COMET SYSTEM

Web Sensor T5540

Web Sensor T5541

Web Sensor T5545

Web Sensor T6540

Web Sensor T6541

Web Sensor T6545

USER GUIDE

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Revision history

This manual describes devices with latest firmware version according the table below. Older version of manual can be obtained from a technical support.

Document version	Date of issue	Firmware version	Note
IE-SNC-T5(6)5xx-03	2012-08-31	1-5-3-x	Latest revision of manual for an old generation of firmware for Tx5xx devices.
IE-SNC-T5(6)5xx-04	2013-04-29	1-5-5-x 1-5-6-0	Initial revision of manual for new generation of Tx5xx firmware.
IE-SNC-T5(6)5xx-06	2016-03-03	1-5-7-0 1-5-7-1	
IE-SNC-T5(6)5xx-07	2016-07-18	1-5-7-2 1-5-7-3	
IE-SNC-T5(6)5xx-08	2017-09-29	1-5-7-4	

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Chapter

1

Introduction

This chapter provides basic information about device. Before starting please read this manual carefully.

The Web Sensor devices are designed for measurement of temperature, relative humidity and carbon dioxide concentration of air without aggressive substances. Measured quantities are according device type. Devices with relative humidity measurement can show one of computed quantities: dew point temperature, absolute humidity, specific humidity, mixing ratio and specific enthalpy. Temperature units are °C or °F. Communication interface of Web Sensors is Ethernet. Device types:

Type	Temperature	Relative humidity	CO$_2$ concentration	Computed quantity
T5540			✓	
T5541			✓	
T5545			✓	
T6540	✓	✓	✓	✓
T6541	✓	✓	✓	✓
T6545	✓	✓	✓	✓

Models marked TxxxxZ are custom-specified devices. Description of these devices is not included in this manual.

A multiple point CO$_2$ and temperature adjustment procedure leads to excellent CO$_2$ measurement accuracy over the entire temperature working range; this is a must for process control and outdoor applications. The dual wavelength NDIR CO$_2$ sensing procedure compensates automatically for ageing effects. The CO$_2$ module is highly resistant to pollution and offers maintenance free operation and outstanding long term stability.

Measured values can be read in „SLOW mode" (filtered, averaged) or in „FAST mode" (current values without averaging). „SLOW mode" has advantages in applications like climate control because of filtering short time peaks. As an example exhaled air from an employee passing the sensor could affect the climate control negatively with a short response time because the control would trigger a change of the ventilation based on this one-time measurement. On the contrary in „FAST mode" no software filter is used for calculating the output value. This fact adds a noise of typ. ±30ppm which has to be considered in terms of accuracy. Of principle measurement is the measured value of CO$_2$ concentration depends on the value of air pressure - altitude at the installation site. For this reason, it is suitable for accurate measurement to set the altitude of the installation site.

After power up of the device starts internal test. During this time (about 20s) LCD display shows (----) instead of CO$_2$ concentration value. Web pages show n/a.

General safety rules

The following summary is used to reduce the risk of injury or damage the device.
To prevent injury, please follow instructions.

⚠ The device can be services only by a qualified person. The device contains no serviceable parts inside.

Don't use the device, if it doesn't work correctly. If you think, that the device is not working correctly, let check it by qualified service person.

It's forbidden to use the device without the cover. Inside the device can be a dangerous voltage and may be risk of electric shock.

Use only the appropriate power supply adapter according to manufacturer specifications and approved according to relevant standards. Make sure, that the adapter does not have damaged cables or covers.

Connect the device only to network parts approved according to relevant standards.

Connect and disconnect the device properly. Don't connect or disconnect Ethernet cable, if the device is powered.

The device may be installed only in prescribed areas. Never expose the device to higher or lower temperatures than is allowed. The device has not improved resistance to moisture. Protect it from dripping or splashing water and do not use at areas with condensation.

Devices are not designed for locations with chemically aggressive environment. Temperature and humidity sensors must not be exposed to direct contact with water or other liquids. It is not allowed to remove the sensor cover to avoid any mechanical damage of the sensors.

Don't use device in potentially explosive environments.

Don't stress the device mechanically.

Device description and important notices

This chapter contains information about basic features. Also there are important
notices concerning to functional safety.

Measured values can be displayed on LCD display or can be read using an Ethernet connection. The visual indication of CO_2 concentration is provided by three-color LED. The following formats are supported:

- Web pages
- Current values in XML and JSON format
- Modbus TCP protocol
- SNMPv1 protocol
- SOAP protocol

The device can also be used to check measured values and if the limit is exceeded, device sends warning messages. Possible ways to sending warning messages:

- Sending e-mails up to 3 e-mail addresses

- Sending SNMP traps up to 3 configurable IP addresses

- Displaying the alarm status on web page

- Sending messages to Syslog server

The device setup can be made by the TSensor software or web interface. TSensor software can be free downloaded from the manufacturer's website. Latest firmware can be obtained from the technical support. Do not upload to your device firmware which is not designed for it. Unsupported firmware can damage your device.

Device does not support powering over Ethernet cable (PoE). PoE splitter must be used. Compatible PoE splitter can be purchased as optional accessories. Splitter must have 12V output with approximately 1W.

Reliability of warning messages delivering (e-mail, trap, syslog), depends on actual availability of necessary network services. The device should not be used for critical applications, where malfunction could cause to injury or loss of human life. For highly reliable systems, redundancy is essential. For more information please see standard IEC 61508 and IEC 61511.

Never connect the device directly to the Internet. If it is necessary connect the device to the Internet, properly configured firewall must be used. Firewall can be partially replaced by the NAT.

Chapter

2

Getting started

Here you can find information necessary to put newly purchased equipment to operation. This procedure is only informative.

What is needed for operation

To install the unit you need to the following equipment. Before installation check if it's available.

- Web Sensor Tx5xx device

- power supply adapter 9 - 30V/200mA

- RJ45 LAN connection with appropriate cable

- free IP address in your network

Mounting the device

- check if the equipment from previous chapter is available

- install the latest version of TSensor software. This software is used to all device settings.

- TSensor software can be free downloaded from the manufacturer's website. Software can be also supplied on CD. Device configuration can be made using web interface. For web configuration is not TSesnor software necessary.

- contact your network administrator to obtain following information for the connection to the network:

IP address:	_____._____._____._____
Default gateway:	_____._____._____._____
DNS serer IP:	_____._____._____._____
Subnet mask:	_____._____._____._____

- check if there is no IP address conflict when you connect the device into network for the first time. The device has from factory set the IP address to

192.168.1.213. This address must be changed according to information from the previous step. When you installing several new devices, connect them to the network one after another.

- connect the Ethernet connector

- connect the power adapter 9 - 30V (e.g. 12V/200mA)

- LEDs on LAN connector should blink after connecting the power and LCD start showing measured values.
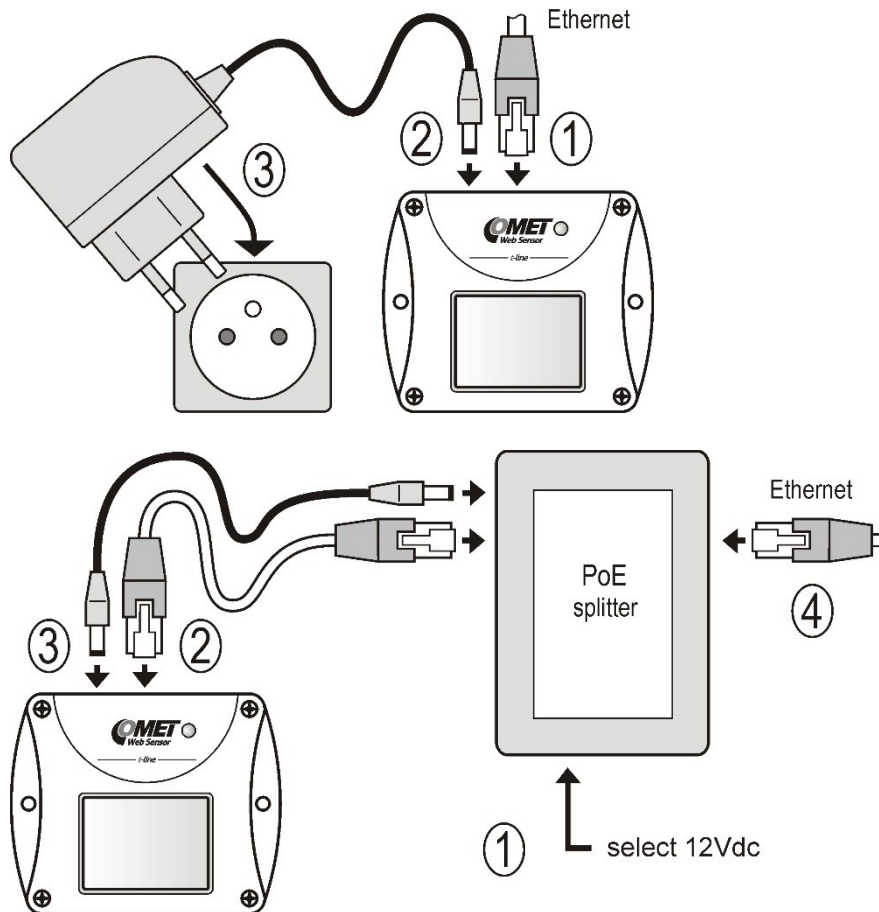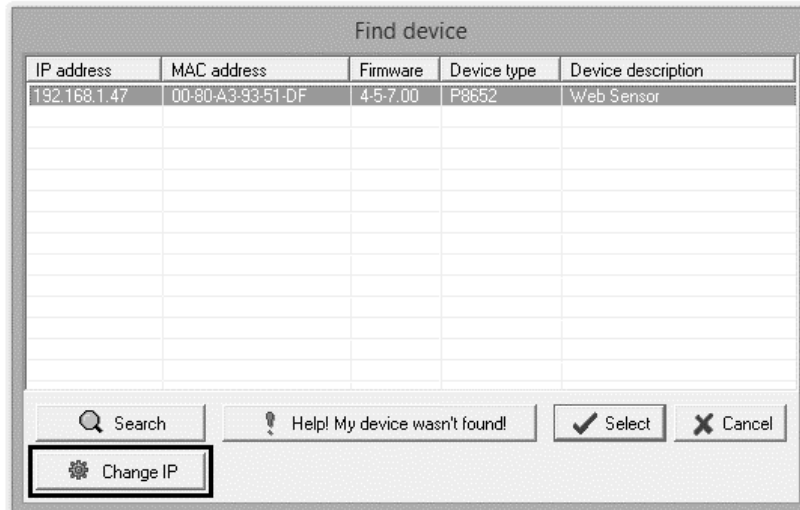

Device settings

- run configuration software TSensor on your PC

- switch to an **Ethernet** communication interface

- press button **Find device...**
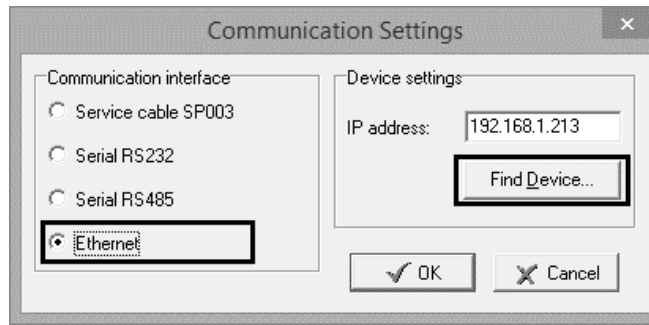
- the window shows all available devices on your network

- click to **Change IP** to set new address according to network administrator instructions. If your device is not listed, then click **Help! My device wasn't found!** Then follow the instructions. MAC address is on product label. The device is factory set to IP **192.168.1.213**.
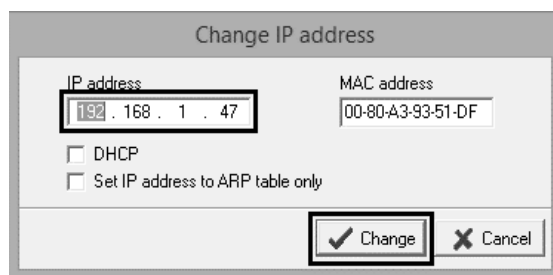
- gateway may not be entered if you want to use the device only in local network. If you set the same IP address which is already used, the device will not work properly and there will be collisions on the network. If the device detects a collision of IP address then reboot is performed automatically.

- after changing IP address device is restarted and new IP address is assigned. Restart of the device takes about 10 seconds.

- connect to device using TSensor software and check the measured values. Set the other parameters (alarm limits, SMTP server, etc.). Settings are saved after click on button **Save changes**.

Checking functions

The last step is to check measured values on the device website. In the address bar of the web browser, enter the device IP address. If the default IP address was not changed, then insert **http://192.168.1.213**.

Displayed web page lists actual measured values. If the web pages are disabled, you can see text **Access denied**. In the case of measurement error a text **Error** is shown instead value.

Chapter

3

Device setup

This chapter describes basic device configuration. There is a description of settings using web interface.

Setup using web interface

Device can be setup using web interface or TSensor software. Web interface can be managed by the web browser. Main page will be shown when you insert device address into address bar of your web browser. There you find actual measured values. Page with history graphs is shown when you click to tile with actual values. Access to device setup is possible via tile **Settings**.

General

Device name can be changed using item **Device name**. Measured values are stored into memory according **History storage interval** field. After changing of this interval all history values will be cleared. Changes must be confirmed by **Apply settings** button.

Network

Network parameters can be obtain automatically from DHCP server using option **Obtain an IP address automatically**. Static IP address is configurable via field **IP address**. It is not necessary setup **Default gateway** while you use device inside one subnet only. **DNS server IP** is required to set for proper function of DNS. Option **Standard subnet mask** sets network mask automatically according A, B or C network class. **Subnet mask** field must be set manually, when network with non-standard range is used. **Periodic restart interval** enables to restart device after selected time since device start.

Back Exit to main menu	**Settings**	**Network**

Basic settings of the network interface. IP address can be set as either static or obtained automatically by the DHCP server. After saving the setting, device will be rebooted automatically. Before changing IP address, please contact your network administrator.

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Obtain an IP address automatically ☐

    IP address   192.168.1.213

    Default gateway   192.168.1.1

    DNS server IP   192.168.1.1

    Standard subnet mask ☐

    Subnet mask   255.255.255.0

Periodic restart interval   Off

[Apply settings] [Cancel changes]

Alarm limits

For each measurement channel is possible to set upper and lower limits, time-delay for alarm activation and hysteresis for alarm clearing.

Example of setting the limit to the upper alarm limit:
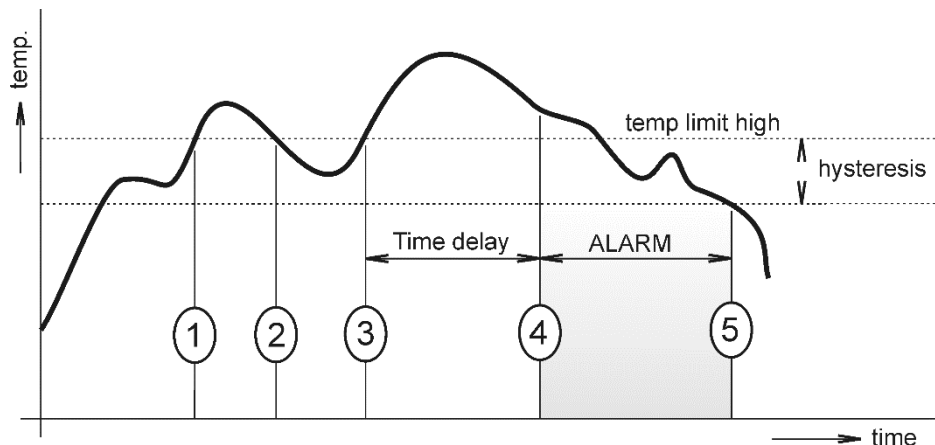
In Point 1 the temperature exceeded the limit. From this time, the time-delay is counting. Because at point 2 the temperature dropped below the limit value before the time delay expired, alarm was not set.

In Point 3 the temperature has risen over limit again. During the time-delay the value does not drop below the set limit, and therefore was in Point 4 caused alarm. At this moment were sent e-mails, traps and set alarm flag on website, SNMP and Modbus.

The alarm lasted up to Point 5, when the temperature dropped below the set hysteresis (temperature limit – hysteresis). At this moment was active alarm cleared and e-mail sent.

When alarm occurs, alarm messages will be sent. In case of power failure or device reset (e.g. changing the configuration) will new alarm state evaluated and new alarm messages will be sent.

Measuring

Page contains settings of the measuring part of the device. Settings can be saved only if jumper inside device is closed. Fields in this page are shown according device type.

It is possible set visibility of measured values on device LCD. Display can be switched off. Units of measured and computed quantities are selectable by fields **Temperature unit** and **Computed value**. Field **Pressure value for computed values** is required to set for proper calculation of computed quantities. Mode of CO_2 concentration measuring can be set by item **Average CO_2 measuring mode** – „SLOW mode". Because principle of CO_2 concentration measurement depends on atmospheric pressure (altitude), it is recommended for accurate CO_2 measurement set **Altitude for CO_2 compensation**.

Whole measuring range of CO_2 concentration (0 to 2000/10000ppm) can be divided into three areas. Using three-color LED the transmitter indicates, in which of these areas the measured value is. LED configuration is possible via fields **Yellow LED limit** and **Red LED limit**.
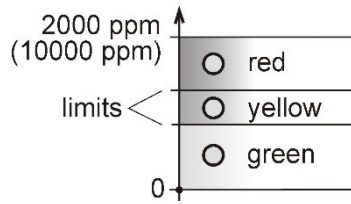
SOAP protocol

SOAP protocol can be enabled by option **SOAP protocol enabled**. Destination SOAP server can be set via **SOAP server address**. For setup of server port can be used option **SOAP server port**. Device sends SOAP message according selected **Sending interval**. Option **Send SOAP message when alarm occurs** sends message when an alarm on channel occurs or alarm is cleared. These SOAP messages are sent asynchronously to selected interval.

Email

Email sending enabled option allows email features. It is necessary set address of the SMTP server into **SMTP server address** field. Domain name for SMTP server can be used. Default port of the SMTP server can be changed using item **SMTP server port**. SMTP authentication can be enabled using **SMTP authentication** option. When authentication is enabled **Username** and **Password** must be set.

For successfully email sending it is necessary insert **Email sender address**. This address is usually same as username of the SMTP authentication. Into fields **Recipient 1** to **Recipient 3** it is possible set address of email recipients. Option **Short email** enable sending emails in short format. This format is usable when you need to forward emails into SMS messages.

When option **Alarm email repeat sending interval** is enabled and there is active alarm on channel, then emails with actual values are sent repeatedly. **Info email sending interval** option enables sending emails at selected time interval. CSV history file can be sent together with the repeat/info emails. This feature can be enabled by **Alarm and Info emails attachment** option.

It is possible to test email function using button **Apply and test**. This button save a new settings and send a testing email immediately.

Modbus a Syslog protocols

ModbusTCP and Syslog protocol settings are configurable via menu **Protocols**. Modbus server is enabled by default. Deactivation is possible via **Modbus server enabled** option. Modbus port can be changed via **Modbus port** field. Syslog protocol can be enabled using item **Syslog enabled**. Syslog messages are sent to IP address of the Syslog server - field **Syslog server IP address**.

Back Exit to main menu	**Settings**	**Protocols**
General General device settings		**ModbusTCP protocol** Configuration of the ModbusTCP protocol. Current measured values can be read using ModbusTCP protocol. Modbus registers are described inside the user manual.
Network Basic settings of the network interface		Modbus server enabled ☑
Alarm limits Configuration of the alarm limits		Modbus port `502`
Measuring Units, display settings, etc.		**Syslog protocol** Configuration of the Syslog protocol. Alarm messages can be sent to the Syslog server using UDP protocol.
SOAP protocol Setup SOAP protocol for database system		Syslog enabled ☑
Email Alarm emails configuration		Syslog server IP address `192.168.1.20`
Protocols Syslog and ModbusTCP protocol settings		[Apply settings] [Cancel changes]
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Time Synchronization with NTP server		
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SNMP

For reading values via SNMP it is necessary to know password - **SNMP read community**. SNMP Trap can be delivered up to three IP address - **IP address of the Trap recipient**. SNMP Traps are sent at alarm or error state on the channel. Trap feature can be enabled by option **Trap enabled**.

Time

Time synchronization with SNTP server can be enabled by **Time synchronization enabled** option. IP address of the SNTP is necessary to set into **SNTP server IP address** item. List of free NTP servers is available at www.pool.ntp.org/en. SNTP time is synchronized at UTC format, and due to be necessary set corresponding time offset - **GSM offset [min]**. Time is synchronized every 24 hours by default. Option **NTP synchronization every hour** decrease this synchronization interval to one hour.

Back Exit to main menu **Settings**	**Time**

Time can be synchronized according the SNTP server. To correct time is necessary set GMT offset of your time zone. Time synchronisation is required for timestamps inside CSV files.

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Time synchronised with server   no

Time synchronization enabled   ☑

    SNTP server IP address   `192.168.1.2`

    GMT offset [min]   `120`

    NTP synchronization every hour   ☐

Apply settings   Cancel changes

WWW and security

Security features can be enabled by the **Security enabled** option. When security is enabled it is necessary to set administrator password. This password will be required for device settings. When secured access is required even to actual values reading it is possible to enable **User account only for viewing enabled**. Port of the www server can be changed from the default value 80 using filed **WWW port**. Web pages with actual values are refreshed according to **Web refresh interval** field.

Memory for minimal and maximal values

Minimal and maximal measured values are stored into the memory. This memory is independent from values stored in history memory (charts). Memory for minimal and maximal values is cleared in case of device restart or by the user request. In case of device time is synchronized with SNTP server, timestamps for minimal and maximal values are available.

Backup and restore configuration

Device configuration can be saved into file and restored if needed. Compatible parts of configuration can be uploaded into another device type. Configuration can be moved only within devices at same family. It is not possible restore configuration from t-line Web Sensor into h-line Web Sensor and conversely.

Setup using TSensor software

TSensor software is an alternative to web configuration. Some less important parameters are configurable only by the TSensor software. TSesnor software allows user adjustment of measured values.

Parameter **MTU size** can reduce size of the Ethernet frame. Lowering of this size can solve some communication problems mainly with Cisco network infrastructure.

Factory defaults

Factory defaults field set the device into factory configuration. Network parameters (IP address, Subnet mask, Gateway, DNS) are left without changes. Settings relating to measurement are not restored by factory defaults.

Network parameters are changed while you close jumper and push button inside device during connecting power supply. Factory parameters settings:

Parameter	Default value
SMTP server address	example.com
SMTP server port	25
Alarm email repeat sending interval	off
Info email repeat sending interval	off
Alarm and Into emails attachment	off
Short email	off
E-mail recipients addresses	cleared
E-mail sender	sensor@websensor.net
SMTP authentication	off
SMTP user/SMTP password	cleared
E-mail sending enabled	off
IP addresses SNMP traps recipients	0.0.0.0
Password for SNMP reading	public
Sending SNMP Trap	off

Parameter		Default value
Website refresh interval [sec]		10
Website enabled		yes
Website port		80
Security		off
Administrator password		cleared
User password		cleared
Modbus port		502
Modbus server enabled		yes
History storage interval [sec]		60
SOAP server port		80
SOAP server address		cleared
SOAP sending interval [sec]		60
SOAP message when alarm occurs		yes
SOAP protocol enabled		off
Syslog server IP address		0.0.0.0
Syslog protocol enabled		off
SNTP server IP address		0.0.0.0
GMT offset [min]		0
NTP synchronization every hour		off
SNTP synchronization enabled		off
MTU		1400
Periodic restart interval		off
Demo mode		off
Temperature	High limit	50
	Low limit	0
	Hysteresis	1
	Time delay [sec]	30
Relative humidity	High limit	80
	Low limit	20
	Hysteresis	1
	Time delay [sec]	30
Computed quantity	High limit	50
	Low limit	0
	Hysteresis	1
	Time delay [sec]	30
CO_2 concentration	High limit	10000
	Low limit	7000
	Hysteresis	100
	Time delay [sec]	30
Device name		Web Sensor

Chapter

4

Communication protocols

Short introduction to communication protocols of the device. To use some communication protocols is necessary software, which can use the protocol. This software is not included. For detailed description of protocols and application notes please contact your distributor.

Website

The device supports displaying of measured values, history graphs and configuration using web browser. History graphs are based on HTML5 canvas. Web browser must support this feature for proper function of graphs. Firefox, Opera, Chrome or Internet Explorer 11 can be used. If the device has IP address **192.168.1.213** type into your browser **http://192.168.1.213**. Using TSensor software or web interface can be set automatic webpages refresh interval. The default value is 10sec. Actual measured values can be obtained using XML file **values.xml** and JSON file **values.json**.

Values from history can be exported in CSV format. History storage interval can be set using TSensor software or web interface. History is erased after every reboot of the device. Reboot of the device is performed when the power supply is disconnected and also after configuration change.

SMTP – sending e-mails

When measured values are over the set limits, the device allows send e-mail to a maximum of 3 addresses. E-mail is send when alarm condition on the channel is cleared or a measuring error occurs. It is possible to set repeat interval for email sending. For correct sending of e-mails it is necessary to set address of SMTP server. Domain address can be used as SMTP server address too. For proper function of DNS is required to set DNS server IP address. SMTP authentication is supported but SSL/STARTTLS not. Standard SMTP port 25 is used by default. SMTP port can be changed. Contact your network administrator to obtain configuration parameters of your SMTP server. E-mail sent by the device cannot be answered.

SNMP

Using SNMP protocol you can read actual measured values, alarm status and alarm parameters. Via SNMP protocol is also possible to get last 1000 measured values from history table. Writing via SNMP protocol is not supported. It is supported **SNMPv1** protocol version only. SNMP used **UDP port 161**. OID keys description can be found in the MIB table, which can be obtained from device website or from your distributor. The password for reading is factory set to **public**. The changes can be made using TSensor software or web interface. OID keys:

OID	Description	Type
.1.3.6.1.4.1.22626.1.2.1		
.1.3.6.1.4.1.22626.1.2.1.1.0	Actual measured temperature	String
.1.3.6.1.4.1.22626.1.2.1.2.0	Actual measured relative humidity	String
.1.3.6.1.4.1.22626.1.2.1.3.0	Actual measured computed quantity	String
.1.3.6.1.4.1.22626.1.2.1.4.0	Actual measured CO_2 concentration	String
.1.3.6.1.4.1.22626.1.2.1.5.0	Temperature alarm state ("none", "high",	String
.1.3.6.1.4.1.22626.1.2.1.6.0	Relative humidity alarm state	String
.1.3.6.1.4.1.22626.1.2.1.7.0	Computed quantity alarm state	String
.1.3.6.1.4.1.22626.1.2.1.8.0	CO_2 concentration alarm state	String
.1.3.6.1.4.1.22626.1.2.1.9.0	Temperature unit	String
.1.3.6.1.4.1.22626.1.2.1.10.0	Relative humidity unit	String
.1.3.6.1.4.1.22626.1.2.1.11.0	Computed quantity unit	String
.1.3.6.1.4.1.22626.1.2.1.12.0	CO_2 concentration unit	String
.1.3.6.1.4.1.22626.1.2.1.13.0	Min. temperature memory	String
.1.3.6.1.4.1.22626.1.2.1.14.0	Min. relative humidity memory	String
.1.3.6.1.4.1.22626.1.2.1.15.0	Min. computed value memory	String
.1.3.6.1.4.1.22626.1.2.1.16.0	Min. CO_2 concentration memory	String
.1.3.6.1.4.1.22626.1.2.1.17.0	Max. temperature memory	String
.1.3.6.1.4.1.22626.1.2.1.18.0	Max. relative humidity memory	String
.1.3.6.1.4.1.22626.1.2.1.19.0	Max. computed value memory	String
.1.3.6.1.4.1.22626.1.2.1.20.0	Max. CO_2 concentration memory	String
.1.3.6.1.4.1.22626.1.2.2		
.1.3.6.1.4.1.22626.1.2.2.1.0	Device name	String
.1.3.6.1.4.1.22626.1.2.2.2.0	Device serial number	String
.1.3.6.1.4.1.22626.1.2.2.3.0	Device type	String
.1.3.6.1.4.1.22626.1.2.3		
.1.3.6.1.4.1.22626.1.2.3.1.0	Actual measured temperature	Int*10
.1.3.6.1.4.1.22626.1.2.3.2.0	Actual measured relative humidity	Int*10
.1.3.6.1.4.1.22626.1.2.3.3.0	Actual measured computed quantity	Int*10
.1.3.6.1.4.1.22626.1.2.3.4.0	Actual measured CO_2 concentration	Integer
.1.3.6.1.4.1.22626.1.2.3.5.0	Temperature alarm (0–none, 1–high, 2–low)	Integer
.1.3.6.1.4.1.22626.1.2.3.6.0	Relative humidity alarm state	Integer
.1.3.6.1.4.1.22626.1.2.3.7.0	Computed quantity alarm state	Integer
.1.3.6.1.4.1.22626.1.2.3.8.0	CO_2 concentration alarm state	Integer
.1.3.6.1.4.1.22626.1.2.4		
.1.3.6.1.4.1.22626.1.2.4.1.0	Temperature low limit	Int*10
.1.3.6.1.4.1.22626.1.2.4.2.0	Temperature high limit	Int*10
.1.3.6.1.4.1.22626.1.2.4.3.0	Relative humidity low limit	Int*10
.1.3.6.1.4.1.22626.1.2.4.4.0	Relative humidity high limit	Int*10
.1.3.6.1.4.1.22626.1.2.4.5.0	Computed quantity low limit	Int*10
.1.3.6.1.4.1.22626.1.2.4.6.0	Computed quantity high limit	Int*10
.1.3.6.1.4.1.22626.1.2.4.7.0	Temperature time-delay	Integer
.1.3.6.1.4.1.22626.1.2.4.8.0	Relative humidity time-delay	Integer
.1.3.6.1.4.1.22626.1.2.4.9.0	Computed quantity time-delay	Integer

OID	Description	Type
.1.3.6.1.4.1.22626.1.2.4.10.0	Temperature hysteresis	Int*10
.1.3.6.1.4.1.22626.1.2.4.11.0	Relative humidity hysteresis	Int*10
.1.3.6.1.4.1.22626.1.2.4.12.0	Computed quantity hysteresis	Int*10
.1.3.6.1.4.1.22626.1.2.4.13.0	CO_2 concentration low limit	Integer
.1.3.6.1.4.1.22626.1.2.4.14.0	CO_2 concentration high limit	Integer
.1.3.6.1.4.1.22626.1.2.4.15.0	CO_2 concentration time-delay	Integer
.1.3.6.1.4.1.22626.1.2.4.16.0	CO_2 concentration hysteresis	Integer
.1.3.6.1.4.1.22626.1.5.5.1.0	SNMP Trap	String
.1.3.6.1.4.1.22626.1.5.6.1.1.1.nr	Temperature history values	Int*10
.1.3.6.1.4.1.22626.1.5.6.1.1.2.nr	Relative humidity history values	Int*10
.1.3.6.1.4.1.22626.1.5.6.1.1.3.nr	Computed quantity history values	Int*10
.1.3.6.1.4.1.22626.1.5.6.1.1.4.nr	CO_2 concentration history values	Integer

When alarm occurred a warning messages (trap) can be sent to selected IP addresses. Addresses can be set using TSensor software or web interface. Traps are sent via **UDP** protocol on **port 162**. The device can send following traps:

Trap	Description	
0/0	Reset of the device	
6/0	Testing Trap	
6/1	NTP synchronization error	
6/2	E-mail sending error	SMTP server login error
6/3		SMTP authentication error
6/4		Some error occurred during SMTP communication
6/5		TCP connection to server cannot be opened
6/6		DNS error
6/7	SOAP message sending error	SOAP file not found inside web memory
6/8		DNS error or Host error
6/9		TCP connection to server cannot be opened
6/10		Wrong response code from the SOAP server
6/11 – 6/14	Upper alarm on channel	
6/21 – 6/24	Lower alarm on channel	
6/31 – 6/34	Clearing alarm on channel	
6/41 – 6/44	Measuring error	

Modbus TCP

Device supports Modbus protocol for communication with SCADA systems. Device use Modbus TCP protocol. **TCP port** is set to **502** by default. Port can be changed using TSensor software or web interface. Only two Modbus clients can be connected to device at one moment. Modbus device address (Unit Identifier) can be arbitrary. Modbus write command is not supported. Specification and description of the Modbus protocol is free to download on: www.modbus.org.

Supported Modbus commands (functions):

Command	Code	Description
Read Holding Register (s)	0x03	Read 16b register(s)

Modbus device registers. Address could be by 1 higher, depending on type used communication library:

Address [DEC]	Address [HEX]	Value	Type
49	0x0031	Measured temperature	Int*10
50	0x0032	Measured relative humidity	Int*10
51	0x0033	Measured computed quantity	Int*10
52	0x0034	Measured CO_2 concentration	Integer
53	0x0035	Dew point temperature	Int*10
54	0x0036	Absolute humidity	Int*10
55	0x0037	Specific humidity	Int*10
56	0x0038	Mixing ration	Int*10
57	0x0039	Specific enthalpy	Int*10
4149	0x1035	Serial number high	BCD
4150	0x1036	Serial number low	BCD
4151	0x1037	Device type	HEX
20481	0x5001	Temperature low limit	Int*10
20482	0x5002	Temperature high limit	Int*10
20483	0x5003	Relative humidity low limit	Int*10
20484	0x5004	Relative humidity high limit	Int*10
20485	0x5005	Computed quantity low limit	Int*10
20486	0x5006	Computed quantity high limit	Int*10
20487	0x5007	Temperature hysteresis	Int*10
20488	0x5008	Temperature time-delay	DEC
20489	0x5009	Relative humidity hysteresis	Int*10
20490	0x500A	Relative humidity time-delay	DEC
20491	0x500B	Computed quantity hysteresis	Int*10
20492	0x500C	Computed quantity time-delay	DEC
20493	0x500D	Temperature alarm state	String
20494	0x500E	Relative humidity alarm state	String
20495	0x500F	Computed quantity alarm state	String
20496	0x5010	CO_2 concentration low limit	Integer
20497	0x5011	CO_2 concentration high limit	Integer
20498	0x5012	CO_2 concentration hysteresis	Integer
20499	0x5013	CO_2 concentration alarm state	String
20500	0x5014	CO_2 concentration time-delay	DEC
20501	0x5015	Min. temperature memory	Int*10
20502	0x5016	Max. temperature memory	Int*10
20503	0x5017	Min. relative humidity memory	Int*10
20504	0x5018	Max. relative humidity memory	Int*10
20505	0x5019	Min. computed value memory	Int*10

Address [DEC]	Address [HEX]	Value	Type
20506	0x501A	Max. computed value memory	Int*10
20507	0x501B	Min. CO_2 concentration memory	Int*X
20508	0x501C	Max. CO_2 concentration memory	Int*X

Type:

DEC	register is in range 0 – 4500 (16bit)
BCD	register is in BCD format (16bit)
HEX	number in HEX format (16bit)
String	two characters in one 16bit register:

no   – no alarm

hi   – value is lower than set limit

lo   – value is higher than set limit

Int*10   register is in format integer*10 – (16 bit):

(125=12.5°C; error = 9999 or -9999)

Integer   register is in range 0 – 10000 (16bit):

(1050=1050ppm; error = -9998 or -9999)

SOAP

The device allows you to send currently measured values via **SOAP v1.1** protocol. The device sends values in XML format to the web server. The advantage of this protocol is that communication is initialized by the device side. Due to it is not necessary use port forwarding. If the SOAP message cannot be delivered, warning message via SNMP Trap or Syslog protocol is sent. The file with the XSD schema can be downloaded from: http://cometsystem.cz/schemas/soapTx5xxCO2.xsd. SOAP message example:

```xml
<?xml version="1.0" encoding="utf-8"?>
<soap:Envelope xmlns:soap="http://schemas.xmlsoap.org/soap/envelope/"
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xmlns:xsd="http://www.w3.org/2001/XMLSchema">
   <soap:Body>
     <InsertTx5xxCO2Sample xmlns="http://cometsystem.cz/schemas/soapTx5xxCO2.xsd">
        <passKey>13960932</passKey>
        <device>4158</device>
        <temp>1.4</temp>
        <relHum>91.9</relHum>
        <compQuant>0.3</compQuant>
        <co2>1050</co2>
        <alarms>hi,no,no,no</alarms>
        <lev1>0</lev1>
        <lev2>1</lev2>
        <lev3>0</lev3>
        <compType>Dew point</compType>
        <tempU>C</tempU>
        <timer>60</timer>
```

```
        </InsertTx5xxCO2Sample>

    </soap:Body>

</soap:Envelope>
```

Element	Description	
<passKey>	Contains the device serial number (an eight digit number).	
<device>	Device type identification number (code):	
	Device	**Code[DEC]**
	T5540	4155
	T6540	4158
	T5541	4161
	T6541	4164
	T5545	4191
	T6545	4194
<temp>	Contains the value of temperature (a decimal part of number is separated by a dot). Error on channel is signaled by **9999** or **-9999**.	
<relHum>	Contains the value of relative humidity. Error value: **9999** or **-9999**.	
<compQuant>	Contains the value of computed quantity. Error value: **9999** or **-9999**.	
<co2>	Contains the value of CO_2 concentration. Error value: **-9999** or **-9998**.	
<alarms>	State of alarm on temperature, relative humidity, computed quantity and CO_2 concentration channel. Format: **tm,rh,cq,co2** where: **tm** – temperature alarm, **rh** – relative humidity alarm, **cq** – computed quantity alarm, **co2** – CO_2 concentration alarm and alarm values: **no** – no alarm or value is not supported, **hi** – high alarm, **lo** – low alarm.	
<lev1>	CO_2 concentration LED – green	
<lev2>	CO_2 concentration LED – yellow	
<lev3>	CO_2 concentration LED – red	
<compType>	Computed quantity type: **Absolute humidity**, **Specific humidity**, **Mixing proportion**, **Specific enthalpy**, **Dew point** or **n/a**.	
<tempU>	Temperature and dew point unit. Values: **C** – temperature in °C, **F** – temperature in °F.	
<timer>	SOAP sending interval [sec].	

Syslog

The device allows sending text message to selected Syslog server. Events are send using **UDP** protocol on **port 514**. Syslog protocol implantation is according to RFC5424 and RFC5426. Events when Syslog messages are send:

Text	Event
Sensor - fw 1-5-7.x	Reset of the device
NTP synchronization error	NTP synchronization error
Testing message	Test Syslog message
Email login error	E-mail sending error
Email auth error	
Email some error	
Email socket error	
Email dns error	
SOAP file not found	SOAP message sending error
SOAP host error	
SOAP sock error	
SOAP delivery error	
SOAP dns error	
Text XXXX is set according channel type: Temperature, Relative humidity, Dew point, Absolute humidity, Specific humidity, Mixing proportion, Specific enthalpy, CO2 level.	
High alarm XXXX	Upper alarm on channel
Low alarm XXXX	Lower alarm on channel
Clearing XXXX alarm	Clearing alarm on channel
Error XXXX	Measuring error

SNTP

The device allows time synchronization with NTP (SNTP) server. SNMP protocol version 3.0 is supported (RFC1305). Time synchronization is made every 24 hours. Time synchronization every hour can be enabled. For time synchronization it is necessary set IP address to the SNTP server. It is also possible set GMT offset for correct time zone. Time is used in graphs and history CSV files. Maximum jitter between two time synchronization is 90sec at 24 hours interval.

Software development kit

Device provides on own web pages documentation and examples of usage protocols. SDK files are available at library page (About – Library).

SDK File	Note
snmp.zip	Description of SNMP OID's and SNMP Traps, MIB tables.
modbus.zip	Modbus registers numbers, example of get values from the device by Python script.
xml.zip	Description of file values.xml, examples of values.xml file, XSD schematic, Python example.
json.zip	Description of values.json file, example of values.json file, Python example.
soap.zip	Description of SOAP XML format, example of SOAP messages, XSD schematic, examples of get SOAP values at .net, PHP and Python.
syslog.zip	Description of syslog protocol, simple syslog server in Python.

Troubleshooting

The chapter describes the common problems with devices Web Sensor Tx5xx and methods how to fix these problems. Please read this chapter before you will call technical support.

I forgot the device IP address

IP address is factory set to **192.168.1.213**. If you had changed it and forgot new IP address, run the TSensor software and press **Find device...** In the window are displayed all available devices.

I cannot connect to the device

In search window is only IP and MAC address displayed

Other details are marked **N/A**. This problem occurs if IP address of the device is set to another network.

Select the window **Find device** in TSensor software and press **Change IP address**. Follow the software instructions. To assign IP address automatically using DHCP server, set the device IP address to **0.0.0.0**.

Device IP address is not displayed in window Find device

In TSensor software menu press **Help! My device was not found!** in window **Find device**. Follow the software instructions. MAC address of the device can be found on product label.

The device is not found even after manually setting MAC address

This problem occurs especially in cases when the IP address of the device belongs to another network and also Subnet mask or Gateway are incorrect.

In this case is DHCP server in the network necessary. In TSensor software menu press **Help! My device was not found!** in window **Find device**. As new IP address set **0.0.0.0**. Follow the software instructions. An alternative is to reset device to factory defaults using factory-defaults button.

I forgot the password for setup

Please reset device to factory defaults. Procedure is described at following point.

Factory defaults

This procedure restore device to factory settings including network parameters (IP address, Subnet mask, etc.). Settings relating to measurement are not restored by factory defaults. For factory-defaults follow these steps:

- disconnect the power supply
- unscrew upper cover of the device case
- close the jumper inside device
- press button inside device and power on device at same time
- keep the button pressed for 10 sec
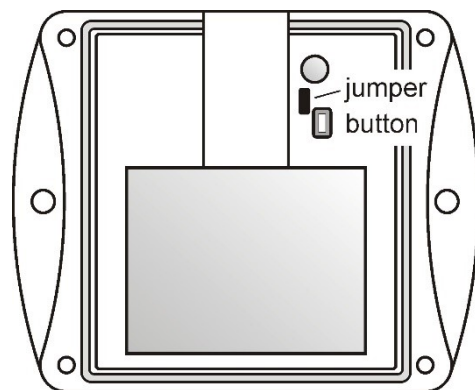
- close the device

Display is off

Check if power supply is connected. Disconnect power connector and connect connector again – watch the display at the moment of connecting the power. If all LCD segments light for 1 second and go out again, the display is turned off by software.

Device error states

Device still make self-tests. If error occurred, LCD shows error codes:

| Error	LCD display	Description
Error 0	Err0	Internal memory CRC error. In this state device doesn't work. This is a critical error, contact the distributor.
Error 1	Err1	Measured value or computed quantity (expect CO_2 concentration) is over the upper limit. Error code 9999. This state appears in case of: - Measured temperature is higher than approximately +600°C (i.e. high non-measurable resistance of temperature sensor, probably open circuit) - Relative humidity is higher than 100%RH (i.e. damaged humidity sensor or humidity calculation is not possible due to temperature error) - Unable to calculate computed quantity (temperature or humidity measurement error)
Error 2	Err2	Measured or computed quantity is under lower limit or is error in CO_2 concentration measuring. Error code -9999. This state appears in case of: - Measured temperature is lower than approximately -210°C (i.e. resistance is too small, probably short circuit) - Relative humidity is lover than 0%RH (i.e. damaged humidity sensor or humidity calculation is not possible due to temperature error) - CO_2 concentration measuring error - Unable to calculate computed quantity (temperature or humidity measurement error)
Error 3	Err3	Internal A/D converter error. Error code -9999. In this state device doesn't work. Contact the distributor.
Error 4	Err4	Internal CO_2 sensor error. Error code -9999. In this state device not measure CO_2 concentration. Contact the distributor.

Technical specifications

Information about technical specifications of the device.

Dimensions

Web Sensor T5540:
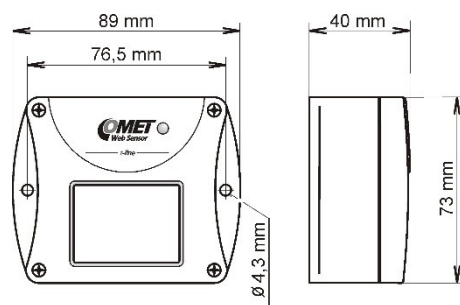
Web Sensor T5541:
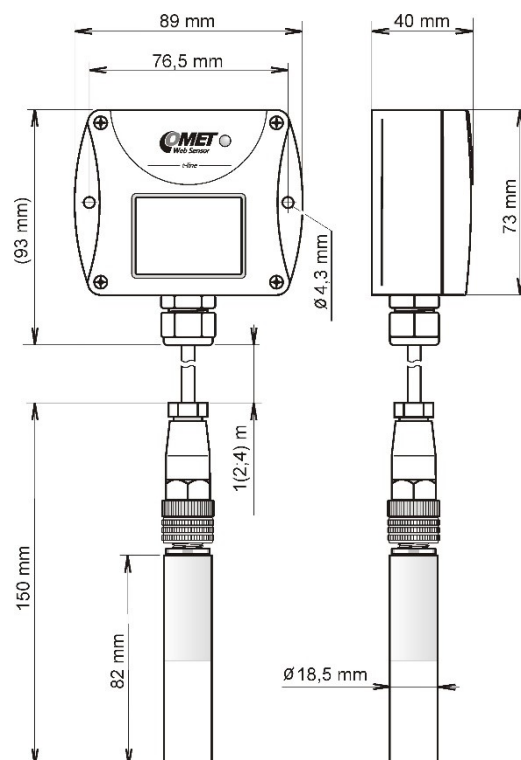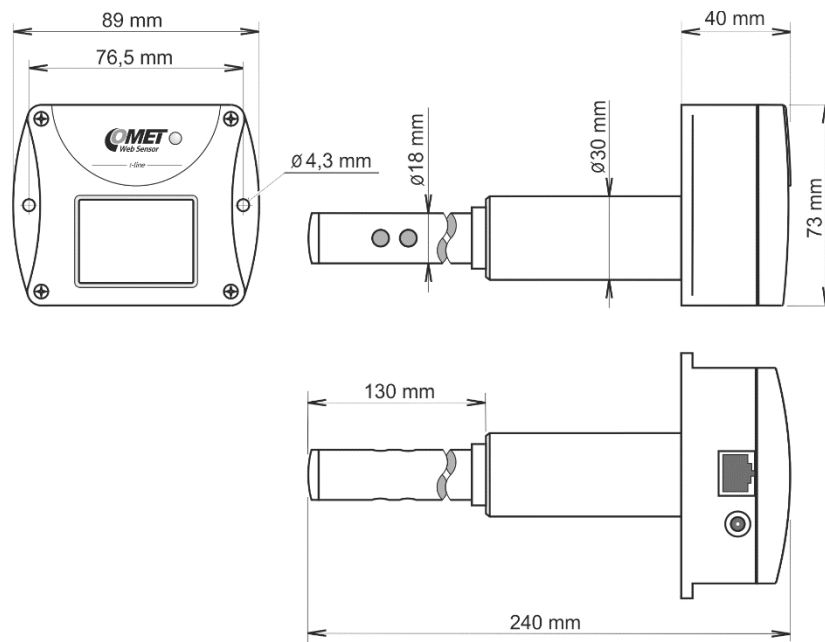
Web Sensor T5545:

Web Sensor T6541:
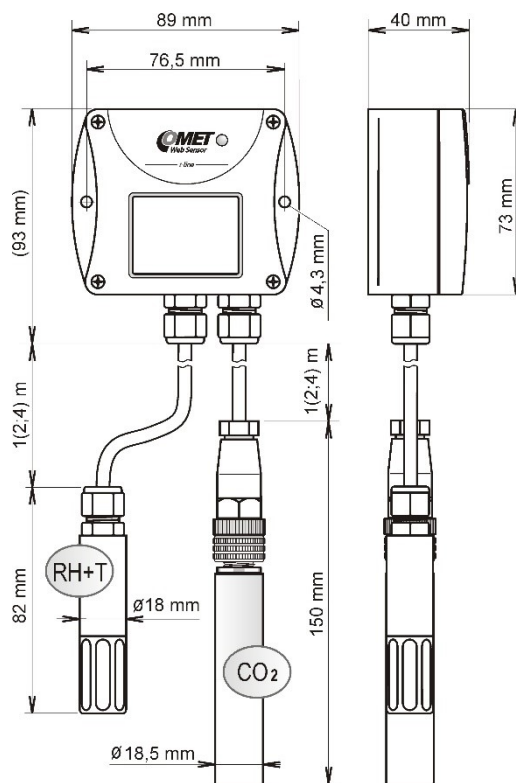
Web Sensor T6540:
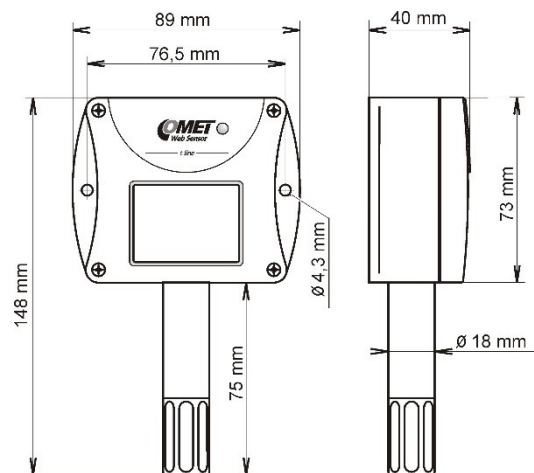
Web Sensor T6545:
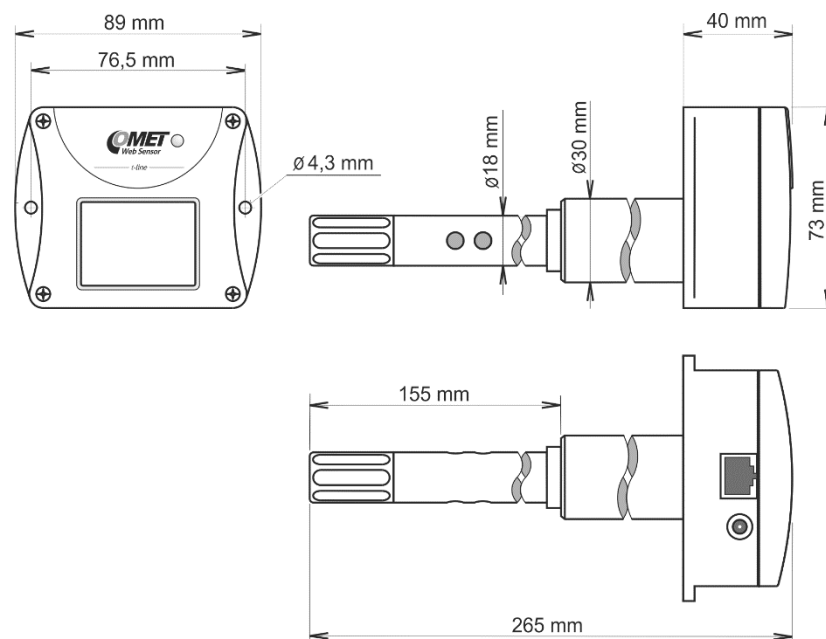
General parameters

Supply voltage:

DC voltage from 9V to 30V, coaxial connector, 5x2.1mm diameter, center positive pin

Consumption:

~ 1W continuously, max. 4W for 50ms with 15s period

Measuring interval of temperature and relative humidity:

2sec

Measuring interval of CO_2 concentration:

15sec

Display switching interval:

4sec (when more than two values are displayed)

Not allowed manipulations:

It is not allowed to operate the device under conditions other than specified in technical parameters. Devices are not designed for locations with chemically aggressive environment. Temperature and humidity sensors must not be exposed to direct contact with water or other liquids. It is not allowed to remove the sensor cover to avoid any mechanical damage of the sensors.

Case material:

ABS

Weight:

T5540 ~140g

T6540 ~160g

T5541/1m probe ~240g, T5541/2m probe ~270g, T5541/4m probe ~330g

T6541/1m probe ~320g, T6541/2m probe ~390g, T6541/4m probe ~530g

T5545 ~ 280g

T6545 ~ 290g

Mounting the device:

With two holes at the bottom of the unit

Communication port:

RJ45 connector, 10Base-T/100Base-TX Ethernet (Auto-Sensing)

Recommended Connector Cable:

for industrial use is recommended Cat5e STP cable, in less demanding applications can be replaced by Cat5 cable, maximum cable length 100m

Supported protocols:

TCP/IP, UDP/IP, ARP, ICMP, DHCP, TFTP, DNS

HTTP, SMTP, SNMPv1, ModbusTCP, SNTP, SOAPv1.1, Syslog

Supported SNMP authentication types:

AUTH LOGIN

Supported web browsers:

Internet Explorer 11, Mozilla Firefox 55 and later, Google Chrome 60 and later, Microsoft Edge 25 and later

Recommended minimum screen resolution:

1024 x 768

Memory:

    1000 values for each channel inside non-backup RAM memory

EMC:

    EN 61326-1, EN 55011

Measured values

Type	Temperature	Relative humidity	CO_2 concentration	Computed quantity
T5540			✓	
T5541			✓	
T5545			✓	
T6540	✓	✓	✓	✓
T6541	✓	✓	✓	✓
T6545	✓	✓	✓	✓

Temperature measurement

Temperature and humidity measuring range is limited - see graph below.

Type	Operating temperature of electronic	Accuracy	Range	Resolution
T6540	-30 to +60°C (-22 to +140°F)	±0.6°C (±1.1°F)	-30 to +80°C (-22 to +176°F)	0.1°C (0.2°F)
T6541	-30 to +80°C (-22 to +176°F)	±0.4°C (±0.7°F)	-30 to +105°C (-22 to +221°F)	0.1°C (0.2°F)
T6545	-30 to +60°C (-22 to +140°F)	±0,4°C (±0.7°F)	-30 to +80°C (-22 to +176°F)	0,1°C (0.2°F)

Temperature response time with stainless steel sensor cover (F5200) in air flow 1m/s:

    t90 < 6min, temperature step 20°C (36°F)

Relative humidity measurement

Temperature and humidity measuring range is limited - see graph below.

Type	Operating humidity of electronic	Accuracy	Range	Resolution
T6540	5 to 95%RH without condensation	±2.5%RH in range 5 to 95%RH in 23°C (73.4°C)	0 to 100%RH temperature compensated	0.1%RH
T6541	0 to 100%RH without condensation			
T6545	5 to 95%RH without condensation			

Humidity response time with stainless steel sensor cover (F5200) in air flow 1m/s:

    t90 < 30s (humidity step 65%RH, constant temperature)

Relative humidity and temperature restrictions:
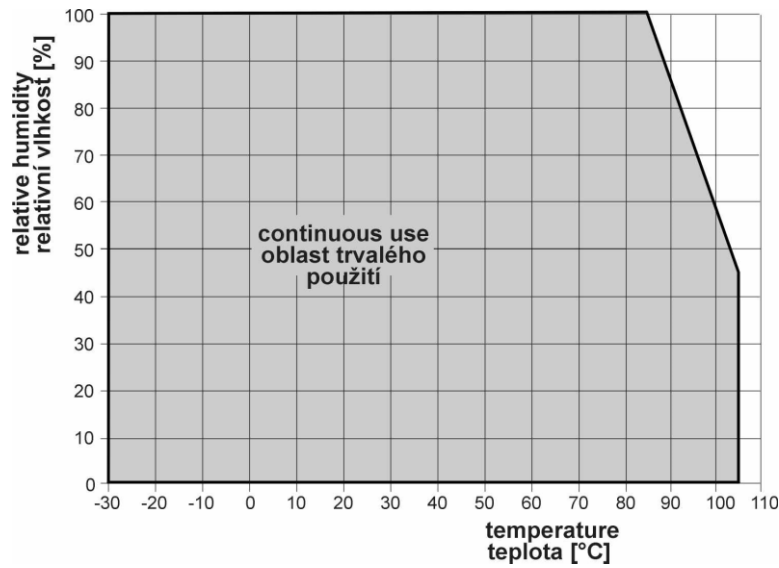
CO₂ concentration measurement

Type	Range	Accuracy	Resolution
T5540			
T6540	0 to 2000ppm	±50ppm + 2% of measuring value at 25°C (77°F) and 1013hPa	
T5545			
T6545			1ppm
T5541	0 to 10000ppm	±100ppm + 5% of measuring value at 25°C (77°F) and 1013hPa	
T6541			

Temperature dependence:

      typ. 2ppm CO_2 / °C in the range 0 to 50°C (32 to 122°F)

Lon term stability:

      typ. 20ppm / year

Response time:

      t90 < 105s in „SLOW" – average measurement mode

      t90 < 60s in „FAST " measurement mode

Computed quantities
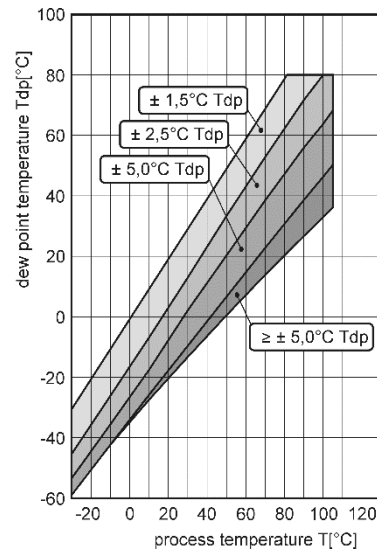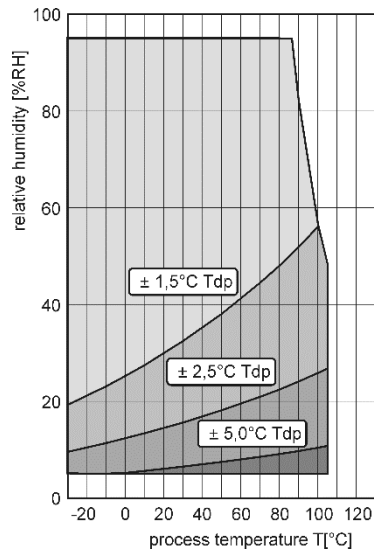
Dew point temperature

Range:

      -60 to +80°C (-20 to 176°F)

Accuracy:

      ±1.5°C (±2.7°F) at ambient temperature T < 25°C (77°F) a RH > 30%, for more details see graphs:

Specific humidity

This value depends on atmospheric pressure. Pressure for quantities calculation is stored in device memory. Default value is 1013hPa and can be changed by software.

Range:

> 0 to 550g/kg

Accuracy:

> $\pm$2.1g/kg at ambient temperature T < 35°C (95°F)

Mixing ratio

This value depends on atmospheric pressure. Pressure for quantities calculation is stored in device memory. Default value is 1013hPa and can be changed by software.

Range:

> 0 to 995g/kg

Accuracy:

> $\pm$2.2g/kg at ambient temperature T < 35°C (95°F)

Specific enthalpy

This value depends on atmospheric pressure. Pressure for quantities calculation is stored in device memory. Default value is 1013hPa and can be changed by software.

Range:

> 0 to 995kJ/kg

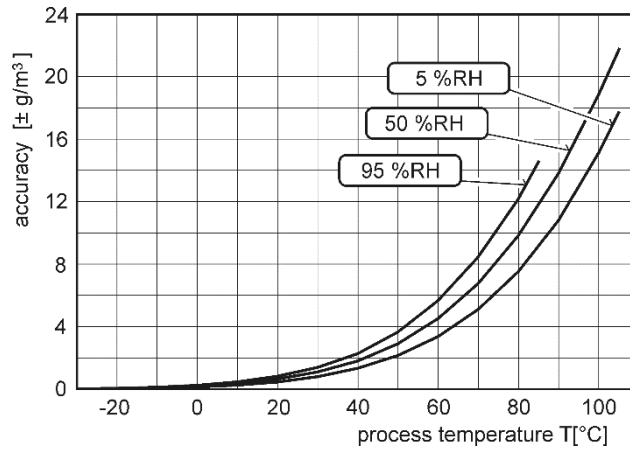Accuracy:

> $\pm$4kJ/kg at ambient temperature T < 25°C (77°F)

Absolute humidity

Range:

> 0 to 400g/m^3

Accuracy:

±3g/m3 at temperature T < 40°C (104°F), for more details see graph:

Operating terms

Temperature operating range:

Type	Case with electronic	Measuring end of stem	CO$_2$ probe	RH+T probe
T5540	-30°C to +60°C (-22°F to +140°F)	-	-	-
T6540		-30°C to +80°C (-22°F to +176°F)		
T5541	-30°C to +80°C (-22°F to +176°F)	-	-40°C to +60°C (-40°F to +140°F)	-
T6541		-		-30°C to +105°C (-22°F to +221°F)
T5545	-30°C to +60°C (-22°F to +140°F)	-30°C to +60°C (-22°F to +140°F)	-	-
T6545	-30°C to +60°C (-22°F to +140°F)	-30°C to +60°C (-22°F to +140°F)		

It is recommended to switch off in temperature over +70°C.

Operating humidity range:

Type	Humidity range
T5540	5 to 95%RH without condensation
T6540	
T5545	
T6545	
T5541	0 to 100%RH without condensation
T6541	

Operating barometric pressure range:

850 to 1100hPa

Protection:

Type	Case with electronic	Measuring end of stem	CO$_2$ probe	RH+T probe
T5540		-	-	-
T6540		IP40		
T5541	IP30	-	IP65	-
T6541				IP40
T5545		IP20	-	-
T6545		IP20		

Other environmental conditions (external influences) according to HD 60364-5-51:

normal

Storage conditions:

temperature: -40°C to +60°C (-40°F to +140°F)

relative humidity: 5 to 95%RH (without condensation)

barometric pressure: 700 to 1100hPa

Working position T5541, T6541:

arbitrary

Working position T5540:

with connectors upwards

Working position T6540:

with sensor cover downwards. When mounting in RACK 19" with universal holder MP046 (optional accessories) then sensor cover can be placed horizontally.

Working position T5545, T6545:

arbitrary - the holes in the stem must be routed in the direction of the air flow (see picture)

air flow direction
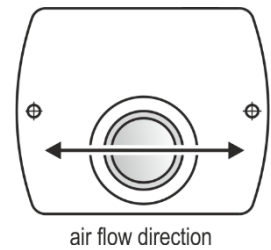
End of operation

Disconnect the device and dispose it according to current legislation for dealing with electronic equipment (WEEE directive). Electronic devices must not be disposed of with your household waste and need to be professionally disposed.

Technical support and service

Technical support and service is provided by distributor. Contact is included in warranty certificate.

Preventive maintenance

Make sure the cables are not damaged periodically. We recommend you periodic calibration for measurement accuracy validation. Recommended calibration interval:

Type	Calibration interval
T5540	5 years
T5541	5 years
T5545	5 years
T6540	1 year (temperature 2 years, relative humidity 1 year, CO_2 concentration 5 years)
T6541	1 year (temperature 2 years, relative humidity 1 year, CO_2 concentration 5 years)
T6545	1 year (temperature 2 years, relative humidity 1 year, CO_2 concentration 5 years)

Optional accessories

This chapter contains list of optional accessories, which can be ordered by extra cost. Manufacturer recommends using only original accessories. All available optional accessories are on manufacturer webpages.

Power supply Adapter A1515

Power supply adapter with CEE 7 plug, 100-240V 50-60Hz/12V DC, 0.5A for Web Sensor devices.

UPS for DC device UPS-DC001

UPS 5-12V DC 2200mAh for up to 5 hours backup for Web Sensor.

Device case holder for RACK 19" MP046

MP046 is a universal holder for mounting of Web Sensor devices into RACK 19".

Probes holder for RACK 19" MP047

Universal holder for easy mounting probes in RACK 19".

Vessel for calibration of humidity and humidity standards

Vessel MD046 is designed for adjustment and calibration of relative humidity. Vessel is used with humidity standards HM023 10%RH and HM024 80%RH.

Comet database

Comet database provide a complex solution for data acquisition, alarm monitoring and measured data analyzing from Comet devices. Central database server is based on MS SQL technology. Client-server conception allows to easy and instant access to data. Data are accessible from multiple places by the Database Viewer software. One license of Comet Database includes also one license for Database Viewer.