User's Manual

ADMAG CA

Models CA100S and 200S Capacitance Magnetic Flowmeter

IM 1E8B0-01E

vigilantplant®

YOKOGAWA
Yokogawa Electric Corporation

IM 1E8B0-01E
9th Edition

Models CA100S and 200S
Capacitance Magnetic Flowmeter

IM 1E8B0-01E 9th Edition

Contents

1. INTRODUCTION

Thank you for purchasing CA capacitance magnetic flowmeter.
To ensure correct use of the instrument, please read this manual thoroughly and fully understand how to operate the instrument before operating it.

NOTE

This manual describes the hardware and software configuration of CA capacitance magnetic flowmeter.

■ Regarding This Manual

- This manual should be passed on to the end user.
- The contents of this manual may be changed without prior notice.
- All rights are 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 material, including, but not limited to, implied warranties of merchantability and suitability for a particular purpose.
- All reasonable effort has been made to ensure the accuracy of the contents of this manual. However, if any errors or omissions are found, please inform Yokogawa.
- 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 instruments.
- Please note that this manual may not be revised for any specification changes, construction changes or operating part changes that are not considered to affect function or performance.
- Yokogawa assumes no responsibilities for this product except as stated in the warranty.
- If the customer or any third party is harmed by the use of this product, Yokogawa assumes no responsibility for any such harm owing to any defects in the product which were not predictable, or for any indirect damages.

■ Safety and Modification Precautions

- The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific WARNINGS given elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Yokogawa assumes no liability for the customer's failure to comply with these requirements. If this instrument is used in a manner not specified in this manual, the protection provided by this instrument may be impaired.
- Yokogawa will not be liable for malfunctions or damage resulting from any modification made to this instrument by the customer.
- The following safety symbol marks are used in this manual and instrument.

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 the product.

IMPORTANT

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

NOTE

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

⏚ Protective grounding terminal.
⏚ Functional grounding terminal. This terminal should not be used as a "Protective grounding terminal".
~ Alternating current.
⎓ Direct current.

1.1 Using This Instrument Safely

(1) 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. The magnetic flowmeter must be installed within the specification conditions.
- The magnetic flowmeter is a heavy instrument. 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.
- When the magnetic flowmeter is processing hot fluids, the instrument 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 instrument has been taken off the piping line for maintenance and so forth.
- Do not apply excessive weight, for example, a person stepping on the magnetic flowmeter.
- All procedures relating to installation must comply with the electrical code of the country where it is used.

(2) 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.
- When connecting the wiring, check that the supply voltage is within the range of the voltage specified for this instrument before connecting the power cable. In addition, check that no voltage is applied to the power cable before connecting the wiring.

(3) Operation

WARNING

- Do not open the cover in wet weather or humid environment. When the cover is open, stated enclosure protection is not applicable.
- When opening the cover, wait for more than 10 minutes after turning off the power.
- Be sure to set parameters as "Protect" on the write protect function after finish of parameter setting work.

(4) Maintenance

WARNING

- Maintenance of the magnetic flowmeter should be performed by the trained personnel having knowledge of safety standard. No operator shall be permitted to perform any operations relating to maintenance.
- Do not open the cover in wet weather or humid environment. When the cover is open, stated enclosure protection is not applicable.
- When opening the cover, wait for more than 10 minutes after turning off the power.
- Always conform to maintenance procedures outlined in this manual. If necessary, contact Yokogawa.
- Care should be taken to prevent the build up of dirt, dust or other substances on the display panel glass or name plate. If these surfaces do get dirty, wipe them clean with a soft dry cloth.

(5) Explosion Protected Type Instrument

WARNING

- Magnetic flowmeters with the model name CA□□□SC, SN are products which have been certified as explosion proof type instruments. Strict limitations are applied to the structures, installation locations, external wiring work, maintenance and repairs, etc. of these instruments. Sufficient care must be taken, as any violation of the limitations may cause dangerous situations.
  Be sure to read Chapter 13 “HAZARDOUS DUTY TYPE INSTRUMENT” before handling the instruments. The description in Chapter 13 is prior to the other description in this manual.
  For TIIS flameproof type instruments, be sure to read “INSTALLATION AND OPERATING PRECAUTIONS FOR TIIS FLAMEPROOF EQUIPMENT” at the end of this manual.
- Only trained persons use this instrument in the industrial location.
- Take care not to generate mechanical spark when access to the instrument and peripheral devices in hazardous locations.

1.2 Warranty

- The terms of this instrument that are guaranteed are described in the quotation. We will make any repairs that may become necessary during the guaranteed term free of charge.
- Please contact our sales office if this instrument requires repair.
- If the instrument is faulty, contact us with concrete details about the problem and the length of time it has been faulty, and state the model and serial number. We would appreciate the inclusion of drawings or additional information.
- The results of our examination will determine whether the meter will be repaired free of charge or on an at-cost basis.

■ The guarantee will not apply in the following cases:

- Damage due to negligence or insufficient maintenance on the part of the customer.
- Problems or damage resulting from handling, operation or storage that violates the intended use and specifications.
- Problems that result from using or performing maintenance on the instrument in a location that does not comply with the installation location specified by Yokogawa.
- Problems or damage resulting from repairs or modifications not performed by Yokogawa or someone authorized by Yokogawa.
- Problems or damage resulting from inappropriate reinstallation after delivery.
- Problems or damage resulting from disasters such as fires, earthquakes, storms, floods, or lightning strikes and external causes.

■ Trademarks:

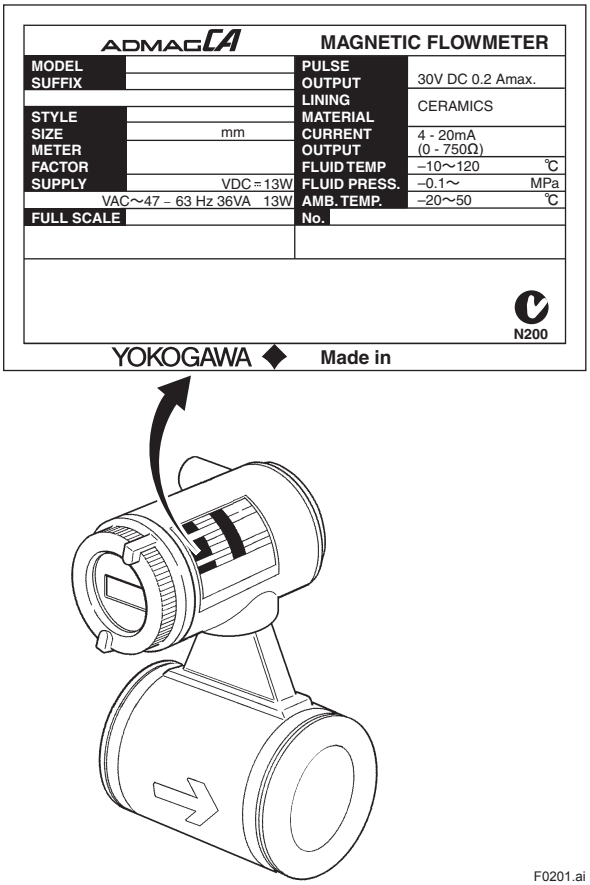
- ‘ADMAG’ and ‘BRAIN TERMINAL’ are registered trademarks of Yokogawa Electric Corporation.
  Company names and product names used in this material are registered trademarks or trademarks of their respective owners.
- In this manual, trademarks or registered trademarks are not marked with ™ or ®.

2. HANDLING PRECAUTIONS

This instrument has been inspected carefully at the factory before shipment. When the instrument is delivered, visually check that no damage has occurred during transportation.
Read this section carefully as it contains important information on handling this instrument. Refer to the relevant sections for information not contained in this section. If you have any problems or questions, please contact Yokogawa sales office.

2.1 Checking Model and Specifications

The model code and specifications are found on the name plate located on the outside of the case. Check that the model code and specifications match what you have ordered (Refer to Chapter 10 “OUTLINE”).
Be sure you have your model number and serial number available when contacting Yokogawa.



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2.2 Accessories

Check that the parts shown below are included in the package.

- Data sheet (1-sheet)
- Unit labels (1-sheet)
- Centering device (1-set)
- Plug (for DC power supply only) (1-piece)
- Hexagonal Wrench (only for hazardous duty type instrument) (1-piece)

2.3 Storage Precautions

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

(1) 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 (-4 to 122°F)
  Humidity: 5 to 80% RH (no condensation)
  The preferred ambient temperature and humidity levels are 25°C (75°F) and approximately 65% RH.

(2) The instrument should be stored in its original packing condition in the storage location.

(3) If the CA magnetic flowmeter 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 CA capacitance magnetic flowmeter as soon as possible after transferring it to the installation location.

2.4 Installation Location Precautions

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

- **Ambient Temperature:**

  Avoid installing the instrument 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 instrument 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:**

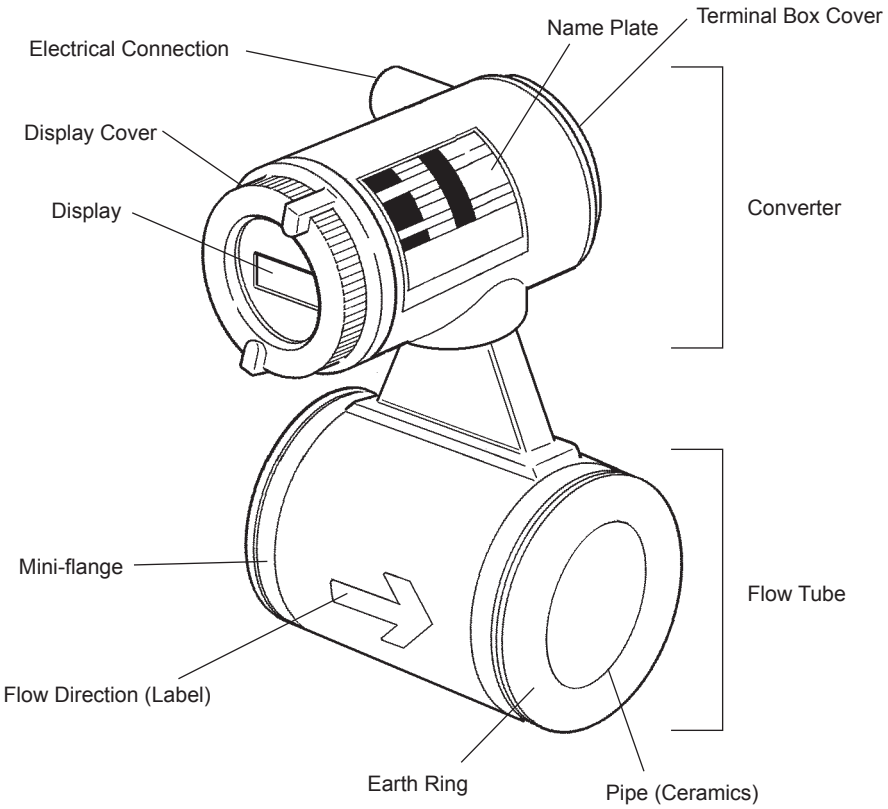
  Avoid installing the instrument in a place subject to shocks or vibrations.

2.5 Converter Reorientation Precautions

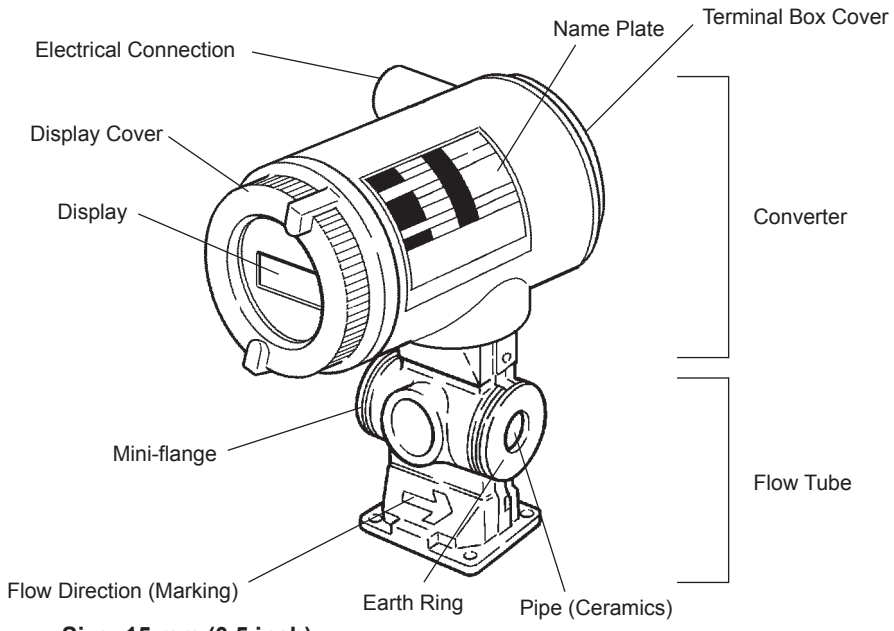
WARNING

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

3. COMPONENT NAMES



Size: 25 to 200mm (1 to 8 inch)



Size: 15 mm (0.5 inch)

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4. INSTALLATION

4.1 Piping Design Precautions

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

Design piping correctly, referring to the following to prevent damage to flowtubes 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 flowtube. For more information, refer to Chapter 10 “OUTLINE”.

(2) Noise Avoidance

IMPORTANT

- The flowmeter should be installed away from electrical motors, transformers, inverters and other power sources in order to avoid interference with measurement.
- In case several capacitance Magnetic Flowmeters are installed, please install them 1 m (40 in.) or more apart.

(3) Required Straight Pipe Length

To maintain accurate measurement, see JIS B 7554 which explains the requirements for upstream piping conditions of magnetic flowmeters.

The piping conditions we recommend as shown in Figure 4.1.1 are based on JIS B 7554 and on our piping condition test data.

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 magmeter be 20D (where D denotes flowtube size) or more. Please be careful that gasket material dose not protrude in pipe inner surface.

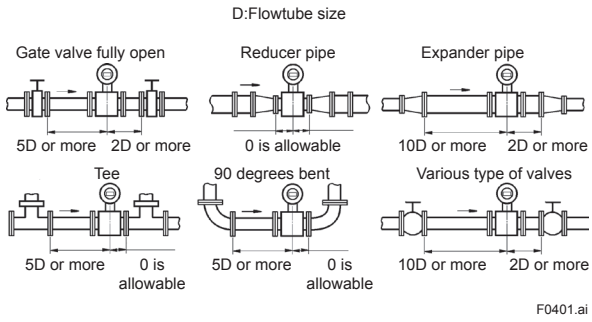


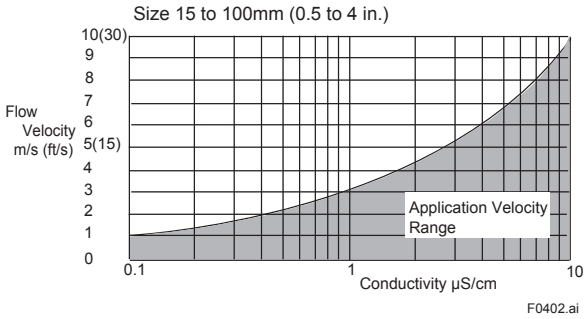
Figure 4.1.1 Required Straight Pipe Length

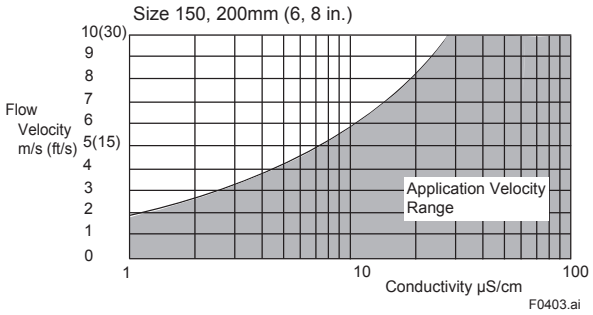
*1: Do not install anything in the vicinity that may interfere with the magnetic field, induced signal voltages, or flow velocity distributions of the flowmeter.
*2: A straight run may not be required on the downstream side of the flowmeter. However, if a downstream valve or other fitting causes irregularity or deviation in flows, provide a straight run of 2D to 3D on the downstream side.
*3: Highly recommend to mount valves on the downstream side so that deviated flows do not occur in the flowtube and to avoid startup from an empty condition.

(4) Applicable Velocity Range in Low Conductivity Fluid Measurement

IMPORTANT

- In the application for pure water, pure alcohol and other fluids which have low conductivity with low viscosity, fluid velocity should be within the range of Applicable velocity range which is shown in the figure listed below depending on fluid conductivity.
- 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 length of straight run (approximately 50D) to ensure the proper mixture of fluids.

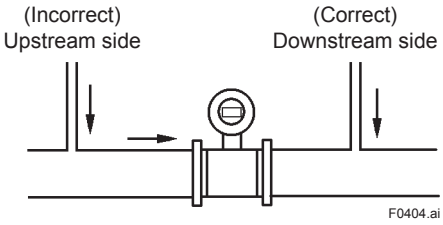


Figure 4.1.2 Chemical Injection

(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 earth 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.

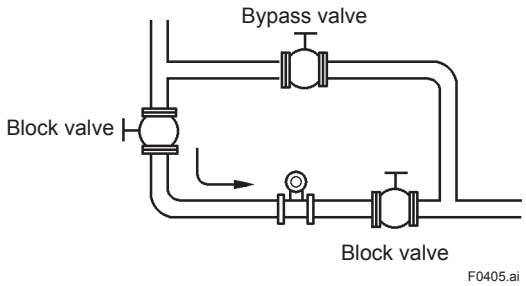


Figure 4.1.3 Bypass Line

(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.

(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 flowtube 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.

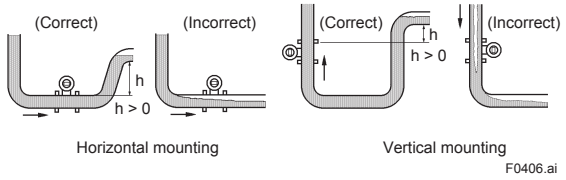


Figure 4.1.4 Mounting Positions

(11) Avoiding 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 flowtube.

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.

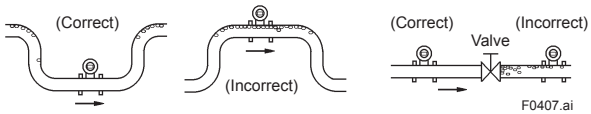


Figure 4.1.5 Avoiding Air Bubbles

(12) Mounting Orientation

IMPORTANT

If electrodes are perpendicular to the ground, air bubbles near the top or precipitates at the bottom may cause measurement errors. Ensure that the converter of flowmeter are mounted above the piping to prevent water from entering them.

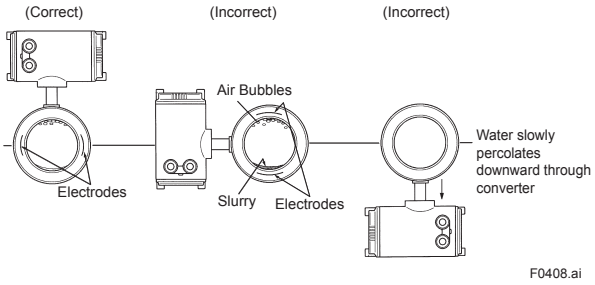


Figure 4.1.6 Mounting Orientation

(13) Grounding

IMPORTANT

Grounding resistance of 100 Ω or less is necessary. When the optional code A (lightning protector) is selected, grounding resistance of 10 Ω or less is necessary.
When the optional code JF3 (TIIS Flameproof type) is selected, grounding resistance of 10 Ω or less (Class A or Class C) is necessary.
In case of explosion proof type except TIIS, follow the domestic electrical requirements as regulated in each country.

IMPORTANT

Improper grounding can have an adverse effect on the flow measurement. Ensure that the instrument 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 flowtube and converter 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 a eath ring that makes a connection with the charge of the measured fluid for grounding. The flowmeter should be grounded by certain specifications (Refer to Figure 4.1.7).
Grounding is mandatory especially for insulated piping such as PVC-sheathed pipes. If not, the magnetic flowmeter measures the flow incorrectly because the reference electrical potential is floating.

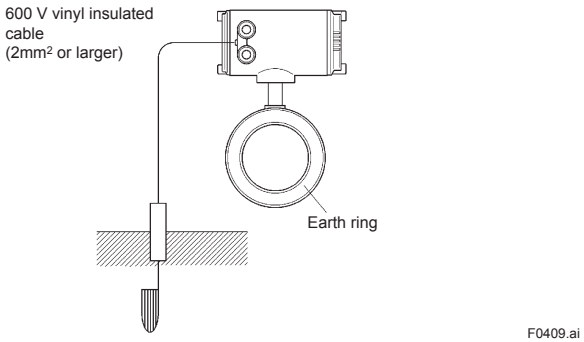


Figure 4.1.7 Grounding

4.2 Handling Precautions

WARNING

The magnetic flowmeter is a heavy instrument. 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.

4.2.1 General Precautions

(1) 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 4.2.1. Please never lift up by using a bar through the flow tube.

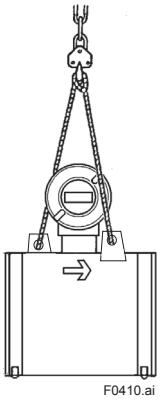


Figure 4.2.1 Lifting Method

(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 flange surface to shock. This may lead to liner 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 wiring ports 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 flowmeter perform supplementary inspections.

4.2.2 Flowmeter piping

CAUTION

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

IMPORTANT

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

(1) Correct any misaligned or slanted piping, and any gaps that may exist between mounting flanges before installing the flowmeter (refer to Figure 4.2.2).

(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 flowtube during measurement.

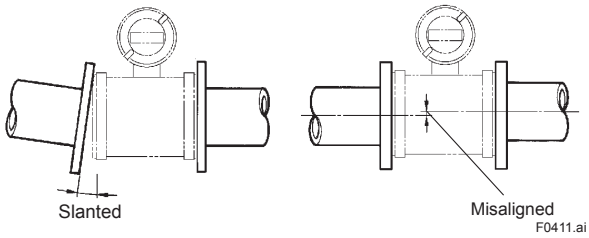


Figure 4.2.2 Slanted and Misaligned Flowmeter Piping

4.2.3 Alteration of LCD Display Orientation

LCD display orientation can be altered according to piping configurations if horizontal or vertical, just by removing four screws, adjusting unit orientation and fixing the screws tightly again as shown in Figure 4.2.3.

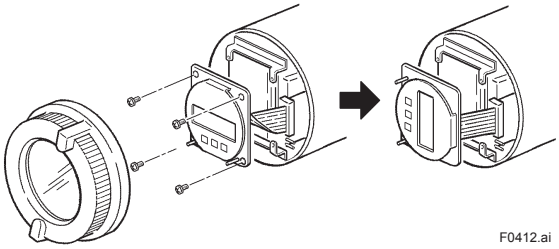


Figure 4.2.3 Procedure of Altering LCD Display Orientation

NOTE

- Orientation of display unit is limited to the two positions shown in Figure 4.2.3.
- Before altering LCD orientation, make sure to turn off the power supply and disconnect the power source.
- Explosion protected type must be, as a rule, removed to a non-hazardous area for altering LCD display orientation. For details, refer to “INSTALLATION AND OPERATING PRECAUTIONS FOR TIIS FLAMEPROOF EQUIPMENT” at the end of this manual.

4.3 Mounting

4.3.1 Nominal Diameter (15 to 40 mm (0.5 to 1.5 in.))

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. Use compressed non-asbestos fiber gasket, PTFE gasket or the gasket which has equal elasticity. For PVC piping, select an optional code FRG, please use rubber gasket or others which has equal elasticity. Be sure to choose a gasket with inner and outer diameters that does not protrude inside the piping (Refer to Table 4.3.6). If the inner diameter of the gasket is too large, or outer diameter of the gasket is too small, fluid leakage may result.

(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, refer to Subsection 6.3.6 “Reversing Flow Direction” or Subsection 7.2.8 “Reversing Flow Direction”.

(2) Mounting Centering Devices

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

(3) Positioning the Flowmeter

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. Pass the other through-bolts through the other holes (refer to Figure 4.3.1 and 4.3.2). 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.

(4) Tightening Nuts

Tighten the nuts according to the torque values for metal piping in Table 4.3.1. For PVC piping, select an optional code FRG, use rubber gaskets and tighten the nuts to the torque values PVC piping in Table 4.3.2.

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.

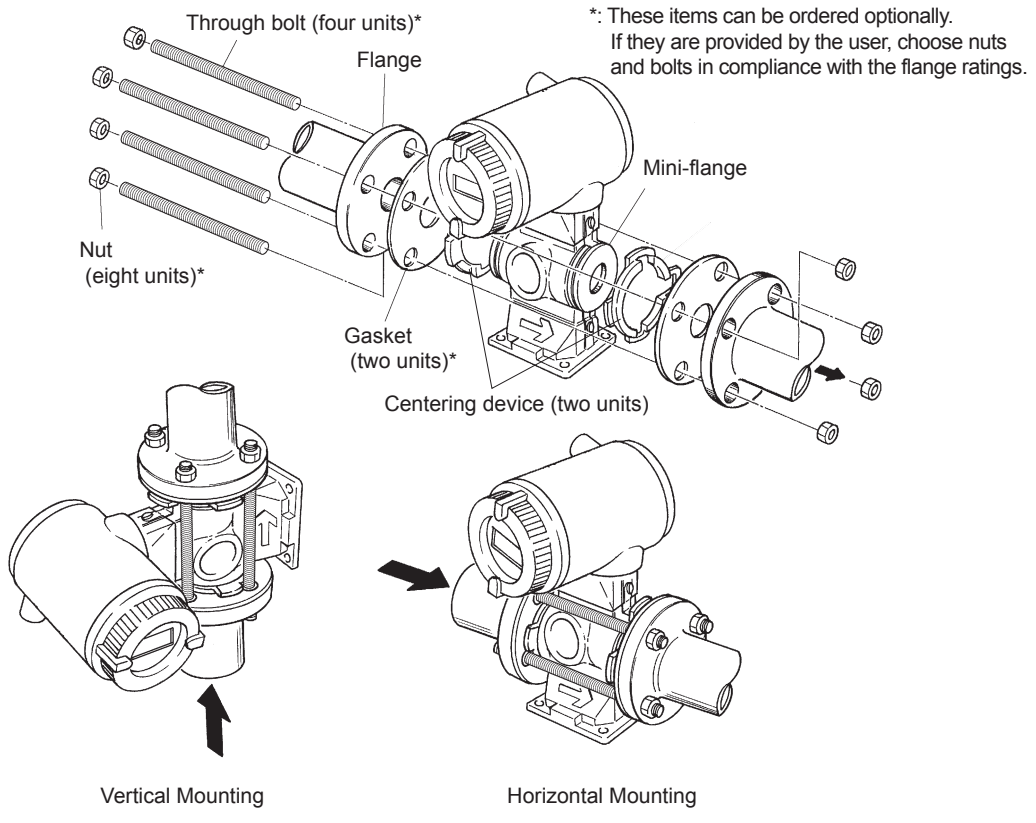


Figure 4.3.1 Mounting Procedure (size: 15mm (0.5 in.))

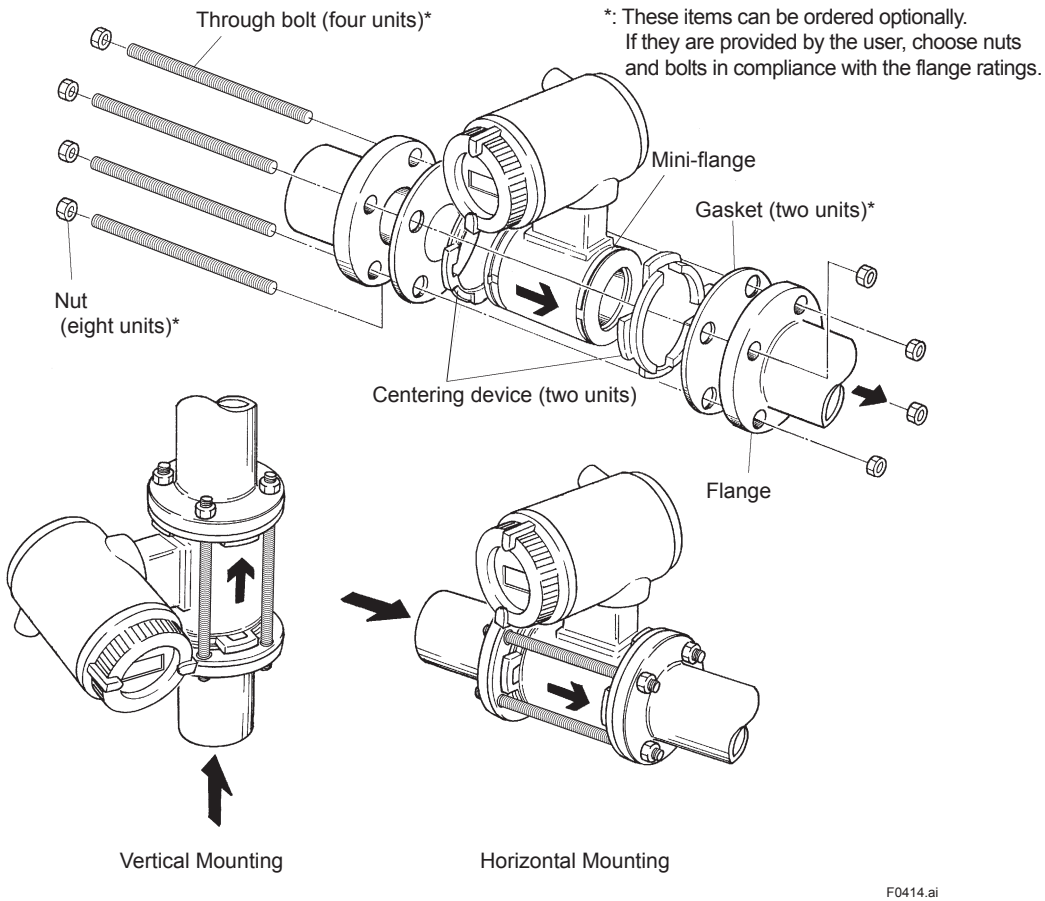


Figure 4.3.2 Mounting Procedure (size: 25, 40mm (1, 1.5 in.))

Table 4.3.1 Maximum Tightening Torque Values for Metal Piping N·m {kgf·cm} [in-lbf]

Flange Rating / Size mm(inch)	JIS		ANSI		DIN
	10K	20K	150	300	PN 10/16
15(0.5)	14{143}[124]	14{143}[124]	14{143}[124]	14{143}[124]	14{143}[124]
25(1)	30{306}[265]	30{306}[265]	22{224}[195]	30{306}[265]	25{255}[221]
40(1.5)	44{449}[389]	44{449}[389]	33{337}[292]	51{520}[451]	50{510}[442]

* Please use compressed non-asbestos fiber gasket, PTFE gasket or the gasket which has equal elasticity.

Table 4.3.2 Maximum Tightening Torque Values for PVC Piping N·m {kgf·cm} [in-lbf]

Flange Rating / Size mm(inch)	JIS		ANSI		DIN
	10K	20K	150	300	PN 10/16
15(0.5)	1.3{13}[12]	—	1.3{13}[12]	—	1.3{13}[12]
25(1)	3.5{36}[31]	—	2.8{29}[25]	—	2.7{28}[24]
40(1.5)	5.7{58}[50]	—	4.6{47}[41]	—	5.7{58}[50}

* Please select optional code FRG and use rubber gasket or others which has equal elasticity.

4.3.2 Nominal Diameter (50 to 200 mm (2 to 8 in.))

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. Use compressed non-asbestos fiber gasket, PTFE gasket or the gasket which has equal elasticity. For PVC piping, select an optional code FRG, please use rubber gasket or others which has equal elasticity. Be sure to choose a gasket with inner and outer diameters that does not protrude inside the piping (Refer to Table 4.3.6). If the inner diameter of the gasket is too large, or outer diameter of the gasket is too small, fluid leakage may result.

(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, refer to Subsection 6.3.6 “Reversing Flow Direction” or Subsection 7.2.8 “Reversing Flow Direction”.

(2) Mounting Centering Devices

To maintain concentricity of the flowmeter with the pipes, install centering devices. From the process piping side, pass two through-bolts through the four centering devices (two for each bolt) and the adjacent two holes (the lower two holes for horizontal mounting) of both of the flanges (Refer to Figure 4.3.3). Use the appropriate centering devices according to the nominal diameter and the flange ratings. The centering devices are engraved with an identifying character. Use the appropriate ones which meet the required specifications by referring to Table 4.3.5.

(3) Positioning the Flowmeter

Position the flowmeter so that the Mini-flanges and the centering devices come in close contact with each other. Be careful to prevent the four centering devices from coming into contact with the housing. If stud-type through-bolts are used, position them in such a way that the four centering devices come in contact with the bolt threads (Refer to Figure 4.3.3). Pass the other through-bolts through from the process piping side.

(4) Tightening Nuts

Tighten the nuts according to the torque values for metal piping in Table 4.3.3. For PVC piping, select an optional code of FRG, use rubber gaskets and tighten the nuts to the torque values for PVC piping in Table 4.3.4.

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.

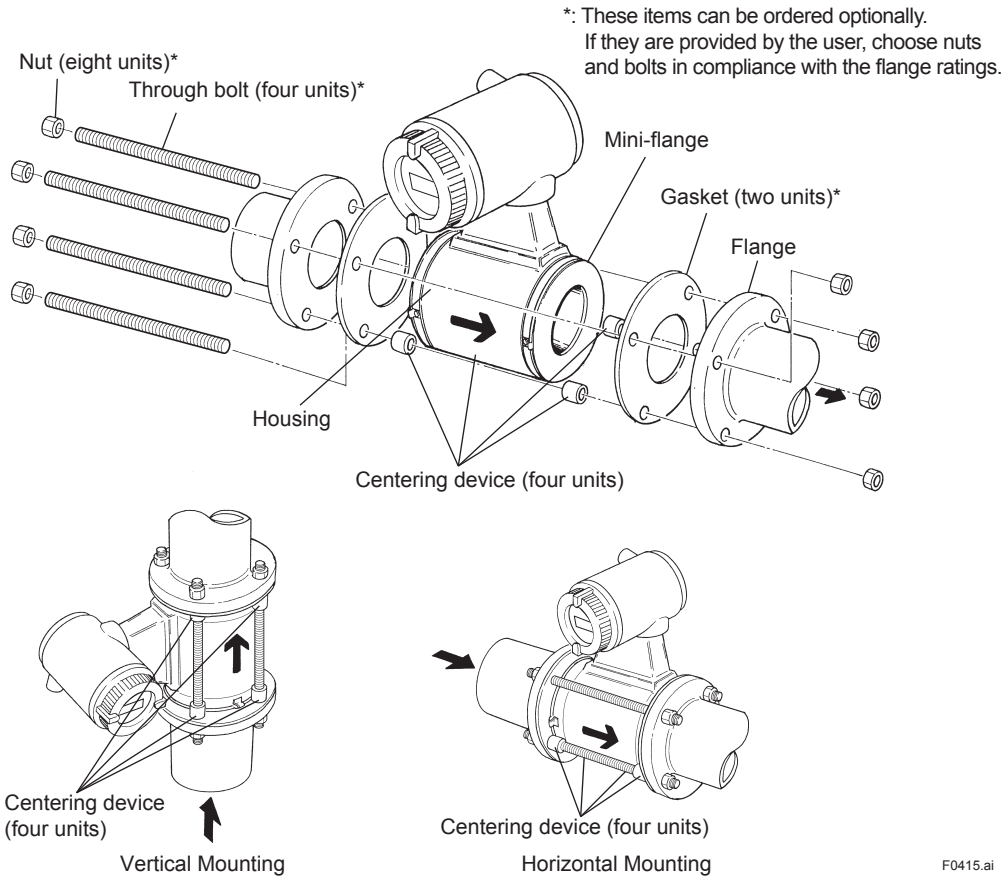


Figure 4.3.3 Mounting Procedure (size: 50 to 200 mm (2 to 8 in.))

Table 4.3.3 Maximum Torque Value for Metal Piping N·m {kgf·cm} [in-lbf]

Flange Rating / Size mm(inch)	JIS		ANSI		DIN		JIS G3451 F12(75M)
	10K	20K	150	300	PN 10	PN 16	
50(2)	50{510}[442]	27{276}[239]	50{510}[442]	27{276}[239]	—	63{643}[558]	—
80(3)	36{367}[319]	44{449}[389]	75{765}[664]	44{449}[389]	—	36{367}[319]	80{816}[708]
100(4)	48{490}[425]	58{592}[513]	49{500}[434]	56{571}[496]	—	48{490}[425]	105{1071}[929]
150(6)	79{806}[699]	55{561}[487]	66{673}[584]	43{439}[381]	—	76{776}[673]	84{857}[743]
200(8)	70{714}[619]	76{776}[673]	102{1041}[903]	76{776}[673]	103{1051}[911]	67{684}[593]	102{1041}[903]

* Please use compressed non-asbestos fiber gasket, PTFE gasket or the gasket which has equal elasticity.

Table 4.3.4 Maximum Torque Value for PVC Piping N·m {kgf·cm} [in-lbf]

Flange Rating / Size mm(inch)	JIS		ANSI		DIN		JIS G3451 F12(75M)
	10K	20K	150	300	PN 10	PN 16	
50(2)	8.2{84}[73]	—	8.2{84}[73]	—	—	8.2{84}[73]	—
80(3)	6.2{63}[55]	—	12.4{127}[110]	—	—	6.2{63}[55]	12.3{126}[109]
100(4)	8.0{82}[71]	—	8.1{83}[72]	—	—	8.0{82}[71]	16.1{164}[142]
150(6)	19.8{202}[175]	—	18.9{193}[167]	—	19.8{202}[175]	19.8{202}[175]	21.6{220}[191]
200(8)	17.5{179}[155]	—	25.1{256}[222]	—	26.2{267}[232]	17.5{179}[155]	28.7{293}[254]

* Please select optional code /FRG and use rubber gasket or others which has equal elasticity.

Table 4.3.5 Centering Device Identification

Flange Rating / Size mm(inch)	JIS 10K	JIS 20K	JIS G3451 F12	ANSI 150	ANSI300	DIN PN 10/16
50(2)	B	B	-	B	F	F
80(3)	B	F	H	F	C	G
100(4)	B	F	H	C	H	F
150(6)	B	C	G	B	D	B
200(8)	B	C	C	G	J	B

* Each Centering Devices is engraved a character as identification.

Table 4.3.6 Earth Ring Inside Diameter

Unit:mm(inch)

Size	Earth Ring Inside Diameter
15(0.5)	ø15(0.6)
25(1)	ø27(1.1)
40(1.5)	ø40(1.6)
50(2)	ø52(2.1)
80(3)	ø81(3.2)
100(4)	ø98(3.9)
150(6)	ø144(5.7)
200(8)	ø192(7.6)

* Please be sure the inner diameter of a gasket does not protrude to the each ring inside diameter.

4.4 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.

CAUTION

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

The external signal wirings are connected into the terminal inside the converter.
Please connect to each terminal (Refer to Figure 4.4.1) by taking off a cover backside the converter.

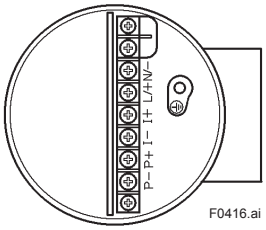


Figure 4.4.1 Terminal Configuration

Terminal Symbols	Description
⏚	Protective grounding
L/+ N/-	Power Supply
I+ I-	Current Output 4 to 20mA DC
P+ P-	Pulse or alarm output (Select one)

CAUTION

Please give attention to avoid the cable is bended excessively.

4.4.1 Wiring Precautions

Be sure to observe the following precautions when wiring:

(1) Wiring

CAUTION

- 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.
- All the cable ends must be provided with round crimp-on terminals and be securely wired.
- Power cables and output signal cables must be routed in steel conduit tubes separately. (except 4-core DC cable wiring)
- When waterproof glands or union equipped waterproof glands are used, avoid tightening the glands with an excessive torque.
- In case of DC Power Supply, a plug is provided. When 4-core cable is used, use this plug to cover the unused wiring port.
- Be sure to turn the power off before opening the terminal box cover.
- Before turning the power on, tighten the terminal box cover securely.
- Please install a external switch or circuit breaker as a means of power off (capacitance:15A, conform to IEC 60947-1 and IEC 60947-3). The preferable location is either near the instrument or other places to easy operation. Furthermore, please indicate “power off equipment” on the those external switch or circuit breaker.
- 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.

(2) Grounding

CAUTION

Be sure to connect protective grounding of ADMAG CA with cable of 2mm^2 or larger cross section in order to avoid the electrical shock to the operators and maintenance engineers and prevent the influence of external noise. And further connect the grounding wire to the ⏚ mark (100 Ω or less).

IMPORTANT

Grounding resistance of 100 Ω or less is necessary. When the optional code A (lightning protector) is selected, grounding resistance of 10 Ω or less is necessary.
When the optional code JF3 (TIIS Flameproof type) is selected, grounding resistance of 10 Ω or less (Class A or Class C) is necessary.
In case of explosion proof type except TIIS, follow the domestic electrical requirements as regulated in each country.

4.4.2 Power and Output Cables

Power cable:
Crimp-on Terminal
60˚C heat resistance
Green/Yellow covered conductors shall be used only for connection to PROTECTIVE CONDUCTOR TERMINALS.
Conform to IEC 227 or IEC245 or equivalent national authorization.

Output Cable:
Please use Polyvinyl chloride insulated and sheathed control cables (JIS C 3401) or Polyvinyl chloride insulated and sheathed portable power cables (JIS C 3312) or equivalents.

Outer Diameter:
6.5 to 12mm
waterproof grand (optional code: ECG, ECU) :
10.5 to 11.5mm

Nominal Cross Section:
Single wire; 0.5 to 2.5mm^2
Stranded wire; 0.5 to 2.5mm^2

4.4.3 DC Connections

(1) Connecting Power Supply

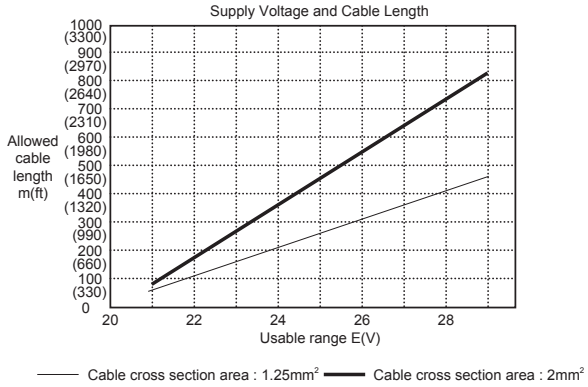
IMPORTANT

- In case of 24V DC power supply, AC power supplies or reversed polarities cannot be connected.
  It will cause the fuse to burnout.

(2) Supply Voltage Rating

IMPORTANT

- In case of 24V DC power supply, the specification for the supply voltage is 24V DC (-15 to +20%), but the input voltage of the converter drops due to cable resistance so it should be used within the following range.



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4.4.4 Wiring Ports

This instrument is of watertight construction as stipulated in JIS C 0920. It is shipped with a wiring bracket (waterproof gland or waterproof gland with union) or a plastic gland attached, only in cases where an optional specification is selected for the wiring port.
In case of the explosion proof type, refer to Chapter 13 “HAZARDOUS DUTY TYPE INSTRUMENT”.

IMPORTANT

The wiring port is sealed with a cap (not water-proof). Use the plug which is packed for the unused wiring port. If waterproof property is necessary, please use waterproof glands.

(1) When waterproof property is unnecessary (When there are no particular optional specifications)

The wiring port is sealed with a cap (not water-proof) that must be removed before wiring. At this time, handle the wiring port in accordance with the JIS C 0920 mentioned above. Use the plug which is packed for the unused wiring port.

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

IMPORTANT

To prevent water or condensation from entering the converter 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.

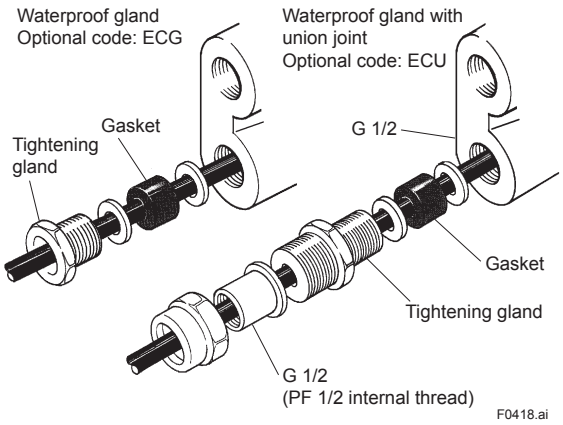


Figure 4.4.2 Waterproof Gland

(3) Conduit Wiring

When wiring the conduits, pass the conduit through the wiring connection port, and utilize the waterproof gland to prevent water from flowing in. Place the conduit pipe on an angle as shown in Figure 4.4.3. Install a drain valve at the low end of the vertical pipe, and open the valve regularly.

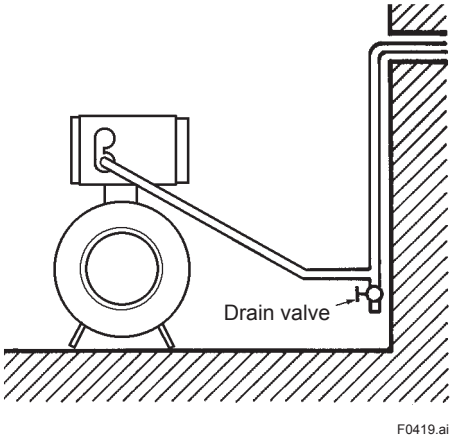


Figure 4.4.3 Conduit Wiring

4.4.5 Connecting to External Instruments

CAUTION

All the devices to be connected to current output and pulse output must be conformed to CSA1010, CSA950, IEC1010 or IEC950.

(1) Analog Signal Output (4 to 20mA DC signal is output)

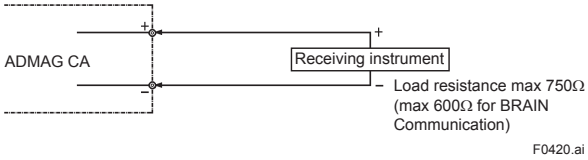


Figure 4.4.4 Connection for Analog Signal Output

(2) Pulse Output

IMPORTANT

This is a transistor contact (insulated type) so attention must be paid to voltage and polarity when making connections.

- In case of the constant of inputfilter of Electric Counter is more than the pulse width, it makes signal decreases and can't calculate correctly.
- In case of input impedance of Electric Counter is large, inductive noise from power supply bring bad influence to it. To calculate correctly, it is recommended to use sealed cable or to make input impedance small enough within the limits of pulse output of Magnetic Flowmeter.

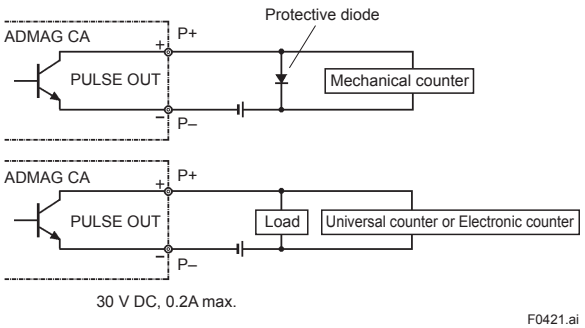


Figure 4.4.5 Connection for Pulse Output

(3) Alarm Output

IMPORTANT

This is a transistor contact (insulated type) so attention must be paid to voltage and polarity when making connections.
This output cannot switch an AC load. To do this a special relay (Refer to Figure 4.4.6) is required.
* The alarm output is normally closed.

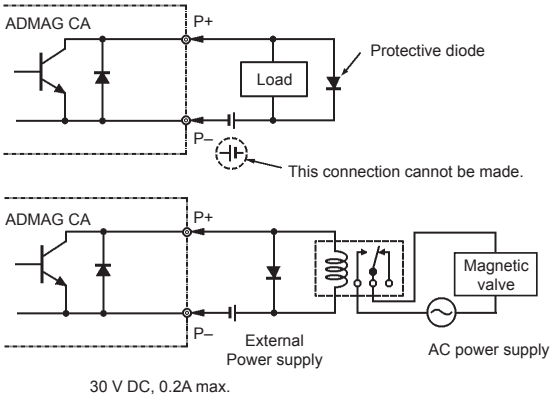


Figure 4.4.6 Alarm Output Connection

5. BASIC OPERATING PROCEDURES

All data settings can be performed with the three keys on the front panel (SET, SHIFT and INC) or using a handheld BRAIN TERMINAL (BT200).
The following sections describe basic data configurations and how to use the three panel keys. (Refer to Chapter 7 “OPERATION VIA BRAIN TERMINAL” for BT200 operations.)

5.1 Liquid Crystal Display

Figure 5.1 shows the configuration of the ADMAG CA display panel (if equipped).

(**Note:** The figure shows display when fully lit)

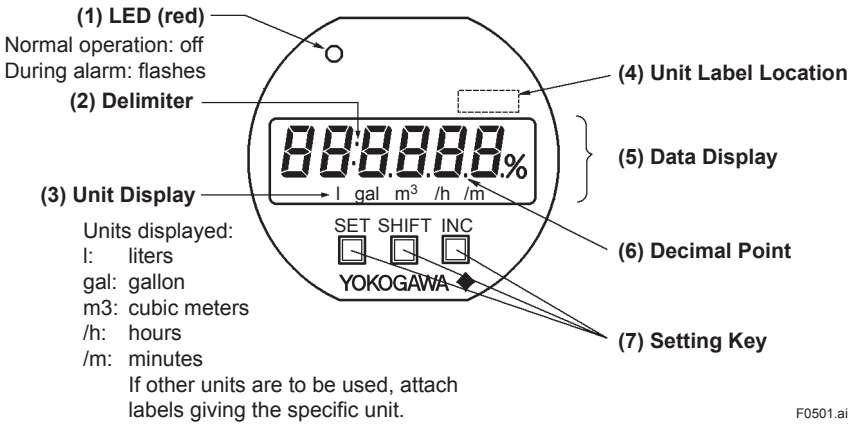
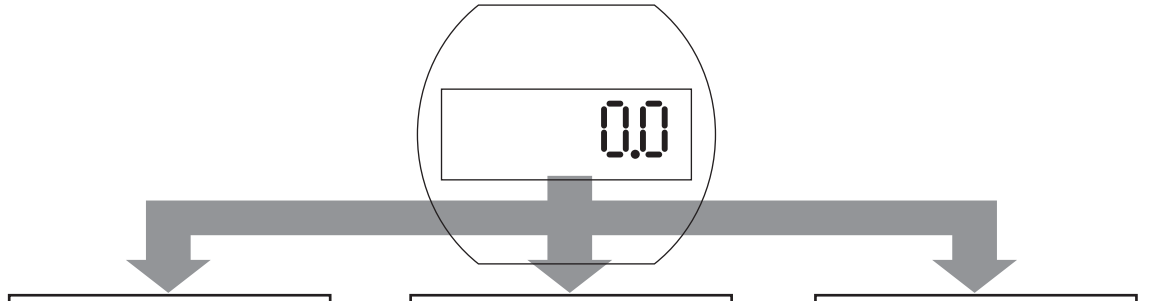


Figure 5.1 Configuration of Display

(1) LED (red): This LED is off during normal operation and flashes when an alarm condition has occurred.
(2) Delimiter: The delimiter “ : ” (colon) indicates that the displayed data is in setting mode.
(3) Unit Display: Displays flow rate units. In order to display other units, the required unit label should be selected from the provided data sheets and attached as shown.
(4) Unit Label Location: To display units not on the LCD, select the required label from the provided data sheets and attach it here.
(5) Data Display: Displays flow rate data, setting data and type of alarm generated.
(6) Decimal Point: Displays decimal point in the data.
(7) Setting Keys: These keys are used to change flow rate data displays and type of setting data.

5.2 Types of Display Data

Three major types of data are displayed.

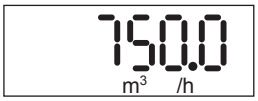


1. Flow Rate Date Display Mode

This mode displays flow rates and totalization data.
Go to the setting mode and use parameter "**d1**" to change display items.
This mode can be called up by pressing "**SET**" key while pressing "**SHIFT**" key when setting mode is displayed.

Display Example

(Flow rate %)



(Actual flow rate)

(Flow rate totalization value)

(Alternate display of flow rate % and flow rate totalization value)

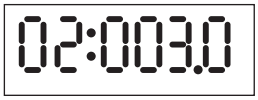
(Alternate display of actual flow rate and flow rate totalization value)

(Alternate display of actual flow rate and flow rate %)

2. Setting Mode

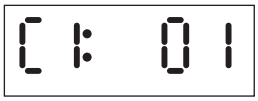
This mode is used to check parameter content and rewrite data. This mode can be called up from the flow rate data display mode by pressing the "**SET**" key.

Display Example

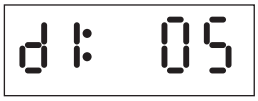


(Parameter No. **02**: 3 sec.dumping)

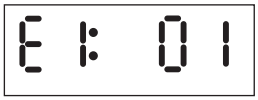
(Parameter No. **03**: Span 50.0)



(Parameter No. **C1**: Zero adjust not possible)



(Parameter No. **d1**: Selection of display items)

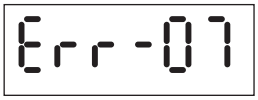


(Parameter No. **E1**: Selection of totalization units)

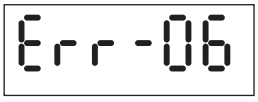
3. Alarm Display Mode

When an alarm situation occurs, this mode will replace the current mode (flow rate or setting mode) to show what type of alarm has occurred.

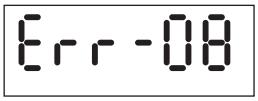
Display Example



(Alarm No. **07**: Coil open)



(Alarm No. **06**: Input signal error)



(Alarm No. **08**: Incorrect span setting)

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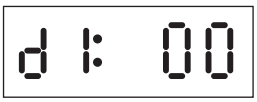
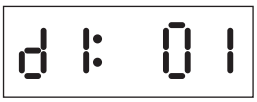
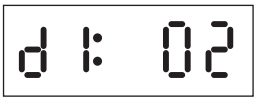
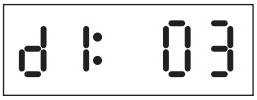
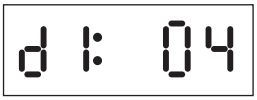
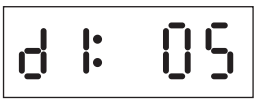
5.2.1 Flow Rate Data Display Mode

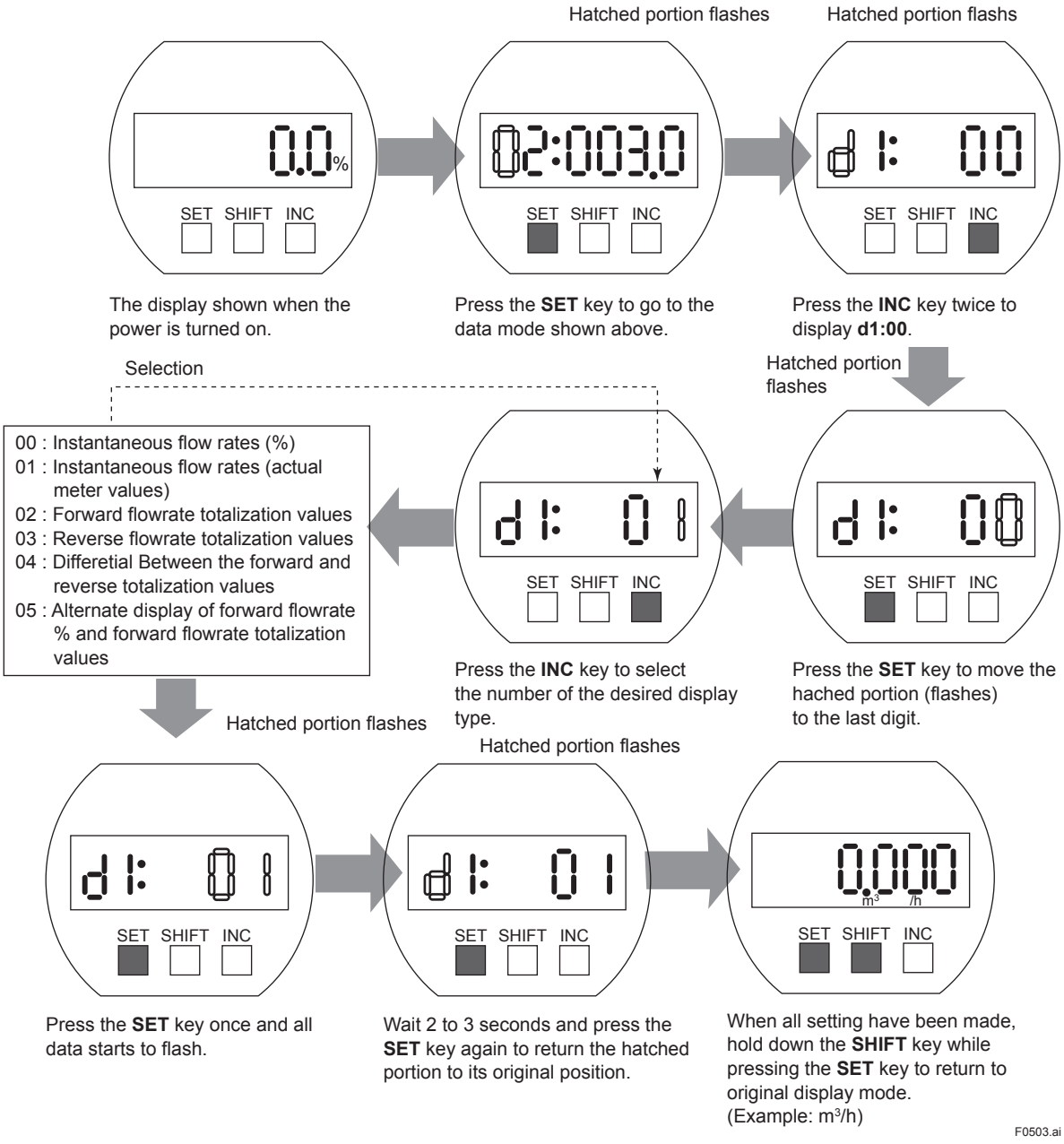
- The flow rate data display mode indicates instantaneous flow and totalized flow values. The ADMAG CA can display 6 types of flow rate data.
- These functions can be displayed by pressing the "**d1**" key on the flow converter.
- For changing from setting mode to flow rate data display mode, press "SET" key while pressing "SHIFT" key.
- When a BT200 is used, call up the parameter No. **D01** to select functions.

Display item	Content	ADMAG CA Setting	BT Setting
Flow rate %	Instantaneous flow rate is displayed within a range of -8.0 to 108.0 for the span.		D01: DISP SELECT RATE(%)
Actual flow rate	The actual meter rate of instantaneous flow rate is displayed (Note 1). The decimal point position is the same as when you set the span. However, it may display value differently on BT200 and ADMAG CA. (If the value is set to 0.0001 on BT200, it is displayed as 0.000 on ADMAG CA.)		D01: DISP SELECT RATE
Flow rate totalization values	Display totalized flow rate		D01: DISP SELECT TOTAL
(Alternate display of flow rate % and flow rate totalization value)	The Display switches between display of instaneous flow rates (%) and totalized flow rates every 4 seconds interval.		D01: DISP SELECT RATE(%)/TOTAL
(Alternate displayof actual flow rate totalization value)	The Display switches between display of instaneous flow rates (actual values) and totalized flow rates every 4 seconds interval.		D01: DISP SELECT RATE/TOTAL
(Alternate display of actual flow rate and flow rate %)	The Display switches between display of instantaneous flowrate (%) and instantaneous flow rates (actual values) every 4 seconds interval.		D01: DISP SELECT RATE(%)/RATE

Note 1: The LCD can display the following combination of units (by selecting a parameter)
Units other than those shown below can be displayed by attaching the provided unit labels .
l (liters) /h, l (liters) /m, m3/h, m3/m, gal/h, gal/m

(1) Changes in Flow Data Display Items

- Shows how the display changes when the flow converter switches are pressed.
- Refer to Chapter 7 “OPERATION VIA BRAIN TERMINAL” for information on changes using the BT200.

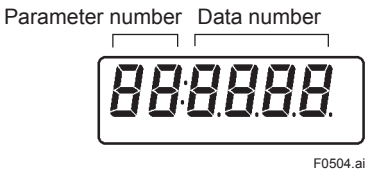


5.2.2 Setting Mode

- The setting mode is used for checking parameters and rewriting data.
- The following is an overview of the setting mode. Refer to Chapter 6 “FUNCTION AND DATA SETTINGS” for detailed information.

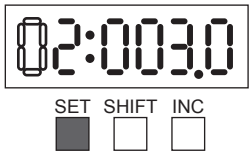
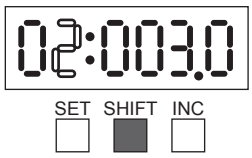
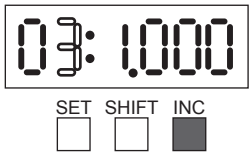
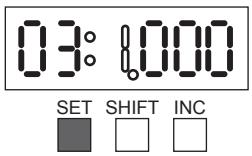
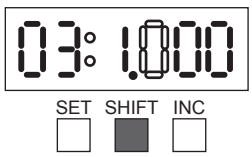
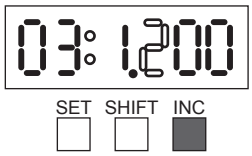
(1) Structure of Setting Mode Display

- The display consists of two areas, two digits to the left of the colon and four digits to the right of it.
- Two types of data can be entered: direct entry of numerals and entry of desired data items using codes. Refer to Chapter 12 “PARAMETER SUMMARY” for information on how to change settings.

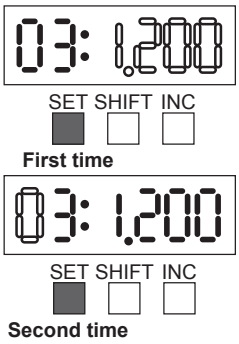
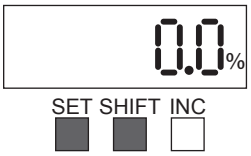


(2) Procedures for Setting and Changing Data

Example of parameter change: Changing the span (parameter No. **03**) from 1.000 to 1.200

Item	Display	Content
① Switch to “Setting Mode”		Press the **SET** key to go from the flow rate data display to the setting mode.The delimiter “ : ” is displayed to indicate that the mode has been swiched.
② Parameter Selection		Press the **SHIFT** key to move the flashing segment (the selected item)
		Use the **INC** key to change the items displayed in the flashing segment. * Contains 5-digit data which cannot be displayed as shown on the left but has to be scrolled.
③ Data Rewrite		Use the **SET** key to move the flashing segment to the most significant location of the data area. * When change the data, the delimiter “ : ” is flashed.
		Use the **SHIFT** key to move the flashing segment within the data area.
		Use the **INC** key to change the data area in the flashing segment (the selected item).

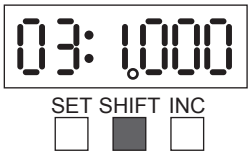
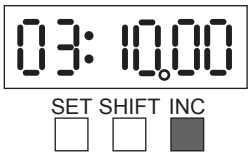
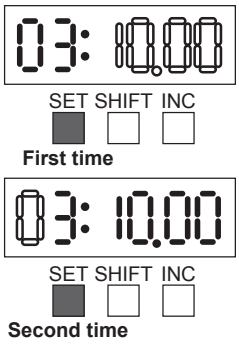
---Continued---

Item	Display	Content
④ Data Input		Press the **SET** key twice to enter data. (All data will start flashing when the key is pressed the first time. Then wait 2 to 3 seconds before pressing the key the second time.)
⑤ Switching to Flow Data Entry		Hold down the **SHIFT** key and press the **SET** key to switch to the flow rate data display.

(3) Procedures for Changing Decimal Place

Before starting this procedure check in the data list if the position of the decimal point for the desired parameter decimal places can be changed.

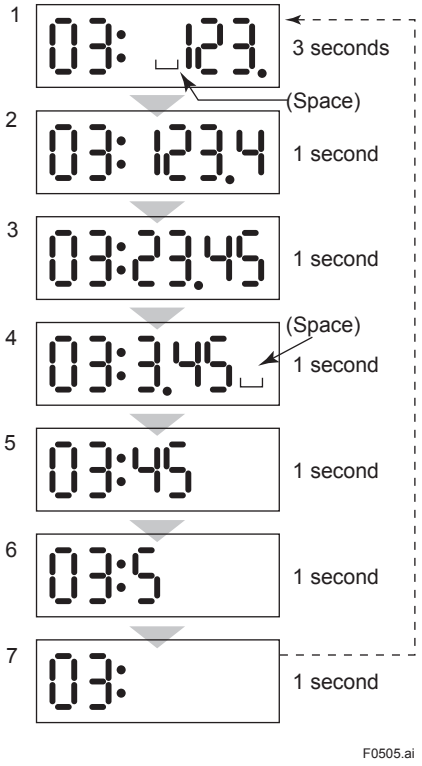
Example of parameter change: Changing the span from 1.000 to 10.00

Item	Display	Content
① Selecting Decimal Point		Use the **SET** key to move the flashing segment to the most significant location of the data area. Press the **SHIFT** key to move the flashing segment to the decimal point.
② Moving Decimal Point		Press the **INC** key to move the decimal point to the right.
③ Data Entry		Press the **SET** key twice to enter data. (All data will start flashing when the key is pressed the first time. Then wait 2 to 3 seconds before pressing the key the second tme.)

(4) Display of 5-digit Data

- The data display area has 4-digit and can therefore not display span and other 5-digit data parameters. To display such data, the data is automatically shifted (scrolled) to the left one digit at a time . When parameter number is selected, the delimiter " : " starts to flash.
- When the flashing segment is aligned with the last digit and the data includes a space, the data is displayed as shown "4" on the right.

Example: Display of span 123.45

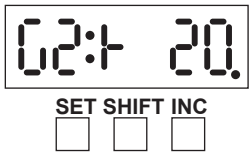
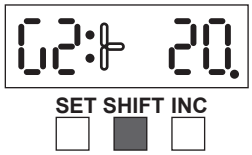
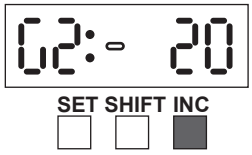
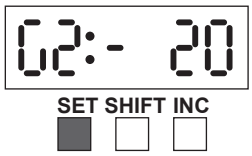


(5) Display of 6-digit Data

The data display area has 4-digit and can therefore not display span and other 6-digit data parameters. (Parameter number **E05** is the only 6-digit parameter.)
Like 5-digit data, 6-digit data is displayed by automatically shifting (scrolling) it to the left one digit at a time.
When parameter number is selected, the delimiter " : " starts to flash.

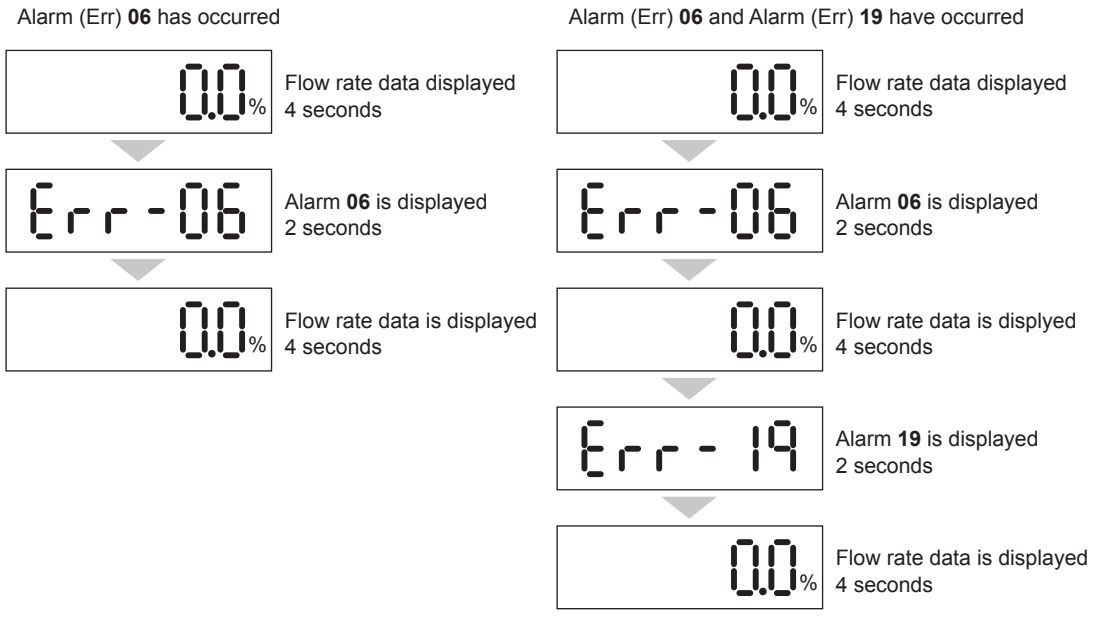
(6) Display and Setting Coded Data

Example of change: Changing from +20 to -20

Item	Display	Content
1. Selecting Coded Data		The display on right indicates “+20”.
2. Coded Data Flashes		Cause the “+” sign to flash.
3. Change of Coded Data		Press the **INC** key to change the “+” sign to the “-” sign.
4. Inputting Coded Data		Press the **SET** key twice.

5.2.3 Alarm Display Mode

- When an alarm occurs, an alarm number indicating is displayed in place of the normal display mode. However, this happens only when the current display mode is the flow rate data display mode or when parameter number are being changed in the setting mode. (Alarms are not displayed when data items are being changed.)



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- Refer to Section “8.2 Self-diagnostics Functions” for information on alarm numbers.

6. FUNCTION AND DATA SETTINGS

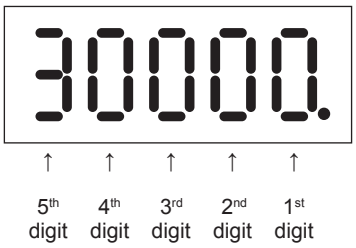
A Magnetic flowmeter calculates volume flow rate from a minute voltage that corresponds to the flow velocity of a fluid an outputs as a 4 to 20mA signal.

NOTE

The three parameters must be set to obtain a correct signal.
Nominal size, flow span and meter factor must be set.
In these three factors, Nominal size (unit:mm) and meter factor are set before shipment.

This chapter explaines how to set flow span, other functions and data settings.
Please set data correctly.

NOTE



- Regardless of the position of the decimal point, the largest value that can be set on the display unit is 30000. If “3” is set in the 5th digit, it is not possible to set a number other than “0” in the 1st to 4th digits.
- It is not possible to set a number “4” or larger in the 5th digit even though it can be incremented up to “4” or larger in the setting procedure.
- If the highest-order digit of the number to be set is “4” or larger, set it from the 4th digit.
- Data range is different for each parameter number. For detail, refer to Chapter 12 “PARAMETER SUMMARY.”

Example: A value of 345.67 is represented by the character string 34567, and since this exceeds 30000, it cannot be set. In such a case, the value 345.6 should be set instead.

Basic Key Operations

Item	Key Operation
How to change the display into the setting mode?	SET
How to move the cursor on the display during parameter setting?	SHIFT
How to change the display into the data changing mode?	SET
How to move the cursor in the data changing mode?	SHIFT
How to change the data?	INC
Finally, How to input the set data?	SET (Twice)

6.1 Flow Rate Span Setting

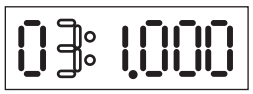
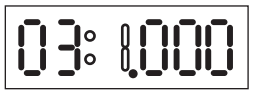
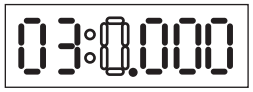
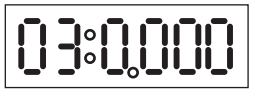
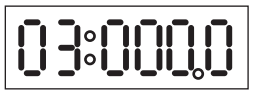
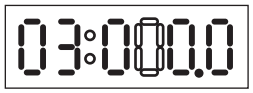
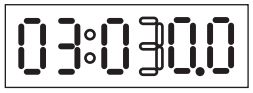
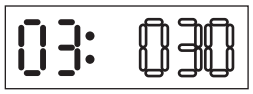
(1) Determining the Flow Rate Span Value

The flow rate span is the instantaneous flow rate value at which the output current is to be 20 mA. Please determine the span under considering the followings.

- Please set the maximum flow rate at the most variable flow rate line.
  If the flow rate of the fluid exceeds the flow rate span value, the flow rate that exceeds this value (20mA or more) is not output and the flowmeter will not display the correct flow rate. (108% or more can’t be output)
- In a line where the flow rate is comparatively stable, set a value that is 1.5 to 2.0 times larger than the normal flow rate.
- Please set a value that will correspond to a flow velocity of 0.5 to 10m/s.
  Please comfirm the flow velocity by sizing data or parameter number “**13**”.
  (Parameter number “**13**” indicates corresponding flow velocity to set span)
- The basic input value for display is flow span value. It is recommended that the accuracy of the first digit is in a 0.05 to 0.1% in case inputting the flow rate span value.
  For example, 30m^3/h should be set as 30.00m^3/h.
- In a span setting, the maximum value that can set is “30000” except any relation with decimal position.

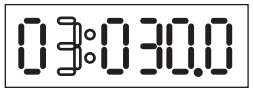
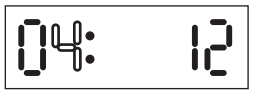
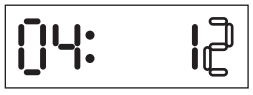
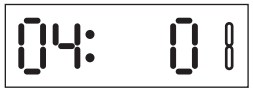
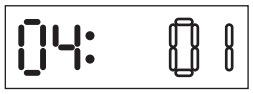
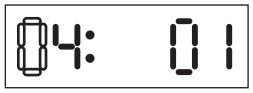
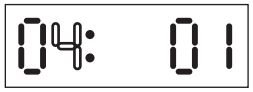
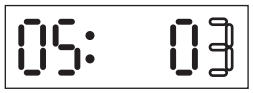
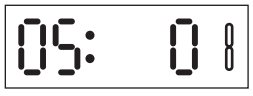
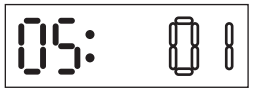
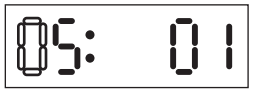
(2) Span Setting using Display Keys (Example setting: 30.00 m^3/h)

- **Span Value Setting**

Switch Operation	Display	Description
SET SHIFT INC ■ □ □		Press the **SET** key during normal flow rate data display to display the data mode shown in the left figure.
SET SHIFT INC □ ■ □		Press the **SHIFT** key to cause the second digit from the left to flash.
SET SHIFT INC □ □ ■		Press the **INC** key to call up parameter number **"03"**.
		Default is set as 1.0000, change to 030.00.
SET SHIFT INC ■ □ □		Press the **SET** key to move the flashing segment to the first digit in the data area. * When change the data, the delimiter " : " is flashed.
SET SHIFT INC □ □ ■		Press the **INC** key to set the first digit to 0.
SET SHIFT INC □ ■ □		Press the **SHIFT** key to move the decimal point.
SET SHIFT INC □ □ ■		Press the **INC** key to move the decimal point to "000.00". *To set a "00000." as the data area is a 4-digit LCD, the three digits and the space will be displayed as "000".
SET SHIFT INC □ ■ □		Press the **SHIFT** key to move the flashing segment two digits to the right.
SET SHIFT INC □ □ ■		Press the **INC** key to enter "3".
SET SHIFT INC ■ □ □		Press the **SET** key once to cause all the data to flash. * As the data display now will be scrolled, it may not appear as shown in the left figure.
SET SHIFT INC ■ □ □		Wait 2 to 3 seconds when the data starts flashing. Then press the **SET** key to return the flashing segment to the leftmost digit. * This display will also be scrolled to display 5-digit data.
	(Setting is now completed)	

Note: 5-digit span data can be displayed, but only digits will be supplyed at one time. As a result, when the last digit is changed, the last digit and the space will be displayed as the last three digits. (Refer to Subsection 5.2.2 "Display of 5-digit data".)

- **Setting Volume Measurement (m^3) and Time Unit (/h)**

Switch Operation	Display	Description
	(↓ Selecting m^3)	
SET SHIFT INC		Press the **SHIFT** key to cause the second digit from the left to flash.
SET SHIFT INC		Press the **INC** key to call up parameter number **"04"**.
SET SHIFT INC		Press the **SET** key to move the flashing segment to the data area.
SET SHIFT INC		Press the **INC** key to select the code "01" to display m^3. (Refer to the table on the right.)
SET SHIFT INC		Press the **SET** key once to casue all the data to flash.
SET SHIFT INC		Wait 2 to 3 seconds when the data starts flashing. Then press the **SET** key to return the flashing segment to the lesfmost digit.
	(↓ Selecting /h)	
SET SHIFT INC		Press the **SHIFT** key to cause the second digit from the left to flash.
SET SHIFT INC		Press the **INC** key to call up parameter number **"05"**.
SET SHIFT INC		Press the **SET** key to move the flashing segment to the data area.
SET SHIFT INC		Press the **INC** key to select the code "01" to display /h. (Refer to the table on the right.)
SET SHIFT INC		Press the **SET** key once to cause all the data to flash.
SET SHIFT INC		Wait 2 to 3 seconds when the data starts flashing. Then press the **SET** key to return the flashing segment to the leftmost digit.
	(Setting is now completed.)	

Code	Volume Unit	
00	k m^3 ($10^3 \times m^3$)	
01	m^3	
02	l (liter) ($10^{-3} \times m^3$)	
03	cm^3 ($10^{-6} \times m^3$)	
04	Mgal	
05	kgal	
06	gal	
07	mgal	
08	kbbl	
09	bbl	
10	mbbl	
11	µbbl	
12	m	← Default
13	ft	

Code	Time Unit	
00	/d (day)	
01	/h (hour)	
02	/m (minute)	
03	/s (second)	← Default

6.2 Measuring Mode Setting

(1) Measuring Modes

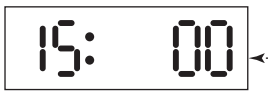
The measuring mode is Standard or Noise Reduction mode. Standard mode is set before shipment. If the output fluctuation is large when a fluid actually flows, the fluctuation is reduced by increasing the damping time constant.

- If the output fluctuation is still large when the damping time constant is increased, use the Noise Reduction mode.
- Use the standard mode for sticky fluids.

After the measuring mode is changed from Standard mode to Noise Reduction mode or from Noise Reduction mode to Standard mode, be sure to adjust the zero point. Perform zero adjustment with the metering tube filled with the fluid and with the fluid static.

IMPORTANT

- Standard mode “00” must be set in case of size 150, 200 mm (6, 8 in.). It cannot be measured in Noise Reduction mode “01”.

Display	Description
	Select the measuring mode in parameter number “**15**”.

Code	Measuring Mode	
00	Standard mode	← Default
01	Noise Reduction mode	

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6.3 Other Functions and Settings

6.3.1 Pulse Output

(1) Pulse Output Overview

- By setting a pulse weighting, a scaled pulse is transmitted to external counters and measuring instruments.

Pulse Output Overview

Item	Content
Output specifications	Transistor contact output (contact capacity is 30V DC, 200mA)
Connecting terminals	P+, P– (When using these for pulse output, alarm output is not available as the terminal is used commonly.)
Pulse width	Selection: DUTY50%, 0.5, 1, 20, 33, 50,100ms
Output rate	Min. 0.0001 p/s Max. 1000 p/s

* Refer to Subsection 4.4.5 “Connecting to External Instruments” for information on how to connect external instruments.

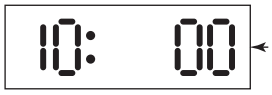
NOTE

P+, P– terminals are for common use with pulse and alarm output functions. Therefore, in case this function is used, another function is not available to use.

(2) Procedures for Setting Pulse Output

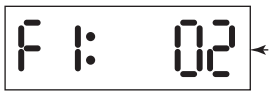
Example: 10 liter output per pulse in a flow rate span of □□□ m^3/h

Display



Select "Pulse output" in parameter number "**10**".

Code	Content	
00	Pulse output	← Default
01	Alarm output	

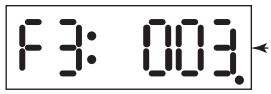


Select the volume unit for pulse weight using parameter number "**F1**".

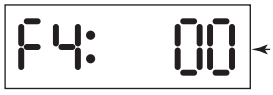
Code	Volume Unit	
00	Volume unit used in 10^{-9} × flow rate span	
01	Volume unit used in 10^{-6} × flow rate span	
02	Volume unit used in 10^{-3} × flow rate span	
03	Volume unit used in 1 × flow rate span	
04	Volume unit used in 10^{3} × flow rate span	
05	Volume unit used in 10^{6} × flow rate span	
06	Number of pulses output per second at 100% of output	← Default

Example : When pulses are to be output per liter in a span of □□m^3/h,
select the code "02" since l(liter) = $10^{-3} \times m^3$

Set pulse weight "10 (liter)" in parameter number "**E2**".
Data range : 0 to 30000
Default : 0
* Since parameter number "**F2**" is a 5-digit data item, scrolling is necessary to display all the data. Mind the decimal point when setting are made. (The decimal point can be moved if required.)



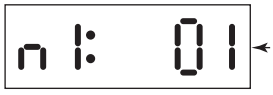
Set the low cut range percentage in parameter number "**F3**".
Data range : 0 to 100% (of span)
Default : 3% (of span)



Select the pulse width in parameter number "**F4**".

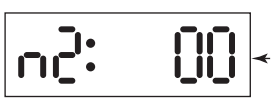
Code	Pulse Width			
00	50%DUTY	(Max. 1100p/s	Min 0.0001p/s)	← Default
01	0.5ms	(Max. 1000p/s	Min 0.0001p/s)	
02	1ms	(Max. 500p/s	Min 0.0001p/s)	
03	20ms	(Max. 25p/s	Min 0.0001p/s)	
04	33ms	(Max. 15p/s	Min 0.0001p/s)	
05	50ms	(Max. 10p/s	Min 0.0001p/s)	
06	100ms	(Max. 5p/s	Min 0.0001p/s)	

Normally, these are all required settings. The following settings are made depending on the applications.
The N item can be opend by entering "55" in paramter number "**L2**".



Select instantaneous flow rate data or damped flow rate data for the pulse output calculation in parameter number "**n1**". (The damped value is the value set in parameter number "**02**".)

Code	The pulse output calculation	
00	Flow rate data	
01	Damped flow rate data	← Default



Set the code "01" in parameter number "**n2**", when the pulse output transistor is to be off active.

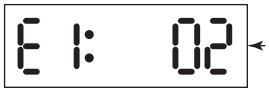
Code	The pulse output transistor	
00	ON ACTIVE	← Default
01	OFF ACTIVE	

6.3.2 Display of Internal Totalization Values

The flow converter can display totalization values by setting the pulse weight.

Example: Display 10 liter output per pulse in a flow rate span of □□□ m^3/h

Display



Description

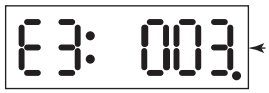
Select the volume unit for pulse weight using parameter number "**E1**".

Code	Volume Unit	
00	Volume unit used in 10^{-9} × flow rate span	
01	Volume unit used in 10^{-6} × flow rate span	
02	Volume unit used in 10^{-3} × flow rate span	
03	Volume unit used in 1 × flow rate span	
04	Volume unit used in 10^{3} × flow rate span	
05	Volume unit used in 10^{6} × flow rate span	
06	Number of pulses output per second at 100% of output	← Default

Example : When pulses are to be output per liter in a span of□□ m^3/h,
select the code "02" since L(liter) = 10^{-3} × m^3

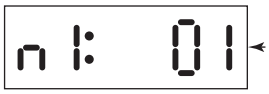
Set pulse weight "**10** (L)" in parameter number "**E2**".
Data range : 0 to 30000
Default : 0

* Since parameter number "**E2**" is a 5-digit data item, scrolling is necessary to display all the data. Mind the decimal point when setting are made. (The decimal point can be moved if required.)



Set the low cut range percentage in parameter number "**E3**".
Data range : 0 to 100% (of span)
Default : 3% (of span)

Normally, these are all required settings. The following settings are made depending on the applications.
The N item can be opened by entering "55" in parameter number "**L2**".



Select pulse output calculation of instantaneous flow rate or flow rate after damping in parameter number "**n1**".
(Use parameter number "**02**" to set damping constant.)

Code	The pulse output calculation	
00	Flow rate data	
01	Damped flow rate data	← Default

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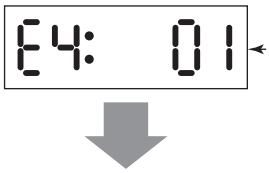
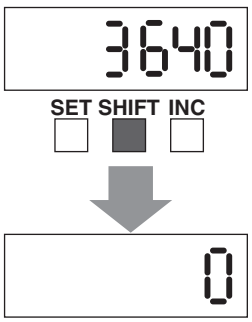
6.3.3 Presetting for Totalization Display

- This function is used to reset or preset totalization values of the display unit.
- Hold down the **SHIFT** key for more than 2 seconds while the totalization values of the flow rate reading are displayed to set the totalization value to the value set in parameter number "**E5**".

Display	Description
	Select totalization enable in parameter number "**E4**" Code / Description 00 Totalization presetting disabled ← Default 01 Totalization presetting enabled
	Set the totalization preset value in parameter number "**E5**". If it is no setting, the function is zero setting. Data Range : 0 to 999999 Default : 0
	In case "01" is selected in parameter number "**E4**", hold down the **SHIFT** key for more than 2 seconds while the totalization values of the flow rate reading are displayed to set the totalization value to the value set in parameter number "**E5**".

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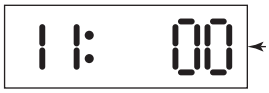
6.3.4 Damping Time Constant

- The time constant can be changed by setting the parameter number "**02**" to suppress a fluctuation or change a response time.
- The time constant influences to flow rate, pulse output and internal totalization.
  However, in case "00" is selected in parameter number "**n1**", the pulse output and internal totalization are not influenced by it.

Display	Description
	Set the value in parameter number "**02**". Data range : 1.0 to 200.0 seconds Default : 3.0 seconds

6.3.5 Current Output During Alarm Occurrence

The current output and display values during alarming can be selected in advance.

Display	Description
	Set a value for current output to be used during alarms in parameter number "**11**" Code / Contents 00 2.4mA or less ← Default 01 4.0mA 02 Hold 03 21.6mA or more

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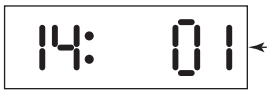
6.3.6 Reversing Flow Direction

The flow direction is set to “FORWARD” at the factory. This function enables to set flow direction from “FORWARD” to “REVERSE”.

* Note that measurements cannot be made both in reverse and forward directions.

Display	Description
	Set the flow direction in parameter number “**14**”.

Code	Contents	
00	Forward direction to flow arrow	← Default
01	Reverse direction to flow arrow	

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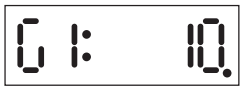
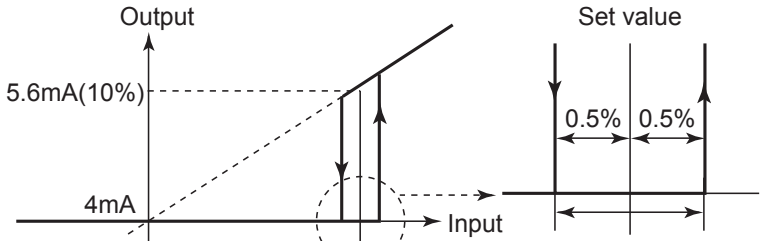
6.3.7 Limiting on Current Output

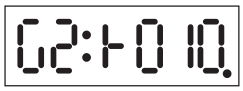
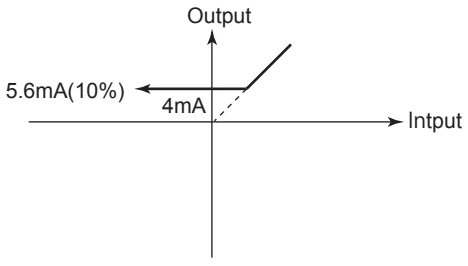
(1) 4 to 20 mA Low Cut Output (Current Output near by 0% Range)

This function makes it possible to reduce noise in the 4mA region to reduce it to 0%.

Display	Description
	Set the 4 to 20 mA low cut output range in parameter number “**G1**”. Data range : 0 to 10% Default : 0% Example : Set to 10% 

(2) 4 to 20 mA Low Limit

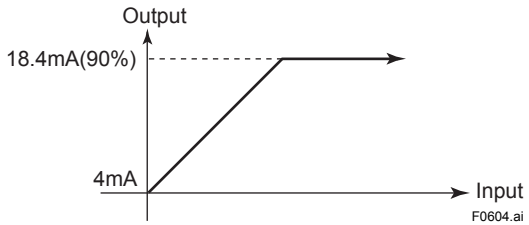
- This function limits the low end of the 4 to 20mA output.
- The default value is -20% (0.8mA). Please set in case other setting is required.
- 2.4mA or less output in alarming is also limited.

Display	Description
	Set the 4 to 20 mA low limit in parameter number “**G2**”. Data range : -20 to 100% Default : -20% Example : Set to 10% 

F0603.ai

(3) 4 to 20 mA High Limit

- This function limits the high end of the analog output.
- The default value is 120% (23.2mA). Please set in case other setting is required.
- 21.6 mA or more output in alarming is also limited.

Display	Description
G3: 090.	Set the 4 to 20 mA high limit in parameter number "**G3**". Data range : 0 to 120% Default : 120% Example : Set to 90% 

6.3.8 Alarm Output

- This function outputs a signal from the P+ and P- terminals when an alarm occurs.

NOTE

These terminals are also used for pulse output and cannot be used for this function when they are outputting pulses.

- The contact goes from close to open (OFF) during alarming.

Display	Description
10: 01	Set "01" in parameter number "**10**" to use the P+ and P- terminals for alarm output. Code / Content: 00 Pulse output ← Default; 01 Alarm output T0607.ai

6.3.9 Data Setting Enable / Inhibit

This function can inhibit to change all data except parameter number "**L1**".
However, auto zero adjustment function can work, if it has been set in parameter number "**C1**".
And the preset totalization value function also can work, if it has been set in parameter number "**E4**".

Display	Description
L 1: 00	The data setting inhibit item can be set "00" in parameter number "**L1**". Code / Content: 00 INHIBIT; 01 ENABLE ← Default T0608.ai

6.3.10 Procedure of Selecting Special Application Items

Only the special apprication (N item) shipped being unpublished.
In case the N item should be used, it can be set “55” in parameter number “**L2**”.

Display	Description
L2: 55	The N item can be set “55” in parameter number “**L2**”.

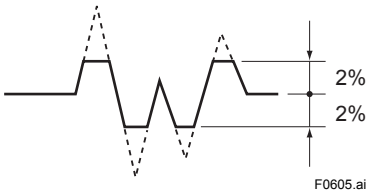
Code	Content	
00	Accessible up to L parameters.	← Default
55	Accessible up to N parameters.	

T0609.ai

6.3.11 Rate Limit

- This function is used to remove noise that cannot be removed by increasing the damping time constant.
- In case unexpected noise from step signal or slurry is entered, a basis is set to recognize that signal is flow rate or noise.
  The recoginition depends on rate limit value (upper and lower limit) and dead time (sampling time).
- Determination of rate limit value and dead time.

Rate limit value:
Determine the level to reduce output fluctuation.
For example, reducing 2% or more fluctuation by setting as 2% to reduce.



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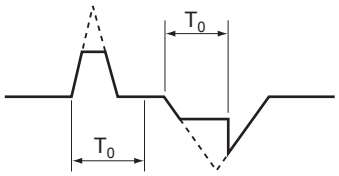
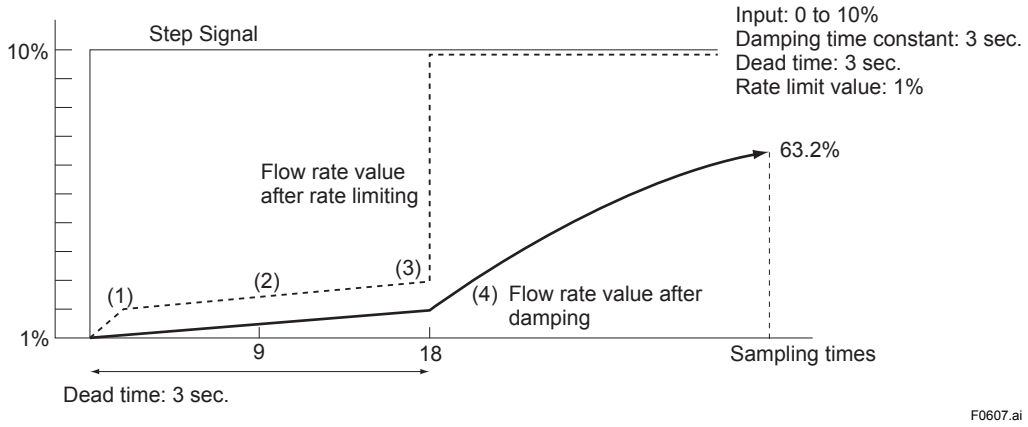
Dead time T_0:
Please determine the dead time depending on ouput fluctuation width.
In case of noise of which is longer than the dead time, please set the dead time longer.



F0606.ai

- **Signal processing procedures:**
  The function sets a certain upper and lower limit (rate limit value) for first order delay response values of flow rate data obtained in a previous sampling. If currently sampled flow rate data exceeds or goes below the limit is regarded as current flow rate value. Signals whose protruding portions show the same trends during a certain number of sampling times (dead time) are identified as flow rate signals.

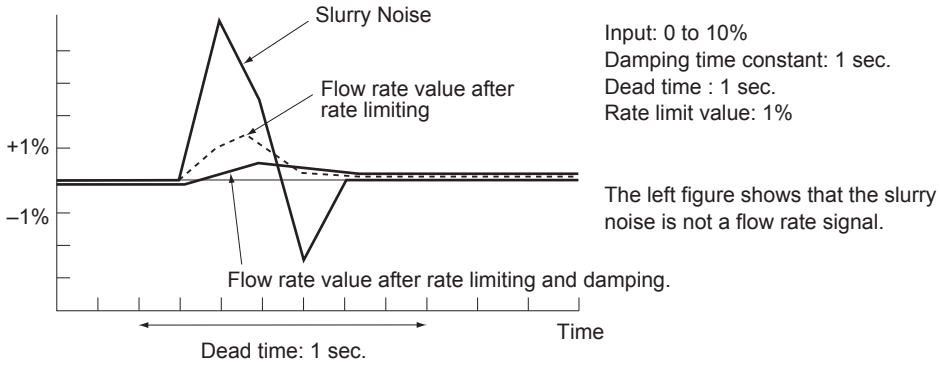
Example 1: Step Input



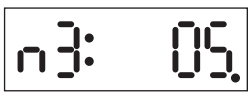
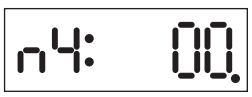
F0607.ai

(1) Shows 1% response cause of excessive signal beyond the rate limit. However, actual output is under damping that described by a solid line.
(2) Shows the flow rate signal (1%) of just after damping calculation (1) and rate limit value.
(3) This signal is recognized as a flow rate signal since it does not return to within the rate limit value within the dead time.
(4) The output signal follows the damping curve and tracks the step signal.

Example 2: Slurry Noise



F0608.ai

Display	Description
	Set a rate limit function value in parameter number "**n3**". Data range : 0 to 10%. Default : 5%
	Set the dead time in parameter number "**n4**". If it is zero, rate limit function is stopped. Data range : 0 to 15 seconds Default : 0 s

* The N item can be opened by entering "55" in parameter number "**L2**".

7. OPERATION VIA BRAIN TERMINAL

Products provided with optional code / BR come equipped with a BRAIN communication function which allows them to communicate with dedicated BRAIN TERMINAL (BT200) or CENTUM-XL / CS. In the BRAIN - Series communications system, a ±2 mA, 2.4 kHz modulated signal is superimposed onto the 4 to 20 mA DC analog signal for data transmission. Since the modulated wave is an AC signal, superimposing it on the analog signal will cause no error in the DC component of the analog signal. Thus, monitoring can be performed via communications while the ADMAG CA is online. A BT200 can be connected to the terminals shown in Figure 7.1 on products that are not provided with a / BR (brain communication function).

7.1 Operation Via BT200

This section describes the operation procedures using a brain terminal. For details on the functions of the ADMAG CA, refer to Chapter 6, “FUNCTION AND DATA SETTINGS.” And also, refer to “BT200 Instruction Manual” (IM 01C00A11-01E) for more detailed information.

7.1.1 BT200 Connections

(1) Connecting BT200 to Flow Converter

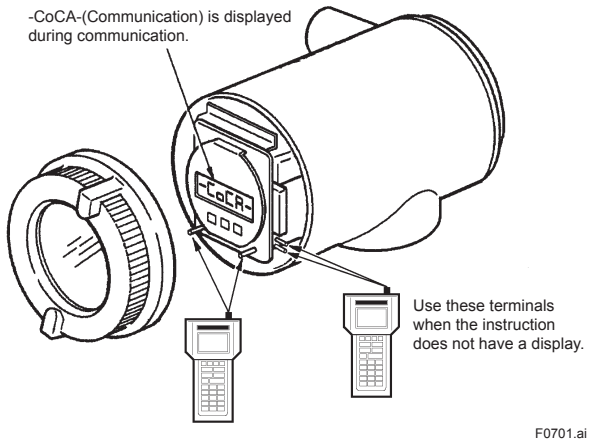


Figure 7.1 Connection of BT200 to Flow Converter

For products not provided with the /BR (BRAIN communication function), the terminals for BRAIN communication are provided on the circuit board. Please connect BT200 to the terminals on the circuit board directly.

IMPORTANT

These terminals are used for a communication with the BT200 only. Thus, the communication error will occur via FieldMate when using these terminals.
Please connect to the 4 to 20 mA DC transfer line when communicating via FieldMate.

(2) Connecting the BT200 to a 4 to 20 mA DC Transfer Line

The communication signal of the ADMAG CA with the / BR function (optional specification) is superimposed onto the 4 to 20 mA DC analog signal to be transferred.

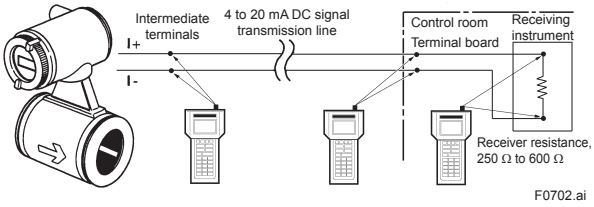
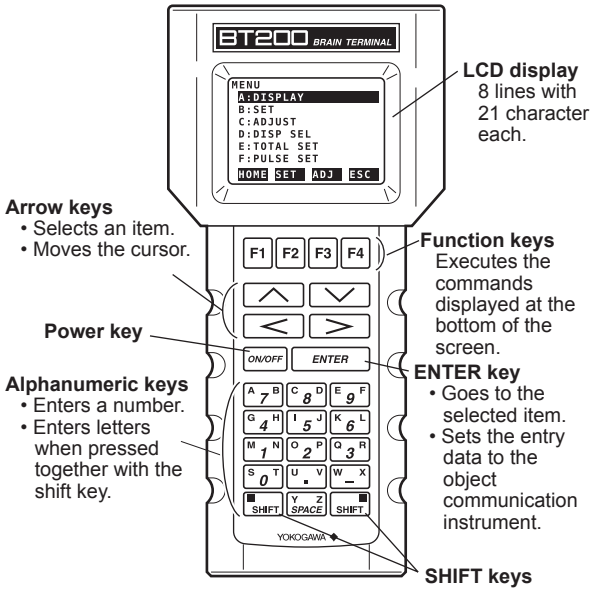


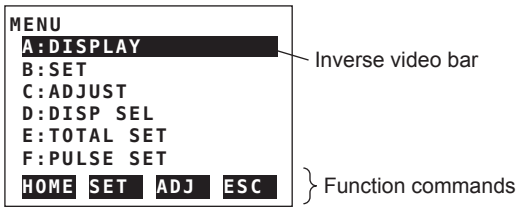
Figure 7.2 Communicating via a 4 to 20 mA DC Signal Line

7.1.2 BT200 Key Layout

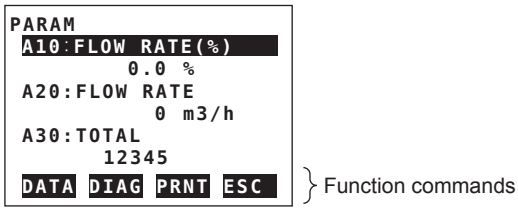
Figure 7.3 shows the key layout of the BT200.



Menu panel
Major parameters items
A maximum of six items are displayed.



Parameter panel
Parameter data
A maximum of three items are displayed.



F0703.ai

Figure 7.3 Key Layout and Functions

7.1.3 Character Input via BT200

(1) Entry of Alphanumeric Characters

Numbers, codes and letters can be entered in combinations of the alphanumeric keys and the SHIFT key.

- **Entry of numbers, codes and a space (0 to 9, . , -, ␣)**

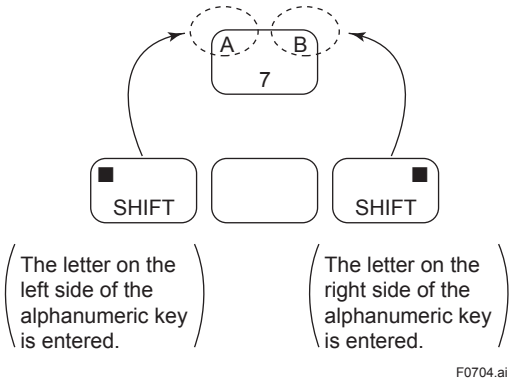
Entering of them is possible by using the alphanumeric keys.

Example of entry	Key Operation
-4.3	W X _ → G H 4 → U V . → Q R 3
1␣-0.3	M N 1 → Y Z SPACE → W X _ → S T 0 → U V . → Q R 3

T0701.ai

- **Entry of letters**

Press an alphanumeric key while one of the SHIFT keys is pressed and the letter on the same side of the key as the shift key that is pressed can be entered. Press the SHIFT key each time when entering a letter.



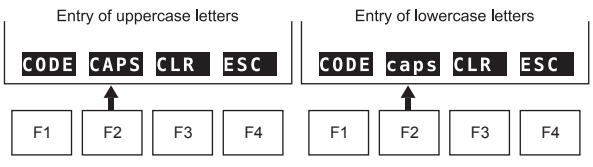
F0704.ai

Example of entry	Key Operation
WIC	SHIFT → W X _ → SHIFT → I J 5 → SHIFT → C D 8
J.B	SHIFT → I J 5 → U V . → SHIFT → A B 7

T0702.ai

- **Selection of uppercase / lowercase of letters**

Uppercase and lowercase letters can be selected alternately by pressing the function key [F2] **CAPS**.



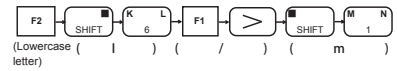
F0705.ai

- **Entry of codes**

Codes can be entered by pressing the function key [F1] CODE. Every time [F1] CODE is pressed, the codes are displayed at the cursor position in the order shown below.

/ . - , + *) (‘ & % $ # “ !

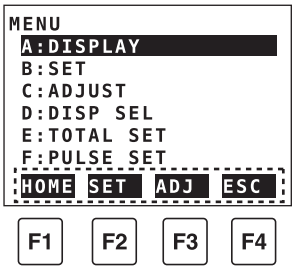
To enter characters after the codes above, move the cursor using the [>] key before entry.

Example of entry	Key Operation
l/m	

T0703.ai

(2) Function Keys

The functions of the function keys vary with the commands being displayed on the display panel.



F0706.ai

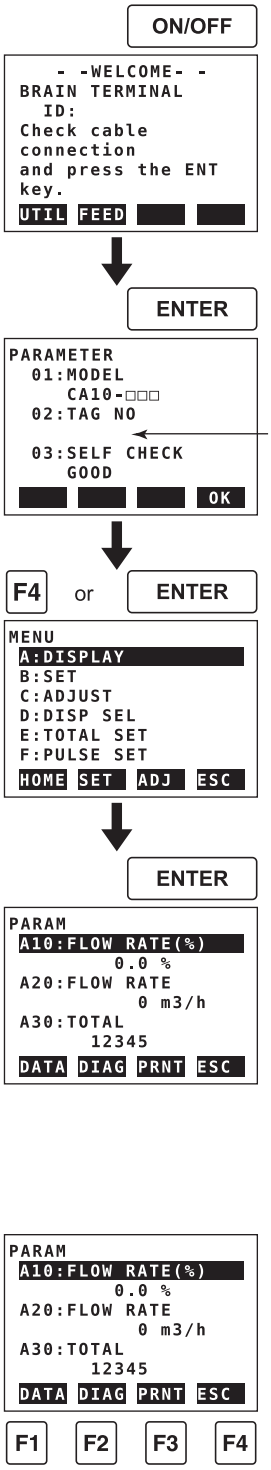
Function Command List

Command	Function
ADJ	Displays the ADJ menu
CAPS/caps	Selects uppercase or lowercase
CODE	Selects symbols
CLR	Erases input data or deletes all data
DATA	Updates parameter data
DEL	Deletes one character
DIAG	Calls the self-check panel
ESC	Returns to the most recent display
HOME	Displays the menu panel
NO	Quits setup and returns to the previous display
OK	Proceeds to the next panel
PARM	Enters the parameter number setup mode
SET	Displays the SET menu
SLOT	Returns to the slot selection panel
UTIL	Calls the utility panel
COPY*	Prints out parameters on display
FEED*	Paper feed
LIST*	Lists all parameters in the menu
PON/POFF*	Automatic printout mode on or off
PRNT*	Changes to the print mode
GO*	Starts printing
STOP*	Cancels printing

* Available on BT200-P00 (with printer).

7.1.4 Displaying Flow Rate Data

Flow rate data can be displayed on the BT200 screen according to the following procedure.



Turn the power on and the screen on the left appears after “please wait...” is displayed for a few seconds.

Pressing the ENTER key causes the initial data screen on the left to be displayed.
The tag number specified upon ordering is entered.

Pressing the F4 key or the ENTER key causes the menu screen on the left to be displayed.

- With “A : DISPLAY” displayed on the menu panel in the inverse video bar, press the ENTER key and the flow data screen appears.
- A maximum of three data items can be displayed on one screen.
- Data are communicated at an interval of 5 seconds. Thus, the data are updated every 5 seconds.
- The arrow keys, [ ], [ ] or [ ], [ ], are used for page feeds or item selection.

Execution of the function keys

F1: Updates the current data. Pressing this key causes forcible communication with the connected instruments and the data of the instruments are loaded to be read.
F2: Displays the self-check screen.
F3: If BT200-P00 (with printer), displays the parameter print screen.
F4: Returns to the previous panel (menu panel).

F0707.ai

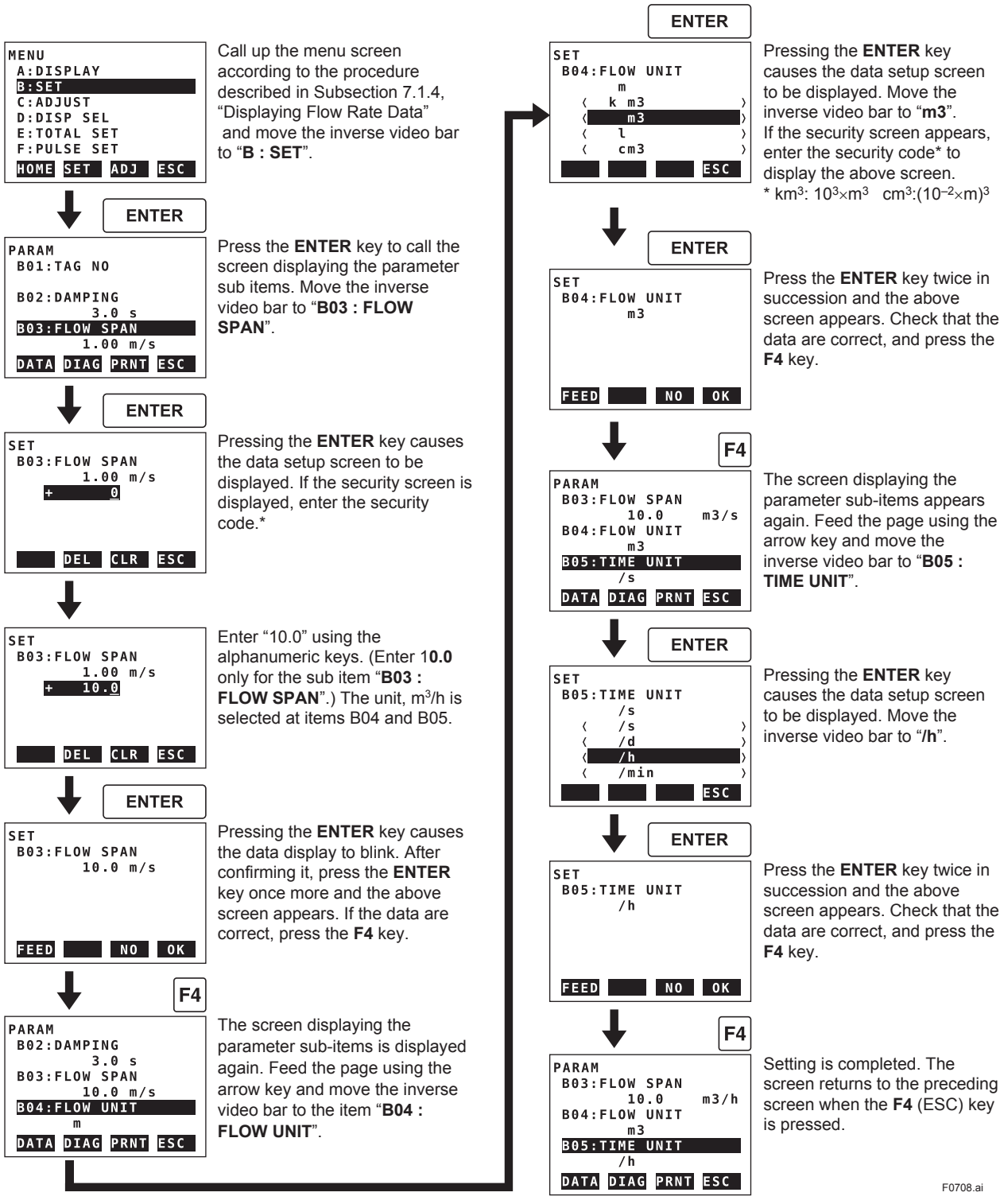
7.2 Setting Parameters Via BT200

NOTE

The three parameters must be set to obtain a correct signal.
Nominal size, flow span and meter factor must be set.
In these three factors, Nominal size (unit:mm) and meter factor are set before shipment.

7.2.1 Setting Flow Span

Example: Flow span 10.0 m^3/h



*For entry of the security code, see IM 01C00A11-01E.

7.2.2 Measuring Mode Setting

Measuring Modes

The measuring mode is Standard or Noise Reduction mode. Standard mode is set before shipment. If the output fluctuation is large when a fluid actually flows, the fluctuation is reduced by increasing the damping time constant.

- If the output fluctuation is still large when the damping time constant is increased, use the Noise Reduction mode.
- Use the standard mode for sticky fluids.

After the measuring mode is changed from Standard mode to Noise Reduction mode or from Noise Reduction mode to Standard mode, be sure to adjust the zero point. Perform zero adjustment with the metering tube filled with the fluid and with the fluid static.

IMPORTANT

- Standard mode (STD) must be set in case of size 150, 200 mm (6, 8 in.). It cannot be measureed in Noise Reduction mode (FNR).

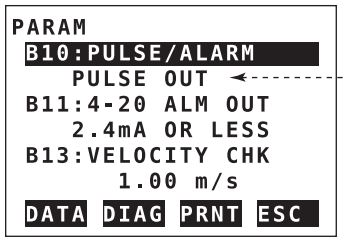
Display	Description
PARAM B13:VELOCITY CHK 1.00 m/s B14:FLOW DIR FORWARD B15:MEAS MODE STD DATA DIAG PRNT ESC	Select the measuring mode in parameter number "**B15**". **Code** / **Measuring Mode** STD — Standard mode ← Default FNR — Noise Reduction mode

T0704.ai

7.2.3 Pulse Output

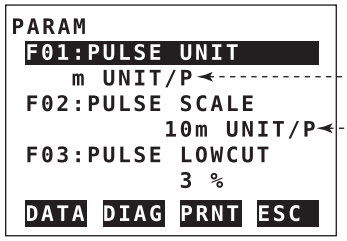
Example setting: 10 liter output per pulse in a flow rate span of □□□ m³/h

Display	Description



Select "Pulse output" in parameter number "**B10**".

Code	Content	
PULSE OUT	Pulse output	← Default
ALARM OUT	Alarm output	

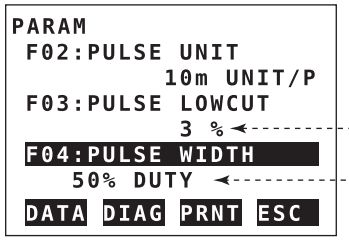


Select the volume unit for the pulse weight in parameter number "**F01**".

Code	Volume unit	
n UNIT/P	Volume unit used in 10^{-9} × flow rate span	
m UNIT/P	Volume unit used in 10^{-6} × flow rate span	
m UNIT/P	Volume unit used in 10^{-3} × flow rate span	
UNIT/P	Volume unit used in 1 × flow rate span	
k UNIT/P	Volume unit used in 10^{3} × flow rate span	
M UNIT/P	Volume unit used in 10^{6} × flow rate span	
PULSE/s	Number of pulses output per second at 100% of output	← Default

Example) When pulses are to be output per same liter in a span of □□m³/h, select "m UNIT/P" since a L(liter) = 10^{-3} × m³

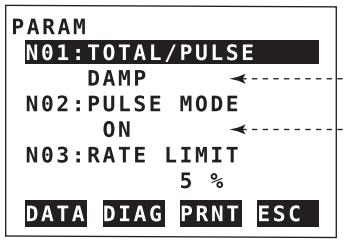
Set the pulse weight "10 (L)" in parameter number "**F02**".
Data range : 0 to 30000
Default : 0



Set the low cut range percentage in parameter number "**F03**".
Data range : 0 to 100% (of span)
Default : 3% (of span)
Select the pulse width in parameter number "**F04**"

Pulse width	Pulse output		
50%DUTY	(Max. 1100p/s	Min. 0.0001p/s)	← Default
0.5ms	(Max. 1000p/s	Min. 0.0001p/s)	
1ms	(Max. 500p/s	Min. 0.0001p/s)	
20ms	(Max. 25p/s	Min. 0.0001p/s)	
33ms	(Max. 15p/s	Min. 0.0001p/s)	
50ms	(Max. 10p/s	Min. 0.0001p/s)	
100ms	(Max. 5p/s	Min. 0.0001p/s)	

Normally, these are all required settings. The following settings are made depending on the applications.
The N item can be opend by entering "55" in parameter number "**L02**".



Select instantaneous flow rate data or damped flow rate data for the pulse output calculation in parameter number "**N01**".
(The damping time value is the value set in parameter number "**B02**".)

Code	The pulse output calculation	
NO DAMP	Flow rate data	
DAMP	Damped flow rate data	← Default

Set parameter number **"N02"** to "OFF" when the pulse output transistor is to be active in the off mode.

Code	The pulse output transistor	
ON	ON ACTIVE	← Default
OFF	OFF ACTIVE	

T0705.ai

7.2.4 Display of Internal Totalization

Example: 10 L (liter) output per pulse in a flow rate span of □□□ m^3/h

Display

```
PARAM
 E01:TOTAL UNIT
    m UNIT/P
 E02:TOTAL SCALE
          10m UNIT/P
 E03:TOTAL LOWCUT
            3 %
 DATA DIAG PRNT ESC
```

Description

Select the volume unit for the pulse weight in parameter number "**E01**".

Code	Volume unit	
n UNIT/P	Volume unit used in 10^{-9} × flow rate span	
μ UNIT/P	Volume unit used in 10^{-6} × flow rate span	
m UNIT/P	Volume unit used in 10^{-3} × flow rate span	
UNIT/P	Volume unit used in 1 × flow rate span	
k UNIT/P	Volume unit used in 10^{3} × flow rate span	
M UNIT/P	Volume unit used in 10^{6} × flow rate span	
PULSE/s	Number of pulses output per second at 100% of output	← Default

Example) When pulses are to be output per L(liter) in a span of □□ m^3/h, select "m UNIT/P" since a L =10^{-3} × m^3

Set the pulse weight "10 (L)" in parameter number "**E02**".
Data range : 0 to 30000
Default : 0

Set the low cut range percentage in parameter number "**E03**".
Data range : 0 to 100% (of span)
Default : 3%

Normally, these are all required settings. The following settings are made depending on the applications.
The N item can be opend by entering "55" in parameter number "**L02**".

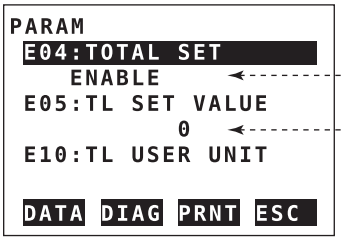
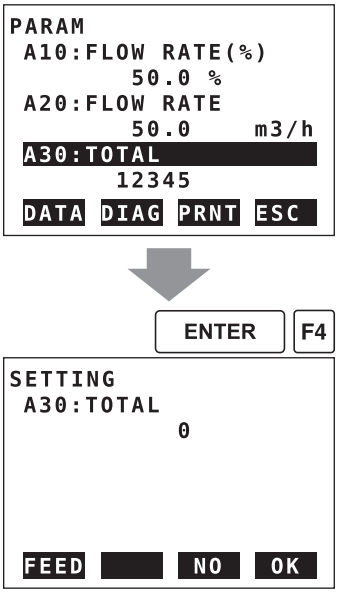
```
PARAM
 N01:TOTAL/PULSE
     DAMP
 N02:PULSE MODE
      ON
 N03:RATE LIMIT
            5 %
 DATA DIAG PRNT ESC
```

Select instantaneous flow rate data or damped flow rate data for the pulse output calculation in parameter number "**N01**".
(The damping time value is the value set in parameter number "**B02**".)

Code	The pulse output calculation	
NO DAMP	Flow rate data	
DAMP	Damped flow rate data	← Default

T0706.ai

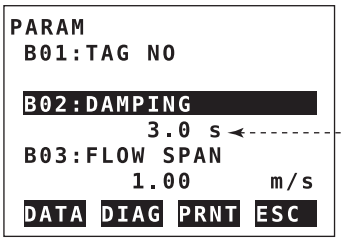
7.2.5 Presetting Totalization Display

Display	Description
	Select totalization enable in parameter number "**E04**". Code / Description INHIBIT — Totalization presetting inhibit ← Default ENABLE — Totalization presetting enabled Set the totalization preset value in parameter number "**E05**". If the setting is omitted, the parameter functions reset to 0. Data range : 0 to 999999 Default : 0
	If the ENTER key is pressed twice while parameter number "**A30**" is displayed on the setting screen, the totalization value will be replaced with the values set in parameter number "**E05**".

T0707.ai

7.2.6 Damping Time Constant

- The time constant can be changed by setting the parameter number "**B02**" to suppress a fluctuation or change a response time.
- The time constant influences to flow rate, pulse output and internal totalization.
  However, in case "NO DAMP" is selected in parameter number "**N01**", the pulse output and internal totalization are not influenced by it.

Display	Description
	Set the value in parameter number "**B02**". Data range : 1.0 to 200.0 Default : 3.0

T0708.ai

7.2.7 Current Output During Alarm Occurrence

The current output and display values during alarming can be selected in advance.

Display	Description
PARAM B10:PULSE/ALARM PULSE OUT B11:4-20 ALM OUT 2.4mA OR LESS B13:VELOCITY CHK 1.00 m/s DATA DIAG PRNT ESC	Set the value for current output to be used during alarms in parameter number "**B11**".

Code	Content	
2.4mA OR LESS	2.4 mA or less	← Default
4.0mA	4.0 mA	
HOLD	Hold	
21.6mA OR MORE	21.6 mA or more	

T0709.ai

7.2.8 Reversing Flow Direction

The flow direction is set to "FORWARD" at the factory. This function enables to set flow direction from "FORWARD" to "REVERSE".

* Note that measurements cannot be made both in reverse and forward directions.

Display	Description
PARAM B13:VELOCITY CHK 5 m/s B14:FLOW DIR REVERSE B15:MEAS MODE STD DATA DIAG PRNT ESC	The flow direction can be set in parameter number "**B14**".

Code	Description	
FORWARD	Forward direction to flow arrow	← Default
REVERSE	Reverse direction to flow arrow	

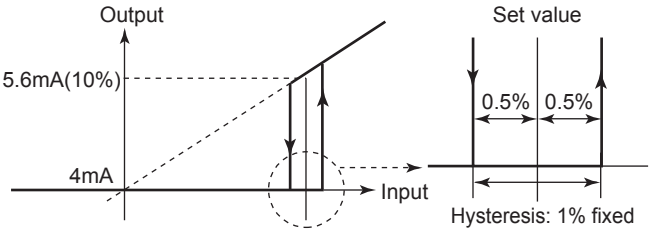
T0710.ai

7.2.9 Limiting Current Output

(1) 4 to 20 mA Low Cut Output (Current Output Near by 0% Range)

This function makes it possible to reduce noise in the 4mA region to reduce it to 0%.

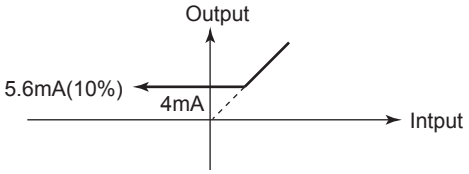
Display	Description
PARAM G01:4-20 LOW CUT 10 % G02:4-20 LOW LMT 10 % G03:4-20 H LMT 90 % DATA DIAG PRNT ESC	Set the 4 to 20 mA low cut output range in parameter number "**G01**". Data range : 0 to 10% Default : 0% Example : Set to 10%



T0711.ai

(2) 4 to 20 mA Low Limit

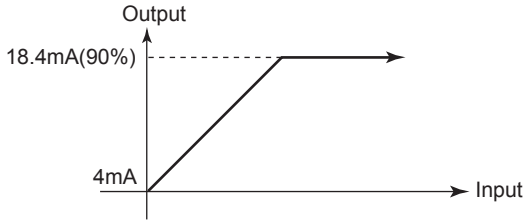
- This function limits the low end of the 4 to 20mA output.
- The default value is -20% (0.8mA). Please set in case other setting is required.
- 2.4mA or less output in alarming is also limited.

Display	Description
PARAM G01:4-20 LOW CUT 10 % G02:4-20 LOW LMT 10 % G03:4-20 H LMT 90 % DATA DIAG PRNT ESC	Set the 4 to 20 mA low limit in parameter number "**G02**". Data range : -20 to 100% Default : -20% Example : Set to 10% 

T0712.ai

(3) 4 to 20 mA High Limit

- This function limits the high end of the analog output.
- The default value is 120% (23.2mA). Please set in case other setting is required.
- 21.6 mA or more output in alarming is also limited.

Display	Description
PARAM G01:4-20 LOW CUT 10 % G02:4-20 LOW LMT 10 % G03:4-20 H LMT 90 % DATA DIAG PRNT ESC	Set the 4 to 20 mA high limit in parameter number "**G03**". Data range : 0 to 120% Default : 120% Example : Set to 90% 

T0713.ai

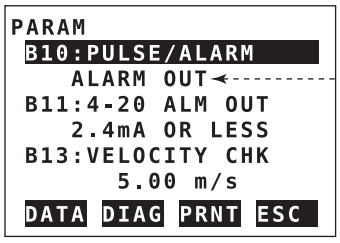
7.2.10 Alarm Output

- This function outputs a signal from the P+ and P- terminals when an alarm occurs.

NOTE

These terminals are also used for pulse output and cannot be used for this function when they are outputting pulses.

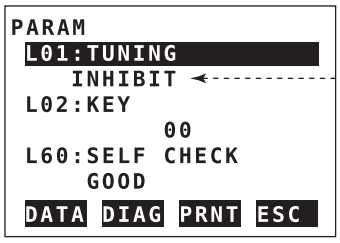
- The contact goes from close to open (OFF) during alarming.

Display	Description
	Set “ALARM OUT” in parameter number “**B10**” to use the P+ and P- terminals for alarm output only. **Code** / **Content** PULSE OUT — Pulse output ← Default ALARM OUT — Alarm output

T0714.ai

7.2.11 Data Setting Enable / Inhibit

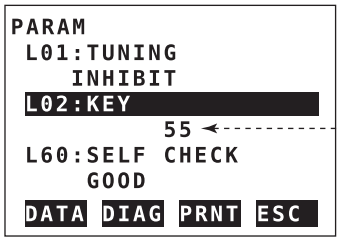
This function can inhibit to change all data except parameter number “ **L01**”.
However, auto zero adjustment function can work, if it has been set in parameter number “**C01**”.
And the preset totalization value function also can work, if it has been set in parameter number “**E04**”.

Display	Description
	Selecting "INHIBIT" in parameter number “**L01**” disables data setting. **Code** / **Content** INHIBIT — Data setting inhibit. ENABLE — Data setting enabled. ← Default

T0715.ai

7.2.12 Procedure of Selecting Special Application Items

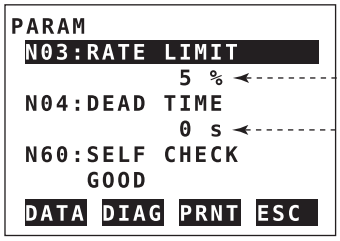
Only the special apprication (N item) shipped being unpublished.
In case the N item should be used, it can be set “55” in parameter number “**L02**”.

Display	Description
	The N item can be set “55” in parameter number “**L02**”. **Code** / **Content** 00 — Accessible up to L parameters ← Default 55 — Accessible up to N parameters

T0716.ai

7.2.13 Rate Limit

This function sets the rate limit and the dead time.

Display	Description
	Set the rate limit value in parameter number "**N03**". Data range : 0 to 10% Default : 5% Set the dead time in parameter number "**N04**". Data range : 0 to 15 Default: 0 (Rate limit function off)

* The N item can be opend by entering "55" in parameter number "**L02**".

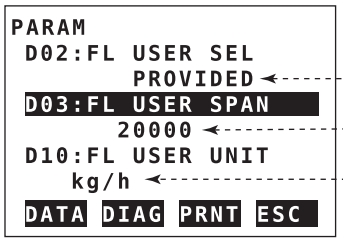
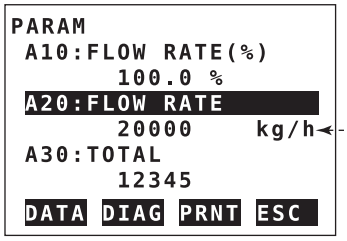
T0717.ai

7.2.14 User-Defined Units

This function displays the instantaneous flow rate indicated in "A20 FLOW RATE" in units other than those selectable with parameter number "**B04**". If the specific gravity of the fluid is known, the instantaneous flow rate can be displayed in weight units.

(1) User-Defined units for Instantaneous Flow Rate

Example: Displaying the flow rate of a fluid (its specific gravity is 2) in weight (kg) in a flow rate span of 10m³/h. When the flow rate is 100%, 20,000kg is displayed.

Display	Description
	Select "PROVIDED" in parameter number "**D02**". Code / Content: NOT PROVIDED — User-Defined units unavailable ← Default PROVIDED — User-Defined units available For parameter number "**D03**", set the value to be displayed in parameter number "**A20**" when the flow rate is 100% in the span set in parameter number "**B03**". Set the unit in parameter number "**D10**". Set the user-defind units in parameter number "**D10**".
	The maximum flow rate value of 20,000 kg is displayed as the instantaneous flow rate in parameter number "**A20**"

T0718.ai

(2) User-Defined Unit for Totalization Values

Units can be added to parameter number "**A30**" (totalization display) .

Display	Description
PARAM E04:TOTAL SET INHIBIT E05:TL SET VALUE 0 E10:TL USER UNIT □□□ DATA DIAG PRNT ESC	Set the special unit in parameter number "**E10**".
PARAM A10:FLOW RATE(%) 100.0 % A20:FLOW RATE 200.0 kg/h A30:TOTAL 12345 □□□ DATA DIAG PRNT ESC	Parameter number "**A30**" is displayed in the units set for parameter number "**E10**".

T0719.ai

7.2.15 Other Precautions

(1) The automatic power-off function turns the terminal off automatically if no key is pressed for about 5 minutes or more. However, this function does not operate when the terminal is displaying the variables in (2) below.

(2) When parameter number "**A10**" or "**A20**" is displayed, data are updated every 5 seconds.

(3) UPLD is used when the parameters of one ADMAG CA are copied to the BT200 and DNLD is used when the parameters copied to the BT200 are copied to another ADMAG CA. This function can be used between the flowmeters which have same model name (model name is shown when the power of BT200 is turned on). (For details, see the "BT200 Instruction Manual " (IM 01C00A11-01E).
Parameters that can be copied include span and pulse factor parameters such as the following:

B02 DAMPING, B03 FLOW SPAN, B04 FLOW UNIT, B05 TIME UNIT,
B06 SIZE UNIT, B07 NOMINAL SIZE, B10 PULSE/ALARM, B11 4-20 ALM OUT
D01 DISP SELECT, D02 FL USER SEL, D03 FL USER SPAN, D10 FL USER UNIT,
E01 TOTAL UNIT, E02 TOTAL SCALE, E03 TOTAL LOWCUT, E04 TOTAL SET,
E05 TL SET VALUE, E10 TL USER UNIT,
F01 PULSE UNIT, F02 PULSE SCALE, F03 PULSE LOWCUT, F04 PULSE WIDTH,
G01 4-20 LOW CUT G02 4-20 LOW LMT, G03 4-20 H LMT

8. ACTUAL OPERATION

After you have installed the flowtube into the process piping, wired the input / output functions, set up the required converter parameters, and performed the pre-operation zero adjustment, the magnetic flowmeter should output an accurate flow signal from its terminals as soon as the measured liquid begins to flow.
This section describes procedures of zero adjustment and alarms countermeasure.

8.1 Pre-Operation Zero Adjustment

In the magnetic flowmeter, zero adjustment is required before beginning operation in order to obtain a 4 to 20mA signal that is accurately proportional to the flow.
This section describes two procedures for performing zero adjustment. Using the data setting keys on the converter front panel or using a BT200.
Zero adjustment is made to set the instrument output to 0% (4mA) when the flow rate is 0.

The detector must be filled with fluid and let it stand until all motion has ceased.

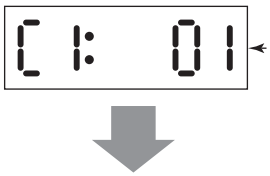
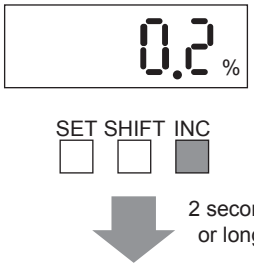
IMPORTANT

1. Zero adjustment should be done only when the fluid is filled in the flow tube and the fluid velocity is completely zero by closing the valve.
2. Zero adjustment should be done prior to the other operation. For 60 seconds during the zero adjustment, any setting cannot be accepted.
3. As warming up time for converter, please wait 5 min. for size 15 to 100 mm (0.5 to 4 in.) or 10 min. for size 150, 200 mm (6, 8 in.) before zero adjustment after the power is turned on.

8.1.1 Zero Adjustment Using Data Setting Keys

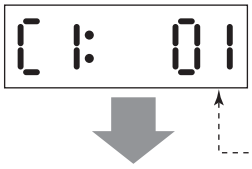
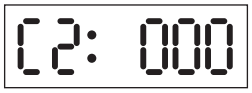
The following two procedures can be used to perform zero adjustment with the data setting keys.

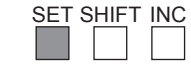
(1) Hold Down the INC Key for Two Seconds in Flow Rate Data Display Mode.

Display	Description
	Call up the setting mode and set “01” in parameter number “**C1**” (zero adjustment enable / disable). Code / Content 00 Zero adjustment disabled 01 Zero adjustment enabled ← Default
	Hold down the **INC** key for two seconds in flow rate data display mode.
	The display panel shows “-ZEro-”. After about 60 seconds, the zero correction is displayed. Then the meter returns to data display mode.

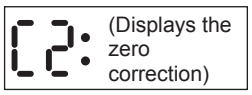
T0801.ai

(2) Display parameter number “C2” and Press the SET Key Twice.

<table>
<tr><th>Display</th><th>Description</th></tr>
<tr><td> 
</td><td>Call up the setting mode and set “01” in parameter number “C1” (zero adjustment enable/disable).
<table>
<tr><th>Code</th><th>Content</th></tr>
<tr><td>00</td><td>Zero adjustment disabled</td></tr>
<tr><td>01</td><td>Zero adjustment enabled</td></tr>
</table>
← Default</td></tr>
<tr><td> 



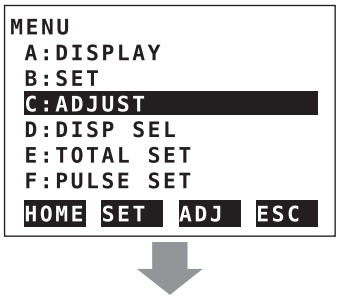
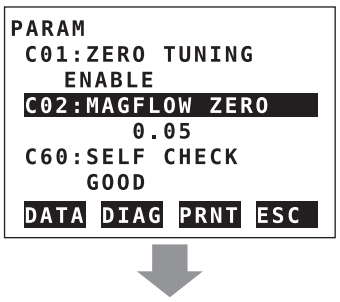
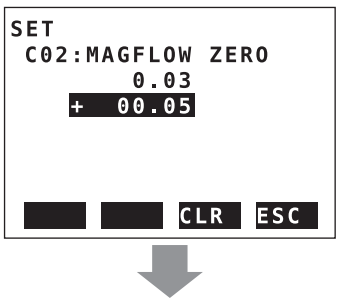
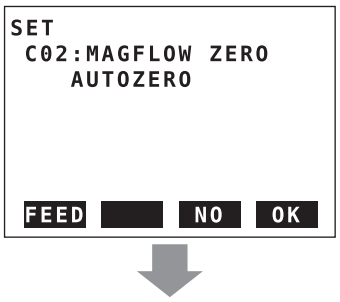
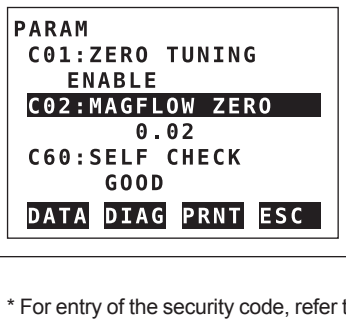
Twice</td><td>Call up parameter number “C2” and press the SET key twice (as for data entry).</td></tr>
<tr><td> 

60 seconds later


(Displays the zero correction)</td><td>The display panel shows “-ZEro-”.
After about 60 seconds, the zero correction is displayed. Then the meter returns to data display mode.</td></tr>
</table>

T0802.ai

8.1.2 Zero Adjustment Via BT200

Setting displayed	Description
	Call up the menu screen and select "**C:ADJUST**".
	Press the **ENTER** key to call the screen displaying the parameter sub items. Move the inverse video bar to parameter number "**C02**".
	Pressing the **ENTER** key causes the data setup screen to be displayed. If the security screen is displayed, enter the security code.
	While parameter number "**C02**" is displayed, press the **ENTER** key once, then wait a few seconds and press again. "**AUTO ZERO**" is now displayed
	While running "AUTO ZERO", "-ZEro-" is displayed at ADMAG CA. After "AUTO ZERO" is finished, screen return to the measurement value display. After about 60 seconds, press the "**F4**" of the Function key causes the Menu screen to be displayed. The zero correction is displayed. Then the meter returns to data display mode.

T0803.ai

* For entry of the security code, refer to IM 01C00A11-01E.

8.2 Self-diagnostics Functions

- The self-diagnostic function displays instrument internal errors, input/output signal abnormalities, setting errors, and other problems.
- When an alarm occurs, an alarm number announcing that an error has occurred is superimposed on the normal data display. However, alarms are only displayed during normal flow rate data display mode and when parameter numbers are changed in the setting mode. (Alarms are not displayed when data items are being changed.)
- When the BT200 is used, alarms are displayed in the A60 to N60 SELF CHECK parameter. If an error is detected and ERROR appears in the display, investigate the nature of the error.

8.2.1 Display and Output Status during Alarm Occurrence

- If an error occurs, the panel display LED flashes and an alarm number is superimposed on the normal display.
  During this time the current output is fixed to 2.4mA max., 4mA, HOLD or 21.6mA max., as selected in B11: 4-20 ALM OUT (output current during alarm).
- An alarm (status contact output) is output for any of the errors indicated in the table at right.

CA	BT200	LED	Contact output	Current output	Totalization pulse
00	GOOD	OFF	ON	Normally	Normally
01	ERROR	Flashing	OFF	Fixed (Note)	Stops
02	µP FAULT				
03	EEPROM FAULT				
04	A/D(H) FAULT				
05	A/D(L) FAULT				
06	SIGNAL OVERFLOW				
07	COIL OPEN				
08	SPAN VEL.>10m/s				
09	SPAN VEL.<0.5m/s				
10	P.SPAN>1000p/s				
11	P.SPAN>500p/s				
12	P.SPAN>25p/s				
13	P.SPAN>15p/s				
14	P.SPAN>10p/s				
15	P.SPAN>5p/s				
16	P.SPAN<0.0001p/s				
17	T.SPAN>1000p/s				
18	T.SPAN<0.0001p/s				
19	4-20 LMT ERROR				

Note: As selected in B11: 4-20 ALM OUT (output current during alarm)

8.2.2 Error Description and Countermeasures

CA	BT200	Error Contents	Countermeasures
02	µP FAULT	Microprocessor error	Contact the nearest Yokogawa office, or service center
03	EEPROM FAULT	EEPROM error	
04	A/D(H) FAULT	A/D converter (high frequency side) error	
05	A/D(L) FAULT	A/D converter (low frequency side) error	
06	SIGNAL OVERFLOW	Excessive input signal	Check for the following: • Mixup of the signal, power supply, execution, and other cable. • Stray electorical currents in the measured liquid. • Improper grouping
07	COIL OPEN	Detector coil open-circuit	Contact the nearest Yokogawa office, or service center
08	SPAN VEL.>10m/s	Setting for span flow velocity exceeds 11 m/s	Change setting
09	SPAN VEL.<0.5m/s	Setting for span flow velocity is 0.4 m/s or below	
10	P.SPAN>1000p/s	Pulse output rate exceeds 1100 p/s, at 50% DUTY Pulse output rate exceeds 1000 p/s, at 0.5 ms pulse width	
11	P.SPAN>500p/s	Pulse output rate exceeds 500 p/s at 1 ms pulse width	
12	P.SPAN>25p/s	Pulse output rate exceeds 25 p/s at 20 ms pulse width	
13	P.SPAN>15p/s	Pulse output rate exceeds 15 p/s at 33 ms pulse width	
14	P.SPAN>10p/s	Pulse output rate exceeds 10 p/s at 50 ms pulse width	
15	P.SPAN>5p/s	Pulse output rate exceeds 5 p/s at 100 ms pulse width	
16	P.SPAN<0.0001p/s	Pulse output rate is 0.00005 p/s or below	
17	T.SPAN>1000p/s	Internal totalization exceeds 1100 p/s	
18	T.SPAN<0.0001p/s	Internal totalization at 0.00005 p/s or less	
19	4-20 LMT ERROR	4-20 low limit > 4-20 high limit	

9. MAINTENANCE

9.1 Loop Test (Test Output)

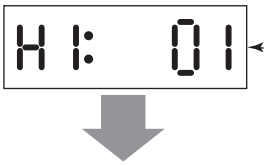
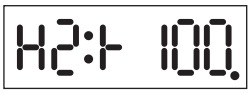
This function enables you to set up any desired value, and to output it from the converter. Since this output is also shared with the totalization display and pulse output, this makes it possible to check operation of individual functions.
The test function of contact output (Alarm) is also provided.

IMPORTANT

Test output is prior to flow signal. Do not forget to return to the normal operation mode after the loop test.

9.1.1 Settings for Test Output Using Data Setting Keys

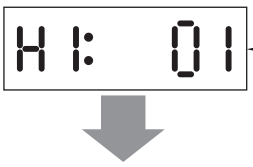
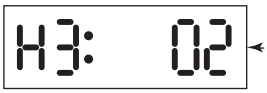
(1) Current Output (Corresponding to Flow Rate, Pulse and Totalization Display)

Display	Description
	Call up the setting mode and display parameter number "**H1**" (test mode) and set "01" Code / Content: 00 Normal operation ← Default; 01 Test output
	Display parameter number "**H2**" and the value to be output in % of maximum span. (The figure shows a 100% setting.) Data range : -8 to 108% Default : 0%

T0901.ai

* These functions must be returned to their original status during flow rate measurements.

(2) Contact Output (Alarm Output)

Display	Decription
	Call up the setting mode and display parameter number "**H1**" (test mode) and set "01". Code / Content: 00 Normal operation ← Default; 01 Test output
	Select the mode of status to be output in parameter number "**H3**". Code / Content: 00 Normal operation ← Default; 01 Transistor contact (ON); 02 Transistor contact (OFF)

T0902.ai

* These functions must be returned to their original status during flow rate measurements.

9.1.2 Test Output Setting Via BT200

(1) Current Output (Corresponding to Flow Rate, Pulse and Totalization Display)

Display	Description
PARAM H01:TEST MODE TEST ← H02:OUTPUT VALUE 100 % ← H03:ALARM OUT NORMAL DATA DIAG PRNT ESC	Select “TEST” (test mode) in parameter number “**H01**”. **Code** / **Description** NORMAL / Normal operation ← Default TEST / Test output Set the value to be output in % of the span in parameter number “**H02**”. (The figure shows a 100% setting.) Data range : –8 to 108% Default : 0%

T0903.ai

* These functions must be returned to their original status during flow rate measurements.

(2) Contact Output (Alarm Output)

Display	Description
PARAM H01:TEST MODE TEST ← H02:OUTPUT VALUE 100 % H03:ALARM OUT NORMAL ← DATA DIAG PRNT ESC	Select “TEST” (test mode) in parameter number “**H01**”. **Code** / **Content** NORMAL / Normal operation ← Default TEST / Test output Select the mode of status to be output in “**H03**”. **Code** / **Content** NORMAL / Normal operation ← Default CLOSED(ON) / Trarsistor contact (ON) OPEN(OFF) / Trarsistor contact (OFF)

T0904.ai

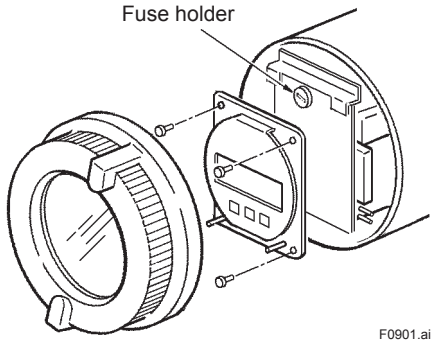
* These functions must be returned to their original status during flow rate measurements.

9.2 Fuse Replacement

WARNING

This instrument must be installed by expert engineer or skilled personnel. Fuse replacement is not permitted for operators.

The fuse holder is located under the display which has to be removed to allow fuse replacement.



F0901.ai

CAUTION

- Before replacing the fuse, make sure to turn OFF the power supply and disconnect the power source. Use only specified fuses which should be obtained from your nearest sales & service Office. The use of other fuses might cause fire.
- Explosion protected type must be, as a rule, removed to a non-hazardous area for replacing the fuse. For details, refer to “INSTALLATION AND OPERATING PRECAUTIONS FOR TIIS FLAMEPROOF EQUIPMENT” at the end of this manual.

9.3 Maintenance of the LCD Display

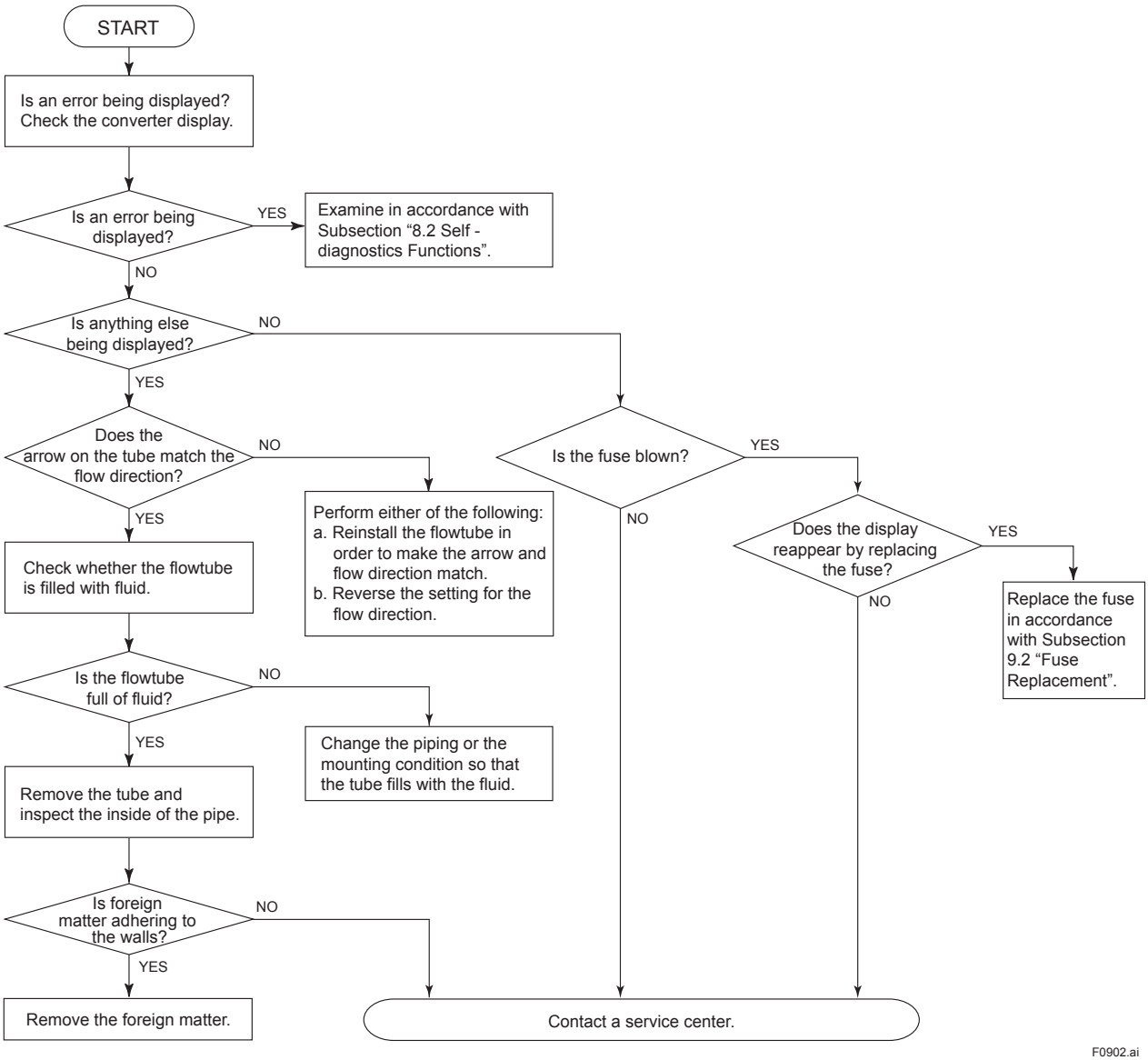
CAUTION

The LCD display has certain lifespan and it may deteriorate during operation. Please contact Yokogawa office in this case.

9.4 Troubleshooting

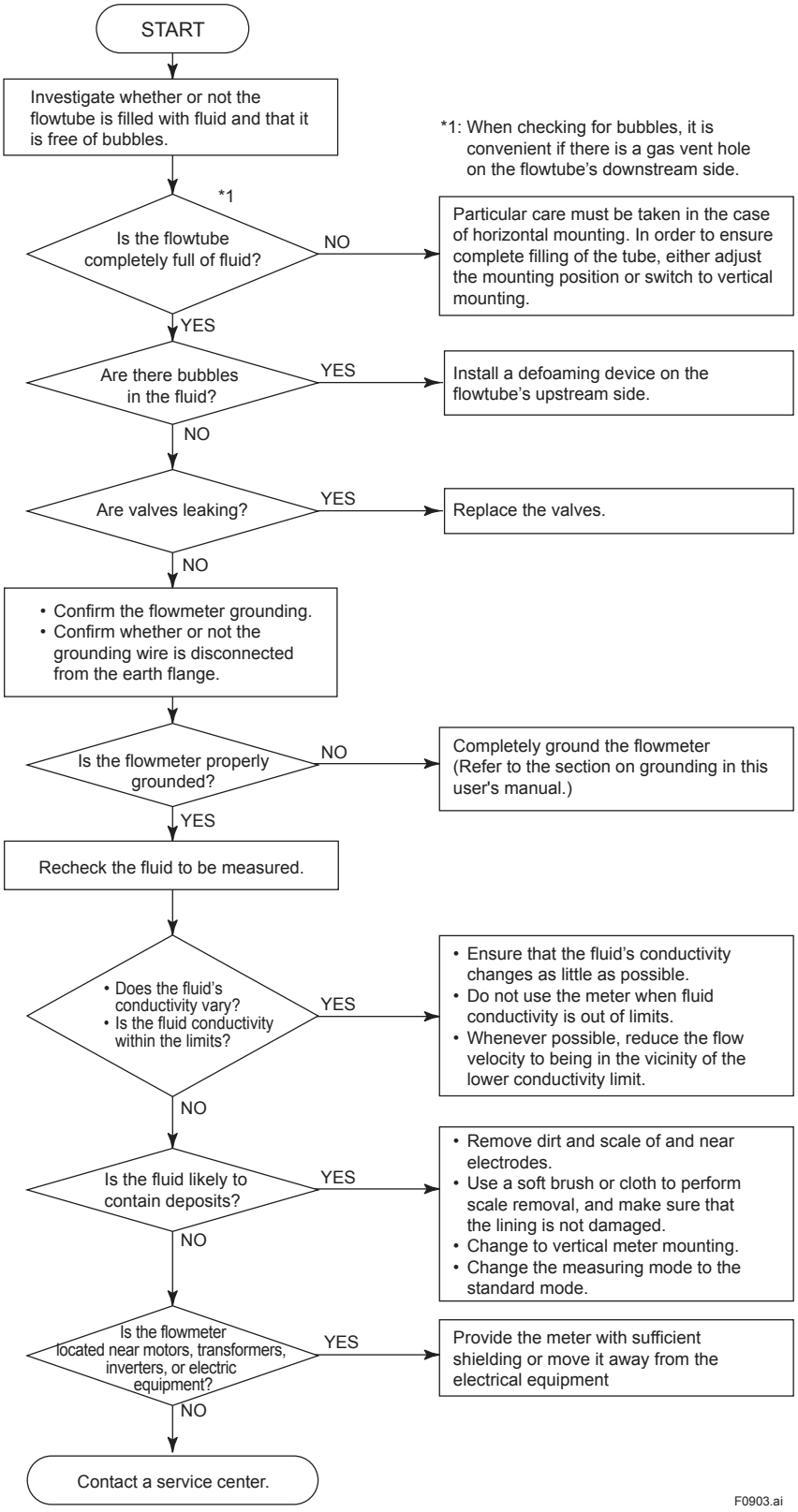
Although magnetic flowmeters rarely require maintenance, failures may occur when the instrument is not operated correctly. This section describes troubleshooting procedures where the cause of the breakdown is identified through receiver indication.

9.4.1 No Indication



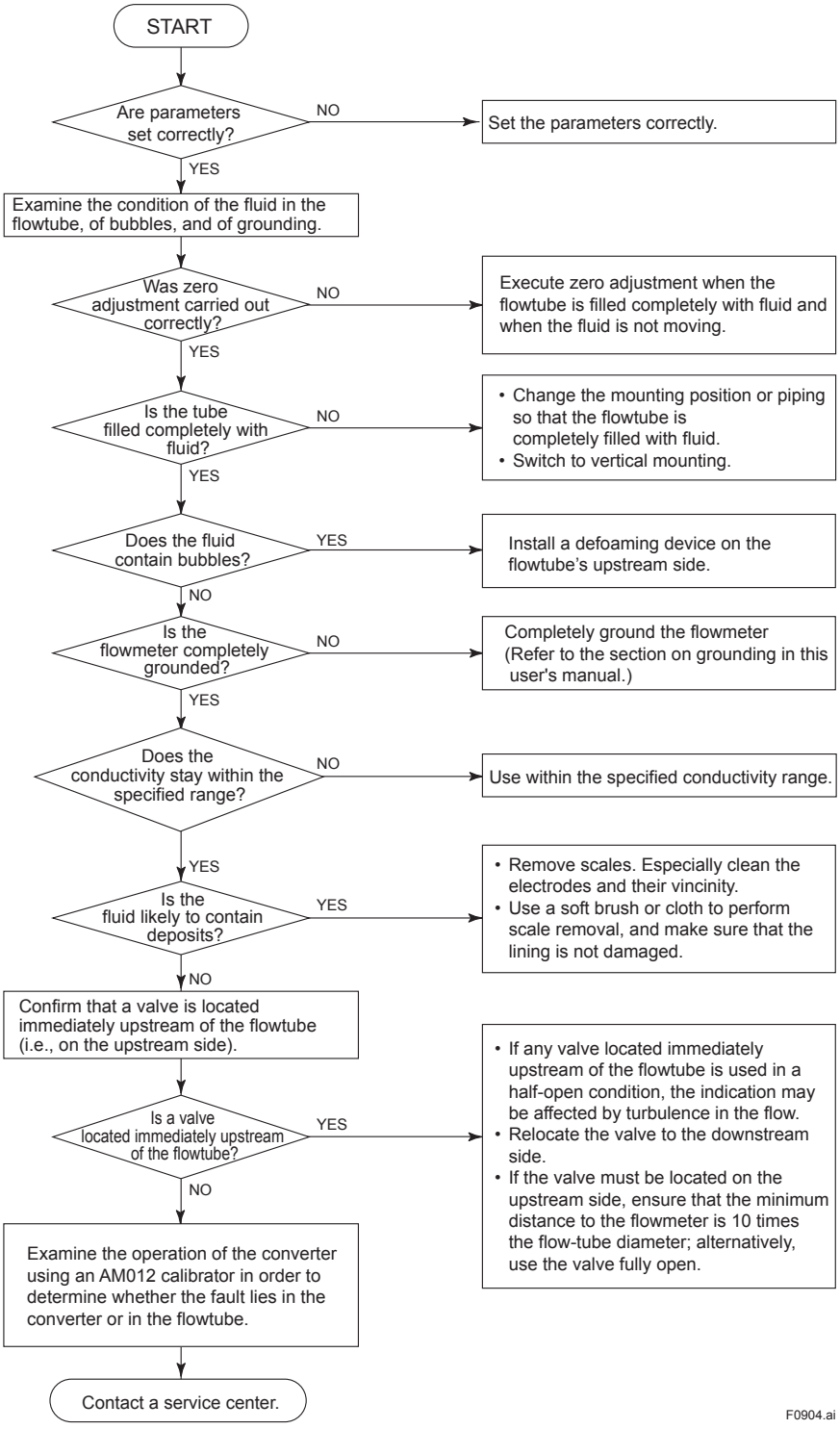
F0902.ai

9.4.2 Unstable Zero



*1: When checking for bubbles, it is convenient if there is a gas vent hole on the flowtube's downstream side.

9.4.3 Disagreement between Indication and Actual Flow



F0904.ai

10. OUTLINE

■ Standard Specifications

- **Degrees of Protection**: IP67, Type 4X
- **Grounding**:
  - 100Ω or less
  - When optional code A (lightning protector) is selected, Class C (10Ω or less)
  - In case of TIIS Flameproof type, Class A (10Ω or less) or Class C (10Ω or less)
  - In case of explosion proof type except TIIS, follow the domestic electrical requirements as regulated in each country.

○ Magnetic Flow Converter

- **Output Signal**:
  Current output;
  4 to 20mA DC (Load resistance 0 to 750Ω)
  Pulse output / Alarm output;
  Transistor contact
  (contact rating: 30V DC (OFF), 200mA(ON))
- **Communication signals (optional):**
  BRAIN communication signals
  (superimposed on a 4 to 20mA DC signal)
  Load resistance; 250 to 600Ω (including cable)
  Load capacity; 0.22μF or less (including cable)
  Load inductance; 3.3mH or less (including cable)
  Maximum cable length; 2km (6560 ft) (using CEV cable)
  Space from power line; 15cm or more (parallel wiring should be avoided)
  Input Impedance of Receiver Connected to the Receiving Resistance; 10kΩ or larger (at 2.4kHz)
- **Span Setting Functions**:
  Volumetric flow setting is possible by setting volume unit, time unit, flow rate value and flow tube size.
  Volume units; m^3, l (liter), cm^3, gallon (us), barrel (=158.987L)
  Velocity units; m, ft
  Time units; s (sec), min (minute), h (hour), d (day)
  Flow Tube Size; mm, inch
- **Instantaneous Flow Rate Display Function**:
  Flow rate can be displayed either in engineering units or percent of span.
- **Totalizer Display Function**:
  Totalized volume in engineering unit can be displayed by setting a totalizing factor.
- **Pulse Output Function**:
  Pulse output after scaling can be output by setting a pulse factor.
  Pulse width;
  Duty 50% or fixed pulse width (0.5, 1, 20, 33, 50 or 100ms)
  Output rate; 0.0001 to 1000p/s

NOTE

The output terminal is also used for alarm output. Cannot be used when alarm output.

- **Alarm Output Function:**
  Indicates that alarm occurs (Normal close fixed)
- **Self-diagnostics Function**:
  Converter failure, flow tube failure, errouneous settings, etc. can be diagnosed and displayed.
- **Data Security During Power Failure:**
  Data storage in EEPROM — no back-up battery required.
- **Damping Time Constant:**
  Settable from min. 1 to 200 seconds (63% response time).
- **Electrical Connection**:
  G 1/2 (JIS PF 1/2) female, ANSI 1/2 NPT female, DIN Pg 13.5 female, ISO M20×1.5 female
- **Terminal Connection:**
  M4 screw terminal
- **Case Material**:
  Aluminum alloy
- **Coating**:
  Polyurethane corrosion-resistant coating
- **Color of Coating**:
  Cover; Deep sea moss green (equivalent to Munsell 0.6GY3.1/2.0 or the equivalent)
  Case; Frosty white (equivalent to Munsell 2.5Y8.4/1.2)

○ Magnetic Flow Tube

- **Size**
  15, 25, 40, 50, 80, 100, 150, 200 mm
  (0.5, 1, 1.5, 2, 3, 4, 6, 8 in.)
- **Coating**
  Size 15 to 100mm (0.5 to 4 in.);
  No coating (Stainless steel surface)
  Size 150, 200mm (6, 8 in.);
  Polyurethane corrosion-resistant coating
  Frosty white (Munsell 2.5Y8.4/1.2)
- **Flow Tube Material**
  Housing;
  Stainless steel (15 mm: SCS11, 25 to 200 mm: SUS304)
- **Wetted Part Material**
  Pipe; Alumina ceramics (99.9%)
  Earth Ring; Stainless steel (SUS316), Hastelloy C276 equivalent, Titanium

NOTE

Hastelloy is a registered trademark of Haynes International Inc.

Gasket;

- Fluoro resin PTFE with filler (between flow tube body and earth ring)
- Fluoro rubber, viton (between flow tube body and earth ring; for optional code / FRG)
- Non-asbestos joint sheet sheathed with fluoro resin PTFE (between earth ring and process flange; for optional code / BCF or /BSF)
- Chloroprene rubber (between earth ring and process flange; for optional code / BCC or /BSC)

NOTE

Other gaskets between flow tube body and earth ring:

- Alkali resistance gasket (Fluoro resin PTFE with carbon)
- Alkali resistance gasket for PVC piping (Fluoro rubber)
- Acid resistance gasket for PVC piping (Fluoro rubber)

Contact Yokogawa office.

- **Electrode Construction:** Non-wetted type.

■ Standard Performance

- **Accuracy**;
  Size 15 to 100 mm (0.5 to 4 in.)
  (fluid conductivity of 0.1 µS/cm or more)

Size in mm (inch)	Span in m/s (ft/s)	Accuracy
15 (0.5)	0.5 to 1 (1 to 3)	±1.0% of span
	1 to 10 (3 to 33)	±0.5% of span (at indications below 50% of span)
		±1.0% of flow rate (at indications 50% of span or more)
25 to 100 (1 to 4)	0.5 to 1 (1 to 3)	±0.5% of span
	1 to 10 (3 to 33)	±0.25% of span (at indications below 50% of span)
		±0.5% of rate (at indications 50% of span or more)

Size 150, 200 mm (6, 8 in.)
(fluid conductivity of 1 µS/cm or more)

Size in mm (inch)	Span in m/s (ft/s)	Accuracy
150, 200 (6, 8)	0.5 to 1 (1 to 3)	±1.0% of span
	1 to 10 (3 to 33)	±0.5% of span (at indications below 50% of span)
		±1.0% of flow rate (at indications 50% of span or more)

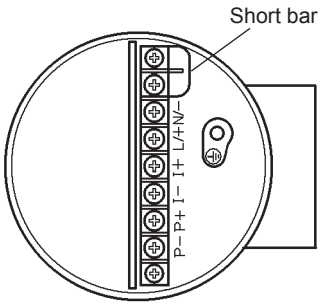
- **Repeatability**:
  ±0.1% of flow rate (Minimum ±1mm/s)
- **Maximum Power Consumption**:
  14W (for combination of flow tube and converter)
- **Insulation Resistance**:
  - 100MΩ between power terminals and ground terminal at 500 V DC.
  - 100MΩ between power terminals and each output terminal at 500 V DC.
  - 20MΩ between each output terminal and ground terminal at 100 V DC.
- **Withstanding Voltage**:
  - 1500 V AC for 1 minute between power terminals and ground terminal.
- **EMC Conformity Standard**:
  AS/NZS CISPR11

CAUTION

This instrument is a Class A product, and it is designed for use in the industrial environment. Please use this instrument in the industrial environment only.

CAUTION

When performing the Voltage Breakdown Test, Insulation Resistance Test, or any unpowered electeical test, wait 10 seconds after the power supply is turned off before removing the housing cover. Be sure to remove the Short Bar at terminal “G”. After testing, return the Short Bar to it’s correct position. Please be sure to use resistance when discharging.
Screw tightening torque should be 12kgf.cm (0.88ft-lb) or more, because the G-terminal is thought as a protective grounding and should conform to the Safety Requirements.



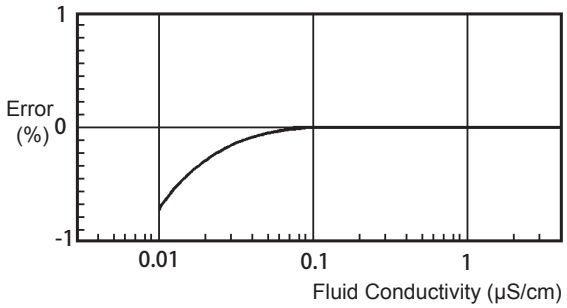
F1001.ai

■ Normal Operating Conditions

- **Ambient Temperature:**
  -20 to 50°C (-4 to 122˚F)
- **Ambient Humidity**:
  5 to 80%RH (no condensation)
- **Power Supply**:
  Range 80 to 264 V AC / 100 to 130 V DC,
  Range 20.4 to 28.8 V DC
- **Power Supply Frequency for Power Supply**:
  47 to 63 Hz
- **Measurable Fluid Conductivity**:
  - Size 15 to 100mm (0.5 to 4 in.): 0.01µS/cm or more
  - Size 150, 200mm (6, 8 in.): 1µS/cm or more

  * In case of size 5 to 100mm (0.5 to 4 in.) for fluid of which conductivity is from 0.01µS/cm to 0.1µS/cm, refer to accuracy in the figure below.

  Measured Data for Reference; Measured Condition
  Size: 25mm (1 in.)
  Fluid name: Glycerin + Ethylene glycol
  Viscosity: 30cSt
  Flow velocity: 1m/s
  Damping: 3s
  Measured Time: 20s



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- **Measurable Flow Range**:

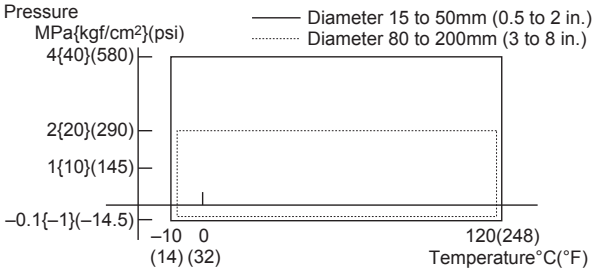
SI Units (Size: mm, Flowrate: m³/h)

Size	Min. Range @0.5m/s	Max. Range @10m/s
15	0 to 0.3181	0 to 6.361
25	0 to 0.8836	0 to 17.671
40	0 to 2.2620	0 to 45.23
50	0 to 3.535	0 to 70.68
80	0 to 9.048	0 to 180.95
100	0 to 14.138	0 to 282.74
150	0 to 31.81	0 to 636.1
200	0 to 56.55	0 to 1,130.9

English Units (Size: inch, Flowrate: GPM)

Size	Min. Range @1.6ft/s	Max. Range @33ft/s
0.5	0 to 1.0040	0 to 20.078
1	0 to 4.016	0 to 80.31
1.5	0 to 9.036	0 to 180.70
2	0 to 16.063	0 to 321.2
3	0 to 36.15	0 to 722.8
4	0 to 64.26	0 to 1,285.0
6	0 to 144.57	0 to 2,891.3
8	0 to 257.01	0 to 5,140

- **Fluid Temperature and Pressure**



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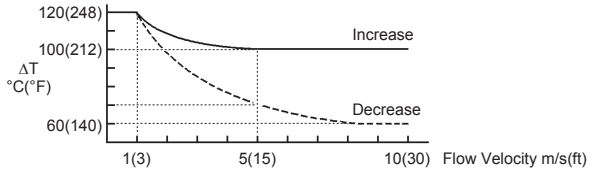
CAUTION

This limits show maximum allowable fluid pressure for Flow Tube itself. Further fluid pressure should also be limitted according to flange rating.

- **Reasonable Figures for Thermal Shock for Ceramics**

  1. Size 15, 25mm (0.5, 1 in.)



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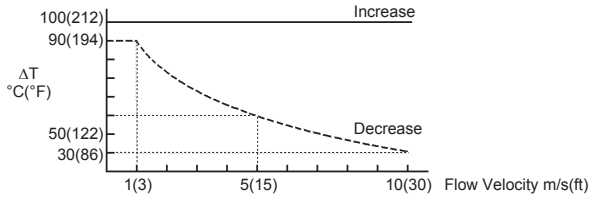
  2. Size 40, 50 mm (1.5, 2 in.)



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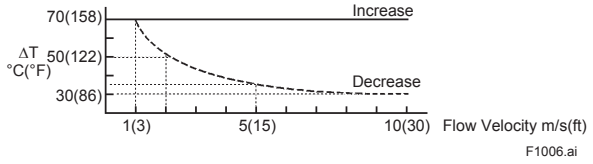
  3. Size 80 to 200 mm (3 to 8 in.)



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■ Model and Suffix Code

Model	Suffix Code	Description
CA115S		Size 15mm(0.5 in.)
CA202S		Size 25mm (1 in.)
CA204S		Size 40mm (1.5 in.)
CA205S		Size 50mm (2 in.)
CA208S		Size 80mm (3 in.)
CA210S		Size 100mm (4 in.)
CA215S		Size150mm (6 in.)
CA220S		Size 200mm (8 in.)
Use	G	General purpose type
	N	FM/CSA Explosion proof type (Only for sizes 15 to 100mm)(*3)
	C	TIIS Flameproof type (Only for sizes 15 to 100mm)(*2)
Pipe (*4)	-C	Ceramics
Process Connection (*5)	K1	JIS 10K wafer
	K2	JIS 20K wafer
	B1	ANSI 150 wafer
	B2	ANSI 300 wafer
	E2	DIN PN10/16 wafer
	H1	JIS F12(75M) wafer(*1)
Electrode material	-N	Always N
Earth ring material (*4)	S	SUS316
	H	Hastelloy C276 equivalent
	V	Titanium
Electrical connection (*2)	J	JIS G1/2 (PF1/2) female(*2)
	A	ANSI 1/2NPT female(*3)
	D	DIN Pg13.5 female
	M	ISO M20X1.5 female
Power supply	-A1	80 to 264V AC / 100 to 130V DC
	-D1	20.4 to 28.8V DC
Indicator (*6)	DH	Horizontal (7 Segment LCD)
	DV	Vertical (7 Segment LCD)
	N	None
Optional specification	/□	

*1: H1 is only for size 80 to 200mm (3 to 8 in.).

*2: Select JIS G1/2 female electrical connection (code J) and optional code /JF3 with /G11 or /G12 in case of requirement of TIIS Flameproof type.

*3: Select ANSI 1/2 NPT female electrical connection(code A) in case of requirement of FM/CSA explosion proof type.

*4: ⚠ Users must consider the characteristics of selected wetted parts material and the influence of process fluids. The use of inappropriate materials can result in the leakage of corrosive process fluids and cause injury to personnel and/or damage to plant facilities. It is also possible that the instrument itself can be damaged and that fragments from the instrument can contaminate the user's process fluids.
Be very careful with highly corrosive process fluids such as hydrochloric acid, sulfuric acid, hydrogen sulfide, sodium hypochlorite, and high-temperature steam (150°C [302°F] or above).
Contact Yokogawa for detailed information of the wetted parts material.

*5: Allowable fluid pressure should also be limited according to fluid temperature and pressure.

*6:

DH DV N

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■ Optional Specifications

A: Available N: Not available

ITEM	Specification	Use			Code
		General Purpose	Ex.Proof		
		CA***SG	CA***SC	CA***SN	
Waterproof Gland	Waterproof Glands are attached to Power and signal wiring ports. For JIS G1/2 only.	A	N	N	ECG
Waterproof Gland with Union Joint	Waterproof Glands(union joint) are attached to Power and signal wiring ports. For JIS G1/2 only.	A	N	N	ECU
Gasket for PVC pipe (Note 4)	Gaskets are attached between earth ring and flow tube.	A	A	A	FRG
Lightning Protector	Built-in Lightning Protector(Only for 24VDC version)	A	A	A	A
BRAIN Communication	Digital communication with BRAIN protocol	A	A	A	BR
Epoxy Coating	Coating is changed to Epoxy coating.	A	A	A	EPF
High Anti-corrosion Coating	Coating is changed to three-layer coating (Urethane coating on two-layer epoxy coating)	A	A	A	X2
Material Certificate	Reproduced material certificate for earth ring.	A	A	A	M01
Bolt & Nut Assembly (Note 1)	Carbon steel bolts/nuts and chloroprene gaskets assembly.	A	A	A	BCC
	Carbon steel bolts/nuts and non-asbestos PTFE-wrapped gaskets assembly.	A	A	A	BCF
	Stainless steel bolts(SUS304)/nuts(SUS403) and chloroprene gaskets assembly.	A	A	A	BSC
	Stainless steel bolts(SUS304)/nuts(SUS403) and non-asbestos PTFE-wrapped gaskets assembly.	A	A	A	BSF
TIIS Flameproof (Note 2) (Note 3)	TIIS Flameproof type	N	Note3	N	JF3
Flameproof Packing Adapter for TIIS Flameproof(Note 3)	One Flameproof Packing Adapter and a blind plug are attached.	N	Note3	N	G11
	Two Flameproof Packing Adapters are attached.	N	Note3	N	G12
FM Approval (Note 2)	FM Explosionproof	N	N	A	FF11
CSA Certification (Note 2)	CSA Explosionproof	N	N	A	CF11
Mirror Finished Ceramics	Mirror Finishing on the inside of ceramic tube (Rmax. <= 1micro-meter)	A	A	A	MRR
180deg. Rotate Converter	Set “01” in the parameter number 14, or “REVERSE” in the parameter number B14. Then reverse the direction of the flow direction arrow on the flowtube. (Note 5)	A	A	A	CRC
Oil-prohibited Use	Degreased cleansing treatment	A	A	A	K1
Oil-prohibited Use with Dehydrating Treatment	Degreased cleansing treatment; Packing with desiccant	A	A	A	K5
Hydrostatics Test Certificate	Test pressure depends on process connection (Test duration 10minutes) Test result is full in NOTE of QIC.	A	A	A	T01
Calibration Certificate	Level2: Declaration and Calibration Equipment List	A	A	A	L2
	Level3: Declaration and Primary Standard List	A	A	A	L3
	Level4: Declaration and YOKOGAWA Measuring Instruments Control System	A	A	A	L4

Note 1: It is available only for JIS 10K wafer, JIS 20K wafer or ANSI 150 wafer type.

2: It is available only for size 15 to 100mm (0.5 to 4 in.).

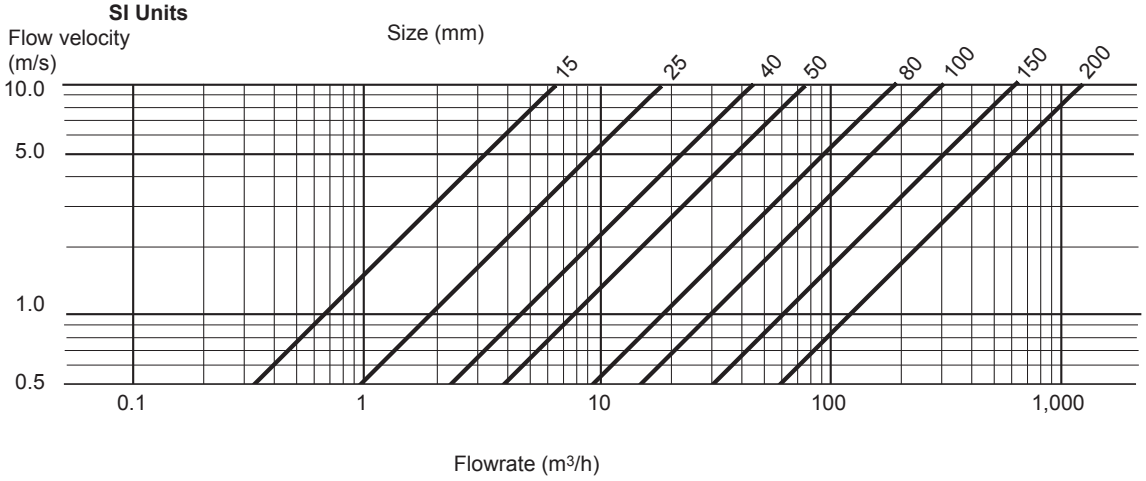
3: Select optional code /JF3 with /G11 or /G12 in case of requirement of TIIS Flameproof type.
/G11 is selectable only for DC power supply and 4-conductor cable use.

4: ⚠ Users must consider the characteristics of selected wetted parts material and the influence of process fluids. The use of inappropriate materials can result in the leakage of corrosive process fluids and cause injury to personnel and/or damage to plant facilities. It is also possible that the instrument itself can be damaged and that fragments from the instrument can contaminate the user’s process fluids.
Be very careful with highly corrosive process fluids such as hydrochloric acid, sulfuric acid, hydrogen sulfide, sodium hypochlorite, and high-temperature steam (150°C [302°F] or above).
Contact Yokogawa for detailed information of the wetted parts material.

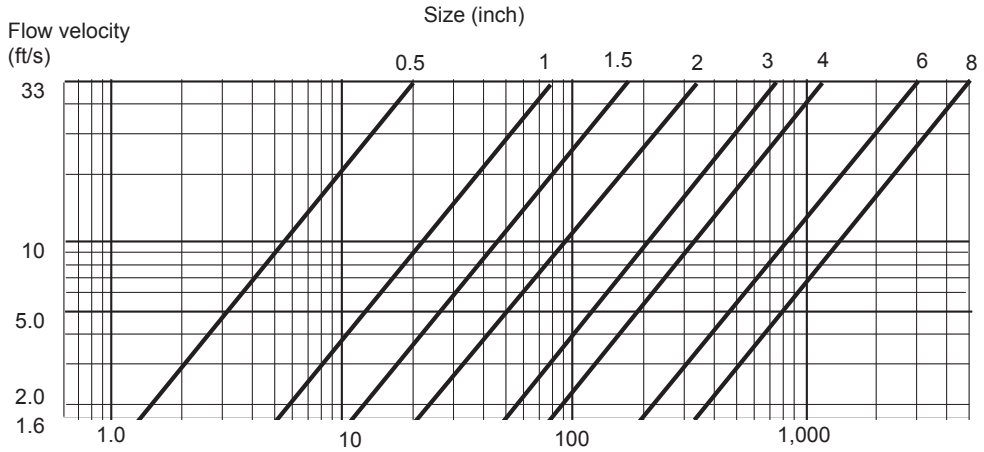
5: For model CA115, the arrow on the flowtube comes to the back side of the display.

■ Sizing Data

SI Units



English Units



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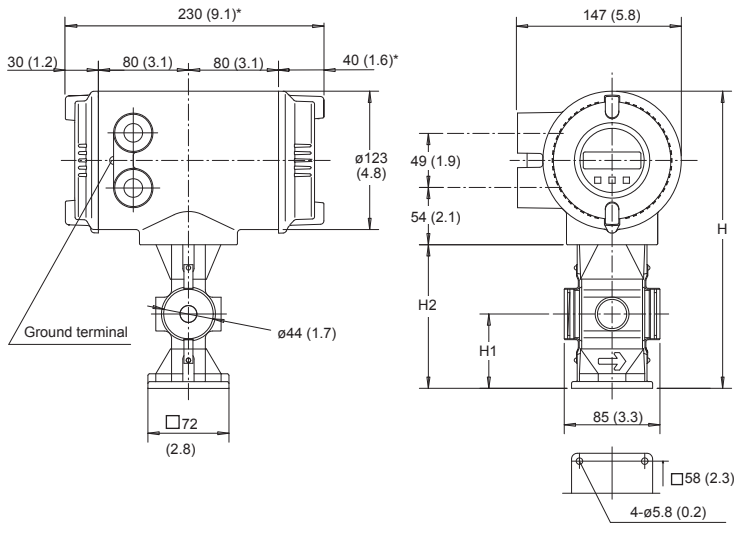
Note; Measurable flow velocity is from 0 m/s.

■ External Dimensions

- **CA115**

Unit: mm (inch)



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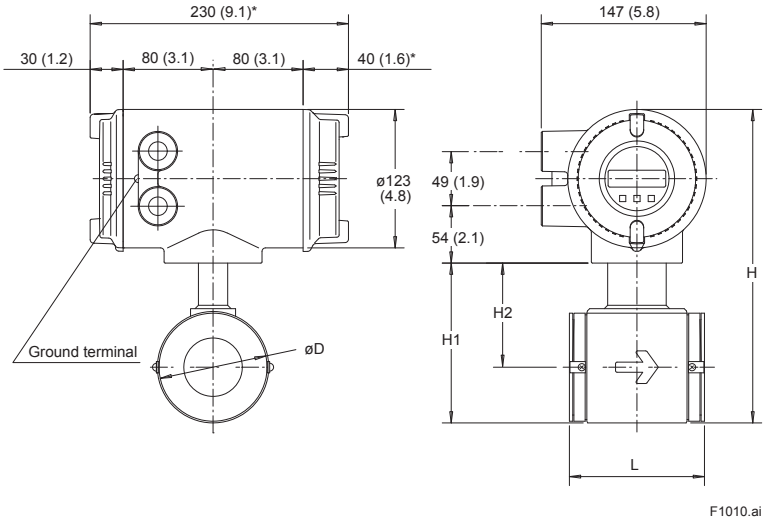
CA115S Unit: mm (inch)

Type		General (G)	Ex-proof (N/C)
Size code		115	
Size		15 (0.5)	
Lining		Ceramics	
Height	H	267.5 (10.5)	265 (10.4)
Height	H1	66 (2.6)	66 (2.6)
Height	H2	127.5 (5.0)	125 (4.9)
Weight kg (lb)		4.7 (10.4)	4.7 (10.4)

* The length marked as * is shorter by approx. 10 mm (0.4 in.) for non indicator type.

- **CA202, 204, 205, 208, 210**

Unit: mm (inch)



202
204
CA205S
208
210

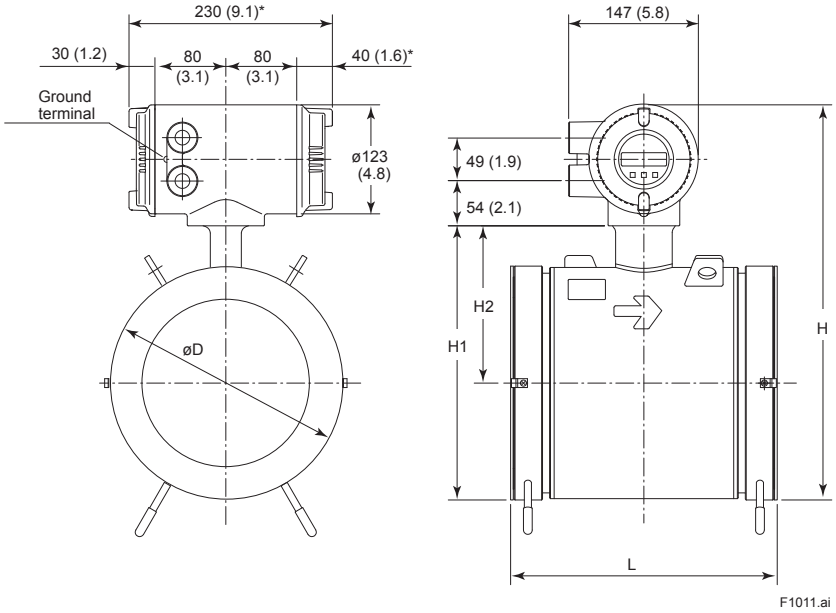
Unit: mm (inch)

Type		General (G)					Ex-proof (N/C)				
Size code		202	204	205	208	210	202	204	205	208	210
Size		25 (1.0)	40 (1.5)	50 (2.0)	80 (3.0)	100 (4.0)	25 (1.0)	40 (1.5)	50 (2.0)	80 (3.0)	100 (4.0)
Lining		Ceramics									
Face-to-face length	L	93 (3.7)	106 (4.2)	120 (4.7)	160 (6.3)	180 (7.1)	93 (3.7)	106 (4.2)	120 (4.7)	160 (6.3)	180 (7.1)
Outer diameter	øD	67.5 (2.7)	86 (3.4)	99 (3.9)	129 (5.1)	155 (6.1)	67.5 (2.7)	86 (3.4)	99 (3.9)	129 (5.1)	155 (6.1)
Height	H	250.6 (9.9)	271 (10.7)	283.5 (11.2)	313.5 (12.3)	349.5 (13.8)	248.6 (9.8)	269 (10.6)	281.5 (11.1)	311.5 (12.3)	347.5 (13.7)
Height	H1	110.6 (4.4)	131 (5.2)	143.5 (5.6)	173.5 (6.8)	209.5 (8.2)	108.6 (4.3)	129 (5.1)	141.5 (5.6)	171.5 (6.8)	207.5 (8.2)
Height	H2	76.8 (3.0)	87.5 (3.4)	94 (3.7)	109 (4.3)	132 (5.2)	74.8 (2.9)	85.5 (3.4)	92 (3.6)	107 (4.2)	130 (5.1)
Weight kg (lb)		4.6 (10.1)	5.5 (12.1)	6.5 (14.3)	9.2 (20.3)	12.3 (27.1)	4.6 (10.1)	5.5 (12.1)	6.5 (14.3)	9.2 (20.3)	12.3 (27.1)

* The length marked as * is shorter by approx. 10 mm (0.4 in.) for non indicator type.

- **CA215, 220**

Unit: mm (inch)



CA$^{215}_{220}$S

Unit: mm (inch)

Type		General (G)	
Size code		215	220
Size		150 (6.0)	200 (8.0)
Lining		Ceramics	
Face-to-face length	L	232 (9.2)	302 (11.9)
Outer diameter	øD	214 (8.4)	264 (10.4)
Height	H	406 (16.0)	456 (18.0)
Height	H1	266 (10.5)	316 (12.4)
Height	H2	159 (6.3)	184 (7.2)
Weight kg (lb)		23.9 (52.6)	35.9 (79.1)

* The length marked as * is shorter by approx. 10 mm (0.4 in.) for non indicator type.

● Unless otherwise specified, difference in the dimensions are refer to the following table.

General tolerance in the dimensional outline drawing.

Unit: mm (approx.inch)

Category of basic dimension		Tolerance	Category of basic dimension		Tolerance
Above	Equal or below		Above	Equal or below	
	3 (0.12)	±0.7 (±0.03)	500 (19.69)	630 (24.80)	±5.5 (±0.22)
3 (0.12)	6 (0.24)	±0.9 (±0.04)	630 (24.80)	800 (31.50)	±6.25 (±0.25)
6 (0.24)	10 (0.39)	±1.1 (±0.04)	800 (31.50)	1000 (39.37)	±7.0 (±0.28)
10 (0.39)	18 (0.71)	±1.35 (±0.05)	1000 (39.37)	1250 (49.21)	±8.25 (±0.32)
18 (0.71)	30 (1.18)	±1.65 (±0.06)	1250 (49.21)	1600 (62.99)	±9.75 (±0.38)
30 (1.18)	50 (1.97)	±1.95 (±0.08)	1600 (62.99)	2000 (78.74)	±11.5 (±0.45)
50 (1.97)	80 (3.15)	±2.3 (±0.09)	2000 (78.74)	2500 (98.43)	±14.0 (±0.55)
80 (3.15)	120 (4.72)	±2.7 (±0.11)	2500 (98.43)	3150 (124.02)	±16.5 (±0.65)
120 (4.72)	180 (7.09)	±3.15 (±0.12)			
180 (7.09)	250 (9.84)	±3.6 (±0.14)			
250 (9.84)	315 (12.40)	±4.05 (±0.16)			
315 (12.40)	400 (15.75)	±4.45 (±0.18)			
400 (15.75)	500 (19.69)	±4.85 (±0.19)			

Remarks: The numeric is based on criteria of tolerance class IT18 in JIS B 0401.

■ Earth Ring Inside Diameter

Unit: mm (inch)

Size	EARTH RING INSIDE DIAMETER
15 (0.5)	ø15 (0.6)
25 (1)	ø27 (1.1)
40 (1.5)	ø40 (1.6)
50 (2)	ø52 (2.1)
80 (3)	ø81 (3.2)
100 (4)	ø98 (3.9)
150 (6)	ø144 (5.7)
200 (8)	ø192 (7.6)

* Please be sure the inner diameter of a gasket does not protrude to the earth ring inside diameter.

11. OPERATING PRINCIPLE

11.1 Principle of Magnetic Flowmeter Operation

The operating principle of the magnetic flowmeter is based on the law of electromagnetic induction which states that when a conductor moves in a magnetic field, in the direction perpendicular to the magnetic field, an electromotive force is induced perpendicular to the direction of the conductor movement and to the direction of the magnetic field. The value of the electromotive force is proportional to the conductor velocity and magnetic flux density. In Figure 11.1, when a conductive fluid flows at an average velocity of V (m/s) through a pipe whose inner diameter is D (m), in which a magnetic field of uniform flux density B (tesla) exists, an electromotive force E (volts) is induced perpendicular to the direction of the magnetic field and to the flow.

$$E\ (V) = D \cdot V \cdot B \quad \cdots\cdots\cdots\cdots\cdots (1)$$

The volumetric flowrate Q is obtained from the following equation.

$$Q\ (m^3/s) = \frac{\pi}{4} \cdot D^2 \cdot V \quad \cdots\cdots (2)$$

From equations (1) and (2), the next equation is obtained.

$$Q\ (m^3/s) = \frac{\pi}{4} \cdot \frac{D}{B} \cdot E \quad \cdots\cdots (3)$$

Therefore, the electromotive force E is expressed as shown below.

$$E\ (V) = \frac{\pi}{4} \cdot \frac{B}{D} \cdot Q \quad \cdots\cdots\cdots (4)$$

If B is constant, then Q will be proportional to E from equation (3).

The magnetic flow converter amplifies and converts this electromotive force E to a standard signal of 4 to 20 mA or a pulse signal.

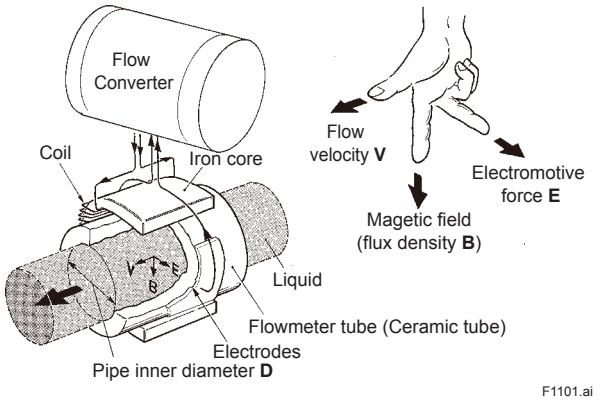


Figure 11.1 Operating Principle

11.2 Principal and Features of the Capacitance Magnetic Flowmeter

The measuring principle of the capacitance magnetic flowmeter (ADMAG CA) is basically the same as that of a conventional wetted-electrode magnetic flowmeter. The capacitance magnetic flowmeter, however, picks up the e.m.f. signal generated in a liquid through the ceramic tube wall's capacitance by placing both electrodes outside the metering tube (ceramic tube) making them non-wetted.
The ADMAG CA can offer stable measurement by taking the following measures against fluid noise (slurry noise and flow noise) which are problematic in flow measurement by magnetic flowmeters.

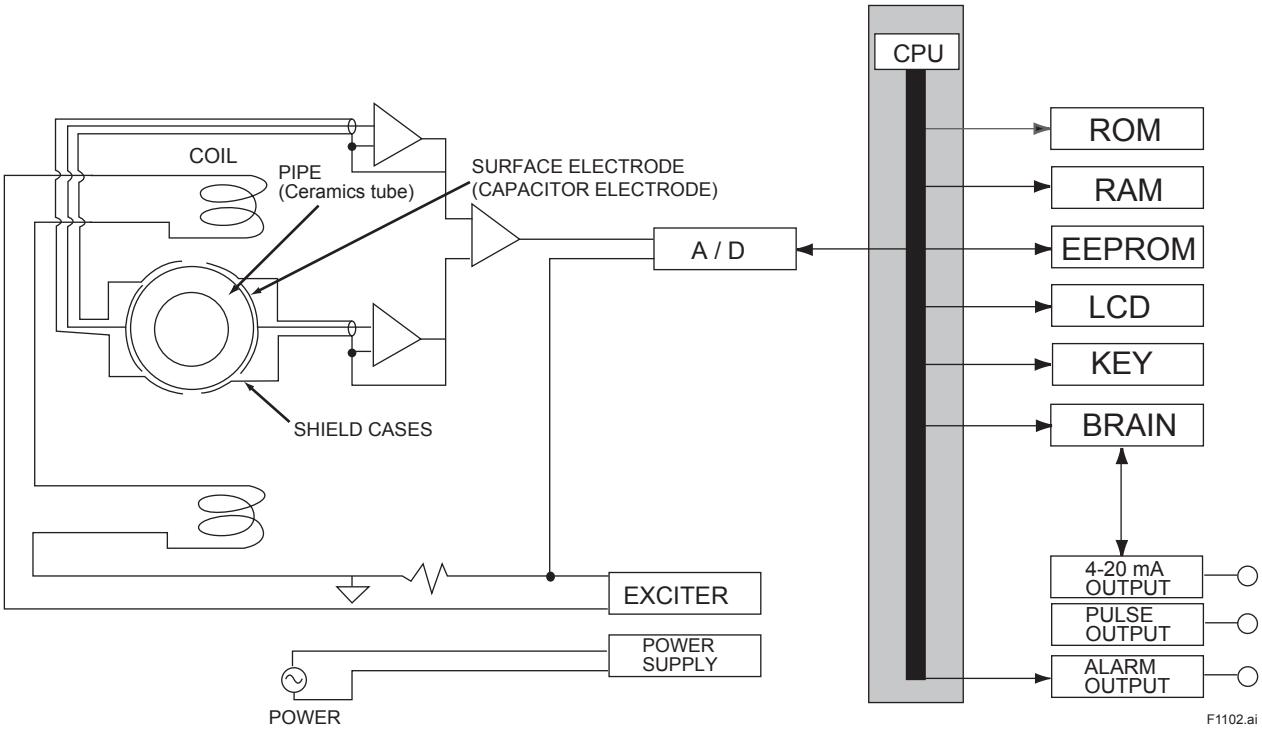
(1) Slurry Noise

Slurry noise is the noise generated when solid matter in a fluid collides with the electrodes. Against this noise, stable measurement is realized by employing a capacitance detection construction in which the electrodes are not wetted.

(2) Flow Noise

Flow noise voltages generated when measuring low-conductivity fluids have the characteristic, the higher the frequency, the smaller the noise voltage. The ADMAG CA provides the flow measurement of fluids having a very low conductivity by adopting a high-frequency excitation affected less by flow noise and by taking zero-stability measures by improving the magnetic circuit and employing capacitance electrodes.

11.3 Capacitance Magnetic Flowmeter Circuit Configuration



(1) Circuit Configuration

A capacitance magnetic flowmeter differs from a wetted-electrode magnetic flowmeter in forming area electrodes outside the metering tube. The magnetic flow detector consists of a ceramic tube, capacitance electrodes formed outside the ceramic tube, a magnetic circuit including excitation coils and a core, earth rings and shield cases.
Since electrode impedances are extremely high for capacitance electrodes, driven shield is implemented for capacitance electrodes by providing shield cases in the form of enclosing the capacitance electrodes to prevent the effect of stray capacitance.
The converter is composed of the exciting circuit for dual square wave frequency excitation, an amplify circuit to amplify the e. m. f. generated between capacitance electrodes and digital circuit including an A/D converter and timing circuits.

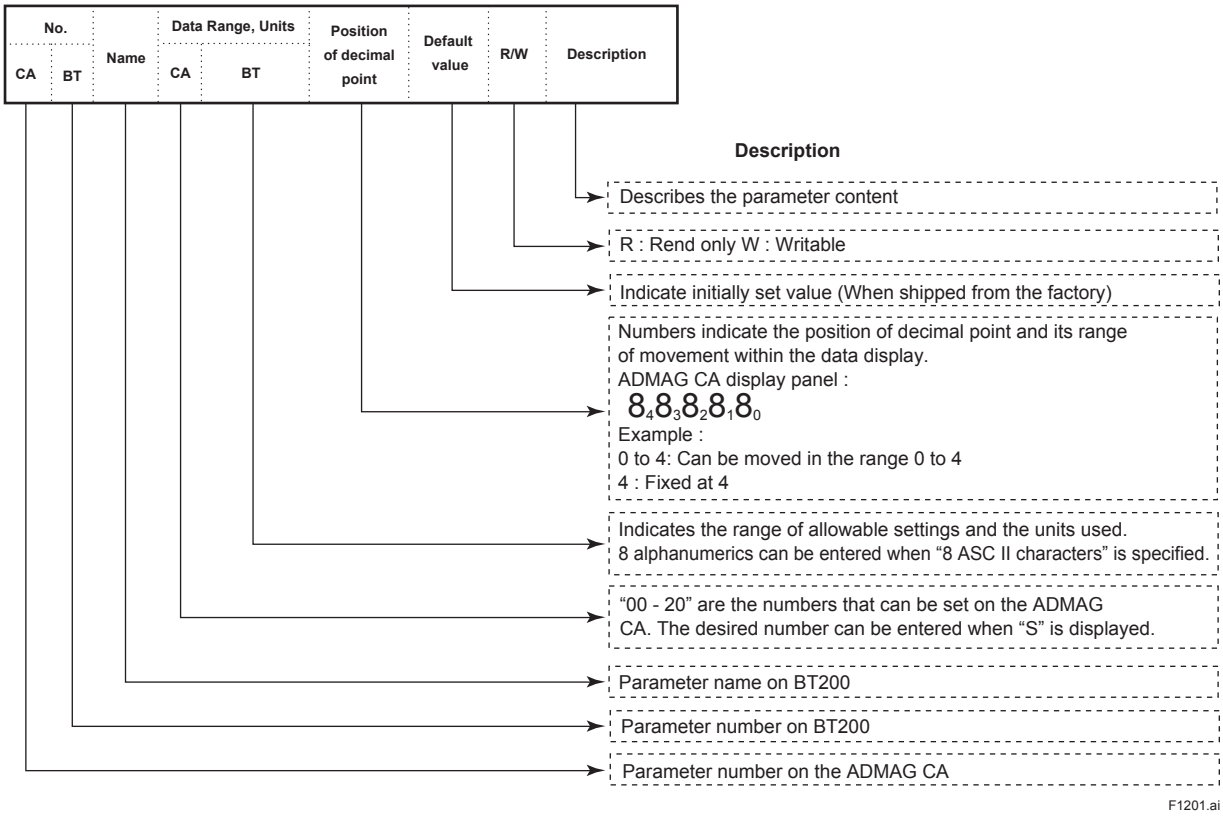
(2) Circuit features

- Power supply (switching regulator system)
  The switching regulator system is a power circuit unique to Yokogawa. Supply Voltage changes do not affect the converters Yokogawa. Supply voltage changes do not affect the converters operation because this system not only can be driven by either AC or DC power but also continuously controls the secondary voltage.
- Excitation system and signal conditioning
  There is a problem with an unstable zero point in high-frequency excitation that is less affected by fluid noise. To resolve this problem, it is necessary to make the rise of magnetic field faster and have the magnetic field remain constant during signal sampling. The ADMAG CA stabilizes the zero point by adopting capacitance electrodes and improving.
  The signal allows the stable measurement of fluids whose conductivity is very low or fluids which are stick because the signal is less affected by flow noise.
- Functions
  Soft ware engineering actively utilizes the capability of microcomputers to its maximum. The converter is provided with various functions such as span setting in an engineering unit, totalization, pulse output, self-diagnosis and others as well as active use of microcomputer for excitation and signal conditioning.

12. PARAMETER SUMMARY

This chapter describes all parameters used by ADMAG CA.

- Description of Items



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No.		Name	Data Range, Units		Position of decimal point	Default value	R/W	Description
CA	BT		CA	BT				
—	A00	DISPLAY	—				R	Major display items
—	A10	FLOW RATE(%)	—	- 8.0 to 108.0%	1	—	R	Displays instantaneous flow in %
—	A20	FLOW RATE	—	- 300.0 to 300.0	0 to 5	—	R	Displays instantaneous flow in actual units
—	A30	TOTAL	—	0 to 999999	0	0	W	Displays forward direction totalization values
—	A60	SELF CHECK	00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19	GOOD ERROR µP FAULT EEPROM FAULT A/D (L) FAULT A/D (H) FAULT SIGNAL OVERFLOW COIL OPEN SPAN VEL.>10m/s SPAN VEL.<0.5m/s P. SPAN>1000p/s P. SPAN>500p/s P. SPAN>25p/s P. SPAN>15p/s P. SPAN>10p/s P. SPAN>5p/s P. SPAN<0.0001p/s T. SPAN>1000p/s T. SPAN<0.0001p/s 4 - 20 LMT ERROR			R	Self check Indicates nature of alarm when alarm occurs.
—	B00	SET	—				R	Major parameter setting items
—	B01	TAG NO	—	16 ASCII characters		(Space)	W	Specifies tag number using up to 16 characters.
02	B02	DAMPING	S	1.0 to 200.0	1	3.0	W	Sets output time constants.
03	B03	FLOW SPAN	S	1 to 30000	0 to 5	1.0000	W	Flow rate span A combination of B04 and B05 units are used.
04	B04	FLOW UNIT	00 01 02 03 04 05 06 07 08 09 10 11 12 13	k m3 ($10^3 \times m^3$) m3 l (liter) ($10^{-3} \times m^3$) cm3 ($10^{-6} \times m^3$) Mgal kgal gal mgal kbbl bbl mbbl ubbl m ft		m	W	Select volume units of flow rate span.
05	B05	TIME UNIT	00 01 02 03	/d (day) /h (hour) /min (minute) /s (second)		/s	W	Select time constants of flow rate span.
06	B06	SIZE UNIT	00 01	mm inch		mm	W	Sets unit of meter tube size
07	B07	NOMINAL SIZE	S	1.0 to 3000.0	1	(Set)	W	Sets meter tube size using B06 units.
08	B08	STD MF	S	0.2500 to 3.0000	4	(Set)	W	Standard measurement meter factor.

No.		Name	Data Range, Units		Position of decimal point	Default value	R/W	Description
CA	BT		CA	BT				
09	B09	FNR MF	S	0.2500 to 3.0000	4	(Set)	W	Flow noise reduction measurement meter factor. Effective only for size 100 mm (4 in.) or smaller.
10	B10	PULSE / ALARM	00 01	PULSE OUT ALARM OUT		PULSE OUT	W	Select pulse output/alarm output
11	B11	4 - 20 ALM OUT	00 01 02 03	2.4mA OR LESS 4.0mA HOLD 21.6mA OR MORE		2.4mA OR LESS	W	Select current to be output during alarm. However, a hardware failure that causes a burn-out will result in 0 mA output.
13	B13	VELOCITY CHK	S	0 to 32.767	3		R	Range span displayed in m/s
14	B14	FLOW DIR	00 01	FORWARD REVERSE		FORWARD	W	Select flow direction
15	B15	MEAS MODE	00 01	STD FNR		STD	W	Select measurement mode (STD must be set for size 150, 200 mm (6, 8 in.))
—	B60	SELF CHECK	00 ↓ 19	GOOD ↓ 4 - 20 LMT ERROR			R	See parameter number “A60”
—	C00	ADJUST	—				R	Parameter for setting auto zero adjust
C1	C01	ZERO TUNING	00 01	INHIBIT ENABLE		ENABLE	W	Parameter for setting auto zero adjust
C2	C02	MAGFLOW ZERO	S	- 99.99 to 99.99	2	0.00	W	Displays zero correction
—	C60	SELF CHECK	00 ↓ 19	GOOD ↓ 4 - 20 LMT ERROR			R	See parameter number “A60”
—	D00	DISP SEL	—				R	Display panel selections
d1	D01	DISP SELECT	00 01 02 03 04 05	RATE(%) RATE TOTAL RATE(%) / TOTAL RATE / TOTAL RATE(%) / RATE		RATE(%)	W	Display selection items
d2	D02	FL USER SEL	00 01	NOT PROVIDED PROVIDED		NOT PROVIDED	W	Select whether user-defined units are to be used for instantaneous flow rates
d3	D03	FL USER SPAN	S	0 to 30000	0 to 5	100	W	Sets the value to be displayed in the special unit at 100% output
—	D10	FL USER UNIT	—	8 ASCII characters		(Space)	W	Sets the special instantaneous flow rate unit
—	D60	SELF CHECK	00 ↓ 19	GOOD ↓ 4 - 20 LMT ERROR			R	See parameter number “A60”
—	E00	TOTAL SET	—				R	Totalization display items
E1	E01	TOTAL UNIT	00 01 02 03 04 05 06	n UNIT/P μ UNIT/P m UNIT/P UNIT/P k UNIT/P M UNIT/P PULSE/s		PULSE/s	W	Sets flow rate unit per pulse for totalization display
E2	E02	TOTAL SCALE	S	0 to 30000	0 to 5	0	W	Sets flow rate per pulse for totalization display

No.		Name	Data Range, Units		Position of decimal point	Default value	R/W	Description
CA	BT		CA	BT				
E3	E03	TOTAL LOWCUT	S	0 to 100%	0	3	W	Sets the range in vicinity of 0% within which totalization will be halted
E4	E04	TOTAL SET	00 01	INHIBIT ENABLE		INHIBIT	W	Totalization preset(reset) enabled/ inhibited
E5	E05	TL SET VALUE	S	0 to 999999	0	0	W	Sets preset (reset) value
—	E10	TL USER UNIT	S	8 ASCII characters		(Space)	W	Sets special totalization units
—	E60	SELF CHECK	00 ↓ 19	GOOD ↓ 4 - 20 LMT ERROR			R	See parameter number “A60”
—	F00	PULSE SET	—				R	Pulse output items
F1	F01	PULSE UNIT	00 01 02 03 04 05 06	n UNIT/P μ UNIT/P m UNIT/P UNIT/P k UNIT/P M UNIT/P PULSE/s		PULSE/s	W	Selects pulse rate units
F2	F02	PULSE SCALE	S	0 to 30000	0 to 5	0	W	Sets pulse rate
F3	F03	PULSE LOWCUT	S	0 to 100%	0	3	W	Sets the range in vicinity of 0% wihtin which pulse output will be halted
F4	F04	PULSE WIDTH	00 01 02 03 04 05 06	50% DUTY 0.5 ms 1 ms 20 ms 33 ms 50 ms 100 ms		50% DUTY	W	Sets width of pulse output
—	F60	SELF CHECK	00 ↓ 19	GOOD ↓ 4 - 20 LMT ERROR			R	See parameter number “A60”
—	G00	4 - 20 SEL	—				R	Current output (4 to 20) settings
G1	G01	4 - 20 LOW CUT	S	0 to 10%	0	0	W	Sets low cut range for 4 to 20 mA output
G2	G02	4 - 20 LOW LMT	S	-20 to 100%	0	-20	W	Sets low limit for 4 to 20 mA output
G3	G03	4 - 20 H LMT	S	0 to 120%	0	120	W	Sets high limit for 4 to 20 mA output
—	G60	SELF CHECK	00 ↓ 19	GOOD ↓ 4 - 20 LMT ERROR			R	See parameter number “A60”
—	H00	TEST	—				R	Test mode items
H1	H01	TEST MODE	00 01	NORMAL TEST		NORMAL	W	Sets normal mode/test mode
H2	H02	OUTPUT VALUE	S	-8 to 108%	0	0	W	Sets test output values
H3	H03	ALARM OUT	00 01 02	NORMAL CLOSED (ON) OPEN (OFF)		NORMAL	W	Sets state of alarm output
—	H60	SELF CHECK	00 ↓ 19	GOOD ↓ 4 - 20 LMT ERROR			R	See parameter number “A60”
—	L00	OTHER	—				R	Data change inhibit/enable and display restrictions
L1	L01	TUNING	00 01	INHIBIT ENABLE		ENABLE	W	Select whether data chenges should be inhibit or enabled

No.		Name	Data Range, Units		Position of decimal point	Default value	R/W	Description
CA	BT		CA	BT				
L2	L02	KEY	00 55	00(TO “L”) 55(TO “N”)		00	W	Display restrictions Set 55 and items up to N will be displayed
—	L60	SELF CHECK	00 ↓ 19	GOOD ↓ 4 - 20 LMT ERROR			R	See parameter number “A60”
—	N00	APPL SET	—				R	
n1	N01	TOTAL / PULSE	00 01	NO DAMP (Flow rate data) DAMP (Damped flow rate data)		DAMP	W	Select whether instantaneous flow rate values or damping derived flow rate values are to be used in totalization / pulse
n2	N02	PULSE MODE	00 01	ON OFF		ON	W	Select whether the pulse output transistor is to be set to ON ACTIVE or OFF ACTIVE
n3	N03	RATE LIMIT	S	0 to 10%	0	5	W	Sets rate limit value in percentage
n4	N04	DEAD TIME	S	0 to 15	0	0	W	Sets rate limit dead time
—	N60	SELF CHECK	00 ↓ 19	GOOD ↓ 4 - 20 LMT ERROR			R	See parameter number “A60”

13. HAZARDOUS DUTY TYPE INSTRUMENT

WARNING

- In this section, further requirements and differences for explosion proof type instrument are described. For explosion proof type instrument, the description in this chapter is prior to other description in this Instruction Manual.
- The terminal box cover and display cover are locked by special screw. In case of opening the terminal box cover, please use the Hexagonal Wrench attached.
- Be sure to lock the cover with the special screw using the Hexagonal Wrench attached after tightening the cover.

13.1 FM (Only for sizes 15 to 100 mm (0.5 to 4 in.))

(1) Technical Data

Optional code /FF11
Applicable Standard: FM 3600, FM 3615, FM 3810, ANSI/NEMA 250
Explosion proof for Class I, Division 1, Groups A, B, C and D.
Dust-ignitionproof for Class II/III, Division 1, Groups E, F and G.
Temp. Code: T6
Ambient Temp.: –20°C to +50°C (–4 to 122°F)
Maximum power supply voltage: 240 Vac/ 120 Vdc
Enclosure: Type 4X

(2) Installation

WARNING

- Installation shall be in accordance with the manufacturer's instructions and the National Electric Code, ANSI/NFPA-70
- In hazardous locations, wiring to be in conduit as shown in the figure.

(3) Operation

WARNING

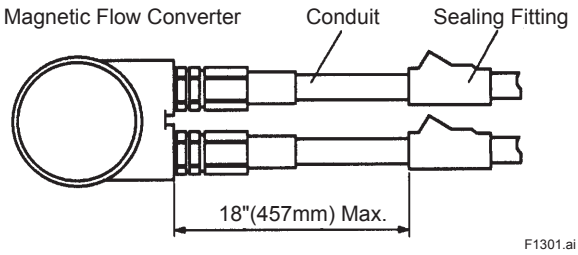
- Open circuit before opening the covers and seal all conduits with in 18 inches in hazardous locations.
- Take care not to generate mechanical spark when access to the instrument and peripheral devices in hazardous locations.

(4) Maintenance and Repair

WARNING

The instrument modification or parts replacement by other than authorized representative of Yokogawa Electric Corporation is prohibited and will void the approval of Factory Mutual Research Corporation.

HAZARDOUS LOCATIONS



13.2 CSA (Only for sizes 15 to 100 mm (0.5 to 4 in.))

(1) Technical Data

Optional code /CF11
Applicable Standard: CSA Standard C22.2 No.0, No.0.4, No.0.5, No.25, No.30, No.94, No.61010-1
Certificate: 1500865
Explosion proof for Class I, Groups B, C and D; Class II, Groups E, F and G; Class III
Temp. Code: T6 T5 T4
Process Temp.: 70 85 120°C
Ambient Temp.: –20°C to +50°C (–4 to 122°F)
Maximum power supply voltage: 240 Vac/ 120 Vdc
Enclosure: Type 4X

(2) Installation

WARNING

All wiring shall comply with Canadian Electrical Code Part I and Local Electrical Codes.
In hazardous location, wiring shall be in conduit as shown in the figure.
CAUTION: SEAL ALL CONDUITS WITHN 50cm OF THE ENCLOSURE'
UN SCELLEMENT DOIT ÉTRE INSTALLÉ À MOINS DE 50cm DU BOÎTIER.

(3) Operation

WARNING

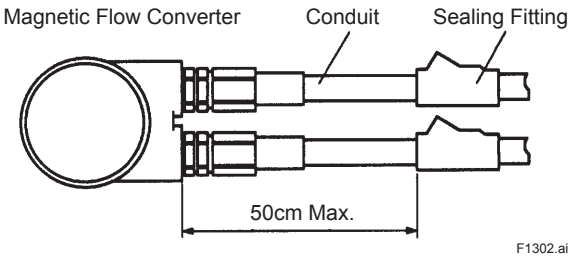
CAUTION: OPEN CIRCUIT BEFORE REMOVING COVER.
OUVRIR LE CIRCUIT AVANT D'ENLEVER LE COUVERCLE.
Take care not to generate mechanical spark when access to the instrument and peripheral devices in hazardous location.

(4) Maintenance and Repair

WARNING

The instrument modification or parts replacement by other than authorized representative of YOKOGAWA Electric Corporation or YOKOGAWA Corporation of AMERICA is prohibited and will void Canadian Standards Explosionproof Certification.

HAZARDOUS LOCATIONS



13.3 TIIS (Only for sizes 15 to 100 mm (0.5 to 4 in.))

WARNING

Care should be taken to install, wiring, piping to keep safety. This instrument is restricted to maintenance and repair. Please read "INSTALLATION AND OPERATING PRECAUTIONS FOR TIIS FLAMEPROOF EQUIPMENT" in the end of this mannual.

(1) Technical Data

- Certificate:

Size (mm)	Certificate	Size (mm)	Certificate
15	TC13644	50	TC13647
25	TC13645	80	TC13648
40	TC13646	100	TC13649

- Construction: Ex d e IIC T4 X
  : Converter; Flameproof
  Flow Tube; Increased Safety
  : Ignition and Explosion Class of gas or vapour; II CT4
- Ambient Temperature: –20 to 50˚C
- Fluid Temperature: 120˚C or less
- Maximum power supply voltage: 250V AC/130V DC
- Grounding: JIS Class C(10Ω or less) or JIS Class A(10Ω or less)

WARNING

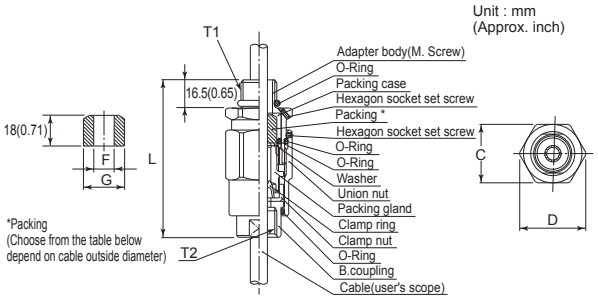
Maintenance and repair of the converter should be done in nonhazardous location after turning off.

(2) Wiring

Flameproof packing adapter is attached to electrical connection.

WARNING

Please use /G11 or /G12(option) flameproof packing adapter attached.



Dimension					Cable outer diameter	Packing diameter		Identification mark	Weight kg (lb)
T1	T2	C	D	L		F	G		
G 1/2	G 1/2	35 (1.38)	39 (1.54)	94.5 (3.72)	ø8.0 to ø10.0 (0.31 to 0.39)	ø10.0(0.39)	ø20.0 (0.79)	16 8-10	0.26 (0.57)
					ø10.0 to ø12.0 (0.39 to 0.47)	ø12.0(0.47)		16 10-12	

F1303.ai

Figure 13.1 Flame Proof Packing Adapter

Follow the procedure for flame proof packing adapter setting.

CAUTION

Before tightening, confirm cable length from terminal to flame proof packing adapter when setting. Once it is tightened, loosening and re-tightening may damage its sealing performance.

(a) Measure the bi-direction of the cable outside diameter to one decimal place in mm.
(b) Calculate the average of these value, and choose the suitable packing from attached two. [Refer to the Figure.13.1]
(c) Screw the M.screw into the electrical connection. (Ensure O-ring)
(d) Set union nut, B.coupling, clamp nut, clamp ring, packing gland, packing case with inserted packing and washer in that order around the cable, and tighten packing gland. And then tighten clamp nut. Confirm packing is compressed and cable is fixed.
(e) Insert packing gland into M.screw.
(f) Connect each wire of the cable to terminal.
(g) Tighten and fix union nut.
(h) Tighten and fix hexagon socket set screw of M.screw and union nut.

INSTALLATION AND OPERATING PRECAUTIONS FOR TIIS FLAMEPROOF EQUIPMENT

Apparatus Certified Under Technical Criteria (IEC-compatible Standards)

1. General

The following describes precautions on electrical apparatus of flameproof construction (hereinafter referred to as flameproof apparatus) in explosion-protected apparatus.

Following the Labour Safety and Health Laws of Japan, flameproof apparatus is subjected to type tests to meet either the technical criteria for explosionproof electrical machinery and equipment (standards notification no. 556 from the Japanese Ministry of Labour) (hereinafter referred to as technical criteria), in conformity with the IEC Standards, or the “Recommended Practice for Explosion-Protected Electrical Installations in General Industries,” published in 1979. These certified apparatus can be used in hazardous locations where explosive or inflammable gases or vapours may be present.

Certified apparatus includes a certification label and an equipment nameplate with the specifications necessary for explosion requirements as well as precautions on explosion protection. Please confirm these precautionary items and use them to meet specification requirements.

For electrical wiring and maintenance servicing, please refer to “Internal Wiring Rules” in the Electrical Installation Technical Standards as well as “USER’S GUIDELINES for Electrical Installations for Explosive Gas Atmospheres in General Industry,” published in 1994.

To meet flameproof requirements, equipment that can be termed “flameproof” must:

(1) Be certified by a Japanese public authority in accordance with the Labour Safety and Health Laws of Japan and have a certification label in an appropriate location on its case, and

(2) Be used in compliance with the specifications marked on its certification label, equipment nameplate and precautionary information furnished.

2. Electrical Apparatus of Flameproof Type of Explosion-Protected Construction

Electrical apparatus which is of flameproof construction is subjected to a type test and certified by the Japanese Ministry of Labour aiming at preventing explosion caused by electrical apparatus in a factory or any location where inflammable gases or vapours may be present. The flameproof construction is of completely enclosed type and its enclosure shall endure explosive pressures in cases where explosive gases or vapours entering the enclosure cause explosion. In addition, the enclosure construction shall be such that flame caused by explosion does not ignite gases or vapours outside the enclosure.

In this manual, the word “flameproof” is applied to the flameproof equipment combined with the types of protection “e”, “o”, “i”, and “d” as well as flameproof equipment.

3. Terminology

(1) Enclosure

An outer shell of an electrical apparatus, which encloses live parts and thus is needed to configure explosion-protected construction.

(2) Shroud

A component part which is so designed that the fastening of joint surfaces cannot be loosened unless a special tool is used.

(3) Enclosure internal volume

This is indicated by:— the total internal volume of the flameproof enclosure minus the volume of the internal components essential to equipment functions.

(4) Path length of joint surface

On a joint surface, the length of the shortest path through which flame flows from the inside to outside of the flameproof enclosure. This definition cannot be applied to threaded joints.

(5) Gaps between joint surfaces

The physical distance between two mating surfaces, or differences in diameters if the mating surfaces are cylindrical.

Note: The permissible sizes of gaps between joint surfaces, the path length of a joint surface and the number of joint threads are determined by such factors as the enclosure's internal volume, joint and mating surface construction, and the explosion classification of the specified gases and vapours.

4. Installation of Flameproof Apparatus

(1) Installation Area

Flameproof apparatus may be installed, in accordance with applicable gases, in a hazardous area in Zone 1 or 2, where the specified gases are present. Those apparatus shall not be installed in a hazardous area in Zone 0.

Note: Hazardous areas are classified in zones based upon the frequency of the appearance and the duration of an explosive gas atmosphere as follows:
Zone 0: An area in which an explosive gas atmosphere is present continuously or is present for long periods.
Zone 1: An area in which an explosive gas atmosphere is likely to occur in normal operation.
Zone 2: An area in which an explosive gas atmosphere is not likely to occur in normal operation and if it does occur it will exist for a short period only.

(2) Environmental Conditions

The standard environmental condition for the installation of flameproof apparatus is limited to an ambient temperature range from –20°C to +40°C (for products certified under Technical Criteria). However, some field-mounted instruments may be certified at an ambient temperature up to +60°C as indicated on the instrument nameplates. If the flameproof apparatus are exposed to direct sunshine or radiant heat from plant facilities, appropriate thermal protection measures shall be taken.

5. External Wiring for Flameproof Apparatus

Flameproof apparatus require cable wiring or flameproof metal conduits for their electrical connections. For cable wiring, cable glands (cable entry devices for flameproof type) to wiring connections shall be attached. For metal conduits, attach sealing fittings as close to wiring connections as possible and completely seal the apparatus. All non-live metal parts such as the enclosure shall be securely grounded. For details, see the "USER'S GUIDELINES for Electrical Installations for Explosive Gas Atmospheres in General Industry," published in 1994.

(1) Cable Wiring

- For cable wiring, cable glands (cable entry devices for flameproof type) specified or supplied with the apparatus shall be directly attached to the wiring connections to complete sealing of the apparatus.
- Screws that connect cable glands to the apparatus are those for G-type parallel pipe threads (JIS B 0202) with no sealing property. To protect the apparatus from corrosive gases or moisture, apply nonhardening sealant such as liquid gaskets to those threads for waterproofing.
- Specific cables shall be used as recommended by the "USER'S GUIDELINES for Electrical Installations for Explosive Gas Atmospheres in General Industry," published in 1994.
- In necessary, appropriate protective pipes (conduit or flexible pipes), ducts or trays shall be used for preventing the cable run (outside the cable glands) from damage.
- To prevent explosive atmosphere from being propagated form Zone 1 or 2 hazardous location to any different location or non-hazardous location through the protective pipe or duct, apply sealing of the protective pipes in the vicinity of individual boundaries, or fill the ducts with sand appropriately.
- When branch connections of cables, or cable connections with insulated cables inside the conduit pipes are made, a flameproof or increased-safety connection box shall be used. In this case, flameproof or increased-safety cable glands meeting the type of connection box must be used for cable connections to the box.

(2) Flameproof Metal Conduit Wiring

- For the flameproof metal conduit wiring or insulated wires shall be used as recommended by the USER'S GUIDELINES for Electrical Installations for Explosive Gas Atmospheres in General Industry, published in 1994.
- For conduit pipes, heavy-gauge steel conduits conforming to JIS C 8305 Standard shall be used.
- Flameproof sealing fittings shall be used in the vicinity of the wiring connections, and those fittings shall be filled with sealing compounds to complete sealing of the apparatus. In addition, to prevent explosive gases, moisture, or flame caused by explosion form being propagated through the conduit, always provide sealing fittings to complete sealing of the conduit in the following locations:
  (a) In the boundaries between the hazardous and non-hazardous locations.
  (b) In the boundaries where there is a different classification of hazardous location.
- For the connections of the apparatus with a conduit pipe or its associated accessories, G-type parallel pipe threads (JIS B 0202) shall be used to provide a minimum of five-thread engagement to complete tightness. In addition, since these parallel threads do not have sealing property, nonhardening sealant such as liquid gaskets shall thus be applied to those threads for ensuring waterproofness.
- If metal conduits need flexibility, use flameproof flexible fittings.

6. Maintenance of Flameproof Apparatus

To maintain the flameproof apparatus, do the following. (For details, see Chapter 10 "MAINTENANCE OF EXPLOSION-PROTECTED ELECTRICAL INSTALLATION" in the USER'S GUIDELINES for Electrical Installations for Explosive Gas Atmospheres in General Industry.)

(1) Maintenance servicing with the power on.

Flameproof apparatus shall not be maintenance-serviced with its power turned on. However, in cases where maintenance servicing is to be conducted with the power turned on, with the equipment cover removed, always use a gas detector to check that there is no explosive gas in that location. If it cannot be checked whether an explosive gas is present or not, maintenance servicing shall be limited to the following two items:

(a) Visual inspection
Visually inspect the flameproof apparatus, metal conduits, and cables for damage or corrosion, and other mechanical and structural defects.

(b) Zero and span adjustments
These adjustments should be made only to the extent that they can be conducted from the outside without opening the equipment cover. In doing this, great care must be taken not to cause mechanical sparks with tools.

(2) Repair

If the flameproof apparatus requires repair, turn off the power and transport it to a safety (non-hazardous) location. Observe the following points before attempting to repair the apparatus.

(a) Make only such electrical and mechanical repairs as will restore the apparatus to its original condition. For the flameproof apparatus, the gaps and path lengths of joints and mating surfaces, and mechanical strength of enclosures are critical factors in explosion protection. Exercise great care not to damage the joints or shock the enclosure.

(b) If any damage occurs in threads, joints or mating surfaces, inspection windows, connections between the transmitter and terminal box, shrouds or clamps, or external wiring connections which are essential in flameproofness, contact Yokogawa Electric Corporation.

CAUTION

Do not attempt to re-process threaded connections or refinish joints or mating surfaces.

(c) Unless otherwise specified, the electrical circuitry and internal mechanisms may be repaired by component replacement, as this will not directly affect the requirements for flameproof apparatus (however, bear in mind that the apparatus must always be restored to its original condition). If you attempt to repair the flameproof apparatus, company-specified components shall be used.

(d) Before starting to service the apparatus, be sure to check all parts necessary for retaining the requirements for flameproof apparatus. For this, check that all screws, bolts, nuts, and threaded connections have properly been tightened.

(3) Prohibition of specification changes and modifications

Do not attempt to change specifications or make modifications involving addition of or changes in external wiring connections.

7. Selection of Cable Entry Devices for Flameproof Type

IMPORTANT

The cable glands (cable entry devices for flameproof type) conforming to IEC Standards are certified in combination with the flameproof apparatus. So, Yokogawa-specified cable entry devices for flameproof type shall be used to meet this demand.

References:

(1) Type Certificate Guide for Explosion-Protected Construction Electrical Machinery and Equipment (relating to Technical Standards Conforming to International Standards), issued by the Technical Institution of Industrial Safety, Japan

(2) “USER’S GUIDELINES for Electrical Installations for Explosive Gas Atmospheres in General Industry” (1994), issued by the Japanese Ministry of Labour, the Research Institute of Industrial Safet

Revision Information

- Title: Models CA100S and 200S Capacitance Magnetic Flowmeter
- Manual No.: IM 1E8B0-01E

Edition	Date	Page	Revised Item	
9th	Oct. 2013	P.1-1 to P.1-3	1	Added the WARNING and Trademarks
		P.3-1	3	Added the component names.
		P.4-4	4.1 (13)	Changed the sentence.
		P.4-5	4.2.3	Added the NOTE for alteration of LCD display orientation.
		P.4-13	4.4.1 (2)	Added the IMPORTANT for grounding.
		P.5-8	5.2.2 (6)	Changed the example.
		P.8-1 to P.8-2	8.1.1	Changed the figure of display.
		P.9-2	9.2	Added the CAUTION for fuse replacement.
		P.9-3	9.3	Added the Section 9.3.
		P.10-6	10	Changed the description on rotating converter.
		P.13-2	13.3	Revised the marking of TIIS explosion-proof.