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## Intelligent sensor

# THT2

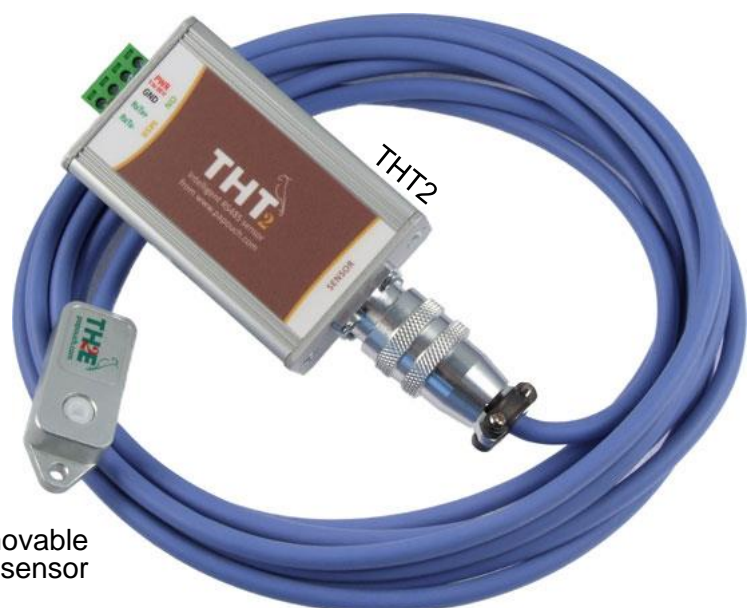
Humidity measuring range: 0 to 100 %

Temperature measuring range: -40 to +125 °C

Dew point automatic calculation

Communication via RS485 line

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Removable  
sensor

# THT2

## Datasheet

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## ABOUT DEVICE

THT2 is an intelligent hygrometer and thermometer. It measures humidity directly in percentage and temperature in degrees Celsius. Also, it is able to combine both values to calculate the dew point. Values in digital format are made available via the RS485 communication line.

THT2 has low consumption – it is easy to create a network of these devices connected via a single four-wire cable (RS485 + power supply) ranging up to 1200 meters.

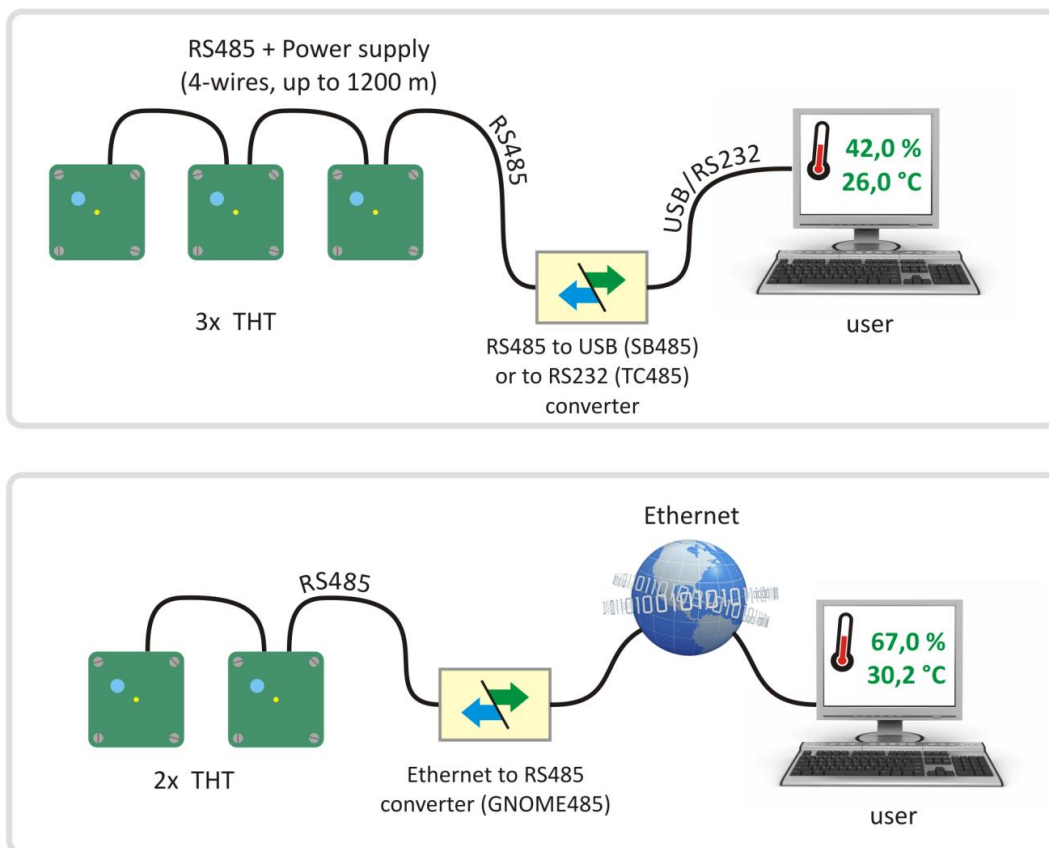


Fig. 1 – Example of THT2 sensors connection to PC (directly or over Ethernet)

## Available models

### THT2

Electronics in an enclosure to be connected to an external sensor. Sensor is sold separately. These types are available:

- Temperature and humidity sensor or
- Temperature sensor only.

### THT2 I

- Electronics with temperature and humidity sensor within interior enclosure.



## Main features

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- Measures relative **humidity** within the range of 0 % to 100 %. <sup>1</sup>
- Measures **temperature** within the range of -40 to +125 °C or -55 to +125 °C. <sup>1</sup> (Interior design max. up to 70 °C - limited by plastic box.)
- **Dew point** calculation. <sup>1</sup>
- Sensor connected with the electronics via a silicon highly durable cable. <sup>1</sup>
- Temperature conversion into several temperature units.
- Extreme values memory option – THT2 remembers the highest and lowest measured value for each measured physical quantity.
- Connection and communication via the RS485 bus (only two wires, up to 1.2 km).
- **Spinel** and **Modbus RTU** communication protocols.
- **Tip for developers:**
  - [Online spinel parser](#).
  - [Spinel.NET](#) on GitHub: Windows SDK for easy work with THT2 in .NET environment. (Documentation only in Czech language.)
- Free [Wix](#) software for Windows.
- Power supply: 5 V to 30 V.
- Mountable on DIN 35 mm rail.

## Detailed features

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### Measurement

- Measures temperature, humidity and dew point or just temperature based on the type of connected sensor.
- Memory of extreme values for each measured quantity. One entry for the historically highest measured value and one for the lowest measured value.
- Possibility to set the upper and lower limit for each measured quantity. Whenever exceeding the preset range the device sends an automatic message.
- The possibility to activate value monitoring separately for each measured quantity.
- Temperature units: Celsius, Fahrenheit or Kelvin.
- Possibility to set hysteresis for measurements carried out at locations with fluctuating values.

### Hardware

- Measures relative humidity within the range of 0 % to 100 %.
- Measures temperature within the range of -40 to +125 °C or -55 to +125 °C. (Interior design max. up to 70 °C - limited by plastic box.)
- Dew point calculation.
- THT2: Silicon cable (up to 20m) with metal sensor at its end.
- THT2 I: Interior model with integrated sensor.

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<sup>1</sup> Depending on the type of connected sensor. (The sensor is not included in the price – it is supplied separately, please, specify when making your order.)

- Power supply: 5 to 30 V

## Design

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### Electronics

- THT2: In a metal box made of anodized aluminum.
- THT2 I: Plastic enclosure with all-around vents, embedded temperature and humidity sensor.

### Sensor

- THT2: **TH3** – Integrated humidity and temperature sensor (+ dew point calculation) – in a  $40 \times 16 \times 10$  mm metal box.  
*Cable*: Silicon; diameter 4.3 mm; length 3m (max. 20 m); thermal resistance -60 to +200 °C; blue color.



Fig. 2 – TH3: Integrated humidity and temperature sensor for THT2

- THT2: **Temperature only** – in the duralumin stem. Standardized diameter 6 mm, length 60 mm. The sensor is designed for contact temperature measurement of liquid or gaseous substances.  
*Cable*: Silicon; diameter 4.3 mm; length 3m (max. 20 m); thermal resistance -60 to +200 °C; blue color.



Fig. 3 – Temperature sensor for THT2

- THT2 I: Integrated temperature and temperature sensor (+ dew point calculation)



fig. 4 – Interior model THT2 I

### Mounting (THT2 only)

- Without a mounting clip (*standard design*)
- With a mounting clip for 35 mm DIN rail



Fig. 5 – THT2 with a mounting clip for 35 mm DIN rail

### Supply

- 5 to 30 V DC

*Do not hesitate to contact us if you have any other special requirements concerning the design and functions of the THT2 sensor.*

## CONNECTION

- 1) *THT2 only*: Connect the temperature or temperature/humidity sensor. After the power supply is connected, the connected sensor is self-detected in the device. If no sensor is found, the type is set to TH3. For proper functionality of the device, we recommend connecting the sensor first and then the power supply.
- 2) In most cases, shielded TP cable (so called STP or FTP cable – standard cable used in computer networks) will be fully sufficient as interconnector.

This cable contains four pairs of twisted conductors:

Use the first pair for data. One wire shall be **RxTx+**, the other one **RxTx-**.

The second pair: interconnect both conductors and use them for the positive pole of the power supply (**PWR**).

The third pair: interconnect both conductors and use them for power supply grounding (**GND**).

The fourth pair: Leave unconnected. As a backup for any future use.

If more THT devices are to be connected via the RS485 line, connect the cable in the way as illustrated below – i.e. one module after the other. The total length of the cable can reach up to 1200 meters.

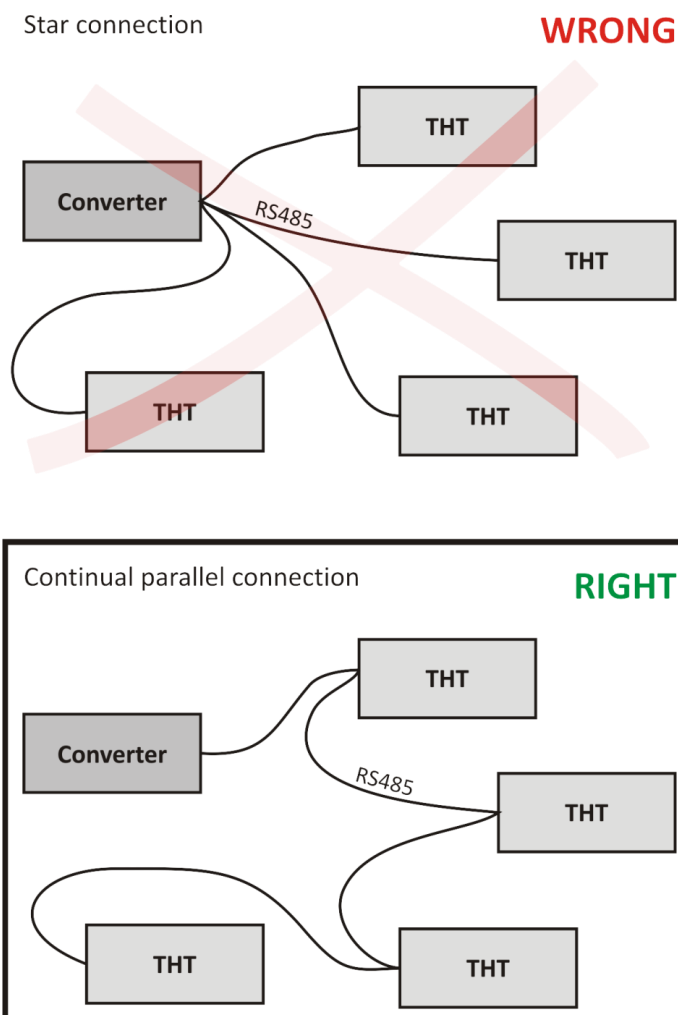


Fig. 6 – Incorrect and correct method of connecting a higher number of THT2 devices via RS485



Connect the terminal block (bus) for RS485 and power supply. Wires are connected to THT2 via a removable terminal block with screws:



Fig. 7 – Connectors on the electronics board

THT2 I has two separate terminals:

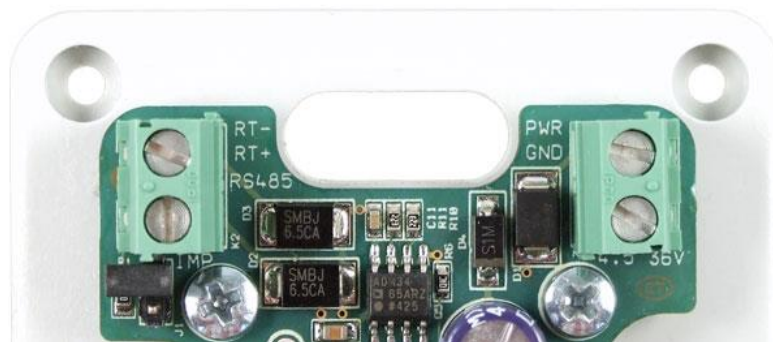


Fig. 8 – THT2 I terminals <sup>2</sup>

PWR.....Power supply positive pole.

GND.....Power supply grounding.

RxTx+ .....More positive wire of the RS485 communication line (can also be marked A)

RxTx- .....More negative wire of the RS485 communication line (can also be marked B)

- 3) THT2 I only: When the sensor is mounted on a wall, make sure one of the two arrows marked TOP aims straight upwards.
- 4) With other devices the RS485 communication lines shall be connected 1:1, i.e. RxTx+ on THT2 to RxTx+ of the other device and RxTx- to RxTx- respectively.

An example of a connection between a THT2, [GNOME485](#)<sup>3</sup> converter and any other additional devices is shown in the following figure.

<sup>2</sup> The jumper next to the RS485 terminal block is used to connect the impedance termination of the RS485 line. If the sensor is the last one on the communication line, short the jumper.

<sup>3</sup> RS485 to Ethernet converter. It can be used to connect the sensors to a computer network and even to the Internet and thus to collect data from any place connectable to the Internet. For more information about GNOME485 converter visit [en.papouch.com](http://en.papouch.com).

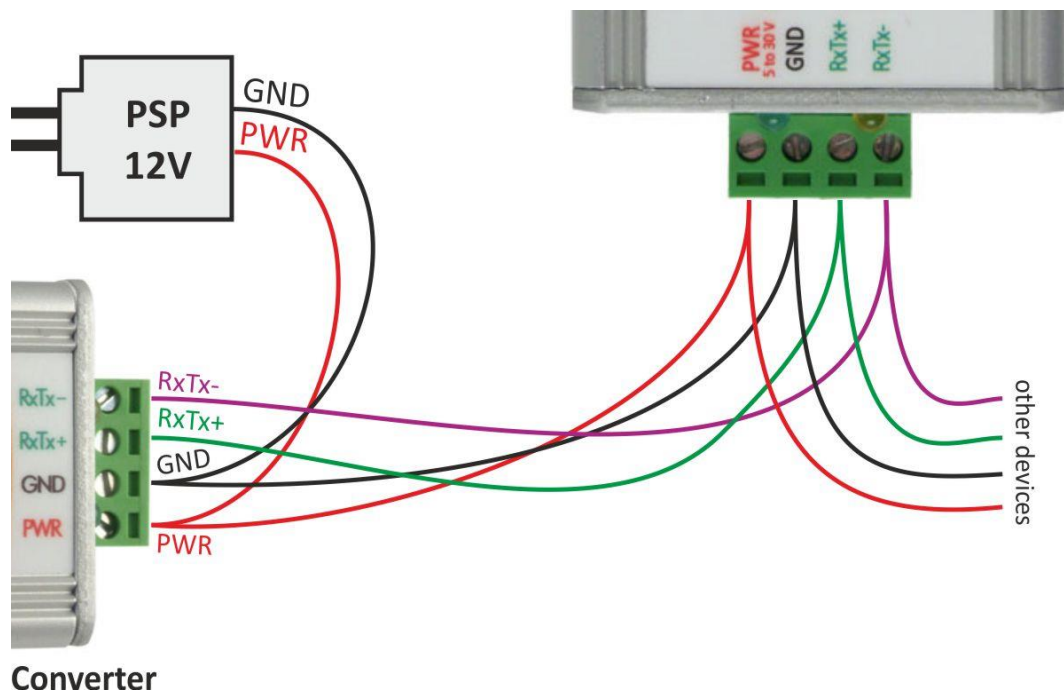


Fig. 9 – Example of a connection between a converter, THT2 and other devices

## INDICATION

### THT 2

#### Green LED indicator

The light glows when the device is connected to power supply.

#### Yellow LED indicator

After power on, it blinks to indicate correct initialization. The light also flashes (200 ms) when communicating over RS485 and flashes once every 10 sec for a very short period (50 ms) to indicate the internal program is running.

### THT 2 I

- *After start:* Flashes orange (green + red).
- *Everything is fine:* Flashes green every 5 sec.
- *Sensor error:* Flashes red every 5 sec.
- *When communicating:* Flashes orange (green + red).

**TECHNICAL PARAMETERS**

**Integrated temperature and humidity sensor<sup>4</sup>**

Important Notice: Polymer sensor is a highly sensitive element that reacts with chemicals. Do not expose even the outer shell of the sensor to chemicals or their vapours (cleaning with alcohol, petrol etc.). Especially organic solvents and compounds can negatively affect the sensor accuracy by as tens of percent RH.

Coverage.....IP 54  
 Dimensions.....40 × 16 × 10 mm  
 Material.....hardened aluminum

**Humidity sensor**

Humidity range .....0 % to 100 % RH (non-condensing)<sup>5</sup>  
 Recommended measurement range .....20 – 80 %  
 Resolution.....1% RH  
 Humidity measurement accuracy .....see Fig. 10  
 Sensor element .....polymer sensor  
 Sensor mechanical finish.....under the plastic mesh on top of the device

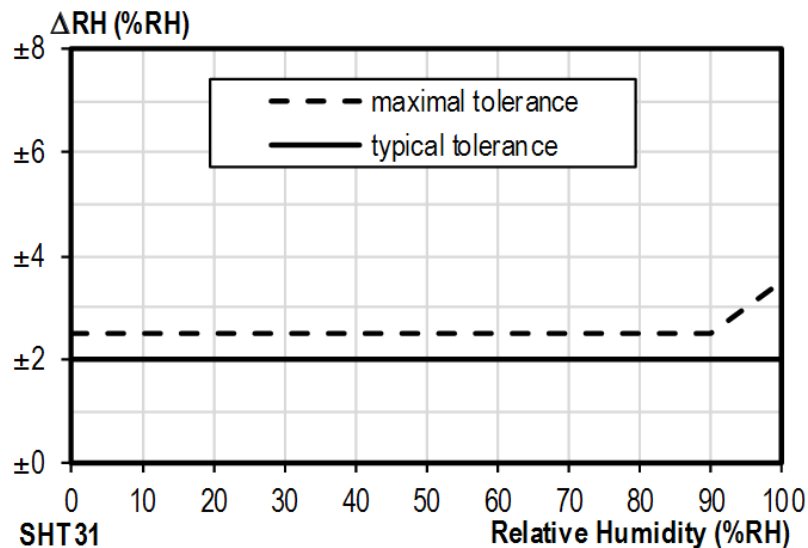


Fig. 10 – Accuracy of humidity measuring

<sup>4</sup> Sensor marked TH3 is supported in firmware including and above version 2.10. If you have an older firmware, you will have to flash the firmware to be able to read from TH3 sensor. Here are the key differences between the old version (Marked as TH2E) and TH3 version:

	TH3 (new sensor)	TH2E (old sensor)
Measurement accuracy within 0 – 10 %	±2 %	±2 to ±4 %
Measurement accuracy within 90 – 100 %	±2 %	±2 to ±4 %
Recommended measurement range	20 – 80 % RH	
Temperature measurement range	-40.0 °C to +125.0 °C	-40.0 °C to +123.8 °C
Temperature measurement accuracy	±0.3 to ±0.5 °C	±0.4 to ±2.0 °C

<sup>5</sup> See also the operating humidity range of electronics!

Operating and Maximum Range of Values

- Sensor is stable in standard range of humidity values. Long-term exposure to conditions outside these values (humidity above 80% in particular) can temporarily shift the measured-out values (by +3% for 60 hours). When the sensor is back to standard ranges, it returns to its pre-calibrated state slowly.<sup>6</sup>
- Long-term exposure to extreme conditions or to chemically aggressive vapor can speed up the aging process of the sensor significantly. It can also shift the measurements.

**Temperature sensor**

Range ..... -40.0 °C to +125 °C

Resolution ..... 0.1 °C

Sensor element ..... semiconductor

Sensor mechanical finish ..... inside hardened aluminum block

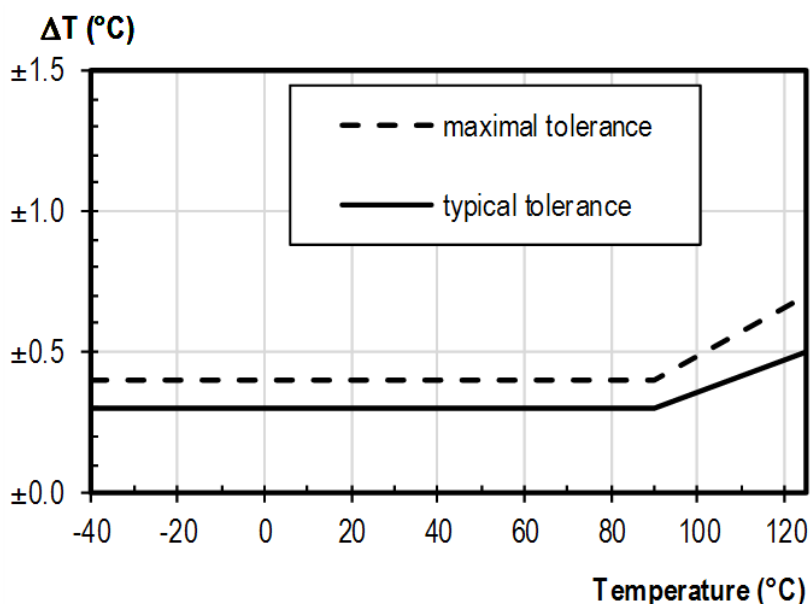


Fig. 11 – Accuracy of temperature measurement

**Temperature Sensor**

Type of sensor ..... semiconductor

Range of measured temperature ..... -55 °C to +125 °C

Accuracy ..... ±0,5 °C in the range -10 °C to +85 °C; otherwise ±2 °C

Temperature drift ..... ±0,2 °C in 1000 hours at 125 °C

Dimensions ..... standardized diameter of 6 mm, 60 mm long

Cover material ..... anodized aluminum

Degree of protection ..... IP 68 (permanent immersion to the depth of 1 m max.)

<sup>6</sup> You can speed up this process by doing following:

- 1) Leave the sensor in environment above 100 to 105 °C and humidity below 5 % for at least 10 hours.
- 2) Leave the sensor in environment above 20 to 30 °C and humidity approximately 75 % for around 12 hours. (Humidity 75% can be achieved with saturated solution of NaCl.)

## Other parameters

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Availability of measured values ..... 15 sec after power on

### Sensor cable

Jacket ..... silicon rubber, blue

Wire insulation ..... FEP polymer

Standard length ..... 3 m (up to 20 m upon request)

Range of temperatures – permanent ..... -60 °C to +200 °C

Maximum permissible temperature ..... +220 °C

Cable diameter ..... 4.3 mm (±0.1 mm)

The cable shows great resistance against humidity, chemical substances and hydrocarbons.

## Electronics

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### Communication

Communication line ..... RS485

Protocols ..... Spinel, Modbus RTU

Default protocol ..... Spinel

Default address in Spinel protocol ..... 31H ("1")

Default communication speed ..... 9600 Bd

Adjustable communication speeds .... 1 200, 2 400, 4 800, 9 600, 19 200, 38 400, 57 600,  
115 200 Bd <sup>7</sup>

Data bits number ..... 8

Parity ..... no parity

Stop-bits number ..... 1

Termination ..... No, only 22 kΩ resistors defining the idle status

### THT2 only

Dimensions ..... 41.5 × 24 × 72 mm

Weight ..... 75 g

Ingress Protection Code ..... IP 30

Wire connection ..... removable terminal block (bus) with screws

Power consumption ..... typ. 8 mA @ 12 V

### THT2 I only

Dimensions ..... 62 × 62 × 28 mm

Weight ..... 50 g

Ingress Protection Code ..... IP 20

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<sup>7</sup> Lower and higher communication speeds can be added on request.

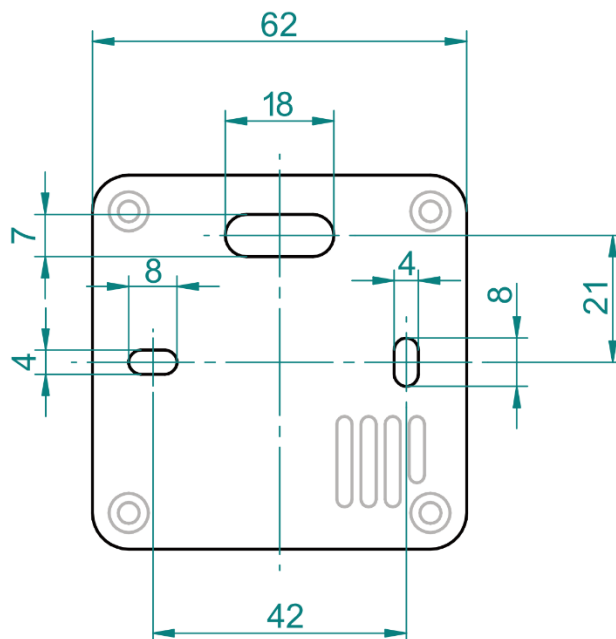


fig. 12 – THT2I: Location of mounting holes (pair of 8 × 4 mm) and wiring hole (18 × 7 mm)

Wire connection .....	screw on terminal
Power consumption.....	typ. 1.7 mA @ 12 V typ. 840 µA @ 30 V

#### Other Parameters

Electronics operating temperature ....	-40 °C to +85 °C
Power supply .....	5 to 30 V DC
Working humidity of electronics .....	max. 90 %, non-condensing
Polarity reversal protection.....	yes

*Do not hesitate to contact us in case of any other special requirements concerning the THT2 module design and functions.*

*We are happy to modify the internal firmware or change the hardware design for you.*

## COMMUNICATION PROTOCOL

The THT2 module is equipped with standardized **Spinel** protocol (formats 66 and 97) and **Modbus RTU**.

The detailed description of both Protocols protocol used by THT2, including described examples, can be found on [papouch.com](http://papouch.com).



# Papouch s.r.o.

Data transmission in industry, line and protocol conversions, RS232/485/422/USB/Ethernet/GPRS/WiFi, measurement modules, intelligent temperature sensors, I/O modules, and custom-made electronic applications.

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