

# HMT360 Series Transmitters for Hazardous Areas *USER'S GUIDE*

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 **VAISALA**

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# CHAPTER 1 GENERAL INFORMATION

## Safety

Throughout the manual important instructions regarding the safety considerations are focused as follows.

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**WARNING** Warning denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in injury to or death of personnel.

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**CAUTION** Caution denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product.

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**NOTE** Note highlights important information. It calls attention to an essential procedure, practice, condition or the like.

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## Warranty

Vaisala issues a guarantee for the material and workmanship of this product under normal operating conditions for one (1) year from the date of delivery. Exceptional operating conditions damage due to careless handling and misapplication will void the guarantee.

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## CHAPTER 2 PRODUCT DESCRIPTION

The HMT360 series transmitters are microprocessor based two-wire transmitters for measuring relative humidity and temperature in hazardous areas, which require an EX classification. Always connect the transmitter via a zener barrier or galvanic separators when you use it for measurements in hazardous environments.

The transmitters conform with the European standards EN 50014 and EN 50020 and meet the requirements of the marking of protection EEx ia IIC T5.

### Options and output quantities

The transmitters can be ordered with a local display and two output current channels or, as an alternative for current loops, equipped with a LonWorks<sup>®</sup> interface module. The transmitter can measure and calculate the following quantities:

quantity	abbreviation
relative humidity	RH
temperature	T
dewpoint temperature	Td
absolute humidity	a
mixing ratio	x
wet bulb temperature	Tw
mass proportion*	ppm
water activity*	a <sub>w</sub>
relative humidity of saturation*	RS
saturation temperature*	Ts

\* Available only for HMT368 transmitter for moisture measurement in liquids.

## Probe options

The HMT360 transmitter series has various options for transmitter units, sensor heads and cable lengths. The available probe types are the following:



HMP361



HMP363



HMP364



HMP365



HMP368

HMP361:

probe for wall mounting

HMP363:

probe head (Ø 13.5 mm) for tight spaces.

HMP364:

probe for pressurized spaces up to 100 bars.

HMP365

probe for high temperatures up to 180°C

HMP368

probe for installations in pressurized pipelines up to 40 bars; pressure tight sliding clasp nut

Sensor head cable lengths available are 2, 5 and 10 metres (except for HMP361).

## Maintenance

The transmitter's electronics unit can be removed and replaced in the field, as well as the probe; see **FIGURE 3-1**, **FIGURE 3-2** and **FIGURE 8-1** for detailed information.

All other maintenance procedures are performed at the factory. Should your transmitter result damaged, contact Vaisala or Vaisala distributor and send the instrument to the address below:

Vaisala Oyj  
SSD Service  
P.O. Box 26  
FIN-00421 Helsinki  
FINLAND

Please, include a short description of the fault found and the date and place of purchase.

## CHAPTER 3    **INSTALLATION**

### **General instructions**

Select a place with stable conditions for mounting the transmitter. Do not expose the transmitter to direct sunlight or rain. When mounting the sensor head, select a place that gives a true picture of the process conditions.

Please, note also that if there is a difference between the process and ambient temperatures, we recommend that the sensor head and at least one meter of cable are mounted inside the process. This is to avoid incorrect humidity readings due to temperature difference. If this installation is not possible and you must install the sensor head through the wall (e.g. with a flange), make sure to insulate carefully the sensor head and the cable.

You can measure the true temperature of the process with a reference instrument and compare it with the transmitter reading. The heat transfer is less evident if you remove the protective filter of the sensor for a short-term test. However, never use the sensor long periods without the filter as this may cause a faster contamination of the sensor. The transmitter fulfils the specified EMC regulations with the protective filter on the sensor head.

## Mounting the transmitter

1. Attach the mounting plate to the wall with 4 screws.
2. Press down the transmitter so that it slides along the rails of the mounting plate.
3. Fasten the transmitter to the mounting plate with the Allen screw.\*
4. The probe can be detached and replaced when needed by simply unfastening the two Allen screws.

\* 3 mm Allen key provided

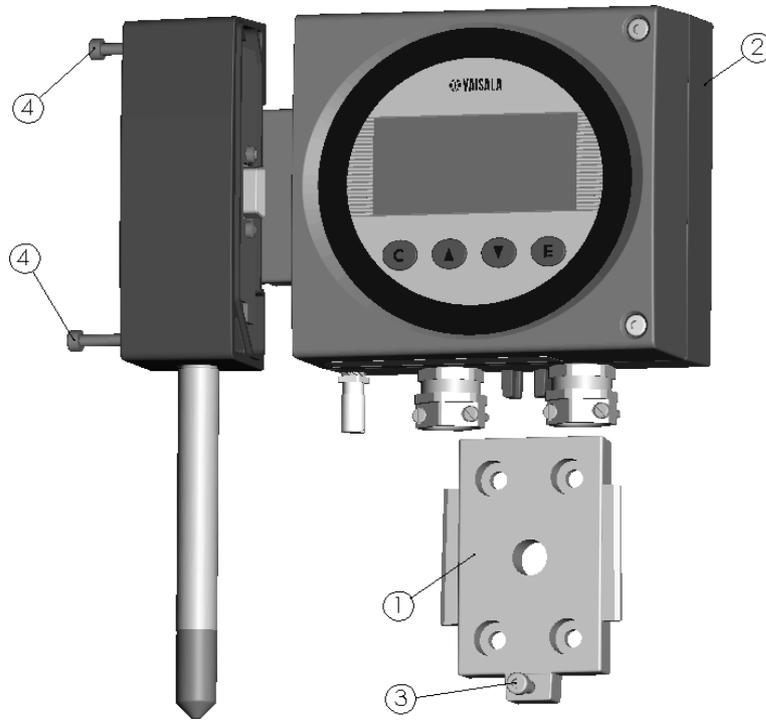


FIGURE 3-1 Mounting the transmitter and detaching the probe

1. electronics unit
2. transmitter base
3. probe; including a part of measurement electronics (e.g. calibration memory and the sensor head)
4. protective covers
5. flat cable
6. sensor head

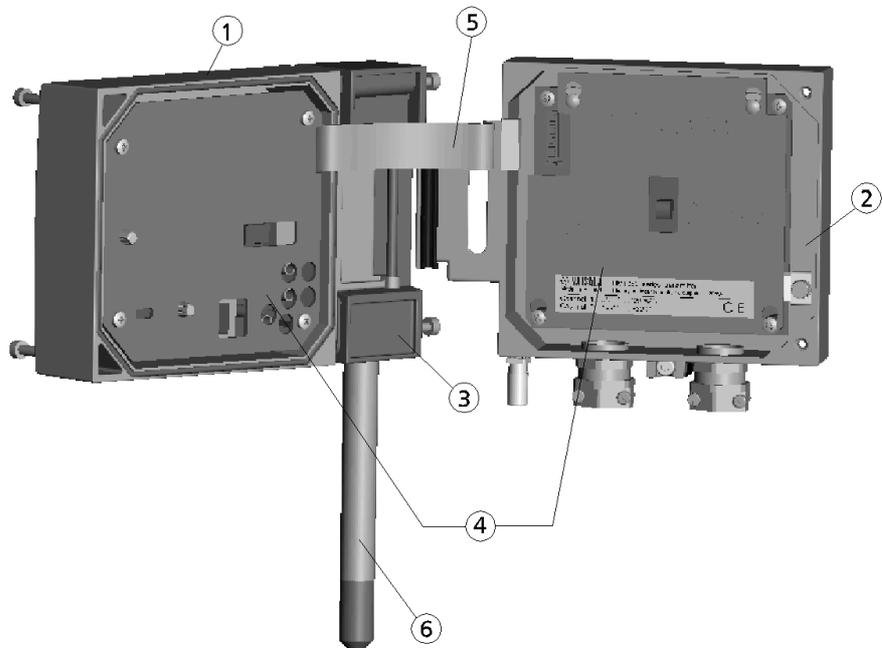


FIGURE 3-2 Different parts of the transmitter

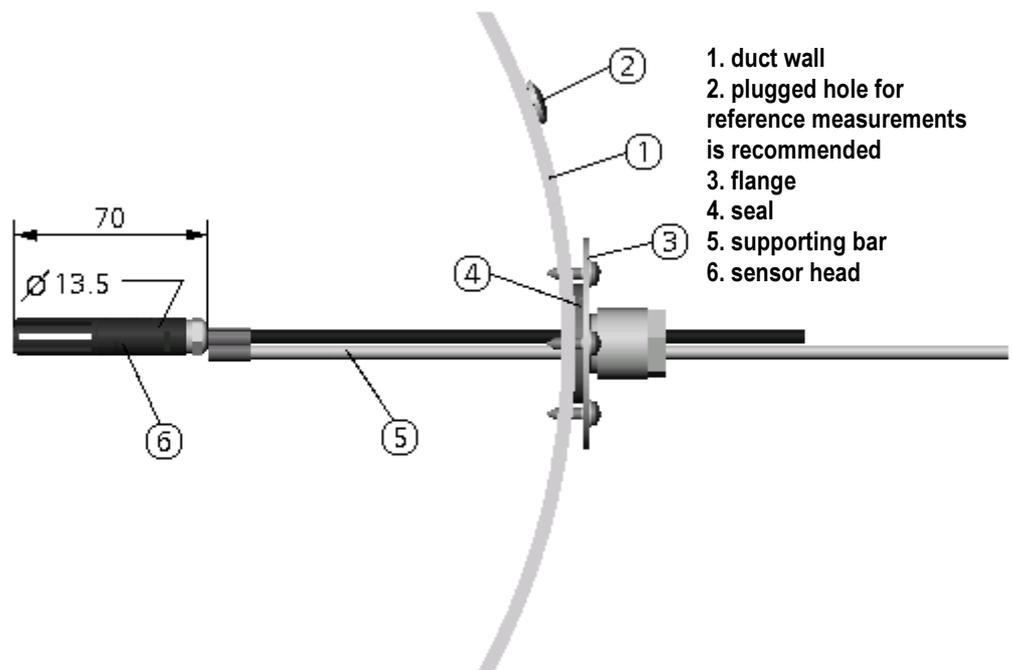
## Mounting the probes

**NOTE**

Do not unsolder and then again resolder the sensor head cable from and to the printed board during installation; this procedure may alter the humidity calibration of the transmitter.

### The HMP363 probe for confined spaces

The HMP363 is a small size general-purpose probe. Due to its lightweight, the thermal stabilization time is short. The HMP363 probe is suitable for installation in ducts and channels with the installation kit available. The installation kit includes a flange, a supporting bar for the sensor head cable and screws for attaching the flange to the duct wall. You can easily adjust the distance between the sensor and the channel wall using the installation kit. The adjustment range is 100 - 320 mm; measure the distance from the tip of the sensor head to the flange.

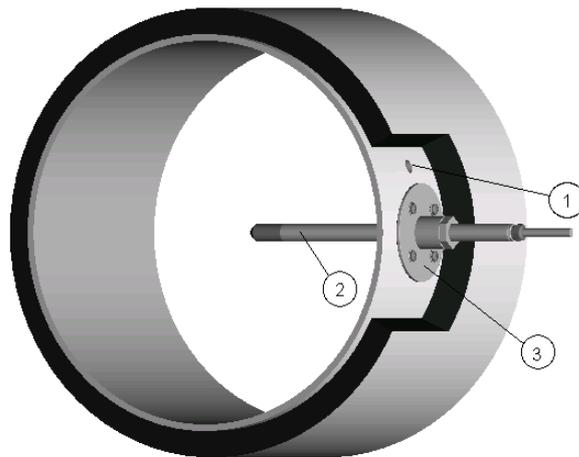


**FIGURE 3-3** Installing the sensor head HMP363 in a channel with a flange and a supporting bar

## The HMP365 probe for high temperatures

The stainless steel structure gives the high mechanical stability for the HMP365 probe. This probe is developed for high temperature applications. If you install the HMP365 sensor head in a duct or channel, please note that the temperatures inside and outside the duct must be as close to each other as possible, because the sensor head conducts heat.

1. a plugged hole for reference measurements
2. sensor head
3. mounting



**FIGURE 3-4** Mounting the HMP365 sensor head in a duct or channel

## The HMP364 probe for pressurized processes

### NOTE

The atmospheric pressure has an effect on mixing ratio and wet bulb temperature. Therefore, accurate calculations require the ambient pressure to be taken into consideration. The transmitter also uses the pressure data compensation of the HUMICAP<sup>®</sup> sensor ensuring the best possible measurement accuracy.

If the process pressure differs from normal atmospheric pressure, please enter the value (in hPa or mbar) into the transmitter memory (see page 24 or 30).

The HMP364 probe is developed for the humidity measurements in pressurized rooms and industrial processes. It comes equipped 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:

- Unscrew the fitting screw from the nut and the sensor head.
- 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  $150 \pm 10$  Nm ( $110 \pm 7$  ft-lbs)
- 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.
- Mark both the fitting screw and the nut hex.

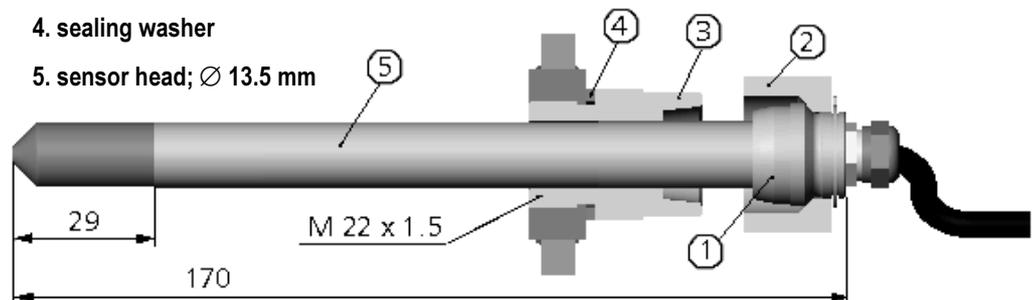
1. tightening cone

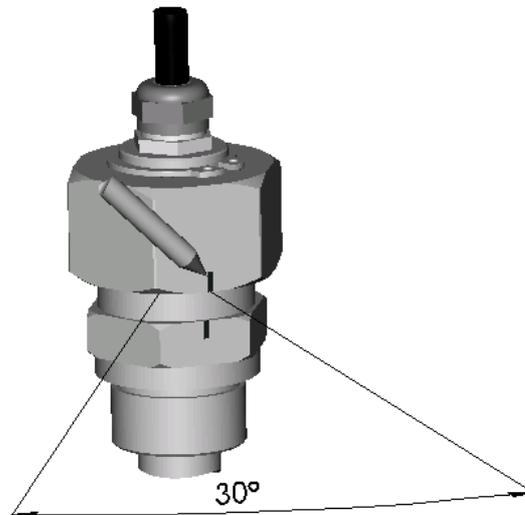
2. nut

3. fitting screw

4. sealing washer

5. sensor head;  $\varnothing$  13.5 mm



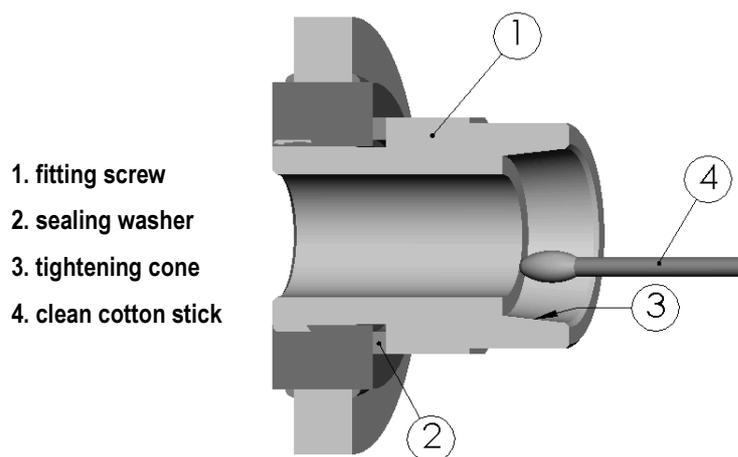


- Tighten the nut a further 30° (1/12 turn) or if you have a torque spanner tighten it with a torque of  $80 \pm 10$  Nm ( $60 \pm 7$  ft-lbs).

**NOTE**

After detachment the nut must be tightened without increased effort.

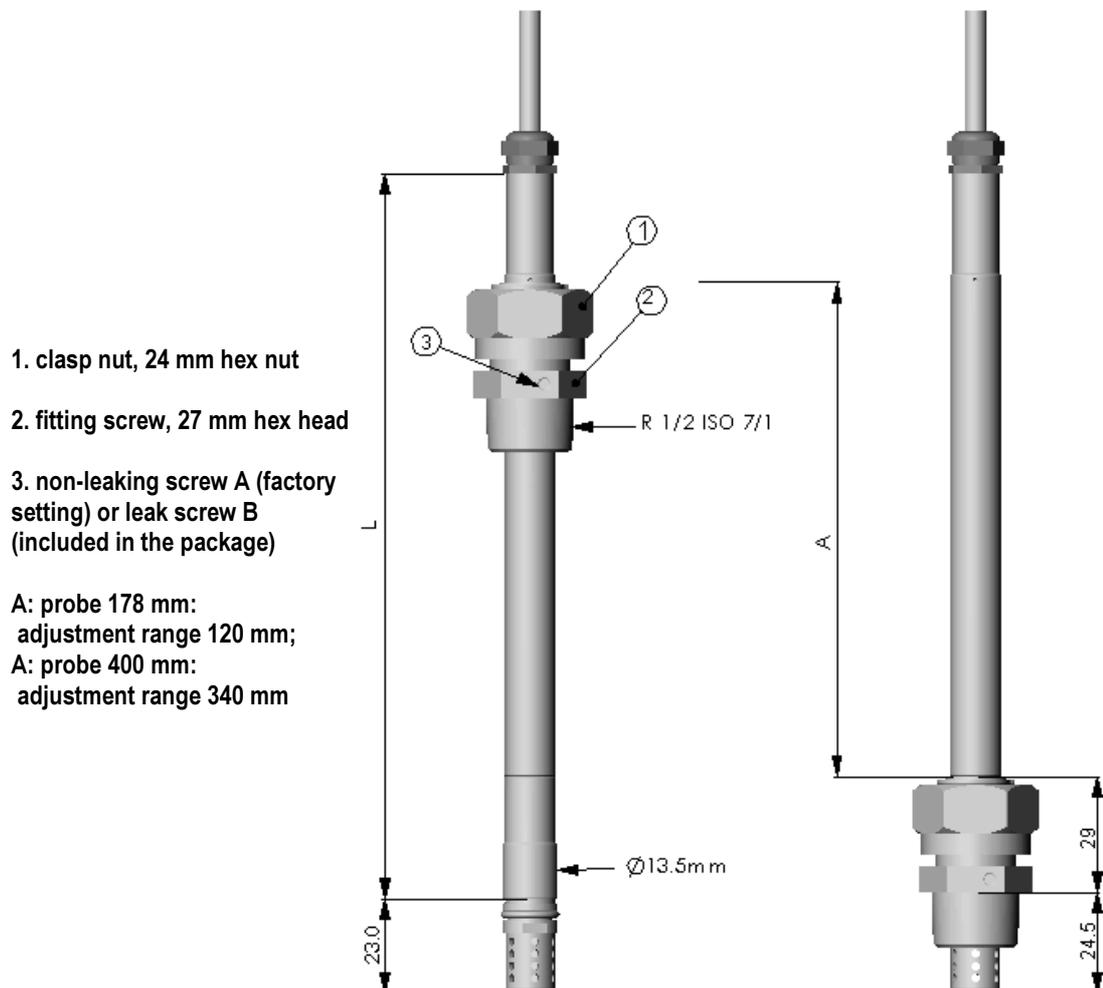
- Clean and grease the tightening cone of the fitting screw after every tenth detachment. Use high-vacuum grease (e.g. Down Corning, Europe) or a similar grease.

**NOTE**

Change the sealing washer every time the fitting screw is detached.

## The HMP368 probe for measuring humidity in pressurized pipelines or moisture in liquids

The HMP368 probe is intended for measuring the humidity in pressurized process gases or with the HMT368 special version the moisture in liquids. Due to the sliding fit, the HMP368 is easy to install into and remove from the pressurized process. The probe is specifically suitable for the measurements in pipelines.



**FIGURE 3-5** Probe dimensions (in mm); standard 178 and optional 400 mm.

**NOTE**

The atmospheric pressure has an effect on mixing ratio and wet bulb temperature. Therefore, accurate calculations require the ambient pressure to be taken into consideration. The transmitter also uses the pressure data compensation of the HUMICAP<sup>®</sup> sensor ensuring the best possible measurement accuracy.

If the process pressure differs from normal atmospheric pressure, enter the value (in hPa or mbar) into the transmitter memory.

There are several ways to install the HMP368 probe.

1. The sensor head should preferably be installed directly in the process through a ball valve assembly if the probe is used for measuring relative humidity in a pressurized pipeline or water activity in liquids (e.g. feeder routes).
2. The installation through a ball valve set makes it unnecessary to empty or shut down the chamber or the duct for installation or removal of the probe. Install the sensor head transversely against the direction of the process flow (see more detailed instructions on page 15).
3. If it is impossible to install the probe directly into the process gas, install it in a 'leak-through' position by changing the non-leaking screw (factory setting) to leaking screw. This installation requires a slight over-pressure in the process gas. When the probe is mounted behind a ball valve assembly, the gas flow passes through the sensor head and leaks out through the vent hole in the fitting screw.

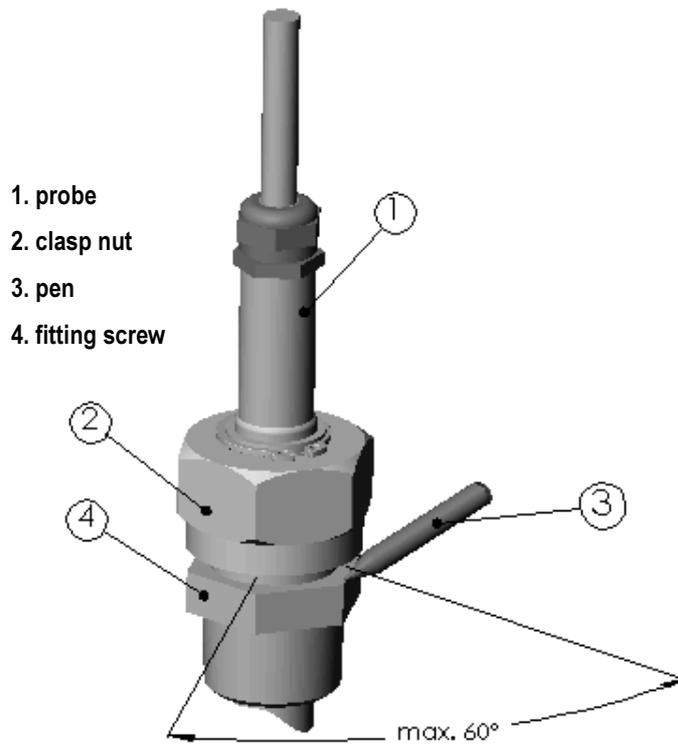
**NOTE**

Make sure that the temperature at the measurement point is equal to that of the process, otherwise the humidity reading may be incorrect.

**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.

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



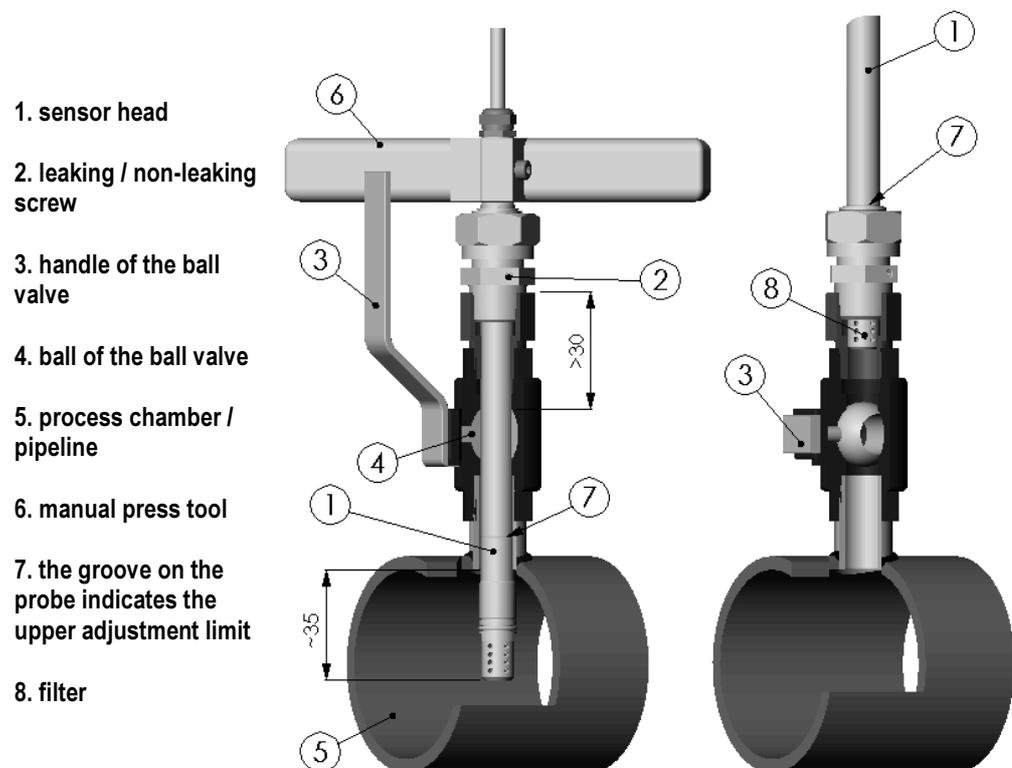
**FIGURE 3-6** Tightening the clasp nut

**NOTE**

Take care not to tighten the clasp nut more than 60° as this may result in difficulties when opening it.

## Installing the probe through the ball valve assembly

The best way for installing the sensor head to pressurized process or pipeline is to install it through the ball valve assembly. This kind of installation makes it unnecessary to empty or shut down the process for installing or removing the sensor head. Use the Vaisala DMP248BVS ball valve set or a 1/2" ball valve assembly with a ball hole of  $\varnothing 14$  mm or more. If you install the sensor head ( $\varnothing 13.5$  mm) in a process pipe, please note that the nominal size of the pipe must be at least 1 inch (2.54 cm). The manual press tool can be used to press the sensor head into the pressurized ( $< 10$  bar) process or pipeline.



**FIGURE 3-7** Installing the sensor head through the DMP248BVS ball valve assembly

### NOTE

You can install the probe in the process through a ball valve assembly provided that the process pressure is less than 10 bars. This makes it unnecessary to shut down the process when installing or removing the probe. However, if you shut down the process before installing or removing the probe, the process pressure can be max. 40 bars.

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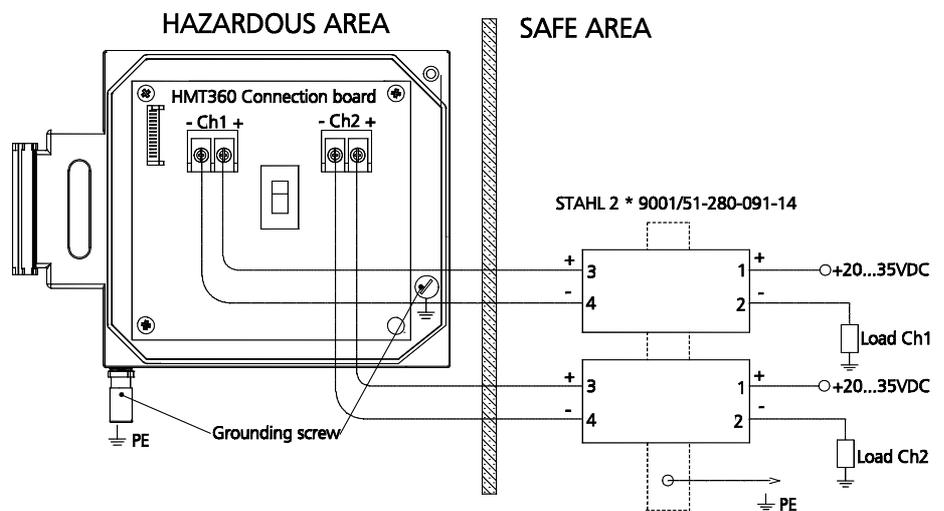
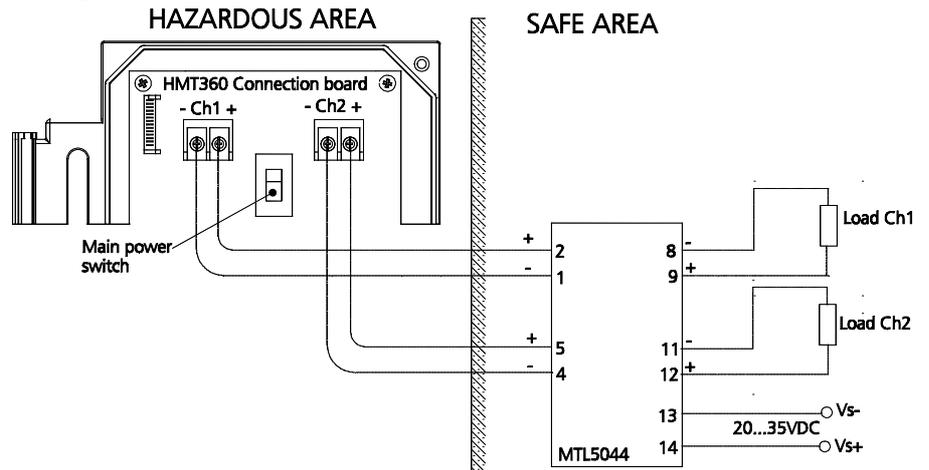
# CHAPTER 4 ELECTRICAL CONNECTIONS

Refer to local requirements regarding cabling, grounding and barrier connections.

**WARNING** Be sure that the main power switch of the transmitter is set off before making any electrical installations in hazardous areas.

Remove the protective cover of the transmitter base and connect the unpowered wires to the connectors. Attach the cover. Connect the power supply on the safe area and turn the transmitter on.

Examples of barrier connections:



## CHAPTER 5 OPERATION

After having mounted the probe head and the transmitter base and having made the signal cabling through the barrier elements, attach the protective cover. Turn the transmitter ON with the 'main switch' S1 and close the transmitter. After power-up, the transmitter is ready for use.

The LED indicator is dark or, if the transmitter has a display, measurement readings appear. You can read analog output signals from the system or load resistor. If the transmitter has a LonWorks<sup>®</sup> module installed, please, refer to the instructions in chapter 9 on 45.

<b>NOTE</b>	Avoid static discharge! Always use a wet cloth for wiping the display.
-------------	--

### LED indicator on the cover

If the transmitter does not have a display, the red LED indicator on the cover indicates various phases of calibration and possible errors. If the LED is lit and all calibration or test dip switches are disabled, it is an indication of an internal error. Otherwise, the LED indicates the following:

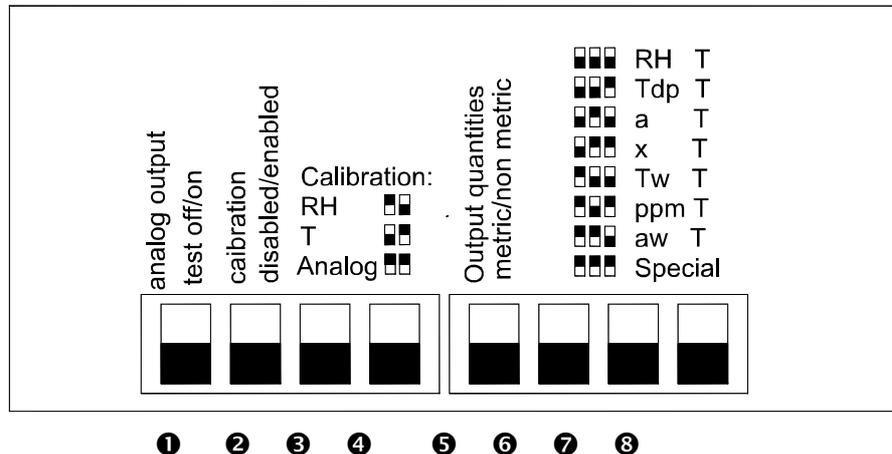
LED blinking = calibration of the dry end (offset)

LED lit = calibration of the wet end (gain)

<b>NOTE</b>	If calibration is concluded but dip switch settings are not restored, the LED indicator keeps blinking.
-------------	---

## DIP Switch functions

The table below is also printed on the protection board:



### NOTE

Always restore the DIP switch settings after having tested the analog outputs or performed the calibration.

#### ❶: ANALOG OUTPUT TEST ON/OFF:

if you turn the switch to ON position (up), you can force the outputs to states 4 mA, 12 mA and 20 mA by pressing the buttons ▲ or ▼ on the cover.

#### ❷: CALIBRATION DISABLED/ENABLED:

the EEPROMs are write protected. If this switch is in the DISABLED position (down), it does not allow any calibrations.

### NOTE

Keep this switch always in the disabled position during normal use of the transmitter!

#### ❸ and ❹ CALIBRATION RH, T, ANALOG:

with these combinations you can perform relative humidity, temperature or analog output calibrations with a multimeter or with the transmitter display unit. Turn the dip switches to the desired position according to the table printed on the protective cover.

**⑤ OUTPUT QUANTITIES:**

determines whether the output units are metric (down) on non-metric.

**⑥, ⑦ and ⑧ SELECT OUTPUT QUANTITIES:**

with the three dip switches on the right, you can select the output quantities according to the table printed on the right side of the protective cover. Note that only the ordered quantities can be selected. The SPECIAL option gives you the choice of setting any ordered quantity to each channel.

## CHAPTER 6 DISPLAY/KEYPAD COMMANDS

You can easily calibrate the transmitter with display/keypad commands. With these commands you can also scale the outputs and select special output quantities if the transmitter configuration allows that. **Note that you give the command with transmitter's internal dip switches** and the keypad serves for adjusting the values.

**NOTE**

Chapter 8 describes separately display/keypad commands for calibration.

### Scaling the analog outputs

Turn the transmitter's internal dip switch CALIBRATION ENABLED/DISABLED to upward position (ON). Press the button **C** on the display cover and a text similar to the following appears:



RH SCAL %  
0.00  
Set Hi

Numbers on the second line indicate the low end scaling of channel 1 currently stored in the transmitter memory. The text SET LO on the lower left hand corner indicates that you can now change the low end scaling with buttons ▲ or ▼. Acknowledge the value with button **E** and a text similar to the following appears:



RH SCAL %  
100.00  
Set Hi

Numbers on the second line indicate the high end scaling of channel 1. The text SET HI on the lower left hand corner indicates that you can now change the high end scaling with buttons ▲ or ▼. Acknowledge with button E.

If there is another channel available, the display shifts to the scaling menu of channel 2. You can now scale the analog outputs for the channel 2 in the same way as described above.

Press the button C to exit the display command mode or continue with selecting the output quantities. This menu starts automatically after the scaling menu only if the OUTPUT SELECTION dip switches are on the position SPECIAL (all up) from the beginning.

---

**NOTE**

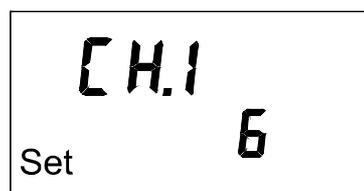
Remember to restore the dip switch settings.

---

## Selecting the output quantities

You can select the output quantities for channels 1 and 2 in the display command mode. Turn the CALIBRATION ENABLED/DISABLED dip switch to position ENABLED (up) and the three OUTPUT SELECTION dip switches to position SPECIAL (all up).

Press the button C on the display cover and the SCAL text appears on the display. Perform the steps according to the instructions given in previous paragraphs (see Scaling the analog outputs, page 21). After the scaling a text like the following appears.



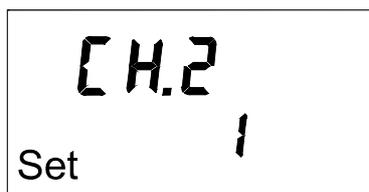
The numbers on the second line of the display in this menu correspond to the quantities according to the following table:

number	quantity	abbreviation
0	relative humidity	RH
1	temperature	T
2	dewpoint temperature	Td
3	absolute humidity	a
4	mixing ratio	x
5	wet bulb temperature	Tw
6	mass proportion*	ppm
7	water activity*	aw
8	relative humidity of saturation*	RS
9	saturation temperature*	Ts

\* Available only for HMT368 transmitter version for moisture measurements in liquids.

Select the quantity for channel 1 with buttons ▲ or ▼ and acknowledge the selection with button **E**.

You can now select the quantity for channel 2 the same way, for example:



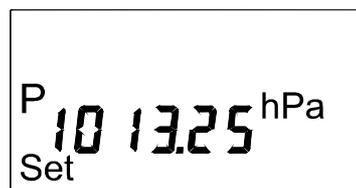
Press the button **C** to exit the display command mode or continue with setting the ambient pressure.

**NOTE**

Remember to restore the dip switch settings.

## Setting the ambient pressure for calculations

You can enter the ambient pressure to the transmitter for achieving the most accurate calculations for mixing ratio. See the pressure conversion table on page 30. The pressure setting is the last menu in the display command mode. Press the button **C** on the display cover and the **SCAL** text appears on the display. Perform the steps according to the given instructions (see *Scaling the analog outputs*, page 21). After the scaling, a text like the following appears. If the output selection is on, the following text appears only after that.



Adjust the pressure reading with buttons ▲ or ▼ and acknowledge the reading with button **E**. You have now completed giving the display commands.

**NOTE**

Remember to restore the dip switch settings.

## CHAPTER 7 SERIAL INTERFACE

Use the serial interface for calibration and testing purposes in safe areas. Always use the serial interface cable 19446ZZ for connection. Connect the other end of the cable to the serial port of your computer and the other to the connector marked 'RS 232C' on the transmitter's electronics unit.

In some countries, the serial interface can also be used in hazardous areas when equipped with an approved terminal e.g. MTL611 pocket data terminal with a SCM62 serial data communication module.

**NOTE**

With serial communication the current consumption increases and the transmitter is not able to operate with 4 mA; it requires approximately 7 mA. Therefore, we recommend that you use serial communication only temporarily for changing settings or for calibrating the transmitter in a safe area. With serial port, the minimum supply voltage is 15 VDC.

**NOTE**

The transmitter incorporates a serial interface detector. However, not all terminals or PC serial ports (e.g. opto-isolated or ports not meeting RS232C standards) recognize this standard. If the communication is not possible via a serial interface, use a forced activation by pressing simultaneously buttons **▲** and **E** on the transmitter cover. To deactivate the forced activation, press these buttons again or reset the transmitter. If the transmitter does not receive any commands for a half an hour, it automatically closes the serial communication.

## Giving the communication parameters

Give the communication parameters when using this terminal session for the first time; save them for future use. See instructions in the following tables for giving them in Windows environment.

**TABLE 7-1** Default communication parameters

parameter	value
bauds	2400
parity	none
data bits	8
stop bits	1

**TABLE 7-2** Giving parameters in Windows 3.1

MENU	DESCRIPTION
<b>PROGRAM MANAGER</b>	
↓	
<b>ACCESSORIES</b>	double click
↓	
<b>TERMINAL</b>	double click
↓	
<b>Settings</b>	click
↓	
<b>Communications</b>	click and select parameters (see <b>FIGURE 7-1</b> next page); click OK
↓	move the cursor to:
<b>File</b>	click
↓	
<b>Save as</b>	click and save settings: type the name of the file (e.g. HMT360) and click OK
Turn the HMT360 on and follow the instructions on page 29.	

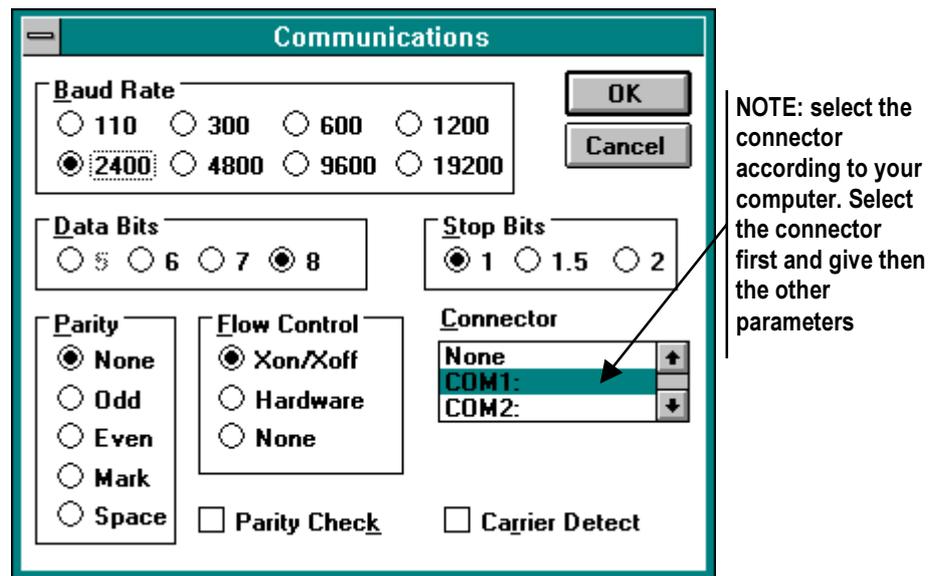
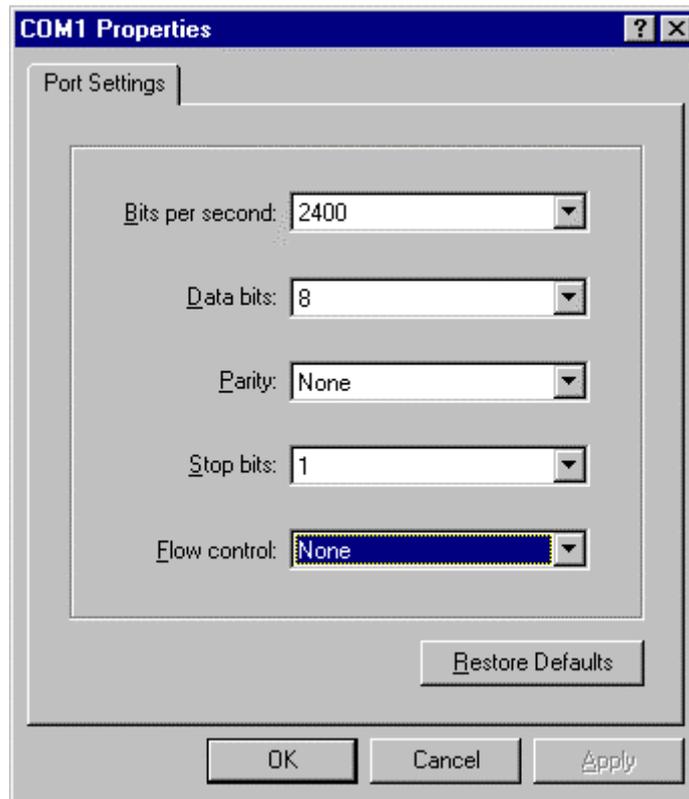


FIGURE 7-1 Giving the parameters in Windows 3.1

TABLE 7-3 Giving parameters in Windows 95 and Windows NT

WINDOWS 95		WINDOWS NT	
MENU	WHAT TO DO	MENU	WHAT TO DO
<b>Start</b>		<b>Start</b>	
↓	move the cursor to:	↓	move the cursor to:
<b>Programs</b>		<b>Programs</b>	
↓	move the cursor to:	↓	move the cursor to:
<b>Accessories</b>		<b>Accessories</b>	
↓	move the cursor to:	↓	move the cursor to:
<b>HyperTerminal</b>	click	<b>Hyperterminal</b>	click
↓	move the cursor to:	↓	
<b>Hypertrm</b>	double click	<b>Connection Description</b>	type the name of the connection (e.g. HMT360) in the appropriate field and select an icon if available; click OK.
↓		↓	
<b>Connection Description</b>	type the name of the connection (e.g. HMT360) in the appropriate field and select an icon if available; click OK.	<b>Connect to</b>	move the cursor to the field CONNECT USING and select 'COM x' (x = serial port available); click OK
↓			
<b>Phone Number</b>	move the cursor to the field CONNECT USING and select 'direct to COM x' (x = serial port available); click OK	<b>COM x properties</b>	select parameters according to the screen in FIGURE 7-2; click OK
↓		↓	
<b>COM x properties</b>	select parameters according to the screen in FIGURE 7-2; click OK		
Turn the HMT360 on and follow the instructions on page 29.			



**FIGURE 7-2** Selecting the parameters in Windows 95 and NT.

When you have given the communication parameters, you can start using the serial commands. Note that communication parameters can be stored in the computer for future use.

## Giving commands

To start giving commands, make sure that the HMT360 is connected to a serial port of your computer and that the terminal session is open. Turn the power on. Give commands by typing them on your computer according to the following instructions. In these commands, ↵ stands for pressing ENTER.

**NOTE**

Each time the HMT360 transmitter sends something to the terminal, it also sends line feed and carriage return.

## Setting the ambient pressure for calculations

**PRES aaaa.a ↵**

where: aaaa.a = pressure (hPa)

for example:

```
>PRES 2400 ↵
Pressure : 2400
>
```

```
>PRES ↵
Pressure : 2400
>
```

**TABLE 7-4** Pressure conversion chart

**FROM**

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

**Example:**  $29.9213 \text{ inHg} = 29.9213 \times 33.86388 = 1013.25 \text{ hPa / mbar}$

**NOTE**

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.

## Selecting and scaling analog outputs

**ASEL xxx yyy ↵**

where: **xxx** = quantity of channel 1 and **yyy** = quantity of channel 2

output quantity	abbreviation
relative humidity	RH
temperature	T
dewpoint temperature	Td
absolute humidity	a
mixing ratio	x
wet bulb temperature*	Tw
mass proportion*	ppm
water activity*	aw
relative humidity of saturation*	RS
saturation temperature*	Ts

\* Available only for HMT368 transmitter version for moisture measurements in liquid.

For example:

```
>asel rh t ↵
Ch1 RH lo : 0.00 %RH
Ch1 RH hi : 100.00 %RH
Ch2 T lo : -40.00 'C
Ch2 T hi : 60.00 'C
>
```

## Scaling the relative humidity output

**SRH aa.a bb.b ↵**

where: **aa.a** = lower RH limit

**bb.b** = upper RH limit

for example:

```
>SRH 0 100 ↵
RH lo 0.00 %RH
RH hi 100.00 %RH
>
```

## Scaling the temperature output

**ST aa.a bb.b ↵**

where: **aa.a** = lower temperature limit **bb.b** = upper temperature limit

for example:

```
>ST -40.0 180.0 ↵
T lo -40.0 'C
T hi 180.00 'C
>
```

## Scaling other quantities

**Szz aa.a bb.b ↵**

where: **zz** = quantity (Td, x, a, Tw, ppm, aw, RS, Ts)

**aa.a** = lower limit of the quantity **bb.b** = upper limit of the quantity

## Relative humidity calibration

### NOTE

Read also the calibrator e.g. HMK15 manual and refer to page 37 of this manual for more detailed instructions on salt bath calibration.

**CRH ↵**

The transmitter asks and measures relative humidity and calculates the calibration coefficients, for example:

```
>CRH ↵
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.

### NOTE

Read also the calibrator manual and refer to page 43 of this manual for more detailed instructions on salt bath calibration.

## Temperature calibration

### CT ↵

The transmitter asks and measures temperature readings and calculates the calibration coefficients, for example:

```
>CT ↵
T   :   0.81      1. ref  ?      0.5 ↵
Press any key when ready... ↵
T   :   99.12    2. ref  ?      99.5 ↵
OK
>
```

The OK indicates that the calibration has succeeded.

## Analog output calibration

**NOTE**

Read also the calibrator manual and refer to page 44 of this manual for more detailed instructions on analog output calibration.

### ACAL ↵

The transmitter suggests some current reading values, takes in the actual analog outputs measured with circuit analyzer (multimeter) and calculates the coefficients. For example:

```
>ACAL ↵
Ch1 I1 (mA) ?   4.846 ↵
Ch1 I2 (mA) ?  19.987 ↵
>
```

## Testing the analog outputs

**ITEST aa.aaa bb.bbb ↵**

where: aa.aaa = current value to be set for channel 1 (mA)

bb.bbb = current value to be set for channel 2 (mA)

This command outputs the current value of each channel and the corresponding control signal of the digital-to-analog converter, for example:

```
>ITEST 8 12 ↵
8.000 3F8 12.000 700
>
```

```
>ITEST ↵
6.349 25A 19.001 E93
>
```

The set current values remain valid until you give the command ITEST without readings. With this command the desired outputs of the transmitter are shown.

## Outputting the measurement values

**SEND ↵**

This command outputs the measured values in one point. For example:

```
>SEND ↵
RH= 55.4 %RH T= 18.7...
>
```

## Activating a continuous output

**R ↵**

With the command R the transmitter outputs measured values continuously. For example:

```
>R ↵
RH= 55.4 %RH T= 18.7...
...
>
```

## Stopping the continuous output

```
S ↵
```

The continuous outputting is stopped with the command s. For example:

```
>s ↵
```

If outputting is active, this command is not echoed.

## Setting the output interval

```
INTV n xxx ↵
```

where: **n** = 1 - 255      **xxx** = SEC, MIN or H

Sets the output interval when the transmitter outputs measurement readings. The time interval is used when the continuous output is active. For example, the output interval is set to 10 minutes:

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

This page intentionally left blank.

## CHAPTER 8 CALIBRATION

The new transmitter has been calibrated at the factory.

The ambient conditions determine the need for new humidity calibration. We suggest that you perform a humidity calibration check after 1 - 3 months of the installation. After this check, in typical conditions a one year calibration interval is recommended.

If you use serial commands for calibrating the transmitter, please refer to instructions on page 33. If you use the keypad for calibration, please note that you can always terminate the calibration by pressing the button C.

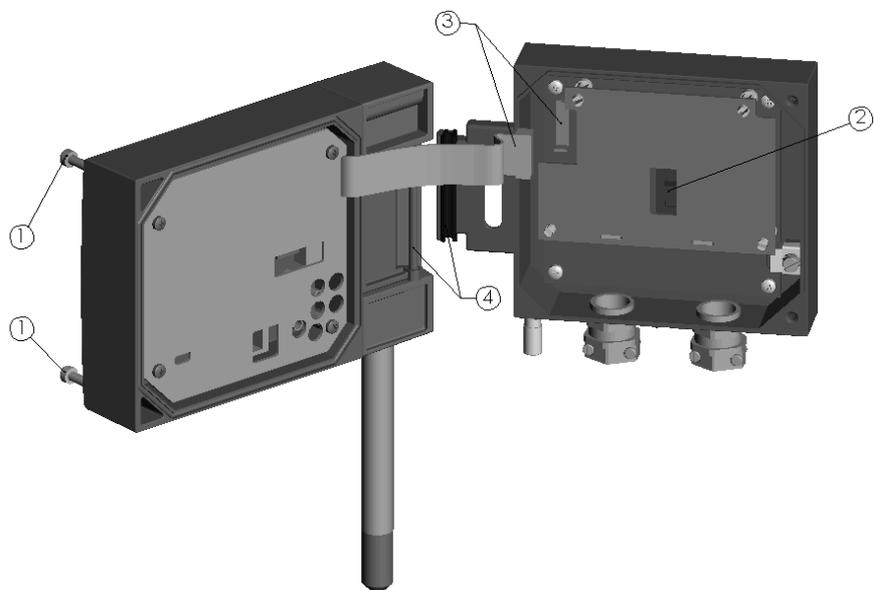
### Removing the transmitter and detaching the electronics

1. Unfasten the screws and open the cover.

2. Switch the transmitter off with the ON/OFF switch.

3. Disconnect the flat cable by lifting it carefully e.g. with a screw-driver.

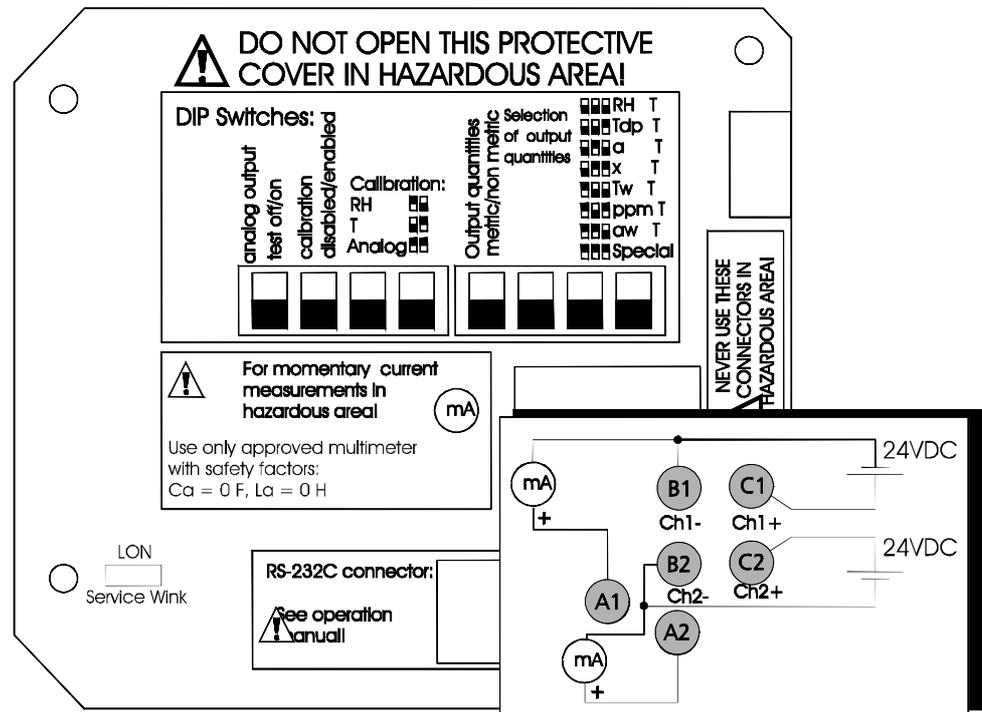
4. Turn the electronics unit slightly upwards to release it from the hinges. Leave the transmitter base with the cable connections on place. When putting the electronics unit back to place, attach the upper hinge first.



**FIGURE 8-1** Detaching the electronics unit with the probe for calibration

# Connecting a temporary power supply and current measurement

**NOTE** Always restore the dip switch setting after calibration; otherwise, the LED indicator keeps blinking or the text SET appears on the display.



**FIGURE 8-2** Connecting the power supply and multimeter for calibration

When the electronics unit has been detached for calibration, the power supply and the multimeter can be connected with banana plugs through the protective cover as shown in

**FIGURE 8-2.** Connect the power supply to the terminals B1 and C1 (channel 1). The multimeter is connected in series with the supply. Follow the same procedure with channel 2 using the terminals B2 and C2. Use as a supply voltage 12...24 VDC. If you use a serial port, the minimum supply voltage is 15 VDC. You can now calibrate or check the humidity and temperature or the analog outputs according to the instructions given in calibration chapters.

If the current measurement is needed on site in a hazardous area, the multimeter is connected to the terminals A1 and B1. Use only an approved multimeter. Never use the terminals C1 and C2 in hazardous areas.

**WARNING** The power supply connectors (C1 and C2 in **FIGURE 8-2**) **MUST NOT** be used in hazardous areas.

For calibration in a hazardous area use only an approved multimeter, which fulfils the safety factors printed on the protective cover.

## Calculating the correspondence of current values and output quantities

Calculate the correspondence of current values and output quantities according to the following equation:

$$I = 4mA + 16mA \cdot \frac{(Q_{ref} - Q_{min})}{(Q_{max} - Q_{min})} \quad (8-1)$$

where:  $Q_{ref}$  = reference value of the calibrated quantity  
 $Q_{min}$  = value corresponding to 4 mA  
 $Q_{max}$  = value corresponding to 20 mA

### Example 1:

relative humidity scaling 0 - 100 %RH, reference 11.3 %RH:

$$I = 4mA + 16mA \cdot \frac{(11.3\% RH - 0\% RH)}{(100\% RH - 0\% RH)} = 5.808mA \quad (8-2)$$

### Example 2:

temperature scaling -40 - +120 °C, reference 22.3 °C:

$$I = 4mA + 16mA \cdot \frac{(22.3^{\circ}C - -40^{\circ}C)}{(120^{\circ}C - -40^{\circ}C)} = 10.230mA \quad (8-3)$$

# Relative humidity calibration

## Automatic calibration adjustment procedure

During the automatic calibration procedure, the reference values do not need to be set manually. The transmitter projects the basic value (generated by salt solution), and calculates the accurate value based on the measured temperature and the Greenspan table stored into the transmitter memory. The display chart of the calibration procedure is presented in **FIGURE 8-3**

- Set the calibration dip switches to RH calibration position.
- Press the button **C** to start the automatic calibration procedure.
- Remove the filter and insert the probe head into a measurement hole of the LiCl salt chamber in the humidity calibrator. Acknowledge by pressing the button **E**. Alternatively select the 0.1 (humidity in Nitrogen) with buttons ▲ or ▼, and again acknowledge with the button **E**.
- The transmitter remains to wait for the process stabilization (10-15 min) and then stores the correction.
- Insert the probe head into a measurement hole of the NaCl salt chamber in the humidity calibrator Acknowledge by pressing the button **E**. Alternatively you can select K<sub>2</sub>SO<sub>4</sub> value with buttons ▲ or ▼.
- The transmitter remains to wait for the stabilization and then stores the correction. The text CAL PASS is displayed after the calibration is performed.

**NOTE**

Remember to restore the dip switch settings.

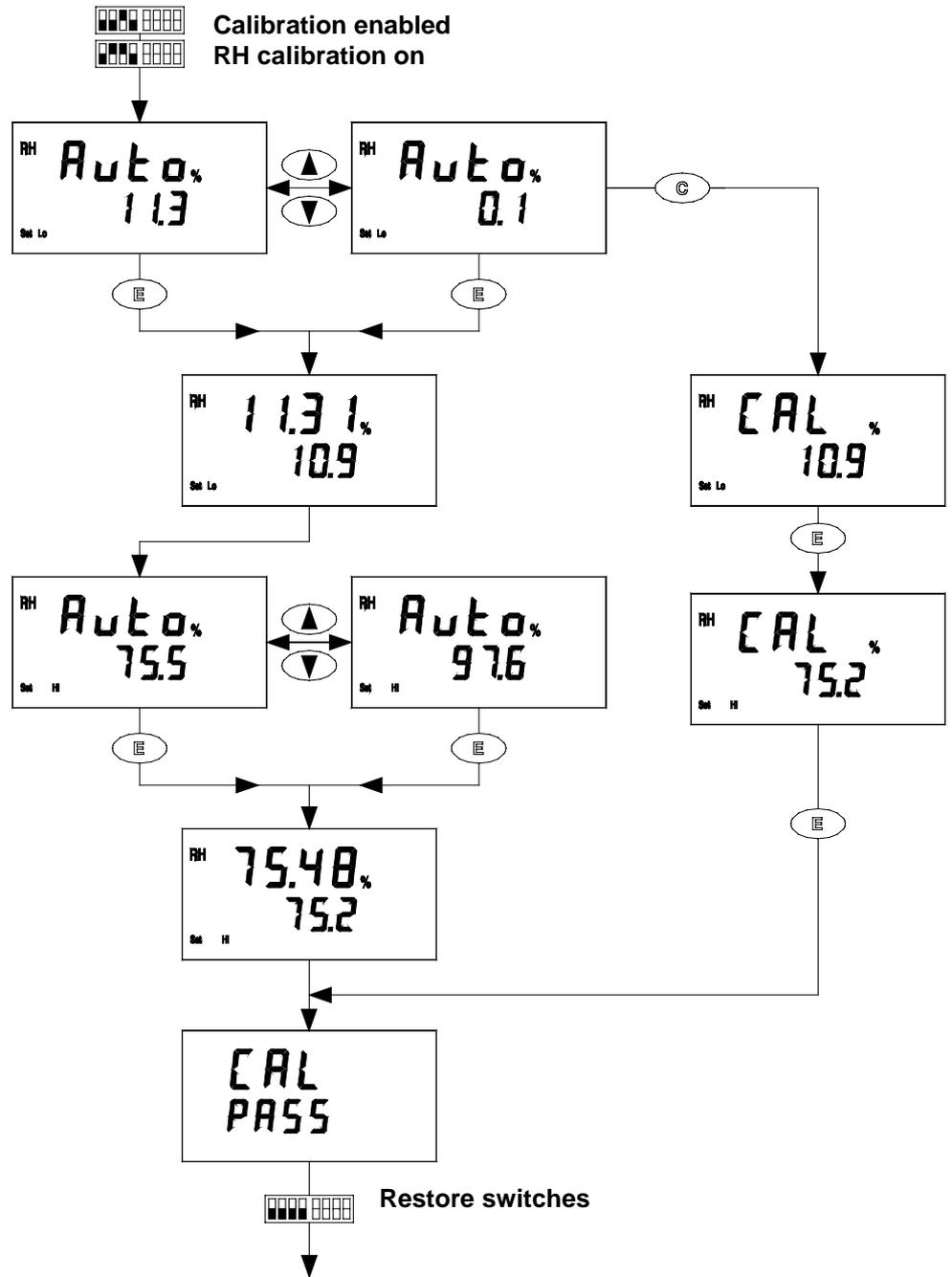


FIGURE 8-3 Display chart of the automatic calibration procedure

## One point calibration (offset correction)

If the manual calibration procedure is preferred, the automatic calibration procedure can be ignored by pressing the button C (see **FIGURE 8-3**).

- Remove the filter and insert the probe head into a measurement hole of the dry end reference chamber (e.g. LiCl: 11 %RH) in the humidity calibrator.

**NOTE**

If you use serial commands, please refer to page 32.

- Set the calibration dip switch to upward position (ON).
- Set the transmitter's calibration dip switches to position 'RELATIVE HUMIDITY CALIBRATION' according to the table printed on the protective cover. The humidity reading measured by the transmitter appears on the display and on the lower left hand corner you can see the text SET LO. If the transmitter has a blank cover, the LED indicator is blinking.
- According to the calibrator used, wait at least 10 - 15 minutes for the sensor to stabilize; use a multimeter or the transmitter display to monitor the stabilization.
- Press the buttons ▲ or ▼ to adjust the reading to correspond the reference value and press the button E to conclude the one point calibration.
- If offset calibration is sufficient, press the button E again to conclude the calibration and restore the dip switch settings; set the calibration dip switch to position DISABLED (down). To continue the two point calibration follow the instructions in next chapter.

## Two point calibration (gain correction)

- After having made the offset correction, insert the probe head into a measurement hole of the NaCl (75 %RH) salt chamber in the humidity calibrator. Please, note that the difference between the two humidity references must be at least 30%RH.

**NOTE**

If you use serial commands, please refer to page 32.

- The readings measured by the transmitter appear on the display, as well as the text, SET HI on the lower left hand corner. If the transmitter has a blank cover, the LED indicator lights up.
- Wait at least 10 - 15 minutes for the sensor to stabilize; use a multimeter or the transmitter display to monitor the stabilization.
- Press the buttons ▲ or ▼ to adjust the reading and conclude the calibration with the button E.
- Restore the dip switch settings. Set the calibration dip switch to position DISABLED (down).

## Temperature calibration

### One point calibration (offset correction)

Always use a high quality standard for calibrating the temperature.

**NOTE**

If you use serial commands, please refer to page 33.

- Set the calibration dip switch to position ENABLED (up).
- Set the calibration dip switches to position 'TEMPERATURE CALIBRATION' according to the table printed on the protective cover. The temperature value measured by the transmitter appears on the display as well as the text SET LO on the lower left hand corner. If the transmitter has a blank cover, the LED indicator starts to blink.
- Let the sensor stabilize; use a multimeter or the transmitter display to monitor the stabilization.
- Press the buttons ▲ or ▼ to adjust the reading to correspond the reference value and conclude the one point calibration with the button E.
- If offset calibration is sufficient, press the button E again and restore the dip switch settings; set the calibration dip switch to position DISABLED (down).
- To continue the two point calibration follow the instructions in next chapter.

## Two point calibration (gain correction)

- After having concluded the offset correction, change the reference temperature at least 30 °C. The text SET HI appears on the display. If the transmitter has a blank cover, the LED indicator lights up.

**NOTE**

If you use serial commands, please refer to page 33.

- Let the sensor stabilize. Use a multimeter or the transmitter display to monitor the stabilization.
- Press the buttons ▲ or ▼ to adjust the reading and conclude the calibration with the button E.
- Restore the dip switch settings; set the calibration dip switch to position DISABLED (down).

## Analog output calibration

Calibration is necessary only in case the analog output unit is replaced. Use an accurate calibrated multimeter as a reference unit.

**NOTE**

If you use serial commands, please refer to page 33.

- Set the calibration dip switch to position ENABLED (up).
- Set the calibration dip switches to position 'ANALOG OUTPUT CALIBRATION' according to the table printed on the protective cover. The text SET LO appears on the lower left hand corner of the display. If the transmitter has a blank cover, the LED indicator starts to blink.
- Adjust the reading of the multimeter to 4.000 mA with buttons ▲ or ▼ and conclude the one point calibration with the button E.
- The text SET HI appears on the display. If the transmitter has a blank cover, the LED indicator lights up.
- Adjust the reading of the multimeter to 19.980 mA with buttons ▲ or ▼ and conclude the one point calibration with the button E.
- Restore the dip switch settings; set the calibration dip switch to position DISABLED (down).

## CHAPTER 9 LONWORKS<sup>®</sup> INTERFACE

### General

The HMT360 LonWorks<sup>®</sup> interface enables communication between a LonWorks<sup>®</sup> network and the HMT360-series transmitter over a twisted pair.

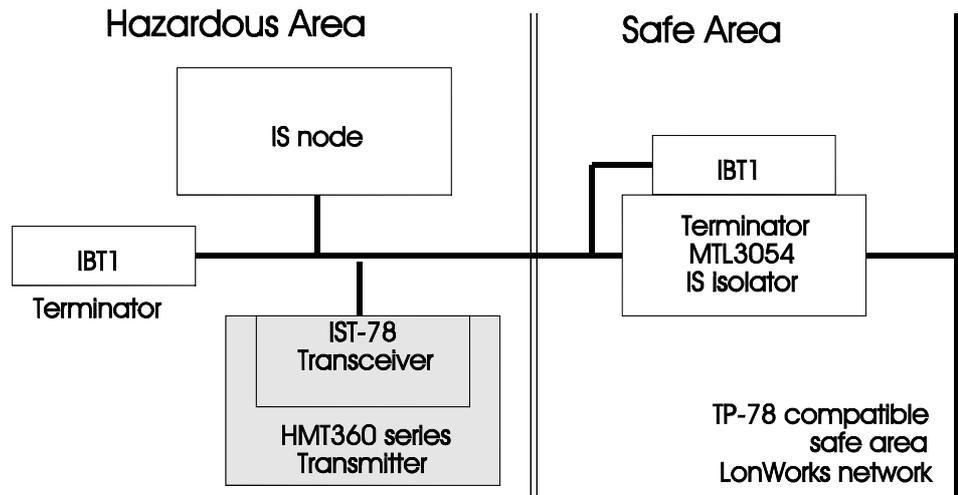
The HMT360 LonWorks<sup>®</sup> interface consists MTL's (Measurement Technology Limited) IST-78-transceiver, which is certificated for hazardous areas and an HM360LON-module. The connection type is XF78 and it does not need external power line. For more information about IST-78 and required additional components see MTL's application note TP1114-1 or contact the MTL's local representative.

### Commissioning

The required modules IST-78 and HM360LON-module are already connected on to the mother board during the manufacturing.

Connect the wiring to connection unit's LON-terminal switch on the transmitter and configure the transmitter:

Press the blue service button (marked service on the protective cover), and the transmitter sends service pin message to the configuration unit. The (Wink) LED lights up, when the button is pressed. After the configuration, close the transmitter cover.



**FIGURE 9-1** An example to connect the HMT360 to the LonWorks field bus.

During normal operation, the LED (Wink) indicates the following:

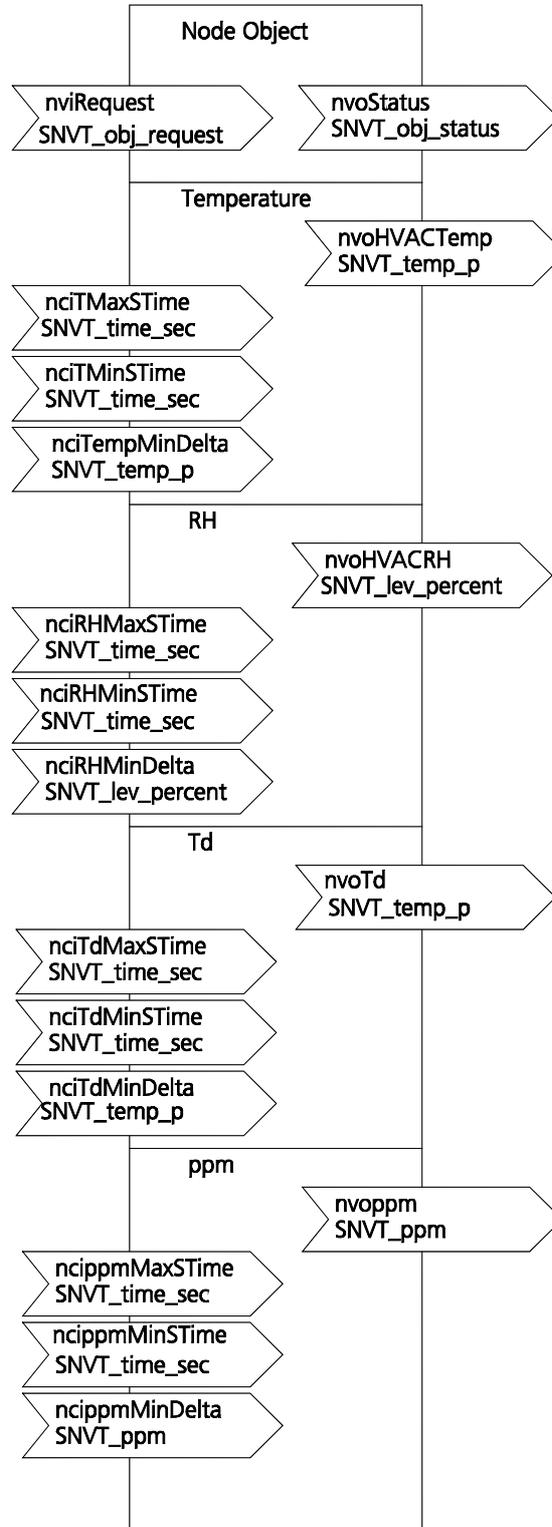
- Dark - the transmitter configuration and operation are in order
- Lit - transmitter failure
- Blinking - the transmitter has not been configured

## Technical Data

Communication speed	78.125kbit/s
Maximum cable length	1000 m with dual terminated bus topology 300 m with free topology (including terminators)
Application power	2 wire power and signal
Signalling form	unipolar:IS node draws 20 mA to transmit

**NOTE** According to MTL application note TP1114-1, IS requirements prevent the TP/XF-78 transceiver in an MTL3054 (IS isolator) from conforming to LonMark™ interoperability guidelines.

## Network variables



- nviRequest:** to request modes for objects within this node
- nvoStatus:** to report the status of a object on this node
- nvoHVACRH:** this output variable reports the RH value detected by the sensor
- nvoHVACTemp:** this output variable reports the value detected by the sensor
- nvoTd:** this output variable reports the  $T_d$  value calculated by the transmitter
- nvoppm:** : this output variable reports the value of water proportion in liquid by weight calculated by the transmitter
- nciRHMaxSTime:** indicates the maximum period of time that expires before the sensor object automatically updates all of its output variables (default value 300 seconds)
- nciRHMinSTime:** indicates the minimum period between the output network variable transitions (default value 5 seconds)
- nciRHMinDelta:** indicates the minimum RH value change required to update the output network variables ( default 1%RH)
- nciTMaxSTime:** indicates the maximum period of time that expires before the sensor object automatically updates all of its output variables (default value 300 seconds)
- nciTMinSTime:** indicates the minimum period between the output network variable transitions (default value 5 seconds)
- nciTempMinDelta:** indicates the minimum T value change required to update the output network variables ( default 0.3°C)
- nciTdMaxSTime:** indicates the maximum period of time that expires before the sensor object automatically updates all of its output variables (default value 300 seconds)
- nciTdMinSTime:** indicates the minimum period between the output network variable transitions (default value 5 seconds)
- nciTdMinDelta:** indicates the minimum Td value change required to update the output network variables ( default 0.3°C)
- ncippmMaxSTime:** indicates the maximum period of time that expires before the sensor object automatically updates all of its output variables (default value 300 seconds)
- ncippmMinSTime:** indicates the minimum period between the output network variable transitions (default value 5 seconds)
- ncippmMinDelta:** indicates the minimum ppm value change required to update the output network variables ( default 1 ppm)

## CHAPTER 10 SPECIFICATIONS

### Measured variables

#### Relative humidity

Measurement range	0 - 100 %RH
Accuracy (including non-linearity and repeatability); when calibrated against: high quality, certified humidity standards	$\pm 1$ %RH (0 - 90 %RH) $\pm 2$ %RH (90 - 100 %RH)
salt solutions (ASTM E104-85)	$\pm 2$ %RH (0 - 90 %RH) $\pm 3$ %RH (90 - 100 %RH)
Response time (90%) at 20 °C in still air (with sintered filter)	15 seconds
Sensors: HUMICAP®180 HUMICAP®180J HUMICAP®L	for typical applications for hydrogen applications for applications with a demanding chemical environment (max. +40 °C in high humidities)

#### Temperature

Measurement ranges:	-40...+180 °C (depends on selected probe)
Typical accuracy of electronics at +20 °C	$\pm 0.1$ °C
Typical temperature dependence of electronics	0.005 °C/°C
Sensor	Pt 1000 RTD 1/3 Class B IEC 751

## Calculated variables

Typical ranges:

### With HMP361 probe

dewpoint temperature	-40...+60 °C
mixing ratio	0...160 g/kg d.a.
absolute humidity	0...160 g/m <sup>3</sup>
wet bulb temperature	0...+60 °C

### With HMP363, HMP364, HMP365 & HMP368

dewpoint temperature	-40...+100 °C
mixing ratio	0...500 g/kg d.a.
absolute humidity	0...600 g/m <sup>3</sup>
wet bulb temperature	0...+100 °C

## Accuracies of the 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  $\pm 0.2$  °C.

### Accuracies 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

### Accuracies 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	—	—	—	—	—	—	—

### Accuracies 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

### Accuracies 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

## Outputs

Two analog outputs (one standard, one optional)	Two wire 4...20 mA
Typical accuracy of analog Outputs at +20 °C	±0.05% full scale
Typical temperature dependence of analog outputs	0.005% / °C full scale
Optional LonWorks® channel	
RS232C serial output for service use	connector type RJ45
Output connections via safety barriers	

## Classification with current outputs

GENELEC	EEx ia IIC T5
EU (76/117/EEC)	VTT No. Ex-99.E.005X
EU (94/9/EC, ATEX100a)	II 1 G Pending
U.S.A.	Pending
Canada	Pending
Japan	Pending
Australia	Pending
Safety factors	Ui=28 V, Ii=100 mA, Ci=48 nF, Li=22 µH

## LonWorks® Module

Connections	screw terminals, 0.33...2.0 mm <sup>2</sup> wires (AWG 14-22)
Connection type	XF78 (TP78)
Communication speed	78.125 kbit/s
Maximum cable length	
with dual terminated bus topology	1000 m
with free topology (incl. Terminators)	300 m
Signalling form (unipolar)	IS node draws 20 mA to transmit
<b>LonWorks® module classification</b>	
GENELEC	Eex ia IIC T4
EU (76/117/EEC)	VTT No. Ex-99.E.006X
Safety factors	Ui=24 V, Ii=225 mA, Pi=1.2 W, Ci=0 nF, Li= 22 µH

## General

Operating voltage	12...28 V
with serial port (service mode)	15...28 V
Connections	screw terminals, 0.33...2.0mm <sup>2</sup> wires (AWG 14-22)
Cable bushing	Pg11 (5...12mm)
Conduit fitting	Pg11/NPT 1/2"-14
Operating temperature range for electronics	-40...+60 °C
with display and/or with LonWorks® module	-20...+60 °C
Storage temperature range	-40...+70 °C
Housing material	G-A1Si 10 Mg (DIN 1725)
Housing classification	IP 65 (NEMA 4)
Housing dimensions	164 x 115 x 62 mm
Housing weight	950g
Fully electromagnetically compatible according to standards	EN50081-1 and EN50082-2

## Probes

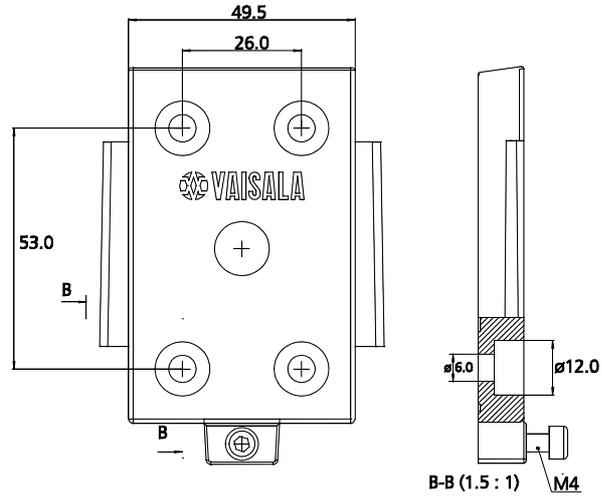
Probe cable length	2, 5, or 10 m
Probe cable diameter	5.5 mm
Sensor protection options	stainless steel sintered filter stainless steel filter PPS grid with steel netting filter PPS grid
<b>HMP361 Probe - wall mount</b>	
Temperature range	-40...+60 °C
<b>HMP363 Probe - confined spaces</b>	
Temperature range	-40...+120 °C
<b>HMP364 Probe - high pressures</b>	
Temperature range	-40...+180 °C
Pressure range	0...10 MPa (0...100 bar)
<b>HMP365 Probe - high temperatures</b>	
Temperature range	-40...+180 °C
<b>HMP368 Probe - pressurized pipelines</b>	
Temperature range	-40...+180 °C
Pressure range	0...4 MPa (0...40 bar)

## Options and accessories

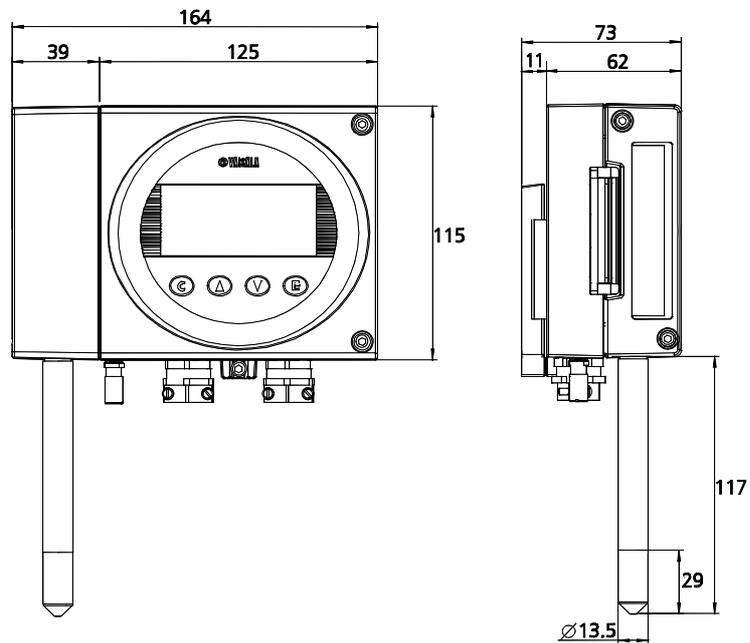
Display	two-line LCD
character size (1 <sup>st</sup> line/2 <sup>nd</sup> line)	12 mm/10 mm
Calculated output variables	dewpoint temperature
	mixing ratio
	absolute humidity
	wet bulb temperature
Additional analog output	4...20 mA
LonWorks® channel	XF78 (TP78)
Duct mounting installation kit (for HMP363 sensor head)	Order code: HMP233FAH
Installation flange (for HMP365 sensor head)	
aluminium	Order code: HMP235FA
stainless steel	Order code: HMP235 FS
Ball valve set (for HMP368 sensor head)	Order code: DMP248VS
pressure range at +20 °C	0...70 bar
Serial interface cable for PC	
connectors RJ45 - D9 female	Order code: 19446ZZ

# APPENDIX 1 Dimensions

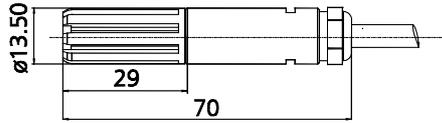
## Mounting plate



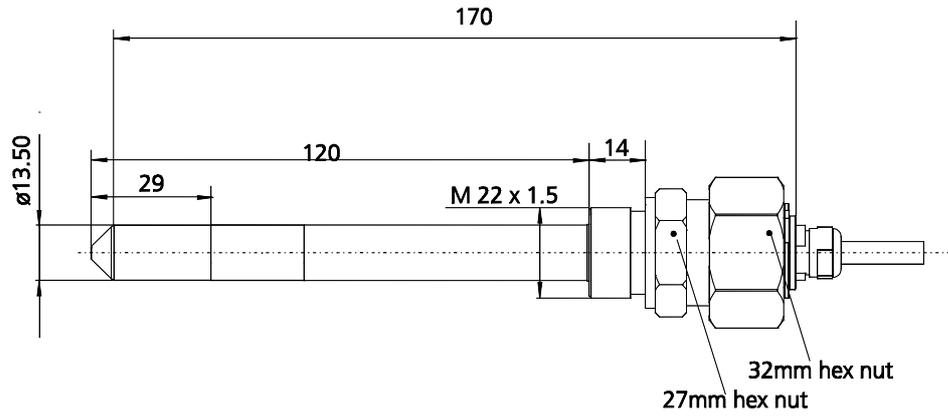
## HMT361



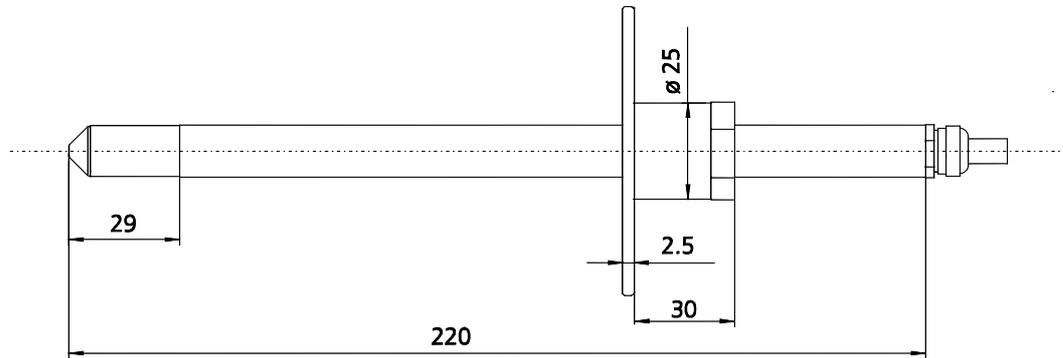
### HMP363



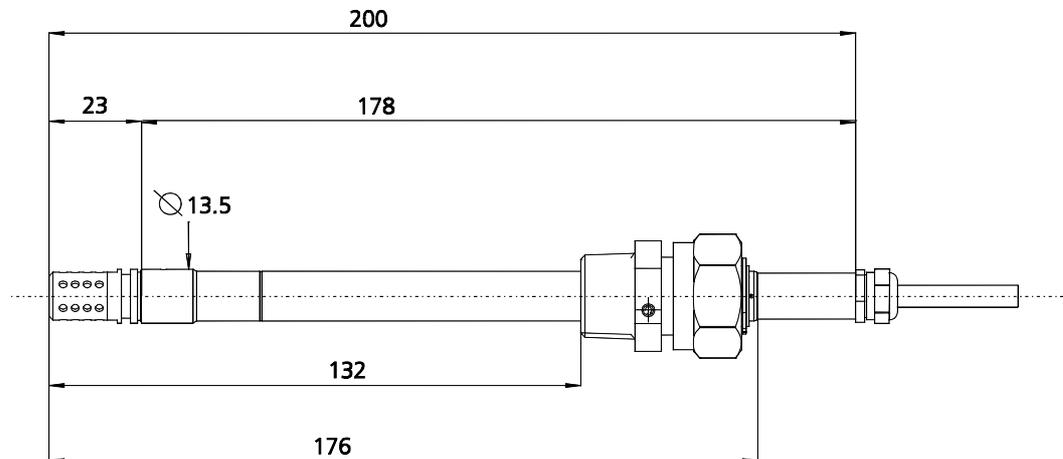
### HMP 364



### HMP365



### HMP368





1. **CERTIFICATE OF CONFORMITY**



2. Certificate reference: VTT No. Ex-99.E.005X

3. This Certificate is issued for the following electrical equipment, intended for use in potentially explosive atmospheres:

**A humidity and temperature transmitter**

Certified type: **HMT360 series**

4. Manufactured by: **VAISALA Oyj, FINLAND**

5. This electrical apparatus or system and any acceptable variations thereto are specified in the Annex and possible supplement(s) to this Certificate and in the descriptive documents therein referred to.

6. VTT, being an Approved Certification Body in accordance with Article 14 of the Council Directive of the European Communities of 18. December 1975 (76/117/EEC),

- certifies that the apparatus has been found to comply with the following harmonized European Standards:

EN 50 014 (1992)

EN 50 020 (1994)

and has successfully met the type verification and test requirements of these Standards.

- confirms that confidential Research Report No. AUT/TES/56/99 has been completed on these verifications and tests.

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7. The code for the electrical apparatus is:

**EEx ia IIC T5**  
-40 °C T<sub>amb</sub> +60 °C

8. By marking the supplied electrical apparatus, the manufacturer attests on his own responsibility that this electrical apparatus complies with the descriptive documents referred to in the Annex to this Certificate and has satisfied routine verifications and tests required in the harmonized European Standards referred to in point 6 above.
9. The electrical apparatus may be marked with the distinctive community mark as printed on this Certificate, and specified in Annex II of Council's Directive of January 1984 (84/47/EEC).
10. If there appears sign X after the Certificate number, there are special conditions for safe use which are specified in the Annex of this Certificate.

The Annex to this Certificate consists totally of 2 pages.

This Certificate, including the Annex, may only be reproduced in its entirety and without change.

Espoo, 11.03.1999

VTT AUTOMATION  
Electrotechnical Testing

Martti Siirola  
Research scientist

Paul Lindström  
Senior research scientist



**The humidity and temperature transmitter, type HMT360 series**

**1. CERTIFICATE NUMBER**

The Certificate of Conformity

VTT No. Ex-99.E.005X

has been given to the test specimen. The sign X in the Certificate number means the allowed ambient temperature range is  $-40^{\circ}\text{C} \dots +60^{\circ}\text{C}$ . The device is meant to be earthed and there are surge arresters between the input lines and earth, so the electric strength between the frame and intrinsically safe circuit is less than 500 voltage.

**2. TECHNICAL DATA**

The HMT360 series transmitters are two-wire transmitters with microprocessors for measuring relative humidity and temperature. The transmitters may be equipped with a local display and two output current channels. The HMT360 series transmitter has various options for transmitter units, sensor heads and cable lengths. The available probe types are HMP361, HMP363, HMP364, HMP365 and HMP368. The maximum operating temperature for probe type HMP361 is  $60^{\circ}\text{C}$ , for probe type HMP363 is  $120^{\circ}\text{C}$  and  $180^{\circ}\text{C}$  for probe types HMP364, HMP365 and HMP368.

The transmitter is equipped with appropriate connectors and an external grounding screw. The transmitter is equipped with a RS232C connector. The specifications of the RS232C port are:  $U_{\text{max:in}} = 9 \text{ V}$ ,  $U_{\text{max:out}} = 5.5 \text{ V}$ ,  $I_{\text{max:out}} = 6 \text{ mA}$ . The interface can be used with an approved intrinsically safe serial-data communication device e.g. MTL611 (ref BAS No Ex91C2071) pocket data terminal with a SCM62 serial data communication module.

The maximum input values of the transmitter type HMT360 series are:

$$\begin{array}{ll} U_i = 28 \text{ V} & I_i = 100 \text{ mA} \\ C_i = 48 \text{ nF} & L_i = 22 \mu\text{H} \end{array}$$

The transmitter is intended to be connected to an associated apparatus fulfilling the safety values.



**3. LIST OF DRAWINGS AND DOCUMENTS**

<u>Name</u>	<u>Date</u>
<b>Electrical drawings</b>	
HM360PRB, Probe Module	
Circuit diagram, Dwg no HM37146.C	22.01.1999
Component layout, Dwg no HM47148.B, 2 pages	02.07.1998
Product Structure, HM360PRB, 8 pages	11.02.1999
HM360CPU, CPU Module	
Circuit diagram, Dwg no HM37149.C	05.02.1999
Component layout, Dwg no HM37150.B, 2 pages	02.07.1998
Product Structure, HM360CPU, 8 pages	11.02.1999
HM360AOUT, Output Module	
Circuit diagram, Dwg no HM37152.B	02.07.1998
Component layout, Dwg no HM47153.B, 2 pages	02.07.1998
Product Structure, HM360AOUT, 5 pages	11.02.1999
HM360CON, Connection Board	
Circuit diagram, Dwg no HM47142.B	02.07.1999
Component layout, Dwg no HM47155.C	02.07.1998
Product Structure, HM360CON, 2 pages	11.02.1999
<b>Assembly</b>	
Standard Cover HMT360LS, Dwg no HM27170.B	15.02.1999
Cover with Display HMT360LD, Dwg no HM27168.B	15.02.1999
HMT360 Transmitter Body, Dwg no HM27175.B	15.02.1999
HMP360B Probe, Dwg no HM27178.A	27.08.1998

HMT360 Series Transmitters for Hazardous Areas, User's Guide

**4. VALIDITY**

The Certificate is valid until 30.06.2003 concerning the manufacture and the sale of the apparatus.

Espoo, 11.03.1999

VTT AUTOMATION  
Electrotechnical Testing

Martti Siirola  
Research scientist

Paul Lindström  
Senior research scientist

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1. **CERTIFICATE OF CONFORMITY**



2. Certificate reference: VTT No. Ex-99.E.006X

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**A humidity and temperature transmitter with LonWorks**

Certified type: **HMT360 series**

4. Manufactured by: **VAISALA Oyj, FINLAND**

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7. The code for the electrical apparatus is:

**EEx ia IIC T4**  
-20 °C T<sub>amb</sub> +60 °C

8. By marking the supplied electrical apparatus, the manufacturer attests on his own responsibility that this electrical apparatus complies with the descriptive documents referred to in the Annex to this Certificate and has satisfied routine verifications and tests required in the harmonized European Standards referred to in point 6 above.
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**The humidity and temperature transmitter with LonWorks, type HMT360 series****1. CERTIFICATE NUMBER**

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VTT No. Ex-99.E.006X

has been given to the test specimen. The sign X in the Certificate number means the allowed ambient temperature range is  $-20^{\circ}\text{C} \dots +60^{\circ}\text{C}$ . The device is meant to be earthed and there are surge arresters between the input lines and earth, so the electric strength between the frame and intrinsically safe circuit is less than 500 voltage.

**2. TECHNICAL DATA**

The HMT360 series transmitters are two-wire transmitters with microprocessors for measuring relative humidity and temperature. The transmitters may be equipped with a local display and the transmitter has LonWorks module for communicating. The LonWorks module is MTL IST-78 LonWorks transceiver and it is EEx ia IIC T4 approved by BASEEFA Certificate BAS Ex95D2464U. The HMT360 series transmitter has various options for transmitter units, sensor heads and cable lengths. The available probe types are HMP361, HMP363, HMP364, HMP365 and HMP368. The maximum operating temperature for probe type HMP361 is  $60^{\circ}\text{C}$ , for probe type HMP363 is  $120^{\circ}\text{C}$  and  $180^{\circ}\text{C}$  for probe types HMP364, HMP365 and HMP368.

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The maximum input values of the transmitter type HMT360 series with LonWorks module are:

$$\begin{array}{lll} U_i = 24 \text{ V} & I_i = 225 \text{ mA} & P_i = 1,2 \text{ W} \\ C_i = 0 \text{ nF} & L_i = 22 \mu\text{H} & \end{array}$$

The transmitter is intended to be connected to the MTL 3054 communication isolator/repeater (ref BASEEFA No Ex95C2228) or other associated apparatus fulfilling the safety values.



**3. LIST OF DRAWINGS AND DOCUMENTS**

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Circuit diagram, Dwg no HM37149.C	05.02.1999
Component layout, Dwg no HM37150.B, 2 pages	02.07.1998
Product Structure, HM360CPU, 8 pages	11.02.1999
HM360LON, LonWorks Module	
Circuit diagram, Dwg no HM47156.C	25.02.1999
Component layout, Dwg no HM47157.B, 2 pages	02.07.1998
Product Structure, HM360LON, 3 pages	26.02.1999
HM360CON, Connection Board	
Circuit diagram, Dwg no HM47142.B	02.07.1999
Component layout, Dwg no HM47155.C	02.07.1998
Product Structure, HM360CON, 2 pages	11.02.1999
<b>Assembly</b>	
Standard Cover HMT360LS, Dwg no HM27170.B	15.02.1999
Cover with Display HMT360LD, Dwg no HM27168.B	15.02.1999
HMT360 Transmitter Body, Dwg no HM27175.B	15.02.1999
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