

## Duct CO<sub>2</sub> Sensor

### Overview

Duct CO<sub>2</sub> sensor Model CY8100C1001 in combination with Part No. 83165722-002 is a duct-mount CO<sub>2</sub> sensor used for detecting carbon dioxide (CO<sub>2</sub>) concentration in a duct. This product is used in a wide range of applications such as monitoring of CO<sub>2</sub> concentration in a return duct, control of outdoor air intake, and so on.

### Features

- Non-dispersive infrared (NDIR) sensor
- Linear output signal in 1 V DC to 5 V DC range
- Long-term stability
- CE Marking certified product:  
Model CY8100C1001 conforms to all the applicable standards of CE Marking.



### Model Number

Model number	Description
CY8100C1001	Duct CO <sub>2</sub> sensor

### Part Numbers of Items Sold Separately

Part number	Description
83165722-002	Assembly kit: - Sampling probe - Sealing gasket, two screws, two washers - Cable assembly
83104511-001	Zero calibration service bag (calibration gas (at 0 ppm CO <sub>2</sub> ) generator)

### IMPORTANT:

In a system where harmful chemical substances or viral pathogens, etc., are handled, do not limit outdoor air intake using this product or other CO<sub>2</sub> measuring instruments.

It is dangerous to limit fresh outdoor air intake in such systems where fresh air is continuously required.

**Safety Precautions**

Please read instructions carefully and use the product as specified in this manual. Be sure to keep this manual nearby for quick reference.

**Restrictions on Use**

This product was developed, designed, and manufactured for general air conditioning use.

Do not use the product in a situation where human life may be at risk or for nuclear applications in radiation-controlled areas. If you wish to use the product in a radiation-controlled area, please contact Azbil Corporation.

Particularly when the product is used in applications like the following where safety is especially required, implementation of fail-safe design, redundant design, regular maintenance, etc., should receive appropriate consideration so that the product can be used safely and reliably.

- Safety devices for protecting the human body
- Start/stop control devices for transportation machines
- Aeronautical/aerospace machines

For system design, application design, instructions for use, or product applications, please contact Azbil Corporation. Azbil Corporation bears no responsibility for any result, or lack of result, deriving from the customer's use of the product.

**Recommended Design Life  
(Recommended Period of Use)**



It is recommended that this product be used within its design life. The design life is the period during which you can use the product safely and reliably based on the design specifications. If the product is used beyond this period, its failure ratio may increase due to time-related deterioration of parts, etc.

The design life during which the product can operate reliably with the lowest failure ratio and least deterioration over time is estimated scientifically based on acceleration tests, endurance tests, etc., taking into consideration the operating environment, conditions, and frequency of use as basic parameters.





The design life of this product is 10 years.











The design life specified for this product assumes that maintenance, such as replacement of the limited-life parts, is carried out properly. Refer to the section on maintenance in this manual.

**Warnings and Cautions**

	<b>WARNING</b>	Alerts users that improper handling may cause death or serious injury.
	<b>CAUTION</b>	Alerts users that improper handling may cause minor injury or material loss.

**Symbols**

	Notifies users that specific actions are prohibited to prevent possible danger. The symbol inside  graphically indicates the prohibited action. (For example, the sign on the left means that disassembly is prohibited.)
	Instructs users to carry out a specific obligatory action to prevent possible danger. The symbol inside  graphically indicates the actual action to be carried out. (For example, the sign on the left indicates general instructions.)

 <b>CAUTION</b>	
	Use the product under the operating conditions (temperature, humidity, power, vibration, shock, mounting direction, atmospheric condition, etc.) as listed in the specifications. Failure to do so might cause fire or device failure.
	Use the product within the rated operating ranges as listed in the specifications. Failure to do so might cause device failure.
	Installation and wiring must be performed by qualified personnel in accordance with all applicable safety standards.
	All wiring must comply with applicable codes and ordinances.
	Before wiring, be sure to turn off the power to the product.
	Use crimp terminals with insulation for connections to the product terminals. Failure to do so may cause short circuit leading to fire or device failure.
	Tighten the terminal screws with the specified torque. Insufficient tightening of the terminal screws may cause fire or overheating.
	Be sure to provide a circuit breaker for the power to the product as the product does not have a power switch.
	Do not disassemble the product. Doing so might cause device failure.

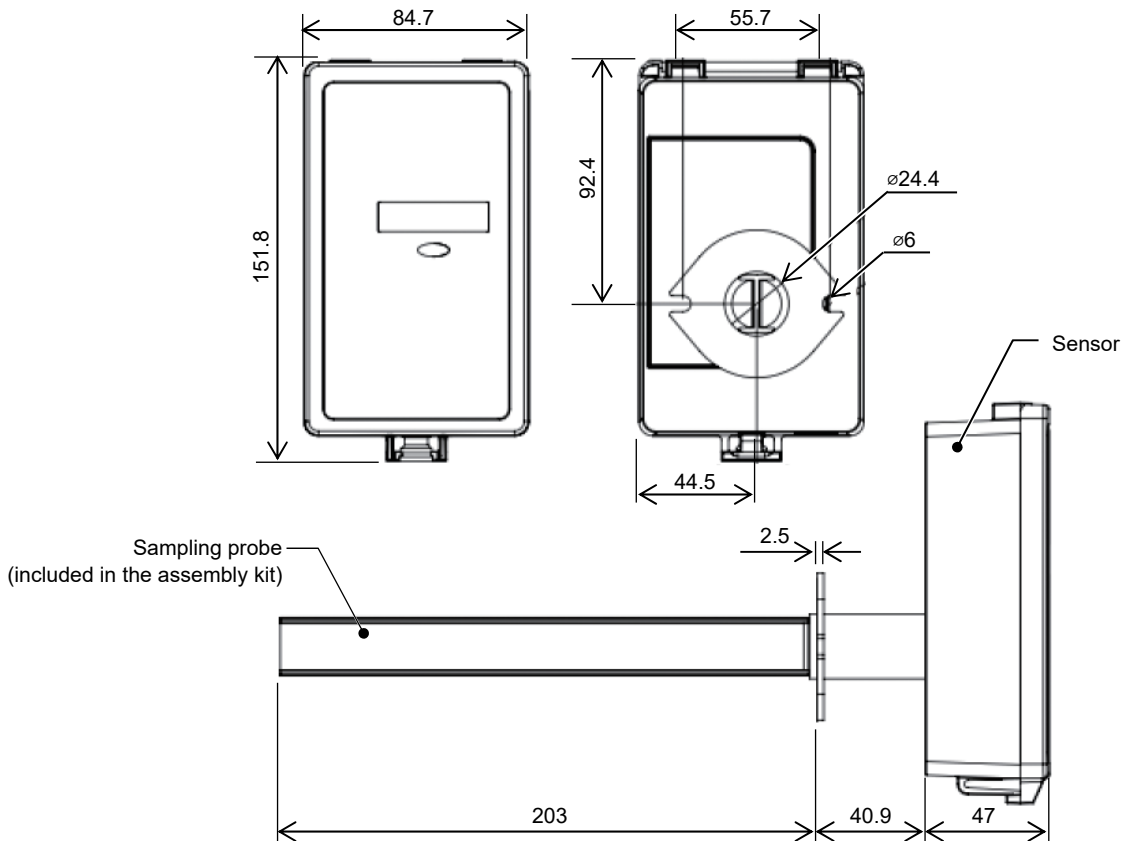
## Specifications

Item		Specification
Power		24 V AC +10 %, -15 % (at 50 Hz to 60 Hz)
Consumption power		Max. 3 VA
Output signal		1 V DC to 5 V DC (Linear to 0–2000 ppm CO <sub>2</sub> concentration)
Allowable load resistance		Min. 5 kΩ
Measuring range		0 ppm to 2000 ppm CO <sub>2</sub> concentration
Operating principle		Non-dispersive infrared (NDIR)
Accuracy		± 50 ppm ± 5 % of reading D/A conversion accuracy: ± 2 % of reading ± 20 mV D/A resolution: 10 mV
Drift	Continuous ON	± 150 ppm/year (at 1000 ppm)
	Continuous OFF (reference)	± 15 ppm/48 hours for 50 %RH
Time constant	0.6 m/s air velocity	Max. 3 min
Environmental conditions	Operating conditions	CO <sub>2</sub> concentration: 0 ppm to 2000 ppm
		Temperature: 0 °C to 50 °C
		Humidity: 0 %RH to 85 %RH (non-condensing)
	Wind velocity	More than 0.6 m/s
Transport/storage conditions	Temperature: -20 °C to 50 °C	
	Humidity: 0 %RH to 95 %RH (in unopened package)	
Vibration resistance		4.9 m/s <sup>2</sup> (at 10 Hz to 150 Hz)
Insulation resistance		Min. 100 MΩ at 500 V DC (between case and each lead wire)
Dielectric strength		Max 1 mA leakage current at 500 V AC for 1 minute (between bobbin and each lead wire)
Protection class		IP65 (dust-proof and splash-proof) for the sensor
Materials		Sensor and sampling probe: PC-ABS plastic
		Lid: PC plastic
Color		Sensor and sampling probe: Black
		Lid: Transparent
Weight		Approximately 0.35 kg
Installation		Indoor duct, chamber
Initial warm-up time		Continuously unpowered sensor for 48 hours or over: Approximately 10 days (Product which has just been unpacked is exceptional.) Other than the above: Approximately 3 days
Wiring	Power	Two-wire
	CO <sub>2</sub> concentration output	Two-wire

ABS: Acrylonitrile butadiene styrene

**Dimensions**

**Sensor and sampling probe assembled**



Note: Total length of the cable, attached to the printed circuit board in the product, is 1 m.

Figure 1. Dimensions (mm): Sensor and sampling probe assembled

**Assembly kit**

**Sampling probe**

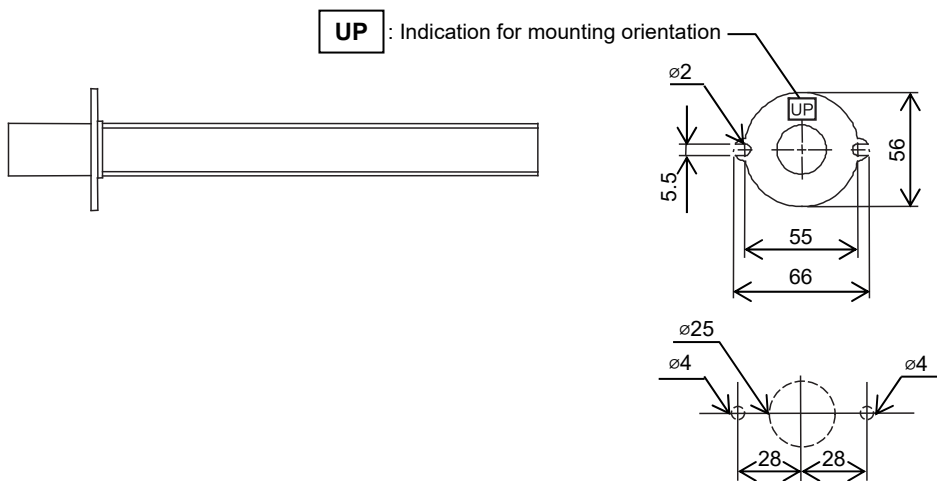


Figure 2. Dimensions (mm): Sampling probe

**Cable assembly**

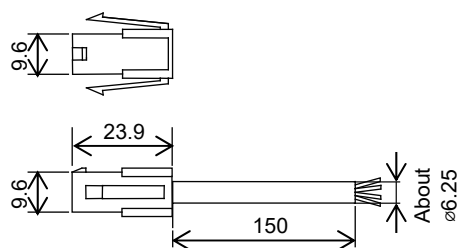


Figure 3. Dimensions (mm): Cable assembly

## Installation

### Precautions for installation

- Installation environment  
Although the sensor’s enclosure conforms to IEC IP65 for dust-proof and splash-proof, avoid installing in locations exposed to corrosive atmosphere or direct sunlight.  
IEC: International Electrotechnical Commission
- Handling of the sensor  
Annual drift of the continuously powered sensor is  $\pm 150$  ppm.  
The sensor is packaged in a tightly sealed aluminum moisture-proof bag for shipment. This prevents large output drift that may be caused from moisture absorption of the unpowered sensor. Table 1 shows the output drift (reference) of the unpowered sensor.







Table 1. Output drift of sensor unit without power supply

Hours without power supply	Humidity		
	30 %RH	50 %RH	80 %RH
To 6 hours	< $\pm 10$ ppm	< $\pm 10$ ppm	< $\pm 10$ ppm
To 12 hours			< $\pm 15$ ppm
To 24 hours		< $\pm 15$ ppm	< $\pm 25$ ppm
To 48 hours			

#### IMPORTANT:

- The sensor is packaged for shipment after inspection and calibration. To minimize the output drift after the installation, unpack and install the sensor just before turning on the power (approximately 48 hours or shorter time before the power is turned on).  
If the sensor continuously unpowered (for 48 hours or over) since it is unpacked or since it is turned off, be sure to execute the zero calibration (explained later) after the power is turned on.
- Vibration at the installation site accelerates damage. Do not install the sensor in a place where vibration above the vibration resistance occurs.

#### CAUTION

-  Installation and wiring must be performed by qualified personnel in accordance with all applicable safety standards.
-  All wiring must comply with applicable codes and ordinances.
-  Before wiring, be sure to turn off the power to the product.
-  Use crimp terminals with insulation for connections to the product terminals. Failure to do so may cause short circuit leading to fire or device failure.
-  Tighten the terminal screws with the specified torque. Insufficient tightening of the terminal screws may cause fire or overheating.
-  Be sure to provide a circuit breaker for the power to the product as the product does not have a power switch.

### Precautions for assembling the sensor with the assembly kit

The assembly kit (sampling probe and cable assembly) and the sensor must be ordered and mounted separately to minimize the drift (shown in the above **Precautions for installation** section.) caused by the unpackaged sensor being left without power. If it takes more than 48 hours for the sensor to be installed before being powered, mount the sampling probe and connect the cable assembly first, and then unpack, install, and wire the sensor just before supplying the power.

**Installation of the assembly kit**

Sampling probe: Mount the sampling probe before assembling the sensor with the sampling probe.

- 1) Select a probe mounting position where the typical CO<sub>2</sub> concentration of process fluid can be measured and where the specified air velocity can be acquired.
- 2) Put the whole section to be inserted (sampling probe) into the duct (i.e., the process fluid to be measured).
- 3) The sampling probe has top and bottom sides. Mount the probe onto the duct so that the UP mark on the probe is on the upper side.

The sampling probe has an UP mark that indicates its top side (Fig. 2).

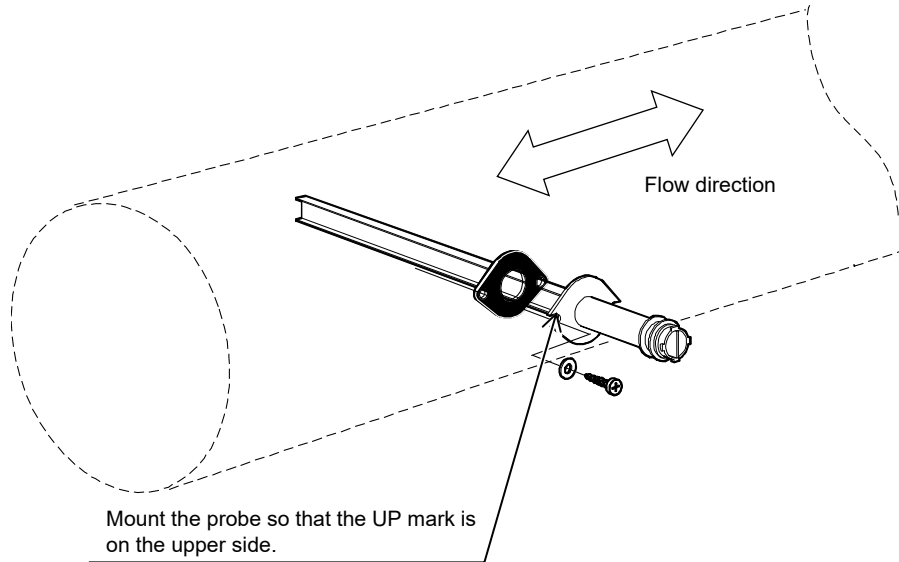


Figure 4. Mounting the sampling probe

- 4) Drill a  $\varnothing 25$  mm hole for mounting the transmitter and two  $\varnothing 4$  mm holes on both sides of the mounting hole.
- 5) Insert the sampling probe into the duct through a gasket. Here, be sure to insert the probe into the duct as far as it will go. Secure it at two points by tightening the attached screws with the specified torque (1.1 N·m). (The flow direction is not specified.)

Cable assembly: Following is an example of the cable assembly connection in a round outlet box (conforming to JIS C8340).  
JIS: Japanese Industrial Standard

- 1) Connect the cable from the controller and the cable assembly.
- 2) The sensor connector is inserted through a knockout before turning on the power, so select a box with a knockout through which the connector on the sensor side (see Fig. 1) can pass.

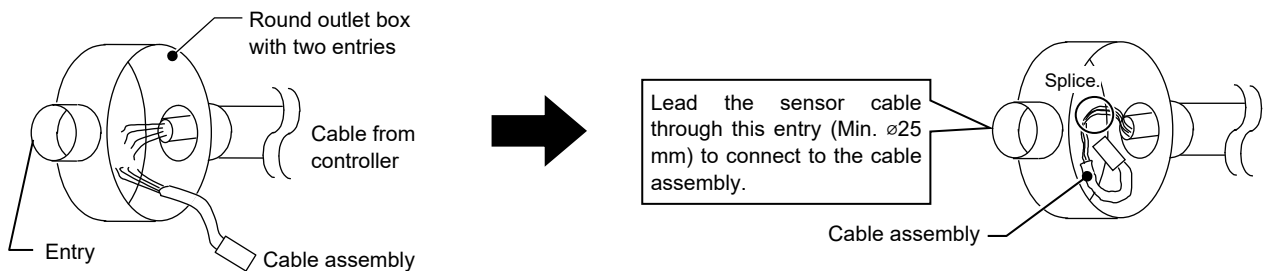


Figure 5. Cable connection example: Splicing the cable assembly

**Installation of the sensor**

The sensor is easily assembled with the sampling probe by snap-in bayonet mount. Refer to the following steps.

- 1) Engage the notches of the sensor with the locking knobs of the sampling probe, then lightly press the sensor.

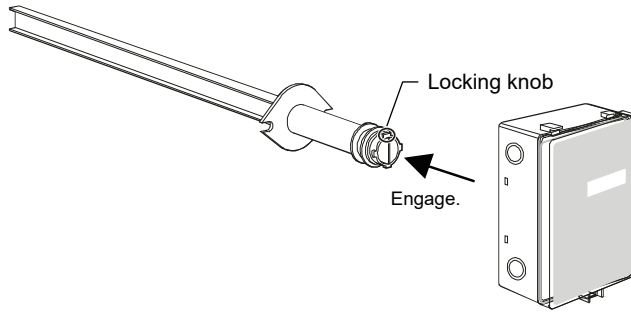


Figure 6. Assembling the sensor with the sampling probe (1)

- 2) Turn the sensor clockwise until it stops, as shown in Fig. 7.

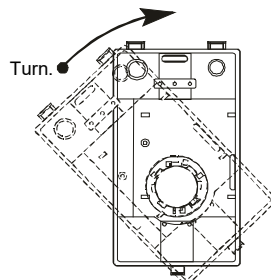


Figure 7. Assembling the sensor with the sampling probe (2)

- 3) Lead the sensor cable through the entry of the round outlet box, and connect the connector of the sensor cable to the connector of the cable assembly, which has been already connected to the cable from the controller.

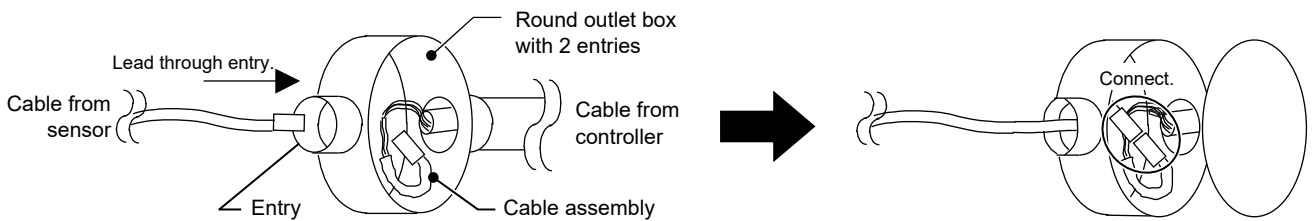


Figure 8. Cable connection example: Connecting the sensor cable

Wiring

⚠ CAUTION	
❗	Installation and wiring must be performed by qualified personnel in accordance with all applicable safety standards.
❗	All wiring must comply with applicable codes and ordinances.
❗	Before wiring, be sure to turn off the power to the product.
❗	Use crimp terminals with insulation for connections to the product terminals. Failure to do so may cause short circuit leading to fire or device failure.
❗	Tighten the terminal screws with the specified torque. Insufficient tightening of the terminal screws may cause fire or overheating.
❗	Be sure to provide a circuit breaker for the power to the product as the product does not have a power switch.

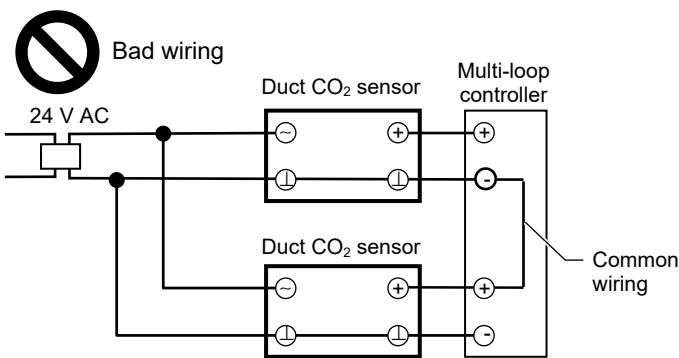
**IMPORTANT:**

- Do not supply the power other than 24 V AC to this product. Failure to do so might damage the product.
- Use isolated transformer to supply the power to this product.  
 Since the common wiring terminals (of green and white wire terminals) are internally connected, single product must be powered by a single 24 V AC transformer. If the multiple products or this product and a device in connection are powered by a single 24 V AC transformer, the common wiring will form a loop, and the product will get damaged.
- See Table 2 for correctly connecting the wires. Miss connection will cause short-circuit of the power supply and will damage the product.

Table 2. Lead wire description

Lead wire color	Description	Note
Brown	24 V AC power	—
White	24 V AC power (common)	Internally connected
Green	(-) output (common)	
Yellow	(+) output	—

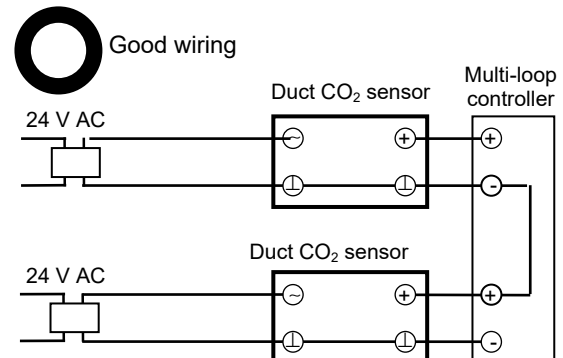
Wiring example:  
Multiple products powered by a single transformer



Common wiring forms a loop.

Figure 9. Bad wiring example

Wiring example:  
Multiple products powered by multiple transformers



Common wiring does not form a loop.

Figure 10. Good wiring example



## Operation

### Operation check

- 1) Remove the lid from the sensor and blow your breath on the sensor from approximately 10 cm away from the sensor.
- 2) Check that the CO<sub>2</sub> concentration displayed on the sensor LCD and the output voltage quickly rise.

LCD: Liquid crystal display

### LCD indication

On the sensor LCD, CO<sub>2</sub> concentration is continuously displayed. When an error occurred in the product, the tool icon appears on the LCD, as shown in Fig. 13.

### LED indication (yellow)

Table 3. LED indication

Operating status	LED operation
Normal	OFF
Initializing	Flashing
Zero calibration	
Error	ON

LED: Light-emitting diode

## Maintenance

### Cleaning

Since process fluid flows into the sensor, clean the circuit board inside the sensor approximately once a year.

### Zero calibration

Annual drift of the continuously powered sensor is  $\pm 150$  ppm. Be sure to execute the zero calibration once a year.

<p><b>IMPORTANT:</b></p> <ul style="list-style-type: none"> <li>• As mentioned in the <b>Installation</b> section, the long-term unpowered sensor may cause drift shown in Table 1. In such a case, the zero calibration must be executed after the sensor is powered again.</li> <li>• Approximately 10 days are needed for the long-term unpowered sensor to stabilize its output. Calibrate the sensor in 10 days approximately after the sensor is turned on.</li> <li>• If this product is powered off during calibration, it may break down. After calibration is complete, turn off the power.</li> </ul>
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For the sensor calibration, zero calibration service bag (Part No. 83104511-001) is needed. Refer to the following and execute the zero calibration.

- 1) Remove the lid from the sensor.
- 2) Remove the plastic tube attached to the rear surface of the lid, and insert the tube into one of the calibration gas inlets of the sensor. Note that either of the inlets can be used for the zero calibration.

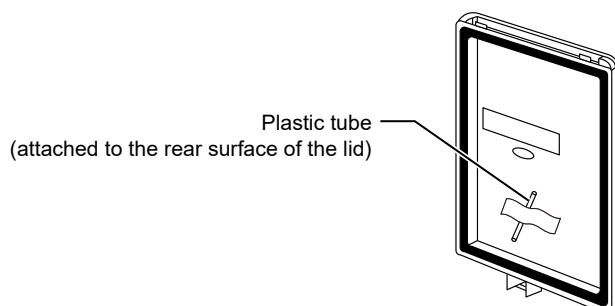


Figure 11. Rear surface of the lid

- 3) Connect the tubing of the zero calibration service bag to the plastic tube. Securely connect the tubing to prevent gas leakage.
- 4) Turn on the switch of the zero calibration service bag to purge the calibration gas (at 0 ppm CO<sub>2</sub>) to the sensor.
- 5) Keep purging the gas until the measured values become stable (for approximately five minutes).

## AB-7175

- 6) When the values become stable, press and hold the zero calibration button (shown in Fig. 12) of the sensor for approximately three seconds to activate the zero calibration.
- 7) Check that the yellow LED flashes. It flashes four times (approximately for ten seconds) when the calibration is executed, and turns off when the calibration is successfully finished.
- 8) Disconnect the tubing of the zero calibration service bag from the plastic tube.
- 9) Remove the plastic tube from the calibration gas inlet of the sensor and attach the plastic tube back to the rear surface of the lid in order not to lose the plastic tube. Then, attach the lid to the sensor.

Note:

- \* Refer to **AB-5803 Specifications/Instructions: Zero Calibration Service Bag** for handling the zero calibration service bag.

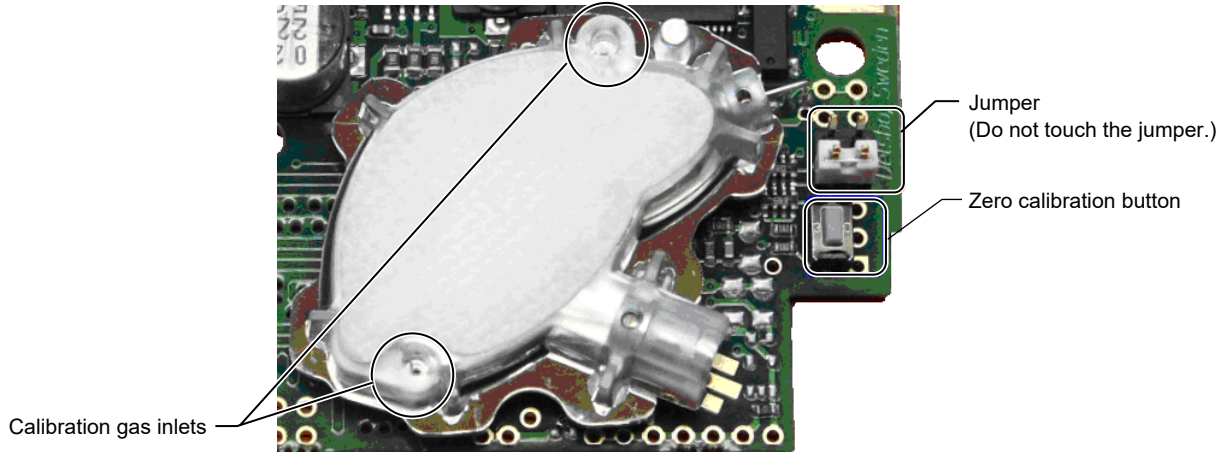


Figure 12. Layout of zero calibration button and the calibration gas inlets

### Error indication

This product contains self-diagnostic function. Self-diagnosis is executed automatically every time the power is turned on and during normal operation. If an error is detected, the yellow LED is turned on, and the tool icon appears on the LCD to indicate the error. Contact our salesperson if an error is detected.



Figure 13. Tool icon on the LCD

### Disposal

When this product is no longer needed, dispose of it as industrial waste in accordance with local regulations.

Do not reuse all or part of this product.

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This product complies with the essential requirements of the Electromagnetic Compatibility Directive (EMCD).

EMCD: EN 61326-1 Class B, Table 1 (for use in a basic electromagnetic environment)

**azbil**

*Specifications are subject to change without notice.*

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