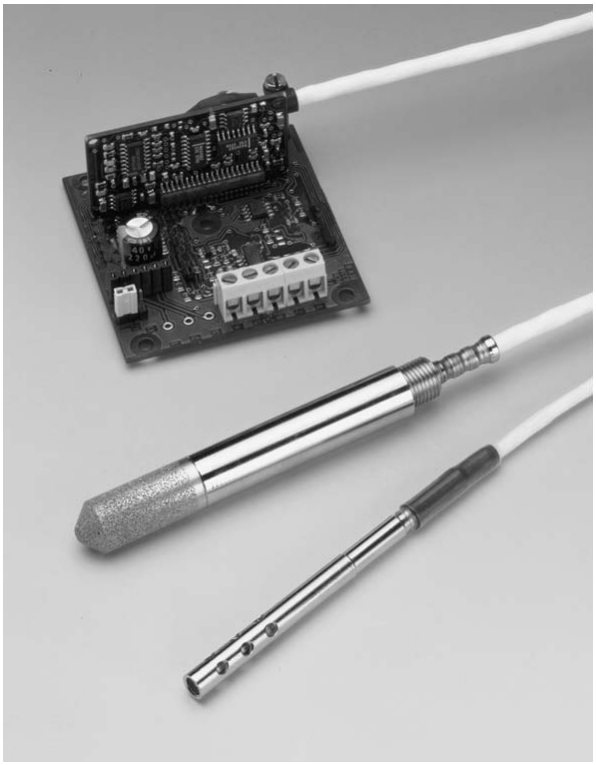
VAISALA

USER'S GUIDE

Vaisala HUMICAP® Humidity and Temperature Module HMM213



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CHAPTER 1 GENERAL INFORMATION

Safety

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

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.

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.

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

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 circumstances exceed the invoice price of any Product for which a warranty claim is made, nor shall Vaisala in any circumstances be liable for lost profits or other consequential loss whether direct or indirect or for special damages.

CHAPTER 2 PRODUCT DESCRIPTION

The HMM213 modules are designed especially for relative humidity measurements in environmental chamber applications with high temperature and humidity levels. They also measure temperature and calculate the dewpoint temperature.

The HMM213 has actually three different module options to choose from:

- HUMIDITY AND TEMPERATURE MODULE:

  with a standard humidity and temperature sensor head

- DEWPOINT MODULE:

  with a warmed sensor head incorporating a composite RH and T sensor

- HUMIDITY AND TEMPERATURE MODULE WITH TWO SENSOR HEADS:

  with a warmed humidity sensor head incorporating a composite sensor, and an additional temperature sensor head for ambient temperature measurement

The HMM213 is a RS232 serial output module. The customer has two options for the humidity probe length. Furthermore, the module can also be ordered with a suitable cable length (0.65 m, 1.50 m or 3.0 m). The temperature measurement range is -70...+180 °C).

Output parameters depend on the module type. The output parameters for the RH and T module are relative humidity and temperature. For the RH and T module with two sensor heads, the parameters are also relative humidity and temperature and for the dewpoint module, the parameter is dewpoint temperature. The dewpoint temperature range is -70...+100 °C.

The probes also have a selectable re-gaining option. Note that with a warmed sensor head, the probe length is always 90 mm and the sensor is protected with a sintered filter.

The HMM213 modules are connected to process control systems with screw terminals. These versatile modules incorporate the HUMICAP®180 humidity sensor, which uses an operating principle based on changes in the capacitance of a thin polymer film as it absorbs water molecules. The HMM213 modules measure temperature with the reliable Pt 100 sensor. If the module is ordered with re-gaining option, it incorporates a composite sensor.

CHAPTER 3 TO BE NOTED WHEN MEASURING HUMIDITY

In the measurement of relative humidity and especially in calibration, it is essential the temperature equilibrium to be reached. Even a slight difference in the temperature between the measured object and the sensor causes an error. For example, at +20 °C (+ 68 °F) and 50 %RH, a temperature difference of ±1 °C between the measured object and the sensor causes an error of ±3 %RH. If relative humidity is 90 %RH, the error is about ±5.4 %RH.

The error is at its greatest when the temperature of the sensor differs from that of the surroundings and the humidity is high. A few degrees' difference in temperature may cause water to condense on sensor surface. Efficient ventilation accelerates the evaporation of the condensed water whereas in an unventilated space, it may take hours. The HUMICAP®180 sensor returns to its normal functioning as soon as water has evaporated. Contaminated water condensing on the sensor may shorten its life span and change the calibration.

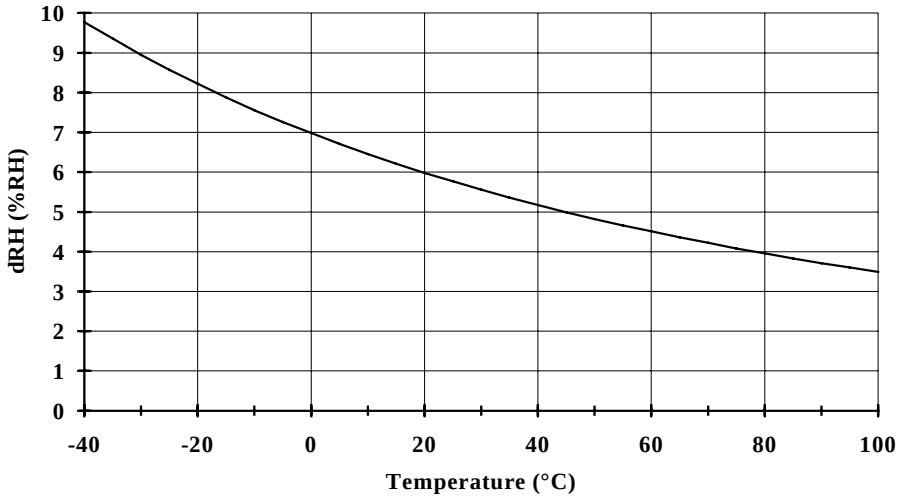


FIGURE 3-1 Measurement error at 100%RH when the temperature difference between the ambient air and the sensor is 1°C

NOTE	With a dewpoint module, the temperature equilibrium is not a problem as the temperature of the sensor head changes continuously and the sensor head has a fast humidity response.

CHAPTER 4 INSTALLATION

Selecting the place of installation

Select a place that gives a true picture of the environment or process and is as clean as possible. Air should flow freely around the sensor head.

Install the sensor head to a sufficient distance from the duct or chamber walls. Make sure to insert enough cable to the same space with the probe in order to prevent heat conduction. If an additional temperature probe is used, install it so that the warmed sensor head does not interfere with the measurement.

Electrical connections

The HMM213 module is connected to a process control system with screw terminals. The wiring diagram is shown in **FIGURE 4-1**.

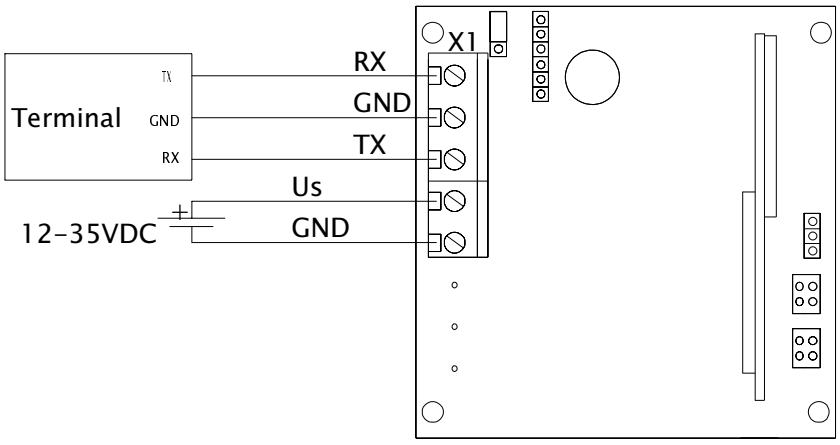


FIGURE 4-1 Electrical connections

Dimensions

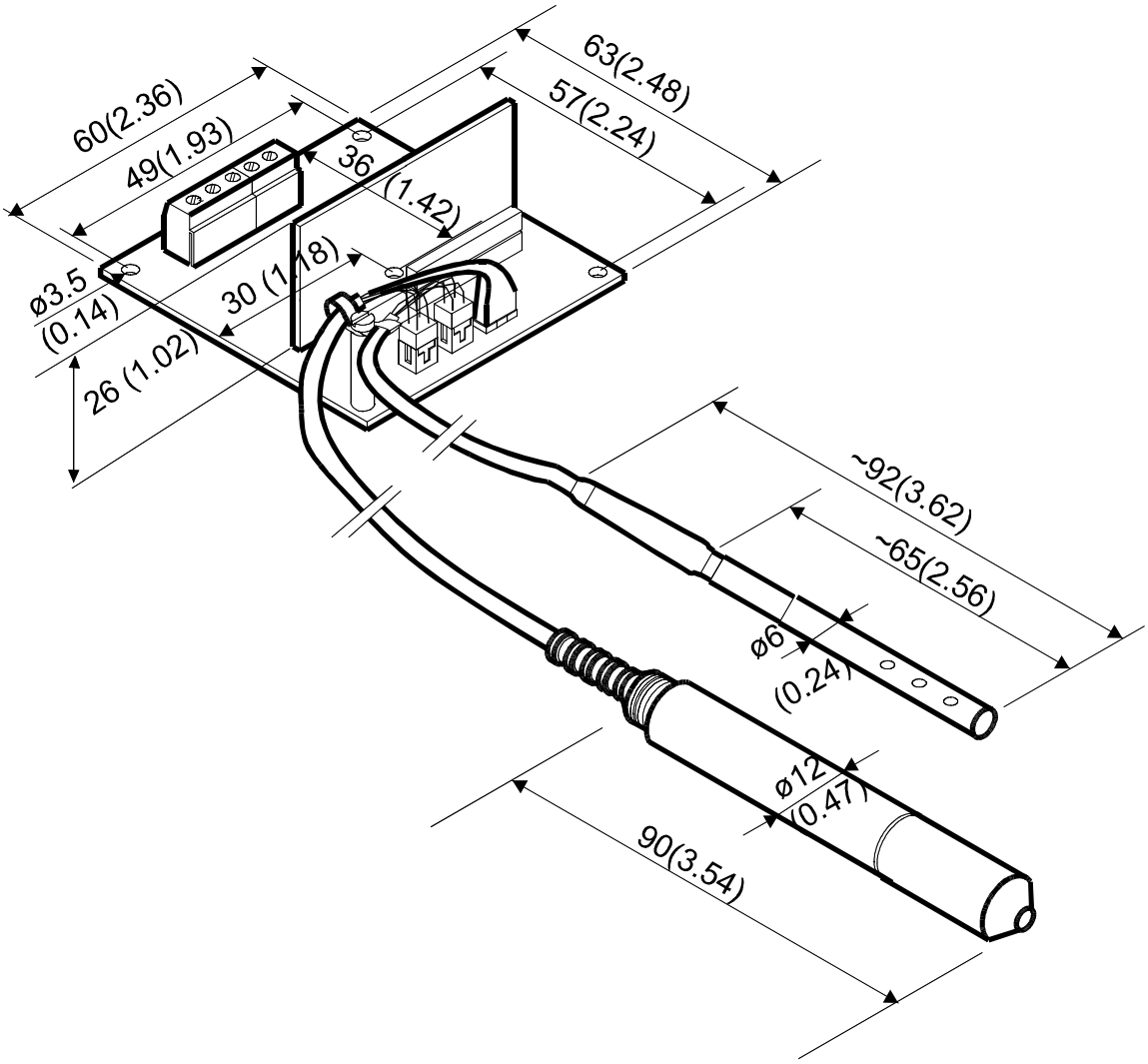


FIGURE 4-2 Dimensions in mm (inches)

Serial bus settings

The serial communication parameters set at factory are:

Baud	1200
Parity	none
Data bits	8
Stop bits	1

CHAPTER 5 SERIAL COMMANDS

Output via the serial bus

R Starting the measurement output

R <cr>

Starts output of measurements to the peripheral devices (PC display or printer); output interval is set with command INTV.

The output format depends on the transmitter configuration and parameters in use. The order, however, is always the same: relative humidity, temperature and dewpoint. An example:

```
RH 43.0 %RH T 21.0 'C Tdp 8.0 'C <cr><lf>
```

When the transmitter sends out the readings, the serial interface does not echo any commands; the only command that can be used is S (stop).

S Stopping the measurement output

S<cr>

Ends the RUN state; after this command all other commands can be used.

SEND Outputting a reading once

SEND <cr> in STOP state

or

SEND aa <cr> in POLL state

aa = address of the transmitter when more than one transmitter is connected to a serial bus (0...99; set with command ADDR)

Outputs the current measurement readings via the serial line. The output format depends on which parameters the transmitter can output. Output types are:

```
"RH 32.25 %RH T 25.74 'C ",<cr><lf>
"Td 7.93 'C",<cr><lf>
```

INTV Setting the output interval for the RUN state

INTV xxx yyy <cr>

xxx	=	output interval (0...255) 0: no pause between outputs
yyy	=	unit (s, min or h)

Sets the output interval when the transmitter outputs measurement readings to a peripheral device.

For example:

```
>INTV 10 MIN<cr>
Output intrv. :  10 min
```

SERI Serial bus settings

SERI b p d s <cr>

b = bauds (150, 300, 600, 1200*, 2400, 4800)
p = parity (n = none*, e = even, o = odd)
d = data bits (7 or 8*)
s = stop bits (1* or 2)
* factory setting

Giving the plain command outputs the current settings:

```
>SERI <cr>
Communication parameters       : 1200 N 8 1
>
```

Example of changing the serial bus settings:

```
>seri 1200 e 7 1
Communication parameters       : 1200 E 7 1
Set terminal settings accordingly
>
```

ADDR Setting the device address

ADDR x

x = 0...99

The command is used to give an address for one device. The address is necessary for communication with a specific transmitter in POLL mode, when there are several modules connected to one serial bus

```
>ADDR 11
Address                        :     11
>
```

UNIT Selecting the output units

UNIT x <cr>

x = **m**(etric units) or **n**(on-metric units)

	metric units	non-metric units
RH	%RH	%RH
T	°C	°F
Td	°C	°F

For example, the command for setting the non-metric units is:

```
>UNIT N <cr>
Unit                           : non metric
>
```

When the command is given with no parameters, the transmitter outputs the currently valid setting.

VERS Displaying software version

VERS

```
>VERS
HMM213  1.03
>
```

RESET Resetting the transmitter

RESET <cr>

Resets the transmitter. All settings that have been changed stay in the memory even after reset or power failure.

Operating via the serial bus

SMODE Setting the serial interface

SMODE xxxx<cr>

xxxx =	STOP, RUN or POLL
In STOP mode:	measurements output only by command, all commands can be used
In RUN mode:	outputting automatically, only command S can be used
In POLL mode:	measurements output only with command SEND. When in POLL mode, the output state is changed as follows:

OPEN aa <cr>
SMODE xxxx<cr>

aa =	address of the transmitter
xxxx =	STOP, RUN or POLL

The OPEN command sets the bus temporarily in STOP MODE so that the SMODE command can be given. For example:

```
>SMODE <cr>                    (which mode is in use at the moment)
Output mode                       : STOP
>SMODE STOP <cr>                  (setting STOP mode)
Output mode                       : STOP
>
```

OPEN & CLOSE

OPEN nn <cr>

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

CLOSE <cr>

In STOP mode:	command OPEN has no effect, CLOSE sets the transmitter in POLL mode
In POLL mode:	command OPEN sets the transmitter temporarily in STOP mode, command CLOSE returns the instrument to POLL mode

When more than one transmitter is connected to the same serial bus, the POLL mode makes it possible to communicate with the transmitters. For example, a relative humidity calibration is performed at transmitter 2 (<bel> = ASCII 7):

```
>OPEN 2 <cr>
<cr><lf> 'HMM nn line opened for operator commands'
<cr><lf><bel>
>CRH <cr>
...
>CLOSE <cr>
<cr><lf><lf> 'line closed' <cr><lf>
```

Setting the output format

MCR Setting the carriage return on/off

MCR x

x = ON/OFF

```
>MCR ON
Msg. cr                         : ON
>
```

MDEC Selecting a decimal separator

MDEC x

x = a character, TAB, SP, CR, LF

```
>MDEC .
dec. separator                  : .
>R
RH 60.50 %RH    T 23.90 'C
RH 60.50 %RH    T 23.90 'C
...
>MDEC Z
dec. separator                  : Z
>R
RH 60Z56 %RH    T 23Z89 'C
RH 60Z56 %RH    T 23Z90 'C
...
>
```

MFLD Selecting a field separator

MFLD x

x = a character, TAB, SP, CR, LF

```
>MFLD SP
fld. separator                  : SP
>R
RH 60.53 %RH T 23.89 'C
RH 60.52 %RH T 23.89 'C
...
```

```
>MFLD TAB
fld. separator                  : TAB
>R
RH 60.58 %RH    T 23.89 'C
RH 60.57 %RH    T 23.89 'C
...
```

MLF Setting the line feed on/off

MLF x

x = ON/OFF

```
>MLF OFF
Msg. lf                         : OFF
>R
>RH 60.78 %RH    T 23.84 'C  (repeating values)

>MLF ON
Msg. lf                         : ON
>R
RH 60.85 %RH    T 23.86 'C
RH 60.80 %RH    T 23.86 'C
...
```

MSPC Setting spaces on/off

MSPC x

x = ON/OFF

MSPC sets on/off the outputting of a space before and after the values of the message.

```
>MSPC OFF
Msg. space                      : OFF
>R
RH57.52%RH      T73.81'F
RH57.50%RH      T73.77'F
RH57.44%RH      T73.76'F
>MSPC ON
Msg. space                      : ON
>R
RH 57.55 %RH    T 73.78 'F
RH 57.55 %RH    T 73.78 'F
RH 57.48 %RH    T 73.82 'F
>
```

MSYMB Setting variable symbols on/off

MSYMB x

x = ON/OFF

```
>MSYMB ON
Msg. symbol                    : ON
>R
RH 60.86 %RH    T 23.87 'C
RH 60.86 %RH    T 23.87 'C
...
>MSYMB OFF
Msg. symbol                    : OFF
>R
60.91 %RH       23.87 'C
60.84 %RH       23.87 'C
...
```

MUNIT Setting variable units on/off

MUNIT x

x = ON/OFF

```
>MUNIT ON
Msg. unit                      : ON
>R
RH 61.01 %RH    T 23.85 'C
RH 60.99 %RH    T 23.85 'C
...
>MUNIT OFF
Msg. unit                      : OFF
>R
RH 60.97        T 23.84
RH 60.98        T 23.87
...
>
```

CHAPTER 6 CALIBRATION

We recommend a re-calibration of the HMM213 module after six months' use. After the first re-calibration, the calibration interval should be approximately 12 months. However, please note that these intervals depend on the operating conditions and the required accuracy. When calibrating humidity instruments, it is important that the probe, the reference instrument and the calibrator are in thermal equilibrium. Therefore, always allow enough time for stabilization before starting the actual calibration.

- **CALIBRATION IN THE CHAMBER:** leave the calibrator (e.g. the HMK15) in the chamber overnight with the chamber door open.
- **CALIBRATION OF A HUMIDITY AND TEMPERATURE MODULE:** allow at least one hour for the stabilization of the calibrator (e.g. HMI41 with a reference probe).
- **CALIBRATION OF A DEWPOINT MODULE OR OF A HUMIDITY AND TEMPERATURE MODULE WITH TWO SENSOR HEADS:** allow at least 3 hours for stabilization if the sensor head is in such an environment that the warming function has been active.
- **CALIBRATION OF A MODULE WITH RE-GAINING OPTION:** re-gaining is activated when the power is connected. When calibrating a probe, turn the power on with the sintered stainless steel filter on the probe, wait for 10 minutes and remove the filter. Let stabilize and perform a calibration. **NOTE: do not turn the power off during calibration.**

NOTE When calibrating a module with the **warmed sensor head**, deactivate first the heating by using command **HEAT 0 <cr>**. If the sensor head is in such an environment that the warming function has been active, allow at least 3 hours for stabilization. After calibration, the heating is reactivated with command **HEAT 1 <cr>**.

Humidity calibration

A one-point calibration can be done against an accurate transfer standard in the field and a two-point calibration using saturated salt solutions in controlled conditions (HMK15 or HMK13B). You can also send the instrument to Vaisala or a Vaisala representative for re-calibration.

Humidity calibration with serial commands

Two-point calibration

CRH <cr>

With this command, the transmitters can be calibrated at two humidity points against a reference.

An example of performing the two point calibration with the HMK15:

1. Leave the calibrator and the probe for at least 1 hour in the same space so that their temperatures have time to equalize.

2. Remove the sintered filter and insert the probe into the measurement hole of the LiCl salt chamber in the humidity calibrator.

3. Give the command CRH and the following text appears:

```
>CRH <cr>
RH  :  12.00   Ref1 ?
```

4. Wait for 20 - 40 minutes. If the stabilization of the sensor to the humidity in the calibrator needs to be monitored, the measurement output can be repeated by <cr> at Ref1 and Ref2

```
>CRH <cr>
RH  :  12.00Ref1 ? <cr>
RH  :  11.70Ref1 ? <cr>
RH  :  11.50Ref1 ? <cr>
...
```

5. Check the temperature and read the closest corresponding RH value in the calibration table. Give the value and acknowledge it with enter.

```
RH  :  12.00   Ref1 ?  11.3 <cr>
Press any key when ready ...
```

6. Insert the probe into the measurement hole of the NaCl chamber. Wait for 20 - 40 minutes.

7. Check the temperature and read the closest corresponding RH value in the calibration table. Give the value and acknowledge it with enter.

```
RH  :  76.00   Ref2 ?  75.5 <cr>
>
```

8. Check again the reading at the first point and repeat the procedure if necessary.

One point calibration

CRH xx.xx yy.yy

xx.xx = current humidity
yy.yy = offset calibration

Example of performing the offset calibration in one reference point:

```
>crh 54.63 2.3
>
```

Use an accurate and calibrated reference only.

Gain calibration

CRH 0 0 xx.xx yy.yy

xx.xx = current humidity

yy.yy = correction (RH_{ref}-$RH_{measured}$)

Example of performing the gain calibration in one reference point:

```
>crh 0 0 73.60 1.7
>
```

Use an accurate and calibrated reference only.

With the HMI41 indicator and calibration cable

The HMM213 module can be calibrated with the HMI41 indicator and an appropriate calibration cable. The cable is connected to the test connector of the HMM213 module; see detailed instructions in the manual delivered with the calibration cable.

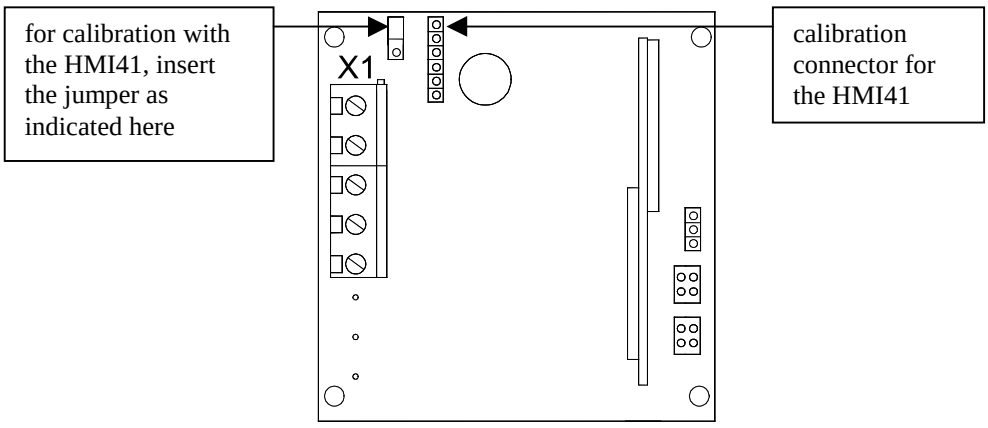


FIGURE 6-1 Calibration connector for the HMI41

NOTE The serial communication parameters are:

1200 bauds, no parity, 8 data bits, 1 stop bit

NOTE When the connection is being established, the message 'CON ERROR' blinks on the HMI41 display for a couple of times after which measurement readings appear. This is quite normal and requires no action; however, if the message is not replaced by measurement readings, it is an indication of an operation error.

Calibration table

TABLE 6-1 Greenspan's calibration table with output values according to the chosen scale

Temperature	°C	15	20	25	30	35
	°F	59	68	77	86	95
LiCl	%RH	*)	11.3	11.3	11.3	11.3
NaCl	%RH	75.6	75.5	75.3	75.1	74.9

*) If the LiCl solution is used or stored in temperatures below +18 °C (+64 °F),the equilibrium humidity of the salt solution may change permanently

Temperature calibration

NOTE The temperature channel of the HMM213 is very stable and the modules have been calibrated at the factory. Unless there is a strong reason to believe that the adjustments have changed, DO NOT perform a temperature calibration. This is a very demanding procedure and requires both expertise and extremely accurate references. Furthermore, it is important to allow enough time for the stabilization during calibration.

If for some reason it is necessary to perform the temperature calibration, follow attentively the instructions given below. Use an accurate and calibrated reference only.

CT Temperature calibration of the warmed humidity sensor head

Two point calibration

CT <cr>

Using this command the transmitters can be calibrated against an accurate reference, such as a Pt 100 simulator. A two-point calibration is performed as follows:

```
>CT <cr>
T  :  23.22   Ref1 ?    23.3 <cr>
Press any key when ready ...
T  :  101.42  Ref2 ?    101 <cr>
```

If the stabilization of the sensor to the temperature of the reference needs to be monitored, the measurement output can be repeated with <cr> at Ref1 and Ref2:

```
>CTA <cr>
T  :  23.19   Ref1 ?     <cr>
T  :  23.20   Ref1 ?     <cr>
.
.
.
T  :  23.22   Ref1 ?    23.3 <cr>
Press any key when ready ...
T  :  101.42  Ref2 ?    101 <cr>
```

One point calibration

CT xx.xx yy.yy

xx.xx = current temperature

yy.yy = offset correction

Example of performing the offset calibration in one reference temperature:

```
>CT 21.2 2.3
>
```

Use an accurate and calibrated reference only.

Gain calibration

CT xx 0 yy.yy zz.zz

xx = temperature in which there is no changes in offset

yy.yy = current temperature

zz.zz = correction (T_{ref}-$T_{measured}$)

Example of performing the gain calibration in one reference point without changing the offset at 0 °C:

```
>CT 0 0 101 -0.5
>
```

Example of performing the gain calibration in one reference point without changing the offset at -70 °C:

```
>CT -70 0 101 -0.5
>
```

Use an accurate and calibrated reference only.

CT Temperature calibration of the additional sensor head

Two point calibration

CTA <cr>

Using this command the transmitters can be calibrated against an accurate reference, such as a Pt 100 simulator. A two-point calibration is performed as follows:

```
>CTA <cr>
T  :  23.19   Ref1 ?   23.3 <cr>
Press any key when ready ...
T  :  101.42  Ref2 ?   101 <cr>
```

If the stabilization of the sensor to the temperature of the reference needs to be monitored, the measurement output can be repeated with <cr> at Ref1 and Ref2:

```
>CTA <cr>
T  :  23.19   Ref1 ?    <cr>
T  :  23.20   Ref1 ?    <cr>
.
.
.
T  :  23.22   Ref1 ?   23.3 <cr>
Press any key when ready ...
T  :  101.42  Ref2 ?   101 <cr>
```

One point calibration

CTA xx.xx yy.yy

xx.xx = current temperature

yy.yy = offset correction

Example of performing the offset calibration in one reference temperature:

```
>CTA 21.2 2.3
>
```

Use an accurate and calibrated reference only.

Gain calibration

CTA xx 0 yy.yy zz.zz

xx = temperature in which there is no changes in offset

yy.yy = current temperature

zz.zz = correction (T_{ref}-$T_{measured}$)

Example of performing the gain calibration in one reference point without changing the offset at 0 °C:

```
>CTA 0 0 101 -0.5
>
```

Example of performing the gain calibration in one reference point without changing the offset at -70 °C:

```
>CTA -70 0 101 -0.5
>
```

Use an accurate and calibrated reference only.

CHAPTER 7 RE-GAINING OPTION

Re-gaining

In some applications, the sensor gain may decrease gradually due to interference caused by some chemical present in the ambient air (see **FIGURE 7-1**). The sensor polymer absorbs the interfering chemical; this reduces its water absorption ability and so decreases the sensor gain. In re-gaining the interfering chemical is evaporated by heating the humidity sensor to a temperature level of approximately +160°C. Automatic re-gaining takes place at power on.

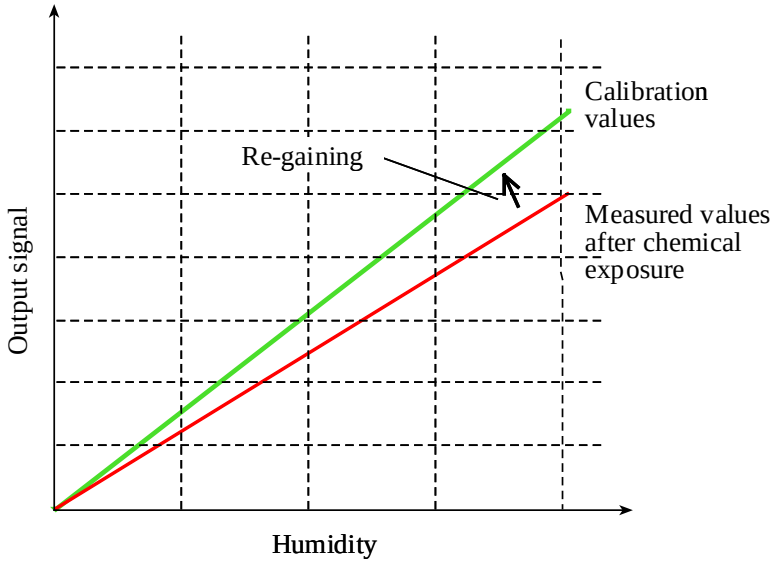


FIGURE 7-1 Decrease of the sensor gain due to an interfering chemical and the effect of the re-gaining process

The re-gainable sensor is a composite sensor in which the HUMICAP® and Pt 100 temperature sensors are attached to each other. The re-gain option requires that the sensor is protected with a stainless steel sintered filter (part no. HM46670).

CHAPTER 8 MAINTENANCE

Replacing the HUMICAP®180 sensor and the filter

Remove the damaged sensor and insert a new one. Handle the sensor by the plastic socket. DO NOT TOUCH THE SENSOR ELEMENT. Recalibrate the transmitter.

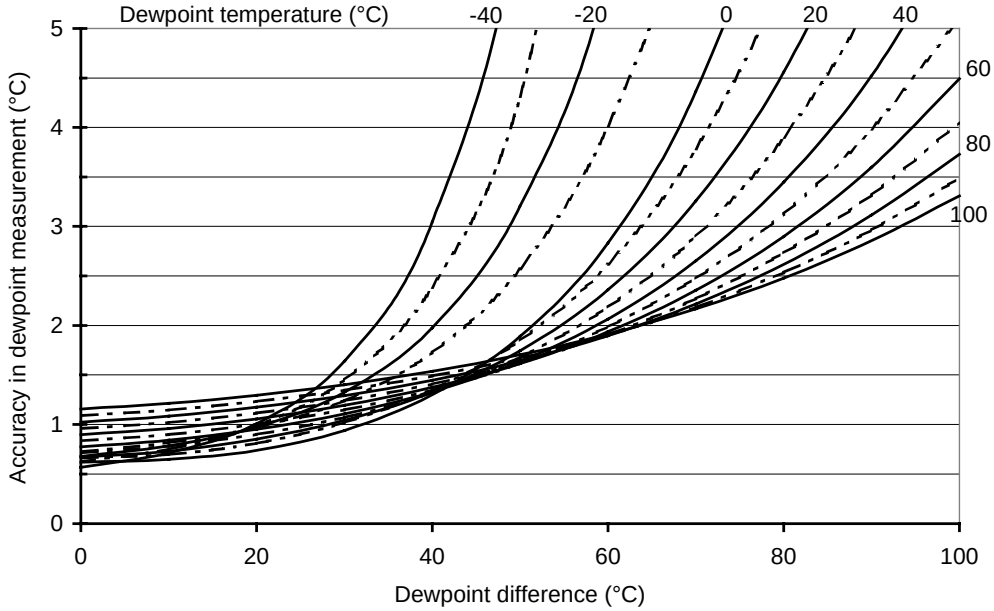
Replace a dirty filter to ensure a maximum lifetime and a fast response for the sensor.

CHAPTER 9 TECHNICAL DATA

Relative humidity

Measurement range	0...100%RH
Accuracy	
against salt solutions	±2%RH (0…90%RH)
(ASTM E104-85)	±3%RH (90…100%RH)
achievable accuracy when calibrated against high quality humidity standards	±2%RH (0...100%RH)
Response time (90%) at +20°C in still air (with sintered filter)	15 s
Typical temperature dependence of electronics	0.02%RH/°C
Humidity sensor	HUMICAP®180
Temperature measurement range	-70...+180°C
Typical accuracy of electronics at +20°C (+68 °F)	±0.1°C
Typical temperature dependence of electronics	0.0025°C/°C
Temperature sensor	Pt 100 RTD 1/3 IEC 751 Class B

Dewpoint temperature



General

Operating temperature range	
probe	-70…+180°C
electronics	-5…+55°C
Storage temperature range (electronics)	-40…+70°C
Sensor protection:	
standard	stainless steel sintered filter
Connections	screw terminals for 0.5...1.5 mm^2 wires

Power supply

	DC	AC
Operating voltage	10 - 35 V	9 - 24 V

AC SUPPLY POSSIBLE ONLY WITHOUT WARMING OR RE-GAINING OPTION.

Current consumption without warming or re-gaining option - voltage output	12 mA at 35 VDC 20 mA at 24 VAC
Average power needed during warming (option)	1 W (100-300 mA modulated current)
Maximum power needed during re-gaining (option)	1.4 W (100-300 mA modulated current)

Options

module	sensor heads	output
RH and T module	one sensor head	RH and T output
dewpoint module	warmed humidity sensor head	dewpoint output
RH and T module with two sensor heads	warmed humidity sensor head	RH and T output

sensor head	cable length
humidity sensor head	65, 150, 300 cm
optional T sensor head/ module with two sensor heads	150 or 300 cm

module	re-gaining
RH and T module	Automatic re-gaining takes place at power-up
dewpoint module	
RH and T module with two sensor heads	

Electromagnetic compatibility

The emission and immunity tests have been performed according to standards EN50081-1 and EN50082-1.

Emissions

Test	Setup according to
RF field emission	CISPR 22 Class B (EN55022)

Immunity

Test	Setup according to
Electrostatic discharge	IEC 1000-4-2 (EN 61000-4-2)
Fast transient burst	IEC 1000-4-4 (EN 61000-4-4)
RF field immunity	IEC 1000-4-3 (EN 61000-4-3)
* GSM-field immunity (*additional test)	ENV 50204:1995
Conducted RF immunity NOTE: cable length max. 8 meters	IEC 1000-4-6 (EN 61000-4-6)

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