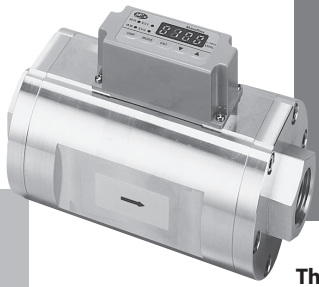
azbil

No. CP-SP-1119E

CMS1500
Gas Mass Flow Meter
User's Manual



Thank you for purchasing this product.

This manual contains information for ensuring the 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 equipment that uses the CMS1500. Be sure to keep this manual nearby for handy reference.

Azbil Corporation

Please read the "Terms and Conditions" from the following URL before ordering or use:

http://www.azbil.com/products/bi/order.html

NOTICE

Be sure that the user receives this manual 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 manual are subject to change without notice.

Considerable effort has been made to ensure that this manual is free from inaccuracies and omissions. If you should find an error or omission, please contact the azbil Group.

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

μF™, Micro Flow™ and Micro Flow Sensor™ are trademarks of Azbil Corporation in Japan.

Conventions Used in This Manual

■ To prevent injury to the operator and others, and to prevent property damage, the following types of safety precautions are indicated:

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

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

⚠	Use caution when handling the product.
⃠	The indicated action is prohibited.
❗	Be sure to follow the indicated instructions.

Handling Precautions:

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

Note: Notes indicate information that might benefit the user.

☞ 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.

Safety Precautions

⚠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. However, do not mount it horizontally with the display facing down. Doing so might cause device failure. If it is mounted vertically, a measurement error could occur.
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 a surge absorber (surge protector) to prevent fire or device 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.

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 1.7 mm, and at a thickness of 0.5 mm, 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:

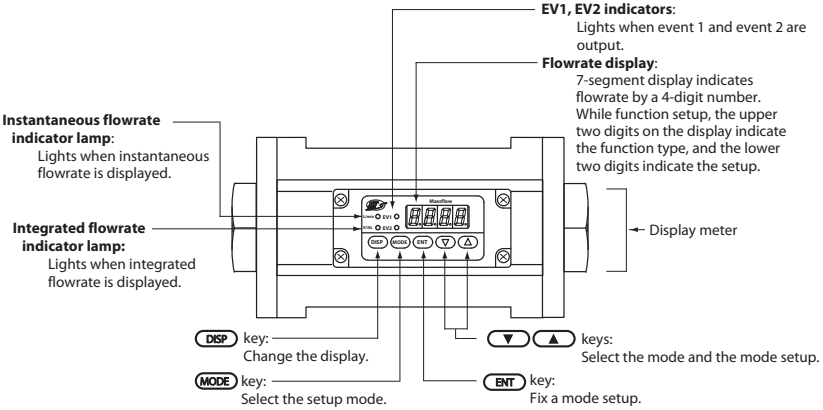
Basic model No.	Flowrate range	Model type	Material	Connection method	Gas type	Output	Optional function				Appended No.	Description
							1	2	3	4		
CMS												Gas Mass Flow Meter
	1500											Standard flowrate range 0 to 1500 L/min (standard)*
		B										With display (flow direction: left to right)
		R										With display (flow direction: right to left)
			A									Aluminium
				R								Rc1
					N							Air / Nitrogen, Argon,Carbon dioxide (CO_2)
						2						Analog output 0-5 Vdc, 1-5 Vdc, 4-20 mA
							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

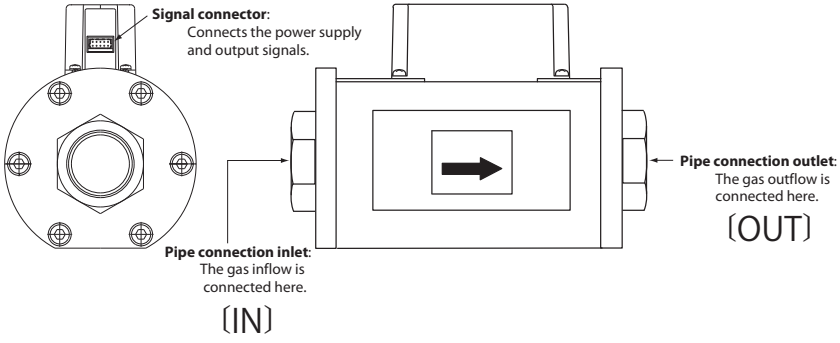
Note

- * "L/min(standard)" refers to a flowrate after conversion to 20˚C in air 101.325 kPa (1 atm).

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 1 μm 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

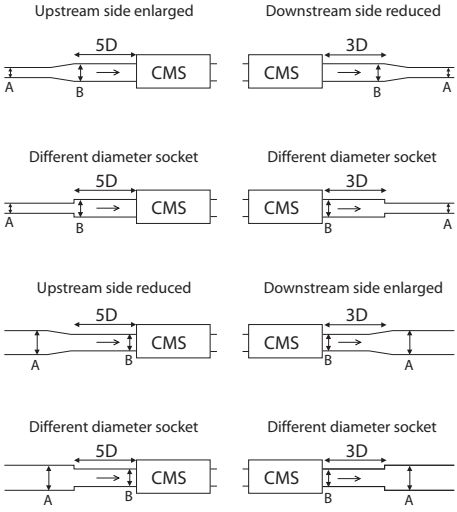
- If foreign matter cannot be fully eliminated by flushing or wiping, or if the regular presence of foreign matter can be expected, be sure to install a filter. If dust, oil or moisture adheres to the metallic mesh or to the μF sensor chip, measurement error or device failure may result.

● Filter installation

For a dedicated filter, contact the azbil Group.
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 : MFF100NAG/MFF100NSG
Specifications: For details, refer to "Lineup of Mist Separators and Filters for Micro Flow Sensors," Azbil Corporation specifications sheet CP-SS-1824E.

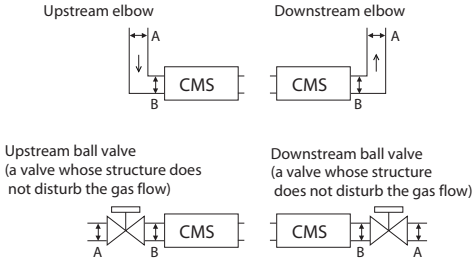
● Straight pipe section

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: 25 mm

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

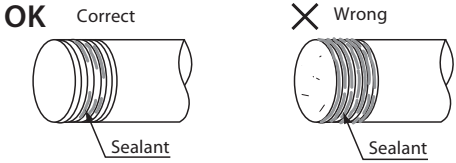


[!] Handling Precautions

- 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.

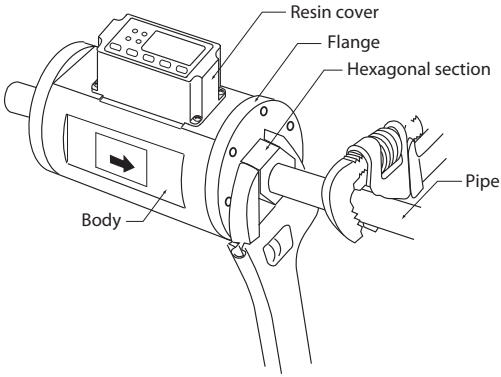
• Coating sealant

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.



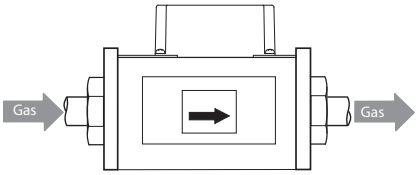
• Connecting Pipes

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

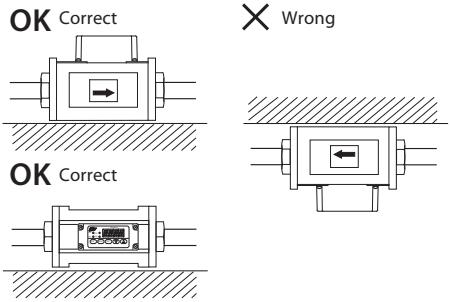
- When feeding gas into the meter, make it flow following the arrow on the side of the channel. If gas is fed in the opposite direction, the gas flow cannot be measured accurately.

● Mounting the body

⚠CAUTION

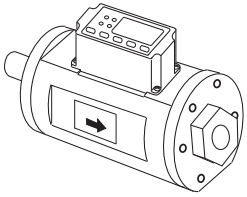
Mount this device horizontally. However, do not mount it horizontally with the display facing down. Doing so might cause device failure. If it is mounted vertically, a measurement error could occur.

• Mounting Position

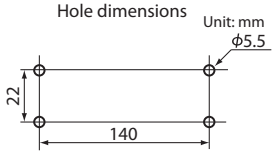


• Mounting

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



Hole dimensions



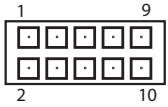
■ Wiring

⚠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 a surge absorber (surge protector) to prevent fire or device 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

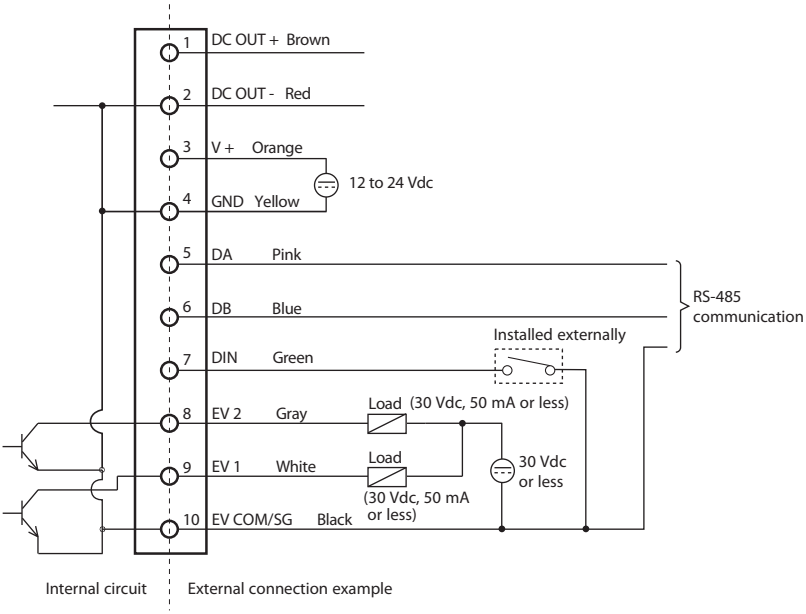
Compatible connector:
DF11-10DS-2C made by HIROSE ELECTRIC CO., LTD.

Item	Model number	Remarks
Harness with dedicated connector (One harness is required for one CMS unit.)	81446594-005	Harness (2 m) for model without communications -- plain wire termination
	81446594-006	Harness (5 m) for model without communications -- plain wire termination
	81446594-007	Harness (2 m) for model with communications -- M3.5 Y-terminals
	81446594-008	Harness (5 m) 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 24 Vdc)	
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

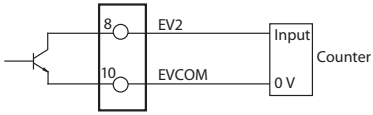


! Handling Precautions

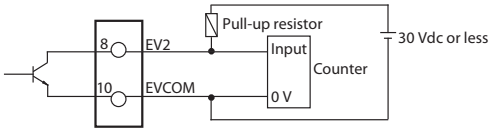
- Power source GND, instantaneous flow rate output (-), and event output common lines are all connected inside this device. If these lines are connected to an external device through a common power supply, interference will cause device failure or faulty operation.
- Take care that the event output does 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

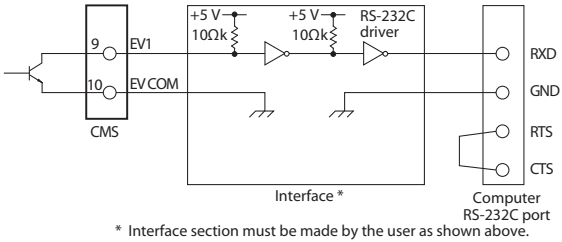


• Voltage input type



● Use of flow rate serial data output

• Connection example

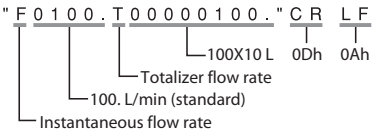


* Interface section must be made by the user as shown above.

• 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 10 L.



• Communications specifications

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

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.

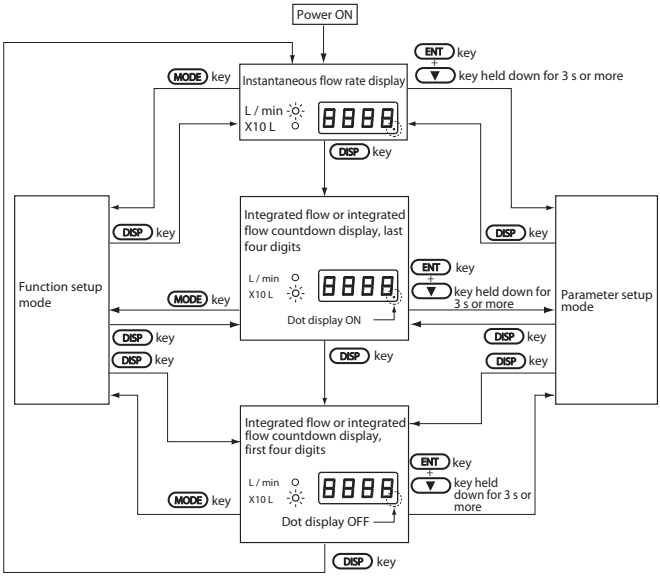
Make sure that the selected analog output type matches the input type of the receiving device. The output-receiving device could be damaged if the analog output type selection is incorrect.

■ 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 key again displays the first four digits of the integrated flow or integrated flow countdown. Pressing DISP key 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.



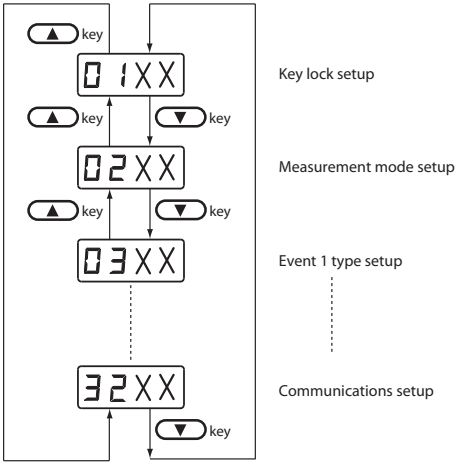
! Handling Precautions

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

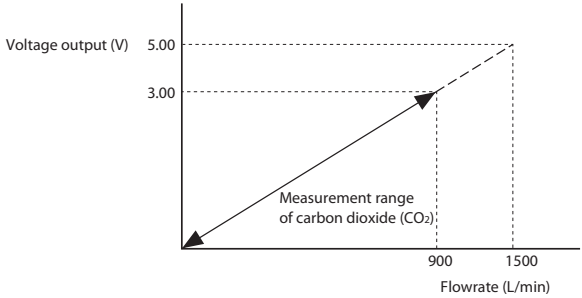
● Function setup menu

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 10 L/1 pulse Totalizer pulse output rate 100 L/1 pulse Totalizer pulse output rate 1000 L/1 pulse	00	
05	ON delay setting (EV1)	00 0	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 If set to "08," also set the gas type conversion factor in parameter setup mode. *2
09	Analog output scaling	00 01 02 03 04	0 to 1500 L/min 0 to 900 L/min 0 to 600 L/min 0 to 300 L/min Desired scaling	00	*1
10	Analog output type selection	00 01 02	0 to 5 V 1 to 5 V 4 to 20 mA	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), 101.325 kPa (1 atm) standard	20	
12	Low flow cutoff	00 01 02 03 04	No low flow cutoff Cutoff below the rated minimum display (15 L/min) 15 L/min 37.5 L/min 75 L/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	9600 bps 4800 bps 2400 bps	00	
32	Data format	00 01	8 data bits, even parity, 1 stop bit 8 data bits, no parity, 2 stop bits	00	

*1 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 (CO_2)), 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 5 V output will be as shown below.



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

• When gas types 00 to 02 are selected

$$\frac{\text{Max. measurable flow rate for the gas}}{\text{Scaling upper limit value}} \times 5\ \text{V}$$

• When gas type 08 is selected

$$\frac{\text{Max. measurable flow rate for the gas}}{\text{Scaling upper limit value}} \times \frac{1}{\text{Gas type conversion factor}} \times 5\ \text{V}$$

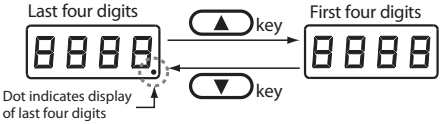
For the maximum measurable flow rate for each gas, see page 20.
The gas type conversion factor is set in parameter setup; see pages 16.

*2 The user can specify any desired gas conversion factor to handle gas mixtures and gases other than the standard compatible ones. For details regarding gas conversion factors, contact the Azbil Group.

■ 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 10 L)	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 10 L)	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 10 L)	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.
If the DISP key is pressed in display OFF mode, the instantaneous flow rate is displayed.

■ Totalization

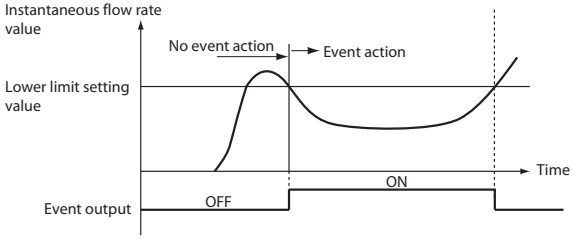
If integrated flow exceeds 9999999, the count returns to 0 and counting continues. When this happens, event output for integrated flow remains OFF until the set value is reached again.
If the integrated flow countdown reaches 0, counting stops.

■ 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.

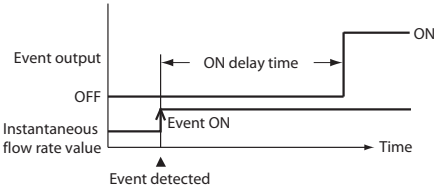
■ Event standby

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 60 s) 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 key 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.
RLH1 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.
Err1 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 the azbil Group and ask for repair.
Err2 is displayed.	Memory data error Contact the azbil Group 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 the azbil Group 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 the azbil Group 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 zero, 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 (CO_2) (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			0 to 1500 L/min (standard)
			"Standard" indicates the standard calibration condition (20 °C, 101.325 kPa (1 atm))
Maximum measured flowrate for each gas (at 20 °C, 101.325 kPa) *2		Air/nitrogen	0 to 1500 L/min
		Argon	1500 L/min
		Carbon dioxide (CO_2)	900 L/min
Measurement accuracy at 23 °C and 101.325 kPa (χ : measured flow rate) *3			±1 % FS ±1 digit (30 ≤ χ < 150 L/min) ±5 % RD ±1 digit (150 ≤ χ ≤ 1500 L/min)
Temperature characteristics between −10 to +60 °C *4			±0.1 % FS/ °C ±1 digit (0 ≤ χ < 1125 L/min) ±0.15 % FS/ °C ±1 digit (1125 ≤ χ ≤ 1500 L/min)
Pressure characteristics *5	Operating pressure 0 to 0.6 MPa		±1 % FS ±1 digit (30 ≤ χ < 150 L/min) ±5 % RD ±1 digit (150 ≤ χ ≤ 1500 L/min)
Pressure range			0 to 0.6 MPa
Pressure resistance			1.0 MPa
Rated voltage			12 to 24 Vdc
Supply voltage range			11.4 to 25.2 Vdc
Current consumption			100 mA max.
Sampling cycle			100 ms ±10 ms
Display	Flow rate display		4-digit 7-segment LED, selectable between instantaneous flow rate and integrated flow display.
	Instantaneous flow rate	Min. display	15 L/min
		Resolution	5 L/min
	Integrated flow rate	Display unit	10 L
		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 1-5 Vdc is selected: • Allowable load resistance 250 kΩ min. • Even if the measurement range is exceeded, output remains less than 6 V. If 4-20 mAdc is selected: • Allowable load resistance 300 Ω max. • Even if the measurement range is exceeded, output remains less than 24 mA.
Output scaling function *6			Selectable from 0 to 300, 0 to 600, 0 to 900, 0 to 1500 L/min. Factory setting: 0 to 1500 L/min.
Event output	Number of outputs		2
	Type		Open collector (absolute maximum ratings 30 Vdc, 50 mA)
	Totalizer pulse output width		100 ms ± 10 %
	Totalizer pulse output weight		10, 100, 1000 L/1 pulse

Item		Specifications
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 ± 1 V Contact ON terminal current: Approx. 0.5 mA (current flowing to contact) Allowable ON contact resistance: 250 Ω max. Allowable OFF contact resistance: 100 kΩ min. Allowable ON residual voltage: 0.8 V max. (open collector on other side) Allowable OFF leakage current: 50 μA max. (open collector on other side)
Serial data output		Open collector (rated 30 Vdc, 50 mA)
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 the azbil Group.
Standard compliance		EN61326-1:2006, EN61326-2-3: 2006
Mass		Approx. 3 kg

*1 The flow rate range is for air. Because this device has a gas-type switching function, the device keys can be used to switch from one gas type to another. For the maximum measurable flow rate and output voltage for various gas types, see the table below.

Gas type	Maximum measurable flow rate [L/min(standard)]	Output voltage [V]	Setting and display resolution [L/min]
Air/Nitrogen	1500	5	5
Argon	1500	5	5
Carbon dioxide (CO_2)	900	3	5
User specified	1500 [L/min] × conversion factor (C.F.)*	5	5

* Users can set the conversion factor from 0.100 to 8.000. In addition, analog output scaling can be changed by using the keys.

*2 Gas types other than those listed above can be handled by using a conversion factor. For details, contact the Azbil Group.

*3 Measured flow rate = χ L/min (standard)
The stated accuracy is for air/nitrogen.

*4 This is the amount of flow rate change at 101.325 kPa with 23 °C as the reference point.

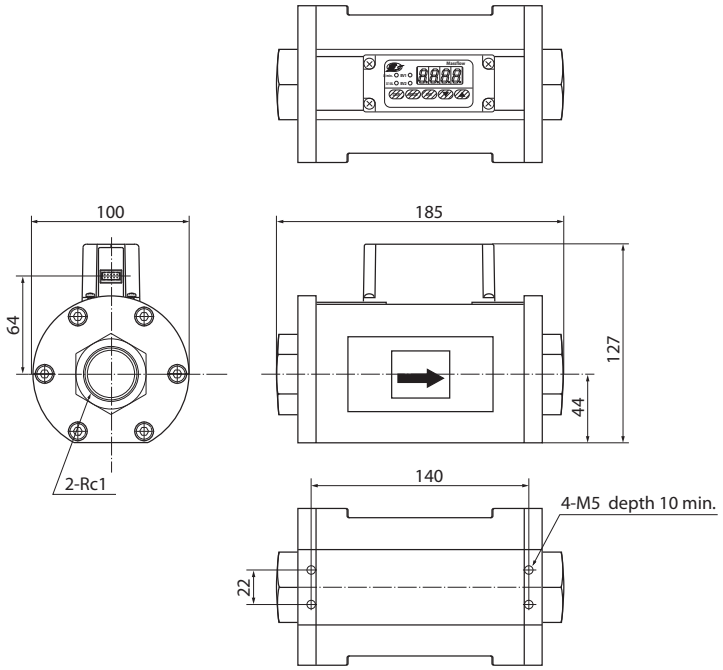
*5 This is the amount of flow rate change at 23 °C with 101.325 kPa as the reference point.

*6 Analog output scaling can be changed by using the keys. If the gas type is changed, the flow rate measurement range changes accordingly, as shown in the table above. However, with this function, analog output is scaled according to the analog output scaling setting even if the gas type is changed.

■ External dimensions

The engineering drawings below show the CMS1500B with left-to-right flow direction. The CMS1500R with right-to-left flow direction has the same dimensions.

Unit: mm

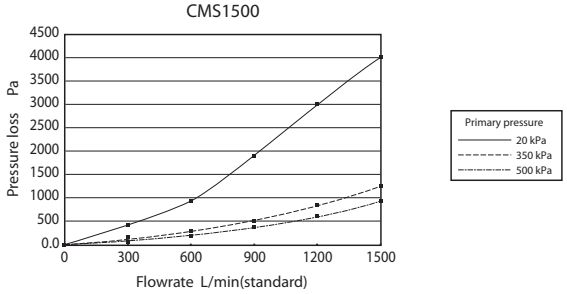


■ Korea Certifications Mark

KCC-REM-A2B-A010

이 기기는 업무용(A급) 전자파 적합기기로서 판매자 또는 사용자는 이점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.

■ 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 600 L/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 600 L/min.
Multiply this value by 1.38, the specific gravity of argon, and the result is 950 X 1.38 = 1311 Pa.

Revision History of CP-SP-1119E

Printed	Edn.	Revised pages	Description
Aug. 2001	**1**		
Dec. 2002	**2**		Fully revised by addition of CMS1500B model.
Sep. 2003	**3**	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.
Apr. 2007	**4**		Allover revised.
Apr. 2012	**5**		Company name changed.
Mar. 2013	**6**	ii, 8 1 2, 8, 22 5 11 14 15 14, 15 17 20, 21 21 22	A CAUTION was changed. "1 atmospheric pressure" was changed to "1 atm." "Model selection guide" table was changed. "CMS" was deleted from diagrams. Filter model No. was changed in "Filter installation" section. A description was added to diagram. "/pulse" was changed to "/ 1 pulse." "Carbon dioxide" was changed to "Carbon dioxide (CO_2)." Notes 1 and 2 were added. A description was added to "Display OFF mode" section. Specifications was changed. Note 2 was changed. A description was added. Korea certification mark was added.

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