control solutions
TERACOM



TSM400-4-TH

Modbus humidity and temperature sensor

USER MANUAL

www.teracomsystems.com

1. Short description

TSM400-4-TH is a humidity and temperature sensor that supports MODBUS RTU protocol over the RS-485 interface. A unique capacitive element is used for measuring relative humidity while the temperature is measured by a band gap sensor. Both sensors are seamlessly coupled to a 12-bit analog to digital-converter. This results in superior signal quality.

The TSM400-4-TH multi-sensor is housed in a slim plastic enclosure. The bottom part of the enclosure is suitable for installation on standard flush-mounted/cavity wall boxes ø68mm, with installation openings on 61 mm.

2. Features

- LED indicator for status of communication;
- Long-term stability based on digital signal processing;
- RS-485 interface carrying up to 32 nodes;
- Changeable bitrate and other communication parameters;
- Firmware update via the interface.

3. Applications

- Environmental quality monitoring and assessment for offices
- Server room and data centers humidity and temperature monitoring
- Smart ventilation systems

4. Specifications

- Physical characteristics
  Dimensions: 81 x 81 x 30mm
  Weight: 66g
- 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: IP20
- Power requirements
  Operating voltage range (including -15/+20% according to IEC 62368-1): 4.5 to 26VDC
  Current consumption: 10mA@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

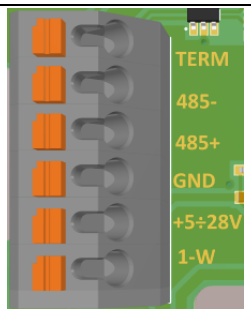
- Interface

  Response time ≤ 50ms

  Master response time-out ≥ Response time + Answer time
  The answer time depends on the number of bits and the baud rate

* 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.
** Higher drift values might occur due to contaminant environments with vaporized solvents, out-gassing tapes, adhesives, packaging materials, etc.

5. Pinout

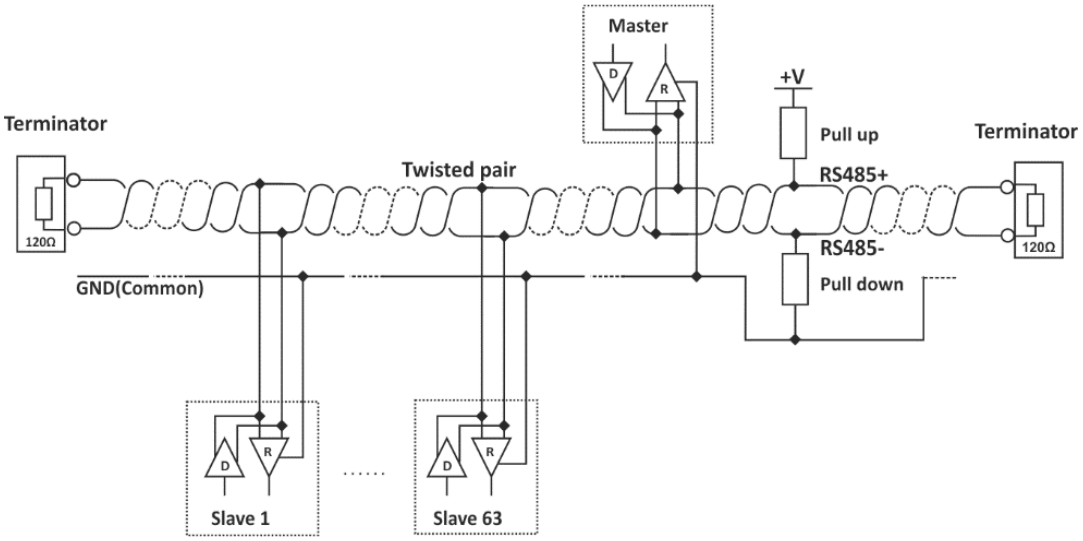


Pin	Description	UTP wires color
TERM	For termination, connect to 485-	
485-	RS485-	Blue
485+	RS485+	Blue/White Tracer
GND	Ground (negative) supply	Brown
+5÷28V	Positive power supply	Brown/White Tracer
1-W	Not used	

6. Installation

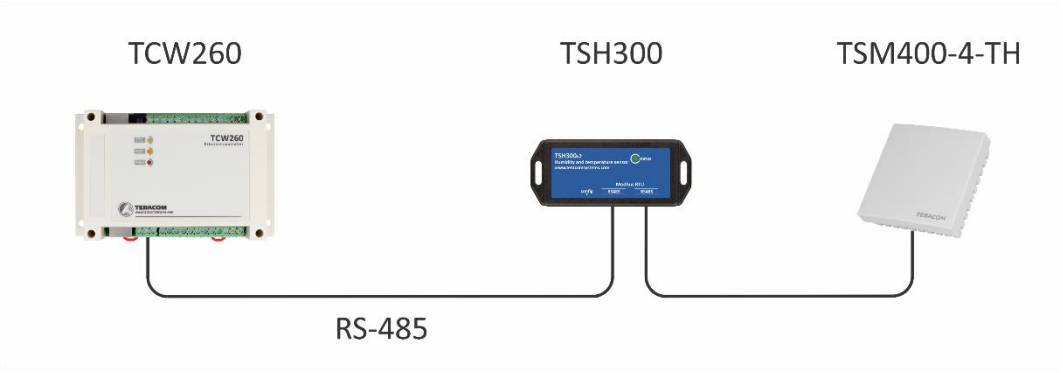
Two-Wire MODBUS definition according to modbus.org:

“A MODBUS solution over a serial line should implement a “Two-Wire” electrical interface in accordance with EIA/TIA-485 standard. On such a “Two-Wire” topology, at any time one driver only has the right for transmitting. In fact, a third conductor must also interconnect all the devices of the bus - the common.”



Attention:

For proper operation of the interface, terminators (120 ohms resistors) must be installed at both ends of the bus. The device has a built-in 120 ohm resistor and to terminate the “RS485-“ and “TERM” must be shortened.
A daisy-chained (linear) topology for multiple sensors should be used. UTP/FTP cables are mandatory for interconnection.

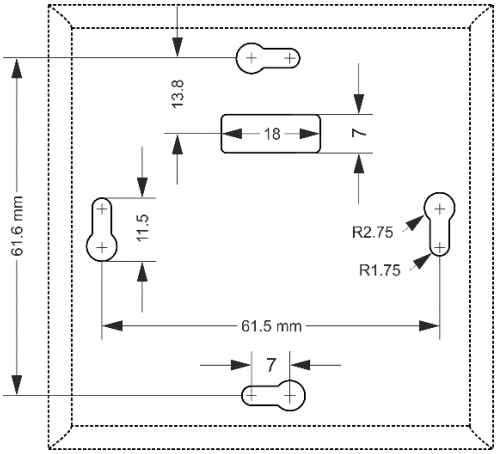


7. Installation tips

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;
- Sensors shall be installed in a place with sufficient air circulation.

TSM400-4-TH sensor is intended for installation on a cavity wall box with 68mm diameter and 61 mm screw spacing.



8. Status indicator

The status of the device is shown by a single LED, located inside the box:

- If the LED blinks for a period of 1 second, the sensor works properly;
- If the LED blinks for a 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 “config” 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 address 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
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		0x00C2
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	400	40401	40001	32-bit float		
Humidity %RH	R	03	402	40403	40001	32-bit float		
Dew point °F	R	03	404	40405	40001	32-bit float		
Temperature °C x 100	R	03	600	40601	40001	16-bit sig. integer		
Humidity %RH x 100	R	03	601	40602	40001	16-bit uns. integer		
Dew point °C x 100	R	03	602	40603	40001	16-bit sig. integer		
Temperature °F x 100	R	03	1000	41001	40001	16-bit sig. integer		
Humidity %RH x 100	R	03	1001	41002	40001	16-bit uns. integer		
Dew point °F x 100	R	03	1002	41003	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.

12.Recycling





Recycle all applicable material.

Do not dispose of with regular household refuse.