User's Manual

Magnetic Flowmeter
CA Series
Installation Manual

IM 01E40A01-01EN



Size 15 mm (0.5in.)



Size 25 to 100 mm
(1 to 4 in.)



Size 150, 200 mm (6, 8 in.)

This manual outlines the basic guidelines for installation and wiring procedures. For the items which are not covered in this manual, read the user's manuals and the general specifications as listed in Table 1.1.
For explosion protection type, also read the applicable user's manual as listed in Table 1.1.

Contents

1. Introduction
1.1 For Safe Use of Product 3
1.2 Warranty....6

2. Receiving and Storage
2.1 Model and Specifications Check 7
2.2 Storage Precautions 7

3. Installation
3.1 Piping Design Precautions 8
3.2 Handling Precautions....10
3.2.1 General Precautions....10
3.2.2 Flowmeter Piping....11
3.3 Installation....12
3.3.1 Gasket Size (customer pipe)....17
3.4 Changing Direction of Display Unit....18

4. Wiring
4.1 Wiring Precautions....20
4.2 Cables....21
4.2.1 Recommended Cable for Power and Input/Output:....21
4.3 Cable Entries 21
4.3.1 When waterproof property is necessary (Wiring using waterproof glands) 22
4.3.2 Conduit Wiring....22
4.4 Connecting to External Products....23
4.4.1 Wiring Precautions for Power Supply Cables....23
4.4.2 DC Power Connection....24
4.4.3 Grounding....24
4.4.4 Connecting to External Products....25
4.4.5 Wiring Procedures....25
4.5 Input and Output 27

5. Basic Operating Procedures
5.1 Operation by Display unit....29
5.2 Display and Basic Configuration....29
5.2.1 Display....29
5.2.2 Basic Configuration for Display 30
5.3 Display Mode and Setting Mode....32
5.4 Parameter Setting from Display Panel 33
5.4.1 Setting example of Select type Data: Flow rate unit....33
5.4.2 Setting example of Numeric type Data: Flow rate span 33
5.4.3 Setting Example of Alphanumeric type Data: Tag No.....33
5.5 microSD Card Setting....34
5.6 HART Configuration Tool 34
5.6.1 Connections with HART Configuration Tool..34
5.6.2 HART Configuration Tool and Device Revision....35

6. Operation
6.1 Pre-operation Zero Adjustment....36
6.2 Zero Adjustment from Display Unit 36
6.3 Hardware Switch Setting 37

7. Errors and Countermeasures (Display unit)

1
2
3
4
5
6
7

YOKOGAWA
Yokogawa Electric Corporation

IM 01E40A01-01EN
3rd Edition

1. Introduction

This manual provides the basic guidelines for installation, wiring procedures and basic operation of Magnetic Flowmeter CA Series with HART protocol.
For the items which are not covered in this manual, read the applicable user's manuals and general specifications as listed in Table 1.1. These documents can be downloaded from the YOKOGAWA website. To ensure correct use of the product, read these manuals thoroughly and fully understand how to operate the product before operating it. For method of checking the model and specifications, read Chapter 2 and general specifications as listed in Table 1.1.
Website address:
https://www.yokogawa.com/fld/doc/
These manuals can be downloaded from the website of YOKOGAWA or purchased from the YOKOGAWA representatives.

Table 1.1 Manual and General Specifications List

Model	Document Title	Document No.
CA####	Magnetic Flowmeter Read Me First	IM 01E21A21-01Z1
	Magnetic Flowmeter CA Series Installation Manual	IM 01E40A01-01EN (this manual)
	Magnetic Flowmeter CA Series Maintenance Manual	IM 01E40A01-02EN
	Magnetic Flowmeter CA Series HART Communication Type	IM 01E40A02-01EN
	Magnetic Flowmeter CA Series FM(USA) Explosion Protection Type	IM 01E40A03-01EN
	Magnetic Flowmeter CA Series IECEx Explosion Protection Type	IM 01E40A03-03EN
	Magnetic Flowmeter CA Series Japan Explosion Protection Type	IM 01E40A03-04JA
	Magnetic Flowmeter CA Series General Specifications	GS 01E40A01-01EN

NOTE

When describing the model name like CA#### in this manual, "####" means any of the following.
0015, 0025, 0040, 0050, 0080, 0100, 0150, 0200

■ Precautions Related to the Protection, Safety, and Alteration of the Product

The following safety symbol marks are used in this manual and product.

WARNING

A WARNING sign denotes a hazard. It calls attention to procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in injury or death of personnel.

CAUTION

A CAUTION sign denotes a hazard. It calls attention to procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product.

IMPORTANT

An IMPORTANT sign denotes that attention is required to avoid damage to the product or system failure.

NOTE

A NOTE sign denotes information necessary for essential understanding of operation and features.

The following symbols are used in the Product and the manual to indicate the accompanying safety precautions:

- Protective grounding terminal
- Functional grounding terminal (This terminal should not be used as a protective grounding terminal.)
- Alternating current
- Direct current
- Caution
  This symbol indicates that the operator must refer to an explanation in the user's manual in order to avoid the risk of injury or death of personnel or damage to the product.

- For the protection and safe use of the product and the system in which this product is incorporated, be sure to follow the instructions and precautions on safety that is stated in this manual whenever you handle the product. Take special note that if you handle the product in a manner that violated these instructions, the protection functionality of the product may be damaged or impaired. In such cases, YOKOGAWA does not guarantee the quality, performance, function, and safety of product.

All Rights Reserved, Copyright © 2022, Yokogawa Electric Corporation

- When installing protection and/or safety as lighting protection devices and equipment for the product and control system or designing or installing separate protection and/or safety circuits for fool-proof design and fail-safe design of the processes and lines that use the product and the control system, the user should implement these using additional devices and equipment.
- Should use the parts specified by YOKOGAWA when replacing. Please contact YOKOGAWA's service office for fuse replacement.
- This product is not designed or manufactured to be used in critical applications that directly affect or threaten human lives. Such applications include nuclear power equipment, devices using radioactivity, railway facilities, aviation equipment, air navigation facilities, aviation facilities, and medical equipment. If so used, it is the user's responsibility to include in the system additional equipment and devices that ensure personnel safety.
- Do not modify this product.
- YOKOGAWA will not be liable for malfunctions or damage resulting from any modification made to this product by the customer.
- The product should be disposed of in accordance with local and national legislation/regulations.

■ Regarding This User's Manual

- This manual should be provided to the end user.
- The contents of this manual are subject to change without prior notice.
- All rights reserved. No part of this manual may be reproduced in any form without YOKOGAWA's written permission.
- YOKOGAWA makes no warranty of any kind with regard to this manual, including, but not limited to, implied warranty of merchantability and fitness for a particular purpose.
- If any question arises or errors are found, or if any information is missing from this manual, inform the nearest YOKOGAWA sales office.
- The specifications covered by this manual are limited to those for the standard type under the specified model number break-down and do not cover custom-made products.
- Note that changes in the specifications, construction, or component parts of the product may not immediately be reflected in this manual at the time of change, provided that postponement of revisions will not cause difficulty to the user from a functional or performance standpoint.
- This manual is intended for the following personnel;
  Engineers responsible for installation and wiring of the product.
  Personnel responsible for normal daily operation of the product.
- To ensure correct use, read this manual and the applicable manuals as listed in Table 1.1 thoroughly before starting operation. Read the general specifications as listed in Table 1.1 for its specification.

■ Trademarks:

- HART is a registered trademark of FieldComm Group.
- All the brands or names of Yokogawa Electric's products used in this manual are either trademarks or registered trademarks of Yokogawa Electric Corporation.
- All other company and product names mentioned in this manual are trade names, trademarks or registered trademarks of their respective companies.
- In this manual, trademarks or registered trademarks are not marked with ™ or ®.

1.1 For Safe Use of Product

For the protection and safe use of the product and the system in which this product is incorporated, be sure to follow the instructions and precautions on safety that is stated in this manual whenever you handle the product. Take special note that if you handle the product in a manner that violated these instructions, the protection functionality of the product may be damaged or impaired. In such cases, YOKOGAWA shall not be liable for any indirect or consequential loss incurred by either using or not being able to use the Product.

(1) General

- This product conforms to IEC safety class I (with Protective grounding terminal), Installation Category (Overvoltage Category) II, No Measurement Category ("O"(Other)), Micro Pollution degree 2, Macro Pollution degree 4.
- CA0015, CA0025, CA0040, CA0050, CA0080 and CA0100 conforms to EN61326-1, EN61326-2-3, EN61000-3-2, and EN61000-3-3 (EMC standard). CA0150, CA0200 conforms to EN61000-3-2, and EN61000-3-3 (EMC standard).
- CA0015, CA0025, CA0040, CA0050, CA0080 and CA0100 conform to EN61326-1 (EMC standard), Class A (for use in commercial, industrial, or business environments).
  CA0150 and CA0200 conform to EN55011 (EMC standard), Class A (for use in commercial, industrial, or business environments).
- This product is complied with IP66 and IP67 in the EN60529.
  YOKOGAWA assumes no liability for the customer's failure to comply with these requirements.
- This product is designed for indoor and outdoor use.
- This product is designed for altitude at installation site Max. 2000 m above sea level.

CAUTION

CA0015, CA0025, CA0040, CA0050, CA0080 and CA0100 conform to Class A product in the EN61326-1 (EMC standard). CA0150 and CA0200 conform to class A product in the EN55011 (EMC standard). Operation of this product in a residential area may cause radio interference, in which case the user is required to take appropriate measures to correct the interference.

IMPORTANT

The minimum ambient temperature is limited by the minimum fluid temperature of the sensor (the lining). For more information, read the applicable general specifications as listed in Table 1.1.

WARNING

- **Purpose of use**
  This product is the Magnetic Flowmeter for use of measuring the liquid flow. Do not use this product for other purposes.

WARNING

- Installation, wiring and maintenance of the magnetic flowmeter must be performed by expert engineer or skilled personnel. No operator shall be permitted to perform procedures relating to installation, wiring and maintenance.
- Wiring work should be done adequate wire, sleeve crimp and torque force. Use terminal with insulating cover for the power supply wiring and protective grounding wiring. Do not pull the wires too much strongly in order to prevent electric shocks caused by their damage.
- Do not open the cover in wet weather or humid environment. When the cover is open, stated enclosure protection is not applicable.
- Ensure that the power supply is off in order to prevent electric shocks.
- When opening the cover, wait for more than 20 minutes after turning off the power. Only expert engineer or skilled personnel are permitted to open the cover.
- When opening and closing the transmitter cover, be sure to handle the transmitter cover carefully so that there are no damage and foreign matter adhesion at its threads and O-ring.
- This product employs the parts which are affected by a function damage caused by static electricity. Thus, you should do the antistatic work using an anti-static wrist band for it and be careful to avoid touching each electrical parts and circuitry directly.
- When connecting the wiring, check that the supply voltage is within the range of the voltage specified for this product before connecting the power cable. In addition, check that no voltage is applied to the power cable before connecting the wiring.
- To prevent electric shocks, ensure the electrical wiring cover is completely attached after the wiring work.
- To prevent electric shocks, do not impress over rated voltage to each input/output terminals.
- If there is any unused cable entry, use the blanking plug to cover which comes with this product or which is supplied by YOKOGAWA. The blanking plug should be fastened into the unused cable entry without any mistake. If not, stated enclosure protection is not applicable.
- To prevent electric shocks, do not remove safety cover (Read section 3.4).

IMPORTANT

- When closing the cover, close it with both hands until the cover does not turn in order to bring the housing and cover into tight contact.
- Tighten while confirming that the cover rotates smoothly.

(2) Installation



WARNING

- The magnetic flowmeter is a heavy product. Be careful that no damage is caused personnel through accidentally dropping it, or by exerting excessive force on the magnetic flowmeter. When moving the magnetic flowmeter, always use a trolley and have at least two people carry it.
- Do not apply excessive weight, for example, a person stepping on the magnetic flowmeter.
- The magnetic flowmeter must be installed within the specification conditions.
- **Connect the Protective Grounding Terminal**
  Ensure to connect the protective grounding to prevent electric shock before turning on the power.
- **Do Not Impair the Protective Grounding**
  Never cut off the internal or external protective grounding wire or disconnect the wiring of the protective grounding terminal. Doing so invalidates the protective functions of the product and poses a potential shock hazard.
- **Do Not Operate with Defective Protective Grounding**
  Do not operate the product if the protective grounding might be defective. Also, ensure to check them before operation.
- **Do Not Operate in an Explosive and Corrosive Atmosphere**
  Do not operate the product in the presence of flammable gas, vapors, or combustible dust in general use. Select the explosion protection type under the explosion-proof environment. Operate the the product comply to appropriate explosion-proof certificate in the presence of flammable gas or combustible dust. Prolonged use in a highly dense corrosive gas (H_2S, SO_x, etc.) will cause a malfunction.
- **Ground the Product before Making External Connections**
  Connect the protective grounding before connecting to the item under measurement or control unit.
- **Damage to the Protection**
  Operating the product in a manner neither described in this manual nor the manuals as listed in Table 1.1 may damage the product's protection.



WARNING

- The flowmeter should be installed away from electrical motors, transformers, and other power sources in order to avoid interference with measurement.
- Install an external switch or circuit breaker as a means to turn the power off (capacitance: 15A, conforming to EN/IEC60974-2 and EN/IEC60947-3. Locate this switch either near the product or in other places facilitating easy operation. Affix a "Power Off Equipment" label to this external switch or circuit breaker.
- All procedures relating to installation must comply with the electrical code of the country where it is used.

(3) Wiring



WARNING

- When wiring the conduits, pass the conduit through the wiring connection port, and utilize the waterproof gland to prevent water from flowing in. Install a drain valve at the low end of the vertical pipe, and open the valve regularly.
- Do not connect cables outdoors in wet weather in order to prevent damage from condensation and to protect the insulation, e.g. inside the terminal box of the flowmeter.
- The transmitter case should be removed by YOKOGAWA's qualified personnel only. Opening the transmitter case is dangerous, because some areas inside the product have high voltages.
- The protective grounding must be connected securely at the terminal with the ⏚ mark to avoid danger to personnel.

(4) Operation



WARNING

Be sure to enable the write protect function to prevent the overwriting of parameters after finishing parameter setting.
In rare cases, the infra-red switches may respond unexpectedly in such conditions as sticking ball of water or extraneous substances on the surface of display panel glass according to the principle of infra-red switch operation. Its probability rises in such cases as sticking rain water by storm or other similar situation and washing up work near flowmeter installation place. Blinking light from a flashlight etc. to the infra-red switches may result in the malfunction.
Read Section 6.3 for the hardware write protect function, and the user's manual of applicable communication type as listed in Table 1.1 for the software write protect function.

(5) Maintenance

WARNING

- When maintaining the product, read the maintenance manual as listed in Table 1.1. Do not perform the maintenance that is not described in the manual. If necessary, contact YOKOGAWA.
- When the magnetic flowmeter is processing hot fluids, the product itself may become extremely hot. Take sufficient care not to get burnt.
- Where the fluid being processed is a toxic substance, avoid contact with the fluid and avoid inhaling any residual gas, even after the product has been taken off the piping line for maintenance and so forth.
- If dirt, dust or other substances surfaces on the glass of display cover, wipe them clean with a soft dry cloth.
- Maintenance of this flowmeter should be implemented in a maintenance service shop where the necessity tools and environment condition are provided.
  The necessity of this environmental condition is that ambient temperature is 5 to 40°C (the maximum relative humidity is 80 % for temperature 5 to 31°C, and decreasing linearly to 50 % relative humidity at 40°C).

(6) Modification

- Do not modify this product.
- YOKOGAWA will not be liable for malfunctions or damage resulting from any modification made to this product by the customer.

(7) Product Disposal

The product should be disposed of in accordance with local and national legislation/regulations.

(8) Power Supply

Ensure that the source voltage matches the voltage of the power supply before turning on the power.
Power Supply Code 1:

- AC Type:
  Rated Power Supply: 100 to 240 V AC, 50/60 Hz
- DC Type:
  Rated Power Supply: 100 to 120 V DC

Power Supply Code 2:

- AC Type:
  Rated Power Supply: 24 V AC, 50/60 Hz
- DC Type:
  Rated Power Supply: 24 V DC

Power Consumption: 13W
Note: Power Consumption is independent of communication and I/O specification.

(9) microSD Card

IMPORTANT

- Do not store or use the microSD card in places with static electricity, near electrically charged objects, or where electrical noise is present. Doing so can result in shock or damage.
- Do not disassemble or modify the microSD card.
- Do not physically shock, bend, or pinch the microSD card.
- During reading/writing of data, do not turn off the power, apply vibration or shock, or pull out the card. Data can corrupt or be permanently lost.
- Use only micro SD cards sold by YOKOGAWA. Operation cannot be guaranteed when other cards are used.
- When inserting the microSD card into the product, make sure to orient the microSD card correctly (face up or down) and insert it securely. If not inserted correctly, the microSD card will not be recognized by the product.
- Do not touch the microSD card with wet hands.
- Do not use the microSD card if it is dusty or dirty.
- The microSD card comes formatted. If you want to format the microSD card, use the product's Format function.
- YOKOGAWA provides no warranty for damage to, or loss of data recorded on the microSD card, regardless of the cause of such damage or loss. We recommend making backup copies of your data.

(10) Explosion Protection Type

WARNING

- Magnetic flowmeters with the model name CA is a product which have been certified as explosion protection type products. Strict limitations are applied to the structures, installation locations, external wiring work, maintenance and repairs, etc. of these products. Sufficient care must be taken, as any violation of the limitations may cause dangerous situations. Be sure to read the user's manual of the applicable explosion protection type as listed in Table 1.1 before handling the products.
- Only trained persons use this product in the industrial location.
- The protective grounding ⏚ must be connected to a suitable grounding system of explosion protection.
- Take care not to generate mechanical spark when access to the product and peripheral devices in hazardous locations.

(11) Ambient Temperature

–20 to 50°C (–4 to 122°F)
Note: Minimum value is limited according to minimum fluid temperature of sensor's specification.

(12) Ambient Humidity

5 to 80% (no condensation)

1.2 Warranty

- The warranty shall cover the period noted on the quotation presented to the purchaser at the time of purchase. Problems occurred during the warranty period shall basically be repaired free of charge.
- In case of problems, the customer should contact the YOKOGAWA representative from which the product was purchased, or the nearest YOKOGAWA office.
- If a problem arises with this product, please inform us of the nature of the problem and the circumstances under which it developed, including the model specification and serial number. Any diagrams, data and other information you can include in your communication will also be helpful.
- Responsible party for repair cost for the problems shall be determined by YOKOGAWA based on our investigation.
- The Purchaser shall bear the responsibility for repair costs, even during the warranty period, if the malfunction is due to:
  - Improper and/or inadequate maintenance by the purchaser.
  - Failure or damage due to improper handling, use or storage which is out of design conditions.
  - Use of the product in question in a location not conforming to the standards specified by YOKOGAWA, or due to improper maintenance of the installation location.
  - Failure or damage due to modification or repair by any party except YOKOGAWA or an approved representative of YOKOGAWA.
  - Malfunction or damage from improper relocation of the product in question after delivery.
  - Reason of force majeure such as fires, earthquakes, storms/floods, thunder/lightening, or other natural disasters, or disturbances, riots, warfare, or radioactive contamination.

2. Receiving and Storage

When the product is delivered, check visually that no damage has occurred during transportation. Also check that all flowmeters mounting hardware shown below is included.

Model	Part name	Qty.
CA0###	Centering Device	1 set
	Blanking Plug (*1)	0 to 2 pcs.
	Gasket (sensor side) (*2)	2 sheets

*1: When the following code is specified for “Power Supply” and “Communication and I/O”, the following quantity of blind plug is attached.

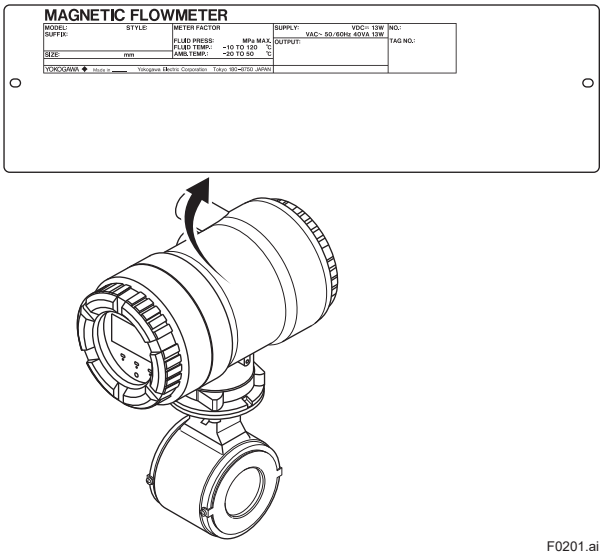
Power Supply code	Communication and I/O code	Qty.
-1	JA	1 pc.
	JE	0 pc.
-2	JA	2 pcs.
	JE	1 pc.

*2: The gaskets (customer pipe side) should be prepared by customers.

2.1 Model and Specifications Check

As shown in Figure 2.1, the model, suffix code, serial number, meter factor, fluid specification, and device information are found on the name plate located on the outside of the housing. And, this product can check their information from parameters. Read the user’s manual of applicable communication type as listed in Table 1.1 for checking device information from parameters.
When checking the matching of model and specification you ordered, see the applicable general specifications as listed in Table 1.1.
Be sure you have the model code and serial number available when contacting YOKOGAWA.
The model and specification described on the nameplate are those of the state at the time of shipment.

Note: Description on the nameplate
- Made in _____: Country of origin



F0201.ai

Figure 2.1 Name Plate

2.2 Storage Precautions

If the product is to be stored for a long period of time after delivery, observe the following points.

- The product should be stored in its original packing condition in the storage location.
- Select a storage location that fulfils the following conditions:
  - A place where it will not be exposed to rain or water
  - A place subject to minimal vibrations or shocks
  - Temperature and humidity levels should be as follows:
    Temperature: -20 to 50°C
    Humidity: 5 to 80% RH (no condensation)
    The preferred ambient temperature and humidity levels are 25°C and approximately 65% RH.
- If the product is transferred to the installation site and stored without being installed, its performance may be impaired due to the infiltration of rainwater and so forth. Be sure to install and wire the product as soon as possible after transferring it to the installation location.

3. Installation

WARNING

Installation of the magnetic flowmeter must be performed by expert engineer or skilled personnel. No operator shall be permitted to perform procedures relating to installation.

IMPORTANT

Please do not change the transmitter orientation at the customer's site.

Installation Location Precautions

Select the installation location with consideration to the following items to ensure long-term stable operation of the product.

■ Ambient Temperature:

Avoid installing the product in locations with constantly fluctuating temperatures. If the location is subject to radiant heat from the plant, provide heat insulation or improve ventilation.

■ Atmospheric Condition:

Avoid installing the product in a corrosive atmosphere. In situations where this is unavoidable, consider ways to improve ventilation and to prevent rainwater from entering and being retained in the conduit pipes.

■ Vibrations or Shocks:

Avoid installing the product in a place subject to shocks or vibrations.

3.1 Piping Design Precautions

IMPORTANT

Design piping correctly, referring to the following to prevent damage to sensors and to assure accurate measuring.

(1) Location

IMPORTANT

Install the flowmeter in a location where it is not exposed to direct sunlight. The minimum ambient temperature is limited by the minimum fluid temperature of the sensor (the lining). For more information, read the applicable general specification as listed inTable 1.1.

(2) Noise Avoidance

IMPORTANT

The flowmeter should be installed away from electrical motors, transformers, and other power sources in order to avoid interference with measurement. When installing two or more magnetic flowmeters, provide a distance of at least 10D (D is size of model code) or 1 m each other. Please select whichever is father distance. If diameters of them are different, let D be the larger one.

(3) Required Straight Pipe Length

Based on JIS B 7554 "Magnetic Flowmeters" and our piping condition test data, we recommend the piping conditions as shown in the following figures. This is not always enough when the piping line incorporates multiple conditions at the same time.

IMPORTANT

In the application for pure water, pure alcohol and other fluids which have low conductivity with low viscosity, we recommend the upper stream length of straight run of the product be 20D (where D denotes sensor size) or more.

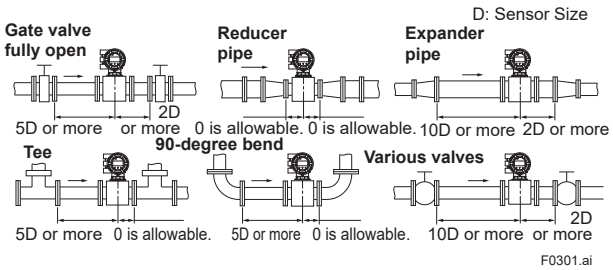


Figure 3.1.1 Required Straight Pipe Length

*1: Do not install anything in the vicinity that may interfere with the magnetic field, induced signal voltages, or flow velocity distributions of the flowmeter.

*2: A straight run may not be required on the downstream side of the flowmeter. However, if a downstream valve or other fitting causes irregularity or deviation in flows, provide a straight run of 2D to 3D on the downstream side.

*3: The valves shall be mounted on the downstream side so that deviated flows do not occur in the sensor and to avoid startup from an empty condition.

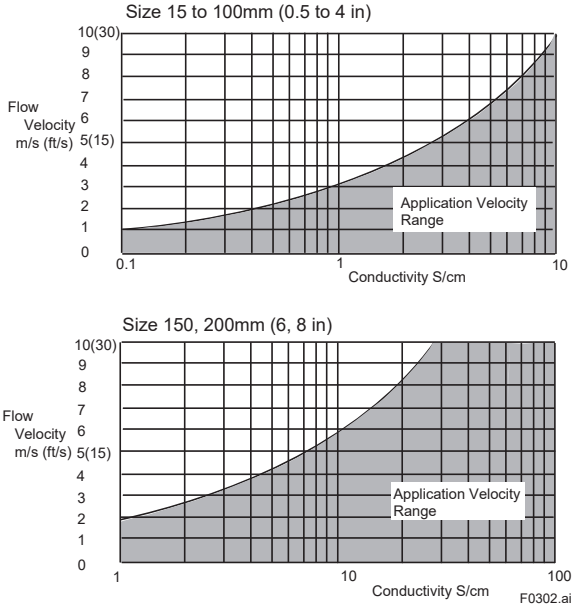
*4: In case the piping conditions are compounded, install on the straight pipe section where the upstream part is sufficiently rectified.

(4) Applicable Velocity Range in Low Conductivity Fluid Measurement

IMPORTANT

① When used for fluids with high flow noise (pure water, alcohols) and low viscosity and low conductivity, Flow velocity in the range below is available.

② The fluid that cause phase separation and has higher fluid conductivity around the inner surface of the flowtube cannot be measured.



(5) Maintaining Stable Fluid Conductivity

IMPORTANT

Do not install the flowmeter where fluid conductivity tends to become uneven. If chemicals are fed near the upstream side of a magnetic flowmeter, they may affect the flow rate's indications. To avoid this situation, it is recommended that the chemical feed ports be located on the downstream side of the flowmeter. If it is unavoidable that chemicals must be fed on the upstream side, provide a sufficient straight pipe length (approximately 50D or more) to ensure the proper mixture of fluids.

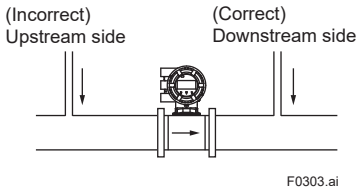


Figure 3.1.2 Chemical Injection

(6) Precautions for Use of Liquid Sealing Compounds

IMPORTANT

Care must be taken in using liquid sealing compounds on the piping, as it may have a negative influence on the flow indications by flowing out and covering the surfaces of an electrode or grounding ring. In particular, care must be taken if a liquid sealing compound is used in the case of vertical piping.

(7) Service Area

Select locations where there is adequate space to service installing, wiring, overhauling, etc.

(8) Bypass Line

It is recommended to install a bypass line to facilitate maintenance and zero adjustment.

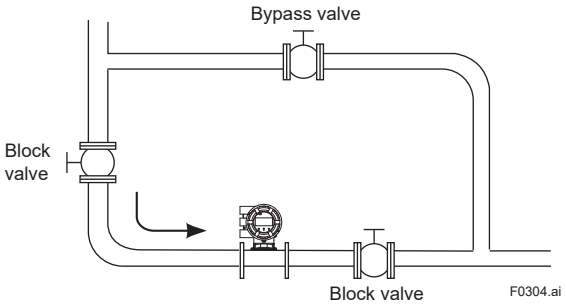


Figure 3.1.3 Bypass Line

(9) Supporting the Flowmeter

CAUTION

Do not secure the flowmeter separately to prevent the vibrations, shocks, and expansion and contraction forces of the piping from affecting it. Fix the pipes first, then support the flowmeter with the pipes. With flowmeter of size 15 mm (0.5 in.), in particular, fix the flowmeter in parallel with the piping on a mounting base.
A non-magnetic material is recommended for the mounting base.

(10) Mounting Positions

- **Pipes must be fully filled with liquids.**

IMPORTANT

If the pipe is empty, the output fluctuates or the Process Alarm (Signal Overflow) occurs. The pipe must be fully filled with liquid.
Piping shall be designed so as to maintain the interior of the sensor filled with fluids.
Vertical mounting is effective in such cases as when fluids tend to separate or solid matter may be precipitated. When employing vertical mounting, direct the fluids from the bottom to the top to ensure that the pipes remain fully filled.

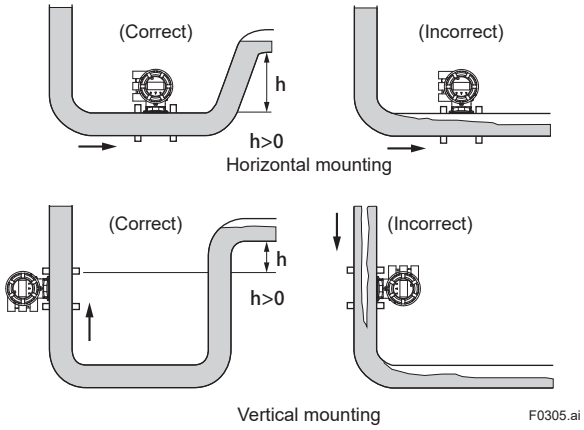


Figure 3.1.4 Mounting Positions

- **Avoid air bubbles.**

IMPORTANT

If air bubbles enter a measurement pipe, flow rate indications may be affected and measurement errors may be caused.

In cases where fluids contain air bubbles, piping must be designed to prevent them from accumulating in the measurement pipe of a sensor.
If a valve exists near the flowmeter, try to mount the flowmeter on the valve's upstream side in order to prevent a possible reduction of pressure inside the pipe, thereby avoiding the possibility of air bubbles.

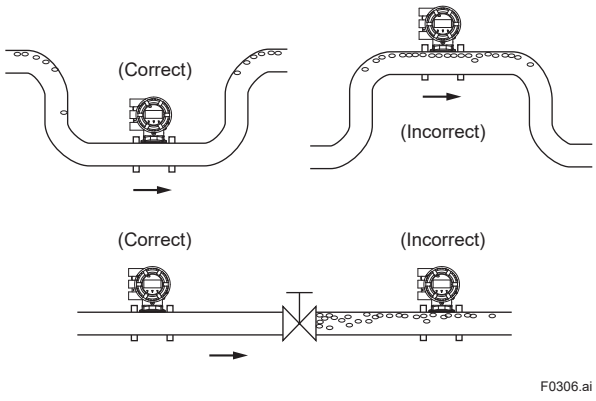


Figure 3.1.5 Avoiding Air Bubbles

- **Mounting orientation**

IMPORTANT

Install the magnetic flowmeter so that the electrodes position is not perpendicular to the ground. Otherwise it may cause the measuring errors because air bubbles at upper side or slurry at downside covers the electrode. Mount the transmitter of the product above the piping to prevent water from entering them.

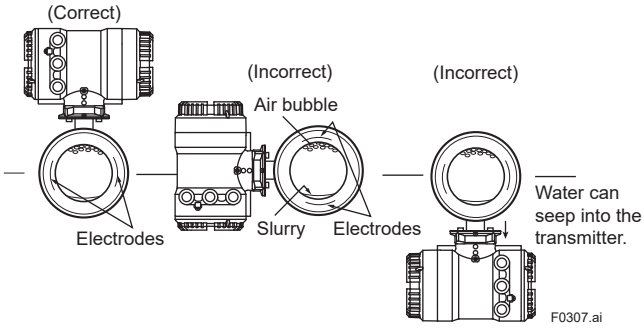


Figure 3.1.6 Mounting Orientation

3.2 Handling Precautions

WARNING

The magnetic flowmeter is a heavy product.
Be careful that no damage is caused to personnel through accidentally dropping it, or by exerting excessive force on the magnetic flowmeter. When moving the magnetic flowmeter, always use a trolley and have at least two people carry it.

3.2.1 General Precautions

(1) Precaution during Transportation

The magnetic flowmeter is packed tightly. When it is unpacked, pay attention to prevent damaging the flowmeter. To prevent accidents while it is being transported to the installing location, transport it to the site in its original packing.

CAUTION

In case the Magnetic Flowmeter size 150, 200 mm (6, 8 in.) lifts up, refer to Figure 3.2.1. Please never lift up by using a bar through the sensor.

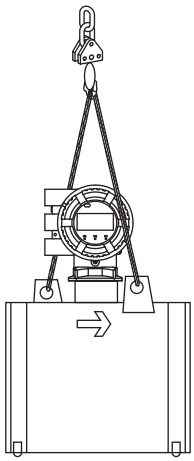


Figure 3.2.1 Lifting Flowmeter

(2) Avoid Shocks from Impact

CAUTION

Care should be taken not to drop the flowmeter or expose it to excessive shock. In particular, be careful not to subject the edge surface to shock. This may lead to lining damage which will result in inaccurate readings.

(3) Terminal Box Cover

IMPORTANT

As it is possible that the insulation will deteriorate, do not open the terminal box cover until it is time to wire it.

(4) Long-term Non-use

IMPORTANT

It is not desirable to leave the flowmeter unused for a long term after installation. If this situation is unavoidable, take care of the flowmeter by observing the following.

- **Confirmation of sealing conditions for the flowmeter**

Confirm that the terminal box screw and cable entries are well sealed. Equip the conduit piping with drain plugs or waterproof glands to prevent moisture or water from penetrating into the flowmeter through the conduit.

- **Regular inspections**

Inspect the sealing conditions as mentioned above, and the inside of the terminal box at least once a year.
Also, due to rain, etc. when it is suspected that water may have penetrated into the inside of the flowmeter, perform supplementary inspections.

3.2.2 Flowmeter Piping

IMPORTANT

Please be sure the inner diameter of the gasket between Magnetic Flowmeter CA Series and piping flange does not protrude to inner piping. It can lead to error in measurement. This is important especially for low conductivity fluid.

WARNING

Misaligned or slanted piping can lead to leakage and damage to the flanges.

(1) Correct any misaligned or slanted piping, and any gaps that may exist between mounting flanges before installing the flowmeter (see Figure 3.2.2).

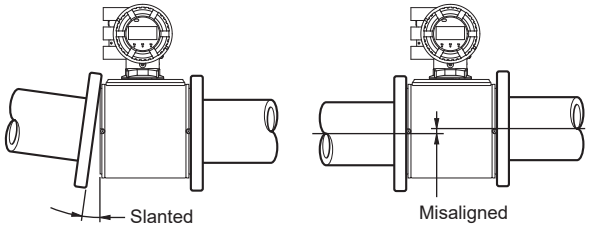


Figure 3.2.2 Slanted and Misaligned Flowmeter Piping

(2) Inside a newly installed pipeline, there may be some foreign substances such as residue from welding or wood chips. Remove them by flushing the piping before mounting the flowmeter. This prevents the lining from being damaged, as well as the occurrence of erroneous measured signals resulting from foreign substances passing through the sensor during measurement.

3.3 Installation

WARNING

All gaskets used for piping of Magnetic Flowmeters should be prepared by customers except in some cases.
The gaskets to be used between the grounding ring and the ceramics tube are shipped with products regardless of specifying optional grounding ring. Be sure to use them. When the gasket for plastic piping is specified (optional code: GA), use the attached gasket as well.

NOTE

The tightening torque of gaskets varies by the type and external dimensions of the gasket. The tightening torque values and the corresponding gasket types are indicated in the tables of this section. The dimentions of the gasket used for piping-side flange should be decided by referring to Subsection 3.3.1.

IMPORTANT

Use bolts and nuts in compliance with the flange ratings.
When stud-type through-bolts are used, be sure the outside diameter of the shank is smaller than that of the thread ridge. Be sure to choose a gasket with inner and outer diameters that does not protrude inside the piping (Refer to Table 3.3.5). If the inner diameter of the gasket is too large, or outer diameter of the gasket is too small, fluid leakage may result.
Ceramics tube is damaged if excessive torsion is applied. Be careful not to apply the torsion to the sensor when connecting pipings near the flowmeter by using pipe thread.

(1) Mounting Direction

Mount the flowmeter so that the flow direction of the fluid to be measured is in line with the direction of the arrow mark on the flowmeter.

IMPORTANT

If it is impossible to match the direction of the arrow mark, the direction of the electrical connection can be changed. In case the fluid being measured flows against the arrow direction, change the value from “Forward” to “Reverse” at the parameter “Flow direct”. Read the user’s manual of the applicable communication type as listed in Table 1.1.

Display Menu Path:
Device setup ► Detailed setup ► AUX calculation ► Flow direct

(2) Mounting Centering Devices

To maintain concentricity of the flowmeter with the pipes, install centering devices. Use the appropriate centering devices according to the nominal diameter and the flange ratings.

- **Size: 15 to 40 mm (0.5 to 1.5 in.)**
  Pass two through-bolts through the adjacent holes of both flanges and position the flowmeter so that the Mini-flanges and the centering devices come in close contact with each other.
  In case stud-type through-bolts are used, position them in such a way that the centering devices come in contact with the bolt threads.
  Pass the other through-bolts through the other holes.
  See Figure 3.3.2 and Figure 3.3.3 for the mounting.
- **Size: 50 to 200 mm (2 to 8 in.)**
  From the process piping side, pass two through-bolts through the adjacent two holes (the lower two holes for horizontal mounting) of both of the flanges and the four centering devices (two for each bolt). Be careful to prevent the four centering devices from coming into contact with the sensor housing.
  In case stud-type through-bolts are used, position them in such a way that the four centering devices come in contact with the bolt threads.
  Pass the other through-bolts through the other holes.
  See Figure 3.3.4 for the mounting.

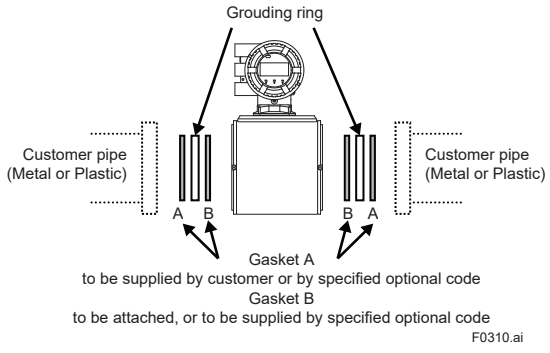
NOTE

For Size 50 to 200 mm (2 to 8 in.), the centering devices are engraved with an identifying character. Be sure to use the appropriate ones which meet the required specifications by referring to Table 3.3.4.

(3) Installation of Gasket

The gaskets (supplied by customer) used for connection with customer pipes differ by the specifications selected. Paying attention to this point, be sure to use the gaskets in compliance with the flange ratings and fluid specification. Install the gaskets as the followings.
Be sure to choose gaskets with inner and outer diameters that do not protrude inside the piping by referring to Subsection 3.3.2.

- **Installation: Plumbing with Metal pipe**
  When Magnetic Flowmeter CA Series is installed to metal pipe without lining, for gasket A (customer pipe side), be sure to use non-asbestos joint sheet gasket, PTFE-sheathed non-asbestos joint sheet gasket (optional code BSF) or gasket with the equivalent hardness. For gasket B (sensor side), use the attached fluororesin with ceramic fillers gasket (Valqua #7020), fluororesin with carbon gasket (optional code GF), or gasket with equivalent hardness. It is recommended to use gasket with same hardness for gasket A and B.
- **Installation: Plumbing with Plastic pipe**
  When Magnetic Flowmeter CA Series is installed to plastic pipe, be sure to use grounding ring. For gasket A (customer pipe side), use fluororubber gasket, chloroprene rubber gasket (optional code BSC) or gasket with the equivalent hardness. For gasket B (sensor side), use fluororubber gasket (optional code GA) or gasket with the equivalent hardness. It is recommended to use gasket with same hardness for gasket A and B.
  - Installation with grounding ring



(4) Tightening Nuts

Tighten the nuts according to the torque values for metal piping in Table 3.3.1. For plastic piping, select an optional code of GA, use rubber gaskets and tighten the nuts to the torque values for plastic piping in Table 3.3.2.
For permeable fluids (such as nitric acid, hydrofluoric acid, or sodium hydrate at high temperatures), tighten the nuts according to the torque values in Table 3.3.3.

CAUTION

Be sure to tighten the nuts according to the prescribed torque values. Tighten them diagonally with the same torque values, step by step up to the prescribed torque value.

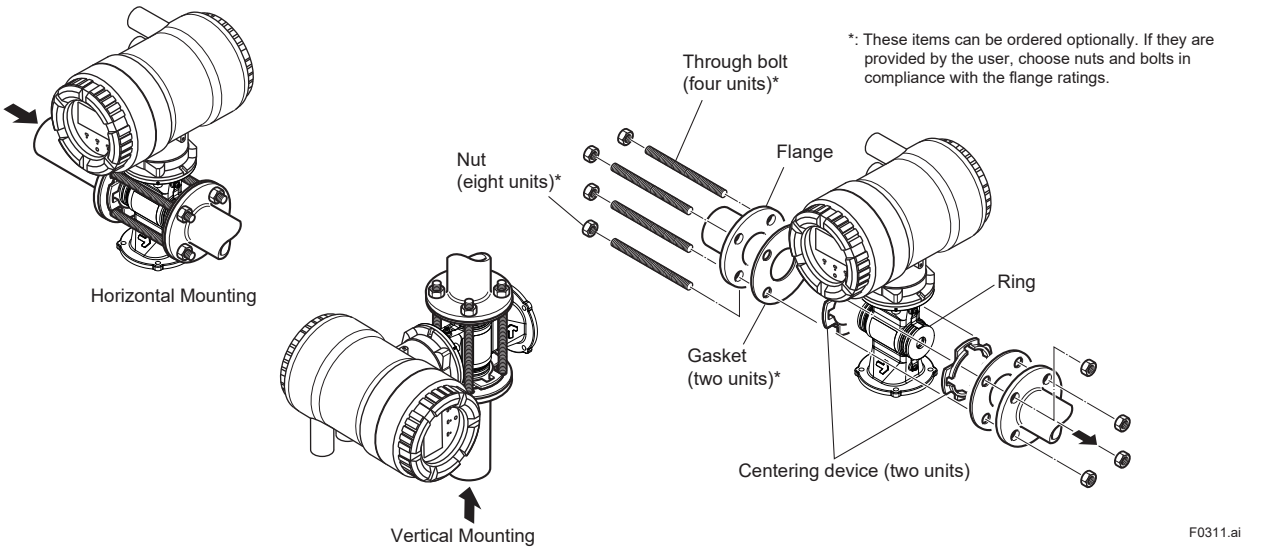


Figure 3.3.1 Mounting Procedure (size: 15mm (0.5 in.))

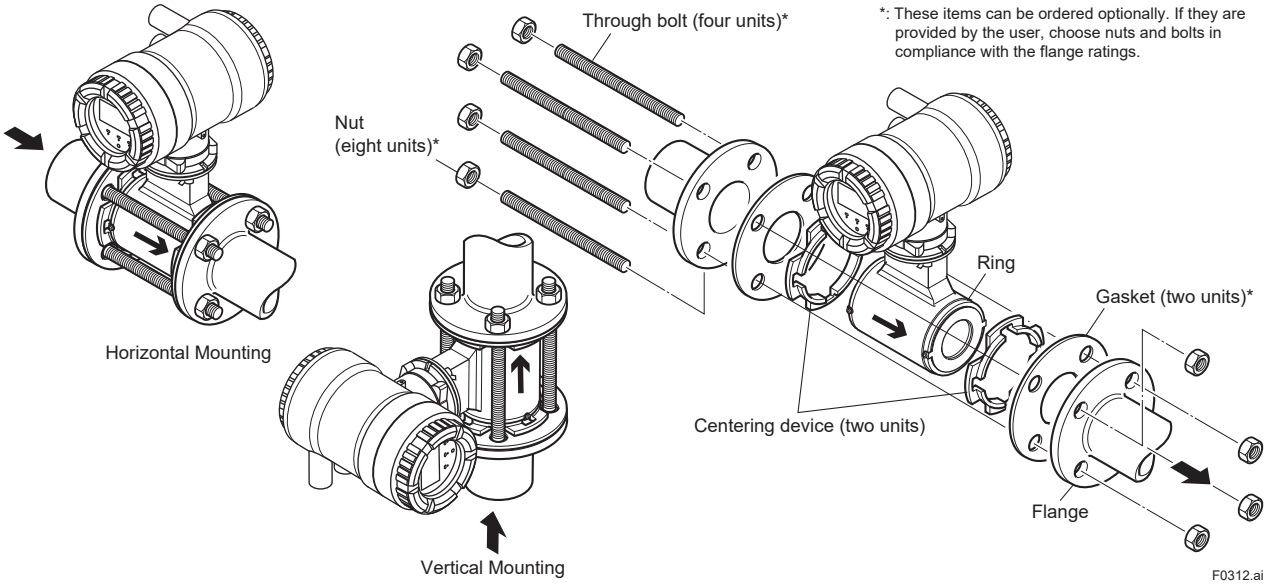


Figure 3.3.2 Mounting Procedure (size: 25, 40mm (1, 1.5 in.))

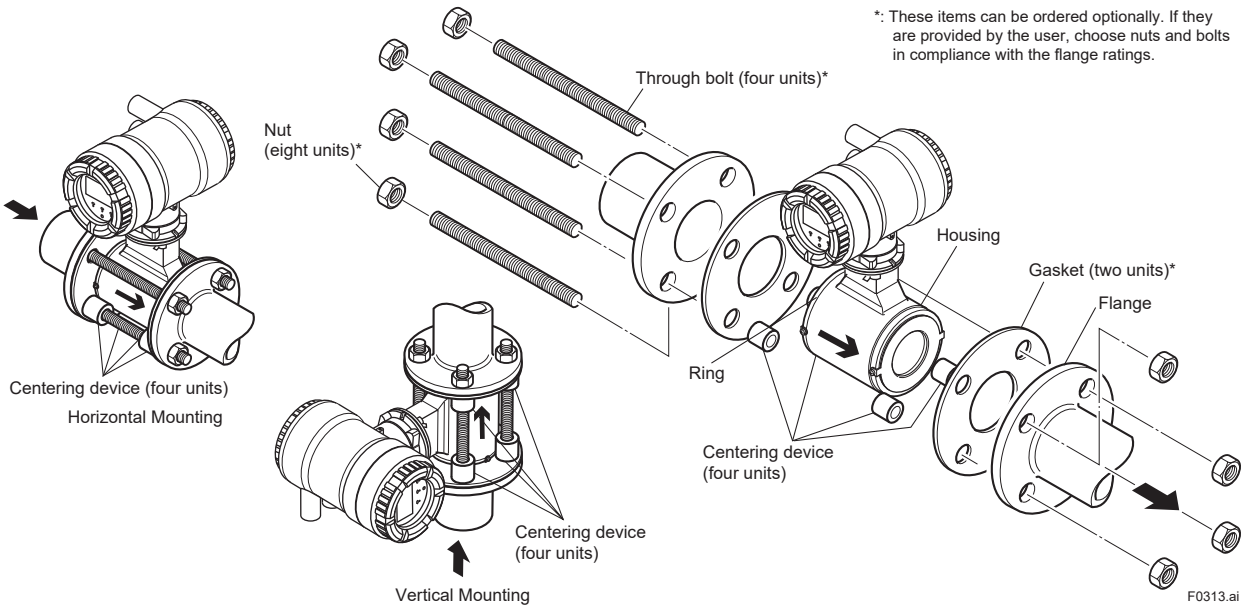


Figure 3.3.3 Mounting Procedure (size: 50 to 200 mm (2 to 8 in.))

Table 3.3.1 Tightening Torque Values for Metal Piping

Tightening torque values (N·m)								
Gasket types within sensor	Fluororesin with ceramic fillers gasket (Valqua #7020) (standard), or fluororesin with carbon gasket (optional code GF)							
Gasket types for user's flange	Non-asbestos gasket, PTFE-sheathed non-asbestos gasket (optional code BSF), or the equivalent in hardness							
Flange Rating / Size mm	JIS 10K	ASME Class 150	EN PN10, GB PN10	JIS 20K	ASME Class 300	EN PN16, GB PN16	EN PN40, GB PN40	JIS F12
15	6.8 to 11.0	6.8 to 11.0	—	6.8 to 11.0	6.8 to 11.0	—	6.6 to 11.0	—
25	18.9 to 24.5	18.9 to 24.5	—	19.1 to 24.5	19.1 to 24.5	—	14.7 to 24.5	—
40	34.5 to 45.7	34.5 to 45.7	—	41.7 to 57.4	41.7 to 57.4	—	34.5 to 57.4	—
50	48.2 to 80.3	48.6 to 81.0	—	23.5 to 39.1	23.7 to 39.5	—	48.2 to 80.3	—
80	31.5 to 52.4	64.2 to 107.0	—	38.8 to 64.7	38.2 to 63.7	31.5 to 52.4	—	63.7 to 106.2
100	36.0 to 59.9	36.3 to 60.4	—	44.3 to 73.8	43.6 to 72.7	36.0 to 59.9	—	73.0 to 121.6
150	75.5 to 125.9	74.4 to 123.9	—	53.4 to 89.1	48.8 to 81.3	75.5 to 125.9	—	82.3 to 137.1
200	72.9 to 121.6	109.1 to 181.8	110.9 to 184.9	79.0 to 131.6	80.0 to 133.3	72.9 to 121.6	—	89.7 to 149.5

Tightening torque values [in·lbf]								
Gasket types within sensor	Fluororesin with ceramic fillers gasket (Valqua #7020) (standard), or fluororesin with carbon gasket (optional code GF)							
Gasket types for user's flange	Non-asbestos gasket, PTFE-sheathed non-asbestos gasket (optional code BSF), or the equivalent in hardness							
Flange Rating / Size inch	JIS 10K	ASME Class 150	EN PN10, GB PN10	JIS 20K	ASME Class 300	EN PN16, GB PN16	EN PN40, GB PN40	JIS F12
0.5	60.2 to 97.4	60.2 to 97.4	—	60.2 to 97.4	60.2 to 97.4	—	58.4 to 97.4	—
1.0	167.3 to 216.8	167.3 to 216.8	—	169.0 to 216.8	169.0 to 216.8	—	130.1 to 216.8	—
1.5	305.4 to 404.5	305.4 to 404.5	—	369.1 to 508.0	369.1 to 508.0	—	305.4 to 508.0	—
2.0	426.6 to 710.7	430.1 to 716.9	—	208.0 to 346.1	209.8 to 349.6	—	426.6 to 710.7	—
3.0	278.8 to 463.8	568.2 to 947.0	—	343.4 to 572.6	338.1 to 563.8	278.8 to 463.8	—	563.8 to 939.9
4.0	318.6 to 530.2	321.3 to 534.6	—	392.1 to 653.2	385.9 to 643.4	318.6 to 530.2	—	646.1 to 1076.3
6.0	668.2 to 1114.3	658.5 to 1096.6	—	472.6 to 788.6	431.9 to 719.6	668.2 to 1114.3	—	728.4 to 1213.4
8.0	645.2 to 1076.3	965.6 to 1609.1	981.5 to 1636.5	699.2 to 1164.8	708.1 to 1179.8	645.2 to 1076.3	—	793.9 to 1323.2

Table 3.3.2 Tightening Torque Values for Plastic Piping

Tightening torque values (N·m)								
Gasket types within sensor	Fluororubber gasket (optional codes GA)							
Gasket types for user's flange	Fluororubber gasket, chloroprene rubber gasket (optional code BSC), or the equivalent in hardness							
Flange Rating / Size mm	JIS 10K	ASME Class 150	EN PN10, GB PN10	JIS 20K	ASME Class 300	EN PN16, GB PN16	EN PN40, GB PN40	JIS F12
15	0.8 to 1.4	0.8 to 1.4	—	0.8 to 1.4	0.8 to 1.4	—	0.8 to 1.4	—
25	2.3 to 3.1	2.3 to 3.1	—	2.4 to 3.1	2.4 to 3.1	—	1.9 to 3.1	—
40	4.4 to 6.0	4.4 to 6.0	—	5.2 to 7.3	5.2 to 7.3	—	4.4 to 7.3	—
50	6.2 to 10.4	6.3 to 10.5	—	2.9 to 4.9	2.9 to 4.9	—	6.2 to 10.4	—
80	4.4 to 7.3	10.6 to 17.7	—	5.3 to 8.8	5.2 to 8.7	4.4 to 7.3	—	9.6 to 16.0
100	5.2 to 8.6	5.7 to 9.5	—	6.0 to 10.0	6.0 to 10.0	5.2 to 8.6	—	11.7 to 19.5
150	10.7 to 17.8	11.6 to 19.3	—	7.0 to 11.6	6.6 to 11.0	10.7 to 17.8	—	13.3 to 22.2
200	10.2 to 17.1	18.9 to 31.5	18.7 to 31.2	10.6 to 17.7	10.8 to 18.0	10.2 to 17.1	—	15.3 to 25.5

Tightening torque values [in·lbf]								
Gasket types within sensor	Fluororubber gasket (optional codes GA)							
Gasket types for user's flange	Fluororubber gasket, chloroprene rubber gasket (optional code BSC), or the equivalent in hardness							
Flange Rating / Size inch	JIS 10K	ASME Class 150	EN PN10, GB PN10	JIS 20K	ASME Class 300	EN PN16, GB PN16	EN PN40, GB PN40	JIS F12
0.5	7.1 to 12.4	7.1 to 12.4	—	7.1 to 12.4	7.1 to 12.4	—	7.1 to 12.4	—
1.0	20.4 to 27.4	20.4 to 27.4	—	21.2 to 27.4	21.2 to 27.4	—	16.8 to 27.4	—
1.5	38.9 to 53.1	38.9 to 53.1	—	46.0 to 64.6	46.0 to 64.6	—	38.9 to 64.6	—
2.0	54.9 to 92.0	55.8 to 92.9	—	25.7 to 43.4	25.7 to 43.4	—	54.9 to 92.1	—
3.0	38.9 to 64.6	93.8 to 156.7	—	46.9 to 77.9	46.0 to 77.0	38.9 to 64.6	—	85.0 to 141.6
4.0	46.0 to 76.1	50.5 to 84.1	—	53.1 to 88.5	53.1 to 88.5	46.0 to 76.1	—	103.6 to 172.6
6.0	94.7 to 157.5	102.7 to 170.8	—	62.0 to 102.7	58.4 to 97.4	94.7 to 157.5	—	117.7 to 196.5
8.0	90.3 to 151.3	167.3 to 278.8	165.5 to 276.1	93.8 to 156.7	95.6 to 159.3	90.3 to 151.3	—	135.4 to 225.7

Table 3.3.3 Tightening Torque Values for Metal Piping and Permeable Fluids

Tightening torque values (N·m)								
Gasket types within sensor	Fluororesin with ceramic fillers gasket (Valqua #7020) (standard), or fluororesin with carbon gasket (optional code GF)							
Gasket types for user's flange	PTFE-sheathed non-asbestos gasket (optional code BSF), or the equivalent in hardness							
Flange Rating / Size mm	JIS 10K	ASME Class 150	EN PN10, GB PN10	JIS 20K	ASME Class 300	EN PN16, GB PN16	EN PN40, GB PN40	JIS F12
15	8.1 to 13.1	8.1 to 13.1	—	8.1 to 13.1	8.1 to 13.1	—	7.9 to 13.1	—
25	22.5 to 29.0	22.5 to 29.0	—	22.7 to 29.0	22.7 to 29.0	—	17.4 to 29.0	—
40	40.6 to 53.8	40.6 to 53.8	—	49.3 to 67.7	49.3 to 67.7	—	40.6 to 67.7	—
50	56.5 to 94.2	57.0 to 95.0	—	27.7 to 46.1	27.9 to 46.5	—	56.5 to 94.2	—
80	37.3 to 62.2	76.0 to 126.7	—	46.2 to 77.0	45.4 to 75.7	37.3 to 62.2	—	75.5 to 125.8
100	42.2 to 70.3	42.5 to 70.8	—	52.0 to 86.7	51.2 to 85.3	42.2 to 70.3	—	85.4 to 142.3
150	87.8 to 146.4	86.4 to 144.0	—	62.4 to 104.0	56.8 to 94.7	87.8 to 146.4	—	95.4 to 159.0
200	84.0 to 140.1	125.4 to 209.1	127.6 to 212.7	91.1 to 151.9	92.3 to 153.8	84.0 to 140.1	—	103.0 to 171.7

Tightening torque values [in·lbf]								
Gasket types within sensor	Fluororesin with ceramic fillers gasket (Valqua #7020) (standard), or fluororesin with carbon gasket (optional code GF)							
Gasket types for user's flange	PTFE-sheathed non-asbestos gasket (optional code BSF), or the equivalent in hardness							
Flange Rating / Size inch	JIS 10K	ASME Class 150	EN PN10, GB PN10	JIS 20K	ASME Class 300	EN PN16, GB PN16	EN PN40, GB PN40	JIS F12
0.5	71.7 to 115.9	71.7 to 115.9	—	71.7 to 115.9	71.7 to 115.9	—	69.9 to 115.9	—
1.0	199.1 to 256.7	199.1 to 256.7	—	200.9 to 256.7	200.9 to 256.7	—	154.0 to 256.7	—
1.5	359.3 to 476.2	359.3 to 476.2	—	436.3 to 599.2	436.3 to 599.2	—	359.3 to 599.2	—
2.0	500.1 to 833.7	504.5 to 840.8	—	245.2 to 408.0	246.9 to 411.6	—	500.1 to 833.7	—
3.0	330.1 to 550.5	672.7 to 1121.4	—	408.9 to 681.5	401.8 to 670.0	330.1 to 550.5	—	668.2 to 1113.4
4.0	373.5 to 622.2	376.2 to 626.6	—	460.2 to 767.4	453.2 to 755.0	373.5 to 622.2	—	755.9 to 1259.5
6.0	777.1 to 1295.7	764.7 to 1274.5	—	552.3 to 920.5	502.7 to 838.2	777.1 to 1295.7	—	844.4 to 1407.3
8.0	743.5 to 1240.0	1109.9 to 1850.7	1129.4 to 1882.6	806.3 to 1344.4	816.9 to 1361.2	743.5 to 1240.0	—	911.6 to 1519.7

Table 3.3.4 Centering Device Identification

Flange Rating / Size mm (inch)	JIS			ASME		EN, GB		
	10K	20K	F12	Class 150	Class 300	PN10	PN16	PN40
50 (2.0)	B	B	—	B	F	—	—	F
80 (3.0)	B	F	H	F	C	—	G	—
100 (4.0)	B	F	H	C	H	—	F	—
150 (6.0)	B	C	G	B	D	—	B	—
200 (8.0)	B	C	C	G	J	B	B	—

*: Each centering device is engraved with a character as identification.

3.3.1 Gasket Size (customer pipe)

WARNING

All gaskets used for piping of Magnetic Flowmeters should be prepared by customers except in some cases.

Be sure to choose a gasket with an inner and outer diameter that does not protrude inside the piping.
If the inner diameter of the gasket is too large, or outer diameter of the gasket is too small, fluid leakage may result.

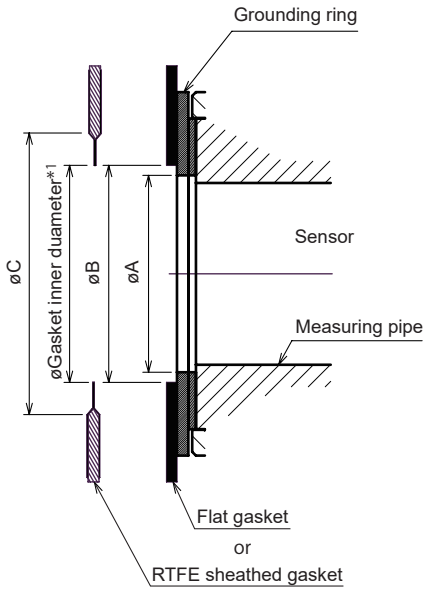
Table 3.3.7 Inner Diameter of Grounding Ring, Outer Diameter for Effective Sealing and Recommended Inner Diameter of Gasket

Unit: mm

Size	Inner Diameter for Effective Sealing [øA]	Recommended Inner Diameter of Gasket		Minimum Inner Diameter of Gasket*1
		Flat Gasket [øB]	PTFE- sheathed Gasket [øC]	
15	15	22		15
25	27	35		27
40	40	49		40
50	52	61		52
80	81	90		81
100	98	115		98
150	144	167		144
200	192	218		192

Unit: inch

Size	Inner Diameter for Effective Sealing [øA]	Recommended Inner Diameter of Gasket		Minimum Inner Diameter of Gasket*1
		Flat Gasket [øB]	PTFE- sheathed Gasket [øC]	
0.5	0.59	0.87		0.59
1.0	1.06	1.38		1.06
1.5	1.57	1.93		1.57
2.0	2.05	2.40		2.05
3.0	3.19	3.54		3.19
4.0	3.86	4.53		3.86
6.0	5.67	6.57		5.67
8.0	7.56	8.58		7.56



*1: To prevent the gasket from protruding into the flow path, make sure that this length is smaller than the minimum inner diameter of the gasket in the table.

3.4 Changing Direction of Display Unit

(1) Removing the Cover

- The following tool is required.
  Hexagonal wrench (nominal size 3)
- Turn off the power to the flowmeter.
- Using the wrench, loosen the cover locking screw (1) (See Figure 3.4.1) clockwise to unlock the cover. Upon shipment from the manufacturing plant, the cover is locked. Hold the flowmeter with your hand. Remove the cover by rotating it counterclockwise.

WARNING

- When opening and closing the cover, be sure to handle the cover carefully so that there are no damage and foreign matter adhesion at its threads and O-ring. Keep checking their condition and clean the threads in case of adhering the foreign matter.
- Replace the cover in case the treads receive damages.
- Replace the O-ring if there is any scarring or transformation. And apply silicone based grease at the O-ring in case of the shortage and exhaustion of grease.

IMPORTANT

- When closing the cover, close it with both hands until the cover does not turn in order to bring the housing and cover into tight contact.
- Tighten while confirming that the cover rotates smoothly.

WARNING

For explosion protection type products, please confirm that it is “no explosive atmosphere”.

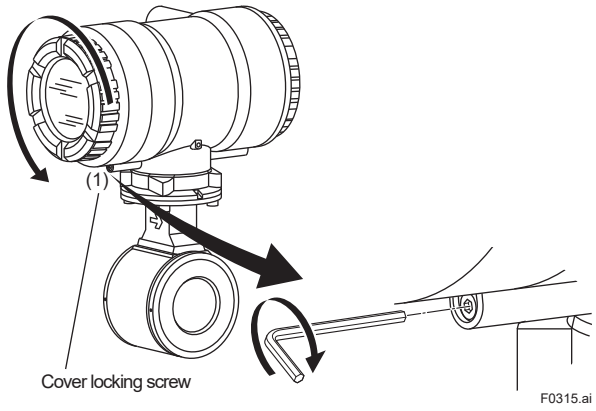


Figure 3.4.1 Removing the Display Cover

(2) Changing Display Unit Direction 90 degrees

- Hold the display unit with your hand and loosen the two mounting screws.
- Rotate the display unit 90 degrees clockwise and confirm the assembling position, taking care of the connector and wire of the display unit.
  At this time, do not remove the connector.
- Secure the display unit using its two mounting screws.

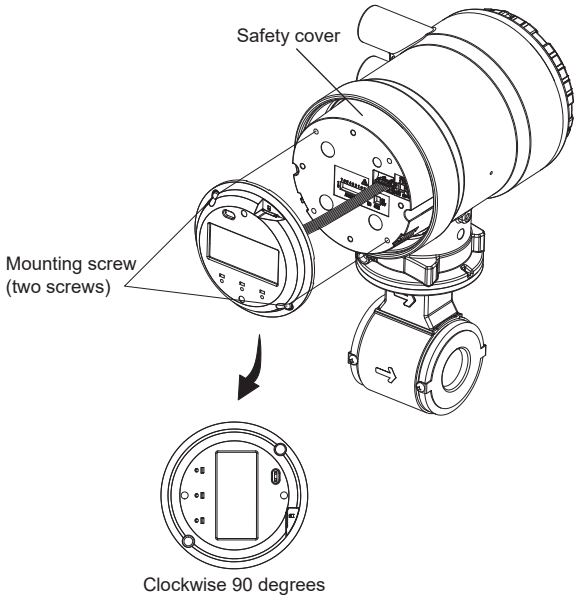


Figure 3.4.2 Changing Display Unit Direction 90 degrees

IMPORTANT

To preserve the safety, do not touch the electrical circuit and cable of shaded area.

WARNING

To prevent electric shocks and maintain performance, do not remove safety cover.

(3) Installing the Cover

- Install the cover to the flowmeter by rotating the cover clockwise.
- Tighten cover locking screw (1) (See Figure 3.4.1) counterclockwise using a hexagonal wrench (nominal size 3) to lock the cover.

IMPORTANT

- When closing the cover, close it with both hands until the cover does not turn in order to bring the housing and cover into tight contact.
- Tighten while confirming that the cover rotates smoothly.

WARNING

- When opening and closing the cover, be sure to handle the cover carefully so that there are no damage and foreign matter adhesion at its threads and O-ring. Keep checking their condition and clean the threads in case of adhering the foreign matter.
- Replace the cover in case the treads receive damages.
- Replace the O-ring if there is any scarring or transformation. And apply silicone based grease at the O-ring in case of the shortage and exhaustion of grease.

4. Wiring

WARNING

The wiring of the magnetic flowmeter must be performed by expert engineer or skilled personnel. No operator shall be permitted to perform procedures relating to wiring.

WARNING

For explosion protection type products, please be sure to read the user's manual of the applicable explosion protection type as listed in Table 1.1 before wiring.

CAUTION

Once all wiring is completed, check the connections before applying power to the product. Improper arrangements or wiring may cause a unit malfunction or damage.

4.1 Wiring Precautions

Be sure to observe the following precautions when wiring:

CAUTION

- In order to maintain performance, wiring according to regulations is necessary.
- When opening the cover, wait for more than 20 minutes after turning off the power.
- Do not connect cables outdoors in wet weather in order to prevent damage from condensation and to protect the insulation, e.g. inside the terminal box of the flowmeter.
- Before turning the power on, tighten the terminal box cover securely.

CAUTION

- Terminate all the cable finish with crimp terminal of a round or rod shape (depending on the shape of the terminal block), and connect them reliably.
- Always route the power and output signal cables in separate steel conduit tubes, except when the power supply voltage is 24 V and four-core cables are used for wiring. Keep conduits or flexible tubes watertight using sealing tape.

CAUTION

- If there is any unused cable entry, use the blanking plug to cover which comes with this product or which is supplied by YOKOGAWA. The blanking plug should be fastened into the unused cable entry without any mistake. If not, stated enclosure protection is not applicable. One or two blanking plug is provided depending on the specifications (24 V for power supply voltage or I/O selection).
- The signal cables must be routed in separate steel conduit tubes 16 (JIS C 8305) or flexible conduit tubes 15 (JIS C 8309).
- When waterproof glands or union equipped waterproof glands are used, avoid tightening the glands with an excessive torque.
- For the instruction of removing/installing the housing covers and handling the locking screws, read Section 4.4.
- Explosion protected types must be wired in accordance with specific requirement (and, in certain countries, legal regulations) in order to preserve the effectiveness of their explosion protected features.

4.2 Cables

4.2.1 Recommended Cable for Power and Input/Output:

JIS C 3401 control cable equivalent
JIS C 3312 power cable equivalent
14 AWG Belden 8720 equivalent

Outer Diameter:

With no gland option:
ø6.5 to ø12 mm (ø0.26 to ø0.47 in.)
With waterproof gland (optional code EG□, EU□):
For power and input/output cable:
ø7.5 to ø12 mm (ø0.30 to ø0.47 in.)
With plastic gland (optional code EP□:
ø6 to ø12 mm (ø0.24 to ø0.47 in.)

Nominal Cross Section:

Single wire; 0.5 to 2.5 mm^2
Stranded wire; 0.5 to 1.5 mm^2

In case of power cable, Green/Yellow covered conductor shall be used only for connection to PROTECTIVE CONDUCTOR TERMINALS. Conform to IEC227, IEC245 or equivalent national authorization.

NOTE

- For power cable, always use a crimp terminal with an insulation cover.
- Use crimp tools supplied by the manufacturer of the crimp terminal you want to use to connect the crimp terminal and cable.
- Use crimp tools that are appropriate for the diameter of the cable to be connected.

4.3 Cable Entries

WARNING

For explosion protection type products, please be sure to read the user's manual of the applicable explosion protection type as listed in Table 1.1.

This product is of watertight construction as stipulated in JIS C 0920. It is shipped with a wiring bracket (waterproof gland, waterproof gland with union or a plastic gland attached), only in cases where an optional specification is selected for the cable entry.
Cable gland has the following kinds depending on the Optional Code.

CA (Size: 15 to 200 mm (0.5 to 8 in.))

Optional Code	Description
EG2	2 pcs. of waterproof gland, and a blanking plug
EG3	3 pcs. of waterproof gland
EU2	2 pcs. of waterproof gland with union joint, and a blanking plug
EU3	3 pcs. of waterproof gland with union joint
EP2	2 pcs. of plastic gland, and a blanking plug
EP3	3 pcs. of plastic gland

IMPORTANT

Apply a blanking plug to the unused cable entry. Seal the cable entries properly comply to usage state.

4.3.1 When waterproof property is necessary (Wiring using waterproof glands)

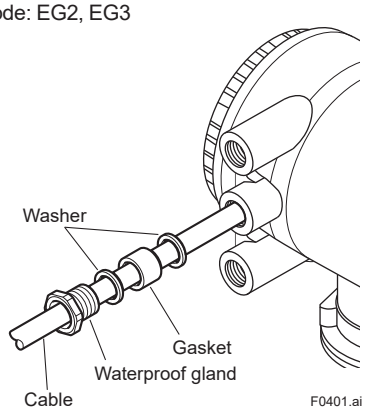
IMPORTANT

To prevent water or condensation from entering the transmitter housing, waterproof glands are recommended. Do not over-tighten the glands or damage to the cables may result. Tightness of the gland can be checked by confirming that the cable is held firmly in place.

For working on the conduit or the flexible tubes (G1/2), remove the waterproof gland and attach them directly to the cable entry.

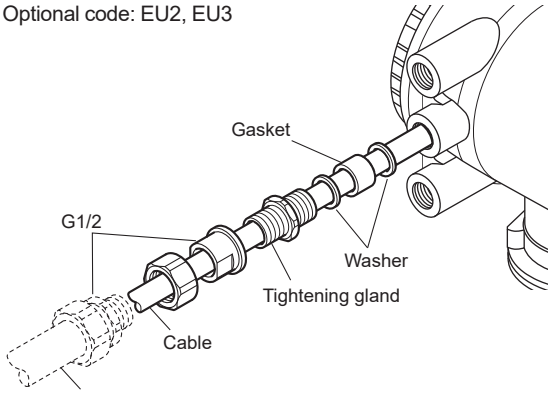
(1) Waterproof Gland

Optional code: EG2, EG3



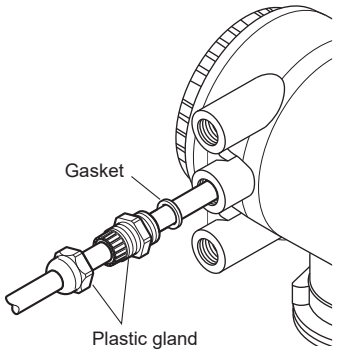
(2) Waterproof Gland with Union Joint

Optional code: EU2, EU3



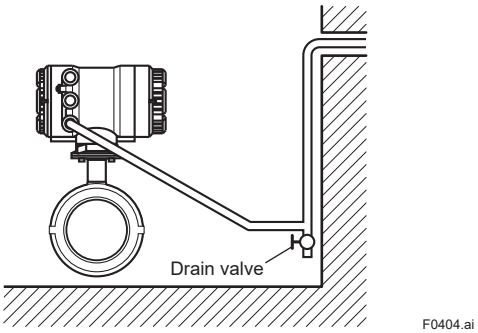
(3) Plastic Gland

Optional code: EP2, EP3



4.3.2 Conduit Wiring

When wiring the conduits, utilize the waterproof gland to prevent water from flowing in through the conduit. Place the conduit pipe on an angle as shown in the following figures.
Install a drain valve at the low end of the vertical pipe, and open the valve regularly.
To prevent noise, do not use the same conduit for signal cable and power cable.



4.4 Connecting to External Products

4.4.1 Wiring Precautions for Power Supply Cables

When connecting to the power supply, observe the points below. Failure to comply with these warnings may result in an electric shock or damage to the product.

WARNING

- Ensure that the power supply is off in order to prevent electric shocks.
- When opening the cover, wait for more than 20 minutes after turning off the power.
- Ensure the protective grounding terminal is grounded before turning on the power.
- Terminate all the cable finish with round or rod shaped crimp terminal (depending on the shape of the terminal block) with insulation cover, and connect them reliably.
- Install an external switch or circuit breaker as a means to turn the power off (capacitance: 15A, conforming to IEC60947-2 and IEC60947-3).
  Locate this switch either near the product or in other places facilitating easy operation. Affix a “Power Off Equipment” label to this external switch or circuit breaker.

WARNING

For explosion protection type products, please be sure to read the user’s manual of the applicable explosion protection type as listed in Table 1.1.

Wiring Procedure

1. Check the product’s power is off, then remove the terminal cover (transparent).
2. Wire the power supply cable and the functional grounding cable to the power supply terminals.
3. Install the terminal cover.

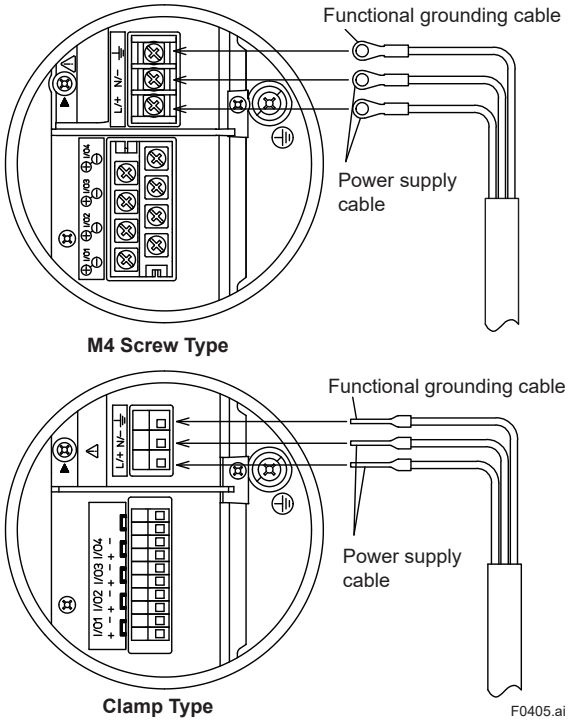
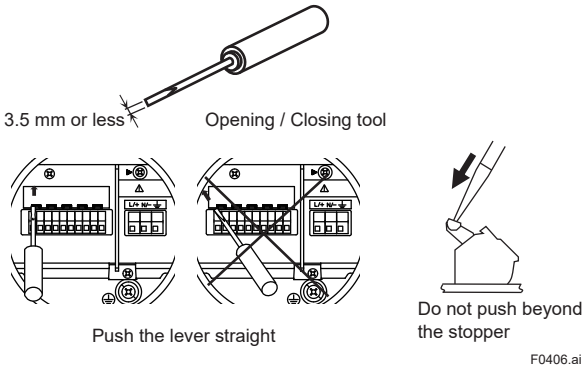


Figure 4.4.1 Power Cable Wiring

CAUTION

When wiring terminal for clamp type with a lever (explosion protection type), care the following points.

- Use opening/closing tool with a tip width of 3.5 mm or less.
- Push the lever opening/closing tool straight against the lever.
- Do not push over the stopper with pushing the lever.



4.4.2 DC Power Connection

When using DC power as the power supply for the transmitter, pay attention to the following points.

(1) Connecting Power Supply

IMPORTANT

Do not connect power supply with reversed polarities.
L/+ terminal: connect to + (power supply)
N/– terminal: connect to - (power supply)

IMPORTANT

For the 24 V power supply version (power supply code -2), power supply with 100 to 240 V AC and 100 to 120 V DC cannot be connected.
The wrong connection results in a damage to the transmitter.

(2) Required Power Supply Voltages

IMPORTANT

For the 24 V power supply version (power supply code -2), the specification of 24 V (–15% to +20%) is the supply voltage between the terminals on the transmitter. Because of voltage drop by cable resisitance, the supply voltage must be applied within the range of Figure 4.4.2.

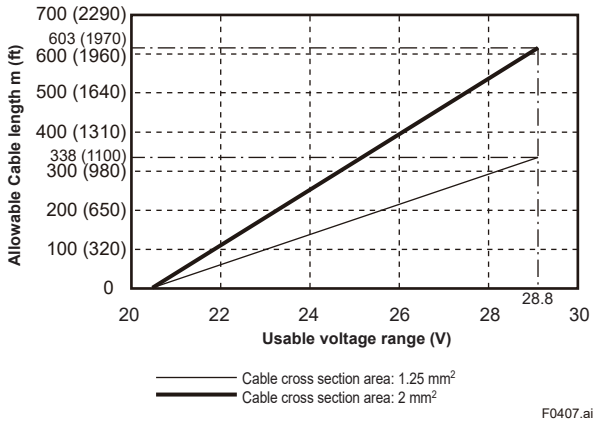


Figure 4.4.2 Supply Voltage and Power Supply Cable Length

4.4.3 Grounding

WARNING

For the wiring of protective grounding, terminate the cable finish with round shaped crimp terminal with insulation cover (for M4 screw), and connect it to the protective grounding terminal reliably.

CAUTION

- The grounding should satisfy grounding resistance requirement, 100 Ω or less (Class D grounding).
- For explosion protection type, the grounding must satisfy the domestic electrical requirements as regulated in each country

IMPORTANT

A lightning protector is built-in. When the lightning protection is needed, the ground should satisfy Class C requirements (grounding resistance, 10 Ω or less).

- The protective grounding terminals ⏚ are located on the inside and outside of the terminal area.
  Either terminal can be used.
- Use 600 V vinyl insulation wires as the grounding wires.

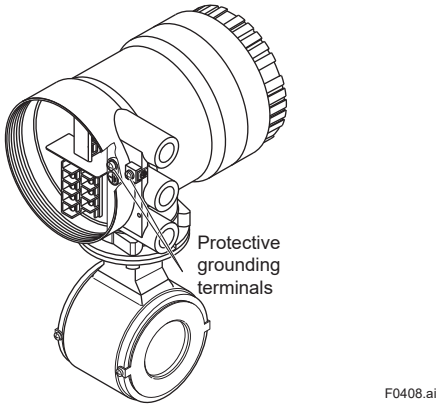
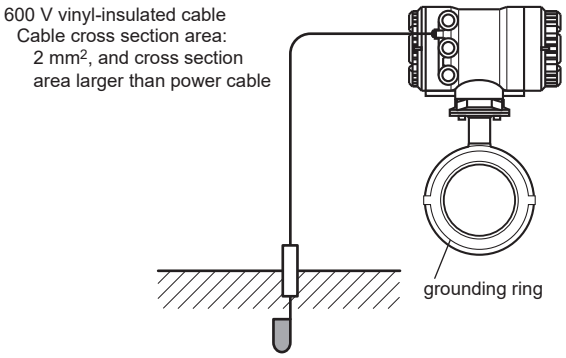


Figure 4.4.3 Position of Protective Grounding Terminal

IMPORTANT

Improper grounding may result in an adverse effect on the flow measurement. Ensure that the product is properly grounded.

The electromotive force of the magnetic flowmeter is minute and it is easily affected by noise, and the reference electric potential is the same as that of the measuring fluid. Therefore, the reference electric potential (terminal potential) of the sensor and transmitter also need to be the same as that of the measuring fluid. Moreover, the potential must be the same as the ground. The magnetic flowmeter is equipped with an grounding ring that makes a connection with the charge of the measured fluid for grounding and protects the lining. Grounding rings are supplied with the products.



Grounding Resistance: 10 Ω or less (Class C requirements)
Note: When lightning protection performance by the built-in lightning protectors is not required, grounding resistance 100 Ω or less (Class D requirements) can be applied.

F0409.ai

CAUTION

- The grounding should satisfy grounding resistance requirement, 100 Ω or less (Class D grounding).
- For explosion protection type, the grounding must satisfy the domestic electrical requirements as regulated in each country.

4.4.4 Connecting to External Products

WARNING

- Before wiring with external products, be sure to turn off the power supply of the magnetic flowmeter.
- Be sure the power supply of the external products is turned off, and then start wiring.

Read Section 4.5 for connection to external products.

4.4.5 Wiring Procedures

1) Removing the Cover

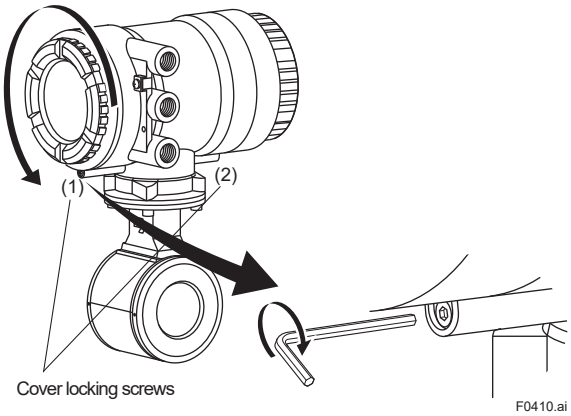
Loosen the cover locking screw (1) (See Figure 4.4.4) clockwise using a hexagonal wrench (nominal size 3) to unlock the cover. Upon shipment from the manufacturing plant, the cover is unlocked. Hold the flowmeter with your hand and remove the cover by turning it in the direction of the arrow as shown below.

WARNING

- When opening and closing the cover, be sure to handle the cover carefully so that there are no damage and foreign matter adhesion at its threads and O-ring. Keep checking their condition and clean the threads in case of adhering the foreign matter.
- Replace the cover in case the treads receive damages.
- Replace the O-ring if there is any scarring or transformation. And apply silicone based grease at the O-ring in case of the shortage and exhaustion of grease.

IMPORTANT

- When closing the cover, close it with both hands until the cover does not turn in order to bring the housing and cover into tight contact.
- Tighten while confirming that the cover rotates smoothly.



F0410.ai

Figure 4.4.4 Removing the Terminal Box Cover

2) Terminal Configuration

When the cover is removed, the connection terminals will be visible.

The description of the terminal symbols is shown in Terminal Configuration.

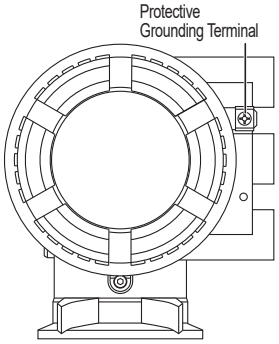
3) Wiring Procedure

1. Check the product's power is off.
2. Wire the power supply cable and output signal cable to each terminal.
3. Install the terminal cover.

4) Installing the Cover

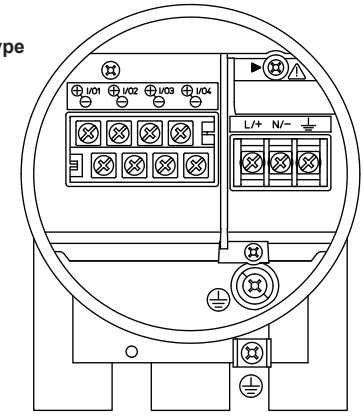
Install the cover to the flowmeter by turning it clockwise. Tighten the cover locking screw (1 and 2) (See Figure 4.4.4) counterclockwise using a hexagonal wrench (nominal size 3) to lock the cover.

■ Terminal Configuration

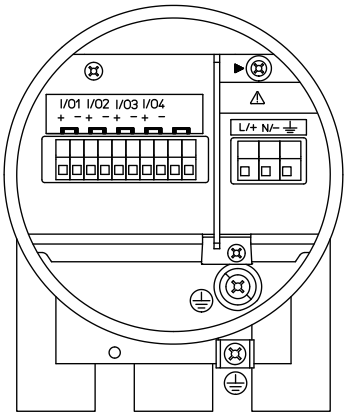


<To be wired to Power Supply and I/Os>

M4 Screw Type



Clamp Type



Terminal Symbol	Description
▶	Shorting Screw (Need to be fixed for normal operation)
⏚	Functional Grounding
N/- **L/+**	Power Supply
I/O4 - **I/O4 +** **I/O3 -** **I/O3 +** **I/O2 -** **I/O2 +** **I/O1 -** **I/O1 +**	Refer to Input/Output Table
⏚	Protective Grounding (Inside and outside of the terminal box)

F0411.ai

■ HART

Communication and I/O code	Connection Terminal			
HART	I/O1	I/O2	I/O3	I/O4
JA	Iout1 Active	P/Sout1 Passive	-	-
JE	Iout1 Active	P/Sout1 Passive	Sin No-voltage	P/Sout2 Passive

Iout1: Current output with HART communication
P/Sout1: Pulse output or status output
P/Sout2: Pulse output or status output
Sin: Status input
The position of Communication and I/O code:
CA0□□□-□□□□□□□□□□□□□□□-□■■□□

4.5 Input and Output

This section provides descriptions of the specificaiton and wiring of the input and output signals.
In accordance with the communication and I/O code specified, the function assigned to each terminal is different. For the specification and terminal configuration, read Section 4.4 and the applicable general specifications as listed in Table 1.1.

(1) Output Signal

Galvanic isolation:

All circuits for inputs, outputs and power supply are galvanically isolated from each other.

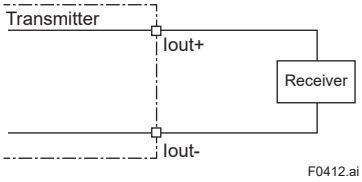
<table>
<tr><th>Output signal type</th><th>Specification</th></tr>
<tr><td>Active current output [Iout]:</td><td>A single current output is available.
Depending on the measured value, the active current output delivers 4 to 20 mA.
<table>
<tr><td>Output current</td><td>4 to 20 mA DC</td></tr>
<tr><td>Load resistance</td><td>750 Ω or less</td></tr>
<tr><td>Load resistance for HART communication</td><td>230 to 600 Ω</td></tr>
<tr><td>Current output accuracy</td><td>±8 μA (±0.05% of span)</td></tr>
</table>


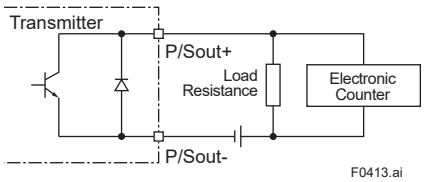
Figure 4.5.1 Connection diagram: Active current output [Iout]</td></tr>
<tr><td>Passive pulse output [P/Sout]:</td><td>Connection of an electronic counter
Maximum voltage and correct polarity must be observed for wiring.
<table>
<tr><td>Maximum load current</td><td>200 mA or less</td></tr>
<tr><td>Power supply</td><td>30 V DC or less</td></tr>
<tr><td>Maximum pulse rate</td><td>10,000 pulses/s</td></tr>
<tr><td>Maximum frequency output rate</td><td>12,500 Hz</td></tr>
</table>


Figure 4.5.2 Connection diagram: Passive pulse output [P/Sout] (Electronic counter)

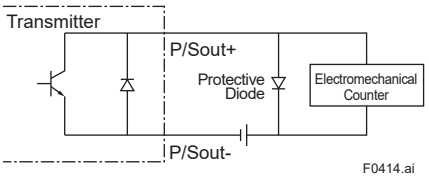
Connection of an electromechanical counter


Figure 4.5.3 Connection diagram: Passive pulse output [P/Sout] (Electromechanical counter)</td></tr>
</table>

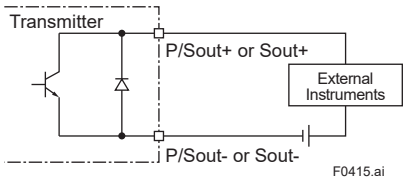
<table>
<tr><th>Output signal type</th><th>Specification</th></tr>
<tr><td>Passive status output [P/Sout or Sout]:</td><td>Because of connecting to a transisiter, observe that maximum allowable voltage, voltage polarity and maximum allowable current are correct.
<table>
<tr><td>Maximum load current</td><td>200 mA or less</td></tr>
<tr><td>Power supply</td><td>30 V DC or less</td></tr>
</table>


Figure 4.5.4 Connection diagram: Passive status output [P/Sout or Sout]

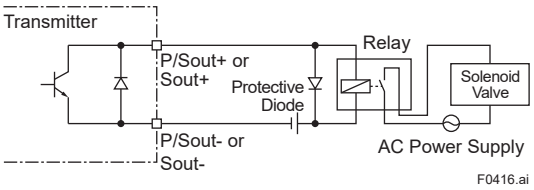
A relay must be connected in series to switch alternating voltage.


Figure 4.5.5 Connection diagram: Passive status output [P/Sout or Sout] (Solenoid valve)</td></tr>
</table>

(2) Input signals

<table>
<tr><th>Input signal type</th><th>Specification</th></tr>
<tr><td>Status input [Sin]:</td><td>IMPORTANT
The status input detects a signal without voltage.
Loading voltage during the switching status "Close" may result in damage on the electrical circuit.

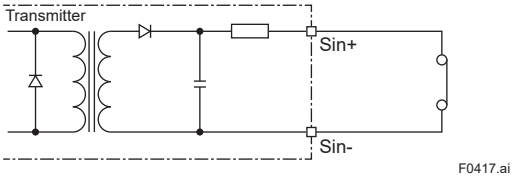
The status input is used for connecting to the following no-voltage contacts.
<table>
<tr><th>Switching status</th><th>Resistance</th></tr>
<tr><td>Closed</td><td>200 Ω or less</td></tr>
<tr><td>Open</td><td>100 kΩ or more</td></tr>
</table>


Figure 4.5.6 Connection diagram: Status input [Sin]</td></tr>
</table>

5. Basic Operating Procedures

5.1 Operation by Display unit

The parameter settings from display unit can be carried out using the three IR (infra-red) switches - namely, the [SET] [SHIFT] and [▼] switches. The IR switches enable the user to set parameters from the outside of the glass of the display cover.
This section provides descriptions of basic parameter configuration and operation procesures of IR switches.
This product can be also operated using the dedicated handheld terminal or the FieldMate (Versatile Device Management Wizard). For operation in details, read the user's manual of the applicable communication type as listed in Table 1.1.

WARNING

Be sure to enable the write protect function to prevent the overwriting of parameters after finishing parameter setting.
In rare cases, the IR switches may respond unexpectedly to water drops or extraneous substances sticking on the surface of display panel, due to the operating principal. The possibility of malfunction arises after rain or cleaning operation near the place where the flowmeter is installed. Turning on and off the flashlight etc. towards the IR switch may also be a cause of malfunction.
Read Section 6.3 for the hardware write protect function, and the user's manual of applicable communication type as listed in Table 1.1 for the software write protect function.

IMPORTANT

Operate the display unit under the condition where direct sunlight, etc... do not shine to the IR switches directly when the parameter setting operation is carried out.

NOTE

- Always keep the cover closed and operate the setting switches from the outside of the glass window.
- If dirt, dust or other substances surfaces on the glass of display cover, wipe them clean with a soft dry cloth.
- The operation with dirty gloves may cause a switch response error.

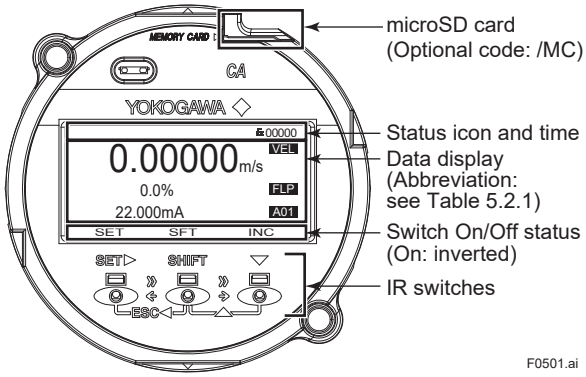
NOTE

The language on the display is set to "English" as default at the factory shipment. Select the adequate language referring to the Subsection 5.2.2. The menu pass of the display on this manual is selected to "English".

5.2 Display and Basic Configuration

The display unit has various functions below.

5.2.1 Display



(1) Basic operation of IR switches

The operation from display panel is done by using the three IR switches; [SET], [SHIFT] and [▼]. The combination of the two switches provides a different function, and the function is indicated on the display.

IR switch (Note 1)	Indicate of switch (Note 2)	Function
[SET▶]	SET	▪ Apply parameter (Note 3) ▪ Enter data (Note 3) ▪ Move to next menu
[SHIFT]	SFT	▪ Move cursor right (Numeric type parameter)
[▼]	INC	▪ Move cursor down (Select type parameter) ▪ Increment value (Numeric type parameter) ▪ Change position of decimal point (Numeric type parameter)
[SHIFT] + [▼] (=[▲])	DEC	▪ Move cursor up (Select type parameter) ▪ Decrement value (Numeric type parameter)
SHIFT + SET▶ (=[ESC◀])	ESC	▪ Cancel ▪ Back to previous menu

Note 1: [A] + [B] (=[C]): The function is changed to switch [C] when switch [B] is pushed while pushing switch [A].
Note 2: [SET], [SFT], [INC], [DEC] and [ESC] indicate the assigned function in accordance with display mode at that time.
Note 3: "Apply" and "Enter" are executed by pushing a switch twice. If the execution does not work properly, release your finger from the display glass completely after initially pressing [SET], and then, press that key again.

(2) Status icons

Icon	Contents	Icon	Contents
	Write protect Invalid		Write protect Valid
	Device Busy		Device Fault
	Ready for microSD card		Accessing microSD card
	Disable to access microSD card		Uploading parameters
	Downloading parameters		Trend graph executing
	HART communication		System alarm occurs
	Process alarm occurs		Setting alarm occurs
	Warning occurs		Information occurs
	Display Damping Valid		Operation level: Operator
	Operation level: Maintenance		Operation level: Specialist

(3) Data indication part

The process values are available to select 8 items maximum on the display. It is possible to indicate 4 items maximum on the display at the same time, and the rest 4 items are able to show by scrolling.

Table 5.2.1 Abbreviation table of process values to be indicated on the display.

Abbreviation	Contents
FLP(*1)	Flow rate %
PRV(*1)	Process value
VEL(*1)	Flow velocity
VFL(*1)	Volumetric flow
MFL(*1)	Mass flow
FLB	Flow rate in % bar graph
TL1(*1)	Totalization value 1
TL2(*1)	Totalization value 2
TL3(*1)	Totalization value 3
TAG	Tag No.
LTG	Long Tag
COM	Communication protocol
AO1(*1)	Analog output value 1
TC1	Count value of totalizer 1
TC2	Count value of totalizer 2
TC3	Count value of totalizer 3

*1: Available to display the online trend graph.

5.2.2 Basic Configuration for Display

For paramter setting from display panel, configurable parameters differ by the three operational levels specfied in Table 5.2.2, and a passcode is needed to enter into Setting mode. No passcode requires for “Operator”, and a passcode corresponding to each level requires for “Maintenance” or “Specialist”.
For parameter in details, read the user’s manual of applicable communication type as listed in Table 1.1.

Table 5.2.2 Parameter setting from display panel and operation level

Operation Level	Reading parameters	Writing parameters
Operator	All parameters	Parameters related with basic display settings including display language.
Maintenance	All parameters	Parameters allowed for Operator level. Parameters related with Zero adjustment.
Specialist	All parameters	All Parameters

The following parameters are available to “Operator” level without passcode.

(1) Display Language Setting

Display Menu Path:
Device setup ► Language

The language on the display is set to “English” as default at the factory shipment. Select the adequate language.

The selectable display language is different by the model and suffix code (display code) specified when ordering.
Position of the display code:

CA0□□□-□□□□□□□□□□□□□□□-□□□□■

Display code	Selectable display language
1	English, French, German, Italian, Spanish, Portuguese, Japanese, or Russian
2	English or Chinese

(2) Display Contrast Setting (shading)

Display Menu Path:
Device setup►Detailed setup►Display set►Optional config►Contrast

Available to change the contrast of the display.

Setting item	Contents
-5 to +5	Set the contrast of the display (The value is small: Low, and the value is big: High)

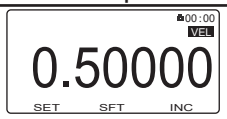
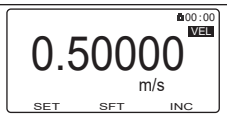
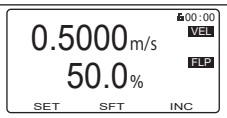
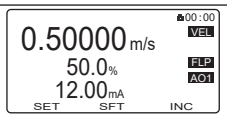
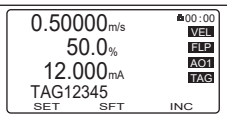
(3) Display Line Setting

Display Menu Path:
Device setup ► Detailed setup ► Display set ► Optional config ► Line mode

Available to select the number of lines of process value to be indicated on the display.
Up to four lines can be displayed at the same time. The character size changes depending on the number of line.

Setting item	Contents
1 line(big)	Number of displayable process value : One (without unit)
1 line	Number of displayable process value : One (with unit)
2 line	Number of displayable process values : Two
3 line	Number of displayable process values : Three
4 line	Number of displayable process values : Four

Table 5.2.3 Display line setting and display example

Lines of display	Example
1 line(big)	 F0502.ai
1 line	 F0503.ai
2 line	 F0504.ai
3 line	 F0505.ai
4 line	 F0506.ai

(4) Date Display Formant Setting

Display Menu Path:
Device setup ► Detailed setup ► Display set ► Optional config ► Format date

The date display format can be specified below.

Setting item	Contents
MM/DD/YYYY	Displays the date in "month/day/year".
DD/MM/YYYY	Displays the date in "day/month/year".
YYYY/MM/DD	Displays the date in "year/month/day".

The date needs to be set every time when the power is turned on.
In case the date is not set:
Date counting starts from 1900/01/01 00:00:00, according to HART specification.

(5) Inverse Display Setting

Display Menu Path:
Device setup ► Detailed setup ► Display set ► Optional config ► Inversion

Available to change from normal diplay to white/black reverse display.

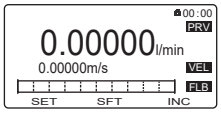
Setting item	Contents
Normal	Characters in the display is Black.
Inverse	Outline characters

5.3 Display Mode and Setting Mode

The device runs in the Display Mode when the power is turned on. For check or change of parameters, the Setting Mode must be activated. The following procedure explains how to change to the Setting Mode. For the function of IR switches, read Subsection 5.2.1.

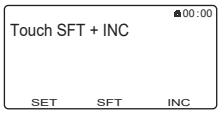
[Procedure]

1) Keep touching [SET] switch for few seconds.



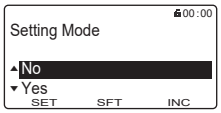
F0507.ai

2) Touch [SFT] + [INC] switches.



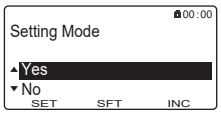
F0508.ai

3) "No" is selected.
Touch [INC] switch and select "Yes".



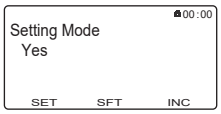
F0509.ai

4) Touch [SET] switch.



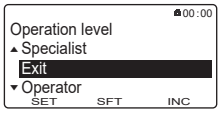
F0510.ai

5) "Yes" is blinking.
Touch [SET] switch again.



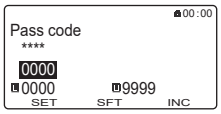
F0511.ai

6) The screen moves to the menu of Operation Level.



F0512.ai

7) Select an appropreate operation level by moving the cursor with [INC] or [DEC] switch.
Passcode is not necessary for "Operator". For "Maintenance" and "Specialist", passcode is necessary for each. For passcode setting, [SFT] is for position change, and [INC] is for number, then twice [SET] is for entry completion.
The default passcode at the factory shipment is set to "0000".



F0513.ai

8) When the Operation Level is determined, the screen moves to "Device setup" as the Setting Mode where parameters can be configured.
9) After completing parameter setting, push [ESC] switch. The screen returns to the Display Mode.

[Passcode Confirmation and Change]

The confirmation and change of the passcode are allowed only by parameter setting from the display unit.

Display Menu Path:
Device setup ▶ Detailed setup ▶ Access cfg ▶ Chg mainte
Device setup ▶ Detailed setup ▶ Access cfg ▶ Chg special

(1) Passcode for "Maintenance" operation level
To change the passcode (Maintenance code), "Maintenance" or "Specialist" as the operational level is required.

(2) Passcode for "Specialist" operation level
To change the passcode (Specialist code), "Maintenance" or "Specialist" as the operational level is required.

IMPORTANT

Display Menu Path: Device setup ▶ Wizard

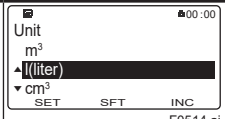
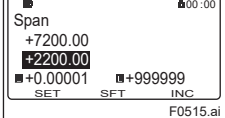
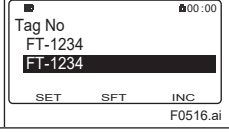
When parameters are changed in the Wizard of Easy setup, "Setting download" in the menu of each parameter must be executed after parameter is changed. Without the execution, any parameter changed is not stored into the device.

NOTE

If 10 minutes past without operation in the Setting Mode, the screen goes back to the Display Mode.

Parameter form

There are three types of parameter form below.

Type	Example of display	Contents
Select type	 F0514.ai	Select the adequate data from among alternatives which are detemined in advance.
Numeric type	 F0515.ai	Specify the data with a combination of number and a decimal point into each digit.
Alphanumeric type	 F0516.ai	Configure the data with a combination of alphanumeric characters. (Tag No., Special unit, etc…)

The alphanumeric type indicates alphanumeric characters in the following order.

0123456789ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz!"#$%&'()*+,-./:;<=>?@[\]^_`{|}~"space"

5.4 Parameter Setting from Display Panel

This section explains how to specify the parameters from display panel. Select “Specialist” at the Operation Level referring to Section 5.3. And select the parameters to be specified in the Setting Mode.

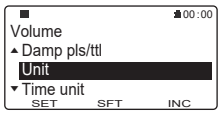
NOTE

For the device with the ordering information specified at ordering, the specified parameters (flow span and unit, tag number, etc.) are stored in the device at the factory shipment. Without the ordering information specified, parameter setting needs to be done by user.

5.4.1 Setting example of Select type Data: Flow rate unit

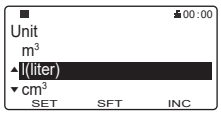
The following is the procedure of changing the flow rate unit as Select type parameter according to the specification of HART protocol.
The flow rate unit needs to be specified with “Physical unit” and “Time unit” individually. When the flow rate unit needs to be set “l/min”, select “l (litter)” at the Physical unit and “/min” at the Time unit.

Display Menu Path:
Device setup ▶ Detailed setup ▶ Pro var ▶ Volume ▶ Unit
Device setup ▶ Detailed setup ▶ Pro var ▶ Volume ▶ Time Unit



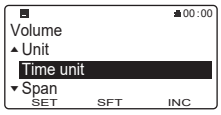
F0517.ai

Specify the Physical unit for volumetric flow.
Move cursor with [INC] and [DEC] according to the menu path above, and select the “unit” then push [SET].



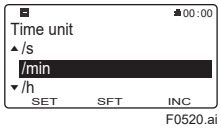
F0518.ai

Move cursor with [INC] and [DEC], and select the “l(liter)” then push [SET]. As the selected unit is blinking, push [SET] to determin. The screen returns to the setting page.



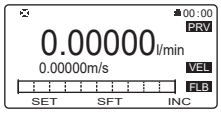
F0519.ai

Specify the Time unit for volumetric flow.
Move cursor with [INC] and [DEC] according to the menu path above, and select the “Time unit” then push [SET].



F0520.ai

Move cursor with [INC] and [DEC], and select the “/min” then push [SET]. As the selected unit is blinking, push [SET] to determin. The screen returns to the setting page after the setting.



F0521.ai

After completing the parameter setting, push [ESC] then the screen returns to the Display Mode.

NOTE

Be sure to set the Flow rate unit in the beginning when the Flow rate unit and Flow span value are changed at the same time.
When the unit is changed, the value of flow rate span is converted to related values automatically according to the unit change.

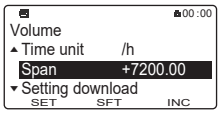
5.4.2 Setting example of Numeric type Data: Flow rate span

The following is the procedure of changing the Flow rate span as Numeric type parameter.

Display Menu Path:
Device setup ▶ Detailed setup ▶ Pro var ▶ Volume ▶ Span

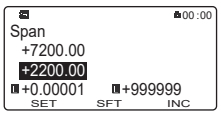
NOTE

Be sure to set the Flow rate unit in the beginning when the Flow rate unit and Flow span value are changed at the same time.
When the unit is changed, the value of flow rate span is converted to related values automatically according to the unit change.



F0522.ai

Specify the Flow rate span unit.
Move cursor with [INC] and [DEC] according to the menu path above, and select the “Span” then push [SET].



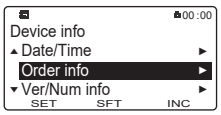
F0523.ai

The switch's functionality of setting the Flow rate span is as below:
Plus/minus and mumeric change: [INC]
Movement on digits: [SFT]
Determination of parameter: [SET]
L : Minimum value
U : Maximum value
Push [SET] to decide while the value of Flow rate span is blinking. The screen returns to the setting page after the setting.

5.4.3 Setting Example of Alphanumeric type Data: Tag No.

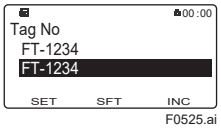
The following is the procedure of changing the Tag No. as Alphanumeric type parameter according to the specification of HART protocol.

Display Menu Path:
Device setup ▶ Detailed setup ▶ Device info ▶ Order info ▶ Tag No.



F0524.ai

Specify the Tag No..
Move cursor with [INC] and [DEC] according to the menu path above, and select the “Order info” then push [SET].



F0525.ai

For Tag No., up to 8 characters can be entered from display panel.
The switch's functionality of setting the Flow rate span is as below:
Plus/minus and mumeric change: [INC]
Movement on digits: [SFT]
Determination of parameter: [SET]
Available characters: ASCII characters
Push [SET] to decide while the value of Tag No. is blinking. The screen returns to the setting page after the setting.

5.5 microSD Card Setting

For the device with optional code MC, by setting the dedicated microSD card into the slot on the display unit, the parameter setting can be stored into it. The stored data can be restored to the device. For the detailed function, read the user's manual of applicable communication type as listed in Table 1.1.

WARNING

Use only micro SD cards sold by YOKOGAWA. Operation cannot be guaranteed when other cards are used.

(1) Installing microSD Card

Carefully insert the dedicated microSD card into the slot on the display unit until the slot holds the card. (see Figure 5.5).

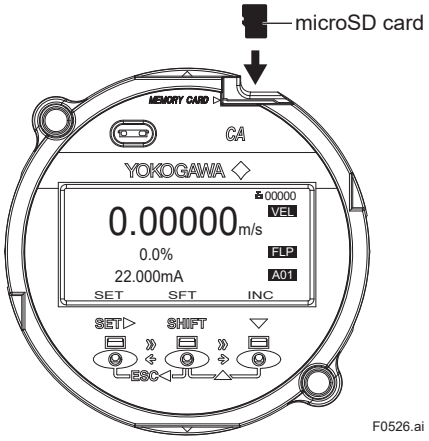


Figure 5.5 microSD setting

(2) Removing microSD Card

The microSD is released from the slot by pushing it. To prevent from losing the microSD card, be careful to handle the card.

IMPORTANT

If the microSD card is removed without execution of "Unmount" on parameter setting, it may result in the corruption of stored data and the abnormal operation of device.

Display Menu Path:
Device setup▶microSD▶Unmount

5.6 HART Configuration Tool

The connection of the HART configuration tool (FieldMate (Versatile Device Management Wizard)) is shown as below. Read the user's manual of HART communication type as listed in Table 1.1 for the detailed parameter setting via HART communication.

NOTE

- For more details regarding the operations of the HART configuration tool, read the manual of HART configuration tool.
- When using FieldMate, be sure that the revision is R3.04.20 or later.

NOTE

Perameters on HART configuration tool are displayed in English only. Even if any language other than English is selected as "display language" from display panel, parameters are displayed in English on HART configuration tool.

5.6.1 Connections with HART Configuration Tool

The HART configuration tool can interface with this device from the control room, this device site, or any other wiring termination point in the loop, provided there is a minimum load resistance of 230 Ω between the connection and the receiving product. To communicate, it must be connected in parallel with this device, and the connections must be non-polarized.
See Figure 5.6.

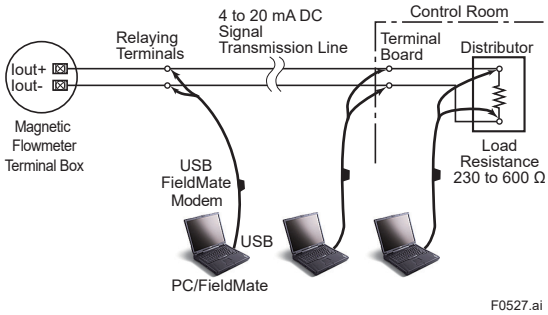


Figure 5.6 Connecting the HART Configuration Tool

IMPORTANT

Communication signal is superimposed on analog output signal. It is recommended to set a low-pass filter (approximately 0.1s) to the receiver in order to reduce the output effect from communication signal. Before online-communication, confirm that communication signal does not give effect on the upper system.

For explosion protection type, the configuration tool should be connected at the safe site of “no explosive atmosphere”.

5.6.2 HART Configuration Tool and Device Revision

IMPORTANT

Protocol revision supported by HART configuration tool must be the same protocol revision or later than that of the device. If it is not, communication error occurs.

(1) Device Description (DD) and Device Revision

Before using the HART configuration tool, confirm that the DD (Device Description) of this device is installed in the configuration tool.
If correct DD is not installed to the configuration tool, install a correct DD from the HART official site, otherwise, contact the respective vendors of the configuration tool for its upgrade information.
The device revision is as follows.

DD Revision	2 or later
Device Type (Transmitter)	CA (0x371E)
Device Revision (Transmitter)	1

- **Confirmation of DD revision**
  (a) Turn on the power of the configuration tool under the standalone condition.
  (b) Confirm the device revision from the installed DD file name according to the procedure provided for the configuration tool.
  DD file name is four digits, upper two digits are device revision and lower two digits are DD revision.

NOTE

Device revision of DD file is given in hexadecimal.

- **Confirmation of Device revision**
  Connect the configurator to this device and confirm the revision by the following parameter.

HART Communication Menu Path: Device Settings ▶ Detailed setup ▶ Device information ▶ HART setup ▶ Device Revision

(2) Device Type Manager (DTM) and Device Revision

When configuring the parameters by FieldMate, use the DTM (Device Type Manager) of the following table.

DTM Name	CA FDT2.0 HART7 DTM
DTM Revision	R3.09.22 or later
Device Type (Transmitter)	CA (0x371E)
Device Revision (Transmitter)	1

* : The DTM is included in Yokogawa DTM Library HART 8.8 or later.

NOTE

The DTM revision can be confirmed by “DTM Setup”.
Device Files is a Media included in FieldMate. The user registration site provides Device Files with the latest update programs.
(URL: https://partner.yokogawa.com/global/fieldmate/)
When updating the DTM, following operation by “DTM Setup” is required.

- Update DTM catalog
- Assign corresponding DTM to the device.

For details, read the user’s manual of FieldMate.

6. Operation

After the installation of sensor into process piping, the wiring of input/output terminals, the configuration of required parameters, and the zero adjustment prior to operation, the flowmeter outputs a flow signal from its terminals as soon as the fluid is sent in the pipe.

CAUTION

If any damages, such as cracks, breakage or destruction on the glass of the display occurs, stop using it and replace the cover. If it is used with damaged glass, it may cause injury, electric shock, malfunction, and specified protection performance of the housing is not provided.

6.1 Pre-operation Zero Adjustment

Zero adjustment is carried out to ensure that the output for zero flow is 0% (i.e., 4 mA). Although adjustment to zero is performed at the manufacturing plant prior to shipment, this procedure must be carried out once again following the installation of piping in order to match the magnetic flowmeter to its operating conditions.
This section describes the zero adjustment procedure using the display unit.

IMPORTANT

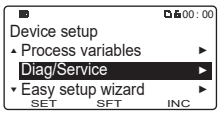
- Zero adjustment should be carried out before actual operation. Note that parameter setting or change cannot be carried out during execution of zero adjustment (i.e., for approximately 60 seconds).
- Zero adjustment should only be carried out when the sensor has been filled with measurement fluid and the fluid velocity is completely zero by closing the valve.
- Each time that the fluid being measured is changed, be sure to carry out zero adjustment with the new fluid.

6.2 Zero Adjustment from Display Unit

A procedure of executing zero adjustment is as follows;

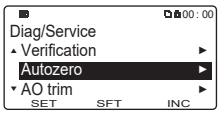
Display Menu Path:
Device setup ▶ Diag/Service ▶ Autozero ▶ Execute
Device setup ▶ Diag/Service ▶ Autozero ▶ Result ▶ Zero value

Enter the Setting Mode. (Read Section 5.3)



F0601.ai

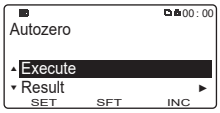
Select “Diag/Service” according to the menu path above.



F0602.ai

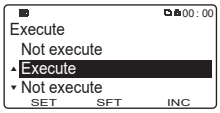
Select “Autozero”.

*: Fieldbus communication type does not have AO/AI trim.



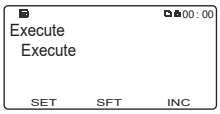
F0603.ai

Select “Execute”.



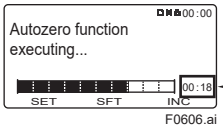
F0604.ai

Select “Execute”.



F0605.ai

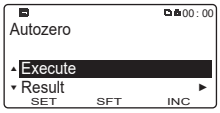
When “Execute” blinks, touch [SET] to execute.



F0606.ai

Autozero starts, and the progress is desplayed with a remaining time and a bar graph. Wait for the completion.

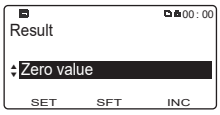
The time remaining until the end.



F0607.ai

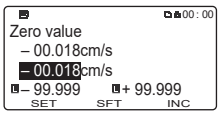
After Autozero finished, the display returns to “Autozero” menu.

• Confirmation of zero adjustment result



F0608.ai

For the result of Autozero, select “Result” and then “Zero value”.



F0609.ai

Result of Autozero is indicated as on the left.

NOTE

When the zero adjustment result exceeds defined value, the warning [092: AZ warn] is indicated.

Zero adjustment can be executed with the following parameter.

HART Communication Menu Path:
Device Settings ▶ Basic setup ▶ Autozero ▶ Autozero Exe

6.3 Hardware Switch Setting

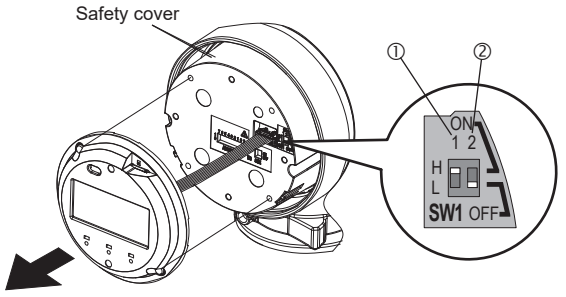
WARNING

For explosion protection type products, please confirm that it is “no explosive atmosphere”.

IMPORTANT

- Removing and installing the cover are necessary for hardware switches. Perform removing and installing the cover as described in Section 3.4. When opening the cover, wait for more than 20 minutes after turning off the power. This work must be carried out by the trained personnel having knowledge of safety standard.
- To preserve the safety, do not touch the electrical circuit and the cables except the setting switches.
- When installing the cover, in order to contact the housing and the cover, be sure to screw it firmly into the housing without any space between them.

(1) Remove the cover.
(2) While holding the display by hand, loosen the two mounting screws.
(3) While holding the display by hand (careful for connecting cable), set the switches. Never remove connector in this case.



① Burnout switch (SW1-1)
② Write protect switch (SW1-2)
F0610.ai

Figure 6.3 Hardware switches

(4) Taking care not to entangle the cables, tighten the two screws on the display.
(5) Install the cover.

WARNING

To prevent electric shock and maintain performance, do not remove the safety cover.

NOTE

The hardware switches are adjacent. Special care should be taken when making switch settings.

● Setting of Burnout Switch

The burnout function sets the direction of current output in situations where the CPU has become damaged. Upon shipment from the manufacturing plant, the burnout direction is set to High (i.e., > 21.6 mA); however, in cases where the optional codes C1 or C2 have been specified, the output direction will be set to Low (i.e., < 2.4 mA). Modification of the burnout direction must be carried out using the burnout switch (SW1-1) (See Figure 6.3).

Table 6.3.1 Burnout switch (SW1-1)

Position of Switch	Burnout Direction	Burnout Output	Description
1 2 H L ON OFF	High	> 21.6 mA	When optional code C1 or C2 is not specified, the setting is “High”.
1 2 H L ON OFF	Low	< 2.4 mA	When optional code C1 or C2 is specified, the setting is “Low”.

● Setting of Write Protect Switch

The write protect function is to prevent the overwriting of parameters.
Write protection can be carried out using either the write protection switch (SW1-2) (See Figure 6.3) or software function with parameter setting. If either of these items is activated, the overwriting of parameters will be prohibited.

Table 6.3.2 Write protect switch (SW1-2)

Position of Switch	Write Protect Function
1 2 H L ON OFF	OFF (Factory setting) Parameter can be overwritten.
1 2 H L ON OFF	ON Parameter can not be overwritten.

7. Errors and Countermeasures (Display unit)

The error messages are described in the following tables.

Explanation of NE107 status:

NE107 status		Status of the device
F	Failure	Device malfunction, Parts malfunction
C	Function Check	The output signal is temporarily invalid for the local operation or manual operation.
S	Out of Specification	The device works in out of specification. The output signal is uncertain for the process or the ambience.
M	Maintenance Required	The maintenance is required in the near future.
N	No Effect	Other issue

The status “Not Defined” defined in the library for HART Condensed Status Map is not supported.
The following table shows possible countermeasures.

■ System Alarm

Device breaks down and causes abnormal measurement.
Device replacement is needed.

NE107 Status	Error Message Display	Error Description	Countermeasure
F	010:Main CPU FAIL	CPU (Main board) failure was detected.	Contact Yokogawa service center.
F	011:Rev calc FAIL	Failure of reverse calculation was detected.	Contact Yokogawa service center.
F	012:Main EEP FAIL	Failure of EEPROM (Main board) was detected.	Turn on the power again within the temperature range. If the problem does not improve, contact Yokogawa service center.
F	013:Main EEP dflt	EEPROM (Main board) was reseted to default values.	Contact Yokogawa service center.
F	014:Snsr bd FAIL	Failure of sensor board was detected.	Contact Yokogawa service center.
F	015:Snsr comm ERR	Communication error of sensor was detected.	Contact Yokogawa service center.
F	016:AD 1 FAIL[Sig]	Failure of A/D transumitter 1 [flow velocity signal] was detected.	Contact Yokogawa service center.
F	017:AD 2 FAIL[Excit]	Failure of A/D transmitter 2 [Exciting current] was detected.	Contact Yokogawa service center.
F	018:Coil open	Coil of sensor was disconnected.	Turn off the power, check coil of sensor and excitation cable.
F	019:Coil short	Coil of sensor was shorted.	Contact Yokogawa service center.
F	020:Exciter FAIL	Failure of excitation circuit was detected.	Contact Yokogawa service center.
F	021:PWM 1 stop	Error of pulse width modulation 1 was detected.	Contact Yokogawa service center.
F	023:Opt bd mismatch	Mismatch of option board was detected.	Contact Yokogawa service center.
F	024:Opt bd EEP FAIL	Failure of EEPROM (option board) was detected.	Contact Yokogawa service center.
F	025:Opt bd A/D FAIL	Failure of A/D (option board) was detected.	Contact Yokogawa service center.
F	026:Opt bd SPI FAIL	Failure of SPI (option board) was detected.	Contact Yokogawa service center.
F	027:Restore FAIL	Restore of parameters was failed.	Retry parameter restoration.
F	028:Ind bd FAIL	Failure of indicator board was detected.	Check the ambient temperature of display is within the range. If the problem does not improve, contact Yokogawa service center.
F	029:Ind bd EEP FAIL	Failure of EEPROM (indicator board) was detected.	Turn on the power again within the temperature range. If the problem does not improve, contact Yokogawa service center.
F	030:LCD drv FAIL	Failure of LCD driver was detected.	Contact Yokogawa service center.
F	031:Ind bd mismatch	Mismatch of Indicator board was detected.	Contact Yokogawa service center.
F	032:Ind comm ERR	Communication error of indicator board was detected.	Check connection of Indicator & main board.
F	033:microSD FAIL	Failure of microSD card was detected.	Change microSD card.

■ Process Alarm

The device works normally and some issue of process causes abnormal measurement.
Maintenance work is needed.

NE107 Status	Error Message Display	Error Description	Countermeasure
S	050:Signal overflow	Failure of input signal was detected.	Check signal cable and grounding.
N	052:H/L HH/LL alm	Flow rate exceeded upper limit or lower limit.	Check flow rate and setting value.

■ Setting Alarm

The device works normally but parameter setting error occurs.
Parameter setting is needed.

NE107 Status	Error Message Display	Error Description	Countermeasure
S	060:Span cfg ERR	Setting error of flow span was detected. (fulfill "0.05 m/s < Span < 16 m/s")	Check or change span parameter setting.
S	062:AO 1 4-20 lmt	Setting error of Current output 1 was detected. (fulfill "LRV < HRV")	Check or change Analog output 1 parameter setting.
S	064:AO 1 mlt rng	Setting error of the multi range function was detected. (Span value settings of each range do not satisfy the relationship of lower range ≤ higher range, multi range settings for the status input and status output are erroneous, or the multi range and the absolute range are selected at the same time)	Check the parameter setting related to the multi range.
N	065:H/L cfg ERR	Setting error of ararm high/low limit function was detected. (fulfill "Hi Alarm - Lo Alarm > H/L Hys" and "HH Alarm - LL Alarm > HH/LL Hys")	Check and change H/L, HH/LL parameter setting.
S	066:Density cfg ERR	Setting error of density value was detected when PV was set to mass flow rate.	Check and change Density parameter setting.
S	067:Pls 1 cfg ERR	Setting error of Pulse output 1 was detected.	Change Pulse output 1 parameter setting.
S	068:Pls 2 cfg ERR	Setting error of Pulse output 2 was detected.	Check and change Pulse output 2 parameter setting.
C	069:Nomi size cfg	Configuration error of nominal size was detected. (fulfill "0.99 mm < nominal size < 3000.10 mm (0.01 inch < nominal size < 120.10 inch)")	Check and change nominal paramter setting.
C	072:Log not start	Data logging failed to start.	Insert microSD card.

■ Warning

The device works normally and measurement is also normal but warning occurs.

NE107 Status	Error Message Display	Error Description	Countermeasure
S	080:AO 1 saturate	Saturation of Analog output 1 was detected.	Check process value and current output 1 parameter setting.
S	082:Pls 1 saturate	Saturation of Pulse output 1 was detected.	Check process value and pulse output 1 parameter setting.
S	083:Pls 2 saturate	Saturation of Pulse output 2 was detected.	Check process value and pulse output 2 parameter setting.
C	086:Coil insulation	Insulation deterioration of coil was detected.	Contact Yokogawa service center.
C	092:AZ warn	Result of Autozero adjustment |Mag Flow Zero| exceeded 20 cm/s.	Check fluid is stopped when executing auto-zero adjustment.
C	093:Verif warn	Interruption of verification function was detected.	Execute Verification again.
C	095:Simulate active	Test mode was executed for any of Flow velocity, Volumetric flow rate, Mass flow rate, Current output, Pulse output, Status input, Status output.	Release simulation or test mode.
S	096:AO 1 fix	It was detected that fixied value is set to Current output 1.	Check current output 1 is test mode or not.
S	098:Pls 1 fix	It was detected that fixied value is set to Pulse output 1.	Check pulse output 1 is test mode or not.
S	099:Pls 2 fix	It was detected that fixied value is set to Pulse output 2.	Check pulse output 2 is test mode or not.
C	101:Param restore run	Restore function of parameter is running.	—
N	102:Disp over	Number of digits available for display exceeded the limit.	Check Display format parameter.
N	103:SD size warn	Free space of microSD card decreased to less than 10%.	microSD card may run out of memory space.
M	104:Bkup incmplt	Parameter backup failed.	Retry parameter backup.
S	105:SD mismatch	Mismatch of microSD card was detected.	Change microSD card.
M	106:SD removal ERR	Removal of microSD card failed.	Remove microSD in appropriate rocedure.

■ Information

The device works normally and measurement is also normal. Just reference information.

NE107 Status	Error Message Display	Error Description	Countermeasure
N	120:Watchdog	Error of Watchdog timer was detected.	Contact Yokogawa service center.
N	121:Power off	Power-off was detected.	—
N	122:Inst power FAIL	Instantaneous power failure was detected.	—
N	123:Param bkup run	Parameter backup is running.	—
N	124:Data log run	Data log is running.	—
N	130:DevID not enter	No data entry of Device ID was detected.	Contact Yokogawa service center.

Revision Information

- Title : Magnetic Flowmeter CA Series Installation Manual
- Manual No. : IM 01E40A01-01EN

Edition	Date	Page	Revised Item
1st	Sep. 2022	—	New publication
2nd	May 2023	—	Added explosion protection
3rd	Feb. 2024	—	Added Japan Explosion protection