DSCDG3-4

DUCT CO$_2$ SENSOR

Mounting and operating instructions

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1. 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 vapours in high concentrations 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 with 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.

DSCDG3-4 | DUCT CO₂ SENSOR

SENTERA CONTROLS

2. PRODUCT DESCRIPTION

DSCDG3-4 is a duct sensor that measures carbon dioxide (CO_2), temperature (T), relative humidity (rH) and dew point delta. The CO_2 level is measured via NDIR (non-dispersive infrared) technology, which has long-term precision and stability.

This device has an ABC self-calibrating algorithm, which compensates for the gradual drifting of the NDIR CO_2 sensor. This algorithm is designed for applications where CO_2 concentrations drop to outside ambient conditions (±400 ppm) for at least 15 minutes once every 7-day period, which is typically seen during unoccupied periods. The lowest reading during a 7-day period is considered fresh outside air (i.e. the baseline). The ABC algorithm is enabled by default and can be disabled via Holding Register 58 through Modbus communication.

3. ARTICLE CODES

Article code	Imax	Connector type
DSCDG3-4	80 mA	Pluggable terminal block

4. INTENDED AREA OF USE

- Demand-controlled ventilation based on CO_2 concentration, temperature and relative humidity
- Air quality monitoring in air ducts

5. TECHNICAL DATA

- Supply voltage: 24 VDC / 24 VAC ± 10%
- Supply overvoltage protection up to 65 VDC
- Modbus RTU communication
- Accuracy of measurements
  - CO_2: ±(30 ppm + 3 %)
  - Temperature: ±0,4 °C
  - Relative humidity: ±2,5 % rH
- Measurement ranges
  - CO_2: 0–2.000 ppm
  - Temperature: -30–70 °C
  - Relative humidity: 0–100 % RH
- Three analogue outputs
  - 0–10 VDC (load resistance ≥ 1 kΩ)
  - 2–10 VDC (load resistance ≥ 1 kΩ)
  - 0–5 VDC (load resistance ≥ 1 kΩ)
  - 0–20 mA (load resistance ≤ 500 Ω)
  - 4–20 mA (load resistance ≤ 500 Ω)
  - PWM Push-Pull (frequency = 1kHz, load resistance ≥ 1 kΩ, output voltage level = 12 VDC)
  - PWM Open Collector (frequency = 1kHz, pull-up resistance ≥ 1 kΩ, pull-up voltage level ≤ 12 VDC)
- Easy firmware updating via Modbus RTU communication
- Minimum recommended airflow velocity: 1 m/s

- Operating conditions
  - Temperature: -10–50 °C
  - Relative humidity: 10–90% (non-condensing)
- Storage conditions
  - Temperature: -10–60 °C
  - Relative humidity: 5–80 % rH
- Protection standard
  - Enclosure: IP54
  - Probe: IP20
- Enclosure type
  - Material: Acrylonitrile Butadiene Styrene (ABS) plastic
  - Colour: Grey (RAL 7035)

6. 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

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7. WARNINGS AND ATTENTION POINTS

- This product is intended for indoor use only.
- Avoid mounting the device in locations affected by direct sunlight.
- Turn off the power supply before all servicing and maintenance.
- Applying overvoltage to any of the intelligent sensor parts will cause improper operation or failure to the internal circuit.
- Do not short-circuit the terminals or the input and output wiring.
- During operation, the unit must be closed.
- If the unit does not work according to the instructions, the wiring connections, supply voltage and settings need to be checked.

8. MOUNTING INSTRUCTIONS IN STEPS

Before you start mounting the unit, read carefully "Safety and Precautions" and choose a smooth surface for installation (a wall, panel, etc.).

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 probe is right in the middle of the duct. Always use the flange to install the sensor on round ducts. It is recommended to use the flange when installing the sensor on rectangular ducts as well. Mounting the sensor on rectangular ducts without the flange is also possible if the sensor probe is entirely enclosed by the duct — see **Fig. 1** and **Fig. 2** below.
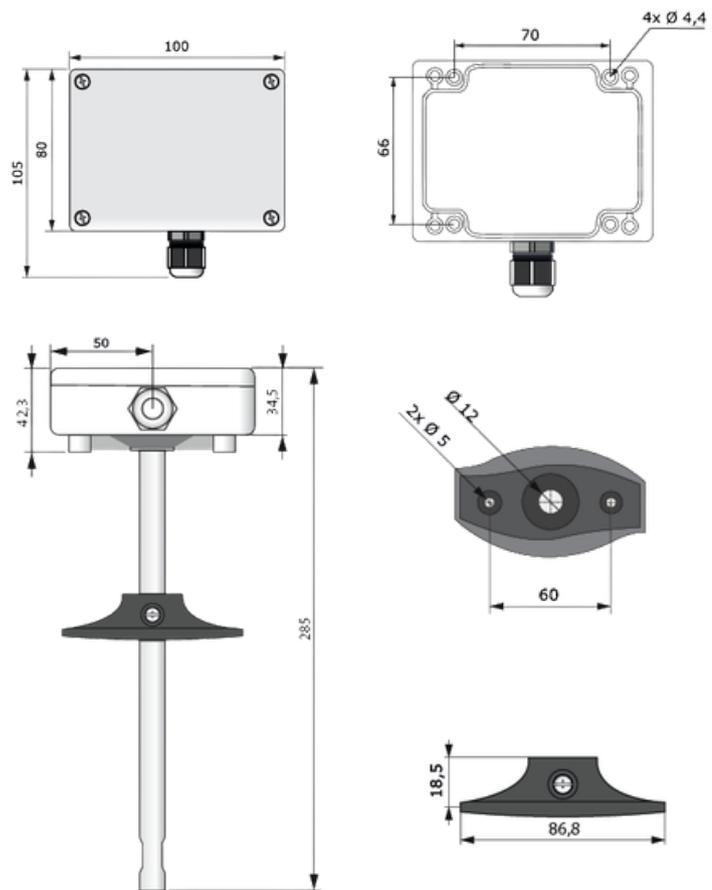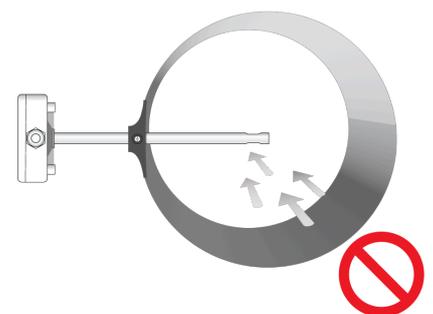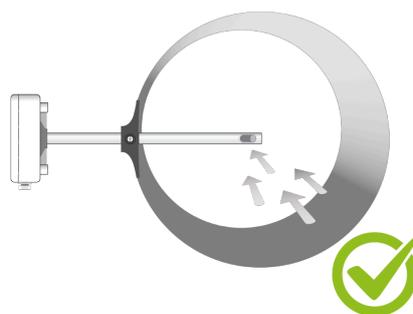
Fig. 1 Mounting dimensions

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.

9. WIRING AND CONNECTIONS

Fig. 3 Wiring and connections

| Supply voltage and Modbus communication	
VIN	24 VDC / 24 VAC ± 10%
A, B	Modbus RTU (RS485)
GND	Common ground
Analogue outputs	
A01	Analogue output 1
GND	
A02	Analogue output 2
GND	
A03	Analogue output 3
GND	
Cable characteristics	Cat5 or EIB cable, cross section ≥ 0,5 mm² max. wire strip length: 7 mm

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 SenteraWeb.

Example 1
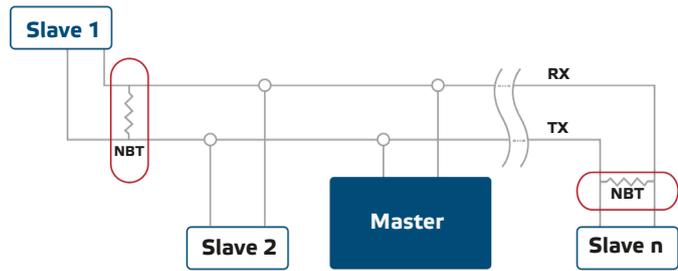
Example 2
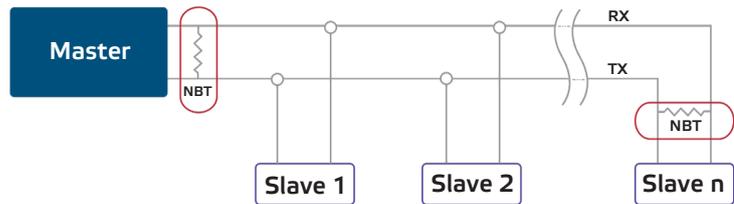
📝 **NOTE**

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

10. OPERATIONAL DIAGRAMS

Temperature Diagram

Temperature [°C]	
70	Alarm
T alarm maximum (HR16)	Alert
T alert maximum (HR14)	OK
T alert minimum (HR13)	Alert
T alarm minimum (HR15)	Alarm
-30	
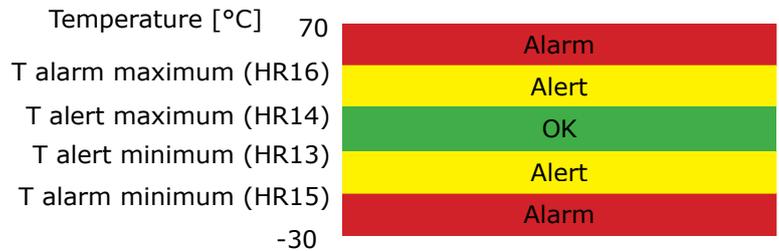
Relative Humidity Diagram

rH [%]	
100	Alarm
rH alarm maximum (HR26)	Alert
rH alert maximum (HR24)	OK
rH alert minimum (HR23)	Alert
rH alarm minimum (HR25)	Alarm
0	

Dew Point Diagram

Dew point delta [°C]	
Dew point delta alert sub-threshold (HR33)	OK
Dew point delta alarm sub-threshold (HR34)	Alert
0	Alarm

CO₂ Level Diagram

CO₂ level 2000

CO₂ level alarm threshold (HR54)

CO₂ level alert threshold (HR53)

0

Alarm
Alert
OK
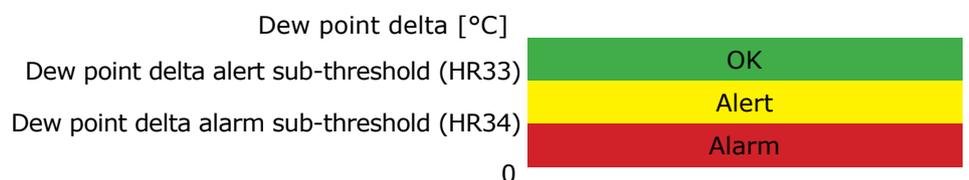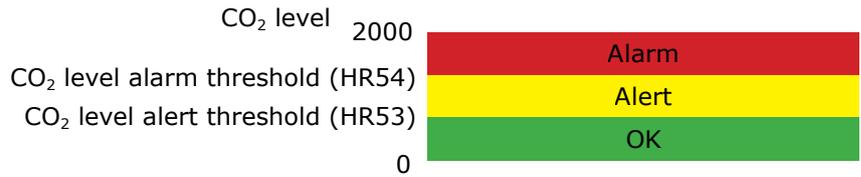
11. OPERATING INSTRUCTIONS

Calibration procedure

No calibration procedure is needed for the temperature and relative humidity measurements. The removable CO_2 sensor has an option of ABC (Automatic Baseline Correction) algorithm. By default, this option is turned on. The ABC algorithm allows to restore sensor accuracy, deteriorated as a result of a long exploitation period. 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 as 400 ppm.

Automatic Baseline Correction algorithm is not recommended for use in greenhouses, hospitals and other environments with constant sources or absorbers of CO_2. In such environments, the sensor's baseline control should be initially switched to Factory mode (reset baseline to default). Then every year or two (depending on the required accuracy) the sensor should be referenced against 400 ppm of CO_2 using Manual Start / Manual Completed baseline correction mode.

According to data from a scientific research, sensor drift should not be higher than 100 ppm per year. 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 %).

2 days	5 days	7 days	7 days

3 weeks to reach full accuracy
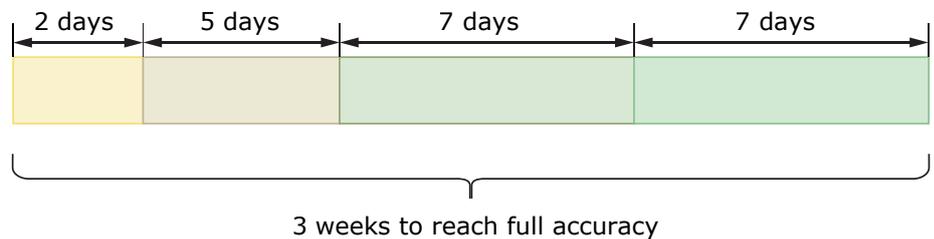
Firmware updates

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

12. TROUBLESHOOTING

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.

No visible signs of functioning

- **How to recognise this issue?**
  - Device is not detected on the Modbus network.
  - On-board "POWER" LED is not lit.
- **How to solve this issue?**
  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

- **How to recognise this issue?**
  - 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.
- **How to solve this issue?**
  Verify that:
- The Modbus master device has correct communication settings (baudrate, parity).
- The slave ID of DSCDG3-4 matches the ID expected by the Modbus master.
- The slave ID of DSCDG3-4 does not match the ID of any other device connected to the same Modbus network.
- DSCDG3-4 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.

Problems with the CO$_2$ module and CO$_2$ measurements

- **How to recognise this issue?**
  - Input register 54 (CO$_2$ sensor state) contains the value 1 (Sensor problem).
  - Input register 51 (CO$_2$ level) contains a questionable value (e.g. 0 ppm).
  - Input register 1 (Device status – errors) contains the value "Sensor fault".
  - Input register 2 (Device status – warnings) contains the value "Sensor warning".
  - Slow blinking of the "SYSTEM" LED.

- **How to solve this issue?**
  - Disconnect the device from the power supply for at least 15 seconds. Then connect it again.
  - Verify that the CO$_2$ module is seated securely in its connector.
  - Carefully disconnect the module, then reconnect it.
  - Try connecting another module of the same type.

Problems with the temperature and relative humidity measurements

- **How to recognise this issue?**
  - Input register 14 (Temperature sensor state) contains the value "Sensor problem".
  - Input register 24 (Relative humidity sensor state) contains the value "Sensor problem".
  - Input register 11 (Temperature level) contains a questionable value.
  - Input register 21 (Relative humidity level) contains a questionable value.
  - Input register 1 (Device status – errors) contains the value "Sensor fault".
  - Input register 2 (Device status – warnings) contains the value "Sensor warning".
  - Slow blinking of the "SYSTEM" LED.
- **How to solve this issue?**
  - 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

- **How to recognise this issue?**
  - Input register 1 (Device status – errors) contains the value "Supply voltage fault"
  - Input register 2 (Device status – warnings) contains the value "Supply Voltage Warning".
  - Input register 3 (Supply voltage) contains a questionable value.
  - Input register 14 (Temperature sensor state) contains the value "Sensor preheating" that persists for more than 1 minute after the device has been powered.
  - Input register 24 (Relative humidity sensor state) contains the value "Sensor preheating" that persists for more than 1 minute after the device has been powered.
  - Input register 54 (CO$_2$ sensor state) contains the value "Sensor preheating" that persists for more than 1 minute after the device has been powered.
  - Input register 144 (Barometric pressure sensor state) contains the value "Sensor preheating" that persists for more than 1 minute after the device has been powered.
- **How to solve this issue?**
  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.

14. FREQUENTLY ASKED QUESTIONS (FAQs)

How can the measurements of the sensor be read?

The sensor measurements can be read through Modbus RTU communication via the SenteraWeb cloud platform, a Building Management System or another Modbus master device.

DSCDG3-4 also features three analogue outputs that, by default, transmit a 0–10 VDC signal. The output signal is based on the device measurements. For instance, output 1 refers to the temperature measurements, where 0 °C corresponds to 0 V and 50 °C to 10 V. In other words, a reading of 25 °C naturally produces a 5 V signal. This proportional logic applies to all of the device outputs. Output 2 is dedicated to relative humidity, and output 3 to CO$_2$ concentration. Different signal types can be selected via the Modbus holding registers of the device.

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.

Is recalibration necessary for this sensor?

Recalibration for this sensor is not necessary since the sensor recalibrates itself. It uses NDIR technology, which can experience a gradual drift of baseline readings due to the ageing 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, it is required that CO$_2$ levels 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%).

15. TRANSPORT AND STORAGE

Avoid shocks and extreme conditions; stock in original packaging.

16. 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.

17. 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.