

User Guide

Vaisala INTERCAP[®] Humidity and
Temperature Transmitters
HMDW80 Series



VAISALA

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1. About this document

1.1 Version information

This document provides instructions for installing, using, and maintaining Vaisala INTERCAP® Humidity and Temperature Transmitters HMD80, HMD82, HMD82D, HMD83, HMD83D, HMS82, HMS82C, HMS83, HMS83C, HMW82, HMW82P100, HMW83, HMW87, HMW87D, HMW88, HMW88D, TMD82, TMS82, TMW82, and TMW88.

Table 1 Document versions (English)

Document code	Date	Description
M211510EN-J	June 2026	Added information about transmitter models HMW87 and HMW87D. Added sections: • Filtering factor (page 19) • Wiring devices with Modbus output (page 36) • Modbus communication (page 40) • Using transmitter with Insight PC software (page 40) • Using transmitter with Indigo80 handheld indicator (page 46) • Field calibration of display models using a reference instrument (page 52) • Field calibration of HMW87(D) using Insight software (page 53) • Field calibration of HMW87(D) using Indigo80 handheld indicator (page 55) • Troubleshooting checklist (page 66) • Error messages in Insight PC software and Indigo80 handheld indicator (page 66) • Modbus reference for HMW87 and HMW87D (page 76) • Regulatory statements (page 86) Updated sections: • Trademarks (page 9) • Introduction to HMDW80 Series (page 10) • HMDW80 series transmitter models (page 10) • Transmitter parts – wall models (page 13) • Display (page 17) • Safety (page 20) • Installing wall models HMW87, HMW88, HMW89, and TMW88 (page 23) • Calibration (page 51) • Replacing the INTERCAP humidity sensor (page 57) • Problem situations (page 66) • HMDW80 series specifications (page 69) • Spare parts and accessories (page 72)
M211510EN-H	September 2025	Updated section HMDW80 series specifications (page 69): • Added table <i>Compliance</i> • Updated table <i>Operating environment</i>

Document code	Date	Description
M211510EN-G	January 2025	Default filter type updated. Minor changes and improvements. Updated sections: • Transmitter parts – wall models (page 13) • HMDW80 series specifications (page 69)

1.2 Related manuals



For the latest versions of these documents, see docs.vaisala.com.

Table 2 Related manuals

Document code	Description
M211328EN	Vaisala HMW82/83 and TMW82/83 Humidity and Temperature Transmitters Quick Guide
M211509EN	Vaisala HMS82, HMS83, and TMS82 Humidity and Temperature Transmitters Quick Guide
M213128EN	Vaisala HMDW110 and HMDW80 Series Transmitters M12 Connector Options Technical Note
M212722EN	Vaisala Indigo80 Handheld Indicator User Guide

1.3 Documentation conventions



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



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



Highlights important information on using the product.



Gives information for using the product more efficiently.



Lists tools needed to perform the task.



Indicates that you need to take some notes during the task.

1.4 Trademarks

INTERCAP® is a registered trademark of Vaisala Oyj.

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

Modbus® is a registered trademark of Schneider Automation Inc.

2. Product overview

2.1 Introduction to HMDW80 Series

Vaisala INTERCAP® Humidity and Temperature Transmitter Series HMDW80 transmitters measure relative humidity and temperature in various building automation applications. The transmitters combine easy installation and reliable operation with a low requirement for maintenance.

HMDW80 series includes transmitters for wall and duct mounting, humid areas, and for outdoor installation. It also includes temperature-only transmitters, transmitters with an optional display, and models with Modbus® RTU output. Calculated humidity parameters – dew point, wet bulb temperature, and enthalpy – are also available.

HMDW80 series transmitters require minimal maintenance thanks to their excellent sensor stability and high-quality materials. If necessary, the INTERCAP humidity sensor can be easily exchanged in the field with practically no downtime.

Transmitter models HMW87 and HMW87D can be connected to Vaisala Indigo80 Handheld Indicator or Vaisala Insight PC software for configuration and field calibration.

Features provided by transmitters in the HMDW80 series:

- ± 3.0 %RH accuracy
- 0–100 %RH measurement range
- Analog and Modbus RTU output models available
- User exchangeable INTERCAP humidity sensor for easy field replacement
- Several output parameters
- Several IP65-classified models for demanding HVAC applications
- UL-V0 flammability rating

More information

- [HMDW80 series transmitter models \(page 10\)](#)
- [Output parameters explained \(page 11\)](#)
- [Configuration with DIP switches \(page 38\)](#)
- [Modbus communication \(page 40\)](#)
- [Using transmitter with Insight PC software \(page 40\)](#)
- [Using transmitter with Indigo80 handheld indicator \(page 46\)](#)
- [Replacing the INTERCAP humidity sensor \(page 57\)](#)
- [HMDW80 series specifications \(page 69\)](#)

2.2 HMDW80 series transmitter models

[Table 3 \(page 11\)](#) lists the most important differences between the HMDW80 series transmitter models. For technical specifications, see [HMDW80 series specifications \(page 69\)](#).

Table 3 HMDW80 series transmitter models

Model	Type	Outputs	Display	IP rating	Output parameters
HMD82	Duct	2 × 4–20 mA	No	IP65	T, RH, T _d , h, T _w
HMD82D	Duct	2 × 4–20 mA	Yes	IP65	T, RH, T _d , h, T _w
TMD82	Duct	1 × 4–20 mA	No	IP65	T
HMD83	Duct	2 × 0–10 V	No	IP65	T, RH, T _d , h, T _w
HMD83D	Duct	2 × 0–10 V	Yes	IP65	T, RH, T _d , h, T _w
TMD83	Duct	1 × 0–10 V	No	IP65	T
HMW82	Wall	2 × 4–20 mA	No	IP30	T, RH
HMW82P100	Wall	2 × 4–20 mA	No	IP30	T, RH
TMW82	Wall	1 × 4–20 mA	No	IP30	T
HMW83	Wall	2 × 0–10 V	No	IP30	T, RH
TMW83	Wall	1 × 0–10 V	No	IP30	T
HMW87	Wall	Modbus RTU	No	IP65	T, RH, T _d , h, T _w
HMW87D	Wall	Modbus RTU	Yes	IP65	T, RH, T _d , h, T _w
HMW88	Wall	2 × 4–20 mA	No	IP65	T, RH, T _d , h, T _w
HMW88D	Wall	2 × 4–20 mA	Yes	IP65	T, RH, T _d , h, T _w
HMW89	Wall	2 × 0–10 V	No	IP65	T, RH, T _d , h, T _w
TMW88	Wall	1 × 4–20 mA	No	IP65	T
HMW89D	Wall	2 × 0–10 V	Yes	IP65	T, RH, T _d , h, T _w
HMS82	Outdoor	2 × 4–20 mA	No	IP65	T, RH, T _d , h, T _w
HMS83	Outdoor	2 × 0–10 V	No	IP65	T, RH, T _d , h, T _w
TMS82	Outdoor	1 × 4–20 mA	No	IP65	T

2.2.1 Output parameters explained

Table 4 Parameters supported by HMDW80 series

Parameter	Symbol	Unit(s)	Description
Temperature	T	°C, °F	Temperature in Celsius or Fahrenheit scale.
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.

Parameter	Symbol	Unit(s)	Description
Dew point	T_d	°C, °F	Temperature at which the water vapor in the air will condense into water at the current pressure. When the dew point is below 0 °C, the transmitter outputs frost point (T_f) instead of dew point.
Enthalpy	h	kJ/kg, BTU/lb	Sum of the internal energy of a thermodynamic system.
Wet bulb temperature	T_w	°C, °F	The minimum temperature that can be reached by evaporative cooling in the current conditions.

2.3 Transmitter parts – duct models

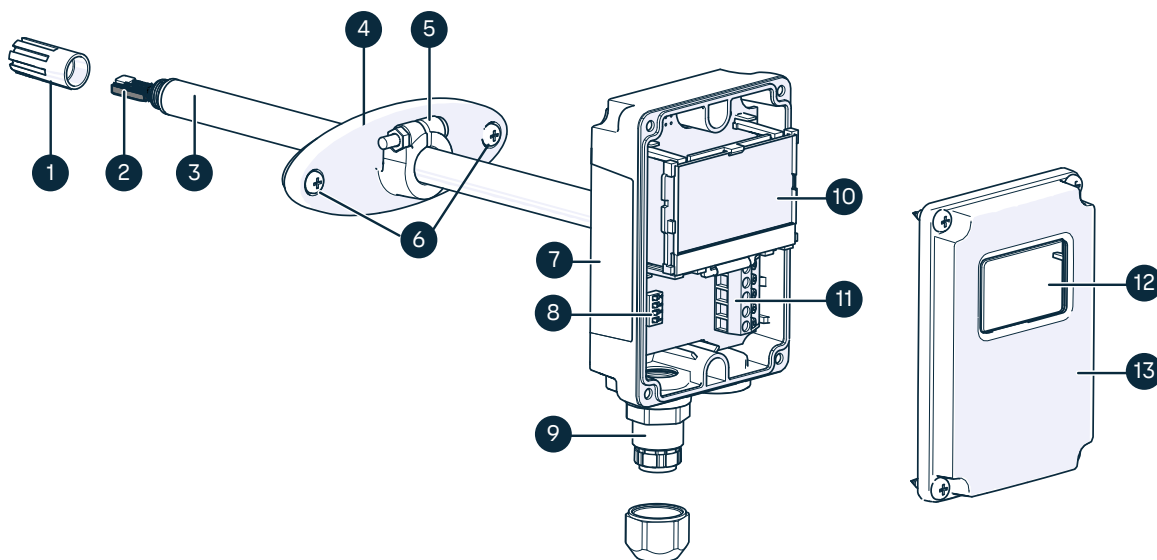


Figure 1 Parts of duct mounted models HMD82/83 and TMD82/83

- 1 PTFE membrane filter (item code ASM210856SP)
- 2 INTERCAP humidity sensor and temperature sensor. Not included in models TMD82 and TMD83.
- 3 Probe
- 4 Fastening flange
- 5 Tightening screw for fastening flange
- 6 Screws for attaching the flange to a duct (2 pcs included)
- 7 Type label
- 8 DIP switches for selecting humidity parameter and display units. Not included in models TMD82 and TMD83.
- 9 Cable gland. Suitable for 4–8 mm diameter cable.
- 10 Display (in models HMD82D and HMD83D)
- 11 Screw terminals
- 12 Window for display (in models HMD82D and HMD83D)
- 13 Transmitter cover with captive screws

2.4 Transmitter parts – wall models

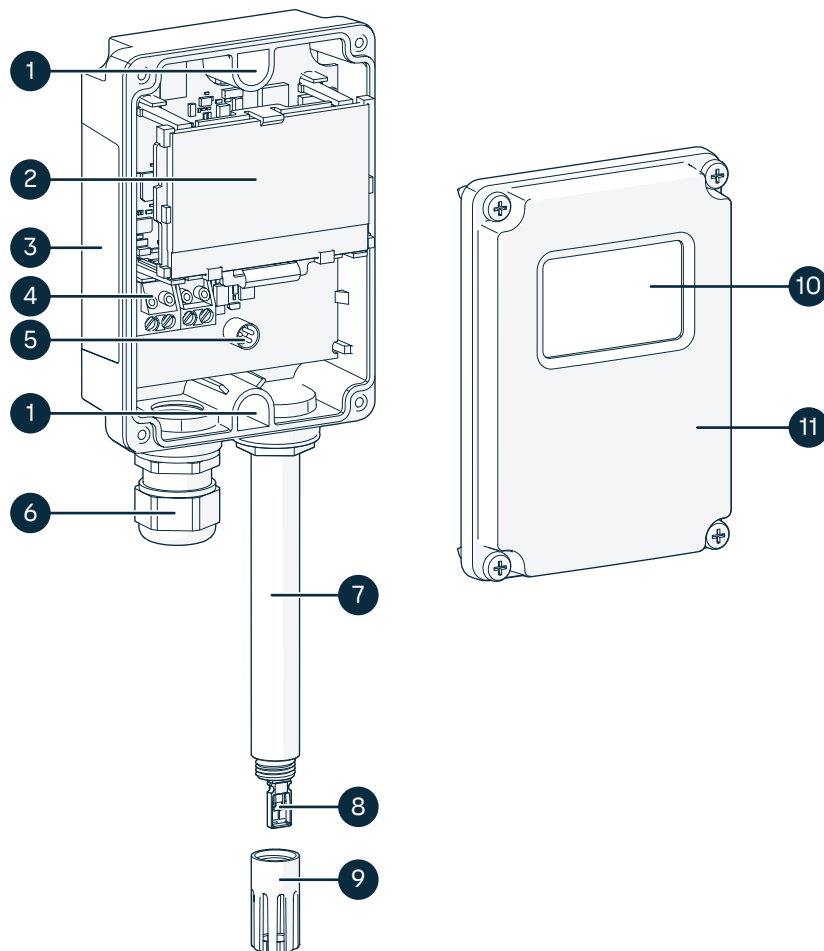


Figure 2 Parts of wall-mounted models HMW87 and HMW87D

- 1 Screw holes for mounting (2 pcs)
- 2 Display (in model HMW87D)
- 3 Type label
- 4 Terminal block for RS-485 output. For Modbus connection.
- 5 Service port connector (4-pin M8)
- 6 Cable gland. Suitable for 4-8 mm diameter cable.
- 7 Probe
- 8 INTERCAP humidity sensor and temperature sensor
- 9 PTFE membrane filter (item code ASM210856SP)
- 10 Window for display (in model HMW87D)
- 11 Transmitter cover with captive screws

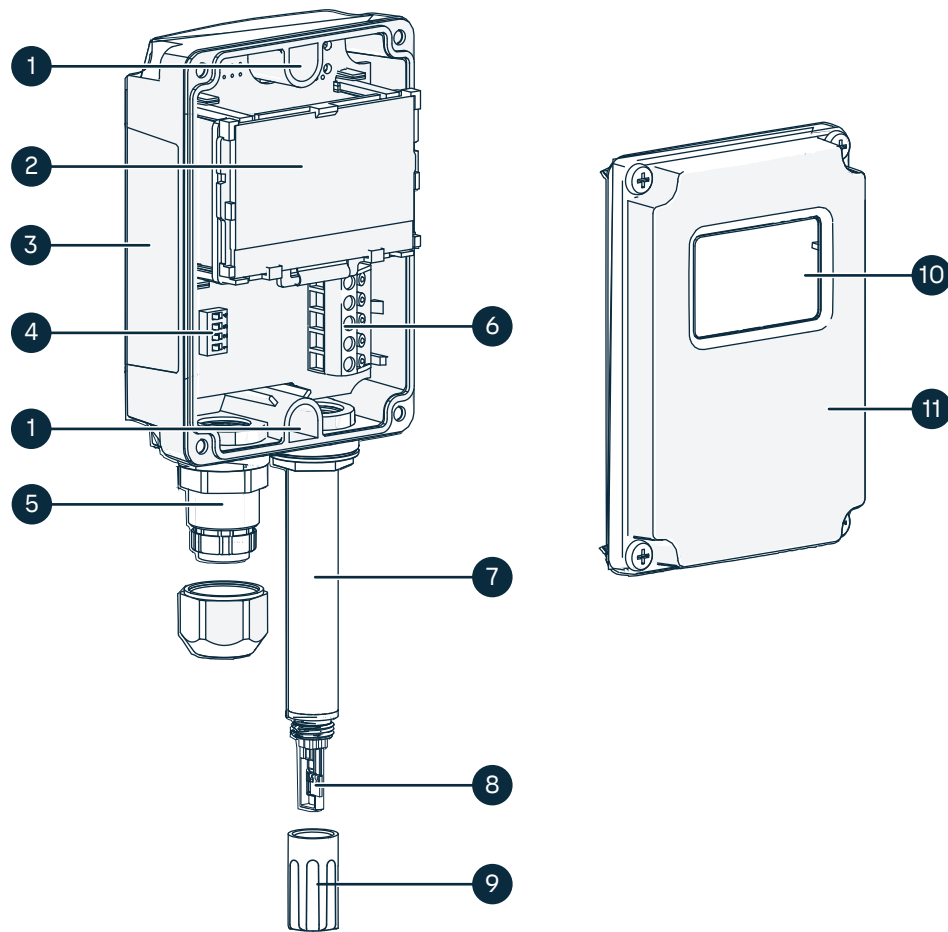


Figure 3 Parts of wall-mounted models HMW88/89 and TMW88

- 1 Screw holes for mounting (2 pcs)
- 2 Display (in models HMW88D and HMW89D)
- 3 Type label
- 4 DIP switches for selecting humidity parameter and display units
- 5 Cable gland. Suitable for 4–8 mm diameter cable
- 6 Screw terminals
- 7 Probe
- 8 INTERCAP humidity sensor and temperature sensor
- 9 PTFE membrane filter (item code ASM210856SP)
- 10 Window for display (in models HMW88D and HMW89D)
- 11 Transmitter cover with captive screws

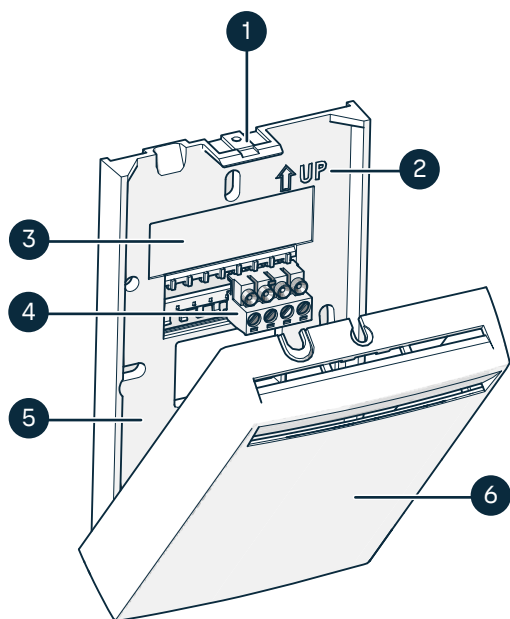


Figure 4 Parts of wall-mounted models HMW82/82P100/83 and TMW82/83

- 1 Opening tab: push down to open the transmitter
- 2 Direction arrow. Must point up after mounting base has been installed on the wall
- 3 Wiring label
- 4 Screw terminals
- 5 Mounting base
- 6 Transmitter cover with component board

2.5 Transmitter parts – outdoor models

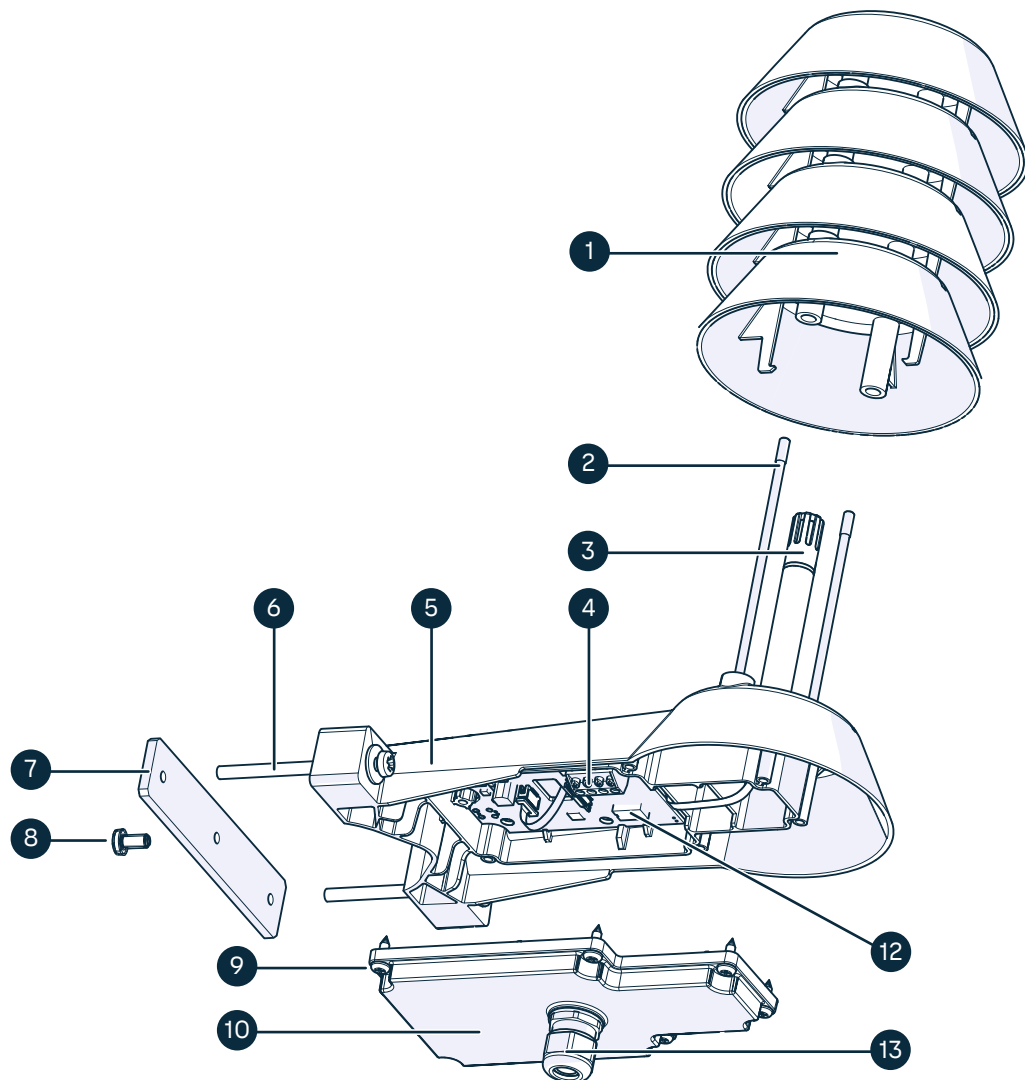


Figure 5 Parts of outdoor models HMS82/83, TMS82

- 1 Radiation shield. Do not remove for installation, only when changing sensor or filter
- 2 Long screws that keep the radiation shield in place (2 pcs), 3 mm hex socket
- 3 INTERCAP humidity sensor and temperature sensor under PTFE membrane filter (filter item code: ASM210856SP)
- 4 Screw terminal. Detachable for easy installation.
- 5 Transmitter body
- 6 Screws for pole mounting (2 pcs), medium size crosshead type (Pozidriv)
- 7 Clamp for pole mounting. The holes are threaded for the included pole mounting screws and set screw
- 8 Set screw, medium size crosshead type (Pozidriv). Install after pole mounting to stop the transmitter from turning.
- 9 Medium size crosshead screws (6 pcs) that hold the transmitter cover in place
- 10 Transmitter cover

- 11 Cable gland. Suitable for 4–8 mm diameter cable.
- 12 Configuration DIP switches. See [Configuration with DIP switches \(page 38\)](#).

2.6 Display

The following models have a display:

- HMD82D and HMD83D
- HMW87D, HMW88D and HMW89D

When the transmitter is powered on, it displays a sequence of information screens about the transmitter. The screens are shown for a few seconds each. Checking the screens on startup is a good way to verify the transmitter's settings and status.

2.6.1 Display in models HMD82/83D and HMW88/89D

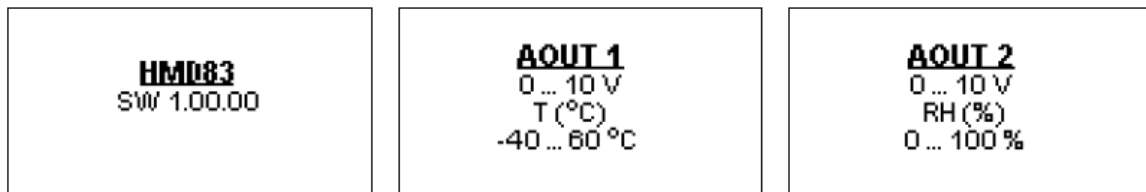


Figure 6 Startup screens (HMD83D)

After the startup screens have been displayed, the transmitter will show the measurement screen.

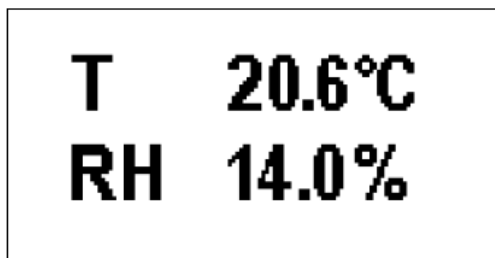


Figure 7 Measurement screen (HMD83D)

If one of the transmitter's error states is active, a notification symbol and error text will appear on the screen. Depending on the error, the affected measurement readings may be replaced by asterisks "***". For more information on the possible errors, see [Error messages on display \(page 68\)](#).

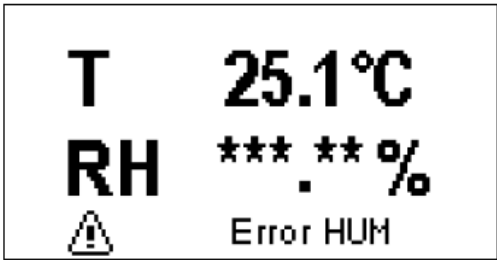


Figure 8 Measurement screen with error (HMD83D)

2.6.2 Display in model HMW87D

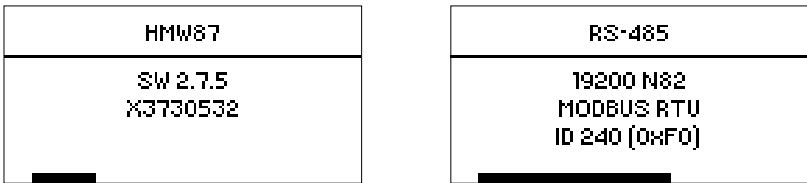


Figure 9 Startup screens (HMW87D)

After the startup screens have been displayed, the transmitter will show the measurement screen.

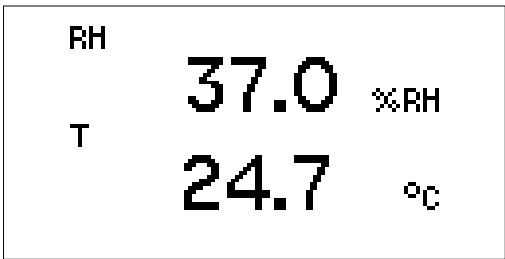


Figure 10 Measurement screen (HMW87D)

If one of the transmitter’s error states is active, a notification symbol, error text, and an identification number in brackets will appear on the screen. HMW87D shows the abbreviated versions of the error messages listed in [Error messages in Insight PC software and Indigo80 handheld indicator \(page 66\)](#).

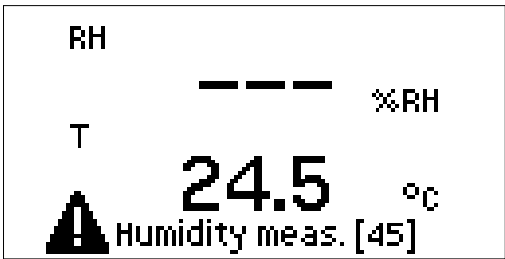


Figure 11 Measurement screen with error (HMW87D)

2.7 Filtering factor

The filtering factor feature in models HMW87 and HMW87D determines how quickly the results of measurement cycles are reflected in the 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 for HMW87 and HMW87D with the Insight software, the Indigo80 handheld indicator, or using the Modbus protocol.

More information

- [Setting filtering factor with Insight \(page 45\)](#)

2.8 Analog output overrange behavior

Analog outputs of the HMDW80 series transmitters have a defined behavior when the values measured by the transmitter are outside the scaled analog output range:

- Output is clipped at the end of the range.
- Output is set to error state when measured value is 5% outside the scaled range. See [Analog output error states \(page 68\)](#).
- Output resumes normal function when measured value is back on the scaled range.



HMW82/83 and TMW82/83 transmitters are different from the rest of the HMDW80 series. Their analog output is clipped at 10% outside the scaled range, and their analog outputs enter the error state when the measured value is 20% outside the range.

For example, consider the temperature output of the HMD82 transmitter. The output is 4–20 mA, scaled to -40 ... +60 °C (-40 ... +140 °F).

- When the measured temperature rises above +60 °C (+140 °F), the output rises to 20 mA and stops rising even if temperature rises further.
- If the temperature rises above +65 °C (+149 °F), the output enters the error state of 3.6 mA.



This overrange behavior does not mean there is a problem with the measurements, and it does not affect the readings shown on the display (if included in the transmitter model). The display always shows the currently measured readings if the measurement is operating without error. For more information on transmitter errors, see [Error messages on display \(page 68\)](#).

2.9 Safety

The HMDW80 series transmitter delivered to you has been tested for safety and approved as shipped from the factory. Note the following precautions:



WARNING! Make sure that you prepare and connect only de-energized wires.



CAUTION! Installation of HMDW80 series transmitters may involve working at a height. Assess the risks and plan your work so it is carried out safely. Try to avoid working at height, if you can.



CAUTION! Do not modify the unit or use it in ways not described in the documentation. Improper modification or use may lead to safety hazards, equipment damage, failure to perform according to specification, or decreased equipment lifetime.



CAUTION! Always choose a power supply unit that conforms to local standards and requirements, and product input specifications. The specified product power supply voltage range must never be exceeded. See [HMDW80 series specifications \(page 69\)](#).

In North America, only power the device with one of the following:

- An approved/certified Class 2 power supply. The output of the power supply may not exceed 100 VA, with operating voltage not more than 30 V_{rms}, 42.4 V_{peak}, or 60 V DC.
- An approved/certified Limited Power Source (LPS) (CAN/CSA-C22.2 No. 60950-1 or UL 60950-1). The output of the power supply may not exceed 100 VA, with operating voltage not more than 30 V_{rms}, 42.4 V_{peak}, or 60 V DC.



CAUTION! Make sure to use the power supply unit only in its specified environmental conditions.

2.9.1 ESD protection

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

Avoid touching component contacts or connectors when working with the device.

3. Installation



To minimize working on wiring and configuration at the installation location, see also the following sections when planning the installation:

- [Wiring \(page 30\)](#)
- [Configuration with DIP switches \(page 38\)](#)
- [Modbus communication \(page 40\)](#)

3.1 Selecting location

When mounting duct model transmitters:

- Avoid installing in a location where condensation may fall on the sensor inside the duct.
- Position the sensor in the center of the duct.
- Select a site where the transmitter can be installed horizontally, onto the side of the duct.

When mounting wall model transmitters:

- Select a location that represents well the area of interest.
- Do not install on the ceiling.
- Avoid placing the transmitter near heat and moisture sources, close to the discharge of the supply air ducts, and in direct sunlight.

When mounting outdoor transmitters:

- Install in a place that receives minimal direct sunlight. In the northern hemisphere, the North side of the building typically provides a suitable shaded location.
- Avoid placing the transmitter near windows, air conditioning units, or other heat and moisture sources such as cooling towers.
- Install the transmitter at least 2.5 m above ground level.

3.2 Installing duct models HMD82/83 and TMD82/83



- Medium size crosshead screwdriver (Pozidriv) for screws on cover and flange
- Small slotted screwdriver for screw terminals.
- Drill with 2.5 mm and 13 mm bits for making the installation holes.
- Tools for cutting and stripping wires.
- 19 mm open-end wrench for tightening the cable gland.

1. Remove the yellow transport protection cap and separate the fastening flange from the transmitter.
2. Use the flange to mark the location and size of the installation holes on the side of the duct.

3. Drill the installation holes in the duct. See [Figure 12 \(page 22\)](#).
4. Secure the fastening flange to the duct with the two screws (included).
5. Push the probe of the transmitter through the flange and into the duct. The probe should reach far enough so that the sensor is located in the middle of the duct.
6. Secure the transmitter to the flange by tightening the screw on the flange that holds the probe in place.
7. Open the transmitter cover, and route the power and signal cable through the cable gland. Connect the wires to the screw terminals. See [Wiring \(page 30\)](#).
8. Check that the DIP switches (if present in your transmitter model) are set as desired. See [Configuration with DIP switches \(page 38\)](#).
9. Tighten the cable gland and close the transmitter cover.

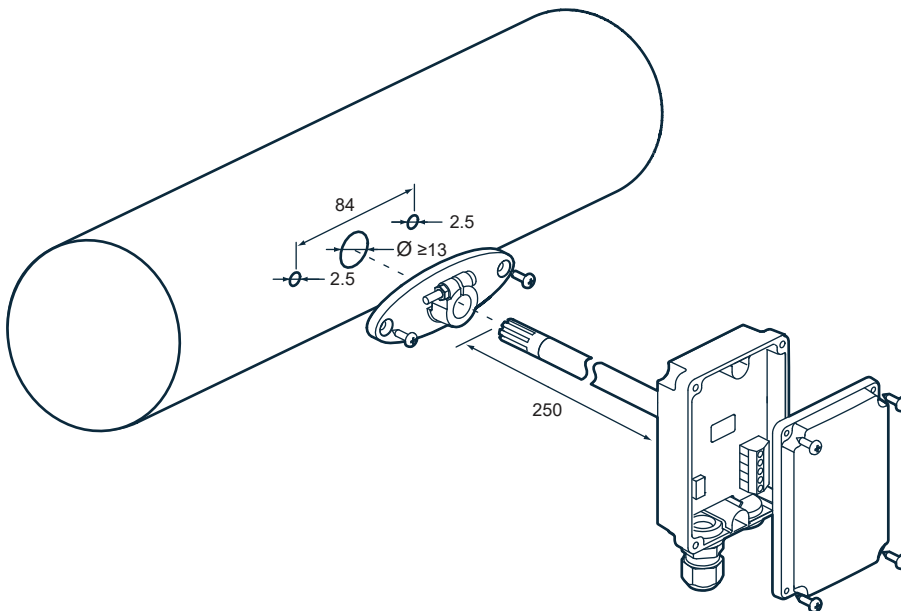


Figure 12 Duct model installation

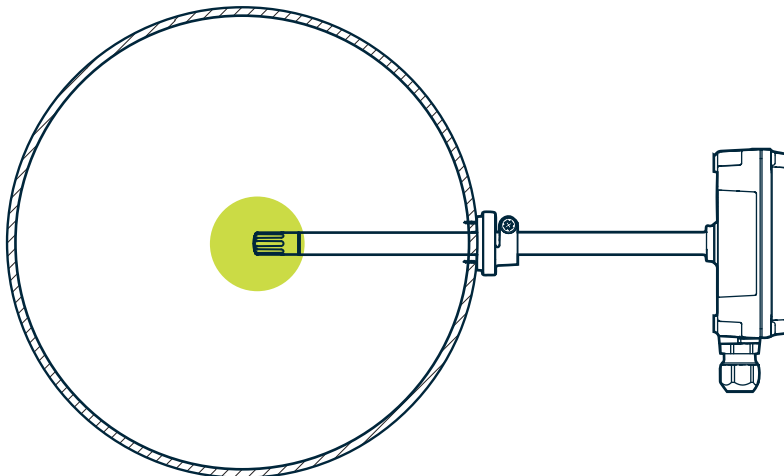


Figure 13 Position the sensor to center of duct

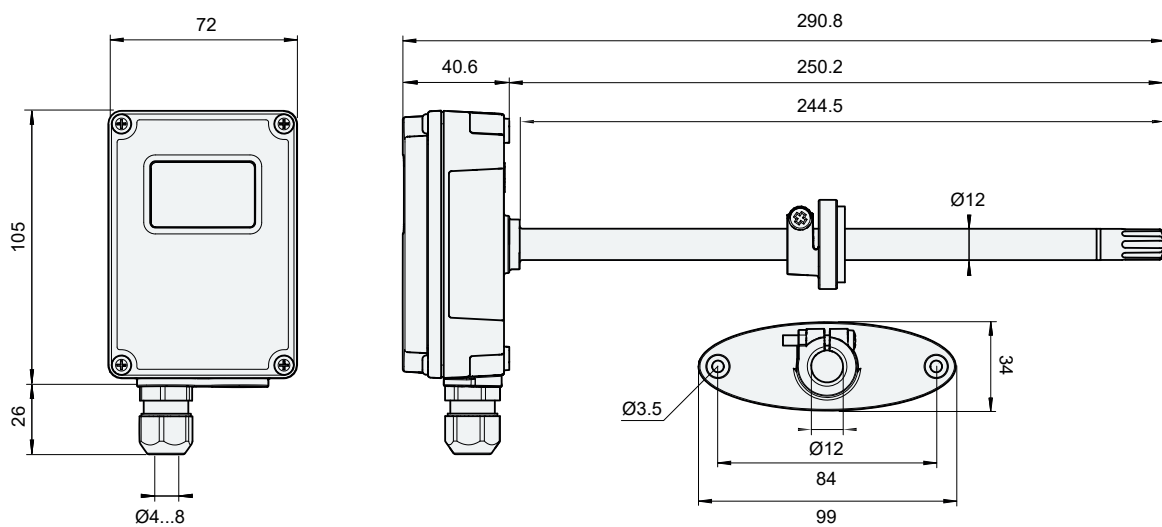


Figure 14 Duct model dimensions (HMD82/83 and TMD82/83)

3.3 Installing wall models HMW87, HMW88, HMW89, and TMW88



- Medium size crosshead screwdriver (Pozidriv) for screws on cover and flange
- Small slotted screwdriver for screw terminals.
- Two installation screws: $\varnothing < 3.5$ mm, head $\varnothing < 10$ mm.
- Depending on the wall material and screw type, you may need a drill and a suitable drill bit to make installation holes for screws.
- Tools for cutting and stripping wires.
- 19-mm open-end wrench for tightening the cable gland.

1. Open the transmitter cover and use two screws (not included) to attach the transmitter to the wall. The probe and cable gland should point down.
2. Route the power and signal cable to the screw terminals and connect the wires. See section *Wiring* in this document.
3. Close the transmitter cover and remove the yellow transport protection cap from the probe.

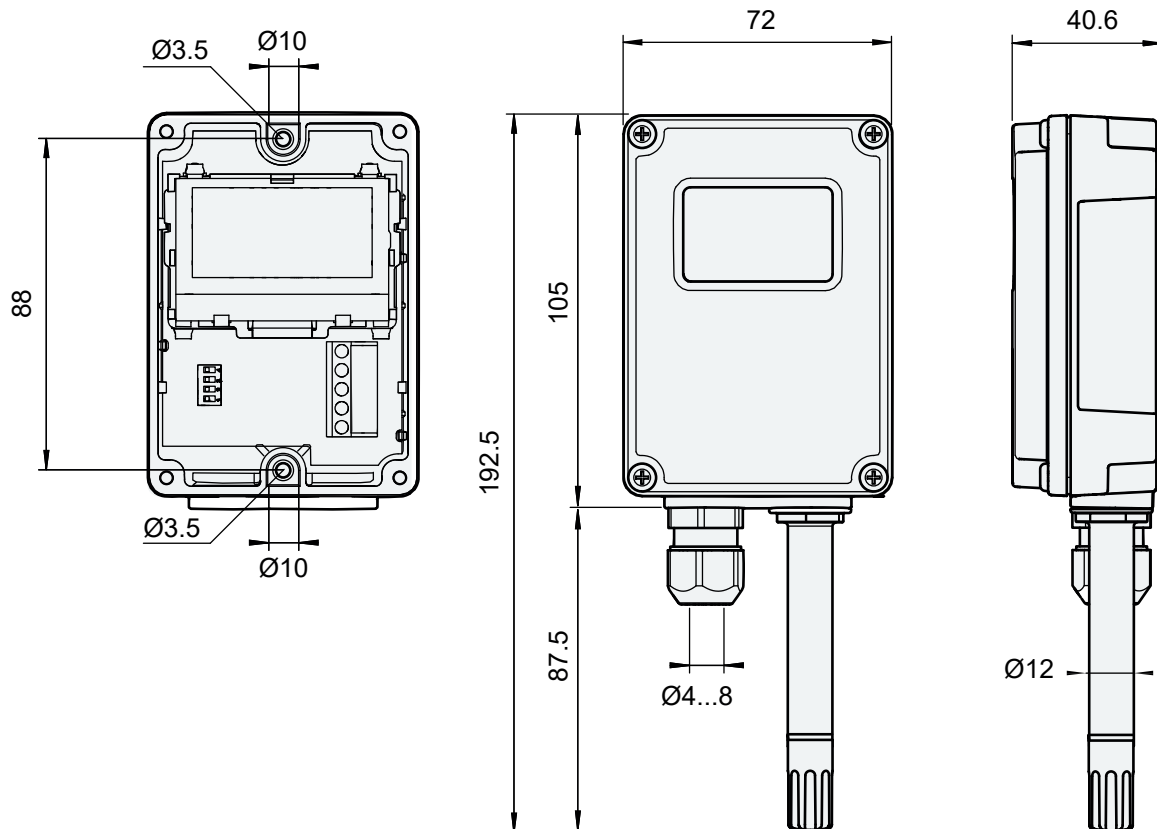


Figure 15 Wall model dimensions (HMW87(D), HMW88(D)/89(D), TMW88)

More information

- [Wiring \(page 30\)](#)

3.4 Installing wall models HMW82/82P100/83 and TMW82/83



- Small flat head screwdriver for opening the transmitter and for screw terminals.
- Two screws, max Ø 4 mm.
- Depending on the wall material and screw type, you may need a drill and a suitable drill bit to make installation holes for screws.
- Tools for cutting and stripping wires.

1. Use a flat head screwdriver to push down the tab on top of the transmitter and separate the mounting base from the transmitter cover.
2. Use the mounting holes to attach the mounting base securely. Use at least two screws (not included, max Ø 4 mm).



The arrow on the mounting base must point straight up after installation. Proper orientation is important: air must flow through the vents on the bottom and top.

3. Route the power and signal cable to the screw terminals and connect the wires. See [Wiring \(page 30\)](#).
4. Close the transmitter cover when done.

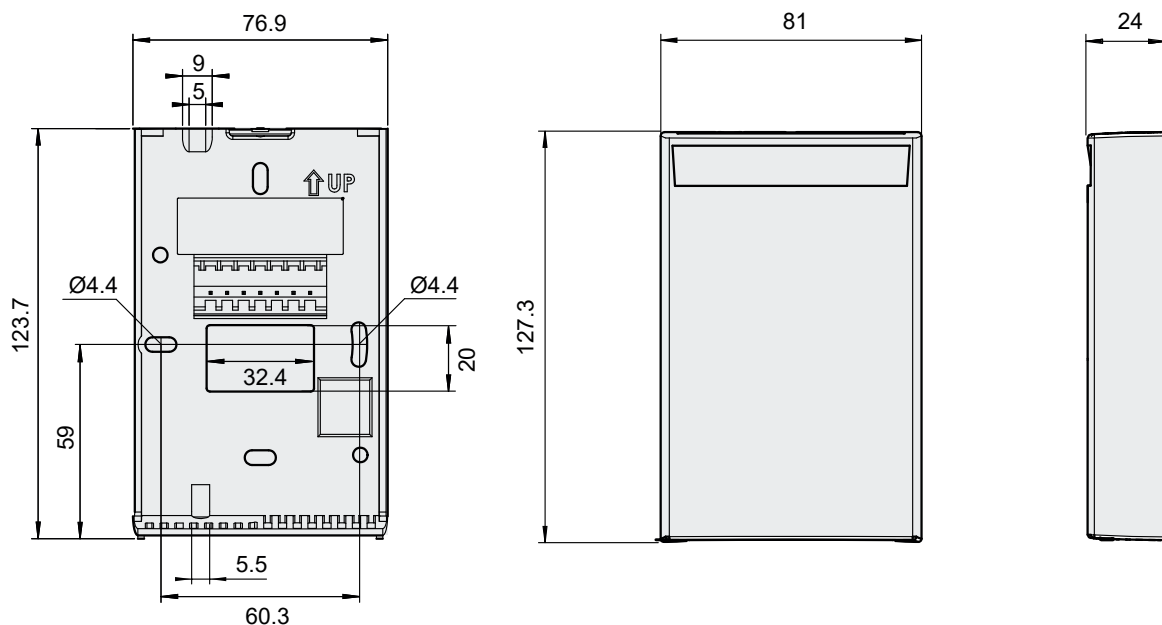


Figure 16 Wall model dimensions (HMW82/82P100/83 and TMW82/83)

3.5 Installing outdoor models HMS82/83 and TMS82



WARNING! Assess the risks posed by the height and accessibility of the installation location, and plan your work so it is carried out safely. Try avoiding work at height, if you can.



- Medium size crosshead screwdriver (Pozidriv)
- Small slotted screwdriver for screw terminals.
- Tools for cutting and stripping wires.
- 19 mm open-end wrench for tightening the cable gland.

Additional tools for pole installation:

- Zip ties for securing the cable to the pole.

Additional tools for wall installation:

- Drill and bits.
- Screws (2 pcs, $\varnothing < 5.5$ mm) and wall plugs.
- Cable clips for securing the cable to the wall.

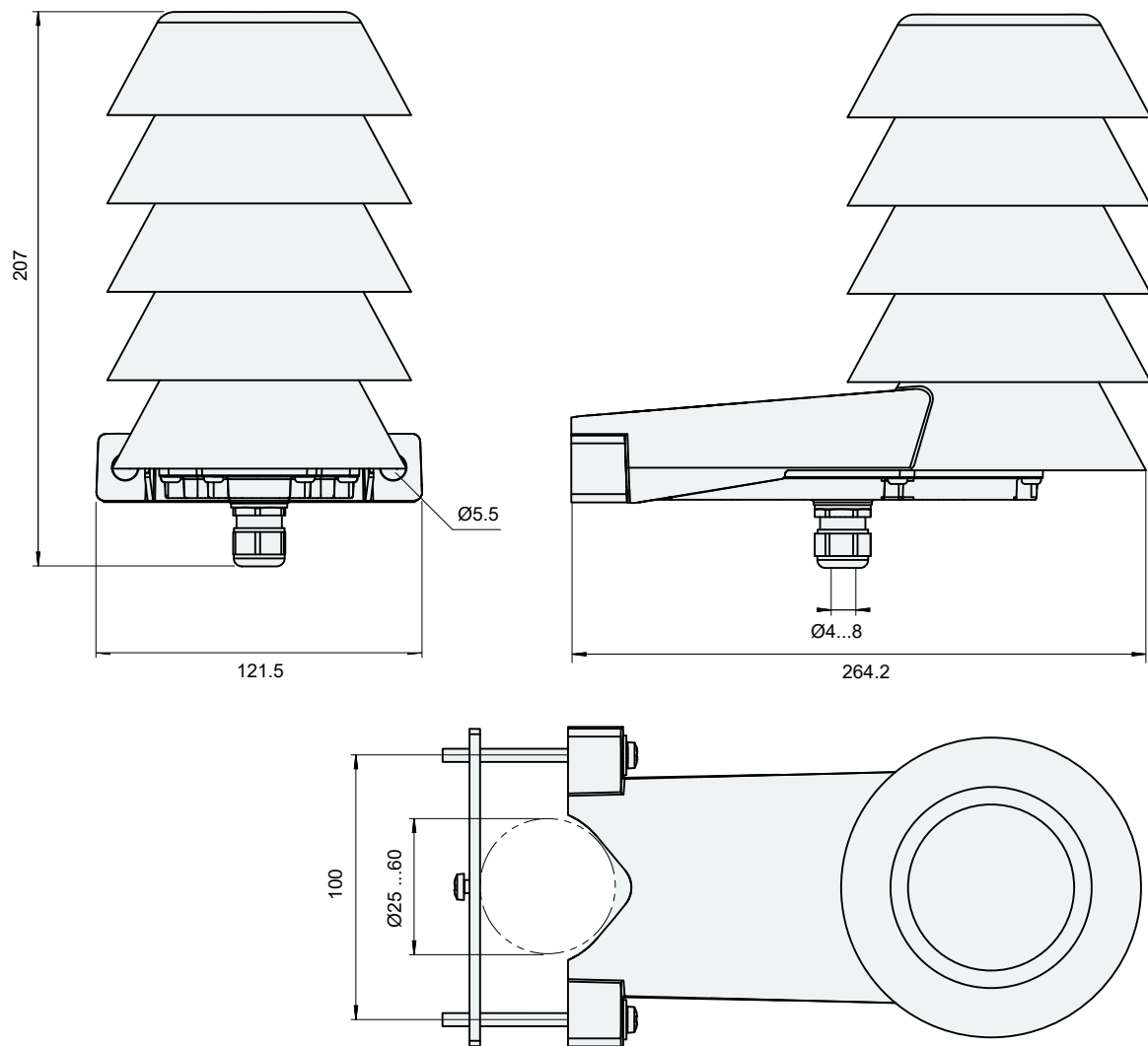


Figure 17 Outdoor model dimensions (HMS82/83, TMS82)

3.5.1 Configuring and wiring

To minimize working at height at the installation location, prepare the transmitter configuration and wiring before climbing up.

- 1. Open the six screws that hold the transmitter cover.
2. Check that the DIP switches are set as desired. See [Configuration with DIP switches \(page 38\)](#).
3. Route the power and signal cable to the screw terminals and connect the wires. See [Wiring \(page 30\)](#).
4. Disconnect the screw terminal block by pulling it away from the component board.
5. Adjust the length of cable between the cable gland and the terminal block. Make the cable short enough to close the cover without leaving a cable loop in the transmitter.
6. Tighten the cable gland. Leave the cover off for now.

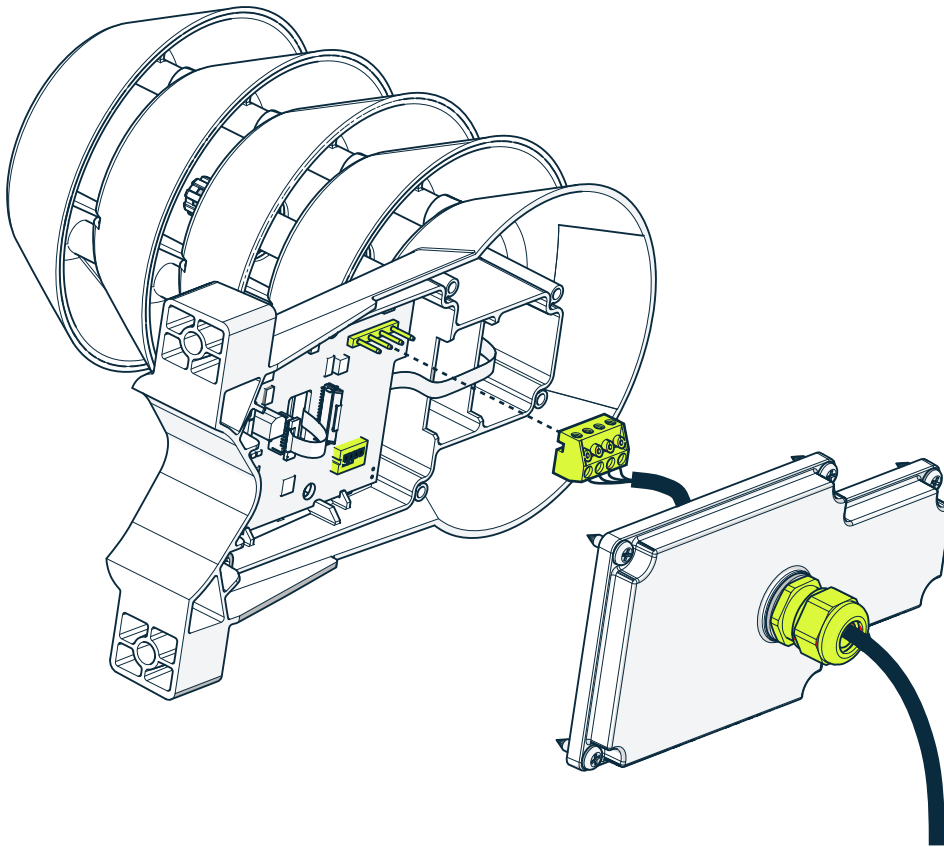


Figure 18 Location of DIP switches and screw terminal

3.5.2 Pole installation

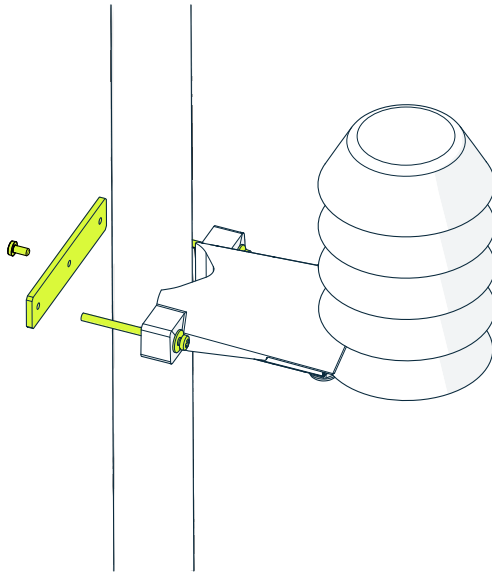


The recommended pole diameter for HMS82/83/TMS82 installation with the supplied clamp and screws is 25–60 mm.

- ▶ 1. Use the supplied clamp and screws to mount the transmitter on a pole.

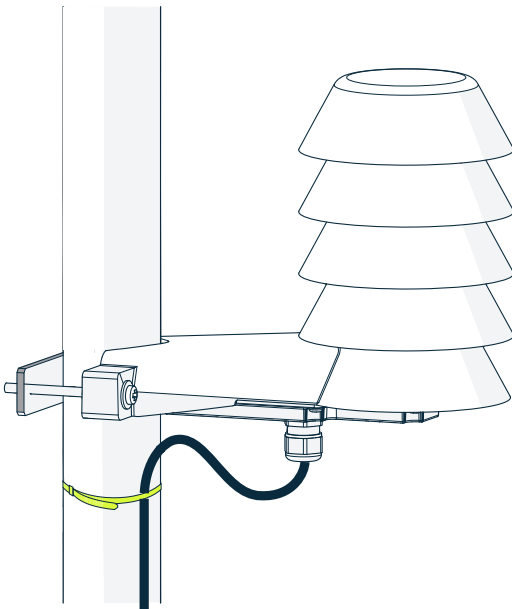
2. To prevent the transmitter from turning on the pole, tighten the set screw on the center hole of the clamp.

Figure 19 HMS82/83 pole installation



3. Plug in the screw terminal block, close the cover, and tighten the screws.
4. Secure the cable to the pole using a zip tie. Allow some cable to hang down from the cable gland to prevent water from entering the transmitter along the cable.

Figure 20 Securing the cable on a pole

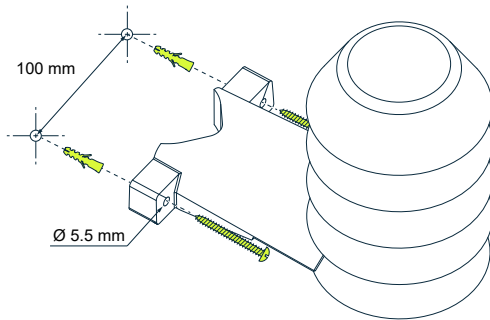


3.5.3 Wall installation

- ▶ 1. Drill two holes for wall plugs 100 mm apart.
2. Place the wall plugs in the holes.

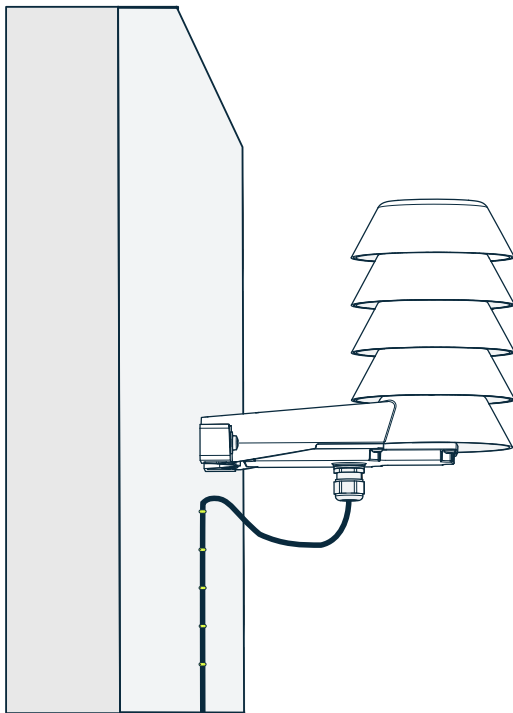
3. Mount the transmitter using two screws of sufficient length.

Figure 21 HMS82/83 wall installation



4. Plug in the screw terminal block, close the cover, and tighten the screws.
5. Secure the cable to the wall using cable ties. Allow some cable to hang down from the cable gland to prevent water from running to the transmitter along the cable.

Figure 22 Securing the cable on a wall



3.6 Wiring



WARNING! Make sure that you prepare and connect only de-energized wires.

Safety requirements for power supply



CAUTION! Always choose a power supply unit that conforms to local standards and requirements, and product input specifications. The specified product power supply voltage range must never be exceeded. See [HMDW80 series specifications \(page 69\)](#).

In North America, only power the device with one of the following:

- An approved/certified Class 2 power supply. The output of the power supply may not exceed 100 VA, with operating voltage not more than 30 V_{rms}, 42.4 V_{peak}, or 60 V DC.
- An approved/certified Limited Power Source (LPS) (CAN/CSA-C22.2 No. 60950-1 or UL 60950-1). The output of the power supply may not exceed 100 VA, with operating voltage not more than 30 V_{rms}, 42.4 V_{peak}, or 60 V DC.



CAUTION! Make sure to use the power supply unit only in its specified environmental conditions.



See HMDW80 series input specifications in [HMDW80 series specifications \(page 69\)](#).

3.6.1 Wiring devices with analog output

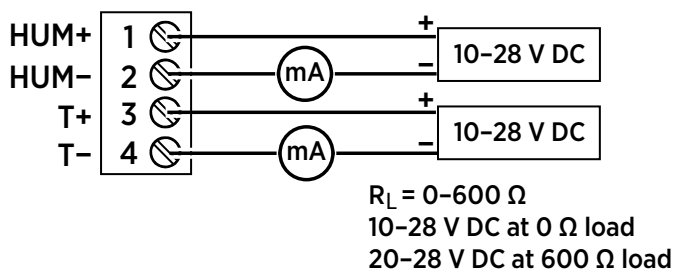
3.6.1.1 Changing default output parameter and scaling

Transmitters with a configurable humidity output parameter use the marking **HUM** on the screw terminal labels. The default output parameter is relative humidity (RH) with output scaled to 0-100 %RH, but the parameter can be changed using DIP switches. Changing the parameter also changes the output scaling. See [Configuration with DIP switches \(page 38\)](#).

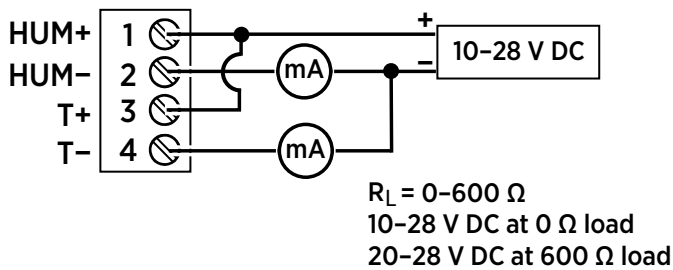
3.6.1.2 HMD82(D), HMW88(D), and HMS82 wiring diagrams

Two 4-20 mA outputs, temperature output scaling -40 ... +60 °C (-40 ... +140 °F).

You must connect the **HUM** channel even if you only want to measure temperature. Connecting the **T** channel is optional.

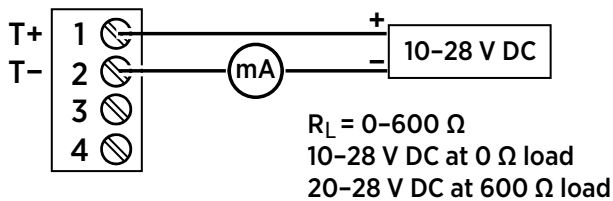


Alternate wiring with one power supply



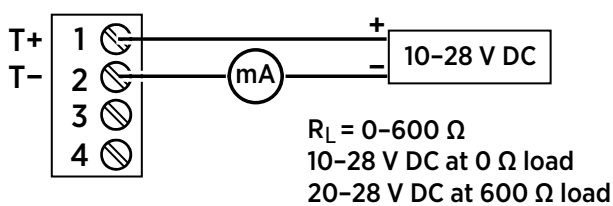
3.6.1.3 TMS82 wiring diagram

4-20 mA output, scaling -40 ... +60 °C (-40 ... +140 °F). Leave terminals 3 and 4 unconnected.



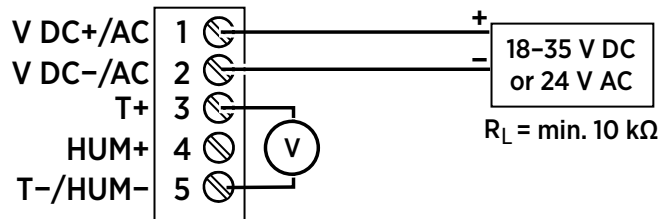
3.6.1.4 TMD82 wiring diagram

4-20 mA output, scaling -40 ... +60 °C (-40 ... +140 °F). Leave terminals 3 and 4 unconnected.

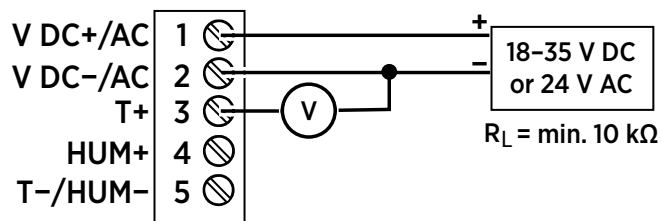


3.6.1.5 TMD83 wiring diagram

One 0-10 V output, scaling -40 ... +60 °C (-40 ... +140 °F).



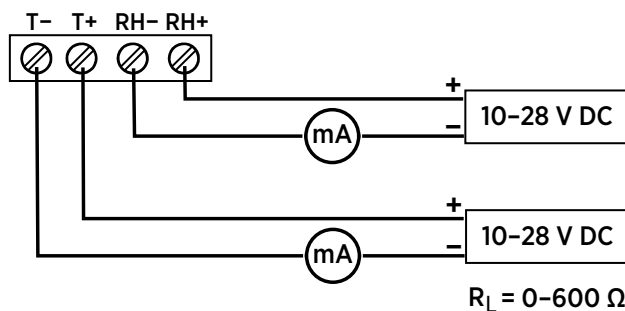
Terminals 2 and 5 are internally connected on the transmitter, so you can also use a cable with three wires.



3.6.1.6 HMW82 wiring diagram

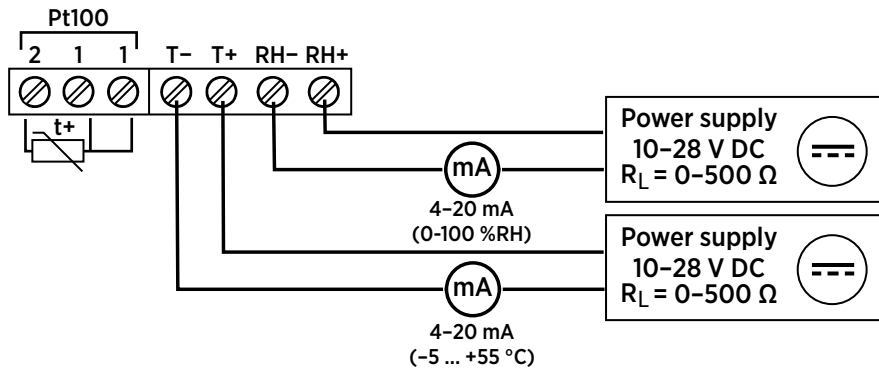
Two 4-20 mA outputs, temperature output scaling -5 ... +55 °C (+23 ... +131 °F).

You must connect the RH channel of the HMW82, even if you only want to measure temperature. Connecting the T channel is optional.



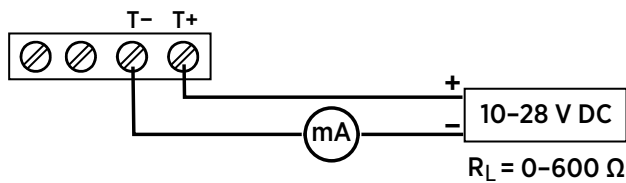
3.6.1.7 HMW82P100 wiring diagram

HMW82P100 includes a passive Pt100 temperature sensor (Class F 0.1 IEC 60751) with a 3-wire connection.



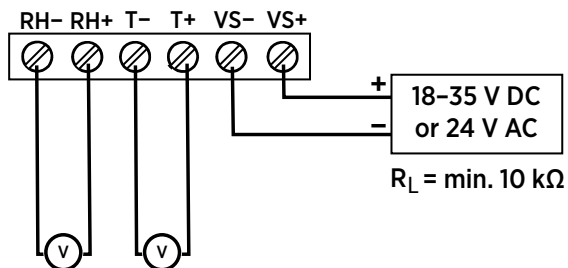
3.6.1.8 TMW82 wiring diagram

One 4-20 mA output, scaling -5 ... +55 °C (+23 ... +131 °F). Leave the two terminals on the left unconnected.

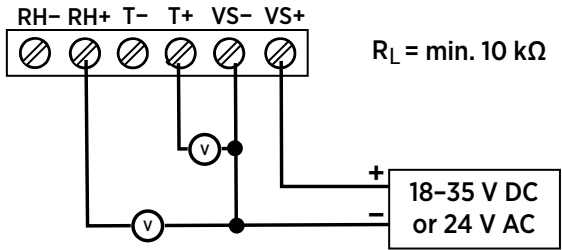


3.6.1.9 HMW83 wiring diagram

Two 0-10 V outputs, temperature output scaling -5 ... +55 °C (+23 ... +131 °F). This is the recommended wiring for long cables.

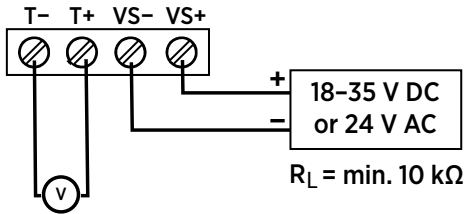


3-wire connection with -VS as common ground. Not recommended if cable resistance is more than 2.5 Ω .

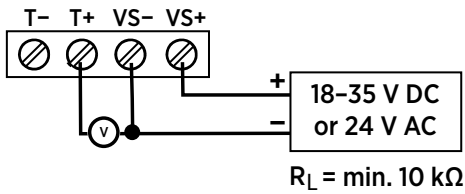


3.6.1.10 TMW83 wiring diagram

One 0-10 V output, temperature output scaling -5 ... +55 °C (+23 ... +131 °F). This is the recommended wiring for long cables.



3-wire connection with -VS as common ground. Not recommended if cable resistance is more than 2.5 Ω .



3.6.2 Wiring devices with Modbus output

3.6.2.1 HMW87 and HMW87D component board

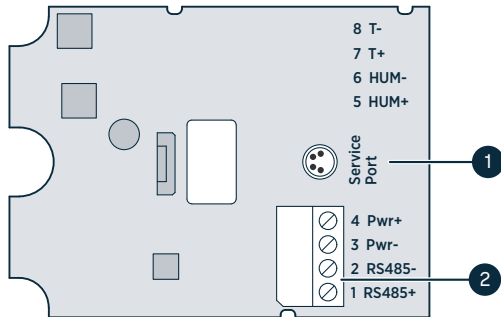


Figure 23 Component board of models HMW87 and HMW87D

- 1 Service port connector (4-pin M8)
- 2 Terminal block for RS-485 output. For Modbus connection.



You can pull out the terminal block from the component board for easier installation, and to disconnect the transmitter from power and RS-485 when using the service port.



CAUTION! The service port connection is only intended for temporary use during configuration, and must not be used for permanent installations. The IP rating and EMC properties of the transmitter can be affected by using the service port in permanent installations.

3.6.2.2 HMW87 and HMW87D wiring diagram

Use terminals 1–4 for supply power and Modbus output. In addition to RS-485 data wires, the common wire (ground reference) must be connected between the RS-485 host and the transmitter.

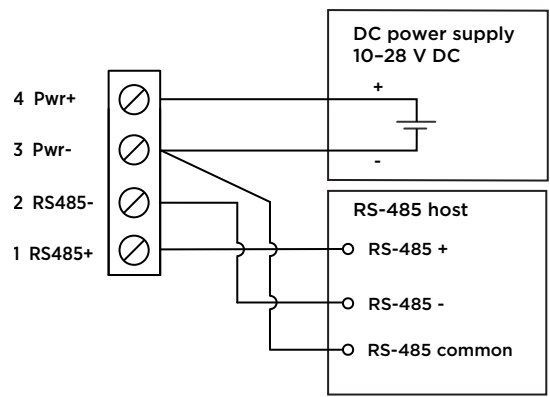


Figure 24 HMW87 and HMW87D transmitter wiring, Modbus output

4. Configuration with DIP switches

The DIP switches on the component board control the humidity output parameter and scaling, and the units that are shown on the display. The switches are present on the following models:

- HMD82(D) and HMD83(D)
- HMW88(D) and HMW89(D)
- HMS82 and HMS83

Figure 25 (page 38) shows the default position of the DIP switches. The default settings are:

- Metric units shown on display.
- Relative humidity (RH) selected as humidity output parameter.

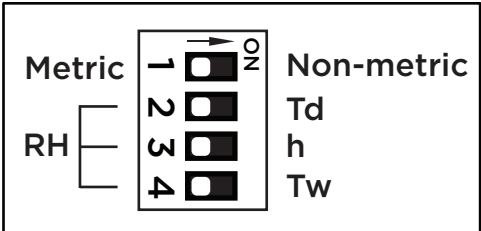


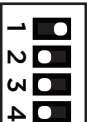
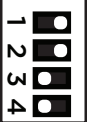
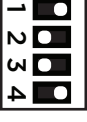
Figure 25 DIP switches on component board

Table 5 DIP switch positions for metric output

DIP position	Analog output parameter and scaling	Parameters and units on display
	Relative humidity (RH) 0-100 % Temperature (T) -40 ... +60 °C	RH (%) T (°C)
	Dew point (Td) -40 ... +60 °C Temperature (T) -40 ... +60 °C	Td (°C) T (°C)
	Enthalpy (h) -40 ... +460 kJ/kg Temperature (T) -40 ... +60 °C	h (kJ/kg) T (°C)

DIP position	Analog output parameter and scaling	Parameters and units on display
	Wet bulb temperature (T_w) -40 ... +60 °C Temperature (T) -40 ... +60 °C	T_w (°C) T (°C)

Table 6 DIP switch positions for non-metric output

DIP position	Analog output parameter and scaling	Parameters and units on display
	Relative humidity (RH) 0–100 % Temperature (T) -40 ... +140 °F	RH (%) T (°F)
	Dew point (T_d) -40 ... +140 °F Temperature (T) -40 ... +140 °F	T_d (°F) T (°F)
	Enthalpy (h) -10 ... +190 BTU/lb Temperature (T) -40 ... +140 °F	h (BTU/lb) T (°F)
	Wet bulb temperature (T_w) -40 ... +140 °F Temperature (T) -40 ... +140 °F	T_w (°F) T (°F)

5. Modbus communication

Transmitter models HMW87 and HMW87D can be accessed and configured using the Modbus serial communication protocol. The supported Modbus variant is Modbus RTU (Serial Modbus) over RS-485 interface.

The supported Modbus functions and registers are described in [Modbus reference for HMW87 and HMW87D \(page 76\)](#).

The following table lists the default Modbus serial communication settings for HMW87 and HMW87D.

Description	Default value
Serial bit rate	19200
Parity	N
Number of data bits	8
Number of stop bits	2
Modbus device address	240
Serial delay	0
Communication mode	Modbus RTU

Use Vaisala Insight PC software or Indigo80 indicator to change the Modbus serial communication settings if needed. Download Insight software at vaisala.com/insight.

More information

- [Using transmitter with Insight PC software \(page 40\)](#)
- [Using transmitter with Indigo80 handheld indicator \(page 46\)](#)

5.1 Using transmitter with Insight PC software



Transmitter models HMW87 and HMW87D are compatible with the Insight PC software.

5.1.1 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.

You can use Insight to check and configure transmitter models HMW87 and HMW87D intuitively, without typing any serial commands. The software guides you when changing the settings on the transmitter.

With the Insight software, you can:

- See device information and status.
- See real-time measurement.
- Configure transmitter settings (for example, filtering factor, display settings, metric/non-metric units of measurement parameters).
- Update information related to calibration: date, description, interval, and expiry date.
- Set a calibration reminder to notify you when the calibration has expired.¹⁾



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

The transmitters can be connected to Insight using the Vaisala Indigo USB adapter (item code USB2) and a Vaisala M12-M8 service cable (item code 262195SP).

5.1.2 Connecting to Insight software



- Computer with Vaisala Insight software installed
- Vaisala Indigo USB adapter (item code USB2) and M12 - M8 service cable (item code 262195SP)
- Medium size crosshead screwdriver (Pozidriv) for opening the transmitter cover
- Small flat head screwdriver for detaching the wiring terminal



CAUTION! The service port connection is only intended for temporary use during configuration, and must not be used for permanent installations.



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.

1) If turned on, the reminder is shown when the transmitter is connected to Insight software or Vaisala Indigo80 Handheld Indicator.

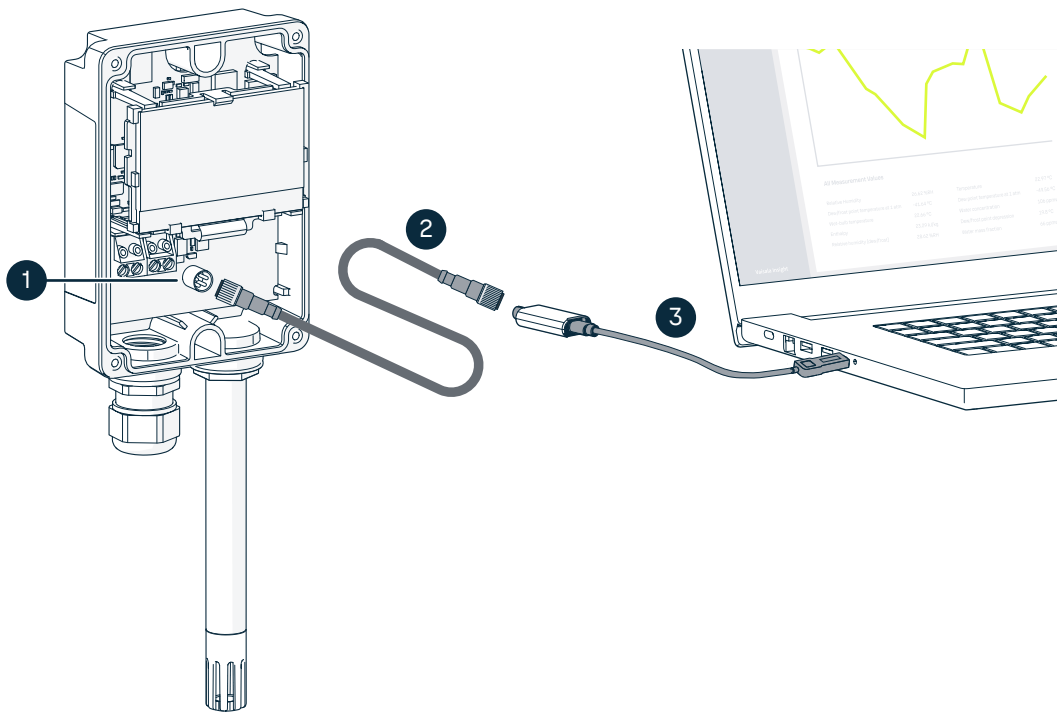
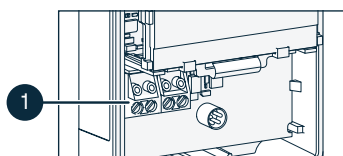


Figure 26 Connecting HMW87D to Insight

- 1 Service port connector (4-pin M8)
- 2 M12 - M8 service cable (Vaisala item code 262195SP)
- 3 Indigo USB adapter (Vaisala item code USB2)

- ▶ 1. If the transmitter has been connected to a power source, disconnect power supply to the transmitter.
- 2. Open the 4 screws on the transmitter cover and remove the cover.
- 3. **Applicable only if your transmitter has already been connected to your automation system:**
 During service port use, the terminal block for terminals 1–4 needs to be disconnected. This prevents communication between the transmitter and the Modbus (RS-485) host from interfering with your connection.
 - a. Locate the terminal block on the transmitter's component board. Pull it out carefully using your fingers or a small flat head screwdriver.



- 1 Location of terminal block on the component board

- 4. Open the Insight software on your computer.

5. Connect the Indigo USB adapter to a free USB port on your PC.
6. Connect the Indigo USB adapter to service cable 262195SP.
7. Connect the M8 connector of cable 262195SP to the service port of the transmitter.
8. Wait for Insight software to detect the transmitter.

If the transmitter is not detected, disconnect and reconnect the M12 - M8 cable to the service port connector of the transmitter.

5.1.3 Insight main view

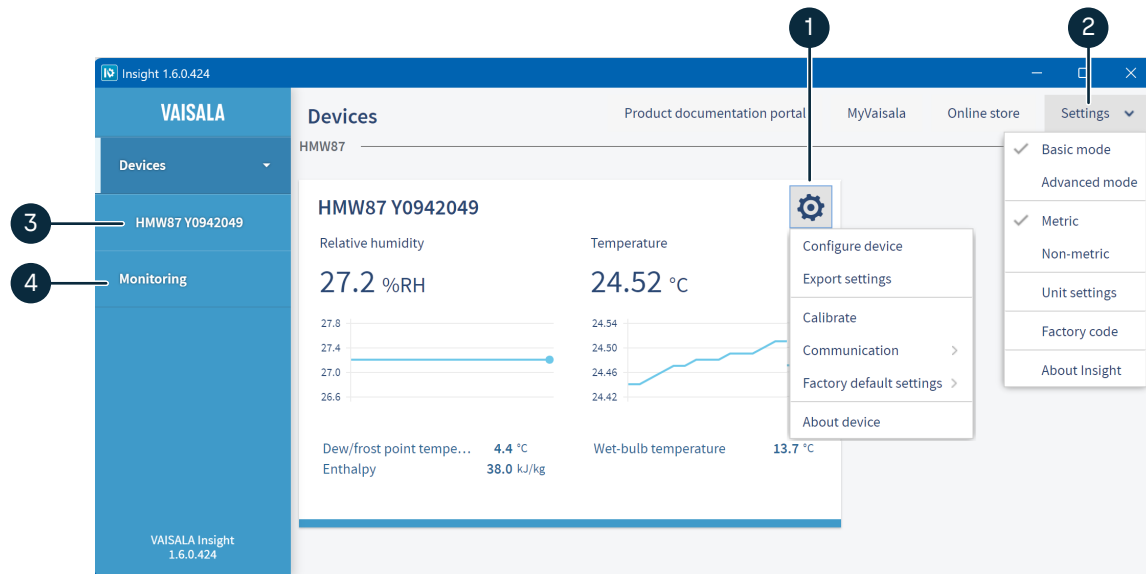


Figure 27 Insight main view and settings

- 1 Select  to access Insight main menu.
 - **Configure device:** filtering factor, Modbus communication settings, and display settings (selection of parameters and metric/non-metric units).
 - **Export settings:** creates a text file export of the device settings.
 - **Calibrate** contains options to update information related to calibration: date, description, interval, and expiry date. You can also set a calibration reminder to notify you when the calibration has expired. ²⁾
 - **Communication:** contains a quick access selection for restarting the device.
 - **Factory default settings:** selection for restoring factory default settings in the transmitter.
 - **About device:** general device information such as serial number and firmware 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 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.
- 4 **Monitoring** provides options for monitoring and recording selected parameters, and exporting the monitoring data as a CSV (comma-separated values) file.

2) If turned on, the reminder is shown when the transmitter is connected to Insight software or Vaisala Indigo80 Handheld Indicator.

5.1.4 Setting filtering factor with Insight



- Computer with Vaisala Insight software installed
- Vaisala Indigo USB adapter (item code USB2) and M12 - M8 service cable (item code 262195SP)
- Medium size crosshead screwdriver (Pozidriv) for opening the transmitter cover
- Small flat head screwdriver for detaching the wiring terminal

Figure 28 Filtering factor configuration view

1. Connect the transmitter to your PC and Insight software. See [Connecting to Insight software \(page 41\)](#).
2. Select **⚙️ > Configure device > General**.
3. Enter a filtering factor below 1.000 to apply filtering to the output (range: 0.001–1.000).



Examples of the effect of filtering on output:

- Filtering factor 1.000 = No filtering, the latest measurement is output directly without integrating previous measurements.
- Filtering factor 0.500 = The reading output integrates 50 % of the previous measurement with the latest measurement.
- Filtering factor 0.100 = The reading output integrates 90 % of the previous measurement with the latest measurement.

4. Select **Save** when done or exit with **Cancel**.

5. At the end of the Insight session:
 - a. Disconnect the cable from the transmitter's service port.
 - b. If you removed the terminal block for terminals 1–4 when connecting the transmitter to Insight, reinstall the block to the component board by pressing it down carefully.
 - c. Place the cover on the transmitter and tighten the screws.
 - d. Power up the transmitter.

5.2 Using transmitter with Indigo80 handheld indicator



Transmitter models HMW87 and HMW87D are compatible with the Indigo80 indicator. You can connect one transmitter at a time to Indigo80.

5.2.1 Indigo80 handheld indicator

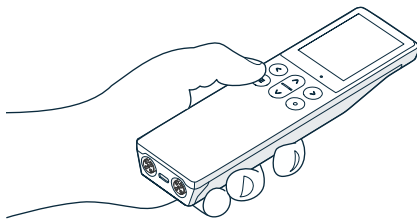


Figure 29 Indigo80 handheld indicator

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
- Configure transmitter settings (for example, filtering factor, display settings, metric/non-metric units of measurement parameters)
- Perform field calibration of the transmitter

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 \(M212722EN\)](#).

5.2.1.1 Indigo80 keypad

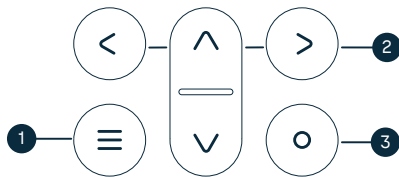


Figure 30 Indigo80 keypad

- 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

5.2.1.2 Indigo80 main menu

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

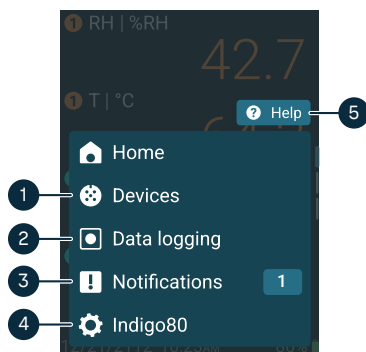


Figure 31 Indigo80 main menu

- 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.

5.2.2 Connecting to Indigo80 handheld indicator



- Medium size crosshead screwdriver (Pozidriv) for opening the transmitter cover
- Small flat head screwdriver for detaching the wiring terminal
- M12 - M8 service cable (Vaisala item code 262195SP)



CAUTION! The service port connection is only intended for temporary use during configuration, and must not be used for permanent installations.

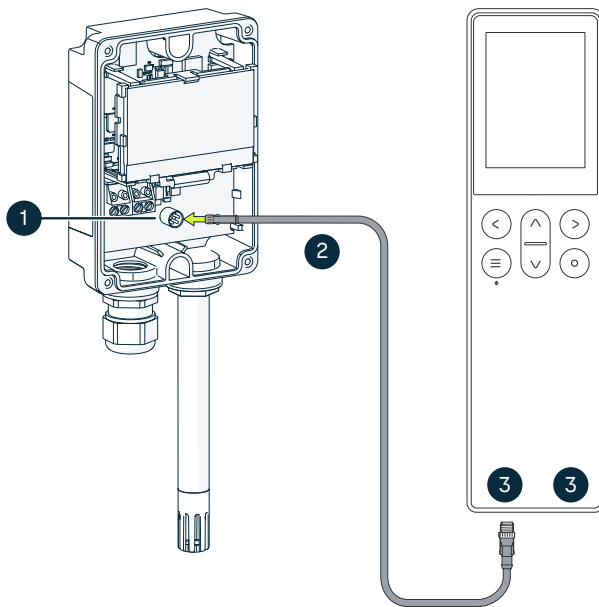


Figure 32 Connecting HMW87D transmitter to Indigo80 handheld indicator

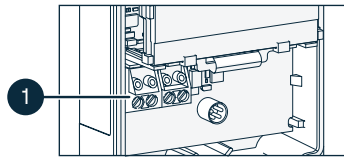
- 1 Service port connector (4-pin M8)
- 2 M12 - M8 service cable (Vaisala item code 262195SP)
- 3 5-pin M12 ports on the bottom of Indigo80 for connecting compatible Vaisala devices. Ports are labeled ❶ (left) and ❷ (right) on Indigo80. You can connect one transmitter at a time to Indigo80.

- 1. If the transmitter has been connected to a power source, disconnect power supply to the transmitter.
- 2. Open the 4 screws on the transmitter cover and remove the cover.

3. **Applicable only if your transmitter has already been connected to your automation system:**

During service port use, the terminal block for terminals 1–4 needs to be disconnected. This prevents communication between the transmitter and the Modbus (RS-485) host from interfering with your connection.

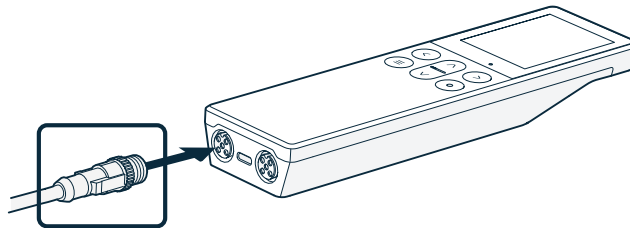
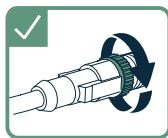
- a. Locate the terminal block on the transmitter's component board. Pull it out carefully using your fingers or a small flat head screwdriver.



- 1 Location of terminal block on the component board

4. Connect the M8 end of the service cable to the service port.
5. Connect the M12 end of the cable to either 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!**



5.2.3 Configuring transmitter features with Indigo80 handheld indicator

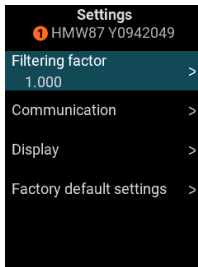


- Medium size crosshead screwdriver (Pozidriv) for opening the transmitter cover
- Small flat head screwdriver for detaching the wiring terminal
- M12 - M8 service cable (Vaisala item code 262195SP)

You can use the Indigo80 handheld indicator to configure transmitter features such as filtering factor, Modbus communication settings, and display settings.

- ▶ 1. Connect the transmitter to Indigo80. See [Connecting to Indigo80 handheld indicator \(page 47\)](#).
2. Switch Indigo80 on by long-pressing  (if not powered on already).

3. Open the indicator main menu by pressing .
4. Select **Devices > Settings** to access and change the features available for the transmitter.



5. Exit the menu by pressing  or return to the main menu by pressing .
6. At the end of the Indigo80 session:
 - a. Disconnect the cable from the transmitter's service port.
 - b. If you removed the terminal block for terminals 1–4 when connecting the transmitter to Indigo80, reinstall the block to the component board by pressing it down carefully.
 - c. Place the cover on the transmitter and tighten the screws.
 - d. Power up the transmitter.

More information

- [Field calibration of HMW87\(D\) using Indigo80 handheld indicator \(page 55\)](#)

6. Maintenance

6.1 Cleaning

The body of the transmitter can be cleaned by wiping with a moistened lint-free cloth. Do not use cleaning agents or solvents, or blow pressurized air into the transmitter housing or on the filter.



Do not attempt to clean contaminated INTERCAP sensors or filters. Instead, replace them with new parts. Filters and sensors can be purchased from Vaisala. For order codes, see [Spare parts and accessories \(page 72\)](#).

More information

- [Replacing the INTERCAP humidity sensor \(page 57\)](#)

6.2 Calibration



If you think the device is not measuring correctly, check the following first:

- Make sure that the location of 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.



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**.



HMDW80 series transmitters have no functions for adjustment. The Vaisala INTERCAP® humidity sensors used in the transmitters are designed to be replaced when necessary.

Transmitter models HMW87 and HMW87D have a calibration reminder, which is set to activate every 12 months by default. ¹⁾

¹⁾ When the default calibration interval expires, it does not necessarily mean that the functionality of the sensor or the HMW87(D) transmitter is affected.

You can verify the performance of your HMDW80 series transmitter by comparing its reading with the reading from a calibration reference. If the comparison indicates that the reading from the transmitter is not within specification, the transmitter may need to have its filter and/or sensor replaced.

This document describes the following calibration methods:

- If you have an HMDW80 series transmitter model with a display, you can perform a simple field calibration of the transmitter's measurement output with a reference instrument. See [Field calibration of display models using a reference instrument \(page 52\)](#).
- Transmitter models HMW87 and HMW87D have an M8 service port on the component board, which allows you to connect the transmitters to Insight PC software or the Indigo80 handheld indicator using a cable. For calibration instructions using Insight software or Indigo80, see:
 - [Field calibration of HMW87\(D\) using Insight software \(page 53\)](#)
 - [Field calibration of HMW87\(D\) using Indigo80 handheld indicator \(page 55\)](#)

More information

- [Replacing the INTERCAP humidity sensor \(page 57\)](#)
- [HMDW80 series specifications \(page 69\)](#)

6.2.1 Field calibration of display models using a reference instrument



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



The required measurement stabilization time can be up to a few hours and is dependent on the stability of the measurement environment, the characteristics of the instruments used, and the desired level of accuracy.

You can perform a field calibration of HMDW80 series transmitters that have a display by comparing the reading of the transmitter to a reliable humidity and temperature measurement instrument that also has a display.

- ▶ 1. Place the probe of the reference instrument (or the entire instrument) in the same environment as the transmitter that you are checking.
The environment should be as stable as possible. If you are close to the instruments, do not breathe in their direction or hold them in your hand.
2. Wait for the humidity and temperature readings to stabilize fully. Verify that the measurements are no longer changing at the end of the stabilization period.
3. Record the readings from both instruments.

6.2.2 Field calibration of HMW87(D) using Insight software



- Computer with Vaisala Insight software installed
- Externally-powered USB hub, in case the computer has only 1 USB port
- Vaisala Indigo USB adapter (item code USB2) and M12 - M8 service cable (item code 262195SP) for connecting HMW87 to Insight
- Medium size crosshead screwdriver (Pozidriv) for opening the transmitter cover
- Small flat head screwdriver for detaching the wiring terminal
- A calibrated Vaisala reference instrument that is compatible with Insight and suitable for the intended measurement environment. See device documentation for instrument alternatives at docs.vaisala.com
- Compatible cable for connecting the reference instrument to Insight (for example, Vaisala Indigo USB adapter (item code USB2))



The required measurement stabilization time can be up to a few hours and is dependent on the stability of the measurement environment, the characteristics of the instruments used, and the desired level of accuracy.

- ▶ 1. Connect the HMW87 transmitter to Insight software. For instructions, see [Connecting to Insight software \(page 41\)](#).
2. Connect the reference instrument to Insight software.
3. Place the reference instrument and HMW87 in the measurement environment.
4. If your reference instrument has the option for pressure setting, set a pressure value that matches the measurement environment. Open the settings menu for the reference instrument by selecting the  icon.
5. In the left-hand panel of Insight, select **Monitoring**.
6. Under **Select devices**, check the boxes for the devices to be monitored: HMW87 and the reference instrument.

- Under **Select measurement values**, select the parameters to be monitored, and select **Start monitoring**.

The screenshot shows the Vaisala Monitoring web interface. On the left is a sidebar with a 'VAISALA' header and a 'Monitoring' section. The main area is titled 'Monitoring' and contains an 'Overview' section with instructions on monitoring and exporting data. Below this is the 'Select devices' section, where two devices are selected: HMW87 Y0942049 and HMP7 A7700003. The 'Select measurement values' section shows two parameters selected: 'Relative humidity' for Parameter 1 and 'Temperature' for Parameter 2. A 'Start monitoring' button is at the bottom.

- Follow measurement stabilization from the graphs. Wait for the measurements to stabilize fully. If you are close to the instruments, do not breathe in their direction or hold them in your hand.



- Check the difference between the readings. It gives you an indication of the approximate drift of HMW87. The difference between the readings should be no greater than the combined calibration uncertainty of HMW87 and the reference instrument.
- Write down the results and repeat the comparison for each parameter you want to check, in case not all parameters were included in the first comparison.

11. Update the calibration information for your HMW87 transmitter:
 - a. Select HMW87 in the left-hand panel of Insight.
 - b. Select  > **Calibrate** > **Yes**.
Fill in any relevant information about the current calibration. You can also set a calibration interval and switch the calibration reminder on/off.
 - c. Select **Close** to save the settings and exit the view.
12. At the end of the Insight calibration session:
 - a. Disconnect the cable from the HMW87 transmitter's service port.
 - b. If you removed the terminal block for terminals 1–4 when connecting the transmitter to Insight, reinstall the block to the component board by pressing it down carefully.
 - c. Place the cover on the transmitter and tighten the screws.
 - d. Power up the transmitter.

6.2.3 Field calibration of HMW87(D) using Indigo80 handheld indicator



- Medium size crosshead screwdriver (Pozidriv) for opening the transmitter cover
- Small flat head screwdriver for detaching the wiring terminal
- Indigo80 handheld indicator, connected to a power source or with enough charge for several hours' use. For Indigo80 user guidance, see [Indigo80 User Guide \(M212722EN\)](#).
- M12 - M8 service cable (Vaisala item code 262195SP) for connecting HMW87 to Indigo80. See [Spare parts and accessories \(page 72\)](#).
- A calibrated Vaisala reference instrument that is compatible with Indigo80 and suitable for the intended measurement environment. See device documentation for instrument alternatives at docs.vaisala.com.²⁾
- Service or connection cable for connecting the reference instrument to Indigo80



The required measurement stabilization time can be up to a few hours and is dependent on the stability of the measurement environment, the characteristics of the instruments used, and the desired level of accuracy.

- ▶ 1. Connect the HMW87 transmitter to **port 1** of Indigo80. For instructions, see [Connecting to Indigo80 handheld indicator \(page 47\)](#).
2. Connect the reference instrument to **port 2** of Indigo80.
3. Place the reference instrument and HMW87 in the measurement environment.
4. Switch Indigo80 on by long-pressing .

2) Indigo80 does not support using another HMW87(D) transmitter or a Vaisala HMP60 or HMP110 series probe as calibration reference.

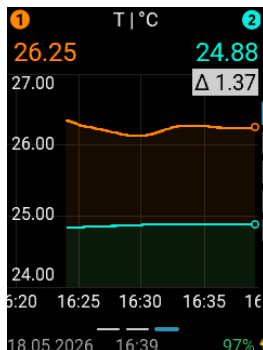
5. If prompted for your reference instrument, set a pressure value that matches the measurement environment:
 - a. Select **Go to settings**, which opens the **Environment settings** menu of your instrument.
 - b. Select **Pressure** and the correct unit.
 - c. Set the pressure value and select **Set**.
 If the **Temperature** setting is available for your instrument, leave the value unchanged.
 - d. Press $\ominus$ and select **Home** to return to the measurement view.
6. Indigo80 displays automatically comparison views for the measurement parameters of the connected devices. Use the $\odot$ and $\odot$ buttons to scroll between the different comparison views.



In the figure above, the measurement value for HMW87 is labeled ❶, and the value for the reference instrument is labeled ❷. The delta value showing the difference between the two is indicated by the Δ symbol.

- If the comparison views are not shown automatically, press $\odot$ and select **Restore default views**.
- If the comparison view for a specific parameter is not included in the default views, press $\odot$, select **Add view > Comparison > Add comparison**, and select the desired parameter.

7. Wait for the measurement to stabilize fully. Use the ⏮ and ⏭ buttons to scroll through the graph view to monitor the stabilization. If you are close to the instruments, do not breathe in their direction or hold them in your hand.



8. Check the difference between the readings. It gives you an indication of the approximate drift of HMW87. The difference between the readings should be no greater than the combined calibration uncertainty of HMW87 and the reference instrument.
9. Write down the results and repeat the comparison for each parameter you want to check, in case not all parameters were included in the first comparison.
10. Update the calibration information for your HMW87 transmitter:
 - a. In the main menu, select **Devices > [your device] > Calibrate / Adjust > Calibration information**.
When navigating to the menu, dismiss any notifications by selecting **OK**.
 - b. To return to the main menu, press ⏮, select **End calibration**, and press ⏮.
11. At the end of the Indigo80 calibration session:
 - a. Disconnect the cable from the HMW87 transmitter's service port.
 - b. If you removed the terminal block for terminals 1–4 when connecting the transmitter to Indigo80, reinstall the block to the component board by pressing it down carefully.
 - c. Place the cover on the transmitter and tighten the screws.
 - d. Power up the transmitter.

6.3 Replacing the INTERCAP humidity sensor

HMDW80 series transmitters use the Vaisala INTERCAP sensor for humidity measurement. The INTERCAP sensor is designed to be replaced when necessary, and does not require adjustment by the user.

6.3.1 Replacing INTERCAP sensor on models HMD82/83, HMW87, and HMW88/89



CAUTION! To avoid contaminating or damaging the sensor:

- Wear lint-free ESD gloves.
- Handle the sensor by its plastic frame.
- Do not touch the sensor surface in the middle.



- New INTERCAP humidity sensor
- New filter (always recommended when replacing the sensor)
- Lint-free ESD gloves
- Duct models only: medium size crosshead screwdriver (Pozidriv)

- ▶ 1. Power down the transmitter.
2. **Duct models only:** loosen the tightening screw on the fastening flange, and pull the probe out of the duct.
3. Remove the filter to access the sensors. See [Figure 33 \(page 59\)](#).
4. Pull out the old INTERCAP sensor, and insert the new one.
5. Insert the new filter.
6. **Duct models only:** push the probe back into the duct, to the same depth where it was before. Tighten the tightening screw on the fastening flange.
7. Power up the transmitter.
8. Verify that the transmitter now provides a valid humidity reading.

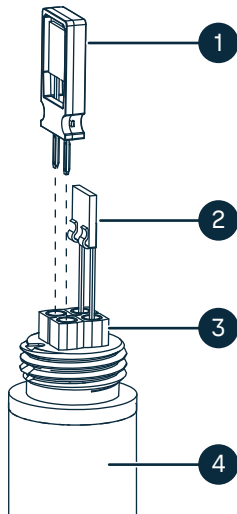


Figure 33 Sensors in models HMD82/83, HMW87, and HMW88/89

- 1 Vaisala INTERCAP sensor. **Handle by the plastic frame.**
- 2 Temperature sensor. **Do not touch or attempt to remove.**
- 3 Sensor socket
- 4 Transmitter probe

6.3.2 Replacing INTERCAP® sensor on wall models HMW82/82P100/83



CAUTION! To avoid contaminating or damaging the sensor:

- Wear lint-free ESD gloves.
- Handle the sensor by its plastic frame.
- Do not touch the sensor surface in the middle.



- New INTERCAP humidity sensor
- Small flat head screwdriver
- Lint-free ESD gloves

- ▶ 1. Use the screwdriver to push down on the tab on the top of the transmitter and open the transmitter cover.
2. Remove the old sensor, and insert the new one. See [Figure 34 \(page 60\)](#).
3. Reconnect the cover to the mounting base.
4. Verify that the transmitter now provides a valid humidity reading.

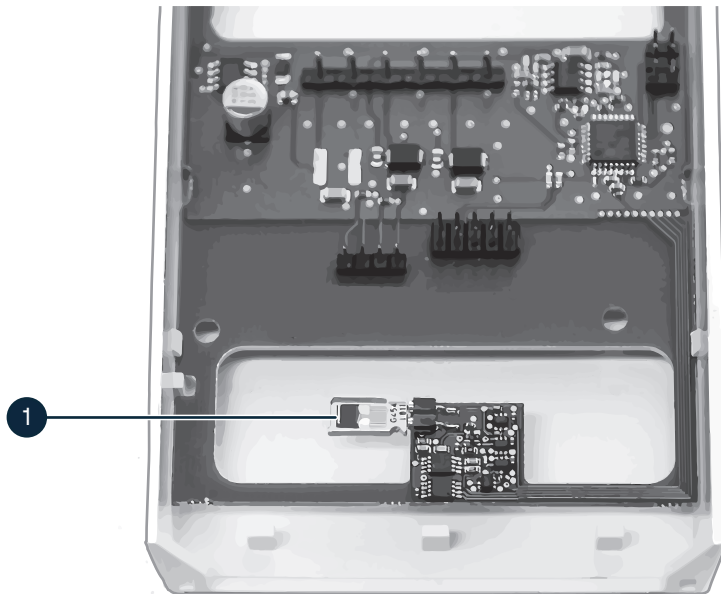


Figure 34 INTERCAP sensor in models HMW82/83

6.3.3 Replacing INTERCAP sensor on outdoor models HMS82/83



CAUTION! To avoid contaminating or damaging the sensor:

- Wear lint-free ESD gloves.
- Handle the sensor by its plastic frame.
- Do not touch the sensor surface in the middle.



- New INTERCAP humidity sensor
- New filter (always recommended when replacing the sensor)
- Medium size crosshead screwdriver (Pozidriv)
- Flat head screwdriver
- 3-mm Allen key for opening the radiation shield screws
- Lint-free ESD gloves
- If the transmitter is mounted on a pole: 2.5-mm Allen key for opening and tightening the set screw



You need to remove the radiation shield to access the sensor, and this is difficult to do while the transmitter remains mounted on a pole or wall. The procedure below takes advantage of the detachable screw terminal to allow the cable to remain in place during the operation.

- 1. Power down the transmitter.

2. Open the transmitter cover and unplug the screw terminal. This allows you to leave the cable and cover at the installation site.

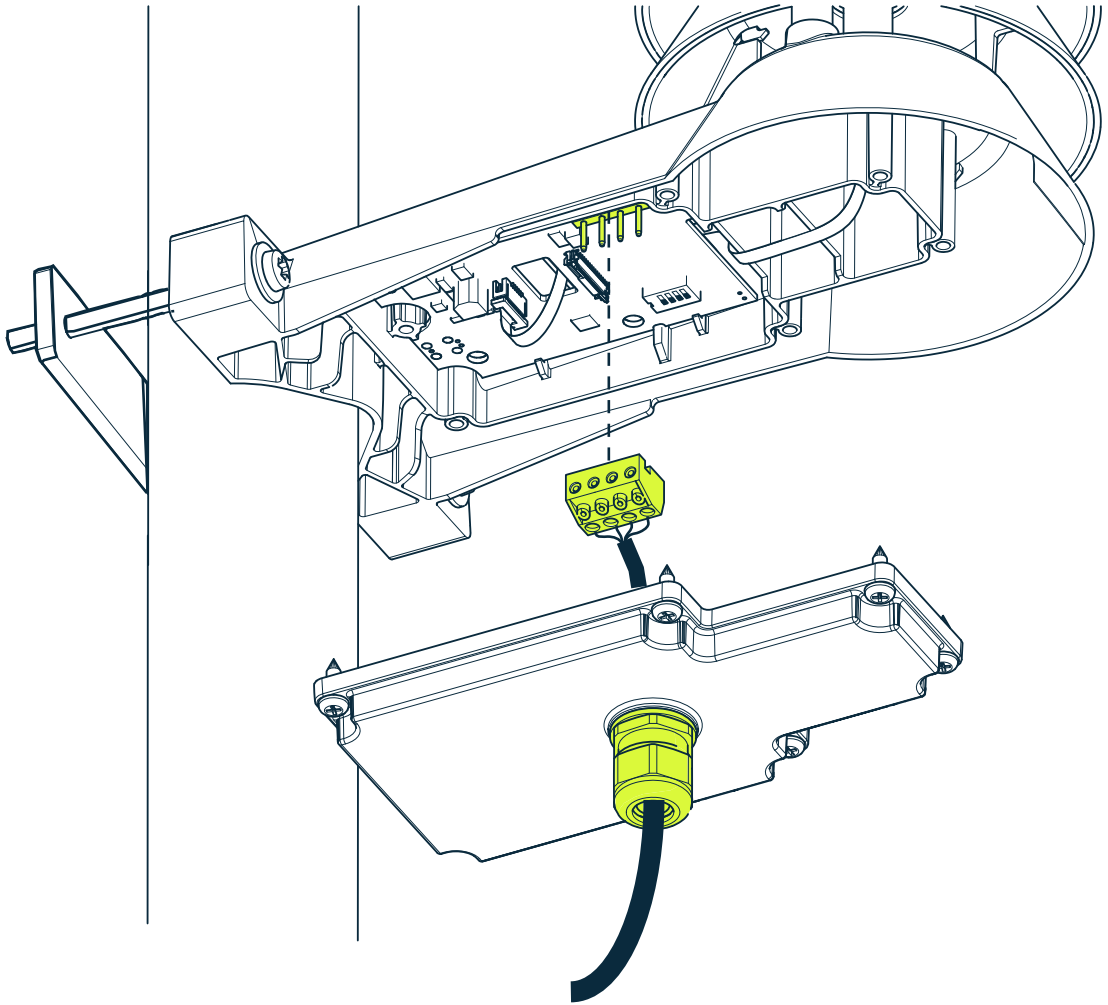


Figure 35 Unplugging the screw terminal

3. Remove the transmitter from its installation point.

4. Open the two long screws that hold the radiation shield, and pull them out.

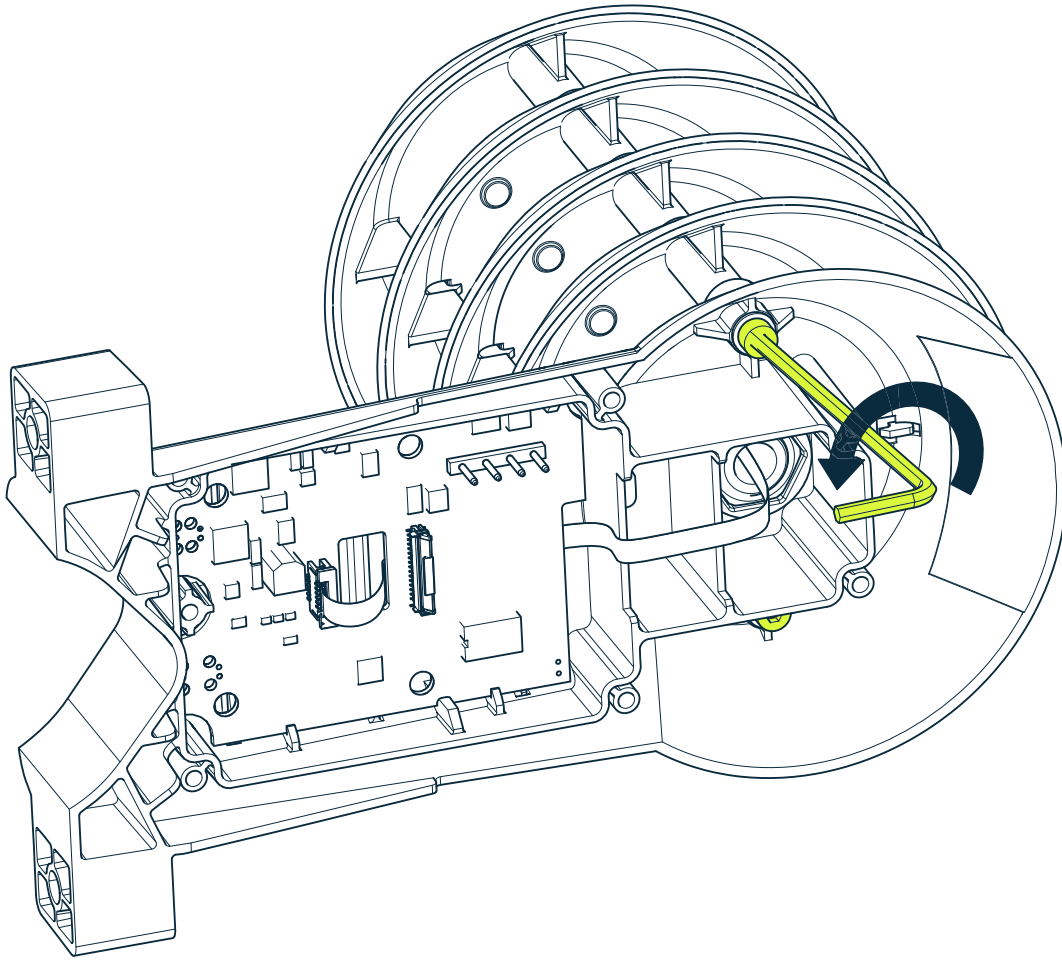


Figure 36 Opening the radiation shield screws

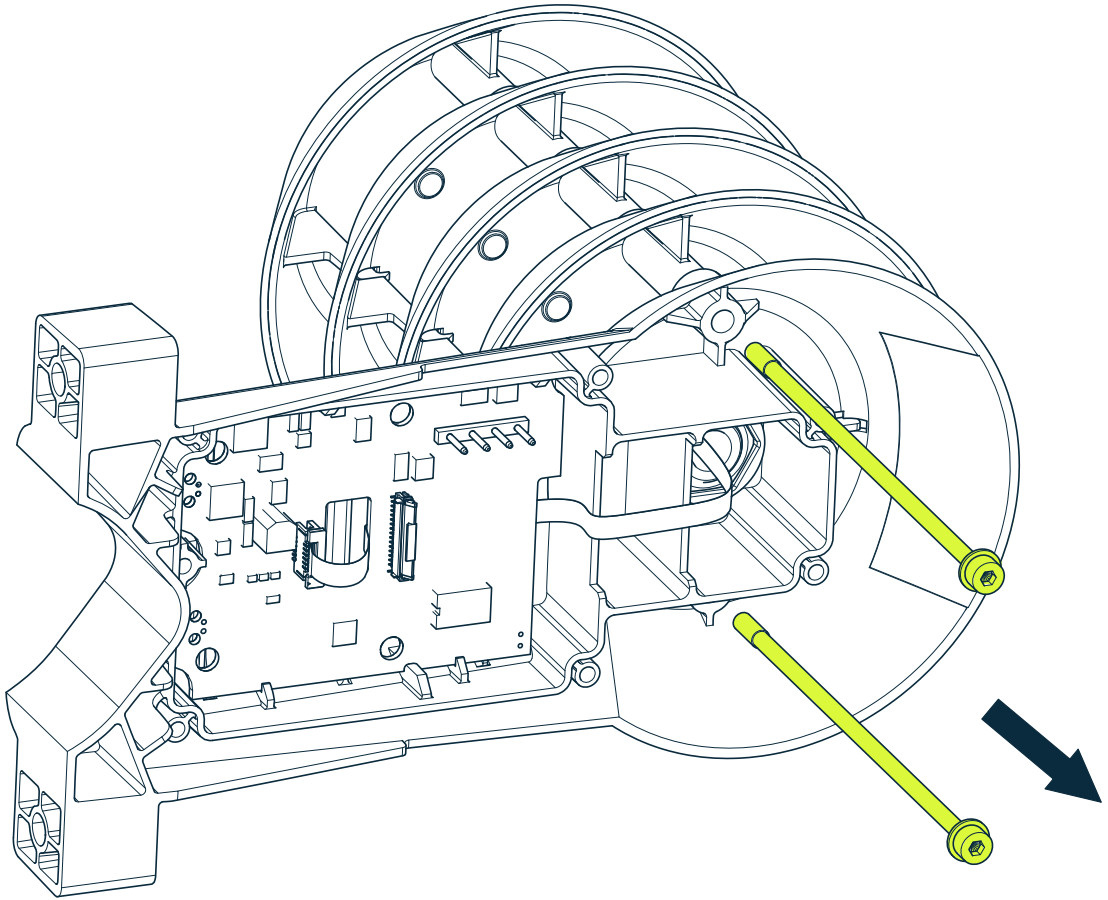


Figure 37 Removing the radiation shield screws

5. Use a flat head screwdriver to push on the visible plastic tab below the radiation shield.

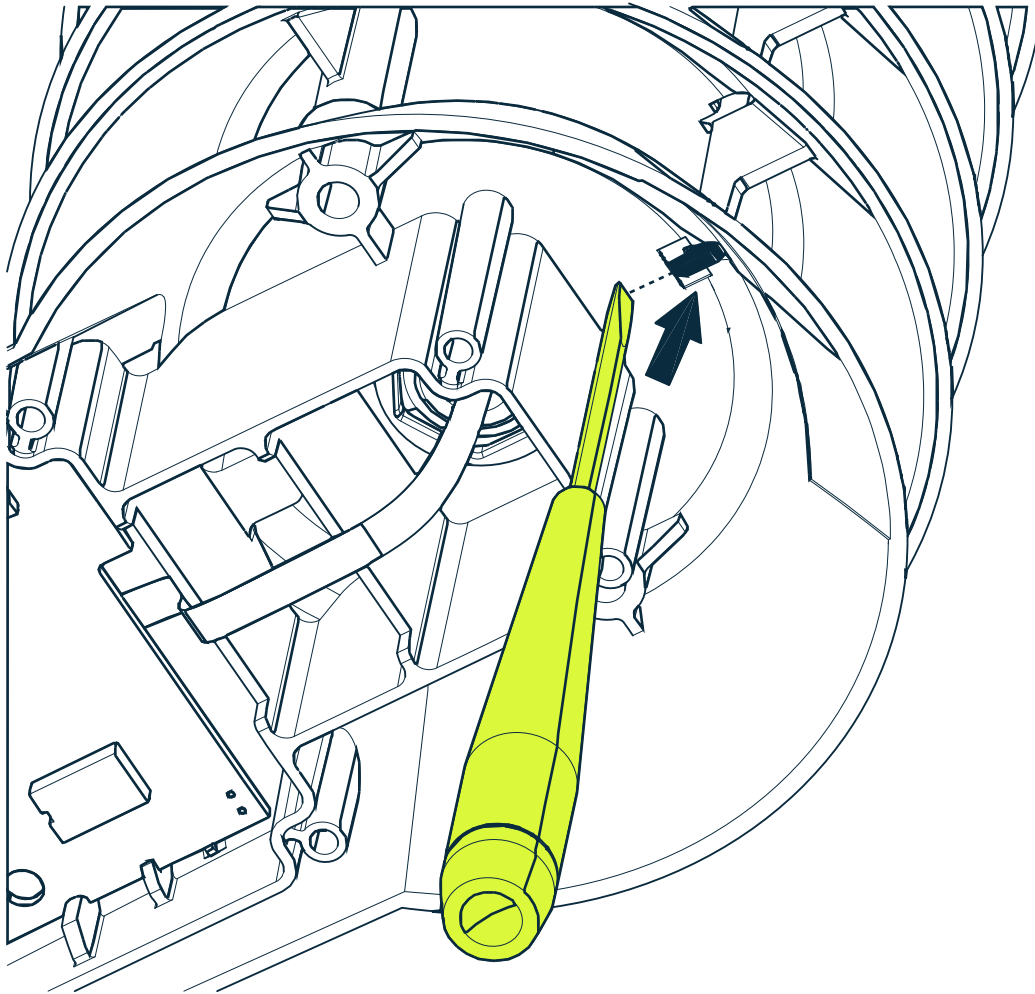


Figure 38 Location of locking tab

6. Tilt the radiation shield away from the opened tab. This opens the second tab on the other side, allowing you to remove the radiation shield.

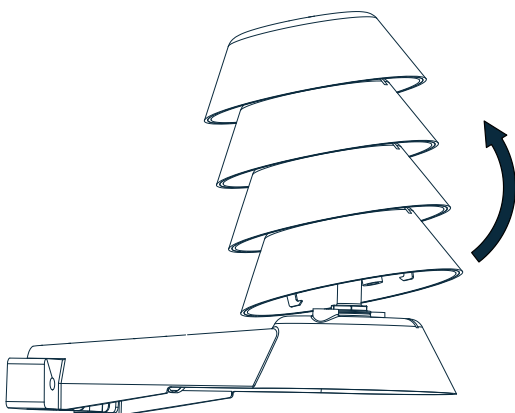


Figure 39 Removing the radiation shield

7. Open the filter to expose the sensors.

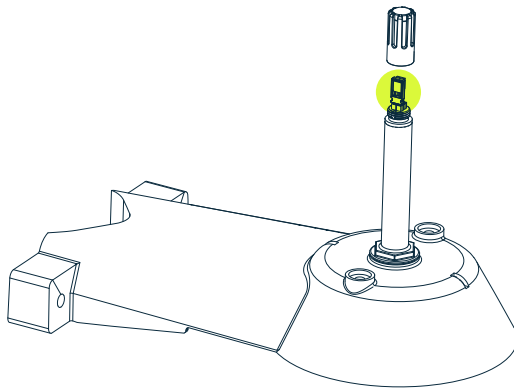


Figure 40 Filter removed

8. Pull out the old INTERCAP sensor, and insert the new one.

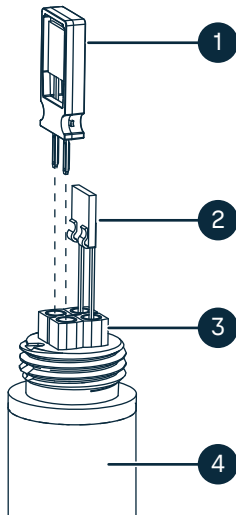


Figure 41 Sensors on models HMS82/83

- 1 Vaisala INTERCAP humidity sensor. **Handle by the plastic frame.**
- 2 Temperature sensor. **Do not touch or attempt to remove.**
- 3 Sensor socket.
- 4 Transmitter probe.

9. Insert the new filter.
10. Reassemble, remount, and reconnect the transmitter.
11. Power up the transmitter.
12. Verify that the transmitter now provides a valid humidity reading.

7. Troubleshooting

7.1 Troubleshooting checklist

When troubleshooting, check the questions listed in [Technical support \(page 74\)](#) and [Table 7 \(page 66\)](#) before contacting Vaisala technical support.

7.2 Problem situations

Table 7 Troubleshooting table

Problem	Probable cause and possible solution
Transmitter outputs an incorrect humidity reading.	1. Models with probes: check if the yellow transport protection cap has been left over the probe. Remove it if present. 2. Models with configurable output parameter: check that the desired output parameter has been selected using the DIP switches.
Temperature reading shown by the transmitter is too high.	1. The transmitter may be installed in an unsuitable location, for example, near a heat source or in sunlight. Use a portable reference meter to check this. 2. HMW82 and HMW83: Check that the transmitter is installed in proper orientation, with the arrow on the mounting base pointing up.
Current output on the temperature channel is ~24 mA.	Check that the humidity output channel is powered. Loop powered HMDW80 series models that have humidity measurement require that the humidity output channel is connected, even if only measuring temperature.
Analog output reading is unchanging and incorrect.	The analog output channel may be in an error state. See Analog output error states (page 68) .
Models HMW87 and HMW87D only: Cannot connect to transmitter using service port.	Check that you are using the specified cables: • Vaisala Indigo USB adapter and M12 - M8 service cable for connecting to Insight software (item codes USB2 and 262195SP) • M12 - M8 service cable for connecting to Indigo80 (item code 262195SP) See Spare parts and accessories (page 72) .

7.3 Error messages in Insight PC software and Indigo80 handheld indicator

[Table 8 \(page 67\)](#) applies to transmitter models HMW87 and HMW87D, which are compatible with Insight software and Indigo80 indicator.

Table 8 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.
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.

In case of constant error, contact Vaisala technical support.

7.4 Error messages on display

The error messages shown by transmitter models with a display (excluding model HMW87D) are listed in [Table 9 \(page 68\)](#).

Model HMW87D shows the abbreviated versions of the error messages listed in [Table 8 \(page 67\)](#).

Table 9 Error messages on the display (excluding HMW87D)

Error message	Possible cause and solution
INTERNAL 1 INTERNAL 2 INTERNAL 3	Internal problem with the transmitter. Restart the transmitter to see if the problem remains. Contact Vaisala technical support if you are unable to remove the problem.
ERROR HUM	Humidity measurement failed. Check if the humidity sensor is damaged or missing.
ERROR T	Temperature measurement failed. Check if the temperature sensor is damaged or missing.

7.5 Analog output error states

HMDW80 series transmitters set the output channel(s) into a defined error level instead of the measured result in two situations:

- Transmitter detects a measurement malfunction. This means an actual measurement problem, such as sensor damage or unsuitable environmental conditions.
- Measured value(s) are well outside the scaled output range. For a more detailed explanation, see [Analog output overrange behavior \(page 19\)](#).

The error level depends on the output type:

- For 0–10 V output, the error level is 11 V. HMW83 and TMW83 are an exception to this, their error level is 0 V.
- For 4–20 mA output, the error level is 3.6 mA.

The transmitter resumes normal operation of the analog output(s) when the cause of the error state is removed.

8. Technical data

8.1 HMDW80 series specifications

Table 10 Measurement performance, HMW82, HMW83, and TMW82

Property	Description/Value
Relative humidity	
Measurement range	0–100 %RH
Accuracy in temperature range +10 ... +30 °C (+50 ... +86 °F)	±3 %RH (0–70 %RH) ±5 %RH (70–100 %RH)
Accuracy in temperature range –5 ... +10 °C, +30 ... +55 °C (+23 ... +50 °F, +86 ... +131 °F)	±7 %RH (0–100 %RH)
Stability in typical HVAC applications	±2 %RH over 2 years
Humidity sensor	Vaisala INTERCAP®
Temperature ¹⁾	
Measurement range	–5 ... +55 °C (+23 ... +131 °F)
Accuracy at +10 ... +30 °C (+50 °F ... +86 °F)	±0.5 °C (±0.9 °F)
Accuracy at –5 ... +10 °C, +30 ... +55 °C (+23 ... +50 °F, +86 ... +131 °F)	±1.0 °C (±1.8 °F)
Temperature sensor	Digital temperature sensor
Temperature sensor HMW82P100	Pt100 Class F 0.1 IEC 60751, 3-wire connection

1) For model-specific operating temperature ranges, see table 'Operating environment'.

Table 11 Measurement performance, HMW87(D)

Property	Description/Value
Relative humidity	
Measurement range	0–100 %RH
Accuracy in temperature range +10 ... +30 °C (+50 ... +86 °F)	±3 %RH (0–90 %RH) ±5 %RH (90–100 %RH)
Accuracy in temperature range –20 ... +10 °C, +30 ... +70 °C (–4 ... +50 °F, +86 ... +158 °F)	±5 %RH (0–90 %RH) ±7 %RH (90–100 %RH)
Accuracy in temperature range –40 ... –20 °C (–40 ... –4 °F)	±7 %RH (90–100 %RH)
Stability in typical HVAC applications	±2 %RH over 2 years
Humidity sensor	Vaisala INTERCAP®

Property	Description/Value
Temperature ¹⁾	
Measurement range	–40 ... +70 °C (–40 ... +158 °F)
Accuracy at +20 °C (+68 °F)	±0.3 °C (±0.54 °F)
Temperature dependence	±0.01 °C/°C
Temperature sensor	Pt1000 RTD Class F0.1 IEC 60751
Calculated parameters	
Measurement range for dew point temperature and wet bulb temperature	–40 ... +70 °C (–40 ... +158 °F)
Measurement range for enthalpy	–40 ... 805 kJ/kg (–10 ... +358 BTU/lb)

1) For model-specific operating temperature ranges, see table 'Operating environment'.

Table 12 Measurement performance, HMD82(D), HMD83(D), TMD82, HMW88(D), HMW89(D), TMW88, HMS82, HMS83, and TMS82

Property	Description/Value
Relative humidity	
Measurement range	0–100 %RH
Accuracy in temperature range +10 ... +30 °C (+50 ... +86 °F)	±3 %RH (0–90 %RH) ±5 %RH (90–100 %RH)
Accuracy in temperature range –20 ... +10 °C, +30 ... +60 °C (–4 ... +50 °F, +86 ... +140 °F)	±5 %RH (0–90 %RH) ±7 %RH (90–100 %RH)
Accuracy in temperature range –40 ... –20 °C (–40 ... –4 °F)	±7 %RH (0–100 %RH)
Stability in typical HVAC applications	±2 %RH over 2 years
Humidity sensor	Vaisala INTERCAP®
Temperature ¹⁾	
Measurement range	–40 ... +60 °C (–40 ... +140 °F) (Analog output scaling –40 ... +60 °C)
Accuracy at +20 °C (+68 °F)	±0.3 °C (±0.54 °F)
Temperature dependence	±0.01 °C/ °C
Temperature sensor	Pt1000 RTD Class F0.1 IEC 60751
Calculated parameters	
Measurement range for dew point temperature and wet bulb temperature	–40 ... +60 °C (–40 ... +140 °F)
Measurement range for enthalpy	–40 ... 460 kJ/kg (–10 ... +190 BTU/lb)

1) For model-specific operating temperature ranges, see table 'Operating environment'.

Table 13 Operating environment

Property	Description/Value
Operating humidity	0–100 %RH
Maximum wind/flow speed	30 m/s
IP rating	Wall models HMW82, HMW82P100, HMW83, TMW82, and TMW83: IP30 (Protected against solid foreign objects of 2.5 mm Ø and greater.) Other models: IP65 (Dust-tight. Protected from water jets from any direction.)
Operating temperature	
HMW87	–40 ... +70 °C (–40 ... +158 °F) ¹⁾
HMW87D	–20 ... +70 °C (–4 ... +158 °F) ^{1) 2)}
HMW82/83 and TMW82	–5 ... +55 °C (+23 ... +131 °F)
HMD82/83, TMD82, HMW88/89, TMW88, HMS82/83, TMS82	–40 ... +60 °C (–40 ... +140 °F)
HMD82/83D, HMW88/89D	–5 ... +60 °C (+23 ... +140 °F)
Storage temperature	
HMW87	–40 ... +70 °C (–40 ... +158 °F) ¹⁾
HMW87D	–30 ... +70 °C (–22 ... +158 °F) ¹⁾
Other models	–40 ... +60 °C (–40 ... +140 °F)

1) Not for permanent exposure to temperatures > +60 °C (+140 °F).

2) Display performance may vary near the extremes of the operating temperature range.

Table 14 Inputs and outputs

Property	Description/Value
Devices with current output (2-wire models)	
Outputs	4–20 mA, loop powered
Loop resistance	0–600 Ω
Supply voltage	20–28 V DC at 600 Ω load 10–28 V DC at 0 Ω load
Devices with voltage output (3-wire models)	
Outputs	0–10 V
Load resistance	10 kΩ min
Supply voltage	18–35 V DC 24 V AC ±20 % 50/60 Hz

Property	Description/Value
Devices with Modbus output ¹⁾	
Interface	RS-485, not isolated, no line termination
Protocols	Modbus RTU
Default serial settings	19200 bps N 8 2
Default Modbus device address	240
Supply voltage	10–28 V DC

¹⁾ See table 'Spare parts and accessories' for a list of configuration cables needed for HMW87 and HMW87D.

Table 15 Mechanical specifications

Property	Description/Value
Max. wire size	1.5 mm ² (AWG 16)
Standard housing color	White (RAL9003)
Housing material	
HMW82/83, TMW82	ABS/PC (UL-V0 approved)
HMW87(D), HMW88/89(D), HMD82/83(D), TMW88, TMD82, HMS82/83, TMS82	PC + 10 %GF (UL-V0 approved)

Table 16 Compliance

Property	Description/Value
EU directives and regulations	EMC Directive (2014/30/EU) RoHS Directive (2011/65/EU) as amended by 2015/863
Electromagnetic compatibility (EMC)	EN 61326-1, basic electromagnetic environment ¹⁾
EMC emissions	CISPR 32 / EN 55032, Class B FCC part 15 B, Class B CAN ICES-3(B)/NMB-3(B)
Compliance marks	CE, China RoHS, RCM

¹⁾ HMW87 and HMW87D transmitter models fulfill the requirements for industrial electromagnetic environment, considering that a maximum permissible electrostatic air discharge of ± 7 kV has been specified for these products.

8.2 Spare parts and accessories



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

Table 17 Spare parts and accessories

Item	Item code
INTERCAP sensor	15778HM
10 pcs of INTERCAP sensors	INTERCAPSET-10PCS
Porous PTFE filter	DRW239993SP
Membrane filter	ASM210856SP
Conduit fitting + O-ring (M16×1.5 / NPT 1/2")	210675SP
Conduit fitting + O-ring (M16×1.5 / PG9, RE-MS)	210674SP
Terminal block, blue	236620SP
Front cover ¹⁾	ASM210793SP
Model-specific accessories	
Fastening set for HMS80	237805
Magnetic bracket ²⁾	ASM215638SP
Configuration cables for HMW87 and HMW87D:	
Vaisala Indigo USB adapter and M12 - M8 service cable (1.5 m (4 ft 11 in)), for connecting to Insight software ³⁾	USB2 and 262195SP
M12 - M8 service cable (1.5 m (4 ft 11 in)), for connecting to Indigo80	262195SP

1) For models HMD82D, HMD83D, HMW87D, HMW88D, and HMW89D.

2) For wall-mount models HMW87, HMW87D, HMW88, HMW88D, TMW88, HMW89, and HMW89D.

3) Vaisala Insight PC Software for Windows® is available at vaisala.com/insight.

9. Vaisala services

9.1 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.

9.2 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.

9.3 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 for HMW87 and HMW87D

A.1 Default communication settings

The following table lists the default Modbus serial communication settings for HMW87 and HMW87D.

Table 18 Default Modbus serial communication settings

Description	Default value
Serial bit rate	19200
Parity	N
Number of data bits	8
Number of stop bits	2
Modbus device address	240
Serial delay	0
Communication mode	Modbus RTU

A.2 Function codes

Table 19 Modbus function codes

Function code (decimal)	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.



For values that have both 32-bit and 16-bit register available, use of the 32-bit register is recommended. Some values may exceed the signed 16-bit range even in normal operation.

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 clients¹⁾ 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 client 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.



CAUTION! 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.

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 20 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
32769	0x8001	Value is –32767 or smaller
32770–65535	0x8002–0xFFFF	Value in range –32766 ... –1 (2's complement)

A.4 Data encoding

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

¹⁾ Formerly 'master'.

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 "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.

Reading the measurement data registers with incorrect floating point format setting may occasionally result in correct-looking values. It is highly recommended to first try reading the register number 7938 (floating point test) to see that you have configured the floating point format correctly on your Modbus host system.



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

A.5 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.



CAUTION! 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.5.1 Measurement data registers

Table 21 Floating point measurement data registers (read-only)

Register number	Address	Description	Data format	Unit
1	0x0000	Relative humidity	32-bit float	%RH
3	0x0002	Temperature	32-bit float	°C
9	0x0008	Dew/frost point temperature	32-bit float	°C
19	0x0012	Wet bulb temperature	32-bit float	°C
27	0x001A	Enthalpy	32-bit float	kJ/kg

Table 22 Integer measurement data registers (read-only)

Register number	Address	Description	Data format	Scale factor	Offset	Unit
257	0x0100	Relative humidity	16-bit signed integer	10	0	%RH
258	0x0101	Temperature	16-bit signed integer	10	0	°C
261	0x0104	Dew/frost point temperature	16-bit signed integer	10	0	°C
266	0x0109	Wet bulb temperature	16-bit signed integer	10	0	°C
270	0x010D	Enthalpy	16-bit signed integer	10	0	kJ/kg

A.5.2 Configuration registers

Table 23 Modbus configuration data registers (writable)

Register number	Address	Register description	Data format	Unit / Valid range
Filtering				
785	0x0310	Filtering factor	32-bit float	0.001 (maximum filtering)–1.000 (no filtering) See Filtering factor (page 19) .
Communication				
1537	0x0600	Modbus address	16-bit integer	1–247 Default: 240 0 = Offline, no response to Modbus client
1538	0x0601	Bit rate (b/s) ¹⁾	enum	5 = 9600 6 = 19200 7 = 38400 8 = 57600
1539	0x0602	Parity, data, stop bits ¹⁾	enum	0 = N81 1 = N82 2 = E81 3 = E82 4 = O81 5 = O82
1540	0x0603	Response delay	16-bit integer	0–1020 ms
Functions				

Register number	Address	Register description	Data format	Unit / Valid range
1542	0x0605	Restart device	16-bit function status	1 = Restart device
7681	0x1E00	Restore settings	16-bit function status	Restore default factory settings and discard any changes made by user. 1 = Restore settings
Display				
3073	0x0C00	Display parameter 1 ²⁾	16-bit register address	0x0000 (Relative humidity) 0x0002 (Temperature) 0x0008 (Dew/frost point temperature) 0x0012 (Wet bulb temperature) 0x001A (Enthalpy)
3074	0x0C01	Display parameter 2 ²⁾	16-bit register address	0x0000 (Relative humidity) 0x0002 (Temperature) 0x0008 (Dew/frost point temperature) 0x0012 (Wet bulb temperature) 0x001A (Enthalpy) 0xFFFF (Disable display parameter 2)
3075	0x0C02	Units ²⁾	enum	Metric Non-metric

1) Changed setting will be activated on device restart.

2) Register applicable only to model HMW87D, which has a display.

A.5.3 Status registers

Table 24 Modbus status registers (read-only)

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

Register number	Address	Description	Data format	Notes
520	0x0207	RH measurement status	16-bit integer	0x0000: Status OK 0x0001: Measurement is not available 0x0040: Calibration expired 0x0080: Sensor failure
521	0x0208	T measurement status	16-bit integer	0x0000: Status OK 0x0040: Calibration expired 0x0080: Sensor failure

Table 25 Status 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]
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 \(page 66\)](#)

A.5.4 Test value registers

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

Table 26 Modbus test registers (read-only)

Register number	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
7940	0x1F03	Text string test	7-character ASCII string	Text string "-123.45"

A.6 Device identification objects

Table 27 Device identification objects

Object ID	Object ID (hexadecimal)	Object name	Example contents
0	0x00	VendorName	"Vaisala"
1	0x01	ProductCode	"HMW87"
2	0x02	MajorMinorVersion	"1.2.3" Software version of the device.
3	0x03	VendorUrl	"https://www.vaisala.com/"
4	0x04	ProductName	"Vaisala INTERCAP(R) Humidity and Temperature Transmitter HMW87"
128	0x80	SerialNumber ¹⁾	"K0710040"
129	0x81	CalibrationDate ¹⁾	"2026-04-24" 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.
132	0x84	CalibrationExpiry ¹⁾	Calibration expiry in YYYY-MM-DD format. Empty string if not set/valid.
133	0x85	HardwareVersion ¹⁾	"87CB"

¹⁾ Vaisala-specific device information.

A.7 Exception responses

Table 28 Modbus exception responses

Code	Name	Reason
01	Illegal function	Unsupported function code
02	Illegal data address	Register address or Object ID out of valid ranges
03	Illegal data value	Otherwise invalid request

Accessing unavailable (temporarily missing) measurement data does not generate a Modbus exception. “Unavailable” value (a quiet NaN for floating point data or 0x8000 for integer data) is returned instead. An exception is generated only for any access outside the applicable register ranges.

A.8 Modbus communication examples

Reading relative humidity value



The device address used in the following examples is 240 (0xF0).
The values returned by the device differ depending on the ambient conditions and/or device settings. Your device might not return exactly same values.

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
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)	 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.	
0x4C			
0x5E	Modbus RTU checksum		
0x96			
(silence for 3.5 bytes)	End of Modbus RTU frame		

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. Regulatory statements

B.1 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.

B.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.

Recycling



Recycle all applicable material according to local regulations.

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