



THCO₂

CO₂ level sensor,
thermometer and hygrometer

Communication: RS485 line, Modbus or Spinel



THCO2

Datasheet

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Changelog

Version 2.4 (03/2026)

- A more modern type of sensor with differences in technical parameters.
- Adjustable audible alarm added.
- Instructions and registers for altitude, calibration type, and audible alarm added.

Version 1

- First version.

BASIC INFORMATION

THCO2 is a CO₂ level sensor that also measures temperature and humidity. It measures from -10°C to +60°C and CO₂ level from 0 to 5 000 ppm. Communication is possible on an RS485 line using Spinel or ModBus RTU protocols. All of the above is possible with very little power consumption. The make of THCO2 makes it ideal to measure air quality in lecture halls, offices and all indoor areas where CO₂ level needs to be monitored.

THCO2 is available as an interior sensor for areas protected from water and condensation.

Areas of use

- Ventilation automation
- Air quality control
- Ventilation to comply with legislation guidance.

Features

- **Measurement of the CO₂ level from 0 to 5 000 ppm**
- CO₂ measurements carried out by optical NDIR sensor ¹
- CO₂ level indicator on the device
- **Temperature measurement** in range from -10 to +60 °C ¹
- **Humidity measurement** from 0 to 100 %RH ¹
- Automatic dew point calculation
- Measured-out values transmitted directly in ppm, degrees Celsius a percent
- RS485 communication
- **Power voltage from 4,5 to 36 V**
- **Low consumption** – typically **only 8 mA @ 12 V**
- Communication protocols: **Spinel** or **Modbus RTU** (*user selectable*)



fig. 1 – comparison of the THCO2 against an AA battery

¹ Exact accuracy shown in technical parameters section at the end of the document.

CONTROLS AND INDICATIONS

Indicator light

A light indicator is visible through the ventilation slots in one of the corners. Indicating different operating states with different colours. The light indicator mode during operation is set via [Modbus](#) or [Spinel](#).

Mode	State	Color	Behavior
Initialization	Modbus protocol	Red	Long flash
Initialization	Spinel protocol	Green	Long flash
Mode 1 (default)	CO ₂ ≤ 1000 ppm	Green	Lit
	CO ₂ 1000–1500 ppm	Red	Lit
	CO ₂ ≥ 1500 ppm	Red	Flashing
Mode 2	Communication	Green	Long flash
	Device activity	Green	Short flash every 10 s
	Sensor fault	Red	Flashing
Mode 3	Sensor fault	Red	Lit
	Normal state	Green	Off

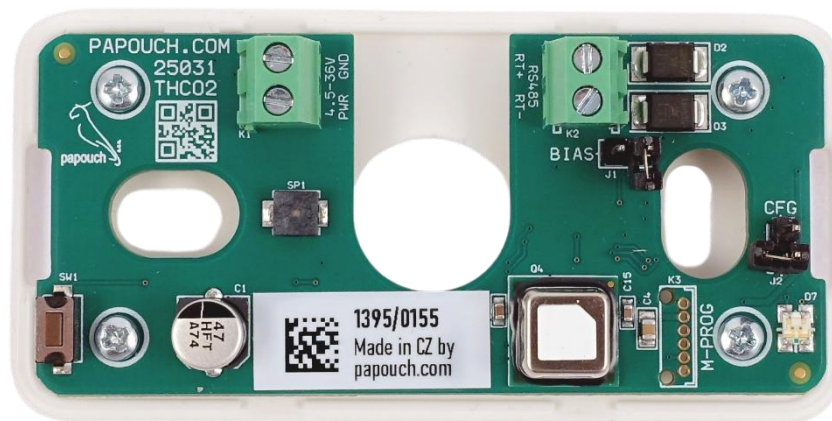


fig. 2 - The indicator light is located at the bottom right of the electronics board inside the box

Sound Indication

The warning signal is enabled by default. It can be enabled or disabled via [Modbus](#) or [Spinel](#).

Situation	Behavior
CO ₂ ≤ 1000 ppm	No sound
CO ₂ 1000–1500 ppm	1× short beep every 10 minutes
CO ₂ ≥ 1500 ppm	2× short beeps every 10 minutes

Test button confirmation	1× beep
Suppression confirmation	2× beeps
Manual calibration confirmation	3× beeps
Factory reset confirmation	4× beeps

Button Behavior

Press	Action	Result
Short	Device test	Red LED flashes, device emits a sound
2 seconds	Suppress sound indication	Sound indication is disabled until CO ₂ returns to a normal level
5 seconds	Manual calibration	Device enters manual calibration mode and stores 400 ppm as a reference
10 seconds	Restore factory settings	Restores default values (address, speed, protocol, automatic calibration)

INSTALLATION

Placement

We recommend placing the sensor on the wall at approximately the expected height of the heads of people who will be in the area. The universal recommended height is approximately 1.5 m. The sensor should not be placed near sources of heat, cold, or glare, as this could negatively affect the measurement.

Connection

THCO2 communicates using a standard two-wire RS485 industrial bus. It uses 4,5 – 36V DC for power, its power input is protected against polarity reversal.

Screw terminals are used both for power and RS485 line. (2.5 mm flat screwdriver)

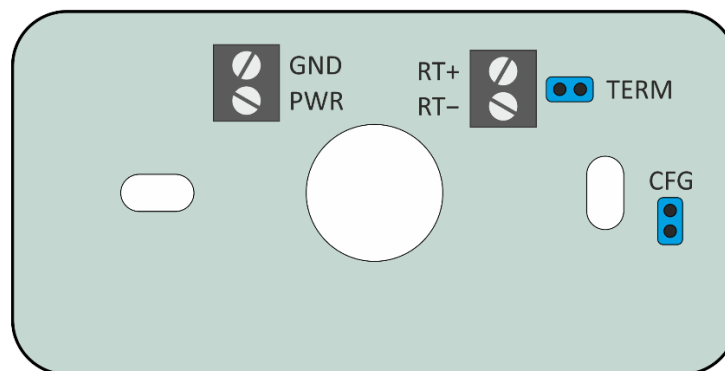


fig. 3 – terminal and jumper placement diagram

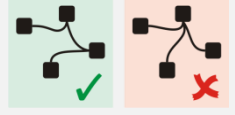
PWR and GND terminals are for power, RT+ and RT- are for **RS485 line**.²

² Alternative designations are used for RS485 wires: „A“ or „RxDx+“ (for RT+) and „B“ or „RxDx-“ (for RT-).

Connecting the RS485 line

Some basic recommendations for connecting RS485 line (bus):

- We recommend using common TP cable used for computer network and using one twisted pair as RS485 communication cables
- All devices should be connected from one to another and not in a star topology (see picture on the right). Maximum length of such line should be 1,2 km
- Use termination at each end of the line (use Termination jumper if available).
- Shielding, if available, connect to the ground on one side of the line only!



The recommended cable for computer network contains four pairs of twisted wires:

- The first pair should be used for data wires. Select one wire as **Tx+** (RxTx+) and the second one as **Tx-** (RxTx-).
- The second pair: Connect the two wires and use them for the positive pole (**PWR**).
- The third pair: Connect the two wires and use them for grounding (**GND**).
- The fourth pair: Leave unconnected for possible future use.

With other devices, RS485 communication wires are connected 1:1, which means Tx+ (RxTx+) of TQS4 to RxTx+ of the other device, and similarly Tx- (RxTx-) to RxTx-.

The following picture shows THCO2, a converter and other devices all connected properly.

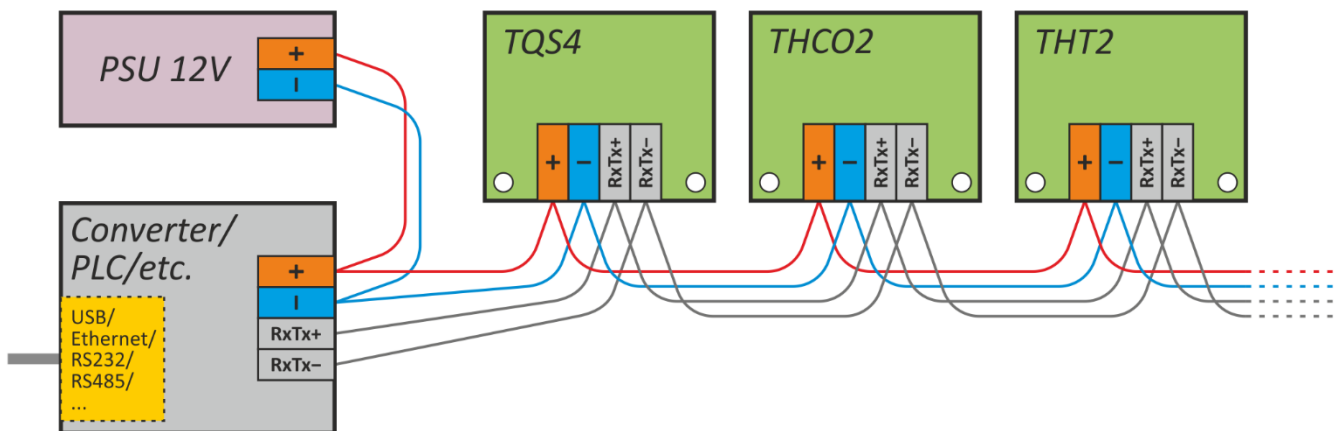


fig. 4 – an example of a proper connection of RS485 line

COMMUNICATION

THCO2 supports Modbus RTU and Spinel protocols (default). Both protocols are described in a separate document, which can be downloaded from the THCO2 product page at papouch.com.

Default communication parameters:

Communication protocol .. Spinel (can be switched to Modbus RTU)
 Speed 9,600 Bd (adjustable from 1,200 to 115,200 Bd)
 Address..... 0x31 (dec. 49, character "1")
 Data word 8 bits, no parity, 1 stop bit

[The Modbus Configurator](#) utility (available for download at papouch.com) or the CFG jumper on the electronics board (short-circuited = Modbus) can be used to switch protocols.

Key information accessible via the communication line:

- CO₂ concentration (ppm)
- Temperature (°C)
- Relative humidity (%RH)
- Dew point (°C) — automatically calculated
- Time since power-up (s) — for evaluating CO₂ measurement stability

TECHNICAL PARAMETERS

CO₂ level measurements³

Range 400 to 5 000 ppm (0 to 40 000 ppm for reference)
 Accuracy, range 400-1000 ppm ⁴ ±(50 ppm + 2.5% of measured value) ⁵
 Accuracy, range 1001-2000 ppm ⁴..... ±(50 ppm + 3% of measured value) ⁵
 Accuracy, range 2001-5000 ppm ⁴..... ±(50 ppm + 5% of measured value) ⁵
 Temperature stability..... ±(5 ppm + 0.5% of measured value)
 Measurement delay (τ_{63%}) 60 s
 sensor type optical (NDIR)

Temperature measurements³

Range -10 to +60 °C
 Resolution 0.1 °C
 Accuracy ⁴ ±0.8 °C in range 10 to 30 °C
 Measurement delay (τ_{63%}) 120 s

³ For complete technical parameters of the sensor, see the [Sensirion SCD41](#) sensor documentation.

⁴ Accuracy can also be negatively affected by heat and cold sources, air circulation and direct sunlight.

⁵ At 25 °C, 50 %RH, pressure 1013 mbar.

Humidity measurement³

Range.....	0 – 100 %RH (non-condensing)
Resolution.....	0.1 %RH
Accuracy ⁴	±6% RH (in range 20 to 65 %RH)
Measurement delay ($\tau_{63\%}$).....	90 s

Communication line

Type.....	RS485
Termination.....	resistor 120 Ω user connected using TERM jumper
BIAS-ing	resistors 22 k Ω
Response delay.....	2.5 ms (from request)
Communication protocol.....	Spinel or Modbus RTU (<i>user selectable</i>)
Default communication protocol	Spinel
Speed.....	to 115.2 kBd (default: 9600 Bd)
Default address	0x31 (character: „1“, decadic: 49)
Data bits	8
Parity	none
Stop bits.....	1
Maximum number of devices on bus.....	32

Mechanical parameters

IP coverage	IP 20
Mechanical sensor placement	directly on the PCB
Dimensions.....	80 x 40 x 20.5 mm
Connections.....	screw terminal for wires 0.2 - 1 mm ²
Terminal tool.....	flat-head screwdriver 0.5 x 2.5 mm

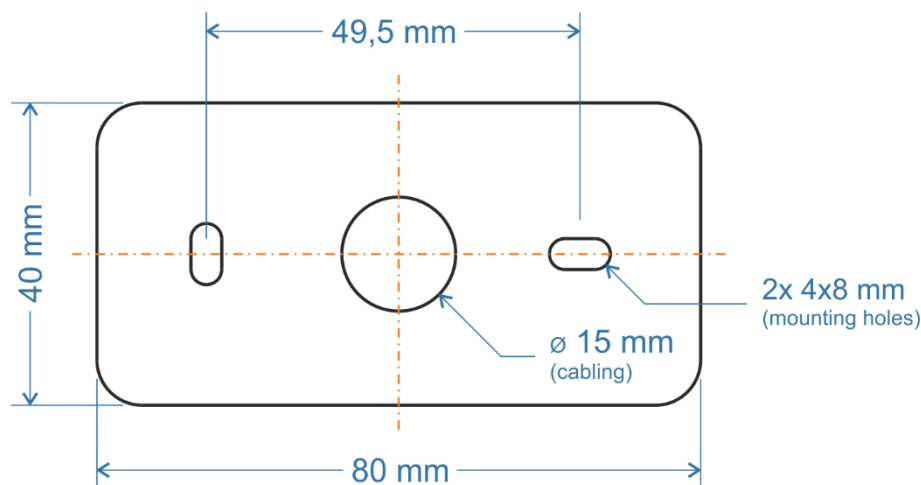


fig. 5 – mount holes and central opening for wiring

Other parameters

Power voltage.....	4.5 to 36 V DC with reverse polarity protection
Current consumption at 12 V	typ. 8 mA; max. 25 mA

Current consumption at 24 V typ. 4 mA; max. 13 mA

Operating temperature of electronics -10 to +60 °C

Operating humidity of electronics 0 to 95%RH (non-condensing)

Weight..... typ. 35 g

Sensor lifetime 10 years³

Papouch s.r.o.

Industrial data transmission, line and protocol converters, RS232, RS485, RS422, USB, Bluetooth, Ethernet, LTE, WiFi, measurement modules, smart temperature sensors, I/O modules, custom development and manufacturing.

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