PAPAGO 2TH

Measure 2x temperature, humidity and dew point

Ethernet and WiFi connectivity

PoE power or external power supply

PAPAGO 2TH

Datasheet

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FIRMWARE VERSIONS

Version 1.5: SNMP extended by variable type.

Version 1.6

- Information e-mails are sent as a single message with all values at once instead of separate e-mails.
- HTTP GET can be turned on by itself for sending when limits are exceeded.

Version 1.7

- *E-mails:* Time in the subject was corrected, temperature state labels corrected as well.
- Fixed: re-directing after log-out from settings.
- Set limits are remembered even if the watching is off.

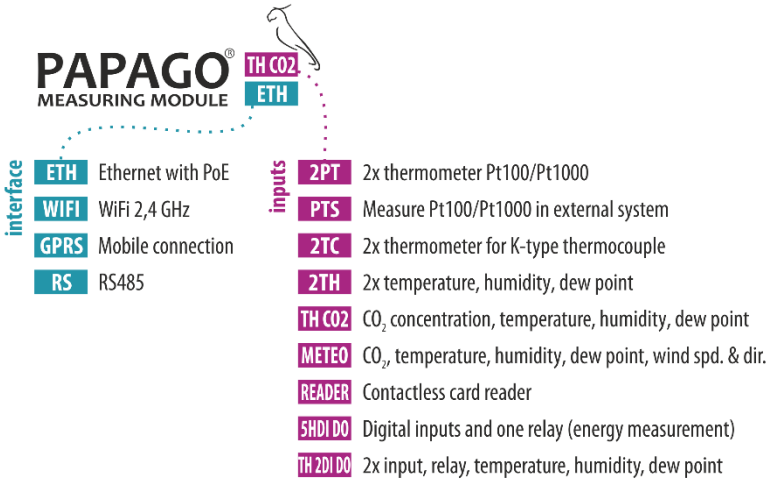
Version 1.12: TH3 sensor support.

Version 2.1: Added communication protocol MQTT.

Version 2.3: Added TCP timeout and options to disable Telnet, Fw update and SNMP. Removed GUID.

ABOUT PAPAGO

PAPAGO is a family of devices with uniform appearance and communication capabilities. It allows to combine communication interfaces on one side and measuring sensors (inputs) on the other side.



Applications

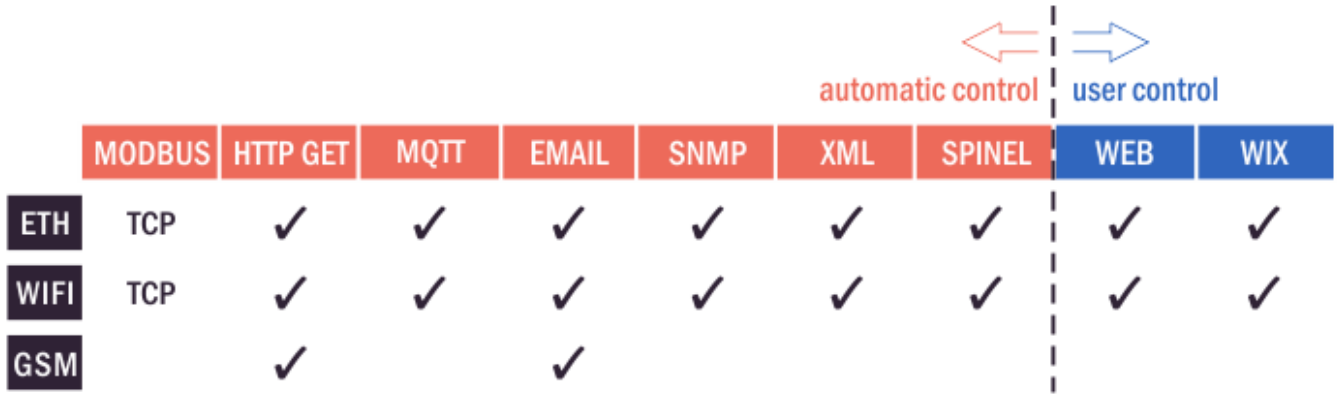
- Temperature and humidity measurement in industry, buildings, server rooms and other environments.
- Measurement of temperature for heating systems.
- Monitoring temperatures in warehouses and archives.
- Monitoring the manufacturing proces.
- Monitoring temperature, humidity and reached limits.
- Environmental monitoring via the internet.
- Measurement for the HACCP system.

Common Features

- Ethernet or WiFi interface to an internal website and many standard communication protocols.
- Ethernet versions with PoE power supply. This eliminates the need to use an external power supply, but the possibility to connect the AC adapter is available.
- Configuration of WiFi parameters via USB interface.
- Internal memory and real-time clock. Measured data including the time of measurement is automatically stored in the memory in the event that communication is lost. The data is automatically sent after the connection is restored.
- Elegant but robust metal box that can be mounted on a DIN rail. The box bears descriptions that allow connection without having to consult the manual. Also LED indicators for all important states help commissioning.
- The possibility to display, store and analyze data in the Wix program.

Communication Options

PAPAGO features different communication options depending on the used interface. PAPAGO can be **controlled by user** via a web interface or via software for Windows. **Machine reading** is possible using various standard methods, so PAPAGO can be easily integrated into your existing systems. You can choose the option that is appropriate for your location:



Machine data-reading: Modbus TCP, MQTT[1], HTTP GET with encryption, e-mail, SNMP, XML, Spinel

User control: Web interface, Wix software

Properties

Papago 2TH can measure temperature, humidity and dew point from two sensors.

Each of the two inputs can be fitted with either of these two sensors:

Sensor A..... temperature: -40 to 125 °C; humidity 0 to 100 %

Sensor B..... temperature: -55 to 125 °C

- Family of measuring devices with Ethernet or WiFi interface.
- Data reading by user via responsive web interface or Wix software.
- Machine data reading via Modbus, HTTP GET, MQTT[1], SNMP, XML, e-mail or Spinel protocol.
- The ability to encrypt data in HTTP GET by 128bit AES encryption.
- Measurements via external thermometer or combined temperature and humidity sensor. (Sensors are not included.)
- WiFi 2,4 GHz.
- Power supply from PoE (IEEE 802.3af standard; Ethernet versions only) or external source.
- External DC power supply 11 to 58 V.
- Current consumption typically 72 mA at 24 V.

[1] MQTT protocol is available only in version with communication via Ethernet.

CONNECTION

1) Ethernet version: Connect the device by a normal uncrossed cable for computer networks to the switch.

2) Ethernet version: If the device cannot be powered by the switch via PoE according to the IEEE 802.3af standard, connect a power adapter to the coaxial connector next to the connector for the Ethernet. DC voltage in the range of 11-58 V is expected. (The positive pole is inside, the input for the power supply has reverse polarity protection.)

   WiFi version: Connect an power adapter to the coaxial connector next to antenna. DC voltage in the range of 11-58 V is expected. (The positive pole is inside, the input for the power supply has reverse polarity protection.)

3) Connect either a temperature sensor or a combined temperature and humidity sensor to both or one of the terminals *sensor a* and *sensor b*.[2]

4) Ethernet version: Now it is necessary to set the correct IP address of the device. The default IP address is 192.168.1.254 and network mask 255.255.255.0. If your network is not compatible with this range, set the IP address of the device using Ethernet configurator.

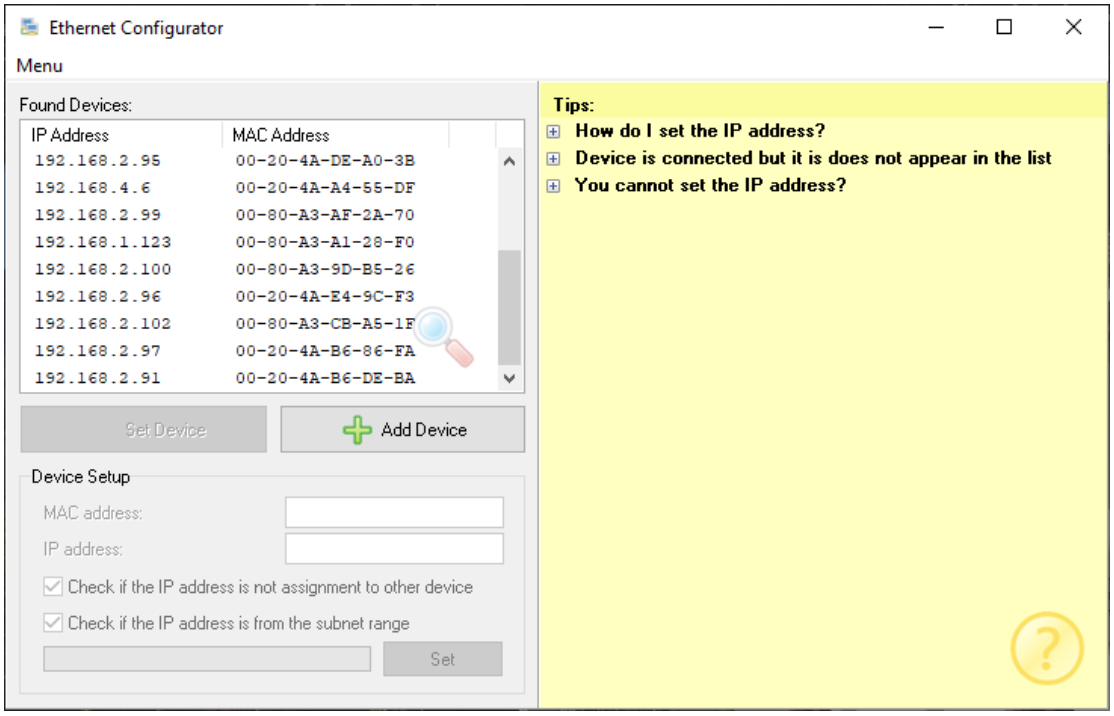


fig. 1 – Ethernet Configurator for setting the IP address

WiFi version: Connect your Papago to a windows PC using the supplied micro USB cable.[3] Run *Papago WiFi Configurator* software, you can download it on papouch.com. Set-up papago to your WiFi network parameters so you can access it from that network.

[2] The individual types of sensors are available from papouch.com.

[3] In Windows 7 or higher driver will be installed automatically.

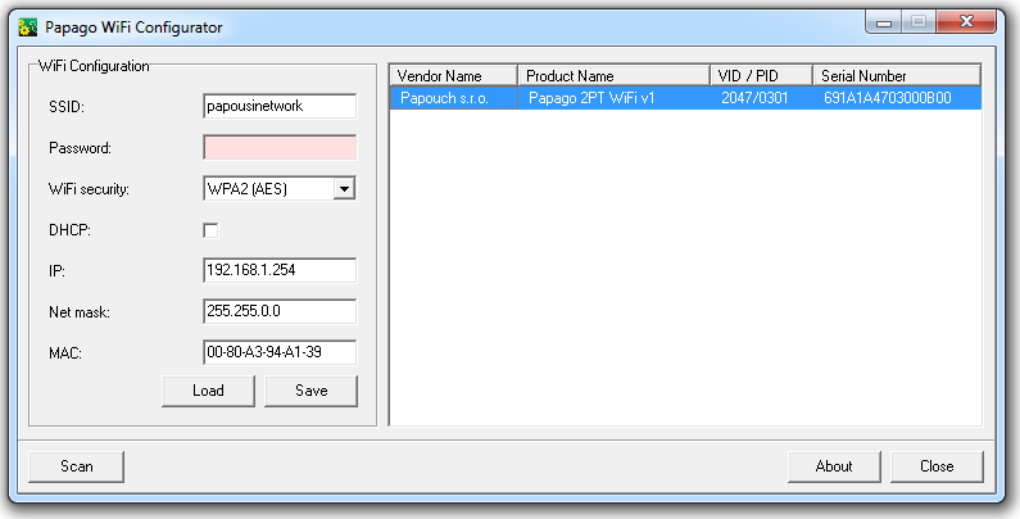


fig. 2 – WiFi configuration via USB

5) After setting the address, you can connect to a Web browser at the address specified as follows: *http://192.168.1.254/* (The example is given for the default IP address.)

CONFIGURATION

Configuration is done via a web interface. The basic network parameters can also be set via Telnet (see page 18). **The web interface** is accessible on the IP address of the device. (The default address is **192.168.1.254**.)

After entering the IP address, the main page will appear showing the latest measured values.

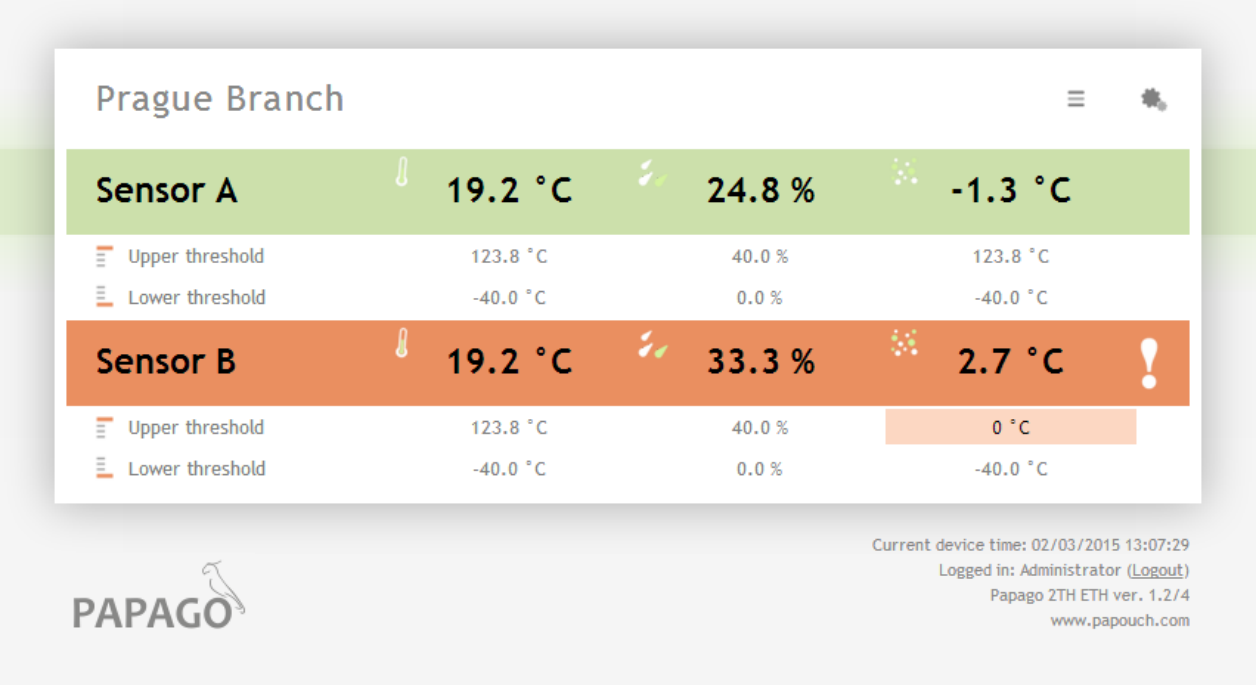


fig. 3 - Three parameters from temperature-humidity sensor connected to connector A (Papago 2TH ETH)

The **web interface is secured** with a username and password. You can choose a separate password for the user (who can only display the values on the main page) and for the administrator (who can also change settings).

The configuration is displayed when you click the icon of gears in the upper right corner. The configuration is divided into sections according to the types of settings and is available in English and Czech.

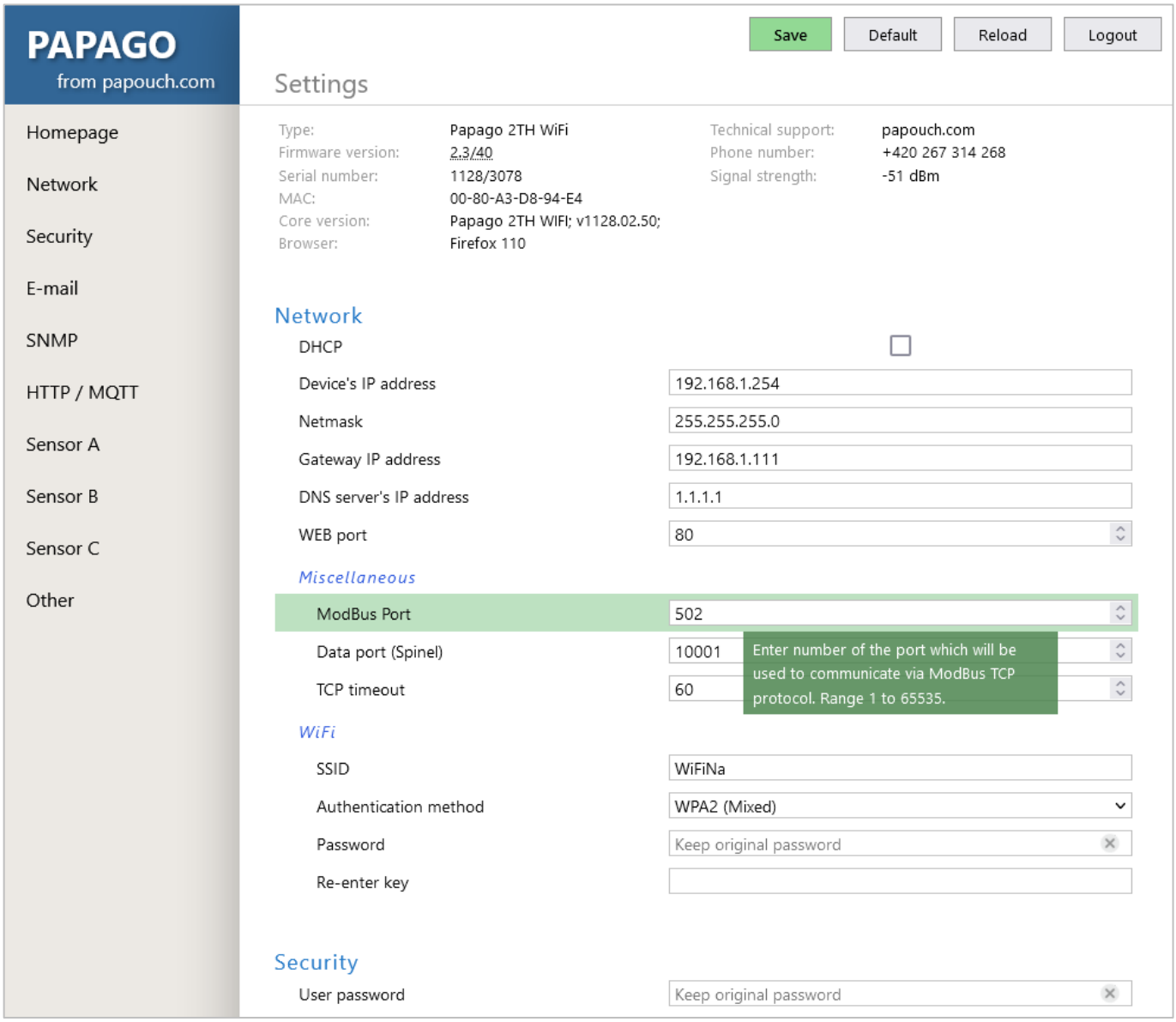


fig. 4 – Papago 2TH WiFi configuration with example of tooltip for Modbus port

Network

This section contains the configuration of network parameters.

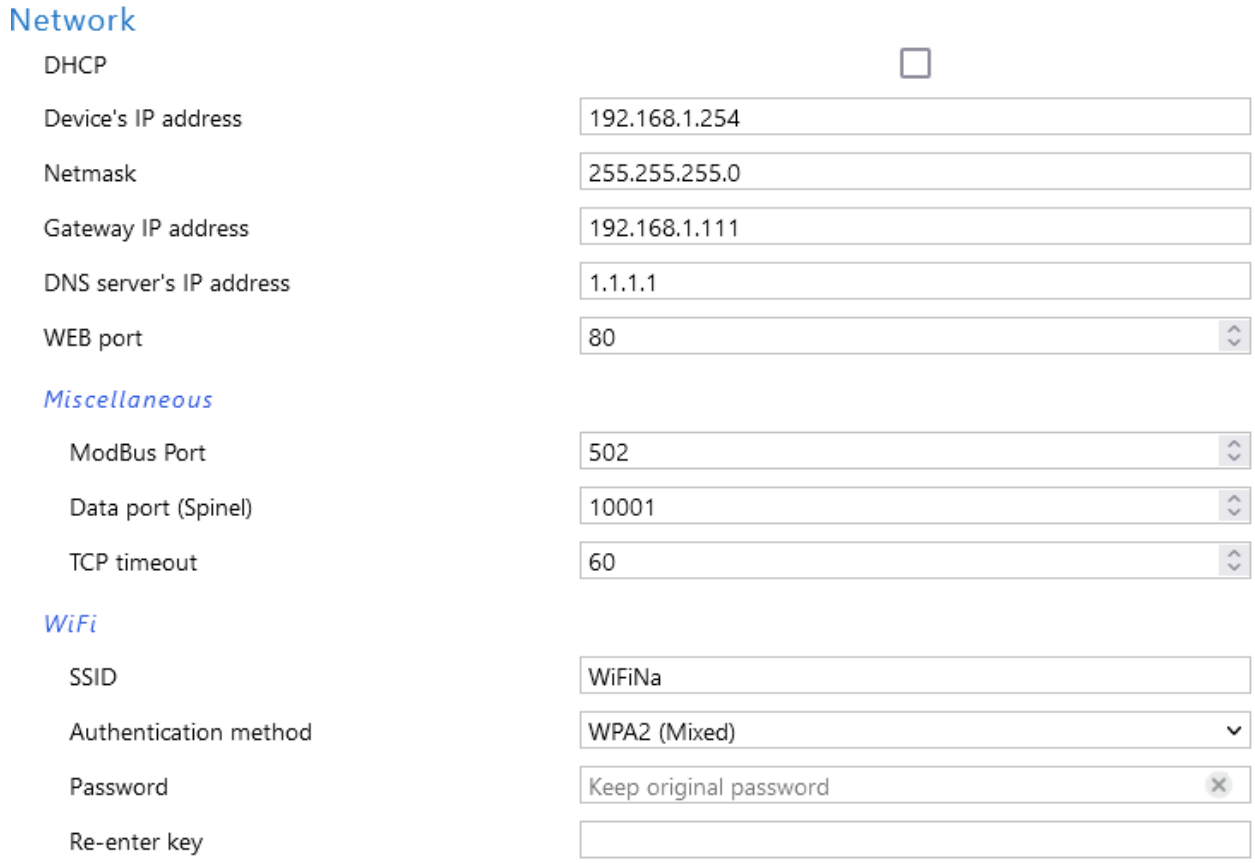


fig. 5 - network configuration

If the box for assigning addresses via DHCP is checked, the fields for *Device's IP address, Netmask, Gateway IP address* and *DNS server's IP address* are reset and upon reloading the settings they are filled again with data obtained from the DHCP server.

TCP timeout is the time in seconds with no communication and after which the TCP connection is automatically terminated. Enter a time from 1 to 3600 or 0 for unlimited time.

If you have a **version with WiFi interface** in the section *Network* is also following parameters:

- As *Authentication method* is available this options: *Open, WEP (open), WEP (shared), WPA (TKIP), WPA (AES), WPA2 (TKIP), WPA2 (AES), WPA2 (Mixed)*.
- Password length is 8 to 30 characters.[4]

Security

The section for setting the password of the user (can only access the main page) and the administrator (has access to both the main page and the settings).

fig. 6 - access security settings

After saving, the passwords are no longer displayed for security reasons. The fields for entering the password show *Not set*, if the password has not been entered, or *Keep original password*, if the password has been entered but is not to be displayed.

The user name is always 'user', the administrator name is always 'admin'. Passwords have a maximum length of 16 characters.[4]

If user has a password, administrator must also have a password. For security reasons, password is not displayed after saving.

Last two items - *Disable Telnet* and *Disable fw upgrade* - are only available in Ethernet version.

Caution: If you disable Telnet protocol and/or upgrade fw and an error occurs during a firmware upgrade, manufacturer service may be required!

[4] Password can contain the following characters:
!#$%()*+,-./0123456789:;=?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[]^_abcdefghijklmnopqrstuvwxyz{|}~

E-mail

The device can send e-mails if one of the thresholds set for any of the measuring channels has been exceeded.

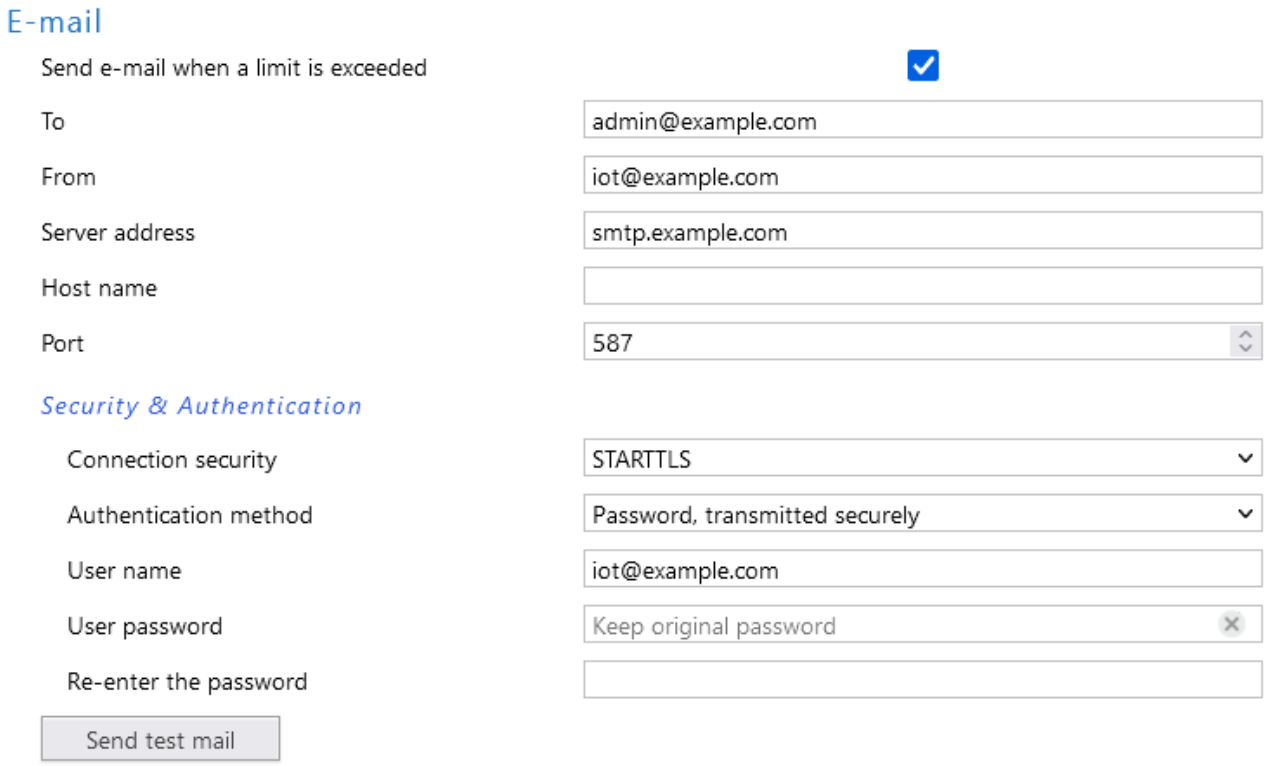


fig. 7 - settings for sending e-mails

Papago 2TH ETH cannot communicate with servers that require a secure (SSL/TLS) connection.

User password length is max. 20 characters.[4]

When the limits are exceede, the device sends an e-mail – format can be seen below:

Example - when limits are exceeded:

Temperature Senzor A is in range. Value is 27.7 °C.
Humidity Senzor A is in range. Value is 27.4 %.
Dewpoint Senzor A is in range. Value is 7.2 °C.
Temperature Senzor B exceeded upper limit 27.0 °C. Value is 27.5 °C.

Example – upon returning in the range:

Temperature Sensor A is in range. Value is 24.3 °C.
Humidity Sensor A is in range. Value is 25.1 %.
Dewpoint Sensor A is in range. Value is 3.1 °C.
Temperature Sensor B is in range. Value is 24.3 °C.

SNMP

Here you can configure communication via SNMP used for data collection in large networks.

fig. 8 - settings for communication via SNMP

For description of SNMP objects see page 21.

HTTP GET / MQTT

Here is settings for sending measured data to remote server - options are *None, MQTT*[1] *and HTTP GET*.

HTTP GET

As *Mode* select HTTP GET.

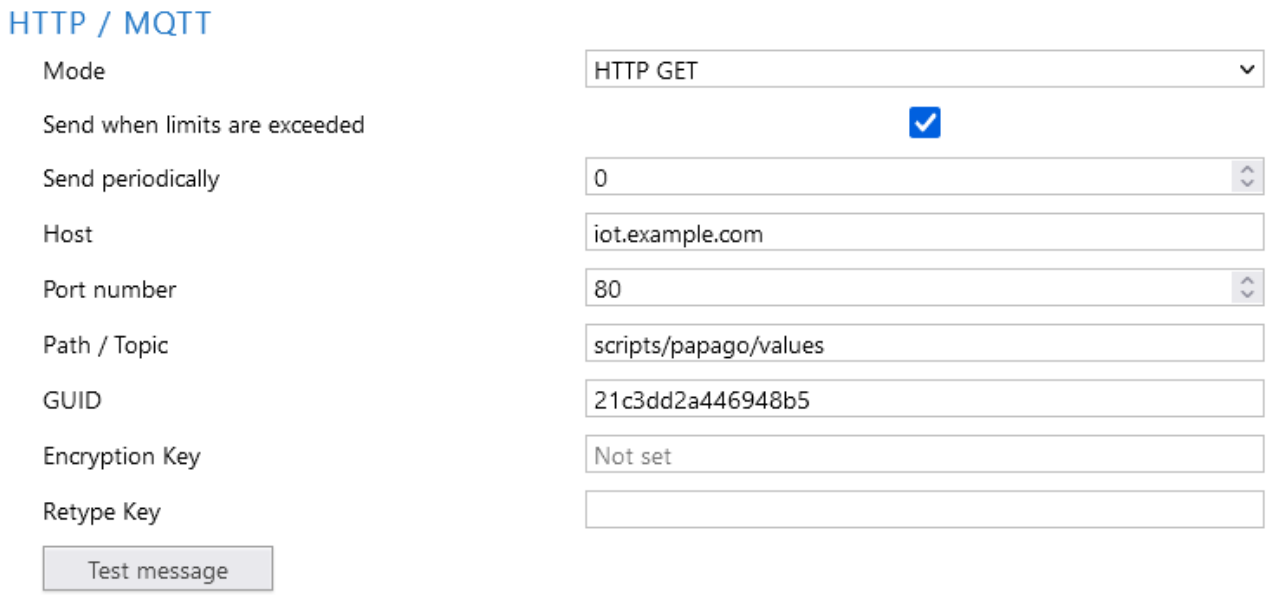


fig. 9 - data sending via HTTP GET

If the sending interval is set to zero, the sending function is turned off. The interval can be set from 0 to 1440 minutes.

If a sensor is set as *Unconnected*, its parameters are not sent in GET.

If you enter an encryption key of 16 characters (upper- and lower-case letters with no diacritical marks and numbers), the HTTP GET data is encrypted by 128-bit AES cipher (Rijndael), the CFB method.

GET Format

- *Example of periodic GET:*

  GET comes from a PAPAGO unit that has one combined and one temperature sensor, one CO_2 sensor and wind speed & direction sensor. & characters are deleted for better readability.

```
script.php?mac=0080A397CF65 type=Papago 2TH ETH guid=PAP
description=LOG log_index=1 date_time=01/28/2015 14:35:00
T1V1_value=21.7 T1V1_units=°C T1V1_status=0 H1V2_value=25.0
H1V2_units=% H1V2_status=0 D1V3_value=0.8 D1V3_units=°C
D1V3_status=0 T2V1_value=23.4 T2V1_units=°C T2V1_status=0
```

- *Example of GET after pressing the button in the settings:*

```
script.php?mac=0080A393A273&type=Papago%202PT%20ETH
&guid=PAPAGO-TEST-GUID&description=TEST
```

- *Example of encrypted GET[5] after pressing the button in the settings:*

```
script.php?encrypted_data=%2C%60%32%08%25%03%44%2E%40%29%63%61%34%08%
44%62%67%CF%70%FE%D0%EA%E9%9C%C3%4C%9B%9D%E3%8B%31%18%10%E4%FB%9E%59%
25%56%A4%60%68%1B%77%CC%EE%23%99%D1%CE%1A%AE%B5%E4%BC%D3%0C%84%9E%7C%
F4%2B%5F%B1%D4%99%C6%11%F8%75%C7%E5%27%10%93%DC%8D%43%EF%13%79%37%F1%
D2%5B%35%6B
```

  Encrypted part above contains following data: `mac=0080A394A139&type=Papago 2TH WIFI&guid=Papago-GUID&description=TEST`

- *Description of get parameters:*
  - *description* ..... Indicates a standard GET with measurement (LOG), GET sent when exceeding a limit (WATCH) or a test GET sent when you press the button on the Web (TEST). GET with measurement and GET sent when exceeding a limit contain the same data
  - *mac* ..... MAC address of the device.
  - *type* ..... Type designation of the device.
  - *guid* ..... Unique user-specified text string.
  - *index* ..... Sequence number of the get request.
  - *log_index* ..... Sequence number of the record in a circular buffer.[6]
  - *date_time* ..... Timestamp
  - *encrypted_data* ..... This parameter contains the data of encrypted GET.[5]

  The following parameters may be given more than once if there are more measured values from one sensor. The first character may be either T (for temperature), H (for

[5] It is 16 bytes of initialization vector followed by encrypted data as specified in the body of standard get. We have examples of get processing for Node.js and PHP in this article on the web (Czech section of website with comments in English): papouch.com/desifrovani-aes-v-http-getu-z-papaga-p3719/

[6] This number applies if the network connection to the device has been discontinued for some time. After restoring the network connection, all accumulated GETs are sent in the form of a circular buffer. The buffer has a capacity of 120 entries.

humidity) or D (dew point). Thus, Papago 2PT with two temperature sensors, provides these parameters:

T1V1[7]*_value* ..... The first temperature as a decimal number.

T2V1_value ..... The second temperature as a decimal number.

T1V1_units ..... The unit of the first measured temperature.

T2V1_units ..... The unit of the second measured temperature.

T1V1_status..... Status of the first value: the value is OK (0), upper limit exceeded (2), lower limit exceeded (3) invalid value (4).

T2V1_status..... Status of the second value: the value is OK (0), upper limit exceeded (2), lower limit exceeded (3) invalid value (4).

CH1_name ..... Channel 1 name.

CH2_name ..... Channel 2 name.

MQTT

As *Mode*, select MQTT[1]. Papago works as MQTT Publisher. It sends variables from connected sensors to configured broker.

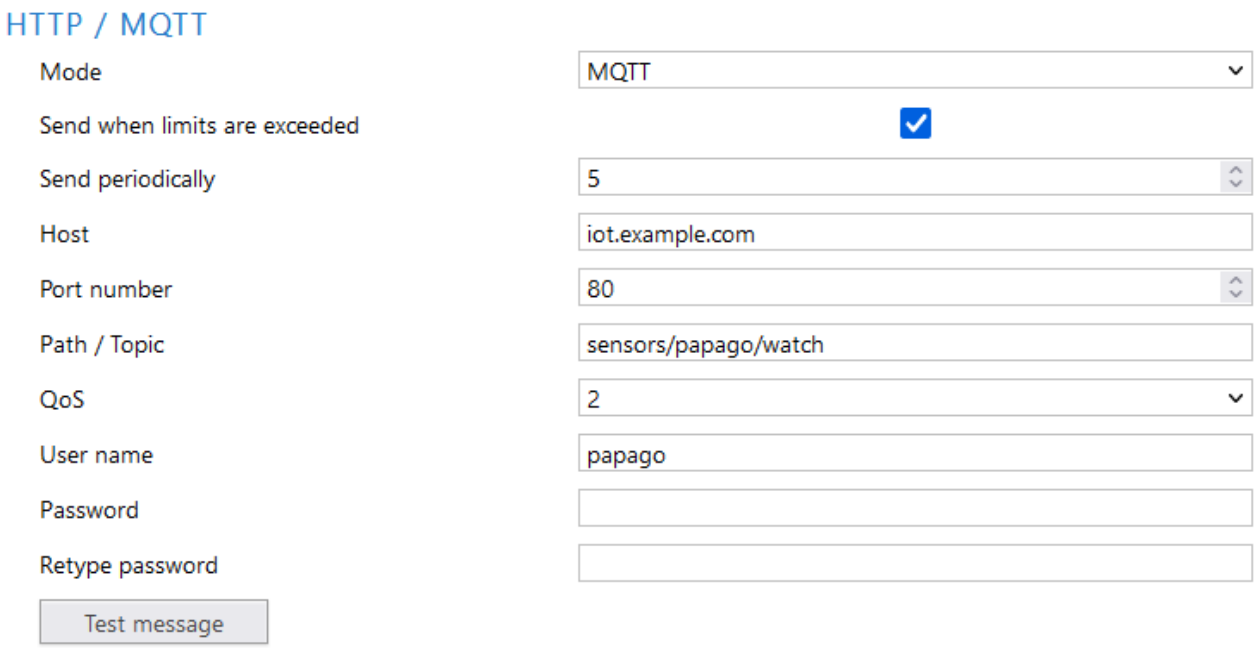


fig. 10 – MQTT settings[1]

If **sending period** is set to zero, sending is disabled. Period can be set from 0 to 1440 minutes.

If sensor is set as *Unused*, its parameters are not sent.

Topic enter into field *Path / Topic* (publish topic).

QoS can be selected as 0, 1 or 2.

Security: SSL/TLS security is not supported.

Password: Maximum 15 characters.[4]

[7] The number after the letter T indicates the serial number of the connector on the device. The number after the letter V indicates the serial number of the parameter from the connected sensor.

Payload format:

Message example from Papago 2TH with one temperature and one temperature/humidity sensor in JSON format:


```
{
    "dev": "Papago 2TH ETH",
    "mac": "0080A3DC7EF4",
    "loc": "U Papoucha",
    "description": "LOG",
    "log_index": 5,
    "time": "06/29/2020 12:38:00",
    "vals": [{
        "t": "temp",
        "v": 28.3,
        "u": 0,
        "io": 1,
        "e": 0
    }, {
        "t": "temp",
        "v": 27.9,
        "u": 0,
        "io": 2,
        "e": 0
    }, {
        "t": "hum",
        "v": 49,
        "u": 0,
        "io": 2,
        "e": 0
    }, {
        "t": "dew",
        "v": 16.2,
        "u": 0,
        "io": 2,
        "e": 0
    }]
}
```


Parameters description:

- **dev:** Device type
- **mac:** MAC address
- **loc:** Location
- **description:** Event type („LOG“, „WATCH“, „TEST“)
  - LOG: Periodically sent message.
  - WATCH: Right now, set limits have been crossed.
  - TEST: Message sent by button in device configuration.
- **log_index:** Sequence number of periodically sent message. This way you can check continuity of sent messages.

- **time:** Message sending time according to Papago's internal clock.
- **vals:** Array with values from connected sensors. Each element of array contains an object with these values:
  - **t**: value type
    - **temp**: temperature
    - **hum**: humidity
    - **dew**: dew point
  - **v**: current value
  - **u**: code of physical unit
    - **0** → degrees Celsius
    - **1** → degrees Fahrenheit
    - **2** → Kelvin
    - **3** → percent (humidity)
  - **io**: connector name from which this variable is read (sensor a = 1, sensor b = 2)
  - **e**: status / error code
    - **0**: everything works
    - **2**: upper limit of measuring range exceeded (overflow)
    - **3**: measured value is less than lower range limit (underflow)
    - **4**: sensor error

Sensor Section

Sensors A and B have their own individual sections with identical settings.

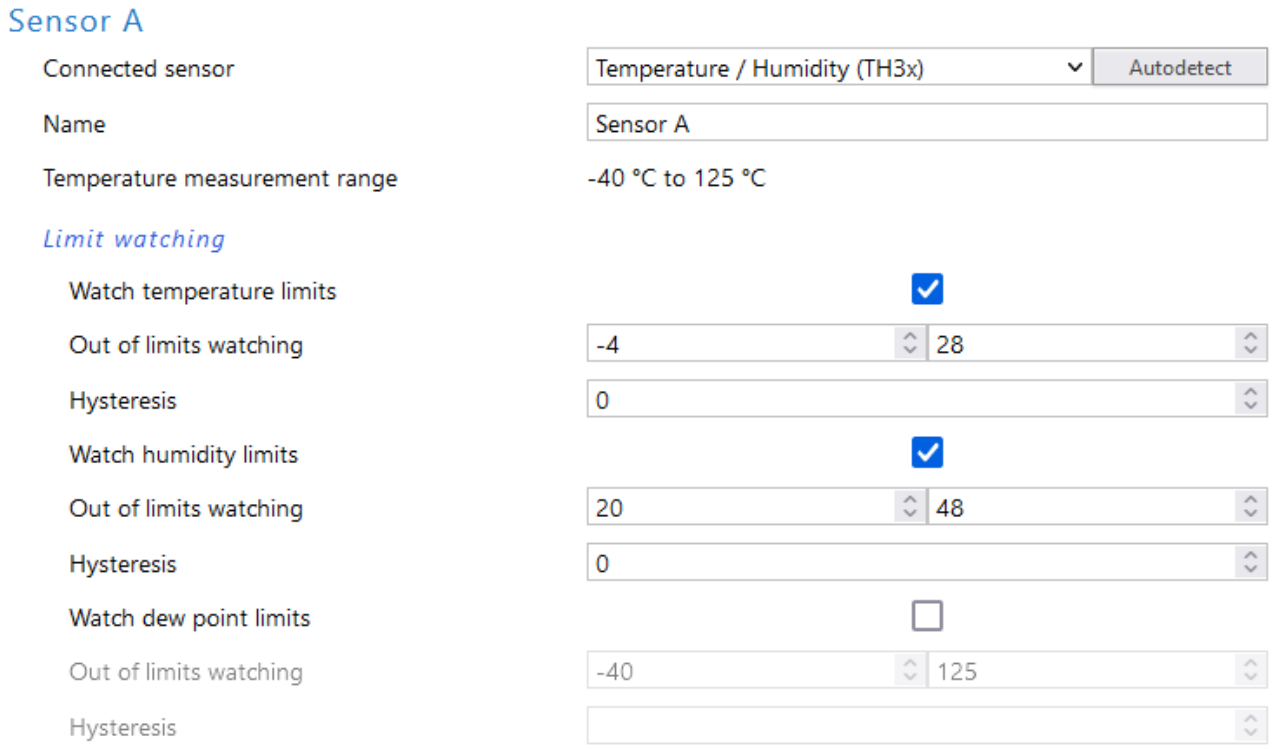


fig. 11 - configuration of one of the sensors

By pressing the *Autodetect* button, all settings for Sensor A and/or B are done automatically according to the currently connected sensor(s), above all the right type of the sensor is entered in the field *Connected sensor*.

Other Settings

This section allows you to set the time, temperature unit, language of the website, etc…

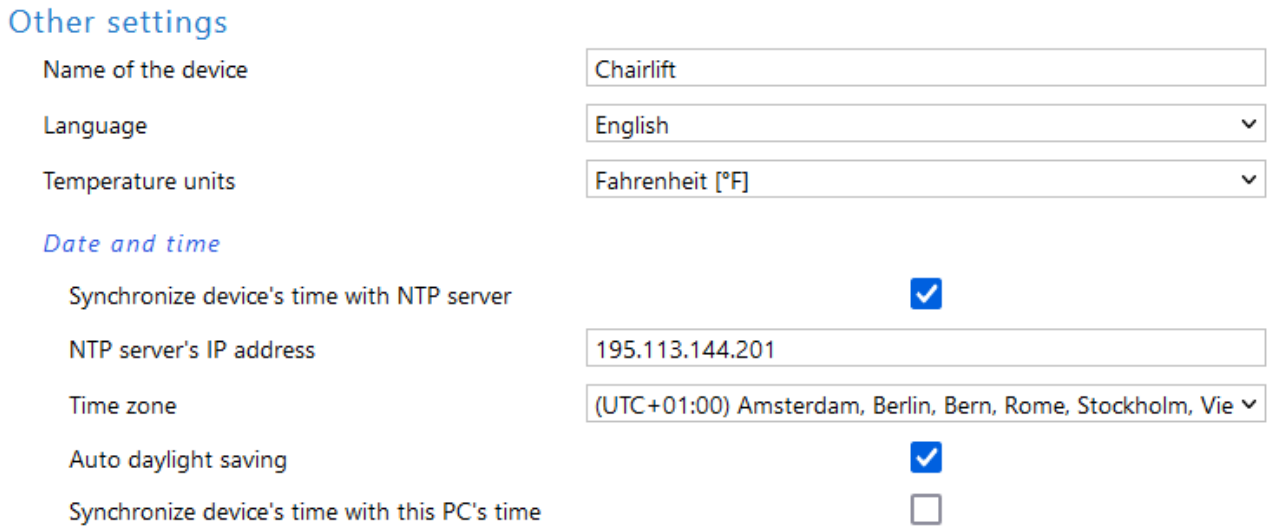


fig. 12 - other settings

The available languages are Czech or English; for temperature units you can choose between degrees Celsius, Fahrenheit or Kelvin.

CONFIGURATION VIA TELNET PROTOCOL

Protocol Telnet can be disabled as follows 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 6).

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. [8])
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.

[8] In Windows 10 or higher, Telnet client is not a standard part of system. Install it using following procedure:
a) In Windows Search (Win + S shortcut), type *Turn Windows features on or off*.
b) Select an item with that name to appear in the list (requires logging in as Administrator).
c) The "Turn Windows features on or off" window opens. In it, check the *Telnet Client* and click OK. The Telnet client will then be installed on the system.

IP address is known

1) In OS Windows choose Start/Run, enter `telnet` in the provided line and press Enter. [8]
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.

XML

It is possible to obtain the last measured values, limits (thresholds) and device name from the device in the form of a text file in the XML format. The file is available at *http:///[IP-adresa]/fresh.xml* – i.e. for example at http://192.168.1.254/fresh.xml for the default settings.

```
<root xmlns="http://www.papouch.com/xml/papago/act">
    <sns id="1" name="Sensor A" type="1" status="0" unit="0" val="19.2" w-min="-40.0" w-max="123.8"
                                type2="2" status2="0" unit2="0" val2="24.8" w-min2="0.0" w-max2="40.0"
                                type3="3" status3="0" unit3="0" val3="-1.3" w-min3="-40.0" w-max3="123.8"/>
    <sns id="2" name="Sensor B" type="1" status="0" unit="0" val="19.2" w-min="-40.0" w-max="123.8"
                                type2="2" status2="0" unit2="0" val2="33.3" w-min2="0.0" w-max2="40.0"
                                type3="3" status3="2" unit3="0" val3="2.7" w-min3="-40.0" w-max3="0"/>
    <status level="2" signal="4" location="My Sensors" time="04/03/2015 10:06:02"/>
</root>
```

fig. 13 – example of XML with actual values

The XML file contains a *sns* tag for each measured parameter as well as the *status* tag:

s t a t u s

location

User-defined name of the device.

time

Current timestamp – see example.

s n s

For sensors that measure more than one value, this tag also contains the attributes of type, status, unit and val with indices 2, 3, etc., which contain other values (type2, status2, type3, …).

id

The serial number of the measured variable. (The first number is 1.)

name

The name of the sensor.

type, type2, type3

Number 1 (parameters of temperature), 2 (parameters of humidity) or 3 (dew point).

status, status2, status3

It describes the status of the measured value. Can show the following values:

0 ..... the value is valid and shows the currently measured value
2 ..... the measured value exceeds the user-set upper limit
3 ..... the measured value exceeds the user-set lower limit
4 ..... measurement error or sensor error (damaged sensor or cable)

unit, unit2, unit3

The number represents the code the chosen temperature unit. It can have the following values:

0 ..... degrees Celsius
1 ..... degrees Fahrenheit
2 ..... degrees Kelvin

val, val2, val3

The currently measured value as a decimal number, with an accuracy of one- or two-tenths depending on the extent and type of the sensor. (For validity of the value see *status*.)

w-min, w-min2, w-min3, w-max, w-max2, w-max3

The lower (*w-min*) and upper (*w-max*) limit of the value set by the user. The value is shown as a decimal number with an accuracy of one-tenth.

SNMP

The SNMP protocol (version 1) contains objects with individual values. For a detailed description of the objects see bellow. The MIB table you can import into your SNMP manager can be downloaded from papouch.com.

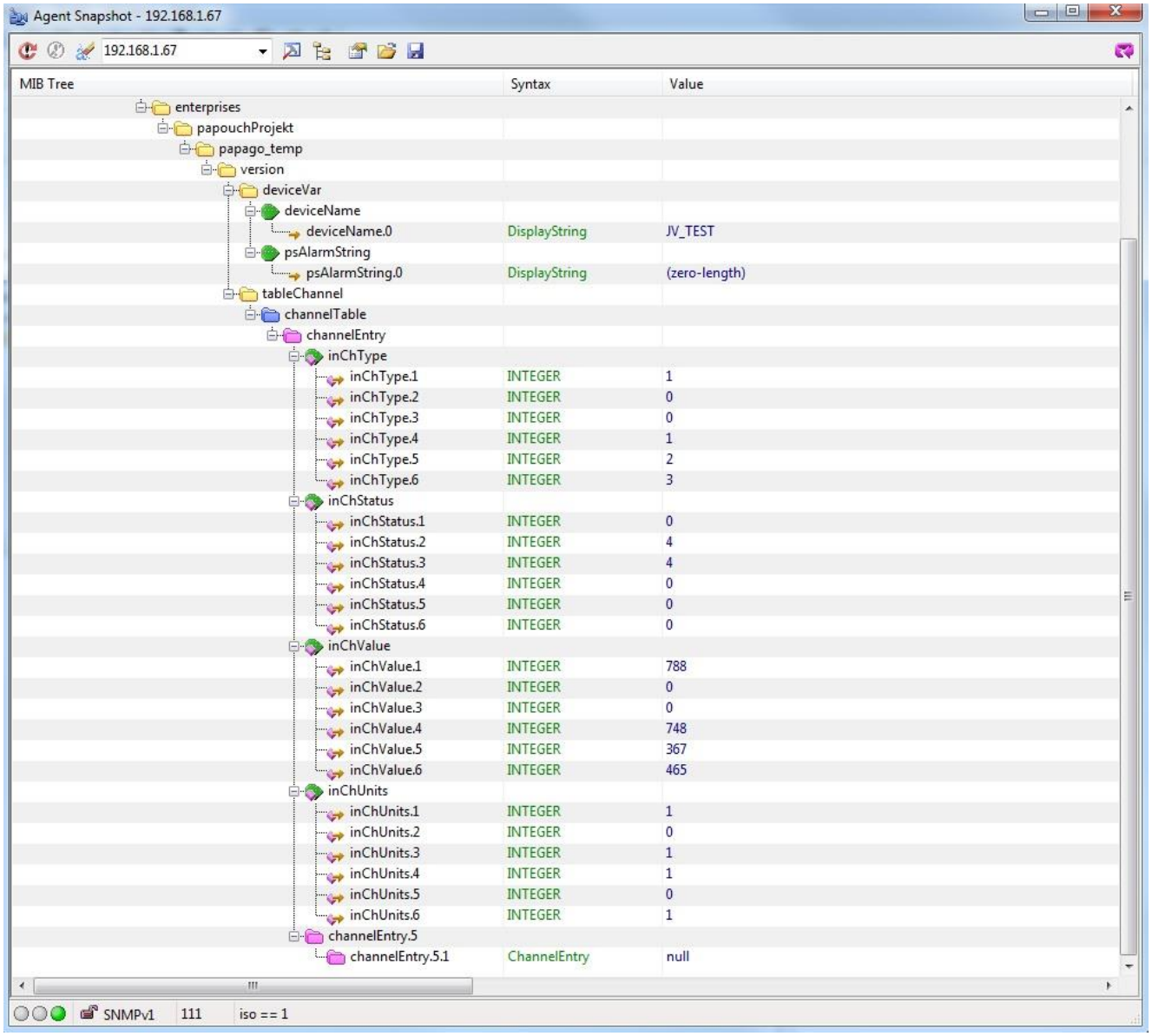


fig. 14 - example from Papago 2TH ETH

If you need to get all the OID objects with the tool SNMPWALK (Linux), then it is necessary to specify the start OID position, for example:

snmpwalk -v1 -c public 192.168.1.254 1.3.6.1.4.1.18248

In case of reading only with the IP address, you will get only basic system OID objects from the ethernet module.

Objects – variables

Type

Name: inChType

Object ID: 1.3.6.1.4.1.18248.31.1.2.1.1.1.1 až 6 [9]

Description: The type of this value. It can have one of the following values:

0 → Not used.
1 → Temperature.
2 → Humidity.
3 → Dew point.

Status

Name: inChStatus

Object ID: 1.3.6.1.4.1.18248.31.1.2.1.1.2.1 to 6 [9]

Description: The status of this value. It describes the current status of the measured value. It can have one of the following values:

0 → The value is valid and within the limits.
1 → The value has not yet been measured.
2 → The value is valid and exceeds the upper limit.
3 → The value is valid and exceeds the lower limit.
4 → The value is invalid – measurement error.

Measured value

Name: inChValue

Object ID: 1.3.6.1.4.1.18248.31.1.2.1.1.3.1 to 6 [9]

Description: The measured value as an integer. To obtain the real value, divide by ten.

Unit

Name: inChUnits

Object ID: 1.3.6.1.4.1.18248.31.1.2.1.1.4.1 to 6 [9]

Description: Unit of the value. May contain one of the following values:

0 → degrees Celsius.
1 → degrees Fahrenheit.
2 → degrees Kelvin.
3 → percentage (humidity)

SNMP objects – general

The following two objects relate to the entire device.

[9] The ID of the objects shows the values from sensors A and B arranged one after another. First A, then B. The values are arranged in the order of temperature, humidity, dew point, i.e. there are 2 or 6 objects.

Device name

Name: deviceName

Object ID: 1.3.6.1.4.1.18248.31.1.1.1.0

Description: User-defined device name.

Alarm text

Name: psAlarmString

Object ID: 1.3.6.1.4.1.18248.31.1.1.2.0

Description: Text of the alarm message sent when a threshold is exceeded.

Traps

Trap 1 – Value is outside the limits

The trap contains the measured value and the limit that was exceeded.

The trap is only sent when one of the limits has been exceeded. The trap can only be delivered to a properly configured IP address of a PC with the SNMP manager.

Trap 2 – Current measured values

The trap contains all current values as well as the name of the device set by the user.

The trap is sent only if a non-zero frequency of sending has been set.

MODBUS TCP

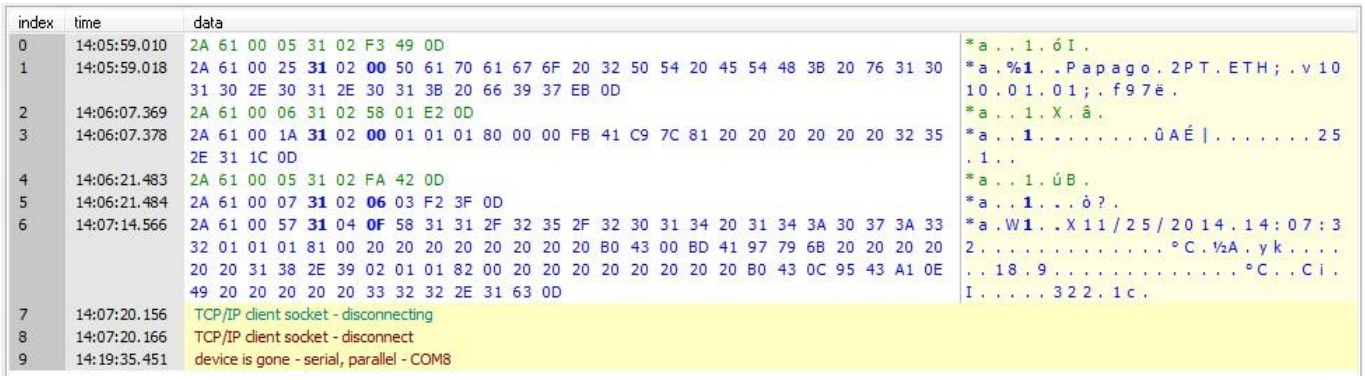
Input Register

Input Register contains the currently measured data from both sensors in several formats.

Address	*Access*	*Function*	*Name*
Sensor 1 – head			
0	read	0x04	**Status** Contains the status of the sensor. Possible values: 0 = this sensor is not used (set to Not Connected in the configuration) 1 = this sensor is used for measuring
1, 2	read	0x04	**Date and time** Date and time of the device in the format of NTP.
Sensor 1 – the first parameter (temperature)			
10	read	0x04	**Status of the measured values** Status of the measured values. Options: 0 = the measured value is within the measuring range 2 = exceeded upper limit of the measuring range (overflow) 3 = exceeded lower limit of the measuring range (underflow) 4 = the measured value is invalid
11	read	0x04	**Value in the form of signed integer**
12	read	0x04	**Value in the float format** The upper two bytes.
13	read	0x04	**Value in the float format** The lower two bytes.
14	read	0x04	**Unit** The unit in which information is stored in the previous registries. 0 = °C, or % for humidity 1 = °F 2 = K
Sensor 1 – the second parameter (humidity)			
20 to 24			
Sensor 1 – the third parameter (dew point)			
30 to 34			
Sensor 2			
from 100			

SPINEL

The device contains the standard Spinel protocol (format 97) for communication via the TCP data channel. Application development with this protocol is easy due to Spinel Terminal, Spinel.NET SDK on Github and Spinel online parser.



index	time	data	
0	14:05:59.010	2A 61 00 05 31 02 F3 49 0D	*a..1.óI.
1	14:05:59.018	2A 61 00 25 **31** 02 **00** 50 61 70 61 67 6F 20 32 50 54 20 45 54 48 3B 20 76 31 30 31 30 2E 30 31 2E 30 31 3B 20 66 39 37 EB 0D	*a.%**1**..Papago.2PT.ETH;.v10 10.01.01;.f97ë.
2	14:06:07.369	2A 61 00 06 31 02 58 01 E2 0D	*a..1.X.â.
3	14:06:07.378	2A 61 00 1A **31** 02 **00** 01 01 01 80 00 00 FB 41 C9 7C 81 20 20 20 20 20 20 32 35 2E 31 1C 0D	*a..**1**.....ûAÉ|.....25 .1..
4	14:06:21.483	2A 61 00 05 31 02 FA 42 0D	*a..1.úB.
5	14:06:21.484	2A 61 00 07 **31** 02 **06** 03 F2 3F 0D	*a..**1**...ò?.
6	14:07:14.566	2A 61 00 57 **31** 04 **0F** 58 31 31 2F 32 35 2F 32 30 31 34 20 31 34 3A 30 37 3A 33 32 01 01 01 81 00 20 20 20 20 20 20 20 20 B0 43 00 BD 41 97 79 6B 20 20 20 20 20 20 20 20 31 38 2E 39 02 01 01 82 00 20 20 20 20 20 20 20 20 B0 43 0C 95 43 A1 0E 49 20 20 20 20 20 33 32 32 2E 31 63 0D	*a.W**1**..X11/25/2014.14:07:32.....°C.½A.yk.... ..18.9.....°C..Ci. I.....322.1c.
7	14:07:20.156	TCP/IP client socket - disconnecting	
8	14:07:20.166	TCP/IP client socket - disconnect	
9	14:19:35.451	device is gone - serial, parallel - COM8	

fig. 15 - communication with the device using the Spinel Terminal program

Summary of implemented instructions:

Temperature reading

This instruction reads the current measured values. The values are converted to the currently selected temperature unit. The measured values are returned as a sign integer, as a value in the float format and as an ASCII string.

Request:

Instruction code: 58H

Parameters: (sensor)

sensor	Sensor No.	length: 1 byte
The number of the sensor to be read. It is possible to choose 01H (sensor a) or 02H (sensor b).		

Response:

Acknowledgement code: ACK 00H

Parameters: {(sensor$_1$)(variable$_1$)(type$_1$)(status$_1$)(unit$_1$)(unita$_1$)(value$_1$)} {…}

sensor	Sensor No.	length: 1 byte
This bytes indicates the sensor number and applies to all subsequent bytes until the next *chn* byte. This means that the following bytes belong to the channel with that number. It is numbered from 01H.		

variable	Variable No.	length: 1 byte
The number of the variable from the given sensor. Numbered from 01H.		

type	Variable type	length: 1 byte
The type of the variable can have one of the following values: 00H ..... not defined 01H ..... temperature 02H ..... humidity 03H ..... dew point		

status	Status of the measured value	length: 1 byte
The status of the measured value for the channel with the number given in the previous *chn*.		
bit 0 (LSb)	0 = the **lower limit of the monitored range** was not exceeded	
	1 = the lower limit of the monitored range was exceeded	
bit 1	0 = the **upper limit of the monitored range** was not exceeded	
	1 = the upper limit of the monitored range was exceeded	
bit 2	0 = the **lower limit of the measuring range** was not exceeded	
	1 = the lower limit of the measuring range was exceeded	
bit 3	0 = the **upper limit of the measuring range** was not exceeded	
	1 = the upper limit of the measuring range was exceeded	
bit 7 (MSb)	0 = the measured value is invalid	
	1 = the measured value is valid	

unit	Unit	length: 1 byte
Unit code: 0 for °C, 1 for °F or 2 Kelvin.		

unita	Unit in ASCII string	length: 10 bytes
Unit Code as a right-aligned ASCII string. For example °C, °F, etc.		

value	Measured value	length: 16 bytes
The measured value from the channel with the number given in the *chn* byte. The values are sent simultaneously in three different formats. The first is a 16bit sign value (integer in the form of MSB:LSB), followed by two values converted for the current range based on the current setup: in the 32 bit float format according to IEEE 754[10] and in the ASCII format. The values are given in the aforementioned order. *Example:* The value of 9215.85 is expressed as follows: `0AH,58H,46H,0FH,FFH,66H,20H,20H,20H,39H,32H,31H,35H,2EH,38H,35H` INT part: `0AH,58H` (2648) IEEE 754 part: `46H,0FH,FFH,66H` ASCII part: `20H,20H,20H,39H,32H,31H,35H,2EH,38H,35H` (9215.85)		

Examples:

Request – read channel 1:
`2AH,61H,00H,06H,31H,02H,58H,01H,E2H,0DH`
Response:
`2AH,61H,00H,1AH,31H,02H,00H,01H,01H,01H,80H,00H,00H,EEH,41H,BEH,D6H,C3H,20H,20H,20H,20H,20H,32H,33H,2EH,38H,93H,0DH`
The value measured on channel 1 was 21,74. Channel number: `01H` Variable number: `01H` Variable type: `01H` Value status: `80H` Unit: `00H`

[10] The description of the IEEE 754 standard is available here: http://en.wikipedia.org/wiki/IEEE_754

INT part: 00H,EEH (5434)
IEEE 754 part: 41H,BEH,D6H,C3H
ASCII part: 20H,20H,20H,20H,20H,00H,32H,33H,2EH,38H (21.74)

Reading of name and version

Reads the name of the device, software version and the list of possible communication formats. Set by the manufacturer.

Request:

Instruction code: F3H

Response:

Acknowledgement code: ACK 00H

Parameters: (string)

string	Name and version	length: 1 byte
Papago 2PT ETH; v1010.01.01; f97 In addition to the information described above, the string can also contain other information in sections introduced by a semicolon, space and a small letter to determine which information follows.		

Examples:

Request:
2AH,61H,00H,05H,31H,02H,F3H,49H,0DH
Response:
2AH,61H,00H,25H,31H,02H,00H,50H,61H,70H,61H,67H,6FH,20H,32H,50H,54H,20H,45H,54H,48H,3BH,20H,76H,31H,30H,31H,30H,2EH,30H,31H,2EH,30H,31H,3BH,20H,66H,39H,37H,EBH,0DH,

Reading of manufacturing data

This instruction reads the manufacturing data of the device.

Request:

Instruction code: FAH

Response:

Acknowledgement code: ACK 00H

Parameters: (product_number)(serial_number)(other)

product_number	length: 2 bytes
Product number. For a device number 0227.00.03/0001 this number is 227.	

serial_number	length: 2 bytes
Serial number. For a device number 0227.00.03/0001 this number is 1.	

other	length: 4 bytes
Other manufacturing information.	

Examples:

Request:
2AH,61H,00H,05H,FEH,02H,FAH,75H,0DH

Automatic message

This response is generated when the preset limits are exceeded or when the measured value exceeds the physical range of the sensor. The message may contain information about one or more channels.

Acknowledgement code: ACK 0FH

Parameters: [event][time] {[sensor][variable][type][status][unit][unitA][value]} {…}

event length: 1 byte Number of the event source
This byte specifies the event source. It can be used to distinguish the automatic message sent when the limits or measuring range are exceeded from other automated messages from the device. The value of this byte is 30H.

time length: 19 bytes time of the event
Event timestamp – see example.

sensor length: 1 byte sensor number
The serial number of the sensor the following bytes belong to. Numbering starts from 01H.

variable length: 1 byte variable number
The serial number of a variable from one sensor, used to distinguishing between different variables obtained from one sensor, if the sensor provides more than one. Numbering starts from 01H.

type length: 1 byte variable type
The type of the variable can have one of the following values: 00H .....not defined 01H .....temperature 02H .....humidity 03H .....dew point

status length: 1 byte Status of the measured value	
bits 0 to 3 (lower nibble)	0000 = the measured value is within the measuring range
	0001 = the lower limit of the monitored range was exceeded
	0010 = the upper limit of the monitored range was exceeded
	0100 = the lower limit of the physical range of the A/D converter was exceeded
	1000 = the upper limit of the physical range of the A/D converter was exceeded
bit 7 (MSb)	0 = the measured value is invalid

1 = the measured value is valid

unit length: 1 byte unit ID
The numerical designation of the unit: 00H ..... °C 01H ..... °F 02H ..... K

unitA length: 10 bytes unit as a string
A right-aligned string designating the selected unit. For example "°C"

value length: 16 bytes measured value
The values are sent simultaneously in three different formats. The first is a 16bit sign value (integer in the form of MSB:LSB), followed by two values converted for the current range based on the current setup: in the 32 bit float format according to IEEE 754[11] and in the ASCII format. The values are given in the aforementioned order. *Example:* The value of 9215.85 is expressed as follows: 0AH,58H,46H,0FH,FFH,66H,20H,20H,20H,39H,32H,31H,35H,2EH,38H,35H INT part: 0AH,58H (2648) IEEE 754 part: 46H,0FH,FFH,66H ASCII part: 20H,20H,20H,39H,32H,31H,35H,2EH,38H,35H (9215.85)

Example:

Automatic response:
2AH,61H,00H,57H,31H,04H,0FH,58H,31H,31H,2FH,32H,35H,2FH,32H,30H,31H,34H,20H,31H,34H,3AH,30H,37H,3AH,33H,32H,01H,01H,01H,81H,00H,20H,20H,20H,20H,20H,20H,20H,20H,B0H,43H,00H,BDH,41H,97H,79H,6BH,20H,20H,20H,20H,20H,20H,31H,38H,2EH,39H,02H,01H,01H,82H,00H,20H,20H,20H,20H,20H,20H,20H,20H,B0H,43H,0CH,95H,43H,A1H,0EH,49H,20H,20H,20H,20H,20H,33H,32H,32H,2EH,31H,63H,0DH
Automatic information about exceeding the lower limit on channel 1 and the upper limit on channel 2. The meaning of the values sent for channel 1: Instruction No,: 58H ASCII time: 31H,31H,2FH,32H,35H,2FH,32H,30H,31H,34H,20H,31H,34H,3AH,30H,37H,3AH,33H,32H Channel No.: 01H Variable No.: 01H Variable type: 01H Value status: 81H Units numerically: 00H Units in ASCII: 20H,20H,20H,20H,20H,20H,20H,20H,B0H,43H Current value: In the form of INT: 00H,BDH In the form of float: 41H,97H,79H,6BH In the form of ASCII: 20H,20H,20H,20H,20H,20H,31H,3BH,2EH,39H

[11] The description of the IEEE 754 standard is available here: http://en.wikipedia.org/wiki/IEEE_754

INDICATIONS

Two LEDs integrated in the Ethernet connector:

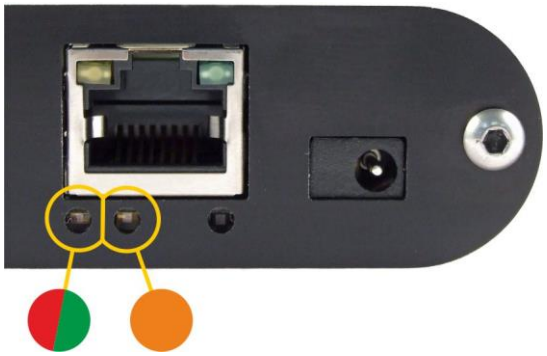
Yellow – LINK: is lit when the device is connected by cable to a switch or PC.

Green – ACT: indicates communication over the Ethernet.

Two LEDs to the left under the Ethernet connector:

Yellow (right): is lit when the connection is established via Spinel or Modbus.

Red-green (left):



- the green light is lit and the red light flashes when the device is working properly and is connected to at least one sensor
- the green and red LEDs are lit when the device works, but is not connected to any sensor
- the red LED is lit to indicate an error

Papago with WiFi connection:

Yellow-blue (right):

- Yellow lights up if Spinel or ModBus connection is established.
- Blue lights up when the Papago is connected to a WiFi network.

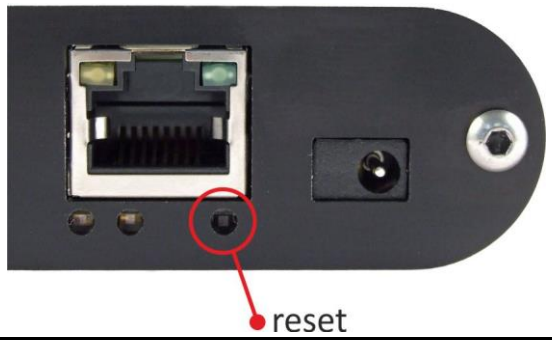
Red-Green (left):

- Green lights up and red flashes if the device is OK and at least one sensor is connected.
- Greend and Red light up when the device is OK but no sensor is connected.
- Red lights up in case of device fault

RESET

Follow the instructions below to restore the default configuration set by the manufacturer. Unlike when the reset is performed via the web interface or using the Telnet protocol (see page 20), the IP address is also reset to the default value of 192.168.1.254.

1) Disconnect the device from the power supply.
2) Press the button located in a small hole on the right side under the Ethernet connector.
3) Turn on the power and wait for about 10 seconds until the yellow light below the Ethernet connector flashes 4 times.
4) Release the button.



TECHNICAL PARAMETERS

Integrated temperature and humidity sensor TH3[12]

Important Notice: Polymer sensor is a highly sensitive element that reacts with chemicals. Do not expose even the outer shell of the sensor to chemicals or their vapours (cleaning with alcohol, petrol etc.). Especially organic solvents and compounds can negatively affect the sensor accuracy by as tens of percent RH.

Coverage ..... IP 54

Dimensions ..... 40 × 16 × 10 mm

Material ..... hardened aluminum

Humidity sensor

Humidity range ..... 0 % to 100 % RH

Recommended measurement range ..... 20 – 80 %

Resolution ..... 1% RH

Humidity measurement accuracy ..... see Fig. 16

Sensor element ..... polymer sensor

Sensor mechanical finish ..... inside hardened aluminum block

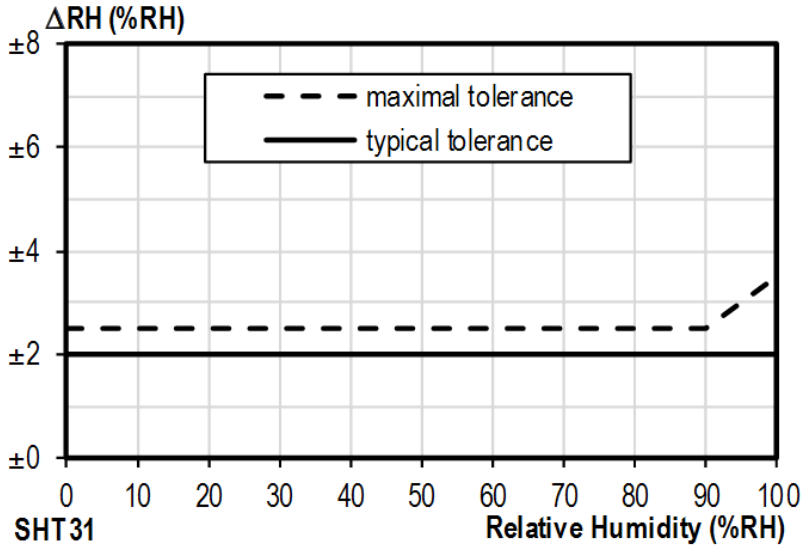


Fig. 16 – Accuracy of humidity measuring

[12] Sensor marked TH3 is supported in firmware including and above version 1.12. If you have an older firmware, you will have to flash the firmware to be able to read from TH3 sensor. Here are the key differences between the old version (Marked as TH2E) and TH3 version:

	TH3 (new sensor)	TH2E (old sensor)
Measurement accuracy within 0 – 10 %	±2 %	±2 to ±4 %
Measurement accuracy within 90 – 100 %	±2 %	±2 to ±4 %
Recommended measurement range	20 – 80 % RH	
Temperature measurement range	-40.0 °C to +125.0 °C	-40.0 °C to +123.8 °C
Temperature measurement accuracy	±0.3 to ±0.5 °C	±0.4 to ±2.0 °C

Operating and Maximum Range of Values

- Sensor is stable in standard range of humidity values. Long-term exposure to conditions outside these values (humidity above 80% in particular) can temporarily shift the measured-out values (by +3% for 60 hours). When the sensor is back to standard ranges, it returns to its pre-calibrated state slowly.[13]
- Long-term exposure to extreme conditions or to chemically aggressive vapor can speed up the aging process of the sensor significantly. It can also shift the measurements.

Temperature sensor

Range .....-40.0 °C to +125 °C

Resolution.....0.1 °C

Sensor element .....semiconductor

Sensor mechanical finish.....inside hardened aluminum block

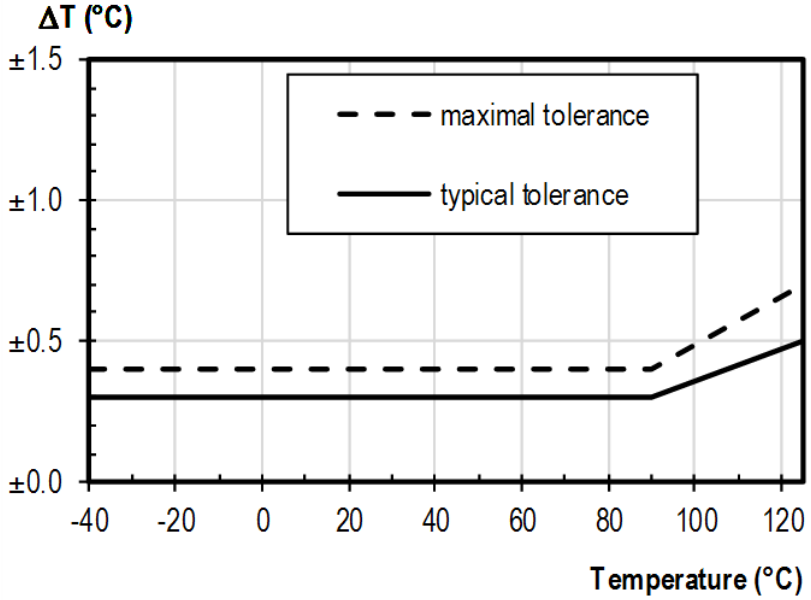


Fig. 17 – Accuracy of temperature measurement

Standalone temperature sensor

Sensor type .....semiconductor

Measuring temperature range .....-55 °C to +125 °C

Accuracy.....±0.5 °C in the range of -10 °C to +85 °C

Temperature drift .....±0.2 °C per 1000 hours at 125 °C

Dimensions.....normalized diameter 6 mm, length 60 mm

Housing material.....hardened alloy

Degree of protection .....IP68 (permanent immersion into 1m max.)

[13] You can speed up this process by doing following:
1) Leave the sensor in environment above 100 to 105 °C and humidity below 5 % for at least 10 hours.
2) Leave the sensor in environment above 20 to 30 °C and humidity approximately 75 % for around 12 hours. (Humidity 75% can be achieved with saturated solution of NaCl.)

Sensor cable

Cable jacket	silicone rubber, blue
Wire insulation	FEP polymer
Length	standard 3 m (optionally up to 20 meters)
Measuring temperature range	-60 °C to +200 °C
Maximum allowable temperature	+220 °C
Cable diameter	4.3 mm (±0.1 mm)

The cable shows excellent resistance to moisture, chemicals and carbohydrates.

Other parameters

Ethernet interface

Connection	TBase 10/100 Ethernet
Connector	RJ45
GET encryption	128 bit AES; Rijndael; CFB method
Protokol SNMP	v. 1
Protokol MQTT	v. 3.1.1

WiFi interface

Type	IEEE 802.11 b/g and IEEE 802.11n (single stream), IEEE 802.11 d/h/i/j/k/w/r
Operating frequency	2,4 GHz
Antenna connector	SMA RP

Clock circuit and internal memory

Clock backup method (RTC)	capacitor (not replaceable by the user)
RTC backup time after power outage	5 days (if the device was previously connected to a power source for at least three hours without interruption)

Device electronics

PoE power supply	according to IEEE 802.3af
Power supply from an external source	11 to 58 V DC (with reverse polarity protection)
Current consumption from ext. source at 15 V	typically 120 mA
Current consumption from ext. source at 24 V	typically 72 mA
Current consumption from PoE	typically 32 mA
Consumption	typically 1.8 W
Power supply connector	coaxial 3.8 × 1.3 mm; + inside
Operating temperature range	-20 to +70 °C
Dimensions (without connectors)	88 × 70 × 25 mm
Housing material	anodized aluminium

Degree of protection .....IP 30

Weight .....typically 130 g

Mountable on 35 mm DIN rail .....optional accessory

Default settings of the Ethernet

IP address 192.168.1.254

Netmask .....255.255.255.0 (8 bits; mask C)

IP address of the gateway 0.0.0.0

Available designs

Mountable on 35 mm DIN rail .....optional accessory

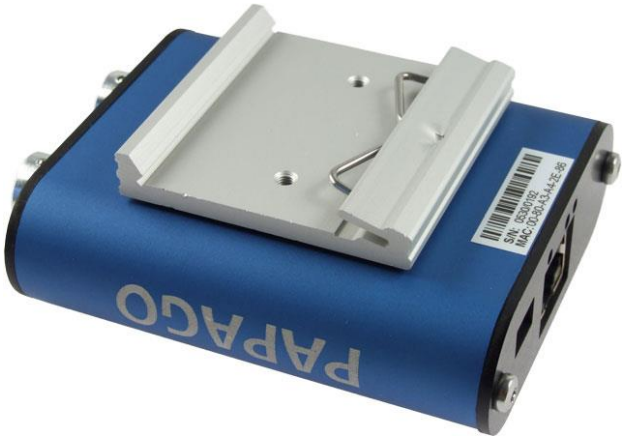


fig. 18 – Papago 2TH ETH with DIN rail holder

Do not hesitate to contact us if you have any other requirements concerning the design and functions of PAPAGO 2TH.

Papouch s.r.o.

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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