

Appendix for Hx5xx manuals

Software development kit for Hx5xx devices family

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1. Web pages design

1.1 Introduction

Hx5xx family regulators (devices) enable to design user's own web pages to display readings from the regulator. To successfully make of user's web pages you need these files: **web2cob.exe**, **mimetype.ini**, **jsgraphics1.js**. Contact manufacturer for obtaining this files. To upload web files to probe is the tftp client needed (included in Windows XP).

Pages are created in HTML code. Insert `<% %>` tag to your HTML code if you need show some measured values from the device (actual temperature, history graphs, etc.). If web browser send web page request to the device, devices web server load this page from a memory and insert requested values. Create HTML pages in any text editor and upload to the device – see *chapter 1.4*.

Address of www pages is <http://device IP address/page.html>. If your home page is named index.html, enter only IP address of the device.

1.2 Hx5xx tags

Insert tag (from the table below), if you need display some value generated by the device. If tag isn't supported device insert blank text. For history graphs is necessary include javascript file **jsgraphics1.js**. Devices Hx5xx supports following tags:

General tags (H453x, H353x and H753x):

Tag	Description	Example of generated text
<code><%srn%></code>	device serial number	07940140
<code><%name%></code>	device name/description	TRh-Sensor+relay
<code><%rfr%></code>	web pages refresh interval	60
<code><%fw%></code>	firmware version	04.01 / 1-5-2.01
<code><%ttbl%></code>	show table with time stamps for history table	<p>If device is synchronized by the SNTP server:</p> <pre><table border="0"> <tr><td>24.11.2008 14:04:28</td></tr> <tr><td>24.11.2008 14:03:28</td></tr> </table></pre> <p>But If device isn't synchronized, values are generated by the javascript.</p> <pre><table border="0"> <script type="text/javascript"> <!-- var datum=new Date(); var c = 0; var datum1=0; var minuty=0; for(c=1;c<=100;c++) { datum1=new Date(datum-((-43+60*(c+1))*1000)); minuty=((datum1.getMinutes()<10)? "0": "")+datum1.getMinutes(); document.write('<tr><td>' + datum1.getDate()+'.'+(datum1.getMonth()+1)+'.' '+datum1.getHours()+':'+minuty + '</td></tr>');</pre>

Tag	Description	Example of generated text
		<pre> } //--> </script> </table> </pre>
<%tstr%>	history storage interval	60
<%time%>	shown actual device time	<p>If device is synchronized by the SNTP server: 24.11.2008 14:13:57</p> <p>But If device isn't synchronized, value is generated by the javascript.</p> <pre> Local PC time: <script type="text/javascript"> <!-- var d = new Date();document.write(d.toLocaleString()); //--> </script> </pre>

Tags for RSS feed (H453x, H353x and H753x):

Tag	Description	Example of generated text
<%rstm%>	time for RSS feed	<p>If device is synchronized by the SNTP server: 24.11.2008 14:13:57</p> <p>But If device isn't synchronized: -----</p>
<%rss%>	IP address for RSS feed. Separately configurable external IP address (gateway with port 80 forward). If RSS IP address isn't set, this tag returns device IP address.	192.168.1.1
<%tmpa%> <%rha%> <%dpa%> <%pra%>	for guid element generating. If new alarm occurred, this tag generates new random value. By the guid element RSS reader identifies a "new article".	<pre> <%tmpa%> tmpa_12345678 <%rha%> rha_12345678 <%dpa%> dpa_12345678 <%pra%> pra_12345678 </pre>
<%tmpg%> <%rhg%> <%dpg%> <%prg%>	guid element for identifying measured value change	<pre> <%tmpg%> tmpg_12345678 <%rhg%> rhg_12345678 <%dpg%> dpg_12345678 <%prg%> prg_12345678 </pre>

Temperature tags (H453x, H353x and H753x):

Tag	Description	Example of generated text
<%tmp%>	actual measured temperature	23.2
<%atmp%>	temperature alarm state	lo or no or hi
<%gtmp%>	temperature history graph, it is necessary include jsgraphics1.js file	
<%ttmp%>	temperature history table	<pre> <table border="0"> <tr><td>23.2</td></tr> <tr><td>24.0</td></tr> :: :: </table> </pre>
<%htmp%>	temperature alarm upper limit	300.0
<%ltmp%>	temperature alarm lower limit	-200.0
<%tmph%>	temperature alarm hysteresis	1.0
<%dtmp%>	temperature alarm time delay	30
<%unt1%>	temperature unit	°C or °F

Relative humidity tags – RH (H353x, H753x):

Tag	Description	Example of generated text
<%rh%>	actual measured relative humidity	37.2
<%arh%>	RH alarm state	lo or no or hi
<%grh%>	relative humidity history graph, include jsgraphics1.js file is necessary	
<%trh%>	relative humidity history table	<pre><table border="0"> <tr><td>37.2</td></tr> <tr><td>37.1</td></tr> .. </table></pre>
<%hrh%>	relative humidity alarm upper limit	100.0
<%lrrh%>	relative humidity lower upper limit	0.0
<%rrh%>	RH alarm hysteresis	1.0
<%drh%>	RH alarm time delay	30
<%unt2%>	relative humidity unit	%RH

Computed value unit tags – CV (H353x, H753x):

Tag	Description	Example of generated text
<%dp%>	actual computed value	0.5
<%adp%>	CV alarm state	lo or no or hi
<%gdp%>	computed value history graph, include jsgraphics1.js file is necessary	
<%tdp%>	CV history table (100 values from history)	<pre><table border="0"> <tr><td>0.5</td></tr> <tr><td>0.4</td></tr> .. </table></pre>
<%hdp%>	CV alarm upper limit	25.0
<%ldp%>	CV alarm lower limit	5.0
<%dph%>	CV alarm hysteresis	1.0
<%ddp%>	CV alarm time delay	30
<%unt3%>	web unit for CV (html)	g/m³, etc.
<%un3%>	text unit for CV	g/m^3, etc.
<%dscr%>	computed value description	Absolute humidity, etc.

Tags for atmospheric pressure (only H753x):

Tag	Description	Example of generated text
<%pr%>	actual atmospheric pressure	1005.2
<%apr%>	atmospheric pressure alarm state	lo or no or hi
<%gpr%>	atmospheric pressure history graph, include jsgraphics1.js file is necessary	
<%tpr%>	atmospheric pressure history table	<pre><table border="0"> <tr><td>1005.2</td></tr> <tr><td>1005.1</td></tr> .. </table></pre>
<%hpr%>	atmospheric pressure alarm upper limit	1013.0
<%lpr%>	atmospheric pressure alarm lower limit	1000.0
<%prh%>	atmospheric pressure alarm hysteresis	1.0
<%dpr%>	atmospheric pressure alarm time delay	30
<%unt4%>	web unit for atmospheric pressure	inH₂>0, etc.
<%un4%>	text unit for atmospheric pressure	inH20, etc.

Tags for binary inputs (H453x, H353x and H753x):

Tag	Description	Example of generated text
<%gin%>	binary inputs history graph, include jsgraphics1.js file is necessary	
<%tin%>	binary inputs history table	<pre><table border="0"> <tr><td>1 1 1</td></tr> <tr><td>1 0 1</td></tr> .. </table></pre>
<%i1n%> <%i2n%> <%i3n%>	binary inputs name (max. 14 characters)	Input BIN1
<%i1v%> <%i2v%> <%i3v%>	actual binary input value	open or closed
<%i1a%> <%i2a%> <%i3a%>	binary inputs alarm state (no – no alarm, lo – alarm on falling edge, hi – raising edge alarm)	lo or no or hi
<%i1c%> <%i2c%> <%i3c%>	binary inputs alarm conditions	e.g. open->closed
<%i1d%> <%i2d%> <%i3d%>	time delay for binary inputs alarms	5

Tags for relay (H453x, H353x and H753x):

Tag	Description	Example of generated text
<%tre%>	relays history table	<pre><table border="0"> <tr><td>cl op</td></tr> <tr><td>cl op</td></tr> .. </table></pre>
<%r1v%> <%r2v%>	actual relay state	open or closed
<%r1c%> <%r2c%>	assigned value to relay	off or Temperature, etc.
<%r1hl%> <%r2hl%>	relay close condition (upper or lower value)	n/a or lo or hi
<%r1a%> <%r2a%>	alarm value assigned to the relay + unit (if binary input is assigned: n/a)	28.0 °C
<%r1h%> <%r2h%>	relay hysteresis	5
<%r1d%> <%r2d%>	relay time delay	10
<%r1oe%> <%r2oe%>	default action, if measuring error occurs	open or close or none

1.3 Examples

1.3.1 Web pages

Following code shows a simple web page example. This page shows only information about measured temperature.

Web page example:

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN">
<html>
  <head>
    <meta http-equiv="refresh" content="<%rfr%>">
    <meta http-equiv="content-type" content="text/html; charset=windows-1250">
    <style>
      <!--
        body{font-family: verdana, arial, helvetica, sans-serif; font-size: 76%;
          color: #000; background-color: #fff;}
        h1{font-size: 2.0em; font-weight: normal;margin-top: 0.5em;
          margin-bottom: 0.2em;}
        .cervene {color: red}
        .modre {color: #0000FF}
      </-->
    </style>
    <script src="jsgraphics1.js"></script>
  </head>

  <body>
    <h1>Current temperature: <%tmp%>
      <%unt1%></h1>
    (<%time%>)
    <h1>Temperature history:</h1>
    <%unt1%>
    <div style="position:absolute;top:120px;left:30px;"><%gtmp%></div>

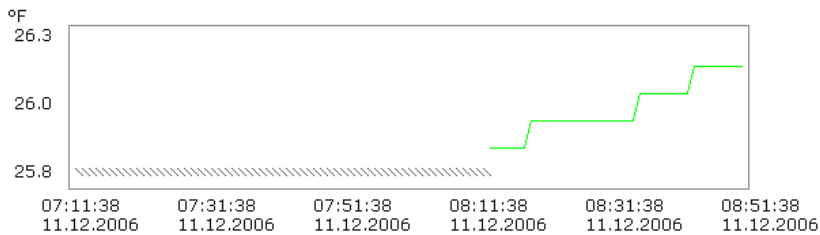
    <div style="position:absolute;top:280px;">
      <h1>Temperature settings:</h1>
      <table>
        <tr>
          <td>Alarm:</td><td><%atmp%></td>
        </tr>
        <tr>
          <td>upper limit:</td><td class="cervene"><%htmp%>
            <%unt1%></td>
        </tr>
        <tr>
          <td>lower limit:</td><td class="modre"><%ltmp%>
            <%unt1%></td>
        </tr>
        <tr>
          <td>hysteresis:</td><td><%tmph%>
            <%unt1%></td>
        </tr>
        <tr>
          <td>time delay:</td><td><%dtmp%> s</td>
        </tr>
        <tr>
          <td>Storage interval:</td><td><%tstr%> s</td>
        </tr>
      </table>
      <br>
    </div>
  </body>
</html>
```


Web pages generated by the example html code:

Current temperature: 26.2 °F

(11.12.2006 08:50:51)

Temperature history:



Temperature settings:

Alarm: no
upper limit: 300.0 °F
lower limit: -200.0 °F
hysteresis: 1.0 °F
time delay: 30 s
Storage interval: 60 s

1.3.2 RSS feed

Device provide information about actual measured values and alarm via RSS feed. For RSS XML files are reserved two files - `rss1.xml` and `rss2.xml`. Device support RSS feed via RSS 2.0 version. Please visit <http://cyber.law.harvard.edu/rss/rss.html> for more information about RSS 2.0. Device is tested with following RSS readers: Opera 9.60, Firefox 3, Internet Explorer 7.

XML file example for channel with information about temperature alarm state (file `rss2.xml`):

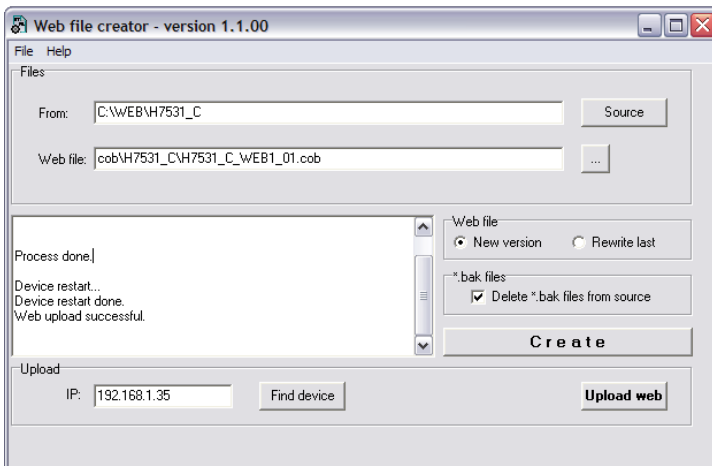
```
<?xml version="1.0" encoding="windows-1250"?>
<rss version="2.0" xmlns:atom="http://www.w3.org/2005/Atom">
  <channel>
    <atom:link href="http://<%rss%>/rss2.xml" rel="self" type="application/rss+xml" />
    <title><%name%> alarms</title>
    <link>http://<%rss%>/</link>
    <description>Serial No:&#160;<%srn%></description>
    <language>en</language>
    <ttl>5</ttl>
    <image>
      <title>Comet system company</title>
      <width>80</width>
      <height>45</height>
      <link>http://www.cometsystem.cz</link>
      <url>http://<%rss%>/logol.gif</url>
    </image>
    <item>
      <title>Temperature alarm:&#160;<%atmp%></title>
      <link>http://<%rss%>/temp.html</link>
      <description>Current temperature:&#160;<%tmp%>
        <%unt1%>, &#160;
        time:&#160;<%rstm%></description>
      <guid isPermaLink="false"><%tmpa%></guid>
    </item>
  </channel>
</rss>
```

1.4 Web compilation and pages upload

For upload web pages to the device, use WebFileCreator software. This software is available on the manufactures web pages. Save pages intended to be uploaded to the device to one directory (best way is create subdirectory at WebFileCreator's directory). In case history graph is required to display, it is necessary to add file `jsgraphics1.js` to the directory with `www` pages. For the correct function of a SOAP messages sending is the `soap` file required (eventually `soap.conf` file).

Web pages upload process:

1. Unpack file `www.zip` to a directory `C:\WEB`
2. New web pages copy to a WebCreatr's subdirectory (e.g. `C:\WEB\H7531_C`)
3. Run software `C:\WEB\WebFileCreator.exe`



4. Insert path to the new web pages to a `From` field (`C:\WEB\H7531_C`)
5. Press `Create` button. Now software compile web pages to a `cob` file.
6. Insert device IP address (field `IP` or use button `Find device`). Then press `Upload web` button. Software now uploads new web pages to your device. This will take approx. 30 sec. For web upload is necessary opened UDP port 69 for TFTP data transfer.

1.5 Supplement

1.5.1 Reserved file names

Device web server has some reserved file names (this names aren't for free use).

File name	Descriptions
<code>index.html</code>	Main web page. If you insert only IP address this file is shown.
<code>*.htm*</code>	File with html. Web tags <code><% %></code> you can use with <code>*.htm</code> and <code>*.html</code> files.
<code>soap</code>	SOAP file. If a SOAP message is sended, this file is processed. This file is for SOAP protocol mandatory.
<code>soap.conf</code>	Configuration file for HTTP SOAPaction header.
<code>jsgraphics1.js</code>	Javascript file is necessary for history graphs.
<code>rss1.xml</code>	Files for RSS feed.
<code>rss2.xml</code>	
<code>export.csv</code>	Virtual files for export history to a CSV files.
<code>export_comma.csv</code>	
<code>diag</code>	Virtual file for device diagnostic (http://IP address/diag).

1.5.2 Restrictions

- Every `<% %>` tag must be placed in new line in source code.
- Tags `<% %>` can be used only in a `*.htm` and `*.html` files.
- Respect reserved file names.
- For history graphs is `jsgraphics1.js` file necessary.
- Maximal size of one HTML file is 64kB.
- Maximal size of web pages is 256kB (summary of all files)
- Capacity of device web server is limited. The larger size of www pages, the lower number of simultaneous accesses is enabled. Small web pages without many graphics and images are recommended. Using `frames` is not recommended. For text and graphic use `css` inside HTML file.

1.6 Web server statistic and error messages

Device provides some basic information about web server function. To web browser insert <http://device IP address/diag> (e.g.: <http://192.168.1.213/diag>). Following items describing device web server:

WWW

```
WWW reg cnt: 55
RSS req cnt: 11
File index.html: ok
File rss1.xml: ok
File rss2.xml: ok
```

Items description:

Item	Description
WWW reg cnt	Number of HTTP requests to a web server. Every file or image is counted.
RSS req cnt	Number of requests to RSS XML file.
File index.html	File exist test (only file name check, file content is not verified)
File rss1.xml	ok file exists
File rss1.xml	not found file is not present on web pages

Web server warning messages:

```
Not found (The requested URL /test was not found on this server.)
```

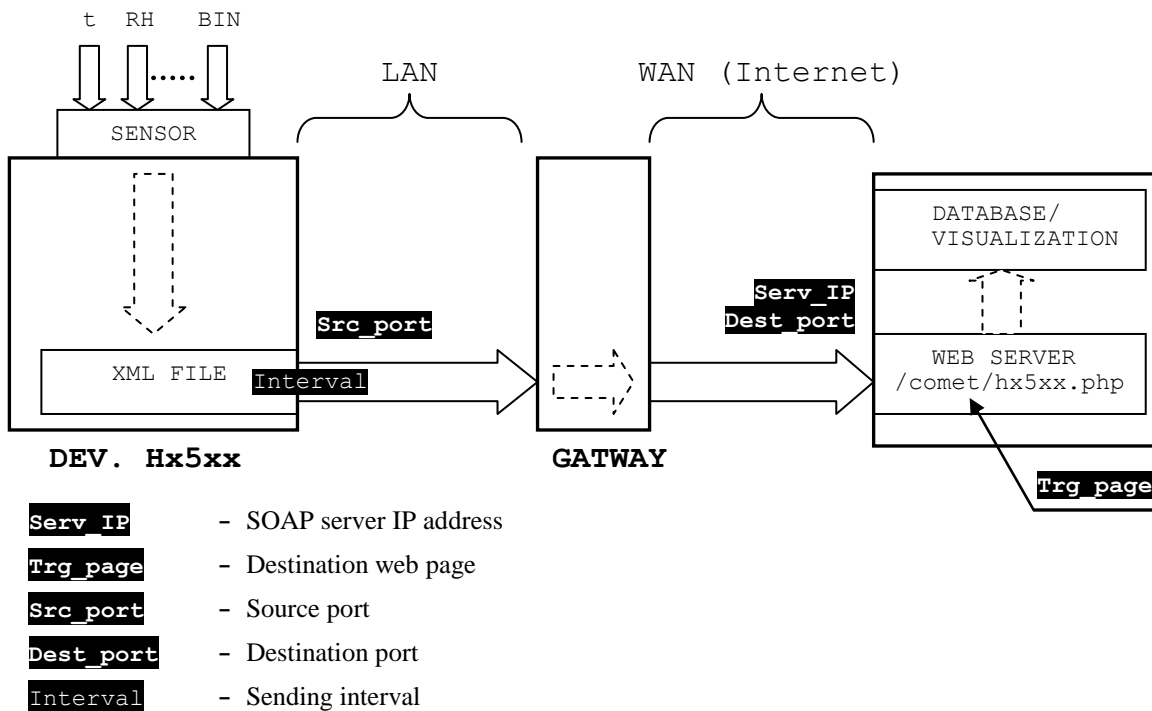
```
ACCESS DENIED!!! (Telnet config.)
```

```
ACCESS DENIED!!! (Server disabled.)
```

2. SOAP protocol

2.1 Introduction

SOAP serves for sending measured data to a HTTP server. With the aid of this protocol data are sent as a XML document (SOAP message). The advantage of this protocol is that sent data aren't binary and for this reason SOAP messages are allowed through firewalls. For more information about SOAP please visit: <http://www.w3.org/TR/soap/>. This device supports only SOAP 1.1.



2.2 Device configuration

For right SOAP message sending to the remote server is necessary setup some device parameters:

Parameter	Description	Example/Conf. dialog label
SOAP protocol enable	SOAP messages sending enable.	SOAP enable: Y
SOAP server IP address	IP address of the SOAP server. This server implements SOAP service for SOAP messages „catching“. If SOAP server isn't at the local network it is necessary setup network gateway also (gateway IP address).	SOAP server IP address: 192.168.1.1
Target web pages	Target to the SOAP file/service for messages reception.	Target web page: http://192.168.1.1/comet/hx5xx.php
Source port	Device source port. Never set this port to 80, because it cause to conflict with internal web server.	Source port: 8080
Destination port	Destination port for SOAP message delivery. This port is mainly comforted to 80, if standard web	Destination port: 80

Parameter	Description	Example/Conf. dialog label
	server is used (Apache+PHP, IIS).	
Sending interval	Sending interval for SOAP messages. Configuring this value less than 10 sec is prohibited.	Sending interval: 60 s

2.3 Standard SOAP message from Hx5xx device

Hx5xx device standard SOAP message:

```
<?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>
    <InsertHx5xxSample xmlns="http://cometsystem.cz/schemas/soapHx5xx.xsd">
      <passKey>07940140</passKey>
      <device>4656</device>
      <temp>25.4</temp>
      <relHum>41.7</relHum>
      <compQuant>8.9</compQuant>
      <pressure>994.5</pressure>
      <alarms>lo,no,hi,hi</alarms>
      <rel>1</rel>
      <re2>0</re2>
      <in1>0</in1>
      <in2>1</in2>
      <in3>0</in3>
      <inAlarms>lo,hi,no</inAlarms>
      <compType>Dew point</compType>
      <tempU>C</tempU>
      <pressureU>hPa</pressureU>
      <timer>30</timer>
    </InsertHx5xxSample>
  </soap:Body>
</soap:Envelope>
```

Element	Description			
<soap:Envelope>	Specifies that the XML document is a SOAP message. It is defined by the SOAP protocol.			
<soap:Body>	Everything what is nested in this element is a SOAP message data. It is defined by the SOAP protocol.			
<InsertHx5xxSample>	<p>It is needed to have running HTTP server for accepting SOAP messages. For example it can be Microsoft IIS or Apache HTTP server. There have to be installed a web service for processing data from the message on this server. For example ASP.NET or PHP can be used for creating the web service. This service must include a method of the same name as this element (thus InsertHx5xxSample). Descendants of the element InsertHx5xxSample (nested elements passKey, device, etc.) must correspond to parameters of the method.</p> <p>The attribute xmlns defines a namespace for elements of the SOAP message. For namespace name was chosen the URI referring to the XSD schema which describes this SOAP message. This schema only defines the structure of the XML document which represents the SOAP message. It is in no manner related to the sending and accepting functionality.</p>			
<passKey>	Contains the device serial number (an eight digit whole number).			
	<device>	Device type identification number (code).		
		Device	Code [DEC]	Code [HEX]
		T0510	4144	0x1030
		T3510	4145	0x1031
T3511	4107	0x100B		

Element	Description																																				
	<table border="1"> <tr><td>T4531</td><td>4106</td><td>0x100A</td></tr> <tr><td>T7510</td><td>4146</td><td>0x1032</td></tr> <tr><td>T7511</td><td>4129</td><td>0x1021</td></tr> <tr><td>H0530</td><td>4656</td><td>0x1230</td></tr> <tr><td>H4531</td><td>4657</td><td>0x1231</td></tr> <tr><td>H0530</td><td>4658</td><td>0x1232</td></tr> <tr><td>H3531</td><td>4659</td><td>0x1233</td></tr> <tr><td>H7530</td><td>4660</td><td>0x1234</td></tr> <tr><td>H7531</td><td>4661</td><td>0x1235</td></tr> <tr><td>H3531R</td><td>4673</td><td>0x1241</td></tr> <tr><td>H4531R</td><td>4674</td><td>0x1242</td></tr> <tr><td>H7531R</td><td>4675</td><td>0x1243</td></tr> </table>	T4531	4106	0x100A	T7510	4146	0x1032	T7511	4129	0x1021	H0530	4656	0x1230	H4531	4657	0x1231	H0530	4658	0x1232	H3531	4659	0x1233	H7530	4660	0x1234	H7531	4661	0x1235	H3531R	4673	0x1241	H4531R	4674	0x1242	H7531R	4675	0x1243
T4531	4106	0x100A																																			
T7510	4146	0x1032																																			
T7511	4129	0x1021																																			
H0530	4656	0x1230																																			
H4531	4657	0x1231																																			
H0530	4658	0x1232																																			
H3531	4659	0x1233																																			
H7530	4660	0x1234																																			
H7531	4661	0x1235																																			
H3531R	4673	0x1241																																			
H4531R	4674	0x1242																																			
H7531R	4675	0x1243																																			
<temp>	Contains the value of temperature (a number whose decimal part is separated by a dot). In case of device failure it can contain value 9999 . This applies to all elements containing a value (relHum , compQuant and pressure).																																				
<relHum>	Contains the value of relative humidity. If the device doesn't support this quantity, the element is set to n/a . This also applies to elements compQuant and pressure .																																				
<compQuant>	Contains the value of computed quantity.																																				
<pressure>	Contains the value of atmospheric pressure. Error value: -9999 .																																				
<alarms>	Temperature, relative humidity, computed value and atmospheric pressure alarm state. Format: tm, rh, cv, pr , where: tm temperature alarm rh relative humidity alarm cv computed value alarm pr atmospheric pressure alarm and alarm values: no no alarm or measured value is not supported by the device hi upper limit alarm lo lower limit alarm example: lo, no, hi, no (lower temperature alarm, no relative humidity alarm, computed value upper limit, no atmospheric pressure alarm)																																				
<re1>	Relay RE1 actual state. This value is set to 1 (closed), 0 (open).																																				
<re2>	Relay RE2 actual state. See RE1.																																				
<in1>	Binary input BIN1 actual state. This value is set to 1 (input is closed – high), 0 (input is opened – low).																																				
<in2>	Binary input BIN2 actual state. See BIN1.																																				
<in3>	Binary input BIN3 actual state. See BIN1.																																				
<inAlarms>	Binary inputs alarm state. Format: i1, i2, i3 , where: i1 alarm BIN1 i2 alarm BIN2 i3 alarm BIN3 and alarm values: no no alarm hi signalize raising edge alarm (closed -> open) lo signalize falling edge alarm (open-> closed) example: lo, no, hi (binary input BIN1 falling edge alarm, BIN2 no alarm, BIN3 raising edge alarm)																																				
<compType>	Computed value type: Absolute humidity, Specific humidity, Mixing proportion, Specific enthalpy, Dew point																																				
<tempU>	Temperature unit (and dew point). Values: C – temperature unit is °C. F – temperature unit is °F.																																				
<pressureU>	Atmospheric pressure unit. Values: hPa, PSI, inHg, mBar, oz/in^2, mmHg, inH2O, kPa .																																				
<timer>	SOAP sending interval (sec).																																				

2.4 Changing a SOAP message structure

It is possible to write your own XML document which represents the SOAP message. You can create it in whatever text editor. Enter proper tag according to tables below to the place where you want to insert any of data field provided by the device. Finally save the file with the name `soap` and add it to the directory with web pages. Maximal size of this file is 900B. Its upload to the device is part of web pages upload. Tags for SOAP messages for Hx5xx devices:

Tag	Description	Example	Stand.
<%srn%>	Serial number of the device.	07940140	✓
<%time%>	Writes a time. It is either synchronized with a SNTP server (format: dd.mm.yyyy hh:mm:ss) or simply a number of seconds elapsed from enabling the device (format: Local: <NumberOfSeconds> /1000)	30.10.2008 11:38:45	
<%type%>	Device type.	H7531	
<%kind%>	Device type identification number.	4661	✓
<%tmr%>	SOAP sending interval (sec).	30	✓
<%ala%>	Temperature, relative humidity, computed value and atmospheric pressure alarm status.	no,no,lo,hi	✓
<%ali%>	Binary inputs alarm status.	hi,no,no	✓
<%c1%>	Actual temperature.	35.8	✓
<%c2%>	Actual relative humidity.	30.0	✓
<%c3%>	Actual computed value (depend on configuration).	5.1	✓
<%c4%>	Actual atmospheric pressure.	993.5	✓
<%r1%>	Relay RE1 actual state.	1	✓
<%r2%>	Relay RE2 actual state.	0	✓
<%i1%>	Binary input BIN1 state.	0	✓
<%i2%>	Binary input BIN2 state.	1	✓
<%i3%>	Binary input BIN3 state.	1	✓
<%dscr%>	Computed value type.	Dew point	✓
<%c1u%>	Temperature unit type.	C	✓
<%c2u%>	Relative humidity unit type.	%RH	
<%c3u%>	Computed value unit type.	C	
<%c4u%>	Atmospheric pressure unit type.	hPa	✓

Simple XML file example (information about temperature, relative humidity and BIN1 only):

```
<?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>
    <InsertHx5xxSample xmlns="http://cometsystem.cz/schemas/soapHx5xx.xsd">
      <temp><%c1%></temp>
      <relHum><%c2%></relHum>
      <in1><%i1%></in1>
    </InsertHx5xxSample>
  </soap:Body>
</soap:Envelope>
```

Edit file `soap.conf`, if `SOAPAction` header change is necessary.

2.5 SOAP diagnostic

Hx5xx device provides this ways for SOAP diagnostic:

- SNMP Trap and Syslog message sending if SOAP communication error occurs
- Diagnostic via web pages

2.5.1 Diagnostic via SNMP Traps and Syslog

Device sends SNMP Traps (Syslog messages), if SNMP or Syslog is properly configured.

Trap	Text Trap/Syslog	Description
1/5	SOAP Halted. Hostname error	Tag Target web page is wrong configured. Target web page isn't selected or less then 5 characters.
1/4	SOAP delivery error	SOPA message delivery error. Message probably wasn't delivery. HTTP server returns wrong response code. Please check your destination target (Target web page) and your SOAP function on the HTTP server.
1/3	SOAP connection error	Connection error to the server. Communication with SOAP server isn't possible (IP address or port is unreachable). Please check SOAP server IP address and destination port.

2.5.2 Diagnostic via web pages

Device provides SOAP diagnostic via web. Insert to the web browser <http://device IP address/diag> (e.g.: <http://192.168.1.213/diag>). Following items describes SOAP diagnostic:

SOAP

```
Cnt (req/ok): 0/0
Err. cnt (sock/req1/req2): 0/0/0
Last code (req1/req2): 9999/9999
File SOAP: ok
```

Item	Description			
Cnt. (req/ok)	SOAP messages counter. First number describes number of SOAP requests and second identifying number of successfully messages sends. Success is signaled when message is correctly deliver to the SOAP server. If SOAP message is delivered to the server, but SOAP service is wrong, this counter probably shows success. Device check only HTTP response header. XML feedback file isn't checked.			
Err. cnt (sock/req1/req2)	SOAP error request counter, where: sock number or TCP connection error. This item is incremented when SOAP server is inaccessible. req1 number of 100-continue request errors. This value is incremented if TCP connection with server is possible, but server not accepts data (it isn't HTTP server, etc.) req2 number of wrong requests for XML data transfer. This item is incremented if server returns some wrong HTTP response code (wrong SOAP service, etc.).			
Last code (req1/req2)	Last SOAP request return codes: Last code (req1/req2): code1,code2			
	code1 (return code to 100-continue request)			
	<table border="1"> <thead> <tr> <th>Code</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>9999</td> <td>Device SOAP service is disabled or no SOAP request yet.</td> </tr> </tbody> </table>	Code	Description	9999
Code	Description			
9999	Device SOAP service is disabled or no SOAP request yet.			

Item	Description																										
	<table border="1"> <tr> <td>8888</td> <td>Parameter Target web page is wrong configured. This parameter must be longer then 5 characters.</td> </tr> <tr> <td>7777</td> <td>Opening TCP connection.</td> </tr> <tr> <td>-1</td> <td>Timeout. Server timeout during 800 ms.</td> </tr> <tr> <td>0</td> <td>TCP connection established, but no HTTP/1.1/n header.</td> </tr> <tr> <td>100</td> <td>Right response code.</td> </tr> <tr> <td>other</td> <td>See: http://www.w3.org/Protocols/rfc2616/rfc2616-sec10.html</td> </tr> <tr> <td colspan="2">kod2 (return code to the XML data)</td> </tr> <tr> <td>9999</td> <td>Device SOAP service is disabled or no SOAP request yet.</td> </tr> <tr> <td>8888</td> <td>Parameter Target web page is wrong configured. This parameter must be longer then 5 characters.</td> </tr> <tr> <td>7777</td> <td>TCP connection opening or timeout or no HTTP/1.1/n header inside the response.</td> </tr> <tr> <td>200</td> <td>Right response code.</td> </tr> <tr> <td>500</td> <td>Internal server error (wrong SOAP service, etc.).</td> </tr> <tr> <td>other</td> <td>See: http://www.w3.org/Protocols/rfc2616/rfc2616-sec10.html</td> </tr> </table>	8888	Parameter Target web page is wrong configured. This parameter must be longer then 5 characters.	7777	Opening TCP connection.	-1	Timeout. Server timeout during 800 ms.	0	TCP connection established, but no HTTP/1.1/n header.	100	Right response code.	other	See: http://www.w3.org/Protocols/rfc2616/rfc2616-sec10.html	kod2 (return code to the XML data)		9999	Device SOAP service is disabled or no SOAP request yet.	8888	Parameter Target web page is wrong configured. This parameter must be longer then 5 characters.	7777	TCP connection opening or timeout or no HTTP/1.1/n header inside the response.	200	Right response code.	500	Internal server error (wrong SOAP service, etc.).	other	See: http://www.w3.org/Protocols/rfc2616/rfc2616-sec10.html
8888	Parameter Target web page is wrong configured. This parameter must be longer then 5 characters.																										
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-1	Timeout. Server timeout during 800 ms.																										
0	TCP connection established, but no HTTP/1.1/n header.																										
100	Right response code.																										
other	See: http://www.w3.org/Protocols/rfc2616/rfc2616-sec10.html																										
kod2 (return code to the XML data)																											
9999	Device SOAP service is disabled or no SOAP request yet.																										
8888	Parameter Target web page is wrong configured. This parameter must be longer then 5 characters.																										
7777	TCP connection opening or timeout or no HTTP/1.1/n header inside the response.																										
200	Right response code.																										
500	Internal server error (wrong SOAP service, etc.).																										
other	See: http://www.w3.org/Protocols/rfc2616/rfc2616-sec10.html																										
File SOAP	SOAP file exist test (only file name check, file content is not verified) ok file exists not found file is not present on web pages																										

Diagnostic example, if all is right:

SOAP

```
Cnt (req/ok): 10/10           10/10 requests was delivered
Err. cnt(sock/req1/req2): 0/0/0 error counters shows zeros, that is also right
Last code (req1/req2): 100/200 req1 code 100 a reg2 code 200
File SOAP: ok              file SOAP was found at web pages area
```

2.6 PHP example for SOAP service

This chapter describes a simple PHP service for SOAP messages from Hx5xx family devices. Example uses Apache (2.2.10) web server and PHP (5.2.6). It is necessary install and enable SOAP extension for PHP. Example catch SOAP message from the device and store values to the hard disk. For more information about SOAP services and PHP see: <http://php.net/soap>.

```
<?
function InsertHx5xxSample($passKey, $device, $temp, $relHum, $compQuant, $pressure,
    $alarms, $rel, $re2, $in1, $in2, $in3, $inAlarms, $compType,
    $tempU, $pressureU, $timer) {

    $data = "Time: ".StrFTime("%y/%m/%d %H:%M:%S", Time()), Temp: ".$temp.
        ", RH: ".$relHum.", CV: ".$compQuant.", Pressure: ".$pressure."\n";
    $file_write = FOpen("soap.log", "a");
    FWrite($file_write, $data);
    FClose($file_write);
}

$server = new SoapServer(null, array('uri' => "http://test-uri/"));
$server->addFunction('InsertHx5xxSample');
$server->handle();
?>
```

2.7 ASP.NET SOAP service example

This is a simple example of the SOAP catching service for ASP.NET. Example is written by the C# language. This service catch SOAP messages from Hx5xx devices and this data save to `soap.log` file at drive C:.

```
using System;
using System.Collections;
using System.ComponentModel;
using System.Data;
using System.Linq;
using System.Web;
using System.Web.Services;
using System.Web.Services.Protocols;
using System.Xml.Linq;
using System.IO;
using System.Text;
using System.Web.Services.Description;

namespace TransmittersWebService
{
    /// <summary>
    /// Example of web service for obtaining values from Hxxxx regulators
    /// </summary>

    [SoapDocumentService(RoutingStyle = SoapServiceRoutingStyle.RequestElement)]
    [WebService(Namespace = "http://cometsystem.cz/schemas/soapHx5xx.xsd")]

    public class HxxxxWebService : System.Web.Services.WebService
    {
        [WebMethod(Description = "Example of processing sample from Hxxxx regulator.")]

        public bool InsertHx5xxSample(string passKey, string device, string temp,
            string relHum, string compQuant, string pressure,
            string alarms, string rel, string re2, string in1,
            string in2, string in3, string inAlarms,
            string compType, string tempU, string pressureU,
            string timer)
        {
            string data = "Time: " + DateTime.Now.ToString()
                + ", serial number: " + passKey
                + ", Temp: " + temp
                + ", Unit: " + tempU;

            FileStream fs = new FileStream("c:\\soap.log", FileMode.Append);
            StreamWriter w = new StreamWriter(fs, Encoding.ASCII);
            w.WriteLine(data);
            w.Flush();
            w.Close();
            fs.Close();
            return true;
        }
    }
}
```

3. E-mail – protocol SMTP

Hx5xx device can send an e-mail if measured value alarm occurred. For e-mail sending is used SMTP protocol. Device signalizes limits overflow and binary inputs and relays state change.

3.1 Supported authentication protocols

Dive use for sending an e-mail SMTP protocol (TCP port 25). Device supports SMTP server with and without authentication – see:

Auth type	Description	Supported
without auth	SMTP server login without authentication. Use this option if local SMTP server without authentication is available.	✓
AUTH LOGIN	Base on base64 authentication algorithm. Use two commands for password and user name transitions.	✓
AUTH PLAIN	Authentication via base64 . Use one command for send password and user name.	
CRAM-MD5	Encrypted login process.	
SSL	Encrypted communication between clients and the SMTP server.	

3.2 SMTP protocol configuration

This table describes SMTP protocol configuration parameters:

Parameter	Description	Example/Conf. dialog label
Enable SMTP protocol	Enabling of sending warning e-mails after alarm activation.	E-mail Sending Enable: Y
IP address of SMTP server	IP address of SMTP server. If SMTP server isn't at the local network it is necessary setup network gateway also (gateway IP address).	IP address of SMTP server: 192.186.1.2
Shot e-mail?	Device send e-mail message without alarm configuration, if you choice this option (Y).	Short e-mail: Y
Sensor e-mail adress	Sensor e-mail address is sensor@IP , if you choice default sender. But if default sender isn't selected, you can setup own sensor e-mail address. It is perhaps necessary setup sensor e-mail address, if SMTP auth is enabled (probably same text as SMTP auth user). For more information please connect your internet provider.	Default mailfrom address: Y Sensor e-mail address: sensor@mynet.com
SMTP auth	Please insert SMTP auth user and SMTP auth password if you select SMTP authentication (Y).	SMTP authentication: Y SMTP auth user: sensor@mynet.com SMTP auth password: psw
E-mail address of receiver	3x address for mail e-mail delivery	

3.3 E-mail examples

Standard e-mail:

Action: Testing message

Actual values:

Temperature: 23.5 °C
Relative humidity: 29.7 %
Absolute humidity: 6.3 g/m³
Pressure: 1005.2 hPa
Relay:
 RE1 is closed
 RE2 is open
Inputs:
 Input BIN1 is high
 test is high
 Input BIN3 is high

Alarm settings:

Temperature: Upper Limit: 300.0 °C, Lower Limit: -200.0 °C, Hysteresis: 1.0 °C,
Alarm Delay: 30 s
Relative Humidity: Upper Limit: 100.0 %RH, Lower Limit: 0.0 %RH, Hysteresis: 1.0 %RH,
Alarm Delay: 30 s
Absolute humidity: Upper Limit: 80.0 g/m³, Lower Limit: -50.0 g/m³, Hysteresis: 1.0
g/m³, Alarm Delay: 30 s
Pressure: Upper Limit: 1100.0 hPa, Lower Limit: 600.0 hPa, Hysteresis: 1.0 hPa, Alarm
Delay: 30 s

Relay RE1: Alarm: 129.7 hPa, Hysteressis: 1.5 hPa, Alarm delay: 5 s
Relay RE2: Alarm: 28.0 °C, Hysteressis: 0.5 °C, Alarm delay: 1 s

Inputs: BIN1: Send alarm: lo -> hi, Alarm delay: 10 s
Inputs: BIN2: Send alarm: ---, Alarm delay: 30 s
Inputs: BIN3: Send alarm: ---, Alarm delay: 30 s

For actual info visit local sensor: <http://192.168.1.35> . Have a nice day.

Short e-mail:

Action: Testing message

Actual values:

Temperature: 23.5 °C
Relative humidity: 29.7 %
Absolute humidity: 6.3 g/m³
Pressure: 1005.2 hPa
Relay:
 RE1 is closed
 RE2 is open
Inputs:
 Door left is low
 Smoke sensor is low
 Input BIN3 is high

For actual info visit local sensor: <http://192.168.1.35> . Have a nice day.

3.4 Diagnostic

Hx5xx device provides this ways for SMTP diagnostic:

- SNMP Trap and Syslog message sending if e-mail sending error occurs
- Diagnostic via web pages

3.4.1 SNMP Trap a Syslog error messages

If e-mail sending error courses, device sends following messages:

Trap	Text Trap/Syslog	Description
1/6	EMAIL send error 1	SMTP server connection error. SMTP server is unreadable (check SMTP server IP address and port - 25). E-mail wasn't send.
1/7	EMAIL send error 2	SMTP server login error. SMTP server isn't supported or wrong server type (some server on port 25, but probably it isn't SMTP server). This message is also shown if SMTP server active refuse connection. E-mail wasn't send.
1/8	EMAIL send error 3,4	Some error during communication occurs. This message is also send if SMTP auth is unsuccessfully. E-mail wasn't probably sent.

3.4.2 Diagnostic via web pages

Device provides SMTP diagnostic via web. To web browser insert <http://device IP address/diag> (e.g.: <http://192.168.1.213/diag>). Following items describes SMTP diagnostic:

Email

```
Last email: 9999: Unknown.
Cnt (req/ok): 0/0
Err. cnt (sock/helo/auth/some): 0/0/0/0
```

Item	Description
Last email	Return code from last e-mail send, where: X: Unknown. – Unknown status or no e-mail request yet. 0: Last e-mail sent successfully. – E-mail was right delivered to the SMTP server. 1: Last e-mail wasn't send. SMTP server not responding. – Isn't possible connect to the SMTP server now. Please check SMTP server IP address (eventually network gateway address). 2: Last e-mail wasn't send. Wrong welcome response. – SMTP server sends wrong welcome code. Server refuse transaction or device not supports this SMTP server. 3: Last e-mail probably wasn't send. Wrong response code. – Some error during e-mail sending. E-mail wasn't probably sent. 4: Last e-mail probably wasn't send. SMTP Auth fail. – SMTP auth error (wrong password or user name, etc.). E-mail wasn't probably sent.
Cnt (req/ok)	E-mail requests and successfully sent counter.
Err. cnt (sock/helo/auth/some)	E-mail error counters: sock – number or SMTP server connection errors (code nr. 1) helo – number or connection establishment errors (code nr. 2) auth – number or SMTP auth errors (code nr. 4) some – number or SMTP communication errors (code nr. 3)

4. Syslog protocol

Device can send warning and error messages via Syslog protocol (using UDP protocol on port 514). Syslog message is also send if measured value alarm occurred. Device sends following Syslog messages:

Syslog message	Description
<00001> Device restart	Ethernet interface restart
<00002> Alarm Relay 1 is Closed/Open	Relay is opened/closed
<00002> Alarm Relay 2 is Closed/Open	
<00002> Alarm Input 1 is High/Low	Indicate raising/falling edge alarm
<00002> Alarm Input 2 is High/Low	
<00002> Alarm Input 3 is High/Low	
<00002> Alarm Temperature High/Low	Measured value alarm occurred
<00002> Alarm Humidity High/Low	
<00002> Alarm Dew point High/Low	
<00002> Alarm Pressure High/Low	
<00004> SOAP Halted. Hostname error	SOAP sending error
<00004> SOAP delivery error	
<00004> SOAP connection error	
<00004> Email send error 3,4	E-mail sending error message
<00004> Email send error 2	
<00004> Email send error 1	
<00004> Settings changed	Device configuration was changed via Modbus or SNMP
<00004> Firmware uploaded	New firmware was uploaded
<00004> NTP connection error	Time synchronization error with SNTP server
<00006> Testing message	Testing Syslog message
<00006> Clearing Temperature Alarm	Alarm clearing message
<00006> Clearing Humidity Alarm	
<00006> Clearing Dew point Alarm	
<00006> Clearing Pressure Alarm	

5. SNMP protocol

By the SNMP protocol is possible read values from the device. For right OID (Object identifier) assignment is a MIB table necessary. MIB tables are available at the manufactures web pages. Device supports only SNMP version 1. In case of alarm activation, warning message (a SNMP Trap) can be sent to specified addresses. SNMP Trap can be send to the 3 independent IP address. Traps description:

Trap	Description			
0/0	Ethernet interface restart			
1/0	Testing SNMP Trap			
1/1	Time synchronization error with SNTP server			
1/2	New firmware was uploaded			
1/3	SOAP sending error message			
1/4				
1/5				
1/6	E-mail sending error message			
1/7				
1/8				
1/9	Device configuration was changed via Modbus or SNMP			
6/3	Measured value (temperature, relative humidity, computed value, pressure) alarm occurred/clearing			
6/11 - 6/55	11	Relay RE1 closed	10	Relay RE1 is opened
	21	Relay RE2 is closed	20	Relay RE2 is opened
	31	BIN1 closed->open (raising edge)	30	BIN1 open->closed (falling edge)
	41	BIN2 closed->open (raising edge)	40	BIN2 open->closed (falling edge)
	51	BIN3 closed->open (raising edge)	50	BIN3 open->closed (falling edge)

6. Modbus protocol

It is possible read actual measured values via Modbus TCP protocol. For data transport is used TCP protocol on port 502. Port configuration is allowed. Maximal number of client transaction is set to 1. Multiple parallel request sending is prohibited (you can send requests only one after another, requesting site must wait for response deliver before new request sending). Some important information about Modbus protocol you can find at: <http://www.modbus.org/specs.php>.

6.1 Modbus address table

Supported Modbus commands:

Command	Code	Description
Read multiple register(s)	0x03	Reads 16 bit register(s)
Write multiple register(s)	0x10	Writes 16 bit register(s)

Modbus registers of regulator:

Variable	Unit	Format	Address [hex]	Address [dec]	Status
measured temperature	°C, °F	Int*10	0x0031	49	r
measured relative humidity (RH)	%	Int*10	0x0032	50	r
computed value (CV)	CV depend	Int*10	0x0033	51	r
measured barometric pressure	CV depend	Int*X	0x0034	52	r
device serial number Hi	-	BCD	0x1035	4149	r
device serial number Lo	-	BCD	0x1036	4150	r
relay 1 status [0/1]	-	Int	0x003B	59	r
relay 2 status [0/1]	-	Int	0x003C	60	r
binary input 1 status [0/1]	-	Int	0x003D	61	r
binary input 2 status [0/1]	-	Int	0x003E	62	r
binary input 3 status [0/1]	-	Int	0x003F	63	r
far relay 1 control [0 – relay open, 1 – relay closed] (see below)	-	Int	0x0042	66	r/w
far relay 2 control [0 – relay open, 1 – relay closed] (see below)	-	Int	0x0043	67	r/w
status of all binary inputs (bit0, 1, 2)	-	Int	0x0008	8	r
status word (described below)	-	Int	0x0007	7	r
firmware version Hi	-	BCD	0x3001	12289	r
firmware version Lo	-	BCD	0x3002	12290	r
lower limit for temperature	°C, °F	Int*10	0x5001	20481	r/w
upper limit for temperature	°C, °F	Int*10	0x5002	20482	r/w
lower limit for humidity	%	Int*10	0x5003	20483	r/w
upper limit for humidity	%	Int*10	0x5004	20484	r/w
lower limit for computed value	CV depend	Int*10	0x5005	20485	r/w
upper limit for computed value	CV depend	Int*10	0x5006	20486	r/w
emperature hysteresis	°C, °F	Int*10	0x5007	20487	r/w
temperature time delay	s	uInt	0x5008	20488	r/w
RH hysteresis	%	Int*10	0x5009	20489	r/w
RH time delay	s	uInt	0x500A	20490	r/w
computed value hysteresis	CV depend	Int*10	0x500B	20491	r/w
computed value time delay	s	uInt	0x500C	20492	r/w

Variable	Unit	Format	Address [hex]	Address [dec]	Status
temperature alarm status	-	ASCII ^{a)}	0x500D	20493	r
RH alarm status	-	ASCII ^{a)}	0x500E	20494	r
computed value alarm status	-	ASCII ^{a)}	0x500F	20495	r
lower pressure limit	CV depend	Int*X	0x5010	20496	r/w
upper pressure limit	CV depend	Int*X	0x5011	20497	r/w
pressure hysteresis	CV depend	Int*X	0x5012	20498	r/w
pressure limit status	-	ASCII ^{a)}	0x5013	20499	r
pressure time delay	s	uInt	0x5014	20500	r/w
relay 1 alarm status	-	ASCII ^{b)}	0x5015	20501	r
relay 2 alarm status	-	ASCII ^{b)}	0x5016	20502	r
binary input 1 alarm status	-	ASCII ^{c)}	0x5017	20503	r
binary input 2 alarm status	-	ASCII ^{c)}	0x5018	20504	r
binary input 3 alarm status	-	ASCII ^{c)}	0x5019	20505	r
binary input 1 time delay	s	uInt	0x501A	20506	r/w
binary input 2 time delay	s	uInt	0x501B	20507	r/w
binary input 3 time delay	s	uInt	0x501C	20508	r/w

Legend:

- r register is designed for read
- w register is designed for write
- Int*10 register is in format of integer*10
- Int*X register is in format of integer*10, int*100, int*1000 depend on type
- BCD register is in format of BCD
- uInt register is at range of 0-65535
- ASCII character, where:
 - a) Temperature, RH, computed value, pressure alarm status
 - no no alarm
 - lo value is bigger than specified upper limit
 - hi value is lower than specified lower limit
 - b) Relay alarm status:
 - op no alarm
 - cl relay is closed, alarm is signaled
 - c) Binary inputs alarm status:
 - no no alarm
 - lo alarm on falling edge
 - hi alarm on raising edge
- Status word: 16b value return, bite description:
 - Bit0 0/1 jumper open/closed
 - Bit3 0/1 relay 1 open/closed
 - Bit4 0/1 relay 2 open/closed
 - Bit5 0/1 internal acoustic alarm status
 - Bit6 0/1 binary input 1 status
 - Bit7 0/1 binary input 1 status
 - Bit8 0/1 binary input 1 status
- Far relay control: open/close relay through Modbus protocol. Before using remote relay control option is necessary setup FAR0 or FAR1 to the relay.
 - FAR0 remote relay control, after device reboot relay is open
 - FAR1 remote relay control, after device reboot

6.2 Alarm relay condition configuration

Follow next steps:

1. To address 0x0044 (68) write value 1 – it enables Modbus setting. By the way it blocks regulator’s keyboard – local keyboard is blocked during remote control setting change.
2. Write the desired settings / changes to the addresses from 0x0045 (69) to 0x004E (78). New setting can be done simultaneously or each register can be written alone
3. To address 0x004F (79) write value 1. Once this step is done, new setting is physically stored into device memory (confirm change). Then registers 0x004F (79) and 0x0044 (68) are automatically cleared (zero). It automatically unlocks the keyboard too. Then Ethernet interface will be restarted – history memory will be cleared. TCP connection (Modbus communication channel) will be closed. Whole setting process can be cancelled by writing value 0 to address 0x0044 (68). At this time no changes are stored and last setting stays valid.

Function	Unit	Description	Address [hex]	Address [dec]	Status
Modbus Remote Control	-	0 ... disable 1 ... enable (for this time device’s keyboard is blocked, if key is pressed, message BLOC is shown)	0x0044	68	R/W
Value assigned to output relay 1	by value	0 ... off 1 ... temperature 2 ... relative humidity 3 ... atmospheric pressure 4 ... computed value 5 ... binary input 1 6 ... binary input 2 7 ... binary input 3 8 ... Far condition 0 9 ... Far condition 1	0x0045	69	R/W
When close relay 1	-	0 ... alarm occurs, when measured value is LOWER than preset alarm value 1 ...alarm occurs, when measured value is HIGHER than preset alarm value	0x0046	70	R/W
Alarm value for relay 1	by value	preset alarm value (threshold)	0x0047	71	R/W
Delay for relay 1	sec	Time in seconds Time in seconds that the condition must be valid to evaluate alarm	0x0048	72	R/W
Hysteresis of relay 1	by value	Value which must be set back below / above a given threshold in order to open the relay	0x0049	73	R/W
Value assigned to output relay 2	by value	0 ... off 1 ... temperature 2 ... relative humidity 3 ... atmospheric pressure 4 ... computed value 5 ... binary input 1 6 ... binary input 2 7 ... binary input 3 8 ... Far condition 0 9 ... Far condition 1	0x004A	74	R/W

Function	Unit	Description	Address [hex]	Address [dec]	Status
When close relay 2	-	0 ... alarm occurs, when measured value is LOWER than preset alarm value 1 .. alarm occurs, when measured value is HIGHER than preset alarm value	0x004B	75	R/W
Alarm value for relay 2	by value	preset alarm value (threshold)	0x004C	76	R/W
Delay for relay 2	sec	Time in seconds Time in seconds that the condition must be valid to evaluate alarm	0x004D	77	R/W
Hysteresis of relay 2	by value	Value which must be set back below / above a given threshold in order to open the relay	0x004E	78	R/W
Confirm changes	-	Read always as 0 write 1 ... physically stores new setup into device's memory, at the end the register is automatically reset to zero.	0x004F	79	R/W

All registers contains 16b number.

6.3 Modbus TCP protocol request

Request actual temperature readings (address 0x30H, word count: 1).

```

Transmission Control Protocol, Src Port: 3787 (3787), Dst Port: 502 (502), Seq: 0, Ack: 0, Len: 12
  Source port: 3787 (3787)
  Destination port: 502 (502)
  Sequence number: 0 (relative sequence number)
  [Next sequence number: 12 (relative sequence number)]
  Acknowledgement number: 0 (relative ack number)
  Header length: 20 bytes
  ⊕ Flags: 0x18 (PSH, ACK)
  window size: 65535
  ⊕ Checksum: 0x3be7 [correct]
Modbus/TCP
  transaction identifier: 0
  protocol identifier: 0
  length: 6
  unit identifier: 1
  Modbus
    function 3: Read multiple registers
    reference number: 48
    word count: 1
-----
0000  00 20 4a b0 0a cd 00 40 ca 85 9b 08 08 00 45 00  .J....@.....E.
0010  00 34 54 7d 40 00 80 06 21 f6 c0 a8 01 84 c0 a8  .4T}@...!.....
0020  01 7c 0e cb 01 f6 ef 7e 6d 1a a2 93 de 60 50 18  .|. ....~m....P.
0030  ff ff 3b e7 00 00 00 00 00 00 06 01 03 00 30    .;.....0
0040  00 01                                     ..

```

Response from the device (value 0x20H 0xf2H = 754DEC, = temperature 75,4 °F).

```

Transmission Control Protocol, Src Port: 502 (502), Dst Port: 3787 (3787), Seq: 0, Ack: 12, Len: 11
  Source port: 502 (502)
  Destination port: 3787 (3787)
  Sequence number: 0 (relative sequence number)
  [Next sequence number: 11 (relative sequence number)]
  Acknowledgement number: 12 (relative ack number)
  Header length: 20 bytes
  ⊕ Flags: 0x18 (PSH, ACK)
  window size: 255
  ⊕ Checksum: 0x470c [correct]
Modbus/TCP
  transaction identifier: 0
  protocol identifier: 0
  length: 5
  unit identifier: 1
  Modbus
    function 3: Read multiple registers
    byte count: 2
    Data
-----
0000  00 40 ca 85 9b 08 00 20 4a b0 0a cd 08 00 45 00  .@.....J.....E.
0010  00 33 30 c8 40 00 40 06 85 ac c0 a8 01 7c c0 a8  .30.@.@. ....|..
0020  01 84 01 f6 0e cb a2 93 de 60 ef 7e 6d 26 50 18  .....~m&P.
0030  00 ff 47 0c 00 00 00 00 00 00 05 01 03 02 02    ..G.....
0040  i2                                     .

```

7. Time synchronization via NTP protocol

The device allows time synchronization with SNTP server. If SNTP servers IP address is right configured, device after restart synchronize time with this server. Then device ask for actual time once a day. Also is necessary setup **UTC time shift**.

Time synchronization interval is set to 8 hours. Maximal time jitter between NTP synchronizations is 30 sec.

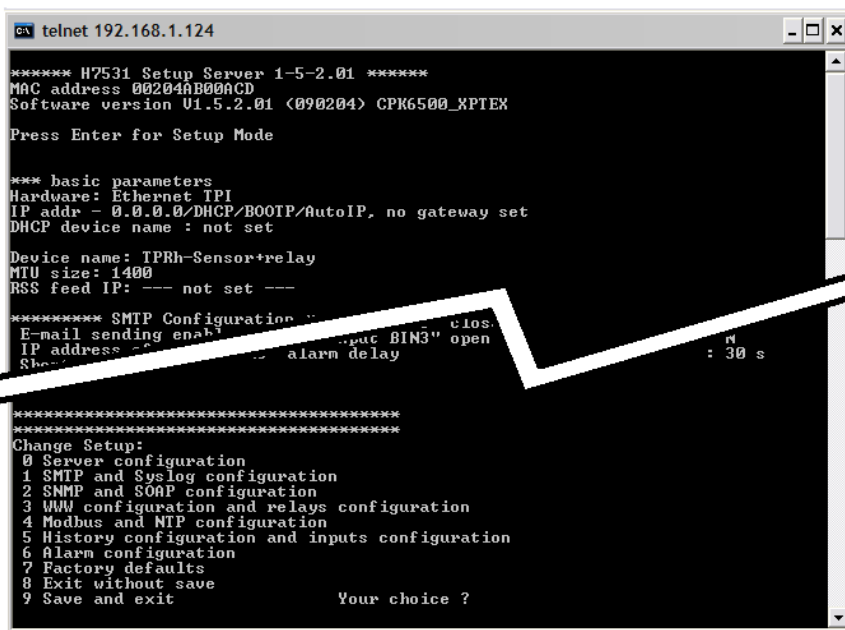
8. Device configuration via Telnet protocol

Setting is performed by means of Telnet, or TSensor program. In this document only settings through the Telnet will be described. Access to the setup can be protected by a password. If items in the Telnet are not confirmed within 5 minutes, the Telnet is ended and the device is restarted. Modified values will not be saved. Use the **save** and **exit** selection to store new values.

During setting of a value in the Setup it is not guaranteed the device works with correctly adjusted values. Correct values are set upon leaving the Telnet. Through the Telnet isn't possible set all device features (display settings, pressure units, relay setting and so on) accessible. Complete device configuration you can setup by the TSensor software.

8.1 Basic introduce

Device has a telnet setup on port 9999. For connection to the Telnet setup use command: **telnet <IP adresa> 9999** (e.g. **telnet 192.168.1.213 9999**).

A screenshot of a telnet window titled 'telnet 192.168.1.124'. The window displays the following text:

```
***** H7531 Setup Server 1-5-2.01 *****
MAC address 00204AB00ACD
Software version U1.5.2.01 <090204> CPK6500_XPTEX

Press Enter for Setup Mode

*** basic parameters
Hardware: Ethernet TPI
IP addr - 0.0.0.0/DHCP/BOOTP/AutoIP, no gateway set
DHCP device name : not set

Device name: TPRh-Sensor+relay
MTU size: 1400
RSS feed IP: --- not set ---

***** SMTP Configuration *****
E-mail sending enabled: yes
IP address: 0.0.0.0
SMTP server: 0.0.0.0
SMTP port: 25
SMTP alarm delay: 30 s

*****
Change Setup:
0 Server configuration
1 SMTP and Syslog configuration
2 SNMP and SOAP configuration
3 WWW configuration and relays configuration
4 Modbus and NTP configuration
5 History configuration and inputs configuration
6 Alarm configuration
7 Factory defaults
8 Exit without save
9 Save and exit

Your choice ?
```

Principle of entering a value in the Setup:

Telnet items are set by means of the command line. Enter any part of the Telnet by pressing keys 0-9 followed by the **Enter** key. The Telnet always prints the current value. If you do not want to change the value, go to the next item by pressing the **Enter** key. The best way to enter a blank string (e.g. as e-mail address) is to press a **space bar**, then erase it by the **backspace** and press **Enter**.

Contact your network administrator to get the correct values of the IP , mask, gateway. Entering incorrect values can cause the device be not found in the network or other complications!

8.2 Telnet items

Items	Description								
\- 0 Server configuration									
\- IP Address 	Setting IP address of the device. Code in brackets shows the current value. By pressing the Enter key the original setting will stay unchanged. Set the IP address to 0.0.0.0, device IP address is obtain by the DHCP server.								
\- Set Gateway IP Address 	Setting of the internet gateway (or gateway between LANs). The value need not be entered if the device will operate only in a local network.								
\- Netmask 	Setting of the network mask of your network. 0 means the standard preset value. Example: <table border="1" data-bbox="858 568 1241 698"> <thead> <tr> <th>Mask</th> <th>No. of bits</th> </tr> </thead> <tbody> <tr> <td>255.255.255.252</td> <td>2</td> </tr> <tr> <td>255.255.255.0</td> <td>8</td> </tr> <tr> <td>255.128.0.0</td> <td>23</td> </tr> </tbody> </table>	Mask	No. of bits	255.255.255.252	2	255.255.255.0	8	255.128.0.0	23
Mask	No. of bits								
255.255.255.252	2								
255.255.255.0	8								
255.128.0.0	23								
\- Change telnet config Password - Y	If you press key Y, telnet ask you for a new password.								
\-Enter new Password	Enter a new password for device configuration (max. 4 characters).								
\- Device name 	The description of the device. This description is displayed on WWW pages and in subjects of sent e-mails. Its maximum length is 63 characters.								
\- MTU size 	Maximal packet size. Default setting is 1400, range is from 512 to 1400. If you have some troubles with connection, try reducing the MTU size.								
\- RSS feed IP 	IP address for RSS feed. Setting address to 0.0.0.0, RSS use device IP address.								
\- 1 SMTP and Syslog config									
\- E-mail Sending Enable 	Enabling of sending warning e-mails after alarm activation. If N is left, no e-mails will be sent to the specified address.								
\- IP address of SMTP server	Setting of an IP of the SMTP server. Correct setting is required for the device to be able to send e-mails.								
\- Short e-mail	Sending e-mails without information about limits configuration.								
\- Default mailfrom address - N	Press Y for default e-mail sender address (sensor@[sensor's IP address]), N for user defined e-mail sender address.								
\- Change mailfrom address - Y	Press Y for user-defined e-mails sender address.								
\- Enter a new mailfrom address	Enter a new sender e-mail address (30 chars max.).								
\- SMTP authentication	Press Y for enable SMTP auth.								
\- SMTP auth user	Enter user name for SMTP authentication. Max. 29 chars.								
\- SMTP auth password	Enter password for SMTP authentication. Max. 14 chars.								
\- E-mail address of rec1 \- E-mail address of rec2 \- E-mail address of rec3	E-mail address of warning e-mail recipients. Maximal address length is 55 characters.								
\- Send test e-mail?	In case of confirmation a test e-mail is sent to the specified address.								
\- SysLog enable	Enable sending Syslog messages.								
\- SysLog server IP address	Syslog server IP address.								
\- Send SysLog message?	Send tasting Syslog message.								
\- 2 SNMP and SOAP config									
\- SNMP Traps Enable	Enabling/disabling of sending SNMP traps.								
\- SNMP community name for read	Setting of the password for access to SNMP MIB tables. Max. 12 chars.								
\- SNMP community name for write	Setting of the password for write to SNMP MIB table of the device. Max. 12 chars.								
\- Trap IP address 1 \- Trap IP address 2 \- Trap IP address 3	The IP address of recipients of SNMP traps.								

Items	Description
\- Send test trap?	Sends a test trap of type 1/0 to the specified IP address.
\- SOAP enable	Enable SOAP protocol.
\- Send SOAP if alarm occurs	Is some alarm occurs (temperature, RH, relays, inputs, etc.) SOAP message is sent. This message is posted out of the SOAP interval.
\- SOAP server IP address	IP address of SOAP server.
\- Target web page 	Path to web page (without http://), where the device send the message. Maximum length 100 characters.
\- Source port	Device's source port. Never set to 80!
\- Destination port	SOAP server destination port.
\- Sending interval	SOAP sending interval.
\- 3 WWW configuration and relays configuration	
\- WWW Enable	Enables the display of www pages.
\- Web Refresh time	Intervals for automatic page refresh (update of measured values). Range 10-65535 sec.
\- Send alarm when relay REx closed/open	Alarm configuration if relay is opened or closed.
\- 4 Modbus and NTP configuration	
\- Modbus Enable	Enable access to the device via Modbus protocol.
\- Set port	Set Modbus communication port.
\- Time synchronization Enable	Enable time synchronization with SNTP server.
\- IP address of NTP server	SNTP server IP address.
\- UTC time shift 	Time shift (in minutes) between device place and UTC (GMT) time. Summer time is not supported.
\- 5 History configuration and inputs configuration	
\- History Storage Time	Storing interval for logging to the history.
\- Input BINx name	Binary inputs name. Max. length 14 characters.
\- Send alarm when input BINx low -> high	Alarm configuration for binary input.
\- Send alarm when input BINx high -> low	
\- Input BINx alarm delay	Time delay for binary inputs.
\- 6 Alarm configuration	
\- xxx upper limit	Alarm configuration (upper and lower limits, hysteresis and time delays).
\- xxx lower limit	
\- xxx hysteresis	
\- xxx alarm delay	
\- 7 Factory defaults 	This operation restore factory configuration. IP address and subnet mask will stay unchanged.
\- 8 Exit without save	Telnet quit, without save or device restart.
\- 9 Save and exit	Saves modifications to the memory and resets the device.

9. Factory defaults

It is possible restore device to the factory defaults, if some configuration problems occur. Device has two different factory defaults. Software factory default (keep device IP adders and subnet mask) or hardware factory defaults (device IP address and subnet mask are also changed to factory state).

A software factory default is via Telnet or TSensor software. Hardware factory default procedure:

1. Power off device
2. Connect jumper (on the right site of the Ethernet interface)
3. Power on device, please wait approx. 20 sec.
4. Power off device
5. Disconnect jumper
6. Power on device. Device configuration will be changed to factory defaults. Device IP address is now set to **192.168.1.213** and subnet mask to **255.255.255.0**.

Following table describes factory defaults parameters:

Parameter	Default value	Factory default	
		HW	SW
Device IP address	192.168.1.213	✓	
Gateway IP address	not set	✓	✓
Subnet mask	255.255.255.0	✓	
Access password for configuration	not set	✓	✓
Device name/description	device type dependent	✓	✓
MTU size	1400	✓	✓
IP address for RSS feed	not set	✓	✓
Email sending enable	no	✓	✓
SMTP server IP address	not set	✓	✓
Send short e-mail	no	✓	✓
Default e-mail sender	yes	✓	✓
Sender e-mail address	sensor@[device IP address]	✓	✓
SMTP auth	no	✓	✓
SMTP auth user	not set	✓	✓
SMTP auth password	not set	✓	✓
E-mail address of receiver	not set	✓	✓
SNTP Trap sending enable	yes	✓	✓
Password for SMTP reading	public	✓	✓
Password for SMTP write	private	✓	✓
Trap IP address	not set	✓	✓
SOAP sending enable	no	✓	✓
Send SOAP if alarm occurs	no	✓	✓
SOAP server IP address	not set	✓	✓
SOAP URL	not set	✓	✓
SOAP source port	0	✓	✓
SOAP destination port	80	✓	✓

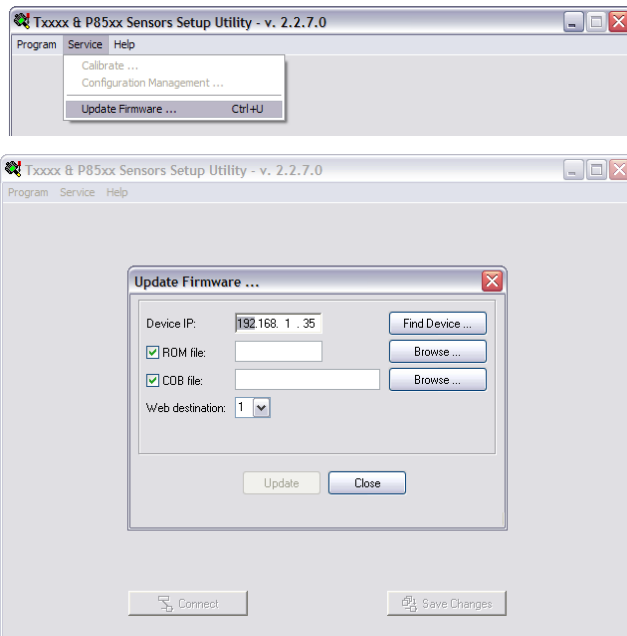
Parameter	Default value	Factory default	
		HW	SW
SOAP sending interval [sec]	60	✓	✓
WWW pages enable	yes	✓	✓
WWW refresh time [sec]	60	✓	✓
Relay alarm configuration	not set	✓	✓
Enable Modbus protocol	yes	✓	✓
Modbus port	502	✓	✓
Enable time synchronization	no	✓	✓
NTP server IP address	not set	✓	✓
UTC time shift [min]	0	✓	✓
History storage time/interval [sec]	60	✓	✓
Binary input 1 name	Input BIN1	✓	✓
Binary input 2 name	Input BIN2	✓	✓
Binary input 3 name	Input BIN3	✓	✓
Binary input alarm configuration	not set	✓	✓
Alarm delay for binary input 1 [sec]	30	✓	✓
Alarm delay for binary input 2 [sec]	30	✓	✓
Alarm delay for binary input 3 [sec]	30	✓	✓
Temperature alarm upper limit [°C, °F]	300	✓	✓
Temperature alarm lower limit [°C, °F]	-200	✓	✓
Temperature alarm hysteresis [°C, °F]	1	✓	✓
Temperature alarm delay [sec]	30	✓	✓
Relative humidity alarm upper limit [%]	100	✓	✓
Relative humidity alarm lower limit [%]	0	✓	✓
Relative humidity alarm hysteresis [%]	1	✓	✓
Relative humidity alarm time delay [sec]	30	✓	✓
Computed value alarm upper limit [-]	80	✓	✓
Computed value alarm lower limit [-]	-50	✓	✓
Computed value alarm hysteresis [-]	1	✓	✓
Computed value alarm time delay [sec]	30	✓	✓
Pressure alarm upper limit [-]	1100	✓	✓
Pressure alarm lower limit [-]	600	✓	✓
Pressure alarm hysteresis [-]	1	✓	✓
Pressure alarm time delay [-]	30	✓	✓

Notice: In particular cases (e.g. wrong configured subnet mask) it can't be possible change device IP address even via hardware factory defaults. In this cases change device IP address via TSensor software to 0.0.0.0 (device use to obtain an IP address DHCP server). Then try hardware factory default again.

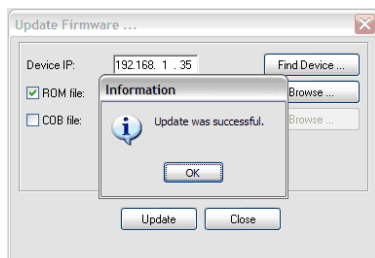
10. Ethernet firmware update

Customer can update Ethernet firmware if new version is available. For firmware update is necessary TSensor software. Use only firmware designed to this device. Firmware update procedure:

1. Download new firmware from manufactures web pages, install latest TSensor software. Unpack downloaded archive with firmware.
2. Turn on device and connect Ethernet connector.
3. Run TSensor with parameter `/service` (e.g. `C:\Program files\Cometloggers\TSensor\TSensor.exe /service`)
4. Open menu for firmware update. Insert device IP address and enter new firmware (**ROM file**) and new web pages (**COB file**) if necessary. Press button **update**.



5. Please wait while new firmware is uploading. This operation takes approx. one minute. After successfully upload, will be shown following message.



11. Communication ports

Following table contain Hx5xx ports list.

Port		Device is Client/ server	Service/Protocol	Change port nr.	Notice
Destin.	Source				
TCP/80		server	Embedded WWW server		
TCP/502		server	Protocol Modbus TCP	✓	
TCP/25		client	SMTP		Protocol for E-mail sending
TCP/80	TCP/8080	client	SOAP	✓	Active sensing via TCP/HTTP
UDP/514	UDP/514	client	Syslog protocol		Active sensing via UDP/Syslog
UDP/161		server	SNMP v1		
UDP/162	UDP/162	client	SNMP – Trap		Active sensing via UDP/SNMP – Trap
TCP/9999		server	Telnet		Protocol for device configuration
UDP/123	UDP/123	client	SNTP		Synchronization with time server
UDP/30718		server	Configuration protocol		Lantronix & Comet UDP configuration command set
UDP/69		server	New firmware upload		New firmware upload via TFTP
TCP/6666		server	New firmware upload		Upload new firmware for MSP via tunnel
ICMP/echo		server	Ping response		Ping can't be deactivated.

12. Document revision table

Following table describe changes between Ethernet firmware versions.

Date	Document revision	Firmware version	Web version
22.12.2008	IE-SNC-H_x5xx-apx-01	1.5.2.00	4.00
02.03.2009	IE-SNC-H_x5xx-apx-02	1.5.2.02	4.02
06.05.2009	IE-SNC-H_x5xx-apx-03	1.5.2.03	4.02
10.06.2010	IE-SNC-H_x5xx-apx-04	04.06 / 1.5.2.04	4.03