User's Manual

ADMAG CA

Models CA100S and 200S
Capacitance Magnetic Flowmeter

IM 1E8B0-01E

vigilantplant.™

YOKOGAWA
Yokogawa Electric Corporation

IM 1E8B0-01E
7th Edition

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INSTALLATION AND OPERATING PRECAUTIONS FOR JIS FLAMEPROOF EQUIPMENT EX-B03E

1. INTRODUCTION

This instrument has been already adjusted at the factory before shipment.

To ensure correct use of the instrument, please read this manual thoroughly and fully understand how to operate the instrument before operating it.

• Regarding This Manual

* This manual should be passed on to the end user.
* Before use, read this manual thoroughly to comprehend its contents.
* The contents of this manual may be changed without prior notice.
* All rights reserved. No part of this manual may be reproduced in any form without Yokogawa's written permission.
* Yokogawa makes no warranty of any kind with regard to this 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 are found, please inform Yokogawa.
* 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 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 Electric Corporation 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.

The following symbol marks are used in this manual and instrument;

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.

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

A **IMPORTANT** sign denotes an attention to avoid leading to damage to instrument or system failure.

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

Protective grounding terminal.

Function grounding terminal. This terminal should not be used as a “Protective grounding terminal”.

Alternating current.

Direct current.

• **Warranty**

* The guaranteed term of this instrument is described in the quotation. We repair the damages that occurred during the guaranteed term for free.
* Please contact with our sales office when this instrument is damaged.
* If the instrument has trouble, please inform us model code, serial number, and concrete substances or situations. It is preferable to be attached a outline or data.
* We decide after the examination if free repair is available or not.
* Please consent to the followings for causes of damages that are not available as free repair, even if it occured during the guaranteed term.

A : Unsuitable or insufficient maintenance by the customer.
B : The handling, using, or storage that ignore the design and specifications of the instrument.
C : Unsuitable location that ignore the description in this manual.
D : Remaking or repair by a person except whom we entrust.
E : Unsuitable removing after delivered.
F : A natural disaster (ex. a fire, earthquake, storm and flood, thunderbolt) and external causes.

For the safety using ;

WARNING

- The Magnetic Flowmeter is a heavy instrument. Please give attention to prevent that persons are injured by carrying or installing. It is preferable for carrying the instrument to use a cart and be done by two or more persons.
- In wiring, please confirm voltages between the power supply and the instrument before connecting the power cables. And also, please comfirm that the cables are not powered before connecting.
- When removing the instrument from hazardous processes, avoid contact with the fluid and the interior of the meter.
- In case of Hazardous duty type instrument, further requirements and differences are described in chapter 13 "HAZARDOUS DUTY TYPE INSTRUMENT". The description in chapter 13 is prior to other description in this instruction manual. Further, in case of JIS flameproof type, please read “INSTALLATION AND OPERATING PRECAUTIONS FOR JIS FLAMEPROOF EQUIPMENT” at the end of this manual.

2. HANDLING PRECAUTIONS

This instrument has been already tested thoroughly at the factory. When the instrument is delivered,please check externals and make sure that no damage occurred during transportation.

In this chapter, handling precautions are described. Please read this chapter thoroughly at first. And please refer to the relative matter about other ones.

If you have any problems or questions, please make contact with Yokogawa sales office.

2.1 Checking Model and Specifications

The model and specifications are shown on the Data Plate of the flow converter. Please comfirm the specifications between the instrument that was delivered and the purchase order (refer to the section 10.4 Model and Suffix Code).

Please let us know Model and Serial No. when making contact with Yokogawa sales office.

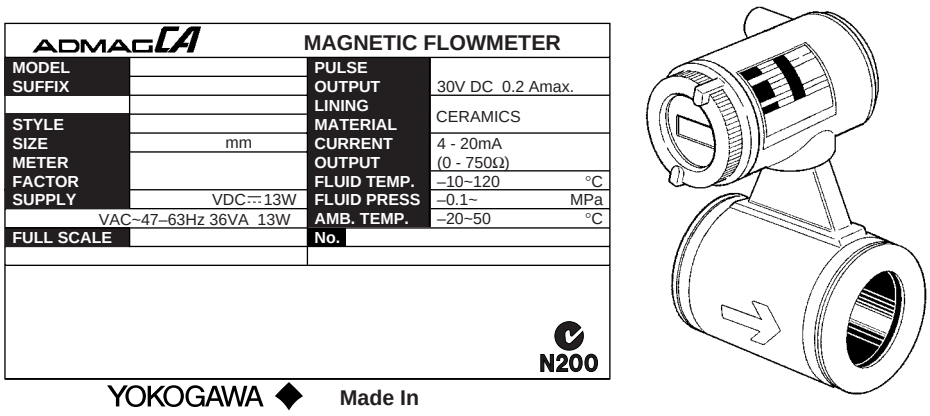


Figure 2.1 Data Plate

2.2 Accessories

When the flowmeter is delivered, make sure that the following accessories are in the package. Spare fuse can be applied only to this product.

- Fuse (250 V, 2 A time lag) (the spare fuse is taped to the converter) (1-piece)
- 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

In case the instrument is expected to be stored over a long term, please give attention to the followings ;

* The instrument should be stored in its original packing condition.

* The storage location should be selected according to the following conditions:

  1) The location where it is not exposed to rain or water.

  2) The location where there is few vibration or shock.

  3) Temperature and humidity should be:

     Temperature : -20 to 50˚C (-4 to 122˚F)

     Humidity : 5 to 80% RH (no condensation)

     Preferable ambient temperature and humidity are 25˚C(75˚F) and about 65% RH.

2.4 Installation Location Precautions

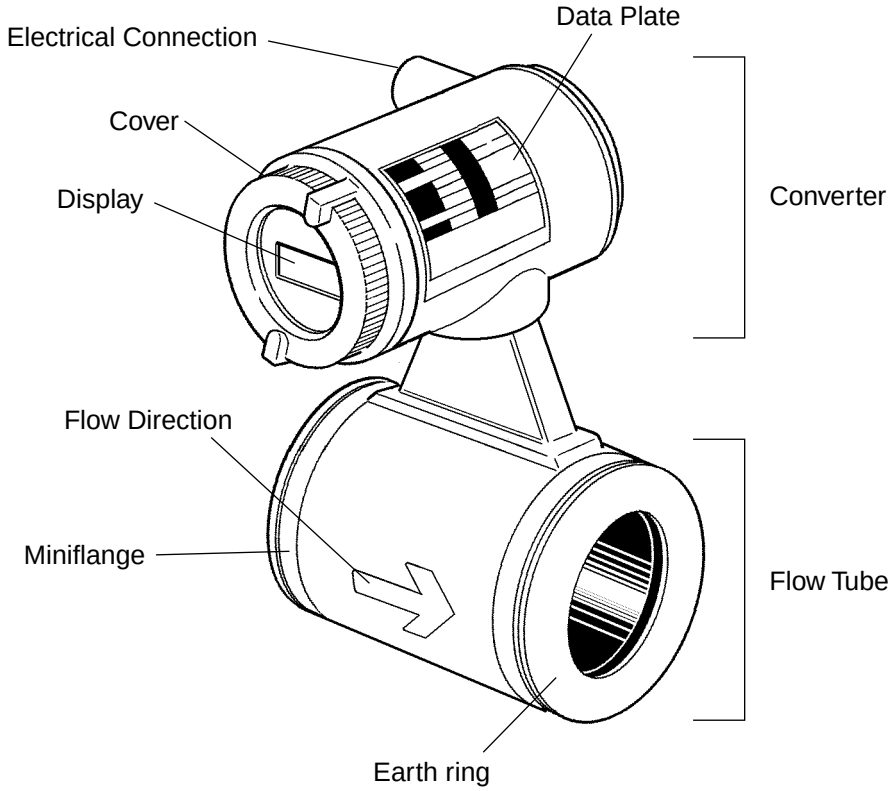
Please select the installation location considering the following items to ensure long term stable operation of the flowmeter.

- Ambient Temperature : Please avoid to install the instrument at the location where temperature changes continuously. If the location receives radiant heat from the plant, provide heat insulation or improve ventilation.
- Atmospheric Condition : Please avoid to install the instrument in an corrosive atmosphere. In case of installing in the corrosive atmosphere, please keep ventilating sufficiently and prevent rain from entering the conduit.
- Vibration or Shock : Please avoid to install the instrument at the location where there is heavy vibration or shock.

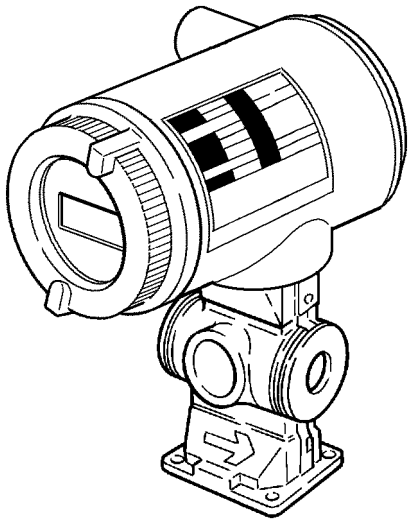
2.5 Converter Reorientation Precautions

Please do not change the converter orientation at the customer's site. If the converter reorientation is required, please contact to Yokogawa office or service center.

3. COMPONENT NAMES



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



Size: 15 mm (0.5 inch)

4. INSTALLATION

WARNING This instrument must be installed by expert engineer or skilled personnel. The procedures described in this chapter are not permitted for operators.

4.1 Piping Design Precautions

IMPORTANT Please design the correct piping referring to the followings to prevent damage for flowmeter and to keep correct measuring.

(1) Location

IMPORTANT Please install the flowmeter to the location where it is not exposed to direct sunlight and ambient temperature is -20 to +50˚C (-4 to 122˚F) .

(2) Noise Rejection

IMPORTANT

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

(3) Length of Straight Run

To keep accurate measuring, JIS B7554 “Electro Magnetic Flowmeters” explains about upstream piping condition of Magnetic Flowmeters.
We recommend to our customers about the piping conditions shown in Figure 4.1.1 based on JIS B7554 and our piping condition test data.

D:Internal diameter of flowmeter

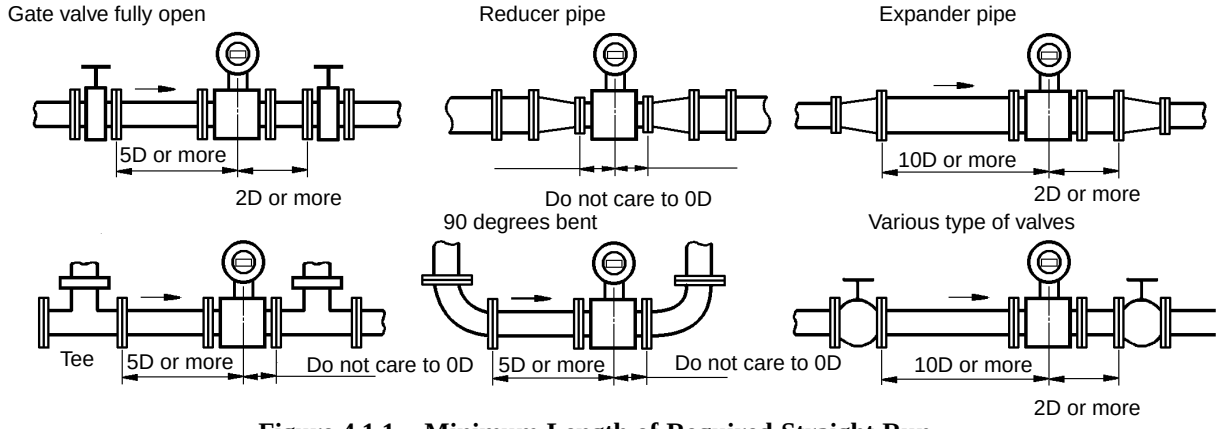


Figure 4.1.1 Minimum Length of Required Straight Run

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 size of flow tube) or more. Please be careful that gasket material dose not protrude in pipe inner surface.

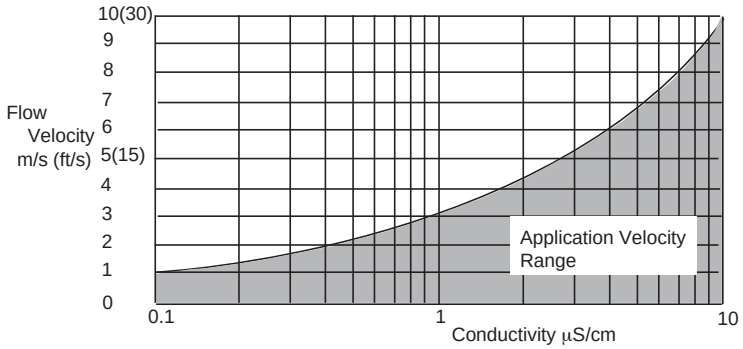
Notes : 1. Nothing must be inserted or installed in the metering pipe that may interfere with the magnetic field, induced signal voltages, and flow velocity distribution.
2. These straight runs may not be required on the downstream side of the flowmeter. However, if the downstream valve or other fittings cause channeling on the upstream side, provide a straight run of 2 D to 3 D on the downstream side.

(4) Applicable Velocity Range in Low Conductivity Fluid Measurement

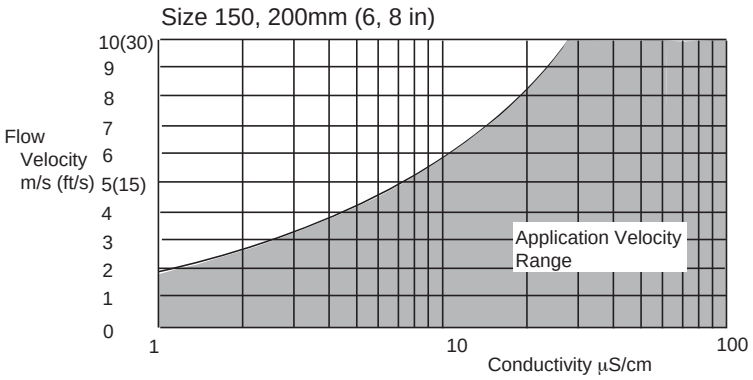
IMPORTANT

- 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.

Size 15 to 100mm (0.5 to 4 in)



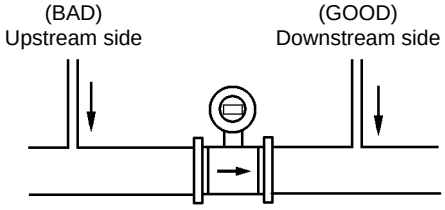
Size 150, 200mm (6, 8 in)



(5) Liquid Conductivity

IMPORTANT

Please avoid to install the flowmeter at location where liquid conductivity is likely to be non-uniform. Because it is possible to have bad influences to the flow indication by non-uniform conductivity when a chemical liquid is injected from upstream side close to the flowmeter. When this occurs, it is recommended that chemical application ports are installed on the downstream side of the flowmeter. In case chemicals must be added upstream side, please keep the pipe length enough so that liquid is properly mixed.



(6) Liquid Sealing Compound

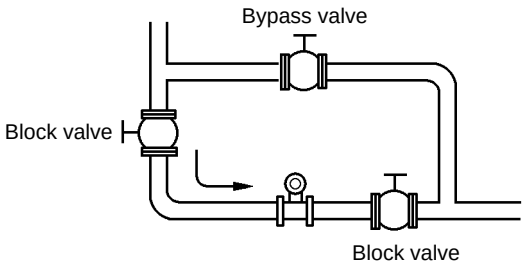
IMPORTANT Please give attention in using Liquid Sealing Compound to the piping, because it brings bad influences to measurement by flowing out and cover the surfaces of earth-ring.

(7) Service Area

Please select the location where there is enough area to service installing, wiring, overhaul,etc.

(8) Bypass Line

It is recommended to install the Bypass Line to facilitate maintenance and zero adjustment.



(9) Supporting the Flowmeter

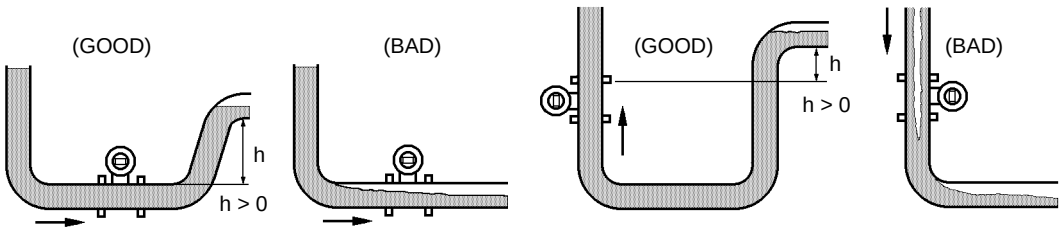
CAUTION Please avoid to support only the flowmeter, but fix pipes at first and support the flowmeter by pipes to protect the flowmeter from forces caused by vibration,shock, expansion and contraction through piping.

(10)Piping Condition

IMPORTANT The piping should be designed so that a full pipe is maintained at all times to prevent loss of signal and erroneous reading.

Please design the piping that a fluid is always filled in the pipes. The Vertical Mounting is effective for fluids that is easily separate or slurry settles within pipes.

In this case, please flow a fluid from bottom to up.



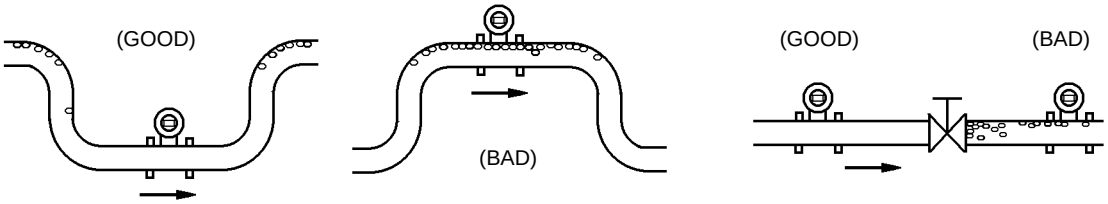
Horizontal mounting

Vertical mounting

(11)No Air Bubbles

IMPORTANT Please give attention to prevent bad influences or measuring errors from air bubbles that gathers inside measuring pipes.

In case the fluid includes air bubbles, please design the piping that prevent to gather air bubbles. In case valves are installed upstream of the flowmeter, it is possible that a valve causes air bubbles, please install the flowmeter upstream side of a valve.



(12)Mounting Direction

IMPORTANT When the electrodes are vertical to ground, the electrode is covered with air bubbles at upper side or slurry at downside, and it may causes the measuring errors.
Please be sure to mount the converter upperside of piping to prevent water penetration into converter case.

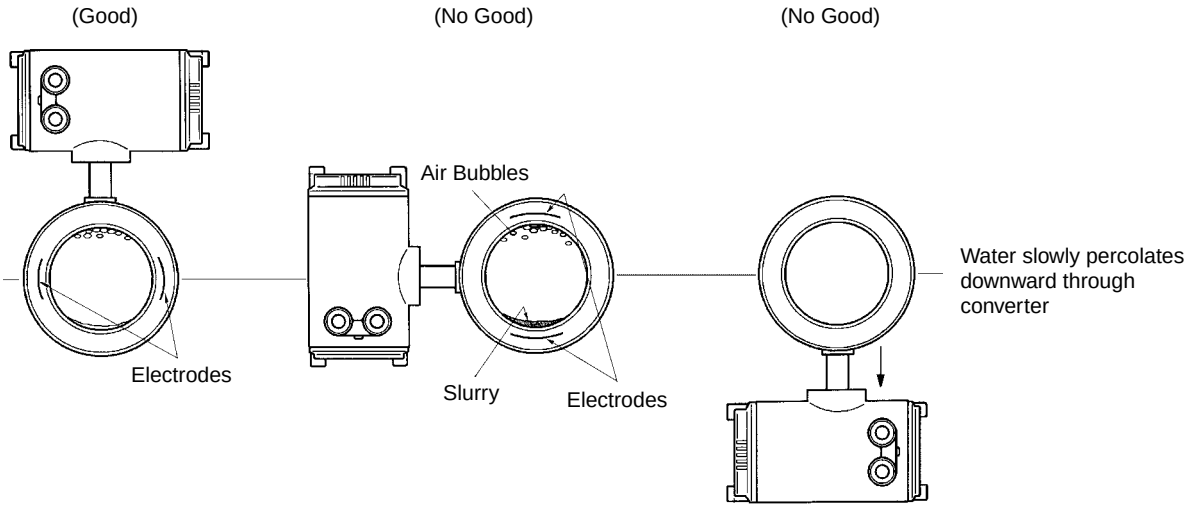


Figure 4.1.6 Mounting Direction

(13)Grounding

IMPORTANT Improper grounding can have an adverse affect on the flow measurement. Please ensure that the instrument is properly grounded.

The electromotive force of the magnetic flowmeter is minute and it is easy to be affected by noise. And also that reference electric potential is the same as the measuring fluid potential. Therefore, the reference electric potential (terminal potential) of the Flow Tube and the Converter/Amplifier also need to be the same as the measuring fluid. And moreover, that the potential must be the same with ground.

Please be sure to grounding according to Figure 4.1.7.

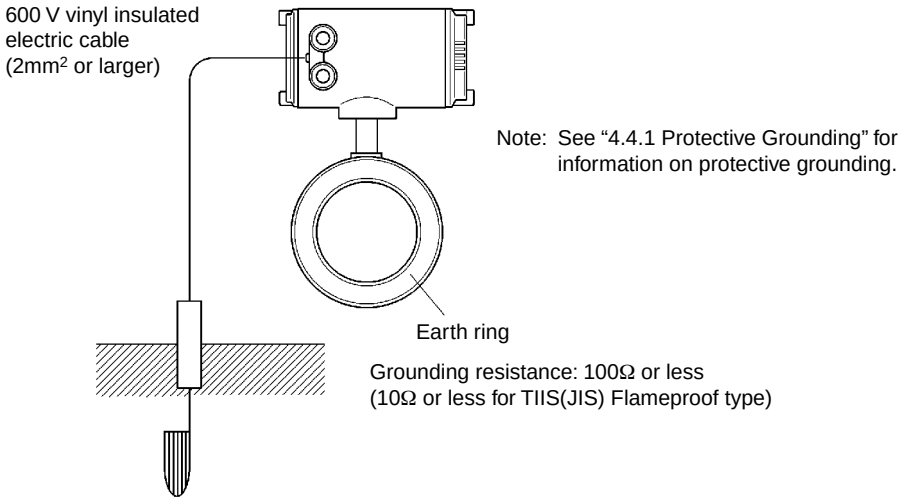


Figure 4.1.7 Gounding

4.2 Mounting Precautions

WARNING The Magnetic Flowmeter is a heavy instrument. Please be careful to prevent persons from injuring when it is handled.

4.2.1 General Precautions

(1) Precaution for Carrying

The Magnetic Flowmeter is packed tightly. When it is unpacked, please give attention to prevent damages to the flowmeter. And to prevent the accident during carry to the installing location, please carry it near the location keeping packed as it delivered.

CAUTION In case the Magnetic Flowmeter size 150, 200 mm (6, 8 inch) lifts up, please refer to Figure 4.2.1. Please never lift up by using a bar through the flow tube.

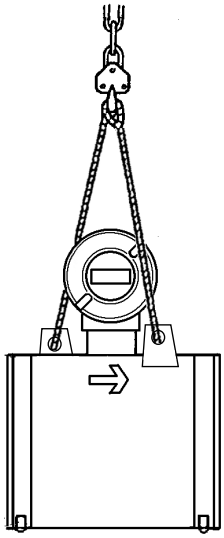


Figure 4.2.1 Lifting Method

(2) Precaution for Shock

CAUTION Care should be taken not to drop the flowmeter or subject it to excessive shock.

(3) Precaution for Terminal Box Covers

IMPORTANT Please never leave the terminal box cover open until wiring to prevent insulation deterioration.

(4) Precaution for Long-Term Non-Use

IMPORTANT

It is not preferable to leave the flowmeter for long term non-use after installation.
In case the flowmeter is compelled to do that, please take care of the flowmeter by the followings.

* Confirmation of Sealing Condition for the Flowmeter
  Please confirm the sealing conditions of the terminal box screw and wiring ports.
  In case of the Conduit Piping, please provide the drain plugs or water-proof glands to it to prevent that moisture or water penetrates into the flow tube through the conduit.
* Regular Inspections
  Please inspect the sealing condition (as above mentioned) and inside of the terminal box. And when it is suspect that water penetration into the inside detector (ex. rain fall), please inspect when it happened.

4.2.2 Flowmeter piping

CAUTION Mis-aligned or slanted piping can lead to leakage and damage to 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.

- Please correct mis-alignment or slanted piping and improper distance between mounting flanges before install the flowmeter. (Please refer to Figure 4.2.2)
- Inside a pipeline which is newly installed, some foreign substances (such as welding scrap or wood chips) may exist. Please remove them by flushing piping before mounting flow tube.

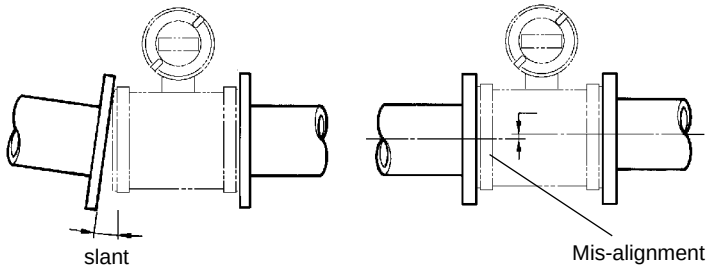


Figure 4.2.2 Slant and Mis-alignment of Flowmeter Piping

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.

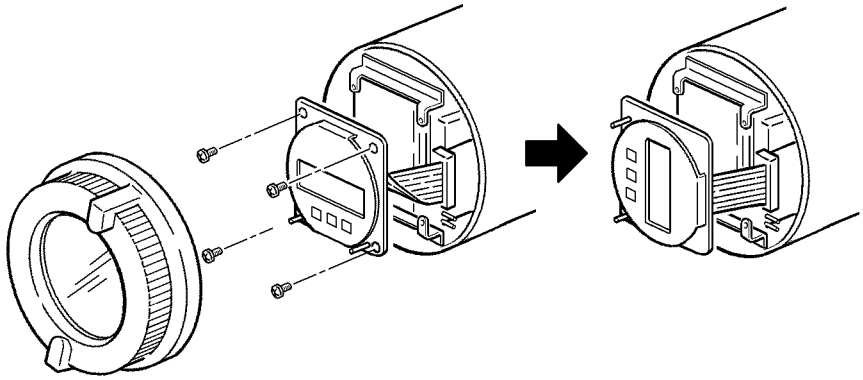


Figure 4.2.3 Procedure of Altering LCD Display Orientation

NOTE Orientation of display unit is limited to the two positions shown in this figure.

4.3 Mounting

4.3.1 Nominal Diameter 15mm (0.5") to 40 mm (1.5")

IMPORTANT

Please use appropriate bolts and nuts according to process connection. In case stud type of through bolts are used, be sure outside diameter of a shank is smaller than a thread ridge's one.
Please use compressed non-asbestos fiber gasket, PTFE gasket or the gasket which has equal elasticity. In case of optional code/FRG, please use rubber gasket or others which has equal elasticity. Be sure the inner diameter of the gasket does not protrude to inner piping. (Refer to Table 4.3.6)

A: Mounting Direction

Please mount the Magnetic Flowmeter matching the flow direction to be measured with the direction of the arrow mark on the flowmeter.

IMPORTANT

If it is impossible to match the direction, please never remodel by changing direction of the converter. In case the measuring fluid flows against the arrow direction, please refer to the section 6.4.6 Reversing Flow Direction.

B: Mounting Centering Devices

To keep concentricity of the Flow Tube with pipes, please mount centering devices on the Mini-Flanges of the Flow Tube.
Please give attention to the nominal diameter and flange ratings of the centering devices.

C: Positioning Flow Tube

Please pass two through-bolts to lower adjacent holes of both flanges and mount the Flow Tube, and pass other through-bolts to other holes. (Refer to Figure 4.3.1 / 4.3.2)
In case stud type of through-bolts are used, position them coming in contact centering devices with thread of bolts.

D: Tightening Nuts

Please tighten the bolts according to Torque Values in Table 4.3.1. In case of PVC piping, please select optional code /FRG, use rubber gasket and tighten with the torque value in Table 4.3.2.

CAUTION

Please be sure to tighten the bolts following prescribed torque values.
Please tighten the flange bolts diagonally with the same torque values, step by step up to the prescribed torque value.

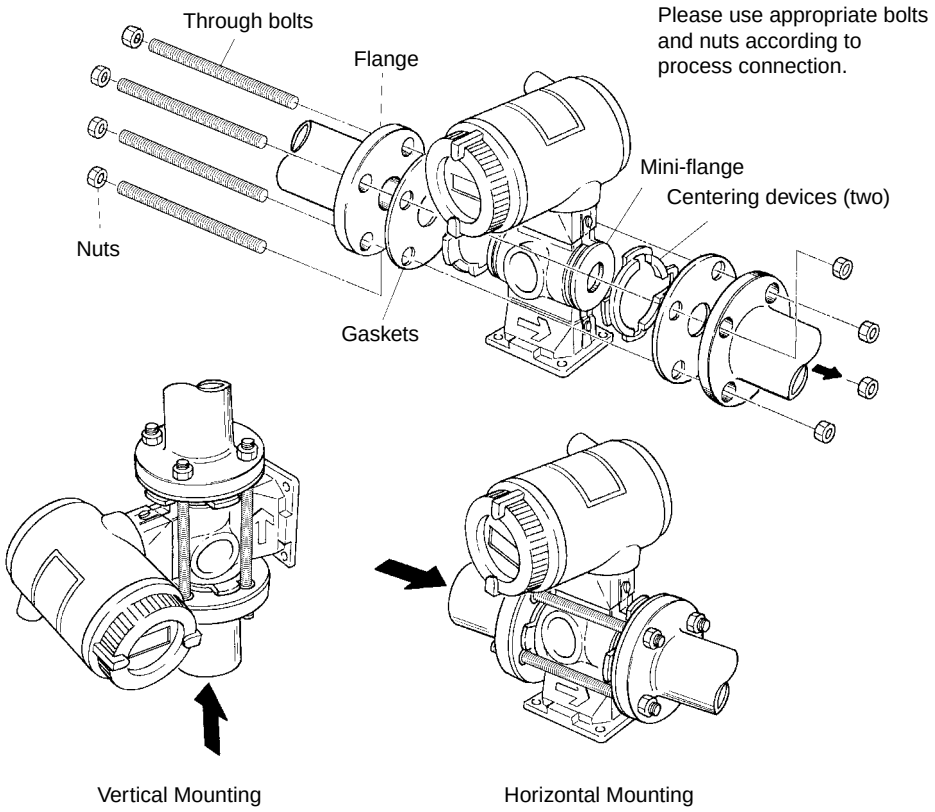


Figure 4.3.1 Mounting Procedure (15mm (0.5”))

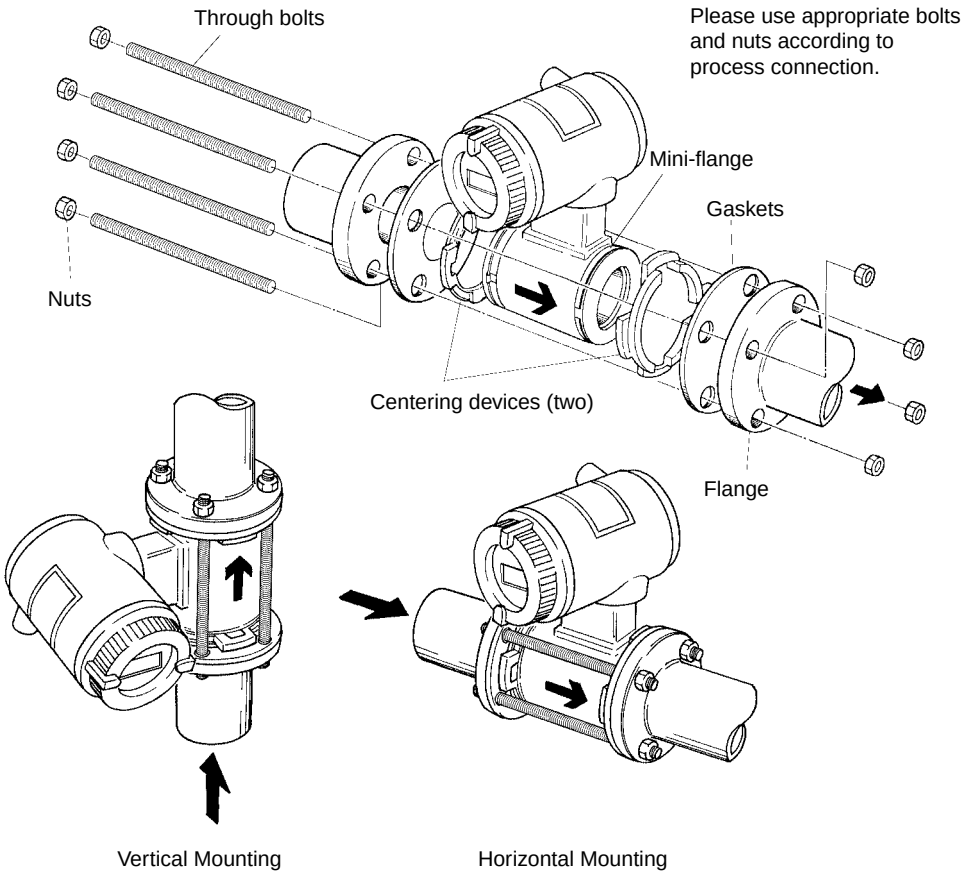


Figure 4.3.2 Mounting Procedure (25(1˝), 40mm (1.5˝))

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 50mm (2˝) to 200 m (8˝)

IMPORTANT

Please use appropriate bolts and nuts according to process connection. In case stud type of through bolts are used, be sure outside diameter of a shank is smaller than a thread ridge's one.
Please use compressed non-asbestos fiber gasket, PTFE gasket or the gasket which has equal elasticity. In case of optional code/FRG, please use rubber gasket or others which has equal elasticity. Be sure the inner diameter of the gasket does not protrude to inner piping. (Refer to Table 4.3.6)

A : Mounting Direction

Please mount the Magnetic Flowmeter matching the flow direction of the fluid to be measured with the direction of the arrow mark on the flowmeter.

IMPORTANT

If it is impossible to macth the direction, please never remodel to change direction of the converter. In case the measuring fluid flows against the arrow direction, please refer to the section 6.4.6 Reversing Flow Direction.

B : Mounting Centering Devices

To keep concentricity between the Flow Tube and pipes, centering devices must be used. Pass two through-bolts through the four centering devices (two for each) and lower adjacent holes of both flanges. (Refer to Figure 4.3.3)

Please give attention to the nominal size and flange ratings of the centering devices. (Refer to Table 4.3.5)

C : Positioning Flow Tube

Position the Flow Tube coming in contact four centering devices with Mini-Flanges. At this time, pay attention to avoid four centering devices come in contact with Housing. In case stud type of through-bolts are used, position them coming in contact four centering devices with thread of the bolts. (Refer to Figure 4.3.3)
After positioning the Flow Tube, pass remaining through-bolts to remaining holes.

D : Tightening Nuts

Please tighten the bolts according to Torque Values in Table 4.3.3. In case of PVC piping, please select optional code /FRG, use rubber gasket and tighten with the torque value in Table 4.3.4.

CAUTION

Please be sure to tighten the bolts following prescribed torque values. Please tighten the flange bolts diagonally with the same torque values, step by step up to the prescribed torque value.

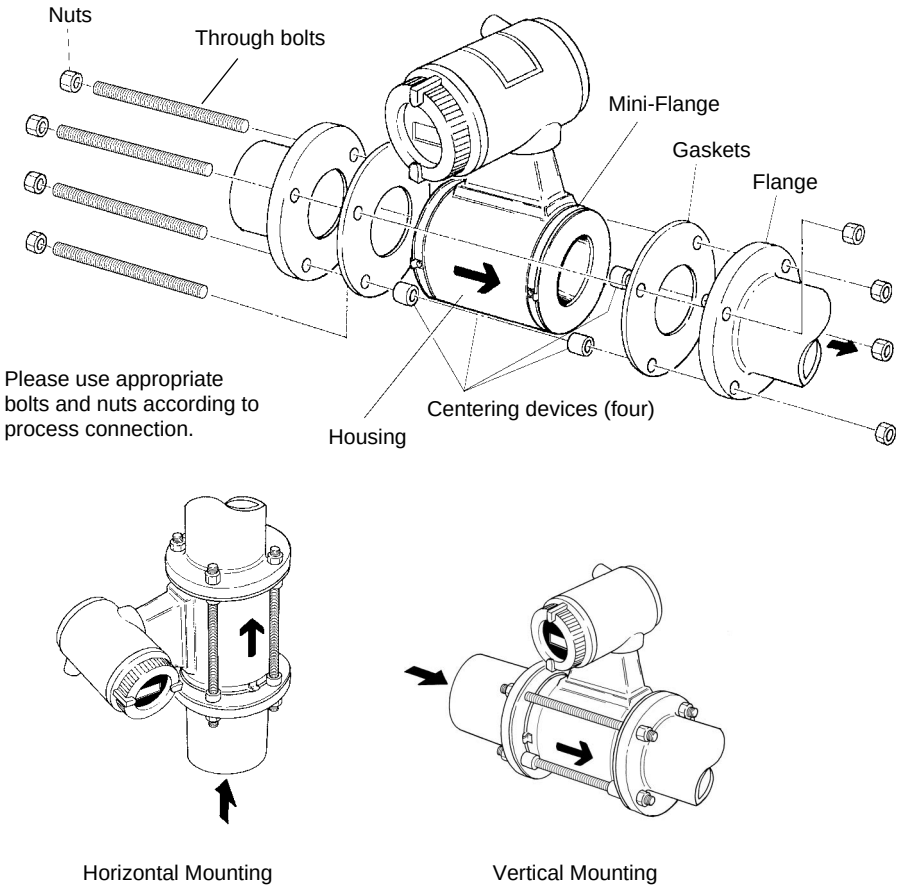


Figure 4.3.3 Mounting Procedure

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(18)	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)	15(0.6)
25(1)	27(1.1)
40(1.5)	40(1.6)
50(2)	52(2.1)
80(3)	81(3.2)
100(4)	98(3.9)
150(6)	144(5.7)
200(8)	192(7.6)

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

4.4 Wiring

CAUTION Confirm that all connections are correct before applying power to the instrument. Improper wiring may damage the flowmeter.

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

Terminal Symbols	Description
⏚	Protective grounding
N–	Power Supply
L+	
I+	Current Output 4 to 20mA DC
I–	
P+	Pulse or alarm output
P–	

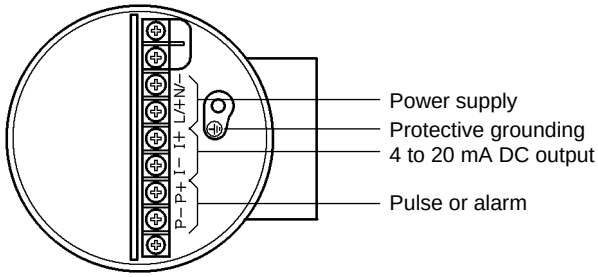


Figure 4.4.1 Terminal

CAUTION Please give attention to avoid the cable is bended excessively.

4.4.1 Protective Grounding

CAUTION Please 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 (100Ω or less).

4.4.2 General Precautions

CAUTION

Observe the following when wiring ;

(1) Do not connect cables outside when it is raining, to ensure insulation within the terminal box of the meter tube and to prevent failure due to moisture.
(2) Power cables and signal wire ends are to be provided with round crimp-on terminal.
(3) Power cables and output signal cables must be routed in steel conduit tubes separately.(except 4-core DC cable wiring)
(4) When waterproof glands, union equipped waterproof glands are used, the glands must be properly tightened to keep the box watertight.
(5) Please install a external switch or circuit breaker as a means of power off (capacitance:15A, conform to IEC 947-1 and IEC 947-3). 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.
(6) Please be sure to fully tighten the covers before the power is turned on.
(7) Please be sure to turn off the power before opening the covers.
(8) In case of DC Power Supply, a plug is attached. When 4-core cable is used, please put that plug into unused electrical connection port.

4.4.3 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 C3401) or Polyvinyl chloride insulated and sheathed portable power cables (JIS C3312) or equivalents.
Outer Diameter	• 6.5 to 12mm in diameter (10.5 or 11.5mm for waterproof gland/ ECG, /ECU)
Nominal Cross Section	• Single wire ; 0.5 to 2.5mm^2 , Stranded wire ; 0.5 to 2.5mm^2

4.4.4 DC Connections

(1) Connecting Power Supply

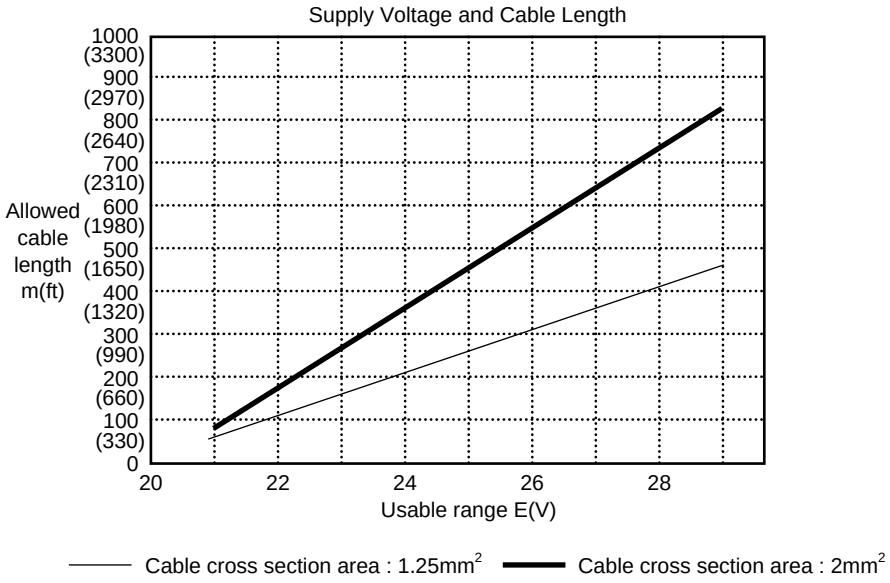
IMPORTANT

- 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.



4.4.5 Wiring Ports

Please select the most suitable standard of wiring procedure for the wiring ports by customer's own.

A: Using the Waterproof Gland

IMPORTANT

To prevent water or condensate from entering the converter housing, water proof 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.

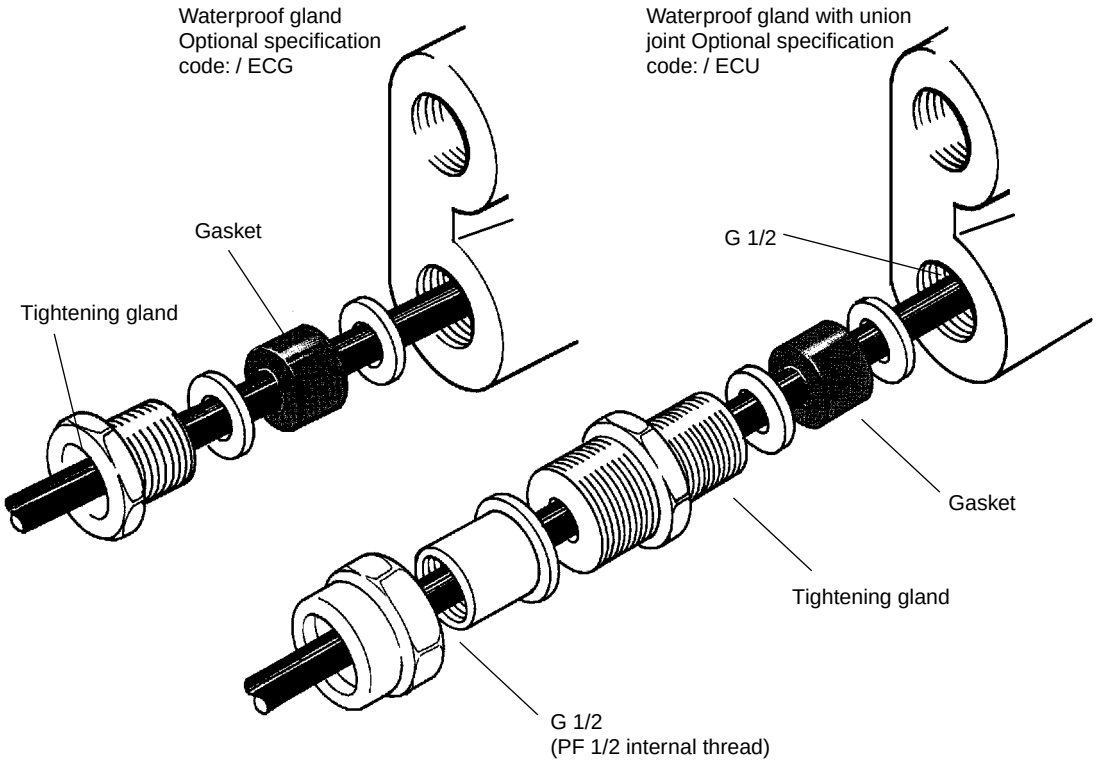


Figure 4.4.2 Waterproof Gland

B: Conduit Wiring

In case of conduit wiring, please use the waterproof gland to prevent water flowing through the conduit pipe into the wiring connection.
Please slope the conduit pipe down, and install a drain valve at the low end of the vertical pipe.
Please open the drain valve regularly.

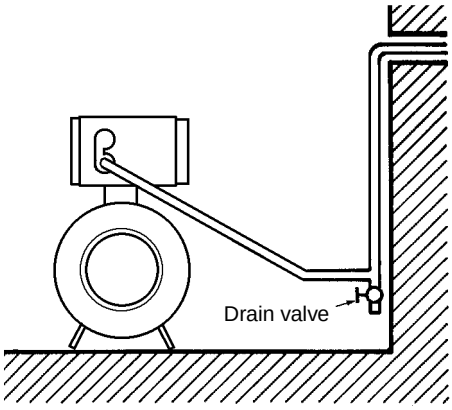


Figure 4.4.3 Conduit Piping

4.4.6 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)

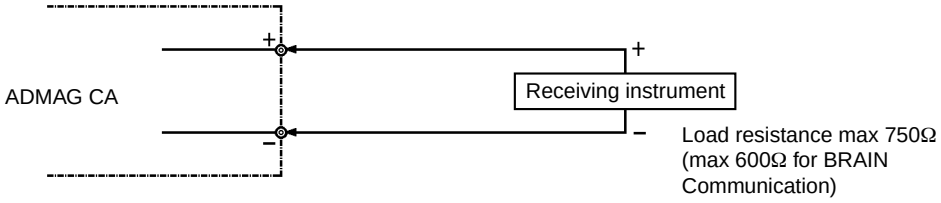


Figure 4.4.4 Connection for Analog Signal Output

(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.

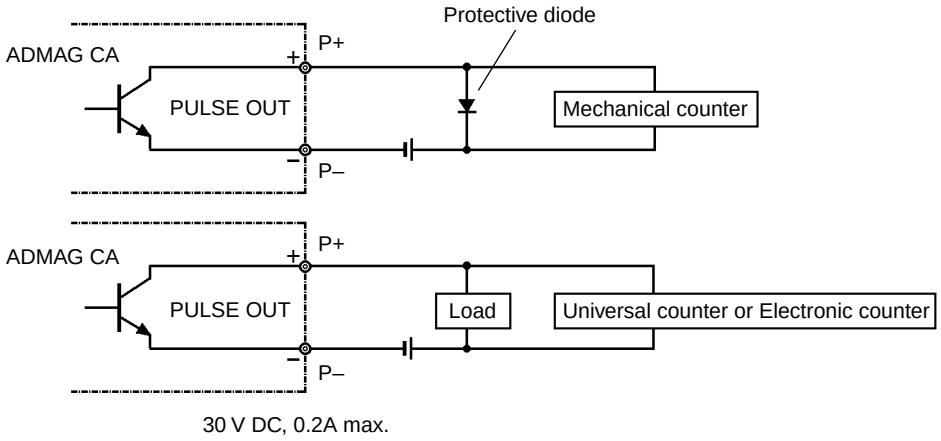


Figure 4.4.5 Pulse Output Connection

(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 the figure) is required. * The alarm output is normally closed.

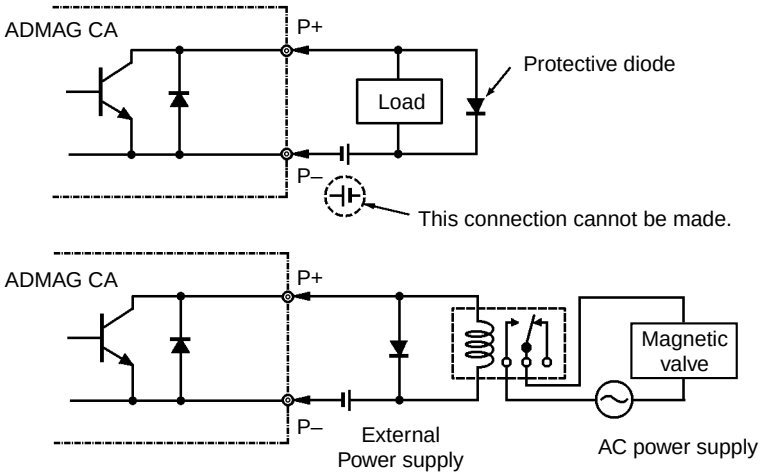


Figure 4.4.6 Alarm Output Connection

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 (BT) terminal.

The following sections describe basic data configurations and how to use the three panel keys. (See Chapter 7 for information on BT operations.)

5.1 Liquid Crystal Display

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

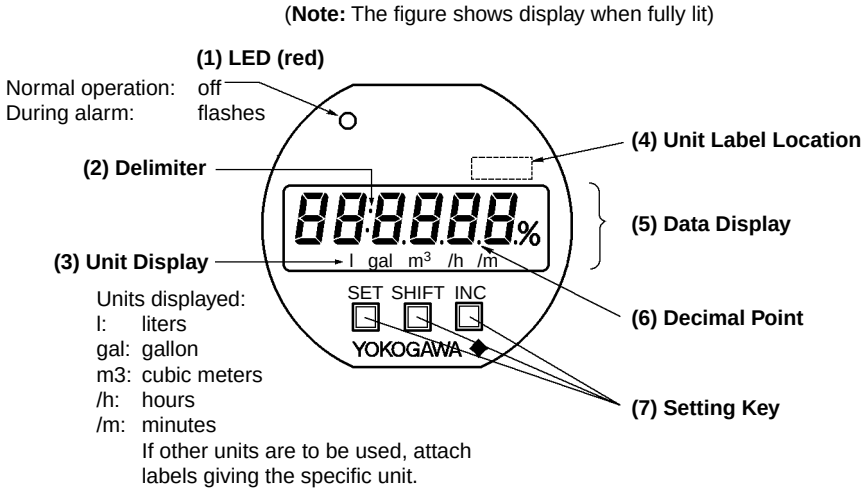


Figure 5.1 Configuration of Display

(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.

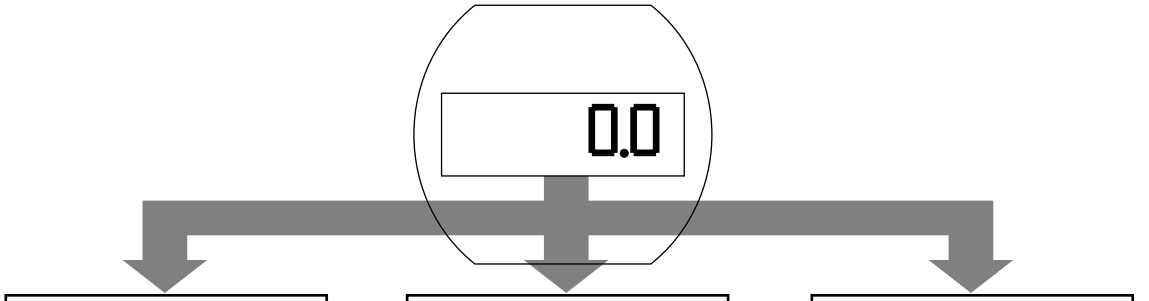
(5) Data Display : Displays flow rate data, setting data and type of alarm generated.

(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.

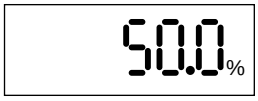


This mode displays flow rates and totalization data.
Go to the setting mode and use parameter "**d1**" to change display items.
This mode can be called up by pressing "**SET**" key while pressing "**SHIFT**" key when setting mode is displayed.

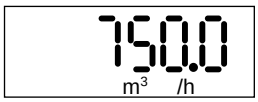
This mode is used to check parameter content and rewrite data. This mode can be called up from the flow rate data display mode by pressing the "**SET**" key.

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.

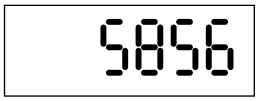
■ **Display Example)**



(Flow rate %)



(Actual flow rate)



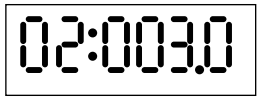
(Flow rate totalization value)

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

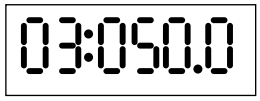
(Alternate display of actual flow rate and flow rate totalization value)

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

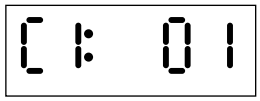
■ **Display Example)**



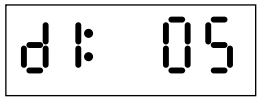
(Data item 02: 3 sec.dumping)



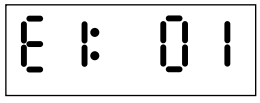
(Data item 03: Span 50.0)



(Data item C1: Zero adjust not possible)

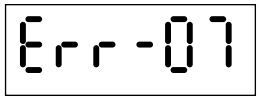


(Data item d1: Selection of display items)

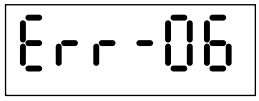


(Data item E1: Selection of totalization units)

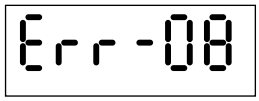
■ **Display Example)**



(Error 07: Coil open)



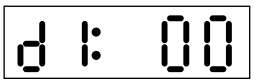
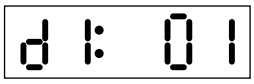
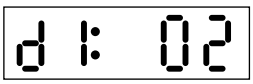
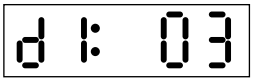
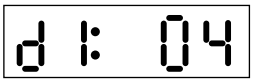
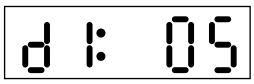
(Error 06: Input signal error)



(Error 08: Incorrect span setting)

5.2.1 Flow Rate Data Display Mode

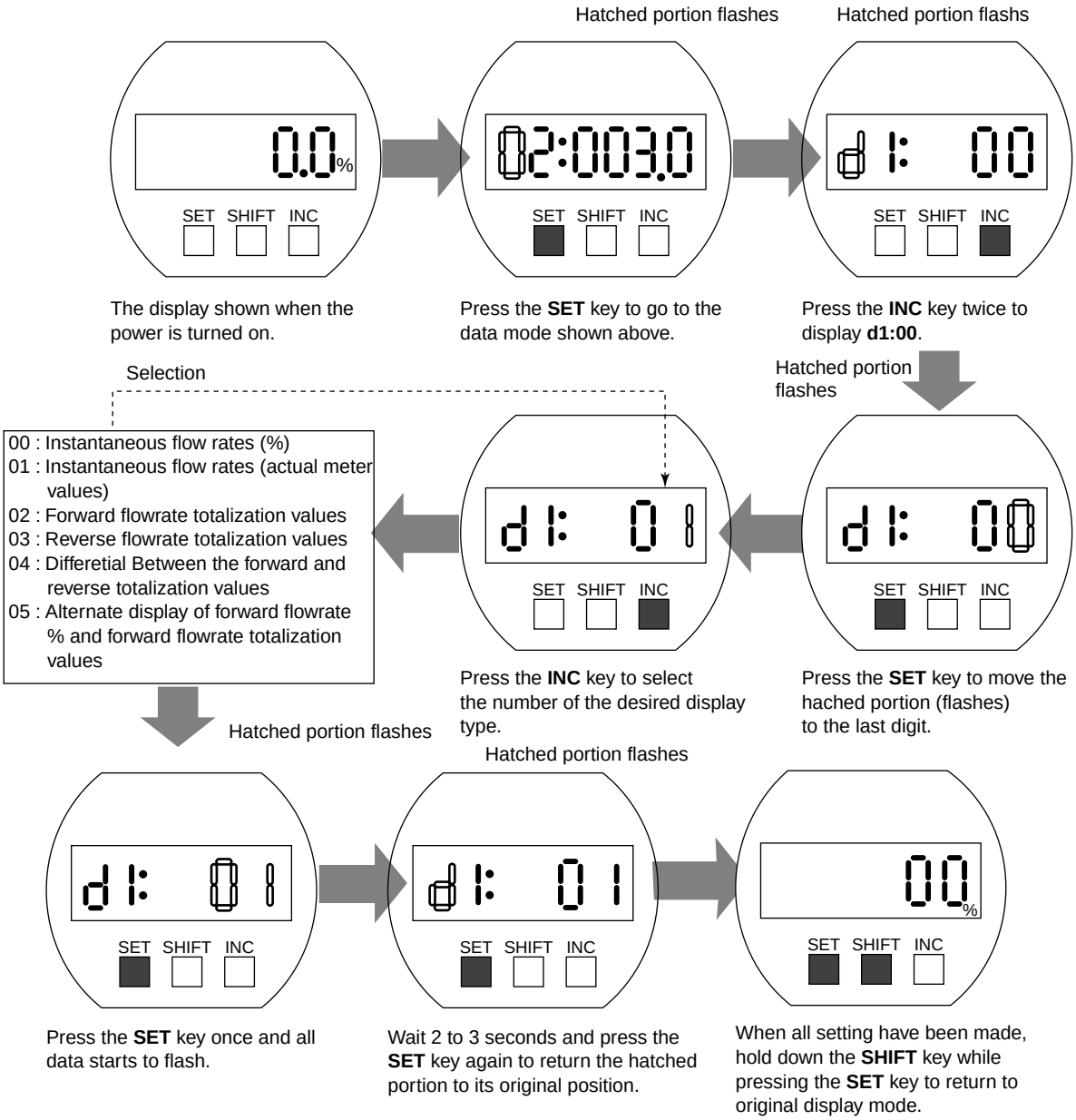
- The flow rate data display mode indicates instantaneous flow and totalized flow values.
  The ADMAG CA can display 6 types of flow rate data.
- These functions can be displayed by pressing the "d1" key on the flow converter.
- For changing from setting mode to flow rate data display mode, press “SET” key while pressing “SHIFT” key.
- When a BT is used, call up the "D01 DISP SELECT" parameter to select functions.

Display item	Content	ADMAG AE Setting	BT Setting
Forward flow rate %	Instantaneous flow rate is displayed within a range of -8.0 to 108 for the span.		**D01 : DISP SELECT RATE(%)**
Actual forward flow rate	The actual meter rate of instantaneous flow rate is displayed.(See note 1.) The decimal place is the same as foe the span setting. However, since a decimal point set at the most sifnigficant bit cannot be displayed. It is automatically shifted 1 igit to the right.BT setting of f0.0001 of displayed as 0.000 on the ADMAG.)		**D01 : DISP SELECT RATE**
Flow rate totalization values	Display totalized flow rate		**D01 : DISP SELECT FOR.TOTAL**
(Alternate displayof flow rate % and flow rate totalization value)	The Display switches between display of instaneous flow rates (%) and totalized flow rates every 4 second interval.		**D01 : DISP SELECT RATE(%)/TTL**
(Alternate displayof actual flow rate totalization value)	The Display switches between display of instaneous flow rates (actual values) and totalized flow rates every 4 second interval.		**D01 : DISP SELECT RATE/ TTL**
(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 second 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, m^3/h, m^3/m, gal/h, gal/m

(1) Changes in Flow Data Display Items

- Shows how the display changes when the flow converter switches are pressed.
- See Chapter 7 for information on changes using the BT200.

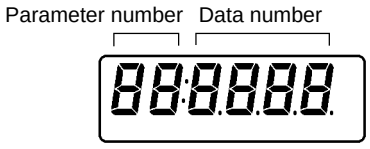


5.2.2 Setting Mode

- The setting mode is used for checking parameters and rewriting data.
- The following is an overview of the setting mode. See Section 6 "Function and Data Settings" for detailed information.

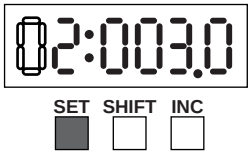
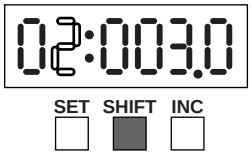
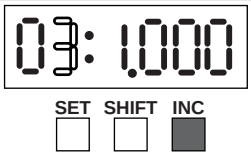
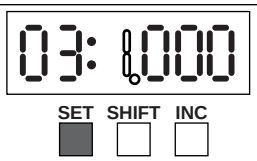
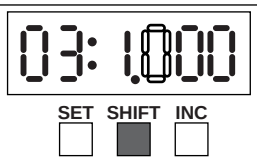
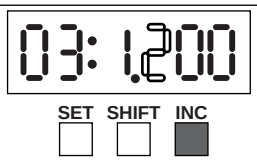
(1) Structure of Setting Mode Display

- 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 "Parameter list" at the end of this manual for information on how to change settings.

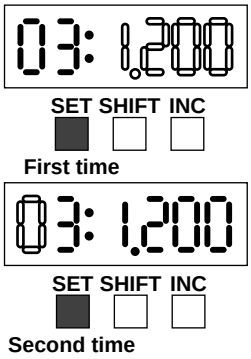
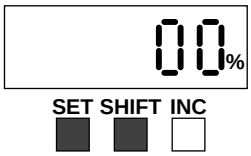


(2) Procedures for Setting and Changing Data

Example of parameter change : Changing the span (number 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(the selected item). ∗ Parameter 03 contains 5-digit data which cannot be displayed as shown on the left but has to be scrolled. (See Page 5-7 for details.)
③ **Data Rewrite**		Use the **SET** key to move the flashing segment (the selected item) to the most significant location of the data area.
		Use the **SHIFT** key to move the flashing segment (the selected item) within the data area.
		Use the **INC** key to change the data area (numeric data) in the flashing segment (the selected item).

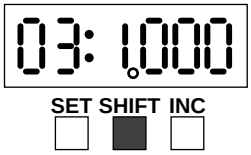
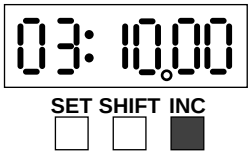
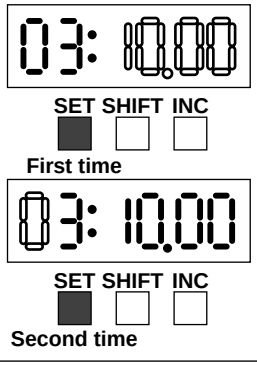
---Continued---

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.

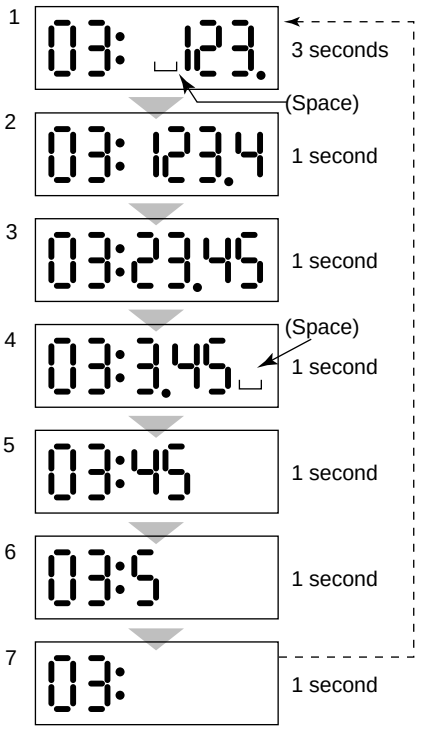
Example of parameter change : Changing the span from 1.000 to 10.00

Item	Display	Content
① **Selecting Decimal Point**		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 four digits 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 a 5-digit parameter 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.

Display example : Display of span 123.45



(5) Display of 6-digit Data

- The data display area has four digits and can therefore not display span and other 6-digit data parameters. (E05 TL SET VALUE 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.

(6) Display and Setting Coded Data

- Example of change : Changing from +120 to -120

Item	Display	Content
1. Selecting Coded Data	C0:+ 120. SET SHIFT INC □ □ □	The display on right indicates "+120".
2. Coded Data Flashes	C0:+ 120. SET SHIFT INC □ ■ □	Cause the "+" sign to flash.
3. Change of Coded Data	C0:- 120 SET SHIFT INC □ □ ■	Press the **INC** key to change the "+" sign to a "-" sign. Press the **SET** key twic.

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.)

- **See the section "Self diagnosis function" for information on alarm numbers.**

6. FUNCTION AND DATA SETTINGS

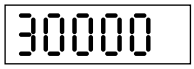
A Magnetic flowmeter calculates volume flow rate from a minute voltage that corresponds to the flow velocity of a fluid an outputs as a 4 to 20mA signal.

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



- you cannot set the leftmost digit of display to numeric value greater than "4". If the leftmost digit of the span must be "4| or more, set the numeric value beginning from the digit second from the left on the display (the fourth digit).
- If the leftmost digit of the display is set to "3", the digits to its right can be set to "0" only, regardless of the decimal point position

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

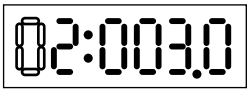
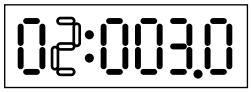
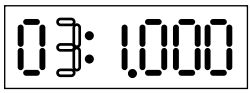
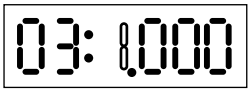
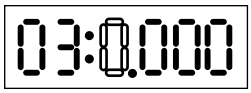
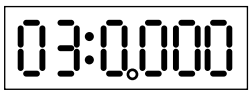
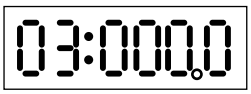
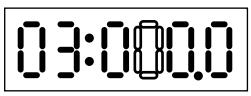
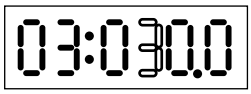
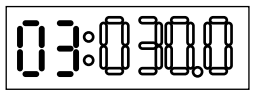
The flow rate span is the instantaneous flow rate value at which the output current is to be 20 mA.

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 No. "**13**".
  (Parameter No. "**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.

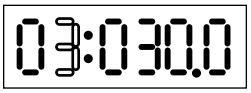
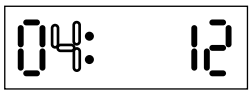
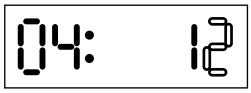
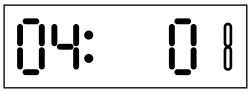
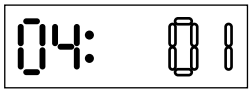
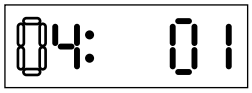
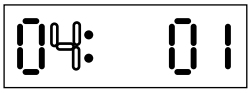
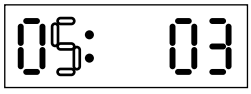
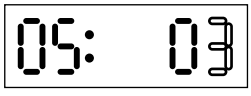
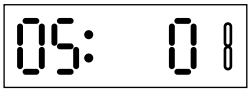
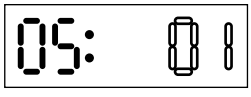
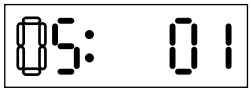
(2) Span Setting using Display Keys (Example setting: 30.00 m³/h)

- **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 this into 030.00.
SET SHIFT INC ■ □ □		Press the **SET** key to move the flashing segment to the first digit in the data area.
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 four-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 ■ □ □	 (Setting is now completed)	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.

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. (See 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 "01" to display m^3.(See 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. (See 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	$km^3(10^3 \times m^3)$
01	m^3
02	l (liter)
03	$cm^3(10^{-2} \times m)^3$
04	Mgal
05	kgal
06	gal
07	mgal
08	kbbl
09	bbl
10	mbbl
11	µbbl
12	m
13	ft

Code	Time Unit
00	/d
01	/h
02	/m
03	/s

6.2 Measuring Mode Setting

(1) Measuring Modes

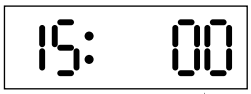
The measuring mode is Standard or Noise Reduction mode. Standard mode is set before shipment. If the output fluctuation is large when a fluid actually flows, the fluctuation is reduced by increasing the damping time constant.

- 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
 Default: 00	Select the measuring mode in parameter number "**15**".

Code	Measuring Mode
00	Standard mode
01	Noise Reduction mode

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 30 V 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

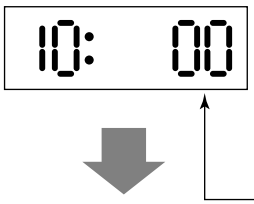
***** See "4.4.6 Connecting external instruments" for information on how to connect external instruments.

NOTE

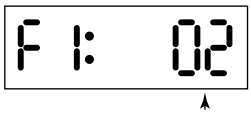
P+, P– terminals are for common use with pulse and alarm output functions. Therefore, in case this function is used, another function is not available to use.

(2) Procedures for Setting Pulse Output

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

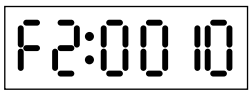
Display	Description
	Select "Pulse output" in parameter nhumber "10".

Code	Content
00	Pulse output
01	Alarm output

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

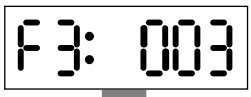
Code	Volume Unit
00	Volume unit used in $10^{-9}\times$ flow rate span
01	Volume unit used in $10^{-6}\times$ flow rate span
02	Volume unit used in $10^{-3}\times$ flow rate span
03	Volume unit used in $1\times$ flow rate span
04	Volume unit used in $10^{3}\times$ flow rate span
05	Volume unit used in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

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



Set pulse weight "**10 (**L**)**" in parameter number "**E2**".

※ 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.)



Default: 3%

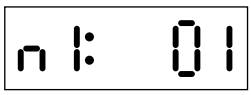
Set the low cut range percentage in parameter "**F3**".
Range of setting : 0 to 100% (of span)

Default: 50%DUTY

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

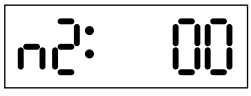
Code	Pulse Width		
00	50%DUTY	(Max. 1000P/s	min. 0.0001P/s)
01	0.5ms	(Max. 1000P/s	min. 0.0001P/s)
02	1ms	(Max. 500P/s	min. 0.0001P/s)
03	20ms	(Max. 25P/s	min. 0.0001P/s)
04	33ms	(Max. 15P/s	min. 0.0001P/s)
05	50ms	(Max. 10P/s	min. 0.0001P/s)
06	100ms	(Max. 5P/s	min. 0.0001P/s)

Normally, these are all required settings. The following settings are made depending on the applications that are used.



Default: 01
(Damped flow rate value)

Select instantaneous flow rate data or damped flow rate data for the pulse output calculation. (The damped value is the value set in "**B2**".)



Default: 00(ON ACTIVE)

Set parameter "**N2**" to "**01**" when the pulse output transistor is to be off active.

*The "**n**" item can be opend by entering "**55**" in paramter number "**L2**".

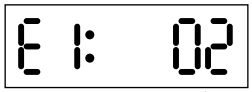
6.3.2 Display of Internal Totalization Values

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

(1) Setting Totalization Pulse Weight

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

Display

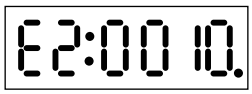


Description

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

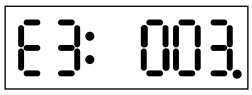
Code	Volume Unit
00	Volume unit used in $10^{-9}\times$ flow rate span
01	Volume unit used in $10^{-6}\times$ flow rate span
02	Volume unit used in $10^{-3}\times$ flow rate span
03	Volume unit used in $1\times$ flow rate span
04	Volume unit used in $10^{3}\times$ flow rate span
05	Volume unit used in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

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



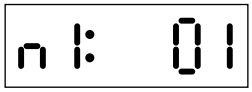
Set pulse weight "**10 (**L**)**" in parameter number "**E2**".

※ 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.)



Defalut: 3%

Set the low cut range percentage in parameter "E3".
Range of setting : 0 to 100% (of span)



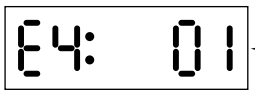
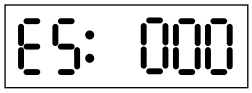
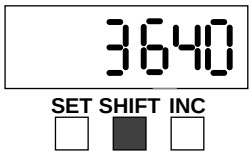
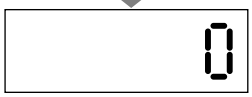
Defalut: 01
(Damped flow rate value)

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

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

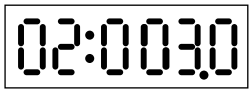
6.3.3 Presetting for Totalization Display

- 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
 Default: 00 (disabled)	Select totalization enable in parameter number "**E4**"
	Code / **Description** 00 — Totalization presetting inhibit 01 — Totalization presetting enabled
 Default: 0	Set the totalization preset value in parameter number "**E5**". The initial value is 0, if it is no setting, the function is zero setting.
	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**"
	

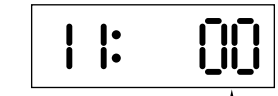
6.3.4 Damping Time Constant

- The time constant can be changed by setting the parameter No. "**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 No. "**n1**", the pulse output and internal totalization are not influenced by it.

Display	Description
 Default: 3 seconds	Set the value in parameter number "**02**". Range of possible settings : 1.0 to 200.0 seconds.

6.3.5 Current Output During Alarm Occurrence

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

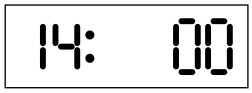
Display	Description
 Default: 00 (2.4 mA or less)	Set a value for current output to be used during alarms in parameter number "**11**"

Code	Contents
00	2.4mA or less
01	4.0mA
02	Hold
03	21.6mA or more

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.

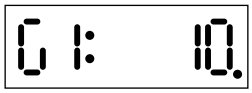
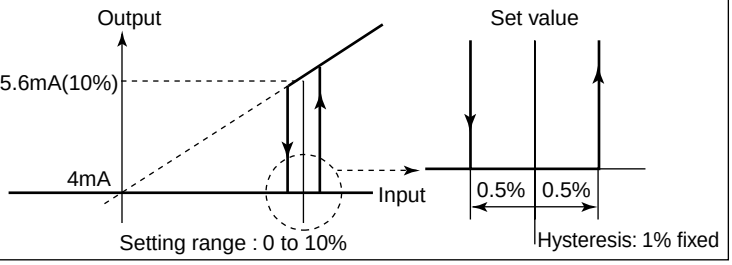
Display	Description
 Default: 00	Set the flow direction in parameter "14".

Code	Contents
00	Forward direction
01	Reverse direction to flow arrow

6.3.7 Limiting on Current Output

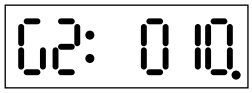
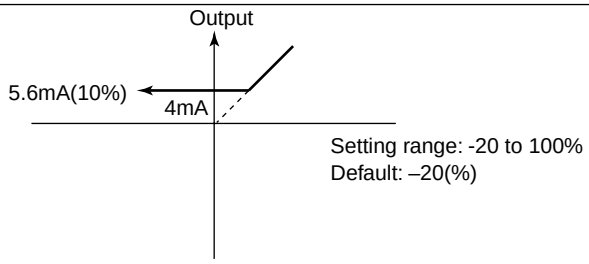
(1) 4 to 20 mA Low Cut Output (Current Output near by 0% Range)

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

Display	Description
 Default: 0(%)	

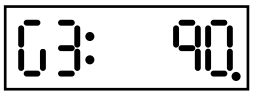
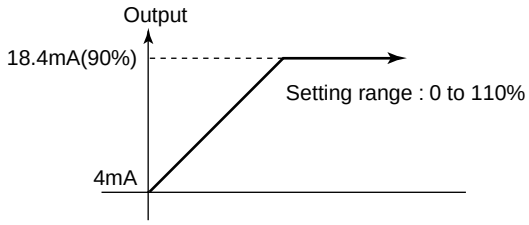
(2) 4 to 20 mA Low Limit

- This function limits the low end of the 4 to 20mA output.
- The default value is -20%, but a -8% (2.72mA) limit is provided to cope with reverse fluid flow. When a lower setting is required, change this value.
- 2.4mA or less output in alarming is also limited.

Display	Description
 Default: –20(%)	

(3) 4 to 20 mA High Limit

- This function limits the high end of the analog output.
- The default value is 110% (21.6mA). Please set in case other setting is required.
- 21.6 mA or more output in alarming is also limited.

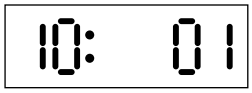
Display	Description
 Default: 110(%)	

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
 Initial setting : 00 (pulse output)	Set "01" in parameter number "10" to use the P+ and P- terminals for alarm output.

Code	Content
00	Pulse output
01	Alarm output

6.3.9 Data Setting Enable/Inhibit

- This function can inhibit to change all data except parameter No. " **L1**".
  However, auto zero adjustment function can work, if it has been set in parameter No. "**C1**".
  And the preset totalization value function also can work, if it has been set in parameter No. "**E4**".

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

6.3.10 Procedure of Selecting Special Application Items

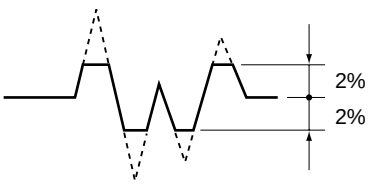
- Only the special apprication ("**n**" items) shipped being unpublished.
  In case the "**n**" items should be used, it can be set "**55**" in parameter No. "**L2**".

Display	Description
L2: 55 Default: 00	The "n" item can be set "**55**" in parameter No. "**L02**". **Code** / **Content** 00 Accessible up to L parameters. 01 Accessible up to N parameters.

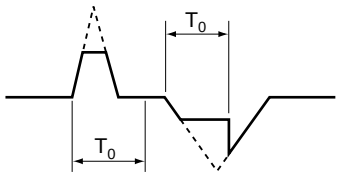
6.3.11 Rate Limit

- 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.

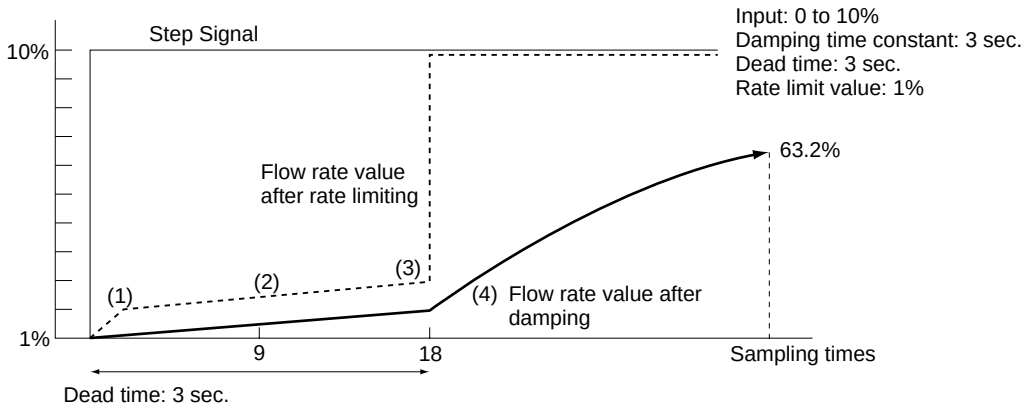


Dead time T_0:
Please determine the dead time depending on ouput fluctuation width.
In case of noise of which is longer than the dead time, please set the dead time longer.



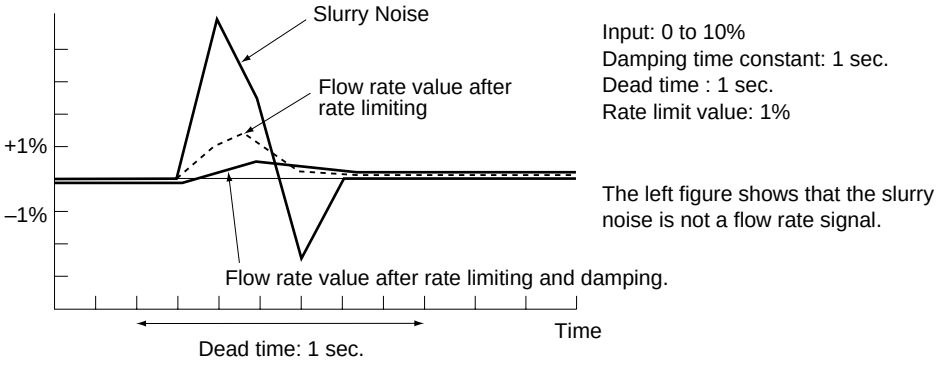
- **Signal processing procedures:**
  The function sets a certain upper and lower limit (rate limit value) for first order delay response values of flow rate data obtained in a previous sampling. If currently sampled flow rate data exceeds or goes below the limit is regarded as current flow rate value. 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



(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



Display	Description
n3: 05. Default: 5%	Set a rate limit function value in parameter number "**N3**". Range of possible settings : 0 to 10%.
n4: 00. Default: 0% (rate limit function off)	set the dead time in parameter number "**N4**". Range of possible settings : 0 to 15 seconds.

*Item "**n**" 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 terminals (BT) 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 the BT200

This section describes the operation procedures using a brain terminal. For details on the functions of the ADMAG CA, see Chapter 6, "Function and Data Settings." And also, see the "BT200 Instruction Manual" (IM IC0A11-01E) for more detailed information.

7.1.1 BT200 Connections

(1) Connecting BT200 to Flow Converter

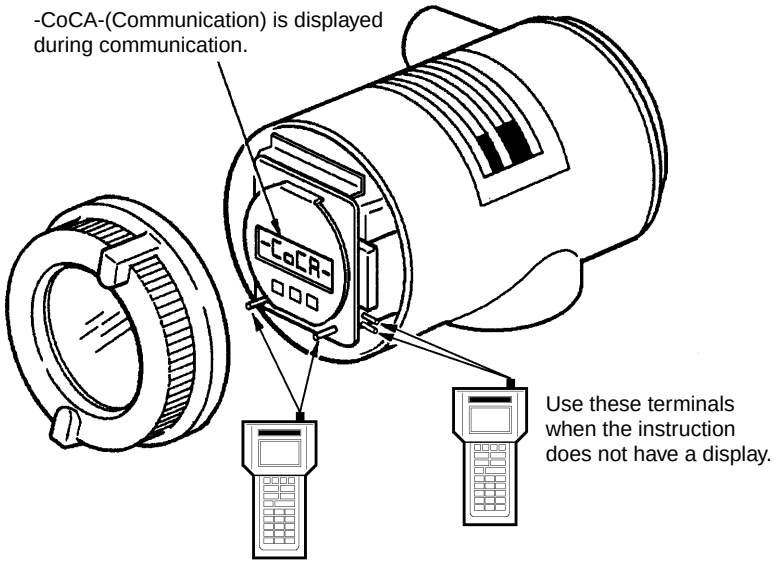


Figure 7.1 Connection of BT200 to Flow Converter

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.

(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.

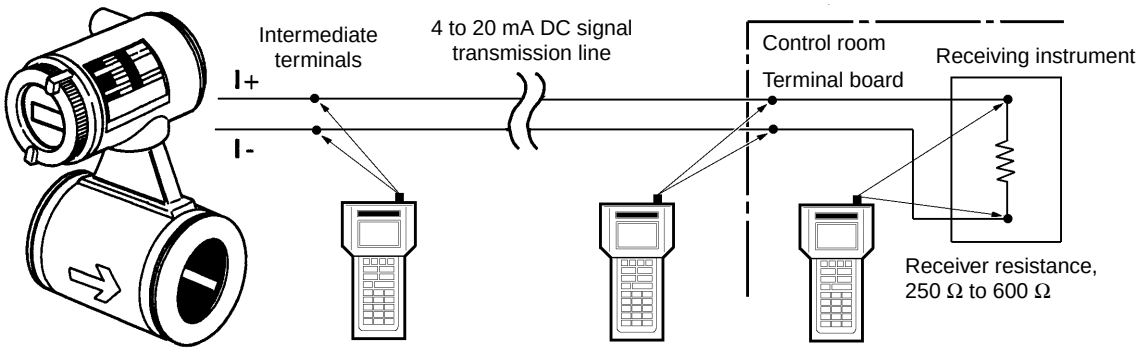


Figure 7.2 Communicating via a 4 to 20 mA DC Signal Line

7.1.2 BT200 Keypad Layout

Figure 7.3 shows the key pad lay out of the BT200.

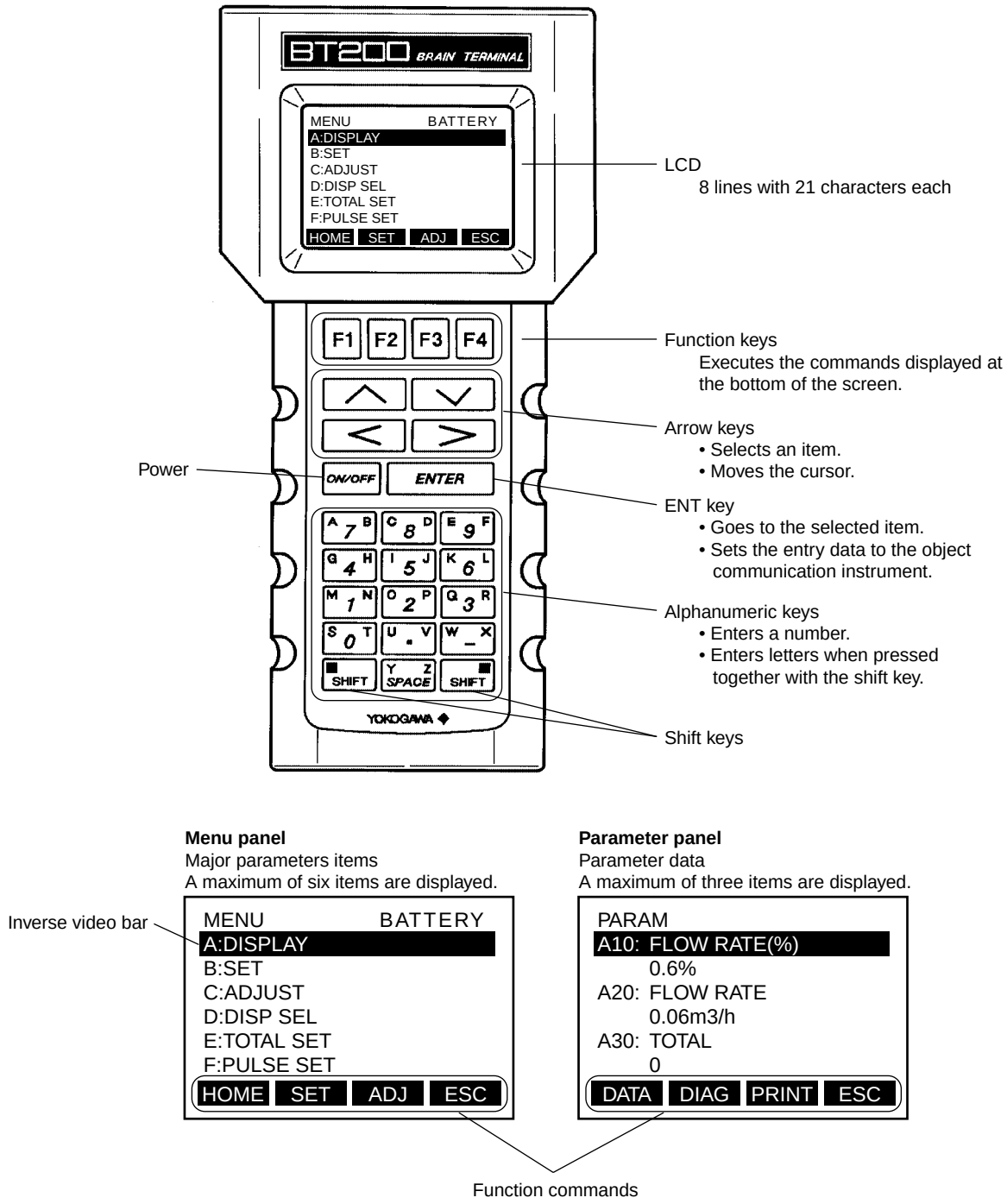


Figure 7.3 Key Layout and Functions

7.1.3 Major BT200 Key Functions

(1) Entry of Alphanumeric Characters

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

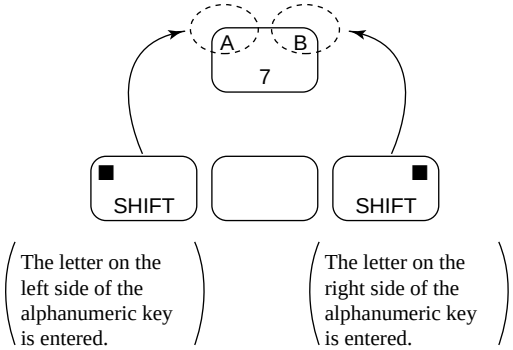
- **Entry of numbers, codes and a space (0 to 9, . , -, ␣)**

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

- **Entry of letters**

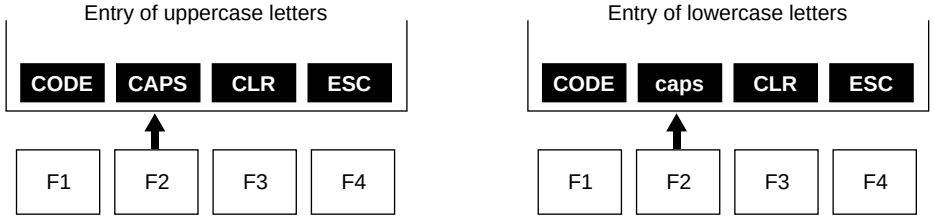
Press an alphanumeric key while one of the SHIFT keys is pressed and the letter on the same side of the key as the shift key that is pressed can be entered. Press the SHIFT key each time when entering a letter.



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

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

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

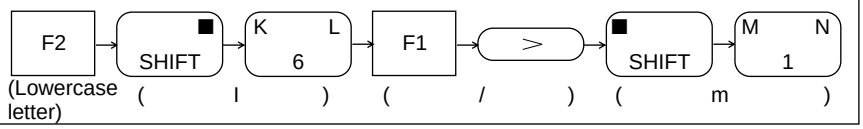


- **Entry of codes**

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.

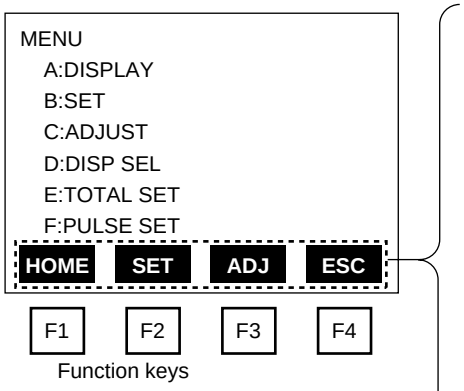
/ . - , + *) (' & % $ # " !

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

Example of entry	Key operation
I/m	

(2) Function Keys

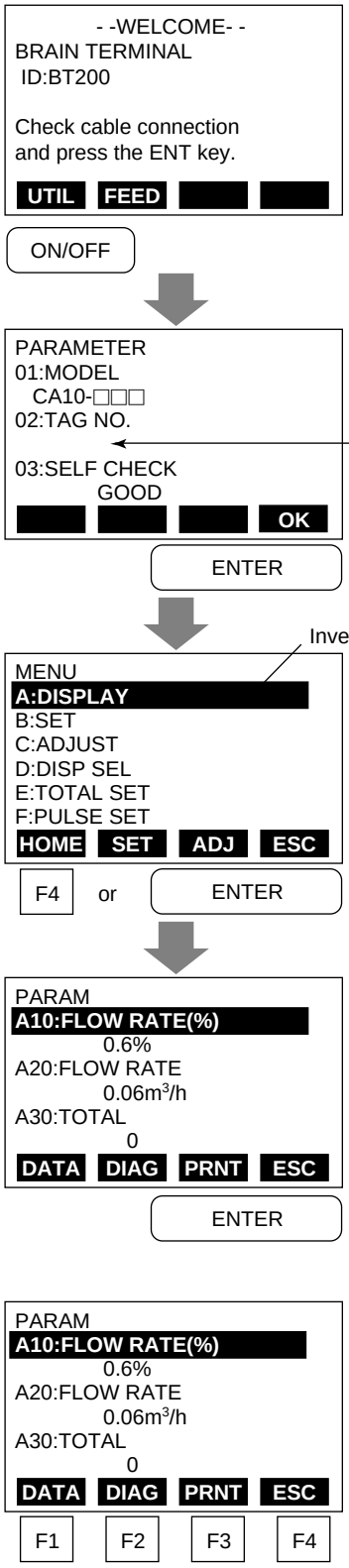
The functions of the function keys vary with the commands being displayed on the display panel.



Command	Description
ADJ	Calls up the zero-adjustment menu.
CAPS/caps	Changes the uppercase/lowercase mode.
C LR	Clears entered data /deletes all data.
COPY	Prints parameters on the screen.
DATA	Updates parameter data.
DEL	Deletes one character.
DIAG	Calls up the self-check screen.
ESC	Returns to the preceding screen.
FEED	Paper feed.
HOME	Calls up the home menu (A : DISPLAY).
LIST	Prints all parameters of the menus.
NO	Setting stop/re-setting. Returns to the previous screen
OK	Goes to the next screen.
PARM	Parameter number setting mode.
PON/POFF	Printer output of data whose setting was changed Mode on/off
PRNT	Changes to the prints mode.
SET	Calls up the setting menu. (B : SETTING)
SLOT	Returns to the slot selection screen.
STAT	Starts print out.
STOP	Stops printing.
UTIL	Transfers to the utility screen.

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: Displays the parameter print screen.
F4: Returns to the previous panel (menu panel).

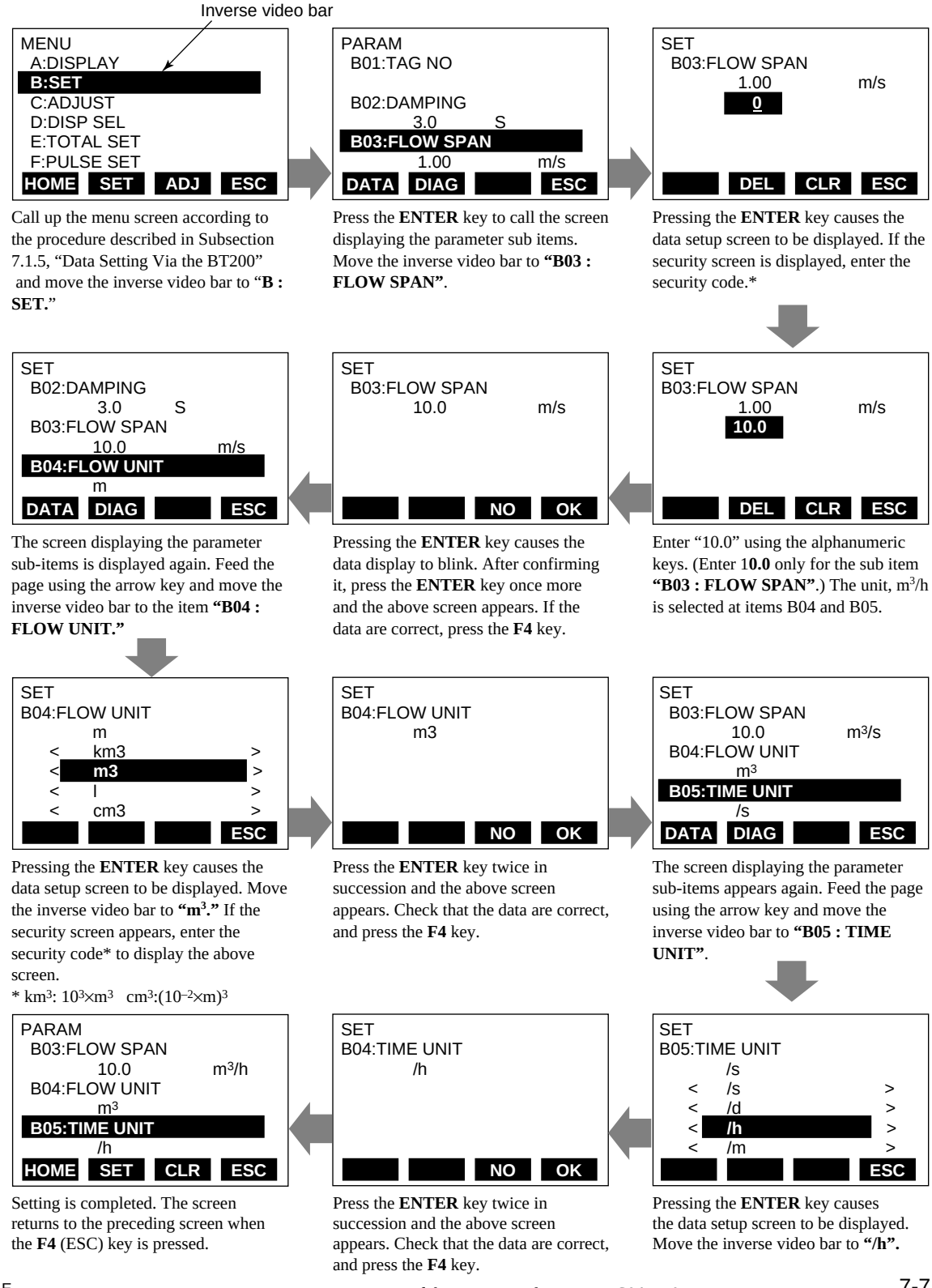
7.2 Setting Parameters

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



Call up the menu screen according to the procedure described in Subsection 7.1.5, "Data Setting Via the BT200" and move the inverse video bar to "**B : SET.**"

Press the **ENTER** key to call the screen displaying the parameter sub items. Move the inverse video bar to **"B03 : FLOW SPAN"**.

Pressing the **ENTER** key causes the data setup screen to be displayed. If the security screen is displayed, enter the security code.*

Enter "10.0" using the alphanumeric keys. (Enter 1**0.0** only for the sub item **"B03 : FLOW SPAN"**.) The unit, m^3/h is selected at items B04 and B05.

Pressing the **ENTER** key causes the data display to blink. After confirming it, press the **ENTER** key once more and the above screen appears. If the data are correct, press the **F4** key.

The screen displaying the parameter sub-items is displayed again. Feed the page using the arrow key and move the inverse video bar to the item **"B04 : FLOW UNIT."**

Pressing the **ENTER** key causes the data setup screen to be displayed. Move the inverse video bar to **"m^3."** If the security screen appears, enter the security code* to display the above screen.

* km^3: $10^3 \times m^3$ cm^3:$(10^{-2} \times m)^3$

Press the **ENTER** key twice in succession and the above screen appears. Check that the data are correct, and press the **F4** key.

The screen displaying the parameter sub-items appears again. Feed the page using the arrow key and move the inverse video bar to **"B05 : TIME UNIT"**.

Pressing the **ENTER** key causes the data setup screen to be displayed. Move the inverse video bar to **"/h".**

Press the **ENTER** key twice in succession and the above screen appears. Check that the data are correct, and press the **F4** key.

Setting is completed. The screen returns to the preceding screen when the **F4** (ESC) key is pressed.

*For entry of the security code, see IM 1C0A11-01E.

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** **ESC**	Select the measuring mode in parameter number "**B15**". **Code** / **Measuring Mode** STD — Standard mode FNR — Noise Reduction mode

7.2.3 Pulse Output (Refer to 6.3.1)

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

Display

```
PARAM
B10:PULSE/ALARM
      PULSE OUT
B11:4-20mA OR LESS
      2.4mA OR LESS
B12:POWER FREQ
      50.03Hz
DATA DIAG      ESC
```

Select "Pulseoutput" in parameter number "B10".

Code	Content
PULSE OUT	Pulse output
ALARM OUT	Alarm output

Select the volume unit for the pulse weight in parameter number "B04".

```
PARAM
 F01:PULSE UNIT
      m  UNIT/P
 F02:PULSE  SCALE
      10  m  UNIT/P
 F03:PULSE  LOWCUT
      3.  %
DATA DIAG      ESC
```

Code	Volume unit
n UNIT/P	Volume unit used in 10^{-9} 5 flow rate span
m UNIT/P	Volume unit used in 10^{-6} 5 flow rate span
m UNIT/P	Volume unit used in 10^{-3} 5 flow rate span
UNIT/P	Volume unit used in 1 5 flow rate span
k UNIT/P	Volume unit used in 10^{3} 5 flow rate span
M UNIT/P	Volume unit used in 10^{6} 5 flow rate span
P ULSE/s	Number of pulses output per second at 100% of output

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

```
PALAM
 F02:PULSE UNIT
      10  m  UNIT/P
 F03:PULSE LOWCUT
      3.  %
 F04:PULSE WIDTH
      50% DUTY
DATA DIAG      ESC
```

Set the pulse weight "10 (L)" in parameter number "F02".

*Since parameter number "F02" is a 5-digit data item, scrolling is necessary to display all the data. Mind the decimal point when seting are made. (The decimal point can be moved if required.)

Set the low cut range percentage in parameter "F03".
Range of setting : (0 to 100% of span)

Select the pulse width in parameter number "F04"

Code	Pulse width
50%DUTY	(Max. of 1000P/s Min. 0.0001P/s)
0.5ms	(Max. of 1000P/s Min. 0.0001P/s)
1ms	(Max. of 500P/s Min. 0.0001P/s)
20ms	(Max. of 25P/s Min. 0.0001P/s)
33ms	(Max. of 15P/s Min. 0.0001P/s)
50ms	(Max. of 10P/s Min. 0.0001P/s)
100ms	(Max. of 5P/s Min. 0.0001P/s)

Nor mally, these are all required settings.
The following settings are made depending on the application that is used.

```
PARAM
N01:TOTAL/PULSE
  NO DAMP
N02:PULSE MODE
  ON
N03:RATE LIMIT
 5.  %
DATA DIAG      ESC
```

Select instantaneous flow rate data or damped flow rate data for the pulse output calculation.
(The damped value is the value set in "B02".)

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

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

7.2.4 Display of Internal Totalization (Refer to 6.3.2)

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

Display

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

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

Description

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

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

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

Set the pulse weight "10 (L)" in parameter number "E02."

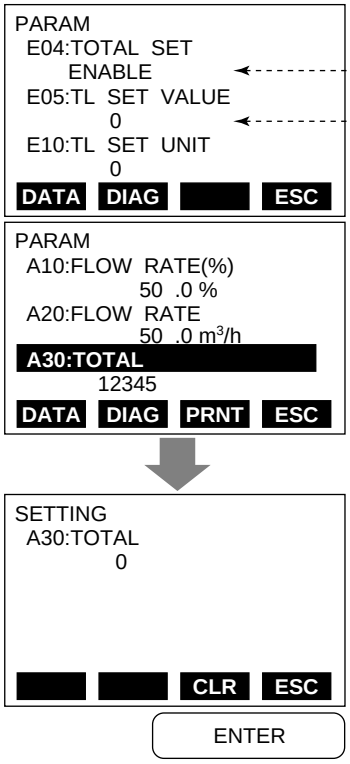
Set the low cut range percentage in parameter "E03." Range of setting : (0 to 100% of span)

Select instantaneous flow rate or flow rate after damping for the pulse output. (The damping time value is the value set in "B02.")
Default: DAMP (damped flow rate data)

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

7.2.5 Presetting Totalization Display (Refer to 6.3.3)

Display



Description

Select totalization enable in parameter number “E04.”

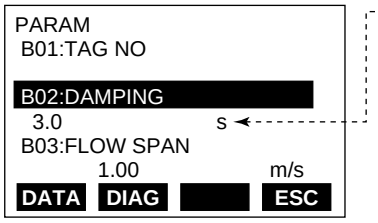
Code	Description
ENABLE	Totalization presetting enabled
INHIBIT	Totalization presetting inhibit

Set the totalization preset value in parameter number “E05.”
The default is 0 and if the setting is omitted, the parameter functions reset to 0.

If the ENT key is pressed twice while “A30 : TOTAL” is displayed on the setting screen, the totalization value (A30 : TOTAL) will be replaced with the values set in “E05.”

7.2.6 Damping Time Constant (Refer to 6.3.4)

Display

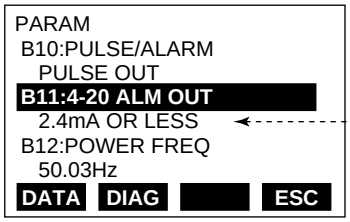


Description

Set the value in parameter number "B02."
Range of possible settings : 1.0 to 200.0 seconds.

7.2.7 Current Output During Alarm Occurrence (Refer to 6.3.5)

Display



Description

Set the value for current output to be used during alarms in parameter "B11."
(Default : 2.4 mA or less)

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

7.2.8 Reversing Flow Direction (Refer to 6.3.6)

Display	Description
PARAM B13:VELOCITY CHK 5 m/s **B14:FLOW DIR** REVERSE B60:SELF CHECK GOOD **DATA DIAG ESC**	The flow direction can be set in parameter number "B14".

Code	Description
FORWARD	Forward direction
REVERSE	Reverse direction to flow arrow

7.2.9 Limiting Current Output (Refer to 6.3.7)

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

Display	Description
PARAM **G01:4-20 LOW CUT** 10 % G02:4-20 LOW LMT -20 % G03:4-20 H LMT 110 % **DATA DIAG ESC**	Output 5.6mA(10%) 4mA Set value 0.5% 0.5% Setting range : 0 to 10% Default: 0% Hysteresis: 1% fixed

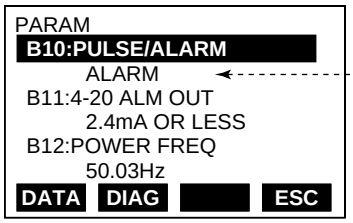
(2) 4 to 20 mA Low Limit

Display	Description
PARAM G01:4-20 LOW CUT 0 % **G02:4-20 LOW LMT** 10 % G03:4-20 H LMT 110 % **DATA DIAG ESC**	Output 5.6mA(10%) 4mA Setting range: -20 to 100% Default: -20%

(3) 4 to 20 mA High Limit

Display	Description
PARAM G01:4-20 LOW CUT 0 % G02:4-20 LOW LMT -20 % **G03:4-20 H LMT** 90 % **DATA DIAG ESC**	Output 18.4mA(90%) 4mA Setting range: 0 to 110% Default: 110%

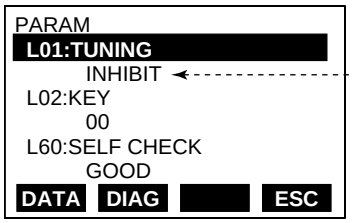
7.2.10 Alarm Output (Refer to 6.3.8)

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

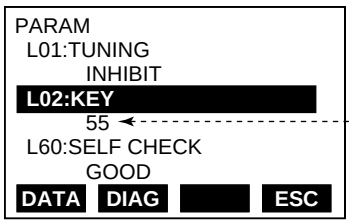
* The "**N**" item can be opend by entering "**55**" in parameter number "**L02**".

7.2.11 Data Setting Enable / Inhibit (Refer to 6.3.9)

- This function makes it possible to inhibit all data changes (except L1). However, automatic zero adjustment can be made if the automatic zero-adjustment function is enabled (set in C1). Also, totalization presetting can be done if the totalization presetting function is enabled (set in E4).

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

7.2.12 Procedure of Selecting Special Application Items (Refer to 6.3.10)

Display	Description
	It is possible to open up to item N when "55" is entered in parameter number "L02." **Code** / **Content** 00: Accessible up to L parameters ← Default 55: Accessible up to N parameters

7.2.13 Rate Limit (Refer to 6.3.11)

Display	Description
PARAM N03:RATE LIMIT 5 % N04:DEAD TIME 0 s N05:POWER SYNCH YES DATA DIAG ESC	Set the rate limit value in parameter number "N03." Range of possible settings: 0 to 10%. Set the dead time in parameter number "N04." Range of possible settings: 0 to 15 seconds. Default: 0 (Rate limit function off)

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

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 B04. If the specific gravity of the fluid is known, the instantaneous flow rate can be displayed in weight units.

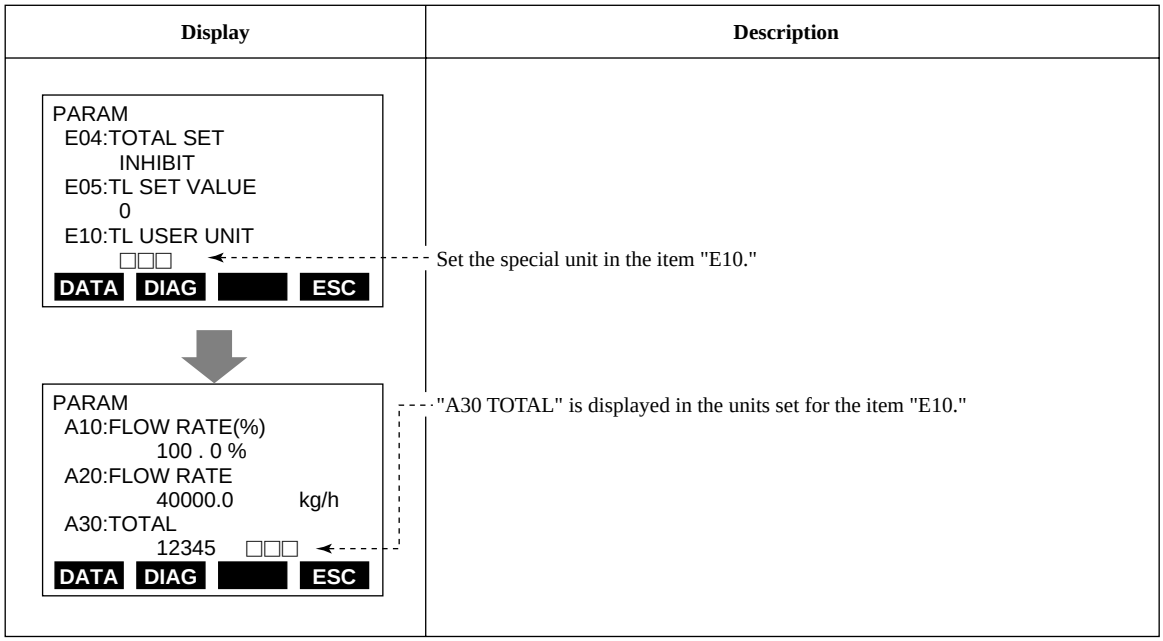
(1) User-Defined units for Instantaneous Flow Rate

Example: Displaying the flow rate of a fluid (its specific gravity is 2) in weight (kg) in a flow rate span of 10m^3/h. When the flow rate is 100%, 20,000kg is displayed.

Display	Description
PARAM D02:FL USER SEL PROVIDED D03:FL USER SPAN 20000.0 D10:FL USER UNIT kg/h DATA DIAG ESC PARAM A10:FLOW RATE(%) 100.0% A20:FLOW RATE 20000.0 kg/h A30:TOTAL 12345 DATA DIAG ESC	Select "PROVIDED" in "D02." For item "D03," set the value to be displayed in "A20 FLOW RATE" when the flow rate is 100% in the span set in "B03FLOW SPAN." Set the unit in "D10". Set the user-defind unit in "D10." The maximum flow rate value of 20,000 kg is displayed as the instantaneous flow rate in "A20 : FLOWRATE."

(2) User-Defined Unit for Totalization Values

Units can be added to the item "**A30 TOTAL**" (totalization display) .



7.2.15 Other Important Points to Note

(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 A10 FLOW RATE (%) or A20 FLOW RATE is displayed, data are updated every 5 seconds.

(3) UPLD is used when the parameters of one ADMAG CA are copied to the BT and DNLD is used when the parameters copied to the BT 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 1C0A11-01E).
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 USERUNIT, E01 TOTAL UNIT, E02 TOTAL SCALE, E03 TOTAL LOWCUT, E04 TOTAL SET, E05 TL SET VALUE, E10 TL USER UNIT, F01 PULSE SELECT, F02 PULSE SCALE, F03 PULSE LOW CUT, F04 PULSE WIDTH, G01 4-20 LOW CUT
G02 4-20 LPW 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.

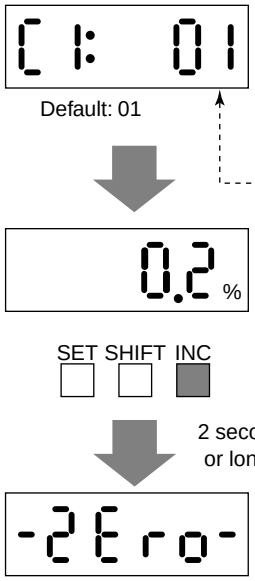
IMPORTANT

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.

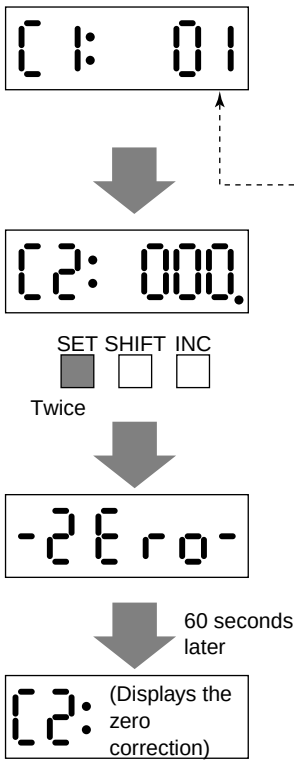
8.1.1 Zero Adjustment Using Data Setting Keys

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

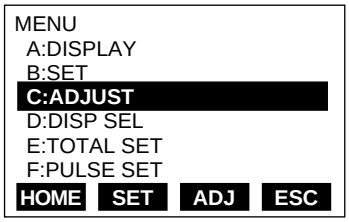
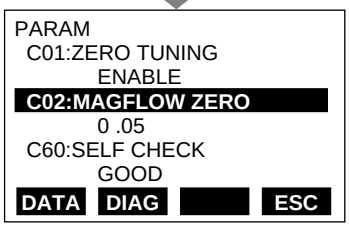
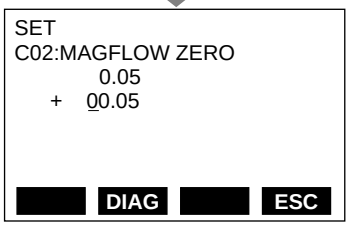
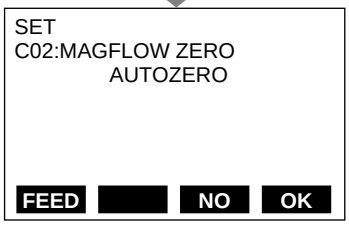
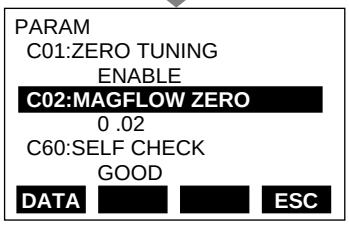
(1) Hold Down the INC Key for Two Seconds in Flow Rate Data Display Mode.

Display	Description
	Call up the setting mode and set "**01**" in "**C1**" (zero adjustment enable / disable). **Code** / **Content** 00 Zero adjustment disabled 01 Zero adjustment enabled 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.

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

Display	Description
	Call up the setting mode and set "**01**" in "**C1**" (zero adjustment enable/disable). **Code** / **Content** 00 Zero adjustment disabled 01 Zero adjustment enabled Call up "**C2**" and press the SET key twice (as for data entry). The display panel shows "**-ZEro-**". After about 60 seconds, the zero correction is displayed. Then the meter returns to data display mode.

8.1.2 Zero Adjustment Via the 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 **C02:MAGFLOW ZERO**
	Pressing the **ENTER** key causes the data setup screen to be displayed. If the security screen is displayed, enter the security code.
	While "**C02:MAGFLOW ZERO**" is displayed, press the **ENTER** key once, then wait a few seconds and press again. "**AUTO ZERO**" is now displayed
	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.

*For entry of the security code, see IM ICA11-0IE

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 A 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 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.

Display		LED	Contact output	Current output	Totalization pulse
CA	Display on BT				
00	GOOD	OFF	ON	Normally	Normally
01	ERROR	Flashing	OFF	Fixed (See note.)	Stops
02	μ P FAULT				
03	EEPROM FAULT				
04	A/D(H) FAULT				
05	A/D(L) FAULT				
06	SIGNAL OVERFLOW				
07	COIL OPEN				
08	VEL. SAPN>10m/s				
09	VEL. SPAN<0.3m/s				
10	P.SPAN>1000p/s				
11	P.SPAN>500m/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 4-20 ALM OUT (output current during alarm)

8.2.2 Error Description and Countermeasures

CA	Display on BT	Error Contents	Countermeasures
02	μ P 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	VEL. SAPN>10m/s	Setting for span flow velocity exceeds 11 m/s	Change setting
09	VEL. SAPN<0.3m/s	Setting for span flow velocity is 0.2 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)

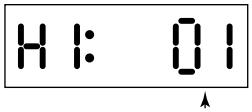
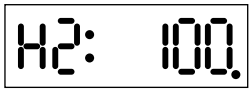
This function enables you to set up any desired value, and to output it from the converter. Since this output is also shared with the totalization display and pulse output, this makes it possible to check operation of individual functions.

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.

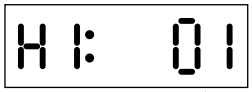
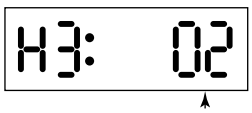
9.1.1 Settings for Test Output Using Data Setting Keys

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

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

* 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 "H1" (test mode) and set "01".
	Code / **Content**: 00 Normal operation; 01 Test output
	Select the mode of status to be output in "H3".
	Code / **Content**: 00 Normal operation; 01 Transistor contact (ON); 02 Transistor contact (OFF)

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

9.1.2 Test Output Setting Via the 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 ESC	Select Test mode in parameter number "**H01**" **Code** / **Description**: NORMAL – Normal operation; TEST – Test output Display "**H02:OUTPUT VALUE**" and set the value to be output in % of the span. (The figure shows a 100% setting.) Setting range: –8 to 108%

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

(2) Contact Output (Alarm Output)

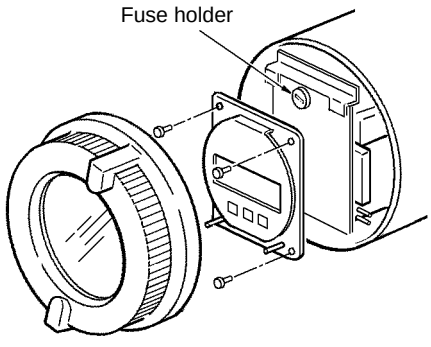
Display	Description
PARAM H01:TEST MODE TEST H02:OUTPUT VALUE 100 % H03:ALARM OUT NORMAL DATA DIAG ESC	Call up the setting mode and display "**H1**" (test mode) and set "**01**". **Code** / **Content**: NORMAL – Normal operation; TEST – Test output Select the mode of status to be output in "**H03**". **Code** / **Content**: NORMAL – Normal operation; CLOSED(ON) – Trarsistor contact (ON); OPEN(OFF) – Trarsistor contact (OFF)

* 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. A spare fuse is taped to the cover of the converter.

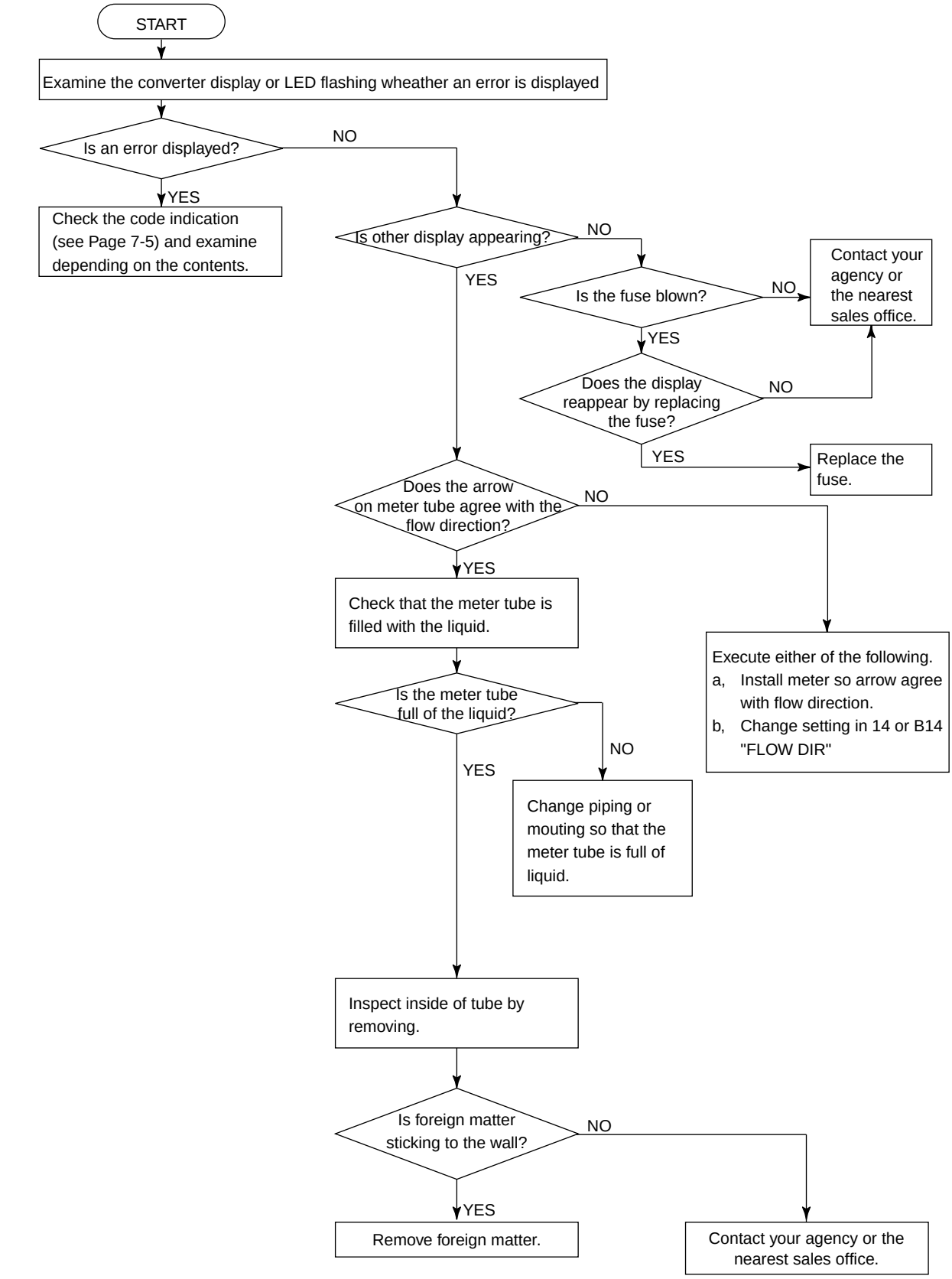


CAUTION Before replacing the fuse, make sure to turn OFF the power supply and disconnect the power source. Use only specified fuses which should be obtained from your nearest Sales & service Office. The use of other fuses might cause fire.

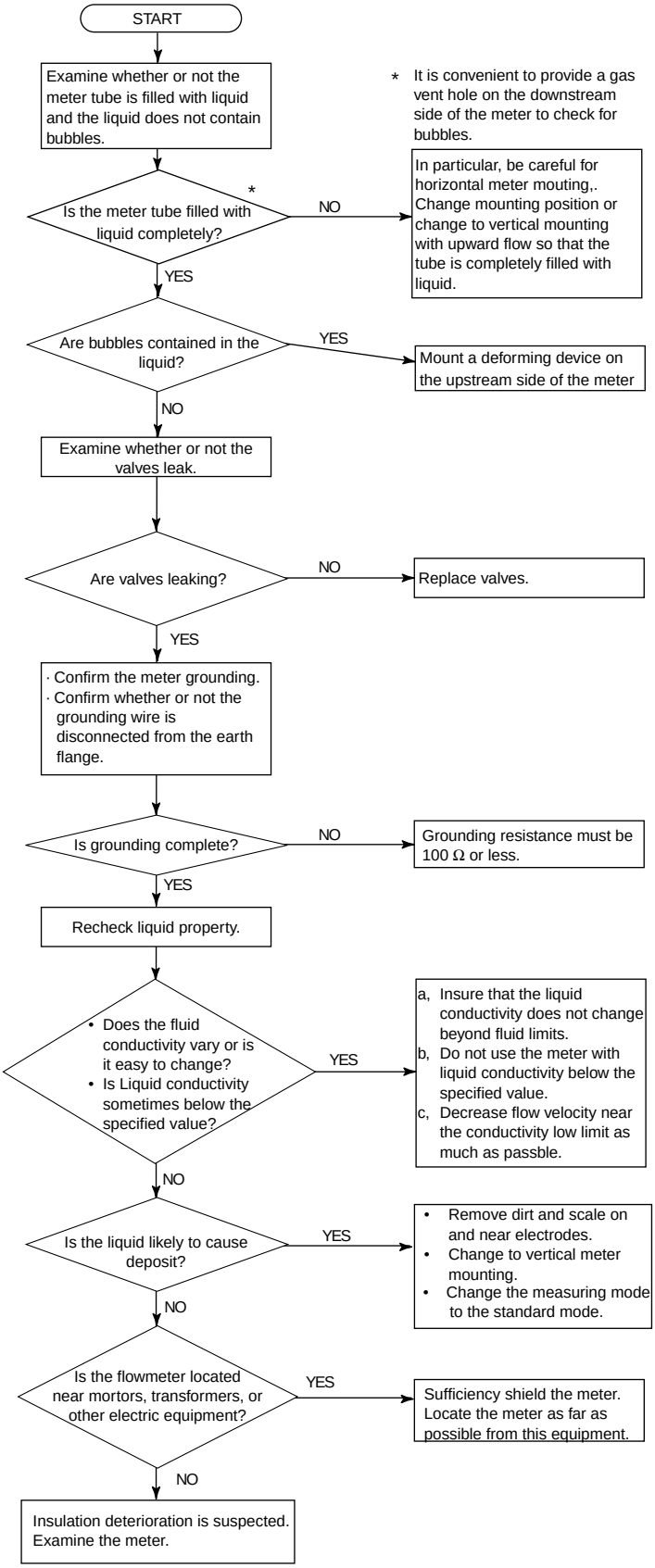
9.3 Trouble Shooting

Although magnetic flowmeters rarely require maintenance, failures occur when the instrument is not operating correctly. Since a failure is located by troubleshooting the receiving instrument information. This information will be described below.

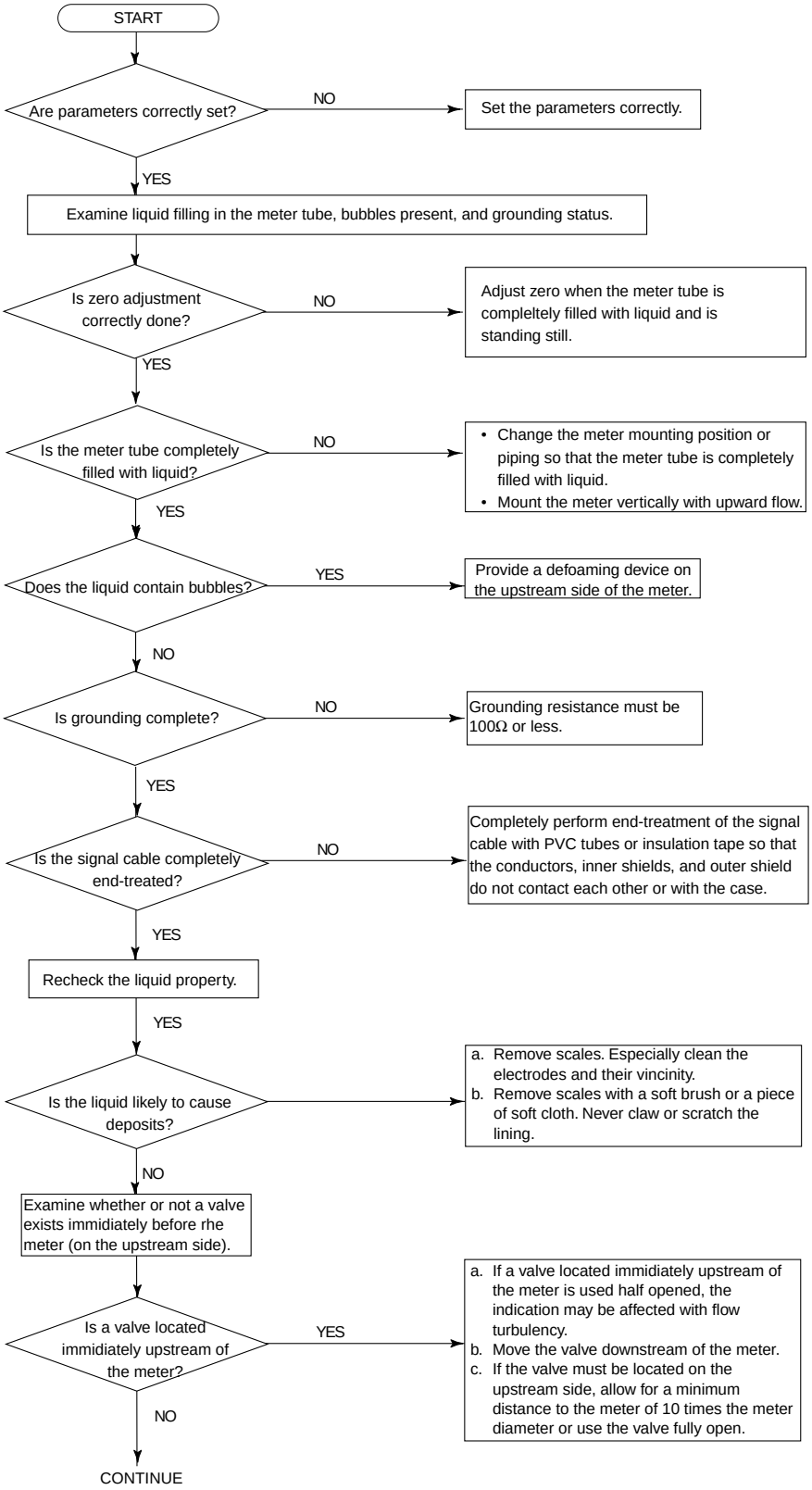
9.3.1 No Indication

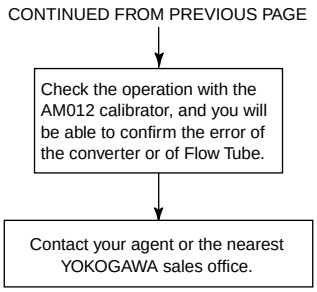


9.3.2 Unstable Zero



9.3.3 Disagreement of Indication with Actual Flow Result




CONTINUED FROM PREVIOUS PAGE
Check the operation with the AM012 calibrator, and you will be able to confirm the error of the converter or of Flow Tube.
Contact your agent or the nearest YOKOGAWA sales office.

10. OUTLINE

10.1 Standard Specifications

10.1.1 Magnetic Flow Converter

> **NOTE** A handheldterminal is necessary to set parameters for models with no indicator.

- **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 ; sec., min., hour, 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 1000PPS

> **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 seconds 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)
- **Degrees of Protection** : IP67, JIS C0920 Water tight protection

10.1.2 Magnetic Flow Tube

- **Degrees of Protection** : IP67, JIS C0920 Water tight protection
- **Size in mm(inch)** : 15 (0.5), 25(1), 40(1.5), 50(2), 80(3), 100(4), 150(6), 200(8)
- **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. (Refer to TI 1E6A0-06E)

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

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

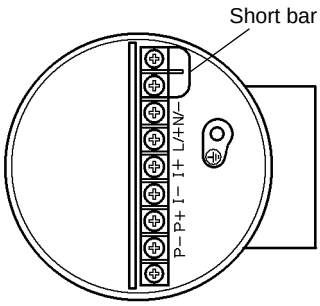
Size 150, 200 mm (6, 8 in) : (fluid conductivity of 1 μS/cm or more)

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** :
  - 100M ohm between power terminals and ground terminal at 500 V DC.
  - 100M ohm between power terminals and each output terminal at 500 V DC.
  - 20M ohm 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

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.



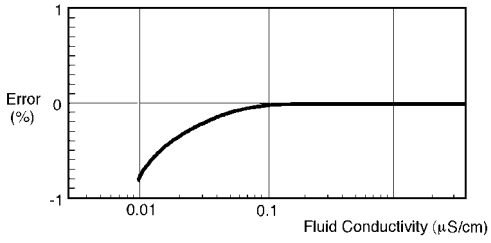
10.3 Normal Operating Conditions

- **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 130VDC, Range 20.4 to 28.8VDC
- **Power Supply Frequency for Power Supply**: 47 to 63 Hz
- **Fuse** : 2A 250V (Time-Lag-Type)
- **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	: 3sec
Measured Time	: 20sec



- **Measurable Flow Range:**

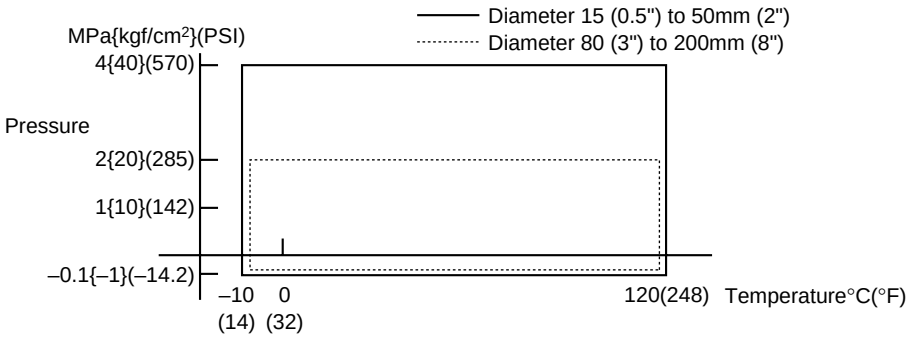
SI Units (Size : mm, Flowrate : m^3/h)

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 20.078	0 to 1.0040
1	0 to 80.31	0 to 4.016
1.5	0 to 180.70	0 to 9.036
2	0 to 321.2	0 to 16.063
3	0 to 722.8	0 to 36.15
4	0 to 1,285.0	0 to 64.26
6	0 to 2,891.3	0 to 144.57
8	0 to 5,140	0 to 257.01

- **Fluid Temperature and Pressure**

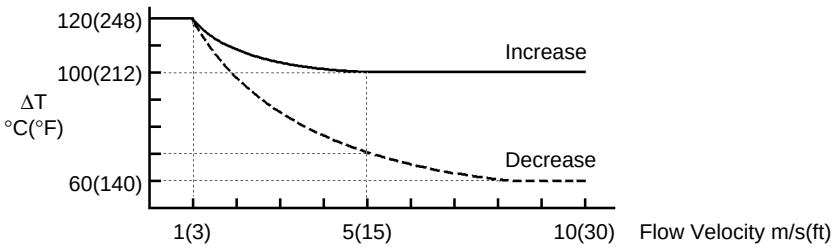


CAUTION

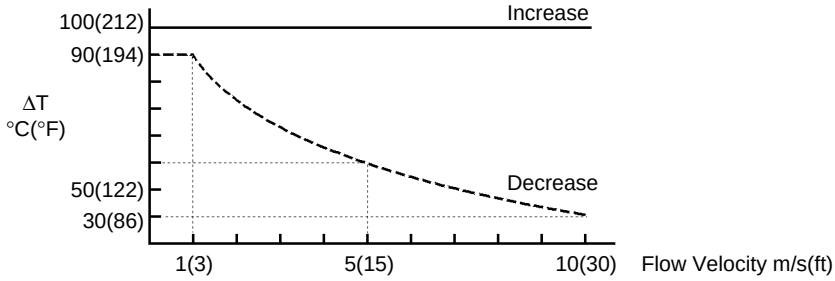
This limits show maximum allowable fluid pressure for Flow Tube itself. Further fluid pressure should also be limitted according to flange rating.

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

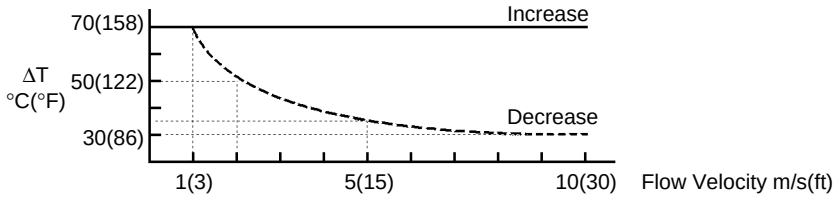
1. Size 15, 25mm (0.5, 1 in)



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



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



10.4 Model and Specification Code

Model	Suffix Code	Description
CA115S CA202S CA204S CA205S CA208S CA210S CA215S CA220S	· · · · · · · · · · · · · · · · · ·	Size 15mm (0.5") Size 25mm (1") Size 40mm (1.5") Size 50mm (2") Size 80mm (3") Size 100mm (4") Size150mm (6") Size 200mm (8")
Use	G · · · · · · · · · · · · · · · · · ·	General purpose type
	N · · · · · · · · · · · · · · · · · ·	FM/CSA Explosion proof type (Only for sizes 15 to 100mm)***
	C · · · · · · · · · · · · · · · · · ·	TIIS(JIS) Flameproof type (For sizes 15 to 200mm)**
Pipe ****	-C · · · · · · · · · · · · · · · · · ·	Ceramics
Process Connection	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*
Electrode material	-N · · · · · · · · · · · · · · · · · ·	Always N
Earth ring material ****	S · · · · · · · · · · · · · · · · · ·	SUS316
	H · · · · · · · · · · · · · · · · · ·	Hastelloy C276 equivalent
	V · · · · · · · · · · · · · · · · · ·	Titanium
Electrical connection **	J · · · · · · · · · · · · · · · · · ·	JIS G1/2 (PF1/2) female**
	A · · · · · · · · · · · · · · · · · ·	ANSI 1/2NPT female***
	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 (Note 1)	DH · · ·	Horizonal (7 Segment LCD)
	DV · · ·	Vertical (7 Segment LCD)
	N · · · ·	None
Optional specification	/ □	

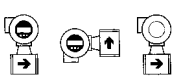
* : H1 is only for size 80 to 200mm.

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

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

**** : ⚠ 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 [302F] or above).
Contact Yokogawa for detailed information of the wetted parts material.

Note 1



DH DV N

10.5 Optional Specifications

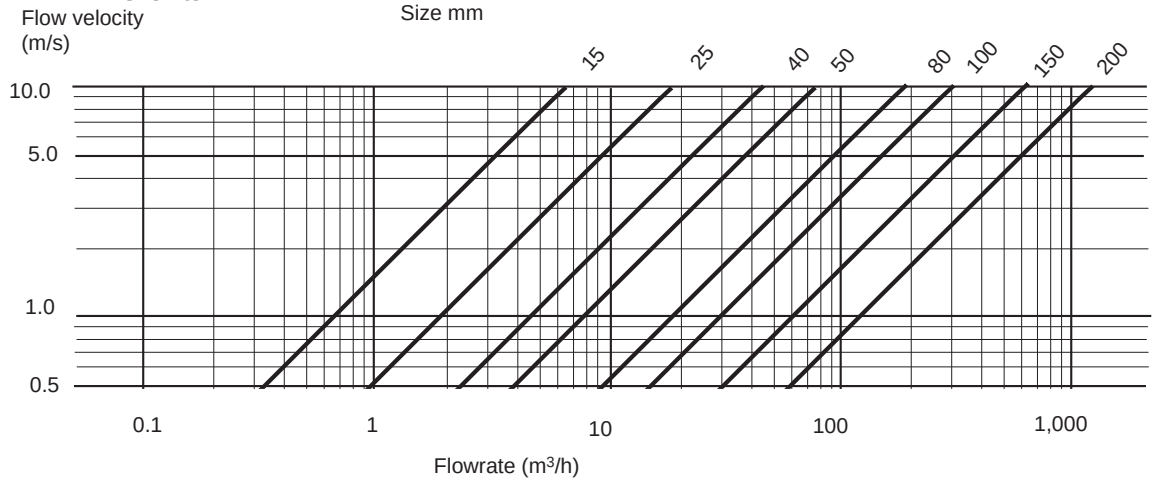
A : Available N : Not available

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 mini-flange and 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(JIS) Flameproof (Note 2) (Note 3)	TIIS(JIS) Flameproof type	N	Note3	N	/JF3
Flameproof Packing Adapter for JIS 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 Explosion proof/FM Non-incendive type	N	N	A	/FF1
CSA Certification (Note 2)	CSA Explosion proof/CSA Non-incendive type	N	N	A	/CF1
Mirror Finished Ceramics	Mirror Finishing on the inside of ceramic tube (Rmax. <= 1micro-meter)	A	A	A	/MRR
180deg. Rotate Converter	180deg. rotate converter for reversed flow direction	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

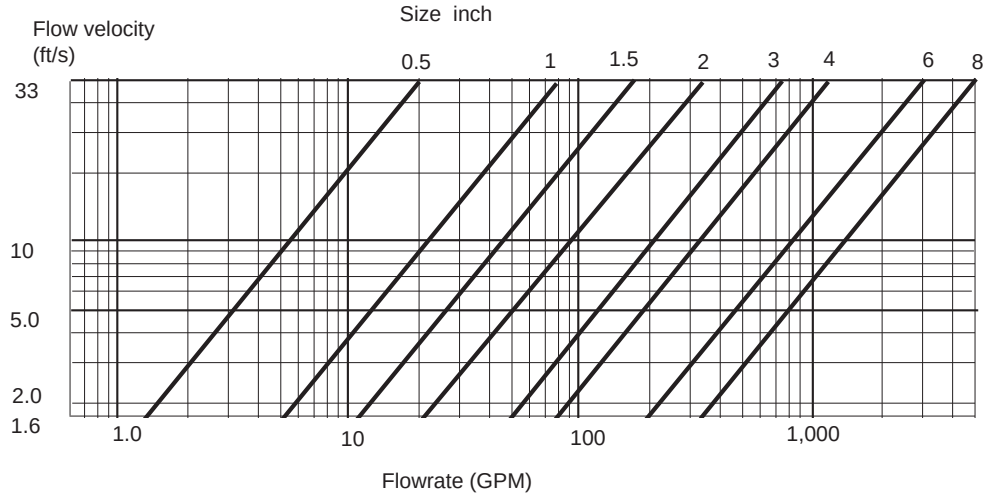
Note 1: It is available only for JIS 10K wafer, JIS 20K wafer or ANSI 150 wafer type.
2: It is available only for size 15 to 100mm (0.5 to 4 in).
3: Select optional code /JF3 with /G11 or /G12 in case of requirement of JIS Flameproof type.
/G11 is selectable only for DC power supply and 4-conductor cable 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.

10.6 Sizing Data

SI Units



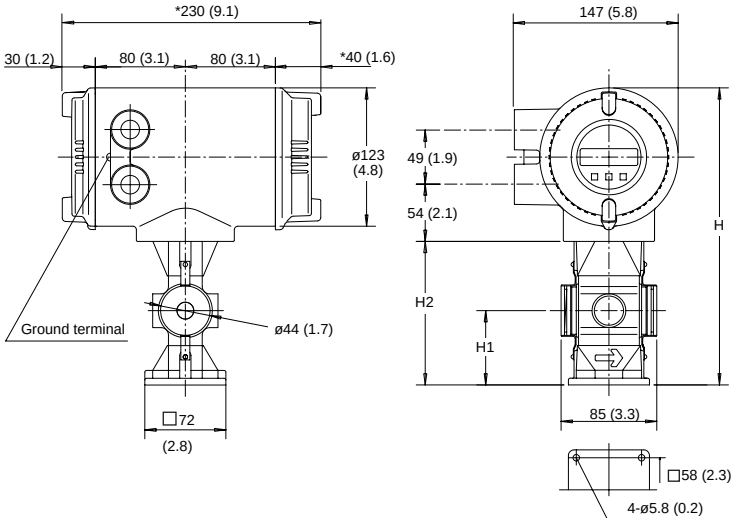
English Units



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

10.7 External Dimensions

- **CA115**

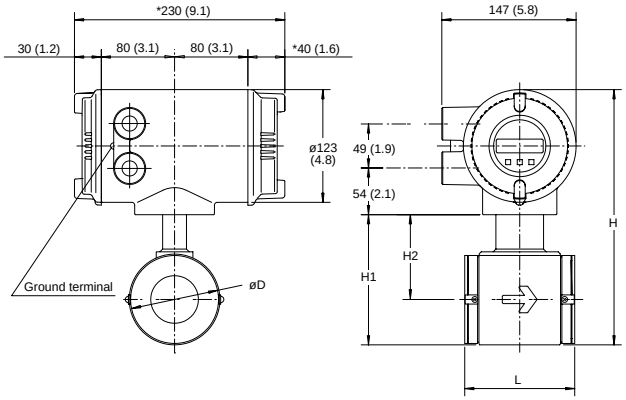


CA115S

Type		General (G)	Ex-proof (N/C)
Size code		115	
Size		15 (0.5)	
Lining		Ceramics	
Hight	H	267.5 (10.5)	265 (10.4)
Hight	H1	66 (2.6)	66 (2.6)
Hight	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") for non indicator type.

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

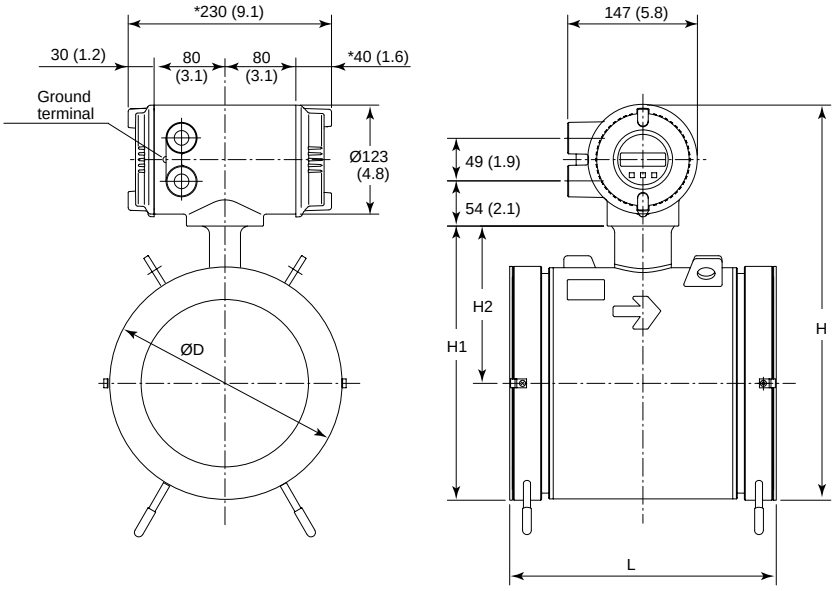


CA202S
204
205
208
210

Type		Gemeral (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	D	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)
Hight	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)
Hight	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)
Hight	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") for non indicator type.

- **CA215, 220**



CA 215 220 S

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	D	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)		22.0 (48.4)	35.0 (76.9)

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

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.

$$E = D \cdot V \cdot B\,(V) \quad \text{..... (1)}$$

The volumetric flowrate Q is obtained from the following equation.

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

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

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

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

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

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.

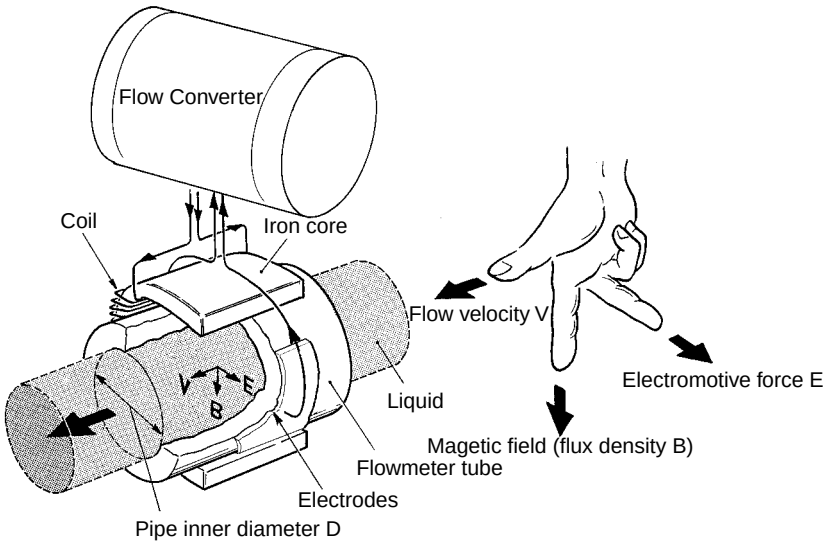


Figure 11.1 Operating Principle

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.

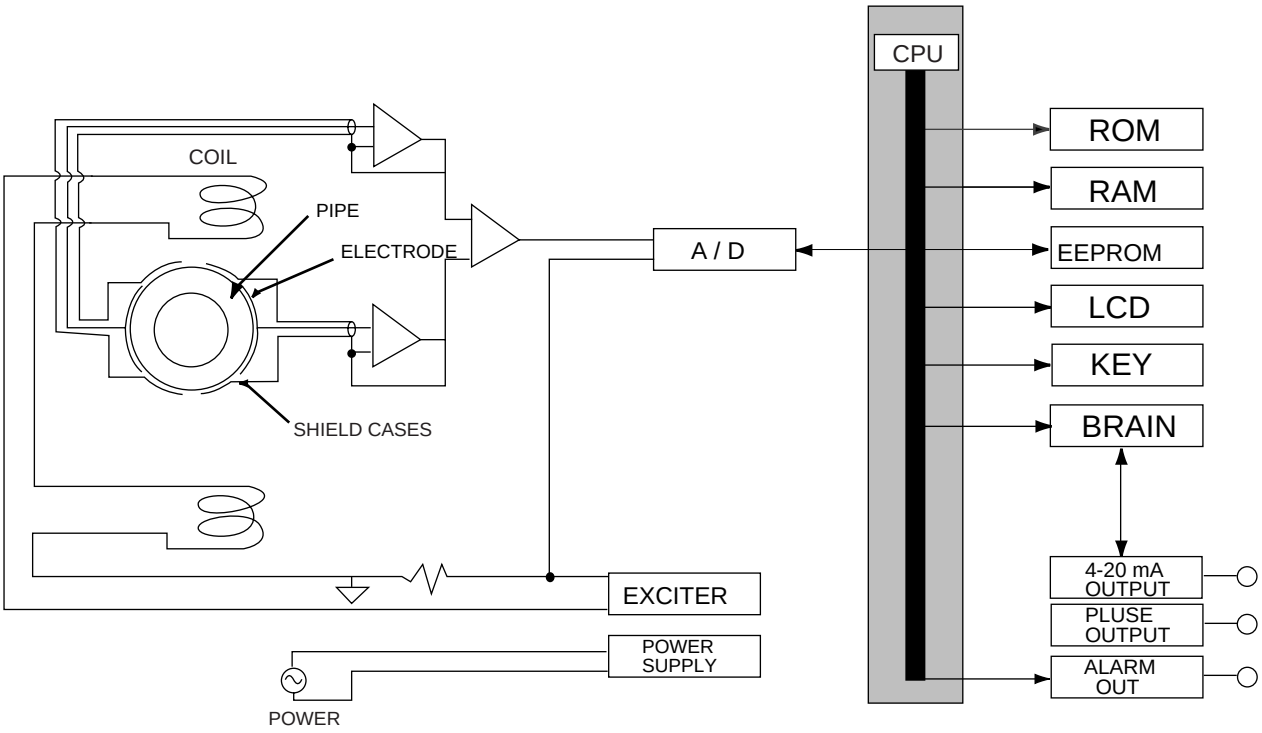
11.3 Capacitance Magnetic flowmeter circuit Configuration

(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, shield drive 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.



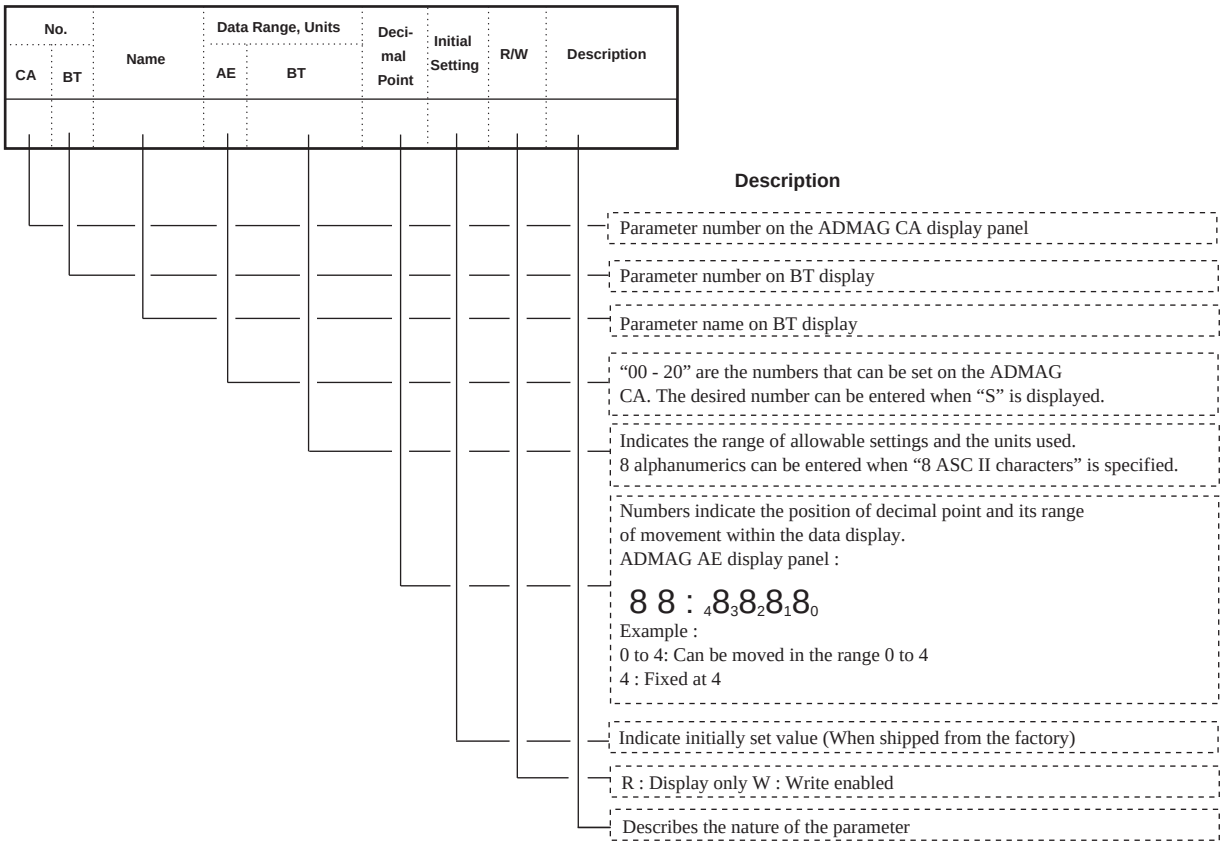
(2) Circuit features

- 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 appendix describes all parameters used by ADMAG CA.

- Description of Items



No.		Name	Data Range, Units		Deci-mal Point	Initial Setting	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	—	±300.0m/s	0 to 4		R	Displays instantaneous flow in actual units
—	A30	TOTAL	—	0 to 999999	0	0	W	Displays forward direction totalization values
	A60	SELF CHECK		GOOD			R	Self check Indicates nature of alarm whe n alarm occurs.
			—	ERROR				
			02	µP FAULT				
			03	EEPROM FAULT				
			04	A/D (L) FAULT				
			05	A/D (H) FAULT				
			06	SIGNAL OVERFLOW				
			07	COIL OPEN				
			08	SPAN VEL.>10m/s				
			09	SPAN VEL.<0.3m/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				

No.		Name	Data Range, Units		Deci-mal Point	Initial Setting	R/W	Description
CA	BT		CA	BT				
—	B00	SET	—				R	Major parameter setting items
—	B01	TAG NO.	—	16 ASII 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 4	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	km3 ($10^3 \times m^3$) m3 l (liter) cm3 $(10^{-2} \times m)^3$ 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 /h /m /s		/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 to 3000.0	1	(Set)	W	Sets meter tube size using B06 units.
08	B08	STD MF		0.2500 to 3.0000	4	(Set)	W	Standard measurement meter factor.
09	B09	FNR MF		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.

No.		Name	Data Range, Units		Deci-mal Point	Initial Setting	R/W	Description
CA	BT		CA	BT				
13	B13	VELOCITY CHK	S	0 to 20.000	3		R	Range span displayed in m/s
14	B14	FLOW DIR	00 01	FORWARD REVERSE		FOR WARD	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	Self check Indicates nature of alarm when alarm occurs.
_	C00	ADJUST	_				R	Parameter for setting auto zero adjust
C1	C01	ZERO TUNING	00 01	INHIBIT ENABLE	2	ENABLE	W	Parameter for setting auto zero adjust
C2	C02	MAGFLOW ZERO	S	0 to ±99.99		0.00	W	Displays zero correction
_	C60	SELF CHECK	00 ↓ 19	GOOD ↓ 4-20 LMT ERROR			R	Self check Indicates nature of alarm when alarm occurs.

No.		Name	Data Range, Units		Deci-mal Point	Initial Setting	R/W	Description
CA	BT		CA	BT				
	D00	DISP SEL	—				R	Display panel selections
d1	D01	DISP SELECT	00 01 02 03 04 05	RATE (%) RATE TOTAL RATE(%) /TTL RATE/TTL RATE/RATE(%)		RATE(%)	W	Display selection items
d2	D02	FL USER SEL	00 01	NOT PROVIDED PROVIDED		NOT PROVIDED	W	Select whether special units are to be used for instantaneous flow rates
d3	D03	FL USER SPAN	S	0 to 30000	0 to 4	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	Self check Indicates nature of alarm when alarm occurs
—	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 4	0	W	Sets flow rate per pulse for totalization display
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

No.		Name	Data Range, Units		Deci-mal Point	Initial Setting	R/W	Description
CA	BT		CA	BT				
—	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	Self check Indicates ature of alarm when alarm occurs.
—	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 4	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 msec 1 msec 20 msec 33 msec 50 msec 100 msec		50% DUTY	W	Sets width of pulse output
—	F60	SELF CHECK	00 ↓ 19	GOOD ↓ 4-20 LMT ERROR			R	Self check Indicates nature of alarm when alarm occurs

No.		Name	Data Range, Units		Deci-mal Point	Initial Setting	R/W	Description
CA	BT		CA	BT				
—	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 110	0	120	W	Sets high limit for 4 to 20 mA output
—	G60	SELF CHECK	00 ↓ 19	GOOD ↓ 4 - 20 LMT ERROR			R	Self check Indicates nature of alarm when alarm occurs
—	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	Self check Indicates nature of alarm when alarm occurs
—	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
L2	L02	KEY	00 55	00(TO"L") 55(TO"N")		0	W	Display restrictions Set 55 and items up to N will be displayed
—	L60	SELF CHECK	00 ↓ 19	GOOD ↓ 4-20 LMT ERROR			R	Self check Indicates nature of alarm when alarm occurs

No.		Name	Data Range, Units		Deci-mal Point	Initial Setting	R/W	Description
CA	BT		CA	BT				
—	N00	APPL SET	—				R	
n1	N01	TOTAL / PULSE	00 01	NO DAMP DAMP		DAMP	W	Select whether instantaneous flow rate values or damping derived flow rate values are to be used in totalization / pulse
n2	N02	OUTPUT MODE	00 01	ON OFF		ON	W	Select whether the pulse output trannsistor is to be set to ON ACTIVE or OFF ACTIVE
n3	N03	RATE LIMIT	S	0 to 10	0	0 to 5	W	Sets rate limit value in percentage
n4	N04	DEAD TIME		0 to 15	0	0	W	Sets rate limit dead time
—	N60	SELF CHECK	00 ↓ 19	GOOD ↓ 4-20 LMT ERROR			R	Self check Indicates nature of alarm when alarm occurs

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

- Applicable Standard:
  FM 3600, FM 3611, FM 3615, FM 3810
  NEMA 250
- Explosion proof for Class I, Division 1 Groups A, B, C & D.
  Dust-ignition proof for Class II/III, Division 1 Groups E, F & G.
  Temp.Code: T6
  Ambient Temp.: –20°C to +50°C (–4 to 122°F)
  Maximum power supply voltage: 250 Vac/ 130V dc
  Enclosure: NEMA 4X
- Non incendive for Class I, Division 2 Groups A, B, C & D Suitable for class II, Division 2, Groups F & G;Class III Division 1& 2
  Temp.Code: T4A
  Ambient Temp.: –20°C to +50°C (–4 to 122°F)
  Maximum power supply voltage: 250 Vac/ 130V dc
  Enclosure: NEMA 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

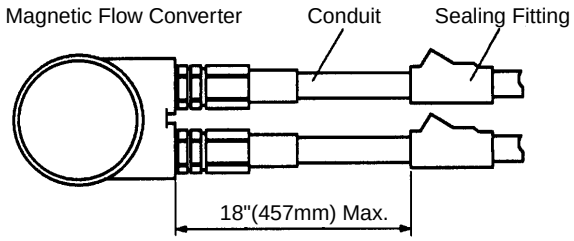
- Open circuit before opening the covers and seal all conduits with in 18 inches in hazardous locations.
- Take care not to generate mechanical spark when access to the instrument and peripheral devices in hazardous locations.

(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



(Note) In the case of non incendive for Division 2 (Zone 2), sealing fittings are not required and installation shall be in accordance with the National Electric Code, ANSI/NFPA-70.

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

(1) Technical Data

- Applicable Standard:
  C22.2 No 0, C22.2 No 0.4, C22.2 No 0.5, C22.2 No 25, C22.2 No 30, C22.2 No 94, C22.2 No 142, C22.2 No 157, C22.2 No 213, C22.2 No 1010.1
- Certificate: 1500865
- Explosion proof for Class I, Groups B, C and D; Class III, 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: 250 Vac/ 130V dc
  Enclosure: Type 4X
- Non incendive for Class I, Div.2 Groups A, B, C and D; Class II, Div.2, Groups E, F and G; Class III:
  Temp.Code: T4A
  Process Temp.: 105˚C
  Ambient Temp.: –20°C to +50°C (–4 to 122°F)
  Maximum power supply voltage: 250 Vac/ 130V dc
  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

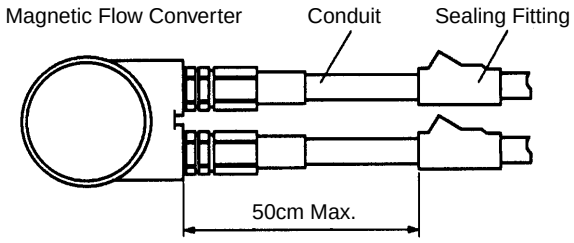
CAUTION : OPEN CIRCUIT BEFORE REMOVING COVER.
OUVRIR LE CIRCUIT AVANT D'ENLEVER LE COUVERCLE.
Take care not to generate mechanical spark when access to the instrument and peripheral devices in hazardous location.

(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



(Note) In the case of non incendive for Division 2, sealing fittings are not required and installation shall be in accordance with the Canadian Electrical Code Part I.

13.3 TIIS(JIS) (For sizes 15 to 200 mm(0.5 to 8 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 JIS INTRINSICALLY SAFE EQUIPMENT" in the end of this mannual.

(1) Technical Data

- Certificate:

Size (mm)	Certificate	Size (mm)	Certificate
15	C13644	80	C13648
25	C13645	100	C13649
40	C13646	150	C14991
50	C13647	200	C14992

- Construction: Exde II CT4
  : 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: 250 Vac/ 130V dc
- Grounding: JIS Class C(10Ω or less) or JIS Class A(10Ω or less)

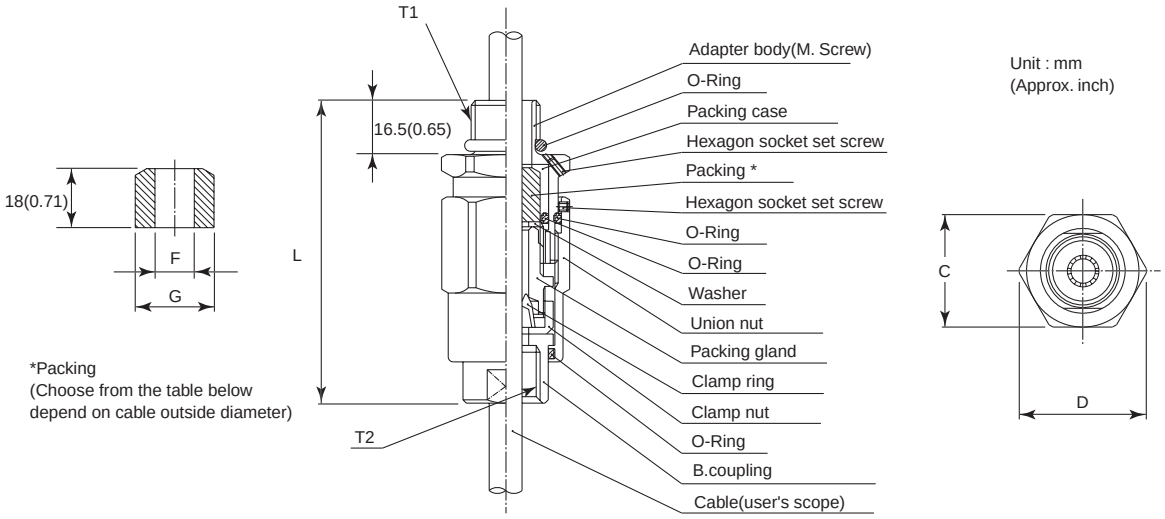
WARNING

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)	ϕ8.0 to ϕ10.0 (0.31 to 0.39)	ϕ10.0(0.39)	ϕ20.0 (0.79)	16 8-10	0.26 (0.57)
					ϕ10.0 to ϕ12.0 (0.39 to 0.47)	ϕ12.0(0.47)		16 10-12	

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 JIS 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