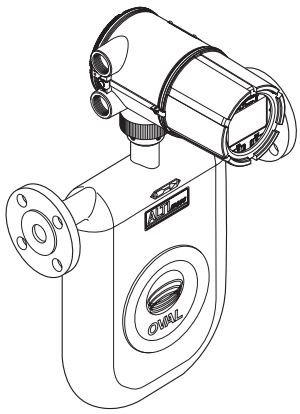
OVAL INSTRUCTIONS

HART COMMUNICATION PROTOCOL

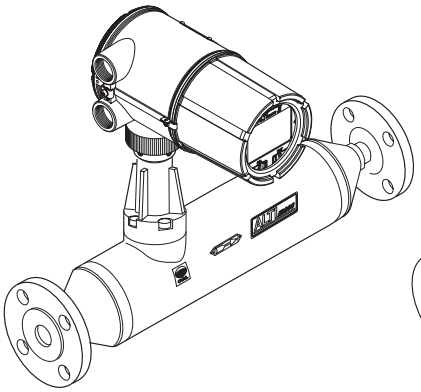
Ins. No. L-760-19-E

Coriolis flowmeter
ALTImass Ⅱ

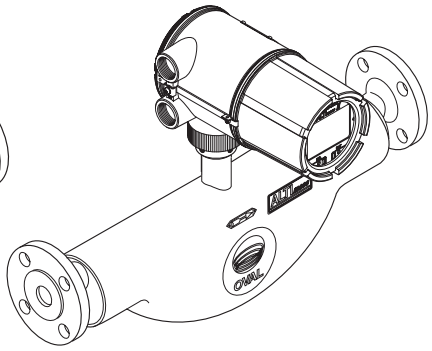
- **Type U/High-accuracy models: CA00A, CA001, CA003, CA006, CA010, CA015 CA025, CA040, CA050, CA080, CA100, CA150 CA15H, CA200, CA20H, CA250**
- **Type S/Straight tube models: CS010, CS015, CS025, CS040, CS050, CSR50**
- **Type B/Low price, general purpose models: CB006, CB010, CB015, CB025, CB040, CB050**
- **Transmitter : PA2K**



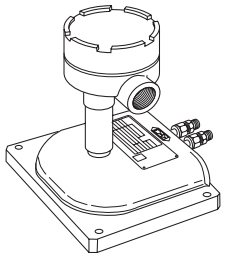
Type U



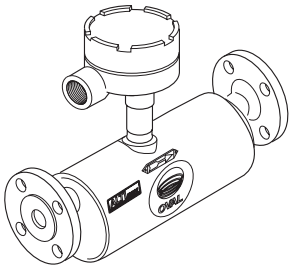
Type S



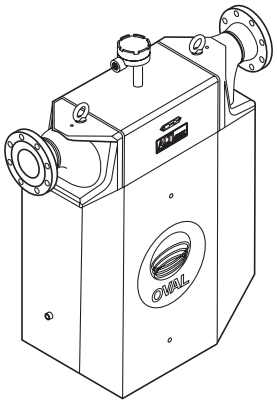
Type B



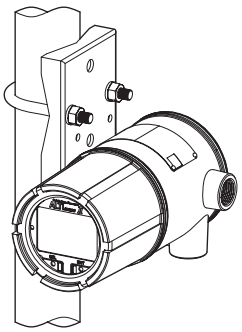
Type U
Extra low flows



Type U
Low flows



Type U
Large size



Separately mounted transmitter

Thank you for choosing OVAL's Coriolis flowmeter ALTImass Ⅱ. Every OVAL product is fabricated, tested, and inspected under stringent quality control before it leaves our factory.

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

CONTENTS

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

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

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

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

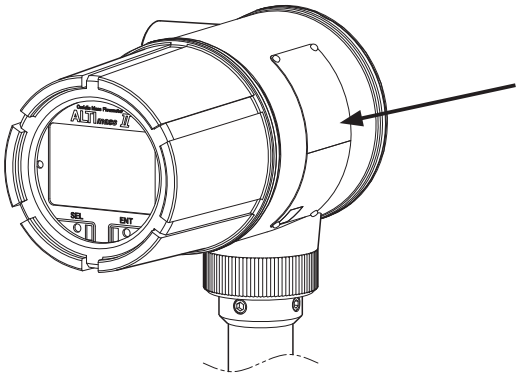
1. BEFORE YOU BEGIN

This device has been fully inspected at the factory before shipment. When the device is delivered, please make sure to check the appearance of the device is free from damages from transportation. Please read this section carefully, as this section contains the necessary precautions for handling.

For any inquiries, call the sales office from which you purchased the product, or contact the nearest OVAL representative in our customer service network.

1.1 Confirming the Tag Information

Product code and major ratings appear on the nameplate attached on the side of transmitter. Make sure that the product you received complies with the specifications in your order.



● **Information stated on the product tag**

Item	Description
MODEL	Product model
BORE	Nominal flange size
DATE	Date of manufacture
SERIAL NO.	Serial No.
MAX. PRESS.	Max operating pressure
MAX. TEMP.	Max operating temperature
FLOW RATE	Flow range
TAG NO.	Instrument No. (only when specified)
POWER	Power

◆ **Reminder** ◆

When you make inquiries, include the product name, model No., serial No. and other pertinent information.

1.2 Transportation Guidelines

(1) To prevent unexpected problems, transport the product to the installation site using the original manufacturer's packing for shipment if circumstances permit.
(2) Do not apply strong impact during transportation and avoid exposure to rain or water.

1.3 Storage Guidelines

Unexpected accidents may occur if the arrived device is to be stored for a long period of time before installation. If long-term storage is anticipated, please be aware of the following items.

(1) Store your product in the manufacturer's original packing used for shipping if possible.
(2) Place of storage should meet the following conditions.
- Free from rain and water.
- Free from vibration or strong impact.
- At room temperature with minimal temperature and humidity variation.
- Storage/shipping conditions
  Temperature：20±15℃
  Relative humidity：65±20%
  Barometric pressure：500 to 1060hPa

1.4 Precautions for Operating Conditions

In order to maintain metering accuracy and long service life, it is essential that the operating conditions, such as the flowrate, pressure, and temperature be held within the specified limits. These operating conditions are stated in Sections "3. SPECIFICATIONS and PERFORMANCE", "13. PRODUCT CODE EXPLANATION" and "14. PRODUCT CODE EXPLANATION OF THE OLD PRODUCT CODE" of this manual. Do not fail to confirm these items before placing the meter in service.

- **If the process fluid is corrosive, meter material must be checked in advance for compatibility.**
- **Cleanse the interior of flow tube thoroughly after use for measuring fluids that tend to deposit solids. A flow tube adhered with solid deposits can affect meter accuracy.**
- **If you want a change in operating conditions, consult OVAL.**
- **Non-uniform gas-liquid multiphase flow or non-uniform solid-liquid multiphase flow may not be measured properly. Consult OVAL for such applications.**
- **Blanking plug(s) included upon shipment is (are) only for protection of the screw thread during transportation and will not guarantee explosion-proof or IP performance.**
  Do not install the device with this blanking plug connected regardless of explosionproof or non-explosionproof.

1.5 Precautions for Installation Location

⚠ CAUTION

To ensure accurate and consistent measurement, the Coriolis flowmeter should be installed in a location where pipeline oscillation do not exceed 0.3G.

1.6 Precautions for power-on

Be sure to close the display lid and the terminal lid of the transmitter before turning on the power. The explosionproof enclosure must be ensured (with the requirements stated in section 10.5 satisfied) before use.

To ensure the stable measuring condition, allow 20 minutes of warm-up period. "WARM UP 20" will be displayed for 20 minutes after powering-on. The number indicates remaining warm-up period (min.).

1.7 Returning Equipment

If the meter must be returned to OVAL for any reason, follow these steps to ensure the most efficient processing.

(1) Clean the unit and flush out the tubes without fail and pack the sensor unit carefully. Fully document the fluid. Inadequate information will delay handling of the meter. (⇒ Fill in the forms prepared on pages 136 and 137.)

(2) Enclose complete information about the material being returned including **model and serial number, the reason for return, return address, and full documentation of the type of fluid.**

(3) Pack the equipment carefully, using the original packing if possible.

(4) Return the complete flowmeter, including the separately electronics unit with all of the circuit boards and associated parts.

Remove the cable entries and all other parts not originally shipped with the meter.
(example: wiring connections)

⚠ IMPORTANT

Be sure to completely remove the deposit of residue on the inner walls of the sensor unit. Sensor unit cannot be disassembled for flushing the inner tubes. Malfunction diagnosis or service repair can not be performed.

1.8 Precautions on Plug

⚠ CAUTION

The explosion-proof / IP rating of this flowmeter are based on condition that proper pressure-tight packing(s) are used at the plug(s). Blanking plug(s) included upon shipment is (are) only for protection of the device during transportation and will not guarantee explosion-proof or IP performance. If the device is used under an environment where explosion-proof or IP performance are required, please be sure to use pressure-tight packing(s). (For the selection of pressure-tight packing under explosion-proof environment, please refer to section "10.6 Precautions on the explosion-proof specification")

2. GENERAL AND FEATURES

2.1 General Description

The ALTImass Ⅱ series, consisting of a high performance model Type U, a straight-tube model Type S, and a low-cost, general purpose model Type B, are Coriolis flowmeters capable of measuring mass flows at a high degree of accuracy. Equipped integrally or separately from the sensor unit is a highly sophisticated transmitter (self diagnosis feature, large size display, and field reconfiguration capability using a touch panel).

2.2 Features

1. Increased self-diagnostic capabilities: checking for cable faults, pipeline vibration, and monitoring transmitter temperatures.
2. Enhanced maintenance functions: error logging, storing factory shipping data, and parameter back-up to the display unit.
3. Transmitter parameters reconfigurable via touch panel (also through communication).
4. Enhanced energy efficiency: Low power consumption (2/3 of the previous model), smaller transmitter.
5. Significant improvement in zero point stability error.
6. High measuring accuracy of density: ±0.0005g/mL (measuring liquid with sensor CA003 to CA250)
7. Fast response
8. Output signals: pulse output, current output (dual output), and status output
9. HART communication compatible.
10. Two alarm indicators provided.
11. The measurement of bubble mixed fluid is possible by the adjustment of Gas Multiphase Flow Alarm (Slug Alarm) which is found in the Self-Diagnosis Function.
12. A two-wire system can be configured by combining a dedicated distributor. (For details, refer to GS.No.GEF223)

3. SPECIFICATIONS AND PERFORMANCE

3.1 Sensor Unit General Specifications

3.1.1 Type U sensor unit general specifications

● Standard model (CA00A, CA001 and CA003)

Item		Description		
Model		CA00A	CA001	CA003
Nominal size		1/4″		10mm, 3/8″ (※ 1), DN15
Materials	Wetted parts	SUS316L		SUS316L, SUS316L+Alloy C, AlloyC (※ 2)
	Housing	SUS304		
	O-rings	Fluorine rubber (std.: FKM), PTFE (option)		—
Process connection		R 1/4		JIS 10, 20, 30, 40, 63K RF/ASME(JPI)150, 300, 600RF/ DIN PN 10, 16, 25, 40RF (※ 3), IDF Ferrule, Screw
Applicable fluid		Liquid and gas		
Density range		0 to 2.0g/mL		
Temperature range		Separately mounted: -200 to +200℃ (※ 5) (※ 6)		
Tube withstand (at 20℃)		15MPa		10MPa
Max operating pressure		15MPa at 20℃		Depends on flange rating
Sensor housing withstand (MPa) (※ 4)		—		7.2
Flow direction		Bidirectional		
Explosionproof configuration		JPEx (Refer to section 10.4 for details.)		
Dusttight, waterproof configuration		IP66 / 67		

➡NOTES ※1: 1/2" for ASME and JPI flanged sensors.
※2: When wetted parts are made from Alloy C, only screw type connection is available.
※3: DIN flanges are available only to meters of the wet part material, "SUS316L" and "SUS316+Alloy C".
※4: This pressure does not represent the rated test pressure of a pressure vessel, but 1/4 of the breakdown test pressure at OVAL (distorted enclosures do not constitute a failure of the test), or the data obtained from the FEM analysis, whichever is lower (or safer).
※5: Refer to section 10.4 for explosionproof specifications.
※6: Refer to section 10.5 for the ambient temperature.
※ : For products conforming to the high pressure gas safety regulations consult OVAL.
※ : Separately mounted transmitter only. (with exclusive Interconnect cable)

● Standard model (CA006 to CA080)

Item		Description						
Model		CA006	CA010	CA015	CA025	CA040	CA050	CA080
Nominal size		10mm, 3/8" (※ 1), DN15	15mm, 1/2″, DN15		25mm, 1″, DN25	40mm, 1･1/2″, DN40	50mm, 2″, DN50	80mm, 3″, DN80
Materials	Wetted parts	SUS316L, SUS316L + Alloy C, Alloy C						
	Housing	SUS304						
Process connection		JIS 10, 20, 30, 40, 63K RF/ASME(JPI)150, 300, 600RF/DIN PN 10, 16, 25, 40RF (※ 2), IDF Ferrule, Screw						
Applicable fluids		Liquid and gas						
Density range		0 to 2.0g/mL						
Temperature range		-200 to +200℃ (※ 4)						
Tube withstand (at 20℃)		9.4MPa						
Max operating pressure		Depends on flange rating						
Sensor housing withstand (MPa) (※ 3)		3.8	3.0	2.2	1.6	1.8		1.4
Flow direction		Bidirectional						
Explosionproof configuration		JPEx (Refer to section 10.4 for details.)						
Dusttight, waterproof configuration		IP66 / 67						

➡NOTES ※1: 1/2" for ASME and JPI flanged sensors.
※2: DIN flanges are available only to meters of the wet part material, "SUS316L" and "SUS316+Alloy C".
※3: This pressure does not represent the rated test pressure of a pressure vessel, but 1/4 of the breakdown test pressure at OVAL (distorted enclosures do not constitute a failure of the test), or the data obtained from the FEM analysis, whichever is lower (or safer).
※4: Refer to section 10.4 for explosionproof specifications. Max measurement temperature of (transmitter) integral type is 150℃.
Refer to section 10.5 for the ambient temperature.
※: For products conforming to the high pressure gas safety regulations consult OVAL.

■ Polishing Specifications

● Parts and Models

Polishing Parts	Polished 1	Polished 2	Polished 3	Polished 4	Polished 5	Polished 6
Flowtube	◎	—	◎	—	◎	◎
Manifold	—	○	○	○ (※1)	○ (※1)	○ (※2)
Fittings	—	○	○	○	○	
Models	CA010 to CA080	CA006 to CA080	CA010 to CA080	CA006 to CA050	CA010 to CA050	
Main part material [Model Code: ⑨]	S: SUS316L					
Polish specification identification [Model code:㉔]	1	2	3	4	5	6

◎:Electropolishing, ○:Buffing (#400 equivalent)
※1:Applied to machined forged material
※2:Applied to integrated machined forged material (Manifold + Ferrule Fitting)
Note) May not be applicable depending on selection conditions.
・For process connection: Tapered male / female thread
・For Enlarged bore type (CA015, CA025, CA080)
・For Strength Calculation requirement

● Standard model (CA100 to CA250)

Item		Description					
Model		CA100	CA150	CA15H	CA200	CA20H	CA250
Nominal size		100mm, 4″, DN100	150mm, 6″, DN150		200mm, 8″, DN200		250mm, 10″, DN250
Materials	Wetted parts	SUS316L					
	Housing	SUS304					
Process connection		JIS 10, 20, 30K RF/ASME(JPI) 150, 300, 600RF/DIN PN 10, 16, 25, 40RF					
Applicable fluids		Liquid					
Density range		0.3 to 2.0g/mL					
Viscosity range		Max 10000mPa･s (※ 1)					
Temperature range		-200 to +200℃ (※ 2)					
Tube withstand (at 20℃)		13.56MPa		10.6MPa		8.8MPa	
Max operating pressure		Depends on flange rating					
Flow direction		Bidirectional					
Explosionproof configuration		JPEx (Refer to section 10.4 for details.)					
Dusttight, waterproof configuration		IP66 / 67					

➡NOTES ※1: If the viscosity is 10000mPa･s or more, contact OVAL.
※2: Refer to section 10.4 for explosionproof specifications. Max measurement temperature of (transmitter) integral type is 150℃.
Refer to section 10.5 for the ambient temperature.
※: For products conforming to the high pressure gas safety regulations, consult OVAL.

● High pressure service model (CA010 and CA015)

Item		Description	
Model		CA010 (High pressure service)	CA015 (High pressure service)
Materials	Wetted parts	Flow tube: Alloy C, Manifold: Alloy C equivalent (CX2MW)	
	Housing	SUS304	
Process connection		Screw Rc3/8	Screw Rc3/4
Applicable fluid		Liquid and gas	
Density range		0.3 to 2.0g/mL	
Temperature range		-200 to +200℃ (※ 1)	
Max operating pressure		36MPa at room temperature	43MPa at room temperature
Sensor housing withstands (MPa) (※ 2)		3.0MPa	2.2MPa
Flow direction		Bidirectional	
Explosionproof configuration		JPEx (Refer to section 10.4 for details.)	
Dusttight, waterproof configuration		IP66 / 67	

➡NOTES ※1: Refer to section 10.4 for explosionproof specifications. Max measurement temperature of (transmitter) integral type is 150℃.
Refer to section 10.5 for the ambient temperature.
※2: This pressure does not represent the rated test pressure of a pressure vessel, but 1/4 of the breakdown test pressure at OVAL (distorted enclosures do not constitute a failure of the test), or the data obtained from the FEM analysis, whichever is lower (or safer).
※: For products conforming to the high pressure gas safety regulations consult OVAL.

● High temperature service model (CA025 to CA150)

Item		Description					
Model		CA025 (High temp. service model)	CA040 (High temp. service model)	CA050 (High temp. service model)	CA080 (High temp. service model)	CA100 (High temp. service model)	CA150 (High temp. service model)
Nominal size		25mm, 1″, DN25	40mm, 1・1/2″, DN40	50mm, 2″, DN50	80mm, 3″, DN80	100mm, 4″, DN100	150mm, 6″, DN150
Materials	Wetted parts	SUS316L			SUS316L SUS316L + Alloy C Alloy C	SUS316L	
	Housing	SUS304					
Process connection		25 to 80mm : JIS 10, 20, 30, 40, 63K RF/ASME (JPI) 150, 300, 600RF/DIN PN 10, 16, 25, 40RF 100 and 150mm : JIS 10, 20, 30K RF/ASME (JPI) 150, 300, 600RF/DIN PN 10, 16, 25, 40RF					
Applicable fluids		Liquid					
Density range		0.3 to 2.0g/mL					
Temperature range		–40 to +350℃ (※ 1)					
Tube withstand (at 20℃)		9.4MPa				13.5MPa	
Max operating pressure		Depends on flange rating					
Sensor housing withstand (MPa) (※ 2)		1.6	1.8		1.4	–	
Flow direction		Bidirectional					
Explosionproof configuration		JPEx (Refer to section 10.4 for details.)					
Dusttight, waterproof configuration		IP66 / 67					

Heat Tracer Specifications (CA025 to CA080 Option)

Applicable fluids	Hot water, Saturated steam, Superheated steam
Heat retention fluid max output pressure	0.98MPa
Joint port for heat retention fluid	ϕ10 stainless tube
Recommended joint fitting	Tube joint fitting manufactured by Swagelok Company

➡NOTES ※1: Make the ambient temperature of sensor unit up to 50℃.
※2: This pressure does not represent the rated test pressure of a pressure vessel, but 1/4 of the breakdown test pressure at OVAL (distorted enclosures do not constitute a failure of the test), or the data obtained from the FEM analysis, whichever is lower (or safer).
※: For products conforming to the high pressure gas safety regulations, consult OVAL.
※: Separate mount transmitter only. (with exclusive interconnect cable)
※: Correspondence is not to be used for cooling purposes.

● Low temperature explosionproof service model (CA025 to CA250)

Item		Description									
Model		CA025	CA040	CA050	CA080	CA100	CA150	CA15H	CA200	CA20H	CA250
Nominal size		25mm, 1″, DN25	40mm, 1•1/2″, DN40	50mm, 2″, DN50	80mm, 3″, DN80	100mm, 4″, DN100	150mm, 6″, DN150		200mm, 8″, DN200		250mm, 10″, DN250
Materials	Wetted parts	SUS316L, SUS316L + Alloy C, Alloy C				SUS316L					
	Housing	SUS304									
Process connection (※ 1)		JIS 10, 20, 30, 40, 63K RF/ ASME (JPI) 150, 300, 600RF DIN PN 10, 16, 25, 40RF (※ 2), IDF Ferrule				JIS 10, 20, 30K RF/ASME (JPI) 150, 300, 600RF DIN PN 10, 16, 25, 40RF (※ 2)					
Applicable fluids		Liquid and gas				Liquid					
Density range		0.3 to 2.0g/mL									
Temperature range		–200 to +50℃ (Separately mounted only) (※ 3)									
Tube withstand		9.4MPa at 20℃				13.56MPa at 20℃		10.6MPa at 40℃		8.8MPa at 40℃	
Max operating pressure		Depends on flange rating									
Sensor housing withstand (※ 4)		1.6MPa	1.8MPa		1.4MPa	–					
Flow direction		Bidirectional									
Explosionproof configuration		JPEx (Refer to section 10.4 for details.)									
Dusttight, waterproof configuration		IP66 / 67									

➡NOTES ※1: When“SUS316L”or“SUS316L+Alloy C”is selected for the materials of wetted parts, the flange material is termed as“SUS316”.(CA025 to CA080)

※2: For the material of DIN flange, you cannot select “Alloy C”.

※3: Refer to section 10.5 for the ambient temperature.

※4: This pressure does not represent the rated test pressure of a pressure vessel, but 1/4 of the breakdown test pressure at OVAL (distorted enclosures do not constitute a failure of the test) or the data obtained from the FEM analysis, whichever is lower (or safer).

※: For products conforming to the high pressure gas safety regulations consult OVAL.

※: Separate mount transmitter only. (with exclusive interconnect cable)

3.1.2 Type S sensor unit general specifications

● Titanium tube type (CS010 to CSR50)

Item		Description					
Model		CS010	CS015	CS025	CS040	CS050	CSR50
Nominal flange size		10mm or 1/2"	15mm or 1/2"	25mm or 1"	40mm or 1･1/2"	50mm or 2"	80mm or 3"
Materials	Wetted parts	SB338 Grade-9 ＋ TB480H					
	Housing	SUS304					
Process connection		JIS 10, 20K / ASME (JPI) 150 / IDF ferrule (※1)					
Acceptable fluid		Liquid					
Density range		0.5 to 1.0g/mL, 0.7 to 1.3g/mL, 1.0 to 1.5g/mL (※2)					
Measurable temperature range		–40 to ＋130℃ for both integrally and separately mounted types (※3)					
Heatproof temperature		150℃ max (※4)					
Max operating pressure		2.45MPa or less (Varies according to process connection.)					
Sensor housing withstands		2.8MPa					
Flow direction		Bidirectional					
Explosionproof configuration		JPEx (Refer to section 10.4 for details.)					
Dusttight, waterproof configuration		IP66 / 67					

NOTE ※1: Loose flange is applied. Ferrule connections of models CS010 and CS015 comply with ISO2852.
※2: Density range varies with the measured fluid.
※3: To measure fluid having a temperature of 80℃ or higher with integral type, the max ambient temperature of the transmitter should be reduced. (When the temperature of fluid is 130℃, the max ambient temperature of the transmitter should be 45℃.)
※4: CIP/SIP procedures must be performed within the heatproof temperature range.

3.1.3 Type B sensor unit general specifications

Item		Description					
Model		CB006	CB010	CB015	CB025	CB040	CB050
Nominal flange size		10mm or 1/2"	15mm or 1/2"	15mm or 1/2"	25mm or 1"	40mm or 1･1/2"	50mm or 2"
Materials	Wetted parts	SUS316L					
	Housing	SUS304					
Process connection		JIS 10, 20, 30K RF / ASME (JPI) 150, 300, 600 RF, IDF ferrule					
Acceptable fluid		Liquid					
Density range		0.3 to 2.0g/mL					
Measurable temperature range		–40 to ＋130°C for both integrally and separately mounted types (※ 1, 2)					
Heatproof temperature		150℃ max (※3)					
Max operating pressure		Varies according to process connection					
Flow direction		Bidirectional					
Explosionproof configuration		JPEx (Refer to section 10.4 for details.)					
Dusttight, waterproof configuration		IP66 / 67					

NOTE ※1: Refer to section 10.4 for explosionproof specifications.
※2: To measure fluid having a temperature of 80℃ or higher with integral type, the max ambient temperature of the transmitter should be reduced. (When the temperature of fluid is 130℃, the max ambient temperature of the transmitter should be 45℃.)
※3: CIP/SIP procedures must be performed within the heatproof temperature range.

3.1.4 Transmitter specifications

Refer to GS.No.GEJ516 for the rack-mounted type transmitter and GS.No.GEF223 for the 2-wire system configuration.

Item	Description	
Model	PA2K	
Power supply	85 to 264VAC 50/60Hz or 20 to 30VDC (Safety rated 100 to 240VAC 50/60Hz)	
Power consumption	AC type: Max 10W, 25VA DC type: Max 10VA	
Ambient temperature	–40 to +55℃ (※1)	
Transmission length (separate type)	Type U	max 200 meters. (max 100 meters for CA00A, CA001) (using dedicated 9-core cable) (※2)
	Type S	Titanium tube type: max 100 meters (using dedicated 9-core cable) (※2)
	Type B	max 50 meters (using dedicated 9-core cable) (※2)
Explosionproof configuration	JPEx (Refer to section 10.4 for details.)	
Dusttight, waterproof configuration	IP67	
Transmitter configuration	Integral or separately mounted	
Finish	Body: Munsell 10B8/4, Covers (front and rear): 2.5PB4/10	
Display	LCD display provided (128×64 dots), backlit (white, orange) Infrared light switches: 2, LED: 2 (green, red)	
Weight	3.0kg approx.	
Communication interface	HART	HART protocol version 7, Bell202 (※3)
Damping (default)	Type U/ Flow rate 0.8sec, density 4sec, temperature 2.5sec. Type S/ Flow rate 1sec, density 4sec, temperature 2.5sec Type B/ Flow rate 1sec, density 4sec, temperature 2.5sec	
Low flow cutoff (default)	Type U/ 0.6% Type S/ 1.5% Type B/ 1.0% } or less of maximum normal flowrate	
Pulse output	Open drain output (equivalent to open collector output) [Max 30V, 50mADC, ON resistance 0.6Ω or less] or Voltage pulse (Low level: 1.5V max, High level: 13V min. Output impedance: 2.2kΩ) Setting range: 0.1 to 10000Hz (Max output 11000Hz)	
Analog output	4 to 20mADC (max load 600Ω) Select two outputs from instant flowrate (mass or volume) temperature, and density. For the analog output 2, the status output function can be allocated (4mA/20mA current output) Select one of error (※4), flow direction, and High/Low alarm	
Status input	Contact-closure input (Form "a" contact) Close: 200Ω max, Open: 100kΩ min. Select one output from remote zero, total reset, 0% signal lock, or function off (default is function off).	
Applicable standard	EMC : IEC61000-6-2	

➡NOTES ※1: The operating temperature range of the display is -20 to +55℃.

※2: If signal transmission length exceeds max transmission lengths, consult OVAL.
The operating temperature range of the dedicated cable (PVC: model code CBP2) is -15 to +80℃.
Use dedicated cable (PTFE: model code CBT2) instead in an environment that exceeds above temperature range.

※3: Of the two analog output systems,only analog output 1 is available for HART communication.

※4: The status output during zero point adjustment can also be set within the error output.

※: Noise suppression parts are implemented between the power line and earth ground.
Make sure that the applied voltage is below the following levels when conducting an insulation test or withstand voltage test on the corresponding line.
Power - Ground withstand voltage test: AC 1500V (leakage current 5mA) DC 500V

■Specifications for ALTImass Transmitter to be combined with Distributor Dedicated for ALTImass II (SU1522)

Power supply	DC power supply type only (AC power supply type cannot be selected)
Pulse type	Open drain (equivalent to open collector output), Max. 500Hz ※
Pulse output state when an error occurs	Upscale (11kHz output) cannot be selected
Version	"C: 2-wire compatible version" can be selected (version B cannot be selected)

※For details of pulse output setting, refer to GS.No.GEF223.

3.2 General Performance

3.2.1 Type U general performance

● Flowrate

Type	Model	Inch	Guaranteed min. rate (kg/h)	Min. setting rate (kg/h)	Max. service rate (kg/h)	Max. allowable rate (kg/h)	Zero stability (kg/h)
Standard model	CA00A	1/4″	0.024 (0.4g/min)	0.12 (2g/min)	2.4 (40g/min)	3.6 (60g/min)	0.00024
	CA001		0.09 (1.5g/min)	0.45 (7.5g/min)	9 (150g/min)	13.5 (225g/min)	0.0009
	CA003	3/8″	0.72 (0.9 ※ 1)	3.6	72	144 (180 ※ 1)	0.0018
	CA006	3/8″	3.6	18	360	720	0.018
	CA010	1/2″	12	60	1200	2400	0.06
	CA015	1/2″	36	180	3600	7200	0.18
Standard model and Low temperature explosionproof service model	CA025	1″	108	540	10800	21600	0.54
	CA040	1·1/2″	390	1950	39000	78000	1.95
	CA050	2″					
	CA080	3″	1200 (1.2t/h)	6000 (6t/h)	120000 (120t/h)	240000 (240t/h)	6
	CA100	4″	3420 (3.42t/h)	17100 (17.1t/h)	342000 (342t/h)	684000 (684t/h)	17.1
	CA150	6″					
	CA15H	6″	7000 (7t/h)	35000 (35t/h)	700000 (700t/h)	1400000 (1400t/h)	35
	CA200	8″					
	CA20H	8″	14000 (14t/h)	70000 (70t/h)	1400000 (1400t/h)	2800000 (2800t/h)	70
	CA250	10″					
High pressure service model	CA010	Rc3/8	24	120	840	1680	0.21
	CA015	Rc3/4	78	390	2550	5100	0.636
High temperature service model	CA025	1″	108	540	10800	21600	1.08
	CA040	1·1/2″	390	1950	39000	78000	3.9
	CA050	2″					
	CA080	3″	1200 (1.2t/h)	6000 (6t/h)	120000 (120t/h)	240000 (240t/h)	12
	CA100	4″	3420 (3.42t/h)	17100 (17.1t/h)	342000 (342t/h)	684000 (684t/h)	34.2
	CA150	6″					

➡NOTES ※ 1: When maximum allowable range 180 kg/h is adopted, the minimum flow rate is 0.9 kg/h.

※ : For gas measurement, max. permissible flow velocity varies with the type of gas. Some gas may not be properly measured. Please seek our technical assistance in advance.

● Accuracy

		Standard model and Low temperature explosionproof service model	High accuracy option (※ 4)	CA00A CA001	High pressure service model (※ 5)	High temperature service model	Analog output accuracy
Liquids	Accuracy	± 0.1% (※ 1, 3)	± 0.05%	± 0.2%	± 0.2% ± ZS	± 0.1% ± ZS	Accuracy ± 0.1% of full scale
	Repeatability	± 0.05% (※ 2, 3)	± 0.025%	± 0.05%	± 0.1% ± 1/2ZS	± 0.05% ± 1/2ZS	
Gases	Accuracy	± 0.5% ± ZS	—	± 0.5% ± ZS	± 0.5% ± ZS	—	
	Repeatability	± 0.25% ± 1/2	—	± 0.25% ± 1/2	± 0.25% ± 1/2ZS	—	

➡NOTES ※ 1: ± ZS is applied for flow rates below 5% (2.5% in case of CA003) of the max. service rate. (within guaranteed flow range)
※ 2: ± 1/2 ZS is applied for flow rates below 5% ((2.5% in case ofC A003, 10% in case of CA00A and CA001) of the max. service rate. (within guaranteed flow range)
※ 3: Accuracy of liquid measurement is ± 0.1% ± ZS, and repeatability of liquid measurement is ± 0.05% ± 1/2ZS in case of CA20H and CA250.
※ 4: High accuracy option is available for limited size and conditions. Please consult OVAL for this requirement.
※ 5: If the flowrate exceeds the maximum normal flowrate, it will be "±0.3% ±ZS of the expressed amount."
※ : Accuracy is based on factory calibration accuracy (mass flowrate and density accuracy).
※ : If you request volume flow measurement for the purpose of taxing or transactions, contact OVAL.
※ : Please consult OVAL for cryogenic fluid measurement such as LNG
※ : ZS = Zero stability error

$$\text{Zero stability error} = \frac{\text{Zero stability}}{\text{Flowrate at the moment}} \times 100\%$$ (Zero stability and flowrate during the test should read in the same measurement unit.)

● Density (Liquids)

Type	Model	Inch	Density (Liquids) Metering range	Accuracy (Option)	Analog output accuracy
Standard model	CA00A	1/4″	0.3 to 2g/mL	± 0.003g/mL	Accuracy ± 0.1% of full scale
	CA001				
	CA003	3/8″		± 0.0005g/mL	
	CA006	3/8″			
	CA010	1/2″			
	CA015	1/2″			
Standard model and Low temperature explosionproof service model	CA025	1″			
	CA040	1·1/2″			
	CA050	2″			
	CA080	3″			
	CA100	4″			
	CA150	6″			
	CA15H	6″			
	CA200	8″			
	CA20H	8″			
	CA250	10″			

Type	Model	Inch	Density (Liquids) Metering range	Accuracy (Option)	Analog output accuracy
High pressure service model	CA010	Rc3/8	0.3 to 2g/mL	± 0.004g/mL	Accuracy ± 0.1% of full scale
	CA015	Rc3/4			
High temperature service model	CA025	1″	0.3 to 2g/mL	± 0.003g/mL	
	CA040	1·1/2″			
	CA050	2″			
	CA080	3″			
	CA100	4″			
	CA150	6″			

➡NOTES ※ : The accuracy is based on the calibration accuracy at factory. When measuring a cryogenic fluid such as LNG, please contact us.

3.2.2 Type S general performance

● Titanium tube type

Item		Description				
Model		CS010	CS015	CS025	CS040	CS050/CSR50
Flow rate	Guaranteed min. rate (kg/h)	36	120	360	900	1800
	Min. setting rate (kg/h)	72	240	720	1800	3600
	Max service rate (kg/h)	1220	4080	12200	30600	6120
	Max allowable rate (kg/h)	1830	6120	18300	45900	91800
	Accuracy	±0.15% ± zero stability error of RD				
	Repeatability	±0.075% ± 1/2 zero stability error of RD				
	Zero stability (kg/h)	0.12	0.41	1.22	3.06	6.12
Density (Liquid)	Metering range	0.5 to 1.0g/mL, 0.7 to 1.3g/mL, 1.0 to 1.5g/mL (※1)				
	Accuracy (option)	±0.002g/mL				
Analog output accuracy		±0.1% of FS added to each accuracy				

➡NOTES ※1: Density range varies depending on the fluid to be used.
※: The general performance is based on factory calibration accuracy.
※: If the temperature of liquid is 40℃ or higher for density measurement, heat retention measures must be taken.

$$\text{Zero stability error} = \frac{\text{Zero stability}}{\text{Flow rate at the moment}} \times 100\%$$

※: Zero stability and flowrate during the test should read in the same measurement unit.

3.2.3 Type B general performance

Item		Description					
Model		CB006	CB010	CB015	CB025	CB040	CB050
Flow rate	Guaranteed min. rate (kg/h)	24	76.8	192	576	1920	
	Min. setting rate (kg/h)	60	192	480	1440	4800	
	Max service rate (kg/h)	600	1920	4800	14400	48000	
	Max allowable rate (kg/h)	1200	3840	9600	28800	96000	
	Accuracy	±0.2% of RD（※ 1）					
	Repeatability	±0.1% of RD（※ 2）					
	Zero stability (kg/h)	0.09	0.288	0.72	2.16	7.2	
Density (Liquid)	Metering range	0.3 to 2g/mL					
	Accuracy (Option)	±0.003g/mL					
Analog output accuracy		±0.1% of FS added to each accuracy					

➡NOTES ※1：±Zero stability error is applied for flow rates below 7.5% of the max. service rate. (within guaranteed flow range)
※2：±1/2 Zero stability error is applied for flow rates below 7.5% of the max. service rate. (within guaranteed flow range)
※ ：The general performance is based on factory calibration accuracy.

$$\text{Zero stability error} = \frac{\text{Zero stability}}{\text{Flow rate at the moment}} \times 100\%$$

※: Zero stability and flowrate during the test should read in the same measurement unit.

3.3 Display

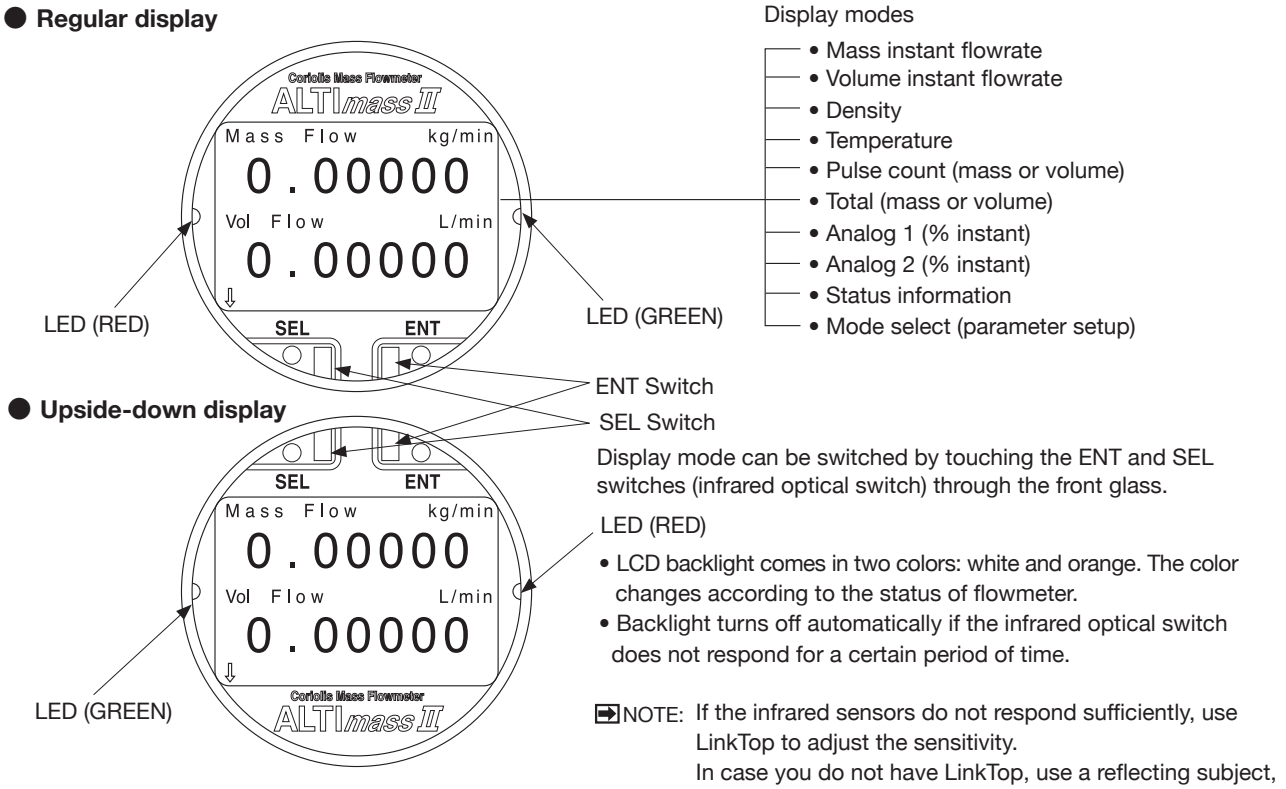


Fig. 3.1

4. PRESSURE LOSSES

4.1 Type U pressure losses

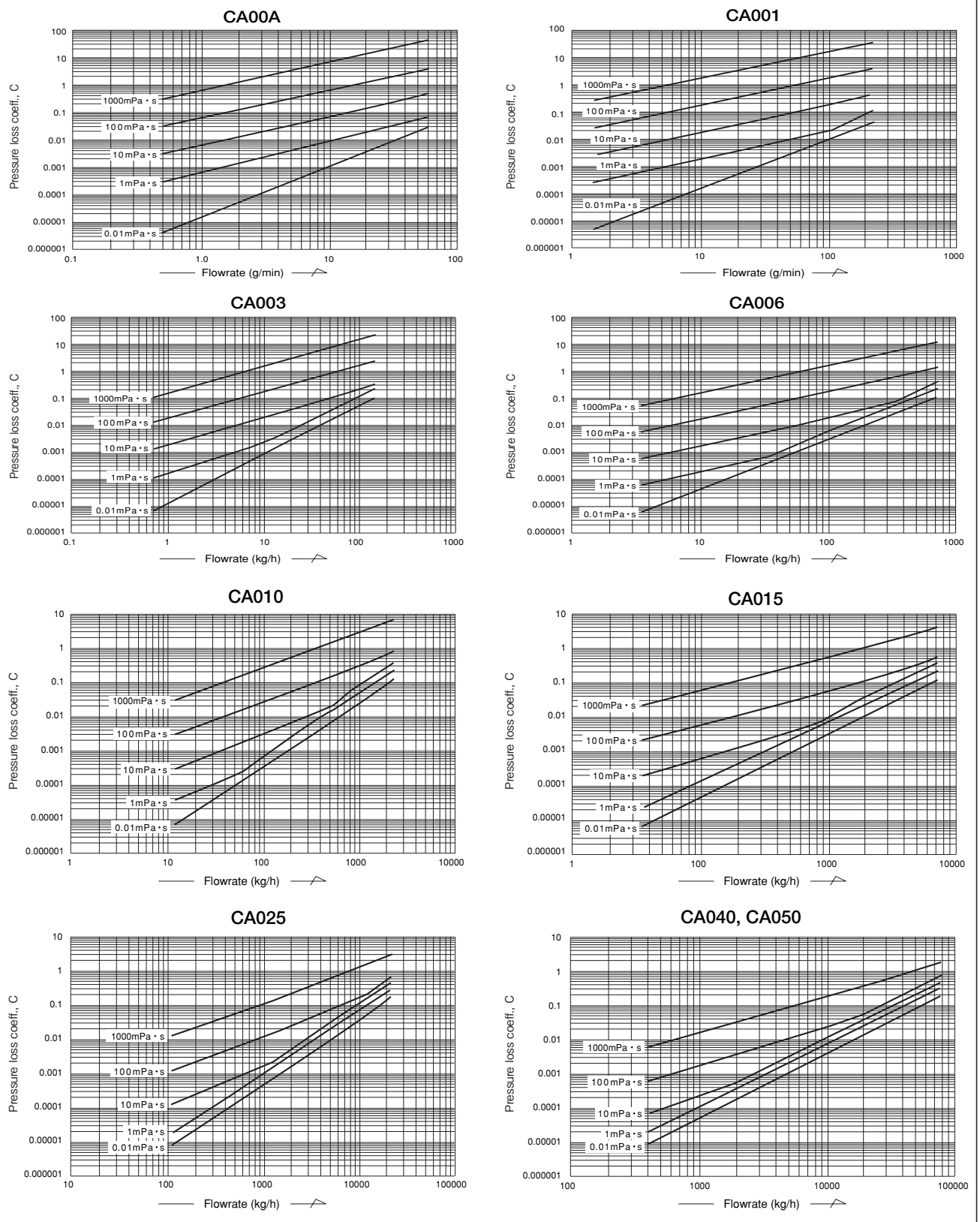
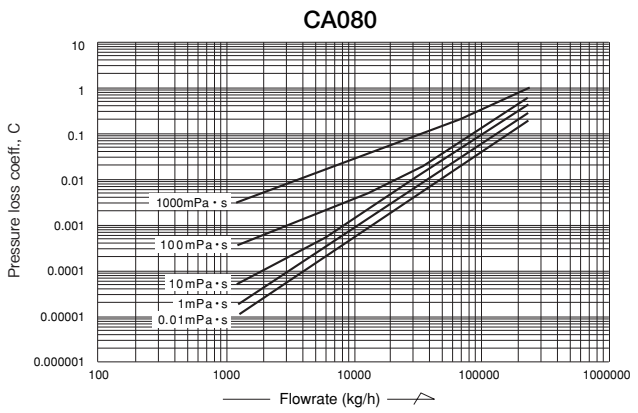
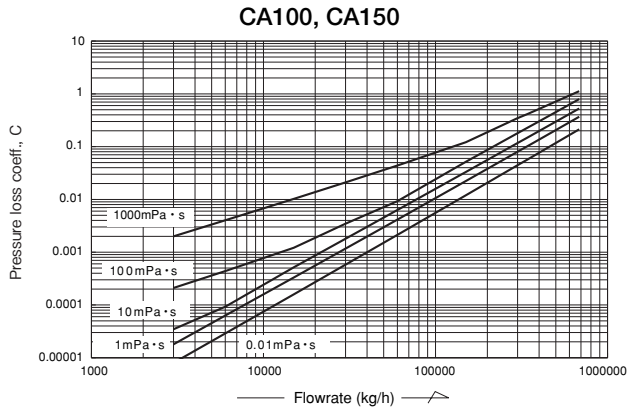
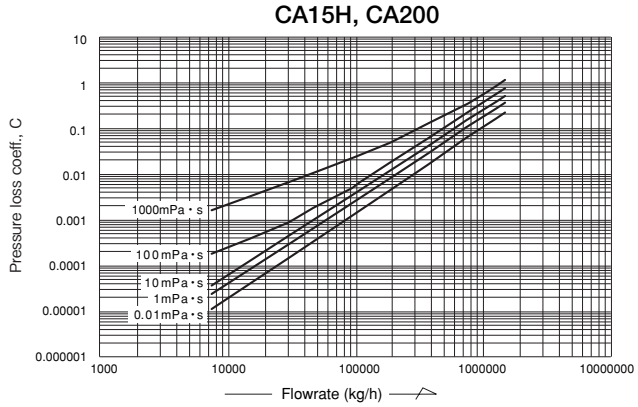


Fig.4.1.1

⇨ Cont'd on next page


CA080
Pressure loss coeff., C
10
1
0.1
0.01
0.001
0.0001
0.00001
0.000001
1000mPa・s
100mPa・s
10mPa・s
1mPa・s
0.01mPa・s
100
1000
10000
100000
1000000
Flowrate (kg/h)


CA100, CA150
Pressure loss coeff., C
10
1
0.1
0.01
0.001
0.0001
0.00001
1000mPa・s
100mPa・s
10mPa・s
1mPa・s
0.01mPa・s
1000
10000
100000
1000000
Flowrate (kg/h)


CA15H, CA200
Pressure loss coeff., C
10
1
0.1
0.01
0.001
0.0001
0.00001
0.000001
1000mPa・s
100mPa・s
10mPa・s
1mPa・s
0.01mPa・s
1000
10000
100000
1000000
10000000
Flowrate (kg/h)

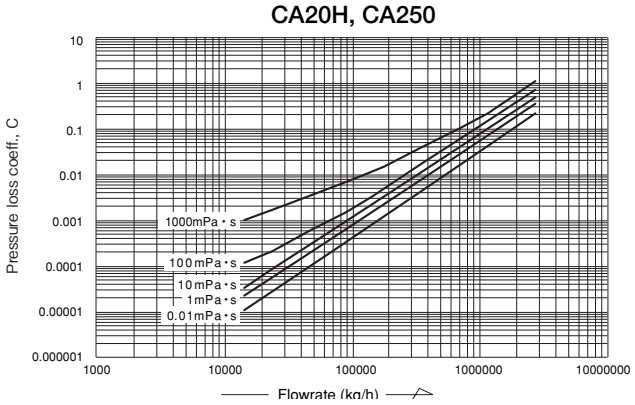

CA20H, CA250
Pressure loss coeff., C
10
1
0.1
0.01
0.001
0.0001
0.00001
0.000001
1000mPa・s
100mPa・s
10mPa・s
1mPa・s
0.01mPa・s
1000
10000
100000
1000000
10000000
Flowrate (kg/h)

Fig.4.1.2

4.2 Type S pressure losses

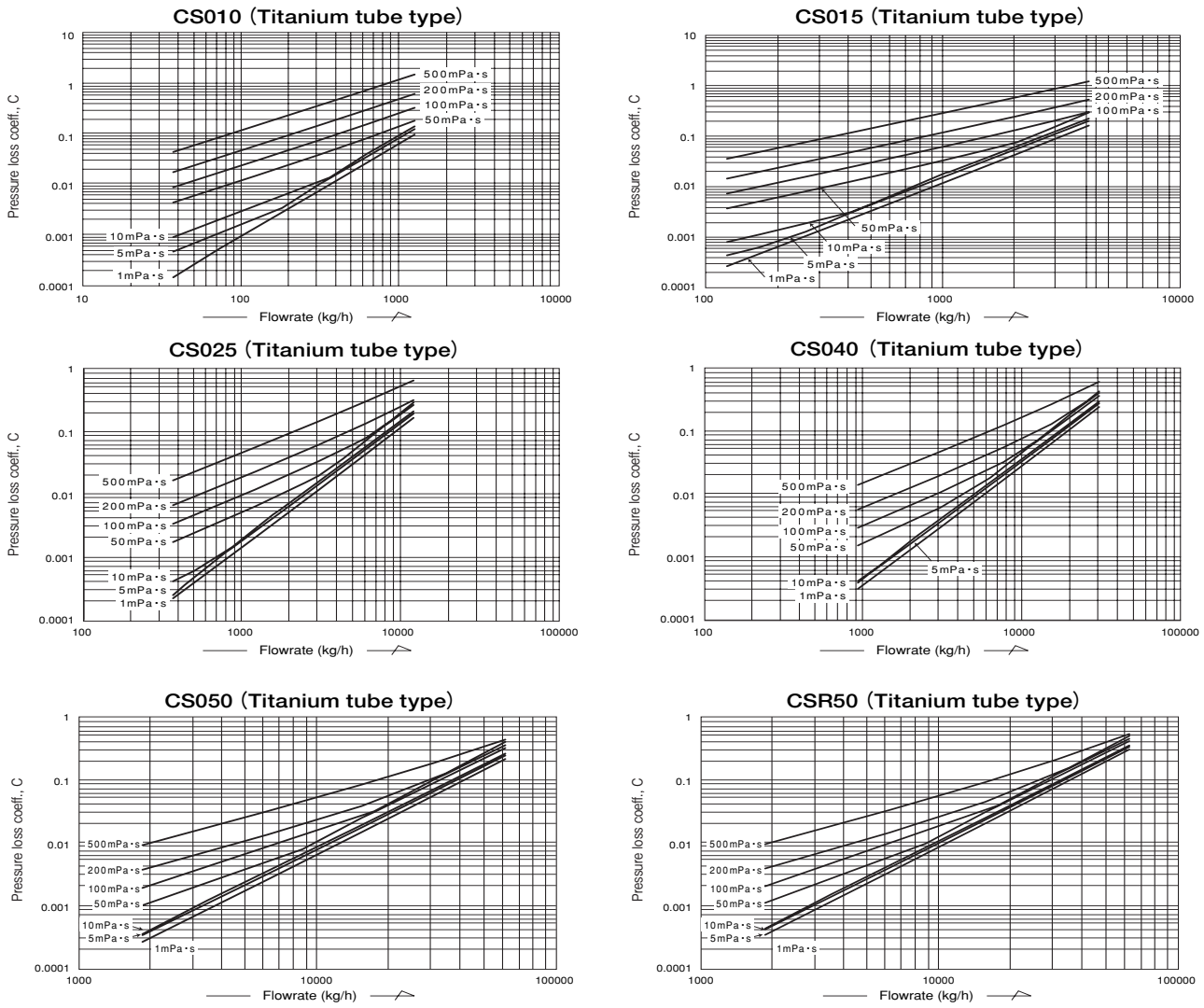


Fig.4.2

4.3 Type B pressure losses

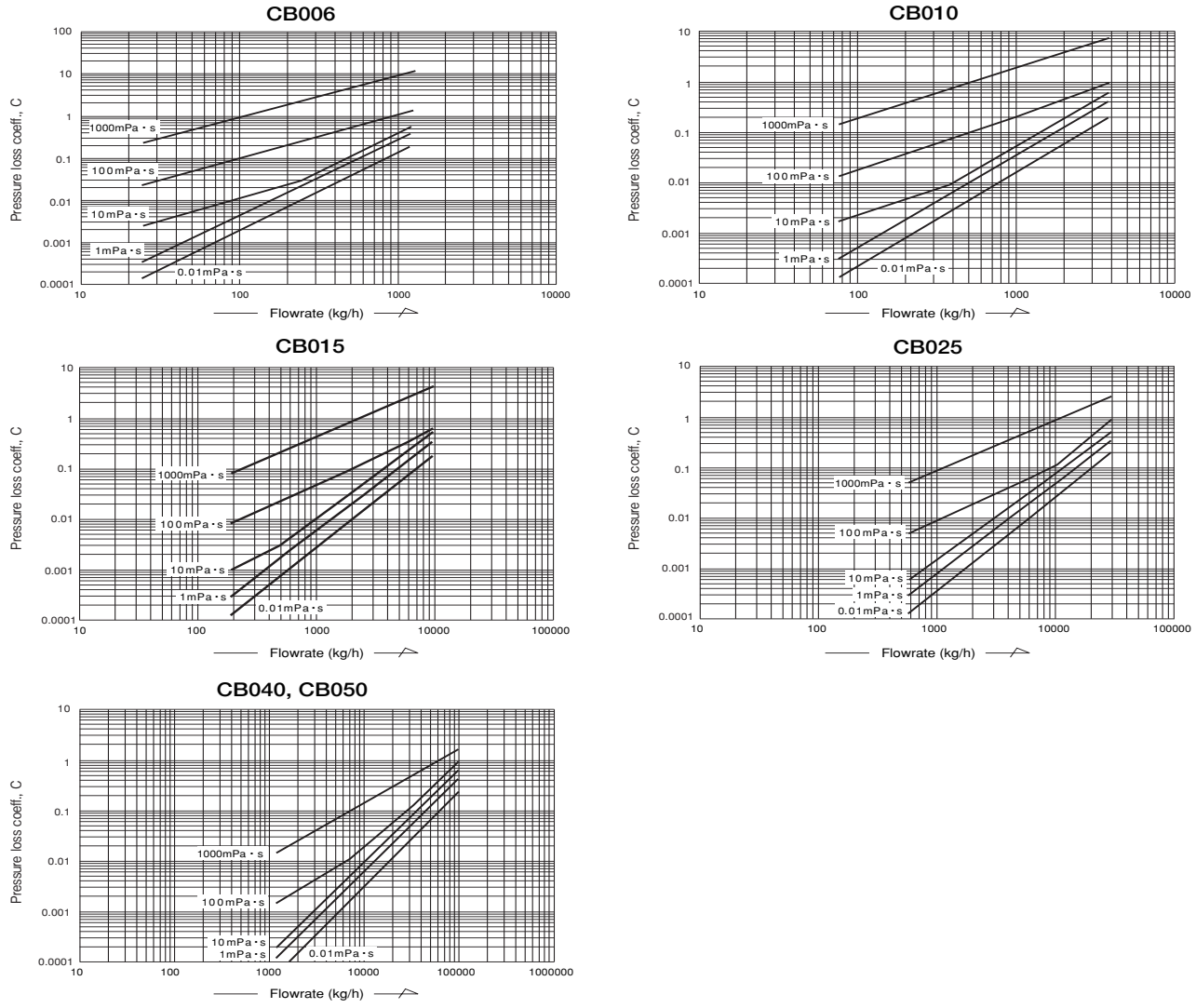


Fig.4.3

◎ **How to determine pressure loss** (※1)

(1) Seeing the graph of the type of flowmeter to be used, find the pressure loss coefficient C from the flowrate (g/min. or kg/h) and viscosity (mPa・s). Dividing this value C by specific gravity d (1 for water) gives the pressure loss, or

$$\Delta P = \frac{C}{d} \text{ (MPa)}$$

※1: Pressure loss is calculated with Newtonian fluid. For Non-Newtonian fluid, please consult OVAL.

(2) For high-viscosity liquids not shown in the graphs, calculate the pressure loss by the following equation:

$$\Delta P_2 = C \times \frac{\mu_2}{\mu_1} \times \frac{1}{d}$$

where ΔP_2: Pressure loss of high-viscosity liquid (MPa)
μ_1: Maximum viscosity shown in the graph (mPa・s)
μ_2: Viscosity of high-viscosity liquid (mPa・s)
d: Specific gravity of high-viscosity liquid (1 for water)
C: Pressure loss coefficient found from the maximum viscosity curve at a given flowrate (g/min. or kg/h)

5. PART NAMES AND OUTLINE DIMENSIONS

5.1 Type U

5.1.1 CA00A, CA001 and CA003

Dimensions in millimeters

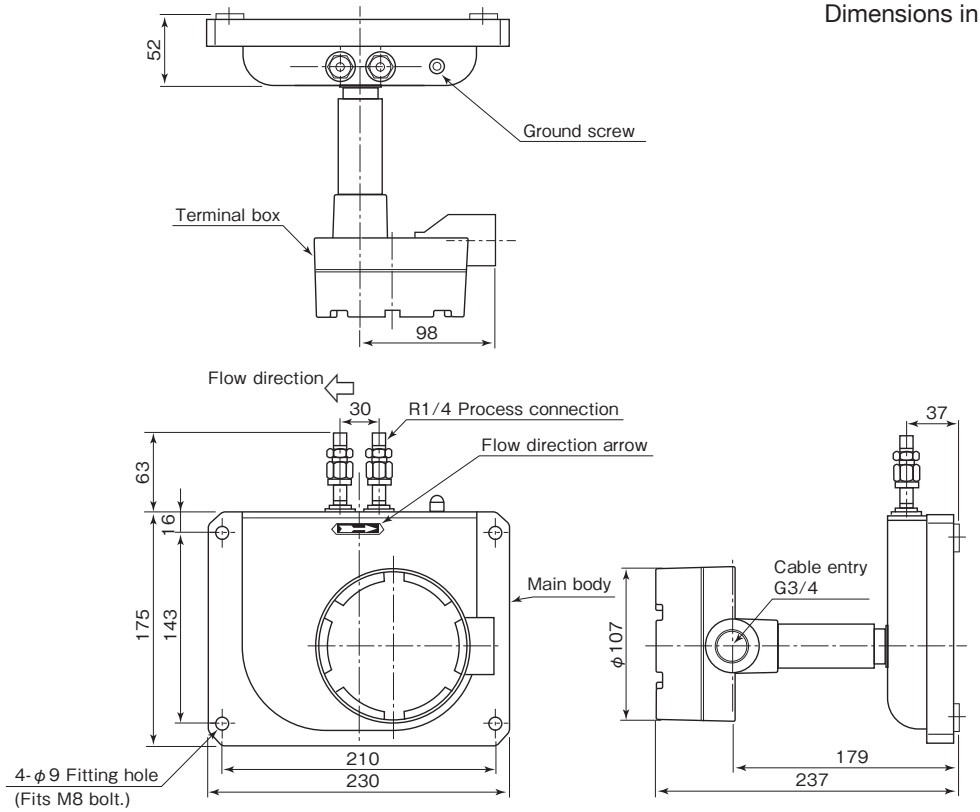
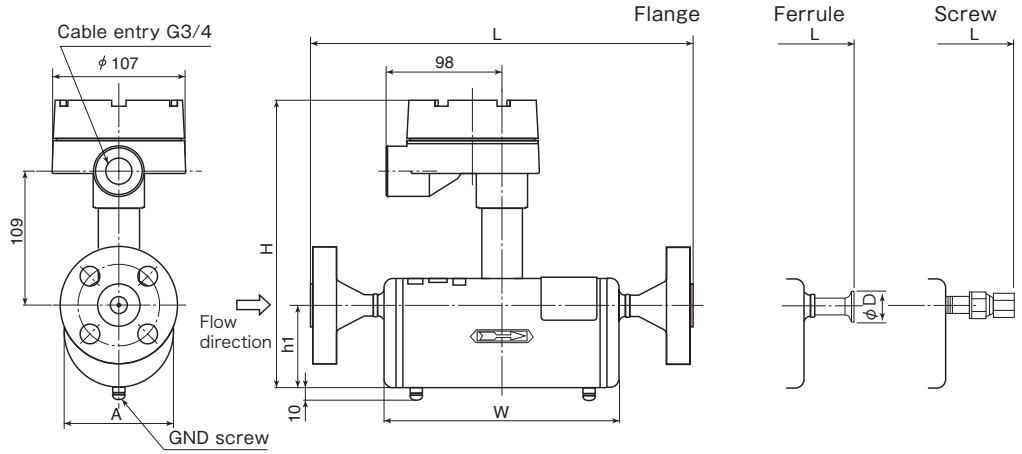


Fig. 5.1 Outline Dimensions of Sensor Unit (CA00A and CA001) Approx. weight: 9 kg



Model	Nom. size					L										H	h1	A	W	φD (Ferrule)	App. Weight kg (JIS10K)
	Flange			Ferrule	Screw Connection	Flange								Ferrule	Screw Connection						
	JIS	ASME JPI	DIN			JIS			ASME/JPI			DIN									
						10K 20K	30K 40K	63K	150	300	600	PN10 PN16	PN25 PN40								
CA003	10	1/2"	DIN15	10A	Rc3/8	275	293	313	301	310	322	281	281	265	332	230	67	89	192	34	5

※: The table above applies to material codes S and M. In case of code H, consult OVAL.

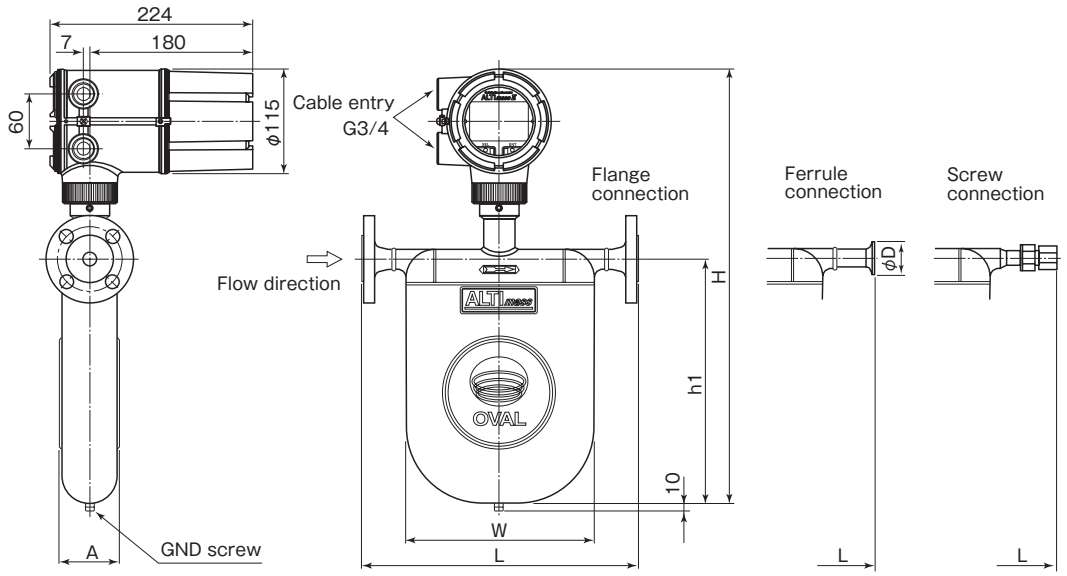
※: As long as flange O.D. and bolt holes remain the same while flange rating may differ, the flange thickness with the higher rating is chosen in the above.

※: DIN flanges are available only to meters of the material codes S and M.

※: ASME (JPI) Flange size of model CA003 is 1/2".

Fig. 5.2 Outline Dimensions of Sensor Unit (CA003)

5.1.2 CA006 to CA080 (integrally mounted models)



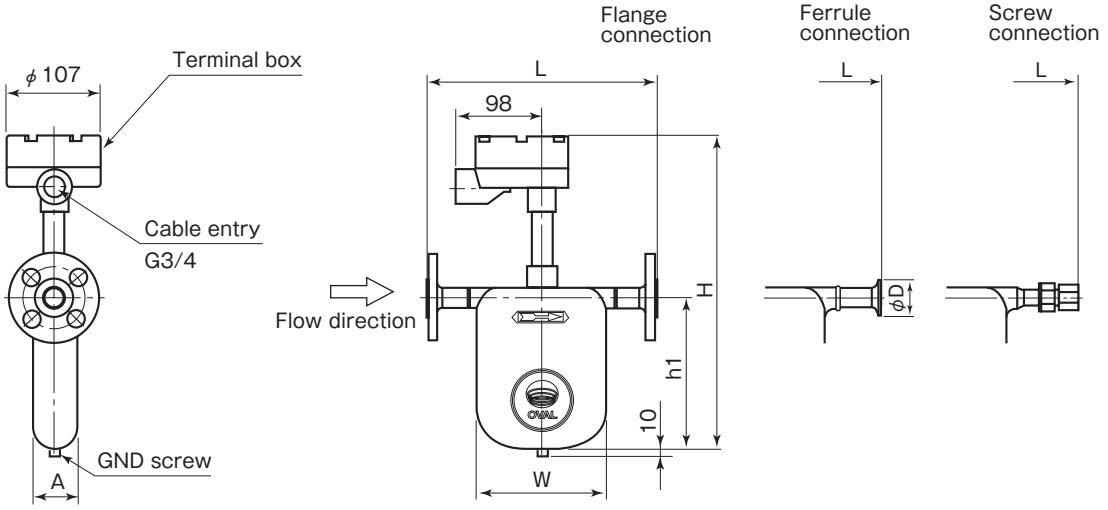
Dimensions in millimeters

Model	Nominal size					L												H	h1	A	W	φD (Ferrule)	Approx. Weight kg (JIS10K)
	Flange			Ferrule	Screw Connection	Flange										Ferrule	Screw Connection						
	JIS	ASME JPI	DIN			JIS				ASME/JPI			DIN										
						10K	20K	30K 40K	63K	150	300	600	PN10 PN16	PN25 PN40									
CA006	10	1/2″	DN15	10A	Rc3/8	242		260	280	267	276	289	247	247	232	296	384	180	53	148	34	6
CA010	15	1/2″	DN15	15A	Rc3/8	256		276	294	282	291	303	261	261	256	312	422	218	53	163		7
CA015	15	1/2″	DN15	15A	Rc3/4	299		319	343	325	334	347	305	305	289	382	472	268	65	205		8
CA025	25	1″	DN25	25, 1S	—	380		400	422	411	424	437	380	380	370	—	540	329	83	262	50.5	12
CA040	40	1·1/2″	DN40	38, 1.5S	—	513		541	585	547	560	575	513	513	493	—	670	452	121	385		22
CA050	50	2″	DN50	51, 2S	—	513	523	561	595	550	563	582	513	519		—					64	
CA080	80	3″	DN80	76.1, 3S	—	657	675	725	771	698	717	737	659	675	659	—	840	602	174	510	91	56
CA080	100	4″	DN100	—	—	887	899	911	—	913	931	977	863	889	—	—	840	602	174	510	—	63

NOTES ※: The table above applies to material codes S and M. In case of code H, consult OVAL.
※: As long as flange O.D. and bolt holes remain the same while flange rating may differ, the flange thickness with the higher rating is chosen in the above.
※: DIN flanges are available only to meters of the material codes S and M.

Fig. 5.3 Outline Dimensions of Sensor Unit (CA006 to CA080) Integrally Mounted Models

5.1.3 CA006 to CA080 (separately mounted models)



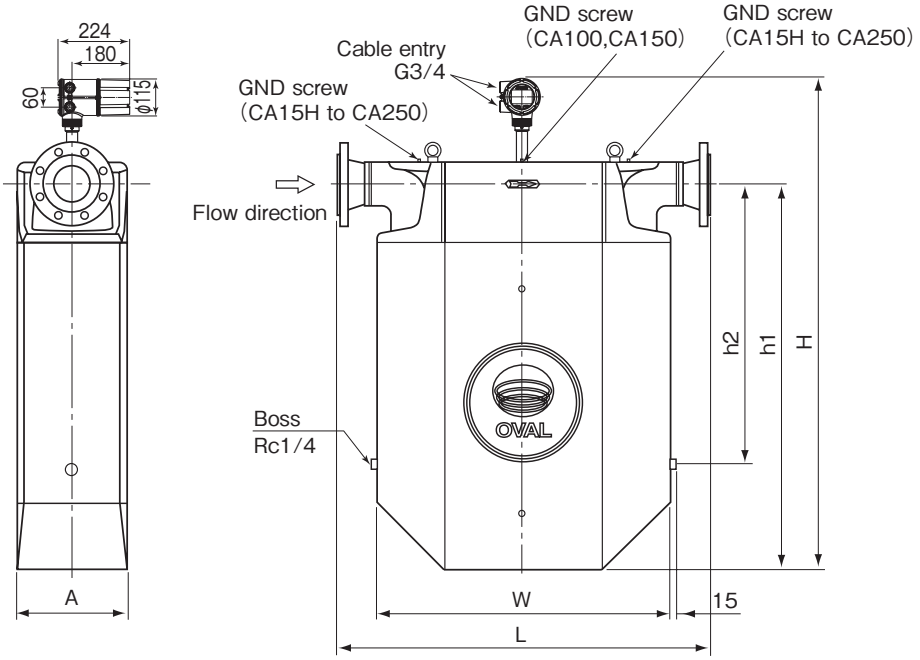
Dimensions in millimeters

Model	Nominal size					L											H	h1	A	W	ϕD (Ferrule)	Approx. Weight kg (JIS10K)
	Flange			Ferrule	Screw Connection	Flange									Ferrule	Screw Connection						
	JIS	ASME JPI	DIN			JIS				ASME/JPI			DIN									
						10K	20K	30K 40K	63K	150	300	600	PN10 PN16	PN25 PN40								
CA006	10	1/2″	DN15	10A	Rc3/8	242		260	280	267	276	289	247	247	232	296	324	180	53	148	34	4
CA010	15	1/2″	DN15	15A	Rc3/8	256		276	294	282	291	303	261	261	256	312	362	210	53	163		5
CA015	15	1/2″	DN15	15A	Rc3/4	299		319	343	325	334	347	305	305	289	382	412	268	65	205		6
CA025	25	1″	DN25	25A, 1S	—	380		400	422	411	424	437	380	380	370	—	480	329	83	262	50.5	10
CA040	40	1·1/2″	DN40	38A, 1.5S	—	513		541	585	547	560	575	513	513	493	—	610	452	121	385		20
CA050	50	2″	DN50	51A, 2S	—	513	523	561	595	550	563	582	513	519		—					64	
CA080	80	3″	DN80	76.1A, 3S	—	657	675	725	771	698	717	737	659	675	659	—	780	602	174	510	91	54
CA080	100	4″	DN100	—	—	887	899	911	—	913	931	977	863	889	—	—	780	602	174	510	—	60

NOTES ※: The table above applies to material codes S and M. In case of code H, consult OVAL.
※: As long as flange O.D. and bolt holes remain the same while flange rating may differ, the flange thickness with the higher rating is chosen in the above.
※: DIN flanges are available only to meters of the material codes S and M.

Fig. 5.4 Outline Dimensions of Sensor Unit (CA006 to CA080) Separately Mounted Models

5.1.4 CA100 to CA250 (integrally mounted models)

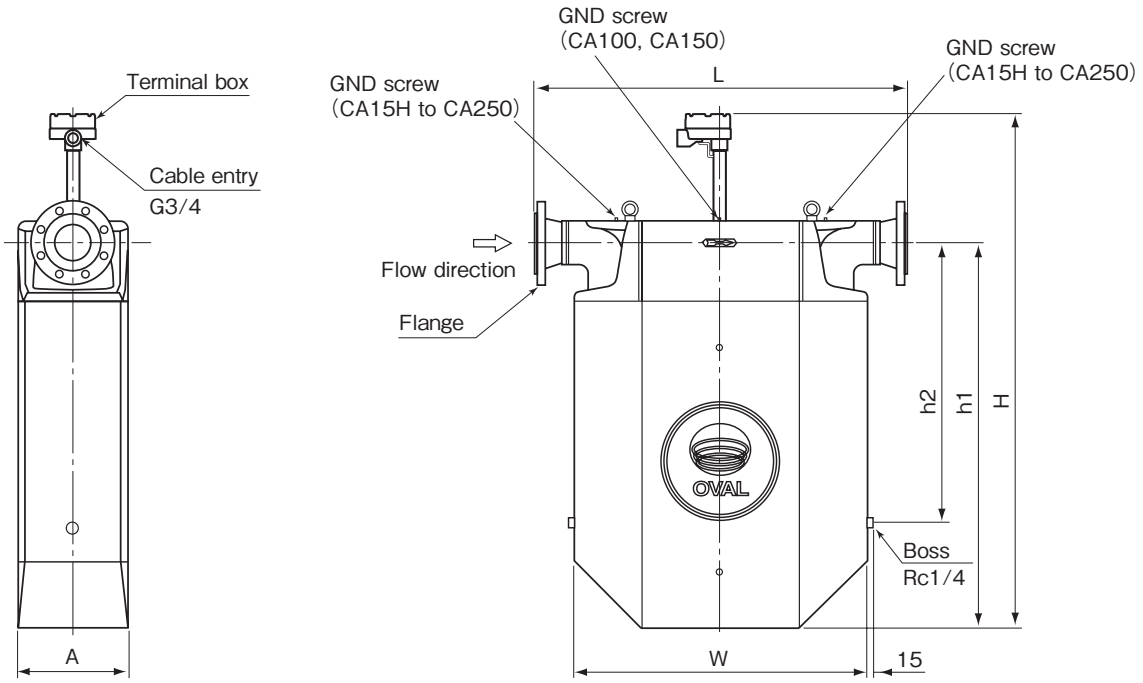


Dimensions in millimeters

Model	Nominal size			L										H	h1	h2	A	W	Approx. Weight kg (JIS10K)
	Flange			Flange															
	JIS	ASME JPI	DIN	JIS			ASME/JPI			DIN									
				10K	20K	30K	150	300	600	PN10	PN16	PN25	PN40						
CA100	100	4″	DN100	992	1006	1016	1018	1036	1082	968		994		1363	1015	660	300	810	230
CA150	150	6″	DN150	1300	1320	1330	1318	1338	1388	1250		1290							245
CA15H	150	6″	DN150	1015	1055	1099	1087	1107	1157	1019		1059		1564	1190	851	320	810	310
CA200	200	8″	DN200	1330	1368	1418	1418	1438	1494	1338		1374	1390						340
CA20H	200	8″	DN200											1790	1390	960	420	1110	610
CA250	250	10″	DN250	1699	1743	1805	1773	1805	1887	1705	1709	1745	1779						650

Fig. 5.5 Outline Dimensions of Sensor Unit (CA100 to CA250) Integrally Mounted Models

5.1.5 CA100 to CA250 (separately mounted models)



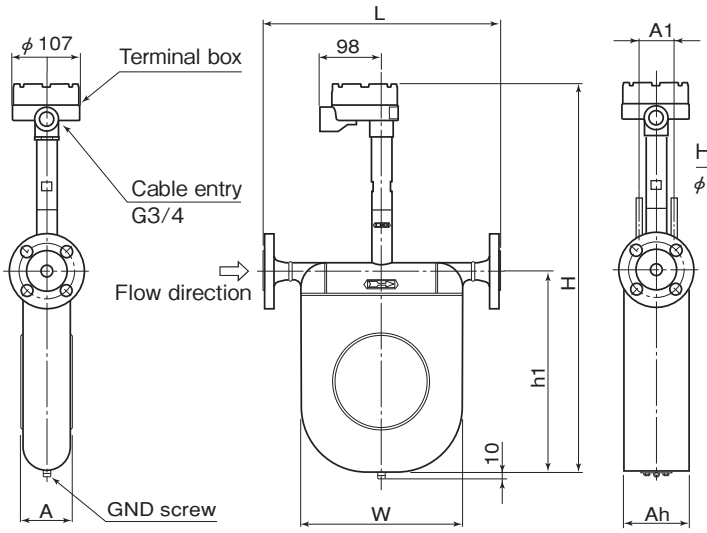
Dimensions in millimeters

Model	Nominal size			L										H	h1	h2	A	W	Approx. Weight kg (JIS10K)
	Flange			Flange															
	JIS	ASME JPI	DIN	JIS			ASME/JPI			DIN									
				10K	20K	30K	150	300	600	PN10	PN16	PN25	PN40						
CA100	100	4″	DN100	992	1006	1016	1018	1036	1082	968		994		1309	1015	660	300	810	231
CA150	150	6″	DN150	1300	1320	1330	1318	1338	1388	1250		1290							246
CA15H	150	6″	DN150	1015	1055	1099	1087	1107	1157	1019		1059		1510	1190	851	320	810	310
CA200	200	8″	DN200	1330	1368	1418	1418	1438	1494	1338		1374	1390						340
CA20H	200	8″	DN200											1736	1390	960	420	1110	610
CA250	250	10″	DN250	1699	1743	1805	1773	1805	1887	1705	1709	1745	1779						650

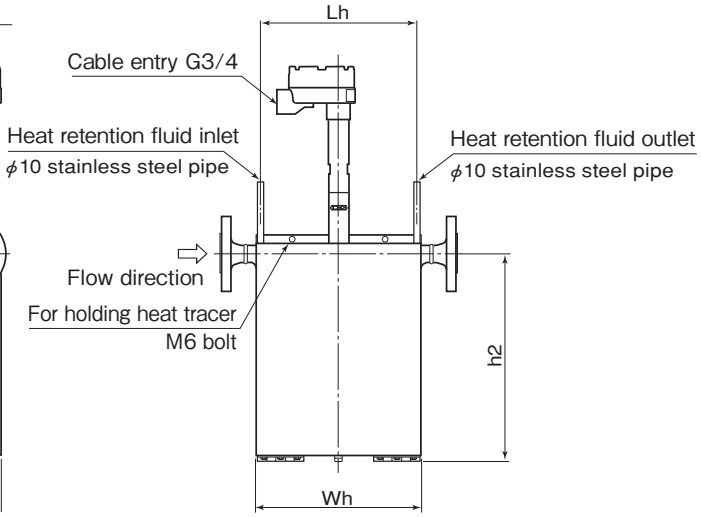
Fig. 5.6 Outline Dimensions of Sensor Unit (CA100 to CA250) Separately Mounted Models

5.1.6 High temperature service models CA025 to CA150 (separately mounted models)

● CA025 to CA080



Sensor unit



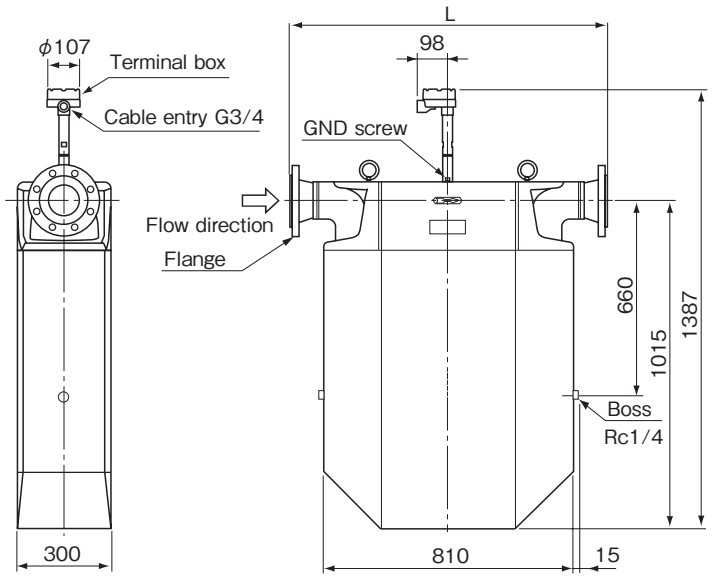
Sensor Unit with Heat Tracer

Dimensions in millimeters

Model	Nominal size	L										H	h1	A	W	Approx. Weight kg (JIS 10K)	with Heat Tracer					
		Ferrule																				
		JIS					ASME、JPI			DIN												
		10K	20K	30K	40K	63K	150	300	600	PN 10、16	PN 25、40						Lh	h2	Ah	A1	Wh	Approx. Weight kg
CA025 (High temp.)	25 (1″)	380	380	400	400	422	411	424	437	380	380	638	329	83	262	10.9	254	340	106	56	268	16.9
CA040 (High temp.)	40 (1・1/2″)	513	513	541	541	585	547	560	575	513	513	768	452	121	385	20.3	376	464	144	70	390	31.8
CA050 (High temp.)	50 (2″)	513	523	561	561	595	550	563	582	513	519					20.7						32.2
CA080 (High temp.)	80 (3″)	657	675	725	725	771	699	717	737	659	675	960	602	174	510	54.1	501	612	198	110	545	75.1

● CA100 to CA150

Dimensions in millimeters

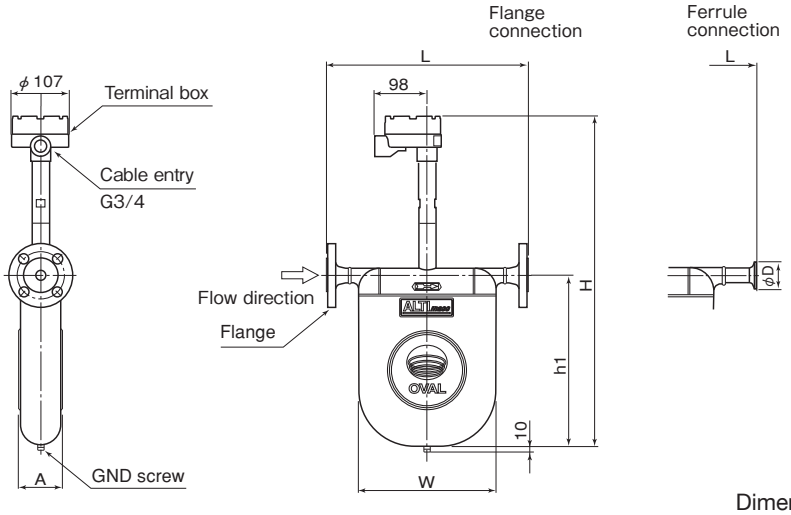


Model	Flange		L	Approx. Weight kg (JIS 10K)
	Nominal size	Flange rating		
CA100	100	JIS 10K	992	231
		JIS 20K	1006	
		JIS 30K	1016	
	4″	ASME、JPI 150	1018	
		ASME、JPI 300	1036	
		ASME、JPI 600	1082	
	DN100	PN 10、16	968	
		PN 25、40	994	
CA150	150	JIS 10K	1300	246
		JIS 20K	1320	
		JIS 30K	1330	
	6″	ASME、JPI 150	1318	
		ASME、JPI 300	1338	
		ASME、JPI 600	1388	
	DN150	PN 10、16	1250	
		PN 25、40	1290	

Fig. 5.7 Outline Dimensions of High Temperature Model Sensor Unit (CA025 to CA150)

5.1.7 Low temperature explosionproof models CA025 to CA250 (separately mounted models)

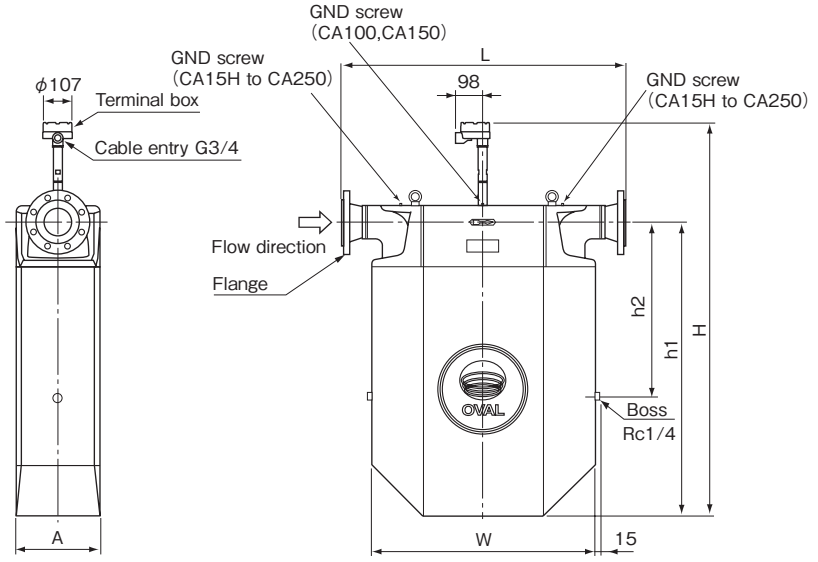
● CA025 to CA080



Dimensions in millimeters

Model	Nominal size				L										H	h1	A	W	φD (Ferrule)	Approx. Weight kg (JIS10K)
	Flange			Ferrule ISO, IDF	Flange									Ferrule						
	JIS	ASME JPI	DIN		JIS				ASME/JPI			DIN								
					10K	20K	30K 40K	63K	150	300	600	PN10 PN16	PN25 PN40							
CA025	25	1″	DN25	25A, 1S	380		400	422	411	424	437	380	380	370	660	329	83	262	50.5	11
CA040	40	1·1/2″	DN40	38A, 1.5S	513		541	585	547	560	575	513	513	493	790	452	121	385		20
CA050	50	2″	DN50	51A, 2S	513	523	561	595	550	563	582	513	519						64	21
CA080	80	3″	DN80	76.1A, 3S	657	675	725	771	699	717	737	659	675	659	960	602	174	510	91	54

● CA100 to CA250



Dimensions in millimeters

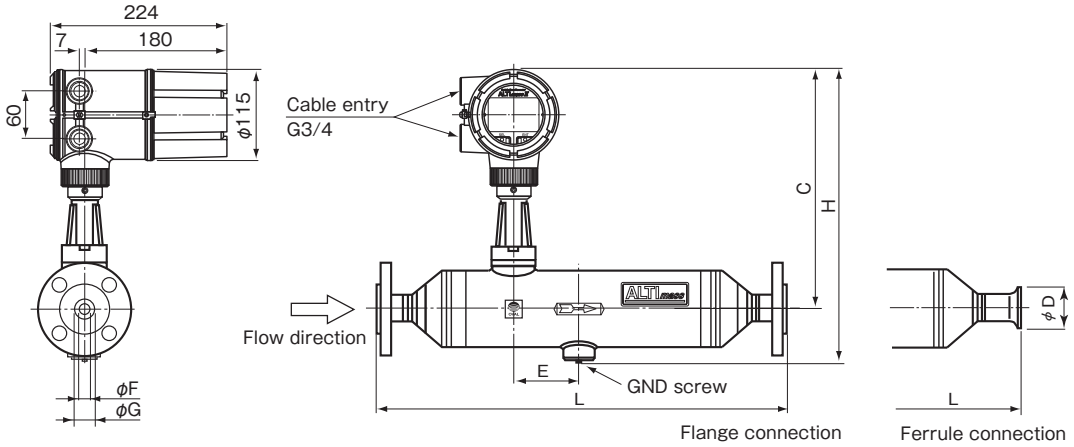
Model	Nominal size			L										H	h1	h2	A	W	Approx. Weight kg (JIS10K)
	Flange			Flange															
	JIS	ASME JPI	DIN	JIS			ASME/JPI			DIN										
				10K	20K	30K	150	300	600	PN10	PN16	PN25	PN40							
CA100	100	4″	DN100	992	1006	1016	1018	1036	1082	968		994		1387	1015	660	300	810	231
CA150	150	6″	DN150	1300	1320	1330	1318	1338	1388	1250		1290							246
CA15H	150	6″	DN150	1015	1055	1099	1087	1107	1157	1019		1059		1588	1190	851	320	810	310
CA200	200	8″	DN200	1330	1368	1418	1418	1438	1494	1338		1374	1390						340
CA20H	200	8″	DN200											1814	1390	960	420	1110	610
CA250	250	10″	DN250	1699	1743	1805	1773	1805	1887	1705	1709	1745	1779						650

Fig. 5.8 Outline Dimensions of Low Temperature Explosionproof Model Sensor Unit (CA025 to CA250)

5.2 Type S

5.2.1 Titanium tube type (integrally and separately mounted models)

● Integrally mounted models

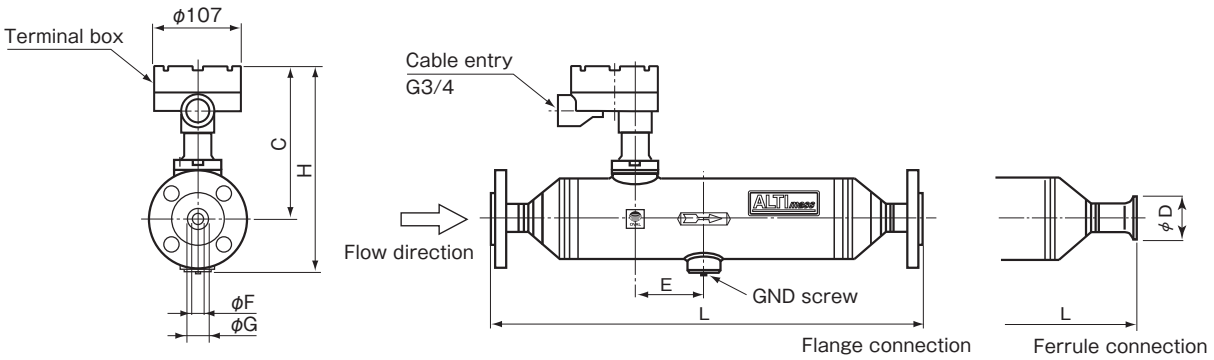


Dimensions in millimeters

Model	Nominal size			L				H	C	φF	φG	E	φD (Ferrule)	Approx. Weight kg (JIS10K)
	Flange		Ferrule ISO, IDF	Flange			Ferrule							
	JIS	ASME JPI		JIS		ASME/JPI								
				10K	20K	150								
CS010	10	1/2″	10A	426	452	458	426	350	300	6.3	11.4	69	34	9
CS015	15	1/2″	15A	464	490	496	464			9.3	16.8	80		10
CS025	25	1″	38, 1.5S	529	555	570	529	383	313	15.4	26.6	88	50.5	17
CS040	40	1·1/2″	51, 2S	716	733	749	716	399	319	22.3	40.4	112	64	27
CS050	50	2″	63.5, 2.5S	882	906	919	882	434	332	30.5	52.6	153	77.5	37
CSR50	80	3″	88.9, 3.5S	1032	1046	1073	1032				77.8		106	39

➡NOTES ※ Loose flange is applied.
※ Ferrule connections of models CS010 and CS015 comply with ISO2852.
※ Nominal size S: Inch Sanitary version

● Separately mounted models



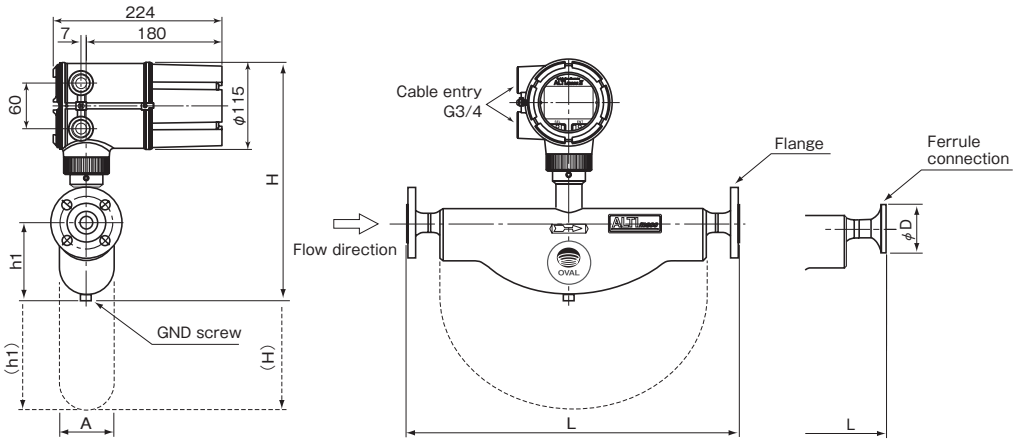
Dimensions in millimeters

Model	Nominal size			L				H	C	φF	φG	E	φD (Ferrule)	Approx. Weight kg (JIS10K)
	Flange		Ferrule ISO, IDF	Flange			Ferrule							
	JIS	ASME JPI		JIS		ASME/JPI								
				10K	20K	150								
CS010	10	1/2″	10A	426	452	458	426	246	197	6.3	11.4	69	34	7
CS015	15	1/2″	15A	464	490	496	464			9.3	16.8	80		8
CS025	25	1″	38, 1.5S	529	555	570	529	280	210	15.4	26.6	88	50.5	15
CS040	40	1·1/2″	51, 2S	716	733	749	716	296	216	22.3	40.4	112	64	25
CS050	50	2″	63.5, 2.5S	882	906	919	882	332	229	30.5	52.6	153	77.5	35
CSR50	80	3″	88.9, 3.5S	1032	1046	1073	1032				77.8		106	37

Fig. 5.9 Outline Dimensions of Titanium Tube Type

5.3 Type B

5.3.1 Integrally mounted models



※: Dotted lines represent sensor units CB040 and 050.

Dimensions in millimeters

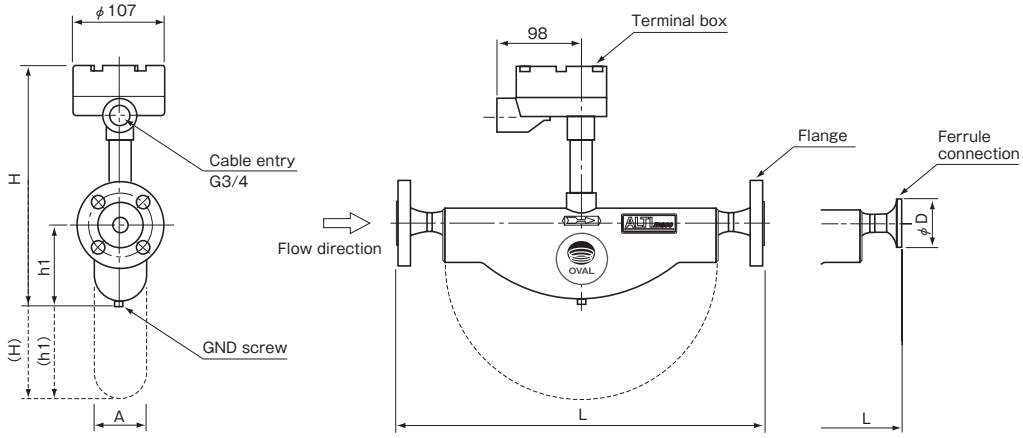
Model	Nominal size			L							H	h1	A	φD (Ferrule)	Approx. Weight kg (JIS10K)
	Flange		Ferrule ISO, IDF	Flange						Ferrule					
	JIS	ASME JPI		JIS			ASME/JPI								
				10K	20K	30K	150	300	600						
CB006	10	1/2″	10A	343	343	361	369	378	391	333	314	94	59	34	6
CB010	15	1/2″	15A	380	380	400	406	415	428	380	310				7
CB015	15	1/2″	15A	486	486	506	512	521	534	476	401	168	91		11
CB025	25	1″	25, 1S	569	569	589	601	613	626	559	396	175		50.5	13
CB040	40	1•1/2″	38, 1.5S	626	626	654	660	673	689	606	548	323	125		32
CB050	50	2″	51, 2S	626	636	674	663	676	695					64	

Process connection: A in mm; S (sanitary) in inches.

➡NOTES ※: As long as flange O.D. and bolt holes remain the same while flange rating may differ, the flange thickness with the higher rating is chosen in the above.

Fig. 5.10 Outline Dimensions of Integrally Mounted Model

5.3.2 Separately mounted models



※: Dotted lines represent sensor units CB040 and 050.

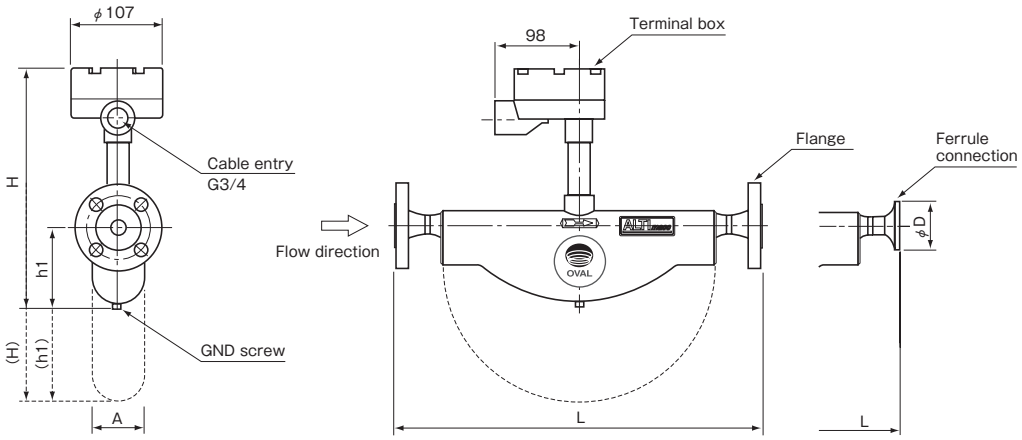
Dimensions in millimeters

Model	Nominal size			L							H	h1	A	φD (Ferrule)	Approx. Weight kg (JIS10K)
	Flange		Ferrule ISO, IDF	Flange						Ferrule					
	JIS	ASME JPI		JIS			ASME/JPI								
				10K	20K	30K	150	300	600						
CB006	10	1/2″	10A	343	343	361	369	378	391	333	257	94	59	34	5
CB010	15	1/2″	15A	380	380	400	406	415	428	380	254				
CB015	15	1/2″	15A	486	486	506	512	521	534	476	345	168	91		9
CB025	25	1″	25, 1S	569	569	589	601	613	626	559	340	175		50.5	12
CB040	40	1•1/2″	38, 1.5S	626	626	654	660	673	689	606	491	323	125		30
CB050	50	2″	51, 2S	626	636	674	663	676	695					64	31

Process connection: A in mm; S (sanitary) in inches.

Fig. 5.11 Outline Dimensions of Separately Mounted Model

5.3.2 Separately mounted models



※: Dotted lines represent sensor units CB040 and 050.

Dimensions in millimeters

Model	Nominal size			L							H	h1	A	ϕD (Ferrule)	Approx. Weight kg (JIS10K)
	Flange		Ferrule ISO, IDF	Flange						Ferrule					
	JIS	ASME JPI		JIS			ASME/JPI								
				10K	20K	30K	150	300	600						
CB006	10	1/2″	10A	343	343	361	369	378	391	333	257	94	59	34	5
CB010	15	1/2″	15A	380	380	400	406	415	428	380	254				
CB015	15	1/2″	15A	486	486	506	512	521	534	476	345	168	91		9
CB025	25	1″	25, 1S	569	569	589	601	613	626	559	340	175		50.5	12
CB040	40	1･1/2″	38, 1.5S	626	626	654	660	673	689	606	491	323	125		30
CB050	50	2″	51, 2S	626	636	674	663	676	695					64	31

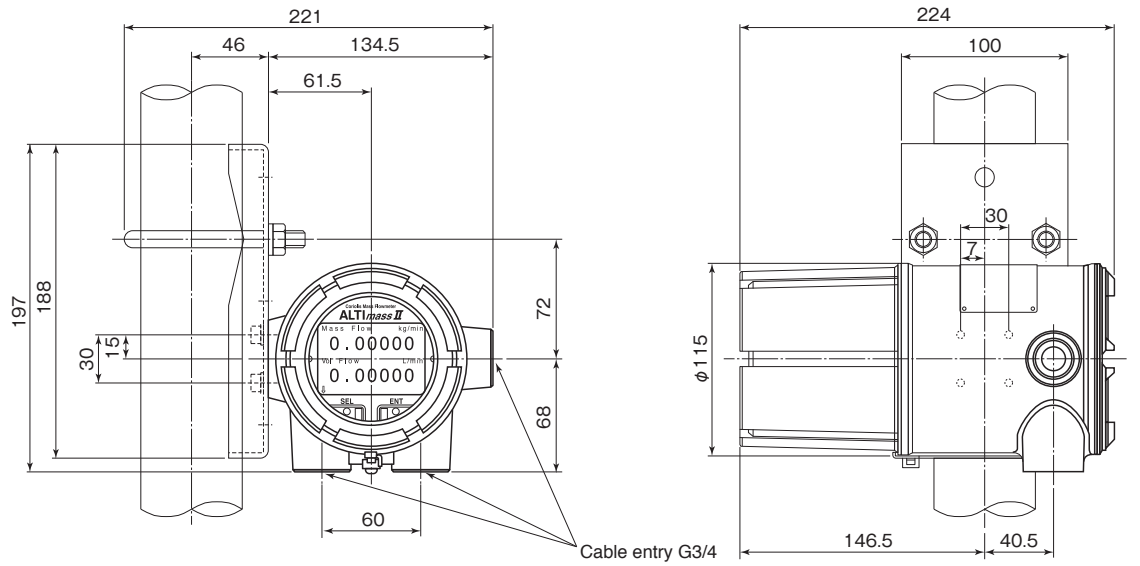
Process connection: A in mm; S (sanitary) in inches.

Fig. 5.12 Outline Dimensions of Separately Mounted Model

5.4 Separately mounted Transmitter

• Stanchion mounting

Dimensions in millimeters



※ : While stanchion mounting bracket and U bolts are furnished as standard accessories, the stanchion itself must be provided by the customer.

Fig. 5.13 Outline Dimensions of Transmitter

6. INSTALLATION

6.1 Installation Guidelines

(1) Select a location easy to access for inspection and maintenance.
(2) Avoid a location subject to excessive temperature variation and vibration.
(3) Avoid direct exposure to the sun. (Provide a sunshade or similar protection to keep the meter out of exposure to direct sunlight if necessary.)
(4) Avoid a location where immersion in water is a possibility.
(5) Select a location free from an atmosphere of corrosive gases.
(6) Location should be free from dust and mist.
(7) Separate at least one meter from sources of electromagnetic induction, such as large transformers and motors. Also, keep the meter away as far as possible from the sources of severe vibration, such as motors and pumps.
(8) To ensure consistent and accurate measurement, adhere to the instructions in 6.2 Physical Orientation, 6.3 Installation Location, 6.4 Installation Guidelines, and 6.6 Installing Proper Pipe Supports.
(9) The Coriolis flowmeter requires an installation location where pipeline oscillation is held below 0.3G to ensure consistent and accurate measurement. External vibration (including pulsation) particularly with the same frequency as the drive frequency of the measuring pipe may affect the measurement. Contact OVAL regarding drive frequency of each model.
(10) Locate the control valve downstream of the flowmeter.
Where cavitation is likely to occur, install the flowmeter at least five meters away.

6.2 Physical Orientation

6.2.1 Type U physical orientation

(1) The sensor may be installed either in a horizontal run or vertical run. The following physical orientations are suggested, depending on the type of process fluid. [Orientation (2) shows the typical orientation for liquids.]

(2) If cable entry points upwards, there must be adequate provisions for sealing off or preventing rainwater and other moisture from entering the meter.

● CA003 to CA250

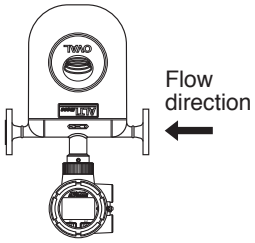
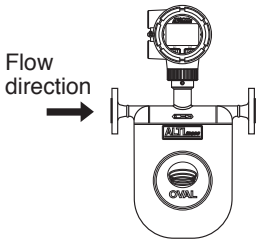
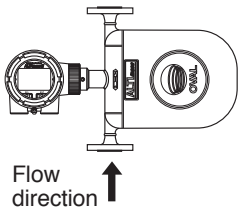
	Horizontal run		Vertical run
	No.1	No.2	No.3
Orientation			
Fluids	● Gases ● Slurries	● Liquids	● Slurries (requiring cleaning) ● Liquids ● Gases

Fig. 6.1

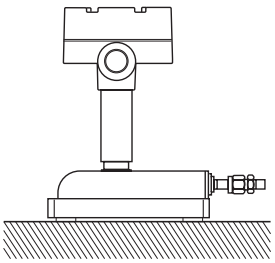
➡NOTE: ※1: For installation orientation in No. 1, we recommend the separately mounted transmitter. If the integrally mounted transmitter is preferred, contact OVAL.

※2: The measuring tube of the CA003 is in double-loop configuration without self-draining feature.

● CA00A and CA001

Installation on a bench or wall are acceptable. We recommend the following orientations:

◆ **Installation on a bench**



◆ **Installation on a wall**

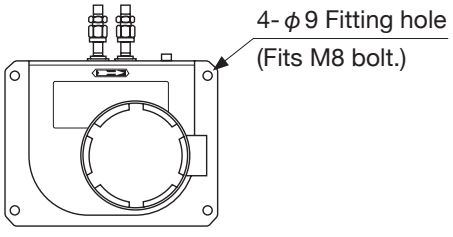


Fig. 6.2

➡NOTE: For wall mounting, secure the body with bolts, making use of sensor unit fitting holes.

6.2.2 Type S physical orientation

➡NOTE: Refer to Item-12 for EHEDG Certified Product.

(1) The flowmeter may be installed either in a horizontal line or a vertical line.
(2) Where cleansing is required or where air bubble entrapment is likely, we suggest installation in a vertical run.
(3) If cable entry points upwards, take necessary measures to prevent rain and water from entering the meter.

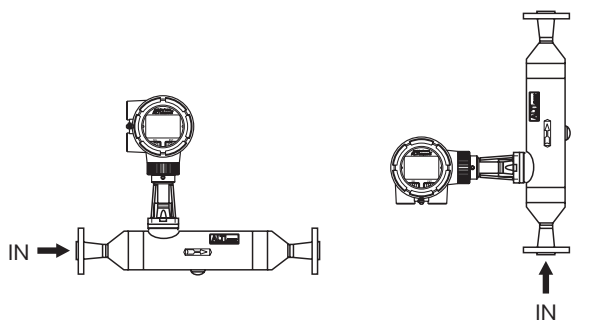


Fig. 6.3

6.2.3 Type B physical orientation

(1) The flowmeter may be installed either in a horizontal line or a vertical line.
(2) Where cleansing is required or where air bubble entrapment is likely, we suggest installation in a vertical run.
(3) If cable entry points upwards, take necessary measures to prevent rain and water from entering the meter.

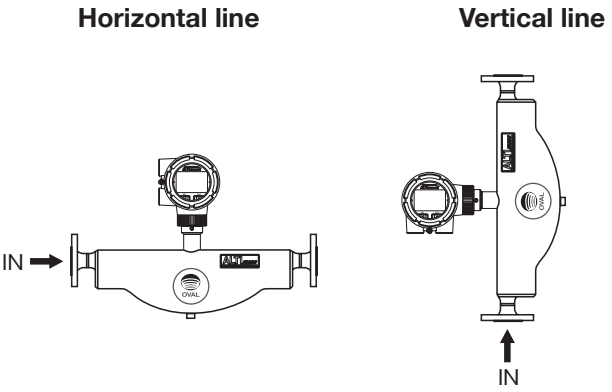
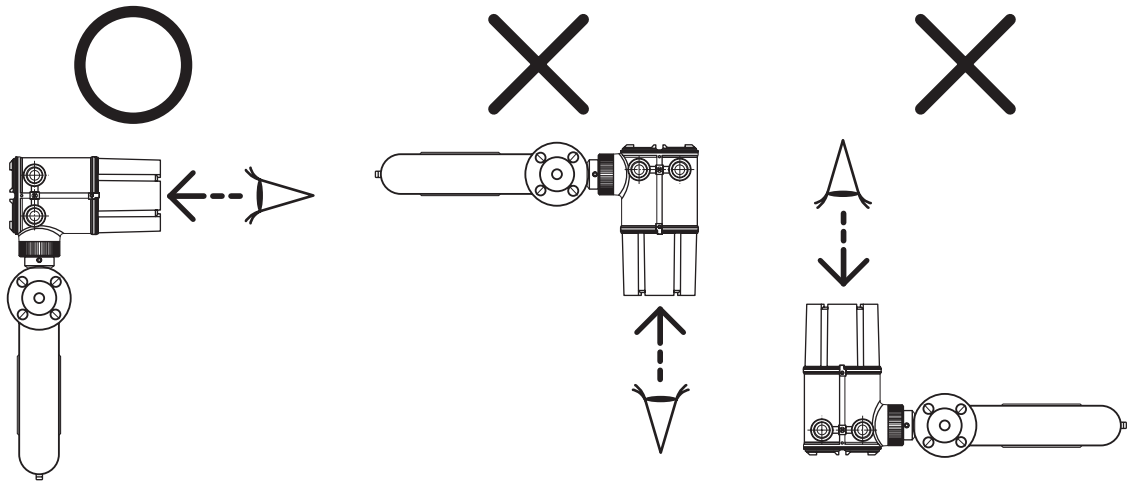


Fig. 6.4

6.2.4 Transmitter orientation

Transmitter installation is correct if its display face is not in the horizontal plane.



View from side　　View from bottom　　View from top

※ The above figures represent Type U, but Type S and Type B must be installed the same way.

Fig. 6.5

➡NOTE: For the orientation of separately mounted transmitter, see 6.9 Separately Mounted Transmitter Installation.

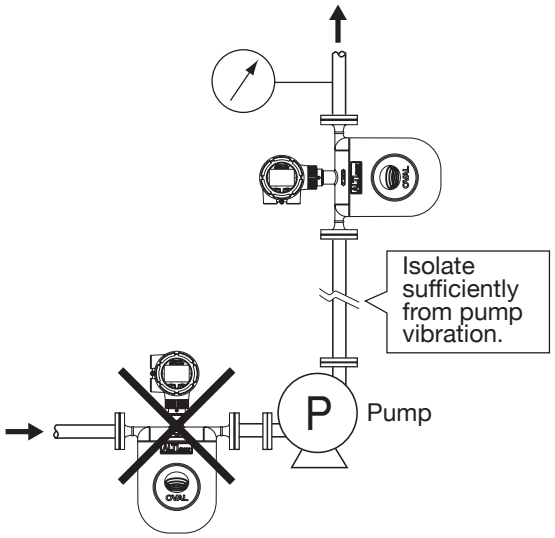
6.3 Installation Location

Because air bubbles in the flow tube produce a loss of meter accuracy, avoid the following installation or practice.

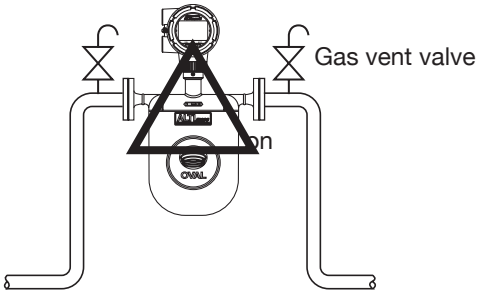
- Locating the flowmeter at the highest point in the piping system.
- In a vertical piping system, directly discharging the metered fluid from the piping system without the provision of a valve or similar controlling device.

(While Type U meter is used in the installation examples below, the same applies to Types S and B.)

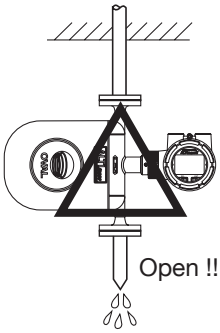
① Avoid installing on the suction side of a pump.



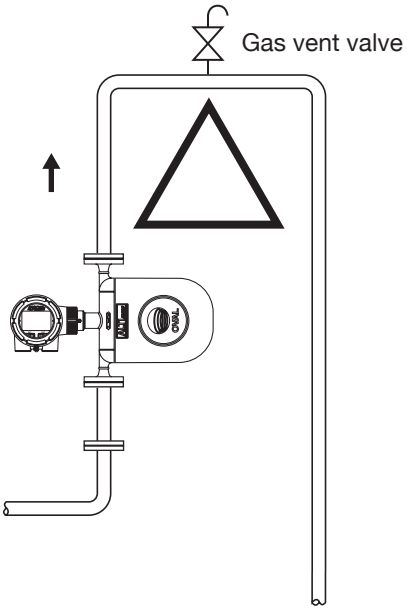
② If the flowmeter is to be installed at the highest point of the process, make sure that gas is not retained in the pipeline.
Installation of valves for gas venting is recommended.



③ To prevent cavitation, avoid installation at the outlet which is open to the atmosphere.
In cases where such installation is unavoidable due to limited space, install a valve on the outlet side.



④ For vertical installation, avoid routing the outlet pipe as shown in the diagram below.
In cases where such installation is unavoidable, install a valve for gas venting.



⑤ Where hydrostatic head is used.

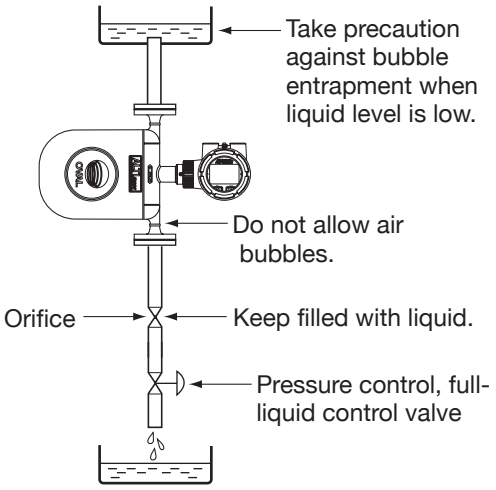


Fig. 6.6

6.4 Installation Guidelines

6.4.1 Standard piping conditions

(1) A Coriolis mass flowmeter is unaffected by the flow pattern of process fluid. Basically, therefore, it does not require any flow straightener. However, connection to a piping with different diameter should be done using a concentric reducer or tapered pipe.
(2) Locate the meter sufficiently away from sources of vibration and pulsations.
(3) For use in zeroing, a valve that can shut off the process flow completely should be provided downstream of the meter. (For maintenance purposes, installation of another valve upstream of the meter is recommended.)
(4) Avoid giving pipe stress on the sensor.

Type U standard piping conditions

(While Type U meter is used in the installation examples below, the same applies to Types S and B.)

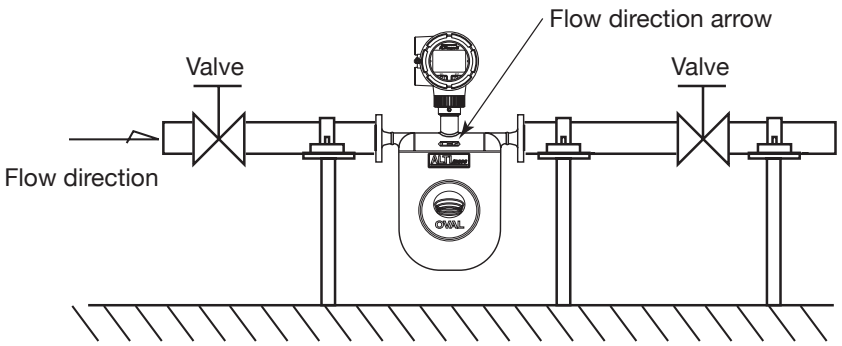


Fig.6.7

⚠CAUTION: This meter is designed for flange mounting. It should be supported on the part of the pipeline. Do not support the sensor body.
Although models CA00A and CA001 are designed to be sensor-body mounting, make sure to provide the piping support both upstream and downstream of the meter.

6.4.2 Influence of vibration and pulsation

Generally, Coriolis mass flowmeters can best perform in measurements with least pipeline vibration and pulsation. In applications where vibration and pulsation are not negligible, the following considerations must be taken into account:

(1) Locate the meter sufficiently away from the sources of vibration and pulsation.
(2) Provide attenuators, such as flexible tubes and chambers. However, if these elements are caused to vibrate by the drive of the flowmeter, take measure such as keeping these elements away from the flowmeter to avoid zero shifts.
(3) Close shutoff valves upstream and downstream of the meter at process flow shutdown. (This is to prevent erratic signal generation at shutoff. Bear in mind, however, to prevent pressure buildup inside from exceeding the max allowable pressure of the meter.)
(4) If meters of the same kind are to be installed in the same pipeline, locate them sufficiently apart (at least five times the face-to-face dimension of the meter).

6.4.3 Prevention of cavitation

Cavitation can cause a loss of meter accuracy in measurement. Maintain line pressures that will not cause cavitation upstream and downstream of the meter for this reason. Avoid making such an arrangement as to open the line to the atmosphere immediately downstream of the meter. Care must be taken particularly in handling liquids of high steam pressure.
In practice, recommended minimum backpressure (downstream pressure) of the meter is calculated by the formula:

$$Pd = 3 \Delta P + 1.3Pv$$

where Pd: Downstream pressure (MPa [absolute])
ΔP: Pressure loss across the flowmeter (MPa)
Pv: Steam pressure of the liquid at the temperature of measurement (MPa [absolute])

6.4.4 Prevention of excessive flows

⚠CAUTION: Exceeding the meter's maximum flowrate will not significantly reduce the meter's long term durability. Bear in mind, however, that the output will be clamped at 110% of the allowable full scale flowrate.

6.4.5 Prevention of gas mixed flows

Slug flows (gases exist in the process liquid) are generally not measurable at a high degree of accuracy. It also causes erratic pulse generation at shutdown of the flow.
This transmitter is capable of detecting gas mixed flows. On finding the result of densitometer measurement exceeding 0.3 to 2g/mL (default setting for liquid measurement), the meter interprets it as a slug flow and reduces the instant flowrate to zero, interrupting the flow output.
For gas measurement, default setting is 0 to 10g/L so that gas mixed flow detection function is disabled. For details about setting and operation of the gas mixed flow detection function, see 9.17 Gas Mixed Flow Alarm.

6.4.6 Keeping the sensor filled with process liquid

⚠CAUTION: The sensor must be filled with the process fluid during measurement. A partially filled meter results in large errors particularly at zeroing.

[Reference]
For models CA100 to CA250 installed on the horizontal pipeline, it is difficult to wash away air bubbles in the flow tube at flow rates below 10% of Max service flow rate (water used as the metered fluid). In such cases, run the fluid at flow rate greater than 10% of Max service flow rate first, then adjust the flow rate to the required rate.
Even with the flow rate greater than 10% of Max service flow rate, it will take approx. 40 seconds to completely fill the flow tube from its empty state (water used as the metered fluid).
Expansion of the process fluid due to freezing may damage the measuring pipe. Take measures to prevent process fluid from freezing.

6.4.7 Bypass loop

To facilitate maintenance and servicing, providing a bypass loop is recommended.

- **Type U (CA003 to CA250), Type S, and Type B**

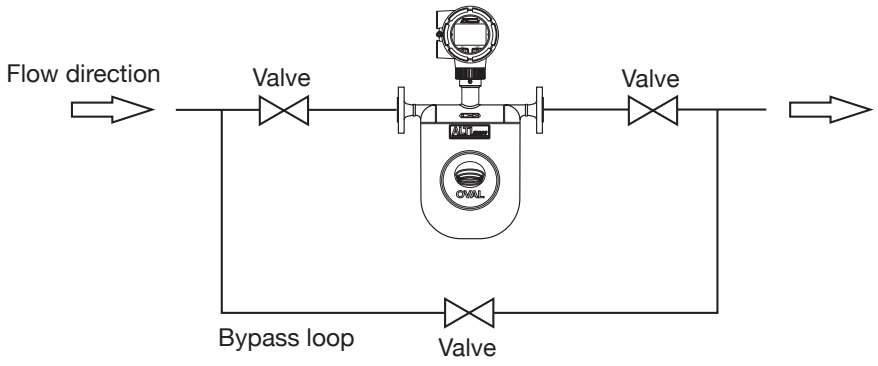


Fig. 6.8

- **Type U (CA00A and CA001)**

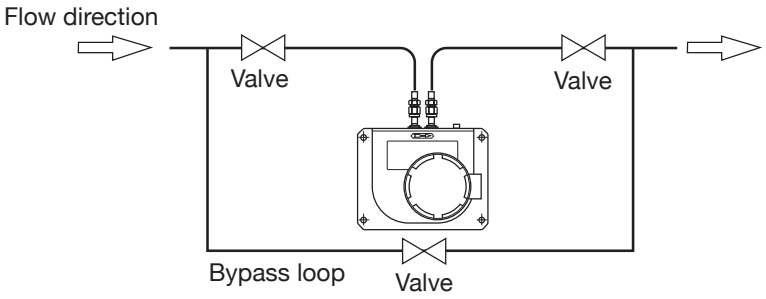


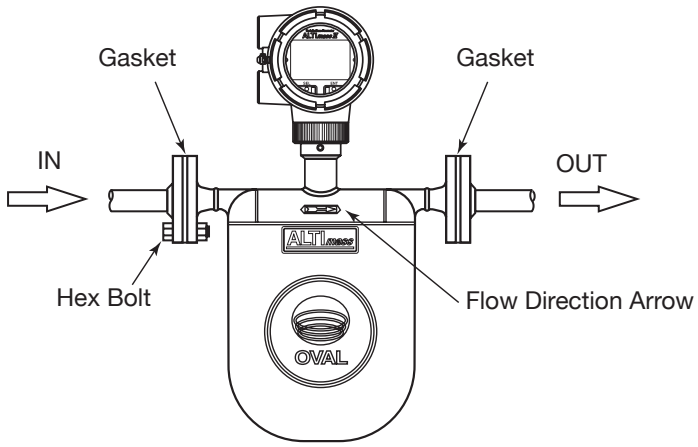
Fig. 6.9

6.5 Installation Guidelines

6.5.1 Flange type

(1) In order to avoid strains on sensor flanges, be sure to correct the flange face-to-face dimension, tilt and off-center alignment of pipes immediately before and after the sensor.
(2) Make sure of the flow direction by referring to the flow direction plate.
(3) Align the sensor flange O.D. with the flange O.D. of the pipeline, install gaskets, and tighten hex bolts evenly.

⚠CAUTION: Remove, before installation, protective seals on sensor flanges that are attached before shipment from factory.



※ While Type U meter is used in the figure, the same applies to Types S and B.

Fig.6.10

⚠CAUTION

Models CA100 and CA150 weigh approx. 250kg, CA15H and CA200 weigh 340kg, CA20H and CA250 weigh 650kg (JIS 10K flange connection). Installation (removal) involves risks. For safety reasons, make sure that qualified personnel (slinging workers) perform work of crane operation. (Take into consideration your local law).

Shown in Fig. 6.11 is the center of gravity of equipment. When working with a vertical run in particular, carefully review proper slinging position, etc. with its weight and center of gravity in mind.

Incidentally, two M20 (CA100 to CA200) eyebolts*1 (made of SUS304) are installed in the housing of sensor unit (two places). Since eyebolts can become loose and come off with time due to vibration, it is good practice to retighten firmly or remove upon installation in the piping assembly.

***1: M24 eyebolts are used for CA20H and CA250.**

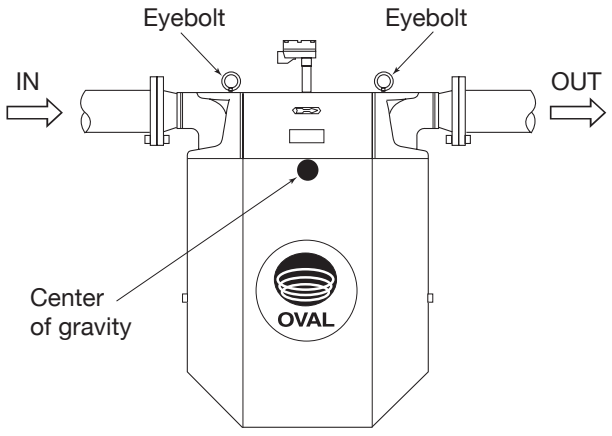


Fig. 6.11

6.5.2 Sanitary fitting type

The sanitary fitting type is of clamp connections. Using pipe fittings (option), install according to the procedure given below.

(1) Welding the companion sleeve (weld ferrule)

Weld the companion sleeves furnished to the piping. Pay attention to the perpendicularity of ferrule end face and difference in height at the weld.

As piping material, use JIS G 3447 "Stainless Steel Sanitary Tubes".

(2) Installation

Sandwich the gasket between the sensor and ferrule and tighten with the clamp. Be sure to install the gasket in line with the groove in the ferrule end face before tightening up.

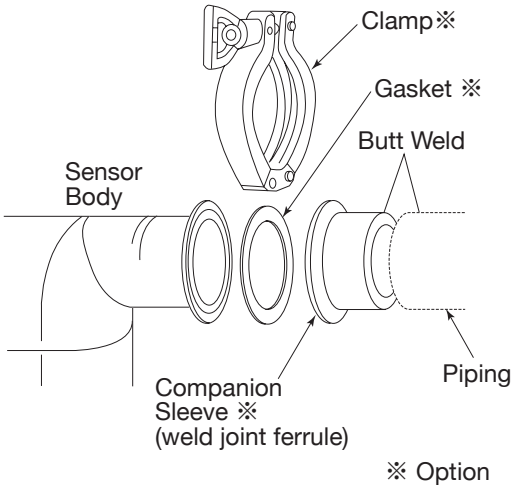


Fig.6.12

6.5.3 Screw-in type

(1) CA00A and CA001

Install a screw fitting (R1/4) onto the piping, fit an O-ring between the end of piping and the gland of sensor unit, and then tighten them firmly.

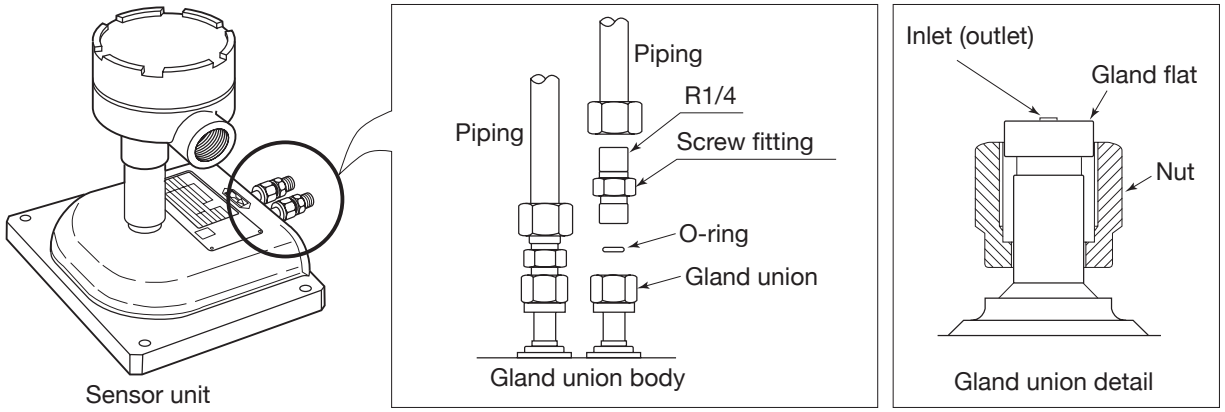


Fig.6.13

⚠CAUTION 1. Be careful to avoid damaging the gland flat and the protrusion of flow inlet (outlet).

2. Exercise care not to overtighten the nut. Overtightening it can damage the gland flat.

(2) CA003 to CA015

Sandwich an O-ring between the probe and union fitting and tighten.

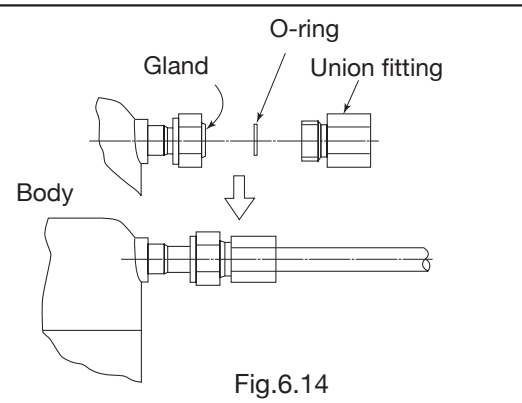


Fig.6.14

6.6 Installing Proper Pipe Supports

If pipeline oscillation is large or for accurate measurement on low flows, take into account the following:

(1) Provide pipe supports in the range shown below preferably with pipes clamped arranged symmetrically both upstream and downstream of the sensor.

(2) Clamp the pipeline securely without using rubber bushings or similar cushioning material intended for the absorption of shock and vibration.

(3) While it is necessary that the rigidity of clamps supporting upstream and downstream piping, pedestal, floor, etc. that hold individual supporting members be sturdy enough to bear their weight, it is more important to secure and maintain the overall rigidity of the entire structure. In large sized installations in particular, changes in the spring elements present in the area surrounded by dot lines in Fig. 6.16 due to exposure to thermal stress, line pressure, shocks, aging, and other contributing factors can cause zero shifts.

⚠CAUTION: Support the pipeline with hold-down clamps; never hold down the sensor unit.

6.6.1 Type U pipe supports

● CA003 to CA080

D: Nominal pipe size

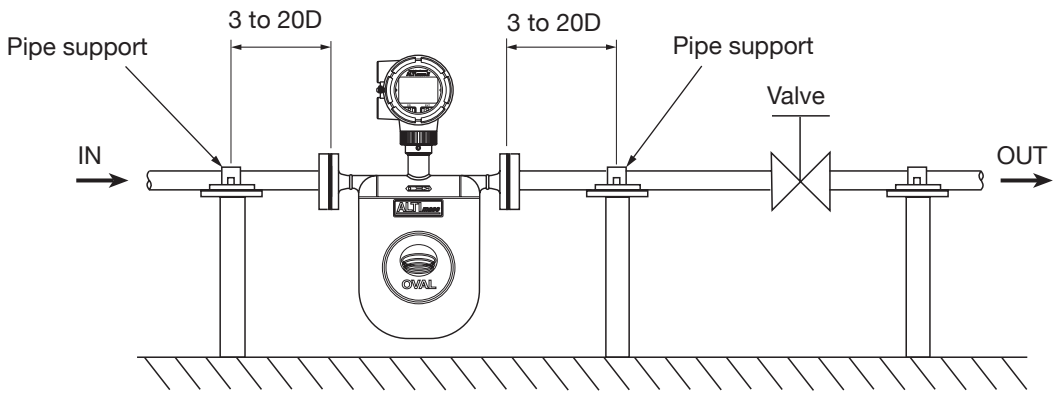


Fig.6.15

● CA100 to CA250

D: Nominal pipe size

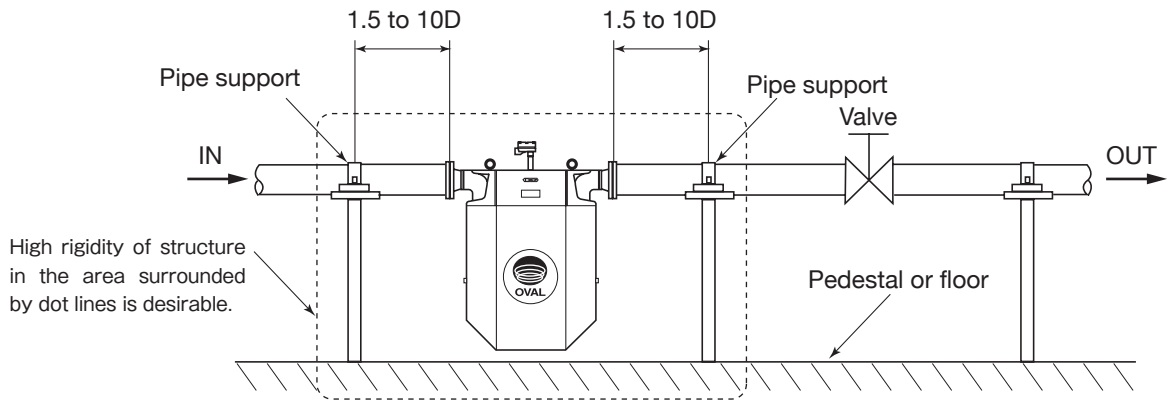


Fig.6.16

6.6.2 Type S pipe supports

D: Nominal pipe size

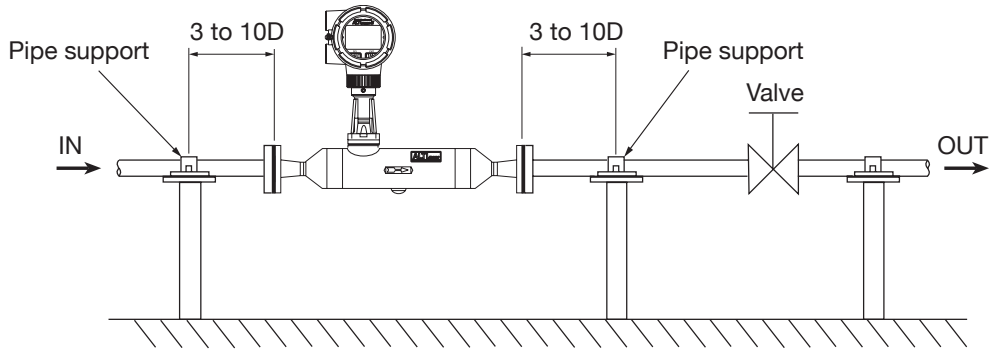


Fig.6.17

6.6.3 Type B pipe supports

D: Nominal pipe size

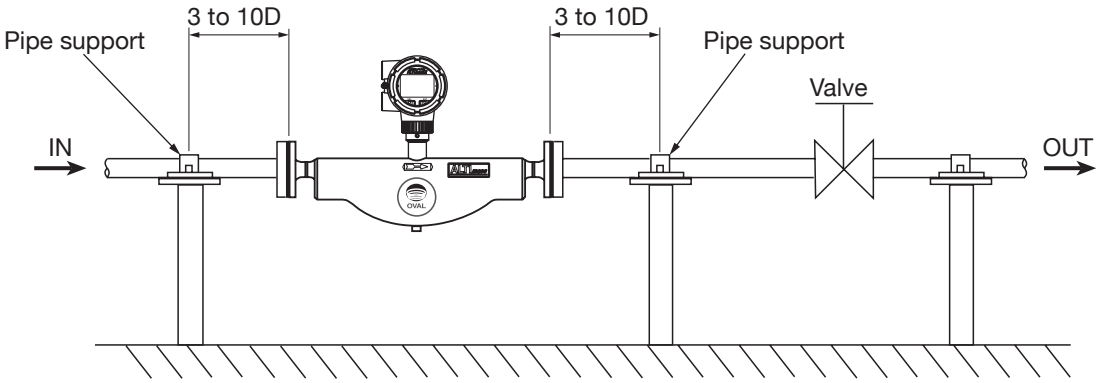


Fig.6.18

6.7 Heat and Cold Retention Procedures

When the fluid to be measured requires temperature retention at low or high temperature, you can keep the sensor unit at high or low temperature. Here, correct heat retaining and cold retaining methods are described.

(1) When installing heat retaining or cold retaining material on the sensor unit, apply heat retention or cold retention to only main body. As the fluid passes through the sensor case, heat retention or cold retention on the mounting tube and terminal box has no effect. Especially, in the case of high temperature type and low temperature explosionproof type, do not install heat retaining or cold retaining material within a distance of 20mm from the mounting tube so that the terminal box is protected against heat (heat and cold) (see Fig. 6.20).

(2) For easy maintenance, a simplified heat retaining system is recommended on the sensor unit.

(3) When covering the heat insulating material with outer sheath for heat retention or cold retention, if the natural frequency of the outer sheath is close to the frequency of the tube oscillating in the sensor unit *1, it may possibly cause some effect on the measurement.

(4) Careful attention should be paid to the maximum permissible temperature when steam trace is applied. Trace temperature should be the same as that of the metered fluid. (⇒ See 3.1 Sensor Unit General Specifications).

(5) If you plan to spirally wind copper tubing or similar around the sensor unit, secure the copper tubing with pipe retainers shown in Figs. 6.19 through 6.23 - and spot weld the copper tubing to the sensor unit.

(6) Use of heat tracer is recommended for CA025, CA040, CA050, and CA080 of TypeU.

*1：The frequency band for CA100 to CA250 will be 70 to 100Hz.

➡NOTE: Vibrating copper tubing caused by the flowmeter in operation can produce zero shifts. In such a case, increasing the number of fixed points is one solution that will work.

➡NOTE: To minimize transmission of oscillation to the sensor, the spirally wound copper tubing should start and end at the manifold of flanged sensor housing.

➡NOTE: Sudden temperature change may damage the performance of the flowmeter. Keep the temperature change of the fluid within ±12℃/min. for both heating and cooling.

⚠CAUTION: 1. Do not use electric heaters which could be a source of noises.
2. If ambient temperature around the transmitter is expected to exceed 55°C, separately mounted type is recommended.

6.7.1 Type U

• CA00A, CA001 and CA003

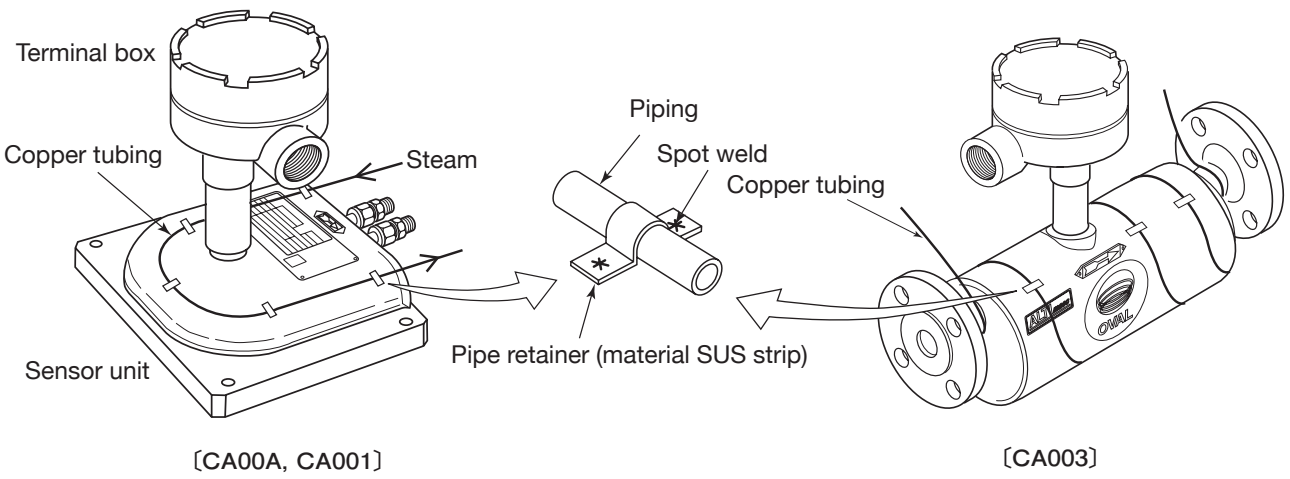
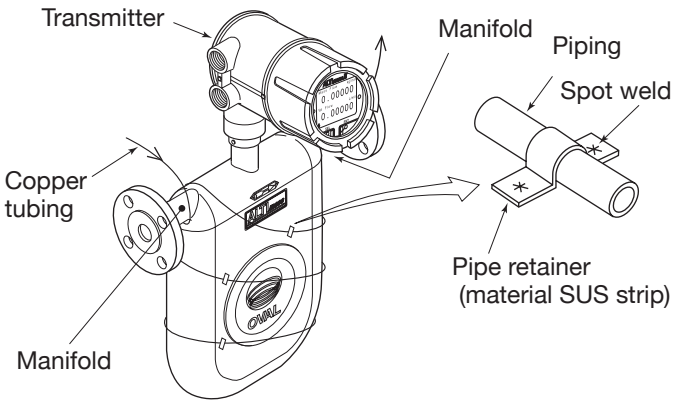


Fig.6.19

● **CA006 to CA080**



● **High temperature service models**
CA025 to CA150

● **Low temperature explosionproof service models**
CA025 to CA250

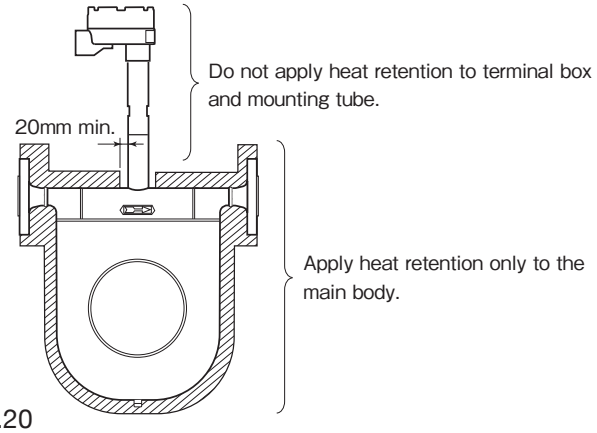


Fig.6.20

● **CA100 to CA150**

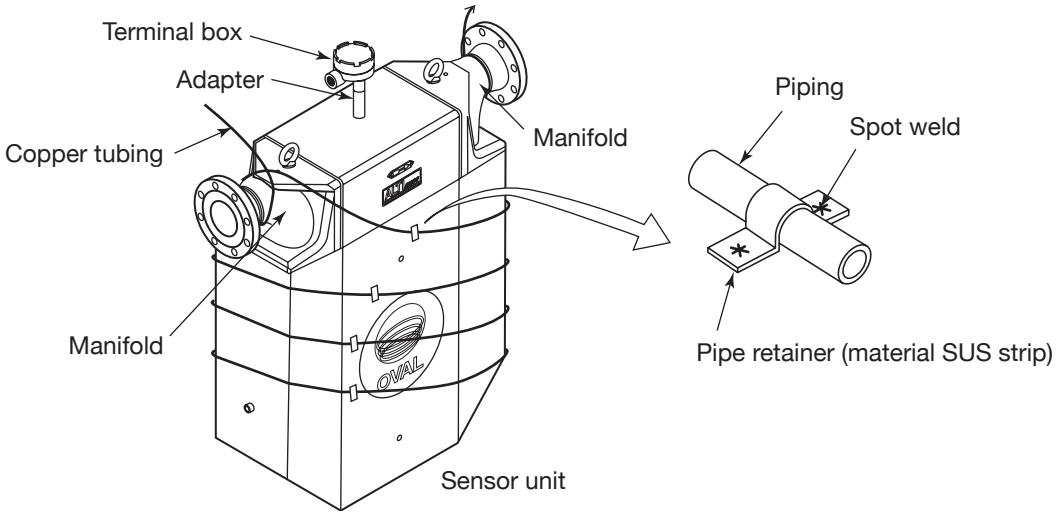
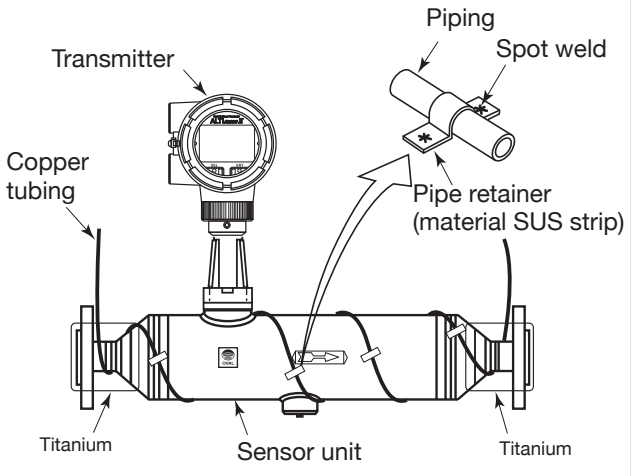


Fig.6.21

6.7.2 Type S



※ Please note that the SUS strips cannot be spot-welded to the stub ends and parts of the neck since these parts are made of titanium.

Fig.6.22

6.7.3 Type B

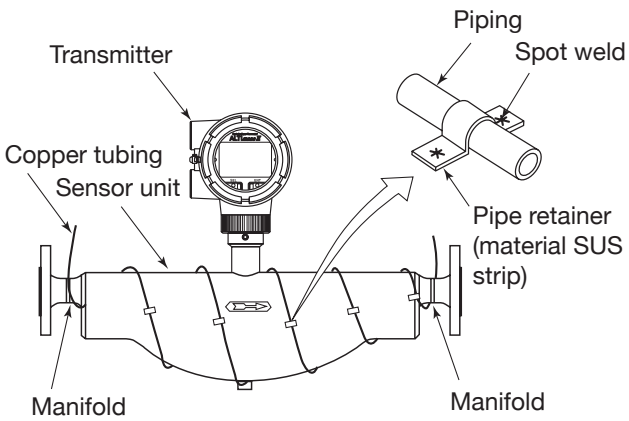


Fig.6.23

6.8 A boss for pressure relief device – its use

ALTImass Type U for high pressure service is provided with a pressure relief boss (Rc1/4). This pressure relief boss is installed for emergency treatment purpose for unlikely event of tube damage due to process pressure exceeding allowable tube pressure. (Fig. 6.24).
Since the permissible pressure the sensor housing can withstand is lower than that of the tube, should an emergency occur with tube rupture, the sensor housing might eventually be damaged depending on the process conditions.
Prior to shipment from the factory, a hex socket head plug (R 1/4) is screwed in the female taper pipe thread (Rc 1/4) of the boss. You may, for added security to protect the housing against damage, install a pressure switch or relief valve in the boss.

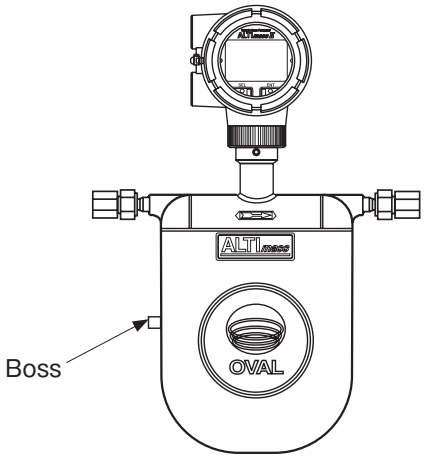


Fig.6.24 Pressure relief boss

⚠WARNING: The sensor housing is filled with an inert gas; do not attempt to remove the hex socket head plug unless it is absolutely necessary.

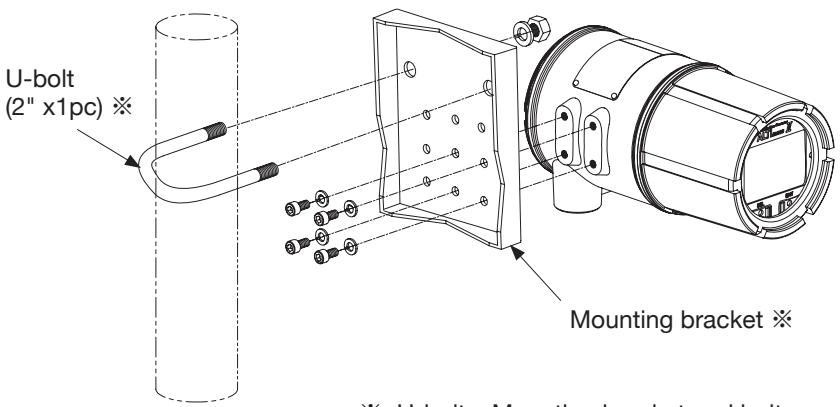
6.9 Separately Mounted Transmitter Installation

(1) The maximum transmission cable length varies with the type of sensor unit: locate the transmitter within this range.
(2) Secure the transmitter to a horizontal or vertical steel pipe 2 inches in nominal size using the U-bolts furnished as standard accessories.
(3) Installation location should be accessible for maintenance and in good environment.
(4) The customer to furnish the stanchion (steel pipe).

⚠CAUTION
Avoid installation in such location as

① Difficult to access for maintenance and servicing.
② Excessive temperature changes and vibration.
③ Potential immersion in water.

Installation on a vertical pipe



※: U-bolts, Mounting bracket and bolts are standard accessories.

Fig.6.25

6.10 How to Change Transmitter Orientation

⚠WARNING: Be sure to turn off power before you start working.

To change transmitter orientation, follow the steps given below:

(1) Turn off power.

(2) Make preparations for conduit and cable so that they will by no means cause you any trouble while changing transmitter orientation.
Work on a level plane with the transmitter up and the sensor secured so that loosening bolts will not cause the transmitter to come off.

(3) Loosen bolts holding the transmitter adapter with hex wrench. (M8 hex socket head screws at four places).

⚠WARNING: Never loosen the hex socket head screws located on the transmitter body.

⚠WARNING: You may loosen bolts but never separate the transmitter from the sensor unit.

(4) Rotate the transmitter to the desired position and secure it with setscrews (four places).

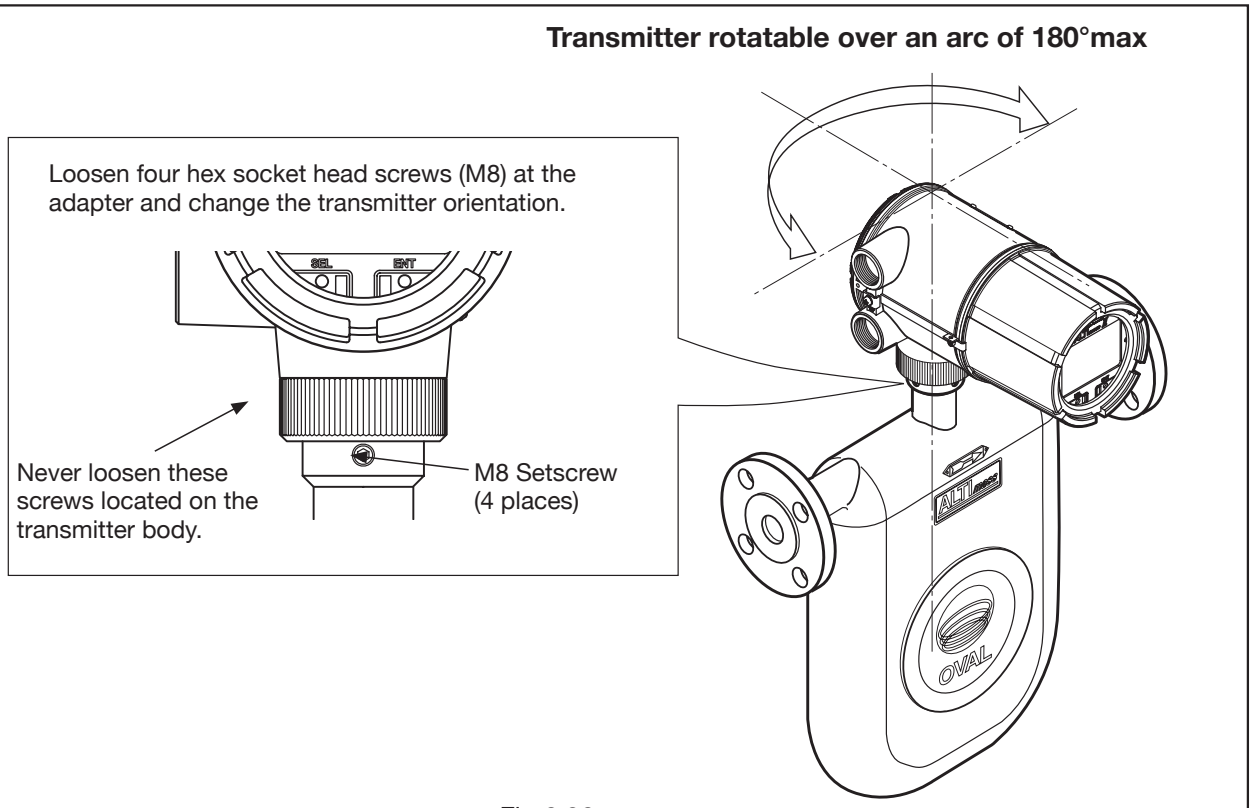


Fig.6.26

⚠CAUTION

The transmitter may be rotated over an 180°arc as shown in Fig. 6.26. But rotating it beyond 180°will twist the harness from the sensor unit to the extent the equipment is damaged.

(5) Confirming that the transmitter is secured in place, make conduit and wiring connections.

(6) Verify that the flowmeter operates properly.

⚠WARNING: With CS sensor unit, do not attempt to adjust orientation with hex socket head bolts shown in the figure below, or its functions as a flowmeter will be lost.

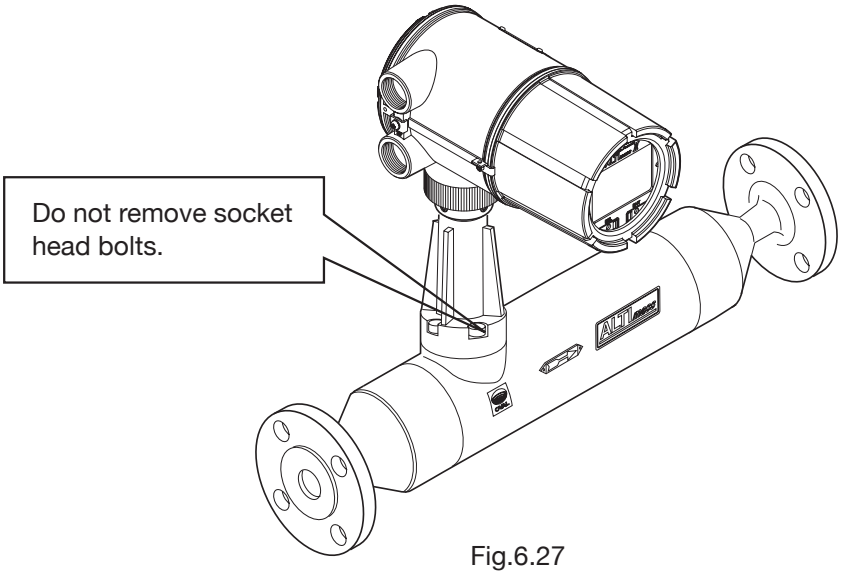


Fig.6.27

6.11 How to Change Transmitter Display Orientation

The transmitter display can be rotated to 0°, 90°, 180°, and 270°as shown in the below figures.

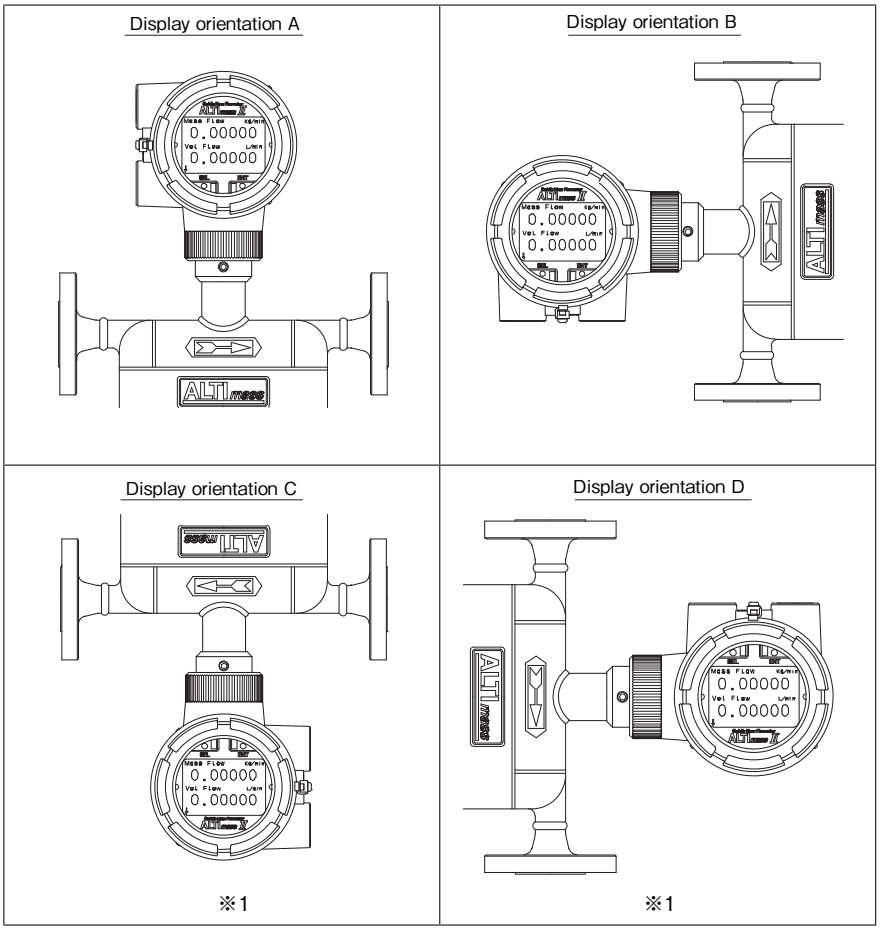
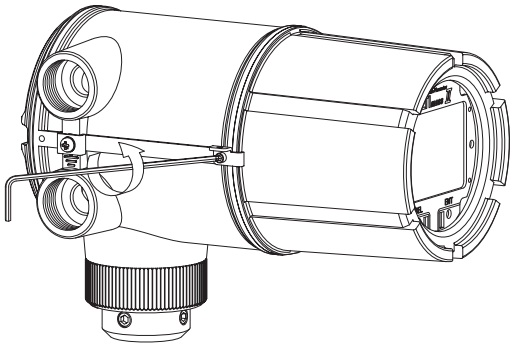


Fig.6.28

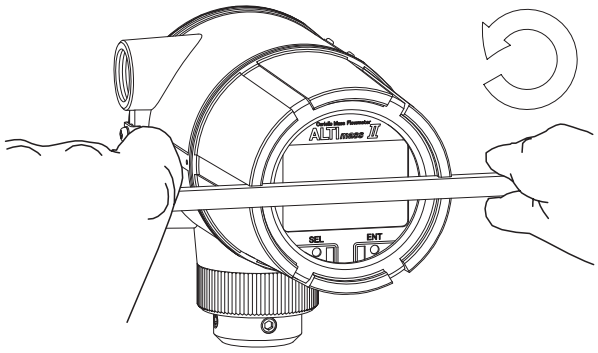
※1: For display orientations C and D, LCD orientation has to be reversed via parameter setting and the face plate needs to be turned over.

To rotate the display, follow the procedures bellow:



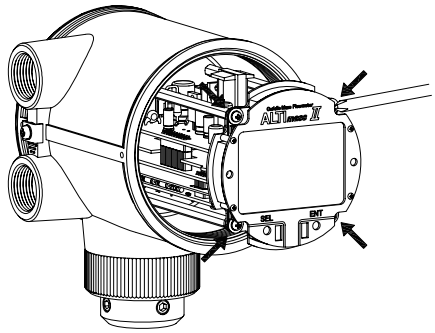
① Remove the locking piece.

Fig.6.29



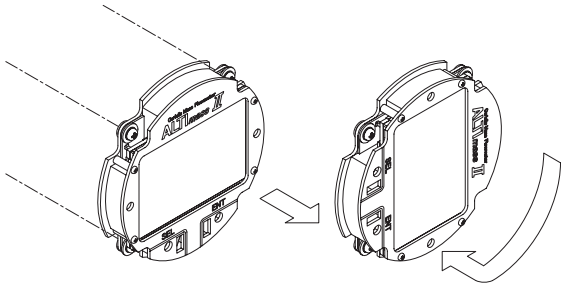
② Using a flat tool 10mm wide approx., turn the display lid counterclockwise to loosen, and loosen further by hand. (Be careful so as not to damage the finish.)

Fig.6.30



③ Loosen display unit fitting screws (4 places).

Fig.6.31



④ Rotate and reattach the display unit. ※1

Fig.6.32

※1 Display orientation C and D

For display orientations C and D, first change the parameter setting (see 9.2.2 Transition chart (1) [1-5] LCD Reverse) to vertically reverse LCD display. Then turn the face plate over as illustrated below to show the side with upside-down design printed on.

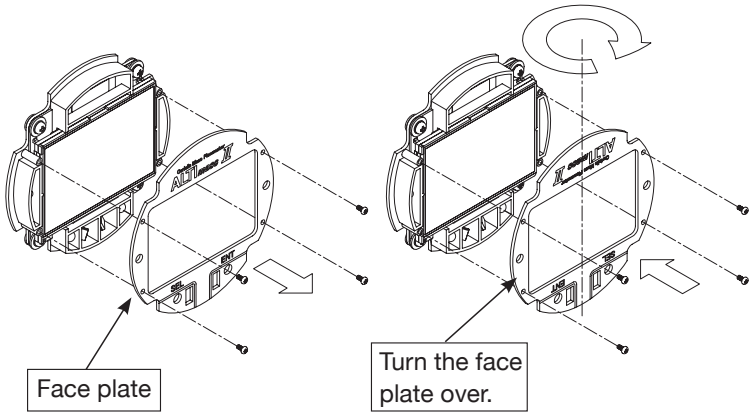


Fig.6.33

① Set [LCD Reverse] parameter to ON.

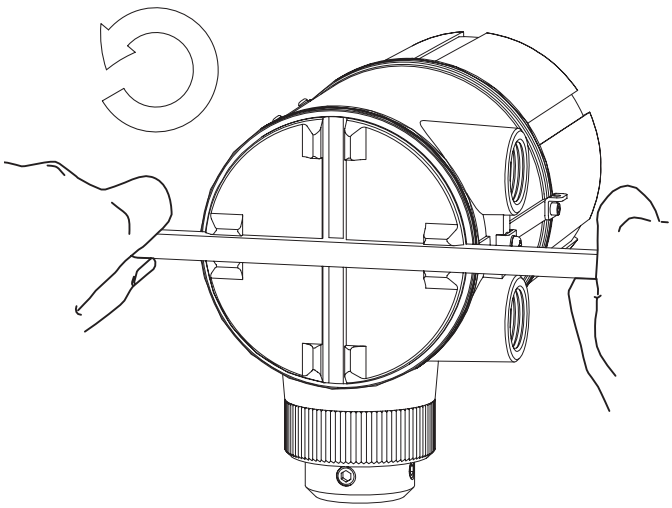
② Unscrew face plate fitting screws (4 places) and flip over the face plate. Then screw the face plate back.

7. WIRING INSTRUCTIONS

7.1 Opening Terminal Box

Terminals for wiring connections are found at the back of transmitter housing. Remove the cover and make wiring connections.

⚠WARNING: Be sure to turn off power before opening the terminal box.



② Using a flat tool, slowly turn the terminal box lid counterclockwise to loosen and then loosen by hand. (Use care to avoid damaging the finish.)

Fig.7.1

Inside of terminal box

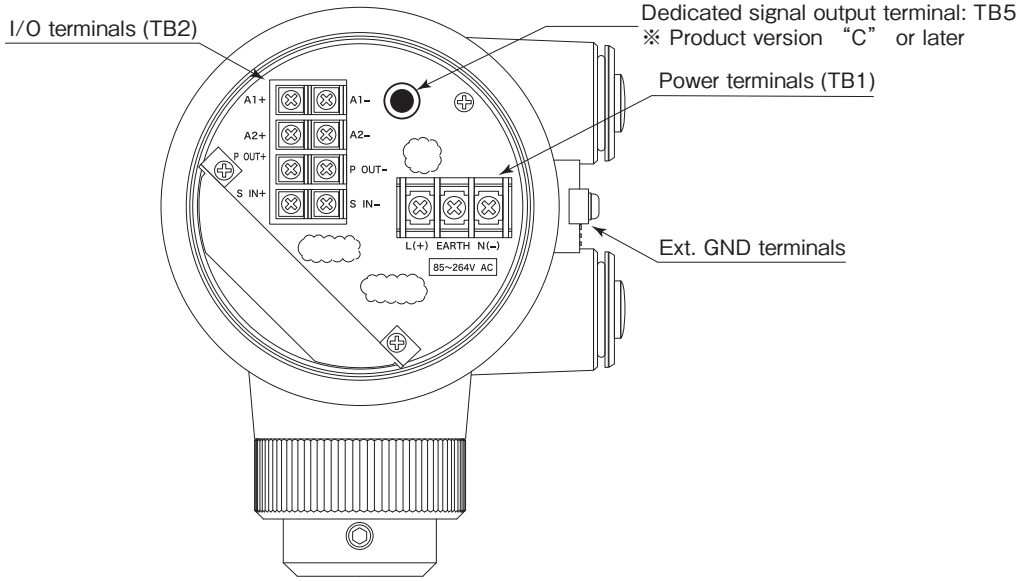
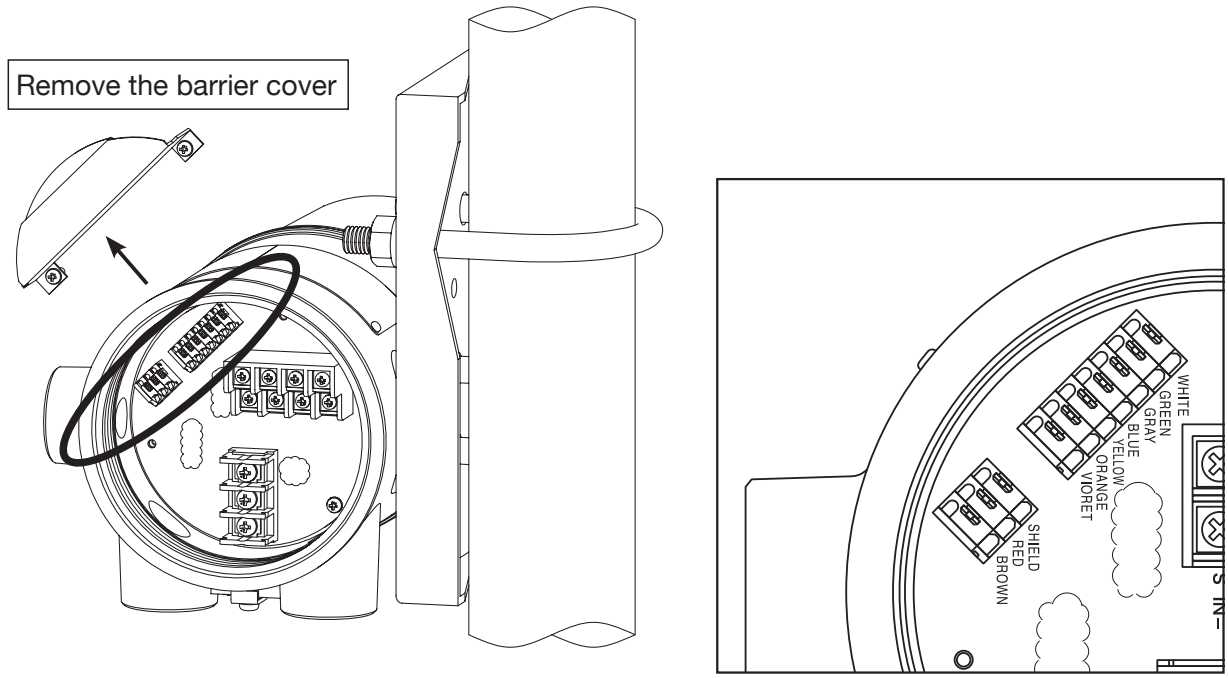


Fig.7.2

7.2 Connections between separately mounted transmitter and sensor unit

Open the terminal box and remove the barrier cover to make wiring connections between a sensor unit and sensor connection terminals of the transmitter.
Exclusive interconnect cable must be used for the connection between separately mounted transmitter and sensor unit.

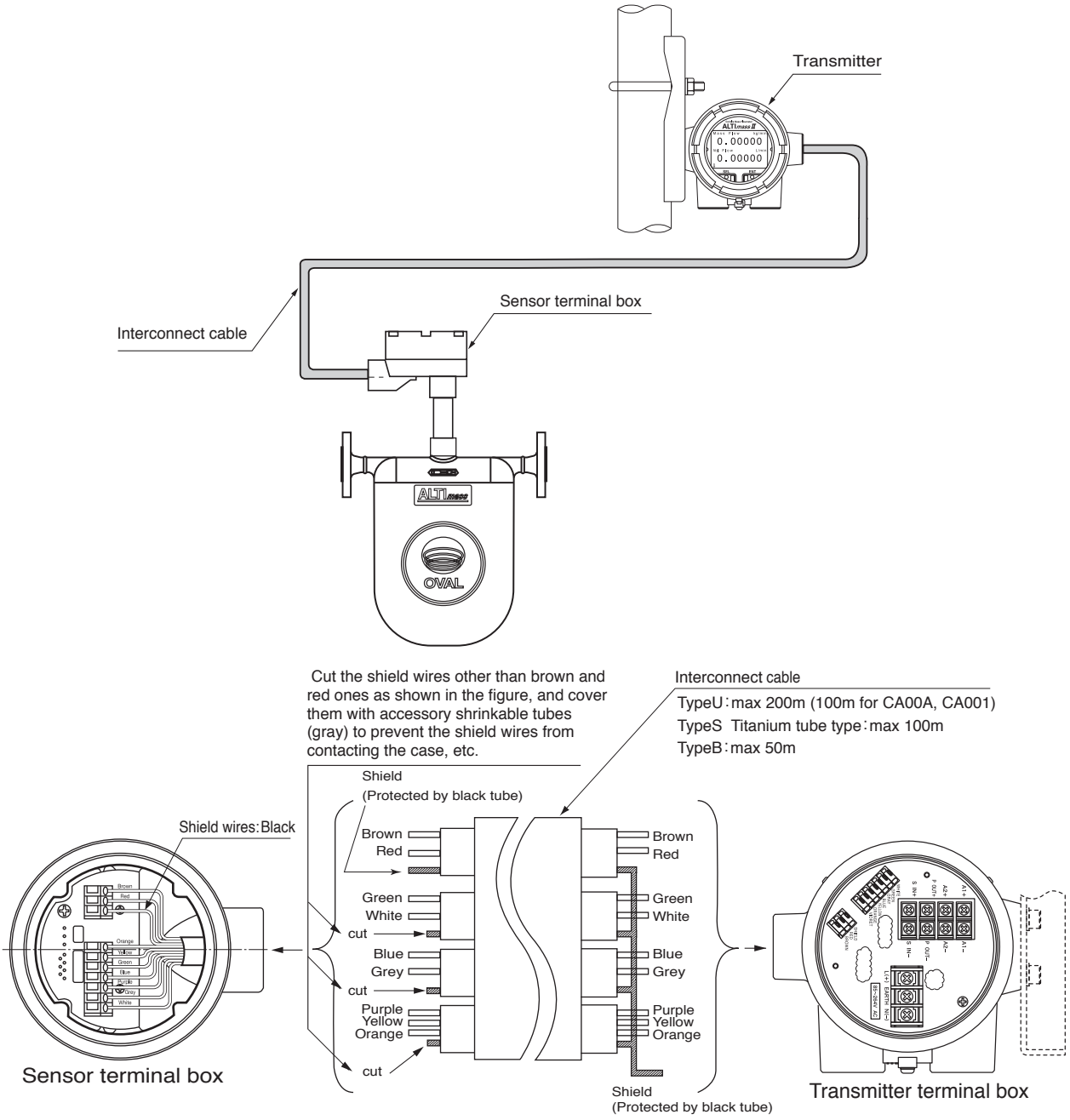
➡NOTE: Maximum lengths of exclusive interconnect cable are: 200m for TypeU (100m max for CA00A, CA001), 100m for TypeS titanium tube, and 50m for TypeB.



Sensor signal input terminals (separately mounted type)

Terminals		Description
TB3	BROWN	Flow tube drive output
	RED	
	SHIELD	Connection of cable shields
TB4	VIOLET	Temperature input
	ORANGE	
	YELLOW	
	BLUE	Right position pickoff sensor input
	GRAY	
	GREEN	Left position pickoff sensor input
	WHITE	

Fig.7.3



NOTE 1. Do not fail to use dedicated interconnect cable.

2. Shield wire preparation

(1) Transmitter end：

As shown in the above figure, bundle shield wires colored in brown/red, green/white, blue/grey, purple/yellow/orange, twist them, and cover the wires with a black tube. Then connect only one wire to the terminal box (black) taking care to avoid potential contact with the housing or conductive parts.

(2) Sensor end：

As shown in the figure, cover the brown/red shield wire with a black tube and connect it to the terminal box taking care to avoid potential contact with the housing or conductive parts. Cut the shield wires other than brown and red ones as shown in the figure, and cover them with accessory shrinkable tubes (gray) to prevent the shield wires from contacting the case, etc..

3. Recommended cable end treatment:

Use of a stick type crimp terminal is not necessary.

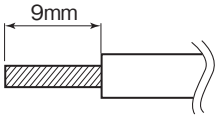


Fig.7.4

7.3 Power Supply Lines and Ground Terminal

Power terminals

Terminal		Description
TB1	N （—）	Power terminal AC85 to 264V/ DC20 to 30V (— terminal)
	EARTH	Explosionproof type:intrinsically safe grounding terminal (Class A grounding)* Non-explosionproof type:ground terminal
	L （＋）	Power terminal AC85 to 264V/DC20 to 30V (＋terminal)

(1) Power source primary lines are connected to terminals L (+) and N (–).

(2) Connection to earth ground terminal:
Connect only to EARTH on the power terminal block or external ground terminal.

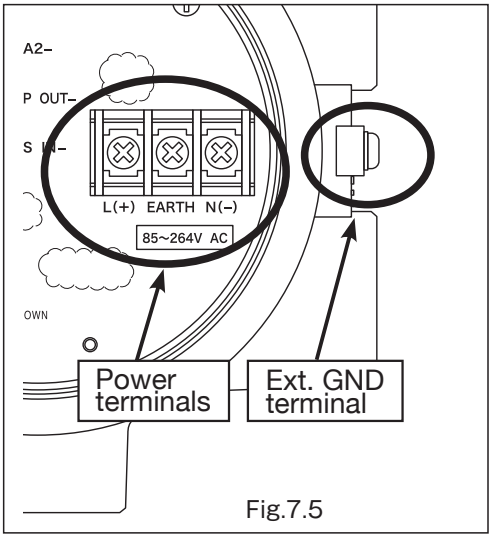


Fig.7.5

⚠CAUTION: Supply voltage must be within the range shown in the product nameplate attached to the housing.

7.4 Wiring Instructions

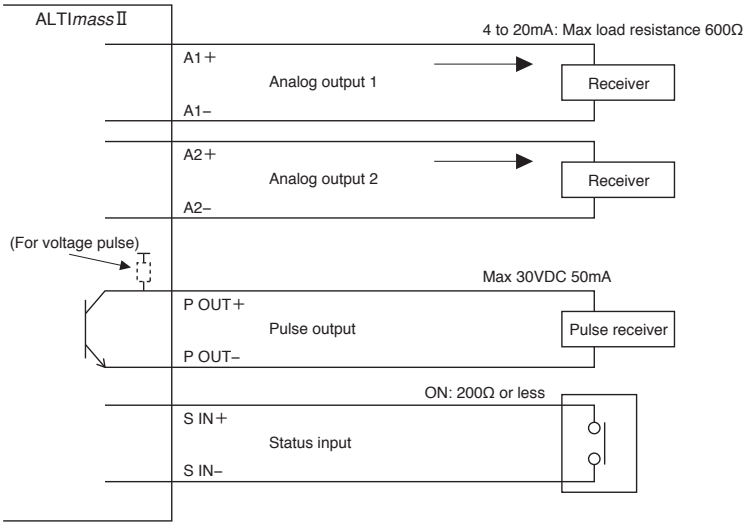
I/O terminals

Terminal		Description
TB2	A1 （＋）	Analog 4 to 20mA output 1 Max load resistance: 600Ω (※1)
	A1 （–）	
	A2 （＋）	Analog 4 to 20mA output 2 Max load resistance: 600Ω (※1)
	A2 （–）	
	P_OUT （＋）	Open drain (open collector equivalent) Max applied voltage: 30VDC, allowable current: 50mA Or voltage pulse (※2) (Low level: 1.5V max, High level: 13V min., Output impedance: 2.2kΩ)
	P_OUT （–）	
	S_IN （＋）	Contact-closure input (Pulse width: 300ms or more, ON resistance: 200Ω or less, OFF resistance: 100kΩ or more)
	S_IN （–）	

Each I/O terminal is isolated.

※1：Analog output transmission length:
1km (if load resistance + cable resistance are 600Ω or less, transmission is available regardless of length)
Same applies to HART communication

※2：Pulse output (voltage pulse) transmission length:
at 10kHz … Max10m, at 1kHz … Max100m, at 100Hz … Max1km
For any inquiries, please consult OVAL sales office or nearest representative.



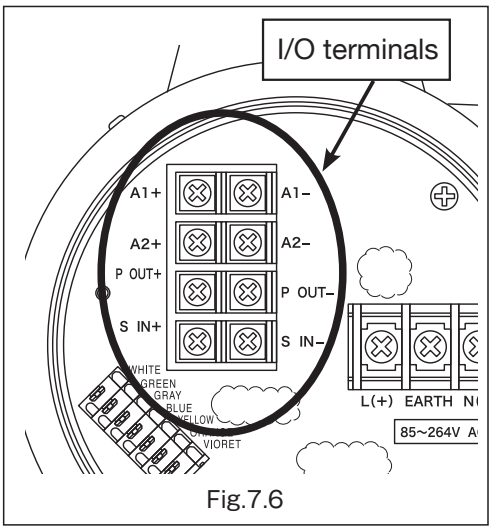
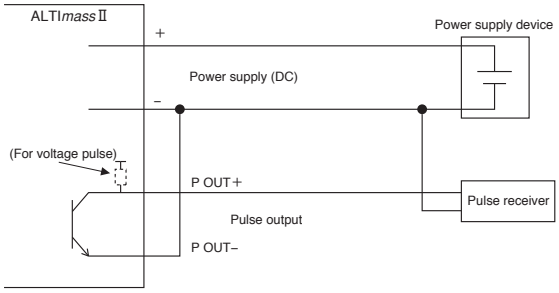


Fig.7.6

●DC power type: 3-wire pulse output connection



※If using the cable in long-distance, the Lo level power supply of pulse signal will increase due to stationary current of the transmitter and line resistance of the cable. Adjust the trigger value of the receiver properly.
For example:
If the cable length is 500m, Lo level increases approx, 2.5V (given 1.25sq: 16Ω/km)

●Connecting diagram

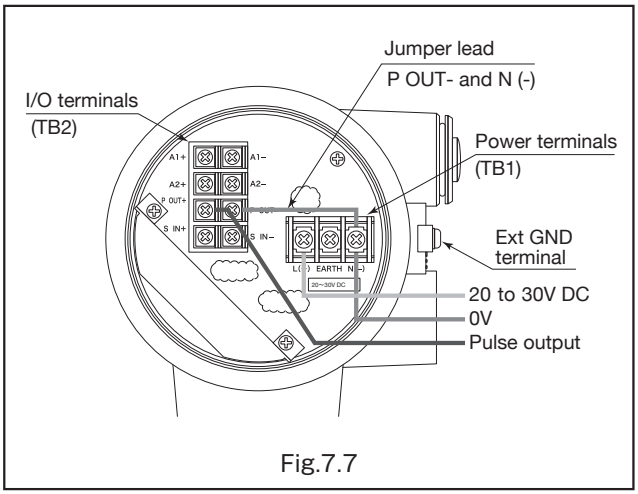


Fig.7.7

Dedicated signal output terminal *Product version "C" or later	Description
TB5	TB5 is provided in product version "C" or later, and is masked with a seal at the time of shipment from the factory. The mask should be removed only when connecting to the Distributor Dedicated for ALTImass (SU1522), and wire connection should be done with the connecting screw for dedicated output terminal" and "jumper cable for ALTImass II (red)" supplied with SU1522. For how to connect wire when using TB5, refer to the instruction manual (E-947) or startup guide (E-947-SU) for Distributor Dedicated for ALTImass (SU1522).

7.4.1 Analog output wiring

In order to connect a receiving instrument to analog output (4-20mA) terminals, connect Analog Output 1 to terminals A1 (+) and A1 (—) and Analog Output 2 to terminals A2 (+) and A2 (—). Maximum load resistance is 600Ω. Analog output setup procedure appears in 9.7.1 Analog output functions.

7.4.2 Pulse output wiring

In order to connect a receiving instrument to pulse output terminals, connect Pulse Output 1 to terminals [P_OUT+] and [P_OUT—].

Signal transmission length has restrictions based on output frequency.

(Values below are based on wire material 0.75 sq in cross section.)

Pulse output transmission length 10kHz・・・Max 10m
1kHz・・・Max 100m
100Hz・・・Max 1km

To switch between open drain pulse output and voltage pulse output, remove the front cover and change the position of the switch as shown below. Voltage pulse output operates by the drain terminal of open drain pulse pulled up with a resistor. Output logic of voltage pulse is the same as that of open drain pulse: ON =Low, OFF = High.

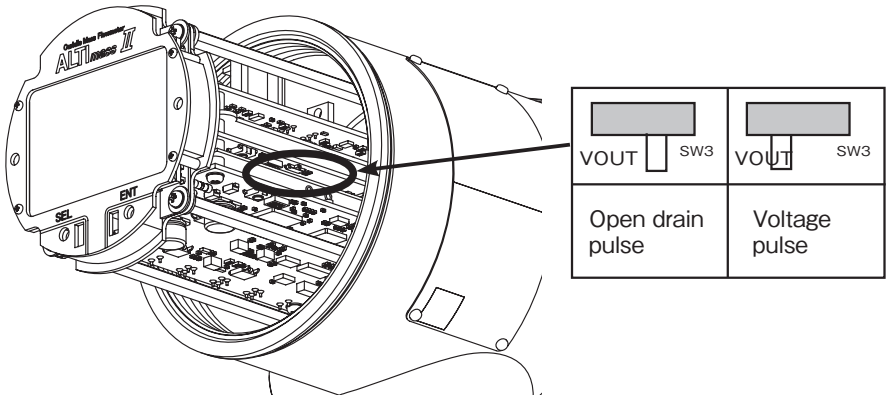


Fig.7.8

See 9.7.2 Pulse output for pulse output setting.

7.4.3 Status Input Wiring

Status input appears across terminals S_IN+ and S_IN-.
Status input setup procedure appears in 9.7.4 Status input.

7.4.4 Recommended Cables condition

Item	Label	Recommended condition				
		Rating voltage/ allowable current (at 30℃)	Cross-section	Cable OD	Solderless terminals	Maximum operating temp.
Power	L (+)	300V over, 2A over	1.25sq to 2.0sq AWG14 to 16	ϕ10.1 to ϕ14.0	R-type, 8.1mm or less Size: M4	70℃ or above
	EARTH					
	N (–)					
Signal	A1 (+)	100V over, 0.1A over	0.75sq to 2.0sq AWG14 to 18	ϕ10.1 to ϕ14.0	R-type, 8.1mm or less Size: M3.5	
	A1 (–)					
	A2 (+)					
	A2 (–)					
	P_OUT (+)					
	P_OUT (–)					
	S_IN (+)					
	S_IN (–)					
External ground	—	600V over, 40A over	4sq over AWG12 over	—	Directly wiring or Solderless terminal (R-type, 8.1mm less)	

➡NOTE: Please select the cable size to be used with the number of signals.
Use shielded cable for signal cable.

With an explosionproof specification meter, make sure to use a proper rubber packing for cable gland which matches with finished OD (outside diameter) of the cable.

Packing nominal code	Packing ID	Cable OD
11	ϕ11	ϕ10.1 to ϕ11
12	ϕ12	ϕ11.1 to ϕ12
13	ϕ13	ϕ12.1 to ϕ13
14	ϕ14	ϕ13.1 to ϕ14

7.5 How to Change Cable Entry Orientation of Terminal Box (Separately Mounted Type)

Of the sensor unit, the orientation of the terminal box's cable entry can be changed.

➡NOTE: Although the terminal box can be rotated by loosening four hex-socket head screws at the adapter, the following procedure must be followed.

⚠**CAUTION: Rotating the terminal box without following the procedure will cause sensor damage.**

◆Procedure◆

① Turn OFF flowmeter power.

② Using a flat tool, slowly loosen the terminal box lid by turning counterclockwise, and loosen further by hand.
(Be careful not to damage the finish.)（Fig.7.9）

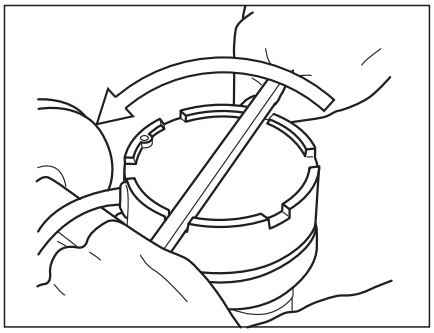
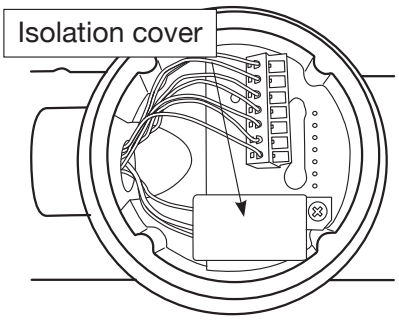
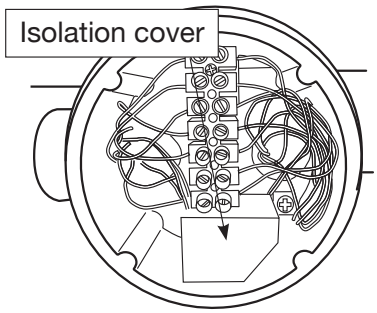
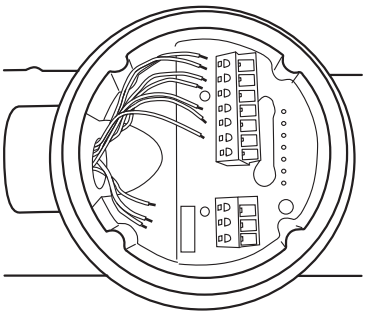
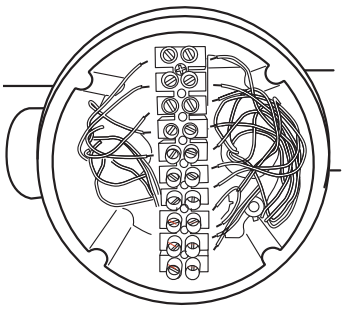
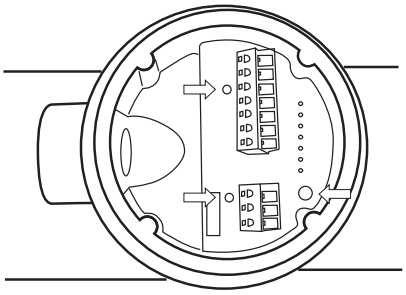
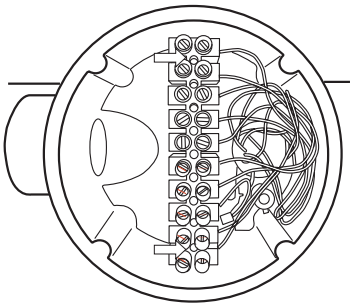


Fig.7.9

Inside, the structure of terminal block can be either A or B shown below. Follow procedure ③～⑤ according to the type of your terminal block.

	Terminal block A	Terminal block B
③ Remove the isolation cover. （Fig.7.10, Fig.7.11）	 Fig.7.10	 Fig.7.11
④ Disconnect the cables from the terminal block. （Fig.7.12, Fig.7.13）	 Fig.7.12	 Fig.7.13

	Terminal block A	Terminal block B
⑤ Remove screws from terminal block. (3 places for A, 2 places for B) ※ Make sure not to drop or lose screws. （Fig7.14, Fig.7.15）	 Fig.7.14	 Fig.7.15

⑥ Remove caution label (sticker) and loosen hex-socket head screws (4 places).（Fig.7.16, Fig.7.17）

⑦ Rotate terminal box without exerting excessive force onto sensor cables.

⑧ After rotating, reassemble terminal box in reverse procedure.

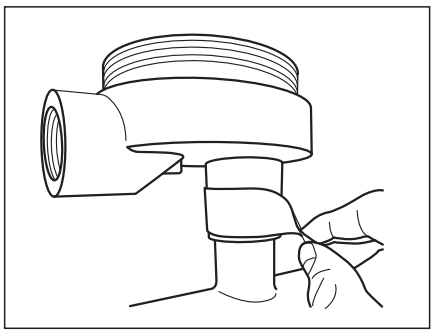


Fig.7.16

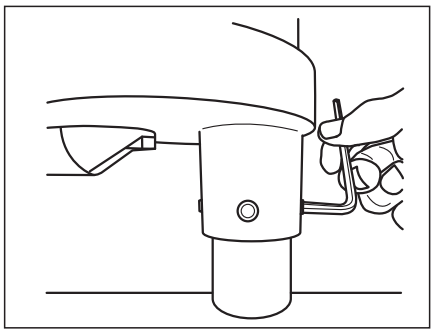


Fig.7.17

8. OPERATION

8.1 Flushing the Piping Assembly

If scale and sludge are expected to be left in the piping assembly, particularly in a new piping assembly, flush the assembly prior to sensor unit installation.

8.2 Confirming the Sensor Unit for Correct Installation

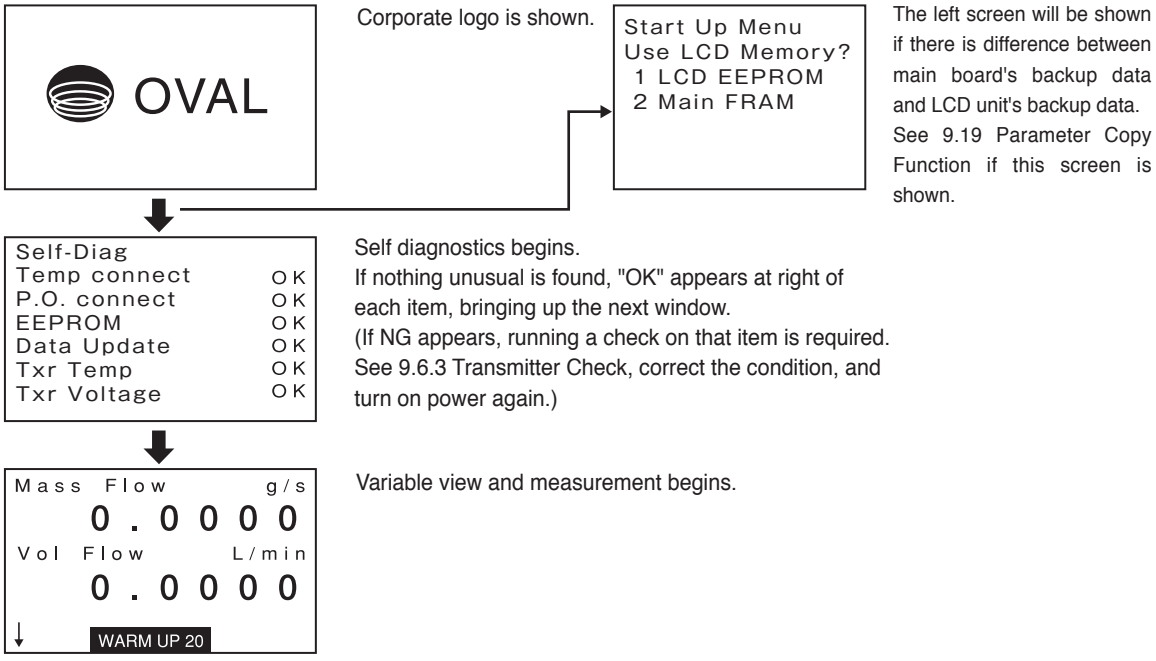
For safety's sake, confirm connecting bolts to tightness and gaskets for condition. Make certain of flow direction at the same time.

8.3 Leak Check

Fill the sensor tube completely with process fluid and check for any leak from connections.

8.4 Supplying the Power

Upon completion of checks for correct wiring connections, supply power. The LCD will show the following information:



8.5 Measurement Line Startup

By starting up the pump, opening valves, etc., carefully allow the process fluid to flow.

8.6 Warm-up

To ensure stability of the measuring conditions of equipment, provide about 20 minutes' warmup period. (A message "WARMUP 20" stays on after startup. The number shows remaining time (min).)

8.7 Zeroing Procedure

On seeing that the measuring conditions have come to an equilibrium, shut off the downstream valve completely. Make a zeroing adjustment under these conditions (see the topic under 9.8 Zeroing).

8.8 Readying for Operation

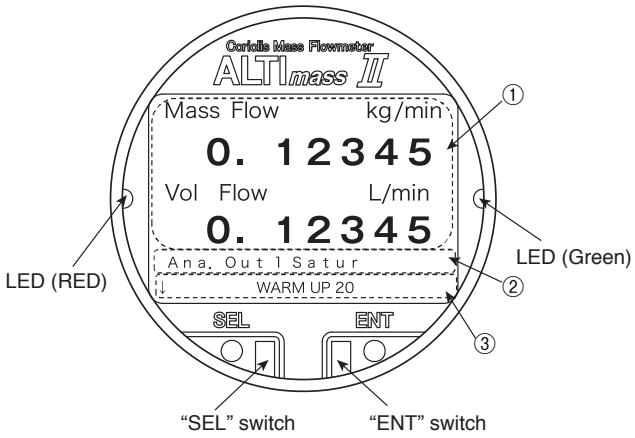
Now preparation for operation is complete. Initiate measurement.

9. DESCRIPTION OF INCORPORATED FUNCTIONS

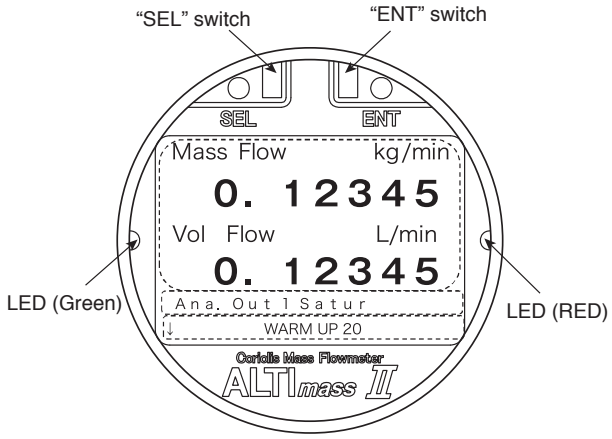
9.1 Display

9.1.1 Description of display

●Regular display



●Upside-down display



(1) LCD top row (①)
Shows measurements. Other variables also can be shown with switches. (An example at above shows instant mass flowrate and instant volume flowrate. For details of displayed variables, see 9.1.3 View variables.)

(2) LCD middle row (②)
Shows an error / status message.
For error messages, see 10.1 Error Messages and 10.2 Status Messages. If more than two messages exist, they are shown one after another.

(3) LCD bottom row (③)
In the view variables screen, an arrow appears, pointing to the direction of scroll. By reversing the arrow direction, you can reverse the direction of scroll. (For details, see 9.1.3 View variables.)
A black circle ● may blink on and off at right of arrow. (It indicates that the number of running hours has exceeded 100,000. For necessary treatment, see 10.2 Status Messages.)

(4) Red LED and green LED
Similar to messages, these LED show the status of flowmeter.
In normal operation, red LED stays off; green LED stays on.
Anything else is indicative of occurrence of something erratic.
See 10.1 Error Messages and 10.2 Status Messages.

(5) "SEL" and "ENT" switches
An infrared switch. Responds to a finger held close to it.
For operating procedure, see 9.1.2 Switch operation.
➡ NOTE: If the infrared sensors do not respond sufficiently, use LinkTop to adjust the sensitivity. In case you do not have LinkTop, use a reflecting subject, such as a sheet of paper, to operate the switches.

In order to reverse the LCD display, see 9.2.2 Transition chart of view (1) for details.

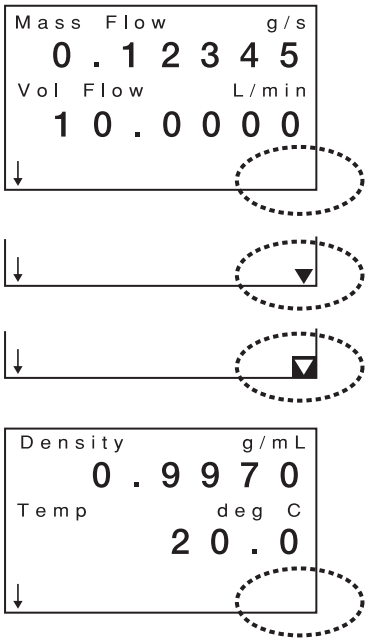
9.1.2 Switch operation

The transmitter has two infrared switches: "SEL" and "ENT". Operation of these switches is described here. For information about parameter configuration and other functions, see the respective sections.

(1) "ENT" operation

This switch is used for scrolling the display, scrolling the cursor, etc.

Here we cover "ENT" operation as an example of switching variables view screens.



① Touch ENT key at lower right of screen over glass faceplate with your finger.
When the key responds, a down arrow ▼ appears at lower right of screen (surrounded by a dotted circle) where nothing was found as shown in the next screen.

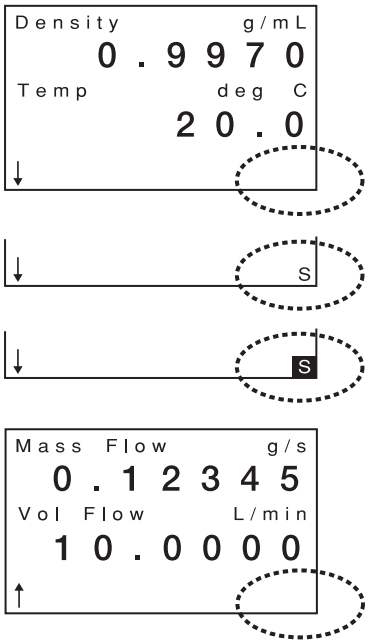
② After down arrow comes on for 0.5 sec, arrow ▼ is highlighted as shown in the following screen.

③ While the highlighted arrow stays on (0.5s), remove your finger.
Arrow ▼ goes out and the screen changes.
(With your finger held on, you can continue "ENT" operation. It is beneficial for fast scroll.)

④ End of "ENT" operation
The next screen appears.

(2) "SEL" operation

This operation is used to switch screen direction, increasing the number, parameter select, etc. Here we cover "SEL1" operation as an example of switching screen direction.



① Touch SEL key at lower left of screen over glass faceplate with your finger.
When the key responds, a letter S appears at right bottom of screen (surrounded by a dotted circle) where nothing was found as shown in the next screen.

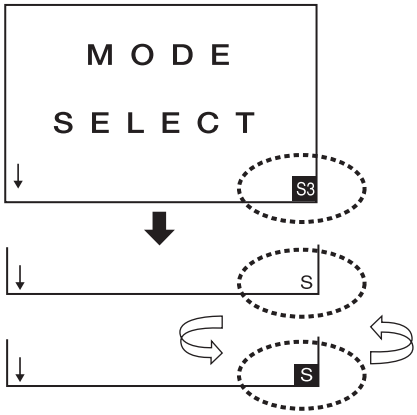
② After letter S comes on for 0.5 sec, the letter S appears highlighted as shown in the following screen.

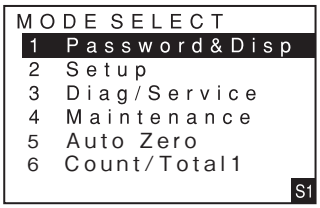
③ While the highlighted S stays on (0.5s), remove your finger.
Letter S goes out and arrow ↓ at bottom left of screen changes to ↑.
(With your finger held on, you can continue "SEL" operation. It is beneficial for quickly increasing the number.)

④ End of "SEL" operation
Arrow ↓ has changed to ↑.
Operating "ENT" in this state allows the screen to scroll in the opposite direction.

(3) "SEL3" operation

This operation is used to finalize the numeric value that has been changed and activate it, etc.
Here we cover "SEL3" operation as an example of switching to MODE SELECT menu screen.





① Touch SEL key at lower left of screen over glass faceplate with your finger.
When the key responds, a letter S appears in the highlighted S3 area at lower right of screen.
(On certain screens, letter S3 may appear at lower center of screen.)

② Hold you finger on.
After letter S comes on for 0.5 sec, the letter S appears highlighted as shown in the following screen.

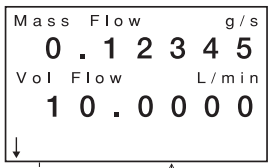
③ While holding your finger on, the screen repeats a change between highlighted and unhighlighted.
On the third appearance of highlighted S (duration 0.5 sec), remove your finger. A switch to MODE SELECT menu screen takes place.

④ End of "SEL3" operation
A switch to MODE SELECT menu screen is complete.

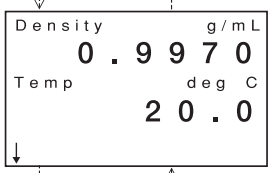
9.1.3 View the Variables

(1) Description of displayed information

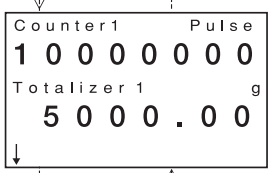
Shown below is a flow diagram with Type U (default settings).
At right of each screen is the description of information displayed in the screen.
The window changes from one screen to another with switch operation. Repeat touching the switch until the desired screen appears.



Click "ENT". (※1 with ↓) Click "ENT". (※1 with ↑)



Click "ENT". (※1 with ↓) Click "ENT". (※1 with ↑)



Click "ENT". (※1 with ↓) Click "ENT". (※1 with ↑)

····· ● Mass Flow: Instant mass flowrate
Decimal point placement is alterable by config. (See 9.2.2 Transition chart (1) [No. 1-3-4-1].)
Units of measure are alterable by config. (See 9.2.3 Transition chart (2) [No. 2-1-1].)

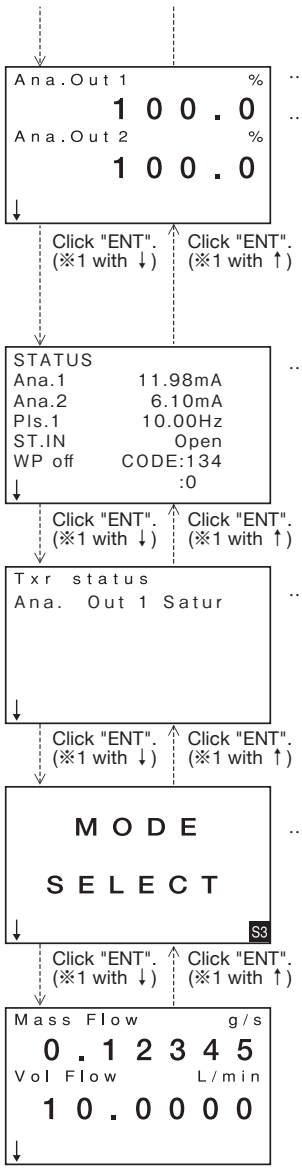
····· ● Vol Flow or Vol Flow(s): Instant volume flowrate
Decimal point placement is alterable by config. (See 9.2.2 Transition chart (1) [No. 1-3-4-2].)
Units of measure are alterable by config. (See9.2.3 Transition chart (2) [No. 2-1-2].)
If fixed density is your option, Vol Flow(s) appears.
Below 0.3g/m in density, volume flow is clamped to 0.

····· ● Density: Fluid density
Decimal point placement is alterable by configuration. (See 9.2.2 Transition chart (1) [No. 1-3-4-3].)
Units of measure are alterable by config. (See 9.2.3 Transition chart (2) [No. 2-2-1].)

····· ● Temp: Fluid temperature
Units of measure are alterable. (See 9.2.2 Transition chart (2) [No. 2-3-1].)

····· ● Counter 1: The number of counts of pulse output 1.
When reading exceeds "99999999", it resets to 0.
The reading is retained irrespective of power cycling.
Can be reset to 0 with Count/Total 1 reset function. (See 9.2.7 Transition chart (6) [No.3-5-1].)
If pulse output 1 related parameter is modified, the counter is reset to 0.

····· ● Totalizer 1: Total flow of pulse output 1
When reading exceeds the max value, the counter resets to 0 with the next count.
Unit of measure keeps track of the flow unit assigned to pulse output 1.
Decimal point pos. is alterable by configuration (See 9.2.2 Transition chart (1) [No. 1-3-4-4].)
This reading is retained irrespective of power cycling.
Can be reset to 0 with Count/Total 1 reset function. (See 9.2.7 Transition chart (6) [No. 3-5-1].).
If pulse output 1 related parameter is modified, the counter is reset to 0.



····· ● Ana. Output 1: % analog output 1
Measurement range: –10 to 110%
····· ● Ana. Output 2: % analog output 2
Measurement range: –10 to 110%

····· ● STATUS
・Ana.1, 2: Analog output
・Pls.1: Pulse output frequency
・ST.IN: Status input status
・WP: Write protect status
・CODE: HART communication model code, polling address

····· ● Status / error information
Not shown unless there are errors or status information.
For errors and status information, see 10.1 Error Messages and 10.2 Status Messages.
If more than one error occurs, the screen will automatically display and cycle through the information of each error.

····· ● MODE SELECT screen: A screen to enter the setup screen.
Parameter configuration and utilizing various functions starts from this screen.

Back to the initial screen.

※1: Scroll direction can be changed by reversing the arrow direction at lower left with "SEL1".
(See "SEL1" operation in 9.1.2 Switch operation (2).)

(2) To change the style of view variables

・Display/hide of individual items and their priority can be changed.
(For details, see 9.11 Variables view screen setup.)

・Display font size can be changed.
In default setting, alphanumeric is displayed in large fonts; two items appear in one screen. By selecting the standard font, it is possible to indicate 3 items in one screen.
(For details, see 9.2.2 Transition chart (1) [No. 1-3-3].)

9.2 View Parameters and Description

Numerous parameters and functions are incorporated in this transmitter.
In 9.2.1 Setup menu window, procedures to bring up MODE SELECT menu screen, the initial screen to show menu items, are covered. For explanation of individual parameters, see 9.2.2 Transition chart.

⚠CAUTION: Notes on Write Protect mode

Write protect mode is a factory preset mode which restricts parameter changes or executing functions related to measurement accuracy, performance, and measurement values of this device to prevent posing problems in case the device is used for custody transfer, etc.

If the target parameter is changed or the function is executed when the device is set to Write Protect mode, the message "Write protect" ("Write protected" on LinkTop) is displayed on the LCD screen or screen of communication terminal such as LinkTop and the operation is not accepted. For the target parameters of Write Protect mode, refer to the note "*1" shown in sections 9.2.2 to 9.2.7.

Write Protect mode cannot be set or canceled by customer. If setting/canceling of this mode is required, please contact the distributor you purchased the product.

9.2.1 View the setup menu

To reconfigure parameters, etc., it is necessary to bring up the MODE SELECT menu screen at first.
The following is the procedure:

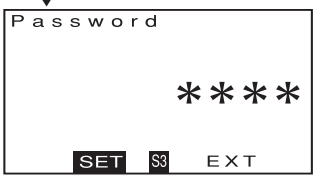
Operate "SEL3".

(1) Bringing up "MODE SELECT" screen
Repeat "ENT" operation until "MODE SELECT" screen appears.
(For detail of operation, see 9.1.2 Switch operation.)
Shown at left is the "MODE SELECT" screen.

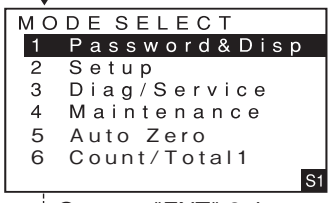
(2) Operation on menu view
Click "SEL3". A switch to "MODE SELECT menu" screen takes place.
(If password is enabled, a password setup screen appears.)
(See 9.5 Password Function which will guide you the rest of the way.)

★ Password is not set.

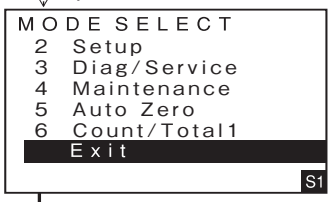
★ Password is set.



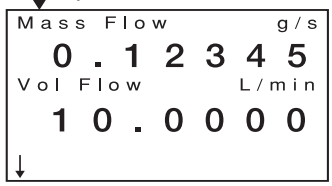
Password setup screen
For the rest of the way, see 9.5 Password Functions.



Operate "ENT" 6 times.



Operate "SEL1".



3) "MODE SELECT" menu screen appears.
From this screen, you are ready to configure parameters and to run various functions.
For view parameters and description, see the respective item in 9.2.2 to 9.2.7 Transition charts.

To return to the normal screen without proceeding to setup process, operate "ENT" 6 times and select Exit.
Then, operate "SEL1" to return to the normal screen.

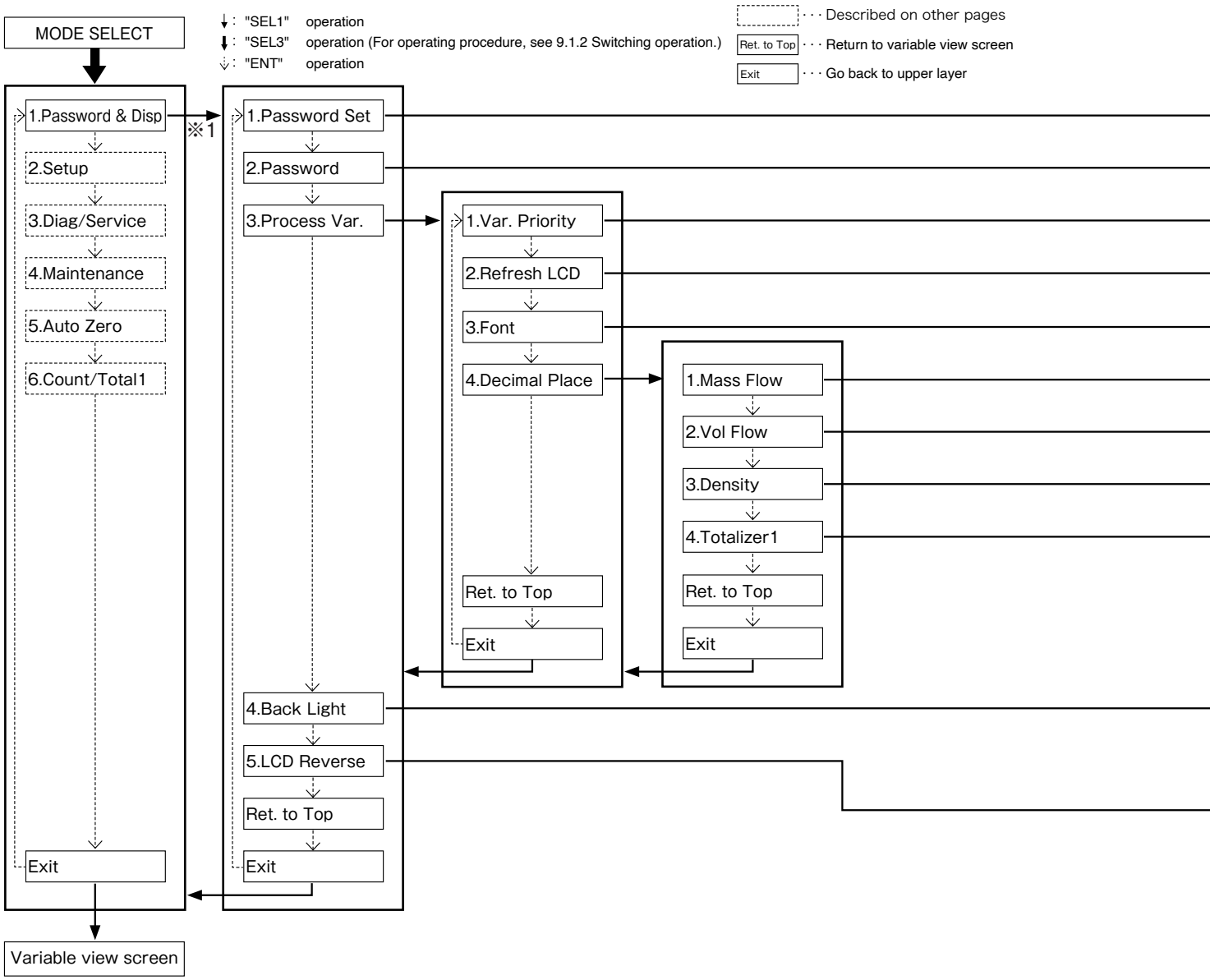
(4) Normal screen appears.

⚠CAUTION: Normally if no command arrives within 5 minutes (※1) at "Mode Select" menu screen, it returns to the normal window.

※1 Automatic OFF duration of the back light is synchronized with "Back Light" parameter setting. (If set to "Off", the screen goes back to normal screen after 5 minutes.)

※2 The screen does not automatically return to the measuring screen if simulated signal output is in progress.

9.2.2 Transition chart of view (1)

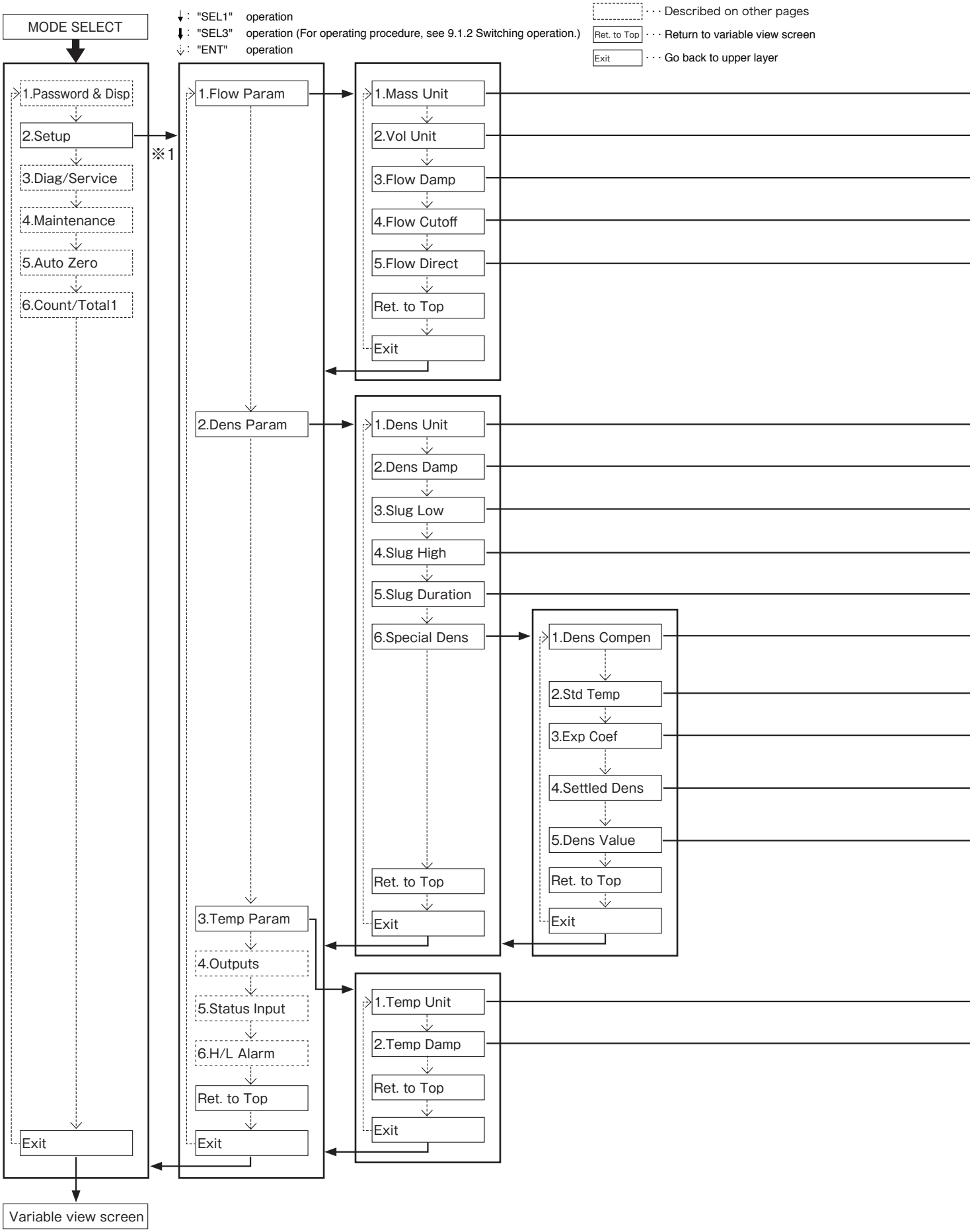


NOTE: ※1：For this function, the setting change is disabled in Write Protect mode (refer to section 9.2).

No.	Item	Description	Setup	Default
1-1	Password Set	Selects password active/inactive. With "ON" selected, entering a password is requested before entering setup menu screen from "MODE SELECT" screen. This prevents unauthorized password change. For details of password, see 9.5 Password Function.	See 9.4	Off
1-2	Password	Sets a password. To validate the setting, password function in [No. 1-1] requires to be turned "ON". A precaution to remember: If password is forgotten, there will be no way to change parameters.	See 9.3	9999
1-3-1	Var. Priority	Selects run indicator display/hide and priority of variables view. For details, see 9.1.1 Variables view screen setup.	See 9.11	
1-3-2	Refresh LCD	Changes LCD display refresh rate (ms). Select one from 1: 100ms, 2: 200ms, 3: 500ms, 4: 1000ms, or 5: 2000ms. Select a slower rate if the reading changes too fast, making it difficult to read; select a faster rate if prompt readout is desired.	See 9.4	500ms
1-3-3	Font	Changes LCD font size. 1: Double angle ⇒ Larger font, allowing 2 variables view in one screen. 2: Normal ⇒ Smaller font, allowing 3 variables view in one screen.	See 9.4	Double
1-3-4-1	Mass Flow	Changes dcml pt. pos. in LCD instant mass rate. Select one that matches instant mass rate used. Select from 1: Auto ⇒ Auto (from 5th dcml. plc. to no fractions, 2: Integer ⇒ No fractions, 3: 1st decimal ⇒ to 1st dcml place, 4: 2nd decimal ⇒ to 2nd dcml plc., 5: 3rd decimal ⇒ to 3rd dcml plc., 6: 4th decimal ⇒ to 4th dcml plc.	See 9.4	Auto
1-3-4-2	Vol Flow	Changes dcml pt. pos. in instant volume rate on LCD. Select one that matches instant mass rate used. Select from 1: Auto ⇒ Automatic, 2: Integer ⇒ No fractions, 3: 1st decimal ⇒ to 1st dcml place, 4: 2nd decimal ⇒ to 2nd dcml plc., 5: 3rd decimal ⇒ to 3rd dcml plc., 6: 4th decimal ⇒ to 4th dcml plc.	See 9.4	Auto
1-3-4-3	Density	Changes LCD decimal point position in density. Set to match the density used. Selectable from 1: Auto ⇒ Automatic, 2: Integer ⇒ No fractions, 3: 1st Decimal ⇒ to 1st dcml place, 4: 2nd Decimal ⇒ to 2nd dcml place, 5: 3rd Decimal ⇒ to 3 rd dcml place, 6: 4th Decimal ⇒ to 4th dcml place.	See 9.4	Auto
1-3-4-4	Totalizer1	Changes LCD decimal point position in total flow 1. Set to match the total flow 1 used. Selectable from 1: Auto ⇒ Automatic, 2: Integer ⇒ No fractions, 3: 1st Decimal ⇒ to 1st dcml place, 4: 2nd Decimal ⇒ to 2nd dcml place, 5: 3rd Decimal □ to 3rd dcml place, 6: 4th Decimal ⇒ to 4th dcml place.	See 9.4	Auto

No.	Item	Description	Setup	Default
1-4	Back Light	Selects backlight mode. (In an erratic condition, it stays on or blinks depending on its nature.) 1: Off: Backlight stays off. 2: Sleep 5 min: Stays on for 5 min before it goes out. 3: Sleep 10 min: Stays on for 10 min before it goes out. 4: Sleep 20 min: Stays on for 20 min before it goes out. 5: Sleep 30 min: Stays on for 30 min before it goes out.	See 9.4	Sleep 5min
1-5	LCD Reverse	Flips the display of LCD vertically, including the assignment of SEL and ENT switches. OFF: Not reversed ON: Reversed	See 9.4	OFF

9.2.3 Transition chart of view (2)



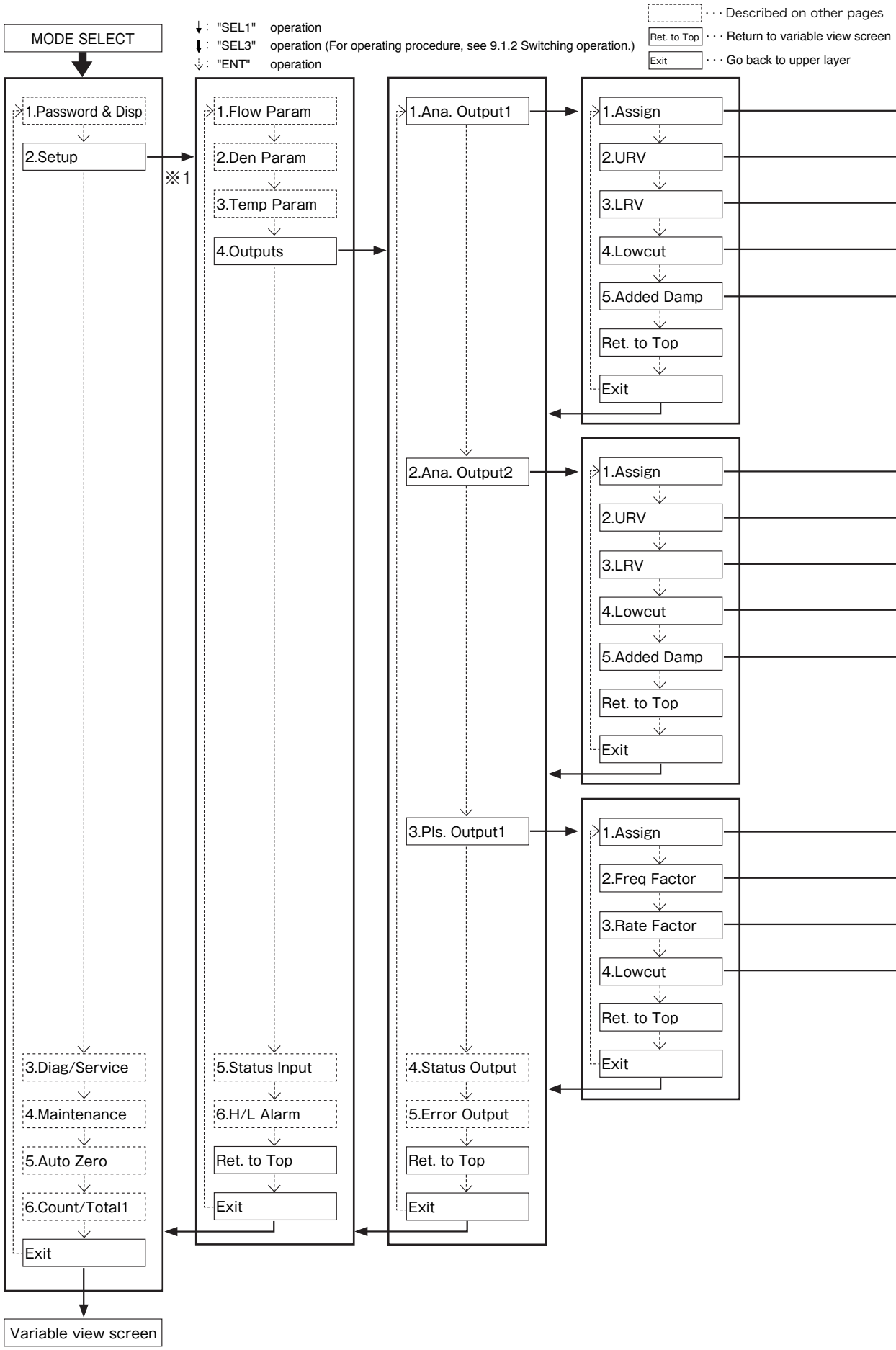
NOTE: ※1：For this function, the setting change is disabled in Write Protect mode (refer to section 9.2).

No.	Item	Description	Setup	Default
2-1-1	Mass Unit	Selects instant mass flowrate unit. For available units of measure, see 9.20 Available setup units. Units of flowrate-related views and settings keep track of the units selected.	See 9.4	kg/min
2-1-2	Vol Unit	Selects unit of instant volume flowrate. For available units of measure, see 9.20 Available setup units. Flowrate-related units of measure and settings keep track of the units selected.	See 9.4	L/min
2-1-3	Flow Damp	Changes instant flowrate damping factor (sec). If flowrate fluctuates excessively, select a larger value; if fast response is desired, select a smaller value (0 to 200 sec).	See 9.3	0.8
2-1-4	Flow Cutoff	Changes cutoff (%) of instant mass rate. With respect to the cutoff rate multiplied by max allowable instant mass rate and cutoff rate, instant rate is clamped at 0 within the range where – cutoff rate < instant mass rate < +cutoff rate. If flowrate fluctuates excessively, select a larger value; if measurement down to small flows is desired, select a smaller value (0 to 5 %).	See 9.3	0.3
2-1-5	Flow Direct	Changes flow direction. 1: Forward ⇒ + flow when the fluid runs in the flow direction of sensor; – flow if the fluid runs opposite to the flow direction of sensor. 2: Reverse ⇒ – flow when the fluid runs in the flow direction of sensor; + flow if the fluid runs opposite to the flow direction of sensor.	See 9.4	Forward

No.	Item	Description	Setup	Default
2-2-1	Dens Unit	Selects density unit. For available units of measure, see 9.20 Available setup units. The unit of density-related views and settings keep track of the unit selected.	See 9.4	g/ml
2-2-2	Dens Damp	Changes density damping factor (sec). If density fluctuates excessively, select a larger value; if fast response is desired, select a smaller value.	See 9.3	4.0
2-2-3	Slug Low	Sets lower limit density (low end in normal density) for slug flow detection. Set a value smaller than expected flow density.	See 9.3	Liquid: 0.3 Gas: 0
2-2-4	Slug High	Sets higher limit density (high end in normal density) for slug flow detection. Set a value larger than expected flow density.	See 9.3	Liquid: 2 Gas: 10
2-2-5	Slug Duration	Sets the duration required for detecting slug flows. During the preset duration, if measured density falls below lower limit density [No. 2-2-3] or exceeds upper limit density [No. 2-2-4], it is identified as slug flow to indicate an alarm.	See 9.3	0
2-2-6-1	Dens Compen	Sets enable/disable of reference temp. conversion function on density. 1: Off ⇒ Reference temp. conv. function disabled. 2: On ⇒ Ref. temp. conv. function is activated based on the following formula and the obtained dens. value is used in the view and output, etc. Dens. after ref. temp. conv. = Measured dens. + {ref. temp. conv. factor [No. 2-2-6-3]×(fluid temp. – ref. temp. [No. 2-2-6-2])}	See 9.4	Off
2-2-6-2	Std Temp	Changes the ref. temperature (°C) of the ref. temperature conversion function. The setting is valid when selection [No. 2-2-6-1] of ref. temperature conversion function is active.	See 9.3	20.00
2-2-6-3	Exp Coef	Changes ref. temp. conversion factor ([g/ml/°C]) in the ref. temp. conversion function. The setting is valid when selection [No. 2-2-6-1] of ref. temperature conversion function is active.	See 9.3	0.00024
2-2-6-4	Settled Dens	Sets enable/disable of fixed density function. 1: Off ⇒ Fixed density function is inactive. 2: On ⇒ Irrespective of density measurement, the fixed density [No. 2-2-6-5] is reflected in the output. (True density is displayed as density value.) (With On selected, vol flow is suffixed with (s) to avoid confusion with true density volume output.	See 9.4	Off
2-2-6-5	Dens Value	Changes fixed density (g/ml) of fixed density function. The setting is valid when selection [No. 2-2-6-4] of fixed density function is active.	See 9.3	1.0000

No.	Item	Description	Setup	Default
2-3-1	Temp Unit	Selects temperature unit of measure. For available units, see 9.20 Available setup units. The unit of temperature-related views and settings keeps track of the unit selected.	See 9.4	°C
2-3-2	Temp Damp	Changes temperature damping factor (sec). If temperature varies widely, select a larger value; if fast response is desired, select a smaller value.	See 9.3	4.0

9.2.4 Transition chart of view (3)



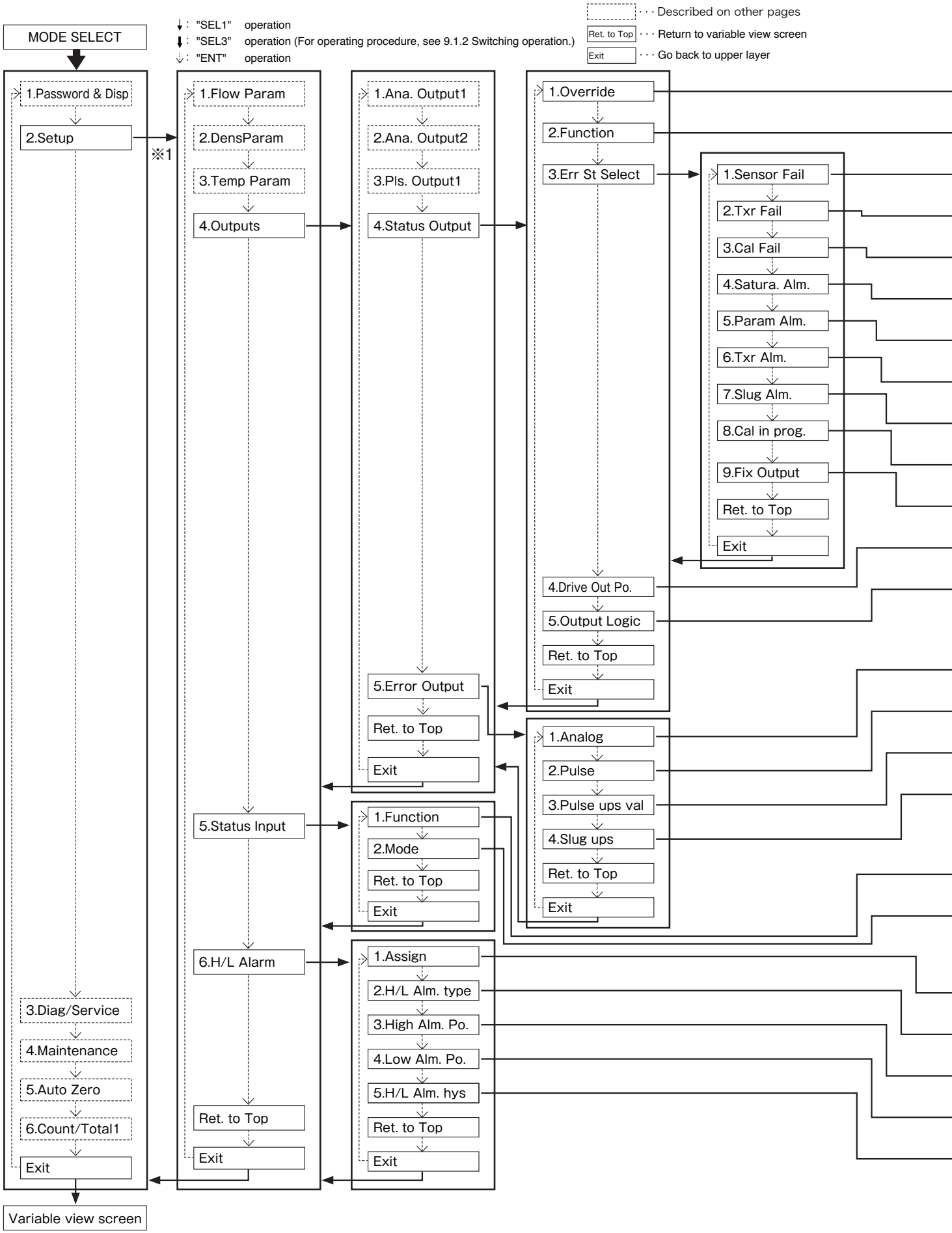
NOTE: ※1：For this function, the setting change is disabled in Write Protect mode (refer to section 9.2).

No.	Item	Description	Setup	Default
2-4-1-1	Assign	Changes analog output 1 assignment. (See 9.13 Analog Output Function.) If assignment is changed, reconfigure upper limit [No. 2-4-1-2], lower limit [No. 2-4-1-3], low cutoff [No. 2-4-1-4], and damping factor [No. 2-4-1-5] for optimum settings.	See 9.4	Mass Flow
2-4-1-2	URV	Changes analog output 1 upper limit. A 20mA output is produced at the value so set. A value smaller than lower limit [No. 2-4-1-3] and a value larger than max allowable range are not acceptable.	See 9.3	180.000
2-4-1-3	LRV	Changes analog output 1 lower limit. A 4mA output is produced at the value so set. A value larger than upper limit [No. 2-4-1-2] and a value larger than the max allowable range are not acceptable.	See 9.3	0.00000
2-4-1-4	Lowcut	Changes analog output 1 low cutoff (%). When low flow cutoff is greater than proportion of analog output where upper limit [No. 2-4-1-2] is set at 100% and lower limit [No. 2-4-1-3] at 0%, analog output is clamped at 4mA.	See 9.3	0.0
2-4-1-5	Added Damp	Changes analog output 1 damping factor (sec). If analog output 1 fluctuates excessively, select a larger value; if fast response is desired, select a smaller value.	See 9.3	0.0

No.	Item	Description	Setup	Default
2-4-2-1	Assign	Changes analog output 2 assignment. (See 9.13 Analog Output Function.) If assignment is changed, reconfigure upper limit [No. 2-4-2-2], lower limit [No. 2-4-2-3], low cutoff [No. 2-4-2-4], and damping factor [No. 2-4-2-5] for optimum settings.	See 9.4	Mass Flow
2-4-2-2	URV	Changes analog output 2 upper limit. A 20mA output is produced at the value so set. A value smaller than lower limit [No. 2-4-2-3] and a value larger than the max allowable range are not acceptable.	See 9.3	180.000
2-4-2-3	LRV	Changes analog output 2 lower limit. A 4mA output is produced at the value so set. A value larger than upper limit [No. 2-4-2-2] and a value larger than the max allowable range are not acceptable.	See 9.3	0.00000
2-4-2-4	Lowcut	Changes analog output 2 low cutoff (%). When low flow cutoff is greater than proportion of analog output where upper limit [No. 2-4-2-2] is set at 100% and lower limit [No. 2-4-2-3] at 0%, analog output is clamped at 4mA.	See 9.3	0.0
2-4-2-5	Added Damp	Changes analog output 2 damping factor (sec). If analog output 2 fluctuates excessively, select a larger value; if fast response is desired, select a smaller value.	See 9.3	0.0

No.	Item	Description	Setup	Default
2-4-3-1	Assign	Changes pulse output 1 assignment. (For functions, see 9.12 Pulse Output Function.) If assignment is changed, reconfigure frequency at full scale [No. 2-4-3-2], full scale flowrate [No. 2-4-3-3], and low cutoff [No. 2-4-3-4] for optimum settings.	See 9.4	Mass Flow
2-4-3-2	Freq Factor	Changes the max frequency of pulse output 1. An output is produced at the frequency (duty 50%) set at full scale [No. 2-4-3-3]. Set up to match the measuring frequency range of instrument used for pulse output measurement.	See 9.3	1000.0
2-4-3-3	Rate Factor	Changes pulse output 1 full scale flowrate. An output is produced at the max frequency [No. 2-4-3-2] when preset flowrate is reached.	See 9.3	180.000
2-4-3-4	Lowcut	Changes low cutoff (%) of pulse output 1. When proportion of flowrate falls below low cutoff where full scale flowrate [No. 2-4-3-3] is set at 100%, the pulse output is clamped at 0.	See 9.3	0.0

9.2.5 Transition chart of view (4)



NOTE: ※1：For this function, the setting change is disabled in Write Protect mode (refer to section 9.2).

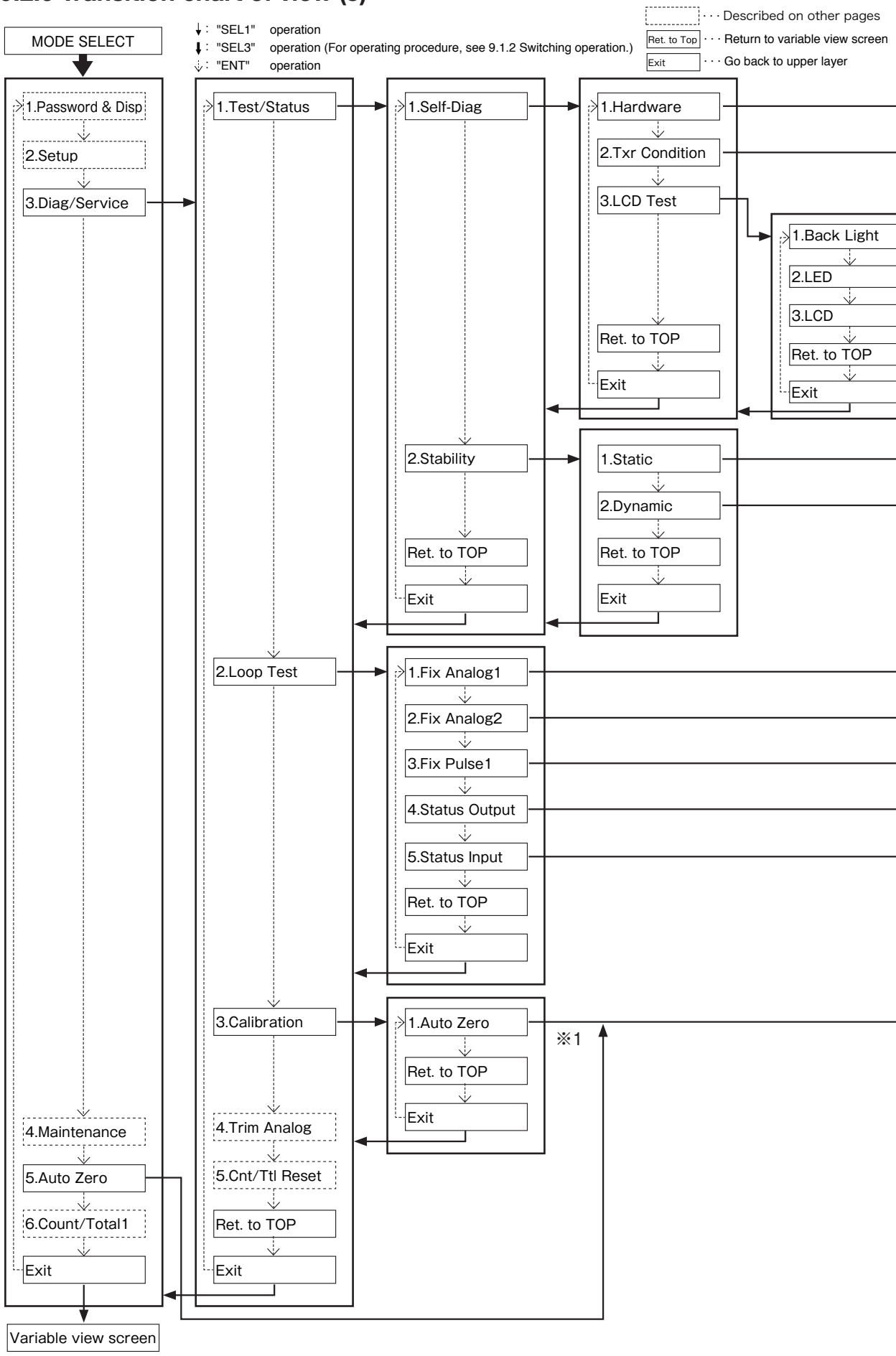
No.	Item	Description		Setup	Default
2-4-4-1	Override	Assigns status output to analog output 2. (For detail, see 9.14 Status Output Function)		See 9.4	Off
2-4-4-2	Function	Changes status output assignment. (For detail, see 9.14 Status Output Function.)		See 9.4	No Function
2-4-4-3-1	Sensor Fail	Sets output item(s) when [Error Status] is selected under assignment selection [No.2-4-4-2] of status output. (Multiple settings available)	1: Off ⇒ No assignment to status output, 2: On ⇒ Sensor Fail state is assigned to status output. For detail of Sensor Fail, see 10.1 Error Messages.	See 9.4	Off
2-4-4-3-2	Txr Fail		1: Off ⇒ No assignment to status output, 2: On ⇒ Txr Fail state is assigned to status output. For detail of Txr Fail, see 10.1 Error Messages.	See 9.4	Off
2-4-4-3-3	Cal Fail		1: Off ⇒ No assignment to status output, 2: On ⇒ Calibration Fail state is assigned to status output. For detail of Calibration Fail, see 10.1 Error Messages.	See 9.4	Off
2-4-4-3-4	Satura. Alm.		1: Off ⇒ No assignment to status output, 2: On ⇒ Saturated alarm state is assigned to status output. For detail of Saturation alarm, see 10.1 Error Messages.	See 9.4	Off
2-4-4-3-5	Param Alm.		1: Off ⇒ No assignment to status output, 2: On ⇒ Parameter alarm state is assigned to status output. For detail of Parameter alarm, see 10.1 Error Messages.	See 9.4	Off
2-4-4-3-6	Txr Alm.		1: Off ⇒ No assignment to status output, 2: On ⇒ Txr alarm state is assigned to status output. For detail of Txr alarm, see 10.1 Error Messages.	See 9.4	Off
2-4-4-3-7	Slug Alm.		1: Off ⇒ No assignment to status output, 2: On ⇒ Slug alarm state is assigned to status output. For detail of Slug alarm, see 10.1 Error Messages.	See 9.4	On
2-4-4-3-8	Cal in prog.		1: Off ⇒ No assignment to status output, 2: On ⇒ Cal in Progress state is assigned to status output. For detail of Cal in Progress, see 10.1 Error Messages.	See 9.4	Off
2-4-4-3-9	Fix Output		1: Off ⇒ No assignment to status output, 2: On ⇒ Fix output state is assigned to status output. For detail of Fix output, see 10.1 Error Messages.	See 9.4	Off
2-4-4-4	Drive Output Po.	The threshold value of a drive output can be set up.		See 9.4	100
2-4-4-5	Output Logic	1: Negative ⇒ Sets output logic as negative logic 2: Positive ⇒ Sets output logic as positive logic		See 9.4	Negative

No.	Item	Description	Setup	Default
2-4-5-1	Analog	Selects analog output pattern when an alarm condition occurs (sensor failure, Txr failure, or parameter alarm). 1: Downscale ⇒ Produces 2.4mA, 2: Zero ⇒ Produces 4mA, 3: Hold ⇒ Produces analog value as it is in an error, 4: Upscale ⇒ Produces 21.6mA.	See 9.4	Downscale
2-4-5-2	Pulse	Selects pulse output pattern in an error (sensor failure, Txr failure, or parameter alarm). 1: Zero ⇒ Stops pulse output, 2: Hold ⇒ Produces pulse output value as it is in an error, 3: Upscale ⇒ Produces an 11kHz output.	See 9.4	Zero
2-4-5-3	Pulse ups val	Sets pulse upscale frequency during an alarm.	See 9.4	11000Hz
2-4-5-4	Slug ups	Selects status of pulse and analog output during Slug Alm. 1: Upper→Upscale frequency, 21.6mA 2: Lower→0Hz, 4mA ※Applied to analog output only when flowrate is assigned.	See 9.4	Lower

No.	Item	Description	Setup	Default
2-5-1	Function	Changes status input assignment. (See 9.15 Status input functions.)	See 9.4	No function
2-5-2	Input Logic	Selects status input operating conditions. 1: Normal Open ⇒ Input is recognized when status input is close and begins operation. 2: Normal Close ⇒ Input is recognized when status input is open and begins operation.	See 9.4	Normal Open

No.	Item	Description	Setup	Default
2-6-1	Assign	Changes H/L alarm assignment. (See 9.16 High low alarm functions.) To validate this setting, it is necessary that H/L alarm be selected at status output assignment.	See 9.4	Mass Flow
2-6-2	H/L Alm. Type	Selects type of H/L alarm. 1: High alarm ⇒ High alarm is active, 2: Low alarm ⇒ Low alarm is active, 3: H/L alarm ⇒ Both high and low alarms are active.	See 9.4	High Alarm
2-6-3	High Alm. Po.	Changes high alarm setting. A value exceeding this setting activates high alarm; when it falls below this setting by H/L alarm hysteresis [No. 2-6-5], high alarm condition is reset. A setting smaller than low alarm [No. 2-6-4] is not acceptable.	See 9.3	0.0
2-6-4	Low Alm. Po.	Changes low alarm setting. A value falling below this setting activates low alarm; when it exceeds this setting by H/L alarm hysteresis]No. 2-6-5], low alarm condition is reset. A setting smaller than high alarm [No. 2-6-3] is not acceptable.	See 9.3	0.0
2-6-5	H/L Alm. hys	Changes high/low alarm hysteresis setting. Frequent annoying false alarms (repetitive alarm on/off in short duration) can be alleviated by choosing a larger value. To get an accurate picture of alarm condition, choose a smaller value.	See 9.3	0

9.2.6 Transition chart of view (5)



NOTE: ※1：This function is disabled in Write Protect mode (refer to section 9.2).

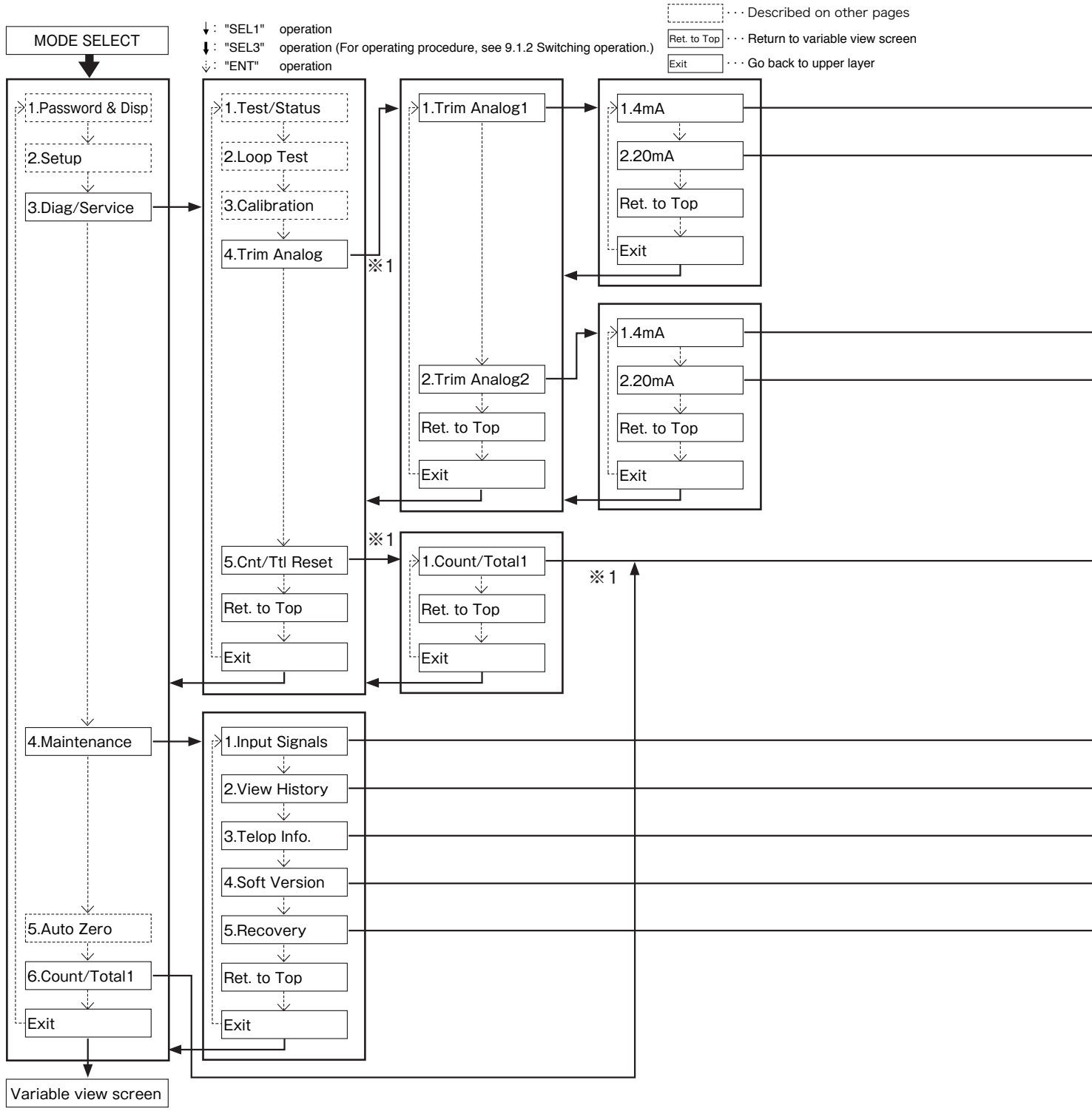
No.	Item	Description	Setup	Default
3-1-1-1	Hardware	Runs a check for possible problems in the probe. For details, see 9.6.1 Probe check. CAUTION: Be very careful as this check can stop outputs under certain circumstances.	See 9.6.1	—
3-1-1-2	Txr Condition	Runs a check for possible problems in the transmitter. For details, see 9.6.3 Transmitter check.	See 9.6.3	—
3-1-1-3-1	Back Light	Tests backlight for possible problems by forcibly turning it on and off. While test continues, the LCD remains dead. Performance test consist of WHT backlight lit (3 sec), ORG backlight lit (3 sec) and backlight unlit (3 sec) conducted twice one after the other (total of 18 sec) and ends automatically. After the test, the LCD restores normal illumination.	See 9.4	—
3-1-1-3-2	LED	Tests LEDs for possible problems by forcibly turning them on and off. While test continues, the LCDs remain dead. Performance test consist of RED LED lit (1.5 sec) and GRN LED lit (1.5 sec) conducted 6 times alternately (total of 18 sec) and ends automatically. After the test, the LCDs restore normal illumination.		—
3-1-1-3-3	LCD	Tests LCD for possible problems by illuminating and extinguishing all LCD dots. While test continues, the LCDs are forcibly switched in and out. Performance test consist of all dots lit (3 sec) and all dots unlit (3 sec) conducted twice alternately and ends automatically (a total of 12 sec). After the test, the LCDs restore normal illumination.		—

No.	Item	Description	Setup	Default
3-1-2-1	Static Flow Measurement Stability Check (zero flow)	Runs a check for stability of sensor signal at zero flow. For details, see 9.6.3 Flow measurement stability check (zero flow).	See 9.6.3	—
3-1-2-2	Dynamic Flow Measurement Stability Check (normal flow)	Runs a check for stability of sensor signal while allowing the fluid. For details, see 9.6.4 Flow measurement stability check (normal flow).	See 9.6.4	—

No.	Item	Description	Setup	Default
3-2-1	Fix Analog1	Produces a simulated output of analog output 1. It is beneficial for testing cable fault and performance of associated equipment. For details, see 9.7.1 Analog output.	See 9.7.1	—
3-2-2	Fix Analog2	Produces a simulated output of analog output 2. It is beneficial for testing cable fault and performance of associated equipment. For details, see 9.7.1 Analog output.	See 9.7.1	—
3-2-3	Fix Pulse1	Produces a simulated output of pulse output 1. It is beneficial for testing cable fault and performance of associated equipment. For details, see 9.7.2 Pulse output.	See 9.7.2	—
3-2-4	Status Output	Produces a simulated output of status output. It is beneficial for testing cable fault and performance of associated equipment. For details, see 9.7.3 Status output.	See 9.7.3	—
3-2-5	Status Input	Monitors status input. It is beneficial for testing cable fault and performance of associated equipment. For details, see 9.7.4 Status monitor input.	See 9.7.4	—

No.	Item	Description	Setup	Default
3-3-1	Auto Zero	Performs zeroing. When you perform zeroing, verify that the flow is at zero. For details, see 9.8 Zeroing Function.	See 9.8	—

9.2.7 Transition chart of view (6)



➡NOTE: ※1：This function is disabled in Write Protect mode (refer to section 9.2).

No.	Item	Description	Setup	Default
3-4-1-1	4mA	Trims 4mA analog output 1. It is factory adjusted and normally further adjustment is not required. However, if it is absolutely necessary, follow the procedure outlined. For details, see 9.9 Analog Output Trim.	See 9.9	—
3-4-1-2	20mA	Trims 20mA analog output 1. It is factory adjusted and normally further adjustment is not required. However, if it is absolutely necessary, follow the procedure outlined. For details, see 9.9 Analog Output Trim.	See 9.9	—

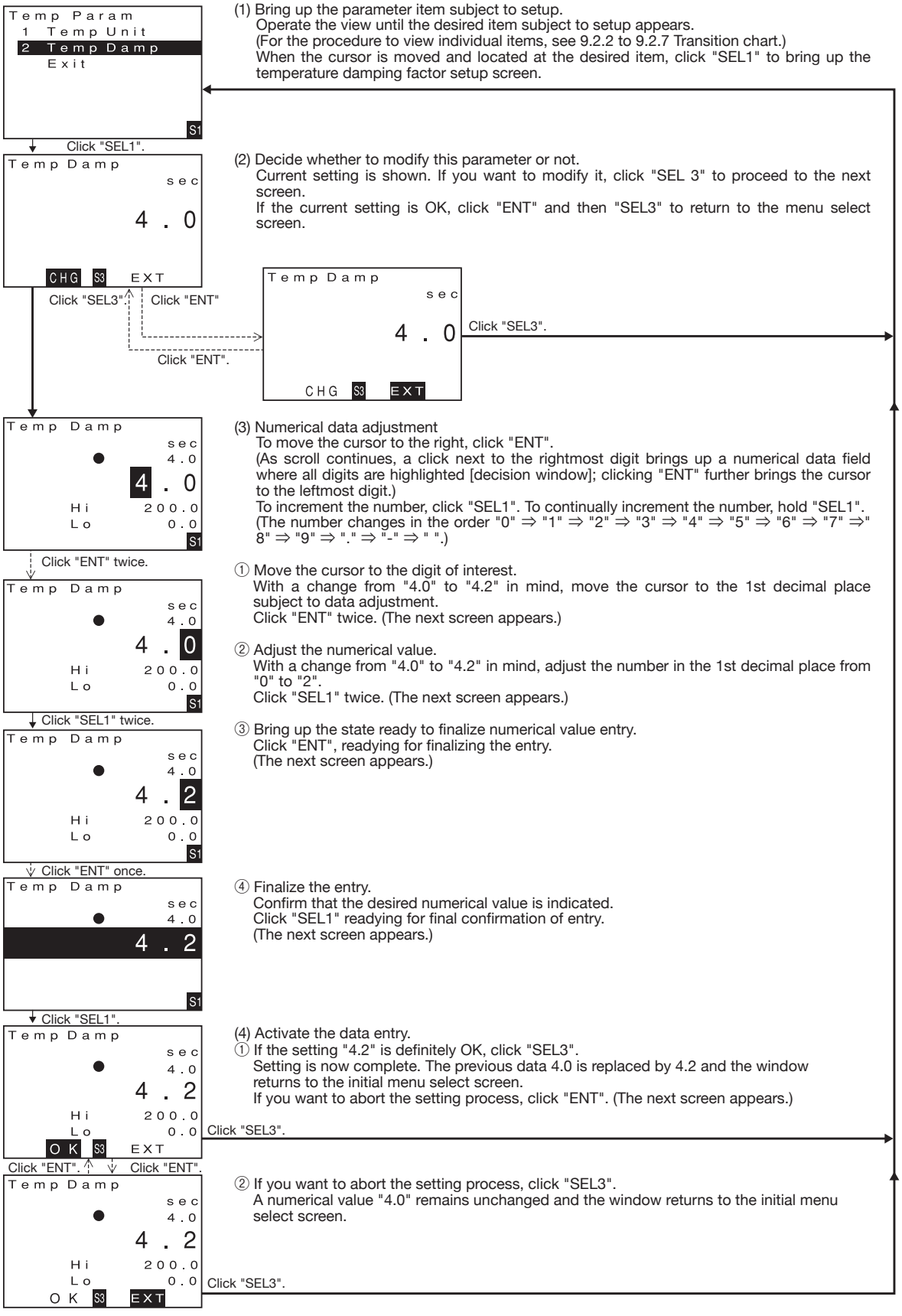
No.	Item	Description	Setup	Default
3-4-2-1	4mA	Trims 4mA analog output 2. It is factory adjusted and normally further adjustment is not required. However, if it is absolutely necessary, follow the procedure outlined. For details, see 9.9 Analog Output Trim.	See 9.9	—
3-4-2-2	20mA	Trims 20mA analog output 2. It is factory adjusted and normally further adjustment is not required. However, if it is absolutely necessary, follow the procedure outlined. For details, see 9.9 Analog Output Trim.	See 9.9	—

No.	Item	Description	Setup	Default
3-5-1	Count/Total1	Resets counter 1 and totalizer 1 reading to 0. For details, see 9.10 Reset Function.	See 9.10	—

No.	Item	Description	Setup	Default
4-1	Input Signals	The screen is used for maintenance.	View only	—
4-2	View History	Shows the number of running hours of transmitter. Can be switched to calendar view. (Incorporated clock is maintenance oriented; No updating takes place if power to the transmitter is interrupted.)		—
4-3	Telop Info.	When the number of running hours exceeds 100,000, a black circle "●" begins to blink at lower left of LCD which can be canceled. 1: Off ⇒ "●" stays off irrespective of elapsed hours. 2: ON ⇒ warning "●" begins to blink after 100,000 hours.	See 9.4	ON
4-4	Soft Version	Shows the software version and checksum value.	View only	—
4-5	Recovery Parameter operation	Recovers the parameters from parameter back-up area. For details, see 9.19 Parameter Copy Function.	See 9.19	—

9.3 Parameter Value Entry

The procedure to enter a numerical data of parameters is described here. As an example, reconfiguring the temperature damping factor from "4.0" to "4.2" is covered in this section. A similar procedure applies to setting up other parameters.



(1) Bring up the parameter item subject to setup.
Operate the view until the desired item subject to setup appears.
(For the procedure to view individual items, see 9.2.2 to 9.2.7 Transition chart.)
When the cursor is moved and located at the desired item, click "SEL1" to bring up the temperature damping factor setup screen.

(2) Decide whether to modify this parameter or not.
Current setting is shown. If you want to modify it, click "SEL 3" to proceed to the next screen.
If the current setting is OK, click "ENT" and then "SEL3" to return to the menu select screen.

(3) Numerical data adjustment
To move the cursor to the right, click "ENT".
(As scroll continues, a click next to the rightmost digit brings up a numerical data field where all digits are highlighted [decision window]; clicking "ENT" further brings the cursor to the leftmost digit.)
To increment the number, click "SEL1". To continually increment the number, hold "SEL1".
(The number changes in the order "0" ⇒ "1" ⇒ "2" ⇒ "3" ⇒ "4" ⇒ "5" ⇒ "6" ⇒ "7" ⇒" 8" ⇒ "9" ⇒ "." ⇒ "-" ⇒ " ".)

① Move the cursor to the digit of interest.
With a change from "4.0" to "4.2" in mind, move the cursor to the 1st decimal place subject to data adjustment.
Click "ENT" twice. (The next screen appears.)

② Adjust the numerical value.
With a change from "4.0" to "4.2" in mind, adjust the number in the 1st decimal place from "0" to "2".
Click "SEL1" twice. (The next screen appears.)

③ Bring up the state ready to finalize numerical value entry.
Click "ENT", readying for finalizing the entry.
(The next screen appears.)

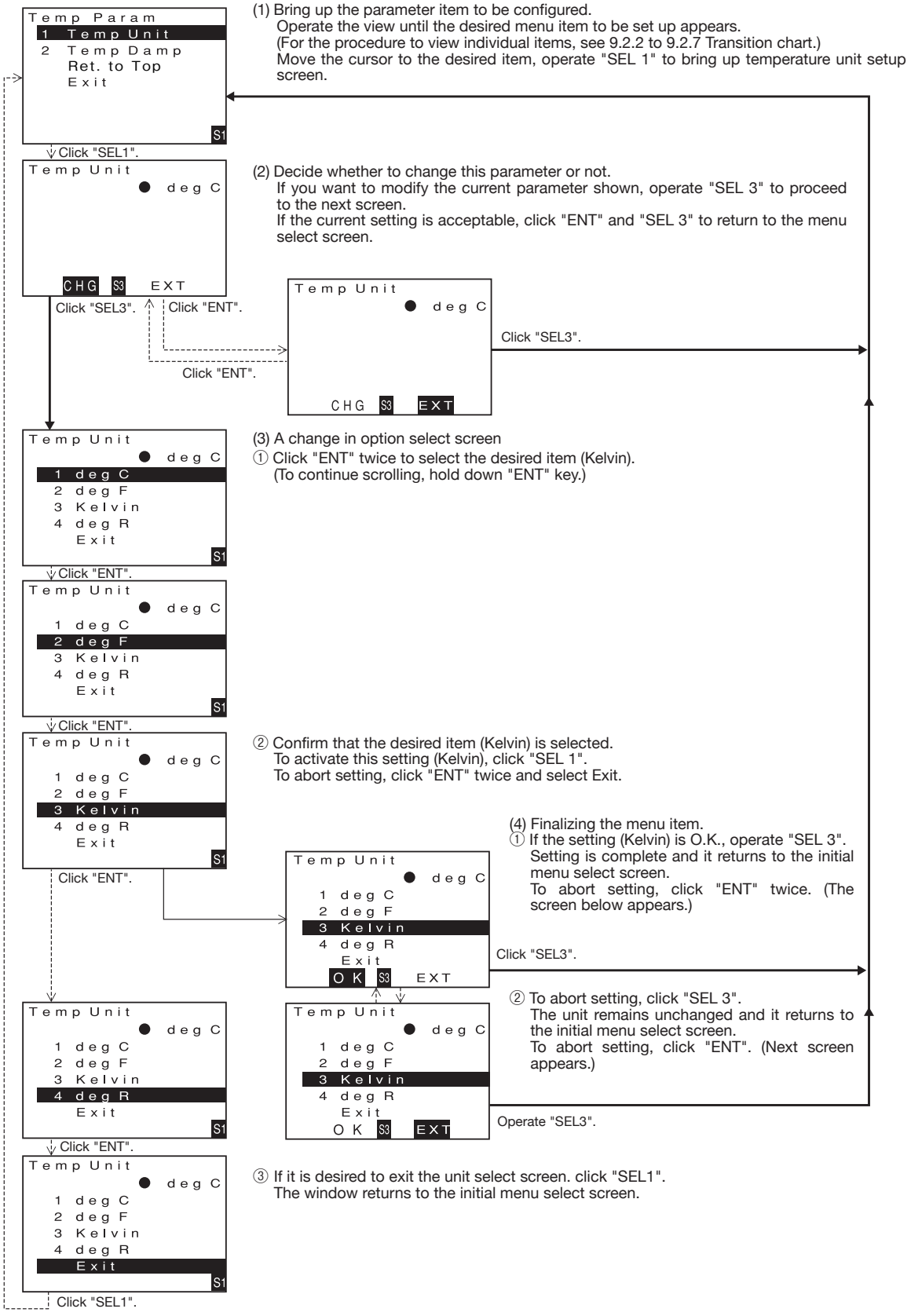
④ Finalize the entry.
Confirm that the desired numerical value is indicated.
Click "SEL1" readying for final confirmation of entry.
(The next screen appears.)

(4) Activate the data entry.
① If the setting "4.2" is definitely OK, click "SEL3".
Setting is now complete. The previous data 4.0 is replaced by 4.2 and the window returns to the initial menu select screen.
If you want to abort the setting process, click "ENT". (The next screen appears.)

② If you want to abort the setting process, click "SEL3".
A numerical value "4.0" remains unchanged and the window returns to the initial menu select screen.

9.4 Parameter Selection

The procedure to select a menu item of parameters is described here. As an example, selecting "Kelvin" in temperature unit setting is covered in this section. A similar procedure applies to setting up other parameters.



9.5 Password Function (Password)

➡NOTE: For this function, the setting change is disabled in Write Protect mode (refer to section 9.2).

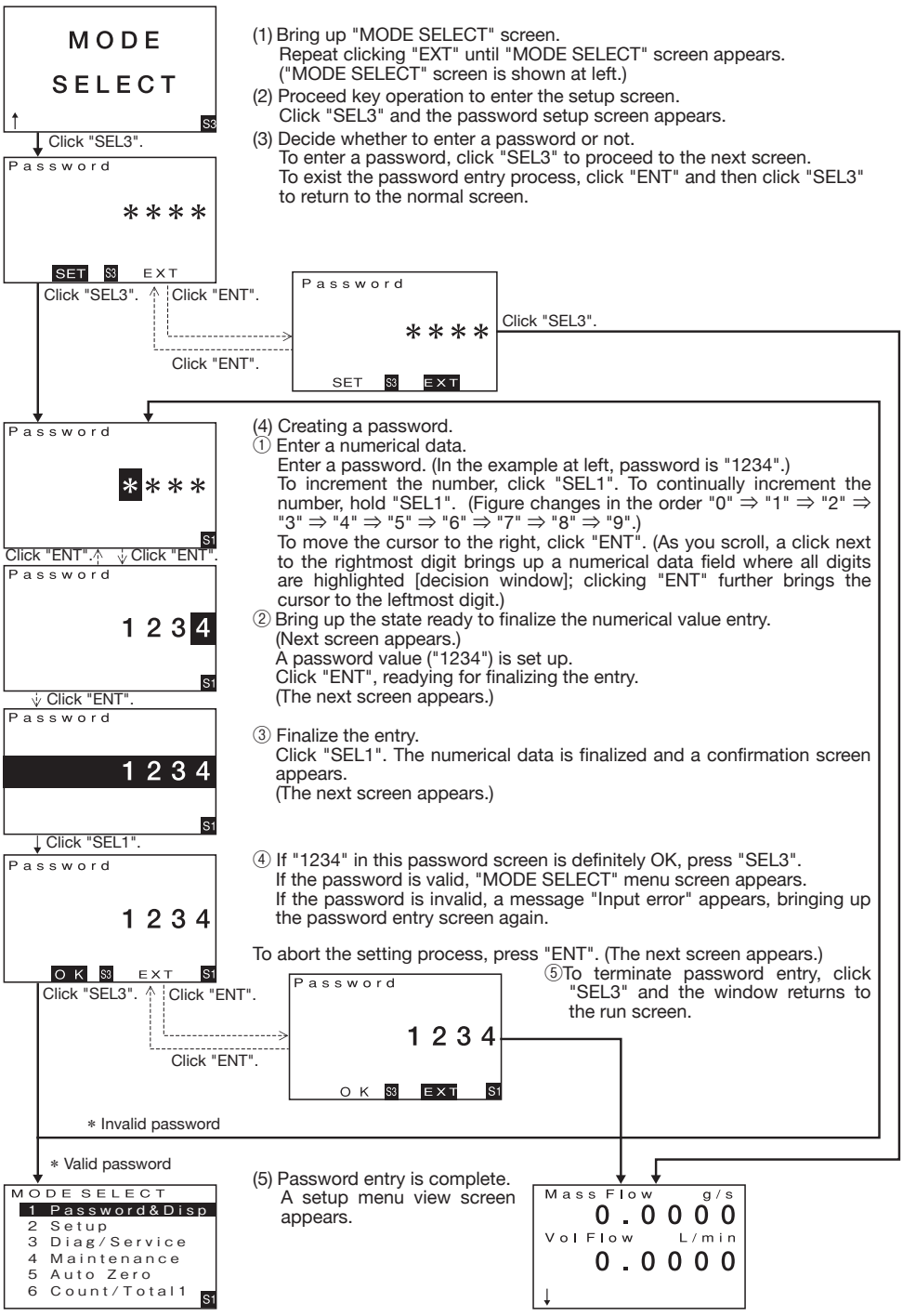
To safeguard transmitter signals and readings against unauthorized parameter modification, you can configure the transmitter to request entering a password before bringing up the configuration screen.

9.5.1 Password function setup

To enable the password function, it is necessary that the following items be set up.

(1) Password function setting (Password Set) (See 9.2.2 Transition chart and description (1) [No. 1-1].)
To activate password function, select "ON" ; to deactivate it, select "OFF".

(2) Creating a password (Password) (See 9.2.2 Transition chart and Description (1) [No. 1-2].)
Enter a 4-digit login password of numerals.
Once these setting are activated, entering a password is asked before any request for password modification. Use extra care in the setup process because if the user forgets his password, there will be no way to get to the reconfiguration screen.

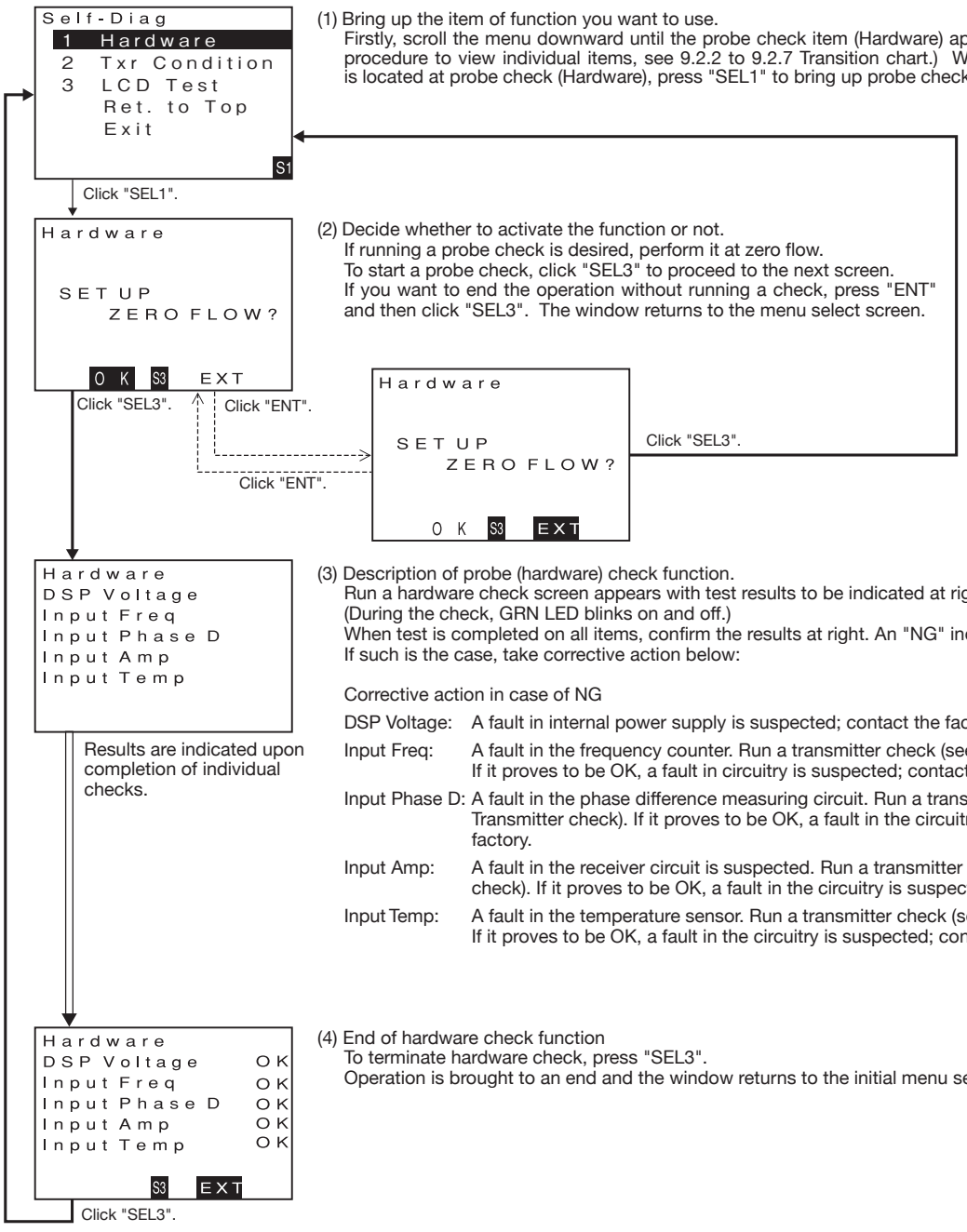


9.6 Self-diagnostic Capabilities (Self-Diag)

Comprehensive self diagnostic capabilities are incorporated in this transmitter. To derive the maximum benefit from the instrument, make full use of these functions during maintenance and inspection for early identification of trouble or for investigation of the causes of trouble in a fault condition.

9.6.1 Probe check (Hardware)

A diagnostic test can be conducted to see if the transmitter is free from any problem in the probe circuitry.
If an error is detected upon diagnosis, there is a possibility that it presents a risk to maintaining accurate measurement. You are prompted to follow the instructions given at an NG sign.



(1) Bring up the item of function you want to use.
Firstly, scroll the menu downward until the probe check item (Hardware) appears. (For the procedure to view individual items, see 9.2.2 to 9.2.7 Transition chart.) When the cursor is located at probe check (Hardware), press "SEL1" to bring up probe check start screen.

(2) Decide whether to activate the function or not.
If running a probe check is desired, perform it at zero flow.
To start a probe check, click "SEL3" to proceed to the next screen.
If you want to end the operation without running a check, press "ENT" and then click "SEL3". The window returns to the menu select screen.

(3) Description of probe (hardware) check function.
Run a hardware check screen appears with test results to be indicated at right.
(During the check, GRN LED blinks on and off.)
When test is completed on all items, confirm the results at right. An "NG" indicates possible fault.
If such is the case, take corrective action below:

Corrective action in case of NG

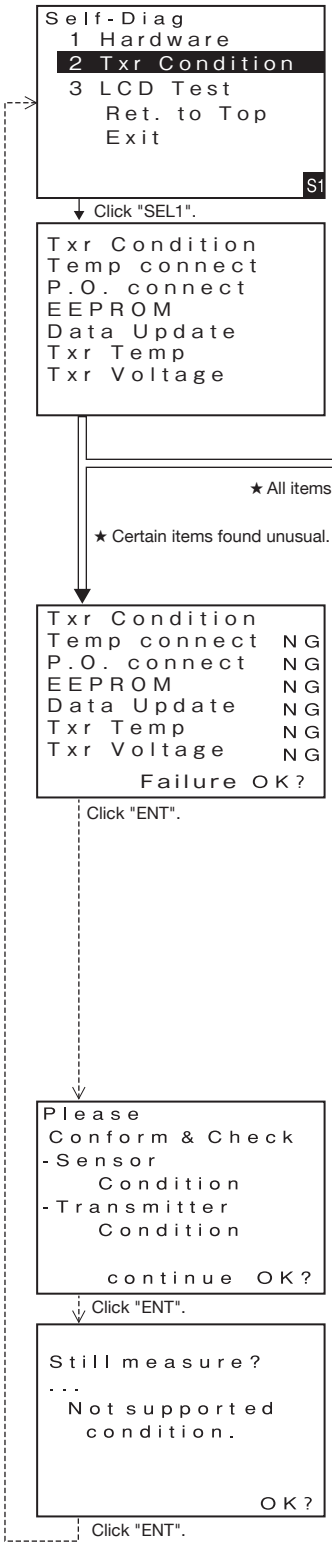
DSP Voltage:	A fault in internal power supply is suspected; contact the factory for repair.
Input Freq:	A fault in the frequency counter. Run a transmitter check (see 9.6.2 Transmitter check). If it proves to be OK, a fault in circuitry is suspected; contact the factory.
Input Phase D:	A fault in the phase difference measuring circuit. Run a transmitter check (see 9.6.2 Transmitter check). If it proves to be OK, a fault in the circuitry is suspected; contact the factory.
Input Amp:	A fault in the receiver circuit is suspected. Run a transmitter check (see 9.6.2 Transmitter check). If it proves to be OK, a fault in the circuitry is suspected; contact the factory.
Input Temp:	A fault in the temperature sensor. Run a transmitter check (see 9.6.2 Transmitter check). If it proves to be OK, a fault in the circuitry is suspected; contact the factory.

(4) End of hardware check function
To terminate hardware check, press "SEL3".
Operation is brought to an end and the window returns to the initial menu select screen.

9.6.2 Transmitter check (Txr Condition)

A diagnostic test can be conducted to see if the transmitter is free from any problem. If an error is detected upon diagnosis, there is a possibility that it presents a risk to maintaining accurate measurement. You are prompted to follow the instructions given.

A precaution to remember: While the check is in progress, flowmetering is disabled with flowrate at 0 (zero).



(1) Bring up the item of function you want to use.
Firstly, scroll the menu downward until transmitter check (Txr Condition) appears.
(For the procedure to view individual items, see 9.2.2 to 9.2.7 Transition chart.)

(2) Run the function
Place the cursor over transmitter check (Txr Condition) and click "SEL1".
Transmitter coil check begins and the next screen appears.

(3) Description of transmitter check function
A check is conducted sequentially on individual items and results are indicated at right.
(During the check, GRN LED blinks on and off.)

① Diagnostic results are OK.
No problem is found in the transmitter. A switch to menu select screen takes place automatically.

② A problem is found in the diagnostic test.
A fault is in the transmitter.
Review the nature of item found to be NG and correct the conditions according to the instructions below.
To exit the transmitter check process, click "ENT".

Corrective actions in case of NG

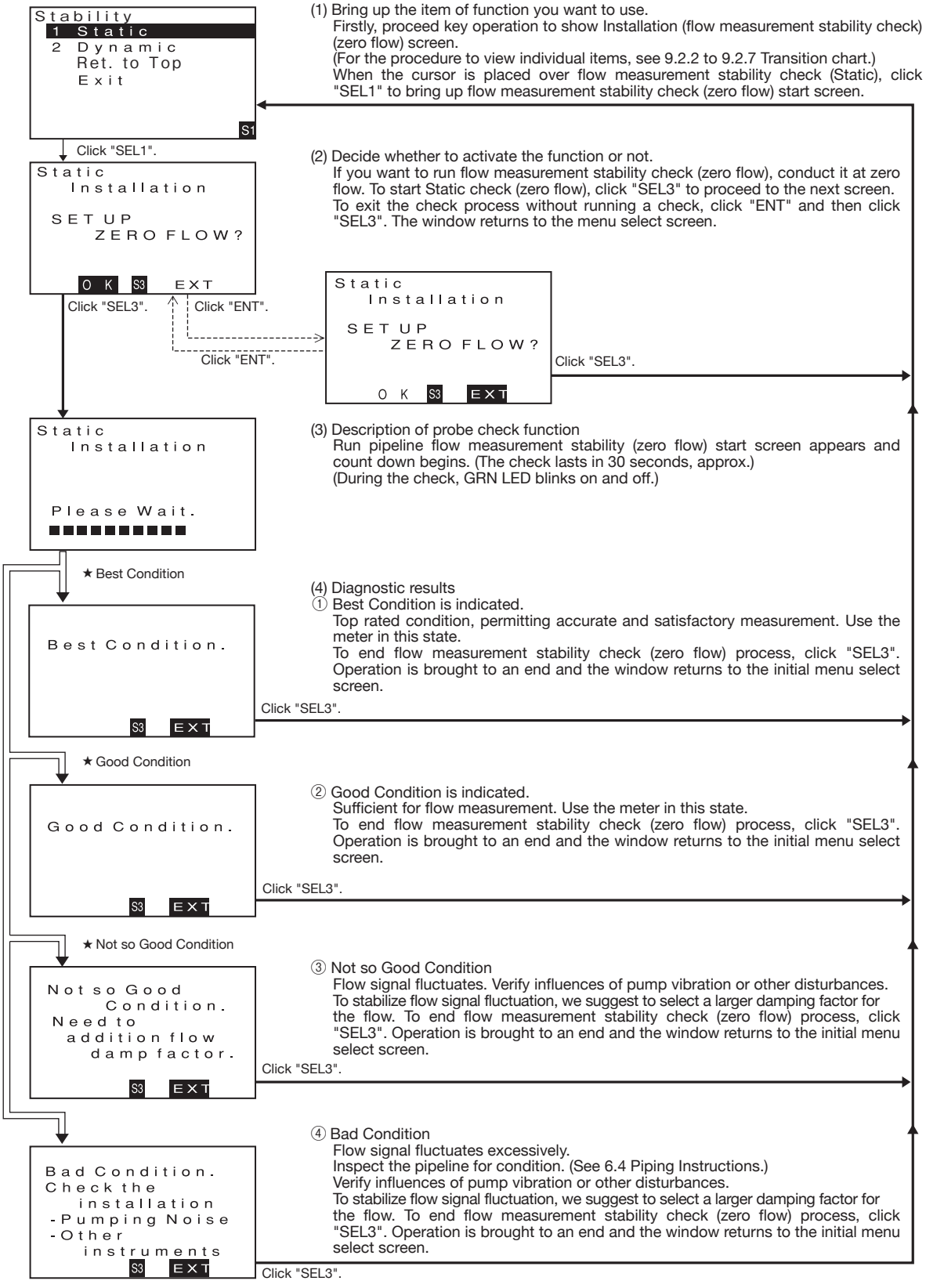
Temp. Connect:	A fault is found in temperature sensor connections. Verify sensor connections. (See 7. Wiring Connections.) If erratic condition persists, contact the factory.
P.O.Connect:	A fault is found in pickoff sensor connections. Verify sensor connections. (See 7. Wiring Connections.) If erratic condition persists, contact the factory.
EEPROM:	Erratic data in EEPROM. A problem in operation is a possibility; contact the factory. A problem in proper operation is a possibility; contact the factory.
Date Update:	Data error exists. A problem in proper operation is a possibility; contact the factory.
Txr Temp:	Internal temp. of transmitter is out of acceptable range; continued operation in this condition will reduce life of parts. Take necessary steps to lower temp. If NG sign persists despite normal ambient temperature, a defect in the transmitter is suspected; contact the factory.
Txr Voltage:	Internal voltage of transmitter is erroneous. Problem in proper operation is a possibility; contact the factory.

③ A warning message upon detection of a fault.
To exit the transmitter check process, click "ENT".

④ A warning message upon detection of a fault.
The message tells the operator that correct measurement is no longer warranted under the current conditions..
To exit the transmitter check process, click "ENT".
Operation is brought to an end and the window returns to the initial menu select screen.

9.6.3 Flow measurement stability (at zero flow)

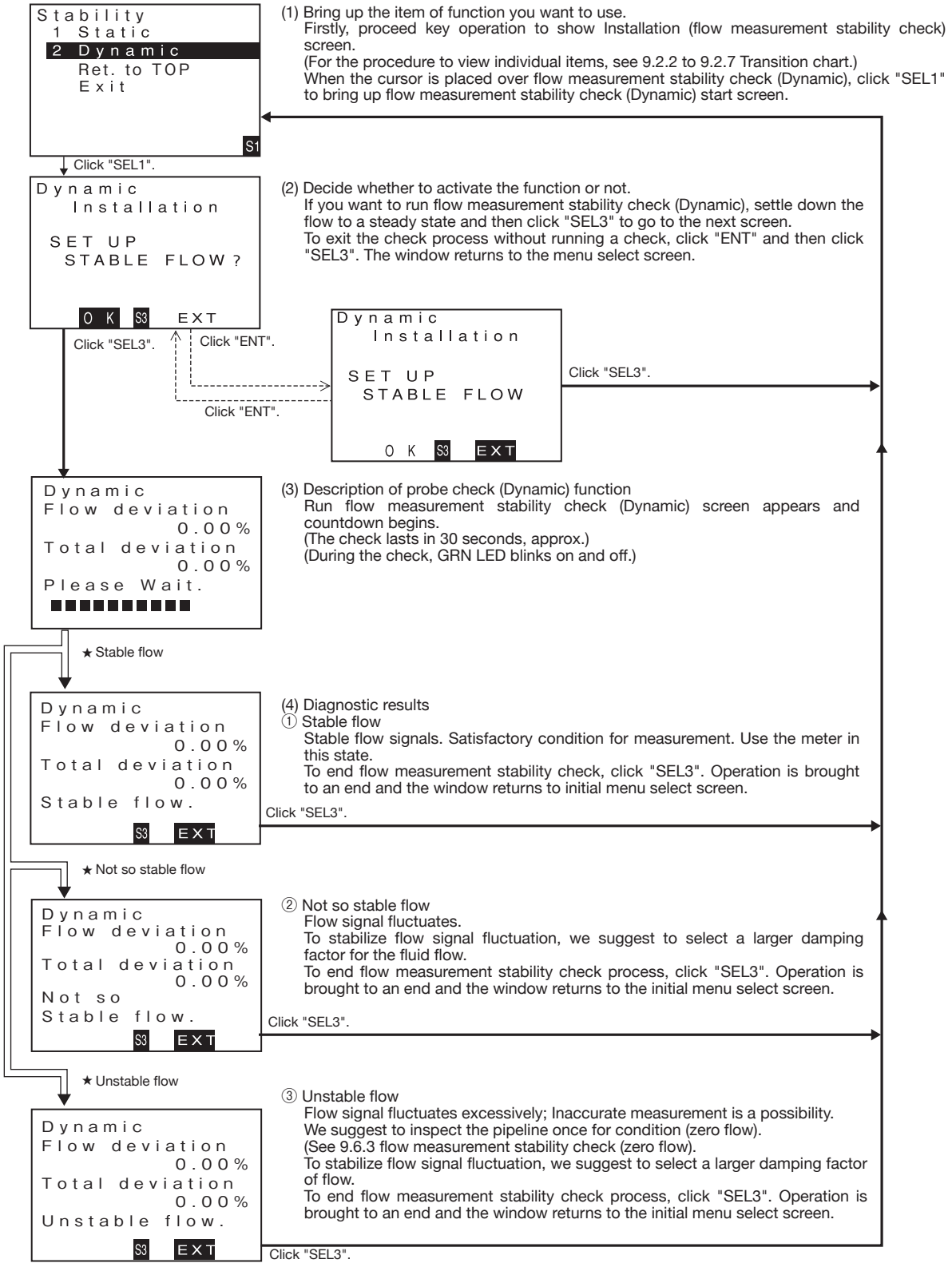
This check diagnoses your flow measurement installation for condition – whether it is free from external disturbances and noises resulting from pipeline vibration or other factors.
To be successful in obtaining accurate results, run the test at zero flow.
Upon completion of the check, diagnostic results will be indicated and you will be prompted to follow the instructions given.



9.6.4 Flow measurement stability check (at normal flow)

This check diagnoses your flow measurement installation for condition while allowing the fluid flow – whether it is free from external disturbances and noises resulting from pipeline vibration or other factors. Upon completion of the check, diagnostic results will be indicated and you will be prompted to follow the instructions given.

During the process of diagnosis, analog output and pulse output operations are suspended.

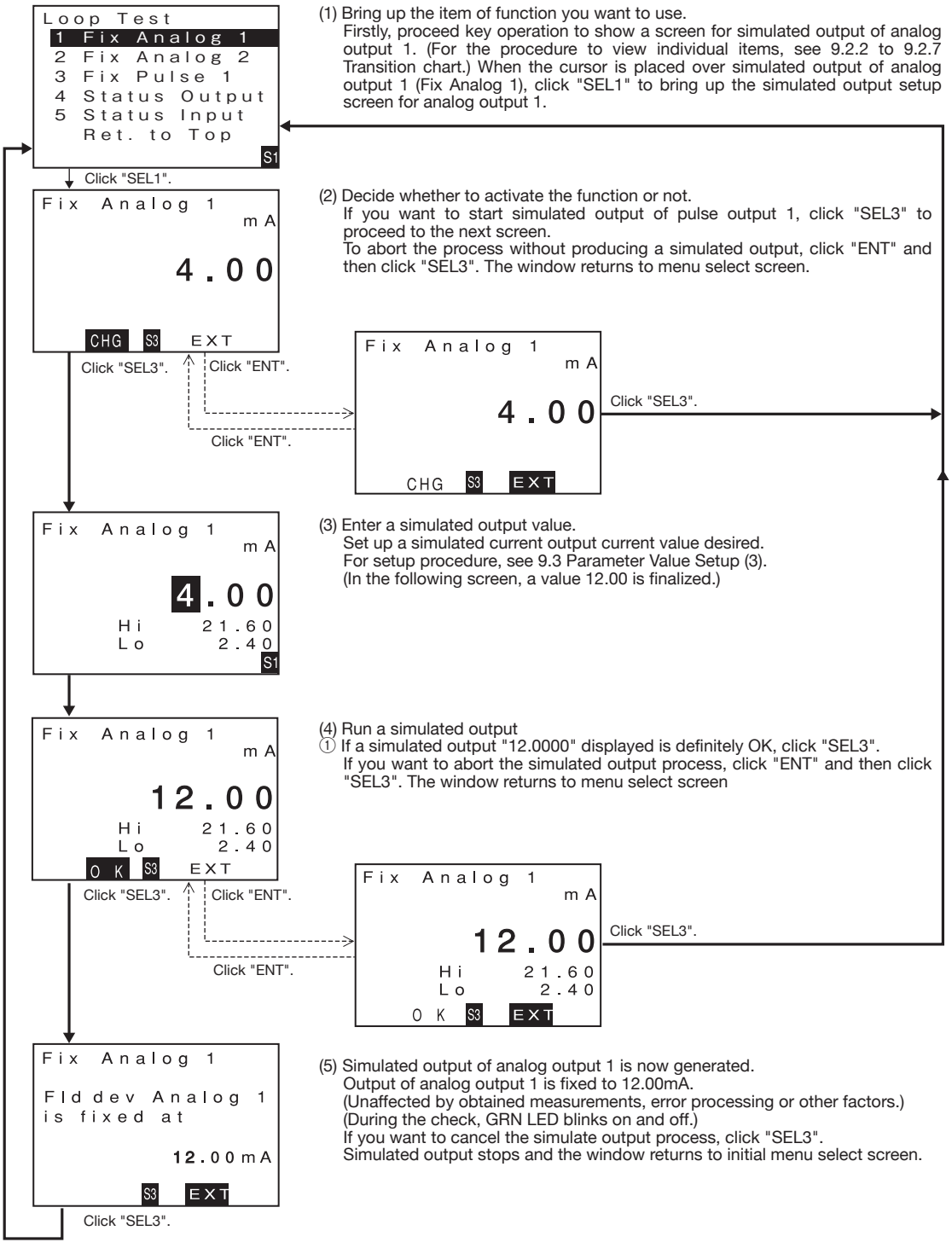


9.7 Simulated Signal Input/Output Capabilities (Loop Test)

This transmitter features simulated output and input monitor functions. They are beneficial for running a loop check after installation and for diagnosing erratic flow signals.

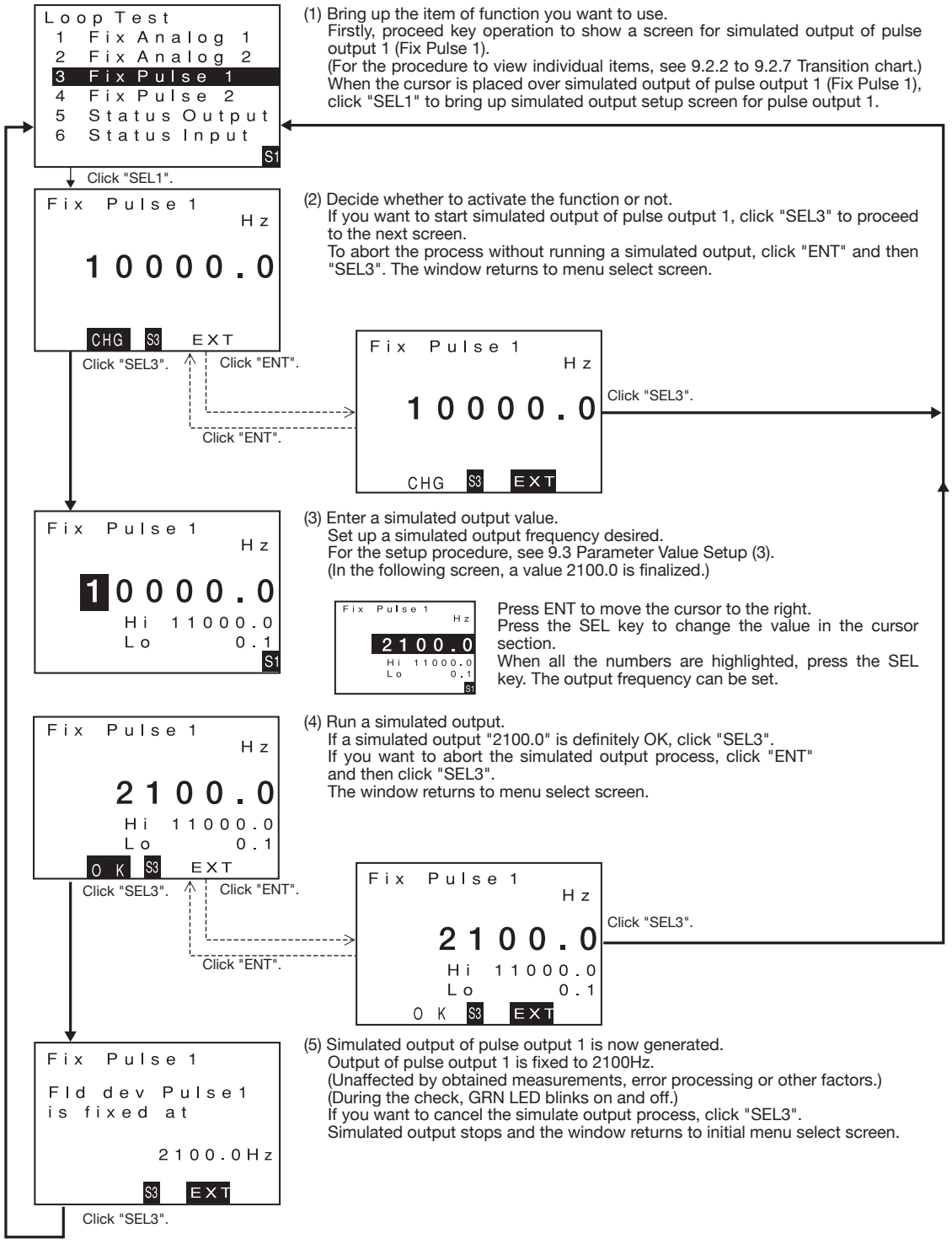
9.7.1 Analog output

An analog output is available at any current magnitude.
(The procedure to provide a 12.00mA simulated output of analog output 1 is described here in the example below.)



9.7.2 Pulse output

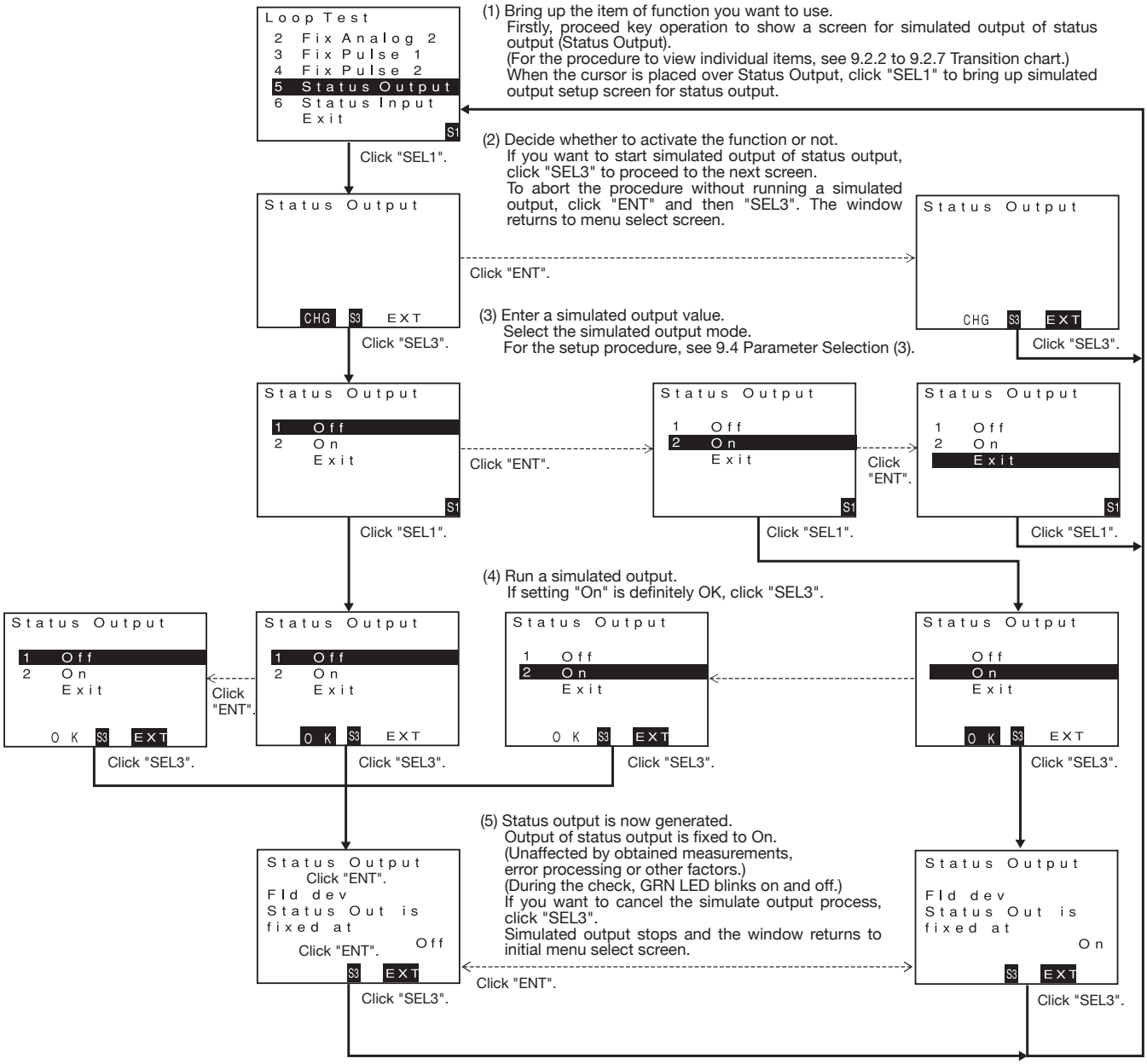
A pulse output is available at any frequency desired.
(Simulated output in pulse output 1 is described here in the example below.)
This section covers the procedure to provide a 2100Hz simulated pulse output. A similar procedure applies to other output settings.



9.7.3 Status output

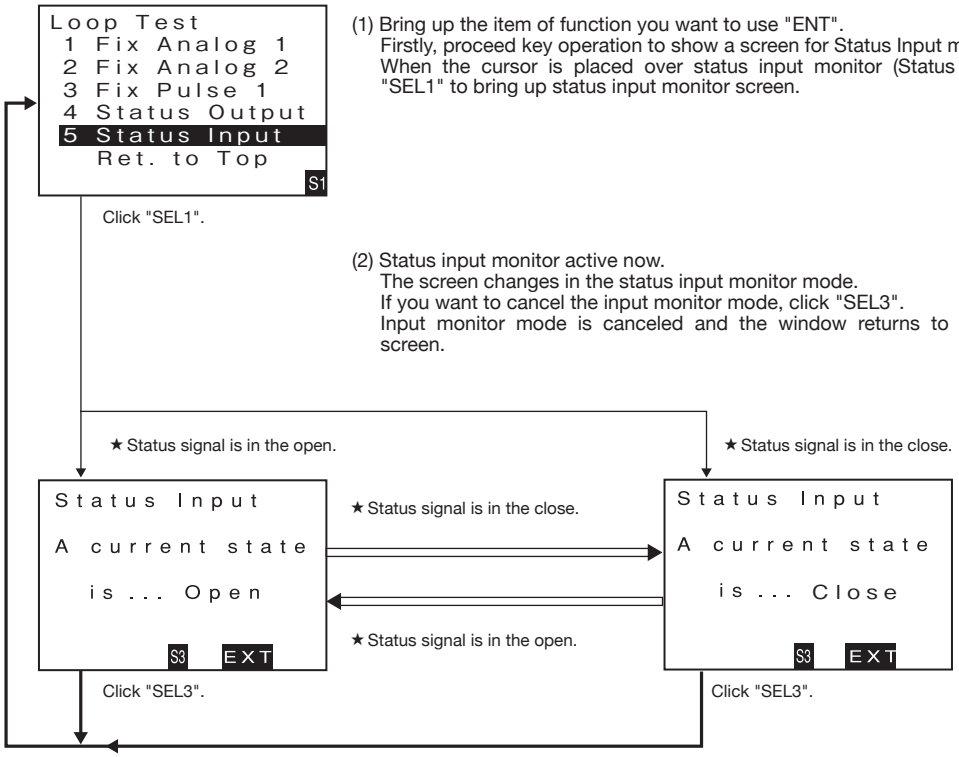
A status output is available at any level desired.

This section covers the procedure to provide a simulated status output in the setting ON. A similar procedure applies to other output settings



9.7.4 Status input

You can monitor the status of status input signal.



➡NOTE: Functions assigned to status input are still effective while monitoring. Set no assignment (No Function) before monitoring if necessary.

9.8 Zeroing Function

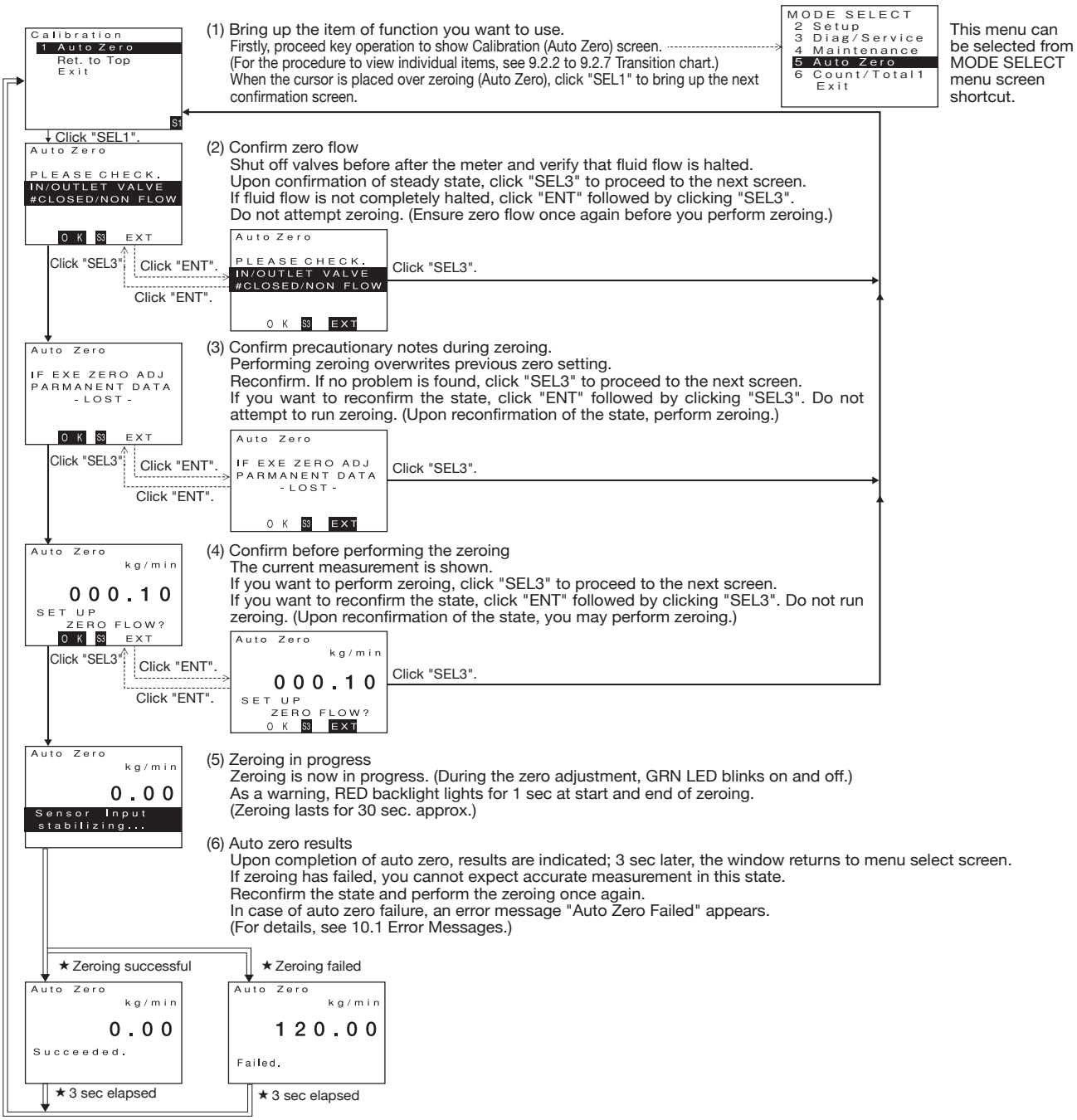
This feature detects errors in zeroing and reduces offset flowrate drift to minimum. At the stage of installation and in cases where flow conditions significantly change, zeroing is an essential part of the routines required for maintaining accurate and consistent measurement.
During the zeroing, fill the sensor unit completely with the fluid the temperature of which is within ±10℃ from the temperature at which it operates.

⚠CAUTION: 1. Before using this function, close both the display lid and the terminal lid of the transmitter and make sure that the transmitter is in the condition as the actual operating condition.
2. Fluid (liquid or gas) must completely fill the sensor unit and be absolutely at zero flow.
3. Accurate zeroing cannot be achieved unless fluid flow is completely halted.
4. Ensure that the shutoff valve has no leaks.

Zero adjustment comes in three options: with LCD switches, with status input, and through communication. Each has identical functions. Choose one that best suits your task.

9.8.1 Through LCD display switches

➡NOTE: This function is disabled in Write Protect mode (refer to section 9.2).



9.8.2 Through status input signal

You can perform the zeroing with status input signal. Follow the procedure given below for preparation and operation:

(1) Preparation to assign status input to zeroing

・Set status input function to "Auto Zero".
(For details of setup, see 9.15 Status Input and 9.2.5 Transition chart (4) [No. 2-5-1].

・Set the logic of status input.
(For details of setup, see 9.15 Status Input and 9.2.5 Transition chart (4) [No. 2-5-2].

(2) Procedure to run the zeroing

By working with status input, you can perform the zeroing. Follow the procedure outline below:

① Preparation

Verify the following precautions:

During the zeroing, fill the sensor unit completely with the fluid the temperature of which is within ±10℃ from the temperature at which it operates.

⚠**CAUTION: 1. Fluid (liquid or gas) must completely fill the sensor unit and be absolutely at zero flow.**

2. Accurate zeroing cannot be achieved unless fluid flow is completely halted.

3. Ensure that the shutoff valves, etc. have no leaks.

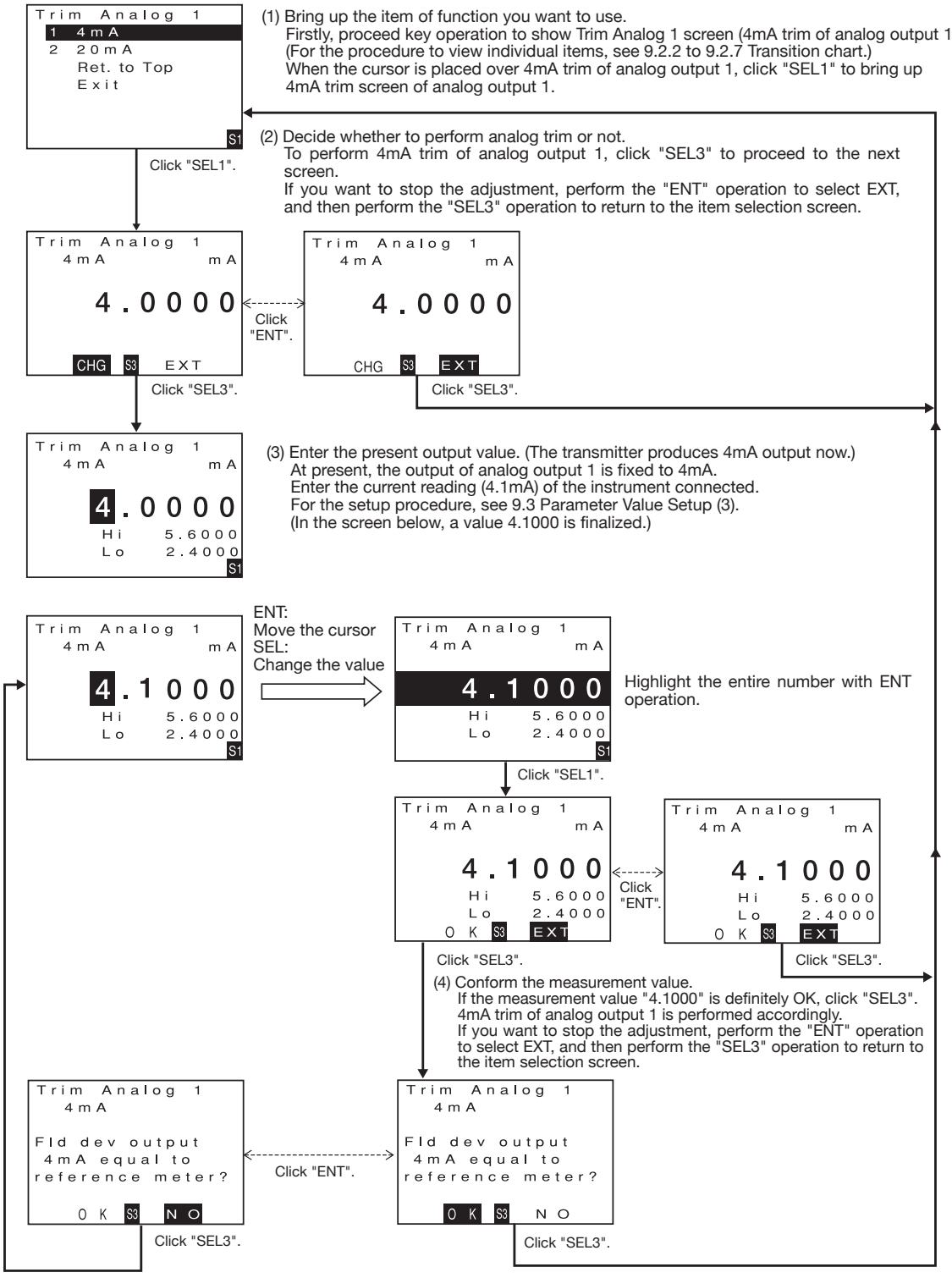
② Run the zeroing: set the status input to 0.3 sec or longer in the "Close" (when input mode is "Normal Open"). Upon detection of an input, the zeroing process starts and this process lasts in about 30 seconds.

In the event zeroing has failed, you cannot expect accurate measurement. Upon completion of zeroing, do not forget to run a check for possible errors.

9.9 Analog Trim Function

NOTE: This function is disabled in Write Protect mode (refer to section 9.2).

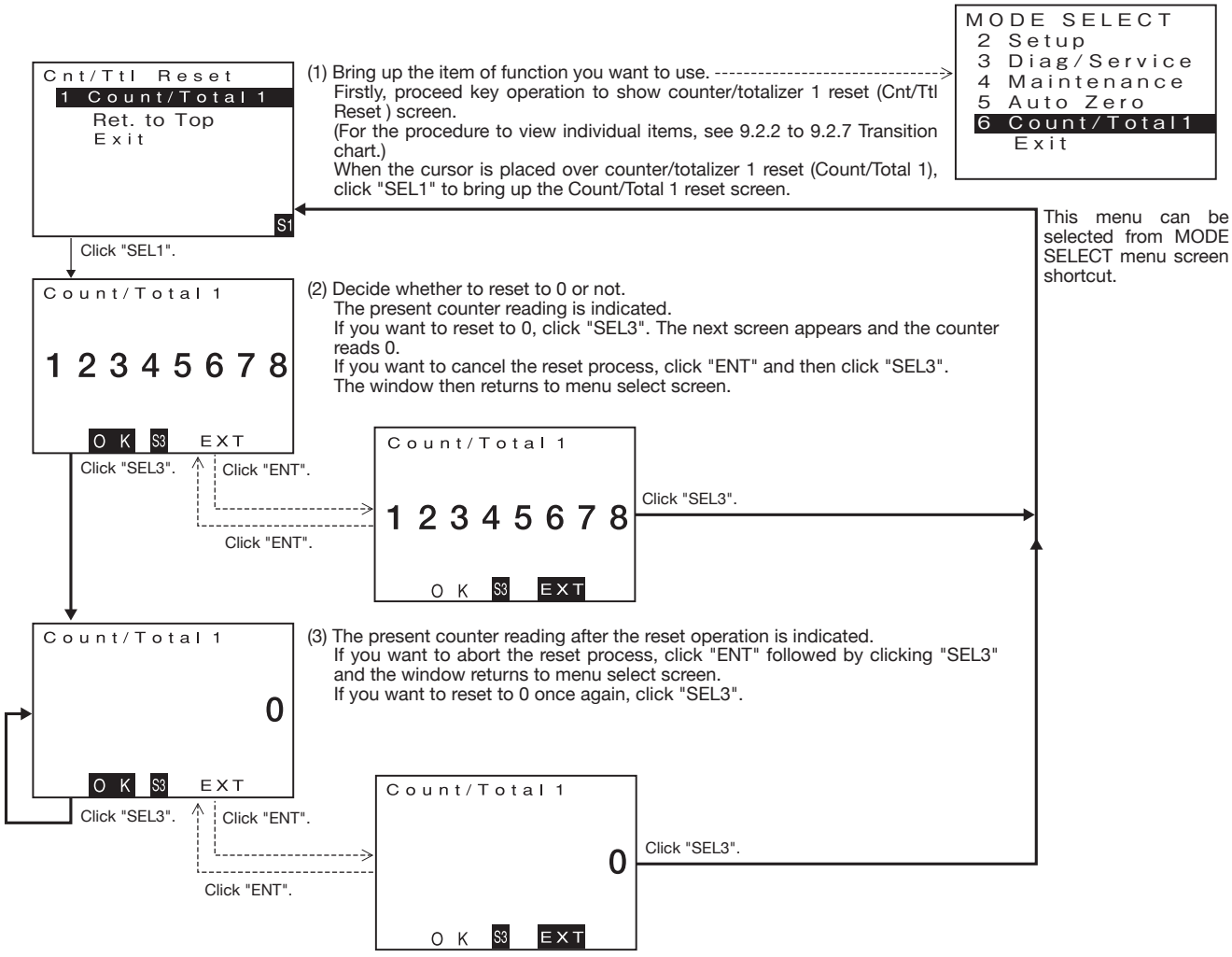
The transmitter is provided with two analog outputs. Both are factory adjusted and requires no further adjustment. However, if it is absolutely necessary to readjust, follow the instructions outlined below.
Prior to making adjustment, connect required measuring instruments in place for making output level measurement of analog output. Covered below is the procedure to make 4mA trim of analog output 1 (trimming 4.1mA to 4mA in the example below). A similar procedure applies to other adjustments.



9.10 Reset Function

➡NOTE: This function is disabled in Write Protect mode (refer to section 9.2).

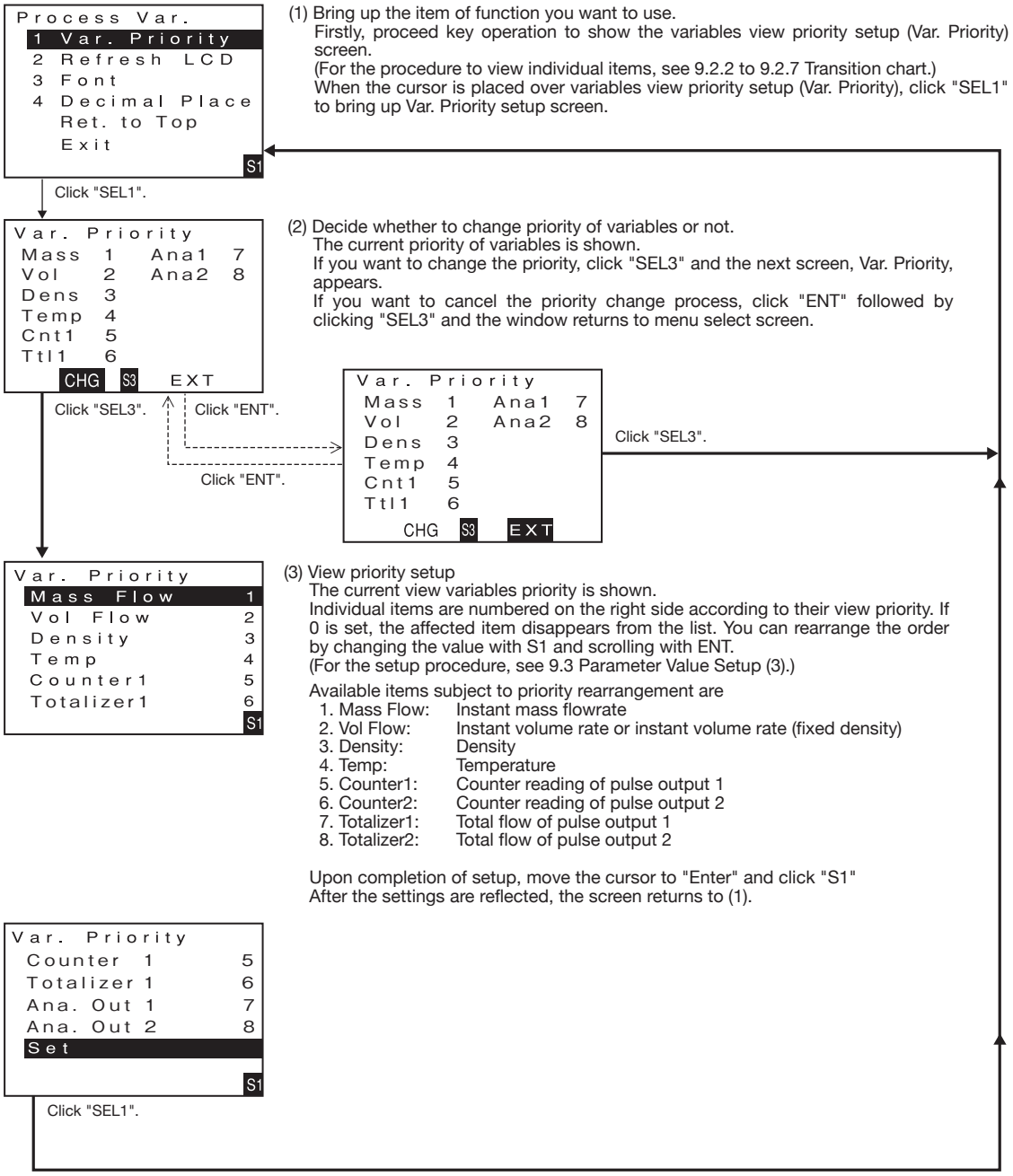
If it is desired to reset the counter (Counter1) and totalizer (Totalizer1) follow the procedure outlined below. (Since the totalizer counts pulses coming in from the counter, you cannot reset them independently.)



9.11 View Variables Screen Setup

➡NOTE: For this function, the setting change is disabled in Write Protect mode (refer to section 9.2).

Display / Hide and priority of variables view can be set up at the view variables screen.
Follow the procedure outlined below:



9.12 Pulse Output Function

➡NOTE: For this function, the setting change is disabled in Write Protect mode (refer to section 9.2).

The transmitter's pulse output capability enables the output of mass flowrate and volume flowrate.
(NOTE: When the pulse output assignment, full scale flowrate, or frequency at full scale is modified, the Counter/Totalizer will be reset.)

9.12.1 Pulse output 1

If you want to use pulse output 1, it is required that the following be set up.

(1) Setup procedure

① Pulse output 1 assignment (Assign) (See 9.2.4 Transition chart (3) [No. 2-4-3-1].)
Kind of flow is selected.
- Mass Flow: Mass flow
- Volume Flow: Volumetric flow

② Frequency of pulse output 1 at full scale flowrate (Freq Factor) (See 9.2.4 Transition chart (3) [No. 2-4-3-2].)
The frequency at the flowrate set in ③ is set up. Set it to match the measurable range of the instrument that measures pulse output. Acceptable setting range is from 0.1 to 10000Hz.

③ Full scale flowrate of pulse output 1 (Rate Factor) (See 9.2.4 Transition chart (3) [No. 2-4-3-3].)
An output is generated at the frequency set in ② when the preset flowrate is reached.

④ Low flow cutoff of pulse output 1 (Lowcut) (See 9.2.4 Transition chart (3) [No. 2-4-3-4].)
When the proportion of flowrate is smaller than the low flow cutoff value - where the flowrate set in ③ is set to 100% - the output is clamped at 0. Acceptable setting range is from 0.0 to 10.0%.

⑤ The state of pulse output in an error (Pulse) (See 9.2.5 Transition chart (4) [No. 2-4-5-2].)
Pulse output value in an error can be selected from the following three options:
- Zero: Pulse output is halted.
- Hold: Pulse output immediately before an error is maintained.
- Upscale: Output of the frequency set under "Pls ups val" parameter. (See 9.2.5 Transition chart (4) [No. 2-4-5-3].) (For detail of output in an error, see 10.1 Error Messages.)

9.13 Analog Output Function

➡NOTE: For this function, the setting change is disabled in Write Protect mode (refer to section 9.2).

The transmitter is provided with two analog outputs which can be assigned to "mass flow", "volume flow", "temperature", "density" and "drive output". The setup procedure is outlined below.
If status output is to be assigned to analog output 2, refer to section 9.14 Status Output.

(1) Setup procedure

By reconfiguring the following five parameters, outputs that suit your particular application are made available.

① Output assignment (Assign) (See 9.2.4 Transition chart (3) [No. 2-4-1-1] and [No. 2-4-2-1].)
Types of measurement are selected.
- ・Mass Flow: Instant mass flowrate
- ・Vol Flow: Instant volume flowrate
- ・Density: Density
- ・Temp: Temperature
- ・Drive Output: Drive output

When assignments are modified, reconfigure upper limit, lower limit, low flow cutoff, and damping factor to values that best suit your application.

② Upper limit value (URV) (See 9.2.4 Transition chart (3) [No. 2-4-1-2] and [No. 2-4-2-2].)
The upper limit of analog output can be changed; a 20mA output is produced when the preset value is reached. Values outside the maximum range (※1) and smaller than the lower limit value are unacceptable, however.

③ Lower limit value (LRV) (See 9.2.4 Transition chart (3) [No. 2-4-1-3] and [No. 2-4-2-3].)
The lower limit of analog output can be changed; a 4mA output is produced when the preset value is reached. Values outside the maximum range (※1) and larger than the upper limit value are unacceptable, however.

④ Low flow cutoff (Lowcut) (See 9.2.4 Transition chart (3) [No. 2-4-1-4] and [No. 2-4-2-4].)
The low flow cutoff of analog output (%) can be changed. When the low flow cutoff value is larger than the proportion of analog output – where the upper limit is set to 100% and the lower limit is 0% – the analog output becomes 4mA. Acceptable setting range is from 0% to 10%.

⑤ Damping factor (Added Damp) (See 9.2.4 Transition chart (3) [No. 2-4-1-5] and [No. 2-4-2-5].)
Damping constant of analog output (sec) can be changed. Select a larger value when analog output fluctuates excessively; select a smaller value when fast response is desired.
Acceptable setting range is from 0 to 200 (sec).

⑥ The state of analog output in an error (Analog) (See 9.2.5 Transition chart (5) [No. 2-4-6-1].)
- ・Downscale: 2.4mA is output.
- ・Zero: 4mA is output.
- ・Hold: Analog output immediately before an error is maintained.
- ・Upscale: 21.6mA is output.

(For details of outputs in an error, see 10.1 Error Messages.)

※1 Maximum range

Instant mass flowrate:	– Max allowable range to max allowable range
Instant volume flowrate:	– Max allowable range/0.3 to max allowable range/0.3
Temperature:	Max temperature range of sensor
Density:	0.0 to 5.0

⚠CAUTION: When measurement-related unit set up at Assign is modified, the upper and lower limit values will be converted automatically to the measures to read in the unit selected.

9.14 Status Output Function

➡NOTE: For this function, the setting change is disabled in Write Protect mode (refer to section 9.2).

Status output function can be assigned to the analog output 2 port.
Choose one from: status information, flow direction, H/L alarm, or drive output alarm.
Remote status monitoring is available with the current value [High (20mA), Low (4mA)] from analog output 2.

9.14.1 Setting status output function

① Assigning status output to analog output 2 (Override)
Assign status output to analog output 2. (See 9.2.5 Transition chart (4) [2-4-4-1].)
Off: No status output assigned to analog output 2
On: Status output assignment to analog output 2 enabled
Once set to "On" status output is given priority over analog output 2 setting. Output originally set for analog output 2 is disabled and status output function is enabled instead.

② Selecting status output function assignment (Function)
Select the function for status output to be assigned from the list below.
(See 9.2.5 Transition chart (4) [2-4-4-2].)
No Function · · · · None
Error Status · · · · Output status selected under [Err St Select], such as error status.
Bi Direction · · · · Output the direction of flow (See 9.18 Bi-directional Flow Output)
H/L Alarm · · · · Output H/L alarm
Drive O Alm. · · · · Output drive output alarm (for maintenance)
For details, see the section corresponding to each function.

③ Status output logic setting (Output Logic)
Select logic (Positive/Negative) for status output. (Default: Negative)
(See 9.2.5 Transition chart (4) [2-4-4-5].)

Example: When setting H/L alarm
Positive (positive logic)

Status of H/L Alarm	Status	Analog Output 2
Normal Status	Normal	4mA (Low)
Alarm ON	ON	20mA (High)

Negative (negative logic) [Default]

Status of H/L Alarm	Status	Analog Output 2
Normal Status	Normal	20mA (High)
Alarm ON	ON	4mA (Low)

9.14.2 Error status output selection (Err St Select)

By assigning error status output to the status output, state of the flowmeter of interest can be output. Listed below are the available flowmeter-related items, and multiple items can be set. A change in at least one status alternates the status output.

- Sensor error (Sensor Fail)
- Transmitter error (Txr Fail)
- Calibration error (Cal Fail)
- Output error (Satura. Alm.)
- Parameter alarm (Param Alm.)
- Transmitter alarm (Txr Alm.)
- Slug flow alarm (Slug Alm.)
- Calibration in progress (Cal in Prog.)
- Simulated output in progress (Fix Output)

(For details, see 10.1 Error Messages and 10.2 Status Messages.)

(1) Operating procedure

- Select "Error Status" under status output function assignment (Function).
  (See 9.2.5 Transition chart (4) [No. 2-4-4-2].)
- The flowmeter-related states listed above are available for output; select On/Off for each item.
  (See 9.2.5 Transition chart (4) [No. 2-4-4-3-1] to [No. 2-4-4-3-9].)
- Set the logic of status output under [Output Logic] setting. (Default: Negative)
  (See 9.2.5 Transition chart (4) [No. 2-4-4-5].)

By setting the above, the function becomes available.

9.14.3 H/L alarm output (H/L Alarm)

By assigning the high/low alarm output to the status output, an error output of high/low alarm of interest can be provided. Listed below are available variables that can be set up.

- Mass Flow: Instant mass flowrate
- Vol Flow: Instant volume flowrate
- Dens: Density
- Temp: Temperature
- Counter 1: Counter 1

(For details of high/low alarms, see 9.16 High/Low Alarm Functions.)

(1) Operating procedure

- Select "H/L Alarm" in selecting the status output function assignment (Function); the state of high/low alarm can then be output. (See 9.2.5 Transition chart (4) [No. 2-4-4-2].)
- Set the status output logic at [Output Logic] setting. (Standard: Negative)
  (See 9.2.5 Transition chart (4) [No. 2-4-4-5)

9.14.4 Drive Output Alarm (Used for maintenance purpose)

By assigning the drive output alarm to status output, the alarm can be activated when the drive output exceeds the threshold.

(1) Operating procedure

- Select "Drive O Alm." for the status output function assignment (Function); the state of drive output can then be output.
  (See 9.2.5 Transition chart (4) [No. 2-4-4-2])
- Enter the threshold to determine at what percentage of the drive output the alarm output should be activated. The initial value is 100%.
  (See 9.2.5 Transition chart (4) [No. 2-4-4-4])
- Set the status output logic at [Output Logic] setting. (Standard: Negative)
  (See 9.2.5 Transition chart (4) [No. 2-4-4-5)

9.14.5 No assignment (No Function)

When this setting takes effect, there is no assignment for status output.

(1) Operating procedure

- Select "No Function" in selecting the status output function assignment (Function).
  (See 9.2.5 Transition chart (4) [No. 2-4-4-2].)

9.15 Status Input Function

➡NOTE: For this function, the setting change is disabled in Write Protect mode (refer to section 9.2).

One from "0% Sig Lock", "Auto Zero", "Reset Total 1", and "No Function" can be assigned to the status input.
For details of individual functions, refer to the respective items below.

9.15.1 Pulse/analog output fixed to 0% (0% Sig Lock)

When an input arrives across status input terminals, pulse output and analog output are fixed to 0Hz and 4mA, respectively.
Stopping an input across status input terminals cancels fixing of the output.

(1) Operating procedure

- Select "0% Sig Lock" in selecting the status input function assignment.
  (See 9.2.5 Transition chart (4) [No. 2-5-1].)
- Set the input mode of status input. According to the settings, the following input mode will be enabled:
  "Normal Open" setting: the function is activated 0.3 seconds after the condition of the circuit between status input terminals is changed from open to closed.
  "Normal Close" setting: the function is activated 0.3 seconds after the condition of the circuit between status input terminals is changed from closed to open.
  (See 9.2.5 Transition chart (4) [No.2-5-2])

  The function becomes available by setting the above.

9.15.2 Zero adjustment (Auto Zero)

When an input arrives across status input terminals, automatic zero is initiated to reduce offset flowrate drift to minimum.
(For detail of the function, see "9.8 Zeroing Function".)

(1) Operating procedure

- Select "Auto Zero" in selecting the status input function assignment.
  (See 9.2.5 Transition chart (4) [No. 2-5-1].)
- Set the input mode of status input. According to the settings, the following input mode will be enabled:
  "Normal Open" setting: the function is activated 0.3 seconds after the condition of the circuit between status input terminals is changed from open to closed.
  "Normal Close" setting: the function is activated 0.3 seconds after the condition of the circuit between status input terminals is changed from closed to open.
  (See 9.2.5 Transition chart (4) [No.2-5-2])

  The function becomes available by setting the above.

9.15.3 Totalizer 1 reset (Reset Total 1)

The transmitter is provided with counter (Counter 1) and totalizer (Totalizer 1) which work in synchronism with pulse output. When an input arrives across status input terminals, counter 1 and totalizer 1 are reset to 0. (For detail of the function, see 9.10 Reset Functions.)

(1) Operating procedure

- Select "Reset C/T 1" in selecting the status input function assignment.
  (See 9.2.5 Transition chart (4) [No. 2-5-1].)
- Set the input mode of status input. According to the settings, the following input mode will be enabled:
  "Normal Open" setting: the function is activated 0.3 seconds after the condition of the circuit between status input terminals is changed from open to closed.
  "Normal Close" setting: the function is activated 0.3 seconds after the condition of the circuit between status input terminals is changed from closed to open.
  (See 9.2.5 Transition chart (4) [No.2-5-2])

  The function becomes available by setting the above.

9.16 High/Low Alarm Function

➡NOTE: For this function, the setting change is disabled in Write Protect mode (refer to section 9.2).

The transmitter provides the operator with quick grasp of conditions of the installation – flowrate, temperature, density and total flow – when high/low alarms are set up. In the event the preset alarm conditions are met, it tells the operator the event with an alarm message along with a status output signal.

Setup procedure and behavior of alarm functions are described below:

(1) Setup procedure

Ensure positive settings on individual items.

① Assigning status output to analog output 2 (Override)
Select "On" for status output assignment to analog output 2. (See 9.2.5 Transition chart (4) [2-4-4-1].)

② Status output function assignment (Function) (See 9.2.5 Transition chart (4) [No. 2-4-4-2].)
To use high/low alarm function, it is essential to assign high/low alarms to status output.
Set "H/L Alarm" to status output function assignment.
("H/L Alarm" setting is required even in cases of high alarm only or low alarm only.)

③ Logic setting of status output (Output Logic) (See 9.2.5 Transition chart (4) [No. 2-4-4-5].)
Set up the logic of status output.

・Logic setting of status output: Negative or Positive
(For detail of the status output function, see 9.14 Status Output Function.)

④ Assignment of H/L alarm values (Assign) (See 9.2.5 Transition chart (4) [No. 2-6-1].)
From the following options, select the variables against which the transmitter identifies alarmed conditions.

・Mass Flow: Instant mass flowrate
・Vol Flow: Instant volume flowrate
・Dens: Density
・Temp: Temperature
・Counter 1: Counter 1

⑤ Alarm type selection (H/L Alm. Type) (See 9.2.5 Transition chart (4) [No. 2-6-2].)
Select alarm type from the following options.

・To validate only high alarm, select "High Alarm".
・To validate only low alarm, select "Low Alarm".
・To validate both high and low alarms, select t "H/L Alarm".

⑥ High alarm value setting (High Alm. Po.) (See 9.2.5 Transition chart (4) [No. 2-6-3].)
If the input exceeds this setting, the high alarm is activated. Set the high alarm value desired.
In the case "Low Alarm" is set in ④, setting is not required.

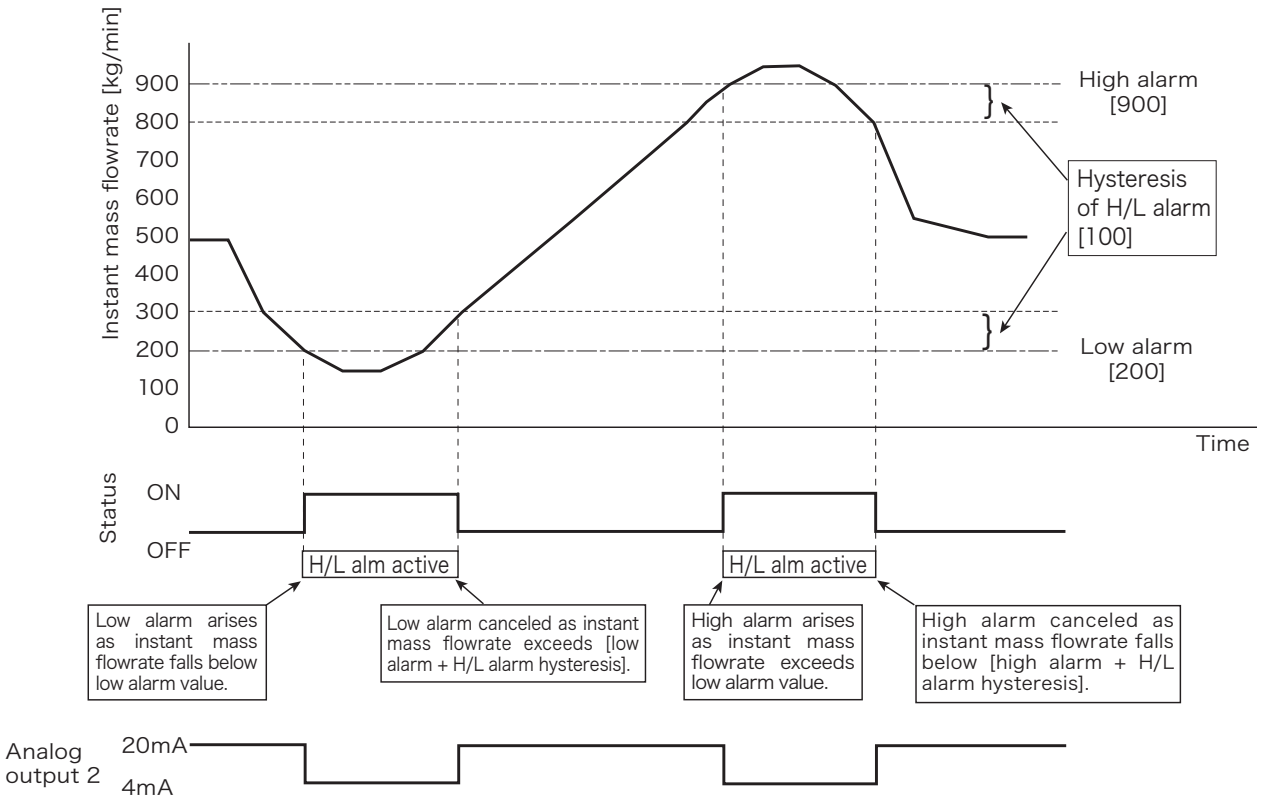
⑦ Low alarm value setting (Low Alm. Po.) (See 9.2.5 Transition chart (4) [No. 2-6-4].)

・Low Alm. Po.: Low alarm value
In the case "High Alarm" is set in ④, setting is not required.

⑧ Hysteresis value setting for high/low alarms (H/L Alm. hys)
(See 9.2.5 Transition chart (4) [No. 2-6-5].)
The setting determines a dead (or immunity) zone following the occurrence of an alarm.
Select a larger value when measurement fluctuates excessively; select a smaller value if fast recovery from alarmed condition is desired.

(2) An example of settings and assignments

Status output assignment for analog output 2 (Override):	On
Status output function assignment (Function):	H/L Alarm
Logic setting of status output (Output Logic):	Negative
H/L alarm value assignment (Assign):	Mass Flow
Alarm type selection (H/L Alm. Type):	H/L Alarm
High alarm value setting (High Alm. Po.):	900 [kg/min]
Low alarm value setting (Low Alm. Po.):	200 [kg/min]
High/low alarm hysteresis value setting (H/L Alm. hys):	100 [kg/min]



9.17 Gas Mixed Flow Alarm Function (Slug Alm.)

➡NOTE: For this function, the setting change is disabled in Write Protect mode (refer to section 9.2).

If gases exist in large quantities in the process fluid, it is impossible to make accurate flow measurement. This feature, if correctly set up, detects gases entrapped in the fluid, indicates a slug flow alarm, fixes the instantaneous flow rate at 0, and provides a status output telling the operator the alarm event. (If you do not want to use this function, set the higher limit density value of slug flow to 10 g/ml and the lower limit density value of slug flow to 0 g/ml. This function then remains disabled.) The setup procedure of slug flow function is outlined below.

(1) Setup procedure

Ensure positive settings of individual items.

① Lower limit density of slug flow (Slug Low) (See 9.2.3 Transition chart (2) [No. 2-2-3].)
Upon detection of density smaller than this setting, the circuitry interprets it as slug flow and starts analysis.
Set a value small enough with respect to the density expected for the fluid of interest.

② Higher limit density of slug flow (Slug High) (See 9.2.3 Transition chart (2) [No. 2-2-4].)
Upon detection of density larger than this setting, the circuitry interprets it as an error and starts analysis.
Set a value large enough with respect to the density expected for the fluid of interest.

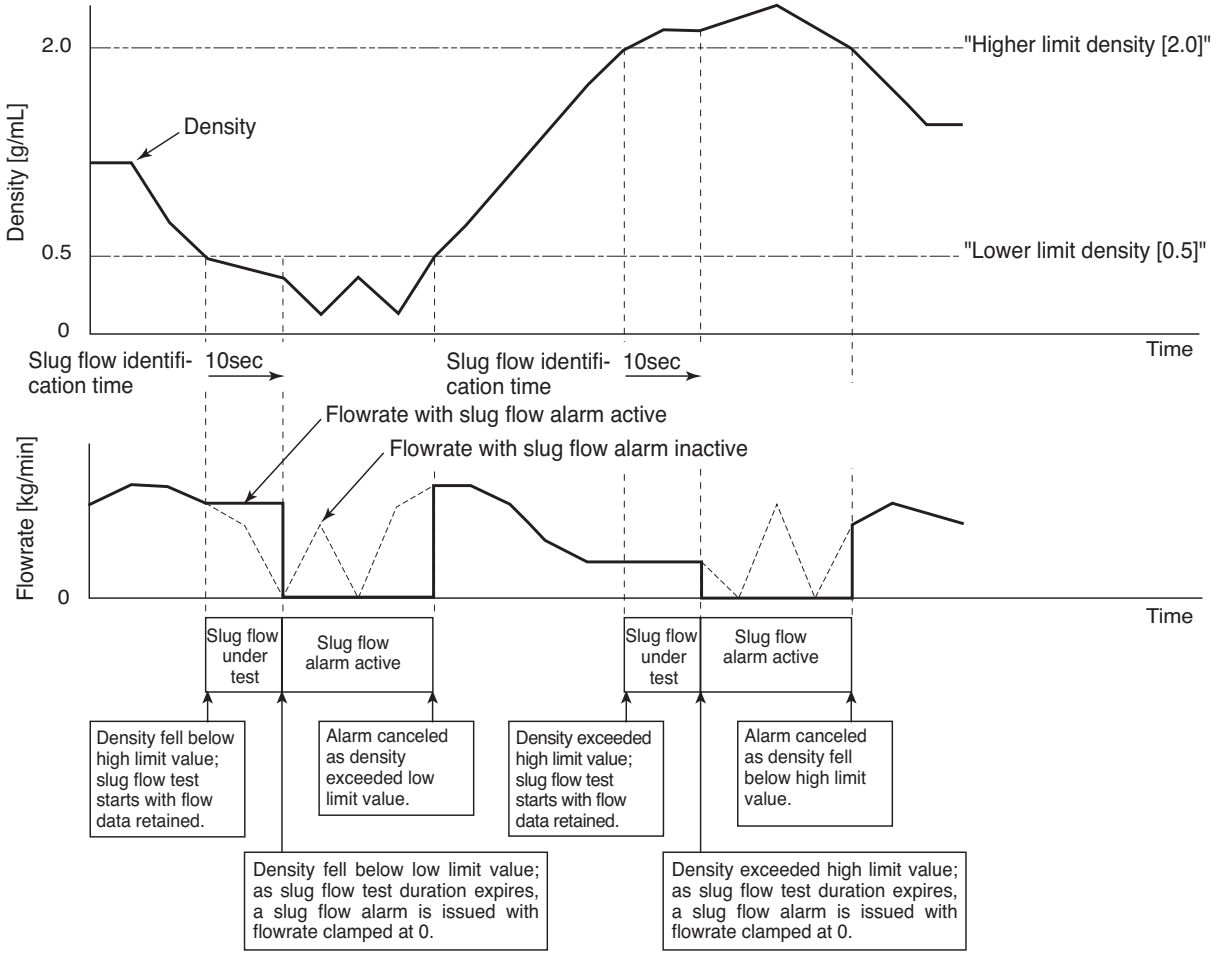
③ Slug flow identification time (Slug Duration) (See 9.2.3 Transition chart (2) [No. 2-2-5].)
It is the time required for the circuitry to identify the slug flow being outside the slug flow high/low limit and to issue a slug flow alarm (sec). Until this slug flow identification time expires, it retains the most recent and properly measured value. After the expiration of this preset time, the flowrate becomes 0.

④ If you want to assign this slug flow alarm in the status output function to the status output, setting the following is required: (For detail of this output function, see 9.14 Status Output Function.)
Assign status output to analog output 2 (Override): On (See 9.2.5 Transition chart (4) [No. 2-4-4-1].)
- Status output function assignment: Error Status (See 9.2.5 Transition chart (2) [No. 2-4-4-2].)
- Slug flow error select: On (See 9.2.5 Transition chart (4) [No. 2-4-4-3-7].)
- Logic setting of status output: Negative or Positive (See 9.2.5 Transition chart (4) [No. 2-4-4-5].)

⑤ Configure pulse output status (zero/upscale) setting for the occurrence of slug flow alarm under "Slug ups" parameter. (See 9.2.5 Transition chart (4) [No. 2-4-5-4].)

(2) An example of settings and behavior

- Lower limit density value of slug flow: 0.5 [g/mL]
- Upper limit density value of slug flow: 2.0 [g/mL]
- Slug flow identification time: 10 [sec]



Pulse and analog output status while slug flow alarm is on depends on "Slug ups" parameter setting. (See 9.2.5 Transition chart (4) [No. 2-4-5-4].)

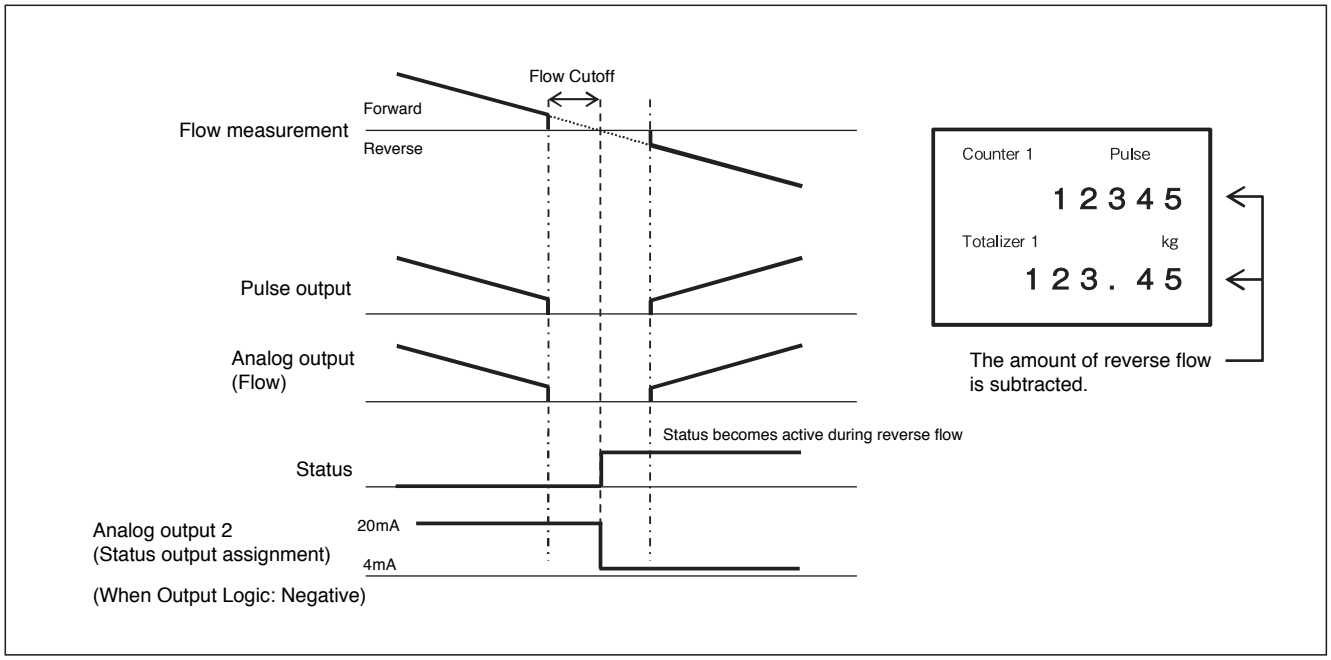
9.18 Bi-directional Flow Output (Bi.Direction)

Flow direction can be assigned to status output function. Forward/reverse flow rate can be measured by combining status output of forward/reverse flow direction assigned to analog output 2 and pulse/analog (absolute value) output of flow rate.

(1) Behavior

Item	Behavior
Flow pulse output	Pulse output of forward/reverse flow (absolute value)
Flow analog output	Analog output of forward/reverse flow (absolute value)
Status output	Output of flow direction (Status becomes active during reverse flow)
Instantaneous flowrate display	Displays instantaneous flowrate of forward/reverse flow
Total flow display	Displays total with forward flow added and reverse flow subtracted
Pulse output count display	Displays total with forward flow added and reverse flow subtracted

Example



(2) Setup procedure

① Select [Bi.Direction] under status output function assignment (Function).
(See 9.2.5 Transition chart (4) [No. 2-4-4-2])
Bi-directional flow output function is enabled by setting [Bi.Direction].
During reverse flow, the status becomes [Status active].

② Configure other settings related to status output. (See 9.14 Status Output Function)

③ Configure pulse output and analog output settings as necessary.
Since analog flow output is absolute value, the lower limit value (LRV) of analog output does not require to be set at a negative value. (In the example above, LRV = 0)

9.19 Parameter Copy Function

➡NOTE: This function is disabled in Write Protect mode (refer to section 9.2).

The ALTImass Ⅱ is capable of copying transmitter parameters by replacing display unit, without using communication.

When copying parameters of Transmitter B to Transmitter A, place the display unit of Transmitter B onto Transmitter A and operate copying procedure.

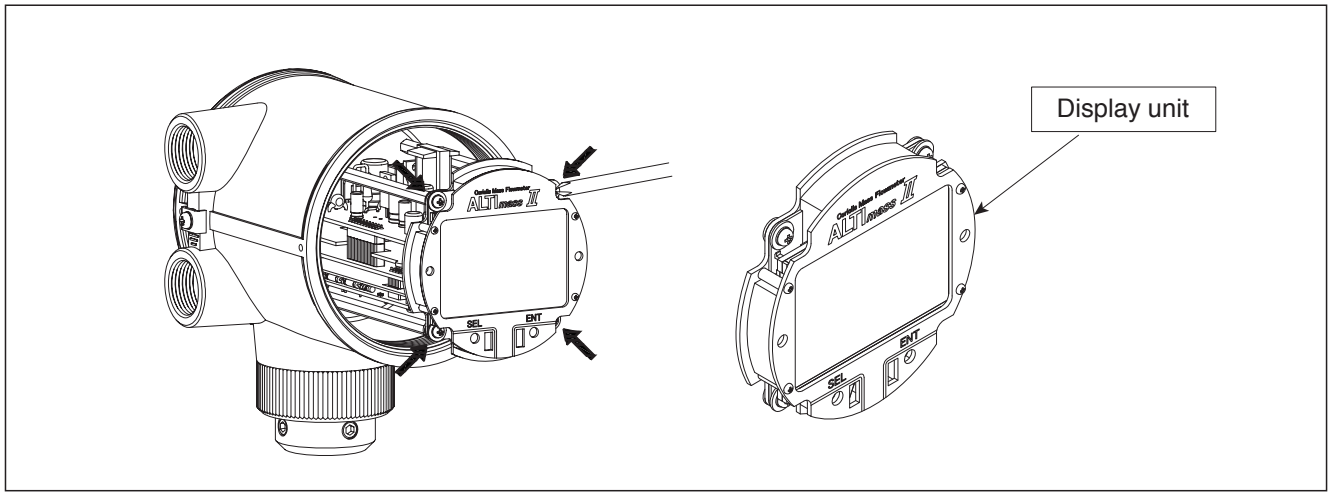
Among the parameters saved in transmitter (setting parameters, analog output adjust data, total value data), only setting parameters will be copied. Total value and analog output adjust data do not need to be reconfigured.

Procedure

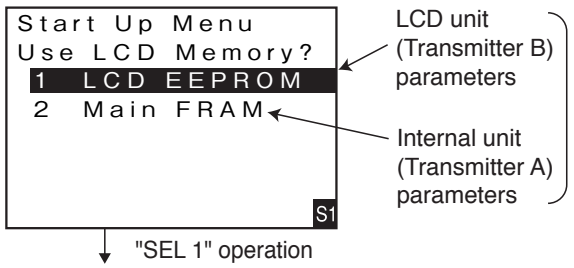
When copying parameters of Transmitter B to Transmitter A

① Place the display unit of Transmitter B onto Transmitter A.

⚠**Make sure turn off power before operating this procedure**

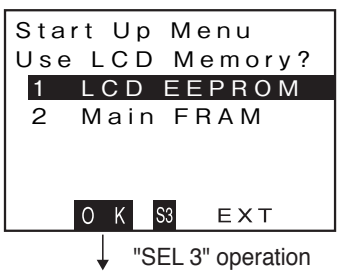


② The screen below will appear once Transmitter A is powered. Select [1 LCD EEPROM].



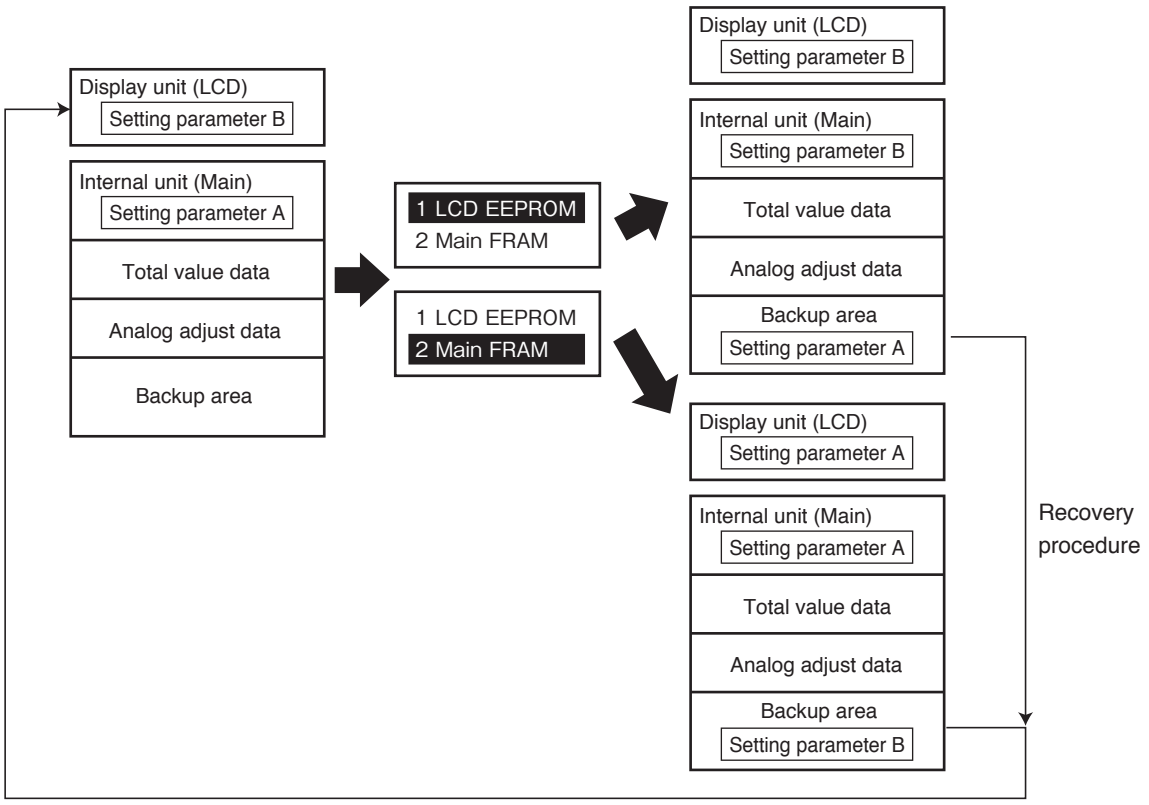
The left screen offers selections about which set of parameters to be used for start-up.
※ This screen appears only when parameters of LCD unit do not match the parameters of internal unit.

③ Execute "OK" at the confirmation screen below.



④ The transmitter will automatically restart once parameter copy is complete, then begin normal operation.

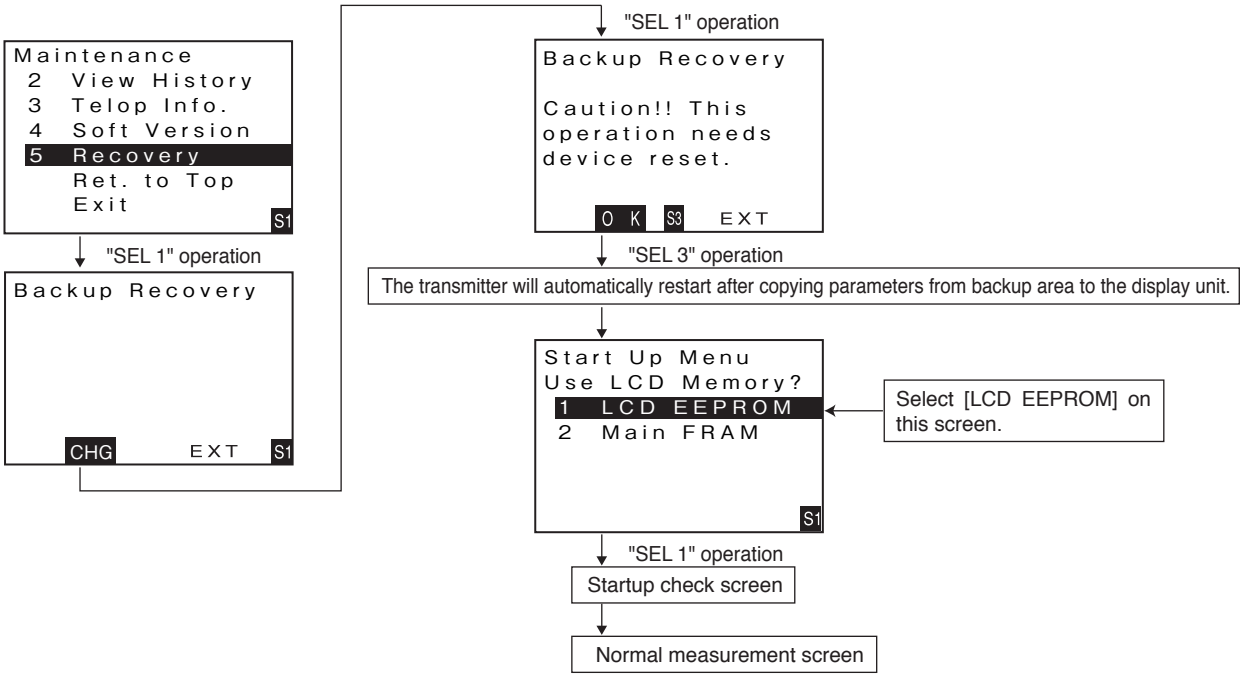
Parameter copy function flow chart



※ If the wrong set of parameters is selected, re-selection of parameters is possible by copying parameters from backup area to the display unit by "Recovery" procedure.

Recovery procedure

If the wrong set of parameters is selected while copying parameters, parameters can be recovered by "Recovery" procedure. (See 9.2.7 Transition chart (6) [No. 4-5].)



9.20 Setup Units List

Measurement type	No.	Acceptable setup units	LCD display
Instantaneous mass flowrate	M-1	g/sec	g/s
	M-2	g/min	g/min
	M-3	g/hr	g/h
	M-4	kg/sec	kg/s
	M-5	kg/min	kg/min
	M-6	kg/hr	kg/h
	M-7	kg/day	kg/d
	M-8	MetTon/min	Mt/min
	M-9	MetTon/hr	Mt/h
	M-10	MetTon/day	Mt/d
	M-11	lb/sec	lb/s
	M-12	lb/min	lb/min
	M-13	lb/hr	lb/h
	M-14	lb/day	lb/d
	M-15	ShTon/min	St/min
	M-16	ShTon/hr	St/h
	M-17	ShTon/day	St/d
Instantaneous volume flowrate	V-1	ml/sec	mL/s
	V-2	ml/min	mL/min
	V-3	ml/hr	mL/h
	V-4	liter/sec	L/s
	V-5	liter/min	L/min
	V-6	liter/hr	L/h
	V-7	liter/day	L/d
	V-8	CuMtr/sec	Cm/s
	V-9	CuMtr/min	Cm/min
	V-10	CuMtr/hr	Cm/h
	V-11	CuMtr/day	Cm/d
	V-12	gal/sec	ga/s
	V-13	gal/min	ga/min
	V-14	ImpGal/min	Ig/min
	V-15	ImpGal/hr	Ig/h
	V-16	ImpGal/day	Ig/d
	V-17	CuFt/sec	Cf/s
	V-18	CuFt/min	Cf/min
	V-19	CuFt/hr	Cf/h
	V-20	bbl/sec	bl/s
	V-21	bbl/min	bl/min
	V-22	bbl/hr	bl/h
	V-23	bbl/day	bl/d
Density	D-1	g/ml	g/mL
	D-2	g/cc	g/cc
	D-3	kg/l	kg/L
	D-4	kg/CuMtr	kg/Cum
	D-5	lb/gal	lb/gal
	D-6	lb/CuFt	lb/Cf
	D-7	SGU	SGU
Temperature	T-1	°C	deg C
	T-2	°F	deg F
	T-3	Kelvin	Kelvin
	T-4	°R	deg R

10. MAINTENANCE

In the event an error occurs, an error message appears at the bottom of LCD display. Make sure of its nature. Sections 10.1 Error Messages and 10.2 Status Messages will assist you in identifying the cause of trouble and finding necessary corrective action. If the problem persists, or if you have any question, contact OVAL.

10.1 Error Messages

Error type	Status (Status display)	Description	Coping action	Indications in error			Influences on output in an error			
				RED LED	GRN LED	Backlight (※1)	Analog Output 1	Analog Output 2	Pulse Output 1	Status Output
Saturated Alarm	Analog Output 1 Saturated (Ana. Out 1 Satur)	Analog output 1 out of range; failure to produce proper output.	Measurement is out of range. Adjust measurement such that measurement selected falls within [lower limit of analog output to upper limit value], or modify setting.	Blink	ON	OFF	21.6mA	None	Unaffected	Per status select (※7)
	Analog Output 2 Saturated (Ana. Out 2 Satur)	Analog output 2 out of range; failure to produce proper output.					2.4mA	None		
							None	21.6mA		
							None	2.4mA		
	Pulse Output 1 Saturated (Pls. Out 1 Satur)	Pulse output 1 exceeding upper limit; failure to produce proper output.	Lower instant flowrate for use or increase full scale flowrate setting. (※5)				Unaffected		11KHz	
Sensor Failure	Drive Input Out of Range (Drive OutOfRange)	Drive frequency out of normal range; failure to make proper measurement.	A fault in drive oil connections is a possibility. Verify drive coil connections.	ON	OFF	ORG (※4)	Per error output Setting (※6)		Per error output Setting (※5)	Per status select (※7)
	Scale Over (Scale Over)	Mass flowrate exceeds 110% of max allowable range; possible failure to make proper measurement.	Mass flowrate exceeds the specification. Use within the maximum allowable range.							
	Temperature Out of Range (Temp OutOfRange)	Temperature out of normal range, failure to make proper measurement.	A fault in temperature sensor is a possibility. Verify temperature sensor connections by self diagnostics.							
	Density Outside Limit (Density Outside)	Density out of normal range (0-5 g/mL), failure to make proper measurement.	Fluid density out of measurable range. Check for bubble entrapment.							
	P.O. Sig Error (P.O. Sig Err)	Pickoff signal voltage out of normal range, failure to make proper measurement.	A fault in pickoff sensor is a possibility. Verify pickoff coil connections by self diagnostics.							
	Temperature Connect Error (Temp Connect Err)	A fault possible in temperature sensor wiring connections	A fault in temperature sensor is a possibility. Check temperature sensor connections.							
	P.O. Connect Error (P.O. Connect Err)	A fault possible in pickoff sensor wiring connections	A fault in pickoff coil connections. Check pickoff coil connections for condition.							
Transmitter Failure	EEPROM Error (EEPROM Err)	An error in parameters; inactive operation	A fault in EEPROM is suspected. Contact the factory.	Blink (※2)	OFF	ORG (※4)	2.4mA		Stopped	OFF
	Voltage Error (Voltage Err)	Error in internal voltage status	A fault in transmitter internal voltage. Verify power supply. A fault in transmitter is suspected. Contact the factory.	ON	OFF	ORG (※4)	Per error output setting		Per error output setting	Status Select (※7)
	Data Update Error (Data Update Err)	A fault in internal data	A fault in transmitter is suspected. Contact the factory.	ON	OFF	ORG (※4)	Per error output setting (※3, 6)		Per error output setting (※3, 5)	Status Select (※7)
Parameter Alarm	Analog 1 Set Alarm (Ana. 1 Set Alm.)	Parameter setting of analog output 1 or analog output 2 comes under any of the following conditions ・Upper limit < lower limit ・Upper limit or lower limit > max acceptable setting ・Upper limit or lower limit <-max acceptable setting	Verify parameters and reconfigure to acceptable values.	Blink	ON	OFF	Per error output setting		Per error output setting	Status Select (※7)
	Analog 2 Set Alarm (Ana. 2 Set Alm.)									
	Output Port Combination Alarm (Op Combin Alm.)	Error in set value of status output assignment	Verify set value of status output assignment.							
	H/L Alarm Point Set Alarm (H/L Po. Set Alm.)	H/L alarm parameter setting comes under any of the following conditions ・High alarm < Low alarm ・High alarm or low alarm > max acceptable setting ・High alarm or low alarm <- max acceptable setting	Verify parameters and reconfigure to acceptable values.							
Calibration Failure	Auto Zero Failed (Auto Zero Fail)	Auto zero did not complete properly.	Wait until the fluid flow settles down to a steady state and retry zeroing.	Blink	OFF	OFF	Unaffected		Unaffected	Status Select (※7)
Slug Flow Alarm	Slug Flow Alarm (Slug Flow)	Stays on for a preset duration (slug flow check) upon detention of gas entrapment	Air entrapment in the fluid is a possibility. Verify the fluid and line for conditions.	Blink	ON	OFF	Only flow output on hold		Hold	Status Select (※7)
		After expiration of slug flow check duration upon gas entrapment detection					Depends on Slug ups setting		Depends on Slug ups setting	
Transmitter Alarm	Xmtr Temperature Alarm (Txr Temp Alm.)	Transmitter's internal temperature is unusual (below -50℃ or above 90℃).	High ambient temperature cause a rise in the transmitter's internal temperature, leading to shorten life of components. Take necessary step to lower ambient temperature.	Blink	ON	OFF	Continued		Continued	Status Select (※7)
	Switch Alarm (Switch Alm.)	Faulty operating switches	Faulty switch operation. Contact the factory.	Blink	ON	OFF	Continued		Continued	

※1: Even with the run indicator staying off, the white backlight comes on in response to switch operation when backlight is set in the "ON" or "sleep".
※2: In an alarm, the LED blinks at a faster rate (at intervals of 100ms) than in other alarms (at intervals of 250ms).
※3: Outputs can go uncontrolled under certain circumstances if the transmitter fails, however.
※4: For 5 minutes after occurrence of an alarm condition (or sleep duration of backlight setting), the ORG backlight comes on; after which it will blink on and off.
※5: For details,see 9.12 Pulse Output Function.
※6: For details,see 9.13 Analog Output Function.
※7: For details,see 9.14 Status Output Function.

Status type	Status (Status display)	Description	Indications in error			Influences on output in an error			
			RED LED	GRN LED	Backlight (※1)	Analog Output 1	Analog Output 2	Pulse Output 1	Status Output
Fixed Output	Analog Output 1 Fixed (Ana. Out 1 Fix)	Analog output 1 fixed is active (※2)	OFF	Blink	OFF	Fixed output	Unaffected	Unaffected	Unaffected
	Analog Output 2 Fixed (Ana. Out 2 Fix)	Analog output 2 fixed is active (※2)				Unaffected	Fixed output		
	Pulse Output 1 Fixed (Pls. Out 1 Fix)	Pulse output 1 fixed is active (※2)				Unaffected		Fixed output	
	Status Output Fixed (Status Out Fix)	Status output fixed is active (※2)				Unaffected		Unaffected	Fixed output
	0% Sig Lock (0% Sig Lock)	With a status input, 0% signal lock is active. (※2)				4mA		Stopped	Unaffected
Calibration in Progress	Calibration in Progress (Cal. in Progress)	Auto zero in progress	OFF	Blink	ORG indicator blinks at operation startup and shutoff. OFF during the test	Unaffected		Unaffected	Unaffected
H/L Alarm	H/L Alarm Triggered (H/L Alm. Trig.)	H/L alarm occurred and is active. (For details, see 9.16 High/Low Alarm Function.)	OFF	Blink	OFF	Unaffected		Unaffected	Unaffected
Drive Out Alarm	Drive Out Alarm (Drive Out Alarm)	Drive output is exceeds the threshold.	OFF	Blink	OFF	Unaffected		Unaffected	Unaffected
Test	Self Diagnosis (Self-Diag)	Self diagnosis in progress	OFF	Blink	OFF	0%		Stopped	Unaffected
	Stability (Stability)	Flow measurement stability check in progress	OFF	Blink	OFF	0%		Stopped	Unaffected
	Maintenance Test (Maintenance Test)	Maintenance in progress	OFF	Blink	OFF	Unaffected (Set output during simulated output)		Unaffected (Set output during simulated output)	Unaffected (Set output during simulated output)
Transmitter Operation	Key Protect (Key protect.)	If parameter change is made by switch operation while the Key Protect was ON. (If key operation is required, reconfiguration is needed.)	OFF	ON	OFF	Unaffected		Unaffected	Unaffected
	Write protect.	When the target parameter is changed or the operation for executing the target function is carried out in Write Protect mode.	OFF	ON	OFF	Unaffected		Unaffected	Unaffected
	Xmtr Operating-Time Over ("●" blinks at lower left of LCD)	When the number of run hours has exceeded 100,000 hours, it could lead to component failure or degradation. We suggest transmitter replacement. (You can cancel indicator ●).	OFF	ON	OFF	Unaffected		Unaffected	Unaffected
	Xmtr Warm up (WARMUP 20)	Warmup in progress (Stays on for 20 minutes upon power on. Countdown value decrements at one (1) minute intervals.)	OFF	ON	OFF	Unaffected		Unaffected	Unaffected
	Power OK ?	Poor power supply condition is a possibility. (A short duration power cycling has occurred a couple of times.) While there is no problem in continuation of operation, we suggest to run a check for condition of power supply. This message goes out automatically in 20 minutes.	OFF	ON	OFF	Unaffected		Unaffected	Unaffected

※1: Even with the run indicator staying off, the white backlight comes on in response to switch operation if backlight is set in the sleep mode.
※2: Simulated output is available irrespective of the state of alarm. (Certain types of error disables output, however.)

10.3 Replacement Parts

We recommend to keep replacement spare parts to reduce downtime. Replacement parts can be purchased through OVAL representative in your area or OVAL Customer Service Department. Please supply us with the flowmeter model, part name, product number, and quantity at the time of order.

Interconnect cable (Teflon or PVC): Quantity 1

Replacement of parts such as o-rings and sheet packing for transmitter and terminal box

O-rings and gaskets are used as sealing components with limited service life.
Although the exact service life depends on the operating environment, periodic replacement is recommended. Recommended replacement period: 5 to 8 years after the delivery

⚠CAUTION: 1. Whenever you open or disassemble the instrument, inspect the O-rings and gaskets. Replace the deteriorated parts.
2. To ensure the soundness, periodic re-torquing of the corresponding parts is recommended.

Corresponding parts:
- Transmitter: O-ring between display lid (front) - body
- Transmitter: O-ring between terminal box lid (rear) - body
- Transmitter: Gland packing and round packing between adopter - body (Integral type only)
- Transmitter: O-ring on sensor unit (Integral type only)
- O-ring between terminal box - lid (Separate type only)
- Cable gland: rubber seal and O-ring

Please contact OVAL sales office when replacement is necessary

10.4 Explosionproof specification

Applicable standard: Announcement No.16 of Industrial Safety and Health Act - Electric Equipment Explosionproof Structural Standard

● Integral type

Transmitter symbol: Ex de [ib] ⅡC T4 X
Sensor symbol: Ex ib ⅡC T3, T4 Gb（CA series）
Ex ib ⅡB T4 Gb（CB and CS series）
Transmitter-Sensor Ambient Temp.:–20℃ to +55℃
Ex-proof applied temp.: +68℃

➡ NOTES: ※If the group of the sensor is ⅡB, compatible gas subject to explosionproof configration is limited to **II**B as well.
※If the temperature class of sensor is T3, applicable explosive atmosphere is limited to up to T3 as well.

● Separate type:

Transmitter symbol: Ex de [ib] ⅡC T6
Sensor symbol: Ex ib ⅡC T1, T2, T3, T4, T5 Gb（CA series）
Ex ib ⅡB T3, T4 Gb（CB, CS series）
Transmitter Ambient Temp: –20℃ to +60℃
Sensor Ambient Temp.：As shown in the table below
Power source: AC220V 50/60Hz（100mA）, or DC30V（260mA）
Allowable voltage: AC250V 50/60Hz, DC250V

Applicable models

※ Explosionproof specifications such as temperature class, ambient temperature, and fluid temperature vary depending on the combination of transmitter and sensor.
Refer to the table below for the explosionproof specification of each combination. The cells with no temperature description indicate unavailable combination.

Type U

	Temperature class (Transmitter-sensor: spec.)	T1 (Transmitter-sensor: separate type)	T2 (Transmitter-sensor: separate type)	T3 (Transmitter-sensor: separate type)
	Group	ⅡC	ⅡC	ⅡC
Model / Ambient temp./ Measurable fluid temp.	CA00A/ CA001	–	–	–40℃ to +60℃ / –40℃ to +150℃
	CA003	–	–40℃ to +60℃ / –40℃ to +200℃	
	CA006/ CA010/ CA015	–		
	CA025/CA040/ CA050/CA080/ CA100/CA150	–20℃ to +50℃ / –20℃ to +350℃		
	CA15H/CA200/ CA20H/CA250	–		

	Temperature class (Transmitter-sensor : spec.)	T3 (Transmitter-sensor: integral type)	T4 (Transmitter-sensor: separate type)	T4 (Transmitter-sensor: integral type)	T5 (Transmitter-sensor: separate type)
	Group	ⅡC	ⅡC	ⅡC	ⅡC
Model Ambient temp./ Measurable fluid temp.	CA00A/ CA001	—	–40℃ to +60℃ / –40℃ to +80℃	—	—
	CA003	—		—	—
	CA006/CA010/ CA015	–20℃ to +55℃ / –40℃ to +150℃		–20℃ to +55℃ / –40℃ to +80℃	—
	CA025/CA040/ CA050/CA080/ CA100/CA150				–20℃ to +50℃ / –200℃ to +50℃
	CA15H/CA200/ CA20H/CA250				

Type S

	Temperature class (Transmitter-sensor : spec.)	T3 (Transmitter-sensor : separate type)	T4 (Transmitter-sensor : Integral type)	T4 (Transmitter-sensor : separate type)
	Group	ⅡB	ⅡB	ⅡB
Model Ambient temp./ Measurable fluid temp.	CS010/CS015/ CS025/CS040/ CS050/CSR50	−40℃ to +60℃ / −40℃ to +130℃	−20℃ to +55℃ / −40℃ to +80℃	−40℃ to +60℃ / −40℃ to +80℃

Type B

	Temperature class (Transmitter-sensor : spec.)	T3 (Transmitter-sensor : separate type)	T4 (Transmitter-sensor : Integral type)	T4 (Transmitter-sensor : separate type)
	Group	ⅡB	ⅡB	ⅡB
Model Ambient temp./ Measurable fluid temp.	CB006/CB010	–40℃ to +60℃ / –40℃ to +125℃	–20℃ to +55℃ / –40℃ to +100℃	–40℃ to +60℃ / –40℃ to +80℃
	CB015		–20℃ to +55℃ / –40℃ to +70℃	–40℃ to +60℃ / –40℃ to +70℃
	CB025		–20℃ to +55℃ / –40℃ to +105℃	–40℃ to +60℃ / –40℃ to +80℃
	CB040/CB050		–20℃ to +55℃ / –40℃ to +80℃	

10.5 Ambient Temperature

Allowable ambient temperature permitted for the sensor unit is as described in the table below.
(The following table describes the condition for the non-explosionproof models. For explosionproof models, make sure to satisfy the temperature conditions described in Section 10.4, as well as the condition described below.)

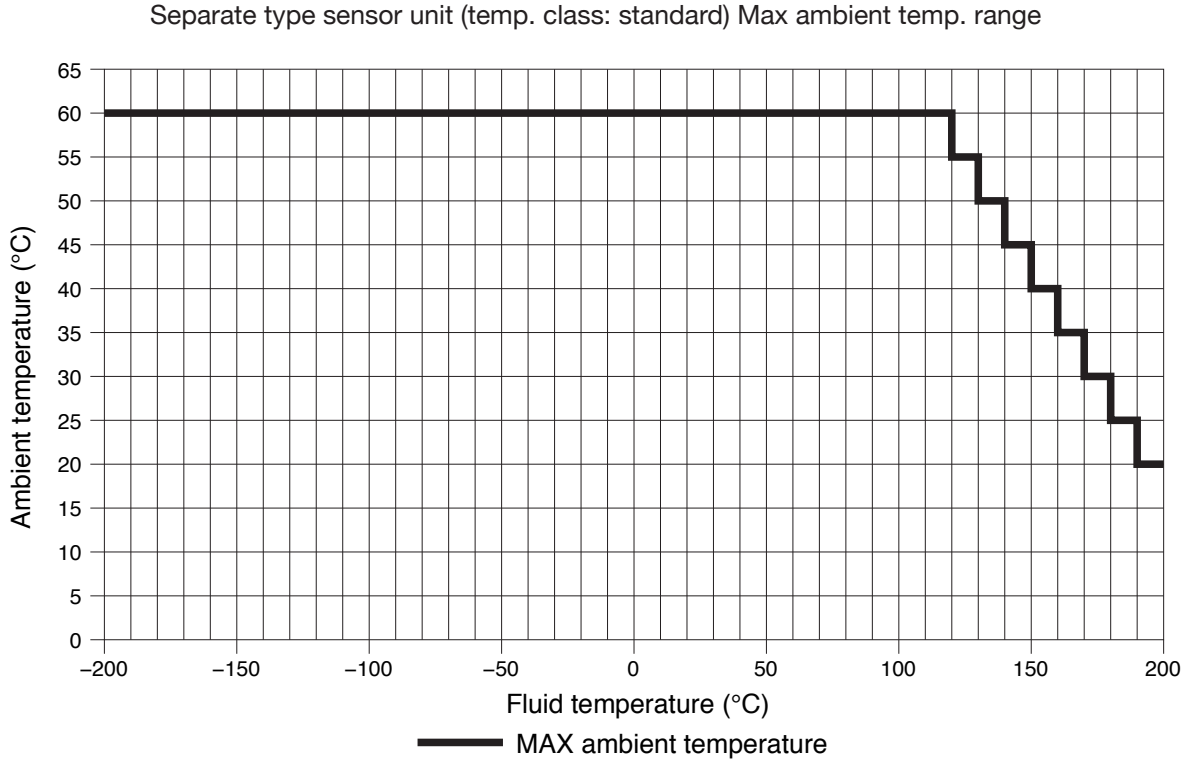
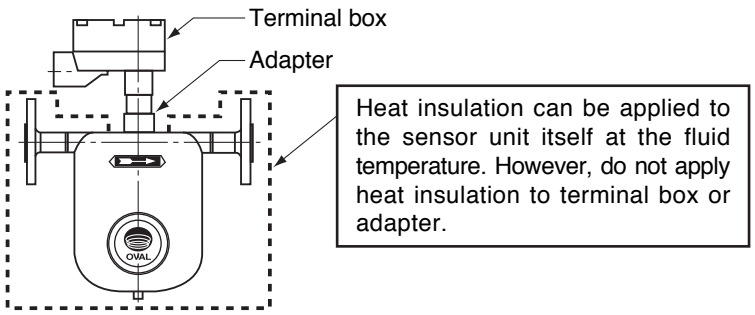


Fig.10.1

NOTE: Please contact OVAL in case the ambient temperature exceeds max ambient temperature in the graph.

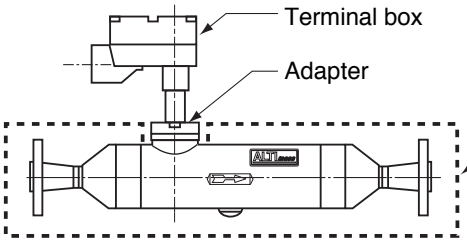
■ Type U

Sensor unit temp. class	Transmitter construction	
	Integral type	Separate type
Standard (200℃ and lower)	[Fluid temperature] 150℃ and lower [Ambient temperature] –40 to +55℃	[Sensor unit ambient temp.] –40℃ to max ambient temp. on Fig.10.1
High temperature service model (350℃ and lower)	None	[Sensor unit ambient temp.] –40 to +55℃
Low-temperature explosionproof service model	None	[Sensor unit ambient temp.] –20 to +50℃



■ Type S

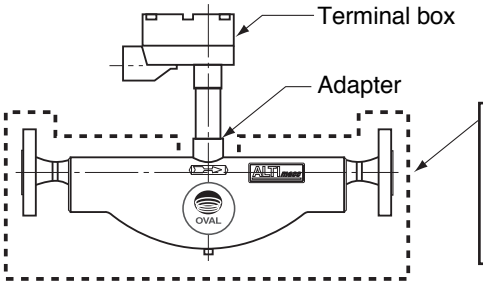
Transmitter construction	
Integral type	Separate type
[Fluid temperature] +130℃ and lower [Ambient temperature] –40 to +55℃	[Sensor unit ambient temp.] –40℃ to max ambient temp. on Fig.10.1



Heat insulation can be applied to the sensor unit itself at the fluid temperature. However, do not apply heat insulation to terminal box or adapter.

■ Type B

Transmitter construction	
Integral type	Separate type
[Fluid temperature] +130℃ and lower [Ambient temperature] –40 to +55℃	[Sensor unit ambient temp.] CB006 to CB025 : –40℃ and above CB040/CB050 : –20℃ and above to max ambient temp. on Fig.10.1



Heat insulation can be applied to the sensor unit itself at the fluid temperature. However, do not apply heat insulation to terminal box or adapter.

10.6 Precautions on the explosionproof specification

10.6.1 About the explosionproof

Special conditions to use the explosionproof equipment safely:

- Do not modify parts constituting the explosionproof performance
  Flameproof constitution parts: Display (glass) – body/terminal lid – parts screwed on the body
- Transmitter shall be used only in the position specified in the instruction manual.

10.6.2 About handling of the flameproof enclosure

The enclosure of the transmitter (PA2K) is a flameproof configuration. In order to maintain the explosionproof performance, due attention to the followings is required.

- Screw type part of explosion-proof equipment:
  The screw type part is an important part for maintaining explosion-proof performance, therefore be careful not to damage or let in any foreign matter inside. If you find any damage, please contact your nearest OVAL service center.

About cable gland:

1. Use only the auxiliary cable gland supplied by OVAL. Use of other cable glands are not recommended.
2. Make sure to use a proper rubber packing for cable gland which matches with finished OD (outside diameter) of the cable.

➡NOTE: The number of furnished cable glands varies with the product type of your order.
Integrally mounted type: 2 sets, Separately mounted type: 3 sets

Table Applicable cable OD Unit: mm

Packing nominal code	Packing ID	Cable OD
11	ϕ11	ϕ10.1 to ϕ11
12	ϕ12	ϕ11.1 to ϕ12
13	ϕ13	ϕ12.1 to ϕ13
14	ϕ14	ϕ13.1 to ϕ14

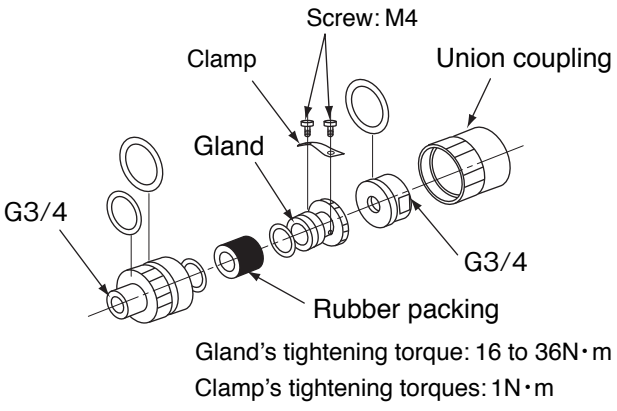


Fig.10.2

⚠ CAUTION

Cautions in assembling

(1) : Putting the cable through rubber packing, screw in the gland and press the packing. In this, make sure to screw in the gland enough until the cable stops.

(2) : This cable gland is furnished with a hook. After (1), make sure to screw in the clamp with a M4 screw and fix the cable.

10.6.3 Insulation performance

A built-in noise eliminator is equipped between power line and ground.
To perform insulation or withstand voltage test, make sure that applied voltage is below the following value:
Power to ground: AC1500V (leak current 5mA, 1minute) DC 500V

10.6.4 Earthing terminal

1. Use GND of power source terminal block or any of external grounding terminals.
2. Use wires of cross section area of 4mm^2 min. (AWG11 min.) for grounding.
3. Coating color of the grounding wires shall be green or stripe of green and yellow.
4. Class A grounding is necessary.
5. In case external wirings are used, make sure that the grounding wire is connected with the earth terminal cover and plain washer in the sketch below.

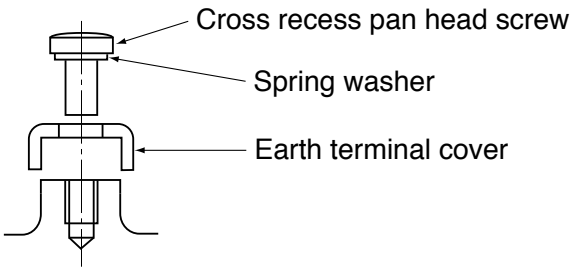


Fig.10.3

10.6.5 About dedicated cable (for only separate type)

1. In case of separate type, a dedicated cable is used for connection between the sensor and transmitter. Use of other cables are not allowed to maintain explosionproof.
2. Place the dedicated cable between the sensor and the transmitter. If a current or voltage is induced, it may cause electromagnetic induction or electrostatic induction, which may harm the intrinsically safe explosion-proof performance.

10.6.6 Maintenance and checking

In order to use OVAL's Coriolis Flowmeters for long period of time, please perform inspection and maintenance according to the following items. Also, make sure to check and inspect the Flowmeter while de-energizing without hazardous gas in the surrounding area.

Check item	Description	Check
General	Is dedicated cable used ? Is the cable touching with other lines, particularly with power supply lines ?	
	Is coating damaged or peeled off ?	
	Is the dedicated cable properly connected ? Is the terminal end properly treated ?	
	Is the separation cover installed ?	
	Is the lid for the terminal box installed ?	
	Are bolts and hex socket set screws for fastening the transmitter loose ?	
Grounding	Is the grounding made properly ? Is the screw for the grounding terminal loose ? Are the grounding wires deteriorated ?	
Sensor	Drive circuit resistance: Resistance range: 50 to 5kΩ *1 Pick-off circuit resistance: Resistance range: 60 to 600Ω *1 Temp. sensor circuit resistance: (100+0.385×Temp.) Ω *1: There are some differences depending on each sensor and fluid temp. *2: This measurement is possible only with the separate type. If measured at the transmitter side, the interconnection resistance of dedicated cable is added.	
Transmitter	Are any of the connections of display lid, terminal lid, or side lid loose ?	
	Are any of the cable gland loose ?	
	Is the packing of the cable gland discolored, hardened, torn, or cracked ?	
	Are there any crack or deform seen on the casing or display glass ? *Paint is not regarded as enclosure.	

Handling of grease on bonded surfaces:

If insufficient grease or deterioration is found during normal use, apply it appropriately. For this reason, periodic inspection is recommended.

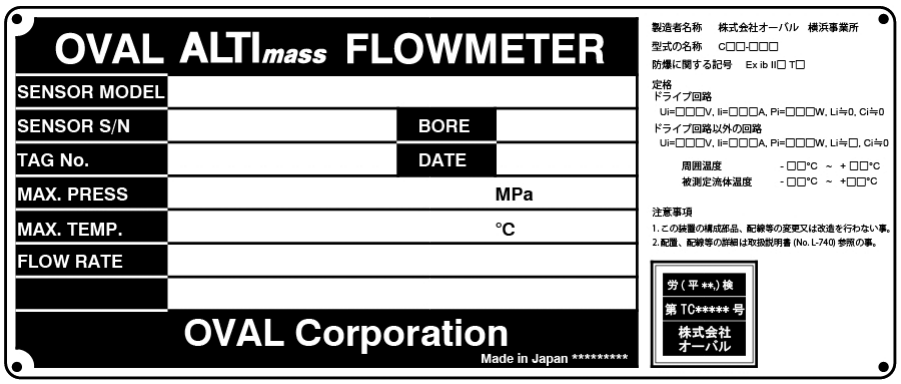
Where to use screw-type parts: Terminal box – lid (separately mounted only)

11. EX-INFORMATION

11.1 Nameplates

Explosionproof pertinent information is described (as“PRODUCT”or“Ex”) on the name plate attached on the product.

SENSOR SIDE



TRANSMITTER SIDE

Integrally mounted type

Separately mounted type

Fig.11.1

➡NOTES The name plate of sensor is common among ALTImass series and it may refer to Instruction Manual No. L-740. However, please refer to Instruction Manual No. L-760 (this manual).

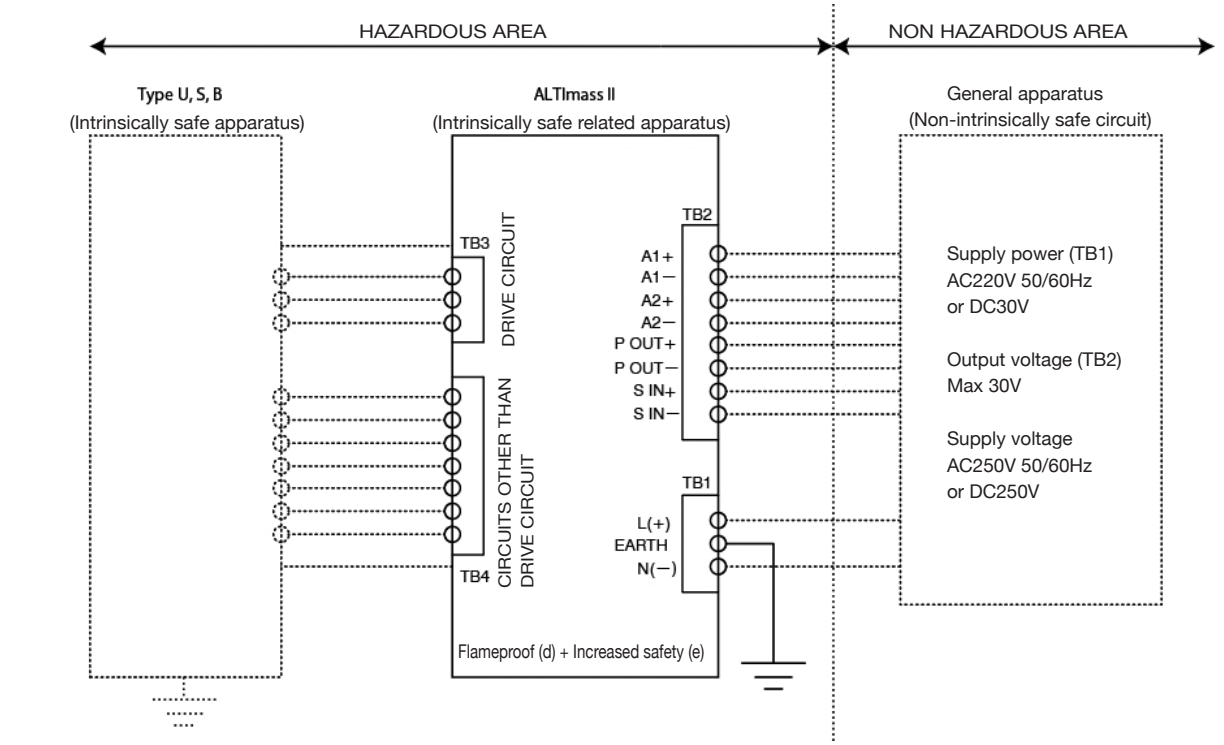
⚠WARNING: 1. Do not modify or alter components and wiring of the device.

2. See Section 7.10 Wiring Diagram for the details of arrangement and wiring.

3. Do not open the cover in explosive atmosphere.

SYSTEM BLOCK DIAGRAM (CONTROL DRAWING)

●Integrally mounted type



●Separately mounted type

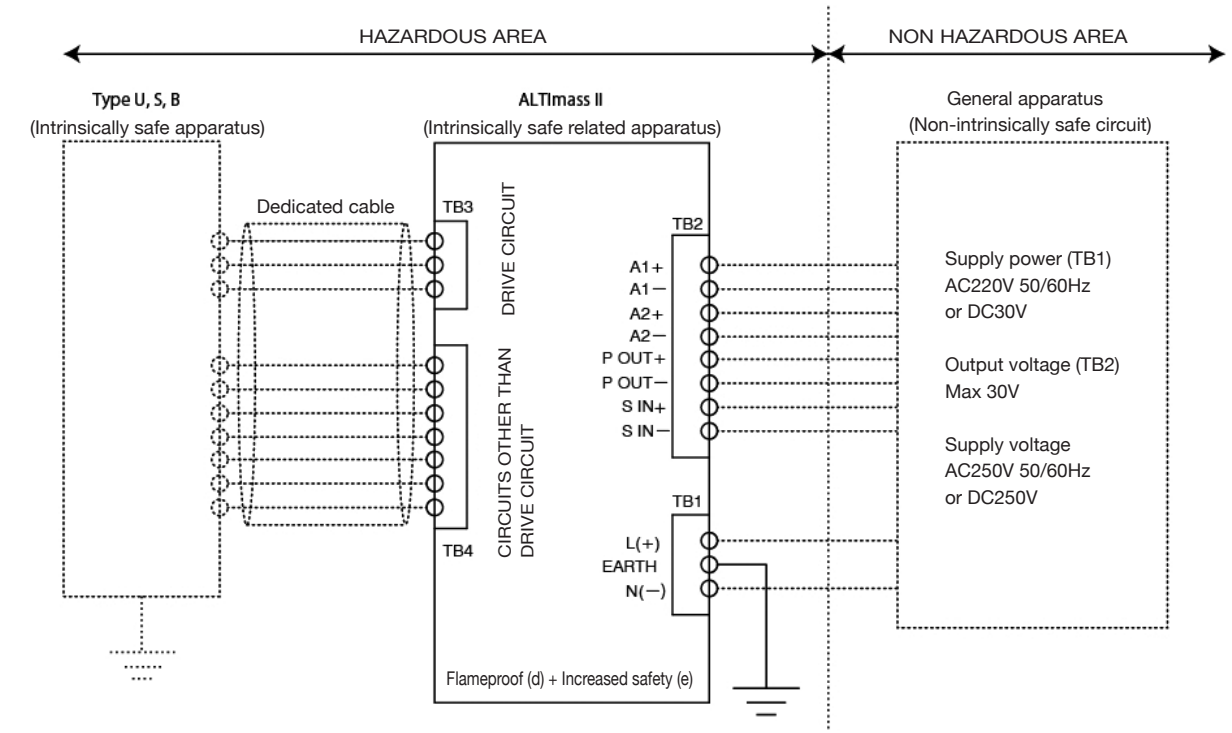
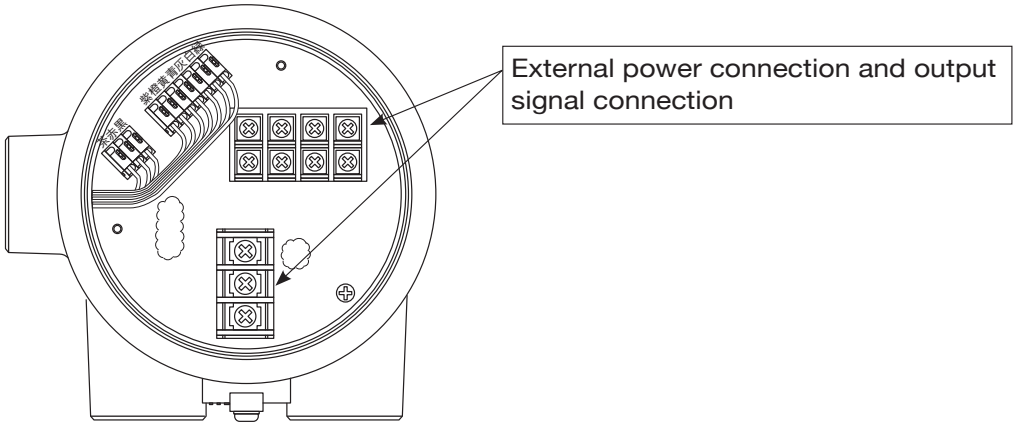


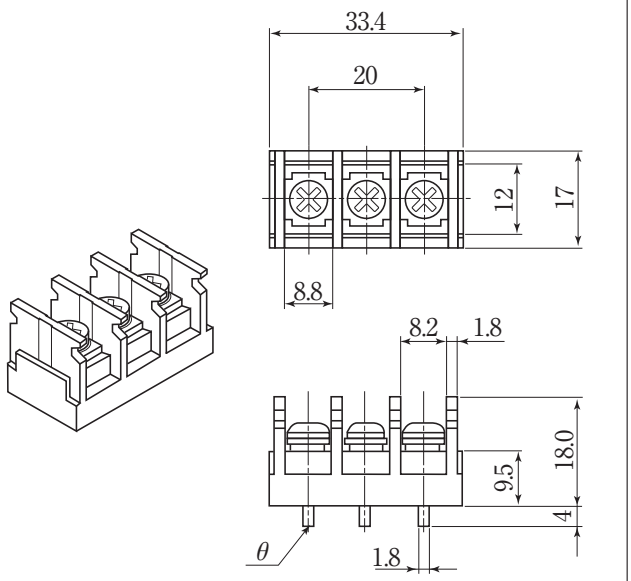
Fig.11.2

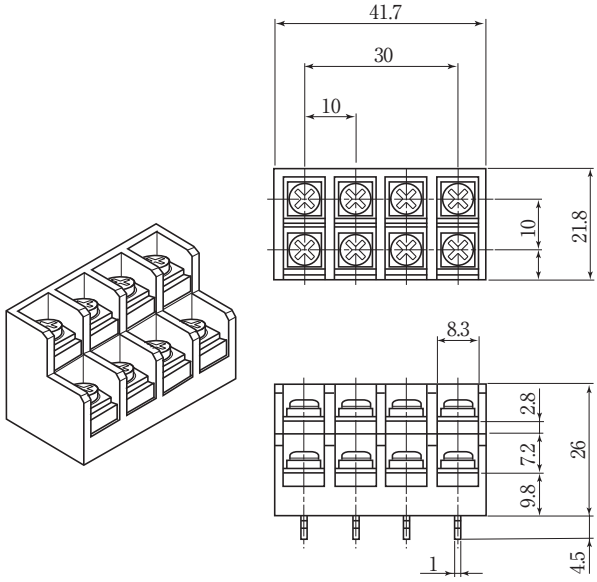
➡NOTES ※1: For CA00A, CA001,CA003 and CA High, Low Temp. service model, only separate types are applicable.
※2: In case of CB006 to CB050, the upper limit temp. is +125deg.C
※3: In case of CS010 to CSR50, the upper limit temp. is +130deg.C

11.2 Considerations on Increased Safety Explosionproof Configuration

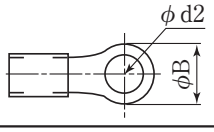
● Terminal box







External power connection terminals	Output signal connection terminals
Number of conductors: 3	Number of conductors: 8
Max current: 24 [A]	Max current: 10 [A]

Applicable wire (mm^2)	Round crimp terminal with insulated sleeve	Dimension		
		B (mm)	ϕ d2 (mm)	
0.2 to 0.5	0.5 to 4	6.6	4.3	
0.5 to 1.25	1.25 to 4			
1.25 to 2.0	2 to 4			

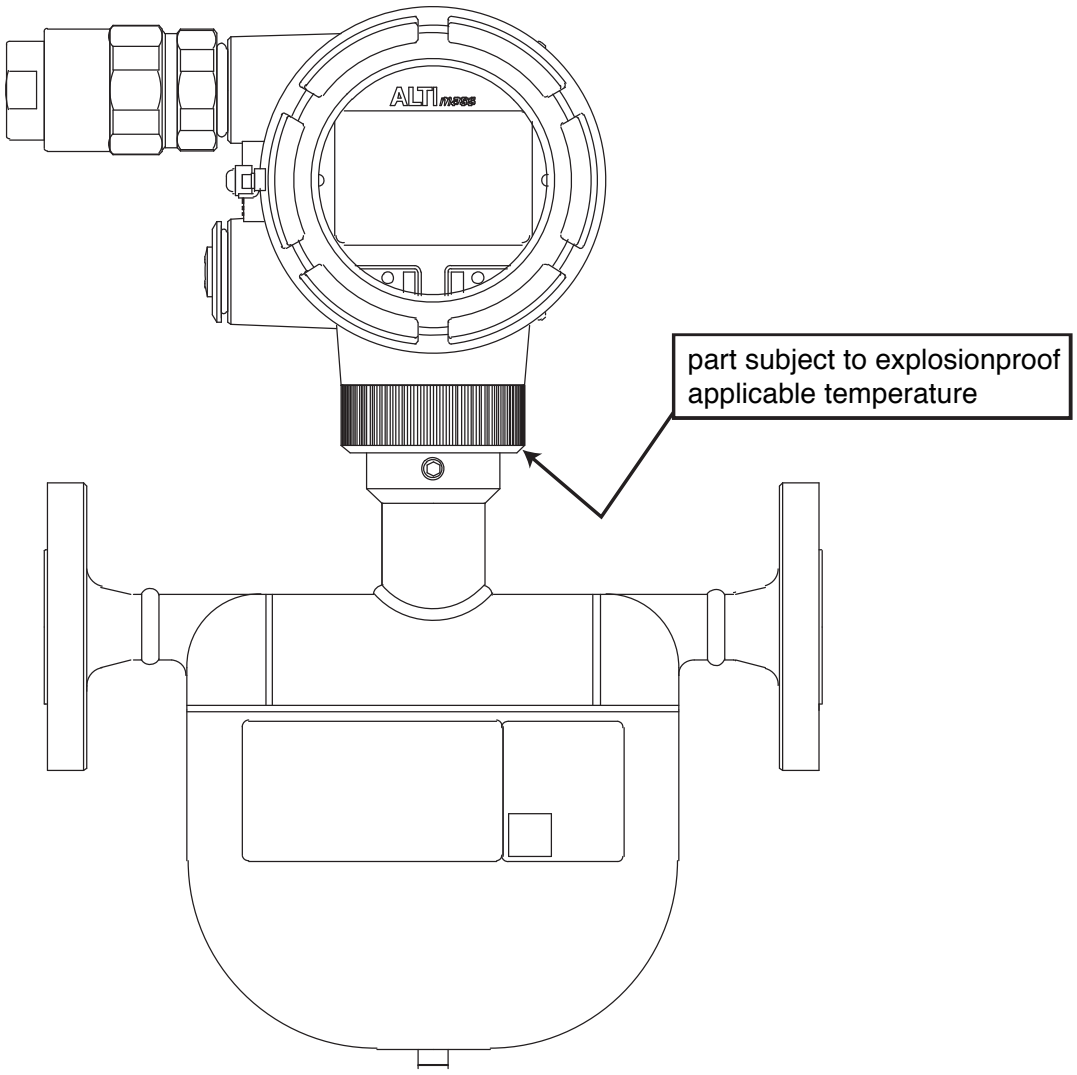
Crimp terminals must be used for wiring connection to the terminals.
Conductor wire size for crimp terminal connection: 0.3 to 2.0mm^2

11.3 Explosionproof Applicable Temperature (Integrally Mounted Type Only)

The integrally mounted explosionproof transmitter of ALTImass Ⅱ adopts "Explosionproof applicable temperature".

Whenever this instrument is used in explosive atmosphere, temperature must be controlled so that the temperature of the part subject to explosionproof applicable temperature shown below never exceeds the specified temperature.

Explosionproof applied temperature: 68°C



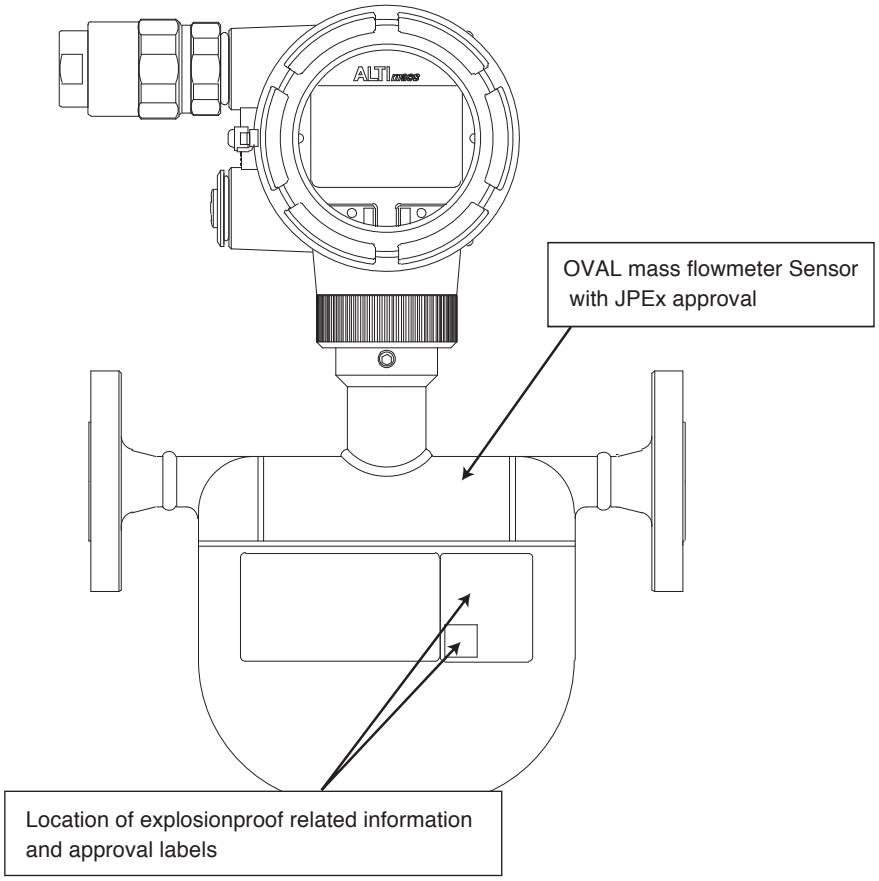
Location of the part subject to explosionproof applicable temperature

11.4 Requirement for Sensor Connectable to Integrally Mounted Transmitter

⚠CAUTION:

For the integrally mounted type transmitter with explosionproof specification, only the sensor (sensor part) shipped with JPEx approved OVAL transmitter for mass flowmeter can be connected. JPEx explosionproof sensors other than OVAL's, sensors of other types of explosionproof classifications, or non-explosionproof sensors cannot be connected. (※1)

When connecting sensor, intrinsically safe explosionproof parameter must be confirmed. If connection availability is unknown, please contact OVAL sales representatives or service center.



➡NOTES ※1. The sensor (sensor part) to be connected to the said transmitter must meet the following requirements:

1. The sensor must be of JPEx approved mass flowmeter manufactured by OVAL Corporation.
2. The sensor must be equipped with a mounting tube (ϕ33.5 [-0.005_-0.062] made of SUS304) for the connection to the transmitter gland.
3. When the sensor is connected to the transmitter, internal cables must be completely protected by both transmitter and sensor and cannot be accessed from outside.
4. The sensor must fulfill above requirements 1 through 3 before connecting the transmitter.
5. No modification or alteration has been made.
6. Explosionproof configuration of the sensor must be Ex ib IIC/IIB/IIA T4.
7. The part subject to explosionproof applicable temperature does not exceed the specified temperature regardless of the type of sensor connected.

12. REGARDING EHEDG CERTIFICATION

Type S (EHEDG Specifications) has been certified by European Hygienic Engineering & Design Group.

Certification Type: TYPE EL CLASS Ⅰ

Acceptable Model: CS025, CS040, CS050

Process Connection: ISO Ferrule

It is recommended to refer EHEDG Document Number 8 [Design Criteria for Sanitary Equipment/ Device] for details.

Comply strictly with your service conditions below in case of EHEDG Specifications.

(1) Mounting Orientation

- Install this equipment vertically in the line so as to enable self-drain.
- In case the electric conduit faces upward, make sure to prepare a countermeasure to rainwater from intruding inside.

(2) Important Point at CIP Washing

Use wash solution at flow velocity of 1.5m/s min.

(3) Process Connection and Seal

Conform to EHEDG Document.

Refer to EHEDG Position Paper “Pipe Coupling and Process Connections”(current version).

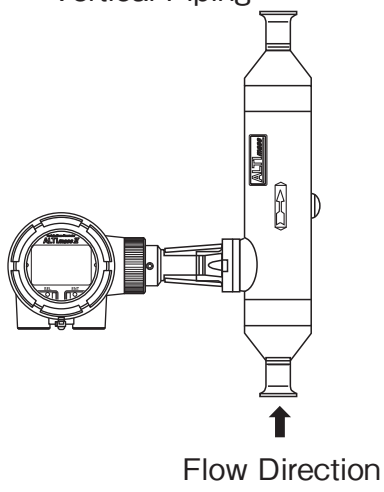
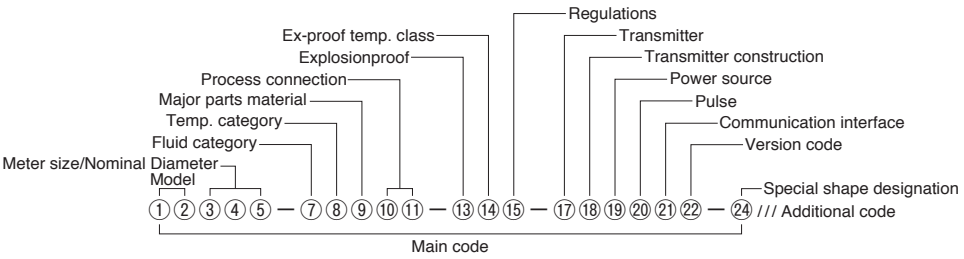


Fig.12.1

13. PRODUCT CODE EXPLANATION

13.1 Type U product codes



●Main code (CA00A to CA080)　○ : Compatible, × : Not applicable, △ : Request inquiries

①	②	Model	Selector Chart										
C	A	ALTI*mass* Ⅱ Type U	CA00A, CA001	CA003	CA006	CA010	CA015	CA025	CA040, CA050	CA080	High temp. service: CA025, CA040, CA050	High temp. service: CA080	Low temp. explosionproof service: CA025, CA040, CA050, CA080
③	④	⑤ Meter size/Nominal Diameter											
		JIS Flange / ASME·JPI Flange / DIN Flange / Ferrule / Screw											
0	0	A											
0	0	1											
0	0	3	10mm	1/2″	DN 15	10A	Rc3/8						
0	0	6	10mm	1/2″	DN 15	10A	Rc3/8						
0	1	0	15mm	1/2″	DN 15	15A	Rc3/8						
0	1	5	15mm	1/2″	DN 15	15A	Rc3/4						
			25mm	1″	DN 25								
0	2	5	25mm	1″	DN 25	25 (ISO), IDF 1S							
			40mm	1″-1/2″	DN 40								
0	4	0	40mm	1″-1/2″	DN 40	38 (ISO), IDF 1.5S							
0	5	0	50mm	2″	DN 50	51 (ISO), IDF 2S							
0	8	0	80mm	3″	DN 80	76.1 (ISO), IDF 3S							
			100mm	4″	DN 100								
⑥	—												
⑦	**Fluid category**												
L	Liquid		○	○	○	○	○	○	○	○	○	○	○
G	Gas		○	○	○	○	○	○	○	○	×	×	○
⑧	**Temp. category ※ 1**												
2	Standard (200℃ and lower)		○	○	○	○	○	○	○	○	×	×	×
3	High temp. (350℃ and lower)		×	×	×	×	×	×	×	○	○	○	×
4	Low temp. explosionproof (− 200℃ to +50℃)		×	×	×	×	×	×	×	×	×	×	○
⑨	**Major parts material**												
S	SUS316L		○	○	○	○	○	○	○	○	○	○	○
M	SUS316L+Alloy C		×	○	○	○	○	○	○	○	×	○	○
H	Alloy C	※ 2	×	○	○	○	○	○	○	○	×	○	○
P	Alloy C (High Pressure)	※ 3	×	×	×	○	○	×	×	×	×	×	×
⑩	⑪	**Process connection**											
J	1	JIS10K	(Standard nominal size ※ 5)	×	○	○	○	○	○	○	○	○	○	○
J	2	JIS20K	(Standard nominal size ※ 5)	×	○	○	○	○	○	○	○	○	○	○
J	3	JIS30K	(Standard nominal size ※ 5)	×	○	○	○	○	○	○	○	○	○	○
J	4	JIS40K	(Standard nominal size ※ 5)	×	○	○	○	○	○	○	○	○	○	○
J	6	JIS63K	(Standard nominal size ※ 5)	×	○	○	○	○	○	○	○	○	○	○
A	1	ASME150	(Standard nominal size ※ 5)	×	○	○	○	○	○	○	○	○	○	○
A	3	ASME300	(Standard nominal size ※ 5)	×	○	○	○	○	○	○	○	○	○	○
A	6	ASME600	(Standard nominal size ※ 5)	×	○	○	○	○	○	○	○	○	○	○
P	1	JPI150	(Standard nominal size ※ 5)	×	○	○	○	○	○	○	○	○	○	○
P	3	JPI300	(Standard nominal size ※ 5)	×	○	○	○	○	○	○	○	○	○	○
P	6	JPI600	(Standard nominal size ※ 5)	×	○	○	○	○	○	○	○	○	○	○
D	1	DIN PN10	※ 4(Standard nominal size ※ 5)	×	○	○	○	○	○	○	○	○	○	○
D	B	DIN PN16	※ 4(Standard nominal size ※ 5)	×	○	○	○	○	○	○	○	○	○	○
D	3	DIN PN25	※ 4(Standard nominal size ※ 5)	×	○	○	○	○	○	○	○	○	○	○
D	4	DIN PN40	※ 4(Standard nominal size ※ 5)	×	○	○	○	○	○	○	○	○	○	○
K	1	JIS10K	(Expanded nominal size ※ 6, ※ 7)	×	×	×	×	△	△	×	○	×	×	×
K	2	JIS20K	(Expanded nominal size ※ 6, ※ 7)	×	×	×	×	△	△	×	○	×	×	×
K	3	JIS30K	(Expanded nominal size ※ 6, ※ 7)	×	×	×	×	△	△	×	○	×	×	×
B	1	ASME150	(Expanded nominal size ※ 6, ※ 7)	×	×	×	×	△	△	×	○	×	×	×
B	3	ASME300	(Expanded nominal size ※ 6, ※ 7)	×	×	×	×	△	△	×	○	×	×	×
B	6	ASME600	(Expanded nominal size ※ 6, ※ 7)	×	×	×	×	△	△	×	○	×	×	×
Q	1	JPI150	(Expanded nominal size ※ 6, ※ 7)	×	×	×	×	△	△	×	○	×	×	×
Q	3	JPI300	(Expanded nominal size ※ 6, ※ 7)	×	×	×	×	△	△	×	○	×	×	×
Q	6	JPI600	(Expanded nominal size ※ 6, ※ 7)	×	×	×	×	△	△	×	○	×	×	×
E	1	DIN PN10	※ 4(Expanded nominal size ※ 6, ※ 7)	×	×	×	×	△	△	×	○	×	×	×
E	B	DIN PN16	※ 4(Expanded nominal size ※ 6, ※ 7)	×	×	×	×	△	△	×	○	×	×	×
E	3	DIN PN25	※ 4(Expanded nominal size ※ 6, ※ 7)	×	×	×	×	△	△	×	○	×	×	×
E	4	DIN PN40	※ 4(Expanded nominal size ※ 6, ※ 7)	×	×	×	×	△	△	×	○	×	×	×
T	T	Screw (Male)	※ 8	○	×	×	×	×	×	×	×	×	×	×
T	C	Screw (Female)	※ 8	×	○	○	○	○	×	×	×	×	×	×
H	S	ISO Ferrule		×	○	○	○	○	○	○	○	×	×	×
Z	9	Special		○	○	○	○	○	○	○	○	○	○	○

⑫	—	
⑬	**Explosionproof**	
0	Non-explosionproof	
1	JPEx	
⑭	**Ex-proof temp. class**	
0	Non-explosionproof	
1	T1	
2	T2	
3	T3	
4	T4	
5	T5	
⑮	**Regulations**	
0	Standard	
G	High Pressure Gas Safety Act (Approved product)	※ w/Material test certificate ※ 9
H	High Pressure Gas Safety Act (Individual test)	※ w/Material test certificate ※ 9
J	High Pressure Gas Safety Act (Completion inspection)	※ w/Material test certificate ※ 9
M	Gas Business Act	※ w/Material test certificate ※ 9
T	Fire Service Act	※ w/Material test certificate
F	w/Material test certificate	
⑯	—	
⑰	**Transmitter ※ 10**	
2	ALTI*mass* Ⅱ	
3	Rack-mount transmitter (Refer to GS No.GEJ516E.)	
⑱	**Transmitter construction ※ 11**	
1	Integrally mounted	
2	Separately mounted	
⑲	**Power source**	
1	20 to 30VDC	
2	85 to 264VAC (safety rating: 100 to 240VAC) 50/60Hz	
⑳	**Pulse**	
B	Voltage	
G	Open drain (open collector output equivalent) (Standard)	
㉑	**Communication interface**	
1	HART communication (HART protocol version 7, Bell202)	
㉒	**Version code**	
B	Version code B: (2-wire system not supported)	
C	Version code C: (2-wire system supported)	
㉓	—	
㉔	**Special shape designation**	
0	Standard	
1	Polished 1	
2	Polished 2	
3	Polished 3	
4	Polished 4	※ 12
5	Polished 5	※ 12
6	Polished 6	※ 13
Z	Special shape (including long neck)	

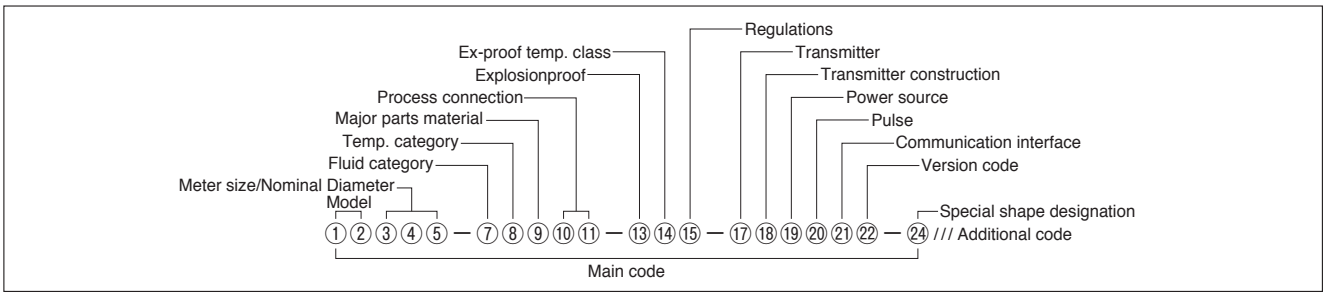
※ 1: When in explosion-proof specifications, there are limitations based on the temperature class.
※ 2: When selecting "H" for Major parts material ⑨, CA003 is applicable only for screw connections, and CA006 to CA080 are applicable only for loose flanges.
※ 3: When selecting the high-pressure "P" for Major parts material ⑨, only screw connections are applicable.
※ 4: DIN flanges are compatible only with "S" or "M" for Major parts material ⑨.
※ 5: The standard bore sizes for each type are as follows:

Model	JIS Flange	ASME•JPI Flange	DIN Flange
CA003	10mm	1/2″	DIN15
CA006	10mm	1/2″	DIN15
CA010	15mm	1/2″	DIN15
CA015	15mm	1/2″	DIN15
CA025	25mm	1″	DIN25
CA040	40mm	1·1/2″	DIN40
CA050	50mm	2″	DIN50
CA080	80mm	3″	DIN80

※ 6: The enlarged bore sizes for each type are as follows:.

Model	JIS Flange	ASME•JPI Flange	DIN Flange
CA015 (Request inquiries)	25mm	1″	DIN25
CA025 (Request inquiries)	40mm	1·1/2″	DIN40
CA080	100mm	4″	DIN100

※ 7: The enlarged bore type is only compatible with "S" or "M" for Major parts material ⑨. Additionally, polishing is not possible.
※ 8: When selecting "TT" or "TC" for process connection ⑩⑪, polishing is not possible.
※ 9: Polishing is not possible for products subject to the High-Pressure Gas Safety Law, Gas Business Law.
※ 10: For rack-mount transmitters, compatible specifications vary. Please refer to GS No. GEJ516E for details on product codes.
※ 11: The maximum measured temperature for integrally mouted models are up to 150℃.
CA00A to CA003, high-temperature and low-temperature explosionproof types, are only available in separately mounted models.
※ 12: Applies to manifolds when it is a machined product.
※ 13: Applies to manifolds and ferrule fittings when it is an integral machined product.

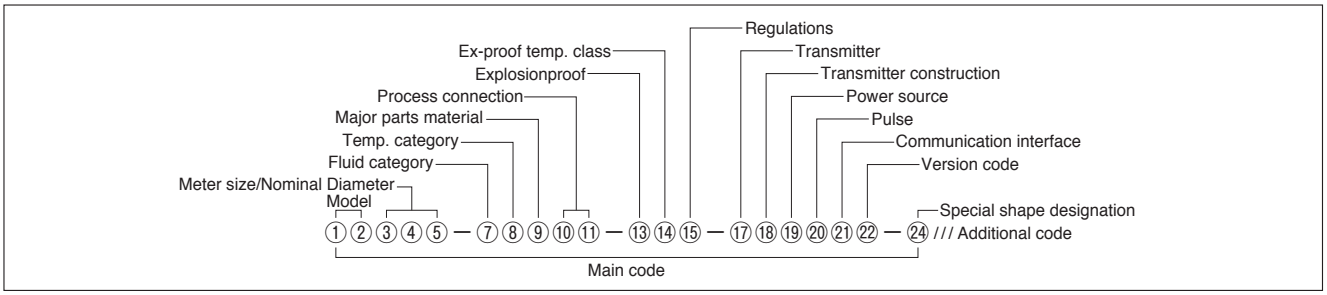


● Main code (CA100 to CA250)

①	②	Model	Selector Chart		
C	A	ALTI*mass* Ⅱ Type U	CA100, CA150, CA15H, CA200, CA20H, CA250	High temp. service: CA100, CA150	Low temp. explosionproof service: CA100, CA150, CA15H, CA200, CA20H, CA250
③	④	⑤ Meter size/Nominal Diameter			
		JIS Flange / ASME·JPI Flange / DIN Flange			
1	0	0 100mm / 4″ / DN 100			
1	5	0 150mm / 6″ / DN 150			
1	5	H 150mm / 6″ / DN 150			
2	0	0 200mm / 8″ / DN 200			
2	0	H 200mm / 8″ / DN 200			
2	5	0 250mm / 10″ / DN 250			
⑥	—				
⑦	**Fluid category**				
L	Liquid		○	○	○
⑧	**Temp. category ※ 1**				
2	Standard (200℃ and lower)		○	×	×
3	High temp. (350℃ and lower)		×	○	×
4	Low temp. explosionproof (–200℃ to +50℃)		×	×	○
⑨	**Major parts material**				
S	SUS316L		○	○	○
⑩	⑪	**Process connection**			
J	1	JIS10K	○	○	○
J	2	JIS20K	○	○	○
J	3	JIS30K	○	○	○
A	1	ASME150	○	○	○
A	3	ASME300	○	○	○
A	6	ASME600	○	○	○
P	1	JPI150	○	○	○
P	3	JPI300	○	○	○
P	6	JPI600	○	○	○
D	1	DIN PN10	○	○	○
D	B	DIN PN16	○	○	○
D	3	DIN PN25	○	○	○
D	4	DIN PN40	○	○	○
Z	9	Special	○	○	○

※ 1: When in explosion-proof specifications, there are limitations based on the temperature class.
※ 2: For rack-mount transmitters, compatible specifications vary. Please refer to GS.No. GEJ516E for details on product codes.
※ 3: Max measurement temperature of (transmitter) integral type is 150℃ .
"High temp. and low temp. type" are only "(transmitter) separate type".

⑫	—
⑬	**Explosionproof**
0	Non-explosionproof
1	JPEx
⑭	**Ex-proof temp. class**
0	Non-explosionproof
1	T1
2	T2
3	T3
4	T4
5	T5
⑮	**Regulations**
0	Standard
G	High Pressure Gas Safety Act (Approved product) CA100 and CA150 only ※ w/Material test certificate
H	High Pressure Gas Safety Act (Individual test) ※ w/Material test certificate
J	High Pressure Gas Safety Act (Completion inspection) ※ w/Material test certificate
M	Gas Business Act ※ w/Material test certificate
T	Fire Service Act ※ w/Material test certificate
F	w/Material test certificate
⑯	—
⑰	**Transmitter ※ 2**
2	ALTI*mass* Ⅱ
3	Rack-mount transmitter (Refer to GS No.GEJ516E.)
⑱	**Transmitter construction ※ 3**
1	Integrally mounted
2	Separately mounted
⑲	**Power source**
1	20 to 30VDC
2	85 to 264VAC (safety rating: 100 to 240VAC) 50/60Hz
⑳	**Pulse**
B	Voltage
G	Open drain (open collector output equivalent) (Standard)
㉑	**Communication interface**
1	HART communication (HART protocol version 7, Bell202)
㉒	**Version code**
B	Version code: B (2-wire system not supported)
C	Version code: C (2-wire system supported)
㉓	—
㉔	**Special shape designation**
0	Standard
Z	Special shape



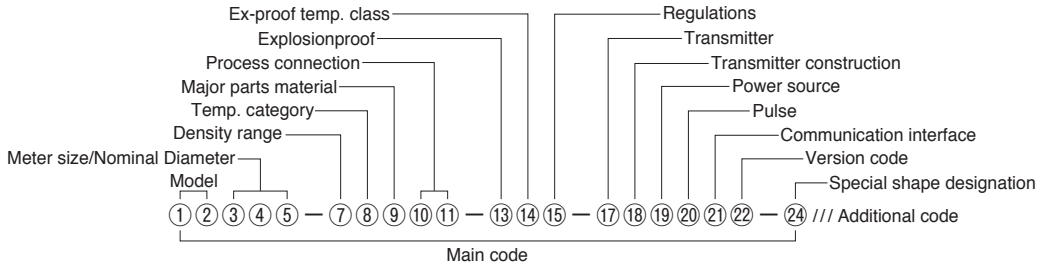
●Additional code

Category of High Pressure Gas				
H	P	0	Other than High Pressure Gas	
H	P	1	Toxic gas and flammable gas	
H	P	2	Toxic gas	
H	P	3	Flammable gas	
H	P	4	Other than toxic or flammable gas	
Density calibration				
M	0	0	Density calibration	
Special test (instrumental error)				
A	1	0	Taxed custody transfer	
A	2	0	By certified measurer	
A	9	9	Designation of instrumental error test method	Addition of one (1) test point, etc.
Flow direction				
F	L	0	Left to right	
F	R	0	Right to left	
F	D	0	Bottom to top	Electric conduit at the bottom
Designated special paint on body				
B	X	0	Customer designation	
Designated special paint on transmitter				
S	F	0	Corrosion proof	Special treatment
S	D	0	Salt Proof	
S	E	0	Acid Proof	Special treatment
S	X	0	Customer designated paint	Special treatment
Cleansing				
T	W	0	Oil free and Water free treatment	
T	F	0	Food cleansing	
Accuracy				
R	A	5	± 0.05% RD ※1	
JPEx explosionproof cable gland				
J	F	1	Standard (Explosionproof model: Included, Non-explosionproof model: Not included)	

※1: When polishing specifications are selected, the high accuracy option is not available.
※2: When polishing specifications are selected, the strength calculation sheet cannot be issued.

Document				
D	S	J	SPEC. & DWG (Approval Drawing) (Japanese)	
D	S	E	SPEC. & DWG (Approval Drawing) (English)	
D	R	0	Re-submission of SPEC. & DWG	
D	C	J	Final DWG (Japanese)	
D	C	E	Final DWG (English)	
D	P	J	Strength calculation sheet (Japanese) ※2	
D	P	E	Strength calculation sheet (English) ※2	
S	E	J	Inspection Certificate (Calibration report) (Japanese)	
S	E	E	Inspection Certificate (Calibration report) (English)	
S	T	J	Pressure test report (Japanese)	
S	T	E	Pressure test report (English)	
S	A	J	Airtight test report (Japanese)	
S	A	E	Airtight test report (English)	
D	D	J	Dimensional check record (Japanese)	
D	D	E	Dimensional check record (English)	
S	P	J	Penetrant test report (Japanese)	Welded part of pressure resistant vessel
S	P	E	Penetrant test report (English)	Welded part of pressure resistant vessel
S	R	J	Radiographic inspection (Japanese)	Welded part of pressure resistant vessel
S	R	E	Radiographic inspection (English)	Welded part of pressure resistant vessel
S	X	J	PMI test report (Japanese)	
S	X	E	PMI test report (English)	
S	S	J	Impact test report (Japanese)	
S	S	E	Impact test report (English)	
D	Y	J	WPS/PQR (Japanese)	
D	Y	E	WPS/PQR (English)	
D	9	J	Photo (Japanese)	
D	9	E	Photo (English)	
D	T	J	Inspection procedure (Japanese)	
D	T	E	Inspection procedure (English)	
C	A	J	Traceability certificate: A set	Only available in Japanese
C	B	J	Traceability certificate: B set	Only available in Japanese
C	C	J	Traceability certificate: C set	Only available in Japanese
C	D	J	Traceability certificate: D set	Only available in Japanese
Witness Test				
V	1	0	Required	

13.2 Type S product codes

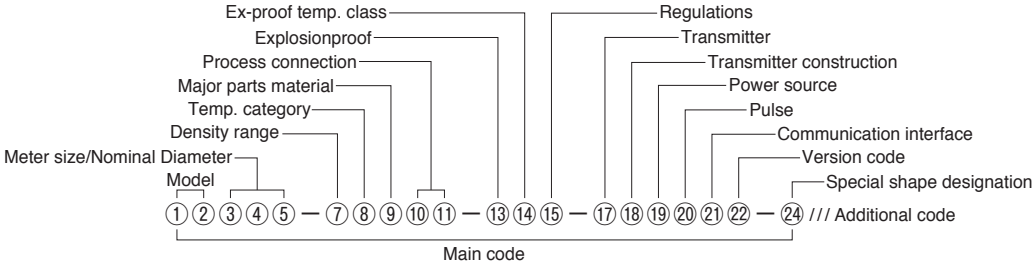


●Main code

①	②	**Model**		
C	S	ALTI*mass* Ⅱ Type S		
③	④	⑤ **Meter size/Nominal Diameter**		
		JIS flange	**ASME·JPI flange**	**Ferrule**
0	1	0 10mm	1/2″	10A
0	1	5 15mm	1/2″	15A
0	2	5 25mm	1″	38 (ISO), IDF 1.5S
0	4	0 40mm	1·1/2″	51 (ISO), IDF 2S
0	5	0 50mm	2″	63.5 (ISO), IDF 2.5S
R	5	0 80mm	3″	88.9 (ISO), IDF 3.5S
⑥	—			
⑦	**Density range**			
1	Low density liquids (0.5 to 1.0g/mL)			
2	Ordinary density (0.7 to 1.3g/mL)			
3	High density liquid (1.0 to 1.5g/mL)			
⑧	**Temp. category ※ 1**			
1	Standard (130℃ and lower)			
⑨	**Major parts material**			
T	SB338 Grade-9 + TB480H			
⑩	⑪	**Process connection**		
J	1	JIS10K		
J	2	JIS20K		
A	1	ASME150		
P	1	JPI150		
H	S	ISO Ferrule		
Z	9	Special		
⑫	—			
⑬	**Explosionproof**			
0	Non-explosionproof			
1	JPEx			

⑭	**Ex-proof temp. class**	
0	Non-explosionproof	
3	T3	
4	T4	
⑮	**Regulations**	
0	Standard	
E	EHEDG	w/Material test certificate ※ 4
T	Fire Service Act	w/Material test certificate
F	w/Material test certificate	
⑯	—	
⑰	**Transmitter ※ 2**	
2	ALTI*mass* Ⅱ	
3	Rack-mount transmitter (Refer to GS No.GEJ516E.)	
⑱	**Transmitter construction ※ 3**	
1	Integrally mounted	
2	Separately mounted	
⑲	**Power source**	
1	20 to 30VDC	
2	85 to 264VAC (Safety rated 100 to 240VAC) 50/60Hz	
⑳	**Pulse**	
B	Voltage pulse	
G	Open drain pulse (equivalent to open collector pulse) (standard)	
㉑	**Communication protocol**	
1	HART communication (HART protocol version 7, Bell202)	
㉒	**Version code**	
B	Version code: B (2-wire system not supported)	
C	Version code: C (2-wire system supported)	
㉓	—	
㉔	**Special shape designation**	
0	Standard	
Z	Special shape (including polishing, long neck)	

※ 1: Explosionproof specifications are restricted based on temperature class.
※ 2: For rack-mount transmitters, compatible specifications vary. Please refer to GS No. GEJ516E for details on product codes.
※ 3: If temperature of the fluid exceeds 80℃ for explosionproof types, only "Separately mounted" model is available for the transmitter construction.
In case of non-explosionproof, Integrally mounted model can be used up to 130℃ by restricting the transmitter ambient temp. to 45℃ at maximum.
※ 4: Process connections for CS025, CS040, and CS050 only apply to ISO ferrule.

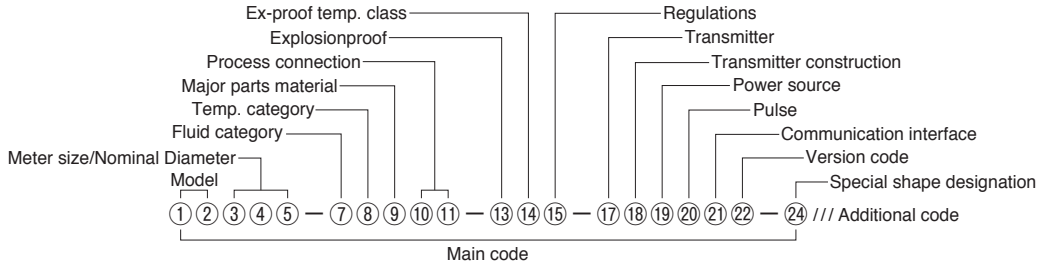


●Additional code

Category of High Pressure Gas				
H	P	0	Other than High Pressure Gas	
Density calibration				
M	0	0	Density calibration	
Special test (instrumental error)				
A	2	0	By certified measurer	
A	9	9	Designation of instrumental error test method	Addition of one (1) test point, etc.
Flow direction				
F	L	0	Left to right	
F	R	0	Right to left	
F	D	0	Bottom to top	Electric conduit at the bottom
Designated special paint on body				
B	X	0	Customer designation	
Designated special paint on transmitter				
S	F	0	Corrosion proof	Special treatment
S	D	0	Salt Proof	
S	E	0	Acid Proof	Special treatment
S	X	0	Customer designated paint	Special treatment
Cleansing				
T	W	0	Oil free and Water free treatment	
T	F	0	Food cleansing	
JPEx explosionproof cable gland				
J	F	1	Standard (Explosionproof model: Included, Non-explosionproof model: Not included)	

Document				
D	S	J	SPEC. & DWG (Approval Drawing) (Japanese)	
D	S	E	SPEC. & DWG (Approval Drawing) (English)	
D	R	0	Re-submission of SPEC. & DWG	
D	C	J	Final DWG (Japanese)	
D	C	E	Final DWG (English)	
D	P	J	Strength calculation sheet (Japanese)	
D	P	E	Strength calculation sheet (English)	
S	E	J	Inspection Certificate (Calibration report) (Japanese)	
S	E	E	Inspection Certificate (Calibration report) (English)	
S	T	J	Pressure test report (Japanese)	
S	T	E	Pressure test report (English)	
S	A	J	Airtight test report (Japanese)	
S	A	E	Airtight test report (English)	
D	D	J	Dimensional check record (Japanese)	
D	D	E	Dimensional check record (English)	
S	P	J	Penetrant test report (Japanese)	Welded part of pressure resistant vessel
S	P	E	Penetrant test report (English)	Welded part of pressure resistant vessel
S	R	J	Radiographic inspection (Japanese)	Welded part of pressure resistant vessel
S	R	E	Radiographic inspection (English)	Welded part of pressure resistant vessel
S	X	J	PMI test report (Japanese)	
S	X	E	PMI test report (English)	
D	9	J	Photo (Japanese)	
D	9	E	Photo (English)	
D	T	J	Inspection procedure (Japanese)	
D	T	E	Inspection procedure (English)	
C	A	J	Traceability certificate: A set	Only available in Japanese
C	B	J	Traceability certificate: B set	Only available in Japanese
C	C	J	Traceability certificate: C set	Only available in Japanese
C	D	J	Traceability certificate: D set	Only available in Japanese
Witness by customer				
V	1	0	Required	

13.3 Type B product codes

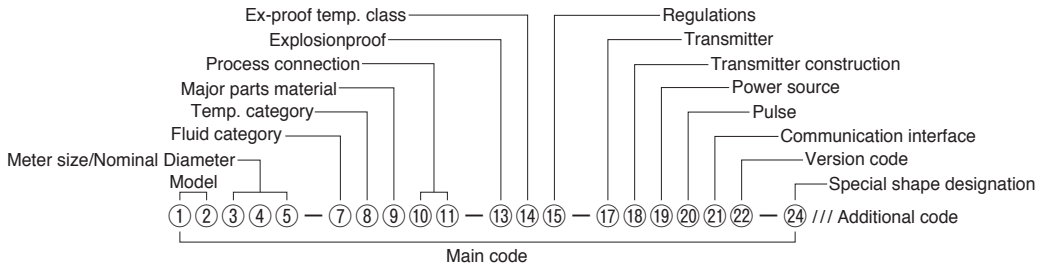


●Main code

①	②	**Model**		
C	B	ALTImass Ⅱ Type B		
③	④	⑤	**Meter size/Nominal Diameter**	
			JIS flange	**ASME·JPI flange**	**Ferrule**
0	0	6	10mm	1/2″	10A
0	1	0	15mm	1/2″	15A
0	1	5	15mm	1/2″	15A
0	2	5	25mm	1″	25 (ISO), IDF 1S
0	4	0	40mm	1·1/2″	38 (ISO), IDF 1.5S
0	5	0	50mm	2″	51 (ISO), IDF 2S
⑥	—				
⑦	**Fluid category**				
L	Liquid				
⑧	**Temp. category ※ 1**				
1	Standard (130℃ and lower)				
⑨	**Major parts material**				
S	SUS316L				
⑩	⑪	**Process connection**			
J	1	JIS10K			
J	2	JIS20K			
J	3	JIS30K			
A	1	ASME150			
A	3	ASME300			
A	6	ASME600			
P	1	JPI150			
P	3	JPI300			
P	6	JPI600			
H	S	ISO Ferrule			
Z	9	Special			
⑫	—				
⑬	**Explosionproof**				
0	Non-explosionproof				
1	JPEx				
⑭	**Ex-proof temp. class**				
0	Non-explosionproof				
3	T3				
4	T4				

⑮	**Regulations**	
0	Standard	
T	Fire Service Act	※ w/Material test certificate
F	w/Material test certificate	
⑯	—	
⑰	**Transmitter ※ 2**	
2	ALTI*mass* Ⅱ	
3	Rack-mount transmitter (Refer to GS No.GEJ516E.)	
⑱	**Transmitter construction ※ 3**	
1	Integrally mounted	
2	Separately mounted	
⑲	**Power source**	
1	20 to 30VDC	
2	85 to 264VAC (Safety rated 100 to 240VAC 50/60Hz)	
⑳	**Pulse**	
B	Voltage pulse	
G	Open drain pulse (equivalent to open collector pulse) (standard)	
㉑	**Communication protocol**	
1	HART communication (HART protocol version 7, Bell202)	
㉒	**Version code**	
B	Version code: B (2-wire system not supported)	
C	Version code: C (2-wire system supported)	
㉓	—	
㉔	**Special shape designation**	
0	Standard	
Z	Special shape	

※ 1: Explosionproof specifications are restricted based on temperature class.
※ 2: For rack-mount transmitters, compatible specifications vary. Please refer to GS No. GEJ516E for details on product codes.
※ 3: If temperature of the fluid exceeds 80℃ for explosionproof types, only "Separately mounted" model is available for the transmitter construction.
In case of non-explosionproof, Integrally mounted model can be used up to 130℃ by restricting the transmitter ambient temp. to 45℃ at maximum.



●Additional code

Category of High Pressure Gas				
H	P	0	Other than High Pressure Gas	
Density calibration				
M	0	0	Density calibration	
Special test (instrumental error)				
A	2	0	By certified measurer	
A	9	9	Designation of instrumental error test method	Addition of one (1) test point, etc.
Flow direction				
F	L	0	Left to right	
F	R	0	Right to left	
F	D	0	Bottom to top	Electric conduit at the bottom
Designated special paint on body				
B	X	0	Customer designation	
Designated special paint on transmitter				
S	F	0	Corrosion proof	Special treatment
S	D	0	Salt Proof	
S	E	0	Acid Proof	Special treatment
S	X	0	Customer designated paint	Special treatment
Cleansing				
T	W	0	Oil free and Water free treatment	
T	F	0	Food cleansing	
JPEx explosionproof cable gland				
J	F	1	Standard (Explosionproof model: Included, Non-explosionproof model: Not included)	

Document				
D	S	J	SPEC. & DWG (Approval Drawing) (Japanese)	
D	S	E	SPEC. & DWG (Approval Drawing) (English)	
D	R	0	Re-submission of SPEC. & DWG	
D	C	J	Final DWG (Japanese)	
D	C	E	Final DWG (English)	
D	P	J	Strength calculation sheet (Japanese)	
D	P	E	Strength calculation sheet (English)	
S	E	J	Inspection Certificate (Calibration report) (Japanese)	
S	E	E	Inspection Certificate (Calibration report) (English)	
S	T	J	Pressure test report (Japanese)	
S	T	E	Pressure test report (English)	
S	A	J	Airtight test report (Japanese)	
S	A	E	Airtight test report (English)	
D	D	J	Dimensional check record (Japanese)	
D	D	E	Dimensional check record (English)	
S	P	J	Penetrant test report (Japanese)	Welded part of pressure resistant vessel
S	P	E	Penetrant test report (English)	Welded part of pressure resistant vessel
S	R	J	Radiographic inspection (Japanese)	Welded part of pressure resistant vessel
S	R	E	Radiographic inspection (English)	Welded part of pressure resistant vessel
S	X	J	PMI test report (Japanese)	
S	X	E	PMI test report (English)	
S	S	J	Impact test report (Japanese)	
S	S	E	Impact test report (English)	
D	Y	J	WPS/PQR (Japanese)	
D	Y	E	WPS/PQR (English)	
D	9	J	Photo (Japanese)	
D	9	E	Photo (English)	
D	T	J	Inspection procedure (Japanese)	
D	T	E	Inspection procedure (English)	
C	A	J	Traceability certificate: A set	Only available in Japanese
C	B	J	Traceability certificate: B set	Only available in Japanese
C	C	J	Traceability certificate: C set	Only available in Japanese
C	D	J	Traceability certificate: D set	Only available in Japanese
Witness by customer				
V	1	0	Required	

14. PRODUCT CODE EXPLANATION OF THE OLD PRODUCT CODE

14.1 Type U product codes

Product code has been renewed on April 2017.
Old product code will not be updated after April 2017.
Please consult OVAL if you need to maintain using old product code due type approval.

14.1.1 CA00A to CA080

Item	Product Code ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱	Description	Selector Chart: CA00A, CA001	CA003	CA006	CA010, CA015	CA025, CA040, CA050, CA080	High temp. service:CA025, CA040, CA050 (below 350℃)	High temp. service : CA080 (below 350℃)	Low temp. explosionproof service : CA025, CA040, CA050, CA080
Model	C A	ALTImass Type U								
Nominal size	0 0 A	1/4″ connection								
	0 0 1	1/4″ connection								
	0 0 3	10mm connection (3/8″)								
	0 0 6	10mm connection (3/8″)								
	0 1 0	15mm connection (1/2″)								
	0 1 5	15mm connection (1/2″)								
	0 2 5	25mm connection (1″)								
	0 4 0	40mm connection (1•1/2″)								
	0 5 0	50mm connection (2″)								
	0 8 0	80mm connection (3″)								
Fluid category	A	Liquid service	○	○	○	○	○	○	○	○
	B	Gas service	○	○	○	○	○	×	×	○
Temp. category (※1)	1	Standard (below 130℃)	×	×	○	○	○	×	×	×
	2	Standard (below 200℃)	○	○	○	○	○	×	×	×
	3	High temperature service (below 350℃)	×	×	×	×	×	○	○	×
	4	Low temperature explosionproof service (−200℃ to +50℃)	×	×	×	×	×	×	×	○
Pressure category	1	Standard	○	○	○	○	○	○	○	○
	2	High pressure service (※2)	×	×	×	○	×	×	×	×
Major parts material	S	SUS316L	○	○	○	○	○	○	○	○
	M	SUS316L + Alloy C	×	○	○	○	○	×	○	×
	H	Alloy C (※3)	×	○	○	○	○	×	○	×
	X	Other material	○	○	○	○	○	○	○	○
Process connection	A	Screw-in	○	○	○	○	×	×	×	×
	B	Ferrule	×	○	○	○	○	×	×	×
	C	JIS 10K	×	○	○	○	○	○	○	○
	D	JIS 20K	×	○	○	○	○	○	○	○
	E	JIS 30K	×	○	○	○	○	○	○	○
	F	JIS 40K	×	○	○	○	○	○	○	○
	G	JIS 63K	×	○	○	○	○	○	○	○
	H	ASME 150	×	○	○	○	○	○	○	○
	J	ASME 300	×	○	○	○	○	○	○	○
	K	ASME 600	×	○	○	○	○	○	○	○
	L	JPI 150	×	○	○	○	○	○	○	○
	M	JPI 300	×	○	○	○	○	○	○	○
	N	JPI 600	×	○	○	○	○	○	○	○
	P	DIN PN 10	×	○	○	○	○	○	○	○
	Q	DIN PN 16	×	○	○	○	○	○	○	○
	R	DIN PN 25	×	○	○	○	○	○	○	○
	S	DIN PN 40	×	○	○	○	○	○	○	○
	Z	Other than above	×	○	○	○	○	○	○	○
Transmitter construction (※4)	1	Integrally mounted	×	×	○	○	○	×	×	×
	2	Separately mounted	○	○	○	○	○	○	○	○
Power source	1	20 to 30VDC								
	2	85 to 264VAC (Safety rated 100 to 240VAC), 50/60Hz								
Analog output (※5)	A	Output 1: Mass flow Output 2: Mass flow								
	B	Output 1: Mass flow Output 2: Density								
	C	Output 1: Mass flow Output 2: Temperature								
	D	Output 1: Mass flow Output 2: Volume flow (true density)								
	E	Output 1: Mass flow Output 2: Volume flow (fixed density)								
	F	Output 1: Density Output 2: Temperature								
	G	Output 1: Volume flow (true density) Output 2: Density								
	H	Output 1: Volume flow (fixed density) Output 2: Density								
	J	Output 1: Volume flow (true density) Output 2: Temperature								
	K	Output 1: Volume flow (fixed density) Output 2: Temperature								
	L	Output 1: Mass flow Output 2: Status								
	M	Output 1: Density Output 2: Status								
	N	Output 1: Temperature Output 2: Status								
	P	Output 1: Volume flow (true density) Output 2: Status								
	Q	Output 1: Volume flow (fixed density) Output 2: Status								
Pulse output (※5)	A	Mass flow								
	B	Volume flow (true density)								
	C	Volume flow (fixed density)								
Pulse output type	1	Open drain pulse (equivalent to open collector pulse) (standard)								
	2	Voltage pulse								
Communication interface	0	No communication capability								
	1	HART protocol version 7, Bell202								
Explosionproof rating	0	Non-explosionproof								
	1	TIIS								
Explosionproof temperature class	0	Non-explosionproof								
	1	Sensor unit: Temp. class T1, separate transmitter only, CA025 to CA080 (high temp. service model) only								
	2	Sensor unit: Temp. class T2, separate transmitter only, CA003 to CA080 only								
	3	Sensor unit: Temp. class T3, separate transmitter only								
	4	Sensor unit: Temp. class T4								
	5	Sensor unit: Temp. class T5, separate transmitter only, CA025 to CA080 (Low temp. explosionproof service) only								

NOTES ※1: Explosionproof specifications are restricted based on temperature class.
※2: If "High pressure service" is selected for the pressure category, process connection will be "Screw-in".
※3: When "H" (Alloy C) is selected as major part material code, only loose flange is applicable for CA006.
※4: For integrally mounted type, the maximum fluid temperature is 130℃. If the fluid temperature exceeds 80℃, maximum ambient temperature of the transmitter must be lowered. (For example, if the fluid temperature is 130℃, max ambient temperature of the transmitter is 45℃.)
※5: Simultaneous output of both "Volume flow (fixed density)" and "Volume flow (true density)" for analog output and pulse output is not available.

14.1.2 CA100 to CA250

Product code has been renewed on April 2017.
Old product code will not be updated after April 2017.
Please consult OVAL if you need to maintain using old product code due type approval.

Item	Product Code ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱	Description	Selector Chart: CA100, CA150 CA15H, CA200, CA20H, CA250	Selector Chart: High temp. service: CA100, CA150 (below 350℃)	Selector Chart: Low temp. explosionproof service: CA100, CA150,CA15H,CA200,CA20H,CA250
Model	C A	ALTImass Type U			
Nominal size	1 0 0	100mm connection (4″)			
	1 5 0	150mm connection (6″)			
	1 5 H	150mm connection (6″)			
	2 0 0	200mm connection (8″)			
	2 0 H	200mm connection (8″)			
	2 5 0	250mm connection (10″)			
Fluid category	A	Liquid service	○	○	○
Temp. category (※1)	2	Standard (below 200℃)	○	×	×
	3	High temperature service (below 350℃)	×	○	×
	4	Low temperature explosionproof service (−200℃ to +50℃)	×	×	○
Pressure category	1	Standard	○	○	○
Major parts material	S	SUS316L	○	○	○
Process connection	C	JIS 10K	○	○	○
	D	JIS 20K	○	○	○
	E	JIS 30K	○	○	○
	H	ASME 150	○	○	○
	J	ASME 300	○	○	○
	K	ASME 600	○	○	○
	L	JPI 150	○	○	○
	M	JPI 300	○	○	○
	N	JPI 600	○	○	○
	P	DIN PN 10	○	○	○
	Q	DIN PN 16	○	○	○
	R	DIN PN 25	○	○	○
	S	DIN PN 40	○	○	○
	Z	Other than above	○	○	○
Transmitter construction (※2)	1	Integrally mounted	○	×	×
	2	Separately mounted	○	○	○
Power source	1	20 to 30VDC			
	2	85 to 264VAC (Safety rated 100 to 240VAC), 50/60Hz			
Analog output (※3)	A	Output 1: Mass flow Output 2: Mass flow			
	B	Output 1: Mass flow Output 2: Density			
	C	Output 1: Mass flow Output 2: Temperature			
	D	Output 1: Mass flow Output 2: Volume flow (true density)			
	E	Output 1: Mass flow Output 2: Volume flow (fixed density)			
	F	Output 1: Density Output 2: Temperature			
	G	Output 1: Volume flow (true density) Output 2: Density			
	H	Output 1: Volume flow (fixed density) Output 2: Density			
	J	Output 1: Volume flow (true density) Output 2: Temperature			
	K	Output 1: Volume flow (fixed density) Output 2: Temperature			
	L	Output 1: Mass flow Output 2: Status			
	M	Output 1: Density Output 2: Status			
	N	Output 1: Temperature Output 2: Status			
	P	Output 1: Volume flow (true density) Output 2: Status			
	Q	Output 1: Volume flow (fixed density) Output 2: Status			
Pulse output (※3)	A	Mass flow			
	B	Volume flow (true density)			
	C	Volume flow (fixed density)			
Pulse output type	1	Open drain pulse (equivalent to open collector pulse) (standard)			
	2	Voltage pulse			
Communication interface	0	No communication capability			
	1	HART protocol version 7, Bell202			
Explosionproof rating	0	Non-explosionproof			
	1	TIIS			
Explosionproof temperature class	0	Non-explosionproof			
	1	Sensor unit: Temp. class T1, separate transmitter only, CA100 to CA150 (high temp. service model) only			
	2	Sensor unit: Temp. class T2, separate transmitter only			
	3	Sensor unit: Temp. class T3, separate transmitter only			
	4	Sensor unit: Temp. class T4			
	5	Sensor unit: Temp. class T5, separate transmitter only, Low temp. explosionproof service only			

NOTES ※1: Explosionproof specifications are restricted based on temperature class.
※2: For integrally mounted type, the maximum fluid temperature is 130℃. If the fluid temperature exceeds 80℃, maximum ambient temperature of the transmitter must be lowered. (For example, if the fluid temperature is 130℃, max ambient temperature of the transmitter is 45℃.)
※3: Simultaneous output of both "Volume flow (fixed density)" and "Volume flow (true density)" for analog output and pulse output is not available.

14.2 Type S product codes

Product code has been renewed on April 2017.
Old product code will not be updated after April 2017.
Please consult OVAL if you need to maintain using old product code due type approval.

14.2.1 Stainless steel tube type (CS010 to CS080)

Item	Product Code ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱	Description
Model	C S	ALTImass Type S
Nominal size	0 1 0	15mm connection (1/2")
	0 1 5	15mm connection (1/2")
	0 2 5	25mm connection (1")
	0 4 0	40mm connection (1･1/2")
	0 5 0	50mm connection (2")
	0 8 0	80mm connection (3")
Fluid category	C	High density liquid (1.0 to1.5g/ml)
	D	Ordinary density liquid (0.7 to 1.3g/ml)
	E	Low density liquids (0.5 to 1.0g/ml)
Temp. category (※1)	1	Standard (below 130°C)
Pressure category	1	Standard
Major parts material	S	SUS316L
Process connection	B	Ferrule
	C	JIS 10K
	D	JIS 20K
	H	ASME 150
	L	JPI 150
	Z	Other than above
Transmitter construction (※2)	1	Integrally mounted
	2	Separately mounted
Power source	1	20 to 30VDC
	2	85 to 264VAC (Safety rated 100 to 240VAC), 50/60Hz
Analog output	A	Output 1: Mass flow Output 2: Mass flow
	C	Output 1: Mass flow Output 2: Temperature
	E	Output 1: Mass flow Output 2: Volume flow (fixed density)
	L	Output 1: Mass flow Output 2: Status
	N	Output 1: Temperature Output 2: Status
	Q	Output 1: Volume flow (fixed density) Output 2: Status
Pulse output	A	Mass flow
	C	Volume flow (fixed density)
Pulse output type	1	Open drain pulse (equivalent of open collector output) (standard)
	2	Voltage pulse
Communication interface	0	No communication capability
	1	HART protocol version7, Bell202
Explosionproof rating	0	Non-explosionproof
	1	TIIS
Explosionproof temperature class	0	Non-explosionproof
	3	Sensor unit: Temp. class T3, separate transmitter only
	4	Sensor unit: Temp. class T4

NOTES ※1: Explosionproof specification has restrictions on temperature class.
※2: To measure fluid flow of temperature 80℃ or higher with integral type, the max ambient temperature of the transmitter should be reduced. (When the temperature of fluid is 130℃, the max ambient temperature of the transmitter should be 45℃.)

Product code has been renewed on April 2017.
Old product code will not be updated after April 2017.
Please consult OVAL if you need to maintain using old product code due type approval.

14.2.2 Titanium tube type (CS010 to CSR50)

Item	Product Code ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱	Description
Model	C S	ALTI*mass* Type S
Nominal size	0 1 0	10mm connection (1/2")
	0 1 5	15mm connection (1/2")
	0 2 5	25mm connection (1")
	0 4 0	40mm connection (1•1/2")
	0 5 0	50mm connection (2")
	R 5 0	80mm connection (3")
Fluid category	C	High density liquid (1.0 to1.5g/ml)
	D	Ordinary density liquid (0.7 to 1.3g/ml)
	E	Low density liquids (0.5 to 1.0g/ml)
Temp. category (※1)	1	Standard (130℃ or below)
Pressure category	1	Standard
Major parts material	T	SB338 Grade-9 + TB480H
Process connection	B	Ferrule
	C	JIS 10K
	D	JIS 20K
	H	ASME 150
	L	JPI 150
	Z	Other than above
Transmitter construction (※2)	1	Integrally mounted
	2	Separately mounted
Power source	1	20 to 30VDC
	2	85 to 264VAC (Safety rated 100 to 240VAC), 50/60Hz
Analog output (※3)	A	Output 1: Mass flow Output 2: Mass flow
	B	Output 1: Mass flow Output 2: Density
	C	Output 1: Mass flow Output 2: Temperature
	D	Output 1: Mass flow Output 2: Volume flow (true density)
	E	Output 1: Mass flow Output 2: Volume flow (fixed density)
	F	Output 1: Density Output 2: Temperature
	G	Output 1: Volume flow (true density) Output 2: Density
	H	Output 1: Volume flow (fixed density) Output 2: Density
	J	Output 1: Volume flow (true density) Output 2: Temperature
	K	Output 1: Volume flow (fixed density) Output 2: Temperature
	L	Output 1: Mass flow Output 2: Status
	M	Output 1: Density Output 2: Status
	N	Output 1: Temperature Output 2: Status
	P	Output 1: Volume flow (true density) Output 2: Status
	Q	Output 1: Volume flow (fixed density) Output 2: Status
Pulse output (※3)	A	Mass flow
	B	Volume flow (true density)
	C	Volume flow (fixed density)
Pulse output type	1	Open drain pulse (equivalent to open collector pulse) (standard)
	2	Voltage pulse
Communication interface	0	No communication capability
	1	HART protocol version7, Bell202
Explosionproof specification	0	Non-explosionproof
	1	TIIS
Explosionproof temperature class	0	Non-explosionproof
	3	Sensor unit: Temp. class T3, separate transmitter only
	4	Sensor unit: Temp. class T4

NOTES ※1: Explosionproof specification has restrictions on temperature class.
※2: To measure fluid flow of temperature 80℃ or higher with integral type, the max ambient temperature of the transmitter should be reduced. (When the temperature of fluid is 130℃, the max ambient temperature of the transmitter should be 45℃.)
※3: Simultaneous output of both "Volume flow (fixed density)" and "Volume flow (true density)" for analog output and pulse output is not available.

Product code has been renewed on April 2017.
Old product code will not be updated after April 2017.
Please consult OVAL if you need to maintain using old product code due type approval.

14.3 Type B product codes

Item	Product Code ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱	Description
Model	C B	ALTImass Type B
Nominal size	0 0 6	10mm connection (1/2")
	0 1 0	15mm connection (1/2")
	0 1 5	15mm connection (1/2")
	0 2 5	25mm connection (1")
	0 4 0	40mm connection (1・1/2")
	0 5 0	50mm connection (2")
Fluid category	A	Liquid service
Temp. category (※1)	1	Standard (130℃ and below)
Pressure category	1	Standard
Major parts material	S	SUS316L
Process connection	B	Ferrule
	C	JIS 10K
	D	JIS 20K
	E	JIS 30K
	H	ASME 150
	J	ASME 300
	K	ASME 600
	L	JPI 150
	M	JPI 300
	Z	Other than above
Transmitter construction (※2)	1	Integrally mounted
	2	Separately mounted
Power source	1	20 to 30VDC
	2	85 to 264VAC (Safety rated 100 to 240VAC), 50/60Hz
Analog output (※3)	A	Output 1: Mass flow Output 2 : Mass flow
	B	Output 1: Mass flow Output 2 : Density
	C	Output 1: Mass flow Output 2 : Temperature
	D	Output 1: Mass flow Output 2 : Volume flow (true density)
	E	Output 1: Mass flow Output 2 : Volume flow (fixed density)
	F	Output 1: Density Output 2 : Temperature
	G	Output 1: Volume flow (true density) Output 2 : Density
	H	Output 1: Volume flow (fixed density) Output 2 : Density
	J	Output 1: Volume flow (true density) Output 2 : Temperature
	K	Output 1: Volume flow (fixed density) Output 2 : Temperature
	L	Output 1: Mass flow Output 2: Status
	M	Output 1: Density Output 2: Status
	N	Output 1: Temperature Output 2: Status
	P	Output 1: Volume flow (true density) Output 2: Status
	Q	Output 1: Volume flow (fixed density) Output 2: Status
Pulse output (※3)	A	Mass flow
	B	Volume flow (true density)
	C	Volume flow (fixed density)
Pulse output type	1	Open drain pulse (equivalent of open collector output) (standard)
	2	Voltage pulse
Communication interface	0	No communication capability
	1	HART protocol version7, Bell202
Explosionproof rating	0	Non-explosionproof
	1	TIIS
Explosionproof temperature class	0	Non-explosionproof
	3	Sensor unit: Temp. class T3, separate transmitter only
	4	Sensor unit: Temp. class T4

NOTES ※1: Explosionproof specification has restrictions on temperature class.

※2: To measure fluid flow of temperature 80℃ or higher with integral type, the max ambient temperature of the transmitter should be reduced. (When the temperature of fluid is 130℃, the max ambient temperature of the transmitter should be 45℃.)

※3: Simultaneous output of both "Volume flow (fixed density)" and "Volume flow (true density)" for analog output and pulse output is not available.

■ Shipping Parameters

Given below is the explanation of parameters found in the parameter list attached to the product.

ALTI*mass* Ⅱ

No.	Item	Description	Factory setting	Setting
Device information				
1	Tag	Tag number (8-character)		
2	Long Tag	Tag number (32-character)		
3	Descriptor	Description		
4	Message	Message		
5	Date	Date of manufacture		
6	Dev ID	Device ID		
7	Final asmbly num	Final assembly number		
8	Snsr s/n	Sensor serial number		
9	Snsr model	Sensor model		
10	Flange	Flange rating		
11	Snsr matl	Sensor material		
12	Hardware rev	Hardware revision		
Sensor type				
13	Sensor type	Sensor type		
14	Mass flow USL	Mass flow max allowable range		
15	Mass flow LSL	Mass flow min. allowable range		
16	Temperature USL	Temperature max allowable range		
17	Temperature LSL	Temperature min. allowable range		
18	Vol flow USL	Volume flow max allowable range		
19	Vol flow LSL	Volume flow min. allowable range		
20	Density USL	Density max allowable range		
21	Density LSL	Density min. allowable range		
Flow				
22	Mass flow unit	Instantaneous mass flow unit		
23	Vol flow unit	Instantaneous volume flow unit		
24	Flow direction	Flow direction setting		
25	Flow damp (Mass)	Flow (Mass) damping		
26	Flow cutoff	Flow (Mass) cutoff		
27	Vol flow coef	Volume flow correction coefficient		
Density				
28	Unit	Density unit		
29	Damp	Density damping		
30	Slug low limit	Lower density limit of gas multiphase flow detection		
31	Slug high limit	Upper density limit of gas multiphase flow detection		
32	Slug duration	Time duration of gas multiphase flow detection		
33	Compensation	Standard temp. compensation setting		
34	Standard temp	Standard temperature		
35	Expansion coef	Expansion coefficient		
36	Settied density	Fixed density compensation setting		
37	Density Value	Fixed density value		
Temperature				
38	Unit	Temperature unit		
39	Damp	Temperature damping		
Analog output 1				
40	Assign	Analog output 1 assignment		
41	URV	Analog output 1 setting at 20mA		
42	LRV	Analog output 1 setting at 4mA		
43	Lowcut	Analog output 1 low-cut		
44	Added damp	Analog output 1 added damping		
Analog output 2				
45	Assign	Analog output 2 assignment		
46	URV	Analog output 2 setting at 20mA		
47	LRV	Analog output 2 setting at 4mA		
48	Lowcut	Analog output 2 low-cut		
49	Added damp	Analog output 2 added damping		

Continued on next page➡

No.	Item	Description	Factory setting	Setting
Pulse output 1				
50	Assign	Pulse output 1 assignment		
51	Freq factor	Pulse output 1 full scale frequency		
52	Rate factor	Pulse output 1 full scale flow rate		
53	Lowcut	Pulse output 1 low cut		
Pulse output 2				
54	Assign	Pulse output 2 assignment		
55	Double pulse mode	Double pulse output 2 assignment		
56	Freq factor	Pulse output 2 full scale frequency		
57	Rate factor	Pulse output 2 full scale flow rate		
58	Lowcut	Pulse output 2 low cut		
Status input/output				
59	Input function	Status input function selection		
60	Input mode	Status input mode selection		
61	Output function	Status output function selection		
62	Drive out point	Drive output voltage threshold		
63	Output mode	Status output mode selection		
H/L alarm				
64	H/L alarm assign	H/L alarm assignment		
65	H/L alarm type	H/L alarm type selection		
66	High alarm point	High alarm point		
67	Low alarm point	Low alarm point		
68	H/L alarm hys	H/L alarm hysteresis value		
Error select				
69	Sensor failure	Output selection for each item		
70	Transmitter failure			
71	Calibration failure			
72	Saturated alarm			
73	Parameter failure			
74	Transmitter alarm			
75	Slug flow alarm			
76	Calibration in progress			
77	Fixed output			
Error output				
78	Analog	Analog output pattern on errors		
79	Pulse	Pulse output pattern on errors		
Flow cal				
80	SK20	Meter factor of flow rate		
81	SKM	Meter error correction item		
82	SKt	Flow correction coefficient (Skt)		
83	Cal temp	Flow calibration temperature		
84	Cal temp (Outer)	Flow calibration temperature		
85	Cal freq	Flow calibration frequency		
86	SKdt	Flow correction coefficient (Skdt)		
87	SKfa	Flow correction coefficient (Skfa)		
88	SKfb	Flow correction coefficient (Skfb)		
89	FKt	Flow correction coefficient (Fkt)		
90	FKdt	Flow correction coefficient (Fkdt)		
Zero factor				
91	Snsr zero value	Sensor zero adjusting value		

➡NOTES ※1. If status output function is assigned to analog output 2, output will be made based on status output function setting, regardless of analog output 2 setting.

※2. This transmitter does not have pulse output 2 function. Only the parameters are stored internally.

SAFETY STATEMENT ON RETURNED GOODS

When you return your Coriolis flowmeter for repair or other processing, send us a fax of this Safety Statement and, at the same time, attach it to the equipment to be returned as we need to provide a safe working environment for our employees.
Unless the Safety Statement on Returned Goods is attached to the returned equipment, or if we find it difficult to ensure safety, we may decline, at our discretion, to accept and process the returned equipment.
(In case some residual metered fluid may be present in the housing, consult the factory.)

	Oval Coriolis Flowmeter ALTI*mass Ⅱ*	
Model		
Serial No.		
Process Fluid Names	List all chemicals and process fluids in contact with the equipment.	
Health and Safety Hazards	If an SDS is available, attach here.	
Precautions (First aid)	If an SDS is available, attach here.	

NOTE: SDS stands for Safety Data Sheet. It informs us of the physical and chemical properties of materials and how to handle them

I hereby certify that the equipment being returned has been cleaned and decontaminated in accordance with good industrial practices. This equipment poses no health or safety risks due to contamination.

Date:

Company Name			
Address			
Phone No.		Fax No.	
Job Title			
Signature by			
Reason for return			
Remarks			

REPAIR REQUEST SHEET

Company name			
Address			
Contact			
Return (shipping)			
Reason for return (type of order)	☐ Repair ☐ Calibration ☐ Replacement ☐ Return ☐ Others		
Delivery date		Date of installation	
Date of failure			
Descriptions of nonconformance (failure)			

◆ Unless the statements below are fully documented, returned equipment will not be processed.

Model			
Serial No.			
Fluid name			
Fluid density			
Fluid temperature			
Line pressure			
Specification modification	☐ Yes ☐ No		
Full scale flowrate			
Pulse output ①	☐ Mass ☐ Volume (fixed) ☐ Volume ☐ Pulse unit:		☐ O.C. ☐ Voltage
Analog output ①	☐ Mass ☐ Volume (fixed) ☐ Temperature ☐ Density	to	
Analog output ②	☐ Mass ☐ Volume (fixed) ☐ Temperature ☐ Density	to	
Sensor conditions	☐ Tubes empty (no obstacles)		
	☐ Sensor empty (no obstacles)		
	☐ Tubes clogged / contaminated		
Type of cleaning material used for sensor unit			

◆IMPORTANT

If sensor tubes leak, make sure that no process fluids remain in the housing. To provide a safe working environment for our employees and engineers, this form must be filled in completely and accurately. Unless accurate and precise information about the process fluids is given, returned equipment will NOT be processed. Include your instructions and conditions accurately and in detail.

➡NOTE: To avoid misunderstanding, completely fill in this form.

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L-760-19-E (1)

All specifications are subject to change without notice for improvement.

OVAL Corporation

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