USER'S GUIDE

Vaisala Humidity and Temperature Probes HMP60, HMP110 and HMP110T

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CHAPTER 1
GENERAL INFORMATION

This chapter provides general notes for the manual and the products.

About This Manual

This manual provides information for installing, operating, and maintaining Vaisala Humidity and Temperature Probes HMP60, HMP110 and HMP110T.

Contents of This Manual

This manual consists of the following chapters:

- Chapter 1, General Information, provides general notes for the manual and the products.
- Chapter 2, Product Overview, introduces the product features and options.
- Chapter 3, Installation, provides you with information that is intended to help you install the product.
- Chapter 4, Operation, contains information that is needed to operate the product.
- Chapter 5, Maintenance, provides information that is needed in basic maintenance of the product.
- Chapter 6, Troubleshooting, describes common problems, their probable causes and remedies, and contact information for technical support.
- Chapter 7, Technical Data, provides the technical data of the product.

Version Information

Table 1   Manual Revisions

Manual Code	Description
M211060EN-C	June 2011. This manual. Applicable from software version 1.05.2 onward. Probe material changed to stainless steel. Technical specification updated.
M211060EN-B	Previous version. New probe type HMP110T added. Serial command AOVER added in software version 1.03. Serial command descriptions updated. Technical specification updated.

Related Manuals

Table 2   Related Manuals

Manual Code	Manual Name
M211059EN	HMP60, HMP110 and HMP110T Quick Guide
M211106EN	Loop Power Converter Quick Reference Guide
M211080EN	Mounting Flange for Humidity Probes Quick Reference Guide

Documentation Conventions

Throughout the manual, important safety considerations are highlighted as follows:

WARNING	Warning alerts you to a serious hazard. If you do not read and follow instructions very carefully at this point, there is a risk of injury or even death.

CAUTION	Caution warns you of a potential hazard. If you do not read and follow instructions carefully at this point, the product could be damaged or important data could be lost.

NOTE	Note highlights important information on using the product.

Safety

The product delivered to you has been tested for safety and approved as shipped from the factory. Note the following precautions:

WARNING	Ground the product, and verify outdoor installation grounding periodically to minimize shock hazard.

CAUTION	Do not modify the unit. Improper modification can damage the product or lead to malfunction.

ESD Protection

Electrostatic Discharge (ESD) can cause immediate or latent damage to electronic circuits. Vaisala products are adequately protected against ESD for their intended use. It is possible to damage the product, however, by delivering electrostatic discharges when touching, removing, or inserting any objects inside the equipment housing.

To make sure you are not delivering high static voltages yourself:

- Handle ESD sensitive components on a properly grounded and protected ESD workbench.
- When an ESD workbench is not available, ground yourself to the equipment chassis with a wrist strap and a resistive connection cord.
- If you are unable to take either of the above precautions, touch a conductive part of the equipment chassis with your other hand before touching ESD sensitive components.
- Always hold component boards by the edges and avoid touching the component contacts.

Recycling

	Recycle all applicable material.

	Dispose of batteries and the unit according to statutory regulations. Do not dispose of with regular household refuse.

Regulatory Compliances

The HMP60, HMP110 and HMP110T are in conformity with the provisions of the following EU directive(s):

ROHS Directive (2002/95/EEC)
WEEE Directive (2002/96/EEC)
EMC Directive (2004/108/EC)

The electromagnetic compatibility of the HMP60, HMP110 and HMP110T has been tested according to the following product family standards:

EN 61326-1: Electrical equipment for measurement, control and laboratory use - EMC requirements – for use in industrial locations.

EN 55022 Class B: Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement.

$$C \in$$

Patent Notice

The HMP60 and HMP110 are protected by the following patents and patent applications and their corresponding national rights:

Finnish patent 98861, French patent 6650303, German patent 69418174, Japanese patent 3585973, UK patent 0665303, U.S. patent 5607564.

Trademarks

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Windows® is a registered trademark of Microsoft Corporation in the United States and/or other countries.

License Agreement

All rights to any software are held by Vaisala or third parties. The customer is allowed to use the software only to the extent that is provided by the applicable supply contract or Software License Agreement.

Warranty

Visit our Internet pages for more information and our standard warranty terms and conditions: www.vaisala.com/services/warranty.html.

Please observe that any such warranty may not be valid in case of damage due to normal wear and tear, exceptional operating conditions, negligent handling or installation, or unauthorized modifications. Please see the applicable supply contract or Conditions of Sale for details of the warranty for each product.

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CHAPTER 2
PRODUCT OVERVIEW

This chapter introduces the product features and options.

Introduction to HMP60, HMP110, and HMP110T

Vaisala Humidity and Temperature Probes HMP60 and HMP110 are simple and cost-effective humidity transmitters suitable for volume applications, integration into other manufacturers' equipment, incubators, glove boxes, greenhouses, fermentation chambers, and data loggers.

HMP60 uses the interchangeable Vaisala INTERCAP® sensor. No recalibration is required after sensor replacement.

HMP110 uses the Vaisala HUMICAP® 180R sensor for increased accuracy. The HMP110 requires calibration after sensor replacement. This can be done on the serial line using the optional Vaisala USB cable.

0912-101

Figure 1   HMP60 (Left) and HMP110 (Right)

Table 3   Quantities Measured by the HMP60 and HMP110

Quantity	Abbreviation	Metric Unit	Non Metric Unit
Relative humidity	RH	%RH	%RH
Dewpoint/Frostpoint temperature*	$T_{d/f}$	ºC	ºF
Temperature	T	ºC	ºF

* When the dewpoint is below 0 °C, the probe outputs frostpoint for T_d

HMP110T is a temperature measurement only version of the HMP110 probe. It has the same temperature measurement performance and specifications as the HMP110, but is not equipped with a humidity sensor.

Table 4   Quantities Measured by the HMP110T

Quantity	Abbreviation	Metric Unit	Non Metric Unit
Temperature	T	ºC	ºF

Basic Features and Options

- HMP60 and HMP110 analog output mode: two analog output channels, selectable from 0 ... 1 V / 0 ... 2.5 V / 0 ... 5 V / 1 ... 5 V

- HMP110T: analog output mode: single analog output channel (CH1), selectable from 0 ... 1 V / 0 ... 2.5 V / 0 ... 5 V / 1 ... 5 V

- RS-485 output mode

- Small size

- Low power consumption

- IP65 stainless steel body

- Options and accessories:

    - Filter options: plastic grid filter, membrane filter, and stainless steel sintered filter

    - Probe mounting clamp

    - Probe mounting flange

    - Duct installation kit

    - One channel loop power converter 4 ... 20 mA (separate module, compatible with humidity accuracy only)

    - Shielded 0.3 m and 3.0 m connection cables with threaded connector for probe connection, open end wires on the other end

    - Plastic M12 installation nuts

Filter Options

The available filters for HMP60, HMP110 and HMP110T are shown in Figure 2 below. For order codes, see section Options and Accessories on page 62.

1001-008

Figure 2   Filter Options

Table 5   Filter Properties

No.	Filter	Diameter	Pore Size
1	Plastic grid filter (fastest response time)	12 mm	-
2	Membrane filter	12 mm	0.2 µm
3	Stainless steel sintered filter	12 mm	38 µm

Installation Accessories (Optional)

Probe Mounting Clamp

The optional mounting clamp makes it easy to install the probe on the wall of the measurement environment. The probe can be detached for calibration simply by loosening the lower screw.

1001-138

Figure 3   Probe Mounting Clamp in Use

Probe Mounting Flange

The probe mounting flange is a silicone flange that can be used to hold the probe in a through-wall installation. The flange is a general purpose mounting accessory for Ø 12mm probes, and comes with a sealing plug for coaxial cables that is not needed when the flange is used with HMP60, HMP110 and HMP110T.

0911-109

Figure 4   Probe Mounting Flange

Duct Installation Kit

The duct installation kit includes a plastic pipe with a flange (Vaisala order code: 215619). To install the probe with the duct installation kit, drill a hole to the duct wall, assemble the probe to the duct installation kit, slide the probe head through the hole, and attach the flange to the duct wall with four screws. See page 20 for details.
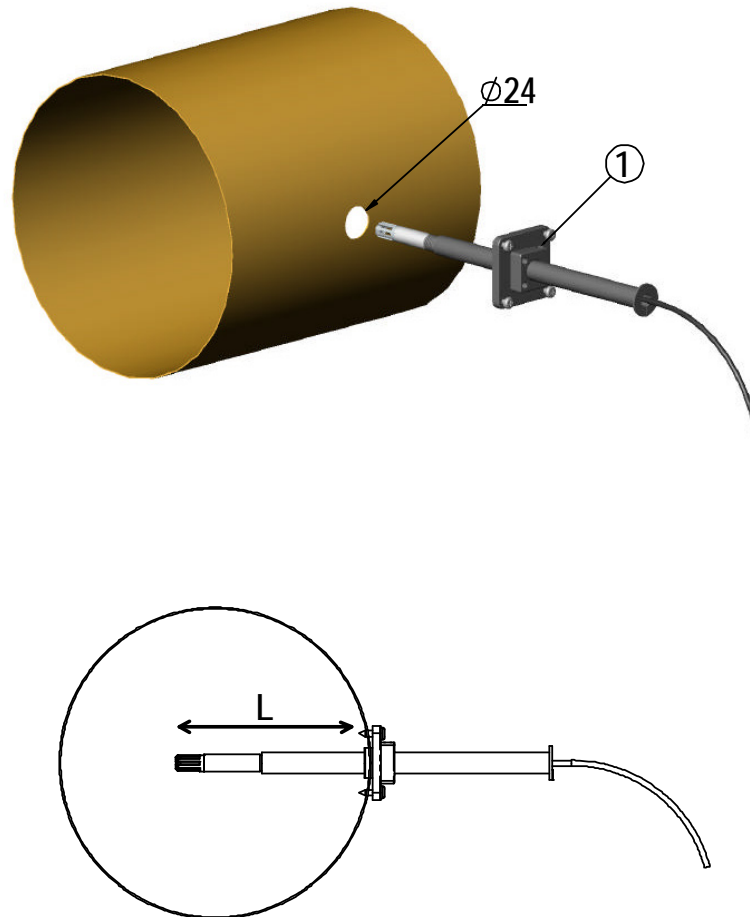
0505-176

Figure 5   Probe Installation with the Duct Installation Kit

The following explanations refer to Figure 5 above:

1   =   Tension screw

Distance L can be adjusted and locked in place with the tension screw.

Loop Power Converter

The loop power converter is an open frame module that converts one
0 ... 2.5 VDC voltage output to a 4 ... 20 mA current output. To use the
loop power converter module, the probe:

- must be in the analog output mode
- the desired quantity must be on channel 1
- channel 1 must be scaled to 0 ... 2.5 V

Wiring instructions are provided in section Wiring with the Loop Power
Converter on page 22.

1001-001

Figure 6   Loop Power Converter

Cables

The probe cables have a standard M8 connector. Also other compatible M8 series cables can be used.

0910-135

Figure 7   Cable with Threaded Connector

The USB Serial Interface Cable uses a snap-on connector. The USB cable is intended for maintenance purposes only, not for permanent installation.

0809-002

Figure 8   USB Serial Interface Cable

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CHAPTER 3
INSTALLATION

This chapter provides you with information that is intended to help you install the product.

Dimensions
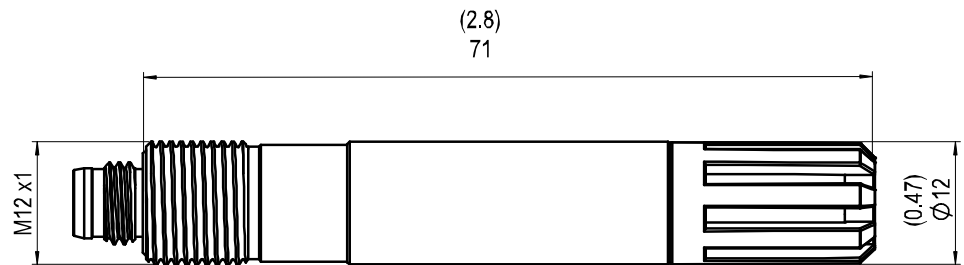
0912-103

Figure 9   HMP60, HMP110, and HMP110T Dimensions
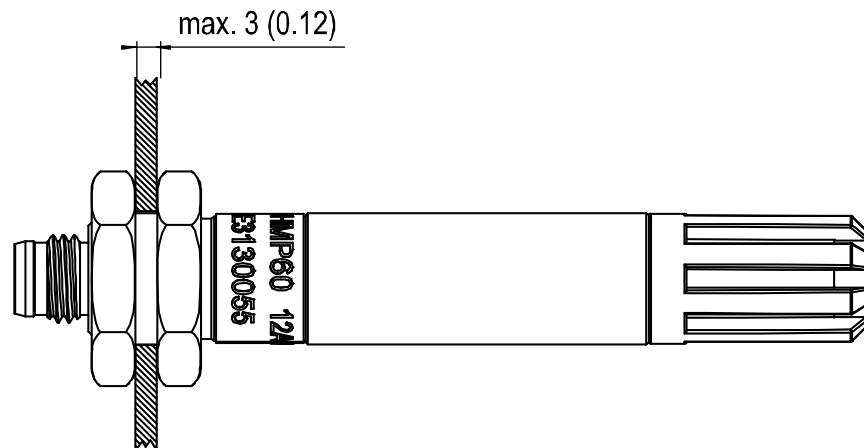
0912-102

Figure 10   Installation with Plastic M12 Nuts, Dimensions

Mounting the Probe

HMP60, HMP110 and HMP110T are designed to be mounted from the M12 thread on the probe body or from the smooth part of the probe body. For a convenient installation, use the optional installation accessories:

- Use the plastic mounting nuts to hold the probe in a through-wall installation.
- Use the probe mounting clamp to hold the probe on a wall.

NOTE	Avoid placing the probe in a place where condensation can run onto the sensor.

Probe Assembly with Duct Installation Kit
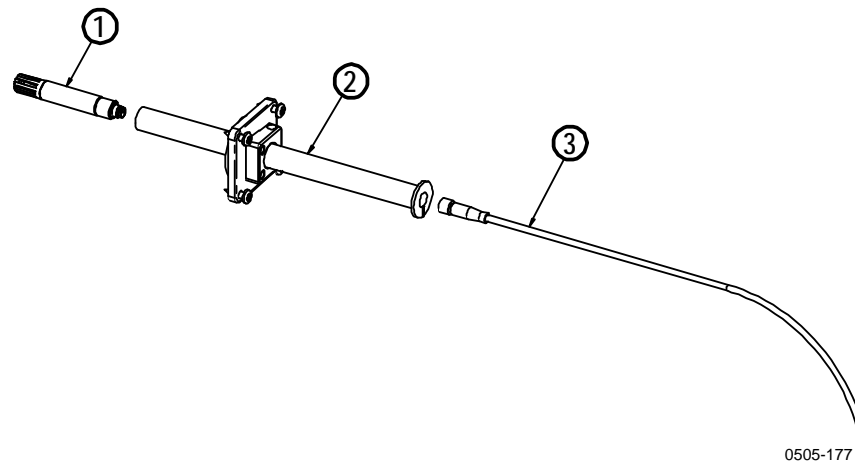
0505-177

Figure 11   Assembly of the Probe with Duct Installation Kit

The following numbers refer to Figure 11 above:

1   =   HMP60, HMP110 or HMP110T probe
2   =   Duct installation kit
3   =   Probe cable

1.   Slide the probe cable through the duct installation kit plastic pipe.

2.   Attach the cable to the probe.

3.   Attach probe assembly to the duct.

Drilling Instructions for Duct Installation Kit
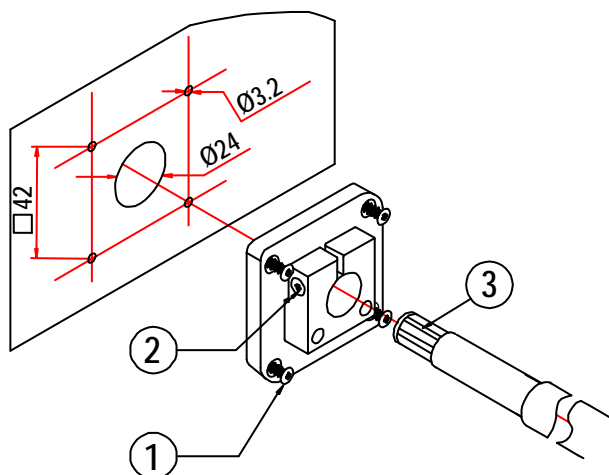
0505-178

Figure 12   Drilling Instructions

The following numbers refer to Figure 12 above:

1   =   Mounting screw
2   =   Tension screw
3   =   Probe assembled in duct installation kit plastic pipe

Drill the holes for the duct installation kit as follows:

1.   Use a 24-mm drill bit to drill a hole to the duct wall for the
        humidity probe.
2.   Drill holes for the duct installation kit mounting screws around the
        hole in a square arrangement, 42 mm apart from each other. Use a
        3.2-mm drill bit to drill the holes for the mounting screws
        (four ST4.2×16-C-Z DIN 7981 screws).

Wiring

For a secure connection to the probe, connect to the 4-pin M8 connector using a threaded connector.

Connect the shield if using a shielded cable. In the shielded cables supplied by Vaisala, the threaded connector connects the shield to the probe housing.
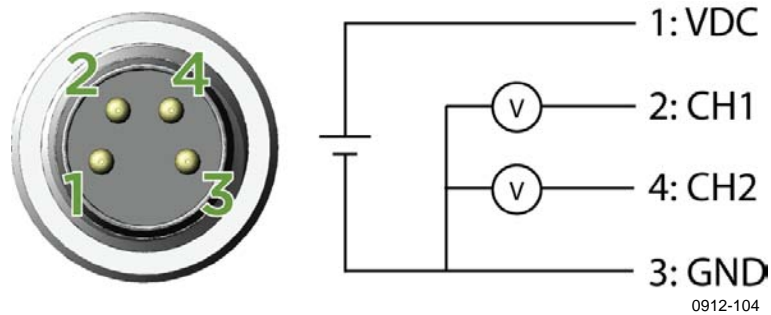
Figure 13   Wiring of Analog Output
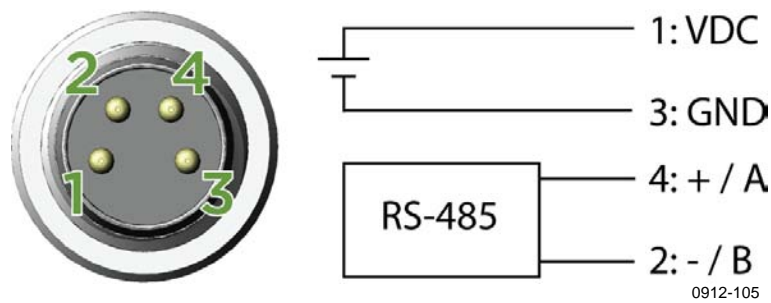
Figure 14   Wiring of Digital Output

Table 6   Pinout of the Probe Connector

Pin	Analog output model	RS-485 output model	Wire color
1	VDC supply +	VDC supply +	Brown
2	Signal Channel 1	RS-485 - / B	White
3	GND	GND	Blue
4	Signal Channel 2*	RS-485 + / A	Black

* HMP110T has no output on channel 2

Wiring with the Loop Power Converter

To use the loop power converter module with HMP60, HMP110, or HMP110T, make sure that:

- The probe is in the analog output mode
- The desired quantity must be on channel 1
- Channel 1 is scaled to 0 ... 2.5 V

When using the loop power converter module, power the module with 8 ... 28 VDC. The operating voltage for the probe (5 VDC) is delivered by the module.

For more information, see the Loop Power Converter Quick Reference Guide.
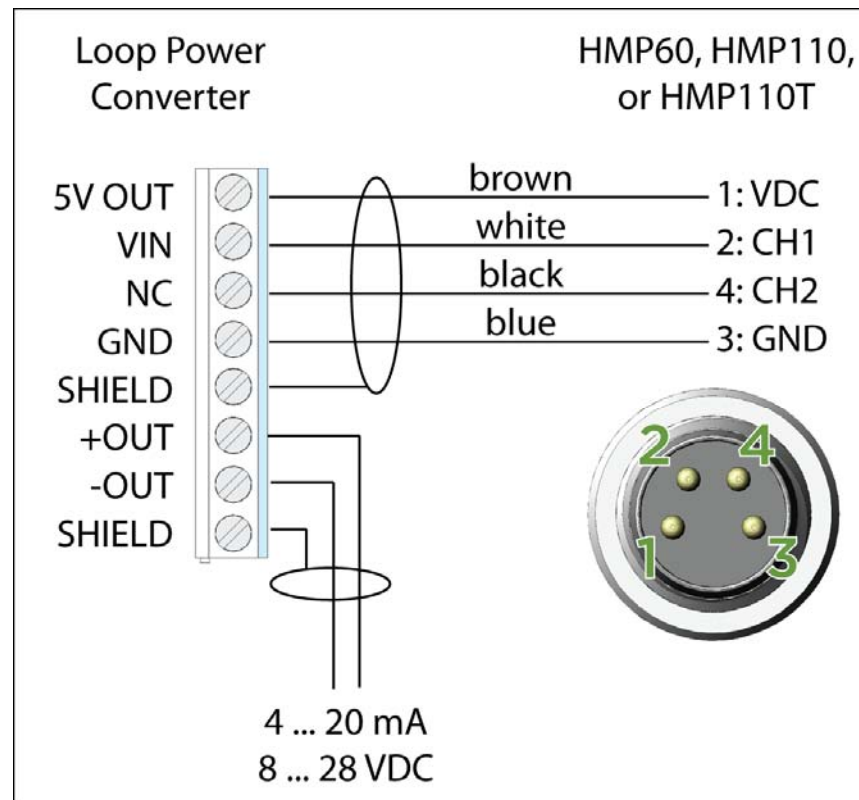
1001-041

Figure 15   Wiring with the Loop Power Converter Module

Power Supply Requirements

The operating voltage for the HMP60, HMP110 and HMP110T probes must be in the following range:

- 5 ... 28 VDC when using the 0 ... 1 V, 0 ... 2.5 V or RS-485 output
- 8 ... 28 VDC when using the 0 ... 5 V or 1 ... 5 V output

Current consumption is 1 mA on average, which makes the probes well suited for running on battery power. The maximum peak consumption is 5 mA.

Recommendations

- Continuous use over high operating voltage may cause heating.
  To conserve power and minimize the warming of the probe, use the lowest operating voltage in the allowed range.
- Using low impedance loads on the signal outputs increase the current consuption by up to 0.5 mA. High impedance loads are recommended to minimize warming of the probe.
- Frequent interrogation of the probe using the RS-485 interface will also increase current consumption from the average value. More frequent interrogation than once per second is not recommended.

CHAPTER 4
OPERATION

This chapter contains information that is needed to operate the product.

Getting Started

When the probe is connected to a power supply, there is a delay as the probe starts up and the analog output stabilizes. The delay depends on the output type, and on the operating voltage that is supplied to the probe:

- Probes with analog output:
    - 4 s at operating voltage 13.5 ... 16.5 VDC
    - 2 s at other valid operating voltages
- Probes with digital output: 1 s

Serial Line Communication

HMP60, HMP110 and HMP110T support two-wire RS-485 communication. The RS-485 interface is non-isolated and offers a maximum communications rate of 57600 bits/s.

There is no internal termination for the RS-485 on the probe. Use of termination resistors is not recommended. If the resistors are used, the possible increase in current consumption should be taken into account.

Connecting to the Serial Interface

The connection to the serial interface is via the 4-pin connector on the probe; see connector pinout on page 20.

For temporary use of the serial interface (for example, calibration), you can use the optional USB cable (Vaisala order code: 219690). Before you can use the USB cable, you must install the provided USB driver on your PC, see Installing the Driver for the USB Cable on page 26.

NOTE	The Vaisala USB cable is not designed for permanent installation. When using the USB cable, no separate power unit is needed. The probe is powered through the USB port.

For permanent interfacing to a host system, use a shielded cable with a threaded connector. See list of available cables in section Options and Accessories on page 62.

You can change the serial settings and operate in RUN, STOP and POLL modes. The probe does not echo typed characters back to the terminal screen. To see the commands you type, you need to enable the "local echo" setting in your terminal program.

A new command cannot be received while the probe is sending data out. Wait until the instrument has completed its response before entering the next command.

Table 7   Default Serial Communication Settings

Parameter	Value
Baud rate	19200
Parity	None
Data bits	8
Stop bits	1
Flow control	None

After power-up the probe (in STOP mode) outputs the software version and the command prompt.

In RUN mode, a measurement output starts immediately after power-up.

In POLL mode, the probe does not output anything after power-up, see section Set Serial Line Settings on page 35.

Installing the Driver for the USB Cable

Before taking the USB cable into use, you must install the provided USB driver on your PC. When installing the driver, you must acknowledge any security prompts that may appear. The driver is compatible with Windows 2000, Windows XP, and Windows Vista.

1. Check that the USB cable is not connected. Disconnect the cable if you have already connected it.

2. Insert the media that came with the cable, or download the driver from www.vaisala.com.

3. Execute the USB driver installation program (setup.exe), and accept the installation defaults. The installation of the driver may take several minutes.

4. After the driver has been installed, connect the USB cable to a USB port on your PC. Windows will detect the new device, and use the driver automatically.

5. The installation has reserved a COM port for the cable. Verify the port number, and the status of the cable, using the **Vaisala USB Instrument Finder** program that has been installed in the Windows Start menu. The reserved ports are also visible in the **Ports** section of the Windows Device Manager.

Remember to use the correct port in the settings of your terminal program. Windows will recognize each individual cable as a different device, and reserve a new COM port.

There is no reason to uninstall the driver for normal use. However, if you wish to remove the driver files and all Vaisala USB cable devices, you can do so by uninstalling the entry for **Vaisala USB Instrument Driver** from the **Add or Remove Programs** (**Programs and Features** in Windows Vista) in the Windows Control Panel.

Terminal Application Settings for Probes in RS-485 Mode

The steps below describe how to connect to the HMP60, HMP110 and HMP110T using the PuTTY terminal application for Windows (available for download at www.vaisala.com) and the USB serial interface. The instructions assume that your probe has been ordered with the RS-485 output.

If your probe has been ordered without the RS-485 output, you can still connect to the serial line by following the instructions in section Terminal Application Settings for Probes in Analog Mode on page 30.

1.   Connect the USB serial interface cable between your PC and the probe.

2.   Start the PuTTY application.

3.   Select the **Serial** settings category, and check that the correct COM port is selected in the **Serial line to connect to** field.

      You can check which port the USB cable is using with the **Vaisala USB Instrument Finder** program that has been installed in the Windows Start menu.

4.   Check that the other serial settings are correct for your connection, and change if necessary. Refer to Table 7 on page 26 for the default serial line settings of the probe.

5.   Click the **Open** button to open the connection window and start using the serial line.

      If PuTTY is unable to open the serial port you selected, it will show you an error message instead. If this happens, restart PuTTY and check the settings.

6.   You may need to adjust the **Local echo** setting in the **Terminal** category to see what you are typing on the serial line. To access the configuration screen while a session is running, click the right mouse button over the session window, and select **Change Settings...** from the pop-up menu.
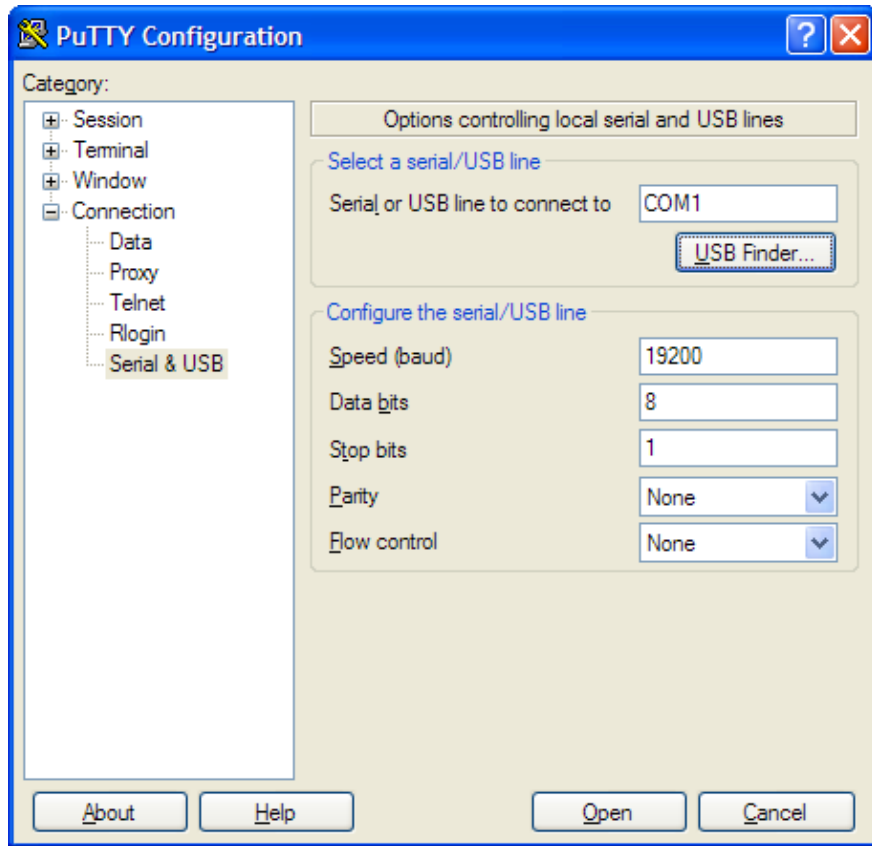
0810-070

Figure 16   PuTTY Terminal Application

Terminal Application Settings for Probes in Analog Mode

Follow the steps below to connect to the serial line on probes that have been ordered with analog outputs. You must use the Vaisala USB cable in this case.

1.   Start the PuTTY application.

2.   Connect the USB serial interface cable to your PC. Do not connect the other end to the probe yet.

3.   Select the **Serial** settings category, and check that the correct COM port is selected in the **Serial line to connect to** field.

     You can check which port the USB cable is using with the **Vaisala USB Instrument Finder** program that has been installed in the Windows Start menu.

4.   Check that the other serial settings are set to the default settings of the probe. Refer to Table 7 on page 26.

5.   Click the **Open** button to open the connection window and start using the serial line.

6.   Connect the other end of the USB cable to the probe, and immediately press the **Enter** key a few times. This will cause the probe to start in RS-485 mode, using the default serial settings.

List of Serial Commands

All commands can be issued either in uppercase or lowercase. In the command examples, the keyboard input by the user is in **bold** type.

The notation <cr> refers to pressing the carriage return (**Enter**) key on your computer keyboard. Enter a <cr> to clear the command buffer before starting to enter commands.

Table 8   List of Serial Commands

Command	Description
?	Output information about the device
ADJD	View the adjustment date
AMODE	View or set the analog output mode
AOVER [ON/OFF]	Allow analog outputs to exceed their range 10%
CDATE	View the calibration date
CODE	View the order code of the probe
CRH	Calibrate and adjust RH measurement
CRHCLR	Clear adjustment of RH measurement
CT	Calibrate and adjust T measurement
CTCLR	Clear adjustment of T measurement
CTEXT	View the calibration information field
ERRS	List present probe errors
FILT [0.001 … 1]	Set the result filtering
FRESTORE	Restore factory settings
HELP	List available commands
INTV [0 ... 255 S/MIN/H]	Set the continuous output interval (for RUN mode)
L	Displays user adjustment parameters
R	Start the continuous outputting
RESET	Reset the probe
S	Stop the continuous outputting
SDELAY [0 … 255]	View or set serial line answer minimum delay
SEND [0 ... 99]	Output the reading once
SNUM	View the serial number of the probe
UNIT	Select metric or non-metric output units
VERS	View software version of the probe

Table 9   Additional Commands for Probes with RS-485 Output

Command	Description
??	Output information about the device in POLL mode
ADDR [0 ... 99]	Set the probe address (for POLL mode)
CLOSE	Close the temporary connection (Back to POLL mode)
OPEN [0 ... 99]	Open a temporary connection to a POLL mode device
SERI [baud p d s]	User Port settings (Default: 19200 N 8 1) baud: 300 ... 57600
SMODE [STOP/RUN/POLL]	Set the serial interface mode

Device Information and Status

View Device Information

The **?** command outputs a listing of device information.

?<cr>

Example:

```
?
HMP60 / 1.00.0
Serial number  : E3950006
Batch number   : E3950006
Sensor number  : A0000000
Sensor model   : Intercap
Order code     :
Cal. date      : 20091201
Cal. info      : NONE
Time           : 00:00:24
Serial mode    :     STOP
Baud P D S     :    19200 N 8 1
Output interval:        5 S
Serial delay   :       50
Analog delay   :       30 S
Address        :        0
Filter         :    1.000
Ch1 output     :  0 ... 5 V
Ch2 output     :  0 ... 5 V
Ch1 RH   lo    :     0.00 %RH
Ch1 RH   hi    :   100.00 %RH
Ch2 T    lo    :   -40.00 'C
Ch2 T    hi    :    60.00 'C
```

If the probe is in poll mode, but a connection has not been opened using the **OPEN** command, issue the **??** command. For a description of the serial interface modes, see section Set Serial Line Settings on page 35.

??<cr>

View Calibration Information

Use the **CDATE** command to view the calibration date, **CTEXT** to view the calibration info text, and **ADJD** command to view the adjustment date. Date format for **CDATE** and **ADJD** is YYYYMMDD.

CDATE<cr>

CTEXT<cr>

ADJD<cr>

Examples:

```
cdate
Cal. date      : 20091201
```

```
ctext
Cal. info      : VAISALA/HELSINKI
```

```
adjd
Adj.date       : 20091201
```

View Order Code

Use the **CODE** command to view the order code that has been stored in the probe. This command is useful if you need to order a new probe with the same options.

CODE<cr>

Example:

```
code
Order code     : A12A01B0
```

View Serial Number

Use the **SNUM** command to view the serial number of the probe.

SNUM<cr>

Example:

```
snum
Serial number  : E3950006
```

View Software Version

Use the **VERS** command to display the software version of the probe.

VERS<cr>

Example:

```
vers
HMP60 / 1.00.0
```

Serial Line Output Commands

Start Measurement Output

Use the **R** command to start the continuous outputting of measurement values as an ASCII text string to the serial line.

For HMP60 and HMP110, the output always includes readings for temperature, RH and Td. For HMP110T, the output includes only temperature.

R<cr>

Example (HMP60 and HMP110):

```
r
T= 22.6 'C RH= 22.8 %RH Td=  0.3 'C
T= 22.6 'C RH= 22.5 %RH Td=  0.2 'C
T= 22.6 'C RH= 22.5 %RH Td=  0.2 'C
…
```

Example (HMP110T):

```
r
T= 22.6 'C
T= 22.6 'C
T= 22.6 'C
…
```

Outputting the results continues in intervals issued with the command **INTV**. You can stop the output by entering the **S** command.

Stop Measurement Output

Use the **S** command to stop the continuous measurement output.

S<cr>

Output the Measurement Message Once

Use the **SEND** command to output the measurement values once. If the probe is in POLL mode and the line is not open for commands, specify the address of the probe to receive the measurement message.

SEND [*aaa*]<cr>

where

aaa =   Address of the probe, range 0 ... 254. Set with the **ADDR** command.

Example (probe in STOP mode, no address needed):

send
```
T= 22.7 'C RH= 20.0 %RH Td= -1.5 'C
```

Example (probe in POLL mode, with address 10):

send 10
```
T= 22.8 'C RH= 20.1 %RH Td= -1.3 'C
```

Configuring Serial Line Operation

Set Serial Line Settings

Use the **SERI** command to show or set the serial line settings. The new settings will be taken into use when the probe is reset or powered up.

SERI [*b p d s*]<cr>

where

b   =   baud rate
         (300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600)
p   =   parity (n = none, e = even, o = odd)
d   =   data bits (7 or 8)
s   =   stop bits (1 or 2)

Example (shows default settings):

seri
```
Baud P D S    :    19200 N 8 1
```

Set Serial Interface Mode

SMODE [*xxx*]<cr>

where

xxx   =   STOP, RUN, or POLL

In STOP mode: outputting only when command is issued, any command can be used.

In RUN mode: outputting automatically, only command **S** can be used. In POLL mode: outputting only when command is issued, any command can be used after the line has been opened using the **OPEN** command.

The polling mode can be used when more than one probe is connected to one serial bus. When set to POLL mode, the probes communicate one at a time when the specific address is called on the serial line. See descriptions of the commands **ADDR** on page 38 and **OPEN** on page 45.

Examples:

```
smode stop
Serial mode    :    STOP

smode run
Serial mode    :    RUN


smode poll
Serial mode    :    POLL
```

NOTE	In the RUN mode, the probe may send the measurement data message right as you are typing the **S** command to stop the sending. Therefore, you may need to repeat the **S** command. This must be noted especially when designing computer programs to access the probe. You can also use the **Esc** key on your keyboard to stop the sending.

Set Output Interval

Use the **INTV** command to show or set the output interval of the serial line measurement messages (applies when **R** command or RUN mode is used). The shortest output interval is one second. This command has no effect on the operation of the analog output.

INTV [*n xxx*]<cr>

where

n   =   Time interval in range 1 ... 255
xxx   =   time unit = "S", "MIN", or "H"

Example:

```
intv 1 s
Value               : 1
Unit                : S
```

Set Measurement Filtering

Use the **FILT** command to view or set the speed at which the latest measurement result is integrated into the humidity and temperature readings. The command affects both analog output and serial line output.

FILT [*a.aaa*]<cr>

where

a.aaa   =   Range 0.1 ... 1.0.
                          1.0 = No filtering, latest measurement is output
                          without averaging
                          0.5 = Average of last two measurements
                          0.1 = Average of approximately 16 measurements

Example (default setting, no filtering):

```
filt
Filter       :     1.000      ?
```

Example (set filtering to 0.5):

```
filt 0.5
Filter       :     0.500
```

Set Probe Address

Use the **ADDR** command to view or set the probe address. To operate in the POLL mode, the probe must have an address. If multiple probes share the same serial line, each probe must have a different address.

For a description of the serial interface modes, see section Set Serial Line Settings on page 35.

ADDR [*nn*]<cr>

where

nn   =   address (0 ... 99)

Example:

```
addr
Address        :          0
```

Set Serial Interface Delay

Use the **SDELAY** command to view or set the serial interface answer minimum delay.

SDELAY [*delay*]<cr>

where

delay   =   Range 0 ... 255. Value corresponds to four
                   milliseconds (for example, 5 = 0.020 second
                   minimum answer delay)

Example:

```
sdelay
Serial delay   :          30

sdelay 50
Serial delay   :          50
```

Set Measurement Units

Use the **UNIT** command to view or set the measurement units that are used in the serial line measurement messages.

UNIT [*M/N*]<cr>

M is for metric units, N is for non-metric units.

Quantity	Metric Unit	Non-Metric Unit
RH	%RH	%RH
Td	ºC	ºF
T	ºC	ºF

Examples:

unit
Units   : Metric

unit n
Units   : Non metric

Calibration Commands

Calibrate Humidity Measurement

Use the **CRH** command to perform a one-point or two-point correction to the capacitance measurement of the probe. This command changes the offset and/or gain of the humidity measurement, depending on the calibration and reference:

- one-point calibration with a single < 50 %RH reference will adjust the offset of the capacitance measurement
- one-point calibration with a single > 50 %RH reference will adjust the gain of the capacitance measurement
- two-point calibration will adjust both offset and gain. The first point requires a < 50 %RH humidity reference, the second point must be > 50 %RH. There must also be at least 30 percentage point difference between the references.

CRH [reference]<cr>

This command is not available on the HMP110T.

When performing a one-point calibration, you need to place the probe in the reference humidity and wait for 20 – 40 minutes for the humidity to stabilize. To apply the adjustment, enter the **CRH** command with the reference %RH as a parameter.

Example: one-point calibration (LiCl reference, 11 %RH):

```
crh 11
OK
```

Example: one-point calibration with NaCl reference (75 %RH):

```
crh 75
OK
```

Giving the command without parameters starts the two-point calibration. Remember to allow the humidity to stabilize for 20 - 40 minutes after changing the reference.

Example: two-point calibration with LiCl (11 %RH) and NaCL (75 %RH) references:

```
crh
RH  :   11.2684 1. ref ? 11
 Press any key when ready ...
RH  :   75.0612 2. ref ? 75
OK
```

Clear Adjustment of RH Measurement

Use the **CRHCLR** command to clear the adjustment of RH measurement that has been done using the **CRH** command. This command is not available on the HMP110T.

CRHCLR<cr>

Example:
```
crhclr
OK
```

Calibrate Temperature Measurement

Use the **CT** command to perform a one-point or two-point temperature (T) calibration. One-point calibration adjusts the offset for the measurement, two-point calibration adjusts offset and gain.

CT [reference]<cr>

When performing a one-point calibration, you need to place the probe in a single temperature reference and wait for 20 – 40 minutes for the temperature to stabilize. To apply the adjustment, enter the **CT** command with the reference temperature as a parameter.

Example: one-point calibration

```
ct 23.5
OK
```

Giving the command without parameters starts the two-point calibration. Remember to allow the temperature to stabilize for 20 - 40 minutes after changing the reference. The first reference point must be smaller than the second point, and the difference between the reference points must be more than 30 ^{0}C. To update the measured value while the command is running, press enter without inputting a value.

Example: two-point calibration

```
ct
T   :    22.03 Ref1 ? 22
Press any key when ready ...
T   :    55.12 Ref2 ? 55
OK
```

Clear Adjustment of T Measurement

Use the **CTCLR** command to clear the adjustment of temperature measurement that has been done using the **CT** command.

CTCLR<cr>

Example:
```
ctclr
OK
```

View User Adjustment Parameters

Use the **L** command to view the current user adjustment parameters. This command is useful for checking the currently applied customer calibration.

L<cr>

The output values are as follows:

- Cp offset and gain: capacitance, calibrated using the **CRH** command
- T offset and gain: calibrated using the **CT** command

Example (shows default values, no user calibration done):

```
l
Cp offset :   0.00000000E+00
Cp gain   :   1.00000000E+00
T  offset :   0.00000000E+00
T  gain   :   1.00000000E+00
```

Other Commands

Set Analog Output Mode

Use the **AMODE** command to show or set the operation mode of the analog output.

AMODE [ch1] [ch2]<cr>

where

ch1 = Analog output mode for channel 1, range 0 ...3.
The options are:

0 (0 ... 1 V)
1 (0 ... 2.5 V)
2 (0 ... 5 V)
3 (1 ... 5 V)

ch2 = Analog output mode for channel 2, range 0 ...3.
The options are the same as for channel 1.

Example (show current output modes):

```
amode
Ch1 output     :  0 ... 1 V
Ch2 output     :  0 ... 1 V
```

Example (set channel 1 to 0 ... 1 V and channel 2 to 0 ... 5 V):

```
amode 0 2
Ch1 output     :  0 ... 1 V
Ch2 output     :  0 ... 5 V
```

Extend Analog Output Range

Use the **AOVER** command to allow the analog output channels to exceed their specified range by 10%. The scaling of the quantity remains as before; the extra range is used for additional measurement range in the wet end.

AOVER [*ON/OFF*]<cr>

The following example illustrates how the analog output is affected. Channel 1 outputs T_d with voltage output 0 … 5 V (-40 °C … +60 °C). After giving the **AOVER ON** command, the range is 0 … 5.5 V (-40 °C … +70 °C). Note that the +60 °C T_d point is still at 5 V.

Example:

```
aover on
AOVER                 :        ON
```

Display Command List

Use the **HELP** command to display a list of the currently available commands.

HELP<cr>

Display the Currently Active Errors

Use the **ERRS** command to display the currently active error codes. For troubleshooting active errors, see Table 10 on page 57.

ERRS<cr>

Example (no active errors):

```
errs
0000h
No errors
```

Connect to the Probe in POLL Mode

Use the **OPEN** command to connect to a probe that is in POLL mode.

OPEN [*aa*]<cr>

Where

aa　　　　　=　address (0 ... 99)

Example:

```
open 1
HMP110  1 line opened for operator commands
```

Close the Connection in POLL Mode

The **CLOSE** command closes the connection to the probe.

CLOSE<cr>

Example:

```
close
line closed
```

Reset the Probe

Use the **RESET** command to reset the probe. Upon reset or power-up, the probe enters the serial mode that has been set with the **SMODE** command.

RESET<cr>

Example (probe set to serial mode STOP, will output probe model and software version at reset):

```
reset
HMP60 / 1.00.0
```

Example (probe set to serial mode RUN, will start to output measurement messages at reset):

```
reset
T= 23.6 'C RH= 20.2 %RH Td= -0.5 'C
T= 23.6 'C RH= 20.2 %RH Td= -0.5 'C
T= 23.3 'C RH= 20.2 %RH Td= -0.8 'C
...
```

Restore Factory Settings

Use the **FRESTORE** command to restore the factory settings to the probe. All user settings, including the user-performed calibration corrections, will be lost. The probe will revert back to the factory calibrated settings.

FRESTORE<cr>

Example:

```
frestore
Factory settings restored
```

CHAPTER 5
MAINTENANCE

This chapter provides information that is needed in basic maintenance of the product.

Periodic Maintenance

The humidity measurement accuracy of the HMP60 and HMP110 should be calibrated yearly. When calibration indicates that accuracy is not within specification:

- HMP60: change the INTERCAP® Sensor.
- HMP110: adjust the measurement yourself, or have it adjusted at a Vaisala Service Center.

Light cleaning of the probe, and replacement of the filter should be done only when necessary.

Cleaning

The probe body can be wiped clean with a soft, lint-free cloth moistened with mild detergent. Do not use solvents or compressed air.

Note that wiping the membrane filter or stainless steel sintered filter may block its pores and/or deposit residue on the filter. If the filter is heavily contaminated, replace it.

Changing the Filter

The filter on the probe should be replaced when it is damaged or dirty.

1.   Turn the filter counter-clockwise to loosen it.
2.   Remove the filter from the probe. Be careful not to touch the sensors with the filter. Without the filter in place, the sensors are easily damaged – handle the probe carefully.
3.   Install a new filter on the probe, and tighten it so it is finger-tight. Make sure the filter sits straight and meets the threads properly.

New filters can be ordered from Vaisala. For available filters, see section Filter Options on page 13. The order codes of the filters are listed in section Options and Accessories on page 62.

Calibration Procedure

To calibrate your probe, you need a known stable humidity or temperature reference, and a way to read the output of the probe (analog or serial). As a humidity reference you can use, for example, the Vaisala Humidity Calibrator HMK15.

Refer to chapter Technical Data on page 59 for accuracy specifications of the probes.

1.   Connect the power/signal cable to the probe, but do not power it up yet.
2.   Place the probe in the reference environment. For example, you can use a NaCl salt chamber (75 %RH) as the humidity reference.
3.   Wait for 20 – 40 minutes for the reading to stabilize.
4.   Power up the probe and wait for one minute.
5.   Check the measurement reading, and compare it with the reading that the reference should produce.

Adjustment Procedure (HMP110)

NOTE	If you are adjusting a HMP110 or HMP110T probe that is in the analog output mode, see section Terminal Application Settings for Probes in Analog Mode on page 30 for instructions on how to start the probe in RS-485 mode.

One-Point Adjustment of RH Measurement (HMP110)

To perform a one-point adjustment to the capacitance measurement of the HMP110 you need:

- The Vaisala USB cable (Vaisala order code: 219690)
- PC with a terminal application.
- One humidity reference. One-point calibration with a single < 50 %RH reference will adjust the offset of the measurement. One-point calibration with a single > 50 %RH reference will adjust the gain of the measurement.

The procedure below uses the HMK15 Humidity Calibrator. LiCl salt (11 %RH) is used as the reference point.

1.   Connect the USB cable to the PC, but do not connect it to the probe yet.
2.   Insert the probe in the LiCl salt chamber of the humidity calibrator (11 %RH).
3.   Start a terminal application and set the correct connection settings. The default serial settings are **19200 8 N 1**. Remember to check which COM port the USB cable is using.
4.   Wait for 20 – 40 minutes for the humidity to stabilize.
5.   Start the terminal session and connect the USB cable to the probe. If your probe is in the analog output mode, you need to press Enter a few times to start it in RS-485 mode.
6.   Verify that the connection works by giving the **?** command:

       ?

       If the probe does not respond with device information:
       - Disconnect the USB cable from the probe and retry. If your probe is in the analog output mode, press Enter a few times immediately after connecting the USB cable.
       - Try the **??** command in case the probe is in POLL mode, open the line using **OPEN** command if necessary.
       - Check your serial line settings and cable connections.

7. When your serial connection is working, use the L command to see the current user adjustment parameters.

```
l
```

8. Use the **ERRS** command to see that no errors are active:

```
errs
```

9. Give the **CRH** command, with the %RH value of the reference as a parameter (in this case 11 for LiCl):

```
crh 11
OK
```

10. Check with the **L** command that the user adjustment parameters have changed.

   If you wish to remove the effects of RH calibration (returning the RH measurement of the HMP110 to the factory calibrated state), see section Clear Adjustment of RH Measurement on page 41.

Two-Point Adjustment of RH Measurement (HMP110)

To perform a two-point adjustment to the capacitance measurement of the HMP110 you need:

- The Vaisala USB cable (Vaisala order code: 219690)
- PC with a terminal application.
- Two humidity references. The first point requires a < 50 %RH humidity reference, the second point must be > 50 %RH. There must also be at least 30 percentage point difference between the references.

The procedure below uses the HMK15 Humidity Calibrator. LiCl salt (11 %RH) is used as the first reference point, NaCl (75 %RH) as the second.

1. Connect the USB cable to the PC, but do not connect it to the probe yet.
2. Insert the probe in the LiCl salt chamber of the humidity calibrator (11 %RH).
3. Start a terminal application and set the correct connection settings. The default serial settings are **19200 8 N 1**. Remember to check which COM port the USB cable is using.
4. Wait for 20 – 40 minutes for the humidity to stabilize.
5. Start the terminal session and connect the USB cable to the probe. If your probe is in the analog output mode, you need to press Enter a few times to start it in RS-485 mode.

6. Verify that the connection works by giving the **?** command:

```
?
```

If the probe does not respond with device information:

- Disconnect the USB cable from the probe and retry. If your probe is in the analog output mode, press Enter a few times immediately after connecting the USB cable.
- Try the **??** command in case the probe is in POLL mode, open the line using **OPEN** command if necessary.
- Check your serial line settings and cable connections.

7. When your serial connection is working, use the **L** command to see the current user adjustment parameters.

```
l
```

8. Use the **ERRS** command to see that no errors are active:

```
errs
```

9. Use the **SEND** command to verify the currently measured RH value:

```
send
T= 22.9 'C RH= 11.1 %RH Td= -8.0 'C
```

10. Give the **CRH** command with the RH value of the humidity reference as a parameter:

```
crh 11
OK
```

11. After entering the correction, unplug the USB cable from the probe. Insert the probe in the NaCl salt chamber (75 %RH) and wait for 20 – 40 minutes for humidity and temperature to stabilize.

12. Connect the USB cable to the probe and use the **SEND** command to see the currently measured value.

13. Give the **CRH** command with the RH value of the humidity reference as a parameter:

```
crh 75
OK
```

14. Check with the **L** command that the user adjustment parameters have changed.

    If you wish to remove the effects of RH calibration (returning the RH measurement of the HMP110 to the factory calibrated state), see section Clear Adjustment of RH Measurement on page 41.

One-Point Adjustment of T Measurement (HMP110 and HMP110T)

To perform a one-point adjustment to the temperature measurement of the HMP110 or HMP110T you need:

- The Vaisala USB cable (Vaisala order code: 219690)
- PC with a terminal application.
- One known and stable temperature reference.

1. Connect the USB cable to the PC, but do not connect it to the probe yet.
2. Insert the probe in the temperature reference.
3. Start a terminal application and set the correct connection settings. The default serial settings are **19200 8 N 1**. Remember to check which COM port the USB cable is using.
4. Wait for 20 – 40 minutes for the temperature to stabilize.
5. Start the terminal session and connect the USB cable to the probe. If your probe is in the analog output mode, you need to press Enter a few times to start it in RS-485 mode.
6. Verify that the connection works by giving the **?** command:

   ```
   ?
   ```

   If the probe does not respond with device information:
   - Disconnect the USB cable from the probe and retry. If your probe is in the analog output mode, press Enter a few times immediately after connecting the USB cable.
   - Try the **??** command in case the probe is in POLL mode, open the line using **OPEN** command if necessary.
   - Check your serial line settings and cable connections.
7. When your serial connection is working, use the **L** command to see the current user adjustment parameters.

   ```
   l
   ```
8. Use the **ERRS** command to see that no errors are active:

   ```
   errs
   ```
9. Give the **CT** command, with the temperature value of the reference as a parameter:

   ```
   ct 23.5
   OK
   ```

10.   Check with the **L** command that the user adjustment parameters have changed.

If you wish to remove the effects of T calibration (returning the T measurement of the probe to the factory calibrated state), see section Clear Adjustment of T Measurement on page 42.

Repair Maintenance

Changing the INTERCAP® Sensor (HMP60)

This procedure restores the humidity measurement accuracy of the HMP60. No adjustment after the sensor change is needed.

To perform this procedure, you need a new INTERCAP® sensor. It is also recommended that you replace the filter with a new one. For order codes, see section Options and Accessories on page 62.

1.   Remove the filter from the probe by turning it counter-clockwise.
2.   Pull out the old INTERCAP® sensor (the taller of the two sensors inside the probe) and insert a new one. Refer to Figure 17 on page 54. Handle the new sensor by the plastic frame. DO NOT TOUCH THE SENSOR PLATE.
3.   Attach a new filter on the probe.
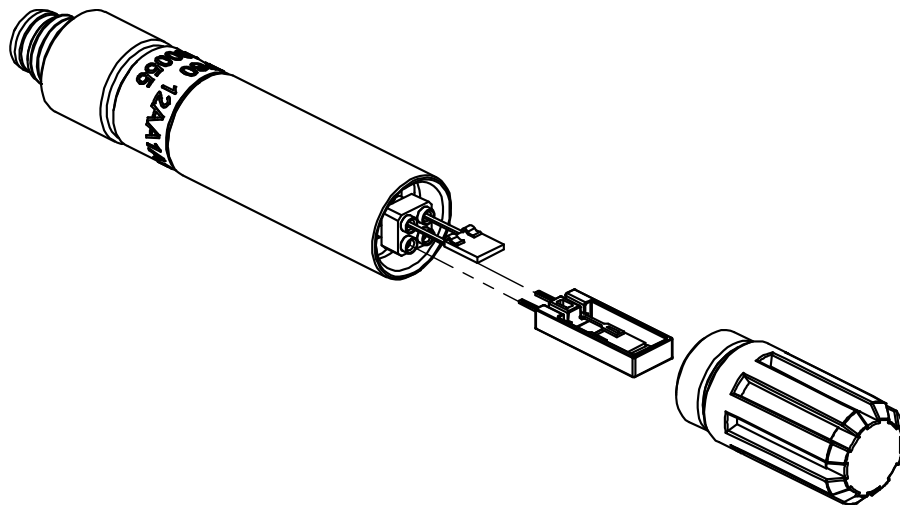
0912-097

Figure 17   Changing the Sensor

Changing the HUMICAP® 180R Sensor (HMP110)

NOTE	Replacing the humidity sensor of the HMP110 is not necessary in normal operation. If the accuracy of the probe does not seem to be within specification, it is likely that the accuracy can be restored by performing the adjustment procedure. See section Two-Point Adjustment of RH Measurement (HMP110) on page 50.

Follow this procedure to replace the humidity sensor of the HMP110 in case it has been damaged, or normal adjustment is not sufficient to restore the measurement accuracy. Calibration and adjustment of the humidity measurement is required after the sensor change.

To perform this procedure, you need a new HUMICAP® 180R sensor. It is also recommended that you replace the filter with a new one. For order codes, see section Options and Accessories on page 62.

1. Remove the filter from the probe by turning it counter-clockwise.
2. Pull out the old HUMICAP® 180R sensor (the taller of the two sensors inside the probe) and insert a new one. Refer to Figure 17 on page 54. Handle the new sensor by the plastic frame. DO NOT TOUCH THE SENSOR PLATE.
3. Perform a two-point adjustment of the RH measurement as instructed in section Two-Point Adjustment of RH Measurement (HMP110) on page 50.
4. Attach a new filter on the probe.

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CHAPTER 6
TROUBLESHOOTING

This chapter describes common problems, their probable causes and remedies, and contact information for technical support.

Solving Typical Problems

You can check the error message via the serial interface by using the **ERRS** command. If you are unable to remove the errors, contact Vaisala technical support. See section Technical Support on page 58.

Table 10   Troubleshooting Table

Problem or Message	Likely Causes and Solutions
Measurement not working. any of the following errors active: - T meas error - RH meas error	- Sensor(s) damaged or missing. Open the filter and check. - Check the supply voltage of the probe. - Check the output mode of the probe using serial line.
Humidity measurement appears to be wrong.	- Check for condensation on the probe and sensor. - Use the **L** command to check the currently applied calibration correction. - Calibrate and adjust the probe (HMP110). - Calibrate the probe and change the sensor if necessary (HMP60).
The probe is not responding to any serial commands.	- Disconnect the USB cable from the probe and retry. If your probe is in the analog output mode, press ENTER a few times immediately after connecting the USB cable. - Try the **??** command in case the probe is in POLL mode, open the line using **OPEN** command if necessary. - Check your serial line settings and cable connections.
The following error is active: - Voltage error	- Operating voltage out of range. Correct voltage and reset probe.

Problem or Message	Likely Causes and Solutions
Any check sum error is active. For example: - Program flash check sum error - Parameter flash check sum error	Internal error. Perform the following steps: 1. Return the probe to factory settings using the **FRESTORE** command. Check again. 2. If the error is still active, contact Vaisala technical support.

Technical Support

For technical questions, contact the Vaisala technical support by e-mail at helpdesk@vaisala.com.

For contact information of Vaisala Service Centers, see www.vaisala.com/services/servicecenters.html.

Product Returns

If the product must be returned for service, see www.vaisala.com/services/return.html.

For contact information of Vaisala Service Centers, see www.vaisala.com/services/servicecenters.html.

CHAPTER 7
TECHNICAL DATA

This chapter provides the technical data of the product.

Specifications

Performance (HMP60)

Relative Humidity

Measurement range	0 ... 100 %RH
Typical accuracy	
temperature range +0 ... +40 °C	
0 ... 90 %RH	±3 %RH
90 ... 100 %RH	±5 %RH
temperature range -40 ... 0 °C and +40 ... +60 °C	
0 ... 90 %RH	±5 %RH
90 ... 100 %RH	±7 %RH
Humidity sensor	Vaisala INTERCAP®

Temperature

Measurement range	-40 ... +60 °C
Accuracy over temperature range	
-40 ... +60 °C	±0.6 °C

Dewpoint

Measurement range	-40 ... +60 °C
Typical accuracy	
temperature range 0 ... +40 °C when temperature - dewpoint < 15 °C	±2 °C
temperature range -40 ... 0 °C and +40 ... +60 °C when temperature - dewpoint < 10 °C	±3 °C

Performance (HMP110)

Relative Humidity

Measurement range	0 ... 100 %RH
Accuracy (incl. non-linearity, hysteresis and repeatability)	
temperature range +0 ... +40 °C	
0 ... 90 %RH	±1.7 %RH
90 ... 100 %RH	±2.5 %RH
temperature range -40 ... 0 °C and +40 ... +80 °C	
0 ... 90 %RH	±3.0 %RH
90 ... 100 %RH	±4.0 %RH
Factory calibration uncertainty (+20 °C)	±1.5 %RH
Humidity sensor	Vaisala HUMICAP® 180R

Temperature

Measurement range	-40 ... +80 °C
Accuracy over temperature range	
0 ... +40 °C	±0.2 °C
-40 ... 0 °C, +40 ... +80 °C	±0.4 °C
Temperature sensor	Pt1000 RTD 1/3 Class B IEC 751

Dewpoint

Measurement range	-40 ... +80 °C
Accuracy (incl. non-linearity, hysteresis and repeatability)	
temperature range 0 ... +40 °C	
when temperature - dewpoint	
< 15 °C	±1 °C
15 ... 25 °C	±2 °C
temperature range -40 ... 0 °C and +40 ... +80 °C when temperature - dewpoint < 15 °C	±2 °C

Performance (HMP110T)

Temperature

Measurement range	-40 ... +80 °C
Accuracy over temperature range	
0 ... +40 °C	±0.2 °C
-40 ... 0 °C, +40 ... +80 °C	±0.4 °C
Temperature sensor	Pt1000 RTD 1/3 Class B IEC 751

Operating Environment

Operating temperature range
   HMP60   -40 ... +60 °C
   HMP110   -40 ... +80 °C
   HMP110T   -40 ... +80 °C
Operating humidity range   0 ... 100 %RH, non-condensing

Electromagnetic compatibility   EN 61326-1: Electrical equipment for measurement, control and laboratory use - EMC requirements – for use in industrial locations.

EN 55022 Class B: Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement.

Inputs and Outputs

Operating voltage
   with 0...1 V / 2.5 V or RS-485   5 ... 28 V
   with 0...5 V / 1 ... 5 V   8 ... 28 V
Current consumption
   typical average   1 mA
   max peak   5 mA
Start-up time
   probes with analog output   4 s at operating voltage 13.5 ... 16.5 VDC
                                        2 s at other valid operating voltages
   probes with digital output   1 s

Outputs
   analog output channels   2
   analog output types   0 ... 1 VDC / 2.5 VDC / 5VDC, 1 ... 5 VDC
   with loop power converter   4 ... 20 mA (separate module, compatible with humidity accuracy only)
   digital output (optional)   RS-485 two-wire half-duplex
External loads
   0 ... 1 R_L min 10 kΩ
   0 ... 2.5 / 0 ... 5 / 1 ... 5 V R_L min 50 kΩ

Mechanics

Materials
   body   Stainless steel (AISI 316)
   grid filter   Chrome coated ABS plastic
   cable   Polyurethane
Housing classification   IP65
Body thread   M12x1 / 10 mm
Cable connector   4-pin M8 (IEC 60947-5-2)
Cable lengths   0.3 and 3 m
Weight
   probe   17 g
   probe with 0.3 m cable   28 g

Options and Accessories

Table 11   HMP60 Options and Accessories
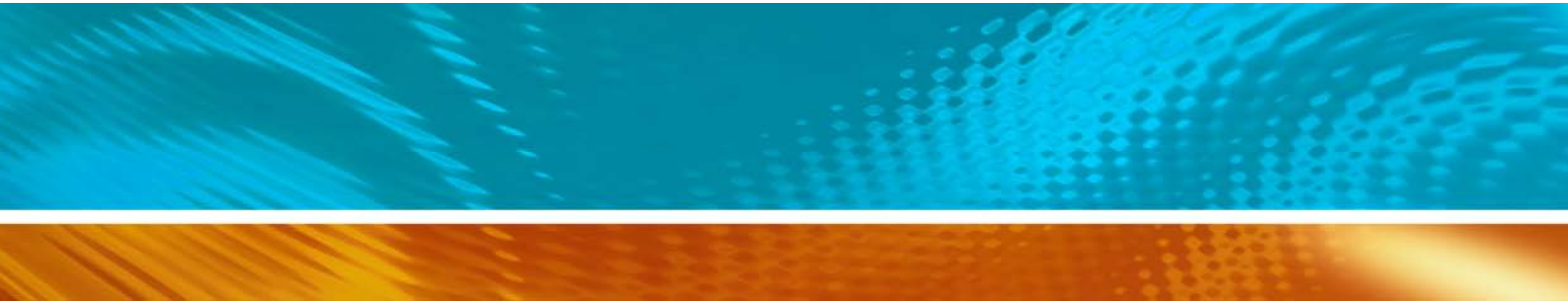
Description	Item Code
Vaisala INTERCAP® sensor	15778HM
Vaisala INTERCAP® sensor, 10 pcs	INTERCAPSET-10PCS
Probe mounting flange	226061
Probe mounting clamps, 10 pcs	226067
Sensor protection	
Plastic grid filter	DRW010522
Membrane filter	DRW010525
Stainless steel sintered filter	HM46670SP
Loop power converter (4 ... 20 mA)	UI-CONVERTER-1
Mounting bracket with lid for loop power converter	225979
Plastic M12 installation nuts, pair	18350SP
Duct installation kit	215619
Shielded cable, 0.3 m	HMP50Z032SP
Shielded cable, 3 m	HMP50Z300SP
FEP cable (+180 ºC), 3 m	226902SP
USB serial interface cable	219690

Table 12   HMP110 Options and Accessories

Description	Item Code
Vaisala HUMICAP® 180R sensor	HUMICAP180R
Probe mounting flange	226061
Probe mounting clamps, 10 pcs	226067
Sensor protection	
Plastic grid filter	DRW010522
Membrane filter	DRW010525
Stainless steel sintered filter	HM46670SP
Loop power converter (4 ... 20 mA)	UI-CONVERTER-1
Mounting bracket with lid for loop power converter	225979
Plastic M12 installation nuts, pair	18350SP
Duct installation kit	215619
Shielded cable, 0.3 m	HMP50Z032SP
Shielded cable, 3 m	HMP50Z300SP
Shielded cable (+80 ºC), 1.5 m	225777SP
Shielded cable (+80 ºC), 3 m	225229SP
FEP cable (+180 ºC), 3 m	226902SP
USB serial interface cable	219690

Table 13   HMP110T Options and Accessories

Description	Item Code
Probe mounting flange	226061
Probe mounting clamps, 10 pcs	226067
Sensor protection	
Plastic grid filter	DRW010522
Membrane filter	DRW010525
Stainless steel sintered filter	HM46670SP
Loop power converter (4 ... 20 mA)	UI-CONVERTER-1
Mounting bracket with lid for loop power converter	225979
Plastic M12 installation nuts, pair	18350SP
Duct installation kit	215619
Shielded cable, 0.3 m	HMP50Z032SP
Shielded cable, 3 m	HMP50Z300SP
Shielded cable (+80 ºC), 1.5 m	225777SP
Shielded cable (+80 ºC), 3 m	225229SP
FEP cable (+180 ºC), 3 m	226902SP
USB serial interface cable	219690

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