

Sep, 2020

# Ultrasonic Flowmeter for Fuel Gas and Factory Air AS-WW

## Handling Manual



# Ultrasonic Flowmeter for Fuel Gas and Factory Air AS Series

## Handling Manual

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○ **Preface/Request and Notice**

Thank you very much for purchasing our ultrasonic flowmeter for fuel gas and factory air AS-WW. Be sure to read this manual thoroughly in order to use it correctly and prevent an accident. This manual is also necessary for maintenance. Be sure to keep it until you dispose of the flowmeter.

○ **Product Overview**

This product is an ultrasonic flowmeter for fuel gas and factory air and capable of flow volume measurement of fuel gas and air at the atmospheric pressure to 1 MPa abs or less. Installation is done by screwing with taper screw or tightening with flanges.

- Screw type (taper screw) models: AS-WW-25, AS-WW-32
- Flange type models: AS-WW-40, AS-WW-50, AS-WW-80, AS-WW-100, AS-WW-150, AS-WW-200

○ **Model**

The models are classified as follows according to the nominal diameter and working pressure.

AS-WW-[nominal diameter]-[pressure sensor specification] BA/4

[Nominal diameter]

25A: 25    32A: 32  
40A: 40    50A: 50    80A: 80  
100A: 100    150A: 150    200A: 200

[pressure sensor specification]

No pressure sensor:                    0 (For all nominal diameters)  
With 0.2MPa pressure sensor\*:    200 (For all nominal diameters)  
With 0.5MPa pressure sensor\*:    500 (For all nominal diameters)  
With 1.0MPa pressure sensor\*:    1000 (For 40A to 200A)

B:[Built-in battery model]  
A:Absolute pressure sensor  
4:Version

○ **Important Notice**

**For safe use of the product and to prevent a failure and unexpected situation, this manual uses the safety indications listed below.**

**Safety indications**

 <b>Danger</b>	Indicates that death or serious injury is imminent if you do not observe the precaution with this symbol.
 <b>Warning</b>	Indicates that death or serious injury is likely if you do not observe the precaution with this symbol.
 <b>Caution</b>	Indicates that an injury or physical damage (fault of the flowmeter) is likely if you do not observe the precaution with this symbol.
	 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**

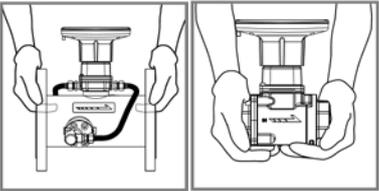
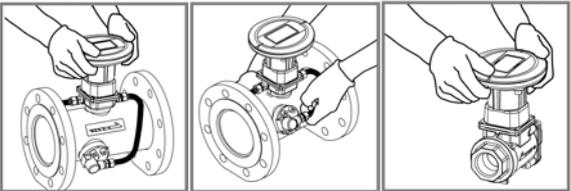
**Notes on use**

 <b>Danger</b>	<ul style="list-style-type: none"> <li>⊘1. Do not use the flowmeter for a purpose which requires safety including, but not limited to, atomic power, railroad, aviation, vehicle, or playground equipment.</li> <li>⊘2. Do not alter the flowmeter.</li> <li>⊘3. Do not use the product in the atmosphere of an inflammable gas, etc., because it is not of explosion-proof specifications</li> </ul>
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## Operating environment and Measurable fluid

 <p><b>Caution</b></p>	<p>⊘ 1. Do not use any other gas than fuel gas and air.</p> <p>ⓘ 2. Observe the temperature and humidity ranges (-20 to +40°C, 90%RH or lower) and pressure range (0.07Mpa to 1.0MPa abs or less).</p> <p>⊘ 3. Avoid usage in an ambient containing corrosive gas (chlorine, hydrogen sulfide, etc.) and/or for an application to fluid containing corrosive gas.</p> <p>⊘ 4. The flowmeter is not waterproof (IP64). Do not install the flowmeter at a place where it can be submerged.</p> <p>ⓘ 5. Install the flowmeter as far away as possible from electrical noise sources. If it should be necessary to install the flowmeter near an electrical noise source, ground the shield of the external connection cable.</p> <p>6. When the flowmeter is installed at a place where it is exposed to direct sunlight, it is recommended to install a sunshade.</p> <p>7. Ultrasonic measurement may become unavailable due to relation between methane concentration and working pressure value. Observe working pressure condition for the following methane concentration.</p>															
	<table border="1"> <thead> <tr> <th>Nominal diameter</th> <th>Methane concentration</th> <th>Working Pressure (absolute)</th> </tr> </thead> <tbody> <tr> <td rowspan="3">200A</td> <td>99%~100%</td> <td>250kPa or higher</td> </tr> <tr> <td>97%~99%</td> <td>150kPa or higher</td> </tr> <tr> <td>97% or lower</td> <td>No restriction</td> </tr> <tr> <td rowspan="2">150A</td> <td>98%~100%</td> <td>100kPa or higher</td> </tr> <tr> <td>98% or lower</td> <td>No restriction</td> </tr> </tbody> </table>	Nominal diameter	Methane concentration	Working Pressure (absolute)	200A	99%~100%	250kPa or higher	97%~99%	150kPa or higher	97% or lower	No restriction	150A	98%~100%	100kPa or higher	98% or lower	No restriction
	Nominal diameter	Methane concentration	Working Pressure (absolute)													
	200A	99%~100%	250kPa or higher													
		97%~99%	150kPa or higher													
		97% or lower	No restriction													
	150A	98%~100%	100kPa or higher													
98% or lower		No restriction														
<p>* No restriction for the 100A and smaller models.</p>																

## Operation

 <p><b>Warning</b></p>	<p>⊘ 1. Do not install the flowmeter on a footstep or do not get on it.</p> <p>⊘ 2. Do not hold the flowmeter with its display portion.</p> <p>Hold the flowmeter with the portions shown in the figure below since it is a precision instrument.</p>
	<p>○ Correct      ○ Correct</p> 
	<p>× Incorrect    × Incorrect    × Incorrect</p>  <p>⊘ 3. Do not press the glass portion.</p>

 <b>Caution</b>	<ul style="list-style-type: none"> <li>ⓘ 1. Open or close the valve slowly. Rapidly opening or closing the valve when there is a pressure difference between the upstream and downstream sides of the valve may damage the flowmeter.</li> </ul>
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### Storage

 <b>Caution</b>	<ul style="list-style-type: none"> <li>⊘ 1. Store the flowmeter away from fire and direct sunlight.</li> <li>⊘ 2. Keep the flowmeter away from combustible, inflammable, and/or heating materials.</li> <li>ⓘ 3. Store the flowmeter in a place where the surrounding temperature is -25 to +70°C with no dewing.</li> </ul>
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### Piping

 <b>Caution</b>	<ul style="list-style-type: none"> <li>1. Install an object which disturbs the flow (e.g., flow regulating valve) at the downstream side of the flowmeter.</li> <li>2. For a new piping system, thoroughly wash it before installation.</li> <li>3. Vertical piping is recommended when a large amount of mist and dust is contained in the fluid. For horizontal piping, be sure to install the flowmeter so that the display portion faces up.</li> <li>4. Do not install the flowmeter where a strong compression or tension force is applied to it.</li> <li>5. Lay pipes in accordance with the flow direction indicated on the flowmeter.</li> <li>6. Do not drop, hit, or apply an excessive impact to the flowmeter.</li> <li>7. When rotating the display portion, do not apply a force in any other direction than the rotation direction.</li> <li>ⓘ 8. Do not touch the ultrasonic sensor.</li> </ul>
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### Wiring

 <b>Danger</b>	<ul style="list-style-type: none"> <li>ⓘ 1. Observe the instructions given in this manual for wiring.</li> <li>ⓘ 2. Observe the rated range. ⊘ Do not use the flowmeter under a voltage exceeding the rated load.</li> </ul>
 <b>Caution</b>	<ul style="list-style-type: none"> <li>1. Keep the cables away from the power and motor cable.</li> <li>2. Do not apply an excessive tension to the external connection cables.</li> <li>3. Be careful so that the tip of an external connection cable is submerged during the wiring work.</li> <li>ⓘ 4. When connecting the power cable to an external power supply, be sure to prevent a short-circuit. Use an external power supply with a short-circuit prevention function.</li> <li>ⓘ 5. Turn off the external power supply at the time of wiring.</li> <li>⊘ 6. Do not perform operation and wiring work with wet hands.</li> </ul>

### Disassembly and inspection

 <b>Caution</b>	<ul style="list-style-type: none"> <li>⊘ 1. Do not disassemble the flowmeter.</li> <li>2. Presence of fluid flow wakes a pilot lamp blink in a normal state. If it does not blink, contact us.</li> <li>3. When a large amount of mist and dust is contained in the fluid, regularly remove the flowmeter and check and clean foreign substances as necessary the inside for.</li> <li>ⓘ Remove the flowmeter from the pipe, cover one of the connection port, and then wash the inside with water or spindle oil. (For details, refer to "ALARM1 turns on" in "After deployment" in "11. Troubleshooting".)</li> <li>ⓘ Do not touch the ultrasonic sensor during inspection.</li> </ul>
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### Disposal

 <b>Warning</b>	<ul style="list-style-type: none"> <li>ⓘ 1. Since this product contains lithium batteries it cannot be disposed as domestic waste.</li> <li>ⓘ 2. Never throw the flowmeter into fire. Combustion or explosion may occur.</li> </ul>
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# 1. Introduction

## 1-1. Checking Supplied Items

Upon delivery of the product, check that the following items are contained.

Name	#	Note
Ultrasonic flowmeter	1	
Centering collar	2	See Page 20 for how to use them. Supplied with the flange type. ( 6 models from AS-WW-40 ~ 200, excluding AS-WW-25 and AS-WW-32)
M4 hexagonal wrench	1	Used to tighten the set screw to change the display unit orientation as well as to push the rear center button (SW3).
Handling Manual (this book)	1	



M4 hex wrench



Handling Manual  
(this book)



Centering collar

## 1-2. Name of each part

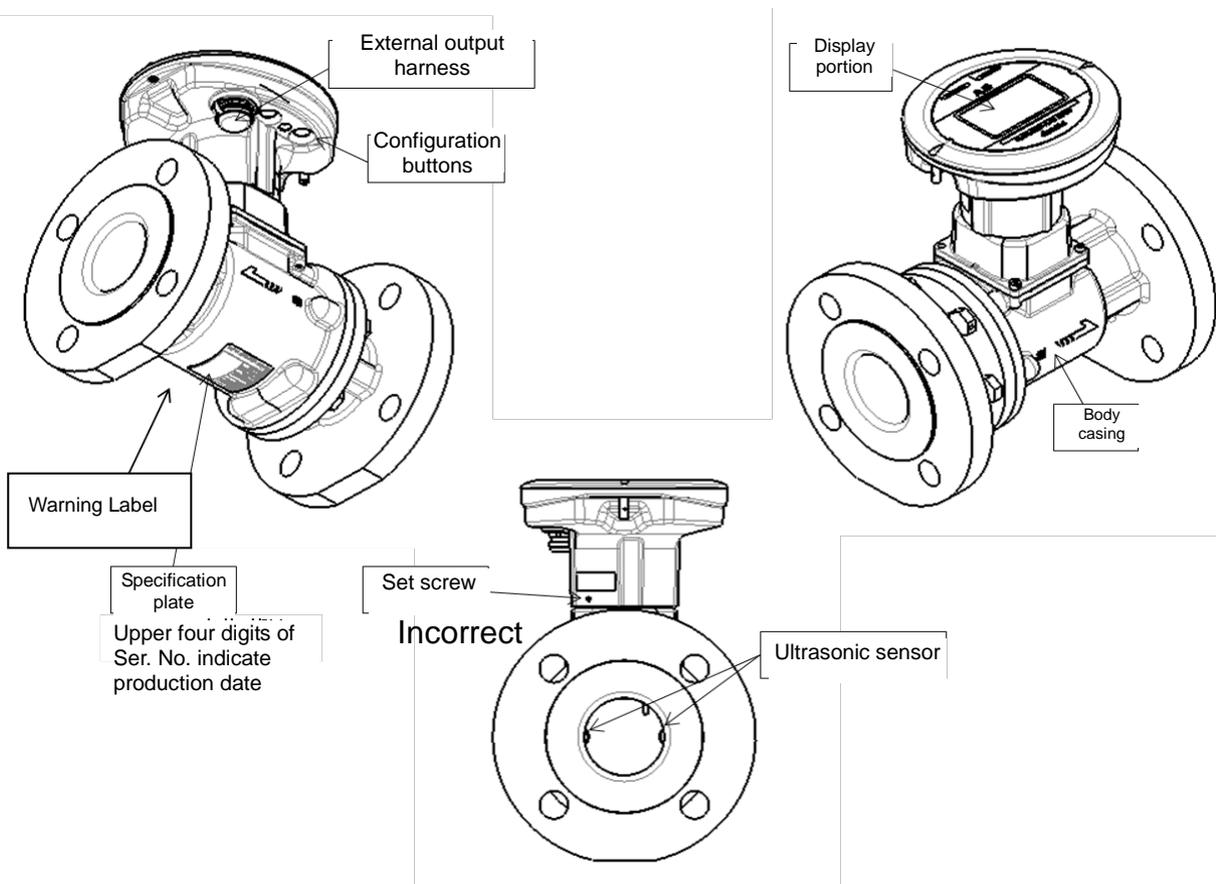
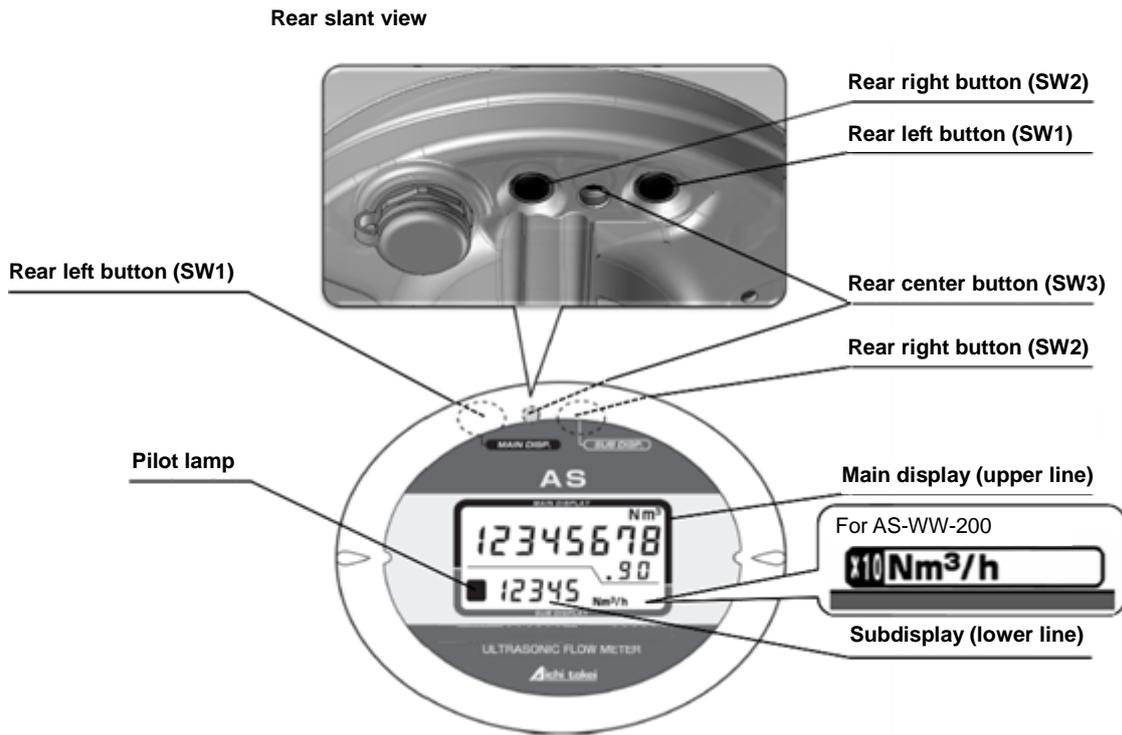


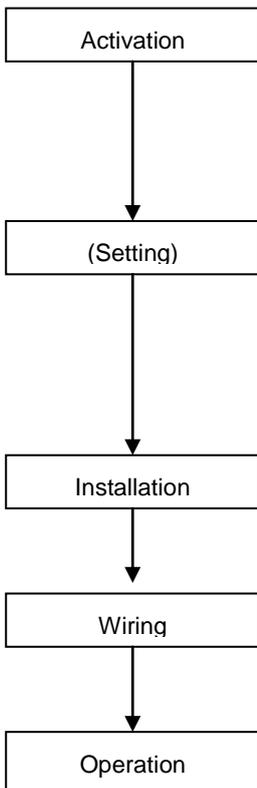
Figure 1-1. Part Names of Operation and Display Portions



### 1-3. Flow of startup operation

The basic flow to start operating is as follows:

While you can configure the flowmeter after installation, it is recommended to configure it before installation.



#### Activation

To prevent the built-in battery from running out, measurement mode was suspended when shipped from factory. Please use the flowmeter after activation.

#### Setting

You can configure items related to measurement, output, and communications. The factory settings are applied to the product when shipped from the factory, and you can use it without any configuration. To customize configuration in according to customer's operational circumstances, refer to "3. Configuration".

#### Installation

Refer to the recommended conditions and notes on piping in "4. Installation". Be sure to read them since improper piping may hinder correct measurement.

#### Wiring

Refer to the notes on wiring between the RS485 power supply and receiver. Be sure to read them to use the flowmeter correctly.

#### Operation

Refer to the notes on starting operation in "6. Operation".

## 2. Activation

To prevent the built-in battery from running out, measurement mode was suspended when shipped from factory. The LCD indication is blank when opened the package. Pressing the back central button (SW3) makes the LCD be illuminated and measurement be started.

Use the enclosed hexagonal wrench or similar tool to press SW3. Do not press it with a sharp tip to avoid any damage.

## 3. Configuration

### 3-1. Standard Factory defaults

You can configure items related to measurement, output, and communications with this flowmeter. (Table 3-1)

The factory defaults are applied to the product when shipped from the factory. You can use it without any configuration.

To change the factory defaults, refer to "3-2 Configuration changing procedure".

Table 3-1. Configuration items and standard factory defaults

Classification 1		Classification 2		Classification 3	Setting Range	factory defaults
No.	Item	No.	Item	Item		
F0	Software version	—	—	—	—	—
F1	Measurement	F1-1	Related to flow measurement	Gas type	G-1: AIR G-2: Natural Gas	G-2
				Maintenance	—	—
				Selection for the indicated accumulated flow volume	Act: Forward actual accumulated flow volume Std: Forward accumulated conversion flow volume	Std
				Instantaneous flow moving average count	1 to 16 [times]	4
				Conversion reference temperature	-10.0~+60.0[°C]	20.0
				Conversion reference pressure	0.00~10.00[kPa]	0.00
		F1-2	Related to pressure measurement	Enable/disable working pressure setting	OFF: Disabled, ON: Enabled	0B: ON 200B、 500B、 1000B: OFF
				Working pressure	0.0~1000.0[kPa]	0BA: 101.3 0BA 以 外: 0.0
				Pressure value moving average count	1 to 4[times]	1
		F1-3	Related to Compressibility Factor	compressibility factor fixed value	0.800~1.200 0.000: Disable the fixed value setting	1.000
				CH4	0.000~1.000	0.800
				N2	0.000~1.000	0.000
				CO2	0.000~1.000	0.000
				C2H6	0.000~1.000	0.200
		C3H8	0.000~1.000	0.000		

Classification 1		Classification 2		Classification 3	Setting Range	factory defaults
No.	Item	No.	Item	Item		
				i-C4H10	0.000~1.000	0.000
				C4H10	0.000~1.000	0.000
				i-C5H12	0.000~1.000	0.000
				C5H12	0.000~1.000	0.000
				C6H14	0.000~1.000	0.000
				C7H16	0.000~1.000	0.000
				C8H18	0.000~1.000	0.000
				C9H20	0.000~1.000	0.000
				C10H22	0.000~1.000	0.000
				H2	0.000~1.000	0.000
				O2	0.000~1.000	0.000
				CO	0.000~1.000	0.000
				H2O	0.000~1.000	0.000
				H2S	0.000~1.000	0.000
				He(Helium)	0.000~1.000	0.000
				Ar(Argon)	0.000~1.000	0.000
F2	Maintenance	—	Maintenance	Maintenance	—	—
F3	Output	F3-1	Related to Flowrate pulse output	Pulse output flow value selection	Act: real flowrate Std: conversion flowrate	Std
				Unit pulse output units	100,1000,10000[L]	1000
				Maintenance	—	—
				Pulse output ON width	50,125,250,500,1000[ms] duty	duty
		F3-2	Related to Communication	Communication bit rate	4800,9600[bps]	4800
				RTU address	000~255	001
F4	Maintenance	—	Maintenance	Maintenance	—	—
F5	Maintenance	—	Maintenance	Maintenance	—	—
—	Blank	—	—	—	—	—

### 3-2. Configuration change procedure

Refer to the display switching flow (Figure 3-1) and use the buttons to change configuration.

**!** Use the enclosed hexagonal wrench or similar tool to press SW3. Do not press it with a sharp tip to avoid any damage.

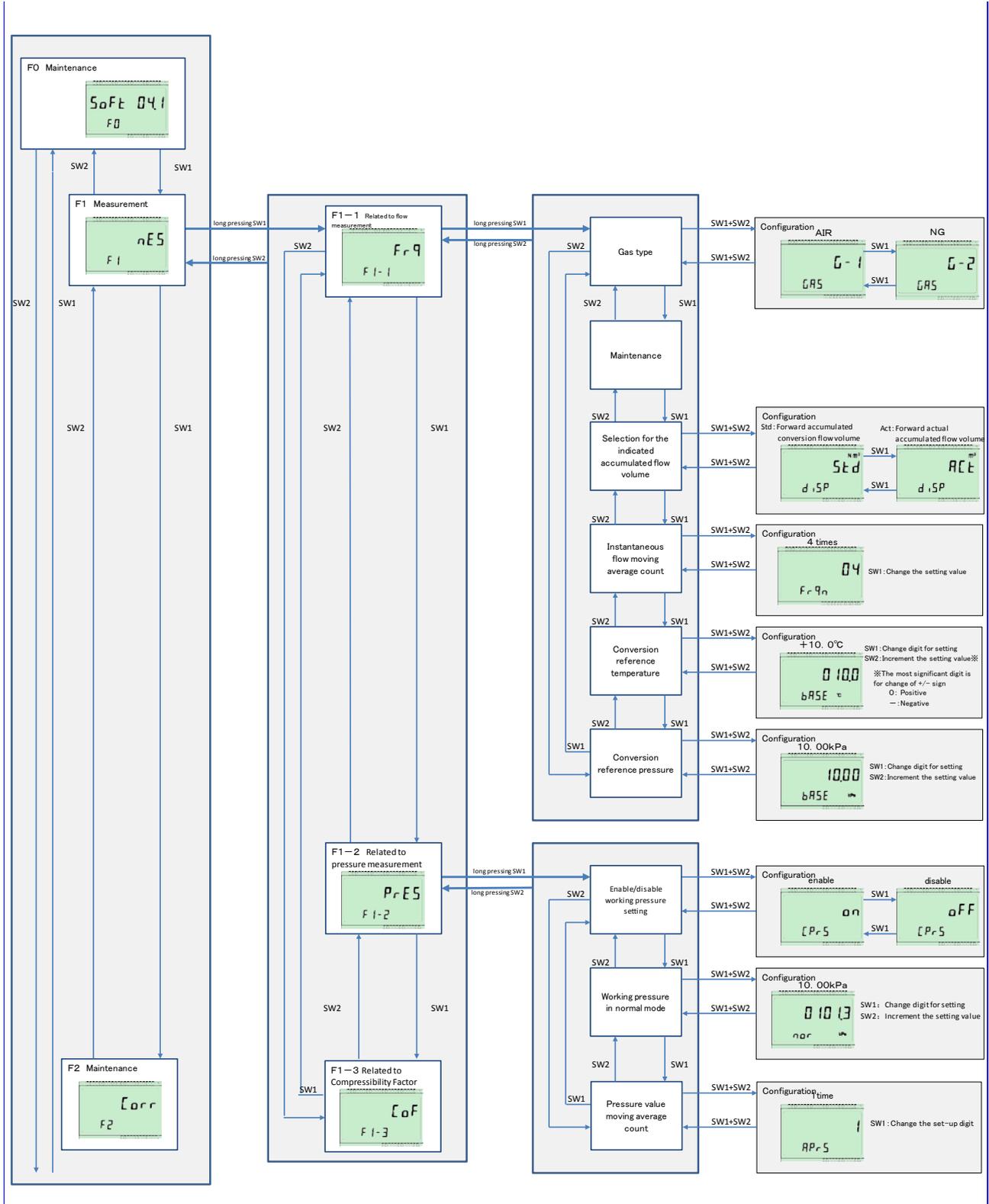


Figure.3-1 Indication switching flow (1/4)

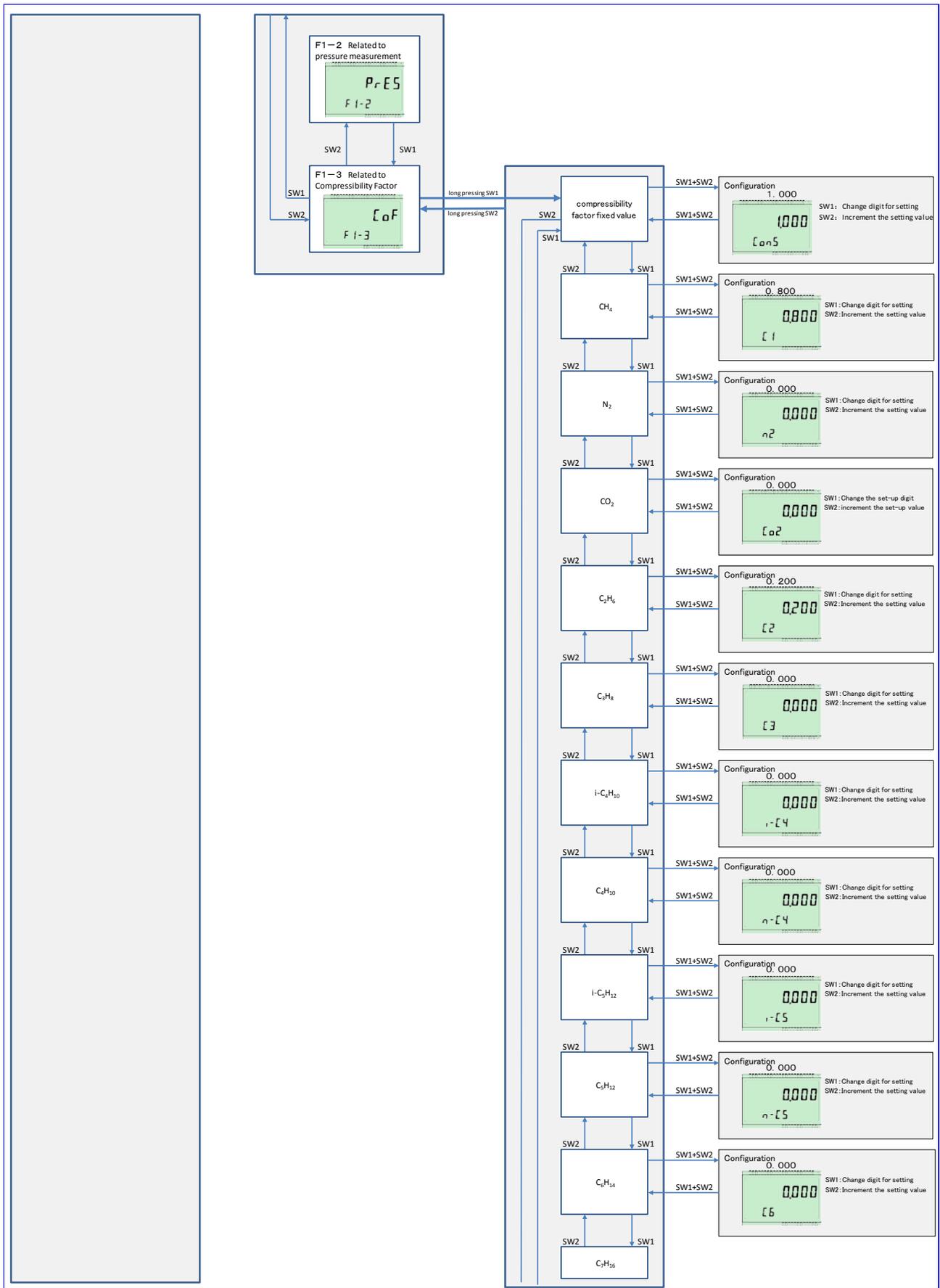


Figure.3-1 Indication switching flow (2/4)



Figure.3—1 Indication switching flow (3/4)

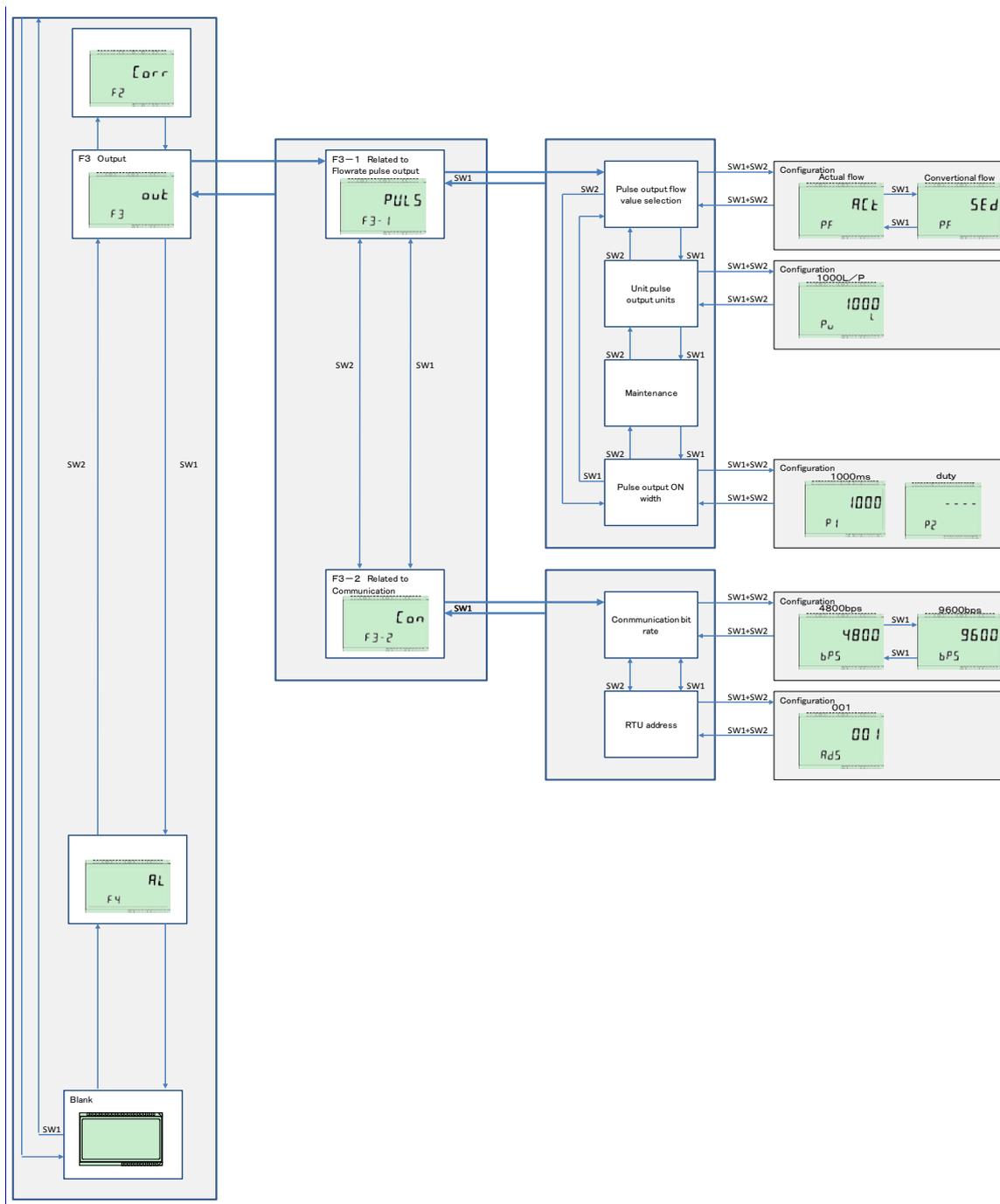


Figure.3-1 Indication switching flow (4/4)

### 3-3. Details of configuration items

- [F1-1] Gas type

Choose the fluid type to use from "Air (G-1)" and "Natural Gas (G-2)".  
The factory default is "Natural Gas (G-2)".

- [F1-1] Selection for the indicated accumulated flow volume

The forward accumulated flow volume indicated on the main LCD portion can be chosen from 「Actual flow (Act)」 or 「Conversion flow (Std)」.

The factory default is "Std".

- [F1-1] Instantaneous flow moving average count

Choose the moving average count for displaying and outputting the instantaneous flow. The default is 4 times and the most recent 4 times measurement values are used.

The moving average count in normal use does not require any charge, however, it is selectable from "No moving average (01)," "2 times (02)", "3 times (03)," ... "14 times (14)," "15 times (15)," and "16 times (16)."

- [F1-1] Conversion reference temperature

Choose the temperature used as the reference for flow conversion within the range from -10.0 to +60.0°C. The factory default is "20.0" (°C).

- [F1-1] Conversion reference pressure

Choose the pressure used as the reference for flow conversion within the range from 0.00 to 10.00 kPa (gauge pressure in increments of 0.01 kPa). The factory default is "0.00" (kPa).

- [F1-2] Enable/disable working pressure setting value

working pressure configuration value can be chosen from 「Enabled(on)」 or「Disabled(OFF)」.

The factory default for 0BA is "on", for 200BA、500BA、1000BA is "OFF"

- [F1-2] Working pressure in normal mode

Choose the working pressure in the normal mode within the range from "0.0kPa (0.0)" to "1000.0kPa (1000.0)".

The factory default is "101.3kPa (101.3)" for 0BA and "0.0kPa (0.0)" for other models.

The set pressure is used when the above [F1-2] working pressure setting value is set by "Enabled on".

- [F1-2] Pressure value moving average count

Choose the moving average count for pressure display from "Once (1)" to "4 times (4)"

Choosing "Once" disables moving average.

- [F1-3] Compressibility factor fixed value

Choose the compressibility factor fixed value from "0.800" to "1.200" and "0.000". When "0.800" to "1.200" is set, this fixed value becomes effective and is used for flow conversion. When "0.000" is set, this fixed value is no longer valid and the compressibility factor, calculated automatically by inputting gas composition, is to be used for flow conversion. The factory default is "1.000".

- [F1-3] Gas composition

When the compressibility factor fixed value is set to invalid "0.000", use this "Gas composition" function to calculate the compressibility factor by the meter internally. For the calculation, the composition of the gas to be measured shall be inputted, and 21 kinds of different gas composition can be inputted. (CH<sub>4</sub>, N<sub>2</sub>, CO<sub>2</sub>, C<sub>2</sub>H<sub>6</sub>, C<sub>3</sub>H<sub>8</sub>, H<sub>2</sub>O, H<sub>2</sub>S, H<sub>2</sub>, CO, O<sub>2</sub>, i-C<sub>4</sub>H<sub>10</sub>, n-C<sub>4</sub>H<sub>10</sub>, i-C<sub>5</sub>H<sub>12</sub>, n-C<sub>5</sub>H<sub>12</sub>, n-C<sub>6</sub>H<sub>14</sub>, n-C<sub>7</sub>H<sub>16</sub>, n-C<sub>8</sub>H<sub>18</sub>, n-C<sub>9</sub>H<sub>20</sub>, n-C<sub>10</sub>H<sub>22</sub>, He, Ar)

The calculation formula is in correspondence with GB/T 17747.1-2011 and GB/T 17747.2-2011. The gas composition is set at a mole fraction of 0.000 to 1.000. The total gas composition should be inputted to be 1.000.

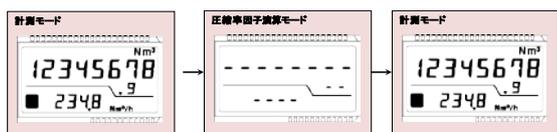
When inputting the gas composition or when activation is performed, the system mode automatically switches to "Compressibility factor calculation mode". Ultrasonic measurements and outputs are discontinued during the "Compressibility factor calculation mode". After the completion of the compressibility factor calculation, the system mode automatically switches to the measurement mode. In case of the fixed value is inputted, the system mode does not switch to "Compressibility factor calculation mode".

Figure.3—2 Display at the time of "Compressibility factor calculation mode"



(a) When activation is performed

(b) When setting gas composition by button operation



(c) When setting gas composition by communication

●[F3-1] Pulse output flow value selection

Choose the pulse output flow value. The factory default is "Conversion flow (Std)". In the "actual flow (Act)" mode, the output signal corresponds to the actual flow.

In the "conversion flow (Std)" mode, the output signal corresponds to the conversion flow.

A converted flow is calculated based on the temperature  $t$  [°C] and/or pressure  $p$  [kPa] monitored together with the flow.

$$Q_2 = Z \times (T_2 / (T_1 + t)) \times (p / P_1) \times Q_1$$

$Q_2$ : Conversion flow [Nm<sup>3</sup>/h]      $Q_1$ : Actual flow [m<sup>3</sup>/h]

$Z$ : Compressibility factor      $T_2$ : Absolute temperature of conversion reference temperature [K]

$T_1$ : Absolute temperature of 0°C      $T_1=273.15$ [K]      $t$ : Fluid temperature [°C]

$P_1$ : Absolute pressure of conversion reference pressure [kPa abs]

$p$ : Measurement pressure (absolute pressure) [kPa abs]

●[F3-1] Unit pulse output units

Choose from "10000", "1000", and "100" for the output pulse unit. (The unit is [L/P] or [NL/P].) It is reflected on the output unit pulse of the contact output (unit pulse: forward flow).

The value range available for selection depends on the nominal diameter.

Table 2-2 lists the available selection range for each nominal diameter.

When the unit pulse output unit is changed, the width of the pulse output ON is automatically set to [duty 50%].

Table 2-2. Available selection range

[One-short]

<25A>

Pulse ON width [ms]	Pulse output unit [L/P] / [NL/P]		
	100	1000	10000
50	○	○	○
125	○	○	○
250	○	○	○
500	×	○	○
1000	×	○	○

<32A>

Pulse ON width [ms]	Pulse output unit [L/P] / [NL/P]		
	100	1000	10000
50	○	○	○
125	○	○	○
250	×	○	○
500	×	○	○
1000	×	○	○

<40A>

Pulse ON width [ms]	Pulse output unit [L/P] / [NL/P]		
	100	1000	10000
50	○	○	○
125	○	○	○
250	×	○	○
500	×	○	○
1000	×	○	○

<50A>

Pulse ON width [ms]	Pulse output unit [L/P] / [NL/P]		
	100	1000	10000
50	○	○	○
125	×	○	○
250	×	○	○
500	×	○	○
1000	×	○	○

<80A>

Pulse ON width [ms]	Pulse output unit [L/P] / [NL/P]		
	100	1000	10000
50	○	○	○
125	×	○	○
250	×	○	○
500	×	○	○
1000	×	×	○

<100A>

Pulse ON width [ms]	Pulse output unit [L/P] / [NL/P]		
	100	1000	10000
50	×	○	○
125	×	○	○
250	×	○	○
500	×	×	○
1000	×	×	○

<150A>

Pulse ON width [ms]	Pulse output unit [L/P] / [NL/P]		
	100	1000	10000
50	×	○	○
125	×	○	○
250	×	×	○
500	×	×	○
1000	×	×	○

<200A>

Pulse ON width [ms]	Pulse output unit [L/P] / [NL/P]		
	100	1000	10000
50	×	○	○
125	×	×	○
250	×	×	○
500	×	×	○
1000	×	×	×

[Duty 50%]

Nominal diameter	Pulse output unit [L/P] / [NL/P]		
	100	1000	10000
25	○	○	○
32	○	○	○
40	○	○	○
50	○	○	○
80	○	○	○
100	×	○	○
150	×	○	○
250	×	○	○

●[F3-1] Pulse Output ON Width

Choose from the duty method ("Duty 50% (----)") and one-shot method (pulse ON width "50ms(50)", "125ms (125)", "250ms (250)", "500ms (500)", and "1000ms (1000)"). The factory default is "Duty 50% (----)".

Available pulse output widths for selection depend on the selected output method and one-shot pulse ON width. For details, refer to Table 2-2.

Also, when the unit pulse output unit is changed, it is automatically set to [Duty 50% (----)].

●[F3-2] Communication bit rate

Choose the communication bit rate from "4800" and "9600" (bps). The factory default is "4800".

●[F3-2] RTU address

Choose the address from "000" to "255". The factory default is "001".

●Maintenance setting

Do not alter this setting since it is intended for use by the maintenance personnel.

## 4. Installation

It is recommended to perform configuration of the flowmeter (**3. Configuration**) and adjustment of the display orientation (**4. Installation**) before installation.

### Notes on applied piping

This flowmeter guarantees the flow measurement accuracy with the pipes listed in Table 4-1.

(If you use a pipe with different pipe standard and size not listed in Table 3-1, the flowmeter may not satisfy the flow measurement accuracy. Consult us in advance if it is considered to use different pipe out of range.

As an example, Table 4-2 shows the piping standards and dimensions for the pipe inner diameter in Table 4-1.

Table 4-1 The recommended pipe inner diameter

Size	25	32	40	50	80	100	150	200
Pipe inner diameter(mm)	28.4	37.1	40.3	50	79.9	100	150	199.1
Connection method	ISO7-1 Taper screw connection (JIS B 0203,BS21,GB/T7306,2-2000) equivalent		ISO7005-1 (GB/T9119-2000 PN1.6Mpa flange)equivalent					

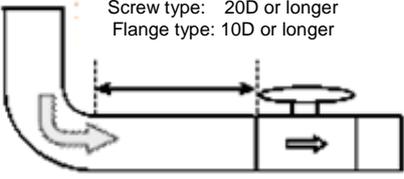
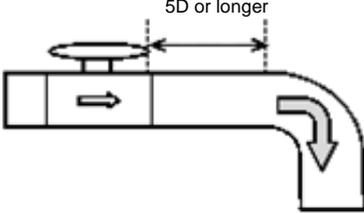
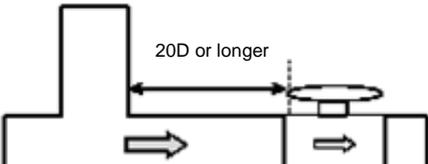
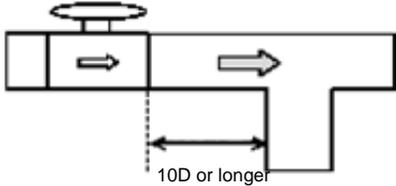
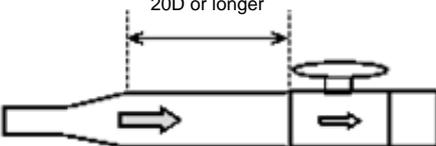
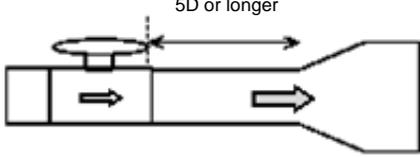
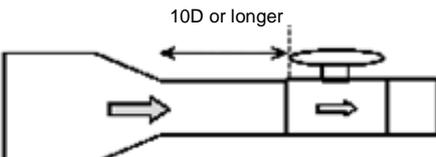
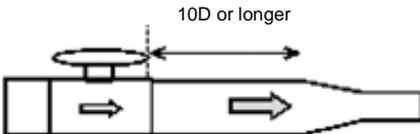
Table 4-2 Examples of piping standards and dimensions that satisfy the recommended pipe inner diameter

Pipe standard	G3459 JIS 10K		EN10208					
Nominal diameter(mm)	25	32	40	50	80	100	150	200
External diameter(mm)	34	42.7	48.3	57	88.9	108	159	219.1
Thickness(mm)	2.8	2.8	4	3.5	4.5	4	4.5	10

Notes on piping conditions

- 1) Align the arrow marked on the body with the forward flow direction of the fluid.
- 2) It is recommended to provide straight pipe length as illustrated in Figure 4-1 in accordance with piping condition.

Figure 4-1. Recommended strait pipe length 1 (D: nominal diameter)

Conditions	Upstream	Down stream
90° elbow/full-bore valve fully opened	 <p>Screw type: 20D or longer Flange type: 10D or longer</p>	 <p>5D or longer</p>
Joining	 <p>20D or longer</p>	 <p>10D or longer</p>
Enlarge pipe	 <p>20D or longer</p>	 <p>5D or longer</p>
Narrowing pipe	 <p>10D or longer</p>	 <p>10D or longer</p>

3) Since installing the flowmeter in the proximity of a reducing valve or flow regulating valve may cause ultrasonic noises to be generated inside the pipe, be sure to strictly observe the "necessary straight pipe length L" shown in Figure 4-2.

In particular, note that a strict restriction is applied when installing the flowmeter at the downstream of a reducing valve. **(Measurement can become unavailable if the necessary condition is not met.)**

(\* When using an elbow, replace "necessary straight pipe length" with "necessary pipe length (including curved pipe)". Also, be sure to provide 10D on straight pipe before the flowmeter.)

$\text{Necessary straight pipe length } L \text{ (mm)} = 10D + \frac{\text{Expected maximum flow (m/s)}}{20 \text{ (m/s)}} \times (0.8) \text{ Number of elbows} \times \text{Differential pressure (kPa)} \times \text{D}$
-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

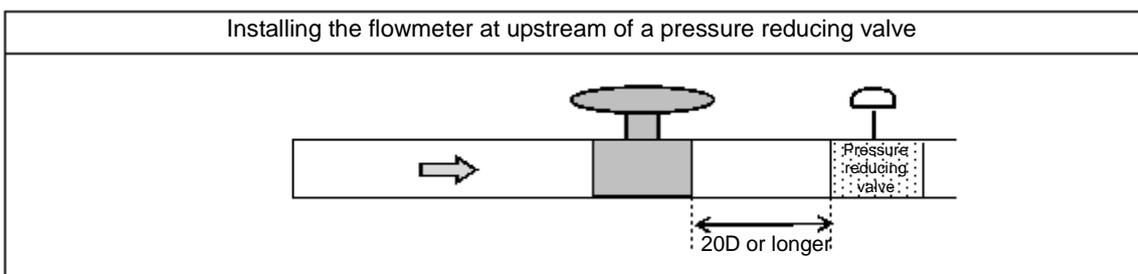
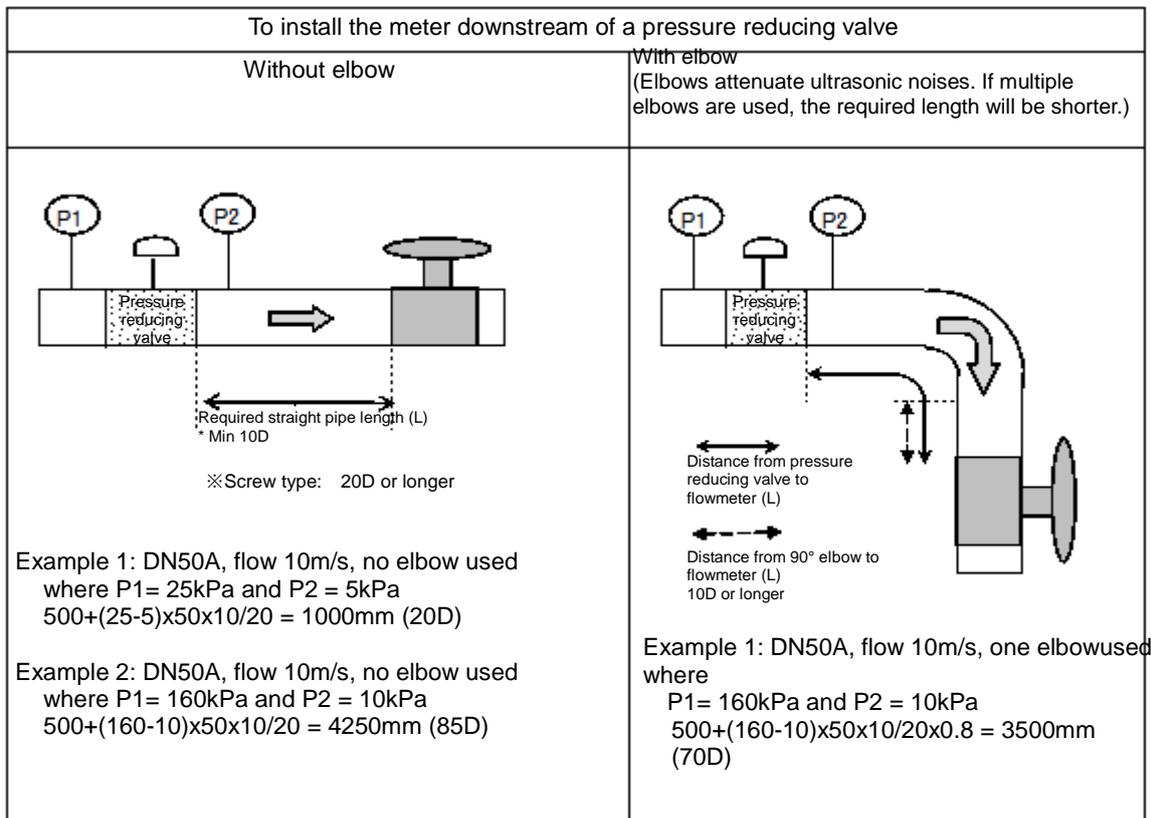
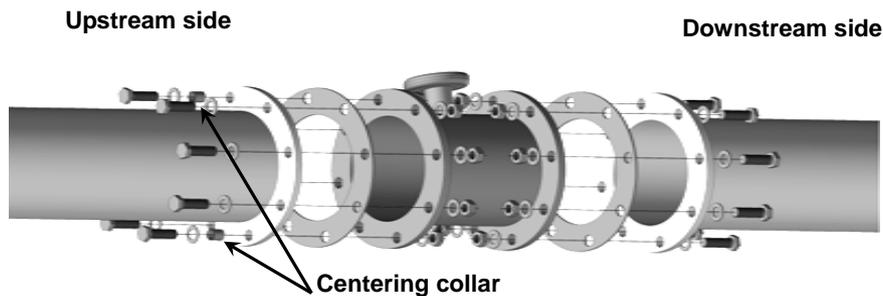


Figure 4-2. Recommended strait pipe length 2 (D: nominal diameter)  
 (When installing the flowmeter in the proximity of the reducing valve or flow regulating valve)

- 4) Install the flowmeter so that the center axis of the flowmeter is aligned with the center axis of the pipe. Be sure to use the supplied centering collars to minimize misalignment between the flowmeter and the center axis of the pipe. Measurement accuracy is not guaranteed without the usage of centering collars.

As shown in Figure 4-3, when installing the flowmeter at the upstream side, insert the centering collars into the gasket and flange holes at diagonal positions.

Figure 4-3. Attaching Centering Collars



- 5) This flowmeter can be installed indoor and outdoor in the horizontal and vertical orientations. Be sure to install the flowmeter at the middle of the straight portion.

Vertical piping is recommended when a large amount of mist and dust is contained in the fluid. The flowmeter is not waterproof (IP64). Do not install the flowmeter at a place where it can be submerged.

When installing the flowmeter outdoors, provide a sunshade to prevent exposure to direct sunlight.

When installing the flowmeter in a place where the flowmeter is exposed to rain drops, install it so that the display portion does not face downward.

- 6) Fix the flange type flowmeter using the M16 (for nominal diameters 40A, 50A, 80A, and 100A) or M20 (for nominal diameters 150A and 200A) bolts and nuts within the torque range listed below. (See Figure 4-3.) Be sure to tighten nuts on the opposite sides alternately with even force. For screw type flowmeter, please screw taper screw within the torque range below.

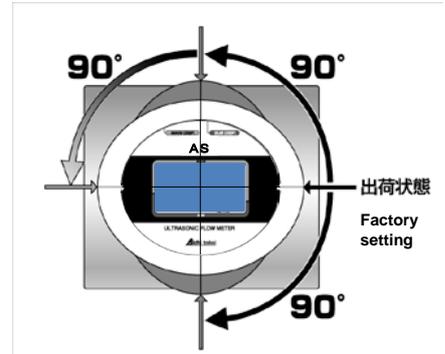
AS-WW-25(R1): 36 to 38Nm	AS-WW-32(R1-1/4): 47 to 49Nm
AS-WW-40: 160 to 180Nm	AS-WW-50: 220 to 240Nm
AS-WW-80: 330 to 350Nm	AS-WW-100: 130 to 150Nm
AS-WW-150: 290 to 310Nm	AS-WW-200: 240 to 260Nm

- 7) For the flange type flowmeter, ensure that the flange gasket does not protrude into the pipe.

- 8) The display portion can be rotated. It is recommended to rotate the display portion before installing the flowmeter. To change the orientation of the display portion, loosen the set screw at the neck below the display portion with the hexagonal wrench, and rotate the display portion. Once the display portion is rotated in the desired orientation, be sure to tighten the set screw to fix the display portion.

It can be rotated by 90° clockwise and 180° counterclockwise from the factory-set position.

When rotating the display portion, do not apply a force in any other direction than the rotation direction.



- 9) When piping, be careful so that foreign substances such as welding chip, dust, or sealant should not be entered. For a new piping system, thoroughly wash it before installation.
- 10) Do not install the flowmeter where a strong compression or tension force is applied to it.
- 11) Do not touch the inside of the flowmeter, especially the ultrasonic sensors (see P.6), during the piping process. In addition, do not drop, hit, or apply an excessive impact to the flowmeter. Do not hold the flowmeter with its display portion.

## 5. Wiring

Connect the optional external connection cable as shown below.

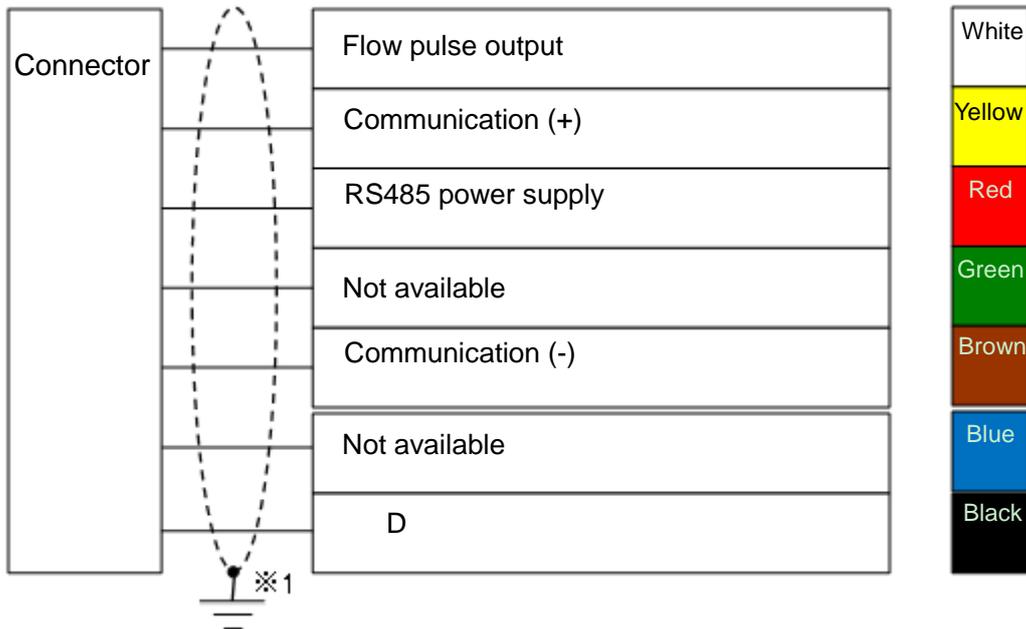


Figure 5-1. External connection cable wiring diagram

· 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 attached to the external connection cable.

### Note) About cable length

When extending the external connection cable, observe the following maximum cable lengths:

Communication line (cable color: brown, yellow): Up to 100m

Signal cable (cable color: white, green, blue, red, black): Up to 20m

The UL202767×0.14mm<sup>2</sup> cable is recommended for cable extension.

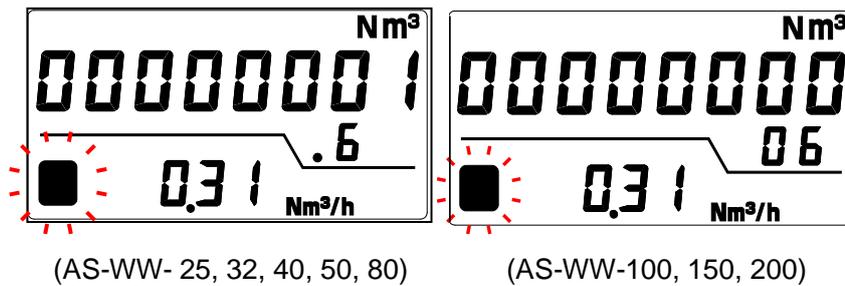
The actual maximum cable length may differ depending on the installation environment, connected equipment, and/or type of cable used.

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

## 6. Operation

 Open or close the valve slowly.

Rapidly opening or closing the valve when there is a pressure difference between the upstream and downstream sides of the valve may damage the flowmeter. When starting operation, gradually open the valve and confirm that the pilot lamp blinks. (Blinking of the pilot lamp indicates that fluid is flowing.)



(Note) Initial operation

When the flowmeter is installed and started for the first time, ALARM1 may turn on due to a drastic pressure change from the atmospheric pressure. However, ALARM1 turns off when the fluid pressure stabilizes in this case. (This is not an error.)

## 7. Operation of Display Portion

### A. Operation

- 1) Normally (in the measurement mode), the main display (upper line) shows the converted forward accumulated value or actual forward accumulated value, and the sub display (lower line) toggles between the instantaneous converted flow, instantaneous actual flow, pressure or working pressure, and temperature at an interval of four seconds. (Figure 7-1)
- 2) Use the three button switches on the backside to configure various settings on site.
- 3) Refer to Figure 1-1 for the location of the SW1, SW2, and SW3 switches.
- 4) The flowmeter toggles between the modes as shown in Figure 7-2 (Page 24) by using the buttons as listed in Table 7-1.

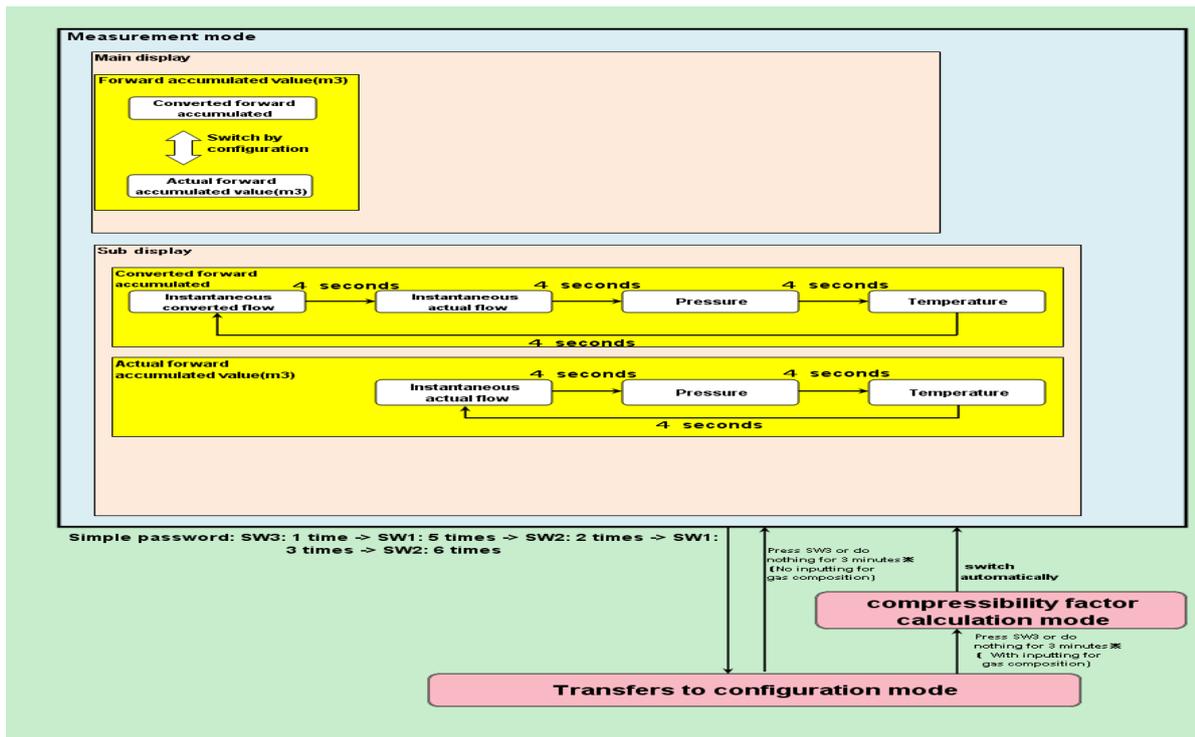
Table 7-1. Button operation in measurement and configuration modes

Button operation	Measurement mode	Configuration mode	
		Configuration display	Detailed configuration
SW3		Switch to measurement mode	
Simple password <sup>Note 1</sup>	Switch to configuration mode		
SW1+SW2 <sup>Note 2</sup>		Toggle between configuration display and detailed configuration	

Note 1) Press the switches in the following sequence: SW3: 1 time -> SW1: 5 times -> SW2: 2 times -> SW1: 3 times -> SW2: 6 times.

Note 2) Means that these two switches should be pressed together.

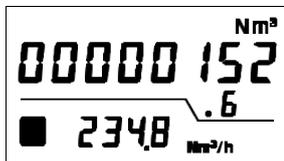
Figure7-2 Button operation during measurement mode and switching flow for various modes



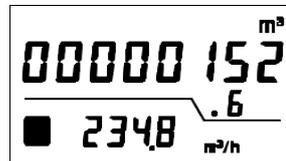
B. Functions in each mode

1) Measurement mode (normal mode)

- Main display contents (upper line)



Converted forward accumulated value (Nm<sup>3</sup>)



Actual forward accumulated value(m<sup>3</sup>)

- Sub display contents (lower line)

Automatically toggles between the items below at an interval of four seconds depending on the flowconversion selection (converted flow or actual flow).

- Converted flow display: Instantaneous converted flow, instantaneous actual flow, pressure\*, and temperature
- Actual flow display: Instantaneous actual flow, pressure\*, and temperature

\* The displayed pressure value depends on the presence of the equipped pressure sensor  
 No pressure sensor: Displays the set absolute pressure value.  
 With pressure sensor: Displays the absolute pressure value.

2) Configuration mode

(1) The configuration mode is activated by pressing the buttons in the following sequence: SW3: 3 time -> SW1: 5 times -> SW2: 2 times -> SW1: 3 times -> SW2: 6 times. To transfer from the configuration mode to the measurement mode, press SW3. If you do nothing in the mode for configuration three minutes, the flow meter will automatically transfer to the measurement mode.

Use the supplied hexagonal wrench key or similar tool to press SW3.

(Note: Do not use a tool with a sharp tip because it may damage SW3.)

(2) In the configuration mode, the items listed in "Table 3-1. Configuration items and factory defaults" can be changed.

(3) Refer to Figure 3-1. Display switching flow for how to use the buttons to change configuration.

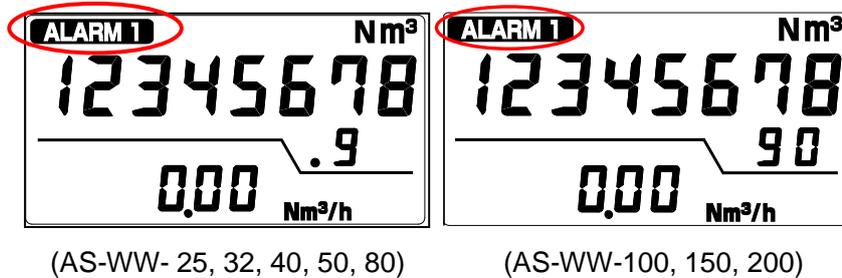
## 8. Error Display and Output

### 8-1. Ultrasonic measurement failure

[Status] Ultrasonic measurement fails.

[Indication] ALARM1 at the upper left of the LCD turns on.

The accumulated flow volume remains at the last value before detecting abnormality and accumulation stops. Instantaneous flow display shows "0.00".



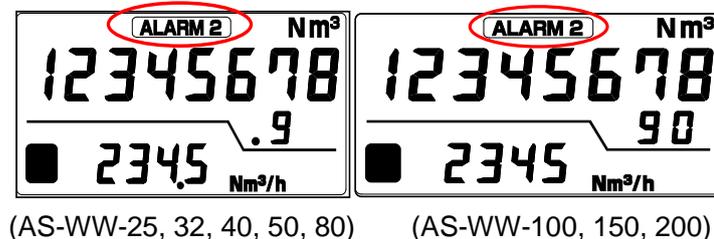
[Output] Flow pulse output: Stopped

[Cause] A foreign substance which hinders propagation of the ultrasonic (e.g., a fluid such as oil) may be adhered to the inside of the measurement pipe or remain in the pipe.  
Consult us if the alarm indication does not disappear after removing the foreign substance.

### 8-2. Low battery voltage error

[Status] The built-in battery has running out.

[Indication] "ALARM2" turns on.



[Output] Flow pulse output: Continues

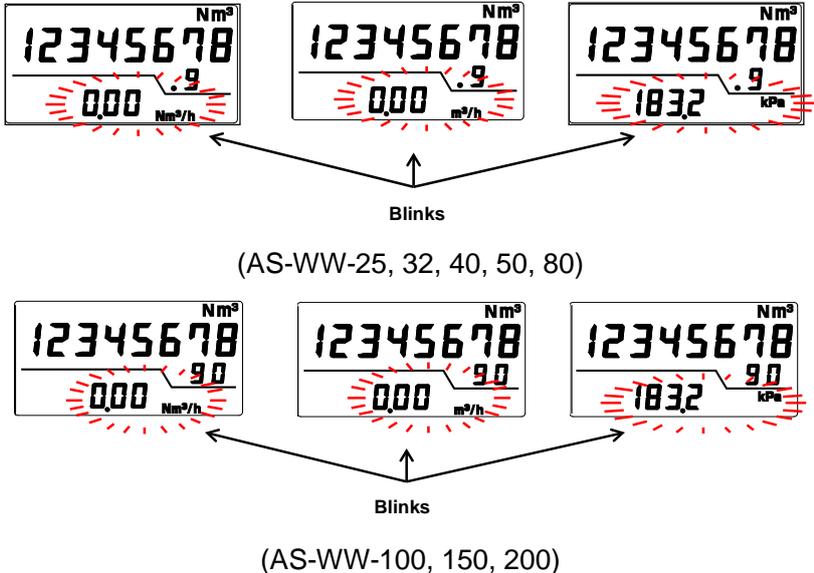
[Counteraction] You can keep using the flowmeter for approximately one month after "ALARM2" turns on (at the room temperature), but early replacement of the flowmeter is recommended for a charge.

8-3. Pressure abnormal value

[Status] Pressure sensor failure

[Indication] Instantaneous flow display shows "0" and the pressure display shows the detected abnormal value. (The temperature display remains on.)

The accumulated flow volume on the main display remains at the last value before detecting abnormality and accumulation stops.



[Output] Flow pulse output: Stopped

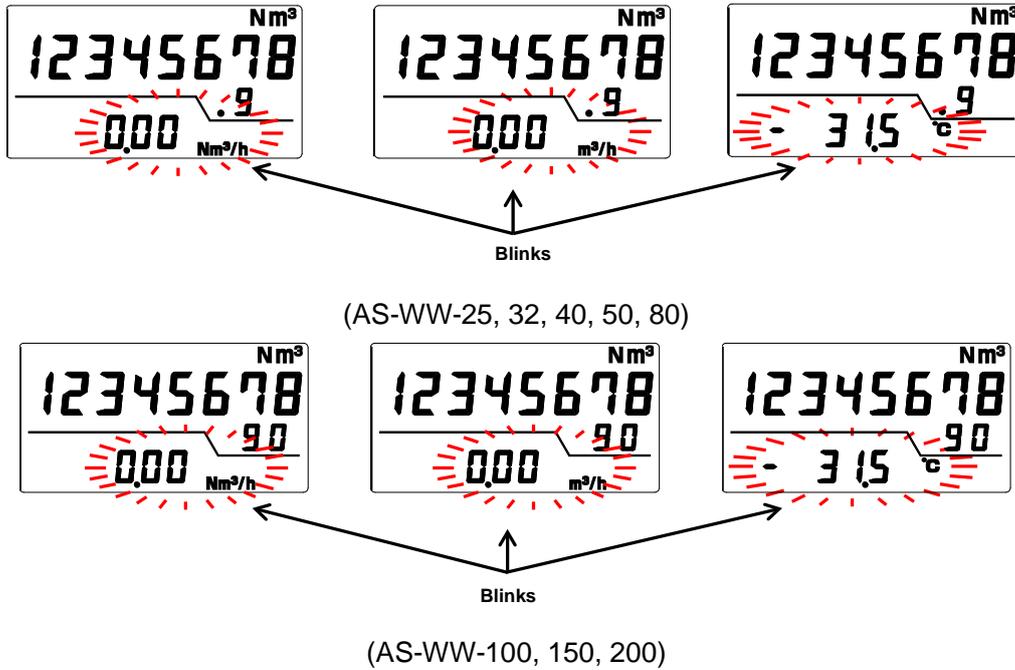
[Counteraction] Consult us.

8-4 Abnormal temperature

[Status] Temperature sensor failure

[Indication] Instantaneous flow display shows "0.00" and the temperature display shows the detected abnormal value (blinking). (The pressure display remains on.)

The accumulated flow volume on the main display remains at the last value before detecting abnormality and accumulation stops.



[Output] Flow pulse output: Stopped

[Counteraction] Consult us.

## 9. Specifications

Model	AS-WW-25	AS-WW-32	AS-WW-40	AS-WW-50	AS-WW-80	AS-WW-100	AS-WW-150	AS-WW-200	
Nominal diameter	25A	32A	40A	50A	80A	100A	150A	200A	
Power supply	Built-in lithium battery, battery life 7 years (at surrounding temperature of 20°C) (Excluding 1 year of storage period)								
Measurable fluids <sup>*1)</sup>	Natural gas, air								
Pressure sensor	A: Absolute pressure sensor								
Working pressure (Absolute pressure)	0.07~0.5MPa(AS-WW- * * -500BA 0.07~0.2MPa(AS-WW- * * -200BA 0.07~0.5MPa(AS-WW- * * -0BA		0.07~1.0MPa(AS-WW- * * -1000BA 0.07~0.5MPa(AS-WW- * * -500BA 0.07~0.2MPa(AS-WW- * * -200BA 0.07~1.0MPa(AS-WW- * * -0BA						
Flow rate range (actual flow rate) <sup>*2)</sup> [m <sup>3</sup> /h]	±0.7~35	±1.3~65	±1.6~80	±3~150	±6~300	±10~500	±24~1200	±40~2000	
Flow rate measurement precision	±5%RD [m <sup>3</sup> /h] (or more to less than)	±0.7~3.5	±1.3~6.5	±1.6~8	±3~15	±6~30	±10~50	±24~120	±40~200
	±2%RD [m <sup>3</sup> /h] (or more to or less)	±3.5~35	±6.5~65	±8~80	±15~150	±30~300	±50~500	±120~1200	±200~2000
Flow rate conversion error <sup>*3)</sup>	±1.8%								
Standard low flow cut off [m <sup>3</sup> /h or less]	±0.1	±0.2	±0.2	±0.4	±0.8	±1.5	±3.2	±5.7	
Pressure loss	Almost zero (similar to straight pipe)								
Fluid temperature and humidity	-20~40°C90%RH or less								
Display	Accumulated flow volume	00000000.0 Nm <sup>3</sup> 9 digits (AS-WW-25,32,40,50,80) 0000000000Nm <sup>3</sup> 10 digits (AS-WW-100,150,200)							
	Instantaneous flow rate	(1) Maximum display ± 19999Nm <sup>3</sup> /h (converted flow rate) (2) Maximum display ± 19999m <sup>3</sup> /h (actual flow rate) (Displays up to 2 decimal places for less than 200, 1 decimal place for 200 to less than 2000, and integer for 2000 or more.)							
		Unit	Display value x 1						Display value x 10
	Temperature	00.0°C 3 digits							
	Pressure	0000.0kPa 5 digits							
	Alarm	ALARM1 (on): Ultrasonic wave signal is too small or cannot be received.							
ALARM2 (on): Battery voltage is low.									
Sub display (blinking): Temperature or pressure value is abnormal.									

Model		AS-WW-25	AS-WW-32	AS-WW-40	AS-WW-50	AS-WW-80	AS-WW-100	AS-WW-150	AS-WW-200	
Output	Communication	RS485 MODBUS/RTU								
	External power supply	+9~ +26.4VDC (+9 to 15.9V under explosion-proof environment)								
	Rated voltage	-9~+9VDC								
	Contact output	Nch open drain output Contact output 1: Unit pulse (forward flow), pulse output unit: 100, 1000, 10000 L/P or NL/P Maximum rated voltage: +24VDC Maximum rated current: 10mA ON-time saturation voltage: 1V or lower OFF-time saturation current: 50μA or less								
History storage function <sup>*4)</sup>	Stored items	Following eleven items: Instantaneous converted flow rate, instantaneous actual flow rate, pressure, temperature, converted forward accumulated value, actual forward accumulated value, converted reverse accumulated value, storage time, converted forward accumulated volume used during storage period, actual forward accumulated volume used during storage period, and error information								
	Number of stored data items	6600 data items (a set of stored 11 items is considered a single data item)								
	Storage interval	5 minutes to 24 hours (can be changed in 5-minute units)								
Response		2 seconds					3 seconds			
Connection method		ISO7-1 Taper screw connection (JIS B 0203, BS21, GB/T7306,2-2000) equivalent			ISO7005-1 (GB/T9119-2000 PN1.6MPa flange) equivalent					
Mounting orientation		Horizontal or vertical								
Gas contact material		Aluminum alloy			Stainless alloy					
		PPS, fluorochemicals silicon rubber								
Weight		1.8kg	1.7kg	7.6kg	9.6kg	13.3kg	13.2kg	20.4kg	35.4kg	
Mounting location		Indoor, outdoor (IP64)								
Storage temperature		-20 to 70°C (no dewing)								

\*1) In case of usage for natural gas measurement, limitation is set for working pressure corresponding to methane concentration. Refer to Table 9-1 for details.

\*2) Refer to Table 9-2 for the conversion flow range.

\*3) Conversion error with each pressure sensor at F.S. (temperature range: -20 to 40°C)

\*4) Refer to the Communications Specifications for details.

Table 9-1 Working pressure corresponding to methane concentration

Size	Methane concentration (%)	Working Pressure (absolute)
200A	99%~100%	250kPa or higher
	97%~99%	150kPa or higher
	97% or lower	No restriction
150A	98%~100%	100kPa 以上
	98% or lower	No restriction

\* No restriction for the 100A or smaller models.

Table 9-2. Converted flow value [conversion example]

Conversion	Temperature pressure	0°C(Nm3/h)				20°C(S*m3/h)			
		1atm				1atm			
	Working pressure(MPa abs)	0.10133		0.5		0.10133		0.5	
	Working temperature (°C)	0	30	0	30	0	30	0	30
AS-WW-25	0.7	0.7	0.6	3.5	3.1	0.8	0.7	3.7	3.3
	35	35.0	31.5	172.7	155.6	37.6	33.3	185.3	167.0
AS-WW-32	1.3	1.3	1.2	6.4	5.8	1.4	1.2	6.9	6.2
	65	65.0	58.6	320.7	289.0	69.8	61.8	344.2	310.2
AS-WW-40	1.6	1.6	1.4	7.9	7.1	1.7	1.5	8.5	7.6
	80	80.0	72.1	394.7	355.7	84.4	76.0	423.7	381.7
AS-WW-50	3	3.0	2.7	14.8	13.3	3.2	2.9	15.9	14.3
	150	150.0	135.2	740.2	666.9	158.2	142.6	794.4	715.7
AS-WW-80	6	6.0	5.4	29.6	26.7	6.3	5.7	31.8	28.6
	300	300.0	270.3	1480.3	1333.8	316.5	285.2	1588.7	1431.5
AS-WW-100	10	10.0	9.0	49.3	44.5	10.5	9.5	53.0	47.7
	500	500.0	450.5	2467.2	2223.0	527.5	475.3	2647.8	2385.8
AS-WW-150	24	24.0	21.6	118.4	106.7	25.3	22.8	127.1	114.5
	1200	1200.0	1081.2	5921.2	5335.3	1265.9	1140.6	6354.8	5725.9
AS-WW-200	40	40.0	36.0	197.4	177.8	42.2	38.0	211.8	190.9
	2000	2000.0	1802.1	9868.7	8892.1	2109.8	1901.0	10591.3	9543.2

\* The LCD shows values in Nm3/h even in the standard conversion mode.

## 10. External View

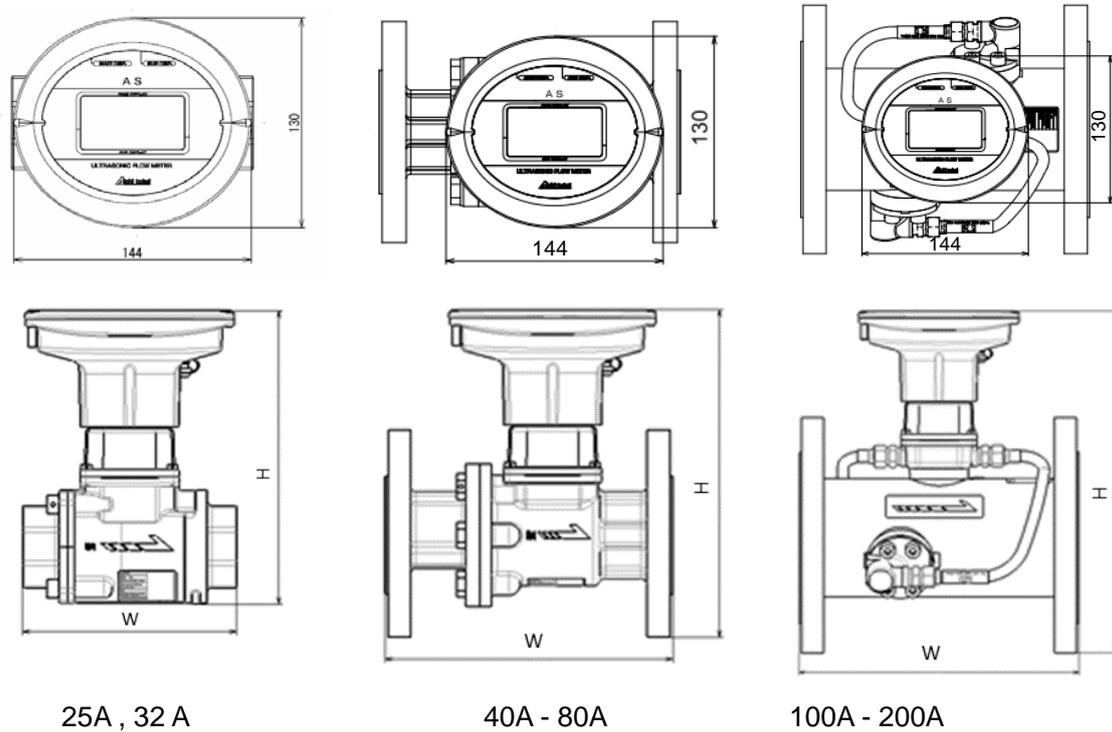


Figure 10-1. External View

Model	Width [mm]	Height [mm]
AS-WW-25-[sensor type]BA/4	147	208
AS-WW-32-[sensor type]BA/4	147	208
AS-WW-40-[sensor type]BA/4	200	233
AS-WW-50-[sensor type]BA/4	220	247
AS-WW-80-[sensor type]BA/4	250	279
AS-WW-100-[sensor type]BA/4	250	313
AS-WW-150-[sensor type]BA/4	300	370
AS-WW-200-[sensor type]BA/4	350	428

## 11. Battery Life

The built-in battery life is 7 years. (At the surrounding temperature of 20°C) (Excluding 1 year of storage period)

Contact us when the built-in battery has run out.

## 12. Troubleshooting

Timing	Phenomenon	Possible cause	Counteraction
Immediately after installation	ALARM1 turns on.	Fluid other than specified is used.	Observe the precautions in "For Safe Use of the Product" (Pages 3 to 5) and the specifications (Pages 29 and 30).
		Flowmeter is used outside the specification range (e.g., installation, pressure, and/or temperature conditions are out of the specification).	
		Foreign substance is adhered to the inside of the measurement part or ultrasonic sensor.	Check for the foreign substance and remove it if any.
		A large electrical noise source exists near the flowmeter.	Remove the noise source, or attach a braided shield to the flowmeter. When using an external connection cable, ground the braided shield.(p.22)
	Accumulation does not start after installation	Adjustment against pressure change is in progress.	Check if the separation line between the main display and subdisplay is blinking. It stops blinking in approximately one minute and accumulation starts.
After starting operation	Displayed instantaneous flow is negative.	The fluid flow direction is opposite to the arrow direction of the flowmeter.	Check if the fluid flow direction is aligned with the arrow direction of the flowmeter.
	ALARM2 turns on.	Battery voltage is low.	The built-in battery is running out. (Consult us.)
	Sub display blinks. (Instantaneous standard flow, instantaneous actual flow, and pressure are blinking.)	Pressure sensor is faulty.	Contact us.
	Sub display blinks. (Instantaneous standard flow, instantaneous actual flow, and temperature are blinking.)	Temperature sensor is faulty.	Contact us.
	Instantaneous flow display seems to fluctuate.	Pressure frequently fluctuates.	Flowmeter is operating normally. For more accurate measurement, it is recommended to install the flowmeter at a location where pressure fluctuation is less likely.
		There is pulsatory motion.	Correct measurement is not possible under a pulsatory environment. For more accurate measurement, it is recommended to install the flowmeter at a location where pulsation is less likely.
		Governor exists near the flowmeter.	Flowmeter is operating normally. For more accurate measurement, it is recommended to install the flowmeter apart from the governor.(Refer to Figure4-2(p.19).)
	Displayed instantaneous flow does not become "0" while there is no flow	Gas is circulating inside the pipe.	Flowmeter is operating normally.
	The instantaneous flow is too high.	Straight pipe length is not sufficient	Provide straight pipes of recommended lengths at the upstream and downstream sides of the flowmeter. (Refer to Figure 4-1 (Page 18).)
	Instantaneous flow display seems not to change.	Excessive flow which is out of the specification exist	Use the flow meter within the specification range(Refer to (p.29 to 30))
	The instantaneous flow is too low	Straight pipe length is not sufficient	Provide straight pipes of recommended lengths at the upstream and downstream sides of the flowmeter. (Refer to Figure 4-1 (Page 18).)
	Separation line between the main display and subdisplay is blinking	Adjustment against pressure change is in progress.	It stops blinking in approximately one minute and accumulation starts.
	ALARM1 turns on.	Foreign substance is adhered to the inside of the measurement part or ultrasonic sensor.	Wash the inside of the measurement pipe as instructed below. Do not hold the display portion while washing the pipe. Repeat washing the pipe until ALARM1 turns off. <When oil is adhered> (1) Seal one edge of the measurement pipe. (2) Pour spindle oil into the pipe and leave it for one or two hours. (3) Spend one or more hours to drain the spindle oil.
			<When dirt other than oil is adhered> (1) Seal one edge of the measurement pipe. (2) Pour water into the pipe and shake it up and down for four or five times. Repeat this step until the dirt is removed. (3) Drain the water and dry the pipe naturally.
		The use conditions have been changed and the flow meter is used outside the specification range (e.g., installation, pressure, and/or temperature conditions are out of the specification).	Observe the precautions in "For Safe Use of the Product" (Pages 3 to 5) and the specifications (Pages 29 and 30).

If the problem persists after taking the measures above, contact us.

## **- Warranty and After-Sales 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 warranty

The followings are not included in the scope of warranty.

- Failure caused by force majeure. such as natural disaster, etc.
- 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

The warranty here means the warranty for our product alone and does not cover damages (damage(s) to other properties than our product, lost profits, opportunity losses, etc.) caused to you by a failure of our product.

### 3) When requesting for a service

Whether the warranty applies or not, explain the defect as detailed as possible to us, including the product name, model (AS-WW), construction number, manufacturing number, and presence of options.

## **Aichi Tokei Denki Co., Ltd.**

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For questions, please contact.