TSVCT | DUCT AIR QUALITY SENSOR

Mounting and operating instructions

Table of contents

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.

PRODUCT DESCRIPTION

TSVCT is a digital sensor that measures air quality (VOC) as well as temperature and relative humidity. The parameters and settings of TSVCT can be easily adjusted remotely via SenteraWeb thanks to Modbus RTU communication.

- TSVCT provides the following benefits:
  - Easy to connect: Thanks to the pluggable screw terminal block of the device, wiring is done effortlessly.
  - Accurate measurements: The sensor uses VOC index to determine trends in indoor air pollution, which is a smart indicator that continuously adapts to its environment and helps detect air quality changes.
  - Compact design: The miniature design of TSVCT allows easy integration into duct systems without requiring significant space.
  - Modbus RTU communication: When the device is connected to a Sentera internet gateway, users can set parameters, read and monitor data and update the firmware of the device via SenteraWeb.

Due to its compact design, precise measurements and easy installation, TSVCT is an essential part of any HVAC system.

ARTICLE CODES

Article code	TSVCT
Imax	20 mA
Supply voltage	24 VDC
Connector type	Pluggable screw terminal block

INTENDED AREA OF USE

- Demand controlled ventilation based on temperature, relative humidity and air quality.
- Air quality monitoring in air ducts.
- For indoor use only

TECHNICAL DATA

- Supply voltage: 24 VDC
- Maximum input current: 20 mA
- Bootloader, unique ID, and automatic slave ID
- Operating ranges:
  - Temperature: -10—50 ºC
  - Relative humidity: 10—90 % rH, non-condensing
- Modbus RTU communication providing:
  - Data monitoring and reading
  - Setting of parameters
  - Firmware upload
- Default Modbus setting:
  - Address 1
  - 19.200 bps baud rate
  - Even parity
  - One stop bit
- Output characteristics: The sensor has no analogue outputs. All measured values are transmitted via Modbus RTU.
- Selectable alert / alarm levels via Modbus registers:
  - Temperature: -30—70 ºC
  - Relative humidity: 0—100 % rH

- VOC index threshold: 1—500
- Accuracy of measurements:
  - Temperature: ±0,4 ºC
  - Relative humidity: ±2,5 % rH
- Pluggable screw terminal block:
  - Supply: 24 VDC, GND
  - Modbus communication: A, /B
- VOC index pre-heating time: 5 minutes
- Minimum recommended airflow velocity: 1 m/s
- Storage conditions:
  - Temperature: -20—60ºC
  - Relative humidity: 5—80% rH
- Enclosure:
  - Material: ABS (Acrylonitrile Butadiene Styrene)
  - Colour: Black
  - Protection class: IP20 (EN 60529)

STANDARDS

CE

- 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

MOUNTING INSTRUCTIONS IN STEPS

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

Follow these steps:

1. When preparing to mount TSVCT, bear in mind that the unit itself must be installed by fixing the flexible flange onto the outer surface of the duct, while the probe is inserted inside the duct — see **Fig. 1** and **Fig. 2**

Fig. 1 Mounting dimensions

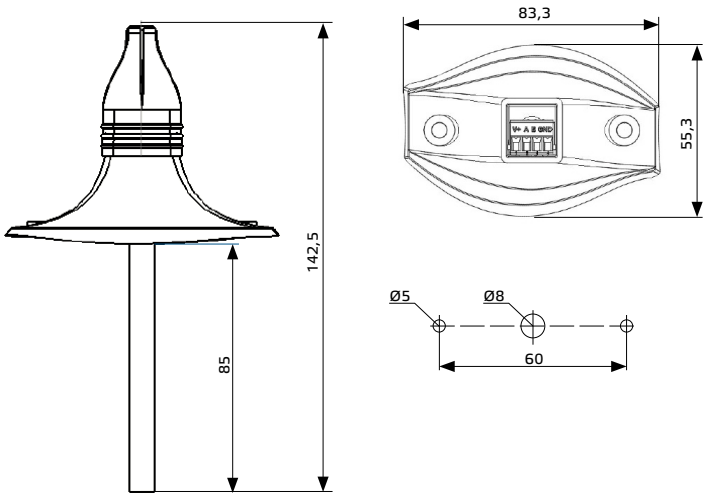
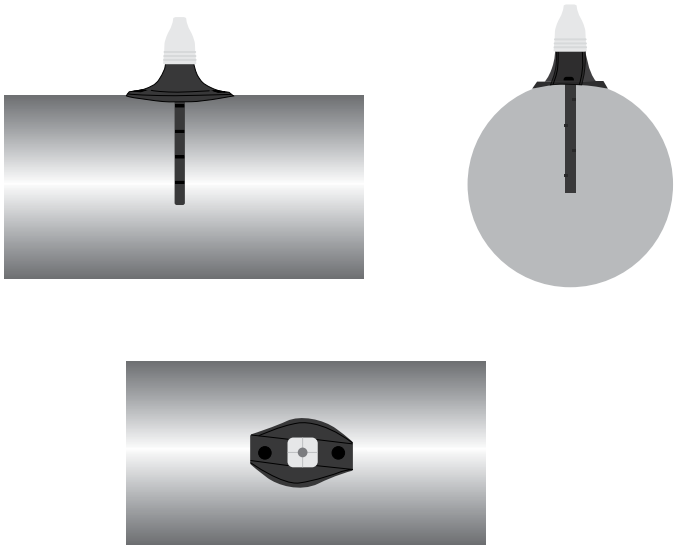


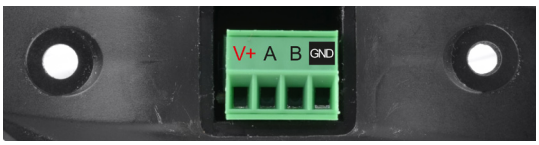
Fig. 2 Mounting position



2. Drill an Ø 8 mm hole into the duct and insert the probe.
3. Drill two small holes for the mounting screws. The size of the holes depends on the screws being used. The diameter of the holes in the enclosure is 5 mm.
4. Fix the probe inside the duct and secure the flexible fixator to the duct using suitable fastening materials.
5. Make sure the supply voltage is within the accepted input voltage rating as defined in the technical specifications of the device.
6. Switch OFF the power supply before connecting any power cables.
7. Do the wiring according to the wiring diagram — see **Fig. 3**.
8. Check the state of the device.

WIRING AND CONNECTIONS

Fig. 3 Wiring diagram

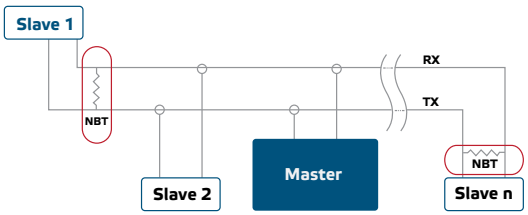


VIN	24 VDC
A	Modbus RTU (RS485), signal A
/B	Modbus RTU (RS485), signal /B
GND	Common ground
Connector type	Pluggable screw terminal block
Cable characteristics	Cat5 or EIB cable

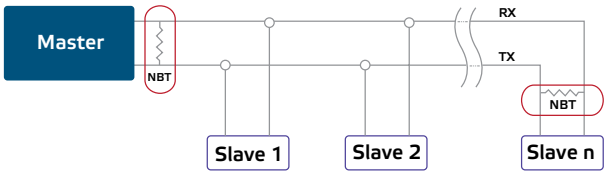
Optional settings

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

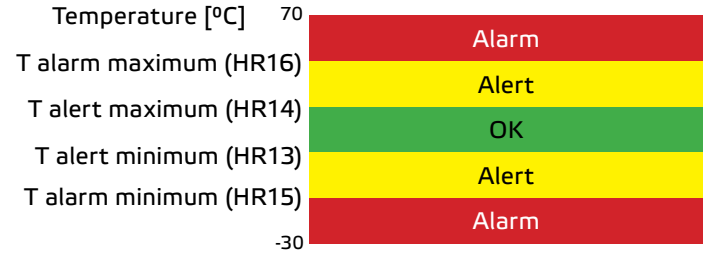


NOTE

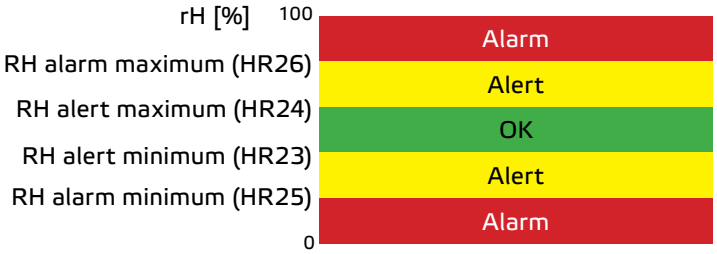
On a Modbus RTU network, two bus terminators (NBTs) need to be activated!

OPERATIONAL DIAGRAMS

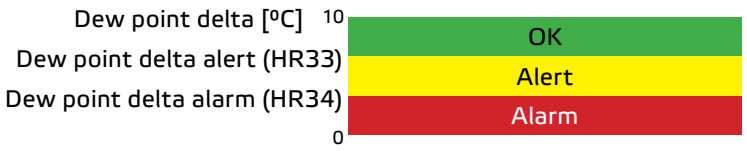
Temperature Alert / Alarm



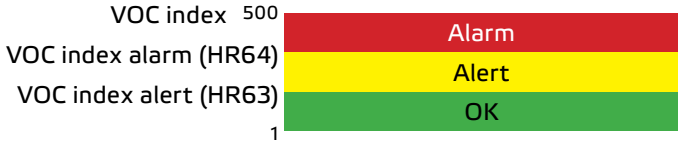
Relative humidity Alert / Alarm



Dew point Alert / Alarm



VOC Index Alert / Alarm



OPERATING INSTRUCTIONS

Calibration procedure

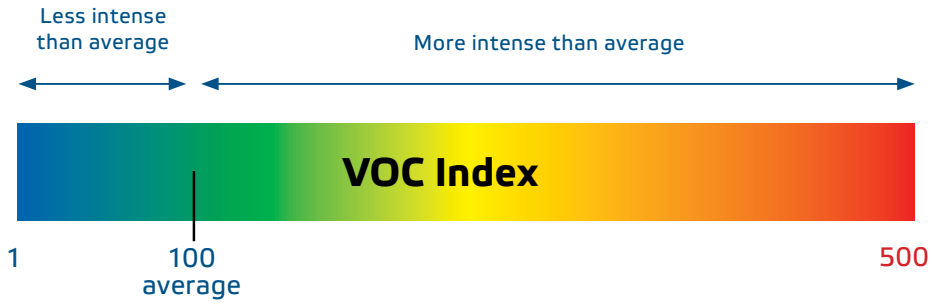
No calibration procedure is needed for the temperature and relative humidity sensor.

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.

VOC index

The VOC index is a smart, adaptive indicator that reflects trends in indoor air pollution from volatile organic compounds (VOCs), similar to how the human nose perceives odours. Value of 100 refers to the average indoor gas composition over the past 24 h. While values between 100 and 500 indicate a deterioration, values between 1 and 100 inform about improvement of the VOC based air quality. The index continuously adapts to its environment and helps detect air quality deterioration or recovery over time.



Air quality indication VOC index

Modbus register value (IR 65)	Description	VOC index
7	Very Bad	400
6	Bad	300
5	Poor	250
4	Fair	150
3	Good	100
2	Very Good	50
1	Excelent	0
0	Preparing	First 5 min

VERIFICATION OF INSTALLATION

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

TROUBLESHOOTING

NOTE

The troubleshooting steps are described in an easy-to-follow order, beginning with the simplest solutions to the more detailed ones. Every single troubleshooting step is independent. This approach is created to help users resolve any issues they may encounter when working with our product. 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:

- **How to recognise this issue?**
  - Device is not detected on the Modbus network.
- **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.
- **How to solve this issue?**

  Verify that:
  - The Modbus master device has correct communication settings (baudrate, parity).
  - The slave ID of TSVCT matches the ID expected by the Modbus master.
  - The slave ID of TSVCT does not match the ID of any other device connected to the same Modbus network.
  - TSVCT 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 temperature and 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".
- **How to solve this issue?**
  - Disconnect the device from the power supply for at least 30 seconds. Then connect it again.
  - Verify that the openings on any device part mounted inside the air duct are not clogged.

- Make sure that there are no water droplets inside the device part mounted in the air duct.

Problems with VOC index measurements

- **How to recognise this issue?**
  - Input register 64 (VOC index sensor state) contains the value “Sensor problem”.
  - Input register 61 (VOC index 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”.
- **How to solve this issue?**
  - Disconnect the device from the power supply for at least 30 seconds. Then connect it again and wait for the preheating time.
  - Verify that the openings on any device part mounted inside the air duct are not clogged.

Other problems:

- **How to recognise this issue?**
  - Input Register 1 (Device status – errors) contains the value “Internal voltage fault”.
  - Input Register 2 (Device status – warnings) contains the value “Internal voltage warning”.
  - Input register 14 (Temperature sensor state) contains the value “Sensor preheating”, which persists for more than 5 minutes after the device is powered on.
  - Input register 24 (Relative humidity sensor state) contains the value “Sensor preheating”, which persists for more than 5 minutes after the device is powered on.
  - Input register 64 (VOC index sensor state) contains the value “Sensor preheating”, which persists for more than 5 minutes after the device is powered on.
- **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.

FREQUENTLY ASKED QUESTIONS (FAQs)

How can the measurements of TSVCT be accessed?

Thanks to Modbus communication, the measurements of the sensor can be accessed remotely via internet. Once the sensor is connected to a Sentera internet gateway, all data and parameters can be accessed and configured via the SenteraWeb cloud platform. The sensor has no analogue outputs.

Is the sensor compatible with non-Sentera products?

TSVCT uses Modbus communication, which allows it to be implemented into HVAC systems. However, in order to connect different devices into a system, the specifications of the devices should be taken into account. All connected devices must use the Modbus RTU transmission mode to make communication possible.
The Modbus RTU communication uses message frames to mark the beginning and ending point of the message allowing the receiving device to determine which device is being addressed and to know when the message is completed. Communication between the connected devices is only possible if they use the same message frame structure.
TSVCT can be connected to non-Sentera devices if they use the same Modbus RTU transmission mode and the same message frame structure.

Is the sensor easy to connect?

The Sentera products are manufactured with user-friendliness in mind. TSVCT stands out in particular with its pluggable screw terminal block. Once the sensor is mounted on a duct, the screw terminal block can be unplugged, which allows users to do the wiring effortlessly without being constrained by the mounting position of the sensor. When the wiring is completed, the screw terminal block can be easily plugged back in place.

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.