Vaisala HUMICAP® Structural Humidity Measurement Kit SHM40

Full SHM40 product presentation and introduction to the borehole method

SHM40 – a starter kit ideal for the borehole method

- Practical tool for humidity measurement of concrete and other structures

- Designed for the borehole method

- Based on the HM40 indicator and HMP40S probes

- Accessories and weather-proof case

  - SHM40 and accessories (e.g. HM40S, HMP40S, HM40SINDI) are non-configurable items

SHM40

Features and Benefits

- Easy to use
- Accurate measurement data in a stabilization graph
- Truly interchangeable HMP40S measurement probes
  - HMP40S is a cable probe with HMP110 and cable with quick connector
- Durable
- IP65 classified measurement probe and case
- Conforms to ASTM standard F2170-09

Standard contents of the SHM40 kit

1. Pocket for documents and accessories

2. HM40 indicator with quick connection adapter (HM40SINDI)

3. HMP40S humidity and temperature probe (HMP40S)

4. Plastic tubes, 12 pcs (19266HM)

5. Rubber plugs, 12 pcs (233976)

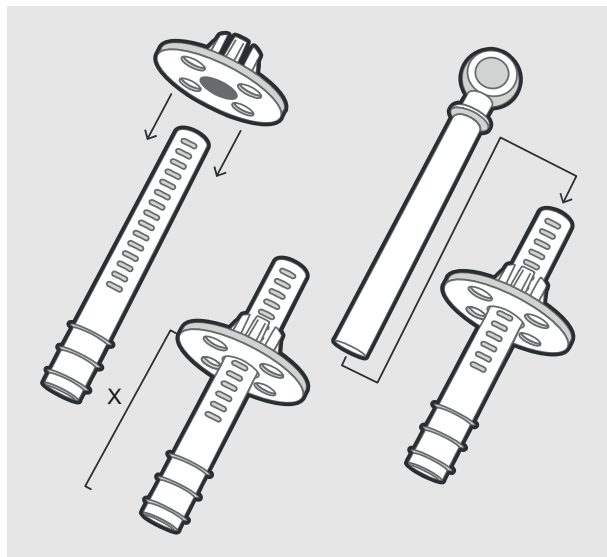6. Protective covers with lid, 3 pcs (19268HM)

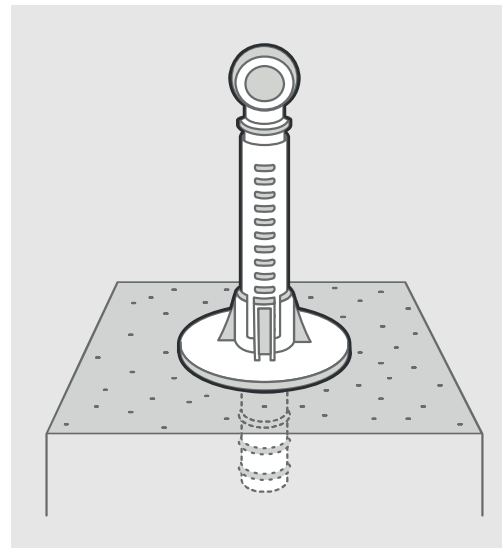*7.&8. optional accessories for wet concrete, see next slide*
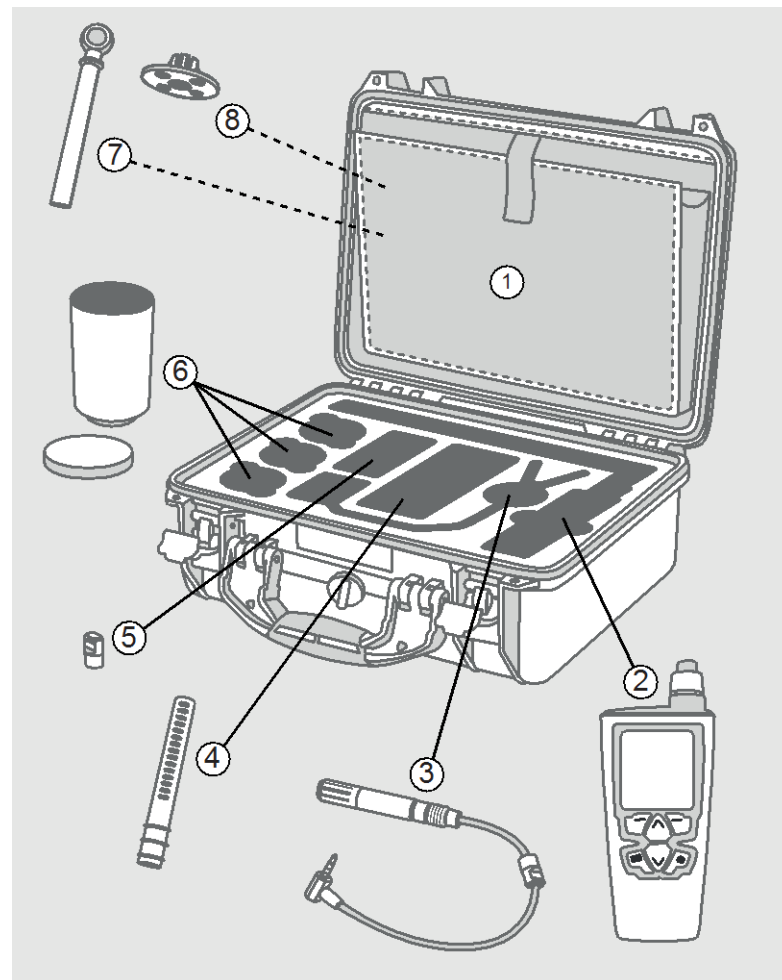
Accessories for wet concrete

- Optional items not included with the standard kit:
  - Long rubber plug for fresh concrete, 12 pcs (26530HM)
  - Plastic flange for fresh concrete, 12 pcs (26529HM)

Preparing the plastic tube, plastic flange and long rubber plug for fresh concrete

Plugged tube with flange in fresh concrete
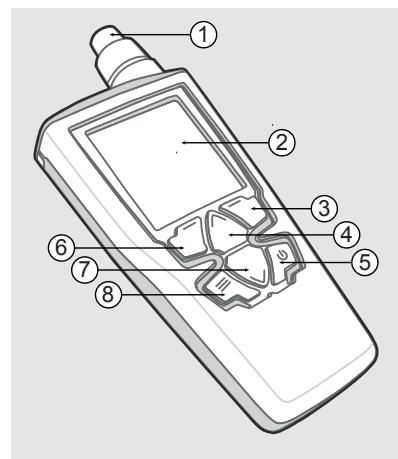
Standard sellable items

- HM40S – HM40 indicator with adapter and cable probe
- HMP40S – RH&T probe
- HM40SINDI – HM40 indicator with adapter (no probe included)
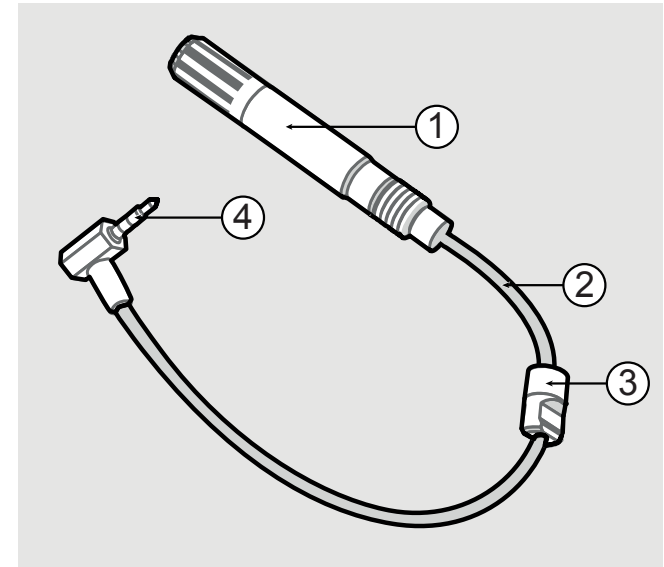

HM40S with standard case

Three HMP40S probes

HM40SINDI (no probe incl.)

# HMP40S – RH&T probe for structural moisture measurements

1. HMP110 probe

2. 30 cm cable

3. Integrated rubber plug

4. Quick connection adapter for HM40

HM40SINDI – Indicator and quick connection adapter

1. Quick connection adapter for HMP40S probe
2. Display
3. Right function button
4. Up arrow button
5. Power button
6. Left function button
7. Down arrow button
8. Menu button

- The HM40 indicator is powered by two AA-size batteries. You can use the following battery types:
  - Alkaline (IEC-LR6)
  - Lithium (IEC-FR6)
  - NiMH (IEC-HR6)
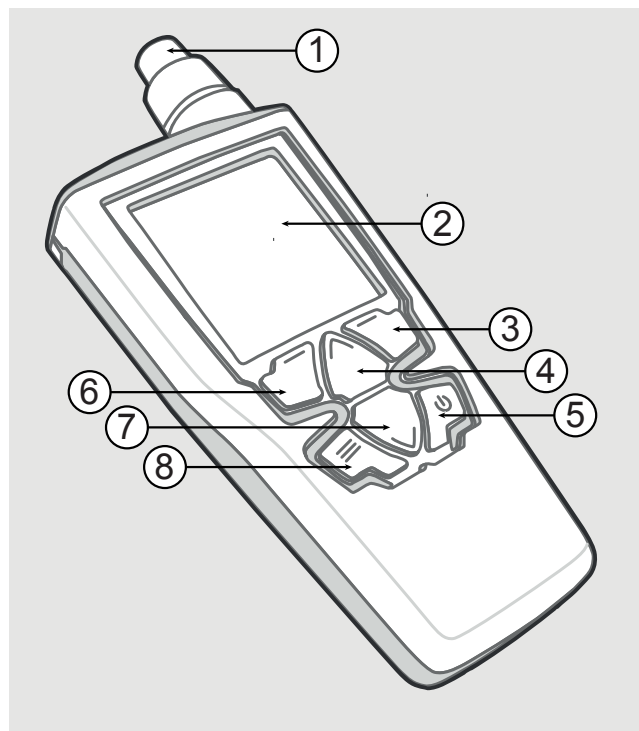
Indicator screen layout and controls

1. Alert indicator
2. Currently selected quantity
3. Battery indicator
4. Measurement display area
5. Currently selected view
6. Left function button: change view
7. Menu button: enter menu
8. Right function button
   Long press: tag point, short press: tag point and hold screen
9. Power button
   Long press: power on/off, short press: activate backlight
10. Arrow buttons: change quantity
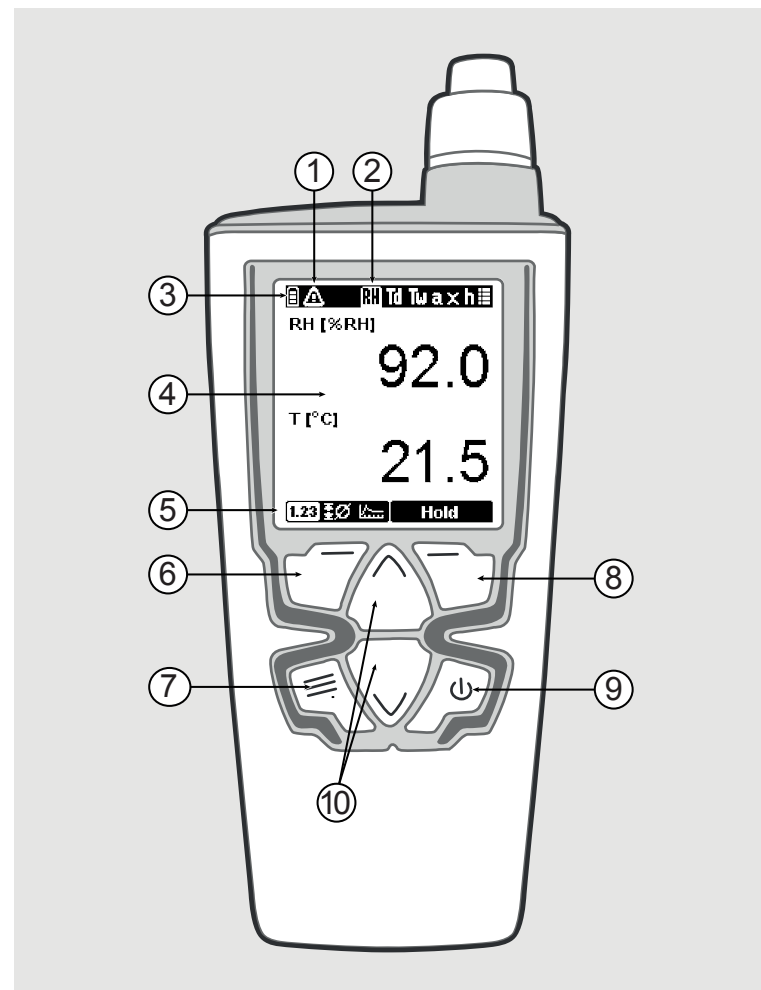
HM40S – Quantities explained

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 HM40 outputs frostpoint (Tf) 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/m3 gr/ft3	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.

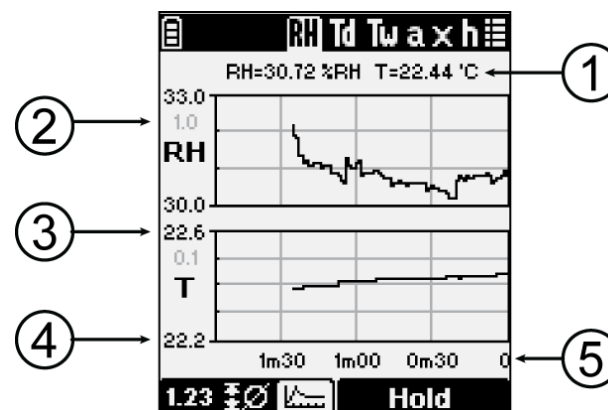# Indicator views
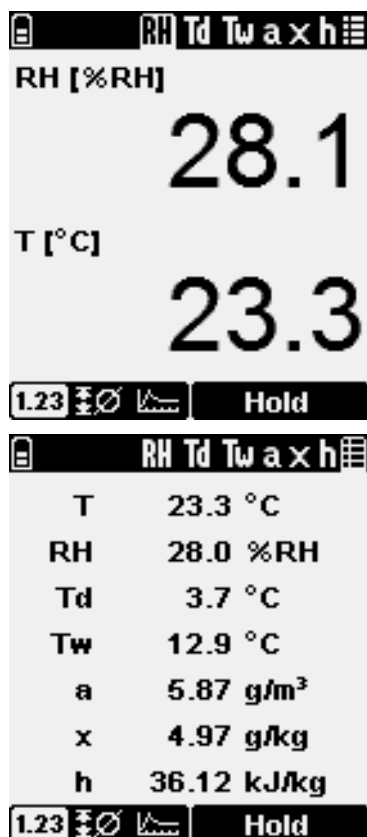
Numeric view
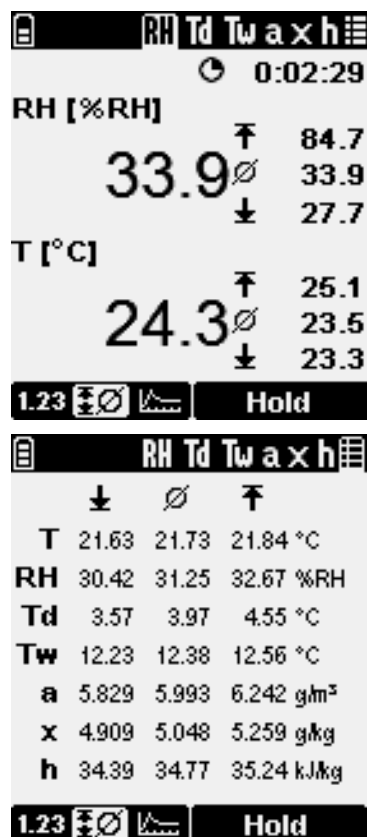
Statistics view

Graphic view

1. Current values
2. Vertical spacing of the grid
3. Graph maximum
4. Graph minimum
5. Time

Other indicator features

- Hold and tag –function
- Calibration of the probe attached
- Settings:
  - Graph duration
  - Units – metric, non-metric
  - Language – English, German, French, Finnish, Spanish, Swedish, Chinese, Russian, Japanese, Portuguese
  - Time and date
  - Pressure – hPa, bar, atm, PSI
  - Backlight, battery, navigation, rounding

The borehole method

- Hole ($\varnothing$ 16 mm) to a suitable depth in the concrete structure

- After drilling, hole is cleaned and covered, and humidity in hole is allowed to equalize with humidity in the concrete. Equilibrium in ~3 days

  - Hole must be sealed during equalization time. Plastic tube and rubber plug in the SHM40 kit should be used. Ideally, probe should be inside plastic tube during equalization.

  - For reliable results, it is recommended to have several measurement points.
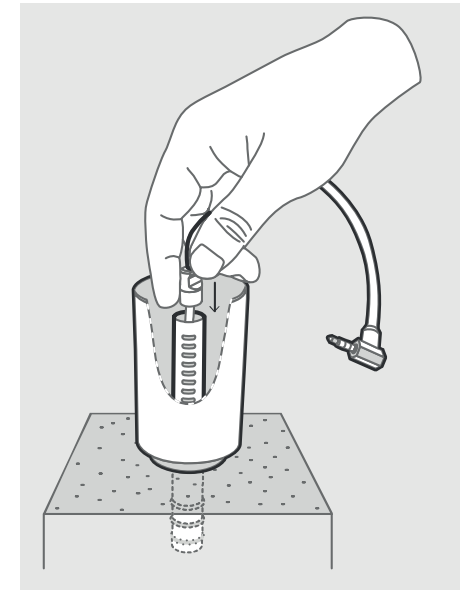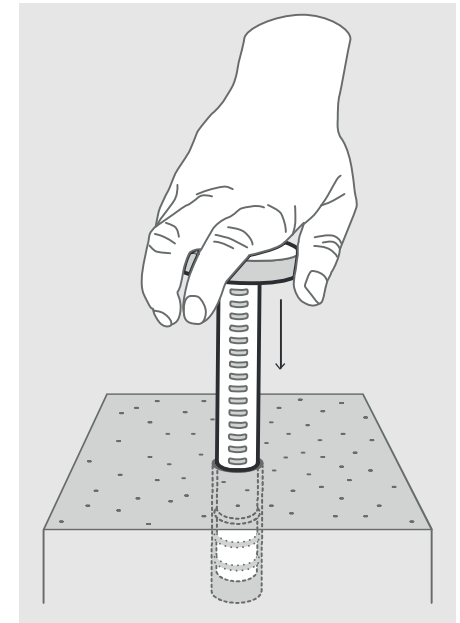
Recommended setup during borehole stabilization

1. Lid
2. Protective cover
3. Probe cable
4. Rubber plug
5. Probe
6. Plastic tube
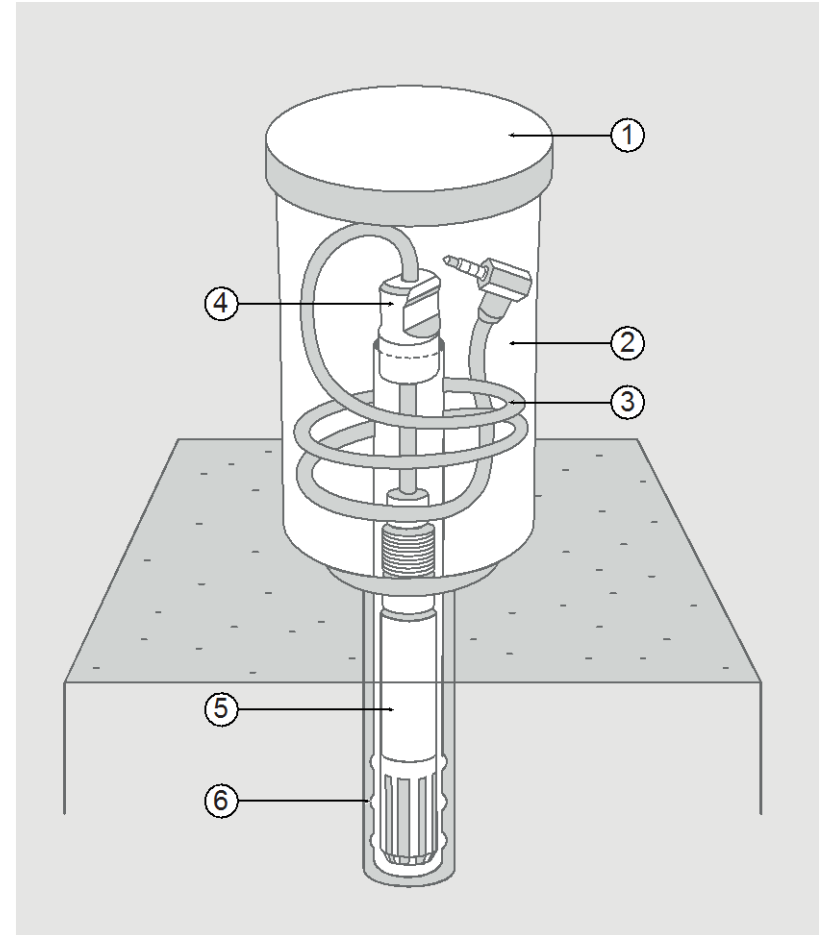
Performing the measurement

Connecting the HMP40S probe to the indicator quick connection adapter

Performing the actual humidity measurement

Specifications (1/2)
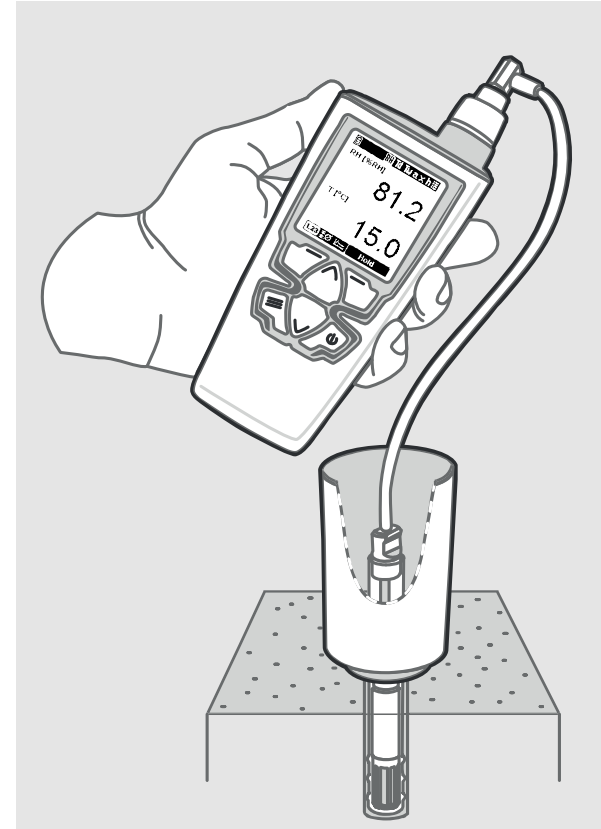
Relative humidity

Measurement range   0 ... 100 %RH

Accuracy (incl. non-linearity, hysteresis and repeatability)
    Temperature range   0 ... +40 °C
        0 ... 90 %RH   ±1.5 %RH
        90 ... 100 %RH   ±2.5 %RH

    Temperature range   -40…0 °C, +40…+80 °C
        0 ... 90 %RH   ±3.0 %RH
        90 ... 100 %RH   ±4.0 %RH

Factory calibration uncertainty at +20 °C   ±1.5 %RH

Humidity sensor   Vaisala HUMICAP® 180R

Stability   ±2%RH over 2 years

Typical stabilization time in a borehole when the concrete and the probe are in the same temperature
               30 min

Temperature

Measurement range   -40…+80 °C

Accuracy over temperature range:
        0…+40 °C   ±0.2 °C
        -40…0 °C, +40…+80 °C   ±0.4 °C

Temperature sensor   Pt1000 RTD Class F0.1 IEC 60751

Specifications (2/2)

General

Operating temperature range for probe	-40 °C...+80 °C
Probe weight with standard cable	31 g
Probe housing material	Stainless steel
Probe filter and sensor protection	Membrane filter with chrome coated ABS plastic
Cable material	Wire: PVC, Jacket: PU
Cable connector	TRRS male 3.5 mm
Probe housing classification	IP65

HM40 Indicator

Operation temperature range for indicator	-10...+60 °C
Storage temperature range	-30...+70 °C
Weight	
Indicator with adapter and batteries	240 g
SHM40 case with standard content	3.7 kg
Indicator materials	PC/ABS blend, Acrylic display lens
Indicator adapter materials	Nickel plated brass and plastic overmolding
Housing classification	IP54
Mechanical drop endurance	1.0 m without the probe
Power-up time	< 3 s
Batteries	2 x AA sized, 1.5V (LR6)
Operation time (Alkaline batteries)	Typical 100 hours (without backlight)
Calculated variables	Td, Tw, a, x, h
Menu languages	English, German, French, Finnish, Spanish, Swedish, Chinese (simplified), Russian, Japanese
Display	LCD (140 x 160 pixels)
Electromagnetic compatibility (EMC)	European Union directive EN61326-1 for portable equipment

HM40 Indicator and HMP40S Probe Dimensions
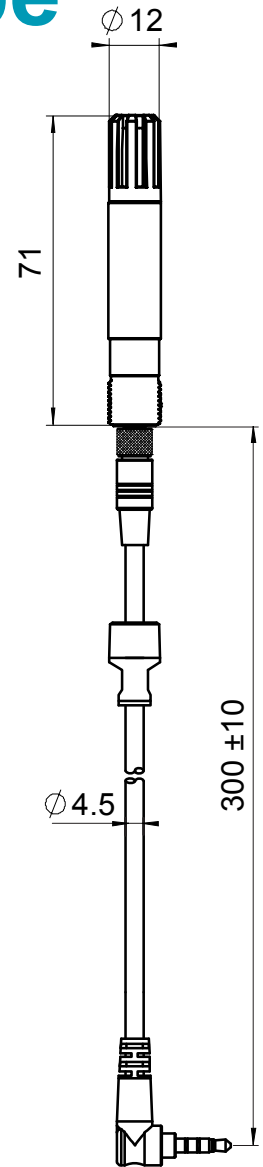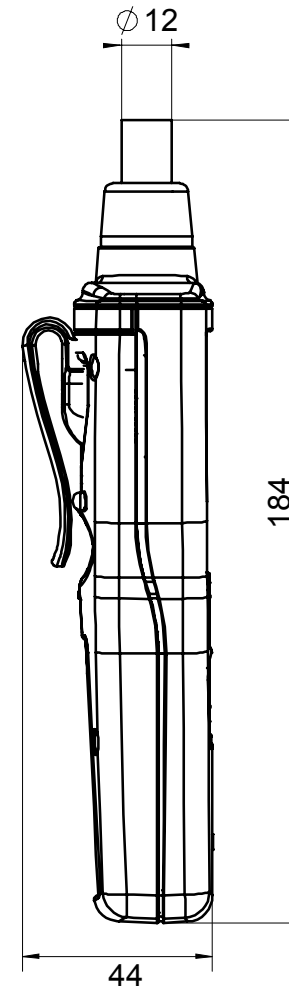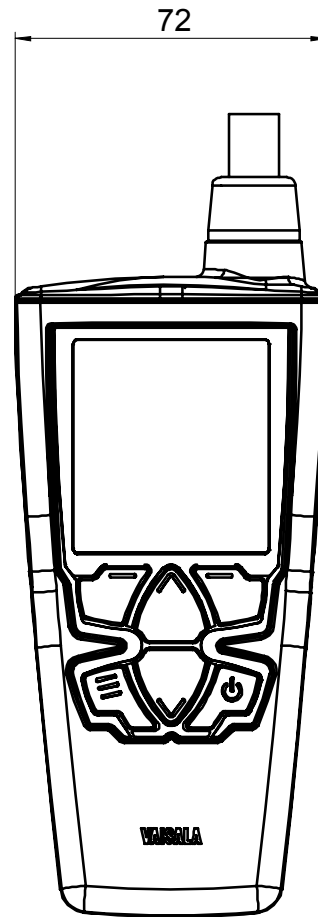
Spare parts and Accessories

Description	Order Code
HM40 indicator with adapter and cable probe for concrete moisture measurements	HM40S
HM40 indicator with adapter	HM40SINDI
RH & T probe with cable for concrete moisture measurements	HMP40S
Adapter for indicator and cable quick connector	HM40SADAPTER
Cable for HMP40S probe	HMP40SCABLE
Long cable (2.7 m) for HMP40S probe	HMP40SCABLE2
Plastic tube set (12 pcs)	19266HM
Rubber plug set (12 pcs)	233976
Weather-proof carrying case with SHM40 filling	233815
Protective cover with lid (3 pcs)	19268HM
Plastic flange set (12 pcs, for wet concrete)	26529HM
Long rubber plug set (12 pcs, for wet concrete)	26530HM
USB recharger for HM40 indicator batteries	229249SP