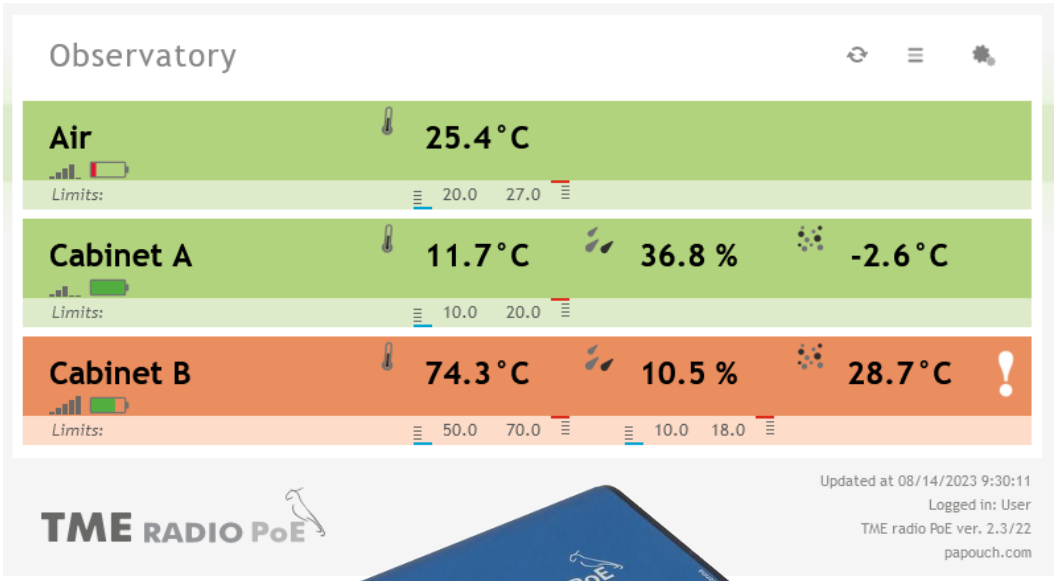
TME multi & TME radio

Collecting temperatures, humidity and CO_2 concentrations from wired or wireless sensors

Ethernet, PoE power supply

Http get, XML, Modbus TCP, SNMP



TME multi & TME radio

Datasheet

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CONTENT

List of device changes

8/2023

- Ability to assign basic network parameters via DHCP.

4/2023

- Added description of TME radio PoE.

12/2020

- TME multi can also provide CO_2 concentration sensors THCO2.

7/2019

- TME radio only: information about signal strength and battery capacity added to Modbus.

11/2018

- TME multi is now also capable of TQS4 sensors.

Version 3.0

- New version with wireless modules – TME radio. It can wireless temperature or wireless humidity + temperature sensor.

Version 2.3

- Possibility to monitor all variables for each sensor + XML and HTTP GET extension.
- Added THT2 I.
- New quick overview of sensors in settings on the web interface.

Version 2.2

- Brand new web interface for both preview and configuration.
- Modified XML and HTTP GET.
- Simplifying Telnet to just basic network settings.
- Extension with Modbus TCP.
- The system can only work with TQS3 and THT2 sensors.

Version 1.1

- TME multi a TME radio can now also communicate with the THT/THT2 sensor, which is a sensor that measures temperature, humidity and can calculate dew point.
- WEB is set as the default mode.

ABOUT DEVICE

TME multi, TME radio and TME radio PoE are autonomous devices that communicate independently with sensors connected via RS485 or wirelessly. They can send sensor data to a remote server or provide it in standard automation formats such as XML, Modbus and SNMP. Actual data is visible in the internal web interface.

No computer or similar system is required for measuring and transmitting data values.

Main unit	*PoE powered*	*Connection method*	*Supported sensors*		
			Type	**PN**	**Measured Quantities**
TME multi	no	wired, RS485	TQS3	199	temperature
			TQS4	1255	temperature
			THT2	523	temperature, humidity, dew point
			THT2I	1011	temperature, humidity, dew point
			THCO2	1395	CO_2 concentration, temperature, humidity
TME radio	no	wireless, 868 MHz	**Type**	**PN**	**Measured Quantities**
TME radio PoE	yes		TMW	740	temperature
			THW	1041	temperature, humidity, dew point

Tab. 1 - main unit types and compatible sensors including product numbers

- Measuring temperature, humidity and carbon dioxide (CO_2) concentration at multiple locations – up to 31 connected sensors.
- **TME multi:**
  - Sensors connected by cable (total max. 1.2 km).
  - Only 4 wires: RS485 bus + power supply (typically 12 V).
- **TME radio** and **TME radio PoE**
  - Wireless sensors in the 868 MHz band.
  - Battery powered sensors.
- User-friendly overview via web interface.
- **Machine reading** of measurements via XML, SNMP, Modbus or TCP/UDP. Sending XML data via Http GET.
- Sending emails when set limits are exceeded.
- Can be ordered with DIN 35 mm rail holder

Communication modes

The device has four operational modes, which determine the available communication options:

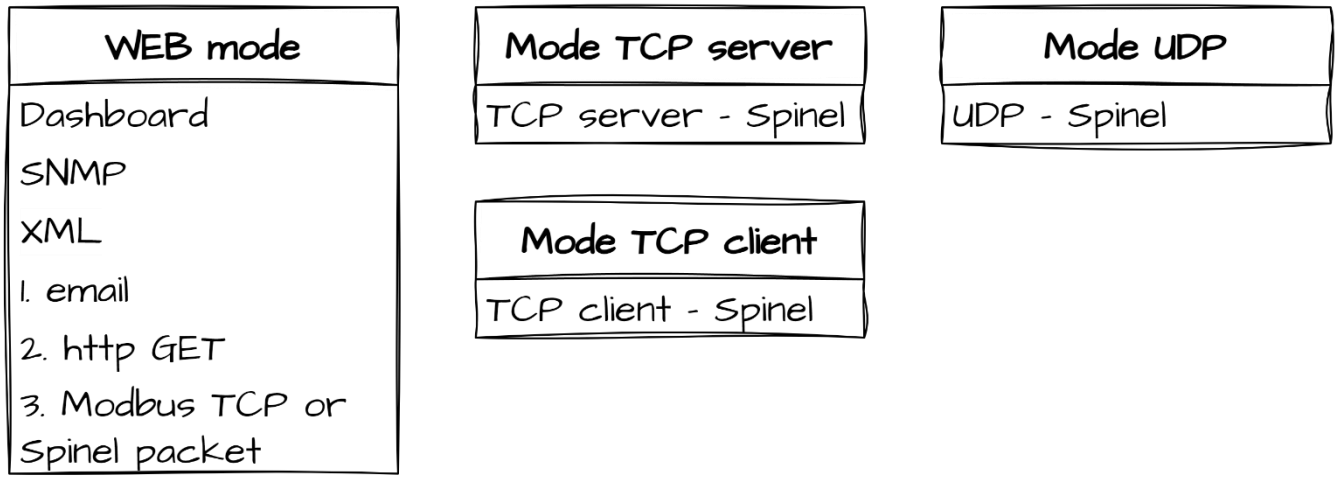


fig. 1 – four operational modes

1. **WEB mode**

   In WEB mode, users can monitor real-time measured values on the internal web page (dashboard).

   For machine reading, SNMP and Modbus TCP protocols are available, along with data in XML and as TCP packets. It also supports email notifications and http get requests.

   Only two out of the three options numbered 1, 2, and 3 shown in fig. 1 can be enabled at the same time.

2. **Mode TCP server**
3. **Mode TCP client**
4. **Mode UDP**

   In these modes, only data communication at the TCP/UDP level using the Spinel protocol is available. Web-based configuration is limited to network settings and security configuration.

WIRING

1) Power supply

TME multi: Connect DC supply voltage from 5 to 30 V to terminals PWR (+) and GND.[1] When power is connected, a green light will illuminate above the terminals.

fig. 2 – Connector for power supply and sensors on TME multi

TME radio: Connect a DC power supply with a range of 5 to 30 V to the coaxial connector next to the antenna. The positive pole is inside.[1]

fig. 3 – Power and antenna connectors on TME radio

TME radio PoE: If you will not be connecting the device to an IEEE 802.3af PoE-powered network switch, connect a DC power supply with a range of 11 to 58 V to the coaxial connector next to the Ethernet connector. The positive pole is inside.[1]

fig. 4 - Connector for Ethernet (with PoE) and alternative power connection to TME radio PoE

2) Ethernet

Connect the device with a standard un-crossed computer network cable to the switch.

TME radio PoE: To use PoE power, the switch must provide PoE according to IEEE 802.3af standard.

[1] The device has built-in protection against damage caused by over-polarity of the supply voltage.

3) IP address settings

The factory default address is 192.168.1.254 and the netmask is 255.255.255.0. If your network is not compatible with this range, set the device to an address suitable for your network with the Ethernet configurator.

After setting the IP address, open *http://[ip-address]/* in your web browser and go to the next point.

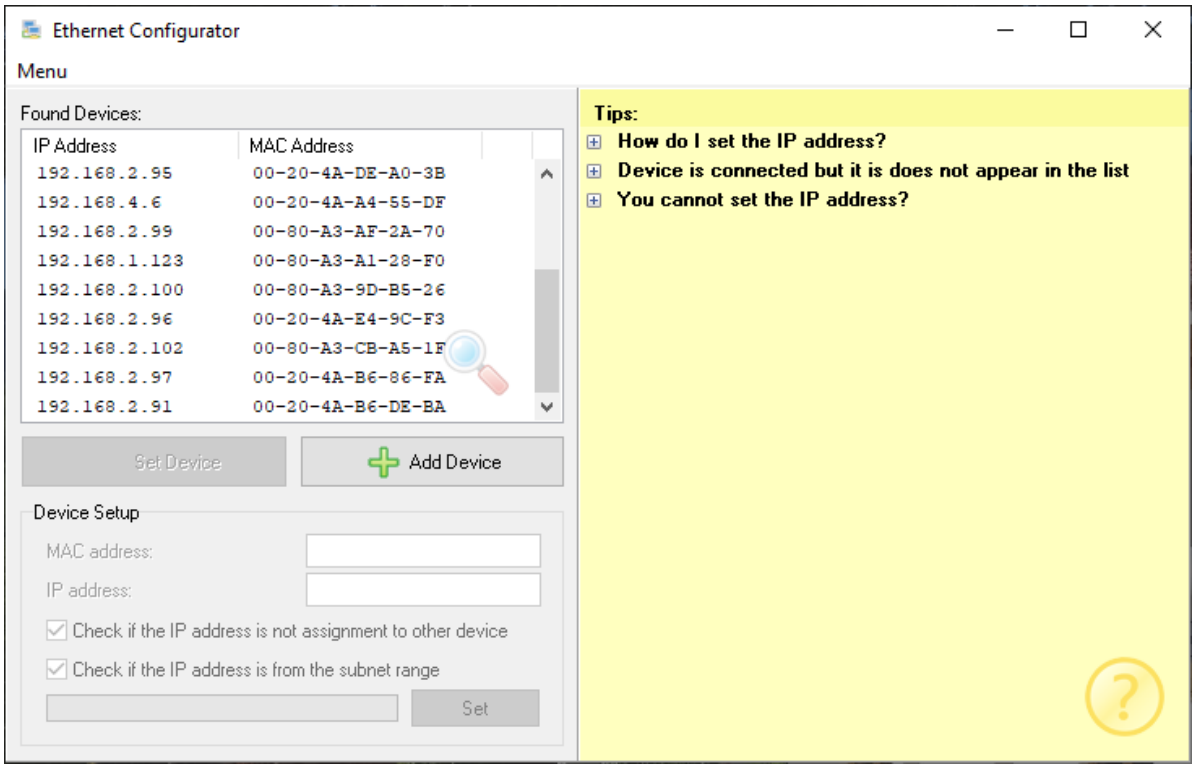


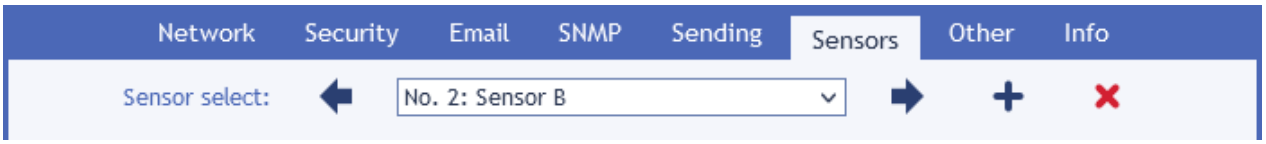
Fig. 5 – Ethernet Configurator for setting the IP address

4) Connecting sensors

TME radio and TME radio PoE

Perform the following procedure with each sensor:

a) In the web interface, go to Settings/Sensors and press the button with the **+** symbol.



b) Enter the serial number of the sensor in the form 1234/56789 (it is on the label on the sensor) and select the serial number you want to assign to the sensor. The sensors are sorted by serial number on the main page.

c) Long press the button on the sensor (for 3 sec). This will start the pairing mode on the sensor and the indicator light on the sensor will light up.

d) Press the Add button on the web interface. There must be no more than 30 sec between pressing the button on the sensor and on the web.

e) If the pairing process was successful, the sensor settings page will appear. Once the settings have been made, press *Save* and continue with the next sensor.

TME multi

a) Write down the serial number of each sensor in the form 1234/56789 (it's on the label on the sensor) and its location or description - you will need them for configuration.

b) Position the sensors and connect them with a cable (RS485 bus + 12 V power supply).

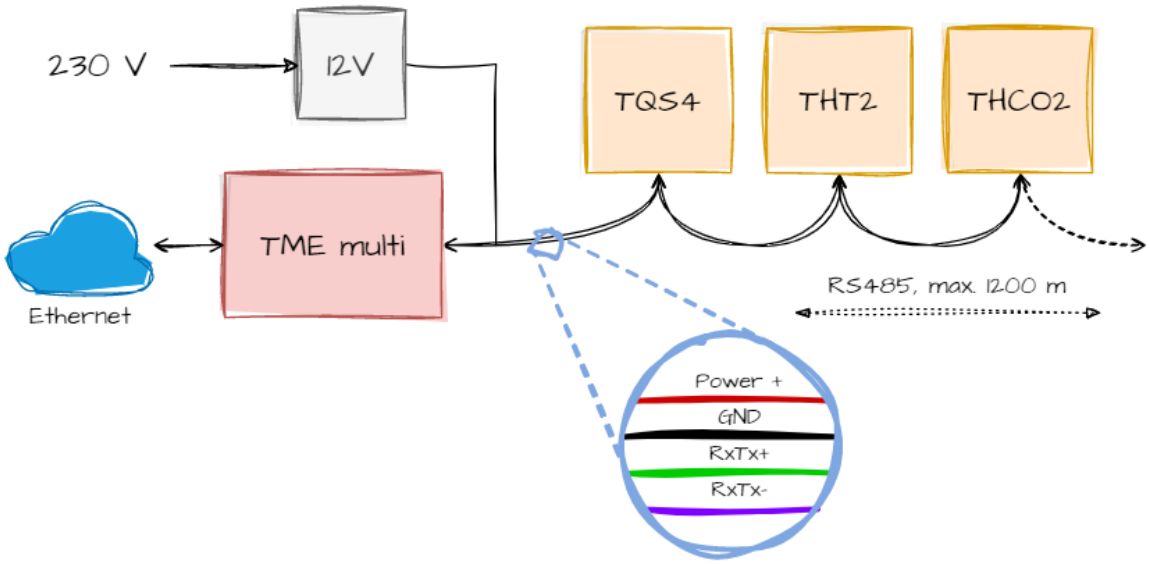


Fig. 6 - Connecting sensors and TME multi

c) As a connecting cable, we recommend using a common cable that is used for computer networks (the so-called UTP cable). This contains four pairs of twisted wires.

d) Use first pair for the data wires – one is **RxTx+**, the other is **RxTx-**.

- Connect all RxTx+ terminals with the first wire.
- Connect all RxTx– terminals with the other wire.

e) Second pair: connect both wires and use them for the positive pole of the 12 V supply (**PWR**).

f) Third pair: connect both wires and use them for the power supply ground (GND).

g) Fourth pair: leave unconnected. It can serve as a possible reserve.

h) Connect the individual parts of the system sequentially – i.e. from one to another – not in a so-called “star”! The total length of the connecting cable can be up to 1200 metres.

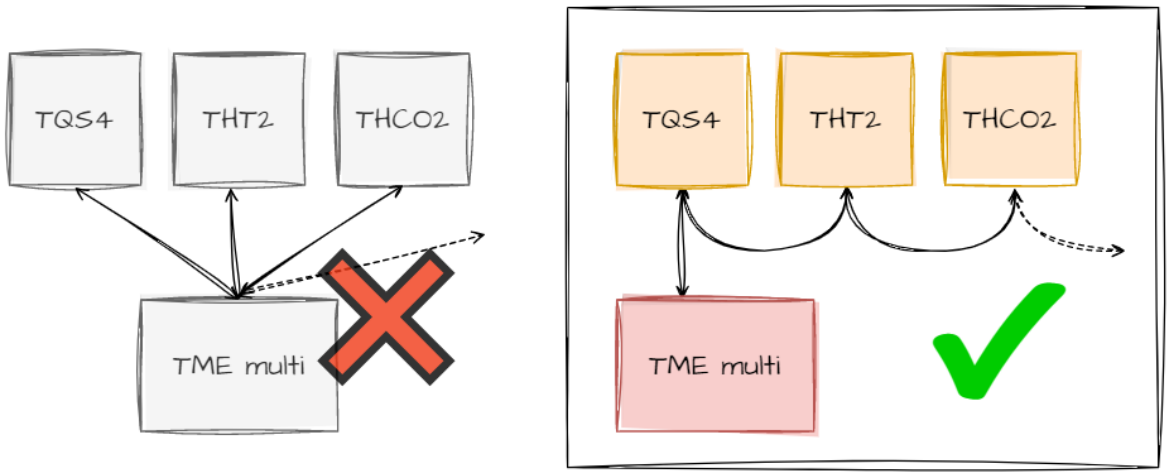


fig. 7 - incorrect "star" wiring vs. correct wiring

CONFIGURATION

Configuration is done via the web interface. The basic network parameters can also be set via Telnet (see page 23). The **web interface** is accessible at the IP address of the device. The factory default address is 192.168.1.254.

After entering the IP address, the main page with the current measured values is displayed.

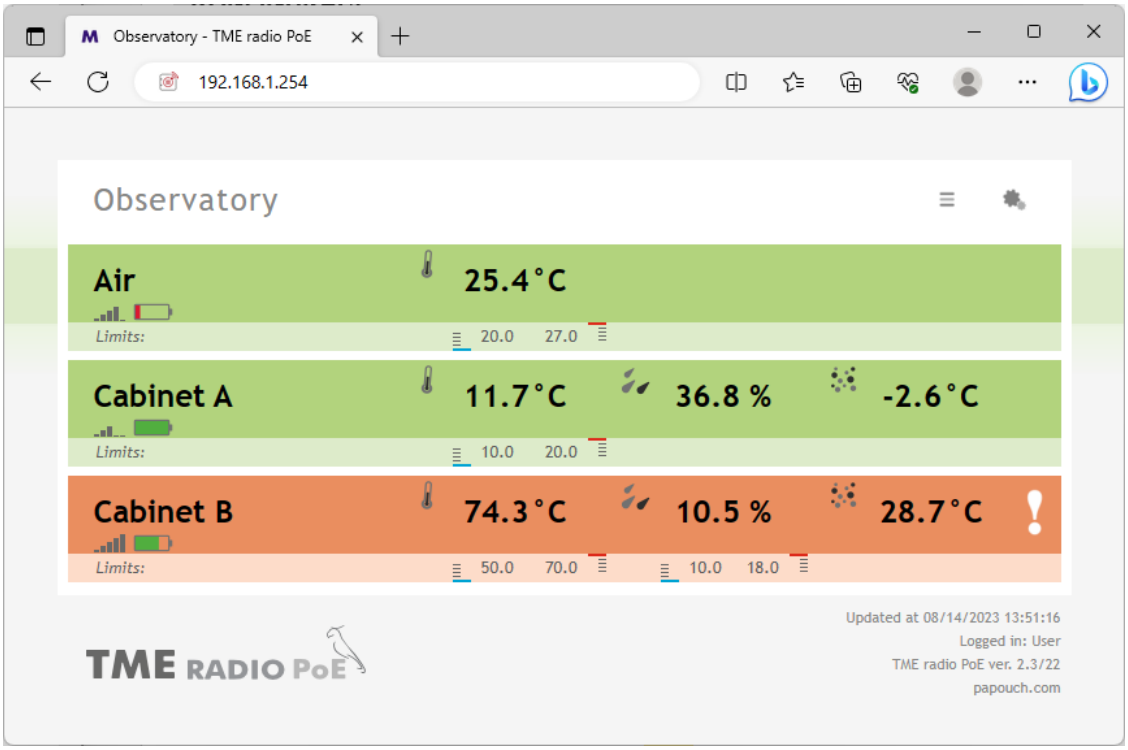


fig. 8 - sample web interface from TME radio PoE

To enter the settings, use the button on the top right of the main web page.

fig. 9 - button to enter the settings on the main page

The settings are organised into the following eight panels:

- *Network* – network interface configuration, IP address, mask, DNS server, mode, ...
- *Security* – setting passwords for accessing the site
- *Emails* – recipient, authorization, settings test
- *SNMP*
- *Sending* – sending values to your server using HTTP GET
- *Sensors* – administration of connected sensors
- *Other* – device name and web interface language settings
- *Info* – information about the device

Tips for working with the settings:

- The login name is always *user* or *admin*.
- The default language of the website is English. It is possible to switch the website to Czech language in the settings on the *Other* panel, using the *Language* parameter.

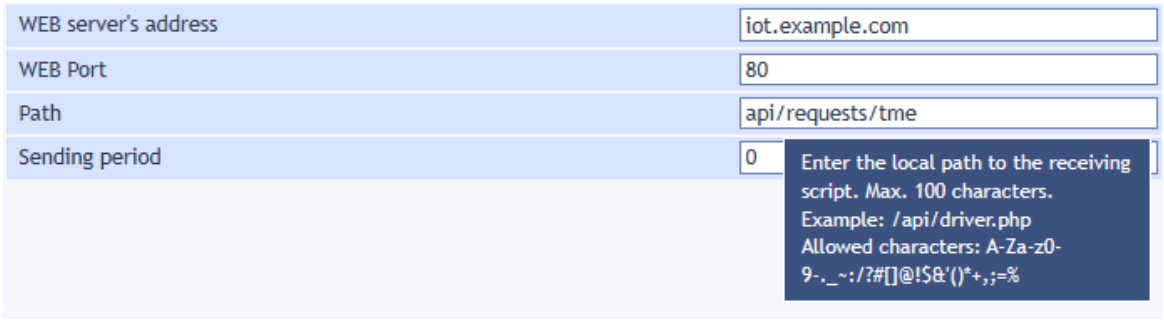


fig. 10 - sample help after hovering the mouse cursor

- You can also open the settings by tapping the S key when the browser window is active.
- The settings can be closed with the Esc key when the browser window is active.

Network

Setting the device network parameters and communication mode.

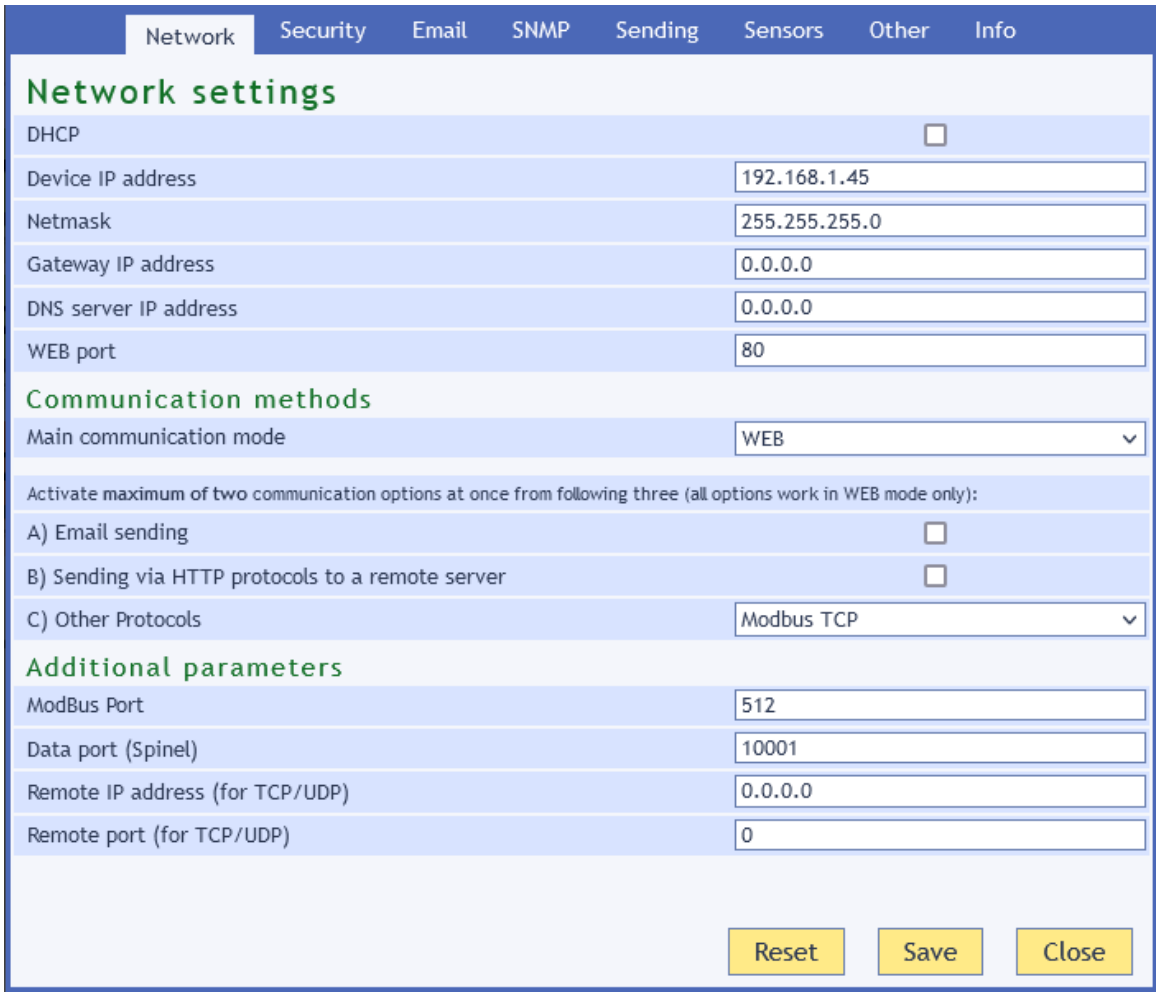


fig. 11 - network settings panel

DHCP

Assign network settings using a DHCP server. If DHCP is checked, the following IP addresses are ignored and are obtained by DHCP after saving. You can find the assigned IP address in your network router.

Device IP address

The IP address of the device. If you are not sure what IP address to enter, consult your network administrator.

Netmask

The mask of the network to which the device is connected.

Gateway IP address

Network gateway address.

DNS server IP address

The IP address of the DNS server on your network.

WEB port

The port number on which the web interface is available. Usually, the port number is 80 or 8080.

Methods of communication

Communication mode

WEB: A mode in which all functions of the device are available, except for data communication via the Spinel protocol ("request-response" mode).

In the following modes, you cannot monitor the current values on the web page, you cannot send emails and HTTP GET messages, you cannot use SNMP and MODBUS TCP. In these modes, the device communicates using the Spinel protocol.

TCP server: the device passively waits for a connection on the set port (*Data port*).

TCP client: the device actively establishes a connection to the remote IP address (*Remote IP address*) and port (*Remote port*).

UDP: The device communicates via the UDP protocol. It expects incoming messages on the *Data port*.

Activate a maximum of two communication modes from the following three options (the options are only functional if WEB is selected as the Main communication mode):

A) Email sending

This option will enable the sending of emails that is set on the *Emails* tab.

B) Sending via HTTP protocols to a remote server

This option enables the HTTP GET sending that is set on the *Sending* tab.

C) Other protocols

Select one of the options:

- *Spinel packet:* Periodically sends information about the measured values to the Spinel port. (This option is functional only in WEB mode.)
- *Modbus TCP: The* Modbus port communicates with the parent system using the Modbus TCP communication protocol. (The option is only functional in WEB mode.)
- *None*

Additional parameters

Modbus port

The data port number for ModBus TCP communication. *(The port is only available if the function is enabled.)*

Data port (Spinel)

Data port number. The port function depends on *the Main communication mode*:

- *WEB mode:* after opening a TCP connection to the Data port, the device sends the current measured data every 10 sec over the established channel. Each connected sensor sends as a separate packet.
- *TCP/UDP modes: the* port on which the device communicates at the TCP/UDP level using the Spinel protocol.

Remote IP address

IP address of the remote device (usually a server) to which the TME multi/TME radio connects in TCP client mode. The established connection communicates via the Spinel protocol.

Remote port

Port number of the remote device (usually a server) to which the TME multi/TME radio connects in TCP client mode. The established connection communicates via the Spinel protocol.

Reset the device

This button can be used to reset all device parameters to the default state. Only the IP address remains unchanged. The site port will be changed to 80.

The Reset button is only available in WEB mode.

This reset is different from the hardware reset button on the device.

Security

Here are the security settings for access to the web interface and key communication protocols.

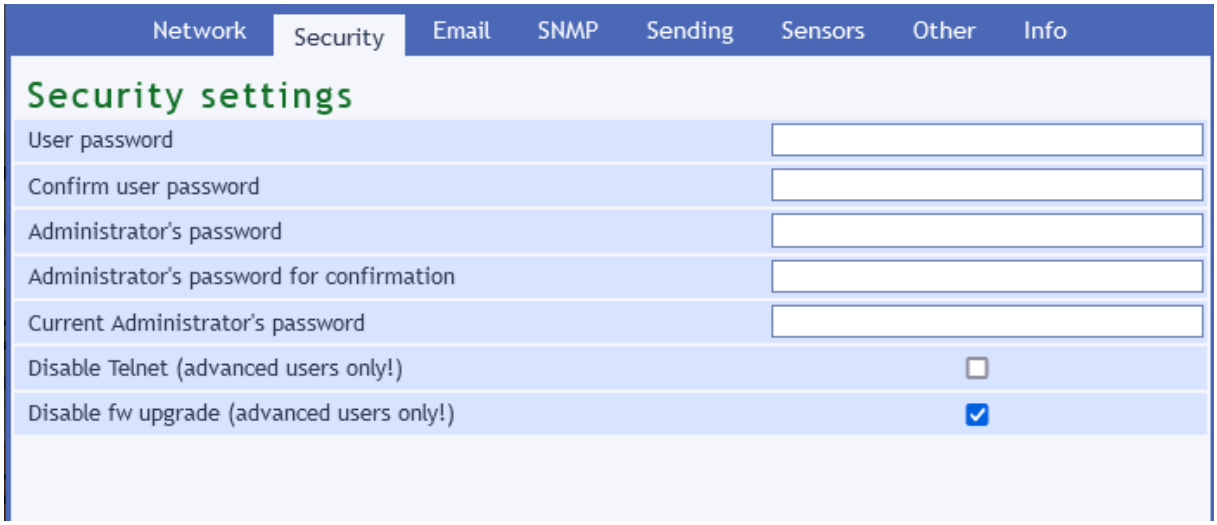


Fig. 12 - security settings panel

User Password and **Confirm User Password** [2]

Enter the password for user access here. This security level only allows monitoring of the measured values. Access to the settings is not allowed.

The user name at login is always *user*

If only the administrator password is entered, the login dialog is sufficient when accessing the page TME multi a TME radio dialog without entering any data.

To cancel the password, leave the fields blank.

[2] Passwords can be up to 16 characters long and can only contain the following characters: !#$%()*+,-./0123456789:;=?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[]^_abcdefghijklmnopqrstuvwxyz{|}~
If a password is entered for the user, a password must also be entered for the administrator. The field is used only for entering values. After saving, no settings are displayed for security reasons.

Administrator's password and **Administrator password for confirmation** [2]

Enter the password for administrator access here. This security level allows you to configure the device in addition to monitoring the values.

The administrator's name at login is always *admin*

To cancel the password, leave the fields blank.

Current Administrator's password [2]

If the administrator has set a password for the current login, enter it here. It is not possible to change passwords without entering the current password.

Disable Telnet (advanced users only!)

If you disable the Telnet protocol and problems occur during firmware playback, manufacturer's service intervention may be necessary!

Disable fw upgrade (advanced users only!)

If you disable the firmware upgrade, it may be that any service intervention can only be performed by the device manufacturer.

Email

Setting to send emails when specified limits are exceeded. The email sending feature only allows you to use SMTP servers that do not require SSL/TLS security. *This feature is globally activated among the communication options on the Network tab!*

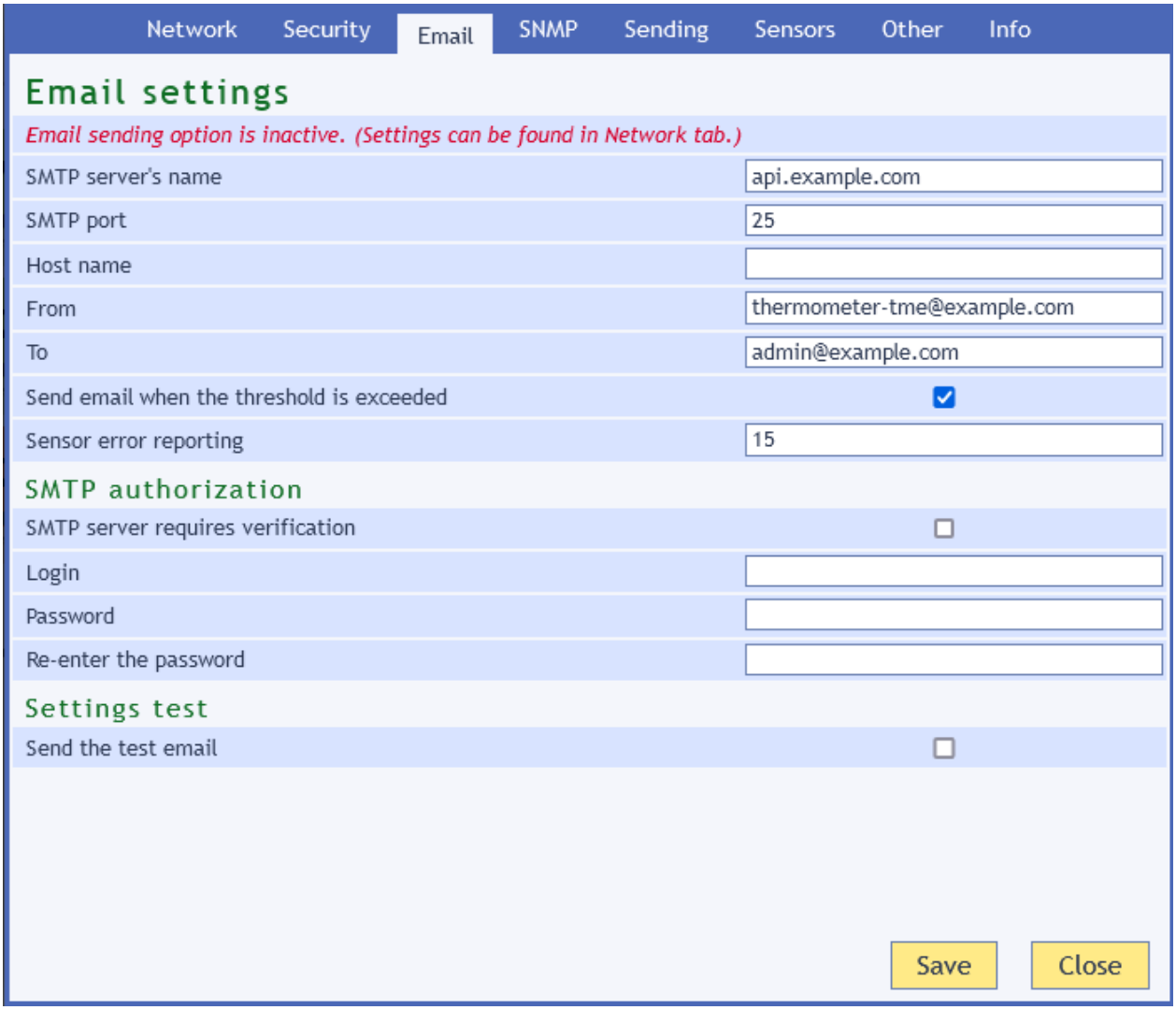


Fig. 13 - email settings

SMTP server's name

Enter the name or IP address of the SMTP server through which you want to send e-mails.

SMTP port

SMTP port number for sending emails. This is usually port 25 or 587.

From

A dummy address from which the measurement information will come. Due to spam filters, it is practical to use an existing email address.

To

Email to which to send measurement information.

Sensor error reporting

If the sensor reports an error after the specified number of minutes, an email notification will be sent.

SMTP authorization

You can enter login credentials here if the SMTP server you are using requires sender identity verification.[3]

Send the test email

Upon saving, a test email will be sent to verify the correct settings.

SNMP

Here you can set the parameters for communication by the SNMP protocol. Activation of traps, periodic sending, etc.

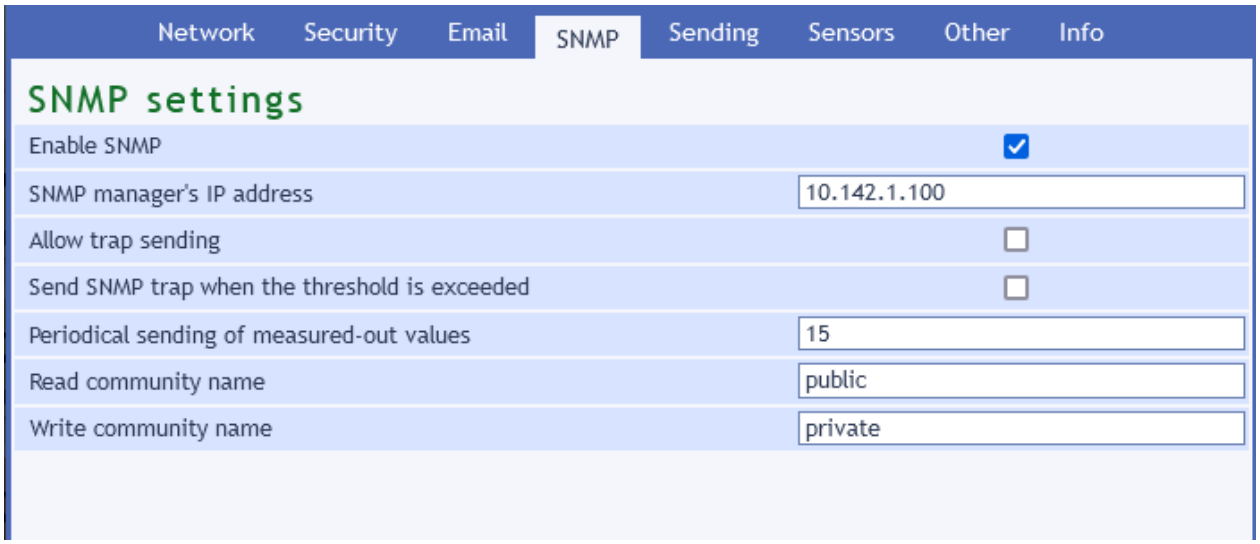


Fig. 14 - SNMP settings

Enable SNMP

SNMP is enabled only when this box is checked.

SNMP manager's IP address

The IP address of the server that collects SNMP messages from devices on the network.

Allow trap sending

Activate trap sending, according to the settings in the following fields.

Send SNMP trap when the threshold is exceeded

If the measured values leave the limits set on the *Sensor* panel, a trap is sent with information about this event.

Periodical sending of measured-out values

The period (in minutes) with which the current measured values are to be sent to the SNMP manager. The values are sent as SNMP trap. If you do not wish to use this feature, enter 0.

[3] The field is used only for entering values. After saving, no settings are displayed for security reasons.

Sending

Parameters for automatic sending of values to the server via Http get. *This function is globally activated among the communication options on the Network tab!*

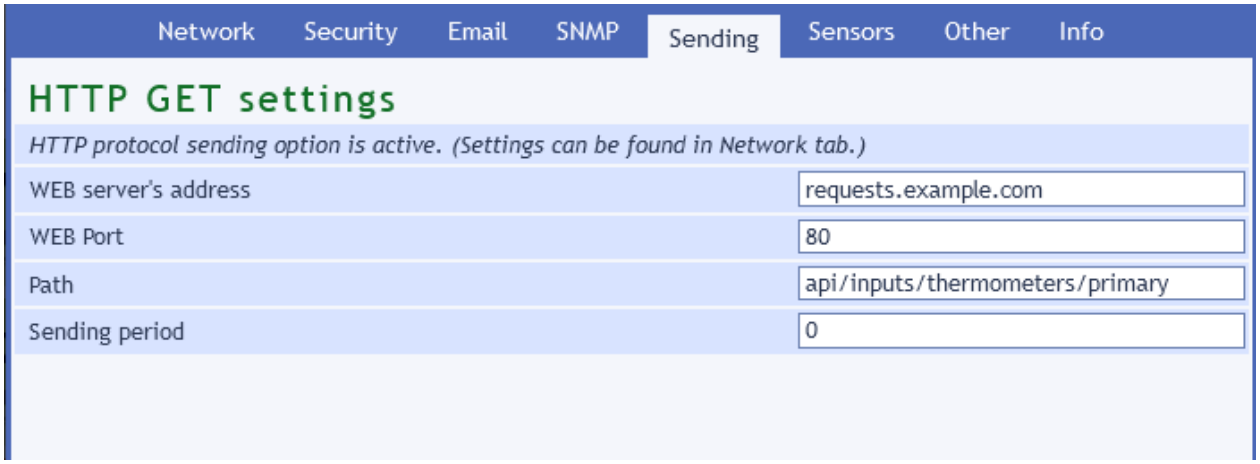


Fig. 15 - panel of settings for sending values via HTTP protocol

Web server address

Enter here the URL or IP address of the web server that is to receive the measured values (http only, not https).

Web port

The web port number of the server that is to receive the measured values. Port 80 is usually used.

Path

Enter the path to the script on the server. For example, if the complete address of the script is *http://example.com/api/values/get*, enter only this: */api/values/get* Maximum length is 100 characters `a-zA-Z0-9.-/_=?`

Sending period

Enter the period of sending the measured values (in minutes). If 0 is entered, sending is disabled.

Sensors

On this tab is the configuration of the individual connected sensors. After opening the tab, a table with an overview of all sensors registered in the device is displayed.

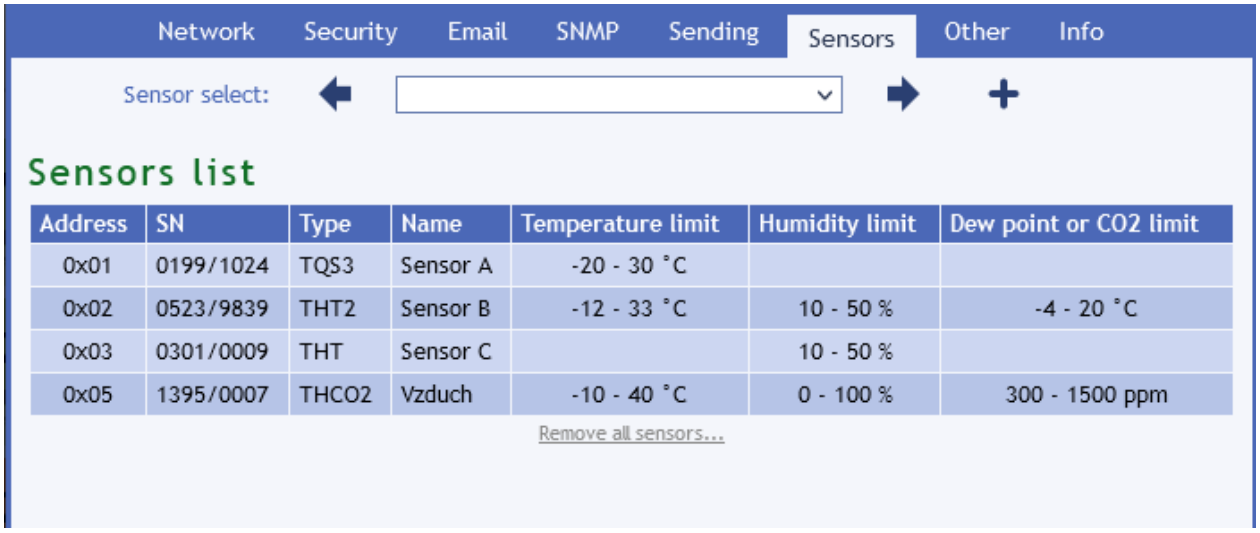


Fig. 16 - overview of registered sensors

Administration of connected sensors

In the header of this panel there are arrows and a box with a list of set sensors that can be used to navigate to the settings of a specific sensor.

The red cross can be used to remove the selected sensor from the system.

Adding or replacing a sensor

The new sensor and the sensor replacement are done using the form that appears after pressing the button with the **+** symbol. The procedure is described under the heading Connecting sensors on page 8.

Sensor settings

By clicking on any of the rows in the table or selecting at the top of the tab, you can navigate to the configuration of a specific sensor.

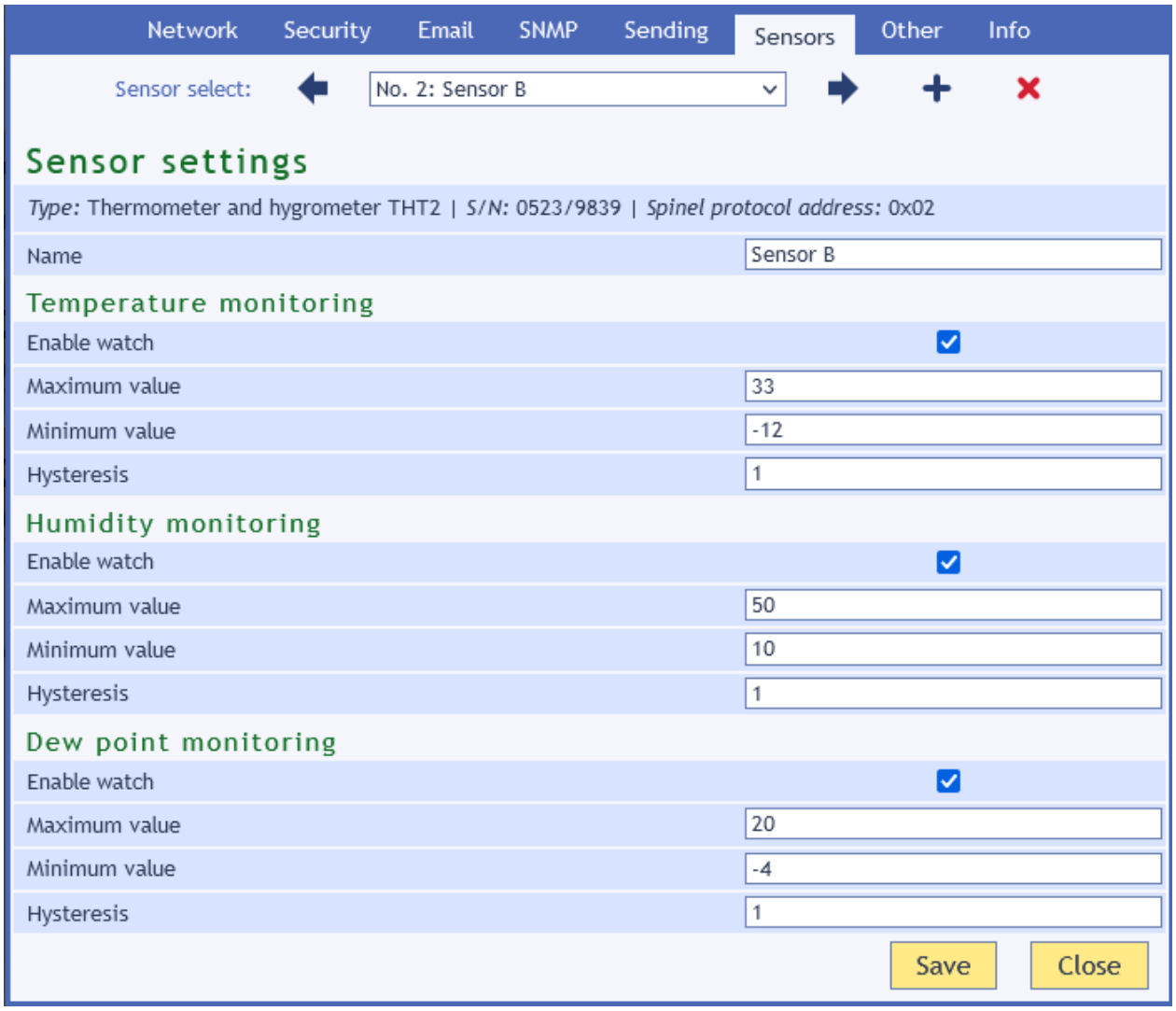


Fig. 17 - sensor settings panel

Name

Here you can name the sensor for easier identification.

Monitoring the measured value

For each of the measured variables of each sensor, it is possible to define upper and lower limits within which the variable should move. If the *Enable watch* option is checked, the variable is monitored. If the set limits are left, an email, SNMP trap, etc. is sent according to other settings. The value is highlighted on the main page as a warning when the set limits are left.

Hysteresis

Hysteresis is applied to the set limits. The value is entered as an integer and applied below the upper limit (or above the lower limit) – see Fig. 18.

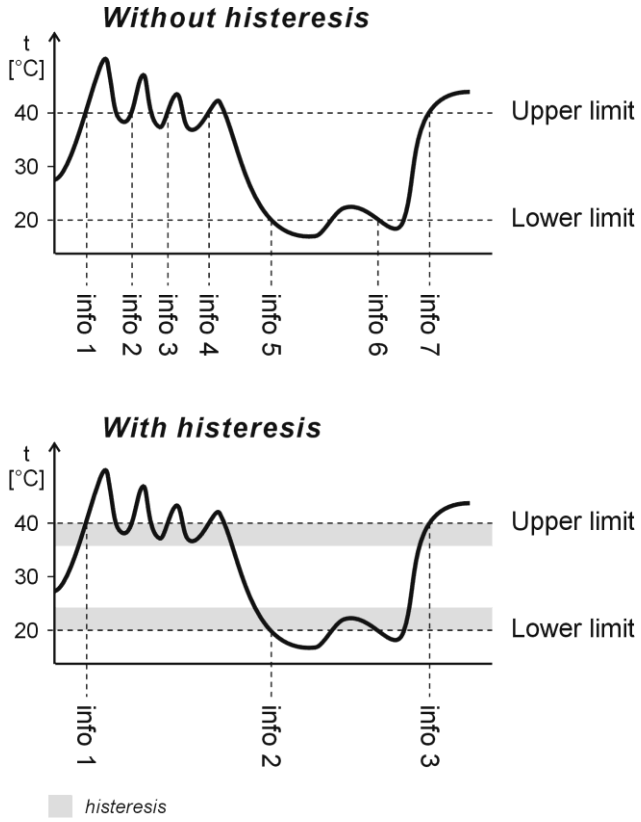


Fig. 18 - hysteresis of set limits (example for temperature limits)

The values marked as "info" in the picture indicate the moment of sending an information e-mail (or SNMP trap - depending on the settings) about exceeding one of the limits.

Other

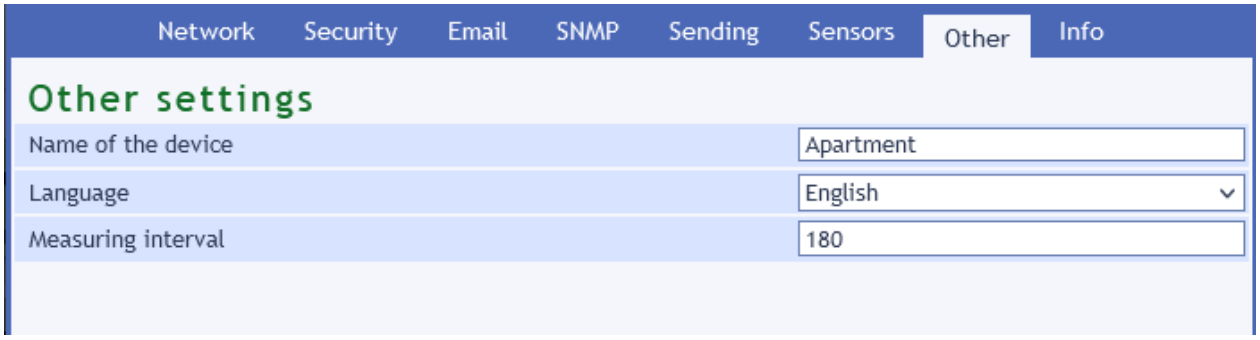


Fig. 19 - panel for setting other parameters

Name of the device

This string can be used to name the device, for example, according to its location, etc. (Only characters without diacritics can be entered.)

Language

Here you can set the language - the options are Czech and English.[4]

[4] Additional language can be added on request.

Measuring interval [5]

This entry only applies to TME radio and TME radio PoE. Specify how often the wireless sensor should send data. Enter in seconds from 180 to 65100 sec.

Note: The period change will only occur the next time the current temperature is received from the wireless sensor! If the next transmission is too long away, the temperature transmission from the sensor and thus the synchronization of the new period setting can also be triggered manually by a short press of the button inside the sensor.

Info

This panel is not a configuration panel, but contains additional information about the device, such as MAC address, firmware version, etc.

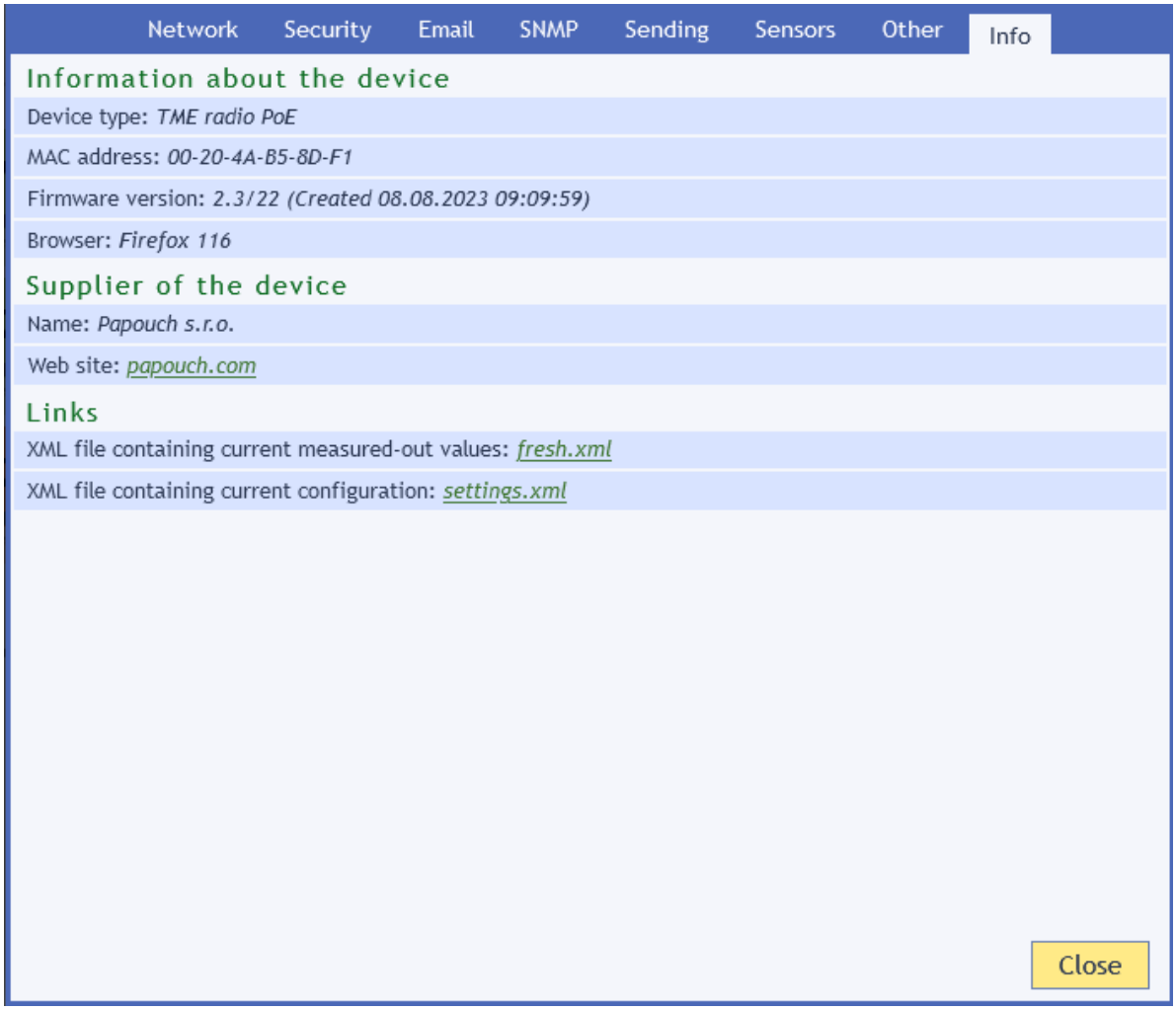


Fig. 20 - Device information panel

[5] This item is set only for the TME radio version.

TELNET CONFIGURATION

Telnet can be disabled this way through the web interface.

Connection

IP address is not known

It is recommended that the IP address should be set using the Ethernet Configurator software (for more information see page 8).

1) Open the window of the cmd command. (In the Windows OS select Start/Run, enter `cmd` in the provided line and click Enter.)
2) Make the following entries into the ARP table:
   a. Type `arp -d` and confirm by Enter. This will delete the current ARP table.
   b. Use the following command to assign 192.168.1.254 to the module MAC address:

      `arp -s [new_ip_address] [MAC_address_of_device]`

      example: `arp -s 192.168.1.254 00-20-4a-80-65-6e`
3) Now open Telnet. (Type in `telnet` and click Enter. [6])
4) Enter `open [new_ip_address] 1` and confirm.
5) After a while, the terminal will display an error message saying that connection failed. However, this step is necessary for the module to enter the IP address into its ARP table.
6) Connect to the IP address of the module. (Type in `open [IP address in dotted format] 9999` and click Enter.)
7) So far you have only entered the configuration mode of the module. The IP address has not yet been set. It must be set in the menu Server Configuration > IP Address. If you close the configuration mode without saving the settings and IP address configuration, the whole procedure must be repeated!
8) If the entered IP address is valid, the device displays an introductory text ending with:

   `Press Enter for Setup Mode`

   Press Enter within 3 seconds, otherwise the configuration mode will close.
9) The device will display a preview of its settings.
10) The preview ends with a paragraph called “Change setup:” which lists the groups of parameters that can be configured. Network parameters can be changed in the “Server” section where you can set a new network address and other parameters.

[6] In Windows 10 or higher, Telnet client is not a standard part of system. Install it using following procedure:

a) Open the “Control Panels/Programs and Features” menu.
b) On the left, click “Enable or disable features of Windows system” (this option requires the administrator to log in).
c) The “Features of Windows system” window displays. Here tick the “Telnet service Client” field and click Ok. The client for Telnet will be installed.

IP address is known

1) In OS Windows choose Start/Run, enter `telnet` in the provided line and press Enter.[6]
2) Connect to the IP address of the module. (Type in `open [IP address in dotted format] 9999` and press Enter.)
3) If the entered IP address is valid, the device displays an introductory text ending with:

   Press Enter for Setup Mode

   Press Enter within 3 seconds, otherwise the configuration mode will close.
4) The device will display a preview of its settings.
5) The preview ends with a paragraph called “Change setup:” which lists the groups of parameters that can be configured. Network parameters can be changed in the “Server” section.

Telnet main menu

Individual items can be chosen using the numbers written next to them. Choose the required number and press Enter.

The menu structure is as follows:

```
Change Setup:
  0 Server
    ...
  7 Defaults
  8 Exit without save
  9 Save and exit              Your choice ?
```

Server

Basic Ethernet settings.

This section contains the following parameters:

```
IP Address : (192) .(168) .(001) .(122)
Set Gateway IP Address (N) ?
Netmask: Number of Bits for Host Part (0=default) (16)
Change telnet config password (N) ?
```

IP Address
(IP address)

IP address of the module. The digits must be entered one by one and separated by Enter.

Default value: 192.168.1.254

Set Gateway IP Address
(set the IP address of the gateway)

Gateway IP addr
(IP address of the gateway)

In “Set Gateway IP Address” enter “Y“ to change the IP address. The system then prompts you to change the Gateway IP address. The digits must be entered one by one and separated by Enter.

Netmask
(network mask)

Here you specify the number of bits of the IP address that make up the network part.

The Netmask is set as a number of bits determining the range of available IP addresses of the local network. If, for example, value `2` is entered, the structure of the Netmask is `255.255.255.252` . The entered value specifies the number of bits from the right. The maximum is 32.

Default value: 8

Example:
The mask 255.255.255.0 (binary form: 11111111 11111111 11111111 00000000) =. number 8.
The mask 255.255.255.252 (binary form: 11111111 11111111 11111111 11111100) = number 2.

Change telnet config password
(Set the password for Telnet)

Enter new Password
(Enter the password for Telnet)

This parameter is used to set a new password which is required prior to any configuration via Telnet or via WEB interface (admin password).

For item “Change telnet config password”, enter “Y” to change the password. The system then prompts you to change the password.

Factory Defaults

By pressing number 7 the device restores the default settings.

The default setting means that all parameters will return to their initial factory settings. The IP address remains unchanged; the web interface port is set to 80.

Exit without save

To close the configuration mode without saving the changed parameters.

Save and exit

This option saves the changes. If any parameter has been changed, the device is restarted. The restart takes several tens of seconds.

CURRENT VALUES STATUS

The actual measured values, listed in the following chapters, have a fixed location, whether they are values listed in an XML file, in SNMP, get, etc. There is always a number in that location, even if the sensor is not connected, has a failure, etc.

Therefore, reading the status of the measured value must always be an integral part of reading the current values from the device. The status is a numerical code that clearly describes whether the measured value is valid or not, whether it is within the expected range, etc.

code	description
`0`	The value is valid and is within the expected range.
`1`	The value is not valid because no measurement (or calculation) of the value has been made yet. We are waiting for the first measurement.
`2`	The value is outside the expected range - the upper limit is exceeded.

3	The value is outside the expected range - a drop below the lower limit.
4	The value is not valid - common error. Check the sensor connection and functionality.

Tab. 2 – list of possible measurement statuses

XML FILE

All current data is available in an XML text file at *http:///[IP_address]/fresh.xml*

Example of data from TME radio PoE with connected TMW sensor:

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<root>
    <sns id="2" vc="740" sn="2" name="Air" w1="1" mx1="270" mi1="200" w2="0" mx2="0"
mi2="0" w3="0" mx3="0" mi3="0" s1="0" v1="254" s2="1" v2="0" s3="1" v3="0" batt="2"
rssi="-45" />
    <status unit="C" location="Location A2" />
</root>
```

In the `status` node, the temperature unit and the user location name are set.

Each sensor has its own `sns` node, which can contain the following attributes depending on the sensor type:

Sensor information

`id` ..... Sensor identification number (position in memory).

`vc` ..... Sensor product number by Tab. 1 on page 5, i.e. 740 for the TMW sensor.

`name` ..... Sensor name.

`batt` ..... Current battery capacity in the wireless sensor as number 1 (discharged) to 8 (full).

`rssi` ..... Signal strength in dB as a signed integer. (The higher the number, i.e., closer to zero, the better the signal.)

Temperature limits

`w1` ..... If the number 1 is set here, the temperature limit monitoring is set. 0 means off.

`mx1` ..... Temperature upper limit as an integer.[7]

`mi1` ..... Lower temperature limit as an integer.[7]

Humidity limits

`w2` ..... If the number 1 is set here, the humidity limit monitoring is set. 0 means off.

`mx2` ..... Upper humidity limit as an integer.[7]

`mi2` ..... Lower humidity limit as an integer.[7]

[7] The resulting value with a resolution to one decimal place is obtained by dividing this number by ten.

Dew point or CO_2 limits

`w3` .....If 1 is entered, a third variable of the sensor type is monitored – it can be dew point or CO_2 concentration.

`mx3` .....Upper dew point limit as an integer. [7]

`mi3` .....Lower dew point limit as an integer. [7]

Measured values

`s1` .....Status of the `v1` value with the measured temperature. See Tab. 2 on page 26.
`v1` .....Temperature as integer.[7]

`s2` .....Status of the `v2` value with the measured humidity. See Tab. 2 on page 26.
`v2` .....Humidity as integer.[7]

`s3` .....Status of `v3` with dew point or CO concentration$_2$ (depending on sensor type). See Tab. 2 on page 26.
`v3` .....Value `v3` as integer. [7] Dew point is in temperature unit; concentration is in ppm.

SENDING USING HTTP GET

The device can periodically call a script (PHP, etc.) on a remote server and pass it the measured data in an http get request. The get is sent separately for each connected sensor. Example:

```
script.php?mac=0080A3994D27&mod=2&type=199&name=Outdoor
&tempS=0&tempV=12.3&humS=1&humV=0&dewS=1&dewV=0
&watch=1&max=25.5&min=20.1&hyst=0.1
```

Depending on the sensor type, the following parameters can be sent in the get:

Sensor information

`mac`.....MAC address of the device.

`mod`.....Identification number of the sensor (corresponds to the automatically assigned address).

`type`.....Sensor product number by Tab. 1 on page 5, i.e. e.g. 740 for a TMW sensor.

`name`.....The user-defined name of the sensor.

Measured values

`tempS`.....Status of `tempV` value with measured temperature. See Tab. 2 on page 26.
`tempV`.....Temperature as a decimal number in degrees Celsius.

`humS`.....Status of `humV` value with measured humidity. See Tab. 2 on page 26.
`humV`.....Humidity as a decimal number in percent.

`dewS`.....Status of `dewV` with dew point. See Tab. 2 on page 26.
`devV`.....Dew point as a decimal number in degrees Celsius.

`co2S`.....Status of `co2V` with CO_2 concentration. See Tab. 2 on page 26.
`co2V`.....Carbon dioxide concentration as an integer in ppm.

Temperature limits

`watchT`.....If the number here is 1, the temperature limit watch is set. 0 means off.

`maxT` ..... Upper limit as a decimal number.

`mintT` ..... Lower limit as a decimal number.

`hystT` ..... Hysteresis as a decimal number.

Humidity limits

`watchH` ..... If number 1 is set here, the humidity limit watch is set. 0 means off.

`maxH` ..... Upper limit as a decimal number.

`minH` ..... Lower limit as a decimal number.

`hystH` ..... Hysteresis as a decimal number.

Dew point limits

`watchD` ..... If 1 is entered, dew point limit monitoring is set. 0 means off.

`maxD` ..... Upper limit as a decimal number.

`minD` ..... Lower limit as a decimal number.

`hystD` ..... Hysteresis as a decimal number.

Carbon dioxide concentration limits

`watchCO2` ..... If 1 is entered, the carbon dioxide limit watch is set. 0 means off.

`maxCO2` ..... Upper limit as a decimal number.

`minCO2` ..... Lower limit as a decimal number.

`hystCO2` ..... Hysteresis as a decimal number.

Reply to http get

As a response to the get, the device expects an HTTP 200 response.

MODBUS TCP

Instructions list

Depending on the type of register, the device allows you to access its memory with the following instructions:

- 0x04 .....input register reading

A maximum of 60 registers can be read at a time. You must wait for a response or allow a timeout before reading more.

Input Register

Address	*Access*	*Function*	*Description*
1. sensor			
0 [8]	read	0x04	**Temperature status** See Tab. 2 on page 26.

[8] It is possible to see registers numbered from one or zero, because this first register has address 0.

Address	*Access*	*Function*	*Description*
1. sensor			
1	read	0x04	**Temperature** The actual value is obtained by dividing by 10.
2	read	0x04	**Humidity status** See Tab. 2 on page 26.
3	read	0x04	**Humidity** The actual value is obtained by dividing by 10.
4	read	0x04	**Dew point** See Tab. 2 on page 26.
5	read	0x04	**Dew point value** The actual value is obtained by dividing by 10.
2. sensor			
6 to 11			
Additional sensors…			
from 12			
Transmitter signal strength and battery status (TME radio and TME radio PoE only)			
1. sensor			
200	read	0x04	**Transmitter battery status** Battery status as a number from 1 to 8. 1 = 0% (low battery) 8 = 100%
201	read	0x04	**Signal strength** A signed integer that represents the signal strength in dB. (The higher the number - i.e. closer to zero - the better the signal.)
2. sensor			
202, 203			
Additional sensors…			
from 204			

CONNECTION VIA TCP

In WEB mode

If the device is set to WEB mode[9], it can work as a TCP server. This means that it expects a connection from another network device - a client - on the configured port. The port number is set in the web configuration under *Network > Port for Spinel*.

Current values – 0x0E

Via an established TCP connection, it sends the measured values to the client every 10 seconds in a format compatible with the Spinel protocol (format 97).[10] For each connected sensor, one message is sent - so every 10 sec 1 to 32 messages can be sent depending on the number of sensors. Only information about the sensors that are configured on the web interface is sent.

PARAMETERS

id	1 byte	Sensor identifier according to the table in the web settings - a number from the range 1 to 32. According to this order, you can see which variables are available at each position. The types of sensors and their variables are not transferred in this simple packet.
status	1 byte	Information in which state the measured value is located. See Tab. 2 on page 26.
value	2 bytes	Measured value as 16-bit signed integer value (signed int)[11] multiplied by ten. The bytes are in the order MSB:LSB.

AUTOMATIC MESSAGE

Structure:	← **0x0E**, id, 0x01, status, value, 0x02, status, value, 0x03, status, value

[9] WEB mode is the default operating mode of the device. The mode can be changed in web interface.

[10] Free tools such as a communication terminal, online parser, Node-RED nodes or .NET library are available for the Spinel protocol.

[11] Negative numbers are expressed as a two's complement. Binary complement is a way of encoding negative numbers in binary. The absolute value of a negative number can be obtained as follows:

Number (binary complement) FFC6H

Subtract one .....FFC6H - 1 = FFC5H

Negate the result .....FFC5H → 003AH, which is decade 58

Example from THT2 sensor:	← 2A 61 00 12 31 00 **0E** 01 01 00 01 06 02 00 01 80 03 00 00 6D 27 0D The temperature was measured at 26,2 °C and the humidity at 38,4 %. The dew point is 10,9 °C. 0x0E → Flag that this is an automatically sent message. 0x01 → This message refers to the first sensor. 0x01 → Temperature: 0x80 → value is valid and within the range 0x0106 → 262 → divide by ten → 26,2 °C 0x02 → Humidity: 0x80 → value is valid and within the range 0x0180 → 384 → divide by ten → 38,4 % 0x03 → Dew point: 0x80H → value is valid and within the range 0x006D → 109 → divide by ten → 10,9 °C

In TCP and UDP modes

In TCP server, TCP client and UDP modes, the device communicates using the Spinel protocol.[10] It is a standard request-response protocol used by all devices in our company. Depending on the type, the device communicates differently in these modes:

TME multi

This protocol can be used to communicate with the connected sensors via the device in a similar way to the Ethernet to serial link converter using the Spinel protocol.

You can use the Spinel instructions as described in the documentation of the specific sensors.

TME radio and TME radio PoE

Name and version – 0xF3

The device responds with information about its name and version.

PARAMETERS

string	x byte	A string with the device identification in the form: *[device-type]; v[device-number].[hw-version].[sw-version];*

READING

Structure:	→ **0xF3** ← string
Example:	→ 2A 61 00 05 FE 02 **F3** 7C 0D ← • Device identification string: TME_radio; V0741.01.06; 97

Sensor information – 0x53

For each sensor, it provides information about the connection, sensor type, signal strength and battery status.

PARAMETERS

id	1 byte	Sensor number from the interval 1 to 32.
status	1 byte	Communication status: • 0x00 – communication has not yet taken place • 0x80 – communication took place at least once • 0x40 – sensor error
product_num	2 bytes	Sensor product number by Tab. 1 on page 5, i.e. e.g. 740 for a TMW sensor.
item_num	2 bytes	Piece number.
rssi	1 byte	Signal strength as a unsigned integer. The value in dB is obtained by multiplying by -1. A higher number (closer to zero) means the signal is better.
batt	1 byte	Current battery capacity in the wireless sensor as number 1 (discharged) to 8 (full).

READING

Structure:	→ **0x53**, id ← id, status, product_num, item_num, rssi, batt
Example:	→ 2A 61 00 06 FE 02 **53 01** 1A 0D ←

Measured values – 0x54

PARAMETRY

id	1 byte	Sensor number from the interval 1 to 32.
quantity	1 byte	Quantity code: • 0x01 – temperature • 0x02 – humidity • 0x03 – dew point or CO_2 concentration (by sensor type)
status	1 byte	Communication status: • 0x00 – communication has not yet taken place • 0x80 – communication took place at least once (*value* is valid) • 0x40 – sensor error
value	2 bytes	Current value as an integer. [7]

READING

The bracketed part () is always included three times in the answer.

Structure:	→ **0x54**, id ← id, (quantity, status, value)
Example:	→ 2A 61 00 05 FE 02 **F3** 7C 0D ←

SNMP

The SNMP protocol contains objects with up-to-date sensor information. The device uses SNMP version 1.

The MIB table that you can import into your SNMP manager can be downloaded from papouch.com.

Tip: If you want to traverse the entire SNMP object tree with the SNMPWALK (Linux) utility, then you need to specify after the IP address from which node to start reading. Example:

snmpwalk -v1 -c public 192.168.1.254 1.3.6.1.4.1.18248

If you provide only the IP address, you will get back only the basic system OID of the device objects.

SNMP objects – variables

The following objects are available for each connected sensor. The last number for each id can therefore take values from 1 to 32.

Sensor type

Name: snsType

Object ID: 1.3.6.1.4.1.18248.30.2.2.1.1.1.1 - 32

Description: Sensor product number by Tab. 1 on page 5, i.e. e.g. 740 for a TMW sensor. If the number 0 is here, this memory position is not used by any sensor.

Sensor name

Name: snsName

Object ID: 1.3.6.1.4.1.18248.30.2.2.1.1.2.1 - 32

Description: User-defined sensor name.

Status of the first variable

Name: snsStatus1

Object ID: 1.3.6.1.4.1.18248.30.2.2.1.1.3.1 - 32

Description: See Tab. 2 on page 26.

Status of the second variable

Name: snsStatus2

Object ID: 1.3.6.1.4.1.18248.30.2.2.1.1.4.1 – 32

Description: See Tab. 2 on page 26.

Status of the third variable

Name: snsStatus3

Object ID: 1.3.6.1.4.1.18248.30.2.2.1.1.5.1 – 32

Description: See Tab. 2 on page 26.

Measured value – first variable

Name: snsValue1

Object ID: 1.3.6.1.4.1.18248.30.2.2.1.1.6.1 - 32

Description: The current measured value is obtained by dividing this number by ten. The validity of the value is described by the corresponding status!

Measured value – second variable

Name: snsValue2

Object ID: 1.3.6.1.4.1.18248.30.2.2.1.1.7.1 - 32

Measured value – third variable

Name: snsValue3

Object ID: 1.3.6.1.4.1.18248.30.2.2.1.1.8.1 - 32

SNMP objects – general

The following object refers to the whole device.

Name of the device

Name: deviceName

Object ID: 1.3.6.1.4.1.18248.30.2.1.1.0

Description.

Alarm text

Name: alarmString

Object ID: 1.3.6.1.4.1.18248.30.2.1.2.0

Description: Text of the alarm message when the set limits are exceeded.

Automatic messages – traps

The device allows sending automatic messages (SNMP traps). There are two settings related to traps, namely the sending permission and the IP address of the trap recipient (the so-called SNMP administrator or manager).

Traps are sent (depending on the setting) if any of the monitored variables leave the set limits.

Trap with current values can be sent periodically according to the settings.

Trap 1 - Greatness is off limits

The measured value and the limit that was exceeded are sent in the trap.

The trap is sent only if the set limits are exceeded. For the trap to be delivered, the IP address of the SNMP manager PC must be set correctly.

Trap 2 - Current measured values

In the trap, all current values are sent, as well as the device name set by the user.

The trap is sent only if a non-zero sending period is set.

INDICATORS ON THE DEVICE

Lights in the Ethernet connector that indicate the status of the network connection:

LNK (left)
No light..... not connected
Yellow ..... connected at 10Mbps
Green..... connected at 100Mbps

ACT (right)
No light..... no communication
Yellow ..... Half-Duplex communication
Green..... Full-Duplex communication

TME multi

On the side of the device, there are two lights near the green terminal:

Green indicator light: (left) Indicates power supply connection.

Yellow indicator light: (right) is on when TCP connection is established via data channel (not on in WEB mode).

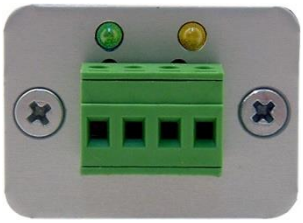


Fig. 21 – indicator lights on TME multi

TME radio

On the side of the device there are two lights next to the antenna – a multi-coloured STS and a green ON light.

ON is green after correct initialization of the device. It goes off briefly whenever it communicates with a wireless sensor.

STS is green when a TCP connection is established with the device.

STS in web mode indicates the module activity by flashing red.

STS in TCP server mode indicates Spinel protocol communication with a red blink.

Fig. 22 - indicator lights on TME radio

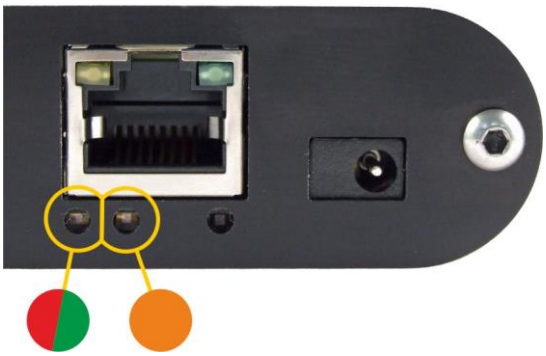
TME radio PoE

There are two lights under the Ethernet connector:

Yellow (right): lights up when a Spinel or Modbus connection is established.

Red-green (left):

- Green lights and red flashes if the device is working properly and at least one sensor is connected
- both green and red lights are on if the device is working but no sensor is connected
- red light on when device error



Wireless sensor

There is a green light on the sensor that flashes when communicating with the base.

RESET

Use the following procedure to reset the device to "factory settings". Unlike the reset that can be done via the web or Telnet, the IP address will be changed to 192.168.1.254 or assigned by the DHCP server.

1) Disconnect the device from the power supply.
2) Press and hold the Reset button in the hole below the Ethernet connector.
3) Continue according to how you want to assign the IP address:
    a. **IP address 192.168.1.254**:
        i. Turn on the power.
        ii. Wait approx. 4 sec.
        iii. Release the button.
        iv. IP address is set, device is in "factory setting".
    b. **IP address assigned by the DHCP server**:
        i. Turn on the power.
        ii. Wait approx. 30 sec and release the button.
        iii. The device is in "factory setting". The IP address assigned by the DHCP server can be found in your DHCP server (typically in your router). The section with such assigned addresses has different names - for example, *DHCP Client List*, *DHCP Clients*, etc.

TECHNICAL PARAMETERS

TME radio and TME radio PoE: Wireless interface

Communication frequency .....868,4 MHz[12]

Signal range .....approx. 100 metres in line of sight [13]

Antenna connector type.....SMA

Max. number of devices on bus/network 32

TME multi: Communication line

Type.....RS485

RS485 connector.....terminal block

RS485 maximum length .....1200 m

Max. number of devices on bus.....32

Used signals of RS485 .....RxTx+, RxTx-

Resistors defining the idle state of RS485.....10 kΩ

Ethernet interface

Ethernet connection.....RJ45 Ethernet 10/100BASE-T

Default IP address 192.168.1.254

Default network mask 255.255.255.0

Default IP address of the gateway.....0.0.0.0

Telnet port .....9999 (can be disabled by user)

TME radio and TME multi: Supply and dimensions

Supply voltage .....5 to 30 V (with reverse polarity protection)

Power consumption .....typically 80 mA at 12 V

Dimensions.....54 (63) mm × 24 mm × 33 mm

Weight .....60 g

TME radio PoE: Supply and dimensions

PoE power supply.....according to IEEE 802.3af

External power supply .....11 to 58 V DC (with reverse polarity protection)

Current consumption .....typ. 120 mA @ 15 V
typ. 72 mA @ 24 V
typ. 32 mA from PoE

Power connector.....typ. 1,8 W

Power connector.....coaxial 3,8 × 1,3 mm; positive pole is inside

Dimensions (without connectors).....88 × 70 × 25 mm

[12] Default frequency for the EU. On request also with communication frequencies for US, Asia etc.

[13] Depending on individual conditions.

Weight ..... 130 g

Other parameters

Operating temperature ..... –25 to +70 °C

Working humidity ..... 0 to 90 %RH, non-condensing

Degree of protection IP30

Available designs

Holder:

- No holder *(standard design)*
- With a DIN rail holder

Fig. 23 – Design with holder for DIN 35 mm rail

Do not hesitate to contact us if you have any further specific requirements for the design and functionality of the TME multi and TME radio modules.

Technical parameters – wireless Sensors

Technical parameters of the sensors for TME multi are described in their separate documentation on papouch.com. Direct links to the website are in Tab. 1 on page 5.

TMW O

Wireless outdoor temperature sensor.

Fig. 24 - Outdoor wireless thermometer

Sensor electronics

Power supply method ..... Lithium battery CR123A (3 V)

Antenna ..... integrated

Recommended replacement interval. 3 to 5 years at 20 °C based on measuring interval

Operating temperature range ..... -40 °C to +60 °C

Dimensions ..... 132.5 × 62 × 33 mm

Degree of coverage IP65

Weight .....0.1 kg

Temperature sensor

Sensor type .....semiconductor

Measured temperature range .....-40 to +125 °C

Accuracy.....0.5 °C in range 0 °C to +65 °C; otherwise 1 °C

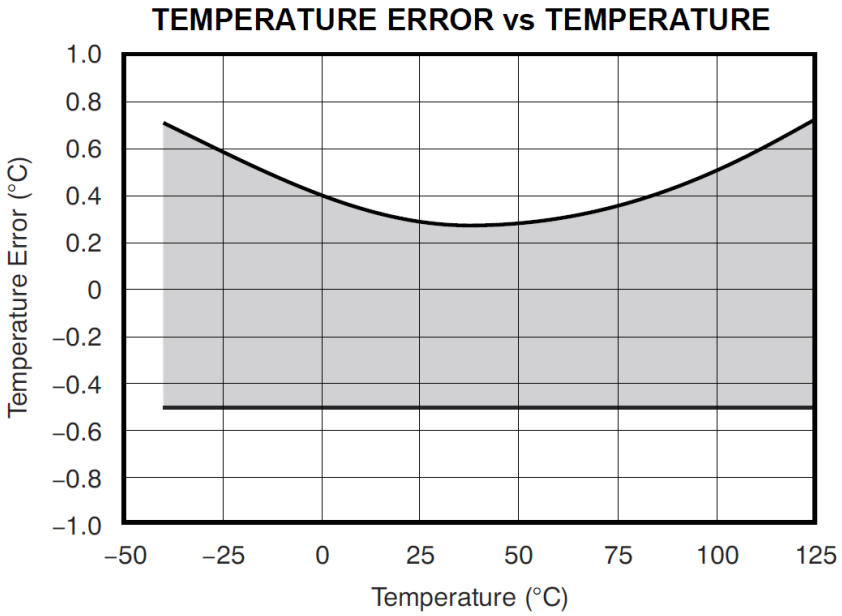


Fig. 25 - Temperature error versus temperature for TMW O and TMW I

Dimensions.....diameter 5,7 ±0,1 mm; length 60 mm

Packaging material .....stainless steel 17240 (corresponds to DIN 1.4301)

Degree of protection .....IP68 h 1 m according to EN 60529

Sensor resistance to external pressure ..... up to 2.5 MPa

TMW I

Wireless indoor temperature sensor.

Fig. 26 - TMW I (left) and THW I (right) without cap

Power supply method .....Lithium battery CR123A (3 V)

Antenna .....integrated

Recommended replacement interval .3 to 5 years at 20 °C based on measuring interval

Measured temperature range..... -40 °C to +60 °C

Working humidity ..... 0 to 90 %RH, non-condensing

Accuracy ..... 0.5 °C over the range 0 °C to +60 °C; otherwise 1 °C

Dimensions ..... 62 × 62 × 27 mm

Degree of coverage..... IP20

Weight..... typ. 65 g

Mounting holes..... spacing 45 mm; diameter 4 mm

THW I

Wireless indoor temperature and humidity sensor.

Fig. 27 - TMW/THW with cap

Operating conditions: The sensor is designed for operation in clean air environments. Use in other types of environments is only possible after thorough testing and consultation with the manufacturer of the SHTxx sensing chip, a Sensirion company.

Caution: Exposure of the sensor to chemicals and other contaminants may result in degradation of sensor accuracy over time. Contaminants can cause a change in the dielectric constant of the sensing material, which can lead to irreversible damage to the sensor. Prolonged exposure to volatile organic compounds and strong acids or bases is particularly critical.

Power supply method..... Lithium battery CR123A (3 V)

Antenna..... integrated

Recommended replacement interval. 3 to 5 years at 20 °C based on measurement interval

Measured temperature range..... -40 °C to +60 °C

Working humidity ..... 0 to 90 %RH, non-condensing

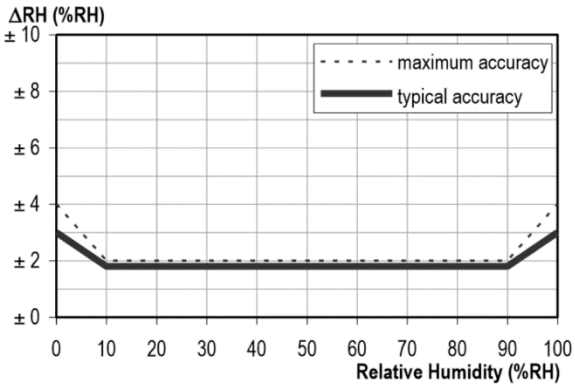
Dimensions ..... 62 × 62 × 27 mm

Degree of coverage..... IP20

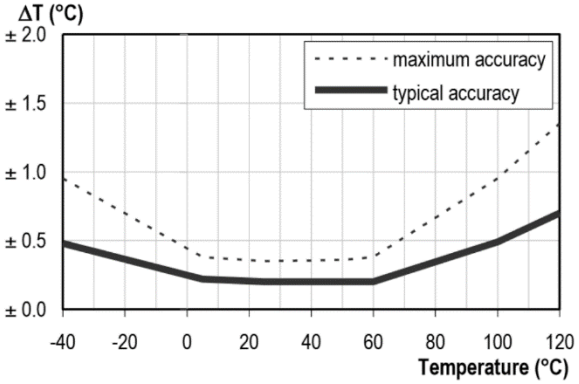
Weight..... typ. 65 g

Mounting holes..... spacing 45 mm; diameter 4 mm

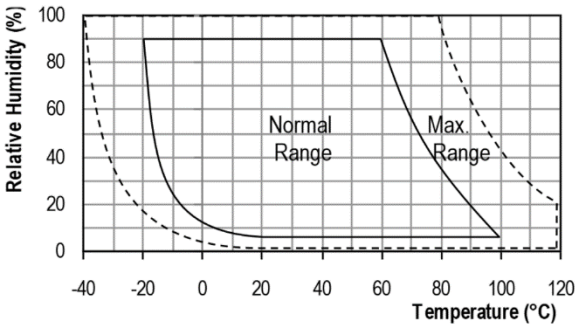
Accuracy.....according to Fig. 28 [14]



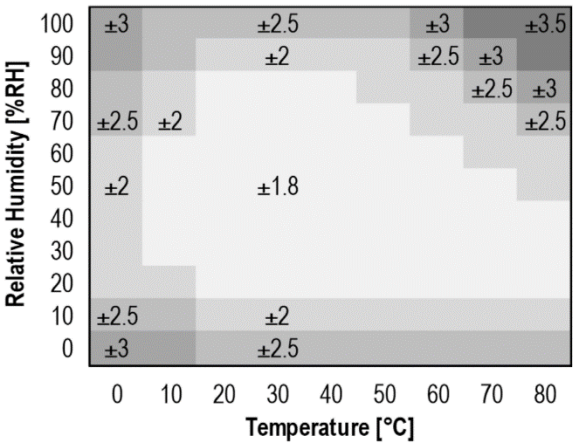
Typical and maximal tolerance at 25°C for relative humidity



Maximal tolerance for temperature sensor in °C



Operating Conditions



Typical accuracy of relative humidity measurements given in %RH for temperatures 0 – 80°C

Fig. 28 – accuracy

[14] If the temperature and humidity move outside the Normal range, especially at humidities above 80%, the humidity measurement may temporarily shift (up to 3% after 60 hours). Once temperature and humidity return to the Normal range, the sensor will slowly return to factory calibration. Prolonged movement of temperature and humidity outside the Normal range accelerates sensor aging.

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Industrial data transmission, line and protocol converters, RS232, RS485, RS422, USB, Bluetooth, Ethernet, LTE, WiFi, measurement modules, smart temperature sensors, I/O modules, custom development and manufacturing.

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