



control solutions

# TERACOM



## IP54 Modbus RTU temperature and humidity sensor TSH331

## USER MANUAL

## 1. Short description

TSH331 is an IP54 temperature and humidity sensor with an RS-485 interface. It supports the Modbus RTU protocol. The temperature and humidity sensor integrates core sensing elements with signal processing and provides a fully calibrated digital output. A unique capacitive element is used to measure relative humidity, while temperature is measured using a band gap sensor. Both sensors are seamlessly coupled to a 12-bit analog-to-digital converter, resulting in superior signal quality. A cable gland with locknut and a screwless terminal block allow easy cable installation.

## 2. Features

- RS-485 interface carrying up to 247 nodes;
- LED indicator for status of communication;
- Changeable bitrate and another communication parameters;
- Firmware update via the interface.

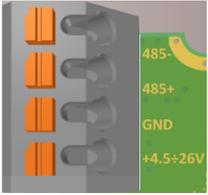
## 3. Applications

- Fleet management systems
- Environmental quality monitoring and assessment
- Humidity and temperature logging for vineyards, greenhouses, etc.
- Humidity and temperature logging for telco facilities
- Server room and data centers humidity and temperature monitoring

## 4. Specifications

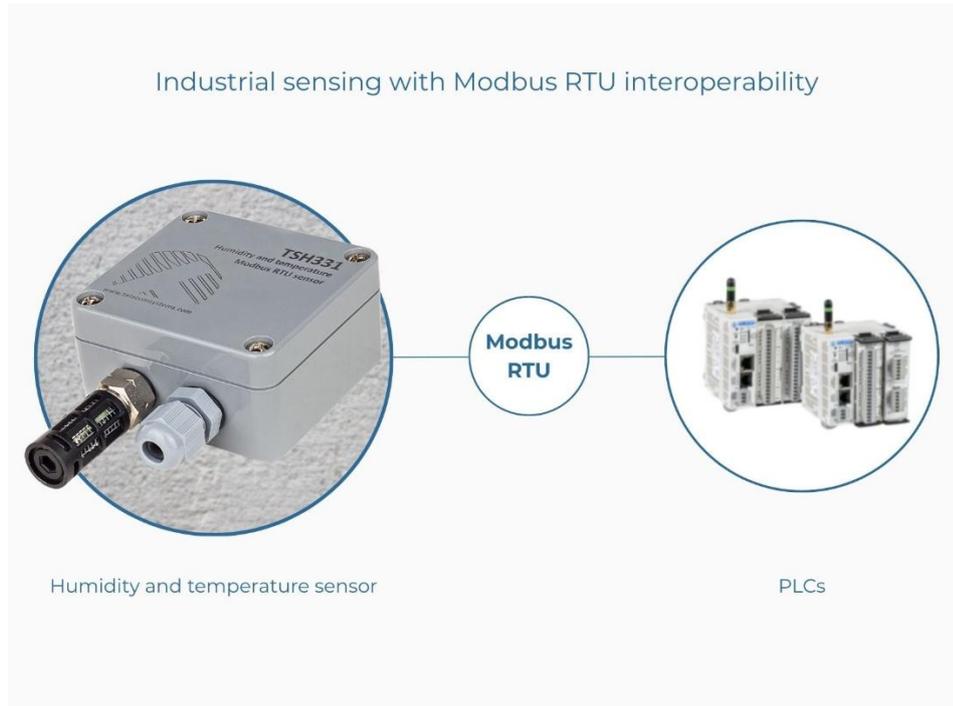
- Physical characteristics  
Dimensions: 68 x 105 x 35mm  
Weight: 70g
- Environmental limits  
Operating temperature range: -20 to 60°C  
Operating relative humidity range: 10 to 90% (non-condensing)  
Recommended operating range is 20% to 80% RH (non-condensing) over -10 °C to 60 °C  
Prolonged operation beyond these ranges may result in a shift of sensor reading, with slow recovery time  
Long term drift typical:  $\pm 0.25\%RH/year$ ,  $\pm 0.05^\circ C/year$   
Higher drift might occur due to contaminant environments with vaporized solvents, adhesives, packaging materials, etc.  
Storage temperature range: -20 to 60°C  
Storage relative humidity range: 10 to 90% (non-condensing)  
Ingress protection: IP54
- Power requirements  
Operating voltage range (including -15/+20% according to IEC 62368-1): 4.5 to 26VDC  
Current consumption: 5mA@5VDC
- Humidity measurements  
Accuracy (min):  $\pm 3.0\%RH$  (in 20 to 80 %RH range)  
Accuracy (max):  $\pm 5.0\%RH$  (in 10 to 90 %RH range)  
Resolution: 0.1%RH
- Temperature measurements  
Accuracy (min):  $\pm 0.4^\circ C$  (in -10 to +60°C range)  
Accuracy (max):  $\pm 0.6^\circ C$  (in -20 to +60°C range)  
Resolution: 0.1°C
- Interface  
Response time  $\leq 50ms$   
Master response time-out  $\geq$  Response time + Answer time  
The answer time depends on the number of bits and the baud rate
- Warranty  
Warranty period: 3 years

## 5. Pinout

|  |  | Pin description | UTP wires color          |
|---|--|-----------------|--------------------------|
|   |  | 485-            | Blue                     |
|   |  | 485+            | Blue/White Tracer        |
|   |  | GND             | Ground (negative) supply |
|   |  | +4.5÷26V        | Positive power supply    |
|   |  |                 | Brown                    |
|   |  |                 | Brown/White Tracer       |

## 6. Installation

A daisy-chained (linear) topology for multiple sensors should be used. UTP/FTP cables are mandatory for interconnection. The last sensor in the chain should have a terminator of 120 ohm installed on the bus. TSH331 has a built-in terminator. To enable it, please close the jumper.



## 7. Installation tips

The location and the mounting position of the sensor have a direct effect on the accuracy of the measurement. The tips below will ensure good measuring results:

- Sensor shall be installed about 1.2-1.4 m above the floor;
- To avoid solar radiation, the sensor should not be installed next to windows or directly in the sunlight;
- For outdoor usage, the sensors should be installed with protection from direct rain;
- Avoid mounting over ventilation shafts and windows/doors;
- Avoid attaching to walls in front of a chimney;
- It is recommended to mount the device in an accessible location for easier maintenance.

### Attention:

The device should be installed with always filter and gland facing the floor.

## 8. Status indicator

The status of the device is shown by single LED, located on the PCB inside the plastic enclosure:

- If the LED blinks on period of 1 second, sensor works properly;
- If the LED blinks on period of 3 seconds, there isn't communication with the controller;
- If LED doesn't blink, there isn't a power supply.

## 9. Factory default settings

Disconnect the sensor from the bus (switch off the power supply).

Press and hold the “BUT” button. Don’t release the button, connecting the sensor to the bus (switch on the power supply).

The “status” LED will be ON for 3 seconds and after this will flash for 7 seconds. After the 10<sup>th</sup> second the LED will be ON.

Release the button. The sensor will restart with factory default settings.

## 10. Firmware update

The firmware of the sensor can be updated with a Teracom controller which supports MODBUS RTU or MBRTU-Update software. For more details ask your dealer.

## 11. Modbus register table

| Register name                      | R/W | FC    | PDU Address (Decimal) | Logical Address (Decimal) | Offset (Decimal) | Data size           | Default | Valid values                           |
|------------------------------------|-----|-------|-----------------------|---------------------------|------------------|---------------------|---------|--|
| RS-485 address                     | R/W | 03/06 | 10                    | 40011                     | 40001            | 16-bit uns. integer | 1       | 1-247                                  |
| Baud rate*                         | R/W | 03/06 | 11                    | 40012                     | 40001            | 16-bit uns. integer | 19200   | 2400, 4800, 9600, 19200, 38400, 57600  |
| Parity, data, stop bits *          | R/W | 03/06 | 12                    | 40013                     | 40001            | 16-bit uns. integer | 1       | 1=E81, 2=O81, 3=N81<br>4=N82           |
| Data order                         | R/W | 03/06 | 13                    | 40014                     | 40001            | 16-bit uns. integer | 1       | 1=MSWF (MSW, LSW)<br>2=LSWF (LSW, MSW) |
| Device code                        | R   | 03    | 14                    | 40015                     | 40001            | 16-bit uns. integer |         | 0x00CC                                 |
| FW version                         | R   | 03    | 15                    | 40016                     | 40001            | 16-bit uns. integer |         |  |
| Vendor URL                         | R   | 03    | 18                    | 40019                     | 40001            | 64 bytes UTF-8      |         | teracomsystems.com                     |
| Float test value (MSWF)            | R   | 03    | 82                    | 40083                     | 40001            | 32-bit float        |         | -9.9(0xC11E6666)                       |
| Float test value (LSWF)            | R   | 03    | 84                    | 40085                     | 40001            | 32-bit float        |         | -9.9(0xC11E6666)                       |
| Signed integer test value          | R   | 03    | 86                    | 40087                     | 40001            | 16-bit sig. integer |         | -999(0xFC19)                           |
| Signed integer test value (MSWF)   | R   | 03    | 87                    | 40088                     | 40001            | 32-bit sig. integer |         | -99999(0xFFFFE7961)                    |
| Signed integer test value (LSWF)   | R   | 03    | 89                    | 40090                     | 40001            | 32-bit sig. integer |         | -99999(0xFFFFE7961)                    |
| Unsigned integer test value        | R   | 03    | 91                    | 40092                     | 40001            | 16-bit uns. integer |         | 999(0x03E7)                            |
| Unsigned integer test value (MSWF) | R   | 03    | 92                    | 40093                     | 40001            | 32-bit uns. integer |         | 99999(0x0001869F)                      |
| Unsigned integer test value (LSWF) | R   | 03    | 94                    | 40095                     | 40001            | 32-bit uns. integer |         | 99999(0x0001869F)                      |
| Temperature °C                     | R   | 03    | 100                   | 40101                     | 40001            | 32-bit float        |         |  |
| Humidity %RH                       | R   | 03    | 102                   | 40103                     | 40001            | 32-bit float        |         |  |
| Dew point °C                       | R   | 03    | 104                   | 40105                     | 40001            | 32-bit float        |         |  |
| Temperature °F                     | R   | 03    | 200                   | 40201                     | 40001            | 32-bit float        |         |  |
| Humidity %RH                       | R   | 03    | 202                   | 40203                     | 40001            | 32-bit float        |         |  |
| Dew point °F                       | R   | 03    | 204                   | 40205                     | 40001            | 32-bit float        |         |  |
| Temperature °C x 100               | R   | 03    | 400                   | 40401                     | 40001            | 16-bit sig. integer |         |  |
| Humidity %RH x 100                 | R   | 03    | 401                   | 40402                     | 40001            | 16-bit uns. integer |         |  |
| Dew point °C x 100                 | R   | 03    | 402                   | 40403                     | 40001            | 16-bit sig. integer |         |  |
| Temperature °F x 100               | R   | 03    | 500                   | 40501                     | 40001            | 16-bit sig. integer |         |  |
| Humidity %RH x 100                 | R   | 03    | 501                   | 40502                     | 40001            | 16-bit uns. integer |         |  |
| Dew point °F x 100                 | R   | 03    | 502                   | 40503                     | 40001            | 16-bit sig. integer |         |  |
| Temperature multiplier **          | R/W | 03/16 | 2101                  | 42102                     | 40001            | 32-bit float        | 1.000   |  |
| Temperature offset °C **           | R/W | 03/16 | 2103                  | 42104                     | 40001            | 32-bit float        | 0.000   |  |
| Temperature offset °F **           | R   | 03    | 2105                  | 42106                     | 40001            | 32-bit float        | 0.000   |  |
| Humidity multiplier **             | R/W | 03/16 | 2111                  | 42112                     | 40001            | 32-bit float        | 1.000   |  |
| Humidity offset **                 | R/W | 03/16 | 2113                  | 42114                     | 40001            | 32-bit float        | 0.000   |  |

The shown logic decimal addresses are calculated with offsets 40001 (holding registers).

MSWF - Most significant word first - (bits 31 ... 16), (bits 15 ... 0); LSWF - Least significant word first - (bits 15 ... 0), (bits 31 ... 16);

PDU address - Actual address bytes used in a Modbus Protocol Data unit

When a floating-point value is not available, the returned value is "NaN" (e.g. in case of measurement error).

When a 16-bit signed integer value is not available, the returned value is "-32768" (e.g. in case of measurement error).

\* The settings will take effect after restarting the device by power-off, power-on.

\*\* Measured sensor values can be corrected by employing a multiplier and an offset.

The corrections are the results of the following calculations:

Corrected Temperature (°C) = Measured Temperature (°C) × Temperature Multiplier + Temperature Offset (°C)

Corrected Humidity = Measured Humidity × Humidity Multiplier + Humidity Offset

Using a multiplier and an offset allows precise adjustments to the sensor readings, ensuring accurate temperature and humidity values.

It's crucial to emphasize that the multiplier and offset are applicable exclusively in degrees Celsius. After obtaining the corrected temperature in Celsius, it can then be converted to Fahrenheit.