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 nods;
- LED indicator for status of communication;
- Changeable bitrate and another communication parameters;
- Firmware update via the interface.

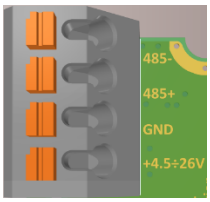
3. Applications

- 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: ±0.25%RH/year, ±0.05°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): ±3.0%RH (in 20 to 80 %RH range)
  Accuracy (max): ±5.0%RH (in 10 to 90 %RH range)
  Resolution: 0.1%RH
- Temperature measurements
  Accuracy (min): ±0.4°C (in -10 to +60°C range)
  Accuracy (max): ±0.6°C (in -20 to +60°C range)
  Resolution: 0.1°C
- Interface
  Response time ≤ 50ms
  Master response time-out ≥ Response time + Answer time
  The answer time depends on the number of bits and the baud rate

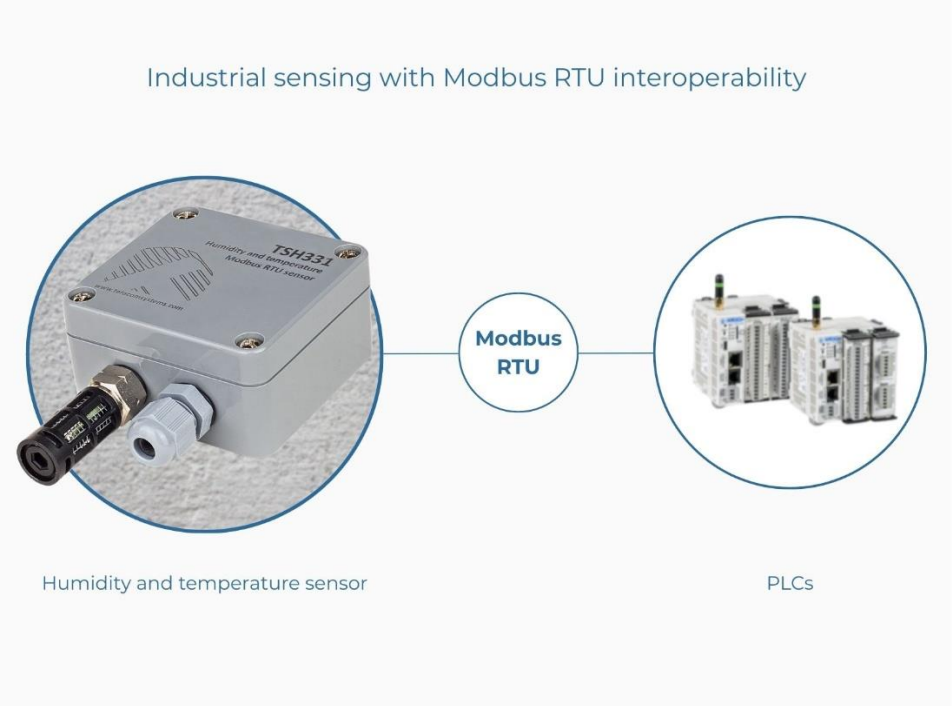
5. Pinout



Pin description		UTP wires color
485-		Blue
485+		Blue/White Tracer
GND	Ground (negative) supply	Brown
+4.5÷26V	Positive power supply	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 10th 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 4=N82
Data order	R/W	03/06	13	40014	40001	16-bit uns. integer	1	1=MSWF (MSW, LSW) 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(0xFFFE7961)
Signed integer test value (LSWF)	R	03	89	40090	40001	32-bit sig. integer		-99999(0xFFFE7961)
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.