VAISALA

USER'S GUIDE

Vaisala HUMICAP® Humidity and Temperature Module HMM212

Table of Contents

List of Figures

List of Tables

CHAPTER 1
GENERAL INFORMATION

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

About This Manual

This manual provides information for installing, operating, and maintaining Vaisala HUMICAP® Humidity and Temperature Module HMM212.

Contents of This Manual

This manual consists of the following chapters:

- Chapter 1, General Information, provides general notes for the manual and the product.
- Chapter 2, Product Overview, introduces the features and advantages of the Vaisala HUMICAP® Humidity and Temperature Module HMM212.
- Chapter 3, To Be Noted When Measuring Humidity, describes issues that need to be noted in the measurement of humidity.
- Chapter 4, Installation, provides you with information that is intended to help you install this product.
- Chapter 5, Calibration, contains information that is needed to calibrate this product.
- Chapter 6, Maintenance, provides information that is needed in basic maintenance of the product.
- Chapter 7, Troubleshooting, describes common problems, their probable causes and remedies, and contact information for technical support.

Version Information

Table 1   Manual Revisions

Manual Code	Description
U338EN-1.1	June 1999
U338EN-1.2	This manual, December 2009 - HUMICAP® sensor type has been changed.

Related Manuals

Table 2   Related Manuals

Manual Code	Manual Name
M210316EN-A	Vaisala HUMICAP® Indicator HMI41 and Probes HMP41/45/46 User's Guide
M210777EN-B	Calibration of Digital Transmitters with Vaisala HUMICAP® Humidity Indicator HMI41 Cables 19164ZZ and 25917ZZ User's Guide
M210185EN-C	Vaisala Humidity Calibrator HMK15 User's Guide

General Safety Considerations

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

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

CAUTION	Caution warns you of a potential hazard. If you do not read and follow instructions carefully at this point, the product could be damaged or important data could be lost.

NOTE	Note highlights important information on using the product.

Feedback

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

Product Related Safety Precautions

The Vaisala HUMICAP® Humidity and Temperature Module HMM212 delivered to you has been tested for safety and approved as shipped from the factory. Note the following precautions:

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

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

CAUTION	Do not touch the sensor element.

ESD Protection

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

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

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

- Always hold the boards by the edges and avoid touching the component contacts.

Recycling

♻	Recycle all applicable material.

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

Regulatory Compliances

The Vaisala HUMICAP® Humidity and Temperature Module HMM212 complies with the following performance and environmental test standards:

The emission and immunity tests have been performed according to standard EN61326-1.

Table 3   Emission Tests

Test	Setup According to
RF field emission	CISPR 22 Class B (EN55022)
Conducted emissions	CISPR 22 B (EN55022)

Table 4   Immunity Tests

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)
Conducted RF immunity NOTE: cable length max. 8 meters	IEC 1000-4-6 (EN 61000-4-6)
Surge	IEC 1000-4-5 (EN 61000-4-5)
Voltage dips, short interrupts	IEC 1000-4-11 (EN 61000-4-11)

Patent Notice

The Vaisala HUMICAP® Humidity and Temperature Module HMM212 is protected by the following patents and patent applications and their corresponding national rights:

Finnish patent 98861, French patent 6650303, German patent 69418174, Japanese patent 3585973, UK patent 0665303, and US patent 5607564.

Trademarks

Vaisala Trademark is a registered trademark of Vaisala Oyj.

HUMICAP® is a registered trademark of Vaisala Oyj.

Warranty

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

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

This warranty is however subject to following conditions:

a)   A substantiated written claim as to any alleged defects shall have been received by Vaisala within thirty (30) days after the defect or fault became known or occurred, and

b)   the allegedly defective Product or part shall, should Vaisala so require, be sent to the works of Vaisala or to such other place as Vaisala may indicate in writing, freight and insurance prepaid and properly packed and labelled, unless Vaisala agrees to inspect and repair the Product or replace it on site.

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

a)   normal wear and tear or accident;

b)   misuse or other unsuitable or unauthorized use of the Product or negligence or error in storing, maintaining or in handling the Product or any equipment thereof;

c)   wrong installation or assembly or failure to service the Product or otherwise follow Vaisala's service instructions including any repairs or installation or assembly or service made by unauthorized personnel not approved by Vaisala or replacements with parts not manufactured or supplied by Vaisala;

d)   modifications or changes of the Product as well as any adding to it without Vaisala's prior authorization;

e)   other factors depending on the Customer or a third party.

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

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

CHAPTER 2
PRODUCT OVERVIEW

This chapter introduces the features and advantages of the Vaisala HUMICAP® Humidity and Temperature Module HMM212.

Introduction to HMM212

The HMM212 modules are designed especially for relative humidity measurements in environmental chamber applications with high temperature and humidity levels.

The HMM212 module is a microprocessor-based instrument with temperature compensation in RH measurements. The module includes separate 4 ... 20 mA loop powered RH and T channels. The humidity probe length is an order-specified option. Furthermore, the customer can also order the module with:

- a suitable cable length (0.65 m, 1.50 m or 3.0 m)
- a temperature loop current scaled for that particular application (0 ... 100 °C, -20 ... +120 °C, -20 ... +180 °C, -40 ... +180 °C or -70 ... +180 °C)

The HMM212 modules are connected to process control systems with screw terminals. These versatile modules incorporate the HUMICAP®180R humidity sensor, which uses an operating principle based on changes in the capacitance of a thin polymer film as it absorbs water molecules. The HMM212 modules measure temperature with the reliable Pt 1000 sensor.

This page intentionally left blank.

CHAPTER 3

TO BE NOTED WHEN MEASURING HUMIDITY

This chapter describes issues that need to be noted in the measurement of humidity.

In the measurement of relative humidity and especially in calibration, it is essential that the temperature equilibrium is 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. A graph of the measurement error at 100 %RH when the temperature difference between ambient air and the sensor is 1 °C is presented in Figure 1 on page 16.

The error is at its greatest when the temperature of the sensor differs from that of the surroundings and the humidity is high. A difference of a few degrees in temperature may cause water to condense on the sensor surface. Efficient ventilation accelerates the evaporation of the condensed water whereas in an unventilated space, it may take hours. The HUMICAP®180R sensor returns to its normal functioning as soon as water has evaporated. Contaminated water condensing on the sensor may shorten its life span and alter the calibration.
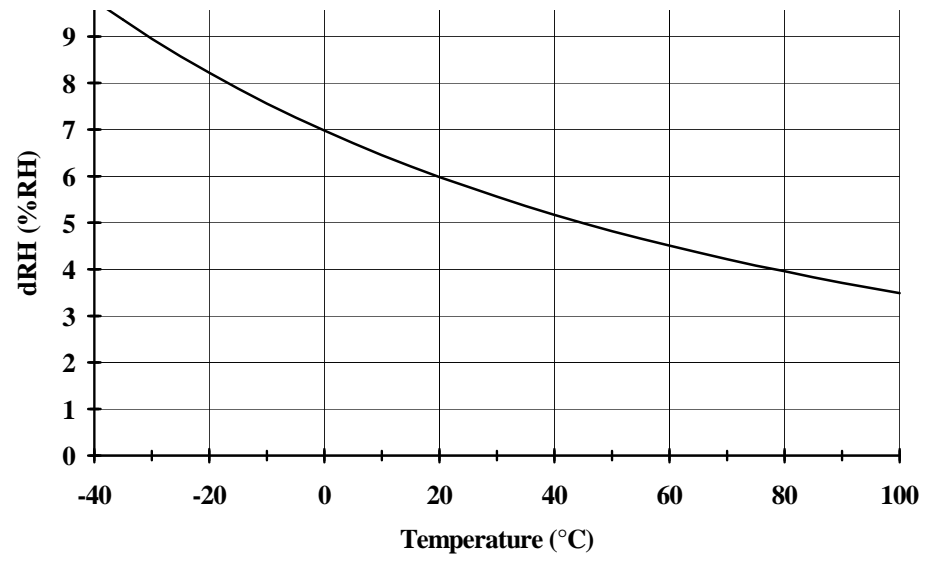
Figure 1   **Measurement Error at 100 %RH when the Temperature Difference between the Ambient Air and the Sensor is 1 °C**

CHAPTER 4
INSTALLATION

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

Selecting Location

Finding a suitable site for HMM212 is important for getting representative ambient measurements.

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.

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.

Dimensions
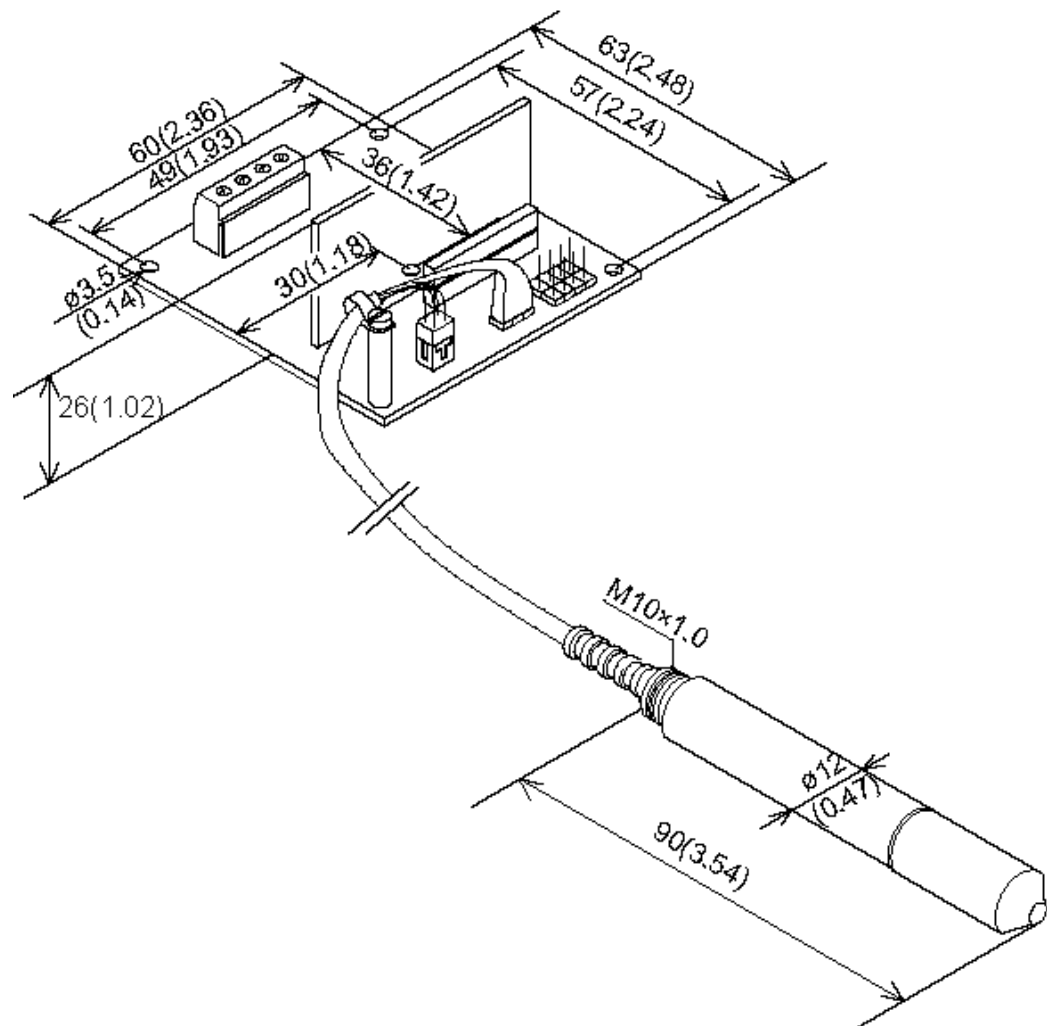
Figure 2   Dimensions in mm (inches)

Electrical Connections

Connect wires according to Figure 3 on page 19.

Figure 3   Electrical Connections of HMM212 Module

The following numbers refer to Figure 3 above:

1 = During normal use, leave the jumper as indicated here (factory setting).
2 = Calibration connector for the HMI41
3 = Calibration jumper when not in use

This page intentionally left blank.

CHAPTER 5
CALIBRATION

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

Vaisala recommends a recalibration of the HMM212 module after six months of use. After the first recalibration, the recommended calibration interval is 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 (for example, 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 (for example, HMI41 with a reference probe).

One-Point Humidity Calibration

With the HMI41 Indicator and Calibration Cable

You can calibrate the HMM212 module with the HMI41 indicator and an appropriate calibration cable (19164ZZ). Connect the cable to the test connector of the HMM212 module and insert the jumper as indicated in Figure 4 on page 22. For detailed instructions, see the following documents:

- Vaisala HUMICAP® Indicator HMI41 and Probes HMP41/45/46 User's Guide
- Calibration of Digital Transmitters with Vaisala HUMICAP® Humidity Indicator HMI41 Cables 19164ZZ and 25917ZZ User's Guide
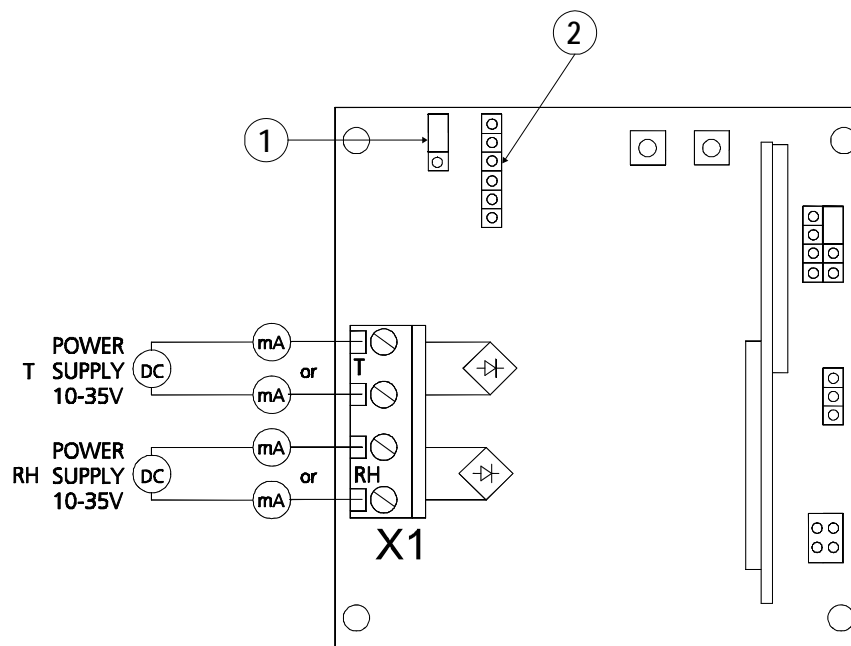
Figure 4   Calibration Connector for the HMI41

The following numbers refer to Figure 4 above:

1 = For calibration with the HMI41, insert the jumper as indicated here.

2 = 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.

NOTE	Do not interrupt the calibration procedure. In case of an interruption or a power failure, the normal mode is restored by completing the calibration or resetting the module. Reset the module by switching off the supply power of temperature channel.

| **NOTE** | During the calibration with HMI41, please note that temperature loop current is not within the scaling. |

With Pushbuttons and a Jumper

You can also perform the calibration with pushbuttons and a jumper on the component board (see Figure 5 on page 24). In addition, you need a digital multimeter (DMM). There are two push buttons (UP and DOWN) and four pairs of pins (RH offset, RH gain, T offset, and T gain), which are connected with the calibration jumper. Vaisala recommends using the RH offset pins if the RH is less than 65 %RH and the gain pins if the RH is greater than 65 %RH.

For example, to perform a one-point humidity calibration using saturated NaCl salt solution at 75.5 %RH as a reference, do as follows:

1. Insert the probe into a NaCl salt chamber and let stabilize.
2. Connect a DMM to the RH current loop and wait until the reading stabilizes.
3. Connect a jumper to the RH gain pins and adjust the DMM reading with buttons UP and DOWN until the loop current corresponds to 75.5 %RH.
4. Disconnect the jumper.

Two-Point Humidity Calibration

You can also perform a two-point calibration with saturated salt calibrators (for example HMK15), or you can send the instrument to Vaisala or a Vaisala representative for recalibration. Figure 6 on page 26 illustrates the difference between offset and gain calibrations.

Two-Point Humidity Calibration Procedure

1. Leave the calibrator and the probe for at least 1 hour in the same environment so that their temperatures have time to equalize. For information on more accurate stabilization times, see Chapter 4, Installation, on page 17.
2. Insert the probe into the measurement hole of the LiCl salt chamber in the humidity calibrator.
3. Wait for 20 to 40 minutes.
4. Check the temperature and read the closest corresponding RH value in the calibration table (Table 5 on page 25)

5. Connect the jumper to the RH offset pins (see Figure 5 below) and adjust the output signal with push buttons to the value given in the calibration table (Table 5 on page 25).

6. Insert the probe into the measurement hole of the NaCl chamber.

7. Wait for 20 to 40 minutes.

8. Check that the reading corresponds within the desired accuracy to the reading given in the calibration table. If not, connect the jumper to the RH gain pins and adjust the reading with push buttons.

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

UP

DOWN

T offset
RH gain (WET)
RH offset (DRY)
T gain
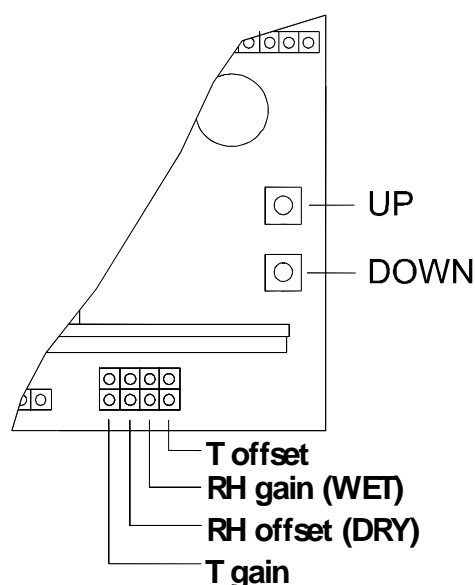
Figure 5   Calibration Pins and Pushbuttons

With the jumper connected to the RH gain pins, each pressing of the UP or DOWN button changes the value approximately 0.05 %RH at 75 %RH. With the jumper connected to the RH offset pins, each pressing changes the value approximately 0.05 %RH.

With the jumper connected to the T offset pins, each pressing of the UP or DOWN button changes the value 0.05 °C or 0.05 °F in all temperatures. With the jumper connected to the T gain pins, each pressing changes the value 0.05 °C or 0.05 °F in the temperature currently prevailing in the process.

Calibration Table

Table 5   **Greenspan's Calibration Table with Output Values According to the Chosen Scale**

Temperature °C °F LiCl	°C °F %RH	15 59 *)	20 68 11.3	25 77 11.3	30 86 11.3	35 95 11.3
4 ... 20 mA	mA		5.81	5.81	5.81	5.81
0 ... 20 mA	mA		2.26	2.26	2.26	2.26
0 ... 1 V	V		0.113	0.113	0.113	0.113
0 ... 5 V	V		0.565	0.565	0.565	0.565
0 ... 10 V	V		1.13	1.13	1.13	1.13

Temperature °C °F NaCl	°C °F %RH	15 59 75.6	20 68 75.5	25 77 75.3	30 86 75.1	35 95 74.9
4 ... 20 mA	mA	16.10	16.08	16.05	16.02	15.98
0 ... 20 mA	mA	15.12	15.10	15.06	15.02	14.98
0 ... 1 V	V	0.756	0.755	0.753	0.751	0.749
0 ... 5 V	V	3.780	3.775	3.765	3.755	3.745
0 ... 10 V	V	7.56	7.55	7.53	7.51	7.49

*)   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 HMM212 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.

Temperature Calibration of an RH and T Module

- Allow enough time for the instruments to stabilize to the temperature in which calibration is performed.
- Connect a DMM to the temperature current loop.
- Connect a jumper to the T offset or the T gain pins. Adjust the reading with UP and DOWN switches (see Figure 5 on page 24). Note that during gain adjustment, the offset point does not change:
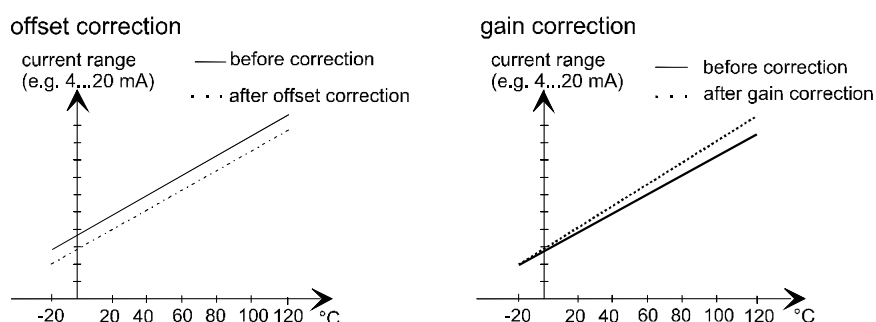

Figure 6   Offset and Gain Calibration Examples

NOTE	After having performed the calibration, disconnect the jumper.

CHAPTER 6
MAINTENANCE

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

Replacing the HUMICAP®180R Sensor and the Filter

Remove the damaged sensor and insert a new one. Handle the sensor by the plastic socket. Recalibrate the transmitter.

CAUTION	Do not touch the sensor element.

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

Replacing Consumables

This section describes how to replace consumables.

Parts List for Consumables

Table 6   Available Spare Parts

Spare Part	Order Code
HUMICAP®180R Sensor	HUMICAP180R
Stainless steel sintered filter	HM46670

This page intentionally left blank.

CHAPTER 7
TROUBLESHOOTING

This chapter describes common problems, their probable causes and remedies, and contact information for technical support.

Troubleshooting Procedure

When troubleshooting the product, write a problem report consisting of the following issues:

- What failed (what worked / did not work)?
- Where did it fail (location and environment)?
- When did it fail (date, immediately / after a while / periodically / randomly)?
- How many failed (only one defect / other same or similar defects / several failures in one unit)?
- What was connected to the product and to which connectors?
- Input power source type, voltage and list of other items (lighting, heaters, motors etc.) that were connected to the same power output.
- What was done when the failure was noticed?

Technical Support

For technical questions, contact the Vaisala technical support:

E-mail   helpdesk@vaisala.com

Fax   +358 9 8949 2790

Return Instructions

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

1. Read the section Warranty on page 11.
2. Contact a Vaisala Service Center or a local Vaisala representative. The latest contact information and instructions are available from www.vaisala.com. Addresses of the Service Centers are provided in section Vaisala Service Centers on page 31.

   Please have the following information on hand:

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

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

Vaisala Service Centers

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

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

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

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

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

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

www.vaisala.com

This page intentionally left blank.

CHAPTER 8
TECHNICAL DATA

This chapter provides the technical data of the product.

Specifications

Table 7   Relative Humidity Specifications

Property	Description / Value
Measurement range	0 ... 100 %RH
Accuracy (including non-linearity, hysteresis and repeatability)	±2 %RH (0 … 90 %RH) ±3 %RH (90 … 100 %RH)
Response time (90%) at +20 °C in still air (with sintered filter)	60 s
Typical temperature dependence of electronics	0.02 %RH/°C
Sensor	HUMICAP$^®$180R

Table 8   Temperature Specifications

Property	Description / Value
Measurement range	-70 ... +180 °C
Typical accuracy of electronics at +20 °C	±0.1 °C
Typical temperature dependence of electronics	0.0025 °C/°C
Sensor	Pt 1000 RTD 1/3 Class B IEC 751

Table 9   Analog Output Specifications

Property	Description / Value
Two analog outputs	4 ... 20 mA Ch1: RH Ch2: T
Typical accuracy	±0.1 %FS
Resolution	Ch1: 0.025 %RH Ch2: 0.01 %FS
Typical temperature dependence	0.005 %FS/°C

Table 10   General Specifications

Property	Description / Value
Operating temperature range Probe Electronics	 -70 … +180 °C -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

Table 11   Power Supply Specifications

Property	Description / Value
Operating voltage	10 ... 35 VDC

www.vaisala.com