

**Steam Flow Meter
STEAMcube
Model: MVC32/MVC33**

User's Manual



Azbil Corporation

NOTICE

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Preface

Thank you for purchasing our steam flow meter “STEAMcube.”

Precautions for safety

Introduction

To use the steam flow meter safely, install, operate, and maintain it properly. Before installing, operating, or maintaining the flow meter, familiarize yourself with the instruction manual and make sure you have a good understanding of the safety-related cautions.

Checking the steam flow meter

- Check the steam flow meter against its specifications and check for damage that might have occurred during shipping. The flow meter has passed tests according to a strict quality control program before being shipped. If you find the flow meter to be defective in quality or specifications, please contact us, making reference to the model No. and serial No. marked on the nameplate.
- The nameplate is on top of the casing.

Precautions for use

The instruction manual uses the following symbols to ensure safety:



Failure to follow these instructions may cause the death or serious injury of the operator.



Failure to follow these instructions may result in minor injury to the operator or damage to property.

To use the equipment correctly and safely, be sure to follow the precautions described below. Azbil Corporation in no case takes responsibility or warrants the equipment if the precautions are not followed.

Precautions for handling

Precautions for installation

WARNING

-
- (1) Depending upon the specifications, there are configurations of this product that weigh 10 kg or more. Exercise sufficient care during transport and installation, for example by using conveyance equipment and the like, or having two or more people carry the product. If the product is transported carelessly and dropped, this can cause injury or product damage.
 - (2) During installation, do not let the gasket protrude at the connection with the process (the connection between the adapter flange and the connecting pipe and flange).
 - (3) Do not use the product in conditions that deviate from the prescribed rated pressure, connection standard, and rated temperature, as this may cause damage that could lead to serious accidents.
 - (4) When performing piping work in explosion-proof areas, follow the construction methods prescribed in explosion-proofing guidelines.
-

CAUTION

-
- (1) Do not use the flow meter as a foothold. Damage to the product or physical injury may result.
 - (2) Do not press a tool against the glass readout panel of the meter, or the panel may break, possibly causing an injury.
 - (3) Be sure to perform grounding correctly. Lack of grounding or insufficient grounding can result in output errors or violation of applicable regulations.
-

Precautions for wiring

WARNING

Do not wire the steam flow meter when your hands are wet or the wires are live. There is a risk of electric shock. Before wiring the equipment, be sure to turn off the power, dry your hands if they are wet, and wear safety gloves as necessary.

CAUTION

-
- (1) Correctly wire the flow meter according to its specifications. Incorrect wiring may cause the equipment to be damaged or malfunction.
 - (2) Use a proper power supply according to the specifications. An improper power supply may damage the flow meter.
 - (3) When supplying power to this product, use a power supply that has overcurrent protection.
-

Precautions for maintenance

WARNING

-
- (1) When detaching the process for product maintenance, be careful of any residual pressure and residues, as there is a danger of being burned or otherwise injured by high-temperature vapor or saturated water. Clear the vents and drains in order to remove residual pressure and residues in the measurement target. Remove the device after it has cooled down.
 - (2) When clearing vents and drains, check the direction in which material will come out in order to avoid any contact with the human body.
 - (3) Do not open the flow meter cover when the meter is in use in an explosion-proof area. Doing so may trigger an explosion.
-

⚠ CAUTION

Do not disassemble or modify this product. Doing so may cause device failure or electric shock. In the case of explosion-proof models, the product cannot be inspected or modified in an explosion hazard area. Also, modifying an explosion-proof product renders it unusable.

Precautions for using communications equipment**⚠ CAUTION**

Depending on the frequency, using communications equipment, such as a walkie-talkie, a cell phone, and a pocket beeper, near the steam flow meter may prevent it from operating properly. When using such equipment, observe the following precautions:

- Keep far enough away from the steam flow meter so that the communications equipment does not affect it.
 - Before using the communications equipment, close the case of the steam flow meter transmitter.
-

Unpacking, checking, and storing the steam flow meter

Unpacking

The steam flow meter is a precision instrument. When unpacking and handling it, exercise the utmost care to prevent damage or an accident.

Checking standard accessories

Check to ensure that the following are included with the steam flow meter:

- 2 gaskets (4 gaskets for vertical installation models) (Used between the detector and the SWS cover flange)
- 4 bolts (8 bolts for vertical installation models) (Used between the detector and the SWS cover flange)
- 3 to 7* cable ties *Number depends on the length of the capillary
- Hex wrench (M3) × 1
- Centering collar × 4 (for wafer models only)

Checking specifications

The meter's specifications are marked on its nameplate. Check them against your required specifications. Be sure to verify the following:

- Tag No.
- Model No.
- Product No.
- Upper and lower limits of the setting ranges
- Power supply voltage
- Explosion-proof certificate mark (if applicable)

Inquiries

If you have any questions, please feel free to contact our branch office or your nearest Azbil Corporation dealer. When making an inquiry, let us know the following information from the nameplate:

- Model No.
- Product No.

Storing the steam flow meter

Storing the steam flow meter

If you store an as-delivered flow meter for a long period of time, observe the following instructions:

- Store the meter in an indoor place free from vibration and impact at about 25 °C and 65 % RH.
- Store the meter without unpacking it.

How to use the instruction manual

How to use the instruction manual

The instruction manual describes under the following section titles how to use the steam flow meter:

Section 1. Design and Functions

Design and functions of the steam flow meter. Read the section first when you are new to the meter.

Section 2. Installing the Steam Flow Meter

Necessary information for installing, piping, and wiring the meter. Descriptions about installation are made for each type of fluid to be measured. Before installing, piping, or wiring the meter, read this section.

Section 3. Starting and Stopping the Steam Flow Meter

Minimum necessary information to prepare for measurements, start, and stop the meter. It also describes the setting of the tag No. and checking the specifications of the steam flow meter necessary for delivering it. Read this section before starting measurements.

Section 4. Operation Menu

Configuration of STEAMcube is done using the Field Communication Software CommStaff.

This section describes items that can be set using CommStaff.

Section 5. Maintenance and Troubleshooting

The section describes how to maintain and troubleshoot the meter. Referring to the applicable instructions, properly maintain or troubleshoot the equipment.

Appendixes

Standard specifications, model No., and external dimensions of the steam flow meter. Refer to the appendixes as necessary.

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Chapter 1: Design and Functions

Overview

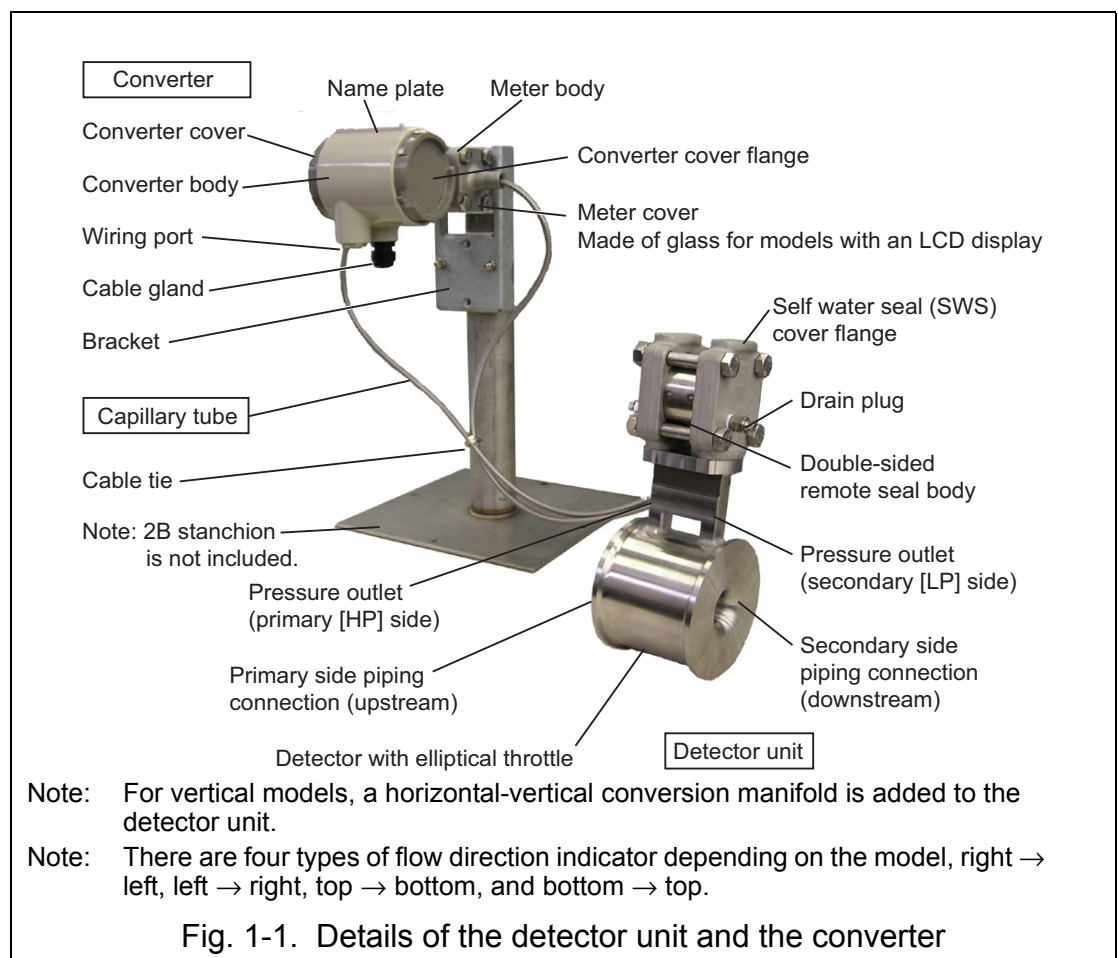
This section describes the design and functions of the steam flow meter. This section is useful for acquiring a basic knowledge of the meter if you are new to it.

1-1: General

The STEAMcube™ MVC32/33 steam flow meter is designed only to measure the flow rate of saturated steam. The meter uses the pressure difference output from a unique elliptical throttle developed by Azbil Corporation. In addition, the meter measures in-pipe pressure to find the density of saturated steam in the piping. Using the differential output and density, the meter calculates and outputs the mass flow rate.

1-2: Design

The MVC32A/33A (remote model) of the steam flow meter is designed as shown below:



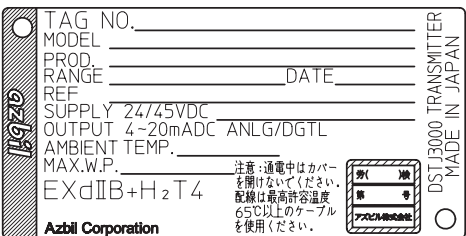
Remote model structure

The MVC32/33 flow meter consists of the following:

- A detector unit, which detects steam flow as a pressure difference
- A converter, which converts the detected pressure difference into an output signal
- A capillary tube section, which connects the detector unit and the converter

1-2-1: Parts

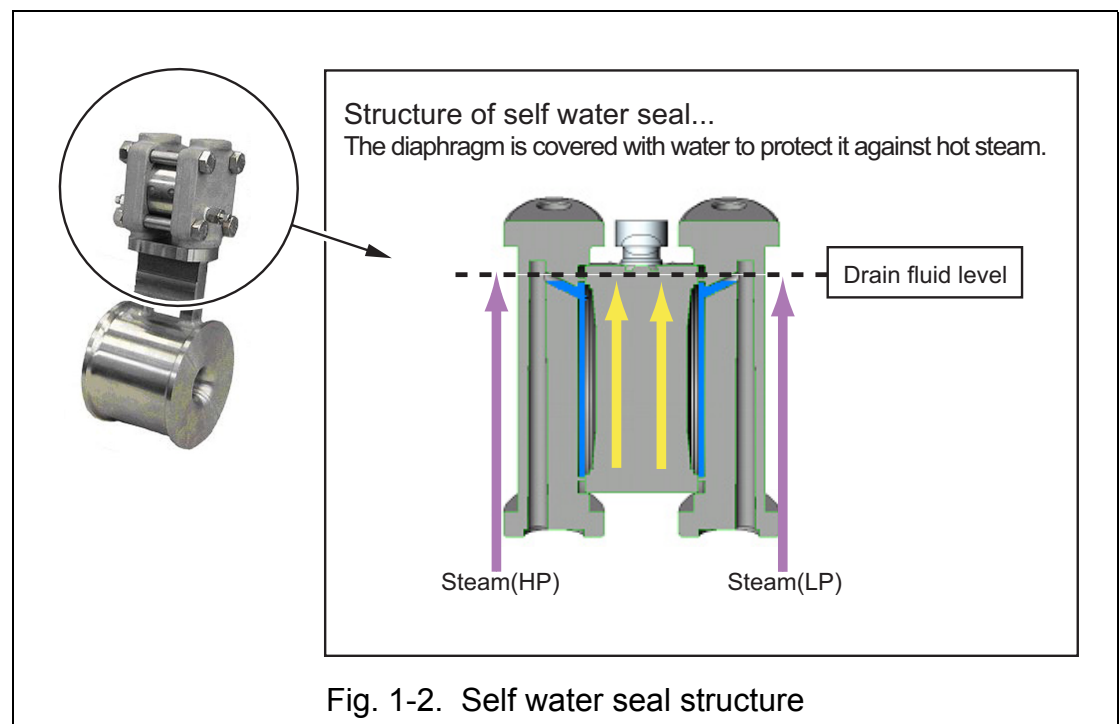
Table 1-1. Parts

	Name	Description
Converter	Main converter unit	Main MVC32/33 unit. The unit converts a pressure difference signal to electrical signals for flow rate, pressure, and temperature and outputs them.
	Meter cover	Converter LCD display cover. The display has a glass readout panel.
	Converter cover	Converter terminal block cover
	Meter body	Converter terminal receiver
	Converter cover flanges	These flanges sandwich the meter body to form a pressure receiver.
	Wiring port	A power and analog output cable, a pulse output cable, and a ground cable run out through this conduit.
	Cable gland	A plastic cable gland is used for waterproof models, and a cable gland is used for explosion-proof models. The wires to be used are 9 to 12 mm in diameter.
	Nameplate	<p>The nameplate is marked with the information given below. Only explosion-proof models have a safety certificate symbol on the nameplate.</p>  <p><u>Information on the Nameplate</u></p> <p>Tag No. Model No. Product No. Setting range Date of production Measured steam pressure Power supply and pulse weight (in underlined part) Output Ambient temperature Maximum load Explosion-proof classification</p>
Bracket	Bracket for attaching the converter to a 2-inch pipe (vertical/horizontal)	
Detector unit	Detector with elliptical throttle	Detector with an elliptical throttle unique to Azbil Corporation. The throttle, whose shape is designed to fit the velocity profile, reduces pressure loss, thus providing a stable differential pressure. The throttle aperture ratios for the MVC32 and the MVC33 are $\beta = 0.4$ and $\beta = 0.6$ respectively.
	Piping connection	These surfaces come in contact with a pipe. Fig. 1-1 shows a wafer type steam flow meter. Flange type steam flow meter models are also available. Select either of the types as necessary.
	Pressure outlet	Pressure outlet for detecting pressure difference generated in the elliptical throttle. In Fig. 1-1, steam, or a fluid to be measured, flows from left to right. An arrow marked on the detector indicates the direction of flow. Be sure to check the direction of the arrow. The primary pressure outlet, which is at the left of the figure, is called the HP (high pressure) side, and the secondary pressure outlet, which is at the right of the figure, is called the LP (low pressure) side.
	Self water seal cover flange	The cover flange and meter body form a space between them. Steam condenses in the space, and its condensate forms a water seal for the diaphragm, thus protecting it. For details, see section 1.2.2.
	Drain plug	This plug is intended to remove condensate from the self water seal.

Capillary	Capillary tube	The capillary tube is a narrow tube which propagates pressure from the double-sided remote seal to the meter body of the converter. The tube is filled with silicone oil, so it cannot be cut and shortened easily.
	Cable tie	Cable ties are used to tie the two capillary tubes together. Cable ties come with the flow meter as a standard accessory. To eliminate the temperature deviation to which each capillary tube is subjected after the installation is complete, be sure to tie them together before use.

1-2-2: Self water seal structure

Since STEAMcube is a differential pressure flow meter, differential pressure that is output from the detector unit is received by the double-sided remote seal diaphragm. It is then converted to a flow rate signal, which is output. The diaphragm is made of stainless steel. However, if the diaphragm is heated to a high temperature, the meter malfunctions. To solve the problem, a water seal is used for the diaphragm (it is covered with water to prevent overheating). This structure, called a self water seal (SWS), allows steam, the fluid to be measured, to cool and condense in the space formed by the SWS cover flange and diaphragm, and then in the form of water it protects the diaphragm. Make sure that the SWS cover flange, the upper part of the detector unit, is exposed to the air so that heat can be dissipated from the flange. The measuring method used for the steam flow meter is the same as that used by a conventional differential pressure transmitter and orifice. A seal pot, used for conventional pressure piping instrumentation, is incorporated into the SWS structure.



⚠ CAUTION

Expose the SWS cover flange to the air to dissipate heat from the flange.

⚠ CAUTION

The temperature of the flow meter can become very high during use. Do not touch it with unprotected hands.

1-3: Output

1-3-1: Types of output

The steam flow meter provides two types of output: analog and pulse.

Analog output

The instantaneous flow rate, pressure, or temperature can be selected for the analog output signal of 4 to 20 mA DC.

Type of output: 4 to 20 mA DC analog signal

Number of output signals: 1

Output: Selection of instantaneous flow rate, pressure, or temperature

Pulse output

The steam flow meter can generate a pulse output signal for calculation of the cumulative flow. The pulse frequency can be adjusted to be within a range from 0 to 200 Hz by varying the pulse weight. The cumulative flow is retained when the power is turned off.

Type of output: Open collector pulse

Number of output signals: 1

Output: Cumulative flow

Pulse supply power: 12 to 30 V DC, 50 mA (max.)

Frequency: 0.006 to 200 Hz

Table 1-2. Frequency range and pulse width

Pulse frequency	Pulse width
50 Hz < maximum pulse frequency < 200 Hz	1 ms
5 Hz < maximum pulse frequency ≤ 50 Hz	10 ms
Maximum pulse frequency ≤ 50 Hz	100 ms

1-3-2: Output signals

The steam flow meter generates flow rate, pressure, and temperature output signals as described below.

1-3-2-1: Flow rate output signal

A flow rate output signal is available in the following three types, which are selectable:

(1) Mass flow rate

When saturated steam flows through the piping, the steam flow meter calculates the mass flow rate from the differential pressure and steam density. Then the meter outputs the calculated value. The pressure difference and steam density are obtained using a primary-pressure measurement and steam tables incorporated in the steam flow meter. The mass flow rate can be provided as analog or pulse output.

$$W = C \sqrt{\Delta p \times \rho}$$

W [kg/h]: Mass flow rate

C: Constant

Δp [kPa]: Pressure difference

ρ [kg/m³]: Density

(2) Volume flow rate

When saturated steam flows through the piping, the steam flow meter calculates the volumetric flow rate from the differential pressure and steam density. Then the meter outputs the calculated value. The pressure difference and steam density are obtained using a primary-pressure measurement and steam tables incorporated in the steam flow meter. The volumetric flow rate can be provided as analog or pulse output.

$$Q = C\sqrt{\Delta p/\rho}$$

Q [m³/h]: Volumetric flow rate
 C : Constant
 Δp [kPa]: Pressure difference
 ρ [kg/m³]: Density

(3) Mass flow rate or volumetric flow rate at a fixed density

According to (1) above, the steam flow meter determines steam density using a primary-pressure measurement. However, this third output type is calculated by substituting a constant steam density into internal formulas. This type of output should be selected when the steam flow meter is used in a flow rate measuring system based on a constant steam density. The steam flow meter can provide fixed-density mass or volumetric flow rate as analog or pulse output.

$$W_c = C\sqrt{\Delta p \times Q_c}$$

$$Q_c = C\sqrt{\Delta p/\rho_c}$$

W_c [kg/h]: Mass flow rate with steam density constant
 Q_c [m³/h]: Volumetric flow rate with the steam density constant
 C : Constant
 Δp [kPa]: Pressure difference
 ρ_c [kg/m³]: Density (substituting a constant steam density into internal expressions)

1-3-2-2: Pressure output

The steam flow meter can output a primary-pressure measurement. Unless otherwise specified by the customer, the primary pressure output is factory-set to a range of 101.3 to 3500 kPa. Only analog primary-pressure output is available with the steam flow meter.

1-3-2-3: Temperature output

When saturated steam flows through the piping, the steam flow meter calculates the saturation temperature using the steam tables and the measured pressure. Unless otherwise specified by the customer, the saturation temperature output is factory-set to a range of 0 to 300 °C. Only analog saturation temperature output is available with the steam flow meter.

1-3-3: Output calculation algorithm

The steam flow meter provides output using the following algorithm:

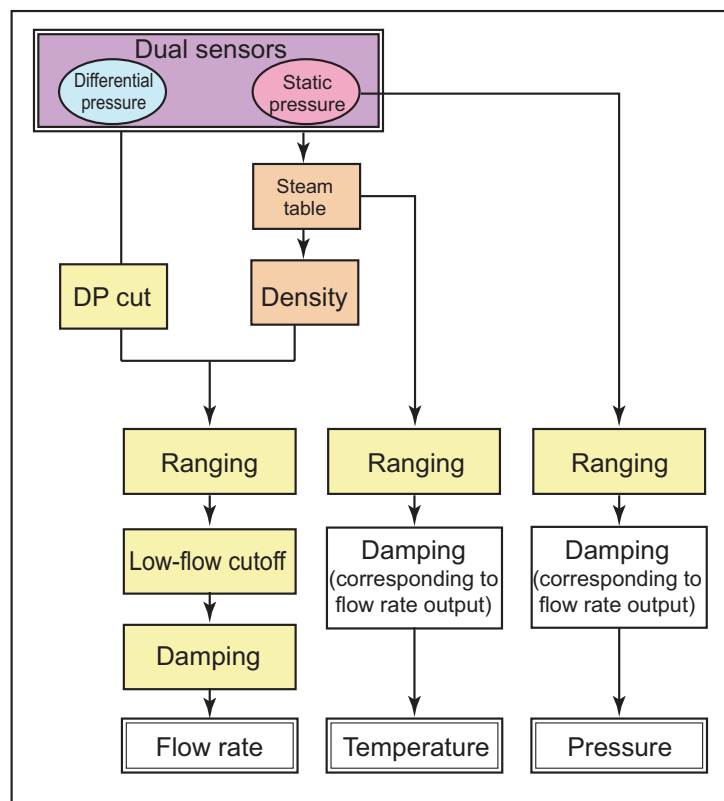


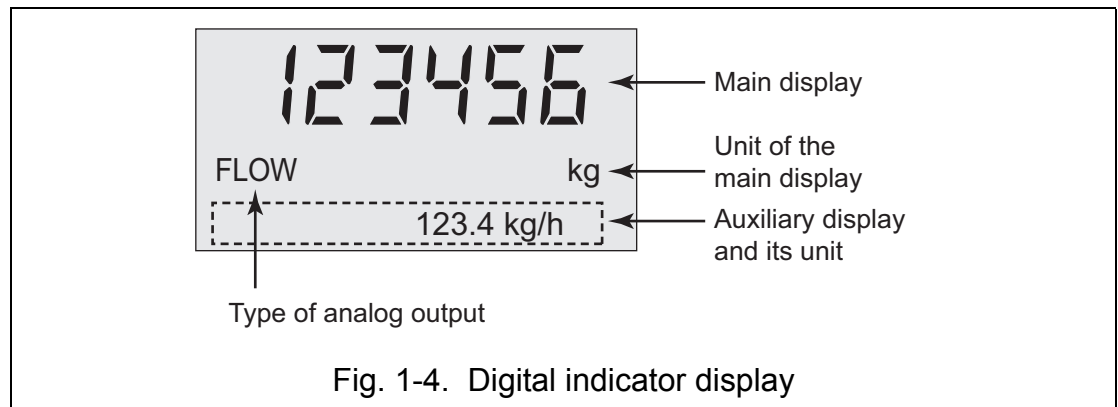
Fig. 1-3. Output calculation algorithm

1-4: Digital indicator (optional)

An optional digital indicator is useful for checking output on the site. The digital indicator indicates the flow rate, pressure, and temperature.

1-4-1: Display

The digital indicator is shown below.



1-4-2: Main display

The following output is possible for the main display.

Table 1-3. Contents of main display

Display	Type of display	Number of digits	Character height
Main	Cumulative flow	6	About 6 mm
	Instantaneous flow rate	4.5 To the first decimal place	

1-4-3: Auxiliary display

The auxiliary display is as follows:

Table 1-4. Auxiliary display

Display	Type of display	Number of digits	Character height
Auxiliary	Cumulative flow	6	About 4 mm
	Instantaneous flow rate	4.5 To the first decimal place	
	Pressure/temperature*	Pressure: 3 Temperature: 3	

* If the pressure/temperature reading provides a saturation temperature based on steam pressure in the piping, the symbol "@" follows the unit "°C." Because the saturation temperature is a calculated value, the pressure/temperature reading gives the steam saturation temperature (about 100°C) if there is no steam flow or under atmospheric pressure. Be careful for reading it.

1-4-4: Combinations of output data

The main and auxiliary displays can give the following combinations of data:

Table 1-5. Combinations of data

Main display	Auxiliary display		
	Cumulative flow	Instantaneous flow rate	Pressure/temperature
Cumulative flow	—	○	○
Instantaneous flow rate	○	—	○
Pressure/temperature	×	×	—

1-4-5: Analog outputs

As given below, the display shows what analog outputs are.

Table 1-6. Analog outputs

Analog output	Displayed text
Instantaneous flow rate	FLOW
Pressure	PP
Temperature*	TEMP

* If the pressure/temperature reading provides a saturation temperature based on steam pressure in the piping, the symbol “@” follows the unit “°C.” Because the saturation temperature is a calculated value, the pressure/temperature reading gives the steam saturation temperature (about 100°C) if no steam flows or under atmospheric pressure. Be careful for reading it.

1-4-6: Examples of readings

Main display: Cumulative flow

Auxiliary display: Instantaneous flow rate

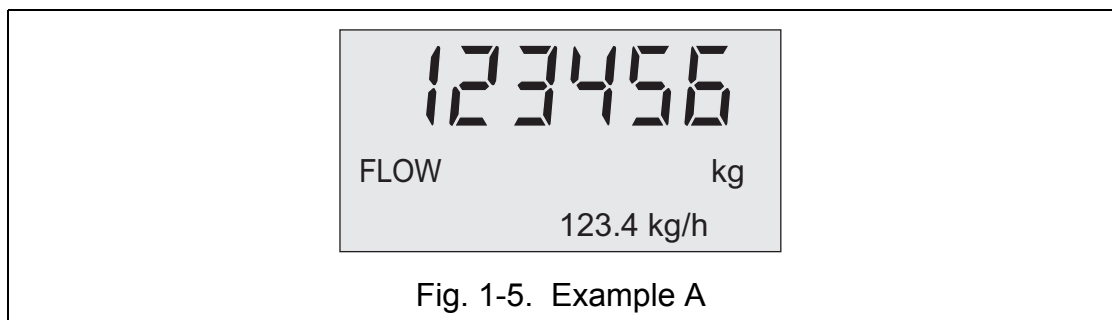


Fig. 1-5. Example A

Main display: Cumulative flow = 123456 kg
 Auxiliary display: Instantaneous flow rate = 123.4 kg/h
 Analog output: Instantaneous flow rate (FLOW)

Main display: Instantaneous flow rate
Auxiliary display: Pressure/temperature

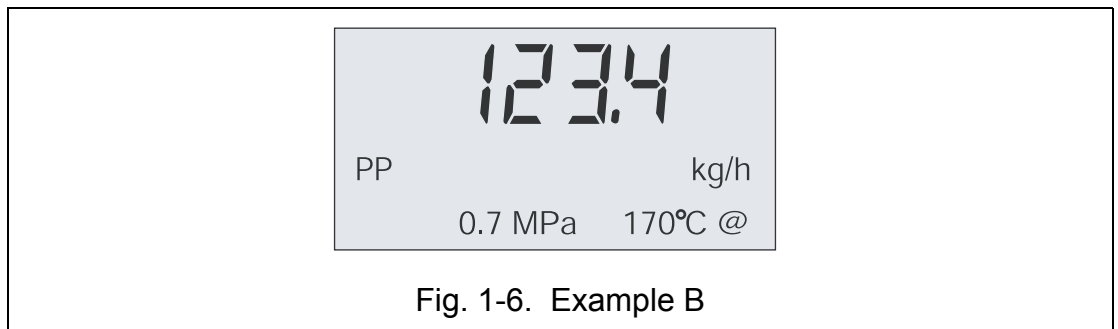


Fig. 1-6. Example B

Main display: Instantaneous flow rate = 123.4 kg/h
Auxiliary display: Pressure/temperature* = 0.7 MPa/170°C@*
Analog output: Pressure (PP)

* The symbol "@," following the temperature reading, means that a saturation temperature based on steam pressure in the piping is displayed.

1-5: Operating condition of STEAMcube, readings, and outputs

Table 1-7.

Item	Operating condition	Normal operation	Serious failure occurs	Overloaded sensor	URL ^{*1} OVER	URV ^{*2} OVER	Reliability warning is given. ^{*3}
	Condition		Self diagnosis finds that the steam flow meter is faulty	The differential pressure is "500 in H ₂ O" or more	The measured flow rate is larger than the URL set point	The measured flow rate is larger than the URV set point	The differential pressure is more than a quarter of the static pressure
	Main display		Flashes on and off.	Flashes on and off.	Flashes on and off.	Flashes on and off.	Flashes on and off.
	Instantaneous flow rate	Displays flow rate.	Error	HHHH	HHHH	Displays flow rate.	Displays flow rate.
	Cumulative flow	Accumulation	No accumulation, or accumulates at rate before breakdown	Accumulates, but pulse output is held at 105% of URV	Accumulates, but pulse output is held at 105% of URV	Accumulation at 105% of URV	Accumulation
	Auxiliary display						
	Instantaneous flow rate	Displays flow rate.	Flow rate	O/L (Overload)	Over Flow	Flow rate	Flow rate
	Cumulative flow	Accumulation	No accumulation, or accumulates at rate before breakdown	Accumulates until 105% of URV	Accumulates until 105% of URV	Accumulation at 105% of URV	Accumulation
	Pressure + temperature	Displayed		Displayed	Displayed	Displayed	Displayed
	Damping	None	None	None	None	None	None
	4 to 20-mA output	Outputs the measured value.	Depends on setting.	20.8 mA	Output up to 21.3 mA	Output up to 21.3 mA	Outputs the measured value.
	4 to 20-mA output damping^{*4}	Gives output based on damping setting.		Gives output based on damping setting.	Gives output based on damping setting.	Gives output based on damping setting.	Gives output based on damping setting.
	Pulse output	Measured value	Stopped or outputs at the pulse rate before breakdown.	Measured value, but holds at 105% of URV	Measured value, but holds at 105% of URV	Measured value, but holds at 105% of URV	Measured value
	Pulse output damping	None	None	None	None	None	None
	Calculation of cumulative flow	Measured value	Stop or Hold	Measured value	Measured value	105% of URV	Measured value
	Flow rate peak holding	Measured value	Measured value	Unavailable	Measured value	Measured value	Measured value
	Pressure difference/static pressure peak holding	Retained	Retained	Retained	Retained	Retained	Retained

Note: *1 URV

An abbreviation for "Upper Range Value," meaning the upper limit of a set range.

*2 URL

An abbreviation for "Upper Range Limit," meaning the upper limit of a range that can be set.

*3 Reliability warning

According to JIS Z 8762 (1995), the expansion correction coefficient formula does not hold true if the relationship between the differential pressure and the static pressure does not satisfy the following statement:

$$0.25 \times \text{static pressure (kPa}_{\text{abs}}) \geq \text{differential pressure (kPa)}$$

*4 Factory default value 2 s (if no value was specified by the customer)

Table 1-8.

Item	Operating condition	Low-flow cutoff	Simulation	Forced pulse	SP cutoff	DP cutoff	Negative differential pressure
	Condition	The flow rate measurement is smaller than the low flow cut value set	Flow rate is simulated using the Field Communication Software CommStaff in order to check the operation of the pulse circuit	Pulse production is forced using the Field Communication Software CommStaff in order to check the operation of the pulse circuit	The static pressure measurement is smaller than the SP cut value set point	The differential pressure measurement is smaller than the DP cut value set point	The zero-point shift is generated for some reason
	Main display						
	* Set reading						
	Instantaneous flow rate	Zero	Simulated flow rate	Actual flow rate	Zero	Zero	Zero/Negative
	Cumulative flow	No accumulation	Accumulation (simulated flow rate)	Accumulation (actual flow rate)	No accumulation	No accumulation	No accumulation
	Auxiliary display						
	* Set reading						
	Instantaneous flow rate	Zero	Apparent flow rate	Actual flow rate	Zero	Zero	Zero/Negative
	Cumulative flow	No accumulation	Accumulation (simulated flow rate)	Accumulation (actual flow rate)	No accumulation	No accumulation	No accumulation
	Pressure + temperature	Displayed	Displayed				
	Damping result LCD display	None	None	None	None	None	None
	4- to 20-mA output	4 mA	Outputs measured value.	Outputs measured value.	4 mA	4 mA	4 mA
	4- to 20-mA output damping^{*4}	Gives output based on damping setting.	Gives output based on damping setting.	Gives output based on damping setting.	Gives output based on damping setting.	Gives output based on damping setting.	Gives output based on damping setting.
	Pulse output	Stopped	Simulated flow rate value	Set flow rate	Stopped	Stopped	Stopped
	Pulse output damping	None	None	None	None	None	None
	Calculation of cumulative flow	Stopped	Measured value	Set flow rate	Stopped	Stopped	Stopped
	Flow rate peak holding	(Unavailable)	Measured value	Unavailable	(Unavailable)	(Unavailable)	(Unavailable)
	Pressure difference/static pressure peak holding	Retained	Not retained	Not retained	Retained	Retained	Retained

^{*4} Factory default value 2 s (if no value was specified by the customer)

Chapter 2: Installing the Steam Flow Meter

Overview

This section describes the essentials of the installation of the steam flow meter, including how to pipe and wire the steam flow meter. Before installing the meter, read this section.

2-1: Requirements for selecting a place for installation

2-1-1: General requirements

Introduction

To obtain maximum performance from the steam flow meter over a long period of time, meet the requirements given below.

Before using an explosion-proof steam flow meter, be familiar with the industrial safety rules and regulations for steam flow meters of that type in the country where you use the meter.

Requirements for selecting a place for installation

Select a place for installation that meets the following requirements:

- A place where temperature changes as little as possible
- If the steam flow meter is exposed to direct sunlight or radiant heat from a plant, the meter may heat up even though the ambient temperature requirement is met. In such a case, please take sufficient care and install a reflector plate to shield the meter from direct sunlight or radiant heat as necessary.
- A place free from vibration and impact (piping vibration acceleration: 5 m/s² or less)
- A place free from extreme water hammering and pulsation
- A place in a noncorrosive environment

Installation height

The remote type flow meter is suitable for installation in a high place or in a place with piping vibration; however, caution should be exercised in installation height of the detector unit and the converter. If there is a difference in height between the detector unit and the converter, the sensor detects the pressure (static pressure) due to the weight of the silicone oil. Therefore, to prevent occurrence of this problem, the value for the installation height is input into the product before shipment based on the value for the installation height previously designated by the customer. If you move the flow meter and accordingly need to reset the value for the installation height, please contact the dealer from whom you purchased the product or a service person in the nearest Azbil Corporation location. We will change the settings for the new installation height as a part of our service.

As for the installation height, using the converter of the flow meter as a benchmark, it is defined as "+X.XXX m" in case the pipe to which the detector is attached is set above the position of the converter. Alternatively, it is defined as "-X.XXX m" in case the pipe to which the detector is attached is set below the position of the converter.

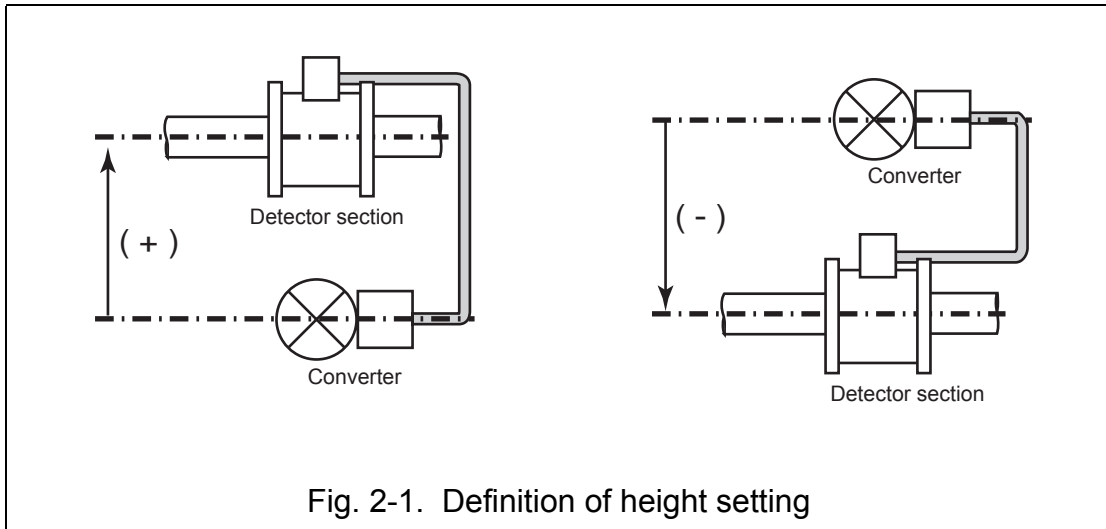


Fig. 2-1. Definition of height setting

⚠ CAUTION

If the installation height is different between the pressure receiver of the converter and the double-sided remote seal of the detector section, the “meter body height” needs to be changed in the height settings inside the converter.

2-1-2: Installation standards for an explosion-proof steam flow meter

Installing an explosion-proof steam flow meter

An explosion-proof steam flow meter that has passed public inspection according to the Industrial Safety and Health Law is permitted to be used in the dangerous places specified below. Explosion-proof models of this steam flow meter are of this explosion-proof type. Take the following precautions to use the meter safely.

An explosion-proof steam flow meter has a nameplate marked with precautions for use and a certificate symbol. Install the steam flow meter correctly, following the precautions.

Installation standards for the explosion-proof steam flow meter

Install the explosion-proof steam flow meter in a place that meets the following requirements for proof against explosion, the degree of ignition, and explosion-proof structure classification:

- Classification of dangerous areas
The explosion-proof steam flow meter may be installed in a Class 1 or Class 2 area. It must not be installed in a Class 0 area.
- Explosion class and the degree of ignition of a gas to be measured
IIB + H₂T4
The explosion-proof steam flow meter may be used for gases and vapor of Class IIB and hydrogen gas. The degree of ignition of gases and vapor for which the explosion-proof device is used must be higher than Grade T4 (ignition temperature at 135°C).
- Temperature
Install the explosion-proof steam flow meter in a place where the temperature ranges from -10 °C to 60 °C as specified on the nameplate with the certification mark. The lettering “AMBIENT TEMP” marked on the nameplate refers to ambient temperature near the meter. The lower ambient temperature limit is -10 °C. This, in turn, means that the explosion-proof steam flow meter may not be used below -10 °C.

Important

Outside the ambient temperature range, the steam flow meter is not guaranteed to be explosion-proof. If such may be the case, take measures,

such as thermally insulating the meter and installing it in a well-ventilated place, to keep the ambient temperature within the specified range.

2-2: Installing the steam flow meter

2-2-1: Installation dimensions

See the attached general view of the product specification.

2-2-2: Place of installation

See Section 2.1.1, “General requirements,” on the previous page.

2-2-3: Installation procedure

This flow meter has a remote type structure. Its converter and detector unit are delivered separately. This is with the intention of the devices being assembled after installing the converter and detector unit in the predetermined sites, as a result of considering the workability of the installation work. However, if it is preferable to install the converter and detector unit after the devices are assembled for reasons of, for example, installation site and installation space, please complete the assembly of the devices and then install them in the piping.

The following points show roughly the steps of the installation procedure.

- (1) Confirm the installation site for the converter and the detector unit and then the pathways and distances of the capillary tubes and wiring.
- (2) Install the converter in the predetermined site.
- (3) Connect the detector to the pipe.
- (4) Attach the pressure receiver, which consists of the double-sided remote seal body and the SWS cover flange, to the detector.
- (5) Tie the two capillary tubes (H side/L side) together with the provided cable ties.
- (6) Take measures to protect the capillary tubes and the wiring.

2-2-4: Installing the converter

As an example, the following describes the attachment of the converter to a 2B pipe.

Preparation for installation

In attaching the converter to a 2B pipe, the use of the optional attachment bracket kit facilitates smooth attachment.

The optional attachment bracket kit includes the following items.

- Bracket
- U bolts and nuts
- Bracket attachment bolts

Attachment procedure

- (1) Find the four bolting holes on the back of the converter cover flange. Take out the bracket from the bracket kit and attach the converter body to the bracket securely by bolting through these holes.

- (2) Attach the bracket, to which the converter has been attached, to the 2B pipe. Use the U bolt and nut included in the bracket kit to attach the bracket to the 2B pipe securely.
- (3) Tie the two capillary tubes tightly together with the provided cable ties. If the two tubes are not tied together, each tube is affected differently by the installation height and the ambient temperature, thereby causing errors.

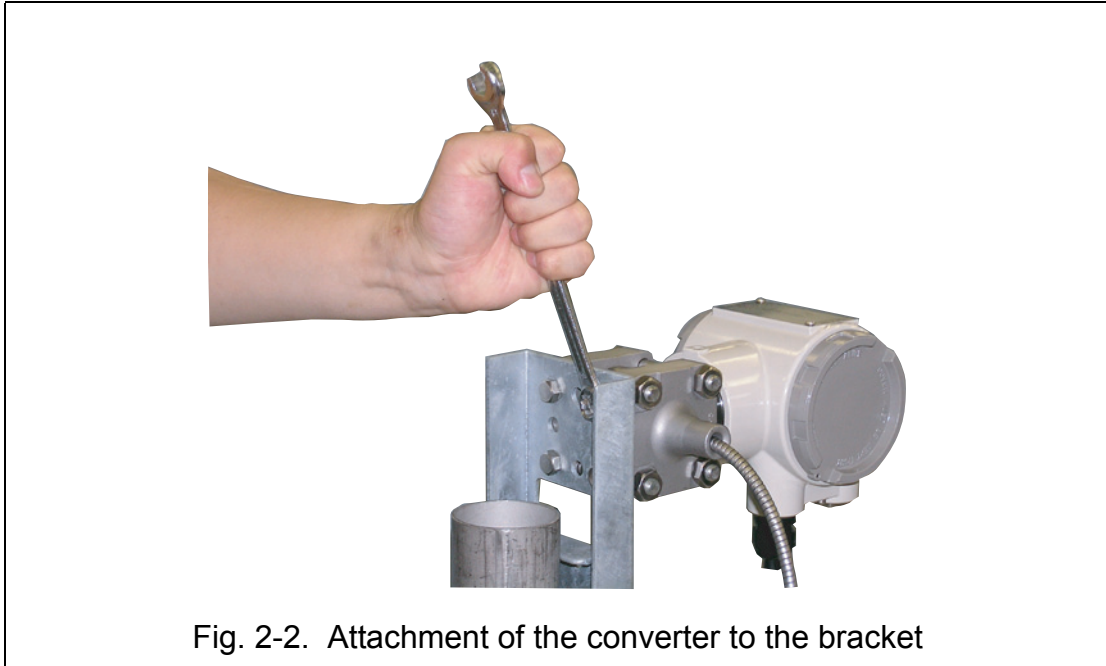


Fig. 2-2. Attachment of the converter to the bracket

⚠ CAUTION

- Do not bend the capillary tubes more than necessary. Bending could result in breakage of the capillary tubes and leakage of silicone oil.
- Do not cut the capillary tubes or adjust their length. Doing so may damage the flow meter and render it unusable.
- Do not set the H side and L side of the meter body of the converter upside down. Doing so will cause shifting of the zero point. Be sure to put the H side and L side on the left and right respectively, so that the pressures of the H and L sides will be equal.

2-2-5: Connecting the detector

This section describes how to connect the wafer type of detector to the piping as an example.

2-2-5-1: Preparations for installation

Connecting the detector requires the equipment given in the following table:

Table 2-1. Equipment needed to connect the detector:

Name	Quantity	Remarks
Centering collar	4 for horizontal piping installation (2 for 150A piping)	Included accessories
	2 for vertical piping installation	
Bolt and nut	Depending on flange rate and size	Optional or supplied by user
Gasket	2	Supplied by user

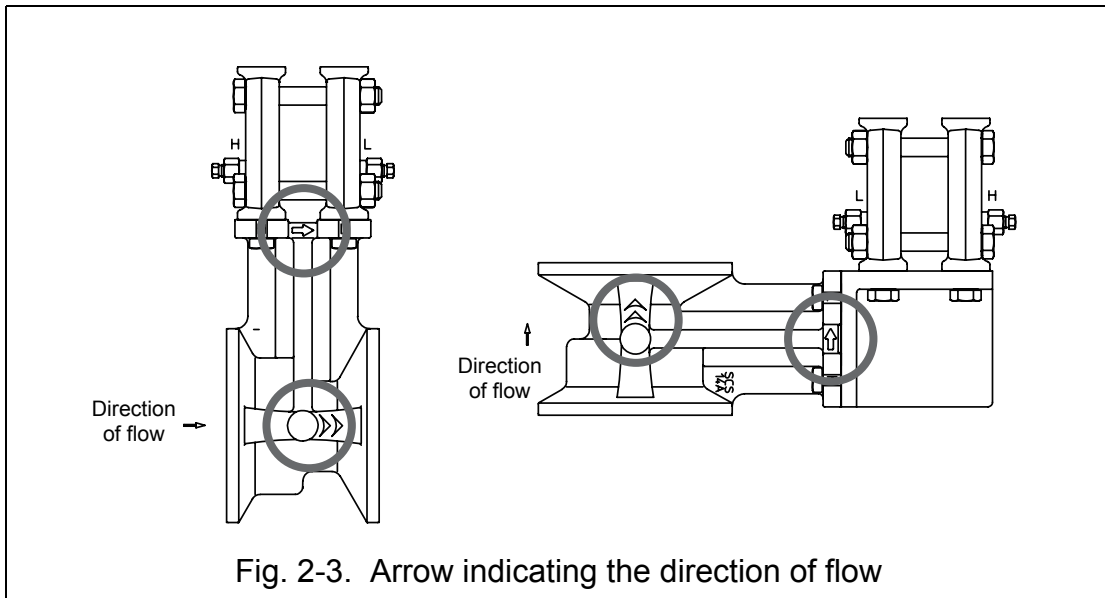
Note on gasket selection

Select a gasket having a larger internal diameter than the steam flow meter. The gasket is interposed between the meter and flange. Install the gasket so that it does not protrude inside the piping. Gasket protrusion will interfere with differential pressure output from the throttle, causing output variations.

2-2-5-2: Caution for installation

Checking the direction of flow

The detector is marked with an arrow that indicates the direction of flow. Install the steam flow meter so that the direction of fluid flow agrees with the arrow. Otherwise an output error may result.

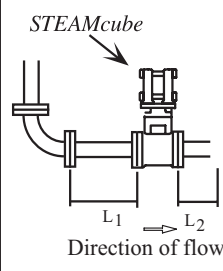
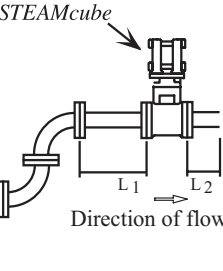
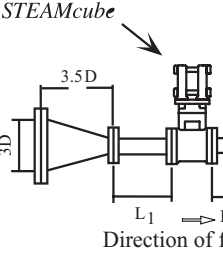
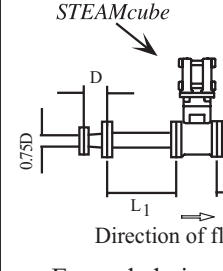
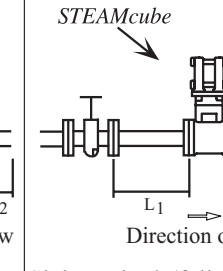


Providing the proper length of upstream and downstream straight pipeline sections

To generate stable pressure difference, the steam flow meter needs the following lengths of straight pipeline sections upstream and downstream. The symbol “D” means diameter. That is, “0.5D” means $0.5 \times D$, indicating that 0.5 times the diameter is required for the straight pipe section.

The lengths are given below. Note that failure to provide the proper length of upstream and downstream straight pipe sections may cause an output error.

Table 2-2. Lengths of upstream and downstream straight pipeline sections

Upstream side, L1		
 <p>One 90° bend</p>	 <p>Two or more 90° bends on the same plane</p>	 <p>Shrunk pipe</p>
0.5	1.5	2.5
Upstream side, L1		Downstream side, L2
 <p>Expanded pipe</p>	 <p>Sluice valve* (fully open)</p>	<p>All couplings on the left</p>
1.5	2.5	0.6

* This valve must be a full-bore type such as a ball valve or gate valve. It cannot be a globe valve or other typical control valve.

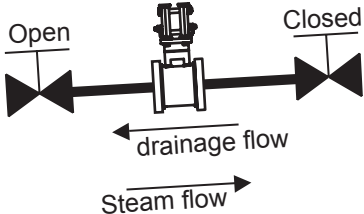
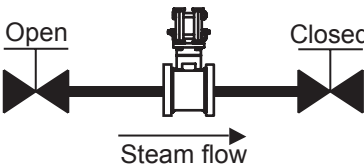
Preventing stagnant drainage

⚠ CAUTION

Do not let drainage accumulate inside the pipes. If a large amount of drainage accumulates in the pipes, a water hammer phenomenon can occur, which may affect not only the flow meter but any device that is located downstream. Moreover, accumulated drainage can give rise to pressure differences that are not due to flow volume, and can even cause output to occur when there is no steam flow. When mounting this flow meter, put a steam trap in the vicinity, and make sure that the drainage is being discharged.

Before installing piping, check whether condensate can collect in the piping. If condensate may collect in the piping, the installations given below are not recommended.

Table 2-3. Examples of installation situations requiring care

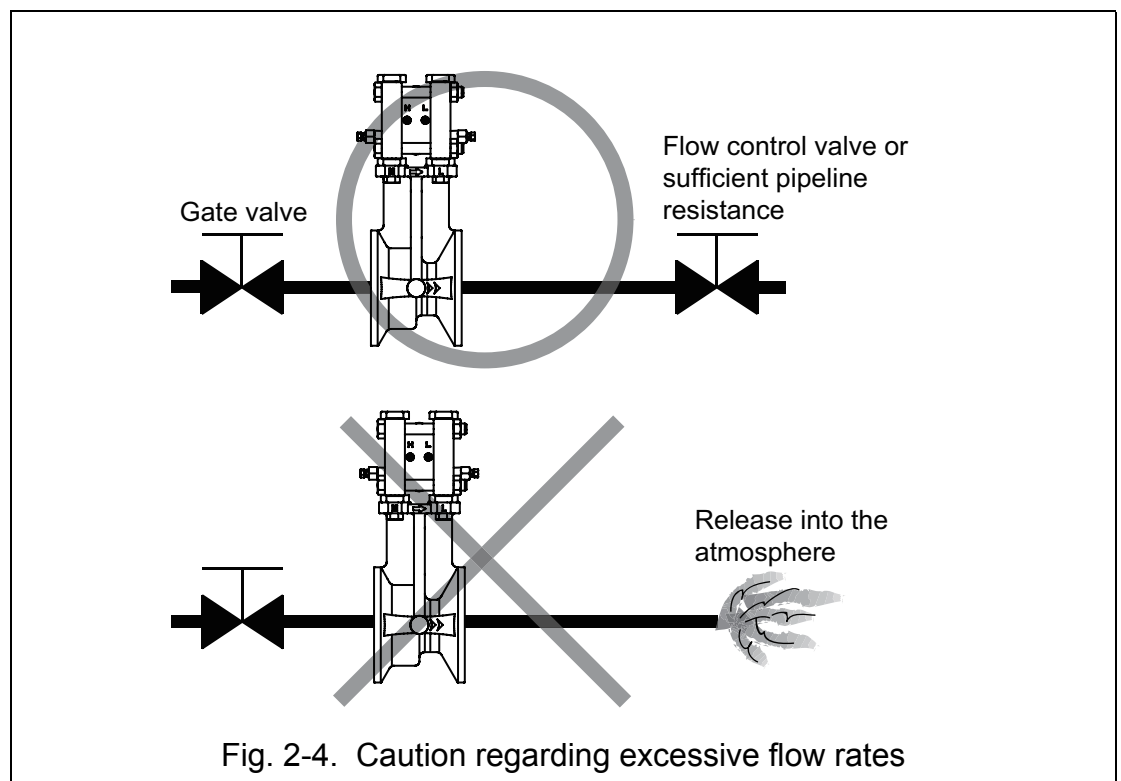
Example	Reason
	<p><u>The piping is slanted against the direction of steam flow.</u></p> <p>If the piping is slanted against the direction of steam flow, a two-phase counterflow may occur in the piping, causing condensate to collect in the piping.</p>
	<p><u>With the piping horizontal, the primary valve is open, while the secondary valve is closed.</u></p> <p>Steam continues to flow through the primary valve. As a result, steam cools down before the secondary valve, thus causing the piping to be full of drainage.</p>

Caution regarding excessive flow rates

When the secondary side of the flow meter is used in or near atmospheric pressure, the steam that passes through the flow meter expands rapidly and the flow velocity inside the flow meter approaches the speed of sound. Accordingly, this may result in a value greatly exceeding the upper limit of the measurable range.

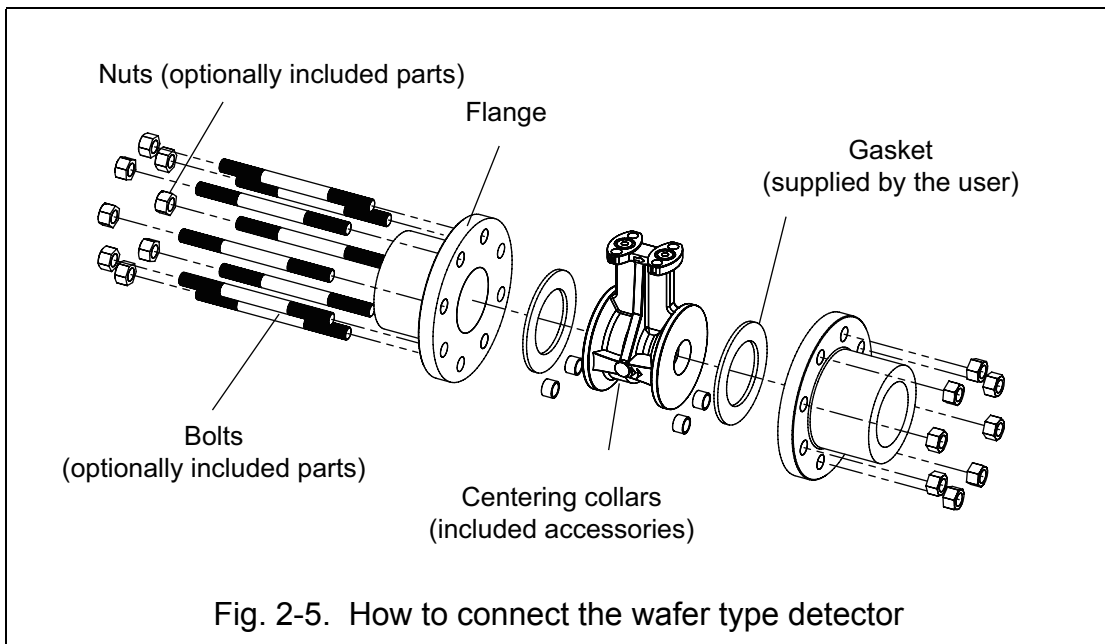
In addition, because the steam itself is no longer saturated steam in such a case, there will presumably be an error in the flow rate output.

Therefore, it is recommended that the pipeline for the flow meter with a load be installed by using, for example, fully resistance, a globe-valve-structure gate valve or a flow control valve on the flow meter's secondary side.



Caution for connecting the steam flow meter to the piping

Fig. 2-5. below shows basically how to install the wafer type detector.

**Tightening the bolts**

Tighten the bolts uniformly. If steam leaks after the bolts are tightened, check to ensure that there is no shift from the center and then gradually tighten the bolts. To use the collars, insert the bolts through them. Place both ends of the detector on the centering collars to position them. For details, see Fig. 2-3 and Table 2-5.

Caution for a pipe connection end

Use utmost care not to damage the pipe connection surfaces. They are very important for providing high sealing performance.

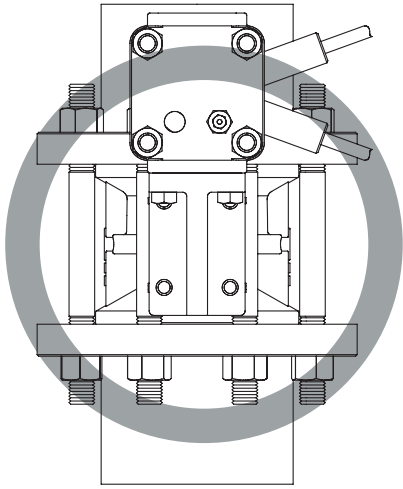
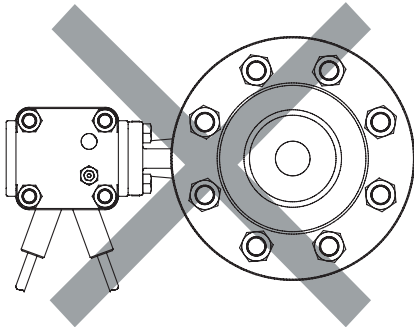
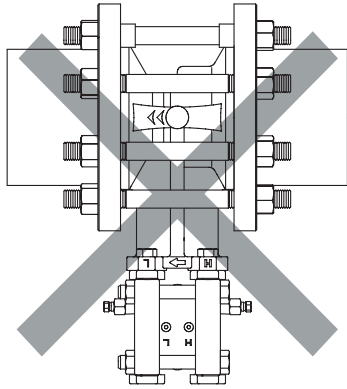
⚠ CAUTION

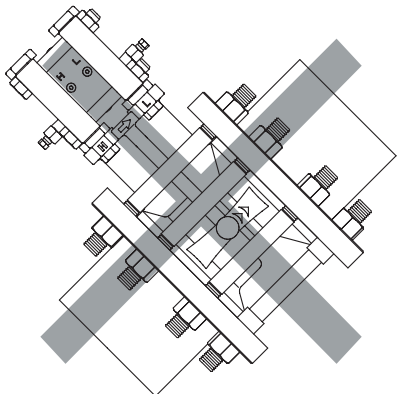
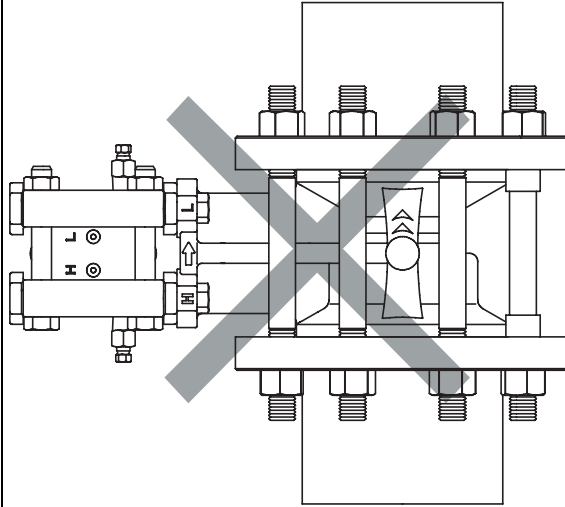
- This flow meter is made of metal and is quite heavy. Accidents involving, for instance, dropping the product on your foot can cause fractures or other injuries. Be sure to perform installation work in a group of two or more people, work in a safe manner, and if necessary employ equipment such as a chain block or crane.
- Never install the steam flow meter upside down, or else no condensate will stay in the SWS flange, thus preventing stable measurement and even damaging the meter. Be sure to use the steam flow meter in an upright position. The meter must not be placed upside down or laid down on the ground.

Caution regarding the installation position

The steam flow meter is designed so that steam can cool down naturally in the self water seal flange. As a result, the condensate covers the pressure receiver diaphragm to prevent it from overheating. Therefore, the steam flow meter needs to be installed in the correct position, which ensures there is always condensate on the self water seal flange and there is no zero shift.

Table 2-4. Installation positions

Good	
	
<p>Correct flow meter position for a horizontal piping specification model</p>	
Bad	
	
<p>Flow meter in a horizontal position for a horizontal piping specification model</p>	<p>Flow meter in an upside-down position for a horizontal piping specification model</p>

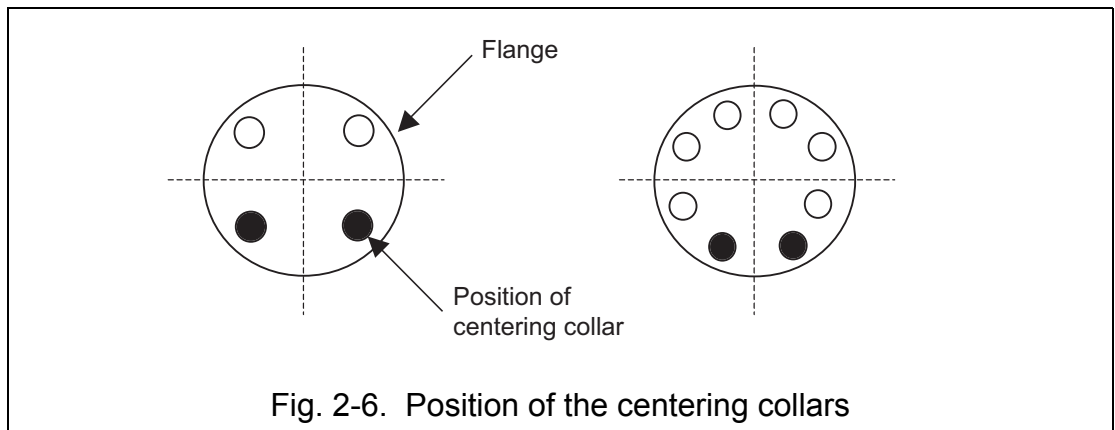
Bad	
	
Flow meter installed on inclined piping	Flow meter installed on vertical piping for a horizontal piping specification model

Need for centering

When installing a horizontal piping specification model, insert the centering collars through the two bottom bolts. On the other hand, when installing a model for vertical piping, insert the centering collars through the two farthest bolts. The centering collars are produced according to your desired piping specifications. Thus the collars cannot be used with non-conforming flanges or for a flange rating other than your specified flange rating.

CAUTION

- Never install the steam flow meter and piping misaligned from the center line. Otherwise output variations or even steam leaks may occur, resulting in physical injury. Be sure to align the meter with the piping, using the centering collars.



Pipeline lagging (insulation)

Take all necessary measures to keep the steam piping warm. If the steam flow meter is used without doing so, the steam will no longer satisfy the saturation condition and will become wet steam. Wet steam cools on the pipe wall and then becomes condensate. The condensate changes into a film and then flows down the pipe wall.

The steam flow meter does not measure condensate that flows down the pipe wall. Note that variations in flow rate output may result if this condensate is depressurized as it flows down the pipe wall and suddenly flashes and returns to steam.

Note on heat lagging for the steam flow meter

The steam flow meter adopts a self water sealing structure that protects the flow meter from exposure directly to steam by actively cooling the steam to condense it. For this reason, be sure to apply heat lagging only to the parts indicated in Figure 2-7.

⚠ CAUTION

- Never apply heat lagging to the parts above the self water sealing flange (self water sealing flange, meter body and converter). Otherwise the flow meter may be damaged.

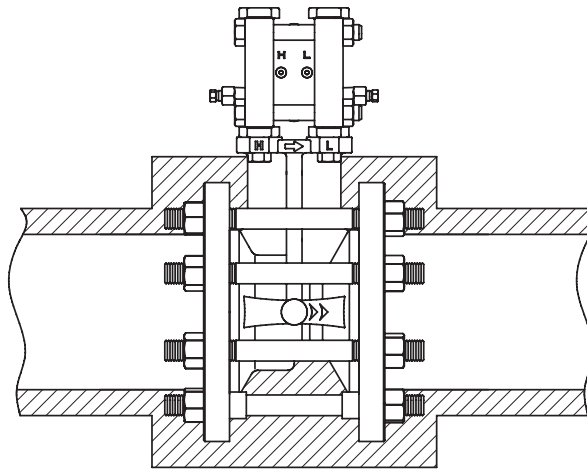
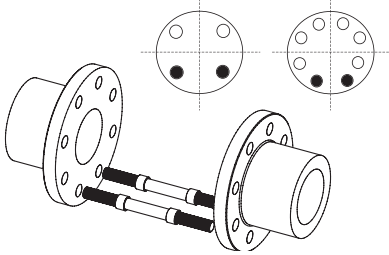
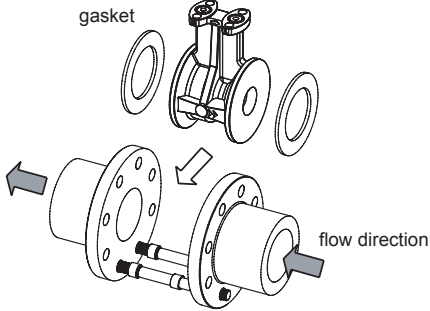
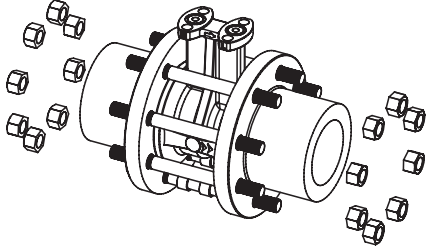
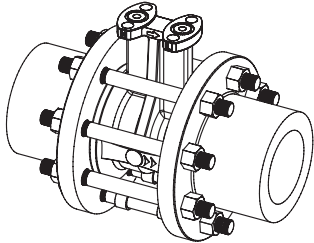


Fig. 2-7. Heat lagging for the steam flow meter

2-2-5-3: Steps for installing the steam flow meter

Install the steam flow meter in the following steps:

Table 2-5. Steps for installing the steam flow meter

Step	Description	Illustration
1	<p>Insert the bolts into the holes indicated by black circles. Pass a bolt through each centering collar.</p> <p>To connect the steam flow meter to horizontal piping, insert the two bottom bolts into the flanges as shown at the right.</p> <p>To connect the meter to vertical piping, insert the two farthest bolts into the flanges.</p>	
2	<p>Match the direction of the arrow on the meter with that of the flow.</p> <p>Interpose the gaskets and detector between the flanges. Place both ends of the detector on the centering collars (for a 150 A steam flow meter, however, use the fittings at the center of the detector).</p> <p>Use the meter with the centering collars installed.</p>	
3	<p>Check to ensure that the flow meter is in alignment with the piping.</p> <p>In addition, make sure that the gaskets do not protrude inside.</p> <p>After completing these checks, place the remaining bolts through the flange holes and tighten the bolts evenly.</p>	
4	<p>Completed installation</p> <p>The procedure for installing the pressure receiver, or a double-sided remote seal, and SWS flange to the detector is given in the next section.</p>	

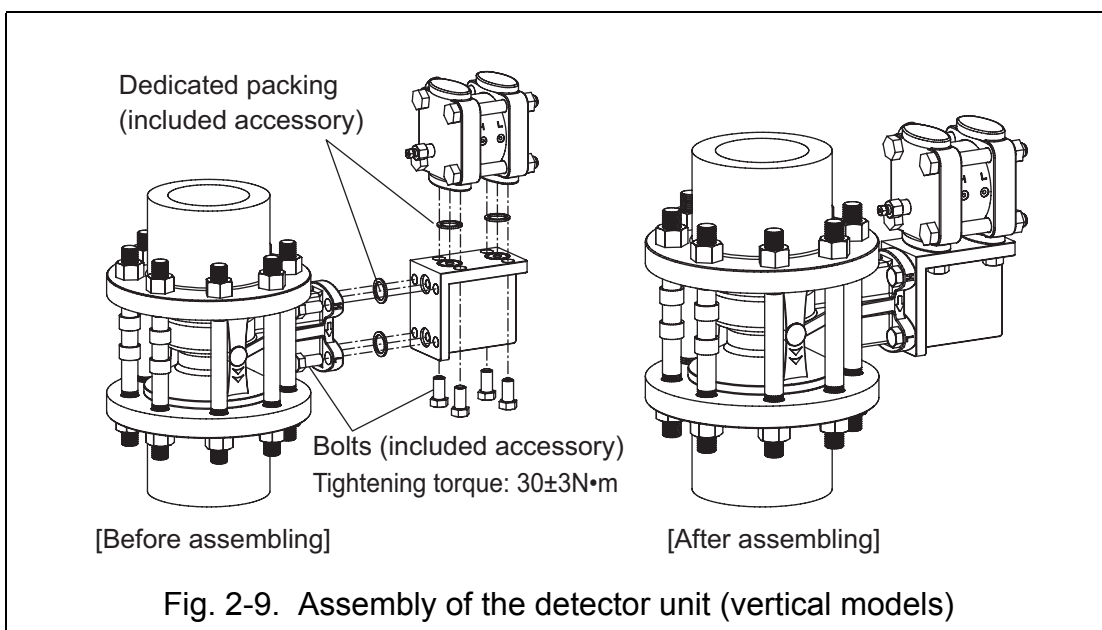
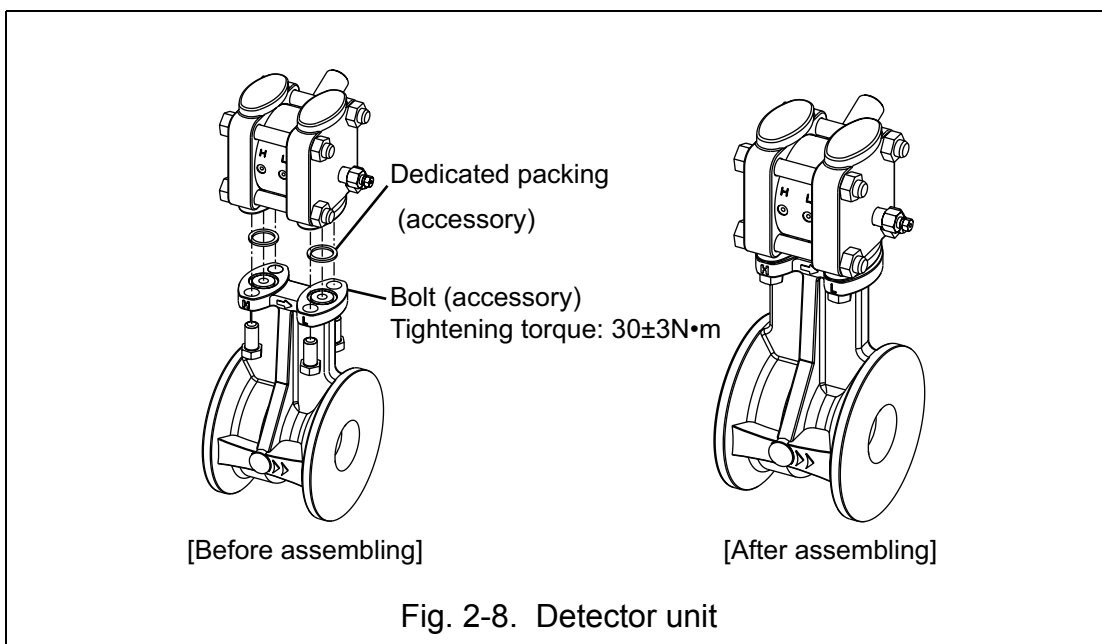
2-2-5-4: Assembling the flow meter

This section describes how to assemble the detector unit.

When assembling, be sure to match the H side of the pressure receiving meter body and the upstream side of the flow direction, and the L side of the pressure receiving meter body and the downstream side.

In addition, when assembling the detector and the pressure receiving meter body, be sure to tighten all of the bolts and the provided dedicated packing to an equal tightening torque.

Detector	Pressure receiving meter body
Upstream	H (high pressure side)
Downstream	L (low pressure side)



2-3: Electrical wiring

2-3-1: Wiring a standard steam flow meter

The section describes how to wire a standard steam flow meter. When wiring an explosion-proof steam flow meter, see section 2.3.2, "Wiring an explosion-proof steam flow meter," also.

2-3-1-1: Running wire into the transmitter case

Run wire into the transmitter case in the following steps:

- Use the conduit hole (G1/2 female threads) to route wire to the terminal block.
- To prevent rainwater from entering the transmitter, close the conduit hole tightly, using sealant or a plug.
- Install wire so that it runs into the transmitter case from below. Otherwise rainwater may enter the case.

2-3-1-2: Grounding

The steam flow meter has two ground terminals. One is located on the terminal block, and the other is located on the outside of the meter. To ground the meter, connect either to a Class D ground (with a resistance of 100 Ω or less) or a higher-grade ground. Be sure to ground an explosion-proof steam flow meter.

CAUTION

Welding near the transmitter:

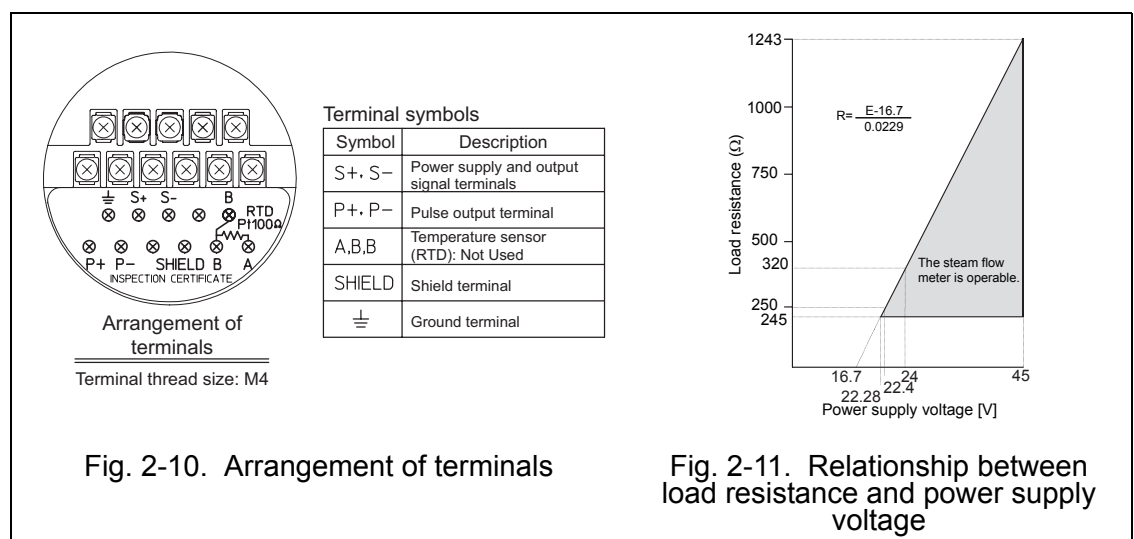
Do not share a ground between the steam flow meter and a welding machine or a welding transformer; otherwise, the welding power supply may affect the meter.

2-3-1-3: Terminal block

The terminal block is as shown below.

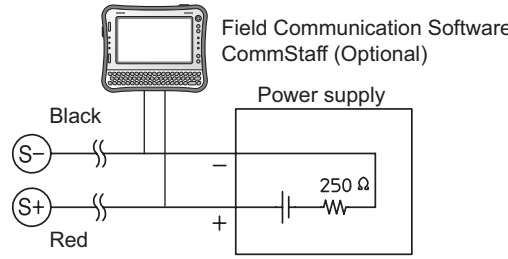
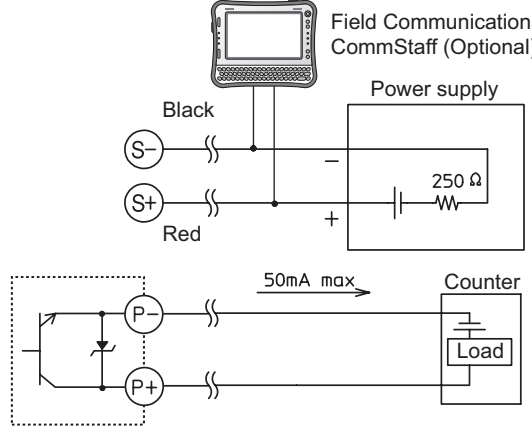
2-3-1-4: Power supply voltage and load resistance

The relationship between the power supply voltage and load resistance is shown below. Keep the external load resistance and the power supply voltage within the ranges given by the shaded region. The external resistance is the sum of the resistance of cables consisting of a loop, the internal resistance of connected instruments, and any resistance connected to the output terminals of the steam flow meter.



2-3-1-5: Output wiring diagram

The wiring diagram for each output is shown below.

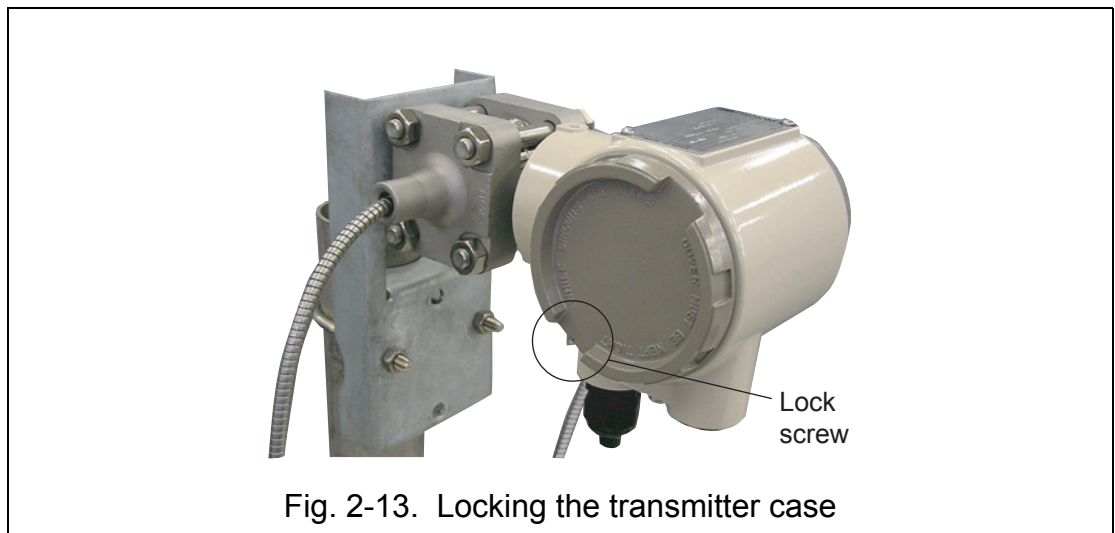
Output	Wiring
<p>Analog output only</p>	
<p>Pulse output or both analog and pulse outputs</p> <p>Counter incorporates power supply.</p>	 <p style="text-align: center;">Fig. 2-12. Wiring diagrams</p>

2-3-2: Wiring an explosion-proof steam flow meter

For wiring an explosion-proof steam flow meter, see section 2.3.1, “Wiring a standard steam flow meter,” and the descriptions given below.

2-3-2-1: Locking

The steam flow meter is designed so that it can be locked. Before wiring the meter, unlock the transmitter case using an M3 Allen wrench. The law requires that the case of the transmitter of an explosion-proof steam flow meter be locked. Before using the meter, securely tighten the case cover completely, and tighten the lock screw.



2-3-2-2: Cable gland

Use the cable gland that comes with the steam flow meter. The cable gland is certified by a test to be explosion-proof as a part of the transmitter case. Combining the cable gland with any cable adapter other than the supplied cable adapter invalidates the guarantee on the steam flow meter.

Chapter 3: Starting and Stopping the Steam Flow Meter

Overview

The section describes steps for using the steam flow meter, including starting the meter and storing it.

3-1: Starting the steam flow meter

Operate the steam flow meter using the following procedure:


(1) Check the electrical connections.

Table 3-1. Turning on the power

Step	Operation
1	Is the power cable correctly connected? The meter uses a 24 V DC power supply (16.7 to 45 V DC). Incorrectly connecting the meter to the power supply damages the meter.
2	Is the meter grounded? Use a Class D ground (with a resistance of 100 Ω or less). Check that two-point grounding is not used.
3	If pulse output is also to be used, check to ensure that a pulse signal cable is connected to the meter. An open collector pulse needs to be used. Check to ensure that a subordinate pulse counter or sequencer supplies power.
4	After completing steps 1 through 3, turn on the power to the meter.
5	If the meter has an LCD, it lights up and the meter starts after the power is turned on. Check that the instantaneous flow rate output is zero (the flow rate is zero). If the meter has no LCD, use a 4 to 20 mA DC signal or a pulse output signal to check that the instantaneous flow rate is zero. When using a pulse output signal, wait for some time and then check whether the counter works.

(2) Check the piping connections.

Table 3-2. Starting steam supply

Step	Description
1	Check to ensure that the steam flow meter is correctly connected (no bent/twisted connections). For the wafer type, check to ensure that the centering collars are used correctly, that is, that the steam flow meter is in alignment with the piping.
2	Check to ensure that the bolts and nuts are securely tightened.
3	Check to ensure that proper packing is correctly selected and used according to the correct packing method.
4	Check to ensure that the bolts connecting the detector and the SWS cover flange are securely tightened.
5	Check to ensure that the drain plug at the detector cover flange fits tightly.
6	Check to ensure that condensate, which can cause a water hammer, has not collected in the piping. Drain any condensate.
7	Check that the two capillary tubes are securely bound together with the cable ties.
8	After completing steps 1 through 7, try supplying steam. Gradually open the valve.
9	<p data-bbox="475 1111 1362 1211">Visually check the steam flow meter for leaks after supplying the steam. If steam leaks, immediately shut off the steam and tighten the bolts to correct the problem.</p> <div data-bbox="571 1267 1382 1413" style="border: 1px solid black; padding: 5px;"> <p data-bbox="576 1272 778 1312"> CAUTION</p> <p data-bbox="667 1330 1382 1402">Steam can make the temperature of this flow meter very high, so exercise sufficient care when handling it.</p> </div>

(3) Start the steam flow meter.

Table 3-3. Starting the steam flow meter

Step	Operation
1	Turn on the power to the steam flow meter as described in item (1). Make sure that the steam flow meter reads zero (the flow rate is zero) when there is no steam flowing.
2	Supply steam as described in item (2) and check the output.

 **CAUTION**

- If steam condenses as it flows, cavitation may occur at the portion of throttle structure, thus generating noise. When the piping becomes free from condensate after the saturation point is reached, the noise decreases. Listen for noise while operating the steam flow meter.

Also, excessive flow rate as described on page 2-9 sometimes generates noise.

3-2: Stopping the steam flow meter

Stop the steam flow meter as described below.

(1) Turn off the steam flow meter.

Table 3-4. Turning off the power

Step	Operation
1	If the steam flow meter is used for control, be sure to switch the host DCS (distributed control system) or PLC (programmable logic controller) to the manual mode before turning off the meter.
2	Turn off the meter.

(2) Shut off the steam flow.

(Alternatively, change to bypass steam to prevent it from flowing through the meter.)

Table 3-5. Shutting off the steam

Step	Operation
1	<p>Close the valve upstream of the meter or change to bypass steam to prevent it from flowing through the meter.</p> <p>⚠ CAUTION</p> <hr/> <ul style="list-style-type: none"> Do not close the valve downstream of the meter without also closing the one upstream. Otherwise condensation will occur in the piping, which, in turn, will become full of condensate. As a result, not only the meter, but also equipment downstream of it may be adversely affected. If condensate is likely to collect, install a steam trap near the meter to drain condensate. Closing both valves upstream and downstream of the meter causes hot steam in the piping to cool down and thus condense. As a result, a vacuum occurs in the piping, causing the meter output to fluctuate. <hr/>

(3) Remove the steam flow meter from the piping

Table 3-6. Removing the steam flow meter from the piping

Step	Operation
1	<p>Remove the steam flow meter from the piping.</p> <p>⚠ CAUTION</p> <hr/> <p>Do not remove the meter when its detector is hot. Otherwise a burn may result. The detector made of stainless steel alloy, has a considerable heat capacity. Let the detector cool down sufficiently.</p> <hr/>
2	<p>After the detector has cooled down, remove the meter in the reverse order of installation.</p> <p>⚠ CAUTION</p> <hr/> <p>Be aware that high-temperature drainage water may still be present in the SWS structure in the upper portion of the detached probe.</p> <hr/>
3	<p>Remove the drain plug to drain collected condensate.</p> <p>⚠ CAUTION</p> <hr/> <p>Do not open the drain plug when pressure is being applied to it, as this will cause high-temperature water and steam to spurt from inside. Always wait for the probe to cool before opening the drain plug.</p> <hr/>
4	<p>After removing the detector, attach a caution tag to the piping and valves or fit a plug into the piping to prevent steam from running out even if mistaken operation of the valve occurs.</p>

Chapter 4: Operation Menu

Overview

Use the CommStaff to check the measurement data and setting data of the steam flow meter.

This section describes the functions that can be performed with the CommStaff. For information on the connection method and the actual operation method of the CommStaff, refer to the common instruction manual (CM2-CFS100-2001) and the STEAMcube instruction manual (CM2-CFS100-2008).

4-1: Functions chart

The following chart shows the functions of the steam flow meter. The functions chart represents the screen structure of the CommStaff to be used in conjunction with the flow meter.

The functions that are used as pre-operational preparation for the flow meter and for maintenance of the flow meter are layered to form the menus.

Screen composition

Table 4-1

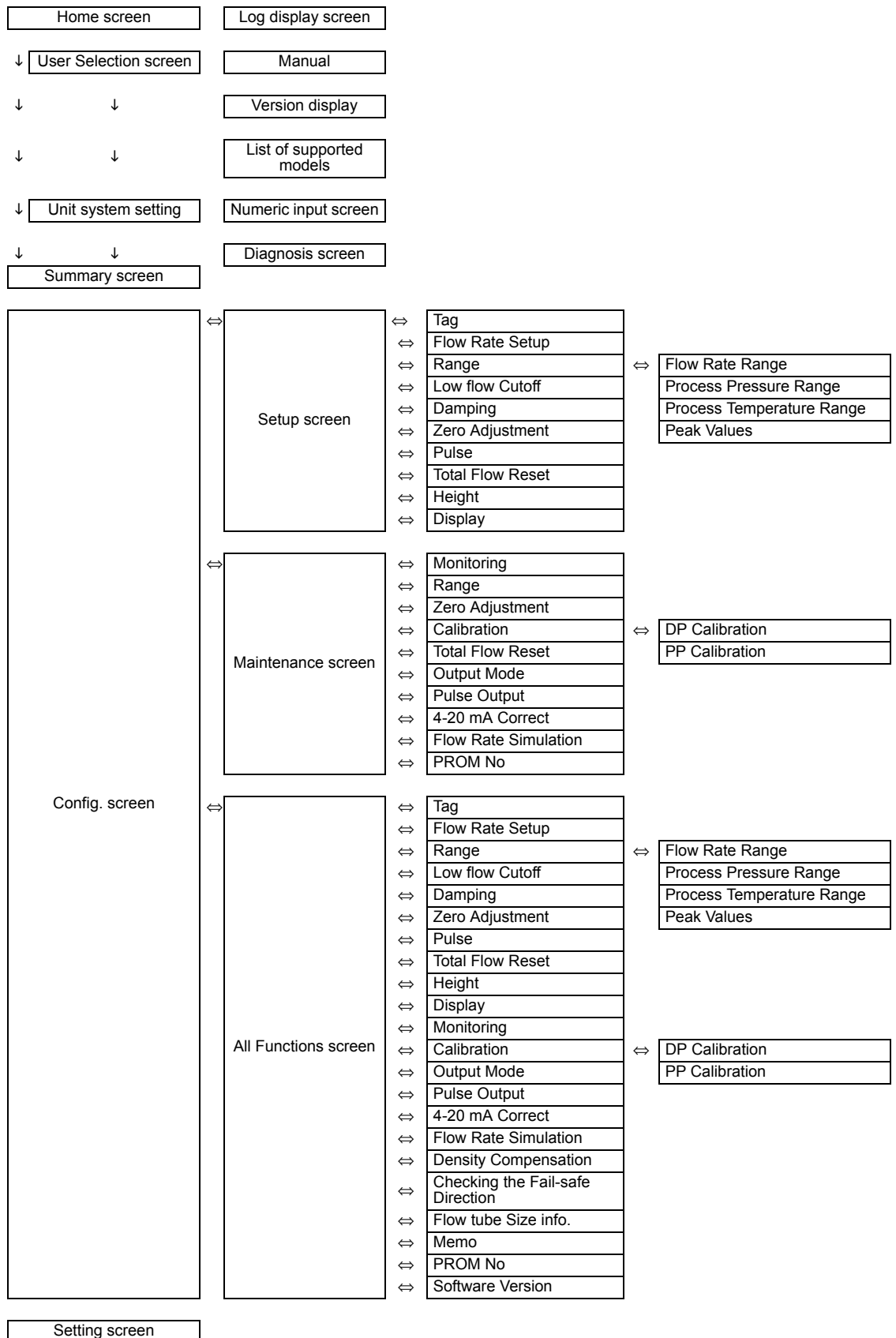


Fig. 4-1. CommStaff menu structure and functions list (functions chart)

4-2: Various functions available on the steam flow meter

Tag

This function provides a Tag No. for the flow meter.

The Tag No. can be up to eight alphanumeric characters. Usable characters are the one-byte alphabetic characters "A" to "Z", numeric characters "0" to "9", " " (space), ".", "-", and "/".

The default of this function is specified by the customer at the time of order placement and is entered into the product before it is shipped. If no Tag No. is specified, "XXXXXXXX" is set as the default.

Flow rate setup

This function determines the method for calculating flow rate. This function can be selected from mass flow and volumetric flow. The engineering units used can also be selected at the same time.

The default for this function is selected by the customer at the time of order placement for certain models.

Range

This function sets the range of analog output as well as the output range (upper range value and lower range value) of flow rate, static pressure, and temperature assigned to the analog output.

The default for this function is specified by the customer at the time of order placement and is entered into the product before it is shipped.

One of the range setting functions is the peak value display function. The peak value display function records the highest values for flow rate, static pressure, and temperature after the power is turned on, and saves the records. Note that the recorded values are deleted when the power is turned off.

Low flow cutoff

This function eliminates low flow from the flow rate output.

There are three types of low-flow cutoff function. Each of the following cutoff functions can be used when the output is unstable, depending on the cause.

<Flow rate cut-off>

The flow rate cutoff function cuts the output when the flow rate is less than XXX% of the flow rate range set point. Since this is a function for cutting off low-level output within the flow rate range, use this function when it is known in advance that there is very little flow rate in the low flow rate region.

The default for this function is specified by the customer at the time of order placement. Unless the customer indicates otherwise, 3% is set by default.

<Static pressure cutoff>

The SP cutoff function cuts the output when the flow rate is less than the static pressure set point. Use this function to cut the low-level output when the in-piping pressure is reduced due to boiler shutdown or similar reason, and it is known in advance that there will be no steam flow.

The default for this function is set to 0.035 MPa.

<Differential pressure cutoff>

The DP cutoff function cuts the output when the flow rate is less than the differential pressure set point. Use this function to cut the low-level output when a differential pressure is produced by the difference of the amount of condensate between the H side and the L side in the SWS flange when no steam is produced.

The default for this function is set to 0.3 kPa.

Since each of the three cutoff functions has an OR circuit, the function with the highest value works when two or more cutoff functions are simultaneously enabled.

Damping

This function sets a damping time for analog output.

It is for analog output smoothing and 0, 2, 4, 8, 16 or 32 seconds can be selected.

The default for this function is set to 2 seconds.

Zero adjustment

This function adjusts the zero point for flow rate output.

Before adjusting the zero point for flow rate output, confirm that the steam flow has stopped and the amount of water on the left and right in the SWS flange is the same. Note that adjusting the zero point without checking may result in output shift.

Preferred method:

Adjust the correct installation position after eliminating the water inside the pipes by disconnecting them.

Or

Adjust the correct installation position after filling the SWS flange with water.

Because the momentary flow rate shows zero in the cutoff range due to the action of various cutoff functions, adjust the zero point by using a monitor to check the value of the differential pressure.

Pulse

This function sets the pulse output.

Set a weight per pulse of the pulse output. The range of pulse frequencies that can be produced is between 0.006 Hz and 200 Hz. The pulse width is automatically changed according to the frequency.

Determine the pulse width and pulse weight in accordance with the pulse receiving specification of the receiver.

Table 4-2

Pulse frequency	Pulse width
50 Hz < pulse frequency \leq 200 Hz	1 ms
16 Hz < pulse frequency \leq 50 Hz	10 ms
5 Hz < pulse frequency \leq 16 Hz	30 ms
pulse frequency < 5 Hz	100 ms

The default value for this function is specified by the customer at the time of order placement. Unless the customer indicates otherwise, 1 (unit)/pulse is set by default depending on the unit of range to be used.

Example 1: If the flow range is between 0 and 500 kg/h, the default is 1 kg/pulse.

Example 2: If the flow range is between 0 and 2 t/h, the default is 1 t/pulse.

Example 3: If the flow range is between 0 and 500 m³/h, the default is 1 m³/pulse.

Total flow reset

This function resets the totalized (cumulative) flow volume.

Height

This function is used for a remote flow meter and is not used for an integral flow meter.

This function adjusts the value of the static pressure in consideration of the sealed liquid's own weight when the height of the detector and the installation height of the converter are different. If the detector is installed at a level higher than the converter, enter the value as +X.X m. If the detector is installed at a level lower than the converter, enter the value as -X.X m.

The default value for this function is specified by the customer at the time of order placement and is entered into the product before it is shipped.

Display

This function sets what to display on the LCD indicator. Two types of display, main display and auxiliary display, are available. The main display indicates the instantaneous flow rate and the totalized flow volume. The auxiliary display shows the momentary flow rate, the totalized flow volume, or the pressure & temperature.

The display length is fixed at 6 digits for totalized flow volume and 4.5 digits (4 digits plus 1 digit after the decimal point) for momentary flow rate and pressure & temperature. The defaults for this function are specified by the customer according to the model type at the time of order placement.

Monitor

This function displays the current measurement state.

The items displayed are momentary flow rate, differential pressure, pressure, saturated steam temperature and sensor temperature.

The latest data can be viewed by clicking the periodic update button.

Calibration

This function calibrates the built-in sensors. The steam flow meter is equipped with dual sensors, one for measuring differential pressure and the other for measuring static pressure. This function allows users to calibrate the pressure sensor and the differential pressure sensor.

Output mode

This function outputs constant current so that the current output circuit of this flow meter and the input circuit of the receiver can be coordinated.

The current to be output can be selected from 0% (= 4 mA), 25% (= 8 mA), 50% (= 12 mA), 75% (= 16 mA) and 100% (= 20 mA), or an arbitrary current can be output.

Pulse output

This function outputs a constant pulse so that the pulse output circuit of this flow meter and the input circuit of the receiver can be coordinated. Any of 0%, 25%, 50%, 75% or 100% of the maximum number of pulses that can be produced by this flow meter, can be output in accordance with the set range and the pulse weight. An arbitrary pulse frequency can also be output.

4-20 mA current

This function calibrates the output current. It uses the constant current output function to check the output circuit of this flow meter and the input circuit of the receiver. The results are used to increase or decrease the output current.

Flow rate simulation

This function calculates the flow rate at an arbitrary differential pressure or pressure by using flow rate computation logic.

Density compensation

This function sets a density to be used for calculating flow rate. Either the value of the static pressure sensor or an arbitrary value can be selected.

<When using the value of the static pressure sensor>

Select "Standard" to correct the density using the value of the static pressure sensor. Whether it is mass flow or volumetric flow, the value of the density to be used is calculated based on the value of the static pressure sensor on the assumption that it is saturated steam.

<When using an arbitrary value>

Select "Fixed density" to correct the density by a desired value, and then enter the value. The default values for this function are selected by the customer according to the model type at the time of order placement.

Checking the Fail-safe Direction

This function sets the type of burnout feature in case of trouble with or damage to this flow meter.

Analog output and pulse output can be set independently.

There are three available selections for analog output in the event of burnout: None, Up and Down.

None:	The output depends on the failure conditions and thus is indefinite.
Up:	Upscale on failure (21.2 mA or more)
Down:	Downscale on failure (3.8 mA or less)

There are two available selections for pulse output in the event of burnout: Low and Hold.

Low:	The pulse is not output.
Hold:	The pulse continues to be produced at its rate before the failure occurred.

Flow tube size info

This function sets information on the flow tube size.

For high-accuracy flow meters, the unique values for the detector used in conjunction with the flow meters have been input. Note that the original value is deleted if the value is rewritten. It is recommended that the original value be saved by writing it down and storing it in a safe place.

Note

This function stores notes in the built-in EEPROM.

There are two functions for taking notes. Up to 16 alphanumeric characters can be recorded in each function.

PROM No.

This function displays the PROM No.

S/W version

This function displays the version of the steam flow meter and of CommStaff.

Chapter 5: Maintenance and Troubleshooting

Overview

The section describes how to maintain and troubleshoot the steam flow meter.

Important

The steam flow meter is sturdily built. However, it is a precision instrument, containing delicate parts. If you find the steam flow meter's operation to be erratic or abnormal, immediately contact your nearest Azbil Corporation branch office or dealer.

Prohibition of disassembly

The steam flow meter has an explosion-proof structure or a waterproof structure. Disassembling the meter may cause the meter to lose its pressure resistance or waterproof capability. Thus the user must not, in principle, disassemble the steam flow meter.

Prohibition of opening an energized steam flow meter

As a rule, an energized steam flow meter must not be opened for maintenance in a dangerous place. If the steam flow meter must be opened in violation of this rule, check with a gas detector to ensure that there is no flammable gas or vapor around the steam flow meter before opening it in order to maintain safety.

5-1: Maintenance

5-1-1: Maintaining waterproof capabilities

Whether the steam flow meter is a waterproof or explosion-proof model, the converter cover and meter cover use an O-ring for waterproofing. Prolonged use of an O-ring causes it to harden, making it less waterproof. To keep the converter and meter covers waterproof, replace the O-rings from time to time. If the steam flow meter is used at normal temperature, an O-ring needs to be replaced about every five years. If the meter is used at high temperatures, an O-ring needs to be replaced about every 3 years. These replacement times do not apply if a stuck case cover is removed by force, damaging the O-ring. When opening the covers, be sure to check the O-rings and replace them as necessary.

5-1-2: Maintaining explosion-proof capabilities

If the internal electrical circuit in a steam flow meter is exposed to flammable gas or vapor, explosion may occur, causing fire to come out of the casing of the meter. The steam flow meter of an explosion-proof type is designed to prevent such an accident. However, if the housing of the steam flow meter is corroded, the meter will lose its explosion-proofing.

To maintain the explosion-proof capabilities, check the case, covers, threads, and contact surfaces for corrosion, deformation, cracks, scratches, etc., when doing maintenance work. In addition, securely install the converter and meter covers and cable gland and lock them to ensure the explosion-proof performance.

5-1-3: Converter cover and meter cover

If the converter and meter covers are found to be cracked or if a screw is found to be missing, replace the covers or install a new screw.

5-1-4: Cable gland for explosion-proofing

Use as a replacement part a cable gland designed exclusively for this steam flow meter. The explosion-proof standards for the steam flow meter are based on the technical standards specified in TIIS. Thus a combination of a special cable gland and the steam flow meter ensures explosion-proof performance. Never use cable glands other than our genuine cable gland.

5-1-5: Changing an internal setting

To change an internal setting, contact your nearest Azbil Corporation branch office or dealer. The following settings are changeable:

Table 5-1. Changeable internal settings

Setting	Remarks
Tag number	Letters and numbers: 8 or less
Range	The range from minimum flow rate to maximum flow rate as specified in the specifications $\times 1.05$
Damping	0, 1, 2, 4, 8, 16, or 32 seconds
Low flow cutoff	3% by default
Analog output	Instantaneous flow rate, pressure, or temperature
LCD display output	Cumulative flow volume, instantaneous flow rate, or pressure and temperature
Unit for LCD display output	kg/h, kg/s, etc.
Burnout	Output if this device malfunctions: "High (21.2 mA)," "Low (3.8 mA)," or "None"

5-2: Replacement parts

The following replacement parts are available from an Azbil Corporation branch office or dealer:

A. STEAMcube Parts list

Table 5-2. Model No.: MVC32A/33A

No.	Part Name	Application Notes	Part Number	Qty
1	Cap assembly with glass window and O-ring	With window	80370008-001	1
2	Cap assembly without glass window and O-ring	Without window	80277719-001	1
3	Cover O-ring		80020935-183	1
4	Plug for explosion-proof use		80377115-0010C	1 or 0
5	Cable gland		80382734-001	1 or 2
6	Explosion proof packing type cable gland		80373094-001	1 or 2
11	Gasket		80372327-001	2
12	Bolts, Carbon Steel	Carbon Steel	80271420-023	4
		SUS304	80271420-020	4
14	LCD board		80372244-001	1
15	Cable for LCD board		80372234-125	1
16	Nameplate (non-explosion proof, engraved)		80372015-002	1
17	Screw		HS397503-0620C	2
18	Caution label		80372325-001	1

Table 5-2. Model No.: MVC32A/33A (Continued)

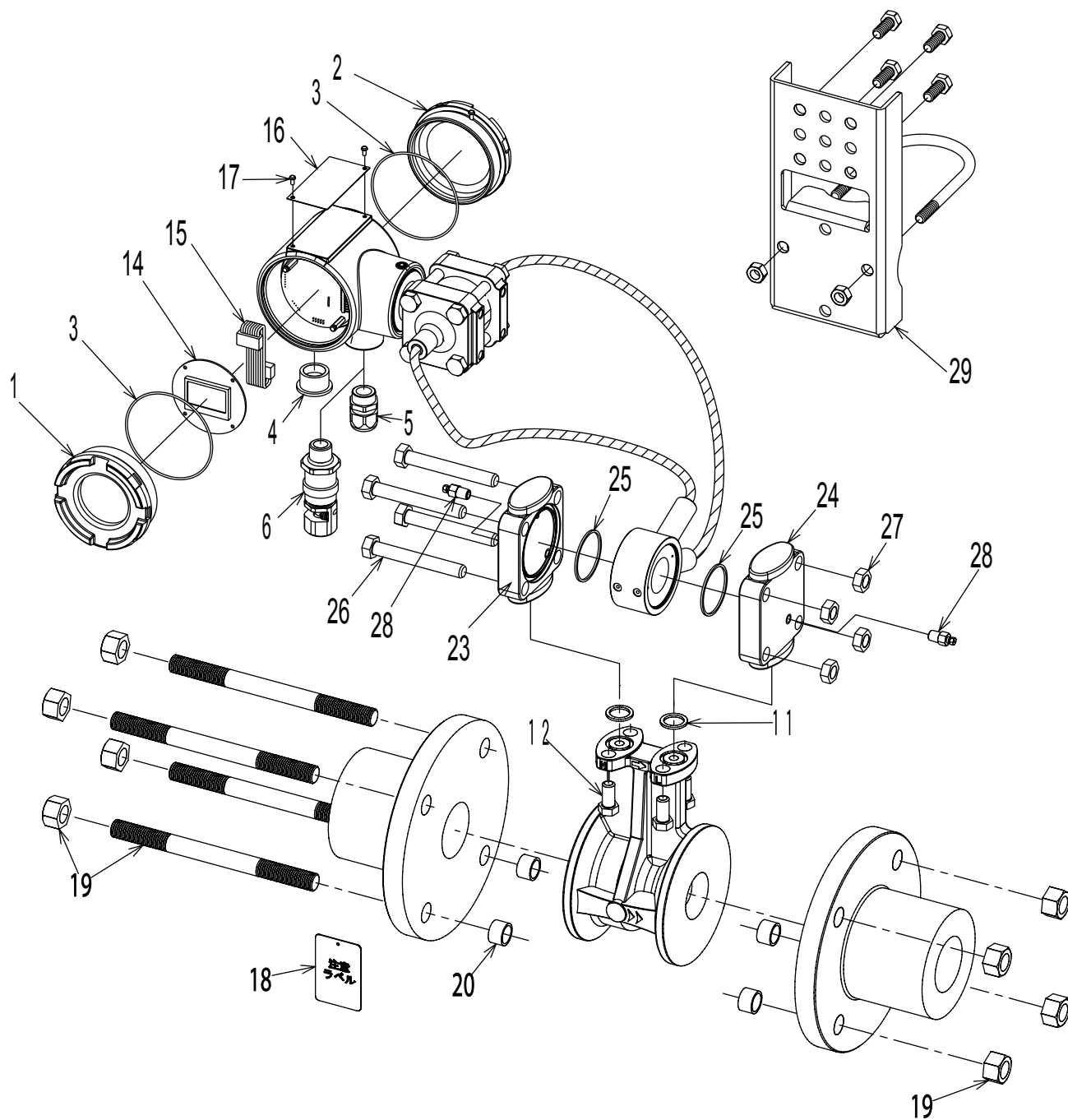
No.	Part Name	Application Notes	Part Number	Qty
19	Bolt Nut assembly (carbon steel)	JIS10K/25A	80372329-011	4
		JIS10K/40A	80372329-011	4
		JIS10K/50A	80372329-011	4
		JIS10K/80A	80372329-112	8
		JIS10K/100A	80372329-113	8
		JIS10K/150A	80372329-122	8
		JIS20K/25A	80372329-011	4
		JIS20K/40A	80372329-011	4
		JIS20K/50A	80372329-111	8
		JIS20K/80A	80372329-121	8
		JIS20K/100A	80372329-121	8
		JIS20K/150A	80372329-231	12
		ANSI150#/25A	80372329-061	4
		ANSI150#/40A	80372329-061	4
		ANSI150#/50A	80372329-071	4
		ANSI150#/80A	80372329-072	4
		ANSI150#/100A	80372329-173	8
		ANSI150#/150A	80372329-183	8
		ANSI300#/25A	80372329-071	4
		ANSI300#/40A	80372329-081	4
		ANSI300#/50A	80372329-172	8
		ANSI300#/80A	80372329-182	8
		ANSI300#/100A	80372329-183	8
		ANSI300#/150A	80372329-284	12
	Bolt Nut assembly (SUS304)	JIS10K/25A	80372329-511	4
		JIS10K/40A	80372329-511	4
		JIS10K/50A	80372329-511	4
		JIS10K/80A	80372329-612	8
		JIS10K/100A	80372329-613	8
		JIS10K/150A	80372329-622	8
		JIS20K/25A	80372329-511	4
		JIS20K/40A	80372329-511	4
		JIS20K/50A	80372329-611	8
		JIS20K/80A	80372329-621	8
		JIS20K/100A	80372329-621	8
		JIS20K/150A	80372329-731	12
ANSI150#/25A		80372329-561	4	
ANSI150#/40A		80372329-561	4	
ANSI150#/50A		80372329-571	4	
ANSI150#/80A		80372329-572	4	
ANSI150#/100A		80372329-673	8	
ANSI150#/150A		80372329-683	8	
ANSI300#/25A		80372329-571	4	
ANSI300#/40A		80372329-581	4	
ANSI300#/50A	80372329-672	8		
ANSI300#/80A	80372329-682	8		
ANSI300#/100A	80372329-683	8		
ANSI300#/150A	80372329-784	12		

Table 5-2. Model No.: MVC32A/33A (Continued)

No.	Part Name	Application Notes	Part Number	Qty
20	Centering collar	JIS10k/25A	80372326-116	4
		JIS10k/40A	80372326-114	4
		JIS10k/50A	80372326-112	4
		JIS10k/80A	80372326-110	4
		JIS10k/100A	80372326-135	4
		JIS10k/150A	80372326-018	2
		JIS20k/25A	80372326-116	4
		JIS20k/40A	80372326-114	4
		JIS20k/50A	80372326-112	4
		JIS20k/80A	80372326-120	4
		JIS20k/100A	80372326-118	4
		JIS10k/150A	80372326-019	2
		ANSI150#/25A	80372326-021	4
		ANSI150#/40A	80372326-020	4
		ANSI150#/50A	80372326-112	4
		ANSI150#/80A	80372326-111	4
		ANSI150#/100A	80372326-138	4
		ANSI150#/150A	80372326-014	2
		ANSI300#/25A	80372326-115	4
		ANSI300#/40A	80372326-022	4
ANSI300#/50A	80372326-139	4		
ANSI300#/80A	80372326-022	4		
ANSI300#/100A	80372326-142	4		
ANSI300#/150A	80372326-015	2		
22	Vertical adapter		80372323-001	
23	SWS cover flange R	Right side	80372324-001	
24	SWS cover flange L	Left side	80372324-002	
25	Gasket		80370271-002	
26	Bolt for head cover	Carbon Steel	80276389-001	
		SUS304	80276389-003	
27	Nut for head cover	Carbon Steel	80276390-001	
		SUS304	80276390-002	
28	Vent plug assembly		80277977-001	
29	Mounting bracket	Carbon Steel	80279919-008	
		SUS304	80279919-014	

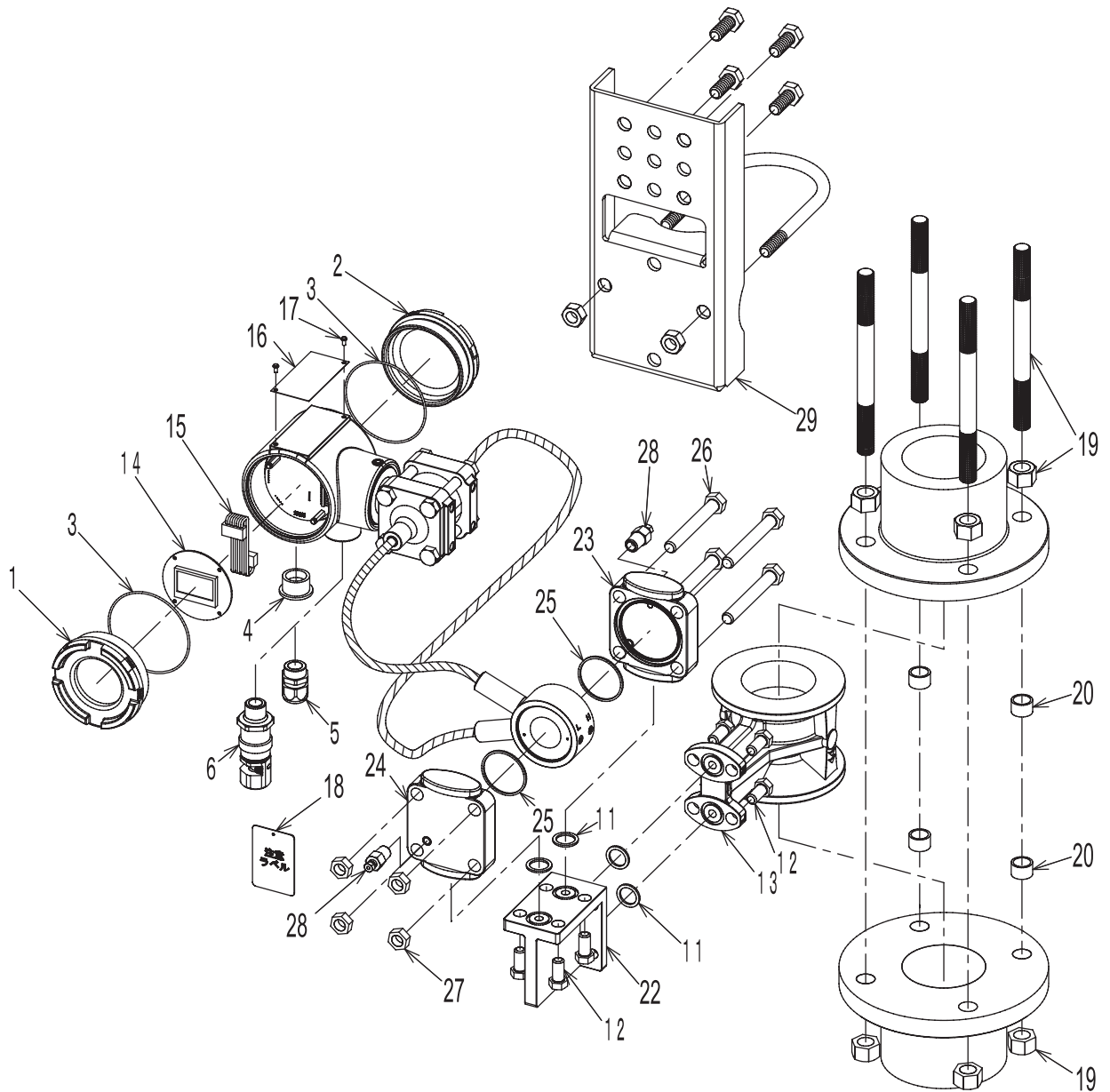
B-1. MVC32A/33A STEAMcube (Remote type)

Horizontal piping installation



B-2. MVC32A/33A STEAMcube (Remote type)

Vertical piping installation



5-3: Troubleshooting

If the steam flow meter does not operate or operates erratically, check it as described below. If the meter is found to have problems other than the following, immediately turn off the power to the meter and contact an Azbil Corporation branch office or dealer.

Table 5-3. Troubleshooting

Phenomenon	Action
The display does not operate.	<ul style="list-style-type: none"> • Check to ensure that the power is correctly connected. • Check to ensure that the correct power voltage is applied.
There is no analog output.	<ul style="list-style-type: none"> • Check to ensure that the power is correctly connected. • Check to ensure that the correct power voltage is applied.
There is no pulse output.	<ul style="list-style-type: none"> • Check to ensure that the power is correctly connected. • Check to ensure that the correct power voltage is applied. • The steam flow meter generates pulses of an open-collector type. Check whether the pulse counter or external equipment is supplying power to the meter.
The value of the analog output is wrong.	<ul style="list-style-type: none"> • Check to ensure that the setting for amount of analog output is correct. • Check to ensure that the range is correct. • Check to ensure that steam is flowing correctly without leaks.
The value of the pulse output is wrong.	<ul style="list-style-type: none"> • Check the pulse counter for proper operation. Check the weight of the pulse from the steam flow meter. • Check to ensure that the receiving specifications of the pulse counter are correct for the pulse output waveform from the steam flow meter.
Output remains at zero.	<ul style="list-style-type: none"> • Check to ensure that steam is flowing correctly without leaks. • Check to ensure that the settings are correct. • Check to ensure that the flow rate is not within the low-flow cutoff range.
Output shifts.	<ul style="list-style-type: none"> • Check to ensure that steam is flowing correctly without leaks. • Check if there is a reverse flow of steam. • Check to ensure that the steam flow meter is not tilted.

Table 5-3. Troubleshooting (Continued)

Phenomenon	Action
Output fluctuates.	<ul style="list-style-type: none">• Check to ensure that steam is flowing correctly without leaks.• Check if there is a reverse flow of steam.• Check to ensure that no condensate has collected inside.• Check to ensure that no equipment generating strong magnetism or using a large current is near the steam flow meter or its signal cables.
The LCD does not work.	<ul style="list-style-type: none">• Check to ensure that the correct power voltage is applied.• Check to ensure that the converter is not too hot or too cold.

5-4: FAQ (Frequently Asked Questions)

Frequently asked questions (FAQ) from users and their answers are given below for your information.

Table 5-4. FAQ

No.	Question	Answer
1	The steam flow meter produces output even after it stops. What should we do?	<ul style="list-style-type: none"> a) Close the valve upstream or downstream of the meter and check it for zero adjustment. Check the piping, including steam traps, for leaks. b) Check whether condensate in the piping causes a pressure difference across the meter in some way or another. The meter is of the differential pressure type, which converts pressure difference into a flow rate. Thus if it detects a pressure difference, the meter may output a flow rate.
2	The output is out of range. What should we do?	<ul style="list-style-type: none"> a) Check the range and extend the range if possible. b) Using the meter with its secondary side open may cause steam to expand. Such steam expansion may affect flow rate calculations by the meter. In such a case, the meter needs to be relocated to change its operating conditions. Alternatively, it is necessary to change the range or meter diameter.
3	How can we change a setting?	A special tool can be used to change a setting. For further information, contact an Azbil Corporation dealer. Azbil's SFC (smart field communicator) cannot be used for the steam flow meter. A special tool will be available soon.

Table 5-4. FAQ (Continued)

No.	Question	Answer
4	What settings are changeable?	<p>The following settings are changeable:</p> <ul style="list-style-type: none"> a. Flow rate range (*range limits are specified for each steam meter diameter.) b. Units (*any applicable SI units) c. Pulse weight d. Burnout e. Dumping f. Low-flow cutoff g. Installation height h. Tag No. i. Output (selectable from among mass flow rate, constant-density mass flow rate, volume flow rate, pressure, and temperature) j. Display (main or auxiliary, selectable from among cumulative flow, instantaneous flow rate, pressure, and temperature)
5	How should we relocate the steam flow meter to another place?	<p>The meter makes flow rate calculations, using measured saturation steam pressure converted into density. For this purpose the meter uses the primary pressure measured by the detector. Because primary pressure changes when the meter is relocated (the positional relationship between the detector and converter changes), the primary pressure needs to be corrected. Thus the height setting on the converter needs to be changed.</p>
6	Can the amount of condensate in the detector unit's self water seal drop to zero?	<p>Saturated steam flowing through the meter condenses as it cools down, so condensate in the self water seal does not run out. However, if the pressure in the piping sharply decreases, condensate may vaporize rapidly. Exercise utmost care if pressure changes (pressure releases) frequently occur.</p>

Table 5-4. FAQ (Continued)

No.	Question	Answer
7	Will it cause a problem if condensate in the detector unit's self water seal freezes?	<p>a) If condensate in the self water seal freezes when the meter is in use, output will become constant or abnormal, and the meter cannot be used.</p> <p>b) If condensate in the self water seal freezes when the meter is not in use such as when the plant is stopped, the meter will not suffer damage. If the meter is restarted with condensate frozen in the self water seal, it will remain frozen for some time, so that abnormal output may occur.</p>
8	How can the meter measure temperature without a thermometer?	The steam flow meter has a steam table in its converter. On the assumption that steam is saturated, the meter calculates the saturation temperature from the saturation pressure and displays the resulting value.
9	Why does the meter read 100 °C even though there is no steam flow?	On the assumption that steam is saturated, the meter displays and outputs the saturated temperature, using a pressure measurement. Thus if there is no steam flow through the meter, it calculates a temperature corresponding to atmospheric temperature from the steam table and outputs the temperature.
10	Is there any difference between steam densities calculated from the steam table and from pressure?	<p>We think that there is no difference under stable conditions. However, if a steam trap, which is unique to steam piping, causes the flow rate to increase sharply, some difference may result.</p> <p>In such a case, temperature reacts slowly to a sharp increase in the flow rate, while pressure reacts to it quickly. Thus correction based on pressure provides more accurate output than correction based on temperature.</p>
11	Is there any difference between the cumulative flow volume obtained with pulse output and analog output?	Because of faster scanning, the cumulative flow calculated by the meter is more accurate than the analog cumulative flow using a DCS. For a receiver receiving pulse output, it is better to monitor auxiliary variables like pressure using analog output.

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

Azbil Corporation's products other than those explicitly specified as applicable (e.g. azbil Limit Switch For Nuclear Energy) shall not be used in a nuclear energy controlled area (radiation controlled area).

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.

In addition,

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
[For use outside nuclear energy controlled areas] [For use of Azbil Corporation's Limit Switch For Nuclear Energy]
 - * 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. 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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