TRA-(G, T)-1604

Ultrasonic Flow Meter for Liquids

TRA-(G, T)

Operation Manual

G: External Power Supply Model

T: Internal Battery Model

Aichi tokei denki co., ltd.

Ultrasonic Flow Meter for Liquids Operation Manual

(TRA40(G,T),TRA50(G,T),TRA80(G,T),TRA100(G,T))

●Table of Contents

○Preface/Request and Notice

Thank you for purchasing our Ultrasonic Flow Meter for Liquids TRA. Be sure to read this manual thoroughly in order to use it correctly and prevent an accident.

Request

Please be certain to hand this manual to a person who uses this product.

This manual is also necessary for maintenance. Be sure to keep it until you dispose of the product.

Notice

1. The contents of this manual are subject to change without prior notice.
2. If you have any question about the contents of this manual, contact us at our local branch or sales office.

○Product Overview

This product is an ultrasonic flow meter for liquids and can be used to measure the flow rate of tap water, industrial water, pure water, and sea water (with salinity of 3.5±0.5%). The flow meter is installed to pipes by being tightened between pipe flanges.

○Important Notice

To ensure the safe use of the product and an to prevent a failure and unexpected situation, instructions to which attention must be paid are indicated with the following symbols.

Safety indications

⚠ Danger	This indicates that if you ignore this instruction, danger which may result in death or serious injury are likely occur.
⚠ Warning	This indicates that if you ignore this instruction, danger which may result in death or serious injury may occur.
⚠ Caution	This indicates that if you ignore this instruction, a physical damage (e.g., defect of the product) can occur.
⚠	⚠ This symbol indicates that if you make a mistake in handling, an accident can occur.
⃠	⃠ This symbol indicates an inhibited action.
❗	❗ This symbol indicates a precaution you must observe.

○For Safe Use of the Product

Notes on use

⚠ Danger	⚠1. Do not use this product for a purpose which requires safety, such as atomic power generation, railways, aviation, vehicle, or playground equipment. ⃠2. Do not alter this product. ⃠3. Do not use this product for food, beverage, and/or medical fluid because it does not conform to the sanitary specifications. ⚠4. Do not use this product in an explosive atmosphere such as a combustible gas because it is not explosion-protected.

Use environment and target fluid

⚠ Caution	⃠1. Never use the product with any fluid other than tap water, industrial water, pure water, and sea water. ❗2. Never install the product where the fluid can freeze or its temperature can exceed 60°C. ❗3. Do not use the product with fluid of which temperature exceeds 50°C. ❗4. Observe **the pressure range (1MPa or less)**. ⃠5. This flow meter is not waterproof **(equivalent to IPX4)**. Do not install it where it can be submerged. ⃠6. Do not install the product where it can be exposed to a corrosive gas (e.g., chlorine or hydrogen sulfide). Corrosion may damage the internal electrical parts. ❗7. Keep the product away from a noise source as far as possible. If you should install it near a noise source, attach the shield to the external connection cable. 8. When installing the flow meter outdoors, provide a shade to prevent exposure to direct sunlight.

Notes on operation

⚠ Caution	1. This product is not a specified measuring instrument defined by the Measurement Law. ❗2. When opening or closing the valve, open or close the valve not all at once but gradually.

Notes on piping

Warning

⃠ 1. Do not install the product on a footstep or do not get on it.

⃠ 2. Do not hold the product with its display part.

Caution

1. Do not install the product on a footstep.

❗ 2. **Do not use the product where air can be mixed with fluid.** Also, do not install it where an air pocket can easily occur (e.g., the upstream side of a falling pipe). Before starting to use the product after installation, drain air sufficiently.

When the product is installed in the horizontal orientation, it is recommended to make the display part facing up or down since a measurement error can occur when it faces sideways.

❗ 3. Install a flow rate adjustment valve which disturbs the flow at the downstream of the product.

❗ 4. Do not install the product on a piping system where an impact pressure such as a water hummer can occur.

⃠ 5. For a new piping system, throughly wash it before installation.

Do not use or make the product in contact with the following chemicals which harm the rigid polyvinyl chloride (body case):

◇Polycyclic aromatic hydrocarbon (e.g., benzene, toluene)

◇Chlorinated aromatic hydrocarbon (e.g., chloroform, cyclohexanone)

◇Ketone (e.g., acetone, methylethylketone)

◇Phenol (e.g., cresol, naphthol)

Commercial products of these chemicals include:

◆ Sealant for screws (containing organic solvent), ◆ Urethane foam,

◆ Caulking agent (containing organic solvent and plasticizer),

◆ Adhesive (when applied too much),

◆ Creosote (wood preservative), ◆ Soil fumigant (for soil sterilization),

◆ Coal tar (for waterproofing construction), ◆ Paint thinner,

◆ Termite eliminator, ◆ Insecticide, ◆ Gasoline and paraffin

⃠ 6. When laying pipes, be careful so that oil or chemical which swells rubbers (e.g., NBR, EPDM) should not be mixed in.

❗ 7. Do not install the product where a strong compression or tension force is applied to it.

8. Lay pipes in accordance with the flow direction indicated on the product.

9. Make sure that no burr exists with the end of the pipes connected to the product.

⃠ 10. Do not drop, hit, or apply an excessive impact to the product. Hold the body when you handle the product and never hold the display part.

11. A scratch to the end part of the product may cause leakage. Do not place the product with the end part (sealed surface) facing down.

12. Be sure to use the supplied gasket when laying pipes.

⃠ 13. Observe the specified tightening torque shown below. **Do not apply an excessive torque.** (Since this product is made with PVC, tightening too much or unevenly may cause a measurement error or damage.)

TRA40: 20Nm or less	TRA50: 25Nm or less
TRA80: 30Nm or less	TRA100:30Nm or less

Notes on cabling

⚠ **Danger**	1. Observe the instructions given in this manual for cabling. 2. Observe the rated range. Do not use a voltage exceeding the rated value.
⚠ **Caution**	1. Keep the cables away from the power and motor cables. 2. It is recommended to electrically isolate receiving instruments from other equipment. 3. When using a current output with the internal battery model, a separate power supply (24VDC±10%) is necessary except for equipment of which indicator outputs 24V. 4. **Since the current is not output correctly if there is an electrical continuity between the case (and metal pipe) and power supply GND, be sure to insulate them. Since there is an electrical continuity between the case and signal ground (SG) of the electrical circuit, if the case electrically connects with the metal pipe, an unintended current loop is formed in addition to the correct current loop and the current may not be output correctly. Be sure to use the centering collars to insulate the flow meter from metallic bolts.** 5. Do not apply an excessive tension to the cables. 6. Be careful so that the tip of an external connection cable is submerged during the cabling work. 7. When connecting the power line to an external power supply, be sure to prevent a short-circuit. Use an external power supply with a short-circuit prevention function. 8. Turn off the external power supply when cabling the product. 9. Do not operate or cable the product with a wet hand.

Notes on storage

⚠ **Caution**	1. Store the product away from fire and direct sunlight. 2. Keep the product away from combustible, inflammable, and/or heating materials. 3. Store the product where excessive temperature and/or humidly as well as dewing are not probable.

Notes on disassembly and inspection

⚠ **Caution**	1. Do not disassemble the product. 2. The pilot lamp blinks while a normal flow exists. If it does not blink, contact us at the nearest local branch office or sales office.

Notes on disposal

⚠ **Warning**	1. This product contains lithium batteries which may heat up, ignite or split if subjected to incorrect treatment so please exercise due care. [Internal battery model only] 2. Never throw the product into fire. Combustion or explosion may occur. [Internal battery model only]

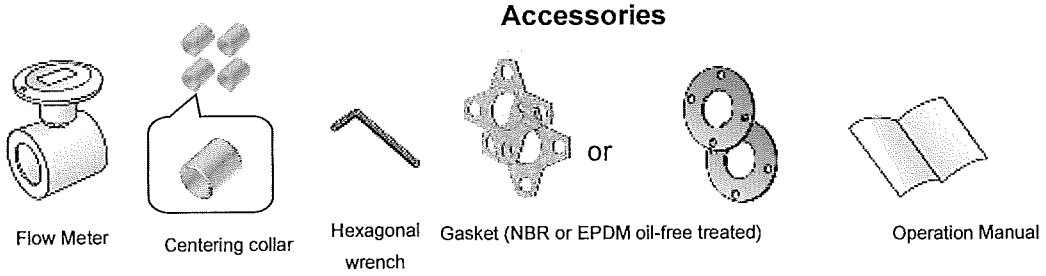
1. Introduction

1-1. Confirmation of package contents

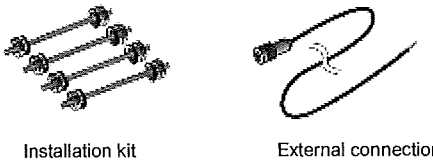
Upon delivery of the product, confirm that the following items are contained in the package.

<table>
<tr><th colspan="2">Name</th><th>#</th><th colspan="4">Note</th></tr>
<tr><td colspan="2">Ultrasonic Flow Meter</td><td>1</td><td colspan="4"></td></tr>
<tr><td rowspan="4">Accessories</td><td>Centering collar</td><td>4</td><td colspan="4">For its use, refer to Pages 10 and 11</td></tr>
<tr><td>Hexagonal wrench</td><td>1</td><td colspan="4">Used to tighten the set screw to change the display unit orientation as well as to push the rear center button (SW3).</td></tr>
<tr><td>Gasket (NBR or EPDM oil-free treated)</td><td>2</td><td colspan="4"></td></tr>
<tr><td>Operation Manual (this book)</td><td>1</td><td colspan="4"></td></tr>
<tr><td rowspan="4">Option</td><td rowspan="3">Installation kit (Bolts, nuts, plain washers)</td><td rowspan="3">1 set</td><td>Contents / Per diameter</td><td>Through bolt</td><td>Washer</td><td>Hexagonal nut</td></tr>
<tr><td>40A, 50A</td><td>4</td><td>8</td><td>8</td></tr>
<tr><td>80A, 100A</td><td>8</td><td>16</td><td>16</td></tr>
<tr><td>External connection cable</td><td>1</td><td colspan="4">Cable length: 5m or 20m</td></tr>
</table>

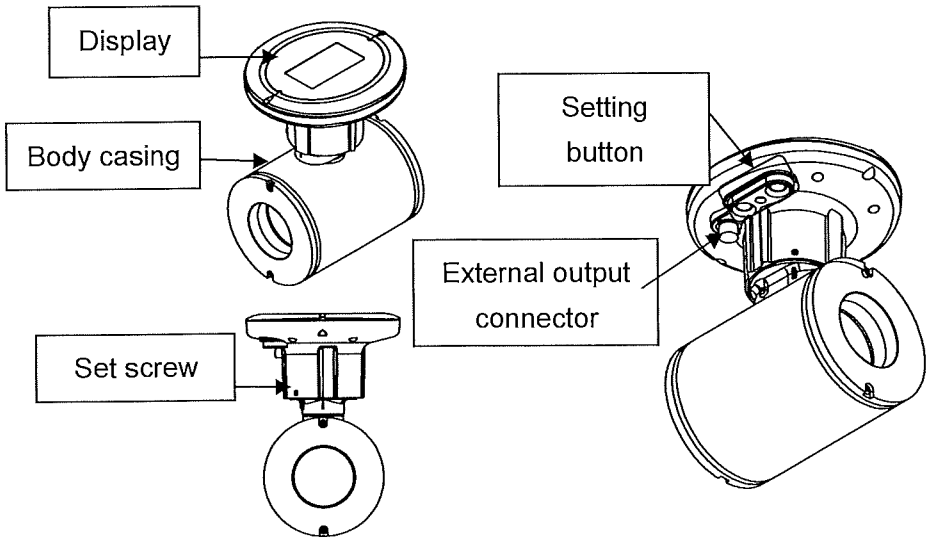
Accessories



Options



1-2. Names of each part

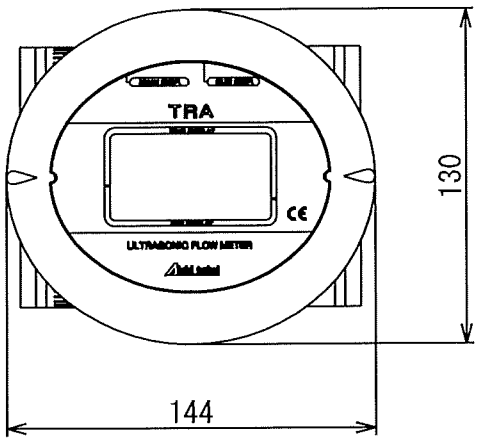


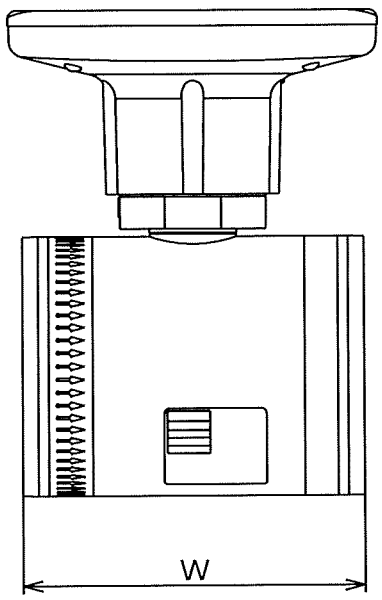
2. Specifications

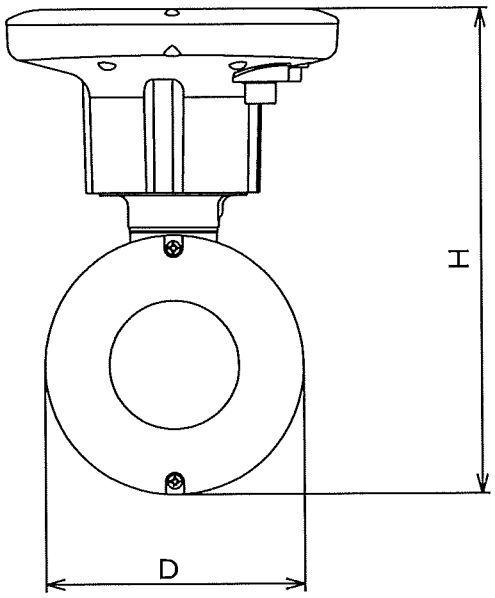
Model	External power supply model	TRA40G	TRA50G,	TRA80G	TRA100G	
	Internal battery model	TRA40T	TRA50T,	TRA80T	TRA100T	
Diameter		40A	50A	80A	100A	
Power supply		1) External power supply: 24VDC±10% (supplied using the external connection cable via the connector) 2) Internal battery: Battery life 10 years (under average environmental temperature of 20°C)				
Target fluid		Tap water, industrial water, pure water, and sea water (with salinity of 3.5±0.5%). (Air or solid which prevents from movement of ultrasonic waves shall not be mixed.)				
Maximum operating pressure		1MPa				
Flow rate range		0.6 - 30 m^3/h	1 - 50 m^3/h	2 - 100 m^3/h	4 - 200 m^3/h	
Precision	±2%RS	3 -30 m^3/h	5 - 50 m^3/h	10 - 100 m^3/h	20 - 200 m^3/h	
	±5%RS	0.6 - 3 m^3/h	1 - 5 m^3/h	2 - 10 m^3/h	4 - 20 m^3/h	
Low flow cutoff		0.12 m^3/h	0.2 m^3/h	0.4 m^3/h	0.8 m^3/h	
Pressure loss		Extremely low (equivalent to a straight pipe)				
Fluid temperature		0 - +50°C (no freezing)				
Display	*1) Accumulated flow quantity	00000000.00 m^3 10 digits (displays leading zeros)				
	*1) Accumulated trip quantity	T 0000000.00 m^3 9 digits (does not display leading zeros)				
	*1) Instantaneous flow rate	000.0 m^3/h 4 digits				
	Temperature	00.0 °C 3 digits				
	Reverse flow	"N" blinks: While flowing in the reverse direction or flowing in the normal direction until the accumulated value returns to the value where the reverse flow started.				
	Alarm	ALARM1 blinking: Measurement is temporarily unavailable due to mixture of air or foreign substances. ALARM1 solid: No water is flowing, the ultrasonic signal level is too low, or the signal cannot be received. ALARM2 blinking: Communication line is short-circuited. ALARM2 solid: Battery voltage is low (for internal battery specification type). Sub-display blinking: Temperature value is abnormal.				
Output	Analog current output	Output format: 4 - 20mA*2) Discharge method (for external power supply model) Two-wire method (for internal battery model) Power supply voltage: 24VDC±10% External load: 400Ω or less Choose one of the following for current output:*1) 1) Instantaneous flow rate 2) Temperature				
		Momentary flow rate	Output current lower limit	4mA (reverse flow to low flow cutoff)		
			Output current upper limit	22mA (clipped at 22mA)		
			Output precision	±0.1mA (except for flow rate measurement precision)		
			Full-scale flow rate: Set by button *3)			
		Temperature	Output method	4mA: 0°C, 20mA: +50°C (cannot be changed)		
			Output current lower limit	4mA (clipped at 4mA)		
			Output current upper limit	22mA (clipped at 22mA)		
	Contact output	Output format: Open drain output (2 lines) Maximum rated voltage: 24VDC±10% Maximum rated current: 10mA ON saturation voltage: 1V or less OFF current: 50μA or less				
		Output 1)	Unit pulse output (choose from 10L/P, 100L/P, and 1m^3/P) Duty: 35 - 65%			
		Output 2)	Choose from upper/lower limit alarm output or message output.			
Pipe connection		Wafer (put between JIS10K flanges)				
Installation orientation		Horizontal (with display part facing up or down) or vertical				
Fluid contact material		Body case: PVC, O-ring: EPDM, gasket: NBR (EPDM)				
Weight		1.5kg	1.7kg	2.5kg	3.2kg	
Installation location		Indoor or outdoor (IPX4 equivalent) (If the product is installed where it is exposed to direct sunlight, it is recommended to provide a sunshade.)				
Installation temperature		-10 - +60°C (no dewing)				

*1) Switched by the button on the back of the display . (See Page 12.)
*2) When using the internal battery model, a separate power supply (24VDC±10%) is necessary.
Power consumption: 1.1W or less, current consumption: 40mA MAX
*3) See Table 6-1 (on Page 14) for the factory setting of the full-scale flow rate.

3. External Drawing







Unit: mm

Dimensions	W	D	H
TRA40(G,T)	123	84	174
TRA50(G,T)	133	99	189
TRA80(G,T)	153	130	220
TRA100(G,T)	173	155	244

4. Installation Overview

Caution

The body is made of the rigid polyvinyl chloride and excessive force may damage it and cause leakage of fluid.

Also refer to the notes on piping (on Page 3) for cautions on installing the flow meter.

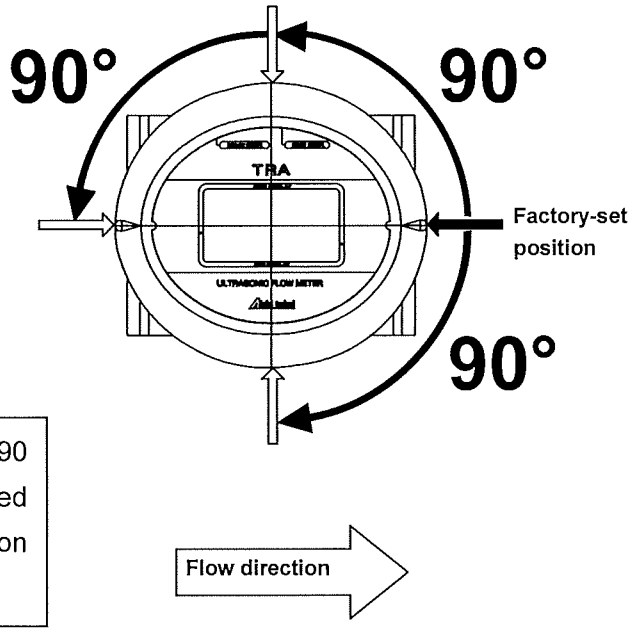
1) Check items before installing the flow meter

Check the following items before installing the flow meter.

1) When installing the flow meter where operation becomes difficult after installation (e.g., high location or inside a pit), it is recommended to perform 1) setting of the flow meter (starting from Page 12) and adjustment of the display orientation before installation.
2) This flow meter can be installed indoor and outdoor in the horizontal and vertical orientations. Install it at the middle of a straight pipe with the arrow indicated on the body aligned with the flow direction of the fluid.
   When installing the flow meter horizontally, be sure to install it so that the display part faces up or down.
3) To connect with a new piping, wash it sufficiently before installation.
4) It is recommended to provide straight pipes of sufficient lengths at the upstream and downstream sides of the flow meter. (See Page 9 for the appropriate lengths of the straight pipes.)
5) Avoid using the flow meter in the following situations:
   - This flow meter is not fully waterproof (equivalent to IPX4). Do not install it where it can be submerged.
   - Do not install the product where it can be exposed to a corrosive gas (e.g., chlorine or hydrogen sulfide). Corrosion may damage the internal electrical parts.
   - Do not install the flow meter near a noise source. If you should install it near a noise source, earth the shield of the external connection cable.
   - Avoid installing the flow meter where air can stay or get mixed in the pipe.
     When a display failure occurs due to mixed air, dry the flow meter, or power it off (for the external power supply model only). This returns the flow meter to the normal measurement mode.
   - Do not install the product on a piping system where an impact pressure such as a water hummer can occur.
   - Do not install the product where a strong compression or tension force is applied to it.
   - Do not install the product where it can be stamped on.

6) When installing the flow meter outdoors, provide a shade to prevent exposure to direct sunlight.

7) The display part can be rotated. Loosen the set screw at the neck below the display part with the hexagonal wrench key, and rotate the display part in 90° units. Once the display part is rotated in the desired orientation, be sure to tighten the set screw to fix the display part.



The display can be rotated clockwise by 90 degrees and the counter can be rotated clockwise by 180 degrees from the orientation at the time of the shipment from the factory.

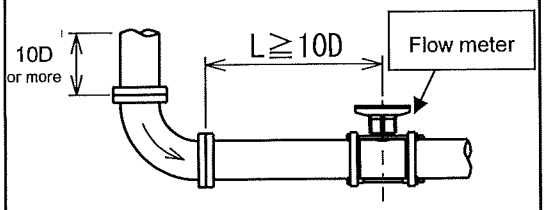
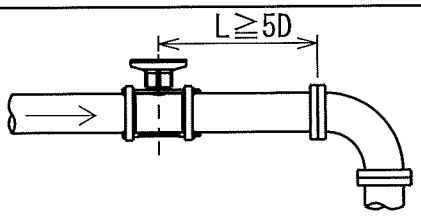
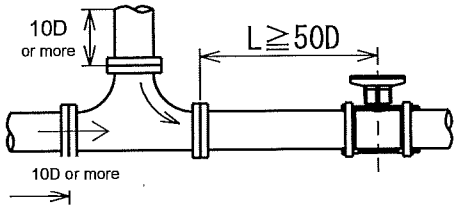
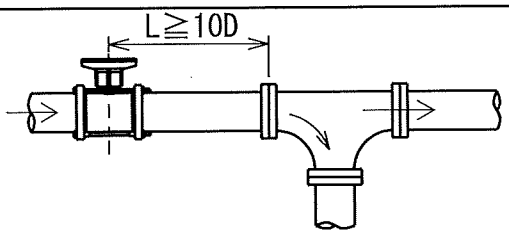
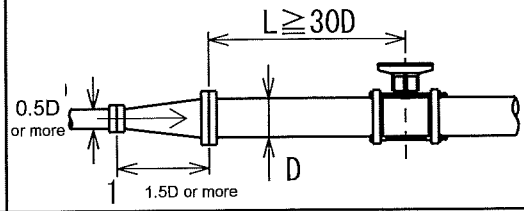
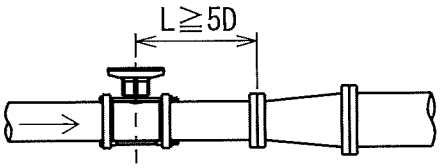
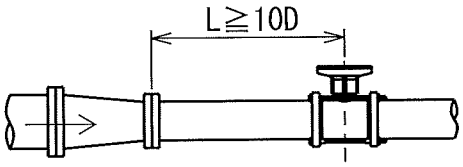
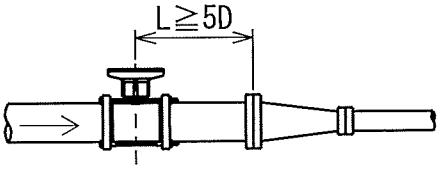
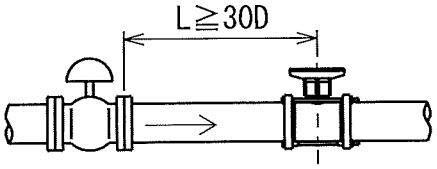
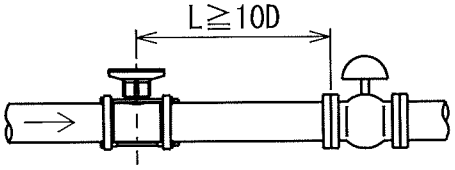
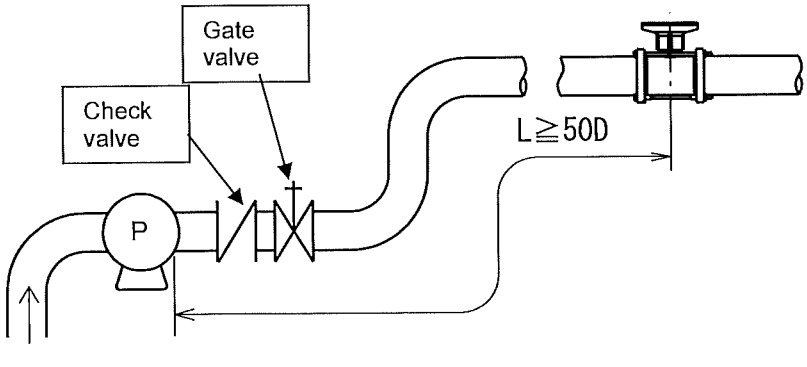
2) Lengths of straight pipes

It is recommended to provide straight pipe length as illustrated below.

Reference: Japan Electric Measuring Instruments Manufacturers' Association

"Flow Rate Measurement Method by Ultrasonic Flow Meter" (JEMIS 032-1987)

("D" is the diameter of the pipe.)

Type	Straight pipe length on the upstream side	Straight pipe length on the downstream side
90° bent		
Tee		
Expanding pipe		
Reducing pipe		
Valve	 When adjusting flow with a valve on the upstream side	 When adjusting flow with a valve on the downstream side
Pump		

3) Notes on installing the flow meter

Install the flow meter after reading the notes thoroughly before installation (starting from Page 8) .

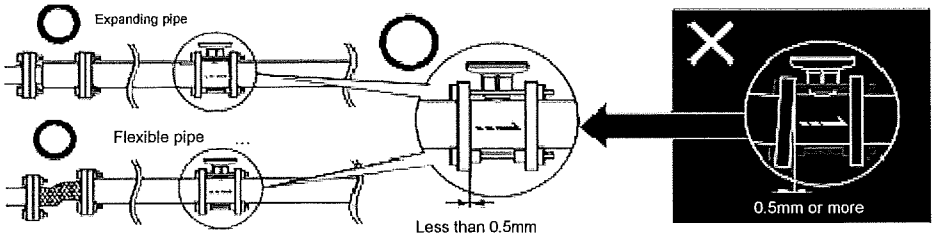
1) When installing the flow meter, be sure to use the supplied rubber gasket which can firmly seal with a low surface pressure.

Note) **Do not use a joint-seat gasket because it requires a high surface pressure.**

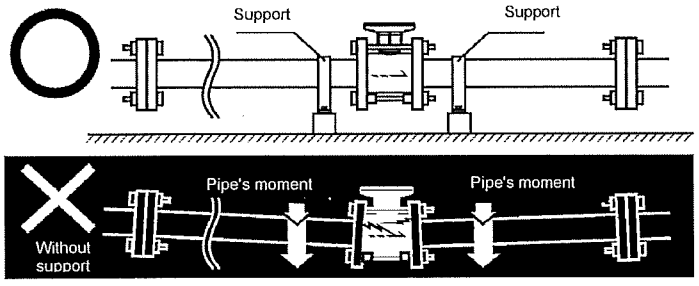
2) Install an expansion pipe or flexible pipe in the midway of the pipe connected to the flow meter to prevent displacement due to temperature change or piping work from being applied to the flow meter.

3) Be sure that flanges holding the flow meter are parallel to each other.

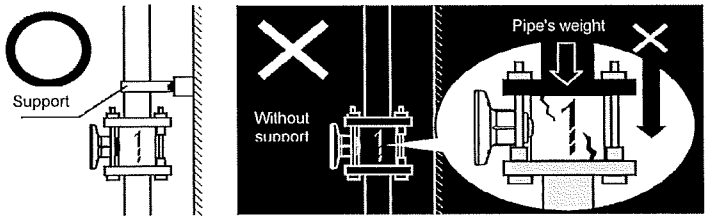
Note) **Confirm that the difference between the maximum and minimum values of the inter-flange distance is 0.5mm or less.**



4) Be sure that weight of the pipe is not applied to the flow meter.



For horizontal pipe



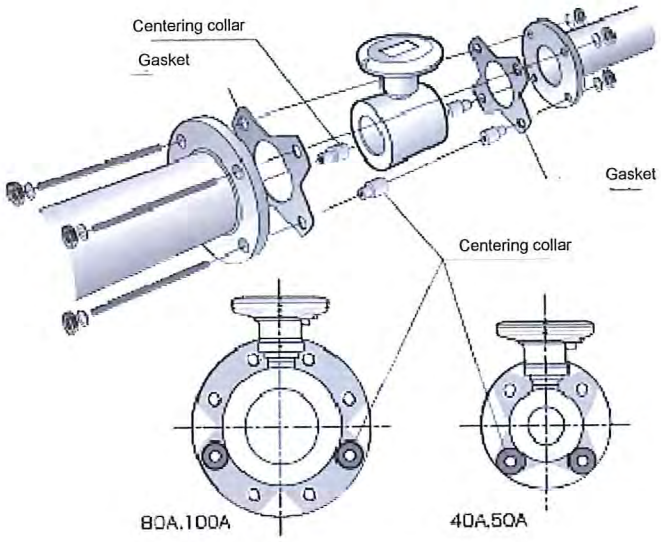
For vertical pipe

5) When laying pipes, be careful so that oil or chemical which swells rubbers (e.g., NBR, EPDM) and/or foreign matters such as welding tip, dust, or sealant should not be mixed in.

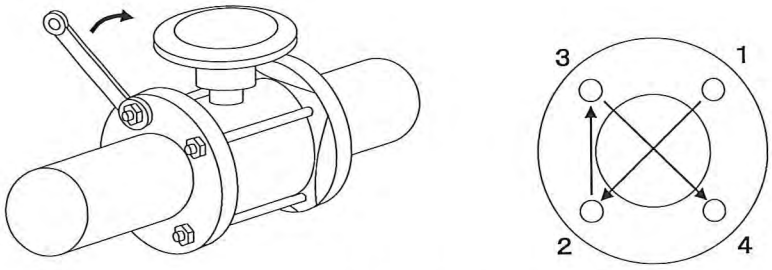
6) Install the flow meter so that the center axis of the flow meter is aligned with the center axis of the pipe to minimize the instrumental error performance. As shown in the figure on the next page, insert the supplied centering collars into the holes of the supplied gasket and flange. By applying the flow meter to the collar, you can align the center axes of the flow meter and pipe. If it is difficult to attach the centering collars on both of the upstream and downstream sides due to misalignment of center of the pipe or any other reasons, attach the collar to the upstream side only.

7) Insert the flow meter between the JIS10K flanges and fix it with M16 threaded bolts. Tighten all the bolts loosely and check that **there is no misalignment of center and inclination of the display part**. Do not apply excessive force to correct center alignment.

Note) **Be careful so that the gasket may not protrude into the pipe.**



8) After correcting center misalignment, **tighten nuts on the opposite sides alternately with even force**. Tighten them until the gasket gets crushed and the body gets in contact with the flange evenly.



9) Observe the specified tightening torque shown below. Do not apply an excessive torque.

Note 1) **To obtain an even surface pressure, tighten the bolts gradually in four or five runs.**

Note 2) **Even if the torque is below the rated value, tightening a bolt in one results in uneven tightening and may cause a damage or leakage.**

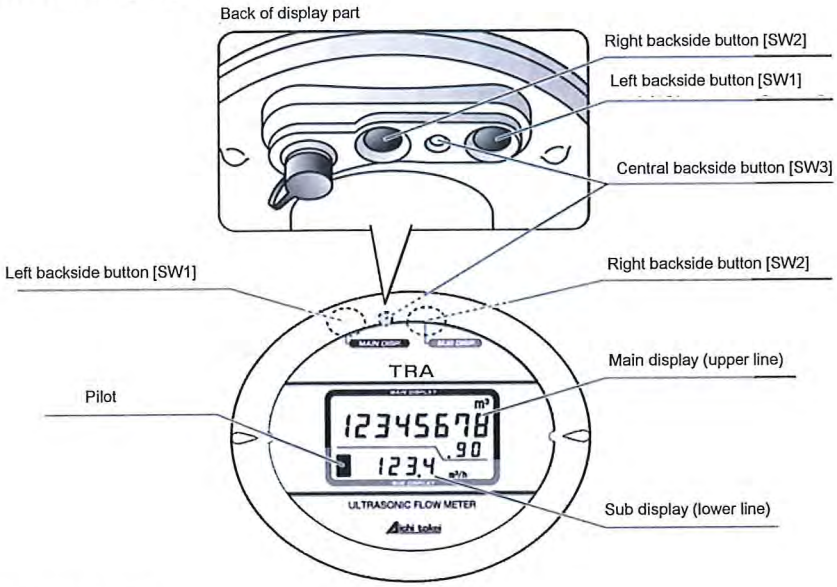
TRA40: 20Nm or less	TRA50: 25Nm or less
TRA80: 30Nm or less	TRA100: 30Nm or less

4) Maintenance after installation

1) When a foreign material is attached to the measurement part of the flow meter to cause a display failure, remove it out of the pipe and wash the entire pipe with clean water. Soak a piece of cloth or soft sponge with water and use a neutral detergent to wash the entire internal surface of the pipe, then rinse it out.

2) If the flow meter does not measure the flow rate correctly in the measurement mode, refer to “10. Alarm Display” (Page 21). When an error occurs, refer to “14. Troubleshooting” (Page 23).

5. Operation of Display



1) Start measurement

To prevent the internal battery from being consumed, the measurement operation is stopped at factory (save mode).

When you unpack the flow meter, "-----" is displayed to indicate that the product is in the save mode. Press and hold the left and right backside buttons together until the LCD turns on and measurement starts. (Measurement mode)

2) Operation

1) Normally (measurement mode), the main display (upper line) shows the accumulated flow quantity and the sub display (lower line) shows the momentary flow rate.
2) Use the three button switches on the backside to configure various settings on site.
3) Refer to the figure above for the location of the SW1, SW2, and SW3 switches.
4) You can move to other modes and configure settings as directed in "7. Configuration Procedure” (Page 18).
5) When the momentary flow rate is above the low flow cutoff value, the pilot lamp (■) at the lower left of the display part blinks at 1Hz.
6) During reverse flow measurement, "N" blinks to the left of "m^3" at the upper right of the main display. "N" keeps blinking until the value returns to the accumulated value at which reverse flow started. During reverse flow measurement (with "N" blinking), flow output (analog and pulse) is unavailable.

3) Function of each mode

3-1) Measurement mode

◇Main display contents (upper line)

To toggle between accumulated flow volume and trip accumulated amount: Press the left backside button [SW1].

1) While the accumulated amount is displayed, pressing the left backside button [SW1] starts trip accumulation.
2) While the trip accumulated amount is displayed, pressing the left backside button [SW1] and right backside button [SW2] simultaneously clears the trip accumulated amount to zero.
3) When the trip accumulated volume overflows from "9999999.99," "0000000.00" will be displayed without suppressing zeros and accumulation will continue.
4) While the trip accumulated amount is displayed, pressing the left backside button [SW1] returns to the accumulated amount display.

◇Sub display contents (lower line)

To toggle between momentary flow rate and temperature: Press the right backside button [SW2].

1) While the momentary flow rate is displayed, pressing the right backside button [SW2] switches to the temperature display.
2) While the temperature is displayed, pressing the right backside button [SW2] returns to the momentary flow rate display.

3-2) Test function

The test function temporarily disables the low flow cutoff function and micro flow rate can be measured. **Be sure to use the test function while there is no flow.**

1) Pressing and holding SW2 for three seconds or longer transfers to the test function. (While the test function is enabled, the sub display blinks at a 0.5-second interval.)
2) The test function duration can be chosen from 3 minutes, 60 minutes, and unlimited, and the test function automatically terminates when the specified time has elapsed. You can also terminate the test function by pressing and holding SW2 for three seconds or longer.
3) While the test function is enabled, the display value is rounded to one decimal place.
   Example) Display: 0.0 [m^3/h] → 0 - 0.04 [m^3/h]
   Display: −0.0 [m^3/h] →−0.04 – 0 [m^3/h]
4) When the momentary flow rate is (+) 0.1 or higher or the pilot lamp is blinking, there might be leakage at the downstream side.*
5) When the momentary flow rate is negative, there might be leakage at the upstream side.*

* Possibility: Since the display value includes an offset for zero flow and internal convection current, this is just a matter of possibility.

3-3) Setting mode

1) Press "SW3" to move to the configuration mode.
Use the supplied hexagonal wrench key or similar tool.
(Note: Do not use a tool with a sharp tip because it may damage SW3.)

2) Press SW3 again in the configuration mode to return to the measurement mode.
If you do nothing in the configuration mode for three minutes, the flow meter will automatically transfer to the measurement mode.

3) In the configuration mode, you can configure settings shown in "Table 6-1. Configuration Items" (Page 15). Refer to "Figure 7-1. Switching Configuration Mode Displays" (Page 18) for how to use the buttons in the configuration mode.

6. Setting of Flow Meter

When installing the flow meter where operation becomes difficult after installation, it is recommended to set it before installation.

You can configure the eleven items shown in "Table 6-1. Configuration Items" for the flow meter. The factory settings are applied to the product when shipped from the factory, and you can use it without any configuration. Change the settings as required in your situation.

Table 6-1. Configuration Items

Panel display	Configuration item	Configuration range	Factory default
F1	Fluid selection	Water or sea water	Water
F2	Current output	Momentary flow rate or temperature	Momentary flow rate
F3	Current output Full-scale flow rate	0 - 9999 [m^3/h]	40A: 30 50A: 50 80A: 100 100A: 200
F4	Contact output	Alarm or message	Message output
F5	Output pulse unit	10, 100, 1000 [L/P]	100
F6	Alarm output contact state	Normal open or normal close	Normal open
F7	Alarm output lower limit flow rate	-9999 - 9999 [m^3/h]	0000
F8	Alarm output upper limit flow rate	-9999 - 9999 [m^3/h]	9999
F9	Alarm threshold hysteresis width	0 - 9999 [m^3/h]	0000
F10	Moving average count	01, 02, 04, 08, or 16 [times]	4
F11	Test function time	3, 6, unlimited [minutes]	3

●Details of setting items

[F1] Fluid selection

Choose from "Water" and "Sea water" as the fluid type.

[F2] Current output

Choose from "Momentary flow rate (Flo)" and "Temperature (tEP)" as the current output signal.

[F3] Current output full-scale flow rate (analog output)

Set the full-scale flow rate (4 digits) when "Momentary flow rate (Flo)" is chosen for the current output.

It is recommended to set the value according to the maximum flow rate. It is also recommended to set the value for the full-scale flow rate.

[F4] Contact output

Choose from "Flow rate upper/lower limit alarm output (AL)" and "Message output (COdE)" for the open drain output 2 signal.

Use “Flow rate upper/lower limit alarm output” to output an alarm and stop measurement at an arbitrary flow rate. When this function is selected, also set [F6] Alarm output contact state, [F7] Alarm output lower limit flow rate, [F8] Alarm output upper limit flow rate, and [F9] Alarm threshold hysteresis width.

[F5] Output pulse unit

Choose from "1000," "100," and "10" for the output pulse unit (in L/P).

This setting is reflected on the output unit pulse for the open drain output 1.

[F6] Alarm output contact state

Choose from "Normal open (n.OP)" and "Normal close (n.CL)" for the contact state of the flow rate upper/lower limit alarm output.

[F7] Alarm output lower limit flow rate

Set the alarm output lower limit flow rate (4 digits) as the lower limit of the flow rate upper/lower limit alarm output.

[F8] Alarm output upper limit flow rate

Set the alarm output upper limit flow rate (4 digits) as the upper limit of the flow rate upper/lower limit alarm output.

[F9] Alarm threshold hysteresis width

For the specified upper and lower flow rates of the flow rate upper/lower limit alarm output, set the alarm threshold hysteresis width (4 digits) to stop the alarm output.

For example, if you set "Alarm output upper limit flow rate" to "1000[m^3/h]," "Alarm output lower limit flow rate" to "200[m^3/h]," "Alarm output contact state" to Normal close (n.CL)," and "Alarm threshold hysteresis width " to "10[m^3/h]," the flow meter triggers an alarm when the flow rate increases to 1000[m^3/h] or higher , and stops it when the flow rate goes lower than 990[m^3/h]. The flow meter also triggers an alarm when the flow rate decreases to 200[m^3/h] or lower, and stops it when the flow rate increases to 210[m^3/h].

[F10] Moving average count

As the moving average count for displaying and outputting the momentary flow rate, choose from "No moving average (01)," "2 times (02)," "4 times (04)," "8 times (08)," and "16 times (16)." The default is "4 times" and the most recent four measurement values are used. You normally do not need to change the moving average count in normal use, however, you can change it if you want to use more samples for the average.

[F11] Test function time

Choose from "3 minutes (3)," "60 minutes (60)," and "Unlimited (--)" for the duration of the test function. The factory default is 3 minutes and you can change it as required.

7. Setting of Procedure (Refer to "5. Operation of Display Part" on Page 13 for the SW1, SW2, and SW3 switches.)

Use the procedure below to change the setting items.

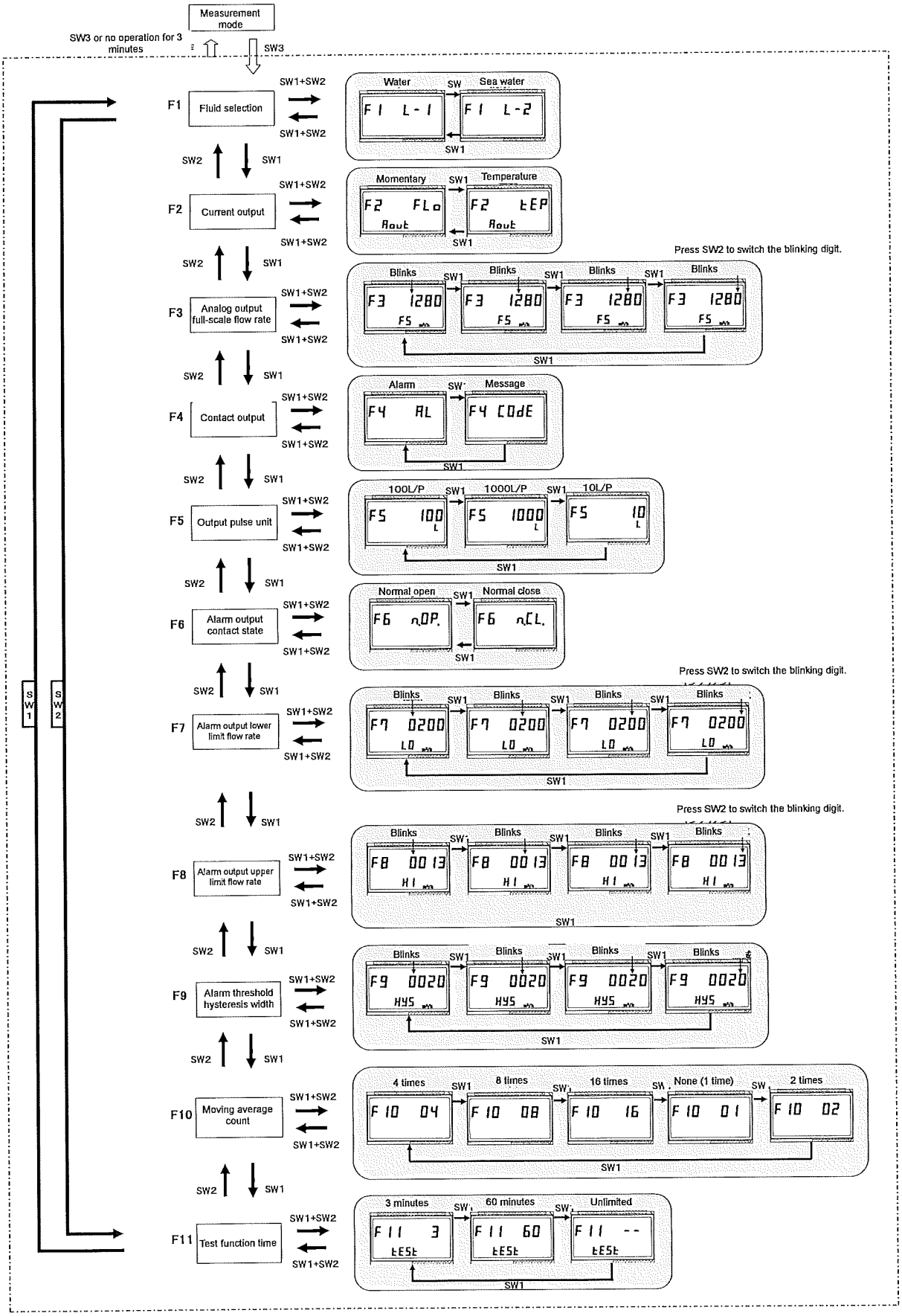


Figure 7-1. Switching Setting Mode Displays

8. Output Signals

When using output

Connect the optional external connection cable to the output connector and wire it as follows:

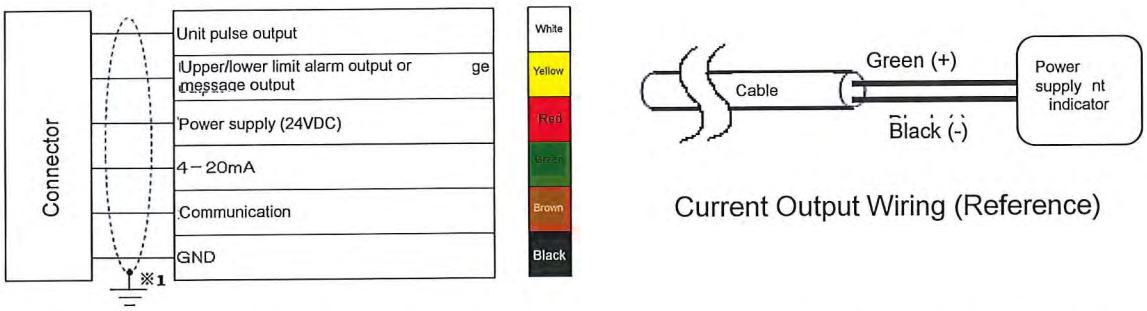


Figure 8-1. External Connection Cable Wiring Diagram for External Power Supply Model (G)

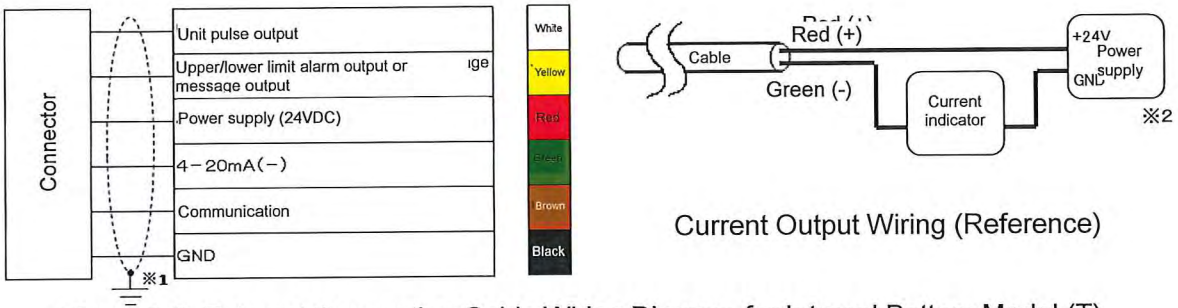


Figure 8-2. External Connection Cable Wiring Diagram for Internal Battery Model (T)

・Body and GND are electrically common.
Use an isolated power supply and indicator as necessary.

*1: If you should install the flow meter near a noise source, ground the braided shield of to the external connection cable.

*2: When using a current output with the internal battery model, a separate power supply (24VDC±10%) is necessary except for equipment of which indicator outputs 24V.

*3: Since the current is not output correctly if there is an conduction between the case (and metal pipe) and power supply GND, be sure to insulate them. Since there is an conduction between the case and signal ground (SG) of the electrical circuit, if the case electrically connects with the metal pipe, an unintended current loop is formed in addition to the correct current loop and the current may not be output correctly. Be sure to use the centering collars to insulate the flow meter from metallic bolts.

(Note) Refer to the Operation Manual of the indicator for its wiring.

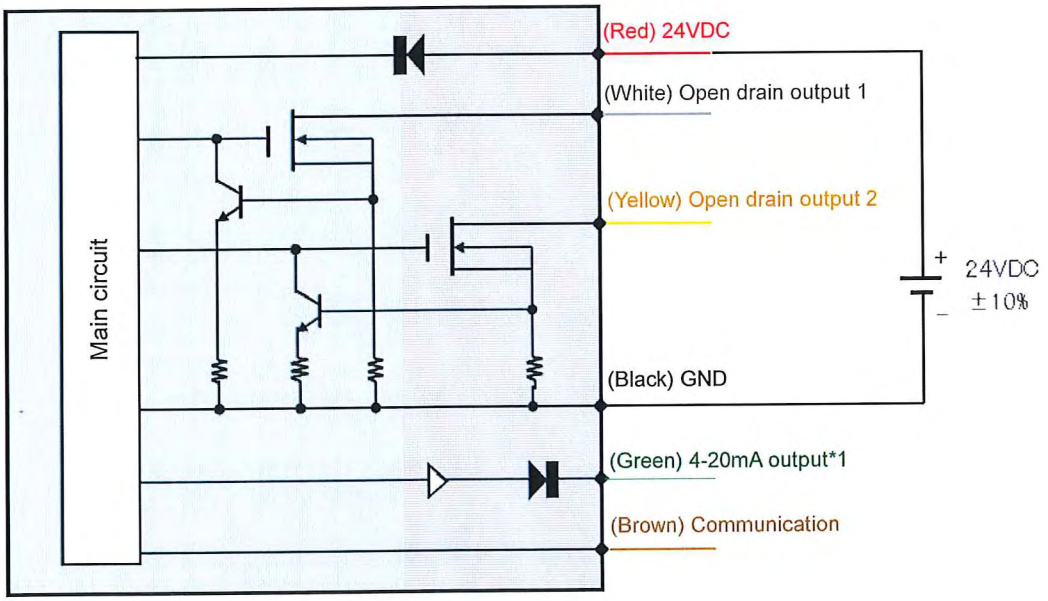
[Reference] Maximum cable length: 100m

This is the maximum operation range confirmed under our test conditions. The actual maximum operation range may differ depending on the installation

environment, connected equipment, and/or type of cable used.

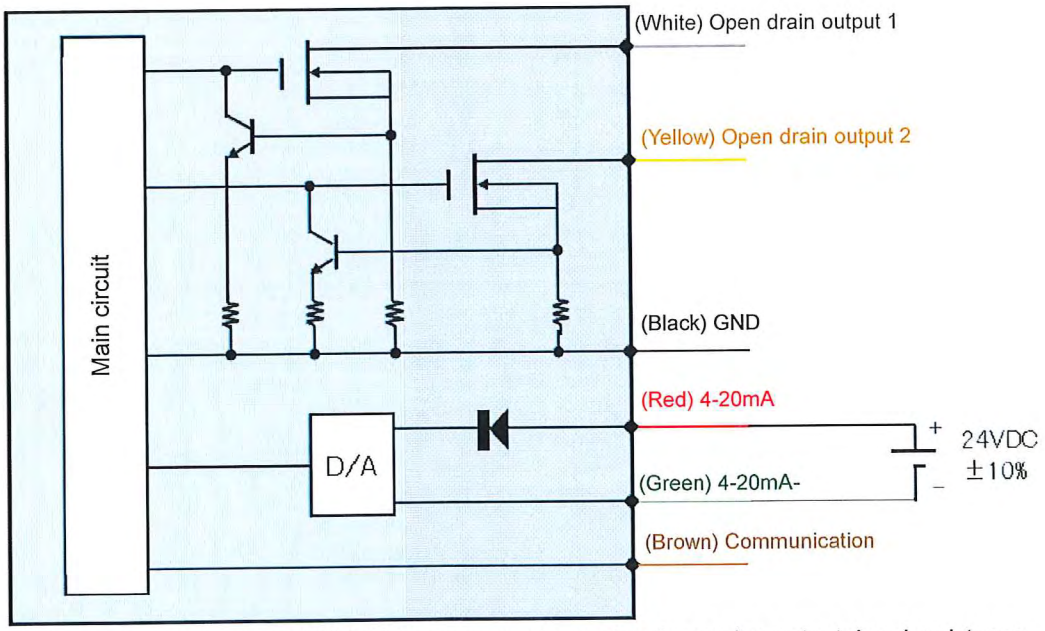
When the cable is too long, signal may be attenuated and/or noise may be superimposed.

The figure below shows the I/O circuit.



*1: Load resistance should be 400Ω or less.

Figure 8-3. I/O Circuit Diagram for External Power Supply Model (G)



*2: Separate power supply (24VDC) is necessary to provide the analog output. Load resistance should be 400Ω or less.

Figure 8-4. I/O Circuit Diagram for Internal Battery Model (T)

9. Starting Operation

1) If there are foreign materials accumulated in the pipe, flow rate distribution in the pipe may be affected. Remove them completely.
2) When starting operation, gradually open the valve and confirm that the pilot lamp blinks. Blinking of the pilot lamp indicates that fluid is flowing.

10. Alarm Display

1) Measurement error

When the ultrasonic signal is weak and cannot be received, "ALARM1" turns on or blinks (when bubbles or foreign substances are temporarily mixed in the fluid), and the instantaneous flow rate is displayed as "0.0," accumulated flow amount remains at the last value before detecting abnormality and accumulation stops, and the analog output feeds 4mA.

Check if the measurement pipe is filled with water, bubbles are not mixed in the fluid in the pipe, a solid substance which prevents from movement of ultrasonic waves is not mixed in the fluid, or a foreign substance is not adhered to accumulated on ultrasonic sensor and the inside of the tube. If "ALARM1" turns on or blinks although any of these abnormalities is found,contact the company you purchased our product from or our branch or sales offices.

2) Low battery voltage [internal battery model]

When the battery voltage becomes low, "ALARM2" is shown before measurement stops. While "ALARM2" is shown, measurement can continue for approximately 1 month (under the normal temperature). However, it is recommended to replace the flow meter as soon as possible.

3) Communication circuit error

When the communication line is short-circuited, "ALARM2" blinks. By resolving the short-circuit, "ALARM2" will disappear within 1 minute. While the communication line is short-circuited, functions other than communication can operate normally.

(Note) When the low battery voltage and communication line error alarms occur simultaneously, the communication line error is given priority so that "ALARM2" blinks.

4) Abnormal temperature

When an abnormal temperature is detected, the instantaneous flow rate or temperature value on the sub-display blinks.

When an abnormal temperature is detected, the momentary flow rate is displayed as "0.0," temperature remains at the last value before detecting abnormality, and the analog output feeds 4mA. The accumulated flow amount on the main display remains at the last value before detecting abnormality and accumulation stops.

Check that the used fluid matches the specifications and setting of the flow meter. If the abnormal temperature persists while using a correct type of fluid, contact the company you purchased our product from or our branch or sales offices.

11. Procedure on Power Failure [External Power Supply Model (G)]

1) Power failure detection

When the power supply voltage goes lower than 18±1.1V, the flow meter judges that a power failure has occurred and stops measurement as well as turns off the display.

2) Recovery from power failure

When the power supply voltage goes higher than 18.8±1.1V, the flow meter resumes measurement and turns on the display.

The accumulated flow amount is recorded once in every 5 minutes after power is on. When the flow meter has recovered from a power failure, the accumulated flow amount recorded immediately before the power failure is restored and accumulation resumes from this value.

After recovering from a power failure, the upper line of the display shows the accumulated flow amount. Note that if a power failure occurs while the trip accumulation display is used, the trip accumulated value will be cleared to zero.

12. Disassembly and Inspection

1) This flow meter cannot be disassembled.
2) Blinking of the pilot lamp indicates that fluid is flowing. If the pilot lamp does not blink, refer to the troubleshooting procedure on Page 23.
3) Regularly check for foreign materials inside the flow meter and remove them if any.

13. Battery Life

The battery life is 10 years (at average environmental temperature of 20°C and 63%RH) and may become shorter or longer depending on the actual environment. When the flow meter is exposed to the direct sunlight, it is recommended to provide a shade.

When the battery voltage becomes low, "ALARM2" is shown.

* When "ALARM2" is shown, it is recommended to replace the flow meter itself as soon as possible.

14. Troubleshooting

Refer to the troubleshooting below when a trouble occurs.

If the trouble cannot be resolved by performing the indicated counteraction or it occurs frequently, contact the company you purchased our product from or our branch or sales offices.

Troubleshooting

Symptom	Possible cause	Counteraction
ALARM1 is shown while fluid exists in the measurement tube.	The measurement tube is not full.	Change the pipe layout so that the pipe becomes full. Move the flow meter to another location so that the pipe becomes full.
	Many bubbles are mixed in the fluid continuously.	Check the pipes and take a measure so that bubbles are not mixed in. If the flow meter is located where bubbles cannot disappear, change the location.
	Solid matters have been mixed in the fluid repeatedly.	Measurement is not possible if a solid matter is mixed in the fluid because it disturbs reception of ultrasonic.
	Foreign substance is adhered to the inside of the pipe.	Use a piece of cloth and sponge to wash the inside of the pipe.
	Tightening torque upon piping was excessive.	Retighten the bolts at the rated torque. (See Page 12.)
	A large electrical noise source exists near the flow meter.	Remove the noise source, or attach a braided shield to the flow meter. When using an external output cable, ground the braided shield. (See Page 19.)
ALARM1 turns on or blinks when water flows and turns off when the flow stops.	Bubbles are mixed in the fluid.	Check the pipes and take a measure so that bubbles are not mixed in. If the flow meter is located where bubbles cannot disappear, change the location.
Displayed instantaneous flow rate is negative.	The fluid flow direction is opposite to the arrow direction of the flow meter.	Check if the fluid flow direction is aligned with the arrow direction of the flow meter.
Displayed instantaneous flow rate fluctuates excessively while the actual flow rate is constant.	Straight pipe length is not sufficient.	Provide straight pipes of recommended lengths at the upstream and downstream sides of the flow meter. (See Page 9.)
	There is something to disturb the flow (e.g., valve or pump).	Provide straight pipes of recommended lengths at the upstream and downstream sides of the flow meter. (See Page 9.)
	There is pulsatory motion.	Move the flow meter where no pulsatory motion is present.
Displayed instantaneous flow rate does not change while the actual flow rate has been changing.	Bubbles are mixed in the fluid.	Check the pipes and take a measure so that bubbles are not mixed in. If the flow meter is located where bubbles cannot disappear, change the location.
Displayed instantaneous flow rate does not become "0" while there is no flow.	Water is circulating inside the pipe.	Check the momentary flow rate with the flow before and after the flow meter completely blocked.
	The pipe is not full when the flow stops.	Change the pipe layout so that the pipe becomes full. Move the flow meter to another location so that the pipe becomes full.
	The test mode is on.	Check if the unit on the sub-display is blinking. (Refer to "Test Mode" on Page 14.)
The instantaneous flow rate is too high.	Bubbles are mixed in the fluid.	Check the pipes so that bubbles are not mixed in. If the flow meter is located where bubbles cannot disappear, easily change the location.
	Adjustment of ultrasonic waves failed when bubbles were mixed in the fluid.	Dry the flow meter, or power it off. (External power supply model only)

Symptom	Possible cause	Counteraction
	Straight pipe length is not sufficient.	Provide straight pipes of recommended lengths at the upstream and downstream sides of the flow meter. (See Page 9.)
	Fluid other than water or sea water	A fluid other than water or sea water cannot be measured correctly.
	The measurement pipe is not full.	Change the pipe layout so that the pipe becomes full. Move the flow meter to another location so that the pipe becomes full.
	Mud and sand are accumulated.	Remove the accumulated mud and sand.
	Foreign matter is adhered to the inside of the pipe.	Use a piece of cloth and sponge to wash the inside of the pipe.
	When the flow meter is installed horizontally, the display faces sideways.	Change the orientation of the display so that it faces up or down.
The instantaneous flow rate is too low.	Bubbles are mixed in the fluid.	Check the pipes and take a measure so that bubbles are not mixed in. If the flow meter is located where bubbles cannot disappear, easily change the location.
	Straight pipe length is not sufficient.	Provide straight pipes of recommended lengths at the upstream and downstream sides of the flow meter. (See Page 10.)
	Fluid other than water or sea water	A fluid other than water or sea water cannot be measured correctly.
	When the flow meter is installed horizontally, the display part faces sideways.	Change the orientation of the display part so that it faces up or down.
ALARM2 turns on.	The battery voltage is low.	Contact the company you purchased our product from or our branch or sales offices. (It means that the internal battery has running out.)
ALARM2 blinks.	Communication circuit error	Check the communication line (brown) to see if it is short-circuited or broken.
Sub-display blinks. (Instantaneous flow rate or temperature display blinks.	Temperature value error	Check that the fluid used matches the specifications and setting of the flow meter.
Displayed temperature differs from the actual temperature.	The built-in temperature sensor is affected by the outside temperature.	Reduce the influence of the outside temperature, for example, by covering the flow meter with a heat insulation material.
Analog output or pulse output is not available.	TRA-S (instantaneous flow rate type) does not provide these outputs.	Replace the flow meter with TRA-T (accumulation type) or TRA-G (external power supply type).
	The fluid is flowing in the reverse direction, or the fluid flowed in the reverse direction and then returned to the normal direction but the accumulated value has not reached the last value recorded before reverse flowing started.	Flow the fluid in the normal direction, and wait until the accumulated value reaches the last value recorded before reverse flowing started.
	The flow meter is powered off. (External power supply model only)	Power on the flow meter. (While the flow meter is powered off, the analog output feeds 0mA.)
Analog output value differs from the value displayed on the flow meter.	The metallic part of the flow meter or the external output cable is short-circuited.	Solve the short-circuit of the metallic part of the flow meter or the external output cable. In order to avoid conduction between a metallic bolt and metallic pipe, be sure to use the centering collars when installing the flow meter on the pipe. (See Page 11.)
Display cannot be switched with the button.	The power supply is not sufficient. (External power supply model only)	Supply 24V voltage.
"ﾄ" is displayed at the beginning of the accumulated flow amount.	Trip accumulation display is active.	Press the switch on the left-hand side when viewed from the display part side.

Memo

Warranty and After-Sales Service

1) Warranty period

If a defect which is subject to our liability should occur during the warranty period under normal use, we shall repair the product or replace it with a normal product for free.

2) Warranty scope

Please understand that the free remedy shall not be applied to a defect:

- Caused by an act of God such as a disaster,
- Caused by disassembly or alteration,
- Caused by misuse of the product,
- Caused by use in a condition (e.g., environment) outside the specifications, and/or
- Caused by a factor for which we are not responsible

3) Repair after the warranty period

If the product can be restored to the functional state by a repair, we shall repair it by your request for a charge.

4) When requesting for a service

Whether it is during or after the warranty period, contact our local branch or sales office with such information as the product name, model (TRA), construction number, serial number, options (if any), and description of the trouble (as detailed as possible).

Aichi tokei denki co., ltd.
1-2-70 Chitose, Atsuta-ku, Nagoya, Aichi Prefecture 456-8691 JAPAN
URL: http://www.aichitokei.co.jp

Contact us at your nearest branch office or sales office.

Sapporo Branch Office	TEL (011)642-9500	Nagoya Branch Office	TEL (052)661-5843
Kushiro Sales Office	TEL (0154)23-7859	Kanazawa Sales Office	TEL (076)252-1942
Sendai Branch Office	TEL (022)258-1181	Shizuoka Sales Office	TEL (054)237-7168
Aomori Sales Office	TEL (017)738-7531	Nagano Satellite Office	TEL (026)254-5677
Morioka Sales Office	TEL (019)646-8836	Osaka Branch Office	TEL (06)6305-9052
Tokyo Branch Office	TEL (03)3209-0631	Hiroshima Sales Office	TEL (082)292-8289
Yokohama Sales Office	TEL (045)661-1491	Takamatsu Sales Office	TEL (087)851-6664
Chiba Sales Office	TEL (03)5658-1320	Okayama Sales Office	TEL (086)207-6828
Omiya Sales Office	TEL (048)668-0131	Fukuoka Branch Office	TEL (092)534-2050
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