TH-AP Modbus
Indoor and outdoor sensor

Technical specifications and installation instructions

Item number

30170

1. Description

The **Temperature and humidity sensor TH-AP Modbus** measures temperature and humidity in indoor and outdoor areas and calculates the dew point.

The devices are Modbus slaves with a RS485 interface and a RTU protocol. The Modbus master, such as PC, SPS or MC can read the **Temperature and humidity sensor TH-AP Modbus** measurement values with "Function 04h (Read Input Register)".

Functions:
- Temperature measurement
- Humidity measurement
- Dewpoint calculation

Notes on dew point calculation:

The **TH-AP Modbus** calculates the dew point of the ambient air. This value can be used for dew point monitoring. This would require another sensor for measuring the surface temperature of the wall or pipe. Also, the dew point needs to be monitored (compare with temperatures) in the Modbus master.

Monitoring predetermines the possible condensate build-up on the surface, giving a chance for timely countermeasures.

1.0.1. Scope of delivery

- Sensor in on-wall housing

1.1. Technical specifications

Housing	Plastic, Sensor sleeve metall
Color	Grey
Assembly	Surface mounting
Protection category	Housing: IP65 Exterior sensor: IP43
Dimensions	approx. 65 × 91 × 38 (W × H × D, mm)
Weight	approx. 77 g
Ambient temperature	Operation -40…+80°C, Storage -40…+85°C,
Operating voltage	24 V DC ±10%. An appropriate power supply unit can be purchased from Elsner Elektronik
Cable cross-section	Massive conductors of up to 0,8 mm^2
Current	max. 15 mA
Interface	RS485
Protocol	RTU
RS485 bus load	1/8 unit load according to RS485 standard
RS485 driver performance	min. 2.4 V at 54 Ohm bus load (corresponds to 32 standard RS485 unit loads)
Measurement range temperature	-40...+80°C
Measurement range humidity	0% rH … 100% rH

The product conforms with the provisions of EU directives.

2. Installation and start-up

Installation, testing, operational start-up and troubleshooting should only be performed by an authorised electrician.

⚠ **CAUTION!**
Live voltage!

- Inspect the device for damage before installation. Only put undamaged devices into operation.
- Comply with the locally applicable directives, regulations and provisions for electrical installation.
- Immediately take the device or system out of service and secure it against unintentional switch-on if risk-free operation is no longer guaranteed.

Use the device exclusively for building automation and observe the operating instructions. Improper use, modifications to the device or failure to observe the operating instructions will invalidate any warranty or guarantee claims.

Operate the device only as a fixed-site installation, i.e. only in assembled condition and after conclusion of all installation and operational start-up tasks, and only in the surroundings designated for it.

Elsner Elektronik is not liable for any changes in norms and standards which may occur after publication of these operating instructions.

2.1. Location

The sensor is designed for surface mounting. When selecting an installation location, please ensure that the measurement results are affected as little as possible by external influences. Possible sources of interference include:
- Direct sunlight
- Drafts from windows and doors
- Warming or cooling of the building structure on which the sensor is mounted, e.g. due to sunlight, heating or cold water pipes
- Connection lines which lead from warmer or colder areas to the sensor

For outdoor installation it must be ensured that a 60 cm gap is left below the sensor in order to prevent it from being snowed during snowfall.

The sensor must be mounted vertically. The measurement probe and the cable outlet must point downwards.

2.2. Notes on mounting and commissioning

Do not open the temperature sensor if penetration of water (rain) is likely: Only a couple of drops could damage the electronic.

Do not dip the measuring tip (metal sleeve with sensor) in water.

2.3. Mounting and connection

2.3.1. Device Design

🛑 **ATTENTION!**
Make sure the connection is correct!
- Connect the power supply to 1 and 2 only.
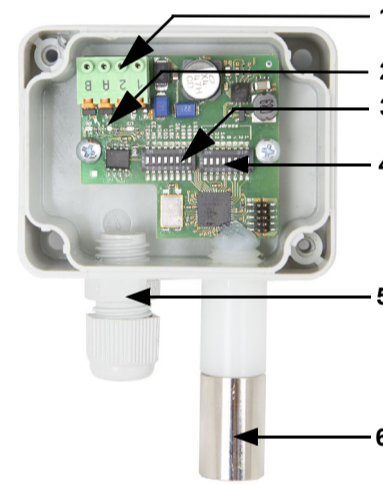- Use the data connections A and B exclusively for Modbus.

Fig. 1 Opened casing, board
1 Connecting plug, suitable for massive conductors of up to 0.8 mm²
1: 24 V DC (+)
2: GND (-)
Data line A: Modbus D0
Data line B: Modbus D1
The reference potential for data lines is GND (-) of the power supply.
2 LEDs
„Green": Power / operating voltage.
„Red": Error / sensor error or erroneous data.
„Yellow: Com / bus communication.
3 DIP switch for interface parameters (see detailed view)
4 DIP switch for slave address (see detailed view)
5 Cable feed with screw joint
6 Sensor tip

Fig. 2 Rear view with dimensioning of openings for mounting

2.4. Bus communication

2.4.1. Bus load

The RS485 transceiver used has 1/8 of a standard RS485 bus load (1/8 unit load) and can manage at least a 2.4 V at 54 Ohm bus load. It can, thus, operate a bus with 32 nodes at standard bus load. If nodes with a lower load than the standard bus load are connected to an RS485 bus, the bus can be operated with more nodes. If, for example, only nodes with 1/8 bus load are connected, up to 32 x 8 = 256 nodes can be connected to the bus.
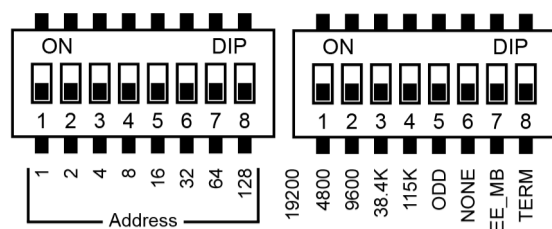
2.4.2. Setting up bus communication

Fig. 3: Detailed view DIP swit-

If all DIP switches are in the OFF position (default setting), the following parameters are active:

Address: 1
Baud rate: 19,200
Parity: Even
Termination: Disabled

Slave address:

The slave address is set with the help of the 8-bit DIP switch "Address". If all switches are in the OFF position, Address 1 is active. Address 0 is reserved for broadcast messages; addresses greater than 247 are not valid.

The coding of the address is binary. For the address 47, you must e.g. set the switches 1, 2, 3, 4 and 6 to ON.

Interface parameters:

1 stop bit is always used.

Further interface parameters are set with the help of the second 8-bit DIP switch.

Baud rate: If the first 4 switches are in the OFF position, the transfer rate amounts to 19,200 bauds. If one of these switches is set to ON, the corresponding baud rate is applicable.

Parity: If the two switches "ODD" and "NONE" are set to OFF, the parity is EVEN. Only "ODD" or "NONE" activates the corresponding parity control.

EE MB: no function.
Term.: bus termination 124 ohms

2.4.3. Connection of the sensor

Remove the screw cover. Lead the cable for the connection through the cable feed at the bottom of the housing and connect power supply 1 (+) / 2 (GND, -) and data lines A (Modbus D0) / B (Modbus D1) to the respective terminals. The reference potential for data lines is GND (-) of the power supply.

Replace the screw cover.

> **ATTENTION!**
> Make sure the connection is correct!
> - Connect the power supply to 1 and 2 only.
> - Use the data connections A and B exclusively for Modbus.

After the bus voltage has been applied, the device will enter an initialisation phase lasting a few seconds. During this phase no information can be received or sent via the bus.

3. Maintenance

> ⚠ Always isolate the device from the voltage supply for servicing and cleaning.

The device must regularly be checked for dirt twice a year and cleaned if necessary. In case of severe dirt, the sensor may not work properly anymore.

> **ATTENTION**
> The device can be damaged if significant volumes of water penetrate the housing.
> - Do not clean with high pressure cleaners or steam jets.

4. Transfer protocol

4.1. Temperature and humidity sensor TH-AP Modbus

4.1.1. Function 04H read input register TH-AP Modbus

Before the first measurement and in case of a faulty sensor, all registers are at "-32768".

Register	Parameter	Data type	Data value	Range
0	Temperature	Signed 16Bit	-400 to +800	-40 to +80°C
1	Relative humidity	Signed 16Bit	0 to 1000	0 to 100 %
2	Dew point temperature	Signed 16Bit	-400 to +800	-40 to +80°C

4.1.2. Request string from master

Byte no.	Variable		Explanation
0	Slave address	xx	
1	Command	04H	Read input registers
2	Start address high byte	xx	Register start address
3	Start address low byte	xx	
4	Word count high byte	xx	Number of registers to be read
5	Word count low byte	xx	
6	CRC low byte	xx	
7	CRC high byte	xx	

Example request string for reading all data for slave address 1:
01H, 04H, 00H, 00H, 00H, 03H, B0H, 0BH

4.1.3. Output string from master TH-AP Modbus

Before the first measurement and in case of a faulty sensor, all registers are at "-32768".

Byte no.	Register address	Variable		Explanation
0		Slave address	xx	
1		Command	04H	Read input register
2		Number of bytes	xx	Master requirement * 2
3	0	Temperature high byte	xx	with algebraic sign, value/10 = Temperature xx.x °C
4		Temperature low byte	xx	
5	1	Relative humidity high byte	xx	Value/10 = relative humidity xx.x %
6		Relative humidity low byte	xx	
7	2	Dew point temperature high byte	xx	with algebraic sign, value/10 = Dew point temperature xx.x °C
8		Dew point temperature low byte	xx	
9		CRC low byte	xx	
10		CRC high byte	xx	

5. Disposal

After use, the device must be disposed of in accordance with the legal regulations. Do not dispose of it with the household waste!