Vaisala HUMICAP® Hand-Held Humidity and Temperature Meter HM40

VAISALA

Table of Contents

First Startup

1. Check that the HMP110 probe is securely attached and remove the yellow transport protection cap from the probe.

2. Open the battery cover and insert two AA-size batteries.

3. Close the battery cover and turn on the meter by pressing the Power button. If the meter does not turn on, check the battery orientation. Replace the batteries with fresh/recharged ones if needed.

Initial Settings

When you power on the HM40 for the first time (or after a factory reset of the settings), you must first select the operation language. You will then be asked if you want to change the following settings:

- Units
- Date
- Time

If you answer **Yes** to the question (recommended), the meter will show the settings screens before showing the measurement view. Use the arrow and function buttons to select. For more information, see section Settings Submenu on page 22.

i	HM40 will retain the date and time even during battery changes. The clock will have to be set again only if the meter is without battery power for several hours.

Product Overview

The Vaisala HUMICAP® Hand-Held Humidity and Temperature Meter HM40 is a hand-held meter for various portable measurement applications.

Main features:

- Compact and robust housing
- Measures a wide range of quantities: RH, Td, Tw, a, x, h, T. See section Quantities Explained on page 9.
- Large graphical display
- Graphs for selected quantity and temperature
- Interchangeable HMP110 probe
- Can be user calibrated (using the HMK15 humidity calibrator, for example)
- Powered by standard AA size batteries (2×)
- Operation temperature range -10°C ... +60°C
- Belt clip

Optional:

- USB-powered portable charger for AA-size NiMH rechargeables
- Membrane filter for HMP110 probe for increased protection against contaminants

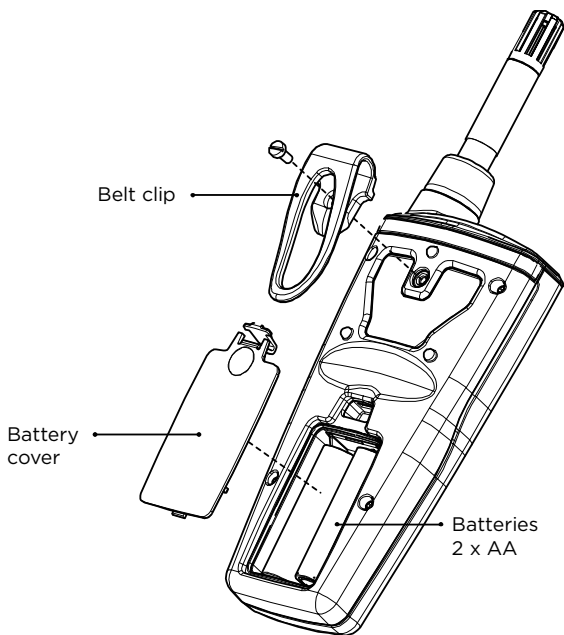> For more information and order codes of the accessories, see section Accessories and Parts on page 38.

The HM40 Meter - Front

Filter and sensor

HMP110 probe

Probe holder

Display

Left function

Up

Menu

Right function

Down

Power

The HM40 Meter – Back

Belt clip

Battery cover
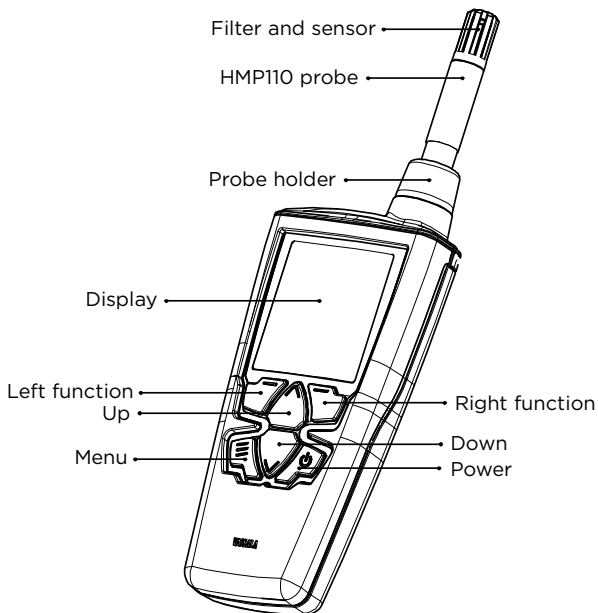
Batteries
2 x AA

Batteries

The HM40 is powered by **two AA-size batteries**. You can use the following battery types:

- Alkaline (IEC-LR6)
- Lithium (IEC-FR6)
- NiMH (IEC-HR6)

> ⚠️ Do not mix batteries of different types. Both batteries must be of the same type.

> ⚠️ Observe instructions storage and operation instructions of the battery manufacturer.

Alkaline batteries are the standard choice in non-rechargeable batteries. They are a good match for the power requirements of the HM40.

Lithium batteries are a good choice if you need the longest battery life or best capacity in low temperatures. Lithium batteries are not rechargeable. Do not confuse them with lithium-ion batteries, which cannot be used in the HM40.

NiMH batteries are rechargeable, and available from Vaisala as an option. For order codes, see section Accessories and Parts on page 38. Instructions for using the optional USB charger are provided in section Charging on page 8.

Charging

The optional USB charger provides a convenient way to charge two NiMH batteries from any powered USB port (for example, from a laptop computer).

1. Place the rechargeable batteries in the charger and plug it into a USB port. The blue LED on top of the charger starts to blink.

2. When the LED stops blinking and stays on, the batteries are charged. The charging time is several hours for two fully discharged NiMH batteries.

If you are not using a Vaisala-supplied charger and rechargeable batteries, read and follow the manufacturer's own charging instructions.

Figure 1   USB Charger with Two NiMH Batteries

> **STOP** Do not attempt to charge non-rechargeable (alkaline or lithium) batteries! Doing so leads to a risk of battery leakage, equipment damage, and risk of explosion and/or fire.
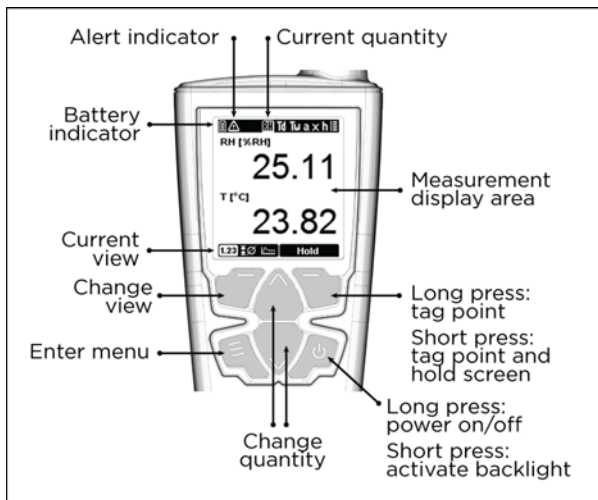
Quantities Explained

The table below describes the quantities measured by the HM40. All of the quantities are measured or calculated when the meter is on, independent of what is currently displayed.

Quantity	Symbol	Unit(s)	Description
Relative humidity	RH	%	Ratio of the partial pressure of water vapor in the air to the saturation vapor pressure of air at the current temperature.
Dewpoint	Td	°C °F	Temperature at which the water vapor in the air will condense into water at the current pressure. When the dewpoint is below 0 °C, the meter outputs frostpoint instead of dewpoint.
Wet bulb temperature	Tw	°C °F	The minimum temperature that can be reached by evaporative cooling in the current conditions.
Absolute humidity	a	g/m^3 gr/ft^3	Quantity of water in a cubic meter (or cubic foot) of air.
Mixing ratio	x	g/kg gr/lb	Ratio of water vapor mass per kilogram (or pound) of dry air.
Enthalpy	h	kJ/kg btu/lb	Sum of the internal energy of a thermodynamic system.
Temperature	T	°C °F	Temperature in Celsius or Fahrenheit scale.

Measurement Views

Screen Layout and Controls

Alert indicator

Current quantity

Battery indicator

Measurement display area

Current view

Change view

Long press: tag point

Short press: tag point and hold screen

Enter menu

Long press: power on/off

Short press: activate backlight

Change quantity

RH [%RH]

25.11

T [°C]

23.82

Hold

Pressing the right function button holds the screen and tags the current measurement point. See Hold and Tag on page 16.

Indicators

Battery charge indicator

Fresh batteries will always show three bars.

When the indicator shows two bars, the voltage of the batteries has started to drop. When there is a single (blinking) bar left, you should replace the batteries. The meter will turn off automatically when the battery voltage drops too low.

Alert indicator

This indicator is shown next to the battery charge indicator if there is a measurement problem. The most likely causes are low battery and probe problems, for example:

- Battery voltage too low to power the probe. The measured values may show asterisks "*" instead of numbers.

- Probe has been disconnected

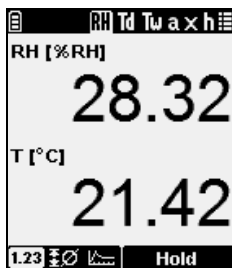- Probe has been damaged

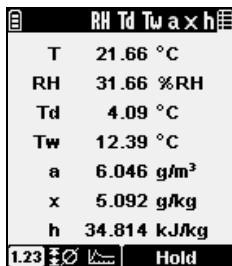- Probe is incompatible

Quantity indicator

The selected quantity is highlighted by a light frame. The symbol on the right stands for all quantities.

For the list of quantities, see section Quantities Explained on page 9.

Numeric View

RH Td Tw a x h

RH [%RH]

28.32

T [°C]

21.42

1.23 ‡Ø ⌐⌐ | Hold

The **Numeric view** shows the currently values of the selected humidity quantity and temperature.

RH Td Tw a x h

T	21.66 °C
RH	31.66 %RH
Td	4.09 °C
Tw	12.39 °C
a	6.046 g/m³
x	5.092 g/kg
h	34.814 kJ/kg

1.23 ‡Ø ⌐⌐ | Hold

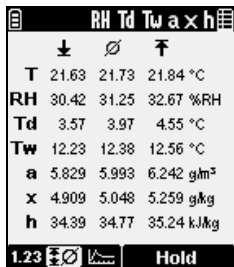In the all quantities view the font is smaller to fit all values on screen.

Statistics View
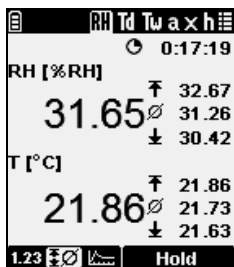
The **Statistics view** shows the current value of the selected quantity, as well as the maximum, average, and minimum value since the measurement was started. There is also a counter that shows how long the measurement has been running.

The icons are:

⊼ Maximum

∅ Average

⊥ Minimum

🕐 Measurement time

The counter for measurement time is not shown in the all quantities view.

	⊥	∅	⊼	
T	21.63	21.73	21.84	°C
RH	30.42	31.25	32.67	%RH
Td	3.57	3.97	4.55	°C
Tw	12.23	12.38	12.56	°C
a	5.829	5.993	6.242	g/m³
x	4.909	5.048	5.259	g/kg
h	34.39	34.77	35.24	kJ/kg
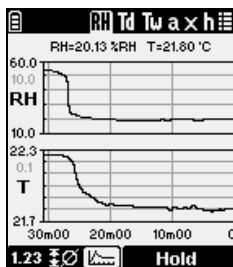
Graph View

The **Graph view** shows a continuously updating graph of the selected quantity and temperature.

The graph limits and spacing adjust dynamically to show the full range of measurements.

Current values

Vertical spacing of the grid

Graph maximum

Graph minimum
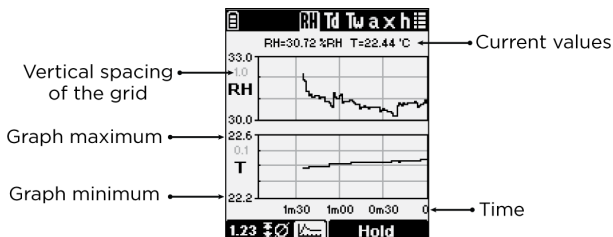
Time

⚠️ HM40 has no permanent memory for measurement data. When the meter is turned off, the graphs are cleared.

Main menu

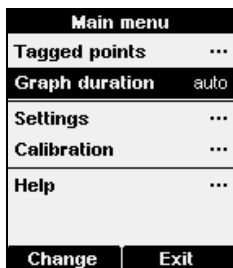|	
Tagged points	...
Graph duration	auto
Settings	...
Calibration	...
Help	...

| Change | Exit |

The timescale of the graph can be changed in the **Main menu**. By default, the graph will automatically change the timescale to fit the measured data. If you select a short timescale, only the most recent data will be visible.

RH Td Tw a x h

All graphs do not fit on the screen at the same time.

1.23 ‡Ø ⌷ Hold
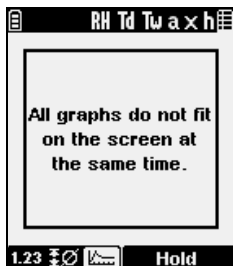
The graph view is not available in the all quantities view. Select a single quantity to show the graph.

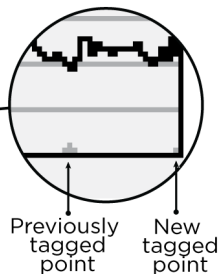# Hold and Tag

If you press the right function button (**Hold** button) in a measurement view, two things happen:

- The measurement view freezes until you press the **Release** button.
- The latest measurement point is tagged (marked and stored in temporary memory). See section Tagged Points on page 19.

Tagged points are shown in the graph view as small dots below the graphs.
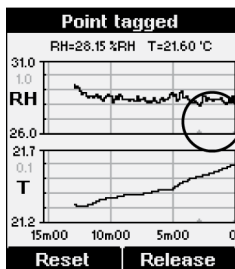
Previously tagged point

New tagged point

Measurement values at the tagged points can be browsed in the menu. See Tagged Points on page 19.
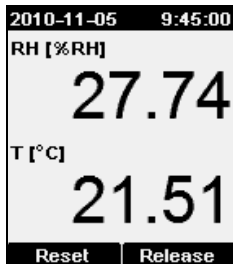
When the screen is held, the top of the display displays the current date and time. This is useful when you want to record the current data (take a photograph or write it down).

If time has not been set, the top of the screen will simply read "HOLD".

When the view is held, you can reset all measurement data by pressing the **Reset** button. This will clear all graphs and tagged points.

If you keep pressing the right function button (long press), the meter will tag the point without freezing the screen.

Main Menu

You can open the menu from the measurement view at any time by pressing the menu button.

If you are already in the menu, pressing the menu button returns you to the measurement view. If you are in a submenu, the menu button returns you to the previous menu level.

Main menu	
Tagged points	...
Graph duration	auto
Settings	**...**
Calibration	...
Help	...
Enter	**Exit**

Use the arrow buttons to move up and down in the menu, and function buttons to operate the menu options. Typical functions in the menus are:

- **View** and **Enter** open the selected menu option or submenu.

- **Change** and **Set** change the value of the selected option.

- **Back** returns to the previous menu view.

- **Exit** closes the menu and returns to the measurement view.

> **i** Some menu screens have more content than can be visible at one time. This is indicated by a scroll bar that appears on the right side of the screen. Use the arrow buttons to scroll up and down.

Tagged Points

Main menu	
Tagged points	⋯
Graph duration	auto
Settings	⋯
Calibration	⋯
Help	⋯
View	Exit

Select **Tagged points** in the main menu to see the list of stored points and values.

Tagged points		
Time	**RH [%RH]**	**T [°C]**
10:18:07	26.89	22.21
11:10:07	26.13	22.19
11:14:07	26.85	22.22
12:06:13	25.63	22.27
12:26:41	26.29	22.41
12:29:21	25.82	22.43
14:08:49	24.47	22.56
View	Back	

Time and temperature value are always shown for each tagged point. The shown humidity quantity is the same as has been selected in the measurement view. If all quantities view has been selected, RH is shown instead.

⚠️ HM40 has no permanent memory for measurement data. When the meter is turned off, the tagged points are deleted.

Graph Duration

Graph duration

auto	×
1.5 min	
3 min	
7 min	
15 min	
30 min	
1 h	

Set | Back
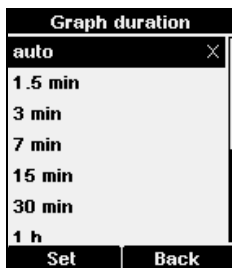
In the **Graph duration** screen, you can select the timescale of the Graph view. The shortest selectable timescale is 1.5 minutes, the longest 32 hours.

You can also select **Autoscale**, which means that the timescale will automatically adjust to show all of the measurement data in memory, up to the maximum of 32 h.

Settings

Settings

Language	English (en)
Units	...
Time & Date	...
Pressure	1.0132 bar
Backlight	Delay (30 s)
Battery	Alkaline

Choose | Back

Opens the **Settings** menu. The menu options are described in section Settings Submenu on page 22.

Calibration
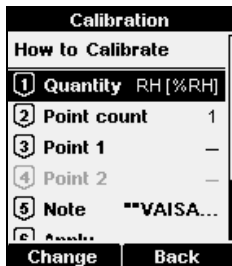
In the **Calibration** submenu, you can perform an adjustment procedure that corrects the humidity and temperature measurement of the meter.

For more information and the adjustment procedure, see section Calibration on page 33.

Help
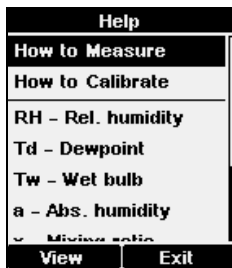
Opens a menu with help topics on measurement, calibration, and the measured quantities.
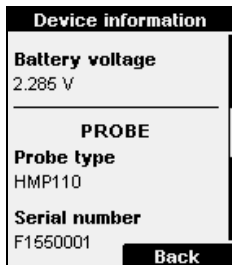
The help menu also includes a device information screen where you can view technical information about your HM40 indicator and the HMP110 probe.

Settings Submenu

Language

Language
suomi (fi)
español (es)
svenska (sv)
中文 (zh)
русский (ru)
日本語 (jp)
português (pt)
Choose | Back

In the **Language** screen, you can change the display language of the meter. The choices are:

- English (en)
- German (de)
- French (fr)
- Finnish (fi)
- Spanish (es)
- Swedish (sv)
- Chinese (zh)
- Russian (ru)
- Japanese (jp)
- Portuguese (pt)

Units

Units	
Units	metric
Pressure unit	bar

Change	Back

The **Units** setting determines the measurement system that is used for the quantities:

- Metric
- Non-metric

The **Pressure unit** is set separately:

- hPa
- bar
- atm
- PSI

Time & Date

Time & Date	
Date	2010-11-05
Formatting	ISO
Time	15:56:09
Formatting	24 h

Set	Back

In the **Time & Date** menu, you can set the current date and time, and their presentation formats. Both date and time have their own pre-set formatting options.

Date setup

Set year

▲
2010-11-05
▼

►Month | OK

In the **Date setup** screen, you can set the current date:

- **Arrow buttons** change the selected value
- **Left function** button selects the next value (year, month, or day).
- **OK** button stores the date and returns to the Settings menu.

After setting the date, set the desired date format using the **Formatting** option in the Time & Date menu.

Time setup

Set hour (24h)

▲
15:57:05
▼

►Minute | OK

In the **Time setup** screen, you can set the current time:

- **Arrow buttons** change the selected value.
- **Left function** button selects the next value (hours, minutes, or seconds).
- **OK** button stores the time and returns to the Settings menu.

After setting the time, select 24h or 12h clock using the **Formatting** option in the Time & Date menu.

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Pressure

In the **Pressure setup** screen, you can set the current ambient pressure. The pressure information is used when calculating certain humidity quantities, such as mixing ratio (symbol x).

If the ambient pressure differs significantly from the default setting of 1.0132 bar (due to high altitude, for example), set the correct pressure value so that the HM40 meter can calculate the measurement correctly.

Backlight

Always on: Screen is always lit. This option will shorten the battery life significantly.

Always off: Screen is always unlit. This option provides the best battery life.

Delay (30s): Backlight will automatically turn on when the user presses any button. The backlight will turn off after 30 seconds of inactivity.

Dimmed: Screen is always lit with a dim backlight.

Battery

Use the **Battery** setting to tell the meter what kind of batteries are installed. This will help to scale the battery indicator correctly. The options are:
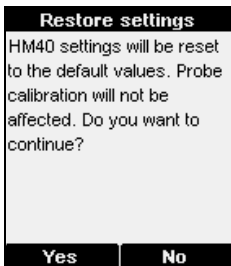
- Alkaline
- Rechargeable

Navigation

The Navigation setting affects the behavior of arrow buttons in the measurement view:

- **Normal**: Up arrow moves quantity selector left, down arrow moves it right
- **Inverted**: Reverses the direction

Factory Settings

The **Factory settings** option restores all settings to their default values. Probe calibration is not affected.

Restore settings

HM40 settings will be reset to the default values. Probe calibration will not be affected. Do you want to continue?

Yes | No

How to Measure

Remove the Transport Protection Cap

Remove the yellow transport protection cap from the probe when taking the meter into use.

Measure in a Stable Environment

If the measurement conditions are changing, you cannot get a reliable measurement result. Do not measure near heat sources, air conditioning, open doors, or windows.

> **i** For best results, leave the meter on in the measurement area and come back to check it later.

Avoid Temperature Differences

Temperature differences are a typical cause of error in humidity measurement and calibration. You must let the meter stabilize long enough: temperature differences level out very slowly.
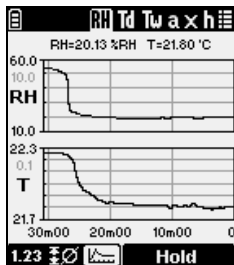
Switch to the Graph view and wait until the graphs level out, indicating that the measurement is now stable.

Avoid Condensation and Rain

If the humidity sensor element becomes wet, the meter cannot measure until the sensor is dry again. Avoid rain and conditions where condensation can form on the sensor.

Do not replace the transport protection cap if the probe or the cap is wet, since it will prevent the probe from drying.

> ⚠️ Do not touch the sensor or blow on it to dry it out.

Calibrate the Meter Regularly

It is recommended that you calibrate the HMP110 probe of the HM40 meter **once a year**, or if you have any reason to believe it is no longer within its accuracy specification. See section Calibration on page 33.

Maintenance

Cleaning

The HM40 can be cleaned by wiping it with a moist cloth.

If the filter becomes contaminated, it is very likely to affect the humidity measurement since residue on the filter will retain some moisture. Dirty filters should be replaced.

Do not use solvents to clean the HM40. Do not spray anything directly on the HM40, since that may deposit impurities on the sensor.
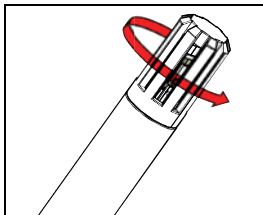
⚠ Do not immerse the HM40 in liquid to clean it.

⚠ Do not attempt to clean the sensor element that is located inside the filter. Any touching (or blowing with pressurized air) may damage it. If the measurement accuracy cannot be restored by calibration and adjustment, it is time to replace the HMP110 probe.

Changing the Filter

1. Twist the filter counter-clockwise to open it.
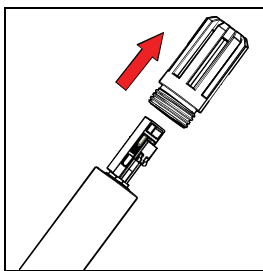
2. Turn the filter until it can be removed. Do not touch the sensors when pulling it away.

3. Install the new filter and tighten it.

Changing the Probe

1. Press the power button to turn off the meter.

2. Twist the probe holder counter-clockwise to disconnect the probe.
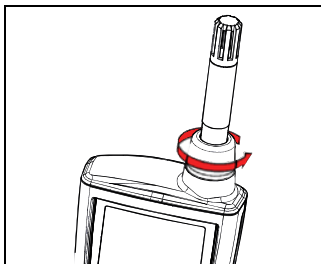
3. Pull the probe holder and probe together away from the connector.

4. Take the HM40 meter and push the pins of the new probe in the holes of the connector. Tighten the probe holder.

5. Press the power button to turn on the meter. It should start up and begin measuring normally.

Calibration
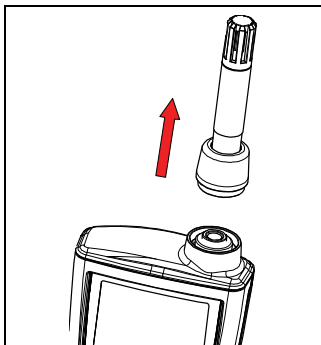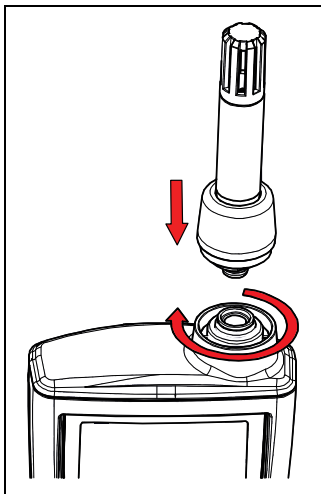
The humidity measurement accuracy of the HMP110 probe should be checked **once a year**. You can do this yourself using a humidity reference (for example, the Vaisala Humidity Calibrator HMK15), or send the probe to a Vaisala Service Center for calibration. See the back cover of this manual for contact information.

If the calibration shows that the measurement accuracy is no longer within specification, the probe must be adjusted. If accuracy cannot be restored with adjustment, the probe must be replaced. All probes that are ordered from Vaisala are delivered calibrated. See section Accessories and Parts on page 38.

If you think the meter is not measuring humidity or temperature correctly, calibration and adjustment is not the first thing to do. Try the following first:

- Make sure 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, you must allow it to dry before you can measure.

- Always wait for the measurement to stabilize.

For an introduction to calibration, order or download the free calibration book from Vaisala at the following address:
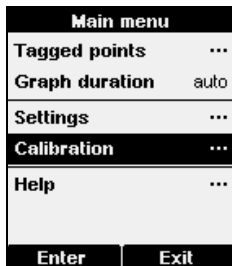www.vaisala.com/calibrationbook

Calibrating the HM40 Using the HMK15 Humidity Calibrator

The HMK15 Humidity calibrator allows you to produce known humidity environments using saturated salt solutions.

> Performing a good calibration takes some time and preparation. Read the HMK15 User's Guide before performing your first calibration with the HMK15.

Main menu	
Tagged points	...
Graph duration	auto
Settings	...
Calibration	...
Help	...
Enter	**Exit**

1. Press the Menu button and select the **Calibration** submenu.

Calibration	
How to Calibrate	
① **Quantity**	RH [%RH]
② **Point count**	1
③ **Point 1**	—
④ Point 2	—
⑤ **Note**	"VAISA...
⑥ Apply	
Change	**Back**
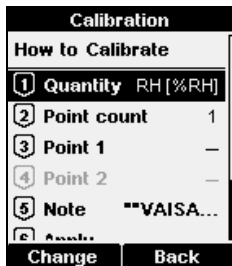
2. Select the quantity to be calibrated at menu item **[1] Quantity**. You can calibrate Temperature (T) or Relative Humidity (RH) measurement. All other humidity quantities are calculated from RH and T, so they will also be adjusted.

Calibration

How to Calibrate

1. **Quantity** RH [%RH]
2. **Point count** 2
3. **Point 1** —
4. **Point 2** —
5. **Note** ··VAISA...
6. **Apply**

Change | Back
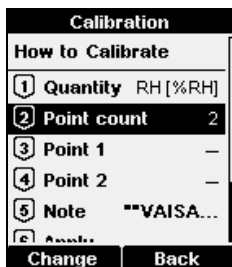
3. Select the number of calibration points at menu item **[2] Points**. You can perform a 1-point or 2-point calibration.

   For 2-point calibration, you need two reference environments. For example, LiCl and NaCl salt chambers provide 11% and 75% relative humidity references.
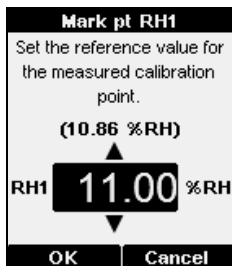
4. Remove the filter from the probe and place the probe in the first reference environment (first calibration point).

   Take care not to damage the sensors. Wait 20 – 40 minutes for the reading to stabilize.

Mark pt RH1

Set the reference value for the measured calibration point.

(10.86 %RH)

▲

RH1 **11.00** %RH

▼

OK | Cancel

5. Select menu item **[3] Point 1** and press the Set button. The meter now shows the currently measured value of the selected quantity. Set the reference value using the arrow buttons and press the OK button.

```
        Calibration
    How to Calibrate
  1  Quantity  RH [%RH]
  2  Point count        2
  3  Point 1 10.86➔11.00
  4  Point 2            —
  5  Note        ••VAISA...
  6  Apply
      Set    |    Back
```
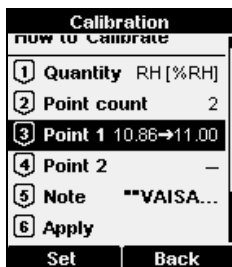
The correction to the measurement at point 1 is now shown in the text for menu item [3]. If you are only doing a 1-point calibration, skip to step 8.

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

```
      Mark pt RH2
  Set the reference value for
   the measured calibration
          point.
       (74.72 %RH)
           ▲
  RH2  75.00  %RH
           ▼
    OK    |    Cancel
```
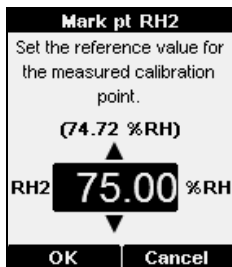
7. Select menu item [4] Point 2 and press the Set button. The meter now shows the currently measured value of the selected quantity. Set the reference value using the arrow buttons and press the OK button.
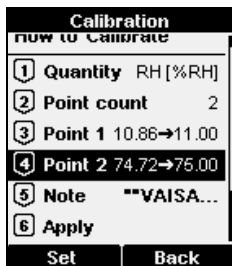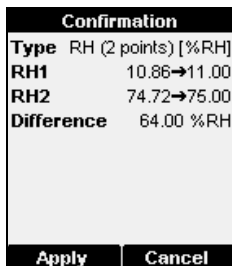
Calibration

How to Calibrate

① Quantity RH [%RH]
② Point count 2
③ Point 1 10.86➔11.00
④ Point 2 74.72➔75.00
⑤ Note ""VAISA...
⑥ Apply

Set | Back

The correction to the measurement at point 2 is now shown in the text for the menu item [4].

Calibration text

A B C D E F G H I J K L
M N O P Q R S T U V W X
Y Z 0 1 2 3 4 5 6 7 8 9
_ . , : ; - + = * ! ?
" # % & / \ ( ) ⌫ ← → OK

""VAISALA/HEL""

Select | Cancel

8. Select menu item [5] Note to edit the calibration info text that is stored in the probe. Edit the text using the select button and arrow keys. When done, select the OK character in the bottom right corner to save the changed text.

To exit without saving, press the Cancel button.

Confirmation

Type RH (2 points) [%RH]
RH1 10.86➔11.00
RH2 74.72➔75.00
Difference 64.00 %RH

Apply | Cancel

9. Select menu item [6] Apply to save the calibration in the probe. Check the applied corrections in the confirmation screen and press the Apply button.

To exit without applying the correction, press the Cancel button.

Accessories and Parts

Description	Order code
HMP110 probe for HM40	HMP110 – separate order form
HMP110R replacement probe for HM40	HMP110R – separate order form
Plastic grid filter for HMP110 probe	DRW010522SP
Plastic grid with membrane filter for HMP110 probe	DRW010525
External battery recharger with USB connection and 2 batteries	229249SP
NiMH rechargeable batteries (4 pcs)	229247SP
Belt clip (3 pcs)	227710SP
Battery cover (3 pcs)	225688SP

HMP110 Probe

If the HMP110 probe on your meter needs to be replaced, you can order a new probe from Vaisala. You can:

- order a new HMP110 probe and keep your current one
- order a new HMP110R probe and return the old one to Vaisala (replacement probe).

The instructions for changing the probe are provided on page 31.

Use the dedicated order forms when ordering a probe for HM40. You cannot use any HMP110 probe since the probe must have the correct software configuration and mechanical attachment.

Filters

Vaisala offers two types of filters for HMP110 for use with the HM40:

- **Plastic grid filter** is the standard choice. It provides the fastest response time, as air can flow freely around the sensors.
- **Plastic grid with membrane filter** has a membrane under the plastic grid (0.2 µm pore size) for additional protection against contaminants. It slows down the response time of the probe.

For instructions on how to replace the filter on the HMP110 probe, see page 26.

Chargers and Batteries

You can order an external battery recharger with USB connection and compatible NiMH rechargeable batteries from Vaisala. For more information, see the following sections of this manual:

- Batteries on page 7
- Charging on page 8

Belt Clips and Battery Covers

If you need a new belt clip or battery compartment cover, you can order replacements from Vaisala.

Technical Data

Performance

Relative Humidity

Measurement range	0 ... 100 %RH
Accuracy (including non-linearity, hysteresis, and repeatability)	
at 0 ... +40 °C (+32 ... +104 °F)	±1.7 %RH (0 ... 90 %RH)
	±2.5 %RH (90 ... 100 %RH)
at -10 ... 0 °C and +40 ... +60 °C (+14 ... +32 °F and 104 ... 140 °F)	±3.0 %RH (0 ... 90 %RH)
	±4.0 %RH (90 ... 100 %RH)
Factory calibration uncertainty at +20 °C (+68 °F)	±1.5 %RH
Humidity measurement response time (90%) with plastic grid filter	17 s
Stability	±2 %RH over 2 years
Humidity sensor	HUMICAP® 180R

Temperature

|	
Measurement range	-10 ... +60 °C (+14 ...+140 °F)
Accuracy over temperature range:	
at 0 ... +40 °C (+32 ... +104°F)	±0.2 °C (0.36 °F)
at -10 ... 0 °C and +40 ... +60 °C (+14 ... 32 °F and +104 ... +140 °F)	±0.4 °C (0.72 °F)
Temperature Sensor	Pt1000 RTD 1/3 Class B IEC 751

Mechanical

Dimensions (H × W × D)	230 × 72 × 44 mm
Weight	
With batteries	240 g
Without batteries	190 g
Materials	
Meter body	PC/ABS blend, acrylic display lens
Probe holder	Aluminum
Probe	Chrome coated aluminum
Filter	Chrome coated ABS plastic
Housing classification	IP54
Mechanical drop endurance	0.5 m with probe attached 1.0 m without the probe

General

Power-up time	<3 s
Batteries	2 × AA sized, 1.5 V
Calculated variables	Td, Tw, a, x, h
Menu languages	English, German, French, Finnish, Spanish, Swedish, Chinese (simplified), Russian, Japanese, Portuguese
Display	LCD (140 x 160 pixels)
Operation time	typical 100 hours (without backlight)
Operation temperature range	-10 ... +60 °C (+14 ... +140 °F)
Storage temperature range	-30 ... +70 °C (-22 ... +158 °F)
Electromagnetic compatibility (EMC)	European Union directive EN61326-1 for portable equipment

Dimensions (in mm)
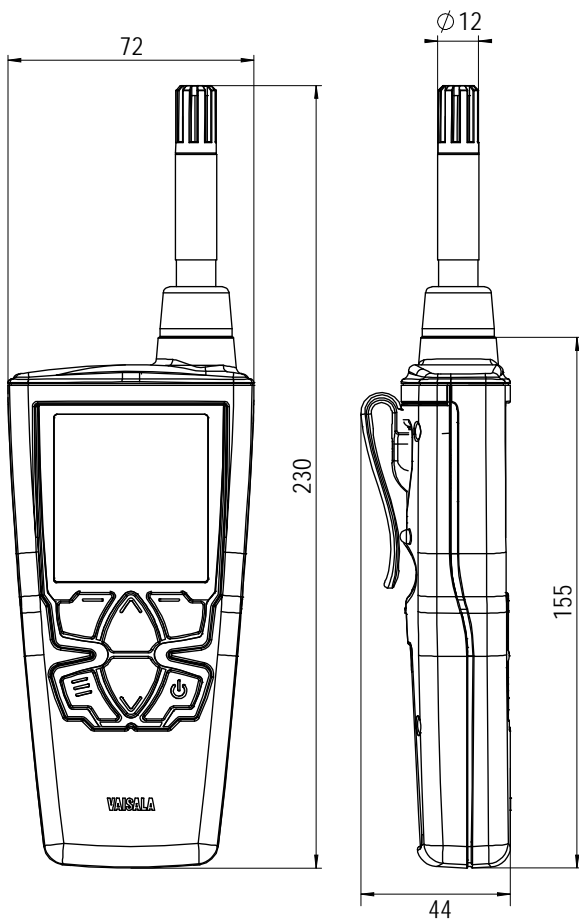
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Warranty

For warranty information, visit our Internet pages at

www.vaisala.com/services/warranty.html

Technical Support

For technical questions, contact the Vaisala technical support by e-mail:

helpdesk@vaisala.com

For contact information of Vaisala Service Centers, see

www.vaisala.com/services/servicecenters.html