M213279EN-A

User Guide

Humidity and Temperature Probes

XMP10



VAISALA

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1. About this document

1.1 Version information

This document provides instructions on installing, operating, and maintaining Vaisala Humidity and Temperature Probe XMP10.

Table 1 Document versions (English)

Document code	Date	Description
M213279EN-A	April 2026	First version.

1.2 Related manuals

Table 2 Related manuals

Document code	Name
M213278EN	Vaisala XMP10 Humidity and Temperature Probes Quick Guide
M213293EN	Vaisala Origo10 Transmitters User Guide
M212722EN	Vaisala Indigo80 Handheld Indicator User Guide
M211060EN	Vaisala HMP60 and HMP110 Series Humidity and Temperature Probes User Guide
M211080EN	Vaisala Mounting Flange for Humidity Probes Quick Reference Guide
M211106EN	Vaisala Loop Power Converter Quick Reference Guide
M210185EN	Vaisala HMK15 Humidity Calibrator User Guide

1.3 Documentation conventions

WARNING! Alerts you to a hazardous situation that, if not avoided, could result in death or serious injury.

CAUTION! Alerts you to a hazardous situation that, if not avoided, could result in minor or moderate injury.

NOTICE! Alerts you to a situation that, if not avoided, could result in the product to be damaged, or important data to be lost.

Highlights important information on using the product.

Lists the tools needed to perform the task.

1.4 Trademarks

Vaisala INTERCAP® and Vaisala HUMICAP® are registered trademarks of Vaisala Oyj.

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

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2. Product overview

2.1 Introduction to XMP10

Vaisala XMP10 Series comprises miniature, probe-style humidity and temperature transmitters which deliver excellent measurement performance in a compact form. XMP10 can function as the sensing element in transmitters or operate independently as a versatile stand-alone device, sending values through analog or Modbus RTU outputs. XMP10 supports easy daisy-chaining via Modbus RTU, which enables the creation of multipoint measurement systems. XMP10's compact design makes it an ideal component for a wide range of OEM applications.

XMP10 probes can be ordered with the Vaisala HUMICAP® 180R sensor for increased accuracy in humidity measurement. For applications where H_2O_2 (for example, vaporized hydrogen peroxide (VHP)) is present, the probe can be ordered with the HUMICAP® 180V catalytic sensor. The Vaisala INTERCAP® sensor is also available.

For INTERCAP, no recalibration is required after sensor replacement. Probes with HUMICAP require calibration after sensor replacement. This can be done, for example, with Vaisala Insight PC software, the Indigo80 handheld indicator, or on the serial line using the optional Vaisala USB cable.

2.1.1 Basic features and options

- Miniature-size humidity and temperature probe
- Up to ±1 %RH measurement accuracy
- Temperature measurement option also available
- Modbus® RTU / voltage analog outputs
- Standard M8 connector
- IP65-rated probe body, metal and plastic options
- Compatible with Vaisala Origo10 transmitters
- Can be connected to Vaisala Insight PC software or Indigo80 handheld indicator for configuration, calibration and adjustment, and monitoring

More information

‣ Specifications (page 71)

2.1.2 Configuration code key

Each device has a unique code on the probe body and on the package label. The code includes one digit for each selection on the device order form.

The following figure explains the measurement and output mode selections in the device configuration code.

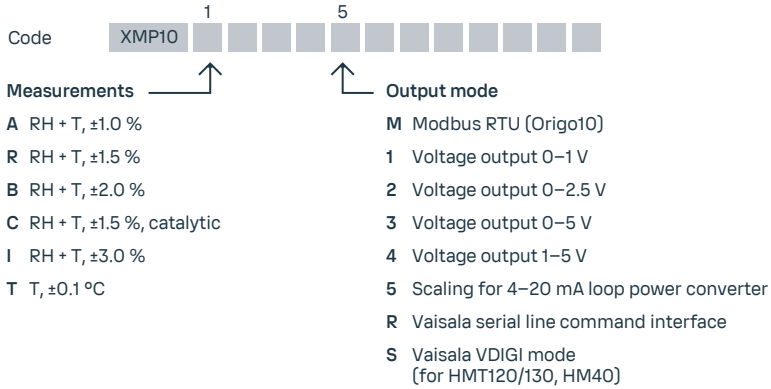


Figure 1 Device configuration code

For detailed explanations for the digits in your device's configuration code, see the device order form at docs.vaisala.com.

2.2 Measured parameters

Parameters measured by XMP10 depend on the configuration selected when ordering the probe.

- XMP10A, XMP10B, XMP10R, XMP10V, and XMP10I: These probes measure both relative humidity and temperature, with several calculated parameters optionally available.
- XMP10T probes measure temperature.

Table 3 Parameters measured by XMP10A, XMP10B, XMP10R, XMP10V, and XMP10I probe models

Parameter	Abbreviation	Metric unit	Non-metric unit
Measured parameters			
Relative humidity	RH	%RH	%RH
Temperature	T	°C	°F
Calculated parameters			
Dew point/frost point temperature [1)]	$T_{d/f}$	°C	°F
Wet bulb temperature	T_w	°C	°F
Absolute humidity	a	g/m^3	gr/ft^3

Parameter	Abbreviation	Metric unit	Non-metric unit
Mixing ratio	x	g/kg	gr/lb
Enthalpy	h	kJ/kg	Btu/lb

1) When the dew point is below 0 °C, the probe outputs frost point for T_d.

Table 4 Parameters measured by XMP10T probe model

Parameter	Abbreviation	Metric unit	Non-metric unit
Temperature	T	°C	°F

2.2.1 Filtering factor

The filtering factor determines how quickly the results of measurement cycles are reflected in values of output parameters. You can use the filtering factor to slow down the response time of the measurement, filtering out rapid changes and measurement noise.

- Maximum value (1) = No filtering, fastest measurement. Output shows 100 % of the most recent measured value.
- Less than maximum value = Filtering is applied and measurement response time is reduced. For example, defining a value that is 90 % of the maximum value means that the filtered output reading = 90 % of the most recent measured value + 10 % of the previous reading.

Filtering factor settings can be configured with the Insight software, the Indigo80 handheld indicator, or using the Modbus protocol.

More information

- Example of configuring filtering factor with Indigo80 handheld indicator (page 39)

2.3 Output options

The probe can be ordered with several preconfigured output options:

- Digital outputs (Modbus RTU, Vaisala serial line command interface)
- Analog outputs (voltage outputs 0–1 / 0–2.5 / 0–5 / 1–5 V DC)
- Vaisala VDIGI mode (for HMT120/130, HM40)

You can change the output configuration of your probe by connecting the probe temporarily to the Insight PC software or the Indigo80 handheld indicator.

More information

- Connecting to Insight PC software (page 33)
- Connecting probes to Indigo80 (page 36)

2.4 Probe structure

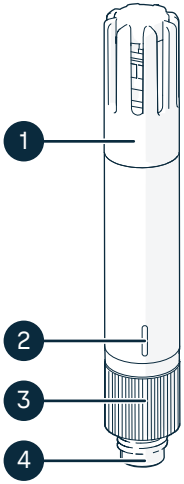


Figure 2 XMP10 probe parts

1 Removable filter over the sensors
2 Orientation mark for inserting the probe into a connector on a host device, such as a transmitter
3 Locking wheel for securing the probe to a cable or a connector on a host device, such as a transmitter
4 M8-4M A-coded connector

More information

- Filter options (page 15)

2.4.1 Filter options

All filters are 12 mm in diameter.

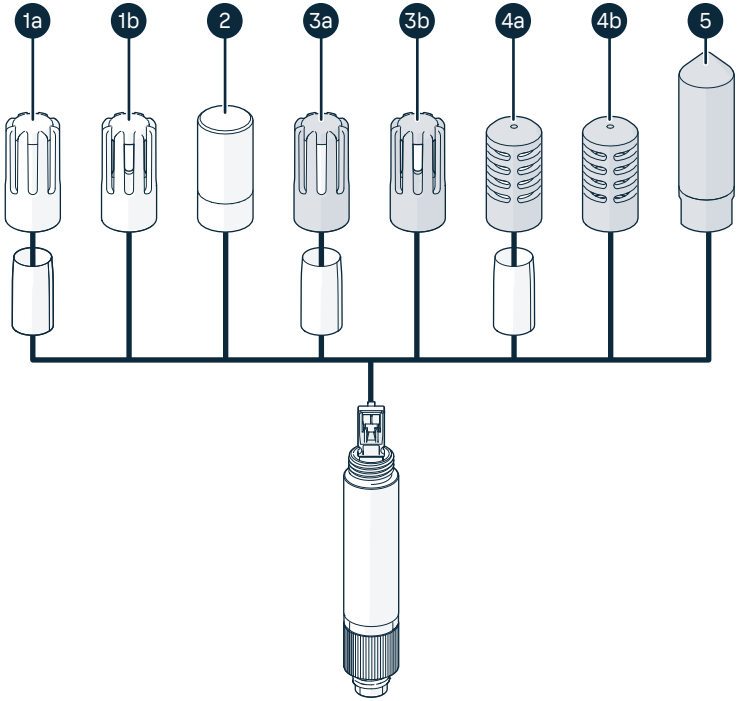


Figure 3 XMP10 filter options

1a Plastic grid with PTFE membrane
1b Grid filter
2 Porous PTFE filter
3a Plastic grid with electroplating and membrane
3b Plastic grid with electroplating
4a Slotted MIM filter with membrane
4b Slotted MIM filter
5 Stainless steel sintered filter

For more information on filter selection, see Selecting the right filter for humidity instruments Datasheet (B212408EN).

More information

- Spare parts and accessories (page 76)

2.5 Installation accessories (optional)

- Probe holder (page 16)
- Probe mounting clamp (page 17)
- Probe mounting flange (page 18)
- Duct installation kit (page 20)
- Loop power converter (page 21)
- Radiation shield with probe installation kit
- Cables (page 22) - Shielded 0.3-m and 3.0-m (1-ft and 9.8-ft) connection cables with threaded connector for probe connection, open end wires on the other end

More information

- Spare parts and accessories (page 76)

2.5.1 Probe holder

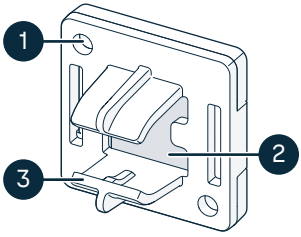


Figure 4 Probe holder ASM213382

1 Holes for attaching the holder with screws (screws not included)
2 Magnet
3 Probe attachment

The probe holder is a versatile mounting accessory for securing Ø 12 mm diameter cable mounted probes.

To attach the probe, simply press the body of the probe into the probe attachment.

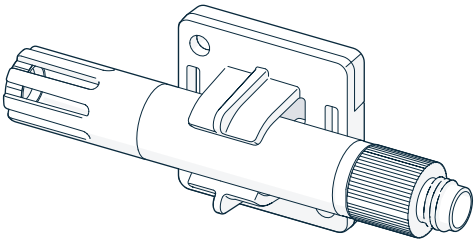


Figure 5 Example probe in the probe holder

2.5.2 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.

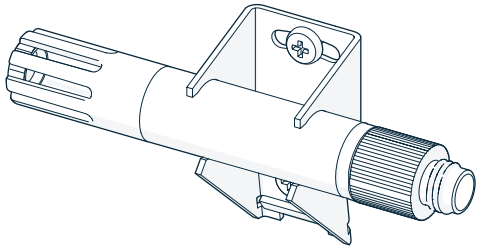


Figure 6 Probe mounting clamp in use

The probe mounting clamp is delivered in 2 parts that must be connected when it is used:

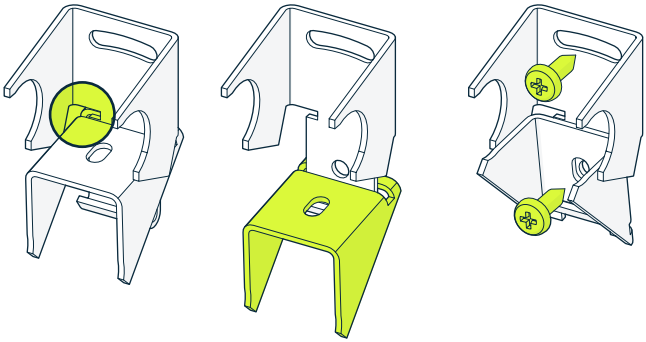


Figure 7 Probe mounting clamp assembly

1. Align the slots on the clamp parts.
2. Slide the lower clamp part over to the bottom end of the upper part.
3. Place the clamp to the intended location and secure the upper clamp part with a screw.
4. Place the probe in the clamp.
5. Tighten the lower clamp part with a screw.

2.5.3 Probe mounting flange

The probe mounting flange is a silicone flange that you can use to hold the probe in a through-wall installation. The flange is a general purpose mounting accessory for Ø 12 mm probes.

For more information, see Mounting Flange for Humidity Probes Quick Reference Guide (M211080EN).

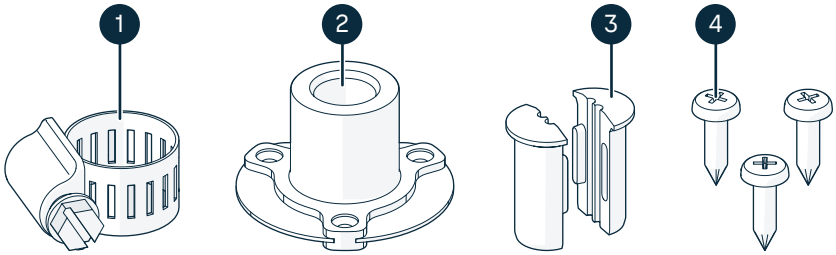


Figure 8 Probe mounting flange parts

1 Stainless steel clamp
2 Mounting flange
3 Sealing plug for coaxial cables. Not needed with XMP10 probes.
4 Three screws

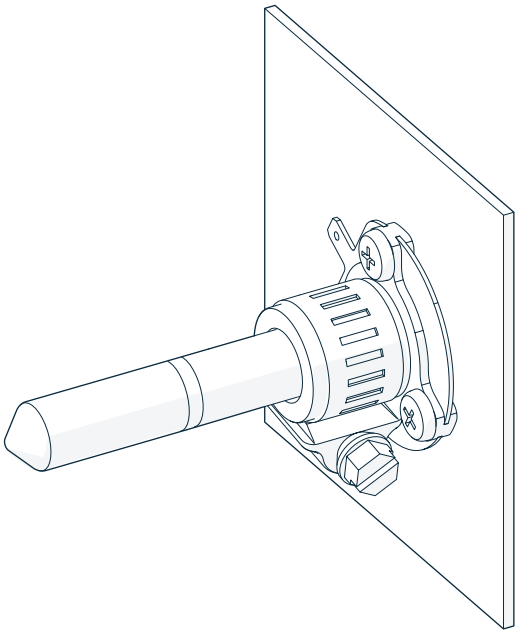
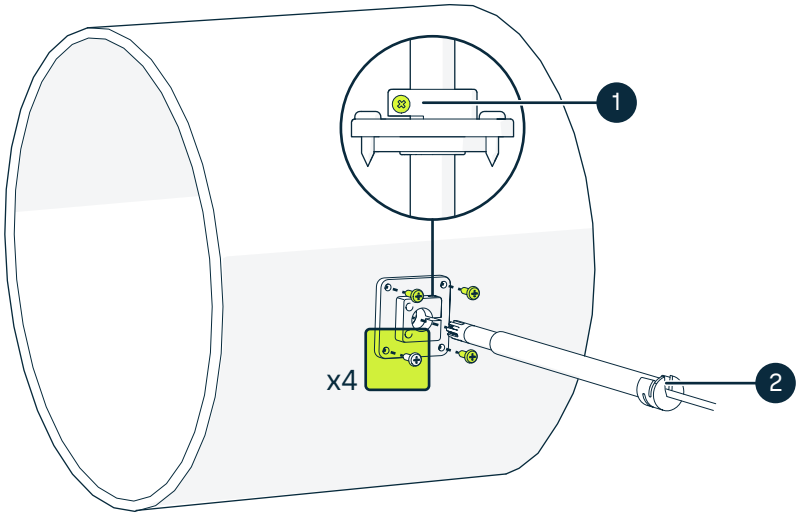


Figure 9 Example probe mounted in flange

2.5.4 Duct installation kit

The duct installation kit includes a plastic pipe with a flange and strain relief. 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 4 screws.



1 Tension screw. Adjust the installation depth and lock in place with the tension screw.
2 Strain relief. Pull the cable to ensure that the probe is firmly inside the pipe.

Figure 10 Probe installation with duct installation kit

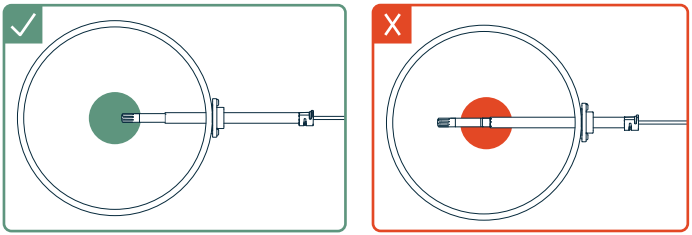


Figure 11 Correct duct installation depth

2.5.5 Loop power converter

The loop power converter is an open-frame module that converts one 0–2.5 V DC 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 parameter is on channel 1, which must be scaled to 0–2.5 V.

The loop power converter is recommended for humidity output only due to conversion accuracy.

> The loop power converter is not intended to be operated without the probe connected. It does not implement logic to detect that the probe is missing, or to control the output in such a case.

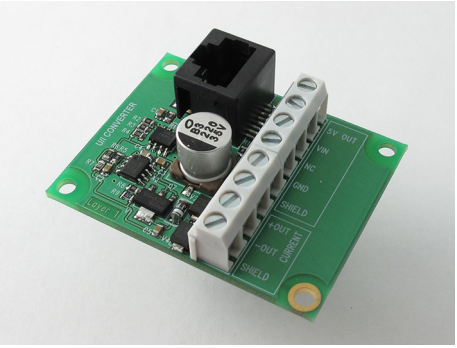


Figure 12 Loop power converter

More information

- Wiring with loop power converter (page 27)

2.5.6 Cables

Connection cables have a straight, threaded female M8 connector on one end and open wires on the other end. You can use other compatible M8 series cables.



Figure 13 Cable with threaded connector

The Vaisala USB cable (item code 219690) has a straight, threaded female M8 connector on one end, and a USB Type A male plug on the other. The USB cable is intended for maintenance purposes only, not for permanent installation.



Figure 14 USB cable for PC connection

2.6 Safety

If any instructions in this document conflict with your local or state legislation or regulations, always follow the local or state legislation or regulations.



CAUTION! The power source for XMP10 must be limited to a maximum of 100 VA, either inherently by the power supply itself or through appropriate overcurrent protection. The supply voltage must not exceed the maximum operating voltage specified in the device's technical data.
Always choose a power supply unit that conforms to the local standards and requirements.
In North America, only power the device with one of the following:

- A certified Class 2 power supply
- A certified Limited Power Source (LPS) compliant with CAN/CSA-C22.2 No. 60950-1 or UL 60950-1



NOTICE! Use only shielded cables when installing the device. If shielded cables and the installation practices described in this manual are not followed, electromagnetic emissions and immunity performance can be impaired, and the installation may not meet the EMC requirements applicable to this product.

Consult local authorities and electricity professionals on decisions that relate to grounding, safe installation, and power supply.



WARNING! Chemical hazard
Devices removed from process may have been contaminated, which can cause injury to the persons handling them. When returning a device for calibration or repair, make sure you send only devices that are safe to handle without special precautions.



CAUTION! Modification of the product can result in injury or damage the product. Do not modify the product or substitute parts unless instructed to do so. Improper modification voids your warranty.



CAUTION! Using components that do not meet Vaisala specifications can result in injury or damage the product. Use only accessories and spare parts that meet the specifications.



Failure to comply with the warnings and cautions in these instructions violates safety standards of design, manufacture, and intended use of the product. Vaisala assumes no liability for the failure to comply with these requirements.

3. Installation

3.1 Installation overview

These instructions cover cable installation of the XMP10 probe.

For instructions on connecting probes to host devices, such as transmitters and data loggers, see the user documentation of the corresponding host device at docs.vaisala.com.

3.2 Mounting

The probe is designed to be mounted from the smooth part of the probe body. For a convenient installation, use the optional installation accessories:

- Use the probe mounting clamp or probe holder to hold the probe on a wall
- Use the probe mounting flange to hold the probe in a through-wall installation

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

More information

- Probe holder (page 16)
- Probe mounting clamp (page 17)
- Probe mounting flange (page 18)

3.3 Wiring

CAUTION! The power source for XMP10 must be limited to a maximum of 100 VA, either inherently by the power supply itself or through appropriate overcurrent protection. The supply voltage must not exceed the maximum operating voltage specified in the device's technical data.
Always choose a power supply unit that conforms to the local standards and requirements.
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- A certified Limited Power Source (LPS) compliant with CAN/CSA-C22.2 No. 60950-1 or UL 60950-1

NOTICE! Use only shielded cables when installing the device. If shielded cables and the installation practices described in this manual are not followed, electromagnetic emissions and immunity performance can be impaired, and the installation may not meet the EMC requirements applicable to this product.

Before you connect the probe to a device, it is recommended to power off the device.

For a secure connection to the probe, tighten the locking wheel to lock the probe to the cable.

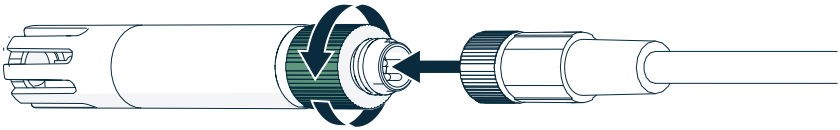
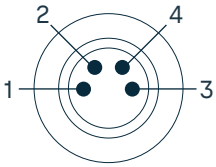


Figure 15 Connecting probe to cable



M8-4M

1	Brown
2	White
3	Blue
4	Black

Analog modes

1	V_{in} 5–28 V DC (V_{out} 0–1 / 0–2.5 V) V_{in} 8–28 V DC (V_{out} 0–5 / 1–5 V)
2	Channel 1: RH / Td/ T 0–1 / 2.5 / 5 V, 1–5 V
3	GND
4	Channel 2: RH / Td / T 0–1 / 2.5 / 5 V, 1–5 V

Digital modes

1	V_{in} 5–28 V DC
2	RS-485: D-
3	GND
4	RS-485: D+

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 V DC
  - 2 s at other valid operating voltages
- Probes with digital output: 2 s

3.3.1 Wiring multiple digital devices

The maximum number of probes that you can connect to a system over the RS-485 interface is 32 when the communication speed is 19200 bps or lower.

Note that the maximum number of probes depends on the line characteristics, such as line length and type of host device. A long line decreases the number of probes.

Use the Insight PC software to configure each probe on the line to have a different Modbus address. In addition, it is recommended to terminate the bus at the last device with a termination resistor when the line length is over 100 m (328 ft).

Connecting other devices can decrease the maximum number of probes.

The following figures show the recommended wiring when connecting multiple devices to the RS-485 interface using either a separate local power supply for each device or a common power supply.

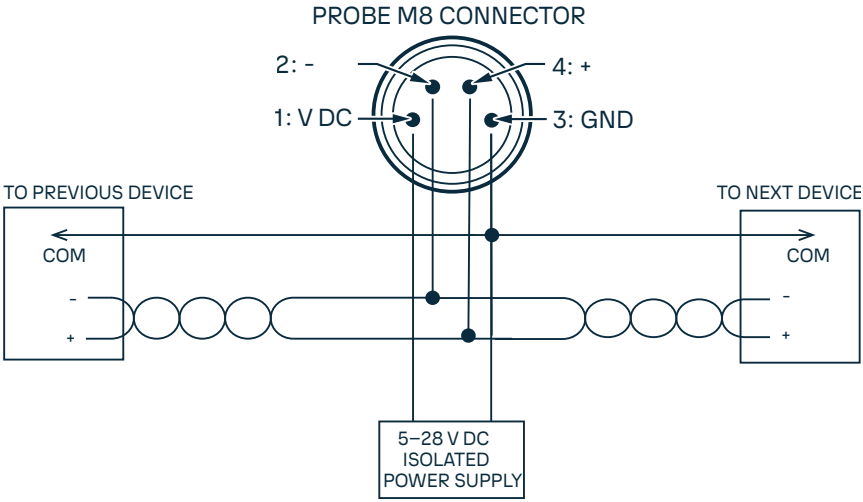


Figure 16 Wiring multiple devices using local power supply

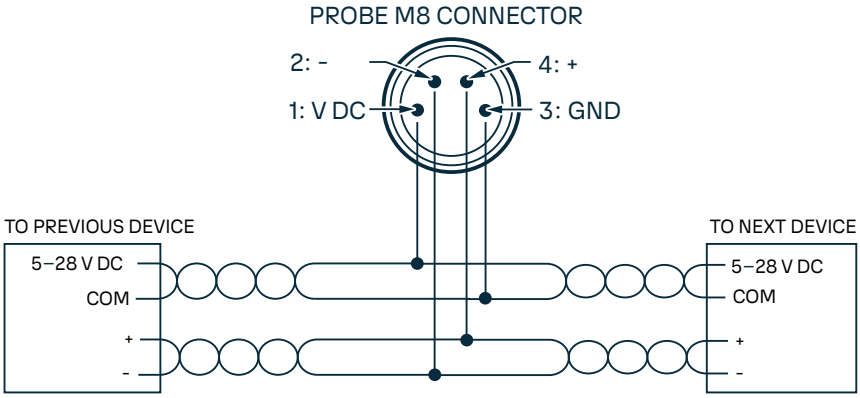


Figure 17 Wiring multiple devices using common power supply

3.3.2 Wiring with loop power converter

To use the loop power converter module with the probe, the probe must be in the analog output mode. The desired parameter is on channel 1, which must be scaled to 0–2.5 V.

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

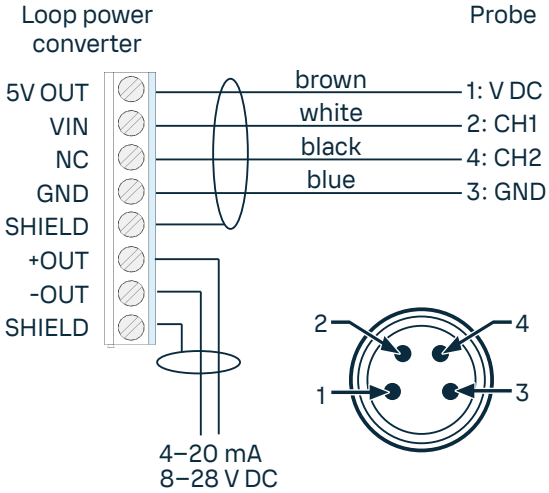


Figure 18 Wiring with loop power converter module

For more information, see Loop Power Converter Quick Reference Guide (M211106EN).

More information

- Output options (page 13)

3.3.3 Power supply requirements

The operating voltage for XMP10 probes depends on the type of output configured for the probe:

Table 5 Operating voltage ranges

Analog modes	Digital modes
5–28 V DC (V_{out} 0–1 / 0–2.5 V)	5–28 V DC
8–28 V DC (V_{out} 0–5 / 1–5 V)	

Current consumption is 0.5 mA at 5 V supply voltage, which makes XMP10 probes well suited for running on battery power. The maximum peak consumption is 3 mA.

Recommendations

- 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 increases the current consumption 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.

4. Modbus communication

The Modbus variant used in XMP10 probes is Modbus RTU. The following table lists the default communication settings used when Modbus is enabled at the factory (chosen when ordering).

Table 6 Default Modbus communication settings

Description	Default value
Serial bit rate	19200
Parity	None
Number of data bits	8
Number of stop bits	2
Flow control	None
Modbus device address	240
Serial delay	0
Communication mode	Modbus RTU

Use Vaisala Insight software to change the Modbus serial communication settings if needed. Download Vaisala Insight software at www.vaisala.com/insight.

The instrument must be switched off and on before the communication setting changes take effect.

More information

- Wiring multiple digital devices (page 26)

5. Vaisala Insight PC software

Vaisala Insight PC software is a configuration and calibration software for Vaisala devices. Insight is available for the Windows operating system (64-bit only). For a full list of supported operating system versions, see vaisala.com/insight.

With Insight, you can:

- See device information and status.
- See real-time measurement data.
- Configure serial communication settings, filtering factor, and analog output parameters and scaling.
- Calibrate and adjust the device.
- Perform short-term data logging for laboratory testing or evaluation purposes, for example.



To ensure support for your device, download the latest version of Insight at vaisala.com/insight.

The probe can be connected to Insight using a Vaisala USB cable (item code 219690).

5.1 Insight PC software overview



Figure 19 Insight PC software main menu view

1 Select ⚙ to access Insight main menu.
   - **Configure device**: probe options and general settings.
   - **Export settings**: creates a text file export of the device settings.
   - **Calibrate**: Probes with HUMICAP® humidity sensor: options for calibrating and adjusting the measurement of the probe, viewing adjustment data, and restoring factory adjustments.
   - Probe reset quick selection.
   - **About device**: general device information such as serial number and software version.
2 Select **Settings** to switch between the **Basic mode** and **Advanced mode** user modes, change the units of parameters (metric/non-metric), enter a factory code to access restricted functionalities, or view information about the Insight software.
3 **Monitoring** provides options for monitoring and recording selected parameters, and exporting the monitoring data as a CSV (comma-separated values) file.
4 Device information menu with the following tabs:
   - **Measurements**: measurement graph view with parameter drop-down selection.
   - **Calibration information**: read-only information about the latest stored calibration.
   - **Diagnostics**: troubleshooting and administrative information about the device status.

5.1.1 Insight software user modes

You can switch between the **Basic mode** and **Advanced mode** user modes in the **Settings** menu.

Depending on the connected device, switching to **Advanced mode** may provide access to additional configuration options. Use these options only as described in the product documentation or as instructed by Vaisala support.

5.2 Connecting to Insight PC software

- Computer with a Microsoft Windows® operating system (64-bit version) and Vaisala Insight PC Software installed
- M8-4F USB service cable (Vaisala item code 219690)

When connecting several devices at the same time, note that your computer may not be able to supply enough power through its USB ports. Use an externally powered USB hub that can supply >2 W for each port.

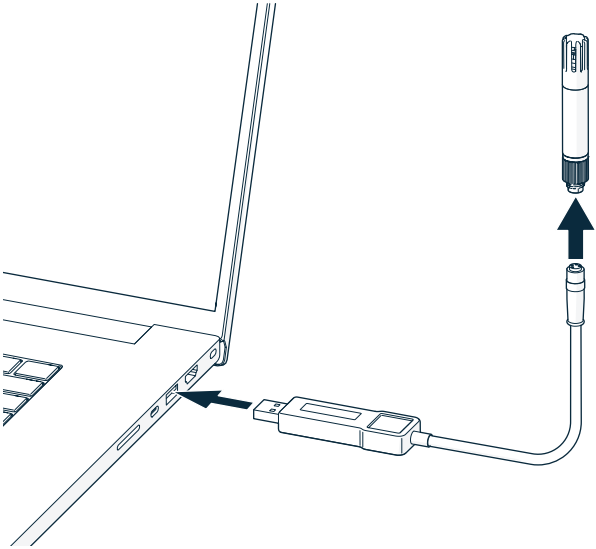


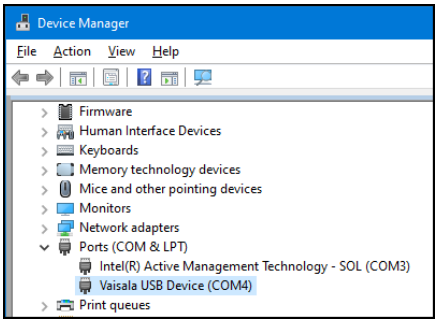
Figure 20 Connecting probe to Insight

1. Open the Insight software on your computer.
2. Connect the USB cable to a free USB port on the computer.
3. Connect the probe to the USB cable.
4. Wait for the Insight software to detect the probe.

5.2.1 Installing driver for the USB service cable

Only Windows® operating systems are supported by the driver of the USB service cable.

1. Connect the USB service cable to a USB port on your computer. Windows detects the new device and installs the appropriate driver.
2. Open **Device Manager** from the Windows **Start** menu. Use search to find it if necessary (search for "device").
3. Locate the cable in the list of devices:
   - If the device is listed as **Vaisala USB Device** with a COM port number in brackets, the cable is ready for use.
   - If the device is listed as **Vaisala USB Instrument Cable** without a COM port number listed, you must install the driver manually.



4. To install the driver manually:
   a. Disconnect the USB service cable from the computer.
   b. Download the Vaisala USB driver at vaisala.com/software (select the appropriate USB Instrument Driver Setup for your cable).
   c. Extract the driver zip file and run the USB driver installation program *`Vaisala USB Device Driver Setup.exe`*. Accept the installation defaults.
   d. Go back to step 1 and verify that the driver installation works as expected.

6. Using probe with Indigo80 handheld indicator

6.1 Indigo80 handheld indicator

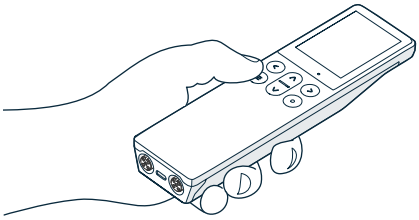


Figure 21 Indigo80 handheld indicator

Vaisala Indigo80 Handheld Indicator is a portable diagnostics tool that accommodates up to two compatible Vaisala devices for measuring a wide range of parameters.

With the indicator, you can:

- See real-time measurements and device and status information
- Log measurement data
- Calibrate and adjust the probe
- Configure probe features and settings such as filtering factor, analog output overrange behavior, serial communication, and analog output.
- Enable another connected probe to function as the reference instrument for relative humidity and/or temperature during calibration and adjustment.

Accessing certain configuration options for your probe is possible only using the free Insight PC software, downloadable at vaisala.com/insight.

The help tours in the indicator's user interface guide you through the key features of the indicator. You can access the tours in the **Help** menu by pressing the ☰ button.

For more information on using the indicator, for example, editing the measurement views and performing data logging, see Indigo80 User Guide (M212722EN).

More information

- Configuring probe features with Indigo80 handheld indicator (page 38)
- Calibration and adjustment with Indigo80 handheld indicator (page 50)

6.1.1 Probe compatibility

For the most up-to-date version compatibility information, see Firmware version compatibility of Indigo80-compatible devices Technical Note (M212901EN).

6.1.2 Indigo80 keypad

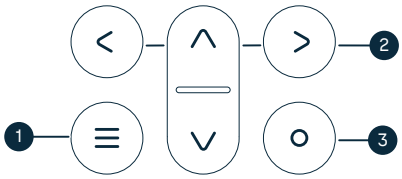


Figure 22 Indigo80 keypad

1 Power on/off and main menu button
2 Arrow buttons for navigating menus and scrolling views
3 Select button for selecting items in the user interface

6.1.3 Indigo80 main menu

Pressing the ☰ button while navigating the Indigo80 menus and views opens the main menu.

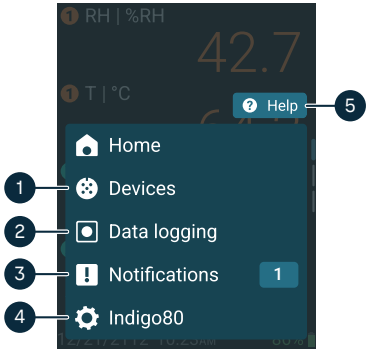


Figure 23 Indigo80 main menu

1 **Devices** menu contains, for example, options related to sensor purge, calibration, and environment settings (depending on the connected device).
2 **Data logging** menu for setting logging interval and duration, and browsing data files.
3 **Notifications** menu displays notifications related to Indigo80 and the connected devices.
4 **Indigo80** menu for changing the settings of Indigo80 (for example, date, time, and language) and viewing device information.
5 **Help** menu contains tours showing the key features of Indigo80, as well as instructions for sending devices to Vaisala for calibration and maintenance.

6.2 Connecting probes to Indigo80

- Probe connection cable (M8-M12, Vaisala item code 262195SP)

Up to two Vaisala Indigo-compatible measurement devices can be connected to the ports located on the bottom of Indigo80. You can connect and disconnect devices both when the indicator is powered on and when it is off.

Vaisala recommends using cables provided by Vaisala when connecting devices to the indicator. Cables and other accessories are available to order at store.vaisala.com.

Connecting two XMP10 and HMP60/HMP110 series probes, or a combination of these probes, to Indigo80 simultaneously is not supported.

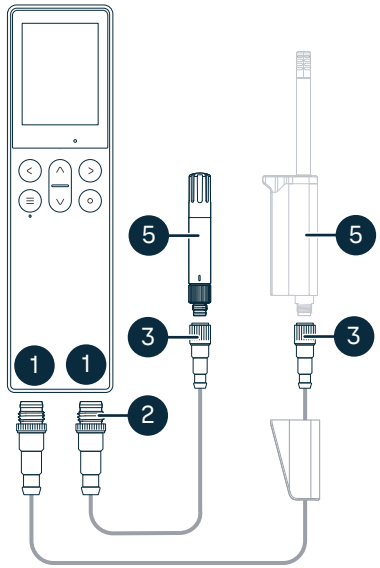
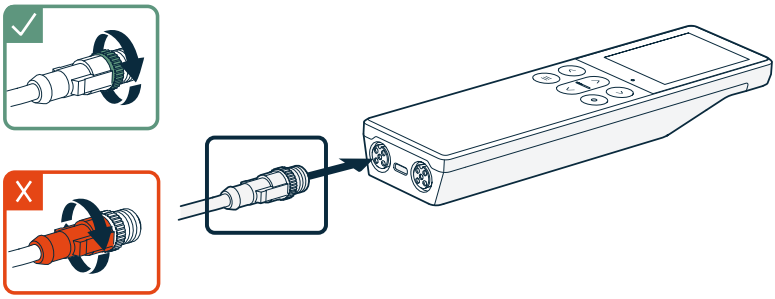


Figure 24 Example of connecting probes to Indigo80

1 M12-5F ports on the bottom of Indigo80 for connecting compatible Vaisala devices. Ports are labeled ❶ (left) and ❷ (right) on Indigo80.
2 M12-5M cable connector
3 M8-4F cable connector
4 Probe displayed as ❶ by Indigo80
5 Probe displayed as ❷ by Indigo80

1. If the indicator is powered and no devices are connected to it, the text **Please connect a measurement device** will be shown on the display.

2. Insert the probe connection cable in one of the ports on the bottom of the indicator.
   - **Note the orientation of the cable connector when inserting it**
   - **Hold the connector in place while turning its locking ring clockwise – never twist the connector body!**



3. Connect the probe to the M8 end of the probe connection cable.

   When the indicator recognizes the connected probe, it shows a notification on the display. A probe connected to the leftmost port in the indicator is labeled ❶ on the indicator's display, while the probe in the rightmost port is labeled ❷.
4. To change probes, simply detach the cable from the probe and connect a new probe.

6.3 Configuring probe features with Indigo80 handheld indicator

- Probe connection cable (M8-M12, Vaisala item code 262195SP)

You can use the Indigo80 handheld indicator to configure probe features such as filtering factor, analog outputs and serial communication. The available features depend on the probe model and firmware version.

Accessing certain configuration options for your probe is possible only using the free Insight PC software, downloadable at vaisala.com/insight.

1. Connect the probe(s) to the indicator.
2. Open the indicator main menu by pressing ☰.

3. Select **Devices**. If you have more than one device connected to the indicator, make a further selection between the devices.
4. Select **Settings** to access and change the features available for your probe.
5. Exit the menu by pressing ⟲ or return to the main menu by pressing ☰.

6.3.1 Example of configuring filtering factor with Indigo80 handheld indicator



- Probe connection cable (M8-M12, Vaisala item code 262195SP)

The filtering factor allows averaging the output if the measuring environment produces occasional exceptionally high or low readings.

This example shows how to configure the filtering factor as **0.9** using the Indigo80 handheld indicator.

This means that the new measurement output is a combination of the latest measurement (90 %) and the previous measurement (10 %).

1. Connect the probe(s) to the indicator.
2. Open the indicator main menu by pressing ☰.
3. Select **Devices**. If you have more than one device connected to the indicator, make a further selection between the devices.
4. Select **Settings**.
5. Select **Filtering factor**.
   a. Use the arrow buttons to set the value as **0.9**.
   b. Select **Set**.
6. Exit the menu by pressing ⟲ or return to the main menu by pressing ☰.

7. Calibration and adjustment

7.1 Overview of calibration and adjustment

Calibration means comparing the measurement output of the device to a known reference, such as a known environment in a calibration chamber or the output of a reference instrument. Correcting the reading of the device so that it measures accurately is referred to as **adjustment**.

If you think the device is not measuring correctly, calibration and adjustment is not the first thing to do. Check the following first:

- Make sure that the location for the probe represents well the area of interest, and nothing is interfering with the measurement: heat sources, temperature differences, or condensation.
- Check that there is no moisture on the probe. If the sensor has become wet, wait for it to dry.
- Always wait for the measurement to stabilize.

Vaisala recommends calibrating the accuracy of the probes yearly. The probe is fully calibrated and adjusted as shipped from the factory, and a calibration reminder with a 12-month interval is activated in the probe. To maintain the accuracy of the measurement, calibrate and adjust the probe as indicated by the calibration reminder, or as needed. Typical calibration interval is one year, but depending on the application it may be necessary to check the accuracy more frequently.

Vaisala offers comprehensive customer care throughout the life cycle of our measurement instruments and systems, including calibration and adjustment. Our factory services are provided worldwide with fast deliveries. See vaisala.com/calibration.

WARNING! Chemical hazard
Devices removed from process may have been contaminated, which can cause injury to the persons handling them. When returning a device for calibration or repair, make sure you send only devices that are safe to handle without special precautions.

To perform calibration and adjustment procedures yourself, follow the applicable procedure(s) as listed in Calibration and adjustment procedures (page 42). Note that there are some requirements to the conditions needed for calibration and adjustment; see Adjustment points and environments (page 41).

If calibration indicates that **humidity measurement accuracy** is not within specification:

- Probes with INTERCAP® humidity sensor:
  Replace the humidity measurement sensor. These probes have no adjustment functions. Vaisala INTERCAP® humidity sensors are designed to be replaced when necessary. The sensor replacement is fast and requires no special equipment or environments.

- Probes with HUMICAP® humidity sensor:
  Perform the applicable adjustment procedure. If adjustment is not enough to restore the humidity measurement accuracy, continue to humidity sensor replacement. Note that adjustment after sensor replacement is also necessary.

If calibration indicates that **temperature measurement accuracy** is not within specification, they should be adjusted using the applicable procedure. The temperature measurement is very stable so adjustment is rarely needed.

The XMP10 probe does not support temperature sensor replacement by users.

7.2 Adjustment points and environments

Measurement probes can be **calibrated** in any environment that is within their operating range. However, probes should only be **adjusted** in conditions where they have good accuracy. Refer to the accuracy specification of the probe you intend to adjust. Probes will not accept the adjustment if the adjustment points are unsuitable.

Adjustment can be done in 1–5 points depending on the parameter, adjustment method, and accuracy requirements. Because stabilization of temperature and humidity takes time, you should expect the adjustment procedure to take at least 30 minutes for each adjustment point.

Adjustment of temperature measurement is typically not necessary.

1-point adjustment adjusts the measurement in a single measurement point only. Output from the entire measurement range is offset by the correction amount. 1-point adjustment is appropriate when accurate measurement is needed in a specific measurement point.

2-point adjustment adjust the measurement in 2 points. Vaisala humidity sensors are so linear that 2 points are enough to reach the specified accuracy over the entire humidity measurement range. 2-point RH and T adjustments have the following requirements:

- When adjusting RH, the first point requires a < 50 %RH humidity reference, and the second point must be > 50 %RH. The difference between the references must be at least 30 %RH.
- When adjusting T, the difference between the 2 references must be at least 30 °C (54 °F).

Multipoint adjustment adjusts the measurement in 3–5 points. This adjustment is available for RH measurement using the Insight software in Advanced mode. The difference between the references must be at least 2 %RH. Multipoint adjustment is only needed if standards or operating procedures explicitly require more than 2 adjustment points.



Vaisala recommends adjusting humidity in 2 points, 11 %RH and 75 %RH. These humidities can be produced using LiCl and NaCl salt chambers of the Vaisala HMK15 Humidity Calibrator. For more information, see HMK15 User Guide (M210185EN).



When working with equipment in extremely hot or cold temperatures, use appropriate personal protective equipment such as thermally insulated gloves and clothing. Wear protective eyewear if working with coolants such as liquid nitrogen, and observe safe handling and storage precautions.

7.3 Calibration and adjustment procedures

A simple way to check the measurement accuracy of the probes is to perform a field calibration using a reference instrument. This method does not require the probe to be disconnected from the host device, and a separate reference environment is not needed either. See Field calibration using a reference instrument (page 42).

Disconnected probes can be connected to a computer or a handheld device for calibration and adjustment. See the following sections for calibration and adjustment procedures:

- Adjustment using Insight PC software (page 43)
- Calibration and adjustment with Indigo80 handheld indicator (page 50)
- Calibration and adjustment using HM40 handheld meter (page 54)
- Adjustment using serial line (page 58)

7.3.1 Field calibration using a reference instrument



- Calibrated reference instrument that measures the parameter(s) being calibrated

When the probe is connected to a transmitter or a data logger that has a display, you can easily perform a field calibration of the probe using a second humidity and temperature measurement instrument that has a display.

1. Place the probe of the reference instrument (or the entire instrument) in the same environment as the probe that you are checking. The environment should be as stable as possible.
2. Wait for 30 minutes for humidity and temperature to stabilize. Verify that measurements are no longer changing at the end of the stabilization period.
3. Record the readings from both instruments.

7.3.2 Adjustment using Insight PC software

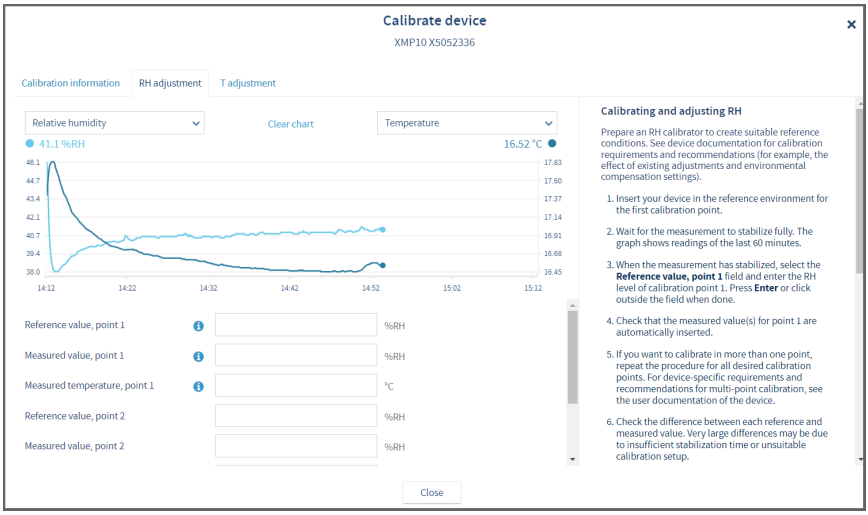


Figure 25 Probe RH calibration view example in Insight

You can adjust humidity and temperature measurement parameters by connecting the probe to the Vaisala Insight PC software. Relative humidity can be adjusted in 1–5 points, and temperature with a 1-point or 2-point adjustment.

Calibrating and adjusting measurements with the Insight PC software requires the following:

- M8-4F USB service cable (Vaisala item code 219690)
- Computer with a Microsoft Windows® operating system (64-bit version) and Vaisala Insight PC Software installed
- Humidity or temperature references for the adjustment points (1–5 for RH, 1 or 2 for temperature). For an example of RH references for a 5-point adjustment using Vaisala Humidity Calibrator HMK15, see Table 7 (page 46).

2 adjustment points (close to the low and high ends of the used RH range) is enough to reach the specified accuracy over the whole range. However, if your standards or operating procedures explicitly require 3–5 adjustment points, you can perform a multipoint adjustment (3–5 points) with the Insight PC software. Note that RH adjustment in more than 2 points (3–5 points) requires using the Insight PC software in the **Advanced mode** user mode. The user mode selection is done in the Insight **Settings** menu.

If you have a list of previously collected calibration readings (for example, from a 3rd party laboratory calibration), you can adjust the device with the Insight PC software without having to generate the calibration conditions and wait for stabilization. For instructions, see Adjustment in Insight using previously measured values (page 47).

More information

- Connecting to Insight PC software (page 33)
- Adjustment points and environments (page 41)

7.3.2.1 1-point and 2-point T adjustment with Insight PC software

To adjust the temperature measurement with the Insight PC software you need:

- M8-4F USB service cable (Vaisala item code 219690)
- Computer with a Microsoft Windows® operating system (64-bit version) and Vaisala Insight PC Software installed
- 1–2 temperature references.

1. Open the Insight software on your computer.
2. Connect the probe to the PC with USB cable 219690 and wait for Insight to detect the probe.
3. Select **> Calibrate > Yes** to open the calibration menu and switch the probe to calibration mode.
4. Open the **T adjustment** tab.
5. Remove the filter from the probe and insert the probe in the first reference environment.
6. Wait for the measurement to stabilize fully. The graph shows readings of the last 60 minutes.
7. When the measurement has stabilized, click the **Reference value, point 1** field and enter the temperature of the first adjustment reference. Press **Enter** or click outside the field when done.
8. Check that the measured value for point 1 is automatically inserted.
9. If you want to make a 2-point adjustment, repeat steps step 5...step 8 for the second adjustment point.
10. Check the difference between each reference and measured value. Very large differences may be due to insufficient stabilization time or unsuitable calibration setup.

    If you want to save the adjustment into the device, select **Activate adjustment**.
    To exit without taking the adjustment in use, select **Close**.
11. After adjusting your device, update the information in the **Calibration information** tab.

7.3.2.2 1-point and 2-point RH adjustment with Insight PC software

To adjust the RH measurement of your probe with the Insight PC software you need:

- M8-4F USB service cable (Vaisala item code 219690)
- Computer with a Microsoft Windows® operating system (64-bit version) and Vaisala Insight PC Software installed
- 1–2 humidity references.

1-point and 2-point RH adjustments are available in both the **Basic mode** and **Advanced mode** Insight user modes. Multipoint RH adjustments (3–5 adjustment points) are only available in **Advanced mode**. The user mode selection is done in the Insight **Settings** menu.

1. Open the Insight software on your computer.
2. Connect the probe to the PC with USB cable 219690 and wait for Insight to detect the probe.
3. Select **> Calibrate > Yes** to open the calibration menu and switch the probe to calibration mode.
4. Open the **RH adjustment** tab.
5. Remove the filter from the probe and insert the probe in the first reference environment.
6. Wait for the measurement to stabilize fully. The graph shows readings of the last 60 minutes.
7. When the measurement has stabilized, click the **Reference value, point 1** field and enter the RH level of the first adjustment reference. Press **Enter** or click outside the field when done.
8. Check that the measured values for point 1 are automatically inserted.
9. If you want to make a 2-point adjustment, repeat steps step 5...step 8 for the second adjustment point.
10. Check the difference between each reference and measured value. Very large differences may be due to insufficient stabilization time or unsuitable calibration setup.

    If you want to save the adjustment into the device, select **Activate adjustment**.
    To exit without taking the adjustment in use, select **Close**.
11. After adjusting your device, update the information in the **Calibration information** tab.

7.3.2.3 Multipoint RH adjustment with Insight PC software

To perform a multipoint adjustment (3–5 adjustment points) to the RH measurement of your probe with the Insight PC software you need:

- M8-4F USB service cable (Vaisala item code 219690)
- Computer with a Microsoft Windows® operating system (64-bit version) and Vaisala Insight PC Software installed
- 3–5 humidity references. For reference examples for a 5-point adjustment, see Table 7 (page 46).

For more information on using a humidity calibrator and salt chamber references, see HMK15 User Guide (M210185EN).

A 2-point adjustment (close to the low and high ends of the used RH range) is enough to reach the specified accuracy over the entire range. However, if your standards or operating procedures explicitly require 3–5 adjustment points, perform a multipoint adjustment (3–5 points) with the Insight PC software.

Table 7 Adjustment reference examples for 5-point adjustment

Salt chamber solution	RH at 25 °C
LiCl	11.3 %RH [1)]
MgCl	32.8 %RH [1)]
NaCl	75.3 %RH [1)]
KCl	84.3 %RH [1)]
K_2SO_4	97.3 %RH [1)]

1) *See Greenspan's calibration table in HMK15 User Guide (M210185EN) for salt reference humidity uncertainties in different temperatures.*

The following 5-point adjustment example procedure uses the Vaisala HMK15 Humidity Calibrator. LiCl salt (11.3 %RH) is used as the first reference point, and following 4 references are as shown in Table 7 (page 46).

1. Open the Insight software on your computer.

   Note that you must use Insight in the **Advanced mode** user mode to carry out a multipoint adjustment (3–5 adjustment points). The user mode selection is done in the Insight **Settings** menu.
2. Connect the probe to the PC with USB cable 219690 and wait for Insight to detect the probe.
3. Select **> Calibrate > Yes** to open the calibration menu and switch the probe to calibration mode.
4. Open the **RH adjustment** tab.
5. Remove the filter from the probe and insert the probe in the LiCl salt chamber of the humidity calibrator (11.3 %RH).

6. Wait for the measurement to stabilize fully. The graph shows the readings of the last 60 minutes.
7. When the measurement has stabilized, click the **Reference value, point 1** field and enter the RH level of calibration point 1 (11.3 %RH). Press **Enter** or click outside the field when done.
8. Check that the measured value(s) for point 1 are automatically inserted.
9. Repeat steps step 5...step 8 for the remaining 2–4 reference humidities (see Table 7 (page 46)).
10. Check the difference between each reference and measured value. Very large differences may be due to insufficient stabilization time or unsuitable calibration setup.

    If you want to adjust the device, select **Activate adjustment**.
    To exit without taking the adjustment in use, select **Close**.
11. After adjusting your device, update the information in the **Calibration information** tab.

7.3.2.4 Adjustment in Insight using previously measured values

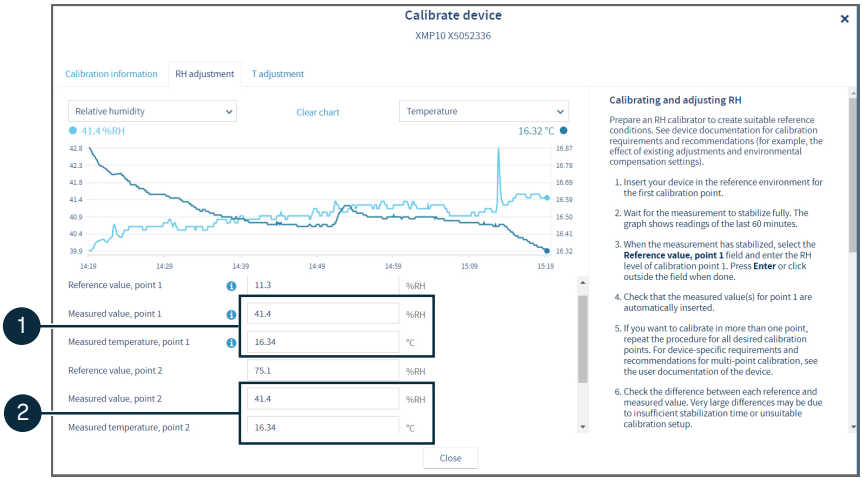


Figure 26 Example RH adjustment view when entering previously measured values

1 Measured RH and T values for point 1
2 Measured RH and T values for point 2

If you have a list of previously collected calibration readings (for example, from a 3rd party laboratory calibration), you can adjust the probe without having to generate the calibration conditions and wait for stabilization. Both RH and T can be adjusted using previously measured values.

If you adjust the probe using previously measured values, the device readings will be corrected and **your previous calibration certificate will not be valid anymore**. If an up-to-date calibration certificate is still needed, you must perform the calibration again to detect any remaining measurement error after the adjustment.

To adjust the measurement of the probe with the Insight PC software using previously measured values, you need:

- M8-4F USB service cable (Vaisala item code 219690)
- Computer with a Microsoft Windows® operating system (64-bit version) and Vaisala Insight PC Software installed
- Previously collected measurement values that are entered in the adjustment.

The following example describes a 2-point RH adjustment in Insight using previously measured values:

1. Open the Insight software on your computer.
2. Connect the probe to the PC with USB cable 219690 and wait for Insight to detect the probe.
3. Select **> Calibrate > Yes** to open the calibration menu and switch the probe to calibration mode.
4. Open the **RH adjustment** tab.
5. When entering previously measured values, there is no need to insert the probe in a reference environment or wait for stabilization. Enter the RH level of your first reference in the **Reference value, point 1** field.
6. Replace the automatically inserted value in the **Measured value, point 1** field with the value that you have measured previously. Also replace the automatically inserted temperature value in the **Measured temperature, point 1** field.
7. Repeat steps step 5 and step 6 for all desired calibration points.

   If you want to save the adjustment into the device, select **Activate adjustment**.
   To exit without taking the adjustment in use, select **Close**.
8. After adjusting your device, update the information in the **Calibration information** tab.

7.3.2.5 Adjusting RH for new HUMICAP sensor in Insight PC software

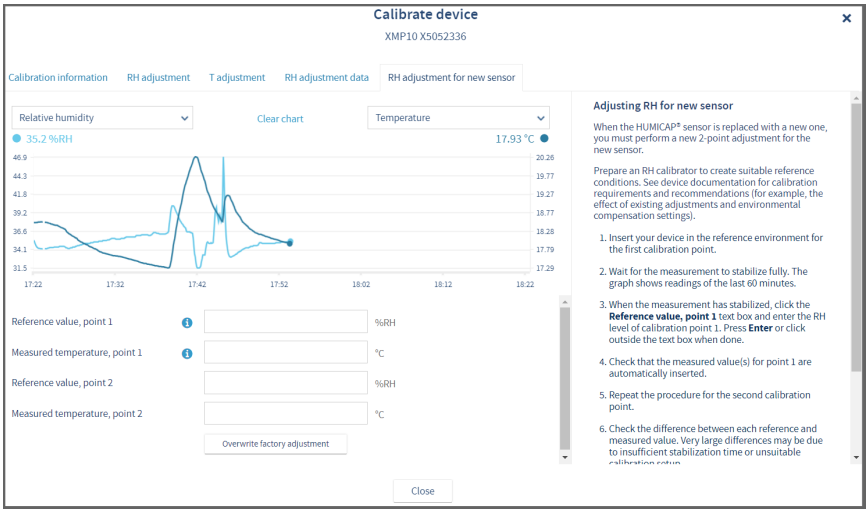


Figure 27 New sensor RH adjustment menu in Insight PC software (Advanced mode required)

When the HUMICAP sensor is replaced with a new one, you must perform a new 2-point adjustment for the new sensor.

NOTICE! Only perform the **RH adjustment for new sensor** procedure after you have replaced the HUMICAP sensor with a new one. Performing this procedure for sensors already in use will disturb the measurement capabilities of the sensor.

- M8-4F USB service cable (Vaisala item code 219690)
- Computer with a Microsoft Windows® operating system (64-bit version) and Vaisala Insight PC Software installed
- 2 humidity references.

1. Prepare an RH calibrator to create suitable reference conditions.
2. Open the Insight software on your computer.

   Note that you must use Insight in the **Advanced mode** user mode to perform an RH adjustment for a new HUMICAP sensor. The user mode selection is done in the **Settings** menu.
3. Connect the probe to the PC with USB cable 219690 and wait for Insight to detect the probe.

4. Remove the filter from the probe and insert the probe in the first humidity reference environment.
5. Select **> Calibrate > Yes** to open the calibration menu and switch the probe to calibration mode.
6. Open the **RH adjustment for new sensor** tab.
7. Wait for the measurement to stabilize fully. The graph shows readings of the last 60 minutes.
8. When the measurement has stabilized, click the **Reference value, point 1** field and enter the RH level of the first reference point. Press **Enter** or click outside the field when done.
9. Check that the measured value(s) for point 1 are automatically inserted.
10. Place the probe in the second reference environment and repeat steps step 7... step 9 for the second reference.
11. To save the adjustment into the device, select **Overwrite factory adjustment**.
12. After adjusting your device, update the information in the **Calibration information** tab.

7.3.3 Calibration and adjustment with Indigo80 handheld indicator

The Indigo80 handheld indicator provides two ways to calibrate and adjust measurements for probes: **Guided calibration** and **Manual adjustment**.

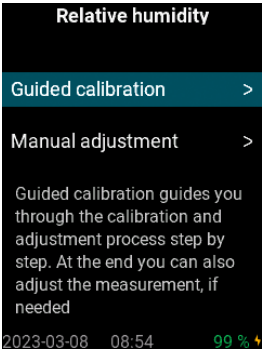


Figure 28 Indigo80 calibration methods for probes

- Choose **Guided calibration** when you have a reference environment or a calibrated reference instrument and want the indicator to guide you through the calibration process step by step. At the end you can also adjust the measurement, if needed.
- Choose **Manual adjustment** if you already have previously collected calibration readings (for example, from a calibration certificate) for 1 or 2 calibration points and want to adjust the probe to correct the observed errors. No separate reference instrument or reference environment is needed during the manual adjustment procedure. For all other use cases, **Guided calibration** is recommended.

7.3.3.1 Performing guided calibration with Indigo80 handheld indicator

- Probe connection cable (M8-M12, Vaisala item code 262195SP)
- Reference environment(s) or reference instruments for producing the desired reference values

In guided calibration, the indicator guides you through the calibration process step by step. At the end, you can also adjust the measurement, if needed.

You can choose to do either 1-point or 2-point calibration, and choose to use the reference environment or instrument of your choice, for example, another probe connected to your indicator.

For relative humidity, you can choose to use Vaisala HMK15 Humidity Calibrator. For more information on HMK15, see HMK15 User Guide (M210185EN).

Guided calibration using a reference environment (including purge and stabilization time, if applicable to the probe), typically takes 1 to 2 hours depending on the number of calibration points.

Before you start, familiarize yourself with information on adjustment points and requirements for your probe.

1. Connect the probe(s) to the indicator.
2. Open the indicator main menu by pressing ☰.
3. Select **Devices**. If you have more than one device connected to the indicator, make a further selection between the devices.
4. Select **Calibrate / Adjust**.
5. Acknowledge the notification by selecting **OK**.
6. Select the type of calibration or adjustment to perform, for example, **RH adjustment**.
7. Select **Guided calibration**.
8. In **Calibration points**, select the number of calibration points: **1 point** or **2 points**.
9. In **Reference**, select the desired reference environment(s) or reference instrument(s).

   Selection **Other reference** allows you to use any reference environment(s) of your choice. For 2-point calibration of relative humidity, you can select two salts from the list, one for each calibration point.
   When you have selected the reference environments for 2-point calibration, press ⟲ to get back to the previous view.

10. Select **Start calibration**.

    The indicator guides you through the calibration process from this point onwards. Press ⓞ to proceed from one view to another.

More information

- Connecting probes to Indigo80 (page 36)
- Adjustment points and environments (page 41)

7.3.3.2 Performing manual adjustment with Indigo80 handheld indicator using previously measured values

- Probe connection cable (M8-M12, Vaisala item code 262195SP)
- Previously collected calibration readings, for example, a calibration certificate

This procedure tells you how to use the Indigo80 handheld indicator to adjust the probe's measurement in 1–2 points when you have a list of previously collected calibration readings available (for example, in a calibration certificate from a third party laboratory calibration). You can adjust the probe without having to generate the calibration conditions and wait for stabilization.

Both RH and T can be adjusted using previously measured values.

Before you start, familiarize yourself with information on adjustment points and requirements for your probe.

If you adjust the probe using previously measured values, the device readings will be corrected and **your previous calibration certificate will not be valid anymore**. If an up-to-date calibration certificate is still needed, you must perform the calibration again to detect any remaining measurement error after the adjustment.

1. Connect the probe(s) to the indicator.
2. Open the indicator main menu by pressing ☰.
3. Select **Devices**. If you have more than one device connected to the indicator, make a further selection between the devices.
4. Select **Calibrate / Adjust**.
5. Acknowledge the notification by selecting **OK**.
6. Select the type of calibration or adjustment to perform, for example, **RH adjustment**.

7. If you have **two probes** connected to the indicator:
   a. Select **Manual adjustment**.
   b. Scroll down and acknowledge the notification by selecting **OK**.
   c. The options **Read from device** and **Enter manually** will be visible at this point. Select **Enter manually**.

      Should you need to read the reference value from another device connected to Indigo80, Vaisala recommends accessing this functionality from the **Guided calibration** menu of Indigo80.
8. If you have **one probe** connected to the indicator:
   a. Select **Manual adjustment**.
   b. Scroll down and acknowledge the notification by selecting **OK**.
9. Select **Reference value, point 1**.
10. Use the arrow buttons to set the reference value (for example, the reference humidity from your calibration certificate), and then select **OK** or **Set**.
11. Scroll down and select the **Measured value, point 1** field. Replace the automatically inserted value with your previously measured calibration reading (for example, the observed humidity value from your calibration certificate).
12. Scroll down and select the **Measured temperature, point 1** field. Select the correct unit, then replace the automatically inserted temperature value with your previously measured value (for example, the observed temperature value from your calibration certificate).

    Scroll down and repeat for **Reference value, point 2**, **Measured value, point 2**, and **Measured temperature, point 2** (if performing a 2-point adjustment).
13. To store the adjustments to the probe, scroll down and select **Activate adjustment > OK**. Confirm by selecting **OK**.

    To exit without taking the adjustment in use, press ☰ to end calibration.
14. Update the calibration information in **Calibrate / Adjust > Calibration information**. Navigate to the **Calibration information** menu by pressing ←.
15. Press ☰ to end calibration.

More information

- Connecting probes to Indigo80 (page 36)
- Adjustment points and environments (page 41)
- Performing guided calibration with Indigo80 handheld indicator (page 51)

7.3.3.3 Restoring factory adjustment with Indigo80 handheld indicator



- Probe connection cable (M8-M12, Vaisala item code 262195SP)

If needed, you can restore the factory adjustment for your probe's output parameters using the Indigo80 handheld indicator.

1. Connect the probe(s) to the indicator.
2. Open the indicator main menu by pressing ☰.
3. Select **Devices**. If you have more than one device connected to the indicator, make a further selection between the devices.
4. Select **Calibrate / Adjust**.
5. Acknowledge the notification by selecting **OK**.
6. Select the type of adjustment to restore.

   For example, select **RH adjustment**.
7. If you have **two probes** connected to the indicator:
   a. Select **Manual adjustment**.
   b. Scroll down and acknowledge the notification by selecting **OK**.
   c. The options **Read from device** and **Enter manually** will be visible at this point. Select **Enter manually**.
8. If you have **one probe** connected to the indicator:
   a. Select **Manual adjustment**.
   b. Scroll down and acknowledge the notification by selecting **OK**.
9. Scroll down and select **Restore factory adjustment > OK**.
10. Confirm by selecting **OK**.
11. Press ☰ to end calibration.

More information

- Connecting probes to Indigo80 (page 36)

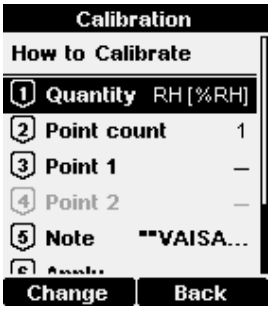
7.3.4 Calibration and adjustment using HM40 handheld meter

If the probe is in analog mode, it cannot be used with the HM40 handheld meter. Instead, use the Insight PC software to adjust the probe.

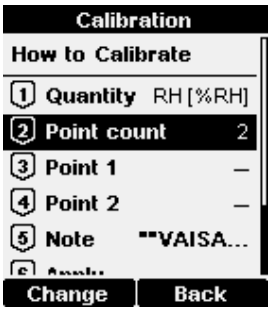
- Connection cable for HM40 Handheld Meter, for example, Vaisala item HMT120Z300
- Reference environments for the desired calibration and adjustment points

You can calibrate and adjust RH and T measurement probes in 1 or 2 points using the HM40 handheld meter.

1. Connect the probe to HM40 using the connection cable.
2. Turn on HM40 and check that measurements from the probe are displayed on the screen.
3. Select **Menu > Settings > Time & Date** and verify that the current time and date are set correctly on the HM40. Correct them if needed. The current date will be automatically set as the calibration date of the probe when adjustment is applied in step 12.
4. Select **Menu > Calibration**.
5. Select the parameter to be calibrated at menu item **[1] Quantity**.

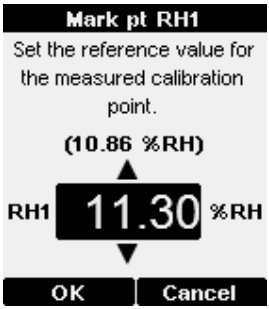


6. Select number of calibration points at menu item **[2] Point count**.

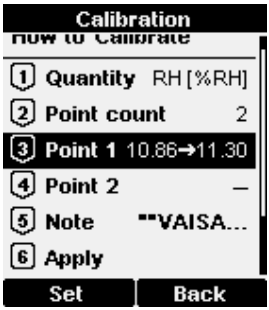


7. Place the probe in the first reference environment (first calibration point). Wait 20 – 40 minutes for the reading to stabilize.

8. Select **[3] Point 1 > Set**. The meter now shows the currently measured value of the selected parameter. Set the reference value using the arrow buttons and select **OK**.

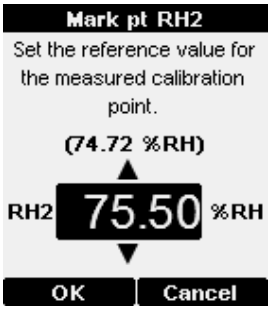


Correction to measurement at point 1 is now shown in the text for menu item **[3] Point 1**. If you are only doing a 1-point calibration, skip to step 11.

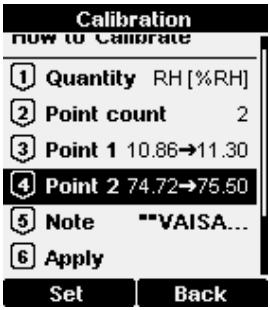


9. Place the probe in the second reference environment (second calibration point). Wait 20 – 40 minutes for the reading to stabilize.

10. Select **[4] Point 2 > Set** The meter now shows the currently measured value of the selected parameter. Set the reference value using the arrow buttons and select **OK**.



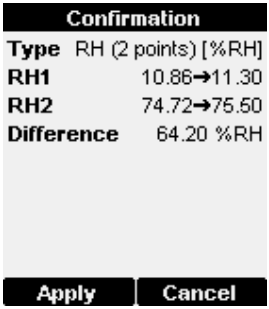
Correction to measurement at point 2 is now shown in the text for the menu item **[4] Point 2**.



11. Select **[5] Note** to edit the calibration info text that will be stored in the probe when the adjustment is applied in step 12. Edit the text using the select button and arrow keys. When done, select the **OK** character in the bottom right corner. To exit without changing the text, select **Cancel**.



12. Select **[6] Apply** to view the calibration result. Verify the corrections in the confirmation screen and select **Apply** to apply the adjustment to the probe, or **Cancel** to exit without applying the adjustment.



13. Disconnect the probe from the HM40.

7.3.5 Adjustment using serial line

If you are adjusting a probe that is in the analog output mode, start the probe in RS-485 mode. For instructions, see Accessing serial line command interface from analog or Modbus mode (page 91).

7.3.5.1 1-point adjustment of RH measurement

To perform a 1-point adjustment to the RH measurement of the probe using serial line, you need:

- M8-4F USB service cable (Vaisala item code 219690)
- PC with a terminal application
- One humidity reference

The following example procedure uses the HMK15 Humidity Calibrator. LiCl salt (11.3 %RH at 25 °C) is used as the reference point. The reference point should be chosen to match the measurement needs.

For more information on using a humidity calibrator and salt chamber references, see HMK15 User Guide (M210185EN).

1. Connect the USB cable to the PC, but do not connect it to the probe yet.
2. Remove the filter from the probe and insert the probe in the LiCl salt chamber of the humidity calibrator (11.3 %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, 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. Use the **ERRS** command to see that no errors are active.

   ```
   errs
   ```

8. Give the **CRH** command, with the **%RH** value of the reference as a parameter (in this case **11.3** for LiCl).

```
crh 11.3
OK
```

More information

- Clear adjustment of RH measurement (page 102)

7.3.5.2 2-point adjustment of RH measurement

To perform a 2-point adjustment to the RH measurement of the HMP110 or HMP113 using serial line you need:

- M8-4F USB service cable (Vaisala item 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 %RH difference between the references.

The following example procedure uses the HMK15 Humidity Calibrator. LiCl salt (11.3 %RH) at 25 °C is used as the first reference point, NaCl (75.3 %RH at 25 °C) as the second.

For more information on using a humidity calibrator and salt chamber references, see HMK15 User Guide (M210185EN).

1. Connect the USB cable to the PC, but do not connect it to the probe yet.
2. Remove the filter from the probe and insert the probe in the LiCl salt chamber of the humidity calibrator (11.3 %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 the **OPEN** command if necessary.
- Check your serial line settings and cable connections.

7. When your serial connection is working, use **ERRS** command to see that no errors are active.

```
errs
```

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

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

9. Give the **CRH** command to display the current RH measurement. Press **Enter** to refresh the RH measurement to check that the measurement has stabilized.

```
crh
RH: 11.39800112 Ref1 ?
RH: 11.38377201 Ref1 ?
RH: 11.37988329 Ref1 ?
```

10. When the shown RH measurement shown is stable, enter the value of the first measurement humidity reference (11.3 %RH) and press **Enter**.

```
RH: 11.37989400 Ref1 11.3
Press any key when ready
```

11. After entering the first reference point correction, press **Enter** to continue to the second reference point correction.
12. Insert the probe in the NaCl salt chamber (75.3 %RH) and wait for 20 ... 40 minutes for humidity and temperature to stabilize.
13. Press **Enter** to refresh the RH measurement to check that the measurement has stabilized.

```
RH: 74.87782214 Ref2 ?
RH: 74.89157890 Ref2 ?
RH: 74.91556023 Ref2 ?
```

14. When the shown RH measurement shown is stable, enter the value of the second humidity measurement reference (75.3 %RH) and press **Enter**.

```
RH: 75.12007531 Ref2 75.3
OK
>
```

15. Use the **SEND** command to verify that the measurement is OK.

> If the entered adjustment is incorrect, you can remove the effects of RH calibration (returning the RH measurement of the probe to the factory calibrated state) with the **CRHCLR** command. For instructions, see Clear adjustment of RH measurement (page 102).

More information

- Clear adjustment of RH measurement (page 102)

7.3.5.3 1-point adjustment of T measurement

To perform a 1-point adjustment to the temperature measurement of the probe using serial line, you need:

- M8-4F USB service cable (Vaisala item 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. Remove the filter from the probe and 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 **ERRS** command to see that no errors are active.

   ```
   errs
   ```

8. Give the **CT** command, with the temperature value of the reference as a parameter.

```
ct 23.5
OK
```

9. Use the **SEND** command to verify that the measurement is OK.



If the entered adjustment is incorrect, you can remove the effects of T calibration (returning the T measurement of the probe to the factory calibrated state) with the **CTCLR** command. For instructions, see Clear adjustment of T measurement (page 103).

More information

- Clear adjustment of T measurement (page 103)

8. Maintenance

8.1 Cleaning

The probes can be lightly cleaned when necessary.

Wipe the probe body clean with a soft, lint-free cloth moistened with mild detergent.

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.

Do not use solvents or compressed air. Do not spray anything directly on the probe.

More information

- Spare parts and accessories (page 76)

8.2 Replacing 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.

Order new filters from Vaisala.

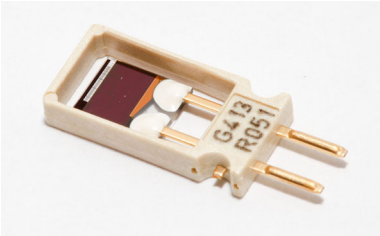
8.3 Changing the HUMICAP 180R/180V sensor

Replacing the HUMICAP® 180R/180V sensor 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.

Follow this procedure to replace the humidity sensor 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/180V sensor. It is also recommended that you replace the filter with a new one.

1. Remove the filter from the probe by turning it counter-clockwise.
2. There are 2 sensors under the filter, the HUMICAP® sensor and a temperature sensor. Identify the HUMICAP® sensor. Do not touch the temperature sensor.



3. Pull out the old HUMICAP® sensor and insert a new one. Handle the new sensor by the plastic frame.

NOTICE! Do not touch the sensor plate.

4. Perform a 2-point adjustment of the RH measurement using the Insight PC software, the **RH adjustment for new sensor** function. This **RH adjustment for new sensor** must be done every time after the sensor has been replaced.
5. Attach a new filter on the probe.

More information

- Adjusting RH for new HUMICAP sensor in Insight PC software (page 49)

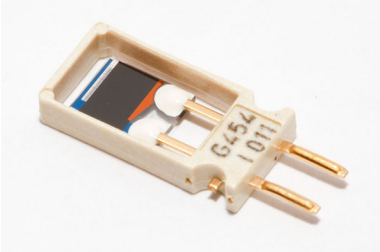
8.4 Changing the INTERCAP sensor

Follow this procedure to replace the INTERCAP® humidity sensor when calibration indicates the humidity measurement is not in specification. 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.

1. Remove the filter from the probe by turning it counter-clockwise.

2. There are 2 sensors under the filter, the INTERCAP® sensor and a temperature sensor. Identify the INTERCAP® sensor. Do not touch the temperature sensor.



3. Pull out the old INTERCAP® sensor and insert a new one. Handle the new sensor by the plastic frame.

NOTICE! Do not touch the sensor plate.

4. Attach a new filter on the probe.

9. Troubleshooting

9.1 Analog output error notification

If the device is unable to measure due to an error, the analog output is set to an error level. The default error level is 0 V.

You can change the analog output error level in the Insight PC software or using the **AERR** command.

More information

- Set analog output error indication level (page 105)

9.2 Solving typical problems

You can check error messages in the Insight PC software, or via the serial interface by using the **ERRS** command. If you are unable to remove the errors, contact Vaisala. For contact information, see Technical support (page 78).

Table 8 Troubleshooting table

Problem or message	Likely causes and solutions
Measurement not working. There is an active error that indicates a problem with measurement.	Sensor(s) damaged or missing. Open the filter and check.
	Check cabling.
	Check the supply voltage of the probe.
	Check the output mode of the probe in the Insight PC software or using serial line.
	Check that the probe is compatible with the host device (transmitter or data logger).
Humidity measurement appears to be wrong.	Check for condensation on the probe and sensor.
	Calibrate and adjust the probe (probes with HUMICAP® humidity sensor).
	Change the sensor if necessary (probes with INTERCAP® humidity sensor).

Problem or message	Likely causes and solutions
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.
One or more errors are active.	See Error messages in Insight PC software and Indigo80 handheld indicator (page 68).

More information

- Technical support (page 78)

9.3 Troubleshooting checklist

When troubleshooting, check the questions listed in Technical support (page 78) before contacting Vaisala technical support.

9.4 Error messages in Insight PC software and Indigo80 handheld indicator

Table 9 Error messages in Insight PC software and Indigo80 handheld indicator

Error	Likely cause	Suggested solution
Temperature measurement error. [44]	Temperature sensor is short circuited, damaged, or missing.	Check that the legs of the temperature sensor are not short circuited. Contact Vaisala if the temperature sensor is damaged.
Humidity measurement error. [45]	Humidity sensor is wet.	Wait for the humidity sensor to dry, or remove the filter and gently dry the sensors and the filter with clean instrument air.
Humidity sensor failure. [46]	Humidity sensor is damaged or missing.	Replace the humidity sensor or contact Vaisala.
Ambient temperature out of range. [48]	Ambient temperature is too high.	Lower the temperature at the installation site.
Supply voltage out of range. [55]	Supply voltage is too low.	Check and correct the power supply and wiring.

Error	Likely cause	Suggested solution
Capacitance reference error. [47]	Internal device failure.	Power-cycle the device, and if necessary, restore the factory settings. If the error remains, contact Vaisala.
Firmware checksum mismatch. [49]		
Device settings corrupted. [50]		
Additional configuration settings corrupted. [51]		
Sensor coefficients corrupted. [52]		
Main configuration settings corrupted. [53]		
Non-volatile memory read/write failure. [57]		
Calibration is about to expire. [352]	This message is displayed by the calibration reminder functionality.	Calibrate the probe and update the calibration expiry date.
Calibration has expired. [353]	This warning is displayed by the calibration reminder functionality if the calibration interval has been exceeded.	Calibrate the probe and update the calibration expiry date.
Invalid communication settings. [944]	The communication settings of the device are not compatible with the Modbus RTU protocol.	Check the communication settings. Make sure that: • Modbus device address is not set to zero (0). The valid range is 1 ... 247. • Number of data bits is set to 8.

In case of constant error, contact Vaisala.

More information

- Technical support (page 78)

9.5 Unknown serial settings

If you do not know the current serial settings of your probe, follow this procedure to access the serial line: Accessing serial line command interface from analog or Modbus mode (page 91).

Alternatively, you can connect the probe to the Insight PC software to verify the current settings.

More information

- Vaisala Insight PC software (page 31)

10. Technical data

10.1 Specifications

Table 10 Probe models

Model order code	Output parameter	Features
XMP10A	RH + T	±1.0 %RH accuracy [1], HUMICAP® 180R sensor
XMP10R	RH + T	±1.5 %RH accuracy [1], HUMICAP® 180R sensor
XMP10B	RH + T	±2.0 %RH accuracy [1], HUMICAP® 180R sensor
XMP10I	RH + T	±3.0 %RH accuracy [1], INTERCAP® sensor
XMP10C	RH + T	±1.5 %RH accuracy [1], HUMICAP® 180V sensor with catalytic protection
XMP10T	T	Pt1000 RTD sensor

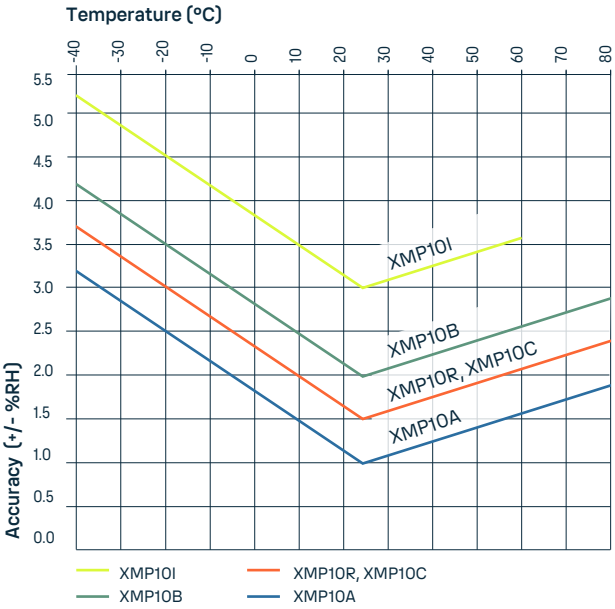
1) *Accuracy 0–90 %RH at +23 °C (+73.4 °F) defined against SI-traceable reference, including non-linearity, hysterisis, and repeatability.*

Table 11 XMP10 measurement performance

Property	Description/Value
Relative humidity	
Measurement range	0–100 %RH
Humidity sensor types	HUMICAP® 180R HUMICAP® 180V INTERCAP®
Factory calibration uncertainty	±1.1 %RH (0–90 %RH) ±1.8 %RH (90–100 %RH)
Stability	< 0.5 %RH/year in optimal conditions
T_{63} response time [1]	12 s
T_{90} response time [1]	27 s
Temperature	
Measurement range with HUMICAP® 180R / 180V sensor and metal probe body	−40 ... +80 °C (−40 ... +176 °F)
Measurement range with HUMICAP® 180R / 180V sensor and plastic probe body	−40 ... +60 °C (−40 ... +140 °F)

Property	Description/Value
Measurement range with INTERCAP® sensor	−40 … +60 °C (−40 … +140 °F)
Accuracy, probes with analog outputs:	
at 0 … +40 °C (+32 … +104 °F)	±0.2 °C (±0.36 °F)
at −40 … 0 °C (−40 … +32 °F) and +40 … +80 °C (+104 … +176 °F)	±0.4 °C (±0.72 °F)
Accuracy, probes with digital outputs:	
at +15 … +25 °C (+59 … +77 °F)	±0.1 °C (±0.18 °F)
at 0 … +15 °C (+ 32 … +59 °F) and +25 … +40 °C (+77 … +104 °F)	±0.15 °C (±0.27 °F)
at −40 … 0 °C (−40 … +32 °F) and +40 … +80 °C (+104 … +176 °F)	±0.4 °C (±0.72 °F)
Temperature sensor	Pt1000 RTD Class F0.1 IEC 60751
Analog outputs	
Accuracy at +20 °C (+68 °F)	±0.2 % of FS
Temperature dependence	±0.01 % of FS/°C (±0.006 % of FS/°F)

1) With metal probe body and plastic grid filter with electroplating.



When RH > 90 %RH, accuracy is reduced by 1 %RH compared to the graph.

Figure 29 XMP10 humidity measurement accuracy as a function of temperature

Table 12 XMP10 operating environment

Property	Description/Value
Operating temperature with HUMICAP® 180R / 180V sensor and metal probe body	−40 ... +80 °C (−40 ... +176 °F)
Operating temperature with HUMICAP® 180R / 180V sensor and plastic probe body	−40 ... +60 °C (−40 ... +140 °F)
Operating temperature with INTERCAP® sensor	−40 ... +60 °C (−40 ... +140 °F)
Operating humidity	0–100 %RH, non-condensing
Pollution degree	Pollution degree 2
IP rating [1)]	IP65: Dust-tight. Protected from water jets from any direction.
Storage temperature	−40 ... +60 °C (−40 ... +140 °F)
Storage humidity	0–100 %RH, non-condensing

1) Excluding the filter and sensor head.

Table 13 XMP10 inputs and outputs

Property	Description/Value
Power consumption	Typical: 3.5 mW (avg. power at 15 V) Max: 20 mW (peak power at 28 V)
Operating voltage [1)]	
With 1 V / 2.5 V output	5–28 V DC
With 5 V output	8–28 V DC
With loop power converter	8–28 V DC
With digital output	5–28 V DC
Start-up time	
Probes with analog outputs	4 s at 13.5–16.5 V DC operating voltage 2 s at other valid operating voltages
Probes with digital outputs	2 s
Outputs	
2 channels	0–1 / 0–2.5 / 0–5 / 1–5 V DC
1-channel loop-power converter (separate module, recommended for humidity output only due to conversion accuracy)	4–20 mA
Digital output (probes with digital output)	RS-485 2-wire half duplex, supports Modbus RTU
External loads	
0–1 V	R_L min. 10 kΩ
Other voltage outputs	R_L min. 50 kΩ
Output parameters	
Relative humidity, temperature, dew/frost point temperature, wet bulb temperature, absolute humidity, mixing ratio, enthalpy	

1) Use lowest available operating voltage to minimize heating.

Table 14 XMP10 compliance

Property	Description/Value
EU directives and regulations	EMC Directive (2014/30/EU) REACH Regulation (EC 1907/2006) RoHS Directive (2011/65/EU) as amended by 2015/863

Property	Description/Value
Electromagnetic compatibility (EMC): [1]	
EMC immunity	IEC/EN 61326-1, industrial environment
EMC emissions	CISPR 11 / EN 55011, Class B FCC part 15 B, Class B ICES-3 / NMB-3 (Class B)
Compliance marks	CE, China RoHS, RCM

1) *Compliance is specified for installations using shielded cables.*

Table 15 XMP10 mechanical specifications

Property	Description/Value
Cable connector	M8 4-pin male (IEC 60947-5-2)
Materials	
Metal probe body	Stainless steel (AISI 316)
Filters for metal probe body	DRW255306SP: AISI 316L ASM214606SP: AISI 316L, PTFE 260647: AISI 316 / EN 1.4401 DRW263049: Metallized PC-ABS ASM215841: Metallized PC-ABS, PTFE
Plastic probe body	PBT + GF, white
Filters for plastic probe body	DRW240185SP: PC + GF ASM210856SP: PC + GF, PTFE DRW256380SP: PTFE
M8 locking wheel	Zinc alloy with nickel-plating
Cable	Polyurethane or FEP
Weight	
With metal probe body	20.7 g (0.73 oz)
With plastic probe body	14.1 g (0.50 oz)

10.2 Dimensions

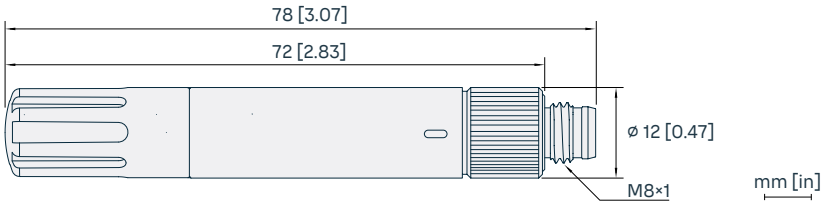


Figure 30 XMP10 probe dimensions

10.3 Spare parts and accessories

Information on spare parts, accessories, and calibration products is available online at vaisala.com and store.vaisala.com.

Table 16 XMP10 spare parts and accessories

Item	Item code
Sensors	
Vaisala HUMICAP® 180R	HUMICAP180R
Vaisala HUMICAP® 180V	HUMICAP180V
Vaisala INTERCAP®	15778HM (1 pc) INTERCAPSET-10PCS (10 pcs)
Sensor protection, filters for metal probe body	
Plastic grid with electroplating	DRW263049
Plastic grid with electroplating and membrane	ASM215841
Slotted MIM filter	DRW255306SP
Slotted MIM filter with membrane	ASM214606SP
Stainless steel sintered filter	260647
Sensor protection, filters for plastic probe body	
Grid filter	DRW240185SP
Plastic grid with PTFE membrane	ASM210856SP
Porous PTFE filter	DRW256380SP
Probe installation	

Item	Item code
Duct installation kit	ASM216258SP
Radiation shield kit	DTR504A
Probe mounting clamp set, 1 pc	225501SP
Probe mounting clamp set, 10 pcs	226067
Probe mounting flange	226061
Probe holder, 5 pcs	ASM213382SP
Connection adapters	
4–20-mA loop power converter	UI-CONVERTER-1CB
Mounting bracket for converter	225979
USB cable for PC connection	219690
Connection cable for Indigo80 handheld indicator	262195SP
Connection cables with open wires	
+60 °C 0.3 m (+140 °F 1 ft)	HMP50Z032SP
+60 °C 1.2 m (+140 °F 4 ft)	HMP50Z120
+60 °C 3 m (+140 °F 9.8 ft)	HMP50Z300SP
+60 °C 5 m (+140 °F 16.5 ft)	HMP50Z500SP
+60 °C 10 m (+140 °F 33 ft)	HMP50Z1000SP
+80 °C 1.5 m (+176 °F 5 ft)	225777SP
+80 °C 3 m (+176 °F 10 ft)	225229SP
+80 °C 15 m (+176 °F 49 ft)	236407SP
+80 °C 20 m (+176 °F 49 ft)	235859SP
+80 °C 1.5 m (+176 °F 5 ft), 90° connector	231519SP
+80 °C 3 m (+176 °F 10 ft), 90° connector	231520SP
+80 °C 5 m (+176 °F 16.5 ft), 90° connector	231521SP
+180 °C 1.5 m (+356 °F 5 ft) FEP	238025
+180 °C 3 m (+356 °F 10 ft) FEP	226902SP
–30 … +90 °C 2 m (-22 … 194 °F 6.5 ft), M8 snap-on connector	211598

11. Vaisala services

11.1 Service centers

Vaisala offers comprehensive customer care throughout the life cycle of our products. Our service centers offer maintenance, calibration, upgrade, and repair services. All the services are provided worldwide with fast deliveries. For more information, go to vaisala.com/services.

The services are available from:

- Vaisala Online Store, store.vaisala.com
- Vaisala Services, helpdesk@vaisala.com

The provided services vary product by product.

11.2 Technical support



You can contact Vaisala technical support at vaisala.my.site.com/myvaisala or helpdesk@vaisala.com. You can find all our support channels at vaisala.com/support.

When contacting technical support, provide the following as applicable:

- Product name, model, and serial number
- Software/Firmware version
- Name and location of the installation site
- Name and contact information of a technical person who can provide further information
- Diagnostics package for the application

If applicable, also provide the following details:

- What failed (what worked / did not work)?
- Where did it fail (location and environment)?
- When did it fail (date, immediately / after a while / periodically / randomly)?
- How many failed (only one defect / other same or similar defects / several failures in one unit)?
- What was done when the failure was noticed?
- What was connected to the product and to which connectors?
- What is the input power source type, voltage, and what else (such as lighting, heaters, and motors) was connected to the same power output?
- Are all parts connected and grounded properly? Take a photo to help the troubleshooting.

11.3 Warranty

For warranty terms and conditions and the warranty claim process, see vaisala.com/warranty.

Note that warranty coverage may not apply if the product is damaged due to normal wear and tear, exceptional operating conditions, negligent handling or installation, or unauthorized modifications. See the applicable supply contract or Conditions of Sale for details of the warranty for each product.

Appendix A. Modbus reference

A.1 Communication settings

The following table lists the default Modbus serial settings of devices ordered with the Modbus configuration option.

Table 17 Modbus communication settings

Property	Description/Value
Serial bit rate	19200
Parity	None
Number of data bits	8
Number of stop bits	2
Flow control	None
Modbus device address	240
Serial delay	0
Communication mode	Modbus RTU

You can use up to 32 probes on the same RS-485 line when the communication speed is 19200 bps or lower. Use the Insight PC software to configure each probe on the line to have a different Modbus address. In addition, it is recommended to terminate the bus at the last device with a termination resistor when the line length is over 100 m (328 ft).



After power-up, it may take up to 2 seconds before the probe responds to any Modbus request.

A.2 Function codes

Table 18 Supported Modbus function codes

Function code	Function code (hexadecimal)	Name
03	0x03	Read Holding Registers
16	0x10	Write Multiple Registers
43 / 14	0x2B / 0x0E	Read Device Identification

A.3 Data encoding

In the data registers, the numeric values are available in one or two formats with separate register addresses: 32-bit IEEE floating point format and/or 16-bit signed integer format.

A.3.1 32-bit floating point or 32-bit integer format

Registers using **32-bit float** data format are encoded using the **binary32** encoding defined in IEEE 754. The format is also known as "single-precision floating point format".

The least significant 16 bits of a floating point number are placed at the Modbus register listed in the table, while the most significant 16 bits are placed in the register with number/address + 1, as specified in Open Modbus TCP Specification, Release 1.0. This is also known as "little-endian" or "Modicon" word order.

Despite the specification, some Modbus masters may expect a "big-endian" word order (most significant word first). In such case, you must select "word-swapped" floating point format in your Modbus master for the Modbus registers of the device.

A complete 32-bit floating point or 32-bit integer value should be read and written in a single Modbus transaction.

NOTICE! Reading the measurement data registers with incorrect floating point format setting may occasionally result in correct-looking, but nevertheless incorrect values.

It is highly recommended to verify that you have configured the floating point format correctly on your Modbus host system by reading a floating point value from a test value register.

More information

- Test value registers (page 85)

A.3.2 16-bit integer format

Some 16-bit integer values in the data registers are scaled to include the necessary decimals. The scaling factors for those values are shown in the register tables.

Table 19 Interpretation of 16-bit signed integer values

Value (decimal)	Value (hexadecimal)	Description
0–32766	0x0000–0x7FFE	Value in range 0–32766
32767	0x7FFF	Value is 32767 or larger
32768	0x8000	Value is not available

Value (decimal)	Value (hexadecimal)	Description
32769	0x8001	Value is −32767 or smaller
32770–65535	0x8002–0xFFFF	Value in range −32766 ... −1 (2's complement)

A.4 Modbus registers

Registers are numbered in decimal, starting from 1. Register addresses in actual Modbus messages (Modbus Protocol Data Unit (PDU)) are in hexadecimal and start from zero. Register number 1 corresponds to address 0x0 in the actual Modbus message.

NOTICE! Reading the wrong register(s) may result in correct-looking values. Check the reference documentation of your Modbus host (PLC) to verify which notation it uses for Modbus register addresses.

A.4.1 Measurement data registers

Table 20 Modbus measurement data registers (read-only)

Register number	Address	Register description	Data format	Unit
Floating point values				
1	0x0000	Relative humidity	32-bit float	%RH
	0x0001			
3	0x0002	Temperature	32-bit float	°C
	0x0003			
9	0x0008	Dew/frost point temperature	32-bit float	°C
	0x0009			
15	0x000E	Absolute humidity	32-bit float	g/m^3
	0x000F			
17	0x0010	Mixing ratio	32-bit float	g/kg
	0x0011			
19	0x0012	Wet-bulb temperature	32-bit float	°C
	0x0013			
27	0x001A	Enthalpy	32-bit float	kJ/kg
	0x001B			

Register number	Address	Register description	Data format	Unit
Integer values				
257	0x0100	Relative humidity	16-bit integer	%RH * 10
258	0x0101	Temperature	16-bit integer	°C * 10
261	0x0104	Dew/frost point temperature	16-bit integer	°C * 10
264	0x0107	Absolute humidity	16-bit integer	g/m^3 * 10
265	0x0108	Mixing ratio	16-bit integer	g/kg * 10
266	0x0109	Wet-bulb temperature	16-bit integer	°C * 10
270	0x010D	Enthalpy	16-bit integer	kJ/kg * 10

A.4.2 Configuration registers

Table 21 Modbus configuration data registers (writable)

Register number	Register address	Register description	Data format	Unit / Valid range
Filtering				
785	0x0310 0x0311	Measurement filtering factor	32-bit float	0.001 (maximum filtering) ... 1.000 (no filtering)
Communication				
1537	0x0600	Modbus address	16-bit integer	1 ... 247
1538	0x0601	Bit rate [1)]	16-bit integer	5 = 9600 6 = 19200 7 = 38400 8 = 57600
1539	0x0602	Parity, data, stop bits [1)]	16-bit integer	0 = None, 8, 1 1 = None, 8, 2 2 = Even, 8, 1 3 = Even, 8, 2 4 = Odd, 8, 1 5 = Odd, 8, 2
1540	0x0603	Response delay	16-bit integer	0 ... 1020 ms (4 ms steps)
1541	0x0604	Protocol	16-bit integer	6 = Modbus RTU

Register number	Register address	Register description	Data format	Unit / Valid range
1542	0x0605	Restart device	16-bit integer	When writing to register: 1 = Restart the device

1) Changed setting will be activated on device restart.

If incompatible settings/protocol are selected and the probe is then restarted, it might no longer be possible to communicate with the probe using Modbus. You can override invalid communication settings in the Vaisala Insight PC software, **Settings** menu.

A.4.3 Status registers

Table 22 Modbus status data registers (read-only)

Register number	Address	Register description	Data format	Note
513	0x0200	Error status	16-bit integer	0x0000: One or more errors active 0x0001: No errors
516	0x0203	Error code	32-bit integer	
	0x0204			
518	0x0205	Security hash	32-bit integer	Security hash changes when any change is made to device settings or adjustments, but also returns back to the previous value if such changes are reverted completely.
	0x0206			

Table 23 Error codes on Modbus interface

Error code register value	Corresponding error
1	Temperature measurement error. [44]
2	Humidity measurement error. [45]
4	Humidity sensor failure. [46]
8	Capacitance reference error. [47]
16	Ambient temperature out of range. [48]
32	Firmware checksum mismatch. [49]

Error code register value	Corresponding error
64	Device settings corrupted. [50]
128	Additional configuration settings corrupted. [51]
256	Sensor coefficients corrupted. [52]
512	Main configuration settings corrupted. [53]
1024 [1)]	Calibration is about to expire. [352]
2048	Supply voltage out of range. [55]
8192	Non-volatile memory read/write failure. [57]
16384 [1)]	Calibration has expired. [353]
32768 [1)]	Invalid communication settings. [944]

1) *This code is readable only via the Insight PC software or Indigo80 handheld indicator.*

If several errors are active at the same time, the Modbus error code register contains the sum of currently active error codes.

More information

- Error messages in Insight PC software and Indigo80 handheld indicator (page 68)

A.4.4 Test value registers

Read the known test values from the test registers to verify the functionality of your Modbus implementation.

Table 24 Modbus test registers (read-only)

Register number	Register address	Register description	Data format	Test value
7937	0x1F00	Signed integer test	16-bit integer	-12345
7938	0x1F01	Floating point test	32-bit float	-123.45
	0x1F02			
7940	0x1F03	Text string test	text	Text string "-123.45"
	0x1F04			
	0x1F05			
	0x1F06			

A.5 Device identification objects

Table 25 Device identification objects

Object ID	Object ID (hexadecimal)	Object name	Example contents
0	0x00	VendorName	"Vaisala"
1	0x01	ProductCode	"XMP10"
2	0x02	MajorMinorVersion	"2.7.2" Software version of the device.
3	0x03	VendorUrl	"http://www.vaisala.com"
4	0x04	ProductName	"Vaisala HUMICAP(R) Humidity and Temperature Probe XMP10"
5	0x05	ModelName	"APPAM00CVNNN" Configuration code of the device.
128	0x80	SerialNumber [1)]	"Y074299"
129	0x81	CalibrationDate [1)]	"2026-02-17" Calibration date in YYYY-MM-DD format. Empty string if not set/valid.
130	0x82	CalibrationText [1)]	"Vaisala/HEL" Calibration information text. Empty string if not set/valid.

1) Vaisala-specific device information object

A.6 Modbus communication examples

Reading relative humidity value

The device address used in the following examples is 240 (0xF0).
The values returned by the device change depending on ambient conditions and/or device settings.

Request		Response	
Bytes on the line (hexadecimal)	**Description**	**Bytes on the line (hexadecimal)**	**Description**
(silence for 3.5 bytes)	Start of Modbus RTU frame	(silence for 3.5 bytes)	Start of Modbus RTU frame
0xF0	Probe address	0xF0	Probe address
0x03	Function (Read Holding Registers)	0x03	Function (Read Holding Registers)
0x00	Register address	0x04	Number of data bytes
0x00		0x7A	Value of first register (least significant word)
0x00	Number of 16-bit registers to read (2)	0xE1	
0x02		0x41	Value of second register (most significant word)
0xD1	Modbus RTU checksum	0xF4	
0x2A		0x62	Modbus RTU checksum
(silence for 3.5 bytes)	End of Modbus RTU frame	0x05	
		(silence for 3.5 bytes)	End of Modbus RTU frame

Communication description	
Register number	1 (1-based Modbus register number) = address 0x0000 (0-based address used in actual communication).
Data format	Two 16-bit Modbus registers interpreted as IEEE 754 binary32 floating point value, least significant word first.
Returned value	0x41F47AE1, which is binary32 representation of 30.56 (%RH).

Writing filtering factor value

Request		Response	
Bytes on the Line (Hexadecimal)	**Description**	**Bytes on the Line (Hexadecimal)**	**Description**
(silence for 3.5 bytes)	Start of Modbus RTU frame	(silence for 3.5 bytes)	Start of Modbus RTU frame
0xF0	Transmitter address	0xF0	Transmitter address
0x10	Function (Write Multiple Registers)	0x10	Function (Write Multiple Registers)
0x03	Register address	0x03	Register address
0x10		0x10	
0x00	Number of registers to write (2)	0x00	Number of 16-bit registers written (2)
0x02		0x02	
0x04	Number of data bytes	0x55	Modbus RTU checksum
0xCC	Value for the first register (least significant word)	0x68	
0xCD		(silence for 3.5 bytes)	End of Modbus RTU frame
0x3E	Value for the second register (most significant word)		
0x4C			
0x5E	Modbus RTU checksum		
0x96			
(silence for 3.5 bytes)	End of Modbus RTU frame		

The response to a write function informs that the function was correctly received by the device. It does not guarantee that the written value was accepted by the device (for example, in case of out-of-range values).

To verify that the value was really accepted by the device, read the register value after writing.

Communication description	
Register number	785 (1-based Modbus register number) = address 0x0310 (0-based address used in actual communication).
Data format	Two 16-bit Modbus registers interpreted as IEEE 754 binary32 floating point value, least significant word first.
Value to write	0.2, in binary32 format 0x3E4CCCCD.

Appendix B. Serial line communication

B.1 Connecting to serial interface

Connection to the serial interface is through the 4-pin connector on the probe.

For temporary use of the serial interface (for example, calibration), you can use the optional Vaisala USB cable (item code 219690). Before you can use the cable, you must install the provided USB driver on your PC.

The Vaisala USB cable is not designed for permanent installations. 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.

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 26 Default serial line communication settings

Property	Description/Value [1)]
Baud rate	19200
Parity	None
Data bits	8
Stop bits	1
Flow control	None

1) Probes ordered with the Modbus RTU output option have their own default settings.

You can change the serial settings and operate in RUN, STOP, POLL, and MODBUS modes.

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. It must be accessed with an addressed command.

- In MODBUS mode, the probe does not output anything after power-up: serial line commands are not in use and the probe must be used with the Modbus protocol.

More information

- Installing driver for the USB service cable (page 34)
- Accessing serial line command interface from analog or Modbus mode (page 91)
- Set serial interface mode (page 97)

B.2 Terminal application settings for digital probes

The following steps describe how to connect to digital probes using the PuTTY terminal application for Windows (available for download at www.vaisala.com/software) and the USB serial interface.

If you have an analog probe, you can still connect to the serial line by following the instructions in Accessing serial line command interface from analog or Modbus mode (page 91).

1. Connect Vaisala USB cable 219690 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.

   To check which port the USB cable is using, open **Device Manager** from the Windows® Start menu and check under the **Ports** category.
4. Check that the other serial settings are correct for your connection, and change if necessary.
5. To open the connection window and start using the serial line, select **Open**.

   If PuTTY is unable to open the serial port you selected, it shows 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, right-click over the session window, and select **Change Settings**.

If the probe is in Modbus mode, to access the serial port command interface, follow the instructions in Accessing serial line command interface from analog or Modbus mode (page 91).

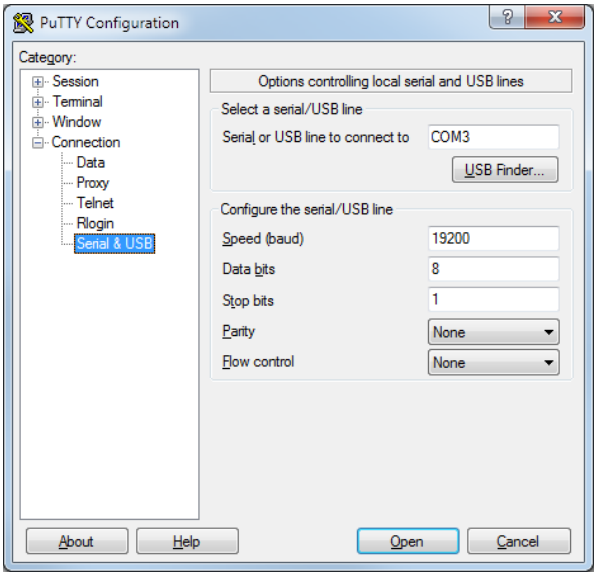


Figure 31 PuTTY terminal application

B.3 Accessing serial line command interface from analog or Modbus mode

Follow the steps below to connect to the serial line when the probe is in analog or Modbus mode. You can also use the procedure to retrieve the communication settings of your device, if you do not know them. You must use the Vaisala USB cable (Vaisala item code 219690) in this case.

1. Connect the USB cable to the PC and install the driver, if necessary. Do not connect the cable to the probe yet.
2. Open the terminal program and open a connection to the corresponding COM port using the default settings 19200, 8, N, 1, no flow control.
3. Select the **Serial** settings category, and check that the **Serial line to connect to** field contains the correct COM port.

   To check which port the USB cable is using, open **Device Manager** from the Windows® Start menu and check under the **Ports** category.
4. To open the connection window and start using the serial line, select **Open**.
5. Keep the **ENTER** key pressed down and connect the other end of the USB cable to the probe. This causes the probe to start in RS-485 mode, using the default serial settings. You can now use the probe with the terminal program.

6. To prevent the analog or Modbus mode from being restored on the next power-up, select a different serial mode with the **smode** command.
7. To switch back to analog mode or Modbus mode from a serial mode, use the **smode analog** or **smode modbus** command to select analog or Modbus mode. Reset or power cycle the probe to restart in the selected mode.

More information

- List of serial commands (page 92)
- Set serial interface mode (page 97)

B.4 List of serial commands

You can issue all commands 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). Press **Esc** to clear the command buffer before starting to enter commands.

Table 27 List of serial commands

Command	Description
?	Output information about the device
AERR	Set analog output error level
AMODE	View or set the analog output mode
AOVER [ON/OFF]	Allow analog outputs to exceed their range 10 %
ASEL	Set analog output parameters and scaling
CDATE	View or set 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 or set the calibration information field
ERRS	List present probe errors
FILT [0.001 ... 1]	Set the result filtering
FRESTORE	Restore factory settings

Command	Description
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
RHLIMIT	Extend maximum RH reading
S	Stop the continuous outputting
SDELAY [0 ... 255]	View or set serial line answer minimum delay
SEND [0 ... 255]	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 28 Additional commands for probes with RS-485 output

Command	Description
??	Output information about the device in POLL mode
ADDR [0 ... 255]	Set the probe address (for POLL mode)
CLOSE	Close the temporary connection (Back to POLL mode)
OPEN [0 ... 255]	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/MODBUS/ VDIGI/ANALOG]	Set the serial interface mode

B.5 Device information and status

B.5.1 View device information

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

?<cr>

```
?
XMP10 / 2.7.2
Serial number  : X5052336
Batch number   : X4858038
Sensor number  : X0000511
Sensor model   : Humicap180R
Order code     : RSMB2RT0VNNN
Cal. date      : 20260109
Cal. info      : Vaisala/HEL
Time           : 00:00:29
Serial mode    :     STOP
Baud P D S     :    19200 N 8 1
Output interval:        1 S
Serial delay   :       30
Address        :      240
Filter         :    0.900
Ch1 output     :  0 ... 2.5 V
Ch2 output     :  0 ... 2.5 V
Ch1 RH   lo    :     0.00 %RH
Ch1 RH   hi    :   100.00 %RH
Ch2 T    lo    :    10.00 'C
Ch2 T    hi    :    50.00 'C
```

If the probe is in POLL mode, but a connection has not been opened using the **OPEN** command, issue the **??** command.

??<cr>

More information

- Set serial line settings (page 97)

B.5.2 View calibration information

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

CDATE<cr>

CTEXT<cr>

Examples:

```
cdate
Cal. date      : 20260109
```

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

B.5.3 Enter calibration information

To enter the calibration date, use the **CDATE** command (**cdate** [YYYYMMDD]). To enter a text string with information about the calibration, use the **CTEXT** command (**ctext** [string]).

CDATE [yyyymmdd] <cr>

CTEXT [text string] <cr>

Example:

```
cdate 20260109

Cal. date      : 20260109
ctext Calibrated in Room 1
Cal. info      : Calibrated in Room 1
```

B.5.4 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
RSMB2RT0VNNN
```

B.5.5 View serial number

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

SNUM<cr>

Example:

```
snum
Serial number  : X5052336
```

B.5.6 View software version

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

VERS<cr>

Example:

```
vers
XMP10 / 2.7.2
```

B.6 Serial line output commands

B.6.1 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 humidity and temperature models of XMP10, the output always includes readings for temperature, RH and Td. For temperature-only probes (XMP10T), the output includes only temperature.

R<cr>

Example, XMP10 probes for humidity and temperature:

```
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, XMP10T probes:

```
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.

B.6.2 Stop measurement output

Use the **S** command or press the **ESC** key to stop the continuous measurement output.

S<cr>

B.6.3 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>

Syntax	Description
aaa	Address of the probe, range 0 ... 255. 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
```

B.7 Configuring serial line operation

B.7.1 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]

Syntax	Description
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
```

B.7.2 Set serial interface mode

Use the **SMODE** command to set the operation mode of the serial interface. The new mode is applied when probe is reset.

SMODE [xxx]<cr>

Syntax	Description
xxx	Operation mode of the serial interface.

Table 29 Serial interface modes

Mode	Description
STOP	Probe outputs only when a command is issued. Any command can be used.
RUN	Probe automatically outputs measurement messages on the serial line. Only command **S** or the **ESC** key can be used to stop the output.
POLL	Probe outputs only when a command is issued. Probes communicate one at a time when the specific address is called on the serial line, which is useful when more than one probe is connected to one serial bus. Any command can be used after the line has been opened using the **OPEN** command. See descriptions of the commands **ADDR** and **OPEN**.
MODBUS	Measurement outputs must be read from the transmitter using the Modbus protocol.
VDIGI	Special serial interface mode that is only used for interoperability with Vaisala devices such as HMT120, HMT130, and HM40. This mode is set at Vaisala for probes that are ordered for such use.
ANALOG	No serial line, analog outputs active. For instructions on how to enter the serial line when in analog mode, see Accessing serial line command interface from analog or Modbus mode (page 91).

Example (check current mode):

```
smode
Serial mode    :     STOP     ?
```

Example (change mode to POLL mode):

```
smode poll
Serial mode    :     POLL
```

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.

B.7.3 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 1 second. This command has no effect on the operation of the analog output.

INTV [n xxx]<cr>

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

Example:

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

B.7.4 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>

Syntax	Description
a.aaa	Range 0.001 ... 1.0. 1.0 = No filtering, the latest measurement is output without averaging 0.5 = Average of the last 2 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
```

B.7.5 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.

ADDR [nn]<cr>

Syntax	Description
nn	Address for POLL mode (0 ... 255) Address for Modbus (1 ... 247)

Example:

```
addr
Address        :        0
```

More information

- Set serial line settings (page 97)

B.7.6 Set serial interface delay

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

SDELAY [delay]<cr>

Syntax	Description
delay	Range 0 ... 255. Value corresponds to 4 milliseconds (for example, 5 = 0.020 second minimum answer delay)

Example:

```
sdelay
Serial delay   :       30
```

```
sdelay 50
Serial delay   :       50
```

B.7.7 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.

Parameter	Metric unit	Non-metric unit
RH	%RH	%RH
T_d	°C	°F
T	°C	°F

Examples:

```
unit
Units          : Metric
```

```
unit n
Units          : Non metric
```

B.8 Calibration commands

B.8.1 Calibrate humidity measurement

Use the **CRH** command to perform a 1-point or 2-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. For more information, see Adjustment points and environments (page 41) and Adjustment using serial line (page 58).

CRH `[reference]`<cr>

This command is not available on the XMP10T.

When performing a 1-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: 1-point calibration (LiCl reference, 11 %RH):

```
crh 11
OK
```

Example: 1-point calibration with NaCl reference (75 %RH):

```
crh 75
OK
```

Giving the command without parameters starts the 2-point calibration. Remember to allow the humidity to stabilize for 20–40 minutes after changing the reference.

Example: 2-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
```

B.8.2 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 XMP10T.

CRHCLR<cr>

Example:

```
crhclr
OK
```

B.8.3 Calibrate temperature measurement

Use the **CT** command to perform a 1-point or 2-point temperature (T) calibration. 1-point calibration adjusts the offset for the measurement, 2-point calibration adjusts offset and gain.

CT [reference]<cr>

When performing a 1-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: 1-point calibration

```
ct 23.5
OK
```

Giving the command without parameters starts the 2-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 °C. To update the measured value while the command is running, press enter without inputting a value.

Example: 2-point calibration

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

B.8.4 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
```

B.9 Other commands

B.9.1 Set analog output mode

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

AMODE [ch1] [ch2]<cr>

Syntax	Description
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
```

B.9.2 Set analog output parameters and scaling

Use the **ASEL** command to show or set the output parameters and scaling of the analog outputs.

ASEL [ch1 ch2] [ch1low ch1high ch2low ch2high]<cr>

Syntax	Description
ch1	Output parameter for channel 1. The options are: • RH = Relative humidity • T = Temperature • Td = Dew point temperature • Tw = Wet bulb temperature • a = Absolute humidity • x = Mixing ratio • h = Enthalpy
ch2	Output parameters for channel 2. The options are same as for channel 1.
ch1low	Low limit for channel 1 output scaling.
ch1high	High limit for channel 1 output scaling.
ch2low	Low limit for channel 2 output scaling.
ch2high	High limit for channel 2 output scaling.

Example (show current output parameters and scaling):

```
asel ?
Ch1 RH lo : 0.00 %RH ?
Ch1 RH hi : 100.00 %RH ?
Ch2 T lo : -20.00 'C ?
Ch2 T hi : 80.00 'C ?
```

Example (change channel 1 to output dew point temperature, adjust scaling to -40 ... 60 °C for channel 1 and to -20 ... 80 °C for channel 2):

```
asel td t -40 60 -20 80
Ch1 Td   lo    :   -40.00 'C
Ch1 Td   hi    :    60.00 'C
Ch2 T    lo    :   -20.00 'C
Ch2 T    hi    :    80.00 'C
```

Example (change channel 1 to output temperature and channel 2 to output relative humidity, adjust scaling for channel 1 to -40 ... 60 °C when prompted):

```
asel t rh
Ch1 T    lo    :   -20.00 'C ? -40
Ch1 T    hi    :    80.00 'C ? 60
Ch2 RH   lo    :     0.00 %RH ?
Ch2 RH   hi    :   100.00 %RH ?
```

B.9.3 Set analog output error indication level

If the device is malfunctioning, the analog output is set to a specified level. This overrides the normal measurement output of the channel. The default error level is 0 V, or another value predefined by the customer when ordering the device. You can set the level using the **AERR** command.

AERR [ch1 ch2] <cr>

Syntax	Description
ch1	Error level of the analog output for channel 1. The available range depends on the output mode (check with **AMODE** command).
ch2	Error level of the analog output for channel 2. The available range depends on the output mode (check with **AMODE** command).

Example (show present output modes):

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

Example (check present analog output error level):

```
aerr
Ch1 error out: 0.000V ?
Ch2 error out: 0.000V ?
```

Example (set analog output error level to 1 V on both channels):

```
aerr 1 1
Ch1 error out: 1.000V ?
Ch2 error out: 1.000V ?
```



The error output value is displayed only when there are minor electrical faults such as humidity sensor damage. When there is a severe device malfunction, the error output value is not necessarily shown.

B.9.4 Extend analog output range

Use the **AOVER** command to allow the analog output channels to exceed their specified range by up to 10 %. The scaling of the parameter 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 0–2.5 V (−40 °C ... +60 °C). After giving the **AOVER** ON command, the range is 0–2.75 V (−40 °C ... +70 °C). Note that the +60 °C T_d point is still at 2.5 V.

Example:

```
aover on
AOVER              :       ON
```

Ranges 0–1 V and 0–2.5 V can always be exceeded by 10 %. Ranges 0–5 V and 1–5 V can be exceeded by 5–10 % depending on ambient temperature and loading of analog outputs.

B.9.5 Extend maximum RH reading

With digital output, use the **RHLIMIT** command to set the maximum RH reading from 100 % (default) up to 120 %.

With analog output, the **RHLIMIT** command allows you to extend the high limit of the analog output scaling up to 120 %. This command does not change the scaling automatically. To change the scaling, use the **ASEL** command.

RHLIMIT [max_rh]<cr>

Syntax	Description
max_rh	Maximum reading of the RH parameter. Possible values are 100.0 ... 120.0. The default value is 100.0.

Example (extend the maximum RH reading to 120 %):

```
rhlimit 120
Max. RH %      :    120.0 %RH
```

Example (on analog output, extend the maximum RH reading to 120 % and scale the RH output on channel 2 from (0 ... 1 V) 0 ... 100 % to (0 ... 1 V) 0 ... 120 %):

```
rhlimit 120
Max. RH %      :    120.0 %RH
asel ?
Ch1 T    lo    :   -20.00 'C ?
Ch1 T    hi    :    80.00 'C ?
Ch2 RH   lo    :     0.00 %RH ?
Ch2 RH   hi    :   100.00 %RH ? 120
```

More information

- Set analog output parameters and scaling (page 104)

B.9.6 Display command list

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

HELP<cr>

B.9.7 Display currently active errors

Use the **ERRS** command to display the currently active error codes.

ERRS<cr>

Example (no active errors):

```
errs
0000h
No errors
```

Table 30 Error messages on ERRS command

ERRS command response	Corresponding error
T MEAS error	Temperature measurement error. [44]
F meas error	Humidity measurement error. [45]
RH sensor failure	Humidity sensor failure. [46]
Frequency measurement outside the permissible value range	Capacitance reference error. [47]
Ambient temperature error	Ambient temperature out of range. [48]
Program flash check sum error	Firmware checksum mismatch. [49]
Parameter flash check sum error	Device settings corrupted. [50]
INFOA check sum error	Additional configuration settings corrupted. [51]
SCOEFS check sum error	Sensor coefficients corrupted. [52]
CURRENT check sum error	Main configuration settings corrupted. [53]

ERRS command response	Corresponding error
Voltage error	Supply voltage out of range. [55]
General flash failure w/r	Non-volatile memory read/write failure. [57]
Invalid communication settings	Invalid communication settings. [944]

Refer to Error messages in Insight PC software and Indigo80 handheld indicator (page 68) for more information about the error states.

More information

- Solving typical problems (page 67)

B.9.8 Connect to the probe in POLL mode

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

OPEN [aa]<cr>

Syntax	Description
aa	address (0 ... 255)

Example:

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

B.9.9 Close the connection in POLL mode

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

CLOSE<cr>

Example:

```
close
line closed
```

B.9.10 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
XMP10 / 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
...
```

B.9.11 Restore factory settings

Use the **FRESTORE** command to restore the factory settings to the probe. All user settings, including the user-performed calibration corrections and RH adjustment for a new HUMICAP® sensor, will be lost. The probe will revert back to the factory calibrated settings, and you need to perform the RH adjustment for a new HUMICAP® sensor again before you can continue using the probe for measurements.

FRESTORE<cr>

Example:

```
frestore
Factory settings restored
```

Appendix C. Regulatory statements

C.1 XMP10 manufacturer contact information

Made in Finland by:

Vaisala Oyj, Vanha Nurmijärventie 21, FI-01670, Vantaa

Imported to UK by:

Vaisala Ltd, 6230 Bishops Court, Birmingham B37 7YB

C.2 FCC Part 15 compliance statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that the interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications to this equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

CAUTION! This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

C.3 Canada ICES-3 / NMB-3 compliance statement

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de classe B est conforme à la norme canadienne NMB-003.

C.4 China RoHS information table

Information table on names and contents of hazardous substances in products						
Hazardous substances 	**Component name**				
	Housing	**Cabling**	**Electronics**	**Accessories**	**Packaging**
Lead (Pb)	O	O	X	O	O
Mercury (Hg)	O	O	O	O	O
Cadmium (Cd)	O	O	O	O	O
Hexavalent chromium (Cr (VI))	O	O	O	O	O
Polybrominated biphenyls (PBB)	O	O	O	O	O
Polybrominated diphenyl ethers (PBDE)	O	O	O	O	O
Dibutyl phthalate (DBP)	O	O	O	O	O
Diisobutyl phthalate (DIBP)	O	O	O	O	O
Butyl benzyl phthalate (BBP)	O	O	O	O	O
Bis(2-ethylhexyl) phthalate (DEHP)	O	O	O	O	O

This table is prepared in accordance with the provisions of GB 26572-2025.

NOTE 1:

O: Indicates that the content of the hazardous substance in all homogeneous materials of the component does not exceed the requirements of the national standard for the restricted use of hazardous substances in electrical and electronic products.

X: Indicates that the content of the hazardous substance in at least one homogeneous material of the component exceeds the requirements of the national standard for the restricted use of hazardous substances in electrical and electronic products.

NOTE 2: Components not listed above indicate that the content of the hazardous substances in these components does not exceed the requirements of the national standard for the restricted use of hazardous substances in electrical and electronic products.

产品中有害物质的名称及含有的信息表						
有害物质		部件名称				
		外壳	线缆	电子部件	附件	包装
铅（Pb）		O	O	X	O	O
汞（Hg）		O	O	O	O	O
镉（Cd）		O	O	O	O	O
六价铬（Cr (VI)）		O	O	O	O	O
多溴联苯（PBB）		O	O	O	O	O
多溴二苯醚（PBDE）		O	O	O	O	O
邻苯二甲酸二正丁酯（DBP）		O	O	O	O	O
邻苯二甲酸二异丁酯（DIBP）		O	O	O	O	O
邻苯二甲酸丁苄酯（BBP）		O	O	O	O	O
邻苯二甲酸二（2-乙基）己酯（DEHP）		O	O	O	O	O

本表依据 GB 26572-2025 的规定编制。

注 1：

O：表示该有害物质在该部件所有均质材料中的含量均不超出电器电子产品有害物质限制使用国家标准要求。

X：表示该有害物质至少在该部件的某一均质材料中的含量超出电器电子产品有害物质限制使用国家标准要求。

注 2：

以上未列出的部件,表明其有害物质含量均不超出电器电子产品有害物质限制使用国家标准要求。

Appendix D. Recycling instructions

These recycling instructions guide you on the end-of-life treatment of this Vaisala product. As waste regulations and infrastructure vary in each country, these instructions only indicate the different components to be separated and common ways to handle them. Always follow local requirements when disposing of the product. Vaisala encourages to use the best available recycling practices to minimize related environmental impacts.

Vaisala is committed to meeting the requirements of the EU Waste Electrical and Electronic Equipment (WEEE) Directive. This directive aims to minimize the impact of electrical and electronic goods on the environment, by increasing reuse and recycling, and reducing the amount of WEEE going to landfill. This symbol indicates that the product should be collected separately from other waste streams and treated appropriately.

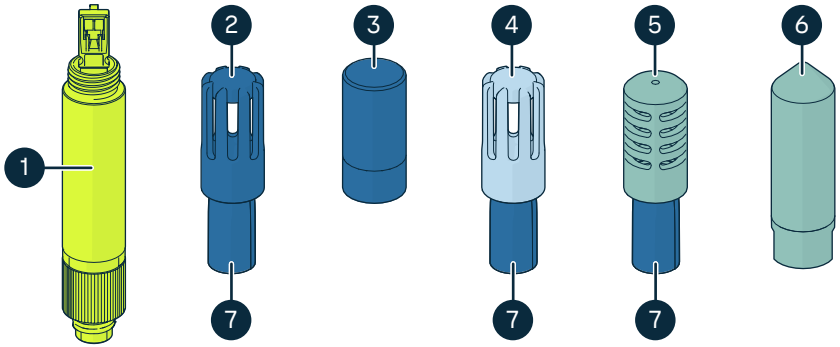


Figure 32 Materials for recycling

Recycling	Part	Material
Electrical and electronic waste	1	Various
Metal waste	5, 6	Stainless steel (AISI 316)
Plastic waste	2, 3, 7	Polycarbonate (PC) + GF, Polytetrafluoroethylene (PTFE)
Mixed waste	4	Metallized polycarbonate (PC)

Online store

Accessories, spare parts, and calibration and repair products are available online at store.vaisala.com.

Recycling



Recycle all applicable material according to local regulations.

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vaisala.com