DSMFT-4 | DUCT CO$_2$ SENSOR

Mounting and operating instructions
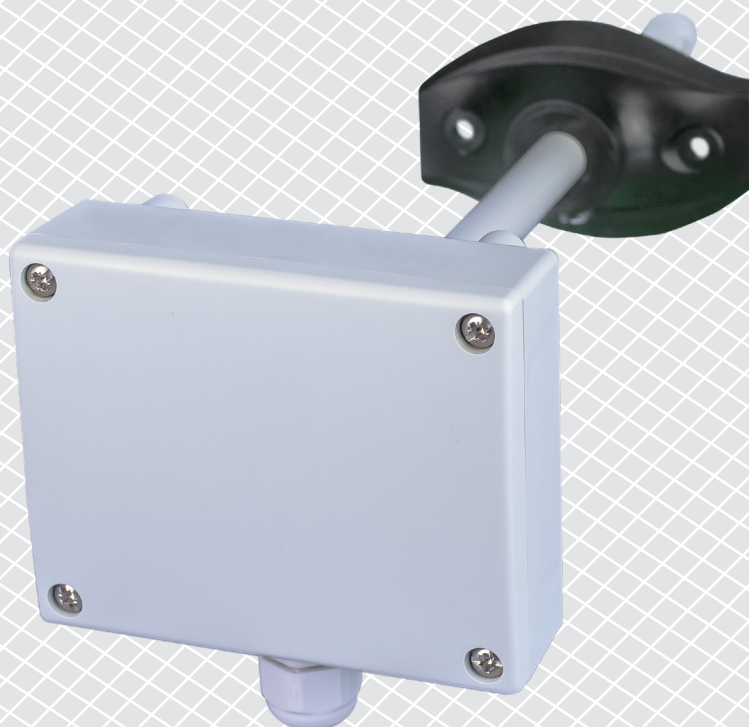
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SAFETY AND PRECAUTIONS

Read all the information in this manual, in the datasheet and in the Modbus Register Map before working with the product. For personal and equipment safety and for optimum product performance, make sure you fully understand the content before installing, using or servicing this product.

For safety and licensing (CE) reasons, unauthorised conversions and / or modifications of the product are inadmissible.

The product should not be exposed to abnormal conditions, such as extreme temperatures, direct sunlight or vibrations. Long-term exposure to chemical vapors in high concentration can affect the product performance. Make sure the work environment is as dry as possible and avoid condensation.

All installations must comply with local health and safety regulations and local electrical standards and approved codes. This product should only be installed by an engineer or a technician with expert knowledge of the product and safety precautions.

Avoid contact with energised electrical parts. Always disconnect the power supply before connecting, servicing or repairing the product.

Always check that you are connecting the correct power supply to the product and use wires of the correct characteristics and cross-section. Make sure all screws and nuts are properly tightened and fuses (if any) are in place.

Consideration should be given to recycling the equipment and packaging. These should be disposed of in accordance with local and national laws and regulations.

If there are questions that are not answered, contact your technical support or consult a professional.

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DSMFT-4 | DUCT CO$_2$ SENSOR

SENTERA CONTROLS

PRODUCT DESCRIPTION

DSMFT-4 is a duct sensor that measures carbon dioxide (CO$_2$), temperature (T), relative humidity (rH) and barometric pressure (BP). NDIR or non-dispersive infrared technology is used to measure CO$_2$ level. This technology has a low life-cycle cost and long-term precision and stability. This sensor also has a barometric air pressure measurement to increase the accuracy of the CO$_2$ measurement and to compensate for height differences. As a result of this compensation, the sensor measurements are accurate regardless of altitude.

- Key features:
  - Long-term stability and accuracy — DSMFT-4 provides precise measurement of temperature, relative humidity, CO$_2$ level and barometric pressure in air ducts.
  - Real-time data — Connect the device to the SenteraWeb cloud platform by using a Sentera internet gateway to receive real-time data for exceeded values or possible issues with the operation of the sensor.
  - Firmware updates — Access firmware updates via the SenteraWeb cloud platform effortlessly.
  - Easy to install — The built-in pluggable terminal block ensures easy installation and tightly secures the wires, as well as prevents cable loosening.
  - Smooth integration with building management systems (BMS) — The sensor can be easily connected to a building management system in order to constantly monitor essential indoor air quality parameters.
  - Recalibration of the sensor — Automatic recalibration of the sensor providing accuracy of measurements

The sensor is specifically designed for installation within air duct systems, making it ideal for HVAC systems in commercial, industrial and residential buildings. This sensor provides real-time, reliable data that enables building management systems (BMS) to take actions regarding ventilation control, air quality management and energy consumption optimisation.

ARTICLE CODES

Article code	DSMFT-4
Imax	40 mA
Supply voltage	24 VDC / 24 VAC ± 10%
Connector type	Pluggable terminal block

INTENDED AREA OF USE

- Demand controlled ventilation systems based on temperature, relative humidity and CO$_2$ level
- Air quality control and monitoring in air ducts
- For indoor use only

TECHNICAL DATA

- Supply voltage:
  - 24 VDC / Power-over-Modbus
  - 24 VAC ± 10 %
- Supply overvoltage protection up to 65 VDC
- Modbus RTU communication only
- Measurement ranges:
  - Temperature: -30—70 ºC
  - Relative humidity: 0—100 %
  - CO$_2$: 0—2.000 ppm

- Easy firmware updating via Modbus RTU communication
- Minimum recommended airflow velocity: 1 m/s
- Operating conditions:
  - Temperature: -10—50ºC
  - Relative humidity: 10—90% (non-condensing)
- Accuracy of measurements:
  - Temperature: ± 0,4 ºC
  - Relative humidity: ± 2,5 % rH
  - CO_2: ± 30 ppm
- Protection standard:
  - Enclosure: IP54
  - Probe: IP20
  - Material: Acrylonitrile Butadiene Styrene (ABS) plastic
  - Colour: Grey
- Storage conditions:
  - Temperature: -10—60 ºC
  - Relative humidity: 5—80% rH

STANDARDS

- Low Voltage Directive 2014/35/EU
- Electromagnetic Compatibility (EMC) Directive 2014/30/EU
- Commission Delegated Directive (EU) 2015/863 (RoHs 3) of 31 March 2015 amending Annex II to Directive 2011/65/EU of the European Parliament and of the Council as regards the list of restricted substances
- WEEE Directive 2012/19/EU

CE

MOUNTING & OPERATING INSTRUCTIONS

Before you start mounting the unit, read carefully **"Safety and Precautions"**.

Follow these steps:

1. When preparing to mount the unit, bear in mind that the probe opening is facing the airflow and the edge of the tube is right in the middle of the duct. Always use the flange to install the sensor on round ducts. It is possible to install the sensor without the flange on rectangular ducts (if necessary), see **Fig. 1** and **Fig. 2** below.

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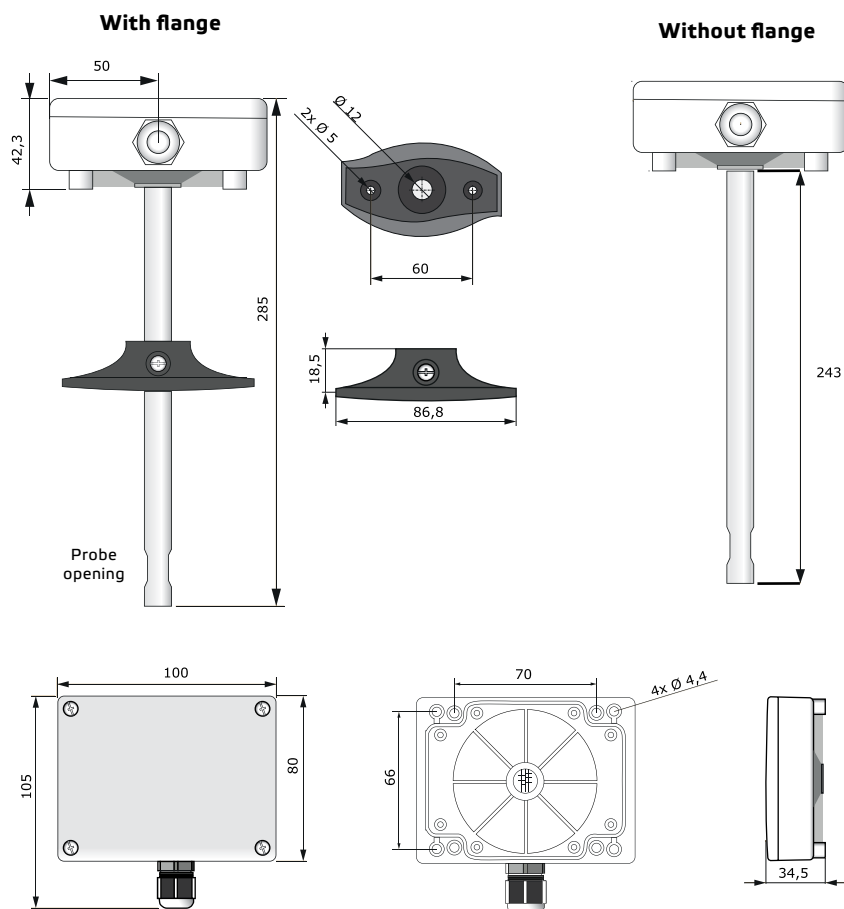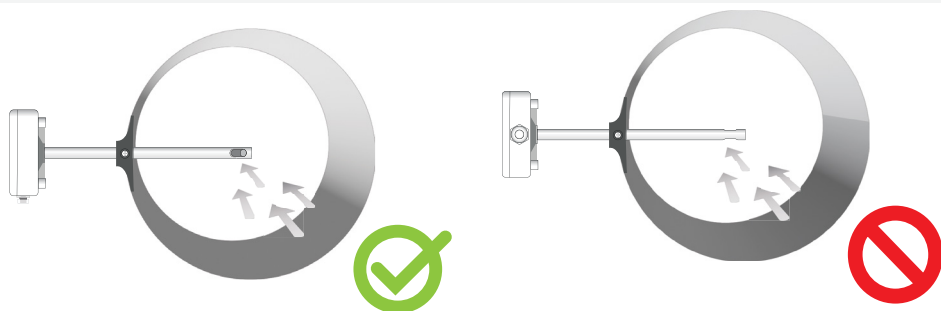
Fig. 1 Mounting dimensions

With flange

Without flange

Probe opening

Fig. 2 Mounting position

Correct	Incorrect

2. Fix the tube inside the duct. Then secure the flexible fixator to the duct using suitable fastening materials to restore the air tightness of the duct and to avoid air leakages.

3. Switch off the mains supply before connecting any power cables.

4. Unscrew the cover of the unit to remove it and insert the connecting cables through the cable gland of the unit.

5. Do the wiring according to the wiring diagram (see **Fig. 3**) while adhering to the information from section **"Wiring and connections"**. The wiring can be done with the pluggable terminal block either plugged or unplugged.

6. Close the enclosure and fix it with the screws. Tighten the cable gland to retain the IP rating of the enclosure.

7. Switch on the mains supply.

8. Check the state of the device.

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WIRING AND CONNECTIONS

Fig. 3 Wiring diagram
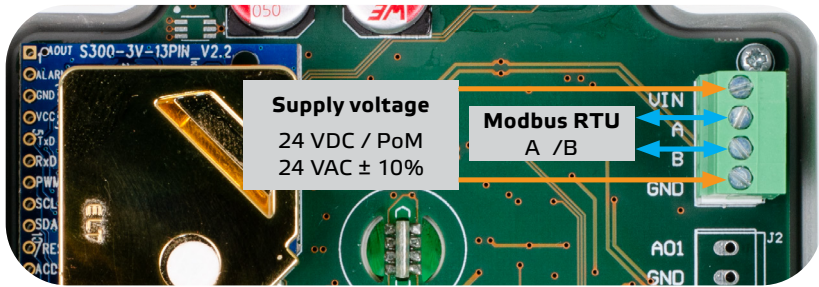

VIN	24 VDC / 24 VAC ± 10%
A	Modbus RTU (RS485), signal A
/B	Modbus RTU (RS485), signal /B
GND	Common ground
Connector type	Pluggable screw terminal block
Cable characteristics	Cat5 or EIB cable

Optional settings
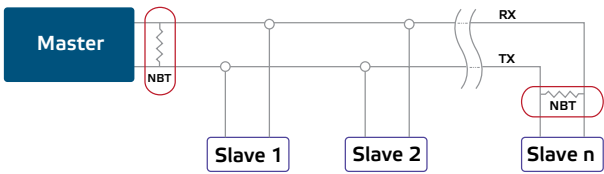
The Network Bus Termination (NBT) Resistor is controlled via Modbus RTU and is disconnected by default. For correct communication, the NBT needs to be activated only in the two furthest devices on the Modbus RTU network. If necessary, enable the NBT resistor via 3SModbus.

Example 1
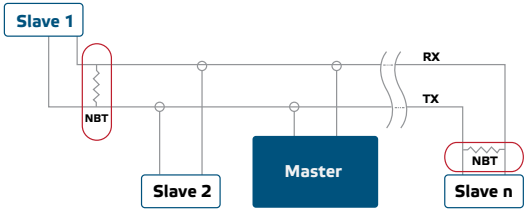
Example 2

⚠ **NOTE**

On a Modbus RTU network, two bus terminators (NBTs) need to be activated!

OPERATING INSTRUCTIONS

Calibration procedure

No calibration procedure is needed for the temperature, relative humidity and barometric pressure measurements.

The removable CO_2 sensor has an option of using the ABC (Automatic Baseline Correction) algorithm. By default, this option is turned on. When the ABC algorithm is enabled, sensor accuracy is restored after a long period of exploitation and the baseline drift is compensated. The algorithm should be used in applications where carbon dioxide concentrations drop to outside ambient conditions (400 ppm) periodically. It keeps the weekly lowest measured value (in ticks, not ppm) and interprets it in 400 ppm. However, devices, using the ABC algorithm should not be used in applications such as greenhouses, hospitals and other environments with constant sources or absorbers of CO_2. Since the baseline is a reference, calibrated by the manufacturer, the ABC algorithm performs an initial calibration of the sensor two days after the device is connected. Then, the algorithm performs recalibration processes on the fifth and the seventh day after the device is turned on. Therefore, by the third week, the sensor achieves a maximum accuracy of ± (30 ppm + 3%).

Firmware updates

The firmware of the unit can be updated via the SenteraWeb cloud platform if the device is connected to a Sentera internet gateway.

TROUBLESHOOTING

NOTE

The troubleshooting steps are described in an easy-to-follow order, beginning with the simplest solutions to the more detailed ones. This approach is created to help users resolve any issues they may encounter when working with our product. Please refer to Fig. 4 when using the troubleshooting steps. If none of the below-described steps fix the problem, we advise you to reach out to a technical specialist of Sentera.

No visible signs of functioning:

- **Signs:**
  - Device is not detected on the Modbus network.
  - On-board "POWER" LED is not lit.
- **Troubleshooting steps — Verify that:**
  - The power supply is enabled.
  - The cable is properly connected to this device.
  - The cable is properly connected to the power supply.
  - The cable pinout is correct.
  - 24 volts are present at the terminal block of the device.

No Modbus communication:

- **Signs:**
  - The device is not detected on the Modbus network by the Modbus master.
  - On-board "RX" LED, which indicates if the device is receiving any Modbus requests, does not blink occasionally.
  - On-board "TX" LED, which indicates if the device is responding to Modbus master requests, does not blink occasionally.
- **Troubleshooting steps — Verify that:**
  - The Modbus master device has correct communication settings (baudrate, parity).
  - The slave ID of DSMFT-4 matches the ID expected by Modbus master.
  - The slave ID of DSMFT-4 does not match the ID of any other device connected to the same Modbus network.
  - DSMFT-4 is responding to the broadcast read command (slave ID = 0, read first 4 Holding registers).

▶ The RS-485 communication line is wired correctly on both sides (A to A, B to B).
▶ The cable length does not exceed 1000 meters.
▶ The device is connected to an isolated Modbus network without other slave devices; check the communication.

Fig. 4 LED Indications
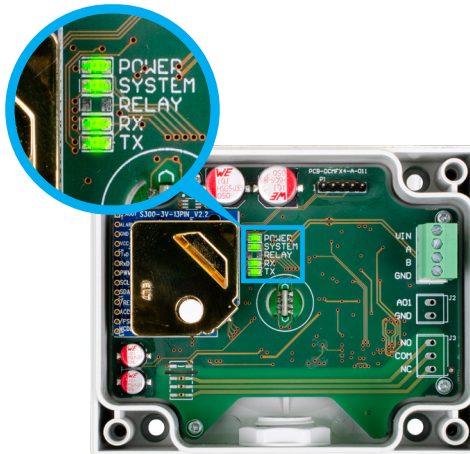
LED indications	POWER	On	Internal power supply (3,3 VDC) of the device is OK
	SYSTEM	On	Device is powered System is OK
		Slow blinking	Device is powered; System error Blinking frequency: 1 time per second / 1 Hz
		Fast blinking	Device is powered; Bootloader mode Blinking frequency: 2 times per second / 2 Hz
	RX	Blink	Modbus request from master (client) is received
	TX	Blink	Modbus response from the device is transmitted

Problems with CO₂ module and CO₂ measurements:

■ **Signs:**

▶ "Sensor Problem" status in the "Carbon Dioxide Sensor State" register (Input Register 54).
▶ Questionable value in the "Carbon Dioxide Level" register (Input Register 51) (e.g. 0 ppm).
▶ "Sensor Fault" status in the "Device Status – Errors" register (Input Register 1).
▶ "Sensor Warning" status in the "Device Status – Warnings" register (Input Register 2).
▶ Slowly blinking "SYSTEM" LED.

■ **Troubleshooting Steps:**

▶ Disconnect the device from the power supply for at least 15 seconds. Then connect it again.
▶ Verify that the CO₂ module is seated securely in its connector.
▶ Carefully disconnect the module, then reconnect it.
▶ Try connecting another module of the same type.

Problems with temperature and humidity measurements:

■ **Signs:**

▶ "Sensor Problem" status in the "Temperature Sensor State" register (Input Register 14).

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- ▶ "Sensor Problem" status in the "Relative Humidity Sensor State" register (Input Register 24).
- ▶ Questionable value in the "Temperature Level" register (Input Register 11).
- ▶ Questionable value in the "Relative Humidity Level" register (Input Register 21).
- ▶ "Sensor Fault" status in the "Device Status – Errors" register (Input Register 1).
- ▶ "Sensor Warning" status in the "Device Status – Warnings" register (Input Register 2).
- ▶ Slowly blinking "SYSTEM" LED.

- ■ **Troubleshooting Steps:**
  - ▶ Disconnect the device from the power supply for at least 15 seconds. Then connect it again.
  - ▶ Verify that the openings of any device part mounted inside the air duct are not clogged.
  - ▶ Make sure there are no water droplets inside the device part mounted in the air duct.

Other problems:

- ■ **Signs:**
  - ▶ "Supply Voltage Fault" status in the "Device Status – Errors" register (Input Register 1).
  - ▶ "Supply Voltage Warning" status in the "Device Status – Warnings" register (Input Register 2).
  - ▶ Questionable value in the "Supply Voltage" register (Input Register 3).
  - ▶ "Sensor Preheating" status in the "Temperature Sensor State", "Relative Humidity Sensor State", "Carbon Dioxide Sensor State" or "Barometric Pressure Sensor State" registers (IR14, IR24, IR54, IR144) that persists for more than 1 minute after the device is powered on.

- ■ **Troubleshooting Steps — Verify that:**
  - ▶ The cable is properly connected to this device.
  - ▶ The cable is properly connected to the power supply.
  - ▶ 24 volts are present at the terminal block of the device.

VERIFICATION OF INSTALLATION

If your unit does not function as expected, please check the connections or refer to the **"Troubleshooting"** section.

FREQUENTLY ASKED QUESTIONS (FAQs)

Can the sensor withstand dust and water ingress?

The sensor is intended for use in air duct systems and is usually installed indoors. The enclosure of the sensor has an IP54 rating, which protects the internal components of the device from dust and water splashes. The sensor element is enclosed in a probe with an opening, ensuring direct contact between the airflow in the duct and the sensor element. The enclosure of the probe has an IP20 rating, which protects the sensor element from solid foreign objects of 12,5 mm or greater. The electronics of the device are also protected against moisture with a special coating.

How can the measurements of the sensor be read?

The measurements of the sensor can be read through Modbus RTU communication via the SenteraWeb cloud platform, a Building Management System or another Modbus master device. The measurements are available in the Modbus input registers. The sensor does not have analogue outputs but relies solely on digital signals (Modbus RTU communication), which are less prone to interferences compared to analogue signals and are less affected by cable length.

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SENTERA
C O N T R O L S

Is recalibration necessary for this sensor?

Recalibration for this sensor is not necessary since it recalibrates itself. The sensor uses NDIR technology, which can experience gradual drift of baseline readings due to aging of components. The sensor uses ABS (Automatic Baseline Correction) algorithm which performs regular recalibration to correct the drift and ensure accurate measurements. For the algorithm to work properly, CO$_2$ level needs to drop to outside ambient conditions (±400 ppm) at least once in seven days (for 15 minutes or longer), which is typically achieved during unoccupied periods. The baseline of the algorithm is the lowest reading during a seven-day period.

Two days after the device is first powered on, the algorithm performs initial recalibration of the sensor. After that, the recalibration occurs again after five days and then again every seven days. By the end of the third week, the sensor reaches a maximum accuracy of ±(30 ppm + 3%).

TRANSPORT AND STORAGE

Avoid shocks and extreme conditions; stock in original packaging.

WARRANTY AND RESTRICTIONS

Two years from the delivery date against defects in manufacturing. Any modifications or alterations to the product after the production date relieve the manufacturer of any responsibilities. The manufacturer bears no responsibility for any misprints or mistakes in this data.

MAINTENANCE

In normal conditions, this product is maintenance-free. If soiled, clean with a dry or damp cloth. In case of heavy pollution, clean with a non-aggressive product. In these circumstances, the unit should be disconnected from the supply. Pay attention that no fluids enter the unit. Only reconnect it to the supply when it is completely dry.