

## CHAPTER 5

# MAINTENANCE

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

## Periodic Maintenance

### Cleaning

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

### Changing the Probe Filter

In the course of time the probe filter will be contaminated with matter that you cannot remove by cleaning. When this happens, the HMP155 response time becomes longer and measurement accuracy decreases. You need to replace the probe filter with a new one:

1. Remove the filter from the probe.
2. After removing the filter, check the O-ring and change it if necessary. See Figure 12 on page 53.
3. Install a new filter on the probe.

New filters can be ordered from Vaisala, see section Options and Accessories on page 77.

## Changing the Sensor

You can change the HUMICAP<sup>®</sup> sensor yourself and the probe does not have to be sent in for service for a sensor change.

**NOTE**

Both HUMICAP<sup>®</sup>180 and HUMICAP<sup>®</sup>180R sensors can be changed, but you must never replace a HUMICAP<sup>®</sup>180 sensor with a HUMICAP<sup>®</sup>180R sensor or vice versa.

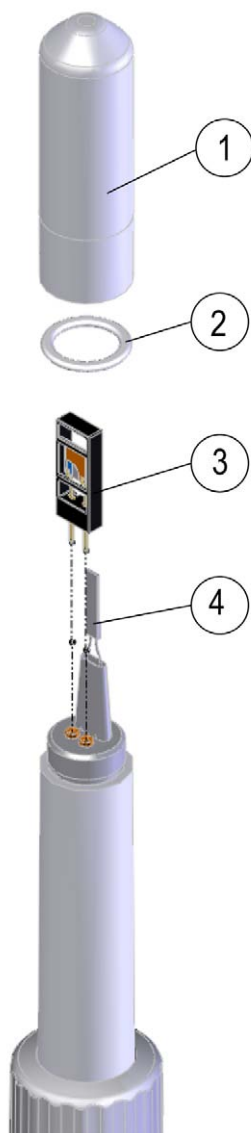
To change the sensor:

1. Remove the filter from the probe. See the instructions in section Changing the Probe Filter on page 51.
2. After removing the filter, check the O-ring and change it if necessary. See Figure 12 on page 53.
3. Remove the damaged sensor and insert a new one. Handle the new sensor by the plastic socket. **DO NOT TOUCH THE SENSOR PLATE.**
4. After sensor change the humidity calibration must be done according to the instructions, see section Relative Humidity Adjustment after Sensor Change on page 65.
5. Attach a new filter on the probe.

**CAUTION**

In HUMICAP<sup>®</sup>180C/180RC models, the temperature sensor is integrated with the relative humidity sensor. It is recommended that these type of sensors are changed by Vaisala Service. See section Product Returns on page 55.

If you do change the sensor yourself, the instructions above apply, except now before removing the damaged sensor, you need to unsolder the connections from the temperature sensor pins. Likewise the new temperature sensor connections need to be soldered to the temperature sensor pins. Be careful when soldering the sensor pins.



0802-159

**Figure 12** Changing the HUMICAP<sup>®</sup> 180/180R Sensors

The following numbers refer to Figure 12 above:

- 1 = Filter
- 2 = O-ring
- 3 = HUMICAP<sup>®</sup> sensor
- 4 = Pt100 temperature sensor

## Error States

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

- Analog channel outputs 0 V (you can use the **AERR** serial line command to change this fault indication value, see section AERR on page 43).
- The serial port outputs stars (\*\*\*) instead of measured values.

You can also check the error message via the serial interface by using the **ERRS** command. In case of constant error, please contact Vaisala, see sections Technical Support and Product Returns on page 55 .

### NOTE

If you do not know the HMP155 serial connection settings, you can force the settings 19200 N 8 1 with the # command. The # command is only available in the first three seconds after power-up.

The possible error messages of HMP155 are listed in Table 15 below.

**Table 15 Error Messages**

Error Message	Description	Action
T MEAS error	Error in temperature measurement	Check the HUMICAP <sup>®</sup> sensor.
T REF error	Error in temperature measurement	Contact Vaisala Service Center, see page 55.
TA MEAS error	Error in T-probe measurement	Check the additional temperature probe.
TA REF error	Error in T-probe measurement	Contact Vaisala Service Center, see page 55.
F MEAS error	Error in humidity measurement	Check the HUMICAP <sup>®</sup> sensor.
F REF1 error	Error in humidity measurement	Contact Vaisala Service Center, see page 55.
F REF3 error	Error in humidity measurement	Contact Vaisala Service Center, see page 55.
Program flash checksum error	Internal error	Contact Vaisala Service Center, see page 55.
Parameter flash checksum error	Internal error	Contact Vaisala Service Center, see page 55.
INFOA checksum error	Internal error	Contact Vaisala Service Center, see page 55.
SCOEFS checksum error	Internal error	Contact Vaisala Service Center, see page 55.

## Technical Support

For technical questions, contact the Vaisala technical support by e-mail at [helpdesk@vaisala.com](mailto:helpdesk@vaisala.com). Provide at least the following supporting information:

- Name and model of the product in question
- Serial number of the product
- Name and location of the installation site
- Name and contact information of a technically competent person who can provide further information on the problem.

## Product Returns

If the product must be returned for service, see [www.vaisala.com/returns](http://www.vaisala.com/returns).

For contact information of Vaisala Service Centers, see [www.vaisala.com/servicecenters](http://www.vaisala.com/servicecenters).

This page intentionally left blank.

## CHAPTER 6

# CALIBRATION AND ADJUSTMENT

The Vaisala HUMICAP® Humidity and Temperature Probe HMP155 is fully calibrated and adjusted as shipped from factory. Recommended calibration interval is one year. Depending on the application, it is good to make more frequent checks. Calibration must always be done when there is reason to believe that the device is not within the accuracy specifications.

It is recommended that calibration and adjustment is carried out by Vaisala. See section Product Returns on page 55.

Calibration and adjustment can also be carried out either by using the buttons on the probe or through the serial line connection.

**NOTE**

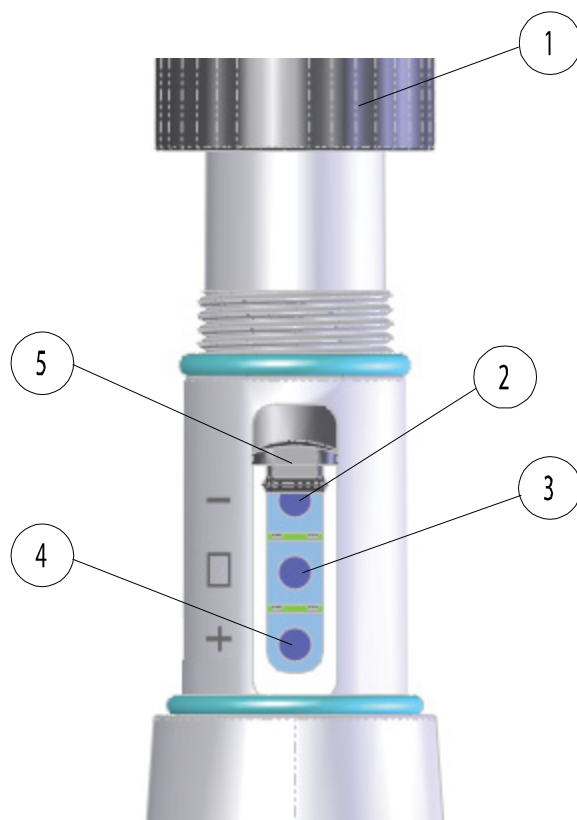
Vaisala recommends that RH adjustment is carried out as a two-point adjustment. With one-point adjustment, the required accuracy can only be achieved if the actual measurement environment (RH and T) is the same as the one-point adjustment environment.

Before attempting calibration, the **ADJ** button has to be held down until a green LED lights up. This turns off the heating and the additional temperature probe in the case you are using an HMP155 with either of those options. After that HMP155 is ready to be checked and calibrated. Because the T-probe is turned off during calibration, it does not need to be inserted into the same reference conditions with the humidity probe.

If a chemical purge option is available, it should always be carried out before calibration.

**NOTE**

Button calibration is not available for the additional temperature probe. In the passive output version of HMP155, the temperature cannot be calibrated.



0801-076

**Figure 13 HMP155 Adjustment Buttons**

The following numbers refer to Figure 13 above:

- 1 = Protective cover (unscrewed)
- 2 = Down button
- 3 = ADJ button
- 4 = Up button
- 5 = Protective plug (lifted up)

There is a two-color indicator LED located under the protective plug and next to the **Down** button, see Figure 13 above. The LED is green and red.

**NOTE**

If you are using a warmed probe (HMP155 active output version option), probe heating will be interrupted when **ADJ** button is pressed, see Figure 13 above. Allow sufficient time for the probe to reach ambient temperature before starting the adjustment procedure.

**NOTE**

Fixed pressure compensation value of 1.01325 bar is used when in adjustment mode.



## Push-Button Calibration

Calibration and adjustment of the HMP155 can be done by using the adjustment buttons found on the probe. The two-point humidity adjustment is carried out by using two relative humidity references: for example saturated salt points 11 % RH (LiCl) and 75 % RH (NaCl). The difference between the two humidity reference points must be at least 30 %RH. The difference between the two temperature reference points must be at least 30 °C.

**NOTE**

In push-button calibration, the probe outputs are by default relative humidity in the range 0...100 %RH in CH1 and temperature in the range -40...+60°C in CH2.

## Two-Point Humidity and Temperature Adjustment

To make a humidity or temperature adjustment:

1. Carry out the chemical purge (if available). See section Chemical Purge (Optional) on page 45.
2. Uncover the adjustment buttons on the probe by removing the protective cover and removing the calibration seal.
3. Open the protective plug and you can see three buttons marked -, □ and +. There is also a two-colored indicator LED. See Figure 13 on page 58.
4. Press the **ADJ** button and hold it down until the green indicator LED lights up. This puts HMP155 in RH calibration mode.
5. Remove the filter and insert the probe into a measurement hole of the dry end reference chamber (for example, LiCl: 11 % RH) to do the low humidity offset adjustment.

**NOTE**

Do not touch the adjustment buttons before the conditions have stabilized. This takes approximately 30 minutes.

6. Using the - and + buttons, make sure the  $A_{out}$  voltage is correct and press the **ADJ** button. Green indicator LED turns off and back on.

**NOTE**

Do not touch the adjustment buttons before the conditions have stabilized.

7. Insert the probe into the high end reference chamber (for example, NaCl: 75 % RH chamber in the humidity calibrator HMK15) and do the high humidity gain adjustment by using the - and + buttons to make sure the  $A_{out}$  voltage is correct. To finish the RH calibration, press the **ADJ** button and the red indicator LED lights up.

**NOTE**

If you do not wish to perform the temperature adjustment at this time, press **ADJ** -button two times and the indicator LED turns off. After reset, HMP155 exits the calibration mode. Otherwise, continue following the instructions from step 8 onwards.

8. Insert the probe into a known reference temperature (if HMK15 Humidity Calibrator is not used) and let the temperature reading stabilize.

**NOTE**

Do not touch the adjustment buttons before the conditions have stabilized.

9. Using the - and + buttons, make the temperature offset adjustment by making sure the  $A_{out}$  voltage is correct and press the **ADJ** button. Red indicator LED turns off and back.

**NOTE**

If you do not wish to perform the two-point temperature adjustment at this time, press the **ADJ** button one more time so that the red indicator LED turns off. After reset, HMP155 exits the calibration mode. Otherwise, continue following the instructions from step 10 onwards.

10. Insert the probe into another reference temperature.

**NOTE**

Do not touch the adjustment buttons before the conditions have stabilized.

11. Using the - and + buttons, make the temperature gain adjustment by making sure the  $A_{out}$  voltage is correct.
12. Press the **ADJ** button and the red indicator LED turns off.

## One-Point Humidity and Temperature Adjustment

To make a one-point humidity or temperature adjustment:

1. Carry out the chemical purge (if available). See section Chemical Purge (Optional) on page 45.
2. Uncover the adjustment buttons on the probe by removing the protective cover and removing the calibration seal.
3. Open the protective plug and you can see three buttons marked -,  $\square$  and +. There is also a two-colored indicator LED. See Figure 13 on page 58.
4. Remove the filter and insert the probe into a measurement hole of the salt chamber to do the humidity adjustment.
5. Press the **ADJ** button and hold it down until the green indicator LED lights up. This puts HMP155 in RH calibration mode.

**NOTE**

Do not touch the adjustment buttons before the conditions have stabilized.

6. Using the - and + buttons, make sure the  $A_{out}$  voltage is correct and press the **ADJ** button. Green indicator LED turns off and back on.
7. To move on to the temperature adjustment, press the **ADJ** button once and the red indicator LED lights up.
8. Insert the probe into the reference temperature.

**NOTE**

Do not touch the adjustment buttons before the conditions have stabilized.

9. Using the - and + buttons, make the temperature offset adjustment by making sure the  $A_{out}$  voltage is correct and press the **ADJ** button. Red indicator LED turns off and back on.
10. Press the **ADJ** button one more time so that the red LED turns off to indicate the probe has quit the calibration mode.

## Passive Output Version Push-Button Calibration

If you are operating a passive output version HMP155, the humidity calibration is carried out similarly to calibration of the active output version. After finishing the humidity adjustment, press the **ADJ** button twice until the LED turns off. Reset the probe to exit the calibration mode.

## Serial Line Calibration

### Two-Point Humidity Adjustment

Note that the difference between the two humidity references must be at least 30 %RH.

To make a humidity adjustment:

1. Connect the HMP155 to a PC. See section Serial Line Communication on page 24. Open a terminal program.
2. Carry out the chemical purge (if available). See section Chemical Purge (Optional) on page 45.
3. Press the **ADJ** button and the green LED lights up.
4. Remove the filter from the probe and insert the probe into a measurement hole of the dry end reference chamber (for example, LiCl: 11 % RH).
5. Enter the **CRH** command and press **ENTER**.
6. Wait at least 30 minutes for the sensor to stabilize.
7. Press **ENTER** a few times to check if the reading has stabilized.
8. When the reading has stabilized, give the reference humidity after the question mark and press **ENTER**.

```
>crh
RH : 16.6675 1. ref ?
RH : 16.4978 1. ref ?
RH : 16.3956 1. ref ? 11.25
Press any key when ready ...
RH : 11.25 Ref2 ?
```

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

```
RH : 75.45 Ref2 ?
RH : 75.57 Ref2 ?
RH : 75.55 Ref2 ?
RH : 75.59 Ref2 ? 75.5
OK
```

12. **OK** indicates that the adjustment has succeeded and the new calibration coefficients are calculated and stored.

13. Enter the adjustment information (date and text) to the memory of the probe; see the commands **CTEXT** and **CDATE**.
14. Reset the probe with the **RESET** command.
15. Take the probe out of the reference conditions and replace the filter.

## Two-Point Temperature Adjustment

**NOTE**

In the passive output version of HMP155, the temperature cannot be calibrated.

Note that the difference between the two temperature references must be at least 30 °C. The additional temperature sensor is suitable for calibration in liquid bath.

To make a temperature adjustment:

1. Press the **ADJ** button to enable the adjustment mode. This lights up the green LED on the probe. If using a warmed probe for measuring, probe heating will be interrupted when **ADJ** button is pressed.
2. Wait some time for the probe to reach ambient temperature.
3. Enter the **CT** command (or **CTA** for additional T-probe) and press **ENTER**.
4. Press **ENTER** a few times to check if the reading is stabilized. Let the reading stabilize, give the reference temperature after the question mark and press **ENTER** three times.

**Example** (2-point adjustment):

```
>ct
T   :  18.6038 1. ref ?
T   :  18.6068 1. ref ?
T   :  18.6098 1. ref ? 19.0
    Press any key when ready ...
T   :  49.5176 2. ref ? 50.0
OK
>
```

5. Move the probe into another reference temperature and let the reading stabilize. Give the reference temperature after the question mark and press **ENTER**, see example above.
6. **OK** indicates that the calibration has succeeded.
7. Enter the calibration information (date and text) to the probe's memory; see the serial commands **CTEXT** and **CDATE**.
8. Reset the probe with **RESET** command.

## Relative Humidity Adjustment after Sensor Change

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

### FCRH

#### Example:

```
>fcrh
RH :    25.19  Ref1 ? 11.3
Press any key when ready ...
RH :    70.02  Ref2 ? 75.5
OK
>
```

The OK indicates that the calibration has been successful.

## One-Point Humidity and Temperature Adjustment

One-point humidity and temperature adjustment can be done by using the following serial line commands:

- **CRH** and **FCRH** commands for humidity adjustment
- **CT** and **CTA** commands for temperature adjustment

To make an adjustment, just enter the command , press space bar and then enter the reference value, as in the example below.

#### Example:

```
Crh 20.0
OK
```

## User Adjustment Commands

You can use the user adjustment commands to display and set parameters. You can only use **LI** command in ADJUST mode.

These parameters are updated with the commands **CRH**, **CT**, and **CTA**.

### L

With the **L** command you can display user adjustment parameters.

#### Example:

```
>l
Cp offset : 0.00000000E+00
Cp gain   : 1.00000000E+00
T offset  : 0.00000000E+00
T gain    : 1.00000000E+00
Ta offset : 0.00000000E+00
Ta gain   : 1.00000000E+00
>
```

### LI

With the **LI** command you can display and ask for new values for the user adjustment parameters.

#### Example:

```
>li
Cp offset : 0.00000000E+00 ?
Cp gain   : 1.00000000E+00 ?
T offset  : 0.00000000E+00 ?
T gain    : 1.00000000E+00 ?
Ta offset : 0.00000000E+00 ?
Ta gain   : 1.00000000E+00 ?
>
```

#### NOTE

If you suspect that something has gone wrong with the calibration, you can use the **LI** command to return the factory values by entering the values shown in the example above.

## Feeding Adjustment Information

The information added with the serial line commands below is shown in the device information fields. You can only use **CTEXT** and **CDATE**



commands in ADJUST mode. To put HMP155 in adjustment mode, just hold down the **ADJ** button until the green LED lights up.

## CTEXT

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

### Example:

```
>ctext  
Cal. info      : Helsinki / FIN ? Finland  
>
```

## CDATE

Use the **CDATE** command to enter date to adjustment information field. Set the adjustment date in format YYYYMMDD.

### Example:

```
>cdate 20080320  
>
```

## Analog Output Adjustment

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

- Voltage output: 10 % and 90 % of the range

Connect HMP155 to a calibrated voltage meter in order to measure voltage.

### NOTE

Hold down the **ADJ** button until a green LED lights up. This puts the HMP155 in ADJUST mode.

### NOTE

The serial line command ACAL cannot be used with HMP155 passive output version.

Enter the **ACAL** command and type the multimeter reading for each case. Continue by pressing **ENTER**. When a channel is specified, only the specified analog output channel is adjusted.

## ACAL [0/1]

### Example:

```
Ch 0:
>acal 0
U1 ( V ) ? 1.001
U2 ( V ) ? 9.011

Ch 1:
>acal 1
U1 ( V ) ? 2.0988
U2 ( V ) ? 8.8997
>
```

## MI70 Check and Adjustment

Vaisala MI70 measurement indicator is an optional accessory that can be used as a display or as a communication device for HMP155. When it is used, HMP155 is powered via MI70.

With MI70 you can check the HMP155 easily on the field. Both the active output version and the passive output version (only RH displayed) can be checked with MI70.

In the active output version relative humidity, temperature and additional T-probe temperature can be calibrated. In the passive output version, only relative humidity calibration is possible.

To check and adjust HMP155 with MI70:

1. Connect HMP155 to MI70 by using a connection cable (Vaisala item 221801).
2. Turn MI70 on by pressing the power key and follow the instructions given on the display.

<b>NOTE</b>	When turning on the passive output version, always hold down the <b>ADJ</b> button simultaneously.
-------------	----------------------------------------------------------------------------------------------------

3. Activate the adjustment mode by holding down the **ADJ** button on the probe until the message below appears on the MI70 display.