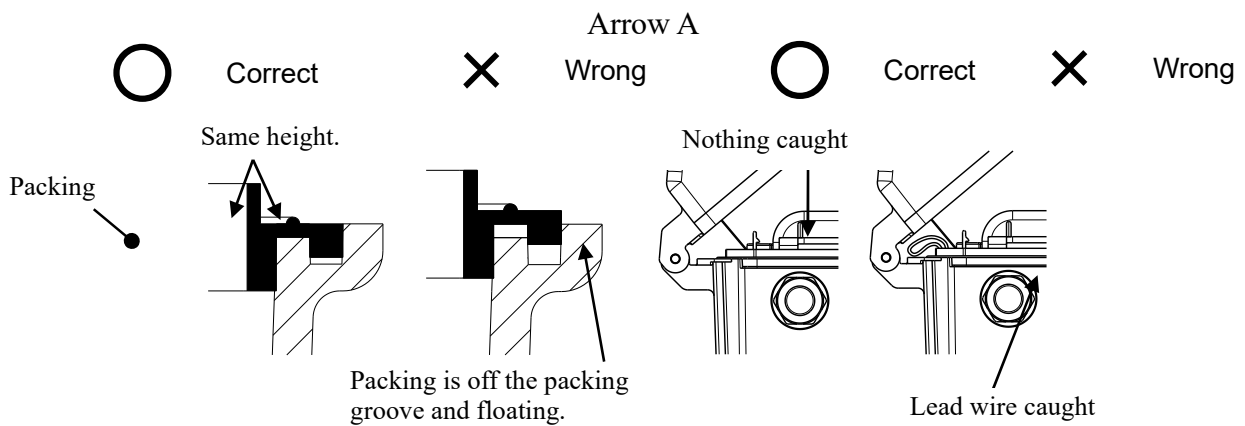
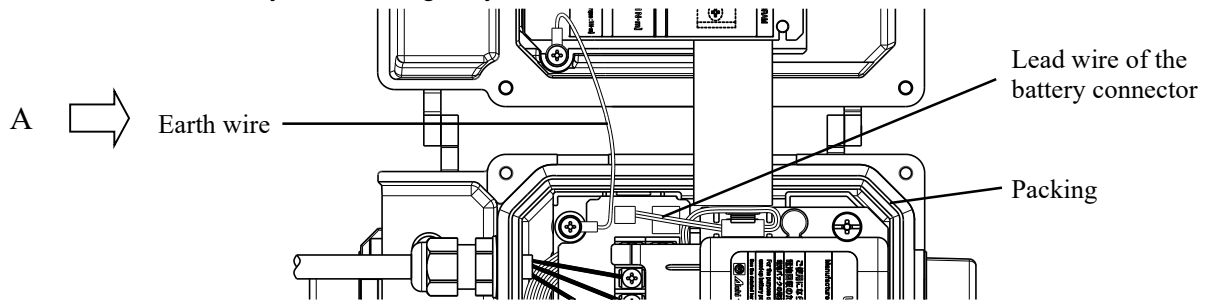


Arrange the lead wire as shown in the photo so that it may not be caught by the cover.

Fix the connector to the hook of the battery pack.

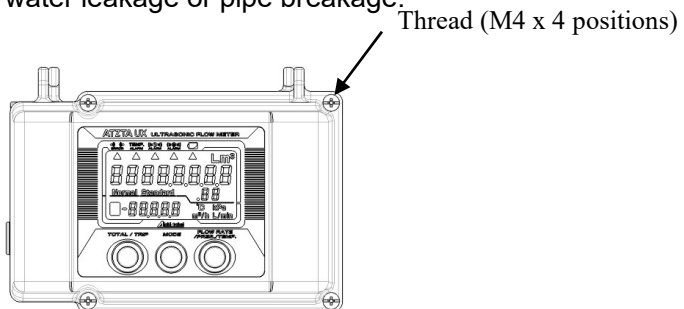
Note: Failure to fix the connector may lead to breakdown.

- 3) Check that packing is not off the packing groove and then close the cover.
Close the cover carefully so that the earth wire and the lead wire of the battery connector may not be caught by the cover.



- 4) Tighten the screws of the display at 4 positions.
(Recommended tightening torque: 1.0 ± 0.1 N-m)

Note: Be careful about insufficient tightening or tightening with excessive torque, which may lead to water leakage or pipe breakage.



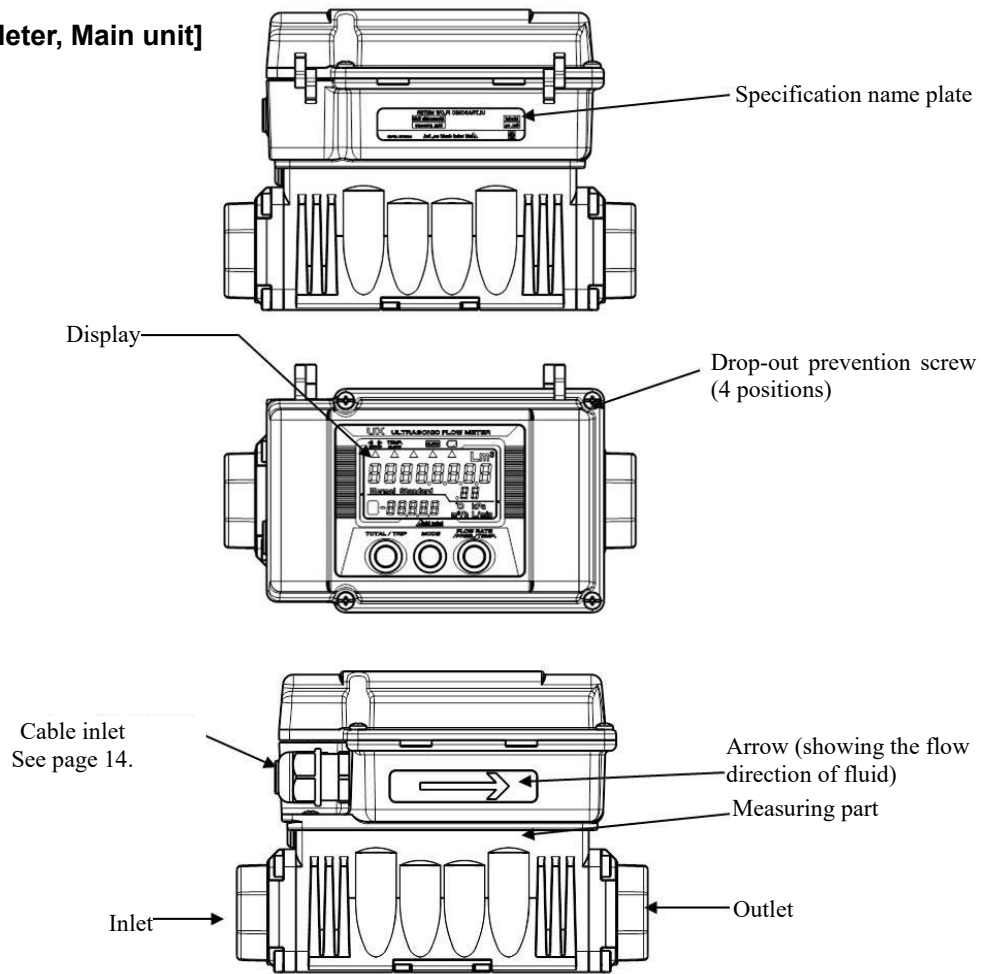
[Battery life and replacement]

The life of the built-in battery is 5 years. (at the environment temperature of 20 °C. The battery life fluctuates depending on the temperature of the installation environment.)

* For battery replacement, contact our branch or sales office nearby.

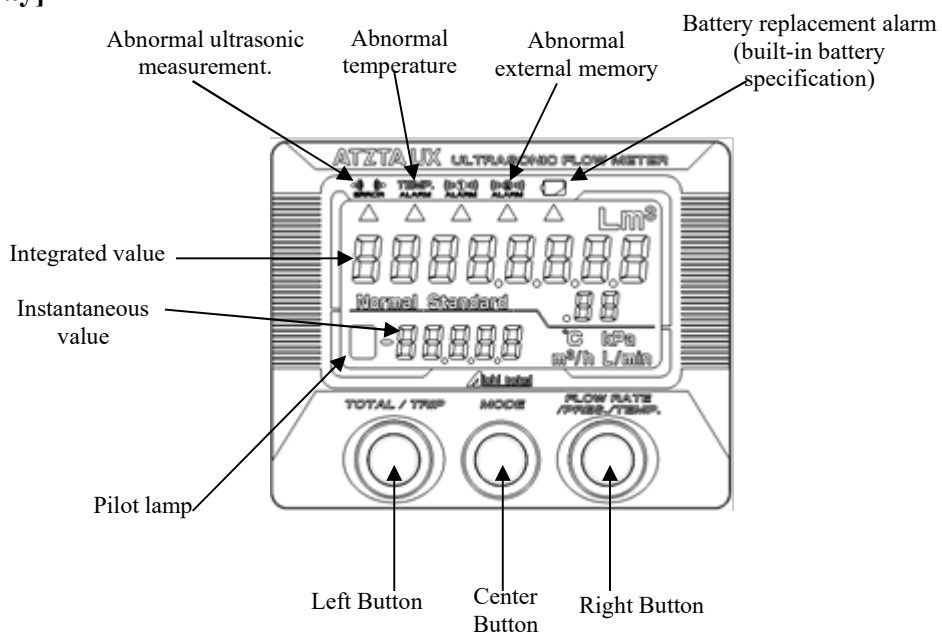
1-3. Name of each part

[Flow Meter, Main unit]



[Display]

Refer to pp. 36-38 for types of emergency alarm.



Refer to pp. 25, 32-35 for button operation.

2. Model composition

Basic model	Diameter	-	Pressure sensor	Power supply	-	Flow direction	-	Gas type	Description
UX									UX
	15								15A
	25								25A
			0						No pressure sensor
				BT					Battery (lithium battery) type
				DC					24VDC type
				AC					100VAC type
						L			From left to right
						R			From right to left
								13A	13A
								PRO	Propane
								BTN	Butane
								N2	Nitrogen

3. Specifications

Model		UX15(25)-0DC	UX15(25)-0AC	UX15(25)-0BT
Power source		External power source 24VDC	External power source 100VAC	Dedicated lithium battery
Connection diameter		Taper pipe thread (screw in) 15A:Rc1/2 25A:Rc1		
Types of gases to be measured		City gas (13A), butane (butane 70% and propane 30%), Propane (propane 98% and butane 2%), nitrogen		
Fluid temperature and humidity		-10 to +60°C (No dew condensation)		
Flow rate range (actual flow rate) *1		0.12-6 m ³ /h		
Accuracy	Flow rate	0.12-0.6 m ³ /h:±0.5%FS 0.6-6 m ³ /h:±2%RD		
	Temperature	±1.5°C		
Low flow cut		Within 0.024 m ³ /h		
Working pressure		0 - 100 kPa (gauge pressure)		
Pressure loss		Max. 200 Pa (city gas 13A, standard atmospheric pressure +2.5 kPa, 6m ³ /h)		
Rated voltage		21.6-26.4VDC	85-115VAC	
Power consumption		Max 2W (Voltage: 26.4V, current output: 22 mA)	Max. 10W (when current output is 22 mA)	
Working environmental temperature		-10 to +60 °C, max 90%RH (No dew condensation)		

Model		UX15(25)-0DC	UX15(25)-0AC	UX15(25)-0BT	
Output	Current output	4-20 mA current output ($\pm 0.5\%$ FS) Select "Instantaneous flow rate" and "Temperature" by switching the button		/	
		Instantaneous flow rate	Zero output current		4 mA (reverse current - low cut-off)
			Min. output current		4 mA (clip at 4 mA)
			Max. output current		22 mA (clip at 22 mA)
		Full-scale flow rate: Set up with the button. Refer to Table 7-1 (p. 21).for factory shipment settings			
	Temperature	Type of output	4mA:-10°C, 20mA:+60°C		
		Min. output current	2 mA (clip at 2 mA)		
Max. output current		22 mA (clip at 22 mA)			
Pulse output	Nch open drain output, duty: 20 to 80%, maximum load:50 mA (at 24VDC)				
Alarm output	Flow rate high upper/low limit alarm or Integrated value upper limit alarm		Flow rate high upper/low limit alarm or battery replacement alarm		
Communication *2)		Conforming to RS485 Modbus/RTU.			
Measurement interval		0.5 sec		2 sec	
Indication	Integrated flow rate	Integrated flow rate : 00000000.00 m ³ (10 digits) Trip integrated flow rate: 0000000.00 m ³ (9 digits)			
	Instantaneous flow rate	000.00 m ³ /h (5 digits)			
	Temperature	00.0 °C (3 digits)			
	Set pressure	000.00 kPa (5 digits)			
	Alarm	Abnormal ultrasonic measurement: Ultrasonic signal is small or no signal is received. Abnormal temperature measurement: Failure of the temperature sensor Battery replacement alarm: Fall in the battery voltage [built-in battery specification].			
Mounting attitude *3		Horizontal, perpendicular			
Conversion function *4		Simple normal conversion flow rate Flow rate converted to 0°C, 1 atmosphere from actual flow rate, measured temperature, and set pressure. Simple standard conversion flow rate Volume flow rate obtained by converting actual flow rate to the conversion standard temperature and pressure from measured temperature and set pressure.			
Conversion accuracy		$\pm 1.5\%$ RD			
Gas contact material		Body of the flow meter: Aluminum alloy, PPS, fluorosilicone rubber, etc.			
Mass		1.8 kg	1.6 kg	1.7 kg	
Location of installation *5)		Indoors, outdoors (supporting IP64)			

*1) Refer to Table 3-1 and Table 3-2 (p. 10) for the range of conversion flow rate.

*2) For detailed specifications, download from our company's web site.
Product website: http://www.aichitokei.co.jp/products/14_s_sonic/ux/

*3) Refer to page 12 for the mounting attitude.

*4) The conversion standard temperature (-10 to +60 °C) and conversion standard pressure (0.00 - 10.00 kPa) can be changed by button and communication (only for external power source specification).

*5) Installation of a sunshade is recommended if the product is exposed to direct sunlight.

■ **Definitions of the terms used in the specifications**

- Actual flow rate

Volume of the fluid flowing during unit time. Actual flow rate will change according to the temperature and pressure of fluid, the flow rate unit is m³/h.

- Simple □□□ conversion flow rate

This flow meter is not provided with pressure sensor. This represents conversion of pressure value with given value (fixed value)

- Normal converted flow rate

Volume flow rate obtained by converting actual flow rate to 0°C, 1 atm from measured temperature and set pressure. The flow rate unit is m³/h (Normal).

- Standard conversion flow rate

Volume flow rate obtained by converting actual flow rate to the conversion standard temperature and pressure from measured temperature and set pressure. The flow rate unit is m³/h (Standard).

The conversion standard temperature (-10 to +60 °C) and conversion standard pressure (0.00 - 10.00 kPa) can be changed by button and communication (only for external power source specification).

Table 3-1. - Normal conversion flow rate value [m³/h] (Normal) [Example of conversion]

Pressure (kPa)		0 (atmospheric pressure)		2		10		100	
Temperature (°C)		0	30	0	30	0	30	0	30
Actual flow rate	0.12(m ³ /h)	0.12	0.11	0.12	0.11	0.13	0.12	0.24	0.21
	6(m ³ /h)	6.00	5.41	6.12	5.51	6.59	5.94	11.92	10.74

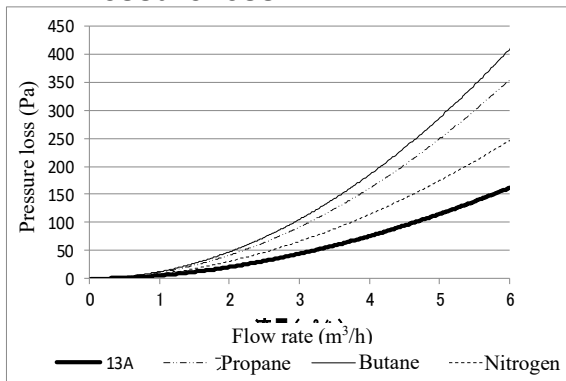
Conversion standard temperature = 0 °C, Conversion standard pressure = 0 kPa (gauge pressure)

Table 3-2. Standard conversion flow rate value [m³/h] (Standard) [Example of conversion]

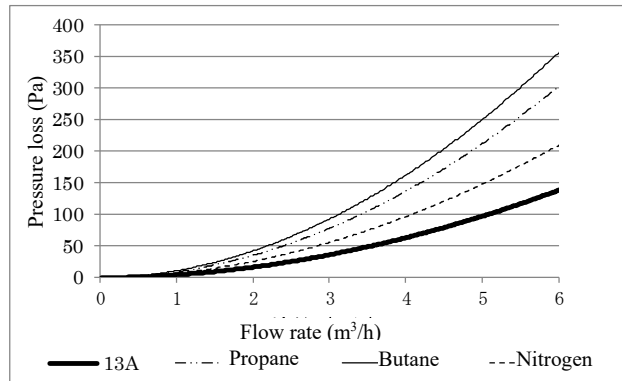
Pressure (kPa)		0 (atmospheric pressure)		2		10		100	
Temperature (°C)		0	30	0	30	0	30	0	30
Actual flow rate	0.12(m ³ /h)	0.13	0.11	0.13	0.12	0.14	0.13	0.25	0.23
	6(m ³ /h)	6.31	5.69	6.44	5.80	6.94	6.25	12.55	11.30

Conversion standard temperature = 20 °C, Conversion standard pressure = 2 kPa (gauge pressure)

■ **Pressure loss**

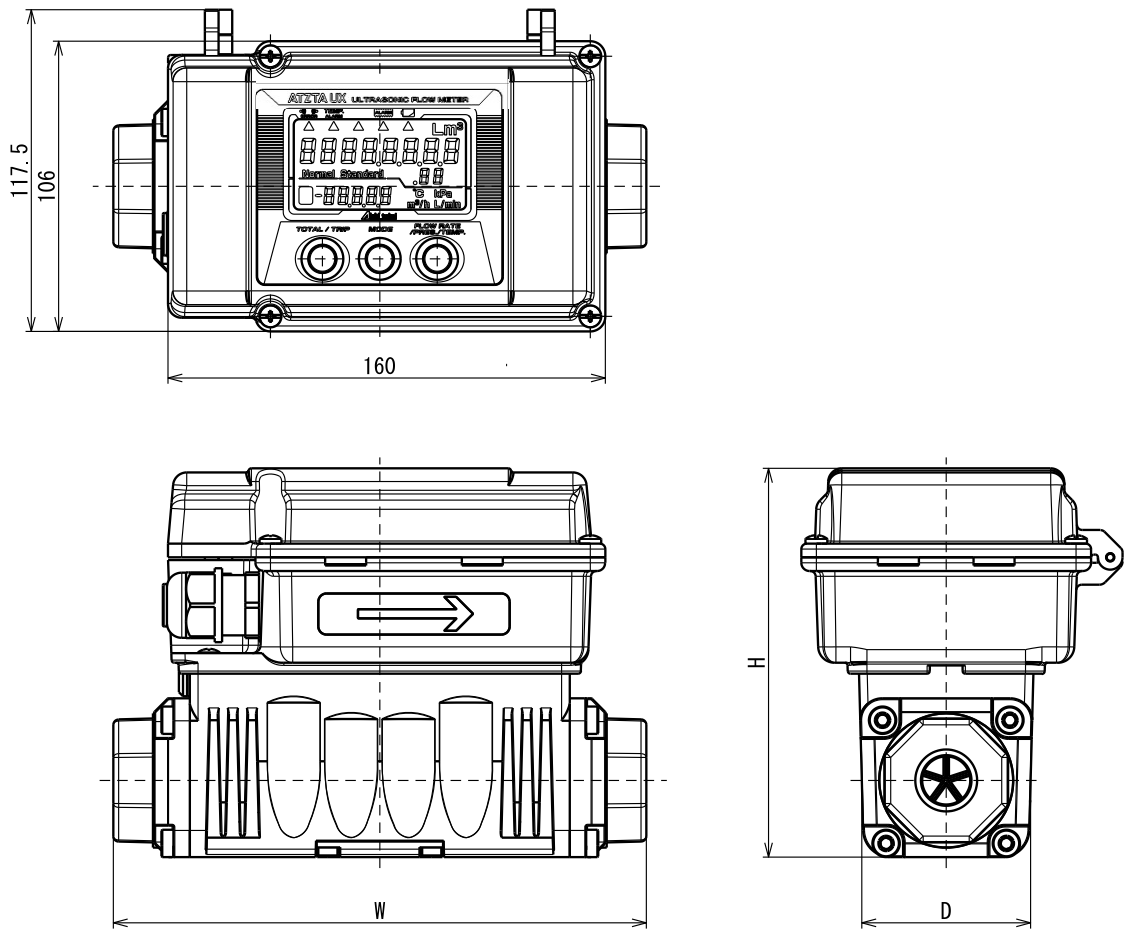


Graph. Pressure loss 13A



Graph. Pressure loss 25A

4. Outline drawing



Unit: mm

W	H	D
195	142	62

Fig 4-1. Outline drawing

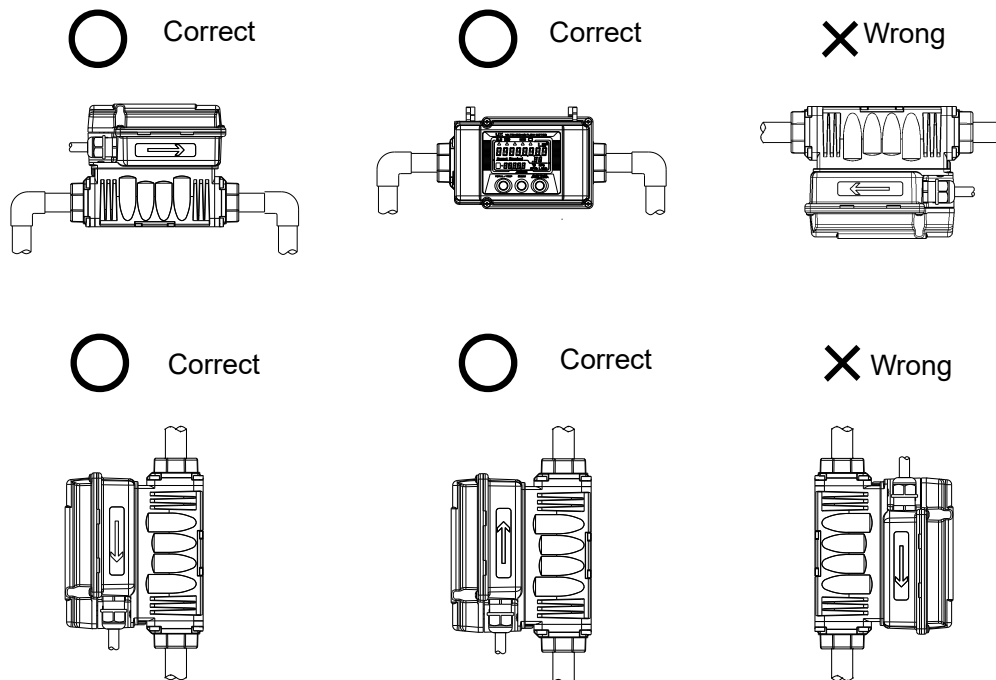
5. Installation procedure

Recommended to perform setting operation (p. 28) before installation.

- 1) The direct flow direction of the fluid must accord with the arrow of the body.
- 2) This product may be installed either indoors or outdoors and either to horizontal or vertical pipes.

Note that when installing the product outdoors, it must not be installed with "display facing downward" or "cable inlet facing upward." Even when installing the product indoors, prevent water from coming into the product through the cable inlet.

* Vertical piping is recommended when oil mist, dust, etc. are contained in a large amount.



- 3) This product does not have a complete waterproof structure (IP64). Do not install it at a place that may be submerged in water.
- 4) Installation of a sunshade is recommended if the product is exposed to direct sunlight.
- 5) Screw in the taper pipe thread within the following torque range.
UX15: 25-30 N-m
UX25: 45-50 N-m
- 6) Be careful about to prevent entry of foreign matter in piping, such as welding tip, dust, sealing tape, or sealing compound.
When installing the product to a new pipe, clean the pipe well before installation.
- 7) Do not install the product at a location where strong load, such as compressive force or tensile force, may be applied after installation.
- 8) Do not drop the product, hit it, or apply excessive impact.

6. Connection

Enter each cable into display in accordance with this procedure when connecting the cable for external output or connecting the cable for external power supply input in the 24VDC / 100VAC specifications.

The main body and GND are electrically common.

Use an isolated power supply or externally connected equipment as necessary.

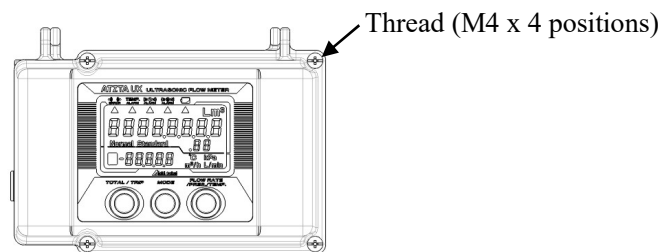
Note: For connection of externally connected equipment, follow the instruction manual of each equipment.

[Reference] Maximum cable length: 100 m

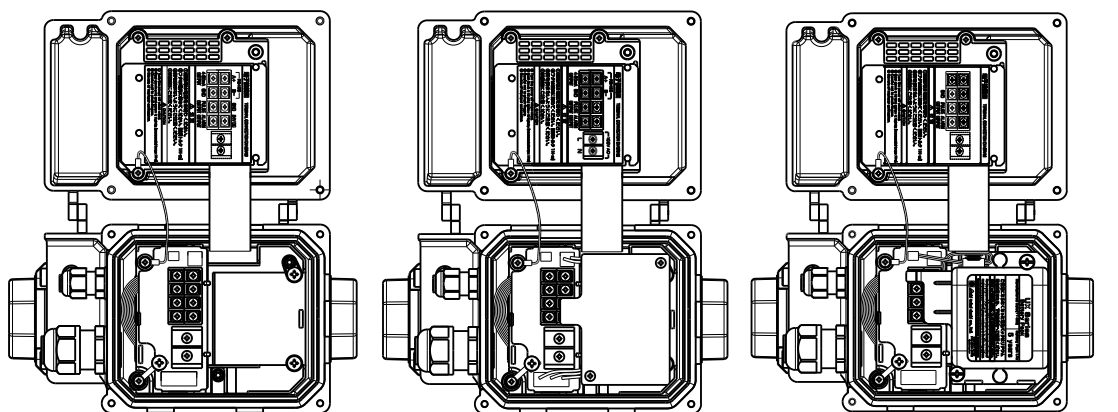
Operating range under our internal test conditions (VCTF, 0.3sq).
Operating range may vary according to the conditions, such as installation environment, connected equipment, and wire types. Be careful that long cables may cause signal attenuation or facilitate superimposition of noise.

■ Procedure

- 1) Loosen the screws of the display at 4 positions to open the cover. Note that the screws are drop-out prevention screws, which cannot be removed from the cover.



The cover-open condition varies as follow according to the specifications of each power supply.



24VDC specification

100VAC specification

Built-in battery specification

2) Connect the cable.

■ **Procedure concerning cable connection for external output**

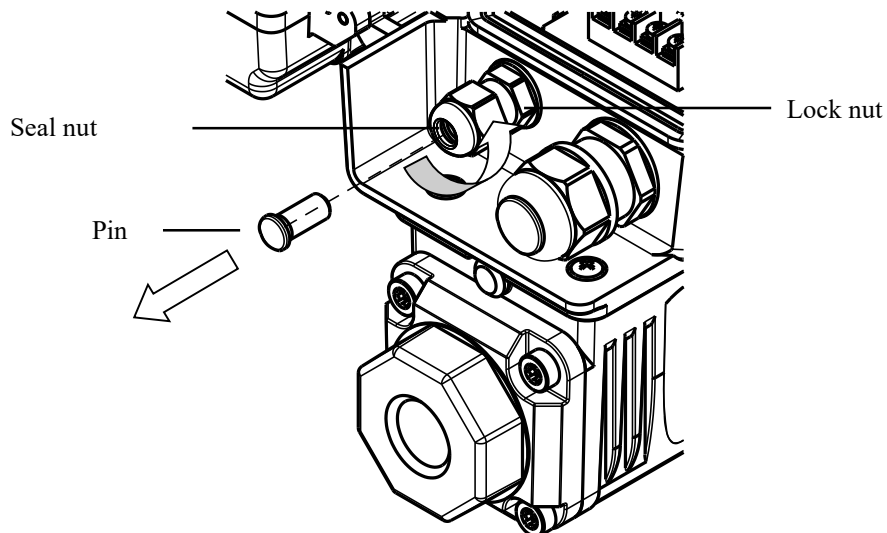
(When not connecting cable for external output, the procedure (1) - (4) are not required.)

Adaptive cable size: $\phi 4-6.8\text{mm}$ (Ex.: VCTF, 0.3 sq, 3/c - 8/c)

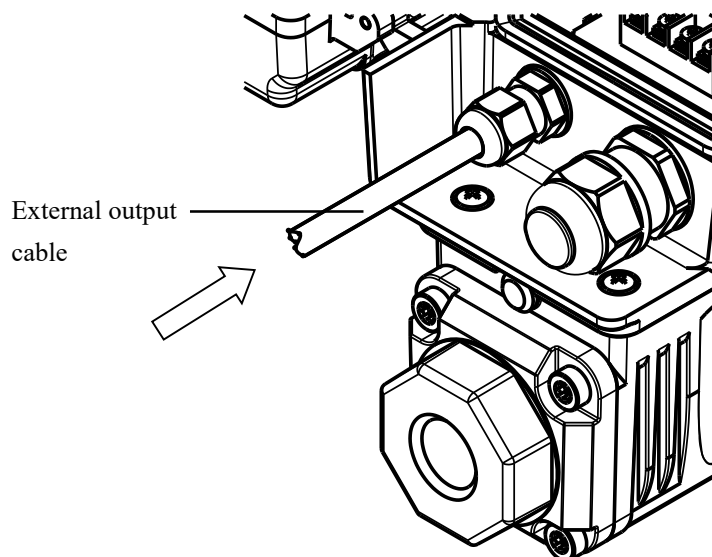
Terminal block: M3

When installing the flow meter around a noise source, use the shielded type for cables connected to the terminal block and ground the shield.

(1) Loosen the seal nut of the cable inlet for external output, and remove the pin.
Be careful not to loosen the lock nut accidentally.



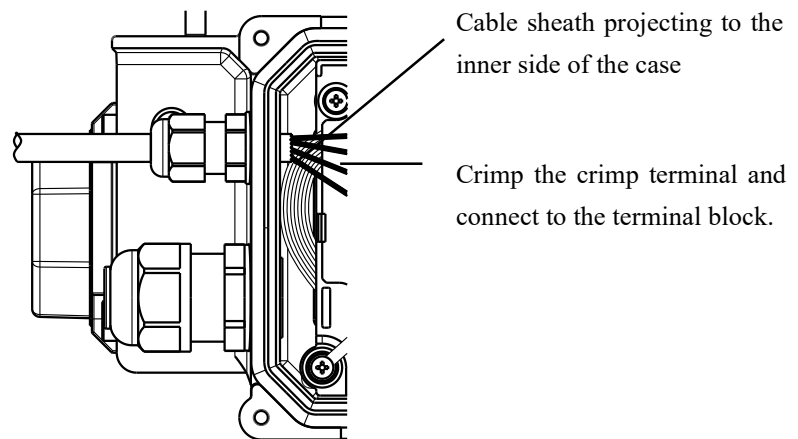
(2) Pass the cable through the cable inlet.



(3) Connect the cable entered into the case to the terminal block, with the cable sheath projecting to the inner side of the case, after crimping the crimp terminal.

(Thread size: M3
Recommended tightening torque: 0.5 ± 0.1 N-m)

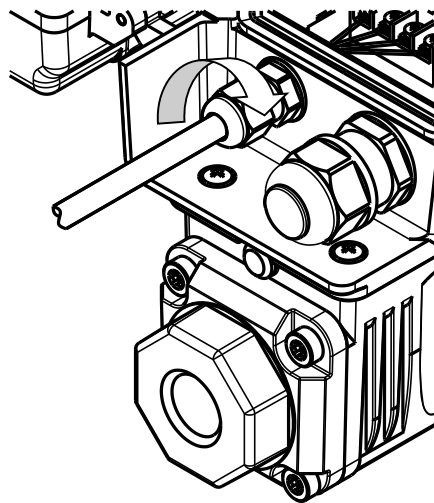
* Be careful that wrong connection may cause failure to the product. Be careful that available terminal block is different according to the specifications of power supply. (For the application of each terminal block, refer to "Terminal Connection Diagram" attached to the reverse side of the cover or "Connection diagram of each power supply specification" at pages 19 and 20.)



(4) Tighten the seal nut.

(Recommended tightening torque: 1.0 ± 0.1 N-m)

If a torque wrench is not available, thoroughly tighten the seal nut manually or with a tool and retighten it 90° (= 1/4 rotation) from the position where load is perceived. Avoid further tightening. (Excessive torque may damage cables, break seal nut, seal deformation and it may cause water leakage and so on.)



- **Procedure concerning cable connection for external power supply input**
(When not connecting cable for external power supply input, the procedure (5) - (8) are not required.)

Adaptation cable size: $\phi 6.5-12.5\text{mm}$

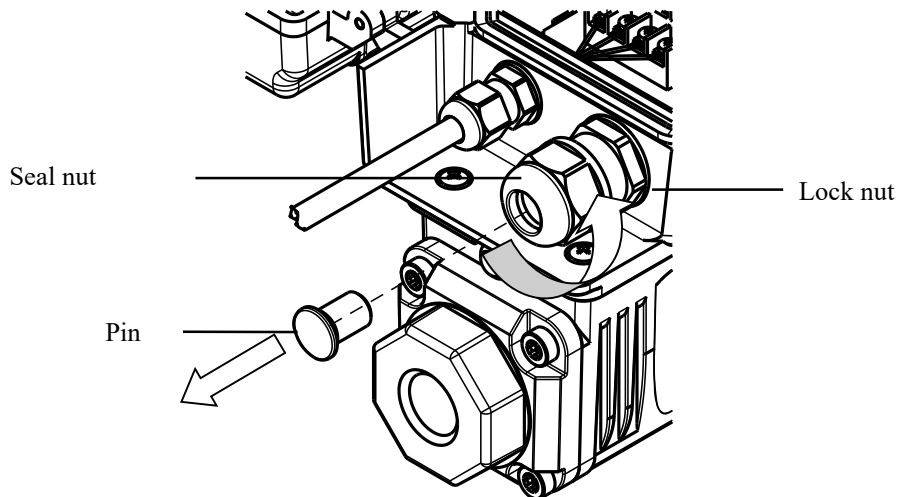
(Ex.: CV 2sq 2/c, CVV 1.25sq, 2/c)

Terminal block: M3 (for 24VDC), M4 (for 100VAC)

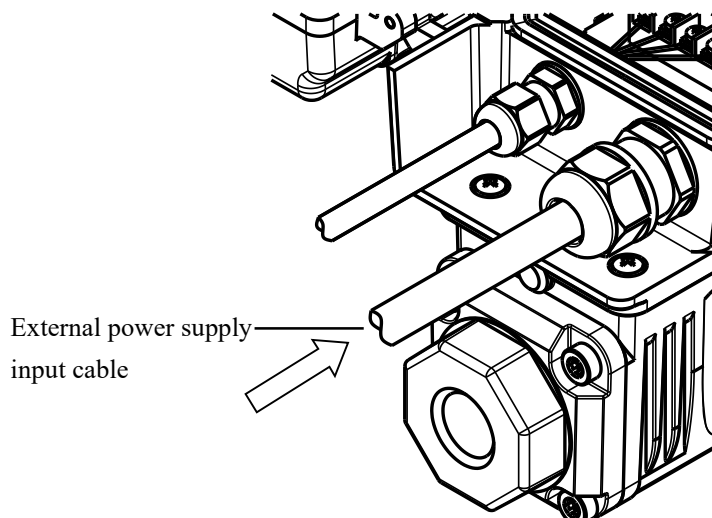
When installing the flow meter around a noise source, use the shielded type for cables connected to the terminal block and ground the shield.

- (5) Loosen the seal nut of the cable inlet for external power supply input, and remove the pin.

Be careful not to loosen the lock nut accidentally.



- (6) Pass the cable through the cable inlet.



- (7) Connect the cable entered into the case to the terminal block, with the cable sheath projecting to the inner side of the case, after crimping the crimp terminal.

[24VDC specification]

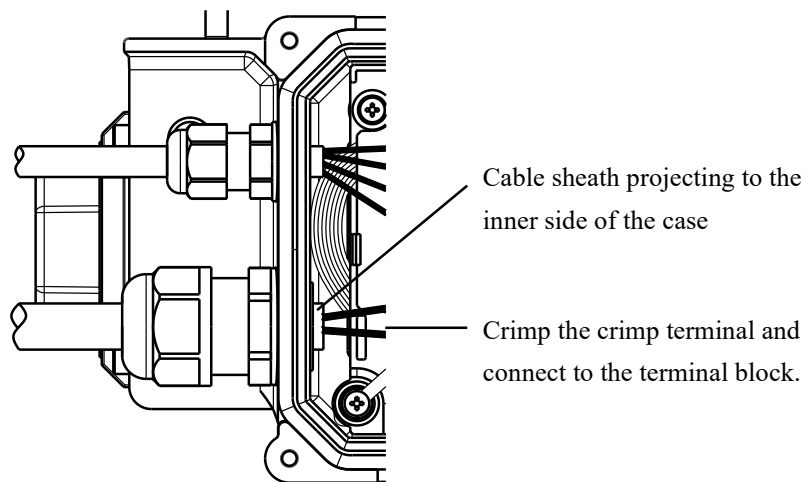
(Thread size: M3
Recommended tightening torque: 0.5 ± 0.1 N-m)

[100VAC specification]

(Thread size: M4
Recommended tightening torque: 1.0 ± 0.1 N-m)

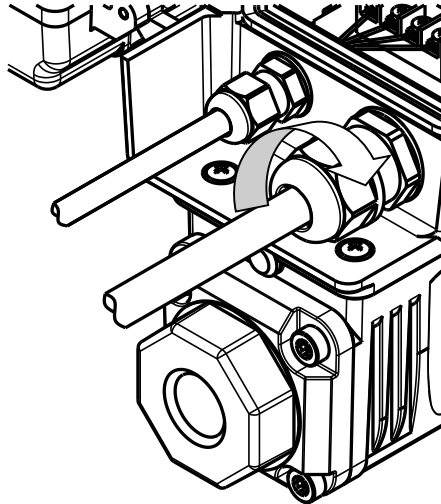
Note: Remove the cover of terminal block in connection and install it as before after connection.

- * Be careful that wrong connection may cause failure to the product. Be careful that available terminal block is different according to the specifications of power supply. (For the application of each terminal block, refer to "Terminal Connection Diagram" attached to the reverse side of the cover or "Connection diagram of each power supply specification" at pages 19 and 20.)

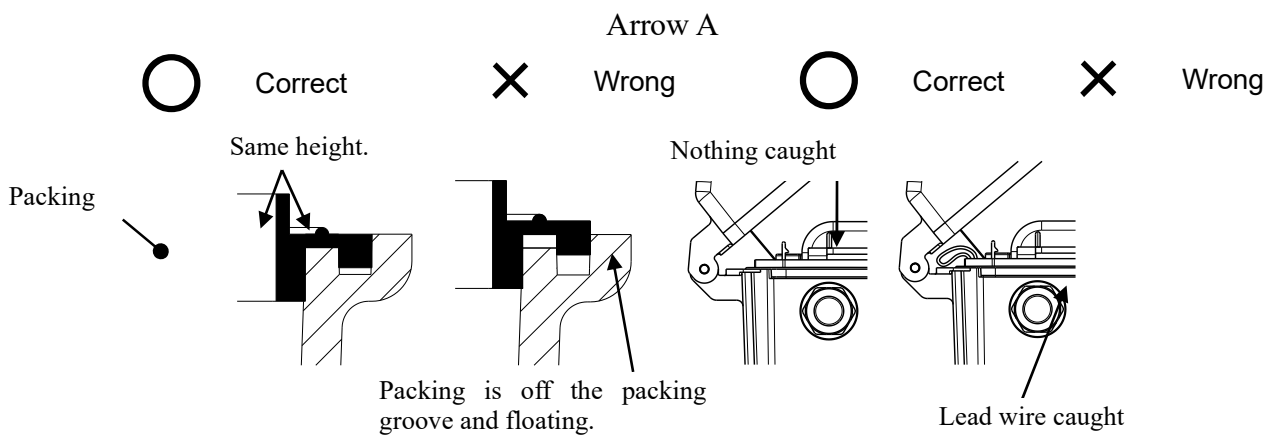
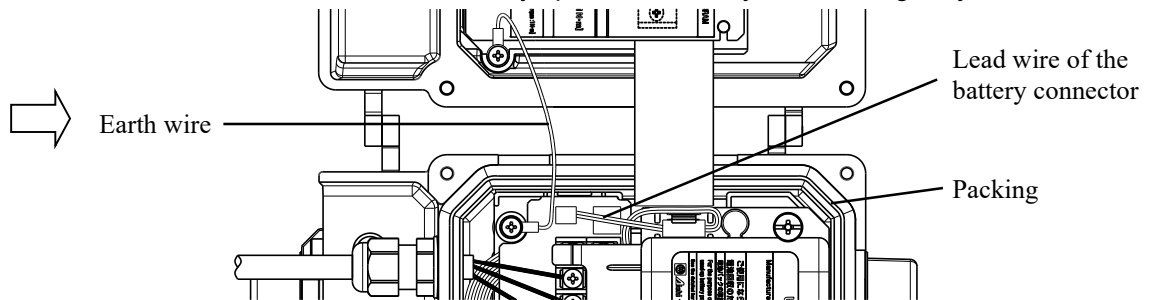


- (8) Tighten the seal nut.
 { Recommended tightening torque: 1.5 ± 0.1 N·m }

If a torque wrench is not available, thoroughly tighten the seal nut manually or with a tool and retighten it 90° (= 1/4 rotation) from the position where load is perceived. Avoid further tightening. (Excessive torque may damage cables, break seal nut, cause leakage etc. due to seal deformation.)

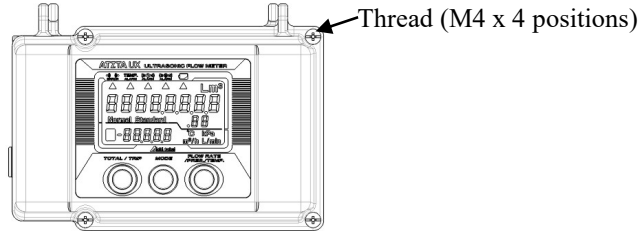


- 3) Check that packing is not off the packing groove and then close the cover.
 Close the cover carefully so that the earth wire and the lead wire of the battery connector in the case of built-in battery specification may not be caught by the cover.



- 4) Tighten the screws of the display at 4 positions.
 [Recommended tightening torque: 1.0 ± 0.1 N-m]

Note: Be careful about insufficient tightening or tightening with excessive torque, which may lead to water leakage or pipe breakage.



"Connection diagram of each power supply specification" is as follows.
 For the application of each terminal block, refer to "Terminal Connection Diagram" attached to the reverse side of the cover.

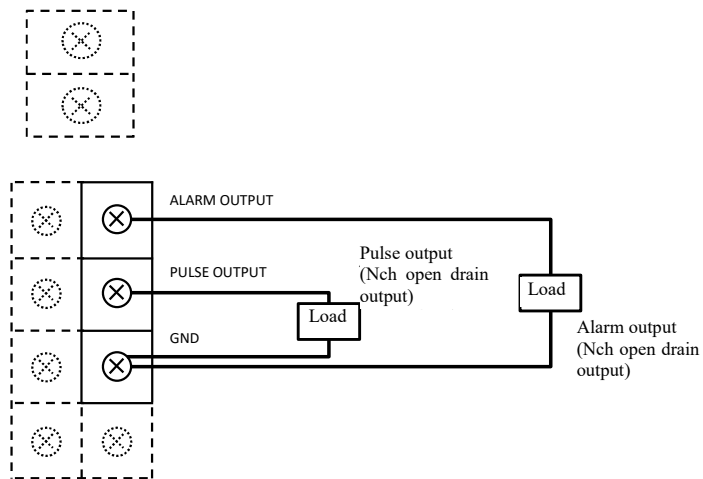


Figure: Connection diagram [Built-in battery specification]

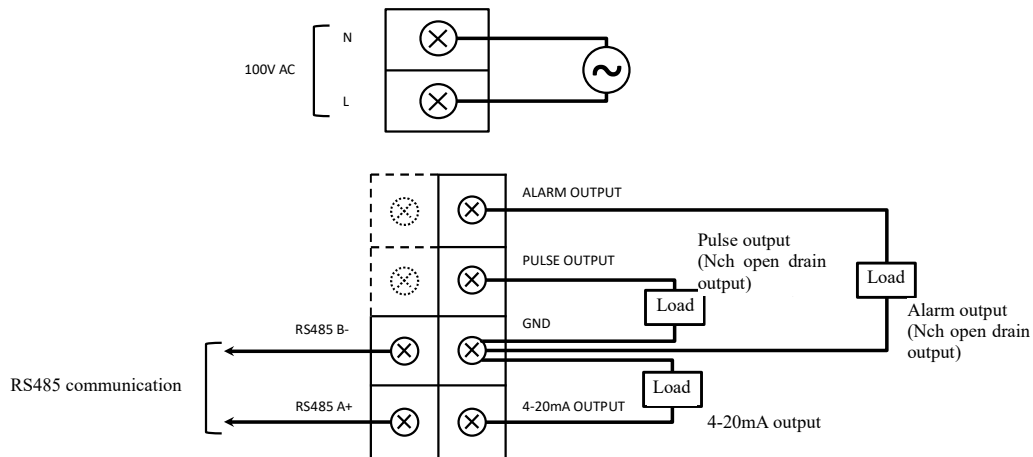


Figure:

Connection diagram [100VAC specification]

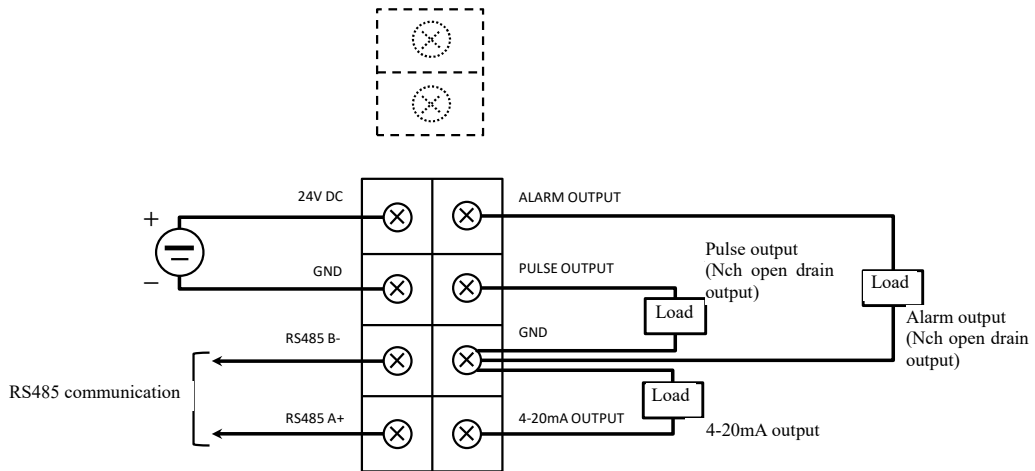


Figure: Connection diagram [24VDC specification]

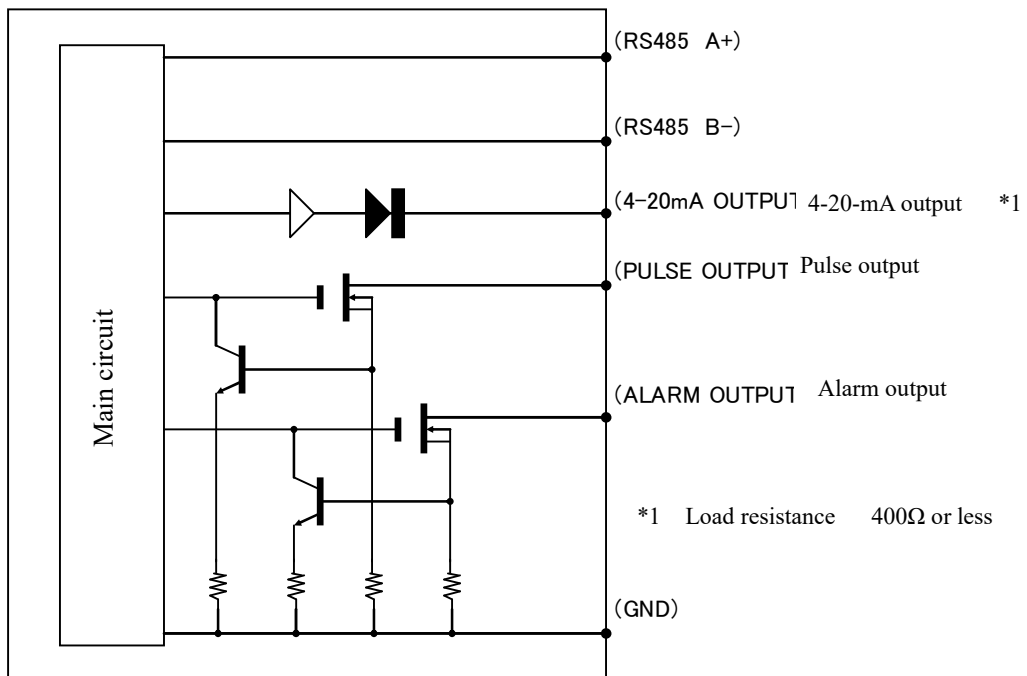


Figure: Input/output circuit diagram

7. Setting of flow meter

Recommended to set the flow meter before installation.

For this product, the items shown in Table 7-1 can be set. On delivery from factory, "factory default settings" in Table 7-1 are arranged, so that the product is available as it is. However, change the setting as necessary according to the condition of your use.

See next section "8. Description of display operation" (p. 25) for button operation and setting procedure.

Table 7-1 Various setting items and details in setting mode

Indication on the panel	Corresponding setting item	Setting detail / range	Factory default setting	
			Built-in battery specification	External power supply specification
F1	Select conversion function	on / oFF	oFF	
F2	Conversion standard	-10 to +60 [°C]	0 °C	
F3	Conversion standard	0.00-10.00[kPa]	0.00kPa	
F4	Output pulse unit	1, 10, 100, 1000, 10000[L/P]	1L/P	
F5	Set pressure	0.00-100.00[kPa]	0.00kPa	
F6	Select alarm output	Built-in battery specification: Battery replacement, flow-rate upper / lower limit External power supply specification: Integrated value upper limit, flow-rate upper / lower limit	Flow-rate upper / lower limit	
F7	Alarm output contact state	Normal open, Normal close	Normal open	
F8	Alarm output lower-limit flow	0.0-+9999.9[m ³ /h]	0000.0 [m ³ /h]	
F9	Alarm output upper-limit flow	0.0-+9999.9[m ³ /h]	9999.9 [m ³ /h]	
F10	Alarm determination value hysteresis width	0.0-+9999.9[m ³ /h]	0000.0 [m ³ /h]	
F11	Current output full-scale flow	0.0-+9999.9[m ³ /h]		6.0 [m ³ /h]
F12	Select current output	Instantaneous flow rate, temperature		Instantaneous flow rate
F13	Communication bit rate	4800, 9600[bps]		9600
F14	RTU address	001-247		001
F15	Average moving times	1-16 [times]	4	
F16	Select test mode time	3 min / 60 min/ No limit	3	
F17	Select gas type	13A, propane, butane, nitrogen	Optional	

Note 1) When [F1] "Select conversion function" is changed, the setting value of [F4] "Output pulse unit" will change automatically to the factory shipment value (1000 [L/P]).After setting [F1], set [F4] again if necessary.

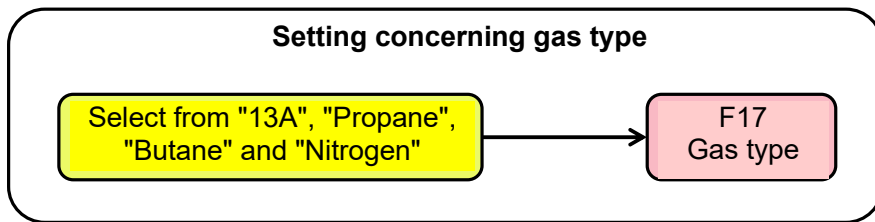
Note 2) The gas type designated at order placement is set to the gas type.

Settings are roughly classified into the following three items.

- 1) Items related to the fluid to be used
- 2) Items related to measurement and indication
- 3) Items related to output

1) Setting of items related to the fluid to be used

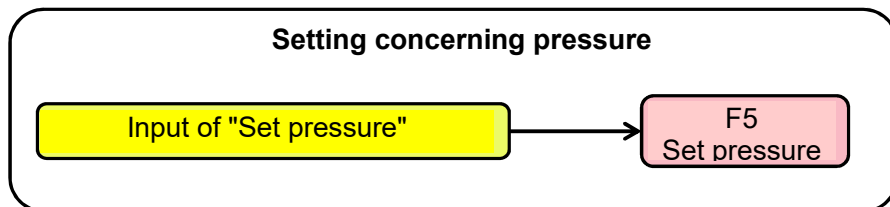
(1) Setting concerning gas type [F17]



Set the type of gas to be used. No need to change this setting since the factory default setting is made to the gas type designated at order placement.

Note that "Air" is displayed on the select screen, which is for maintenance and cannot be selected as a gas type of this product.

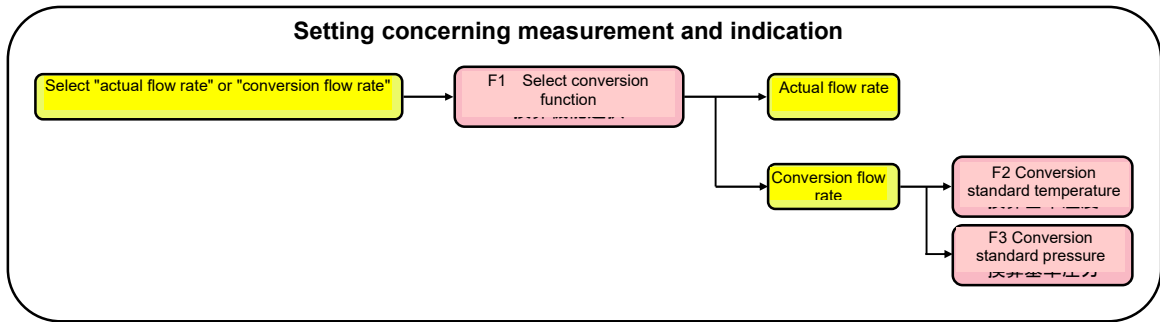
(2) Setting concerning pressure [F5]



Set the pressure value of the environment to be used with a gauge pressure.

Ex.) The pressure value of the environment to be used is 2.00 kPa in gauge pressure: Setting value of [F5] "2.00"

2) Items related to measurement and indication



(1) Setting of Select conversion function [F1]

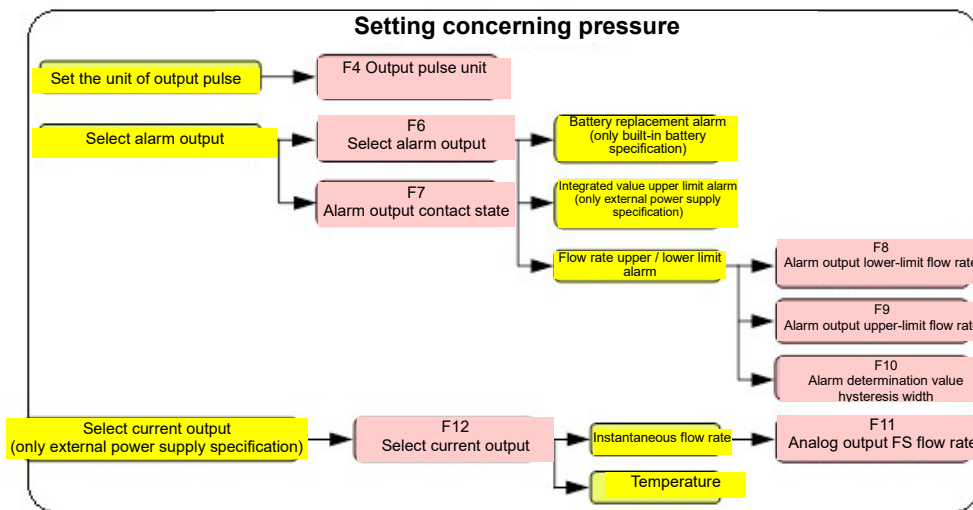
Set "actual flow rate" or "conversion flow rate." When "conversion flow rate" is selected, integrated indication, instantaneous indication, and output signal are all based on the flow rate obtained by converting them to the state set in [F2] or [F3].

(2) Setting of conversion standard temperature [F2] and setting of conversion standard pressure [F3]

When "conversion flow rate" is selected in [F1], the standard temperature and pressure to be converted are set. If the conversion standard temperature is set to 0 °C and the conversion standard pressure is set to 0 kPa, conversion flow rate will be normal conversion flow rate. If the conversion standard temperature is set to a value other than 0 °C and the conversion standard pressure is set to a value other than 0 kPa, conversion flow rate will be standard conversion flow rate.

When "actual flow rate" is selected in [F1], setting of the conversion standard temperature and conversion standard pressure becomes invalid.

3) Setting of items related to output



(1) Setting of output pulse unit [F4]

When pulse output is used, set the output pulse unit in advance according to use conditions.

(2) Setting of Select alarm output [F6]

The following items can be selected in alarm output according to the power supply specification.

Battery specification (BT): Flow-rate upper / lower limit alarm or battery replacement alarm

External power supply specification (DC/AC): Flow-rate upper / lower limit alarm or integrated value alarm

For the flow-rate upper / lower limit alarm output, an alarm can be outputted or stopped with a desired flow-rate value. When this function is selected, set the alarm output lower-limit flow rate [F8], alarm output upper-limit flow rate [F9], and alarm determination value hysteresis width [F10]

(3) Select current output [F12]

Output form is selectable from the two types of instantaneous flow rate and temperature according to the user's application. When the instantaneous flow rate is selected, electric current corresponding to the setting of the maximum flow-rate value of analog output is outputted.

When the temperature is selected, 4 mA is outputted at -10°C, and 20 mA, at +60°C.

(4) Setting of the maximum flow-rate value of analog current output (Analog output FS flow rate) [F12]

When analog output is used by setting to instantaneous flow rate, it is recommended to set the full scale flow-rate (FS flow rate) of the analog current output according to the value corresponding to maximum flow rate used. Note that it is recommended to set a value with a margin when setting FS flow rate. For reference, examples of conversion are provided in Tablets 3-1 and 3-2 (p. 10).

8. Display operation instructions

A.Operation instructions

- 1) Normally (in the measurement mode), integrated flow rate (upper section) and instantaneous flow rate (lower section) are indicated.
- 2) Various individual settings are available on the site by operating the buttons.
- 3) See Figure 8-1 for the arrangement of "Left Button", "Center Button", and "Right Button."

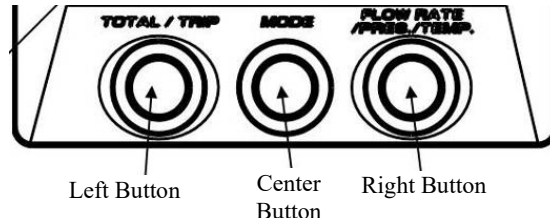


Fig. 8-1. Button Arrangement

- 4) By operating the buttons as described in Table 8-1, various modes can be selected as shown in Figure 8-2.

Table 8-1. Button operation instructions in measurement / setting / test mode

Button title	Measurement mode	Setting mode		Test mode
		Local setting indication	Detailed setting	
Left Button	Total integration /trip integration switching	Switch to next setting item	Switch setting details Move the blinking digit	
Right Button	Switch instantaneous flow rate [m ³ /h] / set pressure / temperature Switch to test mode.	Switch to previous setting item.	Change the value blinking	Release test mode
Center Button	Switch to setting mode.	Switch to measurement mode		
L Button + R Button *1	Clear trip integration *2)	Switching of local setting indication and detailed setting		

*1) "Left Button + Right Button" means to press both switches at the same time.

*2) Trip integrated flow rate is cleared when Left Button and Right Button are pressed together when trip integration is indicated.

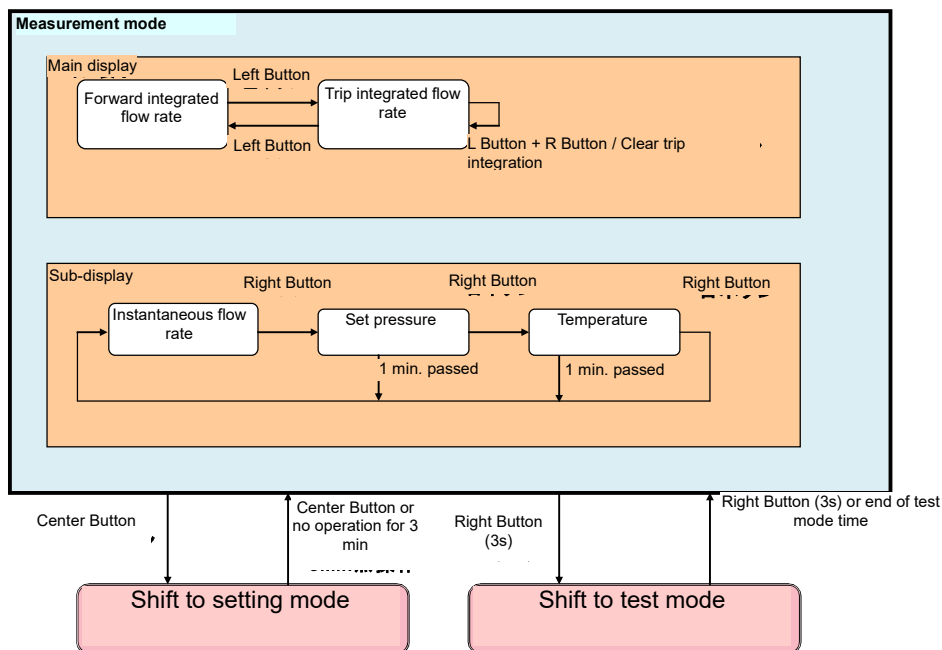


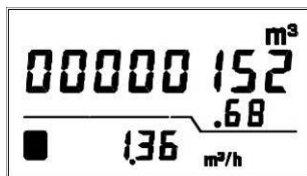
Figure 8-2. Button operation in measurement mode and switching to each mode

B. Functions in each mode

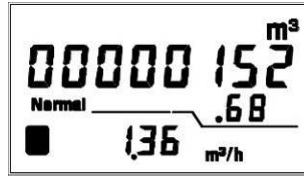
1) Measurement mode (normally)

- Indication of main display (upper section)

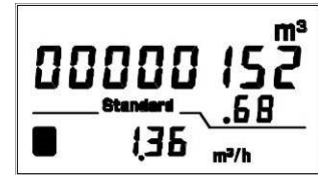
(1) Each time "Left Button" is pressed, the main display indicates in order of integrated flow rate (trip) and integrated flow rate.



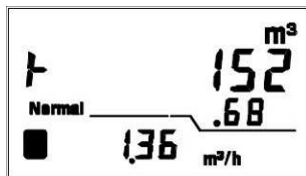
Actual flow rate



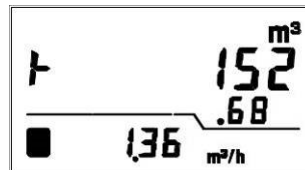
Normal conversion flow rate Indication of integrated flow rate (Ex.)



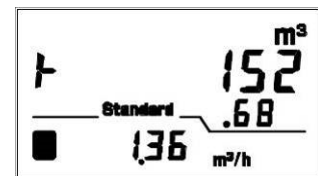
Standard conversion flow rate



Actual flow rate



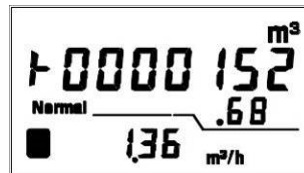
Normal conversion flow rate Indication of trip integrated flow rate (Ex.)



Standard conversion flow rate

(2) When "Left Button" and "Right Button" are pressed simultaneously during the indication of trip integrated flow volume, the integrated trip volume is cleared.

(3) When the trip integrated flow rate overflows from 9999999.99, the display shows 0000000.00 without zero suppression and integrating operation is continued.

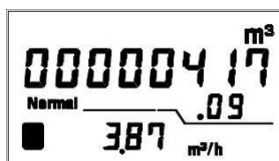


(Trip integrated flow rate value 10000152.68 [Normal / m³])
Indication of trip integrated flow rate with overflow (Ex.)

- Indication of sub display (lower column)

Each time "Right Button" is pressed, the sub-display indicates in order of set pressure (value set in the setting mode [F5]), temperature, and instantaneous flow rate. When one minute elapses during the indication of set pressure / temperature, the display automatically indicates the instantaneous flow rate.

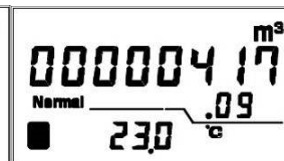
Note that the separator line disappears when set pressure is indicated.



Instantaneous flow rate



Set pressure



Temperature

2) Test mode

The test mode is a function that temporarily releases low flow cutoff.

- (1) Perform the test mode when there is no flow. When "Right Button" is pressed for at least 3 seconds during the measurement mode, the mode shifts to the test mode where a very small flow rate can be measured.
- (2) During the test mode, the unit of sub-display (m^3/h , kPa, $^{\circ}\text{C}$) blinks at the intervals of 0.5 seconds.
- (3) Test mode time is selected from 3 min / 60 min / No limit in the setting mode. When the set time elapses, the test mode automatically shifts to the measurement mode. When "Right Button" is pressed for at least 3 seconds again during the test mode, the mode shifts to the measurement mode.
- (4) When an indicated value of the instantaneous flow-rate is a flow-rate value of (+)0.1 or more, there is a possibility of leakage* at the downstream side.
- (5) If a negative value (-) is indicated as instantaneous flow rate, there may be leakage at the upstream.

* Possibility of leakage: This is only a possibility since values indicated include offset of zero flow-rate and internal convection.

- (6) The value of instantaneous flow rate during the test mode is indicated by rounding at the third decimal place.

Ex.) Measured value: 0 to 0.004 [m^3/h] → Indication: 0.00 [m^3/h]

Measured value: -0.004 to 0 [m^3/h] → Indication: 0.00 [m^3/h]

3) Setting mode

- (1) When "Center Button" is pressed, the mode shifts to the setting mode. To shift from the setting mode to the measurement mode, press "Center Button" again. When no operation is made for 3 minutes in the setting mode, the mode automatically shifts to the measurement mode.
- (2) In the setting mode, settings described in "Table 7-1 Various setting items and details in setting mode" (p. 21) may be changed.
- (3) For button operation in the setting mode, see Figures 8.3 and 8.4 "Display switching in various setting modes" (pp. 32 and 33) in terms of external power supply specification and Figures 8.5 and 8.6 "Display switching in various setting modes" (pp. 34 and 35) in terms of built-in battery specification.

- Details about setting items -

- [F1] Select conversion function

Select "actual flow rate" or "conversion flow rate."

"Actual flow rate" is selected as factory default setting of this product setting. When "Conversion flow rate" is selected, normal conversion flow rate or standard conversion flow rate is applied according to the setting of [F2] Conversion standard temperature and [F3] Conversion standard pressure, as described in Table 8-2.

Conversion flow rate is converted based on the temperature t [°C] and set pressure p [kPa], both measured simultaneously with flow rate,

Table 8-2. Indication / output value in [F1] - [F3] setting

Select actual flow rate conversion [F1]	Conversion standard temperature [F2]	Conversion standard pressure [F3]	Normal / "Standard" Indication	Integration indication, flow rate indication and output
No (oFF)			Nil	Actual flow rate
Selected (on)	0	0	Normal indication	Normal conversion flow rate
Selected (on)	Other than 0	Other than 0	Standard indication	Standard conversion flow rate

Carry out internal arithmetic of the conversion as follows.

$$Q_n = \frac{(T+t_0)}{(T+t_1)} \times \frac{(P+p_1)}{(P+p_0)} \times Q_r$$

Q_r : Actual flow rate [m³/h]

Q_n : Conversion flow rate [Normal(Standard) m³/h]

T : 273.15 [K] (absolute temperature at 0 °C)

t_1 : Fluid temperature [°C]

t_0 : Conversion standard temperature [°C] (set in the setting mode [F2])

P : 101.33 [kPa abs] (absolute pressure of 1 atm)

p_0 : Conversion standard pressure (set in the setting mode [F3])

p_1 : Set pressure (gauge pressure) [kPa] (set in the setting mode [F5])

When the external output function and conversion flow rate are used together, it is recommended to refer to the examples of conversion in Tables 3-1 and 3-2 (p. 10) to set output constant.

- [F2] Conversion standard temperature

When "conversion flow rate" is selected in [F1] Select conversion function, the standard temperature for conversion is set.

When "actual flow rate" is selected, setting of the conversion standard temperature becomes invalid.

- [F3] Conversion standard pressure

When "conversion flow rate" is selected in [F1] Select conversion function, the standard pressure for conversion is set.

When "actual flow rate" is selected, setting of the conversion standard pressure becomes invalid.

- [F4] Output pulse unit

Select the unit of output pulse from 10000, 1000, 100, 10, and 1.(Unit is [L/P])

Note that when setting of [F1] "Select conversion function" is changed, the setting value of [F4] "Output pulse unit" automatically changes to the value of factory shipment setting (1000 [L/P]). After setting [F1], set [F4] again if necessary.

- [F5] Set pressure

Set the pressure value of the environment to be used with a gauge pressure.

- [F6] Select alarm output

The following items can be selected in alarm output according to the power supply specification.

Battery specification (BT): Flow-rate upper / lower limit alarm or battery replacement alarm

External power supply specification (DC/AC): Flow-rate upper / lower limit alarm or upper integrated value limit alarm

<Flow-rate upper / lower limit alarm output>

In alarm output, alarm signal is outputted when instantaneous flow rate is above the setting value of alarm output upper-limit flow rate or when instantaneous flow rate is below the setting value of alarm output lower limit flow rate. In stopping of alarm output, alarm signal stops during alarm output when instantaneous flow rate is above (alarm output lower/limit flow rate + Alarm determination value hysteresis width) or when instantaneous flow rate is below (alarm output upper-limit flow rate - Alarm determination value hysteresis width).

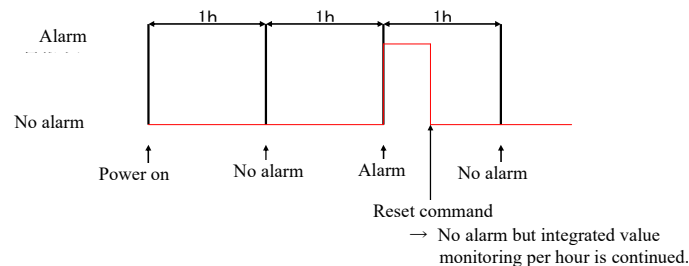
Note that set the values so that (Alarm output upper-limit flow rate) is above (Alarm output lower-limit flow rate + Alarm determination value hysteresis width)

<Battery replacement alarm>

When 6 years (including storage period) have passed after battery connector connection (power on), alarm signal indicating battery replacement is outputted.

<Integrated value upper limit alarm>

When integrated flow rate per hour from power on exceeds the set integrated flow rate, this alarm is outputted and the state is maintained for one hour. Alarm output is stopped when an electronic statement signal requesting reset of the integrated value upper limit alarm is received through communication but monitoring of integrated value per hour is continued.



Set the upper limit of the integrated flow rate through communication.

* For detailed specifications of communication, download from our company's web site.

Product website: http://www.aichitokei.co.jp/products/14_s_sonic/ux/

- [F7] Alarm output contact state

Select either "Normal open (n.OP)" or "Normal close (n.CL)" as the contact state of alarm output.

- [F8] Alarm output lower-limit flow rate

Set the lower-limit flow-rate value of the flow-rate upper/lower limit alarm output. For use in "conversion flow rate," set the converted value.

- [F9] Alarm output upper-limit flow rate

Set the upper-limit flow-rate value of the flow-rate upper/lower limit alarm output. For use "conversion flow rate," set the converted value.

- [F10] Alarm determination value hysteresis width

For the flow rate values set on the upper and lower limit sides of the flow rate upper / lower limit alarm output, set the flow rate for stopping alarm output. For use "conversion flow rate," set the converted value.

For example, when setting the upper limit of flow rate value to 7.00 [m³/h], lower limit of flow rate value to 2.00 [m³/h], and alarm determination value hysteresis width to 1.00 [m³/h], alarm is outputted at 7.00 [m³/h] or higher and stops when less than 6.00 [m³/h] for the upper limit. Similarly for the lower limit, alarm is outputted at 2.00 [m³/h] or lower and stops when higher than 3.00 [m³/h].

- [F11] Current output full-scale flow rate
Set the full-scale flow rate value when instantaneous flow rate is set with analog output. For the factory default, the flow rate value specified in Table 7-1 (p. 21) is set. For use "conversion flow rate," set the converted value.

- [F12] Select current output
Select the output signal of current output from "Instantaneous flow rate (FLo)" and "Temperature (tEP)."

- [F13] Communication bit rate
Communication bit rate can be selected from "4800 bps (4800)" and "9600 bps (9600)."

- [F14] RTU address
RTU address can be selected from 001-247.

- [F15] Average moving times
Select the indication of instantaneous flow rate and average moving times of output. For the factory default, average moving times set to 4 times and the measured values of the last four measurements are adopted.
In normal use, average moving times need not be changed but may be selected from 1 to 16 times in setting. When "1 time" is selected, "No moving average" is set.

- [F16] Time selection in test mode
Test mode time may be selected. Factory default is set to "3 min," in addition to which "60 min" and "No limit" are selectable.

- [F17] Select gas type
Select from "13A (13A)", "Propane (Pro)", "Butane (but)", and "Nitrogen (n2)" according to the types of gas to measure.
Note that "Air" is displayed on the select screen, which is for maintenance and cannot be selected as a gas type of this product.

The following figures show display switching in various setting modes.

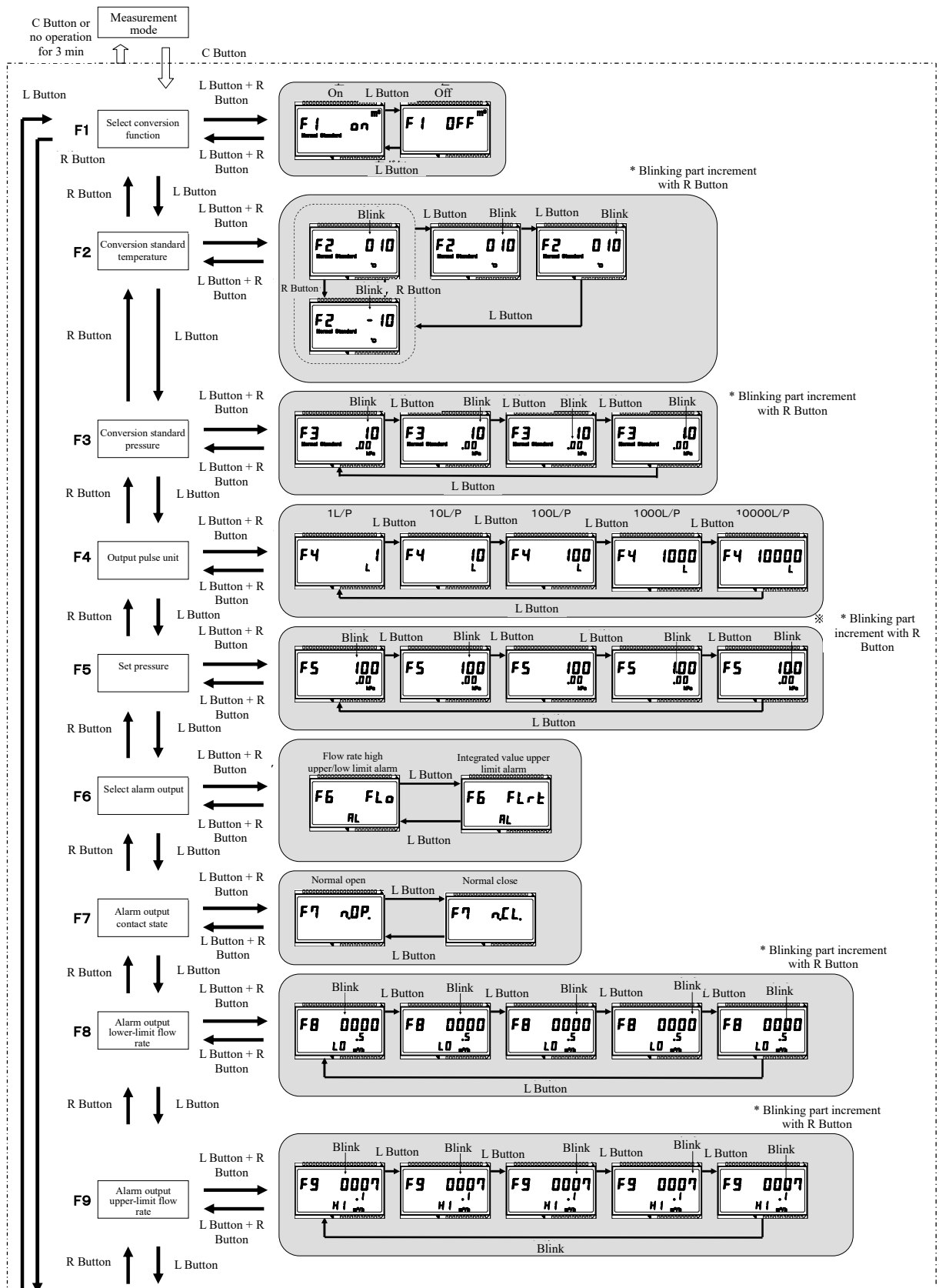


Figure 8-3. Display switching in various setting modes (External power supply specification)

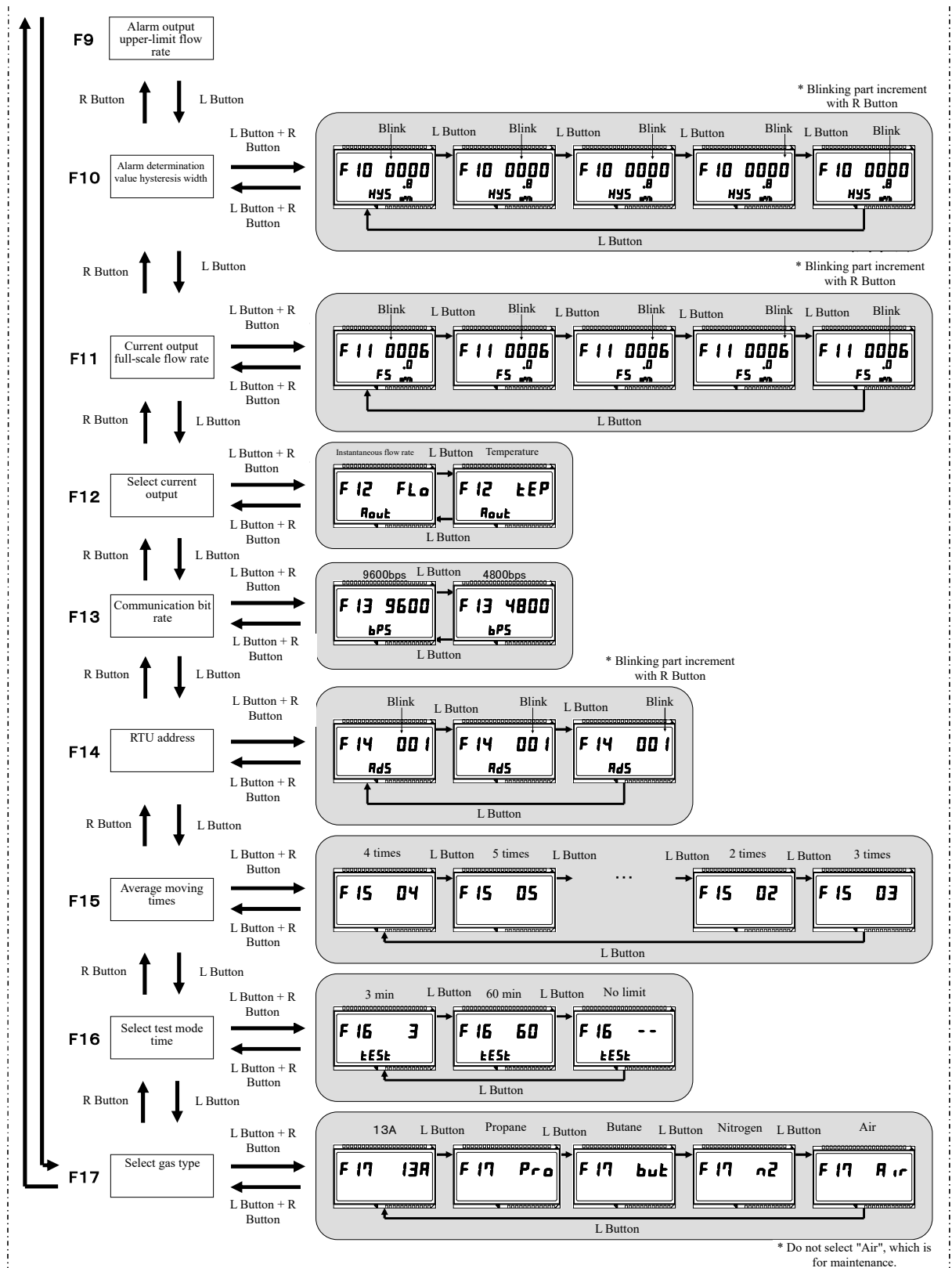


Figure 8-4. Display switching in various setting modes (External power supply specification)

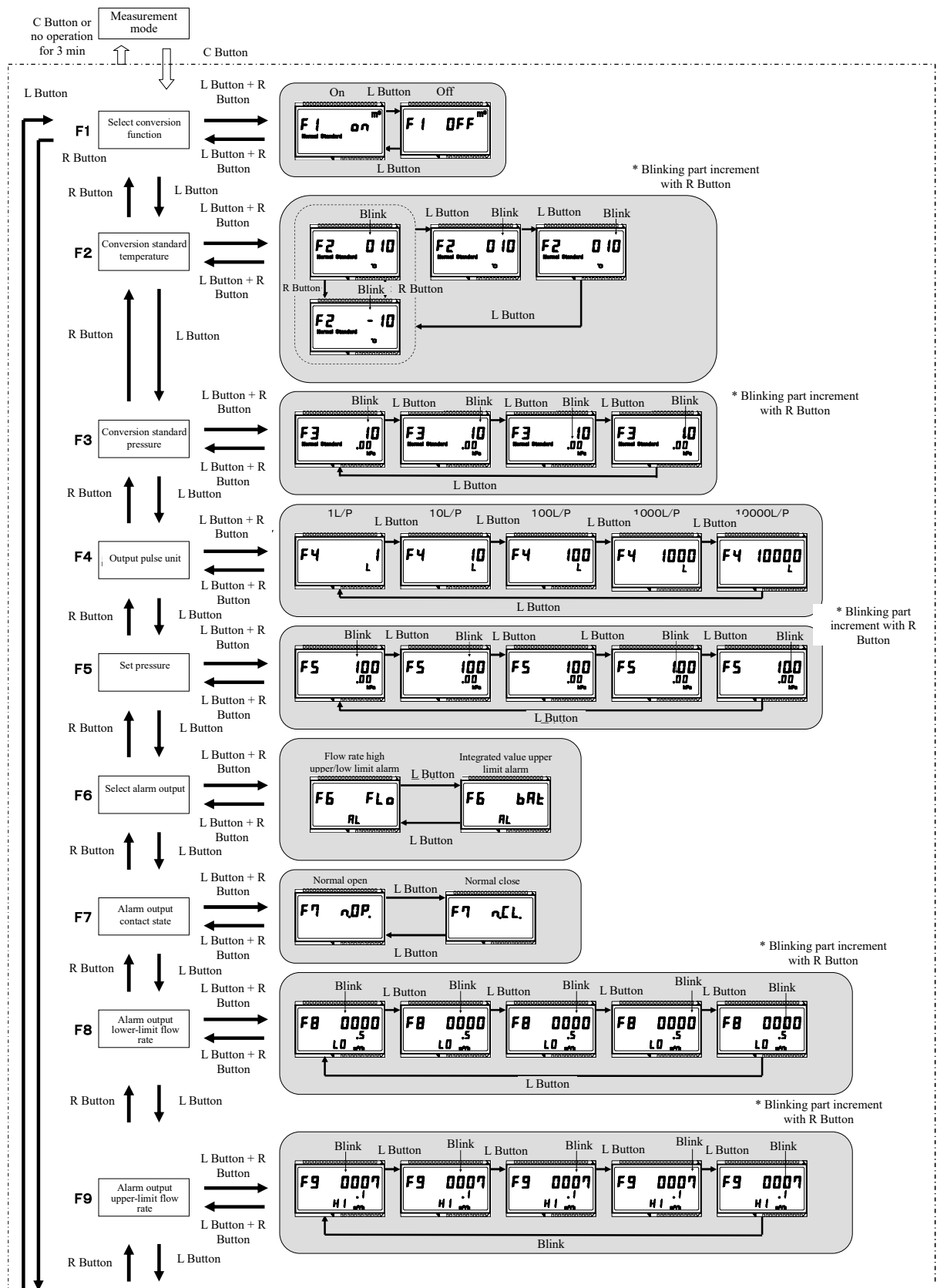


Figure 8-5. Display switching in various setting modes (Built-in battery specification)

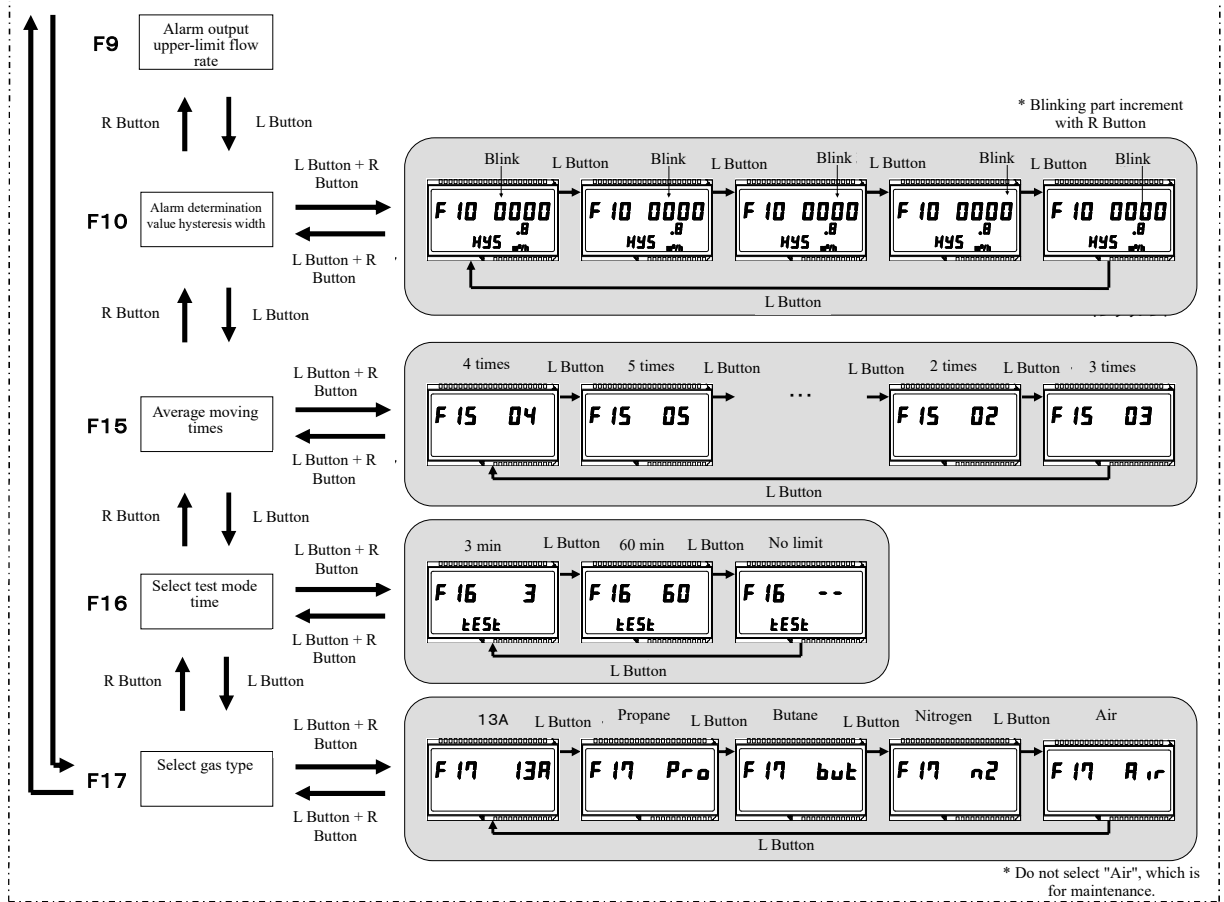
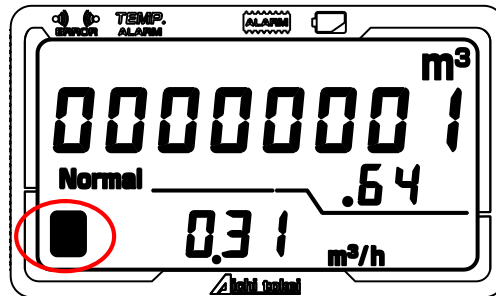


Figure 8-6. Display switching in various setting modes (Built-in battery specification)

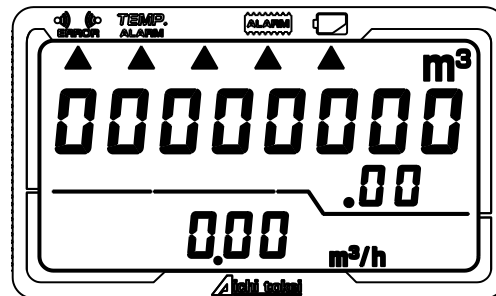
9. Start-up procedure

When starting operation, open the valve gradually and check whether the pilot lamp is blinking. Blinking of the pilot lamp indicates that the fluid is flowing.



10. Alarm indication

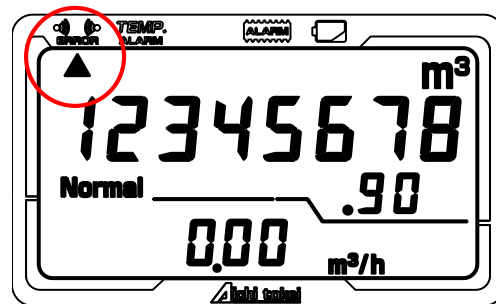
For alarm indication, "▲" corresponding to each alarm turns on.



1) Abnormal ultrasonic measurement

If ultrasonic signals are weak or cannot be received, "Abnormal ultrasonic measurement" lights up and the instantaneous flow rate indicates "0.00". Integration of flow rate is stopped and the integrated flow rate immediately before the occurrence of abnormality is indicated on the display, and analog output outputs 1 mA.

Check whether any foreign matter that obstructs transmission of ultrasonic signals is contained or whether there is any fluid such as oil that adhered to or retains in the pipe. If "Abnormal ultrasonic measurement" still turns on even after no adhesion or retention of foreign matter is observed, contact our branch or sales office nearby.



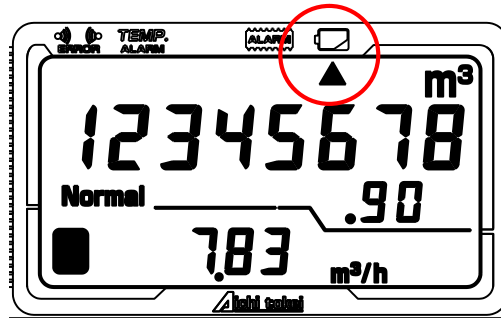
(Note) Operation at start-up

When installing or starting up the flow meter, the alarm may turn on due to an excessive flow rate or mixture of air and gas that may occur when replacing atmospheric air with the gas. This alarm automatically turns off when replacement

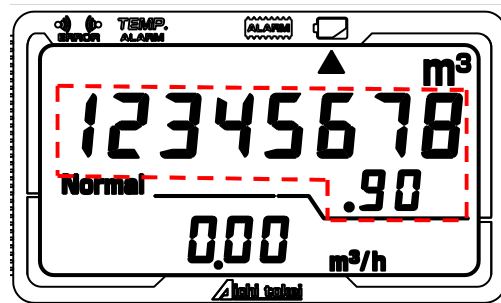
is completed and the fluid becomes stable. (This is not an abnormality.)

2) Battery replacement alarm [Built-in battery specification]

- (1) When 6 years (including storage period) have passed after battery connector connection (power on), "Battery replacement alarm" indicating battery replacement turns on. Even after this alarm turns on, measurement is continued. Earlier replacement of the battery is recommended once "Battery replacement alarm" turns on. For replacement of the battery, contact our branch or sales office nearby.



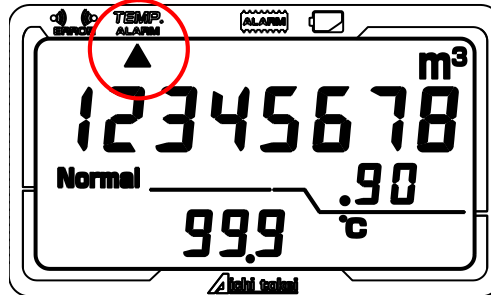
- (2) After "Battery replacement alarm" turns on, when residual battery power becomes very small, "integrated value" blinks in a 0.5-second interval. Measurement operation stops, instantaneous flow rate indicates "0.00", and integrated flow rate stops and keeps on indicating the value immediately before the alarm. Then, replace the battery promptly.
For replacement of the battery, contact our branch or sales office nearby.



Normally, the battery life is at least 5 years but "Battery replacement alarm" may appear in less than 5 years depending on ambient temperature.

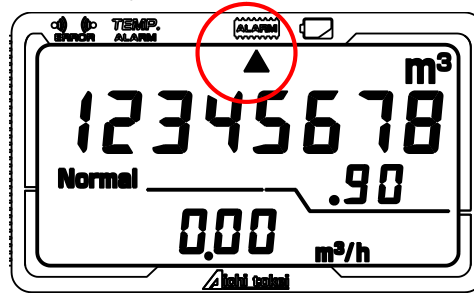
3) Abnormal temperature

When abnormal temperature is detected, "Abnormal temperature" turns on. Instantaneous flow rate indicates "0.00", the temperature shows the abnormal value, and analog output represents 1 mA. Integrated flow rate of the main display stops integration and keeps on indicating the value immediately before the abnormality.

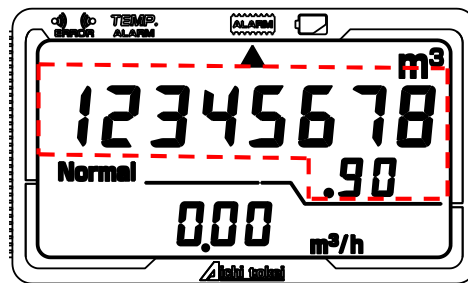


4) Abnormal external memory

(1) "Abnormal external memory" turns on when abnormal data is detected in setting with button operation and integrated value return at power on in the external power supply specification. When "Abnormal external memory" turns on, check the setting value and reset the data. If "Abnormal external memory" does not turn off even after resetting the data, the flow meter may be out of order, so contact our branch / sales office nearby.



(2) When abnormal internal data is detected, "integrated value" blinks in a 0.5-second interval. The flow meter may be out of order, so contact our branch or sales office nearby.



11. Treatment at power failure [24VDC specification]

1) Detection of power failure

The drop of a power source voltage to $18 \pm 1.1\text{V}$ or lower is judged to be a power failure. As a result, the measurement is stopped and the LED display is turned off.

2) Reset from power failure

When the power supply voltage recovers to $18.8 \pm 1.1\text{V}$ or higher, the measurement is resumed and the LED display turns on. Integrated flow rate and trip integration are memorized every 5 minutes after power on. After recovery from the power failure, each integrated value memorized just before power failure is restored and integration resumed from that value.



Note that after recovery from power failure, the LED display of the upper column indicates integrated flow rate.

12. Battery life [Built-in battery type]

The life of the built-in battery is 5 years. (This is the life at the environment temperature of 20°C . The battery life fluctuates depending on the temperature of installation environment.)

Never dispose of this product through the normal disposal route since it has a built-in lithium ion battery. * For battery replacement, contact our branch or sales office nearby.

13. Troubleshooting

Timing	Phenomenon	Possible causes	Actions
Immediately after installation	Abnormal ultrasonic measurement "  " turns on (see p.36).	Replacing the gas.	Abnormal ultrasonic measurement turns off when replacement is finished.
		The flow meter is used outside the specification range (installation conditions, pressure, temperature, etc.)	Check whether "For safe and proper use" [p.2 - p.4] and the Specifications [p. 8 - p. 9] are satisfied.
		There is a large electric noise source near the flow meter.	Take measures for eliminating the noise source or shielding the meter. Use the shielded type for cables connected to the terminal block and ground the shield.
	Integration does not start immediately after installation.	Replacing the gas.	Check whether the partition line between the main display and sub-display is blinking. Integration starts when replacing is finished.
	Instantaneous flow rate represents a negative value.	Flow direction of the fluid is opposite to the flow direction of the flow meter.	Check whether the arrow direction on the external surface of the flow meter corresponds to the flow direction of the fluid.
After start-up	Battery replacement alarm "  " turns on (see p.37).	Low battery voltage	Showing the time to replace the built-in battery. (Contact our branch / sales office nearby.)
	Integrated value blinks.	Battery life expiration	Showing the battery life of the built-in battery is expiring. (Contact our branch / sales office nearby.)
	Instantaneous flow-rate appears to be wavering.	Pressure is fluctuating frequently.	The flow meter is operating normally. Recommended to install the flow meter at a location with less pressure fluctuation to measure more accurately.
		Flow pulsation.	The flow meter is operating normally. Recommended to install the flow meter at a location with less pulsation to measure more accurately.
	Instantaneous flow rate is not zero although no fluid is flowing.	The gas is flowing convectively in the piping.	The flow meter is operating normally.
		Test mode is ON.	Check whether unit of sub-display is blinking. (See test mode [p. 27])
	Instantaneous flow rate is too large.	Integrated flow rate (Normal or Standard) is indicated.	Check whether the unit matching the usage is selected. (For changing the unit, see "Flow meter setting" [p. 21])
	Instantaneous flow rate appears to remain unchanged.	Excessive fluid more than specification is flowing.	Use the flow meter within the specification range. (See [p. 8 - p.9] for the specifications.)
	Instantaneous flow rate is too small.	Actual flow rate (m ³) is indicated.	Check whether the unit matching the usage is selected. (For changing the unit, see "Flow meter setting" [p. 21])
Partition line is blinking.	Under adjustment operation due to pressure fluctuation	The flow meter is operating normally. Adjustment operation ends in about one minute and blinking shifts to turning on.	
No indication of "0" in the high order digit of integrated flow rate.	Trip integration is indicated/	The flow meter is operating normally. (To return the display to forward integrated flow rate, see "Display operation instructions" [p.25 -])	

Contact our sales office nearby if any phenomenon cannot be solved even by taking the measures above.

- Warranty and after-sale service

1) Warranty period

For the period of one year after purchase, in case of a failure that is explicitly attributable to our manufacturing process, we exchange the product for free.

2) Scope of warranty

The following are not included in the scope of warranty.

- Failure caused by force majeure, such as natural disaster.
- Disassembly or alteration of the product.
- Failure caused by mishandling.
- Failure caused by use in excess of the scope of the specifications (environment etc.)
- Other cases determined to be not attributable to our responsibility

Note that the warranty referred to herein means warranty for the single product we delivered and excludes any damage to the user that is derived from failure of our product (e.g. damage / injury to other products than ours, lost profit, opportunity loss).

3) Request for service

Regardless of whether within or outside the warranty period, contact our branch / sales office nearby to provide the product name, model, work number, manufacture number, and other details of the failure.



Warning

4) Precautions for long-term use

[Designed standard use period] 10 years

- The designed standard use period means a standard period for which the product is available after installation without safety problem despite aged deterioration under the standard use conditions (environmental temperature: 20 °C, environmental moisture: 65% RH).
- If the product is used in excess of the designed standard use period, safety problem may occur to the problem, such as reduced water / dust resistance due to aged deterioration, smoke / ignition, and electric shock.
- When the designed standard use period is over, the product should be used carefully checking whether there is any abnormality and replacement with new one should be considered.
- The designed standard use period is not the warranty period, and does not warrant that there are no general failures during the period.

○ Contact

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