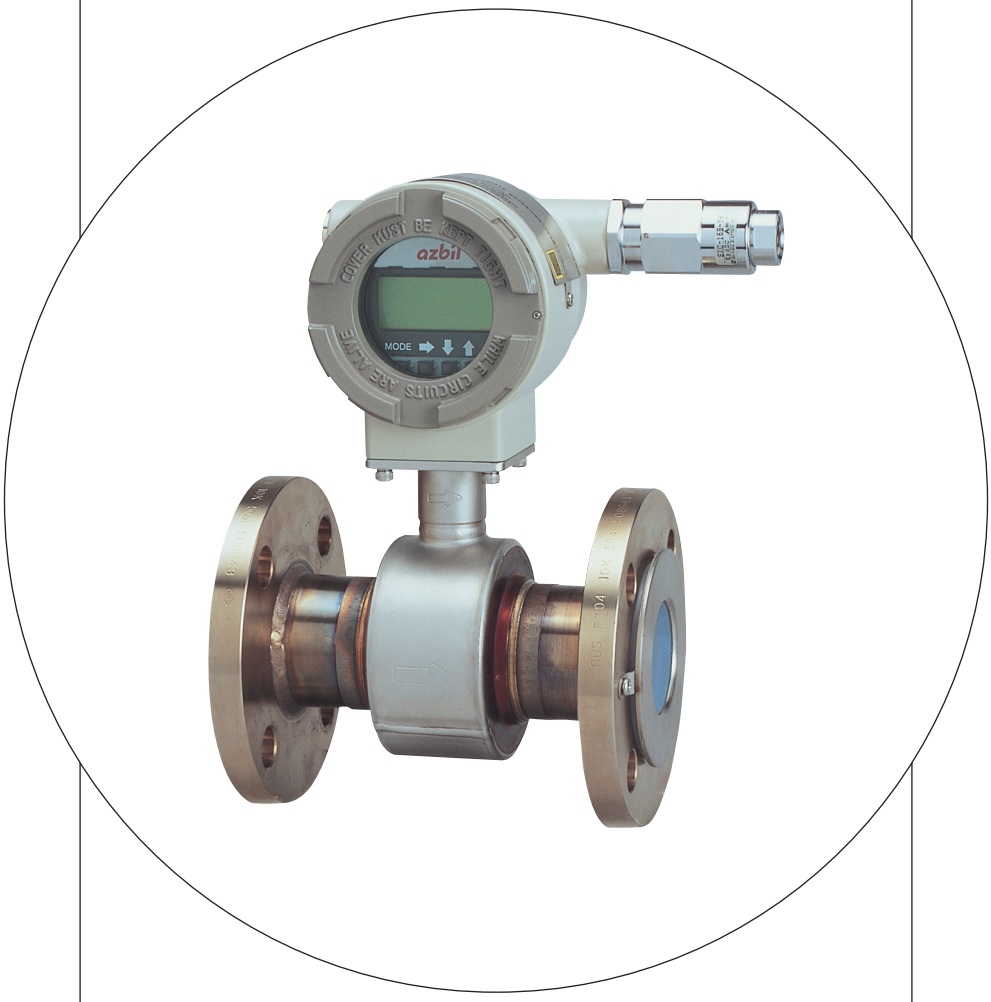
azbil

CM2-MTG400-2001

MagneW™ Two-wire PLUS+ Two-wire Electromagnetic Flowmeter TIIS/KCs Explosion-protected Apparatus

Model MTG15A

User's Manual



Azbil Corporation

NOTICE

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In no event shall Azbil Corporation be liable to anyone for any indirect, special or consequential damages. This information and specifications in this document are subject to change without notice.

Safety

Precautions for Use

For safe use of the product, the following symbols are used in this manual.

⚠WARNING	Warnings are indicated when mishandling the product might result in the death or serious injury of the user.
⚠CAUTION	Cautions are indicated when mishandling the product might result in minor injury to the user or damage to property.

■ In describing the product, this manual uses the icons and conventions listed below.

Use caution when handling the product.

The indicated action is prohibited.

Be sure to follow the indicated instructions.

Handling Precautions:

Handling Precautions indicate items that the user should pay attention to when handling the ATT.

To use this product correctly and safely, always observe the following precautions.

We are not responsible for damage or injury caused by the use of the product in violation of these precautions.

Handling Precautions for This Product

Installation Precautions

⚠WARNING

	When installing, use proper fittings and proper tightening torque for connections to the process and to the exhaust. Gas leakage is dangerous because process gas and calibration gas are flammable. Please refer to the leak check instructions in this manual and verify that there is no gas leakage.
	Do not use the product except at the rated pressure, specified connection standards, and rated temperature. Use under other circumstances might cause damage that leads to a serious accident.
	For wiring work in an explosion-proof area, follow the work method stated in the explosion-proof policy.

⚠CAUTION

After installation, do not step or stand on this unit. Doing so may damage the device or cause injury.
Bumping the glass of the display with a tool may cause damage or injury. Be careful.
Install the device correctly. Incorrect or incomplete installation will cause output errors and violation of regulations.
This product is quite heavy. Protect your feet with safety shoes when working.
Do not subject the product to shock or impact.

Wiring Precautions

⚠WARNING

Do not do wiring work with wet hands or while electricity is being supplied to the product. There is a danger of electric shock. When working, keep hands dry or wear gloves, and turn off the power.

⚠CAUTION

When wiring, check the specifications carefully and make sure to wire correctly. Incorrect wiring can cause device damage or malfunction.
Supply electric power correctly according to the specifications. Supplying power that differs from the specifications can damage the device.
Use a DC power supply that has overload protection.

Maintenance Precautions

⚠WARNING

When removing this device for maintenance, be careful of residual pressure or residual process gas. Leakage of process gas is dangerous.
When working on the vent, check its direction so that people do not come into contact with vented gas. There is a danger of burns or other physical harm.
When the device is being used in an explosion-proof area, do not open the cover. Opening the cover may cause an explosion.

⚠CAUTION

This product was kept under carefully controlled conditions until it was shipped. Never try to modify this device. Doing so could damage it.

Table of Contents

Chapter 1. Measuring configuration system and model MTG structure

Outline of this chapter

This chapter presents the equipment configuration of a measuring system using this instrument.

It also describes the structure and the names and functions of various parts of the main unit.

1-1. System configuration

Measuring system

Introduction

This instrument is a two-wire electromagnetic flowmeter operated on 4-20mA DC. It measures the flow rate of conductive fluid flowing in the detector and outputs a signal that is suitable for the measuring range.

Concept of flow rate measurement by this instrument

The concept of a flow rate measuring system using this instrument is shown.

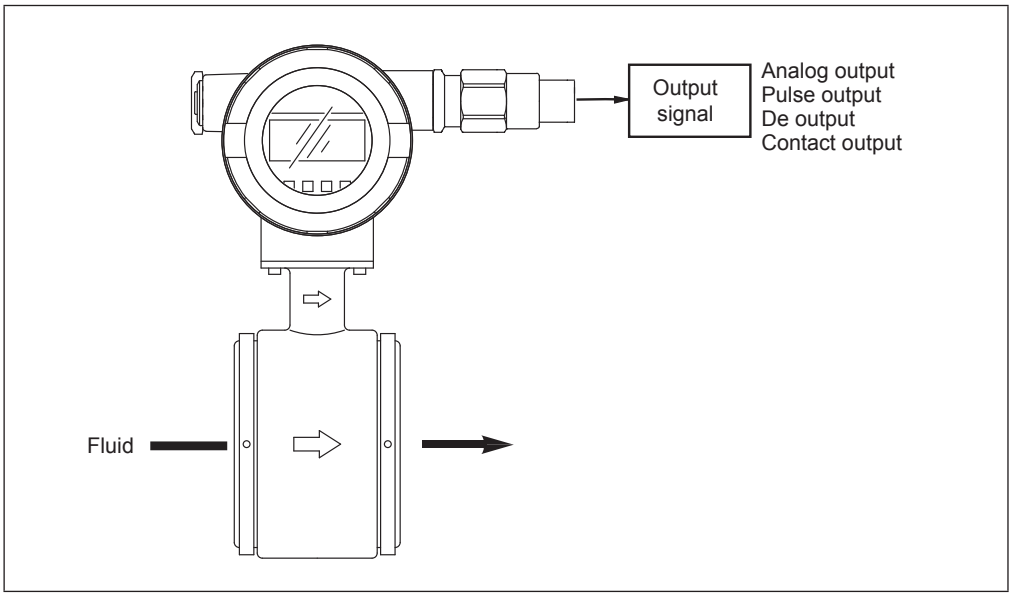


Fig. 1-1. Conceptual drawing of measuring system (integral type)

Analog output

If instantaneous flow rate values are to be output as an analog variable to control equipment, configure the system to output an analog output.

Digital output (DE output)

Use this system configuration if instantaneous flow rate values, instrument database and self-diagnosis results are to be outputted as digital variables (DE outputs) to control equipment.

Pulse output

As a pulse output, the open-collector output is available. Pulse frequencies up to 200 Hz can be outputted. The pulse output can be outputted simultaneously with an analog output.

If integrated flow values are to outputted as a pulse to control equipment, wire an another two-wire to output a pulse output.

Contact output

Instead of the pulse output, a contact output the open-collector output is available. The contact output can be outputted simultaneously with an analog output.

System configuration 1 for analog output

System configuration

An example of system configuration is shown. The instantaneous flow rate values measured by this instrument are outputted as a 4-20mA DC analog signal.

In this system configuration, the analog signal from the instrument can be outputted directly to a host control system.

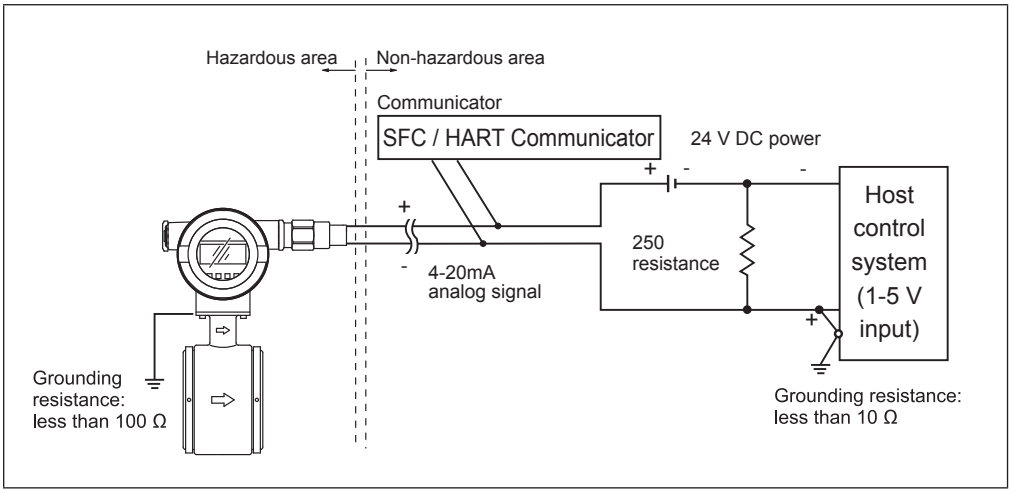


Fig. 1-2. System configuration for analog output

- Smart two-wire electromagnetic flowmeter (main unit): Measures flow rate and outputs instantaneous flow rate value as an analog signal.
- Communicator: Used to communicate with this instrument, read data and change the instrument data settings.

Note) To use the SFC, read "Chapter 6. Operation using SFC communicator" in this manual.

To use the HART communicator, read "Chapter 7. Operation using HART communicator" in this manual.

Compatible with the SFC of Ver 7.0 or over. However, some functions on the main unit cannot be set.

For DD (device description) of the HART® Communicator, use the HCF DD Library Host DD Distribution (HCF-KIT-III) Release 2010 Number 1, Device Description 1, Device Revision 2 or later.

This instrument can communicate on two protocols: Smart Field Communication (SFC) and HART® communication (HART® communicator). The communication method to be used is selected by the (human) data setter.

When configuring a system using this instrument, it is necessary to determine the power supply voltage and load resistance to satisfy the operation conditions of this instrument.

For details, refer to specification sheet (SS2-MTG300-0300).

System configuration for digital output (DE output)

System configuration

In the system configuration shown below, the flow rate measurements, database and self-diagnosis results of this instrument are outputted on the DE (digital enhancement) protocol, which is a communication protocol for digital signals.

In this system configuration, the instrument transmits digital signals on the DE protocol and the smart protocol converter (SPC) converts the digital signals into analog signals, which is outputted to a control system. It can also output the DE protocol based digital signals without conversion to a control system.

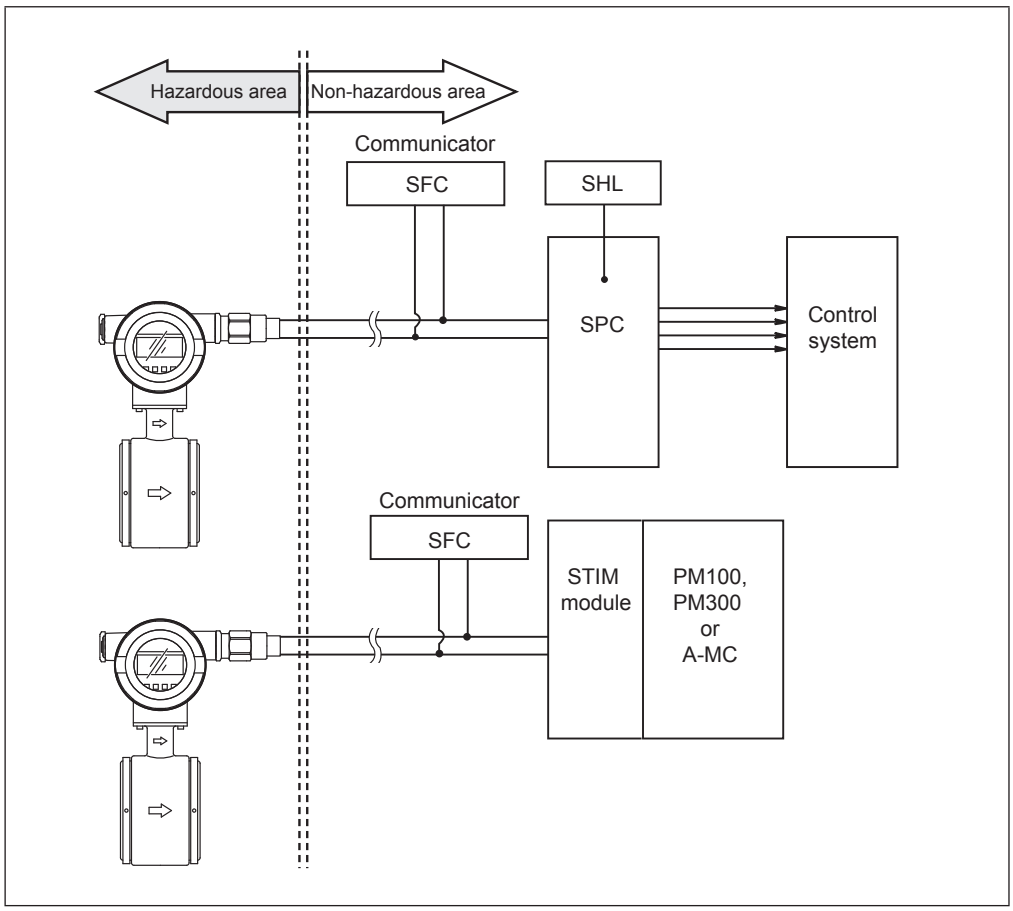


Fig. 1-3. System configuration for digital output

- Smart two-wire electromagnetic flowmeter (main unit): Measures flow rate and outputs the instantaneous flow rate values and the instrument's self-diagnosis results as the form of digital signals.
- Smart protocol converter (SPC): Receives DE protocol based digital signals from this instrument and converts them into a 4-20mA DC or 1-5 V DC analog signal and outputs it.
- Smart handy loader: Used to change SPC settings data.
- Communicator: Used to communicate with this instrument, read data and change the instrument's settings data.
- PM100, PM300, A-MC: These are process controllers on the UCN and do regulatory control, sequences, arithmetic operations, process I/O and other functions simultaneously.
- STIM module: This is an I/O module for smart transmitter interfaces to connect a process manager (PM) to model MTG or other field equipment.

System configuration for pulse output

System configuration

An example of system configuration is shown. Instantaneous flow rate values measured by this instrument are outputted as a pulse output with the specified pulse width and pulse weight.

Besides an analog signal, this system configuration allows the instrument to output a pulse output to an electronic counter, sequencer or other host control system or counter.

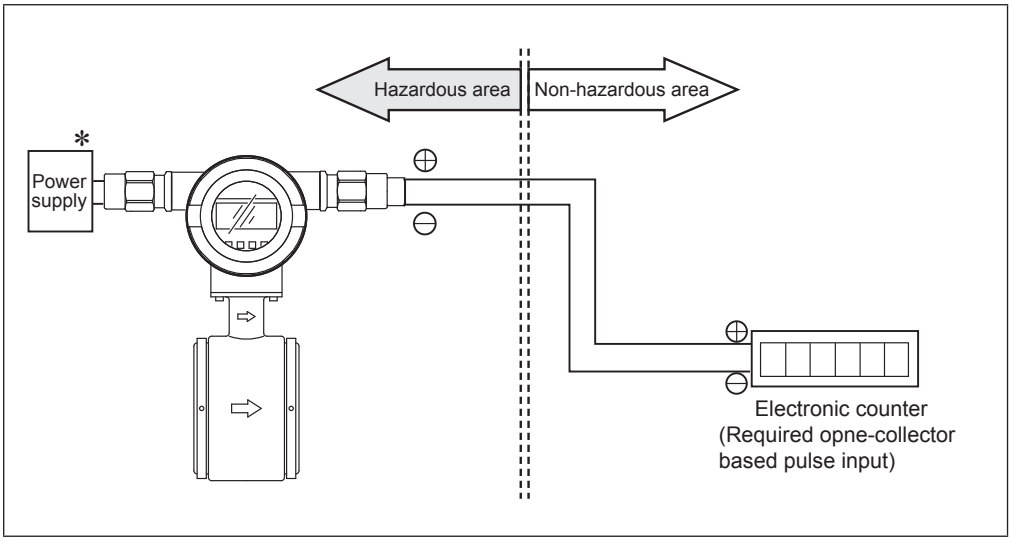


Fig. 1-4. System configuration for pulse output

*Note) *: Refer to Fig. 1-2.*

- Smart two-wire electromagnetic flowmeter (main unit): Measures flow rate and outputs a pulse output signal to an electronic counter. Displays the measured flow rate as a flow rate value.
- Electronic counter: Receives the pulse input signal as input and displays the integrated value and control the target equipment by batch control function.
- Open collector: A pulse output method using a transistor contact.

System configuration for contact output

System configuration

An example of system configuration is shown. If the instantaneous flow rate value measured by this instrument reaches to the upper or lower limit settings or a major failure occurs in the instrument, that state is outputted as a contact output.

In this system configuration, it is not only an analog signal but also the instrument to output the contact output to a sequencer or other host control system.

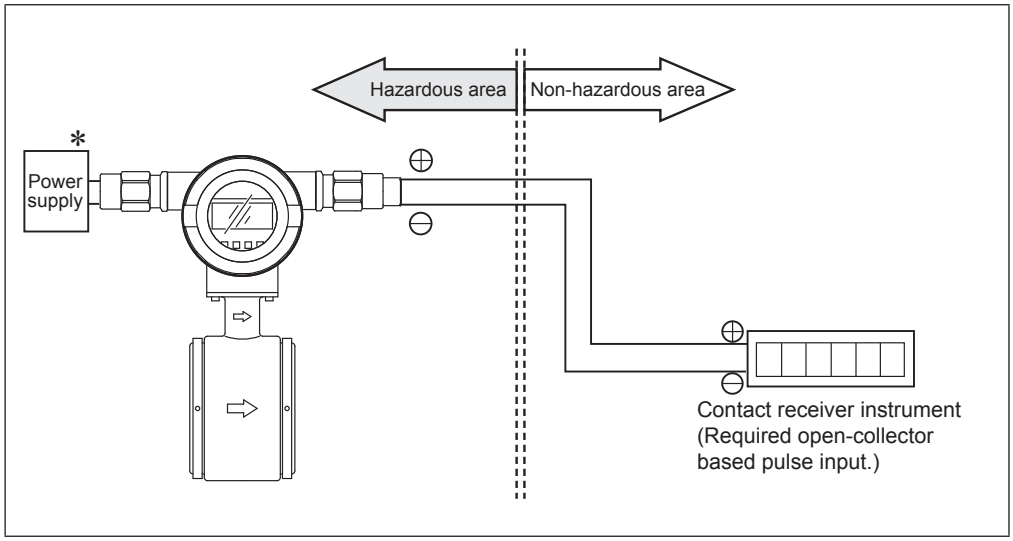


Fig. 1-5. System configuration for contact output

*Note) *: Refer to Fig. 1-2.*

- Smart two-wire electromagnetic flowmeter (main unit): Measures flow rate and outputs an upper or lower limit alarm or major failure as a contact output.
- Contact receive instrument: Receive the contact input.
- Open collector: An output method using a transistor contact.

1-2. TIIS/KOSHA Explosion-protected apparatus

Before use

This is flameproof structure flowmeter. Read this item carefully to ensure correct use.

Flameproof structure

Flameproof structure means a totally enclosed housing that is capable of withstanding an explosion of a gas or vapor within it, and of preventing the ignition of an explosive gas or vapor that may surround it.

⚠ CAUTION

Before opening cover, you must turn off the power and wait for seven (7) minutes.

Location guidelines

Install the flowmeter in accordance with the following guidelines:

■ The flowmeter can be installed in hazardous areas of grade:

$$\frac{\text{IIC}}{1} \quad \frac{\text{T4}}{2}$$

1. Explosive gaseous atmosphere graded IIC
2. Gaseous atmosphere where the ignition temperature is 135°C or greater

This means that the flowmeter can only be installed in Class I and II locations. It cannot be installed in Class 0 locations.

■ When installing the flowmeter in a hazardous or non-hazardous area, refer to the installation specifications described in the appendix for the correct wiring.

■ The pressure-resistant packing cable adapter must be placed in the signal wire outlet of the flowmeter converter. Use the adapter supplied.

■ Handle the flowmeter case and cover carefully to prevent any damage or distortion. Properly tighten the converter cover and never open it during operation.

The specified explosion capability cannot be guaranteed if any of the above guidelines are ignored.

When wiring the flowmeter in a Class 1 Hazardous Area, or in any area where only low voltage wiring work is allowed, follow procedures published by the Technology Institution of Industrial Safety.

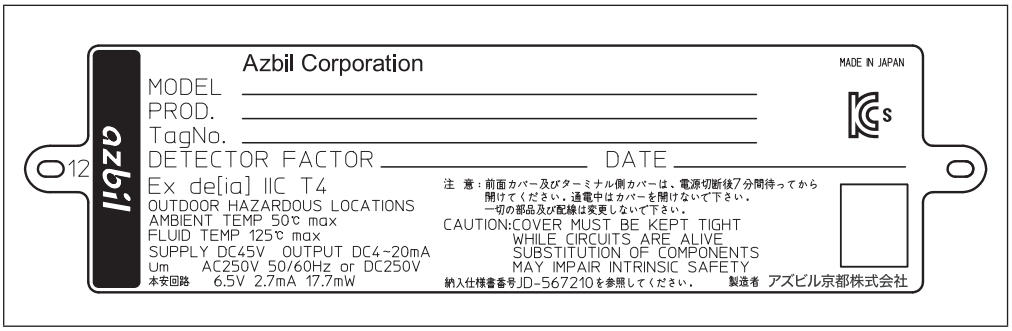


Fig. 1-6. Nameplate

Certificate number (TIIS/KOSHA)

Line size [mm]	Flange (Pipe material: SCS14)	Flange (Pipe material: SUS304)	Wafer (Pipe material: SCS14)	Wafer (Pipe material: SUS304)
2.5	TC19022 12-AV4BO-0368	-	-	-
5	TC19022 12-AV4BO-0368	-	-	-
10	TC19022 12-AV4BO-0368	-	-	-
15	TC19022 12-AV4BO-0368	-	-	-
25	-	TC19028 12-AV4BO-0377	-	TC19028 12-AV4BO-0377
40	-	TC19029 12-AV4BO-0378	TC19024 12-AV4BO-0370	TC19029 12-AV4BO-0378
50	-	TC19031 12-AV4BO-0433	TC19025 12-AV4BO-0371	TC19031 12-AV4BO-0433
65	-	TC19030 12-AV4BO-0379	TC19026 12-AV4BO-0372	TC19030 12-AV4BO-0379
80	-	TC19032 12-AV4BO-0380	TC19027 12-AV4BO-0373	TC19032 12-AV4BO-0380
100	-	TC19020 12-AV4BO-0374	TC19021 12-AV4BO-0381	TC19020 12-AV4BO-0374
150	-	TC19033 12-AV4BO-0375	-	-
200	-	TC19034 12-AV4BO-0376	-	-

1-3. Structure of this instrument and functions of its various parts

Structure of main unit

Major components

This instrument consists of a detector and converter. The converter, consists of the converter proper, indicator/data setter and terminal box. Fig. 1-7. shows overview of the instrument. (The detail specification and outline drawing, refer to SS2-MTG100-0100)

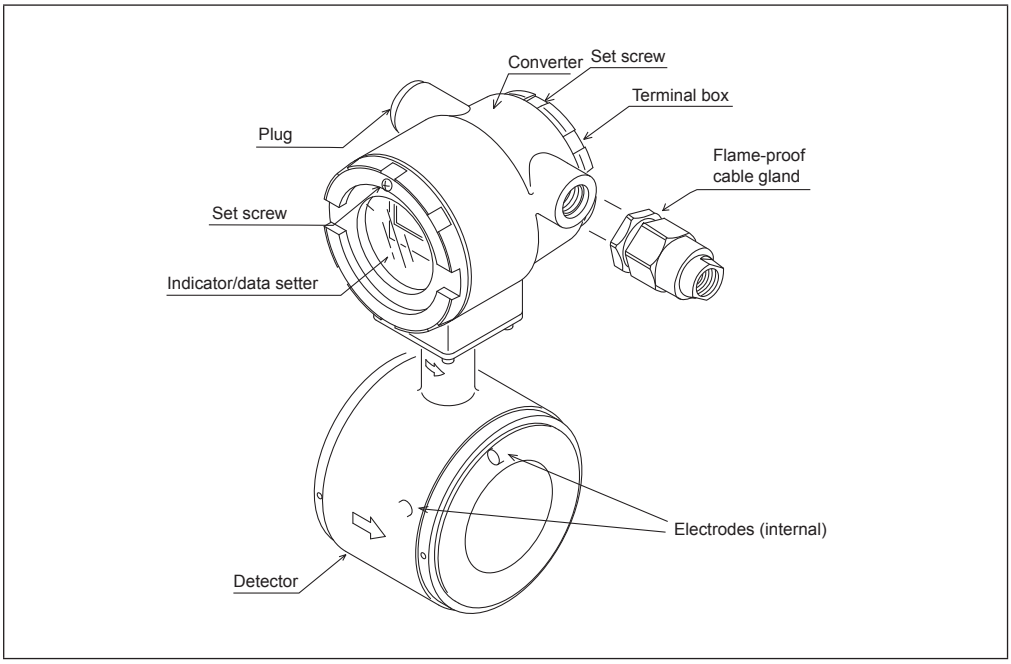


Fig. 1-7. Overview of integral type

Names and description of various parts

The following table gives a description of the various parts.

Name	Description
Detector	■ When a fluid passes through the inside, the detector generates a signal of electromotive force that is proportional to the passing flow rate. ■ Connects to the pipes and supports the entire instrument. ■ As to the electrode position, both electrodes are installed in a horizontal position.
Converter	■ Transmits the signal of electromotive force generated by the detector into an instantaneous flow rate value and outputs it as a flow rate signal.
Indicator/data setter	■ Displays the instantaneous flow rate value and internal conditions of the instrument.
Terminal box	Contains output signal and grounding terminals.
Nameplate	MODEL No., PRODUCT No. and detector constant (EX) are written.
TAG No. plate	TAG No. is stamped according to the order specification.
Set screw	Keep the cover tightened and ensure the flame-proof capability. Use the device with set screw tightened.
Flame-proof cable gland	Seal the cable to assure the flame-proof capability. Required for explosion-proof instrumentation.

Detector 1: Flanged type

Description

The flanged detector has the function and structure as follows:

- When a fluid passes through the inside, the detector generates a signal of electromotive force, which is proportional to the passing flow rate.
- Installs to the pipes and supports the entire instrument.
- As to the electrode position, both electrodes are installed in a horizontal position.

Names of various parts

The structure and names of various parts of the detector are shown.

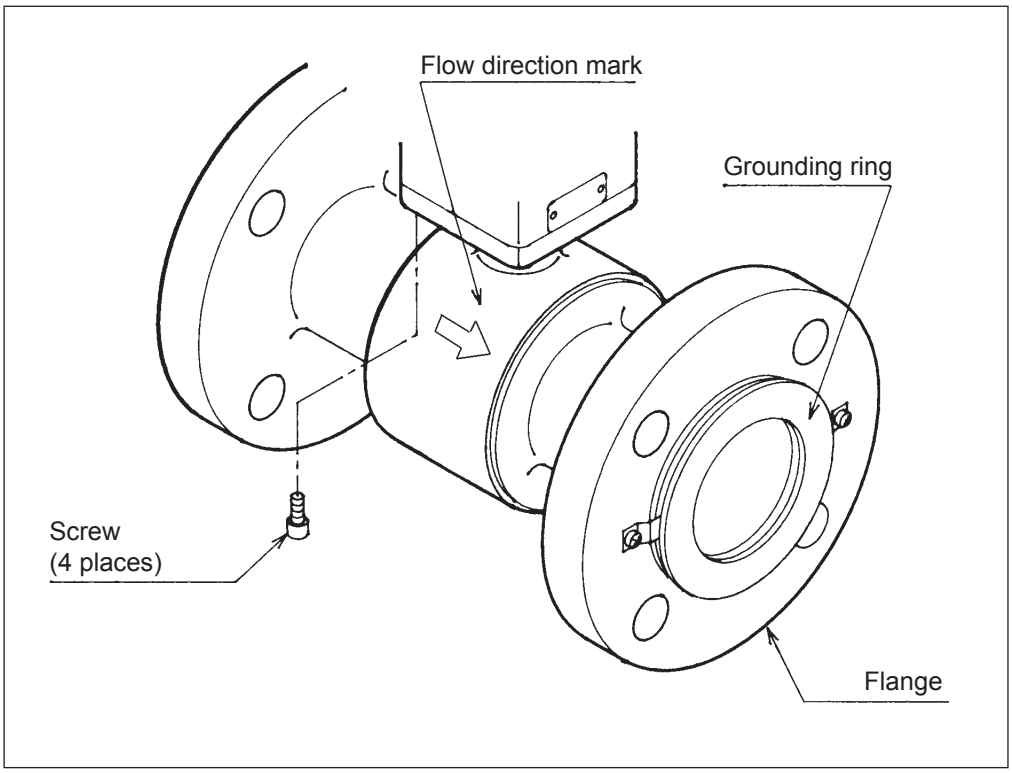


Fig. 1-8. Detector details (Flanged detector)

Names and functions of various parts

The following table describes the various parts of the detector.

Name	Description
Flow direction mark	■ Indicates the flow direction of the fluid. ■ Mount the detector so that the measured fluid flows in the direction indicated by this mark.
Grounding ring	■ Keep reference voltage as zero by grounding the unit. The grounding ring material varies depending on the corrosion characteristics of the measured fluid.
Screw	■ Fixes the detector to the converter. ■ When these screws are removed, the detector direction may be changed with respect to the converter direction.
Flange	The flanges depend on the flanges on the pipes to which to connect.

Detector 2: Wafer type

Description

The wafer type detector has a function and structure as follows:

- ■ When a fluid passes through the inside, the detector generates a signal of electromotive force that is proportional to the passing flow rate.
- ■ As to the electrode position, both electrodes are installed in a horizontal position.

Names of various parts

The structure and names of various parts of the detector are shown.

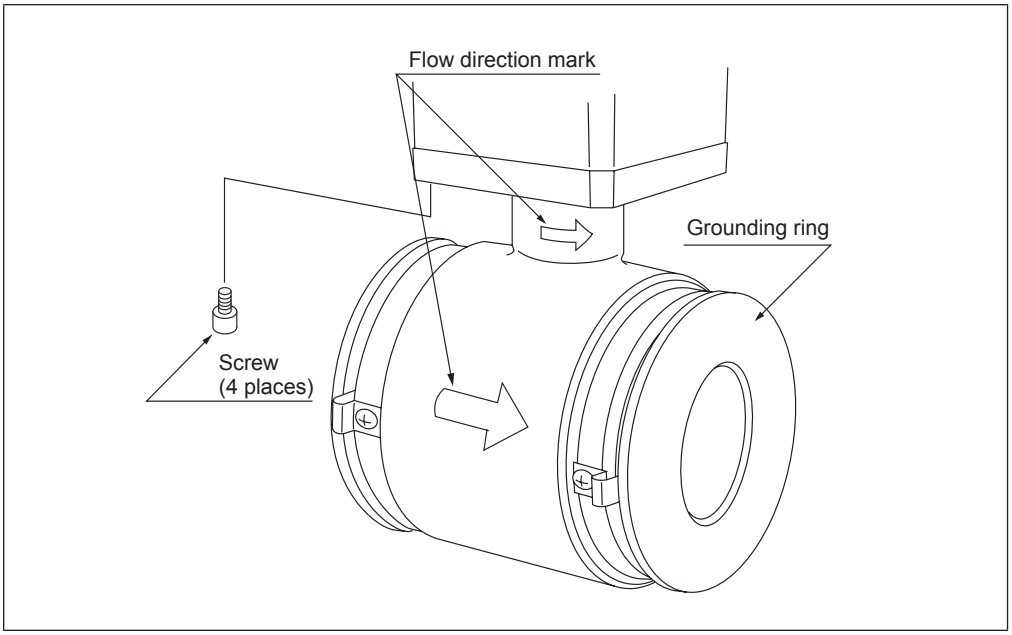


Fig. 1-9. Detector details (wafer-type detector)

Names and functions of various parts

The following table describes the various parts of the detector.

Name	Description
Flow direction mark	■ Indicates the flow direction of the fluid. ■ Mount the detector so that the measured fluid flows in the direction indicated by this mark.
Grounding ring	■ Keep reference voltage as zero by grounding the unit. The grounding ring material varies depending on the corrosion characteristics of the measured fluid.

Indicator / data setter

Description

The indicator/data setter has the following function and structure.

■ Displays the instantaneous flow rate value and internal conditions of the instrument.

■ The indicator face can be turned at intervals of 90 degrees through one turn.

Names of various parts

The names of various parts of the indicator/data setter are shown.

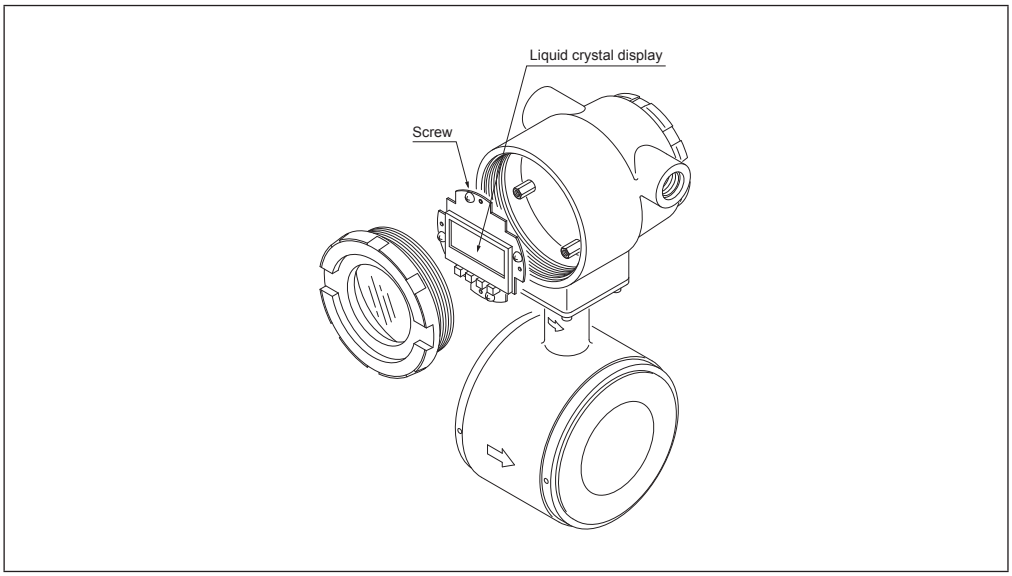


Fig. 1-10. Indicator/data setter details

Terminal box

Description

The terminal box contains output signal terminals.

Names of various parts

Fig. 1-11. shows the structure and names of various parts of the terminal box.

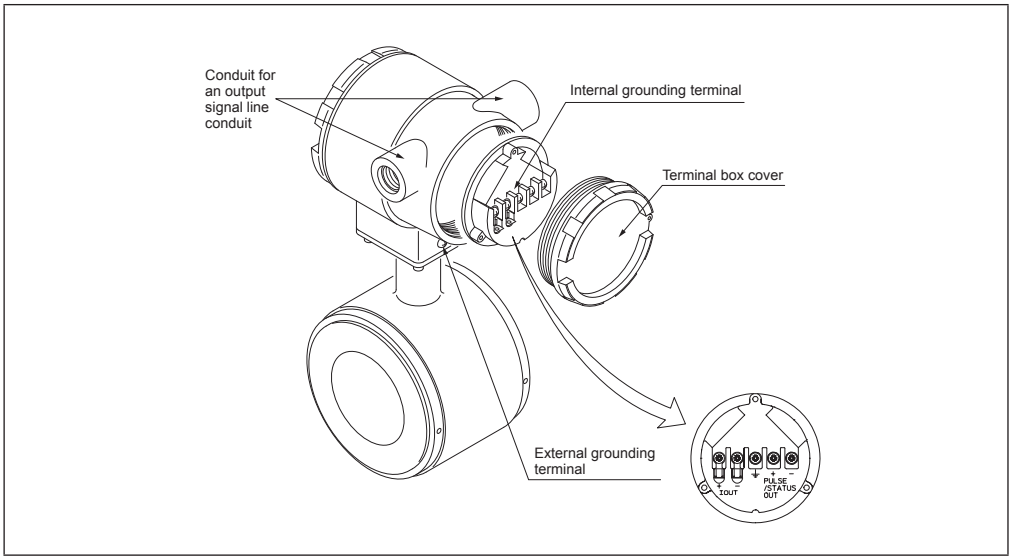
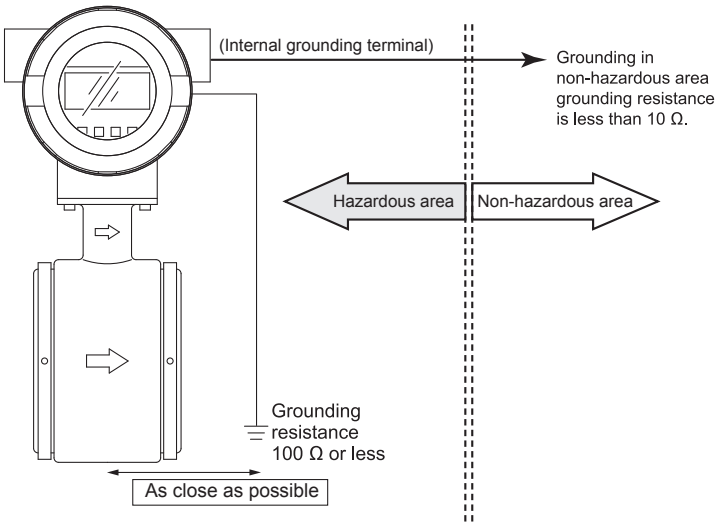


Fig. 1-11. Terminal box details

Names and description of various parts

The following table describes the various parts of the terminal box.

Name	Description
Terminal box cover	■ Watertight construction (equivalent to NEMA 4X)
Wiring precautions	■ Matters to pay attention to when doing wiring work of this instrument are given.
Output signal terminal	■ I.OUT+, - : Analog current output and DC power supply terminals ■ PULSE/STATUS OUT+, - : Open-collector pulse output and contact output terminals
External grounding terminal	■ Make a grounding at a place as close to this instrument as possible. ■ The grounding resistance should be 100 Ω or less. If not grounded, malfunction can result. ■ Internal grounding terminal must be grounded in non-hazardous area with grounding resistance 10 Ω or less. *Note) Grounding in hazardous areas (resistance: 100 Ω max.) and in non-hazardous areas (resistance: 10 Ω max.) must be independent.*  Fig. 1-12. .
Internal grounding terminal	■ If susceptible to noise (while communication takes place), connect one end of the shielded wire to this terminal (which is not used in ordinary cases). ■ Connected inside to the external grounding terminal. When using, take care not to make a two-point grounding.
Socket for an output signal line conduit	■ Wire the signal line through this port. ■ Comes with a plastic dust cover if a type number without a waterproof gland is selected. However, it has no waterproof capability. The customer should provide a waterproof gland.

Chapter 2. Installing the model MTG

Outline of this chapter

This chapter describes the installation and wiring of the instrument.

The necessary components and installing methods depend on the grounding ring material and installed pipe material.

The description proceeds in the following order:

■ Criteria for selecting an installed environment

■ Outline of installing method of the instrument

■ Material wise detailed installing methods

2-1. Before installation

Criteria (1) for installation location

Introduction

To bring out the performance of this instrument to the maximum, choose the optimum installation location according to the following criteria for installation location.

Cautions on surrounding environment

- Install at a place where the ambient temperature is in the range from -4°F to +140°F (-20°C to +60°C) and ambient humidity in the range from 10 to 90% RH. Otherwise, instrument failure or output errors may result.
- Avoid a place close to a large-current cable, motor or transformer that may bring about inductive interferences. Otherwise, instrument failure or output errors may result.
- Avoid a place where there are severe vibrations or a highly corrosive atmosphere. Otherwise, a broken detector or damaged instrument may result.
- Avoid a place exposed to direct sunlight if possible. Otherwise, output errors may result.

Cautions on measured fluid

As to the measured fluid, install the instrument where it satisfies the following conditions. Otherwise, output errors or fluctuations may result.

- A place where the measured fluid has an electric conductivity (the value depending on the converter used in combination) required for measurement and the conductivity distribution can be deemed almost even.
- A place where the measured fluid can be deemed electrochemically homogeneous. If, for example, fluids are mixed upstream of the pipe, a place where the two fluids can be deemed to have mixed together homogeneously.
- If an ingredient is mixed in, a place where the ingredient distribution can deemed to be homogeneous.
- For the accurate flow measurement, verify the zero point value in each excitation current (Manual zero1, manual zero2, and manual zero3) by using manual zero function, if the normal flow velocity is less than 0.3 m/s (0.98 ft/s).
- For the following fluids, do not use this instrument even if the electric conductivity, temperature, pressure and others are within the instrument specifications (see Appendix) because they can cause problems in measurement.

(1) Fluids that have sufficient conductivity at high temperatures, but do not satisfy the conductivity requirement at room temperature (about 68°F (20°C)).
(For example, fatty acids and soap)

(2) Some fluids with a surfactant mixed in
(For example, rinse, shampoo and CWM)

(3) Insulating adhesive materials
(For example, oil, kaolinite, kaolin, calcium stearate)

(4) Slurry fluids containing solid matter
(For example, pulp slurry, mud slurry, cement slurry)

Caution On PLC Connection

A circuit in some PLC may affect the flow measurement and the analog output may fluctuate.

In this case, make sure that the both PLC and the MTG flowmeter are properly grounded. Proper grounding solves the fluctuation problem.

Cautions after installation

⚠CAUTION

(1) Avoid using this instrument as a foothold after installation because such a use may cause damage to equipment or humans.

(2) The integral type of this instrument uses glass for the converter window. It can break if hit by a hand tool or other kind of utensil, and broken glass pieces may injure you. Pay attention.

⚠WARNING

(1) When removing this instrument, do removal work after ascertaining that there is no residual liquid or pressure in the pipe or inside the detector. Otherwise, you may be injured.

- The output signal or indication may fluctuate depending on pulsation or other conditions of the fluid. In such cases, increase the dumping time constant or take some other measure.
- The analog output may fluctuate due to flow noise, which is generated by the process fluid flow. In such a case, connect the upstream grounding ring to the downstream grounding ring by a wire. The output fluctuation may be reduced.
- Keep any transceiver with a transmission frequency of 470 MHz away from the cable because it may affect the output.

Criteria (2) for installation location

Installed position

Install the instrument at a place where the measured fluid always fills inside the detector. An example of installation is shown in the figure below to illustrate this condition.

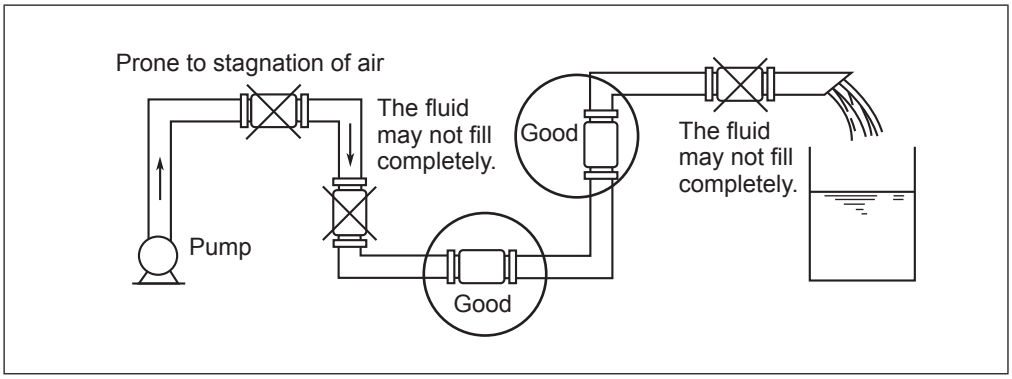


Fig. 2-1. Example of installation

Note) Install the instrument under the condition marked by a circle in the figure above with the detector filled with the fluid in full. If the detector is not filled in full, output errors may result. If empty, output fluctuations may result.

If the measured fluid is highly viscous, we recommend installing the instrument on a vertical pipe and flowing the fluid to ensure an axially symmetrical flow.

Arrange a straight pipe section upstream and downstream of the installed place. For the straight section length, see the figure below.

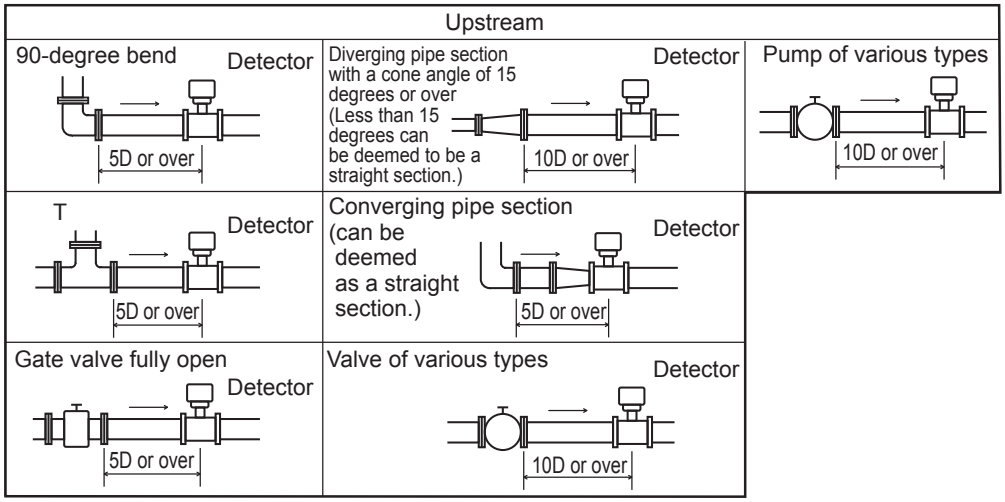


Fig. 2-2. Straight pipe section upstream of detector (D: Nominal detector bore diameter)

■ No straight pipe section is basically needed on the downstream side. However, ensure 2D or over if influences of drift are foreseen.

■ Choose a place where there are little pulsations in the flow (install at a place sufficiently distant from a pump or the like).

■ Ensure a space necessary to maintain the terminal box.

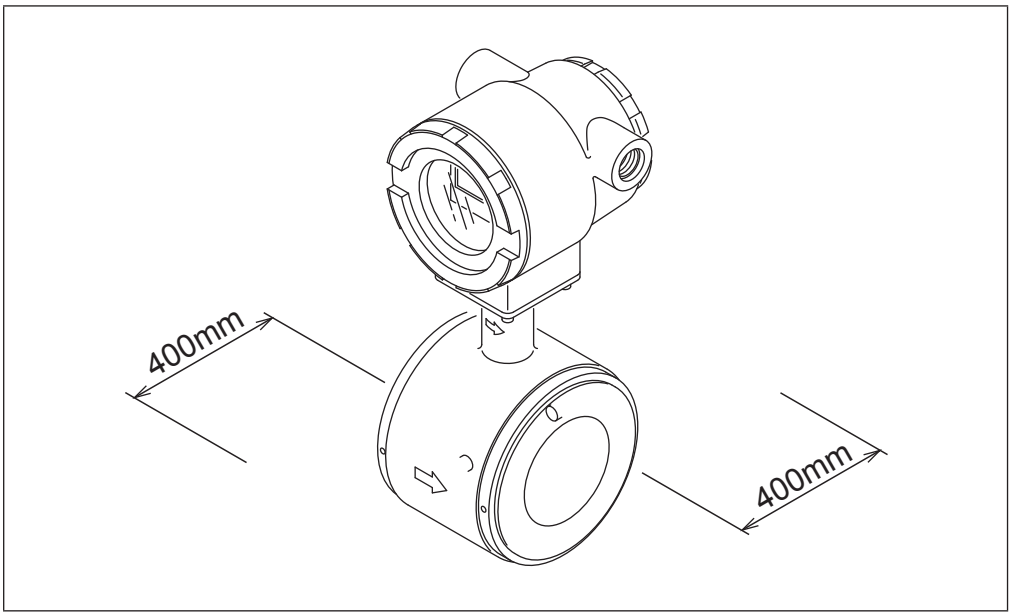


Fig. 2-3. Maintenance space

Direction of display/data setter

Changing the display / data setter direction

The display / data setter can be changed to a horizontal or vertical direction.

Step	Procedure
1	Power-off the converter. For the power-off, use the circuit breaker or the like.
2	The converter front cover is fixed by hexagon socket head setscrews (M3). Loosen the setscrews with an Allen wrench (1.5).
3	Remove the converter front cover by turning it counterclockwise with the dedicated tool. *Note) Remove the front cover straight toward you with care.*
4	The display / data setter is fixed by three screws. Remove these screws. *Note) The screws are not captive to the display / data setter, so take care not to drop them.*
5	Remove the display / data setter. *Note) A cable is attached to the rear side of the display / data setter. This cable is connected to the connector on the converter proper.*
6	Turn the display / data setter to the desired direction and align it to the threaded holes in the converter proper.
7	Fix the display / data setter again using the three screws. When tightening the screws, take care not to entangle the cable.
8	Attach the front cover. *Note) Take care not injure your fingers by the cover edge or the thread in the case.*

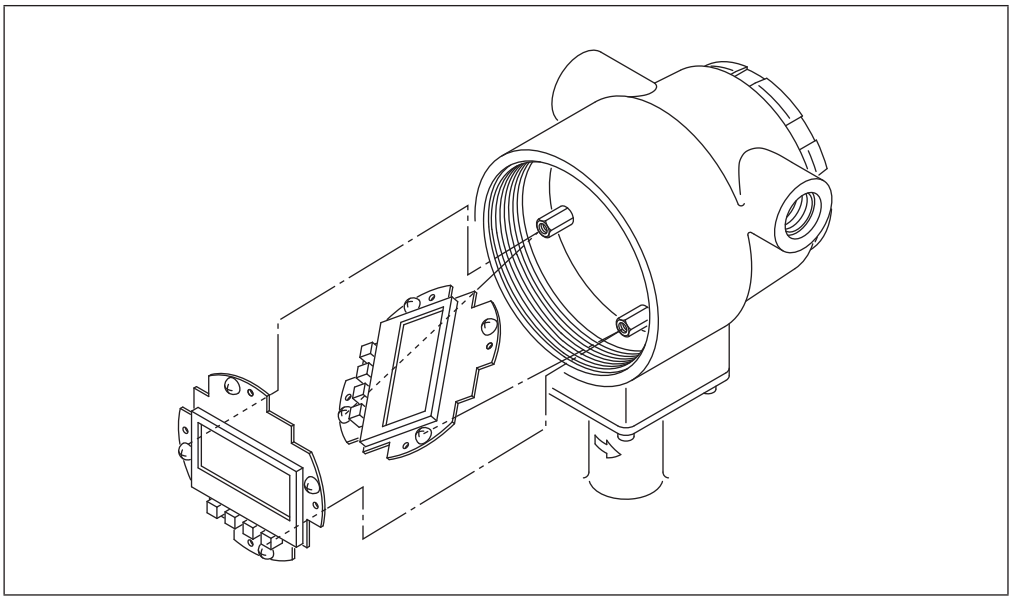


Fig. 2-4. Changing the display / data setter direction

2-2. Method of Installation

2-2-1. Installing a safer type detector

Basic installation method

Introduction

Process connection of the instrument are wafer type, flange type, union, hose, or clamp unit. Referring to the appropriate method of installation, install the unit properly. Installation example Fig. 2-5. shows the basic method for installing the device.

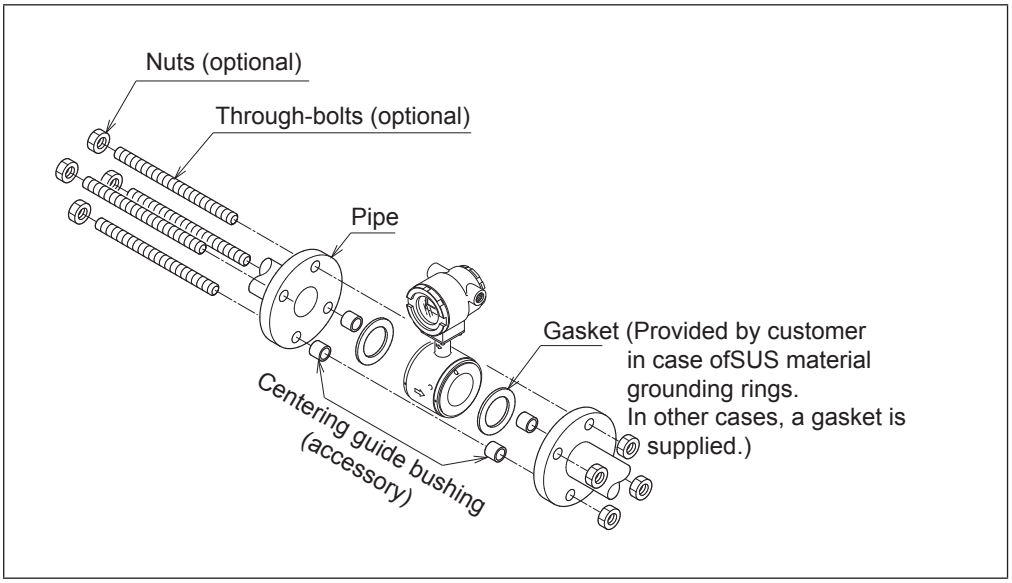


Fig. 2-5. Device installation example

⚠CAUTION

Be careful in handling this unit. It is heavy, dropping it accidentally could cause injury.

Fastening torque

⚠CAUTION

Table 2-1 shows the fastening torque for each pipe bore. Using centering hardware, apply the prescribed fastening torque to prevent any liquid leak from the pipe.

Table. 2-1. Fastening torque

Diameter and flange ratings		Fastening torque N•m (kgf•cm)*	
25 mm (1 inch)	JIS 10K	21 to 31	(214 to 316)*
	JIS 20K	21 to 32	(214 to 326)*
	ANSI/JPI 150	11 to 17	(112 to 173)*
	ANSI/JPI 300	22 to 34	(224 to 347)*
40 mm (1-1/2 inch)	JIS 10K	22 to 32	(224 to 326)*
	JIS 20K	22 to 34	(224 to 347)*
	ANSI/JPI 150	13 to 18	(132 to 184)*
	ANSI/JPI 300	36 to 57	(367 to 581)*
50 mm (2 inches)	JIS 10K	24 to 34	(245 to 347)*
	JIS 20K	19 to 31	(194 to 316)*
	ANSI/JPI 150	23 to 32	(235 to 326)*
	ANSI/JPI 300	20 to 32	(204 to 326)*
65 mm (2-1/2 inches)	JIS 10K	20 to 31	(204 to 316)*
	JIS 20K	37 to 61	(377 to 622)*
	ANSI/JPI 150	26 to 35	(265 to 357)*
	ANSI/JPI 300	37 to 57	(377 to 581)*
80 mm (3 inches)	JIS 10K	20 to 31	(204 to 316)*
	JIS 20K	37 to 61	(377 to 622)*
	ANSI/JPI 150	26 to 35	(265 to 357)*
	ANSI/JPI 300	37 to 57	(377 to 581)*
100 mm (4 inches)	JIS 10K	22 to 33	(224 to 337)*
	JIS 20K	41 to 66	(418 to 673)*
	ANSI/JPI 150	21 to 31	(214 to 316)*
	ANSI/JPI 300	43 to 66	(439 to 673)*

Flange shape

The flanges used should be such that the area of contact with the gasket is maximized, as shown in Fig. 2-6.

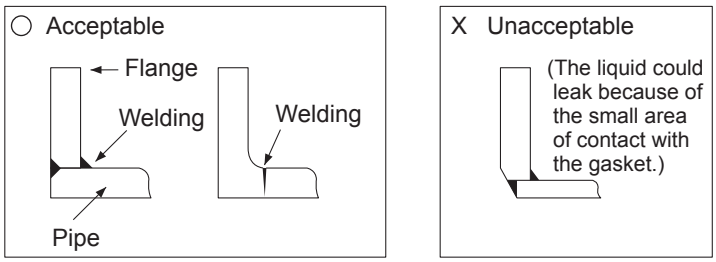


Fig. 2-6. Flange shape

Note) Before installing the detector be sure to flush out any foreign matter that may be present in inside of the detector. Residual foreign matter could cause output fluctuations.

Do not touch the electrodes by your hand or waste cloth with oil. It could cause output fluctuations.

Install the detector in accordance with the flow direction mark on the detector with the direction of the liquid flow. Misalignment could result in a negative output.

⚠ CAUTION

Before installing the detector make sure that the pipe is exactly straight and centered. Any irregularity in these respects could cause leakage or other hazards.

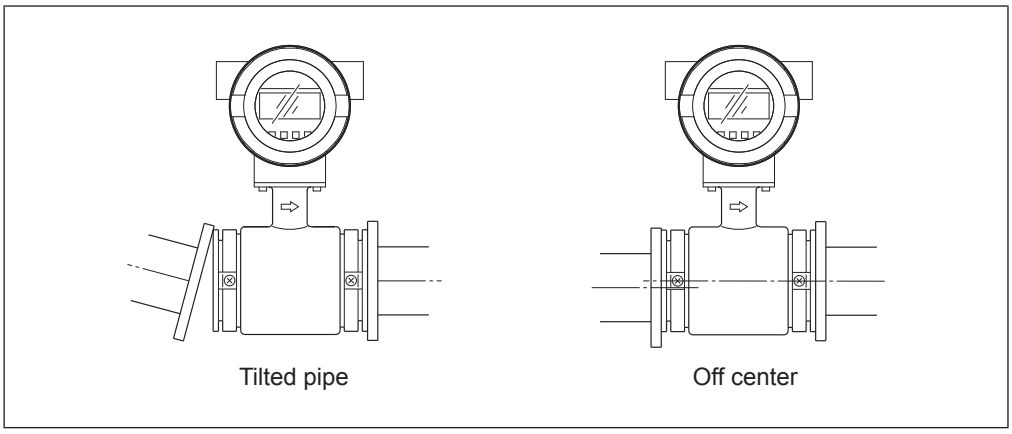


Fig. 2-7. Examples of unacceptable installations (1)

Note) Never force the device between two flanges when the space is too narrow. It can damage the detector.

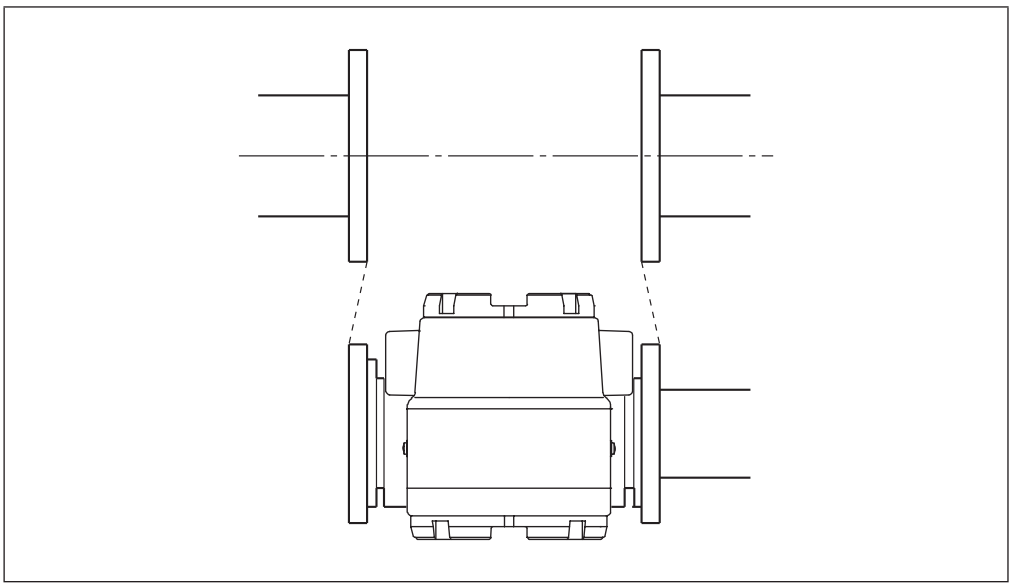


Fig. 2-8. Examples of unacceptable installations (2)

⚠ WARNING

Ensure the bore diameters of the pipe and the detector are exactly the same, install the detector so that the gasket does not protrude into the internal bore of the pipe, as this could result in leakage or other hazards.

Note) Tighten each bolt a little at a time and apply uniform torque to all the bolts while fastening them. If leakage does not stop on completion of fastening, make sure that the pipe is not off center, then tighten the bolts little by little. Install the detector carefully so that the fastening torque does not exceed the prescribed limit; otherwise the detector could be damaged.

Accessory parts for installation

Introduction

The following parts are necessary for the installation of the detector:

- ■ Centering guide bushing (standard accessory)
- ■ Through bolts and nuts (option)
- ■ Gaskets: Provide gaskets by customer when using grounding rings made of SUS material.

  Supplied gaskets as standard accessory, when using grounding rings made of hastelloy, titanium, tantalum, or platinum.
- ■ Protective plate: Required when connecting the detector to polyvinyl chloride (PVC) piping

Centering guide bushings

To install the detector, use centering bushing to ensure the exact centerize of the pipe and the detector.

Slip the centering bolts onto the through-bolts, and set the detector on top of the nuts so that the nuts are on four sides of the detector.

The positions of the centering bushings depend on the direction in which the detector is installed.

For the positions of the centering bushings, refer to Fig. 2-9. and Fig. 2-10.

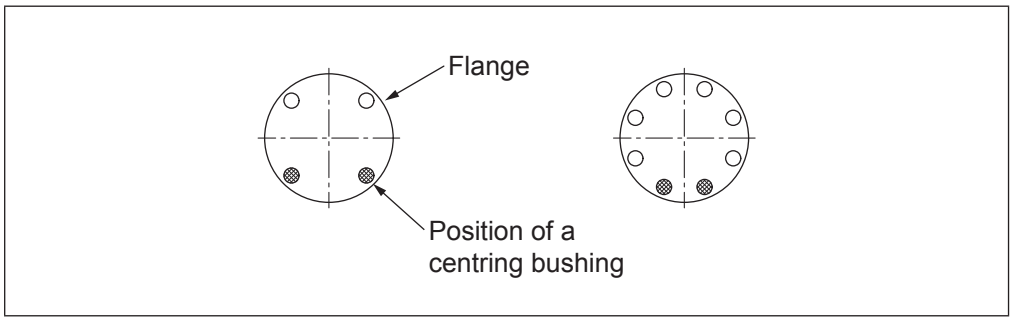


Fig. 2-9. Horizontal centering of the detector (Position two centering bushings against each flange)

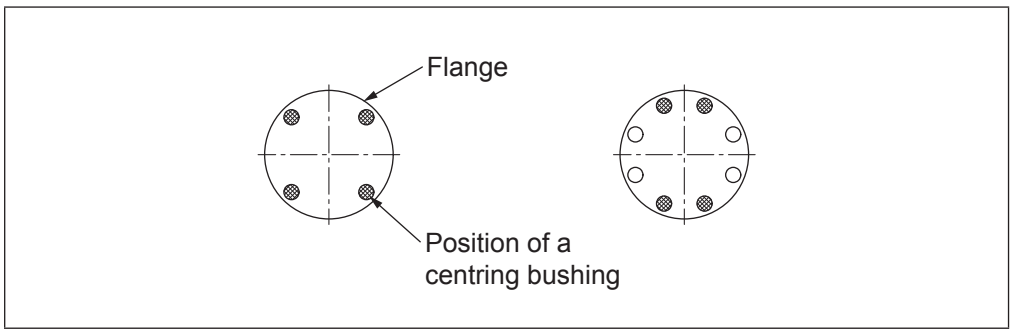


Fig. 2-10. Vertical centering of the detector (Position the four centering bushings on the bottom flange)

Gaskets

Gaskets are supplied with the grounding ring as standard accessory, except when it is made of SUS material. Secure gaskets when you use a grounding ring made of SUS material. We recommend gasket material such as joint sheet or PTFE. For the internal diameters of the gaskets, refer to Table 2-2 We do not recommend the use of rubber gaskets. Observe the precautions below.

Note) A gasket with too small internal diameter may generate turbrent flow and affect resulting in inaccurate measurements.

A gasket with too large internal diameter may cause leakage. Also, any solid substance in the fluid to be measured could accumulate between the gasket and the flange, resulting in inaccurate measurements.

Table. 2-2. Recommended internal diameters of gaskets (Unit: mm)

Body diameter / Dimensions	25 mm (1 inch)	40 mm (1-1/2 inch)	50 mm (2 inches)	65 mm (2-1/2 inches)	80 mm (3 inches)	100 mm (4 inches)
Internal diameter	25±1	40±1	51±1	64±1	76±1	101±1

If you install the detector at a lower torque level using rubber gaskets, you must use gaskets with the internal and external diameters shown in Table 2-3 for the respective pipe size. Depending on the grounding ring material, two gaskets of different thicknesses may be required. (See Fig. 2-16.on page 2-20 and Fig. 2-19.on page 2-22.)

Table. 2-3. Internal and external diameters of rubber gaskets (0.5 to 1 mm thick) (Unit: mm)

Body diameter / Dimensions	25 mm (1 inch)	40 mm (1-1/2 inch)	50 mm (2 inches)	65 mm (2-1/2 inches)	80 mm (3 inches)	100 mm (4 inches)
Internal diameter	25±1	40±1	51±1	64±1	76±1	101±1
External diameter	50±1	75±1	91±1	111±1	121±1	146±1

Table. 2-4. Internal and external diameter of rubber gaskets (3 to 4 mm thick) (Unit: mm)

Body diameter / Dimensions	25 mm (1 inch)	40 mm (1-1/2 inch)	50 mm (2 inches)	65 mm (2-1/2 inches)	80 mm (3 inches)	100 mm (4 inches)
Internal diameter	25±1	39±1	51±1	64±1	76±1	101±1
External diameter	50±1	68±1	84±1	104±1	114±1	139±1

Selecting an installation method

CAUTION

The necessary materials and the installation method vary according to the material of the ring and that of the pipe on which the detector is to be installed. Select the appropriate method of installation after confirming the specifications of the detector to be installed and the conditions of installation. Improper installation may result in leakage or damage to the pipe flanges.

Installation method according to materials

Select the appropriate installation method from the table below.

Pipe material	Grounding ring material	See page
Metal	SUS material	2-17
	Non-SUS material	2-18
PVC	SUS material	2-19
	Non-SUS material	2-21

Installation on horizontal pipe

CAUTION

Improper installation may result in leakage or damage to the pipe flanges.

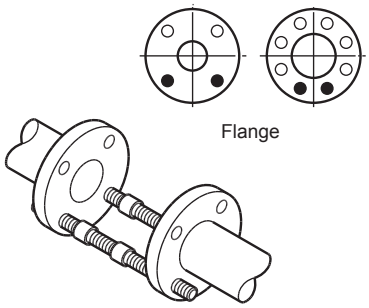
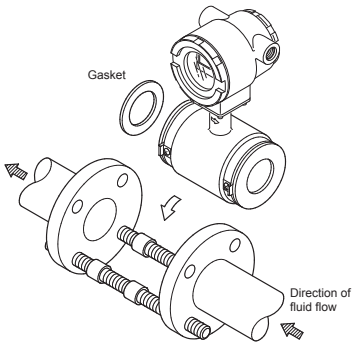
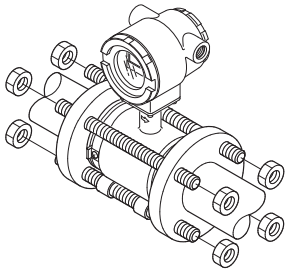
Required accessories

The following parts are required:

- Through-bolts and nuts
- Centering guide bushing
- Gaskets: The required gasket material will vary according to the material of the pipe on which the detector is to be installed. See the installation procedures for different pipe materials described on pages 2-17 to 2-22.

Procedure

Follow this procedure to install the detector on a horizontal pipe.

Step	Action	Drawing
1	Insert through-bolts in the flange holes shown by black dots in the drawing. Slip two centering nuts onto each through-bolt before inserting the bolts.	
2	■ Turn the detector so that the direction mark on the detector matches the direction of fluid flow. ■ Insert the detector and gaskets between the pipe flanges. ■ Position the detector so that it sits on top of the centering.	
3	■ Make sure that the detector remains properly centered. ■ Make sure that the gaskets do not protrude beyond the edges of the pipe flanges. ■ When you have checked these items, insert the remaining through-bolts into the flange holes and tighten the bolts evenly using the appropriate fastening torque given on page 2-14.	

Installation on vertical pipe

⚠CAUTION

Improper installation may result in leakage or damage to the pipe flanges.

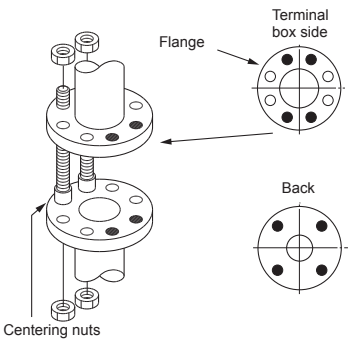
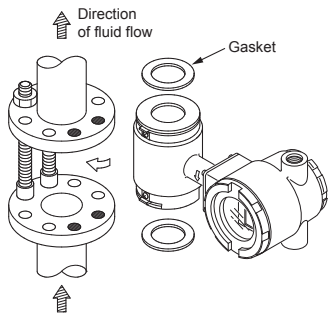
Required accessories

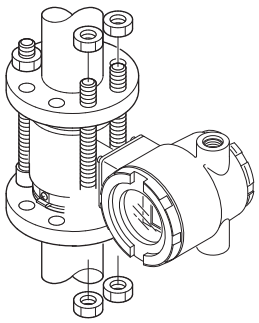
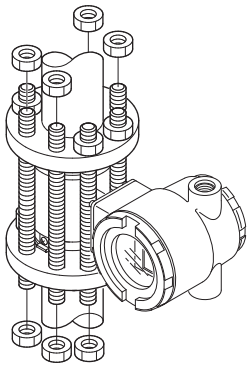
The following parts are required:

- ■ Through-bolts and nuts
- ■ Centering guide bushings
- ■ Gaskets: The required gasket material will vary according to the material of the pipe on which the detector is to be installed. See the installation proce- dures for different pipe materials described on pages 2-17 to 2-22.

Procedure

Follow this procedure to install the detector on a vertical pipe.

Step	Action	Drawing
1	■ Of the flange holes shown by black dots in the drawing, insert through-bolts into the two holes at the back and fasten them lightly with nuts. Slip one centering nut onto each through bolt before inserting the bolts.	
2	■ Turn the detector so that the direction mark on the detector matches the direction of fluid flow. ■ Insert the detector and gaskets between the pipe flanges.	

Step	Action	Drawing
3	■ Insert through-bolts fitted with one centering nut each into the remaining two flange holes shown by black dots in steps 1 and 2.	
4	■ Make sure that the detector remains properly centered. ■ Make sure that the gaskets do not protrude beyond the edges of the pipe flanges. ■ When you have checked these items, insert the remaining through-bolts into the flange holes and tighten the bolts evenly using the appropriate fastening torque given on page 2-16.	

Installation on metal pipe (1)

Introduction

The installation method described in this section corresponds to the following combination of pipe and grounding ring materials. For the installation method corresponding to any other combination, refer to the table on page 2-13.

Pipe material: Metal

Grounding ring material: SUS material

Required accessories

The following parts are required:

- Through-bolts and nuts
- Centering guide bushings
- Gaskets: We recommend non-rubber gaskets such as those made of joint sheet or PTE. For recommended internal diameters, refer to Table. 2-2 on page 2-12. Although rubber gaskets may be used, it is not possible to reduce the fastening torque.

Installation procedure

- Install the detector as shown in Fig. 2-11. The torque level for tightening the bolts is not related to the gasket material. See Table. 2-1 on page 2-8 for the appropriate torque. For the internal diameter of the gaskets, see Table. 2-2 on page 2-12.
- To use rubber gaskets for a low fastening torque, refer to page 2-20.

⚠CAUTION

Please note that the use of rubber gaskets and a lower fastening torque may result in insufficient surface pressure between the lining and the grounding ring, resulting in leakage.

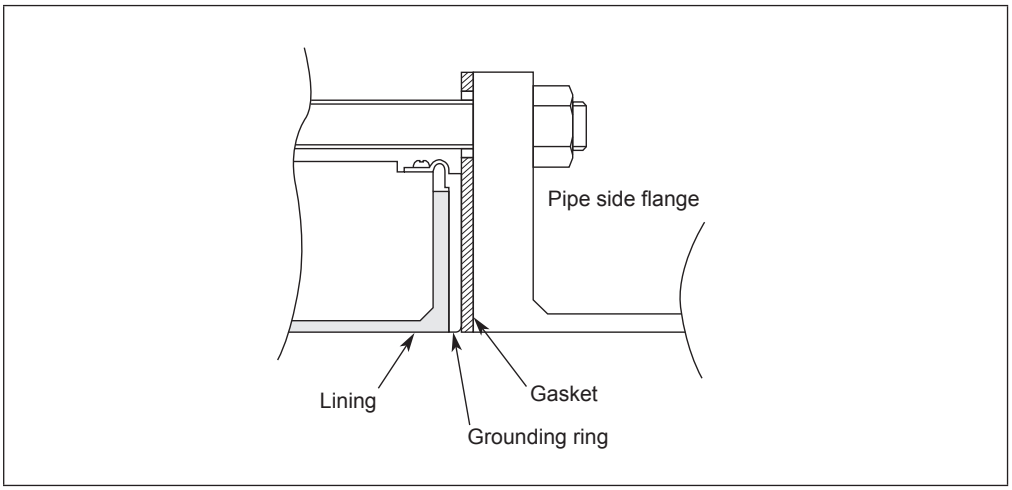


Fig. 2-11. Installation using SUS material grounding ring and metal pipe

Installation on metal pipe (2)

Introduction

The installation method described in this section corresponds to the following combination of pipe and grounding ring materials. For the installation method corresponding to any other combination, refer to the table on page 2-13.

Pipe material: metal

Grounding ring material: other than SUS material

Required accessories

The following parts are required. No gaskets are necessary since PTFE gaskets are provided.

- Through-bolts and nuts
- Centering guide bushings

Installation procedure

- Install the detector as shown in Fig. 2-12. See Table. 2-1 on page 2-8 for the appropriate fastening torque.
- To use rubber gaskets for a low fastening torque, refer to page 2-22.

⚠CAUTION

Please note that the use of an additional gasket besides the existing PTFE gasket may result in leakage (see Fig. 2-13).

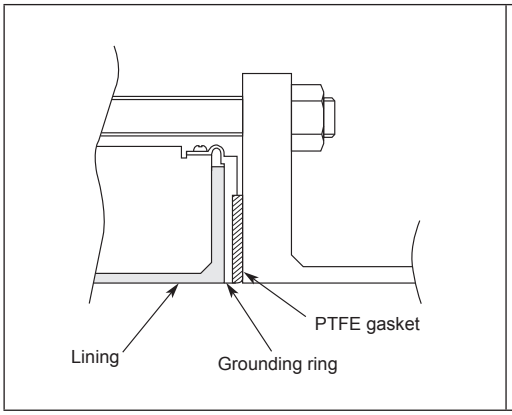


Fig. 2-12. Installation using Non-SUS material grounding ring and metal pipe

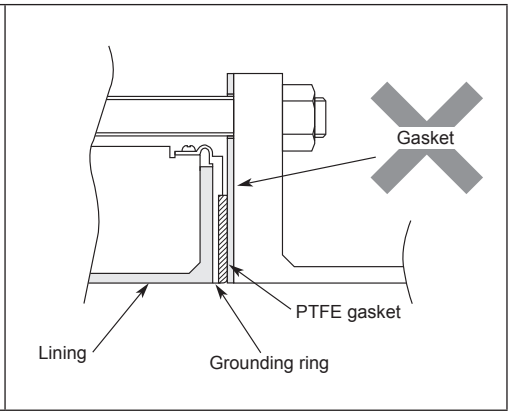


Fig. 2-13. Example of incorrect installation

Installation on PVC pipe (1)

Introduction

The installation method described in this section corresponds to the following combination of pipe and grounding ring materials. For the installation method corresponding to any other combination, refer to the table on page 2-13.

Pipe material: PVC

Grounding ring material: SUS material

Required accessories

The following parts are required:

- Through-bolts and nuts
- Centering guide bushings
- Gaskets: Non-rubber gaskets are recommended (i.e. joint sheet or PTFE). See Table. 2-2 on page 2-12 for the recommended bore diameters. When using rubber gaskets, another gasket of the same material and with a thickness of 0.5 to 1.0 mm is required. See Table. 2-3 on page 2-12 for the appropriated dimensions.
- Protective plate:Use the protective plate if bolt tightening at the specified torque threatens to warp or damage the PVC pipe. See Fig. 2-15. for an illustration of the protective plate.

Installation procedure

The installation procedure varies with such conditions as the fastening torque and the need for a protective plate. Choose one of the following three methods as applicable.

1. Use this method to install the detector with a specified fastening torque.

   Install the detector as shown in Fig. 2-14.

   The torque level for tightening the bolts is not related to the gasket material. See Table. 2-1 on page 2-8 for the appropriate torque. For the internal diameter of the gaskets, see Table. 2-2 on page 2-12.

⚠ CAUTION

Please note that the use of rubber gaskets and a lower fastening torque may result in insufficient surface pressure between the lining and the grounding ring, resulting in leakage.

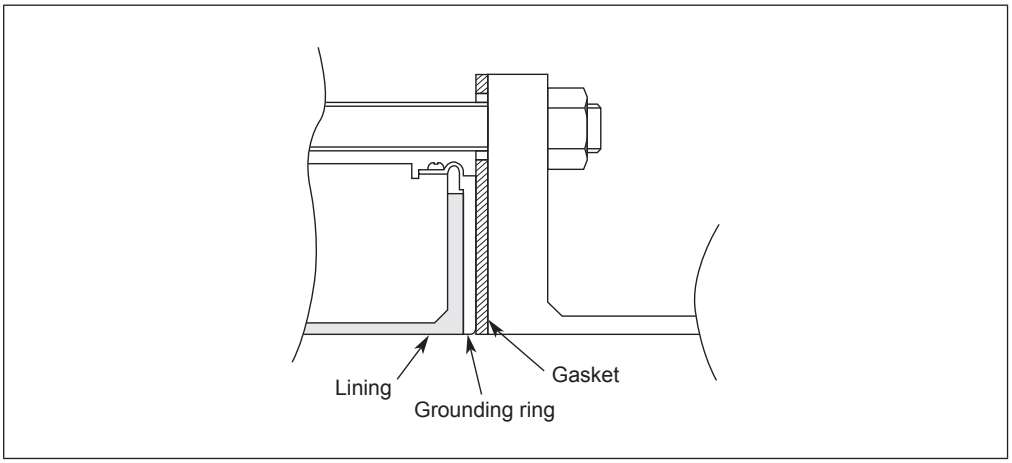


Fig. 2-14. Installation using SUS material grounding ring

2. Use this method to install the detector using a protective plate to prevent the PVC pipe from being deformed or damaged when the bolts are tightened with the specified torque.

   Install the protective plate between the outer side of the PVC flange and the detector, as shown in Fig. 2-15. The protective plate protects the PVC pipe from deformation or damage when secured at the specified torque. The torque level is unrelated to the pipe or grounding ring material. See Table. 2-1 on page 2-8 for the appropriate torque.

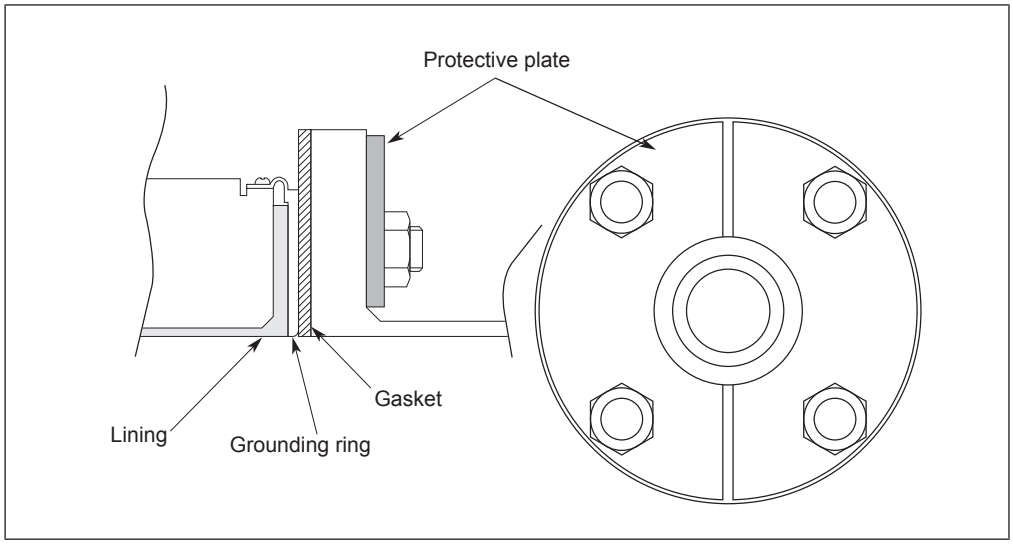


Fig. 2-15. Installation using SUS material grounding ring (with protective plate)

3. Use this method to install the detector using a low fastening torque and rubber gaskets.

   Remove the grounding ring from the detector, insert a rubber gasket 0.5 to 1.0 mm thick, then reinsert the grounding ring on top of the rubber gasket. With the rubber gasket in the position shown in Fig. 2-16, attach the detector to the pipe. Fasten the bolts with a torque that provides a leakproof joint. In this case, use the two kinds of rubber gaskets made of the same material.

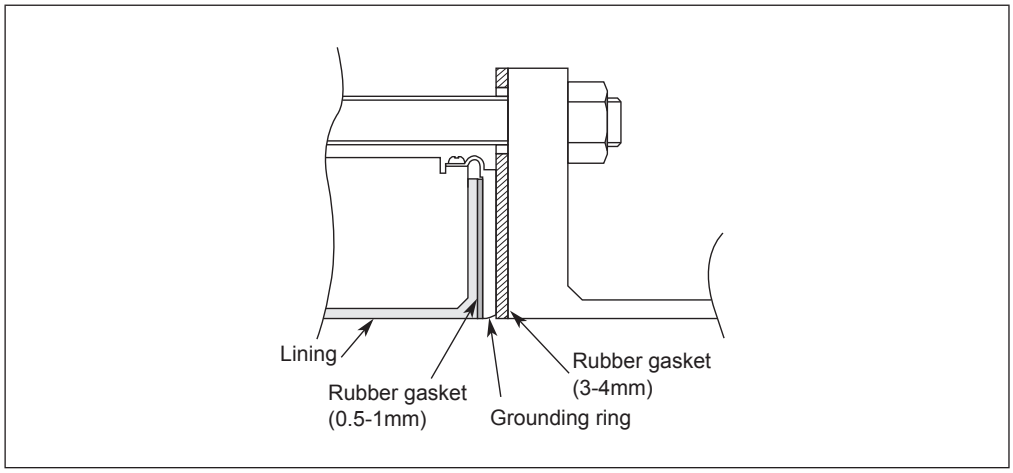


Fig. 2-16. Installation using SUS material grounding ring (with rubber gasket)

Installation on PVC pipe (2)

Introduction

The installation method described in this section corresponds to the following combination of pipe and grounding ring materials. For the installation method corresponding to any other combination, refer to the table on page 2-13.

Pipe material: PVC

Grounding ring material: Other than SUS material

Required accessories

The following parts are required:

- Through-bolts and nuts
- Centering guide bushings
- Gaskets: No gaskets are necessary due to the provision of a PTFE gasket. When using a rubber gasket, gaskets of the same material and of two thicknesses, 0.5 to 1.0 mm and 3.0 to 4.0 mm, are required. See Table. 2-3 and Table 2-4on page 2-21 for the appropriate dimensions.
- Protective plate: A protective plate is required if tightening the bolts to the specified torque may deform or damage the PVC pipe. Use stainless steel or similar hard metal 1 mm thick or over. For the shape, see Fig. 2-18.

Installation procedure

The installation procedure varies with such conditions as the fastening torque and the need for a protective plate. Choose one of the following three methods as applicable.

1. Use this method to install the detector with the specified fastening torque. Install the detector as shown in Fig. 2-17. See Table. 2-1 on page 2-8 for the appropriate fastening torque.

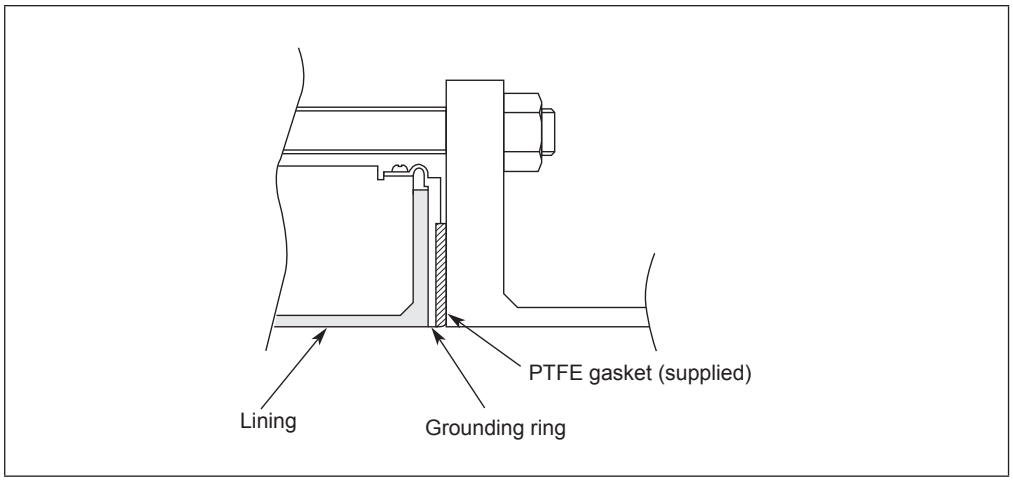


Fig. 2-17. Installation using the grounding ring of Non-SUS material

2. Use this method to install the detector along with a protective plate to prevent PVC pipe from being deformed or damaged when the bolts are tightened to the specified torque.

   Insert a protective plate between the outer side of the PVC flange and the detector as shown in Fig. 2-18. The protective plate protects the PVC pipe from deformation or damage when it is secured to the specified torque. For the appropriate torque, see Table. 2-1 on page 2-8.

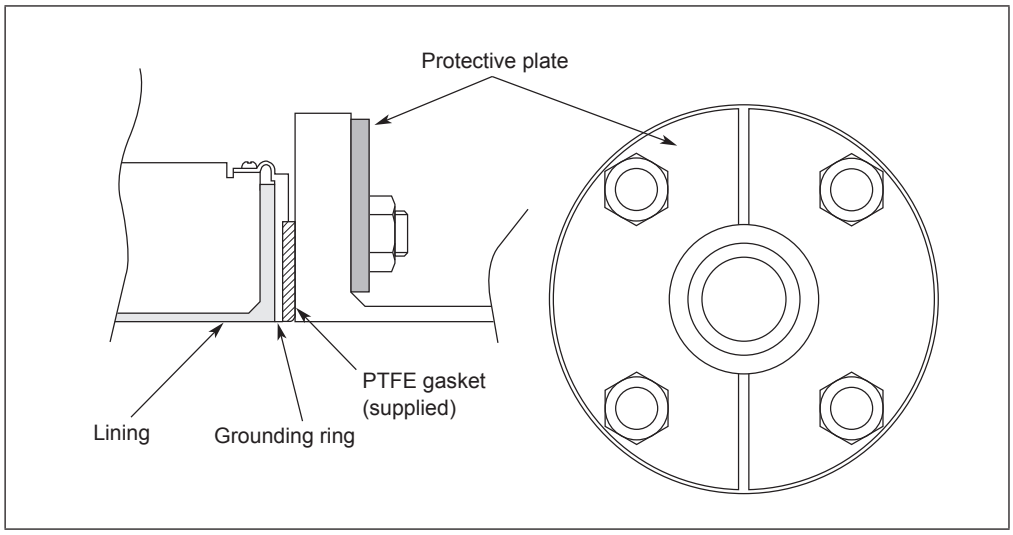


Fig. 2-18. Installation using the grounding ring of Non-SUS material (with protective plate)

3. Use this method to install the detector using a low fastening torque and rubber gaskets.

   First, remove the grounding ring from the detector, then insert a rubber gasket with a thickness of 0.5 to 1.0 mm. Then reinsert the grounding ring on top of the rubber gasket.

   Next, remove the PTFE gasket and insert a rubber gasket 3.0 to 4.0 mm thick to replace it. Under these conditions, install the detector on the pipe as shown in Fig. 2-19. Tighten the bolts to the torque required to achieve a fluid seal for the rubber gasket. In this case, the two kinds of rubber gaskets that are used should be made of the same material. For the dimensions of the rubber gaskets, refer to Table. 2-3 and Table. 2-4 on page 2-12.

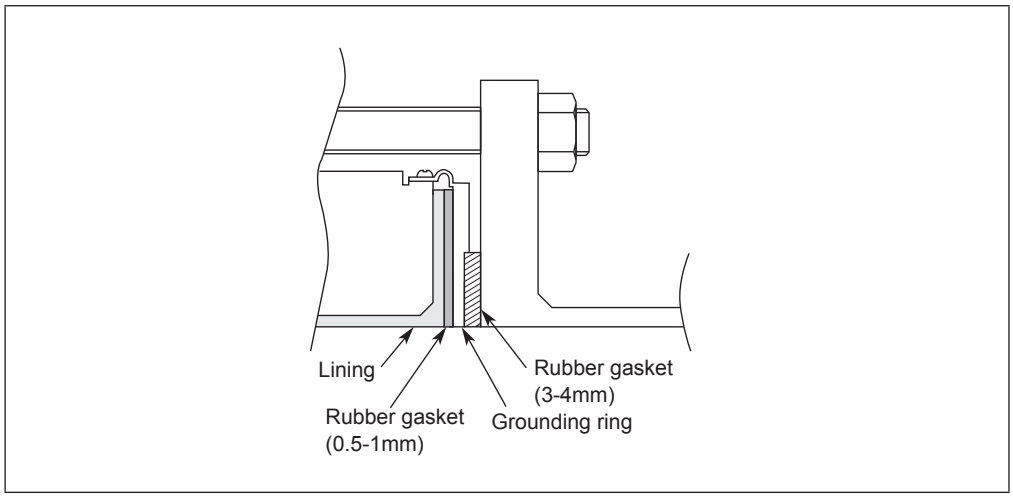


Fig. 2-19. Installation using the grounding ring of Non-SUS material (with rubber gasket)

2-2-2. Installation a flange type detector

Basic installation method

Installation example

Fig. 2-20 shows the basic method for installing the device.

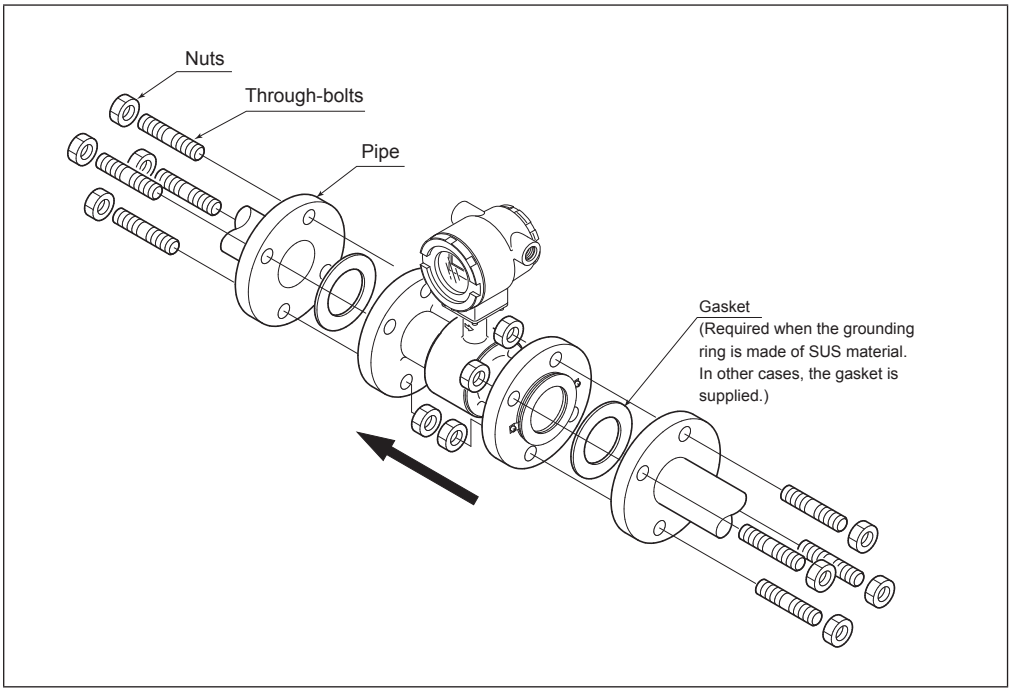


Fig. 2-20. Installation example

Fastening torque

CAUTION

Be careful in handling flanged detectors. Dropping it could cause injury.

WARNING

Table 2-5 shows the fastening torque for each pipe bore. Apply the prescribed fastening torque to prevent leakage.

Table. 2-5. Fastening torque (1)

Diameter and flange ratings		Fastening torque N•m (ft•lb)	
2.5 to 15 mm	JIS 10K	8 to 13	(5.9 to 9.5)
	JIS 20K	8 to 13	(5.9 to 9.5)
	ANSI/JPI 150	9 to 14	(6.6 to 10.3)
	ANSI/JPI 300	10 to 16	(7.3 to 11.8)
25 mm (1 inch)	JIS 10K	21 to 31	(15.4 to 22.8)
	JIS 20K	21 to 32	(15.4 to 23.6)
	ANSI/JPI 150	11 to 17	(8.1 to 12.5)
	ANSI/JPI 300	22 to 34	(16.2 to 25.0)
40 mm (1-1/2 inch)	JIS 10K	22 to 32	(16.2 to 23.6)
	JIS 20K	22 to 34	(16.2 to 25.0)
	ANSI/JPI 150	13 to 18	(9.5 to 13.2)
	ANSI/JPI 300	36 to 57	(26.5 to 42.0)
50 mm (2 inches)	JIS 10K	24 to 34	(17.7 to 25.0)
	JIS 20K	19 to 31	(14.0 to 22.8)
	ANSI/JPI 150	23 to 32	(16.9 to 23.6)
	ANSI/JPI 300	20 to 32	(14.7 to 23.6)
65 mm (2-1/2 inches)	JIS 10K	20 to 31	(14.7 to 22.8)
	JIS 20K	37 to 61	(27.2 to 44.9)
	ANSI/JPI 150	26 to 35	(19.1 to 25.8)
	ANSI/JPI 300	37 to 57	(27.2 to 42.0)
80 mm (3 inches)	JIS 10K	20 to 31	(14.7 to 22.8)
	JIS 20K	37 to 61	(27.2 to 44.9)
	ANSI/JPI 150	26 to 35	(19.1 to 25.8)
	ANSI/JPI 300	37 to 57	(27.2 to 42.0)
100 mm (4 inches)	JIS 10K	22 to 33	(16.2 to 24.3)
	JIS 20K	41 to 66	(30.2 to 48.6)
	ANSI/JPI 150	21 to 31	(15.4 to 22.8)
	ANSI/JPI 300	43 to 66	(31.7 to 48.6)
150 mm (6 inches)	JIS 10K	47 to 67	(34.6 to 49.4)
	JIS 20K	58 to 91	(42.7 to 67.1)
	ANSI/JPI 150	42 to 60	(30.9 to 44.2)
	ANSI/JPI 300	50 to 74	(36.8 to 54.5)
200 mm (8 inches)	JIS 10K	44 to 65	(32.4 to 47.9)
	JIS 20K	66 to 102	(48.6 to 75.2)
	ANSI/JPI 150	42 to 59	(30.9 to 43.5)
	ANSI/JPI 300	81 to 120	(59.7 to 88.5)

Flange shape

Use flanges that will maximize the area of contact with the gasket, as shown in Fig. 2-21.

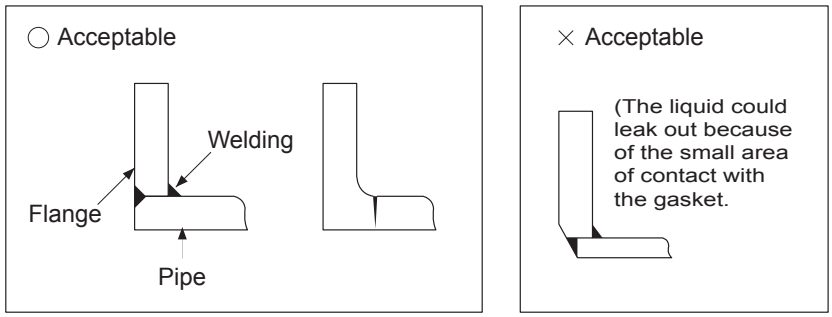


Fig. 2-21. Flange shape

Note) Before installing the detector, make sure any foreign matter is flushed from the inside of the detector. Residual foreign matter could cause output fluctuations.

Do not touch the electrodes by your hand or wasted cloth with oil. This could cause output fluctuations.

Install the detector in accordance with the flow direction mark on the detector in the direction of the liquid flow. Misalignment could result in a negative output.

⚠CAUTION

Never force the detector between two flanges when the space is too narrow.
It can damage the detector.

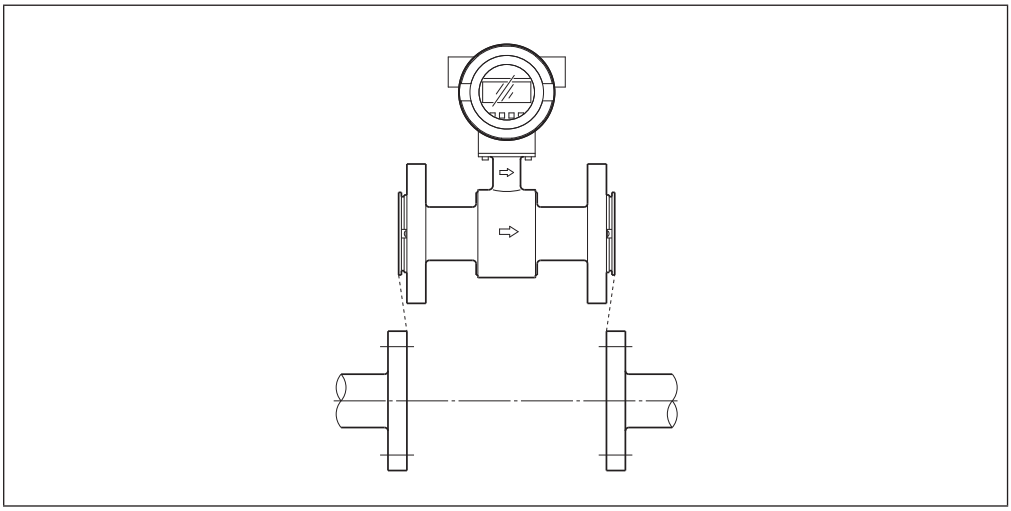


Fig. 2-22. Example of incorrect mounting

⚠WARNING

After ensuring that the internal diameter of the pipe and that of the detector are the exactly the same, install the detector so that the gasket does not protrude into the internal diameter of the pipe. Failing to do so could result in leakage or other hazards.

Note) Tighten each bolt a little at a time, apply uniform torque to all the bolts while fastening them. If leakage does not stop on completion of fastening, make sure that the pipe is not off center, then tighten the bolts little by little. Install the detector carefully so that the fastening torque does not exceed the prescribed limit. Otherwise, the detector could be damaged.

Accessory parts for installation

Introduction

The following parts are necessary for the installation of the detector:

■ Gaskets: Provides gaskets by customer when using grounding rings made of SUS material. Supplied gaskets as standard accessory, when using grounding rings made of other material.

Gaskets

Gaskets are supplied with the grounding ring, except when it is made of SUS material.

Provides the gaskets by customer when you use a grounding ring made of SUS material.

We recommend a non-rubber gasket material such as joint sheet or PTFE.

For the internal diameters of the gaskets, refer to Table. 2-6.

Note) A gasket with small internal diameter may generate turbrent flow and affect, resulting in inaccurate measurements.

A gasket diameter with two large internal may cause leakage. Also, if there are any solids in the fluid to be measured, these may build up between the gasket and the flange, resulting in inaccurate measurements.

Table. 2-6. Recommended internal diameters of gaskets

Body diameter	Internal diameter (mm)
2.5 mm	11±1
5 mm	11±1
10 mm	11±1
15 mm (1/2 inch)	16±1
25 mm (1 inch)	25±1
40 mm (1-1/2 inch)	40±1
50 mm (2 inches)	51±1
65 mm (2-1/2 inches)	64±1
80 mm (3 inches)	76±1
100 mm (4 inches)	101±1
125 mm (5 inches)	124±1
150 mm (6 inches)	148±1
200 mm (8 inches)	196±1

Selecting an installation method

Caution

⚠CAUTION

The necessary materials and the method of installation vary depending on the material of the grounding ring and the material. Select the applicable method of installation after checking the specifications of the detector to be installed and the conditions of installation. Improper installation may result in leakage or damage to the pipe flanges.

Installation method according to material

Select the appropriate installation method from the table below.

Pipe material	Grounding ring material	See page
Metal	SUS material	2-28
	Other than SUS material	2-29
PVC	SUS material	2-30
	Other than SUS material	2-33

Installation on metal pipe (1)

Introduction

The installation method described in this section is to be used with the following grounding ring materials. For the installation method used for any other grounding ring material, refer to the table on page 2-27.

Pipe material: Metal

Grounding ring material: SUS material

Required accessories

The following parts are required:

- Nuts and bolts
- Gaskets: We recommend non-rubber gaskets such as those made of joint sheet or PTFE. For recommended internal diameters, refer to Table. 2-6 on page 2-26 For the recommended internal diameter of the gaskets, see Table. 2-2 on page 2-12.

Installation procedure

- Install the detector as shown in Fig. 2-23. The torque level for tightening the bolts is not related to the gasket material. See Table. 2-5 on page 2-24 for the appropriate torque. For the internal diameter of the gaskets, see Table. 2-2 on page 2-12.

CAUTION

A lower fastening torque may result in insufficient surface pressure between the lining and the grounding ring, resulting in leakage.

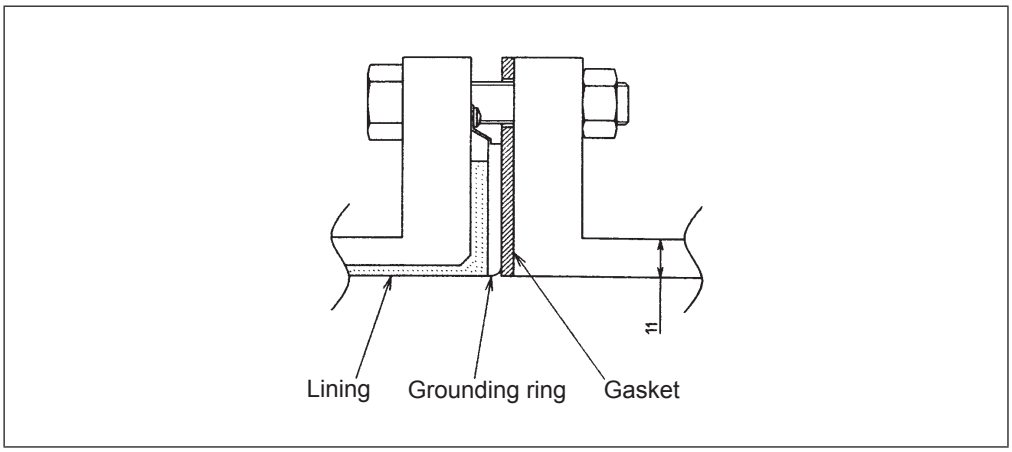


Fig. 2-23. Installation using grounding rings of SUS material

Installation on metal pipe (2)

Introduction

The installation method described in this section is to be used with the following grounding ring materials. For the installation method used with grounding rings of SUS material, refer to the table on page 2-27.

Pipe material: metal

Grounding ring material: other than SUS material

Required accessories

The following parts are required. No gaskets are necessary since PTFE gaskets are provided.

■ Bolts and nuts

Installation procedure

■ Install the detector as shown in Fig. 2-24. See Table. 2-5 on page 2-24 for the appropriate fastening torque.

⚠CAUTION

Please note that the use of an additional gasket besides the existing PTFE gasket may result in leakage (see Fig. 2-25).

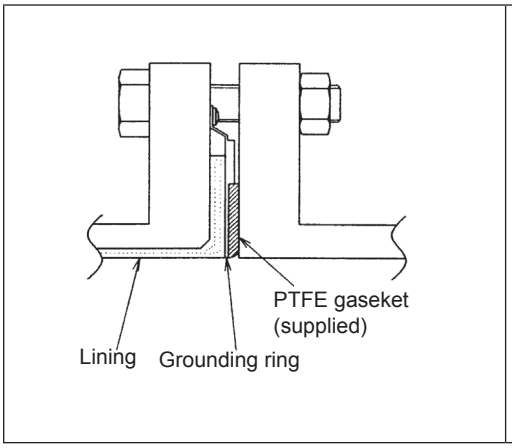


Fig. 2-24. Installation using grounding ring made of Non-SUS material

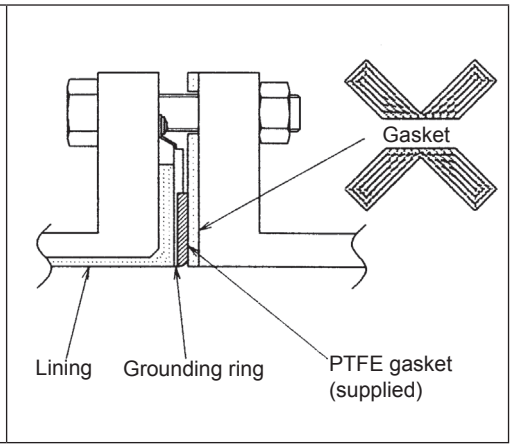


Fig. 2-25. Example of incorrect installation

Installation on PVC pipe (1)

Introduction

The installation method described in this section is used for the following combination of pipe and grounding ring materials. For the installation method corresponding to any other combination, refer to the table on page 2-27.

Pipe material: PVC

Grounding ring material: SUS material

Required parts

The following parts are required:

- Through-bolts and nuts
- Gaskets: Non-rubber gaskets are recommended (i.e. joint sheet or PTFE). See Table. 2-6 on page 2-26 for the recommended bore diameters. When using rubber gaskets, another gasket of the same material and with a thickness of 0.5 to 1.0 mm is required. See Table. 2-3 on page 2-12 for the appropriated dimensions.
- Protective plate: Use a protective plate if bolt tightening to the specified torque threatens to warp or damage the PVC pipe. The plate material must be metal (such as stainless steel at least 6 mm thick) that will not deform when the nuts are tightened. For the shape of the protective plate, see Fig. 2-27.

Installation procedure

The installation procedure varies depending on conditions such as the fastening torque and the need for a protective plate. Choose one of the following three methods as applicable.

1. Use this method to install the detector to the specified fastening torque.

   Install the detector as shown in Fig. 2-26. The torque level for tightening the bolts is not related to the gasket material. See Table. 2-5 on page 2-24 for the appropriate torque. For the internal diameter of the gaskets, see Table. 2-2 on page 2-12.

⚠ CAUTION

Please note that the use of rubber gaskets and a lower fastening torque may result in insufficient surface pressure between the lining and the grounding ring, resulting in leakage.

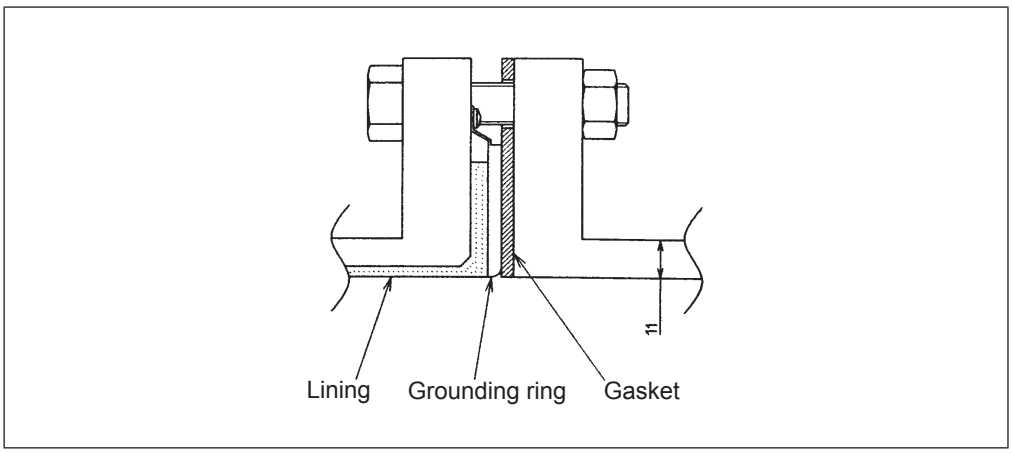


Fig. 2-26. Installation using SUS material grounding ring

2. Use this method to install the detector using a protective plate to prevent PVC pipe from being deformed or damaged when the bolts are tightened to the specified torque.

   Install the protective plate between the outer side of the PVC flange and the detector, as shown in Fig. 2-27. The protective plate protects the PVC pipe from deformation or damage when secured at the specified torque. The torque level is unrelated to the pipe or grounding ring material. See Table. 2-5 on page 2-24 for the appropriate torque. For the internal diameters of the gaskets, see Table. 2-6 on page 2-26.

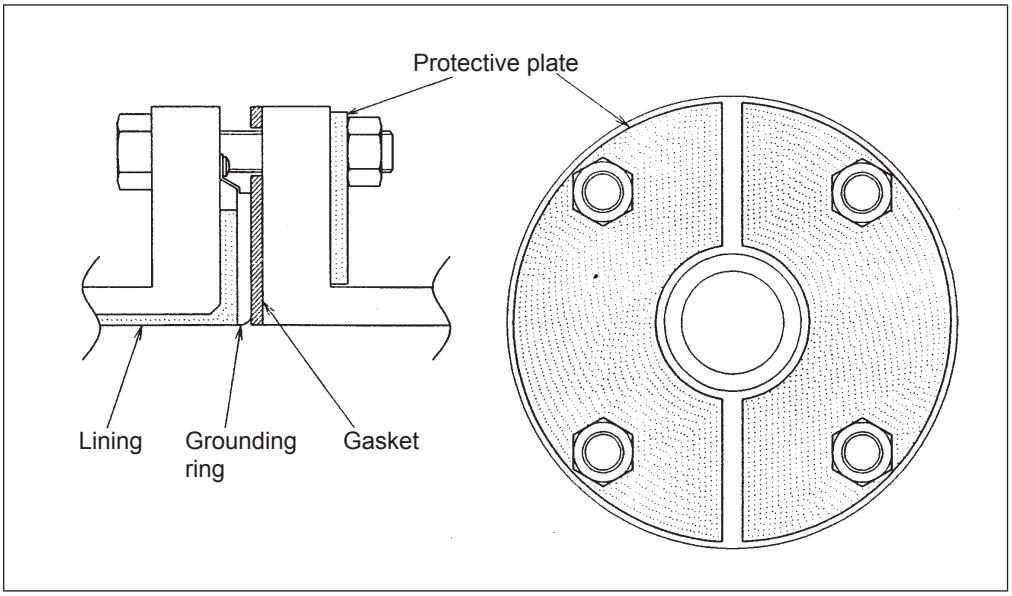


Fig. 2-27. Detector installation using SUS material grounding ring (with protective plate)

3. Use this method to install the detector using a low-fastening torque and rubber gaskets.

   Remove the grounding ring from the detector, insert a rubber gasket 0.5 to 1.0 mm thick between the lining and the grounding ring, then reinsert the grounding ring. Then remove the PTFE gasket, and attach a gasket 3 to 4 mm thick instead. Under these conditions, attach the detector to the pipe as shown in Fig. 2-28. Fasten the bolts to a torque that provides a leakproof joint

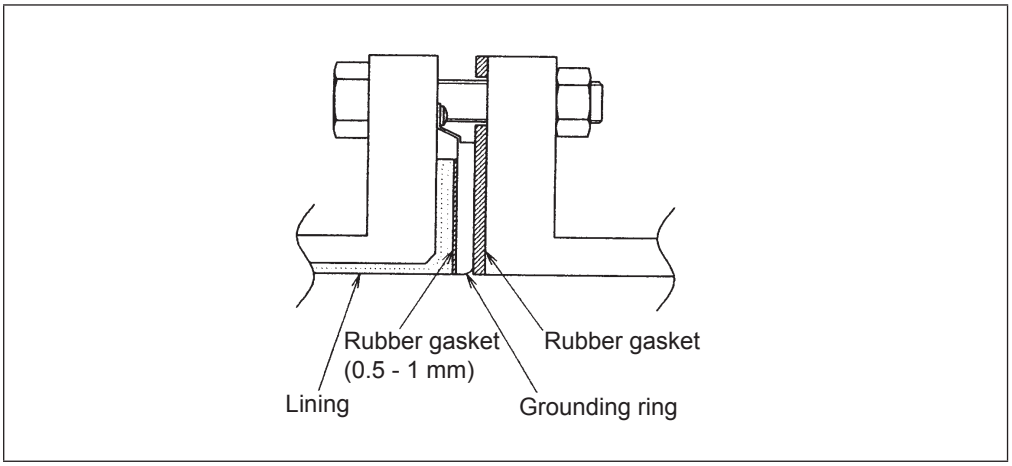


Fig. 2-28. Detector installation using SUS material grounding ring (with rubber gasket)

Installation on PVC pipe (2)

Introduction

The installation method described in this section is to be used for the following combination of pipe and grounding ring materials. For the installation method used for any other combination, refer to the table on page 2-27.

Pipe material: PVC

Grounding ring material: Other than SUS material

Required parts

The following parts are required:

- Through-bolts and nuts
- Gaskets: No gaskets are necessary due to the provision of a PTFE gasket. When using a rubber gasket, gaskets of the same material and of two thicknesses, 0.5 to 1.0 mm and 3.0 to 4.0 mm, are required. See Table. 2-3 and Table. 2-4 on page 2-12 for the appropriate dimensions.
- Protective plate: A protective plate is required if tightening the bolts to the specified torque may deform or damage the PVC pipe. Use stainless or hard metal 1 mm thick or more. For the shape of the metal, see Fig. 2-30.

Installation procedure

The installation procedure varies depending on conditions such as the fastening torque and the need for a protective plate. Choose one of the following three methods as applicable.

1. Use this method to install the detector to the specified fastening torque.
   Install the detector as shown in Fig. 2-29. See Table. 2-5 on page 2-24 for the appropriate fastening torque.

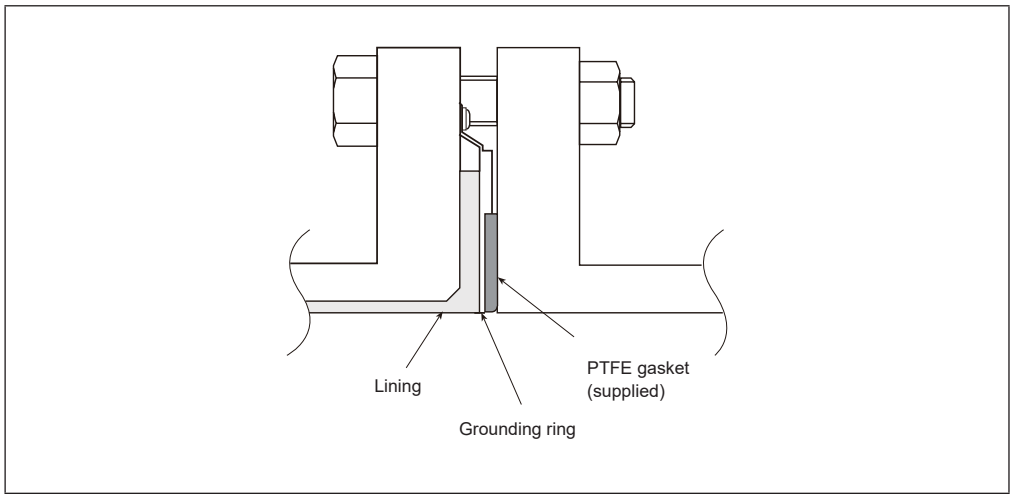


Fig. 2-29. Detector installation using Non-SUS material grounding ring

2. Use this method to install the detector along with a protective plate to prevent PVC pipe from being deformed or damaged when the bolts are tightened to the specified torque.

   Insert a protective plate between the outer side of the PVC flange and the detector as shown in Fig. 2-30. The protective plate protects the PVC pipe from deformation or damage when it is secured to the specified torque. For the appropriate torque, see Table. 2-5 on page 2-24.

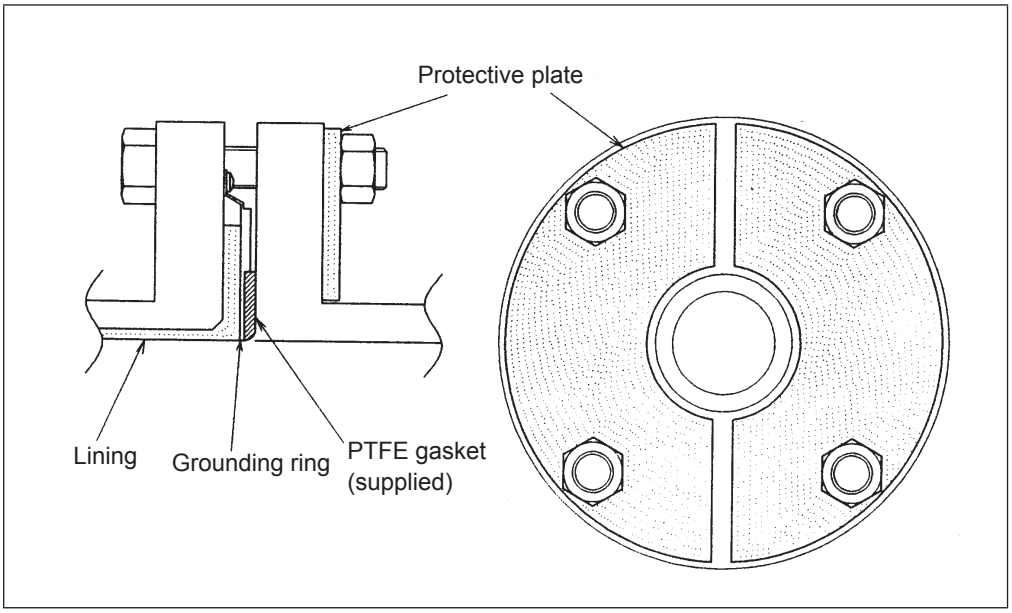


Fig. 2-30. Detector installation using Non-SUS material grounding ring (with protective plate)

3. Use this method to install the detector using a low fastening torque and rubber gaskets.

   First, remove the grounding ring from the detector, then insert a rubber gasket with a thickness of 0.5 to 1.0 mm. Then reinsert the grounding ring on top of the rubber gasket.

   Next, remove the PTFE gasket and insert a rubber gasket 3.0 to 4.0 mm thick to replace it. Under these conditions, install the detector on the pipe as shown in Fig. 2-31. Tighten the bolts to the torque required to achieve a fluid seal for the rubber gasket. In this case, the two kinds of rubber gaskets that are used should be made of the same material. For the dimensions of the rubber gaskets, refer to Table. 2-3 and Table. 2-4 on page 2-12.

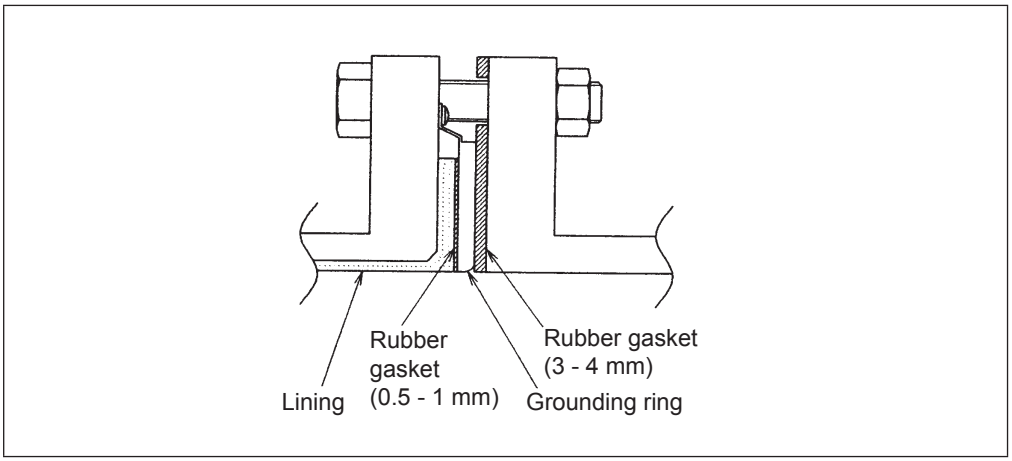


Fig. 2-31. Detector installation using Non-SUS material grounding ring (with rubber gasket)

Chapter 3. Electrical wiring

Outline of this chapter

This chapter describes the electrical wiring of the main unit, SFC and HART® Communicator.

3-1. Electrical wiring

Electrical wiring

Introduction

For this instrument to operate, 15.6 to 42 V DC power supply is required to signals wiring. The electrical wiring of this instrument is described below as to the following items:

- Wiring cable connecting positions
- Dedicated cable connecting positions (detector and converter)
- Power source and load resistance
- Cable selection and cabling
- Grounding
- Wiring connection of power supply and analog current output
- Wiring connection for pulse output
- Wiring connection for contact output
- Wiring procedure

Note) Do not connect commercial power directly to this instrument. Impressing commercial power on this instrument causes unrecoverable damage to the internal measuring circuit.

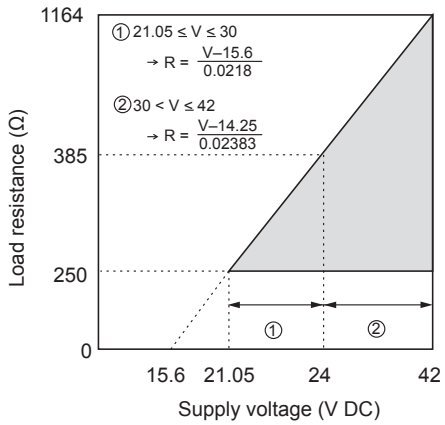
Power and load resistance

Use a direct current (15.6 to 42 V DC) for the power.

Supply 50 V DC or over or 35 V AC or over causes unrecoverable damage to the instrument.

The power ripple should be 1 V or less in peak-to-peak value.

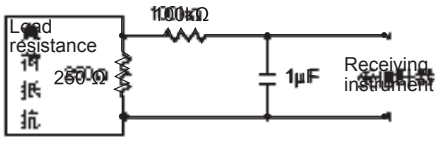
See that the load resistance of the loop wiring should within the operational range shown in Fig. 3-1. with respect to the power supply voltage used.



Note) A load resistance of at least 250 Ω is needed for communication with the SFC or HART® communicator.

Fig. 3-1. Supply power voltage-load resistance characteristics

For a sequencer or other application that does analog/digital conversion of 4-20 mA at high speed, use it after adding the following circuit in parallel with the load resistance.



Selecting the wiring cable

For the electrical cable, we recommend 600 V vinyl insulation, vinyl sheath wire CVV with a conductor area of 2 mm^2 or a stranded wire cable having equivalent or superior performance.

For the wiring in a noisy place, we recommend a two-core shielded cable.

Select a sheath material that can endure the environment (ambient temperature, corrosive gas, corrosive fluid and the like) in which the cable is running.

The cable is wired in to the terminal box through the attached TIIS/KOSHA certified cable gland. Applicable cable outer diameter is from 7 to 12 mm. According to the Fig. 3-2., select an appropriate gland packing and washer to suit the outer diameter of the cable.

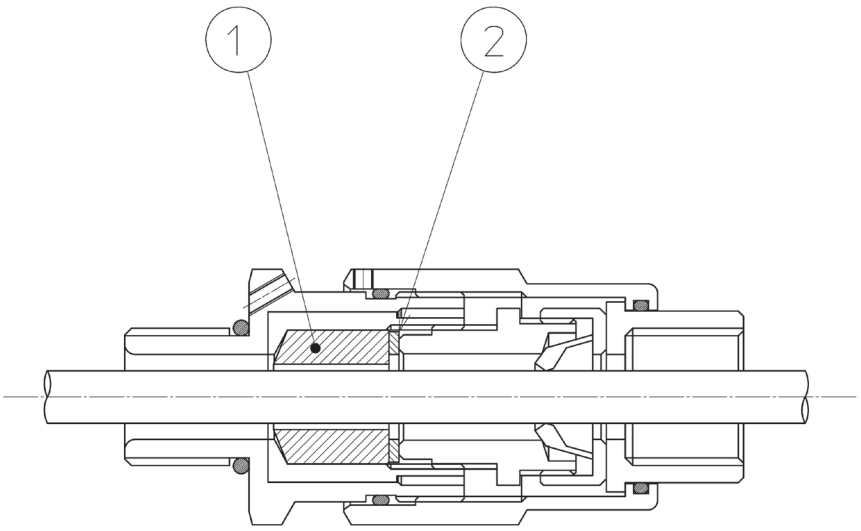
For the terminal treatment of the cable, we recommend a crimp terminal (M4 screw) with an insulating sleeve.

The maximum length of wiring cable is 1500 meters.

Cabling

When running a cable between the instrument and a controller, pay attention to the following:

- The cabling should avoid a large-capacity transformer, motor, power source or other noise source. Do not put the cable in the same tray or duct with other power cables.
- For waterproofing and damage prevention of the wire, we recommend cabling work using conduits and ducts. Use a waterproof gland at the conduit cable ground.



KEY NO.	Name	Material
1	Gland packing	Chloroprene rubber
2	Washer	SUS304

Refer to the following table and select an appropriate gland packing and washer according to the outer diameter of the wired cable.

Outer diameter of the applicable cable	Applicable packing and washer	Remarks
ϕ10 ~12	Gland packing: Inner diameter ϕ12 Washer: Inner diameter ϕ13	Assembled in the cable gland
ϕ7 ~10	Gland packing: Inner diameter ϕ10 Washer: Inner diameter ϕ10	Attached to the cable gland

Fig. 3-2.

Grounding (integral type)

For the grounding terminal, do grounding work (grounding resistance 100 Ω or less) according to Fig. 3-3. or Fig. 3-4. Do not ground both at the same time.

Note) Grounding in hazardous areas (resistance: 100 Ω max.) and in non-hazardous areas (resistance: 10 Ω max.) must be independent.

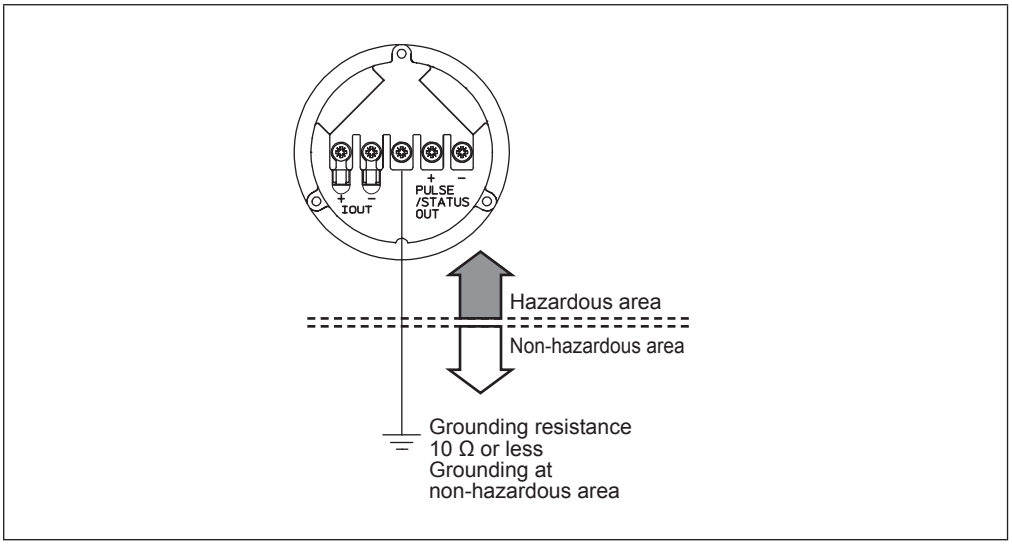


Fig. 3-3. .

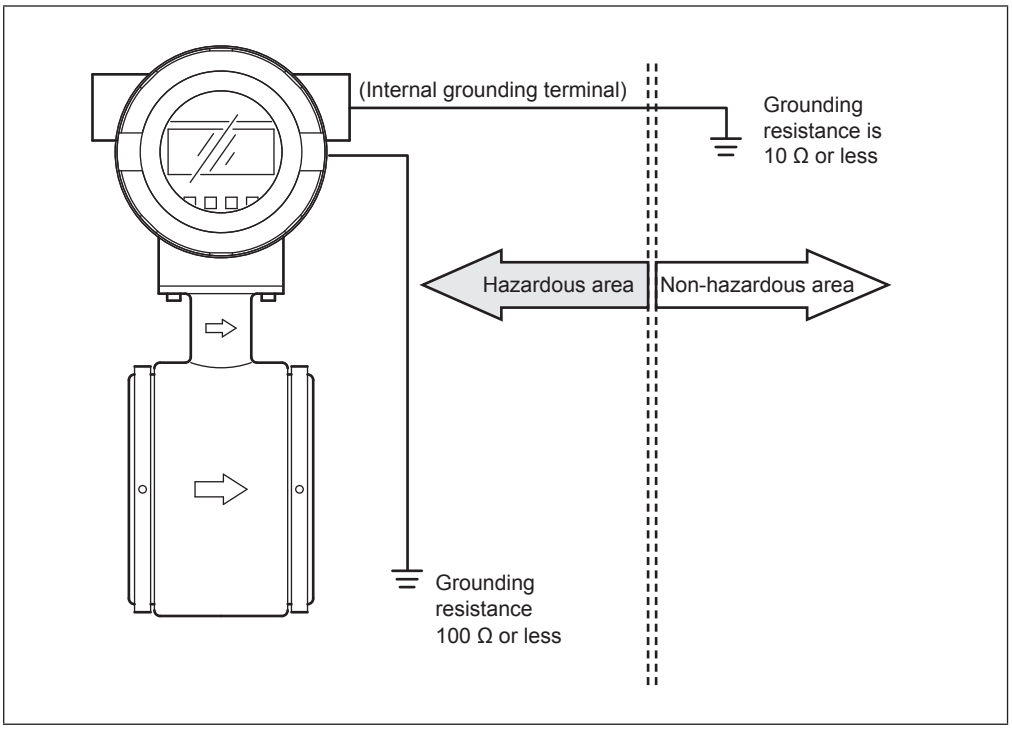
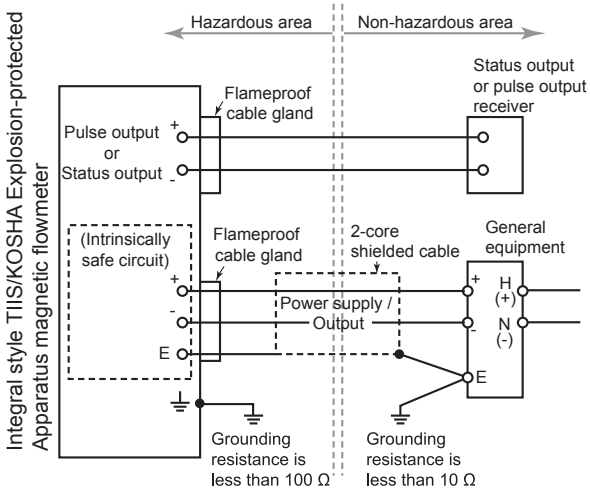
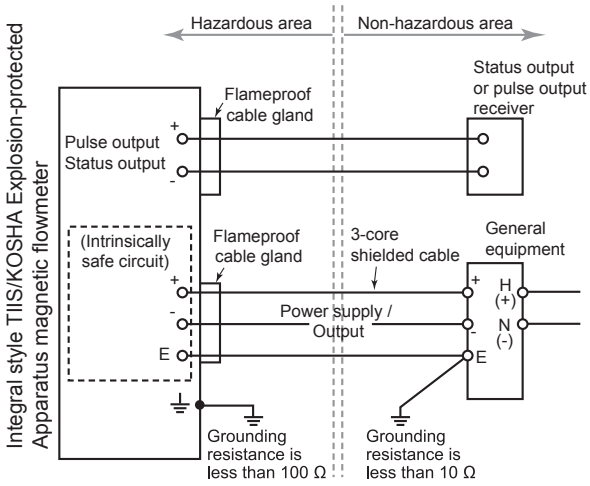


Fig. 3-4. .



or



Note) Grounding in hazardous areas (resistance: 100 Ω max.) and in non-hazardous areas (resistance: 10 Ω max.) must be independent.

Fig. 3-5. Installation method of TIIS/KOSHA Intrinsically Safe

⚠ CAUTION

In accordance with the safety standards of flameproof regulation, please comply with the following instructions:

1. The voltage of general equipment such as the power supply and the receiver should not exceed 250 V AC, 50/60 Hz, 250 V DC at any time at normal or abnormal operation.
2. 1) The ambient temperature around Magnetic Flowmeter is max.50°C (122°F).
   2) The fluid temperature is 125°C (257°F) max. (The line size 10 mm (3/8 inch) or less is 100°C (212°F).)
   3) Please use specified flameproof cable gland adaptors.
   4) Please do not open the case cover during operation.
   5) Please wait for seven minutes after switching OFF the power supply, before opening the front cover or side terminal cover.
3. A specified explosion-proof performance is available only when this electromagnetic flow meter is used according to the described specification.

Wiring connection of power supply and analog current output

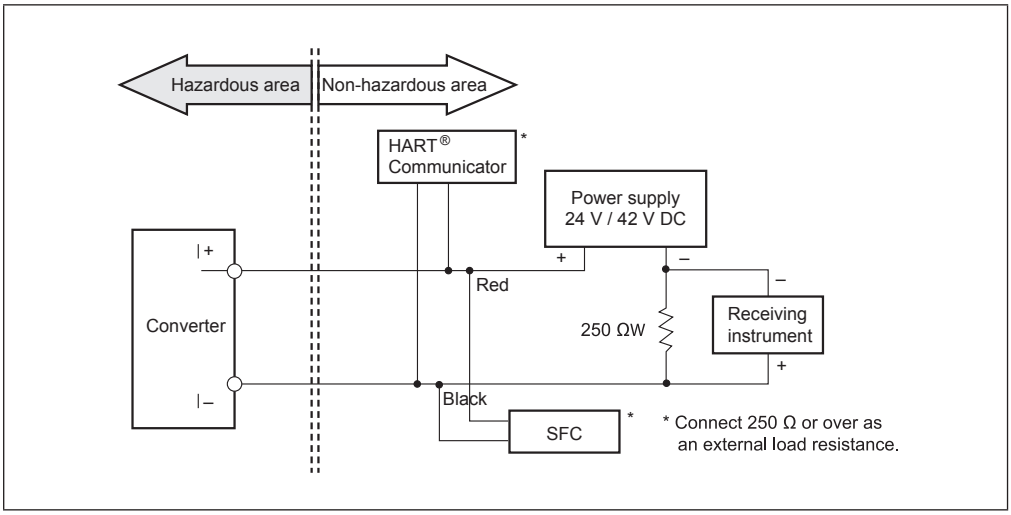


Fig. 3-6. Wire connection diagram

CAUTION

- Incorrect wiring polarity can do damage to the equipment. Double-check the wiring position.
- The SFC and HART® Communicator cannot be used simultaneously.
- Only the communication method selected by the data setter is available.

Wiring connection for pulse output

The pulse output is an open-collector output.

Do wiring paying attention to the voltage and polarity.

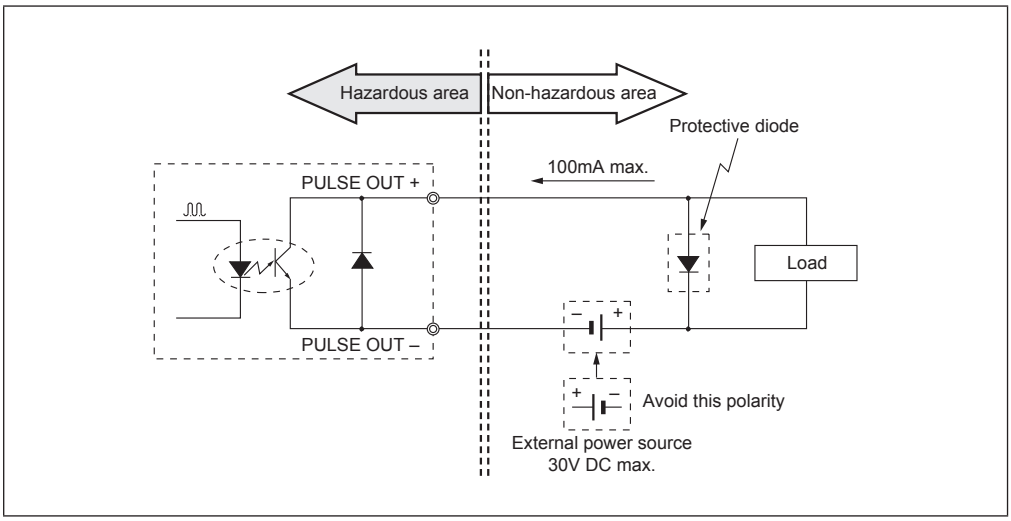


Fig. 3-7. Pulse output wire connection diagram

CAUTION

Incorrect wiring polarity can do damage to the equipment. Double-check the wiring position.

Use an external power source that meets the voltage and capacity specifications.

Wiring connection for contact output

Because of an open-collector output, do wiring paying attention to the polarity.

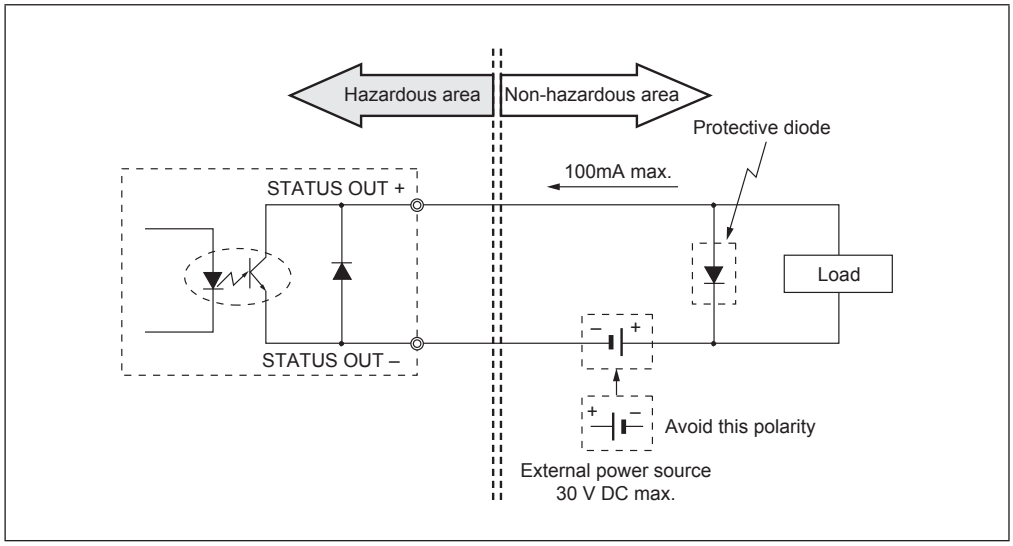


Fig. 3-8. Contact output wire connection diagram

CAUTION

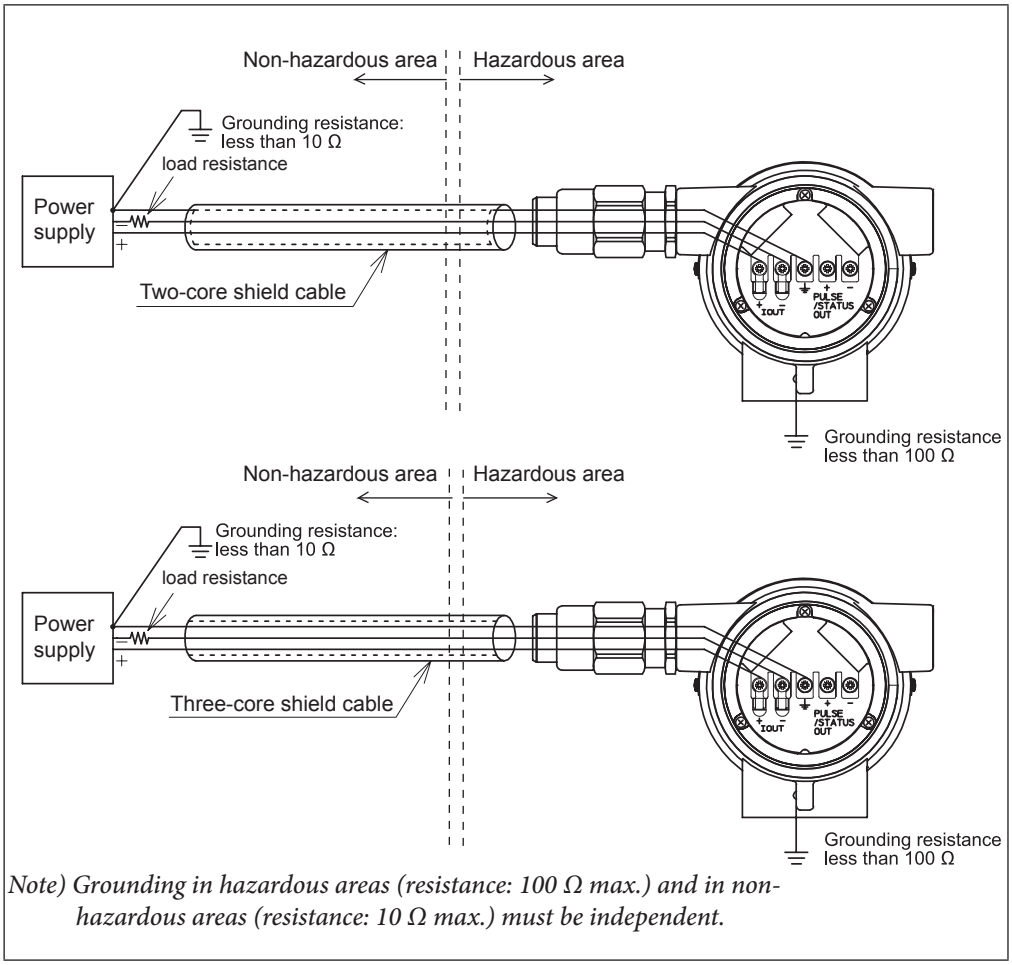
Incorrect wiring polarity can do damage to the equipment. Double-check the wiring position.
Use an external power source that meets the voltage and capacity specifications.

Wiring procedure

Do wiring between the instrument and a power supply according to the following procedure.

Step	Procedure
1	The terminal box cover is fixed by hexagon socket head setscrews (M3). Loosen the setscrews with an Allen wrench (1.5).
2	Remove the terminal box cover by turning it counterclockwise with the dedicated tool.
3	Remove the dust plug in the socket for an output signal line conduit.
4	Insert the cable into the conduit cable ground. *Note) Take care not to do damage to the cable sheath.*
5	Referring to Fig. 3-7, connect the cable to the output signal terminals (IOUT+, -) of the terminal box. *Note) Pay attention to the polarity.* *Tighten the terminal screws well. The recommended tightening torque is 1.1 ft·lb (1.5 N·m).*
6	Waterproof the conduit sufficiently to prevent rainwater or the like from getting in. *Note) We recommend using a silicon resin-based non-curing sealant.*
7	Attach the terminal box cover and tighten it well with the dedicated tool. Then, fix the cover with the setscrews. *Note) Take care not injure your fingers on the cover edge or the thread in the case.*

Wiring for power supply



Note) Grounding in hazardous areas (resistance: 100 Ω max.) and in non-hazardous areas (resistance: 10 Ω max.) must be independent.

Fig. 3-9. Wiring for power supply

Chapter 4. Start and stop operation procedure for model MTG

Outline of this chapter

This chapter describes the procedure to start the instrument and do zero adjustment.

When starting and operating the instrument for the first time, follow the descriptions in this chapter.

4-1. Confirmation before start

Introduction

Before you start up the instrument, confirm the following items. Numbers in parentheses indicate the chapter to which to refer.

(1) Confirm that the electromagnetic flowmeter is installed correctly in the pipes (Chapter 3. Electrical wiring).

(2) Confirm that the electrical wiring is correct (Chapter 3. Electrical wiring).

(3) If communication is required, confirm that the communication equipment is wired correctly (Volume on Communication).

(4) Fill the electromagnetic flowmeter's detector with a fluid and do zero adjustment in a static state (Chapter 5. Operation using the data setting device).

(5) Confirm that there is no leakage at the joint of the electromagnetic flowmeter's detector (Chapter 3. Electrical wiring).

(6) Confirm that the electromagnetic flowmeter's detector is filled with water and there are no stagnant bubbles.

(7) Turn on power and warm up for 30 minutes.

(8) Confirm whether the settings of the data sheet inserted in the converter have been attained. If there is need to change settings to meet your usage, change them using the data setter or the like.

(9) For the accurate flow measurement, verify the zero point value in each excitation current (Manual zero1, manual zero2, and manual zero3) by using manual zero function, if the normal flow velocity is less than 0.3 m/s (0.98 ft/s).

Note) If the detector is not filled with water or many bubbles have adhered inside, the indication may not reach zero flow rate. In such cases, make a flow of water once to ensure that the detector is free of bubbles and filled with water.

With incorrect grounding, the indication of flow rate may fluctuate largely. In such cases, check the grounding condition.

4-2. Stopping

Note) When stopping the instrument from operation and shutting down the output to control equipment, always change over the control equipment to manual control. This is for preventing the instrument's output shutdown from directly influencing the control equipment.

When the following operations are performed, new or changed data are saved in nonvolatile memory.

The time required to write data to nonvolatile memory is about 1 minute, so do not stop operation during that time.

- *Checking data and changing the mode to MEASURING MODE with the data setting device*
- *Changing data and changing the mode to MEASURING MODE with the data setting device*
- *Changing data via HART or SFN communication*

Procedure

When stopping the instrument, follow the following procedure:

Step	Procedure
1	Change over the control equipment of this instrument to be stopped to manual control.
2	Turn off power.

Chapter 5. Operation using the data setting device

This section describes how to operate this system from the data setting device. This system configuration and settings can be made using the four keys on the data setting device.

5-1. Startup

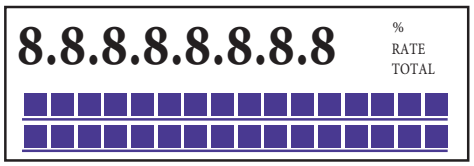
Introduction

With the model MTG, all settings can be configured from the data setting unit.

Startup

When the power supply is turned on, the display changes in the order of OVERALL DISPLAY, SELF CHECK MODE, and MEASURING MODE.

OVERALL DISPLAY



8.8.8.8.8.8.8.8
Main display: 7-segment, 8-digit display
% flow rate Actual flow rate Integration value

Unit display

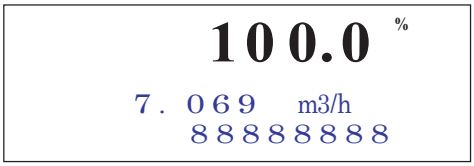
Sub-display Display screen for setting

Displayed for 2 seconds.

SELF CHECK MODE

Main display 7-segment, 8-digit blinks.
The display (-) moves from left to right.
Sub display: SELF CHECK MODE
Displayed for 5 seconds

MEASURING MODE



Display and operation contents of data setting device

Overview of mode

This system provides the following four modes available in accordance with the operations:

Mode	Description
MEASURING MODE	Mode that shows measuring status.
OPERATOR'S MODE	Mode that is set for the operator. This mode is comprised of setting and configuration of data that are set or changed frequently during startup. In this mode, settings can be changed only when the write protect levels are set to 0, 1 and 2. At level 3, only the set data can be checked. (See "5-3-2. Display of write protect level") [Damping constant, auto zero adjustment, counter reset, counter preset value, etc.] **⚠ CAUTION** Set or changed data are temporarily written into the memory. Note that if the configured data are not saved/written into the memory within 10 minutes, the configured data returns to the previous values. Be sure to press the MODE key to return to the MEASURING MODE and to save data.
ENGINEERING MODE	In the set mode for engineering, the mode is comprised of data that is set or changed less frequently than the data in "OPERATOR'S MODE." Data can be set and changed at write protect level 0 or 1. At level 2 or 3, only the set data check is allowed. [ID, function selection, detector data, flow rate range, hysteresis width, pulse data, low flow cut, selecting false mode for output, etc.] **⚠ CAUTION** • When the mode is changed to MEASURING MODE by pressing the MODE key, the set/changed data are saved into a non-volatile memory. Be sure to press the MODE key, to save the configured data. • Set or changed data are temporarily written into the memory. Note that if the configured data are not saved/written into the memory within 10 minutes, the configured data returns to the previous values. Be sure to press the MODE key to return to the MEASURING MODE and to save data.

<table>
<tr><th>Mode</th><th>Description</th></tr>
<tr><td>MAINTENANCE MODE</td><td>A mode for maintenance that is used when adjustments and checks are needed for regular maintenance and when troubles occur. Adjustments and checks are allowed only at write protect level 0.
[Loop check, output adjustment, gain adjustment, etc.]
This mode is furthermore divided into the following three types:
OUTPUT CHECK MODE
CALIBRATION MODE
CRITICAL MODE

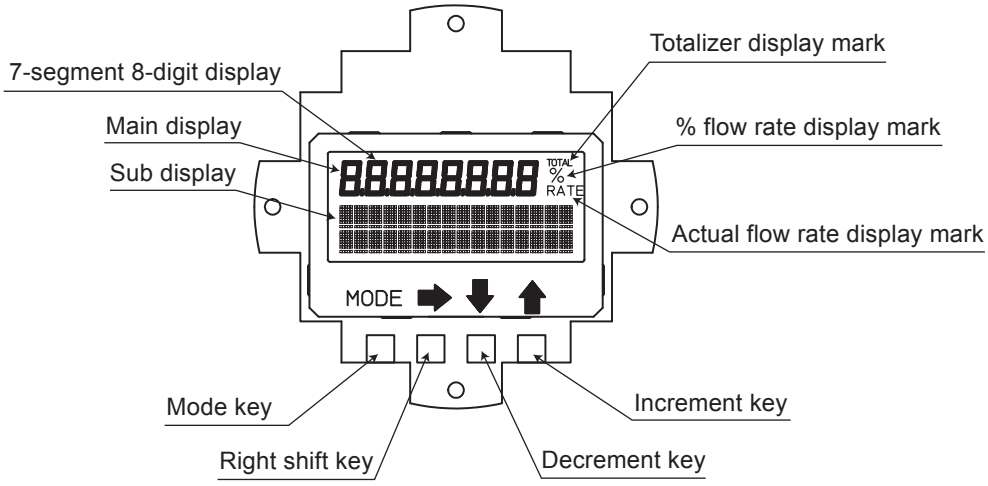
⚠ CAUTION
• CALIBRATION MODE and CRITICAL MODE contains very important adjustment values or operations for the flow rate measurement. Wrong settings make accurate flow rate measurement impossible. For the operation, contact our service engineers.

⚠ CAUTION
• When the mode is changed to MEASURING MODE by pressing the MODE key, the set/changed data are saved into a non-volatile memory. Be sure to press the MODE key, to save the configured data.
• Set or changed data are temporarily written into the memory. Note that if the configured data are not saved/written into the memory within 10 minutes, the configured data returns to the previous values. Be sure to press the MODE key to return to the MEASURING MODE and to save data.
• Writing to nonvolatile memory is executed regardless of whether there has been a change in the data. The time required to write data to nonvolatile memory is about 1 minute, so after changing to MEASURING MODE by pressing the MODE key, wait for at least 1 minute before stopping operation.</td></tr>
</table>

5-2. Functions of the data setting device

5-2-1. Data setting device

Name of parts



Names and Descriptions of Parts

This section describes displays shown on the data setting device.

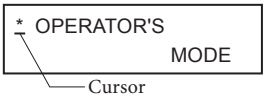
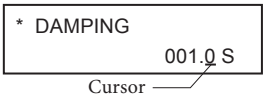
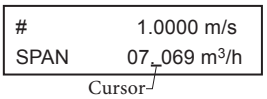
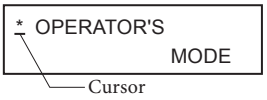
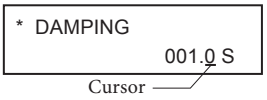
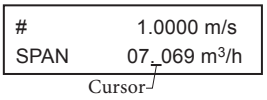
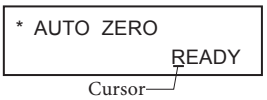
■ Flow rate display

The flow rate display is given at three stages: % flow rate, actual flow rate and totalized value. Operating the key, the main display to be shown at the top stage can be set selecting from the actual flow rate, % flow rate and totalized value.

RATE appears for the actual flow rate display, % for the % flow rate display, and TOTAL for the totalized value display (see "5-3-1. Display overview".).

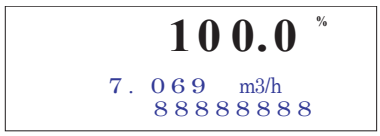
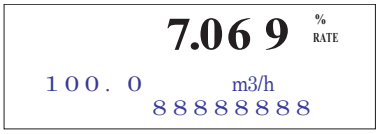
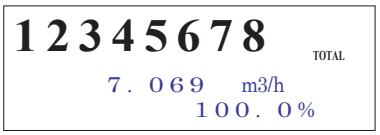
Area	Description
Main display 7-segment 8-digit display	Displays the flow rate display selected for the main display by DISP SELECT in OPERATOR'S MODE.
% flow rate display mark (%)	Displays when % flow rate is shown for the main display.
Actual flow rate display mark (RATE)	Displays when the actual flow rate is shown for the main display.
Totalized value display mark (TOTAL)	Displays when the totalized value is shown for the main display.
Sub display	■ In MEASURING MODE, shows a flow rate display other than a flow rate display selected for the main display by DISP SELECT in OPERATOR'S MODE. ■ In modes other than MEASURING MODE, indicate procedures for setting and adjusting parameters.

This section describes keys on the data setting device.

Name	Description
MODE key	■ Enters OPERATOR'S MODE. ■ When parameters and configured data have been changed in ENGINEERING MODE or MAINTENANCE MODE, press this key to save the data.
Right shift key	■ Moves the cursor to the right.
Decrement key	■ Changes the parameter at a cursor position. ■ Displays the previous screen.  If the key is pressed, when the cursor is placed at the upper left end (*, #, >), the screen will change  If the key is pressed, when the cursor is placed at a number, the number is decremented.  If the cursor is placed at a decimal point, the decimal point moves rightward.
Increment key	■ Changes the parameter at a cursor position. ■ Displays the following screen.  If the key is pressed, when the cursor is placed at the upper left end (*, #, >), the screen will change.  If the key is pressed, when the cursor is placed at a number, the number is incremented.  If the key is pressed, when the cursor is placed at a decimal point, the decimal point moves to the left.  If the cursor is placed over READY, pressing the key starts operation.

5-3. Description of MEASURING MODE

5-3-1. Display overview

% flow rate display 	1st line (Main display): 7-segment 4-digit display % flow rate (%) 2nd line: Actual flow rate display (Significant value of 5 digits) 3rd line: Totalized value display (Significant figure of 8 digits) Write protect level display (WP0 to 3)
Actual flow rate display 	1st line (Main display): 7-segment 4-digit display Actual flow rate (RATE) 2nd line: % flow rate display (Significant figure of 4 digits), unit of actual flow rate 3rd line: Totalized value display (Significant figure of 8 digits) Write protect level display (WP0 to 3)
Totalizer display 	1st line (Main display): 7-segment 8-digit display Totalized value (TOTAL) 2nd line: Actual flow rate display (Significant figure of 4 digits) 3rd line: % flow rate display (Significant figure of 4 digits) Write protect level display (WP0 to 3)

Totalization is not performed, when the output selection is set to the contact output.
However, the previous value is displayed as the totalized value.

* Details on display

% flow rate display: The % flow rate display range is from -115.0% to +115.0%.

A value up to the first decimal place is displayed. The position of the decimal point is fixed.

The integer part to be displayed has up to three digits (0 to 115). In the main display, unnecessary zeros are deleted (but are not deleted in the sub display).

Example) 019.8% → 19.8%

-000.5% → -0.5%

The position of the negative sign (-) is fixed. (The positive sign is not displayed.)

Actual flow rate display: The flow rate displayed in the actual flow rate display is up to 115% of the range or the equivalent.

However, if the flow rate equivalent to 115% of the range exceeds the range of significant figure, the highest value (e.g., 9.999) will be displayed.

In the main display, unnecessary zeros are deleted (but are not deleted in the sub display).

Totalized value display: An totalized value is displayed in 8 digits without signs and decimal points.

In the main display, unnecessary zeros are deleted (but are not deleted in the sub display).

Next to 99999999, totalization starts from 00000000.

5-3-2. Display of write protect level

Protect level

The write protect levels and their corresponding settings and operating condition are shown below.

Write protect level	SW1	SW2	LSC (Key operation)			Communication		
			OPERATOR'S MODE	ENGINEERING MODE	MAINTENANCE MODE	OPERATOR'S MODE	ENGINEERING MODE	MAINTENANCE MODE
0	OFF	OFF	R/W ENABLE	R/W ENABLE	R/W ENABLE	R/W ENABLE	R/W ENABLE	R/W ENABLE
1	ON	OFF	R/W ENABLE	R/W ENABLE	R/W ENABLE	R ONLY	R ONLY	R ONLY
2	OFF	ON	R/W ENABLE	R ONLY	R/W ENABLE	R ONLY	R ONLY	R ONLY
3	ON	ON	R ONLY	R ONLY	R/W ENABLE	R ONLY	R ONLY	R ONLY

R/W: Read and write (Reads and writes set values.)

R: Read

W: Write

ENABLE: Enabled

Disable: Disabled

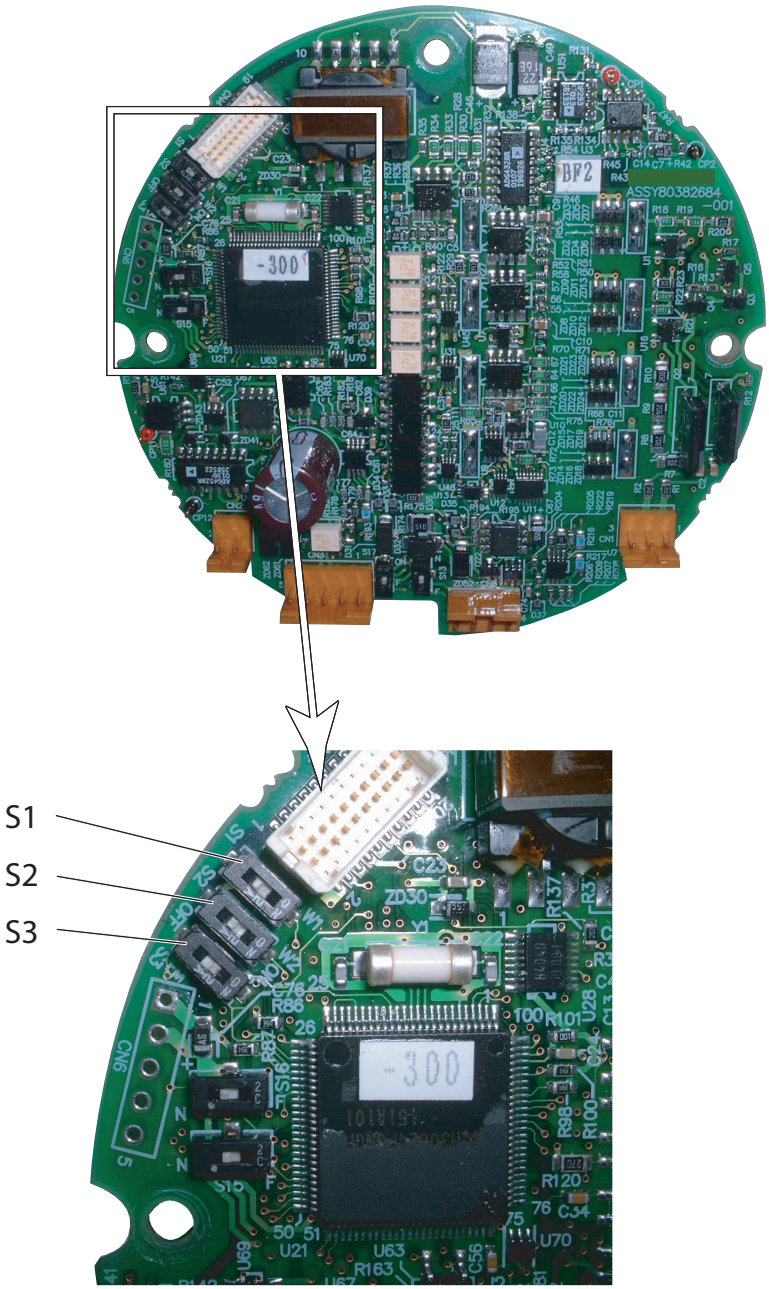
ONLY: Only the indicated operation is enabled.

Note) Be sure to turn off the power supply before changing the write protect level dip switch settings.

Settings of write protect switches

SW No.	At shipment
S1	Determined by WP LEVEL.
S2	Determined by WP LEVEL.
S3	ON (No data change is allowed.)

Main board

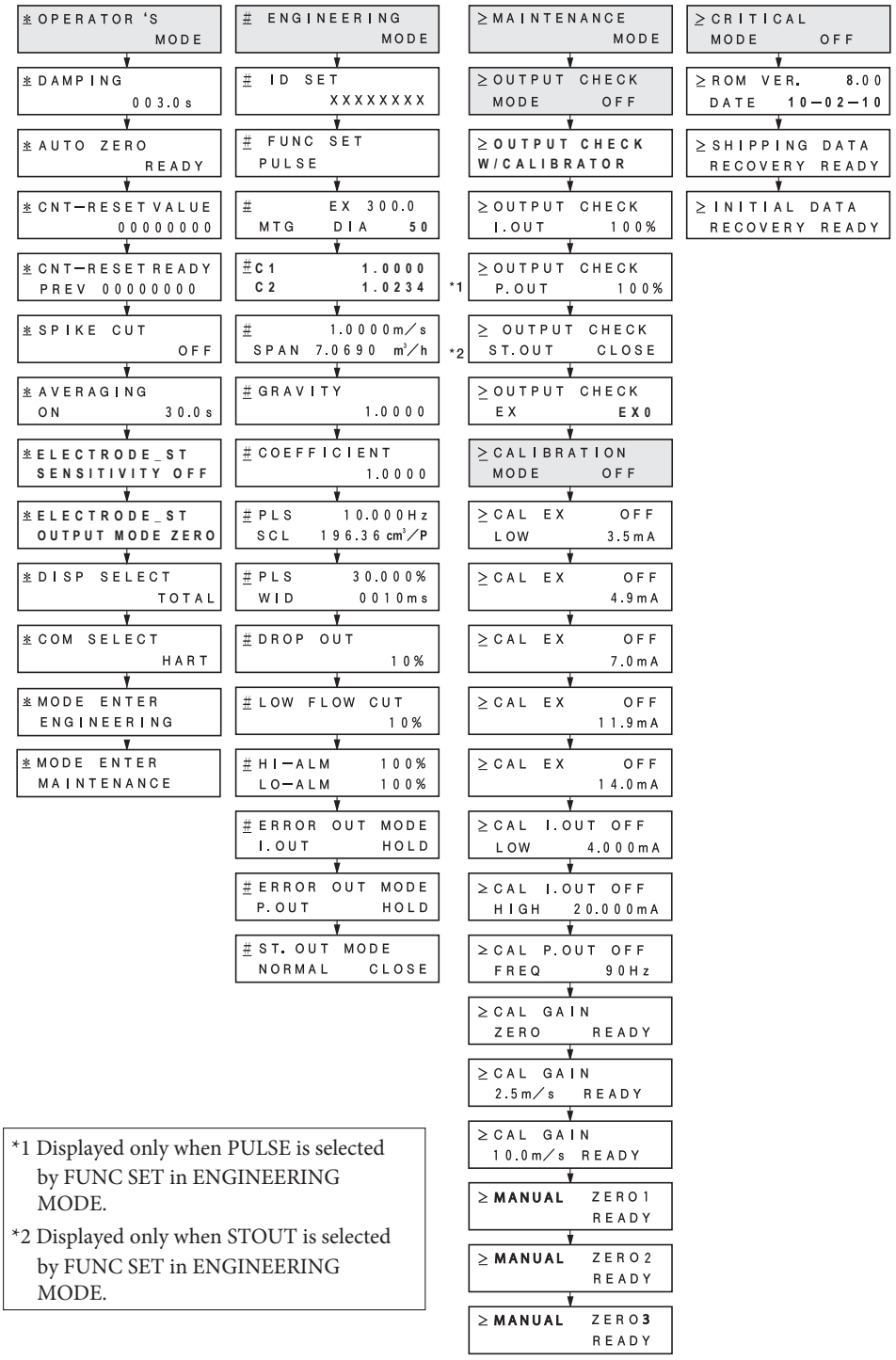


5-4. Overview of operation using the data setting device

Introduction

The data setting device has three types of modes: OPERATOR'S MODE, ENGINEERING MODE, and MAINTENANCE MODE. MAINTENANCE MODE is furthermore divided into three of sub-modes: OUTPUT, CALIBRATION, and CRITICAL. The screen flow is as follows:

Entire display flow 1



*1 Displayed only when PULSE is selected by FUNC SET in ENGINEERING MODE.

*2 Displayed only when STOUT is selected by FUNC SET in ENGINEERING MODE.

5-5. Configuration of OPERATOR'S MODE

Introduction

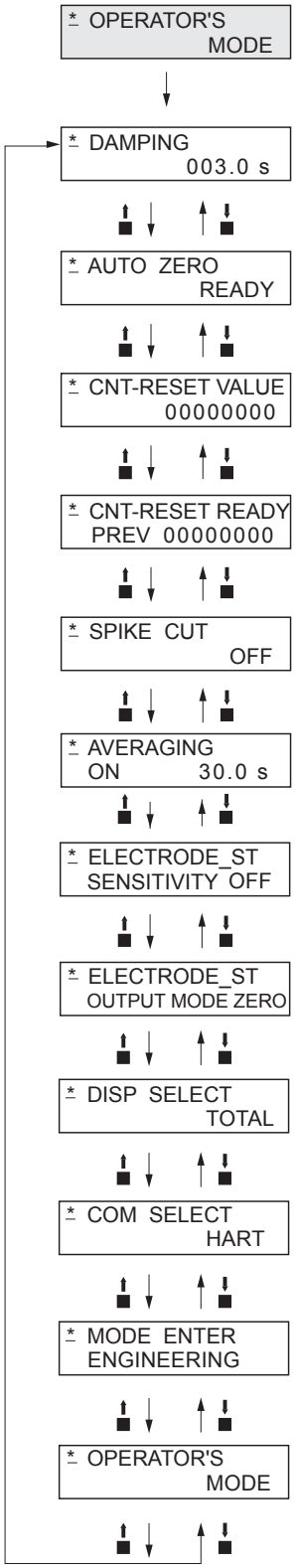
OPERATOR'S MODE provides the following setting and adjustment items.

For details on functions in the items, see “5-5-1. Changing setting of damping time constant” and later.

Item	Contents	Screen
DAMPING	Sets a damping time constant.	20.0 % * DAMPING 005.0 s
AUTO ZERO	Auto zero adjustment	20.0 % * AUTO ZERO READY
CNT-RESET VALUE	Sets a built-in counter reset value.	20.0 % * CNT-RESET VALUE 0 0 0 4 4 4 4
CNT-RESET READY	Resets totalized value to a built-in counter reset value.	20.0 % * CNT-RESET READY 0 0 0 0 0 0 0 0
SPIKE CUT	Sets auto spike cut.	20.0 % * SPIKE CUT OFF
AVERAGING	Sets a moving average function.	20.0 % * AVERAGING OFF
ELECTRODE_ST SENSITIVITY	Sets electrode status diagnostic function. Selects a sensitivity level of electrode status diagnostic function.	20.0 % * ELECTRODE_ST SENSITIVITY OFF
ELECTRODE_ST OUTPUT MODE	Sets output mode when the electrode status diagnostic function detects the empty or scale on electrode condition.	20.0 % * ELECTRODE_ST OUTPUT MODE OFF
DISP SELECT	Selects either % flow rate, actual flow rate or totalized value to be displayed in the main display.	20.0 % * DISP SELECT %
COM SELECT	Selects a communication method.	20.0 % * COM SELECT SFN. A
MODE ENTER ENGINEERING	Enters the ENGINEERING MODE.	20.0 % * MODE ENTER ENGINEERING
MODE ENTER MAINTENANCE	Enters the MAINTENANCE MODE.	20.0 % * MODE ENTER MAINTENANCE

LCD display flow

The LCD display flow of the OPERATOR'S MODE is as shown below:



5-5-1. Changing setting of damping time constant

Damping means a response time of the primary time lag (63.2% response) for a step response of the flow rate. If the out fluctuations are large, increase the damping. A large damping value stabilizes the output but lowers the response performance. We suggest setting the damping to the largest value the system can accept.

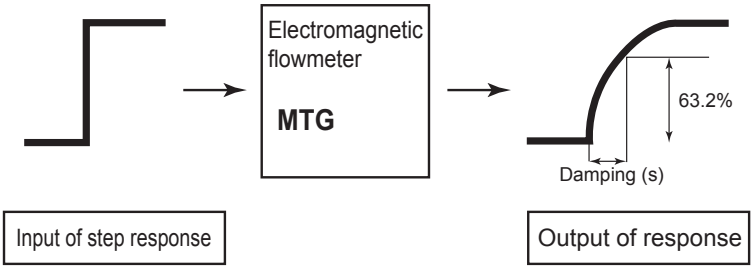


Fig. 5-1. Damping output characteristics

Set the damping time constant in accordance with the following procedure:

Step	Procedure	Screen
1	The screen at right is a screen display example in MEASURING MODE (measurement state). Press the MODE key.	20.0 % 01.94 m³/h WP0 00069401
2	The OPERATOR'S MODE screen appears for approx. two seconds and then the damping setting screen appears.	20.0 % * OPERATOR'S MODE 20.0 % * DAMPING 005.0 s
3	Press the → key until the cursor is at the value to be changed. In this example, the key is pressed three times to move to the position "5."	20.0 % * DAMPING 005.0 s
4	Press the ↑ or ↓ key to display a time constant to be changed. In this example, the ↑ key is pressed five times to change the damping time from 5 seconds to 10 seconds.	20.0 % * DAMPING 005.0 s
5	Press the → key until the cursor is back at the mode indicator. Press the MODE key to return to the MEASURING MODE and save data.	20.0 % * DAMPING 005.0 s

CAUTION

You have only ten minutes to return to MEASURING MODE to save the new value before the system resets it to the previously saved value.

5-5-2. Auto zero adjustment

Auto zero must be carried out only under the condition when the detector is filled with process fluid at zero flow. Run this function only after installing the electromagnetic flowmeter to the process pipe. Performing this function under a condition where the process fluid is not at zero flow may cause measurement errors.

Set range: None in particular

Default: None in particular

Note) The zero adjustment takes approx. two minutes. During the zero adjustment, the output of analog current may rise to approx. 9 mA in some cases. This is not abnormal. To carry out the zero adjustment, set the control loop to manual.

Make the auto zero adjustment in accordance with the following procedure:

Step	Procedure	Screen
1	The screen at right is a screen display example in MEASURING MODE (measurement state). Press the MODE key.	1.0 % 01.94 m^3/h 00069401
2	The OPERATOR'S MODE screen appears for approx. two seconds and then the damping setting screen appears.	1.0 % * OPERATOR'S MODE 1.0 % * DAMPING 005.0 s
3	Press the ↑ key once to display the screen as shown.	0.0 % * AUTO ZERO READY
4	Press the → key to move the cursor to the position READY.	0.0 % * AUTO ZERO READY
5	Press the ↑ key to start the auto zero adjustment. If the main display selects % flowrate, the display of 0.0 blinks during adjustment. With the adjustment completed, the display stops blinking with ON switched to READY. This zero adjustment takes about two minutes.	0.0 % * AUTO ZERO ON 0.0 % * AUTO ZERO READY
6	Press the → key to move the cursor to the position under *. Press the MODE key to return to the MEASURING MODE and save data.	0.0 % * AUTO ZERO READY

⚠ CAUTION

You have only ten minutes to return to MEASURING MODE to save the new value before the system resets it to the previously saved value.

5-5-3. Setting of built-in counter reset value

Set a start value of the built-in counter. The scale of this value is considered as the weight of the pulse. Carry out the built-in counter reset in section 5.4.5 to start totalization from any totalized value.

Set range: 00000000 - 99999999

Default: 00000000

Set an internal counter reset value in accordance with the following procedure:

Step	Procedure	Screen
1	The screen at the right is a screen display example in MEASURING MODE (measurement state). Press the MODE key.	20.0 % 01.94 m^3/h WP0 00069401
2	The OPERATOR'S MODE screen appears for approx. two seconds and then the damping setting screen appears.	20.0 % * OPERATOR'S MODE 20.0 % * DAMPING 005.0 s
3	Press the ↑ key twice to display the screen.	20.0 % * CNT-RESET VALUE 00044444
4	Press the → key to move the cursor to the position under a target value to be changed.	20.0 % * CNT-RESET VALUE 0000<u>0</u>000
5	Press the ↑ or ↓ key to set a desired value.	20.0 % * CNT-RESET VALUE 0000<u>5</u>000
6	Press the → key to move the cursor to the position under *. Press the MDOE key to return to the MEASURING MODE and save data.	20.0 % * CNT-RESET VALUE 00005000

CAUTION

You have only ten minutes to return to MEASURING MODE to save the new value before the system resets it to the previously saved value.

5-5-4. Setting of built-in counter reset value

Reset the built-in counter to start totalization from a value set as the built-in counter reset value. If this value is set to 1000, the built-in counter starts totalization from 1000 after the counter is completely reset.

If the built-in counter is reset, the built-in counter value just before the reset appears at the side of PREV on the LCD display.

Set range: None

Default: None

Reset the internal counter in accordance with the following procedure:

Step	Procedure	Screen
1	The screen at the right is a screen display example in MEASURING MODE (measurement state). Press the MODE key.	20.0 % 01.94 m^3/h WP0 00069401
2	The OPERATOR'S MODE screen appears for approx. two seconds and then the damping setting screen appears.	20.0 % * OPERATOR'S MODE 20.0 % * DAMPING 005.0 s
3	Press the ↑ key three times to display the screen shown on the right..	20.0 % * CNT-RESET READY PREV 00000000
4	Press the → key to move the cursor to the position READY.	20.0 % * CNT-RESET READY PREV 00000000
5	Press the ↑ key to reset. In 0.5 seconds, the reset is completed with ON changing to READY.	20.0 % * CNT-RESET ON PREV 00000000 20.0 % * CNT-RESET READY PREV 00123456
6	Press the → key to move the cursor to the position under *. Press the MDOE key to return to the MEASURING MODE and save data.	20.0 % * CNT-RESET READY PREV 00123456

CAUTION

You have only ten minutes to return to MEASURING MODE to save the new value before the system resets it to the previously saved value.

5-5-5. Setting auto spike cut

This function eliminates steep noise spikes (spike noise) in the flow rate. Noise generated when foreign matters collide with electrode is an example of the spike noise. When the flow rate changes sharply, this function holds the outputs according to the damping time. Generally the spike noise occurs in a few milliseconds and settles down within the output holding time and the outputs are not affected. For ordinary flowrate changes, the output responds after the damping hold time.

It is not recommended to use this function for applications requiring high response and performance, e.g., the function should not be used when a pump frequently generates pulsation.

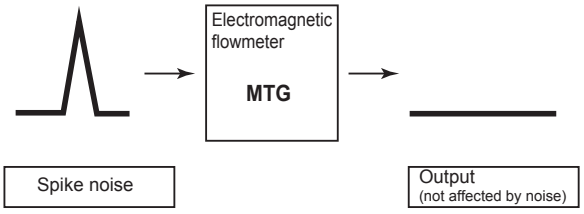


Fig. 5-2. Auto spike cut output characteristics

Set the auto spike cut in accordance with the following procedure.

Step	Procedure	Screen
1	The screen at right is a screen display example in MEASURING MODE (measurement state). Press the MODE key.	20.0 % 01.94 m^3/h WP0 00069401
2	The OPERATOR'S MODE screen appears for approx. two seconds and then the damping setting screen appears.	20.0 % * OPERATOR'S MODE 20.0 % * DAMPING 005.0 s
3	Press the ↑ key four times to display the screen shown on the right..	20.0 % * SPIKE CUT OFF
4	Press the → key to move the cursor to the OFF position.	20.0 % * SPIKE CUT OFF
5	Press the ↑ or ↓ key to select ON or OFF.	20.0 % * SPIKE CUT ON
6	Press the → key to move the cursor to the position under *. Press the MODE key to return to the MEASURING MODE and save data.	20.0 % * SPIKE CUT OFF

CAUTION

You have only ten minutes to return to MEASURING MODE to save the new value before the system resets it to the previously saved value.

5-5-6. Setting moving average processing

This function is used to carry out the moving average processing of the measured flow rate values. The model MTG performs the flow rate calculation every 400 ms. For example, if the moving average process time is set to 2 seconds, the moving average processing will be carried out 2 sec. / 400 ms = 5 times.

If pulsation are generated, this function can be used to suppress the flow rate fluctuations.

The moving average processing can be given by the following formula:

$$Qcurrent = \frac{\sum_{n=1}^{k} Qk}{k}$$

Example) When the moving average processing is set to 2 sec.:

$$Qcurrent = \frac{q_k + Q_{k-1} + Q_{k-2} + Q_{k-3} + Q_{k-4}}{5}$$

where q_k is a value currently measured, and Q_k is a previous output value.

Set range: ON / OFF

ON (1.0 to 30.0 s)

Default: OFF

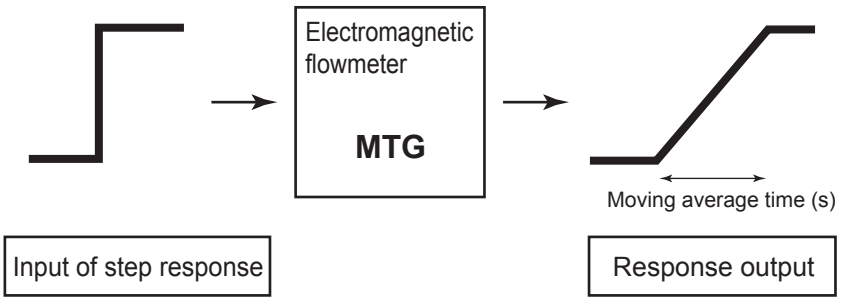


Fig. 5-3. Output characteristics of moving average processing

Set the moving average processing in accordance with the following procedure:

Step	Procedure	Screen
1	The screen at right is a screen display example in MEASURING MODE (measurement state). Press the MODE key.	20.0 % 01.94 m³/h WP0 00069401
2	The OPERATOR'S MODE screen appears for approx. two seconds and then the damping setting screen appears.	20.0 % * OPERATOR'S MODE 20.0 % * DAMPING 005.0 s
3	Press the ↑ key or ↓ key to display the screen shown on the right.	20.0 % * AVERAGING OFF
4	Press the → key to move the cursor to the OFF position.	20.0 % * AVERAGING OFF
5	Press the ↑ key to switch the OFF screen to the ON screen. Press the → key to move the cursor to the value to be changed.	20.0 % * AVERAGING ON 01.0 s
6	Press the ↑ or ↓ key to display a value to be set.	20.0 % * AVERAGING ON 05.0 s
7	Press the → key to move the cursor back to the position under *. Press the MODE key to return to the MEASURING MODE and save data.	20.0 % * AVERAGING ON 05.0 s

CAUTION

You have only ten minutes to return to MEASURING MODE to save the new value before the system resets it to the previously saved value.

5-5-7. Setting Electrode Status Diagnostic function

Overview of electrode status diagnostic function

Electrode status diagnostic function detects the condition of the empty pipe or the scale on the electrodes. The Electrode status diagnostic function makes the analog output and pulse output to the values as selected in the below "Electrode status output mode" table.

The display alternately shows the output values selected and "EMPTY OR SCALE ON ELECTRODE".

"Electrode status output mode" table

Output / Display	Parameter selection in the "Electrode status output mode"		
	OFF	**ZERO**	**HOLD**
Analog 4 - 20 mA output	Output values as the meter measures.	Analog output is fixed to 0% (4 mA).	Analog output is held at its last good value.
Pulse output	Output values as the meter measures.	Pulse output is fixed to 0 (does not generate pulses).	Pulse output is held at its present state.
Display	Display the value as it measures.	Flashes the message 0% and "Empty or scale on electrode" alternately (when % flow rate is specified for the main display). Flashes the message 0.000 RATE and "Empty or scale on electrode" alternately (when actual flow rate is specified for the main display). Flashes the message XXXXXXXX (totalized value at setup) and "Empty or scale on electrode" alternately (when totalized value is specified for the main display).	Flashes the values at its last good values and a message of "Empty or scale on electrode" alternately.

Mechanism of electrode status diagnostic function

Detect empty pipe condition or scale on electrode condition by monitoring flow rate signal. Once the flow rate signal fluctuates over a certain threshold, the device judges that the flowtube is empty or scale appears on the electrodes.

There are five threshold levels to meet an environment where the device is installed.

Set an appropriate threshold level from below.

SENSITIVITY HIGH
SENSITIVITY MID
SENSITIVITY LOW
SENSITIVITY LL
SENSITIVITY LLL

Outputs

Refer to the following table.

Output / Display	Parameter selection in the "Electrode status output mode"		
	OFF	**ZERO**	**HOLD**
Analog 4 - 20 mA output	Output values as the meter measures.	Analog output is fixed to 0% (4 mA).	Analog output is held at its last good value.
Pulse output	Output values as the meter measures.	Pulse output is fixed to 0 (does not generate pulses).	Pulse output is held at its present state.
Display	Display the value as it measures.	Flashes the message 0% and "Empty or scale on electrode" alternately (when % flow rate is specified for the main display). Flashes the message 0.000 RATE and "Empty or scale on electrode" alternately (when actual flow rate is specified for the main display). Flashes the message XXXXXXXX (totalized value at setup) and "Empty or scale on electrode" alternately (when totalized value is specified for the main display).	Flashes the values at its last good values and a message of "Empty or scale on electrode" alternately.

Operation conditions

- The grounding work must be securely carried out (grounding resistance 100 Ω or less).
- The fluid conductivity must be 30 μS/cm or greater.
- The noise level must be higher than or equal to the set threshold value when the pipe is empty.
- The noise level must be lower than or equal to the set threshold value when the pipe is filled with fluid.

Default

SENSITIVITY OFF

Setting parameters

Table 5-1 Set Levels for Electrode Status Diagnostic Function

Electrode Status Diagnostic sensitivity	Noise detection level
SENSITIVITY OFF	Electrode Status Diagnostic Function OFF
SENSITIVITY HIGH	Signal level Threshold LOW
SENSITIVITY MID	Signal level Threshold MID
SENSITIVITY LOW	Signal level Threshold HIGH
SENSITIVITY LL	Signal level Threshold very HIGHER
SENSITIVITY LLL	Signal level Threshold extremely HIGHER

Note) 1. This function is only available for detectors with a bore diameter of 10 mm or more. When the diameter is 2.5 mm or 5 mm, the setting screen for this function appears in the converter's display, but is not applicable.

Note) 2. This function is applicable for the converters with ROM version 8.0 or higher. If it is 6.0 or lower, the setting screen for this function is not displayed. To check the ROM version, refer to "5-7-9. Displaying ROM version and date".

To use the electrode status diagnostic function with the ROM version 6.0 or lower, the main board must be replaced. For details, contact our sales representative.

Set the electrode status diagnostic function in accordance with the following procedure.

Step	Procedure	Screen
1	The screen at right is a screen display example in MEASURING MODE (measurement state).	20.0 % 01.94 m^3/h WP0 00069401
2	Press the MODE key. The OPERATOR'S MODE screen appears for approx. two seconds, and then the damping setting screen appears.	20.0 % * OPERATOR'S MODE 20.0 % * DAMPING 005.0 s
3	Press the ↑ key to display the screen shown on the right.	20.0 % * ELECTRODE_ST SENSITIVITY OFF
4	Press the → key to move the cursor to the OFF position.	20.0 % * ELECTRODE_ST SENSITIVITY OFF
5	Press the ↑ key to select SENSITIVITY HIGH.	20.0 % * ELECTRODE_ST SENSITIVITY HIGH
6	Press the → key to move the cursor to the position under *. Press the MODE key to return to the MEASURING MODE and save the data.	20.0 % * ELECTRODE_ST SENSITIVITY HIGH
7	Empty the pipe with SENSITIVITY HIGH set to check if the function detects the empty status. Or, in case that you find the scale on the electrode, set the SENSITIVITY HIGH to check the function detects the scale on electrode status. Perform the checking when 30 seconds or more have passed, because it takes at least 30 seconds to detect the empty status after the pipe becomes empty or detect the scale on electrode status. (Result) When the empty status or scale on electrode is detected, the screen at right appears. The "EMPTY OR SCALE ON ELECTRODE" message is flashing, the analog output show the output values as selected in the "Electrode status output mode" table.	0.0 % EMPTY OR SCALE ON ELECTRODE

(To the next page)

<table>
<tr><th>Step</th><th>Procedure</th><th>Screen</th></tr>
<tr><td>8</td><td>Repeat steps 1 to 5 to set SENSITIVITY MID or SENSITIVITY LOW, SENSITIVITY LL or SENSITIVITY LLL to check if the function also detects the empty or scale on electrode status with the converter's display.
Depending on whether the empty status is detected in each setting, the result falls into one of the following.

(Results of electrode status diagnostic operation check in empty or scale on electrode status)
<table>
<tr><th>Setting</th><th>Results (1)</th><th>Results (2)</th><th>Results (3)</th><th>Results (4)</th><th>Results (5)</th><th>Results (6)</th></tr>
<tr><td>LLL</td><td>EMPTY OR SCALE ON ELECTRODE flashes</td><td>EMPTY OR SCALE ON ELECTRODE does not flashes</td><td>EMPTY OR SCALE ON ELECTRODE does not flashes</td><td>EMPTY OR SCALE ON ELECTRODE does not flashes</td><td>EMPTY OR SCALE ON ELECTRODE does not flashes</td><td>EMPTY OR SCALE ON ELECTRODE does not flashes</td></tr>
<tr><td>LL</td><td>EMPTY OR SCALE ON ELECTRODE flashes</td><td>EMPTY OR SCALE ON ELECTRODE flashes</td><td>EMPTY OR SCALE ON ELECTRODE does not flashes</td><td>EMPTY OR SCALE ON ELECTRODE does not flashes</td><td>EMPTY OR SCALE ON ELECTRODE does not flashes</td><td>EMPTY OR SCALE ON ELECTRODE does not flashes</td></tr>
<tr><td>LOW</td><td>EMPTY OR SCALE ON ELECTRODE flashes</td><td>EMPTY OR SCALE ON ELECTRODE flashes</td><td>EMPTY OR SCALE ON ELECTRODE flashes</td><td>EMPTY OR SCALE ON ELECTRODE does not flashes</td><td>EMPTY OR SCALE ON ELECTRODE does not flashes</td><td>EMPTY OR SCALE ON ELECTRODE does not flashes</td></tr>
<tr><td>MID</td><td>EMPTY OR SCALE ON ELECTRODE flashes</td><td>EMPTY OR SCALE ON ELECTRODE flashes</td><td>EMPTY OR SCALE ON ELECTRODE flashes</td><td>EMPTY OR SCALE ON ELECTRODE flashes</td><td>EMPTY OR SCALE ON ELECTRODE does not flashes</td><td>EMPTY OR SCALE ON ELECTRODE does not flashes</td></tr>
<tr><td>HIGH</td><td>EMPTY OR SCALE ON ELECTRODE flashes</td><td>EMPTY OR SCALE ON ELECTRODE flashes</td><td>EMPTY OR SCALE ON ELECTRODE flashes</td><td>EMPTY OR SCALE ON ELECTRODE flashes</td><td>EMPTY OR SCALE ON ELECTRODE flashes</td><td>EMPTY OR SCALE ON ELECTRODE does not flashes</td></tr>
</table>
■ If the empty or scale on electrode status is not detected when HIGH has been set (in the case of result (6)), this function is not available in that installation environment.
Repeat steps 1 to 5 to set the function to OFF.</td><td></td></tr>
</table>

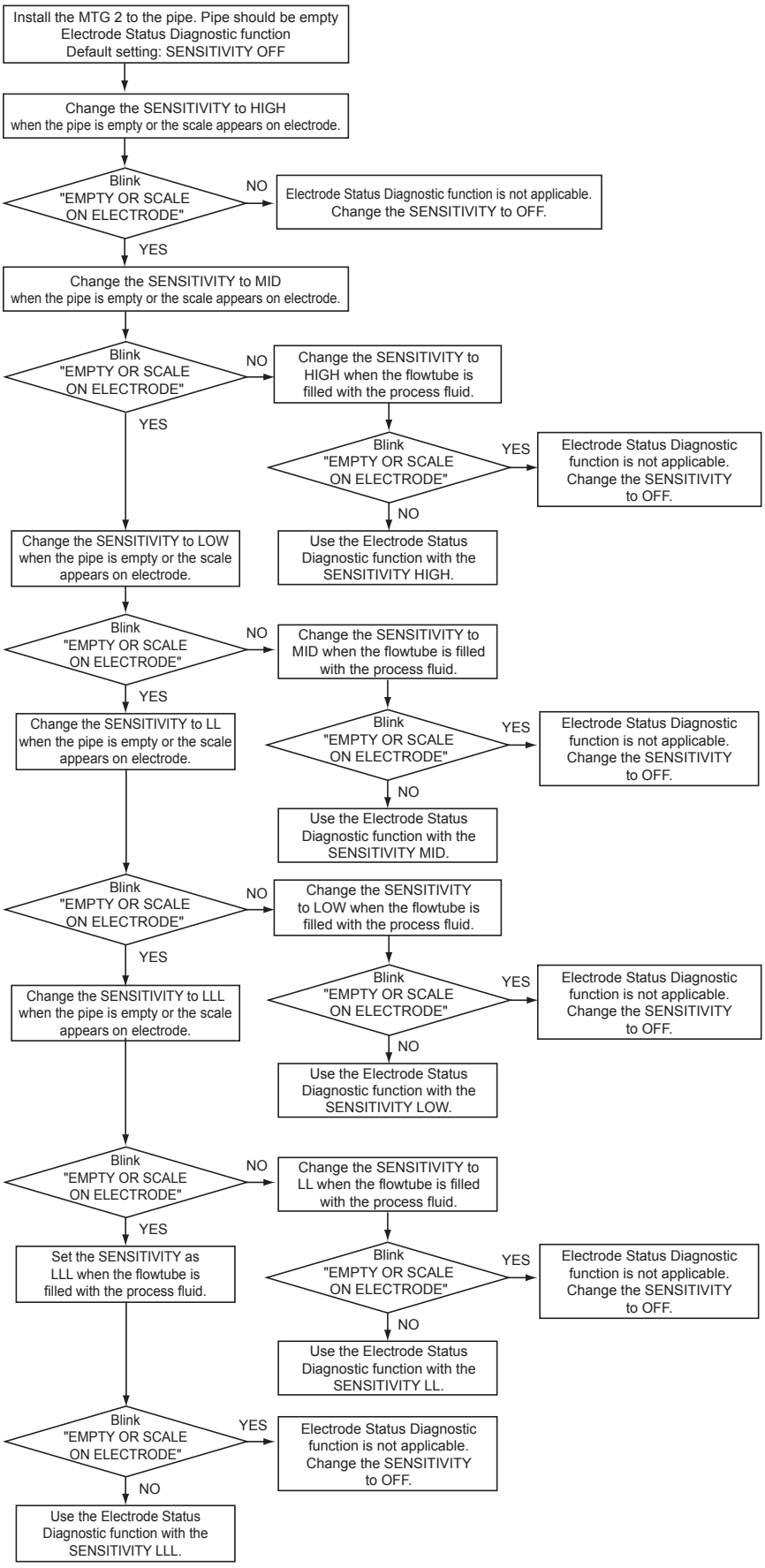
(To the next page)

Step	Procedure	Screen
9	Next, fill fluid into the pipe. If the scale appears on the electrodes, clean the electrodes and fill fluid. Check that the empty or scale on electrode status is not detected in this condition. Since it takes at least 30 seconds to clear the empty or scale on electrode status after fluid is filled in the pipe, perform checking when 30 seconds or more have passed after fluid is filled. (Branch 1) ■ When the result is (1) in step 8 Check that the empty or scale on electrode status is not detected when SENSITIVITY LLL has been set. (Result) ■ If the empty or scale on electrode status is not detected, use that SENSITIVITY LLL setting without change. ■ If the empty or scale on electrode status is detected and the screen shown on the right appears, this function is not available in that environment. Set the function to OFF. (Branch 2) ■ When the result is (2) in step 8 Check that the empty or scale on electrode status is not detected when SENSITIVITY LL has been set. (Result) ■ If the empty or scale on electrode status is not detected, use that SENSITIVITY LL setting without change. ■ If the empty or scale on electrode status is detected and the screen shown on the right appears, this function is not available in that environment. Set the function to OFF. (Branch 3) ■ When the result is (3) in step 8 Check that the empty or scale on electrode status is not detected when SENSITIVITY LOW has been set. (Result) ■ If the empty or scale on electrode status is not detected, use that SENSITIVITY LOW setting without change. ■ If the empty or scale on electrode status is detected and the screen shown on the right appears, this function is not available in that environment. Set the function to OFF.	0.0 % EMPTY OR SCALE ON ELECTRODE 0.0 % EMPTY OR SCALE ON ELECTRODE 0.0 % EMPTY OR SCALE ON ELECTRODE

(To the next page)

Step	Procedure	Screen
9 (Continued)	(Branch 4) ■ When the result is (4) in Step 8 Check that the empty or scale on electrode status is not detected when SENSITIVITY MID has been set. (Result) ■ If the empty or scale on electrode status is not detected, use that SENSITIVITY MID setting without change. ■ If the empty or scale on electrode status is detected and the screen shown on the right appears, this function is not available in that environment. Set the function to OFF. (Branch 5) ■ When the result is (5) in Step 8 Check that the empty or scale on electrode status is not detected when SENSITIVITY HIGH has been set. (Result) ■ If the empty or scale on electrode status is not detected, use that SENSITIVITY HIGH setting without change. ■ If the empty or scale on electrode status is detected and the screen shown on the right appears, this function is not available in that environment. Set the function to OFF.	0.0 % EMPTY OR SCALE ON ELECTRODE 0.0 % EMPTY OR SCALE ON ELECTRODE

Electrode status diagnostic flow chart



Electrode status diagnostic troubleshooting

Troubleshooting

If a problem occurs during electrode status diagnostic, take appropriate actions in accordance with the following procedure.

Trouble	Check point and troubleshooting
■ Electrode status diagnostic mistake when fluid is filled because the unit is used in the place where the flow rate changes swiftly.	When the flow rate swiftly changes due to pulsations from the pump, the function may recognize some of the swinging flow rate signals as those in the empty status or scale on electrode and mistakenly determine it as empty or scale on electrode. In this case, it is recommended to install the unit in the place where no effects from the pulsation can be reached, e.g., by securing a longer upstream straight pipe section. When the unit is installed in a place where swift change of the flow rate may cause misdetection of the empty or scale on electrode status when fluid is filled, set this function to OFF. Please note that increasing the damping time constant does not solve this problem because this function determines the empty or scale on electrode status based on the signals before the damping process.
■ Empty not detected when the pipe is empty.	If there is conductivity between electrodes or between the electrode and grounding ring due to the fluid left in the pipe, etc., the empty status may not be detected even when the pipe is empty. In this case, this function is not available. Set it to OFF. If the display and output are not always fixed to zero because, for example, the fluid drops on the electrode, they may become stable at zero by increasing the setting value for low flow cutoff and setting the auto spike cut to ON.
■ Electrode status diagnostic operation error after the surrounding noise environment has been changed by expansion of equipment etc., such as changing the installation location or installing the high-current motors or pumps.	Since change of the environment also changes the noise volume, the electrode status diagnostic may not function correctly with the conventional threshold value for it. In this case, reset the threshold value.
■ Empty detected with flowing fluid in fluid-filled status (empty not detected with stationary fluid).	The empty status may be detected even when the fluid is filled because of the effects of the flow noises generated from the flowing fluid. In this case, reset the threshold value so that the empty status is not mistakenly detected when the fluid is flowing.

Selecting the Electrode Status Output Mode

Setting the output mode when the Electrode Status Diagnostic function detects the empty or scale on electrode status.

There are the following three electrode status output modes.

■ OFF

■ ZERO

■ HOLD

Default setting: OFF

Detailes of the “Electrode Status Output mode”

Output / Display	**Parameter selection in the “Electrode status output mode”**		
	OFF	**ZERO**	**HOLD**
Analog 4 - 20 mA output	Output values as the meter measures.	Analog output is fixed to 0% (4 mA).	Analog output is held at its last good value.
Pulse output	Output values as the meter measures.	Pulse output is fixed to 0 (does not generate pulses).	Pulse output is held at its present state.
Display	Display the value as it measures.	Flashes the message 0% and “Empty or scale on electrode” alternately (when % flow rate is specified for the main display). Flashes the message 0.000 RATE and “Empty or scale on electrode” alternately (when actual flow rate is specified for the main display). Flashes the message XXXXXXXX (totalized value at setup) and “Empty or scale on electrode” alternately (when totalized value is specified for the main display).	Flashes the values at its last good values and a message of “Empty or scale on electrode” alternately.

Set the Electrode status output mode in accordance with the following procedures.

Step	Procedure	Screen
1	The screen at right is a screen display example in MEASURING MODE (measurement state).	20.0 % 1.94 m3/h WP0 00069401
2	Press the MODE key. The OPERATOR'S MODE screen appears for approximately two seconds, and then the damping setting screen appears.	20.0 % * OPERATOR'S MODE 20.0 % * DAMPING 005.0 s
3	Press the ↑ key to display the screen shown on the right.	20.0 % * ELECTRODE_ST OUTPUT MODE OFF
4	Press the → key to move the cursor to the OFF position.	20.0 % * ELECTRODE_ST OUTPUT MODE OFF
5	Press the ↑ key to select ELECTRODE_ST OUTPUT MODE. Press the ↑ or ↓ key to display the ELECTRODE_ST OUTPUT MODE to be set. Select ZERO, HOLD or OFF.	20.0 % * ELECTRODE_ST OUTPUT MODE ZERO 20.0 % * ELECTRODE_ST OUTPUT MODE HOLD
6	Press the MODE key to return to the MEASURING MODE and to save the data.	

5-5-8. Selecting flow rate to be displayed in the main display

Select the flow rate to be always shown in the main display. The flow rates other than that selected for the main display are shown in the sub displays. Thereby, three flow rates can always be monitored.

Set	Description
%	% flow rate
RATE	Actual flow rate
TOTAL	Totalized value

% (% flow rate): Displays % flow rate

RATE (Actual flow rate)

Setting range: %, RATE, TOTAL

Default: RATE

Select the flow rate to be shown in the main display in accordance with the following procedure:

Step	Procedure	Screen
1	The screen at right is a screen display example in MEASURING MODE (measurement state). Press the MODE key.	20.0 % 01.94 m^3/h WP0 00069401
2	The OPERATOR'S MODE screen appears for approx. two seconds, and then the damping setting screen appears.	20.0 % * OPERATOR'S MODE 20.0 % * DAMPING 005.0 s
3	Press the ↑ or ↓ key to display the screen as shown on the right.	20.0 % * DISP SELECT % 20.0 %
4	Press the → key to move the cursor to the position for the flow rate display method (%, RATE, TOTAL). The screen at right shows an example where % flow rate has been set for the main display.	20.0 % * OPERATOR'S MODE
5	Press the ↑ or ↓ key to select a flow rate display to be set. The screen at right shows an example where RATE (actual flow rate) display has been selected.	0.30 RATE * DISP SELECT RATE
6	Press the → key to move the cursor to the position under *. Press the MODE key to return to the MEASURING MODE and to change to the set flow rate display.	0.30 RATE * DISP SELECT RATE

CAUTION

You have only ten minutes to return to MEASURING MODE to save the new value before the system resets it to the previously saved value.

5-5-9. Selecting a communication system

Select the communication system (SFC, DE, HART, and communication disable).

Select a communication system to be used. Note that the converter will be rebooted when the MODE key is pressed to switch to the MEASURING MODE after the settings are changed.

HART: HART communication by using the HART Communicator.

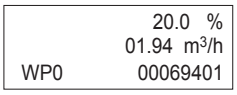
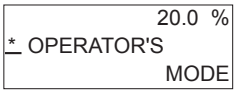
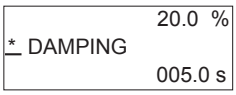
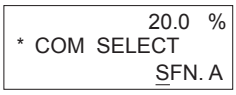
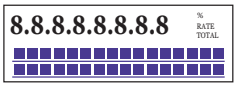
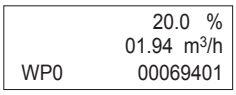
SFN.A: SFC in the analog (4-20 mA) output mode.

SFN.D: DE (Digital Enhanced) communication.

NONE: Communication is not used/disable.

By default, SFN.A: SFC communication is set.

Select a communication system in accordance with the following procedure:

Step	Procedure	Screen
1	The screen at right is a screen display example in MEASURING MODE (measurement state). Press the MODE key.	
2	The OPERATOR'S MODE screen appears for approx. two seconds, and then the damping setting screen appears.	 
3	Press the ↑ three times to display the screen as shown on the right.	
4	Press the → key to move the cursor to the position for the communication system (SFN.A, SFN.D, NONE, HART). The screen at right shows an example where SFN.A has been selected for the communication system.	
5	Press the ↑ or ↓ key to select a desired communication system to be set. The screen at right shows an example where HART communication has been selected.	
6	Press the → key to move the cursor to the position under *. Pressing the MODE key reboots the converter, returns to MEASURING MODE, and the communication system changes and saved.	   

CAUTION

You have only ten minutes to return to MEASURING MODE to save the new value before the system resets it to the previously saved value.

5-5-10. Entering ENGINEERING MODE and MAINTENANCE MODE

Introduction

This section describes how to enter ENGINEERING MODE, in which setup parameters for the electromagnetic flowmeter are to be configured, and MAINTENANCE MODE, in which calibration and check are to be carried out.

Note) The mode selection screen may not appear, depending on the settings of write protect. Operate the write protect switch on the main board, and then select one from levels 1, 2 and 3 to display the screen for selecting ENGINEERING MODE only. Select write protect level 0 to display the screen for selecting both ENGINEERING MODE and MAINTENANCE MODE. See "5-3-2. Display of write protect level".

The procedure for entering ENGINEERING MODE is shown below.

Step	Procedure	Screen
1	The screen shown right is a screen display example in MEASURING MODE (measurement state). Press the MODE key.	20.0 % 01.94 m^3/h WP0 00069401
2	The OPERATOR'S MODE screen appears for approx. two seconds, and then the damping setting screen appears.	20.0 % * OPERATOR'S MODE 20.0 % * DAMPING 005.0 s
3	Press the ↑ key twice to display the screen as shown.	20.0 % * MODE ENTER ENGINEERING
4	Press the → key once to move the cursor to the position shown on the screen.	20.0 % * MODE ENTER ENGINEERING
5	Press the ↑ key. With the display is changed, ENGINEERING MODE is active. The screen appears in approx. two seconds.	20.0 % # ENGINEERING MODE 20.0 % # ID SET XXXXXXXX

The procedure for entering MAINTENANCE MODE is shown below.

Step	Procedure	Screen
1	The screen shown on the right is a screen display example in MEASURING MODE (measurement state). Press the MODE key.	20.0 % 01.94 m^3/h WP0 00069401
2	The OPERATOR'S MODE screen appears for approx. two seconds, and then the damping setting screen appears.	20.0 % * OPERATOR'S MODE 20.0 % * DAMPING 005.0 s
3	Press the ↑ key once to display the screen as shown on the right.	20.0 % * MODE ENTER MAINTENANCE
4	Press the → key once to move the cursor to the position shown on the screen.	20.0 % * MODE ENTER MAINTENANCE
5	Press the ↑ key. With the display is changed, MAINTENANCE MODE is active. The screen appears in approx. two seconds.	20.0 % > MAINTENANCE MODE 20.0 % > OUTPUT CHECK MODE OFF

5-6. Configuration of ENGINEERING MODE

Introduction

ENGINEERING MODE has the following setting and adjustment items:
For details on items, see "5-6-1. Setting ID" to "5-6-15. Setting contact output status".

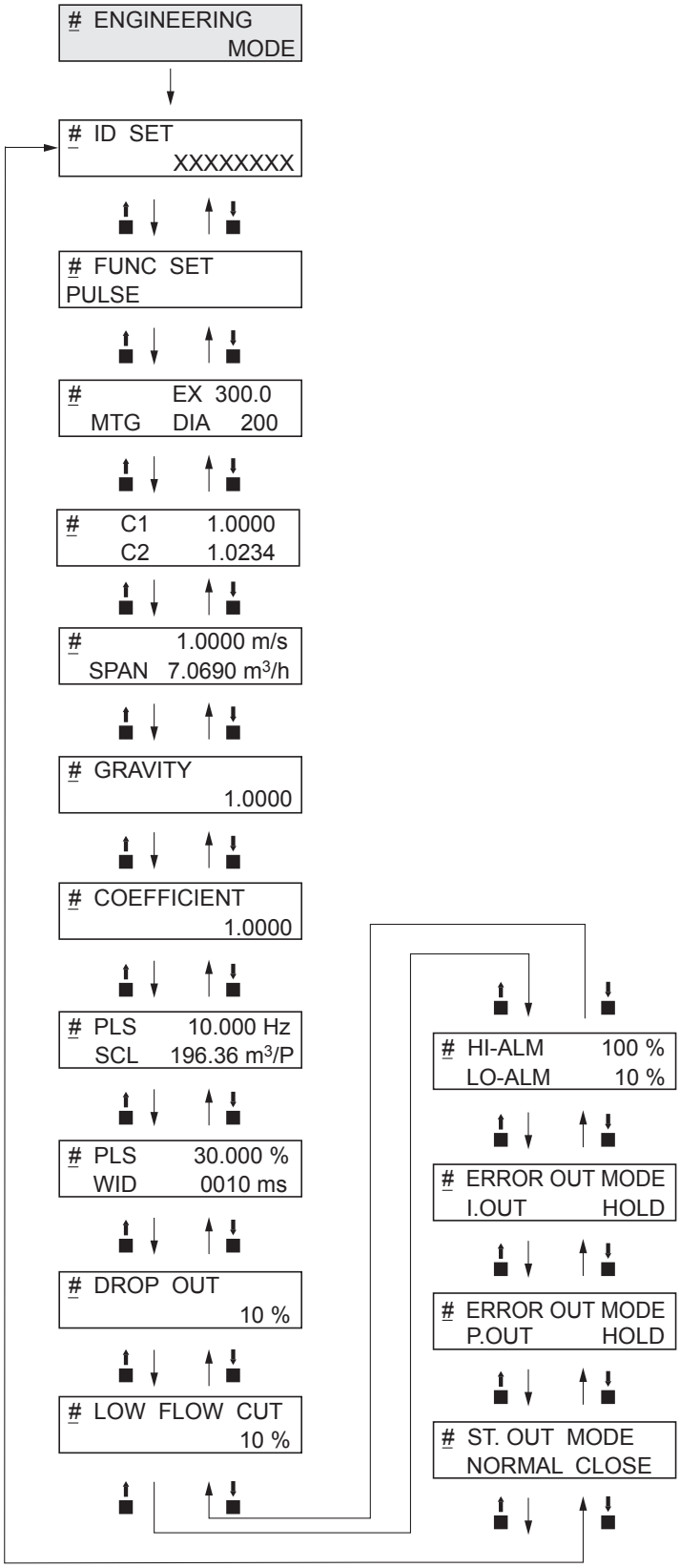
Item	Contents	Screen
ID SET	Sets ID and TAG No.	20.0 % # ID SET XXXXXXXX
FUNC SET	Setting of open collector output, selects pulse output or contact output.	20.0 % # FUNC SET PULSE
EX, TYPE, DIA	Sets the detector information (Ex value, detector type, and bore diameter).	20.0 % # EX 300.0 MTG DIA 200
C1, C2	Sets the flowtube factor.	20.0 % # C1 1.0000 C2 1.0234
SPAN	Sets the flow rate range.	20.0 % # 1.0000 m/s SPAN 7.0690 m^3/h
GRAVITY	Sets the specific gravity when mass flow rate unit is selected.	20.0 % # GRAVITY 1.0000
COEFFICIENT	Sets a compensation coefficient for flow rate calculation.	20.0 % # COEFFICIENT 1.0000
PLS SCL	Sets flow rate (pulse scale) per pulse.	20.0 % # PLS 10.000 Hz SCL 200.00 I/P

Item	Contents	Screen
PLS WID	Sets the output pulse width.	20.0 % # PLS 10.000 Hz WID 0010 ms
DROP OUT	Sets drop out.	20.0 % # DROPOUT 10 %
LOW FLOW CUT	Sets low flow cut.	20.0 % # LOW FLOW CUT 10 %
HI-ALM/LOW-ALM	Sets upper/lower limit alarm.	20.0 % # HI-AIM 100 % LO-AIM 0 %
ERROR OUT MODE I. OUT	Determines the analog output failsafe direction.	20.0 % # ERROR OUT MODE I.OUT HOLD
ERROR OUT MODE P. OUT	Determines the pulse output failsafe direction.	20.0 % # ERROR OUT MODE P.OUT HOLD
ST. OUT MODE	Sets a contact output status.	20.0 % # ST. OUTMODE NORMAL CLOSE

Note) After the MODE key is pressed, configured data in the ENGINEERING MODE are saved in non-volatile memory. When configure data, be sure to press the MODE key to save the data.

LCD display flow

The ENGINEERING MODE display flow is as follows:



5-6-1. Setting ID

You can enter a unique 8-digit alphanumeric code for the flowmeter.

Up to eight alphanumeric characters using any combination of letters (A to Z), numbers (0 to 9), - (dash), / (slash), space and period.

Set an ID in accordance with the following procedure:

Step	Procedure	Screen
1	Enter ENGINEERING MODE (see section 5-5-10. on page 5-33) and display the screen where the ID is to be set.	12.3 % # ID SET XXXXXXXX
2	Press the → key to move the cursor to the position under a desired character to be changed.	12.3 % # ID SET XXXXXXXX
3	Press the ↑ or ↓ key to select a desired character.	12.3 % # ID SET FXXXXXXX
4	If a target TAG NO. has been set, press the → key to move the cursor to the position under #. Press the MODE key to return to MEASURING MODE and to save data.	12.3 % # ID SET FIC-0001

5-6-2. Selecting Pulse Output, Electrode Status Output or High Low Status Output

Pulse output, electrode status output or high low status output are selectable. They are open collector outputs.

When pulse output has been selected:

Set pulse scale, pulse width, drop out, and failsafe mode for the pulse output.

When high low status output has been selected:

As a contact output, self diagnostic output (critical failure) or upper/lower limit alarm is output.

Select % flow rate value for upper/lower alarm or output status (OPEN or CLOSE in normal condition).

When electrode status output has been selected:

As a contact output, empty status output or scale on electrode status alarm is output.

Select output status (OPEN or CLOSE in normal condition).

Setting range: PULSE: Selection of pulse output

HI LO STOUT: Selection of contact output for upper/lower limit alarm or critical failure status ELECTRODE STOUT: Selection of contact output for empty status or scale on electrode diagnostic

Default: PULSE

Select pulse output, electrode status output or high low status output in accordance with the following procedure.

Step	Procedure	Screen
1	Enter ENGINEERING MODE (see "5-5-10. Entering ENGINEERING MODE and MAINTENANCE MODE" on page 5-33). Then press the ↑ or ↓ key to display the screen at right.	20.0 % # FUNC SET PULSE
2	Press the → key to move the cursor to the position for set function. Press the ↑ or ↓ key to display a function to be set. Select PULSE (pulse output), HI LO STOUT (contact output for upper/lower limit alarm or critical failure status) or ELECTRODE STOUT (contact output for empty status or scale on electrode diagnostic).	20.0 % # FUNC SET PULSE 20.0 % # FUNC SET HI LO STOUT 20.0 % # FUNC SET ELECTRODE STOUT
3	Press the MODE key to return to the MEASURING MODE and to save the data.	20.0 % # FUNC SET PULSE

CAUTION

You have only ten minutes to return to MEASURING MODE to save the new value before the system resets it to the previously saved value.

5-6-3. Setting detector information

Set detector information necessary for combination with the converter.

EX value: Each detector has a unique calibration factor (EX value).
This value is determined at shipment in accordance with the actual flow rate calibration. DO NOT change this value or the flowmeter output will be incorrect.

Detector type: When measuring the flow rate, select MTG for the detector type. To perform adjustments and loop check, select TST for the detector type.

Bore diameter: Sets the bore diameter (inside diameter) of the detector. The correct bore diameter is set as factory default setting.

Setting range: Detector constant: 200.0 to 699.9
Detector type: MTG/TST
Bore diameter: 2.5 to 200

Set the detector information in accordance with the following procedure:

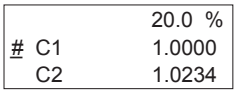
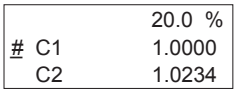
Step	Procedure	Screen
1	Enter ENGINEERING MODE in accordance with the entry into ENGINEERING MODE (see section 5-5-10. on page 5-33). Then press the ↑ or ↓ key to display the screen at right.	12.3 % # EX 300.0 MTG DIA 050.0
2	Press the → key to set the detector constant. Using the ↑ or ↓ key, enter the numeric value found in the EX column stamped on the nameplate of the detector to be combined.	12.3 % # EX 320.0 MTG DIA 050.0
3	In addition, press the → key to select the detector type. Using the ↑ or ↓ key, select the detector type. To measure the flow rate, select MTG. To perform adjustments and loop check, select TST.	12.3 % # EX 320.0 MTG DIA 050.0
4	Then press the → key to select the bore diameter. Using the ↑ or ↓ key, select the bore diameter of the detector.	12.3 % # EX 320.0 MTG DIA 100.0
5	Using the → key, move the cursor to the position under #. Press the MODE key to return to the MEASURING MODE and save data.	12.3 % # EX 320.0 MTG DIA 100.0

CAUTION

You have only ten minutes to return to MEASURING MODE to save the new value before the system resets it to the previously saved value.

5-6-4. Setting detector factor

Set the detector factor. The C1 value is always 1.0000. Set the C2 value to that shown on the detector nameplate under the heading Detector Factor.

Step	Procedure	Screen
1	Enter ENGINEERING MODE (see "5-5-10. Entering ENGINEERING MODE and MAINTENANCE MODE" on page 5-33). Then press the ↑ or ↓ key to display the screen at right.	
2	Press the → key to set the detector factor. C1 is always set to 1.0000. Set the C2 factor to that stamped on the nameplate of the flowmeter.	
3	Press the → key to move the cursor to the position under #. Press the MODE key to return to the MEASURING MODE and to save the data.	

5-6-5. Setting flow rate range

Set the flow rate range. The lower limit of the range is ZERO. The upper limit, which is the value when the output reaches 100%, is entered here along with the selection of engineering and time units. The range has an upper limit value of 10 m/s in flow velocity when it is calculated at the upper stage of the display. It has a lower limit value of 0.3 m/s.

Set the flow rate range so that the regular flow rate to greater than or equal to 50% of the flow rate range.

Pressing the MODE key automatically deletes unnecessary zeros, if any, from the flow rate range.

Example: 07.069 → 7.0690 (Unnecessary zero is deleted.)

Setting range:

Flow rate range: 0 to 0.0001, 0 to 99999.

Units of flow rate:

Unit of SI volume flow rate: m^3, 1, cm^3

Unit of SI mass flow rate: t, kg, g

Unit of non-SI volume flow rate: mG, G, kG, B, mIG, IG, kIG

Unit of SI mass flow rate: lb

Unit of time: d, h, min., s

Default:10.000 m^3/h

Set the flow rate range in accordance with the following procedure:

Step	Procedure	Screen
1	Enter ENGINEERING MODE in accordance with the entry into ENGINEERING MODE (see section 5-5-10. on page 5-33). Then press the ↑ or ↓ key to display the screen at right.	12.3 % # 1.4147 m/s SPAN 10.000 m^3/h
2	Press the → key to move the cursor to a desired digit to be set.	12.3 % # 1.4147 m/s SPAN 10.000 m^3/h
3	Using the ↑ or ↓ key, change the value to a desired one.	12.3 % # 1.4147 m/s SPAN 20.000 m^3/h
4	In addition, press the → key to move the cursor to the position under a desired flow rate unit. Using the ↑ or ↓ key, select the unit.	12.3 % # 1.4147 m/s SPAN 20.000 l/h
5	Then press the → key to move the cursor to the position under the time unit. Using the ↑ or ↓ key, select the unit.	12.3 % # 1.4147 m/s SPAN 333.33l/ min
6	Press the → key to move the cursor to the position under #. Press MODE key to return to the MEASURING MODE, and to save data.	12.3 % # 1.4147 m/s SPAN 333.33l/ min

CAUTION

You have only ten minutes to return to MEASURING MODE to save the new value before the system resets it to the previously saved value.

5-6-6. Setting and changing compensation coefficient

This function is used to set or change the compensation coefficient which is used to multiply the output flow rate as required.

Set range: 0.10000 to 5.9999

Default: 1.0000

Set and change a compensation coefficient in accordance with the following procedure:

Step	Procedure	Screen
1	Enter ENGINEERING MODE in accordance with the entry into ENGINEERING MODE (see section 5-5-10. on page 5-33). Then press the ↑ or ↓ key to display the screen at right.	12.3 % # COEFFICIENT 1.0000
2	Press the → key to move the cursor to the position under a desired value to be set or changed.	12.3 % # COEFFICIENT 1.0000
3	Using the ↑ or ↓ key, change the value to the desired one to be set.	12.3 % # COEFFICIENT 1.0050
4	Press the → key to move the cursor to the position under #. Press the MODE key to return to the MEASURING MDOE and to save data.	12.3 % # COEFFICIENT 1.0050

CAUTION

You have only ten minutes to return to MEASURING MODE to save the new value before the system resets it to the previously saved value.

5-6-7. Setting specific gravity

This function is used to set the specific gravity when selecting a weight unit (t, kg, g, lb) in the flow rate range setting.

Set range: 0.1000 to 5.9999

Default: 1.0000

Set the specific gravity in accordance with the following procedure:

Step	Procedure	Screen
1	Enter ENGINEERING MODE in accordance with the entry into ENGINEERING MODE (see section 5-5-10. on page 5-33). Then press the ↑ or ↓ key to display the screen at right.	12.3 % # GRAVITY 1.0000
2	Press the → key to move the cursor to the position under a desired value to be set or changed.	12.3 % # GRAVITY 1.0000
3	Using the ↑ or ↓ key, change the value to the desired one to be set.	12.3 % # GRAVITY 1.0050
4	Press the → key to move the cursor to the position under #. Press the MODE key to return to the MEASURING MDOE and to save data.	12.3 % # GRAVITY 1.0050

⚠ CAUTION

You have only ten minutes to return to MEASURING MODE to save the new value before the system resets it to the previously saved value.

5-6-8. Setting pulse scale

This function is used to set the flow rate per pulse and associated units for a flowmeter.

Pulse scale of the totalization value indicated on the display is equal to the pulse scale set here.

Set range: 0.0001 to 99999.

However, the pulse scale should be set so that the pulse output span frequency fs (shown in the auxiliary display) is between 0.0001 Hz and 200 Hz.

0.0001 Hz ≤ fs ≤ 200 Hz

Units of flow rate:

Unit of SI volume flow rate:	m^3, 1, cm^3
Unit of SI mass flow rate:	t, kg, g
Unit of non-SI volume flow rate:	mG, G, kG, B, mIG, IG, kIG
Unit of SI mass flow rate:	lb
Unit of time:	d, h, min., s

Default: 10.000 m^3/P

Note) Select the same unit systems (volume unit or mass unit) for the flow rate range and pulse scale. Selection of different unit systems for them will cause set errors (Err-22 PULSE WEIGHT SETTING ERROR). (See page 5-74.)

Calculation method of span frequency:

Span frequency fs can be calculated by the following formula:

fs = (Flow rate range)/(Pulse scale)

To calculate fs, pay attention to the following points:

* Convert flow range into the range per second.
* Select the same unit of flow rate for flow rate range and pulse scale.

Example)When flow rate range: 60 l/min., and pulse scale: 10 cm^3/P:

1. Convert the flow rate range into the flow rate range per second.

60 l/min. → 60/60 l/s

= 1 l/s

2. Select the same unit of flow rate for flow rate range and pulse scale.

In this example, the unit of pulse scale is changed.

10 cm^3/P → 10/1000 l/P

= 0.01 l/P

3. Calculate the span frequency.

(1 l/P) / (0.01 l/P)

= 100 Hz

fs = 100 Hz

Set pulse scale in accordance with the following procedure:

Step	Procedure	Screen
1	Enter ENGINEERING MODE in accordance with the entry into ENGINEERING MODE (see section 5-5-10. on page 5-33). Then press the ↑ or ↓ key to display the screen at right.	12.3 % # PLS 27.780 Hz SCL 100.00 l/p
2	Press the → key to move the cursor to the position under a desired value to be set or changed.	12.3 % # PLS 27.780 Hz SCL 100.00 l/p
3	Using the ↑ or ↓ key, change the value to a desired pulse scale to be set.	12.3 % # PLS 13.890 Hz SCL 200.00 l/p
4	Press the → key to move the cursor to the position under #. Press the MODE key to return to the MEASURING MDOE and to save data.	12.3 % # PLS 13.890 Hz SCL 200.00 l/p

CAUTION

You have only ten minutes to return to MEASURING MODE to save the new value before the system resets it to the previously saved value.

5-6-9. Setting pulse width

Set a pulse width. The pulse width should be set in accordance with the specifications of the pulse receiver installed.

Set range

DUTY 50%

Pulse width that is DUTY 50% of the span frequency, and 1,000 ms (1s) maximum. The pulse duty ratio defines the pulse ON time versus the pulse OFF time as a percentage of the total pulse cycle.

NUM (setting of a real value)

0001 to 1,000 ms (1 s)

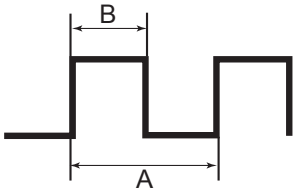
* With DUTY 50%, no setting error appears.
* With NUM (with a real value set), a setting error occurs if the pulse width exceeds the DUTY ratio of 70% in span frequency.

Default:

DUTY 50%

Method of setting pulse width:

The DUTY ratio is B/A (%) in the diagram at right.



1. NUM (when real pulse width is selected)

DUTY ratio < 70%

Set the pulse width as shown above.

Calculation method: When the range is 360 m^3, and pulse scale is 2 l/P,

First convert the unit of range to calculate the span frequency.

Convert the range into the unit of per-second (/s).

360 m^3/s → 0.1 m^3/s

Convert the unit of flow rate range to be same as the unit of pulse scale.

0.1 m^3/s → 0.1*1000 l/s

100 l/s

Calculation of span frequency

(100 l/s) / (2 l/P)

= 50 Hz

50 Hz → 20 ms (= A)

Calculation of pulse width where the DUTY ratio is equivalent to 70%

B= 0.7 × A

= 0.7 × 20 ms

= 14 ms

Therefore, set the pulse width to less than 14 ms.

2. DUTY 50% (Automatically set)

Selecting DUTY 50% automatically sets the pulse width as follows:

Calculation method 1

Make calculations to obtain a pulse width that is DUTY 50% of the span frequency. The pulse width is automatically set. In this case, the calculated value of the pulse width does not appear on the display.

Calculation method 2

In addition, if the pulse width calculated by the calculation method 1 exceeds 1 second, the pulse width is set to 1 second.

Calculation method 1: When the range is 360 m^3/h, and pulse scale is 2 l/P,

First convert the unit of range to calculate the span frequency.

Convert the range into the unit of per-second (/s).

360 $m^3/h \rightarrow 0.1\ m^3/s$

Convert the unit of flow rate range to be same as the unit of pulse scale.

$0.1\ m^3/s \rightarrow 0.1 \times 1000$ l/s

100 l/s

Calculation of span frequency

(100 l/s) / (2 l/P)

= 50 Hz

50 Hz → 20 ms (= A)

Calculation of pulse width where the DUTY ratio is equivalent to 50%

$B = 0.5 \times A$

$= 0.5 \times 20$ ms

= 10 ms

Therefore, the pulse width is 10 ms.

Calculation method 2: When the range is 36 m^3/h, and pulse scale is 100 l/P,

First convert the unit of range to calculate the span frequency.

Convert the range into the unit of per-second (/s).

36 $m^3/h \rightarrow 0.01\ m^3/s$

Convert the unit of flow rate range to be same as unit of pulse scale.

$0.01 m^3/s \rightarrow 0.01 \times 1000$ l/s

10 l/s

Calculation of span frequency

(10 l/s) / (100 l/p)

= 0.1 Hz

0.1 Hz → 10 s (= A)

Calculation of pulse width where the DUTY ratio is equivalent to 50%

$B = 0.5 \times A$

$= 0.5 \times 10$ s

= 5 s

Because the calculated pulse width exceeds 1 s, it takes 1s.

Set a pulse width in accordance with the following procedure:

Step	Procedure	Screen
1	Enter ENGINEERING MODE in accordance with the entry into ENGINEERING MODE (see section 5-5-10. on page 5-33). Then press the ↑ or ↓ key to display the screen at right.	12.3 % # PLS 27.778 % WID NUM 010.00ms
2	Press the → key to move the cursor to the position under NUM.	12.3 % # PLS 27.778 % WID NUM 010.00ms
3	Pressing the ↑ key switches a screen for entering a numeric value for pulse width to a screen for fixing the DUTY ratio to 50%.	12.3 % # PLS WID DUTY 50 %
4	To enter a numeric value for pulse width, press the ↑ key to return to the screen for the entry of numeric values. Using the → key, move the cursor to the position under a desired digit to be set.	12.3 % # PLS 27.778 % WID NUM 010.00ms
5	Using the ↑ or ↓ key, change the value to a desired value to be set.	12.3 % # PLS 13.889 % WID NUM 005.00ms
6	Press the → key to move the cursor to the position under #. Press the MODE key to return to the MEASURING MODE and to save data.	12.3 % # PLS 13.889 % WID NUM 005.00ms

CAUTION

You have only ten minutes to return to MEASURING MODE to save the new value before the system resets it to the previously saved value.

5-6-10. Setting drop out

This function is used to set the drop out value for the pulse output. The pulse output will be cut off at this point to avoid flow pulsation in range values close to zero, thus preventing incorrect totalization of the flow rate.

Pulse counting pauses when the flow rate reaches this preset percentage of the set range.

The low flow cutoff function affects the drop out function of the MagneW Two-wire PLUS+. Please refer to the following table describing how the drop out function of the MagneW Two-wire PLUS+ works.

Drop out function of the MagneW Two-wire PLUS+

LFC: Low flow cutoff, DO: Drop out

	LFC setting value ≥ DO setting value	**LFC setting value < DO setting value**
Pulse output	When the flow rate is less than the LFC setting value, the pulse output is fixed to zero (does not generate pulses).	When the flow rate is less than the DO setting value, the pulse output is fixed to zero (does not generate pulses).
Built-in counter (Totalized value)	When the flow rate is less than the LFC setting value, the totalized value is not counted up.	When the flow rate is less than the DO setting value, the totalized value is not counted up.

Setting range: 0 to 10%

Default: 2%

Set drop out in accordance with the following procedure:

Step	Procedure	Screen
1	Enter ENGINEERING MODE in accordance with the entry into ENGINEERING MODE (see section 5-5-10. on page 5-33). Then press the ↑ or ↓ key to display the screen at right.	12.3 % # DROPOUT 02 %
2	Press the → key.	12.3 % # DROPOUT 02 %
3	Using the ↑ or ↓ key, change the value to a desired value to be set.	12.3 % # DROPOUT 05 %
4	Press the → key to move the cursor to the position under #. Press the MODE key to return to the MEASUREMENT MODE and to save data.	12.3 % # DROPOUT 05 %

CAUTION

You have only ten minutes to return to MEASURING MODE to save the new value before the system resets it to the previously saved value.

5-6-11. Setting low flow cutoff

This function is used to set the low flow cutoff value. When the flow rate reaches the entered value, the analog output is cut off and latched to 4 mA (display flow rate of 0%) to avoid errors due to flow pulsation in range value close to zero.

Also, for reverse flow rate the output is latched to 4 mA (display flow rate of 0%) The lower limit of the low flow cutoff setting is determined by the velocity range.

1. If the velocity range exceeds 3 m/s, the lower limit value is 1%.
2. If the flow speed range is 3 m/s or less, the lower limit value will cut the flow speed of 0.03 m/s or less flow the rate.

   Example: If the flow speed range is set as 2 m/s, the lower limit of the low flow cutoff value is 1.5%. (= 0.03/2 = 0.015 = 1.5%)

Setting range: 1 to 10%

Default: Depends on the velocity range.

Set low flow cut in accordance with the following procedure:

Step	Procedure	Screen
1	Enter ENGINEERING MODE in accordance with the entry into ENGINEERING MODE (see section 5-5-10. on page 5-33). Then press the ↑ or ↓ key to display the screen at right.	12.3 % # LOW-FLOW CUT 02 %
2	Press the → key. The cursor then moves to the position of the low flow cut value.	12.3 % # LOW-FLOW CUT 02 %
3	Using the ↑ or ↓ key, change the value to a desired value to be set.	12.3 % # LOW-FLOW CUT 05 %
4	Press the → key to move the cursor to the position under #. Press the MODE key to return to the MEASUREMENT MODE and to save data.	12.3 % # LOW-FLOW CUT 05 %

CAUTION

You have only ten minutes to return to MEASURING MODE to save the new value before the system resets it to the previously saved value.

5-6-12. Setting upper and lower limit alarm

This function is used to set the upper and lower limit alarm set points when the contact output is selected.

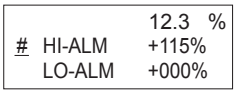
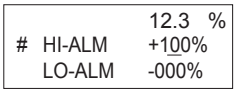
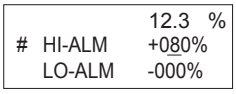
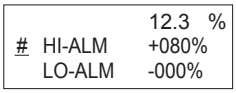
An alarm is output when the flow rate exceeds these preset upper and lower limits.

The alarm output status depends on the “Setting contact output status” described later.

Set range: HI-ALM 0% to +115%
LO-ALM 0% to +115%

Default: HI-ALM +115%
LO-ALM 0%

Set the upper/lower limit alarm in accordance with the following procedure:

Step	Procedure	Screen
1	Enter ENGINEERING MODE in accordance with the entry into ENGINEERING MODE (see section 5-5-10. on page 5-33). Then press the ↑ or ↓ key to display the screen at right.	
2	Using the → key, move the cursor to the position under a digit to be set or changed.	
3	Using the ↑ or ↓ key, change the value to the desired value to be set.	
4	Press the → key to move the cursor to the position under #. Press MODE key to return to the MEASURING MODE and to save data.	

However, set as follows: HI-ALM > LO-ALM.

5-6-13. Selecting failsafe mode for analog outputs

This function is used to determine the analog output direction when the flowmeter detects a critical status condition.

CAUTION

The failsafe mode is very important for the overall safety of the control process. Choose the failsafe direction carefully, as equipment damage can result from a wrong choice.

Setting range: LOW Analog output is driven to low scale (TYP 3.7 mA)
HIGH Analog output is driven to high scale (TYP 21.8 mA)
HOLD Analog output is held at its last good value.
Default: LOW

Set failsafe mode for analog output in accordance with the following procedure:

Step	Procedure	Screen
1	Enter ENGINEERING MODE in accordance with the entry into ENGINEERING MODE (see section 5-5-10. on page 5-33). Then press the ↑ or ↓ key to display the screen at right.	12.3 % # ERROR OUT MODE I.OUT LOW
2	Press the → key.	12.3 % # ERROR OUT MODE I.OUT LOW
3	Using the ↑ or ↓ key, determine the failsafe mode for analog output.	12.3 % # ERROR OUT MODE I.OUT HIGH
4	Press the → key to move the cursor to the position under #. Press the MODE key to return to the MEASUREMENT MODE and to save data.	12.3 % # ERROR OUT MODE I.OUT HIGH

CAUTION

You have only ten minutes to return to MEASURING MODE to save the new value before the system resets it to the previously saved value.

5-6-14. Selecting failsafe mode for pulse output

This function is used to determine the pulse output direction when the flowmeter detects a critical status condition.

CAUTION

The failsafe mode is very important for the overall safety of the control process. Choose the failsafe direction carefully, as equipment damage can result from a wrong choice.

Set range: OFF Outputs no pulse.
HOLD Pulse output signal held at its present state

Default: OFF

Set failsafe mode for pulse output in accordance with the following procedure:

Step	Procedure	Screen
1	Enter ENGINEERING MODE in accordance with the entry into ENGINEERING MODE (see section 5-5-10. on page 5-33). Then press the ↑ or ↓ key to display the screen at right.	12.3 % # ERROR OUT MODE P.OUT OFF
2	Press the → key.	12.3 % # ERROR OUT MODE P.OUT OFF
3	Using the ↑ or ↓ key, determine the failsafe mode for pulse output.	12.3 % # ERROR OUT MODE P.OUT HOLD
4	Press the → key to move the cursor to the position under #. Press the MODE key to return to the MEASUREMENT MODE and to save data.	12.3 % # ERROR OUT MODE P.OUT HOLD

CAUTION

You have only ten minutes to return to MEASURING MODE to save the new value before the system resets it to the previously saved value.

5-6-15. Setting contact output status

This function is used to set contact output status for normal operation.

This function is effective only when contact output has been selected is the function specification.

Set range: CLOSE Sets the open collector output to ON.
OPEN Sets the open collector output to OFF.

Default: OPEN

Set the contact output status in accordance with the following procedure:

Step	Procedure	Screen
1	Enter ENGINEERING MODE in accordance with the entry into ENGINEERING MODE (see section 5-5-10. on page 5-33). Then press the ↑ or ↓ key to display the screen at right.	12.3 % # ST. OUT MODE NORMAL CLOSE
2	Press the → key.	12.3 % # ST. OUT MODE NORMAL CLOSE
3	Using the ↑ key, set the contact output status.	12.3 % # ST. OUT MODE NORMAL OPEN
4	Press the → key to move the cursor to the position under #. Press the MODE key to return to the MEASUREMENT MODE and to save data.	12.3 % # ST. OUT MODE NORMAL OPEN

CAUTION

You have only ten minutes to return to MEASURING MODE to save the new value before the system resets it to the previously saved value.

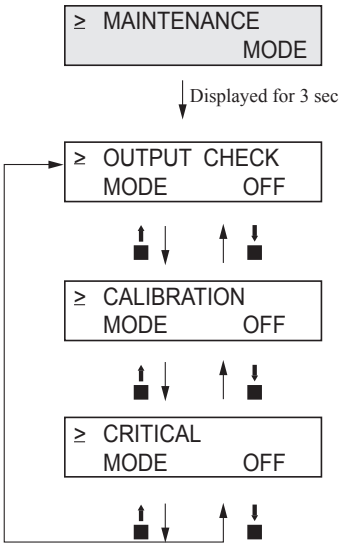
5-7. Configuration of MAINTENANCE MODE

Introduction

MAINTENANCE MODE consists of the following three types: OUTPUT CHECK MODE, CALIBRATION MODE, and CRITICAL MODE. For details on the modes, see the following pages.

LCD display flow

The LCD display flow of MAINTENACE MODE is as follows:



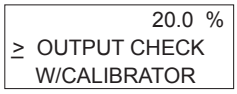
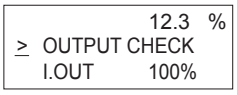
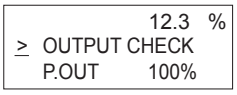
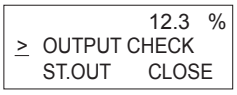
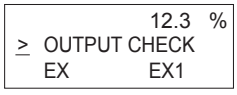
CAUTION

When using an MGZ, use an Ex adaptor. Otherwise, the device may burn out. For details, refer to the user's manual for the MGZ (document No. CM2-MGZ200-2001).

5-7-1. Configuration of OUTPUT CHECK MODE

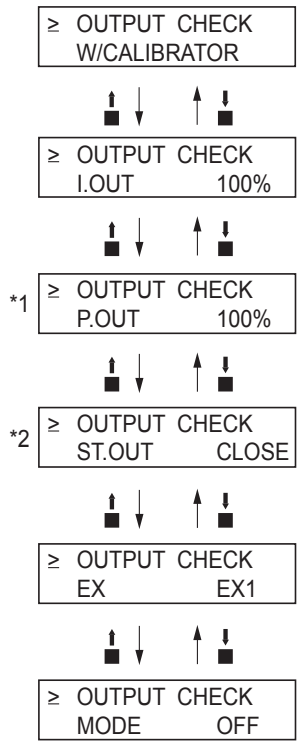
Introduction

OUTPUT CHECK MODE has the following setting and adjustment items.
For details on the function of items, see the following pages.

Item	Content	Screen
OUTPUT CHECK W/CALIBRATOR	Perform loop check by using a calibrator.	
OUTPUT CHECK I.OUT	Outputs a fixed value of analog current output to perform loop check.	
OUTPUT CHECK P.OUT	Outputs a fixed value of pulse output to perform loop check.	
OUTPUT CHECK ST.OUT	Switch ST. OUT OPEN/CLOSE to perform loop check.	
OUTPUT CHECK EX	Outputs a fixed value of excitation current. This value was calibrated in the factory. DO NOT configure this value.	

LCD display flow

The screen flow of OUTPUTCHECK MODE is as follows:



*Note) *1. Displayed only when PULSE is selected by FUNC SET in ENGINEERING MODE.*

**2. Displayed only when H1 LO STOUT or ELECTRODE STOUT is selected by FUNC SET in ENGINEERING MODE.*

5-7-2. Performing loop check of analog output by using a calibrator model MGZ/F1X.

Analog Output Check

With the signal input by a calibrator, the electromagnetic flowmeter outputs analog 4 to 20 mA to perform the loop check. Other instruments in the analog current output loop, such as recorders and controllers can be checked.

Use an Azbil calibrator, model F1X1000 or MGZ14.

Default setting

Signal input by the calibrator

Setting range

0%, 25% to 100%

(The % flow rate input from 1% to 24% are not available.)

Perform loop check of analog outputs by using a calibrator in accordance with the following procedures.:

Step	Procedure	Screen
1	Enter MAINTENANCE MODE (see "5-5-10. Entering ENGINEERING MODE and MAINTENANCE MODE" on page 5-33). Then the screen at right is displayed.	20.0 % ≥ OUTPUT CHECK MODE OFF
2	Press the → key to move the cursor to the OFF position. Press the ↑ key. With the displays switched from OFF to ON, the output check mode is then active.	20.0 % ≥ OUTPUT CHECK MODE OFF 20.0 % ≥ OUTPUT CHECK MODE ON 20.0 % ≥ OUTPUT CHECK W/CALIBRATOR
3	Input the signal from the calibrator and perform the loop check. For the details of the calibrator operation, refer to the users manual of the calibrator.	20.0 % ≥ OUTPUT CHECK W/CALIBRATOR

5-7-3. Performing loop check of analog outputs

Analog output check

The electromagnetic flowmeter can be used as a constant current generator to check analog outputs. Other instruments in the analog current output loop, such as recorders and controllers can be checked.

Default setting

Displays the current output value.

Setting range

Range settings are allowed ranging from 0 to 100%.

Perform loop check of analog outputs in accordance with the following procedure:

Step	Procedure	Screen
1	Enter MAINTENANCE MODE in accordance with the entry into MAINTENANCE MODE (see section 5-5-10. on page 5-33). Then display the screen at right.	20.0 % ≥ OUTPUT CHECK MODE OFF
2	Press the → key to move the cursor to the OFF position. Press the ↑ key. With the display switched from OFF to ON, the output check mode is then active.	20.0 % > OUTPUT CHECK MODE OFF 20.0 % > OUTPUT CHECK MODE ON 20.0 % ≥ OUTPUT CHECK W/CALIBRATOR 20.0 % ≥ OUTPUT CHECK I.OUT 000.0%
3	Press the → key to move the cursor to the position under a desired value to be checked.	20.0 % > OUTPUT CHECK I.OUT 000.0%
4	Pressing the ↑ or ↓ key, change the value to the desired value to be checked. As shown on the screen on the right, the output to the range, given as an analog output, is 100% i.e. 20 mA.	20.0 % > OUTPUT CHECK I.OUT 100.0%
5	Press the → key to move the cursor to the position under >. Movement to another screen by using the ↑ or ↓ key returns to an analog output according to the actual flow rate.	20.0 % ≥ OUTPUT CHECK I.OUT 100.0%

5-7-4. Performing loop check of pulse outputs

Pulse output check

The electromagnetic flowmeter can be used as a pulse generator to check pulse outputs.

This screen appears when pulse output has been selected in FUNC SET of ENGINEERING MODE (see "5-6-2. Selecting Pulse Output, Electrode Status Output or High Low Status Output").

Default setting

Displays the current output value.

Setting range

Range settings are allowed ranging from 0 to 100%.

Perform loop check of pulse outputs in accordance with the following procedure:

Step	Procedure	Screen
1	Enter MAINTENANCE MODE in accordance with the entry into MAINTENANCE MODE (see section 5-5-10. on page 5-33). Then display the screen at right.	20.0 % ≥ OUTPUT CHECK MODE OFF
2	Press the → key to move the cursor to the OFF position. Press the - key. With the display switched from OFF to ON, the output check mode is then active.	20.0 % > OUTPUT CHECK MODE OFF 20.0 % > OUTPUT CHECK MODE ON 20.0 % ≥ OUTPUT CHECK I.OUT 000.0%
3	Press the ↑ key to display the screen at right.	20.0 % ≥ OUTPUT CHECK P.OUT 000.0%
4	Press the → key to move the cursor to the position under a desired value to be checked.	20.0 % > OUTPUT CHECK P.OUT 000.0%
5	Pressing the ↑ or ↓ key, change the value to the desired value to be checked. On the screen at right, a frequency pulse corresponding to flow rate signal 100% is output.	20.0 % > OUTPUT CHECK I.OUT 100.0%
6	Press the → key to move the cursor to the position shown on the screen at right. Movement to another screen by using the ↑ or ↓ key returns to a pulse output according to the actual flow rate.	20.0 % ≥ OUTPUT CHECK I.OUT 100.0%

5-7-5. Performing loop check of contact outputs

Contact output check

Contact outputs of electromagnetic flowmeter can be turned on and off to perform loop check of contact output signals.

This screen appears when contact output has been selected in FUNC SET of ENGINEERING MODE (see "5-6-2. Selecting Pulse Output, Electrode Status Output or High Low Status Output").

Default setting

Displays the current contact output status.

Setting range

Set range "CLOSE" and "OPEN"

Perform loop check of contact outputs in accordance with the following procedure:

Step	Procedure	Screen
1	Enter MAINTENANCE MODE in accordance with the entry into MAINTENANCE MODE (see section 5-5-10. on page 5-33). Then display the screen at right.	20.0 % ≥ OUTPUT CHECK MODE OFF
2	Press the → key to move the cursor to the OFF position. Press the ↑ key. With the displays switched from OFF to ON, the output check mode is then active.	20.0 % > OUTPUT CHECK MODE OFF 20.0 % > OUTPUT CHECK MODE ON 20.0 % ≥ OUTPUT CHECK I.OUT 000.0%
3	Press the ↑ key twice to display the screen at right. In this status, a contact output corresponding to the display is output.	20.0 % ≥ OUTPUT CHECK ST.OUT CLOSE
4	Press the → key to move the cursor to the OPEN or CLOSE position that indicates the status of contact output.	20.0 % > OUTPUT CHECK ST.OUT CLOSE
5	Press the → key to move the cursor to the position under >. Movement to another screen by using the ↑ or ↓ key returns the contact output to the output status according to the current status.	12.3 % ≥ OUTPUT CHECK ST.OUT CLOSE

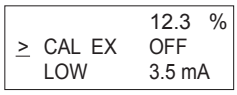
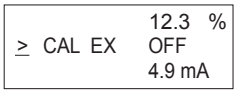
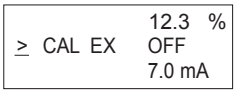
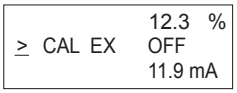
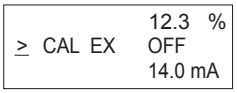
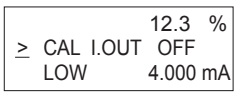
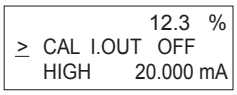
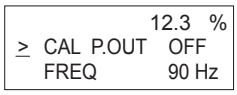
5-7-6. Configuration of CALIBRATION MODE

Introduction

CALIBRATION MODE has the following setting and adjustment items:

Configuration of CALIBRATION MODE requires a dedicated calibrator.

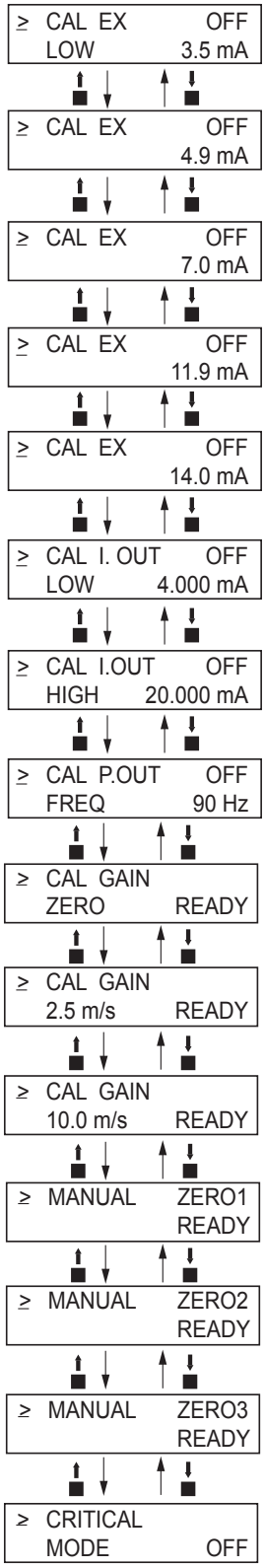
Wrong operation may hinder accurate measurements of the flow rate. To operate in this mode, contact an Azbil Corp. representative.

Item	Content	Screen
CAL EX LOW 3.5 mA	Adjusts 3.5 mA excitation current.	
CAL EX 4.9 mA	Adjusts 4.9 mA excitation current.	
CAL EX 7.0 mA	Adjusts 7.0 mA excitation current.	
CAL EX 11.9 mA	Adjusts 11.9 mA excitation current.	
CAL EX 14.0 mA	Adjusts 14.0 mA excitation current.	
CAL I.OUT LOW 4.000 mA	Adjusts 4 mA analog current output.	
CAL I.OUT HIGH 20.00 mA	Adjusts 20 mA analog current output.	
CAL P.OUT FREQ 90 Hz	Adjusts 90 Hz pulse output.	

Item	Content	Screen
CAL GAIN ZERO	Adjusts 0 m/s gain.	12.3 % > CAL GAIN OFF ZERO READY
CAL GAIN 2.5 m/s	Adjusts 2.5 m/s gain.	12.3 % > CAL GAIN OFF 2.5 m/s READY
CAL GAIN 10.0 m/s	Adjusts 10.0 m/s gain.	12.3 % > CAL GAIN OFF 10.0 m/s READY
MANUAL ZERO1	Fine zero tuning for excitation current 4.9mA.	0.1 % > MANUAL ZERO1 READY
MANUAL ZERO2	Fine zero tuning for excitation current 7.0mA.	0.1 % > MANUAL ZERO2 READY
MANUAL ZERO3	Fine zero tuning for excitation current 11.9mA/14.0mA.	0.1 % > MANUAL ZERO3 READY

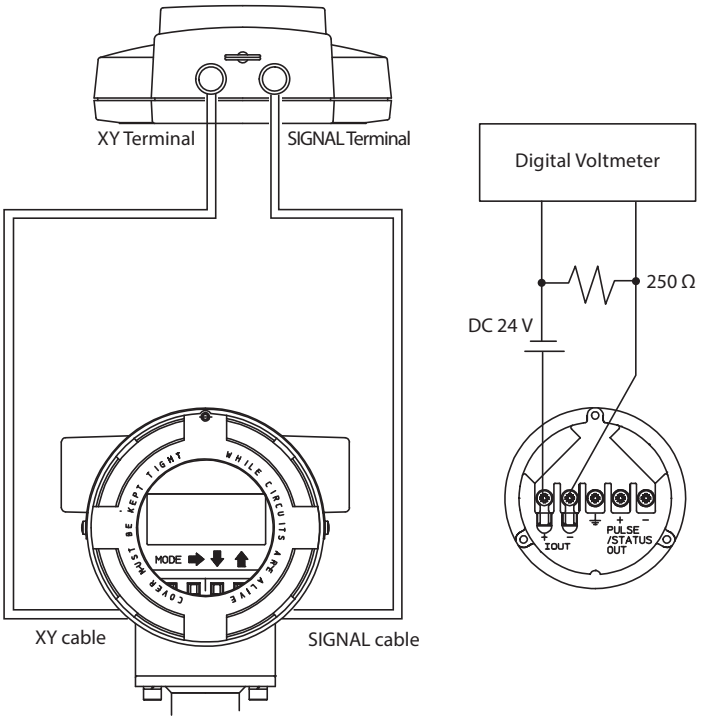
LCD display flow

The LCD display flow of CALIBRATION MODE is as follows:

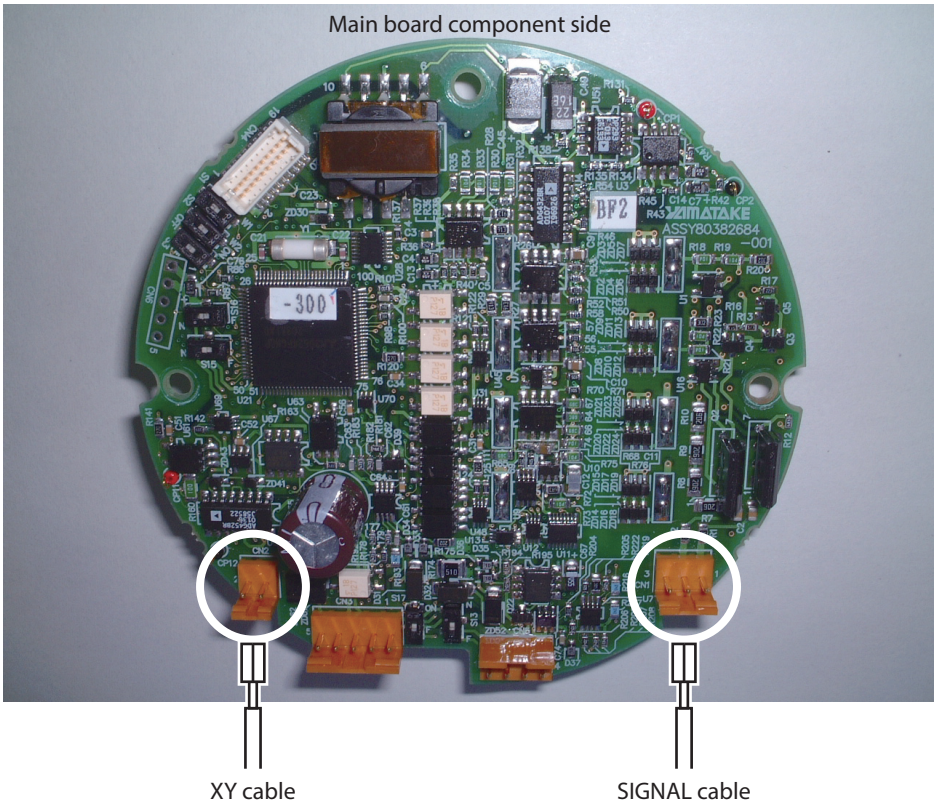


CAUTION

When calibrate the remote style converterwith the calibrator, short C terminal and ground terminal on the converter housing.
By shorting C terminal and ground terminal on the converter housing, accurate calibration can be done.



When you open the cover, you will find the LCD card, and underneath that, the main board.



5-7-7. Manual zero

This function is used to improve flow measurement more accurately when the flow rate becomes 25% or less of setting range.

Model MTG has three manual zeroing functions for each excitation current.

MANUAL ZERO1: Zeroing for the excitation current 4.9mA.

MANUAL ZERO2: Zeroing for the excitation current 7.0mA

MANUAL ZERO3: Zeroing for the excitation current 11.9mA/14.0mA.

Make sure the detector is filled with the process fluid and stands still.

Before manual zeroing, execute auto zero.

Step	Procedure	Screen
1	Enter CALIBRATION MODE. Use ↑ or ↓ key to cycle through the screens until the MANUAL ZERO1 screen appears.	0.5 % > MANUAL ZERO1 READY
2	WORKING is flashing for approximately 20 seconds. Wait until READY appears.	0.5 % > MANUAL ZERO1 WORKING
3	Check the value of zero point. If 0.0% is displayed on the main display, MANUAL ZEROING is not necessary for MANUAL ZERO1. If the value of zero point is not 0.0%, adjust the zero point.	0.5 % > MANUAL ZERO1 READY
4	Move the cursor under READY by pushing the → key.	0.5 % > MANUAL ZERO1 READY

Note) If the main display shows -2.0%, the zero point value may exceed -2.0%. Execute Auto zero before manual zero.

Step	Procedure	Screen
5	Adjust zero point by pushing the ↑ or ↓ key so that the main display shows 0.0%. By pushing the ↑ key once, READY changes to UP and the zero point value increases 0.05%. By pushing the ↓ key once, READY changes to DOWN and the zero point value decreases 0.05%. It takes about 20 seconds to change the zero point value. During manual zeroing, the value in the main display flashes. If you push the ↑ or ↓ key again, wait until the value in the main display does not flash. *Note) Do not keep on pushing the ↑ or ↓ key. Manual zeroing does not work.*	0.0 % > MANUAL ZERO1 READY 0.0 % > MANUAL ZERO1 UP 0.0 % > MANUAL ZERO1 DOWN
6	Move the cursor to the mode indicator by pushing → key.	0.0 % ≥ MANUAL ZERO1 READY
7	Push the ↓ key and display the MANUAL ZERO2 screen.	0.5 % ≥ MANUAL ZERO2 WORKING
8	Execute MANUAL ZERO2, as well as MANUAL ZERO1. (Refer to the Step 2 to 6.)	0.0 % ≥ MANUAL ZERO2 WORKING
9	Push the ↓ key and display the MANUAL ZERO3 screen.	0.5 % ≥ MANUAL ZERO3 WORKING
10	Execute MANUAL ZERO3, as well as MANUAL ZERO1. (Refer to the Step 2 to 6.)	0.0 % ≥ MANUAL ZERO3 WORKING
11	Push the MODE key and return to the MEASURING MODE.	0.5 % MEASURING MODE

5-7-8. Configuration of CRITICAL MODE

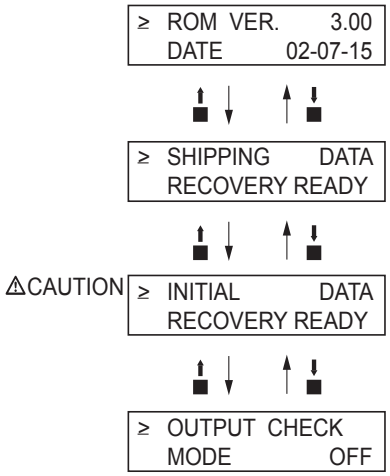
Introduction

CRITICAL MODE has the following setting and adjustment items:

Item	Contents	Screen
ROM VER DATE	Displays the ROM version and date.	20.0 % ≥ ROM VER. □□□ DATE YY-MM-DD
SHIPPING DATA (default value) RECOVERY	You can return the device to factory setting/default values for pertinent operational and configuration parameters. These parameters are entered before the device is shipped, so they are commonly referred to as "shipping data". They include factory calibration data and factory settings or initial default settings for customer configuration data.	20.0 % ≥ SHIPPING DATA RECOVERY READY
INITIAL DATA RECOVERY	Initial data recovery eliminates all calibration data and configuration parameters. DO NOT use this function.	20.0 % ≥ INITIAL DATA RECOVERY READY

LCD display flow

The screen flow of CRITICAL MODE is as follows:



⚠CAUTION

INITIAL DATA RECOVERY function is only for Azbil Corporation service/ maintenance specialist. Please DO NOT use this function. If this function is turned ON, all calibrated data will be missing. The device needs to be back to the factory to calibrate again.

5-7-9. Displaying ROM version and date

Displaying ROM version

The ROM version and date of the converter can be displayed on the display screen.

Display the ROM version and data in accordance with the following procedure:

Step	Procedure	Screen
1	Enter MAINTENANCE MODE in accordance with the entry into MAINTENANCE MODE (see section 5-5-10. on page 5-33). Using the ↑ or ↓ key, display the screen at right.	20.0 % ≥ OUTPUT CHECK MODE OFF
2	Press the ↑ key twice to display the screen at right.	20.0 % ≥ CRITICAL MODE OFF
3	Press the → key to move the cursor to the OFF position. Then press the - key to switch the display from OFF to ON.	20.0 % > CRITICAL MODE ON
4	After the entry into CRITICAL MODE, the screen at right appears. On the screen, the ROM version and date can be checked.	20.0 % ≥ ROM VER. □.□.□ DATE YY-MM-DD

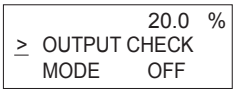
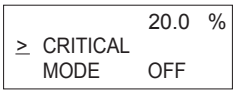
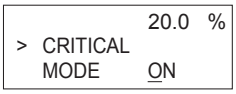
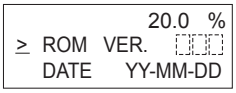
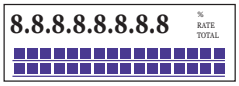
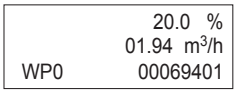
5-7-10. Returning to settings at shipment

SHIPPING DATA (default value) RECOVERY

Performing SHIPPING DATA RECOVERY returns the internal data settings of the device to the settings at time of shipment.

Note that executing this operation erases the data that was set and changed by the customer.

Perform SHIPPING DATA RECOVERY in accordance with the following procedure:

Step	Procedure	Screen
1	Enter MAINTENANCE MODE in accordance with the entry into MAINTENANCE MODE (see section 5-5-10. on page 5-33). Using the ↑ or ↓ key, display the screen at right.	
2	Press the ↑ key twice to display the screen at right.	
3	Press the → key to move the cursor to the OFF position. Then press the ↑ key to switch the display from OFF to ON. After the entry into CRITICAL MODE, the screen at right appears.	 
4	Press the ↑ key to display the screen at right.	
5	Press the → key to move the cursor to the READY position, and then keep pressing the ↑ key for three seconds or more.	
6	SHIPPING DATA RECOVER starts. The display will change as shown on the screen at right.	  
7	When SHIPPING DATA RECOVERY ends, the data settings return to those at the time of shipping, and then the MEASURING MODE screen reappears.	

5-8. Description of Error Messages

Introduction

Errors are classified into critical failure and non-critical failure.

Critical failure

Critical failure may obstruct the electromagnetic flowmeter operation, if not corrected, ultimately damage the flowmeter. When critical failure occurs during operation, an error message will appear on the converter's display and the electromagnetic flowmeter will continue to output the preset value in the abnormality treatment (failsafe) direction. The error message and the self-diagnostic results will be visible on the display.

Perform the proper correction measures, referring to the actions below.

Error code of serious trouble

Error code	Error content	Action	LCD display
Err-02	CPU (ROM, RAM) CHECK SUM ERROR	1. Restore power. 2. Replace ROM. 3. Replace main P/C.	Err - 02 CPU CHECK ERROR
Err-04	NVM READ AFTER WRITE ERROR	1. Restore power. 2. Replace main P/C.	Err - 04 NVM CHECK ERROR

Non-critical error

Non-critical failures will not seriously affect electromagnetic flowmeter operation.

When an error occurs during operation and is regarded as a non-critical problem by the converter self-diagnostics, the output will not burn-out and the electromagnetic flowmeter will continue to output the measured value.

If a wrong setting is found, an error message is displayed for a second, and then the screen set wrongly is displayed.

Error code of set errors

Error code	Error content	Action	LCD display
Err-12	Upper/lower limit alarm set error HI < LO is set.	Set HI>LO.	Err - 12 SETTING ERROR HI<LO
Err-21	Span is set to 12 m/s or more.	Check the settings of flow rate range and detector information (bore diameter and detector type).	Err - 21 SPAN ERROR OVER 12 m/s
Err-22	Pulse frequency is too large or too small. The flow rate range unit system is different from the pulse unit system. Example: SPAN m^3/h pulse scale t/h	1. Check pulse scale. 2. Check the setting of pulse frequency. 3. Adopt a unified unit system.	Err - 22 PULSE WEIGHT SETTING ERROR
Err-23	The pulse width is too large. When pulse frequency is output, the duty is 70% or more.	Check the following settings: 1. Pulse width 2. pulse scale 3. Span	Err - 23 PULSE WIDTH OVER DUTY 70%

Chapter 6. Operation using SFC communicator

6-1. Structure and functions of SFC

6-1-1. Structure of SFC

Introduction

CAUTION

- When communication with the converter is started using the SFC in a system with analog output, be sure to change the control loop of the process to "manual" (manual control).
- Be sure to use the SFC with software version 7.0 or later. Using earlier versions may result in problems such as the absence of some setting items or failure in setting correctly.

Note) Do not overcharge or over discharge (leave with the switch on) the builtin battery of the SFC. This may shorten the battery life.

Detailed information

The SFC has been developed not only as a converter but also as a communicator to be used in connection with various smart field instruments. If you need explanation for instruments other than the loop powered magnetic flowmeter, see the model SFC160/260 User's Manual of the respective series'.

Structure of Smart Field Communicator (SFC)

Names of components

Fig. 1-1. shows the structure and names of components for the Smart Field Communicator (SFC).

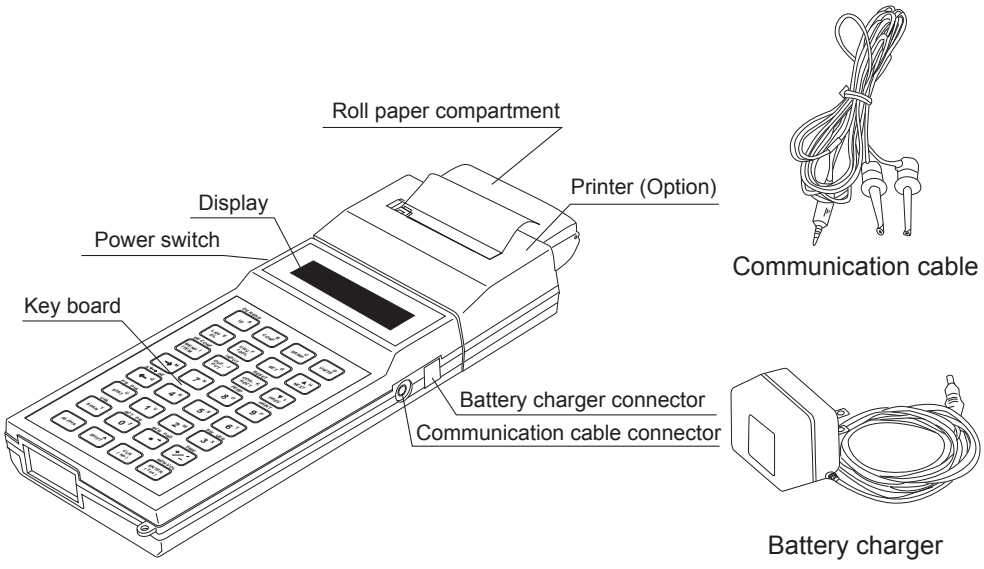
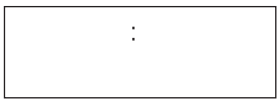


Fig. 6-1. Details of SFC

Names of components and descriptions

The following table describes the components of the SFC.

Name	Description
Paper roll compartment	■ Stores heat-sensitive paper roll for print out.
Printer section (option)	■ This is an optional item. ■ A 24 characters/line thermal printer. ■ Prints out internal data of the converter or communication data. ■ The printer section is combined with the main unit and cannot be separated.
Display window (screen)	■ Displays messages or data from the converter in 16 characters x 2 lines. ■ The data display screen is available in either English or Japanese.
Power switch	■ Turning ON the power switch of the SFC automatically starts self-diagnostics.
Keyboard	■ There are 32 touch keys. ■ Each key provides a separate function and other functions are accessed after pressing the SHIFT key. ■ The keyboard is available in either English or Japanese version.
Communication cable connector	■ Connect the plug side of the communication cable.
Communication cable	■ Be sure to use the supplied dedicated cables.
Battery charger connector	■ Connect the plug side of the battery charger.
Battery charger	■ Charge the battery of the SFC using the supplied battery charger. *Note) When the battery voltage drops, the following sign appears in the display window.*  SFCM00006001D

6-1-2. Functions of SFC

SFC keyboard

Key types

The SFC keyboard has 32 touch keys.

Each key is assigned to up to three types of input functions.

■ The alphabet

To enter a letter of the alphabet press the [ALPHA] key to display the "□" cursor in the display window first. Then, press the key of the desired letter.

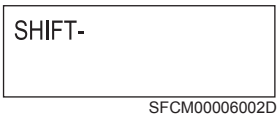
■ Function, numeral or symbol at the center of the [DE READ / ID / A] key

To access this function, numeral or symbol, make sure the "_" cursor is displayed in the display window.

Pressing the [ALPHA] key toggles the "□" cursor and "_" cursor.

■ Function displayed on the key

To access this function, press the [SHIFT] key to display SHIFT in the display window first.



SFCM00006002D

Then, press the key you want to enter. If you have pressed the [SHIFT] key by mistake, press the [CLR / (No)] key.

Key color-coding

The 32 touch keys can be roughly divided into 5 categories according to their function, and are color-coded as follows.

■ Green: Mainly used to communicate with the two wired magnetic flowmeter converter or display or change the setting.

■ Orange: Mainly used to communicate with the two wired magnetic flowmeter or select the screen or decide the menu.

■ Yellow: Mainly used to enter numerals.

■ Dark brown: Mainly used for diagnostics or check.

■ White: Used to control the keyboard or for auxiliary operation.

Rules of key operations and interaction with screens

General rules for key operations

The following points should be noted when operating the SFC keyboard.

- Press keys firmly and slowly. If the screen does not respond, this means the key input has not been accepted. Press the key slowly once again.
- There are active keys and inactive keys depending on the screen in the display window. When an inactive key is pressed, pressing the CLR (No) key will restore to a state in which key input can be accepted. After this, press an active key.

Interaction rules

The SFC can be operated on an interactive basis. Interact with the SFC according to the following rules:

- To answer "Yes" to a question on the screen, press the NON-VOL ENTER (Yes) key. Answering "Yes" to a question on the screen of the CONFIG functions normally moves to a hierarchy one level lower. However, answering "Yes" to the prompt of "EXIT..." exits the function and returns to a hierarchy one level higher.
- To answer "No" to a question on the screen, press the CLR (No) key. Answering "No" to a question on the screen of the CONFIG functions normally moves to a hierarchy one level higher. However, answering "No" to the prompt of "EXIT..." returns to the start screen of the function.
- To select a different function in the same hierarchy, press ▲ H NEXT / ▼ L PREV keys.
- To scroll the screen in order to select a different item in the same hierarchy and with the same function, press the DE CONF. MENU I ITEM key. While the CONFIG function is active, pressing the G SET + CLR (No) keys at any hierarchy will show a screen "EXIT CONFIG?". Pressing the NON-VOL ENTER (Yes) key here makes it possible to exit the CONFIG function at a stroke.

Display of # mark

While the SFC is communicating with the converter, a # mark may appear in the last column at the bottom of the screen. The # mark is an alarm which appears under the following circumstances.

- A minor fault has occurred.
- The converter is operating in constant current generation mode or special mode.

When the # mark appears, check the status of the converter with the F/S DIR U STAT key and take appropriate action with reference to "Error messages and remedial action" on page 6-32.

Key names and functions

This section describes the functions assigned to the green keys, which are mainly used to communicate with the two wired magnetic flowmeter converter or to change or display the settings.

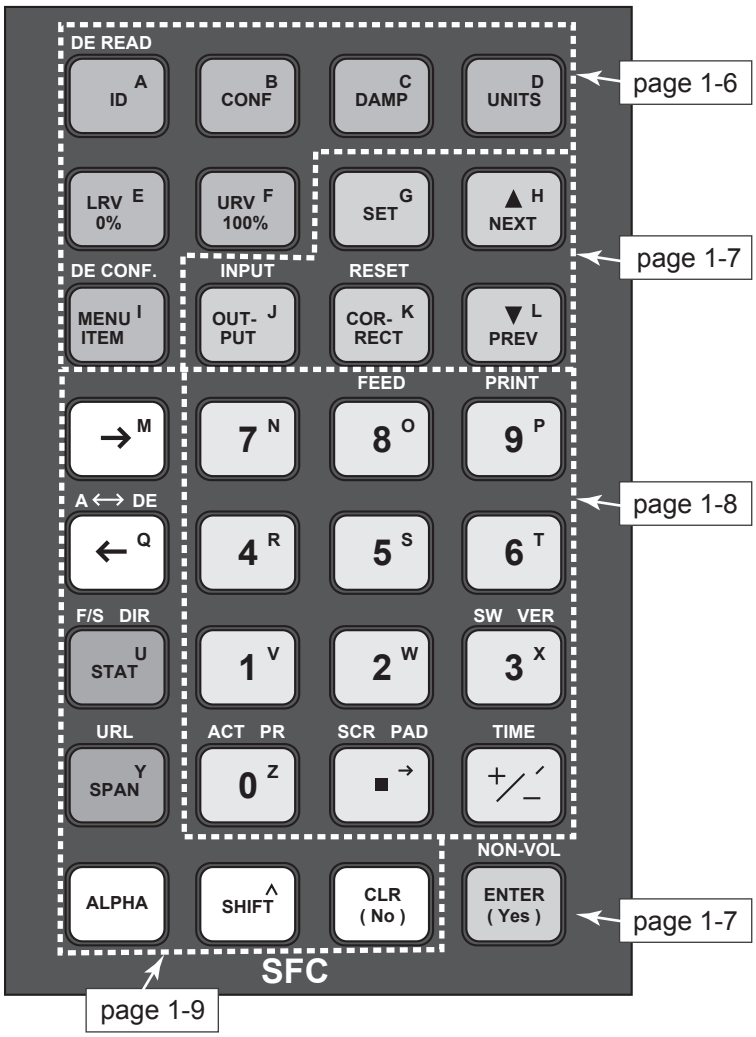
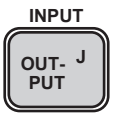
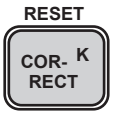


Fig. 6-2. SFC keyboard

Key	Description	
	Press key	Press SHIFT + key
DE READ A ID	ID: Starts communication with the converter. The display window shows TAG No. of the converter. It is possible to write or rewrite the TAG No. on this screen.	Used when the communication method is SFN. D. Has the same function as ID.
B CONF	CONF: Used to correct the converter or change the setting of the internal data. This function has a hierarchical structure. See “Hierarchical structure of CONFIG functions” on page 6-17 for details.	No effect
C DAMP	DAMP: Press this key to display or change the damping time constant of the converter.	No effect
D UNITS	UNITS: Press this key to display or set the engineering units of the flow rate measured using the converter.	No effect
LRV E 0%	LRV 0%: Displays the lower range value of the converter output range. Fixed at 0.0% in the converter. The lower range value refers to the flow rate when the converter output becomes 0% (4 mA DC in the case of analog output).	No effect
URV F 100%	URV 100%: Displays the upper range value of the converter output range. The upper range value refers to the flow rate when the converter output becomes 100% (20 mA DC in the case of analog output).	No effect
DE CONF. MENU I ITEM	MENU ITEM: Used to display or select a different item located at the same hierarchy and with the same function.	DE CONF: Used to display or select variables output in digital communication using SFN.D for communication method.

Key names and functions

This section describes the functions assigned to the orange keys, which are mainly used to communicate with the converter or to select a screen or to select from the menu.

Key	Description	
	Press key	**Press SHIFT + key**
	SET: Used for setting correction coefficient in LRV setting.	No effect
	NEXT: Scrolls up the screen in the CONFIG function.	No effect
	PREV: Scrolls down the screen in the CONFIG function.	No effect
	OUTPUT: Displays a value in percentage, which is transmitted by the converter to the control loop.	INPUT: Displays an instantaneous flow rate value detected by the converter in a real flow rate.
	CORRECT: Press this key to adjust the zero point of the converter. This operation is available while INPUT (input) is being read.	RESET: Resets the internal data of the converter to the factory setting.
	ENTER: Press this key to answer “Yes” to a question on the screen. The screen will move one step up or down or data set by the SFC is written into the database of the converter.	NON-VOL: The data set by the SFC is forcibly written into non-volatile memory of the converter.

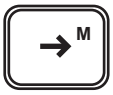
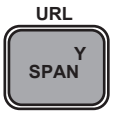
Key names and functions

This section describes the functions assigned to the yellow keys which are used to enter numerals.

Key	Description	
	Press key	**Press SHIFT + key**
PRINT 9 P	9: Enters numeral 9.	PRINT: Prints out internal data of the converter. This printing operation is called "configuration printout".
FEED 8 O	8: Enters numeral 8.	FEED: Advances printing paper by 1 line. The display window shows "PRINTER FEED". As long as this prompt is displayed, each pressing of this key advances paper by 1 line. To cancel this operation, press the CLR key.
7 N to 4 R	7 to 4: Enters numeral 7 to 4.	No effect
SW VER 3 X	3: Enters numeral 3.	Displays the software versions of the converter and SFC. If the SFC is not communicating with the converter, only the version of the SFC is shown.
2 W	2: Enters numeral 2.	Displays "KEYBAORD TEST row* column*" and then displays the row and column of the key pressed immediately after. Used to check the keyboard for any problems.
1 V	1: Enters numeral 1.	No effect
ACT PR 0 Z	0: Enters numeral 0.	ACT PR: Prints out a response from the converter every time the key is operated. This operation is called "action printout".
SCR PAD ■ →	♦: Enters a decimal point.	SCR PAD: Writes a memo into the database of the converter.
TIME +/−	Inverts the sign in the case of numerical input.	TIME: Displays the current year, month, day and time.

Key names and functions

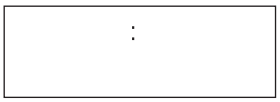
This section describes the functions assigned to the dark brown and white keys which are used to diagnose or check the converter or to control the keyboard, etc.

Key	Description	
	Press key	**Press SHIFT + key**
	→: Moves the cursor to the right.	No effect
	←: Moves the cursor to the left.	A ⇔ DE (analog ⇔ digital): Switches between analog and digital communications.
	STAT: Displays self-diagnostics result of the converter.	No effect
	SPAN: Displays the span of the range of a value currently displayed.	No effect
	ALPHA: Press this key before entering a letter of the alphabet. When the "↕" cursor appears on the display section, it is ready to enter. Press this key once again to enter a function or numeral displayed in the center of each key. When the display section shows a cursor, it is ready to enter this function or numeral.	No effect
	SHIFT: Press this key to enter a function displayed above each key. When the display section shows "SHIFT-", it is ready for input.	No effect
	CLR: Clears the display in the display window and the SFC waits for input. Or press this key to answer "No" to a question on the screen. The screen moves one level up or down.	When exiting the CONFIG function, pressing this key jumps from a lower level to EXIT CONFIG at a stroke.

Charging SFC

CAUTION

When a ":" mark appears in the 8th column at the top of the SFC screen as shown below, stop using the SFC immediately and charge the SFC. Continuing to use the SFC will over discharge the battery of the SFC and make it impossible to charge it further.



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Procedure

For the procedure for charging the SFC, see the SFC User's Manual (CM2-SFC100-2001).

6-1-3. SFC Wiring

Wiring between two wired magnetic flowmeter converter and SFC

This section describes the wiring method between the two wired magnetic flowmeter converter and SFC.

Connect the SFC as shown in Fig. 6-3.

Connect the SFC red terminal to I.OUT+ and the black terminal to I.OUT-.

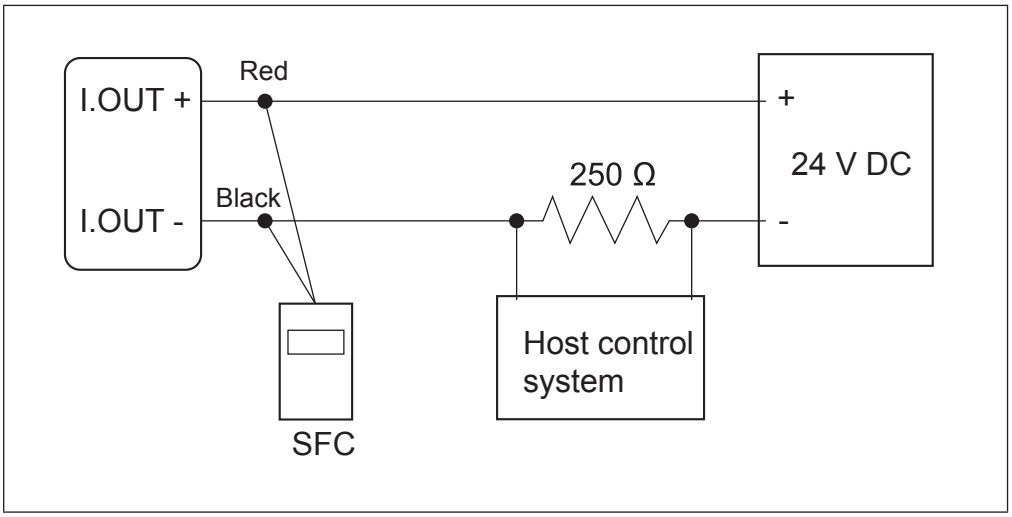

Fig. 6-3. SFC wiring connection

6-1-4. SFC unavailable functions

There are functions which cannot be set or changed from SFC in two wired magnetic flowmeter functions. These function settings or changing can be key operated from the data setting device. To operate these functions, refer to "Chapter 5. Operation using the data setting device".

Functions which cannot be set or changed using the SFC are,

- Auto spike cut
- Moving average processing
- Moving average processing time
- Pulse output adjustment
- Excitation current adjustment

6-1-5. Before operating SFC

Before SFC operation, please read the following:

Status of two wired magnetic flowmeter SFC at SFC communication

Make sure that the two wired magnetic flowmeter is in the Measuring Mode while setting it using the SFC communication.

If communicating with the other mode, SFC will display "IN LOCAL MODE" on the screen and you cannot set or change using SFC communication. In this case, change the two wired magnetic flowmeter in the field to Measuring mode and then, try to communicate again.

Two wired magnetic flowmeter will take this status "LOCAL", as someone setting or changing by touch sensor in the field. This is to prevent the setting and changing operation from both sides.

Confirm write protect mode

Two wired magnetic flowmeter has a write protect function. Write protect function is to prevent access to unauthorized persons and to prevent performing wrong operation.

Write protect can be set by the customer by setting the arbitrary 4 levels.

Please make sure that when write protect level is WP0, reading and writing are available and when write protect level is WP1, 2 or 3, only reading is available.

The protection details are shown by write protect levels.

Write protect level	SW1	SW2	LSC (Key operation)			Communication		
			Operator's mode	Engineering mode	Maintenance mode	Operator's mode	Engineering mode	Maintenance mode
0	OFF	OFF	R/W ENABLE	R/W ENABLE	R/W ENABLE	R/W ENABLE	R/W ENABLE	R/W ENABLE
1	ON	OFF	R/W ENABLE	R/W ENABLE	R/W DISABLE	R ONLY	R ONLY	R ONLY
2	OFF	ON	R/W ENABLE	R ONLY	R/W DISABLE	R ONLY	R ONLY	R ONLY
3	ON	ON	R ONLY	R ONLY	R/W DISABLE	R ONLY	R ONLY	R ONLY

R/W: Read and write (Read and write set values)

R: Read

W: Write

ENABLE: Enabled

DISABLE: Disabled

ONLY: Only the indicated operation is enabled.

Writing on non-volatile memory

After downloading the changed setting data using SFC, save the setting data to MangeW Two-wire PLUS non-volatile memory in approx. 30 seconds. Therefore, do not turn the power off during the operation.

If you want to save the data immediately, press the SHIFT key and NON-VOL ENTER (Yes) key, then the data will be written forcibly to non-volatile memory.

Changing communication method

Two wired magnetic flowmeter has the following 4 communication methods:

- SFN.A… SFC communication (Analog)
- SFN.D… SFC communication (Digital)
- HART… HART communication
- NONE… not using any communication function

Note) SFC communication (Digital) indicates Enhanced DE communication of Honeywell Co.

For SFC communication, select "SFN.A".

To change the communication method, operate using the touch keys. From the data setting screen "COM SELECT" of "OPERATOR'S MODE", it is required to set the communication method to SFN.A. (Fig. 6-4.)

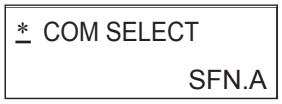

Fig. 6-4. Data setting screen

6-2. Configuration using SFC communicator

Outline of this chapter

This chapter presents how to operate the SFC.
The description proceeds in the following order:

6-2-1: Before communicating using the SFC
Describes the basic operation method.

6-2-2: Setting using SFC communication (1) - setting using key assigned functions
Describes the basic function and setting method.
Describes communication start, range setting, damping constant setting, auto zero point adjustment etc. These can be set by using the key assigned functions (Functions that are directly assigned to each of the SFC keys, refer to next page).

6-2-3: Setting using SFC communication (2) - setting using CONFIG functions
Describes the detailed setting.
Describes the advanced setting for MagneW, screen display, converter information, pulse output/ contact output switching, high low alarm value, burnout direction etc. These can be set by using CONFIG function (entered by pressing the 

key,

refer to page 6-16).

6-2-1. Before communicating using the SFC

What can be done using the SFC

Introduction

It is possible to communicate with the converter, read data or change settings using the SFC. The functions available with the SFC include functions directly assigned to the respective keys and CONFIG functions that are entered by pressing the CONF key.

CAUTION

- Be sure to use the SFC with software version 7.0 or newer. Using earlier versions may fail to operate the SFC correctly.

Key assigned functions

The following are the functions directly assigned to the SFC keys.

CONFIG functions

The CONFIG functions that are entered by pressing the B CONF key include the following 17 sub-functions.

CAUTION

- Do not operate the following screen from the calibration menu. Operating this screen will erase all data entered in the electromagnetic flow meter.

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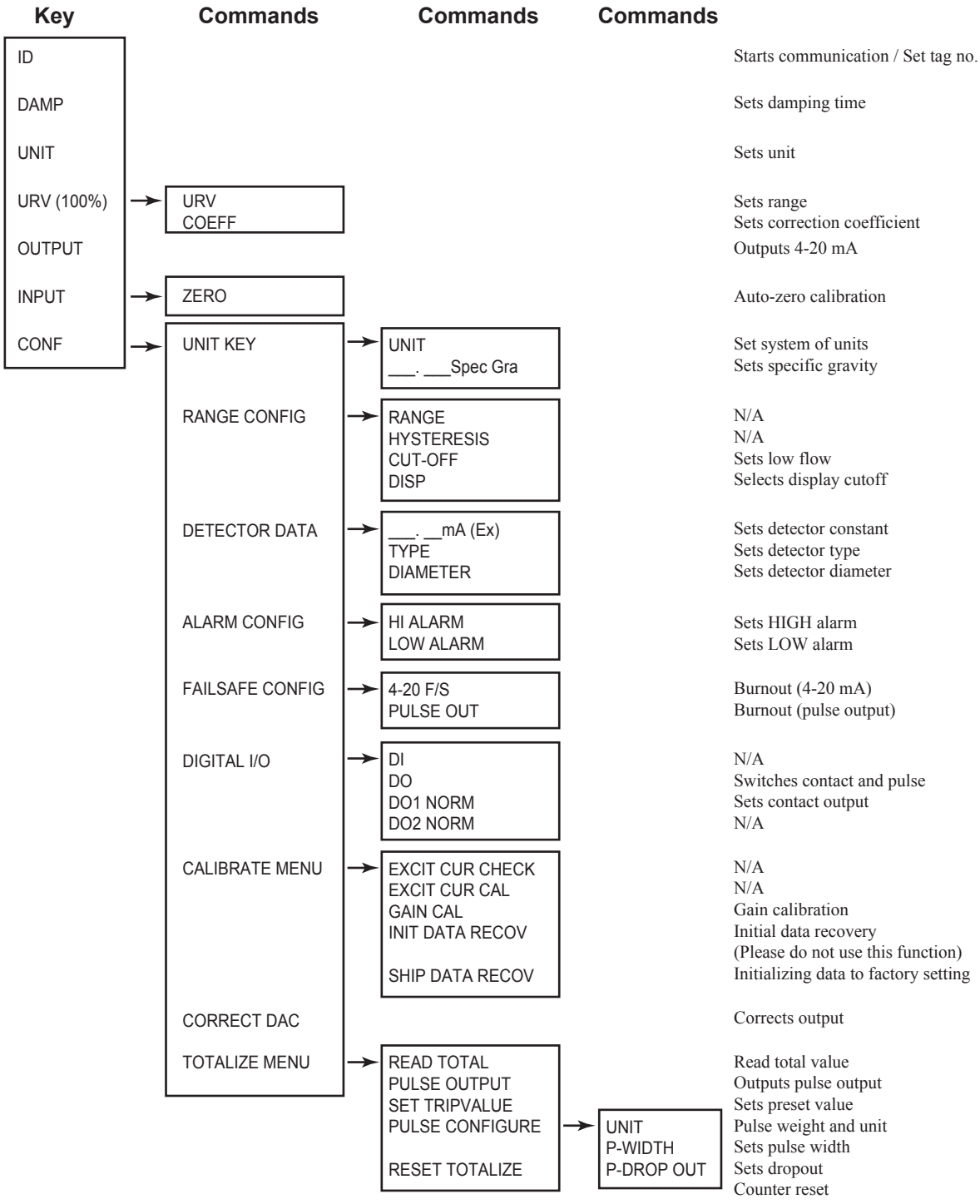
Hierarchical structure of CONFIG functions

Hierarchic structure chart

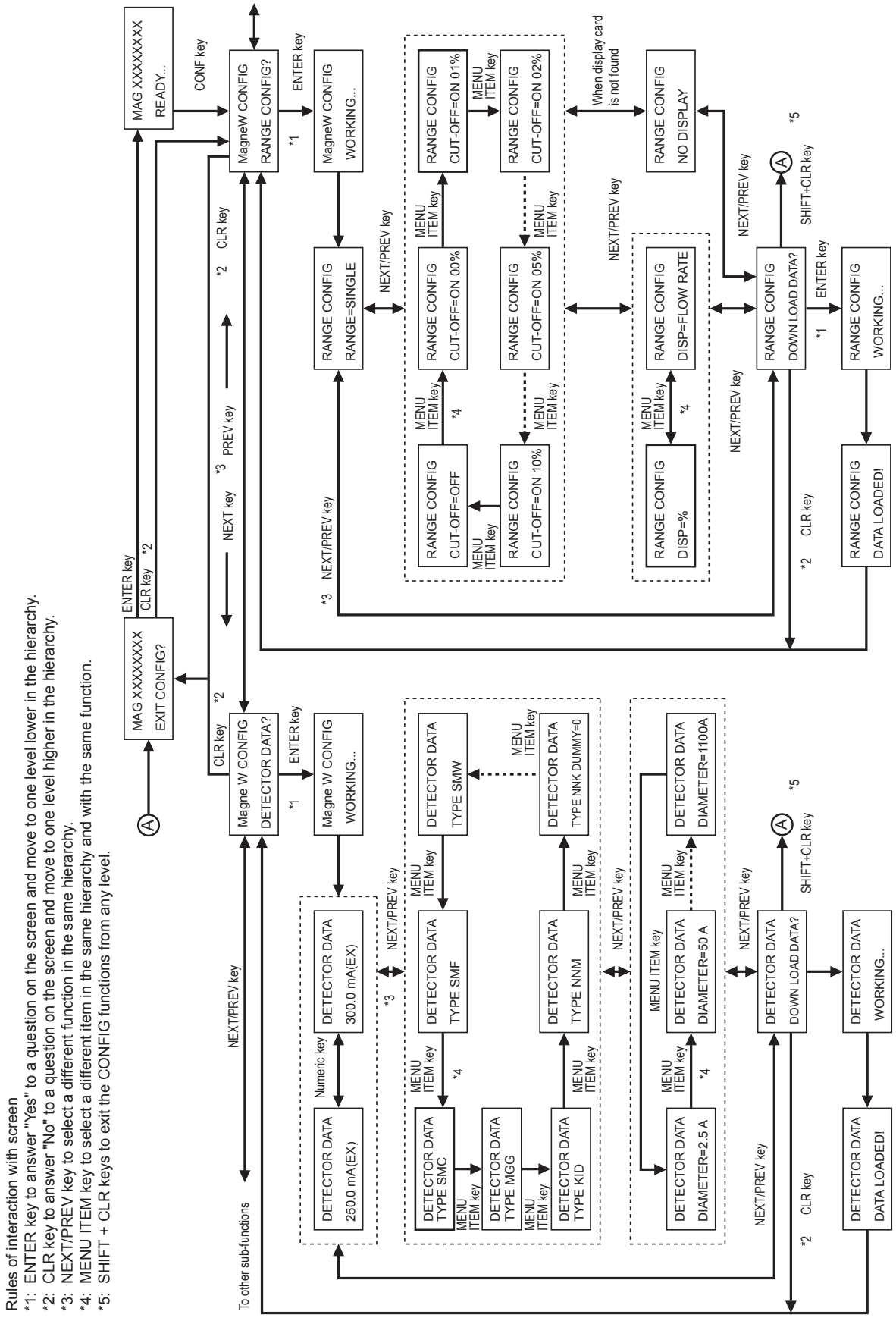
Each functions of SFC form a hierarchical structure. Before setting using the SFC, check the positions of the respective sub-functions with the supplied hierarchical structure chart.

The SFC screen displays only two lines, and so if it is not clear which hierarchy is shown, see the hierarchy chart on page 6-17.

SFC hierarchical structure chart



Example of a key sequence



Rules of interaction with screen
*1: ENTER key to answer "Yes" to a question on the screen and move to one level lower in the hierarchy.
*2: CLR key to answer "No" to a question on the screen and move to one level higher in the hierarchy.
*3: NEXT/PREV key to select a different function in the same hierarchy.
*4: MENU ITEM key to select a different item in the same hierarchy and with the same function.
*5: SHIFT + CLR keys to exit the CONFIG functions from any level.

6-2-2. Setting using SFC communication (1) - setting using key assigned functions

Starting communication: ID/DE READ key

CAUTION

Before starting communication between the SFC in a system with analog output and the converter, be sure to change the control loop to "manual control". This is to prevent fluctuation in analog output of the converter, which is caused by starting the SFC and communicating with the converter, from directly affecting the control loop.

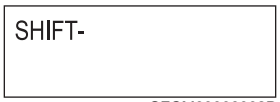
Procedure

Use the following procedure to start the SFC. The key operations of the SFC and display of the display window slightly vary depending on whether the system has digital output or analog output.

Step	Procedure	SFC screen
1	Check that the converter has been started. If not started yet, start the converter with reference to "Chapter 4. Start and stop operation procedure for model MTG" in this manual.	
2	Make sure the wiring between the converter signal line and SFC is correct.	
3	Turn the SFC on. **Result:** ■ The SFC executes self-diagnostics and the screen as shown on the right appears. **CAUTION** This display is intended to prompt the user to take appropriate action to prevent fluctuation in the output of the converter caused by the SFC communicating with the converter from directly affecting the control loop. Before pressing the DE READ / ID / A key, take appropriate action to change the control device to "manual". A system with analog output requires special care.	SELF CHECK... SFCM00006004D LOOP IN MANUAL ? PRESS ID SFCM00006005D

<table>
<tr><th>Step</th><th>Key</th><th colspan="2">Procedure</th></tr>
<tr><td>4</td><td> 


</td><td>■ In the case of a system with digital output,
press the  key here.



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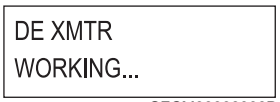
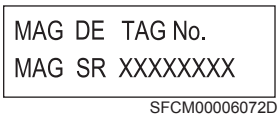
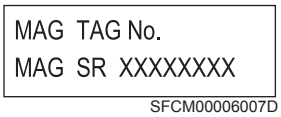
Press the  key.

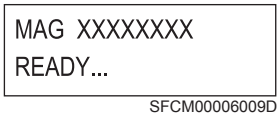


SFCM00006006D


SFCM00006072D</td><td>■ In the case of a system with analog output,
press the  key here.

SFCM00006008


SFCM00006007D</td></tr>
<tr><td></td><td></td><td colspan="2">Result and branch:
■ The following screen appears and a communication between the SFC and converter can be started. Go to step 6.
■ If the TAG No. has not been entered in the converter, the TAG No. displays as XXXXXXXX. Go to step 5.</td></tr>
<tr><td>5</td><td></td><td colspan="2">Here, TAG No. can be entered. For a detailed procedure, see “Entering TAG No.: ID key” on page 6-21.
If there is no need to enter a TAG No., go to step 6.</td></tr>
<tr><td>6</td><td> 
</td><td colspan="2">Press the  key. The following screen appears.

This screen is the basic standby screen. When starting operation, confirm that the following screen has appeared.
 

SFCM00006009D</td></tr>
</table>

Entering TAG No.: ID key

Introduction

To facilitate concentrated control by the control system of the control loop over two or more converters, a TAG No. can be assigned to each converter. Up to 8 alphanumeric characters can be entered as a TAG No.

Procedure

Use the following procedure to enter TAG No.

Step	Key	Procedure	SFC screen
1		Check that the display of the SFC appears as shown to the right. If a different display appears, refer to "6-2-2. Setting using SFC communication (1) - setting using key assigned functions" on page 6-19.	LOOP IN MANUAL ? PRESS ID SFCM00006005D
2	DE READ ID A SHIFT ^ + DE READ ID A	Carry out the following operation according to the output format of the SFC used. ■ For SFN.A analog output communication method, press the DE READ ID A key. ■ For SFN.D digital output communication method, press the SHIFT ^ + DE READ ID A keys.	MAG DE TAG No. MAG SR XXXXXXXX (For SFN.A) MAG TAG No. MAG SR XXXXXXXX SFCM00006007D (For SFN.D)
3	ALPHA A↔DE Q M ALPHA ALPHA	-Use the ALPHA key and numeric keys to enter up to 8 alphanumeric characters for a TAG No. *Note)* ■ *On this screen, the ALPHA key and numeric keys and A↔DE Q key and M key are active. Even if other keys are pressed, there will be no response.* ■ *To enter letters, press the ALPHA key and display the "□" cursor.* ■ *To enter numerals, press the ALPHA key again and display "_" cursor.*	MAG DE TAG No. MAG SR FIC-123 SFCM00006030D

Step	Key	Procedure	SFC screen
4	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. **Result:** ■ After "WORKING..." appears on the screen, the TAG No. just entered appears. Hereafter, this name becomes the TAG No. of this converter.	MAG DE TAG No. MAG SR FIC-123 SFCM00006030D (For SFN.A) MAG DE TAG No. MAG SR FIC-123 SFCM00006030D (For SFN.D)

Setting/changing damping time constant: DAMP key

Introduction

Damping time constant is a response time of the primary delay (65.2% response) for a step response of the flow rate. When the output fluctuations are large increase the damping. A large damping value stabilizes the output but lowers the response performance. The damping time constant can be set to 0.5 up to 199.9 sec. using numeric keys.

Procedure

Use the following procedure to set the damping time constant.

Step	Key	Procedure	SFC screen
1	CLR (No)	Confirm that the SFC is set to "READY". If it is not, press the CLR (No) key to set it to "READY".	MAG XXXXXXXX READY... SFCM00006009D
2	C DAMP	Press the C DAMP key. **Result:** ■ The currently set damping time constant appears as shown here.	DAMPING XXXXXXXX 3.0 SECONDS SFCM00006056D
3		Use numeric keys to set the damping time constant. (Input range: 0.5 to 199.9) **Result:** ■ The changed setting is written into the database of the converter and displayed on the screen.	DAMPING XXXXXXXX WORKING... SFCM00006057D DAMPING XXXXXXXX 5.0 SECONDS SFCM00006058D
4	CLR (No)	Press the CLR (No) key to return to the screen in step 1.	

Setting engineering units: UNITS key

Introduction

The instantaneous flow rate value measured by the converter can be set so that it is displayed in engineering units according to the control process used.

This setting is applied to both display screens of the display panel of the converter and the SFC.

The engineering units that can be set are as follows.

Volume flow rate units	Mass flow rate units
m^3/h, GPH, l/h, cc/h, m^3/min, GPM, l/min, cm^3/min, m^3/day, GPD, kGPD, BPD, m^3/s GPH=gals/hr, GPM=gals/min, GPD=gals/day, kGPD=1000XGPD, BPD=barrels/day	kg/h, lb/h, kg/min, lb/min, kg/s, lb/s, t/s, t/min, t/s, g/h, g/min, g/s

When mass flow rate units are set, the specific gravity can be set.

Procedure

Use the following procedure to set engineering units.

Step	Key	Procedure	SFC screen
1	CLR (No)	Confirm that the SFC is set to “READY”. If it is not, press the CLR (No) key to set it to “READY”.	MAG XXXXXXXX READY... SFCM00006009D
2	D UNITS	Press the D UNITS key. **Result:** ■ The currently set engineering unit appears as shown on the right.	UNIT XXXXXXXX t/h SFCM00006039D

Step	Key	Procedure	SFC screen
3	▲ H NEXT or ▼ L PREV D UNITS CLR (No)	Use the ▲ H NEXT key and ▼ L PREV key to display the engineering unit to be set. Pressing the D UNITS key instead of the ▲ H NEXT key can also change the screen. **Branch:** ■ To exit this function, press the CLR (No) key.	UNIT XXXXXXXX kg/s SFCM00006040D
4	NON-VOL ENTER (Yes) CLR (No)	Press the NON-VOL ENTER (Yes) key. **Result and branch:** ■ The engineering unit to be set is written into the database. Setting is completed when the screen returns to step 2. Press the CLR (No) key to return to step 1. ■ When the engineering unit to be set is mass flow rate, the setting content is written into the database. Go to step 5.	UNIT XXXXXXXX WORKING... SFCM00006041D
5		Press numeric keys to set specific gravity.	UNIT XXXXXXXX 1.5000 Spec Gra SFCM00006042D
6	NON-VOL ENTER (Yes) CLR (No)	Press the NON-VOL ENTER (Yes) key. When the screen as shown on the right appears, press the NON-VOL ENTER (Yes) key once again. The setting is completed when the screen returns to the screen as in step 2. Press the CLR (No) key to return to step 1.	UNIT XXXXXXXX WORKING... SFCM00006041D

Setting output range and correction coefficient: URV key

Introduction

The output range of the converter is set at the factory according to the ordered specifications. This setting can be displayed on the screen of the SFC or changed.

Definition

■ URV (Upper Range Value) refers to a measured value of flow rate when the output of the converter becomes 100% (20 mA DC in the case of analog output) and means an upper range value of the output range of the converter. Pressing the [URV F 100%] key displays the set URV (e.g., 10,000 m^3/h) on the screen. URV setting range is 0.3 to 10 m/s in flow rate conversion.

Procedure

Use the following procedure to display or change the set output range.

Step	Key	Procedure	SFC screen
1	[CLR (No)]	Make sure that the SFC is set to "READY". If it is not, press the [CLR (No)] key to set it to "READY".	MAG XXXXXXXX READY... SFCM00006009D
2	[URV F 100%]	Press the [URV F 100%] key. **Result:** ■ The set URV appears as shown to the right.	URV XXXXXXXX 100.00 m^3/h SFCM00006036D
3	[A↔DE ← Q]	Use numeric keys and [A↔DE ← Q] key to enter the URV to be set.	URV XXXXXXXX 25.00 m^3/h SFCM00006037D
4	[NON-VOL ENTER (Yes)]	Press the [NON-VOL ENTER (Yes)] key.	URV XXXXXXXX 25.00 m^3/h SFCM00006037D
5	[G SET]	When pressing the [G SET] key, correction coefficient will be set. Set if necessary.	COEF XXXXXXXX 1.0000 SFCM00006074D
6	[NON-VOL ENTER (Yes)]	Press the [NON-VOL ENTER (Yes)] key.	
7	[CLR (No)]	Press the [CLR (No)] key to return to step 1.	

Displaying transmitting output: OUTPUT key

Procedure

Use the following procedure to be able to read the current output value from the converter to the SFC.

Step	Key	Procedure	SFC screen
1	CLR (No)	Make sure that the SFC is set to "READY". If it is not, press the CLR (No) key to set it to "READY".	MAG XXXXXXXX READY... SFCM00006009D
2	INPUT OUT- PUT J	Press the INPUT OUT- PUT J key. **Result:** ■ The current output value appears as shown on the right.	OUTPUT XXXXXXXX 25.00 % SFCM00006011D
3	CLR (No)	After checking the current output value, press the CLR (No) key to return to step 1.	

Loop check of output signal

Introduction

The converter is provided with a function of a constant current generator. As the magnitude of a current that can be generated, an arbitrary value of 0 to 100% of the flow rate signal can be set. A loop check can be made using this function.

Used when

Use this function to check the connection status or the operation of devices connected to the converter in the measured loop.

Operation

This function is operated from the SFC. Use the following procedure.

Step	Key	Procedure	SFC screen
1	CLR (No)	Make sure that the SFC is set to "READY". If a screen other than the one as shown on the right is displayed, press the CLR (No) key.	MAG XXXXXXXX READY... SFCM00006009D
2	INPUT OUT- J PUT	Press the INPUT OUT- J PUT key.	OUTPUT XXXXXXXX WORKING... SFCM00006068D
3		Press numeric keys to enter the value of a signal current to be generated in percentage. The example to the right shows a case where a current equivalent to 25% flow rate is generated.	OUTPUT XXXXXXXX 25.00 % SFCM00006011D
4	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. This generates a constant current output from the converter. A "#" mark is displayed on the screen during the output.	OUTPUT XXXXXXXX 25.00 % # SFCM00006069D
5	INPUT OUT- J PUT CLR (No)	To cancel the constant current output, press INPUT OUT- J PUT and then press the CLR (No) key. When the constant current output is canceled, the "#" mark on the screen disappears. Be sure to perform this operation at the end of the loop check. However, even if the instrument is left without performing this operation, the current output is automatically canceled after 10 minutes.	MAG XXXXXXXX READY... SFCM00006009D

Making zero adjustment: CORRECT key

Use the following procedure to do the auto zero adjustment from the SFC.
When adjusting auto zero point, stop and make static the fluid in the flow meter.

Step	Key	Procedure	SFC screen
1	CLR (No)	Make sure that the SFC is set to "READY". If a screen other than the one here to the right is displayed, press the CLR (No) key.	MAG XXXXXXXX READY... SFCM00006009D
2	SHIFT ^ INPUT OUT- PUT J	Press the SHIFT ^ key, and then press the INPUT OUT- PUT J key. **Result:** The actual measured value appears as shown on the right.	INPUT XXXXXXXX 0.00 m^3/h SFCM00006075D
3	RESET COR- RECT K	Press the RESET COR- RECT K key. 'Zero INPUT?' will be displayed. Confirm that the actual flow rate equals to zero.	INPUT XXXXXXXX ZEROINPUT? SFCM00006076D
4	NON-VOL ENTER (Yes)	After checking the flow rate, press the NON-VOL ENTER (Yes) key. **Result:** Auto zero point adjustment is initiated. It takes approx. 2 min. When the screen returns to the previous screen, auto zero adjustment is completed.	INPUT XXXXXXXX WORKING... SFCM00006077D INPUT XXXXXXXX 0.00 m^3/h SFCM00006075D
5	CLR (No)	Press the CLR (No) key to return to at step 1.	INPUT XXXXXXXX READY... SFCM00006078D

Displaying flow rate measured value: INPUT key

Procedure

Use the following procedure to be able to read the instantaneous flow rate value measured by the converter from the SFC.

Step	Key	Procedure	SFC screen
1	CLR (No)	Make sure that the SFC is set to "READY". If it is not, press the CLR (No) key to set it to "READY".	MAG XXXXXXXX READY... SFCM00006009D
2	SHIFT ^	Press the SHIFT ^ key.	SHIFT- SFCM00006002D
3	INPUT OUT- PUT J	Press the INPUT OUT- PUT J key. **Result:** ■ The instantaneous flow rate value appears as shown on the right.	INPUT XXXXXXXX 100.0 ton/hr SFCM00006010D
4	CLR (No)	After checking the instantaneous flow rate value, press the CLR (No) key to return to at step 1.	

Displaying self-diagnostics result: STAT key

Introduction

It is possible to display the self-diagnostics results of the converter sequentially from the SFC. This key is useful when used in combination with Action printout (page 6-31).

Procedure

Use the following procedure to be able to display the self-diagnostics results.

Step	Key	Procedure	SFC screen
1	CLR (No)	Make sure that the SFC is set to "READY". If it is not, press the CLR (No) key to set it to "READY".	MAG XXXXXXXX READY... SFCM00006009D
2	F/S DIR U STAT	Press the F/S DIR U STAT key. **Result:** ■ When no error has occurred, the message shown here to the right appears. ■ If a minor fault has occurred, "#"appears at the end of the bottom line of the SFC display window.	MAG XXXXXXXX WORKING... SFCM00006006D MAG XXXXXXXX STATUS CHECK=OK SFCM00006013D MAG XXXXXXXX OUTPUT MODE # SFCM00006014D
4	CLR (No)	After checking the self-diagnostics results, press the CLR (No) key to return to step 1.	

Error messages and remedial action

Troubleshooting

Whenever problem occurs while the electromagnetic flow meter is in operation, use the 

key of the SFC to read the error message and self-diagnostics result (see previous page) and take action according to the table below.

Stopping converter

If an error message with bold letter in the table below appears, turn OFF the power to the converter to stop the electromagnetic flow meter.

In case of critical failure, burnout function (see page 6-56) and high/low alarm (see page 6-54) will operate.

No.	Error message	Checkpoint and action
1	BAD CONFIG DATA	■ Configuration data is incorrect. ■ Check the setting with the display function of each setting or configuration printout.
2	CORRECTS RESET	■ Re-correction is required to keep precision. ■ Set the CONFIG data. ■ Perform correction and zero point adjustment.
3	ENTRY > SENS RNG	■ The flow rate measured value may exceed the upper range value. ■ Reset the output range.
4	ENTRY HEIGHT	■ The set value of constant current generation exceeds the allowable range. ■ Reset the set value.
5	EXCIT CHECK MODE	■ The excitation current is being checked. *Note)* *The electromagnetic flow meter cannot set the flow direction of the excitation current. The flow direction is fixed at either "X->Y" or "Y->X" independently of the flow direction specified by the SFC.*
6	FAILED COMM CHK	■ Communication failure with the electromagnetic flow meter. ■ Check the SFC and communication loop.
7	HI RES / LO VOLT	■ The load resistance of the loop is too large or the power supply voltage is too low.

No.	Error message	Checkpoint and action
8	ILLEGAL RESPONSE	■ Abnormal communication with the electromagnetic flowmeter. ■ Check the communication cable and load resistance.
9	IN LOCAL MODE	■ The converter is currently being operated from the display panel. ■ At this time, it is not possible to communicate from the SFC.
10	IN OUTPUT MODE	■ The converter is in constant current generation mode. ■ Press the INPUT / OUT- J / PUT key and then press the CLR (No) key to cancel the mode.
11	**INVALID DATABASE**	■ **A critical failure. Stop the electromagnetic flow meter.** ■ This error occurs because the converter database has not been set correctly when the power to the converter is turned ON. ■ Re-enter the CONF data.
12	INVALID REQUEST	■ The requested function cannot be performed. ■ Check the operation procedure of the SFC and press the F/S DIR / STAT U key.
13	LOCAL MODE	■ The converter is being operated. ■ At this time, it is not possible to communicate from the SFC.
14	NO XMTR.RESPONSE	■ There is no response from the electromagnetic flow meter. ■ Check the communication cable and measurement loop.
15	**NVM FAULT**	■ **A critical failure. Stop the electromagnetic flow meter.** ■ The non-volatile memory of the converter is abnormal. Turn OFF the power and then turn it ON again and check the operation. ■ If the same message still appears after taking the action above, contact an Azbil Corp. representative.
16	PRINTER FAIL!	■ The printer does not operate.

No.	Error message	Checkpoint and action
17	**RAM FAULT**	■ **A critical failure. Stop the electromagnetic flow meter.** ■ The RAM of the converter is abnormal. Turn OFF the power and then turn it ON again and check the operation. ■ If the same message still appears after taking the action above, contact an Azbil Corp. representative.
18	**ROM FAULT**	■ **A critical failure. Stop the electromagnetic flow meter.** ■ The ROM of the converter is abnormal. Turn OFF the power and then turn it ON again and check the operation. ■ If the same message still appears after taking the action above, contact an Azbil Corp. representative.
19	SFC FAULT	■ An SFC error. ■ Replace the SFC.
20	SPAN OVER ERROR	■ As a result of setting the span, the maximum measurable flow rate has exceeded 12 m/s. ■ Check the span, diameter or type of the detector.
21	>RANGE	■ The calculation result of the SFC has exceeded the display range. ■ Restart the SFC. ■ The SFC battery is running low.
22	:	■ Charge the SFC. ■ A minor fault.
23	#	■ Press the F/S DIR STAT U key and check the self-diagnostics result of the SFC.

Displaying software version: SW VER key

Procedure

Use the following procedure to confirm the software version of the SFC and the converter connected to the SFC used.

Step	Key	Procedure	SFC screen
1	CLR (No)	Make sure that the SFC is set to "READY". If it is not, press the CLR (No) key to set it to "READY".	MAG XXXXXXXX READY... SFCM00006009D
2	SHIFT	Press the SHIFT key.	SHIFT- SFCM00006002D
3	SW VER 3 X	Press the SW VER 3 X key. **Result:** - The software version is displayed.	S/W VER. XXXXXXXX SFC= . XMTR= . SFCM00006066D
4	CLR (No)	After confirming the software version, press the CLR (No) key to return to the screen in step 1.	

Data printing

Introduction

To carry out correct flow rate measurement, it is important to check the internal setting or response from the converter before starting to operate the converter or while the converter is in operation. At this time, it is convenient if you use the SFC with a printer to communicate with the converter and print out data. The SFC with a printer has two types of printing functions as defined below.

Definition

Configuration printout (data printout):

The SFC printer can print out internal data of the converter such as the converter tag number (TAG No.), damping time constant, low flow cutoff. This printing function is called "configuration printout" or "data printout".

Action printout (continuous printout):

The SFC is provided with a function that continuously prints out results of responses to key operations of the SFC from the converter. This printing function is called "action printout" or "continuous printout".

Printer

The optional SFC printer is a 24 characters/line thermal printer. When the power switch to the SFC is turned ON, the printer automatically starts to move and stops after moving back-and-forth once. At this time, the recording paper will advance a little (approximately 5 mm).

Advancing recording paper

To advance recording paper, press SHIFT + FEED 8 °.

The screen will display "PRINTER FEED" and the recording paper is advanced by one line. While this prompt is displayed, the recording paper is advanced by one line every time the FEED 8 ° key is pressed.

To cancel the feed function, press the CLR (No) key.

Feeding recording paper

When the printer is running short of recording paper, feed the paper roll compartment with a paper roll. For a detailed procedure, see the SFC User's Manual (CM2-SFC100-2001).

Printing internal data: PRINT key

Used when

Configuration printout (data printout) is used to print out internal data of the converter such as a damping time constant, low flow cutoff, etc.

Procedure

Use the following procedure to carry out configuration printout.

Step	Key	Procedure	SFC screen
1		Start communication between the SFC and converter. For a detailed procedure, see “Starting communication: ID/DE READ key” on page 6-19.	
2	CLR (No)	Make sure that the SFC is set to “READY”. If it is not, press the CLR (No) key to set it to “READY”.	MAG XXXXXXXX READY... SFCM00006009D
3	SHIFT ^	Press the SHIFT ^ key.	SHIFT- SFCM00006002D
4	PRINT 9 P	Press the PRINT 9 P key. **Result:** ■ Configuration printout starts.	WORKING... SFCM00006015D PRINTING... SFCM00006016D
5	CLR (No)	When printing is completed, press the CLR (No) key to return step 2.	

Printing example

The following shows an example of an actual configuration printout accompanied by line-by-line descriptions.

Printing example		Meaning
‘02-01-01 00:00		Time when printed
TAG No. XXXXXXXX		Tag no.
Detector		Detector information
DIA	: 50 A	Diameter
TYPE	: MGG	Type
EX	: 300.0 mA	Detector constant
RANGE	: SINGLE	Range
ANA/DE	: ANALOG XMTR	Communication mode
D1	: D1 NOT USED	Setting of contact input
DO	: DO NOT USED	Setting of contact output
SW VER	: 3.1	Software version
DAMP	: 3.00	Damping constant
SPAN1	: 70.69 m^3	Span
GRAVITY	: 1.0000	Specific gravity
COEFF	: 1.0000	Correction coefficient
LOFCUT	: ON 0.6 %	Low flow cutoff
F/S I	: UP	Burnout (4-20 mA output)
DO	: OPEN	Burnout (Contact output)
P	: HOLD	Burnout (Pulse output)
PULSE		Pulse information
CONF	: ADD	Setting of built-in counter
RESET	: 0000000000	Reset value
WEIGHT	: 110 cc/p	Pulse scale
WIDTH	: DUTY 50%	Pulse width
DROP	: 0.5%	Dropout value
INPUT	: 70.69 m^3	Input value
OUTPUT	: 100.02 %	Output value
STATUS CHECK= OK		Status

Continuously printing response result: ACT PRINT key

Used when

Action printout (continuous printout) is used to continuously print out the results of responses from the converter to key operations from the SFC and to keep the data.

Procedure

Use the following procedure to carry out action printout.

Step	Key	Procedure	SFC screen
1		Start communication between the SFC and converter. For the detailed procedure, see "Starting communication: ID/DE READ key" on page 6-19.	
2	CLR (No)	Make sure that the SFC is set to "READY". If it is not, press the CLR (No) key to set it to "READY".	MAG XXXXXXXX READY... SFCM00006009D
3	SHIFT	Press the SHIFT key.	SHIFT- SFCM00006002D
4	ACT PR 0 Z	Press the ACT PR 0 Z key.	MAG XXXXXXXX ACTION PRINT ? SFCM00006017D
5	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. **Result:** Action printout starts by printing: * ACTION PRINT * START TAG No. FIC-123 '02-06-05 15:30 Hereafter, the operation content and results of response from the converter are printed out every time the key is operated.	
6	SHIFT	Press the SHIFT key to stop the action printout operation.	SHIFT- SFCM00006002D

Step	Key	Procedure	SFC screen
7	ACT PR 0 Z	Press the ACT PR 0 Z key.	MAG XXXXXXXX ACTION PRINT ? SFCM00006017D
8	CLR (No)	Press the CLR (No) key. **Result:** The action printout operation ends by printing: * ACTION PRINT * END Then, the screen returns to step 2.	

Printing example

An example of an action printout corresponding to actual key operation will be explained.

Key operation

SHIFT ^ + ACT PR 0 Z (ACT PR) + NON-VOL ENTER (Yes) keys

C DAMP key

▲ H NEXT key

SHIFT ^ + 0 (ACT PR) + CLR (No) keys

Printing example of corresponding action printout

```
* ACTION PRINT  * START
  TAG. No.    FIC-123
        '02-06-05 15:35

DAMP       XXXXXXXX
3.0        S

DAMPING    XXXXXXXX
4.0        S


* ACTION PRINT  * END
```

Switching between digital output and analog output: A ↔ DE key

Introduction

Allows the signal line output of the converter to be switched between analog and digital. Communication method can be displayed on the two wired magnetic flowmeter main body's data setting screen. However, analog communication will be displayed as an SFN.A, and digital as an SFN.D.

CAUTION

Before switching the output, adjust the higher devices according to the output (analog or digital) of the converter. This is to prevent the output coming from the converter from affecting the control loop.

Procedure

Use the following procedure to change the output of the converter.

Step	Key	Procedure	SFC screen
1	CLR (No)	Confirm that the SFC is set to "READY". If it is not, press the key to set it to "READY".	MAG XXXXXXXX READY... SFCM00006009D
2	SHIFT ^ A ↔ DE ← Q	Press the SHIFT ^ key, and then press the A ↔ DE ← Q key. **Result:** ■ If digital output is currently set, the screen to the upper right appears. ■ If analog output is currently set, the screen do shown on the lower right appears.	MAG XXXXXXXX CHNG TO ANALOG ? SFCM00006031D (For digital output) MAG XXXXXXXX CHNG TO DIGITAL ? SFCM00006032D (For analog output)
3	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. To stop switching of the output format, press the CLR (No) key. The screen at step 1 appears.	MAG XXXXXXXX ARE YOU SURE ? SFCM00006033D
4	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key again, and the communication will be switched. Automatically, the screen returns to step 1.	MAG XXXXXXXX WORKING... SFCM00006006D MAG XXXXXXXX ANALOG XMTR SFCM00006034D or MAG XXXXXXXX DE XMTR SFCM00006035D

6-2-3. Setting using SFC communication (2) - setting using CONFIG functions

Selecting unit system and setting specific gravity [UNIT KEY] function

It is possible to select unit system (Mass flow rate and volume flow rate) which is set by two wired magnetic flowmeter converter, and set the specific value (in case of selecting mass flow rate for system units). Use the following procedure to select unit system and to set specific gravity.

Step	Key	Procedure	SFC screen
1	CLR (No)	Confirm that the SFC is set to "READY". If it is not, press the CLR (No) key to set it to "READY".	MAG XXXXXXXX READY... SFCM00006009D
2	B CONF	Press the B CONF key to access the CONFIG functions. Confirm that the screen on the right appears.	MAG NEW CONFIG WORKING... SFCM00006079D MAG NEW CONFIG UNIT KEY? SFCM00006080D
3	NON-VOL ENTER (Yes) DE CONF. MENU I ITEM	Press the NON-VOL ENTER (Yes) key. The screen, which system of units can be selected, appears as shown to the right. Mass flow rate = MASS FLOW Volume flow rate = VOLUME FLOW Press the DE CONF. MENU I ITEM key, and select MASS FLOW or VOLUME FLOW.	UNIT KEY MASS FLOW SFCM00006081D
4	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. The screen as shown on the right appears and the changed setting is saved to the SFC.	UNIT KEY ENTERED IN SFC SFCM00006082D
5	▲ H NEXT or ▼ L PREV	Only when MASS FLOW is selected, a screen for setting the specific gravity appears. Press the ▲ H NEXT key or ▼ L PREV key to show this screen. Press numeric keys to set specific gravity. Available range of specific gravity is from 0.1000 to 5.9999.	UNIT KEY 1.000 Spec Gra SFCM00006083D

Step	Key	Procedure	SFC screen
6	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. Changed setting is saved to SFC.	UNIT KEY ENTERED IN SFC SFCM00006082D
7	▲ H NEXT or ▼ L PREV	Press the ▲ H NEXT key or ▼ L PREV key to show this screen.	UNIT KEY DOWNLOAD DATA? SFCM00006084D
8	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. The changed setting is written into the database of the converter and the setting is completed.	UNIT KEY DATA LOADED! SFCM00006085D
9	CLR (No)	Press the CLR (No) key, and return to the screen as in step 1.	MAG XXXXXXXX READY... SFCM00006009D

Setting or changing low flow cutoff: [CUT-OFF] function

Introduction

When a fluid in the detector is flowing extremely slowly, the converter judges that the fluid is stationary and outputs a signal (4 mA DC in case of analog output) equivalent to a flow rate of zero. The value, which becomes the threshold of this judgment is called "low flow cutoff".

The low flow cutoff is set using a percentage over the upper range value of the flow rate measurement range set by the URV.

CAUTION

The low flow cutoff is a factor of extreme importance that affects the operation of the entire control process. Define the range to be controlled and start the setting carefully.

Procedure

Use the following procedure to set low flow cutoff.

Step	Key	Procedure	SFC screen
1	CLR (No)	Confirm that the SFC is set to "READY". If it is not, press the CLR (No) key to set it to "READY".	MAG XXXXXXXX READY... SFCM00006009D
2	B CONF	Press the B CONF key to access the CONFIG functions.	MagneW CONFIG RANGE CONFIG ? SFCM00006018D
3	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key.	MAGNEW CONFIG WORKING... SFCM00006020D
4	▲ H NEXT	Press the ▲ H NEXT key.	
5	DE CONF. MENU I ITEM DE CONF. MENU I ITEM	Pressing the DE CONF. MENU I ITEM key changes a numeric value to the right of CUT OFF=ON displayed on the screen from 0% up to 10% in 1 point increments. Continuing to press the DE CONF. MENU I ITEM key further sets CUT OFF=OFF and displays CUT OFF=ON 0% again. Display the low flow cutoff to be set in the range of 1- to 10% on the screen.	RANGE CONFIG CUT OFF = ON 1% SFCM00006059D

Step	Key	Procedure	SFC screen
6	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. **Result:** ■ The screen as shown on the right appears and the set low flow cutoff is confirmed.	RANGE CONFIG ENTERED IN SFC SFCM00006051D
7	▲ H NEXT or ▼ L PREV	Press the ▲ H NEXT key or ▼ L PREV key to show this screen (DOWN LOAD).	RANGE CONFIG DOWN LOAD DATA ? SFCM00006053D
8	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. **Result:** ■ The screen as shown on the right appears and the changed setting is written into the database of the converter. The screen returns to step 2. *Note)* *In step 5, if you try to set displaying "CUT OFF = OFF" or "CUT OFF = ON 00%", "INVALID REQUEST" will appear on the screen. Converter will reject the database to be written in.*	RANGE CONFIG WORKING... SFCM00006054D RANGE CONFIG DATA LOADED ! SFCM00006055D
9	SHIFT ^ + CLR (No)	To exit this setting function, press the SHIFT ^ + CLR (No) keys.	
10	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. **Result:** ■ Exiting the low flow cutoff setting function, the screen returns to the screen in step 1.	

Changing flow rate display: [DISP] function

Introduction

It is possible to set whether an instantaneous flow rate displayed on the display panel of the converter should be expressed as real flow rate or percentage.

Percent display refers to a percentage (%) over the maximum flow rate set by the URV.

Procedure

Use the following procedure to set or change flow rate display.

Step	Key	Procedure	SFC screen
1	CLR (No)	Confirm the SFC is set to "READY". If it is not, press the CLR (No) key to set it to "READY".	MAG XXXXXXXX READY... SFCM00006009D
2	B CONF	Press the B CONF key to access the CONFIG functions.	MagneW CONFIG RANGE CONFIG ? SFCM00006018D
3	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key.	MAGNEW CONFIG WORKING... SFCM00006020D
4	▲ H NEXT or ▼ L PREV	Press the ▲ H NEXT key or ▼ L PREV key to display this screen.	RANGE CONFIG DISP = FLOW RATE SFCM00006050D
5	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. **Result:** ■ The screen as shown on the right appears and the set flow rate display is confirmed.	RANGE CONFIG ENTERED IN SFC SFCM00006051D
6	DE CONF. MENU I ITEM DE CONF. MENU I ITEM	Pressing the DE CONF. MENU I ITEM key displays DISP=%, DISP=FLOW RATE and DISP=TOTAL by turns. Display the screen that you want to set.	RANGE CONFIG DISP = % SFCM00006052D

Step	Key	Procedure	SFC screen
7	DE CONF. MENU I ITEM	Press the DE CONF. MENU I ITEM key. **Result:** ■ The screen as shown on the right appears and the set flow rate display is confirmed.	RANGE CONFIG ENTERED IN SFC SFCM00006051D
8	▲ H NEXT or ▼ L PREV	Press the ▲ H NEXT key or ▼ L PREV key to show this screen (DOWN LOAD).	RANGE CONFIG DOWN LOAD DATA ? SFCM00006053D
9	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. **Result:** ■ The screen to the right appears and the changed setting is written into the database of the converter. The screen returns to step 2.	RANGE CONFIG WORKING... SFCM00006054D RANGE CONFIG DATA LOADED ! SFCM00006055D
10	SHIFT ^ + CLR (No)	To exit this setting function, press the SHIFT ^ + CLR (No) keys.	
11	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. **Result:** - Exiting the flow rate display setting function, the screen returns to the screen in step 1.	

Setting detector constant: [EX(mA)] function

Introduction

The detector constant of the converter is set at the factory according to the ordered specifications. This constant can be changed.

Used when

When a combination between the detector and converter has been changed, the detector constant set by the converter needs to be changed.

Procedure

Use the following procedure to set detector constant.

Step	Key	Procedure	SFC screen
1	CLR (No)	Make sure that the SFC is set to "READY". If it is not, press the CLR (No) key to set it to "READY".	MAG XXXXXXXX READY... SFCM00006009D
2	B CONF	Press the B CONF key to access the CONFIG functions.	MAG XXXXXXXX WORKING... SFCM00006006D MagneW CONFIG RANGE CONFIG ? SFCM00006018D
3	▲ H NEXT or ▼ L PREV	Press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right.	MagneW CONFIG DETECTOR DATA ? SFCM00006019D
4	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. **Result:** ■ The currently set detector constant appears as shown on the right.	MAGNEW CONFIG WORKING... SFCM00006020D DETECTOR DATA 300.0 mA (EX) SFCM00006021D
5		Press numeric keys to set the detector constant. Setting range is 200 to 699.9.	DETECTOR DATA 250.0 mA (EX) SFCM00006022D

Step	Key	Procedure	SFC screen
6	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. **Result:** ■ The screen as shown on the right appears and the set detector constant is confirmed.	DETECTOR DATA ENTERED IN SFC SFCM00006023D
7	▲ H NEXT or ▼ L PREV	Press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right.	DETECTOR DATA DOWNLOAD DATA ? SFCM00006024D
8	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. **Result:** ■ The screen as shown on the right appears and the changed setting is written into the database of the converter. The screen returns to step 3.	DETECTOR DATA WORKING... SFCM00006025D DETECTOR DATA DATA LOADED ! SFCM00006026D
9	SHIFT ^ + CLR (No)	To exit this setting function, press the SHIFT ^ + CLR (No) keys.	
10	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. **Result:** ■ The screen exits the detector constant setting function and returns to the screen in step 1.	

Setting detector type: [TYPE] function

Introduction

The type of the detector of the converter is set at the factory according to the ordered specifications. The settings of this type can be changed. When using two wired magnetic flowmeter, it is necessary to select “MGG” (refer to step 6) for detector type.

Procedure

Use the following procedure to set the type of the detector.

Step	Key	Procedure	SFC screen
1	CLR (No)	Make sure that the SFC is set to “READY”. If it is not, press the CLR (No) key to set it to “READY”.	MAG XXXXXXXX READY... SFCM00006009D
2	B CONF	Press the B CONF key to access the CONFIG functions.	MagneW CONFIG RANGE CONFIG ? SFCM00006018D
3	▲ H NEXT or ▼ L PREV	Press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right.	MagneW CONFIG DETECTOR DATA ? SFCM00006019D
4	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key.	MAGNEW CONFIG WORKING... SFCM00006020D
5	▲ H NEXT or ▼ L PREV	Press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right.	DETECTOR DATA TYPE MGG SFCM00006027D
6	DE CONF. MENU I ITEM	Pressing the DE CONF. MENU I ITEM key changes the sign to the right of TYPE displayed on the screen from MGG → KID → NNM → NNK DUMMY=0... NNK DUMMY=9 → SMW → SMF → SMC, sequentially. Display the detector type to be set on the screen.	

Step	Key	Procedure	SFC screen
7	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. **Result:** ■ The screen as shown on the right appears and the set detector type is confirmed.	DETECTOR DATA ENTERED IN SFC SFCM00006023D
8	▲ H NEXT or ▼ L PREV	Press the ▲ H NEXT key or ▼ L PREV key to display the screen (DOWN LOAD) as shown on the right.	DETECTOR DATA DOWNLOAD DATA ? SFCM00006024D
9	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. **Result:** ■ The screen as shown on the right appears and the changed setting is written into the database of the converter. The screen returns to step 3.	DETECTOR DATA WORKING... SFCM00006025D DETECTOR DATA DATA LOADED ! SFCM00006026D
10	SHIFT ^ + CLR (No)	To exit this setting function, press the SHIFT ^ + CLR (No) keys.	
11		**Result:** ■ The screen exits the detector type setting function and returns to step 1.	

Setting diameter of detector: [DIAMETER=] function

Introduction

The diameter of the detector of the converter is set at the factory according to the ordered specifications. The setting of this diameter can be changed.

Used when

When only the detector is replaced with one of a different diameter, this function is used to reset the diameter.

Procedure

Use the following procedure to set the diameter of the detector.

Step	Key	Procedure	SFC screen
1	CLR (No)	Confirm that the SFC is set to "READY". If it is not, press the CLR (No) key to set it to "READY".	MAG XXXXXXXX READY... SFCM00006009D
2	B CONF	Press the B CONF key to access the CONFIG functions.	MagneW CONFIG RANGE CONFIG ? SFCM00006018D
3	▲ H NEXT or ▼ L PREV	Press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right.	MagneW CONFIG DETECTOR DATA ? SFCM00006019D
4	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key.	MAGNEW CONFIG WORKING... SFCM00006020D
5	▲ H NEXT or ▼ L PREV	Press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right.	DETECTOR DATA DIAMETER = 2.5 A SFCM00006028D

Step	Key	Procedure	SFC screen
6	DE CONF. MENU I ITEM	Pressing the DE CONF. MENU I ITEM key changes the numerical value to the right of DIAMETER= shown on the screen from 2.5 mm up to 1100 mm. Range of two wired magnetic flowmeter detector diameter is 2.5 to 200 mm.	DETECTOR DATA DIAMETER = 40 A SFCM00006029D
7	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. **Result:** ■ The screen as shown on the right appears and the set detector typr is confirmed.	DETECTOR DATA ENTERED IN SFC SFCM00006023D
8	▲ H NEXT or ▼ L PREV	Press the ▲ H NEXT key or ▼ L PREV key to display the screen (DOWN LOAD) as shown on the right.	DETECTOR DATA DOWNLOAD DATA ? SFCM00006024D
9	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. **Result:** ■ The screen as shown on the right appears and the changed setting is written into the database of the converter. The screen returns to step 3.	DETECTOR DATA WORKING... SFCM00006025D DETECTOR DATA DATA LOADED ! SFCM00006026D
10	SHIFT ^ + CLR (No)	To exit this setting function, press the SHIFT ^ + CLR (No) keys.	
11		**Result:** ■ The screen exits the detector diameter setting function and returns to step 1.	

Setting high/low alarm values [ALARM CONFIG] function

Use the following procedure to set the high and low alarm values. High and low alarm values can be used only when contact output is selected. (Refer to "Select pulse output / contact output [DIGITAL I/O] function" on page 6-60)

Setting range of the both high and low alarm values are 0 up to 115%. Set the values as to be HI > LO.

Step	Key	Procedure	SFC screen
1	CLR (No)	Confirm that the SFC is set to "READY". If it is not, press the CLR (No) key to set it to "READY".	MAG XXXXXXXX READY... SFCM00006009D
2	B CONF ▲ H NEXT or ▼ L PREV	Press the B CONF key to access the CONFIG functions. Press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right.	MAGNEW CONFIG ALARM CONFIG? SFCM00006086D
3	NON-VOL ENTER (Yes) ▲ H NEXT or ▼ L PREV	Press the NON-VOL ENTER (Yes) key and press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right. Actual high alarm value appears.	ALARM CONFIG 100% HI ALM SFCM00006087D
4		Press numeric keys and enter the high alarm value to be set.	ALARM CONFIG 105% HI ALM SFCM00006088D
5	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. The changed setting is saved to the SFC.	ALARM CONFIG ENTERED IN SFC SFCM00006089D

Step	Key	Procedure	SFC screen
6	▲ H NEXT or ▼ L PREV	Continue to set the low alarm value. Press the ▲ H NEXT key or ▼ L PREV key to display this screen. Actual low alarm value appears.	ALARM CONFIG 20% LOW ALM SFCM00006090D
7		Press numeric keys and enter the low alarm value to be set.	ALARM CONFIG 15% LOW ALM SFCM00006091D
8	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. The changed setting is saved to the SFC.	ALARM CONFIG ENTERED IN SFC SFCM00006089D
9	▲ H NEXT or ▼ L PREV	Press the ▲ H NEXT key or ▼ L PREV key to show this screen.	ALARM CONFIG DOWNLOAD DATA? SFCM00006092D
10	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. The changed setting is written into the database of the converter.	ALARM CONFIG DATA LOADED! SFCM00006093D
11	CLR (No)	Setting is completed. Press the CLR (No) key, and return to the screen as in step 1.	MAG XXXXXXXX READY... SFCM00006009D

Deciding fail-safe direction: [F/S SET UP] function

Introduction

"Deciding fail-safe direction" refers to deciding the direction of output burnout if an error causes the converter to fail to measure the flow rate. For error, refer to "Error messages and remedial action" on page 6-32. There are three directions as shown below.

Analog output

- Burnout up (UP) .....Causes the readout of a signal from the converter to swing fully in the direction of a maximum value (21.8 mA TYP).
- Burnout down (DWN)....Causes the readout of a signal from the converter to swing fully in the direction of a minimum value (3.7 mA TYP).
- Hold (HLD)..... Holds the output immediately to a value before the error occurrence.

Pulse output

- Stop (STOP) .....Stops the pulse output
- Hold (HLD) .....Keeps the output immediately to value before the error occurrence.

CAUTION

The fail-safe direction is a factor of extreme importance in securing the safety of the entire control process. Decide the fail-safe direction considering what would be the safer output when the output of the converter becomes abnormal in the entire control process.

Procedure

Use the following procedure to display or set the fail-safe direction of analog output.

Step	Key	Procedure	SFC screen
1	CLR (No)	Confirm that the SFC is set to "READY". If it is not, press the CLR (No) key to set it to "READY".	MAG XXXXXXXX READY... SFCM00006009D
2	B CONF	Press the B CONF key to access the CONFIG functions.	MagneW CONFIG RANGE CONFIG ? SFCM00006018D
3	▲ H NEXT or ▼ L PREV	Press the ▲ H NEXT key or ▼ L PREV key to show this screen.	MagneW CONFIG FAILSAFE CONFIG SFCM00006094D
4	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key.	MAGNEW CONFIG WORKING... SFCM00006020D

Step	Key	Procedure	SFC screen
5	DE CONF. MENU I ITEM CLR (No)	Pressing the DE CONF. MENU I ITEM key changes the screen sequentially from DWN → HLD → UP → DWN. Display the fail-safe direction to be set on the screen. **Branch:** ■ To stop the fail-safe direction, setting press the CLR (No) key. The screen will return to the one in step 3.	F/S SETUP 4-20mA F/S=DWN SFCM00006061D
6	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. **Result:** ■ The screen to the right appears and the set fail-safe direction is confirmed.	F/S SETUP ENTERED IN SFC SFCM00006062D
7	▲ H NEXT or ▼ L PREV	Press the ▲ H NEXT key or ▼ L PREV key to show this screen (DOWN LOAD).	F/S SETUP DOWN LOAD DATA ? SFCM00006063D
8	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. **Result:** ■ The screen as shown on the right appears and the changed setting is written into the database of the converter. The screen returns to step 3.	F/S SETUP WORKING... SFCM00006064D F/S SETUP DATA LOADED ! SFCM00006065D
9	SHIFT ^ + CLR (No)	To exit the F/S SET UP function, press the SHIFT ^ + CLR (No) keys.	
10	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. **Result:** ■ The screen exits the F/S SET UP function and returns to the screen as in step 1.	

Setting burnout direction of pulse output: [F/S SETUP] function

Use the following procedure to display and to set the fail-safe direction of pulse output.

Step	Key	Procedure	SFC screen
1	CLR (No)	Confirm that the SFC is set to "READY". If it is not, press the CLR (No) key to set it to "READY".	MAG XXXXXXXX READY... SFCM00006009D
2	B CONF	Press the B CONF key to access the CONFIG functions.	MagneW CONFIG RANGE CONFIG ? SFCM00006018D
3	▲ H NEXT or ▼ L PREV	Press the ▲ H NEXT key or ▼ L PREV key to show this screen.	MagneW CONFIG FAILSAFE CONFIG SFCM00006094D
4	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key.	MAGNEW CONFIG WORKING... SFCM00006020D
5	▲ H NEXT or ▼ L PREV	Press the ▲ H NEXT key or ▼ L PREV key to show this screen. Present burnout direction appears.	F/S SETUP PULSE OUT=HOLD SFCM00006095D

Step	Key	Procedure	SFC screen
6	DE CONF. MENU I ITEM	Press the DE CONF. MENU I ITEM key and select the output status to be set. You can select HOLD or STOP.	F/S SETUP PULSE OUT=HOLD SFCM00006095D
7	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. Fail-safe direction, which is set, is confirmed.	F/S SETUP SFCM00006096D
8	▲ H NEXT or ▼ L PREV	Press the ▲ H NEXT key or ▼ L PREV key to show this screen.	F/S SETUP DOWNLOAD DATA? SFCM00006097D
9	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. The screen shown to the right appears and the changed setting is written into the database of the converter.	F/S SETUP WORKING... SFCM00006098D F/S SETUP DATA LOADED! SFCM00006099D
10	CLR (No)	Setting is completed. Press the CLR (No) key, and return to the screen as in step 1.	

Select pulse output / contact output [DIGITAL I/O] function

Two wired magnetic flowmeter can be configured for pulse output or contact output other than the analog current output (4-20 mA).

Use the following procedure to configure the pulse output and contact output.

Step	Key	Procedure	SFC screen
1	CLR (No)	Confirm that the SFC is set to "READY". If it is not, press the CLR (No) key to set it to "READY".	MAG XXXXXXXX READY... SFCM00006009D
2	B CONF ▲ H NEXT or ▼ L PREV	Press the B CONF key to access the CONFIG functions. Press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right.	MAGNEW CONFIG DIGITAL I/O? SFCM00006100D
3	NON-VOL ENTER (Yes) ▲ H NEXT or ▼ L PREV	Press the NON-VOL ENTER (Yes) key to access the DIGITAL I/O function, press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right. Present setting function appears. DO NOT USED..... Pulse output HI-LO ALARM..... Contact output * Following function will appear on the screen but are not available for two wired magnetic flowmeter. ALARM DIAG EMPTY H1-L1/H2-L2 ALM	DIGITAL I/O DO NOT USED SFCM00006101D or DIGITAL I/O HI-LO ALARM SFCM00006102D
4	DE CONF. MENU I ITEM	Press the DE CONF. MENU I ITEM key and specify the function to be set.	DIGITAL I/O HI-LO ALARM SFCM00006102D
5	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. The changed setting is saved to the SFC.	DIGITAL I/O ENTERED IN SFC SFCM00006103D

Step	Key	Procedure	SFC screen
6	▲ H NEXT or ▼ L PREV	Press the ▲ H NEXT key or ▼ L PREV key to show this screen.	RANGE CONFIG DOWN LOAD DATA ? SFCM00006053D
7	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. The changed setting is written into the database of the converter.	DIGITAL I/O WORKING... SFCM00006104D DIGITAL I/O DATA LOADED! SFCM00006105D
8	CLR (No)	Setting is completed. Press the CLR (No) key, and return to the screen as in step 1.	MAG XXXXXXXX READY... SFCM00006009D

Setting contact output status [DIGITAL I/O] function

When contact output (HI-LO ALARM) is selected in the previous page, use the following procedure to set the contact output status (OPEN/CLOSE) in NORMAL status.

Step	Key	Procedure	SFC screen
1	CLR (No)	Confirm that the SFC is set to "READY". If it is not, press the CLR (No) key to set it to "READY".	MAG XXXXXXXX READY... SFCM00006009D
2	B CONF ▲ H NEXT or ▼ L PREV	Press the B CONF key to access the CONFIG functions. Press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right.	MAGNEW CONFIG DIGITAL I/O? SFCM00006100D
3	NON-VOL ENTER (Yes) ▲ H NEXT or ▼ L PREV	Press the NON-VOL ENTER (Yes) key to access the DIGITAL I/O function, press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right. The screen displays the setting of the contact output status (OPEN/CLOSE) in the actual NORMAL status.	DIGITAL I/O DO1 NORM = OPEN SFCM00006106D or DIGITAL I/O DO1 NORM = CLOSE SFCM00006107D
4	DE CONF. MENU I ITEM	Press the DE CONF. MENU I ITEM key and select the status to be set. You can select OPEN or CLOSE.	DIGITAL I/O DO1 NORM = CLOSE SFCM00006107D
5	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. The changed setting is saved to the SFC.	DIGITAL I/O ENTERED IN SFC SFCM00006103D
6	▲ H NEXT or ▼ L PREV	Press the ▲ H NEXT key or ▼ L PREV key to show this screen.	DIGITAL I/O DOWN LOAD DATA ? SFCM00006053D

Step	Key	Procedure	SFC screen
7	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. The changed setting is written into the database of the converter.	DIGITAL I/O WORKING... SFCM00006104D DIGITAL I/O DATA LOADED! SFCM00006105D
8	CLR (No)	Setting is completed. Press the CLR (No) key, and return to the screen as in step 1.	MAG XXXXXXXX READY... SFCM00006009D

Checking output of contact output: [DI/DO CHECK] function

Output of the contact output can be checked from SFC.

Use the following procedure to check the output of the contact output.

Step	Key	Procedure	SFC screen
1	CLR (No)	Confirm that the SFC is set to “READY”. If it is not, press the CLR (No) key to set it to “READY”.	MAG XXXXXXXX READY... SFCM00006009D
2	B CONF ▲ H NEXT or ▼ L PREV	Press the B CONF key to access the CONFIG functions. Press the ▲ H NEXT key or ▼ L PREV key to show the screen here to the right.	MAGNEW CONFIG CALIBRATE MENU? SFCM00006108D
3	B CONF ▲ H NEXT or ▼ L PREV	Press the B CONF key to access the CALIBRATE function, press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right.	CALIBRATE MENU DI/DO CHECK? SFCM00006109D
4	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. The screen shown as shown on the right appears and you will be asked whether you want to check the contact output.	DI/DO CHECK ARE YOU SURE!? SFCM00006110D
5	NON-VOL ENTER (Yes) ▲ H NEXT or ▼ L PREV	Press the DE CONF. MENU I ITEM key to access the DI/DO CHECK function.Press the ▲ H NEXT key or ▼ L PREV key to show the screen here to the right. Present contact output status appears.	DI/DO CHECK D1 = DO/CLOSE SFCM00006111D
6	DE CONF. MENU I ITEM	Press the DE CONF. MENU I ITEM key and select the status to be set. You can select OPEN or CLOSE.	DI/DO CHECK D1 = DO/OPEN SFCM00006112D

Step	Key	Procedure	SFC screen
7	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. The changed setting is saved to the SFC.	DI/DO CHECK ENTERED IN SFC SFCM00006113D
8	▲ H NEXT or ▼ L PREV	Press the ▲ H NEXT key or ▼ L PREV key to show this screen.	DI/DO CHECK SET DI/DI MODE? SFCM00006114D
9	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. The screen as shown on the right will appear. # mark will be displayed to the bottom right, and contact outputs according to the output status.	DI/DO CHECK SET DI/DI MODE? # SFCM00006115D
10	CLR (No)	After confirming, press the CLR (No) key. The screen as shown on the right appears. Press the NON-VOL ENTER (Yes) key. The screen exists the contact output function	DI/DO CHECK SET DI/DO MODE? # SFCM00006163D
11	CLR (No)	Press the CLR (No) key, and return to the screen as in step 1.	MAG XXXXXXXX READY... SFCM00006009D

Adjusting analog current output [CORRECT DAC] function

Analog current output can be adjusted from converter by changing it into constant current generation mode by SFC. Use the following procedure to adjust the analog current output.

Step	Key	Procedure	SFC screen
1	CLR (No)	Confirm that the SFC is set to "READY". If it is not, press the CLR (No) key to set it to "READY".	MAG XXXXXXXX READY... SFCM00006009D
2	INPUT OUT- J PUT	Press the INPUT OUT- J PUT key. Actual output value will be displayed.	OUTPUT XXXXXXXX WORKING... SFCM00006068D OUTPUT XXXXXXXX 50.00 % SFCM00006116D
3	NON-VOL ENTER (Yes)	Press the numeric keys to enter the output value to be adjusted. For example, in case of adjusting 0%, enter "0%", and press the NON-VOL ENTER (Yes) key, the display as shown on the right appears. This display confirms constant current generation mode. Output value is fixed to 0% (4 mA) * "#" mark shown in the bottom right presents the constant current generation mode.	OUTPUT XXXXXXXX 0.00 % # SFCM00006117D
4	CLR (No)	Press the CLR (No) key. Display returns back to the screen as in step 1. Output value is still fixed at 0%.	MAG XXXXXXXX READY... # SFCM00006119D
5	B CONF	Press the B CONF key to access the [CONFIG] function. Press the ▲ H NEXT key or ▼ L PREV key. Display as shown on the right appears.	MAG CONFIG WORKING... # SFCM00006118D MAG CONFIG CORRECT DAC ? SFCM00006120D

Step	Key	Procedure	SFC screen
6	NON-VOL ENTER (Yes) DE CONF. MENU I ITEM ▲ H NEXT or ▼ L PREV	Press the NON-VOL ENTER (Yes) key and enter into the CORRECT DAC screen. Current value shown in the bottom right screen presents the adjustment variation. By pressing the DE CONF. MENU I ITEM key, you can change from 0.002, 0.01, 0.05 to 0.25 mA. Adjust by pressing the ▲ H NEXT key or ▼ L PREV key.	CORRECT DC ZERO INC/DEC 0.002 mA SFCM00006121D
7	CLR (No)	Press the CLR (No) key. Display return back to the screen shown to the right. # will be shown in the bottom right screen. This shows that it is still in constant current generation mode. You need to clear this mode.	MAG XXXXXXXX READY... # SFCM00006119D
8	INPUT OUT- J PUT	Press the INPUT OUT- J PUT key again.	OUTPUT XXXXXXXX 0.00 % # SFCM00006117D
9	CLR (No)	Press the CLR (No) key. Confirm that the "#" mark has been deleted.	MAG XXXXXXXX READY... SFCM00006009D
10		Adjust to 100% (20 mA) by following the same procedure as for adjusting 0% (4 mA).	

Calibrating gain constant [GAIN CAL] function

Gain constant of amplifier which is set inside the converter can be calibrated by using SFC. To do this, Azbil Corporation's smart calibrator will be required.

Use the following procedure to calibrate the gain constant.

Step	Key	Procedure	SFC screen
1	CLR (No)	Confirm that the SFC is set to "READY". If it is not, press the CLR (No) key to set it to "READY".	MAG XXXXXXXX READY... SFCM00006009D
2	B CONF ▲ H NEXT or ▼ L PREV	Press the B CONF key to access the CONFIG functions. Press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right.	MAGNEW CONFIG WORKING... SFCM00006020D MAGNEW CONFIG CALIBRATE CONFIG? SFCM00006122D
3	NON-VOL ENTER (Yes) ▲ H NEXT or ▼ L PREV	Press the NON-VOL ENTER (Yes) key. Press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right.	CALIBRATE CONFIG? GAIN CAL? SFCM00006123D
4	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. For gain calibration press the NON-VOL ENTER (Yes) key, again. Connect the smart calibrator to the converter. (For connecting and operating the smart calibrator, refer to its user's manual).	GAIN CAL? ARE YOU SURE !? SFCM00006124D

Step	Key	Procedure	SFC screen
5	DE CONF. MENU I ITEM	Display shown to the right appears. Press the DE CONF. MENU I ITEM key and select the value to be calibrated. The value to gain calibrate for two wired magnetic flowmeter are the following three: 0 m/s, 2.5 m/s, and 10 m/s. Value 2.5 m/s for two wired magnetic flowmeter will be shown 1.2 m/s in SFC. When calibrating to 2.5 m/s select 1.2 m/s.	GAIN CAL GAIN CAL = 0.0 m/s? SFCM00006125D GAIN CAL GAIN CAL = 1.2 m/s? SFCM00006126D
6	NON-VOL ENTER (Yes)	For example, when calibrating 2.5 m/s, displays screen as shown to the right. For the smart calibrator, enter 2.5 m/s. Then, press the NON-VOL ENTER (Yes) key. Gain calibration starts. When gain calibration completes, display will return back to the screen to select the gain calibration value.	GAIN CAL GAIN CAL = 1.2 m/s? SFCM00006126D GAIN CAL WORKING... SFCM00006128D GAIN CAL GAIN CAL = 1.2 m/s? SFCM00006126D
7		Follow the same procedure for calibrating 0 m/s and 10 m/s.	
8	DE CONF. MENU I ITEM	When gain calibration is completed, press the NON-VOL ENTER (Yes) key and the display as shown on the right appears.	GAIN CAL CLR GAIN MODE ? SFCM00006127D
9	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. Exits from gain calibration function.	GAIN CAL WORKING... SFCM00006128D CALIBRATE MENU GAIN CAL ? SFCM00006129D
10	CLR (No)	Press the CLR (No) key and the screen returns to the screen as in step 1.	MAG XXXXXXXX READY... SFCM00006009D

Resetting the internal data to factory setting (default) [SHIP DATA RECOV] function

By executing shipping data recovery, you can reset the two wired magnetic flowmeter to the default factory setting. (Please note that all the data will be reset when executing the [SHIP DATA RECOV] function.) Use the following procedure to execute the shipping data recovery.

Step	Key	Procedure	SFC screen
1	CLR (No)	Confirm that the SFC is set to "READY". If it is not, press the CLR (No) key to set it to "READY".	MAG XXXXXXXX READY... SFCM00006009D
2	B CONF ▲ H NEXT or ▼ L PREV	Press the B CONF key to access the CONFIG functions. Press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right.	MAGNEW CONFIG WORKING... SFCM00006020D MAGNEW CONFIG CALIBRATE MENU? SFCM00006108D
3	NON-VOL ENTER (Yes) ▲ H NEXT or ▼ L PREV	Press the NON-VOL ENTER (Yes) key. Press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right.	CALIBRATE MENU SHIP DATA RECOV? SFCM00006130D
4	NON-VOL ENTER (Yes)	For [SHIPPING DATA RECOVERY], press the NON-VOL ENTER (Yes) key. Shipping data recovery function starts.	SHIP DATA RECOV ARE YOU SURE !? SFCM00006131D SHIP DATA RECOV WORKING... SFCM00006132D
5		When shipping data recovery completes, the display as shown on the right appears.	MAG Tag No. MAG SR TEST3333 SFCM00006133D
6	CLR (No)	Press the CLR (No) key and the screen returns to the screen as in step 1.	MAG XXXXXXXX READY... SFCM00006009D

Displaying totalized value [READ TOTAL] function

Use the following procedure to display the actual totalized value on the SFC screen.

Step	Key	Procedure	SFC screen
1	CLR (No)	Confirm that the SFC is set to “READY”. If it is not, press the CLR (No) key to set it to “READY”.	MAG XXXXXXXX READY... SFCM00006009D
2	B CONF ▲ H NEXT or ▼ L PREV	Press the B CONF key to access the CONFIG functions. Press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right.	MAGNEW CONFIG WORKING... SFCM00006020D TOTALIZE MENU READ TOTAL ? SFCM00006134D
3	INPUT OUT- J PUT	Press the INPUT OUT- J PUT key. Actual totalized value will be displayed as shown on the right.	READ TOTAL 0123456789 CNTS SFCM00006135D
4	CLR (No)	Press the CLR (No) key and the screen returns to the screen as in step 1.	MAG XXXXXXXX READY... SFCM00006009D

Checking pulse output [PULSE OUTPUT] function

Pulse output can be checked by fixing the pulse output from the converter main body by using SFC.

Use the following procedure to check the pulse output.

Step	Key	Procedure	SFC screen
1	CLR (No)	Confirm that the SFC is set to "READY". If it is not, press the CLR (No) key to set it to "READY".	MAG XXXXXXXX READY... SFCM00006009D
2	B CONF ▲ H NEXT or ▼ L PREV	Press the B CONF key to access the CONFIG functions. Press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right.	MAGNEW CONFIG WORKING... SFCM00006020D MAGNEW CONFIG TOTALIZER MENU ? SFCM00006136D
3	NON-VOL ENTER (Yes) ▲ H NEXT or ▼ L PREV	Press the NON-VOL ENTER (Yes) key to access the TOTALIZER functions. Press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right.	TOTALIZER MENU PULSE OUTPUT ? SFCM00006137D
4	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key to display the screen as shown on the right.	PULSE OUTPUT KEY = PULSE SFCM00006138D
5	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key, again. The actual pulse output will be displayed as shown on the right.	PULSE OUTPUT 28.50 % PLS SFCM00006139D
6		Enter the output value to be checked into the screen as shown on the right using numeric key.	PULSE OUTPUT 50 % PLS SFCM00006140D

Step	Key	Procedure	SFC screen
7	NON-VOL ENTER (Yes)	After entering the value, press the NON-VOL ENTER (Yes) key. Pulse output as a fixed value according to the entered value.	PULSE OUTPUT 50.00 % PLS # SFCM00006141D
8	CLR (No)	After checking the pulse output, press the CLR (No) key and the screen returns to the screen as in step 1.	MAG XXXXXXXX READY... SFCM00006009D

Setting pulse scale and pulse scale unit [PULSE CONFIGURE] function

Use the following procedure to set the pulse scale and the pulse scale unit using SFC.

However, set the span frequency range: 0.001 Hz to 200 Hz. (Span frequency is a pulse frequency when the maximum range (100%) of flow rate flows.)

Step	Key	Procedure	SFC screen
1	CLR (No)	Confirm that the SFC is set to "READY". If it is not, press the CLR (No) key to set it to "READY".	MAG XXXXXXXX READY... SFCM00006009D
2	B CONF ▲ H NEXT or ▼ L PREV	Press the B CONF key to access the CONFIG functions. Press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right.	MAGNEW CONFIG WORKING... SFCM00006020D MAGNEW CONFIG TOTALIZER MENU ? SFCM00006136D
3	NON-VOL ENTER (Yes) ▲ H NEXT or ▼ L PREV	Press the NON-VOL ENTER (Yes) key to access the TOTALIZER functions. Press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right.	TOTALIZER MENU PULSE CONFIGURE ? SFCM00006142D
4	NON-VOL ENTER (Yes) ▲ H NEXT or ▼ L PREV	Press the NON-VOL ENTER (Yes) key to enter into PULSE setting function and press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right. Displays the actual pulse scale unit.	PULSE CONFIGURE UNIT = mG/p SFCM00006143D
5	DE CONF. MENU I ITEM	Press the DE CONF. MENU I ITEM key and select the unit to be set. Available units are in the actual unit system.	PULSE CONFIGURE UNIT = G/p SFCM00006144D

Step	Key	Procedure	SFC screen
6	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. The changed setting is saved on the SFC.	PULSE CONFIGURE ENTERED IN SFC SFCM00006145D
7	▲ H NEXT or ▼ L PREV	Next, set pulse width. Press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right. Actual pulse scale will be displayed. Enter the pulse scale you want to set by pressing the numeric keys.	PULSE CONFIGURE 1.000 G/p SFCM00006146D PULSE CONFIGURE 1.2 G/p SFCM00006147D
8	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. The changed setting is saved on the SFC.	PULSE OUTPUT ENTERED IN SFC SFCM00006164D
9	▲ H NEXT or ▼ L PREV	Press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right.	PULSE OUTPUT DOWNLOAD DATA? SFCM00006148D
10	DE CONF. MENU I ITEM	Press the DE CONF. MENU I ITEM key. Changed setting data is written into the database of the converter.	PULSE OUTPUT DATA LOADED! SFCM00006149D
11	CLR (No)	Press the CLR (No) key and the screen returns to the screen as in step 1.	MAG XXXXXXXX READY... SFCM00006009D

Setting pulse width [PULSE CONFIGURE] function

Use the following procedure to set the pulse width. Available setting range of pulse width is DUTY rate < 70%

Step	Key	Procedure	SFC screen
1	CLR (No)	Confirm that the SFC is set to "READY". If it is not, press the CLR (No) key to set it to "READY".	MAG XXXXXXXX READY... SFCM00006009D
2	B CONF ▲ H NEXT or ▼ L PREV	Press the B CONF key to access the CONFIG functions. Press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right.	MAGNEW CONFIG WORKING... SFCM00006020D MAGNEW CONFIG TOTALIZER MENU ? SFCM00006136D
3	NON-VOL ENTER (Yes) ▲ H NEXT or ▼ L PREV	Press the NON-VOL ENTER (Yes) key to access the TOTALIZER functions. Press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right.	TOTALIZER MENU PULSE CONFIGURE ? SFCM00006142D
4	NON-VOL ENTER (Yes) ▲ H NEXT or ▼ L PREV	Press the NON-VOL ENTER (Yes) key to enter into PULSE setting function and press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right. Displays the actual pulse width.	PULSE CONFIGURE P-WIDTH = 1.0 ms SFCM00006150D

Step	Key	Procedure	SFC screen
5	DE CONF. MENU I ITEM	Press the DE CONF. MENU I ITEM key and select the pulse width to be set. (Select from duty 50, 1/7/10/15/30/50/100/200 ms) You can enter it directly by pressing the numeric keys. Range of two wired magnetic flowmeter is 1 to 1000 ms, however, SFC can only set up to 999.9 ms.	PULSE CONFIGURE P-WIDTH = 7.0 ms SFCM00006151D
6	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. The changed setting is saved on the SFC.	PULSE OUTPUT ENTERED IN SFC SFCM00006164D
7	▲ H NEXT or ▼ L PREV	Press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right.	PULSE CONFIG DOWNLOAD DATA ? SFCM00006152D
8	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. Changed setting data is written into the database of the converter.	PULSE OUTPUT DATA LOADED! SFCM00006149D
9	CLR (No)	Press the CLR (No) key and the screen returns to the screen as in step 1.	MAG XXXXXXXX READY... SFCM00006009D

Setting dropout [PULSE CONFIGURE] function

Dropout function is to fix the pulse output, which is caused by the output fluctuation near 0% of flow rate and is unrelated to the flow rate. Use the following procedure to set the dropout using SFC.

Range of the dropout setting is 0 to 10%.

Step	Key	Procedure	SFC screen
1	CLR (No)	Confirm that the SFC is set to "READY". If it is not, press the CLR (No) key to set it to "READY".	MAG XXXXXXXX READY... SFCM00006009D
2	B CONF ▲ H NEXT or ▼ L PREV	Press the B CONF key to access the CONFIG functions. Press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right.	MAGNEW CONFIG WORKING... SFCM00006020D MAGNEW CONFIG TOTALIZER MENU ? SFCM00006136D
3	NON-VOL ENTER (Yes) ▲ H NEXT or ▼ L PREV	Press the NON-VOL ENTER (Yes) key to access the TOTALIZER functions. Press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right.	TOTALIZER MENU PULSE CONFIGURE ? SFCM00006142D
4	NON-VOL ENTER (Yes) ▲ H NEXT or ▼ L PREV	Press the NON-VOL ENTER (Yes) key to enter into PULSE setting function and press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right. Displays the actual dropout setting.	PULSE CONFIGURE P-DROP OUT = 02% SFCM00006153D

Step	Key	Procedure	SFC screen
5	DE CONF. MENU I ITEM	Press the DE CONF. MENU I ITEM key and select the dropout to be set.	PULSE CONFIGURE P-DROP OUT = 05% SFCM00006154D
6	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. The changed setting is saved on the SFC.	PULSE CONFIGURE ENTERED IN SFC SFCM00006145D
7	▲ H NEXT or ▼ L PREV	Next, set pulse width. Press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right.	PULSE CONFIG DOWNLOAD DATA ? SFCM00006152D
8	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. Changed setting data is written into the database of the converter.	PULSE OUTPUT DATA LOADED! SFCM00006149D
9	CLR (No)	Press the CLR (No) key and the screen returns to the screen as in step 1.	MAG XXXXXXXX READY... SFCM00006009D

Setting counter reset function [RESET TOTALZE] function

Resetting the totalized value and setting reset value are possible using the SFC. When resetting the totalized value, two wired magnetic flowmeter internal counter will be reset and start resetting from the reset value which has been set. You can enter the reset value maximum of 10 figures to SFC, however for two wired magnetic flowmeter only 8 figures are effective. Use the following procedure to reset the totalized value and to set the reset value.

Step	Key	Procedure	SFC screen
1	CLR (No)	Confirm that the SFC is set to "READY". If it is not, press the CLR (No) key to set it to "READY".	MAG XXXXXXXX READY... SFCM00006009D
2	B CONF ▲ H NEXT or ▼ L PREV	Press the B CONF key to access the CONFIG functions. Press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right.	MAGNEW CONFIG WORKING... SFCM00006020D MAGNEW CONFIG TOTALIZER MENU ? SFCM00006136D
3	NON-VOL ENTER (Yes) ▲ H NEXT or ▼ L PREV	Press the NON-VOL ENTER (Yes) key to access the TOTALIZER functions. Press the ▲ H NEXT key or ▼ L PREV key to display the screen as shown on the right.	TOTALIZER MENU RESET TOTALIZE ? SFCM00006155D
4	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. Displays the actual reset value.	RESET TOTALIZE 0012345678 CNTS SFCM00006156D
5		Enter the reset value to be set pressing the numeric keys.	RESET TOTALIZE 0033333333 CNTS SFCM00006157D

Step	Key	Procedure	SFC screen
6	NON-VOL ENTER (Yes)	Press the ▲ H NEXT key. The changed setting is saved on the SFC.	RESET TOTALIZE ENTERED IN SFC SFCM00006158D
7	▲ H NEXT NON-VOL ENTER (Yes)	Press the ▲ H NEXT key. The screen as shown on the right appears. To reset press the NON-VOL ENTER (Yes) key. Totalized value is reset.	RESET TOTALIZE 0000111111 RST ? SFCM00006159D RESET TOTALIZE WORKING... SFCM00006160D RESET TOTALIZE TOTAL RESET! SFCM00006161D
8	CLR (No)	After checking the pulse output, press the CLR (No) key and the screen returns to the screen as in step 1.	MAG XXXXXXXX READY... SFCM00006009D

Chapter 7. Operation using HART communicator

7-1. Preparation for communication, verification and cautions on use

This section describes the preparation necessary for communication between a device and a HART Communicator. This section also covers the procedure to verify communication. The first step for preparation is to perform wiring between the converter and the HART Communicator. After wiring has been completed, turn the power on and verify that communications are functioning properly.

7-1-1. Wiring between converter and HART Communicator

The following describes the methods of wiring between converter and HART Communicator.

Connect the HART Communicator as shown in Fig. 7-1. A 250Ω resistor must be installed on the receiving end of the output current. There is no polarity on the HART Communicator terminal.

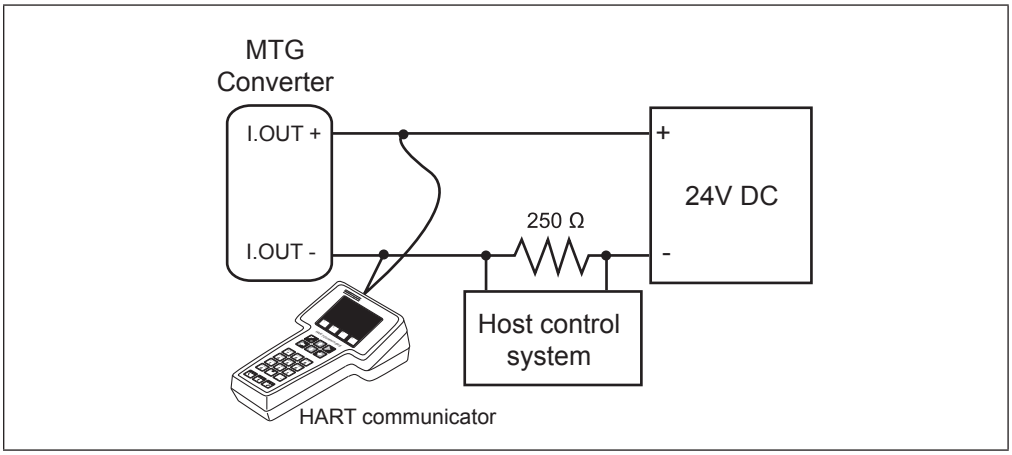


Fig. 7-1. HART Communicator wiring

7-1-2. Two wired magflow meter converter setting

Communication method selection

Set the converter's communication method to HART to communicate with HART Communicator.

Note that after changing the setting, when moving to the measuring mode by pressing the MODE key, converter will reboot.

HART: Set when executing the HART communication using HART Communicator.

SFN.A: Set when using the SFC with analog (4 to 20 mA) output mode

SFN.D: Set when DE (Digital Enhancement) communication is used.

NONE: Set when communication is not used.

Default setting is SFN.A: SFC analog output.

Follow the procedures described below to select the communication method.

Step	Procedure	Screen
1	The screen on the right is an example in the MEASURING MODE. Press the MODE key	20.0 % 01.94 m³/h WP0 00069401
2	Operator's mode will be displayed approx.2 sec. And the damping setting display will appear.	20.0 % * OPERATOR'S MODE 20.0 % * DAMPING 005.0 s
3	Press the ↑ key 3 times. The screen as shown on the right will appear.	20.0 % * COM SELECT SFN. A
4	Move the cursor to the communication method (SFN. A, SFN.D, NONE, HART) by pressing the → key. The screen as shown on the right is an example of when SFN.A is selected for communication method.	20.0 % * COM SELECT SFN. A
5	Press the ↑ key or ↓ key, and select the HART communication method.	20.0 % * COM SELECT HART
6	Press the → key and move the cursor to the bottom of the *. After rebooting the converter by pressing the MODE key, display will return to the MEASURING MODE and the communication method will be changed.	20.0 % * COM SELECT HART 8.8.8.8.8.8.8.8 % RATE TOTAL SELF CHECK MODE 20.0 % 01.94 m³/h WP0 00069401

7-1-3. Verifying communication

After the HART Communicator has been properly interconnected, turn the device's power on. For the external power supply model, turn on the external power supply before turning the device power on.

Once the setting and wiring connections are correct, the HART Communicator's display shows an online menu as shown below and a HART mark will flicker in the upper right hand corner of the display.

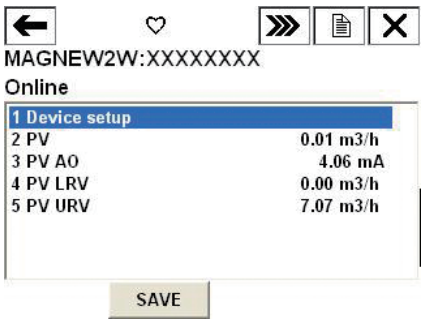


Fig. 7-2. Online menu

If the display is not as shown in Fig. 7-2. but as shown in Fig. 7-3. below, no communications are being made. Recheck the HART Communicator connections and the setting of converter. (The setting of the converter is described page 7-2 .)

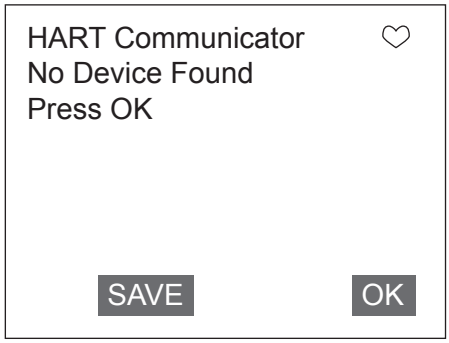


Fig. 7-3. Communication not available

7-1-4. Cautions

CAUTION

Do not remove the HART Communicator cable from the converter while executing communication. If the cable is disconnected during data setting transmission there will be no data transfer to the converter.

7-2. Setting and calibrating devices using the HART Communicator

The HART Communicator enables the user to set a two wired magnetic flowmeter device as well as allowing them to adjust and check the output of the device and to inspect the device. The following values can be set using the HART Communicator:

- Flow unit
- Range
- Specific gravity
- Damping time constant
- Display selection
- Function selection
- Correction coefficient
- Communication method
- Detector diameter
- Detector constant
- Auto spike cut
- Average processing selection
- Average processing time
- Low flow cut
- Drop out
- Pulse scale unit
- Pulse scale
- Pulse width
- Totalized value of integral counter display
- Reset value of integral counter
- Integral counter reset
- High alarm value setting
- Low alarm value setting
- Setting output status setting
- Burnout (Analog output) setting
- Burnout (Pulse output) setting
- Electrode status diagnostic function

Also, the following calibrations and inspection can be made:

- Zero point adjustment
- Current output calibration at 4 mA and 20 mA
- Gain adjustment
- Pulse output adjustment
- Excitation current output adjustment
- Analog output check
- Pulse output check
- Contact output check
- Converter status check
- Tag setting
- Shipping data recovery
- Equipment information check

For a detailed list of all the menus, see the HART Communicator's menu table for the two wired magnetic flowmeter at the back of this manual.

7-2-1. Setting procedures

The procedures to set various device values are described in this section.

Flow units

The unit for the flow is to be set as follows:

1. Select “1. Device setup” from online menu 1 (Fig. 7-4.). The device setup menu will then be displayed. (Fig. 7-4.)

Fig. 7-4. Device setup menu

2. Select “3. Basic setup” from the menu and then the basic setup menu will be displayed. (Fig. 7-5.)

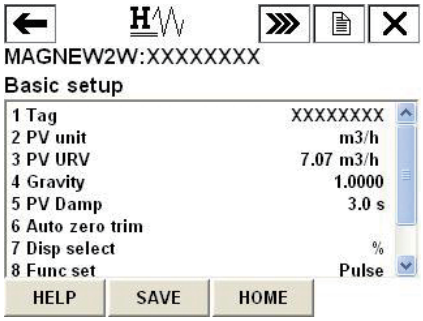


Fig. 7-5. Basic setup menu

3. Select “2. PV unit” from the basic setup menu.

4. Once the display as shown in Fig. 7-6. appears, move the arrow key up or down to select a flow unit. After making a selection, press F4 (ENTER). If F3 (ESC) is pressed here, the selection will be canceled and the display will return to the basic menu.

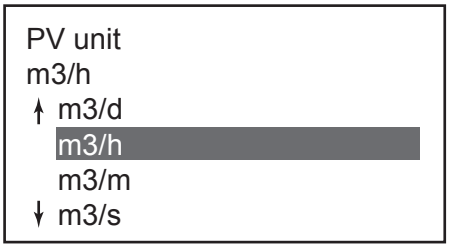


Fig. 7-6. Selection of flow rate

5. After pressing F4 (ENTER) and returning to the basic menu, press F2 (SEND). The HART mark will appear in the upper right hand corner while HART is communicating with the device. (Fig. 7-7.) Once communication is complete, the HART mark will disappear.

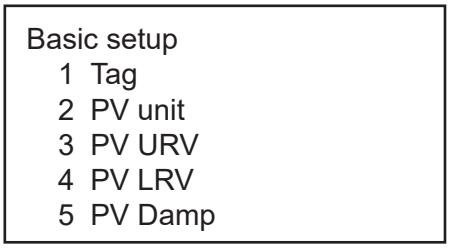


Fig. 7-7. Transmitting the setting

Range

The upper limit of the flow range is set as follows:

1. From online menu,
   Select:
   1. Device setup
   → 3. Basic setup
   → 3. PV URV
   Fig. 7-8. will then be displayed.

Fig. 7-8.

2. Use the numeric keys to enter a new range value in the value input display. Up to six digits including a decimal point can be entered. Setting range of the flow range is 0.3 m/s to 10 m/s in flow rate.
3. Once a new value is entered, press F4 (ENTER) to return to the basic setup menu. When the value is outside the range, error will be displayed. Input the value again.
4. After returning to the basic setup menu, press F2 (SEND). Changed setting will be transmitted to the converter. The HART Communicator mark will appear on the upper right hand corner while HART is communicating with the device. The mark will disappear once communication has properly completed.

Specific gravity

The specific gravity, when selecting the unit of weight is set as follows:

1. From online menu,
   Select:
   1. Device setup
   → 3. Basic setup
   → 4. Gravity
   Fig. 7-9. will then be displayed.

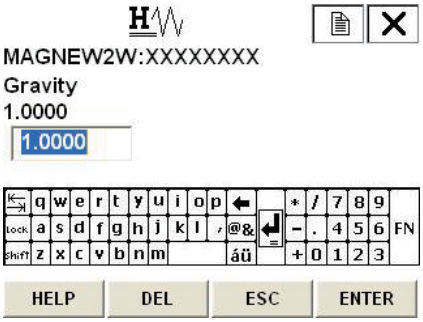


Fig. 7-9.

2. Use the numeric keys to enter a specific gravity value in the value input display. Up to six digits including a decimal point can be entered. Setting range of the specific gravity is 0.1000 to 5.9999.
3. Once a new value is entered, press F4 (ENTER) to return to the basic setup menu. When the entered value is outside the range, error will be displayed.
   Input the value again.
4. After returning to the basic setup menu, press F2 (SEND). Changed setting will be transmitted to the converter. The HART Communicator mark will appear on the upper right hand corner while HART is communicating with the device. The mark will disappear once communication has properly completed.

Damping time constant

The damping time constant is set as follows:

1. From online menu,
   Select:
   1. Device setup
   → 3. Basic setup
   → 5. PV Damp
   Fig. 7-10. will then be displayed.

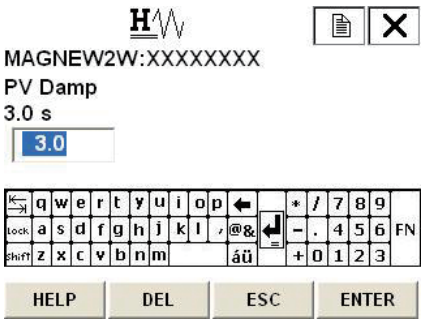


Fig. 7-10.

2. Use the numeric keys to enter a damping time constant value in the value input display. Up to five digits including a decimal point can be entered. Setting range of the damping constant is 0.5 to 199.9.
3. Once a new value is entered, press F4 (ENTER) to return to the basic setup menu. When the value is outside the range, error will be displayed. Input the value again.
4. After returning to the basic setup menu, press F2 (SEND). Changed setting will be transmitted to the converter. The HART Communicator mark will appear on the upper right hand corner while HART is communicating with the device. The mark will disappear once communication has properly completed.

Zero adjustment

Follow the steps described below to set the momentarily flow of static pressure to zero.

1. Stop and make sure that the fluid to be calibrated inside the flowmeter is static.
2. From online menu,
   Select:
   1. Device setup
   → 3. Basic setup
   → 6. Auto zero trim
   Fig. 7-11. will then be displayed.
   To adjust the zero point, press F4 (OK). It will take approx. 120 sec. to adjust the zero point.

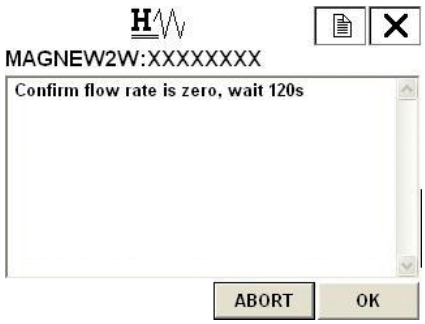


Fig. 7-11.

3. When F4 (OK) is pressed, Fig. 7-12. will be displayed and starts adjusting the zero point. By pressing F3 (ABORT) the procedure is canceled.

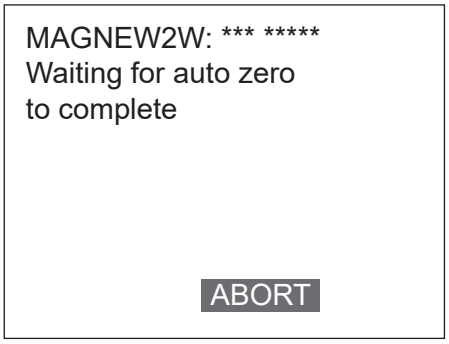


Fig. 7-12.

4. Once zero point adjustment is completed, Fig. 7-13. is displayed.
   Press F4 (OK) and return to the online menu.

Fig. 7-13.

Selecting display

The display selection is set as follows:

1. From online menu,
   Select:
   1. Device setup
   → 3. Basic setup
   → 7. Display select
   Fig. 7-14. will then be displayed.

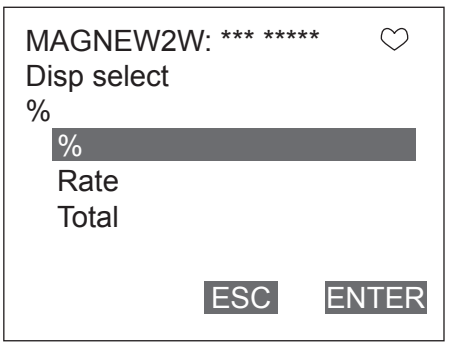


Fig. 7-14.

2. Once the display as shown in Fig. 7-14. appears, move the arrow key up or down to select a display. After making a selection, press F4 (ENTER). % / Rate / TOTAL can be selected. If F3 (ESC) is pressed here, the selection will be canceled and the display will return to the basic menu.
3. After returning to the basic setup menu, press F2 (SEND). Changed setting will be transmitted to the converter. The HART Communicator mark will appear on the upper right hand corner while HART is communicating with the device. The mark will disappear once communication has properly completed.

Selecting function

Pulse output and contact output can be selected.

Follow the procedures described below to select pulse output or contact output.

1. From online menu,
   Select:
   1. Device setup
   → 3. Basic setup
   → 8. Func set
   Fig. 7-15. will then be displayed.

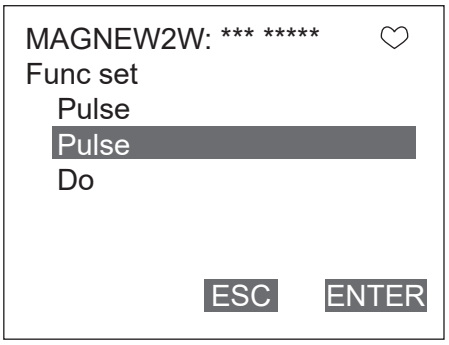


Fig. 7-15.

2. Once the display as shown in Fig. 7-15. appears, move the arrow key up or down to select a display. After making a selection, press F4 (ENTER). Pulse (Pulse output), Hi Lo ST out (contact output), or Electrode ST out (contact output) can be selected. If F3 (ESC) is pressed here, the selection will be canceled and the display will return to the basic menu.
3. After returning to the basic setup menu, press F2 (SEND). Changed setting will be transmitted to the converter. The HART Communicator mark will appear on the upper right hand corner while HART is communicating with the device. The mark will disappear once communication has properly completed.

Correction coefficient setting

Correction coefficient can be set in case multiplying the correction coefficient to the output flow rate according to its need.

The correction coefficient is set as follows:

1. From online menu,
   Select:
   1. Device setup
   → 3. Basic setup
   → 9. Coefficient
   Fig. 7-16. will then be displayed.

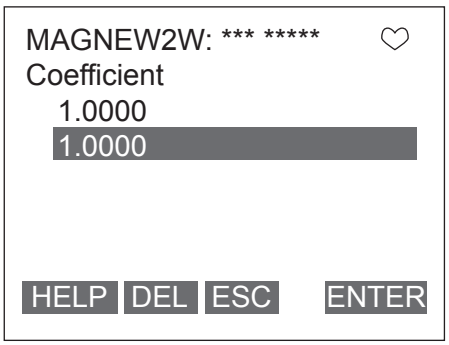


Fig. 7-16.

2. Use the numeric keys to enter a correction coefficient value in the value input display. Up to six digits including a decimal point can be entered. Setting range of correction coefficient is 0.1000 to 5.9999.
3. Once a new value is entered, press F4 (ENTER) to return to the basic setup menu. When the value is outside the range, error will be displayed. Input the value again.
4. After returning to the basic setup menu, press F2 (SEND). Changed setting will be transmitted to the converter. The HART Communicator mark will appear on the upper right hand corner while HART is communicating with the device. The mark will disappear once communication has properly completed.

Changing communication method

This function is used when changing the communication method from HART communication to SFN communication or without communication. This function is not used normally. If changing the communication method other than the HART, HART communication cannot be used. Therefore, if changing the communication other than the HART, see "7-1-2. Two wired magflow meter converter setting" and set the communication method to HART.

1. From online menu,
   Select:
   1. Device setup
   → 4. Detailed setup
   → 2. Conf output
   → 6. COMM output
   Fig. 7-17. will then be displayed.

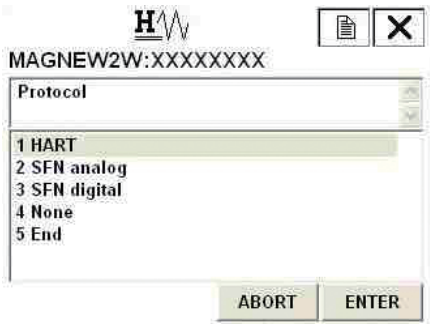


Fig. 7-17.

2. Once the display as shown in Fig. 7-17. appears, move the arrow key up or down to select communication method. After making a selection, press F4 (ENTER). If F3 (ABORT) is pressed here, the selection will be canceled and the display will return to the COMM output menu.
3. When F4 (ENTER) is pressed, Fig. 7-18. will be displayed for confirmation. If communication method is correct select “Yes” and press F4 (ENTER). If “No” selected or F3 (ABORT) is pressed here, selection will be canceled and the display will return to selecting menu display.

Fig. 7-18.

7-2-2. Setting converter data

Detector diameter

Follow the procedures described below to set the detector diameter.
Set the diameter size printed on the nameplate.

1. From online menu,
   Select:
   1. Device setup
   → 4. Detailed setup
   → 1. Detector config
   → 1. Tube size
   Fig. 7-19. will then be displayed.

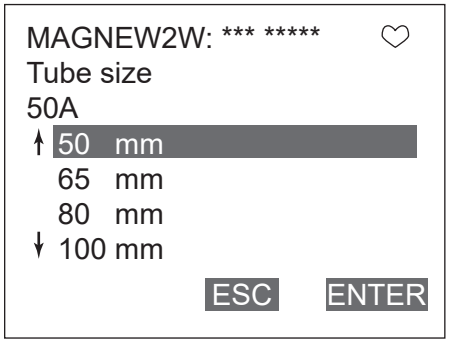


Fig. 7-19.

2. Once the display as shown in Fig. 7-19. appears, move the arrow key up or down to select a detector diameter. After making a selection, press F4 (ENTER). If F3 (ESC) is pressed here, the selection will be canceled and the display will return to the Detector config menu.
3. After returning to the Detector config menu, press F2 (SEND). Changed setting will be transmitted to the converter. The HART communicator mark will appear on the upper right hand corner while HART is communicating with the device. The mark will disappear once communication has properly completed.

Detector type

Follow the procedures described below to set the detector type.
Use MTG at normal measurement.

1. From online menu,
   Select:
   1. Device setup
   → 4. Detailed setup
   → 1. Detector config
   → 2. Detector type
   Fig. 7-20. will then be displayed.

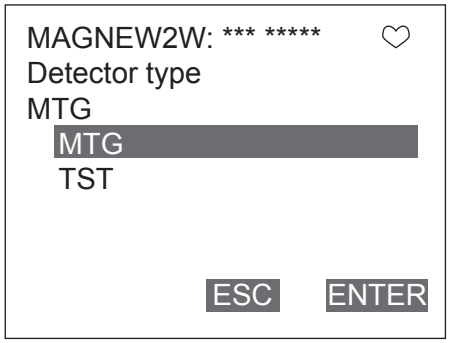


Fig. 7-20.

2. Once the display as shown in Fig. 7-20. appears, move the arrow key up or down to select a detector type. After making a selection, press F4 (ENTER). If F3 (ESC) is pressed here, the selection will be canceled and the display will return to the Detector config menu.
3. After returning to the Detector config menu, press F2 (SEND). Changed setting will be transmitted to the converter. The HART communicator mark will appear on the upper right hand corner while HART is communicating with the device. The mark will disappear once communication has properly completed.

Detector constant

Follow the procedures described below to set the detector constant.

Set the detector constants (Ex value and C2 value) printed on the nameplate.

Ex value

1. From online menu,
   Select:
   1. Device setup
   → 4. Detailed setup
   → 1. Detector config
   → 3. Ex value
   Fig. 7-21. will then be displayed.

Fig. 7-21.

2. Use the numeric keys to enter a detector constant in the value input display.
   Up to 5 digits including a decimal point can be entered. Setting range of the detector constant is 200.0 to 699.9.
3. Once a new value is entered, press F4 (ENTER) to return to the Detector config menu.
   When the value is outside the range, error will be displayed.
   Input the value again.
4. After returning to the Detector config menu, press F2 (SEND). Changed setting will be transmitted to the converter. The HART communicator mark will appear on the upper side while HART is communicating with the device.
   The mark will disappear once communication has properly completed.

C2 value

1. From online menu,
   Select:
   1. Device setup
   → 4. Detailed setup
   → 1. Detector config
   → 4. C2 value R/W
   Fig. 7-22. is then displayed.

Fig. 7-22.

2. Use the numeric keys to enter a detector constant in the value input display.
   Up to 6 digit including a decimal point can be entered. Setting range of the detector constant C2 is 0.5000 to 1.5000.
3. Once a new value is entered, press F4 (ENTER) to return to the detector config menu.
   When the value is outside the range, an error message is displayed. Input the value again.
4. After returning to the detector config menu, press F2 (SEND). The changed setting is sent to the transmitter. The HART communicator mark appears on the upper side while HART is communicating with the device. Once communication is completed, the HART mark disappears.

7-2-3. Signal processing

Auto spike cut

To set On/OFF for auto spike cut, proceed as follows:

1. From online menu,
   Select:
   1. Device setup
   → 4. Detailed setup
   → 3. Noise immunity
   → 2. Auto spike cut
   Fig. 7-23. will then be displayed.

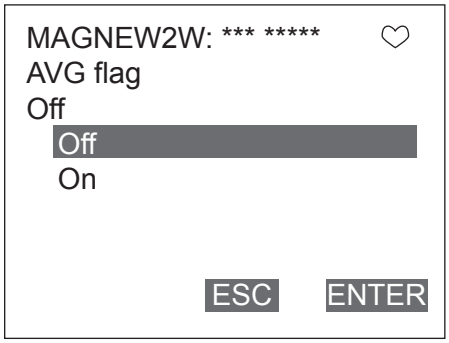


Fig. 7-23.

2. Once the display as shown in Fig. 7-23. appears, move the arrow key up or down to select On or OFF. After making a selection, press F4 (ENTER). If F3 (ESC) is pressed here, the selection will be canceled and the display will return to the Noise immunity menu.
3. After returning to the Noise immunity menu, press F2 (SEND). Changed setting will be transmitted to the converter. The HART communicator mark will appear on the upper right hand corner while HART is communicating with the device. The mark will disappear once communication has properly completed.

Setting average processing

To set ON/OFF for average processing, proceed as follows:

1. From online menu,
   Select:
   1. Device setup
   → 4. Detailed setup
   → 3. Noise immunity
   → 3. Moving average
   Fig. 7-24. will then be displayed.

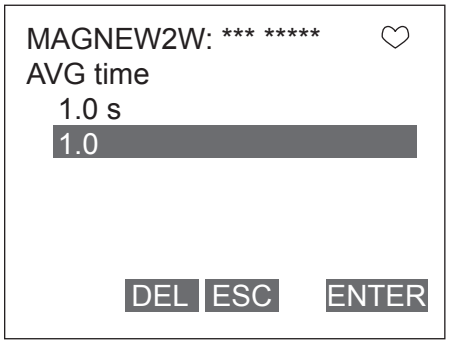


Fig. 7-24.

2. Once the display as shown in Fig. 7-24. appears, move the arrow key up or down to select On or OFF. After making a selection, press F4 (ENTER). If F3 (ESC) is pressed here, the selection will be canceled and the display will return to the Noise immunity menu.
3. After returning to the Noise immunity menu, press F2 (SEND). Changed setting will be transmitted to the converter. The HART communicator mark will appear on the upper right hand corner while HART is communicating with the device. The mark will disappear once communication has properly completed.

Setting the average processing time

To set the value of the average processing time, proceed as follows:

1. From online menu,
   Select:
   1. Device setup
   → 4. Detailed setup
   → 3. Noise immunity
   → 4. Mvng av time
   Fig. 7-25. will then be displayed.

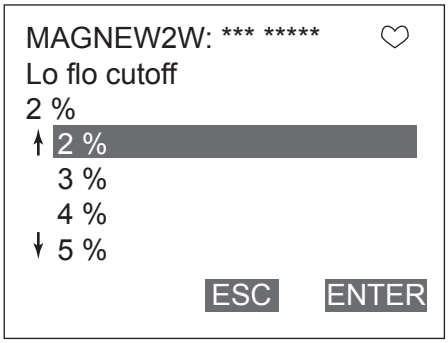


Fig. 7-25.

2. Use the numeric keys to enter an average processing time in the value input display.
   Setting range of average processing time 1.0s to 30.0s.
3. Once a new value is entered, press F4 (ENTER) to return to the Noise immunity menu.
   When the value is outside the range, error will be displayed.
   Input the value again.
4. After returning to the Noise immunity menu, press F2(SEND). Changed setting will be transmitted to the converter. The HART communicator mark will appear on the upper right hand corner while HART is communicating with the device. The mark will disappear once communication has properly completed.

Low flow cutoff

To set the low flow cutoff, proceed as follows:

1. From online menu,
   Select:
   1. Device setup
   → 4. Detailed setup
   → 3. Noise immunity
   → 5. Lo flow cut
   Fig. 7-26. will then be displayed.

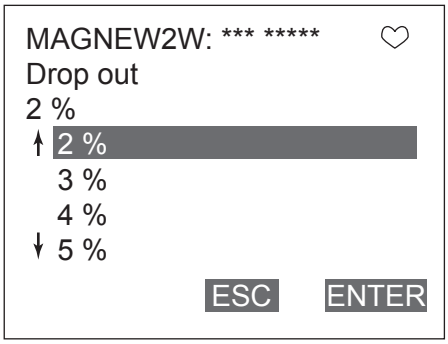


Fig. 7-26.

2. Once the display as shown in Fig. 7-26. appears, move the arrow key up or down to select low flow cut value. Value can be specified from 1% to 10%.
   After making a selection, press F4(ENTER). If F3 (ESC) is pressed here, the selection will be canceled and the display will return to the Noise immunity menu.
3. After returning to the Noise immunity menu, press F2(SEND). Changed setting will be transmitted to the converter. The HART communicator mark will appear on the upper right hand corner while HART is communicating with the device. The mark will disappear once communication has properly completed.

Drop-out

When the drop-out is set to prevent the wrong integration of integrated flow rate, it will not count the pulse when it is within the flow rate of setting against the setting range.

To set the drop-out, proceed as follows:

1. From online menu,
   Select:
   1. Device setup
   → 4. Detailed setup
   → 3. Noise immunity
   → 6. Drop out
   Fig. 7-27. will then be displayed.

Fig. 7-27.

2. Once the display as shown in Fig. 7-27. appears, move the arrow key up or down to select drop-out value. Value can be specified from 0% to 10%. After making a selection, press F4(ENTER). If F3 (ESC) is pressed here, the selection will be canceled and the display will return to the Noise immunity menu.
3. After returning to the Noise immunity menu, press F2(SEND). Changed setting will be transmitted to the converter. The HART communicator mark will appear on the upper right hand corner while HART is communicating with the device. The mark will disappear once communication has properly completed.

Electrode status sensitivity

1. From online menu,
   Select:
   1. Device setup
   → 4. Detailed setup
   → 3. Noise immunity
   → 7. Electrode status sensitivity
   Fig. 7-28. is then displayed.

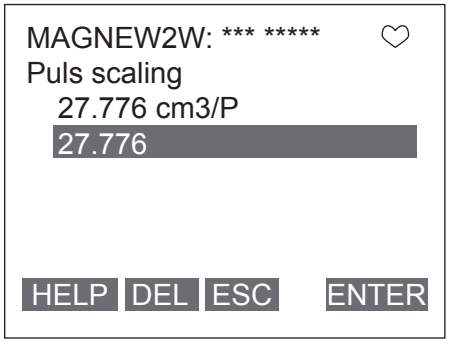


Fig. 7-28.

2. Once the display as shown Fig. 7-28. appears, move the arrow key up or down to select a sensitivity. After marking a selection, press F4 (ENTER).
   OFF, HIGH, MID, LOW, LL, or LLL can be selected. If F3 (ESC) is pressed here, the selection is canceled and the display returns to the Noise immunity menu.
3. After returning to the Noise immunity menu, press F2 (SEND). The changed setting is sent to the transmitter. The HART communicator mark appears on the upper side while HART is communicating with the device. Once communication is completed, the HART mark disappears.
4. To select an appropriate sensitivity level, refer to the flow chart on page 5-27 .

Electrode status output mode

1. From online menu,
   Select:
   1. Device setup
   → 4. Detailed setup
   → 3. Noise immunity
   → 8. Electrode status output mode
   Fig. 7-29. is then displayed.

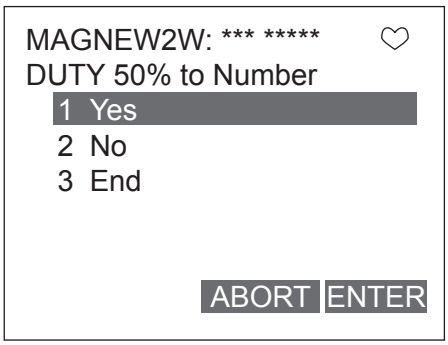


Fig. 7-29.

2. Once the display as shown Fig. 7-29. appears, move the arrow key up or down to select an Electrode status output mode. After marking a selection, press F4 (ENTER).
   OFF, ZERO, or HOLD can be selected. If F3 (ESC) is pressed here, the selection is canceled and the display returns to the Noise immunity menu.
3. After returning to the Noise immunity menu, press F2 (SEND). The changed setting is sent to the transmitter. The HART communicator mark appears on the upper side while HART is communicating with the device. Once communication is completed, the HART mark disappears.

7-2-4. Pulse setting

Pulse scale unit

To set the pulse scale unit, proceed as follows:

1. From online menu,
   Select:
   1. Device setup
   → 4. Detailed setup
   → 2. Conf output
   → 2. Pulse output
   → 1. Puls out unit
   Fig. 7-30. will then be displayed.

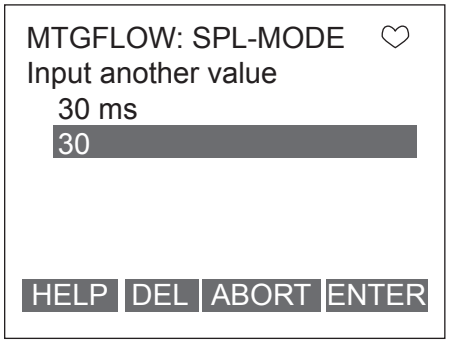


Fig. 7-30.

2. Once the display as shown in Fig. 7-30. appears, move the arrow key up or down to select pulse scale unit. After making a selection, press F4 (ENTER).
   If F3 (ESC) is pressed here, the selection will be canceled and the display will return to the Pulse output menu.
3. After returning to the Pulse output menu, press F2 (SEND). Changed setting will be transmitted to the converter. The HART communicator mark will appear on the upper right hand corner while HART is communicating with the device. The mark will disappear once communication has properly completed.

Pulse scale

To set the pulse scale, proceed as follows:

1. From online menu,
   Select:
   1. Device setup
   → 4. Detailed setup
   → 2. Conf output
   → 2. Pulse output
   → 2. Puls scaling
   Fig. 7-31. will then be displayed.

Fig. 7-31.

2. Use the numeric keys to enter a pulse scale in the value input display.
   Setting range of pulse scale is span frequency of 0.0001 Hz to 200 Hz.
3. Once a new value is entered, press F4 (ENTER) to return to the Noise immunity menu.
   When the value is outside the range, error will be displayed.
   Input the value again.
4. After returning to the Noise immunity menu, press F2 (SEND). Changed setting will be transmitted to the converter. The HART communicator mark will appear on the upper right hand corner while HART is communicating with the device. The mark will disappear once communication has properly completed.

Pulse width

To set the pulse width value, proceed as follows:

1. From online menu,
   Select:
   1. Device setup
   → 4. Detailed setup
   → 2. Conf output
   → 2. Pulse output
   → 3. Pulse width
   Fig. 7-32. will then be displayed.

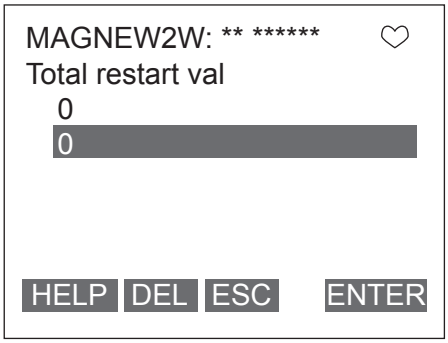


Fig. 7-32.

2. Duty ratio is set 50%. If setting the value arbitrarily, select YES, and press F4 (ENTER). If duty ratio of 50% is fine, select NO.
3. Use the numeric keys to enter a pulse width in the value input display.
   Setting range of pulse width is duty ratio of 70% or less.

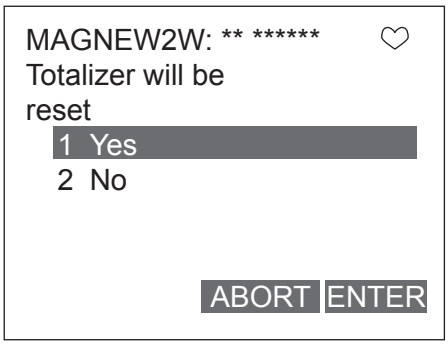


Fig. 7-33.

4. Once a new value is entered, press F4 (ENTER). Data will be transmitted.
   When the value is outside the range, error will be displayed. Input the value again.

7-2-5. Totalized value setting

Displaying totalized value

Follow the procedures described below to display the actual totalized value.

1. From online menu,
   Select:
   1. Device setup
   → 4. Detailed setup
   → 2. Conf output
   → 3. Totalizer
   → 1. Totalizer display
   Fig. 7-34. will then be displayed.

Fig. 7-34.

2. Press F4 (EXIT) to return to the previous display.

Integrated reset value

Follow the procedure described below to set the integrated reset value.

1. From online menu,
   Select:
   1. Device setup
   → 4. Detailed setup
   → 2. Conf output
   → 3. Totalizer
   → 2. Totalizer restart val
   Fig. 7-35. will then be displayed.

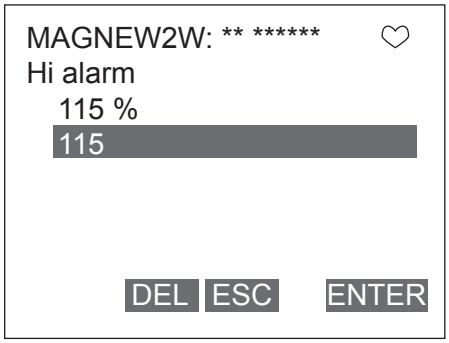


Fig. 7-35.

2. Use the numeric keys to input a integrated reset value.
   Integrated reset value is span frequency of 00000000 to 99999999.
3. Once a new value has been inputted, press F4 (ENTER).
4. After pressing F4 (ENTER) and returning to the Totalizer menu, press F2 (SEND) to transmit the change to the converter. The HART communication will appear in the upper right hand corner while HART is communicating with the device. The mark will disappear once communication is properly completed.

Resetting the totalized value

Follow the procedure described below to reset the totalized value.

1. From online menu,
   Select:
   1. Device setup
   → 4. Detailed setup
   → 2. Conf output
   → 3. Totalizer
   → 3. Reset totalizer
   Fig. 7-36. will then be displayed.

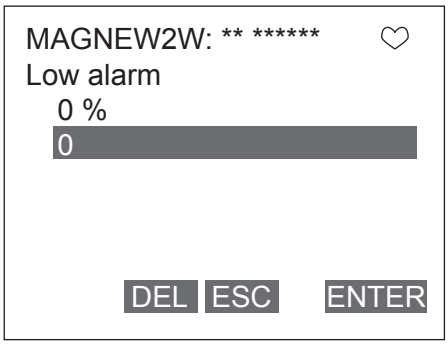


Fig. 7-36.

2. If resetting the totalized value, select Yes, and press F4.
3. After pressing F4 (ENTER), Fig. 7-37. will then be displayed. Fig. 7-37. shows that the totalized value has been reset. After resetting, display will automatically return back to the previous display in 3 sec.

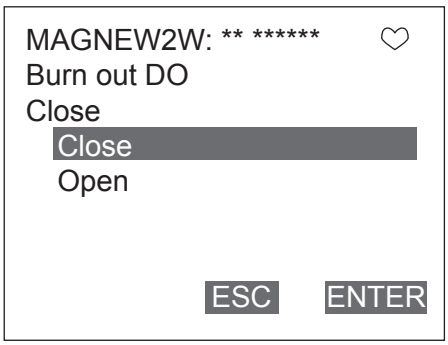


Fig. 7-37.

7-2-6. Contact output setting

High alarm value setting

To set the high alarm value of contact output, proceeds as follows:

1. From online menu,
   Select:
   1. Device setup
   → 4. Detailed setup
   → 2. Conf output
   → 4. Digital output
   → 1. Hi alarm
   Fig. 7-38. will then be displayed.

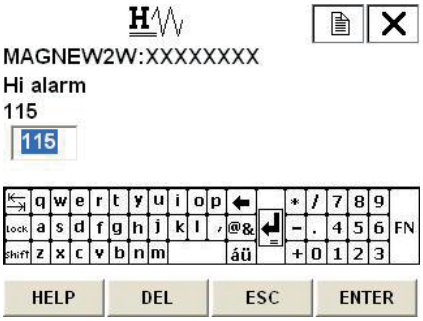


Fig. 7-38.

2. Use the numeric keys to enter a high alarm value in the value input display.
   Setting range of high alarm value is 0% to +115%. Do not set the value to be High alarm value < Low alarm value.
3. Once a new value is entered, press F4 (ENTER) to return to the Digital output menu.
   When the value is outside the range, error will be displayed. Input the value again.
4. After returning to the Digital output menu, press F2 (SEND). Changed setting will be transmitted to the converter. The HART communicator mark will appear on the upper right hand corner while HART is communicating with the device. The mark will disappear once communication has properly completed.

Low alarm value setting

To set the low alarm value of contact output, proceed as follows:

1. From online menu,
   Select:
   1. Device setup
   → 4. Detailed setup
   → 2. Conf output
   → 4. Digital output
   → 2. Low alarm
   Fig. 7-39. will then be displayed.

Fig. 7-39.

2. Use the numeric keys to enter a high alarm value in the value input display.
   Setting range of high alarm value is 0% to +115%. Do not set the value to be High alarm value < Low alarm value.
3. Once a new value is entered, press F4 (ENTER) to return to the Digital output menu. When the value is outside the range, error will be displayed. Input the value again.
4. After returning to the Digital output menu, press F2 (SEND). Changed setting will be transmitted to the converter. The HART communicator mark will appear on the upper right hand corner while HART is communicating with the device. The mark will disappear once communication has properly completed.

Contact output status setting

To select OPEN/CLOSE of contact output in normal status, proceed as follows:

1. From online menu,
   Select:
   1. Device setup
   → 4. Detailed setup
   → 2. Conf output
   → 4. Digital output
   → 3. Burn out DO
   Fig. 7-40. will then be displayed.

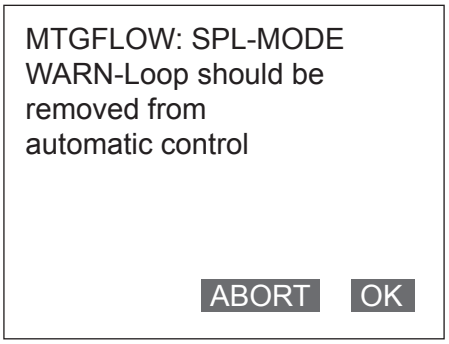


Fig. 7-40.

2. Once the display as shown in Fig. 7-40. appears, move the arrow key up or down to select OPEN or CLOSE. After making a selection, press F4 (ENTER). If F3 (ESC) is pressed here, the selection will be canceled and the display will return to the Digital output menu.
3. After returning to the Digital output menu, press F2 (SEND). Changed setting will be transmitted to the converter. The HART communicator mark will appear on the upper right hand corner while HART is communicating with the device. The mark will disappear once communication has properly completed.

7-2-7. Burnout setting

Analog output burnout setting

To set the output direction of analog current output at critical failure, proceed as follows:

1. From online menu,
   Select:
   1. Device setup
   → 4. Detailed setup
   → 2. Conf output
   → 1. Analog output
   → 5. Burn out AO
   Fig. 7-41. will then be displayed.

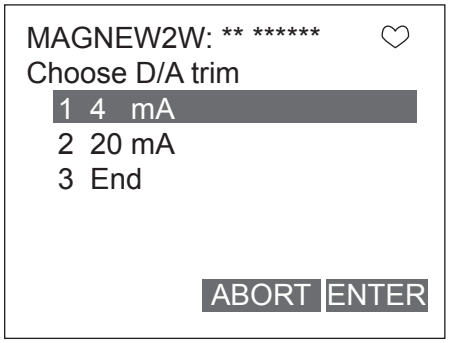


Fig. 7-41.

2. Once the display as shown in Fig. 7-41. appears, move the arrow key up or down to select HIGH, LOW, or HOLD. After making a selection, press F4 (ENTER). If F3 (ESC) is pressed here, the selection will be canceled and the display will return to the Analog output menu.
3. After returning to the Analog output menu, press F2 (SEND). Changed setting will be transmitted to the converter. The HART communicator mark will appear on the upper right hand corner while HART is communicating with the device. The mark will disappear once communication has properly completed.

Pulse output burnout setting

To set the output direction of pulse output at critical failure, proceed as follows:

1. From online menu,
   Select:
   1. Device setup
   → 4. Detailed setup
   → 2. Conf output
   → 2. Pulse output
   → 5. Burn out pls
   Fig. 7-42. will then be displayed.

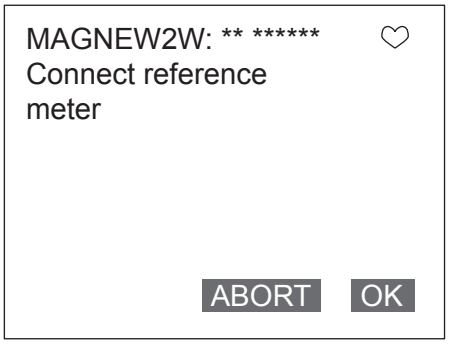


Fig. 7-42.

2. Once the display as shown in Fig. 7-42. appears, move the arrow key up or down to select Off or Hold. After making a selection, press F4 (ENTER). If F3 (ESC) is pressed here, the selection will be canceled and the display will return to the Pulse output menu.
3. After returning to the Pulse output menu, press F2 (SEND). Changed setting will be transmitted to the converter. The HART communicator mark will appear on the upper right hand corner while HART is communicating with the device. The mark will disappear once communication has properly completed.

7-3. Calibrating and Inspecting the device by HART Communicator and other functions

7-3-1. Device adjustment

Analog current output adjustment

To adjust analog output (4 mA and 20 mA) adjustment, proceed as follows:

1. From online menu,
   Select:
   1. Device setup
   → 2. Diag/Service
   → 3. Calibration
   → 1. D/O trim
   Fig. 7-43. will then be displayed.
   If the control system is not affected by the forcible change of the current signal, press F4 (OK). By pressing F3 (ABORT), the procedure is canceled.

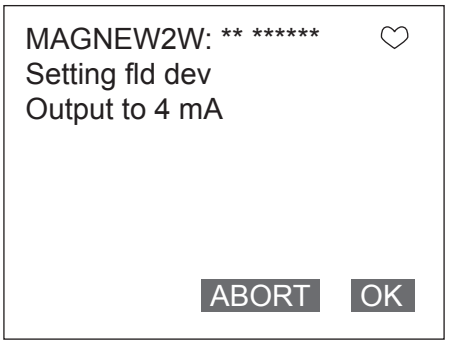


Fig. 7-43.

2. Once the display as shown in Fig. 7-44. appears, move the arrow key up or down to select a current output to adjust, and then press F4 (ENTER). This time, select 4 mA.

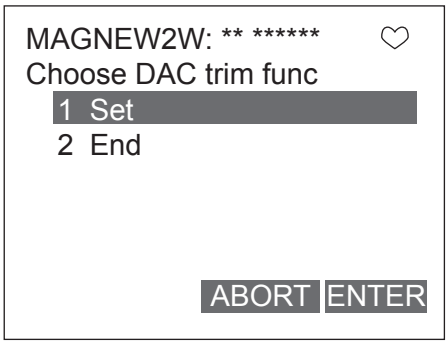


Fig. 7-44.

3. Fig. 7-45. will then appears. Connect the device to measure the current output, and then press F4 (OK).

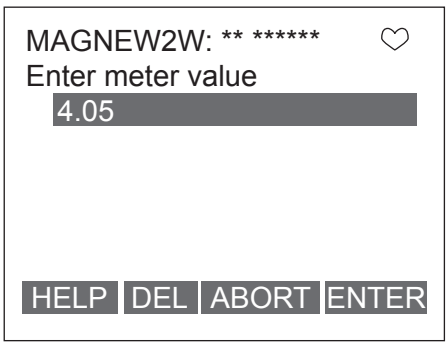


Fig. 7-45.

4. Fig. 7-46. will then appear. By pressing F4 (OK), current adjustment will start and the converter will output a current corresponding to 0% of the flow range. If it is fine, press F4(OK)

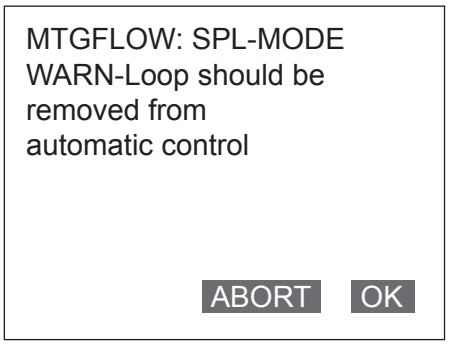


Fig. 7-46.

5. Fig. 7-47. will then appear. When executing the adjustment, select “SET”, and then press F4 (ENTER).

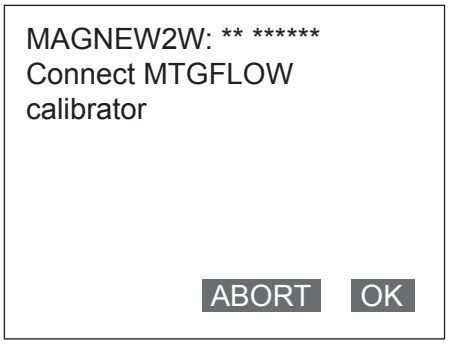


Fig. 7-47.

6. A numerical value input display (Fig. 7-48.) will then appear. Measure the output current from the converter and enter the current value by the mA into the device. Once the input has been completed press F4 (ENTER). The converter will start adjusting to 4mA automatically, and return back to the display as shown in Fig. 7-48. Verify that the current output value is 4 mA, and terminate the adjustment.

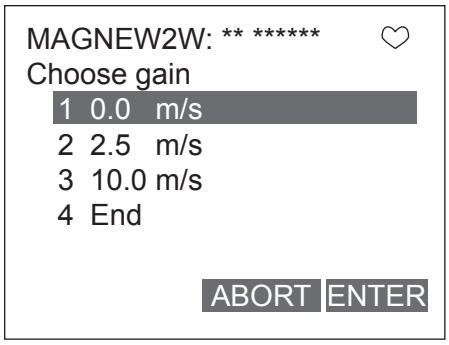


Fig. 7-48.

7. For 20 mA current output adjustment, follow the same procedures as shown in above.

Manual Zero

This function is used to improve flow measurement more accurately when the flow rate becomes 25% or less of setting range. The MTG Flowmeter has three manual zeroing functions for each excitation current. To execute the manual zero, proceed as follows.

1. From online menu,
   Select:
   1. Device setup
   → 2. Diag/Service
   → 3. Calibration
   → 3. Manual zero
   Fig. 7-49. is then displayed.

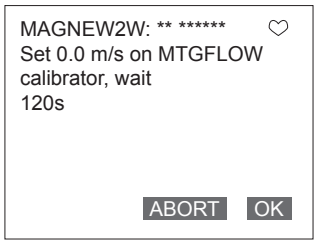


Fig. 7-49.

2. Once the display as shown Fig. 7-49. appears, move the arrow key up or down to select a manual zero to be adjusted.
3. Select the manual zero, then the screen as shown in Fig. 7-50. appears.

Fig. 7-50.

4. To continue the manual zero, press OK. Then the screen as shown in Fig. 7-51. appears. Press OK to continue. The notice as shown in Fig. 7-52. appears.

Fig. 7-51.

Fig. 7-52.

5. Once the display as shown Fig. 7-53. appears, confirm the value appears on the screen and select an appropriate command by moving the arrow key up or down. After marking a selection, press F4 (ENTER). Check the adjustment value by selecting "3 Refresh %" command. If you finish the manual zero, select "4 Quit(Manual zero end) command and press F4 (ENTER). Then screen as shown in Fig. 7-54. appears. Press OK and then return to the Manual zero menu.

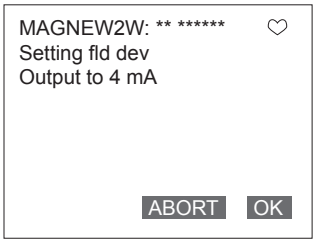


Fig. 7-53.

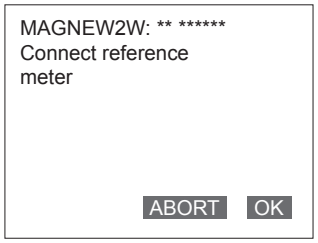


Fig. 7-54.

6. Execute the same procedures for the other two manual zero adjustments.

Gain adjustment

To adjust gain, proceed as follows:

1. From online menu,
   Select:
   1. Device setup
   → 2. Diag/Service
   → 3. Calibration
   → 4. Gain trim
   Fig. 7-55. will then be displayed.
   If the control system is not affected by the forcible change of the current signal, press F4 (OK). By pressing F3 (ABORT), the procedure is canceled.

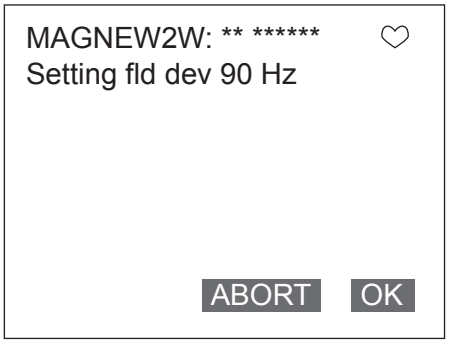


Fig. 7-55.

2. Fig. 7-56. will then appears. Connect the calibrator, and then press F4 (OK).

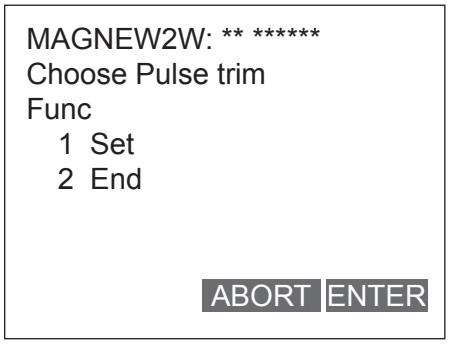


Fig. 7-56.

3. Once the display as shown in Fig. 7-57. appears, move the arrow key up or down to select a gain to adjust, and then press F4 (ENTER). This time, select 0 m/s.

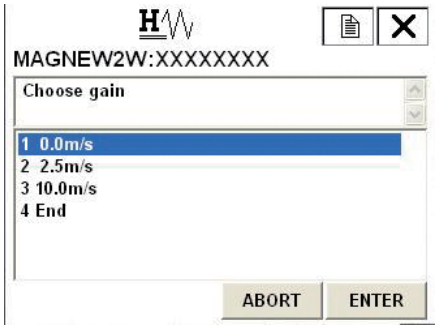


Fig. 7-57.

4. Fig. 7-58. will then appear. Set the connected calibrator value to 0.0 m/s and then press F4 (OK).

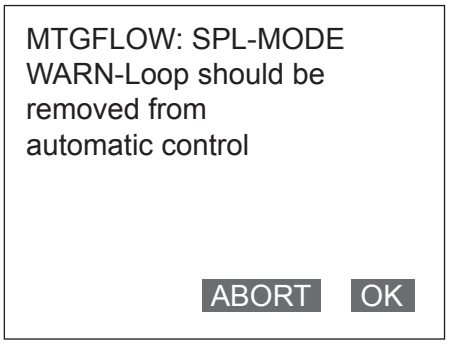


Fig. 7-58.

5. Fig. 7-59. will then appear. When executing the adjustment, press F4 (ENTER) to start the adjustment.

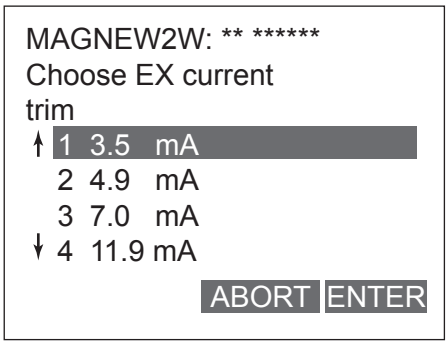


Fig. 7-59.

6. Fig. 7-60. will then appear. Please wait until the adjustment completes.

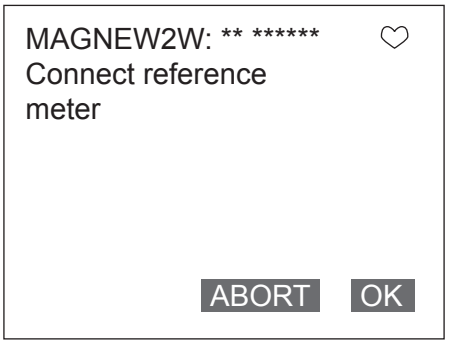


Fig. 7-60.

7. After the gain adjustment has been completed, display shown in Fig. 7-61. appears. Gain adjustment of 0.0 m/s is now completed. For gain adjustment of 2.5 m/s and 10 m/s, follow the same procedures as shown in above.

Fig. 7-61.

Pulse output adjustment

To adjust the pulse output, proceed as follows:

1. From online menu,
   Select:
   1. Device setup
   → 2. Diag/Service
   → 3. Calibration
   → 5. Pulse trim
   Fig. 7-62. will then be displayed.
   If the control system is not affected by the forcible change of the current signal, press F4 (OK). By pressing F3 (ABORT), the procedure is canceled.

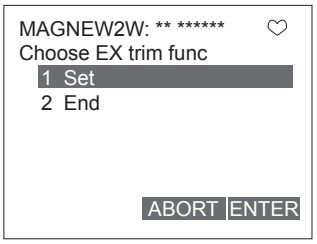


Fig. 7-62.

2. Fig. 7-63. will then appears. Connect the device to measure the pulse output, and then press F4 (OK).

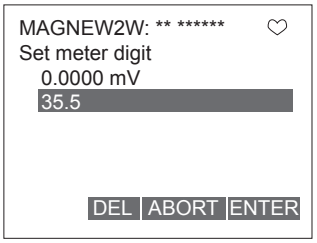


Fig. 7-63.

3. Fig. 7-64. will then appear. By pressing F4 (OK), the pulse output adjustment will start and the converter will output a pulse of 90 Hz. If it is fine, press F4 (OK).

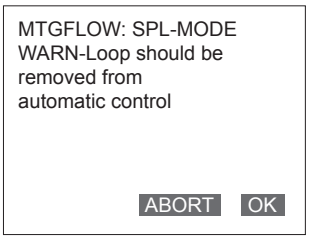


Fig. 7-64.

4. Fig. 7-65. will then appear. When executing the adjustment, select “SET”, and then press F4 (ENTER).

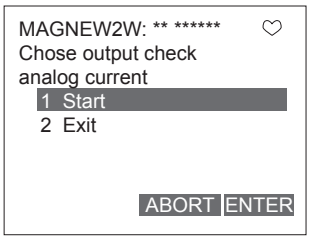


Fig. 7-65.

5. A numerical value input display (Fig. 7-66.) will then appear.
   Measure the pulse frequency from the converter and enter the frequency by the Hz into the device. Once the input has been completed press F4 (ENTER). The converter will start adjusting to 90 Hz automatically, and return back to the display as shown in Fig. 7-65. Verify that the pulse output is 90Hz, and terminate the adjustment.

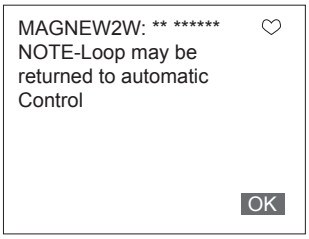


Fig. 7-66.

Excitation current adjustment

To adjust the excitation current adjustment, proceed as follow:

1. From online menu,
   Select:
   1. Device setup
   → 2. Diag/Service
   → 3. Calibration
   → 6. Ex current trim
   Fig. 7-67. will then be displayed.
   If the control system is not affected by the forcible change of the current signal, press F4 (OK). By pressing F3 (ABORT), the procedure is canceled.

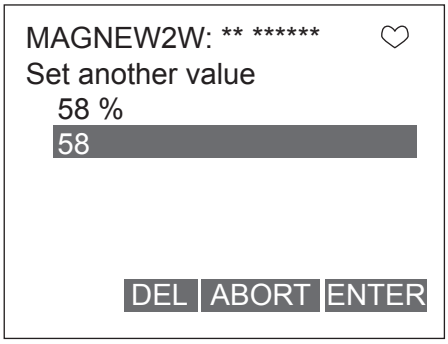


Fig. 7-67.

2. Once the display as shown in Fig. 7-68. appears, move the arrow key up or down to select an excitation current to adjust, and then press F4 (ENTER). This time, select 3.5 mA.

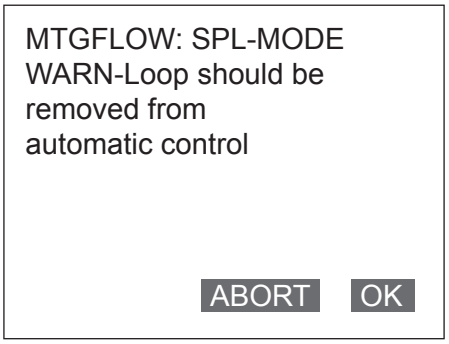


Fig. 7-68.

3. Fig. 7-69. will then appears. Connect the device to measure excitation current to the both ends of the excitation check pin and then press F4 (OK).

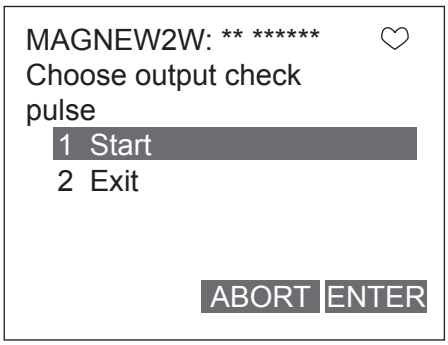


Fig. 7-69.

4. Fig. 7-70. will then appear. By pressing F4 (OK), excitation current adjustment starts, and the converter will adjust the excitation current to 3.5 mA. If it is fine, press F4 (OK).

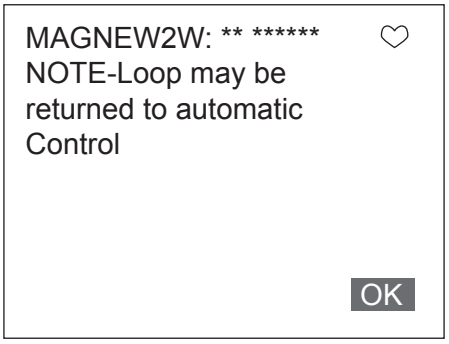


Fig. 7-70.

5. Fig. 7-71. will appear. When executing the adjustment, choose “SET” and press F4 (ENTER).

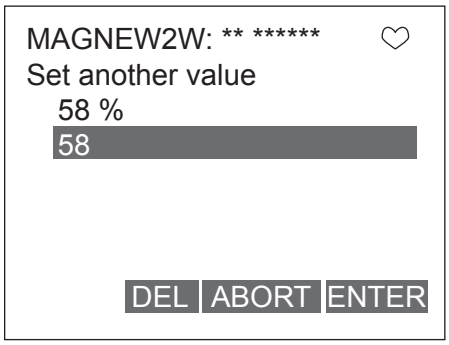


Fig. 7-71.

6. A numerical value input display (Fig. 7-72.) will then appear. Resistance of 10ohm is in between the check pin. Therefore, when the excitation current is 3.5 mA, approx. 35 mV will be output. Measure this value, and input the value by the mV directly. Press F4 (ENTER). The converter will start adjusting to 3.5 mA automatically, and return back to the display as shown in Fig. 7-71. Verify that the excitation current value is 3.5 mA, and terminate the adjustment.

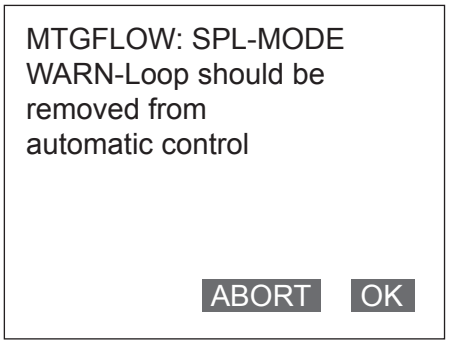


Fig. 7-72.

7. For the other excitation current adjustment, follow the same procedure as shown in above.

7-3-2. Output check

Analog output check with a calibrator

This function is used for the loop check using a calibrator. 0%, or 25% to 100% of setting range can be selected for the analog output check with the calibrator.

To output fixed value of analog current by using the calibrator, proceed as follows.

1. From online menu,
   Select:
   1. Device setup
   → 2. Diag/Service
   → 2. Loop test
   → 1. Loop check mode
   Fig. 7-73. is then displayed.

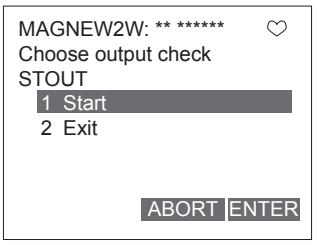


Fig. 7-73.

2. Once the display as shown Fig. 7-73. appears, make sure that the loop is removed from the automatic control. Then press "OK" to execute the output check with the calibrator. Then Fig. 7-74. is displayed.

   Move the arrow key up or down and select "1 Start" to execute the loop check.

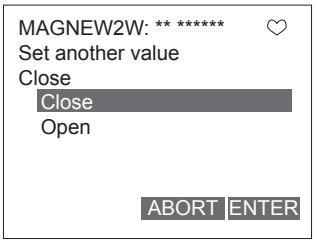


Fig. 7-74.

3. During the loop check, Fig. 7-75. is displayed. If the loop check is finished, move the arrow key up or down and select "1 End" to select other analog output value for the loop check. If you finish the loop check, move the arrow key up or down and select "2 Abort" to abort. Then Fig. 7-76. is displayed.

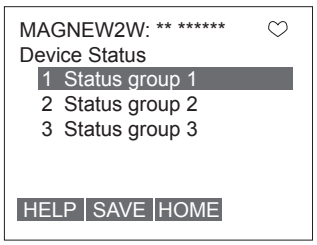


Fig. 7-75.

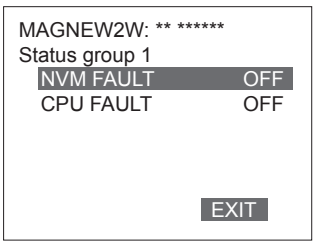


Fig. 7-76.

4. Once the display as shown Fig. 7-76. appears, press "OK" to abort. Then Fig. 7-77. is displayed. Press "OK" and then the screen returns to the loop test menu as shown in Fig. 7-78.

Fig. 7-77.

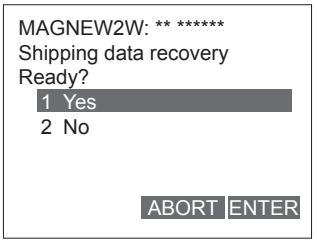


Fig. 7-78.

Analog output check

To output fixed value of analog current, proceed as follows:

1. From online menu,
   Select:
   1. Device setup
   → 2. Diag/Service
   → 2. Loop test
   → 2. Out put check AO
   Fig. 7-79. will then be displayed.
   If the control system is not affected by the forcible change of the current signal, press F4 (OK). By pressing F3 (ABORT), the procedure is canceled.

Fig. 7-79.

2. Fig. 7-80. will then appear. Choose START to start fixed value of analog current output, and then press F4 (ENTER)

Fig. 7-80.

3. Note of caution will appear as shown in Fig. 7-81. To proceed, press F4 (OK).

Fig. 7-81.

4. Use the numeric keys to enter a fixed value to be output in the value input display. Setting range is duty ratio of 0% to +100%. When value is entered, press F4 (ENTER). Analog current corresponding to its output will be output. Press F3 (ABORT) to return to the previous menu.

Fig. 7-82.

Pulse output check

To output pulse fixed value, proceed as follow:

1. From online menu,
   Select:
   1. Device setup
   → 2. Diag/Service
   → 2. Loop test
   → 3. Out put check Pls
   Fig. 7-83. will then be displayed.
   If the control system is not affected by the forcible change of the current signal, press F4 (OK). By pressing F3 (ABORT), the procedure is canceled.

Fig. 7-83.

2. Fig. 7-84. will then appear. Choose START to start fixed value of pulse output, and then press F4(ENTER)

Fig. 7-84.

3. Note of caution will appear as shown in Fig. 7-85. To proceed, press F4(OK).

Fig. 7-85.

4. Use the numeric keys to enter a fixed value to be output in the value input display. Setting range is duty ratio of 0% to +100%. When value is entered, press F4 (ENTER). Pulse corresponding to its output will be output. Press F3 (ABORT) to return to the previous menu.

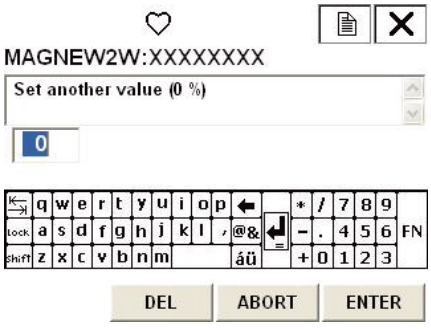


Fig. 7-86.

Contact output check

To output contact fixed value, proceed as follows:

1. From online menu,
   Select:
   1. Device setup
   → 2. Diag/Service
   → 2. Loop test
   → 4. Out put check Do
   Fig. 7-87. will then be displayed.
   If the control system is not affected by the forcible change of the current signal, press F4 (OK). By pressing F3 (ABORT), the procedure is canceled.

Fig. 7-87.

2. Fig. 7-88. will then appear. Choose START to start fixed value of contact output, and then press F4 (ENTER)

Fig. 7-88.

3. Fig. 7-89. will appear. Move the arrow key up or down to select an OPEN or CLOSE. After making a selection, press F4 (ENTER). Selected contact will be output. Press F3 (ABORT) to return to the previous menu.

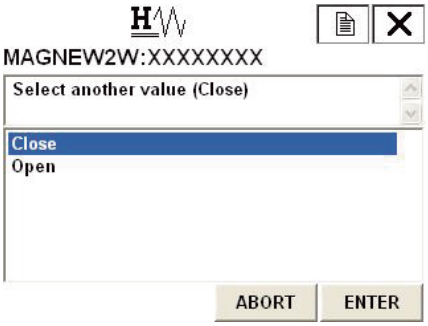


Fig. 7-89.

7-3-3. Other functions

Verifying status of converter

To verify the status and setting of the device, proceed as follow:

1. From online menu,
   Select:
   1. Device setup
   → 2. Diag/Service
   → 1. Device Status
   Fig. 7-90. will then be displayed.

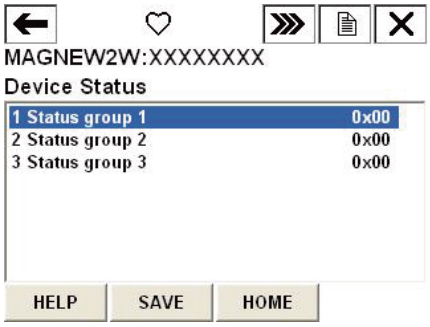


Fig. 7-90.

2. There are 3 groups. Each group has different items to be verified. Fig. 7-91. shows an example of "status group 1".

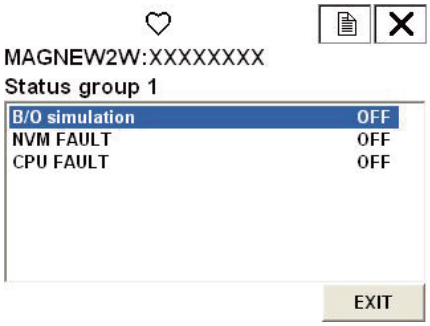


Fig. 7-91.

3. Table 7-1. shows the items to be verified in each group.

Table 7-1 Items in each group

Group	Item	Description
Group 1	B/O simulation	Burn out status
	NVM FAULT	Abnormal non-volatile memory
	CPU FAULT	Abnormal CPU
Group 2	IN LOCAL MODE OFF	Changing the setting from display
	DO OUTPUT MODE OFF	Checking the contact output
	PLS OUTPUT MODE OFF	Checking the pulse output
	AO OUTPUT MODE	Checking the analog output
	IN CALIB MODE	Adjusting
	NOT CALIBRATED	Non adjusted
	EX OUTPUT MODE	Checking the excitation current
Group 3	EMPTY OR SCALE ERROR	Empty or scale appears on electrode
	IN OUTPUT CHECK MODE W/CALIB	Checking the analog output using calibrator
	HI<LO ALM ERROR	Abnormal high/Low alarm setting
	SPAN OVER ERROR	Span gone beyond its high limit
	PLS SCALE ERROR	Pulse scale setting error
	PLS WIDTH ERROR	Pulse width setting error

Tag setting

To set the tag, proceed as follow:

1. From online menu,
   Select:
   1. Device setup
   → 3. Basic setup
   → 1. Tag
   Fig. 7-92. will then be displayed.

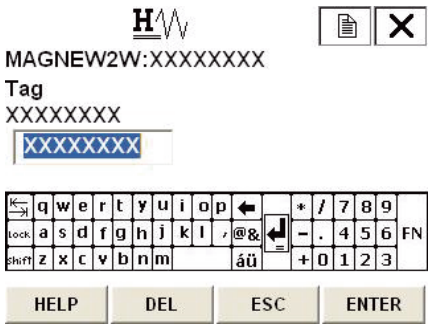


Fig. 7-92.

2. Once the display as shown in Fig. 7-92. appears, use the arrow key up, down, right or left and numerical keys to enter the number. After entering, press F4 (ENTER). If F3 (ESC) is pressed here, the selection will be canceled and the display will return to the Basic setup menu.
3. After returning to the Basic setup menu, press F2 (SEND). Changed setting will be transmitted to the converter.

Shipping data recovery

Follow the procedure described below to execute the shipping data recovery. Please make sure that when it is executed, the internal data will return to the factory setting.

1. From online menu,
   Select:
   1. Device setup
   → 2. Diag/Service
   → 3. Calibration
   → 6. Shipping RCVR
   Fig. 7-93. will then be displayed.

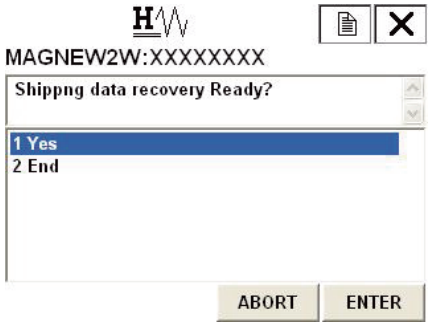


Fig. 7-93.

2. When executing shipping data recovery, select “YES” and press F4 (ENTER). Shipping data recovery will execute, and the display will return to Fig. 7-93. Press F3(ABORT) to return to the previous menu.

Review

1. From online menu,
   Select:
   1. Device setup → 5. Review
   Then, the status of the device can be confirmed (see Fig. 7-94.). Use F2 (PREV) and F3 (NEXT) to move the confirming items.

Review	
Model	MTGFLOW
Distributor	Azbil Corporation
PV unit	m^3/h
PV URV	m^3/h
PV LRV	0.00 m^3/h
PV USL	84.82 m^3/h
PV LSL	0.00 m^3/h
PV Min span	0.00000 m^3/h
Xfer fnctn	Linear
Lo flo cutoff	2 %
Tube size	50 A
Pulse scaling	27.77637 cm^3/P
Pulse Width	30 ms
PV Damp	3.0 s
AO Alrm typ	Lo
Write protect	No
Manufacturer	Azbil Corporation
Dev id	0
Tag	SPL-MODE
Descriptor	XXXXXXXXXXXXXXX
Message	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Universal rev	5
Fld dev rev	1
Software rev	3.0
Poll addr	0
Num req preams	5
Final asmbly num	0

Fig. 7-94.

7-4. Short cut commands and menus for HART communicator

7-4-1. Short cut keys

Select the item to set from the table below, and press the item number from the online menu. You can move to the item, which you want to set quickly.

Basic setting	
Flow unit	132
Range	133
Specific gravity	134
Damping time constant	135
Auto zero	136
Display selection	137
Function selection	138
Correction coefficient	139
Communication method	1426

Detector setting	
Detector diameter	1411
Detector type	1412
Detector constant	1413
Detector constant C2	1414

Signal processing	
Auto spike cut	1432
Moving average processing	1433
Moving average processing time	1434
Low flow cut	1435
Drop-out	1436
Electrode status sensitivity	1437
Electrode status output mode	1438

Pulse setting	
Pulse scale unit	14221
Pulse scale	14222
Pulse width	14223

Totalized value setting	
Totalized value display	14231
Totalized reset value	14232
Totalized value reset	14233

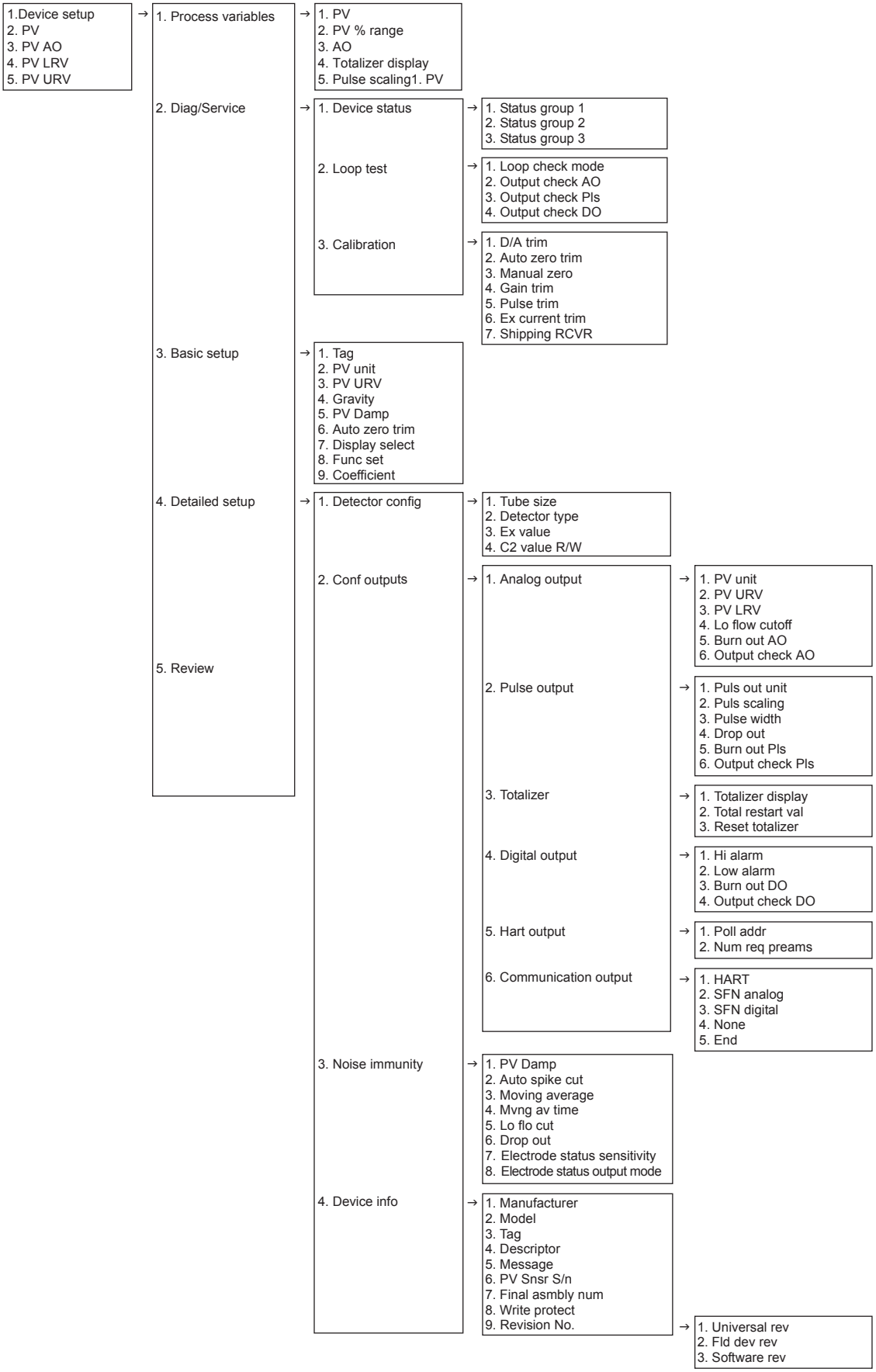
Emergency setting	
High alarm value setting	14241
Low alarm value setting	14242
Contact output status setting	14243
Burnout (Analog output)	14215
Burnout (Pulse output)	14225

Device adjustment	
Analog current output adjustment	1231
Manual zero	1233
Gain adjustment	1234
Pulse output adjustment	1235
Excitation current adjustment	1236

Output inspection	
Analog output check W/calibrator	1221
Analog output check	1222
Pulse output check	1223
Contact output check	1224

Others	
Converter status	121
ID setting	131
Shipping data recovery	1236
Review	15

7-4-2. Menu tree



Chapter 8. Maintenance and troubleshooting

Outline of this chapter

This chapter presents an instrument maintenance and maintenance procedure and information to refer to when doing troubleshooting. Ensure the procedure for maintenance based on the trouble.

8-1. Maintenance and inspection of hardware

Replacement of indicator/data setter

Procedure

Replacement procedure is as follows.

Step	Procedure
1	The converter front cover is fixed by hexagon socket head screws (M3). Loosen these screws with an Allen wrench (1.5).
2	Remove the converter front cover by turning it counterclockwise with the dedicated tool. *Note) Remove the front cover straight and with care.*
3	Remove the 3 fixing screws.
4	Remove by pulling out.
5	Align the new card's connector to the converter connector. *Note) Ensure the correct panel direction. The panel attaching direction can be chosen from two options according to the attaching position of this instrument.*
6	Fix the card again with the 3 screws. *Note) The connector is connected firmly by tightening the screws.*
7	Attach the front cover. *Note) Take care not to injure your fingers on the cover edge or the thread in the case.*

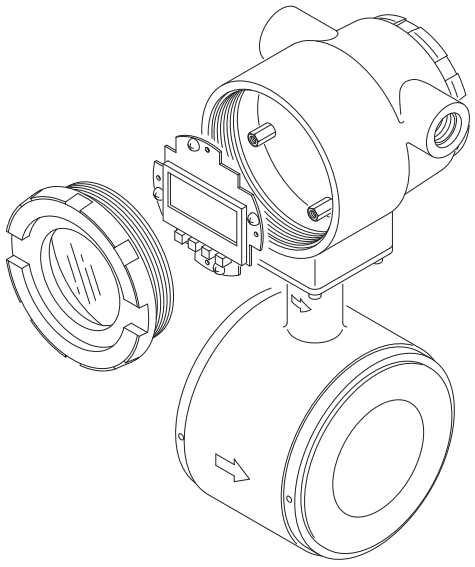


Fig. 8-1. Replacement of indicator/data setter (with the cover removed)

8-2. Troubleshooting

Types of troubles

Introduction

The troubles that can occur when starting up the instrument include the following three types:

- Troubles caused by inconsistencies between the specifications and actual application of the instrument.
- Troubles caused by mistakes in setting or operation
- Troubles caused by failures of the instrument.

The troubles that can occur while running the instrument are divided into major failures and minor failures as described below, and they are recognized, indicated or treated as such by the self-diagnosis function of the instrument.

If trouble should occur, take the appropriate measure referring to the troubleshooting guide described here.

Major failure

A major failure is referred to as a state or failure that causes a grave hindrance to the operation of the instrument and may lead to damage to the instrument itself if left untreated. If major failure occurs while the instrument is running, an error message is displayed on the display panel of the main unit and the output continues to output the value set in the direction of abnormality processing. The error message and self-diagnosis results can be read through communication (SFC, HART® communicator).

Minor failure

A minor failure is referred to as a state or failure that does not cause a grave hindrance to the operation of the instrument. If some trouble occurs while the instrument is running but the instrument self-diagnosis it as minor trouble, the output does not become abnormality-processing output and the instrument continues to output the instantaneous flow rate value.

Troubles at startup

Troubleshooting

If trouble should occur at the start of running, maintain according to the following table. If the trouble cannot be solved even if measures are taken according to the following table, the instrument may have broken down. Contact the nearest our customer service offices.

Trouble	Check point and troubleshooting
Nothing is displayed when powered on.	■ Check the specifications of the power source. ■ Check the wiring. ■ Check that the ambient temperature is not under -4°F (-20°C).
No output when powered on.	■ Check the signal line for correct connection.
Communication failure.	■ Check the signal line for correct connection. A load resistance of 250 Ω or more is required (SFC). ■ Check the communicator for correct connection. (SFC has polarity.) ■ SFC of Version 7.0 or over is used. Operation is impossible with a lower version. ■ Is model MTG DD (device description) down- loaded on the HART® Communicator? The DD for the model MTG should be downloaded from HCF DD Library Host DD Distribution (HCF-KIT-III) Release 2010 Number 1, Device Description 1, Device Revision 2 or later.
No pulse output.	■ Check the counter type, input specifications and contact capacity. ■ Check the pulse setting of the flowmeter.

Trouble during operation

Troubleshooting

When problem occurs during operation, perform the following procedures.

1. Search for the symptom of the trouble in the table on this page. If found, perform the steps indicated in the table.
2. If communication is possible, read the error message and self-diagnosis results.
   Perform referring to “Error Messages and Troubleshooting”.
3. If the above steps cannot solve the trouble, the instrument may have been damaged.
   Contact an Azbil Corp. representative.

Trouble	Check point and troubleshooting
Output fluctuates excessively beyond the estimated flow rate range.	■ Check that the instrument is grounded correctly. ■ Check that the damping time constant is set correctly. ■ Clean the electrodes. ■ The analog output may fluctuate due to flow noise, which is generated by the process fluid flow. In such a case, connect the upstream grounding ring to the downstream grounding ring by a wire. The output fluctuation may be reduced. ■ A circuit in some PLC may affect the flow measurement and the analog output may fluctuate. In this case, make sure that the both PLC and MTG flow meter are properly grounded. Proper grounding solves the fluctuation problem.
Output exceeds 100%.	■ Check if the range is set correctly. ■ Check if zero is adjusted correctly.
Output remains 0%.	■ Check if the signal line is connected correctly. ■ Check the upstream and downstream valves. ■ Check if the range is set correctly. ■ Check whether the device is set to the constant current mode or not. If so, press the CLR (clear) key on SFC to quit this mode. ■ Check if the flow rate is not within the set range of low-flow cutoff. ■ Check if the flow rate is not reversed (negative flow rate). ■ Check the detector for unfilled condition, too low conductivity, excessive noise, or the like.
Output has burnt out.	■ Take measures referring to “Error messages and measures”.
Pulse output is too large or too small for the flow rate.	■ Is the pulse setting (weight and width) correct? ■ Is the output from the main unit correct? ■ Is a pulse counter of appropriate specifications used? ■ Is the dropout value correctly set between 0 and 10%.

Terms and Conditions

We would like to express our appreciation for your purchase and use of Azbil Corporation's products.

You are required to acknowledge and agree upon the following terms and conditions for your purchase of Azbil Corporation's products (system products, field instruments, control valves, and control products), unless otherwise stated in any separate document, including, without limitation, estimation sheets, written agreements, catalogs, specifications and instruction manuals.

1. Warranty period and warranty scope

   1.1 Warranty period

   Azbil Corporation's products shall be warranted for one (1) year from the date of your purchase of the said products or the delivery of the said products to a place designated by you.

   1.2 Warranty scope

   In the event that Azbil Corporation's product has any failure attributable to azbil during the aforementioned warranty period, Azbil Corporation shall, without charge, deliver a replacement for the said product to the place where you purchased, or repair the said product and deliver it to the aforementioned place. Notwithstanding the foregoing, any failure falling under one of the following shall not be covered under this warranty:

   (1) Failure caused by your improper use of azbil product (noncompliance with conditions, environment of use, precautions, etc. set forth in catalogs, specifications, instruction manuals, etc.);
   (2) Failure caused for other reasons than Azbil Corporation's product;
   (3) Failure caused by any modification or repair made by any person other than Azbil Corporation or Azbil Corporation's subcontractors;
   (4) Failure caused by your use of Azbil Corporation's product in a manner not conforming to the intended usage of that product;
   (5) Failure that the state-of-the-art at the time of Azbil Corporation's shipment did not allow Azbil Corporation to predict; or
   (6) Failure that arose from any reason not attributable to Azbil Corporation, including, without limitation, acts of God, disasters, and actions taken by a third party.

   Please note that the term "warranty" as used herein refers to equipment-only-warranty, and Azbil Corporation shall not be liable for any damages, including direct, indirect, special, incidental or consequential damages in connection with or arising out of Azbil Corporation's products.

2. Ascertainment of suitability

   You are required to ascertain the suitability of Azbil Corporation's product in case of your use of the same with your machinery, equipment, etc. (hereinafter referred to as "Equipment") on your own responsibility, taking the following matters into consideration:

   (1) Regulations and standards or laws that your Equipment is to comply with.
   (2) Examples of application described in any documents provided by Azbil Corporation are for your reference purpose only, and you are required to check the functions and safety of your Equipment prior to your use.
   (3) Measures to be taken to secure the required level of the reliability and safety of your Equipment in your use
   Although azbil is constantly making efforts to improve the quality and reliability of Azbil Corporation's products, there exists a possibility that parts and machinery may break down. You are required to provide your Equipment with safety design such as fool-proof design,*1 and fail-safe design*2 (anti-flame propagation design, etc.), whereby preventing any occurrence of physical injuries, fires, significant damage, and so forth. Furthermore, fault avoidance,*3 fault tolerance,*4 or the like should be incorporated so that the said Equipment can satisfy the level of reliability and safety required for your use.

   *1. A design that is safe even if the user makes an error.
   *2. A design that is safe even if the device fails.
   *3. Avoidance of device failure by using highly reliable components, etc.
   *4. The use of redundancy.

3. Precautions and restrictions on application

   3.1 Restrictions on application

   Please follow the table below for use in nuclear power or radiation-related equipment.

	Nuclear power quality*5 required	Nuclear power quality*5 not required
Within a radiation controlled area*6	Cannot be used (except for limit switches for nuclear power*7)	Cannot be used (except for limit switches for nuclear power*7)
Outside a radiation controlled area*6	Cannot be used (except for limit switches for nuclear power*7)	Can be used

   *5. Nuclear power quality: compliance with JEAG 4121 required
   *6. Radiation controlled area: an area governed by the requirements of article 3 of "Rules on the Prevention of Harm from Ionizing Radiation," article 2 2 4 of "Regulations on Installation and Operation of Nuclear Reactors for Practical Power Generation," article 4 of "Determining the Quantity, etc., of Radiation-Emitting Isotopes,"etc.
   *7. Limit switch for nuclear power: a limit switch designed, manufactured and sold according to IEEE 382 and JEAG 4121.

   Any Azbil Corporation's products shall not be used for/with medical equipment.

   The products are for industrial use. Do not allow general consumers to install or use any Azbil Corporation's product. However, azbil products can be incorporated into products used by general consumers. If you intend to use a product for that purpose, please contact one of our sales representatives.

   3.2 Precautions on application

   you are required to conduct a consultation with our sales representative and understand detail specifications, cautions for operation, and so forth by reference to catalogs, specifications, instruction manual, etc. in case that you intend to use azbil product for any purposes specified in (1) through (6) below. Moreover, you are required to provide your Equipment with fool-proof design, fail-safe design, anti-flame propagation design, fault avoidance, fault tolerance, and other kinds of protection/safety circuit design on your own responsibility to ensure reliability and safety, whereby preventing problems caused by failure or nonconformity.

(1) For use under such conditions or in such environments as not stated in technical documents, including catalogs, specification, and instruction manuals
(2) For use of specific purposes, such as:
    * Nuclear energy/radiation related facilities
      [When used outside a radiation controlled area and where nuclear power quality is not required]
      [When the limit switch for nuclear power is used]
    * Machinery or equipment for space/sea bottom
    * Transportation equipment
      [Railway, aircraft, vessels, vehicle equipment, etc.]
    * Antidisaster/crime-prevention equipment
    * Burning appliances
    * Electrothermal equipment
    * Amusement facilities
    * Facilities/applications associated directly with billing
(3) Supply systems such as electricity/gas/water supply systems, large-scale communication systems, and traffic/air traffic control systems requiring high reliability
(4) Facilities that are to comply with regulations of governmental/public agencies or specific industries
(5) Machinery or equipment that may affect human lives, human bodies or properties
(6) Other machinery or equipment equivalent to those set forth in items (1) to (5) above which require high reliability and safety

4. Precautions against long-term use

Use of Azbil Corporation's products, including switches, which contain electronic components, over a prolonged period may degrade insulation or increase contact-resistance and may result in heat generation or any other similar problem causing such product or switch to develop safety hazards such as smoking, ignition, and electrification. Although acceleration of the above situation varies depending on the conditions or environment of use of the products, you are required not to use any Azbil Corporation's products for a period exceeding ten (10) years unless otherwise stated in specifications or instruction manuals.

5. Recommendation for renewal

Mechanical components, such as relays and switches, used for Azbil Corporation's products will reach the end of their life due to wear by repetitious open/close operations.

In addition, electronic components such as electrolytic capacitors will reach the end of their life due to aged deterioration based on the conditions or environment in which such electronic components are used. Although acceleration of the above situation varies depending on the conditions or environment of use, the number of open/close operations of relays, etc. as prescribed in specifications or instruction manuals, or depending on the design margin of your machine or equipment, you are required to renew any Azbil Corporation's products every 5 to 10 years unless otherwise specified in specifications or instruction manuals. System products, field instruments (sensors such as pressure/flow/level sensors, regulating valves, etc.) will reach the end of their life due to aged deterioration of parts. For those parts that will reach the end of their life due to aged deterioration, recommended replacement cycles are prescribed. You are required to replace parts based on such recommended replacement cycles.

6. Other precautions

Prior to your use of Azbil Corporation's products, you are required to understand and comply with specifications (e.g., conditions and environment of use), precautions, warnings/cautions/notices as set forth in the technical documents prepared for individual Azbil Corporation's products, such as catalogs, specifications, and instruction manuals to ensure the quality, reliability, and safety of those products.

7. Changes to specifications

Please note that the descriptions contained in any documents provided by azbil are subject to change without notice for improvement or for any other reason. For inquires or information on specifications as you may need to check, please contact our branch offices or sales offices, or your local sales agents.

8. Discontinuance of the supply of products/parts

Please note that the production of any Azbil Corporation's product may be discontinued without notice. After manufacturing is discontinued, we may not be able to provide replacement products even within the warranty period.

For repairable products, we will, in principle, undertake repairs for five (5) years after the discontinuance of those products. In some cases, however, we cannot undertake such repairs for reasons, such as the absence of repair parts. For system products, field instruments, we may not be able to undertake parts replacement for similar reasons.

9. Scope of services

Prices of Azbil Corporation's products do not include any charges for services such as engineer dispatch service. Accordingly, a separate fee will be charged in any of the following cases:

(1) Installation, adjustment, guidance, and attendance at a test run
(2) Maintenance, inspection, adjustment, and repair
(3) Technical guidance and technical education
(4) Special test or special inspection of a product under the conditions specified by you

Please note that we cannot provide any services as set forth above in a nuclear energy controlled area (radiation controlled area) or at a place where the level of exposure to radiation is equivalent to that in a nuclear energy controlled area.

Document Number:	CM2-MTG400-2001
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