M211399EN-J

User Guide

Vaisala HUMICAP® Humidity and Temperature Transmitters

HMW90 Series



VAISALA

PUBLISHED BY

Vaisala Oyj
Vanha Nurmijärventie 21, FI-01670 Vantaa, Finland
P.O. Box 26, FI-00421 Helsinki, Finland
+358 9 8949 1
vaisala.com
docs.vaisala.com

© Vaisala 2026

No part of this document may be reproduced, published, or publicly displayed in any form or by any means, electronic or mechanical (including photocopying), nor may its contents be modified, translated, adapted, sold, or disclosed to a third party without prior written permission of the copyright holder. Translated document and translated portions of the document are based on the original English version. Parts of the translation may have been created using machine-assisted translation. In ambiguous cases, the English version is applicable, not the translation.

The contents of this document are subject to change without prior notice.

Local rules and regulations applicable to the products and services may vary, and they shall take precedence over the information contained in this document. Vaisala makes no representations on this document's compliance with the local rules and regulations applicable at any given time, and hereby disclaims any and all responsibilities related thereto. You are instructed to confirm the applicability of the local rules and regulations and their effect on the intended use of the products and services.

This document does not create any legally binding obligations for Vaisala towards customers or end users. All legally binding obligations are set forth exclusively in the applicable contract or in the relevant set of General Conditions of Vaisala (vaisala.com/policies).

This product contains software developed by Vaisala or third parties. Use of the software is governed by license terms and conditions included in the applicable contract or, in the absence of separate license terms and conditions, by the General License Conditions of Vaisala Group.

Table of contents

1. About this document 9
1.1 Version information 9
1.2 Related manuals 10
1.3 Documentation conventions 10
1.4 Trademarks 11

2. Product overview 12
2.1 Introduction to HMW90 series 12
2.2 HMW90 series transmitters 12
2.3 Output parameters 14
2.4 Product and part names 15
2.4.1 Opening the transmitter 18
2.5 Decorative cover option 20
2.6 Safety 21
2.6.1 ESD protection 22

3. Installation 23
3.1 Configuration before installation 23
3.1.1 Configuration of analog output models 23
3.1.2 Configuration of digital output models 28
3.2 Selecting location 30
3.3 Installing the mounting base 31
3.4 Wiring 32
3.4.1 Wiring HMW92 34
3.4.2 Wiring HMW93 35
3.4.3 Wiring TMW92 36
3.4.4 Wiring TMW93 37
3.4.5 Wiring HMW95 37
3.4.6 Connecting a common AC power supply to several transmitters 39

4. Operation 40
4.1 Display 40
4.1.1 Startup screens 40
4.1.2 Measurement screen 40
4.1.3 Symbols on the display 42
4.2 Service port 42
4.2.1 Connecting with Indigo80 indicator 42
4.2.2 Connecting with Insight PC software 43
4.2.3 Connecting with computer using terminal application 43
4.2.4 Installing the driver for the USB service cable 45
4.3 List of serial commands 45
4.4 Transmitter information 47
4.4.1 Show transmitter information 47
4.4.2 Show transmitter firmware version 47
4.4.3 Show transmitter serial number 48

4.4.4 Show transmitter status....48
4.4.5 Show measured parameters....48
4.4.6 Show command help....49
4.4.7 Show command list....49
4.5 Measurement settings....50
4.5.1 Set environmental parameters....50
4.5.2 Select units....50
4.6 Analog output settings....50
4.6.1 Set analog output mode....51
4.6.2 Set analog output scaling....51
4.6.3 Set output clipping and error limit....52
4.7 Display settings....53
4.7.1 Select parameters to display....53
4.8 Serial line output commands....54
4.8.1 Start measurement output....54
4.8.2 Stop measurement output....54
4.8.3 Output a reading once....54
4.8.4 Set output interval....54
4.8.5 Set output format....55
4.9 Serial line settings....57
4.9.1 Set remote echo....57
4.9.2 Set serial line turnaround delay....57
4.10 Relay configuration in custom mode....57
4.10.1 Set relay mode....58
4.10.2 Set relay parameter and limits....58
4.10.3 Relay configuration examples....59
4.11 Calibration and adjustment commands....60
4.11.1 Adjust humidity measurement....61
4.11.2 Adjust temperature measurement....62
4.11.3 Enter calibration and adjustment information....63
4.12 Testing commands....63
4.12.1 Test analog outputs....63
4.12.2 Test relay operation....64
4.13 Other commands....65
4.13.1 Enable advanced serial commands....65
4.13.2 Reset transmitter....65

5. Calibration and adjustment....66
5.1 Adjustment using display and trimmers....67
5.2 Calibration and adjustment with Indigo80 handheld indicator....68
5.2.1 Performing guided calibration with Indigo80 handheld indicator....69
5.2.2 Performing manual adjustment with Indigo80 handheld indicator using previously measured values....70
5.3 Adjustment using Insight PC software....71
5.4 Adjustment using HM70....72
5.5 Adjustment using a computer with a terminal application....72

6. Maintenance 74
6.1 Periodic maintenance 74
6.1.1 Cleaning 74
6.2 Repair maintenance 74
6.2.1 Replacing the measurement module 74

7. Troubleshooting 77
7.1 Problem situations 77
7.2 Error messages 77
7.2.1 Viewing error messages on serial line 78
7.3 Error state 79
7.4 Reverting to factory settings 79
7.4.1 Reverting to factory settings using DIP switches 80
7.4.2 Reverting to factory settings using service port 82

8. Technical data 83
8.1 Specifications 83
8.2 Spare parts and accessories 85
8.3 Dimensions and models 86

9. Vaisala services 87
9.1 Service centers 87
9.2 Technical support 87
9.3 Warranty 87

Appendix A: Modbus reference 89

Warranty 92

Maintenance and calibration services 92

Technical support 92

Recycling 93

List of figures

Figure 1 HMW90 series transmitters 12
Figure 2 Transmitter parts - outside 15
Figure 3 Transmitter parts – inside (analog output models) 16
Figure 4 Transmitter parts – inside (digital output models) 17
Figure 5 Opening the transmitter 19
Figure 6 Decorative cover 21
Figure 7 DIP switch settings of analog output models 24
Figure 8 Relay high in DIP mode (HMW93) 26
Figure 9 Relay low in DIP mode (HMW93) 27
Figure 10 DIP switch settings of digital output models 29
Figure 11 Example of transmitter addressing 30
Figure 12 Selecting transmitter location 31
Figure 13 Installing the mounting base 32
Figure 14 Wiring from behind (recommended) 33
Figure 15 Wiring from above 34
Figure 16 Wiring HMW92 35
Figure 17 Three-wire wiring for HMW92 35
Figure 18 Wiring HMW93 36
Figure 19 Three-wire wiring for HMW93 36
Figure 20 Wiring TMW92 36
Figure 21 Wiring TMW93 37
Figure 22 Three-wire wiring for TMW93 37
Figure 23 Wiring HMW95 38
Figure 24 Several transmitters on the same RS-485 Line 38
Figure 25 Connecting a common AC power supply 39
Figure 26 HMW93 startup screens 40
Figure 27 HMW93 measurement screen – normal operation 41
Figure 28 HMW93 measurement screen – problem with measurement 41
Figure 29 PuTTY terminal application 45
Figure 30 Relay Hi_Active in custom mode (HMW93) 59
Figure 31 Relay Lo_active in custom mode (HMW93) 60
Figure 32 Trimmer centering screen 67
Figure 33 Trimmer centering screen 68
Figure 34 Indigo80 calibration methods 68
Figure 35 HTM10 and TM10 modules 74
Figure 36 Replacing the HTM10 module (HMW93) 75
Figure 37 DIP switches in factory reset position 81
Figure 38 DIP switches in factory reset position (HMW95) 81
Figure 39 Dimensions of HMW90 series transmitter cover (left) and mounting base (right) 86

List of tables

Table 1 Document versions (English)....9
Table 2 Related manuals....10
Table 3 HMW90 Series transmitters....13
Table 4 Supported parameters....14
Table 5 Rotary switch and relay setpoint....25
Table 6 Display symbols....42
Table 7 Service port serial interface settings....44
Table 8 Basic serial commands....46
Table 9 Advanced serial commands....46
Table 10 FORM command parameters....56
Table 11 FORM command modifiers....56
Table 12 Troubleshooting table....77
Table 13 Error messages....77
Table 14 HMW90 measurement performance....83
Table 15 HMW90 inputs and outputs....83
Table 16 HMW90 operating environment....84
Table 17 HMW90 compliance....84
Table 18 HMW90 mechanical specifications....85
Table 19 HMW90 spare parts and accessories....85
Table 20 HMW90 models....86
Table 21 Modbus functions supported by HMW90....89
Table 22 HMW90 Modbus measurement data registers....89
Table 23 HMW90 Modbus status registers (read-only)....90
Table 24 HMW90 Modbus error code bits....90
Table 25 HMW90 Modbus configuration parameter registers....91
Table 26 HMW90 Modbus device identification....91
Table 27 HMW90 Modbus exception responses....91

1. About this document

1.1 Version information

This document provides information for installing, operating, and maintaining HMW90 series transmitters. All transmitter models in the HMW90 series are covered, which means that some information in the manual is model-specific.

Table 1 Document versions (English)

Document code	Date	Description
M211399EN-J	June 2026	Updated content in this version: • Added information about using the Indigo80 handheld indicator. • Added information about Vaisala services. • Removed references to the MI70 handheld indicator. • Removed references to the BACnet protocol. New sections: • Connecting with Indigo80 indicator (page 42) • Connecting with Insight PC software (page 43) • Calibration and adjustment with Indigo80 handheld indicator (page 68) • Adjustment using Insight PC software (page 71) Updated sections: • Introduction to HMW90 series (page 12) • DIP switches of digital output models (page 29) • Symbols on the display (page 42) • Service port (page 42) • Show transmitter status (page 48) • Terminal application settings (page 44) • Calibration and adjustment (page 66) • Reverting to factory settings using DIP switches (page 80) • Spare parts and accessories (page 85)
M211399EN-H	April 2016	Updated sections: • Transmitter Parts • Technical Data • Modbus Reference
M211399EN-G	March 2015	Added description of the Decorative Cover accessory. Updated description of BACnet and Modbus protocol implementations. Various small updates.

1.2 Related manuals

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

Table 2 Related manuals

Document code	Name
M211511EN	HMW90 and GMW90 Digital Output Models Multilingual Quick Guide
M211398EN	HMW90 and GMW90 Analog Output Models Multilingual Quick Guide
M212722EN	Indigo80 Handheld Indicator User Guide
M211476EN	HMW90 Series Wall Transmitters Decorative Cover Quick Guide
M211606EN	Printable Insert for HMW90 and GMW90 Series Wall Transmitter Decorative Cover

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

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

Modbus® is a registered trademark of Schneider Automation Inc.

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

All other product or company names that may be mentioned in this publication are trade names, trademarks, or registered trademarks of their respective owners.

2. Product overview

2.1 Introduction to HMW90 series

The HMW90 series transmitters are wall-mount transmitters for building automation applications. Transmitter models in the series share the following common features:

- Detachable mounting base for easy installation and wiring.
- Display (visible or hidden behind the cover).
- Sliding cover for accessing maintenance functions.
- Adjustment trimmers.
- DIP switches for most common configuration tasks.
- RS-485 line for temporary service use with Indigo80 handheld indicator or computer.
- User exchangeable measurement module available as a spare part.

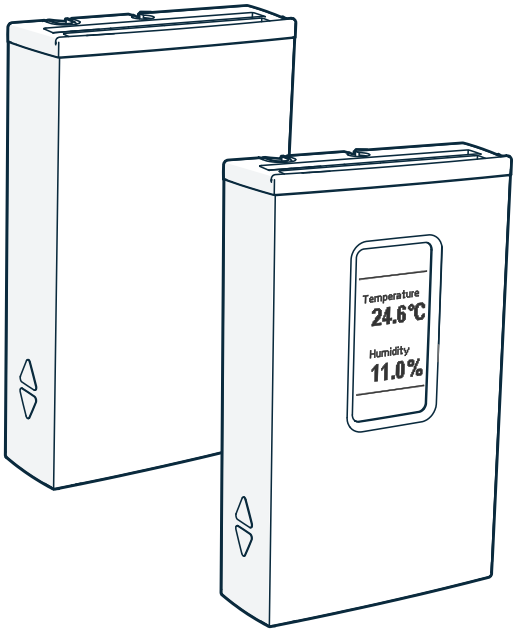


Figure 1 HMW90 series transmitters

2.2 HMW90 series transmitters

This table lists the most important differences between the HMW90 series transmitter models.

Table 3 HMW90 Series transmitters

Product Code	Short Description
HMW92	Humidity and temperature transmitter with: • two current outputs (4–20 mA) • display hidden under sliding cover
HMW92D	Humidity and temperature transmitter with: • two current outputs (4–20 mA) • visible display
HMW93	Humidity and temperature transmitter with: • two voltage outputs (0–5 V or 0–10 V) • relay • display hidden under sliding cover
HMW93D	Humidity and temperature transmitter with: • two voltage outputs (0–5 V or 0–10 V) • relay • visible display
TMW92	Temperature transmitter with: • one current output (4–20 mA) • display hidden under sliding cover
TMW93	Temperature transmitter with: • one voltage output (0–5 V or 0–10 V) • relay • display hidden under sliding cover
HMW95	Humidity and temperature transmitter with: • digital output (isolated RS-485) • display hidden under sliding cover
HMW95D	Humidity and temperature transmitter with: • digital output (isolated RS-485) • visible display
HMW90 TMW90	HMW90 series wall-mount transmitter that has been customized at Vaisala. Check type label on transmitter body and terminal label on the mounting base. Note for customized transmitters with analog outputs: Keep the transmitter in custom mode (DIP switch 8 set to custom) to retain the custom configuration.

More information

‣ Technical data (page 83)

2.3 Output parameters

Humidity parameters are not measured by TMW92, TMW93, and TMW90 transmitters even though the parameters can be selected using the service port (serial line and handheld indicator use).

Table 4 Supported parameters

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.
Dewpoint	Td	°C °F	Temperature at which the water vapor in the air will condense into water at the current pressure.
Dewpoint	Tdf	°C °F	Same as T_d, except when the dewpoint is below 0 °C, the transmitter outputs frostpoint (T_f) instead of dewpoint.
Dewpoint depression	dTd	°C °F	Difference between ambient temperature and dewpoint (T_{df}).
Wet bulb temperature	Tw	°C °F	The minimum temperature that can be reached by evaporative cooling in the current conditions.
Absolute humidity	a	g/m^3 gr/ft^3	Quantity of water in a cubic meter (or cubic foot) of air.
Mixing ratio	x	g/kg gr/lb	Ratio of water vapor mass per kilogram (or pound) of dry air.
Enthalpy	h	kJ/kg btu/lb	Sum of the internal energy of a thermodynamic system.

2.4 Product and part names

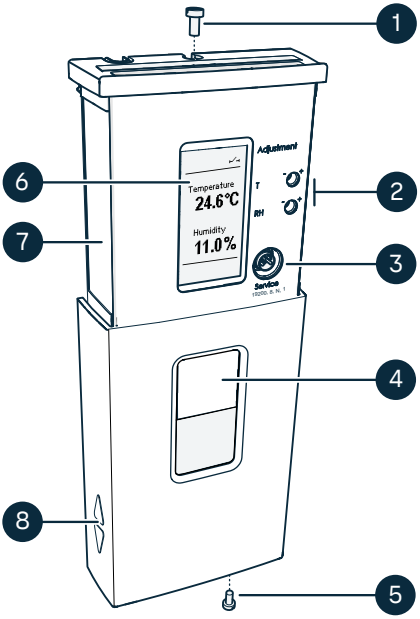


Figure 2 Transmitter parts - outside

Item	Name
1	Locking screw for mounting base (M3×6)
2	Adjustment trimmers
3	Service port
4	Window for display (only in models where the display is visible)
5	Locking screw for slide (M3×6)
6	Display
7	Type label
8	Grip for slide

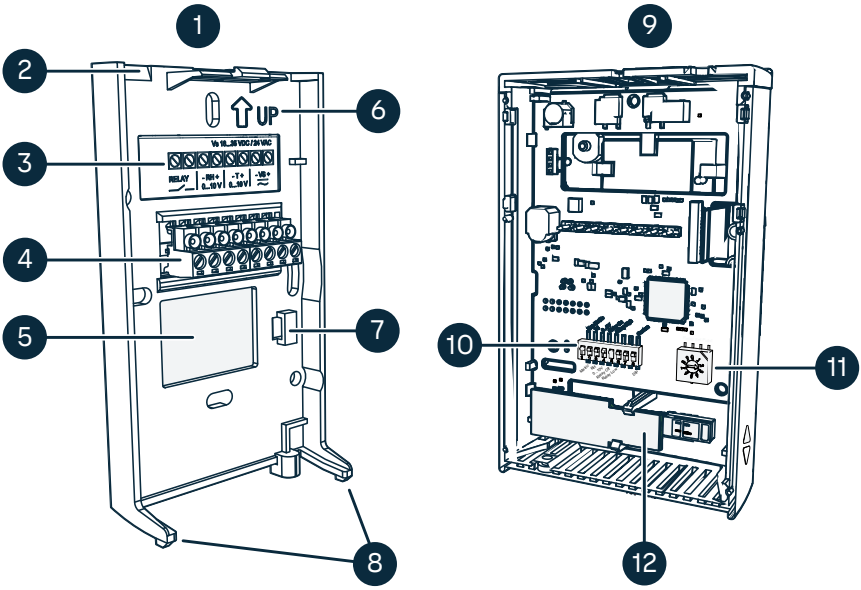


Figure 3 Transmitter parts – inside (analog output models)

Item	Name
1	Mounting base
2	Opening for cable (wiring from top)
3	Terminal label
4	Screw terminals
5	Opening for cable (wiring from behind)
6	Orientation arrow – should point up after the mounting base has been installed.
7	Place for zip tie (for cable strain relief)
8	Supports
9	Transmitter body
10	DIP switches for common configuration options.
11	Rotary switch for relay setpoint (only for models with relay).
12	HTM10 module with HUMICAP® sensor (HMW models) or TM10 module (TMW models, measures temperature only)

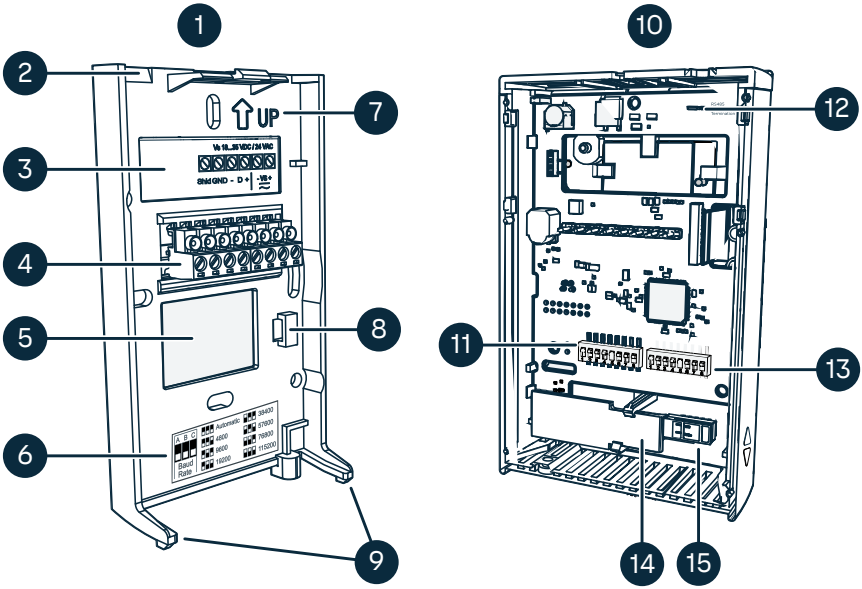


Figure 4 Transmitter parts – inside (digital output models)

Item	Name
1	Mounting base
2	Opening for cable (wiring from top)
3	Terminal label
4	Screw terminals
5	Opening for cable (wiring from behind)
6	Label for RS-485 baud rate DIP switch settings
7	Orientation arrow – should point up after the mounting base has been installed
8	Place for zip tie (for cable strain relief)
9	Supports
10	Transmitter body
11	DIP switches for common configuration options.
12	RS-485 termination jumper (connects a 120 Ω resistor)
13	DIP switches for transmitter address selection
14	HTM10 module

Item	Name
15	HUMICAP® sensor

More information

- DIP switches of analog output models (page 24)
- Relay configuration in DIP mode (page 25)
- DIP switches of digital output models (page 29)

2.4.1 Opening the transmitter



CAUTION! When opening or closing the transmitter, avoid damaging the transmitter electronics with the two plastic supports on the mounting base.

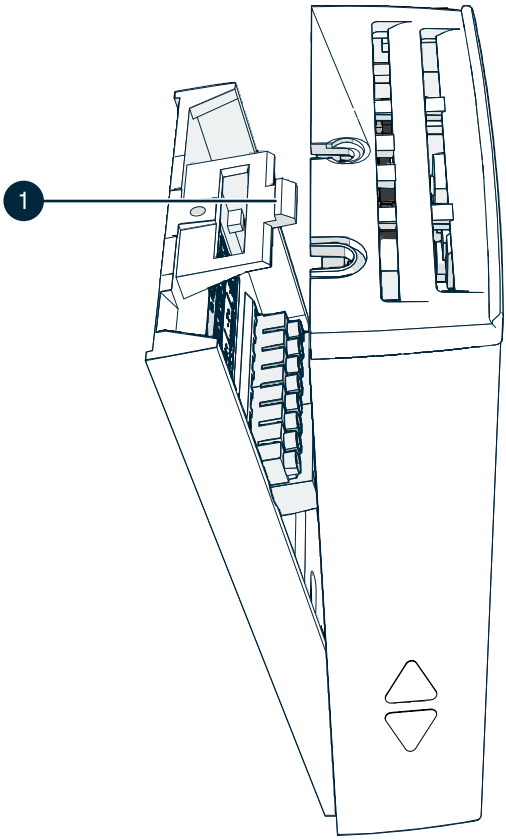


Figure 5 Opening the transmitter

1. To open, use a screwdriver to push down the tab that holds the transmitter cover and mounting base together.
2. Pull the mounting base away from the cover, starting from the top.
3. To close, connect the bottom of the transmitter first, and tilt the top forward to close the tab. Do not push on the display. Closing the transmitter starts it up if power is supplied to the screw terminals.

2.5 Decorative cover option

The decorative cover is an installation accessory for HMW90 and GMW90 series transmitters that can be used to hide the transmitter from view. The cover material is transparent polycarbonate, but the idea is to customize it to match the wall the transmitter is on. There are two easy ways to change the appearance of the cover:

- Paint the cover in the same color as the wall.
- Insert a piece of wallpaper under the lid.

You can also use the cover as a holder for printed material, for example, an informational sign.

You must remove the sliding cover of the transmitter to install the decorative cover. Installation instructions are included with the cover.

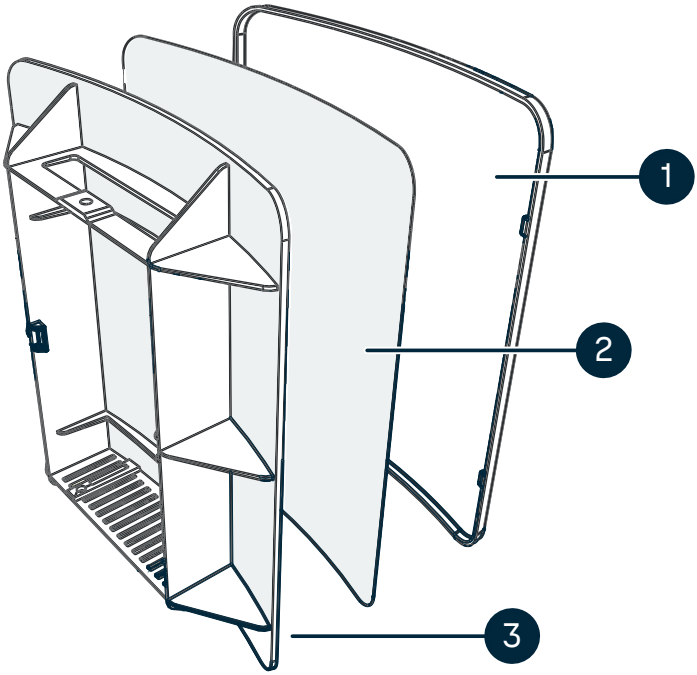


Figure 6 Decorative cover

Item	Name
1	Decorative cover lid. If you intend to paint the cover, paint the outer surface of this part, and leave the other part entirely unpainted.
2	Space for wallpaper or printed insert. The decorative cover is delivered with a quick guide that can be used as a stencil for cutting the required shape.
3	Decorative cover base part

2.6 Safety

WARNING! Only licensed experts may install electrical components. They must adhere to local and state legislation and regulations.

2.6.1 ESD protection

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

To avoid delivering high static voltages to the product:

- Handle ESD-sensitive components on a properly grounded and protected ESD workbench or by grounding yourself to the equipment chassis with a wrist strap and a resistive connection cord.
- If you are unable to take either precaution, touch a conductive part of the equipment chassis with your other hand before touching ESD-sensitive components.
- Hold component boards by the edges and avoid touching component contacts.

3. Installation

3.1 Configuration before installation

If you need to change the settings of the transmitter, it is best to do this before it has been installed. Available configuration options are different for analog output models (such as HMW93) and digital output models (for example, HMW95).

3.1.1 Configuration of analog output models

You can configure analog output models of HMW90 series transmitters in two ways:

- Using the DIP switches (and rotary switch on the HMW93 and TMW93) on the component board.
- Configuring the settings in software through the service port.

These two configuration methods are mutually exclusive. If the DIP switch configuration is used, software settings have no effect on settings that are controlled by the DIP switches. DIP switch number 8 is the master switch that controls which configuration method is used.

More information

- DIP switches of analog output models (page 24)
- Relay configuration in DIP mode (page 25)
- Operation (page 40)
- List of serial commands (page 45)

3.1.1.1 DIP switches of analog output models

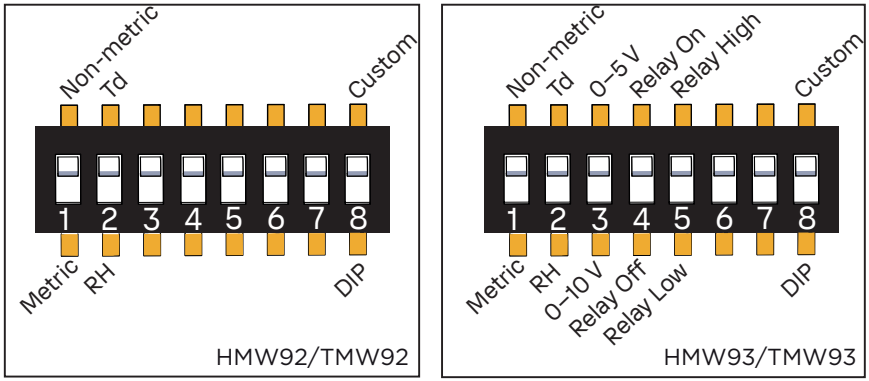


Figure 7 DIP switch settings of analog output models

DIP	Position	Setting
1	Non-metric	Non-metric units (°F)
	Metric	Metric units (°C)
2	Td	T_d (dewpoint) as humidity parameter on display and analog output. Sets analog output scaling to -20 ... +55 °C.
	RH	RH (relative humidity) as humidity parameter on display and analog output. Sets analog output scaling to 0–100 %RH.
3	0–5 V	0–5 V analog output (both channels)
	0–10 V	0–10 V analog output (both channels)
4	Relay On	Relay enabled
	Relay Off	Relay disabled
5	Relay High	Relay closed when measurement above setpoint. Relay operation is linked to RH on HMW93, and T on TMW93.
	Relay Low	Relay closed when measurement below setpoint
6	Not used	
7	Not used	
8	Custom	Configuration through service port only
	DIP	Configuration by DIP switches only

DIP switch 2 does nothing on TMW92 and TMW93.

If DIP switch 8 is set to Custom, the transmitter ignores all other DIP switch settings. In custom mode the transmitter uses settings that are configured in software using the service port. Before changing the position of this switch, see Changing between DIP and custom configuration (page 27).

3.1.1.2 Relay configuration in DIP mode

Relay is included on HMW93 and TMW93 transmitters only.

When the transmitter is configured using DIP switches, the functioning of the relay is configured by DIP switch 5 and the rotary switch on the component board:

- DIP switch 5 determines if the relay is closed above or below the setpoint.
- The position of the rotary switch determines the setpoint according to the table below.

Table 5 Rotary switch and relay setpoint

Rotary switch position	Setpoint on HMW93	Setpoint on TMW93
0	5 %RH	0 °C (32 °F)
1	10 %RH	5 °C (41 °F)
2	20 %RH	10 °C (50 °F)
3	30 %RH	15 °C (59 °F)
4	40 %RH	20 °C (68 °F)
5	50 %RH	25 °C (77 °F)
6	60 %RH	30 °C (86 °F)
7	70 %RH	35 °C (95 °F)
8	80 %RH	40 °C (104 °F)
9	90 %RH	45 °C (113 °F)

The rotary switch only has 10 positions. Do not turn the switch so that it is between two positions.

For examples of relay behavior in DIP mode, see Figure 8 (page 26) and Figure 9 (page 27). Note also the following:

- Relay operation in DIP mode is linked to RH measurement on HMW93, and to T measurement on TMW93.
- Relay contacts are open if the transmitter is in error state (an active error is present).
- Relay contacts are open when transmitter is powered off.

If you need to configure the relay for some other parameter or need additional configuration options.

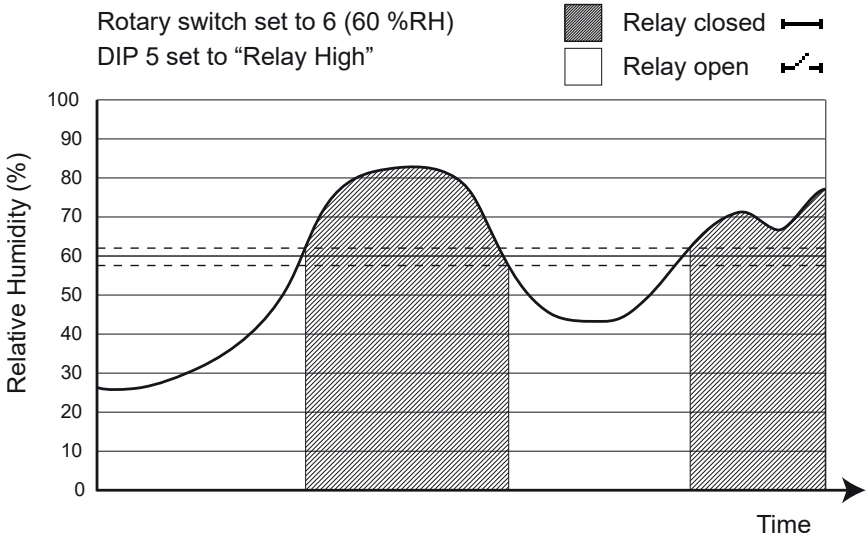


Figure 8 Relay high in DIP mode (HMW93)

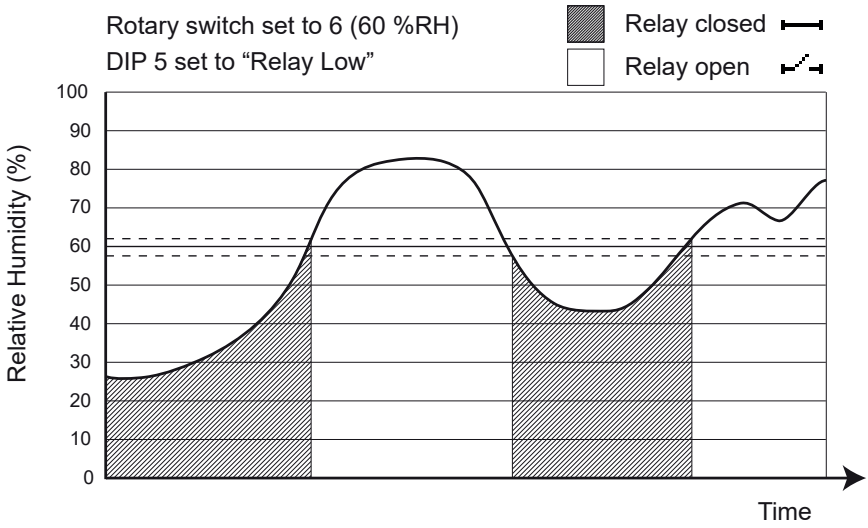


Figure 9 Relay low in DIP mode (HMW93)

There is a hysteresis around the setpoint value to prevent rapid relay switching when the measured value moves around the setpoint. This means that the relay will not close or open exactly at the setpoint, but slightly above and below.

- On HMW93 the hysteresis is 2 %RH in both directions.
- On TMW93 the hysteresis is 1 °C (1.8 °F) in both directions.

More information

- Relay configuration in custom mode (page 57)

3.1.1.3 Changing between DIP and custom configuration

If you change the position of DIP switch 8, note the following:

When changing from **DIP** to **Custom**, the DIP settings that were used when the power was last on are carried over to the custom settings at next power up.

When changing from **Custom** to **DIP**, current custom settings are overwritten by the settings from the DIP switches at next power up. Display layout and analog outputs are set to default settings:

- Channel 1 output parameter T, scaling -5 ... +55 °C.
- Channel 2 output parameter RH, scaling 0–100 %RH (if humidity measurement is present on the transmitter).

If you have a factory-customized transmitter, this may lead to a situation where the wiring label on the mounting base does not reflect the outputs of the transmitter.

3.1.2 Configuration of digital output models

Digital output models of the HMW90 series have the following configuration interfaces:

- DIP switches on the component board control operating protocol, serial line settings, and transmitter MAC address.
- You can set a jumper for RS-485 line termination on the component board (120 Ω resistor).
- Other settings are configured in software. You can change most configuration settings through the service port.
- Some configuration actions can be done using the Modbus protocols.

More information

- Product and part names (page 15)
- DIP switches of digital output models (page 29)
- Operation (page 40)
- Modbus reference (page 89)

3.1.2.1 DIP switches of digital output models

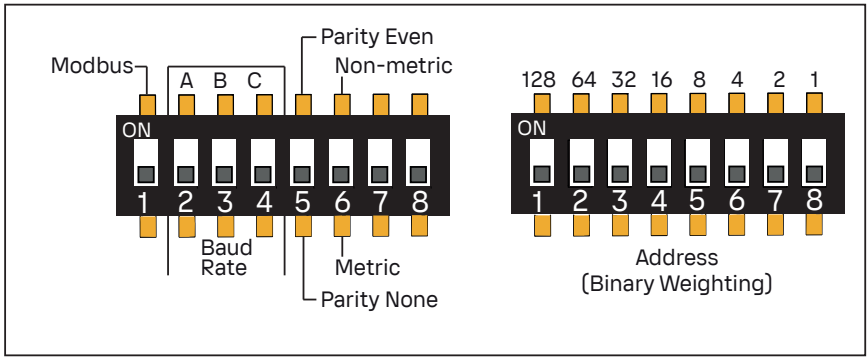


Figure 10 DIP switch settings of digital output models

1	Modbus			Modbus protocol in use
2–4	A	B	C	Serial line baud rate
	Off	Off	Off	Automatic (default)
	Off	Off	On	4800
	Off	On	Off	9600
	Off	On	On	19200
	On	Off	Off	38400
	On	Off	On	57600
	On	On	Off	76800
	On	On	On	115200
5	Parity Even			Selects 8 data bits, parity even, one stop bit (8E1) for Modbus protocol.
	Parity None			Selects 8 data bits, parity none, and two stop bits (8N2) for Modbus protocol.
6	Non-Metric			Uses non-metric units on display and service port. No effect on Modbus.
	Metric			Uses metric units on display and service port. No effect on Modbus.
7	Not used			
8	Not used			

If the serial line baud rate is set to Automatic, the transmitter attempts to determine the baud rate of the traffic in the RS-485 network. The transmitter cycles through all baud rate choices, listening for 10 seconds at each rate. When it detects valid RS-485 traffic, it remains at the detected baud rate until it is reset or power cycled.

The parity setting is only relevant for Modbus protocol, in which it chooses between 8N2 (parity none) and 8E1 (parity even) formats.

Dip switches marked **Address (Binary Weighting)** set the MAC address of the HMW90 series digital transmitter. The address is encoded in eight bit binary form, with each numbered switch representing a single bit. For example:

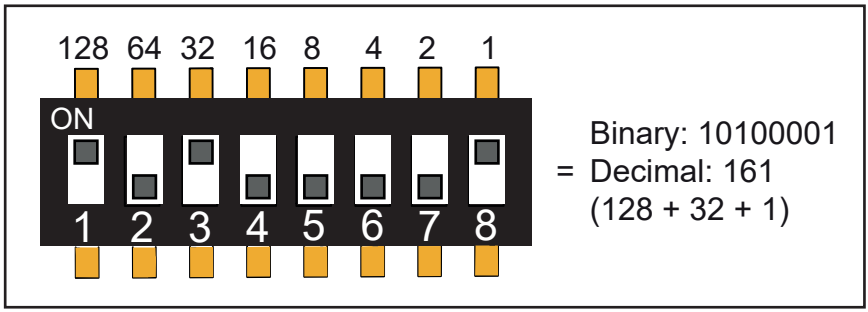


Figure 11 Example of transmitter addressing

3.1.2.2 Addressing with Modbus protocol

Transmitter is always a Modbus responder. MAC Address range for Modbus responders is 1–247.

3.2 Selecting location

The conditions at the location should represent well the area of interest. Do not install the transmitter 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.

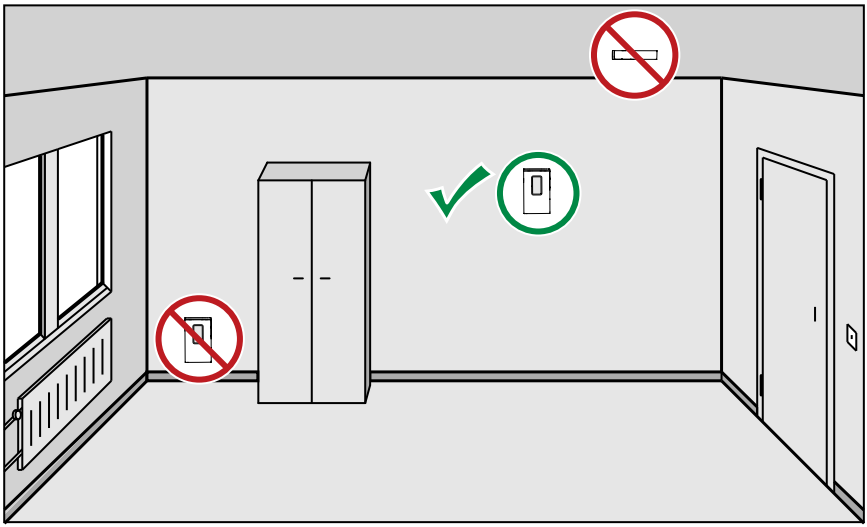


Figure 12 Selecting transmitter location

Use the mounting holes to attach the mounting base securely. Use at least two screws (not included, max. screw diameter 4 mm / 0.16 in). Remember to leave sufficient clearance below the transmitter to operate the slide.

When bringing a cable through the wall, note that the hole may also supply air from outside the room into the transmitter. This may affect the measurement readings. Seal the cable opening if necessary.

More information

- Dimensions and models (page 86)

3.3 Installing the mounting base

Use the mounting holes to attach the mounting base securely. Use at least two screws (not included). 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.

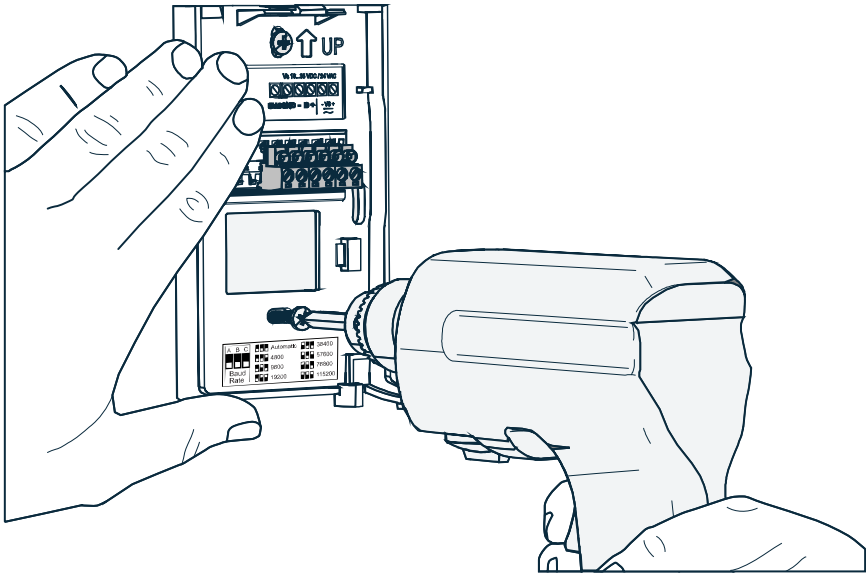


Figure 13 Installing the mounting base

3.4 Wiring

WARNING! Connect only de-energized wires.

1. Connect the wiring to the screw terminals on the mounting base. The supply voltage and terminal assignments are model-specific. Maximum wire size is 2 mm^2 (14 AWG). You can bring the cable to the housing from above or from behind (recommended).

2. After completing the wiring, connect the transmitter body over the mounting base. Note that mounting bases are model-specific.

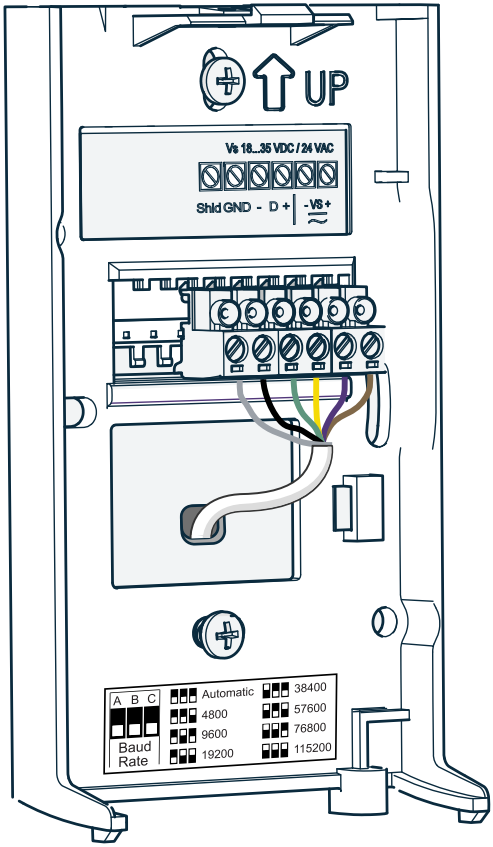


Figure 14 Wiring from behind (recommended)

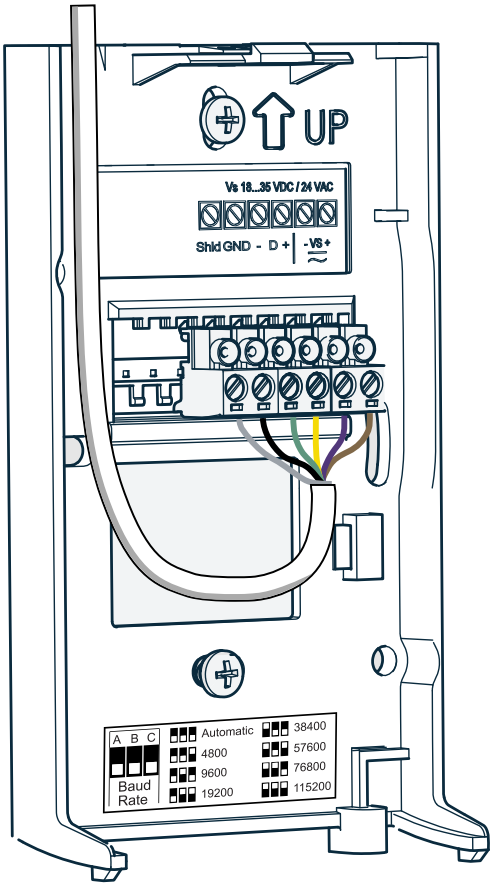


Figure 15 Wiring from above

3.4.1 Wiring HMW92

You must connect the RH channel of the HMW92, even if you only want to measure temperature. Connecting the T channel is optional.

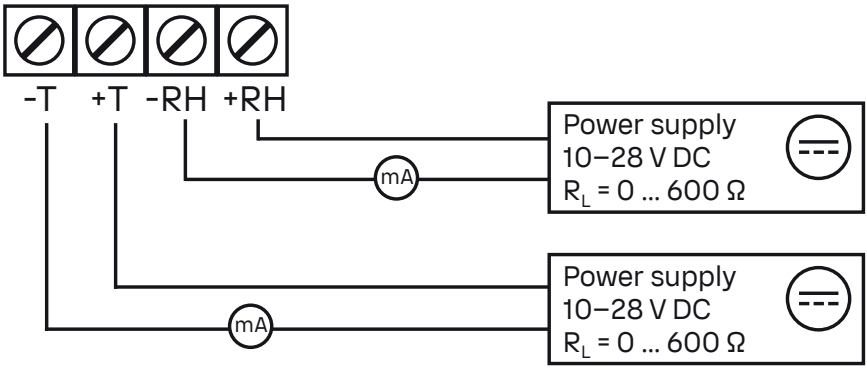


Figure 16 Wiring HMW92

If you want to use a single power supply for the HMW92, you must connect the positive terminals (+T and +RH) together.

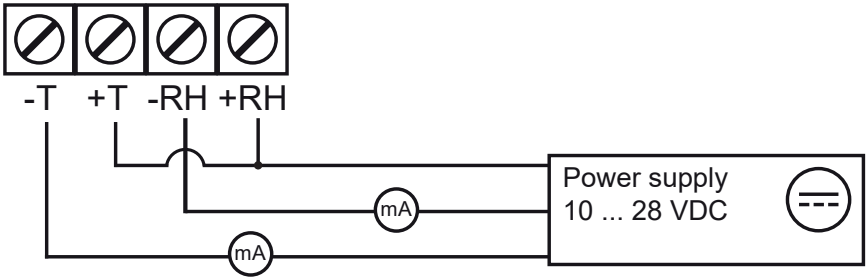


Figure 17 Three-wire wiring for HMW92

3.4.2 Wiring HMW93

Recommended wiring for long cables:

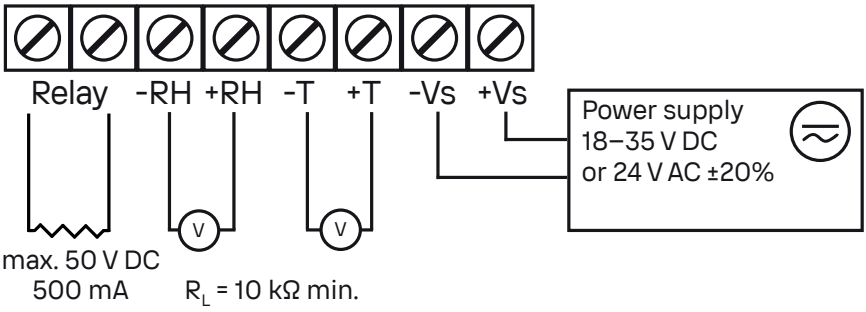


Figure 18 Wiring HMW93

3-wire connection with -Vs as common ground. Maximum cable resistance is 2.5 Ω (24 V supply, 0–10 V output, relay not used).

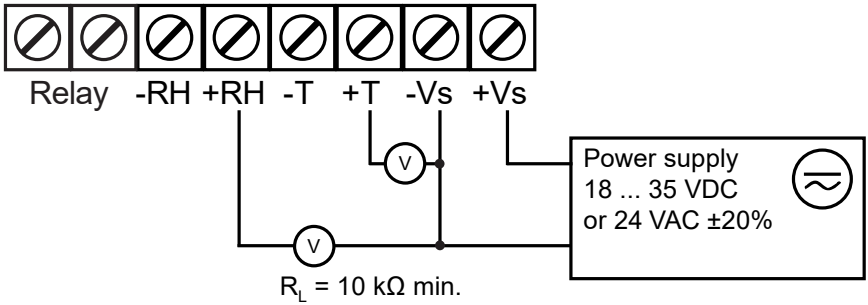


Figure 19 Three-wire wiring for HMW93

3.4.3 Wiring TMW92

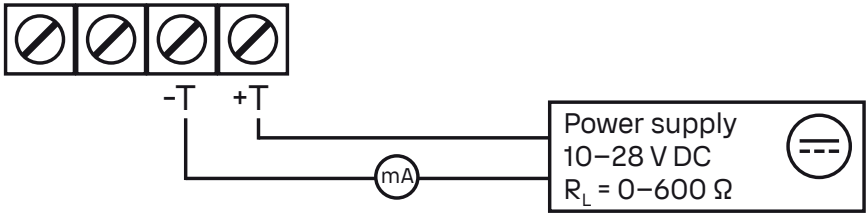


Figure 20 Wiring TMW92

3.4.4 Wiring TMW93

Recommended wiring for long cables:

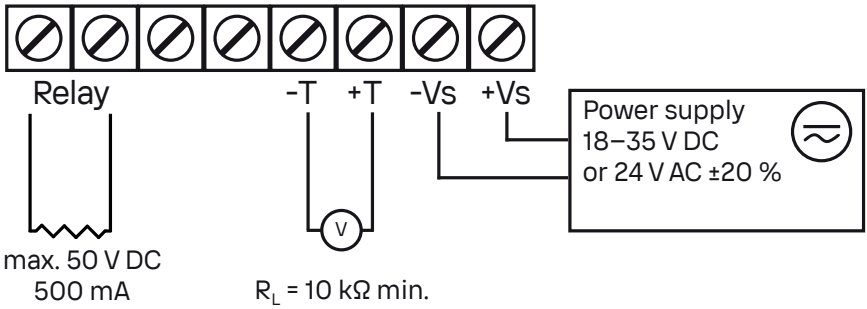


Figure 21 Wiring TMW93

3-wire connection with -Vs as common ground. Maximum cable resistance is 2.5 Ω (24 V supply, 0–10 V output, relay not used).

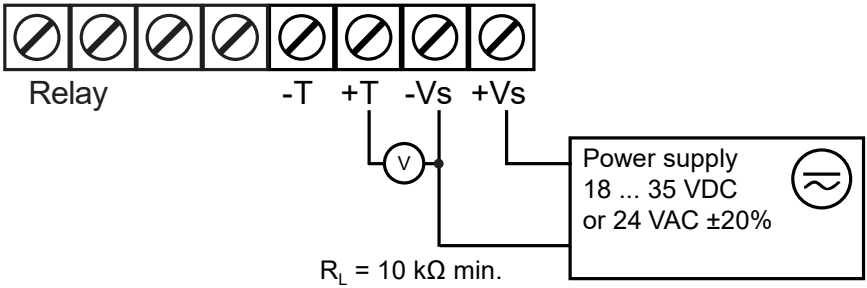


Figure 22 Three-wire wiring for TMW93

3.4.5 Wiring HMW95

The RS-485 line of the transmitter is isolated from the power supply. A separate ground reference terminal (**GND**) is provided for the RS-485 connection.

If you are using a shielded cable, you can use the **Shld** terminal to hold the exposed part of the shield. Note that the Shld terminal is floating (not electrically connected).

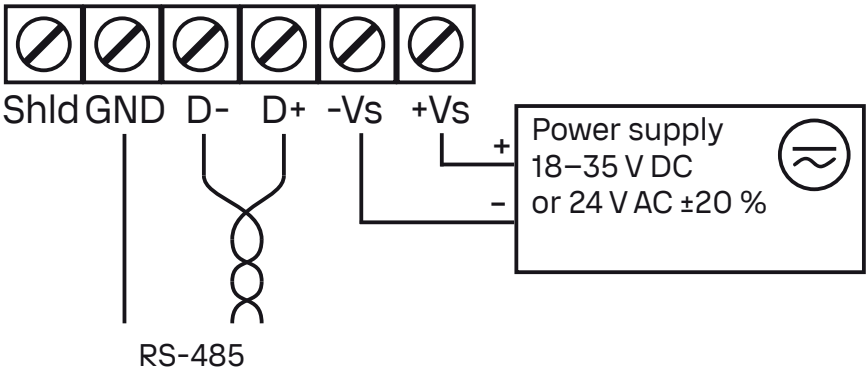


Figure 23 Wiring HMW95

3.4.5.1 Connecting several transmitters on same RS-485 line (HMW95)

Set the RS-485 termination jumper to “ON” on the transmitter that is at the end of the line. This terminates the line with a 120 Ω resistor.

Connect the cable shield to ground on the building controller side.

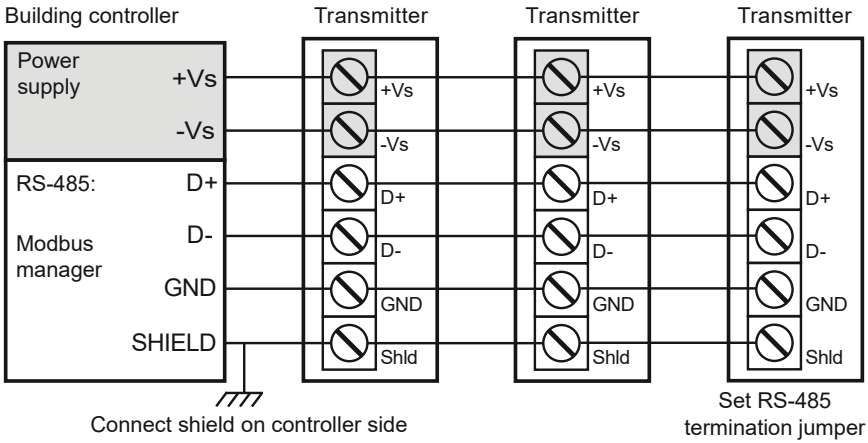


Figure 24 Several transmitters on the same RS-485 Line

More information

- Product and part names (page 15)

3.4.6 Connecting a common AC power supply to several transmitters

If you are connecting a common 24 V AC power supply to several transmitters, make sure to connect the same terminal to +Vs and −Vs on all transmitters. This will prevent a short-circuit through the shared common line at the controller.

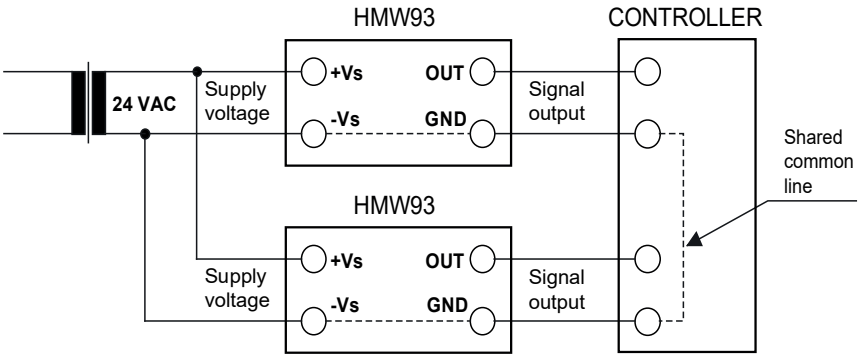


Figure 25 Connecting a common AC power supply

4. Operation

4.1 Display

4.1.1 Startup screens

When the transmitter is powered on, it displays a sequence of information screens. The screens are shown for a few seconds each.

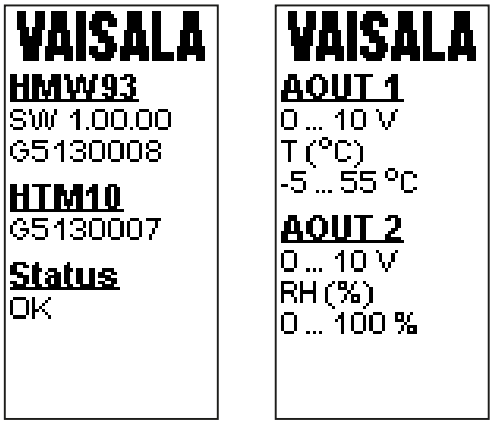


Figure 26 HMW93 startup screens

4.1.2 Measurement screen

Measurement screen shows the measured parameters and currently active indicators.

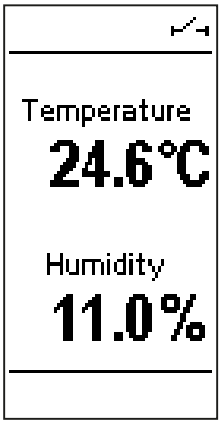


Figure 27 HMW93 measurement screen – normal operation

If there is a problem with measurement, affected readings are replaced with stars. The alarm indicator and an error message will also appear on the screen.

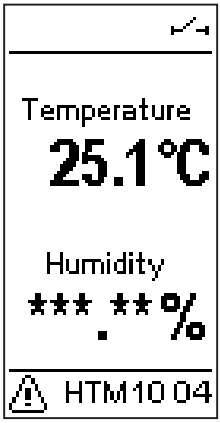


Figure 28 HMW93 measurement screen – problem with measurement

4.1.3 Symbols on the display

Table 6 Display symbols

Symbol	Position on screen	Meaning
	Top right	Communication arrows. Shown only on models with digital output. Down arrow is shown when transmitter detects valid traffic on the RS-458 line. Up arrow is shown when transmitter is transmitting to the RS-485 line.
	Top right	Is shown when relay contacts are open (HMW93 and TMW93 only).
	Top right	Is shown when relay contacts are closed (HMW93 and TMW93 only).
	Top left	Is shown when an Indigo80 indicator is connected to the service port.
	Bottom left	Is shown if an error is active. The error message is written after the symbol.

More information

- Error messages (page 77)

4.2 Service port

You can connect to the service port on the HMW90 series transmitters using a computer or an Indigo80 indicator. The Indigo80 indicator is a portable diagnostics tool for spot-checking and process monitoring, as well as for configuring, troubleshooting, calibrating, and adjusting compatible probes and transmitters.



CAUTION! The service port is not galvanically isolated from the rest of the transmitter electronics. Connect only equipment with a floating power supply (not grounded) to the service port. If you connect a device that is grounded to a different potential than the transmitter's power supply, you will affect the accuracy of the transmitter's analog outputs. You may even affect the transmitter's functionality or cause damage to the transmitter.

4.2.1 Connecting with Indigo80 indicator

When connecting the transmitter to an Indigo80 indicator, use an M8-M12 service cable (Vaisala item code 262195SP). The following functionality is available when using Indigo80:

- Standard Indigo80 functions such as viewing, data logging, and graphs of measurement data.
- Calibration and adjustment functions for the transmitter.
- Configuring the pressure and elevation compensation settings.

More information

- Calibration and adjustment with Indigo80 handheld indicator (page 68)

4.2.2 Connecting with 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.

Vaisala Insight PC software is available for download at vaisala.com/insight.

With the Insight PC software, you can:
- See device information and status.
- See real-time measurement data.
- Configure transmitter settings.
- Calibrate and adjust the connected devices.

Open the Insight PC software and connect the device using the Vaisala USB cable (Vaisala item code 219690). If you have not used the Vaisala USB cable before, install the driver before attempting to use the cable.

More information

- Installing the driver for the USB service cable (page 45)
- Adjustment using Insight PC software (page 71)

4.2.3 Connecting with computer using terminal application

Connecting with a computer allows you to configure and troubleshoot your transmitter using serial line commands.

When connecting using a computer, use the Vaisala USB cable (Vaisala item code 219690) and a suitable terminal application. If you have not used the Vaisala USB cable before, install the driver before attempting to use the cable.

More information

- Terminal application settings (page 44)
- Installing the driver for the USB service cable (page 45)
- List of serial commands (page 45)

4.2.3.1 Terminal application settings

The serial interface settings of the service port are presented in the table below. The settings are fixed, and cannot be changed by the user.

Table 7 Service port serial interface settings

Property	Description / value
Baud rate	19200
Parity	None
Data bits	8
Stop bits	1
Flow control	None

The steps below describe how to connect to the transmitter using the **PuTTY** terminal application for Windows (available for download at www.vaisala.com/software) and a USB serial interface cable:

1. If you have not used the Vaisala USB cable before, install the driver before attempting to use the cable.
2. Connect the USB serial interface cable between your computer and the service port of the transmitter.
3. Start the **PuTTY** application.
4. Select the **Connection** > **Serial** and check that the correct COM port is selected in the **Serial or USB line to connect to** field.
5. Check that the other serial settings are correct for your connection, and change if necessary. **Flow control** should be set to **None** unless you have a reason to change it.
6. Select **Terminal**. Use the following settings:

   Local Echo: Select **Force on**. This setting ensures that your typing is shown on the session window.

   CAUTION! Make sure that the **Send line ends with line feeds (CR+LF)** option is not selected. Enabling this option can cause issues with the terminal connection.

7. To open the connection window and start using the serial line, select **Open**.

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

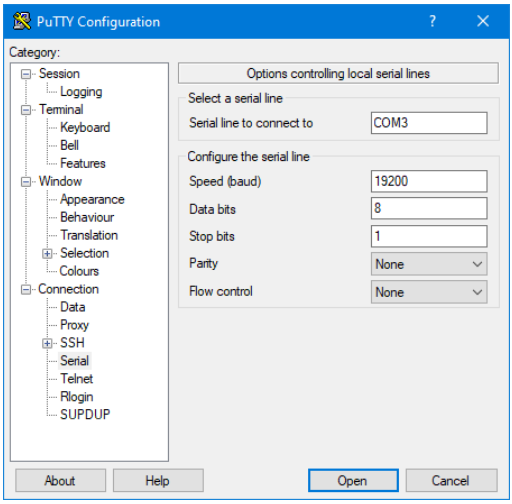


Figure 29 PuTTY terminal application

4.2.4 Installing the driver for the USB service cable

Before taking the USB service cable into use, you must install the provided USB driver on your computer. When installing the driver, you must acknowledge any security prompts that may appear.

1. Disconnect the USB service cable from the computer.
2. Download the Vaisala USB driver at vaisala.com/software (select the appropriate USB Instrument Driver Setup for your cable).
3. Extract the driver zip file and run the USB driver installation program *`Vaisala USB Device Driver Setup.exe`*. Accept the installation defaults.
4. After the driver has been installed, connect the USB service cable to a USB port on your computer. Windows will detect the new device, and use the driver automatically.

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

4.3 List of serial commands

Some commands, such as **RSEL**, are not available if the required feature is not present on the transmitter, or the command is not relevant.

All commands can be issued either in uppercase or lowercase.

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

Table 8 Basic serial commands

Command	Description
?	Show transmitter information.
CALCS	Show all measured and calculated parameters.
ECHO	Show or set remote echo mode.
ENV	Show or set environmental parameters.
ERRT	Show error table.
ERRS	Show currently active errors.
FORM [modifier string]	Show or set output format.
HELP	Show list of currently available serial commands.
INTV [0 … 9999 s/min/h]	Set continuous output interval for **R** command.
PASS [9000]	Access advanced serial commands.
R	Start the continuous outputting.
RESET	Reset the transmitter.
S	Stop the continuous outputting.
SDELAY [0 ... 255]	Show or set serial line turnaround delay in milliseconds.
SEND	Output measurement message once.
SNUM	Show transmitter serial number.
STATUS	Show transmitter status.
UNIT [m/n]	Select metric or non-metric units.
VERS	Show transmitter firmware version.

Table 9 Advanced serial commands

Command	Description
AMODE	Show or set analog output mode.
AOVER	Show or set analog output overrange and clipping behavior.
ASEL	Show or set analog output parameter.
ATEST	Test analog putput.
CDATE	Show or set calibration date.
CRH	Calibrate and adjust RH measurement.

Command	Description
CT	Calibrate and adjust T measurement.
CTEXT	Show or set calibration information.
DSEL	Select parameters to display on screen.
FRESTORE	Restore transmitter to factory settings.
RMODE	Show or set relay operation mode.
RSEL	Show or set relay parameter and limits.
RTEST [open/closed]	Test relay operation.

More information

- Configuration of analog output models (page 23)

4.4 Transmitter information

4.4.1 Show transmitter information

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

?<cr>

Example:

```
>?
Device              : HMW93
SW version          : 1.00.0.0000
SNUM                : G5130008

HTM10 module information
Software version    : 1.00.0
SNUM                : G5130007
```

4.4.2 Show transmitter firmware version

Use the **VERS** command to show the transmitter model and firmware version.

VERS<cr>

Example:

```
>vers
HMW93 / 1.00.0
```

4.4.3 Show transmitter serial number

Use the **SNUM** command to show the transmitter serial number.

SNUM<cr>

Example:

```
>snum
Serial number      : G5130008
```

4.4.4 Show transmitter status

Use the **STATUS** command to view detailed information on transmitter model and configuration.

STATUS [-modbus]<cr>

Example (display full status):

```
>status -modbus
* MODBUS module (MODBUS) *
MODBUS protocol     : active
Address             : 21 (15h)
Baud setting        : 19200 8N2
Current baudrate    : 19200
Baudrate locked     : No
Baud detection interval: 10 s
Valid frames        : 0
Invalid frames      : 0
Unwanted frames     : 0
>
```

4.4.5 Show measured parameters

Use the **CALCS** command to list the measurement parameters that are supported by the HMW90 series transmitters. **RH** and **T** are measured directly by the transmitter, the rest are calculated based on the measured values.

CALCS<cr>

Example:

```
>calcs
RH - Relative Humidity
T - Temperature
Tdf - Dew/Frost point temperature
Td - Dew point temperature
Tw - Wetbulb temperature
h - Enthalpy
x - Mixing ratio
a - Absolute humidity
dTd - Dew/frostpoint depression
```

Using this command on TMW92 and TMW93 transmitters will list all parameters, even though these transmitters only provide the temperature parameters.

4.4.6 Show command help

To see a short description of an individual command, issue the command with a question mark as a parameter.

Example:

```
>calcs ?
Display measured quantities
```

4.4.7 Show command list

Use the **HELP** command to list the currently available serial commands. If the **PASS** command has not been used, only the basic serial commands are available.

HELP<cr>

Example (shows basic serial commands, advanced commands are not enabled here):

```
>help
?
CALCS
ECHO
ENV
ERRT
ERRS
FORM
HELP
INTV
PASS
R
RESET
SDELAY
SEND
SNUM
STATUS
UNIT
VERS
```

4.5 Measurement settings

4.5.1 Set environmental parameters

Use the **ENV** command to set environmental parameters that affect the measurement. For HMW90 series transmitters you can set the ambient pressure value that is used for pressure compensation of calculated parameters.

ENV [pressure]<cr>

where **pressure** is ambient pressure in hPa.

Example:

```
>env 1013.3
Pressure (hPa) : 1013.3
```

4.5.2 Select units

Use the **UNIT** command to select metric or non-metric output units. Only affects data shown on the display and service port, has no effect on the analog and digital outputs. This command is not available on the digital output models (for example, HMW95).

UNIT [x]<cr>

where **x** selects the unit type to output:

- m = metric units, for example, Celsius
- n = non-metric units, for example, Fahrenheit

Example:

```
>unit m
Unit : Metric
```

4.6 Analog output settings

If you want to change analog output settings, you must set the transmitter's configuration DIP switch 8 to position Custom. If the switch is set to DIP, the settings are view-only.

Commands for configuring analog outputs are not available on digital output models (for example, HMW95).

4.6.1 Set analog output mode

Use the **AMODE** command to set the analog output mode and error level. Note that you cannot change between analog output types, for example, from voltage to current output.

AMODE [channel lo_value hi_value error_value]<cr>

where
- channel = analog output channel, 1 or 2
- lo_value = low limit of the channel
- hi_value = high limit of the channel
- error_value = error value of the channel

Example (show current configuration):

```
>pass 9000 >amode
Aout 1 range ( V) : 0.00 ... 5.00 (error: 5.50)
Aout 2 range ( V) : 0.00 ... 5.00 (error: 5.50)
```

Example (set channel 1 to 0 ... 1 V output, with error level at 2 V):

```
>amode 1 0 1 2
Aout 1 range ( V) : 0.00 ... 1.00 (error: 2.00)
```

4.6.2 Set analog output scaling

Use the **ASEL** command to select the output parameter and scaling for analog output channels.

ASEL [channel parameter lo_value hi_value]<cr>

where
- channel = Analog output channel, 1 or 2.
- parameter = Parameter that is output on the channel. Available parameters are:
  - RH (relative humidity)
  - T (temperature)
  - $T_{d/f}$ (dew/frost point temperature)
  - T_d (dew point temperature)
  - T_w (wetbulb temperature)
  - h (enthalpy)
  - x (mixing ratio)
  - a (absolute humidity)
  - dT_d (dew/frost point depression)
- lo_value = Low limit of the scaling, in the units of the selected parameter.
- hi_value = High limit of the scaling in the units of the selected parameter.

Example (set channel 1 to output dewpoint, in the range –10 ... 20 °C):

```
>pass 9000
>asel 1 TD -10 20
Aout 1 quantity : Td (-10.00 ... 20.00 'C)
```

4.6.3 Set output clipping and error limit

Use the **AOVER** command to define the behavior of the analog outputs when the measured value is outside the scaled output range.

AOVER [channel clip% valid%]<cr>

where

- channel = Analog output channel, 1 or 2.
- clip% = Output margin (%) at which the output is clipped. Range 0–20, default is 0.
- valid% = Output margin (%) at which the output of the channel goes into the error state. Range 0–20, default is 5. The error state is defined using the **AMODE** command.



These settings have no effect on the measurements shown on the display. The display will always show the currently measured values, even outside the scaled output range, as long as the measurement is still functioning.

For example, first check the analog output settings using **ASEL**, **AMODE**, and **AOVER** commands:

```
>pass 9000 >asel
Aout 1 quantity : RH (0.00 ... 100.00 %)
Aout 2 quantity : T (-5.00 ... 55.00 'C)
>amode
Aout 1 range ( V) : 1.00 ... 5.00 (error: 6.00)
Aout 2 range ( V) : 1.00 ... 5.00 (error: 6.00)
>aover Aout 1 clipping : 0.00 %
Aout 1 error limit : 5.00 %
Aout 2 clipping : 0.00 %
Aout 2 error limit : 5.00 %
```

The parameter for channel 2 is T, with standard output range 1–5 V and scaling −5 ... 55 °C. Error state is 6 V, which is set when the measured value is 5% outside the scaled output range.

Now give the following **AOVER** command:

```
>aover 2 10.0 20.0
Aout 2 clipping : 10.00 %
Aout 2 error limit : 20.00 %
```

Channel 2 now behaves like this:

- Clipping is now set to 10%, meaning the output is allowed to vary between 0.6–5.4 V. The channel will output the measurement for −11 ... 61 °C, but range 1–5 V remains scaled to show −5 ... 55 °C.
- Error limit is 20 %, which means channel 2 will show the error state (6 V) when the measured value is 20 % outside the scaled output range. With the settings above, this will happen if the measured temperature is outside range −17 ... 67 °C.

- The output will never actually be between 5.4 and 6.0 V because of clipping.

More information

- Set analog output mode (page 51)

4.7 Display settings

4.7.1 Select parameters to display

Use the **DSEL** command to select the parameters that are displayed on the transmitter screen. You can select parameters by abbreviation, or select same parameters as are assigned to the analog outputs. If only one parameter is selected, it is shown vertically centered on the transmitter screen.

DSEL [Q1 Q2 Q3]<cr>

where

- Q1 = First parameter to show on the screen. Available parameters are:
  - **out1** same parameter as analog output channel 1
  - **out2** same parameter as analog output channel 2
  - **RH** relative humidity
  - **T** temperature
  - **Tdf** dew/frost point temperature
  - **Td** dew point temperature
  - **Tw** wetbulb temperature
  - **h** enthalpy
  - **x** mixing ration
  - **a** absolute humidity
  - **dTd** dew/frost point depression
- Q2 = Second parameter to show on the screen. Available parameters are the same as for Q1.
- Q3 = Third parameter to show on the screen. Available parameters are the same as for Q1.

Example (show currently displayed parameters):

```
>pass 9000
>dsel
Quant 1 : T
Quant 2 : RH
Quant 3 : Disabled
```

Example (change display to only show RH):

```
>dsel RH
OK
```

Example (change display to show same parameters as are assigned to analog output channels):

```
>dsel out1 out2
OK
```

4.8 Serial line output commands

4.8.1 Start measurement output

Use the **R** command to start the continuous outputting of measurement values as an ASCII text string to the serial line. The format of the measurement message is set with the **FORM** command.

R<cr>

Example (measurement message in default format):

```
>r
RH = 21.71 %RH T = 23.13 'C
RH = 21.72 %RH T = 23.12 'C
RH = 21.77 %RH T = 23.12 'C
RH = 21.77 %RH T = 23.12 'C
...
```

Outputting the results continues in intervals issued with the command **INTV**. You can stop the output with the **S** command. Since the interface is half-duplex, you must enter the commands when the transmitter is not outputting.

4.8.2 Stop measurement output

You can stop the measurement output with the **S** command:

S<cr>

4.8.3 Output a reading once

Use the **SEND** command to output a single measurement message.

SEND<cr>

Example:

```
>send
RH = 21.72 %RH T = 23.12 'C
```

4.8.4 Set output interval

Use the **INTV** command to change the output interval of the automatically repeating measurement messages. The measurement messages are repeated in the **RUN** mode, or after the **R** command has been given.

INTV [n xxx]<cr>

where
- n = time interval, range 0–9999
- xxx = time unit = "S", "MIN", or "H"

The shortest output interval (with n = 0) outputs the measurement messages as quickly as the transmitter produces them, without additional delay.

Example:

```
>intv 1 min
Output interval : 1 min
```

4.8.5 Set output format

Use the serial line command **FORM** to change the measurement message sent by the transmitter on the service port. You can freely define the output message to include the desired parameters, formatting options, text strings, and additional fields.

FORM [modifier string]<cr>

where
- modifier string = String of parameters and modifiers that defines the output format, length 1–150 characters. Maximum length may be shorter when text strings are used.

Command to set default format:

>form /

Example of default output:

```
RH = 5.17 %RH T = 24.33 'C
RH = 5.17 %RH T = 24.33 'C
RH = 5.18 %RH T = 24.33 'C
RH = 5.18 %RH T = 24.33 'C
...
```

Command to set output format as **Tdf** and **T** with Modulus-256 checksum:

```
>form "Tdf =" U3 4.2 tdf " T =" U3 3.2 t CS2 \r \n
```

Output example:

```
Tdf = -15.72 'C T = 24.38 'C C9
Tdf = -15.71 'C T = 24.38 'C C8
Tdf = -15.71 'C T = 24.38 'C C8
Tdf = -15.69 'C T = 24.38 'C CF
...
```

Command to set output format as **Tdf** and **T**, with start of text (ASCII character 002) and end of text (003) ASCII codes, and without line feed and carriage return at the end:

```
>form #002 "Tdf =" U3 3.2 tdf " T =" U3 3.2 t #003
```

Output example (ASCII codes not visible here):

```
Tdf =-15.14 'C T = 24.40 'CTdf =-15.14 'C T = 24.40 'CTdf =-15.14 'C T = 24.40
'CTdf =-15.14 'C T = 24.40 'CTdf =-15.13 'C T = 24.40 'CTdf =-15.13 'C T =
24.40 'C ...
```

Table 10 FORM command parameters

Measured parameter	Abbreviation in FORM command
Relative humidity	RH
Temperature	T
Dew/frost point temperature	Tdf
Dewpoint temperature	Td
Wetbulb temperature	Tw
Enthalpy	h
Mixing ratio	x
Absolute humidity	a
Dew/frost point depression	dTd

Table 11 FORM command modifiers

Modifier	Description
x.y	Length modifier (number of digits and decimal places)
#t	Tabulator
#r	Carriage-return
#n	Line feed
""	String constant, length 1–15 characters
#xxx	ASCII code value (decimal) of a special character; for example, #027 for ESC
Ux	Shows the name of the measurement unit using “x” number of characters. For example, U3 shows the name of the measurement unit with three characters
CS2	Modulus-256 checksum of message sent so far, ASCII encoded hexadecimal notation
CS4	Modulus-65536 checksum of message sent so far, ASCII encoded hexadecimal notation
CSX	NMEA xor-checksum of message sent so far, ASCII encoded hexadecimal notation

When entering modifiers, you can also use the backslash character "\" instead of the hash "#".

4.9 Serial line settings

4.9.1 Set remote echo

Use the **ECHO** command to enable or disable remote echo by the transmitter.

ECHO [on/off]<cr>

Example:

```
>echo on
Echo : ON
```

4.9.2 Set serial line turnaround delay

With the **SDELAY** command you can set the turnaround delay of the transmitter (time waited before replying to an incoming message) or view the currently set delay value.

SDELAY [delay]<cr>

where

- delay = Turnaround delay in milliseconds, range 1–1000. Default is 1.

Example:

```
>sdelay 5
COM1 transmit delay : 5
```

4.10 Relay configuration in custom mode

Relay is included on HMW93 transmitters only.

Additional configuration options are available when relay functionality is configured via software. The configuration is done using the **RMODE** and **RSEL** commands.

More information

- Relay configuration examples (page 59)

4.10.1 Set relay mode

Use the **RMODE** command to show or set the relay activation mode.

RMODE [mode]<cr>

where
- mode = Activation mode of the relay. Options are:
  - **None** (relay is disabled, always open)
  - **Lo_active** (relay closed when below setpoint)
  - **Hi_active** (relay closed when above setpoint)
  - **Fault** (relay closed when transmitter in error state)
  - **Not_fault** (relay closed when transmitter not in error state)

Example (set relay to **Lo_active** mode):

```
>pass 9000 >rmode lo_active
Relay mode : Lo_Active
```

4.10.2 Set relay parameter and limits

Use the **RSEL** command to show or set the parameter that controls the relay, and the limits that are applied.

RSEL [parameter lo_value hi_value]<cr>

where
- parameter = Parameter that controls the relay. Available parameters are:
  - RH relative humidity
  - T temperature
  - Tdf dew/frost point temperature
  - Td dew point temperature
  - Tw wetbulb temperature
  - h enthalpy
  - x mixing ratio
  - a absolute humidity
  - dTd dew/frost point depression
  - Disabled no parameter, relay disabled
- lo_value = Low limit of relay activation.
- hi_value = High limit of relay activation.

Example (show current settings):

```
>pass 9000
>rsel
Relay configuration : RH (88.00 ... 92.00 %)
```

Example (set temperature as relay parameter, low limit 25, high limit 30):

```
>rsel t 25 30
Relay configuration : T (25.00 ... 30.00 'C)
```

4.10.3 Relay configuration examples

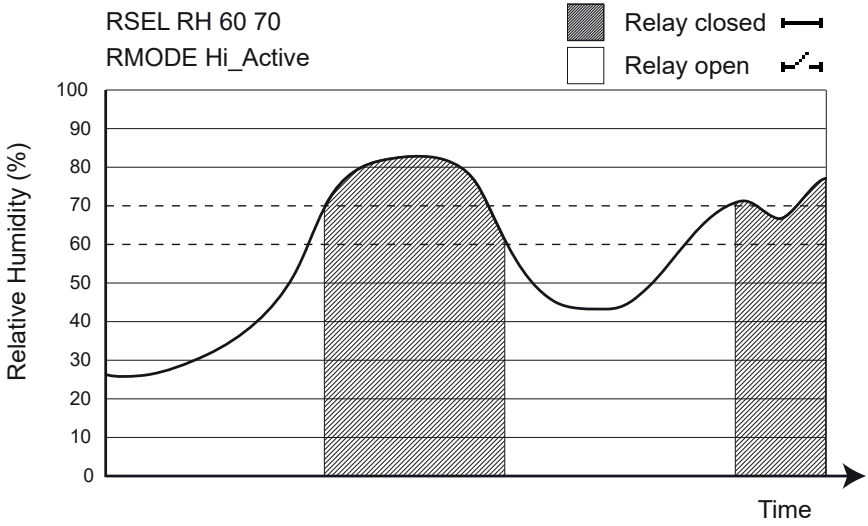


Figure 30 Relay Hi_Active in custom mode (HMW93)

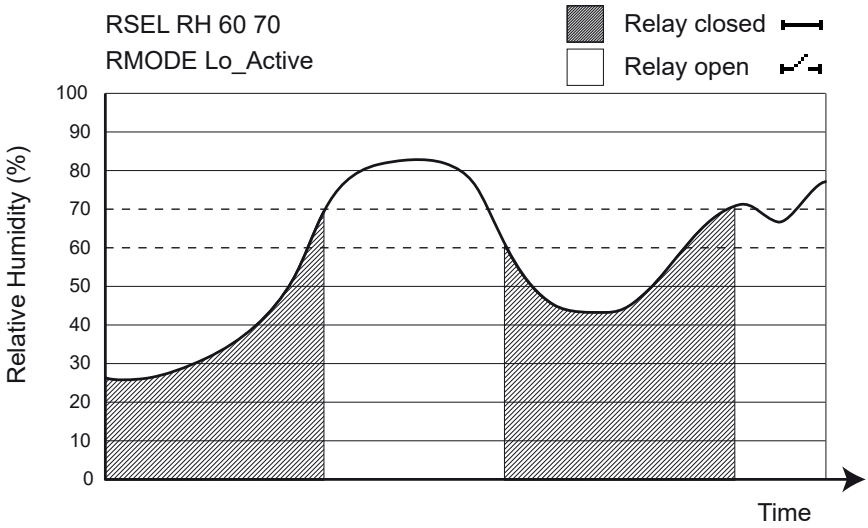


Figure 31 Relay Lo_active in custom mode (HMW93)

4.11 Calibration and adjustment commands

The following sections describe the calibration and adjustment commands of the HMW90 series.

The 1-point humidity adjustment of the HMW90 series adjusts both offset and gain, depending on the adjustment condition. In a dry condition (for example, 11 %RH), offset is adjusted more than gain.

The 1-point humidity adjustment requires that the target condition is at least 50 % of the currently measured value. This prevents the user from making excessive corrections that are very unlikely to be needed. However, if you feel that you may have done an incorrect adjustment, you can easily remove the adjustment using the **CRH RESET** command.

You must enable advanced serial commands using the **PASS 9000** command before using the calibration and adjustment commands.

More information

- Adjustment using a computer with a terminal application (page 72)

4.11.1 Adjust humidity measurement

Use the **CRH** command to perform a humidity adjustment of the relative humidity (RH) measurement. You can do a 1-point or a 2-point adjustment, or clear the adjustment information from the HTM10 module. Note that the factory adjustment will remain intact when user adjustment is cleared.



The **CRH** command does nothing on the TMW92 and TMW93 transmitters.

4.11.1.1 Show current RH adjustment

CRH<cr>

Example (showing default offset and gain):

```
>pass 9000
>crh
RH Gain : 1.000
RH Offset : 0.000
```

4.11.1.2 1-point adjustment of RH measurement

The 1-point adjustment adjusts both offset and gain depending on the adjustment condition. The same type of adjustment is done when turning the RH trimmer.

Place the transmitter in the reference condition and allow it to stabilize before entering the adjustment.

CRH [ONE] [x]<cr>

where

- x = The reference humidity condition (%RH) that the transmitter should be showing.

Example:

```
>pass 9000
>crh one 11
OK
```

4.11.1.3 2-point adjustment of RH measurement

CRH [LO | HI] [x]<cr>

where

- LO = Adjustment point at the dry end (low RH).
- HI = Adjustment point at the wet end (high RH). The difference between the two points should be at least 30 %RH.
- x = The reference humidity condition (%RH) that the transmitter should be showing.

The 2-point correction is not applied immediately – you must use the **CRH SAVE** command to store your adjustment to the HTM10 module. If you have entered user adjustments using the **CRH** command but do not wish to commit them, use the **CRH CANCEL** command.

CRH [SAVE | CANCEL]<cr>

Example (two point adjustment, low point 11 %RH and high point 75 %RH):

```
>pass 9000
>crh lo 11
OK
>crh hi 75
OK
>crh save
OK
```

4.11.1.4 Clear user adjustment of RH measurement

CRH [RESET]<cr>

Example:

```
>pass 9000
>crh reset
OK
```

4.11.2 Adjust temperature measurement

Use the **CT** command to perform an adjustment of the temperature measurement. You can do a 1-point adjustment or clear the adjustment information from the HTM10 module. Note that the factory adjustment will remain intact when user adjustment is cleared.

4.11.2.1 Show current T adjustment

CT<cr>

Example (showing default temperature offset):

```
>pass 9000
>ct
Temperature offset : 0.000
```

4.11.2.2 1-point adjustment of T measurement

Place the transmitter in the reference condition and allow it to stabilize before entering the adjustment.

CT [x]<cr>

where

- x = The reference temperature (in degrees Celsius) that the transmitter should be showing.

Example:

```
>pass 9000
>ct 23
OK
```

4.11.2.3 Clear user adjustment of T measurement

CT [RESET]<cr>

Example:

```
>pass 9000
>ct reset
OK
```

4.11.3 Enter calibration and adjustment information

Use the **CTEXT** command to store a text string that describes the calibration and/or adjustment. To enter a text string with spaces, enclose the string in quotation marks. Use the **CDATE** to store the date.

CTEXT [text]<cr>

CDATE [YYYY-MM-DD]<cr>

Examples:

```
>pass 9000
>ctext “adjusted rhlab/Tech021”
“adjusted rhlab/Tech021”
```

```
>cdate 2011-12-08
Calibration date : 2011-12-08
```

4.12 Testing commands

4.12.1 Test analog outputs

Use the **ATEST** command to force the analog outputs to the given value. Before using the **ATEST** command, it is useful to give the **AMODE** command to verify the output mode of the channels.

ATEST [channel value]<cr>

where

- channel = Number of analog output channel to be tested (1 or 2).
- value = Voltage or current value to set the channel to. Unit is determined according to output type (V or mA).

The value you set may not be achievable by the transmitter. Voltage output can go as high as 12 V, and current output can go up to 25 mA. Also, current output cannot go down to zero.

After testing the output, give the **ATEST** command with the channel number to exit the test mode.

Example (verify output mode of the channels):

```
>pass 9000
>amode
Aout 1 range ( V) : 0.00 ... 5.00 (error: 5.50)
Aout 2 range ( V) : 0.00 ... 5.00 (error: 5.50)
```

Example (set channel 1 to 6 V):

```
>atest 1 6
Aout1 ( V) : 6.000
```

Example (end test mode for channel 1, resume normal output):

```
>atest 1
Aout1 test mode disabled.
```

4.12.2 Test relay operation

Use the command **RTEST** to test the operation of the relay. Issue the command without parameters to end the relay test.

where

- state = State of the relay contacts. Options are:
  - **open** (open the relay contacts)
  - **closed** (close the relay contacts)

Example (close relay contacts):

```
>pass 9000
>rtest closed
Relay test mode : Closed
```

Example (exit relay test mode, resume normal operation):

```
>rtest
Relay test mode : Canceled
```

4.13 Other commands

4.13.1 Enable advanced serial commands

Use the **PASS** command to enable the advanced serial commands.

PASS [passcode]<cr>

where
- passcode = Passcode to enable advanced commands is 9000.

Example:

```
>pass 9000
```

4.13.2 Reset transmitter

Use the **RESET** command to reset the transmitter.

RESET<cr>

Example:

```
>reset
Resetting
HMW93 / 1.00.00.0000 / XM90
>
```

5. Calibration and adjustment

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

HMW90 series transmitters are fully calibrated as shipped from factory. HMW90 series transmitters have a display that makes it easy to compare the measured readings against any portable calibration reference. Note that depending on the ordered configuration, the display may be hidden under the sliding cover.

For adjustment of the measurement, you have the following options:
- 1-point adjustment using the trimmers under the sliding cover.
- 1-point or 2-point adjustment using the service port.

If adjustment is not enough to restore the measurement accuracy of the transmitter, you can also replace the measurement module.

The adjustment of temperature measurement is always a simple 1-point offset correction.

The 1-point humidity adjustment of the HMW90 series adjusts both offset and gain, depending on the adjustment condition. In a dry condition (for example, 11 %RH), offset is adjusted more than gain.

The 1-point humidity adjustment requires that the target condition is at least 50 % of the currently measured value. This prevents the user from making excessive corrections that are very unlikely to be needed. However, if you feel that you may have done an incorrect adjustment, you can easily remove the adjustment using the HM70 or the **CRH RESET** command on the serial line.

Only T adjustment is available on the TMW92 and TMW93 transmitters.

More information

- Adjustment using display and trimmers (page 67)
- Calibration and adjustment with Indigo80 handheld indicator (page 68)
- Adjustment using Insight PC software (page 71)
- Adjustment using HM70 (page 72)
- Adjustment using a computer with a terminal application (page 72)
- Replacing the measurement module (page 74)

5.1 Adjustment using display and trimmers

CAUTION! The trimmers only turn 135 degrees each way, less than half a rotation. Do not force the trimmer past the stopping point. If you wish to apply a greater correction than allowed by the trimmer in a single adjustment, simply adjust the transmitter again. Corrections applied using the trimmers are cumulative.

User calibration settings (adjustment by trimmers or service port) are stored in the HTM10 module. If you replace the module, there is no need to undo previous adjustments.

1. To enter the adjustment screen, open the slide and rotate the RH or T trimmer slightly during normal measurement. If the trimmer is not centered, you see the trimmer centering screen first. Simply turn the trimmer to the center and wait for the progress bar to complete.

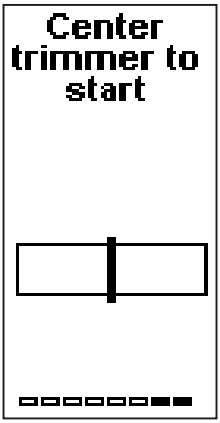


Figure 32 Trimmer centering screen

2. In the adjustment screen, turn the trimmer to set the desired correction. To commit the change, stop turning the trimmer and wait.

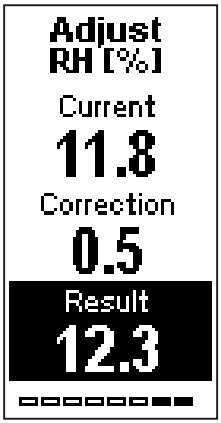


Figure 33 Trimmer centering screen

3. If you wish to apply a greater correction than allowed by the trimmer in a single adjustment, re-enter the adjustment screen and apply a new correction. Corrections applied using the trimmers are cumulative.

5.2 Calibration and adjustment with Indigo80 handheld indicator

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

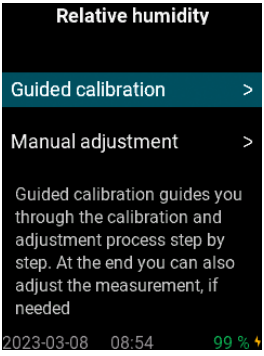


Figure 34 Indigo80 calibration methods

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

More information

‣ Connecting with Indigo80 indicator (page 42)

5.2.1 Performing guided calibration with Indigo80 handheld indicator



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

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

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

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

1. Connect the transmitter to the indicator.
2. Open the indicator main menu by pressing ☰.
3. Select **Devices**. If you have more than one device connected to the indicator, make a further selection between the devices.
4. Select **Calibrate / Adjust**.
5. Acknowledge the notification by selecting **OK**.
6. Select the type of calibration or adjustment to perform, for example, **T adjustment**
7. Select **Guided calibration**.
8. In **Calibration points**, select the number of calibration points: **1 point** or **2 points**.
9. If you are using a reference instrument connected to Indigo80, the name of the connected device is displayed under **Reference**.

   Selection **Other reference** allows you to use any reference environment(s) of your choice. When you have selected the references for 2-point calibration, press ⟲ to get back to the previous view.

10. Select **Start calibration**.

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

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

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

This procedure tells you how to use the Indigo80 handheld indicator to adjust the device's measurement in 1–2 points when you have a list of previously collected calibration readings available (for example, in a calibration certificate from a 3rd party laboratory calibration). You can adjust the device without having to generate the calibration conditions and wait for stabilization.

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

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

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

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

      Should you need to read the reference value from another device connected to Indigo80, Vaisala recommends accessing this functionality from the **Guided calibration** menu of Indigo80.
8. If you have **one device** connected to the indicator:
   a. Select **Manual adjustment**.
   b. Scroll down and acknowledge the notification by selecting **OK**.
9. Select **Reference value, point 1**.
10. Use the arrow buttons to set the reference value (for example, the reference humidity value from your calibration certificate), and then select **OK** or **Set**.
11. Scroll down and select the **Measured value, point 1** field. Replace the automatically inserted value with your previously measured calibration reading (for example, the observed humidity value from your calibration certificate).
12. Scroll down and repeat for **Reference value, point 2** and **Measured value, point 2** (if performing a 2-point adjustment).
13. Scroll down and select **Activate adjustment**.

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

5.3 Adjustment using Insight PC software

1. Connect the transmitter to Insight.
2. Select ⚙ > **Calibrate** > **Yes**.
3. Select the desired adjustment.
4. Follow the instructions on the Insight interface.
5. Disconnect the transmitter from Insight.

More information

- Connecting with Insight PC software (page 43)

5.4 Adjustment using HM70

1. Connect the HMW90 series transmitter to the HM70 handheld meter using the connection cable (Vaisala item code 219980).
2. Depending on the connected devices, you may be prompted by the HM70 meter to check the currently applied environment settings. Check the settings when prompted.
3. In the **Functions** menu of the HM70, select **Calibrate XMW9x** and press **Start**.
4. Confirm **Yes**. Confirm the automatic power off notification with **Ok**.
5. Select parameter for adjustment, T or RH.
6. Screen shows the measured values and their difference. Press **Adjust** to select the Adjustment mode.
7. Select the desired adjustment type using arrow buttons and press **Select**:
   - **To same as reference**: Adjusts the measurement of the HMW90 transmitter to the same reading as the reference that is connected to the other port. When the parameter being adjusted is RH, both offset and gain are adjusted, depending on the adjustment condition (same as when turning the RH trimmer). This option is not available if no reference is connected to the HM70.
   - **1-point adjustment**: Adjusts the measurement of the HMW90 to a reference value that you specify. When the parameter being adjusted is RH, both offset and gain are adjusted, depending on the adjustment condition (same as when turning the RH trimmer). Follow the instructions from the HM70 when using this option.
   - **2-point adjustment**: Adjusts the measurement of the HMW90 at two points to reference values that you specify. This option is not available when adjusting temperature (T).
   - **Revert factory calib.**: This option removes the currently applied user adjustment from the HTM10 module. Only the adjustment for the selected parameter is removed (RH or T).
8. Complete the selected adjustment by following the instructions from the HM70.

5.5 Adjustment using a computer with a terminal application

1. Connect the HMW90 series transmitter to your computer using the Vaisala USB cable (item code 219690).
2. Start a terminal application and open a new session to the service port of the transmitter. The serial line settings are 19200, N, 8, 1.

3. Before changing the adjustment, issue the following commands to see the transmitter's current adjustment information:

```
pass 9000
crh
ct
ctext
cdate
```

4. Place the entire transmitter in the desired reference condition and allow the measurement to stabilize. Follow the stabilization from the serial line (output from the **R** command) or the display.
5. You can now use the **CRH** and **CT** commands to adjust the transmitter's RH and T measurement. Refer to the command descriptions for the available options.
6. After performing the adjustment, verify from the serial line or the display that the measurement has been corrected.
7. After completing the adjustments, you can enter a descriptive text string in the transmitter's memory using the **CTEXT** command, and note the adjustment date using the **CDATE** command.

More information

- Connecting with computer using terminal application (page 43)
- Calibration and adjustment commands (page 60)

6. Maintenance

6.1 Periodic maintenance

6.1.1 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.

Do not attempt to clean contaminated HTM10 modules and HUMICAP® sensors. Dirty modules should always be replaced with new calibrated modules.

6.2 Repair maintenance

6.2.1 Replacing the measurement module

If you cannot restore the measurement accuracy of the transmitter by calibration and adjustment, you can replace the measurement module inside the transmitter. The measurement module is the small separate component board that is connected to the bottom of the component board.

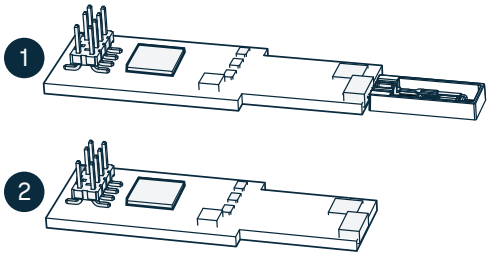


Figure 35 HTM10 and TM10 modules

where

- 1 = HTM10 module that includes a HUMICAP® sensor for humidity measurement and a digital temperature sensor.
- 2 = TM10 module with a digital temperature sensor.

Replace the module in your transmitter with the same type as used originally. Replacing a TM10 module with a HTM10 module does not turn a TMW transmitter (temperature only) into a HMW type (humidity and temperature) transmitter.

User calibration settings (adjustment by trimmers or service port) are stored in the module. If you replace the module, you do not need to undo the previously applied correction.

CAUTION! Handle the HTM10 module carefully. When reinstalling the transmitter body to the mounting base, avoid touching the module or the HUMICAP® sensor.

To replace the module:

1. Disconnect the transmitter body from the mounting base.
2. With your fingers, push apart the two plastic holders that hold the module. Pull out the module. Keep the module straight while pulling it out, otherwise the pins may twist in the connector and damage it.

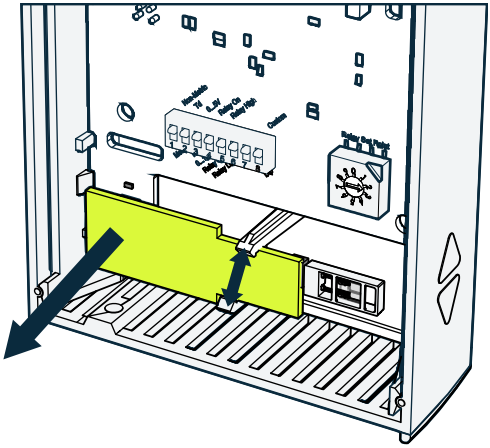


Figure 36 Replacing the HTM10 module (HMW93)

3. Take the new module and align the pins to the connector on the transmitter's component board.
4. Push down on the module so that the plastic holders clip into place. Try not to tilt the module, so that the pins will meet the connector straight on.
5. Reconnect the transmitter to the mounting base.

6. Verify that there are no errors when the transmitter starts up. If you see the errors **HTM10 01** or **HTM10 02** on the screen, it is likely that the module is not seated properly in the connector. In that case, disconnect the transmitter body and try again.

More information

- Product and part names (page 15)

7. Troubleshooting

7.1 Problem situations

Table 12 Troubleshooting table

Problem	Possible causes and solutions
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. See Selecting location (page 30). 2. Check that the transmitter is installed in proper orientation, with the arrow on the mounting base pointing up.
Relay does not seem to be working as configured.	1. Check DIP switch settings. Is the relay configured using DIP switches and rotary switch, or software? Check that the rotary switch is not between two positions. 2. Note the effect of hysteresis in DIP mode; see Relay configuration in DIP mode (page 25). 3. Connect to the service port using a computer and use the **STATUS** command to view the current relay settings. 4. Use the **RTEST** command to test that the relay is working properly.
Transmitter does not recognize a valid serial command, responds with the message: `FAIL 1: Unknown command`	1. The command may be one of the advanced commands, and you have not enabled them using the **PASS 9000** command. 2. If you are using remote echo on the transmitter, disable it with the **ECHO OFF** command to avoid collisions. 3. There may be an intermittent connection problem between the transmitter and your terminal. Issue the command again.

7.2 Error messages

Table 13 Error messages

Error text on display	Error ID on serial line	Possible cause	Remedy
HTM10 01	23	Communication problem with HTM10 module.	Check that the HTM10 module sits firmly in place. Remove and reconnect.
HTM10 02	41		

Error text on display	Error ID on serial line	Possible cause	Remedy
HTM10 04	21	Problem with humidity measurement.	• Check for missing or damaged HUMICAP® sensor on the HTM10 module. • Check for condensation on the HUMICAP® sensor. Wait for the sensor to dry out.
HTM10 03	4	Internal problem with HTM10 module.	• Restart the transmitter. • Replace the module if unable to remove the problem.
HTM10 05	22		
HTM10 06	42		
Internal 1	1	Internal problem with the transmitter.	• Restart the transmitter. • Restore the factory settings using service port or DIP switches if reset does not help.
Internal 2	2		
Internal 3	3		
Internal 4	43		

7.2.1 Viewing error messages on serial line

7.2.1.1 View currently active errors

Use the **ERRS** command to view currently active errors on the serial line:

ERRS<cr>

Example:

```
>errs
NO ERRORS
```

7.2.1.2 View error table

Use the **ERRT** command to view the table of possible transmitter errors. The table includes error ID, error count since last reset, level, current state, and error text.

Critical errors require a transmitter reset to recover. Other errors may be recoverable if their cause is removed.

ERRT<cr>

Example:

```
>errt
Id: N: Level:State: Error text
1: 0: CRITICAL:OFF: FLASH memory corrupted
2: 0: CRITICAL:OFF: Parameter read (using defaults)
3: 0: CRITICAL:OFF: Parameter write
4: 0: CRITICAL:OFF: HTM10 03 FLASH Corrupted
21: 0: ERROR:OFF: HTM10 04 RH measurement
22: 0: ERROR:OFF: HTM10 05 T measurement
23: 0: ERROR:OFF: HTM10 01 Continuous communication failure
41: 0: WARNING:OFF: HTM10 02 Single Communication failure
42: 0: WARNING:OFF: HTM10 06 Device Descriptor match
43: 0: WARNING:OFF: Factory parameter memory not consistent
```

7.3 Error state

If there are any active “critical” or “error” level errors active in the transmitter, both analog outputs are set into a defined error level instead of the measured result. The error level depends on the output type:

- For 0–5 V output, the default error level is 5.5 V
- For 0–10 V output, the default error level is 11 V
- For 4–20 mA output, the default error level is 3.6 mA

If all “critical” and “error” level errors are turned off (by removing their cause), transmitter resumes normal operation of analog outputs.

You can configure the error level using the **AMODE** command.



You can also use the **AOVER** command to configure a channel to go to the error level if the measured parameter is sufficiently far out of the measured range.

More information

- Set analog output mode (page 51)
- Set output clipping and error limit (page 52)

7.4 Reverting to factory settings

HMW90 series transmitters, including factory-customized transmitters, can be reverted to their original shipping configuration using the DIP switches or the service port.

Reverting the transmitter to factory settings clears all user configuration that has been done using the service port. User-made humidity and temperature adjustments are also cleared from the HTM10 module. The factory calibration will remain.

More information

- Changing between DIP and custom configuration (page 27)

7.4.1 Reverting to factory settings using DIP switches

Factory reset functionality using DIP switches is present in transmitters with firmware version 1.0.3 or newer. The firmware version is visible on the transmitter startup screen.

1. Disconnect the transmitter cover from the mounting base.
2. Make a note of the DIP switch positions before changing anything, so you can restore the positions later.

3. Set the DIP switches as follows:
   - Analog output models: Move all switches up as shown below.
   - Digital output models: Set the DIP switches in the leftmost DIP switch bank as shown below. Do not move the switches in the other bank.

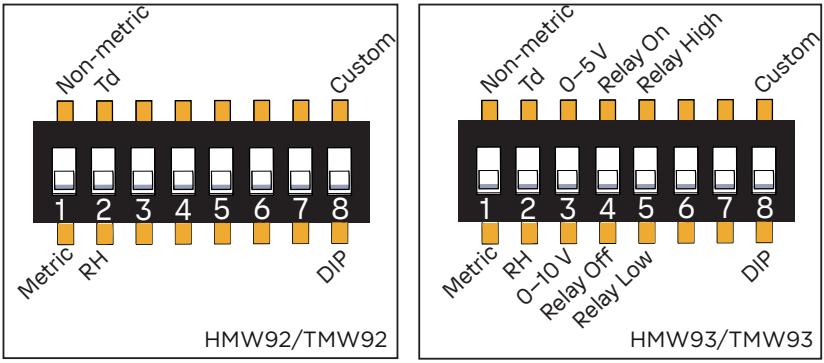


Figure 37 DIP switches in factory reset position

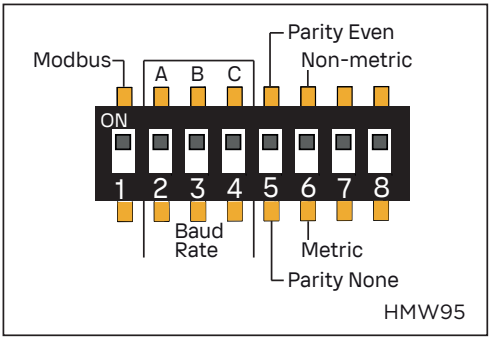


Figure 38 DIP switches in factory reset position (HMW95)

4. Reconnect the transmitter cover to the mounting base so it powers up. Check the screen after power-up: when the DIP switches are in factory reset position, you will see a notification text.
5. Disconnect the transmitter cover again.
6. Set the DIP switches to the positions they were before.
7. Reconnect the transmitter cover to the mounting base. Check the startup screens to verify the configuration.

7.4.2 Reverting to factory settings using service port

Use the **FRESTORE** command to restore the transmitter to factory settings.

FRESTORE<cr>

If you are restoring the factory configuration on a factory customized analog output model (HMW90), leave DIP number 8 to the Custom position to avoid the custom configuration from being overwritten by the default settings at transmitter reset. For more information about this, see Changing between DIP and custom configuration (page 27).

After using the **FRESTORE** command, reset the transmitter using the **RESET** command.

Example:

```
>pass 9000
>frestore
Restoring HTM10 factory parameters
HTM10 factory parameters restored
Restoring HMW93 factory settings
72/72 parameters restored
OK
>reset
Resetting
HMW93 / 1.00.00.0000 / XM90
>
```

8. Technical data

8.1 Specifications

Table 14 HMW90 measurement performance

Property	Description/Value
Relative humidity	
Measurement range	0 ... 100 %RH, non-condensing
Accuracy at temperature range +10 ... +40 °C (+50 ... +104 °F):	
0 ... 90 %RH 90 ... 100 %RH	±1.7 %RH ±2.5 %RH
Accuracy at temperature range −5 ... +10 °C, +40 ... + 55 °C (+23 ... +50 °F, +104 ... +131 °F):	
0 ... 90 %RH 90 ... 100 %RH	±3 %RH ±4 %RH
Stability in typical HVAC applications	±0.5 %RH/year
Humidity sensor	HUMICAP® 180R
Temperature	
Measurement range	−5 ... +55 °C (+23 ... +131 ºF)
Accuracy at +20 ... +30 °C (+68 ... +86 °F)	±0.2 °C (± 0.36 °F)
Accuracy at +10 ... +20 °C, +30 ... +40 °C (+50 ... +68 °F, +86 ... +104 °F)	±0.3 °C (± 0.54 °F)
Accuracy at −5 ... +10 °C, +40 ... +55 °C (+23 ... +50 °F, +104 ... +131 °F)	±0.5 °C (± 0.90 °F)
Temperature sensor	Digital temperature sensor

Table 15 HMW90 inputs and outputs

Property	Description/Value
Service port	RS-485 line for temporary service use
Current output models	
Outputs	2 × 4–20 mA, loop powered
Loop resistance	0–600 Ω
Supply voltage	20–28 V DC at 500 Ω load 10–28 V DC at 0 Ω load

Property	Description/Value
Isolation between output channels	500 V DC
Voltage output models	
Outputs	2 × 0–5 V or 2 × 0–10 V
Load resistance	10 kΩ min.
Supply voltage	18–35 V DC, 24 V AC ±20 % 50/60 Hz
Max. current consumption	12 mA Max. with relay 25 mA
Relay	1 pc (max 50 V DC/50 V AC, 500 mA)
Field bus models	
Supply voltage	18–35 V DC, 24 V AC ± 20 % 50/60 Hz
Max. current consumption (with 120 Ω termination)	30 mA at 24 V DC
Output type	RS-485 (galvanic isolation, 1.5 kV)
RS-485 end of line termination	Enable with jumper, 120 Ω
Supported protocol	Modbus RTU
Modbus RTU address range	1–247

Table 16 HMW90 operating environment

Property	Description/Value
Operating temperature	−5 ... +55 °C (+23 ... +131 °F)
Storage temperature	−30 ... +60 °C (−22 ... +140 °F)
IP rating	IP30: Protected against solid foreign objects of 2.5 mm Ø and greater.

Table 17 HMW90 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, industrial environment CISPR 32 / EN 55032, Class B
Compliance marks	CE, RCM

Table 18 HMW90 mechanical specifications

Property	Description/Value
Weight	155 g (5.5 oz)
Standard housing color	White (RAL9003 [1)])
Optional housing color (configurable models only)	Black (RAL9005 [1)])
Housing material	ABS/PC, UL-V0 approved
Output connector	Screw terminals Max. wire size 2 mm^2 (14 AWG)
Service port connector	4-pin M8

1) *RAL code is only indicative with potential small variations in color shade.*

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 19 HMW90 spare parts and accessories

Item	Order Code
Humidity and temperature module	HTM10SP
Temperature module (for T-only models)	TM10SP
Decorative cover set (10 pcs)	236285
M12 - M8 service cable 1.5 m (4.9 ft), for connecting to Indigo80	262195SP
Connection cable for HM70 handheld meter	219980
USB cable for PC connection	219690

8.3 Dimensions and models

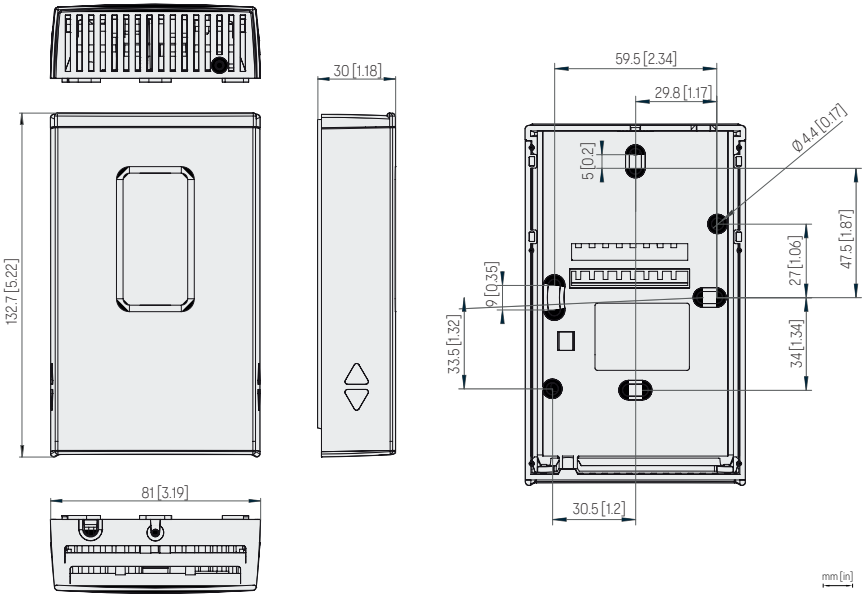


Figure 39 Dimensions of HMW90 series transmitter cover (left) and mounting base (right)

Table 20 HMW90 models

Model	Measurements	Output
TMW92	T-only	2-wire current output
TMW93	T-only	3-wire voltage output
TMW90	T-only	Analog output (configurable)
HMW92	RH+T	2-wire current output
HMW92D	RH+T	2-wire current output, model with display
HMW93	RH+T	3-wire voltage output
HMW93D	RH+T	3-wire voltage output, model with display
HMW90	RH+T	Analog/Modbus RTU output (configurable)
HMW95	RH+T	Modbus RTU output
HMW95D	RH+T	Modbus RTU output, model with display

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 more information on the Modbus protocol, refer to the specifications available at modbus.org.

Serial line settings such as baud rate are configured using DIP switches. See Configuration of digital output models (page 28).

Table 21 Modbus functions supported by HMW90

Function code	Name
03 (0x03)	Read Holding Registers
04 (0x04)	Read Input Register
06 (0x06)	Write Single Register
16 (0x10)	Write Multiple Registers
43 / 14 (0x2B / 0x0E)	Read Device Identification

Table 22 HMW90 Modbus measurement data registers

Name	Metric float	Metric integer	Metric unit	Non-metric float	Non-metric integer	Non-metric unit
RH	0003–0004	0258 (×0.01)	%RH	6403–0004	6658 (×0.01)	%RH
T	0005–0006	0259 (×0.01)	°C	6405–0006	6659 (×0.01)	°F
T_d	0007–0008	0260 (×0.01)	°C	6407–0008	6660 (×0.01)	°F
T_{df}	0009–0010	0261 (×0.01)	°C	6409–0010	6661 (×0.01)	°F
${}_dT_d$	0011–0012	0262 (×0.01)	°C	6411–0012	6662 (×0.01)	°F
T_w	0013–0014	0263 (×0.01)	°C	6413–0014	6663 (×0.01)	°F
a	0015–0016	0264 (×0.01)	g/m^3	6415–0016	6664 (×0.01)	gr/ft^3
x	0017–0018	0265 (×0.01)	g/kg	6417–0018	6665 (×0.01)	gr/lb

Name	Metric float	Metric integer	Metric unit	Non-metric float	Non-metric integer	Non-metric unit
h	0019–0020	0266 (×0.01)	kJ/kg	6419–0020	6666 (×0.01)	btu/lb

Values read from the integer registers must be multiplied with the provided multiplier to get the actual value. All integer values are signed.

Available measurements depend on the transmitter model. Values may be unavailable also in case of device failure. Read status registers or exception status outputs to check for failures. Accessing unavailable (unsupported or temporarily missing) measurement data does not generate an 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 HMW90 registers.

A “quiet NaN” value is returned for unavailable values. Writing any NaN or infinite value is silently ignored.

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

Table 23 HMW90 Modbus status registers (read-only)

Name	Address	Description
Error code (bits 15–0)	0513,6913	0 = no errors

Table 24 HMW90 Modbus error code bits

Bit	Description
0	Any critical error is active. Requires transmitter restart or maintenance.
1	Any error is active. May be recoverable.
2	Internal error (Flash).
3	Module communication or compatibility error.
4	HTM10 module error.
5	Temperature measurement error.
6	Humidity measurement error.
7	Reserved.
8	Reserved.
9	Miscellaneous error.

Table 25 HMW90 Modbus configuration parameter registers

Name	Metric float	Metric integer	Metric unit & valid range	Non-metric float	Non-metric integer	Non-metric unit & valid range
Pressure	0777–0779	1029 (×1)	700–1100 hPa	7177–7179	7429 (×1)	700–1100 hPa
Elevation	0779–0780	1030 (×1)	−700 … 2300 m	7179–7180	7430 (×1)	−2300 … 10000 ft

Elevation is linked to pressure according to the following equation:
$p = 101325\ (1-2.25577\ 10^{-5}\ h)^{5.25588}$
where p is pressure in Pa and h is altitude above sea level in m. This means that changing altitude will also change pressure and vice versa.

Table 26 HMW90 Modbus device identification

Object id	Object name	Description
0x00	VendorName	"Vaisala"
0x01	ProductCode	Transmitter model (for example, "HMW95")
0x02	MajorMinorVersion	Software version (for example, "1.0.0")
0x03	VendorUrl	"http://www.vaisala.com/"
0x04	ProductName	HMW90
0x80	SerialNumber	Serial number (e.g. "H0810040")
0x81	CalibrationDate	Date of the last calibration (for example, "2014-09-11", empty if not available)
0x82	CalibrationText	Information text of the last calibration (empty if not available)

Table 27 HMW90 Modbus exception responses

Code	Name	Reason
01	ILLEGAL FUNCTION	Unsupported function code
02	ILLEGAL DATA ADDRESS	Address out of valid ranges
03	ILLEGAL DATA VALUE	Otherwise invalid request

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.

Maintenance and calibration services



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

- Vaisala Online Store at store.vaisala.com is available for most countries. You can browse the offering by product model and order the right accessories, spare parts, or maintenance and calibration services.
- To contact your local maintenance and calibration expert, see vaisala.com/contactus.

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.

Recycling



Recycle all applicable material according to local regulations.

VAISALA

vaisala.com