

# USER'S GUIDE



## Vaisala HUMICAP<sup>®</sup> Humidity and Temperature Transmitter Series HMT330



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# CHAPTER 1

## GENERAL INFORMATION

This chapter provides general notes for the manual and the product.

### About This Manual

This manual provides information for installing, operating, and maintaining Vaisala HUMICAP<sup>®</sup> Humidity and Temperature Transmitter Series HMT330.

### Contents of This Manual

This manual consists of the following chapters:

- Chapter 1, General Information, provides general notes for the manual and the product.
- Chapter 2, Product Overview, introduces the features, advantages, and the product nomenclature of HMT330.
- Chapter 3, Installation, provides you with information that is intended to help you install the product.
- Chapter 4, Operation, contains information that is needed to operate this product.
- Chapter 5, Maintenance, contains information that is needed in basic maintenance of the product.
- Chapter 6, Calibration and Adjustment, provides information and instructions concerning calibration and adjustment of HMT330.
- Chapter 7, Technical Data, provides the technical data of the product.

- Appendix A, Probe Installation Kits and Installation Examples, presents the installation kits available for HMT330 and provides some installation examples.
- Appendix B, Calculation Formulas, presents the equations used in HMT330 to calculate values of dewpoint, mixing ratio, absolute humidity and enthalpy in normal pressure.

## General Safety Considerations

Throughout the manual, important safety considerations are highlighted as follows:

### **WARNING**

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

### **CAUTION**

Caution warns you of 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.

### **NOTE**

Note highlights important information on using the product.

## Feedback

Vaisala Customer Documentation Team welcomes your comments and suggestions on the quality and usefulness of this publication. If you find errors or have other suggestions for improvement, please indicate the chapter, section, and page number. You can send comments to us by e-mail: [manuals@vaisala.com](mailto:manuals@vaisala.com)

## Product Related Safety Precautions

The Vaisala HUMICAP<sup>®</sup> Humidity and Temperature Transmitter Series HMT330 delivered to you has been tested for safety and approved as shipped from the factory. Note the following precautions:

**WARNING**

Ground the product, and verify outdoor installation grounding periodically to minimize shock hazard.

**CAUTION**

Do not modify the unit. Improper modification can damage the product or lead to malfunction.

## ESD Protection

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

To make sure you are not delivering high static voltages yourself:

- Handle ESD sensitive components on a properly grounded and protected ESD workbench. When this is not possible, ground yourself to the equipment chassis before touching the boards. Ground yourself with a wrist strap and a resistive connection cord. When neither of the above is possible, touch a conductive part of the equipment chassis with your other hand before touching the boards.
- Always hold the boards by the edges and avoid touching the component contacts.

## Recycling



Recycle all applicable material.



Dispose of batteries and the unit according to statutory regulations.  
Do not dispose of with regular household refuse.

## Trademarks

HUMICAP<sup>®</sup> is a registered trademark of Vaisala. Microsoft<sup>®</sup>, Windows<sup>®</sup>, Windows NT<sup>®</sup>, Windows<sup>®</sup> 2000 and Windows<sup>®</sup> XP are registered trademarks of Microsoft Corporation in the United States and/or other countries.

## License Agreement

All rights to any software are held by Vaisala or third parties. The customer is allowed to use the software only to the extent that is provided by the applicable supply contract or Software License Agreement.

## Warranty

Vaisala hereby represents and warrants all Products manufactured by Vaisala and sold hereunder to be free from defects in workmanship or material during a period of twelve (12) months from the date of delivery save for products for which a special warranty is given. If any Product proves however to be defective in workmanship or material within the period herein provided Vaisala undertakes to the exclusion of any other remedy to repair or at its own option replace the defective Product or part thereof free of charge and otherwise on the same conditions as for the original Product or part without extension to original warranty time. Defective parts replaced in accordance with this clause shall be placed at the disposal of Vaisala.

Vaisala also warrants the quality of all repair and service works performed by its employees to products sold by it. In case the repair or service works should appear inadequate or faulty and should this cause malfunction or nonfunction of the product to which the service was performed Vaisala shall at its free option either repair or have repaired or replace the product in question. The working hours used by employees of Vaisala for such repair or replacement shall be free of charge to the client. This service warranty shall be valid for a period of six (6) months from the date the service measures were completed.

This warranty is however subject to following conditions:

- a) A substantiated written claim as to any alleged defects shall have been received by Vaisala within thirty (30) days after the defect or fault became known or occurred, and
- b) The allegedly defective Product or part shall, should Vaisala so require, be sent to the works of Vaisala or to such other place as Vaisala may indicate in writing, freight and insurance prepaid and properly packed and labelled, unless Vaisala agrees to inspect and repair the Product or replace it on site.

This warranty does not however apply when the defect has been caused through

- a) normal wear and tear or accident;
- b) misuse or other unsuitable or unauthorized use of the Product or negligence or error in storing, maintaining or in handling the Product or any equipment thereof;
- c) wrong installation or assembly or failure to service the Product or otherwise follow Vaisala's service instructions including any repairs or installation or assembly or service made by unauthorized personnel not approved by Vaisala or replacements with parts not manufactured or supplied by Vaisala;
- d) modifications or changes of the Product as well as any adding to it without Vaisala's prior authorization;
- e) other factors depending on the Customer or a third party.

Notwithstanding the aforesaid Vaisala's liability under this clause shall not apply to any defects arising out of materials, designs or instructions provided by the Customer.

This warranty is expressly in lieu of and excludes all other conditions, warranties and liabilities, express or implied, whether under law, statute or otherwise, including without limitation any implied warranties of merchantability or fitness for a particular purpose and all other obligations and liabilities of Vaisala or its representatives with respect to any defect or deficiency applicable to or resulting directly or indirectly from the Products supplied hereunder, which obligations and liabilities are hereby expressly cancelled and waived. Vaisala's liability shall under no circumstances exceed the invoice price of any Product for which a warranty claim is made, nor shall Vaisala in any circumstances be liable for lost profits or other consequential loss whether direct or indirect or for special damages.

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## CHAPTER 2

# PRODUCT OVERVIEW

This chapter introduces the features, advantages, and the product nomenclature of HMT330.

## Introduction to HMT330

Vaisala HUMICAP<sup>®</sup> Humidity and Temperature Transmitter Series HMT330 provides reliable humidity measurement in wide range of applications. Analog outputs can be chosen between current and voltage signals. Alternatively, digital outputs RS-232 (standard) or RS-422/485 (optional) can be selected. The quantities measured and calculated by HMT330 are presented in Table 1 below. The quantities available as an option are presented in Table 2 below.

**Table 1 Quantities Measured by HMT330**

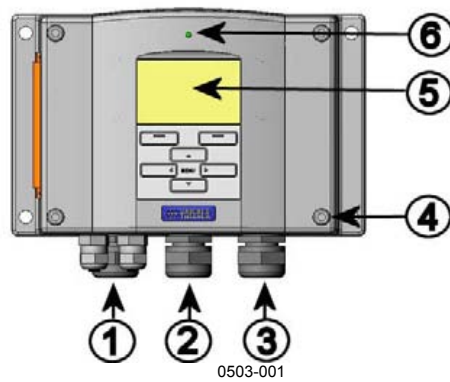
Quantity	Abbreviation	Metric Unit	Non Metric Unit
Relative humidity (RH)	RH	%RH	%RH
Temperature (T)	T	°C	°F

**Table 2 Optional Quantities Measured by HMT330**

Quantity	Abbreviation	Metric Unit	Non Metric Unit
Dewpoint / Frostpoint Temperature ( $T_{df}$ )	TDF	°C	°F
Dewpoint Temperature ( $T_d$ )	TD	°C	°F
Absolute humidity (a)	A	g/m <sup>3</sup>	gr/ft <sup>3</sup>
Mixing ratio (x)	X	g/kg	gr/lb
Wetbulb temperature ( $T_w$ )	TW	°C	°F
Humid air volume/ dry air volume (by volume or by weight) (H <sub>2</sub> O)	H2O	ppmv/ppm <sub>w</sub>	ppmv/ppm <sub>w</sub>
Water vapor pressure ( $P_w$ )	PW	hPa	lb/in <sup>2</sup>
Water vapor saturation pressure ( $P_{ws}$ )	PWS	hPa	lb/in <sup>2</sup>
Enthalpy (h)	H	kJ/kg	Btu/lb
Difference of T and $T_{df}$ ( $\Delta T$ )	DT	°C	°F

## Basic Features and Options

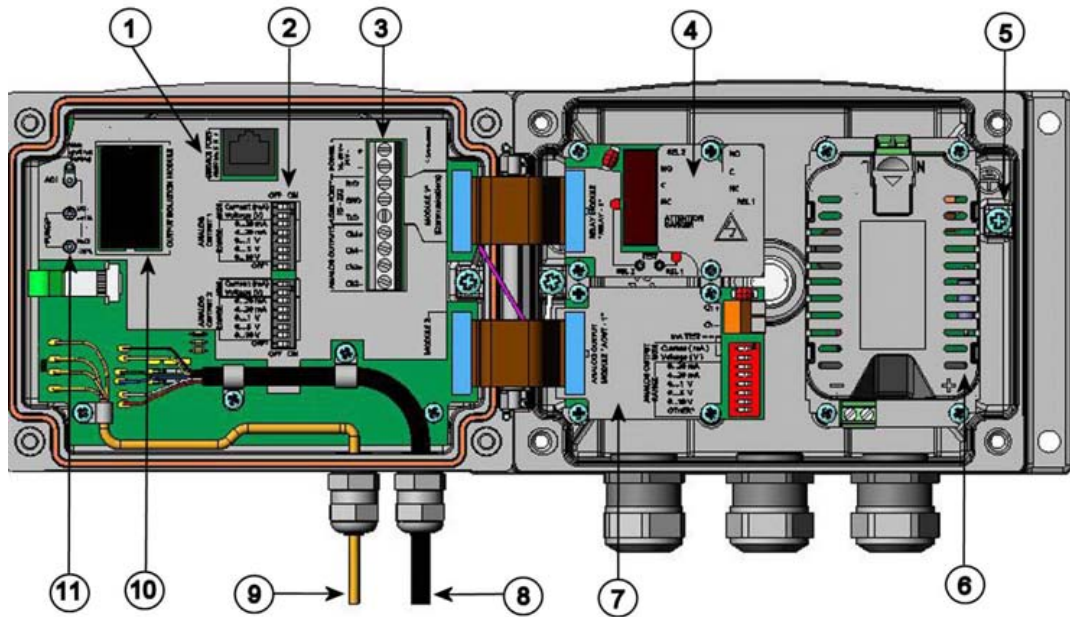
- Several probes for various applications
- User friendly display
- Calculated output quantities available
- Different probe mounting kits, sensor protection options and probe cable lengths
- Transmitter mounting kits for multiple installation purposes
- Chemical purge for applications where interfering chemicals in the measuring environment pose a risk
- Warmed probe and sensor heating for high humidity conditions (HMT337)
- Optional modules: isolated power supply, power supply module, RS-422/485-module, additional analog output module and relay module
- Additional temperature sensor (HMT337)



**Figure 1 Transmitter Body**

The following The following numbers refer to Figure 1 above:

- 1 = Signal + powering cable gland
- 2 = Cable gland for optional module
- 3 = Cable gland for optional module
- 4 = Cover screw (4 pcs)
- 5 = Display with keypad (optional)
- 6 = Cover LED



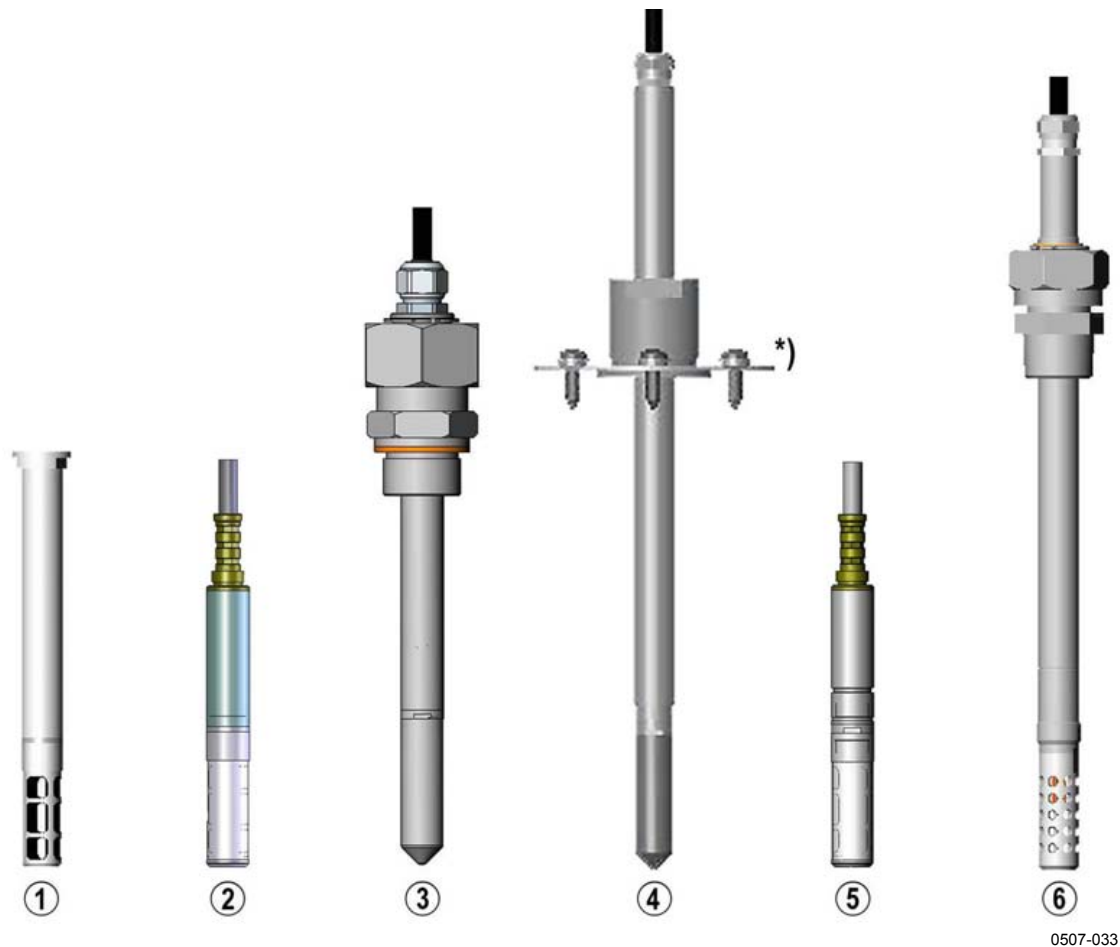
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**Figure 2 Inside of Open Transmitter**

The following numbers refer to Figure 2 above:

- 1 = Service port (RS-232)
- 2 = DIP switches for analog output settings
- 3 = Power supply and signal wiring screw terminals
- 4 = Relay/RS-422/485 module (optional)
- 5 = Grounding connector
- 6 = Power supply module (optional)
- 7 = Analog output relay module (optional)
- 8 = Humidity probe cable
- 9 = Temperature probe cable (optional)
- 10 = Output isolation module (optional)
- 11 = Adjustment buttons (chemical purge buttons) with indicator led

## Probe Options



0507-033

**Figure 3 Probe Options**

The following numbers refer to Figure 3 above:

- 1 = HMT331 for demanding wall-mounted applications
- 2 = HMT333 for ducts and tight spaces
- 3 = HMT334 for high pressure and vacuum applications (up to 100 bars)
- 4 = HMT335 for high temperatures (up to 180 °C, vapor tight)  
\*) Flange available as an option
- 5 = HMT337 for high humidity applications (optional warmed and vapor tight probe head)
- 6 = HMT338 for pressurized pipelines (up to 40 bar)

Probe cable lengths are 2 m, 5 m and 10 m.

## Warmed Probe HMT337

Temperature difference between the probe head and external environment can cause a risk of condensation on the sensor. A wet probe cannot observe the actual humidity in the ambient air. If the condensed water is contaminated, the life span of the probe may shorten and calibration may change.

HMT337 probe shall be used in applications where condensation can occur due to high humidity and rapid humidity changes. The warmed probe head is heated continuously so that its temperature is always higher than in environment. This prevents condensation on the probe. The power consumption of the warmed probe is slightly higher than other probes.

## CHAPTER 3

# INSTALLATION

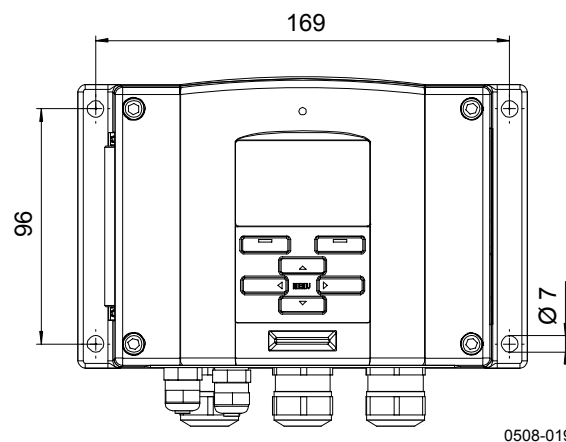
This chapter provides you with information that is intended to help you install the product.

## Mounting the Housing

The housing can be mounted either without the mounting plate or with optional mounting plates.

### Standard Mounting without Mounting Plate

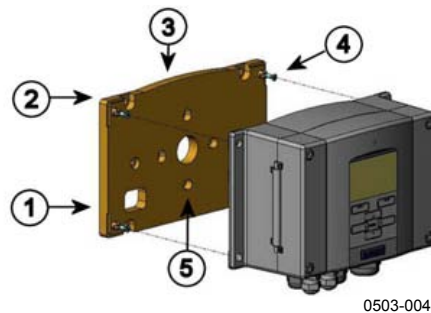
Mount the housing by fastening the transmitter to the wall with 4 screws, for example M6 (not provided).



**Figure 4** Standard Mounting

## Wall Mounting with Wall Mounting Kit

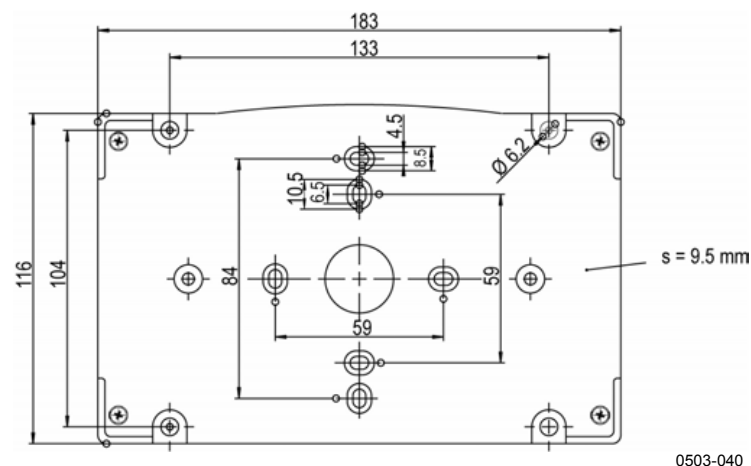
When mounting with wall mounting kit the mounting plate (Vaisala order code 214829) can be installed directly on wall or onto a standard wall box (also US junction box). When wiring through back wall, remove the plastic plug from the wiring hole in the transmitter before mounting.



**Figure 5 Mounting with Wall Mounting Kit**

The following numbers refer to Figure 5 above:

- 1 = Plastic mounting plate
- 2 = Mount the plate to wall with 4 screws M6 (not provided)
- 3 = The arched side up
- 4 = Fasten HMT330 to the mounting plate with 4 fixing screws M3 (provided)
- 5 = Holes for wall/junction box mounting



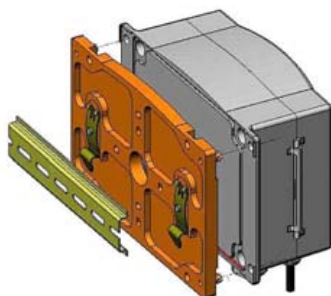
**Figure 6 Dimensions of Plastic Mounting Plate**



## Mounting with DIN Rail Installation Kit

DIN rail installation kit includes a wall mounting kit, 2 clip-fasteners and 2 screws M4 × 10 DIN 7985 (Vaisala order code 215094).

1. Attach two spring holders to the plastic mounting plate by using the screws provided in the installation kit.
2. Fasten HMT330 to the plastic mounting plate with 4 screws provided for that purpose.
3. Press the transmitter onto the DIN rail so that the clip-fasteners snap into the rail.

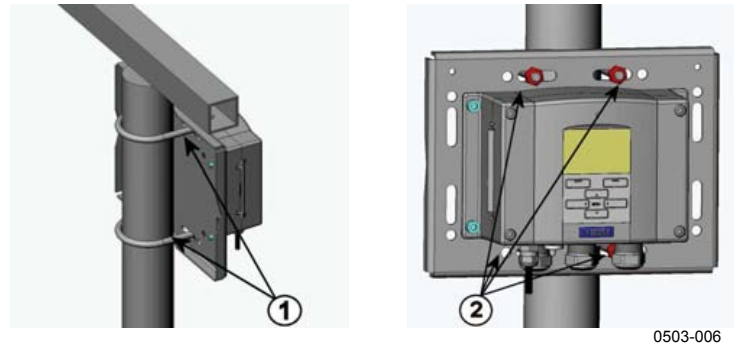


0503-002

**Figure 7** Mounting with DIN Rail Installation Kit

## Pole Installation with Installation Kit for Pole or Pipeline

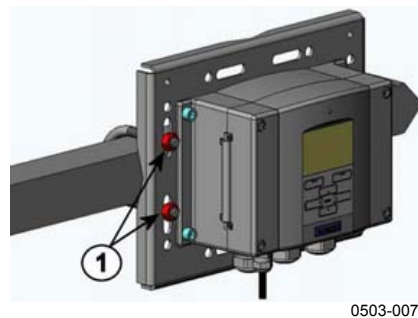
Installation kit for pole or pipeline (Vaisala order code: 215108) includes the metal mounting plate and 4 mounting nuts for pole mounting. When mounting, the arrow in the metal mounting plate must point upwards; see Figure 10 on page 25 below.



**Figure 8** Vertical Pole

The following numbers refer to Figure 8 above:

- 1 = Fixing brackets (2 pcs) M8 (provided) for 30 ... 102 mm poles.
- 2 = Mounting nuts M8 (4 pcs)

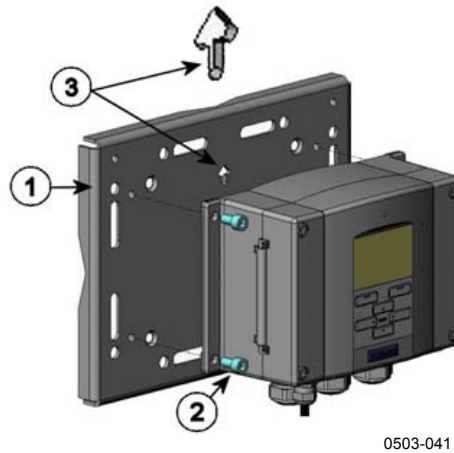


**Figure 9** Horizontal Pole

The following number refers to Figure 9 above:

- 1 = Mounting nuts M8 (4 pcs)

Metal mounting plate is included in rain shield with installation kit and installation kit for pole or pipeline.

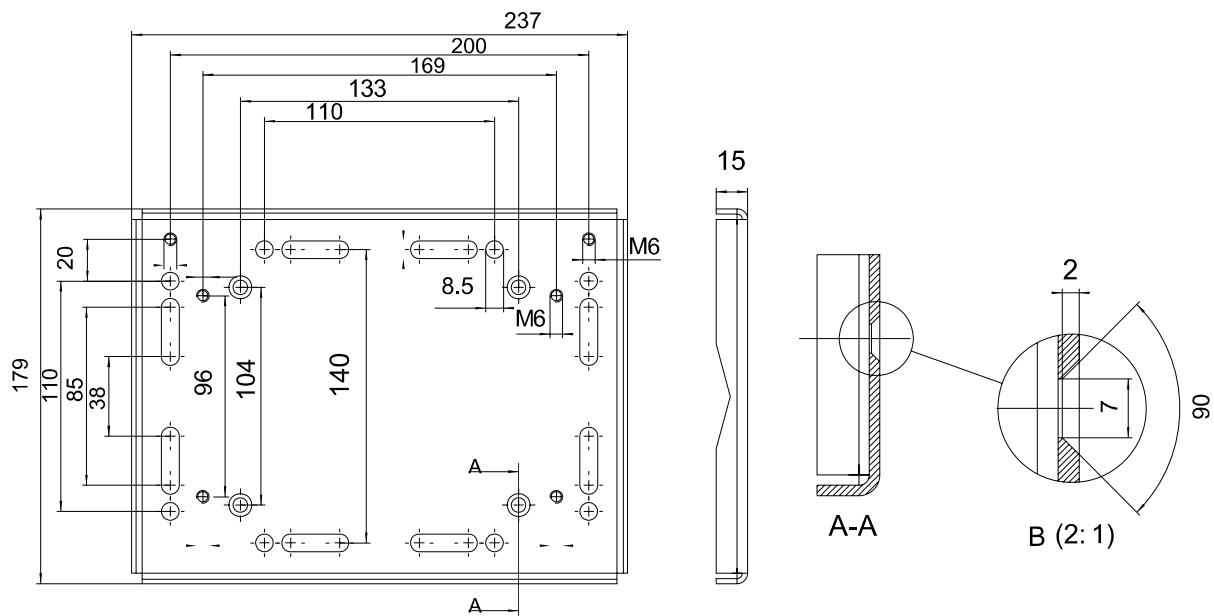


0503-041

**Figure 10 Mounting with Metal Wall Mounting Plate**

The following numbers refer to Figure 10 above:

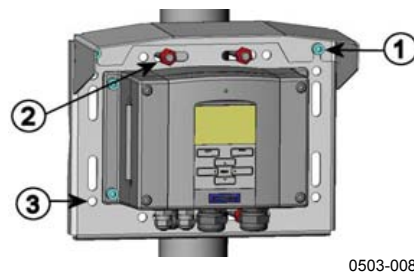
- 1 = Mount the plate to wall with 4 screws M8 (not provided)
- 2 = Fasten HMT330 to the mounting plate with 4 fixing screws M6 (provided)
- 3 = Note the position of the arrow when mounting. This side must be up when mounting.



0508-023

**Figure 11 Dimensions of Metal Mounting Plate (mm)**

## Mounting Rain Shield with Installation Kit



**Figure 12**     **Mounting Rain Shield with Installation Kit**

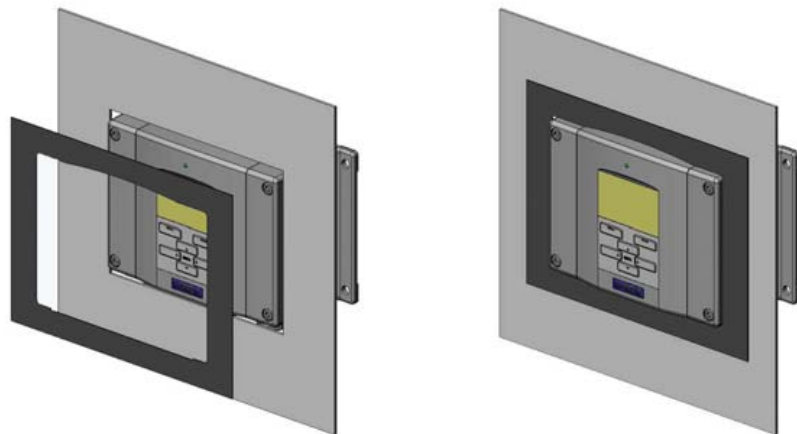
The following numbers refer to Figure 12 above:

- 1     =     Fasten the rain shield with installation kit (Vaisala order code: 215109) to the metal mounting plate with 2 (M6) mounting screws (provided).
- 2     =     Fasten the mounting plate with rain shield with installation kit to the wall or to the pole (see pole installation).
- 3     =     Fasten HMT330 to the mounting plate with 4 fixing screws (provided).

## Panel Mounting Frame

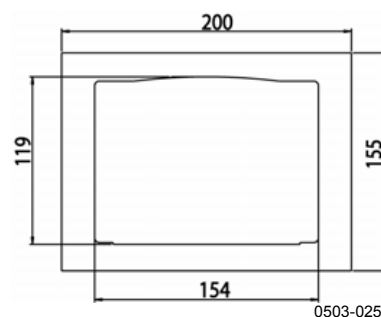
A panel mounting frame with adhesive tape is available as an option (Vaisala order code: 216038). After the HMT330 has been installed through the panel, a frame can be used to finish off the sawed surface of the panel.

1. Mount the HMT330 to the panel.
2. The frame is attached to the panel with an adhesive tape attached to the frame. Remove the paper protecting the tape before attaching.
3. Attach the frame to the panel around the HMT330 to finish off the panel mounting as illustrated, see Figure 13 below.



0503-024

**Figure 13** Panel Mounting with Frame



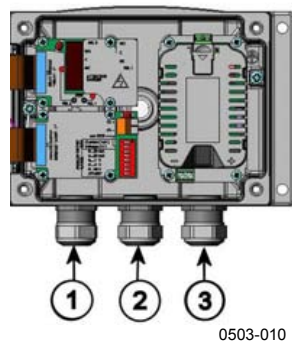
0503-025

**Figure 14** Panel Mounting Dimensions

## Wiring

### Cable Bushings

A single electrical cable with screen and three to ten wires is recommended for power and analog/serial connections. The cable diameter should be 8 ... 11 mm. The number of cable bushings depends on the transmitter options. See the following recommendations for the cable bushings:



**Figure 15** Cable Bushings

The following numbers refer to Figure 15 above:

- 1 = Cable for signal/powering Ø8 ... 11 mm
- 2 = Cable for optional module Ø8 ... 11 mm
- 3 = Cable for optional power supply module Ø8 ... 11 mm

#### NOTE

When there is high electric noise level (for example, near powerful electric motor) in the operating environment it is recommended to use shielded cable or take care that the signal cables are separated from other cables.

## Grounding the Cables

Ground the screen of the electrical cable properly to achieve the best possible EMC performance.

Fig. 1

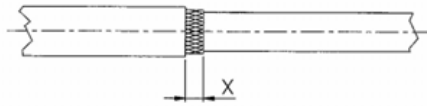


Fig. 2

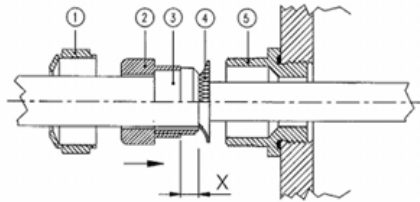
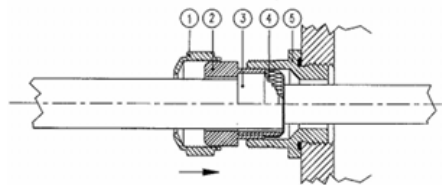


Fig. 3



0504-049

**Figure 16** Grounding the Screen of Electrical Cable

1. Cut back outer sheath to desired length.
2. Cut back screen braiding or screen foil to dimension X (see figure 3).
3. Push the domed cap nut (item 1) and the seal insert with contact socket of the gland (item 2+3) onto the cable as shown in the diagram.
4. Bend over the screen braiding or screen foil by about 90° (item 4).
5. Push the seal insert with the contact socket of the gland (item 2+3) up to the screen braiding or screen foil.
6. Mount lower part (item 5) on the housing.
7. Push the seal with the contact socket of the gland and (item 2+3) flush into the lower part (item 5).
8. Screw the domed cap nut (item 1) onto the lower part (item 5).

## Grounding the Transmitter Housing

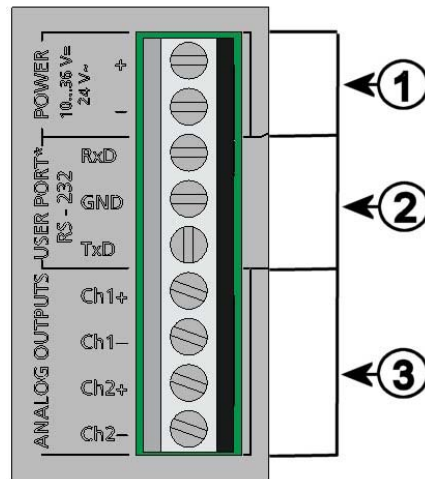
In case you need to ground the transmitter housing, the grounding connector is found inside the housing, see Figure 2 on page 18. Note anyhow that the probe head is connected to the same potential as the housing. Make sure that different groundings are made to the same potential. Otherwise harmful ground currents may be generated.

If it is needed to have galvanic isolation of the power supply line from the output signals, HMT330 can be ordered with optional output isolation module. This module prevents harmful grounding loops.



## Signal and Power Supply Wiring

When connecting transmitter with 8-pin connector, see section 8-Pin Connector on page 55. When wiring the power supply module, see section Power Supply Module on page 44.



0506-028

**Figure 17** Screw Terminal Block on Motherboard

The following numbers refer to Figure 17 above:

- 1 = Power supply terminals 10 ... 35 VDC, 24 VAC
- 2 = User port (RS-232 terminals)
- 3 = Analog signal terminals

### WARNING

Make sure that you connect only de-energized wires.

1. Open the transmitter cover by taking out the four cover screws.
2. Insert the power supply wires and signal wires through the cable bushing in the bottom of the transmitter; see the grounding instructions in the previous sections.
3. Connect the analog output cables to terminals: **Ch1 +**, **Ch1-**, **Ch2+**, **Ch2-**. Connect the RS-232 user port cables to terminals RxD, GND and TxD. For more information about the RS-232 connection refer to section Serial Line Communication on page 63.

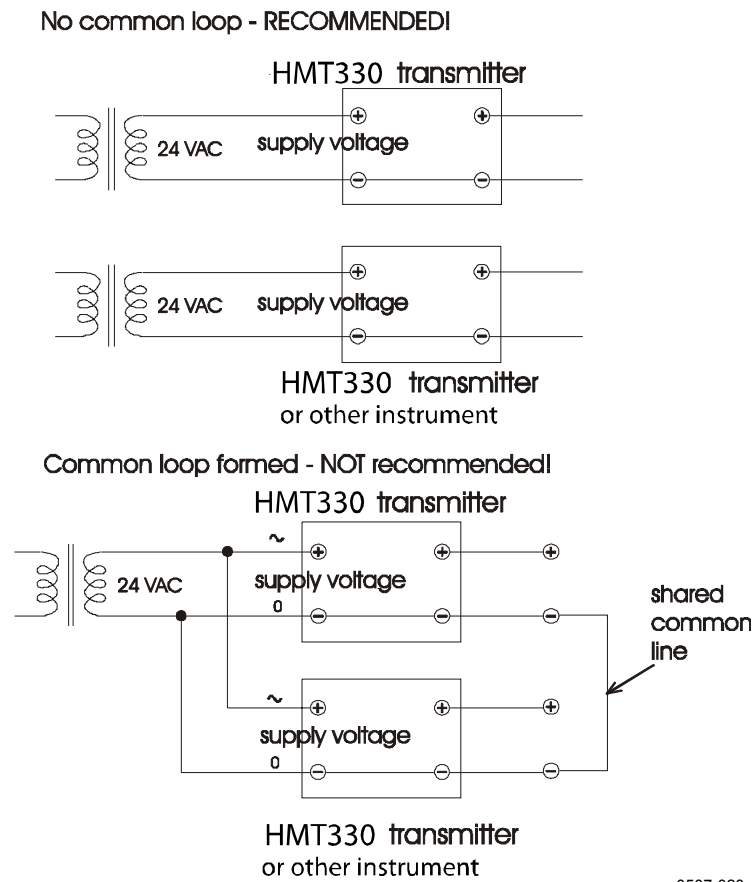
4. When wiring RS-485 module, relay module or additional analog output module, see section RS-422/485 Interface on page 52, section Relays on page 50, and section Third Analog Output on page 48.
5. Connect the power supply wires to the connectors: **POWER 10 ... 35V+ 24V~ (+)** and (-) terminals. If you are using 24 VAC power supply, see the note below before connecting the supply wires.
6. Turn on the power. The indicator led on the cover lit continuously during normal operation.
7. Close the cover and replace the cover screws. The transmitter is ready for use.

## Connections to 24 VAC Power Supply

Separate floating supply for each transmitter is recommended (see upper part of Figure 18 on page 33). If you have to connect several transmitters or other instruments to one AC supply, the phase (~) must always be connected to (+) connector of each transmitter (see lower part of Figure 18).

**CAUTION****24 VAC POWER SUPPLY USE**

To prevent fire and/or damage, if either 24 VAC wire is **grounded** or **connected to a "-", "0", or "GND" terminal** of any other device, you must **connect the same wire on the "-" terminal** also on this instrument.

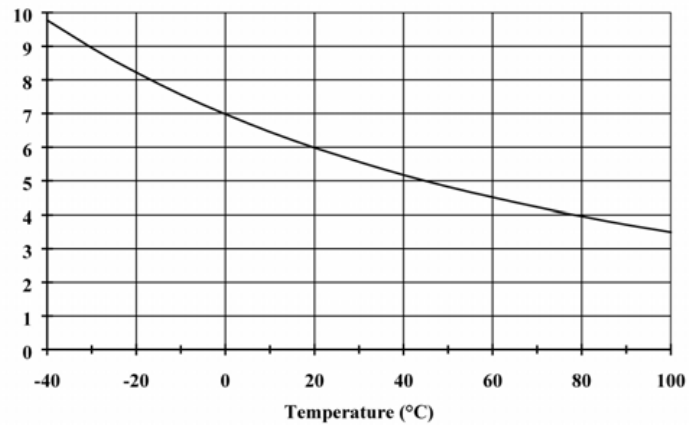


**Figure 18** Connections to 24 VAC Power Supply

## Probe Mounting

In humidity measurement and especially in calibration it is essential that temperature of the probe and measuring environment is the same. Even a small difference in temperature between the environment and the probe causes an error. As the curve below shows, if the temperature is +20 °C and the relative humidity 100 %RH, a difference of  $\pm 1$  °C between the environment and the probe causes an error of  $\pm 6$  %RH.

The graph below illustrates the measurement error at 100 %RH when the difference between the ambient and sensor temperature is 1 °C.

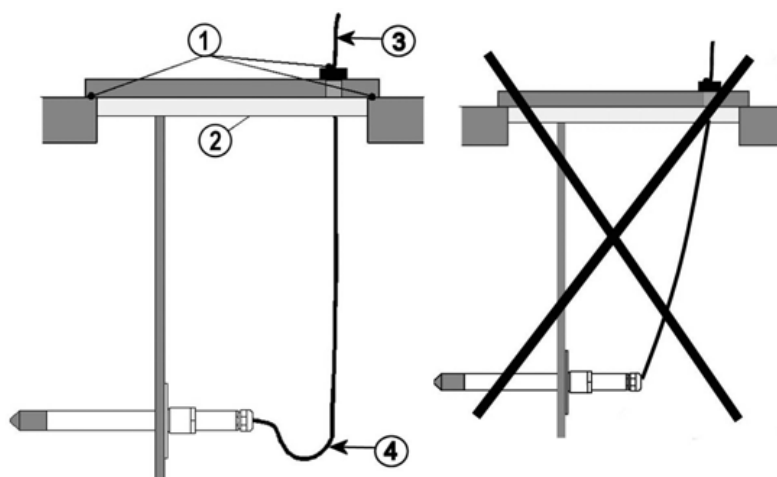


0507-023

**Figure 19 Measurement Error at 100 %RH**

## General Instructions for Probes with Cable

Mount the probes with a cable with the sensor head **horizontally**; this way, any water condensing on the tube cannot flow onto the sensor.



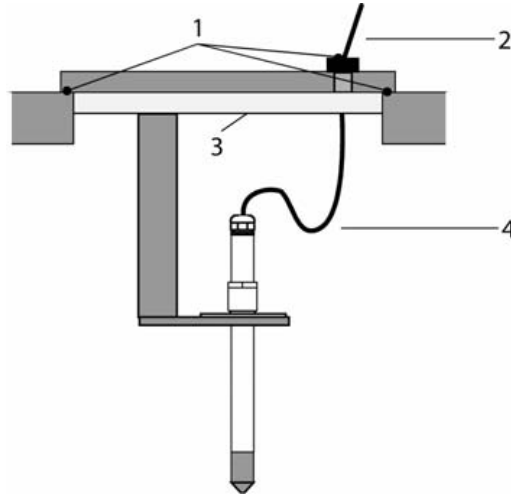
0507-024

**Figure 20** Horizontal Mounting of Sensor Head

The following numbers refer to Figure 20 above:

- 1 = To be sealed.
- 2 = To be insulated.
- 3 = Insulate the cable.
- 4 = Let the cable hang loosely. This prevents condensed water running to the sensor along the cable.

When there is no alternative but to install the sensor head in the process **vertically**, the point of entry must be carefully insulated. The cable must also be allowed to hang loosely as this prevents any condensed water from running onto the sensor head along the cable.



0507-022

**Figure 21 Vertical Mounting of Sensor Head**

The following numbers refer to Figure 21 above:

- 1 = To be sealed.
- 2 = Insulate the cable.
- 3 = To be insulated.
- 4 = Let the cable hang loosely. This prevents condensed water running to the sensor along the cable.

**NOTE**

Please do not attach a heated probe (HMT337) to metal structures to avoid condensation problems caused by heat conduction along the metal.

If the process temperature is much higher than that of the environment, the whole sensor head and preferably plenty of cable must be inside the process. This prevents measuring inaccuracy caused by heat conduction along the cable.

When mounted on the side of a duct or channel, the sensor head must be inserted from the side of the duct. If this is not possible and the sensor head must be inserted from the top, the point of entry must be carefully insulated.

For Vaisala probe installation kits and some installation examples see Appendix A on page 145.

## HMT333 for Ducts and Tight Spaces

The HMT333 is a small size ( $\varnothing = 12\text{mm}$ ) general-purpose probe suitable for ducts and channels with the installation kit available from Vaisala.

The HMT333 provides for two measuring range options. The first probe version is equipped with a flexible cable and can be used when measuring in environments up to 80 °C. The second version is suitable for measuring in environments up to 120 °C.

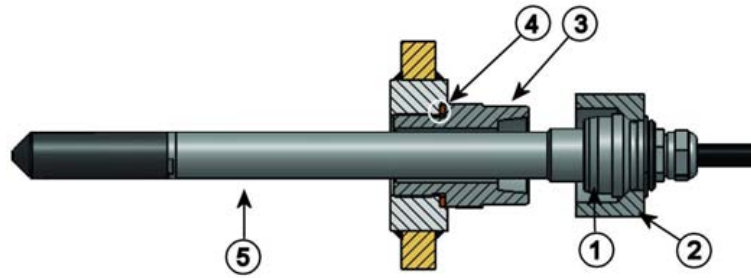
See Appendix A on page 145 for the following probe installation kits for HMT333 and installation examples.

- Duct mounting kit
- Cable gland.

## HMT334 for High Pressure and Vacuum Applications

The HMT334 probe is for the dewpoint measurements in pressurized rooms and industrial processes. The probe is provided with a nut, a fitting screw and a sealing washer. Keep the fitting screw and the nut in place on the body of the sensor head during handling to prevent damage to the highly polished surface of the probe. Follow the instructions below to achieve a leak-tight assembly:

1. Unscrew the fitting screw from the nut and the sensor head.
2. Fasten the fitting screw to the chamber wall with a sealing washer. Tighten the fitting screw into the threaded sleeve with a torque spanner. The tightening torque is  $150 \pm 10 \text{ Nm}$  ( $110 \pm 7 \text{ ft-lbs}$ ).
3. Insert the body of the sensor head into the fitting screw and screw the nut manually to the fitting screw until the connection feels tight.
4. Mark both the fitting screw and the nut hex.



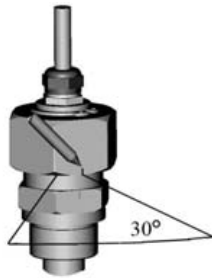
0506-029

**Figure 22 HMT344 Probe**

The following numbers refer to Figure 22 above:

- 1 = Tightening cone
- 2 = Nut
- 3 = Fitting screw, M22x1.5 or NPT 1/2"
- 4 = Sealing washer
- 5 = Sensor head; Ø12 mm.

- 5. Tighten the nut a further 30° (1/12) turn or if you have a torque spanner tighten it with a torque of 80 ± 10 Nm (60 ± 7 ft-lbs).



0503-034

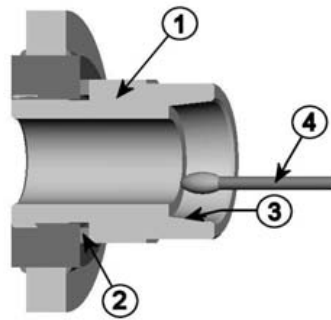
**Figure 23 Tightening the Nut**

**NOTE**

When re-tightening the nut after detachment the nut must be tightened without increased effort.

- 6. Clean and grease the tightening cone of the fitting screw after every tenth detachment. Change the sealing washer every time the fitting screw is detached. Use high-vacuum grease (for example Dow Corning) or similar grease.





0503-033

**Figure 24** Cleaning of Tightening Cone

The following numbers refer to Figure 24 above:

- 1 = Fitting screw
- 2 = Sealing washer
- 3 = Tightening cone
- 4 = Clean cotton stick

**CAUTION**

In pressurized processes it is essential to tighten the supporting nuts and screws very carefully to prevent loosening of the probe by the action of pressure.

**NOTE**

When the HMT330 is installed in a process with a pressure differing from normal atmospheric pressure, please enter the pressure value of the process (in hPa or mbar) into the transmitter memory, see command PRES and XPRES on page 77 or use display/keypad.

## HMT335 for High Temperatures

HMT335 is installed similarly than the HMT333 probe but without the supporting bar. Refer to Appendix A on page 145 for more information on the duct installation kit for HMT335.

To avoid incorrect humidity readings, the temperature differences between inside and outside of the duct must not be remarkable.

## HMT337 for High Humidity Applications

The HMT337 is for environment where relative humidity is very high, near saturation. The warmed probe head prevents the saturation of the sensor. An additional temperature probe is also available.

See Appendix A on page 145 for a presentation of the following probe installation kits for HMT337 with installation examples:

- Duct mounting kit
- Cable gland
- Pressure tight Swagelok connector
- Vaisala's Meteorological Installation kit

The installation kits are available for both humidity and temperature probe.

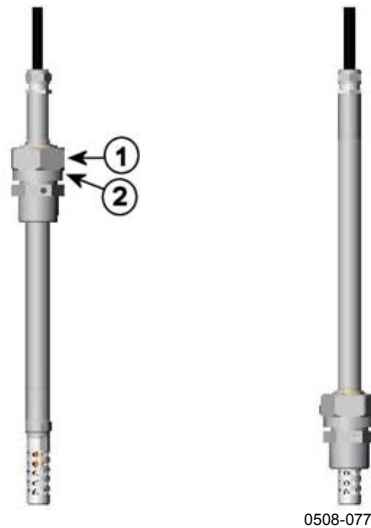
## Temperature Probe (Optional)

An external temperature probe for HMT337 is needed for the measurement of the ambient temperature in case you have a transmitter with a warmed probe. This allows you to measure other humidity quantities apart from dewpoint and mixing ratio.

The temperature probe is connected always in factory.

## HMT338 for Pressurized Pipelines

Due to the sliding fit the HMT338 is easy to install into and remove from the pressurized process. The probe is especially suitable for the measurements in pipelines. See section Ball Valve Installation Kit for HMT338 on page 152.



**Figure 25 HMT338 Probe**

The following numbers refer to Figure 25 above:

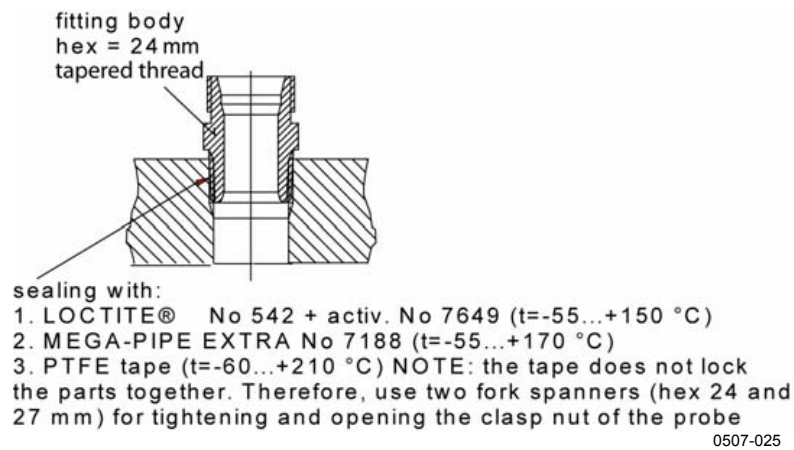
- 1 = Clasp nut, 24 mm hex nut
- 2 = Fitting body, 27 mm hex head

The following two fitting body options are available:

- Fitting Body ISO1/2 solid structure
- Fitting Body NPT1/2 solid structure

**Table 3 HMT338 Probe Dimensions**

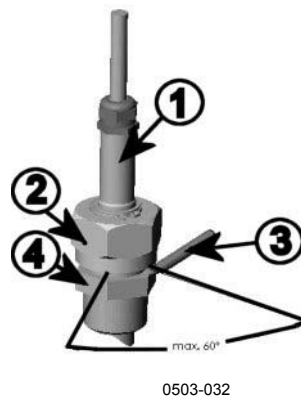
Probe type	Probe Dimension	Adjustment Range
Standard	178 mm	120 mm
Optional	400 mm	340 mm



**Figure 26 Sealing of Fitting Body into Process**

## Tightening the Clasp Nut

1. Adjust the probe to a suitable depth according to the type of installation.
2. Tighten the clasp nut first manually.
3. Mark the fitting screw and the clasp nut.
4. Tighten the nut a further 50 -60° (ca. 1/6 turn) with a wrench. If you have suitable torque spanner, tighten the nut to max 45 ± 5 Nm (33 ± 4 ft-lbs).



**Figure 27 Tightening the Clasp Nut**

The following numbers refer to Figure 27 above:

- 1 = Probe
- 2 = Clasp nut
- 3 = Pen
- 4 = Fitting screw

**NOTE**

Take care not to over tighten the clasp nut to avoid difficulties when opening it.

**CAUTION**

Take care not to damage the probe body. A damaged body makes the probe head less tight and may prevent it from going through the clasp nut.

**CAUTION**

In pressurized processes it is essential to tighten the supporting nuts and screws very carefully to prevent loosening of the probe by the action of pressure.

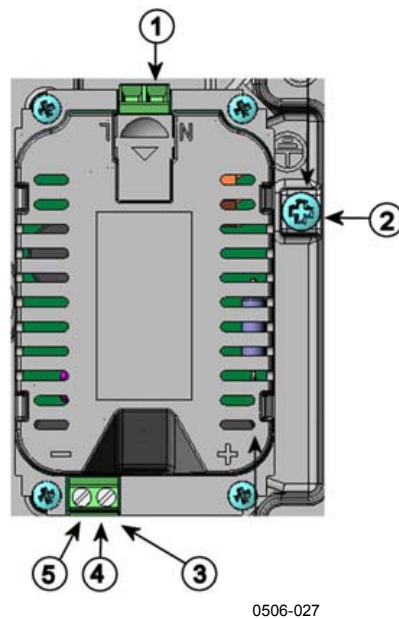
**NOTE**

When installed in a process with a pressure differing from normal atmospheric pressure, please enter the pressure value of the process (in hPa or mbar) into the transmitter memory via the serial line (see command PRES and XPRES on page 77) or by using display/keypad.

## Optional Modules

### Power Supply Module

The AC (mains) power connection may be connected to the power supply module only by an authorized electrician. A readily accessible disconnect device shall be incorporated in the fixed wiring.



**Figure 28 Power Supply Module**

The following numbers refer to Figure 28 above:

- 1 = Connect AC (mains) voltage wires to these terminals
- 2 = Grounding terminal
- 3 = In case the module is not installed in the factory: Connect wires from these terminals to the POWER 10 ... 36V 24V terminals of the mother board.
- 4 = +
- 5 = -

## Installation

1. Disconnect the power and open the transmitter cover.
2. Remove the protective plug from the cable gland and thread the wires. In case the power supply module is installed in the factory, continue with the step 5.
3. To attach the module fasten the power module to the bottom of the housing with four screws. See the position Figure 2 on page 18.
4. Connect the wires from the terminals of the power supply module marked with + and - to the terminals **POWER 10 ... 35 V 24V** on the motherboard of the transmitter.
5. Connect the AC mains voltage wires to the power supply module terminals marked with **N** and **L**.
6. Attach the grounding wire to the grounding terminal on the right-hand side of the transmitter.
7. Connect the power. The LED on the cover of the transmitter is lit continuously during normal operation.

**WARNING**

Do not detach the power supply module from the transmitter when the power is on.

**WARNING**

Do not connect the mains power to power supply module when it is not installed in the transmitter.

**WARNING**

Always connect protective ground terminal.

## Warnings

### **Questo prodotto é conforme alla Direttiva sul basso voltaggio (73/23 CEE).**

- La conduttura elettrica può essere collegata al modulo di alimentazione elettrica soltanto da un elettricista autorizzato.
- Non staccare l'alimentazione elettrica dal trasmettitore quando é acceso.
- Non collegare la corrente elettrica al modulo di alimentazione elettrica se non é installato nel trasmettitore HMT330.
- Collegare sempre il morsetto protettivo a terra!

### **Dette produkt er i overensstemmelse med direktivet om lavspænding (73/23 EØS).**

- Netstrømskoblingen til må kun tilsluttes strømforsyningsmodulet af en autoriseret elinstallatør
- Strømforsyningsmodulet må ikke løsgøres fra senderen, mens spændingen er sluttet til.
- Slut ikke netspændingen til strømforsyningsmodulet, når det ikke er installeret i HMT330-senderen
- Forbind altid den beskyttende jordklemme!

### **Dit product voldoet aan de eisen van de richtlijn 73/23 EEG (Laagspanningsrichtlijn).**

- De stroom kan aan de stroomtoevoer module aangesloten worden alleen door een bevoegde monteur.
- Het is niet toegestaan de stroomtoevoer module van de transmitter los te koppelen wanneer de stroom aan is.
- Het is niet toegestaan de stroom aan de stroomtoevoer module aan te sluiten als deze niet in een HMT330-transmitter is gemonteerd.
- Altijd beschermend aardcontact aansluiten!

### **Este producto cumple con la directiva de bajo voltaje (72/23 EEC).**

- La conexión de la alimentación principal al módulo de alimentación sólo puede realizarla un electricista autorizado.
- No desenchufe el módulo de alimentación del transmisor cuando esté encendido.
- No conecte la alimentación principal al módulo de alimentación cuando no esté instalado en el transmisor HMT330.
- Conecte siempre el terminal de protección de conexión a tierra.

### **See toode vastab madalpinge direktiivile (73/23 EEC).**

- Voolukaabli võib vooluallika mooduli külge ühendada ainult volitatud elektrik.
- Ärge ühendage vooluallika moodulit saatja küljest lahti, kui vool on sisse lülitatud.
- Ärge ühendage voolukaablit vooluallika mooduli külge, kui seda pole HMT330-tüüpi saatjasse paigaldatud.
- Ühendage alati kaitsev maandusklemm!



**Ez a termék megfelel a Kisfeszültségű villamos termékek irányelvnek (73/23/EGK).**

- A hálózati feszültséget csak feljogosított elektrotechnikus csatlakoztathatja a tápegységmodulra.
- A bekapcsolt távadóról ne csatolja le a tápegységmodult.
- Ne csatlakoztassa a hálózati feszültséget a tápegységmodulhoz, ha az nincs beépítve a HMT330 távadóba.
- Feltétlenül csatlakoztasson földelő védőkapcsot!

**Šis produktas atitinka direktyvą dėl žemos įtampos prietaisų (73/23/EB).**

- Elektros tinklą su energijos tiekimo modulių sujungti gali tik įgaliotas elektrikas.
- Niekada neišimkite energijos tiekimo modulio iš siųstuvo, kai maitinimas yra įjungtas.
- Jei energijos tiekimo modulis nėra įmontuotas HMT330 siųstuve, nejunkite jo į elektros tinklą.
- Visada prijunkite prie apsauginės įžeminimo jungties!

**Šis produkt atbilst Zemsprieguma direktivai (73/23 EEC).**

- Strāvas pieslēgumu var pieslēgt pie barošanas avota moduļa tikai autorizēts elektrikš.
- Neatvienot barošanas avota moduli no raidītāja, kad pieslēgta strāva.
- Nepievienot strāvu barošanas avota moduļim, ja tas nav uzstādēts HMT330 raidītājā
- Vienmēr pievienot aizsargājošu iezemētu terminālu !

**Ten produkt spełnia wymogi Dyrektywy niskonapięciowej (73/23 EEC).**

- Napięcie zasilające powinno zostać podłączone do modułu zasilacza tylko przez wykwalifikowanego elektryka.
- Nie wolno odłączać modułu zasilacza od nadajnika, kiedy zasilanie jest włączone.
- Nie wolno podłączać napięcia zasilającego do modułu zasilacza, kiedy nie jest on zamontowany w nadajniku HMT330.
- Zawsze należy podłączać zabezpieczający zacisk uziemiający!

**Tento výrobek vyhovuje Směrnici pro nízké napětí (73/23 EEC).**

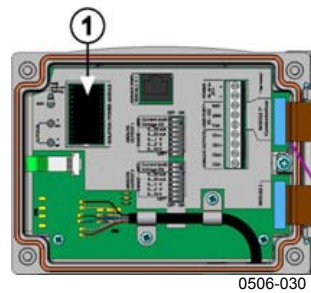
- Připojení síťového napájení k napájecímu modulu smí provádět pouze oprávněný elektrikář.
- Neodpojujte napájecí modul od snímače při zapnutém napájení.
- Nepřipojujte síťové napájení k napájecímu modulu, pokud není instalován ve snímači HMT330.
- Vždy zapojte ochrannou zemnicí svorku!

## Galvanic Isolation for Output

If galvanic isolation of the power supply line from the output signals is needed, HMT330 can be ordered with optional output isolation module. This module prevents harmful grounding loops.

**NOTE**

Output isolation module is not needed when using the power supply module.

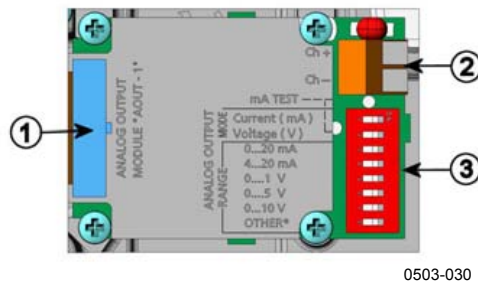


**Figure 29 Galvanic Output Isolation Module**

The following number refers to Figure 29 above:

- 1 = Output isolation module

## Third Analog Output



**Figure 30 Third Analog Output**

The following numbers refer to Figure 29 above:

- 1 = Flat cable pins
- 2 = Screw terminals for signal line
- 3 = DIP switches to select the output mode and range

## Installation and Wiring

1. Disconnect the power. In case the analog output module is installed in the factory, continue with the step 4.
2. To attach the module, open the transmitter cover and fasten the analog output module to the bottom of the housing with four screws. See the position from the picture on page 11.
3. Connect the flat cable between the analog output module and the motherboard's pins MODULE 2.
4. Take out the protective plug from the cable gland and thread the wires.
5. Connect the wires to the screw terminals marked with **Ch+** and **Ch-**.
6. Select the current/voltage output by setting ON either of the switches 1 or 2.
7. Select the range by setting ON one of the switches 3 ... 7.

### NOTE

Only one of the switches 1 and 2 can be ON at a time.

Only one of the switches 3 ... 7 can be ON at a time.

	OFF	ON	Selection
Channel 3 {	1		Current output selection, ON=Current output selected
	2		Voltage output selection, ON=Voltage output selected
	3		0...20 mA selection, ON= 0...20 mA selected
	4		4... 20 mA selection, ON= 4... 20 mA selected
	5		0...1 V selection, ON=0...1 V selected
	6		0...5 V selection, ON=0...5 V selected
	7		0...10 V selection, ON= 0...10 V selected.
	8		For service use only, keep always in OFF position.

8. Connect the power.
9. Select the quantity and scale the channel via the serial line or display/keypad, see section Analog Output Quantities on page 93. For testing the analog output, see Section Analog Output Tests on page 95. For fault indication setting, see section Analog Output Fault Indication Setting on page 96.

## Relays

HMT330 can be equipped with one or two configurable relay modules. Each module contains two configurable relays. See the contact ratings in section Technical Specifications of Optional Modules on page 135.

### Installation and Wiring

1. Disconnect the power and open the transmitter cover. In case the relay-module is installed in the factory, continue with step 5.
2. To attach the module fasten the relay module to the bottom of the housing with four screws. See the position in Figure 2 on page 18.
3. When the mains power is in use attach the grounding wire to the grounding terminal.
4. Connect the flat cable between the relay module and the **MODULE 1** or **MODULE 2** pins of the motherboard.
5. Take out the protective plug from the cable gland and thread the relay wires.
6. Connect the wires to the screw terminals: NO, C, NC.

### Selecting the Activation State of the Relay

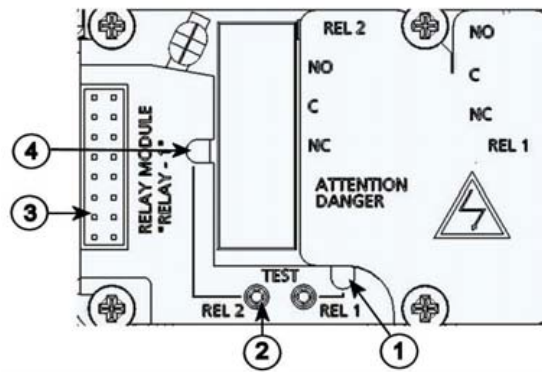
The middlemost C terminal and either one of the terminals NO/NC must be connected. The polarity can be freely selected.

NO Normally open  
C Common relay  
NC Normally closed

Relay NOT activated: C and NC outputs are closed, NO is open  
Relay IS activated: C and NO outputs are closed, NC is open.  
Connect the power and close the cover.

**NOTE**

For instructions on how to operate the relay (for example, select quantity for the relay output and set the relay setpoints) see section Operation of Relays on page 97.



**Figure 31** Relay Module

The following numbers refer to Figure 31 above:

- 1 = Indication led for the relay 1 or 3
- 2 = Relay test buttons
- 3 = Flat cable pins
- 4 = Indication led for relay 2 or 4

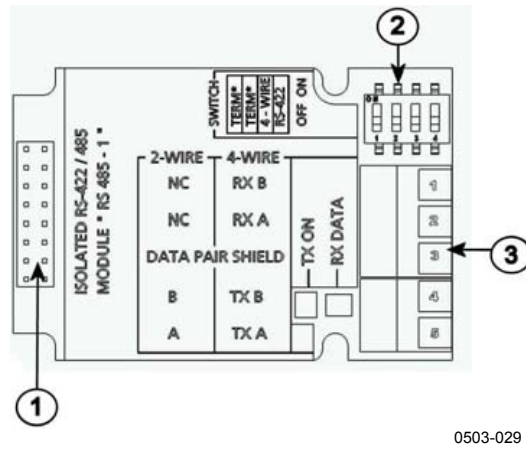
**WARNING**

The relay module may contain dangerous voltages even if the transmitter power has been disconnected. Before opening the transmitter you must switch off **both** the transmitter **and** the voltage connected to the relay terminals.

**WARNING**

Do not connect the mains power to relay unit without grounding the transmitter.

# RS-422/485 Interface



0503-029

**Figure 32 RS-485 Module**

The following numbers refer to Figure 32 above:

- 1 = Flat cable pins
- 2 = Selection switches
- 3 = Screw terminals for wiring

## Installation and Wiring

1. Disconnect the power. In case the RS-485-module is installed in the factory, continue with the item 4.
2. To attach the module, open the transmitter cover and fasten the RS-485 module to the bottom of the housing with four screws.
3. Connect the flat cable between the RS-485 module and the motherboard's pins **MODULE1 (Communications)**.
4. Pull the network wirings through the cable gland.
5. Connect the twisted pair wires (1 or 2 pairs) to the screw terminals as presented in Table 4 below:

**Table 4 Connecting the Twisted Pair Wires to the Screw Terminals**

Screw terminal	Data line (2-wire RS-485)	Data line (4-wire RS-485/422)
1	(not connected)	RxB
2	(not connected)	RxA
3	Data pair shield	Data pair shield
4	B	TxB
5	A	TxA

6. If you use RS-485 (or RS-422) to connect just one HMT330 to a master computer, enable the internal termination of HMT330 by switching switches 1 and 2 ON. Make sure that the master's end of the line is also terminated (by using master's internal termination or with a separate terminator).

If you are connecting many transmitters to the same RS-485 bus, make sure that switches 1 and 2 are OFF and terminate the bus with separate terminators at both ends. This allows removing any transmitter without blocking the bus operation.

**NOTE** If you use the internal termination of the transmitter at the end of the RS-485 bus (instead of using separate terminators) removing that transmitter will block the bus operation.

7. Use the bus type (4-wire/2-wire) to select the selection switch 3. In 4-wire mode RS-485 master sends data to the HMT330 through terminals RxA and RxB and receives data from HMT330 through terminals TxA and TxB.

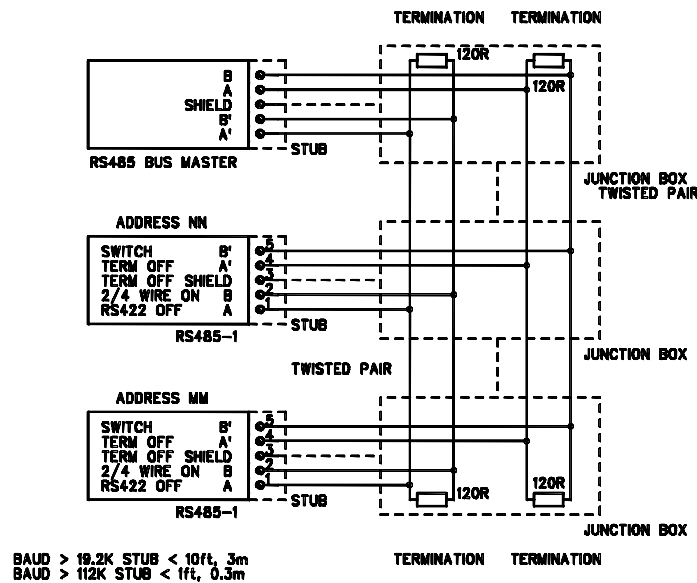


Figure 33 4-Wire RS-485 Bus

Table 5 4-Wire (Switch 3: On)

RS-485 master	Data	HMT330
TxA	→	RxA
TxB	→	RxB
RxA	←	TxA
RxB	←	TxB

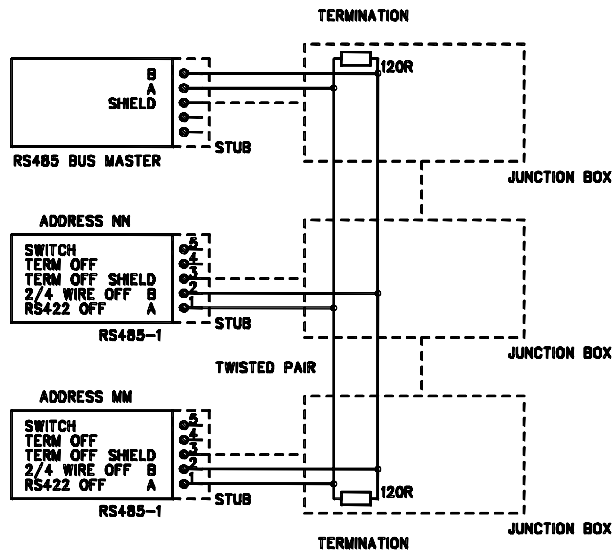


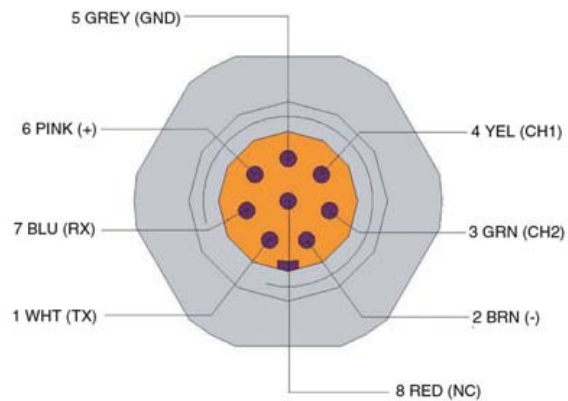
Table 6 2-Wire (Switch 3: Off)

RS-485 master	Data	HMT330
A	↔	A
B	↔	B

8. When operating in communication mode RS-422, set both switches 3 and 4 to ON position (4-wire wiring is required for RS-422 mode).
9. Connect the power and close the cover.



## 8-Pin Connector



0503-026

**Figure 34 Wiring of Optional 8-Pin Connector**

**Table 7 Wiring of 8-Pin Connector**

PIN/Terminal	Wire	Serial Signal		Analog Signal
		RS-232 (EIA-232)	RS-485 (EIA-485)	
1	White	Data out TX	A -	-
2	Brown	(serial GND)	(serial GND)	Signal GND (for both channels)
3	Green	-	-	Ch 2+
4	Yellow	-	-	Ch 1 +
5	Grey	Supply -	Supply -	Supply -
6	Pink	Supply +	Supply +	Supply +
7	Blue	Data in RX	B -	-
8	Shield/Red	Cable shield	Cable shield	Cable shield

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## CHAPTER 4

# OPERATION

This chapter contains information that is needed to operate this product.

## Getting Started

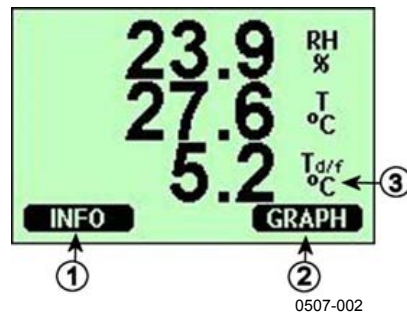
Within a few seconds after power-up the led on the cover of the transmitter is lit continuously indicating normal operation. When using the optional display and turning the transmitter on the first time, the language selection menu window opens. Select the language with arrow buttons and press the SELECT button.

The pressure has an effect on humidity calculations and accuracy. Therefore, accurate calculations can be achieved only when the ambient pressure is taken into consideration. For instructions on how to set the pressure, see section Pressure Compensation Setting on page 77.

## Display/Keypad (Optional)

### Basic Display

Display shows you the measurement values of the selected quantities in the selected units. You can select 1 ... 3 quantities for the numerical basic display (see section Changing Quantities and Units on page 74.)



**Figure 35 Basic Display**

The following numbers refer to Figure 35 above:

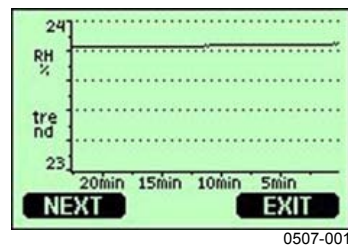
- 1 = The Info shortcut button, see section Device Information on page 82 below
- 2 = The Graph shortcut button, see section Graphic History on page 58 below
- 3 = Quantities selected for display

**NOTE** From any view, a four-second press on the right-hand function button takes you directly to the basic display.

## Graphic History

The graphical display shows the data trend of the selected quantities, one at a time. The graph is updated automatically while measuring. Use the following functions in the graphical display:

- Press the **NEXT** button to have the trend graph and max/min graph in turns and browse through the quantities selected for display.
- Press the **EXIT** button to get back the basic display.



**Figure 36 Graphical Display**

**Trend graph:** Shows you a curve of average values. Each value is a calculated average over a period. See Table 8 on page 59 below.

**Max/min graph:** Shows you the minimum and maximum values in a form of curve. Each value is max/min over a time period. See Table 8 below.

**Table 8 Periods for Trend and Max/Min Calculations**

Observation Period	Period for Trend/Max/Min Calculations (Resolution)
20 minutes	10 seconds
3 hours	90 seconds
1 day	12 minutes
10 days	2 hours
2 months	12 hours
1 year	3 days

- Press the arrow buttons to zoom in and out the time in the graph window.
- Press the arrow buttons to have the cursor mode where you can observe individual measuring points. Press an arrow button to move the cursor (vertical bar) along the time axis. The numerical value at the cursor position is shown at the left upper corner. Time from the present to the chosen moment is shown at the right upper corner.

**Table 9 Graph Information Messages in Cursor Mode**

Message	Interpretation
Power outage	Power failure (marked also with dashed vertical line)
No data	Quantity has not been selected for the display
Device failure	General device failure
T meas. failure	Temperature measurement/sensor failure
RH meas. failure	Humidity measurement/sensor failure
Adj. mode active	Adjustment mode active (data recorded in the adjustment mode is not displayed)

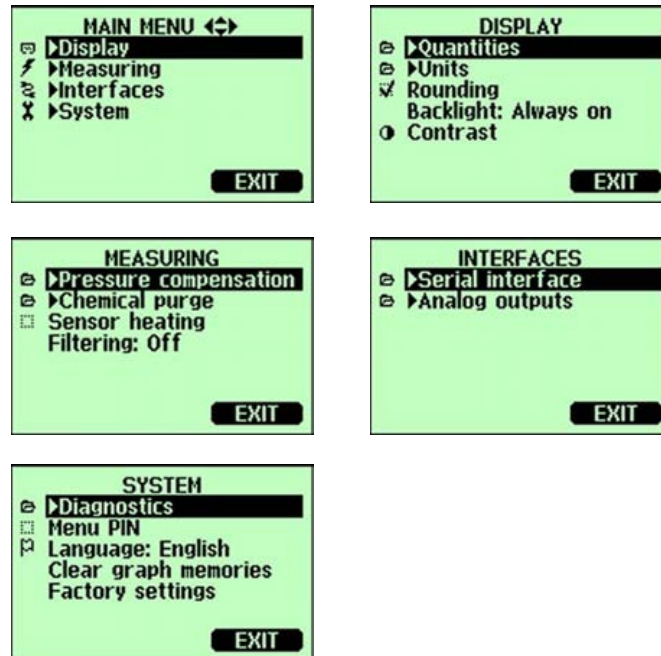
A question mark after time tells you that at least one power failure (dashed vertical line) has occurred after the chosen moment. In this case, the exact time difference between the present and the cursor position is not exactly known.

## Menus and Navigation

You can change settings and select functions in the menus.

1. Open the **MAIN MENU** by pressing any of the arrow buttons in the basic (numeric) display mode.
2. Move in the menus by using the arrow buttons.

3. Open a submenu with **SELECT** button.
4. Press **EXIT** to return to the previous level.
5. Function button **EXIT** returns you back to the basic display.



0507-003

**Figure 37 Main Menus**

## Language Setting

1. Go back to the basic display by keeping the right-hand **SELECT** button pressed for four seconds.
2. Open the **MAIN MENU** by pressing any of the **SELECT** buttons.
3. Select **System** (the lowest row), press **SELECT** button.
4. Select **Language: ...** (the third row marked with a flag icon), press **SELECT** button (left-hand **SELECT** button).
5. Select the menu language with **SELECT** buttons and press **SELECT** button (left-hand **SELECT** button).
6. Press **EXIT** to return to the basic display.

## Rounding Setting

Round off one decimal by using the Rounding function. The default setting is rounding on. Rounding has no effect on quantities without decimals.

1. Open the **MAIN MENU** by pressing any of the arrow buttons.
2. Select **Display** and confirm by pressing the arrow button.
3. Select **Rounding** and press **ON/OFF** button.
4. Press **EXIT** to return to the basic display.

## Display Backlight Setting

As a default the display backlight is always on. In the automatic mode the backlight stays on for 30 seconds from the last press of any button. When pressing any button, the light turns on again.

1. Open the **MAIN MENU** by pressing any of the arrow buttons.
2. Select **Display**, press the arrow button.
3. Select **Backlight**, press the **CHANGE** button.
4. Select **On/Off/Automatic**, press the **SELECT** button.
5. Press **EXIT** to return to the basic display.

## Display Contrast Setting

1. Open the **MAIN MENU** by pressing any of the arrow buttons.
2. Select **Display**, press the arrow button.
3. Select **Contrast**, press the **ADJUST** button.
4. Adjust the contrast by pressing the arrow buttons.
5. Press **OK** and **EXIT** to return to the basic display.

## Keypad Lock (Key guard)

This function locks the keypad and prevents unintentional key presses.

1. Keep pressing the left-hand function button for 4 seconds to lock the keypad (at any display).
2. To unlock the keypad, press the **OPEN** button for 4 seconds.

## Menu PIN Lock

You can prevent unauthorized changes of the device settings by activating the menu PIN lock. When this function is activated, the basic display and graphical view are available but access to the menus is locked. The key symbol indicates the activation of this feature.

1. Open the **MAIN MENU** by pressing any of the arrow buttons.
2. Select **System**, press the arrow button.
3. Select **Menu PIN**, press the **ON** button.
4. Enter a PIN code by using the arrow buttons. Press **OK** to confirm the setting. Now the PIN lock is on and a key symbol is shown in a display.
5. Press **EXIT** to return to the basic display. Returning to the menu is possible only by entering the correct PIN code.

When you want to turn off the PIN lock, go to the menu by giving the PIN code and select **System, Menu PIN**, press **OFF** button.

In case you have forgotten the PIN code, open the transmitter cover and press the **ADJ** button once. Wait for a few seconds and the adjustment menu opens. Select **Clear menu PIN**, press **CLEAR**.

<b>NOTE</b>	You can also disable the keypad completely with serial command <b>LOCK</b> .
-------------	--



## Factory Settings

Use the display/keypad to restore the factory settings. This operation does not affect the adjustments. Only settings available in the menus are restored.

1. Press any of the arrow buttons to open the **MAIN MENU**.
2. Select **System** by pressing the ► arrow button.
3. Select **Factory settings** and press the **REVERT** button to confirm your selection. Press the **YES** button to reset all settings to the factory defaults.

See section General Settings on page 74 for a description of the other menu options.

## MI70 Link Program for Data Handling

The recorded data can be transferred to a PC by using MI70 Link program. You can examine the recorded data easily in Windows environment and transfer it further to a spreadsheet program (such as Microsoft Excel) or virtually to any Windows program in numeric or graphical format. MI70 Link program allows you also to monitor transmitter readings directly with a PC (real-time window function).

MI70 Link program is available from Vaisala, see list of accessories in section Options and Accessories on page 136.

1. Connect the connection cable between the serial port of your PC and the Service Port of HMT330; see Figure 38 on page 64 below.
2. Check that the HMT330 is powered and start using the MI70 Link program.

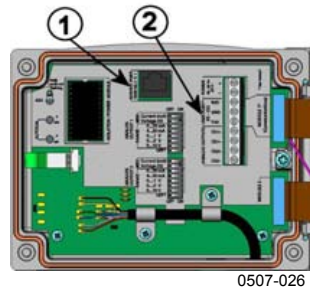
Use a MI70 Link version 1.07, or a newer one, to be able to utilize all the functions of HMT330.

## Serial Line Communication

Connect the serial interface by using either the user port or the service port.

For permanent interfacing to host system, use the user port. You can change the serial settings and operate in RUN, STOP and POLL modes.

For temporary RS-232 connections use the service port. Service port is always available with fixed serial settings.



**Figure 38 Service Port Connector and User Port Terminal on Mother Board**

The following numbers refer to Figure 38 above:

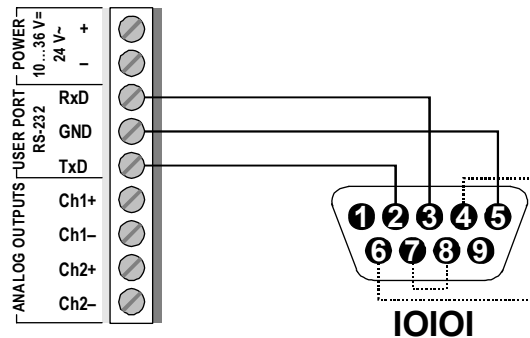
- 1 = Service port connector
- 2 = User port terminals

## User Port Connection

Use suitable serial cable between the user port RxD, GND and TxD screw terminals and the PC serial port, see Figure 39 on page 64 below.

**Table 10 Default Serial Communication Settings for the User Port**

Parameter	Value
Bauds	4800
Parity	Even
Data bits	7
Stop bits	1
Flow control	None



0506-033

**Figure 39 Connection Example Between PC Serial Port and User Port**

Connections to pins 4, 6, 7 and 8 on PC serial port are required only if you are using software requiring hardware handshaking.

After power-up the transmitter (in STOP-mode) outputs the software version and the command prompt.

```
HMT330/2.02  
>
```

In RUN mode a measurement output starts immediately after power-up.

In POLL mode, the transmitter does not output anything after power-up (see section SMODE on page 105).

**NOTE**

User port cannot be used when RS-485 module is connected.

## Service Port Connection

1. Connect the serial interface cable (optional accessory, order code: 19446ZZ) between the serial port of your PC and the service port connector on the motherboard, see Figure 38 on page 64.

**Table 11** Fixed Communication Settings for Service Port

Parameter	Value
Bauds	19200
Parity	No
Data bits	8
Stop bits	1
Flow control	None

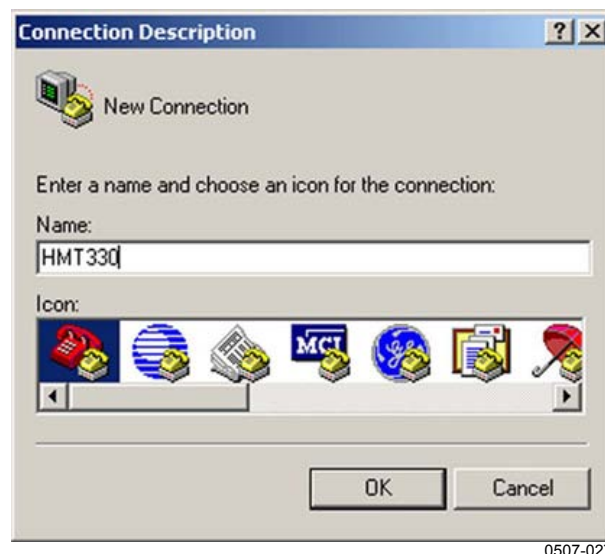
2. Open a terminal program and set the communication settings (see the following section for more detailed instructions).
3. Power-up the HMT330.

## Terminal Program Settings

The following instructions show a connection example with HyperTerminal program (included in the Microsoft Windows).

Follow the instructions below to open a HyperTerminal program:

1. Start HyperTerminal. To get help for starting HyperTerminal, click "Start", select "Help" to open Windows help, and search for "HyperTerminal".



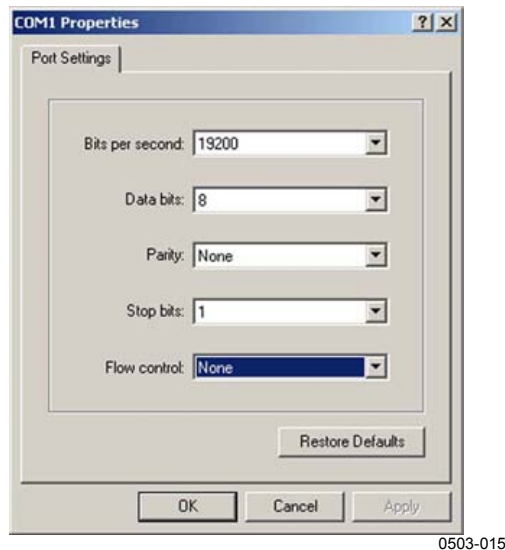
**Figure 40 Starting Hyper Terminal Connection**

2. In the "New Connection" window of the HyperTerminal, define a name for HMT330 serial connection, for example "HMT330". Click OK.
3. In the "Connect using" pull down menu, select the PC communications port where the serial cable is connected. (If your computer has only one COM port, it is called "COM1"). Click OK.



**Figure 41** Connecting to Hyper Terminal

4. Set the port settings in the "Properties" window to match the settings of your HMT330 *user port/service port*. For HMT330, "Flow control" must always be set to "None". Finally click OK to start using the serial connection.



**Figure 42** Hyper Terminal Serial Port Settings

5. Select "File" → "Save" in the HyperTerminal main window to save the serial port settings. To use the saved settings later, start HyperTerminal, click cancel in the "New Connection" window, and select "File" → "Open".

## List of Serial Commands

The bold text in the brackets is the default setting. Commands are entered by typing them on your computer and pressing the Enter key.

### Measurement commands

<b>R</b>	Start the continuous outputting
<b>S</b>	Stop the continuous outputting
<b>INTV</b> [ <b>0</b> ...255 S/MIN/H]	Set the continuous output interval (for RUN mode)
<b>SEND</b> [ <b>0</b> ...99]	Output the reading once
<b>SEND D</b>	Outputting the reading with the raw data
<b>SMODE</b> [ <b>STOP</b> /RUN/POLL]	Set the serial interface
<b>SERI</b> [baud p d s]	User port settings (default: 4800 E 7 1) baud: 300...115200
<b>ADDR</b> [ <b>0</b> ...99]	Set the transmitter address (for POLL mode)
<b>OPEN</b> [ <b>0</b> ...99]	Open temporarily connection to the POLL-mode device
<b>CLOSE</b>	Close the connection (back to POLL mode)
<b>Formatting commands</b>	
<b>FORM</b>	Set the output format of SEND and R commands
<b>TIME</b>	Set the time
<b>DATE</b>	Set the date
<b>FTIME</b> [ON/OFF]	Add time to output to SEND and R outputs
<b>FDATE</b> [ON/OFF]	Add date to R and SEND outputs
<b>FST</b> [ON/OFF]	Add the state of probe heating and chemical purge in connection with SEND and R commands
<b>UNIT</b>	Select the metric or non-metric output units
<b>Data recording commands</b>	
<b>DSEL</b>	Select data recording and display quantities.
<b>PLAY</b> [0 ... 17]	Output recorded data file
<b>DIR</b>	Display recorded files
<b>DELETE</b>	Delete the graph files
<b>UNDELETE</b>	Recovers the deleted files
<b>Chemical purge commands</b>	
<b>PUR</b>	Set the automatic chemical purge
<b>PURGE</b>	Start the manual chemical purge

**Calibration and adjustment commands**

<b>CRH</b>	Relative humidity calibration
<b>CT</b>	Temperature calibration
<b>CTA</b>	Additional temperature probe calibration
<b>FCRH</b>	Relative humidity calibration after sensor change
<b>CTEXT</b>	Give the text to calibration information field
<b>CDATE</b>	Set the calibration date
<b>ACAL</b>	Analog output calibration

**Setting and testing the analog outputs**

<b>AMODE</b>	View the analog output modes
<b>ASEL</b>	Select the parameters for the analog outputs
<b>ITEST</b>	Test the analog outputs
<b>AERR</b>	Change the analog error output values

**Setting and testing the relays**

<b>RSEL</b>	Set and view the relays
<b>RTEST</b>	Test the relays

**Other commands**

<b>?</b>	Output the information about the device
<b>??</b>	Output the information about the device in POLL-state
<b>ECHO [ON/OFF]</b>	Turn the serial interface echo ON/OFF
<b>FIND</b>	All devices in POLL mode are sent their addresses
<b>HELP</b>	List the most common commands
<b>PRES [hPa]</b>	Set the value for pressure compensations
<b>XPRES [hPa]</b>	Set the value for pressure compensations, temporarily
<b>ERRS</b>	List present transmitter errors
<b>FILT</b>	Set the result filtering
<b>VERS</b>	Display the software version information
<b>XHEAT</b>	Sensor heating
<b>LOCK</b>	Lock the menu/disable keypad

## Getting Measurement Message from Serial Line

Enter the **R** command to start output of measurements. Enter the **S** command, press the Esc button or reset the transmitter to stop outputting. See command **SMODE** to change the default (power-up) operation mode.

Format the output by using the following commands:

- Outputting interval can be changed with the **INTV** command.
- Output message format can be changed with a command **FORM**.
- Status of chemical purge and probe heating can be added with a command **FST**.
- Date and time information can be added with commands **FDATE** and **FTIME**

Examples:

```
>r  
RH= 11.3 %RH T= 28.8 'C  
>
```

```
>r  
RH= 11.3 %RH T= 28.8 'C Tdf= -3.7 'C Td= -4.2 'C a= 3.2  
g/m3 x= 2.8 g/kg T  
w= 13.0 'C ppm= 4440 pw= 4.48 hPa pws= 39.53 hPa h=  
36.1 kJ/kg dT= 32.5 'C  
>
```

## Stopping Continuous Outputting

### S

Use the S command to end the RUN mode. After this command all other commands can be used.

## Outputting Reading Once

### SEND

Use the SEND command to output the reading once in STOP mode:

The output format depends on which parameters the transmitter can output.



**Examples:**

```
RH= 98.4 %RH T= 31.1 'C
```

```
RH= 98.4 %RH T= 31.1 'C Td= 36.0 'C Tdf= 36.0 'C a= 42.4
g/m3 x= 38.8 g/kg Tw= 30.8 'C ppm= 62414 pw= 59.53
hPa pws= 60.52 hPa h= 130.7 kJ/kg
```

If a value is too long to fit to the allocated space in the output, or if there is an error in outputting the quantity, the value is displayed with stars '\*'.

**Example:**

```
RH=***.* %RH T= 31.0 'C
```

The output mode can be changed with the commands: **FORM**, **FST**, **FDATE**, and **TIME**.

**Outputting Reading with Raw Data**

```
SEND D
```

**Example:**

```
>send d
 24.1720 15.0399 -3.5743 189.2324 15.0709 15.0399
23.9765
```

Where the readings (from the left) are:

```
24.1720 = Temperature of the humidity probe ( °C)
15.0399 = RH (%RH)
-3.5743 = Tdf (C)
189.2324 = Capacitance (pF)
15.0709 = RH raw: calculated from scaled capacitance (%RH)
15.0399 = Enhancement factor corrected RH (%RH)
23.9765 = Temperature of the additional temperature probe
          (optional) (°C)
```

## Formatting Serial Line Message

### TIME and DATE

To set time enter the **TIME** command. To set date enter the **DATE** command.

TIME

DATE

These time and date settings are shown on the timestamps of **PLAY** command. When you want to include time and date in the **R** and **SEND** commands, use the **FTIME** and **FDATE** commands.

#### Example:

```
>TIME
Current time is 04:12:39
Enter new time (hh:mm:ss) ? 12:24:00
>DATE
Current date is 2000-01-01
Enter new date (yyyy-mm-dd) ? 2004-07-05
>
```

<b>NOTE</b>
-------------

Time and date are cleared to 2000-01-01 00:00:00 at reset or at power failure.
--

### FTIME and FDATE

**FTIME** and **FDATE** commands will enable/disable output of time and date to the serial line. To add time to **R** and **SEND** outputs enter:

**FTIME** [x]

To add date to **R** and **SEND** outputs enter:

**FDATE** [x]

where

x = ON or OFF

**Example:**

```

>send
RH= 98.4 %RH T= 31.0 'C
>ftime on
Form. time      : ON
>send
03:47:59 RH= 98.4 %RH T= 31.0 'C
>fdate on
Form. date      : ON
>send
2004-07-05 03:48:03 RH= 98.4 %RH T= 31.0 'C
>

```

**FST**

To output the state of optional probe heating and chemical purge in connection with SEND and R commands enter:

**FST [x]**

Where

x = ON or OFF (default)

**Example:**

```

>fst on
Form. status    : ON
>send
N   0 RH= 40.1 %RH T= 24.0 'C Td=  9.7 'C Tdf=  9.7 'C
a=  8.7 g/m3   x=   7.5
g/kg Tw= 15.6 'C ppm= 11980 pw=  12.00 hPa pws=  29.91
hPa h=  43.2 kJ/kg
>purge
Purge started, press any key to abort.
>send
S 134 RH= 40.2 %RH T= 24.1 'C Td=  9.8 'C Tdf=  9.8 'C
a=  8.8 g/m3   x=   7.5
g/kg Tw= 15.7 'C ppm= 12084 pw=  12.10 hPa pws=  30.11
hPa h=  43.5 kJ/kg
>

```

For more information on chemical purge, see section Chemical Purge (Optional) on page 108.

Where the state of the probe is indicated by the following letters and values:

N ... xxx	=	Normal operation	where h xxx	=	Probe heat power
X ... xxx	=	Sensor heating	where xxx	=	Sensor temperature (°C)
H ... xxx	=	Chemical purge	where xxx	=	Sensor temperature (°C)
S ... xxx	=	Sensor cooling after purge	where xxx	=	Sensor temperature (°C)

## General Settings

### Changing Quantities and Units

To change quantities and units use serial commands or the optional display/keypad. See Table 1 on page 15 for available quantities and Table 2 on page 16 for optional quantities.

**NOTE**

Only the quantities selected when ordering the device can be selected as a display output quantity.

#### Using Display/Keypad

Use display/keypad to select the display output quantities.

1. Press any of the arrow buttons to open the **MAIN MENU**.
2. Press the ► arrow button to select **Display**.
3. Press ► arrow button to select **Quantities**.
4. Select the quantity by using the ▲▼ arrow buttons. Confirm the selection by pressing **SELECT**. You can select 1 ... 3 display quantities at a time.
5. Press **EXIT** to return to the basic display.

To select display units:

1. Press any of the arrow buttons to open the **MAIN MENU**.
2. Press the ► arrow button to select **Display**.
3. Use the ▲▼ arrow buttons to select **Units**. Confirm the selection by pressing the right-hand arrow button.
4. Use the ▲▼ arrow buttons to select display units. Confirm the selection by pressing **CHANGE**. The unit changes from metric to non-metric or the other way round.
5. Press **EXIT** to return to the basic display.

**NOTE**

Changing the display quantities/units (by using the display/keypad) has no effect on the serial output data.

## Using Serial Line

Use the serial line command **FORM** to change the format or select a certain quantities for the output commands **SEND** and **R**. Use the serial line command **UNIT** to select metric or non-metric output units.

### FORM

Use the serial line command **FORM** to change the format or select a certain quantities for the output commands **SEND** and **R**.

#### **FORM** [x]

where

x = Formatter string

Formatter string consists of quantities and modifiers.

When entering the command, use the abbreviations of the quantities. For more information on quantities, see Table 1 and Table 2 on page 15.

The modifiers are presented in Table 12 below.

**Table 12 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
#xxx	Special character, code "xxx" (decimal), for example #027 for ESC
U5	Unit field and length
ADDR	Transmitter address with two characters [00...99]
ERR	Error flags for P, T, Ta, RH [0000 ... 1111], 0 = no error
STAT	Transmitter status in 7 character field, for example: N 0 no heating h 115 probe heating active, power 115/255 H 159.0 purge heating active, temperature 159°C S 115.0 purge cooling active, temperature 115°C X 95.0 sensor heating active, temperature 95°C
SN	Transmitter serial number
TIME	Time [hh:mm:ss]
DATE	Date [yyyy-mm-dd]
OK	Pressure stability indicator, two characters [OK or " "]
CS2	Modulus-256 checksum of message sent so far, ascii encoded hexadecimal notation

Modifier	Description
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
A3H	Pressure tendency [* or 0...8]

**Example:**

```
>form "RH=" 4.2 rh U5 #t "T=" t U3 #r #n
RH= 14.98%RH T= 74.68'F

>send
RH= 16.03%RH T= 74.66'F

>form "Tfrost=" tdf U3 #t "Temp=" t U3 #r#n
Tfrost= 36.0'C Temp= 31.0'C
>
```

Command **'FORM /'** will return the default output format. The default output format depends on the device configuration.

```
>form /
>send
RH= 98.4 %RH T= 31.1 'C
>
```

**UNIT**

Use the **UNIT** command to select metric or non-metric output units:

**UNIT [x]**

where

x = M or N

where

M = Metric units

N = Non-metric units

**NOTE**

This command changes both the serial output and display units to either metric or non-metric units. When you want to output both metric and non-metric units simultaneously on the display, select the display units later by using the display/keypad.

## Pressure Compensation Setting

The pressure has an effect on humidity calculations and accuracy. Therefore, accurate calculations can be achieved only when the process pressure is taken into consideration.

Note that conversions from mmHg and inHg are defined at 0°C and for mmH<sub>2</sub>O and inH<sub>2</sub>O at 4°C.

### NOTE

Pressure compensation is intended to be used in normal air only. When measuring in other gases, please contact Vaisala for further information.

### Using Display/Keypad

Use display/keypad to set the pressure compensation. To select the pressure unit using display/keypad, see section Changing Quantities and Units on page 74.

1. Press any of the arrow buttons to open the MAIN MENU.
2. Select **Measuring** and press the ► arrow button to confirm your selection.
3. Select Pressure compensation and press the ► arrow button to confirm you selection.
4. Press **SET** and enter the pressure value in the chosen unit by using the arrow buttons.
5. Press **OK** and **EXIT** to return to the basic display.

### Using Serial Line

#### PRES and XPRES

Command **XPRES** should be used if the value is changed frequently. Its value is not retained at reset, and when set to 0; last value set with **PRES** is used instead. Use the serial line and do the following:

**PRES** [aaaa.a]

**XPRES** [aaaa.a]

where

aaaa.a = Absolute process pressure (hPa)

**Example:**

```
>pres
Pressure          : 1013.00 hPa ?
>pres 2000
Pressure          : 2000.00 hPa
>
```

**Table 13 Multiplication Factors**

From	To: hPa
mbar	1
Pa N/m <sup>2</sup>	0.01
mmHg torr	1.333224
inHg	33.86388
mmH <sub>2</sub> O	0.09806650
inH <sub>2</sub> O	2.490889
atm	1013.25
at	980.665
bar	1000
psia <sup>1)</sup>	68.94757

1) psia = psi absolute.

**Example:**

$$29.9213 \text{ inHg} = 29.9213 \times 33.86388 = 1013.25 \text{ hPa}$$

## User Port Serial Settings

### Using Display/Keypad

The communication settings for the user port can be changed via the serial line or by using the optional display/keypad. The communication settings for the service port are fixed and not changeable.

1. Press any of the arrow buttons to open the MAIN MENU.
2. Select **Interfaces** and press the ► arrow button to confirm your selection.
3. Select **Serial interface** and press the ► arrow button to confirm your selection.
4. Select **Bit rate/Serial format/Comm. mode** by pressing the **CHANGE** button. Use the ▲ ▼ arrow buttons to select and press **SELECT** to confirm your selection.
5. If you selected RUN communication mode, select **RUN interval** for and press **SET** to confirm your selection.



6. Use the arrow buttons to set the measuring interval and the unit. Press **OK** to confirm your settings.
7. If you selected POLL communication mode, select POLL address and press **SET** to confirm your selection.
8. Use the arrow buttons to set the transmitter address. Press **OK** to confirm the setting.
9. Use the arrow buttons to select **ECHO**. Press **ON** to turn it on. Press **OFF** to turn it off.
10. Press **EXIT** to return to the basic display.

The new user port settings set using the display/keypad are effective immediately.

## Using Serial Line

### SERI

Use the serial line command **SERI** [*b p d s*] to set communication settings for the user port.

**SERI** [*b p d s*]

where

- b = Bit rate (110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200)
- p = Parity (n = none, e = even, o = odd)
- d = Data bits (7 or 8)
- s = Stop bits (1 or 2)

#### Example:

```
>SERI 600 N 8 1
600 N 8 1
>
```

You need to reset the transmitter to activate the new communication settings set with command SERI.

The settings can be changed one parameter at a time or all parameters at once:

```
>SERI O                                changing parity only
4800 O 7 1
>SERI 600 N 8 1                          changing all parameters
600 N 8 1
>
```

## SMODE

Use the command **SMODE** to set the user port start-up operating mode.

**SMODE** [xxxx]

where

xxx = STOP, RUN or POLL

**Table 14 Selection of Output Modes**

Mode	Output	Available Commands
STOP	Only with the <b>SEND</b> command	All (default mode)
RUN	Automatic output	Only command S
POLL	Only with the <b>SEND</b> [addr] command	Use with RS-485 buses, see Operation of RS-485 Module on page 104.

Selected output mode will be activated after power outages.

## INTV

Use the command **INTV** to set the outputting interval for the RUN mode.

**INTV** [xxx yyy]

where

xxx = Output interval (0 ... 255). 0: the fastest possible output rate.

yyy = Unit (s, min or h)

### Example:

```
>INTV 10 min
Output intrv. : 10 min
>
```

## ECHO

Use the command **ECHO** to set the user port echo. The command either enables or disables echo of characters received.

**ECHO** [x]

where

x = ON (default) or  
= OFF

### NOTE

You can use the SERI, SMODE, INTV and ECHO commands to change/view the user port settings even if you are currently connected to the service port.

## Data Filtering

The averaging data filter calculates an average over a certain period of time. The lowest measurement noise is achieved with the extended filtering. There are three filtering levels available.

**Table 15 Filtering Levels**

Setting	Filtering level
OFF	No filtering
ON (default)	Standard = short filtering (approximately 15 s moving average)
EXTENDED	Extended filtering (default: approximately 1 min average)

Use display/keypad to set the filtering level.

1. Press any of the arrow buttons to open the **MAIN MENU**.
2. Select **Measuring** by pressing the ► arrow button.
3. Select **Filtering** and press **CHANGE** to confirm your selection.
4. Select **Off/Standard/Extended** and press **SELECT** to confirm your selection.
5. Press **EXIT** to return to the basic display.

## FILT

Use the serial line command **FILT** [xxx] to set the filtering level.

**FILT** [xxx]

where

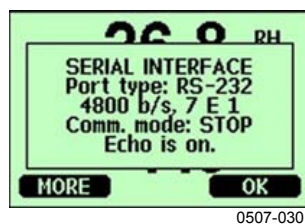
xxx = OFF, ON or EXT (default = ON)

## Device Information

Use the display/keypad or the serial line to display the device information.

Press the **INFO** button in the basic display to see the following information:

- Current sensor operation (for example, chemical purge), if any, in progress
- Present or past unacknowledged errors, if any
- Device information
- Adjustment information fed by the user
- Measuring settings
- Information on chemical purge settings (when applicable)
- Serial interface information
- Analog output information
- Relay output information (when applicable)



**Figure 43** Device Information on Display

Proceed in the information views by pressing the **MORE** button as many times as you get the desired information. You can browse through the information displays also with arrow buttons. Press **OK** to return to the basic display.

**?**

Use the serial line command **?** to check the current transmitter configuration. Command **??** is similar but can also be used if the transmitter is in POLL mode.

**Example:**

```
>?
HMT330 / 2.02
Serial number   : Z4140007
Batch number    : Z4020017
Adjust. date    : 2005-06-20
Adjust. info    : VAISALA/HEL
Date            : 2000-02-12
Time            : 22:58:25
Serial mode     : STOP
Baud P D S     : 4800 E 7 1
Output interval: 0 s
Address         : 0
Echo           : ON
Pressure        : 1013.25 hPa
Filter          : OFF
Ch1 output     : 4...20mA
Ch2 output     : 4...20mA
Ch1 RH low     : 0.00 %RH
Ch1 RH high    : 100.00 %RH
Ch2 T low      : -40.00 'C
Ch2 T high     : 60.00 'C
Module 1       : not installed
Module 2       : not installed
>
```

**HELP**

Use the command **HELP** to list the commands.

**Example:**

```
>help
?          ACAL      ADDR      AERR      ASCL
ASEL       CDATE     CLOSE     CODE      CRH
CT         CTA       CTEXT     DATE      DELETE
DIR        DSEL     DSEND     ECHO      ERRS
FCRH       FDATE     FILT      FORM      FST
FTIME      HELP     INTV      ITEST     MODS
OPEN       PLAY     PRES      R         RESET
SEND       SERI     SMODE     TEST      TIME
UNDELETE  UNIT     VERS     XPRES
>
```

## **ERRS**

Use the command **ERRS** to display transmitter error messages, see Table 16 on page 118.

### **Example:**

```
>ERRS  
NO ERRORS  
>
```

### **Example:**

```
>ERRS  
FAIL  
Error: Temperature measurement malfunction  
Error: Humidity sensor open circuit  
>
```

## **VERS**

Use the command **VERS** to display software version information.

### **Example:**

```
>vers  
HMT330 / 2.02  
>
```

## Resetting Transmitter by Using Serial Line

### RESET

This command resets the device. The user port switches to start-up output mode selected with command SMODE.

## Locking Menu/Keypad by Using Serial Line

### LOCK

Use the **LOCK** command to turn on the menu lock with 4-digit PIN code, for example 4444.

**LOCK** [x yyyy]

where

x = 1 (Menu locked)

yyyy = 4-digit PIN code

### Example:

```
>lock 1 4444
Keyboard lock : 1 [4444]
>
```

Use the **LOCK** command to turn on the menu lock without PIN code access possibility.

**LOCK** [x]

where

x = 1 (Menu locked)

**Example:**

```
>lock 1
Keyboard lock : 1
>
```

Use the **LOCK** command to disable the keypad completely.

**LOCK** [x]

where

x = 2 (Keypad disabled)

**Example:**

```
>lock 2
Keyboard lock : 2
>
```

**NOTE**

Open the locks with the serial command **LOCK 0**. You can open the menu lock also by using the keypad, if a PIN code has been set.



## Data Recording

Data recording function is always on and collects data automatically into the memory of the device. Recorded data do not disappear from the memory when the power is switched off. Collected data can be observed in a form of a graph in the graphical view of the display or it can be listed out by using the serial line or MI70 Link program.

## Selecting Data Recording Quantities

If the device is provided with the optional display, the recorded quantities are always those selected for the display. Up to three quantities can be recorded at a time. For instructions on how to select the display quantities with the keypad, see section Changing Quantities and Units on page 74.

### DSEL

Use the serial line command **DSEL** to select the quantities to be recorded if the transmitter is not equipped with display/keypad.

**DSEL** [xxx]

where

xxx = Data recording quantity. See Table 1 on page 15 and Table 2 on page 16 for the quantities.

#### Example:

```
>dsel rh t tdf
  RH T Tdf
>
```

Enter the command without parameters and press **ENTER** to display current recording parameters.

## View Recorded Data

If the device is provided with the optional display, the graphical display shows the data of the selected quantities, one at a time. See section Graphic History on page 58 for details about graphical display.

You may also dump the logged data to the serial line in numeric form with the following commands.

### DIR

Use the serial line and enter the **DIR** command to check the available files.

The device records six files (six observation periods) for each selected quantity. Thus, total amount of the files depends on the amount of the selected quantities being at minimum 6 and at maximum 18. See Table 8 on page 59.

Select, for example, three quantities (RH, T, and Tdf). The last two columns illustrate software information that is not essential for the user.

### Example:

```
>dir
0 RH latest 20 minutes 00-02-12 22:54:27 135 020A
1 RH latest 3 hours 00-02-12 19:54:27 135 025A
2 RH latest 1 day 00-02-11 20:16:57 135 040C
3 RH latest 10 days 00-02-01 17:16:57 135 0802
4 RH latest 2 months 99-12-07 11:16:57 135 080C
5 RH latest 1 year 99-01-03 23:16:57 135 1003
6 T latest 20 minutes 00-02-12 22:54:27 135 020A
7 T latest 3 hours 00-02-12 19:54:27 135 025A
8 T latest 1 day 00-02-11 20:16:57 135 040C
9 T latest 10 days 00-02-01 17:16:57 135 0802
10 T latest 2 months 99-12-07 11:16:57 135 080C
11 T latest 1 year 99-01-03 23:16:57 135 1003
12 Tdf latest 20 minutes 00-02-12 22:54:27 135 020A
13 Tdf latest 3 hours 00-02-12 19:54:27 135 025A
14 Tdf latest 1 day 00-02-11 20:16:57 135 040C
15 Tdf latest 10 days 00-02-01 17:16:57 135 0802
16 Tdf latest 2 months 99-12-07 11:16:57 135 080C
17 Tdf latest 1 year 99-01-03 23:16:57 135 1003
>
```

## PLAY

Use the **PLAY** command to output the selected file to the serial line. Data in the output is <TAB> limited. This is compatible with most spreadsheet programs. Before giving the command, set the correct date and time with **TIME** and **DATE** commands, if needed.

**PLAY** [x]

where

x = 0 ... 17

### Example:

```
>play 2
RH latest 1 day          99-12-30 22:33:13
Date      Time          trend   min     max
yy-mm-dd hh:mm:ss      %RH     %RH     %RH
99-12-30 22:33:13      19.16   18.99   19.33
99-12-30 22:45:13      19.30   19.09   19.55
99-12-30 22:57:13      20.01   19.28   21.17
99-12-30 23:09:13      21.21   20.98   21.44
99-12-30 23:21:13      19.57   17.72   21.11
99-12-30 23:33:13      19.09   18.62   19.84
```

The <ESC> key can be used to interrupt the output listing.

The **PLAY -1** command can be used to output all files.

### NOTE

Output of large amounts of recorded data can take a long time. If you are using the user port, select the highest serial baud supported to reduce the time required for output.

## Deleting the Recorded Files

Use the keypad/display to delete the recorded files. Note that the transmitter automatically overwrites the old data when the memory gets full, so manual deletion of the recorded files is not necessary.

1. Press any of the arrow buttons to open the **MAIN MENU**.
2. Select **System** by pressing the ► arrow button.
3. Select **Clear graph memories** by pressing the **CLEAR** button. Press the **YES** button to confirm the selection.

**CAUTION**

This function clears all the data history from the memory, all graphs included.

### DELETE/UNDELETE

Use the serial line to delete or undelete data files.

Use the **DELETE** command to delete all data files. Use the **UNDELETE** command to recover the deleted files.

**NOTE**

The **UNDELETE** command will only recover the part of the deleted data that has not been recorded over yet.

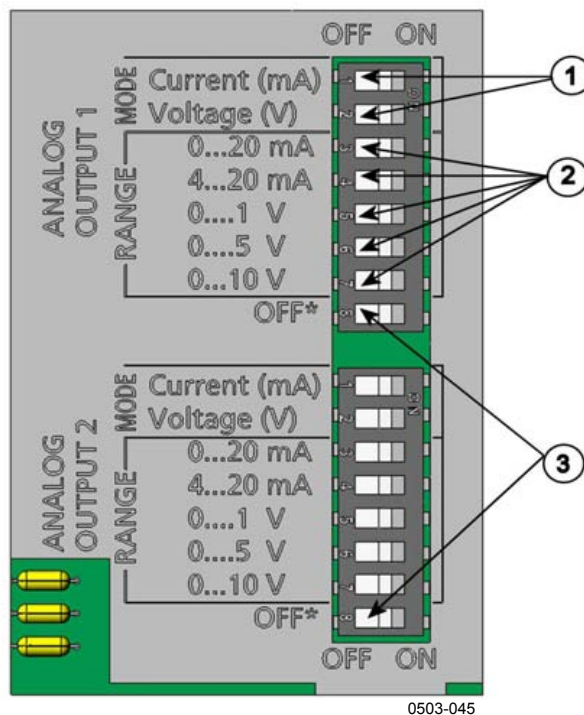
## Analog Output Settings

The analog outputs are set in the factory according to the order form. In case you want to change the settings, follow these instructions. See section Third Analog Output on page 48.

### Changing Output Mode and Range

Both output channels have their own DIP switch module with 8 switches; see the position in Figure 2 on page 18 (DIP switches for analog output settings).

1. Select the current/voltage output; switch ON either of the switches, 1 or 2.
2. Select the range; switch ON one of the switches from 3 to 7.



**Figure 44** Current/Voltage Switches of Output Modules

The following numbers refer to Figure 44 above:

- 1 = Current/voltage selection output switches (from 1 to 2)
- 2 = Current/voltage range selection switches (from 3 to 7) in analog output 1 and 2.
- 3 = Switches for service use only. Keep in OFF position always.

**NOTE**

Only one of the switches 1 or 2 must be ON at a time.

Only one of the switches 3 to 7 must be ON at a time.

**Example:** 0 ... 5 V voltage output selected for channel 1 and 4 ... 20 mA selected for channel 2.

	OFF	ON	Selection
1			Voltage output selected
2			
3			
4			0 ... 5 V selected
5			
6			
7			
8			

1			Current output selected
2			
3			
4			4 ... 20 mA selected
5			
6			
7			
8			

**NOTE**

If you have customized the error output setting (**AERR**), check that the set error values are still valid after changing the output mode/range, see section Analog Output Fault Indication Setting on page 96.

## Analog Output Quantities

Use the display/keypad to change and scale the analog output quantities.

1. Press any of the arrow buttons to open the **MAIN MENU**.
2. Select **Interfaces** by pressing the ► arrow button.
3. Select **Analog outputs** by pressing the ► arrow button.
4. Select **Output 1/2/3** by pressing the ► arrow button.
5. Select **Quantity** by pressing the ▲▼ arrow buttons. Confirm your selection by pressing **CHANGE**.
6. Select the quantity by using the arrow buttons. Press **SELECT** to confirm your selection.
7. Select **Scale, lower limit**, by pressing the ▲▼ arrow buttons. Press **SET** to confirm your selection. Press **OK** to confirm your setting.
8. Select the upper limit by pressing the ▲▼ arrow buttons. Use the arrow buttons to set the upper limit value. Press **SET** to confirm your selection. Press **OK** to confirm your setting.
9. Press **EXIT** to return to the basic display.

### AMODE/ASEL

Use the serial line to select and scale the analog output quantities. Connect the transmitter to the PC. Open the terminal connection between your PC and the transmitter.

1. Check the analog output modes with the **AMODE** command.

#### Example:

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

2. Select and scale the quantities for the analog outputs with the command **ASEL**. Note that the optional quantities can be selected only if they have been selected when ordering the device.

**ASEL** [xxx yyy zzz]

where

xxx = Quantity of channel 1

yyy = Quantity of channel 2

zzz = Quantity of the optional analog output channel 3

Enter always all the quantities for all outputs. For quantities and their abbreviations see Table 1 on page 15 and Table 2 on page 16.

Use the command **ASEL** [xxx yyy] as shown in the example below when using a device with two analog outputs.

**Example:**

```
>asel rh t
Ch1 (RH ) low   : 0.00 %RH ? 0
Ch1 (RH ) high  : 100.00 %RH ? 100
Ch2 (T ) low    : -40.00 'C ? -50
Ch2 (T ) high   : 60.00 'C ? 80
>
```



## Analog Output Tests

Use the display/keypad for testing to test the operation of the analog by forcing the outputs to known values. Measure then the outputs with a current/voltage meter.

1. Press any of the arrow buttons to open the **MAIN MENU**.
2. Select **System** by pressing the ► arrow button.
3. Select **Diagnostics** by pressing the ► arrow button.
4. Select **Analog output tests** by pressing the ► arrow button.
5. Select one of the testing options **Force 0%/50%/100% of scale**. Press **TEST** to confirm your selection. All outputs are tested simultaneously. The actual output value depends on the selected range.
6. Press **OK** to stop testing. Press **EXIT** to return to the basic display.

### ITEST

Use the serial line to test the operation of the analog outputs. Use the command **ITEST** to force the analog outputs to entered values. The set values remain valid until you enter the command **ITEST** without parameters or **RESET** the transmitter.

**ITEST** [*aa.aaa bb.bbb*]

where

*aa.aaa* = Current or voltage value to be set for channel 1 (mA or V)

*bb.bbb* = Current or voltage value to be set for channel 2 (mA or V)

#### Example:

```
>itest 20 5
Ch1 (Td )      :          *          20.000 mA   H'672A
Ch2 (T )       :          *           5.000 mA   H'34F9
>itest
Ch1 (Td )      :    -23.204 'C      16.238 mA   H'FFFE
Ch2 (T )       :     22.889 'C       8.573 mA   H'5950
>
```

## Analog Output Fault Indication Setting

Factory default state for analog outputs during error condition is 0 V/0 mA. Please be careful when selecting the new error value. The error state of the transmitter should not cause unexpected problems in process monitoring.

Use the display/keypad to set the analog output fault indication.

1. Press any of the arrow buttons to open the **MAIN MENU**.
2. Select **Interfaces** by pressing the ► arrow button.
3. Select **Analog Outputs** by pressing the ► arrow button.
4. Select **Output 1/2/3** by pressing the ► arrow button.
5. Select Fault indication. Press **SET** to confirm your selection. Enter the fault indication value by using the arrow buttons. Press **OK** to confirm your setting. This value is outputted if a transmitter error occurs.
6. Press **EXIT** to return to the basic display.

### AERR

Use the serial line **AERR** command to change the error output.

#### AERR

##### Example:

```
>aerr
Ch1 error out : 0.000V ? 5.0
Ch2 error out : 0.000V ? 5.0
>
```

<b>NOTE</b>	The error output value must be within a valid range of the output mode.
-------------	---

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

# Operation of Relays

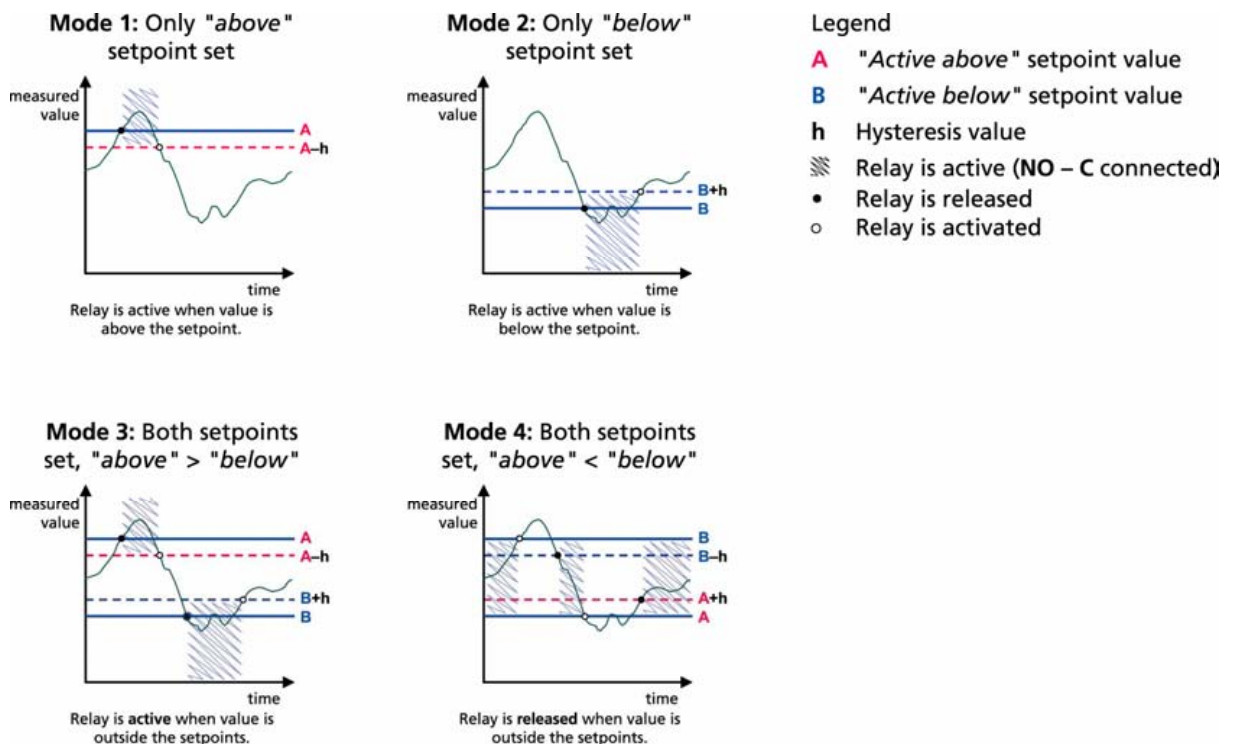
## Quantity for Relay Output

A relay monitors the quantity chosen for the relay output. Any of the quantities available can be chosen.

## Measurement-Based Relay Output Modes

### Relay Setpoints

When the measured value is in between the "above" and "below" values, the relay is passive. When choosing lower value as "above" value and higher value as "below" value, the relay is passive when the measured value is not between the setpoints. You can also set only one setpoint. See Figure 45 below for illustrative examples of the different measurement-based relay output modes.



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**Figure 45 Measurement-Based Relay Output Modes**

Mode 4 is usually used if an alarm needs to be triggered when the measured value exceeds a safe range. The relay is active when measurement is in range, and is released if the value goes out of range or the measurement fails.

**NOTE**

If the measurement of the selected quantity fails or the transmitter loses its power, the relay is released.

## Hysteresis

Hysteresis function is to prevent the relay switching back and forth when the measured value is near to the setpoint values.

Relay is activated when the measured value passes the exact value of the setpoint. When returning and passing the setpoint again relay is not released before the value reaches the setpoint increased/decreased by the hysteresis value.

Hysteresis should be smaller than difference of the setpoints.

**Example:** When the 'active above' value is 60 %RH and the hysteresis value is 5 %RH, relay activates when the relative humidity reaches 60 %RH. As the humidity decreases, relay releases at 55 %RH.

**NOTE**

If both setpoints are specified and "above" setpoint is lower than "below" setpoint, the hysteresis works in the opposite direction, that is, relay is **released** when the measured value passes the exact value of the setpoint.

## Relay Indicating Transmitter Error Status

You can set a relay to follow the operation status of the device. By selecting FAULT/ONLINE STATUS for output quantity a relay changes state on the basis of the operation status as follows:

### FAULT STATUS

Normal operation: relay active (C and NO outputs are closed)

Not measuring state (error state or power off): relay released (C and NC outputs are closed)

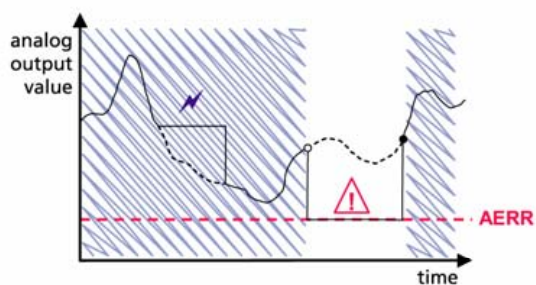
### ONLINE STATUS

Live measurement (data available): relay active (C and NO outputs are closed)

No live data (for example: error state, chemical purge or adjustment mode): relay released (C and NC outputs are closed)







See Figure 46 below for illustrative examples of the FAULT/ONLINE STATUS relay output modes.

#### Analog output vs. "FAULT STATUS" relay

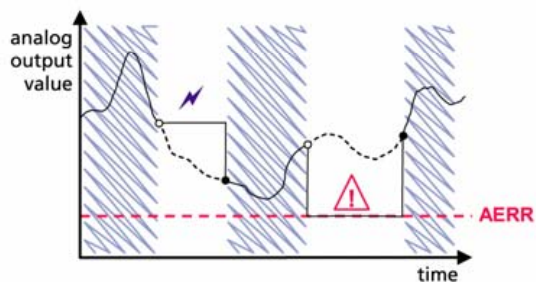


Relay is released in case of a measurement failure only.

#### Legend

- AERR** Analog output "fault indication" value set by user
-  Outputs frozen because of e.g. *Purge* or *Autocal*
-  Measurement failure because of e.g. damaged sensor
-  True value of the measurement parameter during the exceptional situation
-  Relay active (NO – C connected)
-  Relay is activated
-  Relay is released

#### Analog output vs. "ONLINE STATUS" relay



Relay is released when the output values are frozen, the adjustment mode is activated, or an instrument failure is detected

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**Figure 46** FAULT/ONLINE STATUS Relay Output Modes

FAULT/ONLINE STATUS relays are usually used in conjunction with an analog output to obtain validity information for the output value.

#### **NOTE**

If transmitter loses its power, all status-based relays are released similarly to the case of an instrument failure.

## Enabling/Disabling Relays

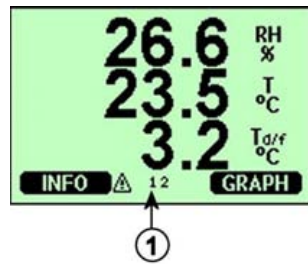
You can deactivate the relay outputs for example for service purposes of your system.

## Setting Relay Outputs

**NOTE**

When having only one relay module installed, its relays are called 'relay 1' and 'relay 2'.

When having two relay modules, the relays of the module connected to slot **MODULE 1** are called 'relay 1' and relay 2' and relays connected to slot **MODULE 2** are called 'relay 3' and 'relay 4'



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**Figure 47 Relay Indicators on Display**

The following number refers to Figure 47 above:

- 1 = Lists enabled relays. Activation state shown in black.  
Disabled relays are not shown.

Use the display/keypad to set the relay outputs.

1. Press any of the arrow buttons to open the **MAIN MENU**.
2. Select **Interfaces**, confirm by pressing the ► arrow button.
3. Select **Relay outputs**, confirm by pressing the ► arrow button.
4. Select **Relay 1/2/3/4**, confirm by pressing the ► arrow button.
5. Select the **Quantity**, confirm by pressing **Change**. Select the Quantity by using the arrow buttons. Confirm your selection by pressing **Select**.
6. Select **Act. above / Act. below**. Press SET to confirm your selection. (If asked, select **MODIFY** if you want to set the setpoint by using the arrow buttons. Select **REMOVE** if you want to remove the setpoint.)

7. Select **Hysteresis** by using the arrow buttons. Press **SET** to set the hysteresis. Press **OK**.
8. Select **Relay enable** by using the arrow buttons, press **ON/OFF** to enable/disable the relay.

## **RSEL**

Use the serial line to select the quantity, setpoints and hysteresis or enable/disable the relay outputs. Enter the **RSEL** command.

**RSEL [q1 q2 q3 q4]**

where

- q1* = quantity for the relay 1 or Fault/Online
- q2* = quantity for the relay 2 or Fault/Online
- q3* = quantity for the relay 3 or Fault/Online
- q4* = quantity for the relay 4 or Fault/Online

Factory setting: all relays disabled.

Use the quantity abbreviations presented above. See Table 1 on page 15 and Table 2 on page 16.

**Example of window limit switch:** Selecting relay 1 to follow dewpoint/frost point temperature measurement and relay 2 to follow temperature measurement. Two relay setpoints are set for both relays.

```
>rsel rh t
Rel1 RH   above: 0.00 %RH ? 30
Rel1 RH   below: 0.00 %RH ? 40
Rel1 RH   hyst : 0.00 %RH ? 2
Rel1 RH   enabl: OFF ? ON
Rel2 T    above: 0.00 'C ? 30
Rel2 T    below: 0.00 'C ? 40
Rel2 T    hyst : 0.00 'C ? 3
Rel2 T    enabl: OFF ? ON
>
```

**Example of normal limit switch:** Selecting relay 1 to follow relative humidity, relay 2 to follow temperature, relay 3 to follow dewpoint and relay 4 to follow dewpoint. One setpoint is chosen for all the outputs.

```
>rsel rh t td td
Rel1 RH   above: 60.00 %RH ? 70
Rel1 RH   below: 70.00 %RH ? -
Rel1 RH   hyst : 2.00 %RH ? 2
Rel1 RH   enabl: ON ? on
Rel2 T    above: 50.00 'C ? 60
Rel2 T    below: 40.00 'C ? -
Rel2 T    hyst : 2.00 'C ? 2
Rel2 T    enabl: ON ? on
Rel3 Td   above: 5.00 'C ? 10
Rel3 Td   below: 0.00 'C ? -
Rel3 Td   hyst : 1.00 'C ? 1
Rel3 Td   enabl: OFF ? on
Rel4 Td   above: 0.00 'C ? 20
Rel4 Td   below: 0.00 'C ? -
Rel4 Td   hyst : 0.00 'C ? 2
Rel4 Td   enabl: OFF ? on
>
```

**Example of using relay 1 as fault alarm:** selecting relay 1 to follow the fault status and relay 2 to follow the temperature measurement.

```
>rsel fault t
Rel1 FAUL above: -
Rel1 FAUL below: -
Rel1 FAUL hyst : -
Rel1 FAUL enabl: ON ?
Rel2 T    above: 0.00 'C ? 30
Rel2 T    below: 0.00 'C ? -
Rel2 T    hyst : 0.00 'C ? 2
Rel2 T    enabl: OFF ? ON
>
```



## Testing Operation of Relays

Testing activates relays even if they are disabled.

Use the module push buttons to activate the relays. Press the **REL 1** or **REL 2** button to activate the corresponding relay.

Relay is activated:	led is lit
Relay is not activated:	led is not lit

Use the display/keypad to test the operation of relays.

1. Open the **MAIN MENU** by pressing any of the arrow buttons.
2. Select **System**, press the ► arrow button.
3. Select **Diagnostics**, press the ► arrow button.
4. Select **Relay tests**, press the ► arrow button.
5. Select **Invert relay 1...**, press **TEST**. Now the selected relay output is forced to opposite state. Press **OK** to return to normal operation.
6. Press **EXIT** to return to the basic display.

### RTEST

Use the serial line command **RTEST** to test the operation of the relays.

**RTEST [x1 x2 x3 x4]**

where

x = ON/OFF

**Example:** Activate and then release all four relays.

```
>rtest on on on on
ON ON ON ON
>
>rtest off off off off
OFF OFF OFF OFF
>
```

Enter the command **RTEST** without parameters to stop testing.

## Operation of RS-485 Module

RS-485 interface enables communication between RS-485 network and HMT330 transmitter. The RS-485 interface is isolated and offers a maximum communications rate of 115 200 bits/s. (For maximum bus length of 1 km, use bit rate 19200 b/s or less.)

When selecting an RS-232-RS-485 converter for the network, avoid self powered converters as they don't necessarily support the needed power consumption.

Echo function shall be always disabled (OFF) when using the 2-wire connection. When using the 4-wire connection you can disable/enable the echo setting.

**NOTE**

User port on HMT330 main board cannot be used and connected when RS-485 module is connected. Service port is operating normally.

## Networking Commands

Set the RS-422/485 interface by using the following commands. The other serial line commands are presented in section List of Serial Commands on page 68.

RS-485 configuration commands **SERI**; **ECHO**; **SMODE**; **INTV** and **ADDR** may be entered by using either the service port or RS-422/485 port. Also the optional display/keypad can be used, see section User Port Serial Settings on page 78.

### **SERI**

Use the **SERI** command to input RS-485 bus settings.

**SERI** [*b p d s*]

where

- b* = bit rate (300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200)
- p* = parity (n = none, e = even, o = odd)
- d* = data bits (7 or 8)
- s* = stop bits (1 or 2)

## ECHO

Use the **ECHO** command to enable/disable echo of characters received over the serial line.

**ECHO** [*x*]

where

*x* = ON/OFF (default = OFF)

When using 2-wire connection, echo must be always disabled.

## SMODE

Use the **SMODE** command to set the default serial interface mode.

**SMODE** [*xxxx*]

where

*xxxx* = STOP, RUN or POLL

In STOP mode: measurements output only by command SEND, all commands can be used

In RUN mode: outputting automatically, only command S can be used to stop.

In POLL mode: measurements output only with command SEND [*addr*].

When several transmitters are connected to the same line, each transmitter must be entered an own address in the initial configuration, and POLL mode must be used.

## INTV

Use the **INTV** command to set the RUN mode output interval.

**INTV** [*n xxx*]

where

*n* = 1 - 255  
*xxx* = S, MIN or H

This command sets the RUN mode output interval. The time interval is used only when the RUN mode is active. For example, the output interval is set to 10 minutes.

```
>INTV 10 min
Output intrv. : 10 min
>
```

Setting RUN output interval to zero enables the fastest possible output rate.

## ADDR

Addresses are required only for POLL mode (see serial line command SMODE on page 80). Use the **ADDR** command to input the RS-485 transmitter address.

**OPEN** [*aa*]

where

*aa* = address (0 ... 99) (default = 0)

**Example:** the transmitter is configured to address 99.

```
>ADDR
Address : 2 ? 99
>
```

## SEND

Use the SEND command to output the reading once in POLL mode:

**SEND** [*aa*]

where

*aa* = address of the transmitter

## OPEN

When all transmitters on the RS-485 bus are in POLL mode the **OPEN** command sets one transmitter temporarily to STOP mode so that other commands can be entered.

**OPEN** [*aa*]

where

*aa* = address of the transmitter (0 ... 99)

## CLOSE

The **CLOSE** command switches the transmitter back to the POLL mode.

### Example:

```
>OPEN 2 (opens the line to transmitter 2, other  
transmitters stay in POLL mode)  
>CRH (for example, calibration performed)  
...  
>CLOSE (line closed)
```

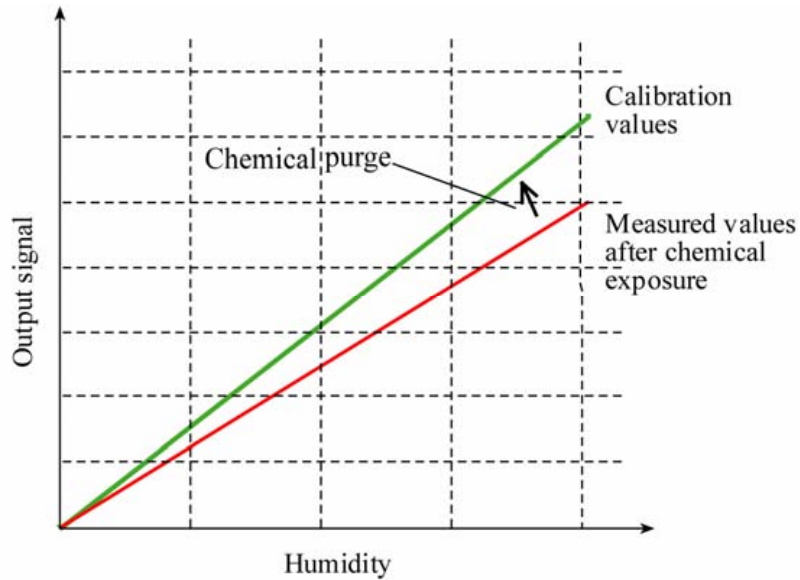
## Sensor Functions

### Chemical Purge (Optional)

In some specific applications the sensor gain may decrease gradually due to an interference caused by a particular chemical present in the measured gas, for example. The decrease of sensor gain due to an interfering chemical and the effect of the chemical purge process are illustrated below, see Figure 48 below. The sensor polymer absorbs the interfering chemical; and this reduces the ability of the polymer to absorb water molecules and consequently the sensor gain decreases. In chemical purge, heating the humidity sensor to a temperature level of approximately +160 °C for several minutes evaporates the interfering chemical.

The purge function starts with heating stage, continues with settling and when the temperature of the sensor is decreased the transmitter returns to normal mode. The whole cycle takes about 6 minutes.

**NOTE** Chemical purge function locks the output values for about 6 minutes.



0508-035

**Figure 48** Decrease of Sensor Gain

Before starting the chemical purge note the following:

- The sensor is protected with a PPS grid with stainless steel netting, a stainless steel sintered filter or with membrane SST filter.
- The sensor temperature must be below 100 °C. At higher temperatures the chemicals evaporate spontaneously from the sensor and the chemical purge is not necessary.

### **Automatic Chemical Purge (Interval Purge)**

When HMT330 leaves the factory the automatic chemical purge (if chosen) takes place repeatedly with the time intervals set in the factory. User can change the interval in which the purge takes place by using serial commands or with the optional display/keypad. This can be needed if the measuring environment contains high concentrations of interfering chemicals. The automatic chemical purge can also be turned off if necessary.

### **Manual Chemical Purge**

The chemical purge should be performed always before calibration (see section Calibration and Adjustment on page 119) or when there is a reason to believe that a sensor has become exposed to an interfering chemical. Make sure that the temperature of the sensor has come down to normal temperature before starting a calibration.

### **Chemical Purge in Power Up**

Chemical purge (start-up purge) can be set to start within 10 seconds from the power-up of the device.

# Starting and Configuring Chemical Purge

## Using Buttons on Motherboard

Start manual chemical purge by pressing simultaneously two **PURGE** buttons on the motherboard inside the transmitter for a few seconds. Indicator led flashes until purge is complete (up to 6 minutes).

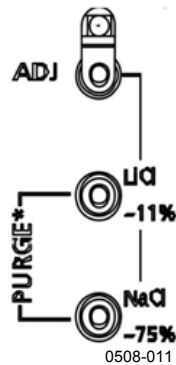


Figure 49 Purge Buttons on Motherboard

## Using Display/Keypad (Optional)

Set the automatic and manual chemical purge by using the display/keypad.

1. Open the **MAIN MENU** by pressing any of the arrow buttons.
2. Select **Measuring**, press button.
3. Select **Chemical purge**, press button.



Figure 50 Chemical Purge Settings



- Turn on/off the automatic purge by selecting **Automatic purge**, press **ON/OFF** button.
  - Set the automatic purge interval by selecting **Interval: ...**, press **SET**. Set the purge interval and the unit (hour/day) by using the arrow buttons. The interval must be 1 hour ... 10 days. Press **OK**.
  - Select **Start-up purge** by using the arrow buttons. Press On/Off to turn the start-up purge on/off.
  - Start manual purge by selecting **Manual purge** and pressing **START**.
4. Press **EXIT** to return to the basic display.

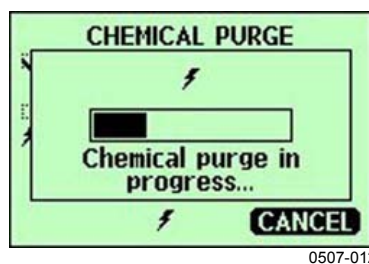


Figure 51 Performing Chemical Purge

## Using Serial Line

### PURGE

Enter the **PURGE** command to start chemical purge immediately.

```
>purge
Purge started, press any key to abort.
>
```

The prompt '>' appears when the heating period is over. However, the transmitter outputs are locked to the values measured before performing chemical purge until the settling time is over.

With **PUR** command you can enable or disable automatic and power-up chemical purge and set the interval for automatic purge. If the sensor is exposed to chemicals it is recommended to have the chemical purge done at least once in 720 min (=12 hours). In applications where the chemical exposure is not likely, the interval can be longer.

It is not recommended to change duration, settling, temperature or temperature difference.

## PUR

Type **PUR** and press ENTER to proceed. The maximum interval is 14400 minutes (=10 days).

### Example:

```
>pur
Interval Purge : OFF ?
Interval       : 720 min ?
Power-up Purge : OFF ?
Duration       : 120 s ?
Settling       : 240 s ?
Temperature    : 160 'C ?
Temp. diff.    : 0.5 'C ?
>
```

**NOTE**

To activate the new interval settings immediately, reset the transmitter.

**NOTE**

When chemical purge in power-up is enabled, wait about 6 min after power-up before taking measurements. The output channels are locked for the first operation minutes to the initial measured values

## Sensor Heating

This function is optionally available only in transmitters with HUMICAP®180 C sensor. It should be used only with the warmed probe head.

The sensor heating is recommended for the high humidity environments where even a small temperature differences can cause water to condense on the sensor. The sensor heating speeds up the recovery of the humidity sensor from condensation.

Sensor heating starts-up when the relative humidity of the measuring environment reaches the RH-value set by a user (RH-limit). The user can define the RH-sensor heating temperature as well as the duration of the heating.

After the heating cycle the humidity conditions are checked and new sensor heating is performed if the predefined conditions are reached again.

**NOTE**

During the sensor heating the outputs are locked to the values measured before the heating cycle.

## Setting Humidity Sensor Heating

When the HMT330 leaves the factory the sensor heating follows the factory default values. You can enable/disable the function, change the RH-limit and define the heating temperature and duration of this function.

### XHEAT

Enables/disables the sensor heating.

XHEAT [xx]

where:

xx = ON / OFF

```
>xheat on
Extra heat      : ON
>xheat off
Extra heat      : OFF
>
```

To configure the sensor heating use the XHEAT command without parameters. Enter the values after question mark. The available ranges include the following:

Extra heat RH -limit (heating function starts-up above the setpoint)	0 ... 100 %RH (default: 95 %RH)
Extra heating temperature	0 ... 200 °C (default: 100 °C)
Extra heating time	0 ... 255 s (default: 30 s)

**Example:**

```
>xheat
Extra heat      : OFF
Extra heat RH  : 95 ? 90
Extra heat temp: 100 ? 85
Extra heat time: 30 ? 10
>xheat on
Extra heat      : ON
>
```

## CHAPTER 5

# MAINTENANCE

This chapter contains information that is needed in basic maintenance of the product.

## Periodic Maintenance

### Cleaning

Clean the transmitter enclosure with a soft, lint-free cloth moistened with mild detergent.

### Changing the Probe Filter

1. Unscrew the filter from the probe head.
2. Screw a new filter on the probe head. When using the stainless steel filter (for oil and fuel cell), take care to tighten the filter properly (recommended force 5 N).

New filters can be ordered from Vaisala, see section Options and Accessories on page 136.

## Changing the Sensor

The user can change the HUMICAP180 and HUMICAP180L sensors

1. Unscrew the filter from the probe head. See the instructions in section Changing the Probe Filter on page 115.
2. Remove the damaged sensor and insert a new one. Handle the new sensor by the plastic socket. **DO NOT TOUCH THE SENSOR PLATE.**
3. After sensor change the humidity calibration must be made according to the instructions, see section Relative Humidity Adjustment after Sensor Change on page 124.
4. Screw a new filter on the probe head. When using the stainless steel filter, take care to tighten the filter properly (recommended force 5 N).



**Figure 52**      **Changing the Sensor**

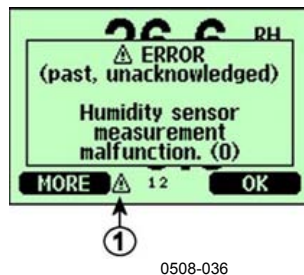
The following numbers refer to Figure 52 above::

- 1 = Pull out the sensor
- 2 = Plastic socket

## Error States

In error state the quantity is not measured and the output is shown as follows:

- Analog channel outputs 0 mA or 0 V (you can use the serial line command **AERR** or display/keypad to change this fault indication value, see section Analog Output Fault Indication Setting on page 96.)
- The serial port outputs stars (\*\*\*)
- The cover LED is blinking
- Optional display: error indicator is lit.



**Figure 53 Error Indicator and Error Message**

The following number refers to Figure 53 above:

1 = Error Indicator

- The error indicator disappears when the error state is over and you have checked the error message. Press the **INFO** button to display the error message.

You can also check the error message via the serial interface by using the command **ERRS**. In case of constant error, please contact Vaisala, see Vaisala Service Centers on page 144.

**Table 16 Error Messages**

<b>Error Message</b>	<b>Action</b>
Humidity sensor measurement malfunction.	Check the integrity of the humidity probe and the probe cable. Clean the probe from dirt, water, ice or other contaminants.
Humidity sensor short circuit	Check the integrity of the humidity probe and the probe cable. Clean the probe from dirt, water, ice or other contaminants.
Humidity sensor open circuit	Check the integrity of the humidity probe and the probe cable.
Temperature sensor open circuit.	Check the integrity of the humidity probe and the probe cable.
Temperature sensor short circuit.	Check the integrity of the humidity probe and the probe cable. Clean the probe from dirt water, ice or other contaminants.
Temperature measurement malfunction	Check the integrity of the humidity probe and the probe cable. Clean the probe from dirt water, ice or other contaminants.
Temperature sensor current leak.	Check the integrity of the humidity probe and the probe cables. Clean the probes from dirt, water, ice or other contaminants.
Internal ADC read error	Internal transmitter failure. Remove the transmitter and return the faulty unit to Vaisala Service.
Internal EEPROM read error	Internal transmitter failure. Remove the transmitter and return the faulty unit to Vaisala Service.
Internal EEPROM write error	Internal transmitter failure. Remove the transmitter and return the faulty unit to Vaisala Service.
Add-on module 1 (or 2) connection failure	Turn off the power and check the module connection. Turn on the power.
Device internal temperature out of range	Ensure that the operating temperature is within the valid range.
Operating voltage out of range	Ensure that the operating voltage is within the valid range.
Internal analog voltage out of range	Internal transmitter failure. Remove the transmitter and return the faulty unit to Vaisala Service.
Internal system voltage out of range	Internal transmitter failure. Remove the transmitter and return the faulty unit to Vaisala Service.
Internal ADC reference voltage out of range	Internal transmitter failure. Remove the transmitter and return the faulty unit to Vaisala Service.
Internal analog output reference voltage out of range	Internal transmitter failure. Remove the transmitter and return the faulty unit to Vaisala Service.
Configuration switches for analog output 1/2/3 set incorrectly	Check and re-set the switches, see page 55.
EEPROM failure on add-on module 1 (or 2)	Disconnect the power and check the analog output module connection.
Communication module installed in incorrect add-on module slot	Disconnect the power and change the communication module to another module slot.
Unknown/incompatible module installed in add-on module slot 1(or 2)	Ensure that the module is compatible with the HMT330.



## CHAPTER 6

# CALIBRATION AND ADJUSTMENT

The HMT330 is fully calibrated and adjusted as shipped from factory. Typical calibration interval is one year. Depending on the application it may be good to make more frequent checks. Calibration must be done always when there is a reason to believe that the device is not within the accuracy specifications.

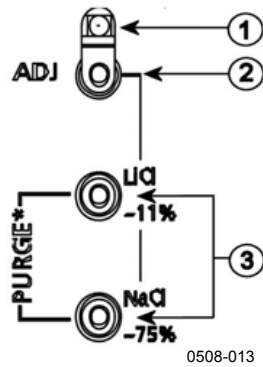
It is recommended that calibration and adjustment should be carried out by Vaisala. See section Vaisala Service Centers on page 144.

Calibration and adjustment is carried out either by using the push-keys on the motherboard, through the serial port or with the optional display/keypad.

(Vaisala portable instruments HM70 and HMI41 can also be used).

## Opening and Closing the Adjustment Mode

1. Open the transmitter cover. The buttons needed in adjustment are on the left-hand side of the motherboard.
2. If the chemical purge option is available, it should be carried out always before calibration. To start chemical purge press simultaneously two **PURGE** push-keys (on the motherboard) for a few seconds. Red indicator led flashes with short pulses until purge is complete (up to 6 minutes).
3. Press the **ADJ** key to open the adjustment mode.
4. Press the **ADJ** key again to close the adjustment mode.



**Figure 54 Adjustment and Purge Buttons**

The following numbers refer to Figure 54 above:

- 1 = Indicator led
- 2 = Adjustment button
- 3 = Press the purge buttons simultaneously to start chemical purge (if available)

Adjustment menu is displayed only when **ADJ** button (on the motherboard inside the transmitter) is pressed.



**Figure 55 Adjustment Menu**

**Table 17 Indicator Led Functions**

Indicator Led Function	Description
LED off	adjustment locked
LED on	adjustment available
LED blinking evenly	measurement not stabilized
LED blinking with short pulses	performing chemical purge

**NOTE** If using a warmed probe (**HMT337 option**), probe heating will be interrupted when **ADJ** key is pressed. Allow sufficient time for the probe to reach ambient temperature before starting the adjustment procedure.

**NOTE** Fixed pressure compensation value of 1013.25 hPa is used when in adjustment mode

# Relative Humidity Adjustment

## Using Push-Buttons

A simple push-button adjustment is carried out by using two relative humidity references: 11 % RH (LiCl) and 75 % RH (NaCl).

1. Carry out the chemical purge (if available).

### LiCl reference

2. Press the **ADJ** button (see Figure 54 on page 120) on the motherboard to open the adjustment mode. The indicator led starts flashing.
3. Remove the filter from the probe and insert the probe head into a measurement hole of the 11 % RH (LiCl) in the humidity calibrator HMK15. Use the adapter fitting for the probes of HMT334, HMT335, HMT337 and HMT338.
4. Wait at least 30 minutes for the sensor to stabilize (the indicator led is lit continuously). Adjustment cannot be done if the conditions are not stabilized (indicator led is flashing).
5. When the indicator led is lit continuously, press the button **LiCl-11%** to adjust the 11 % RH condition. After adjustment transmitter returns to normal operation mode (indicator led is unlit).

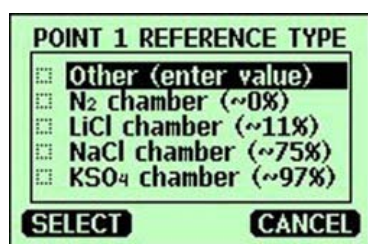
### NaCl reference

6. When adjusting in the second reference 75 % RH, press the **ADJ** button to open the adjustment mode. The indicator led starts flashing.
7. Insert the probe head into a measurement hole of the 75 % RH (NaCl) reference chamber of the humidity calibrator HMK15. Use the adapter fitting for the probes of HMT334, HMT335, HMT337 and HMT338.
8. Wait at least 30 minutes for the sensor to stabilize (the indicator led is lit continuously). Adjustment cannot be done if the conditions are not stabilized (indicator led is flashing).
9. Press the button **NaCl 75 %** to adjust the 75 % RH condition. After adjustment transmitter returns to normal operation mode (indicator led is unlit).

## Using Display/Keypad

Note that the difference between the two humidity references must be at least 50% RH.

1. Carry out the chemical purge (if available).
2. Press the **ADJ** button (opens the **ADJUSTMENT MENU**).
3. Select **Adjust RH measurement**, press **ENTER** button.
4. Select **1-point/ 2-point adjustment**, press. Press **START**.
5. Select the reference as guided by the display, press **SELECT**.



**Figure 56** Selecting Point 1 Reference Type

6. Remove the filter from the probe and insert the probe head into a measurement hole of the dry end reference chamber (for example, LiCl: 11 % RH in the humidity calibrator HMK15.) Use the adapter fitting for the probes of HMT334, HMT335, HMT337 and HMT338.
7. Wait at least 30 minutes for the sensor to stabilize. Follow the stabilization from the **GRAPH** display.
8. Press **READY** when stabilized. If you have chosen the **Other** reference value, enter now the reference value by using the arrow keys.

When carrying out the 2-point adjustment proceed to the next adjustment point and carry out the procedure as described in the previous items.

9. Answer **YES** to confirm the adjustment. Press **OK** to return to the adjustment menu.
10. Press **EXIT** to close the adjustment mode and return to the basic display. Before closing the adjustment mode, feed the adjustment information into the device, see section Feeding Adjustment Information on page 128.

## Using Serial Line

Note that the difference between the two humidity references must be at least 50% RH.

1. Connect the HMT330 to a PC. See section Serial Line Communication on page 63. Open a terminal program.
2. Carry out the chemical purge (if available).
3. Press the **ADJ** button.
4. Remove the filter from the probe and insert the probe head into a measurement hole of the dry end reference chamber (for example, LiCl: 11 % RH in the humidity calibrator HMK15). Use the adapter fitting for the probes of HMT334, HMT335, HMT337 and HMT338.
5. Enter the **CRH** command and press **ENTER**.

### CRH

6. Wait at least 30 minutes for the sensor to stabilize.
7. Type **C** and press **ENTER** a few times to check if the reading is stabilized.
8. When the reading is stabilized, give the reference humidity after the question mark and press **ENTER**.

```
>crh
```

```
RH :    11.25  Ref1 ? c
RH :    11.25  Ref1 ? c
RH :    11.25  Ref1 ? c
RH :    11.24  Ref1 ? c
RH :    11.24  Ref1 ? 11.3
Press any key when ready ...
```

9. Now the device is waiting for the high end reference. Insert the probe head into the measurement hole of the high end reference chamber (for example, NaCl: 75 % RH chamber in the humidity calibrator HMK15). Use the adapter fitting for the HMT334, HMT335, HMT337 and HMT338 probes. Press any key when ready.
10. Let the probe stabilize for about 30 minutes. You can follow the stabilization by typing **C** and pressing **ENTER**.
11. When stabilized, type the high end reference value after the question mark and press **ENTER**.

```
>crh  
  
RH :    11.25  Ref1 ? c  
RH :    11.24  Ref1 ? c  
RH :    11.24  Ref1 ? 11.3  
Press any key when ready ...  
  
RH :    75.45  Ref2 ? c  
RH :    75.57  Ref2 ? c  
RH :    75.55  Ref2 ? c  
RH :    75.59  Ref2 ? 75.5  
OK  
>
```

12. **OK** indicates that the adjustment has succeeded and the new calibration coefficients are calculated and stored. Enter the adjustment information (date and text) to the memory of the transmitter; see the commands **CTEXT** and **CDATE**.
13. Press the **ADJ** button on the motherboard to close the adjustment mode.
14. Take the probe out of the reference conditions and replace the filter.

## Relative Humidity Adjustment after Sensor Change

### Using Display/Keypad

When using the optional display/keypad, follow the instructions on Using Display/Keypad on page 122 but select **Adj. for new RH sensor** (instead of **1-point/ 2-point adjustment**).

### Using Serial Line

After sensor change, carry out the procedure as described in previous sections. Just replace the **CRH** command with the **FCRH** command.

#### FCRH

##### Example:

```
>FCRH  
RH :    1.82 1. ref    ?    0  
Press any key when ready...  
RH :    74.22    2. ref    ? 75  
OK  
>
```

The OK indicates that the calibration has succeeded.

# Temperature Adjustment

## Using Display/Keypad

1. Press the **ADJ** button on the motherboard to open the **ADJUSTMENT MENU**. If using a warmed probe for measuring, probe heating will be interrupted when **ADJ** key is pressed. Wait some time for the probe to reach ambient temperature.
2. Select **Adjust T measurement**, press key.
3. Select **1-point/ 2-point adjustment**, press. Press **START**.
4. Remove the filter from the probe and insert the probe head into the reference temperature.
5. Wait at least 30 minutes for the sensor to stabilize. Follow the stabilization from the **GRAPH** display.
6. Press **READY** when stabilized. Give the reference temperature by using the arrow keys.

When carrying out the 2-point adjustment proceed to the next adjustment point and carry out the procedure as described in the previous item. Please, note that the difference between the two temperature references must be at least 30 °C.

7. Press **OK**. Press **YES** to confirm the adjustment.
8. Press **OK** to return to the adjustment menu.
9. Press **EXIT** to close the adjustment mode and return to the basic display.

## Using Serial Line

1. Press the **ADJ** key on the motherboard to open the adjustment mode. If using a warmed probe for measuring, probe heating will be interrupted when **ADJ** key is pressed. Wait some time for the probe to reach ambient temperature.
2. Remove the probe filter and insert the probe head into the reference temperature.
3. Enter the command **CT** or (**CTA** for additional T probe) and press **ENTER**.

## CT

or for additional T probe:

## CTA

4. Type **C** and press **ENTER** a few times to check if the reading is stabilized. Let the reading stabilize, give the reference temperature after the question mark and press **ENTER** three times.

When using two reference temperatures (2-point calibration) press **ENTER** only twice and insert the probe to the second reference. When the reading is stabilized, give the second reference temperature after the question mark and press **ENTER**. Please, note that the difference between the two temperature references must be at least 30 °C.

Example (1-point adjustment):

```
>ct
T   :   16.06  Ref1 ? c
T   :   16.06  Ref1 ? c
T   :   16.06  Ref1 ? c
T   :   16.06  Ref1 ? c
T   :   16.06  Ref1 ? c
T   :   16.06  Ref1 ? 16.0
Press any key when ready ...
T   :   16.06  Ref2 ?
OK
>
```

5. **OK** indicates that the calibration has succeeded. Enter the calibration information (date and text) to the transmitter's memory; see the serial commands **CTEXT** and **CDATE**.
6. Press the **ADJ** button on the motherboard to close the adjustment mode.
7. Take the probe out of the reference conditions and replace the filter.



## Analog Output Adjustment

In the analog output calibration the analog output is forced to the following values:

- Current output: 2 mA and 18 mA
- Voltage output: 10 % and 90 % of the range

Connect HMT330 to a calibrated current/voltage meter in order to measure either current or voltage depending on the selected output type.

## Using Display/Keypad

1. Press the **ADJ** button to open the **ADJUSTMENT MENU**.
2. Select Adjust analog outputs, press key.
3. Select the output to be adjusted Adjust **analog output 1/2**, press **START**.
4. Measure the first analog output value with a multimeter. Give the measured value by using the arrow buttons. Press **OK**.
5. Measure the second analog output value with a multimeter. Give the measured value by using the arrow buttons. Press **OK**.
6. Press **OK** to return to the adjustment menu.
7. Press **EXIT** to close the adjustment mode and to return to the basic display.

## Using Serial Line

Enter the **ACAL** command and type the multimeter reading for each case. Continue by pressing **ENTER**.

### ACAL

Example (current outputs):

```
>ACAL
Ch1 I1 (mA) ? 2.046
Ch1 I2 (mA) ? 18.087
Ch2 I1 (mA) ? 2.036
Ch2 I2 (mA) ? 18.071
>
```

## Feeding Adjustment Information

This information is shown on the device information fields (see section Device Information on page 82.)

### Using Display/Keypad

1. If you are not in the adjustment menu, press the **ADJ** button on the motherboard (opens the **ADJUSTMENT MENU**).
2. Select **Adjustment info**, press the arrow button.
3. Select **Date**, press **SET**. Give the date by using the arrow buttons. Press **OK**.
4. Select **i**, press **SET**. Enter information text including 17 characters at maximum by using the arrow buttons. Press **OK**.
5. Press **EXIT** to return to the basic display.

### Using Serial Line

#### CTEXT

Use the CTEXT command to enter text to the adjustment information field.

**Example:**

```
>ctext
Adjust. info   : (not set) ? HMK15
>
```

#### CDATE

Use the CDATE command to enter date to adjustment information field. Set the adjustment date in format YYYY-MM-DD.

**Example.**

```
>cdate
Adjust. date   : (not set) ? 2004-05-21
>
```

# CHAPTER 7

## TECHNICAL DATA

This chapter provides the technical data of the product.

### Specifications

#### Performance

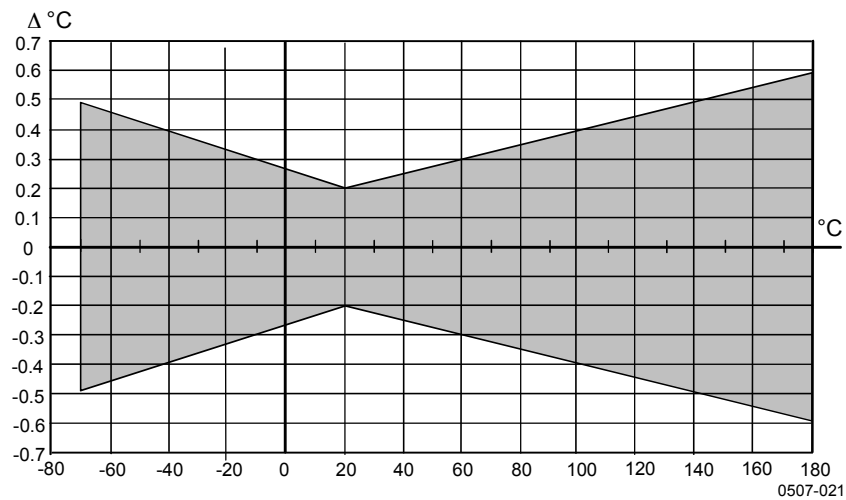
##### Relative Humidity

Measurement range	0 ... 100 %RH
Accuracy (including non-linearity, hysteresis and repeatability)	
with HUMICAP®180 HUMICAP®180C	for typical applications for applications with chemical purge and/or warmed probe
at +15 ... 25 °C	± 1 % RH (0 ... 90 % RH)
at -20 ... +40 °C	± 1.7 % RH (90 ... 100 %RH)
at -40 ... + 180 °C	± (1.0 + 0.008 × reading) % RH ± (1.5 + 0.015 × reading) % RH
with HUMICAP®180L2	for applications with demanding chemical environment
at -10 ... +40 °C	± (1.0 + 0.01 × reading) % RH
at -40 ... +180 °C	± (1.5 + 0.02 × reading) % RH
Factory calibration uncertainty (+20 °C)	±0.6 % RH (0 ... 40 % RH) ±1.0 % RH (40 ... 97 % RH) (Defined as ± 2 standard deviation limits. Small variations possible, see also calibration certificate.)
Response time (90 %) at 20 °C in still air	8 s with grid filter 20 s with grid + steel netting filter 40 s with sintered filter

## Temperature (+ Operating Pressure Ranges)

HMT331	-40 ... +60 °C (-40 ... +140 °F)
HMT333 80 °C	-40 ... +80 °C (-40 ... +176 °F)
HMT333 120 °C	-40 ... +120 °C (-40 ... +248 °F)
HMT334	-70 ... +180 °C (-94 ... +356 °F), 0 ... 10 MPa (0 ... 100 bar)
HMT335 (vapor tight)	-70 ... +180 °C (-94 ... +356 °F)
HMT337 (vapor tight)	-70 ... +180 °C (-94 ... +356 °F)
HMT338	-70 ... +180 °C (-94 ... +356 °F), 0 ... 4 MPa (0 ... 40 bar)

Accuracy at +20 °C (+68 °F)                      ± 0.2 °C  
 Accuracy over temperature range (see graph below):



**Figure 57 Accuracy over Temperature Range**

Temperature sensor                                      Pt 100 RTD 1/3 Class B IEC 751

## Optional Temperature Probe

Temperature measurement range:	-70 ... + 180 °C (-94 ... +356 °F)
Typical accuracy:	0.1 °C (0.18 °F)
Sensor:	Pt100 PRT DIN IEC 751 class 1/4 B
Cable length:	2 m, 5 m, and 10 m
Pressure tight:	up to 7 bar
Probe material:	stainless steel

## Calculated Variables

**Table 18** Calculated Variables (Typical Ranges)

Variable	HMT331 probe	HMT333 probe	HMT334/335/337/338 probes
Dewpoint temperature	-20 ... +60 °C	-20 ... +80 °C	-20 ... +100 °C
Mixing ratio	0 ... 160 g/kg dry air	0 ... 500 g/kg dry air	0 ... 500 g/kg dry air
Absolute humidity	0 ... 160 g/m <sup>3</sup>	0 ... 500 g/m <sup>3</sup>	0 ... 500 g/m <sup>3</sup>
Wet bulb temperature	0 ... 60 °C	0 ... +100 °C	0 ... +100 °C
Enthalpy	-40 ... +1500 kJ/kg	-40 ... +1500 kJ/kg	-40 ... +1500 kJ/kg
Water vapor pressure	0 ... 1000 hPa	0 ... 1000 hPa	0 ... 1000 hPa

## Accuracies of Calculated Variables

Accuracies of the calculated variables depend on the calibration accuracy of the humidity and temperature sensors; here the accuracies are given for  $\pm 2\%$  RH and  $\pm 0.2\text{ °C}$ .

### Accuracy of Dewpoint Temperature °C

Temp.	Relative humidity									
	10	20	30	40	50	60	70	80	90	100
-40	1.86	1.03	0.76	0.63	0.55	0.50	0.46	0.43	—	—
-20	2.18	1.19	0.88	0.72	0.62	0.56	0.51	0.48	—	—
0	2.51	1.37	1.00	0.81	0.70	0.63	0.57	0.53	0.50	0.48
20	2.87	1.56	1.13	0.92	0.79	0.70	0.64	0.59	0.55	0.53
40	3.24	1.76	1.27	1.03	0.88	0.78	0.71	0.65	0.61	0.58
60	3.60	1.96	1.42	1.14	0.97	0.86	0.78	0.72	0.67	0.64
80	4.01	2.18	1.58	1.27	1.08	0.95	0.86	0.79	0.74	0.70
100	4.42	2.41	1.74	1.40	1.19	1.05	0.95	0.87	0.81	0.76
120	4.86	2.66	1.92	1.54	1.31	1.16	1.04	0.96	0.89	0.84
140	5.31	2.91	2.10	1.69	1.44	1.26	1.14	1.05	0.97	0.91
160	5.80	3.18	2.30	1.85	1.57	1.38	1.24	1.14	1.06	0.99

### Accuracy of Mixing Ratio g/kg (Ambient Pressure 1013 mbar)

Temp.	Relative humidity									
	10	20	30	40	50	60	70	80	90	100
-40	0.003	0.003	0.003	0.003	0.003	0.004	0.004	0.004	—	—
-20	0.017	0.018	0.019	0.021	0.022	0.023	0.025	0.026	—	—
0	0.08	0.09	0.09	0.10	0.10	0.11	0.11	0.12	0.13	0.13
20	0.31	0.33	0.35	0.37	0.39	0.41	0.43	0.45	0.47	0.49
40	0.97	1.03	1.10	1.17	1.24	1.31	1.38	1.46	1.54	1.62
60	2.68	2.91	3.16	3.43	3.72	4.04	4.38	4.75	5.15	5.58
80	6.73	7.73	8.92	10.34	12.05	14.14	16.71	19.92	24.01	29.29
100	16.26	21.34	28.89	40.75	60.86	98.85	183.66	438.56	—	—
120	40.83	74.66	172.36	—	—	—	—	—	—	—

### Accuracy of Wet Bulb Temperature °C

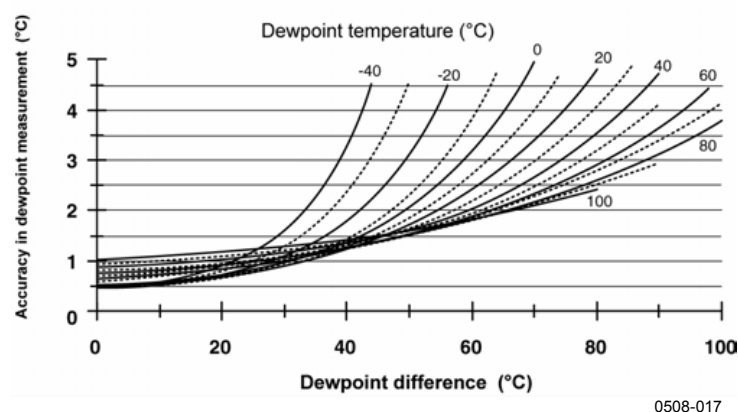
Temp.	Relative humidity									
	10	20	30	40	50	60	70	80	90	100
-40	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	—	—
-20	0.21	0.21	0.22	0.22	0.22	0.22	0.23	0.23	—	—
0	0.27	0.28	0.28	0.29	0.29	0.29	0.30	0.30	0.31	0.31
20	0.45	0.45	0.45	0.44	0.44	0.44	0.43	0.43	0.42	0.42
40	0.84	0.77	0.72	0.67	0.64	0.61	0.58	0.56	0.54	0.52
60	1.45	1.20	1.03	0.91	0.83	0.76	0.71	0.67	0.63	0.60
80	2.23	1.64	1.32	1.13	0.99	0.89	0.82	0.76	0.72	0.68
100	3.06	2.04	1.58	1.31	1.14	1.01	0.92	0.85	0.80	0.75
120	3.85	2.40	1.81	1.48	1.28	1.13	1.03	0.95	0.88	0.83
140	4.57	2.73	2.03	1.65	1.41	1.25	1.13	1.04	0.97	0.91
160	5.25	3.06	2.25	1.82	1.55	1.37	1.24	1.13	1.05	0.99

### Accuracy of Absolute Humidity g/m<sup>3</sup>

Temp.	Relative humidity									
	10	20	30	40	50	60	70	80	90	100
-40	0.004	0.004	0.005	0.005	0.005	0.006	0.006	0.006	—	—
-20	0.023	0.025	0.027	0.029	0.031	0.032	0.034	0.036	—	—
0	0.10	0.11	0.12	0.13	0.13	0.14	0.15	0.15	0.16	0.17
20	0.37	0.39	0.41	0.43	0.45	0.47	0.49	0.51	0.53	0.55
40	1.08	1.13	1.18	1.24	1.29	1.34	1.39	1.44	1.49	1.54
60	2.73	2.84	2.95	3.07	3.18	3.29	3.40	3.52	3.63	3.74
80	6.08	6.30	6.51	6.73	6.95	7.17	7.39	7.61	7.83	8.05
100	12.2	12.6	13.0	13.4	13.8	14.2	14.6	15.0	15.3	15.7
120	22.6	23.3	23.9	24.6	25.2	25.8	26.5	27.1	27.8	28.4
140	39.1	40.0	41.0	42.0	43.0	44.0	45.0	45.9	46.9	47.9
160	63.5	64.9	66.4	67.8	69.2	70.7	72.1	73.5	74.9	76.4

## Dewpoint Temperature (HMT337 Warmed Probe Option)

Find the intersection of the dewpoint temperature curve and the dewpoint difference reading (process temperature-dewpoint temperature) on the x-axis and read the accuracy in dewpoint measurement on the y-axis.



**Figure 58 Accuracy in Dewpoint Measurement**

### Operating Environment

Operating temperature range	
for humidity measurement	-70 ... +180 °C (-94 ... +356 °F) see probe specifications
for transmitter body electronics	-40 ... +60 °C (40 ... +140 °F)
with display	0 ... +60 °C (+32 ... +140 °F)
Storage temperature	-55 ... +80 °C (-67 ... +176 °F)
Electromagnetic compatibility	EN61326-1:1997+ Am1:1998 + Am2:2001 Industrial environment

## Inputs and Outputs

Operating voltage	10 ... 35 VDC, 24 VAC
with optional power supply module	100 ... 240 VAC, 50/60 Hz
Start-up time after power-up	3 s
Power consumption @ 20 °C (U <sub>in</sub> 24VDC)	
RS-232	max 25 mA
U <sub>out</sub> 2 × 0 ... 1V / 0 ... 5V / 0 ... 10V	max 25 mA
I <sub>out</sub> 2 × 0 ... 20 mA	max 60 mA
display and backlight	+ 20 mA
during sensor purge	+ 110 mA max
Analog outputs (2 standard, 3rd optional)	
current output	0 ... 20 mA, 4 ... 20 mA
voltage output	0 ... 1 V, 0 ... 5 V, 0 ... 10 V
Accuracy of analog outputs at 20 °C	± 0.05 % full scale
Temperature dependence of the analog outputs	± 0.005 %/°C full scale
External loads	
current outputs	RL < 500 ohm
0 ... 1V output	RL > 2 kohm
0 ... 5V and 0 ... 10V outputs	RL > 10 kohm
Max wire size	0.5 mm <sup>2</sup> (AWG 20) stranded wires recommended
Digital outputs	RS-232, RS-485 (optional)
Relay outputs (optional)	0.5 A, 250 VAC, SPDT
Display (optional)	LCD with backlight, graphic trend display
Menu languages	English, French, Spanish, German, Japanese, Russian, Swedish, Finnish,

## Mechanics

Cable bushing	M20x1.5 for cable diameter 8 ... 11mm/0.31..0.43"
Conduit fitting	1/2"NPT
User cable connector (optional)	M12 series 8- pin (male)
option 1	with plug (female) with 5 m / 16.4 ft black cable
option 2	with plug (female) with screw terminals
Probe cable diameter	
HMT333 80°C	6.0 mm
Other probes	5.5 mm
Probe cable lengths	2 m, 5 m or 10 m
Housing material	G-AlSi 10 Mg (DIN 1725)
Housing classification	IP 65 (NEMA 4)



## Transmitter Weights

**Table 19 Transmitter Weights (in kg/lb)**

Probe Type	Probe Cable Length		
	2 m	5 m	10 m
HMT333	1.1/2.4	1.2/2.6	1.5/3.3
HMT334	1.4/3.1	1.6/3.5	1.9/4.2
HMT335	1.3/2.9	1.4/3.1	1.7/3.7
HMT337	1.2/2.6	1.3/2.9	1.5/3.3
HMT338 178 mm	1.3/2.9	1.5/3.3	1.7/3.7
HMT338 400 mm	1.4/3.1	1.6/3.5	1.9/4.2

## Technical Specifications of Optional Modules

### Power Supply Module

Operating voltage	100 ... 240 VAC 50/60 Hz
Connections	screw terminals for 0.5 ... 2.5 mm <sup>2</sup> wire (AWG 20 ... 14)
Bushing	for 8 ... 11 mm diameter cable
Operating temperature	-40 ... +60 °C (-40 ... +140 °F)
Storage temperature	-40 ... +70 °C (-40 ... +158 °F)

### Analog Output Module

Outputs	0 ... 20 mA, 4 ... 20 mA, 0 ... 1 V, 0 ... 5 V, 0 ... 10 V
Operating temperature range	-40 ... +60 °C (-40 ... +140 °F)
Power consumption	
$U_{out}$ 0 ... 1 V	max 30 mA
$U_{out}$ 0 ... 5V/0 ... 10V	max 30 mA
$I_{out}$ 0 ... 20 mA	max 60 mA
External loads	
current outputs	$R_L < 500$ ohms
Max load + cable loop resistance	540 ohms
0 ... 1 V	$R_L > 2000$ ohms
0 ... 5 V and 0 ... 10 V	$R_L > 10\,000$ ohms
Storage temperature range	-55 ... +80 °C (-67 ... +176 °F)
3-pole screw terminal	
Max wire size	1.5 mm <sup>2</sup> (AWG16)

## Relay Module

Operating temperature range	-40 ... +60 °C (-40 ... +140 °F)
Operating pressure range	500 ... 1300 mHg
Power consumption @24 V	max 30 mA
Contacts SPDT (change over), for example, Contact arrangement Form C	
I <sub>max</sub>	0.5 A 250 VAC
I <sub>max</sub>	0.5 A 30 VDC
Safety standard for the relay component	IEC60950 UL1950
Storage temperature range	-55 ... +80 °C (-67 ... +176 °F)
3-pole screw terminal / relay	
Max wire size	2.5 mm <sup>2</sup> (AWG14)

## RS-485 Module

Operating temperature range	-40 ... +60 °C (-40 ... +140 °F)
Operating modes	2-wire (1-pair) half duplex 4-wire (2-pair) full duplex
Operating speed max	115.2 kbaud
Bus isolation	300VDC
Power consumption @ 24V	max 50 mA
External loads standard loads	32 RL > 10kohm
Storage temperature range	-55 ... +80 °C (-67 ... +176 °F)
Max wire size	1.5 mm <sup>2</sup> (AWG16)

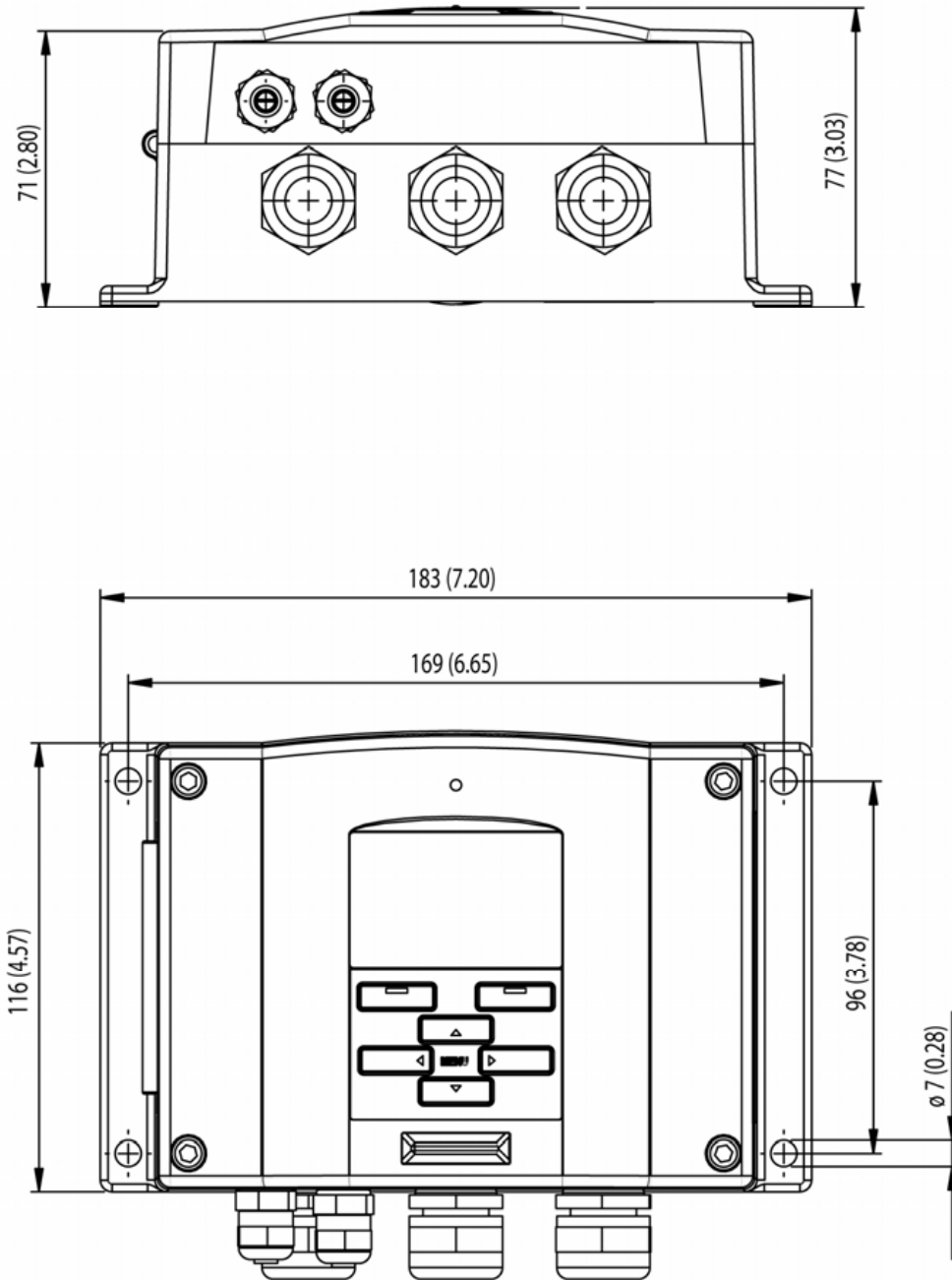
## Options and Accessories

Description	Item code
<b>MODULES</b>	
Relay module	RELAY-1
Analog Output Module	AOUT-1
Isolated RS485 Module	RS485-1
Power Supply Module	POWER-1
Galvanic Isolation Module	DCDC-1
<b>SENSORS</b>	
HUMICAP180	HUMICAP180
HUMICAP180L2	HUMICAP180L2
PT100 Sensor	10429SP
<b>FILTERS</b>	
PPS Plastic Grid with Stainless Steel Netting	DRW010281SP
PPS Plastic Grid Filter	DRW010276SP
Sintered Filter AISI 316L	HM47280SP
Stainless Steel Filter	HM47453SP
Stainless Steel Filter with Membrane	214848SP

Description	Item code
<b>TRANSMITTER MOUNTING ACCESSORIES</b>	
Wall Mounting Kit	214829
Installation Kit for Pole or Pipeline	215108
Rain Shield with Installation Kit	215109
DIN Rail Clips with Installation Plate	215094
Meteorological Installation Kit	HMT330MIK
Panel Mounting Frame	216038
<b>PROBE MOUNTING ACCESSORIES</b>	
<b>HMT334</b>	
Fitting Body M22x1.5	17223
Fitting Body NPT1/2	17225
<b>HMT335</b>	
Mounting Flange For HMT335	210696
<b>HMT337</b>	
Swagelok for 12mm Probe 3/8" ISO Thread	SWG12ISO38
Swagelok for 12mm Probe 1/2" NPT Thread	SWG12NPT12
Swagelok for 6mm Probe 1/8" ISO Thread	SWG6ISO18
Swagelok for 6mm Probe 1/8" NPT Thread	SWG6NPT18
Cable Gland M20x1.5 with Split Seal	HMP247CG
Duct Installation Kit for HMT333 and HMT337	210697
Duct Installation Kit for Temperature Probe	215003
<b>HMT338</b>	
Ball Valve ISO1/2 with Welding Joint	BALLVALVE-1
Fitting Body ISO1/2 Solid Structure	DRW212076SP
Fitting Body NPT1/2 Solid Structure	212810SP
Thread Adapter ISO1/2 to NPT1/2	210662
Manual Press	HM36854SP
<b>CONNECTION CABLES</b>	
Serial Interface Cable	19446ZZ
MI70 Connection Cable with RJ45 Connector	211339
HMI41 Connection Cable with RJ45 Connector	25917ZZ
<b>OUTPUT CABLES FOR 8-PIN CONNECTOR</b>	
Connection Cable 5m 8-pin M12 Female, Black	212142
Connector 8-pin M12 with Screw Terminals	212416
Male Connector 8-pin M12 with Cable and Adapter	214806SP

Description	Item code
<b>CABLE BUSHINGS</b>	
Cable Gland M20x1.5 for 8 ... 11mm Cable	214728SP
Cable Gland M20x1.5 for 11 ... 14mm Cable	214729
Conduit Fitting M20x1.5 for NPT1/2 Conduit	214780SP
Dummy Plug M20x1.5	214672SP
<b>WINDOWS SOFTWARE</b>	
Software Interface Kit	215005
<b>OTHER</b>	
Calibration Adapter for HMK15	211302SP

## Dimensions (in mm)



0506-035

**Figure 59** Transmitter Body Dimensions

## HMT331

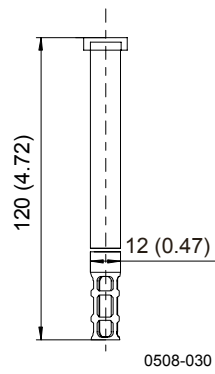


Figure 60 HMT331 Probe Dimensions

## HMT333

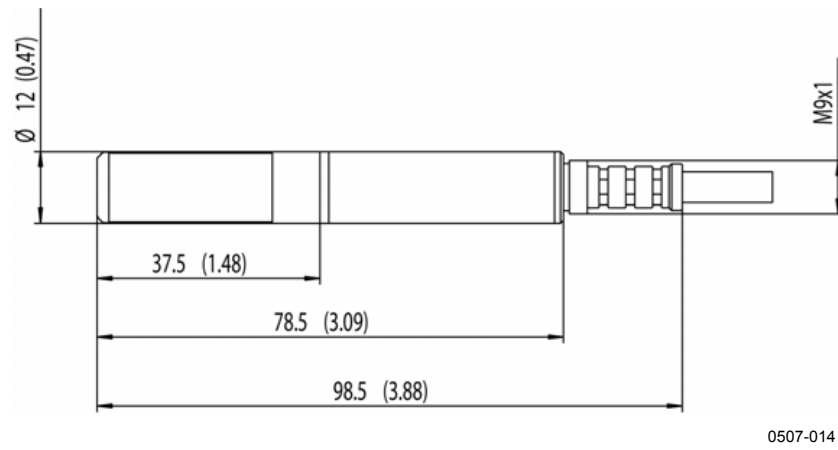
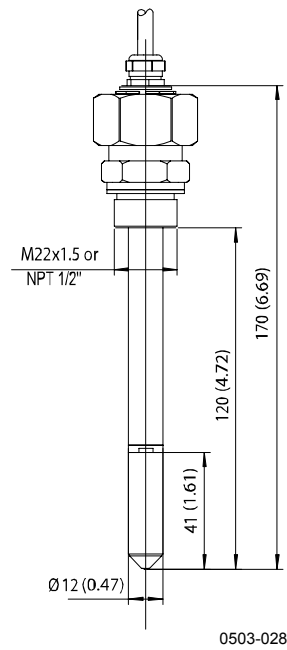


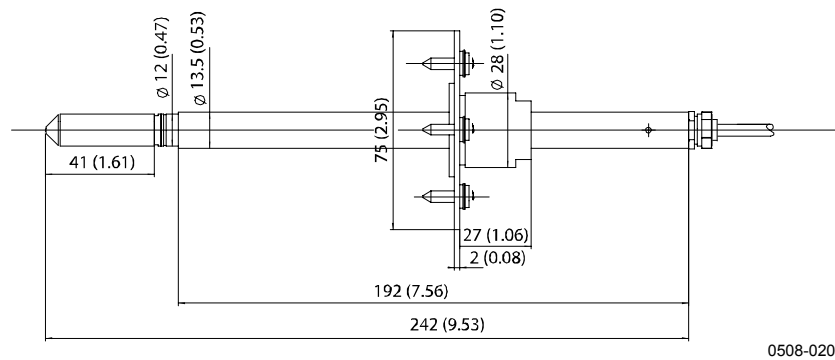
Figure 61 HMT333 Probe Dimensions

## HMT334



**Figure 62 HMT334 Probe Dimensions**

## HMT335



**Figure 63 HMT335 Probe Dimensions**

The flange is available as an option for the HMT335 probe.

## HMT337

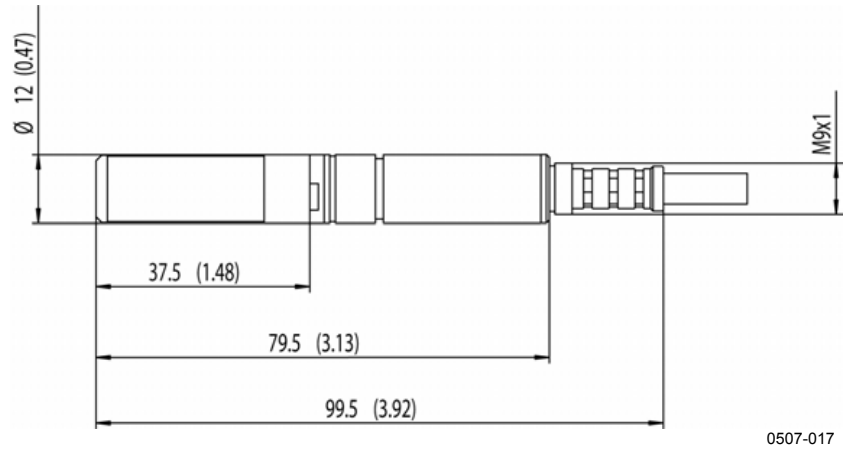


Figure 64 HMT337 Probe Dimensions

0507-017

## HMT338

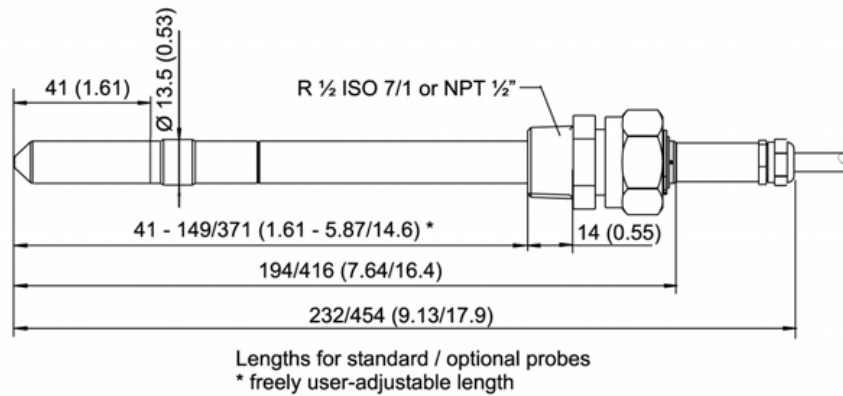


Figure 65 HMT338 Probe Dimensions

0508-078

## Temperature Probe

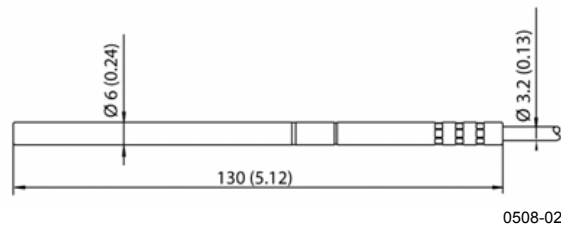


Figure 66 Optional Temperature Probe Dimensions

0508-024



## Technical Support

For technical questions, contact the Vaisala technical support:

E-mail [helpdesk@vaisala.com](mailto:helpdesk@vaisala.com)

Fax +358 9 8949 2790

If the product needs repair, please follow the instructions below to speed up the process and to avoid extra costs to you.

## Return Instructions

If the product needs repair, please follow the instructions below to enable us to serve you better.

1. Read the warranty information on page 13.
2. Please include with the transmitter:
  - serial number of the unit
  - date and place of purchase or last calibration
  - description of the fault
  - circumstances over which the fault occurs/occurred
  - name and contact information of a technically competent person who can provide further information on the problem
3. Include a detailed return address with your preferred shipping method.
4. Pack the faulty product using an ESD protection bag of good quality with proper cushioning material in a strong box of adequate size.
5. Contact the Vaisala Service Center nearest to you and send the box to the addresses on page 144:

## Vaisala Service Centers

Vaisala Service Centers perform calibrations and adjustments as well as repair and spare part services, see contact information below.

Vaisala Service Centers offer also extended services, for example accredited calibrations, maintenance contracts and calibration reminder program. Do not hesitate to contact them to get further information.

### **NORTH AMERICAN SERVICE CENTER**

**Vaisala Inc.**, 10-D Gill Street, Woburn, MA 01801-1068, USA.

Phone: +1 781 933 4500, Fax: +1 781 933 8029

E-mail: [us-customersupport@vaisala.com](mailto:us-customersupport@vaisala.com)

### **EUROPEAN SERVICE CENTER**

**Vaisala Instruments Service**, Vanha Nurmijärventie 21 FIN-01670 Vantaa, FINLAND.

Phone: +358 9 8949 2658, Fax: +358 9 8949 2295

E-mail: [instruments.service@vaisala.com](mailto:instruments.service@vaisala.com)

### **TOKYO SERVICE CENTER**

**Vaisala KK**, 42 Kagurazaka 6-Chome, Shinjuku-Ku, Tokyo 162-0825, JAPAN.

Phone: +81 3 3266 9617, Fax: +81 3 3266 9655

E-mail: [aftersales.asia@vaisala.com](mailto:aftersales.asia@vaisala.com)

### **BEIJING SERVICE CENTER**

**Vaisala China Ltd.**, Floor 2 EAS Building, No. 21 Xiao Yun Road, Dongsanhuan Beilu, Chaoyang District, Beijing, P.R. CHINA 100027.

Phone: +86 10 8526 1199, Fax: +86 10 8526 1155

E-mail: [china.service@vaisala.com](mailto:china.service@vaisala.com)

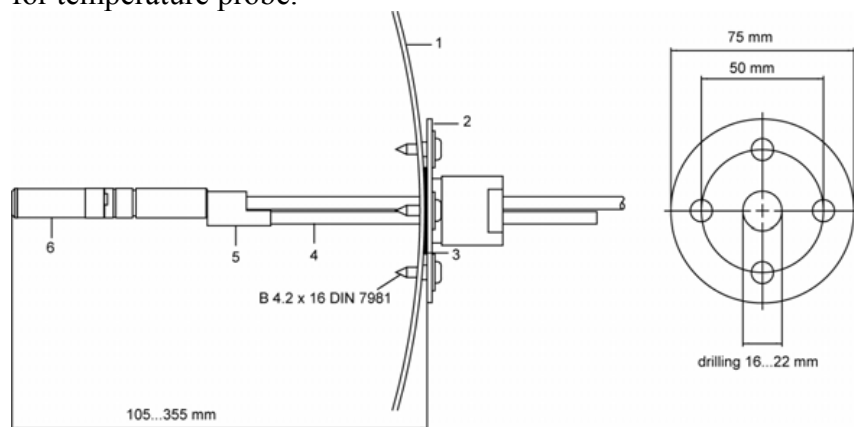
**[www.vaisala.com](http://www.vaisala.com)**

## APPENDIX A

# PROBE INSTALLATION KITS AND INSTALLATION EXAMPLES

## Duct Installation Kits (for HMT333/337/335)

Duct installation kit includes a flange, a sealing ring, a supporting bar and probe attaching part for the sensor head and screws for attaching the flange to the duct wall. Vaisala order codes: 210697 (for HMT333 and HMT337), 210696 (for HMT335, no supporting bar), and 215003 for temperature probe.



0508-021

**Figure 67 Duct Mounting Installation Kit**

The following numbers refer to Figure 67 above:

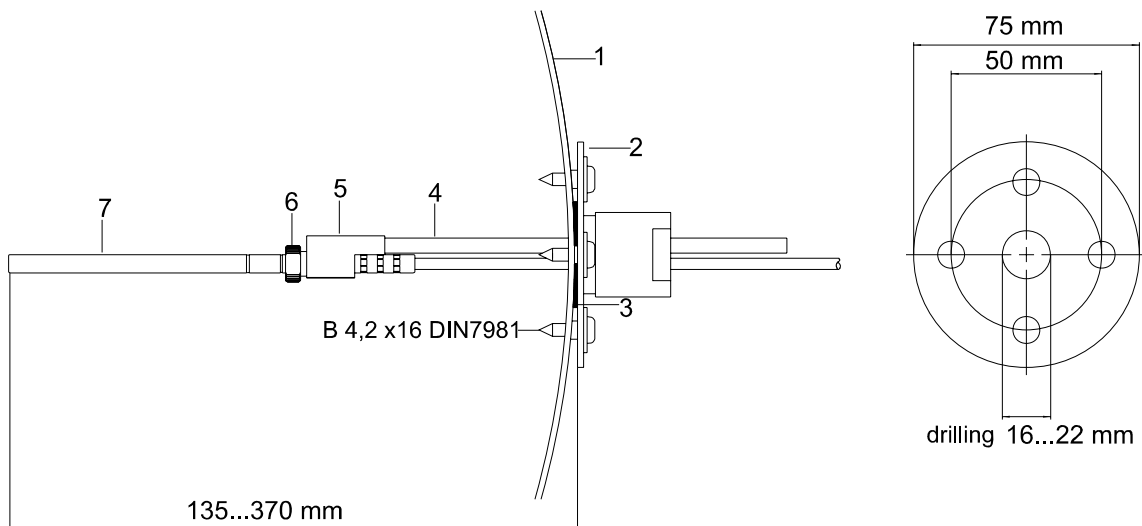
- 1 = Duct wall
- 2 = Flange
- 3 = Sealing ring
- 4 = Supporting bar (not included in the kit for HMT335)
- 5 = Probe attaching part (to be fixed with the supporting bar)
- 6 = Relative humidity probe

### NOTE

When the temperature difference between the duct and the air outside the duct is remarkable, the supporting bar must be installed as deep in the duct as possible. This prevents errors caused by the heat conduction in the bar and cable.

## Duct Installation Kit for Temperature Probe (for HMT337)

Vaisala duct installation kit for the T-probe includes flange, supporting bar, probe attaching part, sealing ring and the fixing screws (4 pcs). Vaisala order code: 215003.



0507-018

**Figure 68 Duct Mounting Installation Kit for T-Probe**

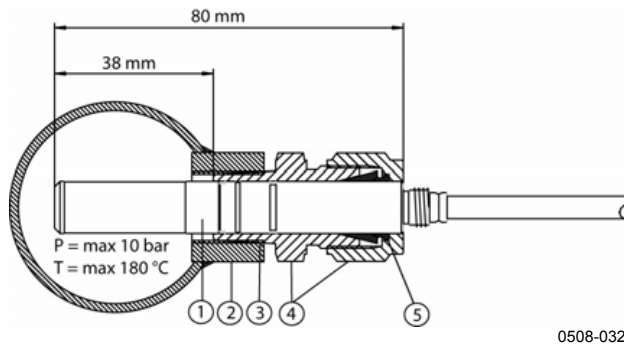
The following numbers refer to Figure 68 above:

- 1 = Duct wall
- 2 = Flange
- 3 = Sealing ring
- 4 = Supporting bar
- 5 = Probe support (to be fixed to the supporting bar)
- 6 = Retainer bushing (to be fixed to the probe support)
- 7 = Temperature probe (to be fixed to the retainer bushing)

# Pressure Tight Swagelok Installation Kits (for HMT337)

## RH Probe Installation

Swagelok installation kit for the relative humidity probe includes Swagelok connector with ISO3/8" or NPT1/2" thread. Vaisala order codes: SWG12ISO38 or SWG12NPT12.



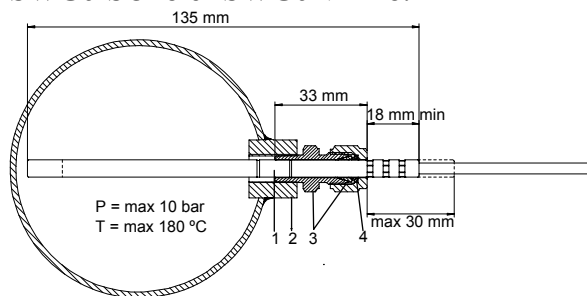
**Figure 69 Swagelok Installation Kit for RH-probe**

The following numbers refer to Figure 69 above:

- 1 = Relative humidity probe
- 2 = Duct connector
- 3 = ISO3/8" or NPT1/2" thread
- 4 = Swagelok connector
- 5 = Ferrules

## Temperature Probe Installation

Swagelok installation kit for T-probe includes Swagelok connector with either ISO1/8" or NPT1/8" thread. Vaisala order codes: SWG6ISO18 or SWG6NPT18.



**Figure 70 Swagelok Installation Kit for T-Probe**

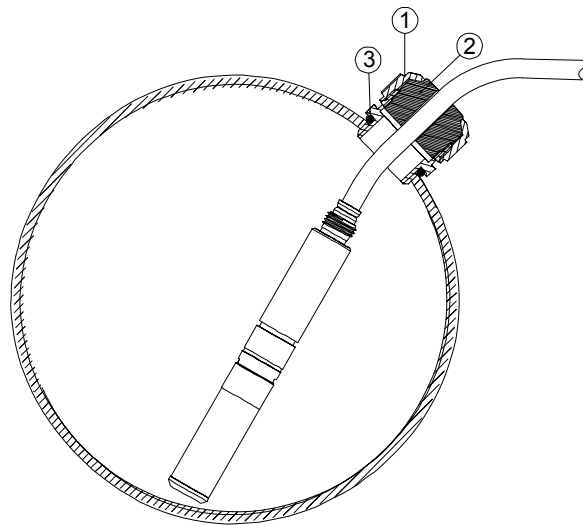
The following numbers refer to Figure 73 below:

- 1 = T-probe
- 2 = Duct connector
- 3 = Swagelok connector
- 4 = Ferrules

# Examples of Vapor Tight Installations with Cable Gland

## RH-Probe Installations (for HMT333/337)

Cable gland AGRO is available from Vaisala (order code: HMP247CG.)

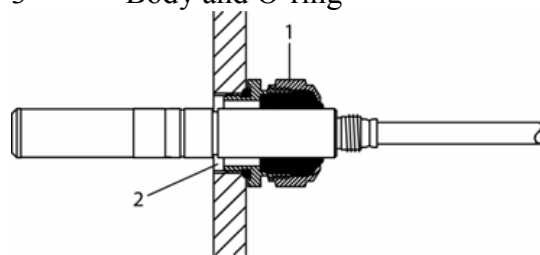


0508-026

**Figure 71 Cable Installation with Cable Gland**

The following numbers refer to Figure 71 above:

- 1 = Nut (to be tightened to the body)
- 2 = Seal
- 3 = Body and O-ring



0508-018

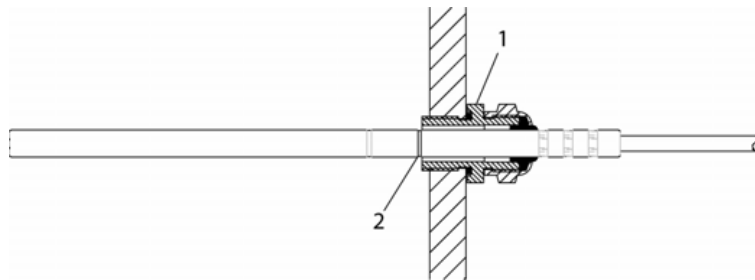
**Figure 72 Probe Head Installation with Cable Gland**

Probe head installation with cable gland is not available from Vaisala.

The following numbers refer to Figure 72 above:

- 1 = AGRO 1160.20.145 (T= -40 ... +100 °C) Not available from Vaisala.
- 2 = In pressurized places, use a locking ring (for example: 11× 1 DIN471).

## T- Probe Installations (HMT337)



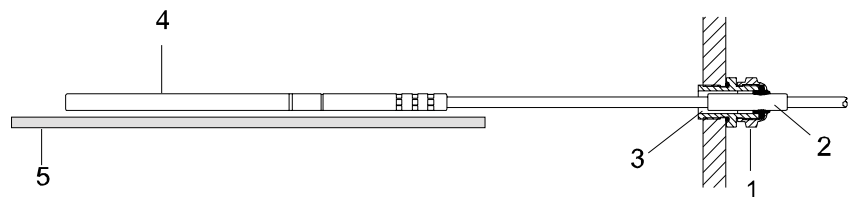
0508-015

**Figure 73 Vapor Tight Installation**

Vapor Tight Installation is not available from Vaisala.

The following numbers refer to Figure 73 above:

- 1 = Cable gland. For example AGRO 1100.12.91.065 (T= -25 ... +200 °C)
- 2 = In pressurized processes, use a locking ring (example: 6x 0.7 DIN471)



0508-022

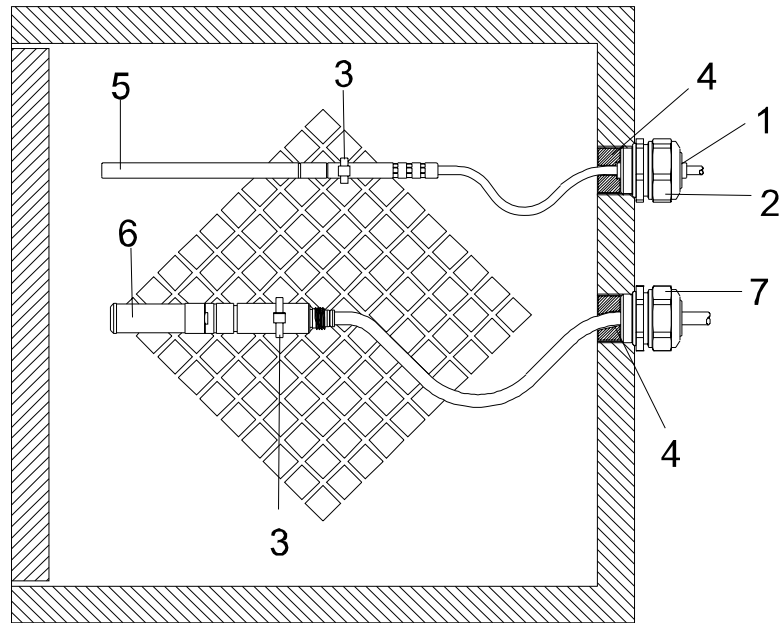
**Figure 74 Wall Mounting Installation**

Wall Mounting Installation is not available from Vaisala.

The following numbers refer to Figure 75 below:

- 1 = Cable gland. For example AGRO 1100.12.91.065
- 2 = Compacted PTFE sleeve
- 3 = Silicon glue between the PTFE sleeve and the cable
- 4 = Temperature probe
- 5 = Recommended support to keep the probe in horizontal position

## Example of Climate Chamber Installation



0507-016

**Figure 75 Climate Chamber Installation (not Available from Vaisala)**

The following numbers refer to Figure 76 below

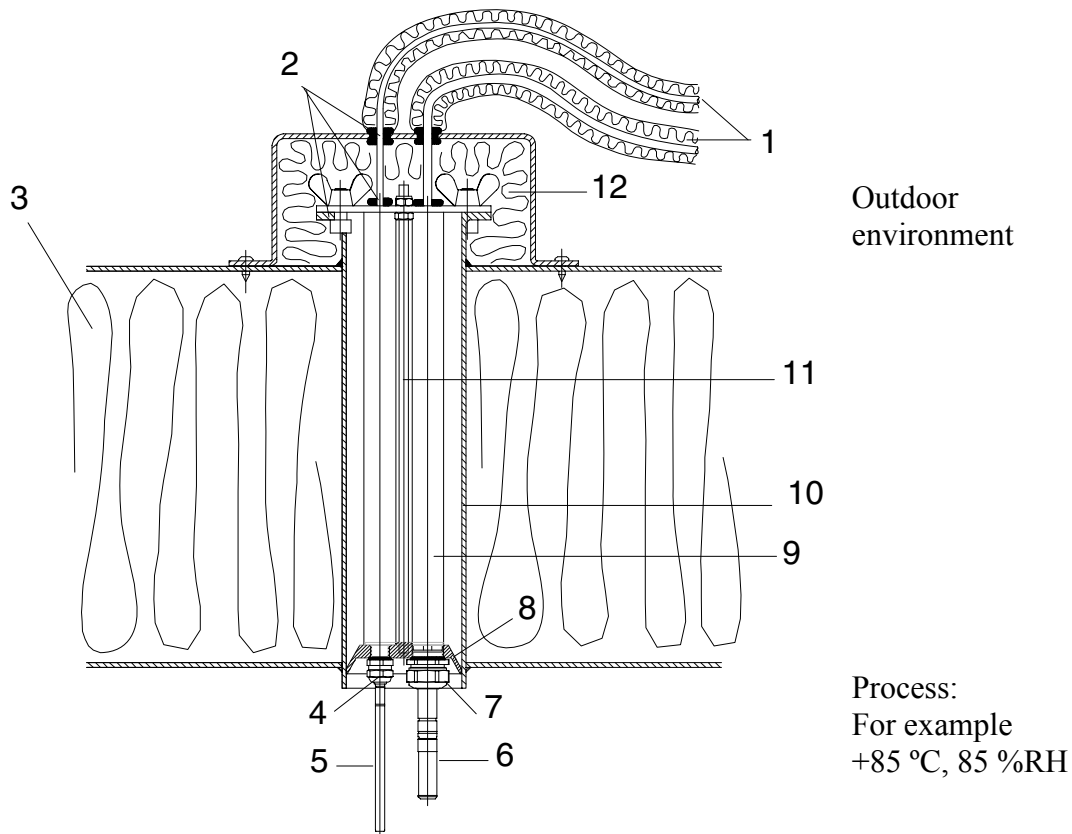
- 1 = PTFE sleeve
- 2 = Cable gland, for example: AGRO 1100.12.91.065
- 3 = Stainless steel cable tie or similar fastener<sup>1</sup>
- 4 = To be sealed (silicone)
- 5 = Temperature probe
- 6 = Relative humidity probe
- 7 = HMP247CG, Cable gland AGRO (available from Vaisala)

**NOTE**

Let the cables hang loosely to prevent condensed water running to the sensor head.



## Example of Installation Through Roof



0507-015

**Figure 76 Example of Installation through Roof**

The following numbers refer to Figure 76 above:

- 1 = Insulated probe cables
- 2 = Sealings
- 3 = Roof
- 4 = Cable gland for temperature probe (for example: AGRO 1100.12.91.065)
- 5 = Temperature probe
- 6 = Relative humidity probe
- 7 = Cable gland for relative humidity probe (for example: AGRO 1160.20.145)
- 8 = Plastic adapter to protect probes from condensation water coming from the pipe. Diameter slightly smaller than tube diameter.
- 9 = Plastic tube for probe heads (2 pcs)
- 10 = Stainless steel tube coming through the roof.
- 11 = Two thread bars holding the plastic adapter.
- 12 = Insulated pipe ending.

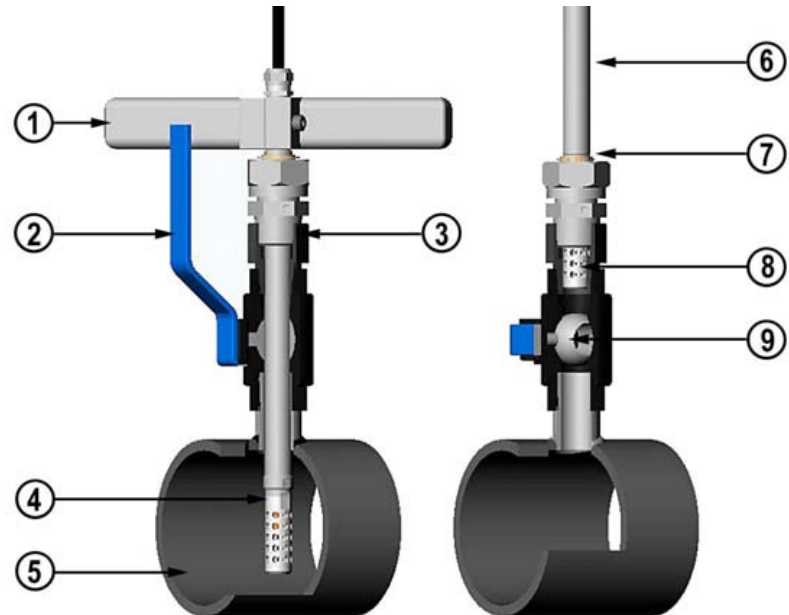
## Ball Valve Installation Kit for HMT338

The ball valve installation kit (Vaisala order code: BALLVALVE-1) is preferred when connecting the probe to a pressurized process or pipeline. Use the ball valve set or a 1/2" ball valve assembly with a ball hole of  $\text{Ø}14$  mm or more. If you install the sensor head ( $\text{Ø} 12$  mm) in a process pipe, please note that the nominal size of the pipe must be at least 1 inch (2.54 cm). Use the manual press handle to press the sensor head into the pressurized ( $< 10$  bar) process or pipeline.

**NOTE**

When measuring temperature dependent quantities make sure that the temperature at the measurement point is equal to that of the process, otherwise the moisture reading may be incorrect.

1. Shut down the process if the process pressure is more than 10 bars. If the pressure is lower there is no need to shut down the process.
2. Make the installation according to the figure below. Install the sensor head transversely against the direction of the process flow through the HMT338 ball valve assembly.



**Figure 77** Installing Sensor Head through Ball Valve Assembly

The following numbers refer to Figure 77 on page 152:

- 1 = Manual press handle
- 2 = Handle of the ball valve
- 3 = Tighten clasp nut first manually; probe is then sliding easily. Finally tighten with a fork spanner about 60° to have a stable installation. Do not over tighten this nut.
- 4 = Sensor head
- 5 = Process chamber/pipeline
- 6 = Probe
- 7 = The groove on the sensor head indicates the upper adjustment limit
- 8 = Filter
- 9 = Ball of the ball valve

You can not close the valve if the groove is not in sight. When installing the sensor head through the BALLVALVE-1 Ball Valve Assembly it is not necessary to empty or shut down the process for installing or removing the sensor head.

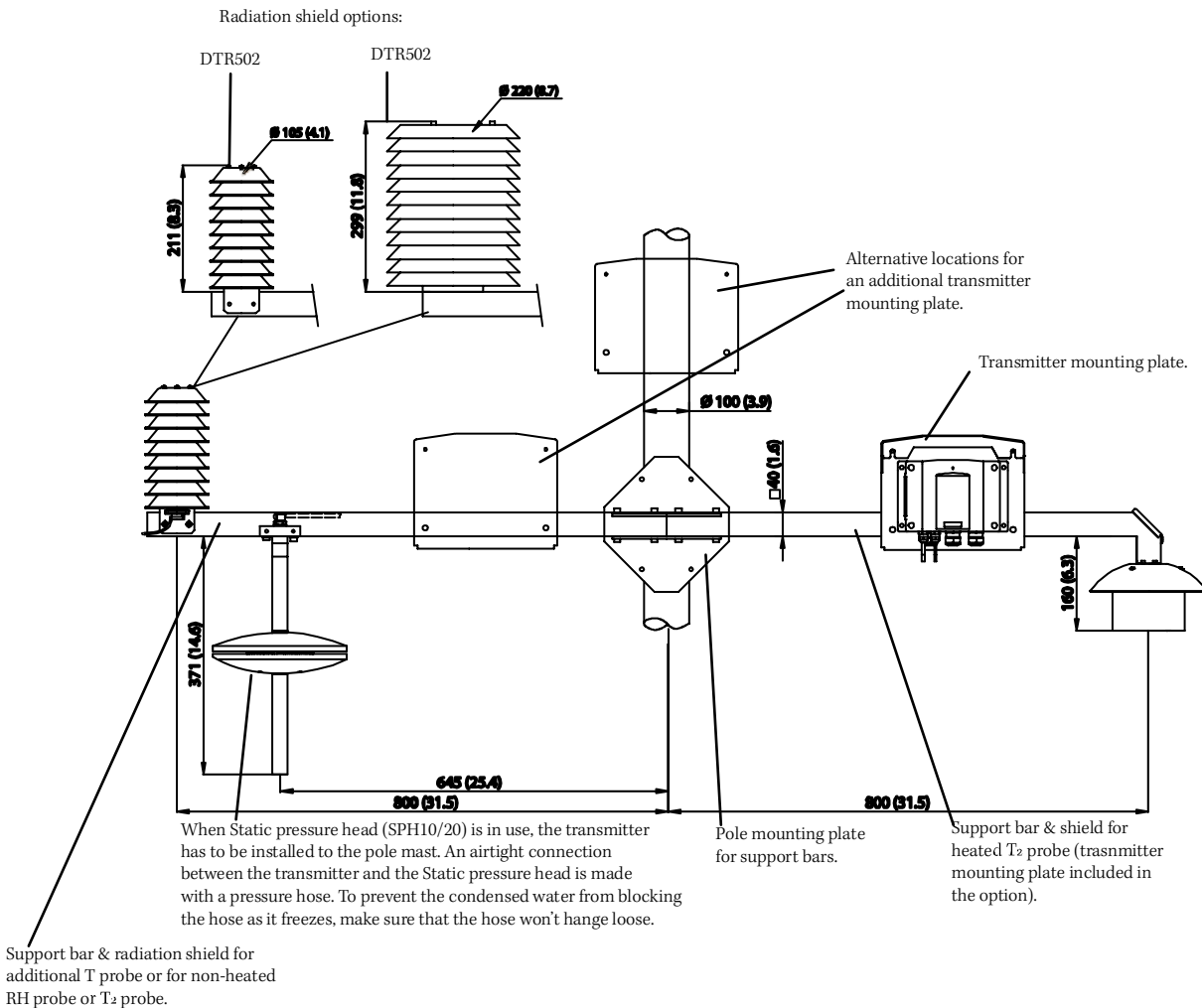
1. Mount the probe with the ball valve assembly closed; tighten the clasp nut manually.
2. Open the ball valve assembly.
3. Push the probe head through the ball valve assembly into the process. If the pressure is high, use a manual press handle. Note that the sensor head must be pushed so deep that the filter is completely inside the process flow.
4. Tighten the clasp nut a further 50-60°.

**NOTE**

The probe can be installed in the process through the ball valve assembly provided that the process pressure is less than 10 bars. This way, the process does not have to be shut down when installing or removing the probe. However, if the process is shut down before removing the probe, the process pressure can be max. 20 bars.

# Meteorological Installation Kit (for HMT337)

The Vaisala meteorological Installation Kit HMT330MIK (Vaisala order code: HMT330MIK) enables the HMT337 to be installed outdoors to obtain reliable measurements for meteorological purposes. For more information, see HMT330MIK brochure and order form.



0610-078

**Figure 78 Meteorological Installation Kit for Outdoor Installation**

## APPENDIX B

# CALCULATION FORMULAS

The HMT330 series transmitters measure relative humidity and temperature. From these values dewpoint, mixing ratio, absolute humidity and enthalpy in normal pressure are calculated using the following equations:

Dewpoint:

$$T_d = \frac{\frac{T_n}{m}}{\log\left(\left(\frac{P_w}{A}\right) - 1\right)} \quad (1)$$

$P_w$  is the water vapor pressure. The parameters  $A$ ,  $m$ , and  $T_n$  depend on temperature according to the following table (\* used for frostpoint calculation if the dewpoint is negative):

<b>t</b>	<b>A</b>	<b>m</b>	<b>Tn</b>
<0 °C *	6.1134	9.7911	273.47
0 ... 50 °C	6.1078	7.5000	237.3
50 ... 100 °C	5.9987	7.3313	229.1
100 ... 150 °C	5.8493	7.2756	225.0
150 ... 180 °C	6.2301	7.3033	230.0

Mixing ratio:

$$x = B \cdot RH \cdot \frac{P_{ws}}{100 \cdot p - (RH \cdot P_{ws})} \quad (2)$$

where

$B$  = coefficient, depends on the molecular weight of the gas  
(for example, for water vapor  $B = 621.99$ )

$P_{ws}$  = water vapor saturation pressure (hPa)

$p$  = atmospheric pressure (hPa)

Absolute humidity:

$$a = 216.68 \cdot \frac{P_w}{T} \quad (3)$$

Enthalpy:

$$h = (T - 273.15) \cdot (1.01 - (0.00189 \cdot x)) - (2.5 \cdot x) \quad (4)$$

The water vapor saturation pressure  $P_{ws}$  is calculated by using two equations (5 and 6):

$$\Theta = T - \sum_{i=0}^3 C_i T^i \quad (5)$$

where:

$T$  = temperature in K

$C_i$  = coefficients

$C_0 = 0.4931358$

$C_1 = -0.46094296 \cdot 10^{-2}$

$C_2 = 0.13746454 \cdot 10^{-4}$

$C_3 = -0.12743214 \cdot 10^{-7}$

$$\ln P_{ws} = \sum_{i=-1}^3 b_i \Theta^i + b_4 \ln \Theta \quad (6)$$

where:

$$\begin{aligned} b_i &= \text{coefficients} \\ b_{-1} &= -0.58002206 * 10^4 \\ b_0 &= 0.13914993 * 10^1 \\ b_1 &= -0.48640239 * 10^{-1} \\ b_2 &= 0.41764768 * 10^{-4} \\ b_3 &= -0.14452093 * 10^{-7} \\ b_4 &= 6.5459673 \end{aligned}$$

The water vapor pressure is calculated using:

$$P_w = RH \cdot \frac{P_{ws}}{100} \quad (7)$$

Parts per million by volume is calculated using:

$$ppm_v = 10^6 \cdot \frac{P_w}{p - P_w} \quad (8)$$

Symbols:

$$\begin{aligned} T_d &= \text{dewpoint temperature (}^\circ\text{C)} \\ P_w &= \text{water vapor pressure (hPa)} \\ P_{ws} &= \text{water vapor saturation pressure (hPa)} \\ RH &= \text{relative humidity (\%)} \\ x &= \text{mixing ratio (g/kg)} \\ p &= \text{atmospheric pressure (hPa)} \\ A &= \text{absolute humidity (g/m}^3\text{)} \\ T &= \text{temperature (K)} \\ h &= \text{enthalpy (kJ/kg)} \end{aligned}$$







[www.vaisala.com](http://www.vaisala.com)