azbil

No. CP-SP-1119E

CMS1500
Gas Mass Flow Meter
User's Manual

Thank you for purchasing the CMS1500 Gas Mass Flow Meter.
This manual contains information for ensuring correct use of the CMS1500. It also provides necessary information for installation, maintenance and troubleshooting. This manual should be read by those who design and maintain devices that use the CMS1500. Be sure to keep this manual nearby for handy reference.

Yamatake Corporation

RESTRICTIONS ON USE

This product has been designed, developed and manufactured for general-purpose application in machinery and equipment.
Accordingly, when used in applications outlined below, special care should be taken to implement a fail-safe and/or redundant design concept as well as a periodic maintenance program.

- Safety devices for plant worker protection
- Start/stop control devices for transportation and material handling machines
- Aeronautical/aerospace machines
- Control devices for nuclear reactors

Never use this product in applications where human safety may be put at risk.

REQUEST

Ensure that this User's Manual is handed over to the user before the product is used.

Copying or duplicating this User's Manual in part or in whole is forbidden. The information and specifications in this User's Manual are subject to change without notice.

Considerable effort has been made to ensure that this User's Manual is free from inaccuracies and omissions.
If you should find any inaccuracies or omissions, please contact Yamatake Corporation.

In no event is Yamatake Corporation liable to anyone for any indirect, special or consequential damages as a result of using this product.

SAFETY PRECAUTIONS

■ About Icons

Safety precautions are for ensuring safe and correct use of this product, and for preventing injury to the operator and other people or damage to property. You must observe these safety precautions. The safety precautions described in this manual are indicated by various icons.
As the following describes the icons and their meanings, be sure to read and understand the descriptions before reading this manual:

⚠**WARNING**	Warnings are indicated when mishandling this product might result in death or serious injury to the user.
⚠**CAUTION**	Cautions are indicated when mishandling this product might result in minor injury to the user, or only physical damage to this product.

■ Examples

	Triangles warn the user of a possible danger that may be caused by wrongful operation or misuse of this product. These icons graphically represent the actual danger. (The example on the left warns the user of the danger of electrical shock.)
	White circles with a diagonal bar notify the user that specific actions are prohibited to prevent possible danger. These icons graphically represent the actual prohibited action. (The example on the left notifies the user that disassembly is prohibited.)
	Black filled-in circles instruct the user to carry out a specific obligatory action to prevent possible danger. These icons graphically represent the actual action to be carried out. (The example on the left instructs the user to remove the plug from the outlet.)

⚠WARNING

⃠	**Do not use this device for oxygen or flammable gases.** **Materials of this device are not selected on the premise that it is used for oxygen or flammable gases. In addition, oil-inhibiting treatment is not performed to the gas-contacting sections.**

⚠CAUTION

❗	**Prevent foreign matter from entering the device.** **If the rust, water droplet, oil mist or dust in the piping flows into the device, measurement error might occur and result in damaging the device.** **If there is a possibility that any foreign matter flows into the device, provide a filter, strainer or mist trap capable of eliminating more than 1μm foreign matter at the upstream, and periodically inspect and replace the filter.**
⃠	**This device is a precision instrument. Do not drop it nor subject it to shock. Doing so might damage the device.**
⃠	**Do not operate the keys with a propelling pencil or sharp-tipped object. Doing so might cause faulty operation.**
⃠	**Do not use this device outside of the operating pressure range. Also, do not subject this device to a pressure above the pressure resistance. Doing so might damage this device.**
⃠	**Do not peel off the pipe connector port seals until immediately before you connect the piping. Doing so might allow foreign objects to enter the connector port and cause defective operation.**
❗	**When connecting piping, fasten the flange section of the pipe connector port, and turn the pipe side to connect.**
❗	**When mounting the device, firmly fasten to prevent vibration.**
⃠	**Do not overapply sealant. Allowing entry of dirt or burrs inside the pipes might cause error.**
❗	**Mount this device horizontally. Do not mount so that the display is facing down.** **Doing so might cause error or trouble.**
❗	**When using a relay as the contact for integrated count reset input, use a relay (gold contact type) for low currents.** **Otherwise, defective contact may cause the device to malfunction.**

⚠CAUTION

❗	**If there is a risk of a power surge caused by lightning, use Yamatake Corporation's SurgeNon to prevent possible fire or equipment failure.**
❗	**Be sure to check that the wiring is correct before you turn the power ON. Incorrect wiring might cause damage or malfunction.**
🚫	**Do not remove a resin cover and disassemble pipe connections. Doing so might case malfunction.**
🚫	**Do not hold a resin cover portion at the time of carrying or piping this device. Doing so might damage the cover, or dropping the device due to slipping might result in getting hurt.**
❗	**Make sure that the selected analog output type matches the input type of the receiving device. The output-receiving device could be damaged if the analog output type selection is incorrect.**

Conventions Used in This Manual

The following conventions are used in this manual:

Handling Precautions : Handling Precautions indicate items that the user should pay attention to when handling the **CMS1500.**

Note : Notes indicate useful information that the user might benefit by knowing.

☞ : This indicates the item or page that the user is requested to refer to.

(1), (2), (3) : The numbers with the parenthesis indicate steps in a sequence or indicate corresponding parts in an explanation.

03, P-07 : This indicates 7-segment indication on the setup display.

(MODE) key : This indicates a key on the setup display.

Contents

Chapter 1. INTRODUCTION

■ Introduction

The CMS1500 Gas mass flow meter uses μF™ (Micro Flow™) sensor in the sensing section. The μF sensor is a thermal flow speed sensor made using proprietary technology. Integrating this ultra-minute flow speed sensor with high-grade channel design technology has achieved high accuracy and high rangeability.

■ Features

- Incorporates a μF sensor made possible by silicon micro-machining technology and thin-film forming technology.
  One side of the μF sensor is a mere 1.7mm, and at a thickness of 0.5mm, this thermal flow speed sensor exhibits high sensitivity and response.
- As the CMS1500 is a mass flow meter, it is not influenced by temperature nor pressure.
- High accuracy of ±5%RD* and high rangeability of 50:1.
- Models with display meter are provided with extensive functions to suit a wide range of applications: analog output, event output, integrating/reverse-integrating display, output scaling, gas type selection.
- Through the RS-485 communications, the integrated flowrate can be read out correctly.

🕮 Note

*: "RD" (Reading) indicates the accuracy of the read value.

■ Model selection guide

The following shows the model Nos. for this flow meter:

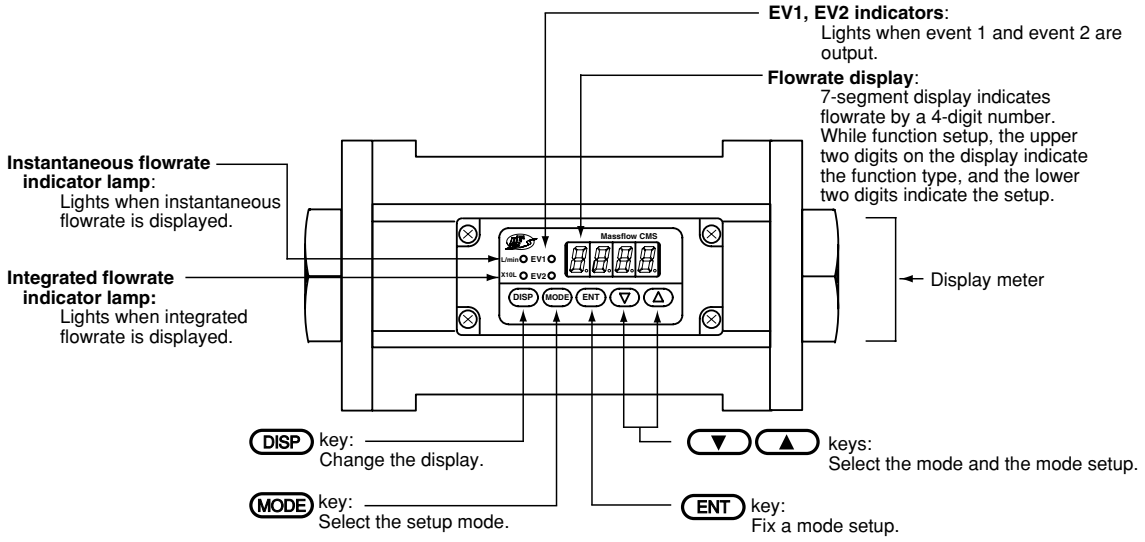
Basic model No.	Flowrate range	Model type	Material	Connection method	Gas type	Out-put	Optional function 1	2	3	4	Appended No.	Description
CMS												Gas Mass Flow Meter
	1500											Standard flowrate range 0 to 1500L/min (standard)*
		B										Model with display
			A									Aluminium
				R								Rc1
					N							Air / Nitrogen, Argon,Carbon dioxide (CO_2)
						2						Analog output 0-5Vdc, 1-5Vdc, 4-20mA
							1					With RS-485 communications
								0				Without optional function
									0			Additional treatment not supported
										0		Without options
										D		Inspection certificate provided
										Y		Traceability certification provided
											0	Product version

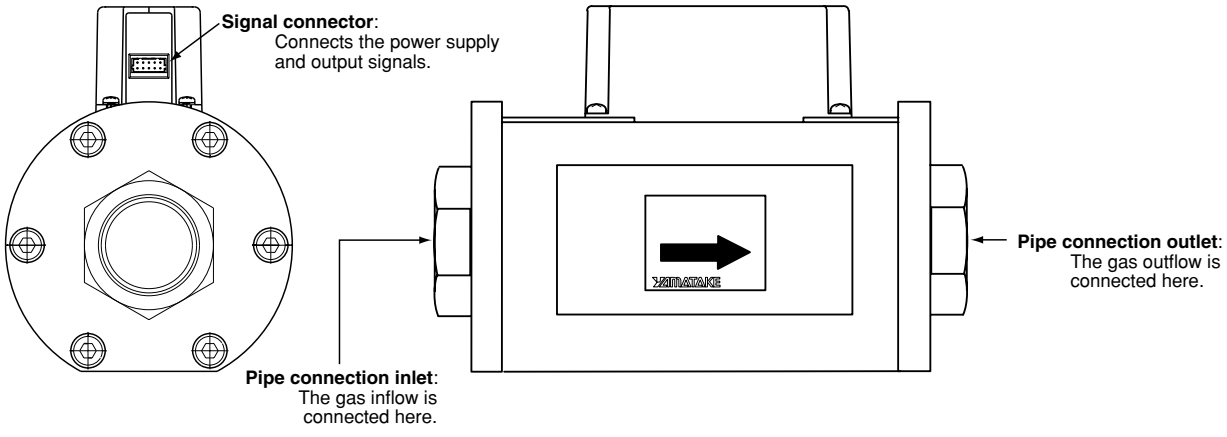
🕮 Note

*: "L/min(standard)" refers to a flowrate after conversion to 20°C in air 101.325kPa (1 atmospheric pressure).

Chapter 2. NAMES AND FUNCTIONS OF PARTS

The following describes the names and functions of parts:





Chapter 3. MOUNTING AND WIRING

⚠WARNING

Do not use this device for oxygen or flammable gases.
Materials of this device are not selected on the premise that it is used for oxygen or flammable gases.
In addition, oil-inhibiting treatment is not performed to the gas-contacting sections.

⚠CAUTION

Prevent foreign matter from entering the device.
If the rust, water droplet, oil mist or dust in the piping flows into the device, measurement error might occur and result in damaging the device.
If there is a possibility that any foreign matter flows into the device, provide a filter, strainer or mist trap capable of eliminating more than 1μm foreign matter at the upstream, and periodically inspect and replace the filter.

Do not use this device outside of the operating pressure range. Also, do not subject this device to a pressure above the pressure resistance.
Doing so might damage this device.

Do not peel off the pipe connector port seals until immediately before you connect the piping. Doing so might allow foreign objects to enter the connector port and cause defective operation.

When connecting piping, fasten the hexagonal section of the pipe connector port, and turn the pipe side to connect.

When mounting the device, firmly fasten to prevent vibration.

Do not overapply sealant. Allowing entry of dirt or burrs inside the pipes might cause error.

Do not hold a resin cover portion at the time of carrying or piping this device. Doing so might damage the cover, or dropping the device due to slipping might result in getting hurt.

Do not remove a resin cover and disassemble pipe connections.
Doing so might cause malfunction.

■ Mounting

● Installation site

Avoid mounting the CMS1500 in the following locations:

1. Locations where operating temperature falls below -10˚C and rises above 60˚C
2. Locations where operating humidity exceeds 90%RH
3. Locations subject to sudden changes in temperature and condensation
4. Locations subject to corrosive gases and flammable gases
5. Locations where there are lots of conductive substances (e.g. dust, salt or iron dust), water droplets, oil mist or organic solvents
6. Locations subject to vibration or shock
7. Locations subject to direct sunlight
8. Locations splashed by water or rain
9. Locations subject to splashing by fluids (e.g. oil, chemicals.)
10. Locations where strong magnetic or electrical fields are generated

■ Pipes

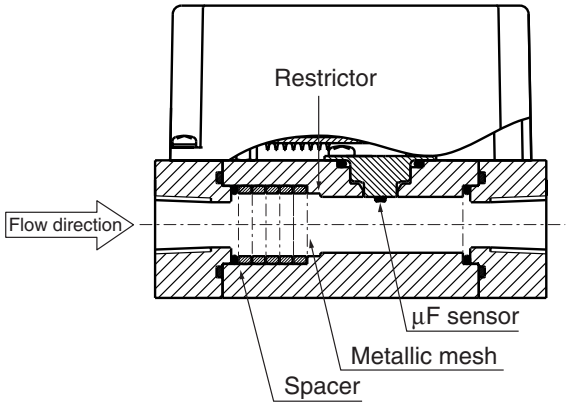
● Precautions for piping installation

This device is a precision instrument. If foreign matter such as dust, oil mist or water enters the device, it may cause measurement error or faulty operation. When installing piping, be sure to follow the procedures below to prevent foreign matter from entering the device.

1. Before installing the device, be sure to flush the upstream and downstream piping thoroughly to remove welding fume particulate and dust.
2. Be sure to wipe the inside of the pipe to be directly connected to this device.
3. After the above two operations are complete, check to be sure that there is no welding fume particulate or dust, and then install the device.

Handling Precautions

- If foreign matter cannot be fully eliminated by flushing or wiping, or if the regular presence of foreign matter can be expected, be sure to install a filter. If dust, oil or moisture adheres to the metallic mesh or to the Micro Flow sensor chip, measurement error or device failure may result.

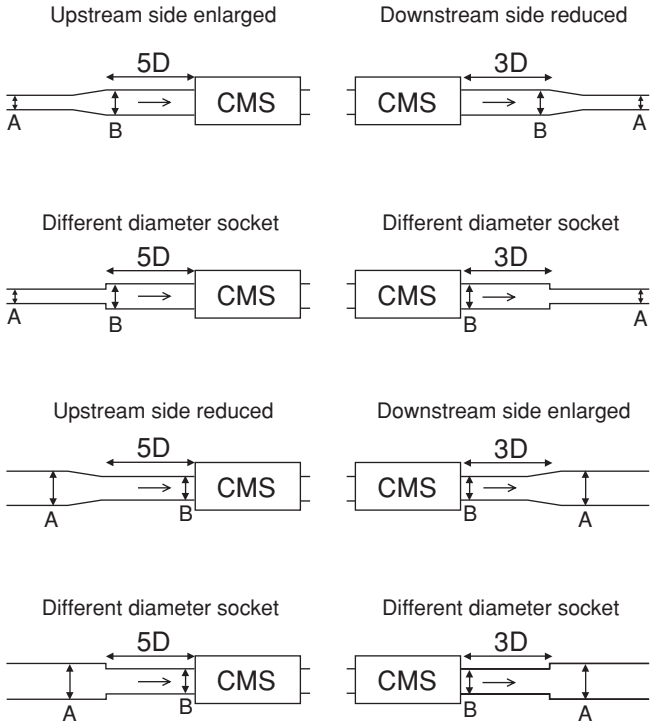


● Filter installation

For a dedicated filter, contact Yamatake Corporation.
For applications with compressed air or propane, which regularly contain oil mist, or applications where rust in the piping is expected, be sure to install a filter.
Model Number : MFF100 series
Specifications: For details, refer to "Lineup of Mist Separators and Filters for Micro Flow Sensors," Yamatake specifications sheet CP-SS-1824E.

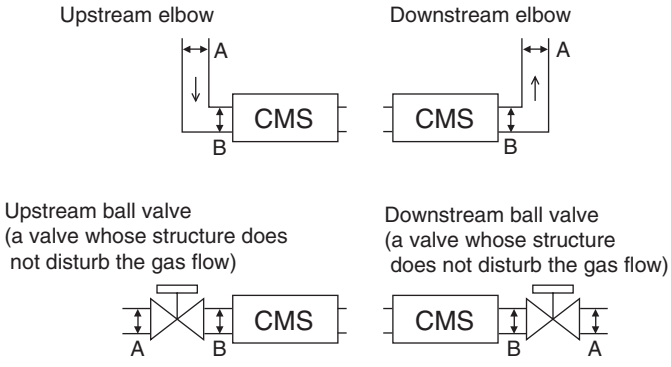
● Straight pipe section

In case of different diameter piping (diameters A and B are different), a straight pipe section is required.



D indicates the connecting port size.
CMS1500: 25mm

In case of same diameter piping (diameters A and B are the same), a straight pipe section is not required.

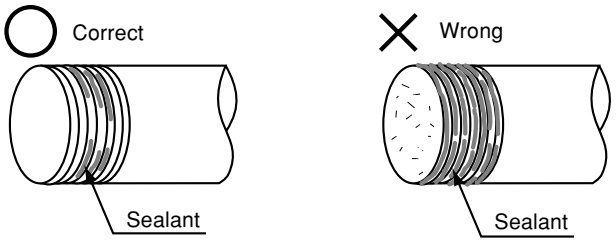


! Handling Precautions

- When using a valve that disturbs the gas flow, such as a butterfly valve, put a 5D straight pipe section between the CMS and the valve.

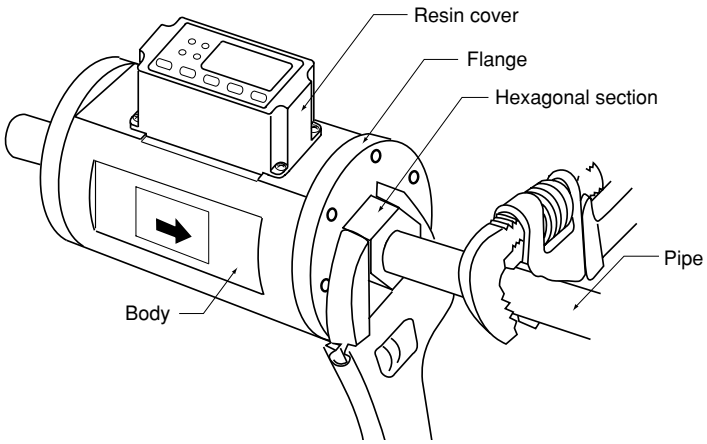
- **Coating sealant**

  Coat with an appropriate amount of sealant. Do not coat the top two threads of the screw. Remove any dirt or burrs from inside the pipes.



- **Connecting Pipes**

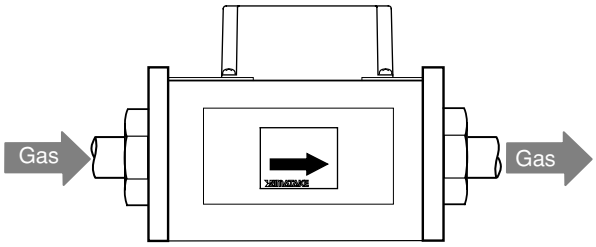
  Connect pipes while gripping the hexagonal section of the pipe connection port with a spanner or wrench.



Handling Precautions

- Do not grip and turn the body. Doing so might damage the body or cause leakage.
- When connecting pipes, do not grasp the resin cover. Doing so might damage the cover.

- **Gas flow**



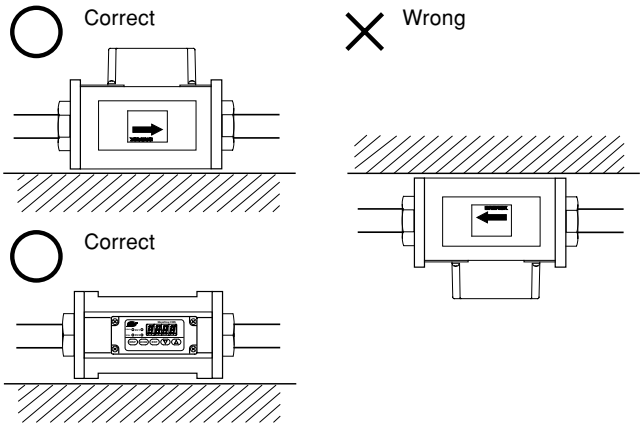
Handling Precautions

When feeding gas into the meter, make it flow following the arrow on the side of the channel. If gas is fed in the opposite direction, the gas flow cannot be measured accurately.

● **Mounting the body**

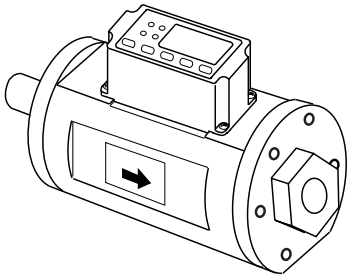
⚠CAUTION
Mount this device horizontally. Do not mount so that the display is facing down. Doing so might cause error or trouble.

- **Mounting Position**

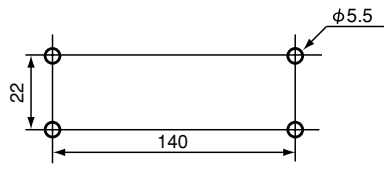


- **Mounting**

  Install this device from the rear by the four M5 screws using the mounting holes on the base of the device. (M5: depth 10mm)



Hole dimensions Unit:mm



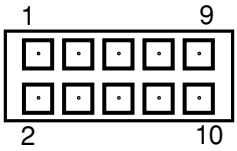
■ Wiring

⚠ CAUTION

- When using a relay as the contact for integrated count reset input, use a relay (gold contact type) for low currents.
  Otherwise, defective contact may cause the device to malfunction.
- If there is a risk of a power surge caused by lightning, use Yamatake Corporation's SurgeNon to prevent possible fire or equipment failure.
- Be sure to check that the wiring is correct before you turn the power ON.
  Incorrect wiring might cause damage or malfunction.

We recommend using a harness with connector (sold separately).

● Connector pin layout



View from connector end

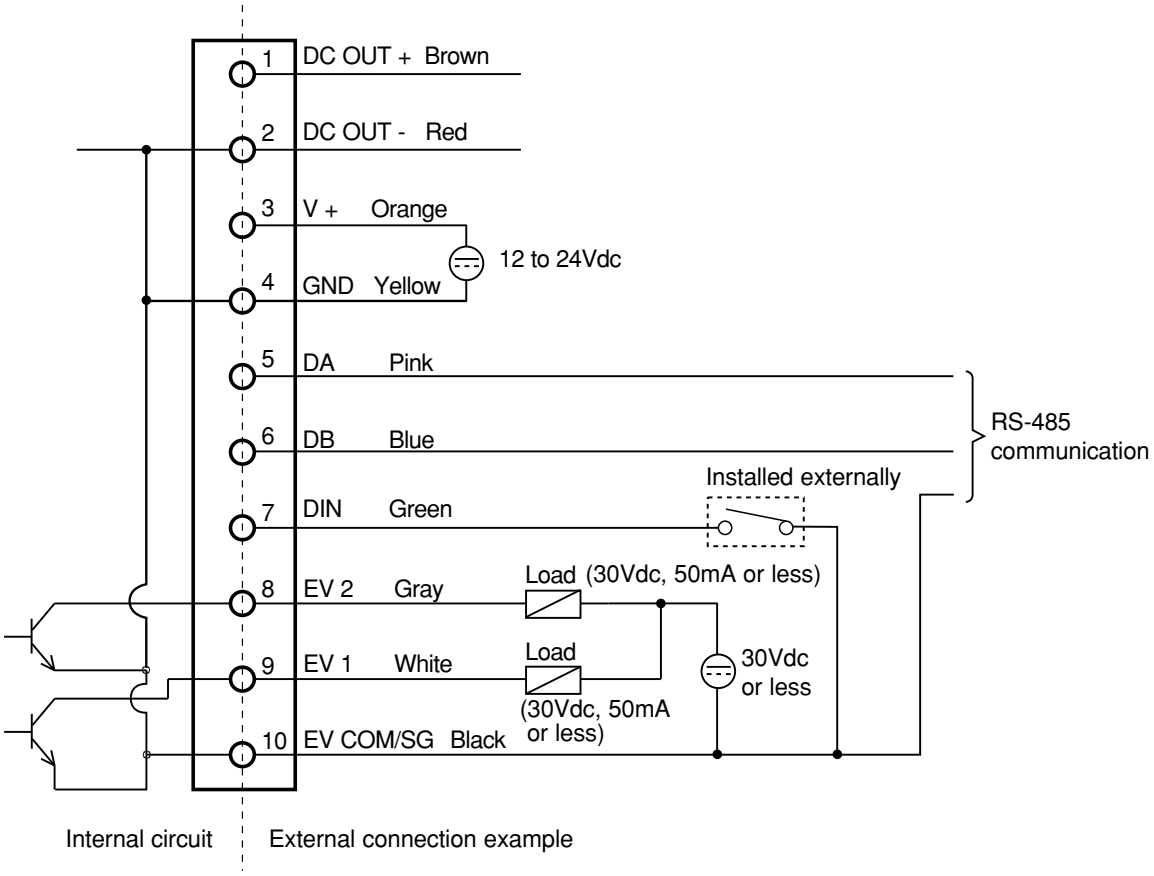
Compatible connector:
DF11-10DS-2C made by HIROSE ELECTRIC CO., LTD.

Item	Model number	Remarks
Harness with dedicated connector (One harness is required for one CMS unit.)	81446594-005	Harness (2m) for model without communications – plain wire termination
	81446594-006	Harness (5m) for model without communications – plain wire termination
	81446594-007	Harness (2m) for model with communications – M3.5 Y-terminals
	81446594-008	Harness (5m) for model with communications – M3.5 Y-terminals

• Connector signal names

Pin number	Signal name	Description	Remarks
1	DC OUT+	Instantaneous flowrate output +	
2	DC OUT-	Instantaneous flowrate output -	
3	V +	Power + (12 to 24Vdc)	
4	GND	Power GND	
5	DA	For RS-485 communications	Connect RS-485 model only
6	DB		
7	DIN	Integration count reset input	
8	EV2	Event 2 output/Integration pulse output	
9	EV1	Event 1 output/Serial data output	
10	EVCOM/SG	Event output common/SG for RS-485	

● **Connection example**

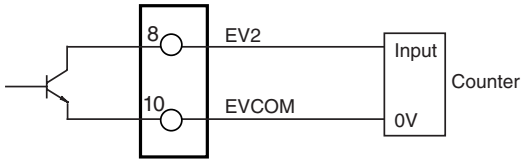


Handling Precautions

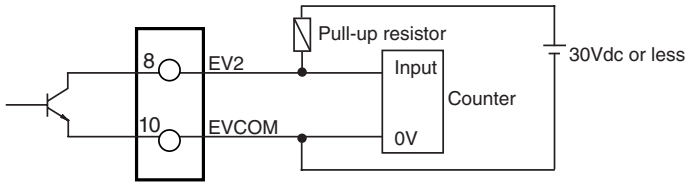
- Power source GND, instantaneous flow rate output (-), and event output common lines are all connected inside this device. If these lines are connected to an external device through a common power supply, interference will cause device failure or faulty operation.
- Take care that the event output does not exceed the output rating of this device. If a relay is used, the coil should have a built-in surge absorption diode. Otherwise device failure could occur.

● Connection of totalizer pulse output to a counter.

- Non-voltage input type

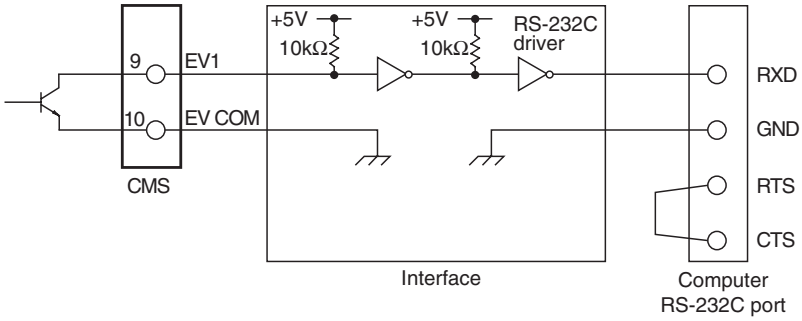


- Voltage input type



● Use of flow rate serial data output

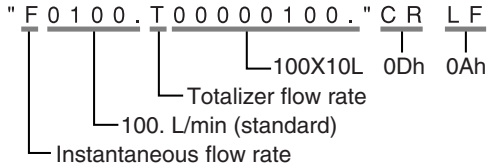
- Connection example



- Communications protocol

  Currently displayed instantaneous flow rate data and totalizer flow data is sent as ASCII code. "F" and the instantaneous flow rate data is sent first, followed by "T" and the totalizer flow data.

  Example: The instantaneous flow rate is 100. L/min (standard), and the totalizer flow is 100 x 10L.



- Communications specifications

Item	Description
Communications system	RS-232C, start-stop transmission
Transmission speed	9600bps
Character length	8 bits
Stop bit	2
Parity	None
Data transmission cycle	100±10ms

Chapter 4. METHOD OF OPERATION

⚠CAUTION

Do not operate the keys with a mechanical pencil, screwdriver, or other sharp-tipped object. Doing so might cause faulty operation.

Make sure that the selected analog output type matches the input type of the receiving device. The output-receiving device could be damaged if the analog output type selection is incorrect.

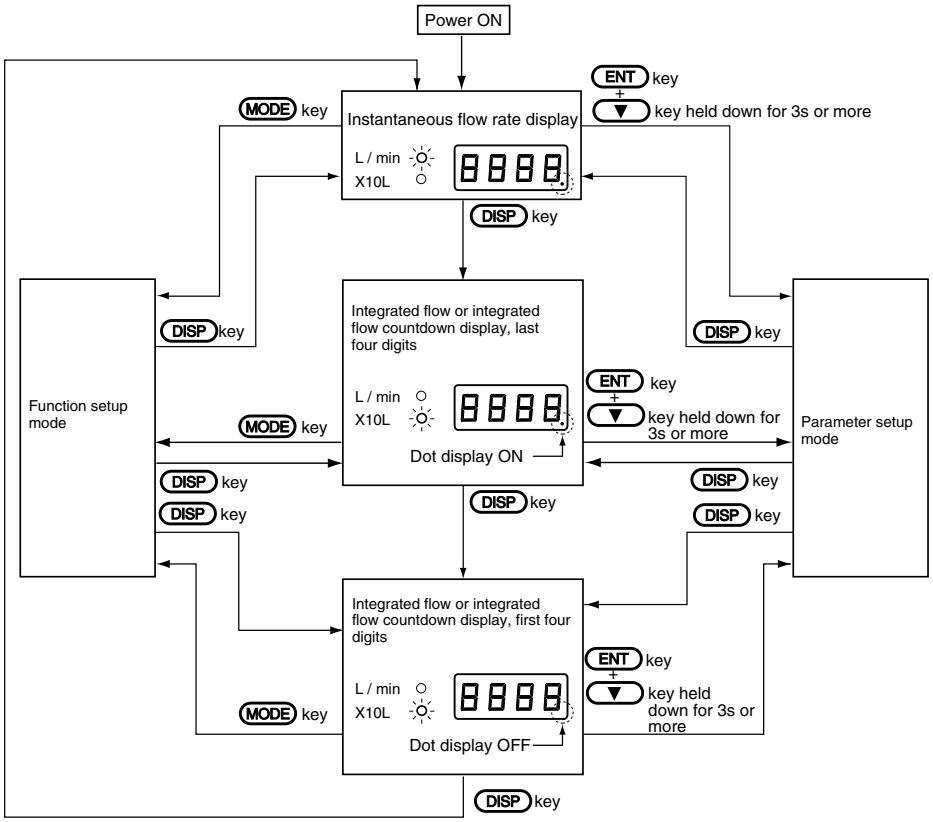
■ State transition diagrams

Upon power-up, with the factory settings, the instantaneous flow rate is displayed and the instantaneous flow rate indicator lamp lights up.

The diagram below shows the relationship between a change in mode and the display.

If the measurement mode (function setup item 02) is set to 01 or 02, the last four digits of the integrated flow or integrated flow countdown can be displayed by pressing the DISP key while the instantaneous flow rate is displayed. Pressing DISP again displays the first four digits of the integrated flow or integrated flow countdown. Pressing DISP again returns the display to the instantaneous flow rate.

When the power is turned OFF and then back ON again, the display state before the power was turned OFF resumes.



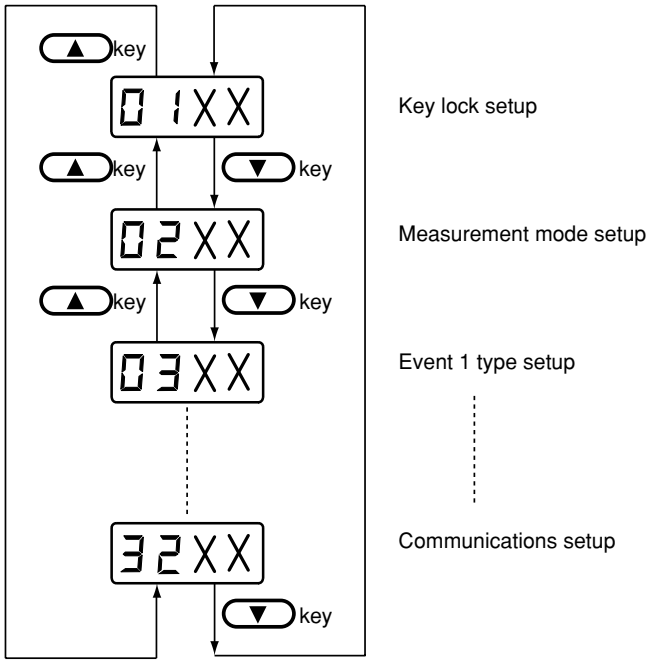
Handling Precautions

- If the MODE key is pressed during setup, the setting returns to its previous value.
- Leave the device powered up for about 30min before use to allow it to stabilize.

■ Function setup

To enter the setup mode, press the MODE key. The first two digits on the display blink. The first two digits identify the function setup item, and the second two digits indicate the setting for that item.

- Pressing the ▼ key moves the display to the next setup item. Pressing the ▲ key moves to the previous setup item.



- Pressing ▼ key when 32 is displayed changes the display to 01.
- Pressing ▲ key when 01 is displayed changes the display to 32.
- When the first two digits display the desired setup item, press the ENT key while it is blinking. This selects the setup item, and the second two digits blink.
- Press the ▲ and ▼ keys to select the desired setting, and then press ENT key. All four digits light up.
- Check that the item and the setting are correct.
- The table on the following pages shows all the functions and settings.

● **Function setup menu**

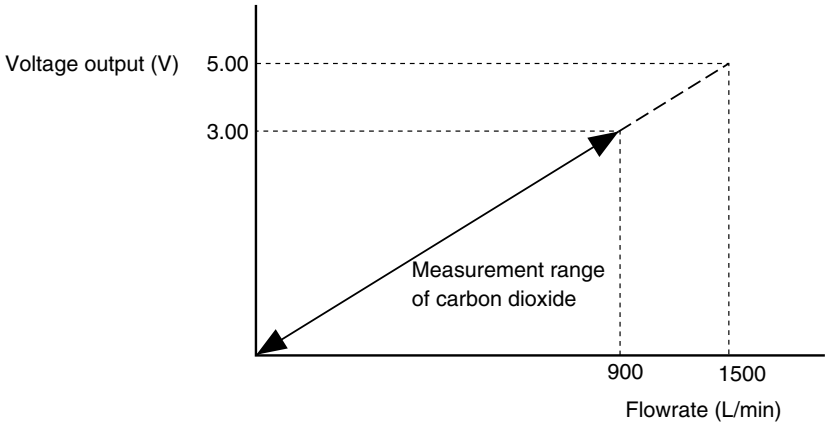
Item	Function	Setting	Setting description	Factory setting	Remarks
01	Key lock	00 01	Key lock disabled Lock ON	00	When key lock is ON, other function and parameter settings can be checked, but cannot be changed.
02	Measurement mode	00 01 02	Only instantaneous flow rate is measured. Instantaneous flow rate and integrated flow are measured. Instantaneous flow rate and integrated flow countdown are measured.	01	
03	Event 1 type (EV1)	00 01 02 03 04 05 06	Not used Instantaneous flow rate upper limit value Instantaneous flow rate lower limit value Integrated flow count up Reverse integrated flow count down Flow rate data serial output Error output	00	Integrated flow count, integrated flow countdown, and totalizer pulse output settings are effective only when function setup item 02 is set to 01 or 02. Integrated flow count and integrated flow countdown cannot be set simultaneously.
04	Event 2 type (EV2)	00 01 02 03 04 05 06 07	Not used Instantaneous flow rate upper limit value Instantaneous flow rate lower limit value Integrated flow count up Reverse integrated flow count down Totalizer pulse output rate 10L/pulse Totalizer pulse output rate 100L/pulse Totalizer pulse output rate 1000L/pulse	00	
05	ON delay setting (EV1)	00 01	Disabled ON	00	Valid only when function 03 is set to 01 or 02.
06	ON delay setting (EV2)	00 01	Disabled ON	00	Valid only when function 04 is set to 01 or 02.
07	Event standby setting	00 01	Disabled ON	00	Valid only when function 03 or 04 is set to 02. ☞Page 17
08	Gas type selection	00 01 02 08	Air/nitrogen Argon Carbon dioxide (CO_2) User specified	00	When gas type is changed, sometimes flowrate measurement rate changed. ☞Page 20
09	Analog output scaling	00 01 02 03 04	0 to 1500L/min 0 to 900L/min 0 to 600L/min 0 to 300L/min Desired scaling	00	For details, ☞Page 15.
10	Analog output type selection	00 01 02	0 to 5V 1 to 5V 4 to 20mA	02	Make sure that the selected analog output type matches the input type of the receiving device.
11	Reference temperature	00 to 35	0 to 35°C (in 1°C intervals), 101.325kPa (1atm) standard	20	
12	Low flow cutoff	00 01 02 03 04	No low flow cutoff Cutoff below the rated minimum display (15L/min) 15L/min 37.5L/min 75L/min	01	If gas type (function setup 08) is set to "user specified"(08), the low flow cutoff is the amount set here multiplied by CF, the gas type conversion (parameter setup P-08). 01 and 02 are the same value.

Item	Function	Setting	Setting description	Factory setting	Remarks
30	Communications address	00 01 to 99	Communication function disabled Communication address	00	
31	Transmission speed	00 01 02	9600bps 4800bps 2400bps	00	
32	Data format	00 01	8 data bits, even parity, 1 stop bit 8 data bits, no parity, 2 stop bits	00	

*** Analog output scaling**

If gas type selection (function setup 08) is changed, the measurable flow rate range changes as specified on page 21 ("Maximum measurable flow rate for each gas type"). However, scaling according to the analog output scaling setting will be applied to the output regardless of what gas type is selected.

Example: If gas type (function setup 08) is changed to 02 (carbon dioxide), the measurable flow rate range changes to 0 to 900 L/min. If scaling is set to 00 (0 to 1500 L/min), the 0 to 5V output will be as shown below.



It the output type is 0 to 5V, and if output scaling is used, the maximum output voltage can be calculated as follows.

- When gas types 00 to 02 are selected

$$\frac{\text{Max. measurable flow rate for the gas}}{\text{Scaling upper limit value}} \text{ X5V}$$

- When gas type 08 is selected

$$\frac{\text{Max. measurable flow rate for the gas}}{\text{Scaling upper limit value}} \text{ X } \frac{1}{\text{Gas type conversion factor}} \text{ X5V}$$

For the maximum measurable flow rate for each gas, see page 20.
The gas type conversion factor is set in parameter setup; see pages 16.

■ Parameter setup

If the key lock function is ON, parameter settings cannot be changed.

To enter the parameter setup mode, hold down the ENT and ▼ keys simultaneously for at least three seconds. If conditions do not allow parameter setup, "P---" is displayed.

Otherwise, in parameter setup mode, P-** is displayed. The last two digits identify the parameter setup item.

Pressing the ▼ key moves the display to the next setup item. Pressing the ▲ key moves to the previous setup item.

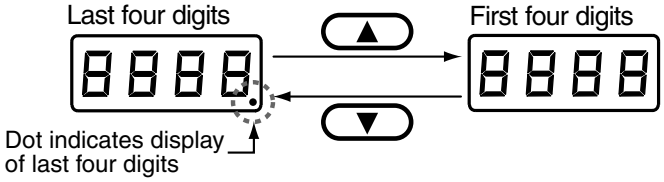
The currently set value for that item is displayed.

If the ENT key is pressed again, the last digit blinks.

If you press the MODE key, the blinking cursor moves to the left. To change the setting at each of these digits, use the ▲ and ▼ keys.

To change the setting to the displayed value, press the ENT key.

If event type (function setup 03 or 04) has been set to 03 or 04, the setting of 8-digit numbers is necessary in P-01, 02 and 07. To do this, switch between the first 4 digits and the last 4 digits as shown below.



Whether parameters P-01 to P-09 are displayed for setup depends upon the function settings. The following tables show the parameters and the necessary function settings.

Parameter	Description	Factory setting	Setting range	Conditions for display (function settings)
P-01	Event output 1 setting value (EV1)	0.	0 to 9995 (L/min)	Item 03 is 01 or 02
		00000000.	0 to 99999999 (X 10L)	Item 03 is 03 or 04
P-02	Event output 2 setting value (EV2)	0.	0 to 9995 (L/min)	Item 04 is 01 or 02
		00000000.	0 to 99999999 (X 10L)	Item 04 is 03 or 04
P-03	EV1 hysteresis	50.	0 to 100 (L/min)	Item 03 is 01 or 02
P-04	EV2 hysteresis	50.	0 to 100 (L/min)	Item 04 is 01 or 02
P-05	EV1 ON delay	0	0 to 60 (s)	Item 03 is 01 or 02
P-06	EV2 ON delay	0	0 to 60 (s)	Item 04 is 01 or 02
P-07	Initial value for integrated flow countdown	00000000.	0 to 99999999 (X 10L)	Item 02 is 02
P-08	Gas type conversion factor	1.000	0.100 to 8.000	Item 08 is 08
P-09	Analog output scaling	100	10 to 250 (%)	Item 09 is 04

! Handling Precautions

- Set a value for event output that is within the measurable range.

■ Display OFF mode

If the DISP key is held down for at least three seconds, all display is turned off except for the instantaneous flow rate indicator lamp, which blinks.

■ Totalization

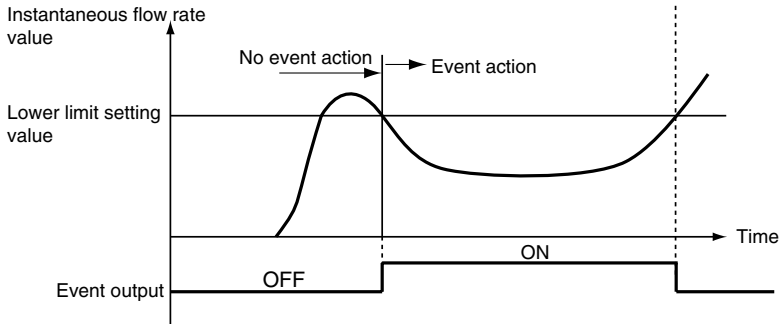
If integrated flow exceeds 9999999, the count returns to 0 and counting continues. When this happens, event output for integrated flow remains OFF until the set value is reached again.
If the integrated flow countdown reaches 0, counting stops.

■ Resetting the count for integrated flow / integrated flow countdown

To reset the count, hold down the ▲ and ▼ keys simultaneously for at least one second while the integrated amount or integrated countdown amount is displayed. The integrated flow count is reset to 0, and the countdown is reset to the default. After reset counting up or counting down resumes.

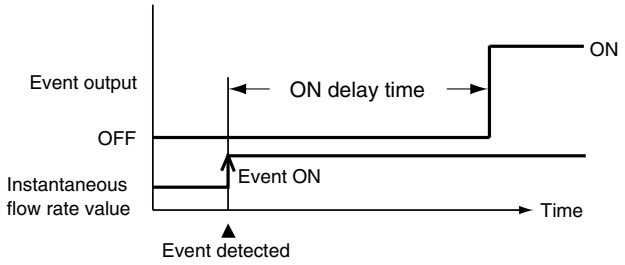
■ Event standby

Event standby operates only on the basis of the instantaneous flow rate lower limit. This function prevents an erroneous low flow alarm when there is no gas flow because the device has just started up, for example. After the power is turned ON, and until the instantaneous flow rate has exceeded the value set for the event lower limit, there is no event action. After the instantaneous flow lower limit has been exceeded once, event action operates normally.



■ Event ON delay

ON delay times (0 to 60s) can be set for both events 1 and 2.



■ Flowrate zero calibration

If the indicated flow rate is not zero even though the actual flow rate is zero, and it seems possible that the sensor's zero point may have shifted, try the following procedure for flow rate zero calibration.

(1) Display the flow rate or integrated flow amount.

(2) Press and hold the ENT key.

(3) After approx. 10s have elapsed, 0. CAL blinks on the flow rate display.

(4) Press and hold ENT again.

(5) After approx. 1 second, 0. CAL stops blinking and remains lit. The amount of sensor output at this moment is now treated as zero.

(6) Press DISP key to return to the instantaneous flow rate or integrated flow display.

! Handling Precautions

- Use flow rate zero calibration only after ensuring that the flow path contains only the gas being measured, and after stabilizing the actual flow rate at zero.

Chapter 5. TROUBLESHOOTING

■ Remedying problems

Refer to the following table if a problem occurs:

Problem	Countermeasure
Nothing on the display.	• Make sure that power with the correct voltage and polarity is being supplied. • Make sure that connectors are correctly connected.
ALH 1 is displayed.	The instantaneous flow rate has exceeded 120% of the measurement range. Reduce the flow rate so that it is within range, and normal operation will automatically resume.
Err 1 is displayed.	Sensor error • Make sure that gas is not flowing back, or the gas flow direction is not reversed. • Make sure that an excess current is not flowing. If the unit is not restored after turning the power OFF, contact Yamatake Corporation and ask for repair.
Err2 is displayed.	Memory data error Contact Yamatake Corporation and ask for repair.
Signal is output even though the flowrate should be zero.	• Check the piping for any gas leaks. • Check the wiring to make sure that it is correct. • If the device is mounted vertically, mount it horizontally. If it seems possible that the sensor's zero point has shifted, try flow rate zero calibration (page 18).
Flow rate has deviated excessively.	• Check the piping for any gas leaks. • Check the piping and connection ports for dirt, oil or other foreign matter. If oily, contact Yamatake Corporation and ask for repair. • Check the wiring to make sure that it is correct. • Check if the flow rate is extremely unstable or greatly exceeds the measurement range.
The displayed value is lower than expected. There should be no flow but the indicated flow rate is higher than zero.	• Check if the gas contains foreign matter such as dust, rust, oil or water. If it seems that there is foreign matter in the flow meter, contact Yamatake Corporation and ask for repair.
The indicated instantaneous flow rate is zero, but the integrated flow counting up or, counting down.	• Check the piping for any gas leaks, and check if the gas flow has actually stopped. • Even if the instantaneous flow rate display is 0, a minute flow smaller than the minimum display value of the flowmeter might be present. For integrated measurements, even a flow under the minimum display value is counted. Set the low flow cutoff to prevent integrated flow countup or countdown. ☞ Function setup, page 13

Chapter 6. SPECIFICATIONS

■ General specifications

Item			Specifications
Applicable gas			Air/Nitrogen, Argon ,Carbon dioxide (Not applicable to oxygen and flammable gases) Gas must not contain corrosive components (chlorine, sulfur, acid, etc.). It also must be a clean gas which does not contain dust or oil mist.
Flow range*1			1500L/min (standard) "standard" indicates the standard calibration condition (20˚C, 101.325kPa (1 atm)
Maximum measured flow rate for each gas (at 20°C, 101.325kPa)		Air/nitrogen	1500 L/min
		Argon	1500 L/min
		Carbon dioxide	900 L/min
Measurement accuracy*2 (χ : measured flowrate)			±1%FS±1digit 30 ≤ χ < 150L/min ±5%RD±1digit 150 ≤ χ ≤ 1500L/min
Temperature characteristics*3 (χ : measured flowrate)			±0.1%FS/°C±1digit 0 ≤ χ < 1125L/min ±0.15%FS/°C±1digit 1125 ≤ χ ≤ 1500L/min
Pressure characteristics*4 (χ : measured flowrate)			±1%FS±1digit 30 ≤ χ < 150L/min ±5%RD±1digit 150 ≤ χ ≤ 1500L/min at pressure range 0 to 0.6 MPa
Pressure range			0 to 0.6MPa
Pressure resistance			1.0MPa
Rated voltage			12 to 24Vdc
Supply voltage range			11.4 to 25.2 Vdc
Current consumption			100mA max.
Sampling cycle			100ms ±10ms
Display	Flow rate display		4-digit 7-segment LED, selectable between instantaneous flow rate and integrated flow display.
	Instantaneous flow rate	Min. display	15L/min
		Resolution	5L/min
	Integrated flow rate	Display unit	10L
		Display range	0 to 99999999
		Data storage	Data is written to memory every 10 minutes. (Integrated flow count or countdown can be reset by control panel key or external contact input.)
		Indicator LEDs	Instantaneous flow rate display, integrated flow display, event 1 & 2 display
Output signal (instantaneous flowrate output)			If 0-5 or 1-5Vdc is selected: • Allowable load resistance 250kΩ min. • Even if the measurement range is exceeded, output remains less than 6V. If 4-20mAdc is selected: • Allowable load resistance 300Ω max. • Even if the measurement range is exceeded, output remains less than 24mA.
Output scaling function			Selectable from 0 to 300, 0 to 600, 0 to 900, 0 to 1500L/min. Factory setting: 0 to 1500L/min.
Event output	Number of outputs		2
	Type		Open collector (absolute maximum ratings 30Vdc, 50mA)
	Totalizer pulse output width		100ms ± 10%
	Totalizer pulse output weight		10, 100, 1000L/pulse
External input	Number of inputs		1 (integrated count reset only)
	Remote circuit type		Circuit type on other side: No-voltage contact or open collector Contact OFF terminal voltage: 4.5 ± 1V Contact ON terminal current: Approx. 0.5mA (current flowing to contact) Allowable ON contact resistance: 250Ω max. Allowable OFF contact resistance: 100kΩ min. Allowable ON residual voltage: 0.8V max. (open collector on other side) Allowable OFF leakage current: 50μA max. (open collector on other side)
Serial data output			Open collector (rated 30Vdc, 50mA)

Item	Specifications
Gas type switching function	Selection of air/nitrogen, argon, carbon dioxide (CO_2), using the control panel keys.
Gas type setup function	Gas type conversion factor between 0.100 and 8.000 can be set using the control panel keys.
Electrical connection	• Harness with a special connector (optional) • Mating connector: Hirose Electric Co. DF-11-10DS-2C
Operating temperature range	-10 to 60˚C
Storage temperature range	-20 to +70˚C
Operating humidity range	10 to 90%RH (condensation not allowed)
Connection aperture	Rc1
Body material	Aluminum
Cover material	Polycarbonate resin
Mounting position	Horizontal mounting. (Top surface must not face down.) If this device is mounted vertically, drift may cause erroneous measurement when the actual flow rate is zero. For details, contact Yamatake Corporation.
Standard compliance	EN61326-1:1997 A1:1998 A2:2001 A3:2003
Mass	Approx. 3kg

*1 : The following table shows the maximum measured flowrate and output voltage for each gas type:
(The output at the maximum measured flowrate is indicated as the voltage.)

Gas type	Flowrate [L/min(standard)]	Output voltage [V]	Setup/display resolution [L/min]
N (Air/Nitrogen)	1500	5	5
A (Argon)	1500	5	5
C (Carbon dioxide: CO_2)	900	3	5
User specified	1500[L/min]x Gas conversion factor	5	5

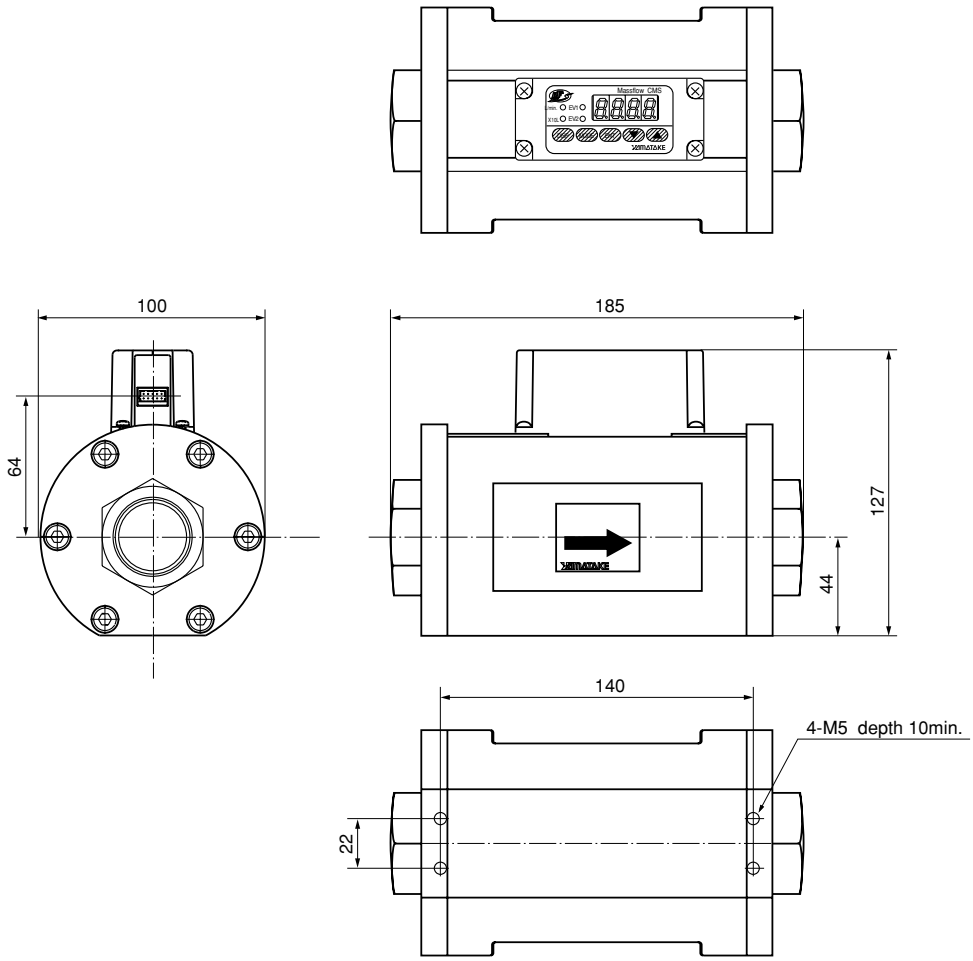
*2 : Measurement accuracy in the operating temperature and gas temperature of 23°C.

*3 : Amount of change on a flowrate referenced to 23˚C in 101.325kPa.

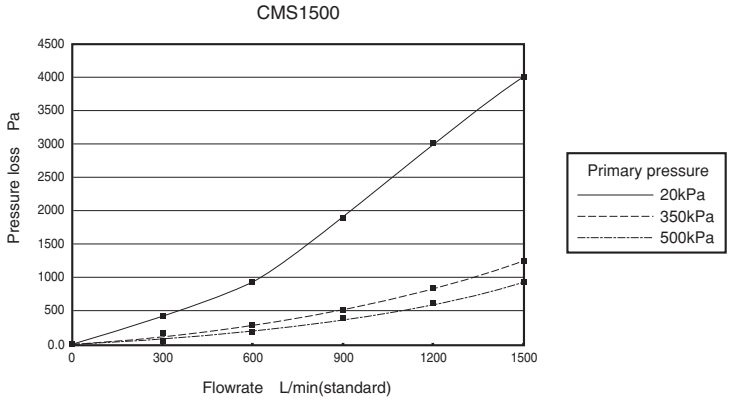
*4 : Amount of change on a flowrate referenced to 101.325kPa in 23˚C.

■ External dimensions

Unit : mm



■ Pressure loss



The graph shows the data in air.
The values for the gases other than air can be obtained by multiplying the specific gravities shown in the table below.

Gas type	Specific gravity*
Argon	1.38
Carbon dioxide	1.53

*With air as 1.0.

Example: The primary pressure is 20 kPa, and the flowrate is 600L/min, the pressure loss for argon is calculated as follows:
From the graph of CMS1500, the pressure loss is about 950 Pa when the primary pressure is 20 kPa and the flowrate is 600L/min.
Multiply this value by 1.38, the specific gravity of argon, and the result is 950 X 1.38 = 1311Pa.

Revision History

Printed Date	Manual Number	Edition	Revised pages	Description
01-08	**CP-SP-1119E**	**1st Edition**		
02-12		**2nd Edition**		Fully revised by addition of CMS1500B model.
03-09		**3rd Edition**	1 3 5 17 20	In features, high rangeability added. 7th caution corrected. In mounting position, new illustration added. Measurement accuracy, temperature characteristics, pressure characteristics changed. Pressure loss added.
07-04		**4th Edition**		Allover revised.

azbil

Yamatake Corporation
Advanced Automation Company

1-12-2 Kawana, Fujisawa
Kanagawa 251-8522 Japan

URL: http://www.azbil.com

Printed on recycled paper. (07)

Specifications are subject to change without notice.

Printed in Japan.
1st Edition: Issued in Aug. 2001 (C)
4th Edition: Issued in Apr. 2007