VAISALA

USER'S GUIDE

Vaisala HUMICAP® Humidity and Temperature Transmitter HMT310

M210619EN-D

PUBLISHED BY

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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 Humidity and Temperature Transmitter HMT310.

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.
- Chapter 3, Installation, provides you with information that is intended to help you install this product.
- Chapter 4, Operation, contains information that is needed to operate Humidity Transmitter HMT310.
- Chapter 5, Measuring at Overpressure, contains important information concerning the use of HMT310 in overpressure conditions.
- Chapter 6, Maintenance, provides information that is needed in basic maintenance of HMT310, and lists contact information for technical support and Vaisala Service Centers.
- Chapter 7, Calibration and Adjustment, describes the relative humidity and temperature adjustment procedures.
- Chapter 8, Technical Data, provides the technical data of the product.
- Appendix A describes the available probe installation kits and provides some installation examples.

Version Information

Table 1 Manual Revisions

Manual Code	Description
M210619EN-A	June 2004 - First release.
M210619EN-B	September 2005
M210619EN-C	September 2007 - Added HUMICAP® 180R and HUMICAP® 180RC as sensor options.
M210619EN-D	November 2009 - Removed HUMICAP® 180, HUMICAP® 180C and HUMICAP® 180L2 from sensor options. Updated Technical Data of the product.

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

Product Related Safety Precautions

The Humidity and Temperature Transmitter HMT310 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.

CAUTION	Do not touch the sensor plate.

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.

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

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.

Regulatory Compliances

The Humidity and Temperature Transmitter HMT310 complies with the following performance and environmental test standards:

Complies with EMC standard EN61326-1, Industrial environment.

NOTE The RF-field susceptibility level according to standard EN 61000-4-3 with frequency band 110 ... 165 MHz horizontal polarization, is only 3 V/m (generic environment) with the specified accuracy.

Emissions

Test	Complies with Standard
Radiated emissions	EN55022 / CISPR16/22 Class B

Immunity

Test	Complies with Standard
Electrostatic discharge (ESD)	EN/IEC 61000-4-2 criteria B
Radiated immunity	EN/IEC 61000-4-3 criteria A
EFT burst (Electric fast transients)	EN/IEC 61000-4-4 criteria B
Surge	EN/IEC 61000-4-5 criteria B
Conducted immunity	EN/IEC 61000-4-6 criteria A

Trademarks

Vaisala Trademark is a registered trademark of Vaisala Oyj.

VAISALA HUMICAP® is a registered trademark of Vaisala.

Microsoft®, Windows®, Windows® NT, and Windows® 2000 are registered trademarks of Microsoft Corporation in the United States and/or other countries.

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 OF 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 cir-cumstances 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.

Introduction to HMT310

The Vaisala HUMICAP® Humidity and Temperature Transmitter HMT310 is a small size humidity and temperature transmitter that powers up with 12 ... 35 VDC. Output alternatives are analog outputs 0/4 ... 20 mA and an RS-232 serial line. The following optional functions are available:

- Several probes for various applications
- Calculated humidity quantities
- Different mounting kits, sensor protection options and probe cable lengths
- Warmed probe and sensor heating for high humidity conditions (HMT317)
- Chemical purge for applications where there is a risk of interfering chemicals in the measuring environment

Components

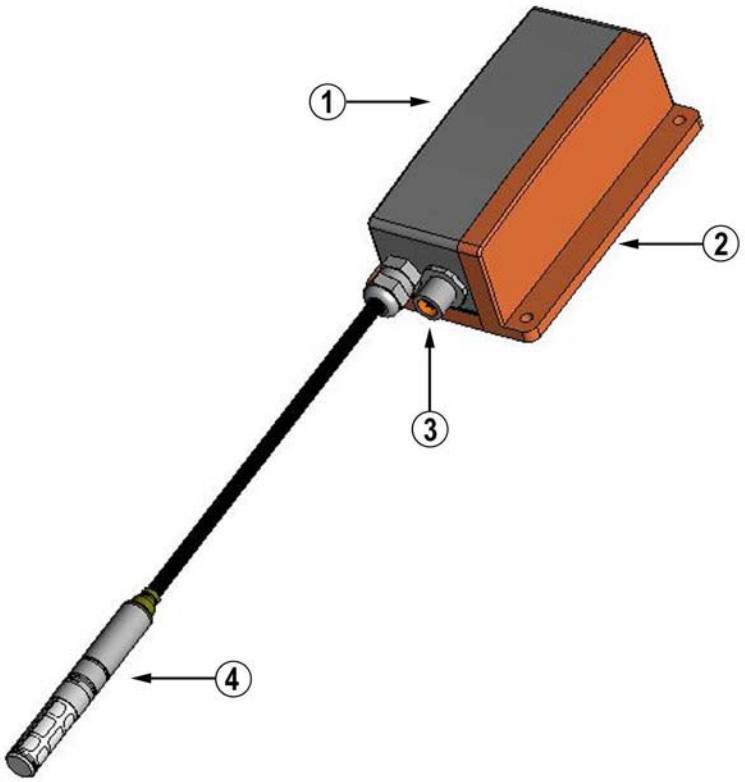

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Figure 1 HMT310 Components

The following numbers refer to Figure 1 above:

1 = Transmitter unit
2 = Mounting plate (smaller mounting plate also available)
3 = Connector for signal output and power supply. Available with female connector with 5 m cable or screw terminal connector.
4 = Probe

Probe Options

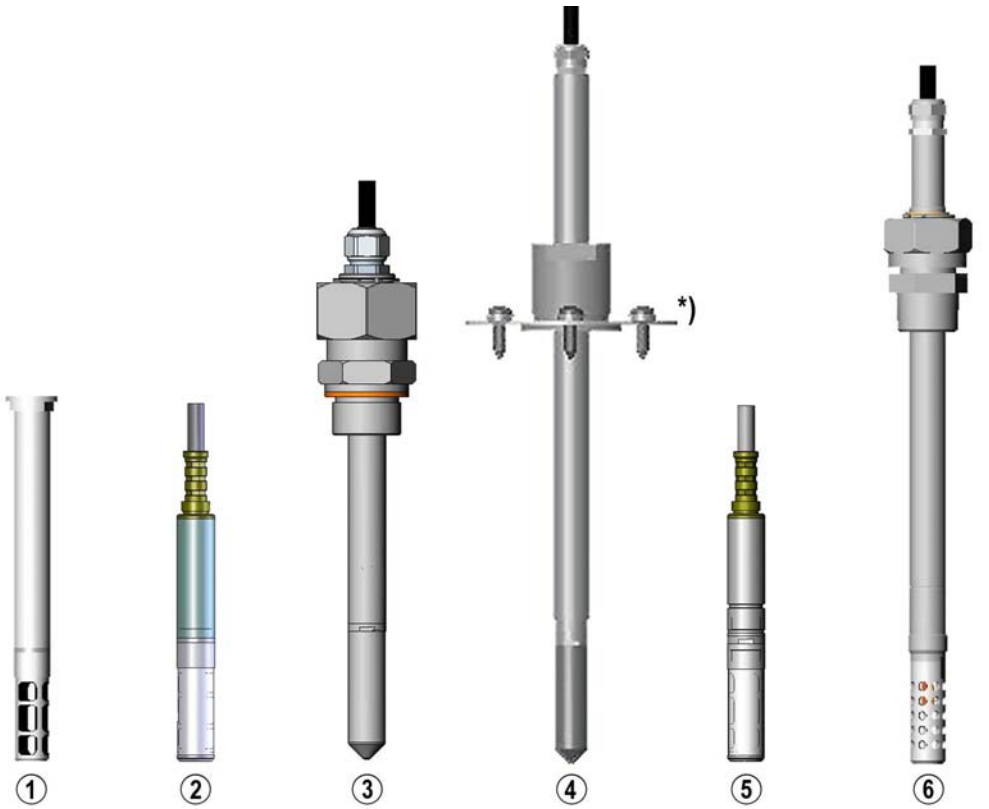

Figure 2 HMT310 Probes

The following numbers refer to Figure 2 above:

1 = HMT311 for wall mounting
2 = HMT313 for general use
3 = HMT314 for pressurized spaces up to 100 bar
4 = HMT315 for high temperatures up to 180 °C (242 mm long probe, vapor-tight)
5 = HMT317 for demanding processes (warmed and vapor-tight probe)
6 = HMT318 for pressurized pipelines (40 bar, ball valve)

*) Flange for HMT315 available as an option

Probe cable lengths: 2, 5 and 10 m.

Output Quantities

Table 2 HMT310 Output Quantities

Quantity	Metric Unit	Nonmetric Unit
RH Relative humidity	%RH	%RH
T Temperature	°C	°F
TDF Dewpoint/Frostpoint	°C	°F
TD Dewpoint	°C	°F
A Absolute humidity	g/m^3	gr/ft^3
X Mixing ratio	g/kg	gr/lb
TW Wet bulb temperature	°C	°F
PPM Humid air volume/ dry air volume	ppm	ppm
PW Water vapor pressure	hPa	lb/in^2
PWS Saturation water vapor pressure	hPa	lb/in^2
H Enthalpy	kJ/kg	Btu/lb

NOTE Only quantities selected when ordering the device can be selected for an output quantity.

CHAPTER 3

INSTALLATION

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

Selecting Location

Finding a suitable site for the Humidity and Temperature Transmitter HMT310 is important for getting representative ambient measurements. The site should represent the general area of interest.

Mounting

Mounting the Transmitter/Removing the Transmitter Unit

Select a place with stable conditions for mounting the transmitter. Do not expose the transmitter to direct sunlight or rain.

NOTE	If the transmitter is mounted outdoors cover it with a shelter (purchased by customer). Always mount the transmitter housing with the cable bushings pointing downwards.

1. Mount the plate onto the wall with four/two screws (Ø 4.5 mm/6.0 mm).
2. Place the transmitter onto the mounting plate and fasten it with two Allen screws.

The transmitter module can be unfastened for calibration by releasing the two Allen screws on the left side.

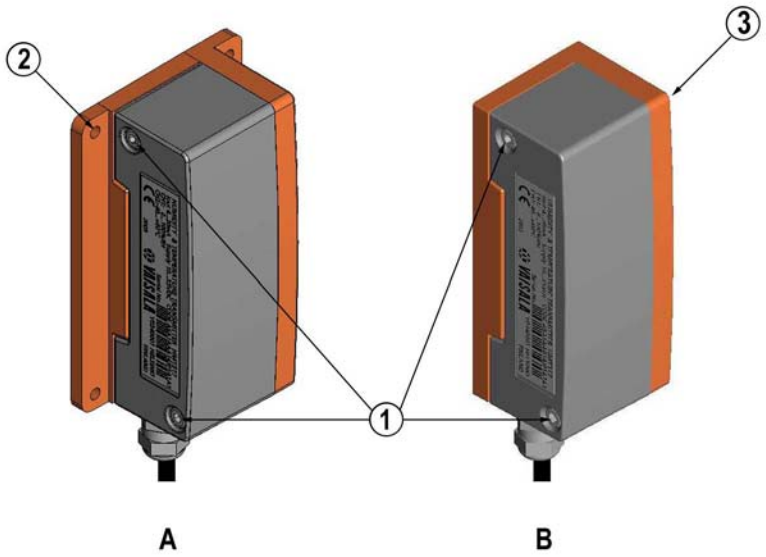

Figure 3 Mounting with Mounting Plates

The following letters and numbers refer to Figure 3 above:

A = Mounting with larger mounting plate
B = Mounting with smaller mounting plate
1 = Two Allen screws for fastening or removing the transmitter module (Allen key provided)
2 = Four screw holes (Ø 4.5 mm) for wall mounting (screws not provided)
3 = Two screw holes (Ø 6.0 mm) on the base of the plate for wall mounting (screws not provided)

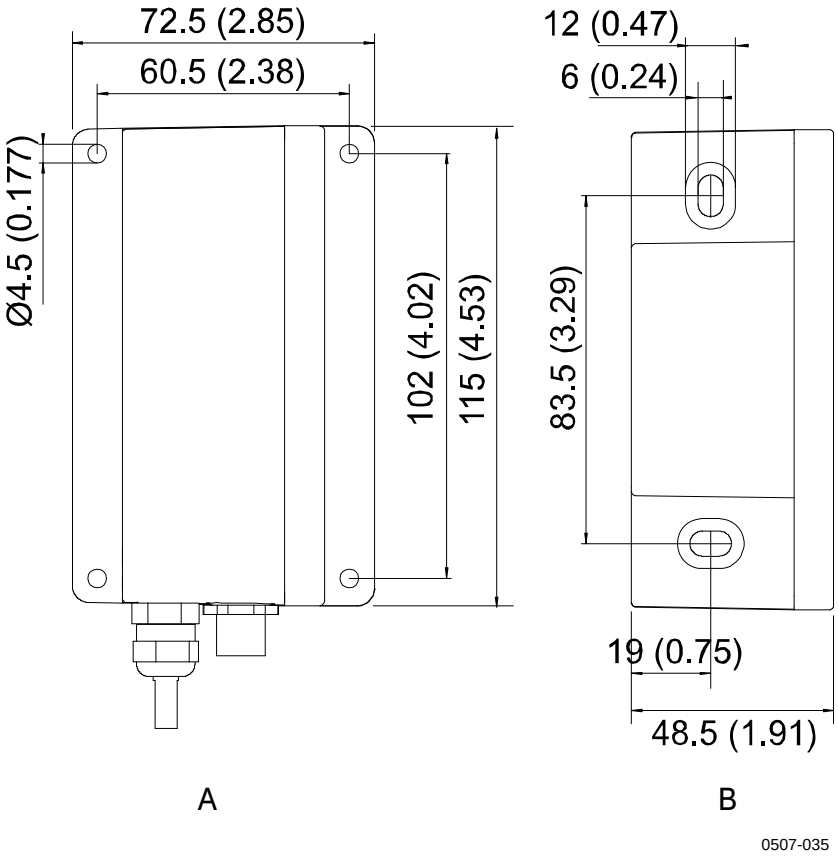

Figure 4 Mounting Plate Dimensions

The following letters refer to Figure 4 above:

A = Larger mounting plate dimensions
B = Smaller mounting plate dimensions

Mounting the Probes

Do not unsolder and then again resolder the probe cable from the mother board during installation; this may alter the humidity calibration of the transmitter.

Beware of Temperature Differences

In humidity measurement and especially in calibration it is essential that the temperature of the probe and the measuring environment is the same. Even a small difference in temperature between the environment and the probe causes an error. As the curve in Figure 5 on page 24 shows, if the temperature is +20 °C and the relative humidity 100 %RH, a difference of ±1 °C between the environment and the probe causes an error of ±6 %RH.

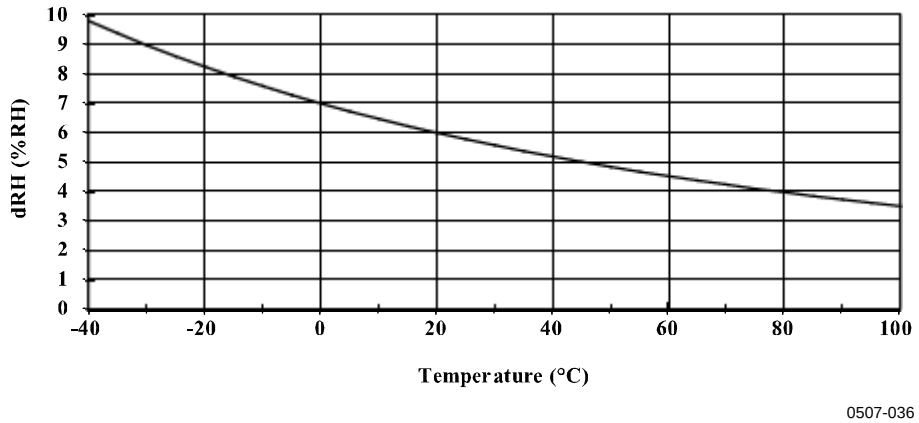

Figure 5 Measurement Error at 100 %RH when Difference Between Ambient and Sensor Temperature is 1 °C

General Instructions for Probes with Cable

It is recommended that the probes with a cable are mounted with the probe **horizontal**; this way, any water condensing on the tube cannot flow onto the sensor.

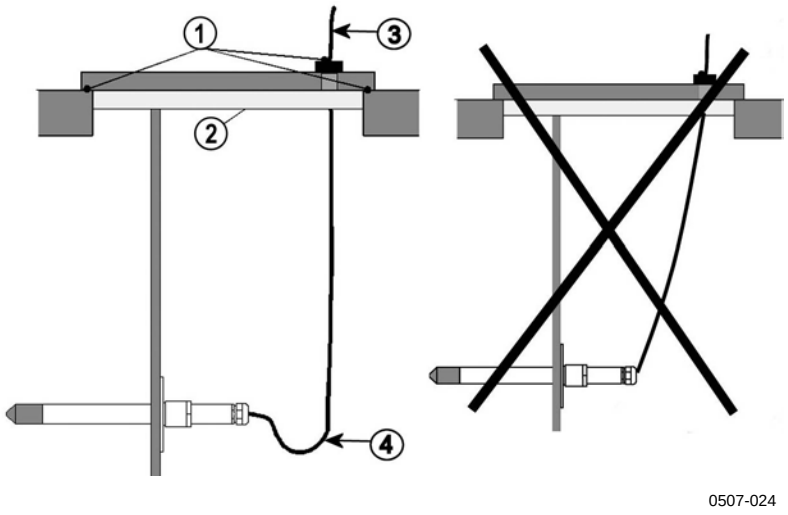

Figure 6 Horizontal Mounting of Probe

The following numbers refer to Figure 6 above:

1 = To be sealed
2 = To be insulated
3 = Insulate
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 probe 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 probe along the cable.

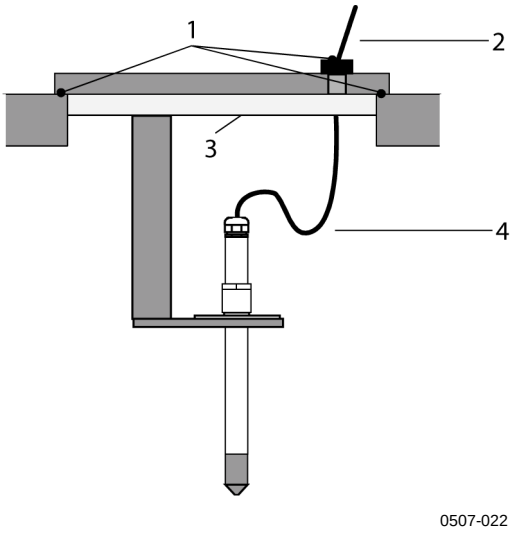

Figure 7 Vertical Mounting of Probe

The following numbers refer to Figure 7 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 (HMT317) 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 probe and preferably a piece of the cable must be inside the process. This prevents measuring inaccuracies caused by heat conduction along the cable.

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

HMT313 for General Use

The HMT313 is a small size (d = 12mm) general-purpose probe suitable for ducts and channels with the installation kit available from Vaisala.

The HMT313 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 ºC. The second version is suitable for measuring in environments up to 120 ºC.

See Appendix A on page 81 for the following probe installation kits for HMT313 and installation examples:

- Duct mounting kit
- Cable gland

HMT314 for Pressurized Spaces

HMT314 probe is for humidity 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 nut in place on the body of the probe during handling to prevent damage to the highly polished surface of the probe. Follow the instructions below to achieve a leak-tight assembly:

1. Remove the fitting screw from the nut and the probe.
2. Attach 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 ± 10 Nm (110 ± 7 ft-lbs).
3. Insert the body of the probe into the fitting screw and attach the nut manually to the fitting screw so that the connection feels tight.
4. Mark both the fitting screw and the nut hex.

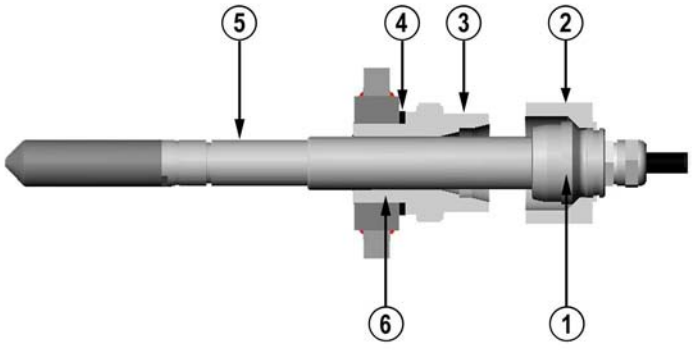

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Figure 8 HMT314 Installation

The following numbers refer to Figure 8 on page 26:

1 = Tightening cone
2 = Nut
3 = Fitting screw
4 = Sealing washer
5 = Probe; Ø 12 mm
6 = M22×1.5 or NPT 1/2"

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).

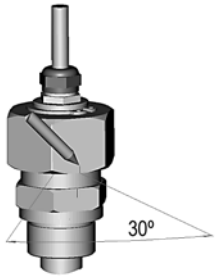

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Figure 9 Marking the Nut

NOTE	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; Down Corning, Europe) or a similar grease.

See also Chapter 5, Measuring at Overpressure, on page 61.

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 HMT314 is installed in a process with 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 PRES Set Ambient Pressure for Calculations on page 48).

HMT315 for High Temperatures

HMT315 is installed similarly than the HMT313 probe but without the supporting bar. Refer to Appendix A on page 81 for more information on the duct installation kit for HMT315.

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

HMT317 for Demanding Processes

The HMT317 is for environment where relative humidity is very high, near saturation. The warmed probe prevents the saturation of the sensor.

See Appendix A on page 81 for a presentation of the following probe installation kits for HMT317 with installation examples:

- Duct mounting kit
- Cable gland
- Pressure tight Swagelok connector

HMT318 for Pressurized Pipelines

Due to the sliding fit the HMT318 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 HMT318 on page 84.

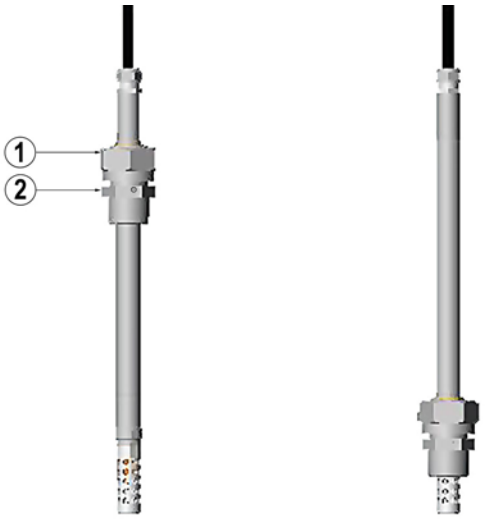


Figure 10 HMT318 Probe Dimensions (in mm)

The following numbers refer to Figure 10 above:

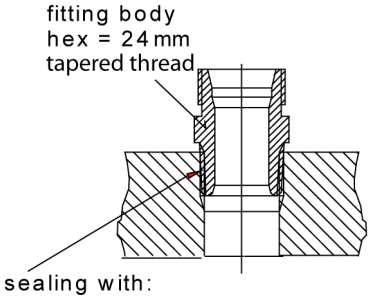
1 = Clasp nut; 24 mm hex nut
2 = Fitting body; 27 mm hex head

The following two fitting body options are available:

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

Table 3 HMT318 Probe Dimensions

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



sealing with:
1. LOCTITE® No 542 + activ. No 7649 (t=-55...+150 °C)
2. MEGA-PIPE EXTRA No 7188 (t=-55...+170 °C)
3. PTFE tape (t=-60...+210 °C) NOTE: the tape does not lock the parts together. Therefore, use two fork spanners (hex 24 and 27 mm) for tightening and opening the clasp nut of the probe

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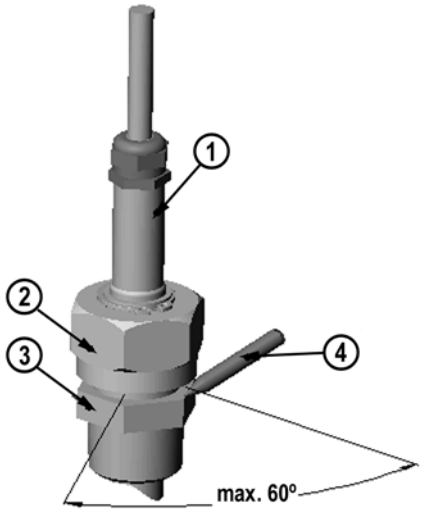
Figure 11 Sealing of Fitting Body into Process

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 - 60º (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).



0505-276

Figure 12 Tightening the Clasp Nut

The following numbers refer to Figure 12 on page 30:

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

NOTE	Take care not to overtighten the clasp nut to avoid difficulties when opening it.

CAUTION	Take care not to damage the probe body. A damaged body makes the probe 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 HMT318 is installed in a process with 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 section PRES Set Ambient Pressure for Calculations on page 48).

Connections

When HMT310 leaves the factory, its measurement ranges, output scaling and quantities have already been set according to order completed by the customer. The unit is calibrated at the factory and the device is ready for use. The transmitter is delivered with a screw terminal connector or with a detachable 5 m cable with eight wires for serial port, analog outputs and 24VDC power supply. See the wiring instructions in Figure 13 below and in Figure 14 on page 33.

Cable Wiring

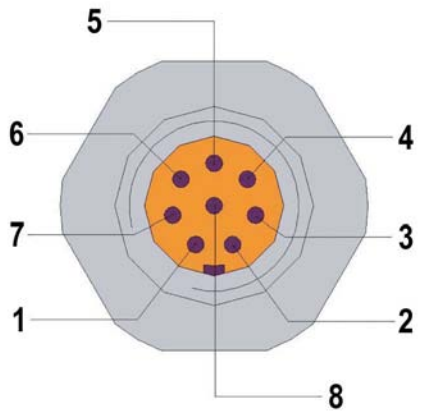


Figure 13 8-Pole Connector

The following numbers and codes refer to Figure 13 above:

Color		Function
1 White (WHT)	=	RS-232 TX
2 Brown (BRN)	=	RS-232 GND
3 Green (GRN)	=	CH2+
4 Yellow (YEL)	=	CH1+
5 Grey (GREY)	=	Supply-/CH1-/CH2 -
6 Pink (PINK)	=	Supply+
7 Blue (BLU)	=	RS-232 RX
8 Red (RED)	=	Not connected

Screw Terminal Connector

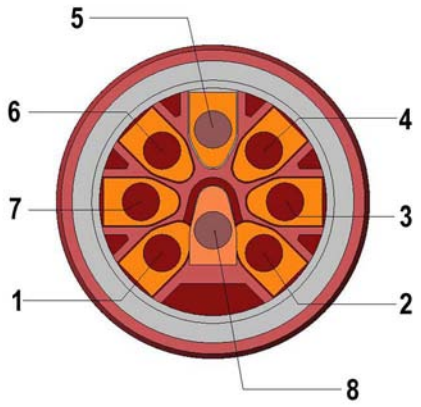


Figure 14 Screw Terminal Connector

The following numbers refer to Figure 14 above:

Color		Function
1 White (WHT)	=	RS-232 TX
2 Brown (BRN)	=	RS-232 GND
3 Green (GRN)	=	CH2+
4 Yellow (YEL)	=	CH1+
5 Grey (GREY)	=	Supply-/CH1-/CH2 -
6 Pink (PINK)	=	Supply+
7 Blue (BLU)	=	RS-232 RX
8 Red (RED)	=	Not connected

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CHAPTER 4

OPERATION

This chapter contains information that is needed to operate Humidity Transmitter HMT310.

Power ON/OFF

Switch on the 24 VDC power supply and the transmitter wakes up.

Entering Serial Communication Parameters

The transmitter communicates via an RS-232 serial interface. The transmitter can be polled or set on RUN-mode with specific commands.

The data format will be (factory settings):

- 1 start bit
- 7 data bits
- 1 stop bit
- Even parity
- 4800 bits per second, programmable to 19200
- Full duplex
- Serial asynchronous
- Configured as Data Terminal Equipment (DTE)

Enter the communication parameters when using this terminal session for the first time; save them for future use. See instructions in Table 4 on page 36.

Table 4 Entering Serial Parameters in Windows® 2000 and Windows NT®

WINDOWS 2000		WINDOWS NT	
MENU	WHAT TO DO	MENU	WHAT TO DO
Start		**Start**	
⇩	move the cursor to:	⇩	move the cursor to:
Programs		**Programs**	
⇩	move the cursor to:	⇩	move the cursor to:
Accessories		**Accessories**	
⇩	move the cursor to:	⇩	move the cursor to:
Communications			
⇩	move the cursor to:		
HyperTerminal	click	**HyperTerminal**	
⇩	move the cursor to:	⇩	move the cursor to:
Hypertrm	double click	**Hyperterminal**	click
⇩		⇩	
Connection Description	type the name of the connection in the appropriate field and select an icon if available; click OK.	**Connection Description**	type the name of the connection in the appropriate field and select an icon if available; click OK.
⇩			
Phone Number	move the cursor to the field CONNECT USING and select '**direct to COM x**' (x = serial port available); click OK	**Connect to**	move the cursor to the field CONNECT USING and select '**COM x**' (x = serial port available); click OK
⇩		⇩	
COM x properties	select parameters according to the following figure; click OK	**COM x properties**	select parameters according to the following figure, click OK

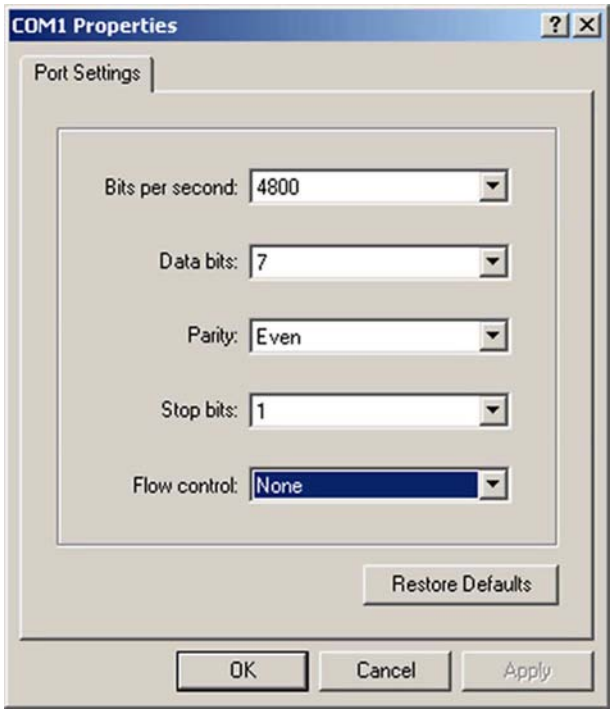

Figure 15 HyperTerminal Settings in Windows® 2000 Environment

List of Commands

The text in **BOLD** letters in the [brackets] indicates the default setting. Issue the commands by typing them on your computer keyboard. <cr> stands for pressing **Enter** (on your computer keyboard). This section presents the command list, the commands are described in detail later in this chapter.

Measurement output	
R	Start continuous outputting
S	Stop continuous outputting
INTV [**0** … 255 **S**/MIN/H]	Set continuous output interval for RUN-mode
SEND [**0** … 99]	Output reading once
SMODE [**STOP**/RUN/POLL]	Set serial interface mode
SERI [baud p d s]	Serial line settings (default: 4800 E 7 1) baud: 300…19200
ADDR [**0** … 99]	Set transmitter address for Use in POLL-mode
OPEN [0 … 99]	Temporarily open transmitter from POLL-mode to receive commands
CLOSE	Set transmitter in POLL-mode

Output formatting

FORM	Serial output format
TIME	Set time
DATE	Set date
FTIME [ON/**OFF**]	Add time to SEND and R outputs
FDATE [ON/**OFF**]	Add date to SEND and R outputs
UNIT	Select metric or nonmetric output units
FST [ON/**OFF**]	Output state of optional probe heating and chemical purge (with SEND and R commands)

Other commands

?	Check transmitter settings
??	Check transmitter settings in POLL-mode
ECHO [**ON**/OFF]	Serial bus echo
FIND	All devices in POLL-mode send their addresses
HELP	List commands
PRES	Set ambient pressure for calculations (non-volatile)
XPRES	Set ambient pressure for calculations
FILT	Set result filtering
RESET	Reset transmitter
ERRS	Display error messages

Setting, scaling and testing analog outputs

AMODE	Set analog outputs (0/4 ... 20 mA)
ASEL	Select parameter for analog outputs
ASCL	Scale analog outputs
ITEST	Test analog outputs
AQTEST	Test analog outputs for desired readings
AERR	Set error outputs

Calibration and adjustment (these are presented in Chapter 7**, section** Calibration and Adjustment Commands **on page 67)**

CRH	Relative humidity calibration
CT	Temperature calibration
LI	Revert factory calibration
FCRH	Relative humidity calibration after sensor change
CTEXT	Set calibration information text
CDATE	Set calibration date
ACAL	Analog output calibration

Chemical purge	
PUR [ON/**OFF**]	Enable or disable automatic chemical purge
PURGE	Activate chemical purge
PURR [ON/**OFF**]	Enable or disable automatic chemical purge in power up
Sensor heating	
XHEAT [ON/OFF]	Enable or disable sensor heating

Measurement Output

R Start Continuous Outputting

Syntax: R<cr>

Starts output of measurements to the peripheral devices (RUN-mode); the only command that can be used is S (stop).

The output mode can be changed with command FORM.

Example:

```
>r<cr>
RH= 28.0 %RH T= 23.3 'C
RH= 28.0 %RH T= 23.3 'C
RH= 28.0 %RH T= 23.3 'C
RH= 28.0 %RH T= 23.3 'C
RH= 28.0 %RH T= 23.3 'C
RH= 28.0 %RH T= 23.3 'C
```

S Stop Continuous Outputting

Syntax: S<cr>

Stops the continuous output. Also the **Esc** key (on your computer keyboard) can be used to stop outputting.

INTV Set Continuous Output Interval for RUN-Mode

Syntax: INTV xxx yyy<cr>

Where

xxx	=	Output interval (0 ... 255)
yyy	=	Unit (s, min or h)

Example:

```
>intv 1<cr>
Output interval: 1 S
>intv 1 min<cr>
Output interval: 1 MIN
>intv 1 h<cr>
Output interval: 1 H
```

SEND Output Reading Once

Syntax in STOP-mode: SEND<cr>

Syntax in POLL-mode: SEND aa<cr>

Where

aa	=	Address of the transmitter when more than one transmitter is connected to a serial bus (0 ... 99)

SMODE Set Serial Interface Mode

Syntax: SMODE x<cr>

Where

x	=	STOP/RUN/POLL STOP-mode: Transmitter in standby for serial commands RUN-mode: Transmitter outputs data continuously POLL-mode: Transmitter only responds to addressed command

Example:

```
>smode run<cr>
Output mode    : RUN

>smode stop<cr>
Output mode    : STOP
```

SERI Serial Line Settings

Syntax: SERI b p d s<cr>

Where

b = bauds (300, 600, 1200, 2400, 4800, 9600,19200)
p = parity (n = none, e = even, o = odd)
d = data bits (7 or 8)
s = stop bits (1 or 2)

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

Example:

```
>seri o<cr>            changing parity only
4800 o 7 1
>seri 600 n 8 1<cr>    changing all parameters
600 n 8 1
```

ADDR Set Transmitter Address for Use in POLL-Mode

Syntax: ADDR aa<cr>

Where

aa = Address (0 ... 99)

Example:

```
>addr<cr>
Address        : 0
>addr 1<cr>
Address        : 1
```

OPEN Temporarily Open Transmitter from POLL-Mode to Receive Serial Commands

Syntax: OPEN nn<cr>

Where

nn = Address of the transmitter (0 ... 99)

The OPEN command sets the bus temporarily in STOP-mode so that the SMODE command can be issued.

Example:

```
>open 4<cr>
Device:  4 line opened for operator commands
>
```

CLOSE Set Transmitter in POLL-Mode

Syntax: CLOSE<cr>

In STOP-mode: command OPEN has no effect, CLOSE sets the transmitter temporarily in POLL-mode.

In POLL-mode: command OPEN sets the transmitter temporarily in STOP-mode, command CLOSE returns the instrument to POLL-mode.

Example:

Relative humidity calibration is performed at transmitter 2, which is in POLL-mode.

```
>open 2<cr>
```

Opens the line to transmitter 2.

```
>crh<cr>
```

Calibration started.

```
...
>close<cr>
```

Line closed.

Output Formatting

FORM Serial Output Format

Syntax: FORM x<cr>

Where

x = Formatter string

Command format can be used to change the format of the output commands SEND and R.

Format string consists of quantities and modifiers: use the quantity abbreviations and modifiers presented in Table 5 on page 44 and in Table 6 on page 44 when selecting the output quantities.

Table 5 Quantity Abbreviations for FORM Command

Abbreviation	Quantity
RH	Relative humidity
T	Temperature
TDF	Dewpoint/Frostpoint
TD	Dewpoint
A	Absolute humidity
X	Mixing ratio
TW	Wet bulb temperature
PPM	Humid air volume/dry air volume
PW	Water vapor pressure
PWS	Saturation water vapor pressure
H	Enthalpy

NOTE Only quantities selected when ordering the device can be selected for an output quantity.

Table 6 Modifiers

Modifier	Description
x.y	Length modifier (whole numbers and decimal places)
#t	Tabulator
#r	Carriage return
#n	Line-feed
""	String-constant
U5	Unit field and length (unit can be changed with command UNIT)

Examples:

```
>form "TD=" 5.2 TD #r#n<cr>
TD=   -3.65

>form "TD=" TD U3 #t "TDF=" TDF U3 #r#n<cr>
TD=   -4.0'C    TDF=   -3.6'C
>
```

Command FORM / returns the default output form:

```
>form /<cr>
>send<cr>
RH= 28.0 %RH T= 23.3 'C
```

TIME, DATE Setting Time and Date

Syntax: TIME<cr>

Syntax: DATE<cr>

Sets the time and date to the transmitter.

Example:

```
>time<cr>
Current time is 04:12:39
Enter new time (hh:mm:ss) ? 12:24:00<cr>
>date<cr>
Current date is 2000-01-01
Enter new date (yyyy-mm-dd) ? 2004-06-30<cr>
>
```

NOTE	Time and date are cleared to 2000-01-01 00:00:00 at reset.

NOTE	Only about 1 % accuracy is obtained with the software clock.

FTIME, FDATE Add Time and Date to SEND and R Outputs

Syntax: FTIME x<cr>

Syntax: FDATE x<cr>

Where

x = ON/OFF

The command enables or disables output of time and date to the serial line.

UNIT Select Metric or Nonmetric Output Units

Syntax: UNIT x<cr>

Where

x = M or N
M = metric units
N = nonmetric units

Table 7 Output Quantities and their Metric and Nonmetric Units

Quantity	Metric Unit	Nonmetric Unit
RH Relative Humidity	%RH	%RH
T Temperature	°C	°F
TDF Dewpoint/frostpoint	°C	°F
TD Dewpoint	°C	°F
A Absolute humidity	g/m^3	gr/ft^3
X Mixing ratio	g/kg	gr/lb
TW Wet bulb temperature	°C	°F
PPM Humid air volume/dry air volume	Ppm	ppm
PW Water vapor pressure	hPa	lb/in^2
PWS Saturation water vapor pressure	hPa	lb/in^2
H Enthalpy	kJ/kg	Btu/lb

Example:

```
>unit m<cr>
Output units   : metric
>unit n<cr>
Output units   : non metric
>
```

FST Output State of Chemical Purge or Sensor Heating (with SEND and R Commands)

Syntax: FST x<cr>

Where

x = ON/OFF (default = OFF)

Example:

```
>fst on<cr>
Form. status   : ON
>send
[1]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<cr>
Purge started, press any key to abort.

>send<cr>
[1]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 about chemical purge, see pages 54 through 57.

For more information about sensor heating, see pages 57 through 59.

[1]Letters and values indicating the state of the probe:

N ... xxx → normal operation	xxx = probe heat power (W)
X ... xxx → sensor heating	xxx = sensor temperature (°C)
H ... xxx → chemical purge	xxx = sensor temperature (°C)
S ... xxx → sensor cooling after purge	xxx = sensor temperature (°C)

Other Commands

? Check Transmitter Settings

Syntax: ?<cr>

Syntax: ??<cr>

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

Example (factory default settings):

```
>?<cr>
HMT310 / 1.07
PRB serial nr  : A0000000
Calibration    : 2004-05-07
Cal. info      : Vaisala/HEL
Output units   : metric
Pressure       : 1013.25 hPa
RS232 settings
Address        : 0
Output interval: 0 S
Baud P D S     : 4800 E 7 1
Serial mode    : STOP
Analog outputs
Ch1 output mode: 0 ...20mA
Ch2 output mode: 0 ...20mA
Ch1 error out  : 0.000mA
Ch2 error out  : 0.000mA
Ch1 RH   lo    :     0.00 %RH
Ch1 RH   hi    :   100.00 %RH
```

```
Ch2 T    lo    :   -40.00 'C
Ch2 T    hi    :    60.00 'C
>
```

ECHO Serial Bus Echo

Syntax: ECHO x<cr>

Where

x = ON/OFF (default = ON)

The command enables or disables echo of characters received over the serial line.

FIND All Devices in POLL-Mode Send Their Addresses

Syntax: FIND<cr>

HELP List Commands

Syntax: HELP<cr>

PRES Set Ambient Pressure for Calculations

Syntax: PRES aaaa.a<cr>

Syntax: XPRES aaaa.a<cr>

Where

aaaa.a = Absolute pressure (hPa)

Command XPRES should be used if the value is changed frequently. Its value is not retained at reset, and when set to 0, value set with PRES is used.

Example:

If gauge pressure is 1.4 bar, set pressure value 2.4 bar (= 2400 hPa)

```
>pres 2400<cr>
Pressure    : 2400
>
```

Table 8 Pressure Conversion Chart

FROM \ TO	hPa mbar	mmHg Torr	inHg	atm	bar	psi
hPa mbar	1	1.333224	33.86388	1013.25	1000	68.94757
mmHg Torr	0.7500617	1	25.40000	760	750.0617	51.71493
inHg	0.02952999	0.03937008	1	29.921	29.52999	2.036021
atm	0.00098692	0.00131597	0.033422	1	0.98692	0.068046
bar	0.001	0.001333224	0.03386388	1.01325	1	0.06894757
psi	0.01450377	0.01933678	0.4911541	14.6962	14.50377	1

Example:

29.9213 inHg = 29.9213 x 33.86388 = 1013.25 hPa/mbar

NOTE Conversions from mmHg and inHg are defined at 0 °C and for mmH2O and inH2O 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.

FILT Set Result Filtering

Syntax: FILT xx<cr>

Enable or disable the filtering or select the extended filter to reduce noise of the measurement.

Where

x = ON, OFF or EXT
ON = Short filter of about 15 s (results the average value of the last 15 s measurement data)
OFF = No filtering (default)
EXT = Extended filter of about 1 min (results the average value of the last 1 min measurement data)

RESET Reset Transmitter

Syntax: RESET<cr>

ERRS Display Error Messages

Syntax: ERRS<cr>

Display transmitter error messages. If there are no errors present, a PASS will be returned.

Examples:

```
>errs<cr>
PASS
>

>errs<cr>
FAIL
Error: Temperature measurement malfunction
Error: Humidity sensor open circuit
>
```

Setting, Scaling and Testing Analog Outputs

AMODE Set Analog Outputs (0/4 ... 20 mA)

Syntax: AMODE ch1 ch2<cr>

Where

ch1 and ch2	=	I0 = 0 ... 20 mA I1 = 4 ... 20 mA

Example:

```
>amode i1 i1<cr>
Ch1 output mode: 4...20mA
Ch2 output mode: 4...20mA
>
```

ASEL Select Parameter for Analog Outputs

Syntax: ASEL xxx yyy<cr>

Where

xxx	=	Quantity of channel 1
yyy	=	Quantity of channel 2

Use abbreviations shown in Table 9 on page 52.

Table 9 Output Quantities and their Metric and Nonmetric Units

Quantity	Metric Unit	Nonmetric Unit
RH Relative Humidity	%RH	%RH
T Temperature	°C	°F
TDF Dewpoint/frostpoint	°C	°F
TD Dewpoint	°C	°F
A Absolute humidity	g/m^3	gr/ft^3
X Mixing ratio	g/kg	gr/lb
TW Wet bulb temperature	°C	°F
PPM Humid air volume/dry air volume	Ppm	ppm
PW Water vapor pressure	hPa	lb/in^2
PWS Saturation water vapor pressure	hPa	lb/in^2
H Enthalpy	kJ/kg	Btu/lb

NOTE Only the quantities selected when ordering the device can be selected for an output quantity.

Examples:

```
>asel td tdf<cr>
Ch1 Td   lo    :   -40.00 'C      ?
Ch1 Td   hi    :   100.00 'C      ?
Ch2 Tdf  lo    :   -40.00 'C      ?
Ch2 Tdf  hi    :    60.00 'C      ?

>asel x td<cr>
Ch1 x    lo    :     0.00 g/kg    ?
Ch1 x    hi    :   160.00 g/kg    ?
Ch2 Td   lo    :   -40.00 'C      ?
Ch2 Td   hi    :    60.00 'C      ?
>
```

ASCL Scale Analog Outputs

Syntax: ASCL<cr>

Example:

```
>ascl<cr>
Ch1 Td   lo    :   -40.00 'C      ?
Ch1 Td   hi    :   100.00 'C      ?
Ch2 x    lo    :     0.00 g/kg    ?
Ch2 x    hi    :   500.00 g/kg    ?
```

ITEST Test Analog Outputs

Syntax: ITEST aa.aaa bb.bbb<cr>

The operation of the analog outputs are tested by forcing the outputs to given values. The values in the analog outputs can then be measured with a current/voltage meter.

Where

aa.aaa	=	Current value to be set for channel 1
bb.bbb	=	Current value to be set for channel 2

Example:

```
>itest 8    12   <cr>
8.000mA3F8  12.000mA  70O
>
```

The set values remain valid until you issue the ITEST command without readings or reset the transmitter.

AQTEST Test Analog Outputs for Desired Readings

Syntax: AQTEST x yyy.yyy<cr>

Use command AQTEST to test current values. Current output is forced to correspond to the chosen values.

Where

x	=	Output quantity of analog channel (use abbreviations, see FORM Serial Output Format on page 43)
yyy.yyy	=	Value

Example:

```
>aqtest td 30<cr>
CH1 Td  :    30.0000  'C        12.00000mA
CH2 x   :     2.5304  g/kg       4.08097mA
>
```

The set values remain valid until you give the command AQTEST without a value or reset the transmitter.

AERR Set Error Outputs

Syntax: AERR<cr>

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

Example:

```
>aerr<cr>
Ch1 error out  : 0.000mA ?
Ch2 error out  : 0.000mA ?
```

NOTE	Error output value needs to be within a valid range for output type.

NOTE	The error output value is shown only when there are minor electrical faults such as a humidity sensor open circuit. When there is a severe device malfunction, like analog output electronics failure or microprocessor ROM/RAM failure, the error output value is not necessarily shown.

Chemical Purge (Optional)

General

In some specific applications the sensor gain may decrease gradually due to an interference caused by some particular chemical present in the ambient (see Figure 16 on page 55). The sensor polymer absorbs the interfering chemical; this reduces the ability of the polymer to absorb water molecules and so decreases the sensor gain. In chemical purge heating the humidity sensor to a temperature level of approximately +180 °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 transmitter returns to normal mode. The whole cycle takes about 8 minutes.

NOTE	Chemical purge function locks the output values for about 8 minutes.

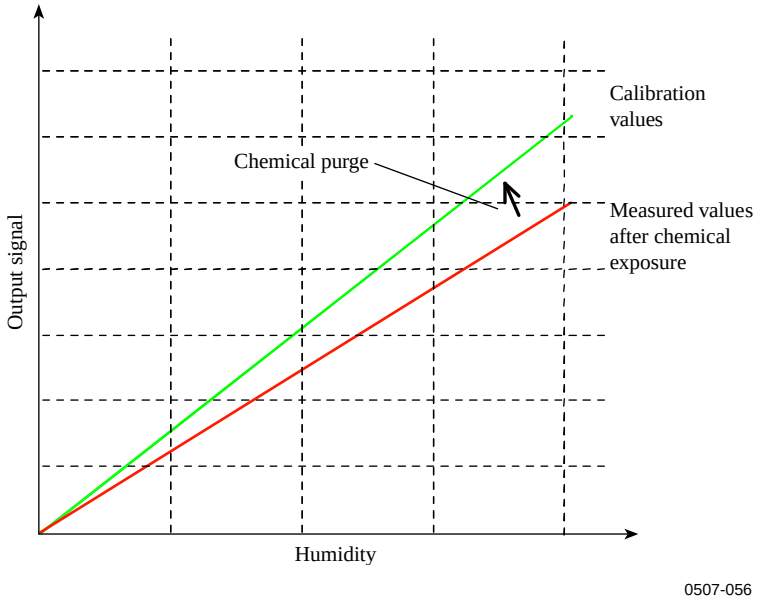

Figure 16 Decrease of Sensor Gain Due to Interfering Chemical and Effect of Chemical Purge Process

Automatic/Manual Chemical Purge

When HMT310 leaves the factory the automatic chemical purge (if selected) takes place repeatedly with the time intervals set in the factory. You can change the interval in which the purge takes place by using serial commands. This may be necessary if the measuring environment contains high concentrations of interfering chemicals. The automatic chemical purge can be also turned off if necessary.

Automatic Chemical Purge Settings

PUR Turn ON/OFF Automatic Chemical Purge

This command enables or disables automatic chemical purge.

Syntax: PUR x<cr>

Where

x = ON/OFF

Example:

```
>pur off
Chemical Purge : OFF
>pur on
Chemical Purge : ON
>
```

PUR Set Chemical Purge Interval

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 may be longer.

It is not recommended to change the other parameters than interval.

Syntax: PUR<cr>

Issue command PUR and type the new interval (in minutes) and press **Enter** five times to finish the command. The maximum interval is 14400 minutes (= 10 days).

Example:

```
>pur<cr>
Chemical Purge : ON       <cr>
Interval min   : 1440 ?   <cr>
Duration s     : 120 ?         <cr>
Settling s     : 240 ?         <cr>
Power          : 160 ?         <cr>
Temp diff      : 0.50 ?        <cr>
>
```

NOTE	To activate the new interval setting immediately, reset the transmitter.

PURR Chemical Purge in Powerup

This command enables or disables the function, which turns on chemical purge within 10 seconds from the powerup of the device.

Syntax: PURR x<cr>

Where

x = ON/OFF (default = OFF)

NOTE	When you enable this function, wait about 8 min after powerup before taking measurements. The powerup chemical purge locks the output values for the first operation minutes.

Chemical Purge Activated Manually

Chemical purge needs to be performed always before calibration (see Chapter 7 Calibration and Adjustment on page 67) or whenever there is reason to believe that the sensor has been exposed to an interfering chemical. Make sure that the temperature of the sensor has come down to normal before starting calibration.

Before starting chemical purge please note the following:

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

Starting Manual Chemical Purge

Type PURGE via the serial line to activate chemical purge.

Syntax: PURGE<cr>

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

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

Sensor Heating

General

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

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.

NOTE	The maximum operation voltage for device with sensor heating is 24 VDC.

Setting Humidity Sensor Heating

When HMT310 leaves the factory the sensor heating follows the factory default values. You can enable or disable the function, change the RH limit and define the heating temperature and duration of the heating period.

Sensor Heating ON/OFF

Enables or disables the sensor heating.

Syntax: XHEAT x<cr>

Where

x = ON/OFF (default = OFF)

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

Setting Heating Parameters

Whenever the RH value seen by the sensor exceeds the predefined RH limit the humidity sensor is warmed up to the predefined temperature. The duration of the heating can also be defined.

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

Syntax: XHEAT<cr>

Type the values after the question mark. The ranges available:

- Extra heat RH -limit: 0 ... 100 %RH (default: 95 %RH, heating function starts-up above the setpoint)
- 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
>
```

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CHAPTER 5
MEASURING AT OVERPRESSURE

This chapter contains important information concerning the use of HMT310 in overpressure conditions.

HMT314 and HMT318 are designed for humidity measurement at overpressure. The maximum measurement pressures depend on the probe as follows:

- HMT314: 0 ... 100 bar (10 MPa), for pressurized rooms and processes, probe is provided with a nut, fitting screw and sealing washer
- HMT318: 0 ... 40 bar (4 MPa), for pressurized pipelines, ball valve set available

The actual pressure in the sampling cell needs to be set to the transmitter by using the serial line command PRES (Set Ambient Pressure for Calculations).

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.

Pressure Regulator Recommended

When sampling pressurized processes exceeding the maximum measurement pressure of the probe, the pressure in the measurement chamber must be regulated to acceptable level or below. It is recommended to use a pressure regulator before the measurement chamber to prevent significant pressure variations.

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CHAPTER 6

MAINTENANCE

This chapter provides information that is needed in basic maintenance of HMT310, and lists contact information for technical support and Vaisala Service Centers.

Periodic Maintenance

Calibration Interval

HMT310 is fully calibrated and adjusted as shipped from factory. Typical calibration interval is one year. In certain applications it may be advisable to do more frequent checks. Calibration needs to be done always when there is reason to believe that the device is not within the accuracy specifications.

You can carry out calibration and adjustment by yourself, or you can send the transmitter to Vaisala Service Centers for recalibration.

Replacing Consumables

Filter Change

1. Remove the filter from the probe.
2. Install a new filter on the probe. When using the stainless steel filter, take care to tighten the filter properly (recommended force is 130 Ncm).

New filters can be ordered from Vaisala, see Parts List for Consumables on page 64.

Sensor Change

You can change Vaisala HUMICAP®180R sensors.

1. Remove the filter from the probe.
2. Remove the damaged sensor and insert a new one. Handle the new sensor by the plastic socket.

CAUTION	Do not touch the sensor plate.

3. After sensor change the humidity calibration must be made according to the instructions, see FCRH Relative Humidity Calibration after Sensor Change on page 68.
4. Install a new filter on the probe. When using the stainless steel filter, take care to tighten the filter properly (recommended force is 130 Ncm).

New sensors can be ordered from Vaisala, see Parts List for Consumables below.

Parts List for Consumables

Table 10 Available Spare Parts

Spare Part	Order Code
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
Vaisala HUMICAP®180R (general purpose)	HUMICAP180R
PT100 sensor	10429SP

Technical Support

For technical questions, contact the Vaisala technical support:

E-mail helpdesk@vaisala.com

Fax +358 9 8949 2790

Return Instructions

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

1. Read the section Warranty on page 13.
2. Contact a Vaisala Service Center or a local Vaisala representative. The latest contact information and instructions are available from www.vaisala.com. Addresses of the Service Centers are provided in section Vaisala Service Centers on page 66.

Please have the following information on hand:

- serial number of the unit
- date and place of purchase or last calibration
- description of the fault
- circumstances in which the fault occurs/occurred
- name and contact information of a technically competent person who can provide further information on the problem

3. Pack the faulty product in a strong box of adequate size, with proper cushioning material to avoid damage.
4. Include the information specified in step 2 in the box with the faulty product. Also include a detailed return address.
5. Ship the box to the address specified by your Vaisala contact.

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 also offer accredited calibrations, maintenance contracts, and a calibration reminder program. Do not hesitate to contact them to get further information.

European Service Center (Finland)
Controlled Environments and Instruments
Vanha Nurmijärventie 21, 01670 Vantaa, FINLAND.
Phone: +358 9 8949 2658, Fax: +358 9 8949 2295

North American Service Center
Controlled Environments and Instruments
10-D Gill Street, Woburn, MA 01801, USA.
Phone: 800-408-9456, Fax: +1 781 933 8029

Japan Service Center
42 Kagurazaka 6-Chome, Shinjuku-ku, Tokyo 162-0825, JAPAN.
Phone: +81 3 3266 9611, Fax: +81 3 3266 9610

China Service Center
Floor 2, EAS Building, No. 21, Xiao Yun Road, Dongsanhuan Beilu,
Chaoyang District, Beijing 100027, CHINA.
Phone: +86 10 8526 1199, Fax: +86 10 8526 1155

www.vaisala.com

CHAPTER 7

CALIBRATION AND ADJUSTMENT

This chapter describes the relative humidity and temperature adjustment procedures.

After adjustment, the original calibration certificate shipped with the product is not valid anymore.

Calibration and Adjustment Commands

LI Revert Factory Calibration

Syntax: LI<cr>

This command reverts only the CRH calibration (see calibration instructions, starting on page 69).

1. Remove the transmitter unit from the mounting plate (see Mounting the Transmitter/Removing the Transmitter Unit on page 21) and press the adjustment button once (see Figure 17 on page 70).
2. Issue command LI and enter value 0 for an offset value and value 1 for a gain value.
3. Reset the transmitter by issuing the RESET command. Transmitter returns to normal mode.

Example:

```
>li<cr>
RH offset :       -0.6000000 ? 0
RH gain   :       1.00000000 ? 1
T  offset :       0.00000000 ? 0
T  gain   :       0.40000000 ? 1
>
```

FCRH Relative Humidity Calibration after Sensor Change

Syntax: FCRH<cr>

The transmitter asks and measures relative humidity and calculates the calibration coefficients. This two-point adjustment needs to be performed after a sensor change. Follow the more detailed calibration instructions on page 69, but instead of the CRH command, use the FRCH command.

Example:

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

The OK indicates that the calibration has succeeded.

CTEXT Set Calibration Information Text

Syntax: CTEXT<cr>

1. Remove the transmitter unit from the mounting plate (see Mounting the Transmitter/Removing the Transmitter Unit on page 21) and press the adjustment button once (see Figure 17 on page 70).
2. Issue command LI and enter value 0 for an offset value and value 1 for a gain value.
3. Issue command CTEXT and enter calibration information text.

Example:

```
>ctext<cr>
Cal. info       : Vaisala/HEL ? HMK15<cr>
>
```

CDATE Set Calibration Date

Syntax: CDATE yyyy mm dd<cr>

1. Remove the transmitter unit from the mounting plate (see Mounting the Transmitter/Removing the Transmitter Unit on page 21) and press the adjustment button once (see Figure 17 on page 70).

2. Issue command LI and enter value 0 for an offset value and value 1 for a gain value.
3. Issue command CDATE and set the calibration date.

Example:

```
>cdate 2001 12 11<cr>
Calibration    : 2001-12-11
>
```

ACAL Analog Output Calibration

Syntax: ACAL<cr>

Connect the HMT310 to a multimeter in order to measure either current or voltage depending on the selected output type. Issue the ACAL command. Then type the multimeter reading and press **Enter**.

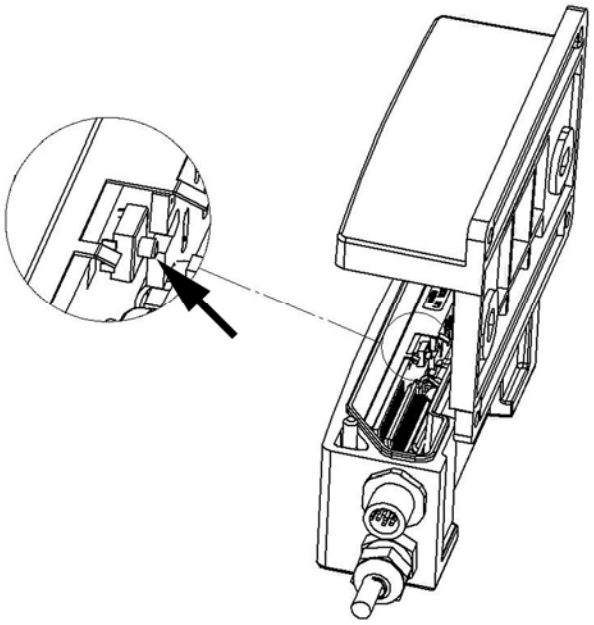
Example (current outputs):

```
>acal<cr>
Ch1    I1   (mA) ?    2.046  <cr>
Ch1    I2   (mA) ?    18.087 <cr>
Ch2    I1   (mA) ?    2.036  <cr>
Ch2    I2   (mA) ?    18.071 <cr>
>
```

Relative Humidity Calibration and Adjustment (in Two Points)

Use two reference humidities over the measurement range. The references need to have a difference of at least 50 %RH.

Before calibration HMT310 needs to be set to adjustment mode by pressing the adjustment button once, see Figure 17 on page 70. (To return to normal operation mode, use command RESET, see RESET Reset Transmitter on page 50).



0507-048

Figure 17 Location of Adjustment Button

NOTE	If using a warmed probe (HMT317 option) or sensor heating function, the heating is interrupted when the adjustment button is pressed. Allow sufficient time for the probe to reach ambient temperature and then start the calibration procedure.

Low End Adjustment

1. Remove the transmitter unit from the mounting plate (see Mounting the Transmitter/Removing the Transmitter Unit on page 21), and press the adjustment button once (see Figure 17 above).
2. Remove the filter from the probe (see instructions on page 63) and insert the probe into the measurement hole of the dry end reference chamber (for example, LiCl: 11 % RH in the humidity calibrator HMK15, use adapter fitting 13.5 mm for HMT314, HMT315, HMT317, and HMT318).
3. Wait at least 30 minutes for the sensor to stabilize.
4. Issue command CRH and press **Enter**.
5. Type C and press **Enter** a few times to check if the reading is stabilized.

6. When the reading is stabilized, type 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 ...
```

Now the device is waiting for the high-end reference.

High End Adjustment

7. After the low end adjustment, insert the probe into a measurement hole of the high end reference chamber (for example, NaCl: 75 % RH chamber in the humidity calibrator HMK15, please use the adapter fitting 13.5 mm for HMT314, HMT315, HMT317, and HMT318). Note that the difference between the two humidity references must be at least 50% RH.
8. Let the probe stabilize for at least 30 minutes. You can follow the stabilization by pressing any key, typing C and pressing **Enter**.
9. 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
>
```

OK indicates that the calibration has succeeded.

10. Take the probe out of the reference conditions and replace the filter. When using the stainless steel filter, take care to tighten the filter properly, recommended force is 130 Ncm.
11. If needed, record the calibration information (text and date) to the memory of the transmitter, see CTEXT Set Calibration Information Text on page 68 and CDATE Set Calibration Date on page 68.
12. Reset the transmitter by issuing the RESET command. The transmitter returns to normal mode.

Temperature Calibration and Adjustment (in One Point)

1. Remove the transmitter unit from the mounting plate (see Mounting the Transmitter/Removing the Transmitter Unit on page 21) and press the adjustment button once (see Figure 17 on page 70).
2. Remove the probe filter (see instructions on page 63) and insert the probe into the reference temperature.
3. Let the sensor stabilize.
4. Issue command CT and press **Enter**.
5. Type C and press **Enter** a few times to check if the reading is stabilized.
6. When the reading is stabilized, type the reference temperature after the question mark and press **Enter** three times.

```
>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
>
```

   OK indicates that the calibration has succeeded.

7. Take the probe out of the reference conditions and replace the filter. When using the stainless steel filter, take care to tighten the filter properly (recommended force 130 Ncm).
8. If needed, record the calibration information (text and date) to the memory of the transmitter, see CTEXT Set Calibration Information Text on page 68 and CDATE Set Calibration Date on page 68.
9. Reset the transmitter by issuing the RESET command. The transmitter returns to normal mode.

CHAPTER 8

TECHNICAL DATA

This chapter provides the technical data of the product.

Specifications

Table 11 Relative Humidity Specifications

Property	Description / Value
Measuring range	0 ... 100 %RH
Accuracy (including nonlinearity, hysteresis and repeatability) with Vaisala HUMICAP®180R Vaisala HUMICAP®180RC at +15 ... 25 °C at -20 ... +40 °C at -40 ... +180 °C	 for typical applications for applications with chemical purge and/or warmed probe ± 1 % RH (0 ... 90 %RH) ± 1.7 % RH (90 ... 100 %RH) ± (1.0 + 0.008 × reading) %RH ± (1.5 + 0.015 × 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 %) for HUMICAP®180R and HUMICAP®180RC at 20 °C in 0.1 m/s air flow	17 s with grid filter 50 s with grid + steel netting filter 60 s with sintered filter

Table 12 Temperature Specifications (and Operating Pressure Ranges)

Property	Description / Value
HMT311	-40 ... +60 °C (-40 ... +140 °F)
HMT313 80 °C	-40 ... +80 °C (-40 ... +176 °F)
HMT313 120 °C	-40 ... +120 °C (-40 ... +248 °F)
HMT314	-70 ... +180 °C (-94 ... +356 °F), 0 ... 10 MPa (0 ... 100 bar)
HMT315 (vapor tight)	-70 ... +180 °C (-94 ... +356 °F)
HMT317 (vapor tight)	-70 ... +180 °C (-94 ... +356 °F)
HMT318	-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 Figure 18 below.
Typical temperature dependence of electronics	±0.05°C/°C (±0.005°F/°F)
Temperature sensor	Pt 100 RTD 1/3 Class B IEC 751

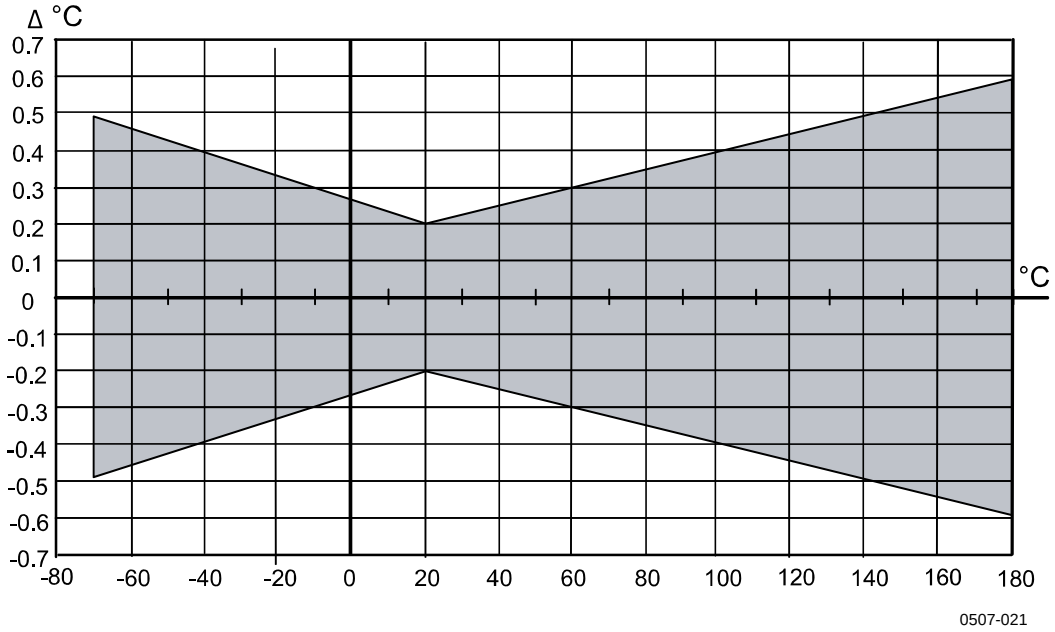


Figure 18 Accuracy over Temperature Range

Table 13 Electronics Specifications

Property	Description / Value
Two analog outputs: selectable and scalable	 0…20 mA or 4…20 mA
Typical accuracy of analog output at +20 °C	±0.05% of full scale
Typical temperature dependence of analog output	0.005%/°C (0.003%/°F) of full scale
Serial output	RS-232
Cable feed through alternatives	M12 8-pole connector with 5 m cable or Female 8-pin connector screw joint for cable diameter 4 ... 8 mm
Operating voltage	12 .... 35 VDC, the maximum operating voltage for device with sensor heating is 24 VDC
Power consumption	30 mA with RS-232
Startup time after powerup	3 s
External load	R_L< 500 ohm

Table 14 Mechanics Specifications

Property	Description / Value
Transmitter housing material	G-AlSi10Mg
Transmitter base material	ABS/PC
Housing classification	IP65
Sensor protection	PPS grid with stainless steel net PPS grid Sintered filter Membrane stainless steel filter Stainless steel grid
Operating temperature range for electronics	-40 ... +60 °C (-40 ... +140 ºF)
Storage temperature	-55 ... +80 °C (-67 ... +176 ºF)
Pressure range: HMT314 HMT317 HMT318	 0…100 bar 0…10 bar 0…40 bar
Probe cable length	2, 5 or 10 meters

Complies with EMC standard EN61326-1, Industrial environment.

NOTE When using the current output, the RF field susceptibility level (according to standard EN61000-4-3 with a frequency band of 110 ... 165 MHz) is only 3 V/m (generic environment) with the specified accuracy.

Options and Accessories

Table 15 Options and Accessories

Description	Order Code
Probe accessories	
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
Sensors	
Vaisala HUMICAP®180R (general purpose)	HUMICAP180R
PT100 sensor	10429SP
Probe mounting accessories	
Fitting Body M22x1.5	17223
Fitting Body NPT1/2	17225
Mounting Flange For HMT315	210696
Swagelok for 12mm Probe 3/8" ISO Thread	SWG12ISO38
Swagelok for 12mm Probe 1/2" NPT Thread	SWG12NPT12
Cable Gland M20x1.5 with Split Seal	HMP247CG
Duct Installation Kit for HMT313 and HMT317	210697
Ball Valve ISO1/2 with Welding Joint	BALLVALVE-1
Thread Adapter ISO1/2 to NPT1/2	210662
Other	
Calibration Adapter for HMK15	211302SP
Connection cable to MI70 indicator /HM70	DRW216050

Dimensions in mm (inches)

Transmitter Enclosure and Mounting Plates

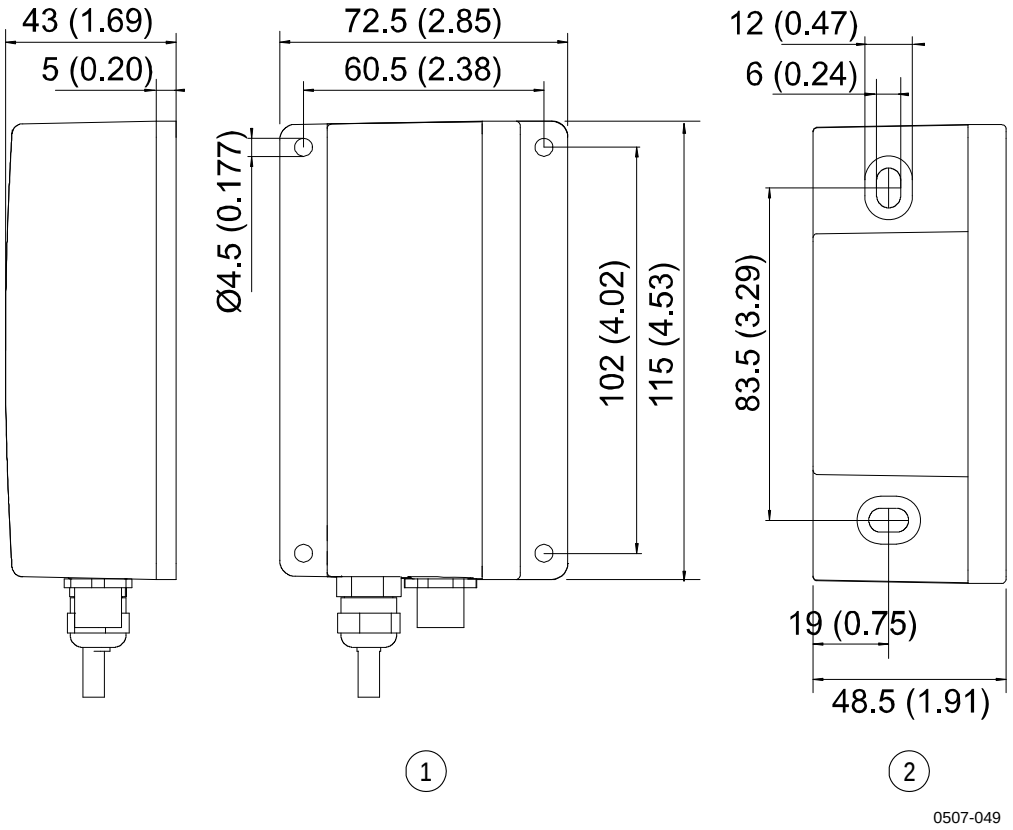


Figure 19 Transmitter Enclosure and Mounting Plate Dimensions

The following numbers refer to Figure 19 above. Mounting plate alternatives:

1 = Wall Plate/Cover, DRW212957 (bigger plate)
2 = Wall Plate/Cover (No Flange), DRW214786 (smaller plate)

Probes

HMT311

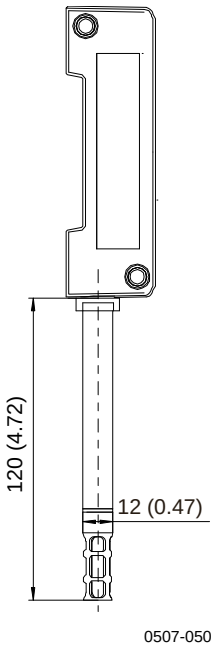


Figure 20 Probe Dimensions

HMT313

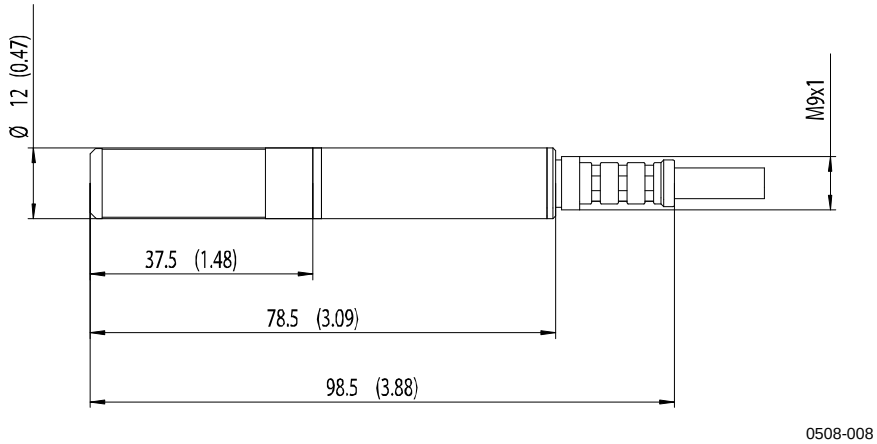


Figure 21 HMT313 Dimensions

HMT314

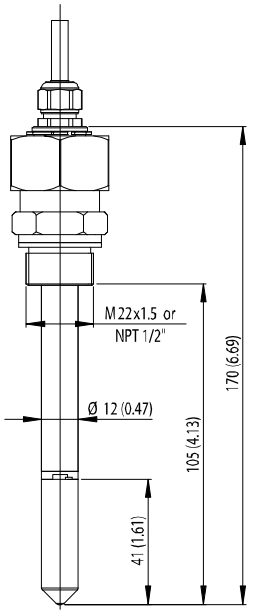


Figure 22 HMT314 Dimensions

HMT315

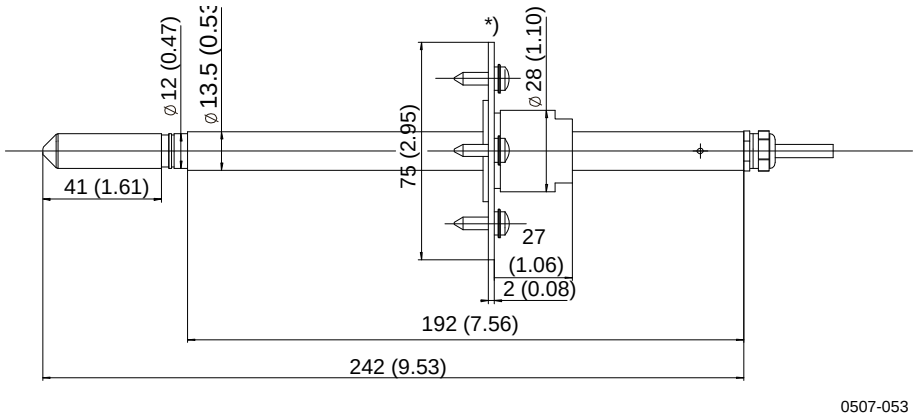


Figure 23 HMT315 Dimensions

*) Flange for HMT315 available as an option

HMT317

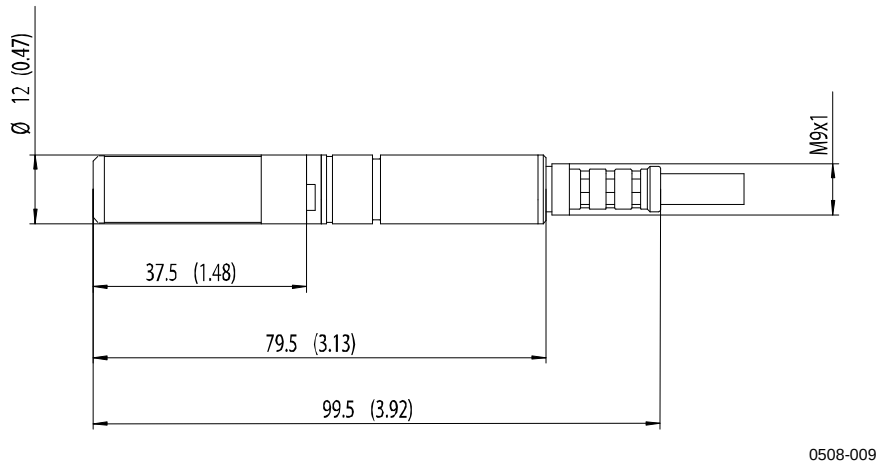


Figure 24 HMT317 Dimensions

HMT318

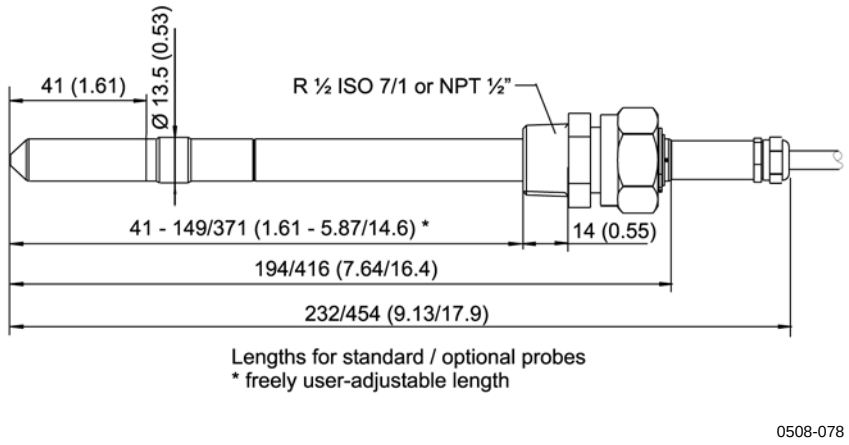


Figure 25 HMT318 Dimensions

APPENDIX A

PROBE INSTALLATION KITS AND INSTALLATION EXAMPLES

This appendix describes the available probe installation kits and provides some installation examples.

Duct Installation Kits (for HMT313/317/315)

Duct installation kit includes a flange, a sealing ring, a supporting bar and probe attaching part for the probe and screws for attaching the flange to the duct wall. Vaisala order codes: 210697 (for HMT313) and 210696 (for HMT315, no supporting bar).

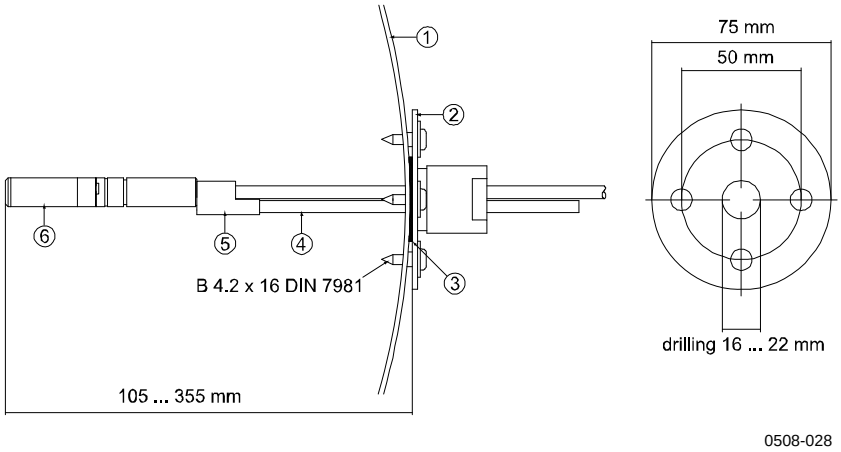


Figure 26 Duct Installation Kit

The following numbers refer to Figure 26 above:

1 = Duct wall
2 = Flange
3 = Sealing ring
4 = Supporting bar (not included in the kit for HMT315)
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 significant, the supporting bar must be installed as deep in the duct as possible. This helps to prevent errors caused by heat conduction in the bar and cable.

Pressure-Tight Swagelok Installation Kits (for HMT317)

RH Probe Installation

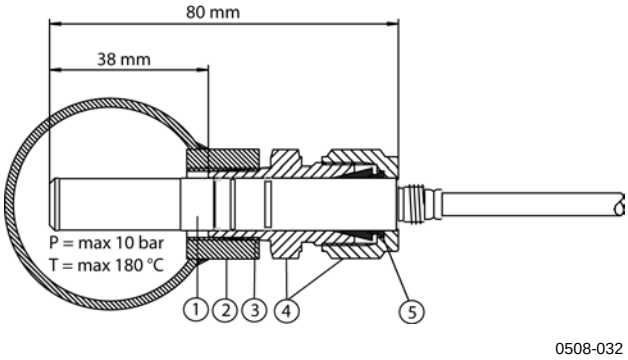


Figure 27 Swagelok Installation Kit for RH Probe

The following numbers refer to Figure 27 above:

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

Examples of Vapor-Tight Installations with Cable Gland

RH Probe Installations (for HMT313/317)

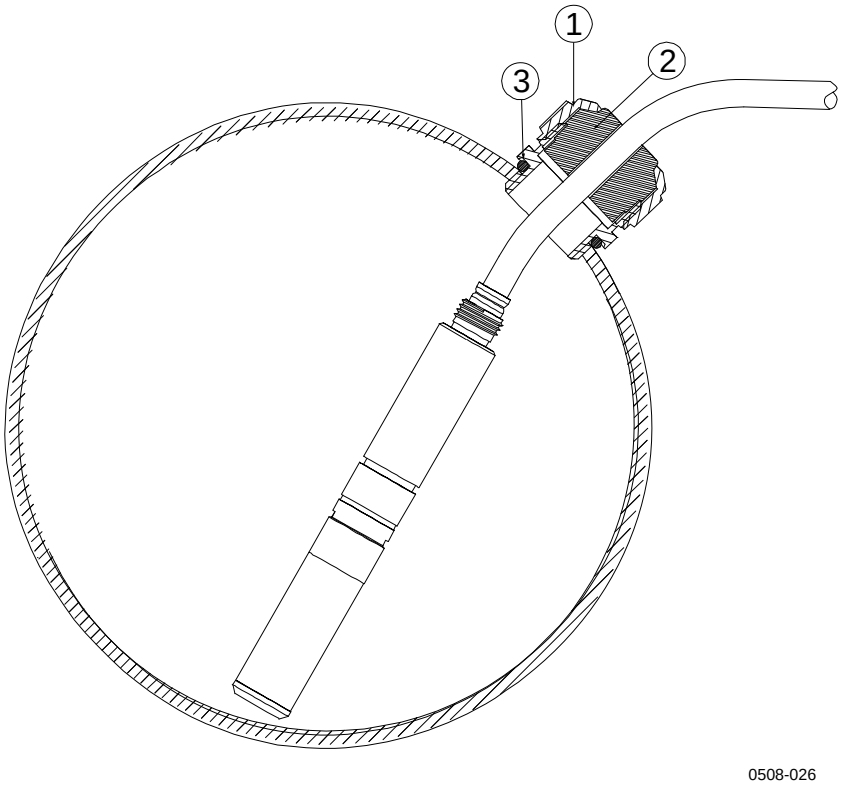


Figure 28 Cable Installation with Cable Gland AGRO

The following numbers refer to Figure 28 above:

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

Vaisala order code for the cable gland: HMP247CG (see Options and Accessories on page 76).

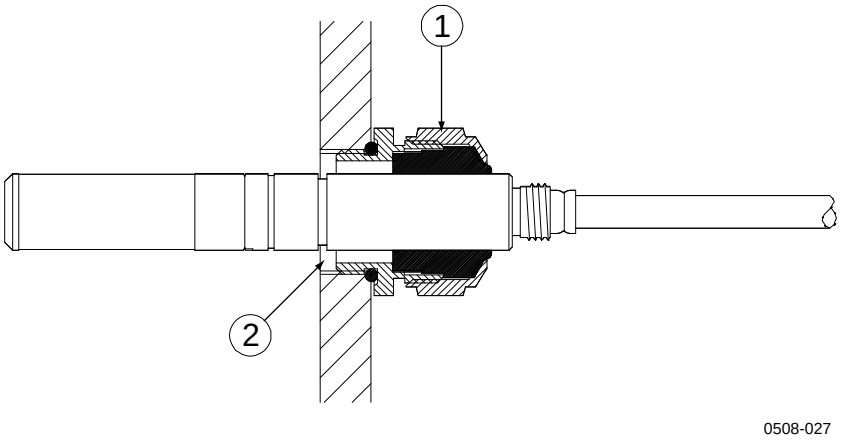


Figure 29 Probe Installation with Cable Gland (not available from Vaisala)

The following numbers refer to Figure 29 above:

1 = Cable gland AGRO 1160.20.145 (T = -40 ... +100 °C)
2 = In pressurized conditions, use a locking ring (for example, 11x 1 DIN471)

The installation option in Figure 29 above is not available from Vaisala and is presented here only as an example of how to achieve a vapor-tight installation with HMT313/317 probes.

Ball Valve Installation kit for HMT318

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 ø14 mm or more. If you install the probe (ø12 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 probe into the pressurized (< 10 bar) process or pipeline.

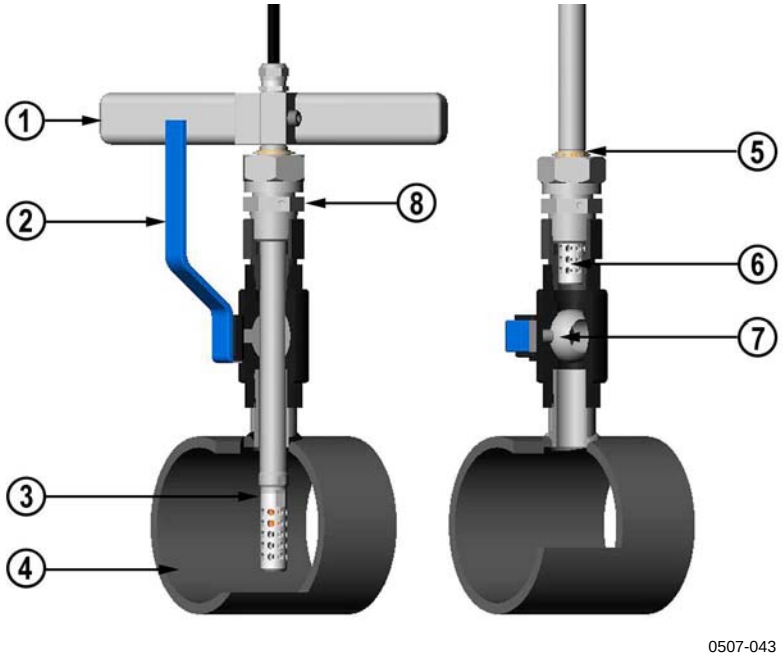


Figure 30 Installing the HMT318 Probe Through a Ball Valve Assembly

The following numbers refer to Figure 30 above:

1 = Manual press tool
2 = Handle of the ball valve
3 = Probe
4 = Process chamber or pipeline
5 = Groove on the probe indicates the upper adjustment limit
6 = Filter
7 = Ball of the ball valve
8 = Clasp nut

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.

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.

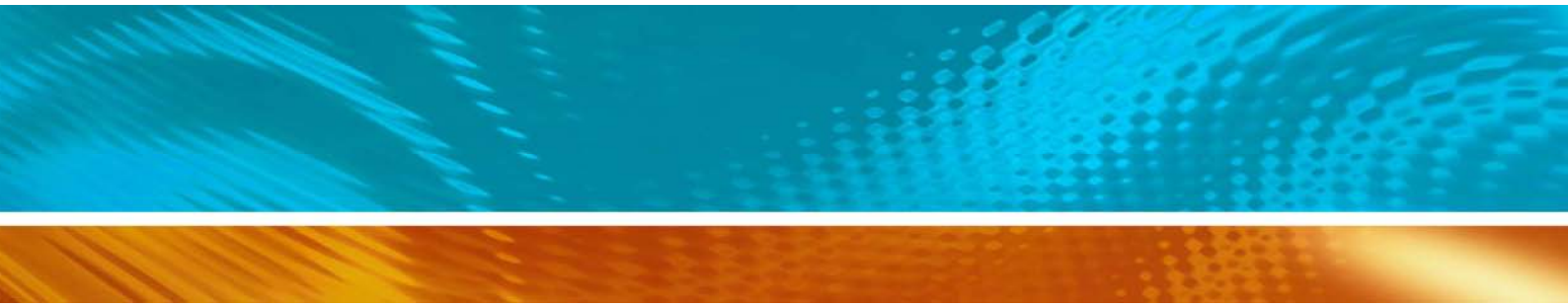
Follow the steps below to install the HMT318 probe through a ball valve assembly. After the installation, the probe should be sitting in the process chamber or pipeline as shown in Figure 30 on page 85.

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. Close the ball valve.
3. Seal the threads on the fitting body; refer to Figure 11 on page 30.
4. Attach the fitting body to the ball valve and tighten it.
5. Slide the clasp nut of the probe toward the filter, as far as it will go.
6. Insert the probe to the fitting body, and manually tighten the clasp nut to the fitting body.
7. Open the ball valve.
8. Push the probe through the ball valve assembly into the process. If the pressure is high, use the pressing handle that is provided with the probe. If you push the probe hard without using the handle, you may damage the cable.

   Note that the probe must be pushed so deep that the filter is completely inside the process flow.
9. Mark the fitting screw and the clasp nut.
10. Tighten the clasp nut with a fork spanner a further 50 ... 60º (ca. 1/6 turn). If you have a suitable torque spanner, tighten the nut to max 45 ± 5 Nm (33 ± 4 ft-lbs). Refer to Figure 12 on page 30.

NOTE	Take care not to tighten the clasp nut more than 60° to avoid difficulties when opening it.

If you wish to remove the probe from the process, note that you have to pull the probe out far enough. You cannot close the valve if the groove on the probe body is not visible.



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