

The Multivariable Air Flow Meter

Model MVC10A/10F

User's Manual



Azbil Corporation

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Preface

Thank you for purchasing our multivariable Air Flow Meter Model MVC10A/10F. This innovative flow meter that has been developed based on our long experience and expertise and has various functions including cost indication and leakage checking useful for energy-saving control in a wide variety of applications.

CAUTION

For the messages displayed on the local data setting device used for setting operation parameters of this instrument, “Japanese” is selected in default.

Thus, before starting the operation, switch the language for display to “English.”

For the details of changing languages for display, refer to the Item “Setting the language for display” under Subsection 4-8, “Initial setting.”

Unpacking and inspection

Unpacking

This flow meter is a precision instrument. When unpacking, handle it with care to prevent accidents or damage. Check that the following items are contained:

Waterproofing gland and gasket	3 pieces each
Blind plug	2 pieces
Remote type kit (for MVC10F only)	1 set
Bracket for remote type model	1 set
Tube for remote type model	1 tube
Tube fitting	1 set
User's manual	--
Test report (issued only when specified)	--

Verifying the specifications

The specifications for this device are written on the nameplate attached to the case of this instrument. Verify that all the specifications on the nameplate are correct paying special attention to the following:

- Basic model number
- Diameter
- Mounting/flow direction

Only if you have specified Tag No., verify the Tag No. checking Tag No. plate on the side of the case.

Inquiries

If you have any questions regarding the specifications, contact our branch and sales representative offices and your local Azbil Corporation distributor. When making an inquiry, be sure to let us know the Model and Product Nos. of the product you have purchased.

Storage precautions

When storing this instrument in the condition in which it was purchased, observe the following instructions:

- Store the instrument indoors at room temperature and humidity (around 25°C, RH 65%)
- Store it in a place safe from vibration or shocks.
- Store it in the same packaging conditions as it was shipped in.

When storing this instrument after usage, observe the following instructions:

1. Tighten the converter and waterproofing gland so that moisture infiltration can be prevented.
2. Return the instrument to its original packaging conditions.
3. Store the instrument indoors at room temperature and humidity in a place free from vibration and shocks.

How this Manual is organized and used

Introduction

Safe use of this instrument requires correct installation and operation, and adequate maintenance. Before starting installation, operation, and maintenance operations, read the safety precautions in this manual to understand them thoroughly.

Usage precautions

The following symbols are used in this manual to alert you to possible hazards:

WARNING

Denotes a potentially hazardous situation, which if not avoided, could result in death or serious injury.

CAUTION

Denotes a potentially hazardous situation, which if not avoided, could result in minor injury or property damage.

How this Manual is organized and used

Organization and method of use

This manual explains how to use this instrument and related equipment in the following order:

- | | |
|-----------|---|
| Chapter 1 | Configuration and structure of the measuring system
Explains the measuring systems using this instrument and describes its structure and the names and functions of its integral parts. |
| Chapter 2 | Installation of this instrument
Describes the methods for installing this instrument and its wiring. The persons responsible for the installation, piping, and wiring operations should read this chapter. |
| Chapter 3 | Operation and shut down of this instrument
Describes the operating sequence of activating, operating, and stopping this instrument. Refer to this chapter when using the installed equipment and when stopping it. |
| Chapter 4 | Setting parameters and operating the local data setting device
Explains how to operate this equipment by using the local data setting device. Refer to this chapter when setting or altering the setting of the available functions. |
| Chapter 5 | Maintenance and troubleshooting of this instrument
Describes the procedures required for the maintenance and inspection of this equipment and when any trouble occurs with it. When looking for the explanations required for maintenance and troubleshooting, use this chapter as an information retrieval means. |
| Appendix | English and Japanese Messages Comparison Table |

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Appendix English and Japanese Messages Comparison Table

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Chapter 1: Configuration and structure of the measuring system

Outline of this chapter

This chapter explains the measuring systems using this instrument.

- The instrument's structure and the names and functions of its integral parts are described.

1-1: System configuration

Measuring system

Introduction

This instrument is utilized in combination with a detector and a converter.

- Integral type The detector and converter are integrated and mounted on a pipe for the actual service.
- Remote type The detector and converter are isolated and connected with a tube.

Concept of flow rate measurement

Figure 1-1 shows the outline of a flow-rate measuring system using this equipment.

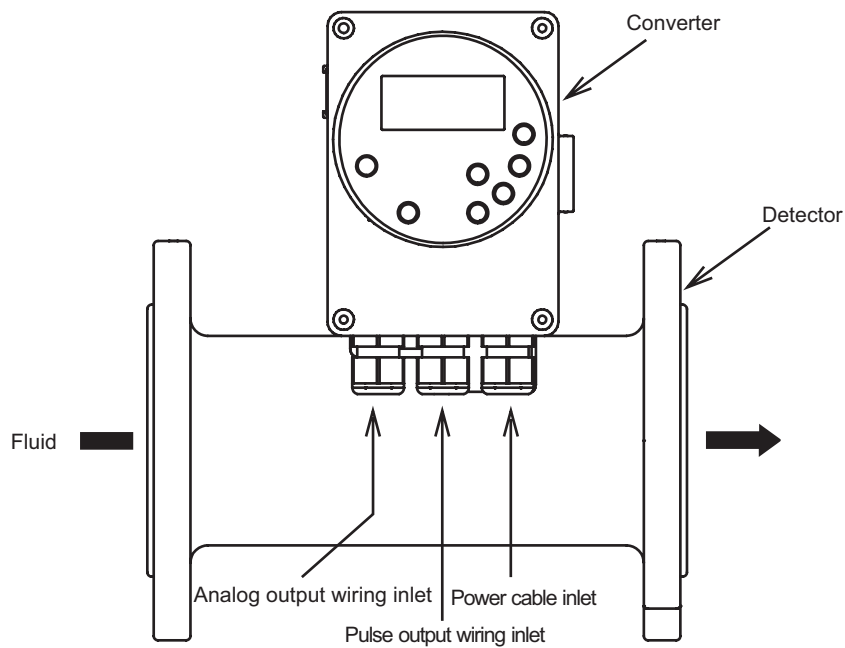


Fig. 1-1 Measuring system in an integral configuration

System configuration of analog signal output (4 to 20 mA DC output)

System configuration

The following illustrates the system configuration in the case where instantaneous flow-rate value is output as an analog signal of 4 to 20 mA DC.

In this system configuration, the analog signal can be output from this instrument to the monitoring or control system in a layer directly above the instrument.

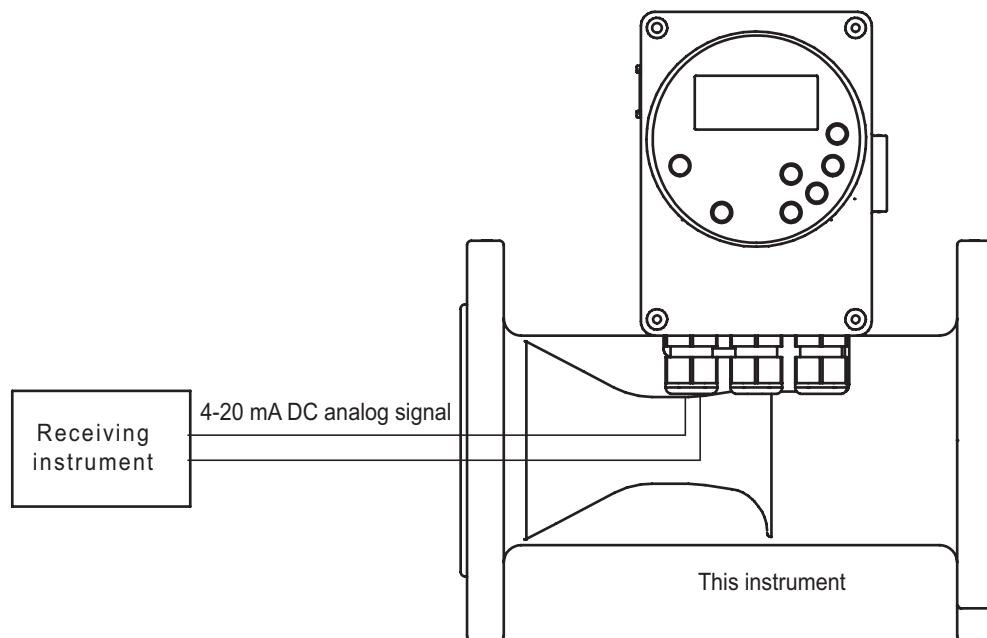


Fig. 1-2 Concept drawing of integral type measuring system

- This instrument: Measures flow-rate and outputs instantaneous flow-rate values in analog signals (4 to 20 mA DC).
- The analog output range is 3.8 mA to 20.8 mA DC (-1.25% to +105%).
- The load resistance is 245 to 300Ω

1-2: Structure and functions of components

Structure of this equipment

Principal component devices

This instrument consists of a flow-rate detector and a converter.

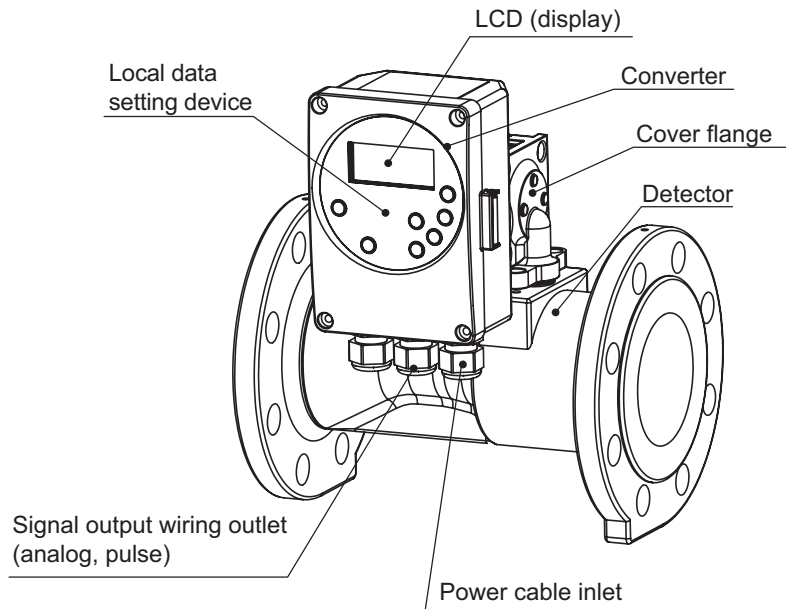


Fig. 1-3 Details of flow meter

Structure of converter

Principal component devices

The converter of this instrument is composed of a main board, a terminal board, a keyboard assembly, and a converter cover.

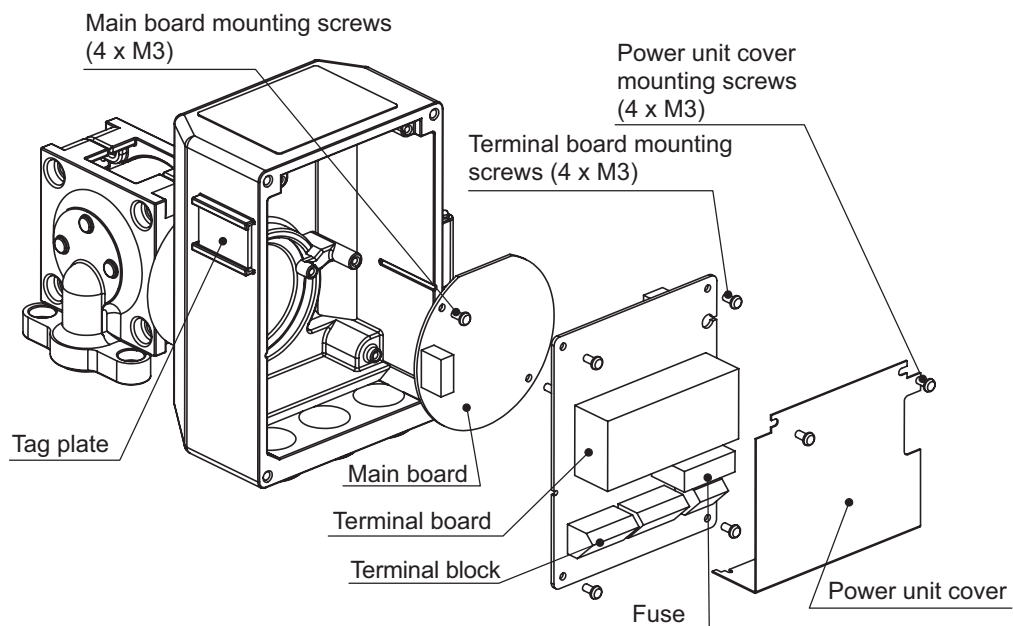


Fig. 1-4 Structure of converter case

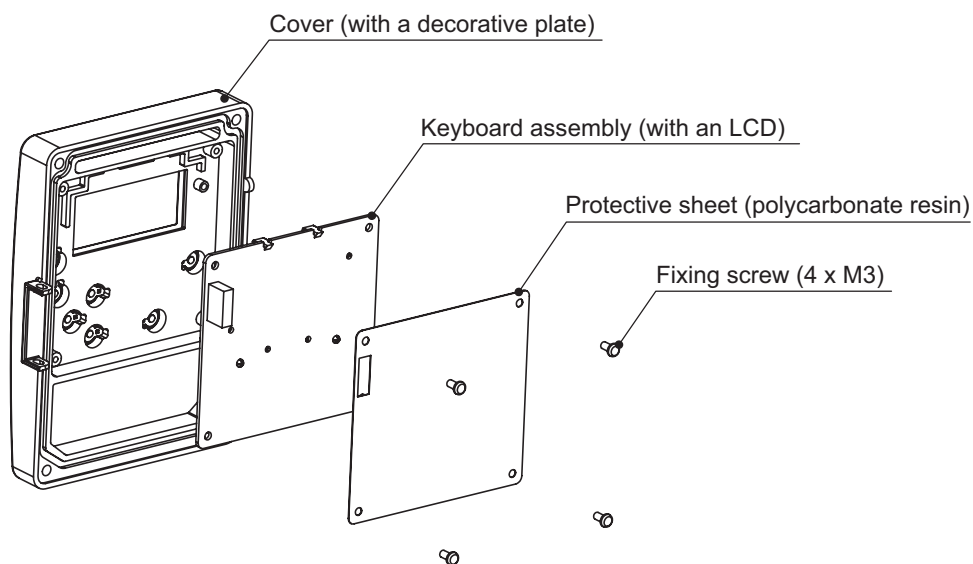


Fig. 1-5 Structure of converter cover

Name and function of each part

Details of each part are described in the following table:

Name	Description
Detector	<ul style="list-style-type: none"> • A tapered orifice is installed in a flow channel to generate a differential pressure between the upstream section and the orifice. • Detects differential pressure and static pressure
Converter	<ul style="list-style-type: none"> • Performs calculation by using the values of detected differential pressure, static pressure, and ambient temperature and converts them into instantaneous flow rate values. • Outputs an instantaneous flow-rate value as an analog or digital signal to the control units.
Terminal board	<ul style="list-style-type: none"> • Accommodates an output terminal block. • Accommodates a power supply unit. • A fuse is provided.
Main board	<ul style="list-style-type: none"> • Indicates calculated results of instantaneous flow-rate values and cumulative values. • Allows the user to set or alter the flow meter functions by using the seven buttons equipped on the panel.
Nameplate	<ul style="list-style-type: none"> • Model No., Product No., and flow-rate range are described on it.
Tag No. plate	<ul style="list-style-type: none"> • A Tag No. is indicated when specified by the purchase order.

Chapter 2: Installation of this instrument

Outline of this chapter

This chapter describes the method for installation and wiring of this instrument.

2-1: Before starting installation

Criteria for selecting the place for installation

Introduction

To maximize the performance of this instrument, choose the optimum installation location to satisfy the following selection criteria:

Precautions in the environment

- Install this instrument at a place where the ambient temperature is in the range from -15 to +50°C and ambient relative humidity 5 to 95%.
- Avoid a place close to a large-current cable, motor, transformers, or power supply sources that may give rise to induction interference and/or acoustic noise, which may cause instrument failure or errors in output values.
- Avoid a place where there are severe vibrations (permissible piping vibration: 5 m/s² maximum) or a highly corrosive atmosphere, which may cause failure of equipment.
- Also avoid whenever possible subjecting the instrument to direct sunlight, which may cause output errors.

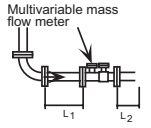
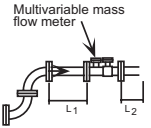
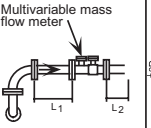
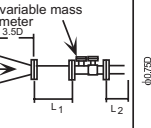
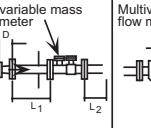
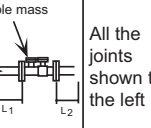
Piping vibration

Use this instrument under the following conditions: Amplitude: 1.5 mm minimum for a frequency 0 to 9 Hz; Acceleration 1.5 m/s² minimum for 9 to 60 Hz.

Influence of straight pipe section lengths

Determine the length of a straight pipe section by referring to the following table.

It is the minimum length of a straight pipe section required for the connection between this instrument and each joint of the upstream and downstream sides of the instrument. Each number in the table denotes a multiple of the pipe diameter.

Upstream side L ₁						Downstream side L ₂
 One 90° bend	 Two or more 90° bends on a single plane	 Two or more 90° bends not lying on a single plane	 Reducer	 Expansion pipe	 Sluice valve (fully open)	All the joints shown to the left
0.5	1.5	4.0	2.5	1.5	2.5	0.6

When a flow control valve is installed on the upstream side, provide a distance of 10 D or more from this instrument.

Note 1: Set the value of curvature radius against a valve to that of the bore diameter or more of the duct line.

Note 2: The straight pipe lengths on the upstream and downstream sides are the distances measured from the upstream and downstream flanges, respectively, of the flow meter.

Fig. 2-1 Straight pipe section on the upstream side of the flow meter
(D: Nominal bore diameter of detector)

Selecting the pipe-fitting direction

Fit the pipe in horizontal or vertical piping.

Flow direction

This instrument has an oval orifice in the pipe, and the service direction is specified. Allow the work fluid to flow in the direction of the arrow marked on the side of the detector.

⚠ NOTE

When the flow velocity of the fluid going through this instrument is relatively high, an unusual sound may be audible, which does not, however, cause any problem in the service of this instrument.

⚠ CAUTION

Since the work fluid contains more or less water, remove the accumulated water inside the remote type tube and pressure-bearing cover of the body. Otherwise, an output shift may result.

2-2: Installation method

Basic installation method

Introduction

This instrument employs a flange type mounting. Refer to the description on mounting method and install it correctly.

An example of mounting the integral type

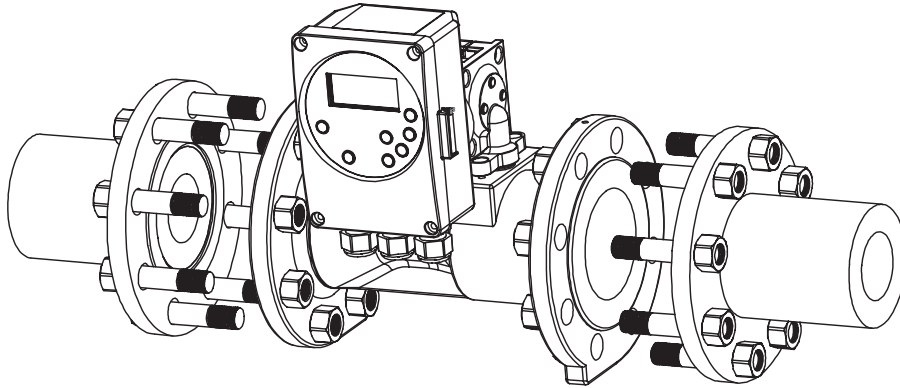


Fig. 2-2 An example of mounting the integral type

⚠ CAUTION

- Since this instrument is a heavy object, exercise great care not to drop it on your feet or other parts of your body. If it is dropped by mistake, you may be wounded or suffer a broken bone.

Bore diameter	50 A	65 A	80 A	100 A	150 A
Weight	9 kg	11 kg	13 kg	18.5 kg	39.5 kg

Note:

- Before installing the flow meter, be sure to exercise flushing (cleaning the inside of the pipe) to remove any foreign matter that may be present inside the pipe. Residual foreign matter could cause output fluctuations.
- Make sure the fluid flow direction matches the flow-direction indicating arrow mark (⇒) of the flow meter. Otherwise, stabilized output cannot be obtained.

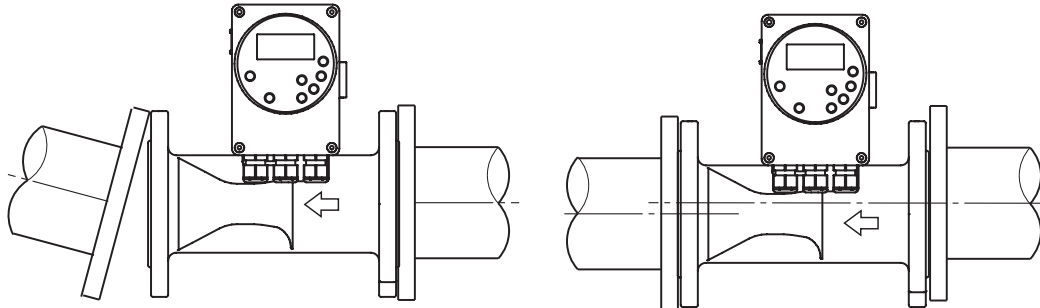


Fig. 2-3 Examples of erroneous installations (1)

Note:

- Never attempt to force the detector between the two piping flanges when the space is too narrow. It can damage the instrument.

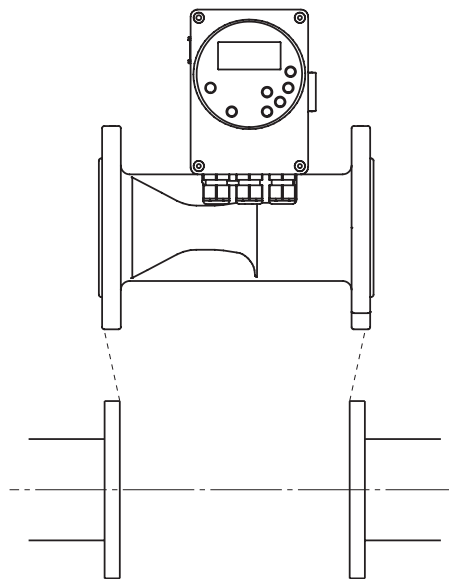


Fig. 2-4 Examples of erroneous installations (2)

Connection with remote type converter

When mounting the converter on a bracket, tighten the bolts and ensure that there is no play. After mounting the converter, if the bolts for fixing the converter with the bracket are loosened, tighten them again. (Bracket tightening torque: 40 N·m) When mounting a tube included in the standard accessories, ensure that the following are in order:

- When cutting to a suitable length, the cut cross-section is clear.
- When cutting a tube, ensure that the tube is not collapsed.
- The bend radius of the tube is not so small as 15 mm or less.
- When mounting the tube on the fitting, ensure that it is securely pushed in.

2-3: Electrical wiring

Introduction

To operate this instrument, wiring of the main power supply (90 to 250 V DC) is required. The electrical wiring of this instrument is described below as to the following items:

- Connecting positions of the main unit and terminal wiring diagram
- Cable specifications
- Cabling
- Wiring connection of current output
- Wiring connection of pulse output

Connecting positions of the main unit

In removing the cover for wiring operation, first loosen the four Philips screws of the cover.

The cover swings open to an angle of 100 to 120°. Be sure to refrain from violently opening it, which may break the circuit in the internal wiring.

Figure 2-5 below shows the main unit's terminal board and gives wiring and grounding terminal diagrams.

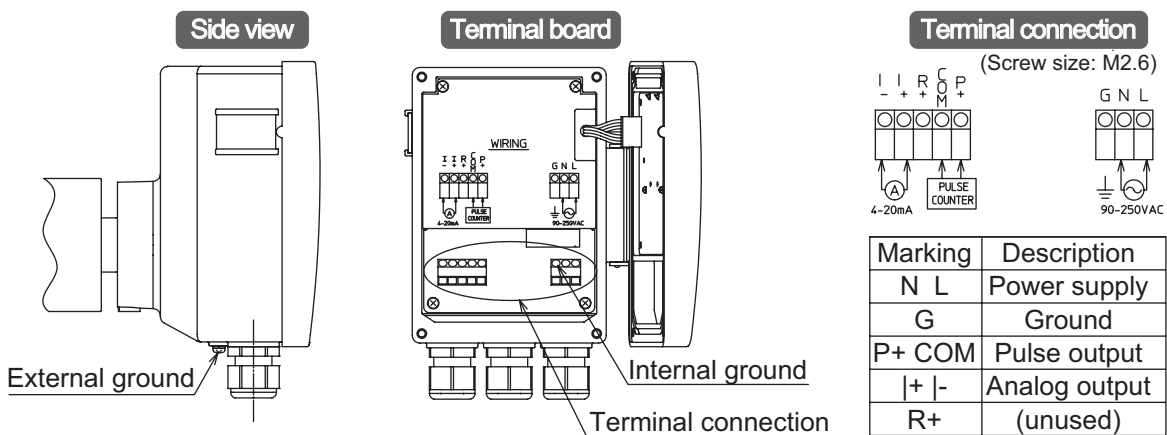


Fig. 2-5 Main unit's terminal board and wiring and grounding terminal diagrams

⚠ WARNING

- Before opening the cover to perform a wiring operation, turn off the power switch to prevent electric shock.
- Never perform wiring while the system is energized. Otherwise an electric shock may occur.

Note:

- Follow the indication for connecting positions and perform the wiring correctly. Otherwise equipment failure may result.
- Power source lines in particular carry a large-capacity power, double-check the wiring positions.

Cable specifications

For wiring with internal terminals of this instrument, use wires in the range of AWG 14 to 24.

Cabling

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

Note:

- The cabling should avoid a large-capacity transformer, motor, or power source that may become a noise source. Do not put the cable in the same tray or duct with other power cables. This may cause output error.
- For waterproofing and damage prevention of the wire, we recommend cabling work using conduits and ducts. Be sure to use a waterproof gland for connecting with each type of wire.

Current output wire connection

- This instrument: Measures flow-rate and outputs instantaneous flow-rate values in analog signals (4 to 20 mA DC).
- The analog output range is 3.8 mA to 20.8 mA DC (-1.25% to +105%).
- The load resistance is 245 to 300 Ω

Internal terminals output the current.

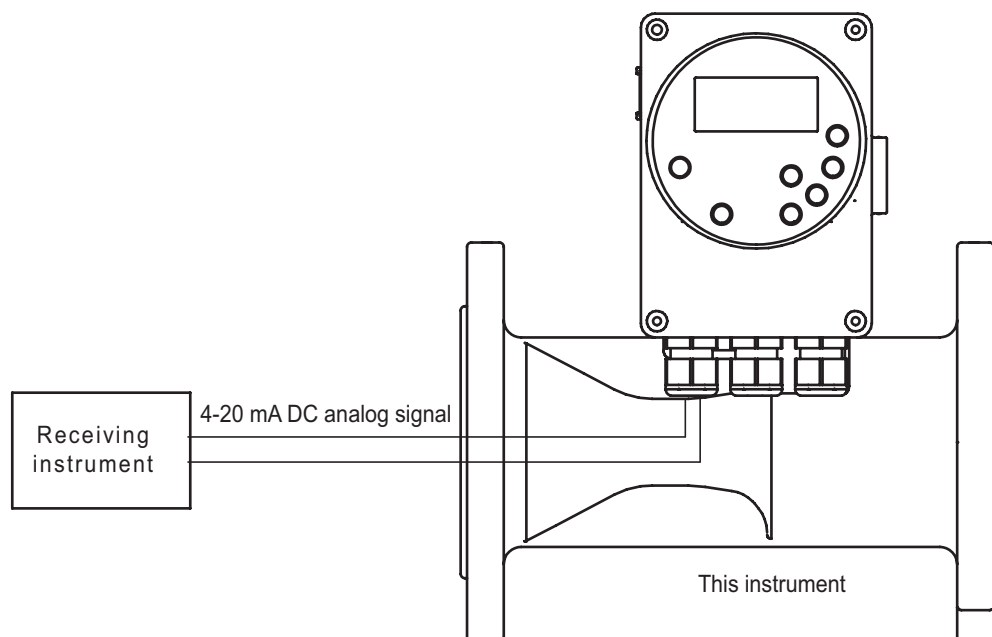


Fig. 2-6 Diagram of wire connection of current output

Note:

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

Wiring connection of pulse output

The pulse output is an open-collector output.

The pulse count and pulse width that are output are determined in reference to the pulse weight. For details of the pulse weight, refer to Item “Setting the pulse weight” under Subsection 4-8, “Initial setting.”

Carry out the wiring paying attention to the voltage and polarity.

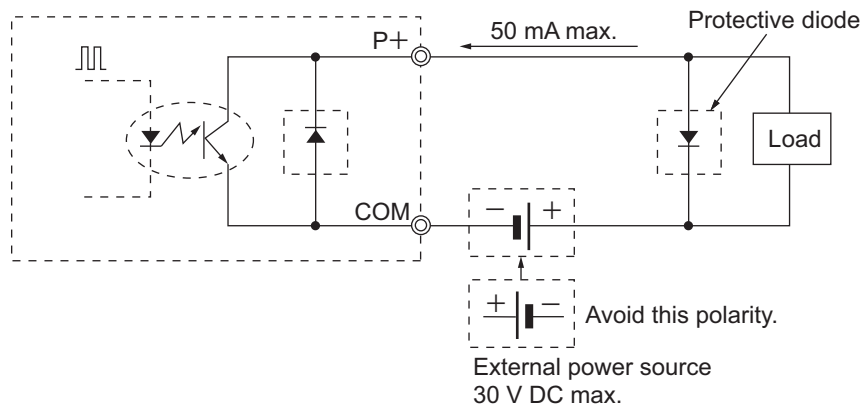


Fig. 2-7 Pulse output wire connection diagram

CAUTION

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

Chapter 3: Operation and shut down of this instrument

Outline of this chapter

This chapter describes the procedure for start-up and operation of the instrument. When practicing the procedure, carefully follow the descriptions in this chapter.

CAUTION

For the messages displayed on the local data setting device used for setting operation parameters of this instrument, “Japanese” is selected in default.

Thus, before starting the operation, switch the language for display to “English.”

For the details of changing languages for display, refer to the Item “Setting the language for display” under Subsection 4-8, “Initial setting.”

3-1: Startup

Activating this instrument

Procedure

Use the following procedure for starting up this instrument:

Step	Procedure
1	Ensure that this instrument is correctly fitted to the piping.
2	Ensure that the wiring of the detector and converter for this instrument have been securely conducted.
3	Fill this instrument with the fluid to be measured and let it stay still for a while.
4	Ensure that no leakage is found from the flanges on which this instrument is fitted.
5	Energize the converter for this instrument.
6	Ensure that LCD display is activated.

3-2: Preparatory operation before measurement

Introduction

After activating this instrument, be sure to make the zero adjustment. Conduct the zero adjustment from the local data setting device.

Method for zero adjustment

Introduction

Conduct the adjustment so that the value of instantaneous flow rate reaches zero.

Note:

- Zero adjustment is a critical process for assuring exact measurement of flow rate. When starting up and operating the instrument for the first time, carefully conduct this operation.
- Before conducting the zero adjustment, ensure that the detector is securely provided with Class D grounding and the fluid to be measured is still.

For the details of zero adjustment, refer to the Item “Zero adjustment” under Subsection 4-8 “Initial setting.”

Step 1: Press the [Menu] key (M) in the display area twice. Then, the title “MAINTENANCE MENU” appears on the display.

Step 2: Press the right arrow key (▶) in the display area. The message “1 <TAG>” appears.

Step 3: Press the down arrow key (▼) in the display area five times. The message “<Zero Adjust>” appears.

Step 4: Press the right arrow key (▶). When the message “Are you sure?” appears, press the [Enter] key (E). When the message “Zero Completely” appears, the process is finished.


Note:

To interrupt the operation, press the [Menu] key (M) to return the display to the flow rate indication.

If an error occurs during execution, either of the following messages is displayed:

- “Zero Over OK?”
This means that the zero point has significantly deviated. Check for any installation disorder, clogging of the pipe, stagnant flow, etc. Pressing the [Enter] key (E) once again causes the system to execute the zero adjustment again.
- “Sensor Range Over”
This message appears when the present value exceeds the sensor range. If this message is displayed, contact our sales representatives' office, your distributor, or our customer services department directly.

3-3: Stopping

 CAUTION
<ul style="list-style-type: none"> When stopping operation of this instrument and shutting down the output to control units, be sure to switch the operation mode of control units to manual control. This procedure is required to prevent the control unit from being directly affected by the shut down of input from this instrument.

Procedure

To stop the operation of this instrument, use the following procedure:

Step	Procedure
1	Switch the operation mode of the control unit for the instrument to be stopped to manual control.
2	Turn off the power supply for the instrument.

Chapter 4: Setting parameters and operating the local data setting device

Outline of this chapter

This chapter explains how to operate the local data setting device that performs setting of various operating parameters.

CAUTION

For the messages displayed on the local data setting device used for setting operation parameters of this instrument, “Japanese” is selected by default.

Thus, before starting the operation for this chapter, switch the language for display to “English.”

For the details of changing languages for display, refer to the Item “Setting the language for display” under Subsection 4-8, “Initial setting.”

4-1: Functions of the local data setting device

Local data setting device

Names and description of parts

Fig. 4-1 gives the name of each part of the local data-setting device.

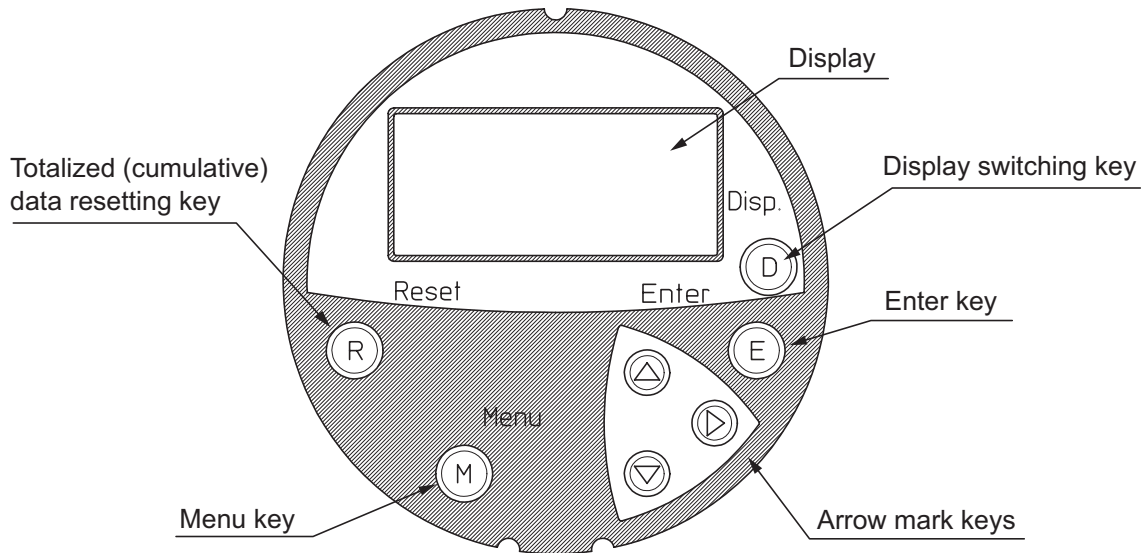


Fig. 4-1 Name of parts on the control panel of the local data setting device

The following describes each display screen appearing on the local data setting device:

Name	Description
Disp. key	<ul style="list-style-type: none"> Switches the items displayed on the sub-display.
Reset key	<ul style="list-style-type: none"> Resets the values of totalized flow rate and cumulated cost.
Menu key	<ul style="list-style-type: none"> Shifts to the setting menu mode.
Enter key	<ul style="list-style-type: none"> Enters various set values and alteration values. Allows the key to be locked. (Keep pressing it for 3 seconds.)
▲, ▼, ►	<ul style="list-style-type: none"> Inputs values. Selects setting menus.

CAUTION

Never press a key with a pencil, ball-point pen, or any other objects having a sharp tip, which may damage the key.

Name and description of display parts

This section describes displays shown on the control panel.



Name	Description
Main display	<ul style="list-style-type: none"> Displays items that constitute main matters. The items displayed are listed in the table. By pressing the “BASIC MENU” in the setting menu mode, the system switches the displayed details. When a flow rate overshoots the measurement precision assurance range, the numeric value flashes. (For details, refer to Chapter 5 “Maintenance and troubleshooting.”)
Main display value unit	<ul style="list-style-type: none"> The unit of value displayed on the main display is indicated.
Sub display value	<ul style="list-style-type: none"> Sub items are displayed. The items displayed are listed in the table given below. The details of display can be switched by using the [Disp.] key (D).
Display category	<ul style="list-style-type: none"> Indicates the type of a value displayed. ↑: Denotes that a main display item is indicated. ↓: Denotes that a sub display item is indicated. By pressing the [Disp.] key (D) displays the sub display item name for 5 seconds. Similarly, the sub display item name appears while the ▼ key is continuously pressed.
Key lock status	<ul style="list-style-type: none"> Indicates the status whether or not the keys are locked. Nevertheless, the details of the sub display can be switched with the [Disp.] key (D). Set: Keep pressing the enter key for 3 seconds or more. Release: When the keys are locked, continuously pressing the enter key for 3 seconds or more causes the lock to be released.

↑ Main display item		↓ Sub display item	
1) T.Vol	Total Volume	1) T.Vol	Total Volume
2) Flow	Flow Rate	2) Flow	Flow Rate
3) T.Cost, Cost	Total Cost, Cost	3) T.Cost, Cost	Total Cost, Cost
4) %Output	%Output (Flow)	4) %Output	%Output (Flow)
		5) Velocity	Velocity
		6) Pressure	Pressure

4-2: Details of operation using the display of the local data setting device

Overview of each mode

This device has two types of modes: MEASURING MODE and SETTING MENU MODE.

- Measuring mode: Displays totalized and instantaneous flow rates.
- Setting menu mode: Allows the operator to conduct various settings and is further divided into two sub-modes: BASIC MENU and MAINTENANCE MENU.
 - BASIC MENU serves for changing settings of displays and others.
 - MAINTENANCE MENU serves for setting detailed functions.

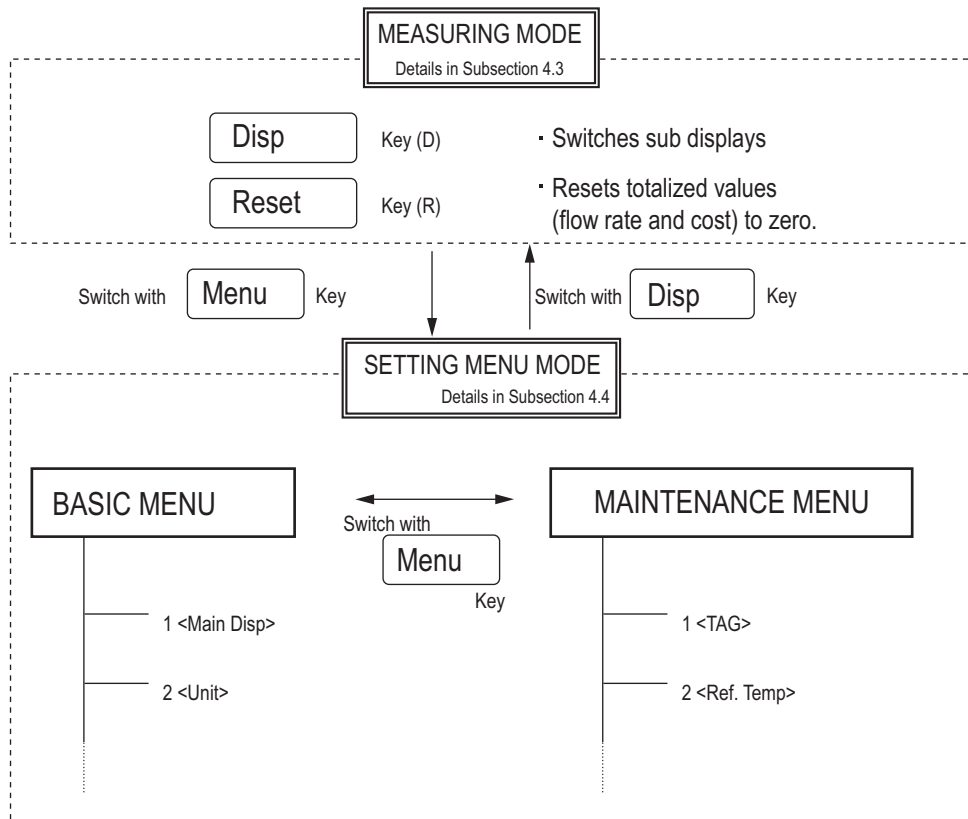


Fig. 4-2 Mode flowchart overview

- Exercising a key operation causes the system to illuminate the LCD automatically. Leaving the keys without operating them for 3 minutes allows the system to turn off the illumination automatically.
- When the keys are left untouched for 3 minutes, automatically switches the system to measuring mode.

4-3: Description of the measuring mode

Description of the measuring mode

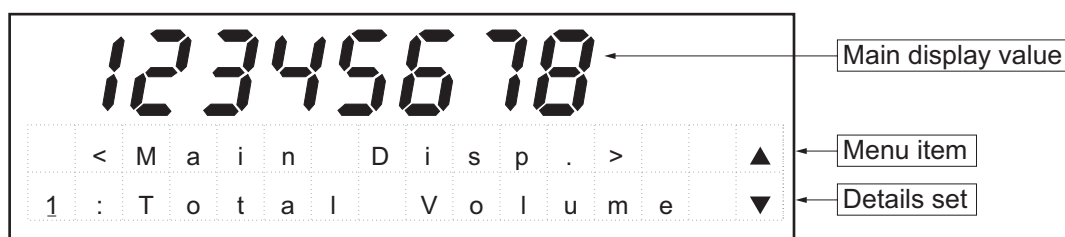
In the measuring mode, main and sub display values appear. For the operation in MEASURING MODE, use the Disp key (D) and Reset key (R).

Key name	Description
Disp key (D)	<ul style="list-style-type: none"> Switches the items to be displayed on the sub display. By pressing the Disp key, displays the sub display name for 5 seconds.
Reset key (R)	<ul style="list-style-type: none"> Resets totalized flow rate value and totalized cost value to zero.

4-4: Description of the setting menu mode

Description of the setting menu mode

Sets various values. Pressing the [Menu] key (M) causes the “BASIC MENU” to appear. Pressing the key again causes the system to switch the display to the “MAINTENANCE MENU.”



An example of a displayed screen in setting menu mode.

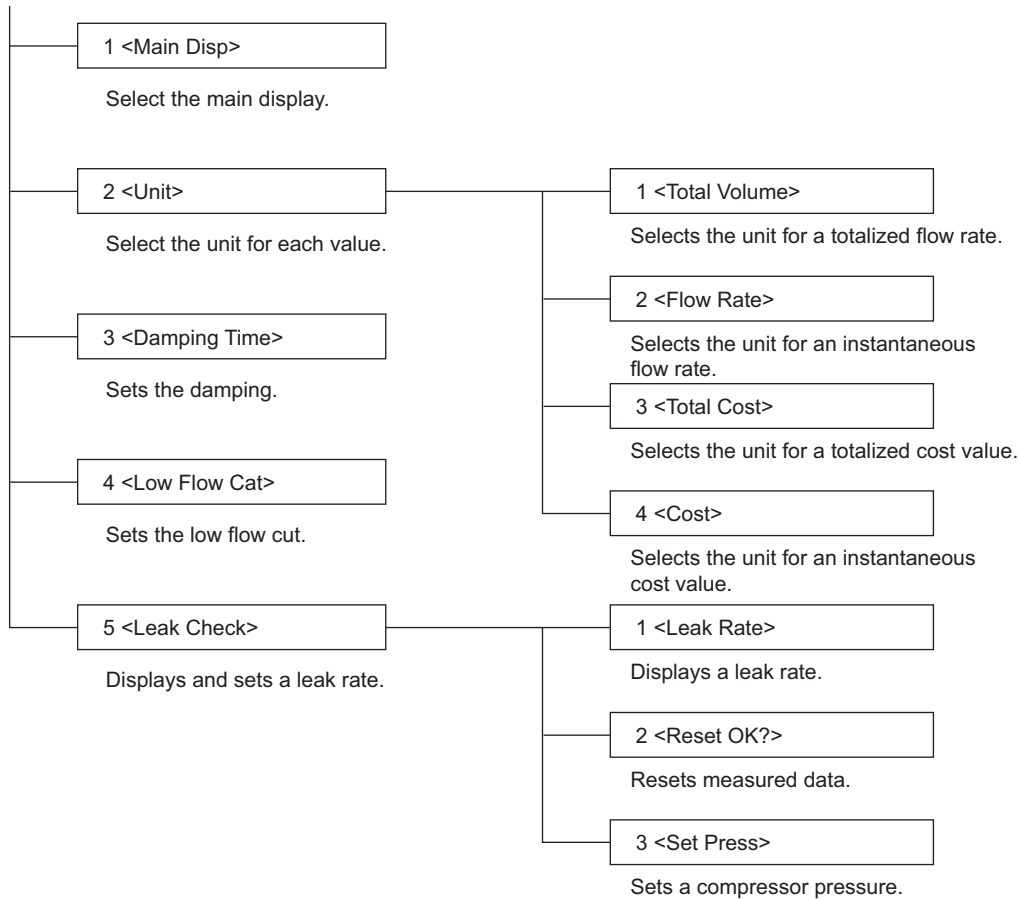
Name	Description
Main display value	<ul style="list-style-type: none"> Main display value appears. (8 digits)
Menu item	<ul style="list-style-type: none"> Two menu item names, namely, “BASIC MENU” and “MAINTENANCE MENU.” (16 digits in 2 lines)
Details set	<ul style="list-style-type: none"> Details of set values of each menu item appear.

- * Pressing the [Disp.] (D) key while operating in the setting menu switches the mode to the measuring mode. Thus, when values of each item are being changed, pressing the [Disp.] key (D) cancels the values.

4-5: Configuration of the “Basic menu”

Configuration of the “basic menu”

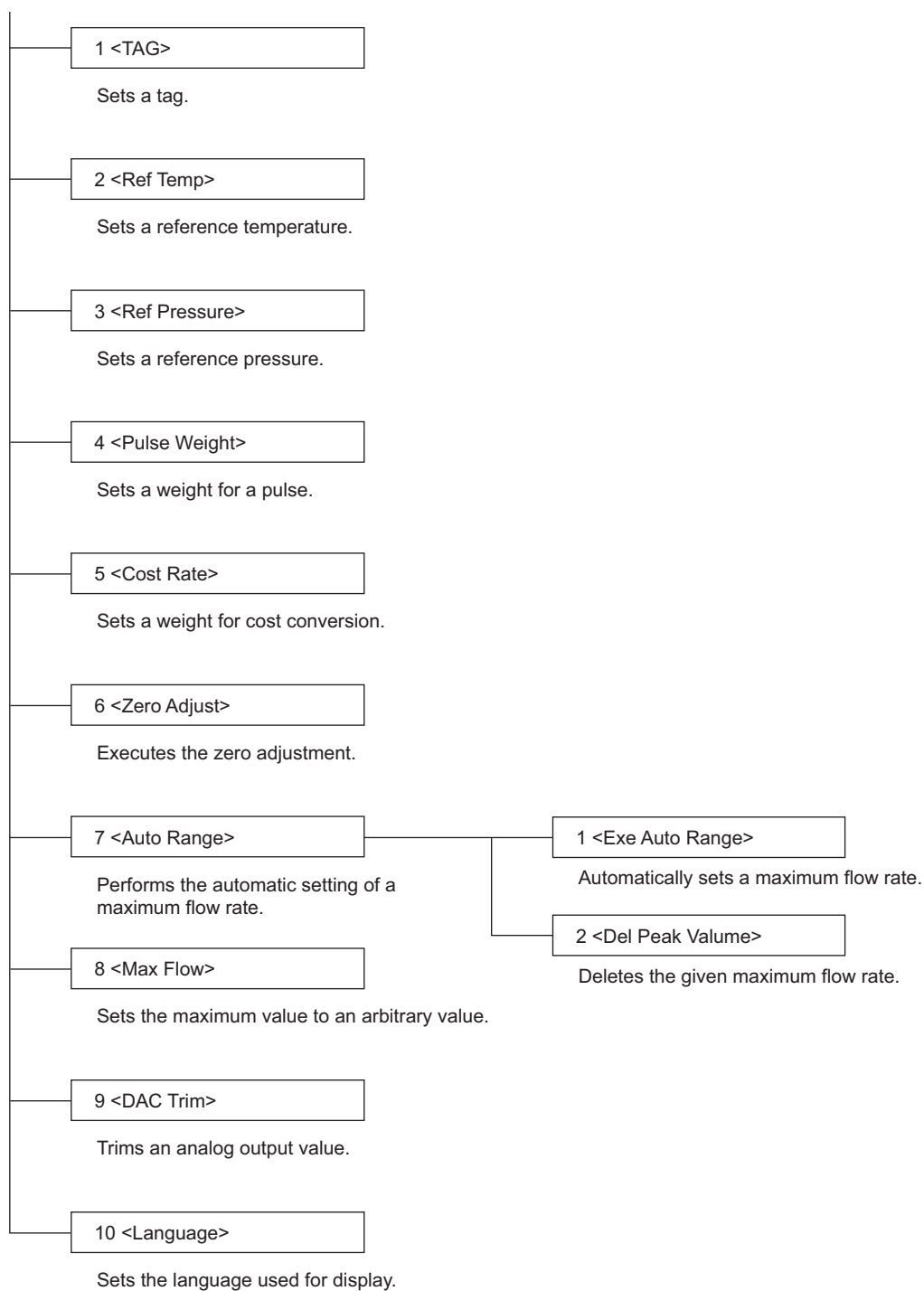
Pressing the [Menu] key (M) once causes the “BASIC MENU” to appear. Pressing the ► key once causes “1 <Main Disp>” to appear. Bringing the cursor to the displayed value and pressing the ▲ or ▼ key allow you to switch the items. The configuration of the “BASIC MENU” is shown below. To terminate the “BASIC MENU,” press the [Menu] key (M) or [Disp.] (D) key.



4-6: Configuration of the “maintenance menu”

Configuration of the “MAINTENANCE MENU”

Pressing the [Menu] key (M) twice causes the “MAINTENANCE MENU” to appear. Pressing the ► key once causes “1 <TAG>” to appear. Bringing the cursor to the displayed value and pressing the ▲ or ▼ key allows you to switch the items. The configuration of the “MAINTENANCE MENU” is shown below. To terminate the “MAINTENANCE MENU,” press the [Menu] key (M) or [Disp.] (D) key.



4-7: Method of operation by using the setting menu mode

The following illustrates the typical key operating methods for the setting menu mode:

Changing items of the setting menu

(1) Change the menu items by using the ▲ or ▼ key.



Put the cursor under the figure.



Press the ▼ key.

Indicates that the number selected by the cursor can be changed by using the ▲ or ▼ key.



The number selected by the cursor is changed.

(2) Set the menu details by pressing the ► key.



Press the ► key.

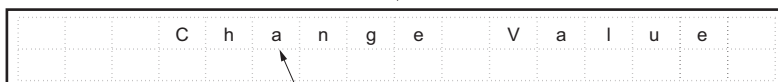


The cursor moves downward.

(3) After changing the menu settings, press the [Enter] key (E) to implement the set details.



Press the Enter key (E).



This message appears.

* To cancel the changes, press the [Menu] key (M) or [Disp.] key (D).

Changing figures within the setting menu

- (1) Move the cursor to the point that should be changed. Press the ? key to move it rightward.

<	R	e	f	.	P	r	e	s	s	u	r	e	>
	1	0	1	.	3	2	5		k	P	a		



Press the ► key.

<	R	e	f	.	P	r	e	s	s	u	r	e	>
	1	0	1	.	3	2	5		k	P	a		

The cursor moves to the next digit in the rightward direction.

- * When the cursor is at the rightmost end, pressing the ► key moves the cursor to the left end.

- (2) Replace the figure by pressing the ▲ or ▼ key to move the cursor upward or downward.

<	R	e	f	.	P	r	e	s	s	u	r	e	>
	1	0	1	.	3	2	5		k	P	a		



Press the ▲ key.

<	R	e	f	.	P	r	e	s	s	u	r	e	>
	1	0	1	.	3	2	5		k	P	a		

The figure selected by the cursor is increased by one.

- (3) Press the [Enter] key (E) to implement the set details.

<	R	e	f	.	P	r	e	s	s	u	r	e	>
	1	1	1	.	3	2	5		k	P	a		



Press the Enter key (E).

	C	h	a	n	g	e		V	a	l	u	e	
--	---	---	---	---	---	---	--	---	---	---	---	---	--

This message appears.

- * When the set figure is beyond the range of setting, an error message appears.

	I	n	p	u	t	V	a	l	u	e	E	r	r	o	r
--	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

4-8: Initial setting

Introduction

After installation, conduct the initial setting on the MAINTENANCE MENU. Set and check the following items:

Setting tags

MAINTENANCE MENU 1 <TAG>

Conduct the setting of a tag number.

Usable characters are 'A through Z', '0 through 9', '/', '.', ',', '-', and 'space' and the maximum number of characters is 8.

Press the [Menu] key (M) twice to display the message "MAINTENANCE MENU."

Press the ► key once to display the message "1 <TAG>." Pressing the ► key causes the cursor to move.

By using the ▲ or ▼ key, select from the usable characters and input the TAG.

After inputting the TAG, press the Enter key (E). When the message "Value Changed" appears, the setting is completed.

Setting the reference temperature

MAINTENANCE MENU 2 <Ref. Temp>

Conduct the setting of a reference temperature.

The allowable range of setting is any number from - 15 to 70°C.

Press the Menu key (M) twice to display the message "MAINTENANCE MENU."

Press the ► key once to display the message "1 <TAG>." Press the ▼ key once to display the message "2 <Ref. Temp>." Pressing the ► key causes the cursor to move. Input by using the ▲ or ▼ key.

After inputting the reference temperature, press the Enter key (E). When the message "Value Changed" appears, the setting is completed.

Note:

- When a set value is changed during operation, the internal flow rate calculation is altered. If it is the case, be sure to reset the totalized value.
- Conducting the reference temperature setting causes the system to change the maximum flow rate value (flow rate range value) to the maximum flow rate value in the set temperature state.
- The third digit after the decimal point is rounded up.

Setting the reference pressure

MAINTENANCE MENU 3 <Ref. Pressure>

Conduct the setting of a reference pressure.

The allowable range of setting is any number from 101.325 to 1100.000 kPa.

Note that when setting the reference temperature to 0°C and reference pressure to 101.325 kPa (standard state), the unit of instantaneous flow rate, namely, "m³/O" turns to "N m³/O," that is, an Italic "N" is added before the unit denotation.

Press the Menu key (M) twice to display the message "MAINTENANCE MENU."

Press the ► key once to display the message "1 <TAG>." Press the ▼ key twice to display the message "3<Ref. Pressure>."

Pressing the ► key causes the cursor to move. Input by using the ▲ or ▼ key. After inputting the reference pressure, press the Enter key (E). When the message "Value Changed" appears, the setting is completed.

Note:

- The value of reference pressure represents the absolute pressure.

- When a set value is changed during operation, the internal flow rate calculation is altered. If this is the case, be sure to reset the totalized value.
- Conducting the reference pressure setting causes the system to change the maximum flow rate value (flow rate range value) to the maximum flow rate value in the set pressure state.
- The third digit after the decimal point is rounded up.

Setting the pulse weights

MAINTENANCE MENU 4 <Pulse Weight>

Conduct the setting of a pulse weight.

The allowable range of setting is any number from 0.01 to 1.00 m³/pulse. Depending on the range of pulse weight, the pulse width is set as described below:

Press the [Menu] key (M) twice to display the message “MAINTENANCE MENU.”

Press the ► key once to display the message “1 <TAG>.” Press the ▼ key three times to display the message “4 <Pulse Weight>.” Pressing the ► key causes the cursor to move. Input by using the ▲ or ▼ key. After inputting the pulse weight, press the [Enter] key (E). When the message “Value Changed” appears, the setting is completed.

Pulse weight	Pulse width (ms)
$0.01 \leq \text{Pulse weight} < 0.10$	1
$0.10 \leq \text{Pulse weight} \leq 1.00$	10

Note:

When a set value is changed during operation, the internal flow rate calculation is altered. If this is the case, be sure to reset the totalized value.

Setting the cost weights

MAINTENANCE MENU 5 <Cost Rate>

Conduct the setting of cost conversion weight.

The allowable range of setting is any number from 0.000 to 99.999 yen/m³. When this function is not used, set the value to “0.00.”

Press the Menu key (M) twice to display the message “MAINTENANCE MENU.”

Press the ► key once to display the message “1 <TAG>.” Press the ▼ key four times to display the message “5<Cost Rate>.”

Pressing the ► key causes the cursor to move. Input by using the ▲ or ▼ key.

After inputting the cost weight, press the Enter key (E). When the message “Value Changed” appears, the setting is completed.

Note:

- When a set value is changed during operation, the internal flow rate calculation is altered. If this is the case, be sure to reset the totalized value.
- When changing the unit of totalized cost, the value of cost weight (or cost rate) is set to “0.” * For the details of cost, refer to Chapter 4, Subsection 4-11, “Explanation on some important functions,” Cost indicating function.

Executing the zero adjustment

MAINTENANCE MENU 6 <Zero Adjust>

Conduct the zero adjustment of flow meter output values.

Press the [Menu] key (M) twice to display the message “MAINTENANCE MENU.”

Press the ► key once to display the message “1 <TAG>.” Press the ▼ key five times to display the message “6. <Zero Adjust>.”

Pressing the ► key causes the system to display the confirmation message “Are you sure?”. Then, press the [Enter] key (E). When the message “Completely!” appears, the adjustment is completed.

Note:

When the operation has to be interrupted, press the [Menu] key (E) to return the display to a flow rate indication.

If an error occurs during execution, either of the following messages appears:

“Zero Over OK?”

The zero point deviates significantly. Check for installation status abnormality, pipe clogging, stagnant flow, or any other malfunctions. Pressing the [Enter] key (E) once again allows you to execute the zero adjustment in these conditions...

“Sensor Range Over”

This message appears when current value overshoots the sensor range. If it is the case, please contact our sales representatives at our branch, sales office, or our distributors from whom you have purchased this instrument, or our customer services department of our head office.

Executing the auto ranging function

MAINTENANCE MENU 7 <Auto Range>

Conduct the automatic setting of maximum flow rate value.

Press the [Menu] key (M) twice to display the message “MAINTENANCE MENU.”

Press the ► key once to display the message “1 <TAG>.” Press the ▼ key six times to display the message “7. <Auto Range>.” Press the ► key once to display the message “Exe Auto Range.” Press the ▼ key once to display “Del Peak Value.” Pressing the ► key for each message causes the system to display the prompt “Are you sure?.” Then, press [Enter] key (E). When the message “OK!,” appears, the setting is completed.

“Exe Auto Range”: The system executes this function.

“Del Peak Value”: Deletes the stored peak value (maximum flow rate value).

Note:

- When setting the maximum flow rate to an arbitrary value, refer to the next Item, “Setting the maximum flow rate value.”
- For the details of the auto ranging function, refer to Chapter 4, Subsection 4-11, “Explanation on some important functions,” Automatic ranging function.

Setting the maximum flow rate value

MAINTENANCE MENU 8 <Max Flow>

Set the maximum flow rate to an arbitrary value.

The allowable range of set values is as specified in the following table. Since the value varies with the bore diameter, check the bore of this instrument to be installed.

Allowable range of maximum flow rate values depending on bore diameter (at $N \text{ m}^3/\text{h}$)

Bore diameter	Maximum flow rate value that can be set
50 A	1650 $N \text{ m}^3/\text{h}$ maximum
65 A	2700 $N \text{ m}^3/\text{h}$ maximum
80 A	3800 $N \text{ m}^3/\text{h}$ maximum
100 A	6500 $N \text{ m}^3/\text{h}$ maximum
150 A	13900 $N \text{ m}^3/\text{h}$ maximum

Note: The allowable range of maximum flow rate values is the value at 0°C and 101.325 kPa abs.

Press the [Menu] key (M) twice to display the message “MAINTENANCE MENU.”

Press the \blacktriangleright key once to display the message “1 <TAG>.” Press the \blacktriangledown key seven times to display 8 <Max Flow>. Pressing the \blacktriangleright key causes the cursor to move. Input by using the \blacktriangle or \blacktriangledown key. After inputting the maximum flow rate value, press the [Enter] key (E). When the message “Value Changed” appears, the setting is completed.

Note:

The unit employed when setting the maximum flow rate is the unit for instantaneous flow rate that has been set in the step of [Menu] key (M) “2 <Unit>,” and thus the maximum flow rate value that can be set varies with the unit employed.

Adjusting the analog output signal

MAINTENANCE MENU 9 <DAT Trim>

Conduct the trimming of an analog output signal.

Press the Menu key (M) twice to display the message “MAINTENANCE MENU.”

Press the \blacktriangleright key once to display the message “1 <TAG>.” Press the \blacktriangledown key eight times to display the message “9 <DAC Trim>.” Pressing the \blacktriangleright key allows the system to display “4 mA Trim.” Then, conduct the trimming of 4 mA output by using the \blacktriangle or \blacktriangledown key.

To switch from the trimming of 4 mA output to 20 mA output, press the Enter key (E). Conduct the trimming of 20 mA output in the same way as for 4 mA by pressing the \blacktriangle or \blacktriangledown key. When the trimming is completed, press the Enter key (E) to implement the input details. The message “Value Changed” indicates that the trimming has been completed. To cancel the trimmed details, press the Menu key (M) or the Disp key (D).

Setting the language used for displayed messages

MAINTENANCE MENU 10 <Language>

Conduct the setting of language to be displayed.

This function can be selected from the “Japanese” and “English.”

Press the Menu key (M) twice to display the message “メンテナンスメニュー” (MAINTENANCE MENU) in Japanese.

Press the \blacktriangleright key once to display the message “1 <タグ>” (TAG) in Japanese. Press the \blacktriangledown key nine times to display the message “10 <Language>.”

Pressing the \blacktriangleright key causes the cursor to move. Select the language to be displayed by using the \blacktriangle or \blacktriangledown key to enter the tag. Then, press the [Enter] key (E). When the message “Value Changed” appears, the setting is completed.

4-9: Setting during operation

Introduction

To enable the setting while the system is running, develop the process starting from the BASIC MENU.

Switching the main displays

BASIC MENU 1 <Main Disp>

Change the main display value.

The following five types of values can be selected:

- 1: Total Volume (totalized or cumulative flow rate)
- 2: Flow Rate (instantaneous flow rate)
- 3: Total Cost (totalized or cumulative cost)
- 4: Cost (instantaneous cost)
- 5: % Output (percent output of flow rate range)

Press the [Menu] key (M) once to display the message “BASIC MENU.”

Press the ► key once to display the message “1 <Main Disp>.” Pressing the ► key causes the cursor to move.

Select by using the ▲ or ▼ key and press the Enter key (E). When the message “Value Changed” appears, the setting is completed.

Setting or changing units

BASIC MENU 2 <Unit>

Set the displayed unit for each value.

The units that can be set are as follows:

Total Volume (totalized or cumulative flow rate)	m ³ , kg, t
Flow Rate (instantaneous flow rate)	○/s, ○/min, ○/h, ○/day
Total Cost (totalized or cumulative cost)	yen, \$
Cost (instantaneous cost)	○/s, ○/min, ○/h, ○/day

Press the [Menu] key (M) once to display the message “BASIC MENU.”

Press the ► key once to display the message “1 <Main Disp>.” Press the ▼ key once to display the message “2 <Unit>.” Next, pressing the ► key causes the system to display “1: Total Volume.” Select the item to be displayed by using the ▲ or ▼ key and press the ► key. As the unit corresponding to the item to be displayed appears, press the Enter key (E). When the message “Value Changed” appears, the setting is completed.

Note:

- In the space before a unit, each unit that has been set in the processes for total flow and total cost calculation is entered. Additionally, changing the unit of totalizing (accumulation) changes the unit of instantaneous flow rate and cost accordingly. For t, xx/s cannot be selected.
- When the unit of total cost is changed, the cost weight is set to “0.”
- When the totalized unit is changed, the totalized value is reset.
- The unit for pressure is fixed to MPa (gauge pressure) and that of flow velocity is fixed to m/s.

Setting or changing the damping time constant

BASIC MENU 3 <Damping Time>

Conduct the setting of damping for 4 - 20 mA output and LCD display.

Values that can be set are classified into the following 12 types:

1: 0 s	7: 4 s
2: 0.16 s	8: 8 s
3: 0.32 s	9: 16 s
4: 0.48 s	10: 32 s
5: 1 s	11: 64 s
6: 2 s	12: 128 s

Press the [Menu] key (M) once to display the message “BASIC MENU.”

Press the ► key once to display the message “1 <Main Disp>.” Press the ▼ key twice to display the message “3 <Damping>.” Next, pressing the ► key causes the system to display “1: 0.00 s.” Select the damping time constant by using the ▲ or ▼ key and press the [Enter] key (E). When the message “Value Changed” appears, the setting is completed.

Setting or changing a low flow cut value

BASIC MENU 4 <Low Flow Cut>

Conduct the setting or changing of the low flow cut for 4 - 20 mA output, LCD display value and totalized (cumulative) value.

The values that can be set are any values in the proportion of 0 to 20% of the flow rate range that has been set.

Press the [Menu] key (M) once to display the message “BASIC MENU.”

Press the ► key once to display the message “1 <Main Disp>.” Press the ▼ key three times to display the message “4 <Low Flow Cut>.” Pressing the ► key moves the cursor. Input an arbitrary value within the range from 0 to 20% by using the ▲ or ▼ key. Then, select the damping time constant by using the ▲ or ▼ key and press the [Enter] key (E). When the message “Value Changed” appears, the setting is completed.

Setting and executing the leak checking function

BASIC MENU 5 <Leak Check>

Conduct the display of leak rate, resetting of measured values, and setting of compressor pressure.

The range of pressures that can be set is 0.3 to 0.98 MPa. For the details, refer to the Item “Leak checking function” under Chapter 4, Subsection 4-11 “Explanation of some important functions.” Items that can be handled by this function are as follows:

Leak Rate	Displays a leak rate.
Reset OK?	Deletes the data for determining a leak rate.
Set Press	Conducts the compressor pressure setting.

Press the [Menu] key (M) once to display the message “BASIC MENU.”

Press the ► key once to display the message “1 <Main Disp>.” Press the ▼ key four times to display the message “5 <Leak Check>.” Pressing the ► key moves the “1: Leak Rate” cursor. Select the items to be set by using the ▲ or ▼ key.

Note:

The value of set pressure in the leak check function represents the gauge pressure.

4-10: Details of default settings

The items and values that are initially set before shipping from the factory are as follows:

Setting item		Set value
Main Disp		Total Volume
Unit	Total Volume	m ³
	Flow Rate	Nm ³ /h
	Total Cost	yen
	Cost	yen/h
Damping Time		1.0 s
LowFlow Cut		3%
Leak Check	Set. Press	0.65 MPaG
TAG		XXXXXXXX
Ref. Temp		0°C
Ref. Pressure		101.325 kPa (abs)
Pulse Weight		Customer-specified value (When unspecified: 0.1 m ³ /pulse)
Cost Rate		0 yen/m ³
Max Flow		Customer-specified value (When unspecified, maximum value for the given bore)
Language		Japanese

4-11: Explanation on some important functions

Cost indicating function

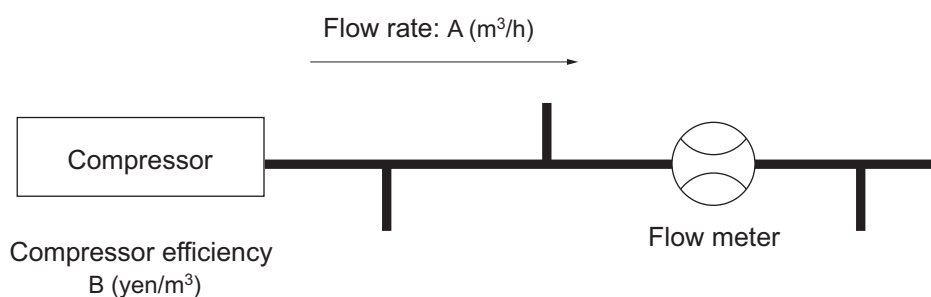
This function converts and displays the approximate amounts of cost against the current flow rate in terms of “Total Cost” and “Cost” indications.

Note:

Since an indicated value is approximate, use it only as a rough yardstick.

Calculating method:

- (1) The user is expected to calculate in advance the amount of cost for a unit flow rate of 1 m³ compressed air (Compressor efficiency B yen/m³) from the compressor power consumption and unit cost of electricity.



- (2) Set the calculated compressor efficiency B (yen/m³) as a “Cost Rate.”

For reference:

The “Cost” (instantaneous cost, yen/h) for while the process fluid is flowing at the above-mentioned instantaneous flow rate A (m³/h) is calculated by the following formula:

$$\text{Cost (yen/h)} = B \text{ (yen/m}^3\text{)} \times A \text{ (m}^3\text{/h)}$$

Similarly, total cost (cumulative cost) can be calculated as follows:

$$\text{Total cost (yen)} = B \text{ (yen/m}^3\text{)} \times \text{Total flow rate (cumulative flow rate, m}^3\text{)}$$

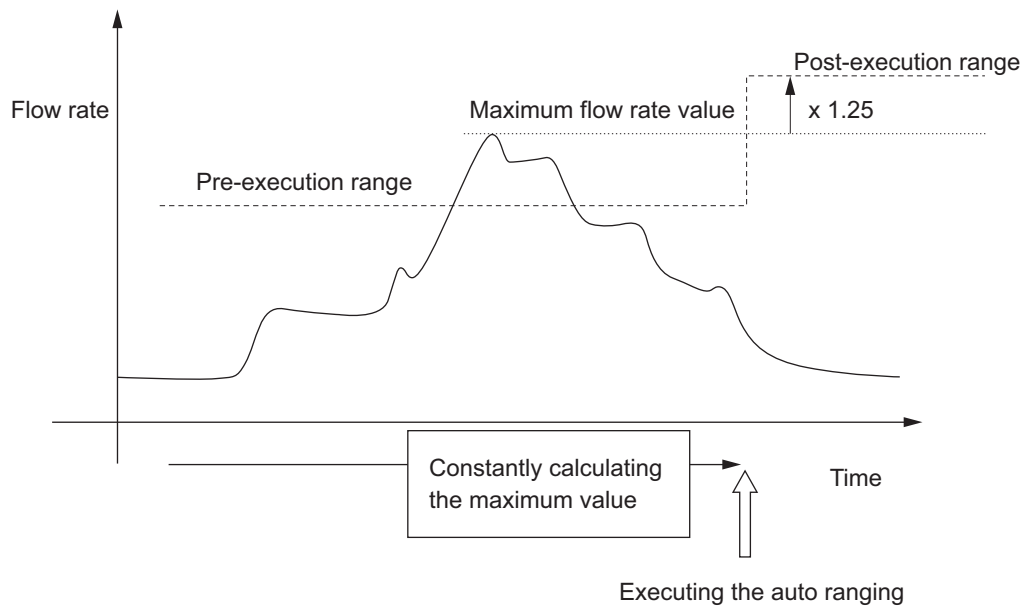
Auto ranging function

This function enables the automatic setting of maximum flow rate value based on the past flow rate since the power supply switch was turned on or the peak value was reset. It is useful for setting the maximum flow rate value when installing this instrument in a system whose flow rate is unknown.

Operation overview:

This device stores the maximum value of instantaneous flow rate and sets the maximum flow rate that employs said maximum value as an 80% value in the operation “Exe Auto Range.”

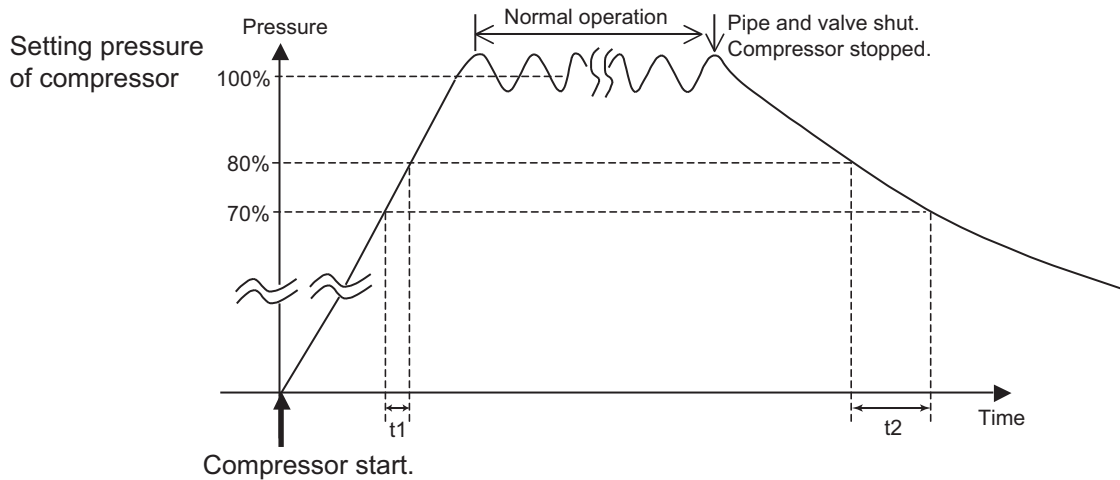
The preceding maximum flow rate value can be deleted by the operation “Del Peak Value.”



- The adjustable range is 10 to 100% of the maximum flow rate value that can be set depending on bore diameter. (For the details of maximum flow rate values that can be set depending on bore diameter, refer to the Item “Setting the maximum flow rate” under Subsection 4-8, “Initial settings.”)
- Maximum value of the flow rate is retained even after terminating the auto ranging.
- Low flow cut values are not changed even after terminating the auto ranging. (Example: When the percentage before auto ranging is 5%, the value will be 5% of a new range after the auto ranging.)
- When reference temperature and pressure have been changed, since the details of internal flow rate calculations are altered, delete the maximum flow rate value in the operation “Del Rate Value.”

Leak checking function

This device can determine the air leak rate by measuring the pressure in the piping.



To measure the pressure, first start up the compressor as indicated in the above diagram and measure the time (t_1) required for the pressure in the piping to reach 80% of the set value of compressor pressure starting at 70% of the set value. Then, close the piping system, stop the compressor, and measure the time (t_2) that elapses from the time when the piping pressure is at 80% of the set value until it reaches 70% of the set value, and allow the system to calculate the leak rate by the following:

$$\text{Leak rate} = \frac{t_1}{t_1 + t_2} \times 100$$

Thus, the lower the value, the smaller the leak amount.

(1) A leak rate is indicated in the operation “Leak Check” - “1 <Leak Rate>.”

1	<	L	e	a	k	R	a	t	e	>
		4	3	.	2	5	%			

(2) When the measured values (t_1 , t_2 , and leak rate) need to be reset, use the process “Leak Check” - “2 <Reset OK?>.”

(3) Setting of the above-mentioned compressor pressure can be conducted by using the process “Leak Check” - “3 <Set Press>.” The allowable pressure setting range is 0.30 to 0.98 MPa.

Chapter 5: Maintenance and troubleshooting of this instrument

Outline of this chapter

This chapter enumerates the steps for maintenance and inspection of this instrument and the matters that should be referred to when conducting troubleshooting.

5-1: Maintenance

Disassembling and assembling

Disassembling

Disassembling of the converter (See Figures 1-4 and 1-5.)

CAUTION

- When opening or closing the cover for the converter, pay adequate attention not to allow dust and rainwater to enter the inside of this instrument.

WARNING

- Before opening the cover, not only for disassembling, but also for any other purposes, be sure to turn off the power. Otherwise an electric shock may result.
- Whenever the system is energized, never perform wiring work. Otherwise an electric shock may result.

Removing the cover

The cover is fixed with M4 screws. Loosen them with a Philip's or flat head screwdriver, and then remove the cover.

Removing the cover for power supply unit

A cable is fed through the gap in the power unit cover and connected to the LCD board. First remove the connector. The power unit cover is fixed to the case with M3 screws, each with a Philip's head, at two spots, which should be removed.

Removing the terminal board and main board

The terminal board is fixed to the case with M3 screws, each with a Philip's head, at four spots.

After removing the terminal board, you will find the main board, which is fixed to the case with M3 screws, each with a Philip's head, at two spots. Before removing them, conduct the static charge removal operation.

Exercise care in this operation not to damage the cable connection of the detector body and FPC.

CAUTION

- Before and after the removal of the terminal board and main board, be sure to perform the static charge removal procedure. Otherwise, the performance of the system may be affected.

Assembling the converter

Use the steps for disassembling the converter in the reverse order for the assembling. When fixing the terminal with screws, pay attention to avoid excessive screw tightening that may damage them. Also take necessary care not to pinch the cable connecting the FPC and LCD with screws or the cover.

Disassembling and assembling the converter and its fixture

The coupling section of the detector and converter has been shipped after conducting an air-tightness test. Do not disassemble the section except for any case of abnormality or periodical maintenance services.

Disassembling of the detector shall be conducted at our service functions or our plant. For the disassembling, please contact our sales representatives at our branch, sales office, or our distributors where you purchased this instrument, or our customer services department of our head office.

Inspection

CAUTION

- When removing this device for maintenance and inspection, pay adequate attention to the residual pressure and fluid inside of the detector.

WARNING

- Before opening the cover, not only for disassembling, but also for any other purposes, be sure to turn off the power. Otherwise an electric shock may result.
- Whenever the system is energized, never perform wiring work. Otherwise an electric shock may result.

Checking for piping leakage

Ensure that no leakage is found in the pipe joints of this instrument.

Insulation resistance and withstand voltage tests

In principle, refrain from conducting any insulation resistance and withstand voltage tests, which may damage the built-in barrister for surge voltage removal.

When they must be conducted for inevitable reasons, use the following procedure:

- (1) Disconnect the external wiring of the transmitter.
- (2) Observe the following applied voltages and judgment criteria. Do not apply any voltage higher than the values specified below in order to prevent potential damage to this instrument:

Insulation resistance

Across the power terminals (AC terminals L and N short-circuited) and grounding terminal (G)

- 20 Megaohms minimum at 250 V DC

Across the pulse output terminal (P+ terminal and COM terminal short-circuited) and grounding terminal (G)

- 20 Megaohms minimum at 100 V DC

Across the current output terminal (I+ terminal and I- terminal short-circuited) and grounding terminal (G)

- 20 Megaohms minimum at 100 V DC

Withstand voltage

Across the power terminals (AC terminals L and N short-circuited) and grounding terminal (G)

- 250 V AC, 1 minute, allowable current 10 mA

Across the pulse output terminal (P+ terminal and COM terminal short-circuited) and grounding terminal (G)

- 100 V AC, 1 minute, allowable current 10 mA

Across the current output terminal (I+ terminal and I- terminal short-circuited) and grounding terminal (G)

- 100 V AC, 1 minute, allowable current 10 mA

Replacing a fuse

Replace the fuse in the following steps:

- (1) Interrupt the supply to the power terminals L and N of this instrument.

Caution: Never perform the operation while the system is energized. Otherwise, damage to equipment and electric shock may result.

- (2) Remove the covers for the main body and the power supply unit.

- (3) Remove the fuse holder cover.

- (4) Replace the fuse. Be sure to use the specified fuse to assure safety.

Specified fuse: MF60NR, 250 V, 2 A (Toyo Fuse Co., Ltd.) or equivalent

Rated voltage 250 V; Rated current 2 A; Fusing characteristics Class B; Size $\phi 6.4 \times 30$

- (5) Bring back the fuse holder cover to the original position.

- (6) Attach the covers for the main body and the power supply unit in the original way.

- (7) Start the power supply through the terminals L and N of this instrument.

5-2: Troubleshooting

Types of troubles

The following three types of troubles are conceivable when activating and starting this instrument:

Such troubles that occur when the actual service conditions differ from the specifications of this instrument

Troubles caused by the setting and operating errors

Troubles due to the failure of this instrument

If any trouble occurs, follow the troubleshooting guide described here and take proper actions.

Troubles at the start of operation

Troubleshooting

If any trouble occurs, take remedial actions in accordance with the following tabulated instructions. If the trouble cannot be solved even after taking these actions, this instrument may be malfunctioning. Then, please contact our sales representatives at our branch, sales office, or our distributors where you purchased this instrument, or our customer services department of our head office.

Trouble	Check points and remedies
Nothing appears on the display after turning on the power switch.	<ul style="list-style-type: none"> • Ensure that the power supply voltage is correctly applied. • Ensure that power supply cable is connected. • Ensure that the fuse is not blown.
No output is transmitted even if the power is turned on.	<ul style="list-style-type: none"> • Ensure that the signal lines are correctly connected.
No pulse output is given.	<ul style="list-style-type: none"> • Ensure that the pulse output lines are correctly wired.
Indication of flow rate remains unchanged at the zero point.	<ul style="list-style-type: none"> • Ensure that the details of settings are correct. • Ensure that the flow rate is not deviating from the low flow cut range. • Ensure that the piping is not clogged.
While the flow rate should be zero, a value other than zero is indicated.	<ul style="list-style-type: none"> • Even a minimal deviation from the zero point may be indicated in a large value in the scale of O/day and O/hour. If this is the case, either change the indication unit or conduct the zero adjustment or set a low flow cut value. • Ensure that the polarity of detector terminals and connection of the converter are correct.

Troubles during operation

Troubleshooting

If any trouble occurs during operation, take actions in the steps specified below.

- Look for the symptoms of the trouble described in the table on this page. When the corresponding details are found, take actions by following the instructions.
- If the trouble still remains unsolved, this instrument may be malfunctioning. Then, please contact our sales representatives at our branch, sales office, or our distributors where you purchased this instrument, or our customer services department of our head office.

Trouble	Check points and remedies
Output value deviates from the expected flow rate.	<ul style="list-style-type: none"> • Check for any fluid leakage from the piping. • Ensure that the fluid is not flowing in the reverse direction. • Ensure that the polarity of detector terminals and connection of the converter are correct. • Ensure that the unit of flow rate displayed is correct.
Main display is flashing.	<ul style="list-style-type: none"> • The flow rate exceeds the measurement precision compensation range. Ensure that the differential pressure generated in the detector meets the following condition: Differential pressure \leq Static pressure \times 0.25
Output value exceeds 100%.	<ul style="list-style-type: none"> • Ensure that the range is correctly set. • Ensure that the zero point is correctly adjusted.
Output value remains unchanged at 0%.	<ul style="list-style-type: none"> • Ensure that the details of setting are correct. • Ensure that the flow rate does not deviate from the low flow cut range. • Ensure that the piping is not clogged.
Sub display does not give instantaneous and totalized cost values, or the cost values on main display remain unchanged at zero.	<ul style="list-style-type: none"> • Ensure that the cost weight is not deviated from “0.” • Changing the unit of totalized cost causes the automatic reset of the cost weight to “0.”
Pulse output value is excessive relative to the flow rate.	<ul style="list-style-type: none"> • Ensure that the pulse settings (weight and width) are correct. • Ensure that correct specifications for pulse counter are used. • Ensure that the value of low flow cut is correctly set.

In addition to the above-mentioned items, check the following items:

- Is air flowing?
- Is any fluid other than air flowing?
- Is the flow direction correct?
- Is there not any leakage in pipe joints?
- Is there not any loosening of tightened bolts on the product side?
- Is there not any sagging or open circuit in wiring?
- Is there not any error in wiring connection?
- Are the power voltage and load resistance as specified?
- Is there not any abnormality such as clogging, foreign matter, or deformation of detector?
- Is there not any clogging or foreign matter in the connecting tube from the detector to the converter? (In the case of MVG10F)
- Are the pressure and temperature as specified?
- Is there not any intense magnetic or noise generating source located nearby?

Display and output state beyond the range of flow rate measurement

When flow rate is beyond the limits of the measuring range, the displayed and the output values are as follows:

	Overload condition	Conditions when exceeding allowable maximum flow rate value setting	Conditions when exceeding the flow rate range	Conditions beyond JIS standards differential pressure > static pressure × 0.25
Main display	Flashing	Flashing	Flashing	Flashing
Instantaneous flow rate (cost) display	“HHHH” displayed	“HHHH” displayed	URL display included	Display
% output display	“HHHH” displayed	“HHHH” displayed	Display	Display
Sub display				
Instantaneous flow rate (cost) display	“O/L” displayed	“OverFlow” displayed	Display	Display
Static pressure display	“O/L” displayed	Display	Display	Display
Flow velocity	“O/L” displayed	“OverFlow” displayed	Display	Display
% output display	“O/L” displayed	“OverFlow” displayed	Display	Display
Display damping	Displayed in 0 second damping	Displayed in 0 second damping	Displayed per damping instruction	Displayed per damping instruction
4 - 20 mA output	3.8 mA maximum	20.8 mA minimum	Output up to 20.8 mA	Measured values output
Output damping	Normal operation	Normal operation	Normal operation	Normal operation
Pulse output	Interrupted	Interrupted	Counted up to URL	Measured value
Totalized flow (cost) calculation	Interrupted	Interrupted	Calculated up to URL	Measured value
Leak check	Check the static pressure at the start of flow. (Specified in the User's Manual.)	Use the measured value	Use the measured value	Use the measured value
Auto ranging (peak value)	Do not used the measured value.	URL	Use the measured value	Use the measured value

Error messages and corrective actions

This instrument periodically performs self-diagnosis. Results of self-diagnosis are displayed on the main display area in terms of flow rate and error message in turn. The error message indicates any critical trouble of the main unit of this instrument. Thus, if it appears in the display area, please contact our sales representatives at our branch, sales office, or our distributors where you purchased this instrument, or our customer services department of our head office.

Error message	Description of error
CHAR PROM FAULT	Abnormality in internal data
SUSPECT INPUT	Abnormality in sensor output
NVM FAULT	NVM abnormality
RAM FAULT	Abnormality in an internal RAM
ROM FAULT	Abnormality in an internal ROM

Appendix English and Japanese Messages Comparison Table

The Japanese and English messages on the LCD display are compared as follows.
(The figures in the parentheses denote the maximum number of characters displayable for a specific item. For katakana, each sonant mark (ten-ten or maru) is counted as one character.)

English	Japanese	Description
T. Vol	セキサン	Totalized (cumulative) flow rate
Flow	シュンジ	Instantaneous flow rate
T. Cost	コスト	Totalized (cumulative) cost
Cost	コスト	Instantaneous cost
% Output	%シュツリョク	Percent output
Velocity	リュウソク	Flow velocity
Pressure	アツリョク	Pressure
BASIC MENU	キホン メニュー	Menu items that are set during operation
MAINTENANCE MENU	メンテナンス メニュー	Menu items that are set during installation
Main Disp	メイン ヒョウジ	Main display item setting
Unit	タンイ	Unit setting
Damping Time	ダンピング	Damping time setting
LowFlow Cost	ローフロー カット	Low flow cut setting
Leak Check	リークチェック	Leak check setting
Total Volume	セキサン リュウリョウ	Cumulative flow rate
Flow Rate	シュンジ リュウリョウ	Instantaneous flow rate
Total Cost	セキサン コスト	Cumulative cost
Cost	シュンジ コスト	Instantaneous cost
% Output	%シュツリョク	Percent output
Total Volume	セキサン リュウリョウ	Cumulative flow rate
Flow Rate	シュンジ リュウリョウ	Instantaneous flow rate
Total Cost	セキサン コスト	Cumulative cost
Cost	シュンジ コスト	Instantaneous cost
Leak Rate	ロウエイリツ	Leak rate display
Reset OK?	ケイソク リセット	Leak-checking measured values resetting
Set. Press	セッテイ アツリョク	Internal pipe systems pressure setting
TAG	タグ	Tag setting
Ref. Temp	キジュン オンド	Reference temperature setting
Ref. Pressure	キジュン アツリョク	Reference pressure setting
Pulse Weight	パルス オモミ	Pulse weight setting
Cost Rate	コスト オモミ	Cost weight setting

English	Japanese	Description
Zero Adjust	ゼロ チョウセイ	Zero adjustment
AutoRange	オートレンジング	Auto ranging
Max Flow	サイダイ リュウリョウ	Maximum flow rate setting
DAC Trim	DACチョウセイ	DACtrimming
Language	Language	Display language setting
Setting items in auto range (in maintenance menu)		
Exe AutoRange	オートレンジ ジッコウ	Auto ranging execution
Del Peak Value	ピークチ ショウキョ	Auto ranging peak value deletion
Other		
Message appearing at leak test or resetting measuring values for leak check		
Reset!	リセット シマシタ!	Measured values resetting screen
Message appearing at zero adjust execution		
Are you sure?	ジッコウ シマスカ?	Can the zero adjustment be executed?
Completely!	ゼロ チョウセイ シマシタ!!	Zero adjustment completed
SensorRange Over	センサレンジ オーバー	Differential pressure twice as high as the sensor range
Zero over OK?	シフトガオオキイデス OK?	Zero point deviation considerable
Message appearing at auto ranging		
Are you sure?	ジッコウ シマスカ?	Can the auto ranging be executed?
OK!!	ジッコウ シマシタ!!	Auto ranging completed
Message appearing at totalized value resetting		
Totalizer Reset?	セキサン リセット?	Cumulative values resetting confirmation
Are you sure?	ヨロシイデスカ?	Cumulative values resetting re-confirmation
Completely!	リセット シマシタ!!	Cumulative values resetting completed
Message appearing at set value changing		
Value changed!	ヘンコウ シマシタ!	An input value has been set
Input Value Error	ニュウリョクチ エラー	Error message for an excessive value of input

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.

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