



Vaisala Humidity Calibrator HMK15





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Vaisala Oyj Vanha Nurmijärventie 21, FI-01670 Vantaa, Finland P.O. Box 26, FI-00421 Helsinki, Finland +358 9 8949 1

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HMK15 User Guide

# **1. About this document**

### 1.1 Version information

This document provides information for operating and maintaining Vaisala Humidity Calibrator HMK15.

#### Table 1 Document versions (English)

Document code	Date	Description
M210185EN-D	March 2021	This manual. New document template.
		Updated sections:
		<ul> <li>Introduction to HMK15 (page 7)</li> <li>Before preparation (page 10)</li> <li>Thermometer (page 17)</li> <li>Calibration (page 19)</li> <li>HMK15 specifications (page 26)</li> <li>Spare parts and accessories (page 27)</li> <li>Added sections:</li> <li>HMK15 chamber cover options (page 28)</li> </ul>
		Added information on the KCl salt option throughout the document. Removed references to the discontinued mercury thermometer and HMP233 probe.
M210185EN-C	March 2006	Previous version. Added chapter <i>General Information</i> . Updated chapter <i>On-Site Calibration and Transportation</i> .
M210185EN-B	September 2002	Updated chapters <i>Calibration</i> and <i>Spare Parts and Accessories</i> .

### 1.2 Related manuals

#### Table 2 Related manuals

Document code	Name
M211060EN	Vaisala HMP60 and HMP110 Humidity and Temperature Probes User Guide
M211289EN	Vaisala Dew Point Transmitter DMT132 User Guide

## 1.3 Documentation conventions



**WARNING!** Warning alerts you to a serious hazard. If you do not read and follow instructions 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** highlights important information on using the product.

# 2. Product overview

### 2.1 Introduction to HMK15

Vaisala Humidity Calibrator HMK15 has been developed for the calibration and checking of humidity probes and transmitters. The functioning of the calibrator is based on the fact that certain salt solutions generate a specific relative humidity in the air above them.



Figure 1 HMK15 calibrator and selected accessories

- 1 Salt chamber with transit cover on
- 2 Thermometer
- 3 Chamber cover with rubber plugs
- 4 Base plate
- 5 Adapter fitting
- 6 Ready-dosed salt package with calibration certificate (accessory)
- 7 Calibration certificate for thermometer
- 8 Ion-exchanged water (accessory)
- 9 Measurement cup
- 10 Measurement spoon

The four holes in the chamber cover are designed for Vaisala probes and transmitters with 12, 13.5 (2 holes), and 18.5 mm (0.47, 0.53, and 0.73 in) diameter.

Optional custom cover sets are available for Vaisala DMT132 dew point transmitter and Vaisala HMP60 and HMP110 humidity and temperature probes <sup>1)</sup>. For instructions on using HMK15 with DMT132 and HMP60/HMP110, see the respective user guides.

The following salt solutions, for example, are suitable for HMK15:

- Lithium chloride LiCl (11 %RH)
- Magnesium chloride MgCl<sub>2</sub> (33 %RH)
- Sodium chloride NaCl (75 %RH)
- Potassium chloride KCI (85 %RH)
- Potassium sulphate K<sub>2</sub>SO<sub>4</sub> (97 %RH)

In calibration, the sensor head is inserted into a salt chamber containing a saturated salt solution. The reading given by the probe or transmitter is then adjusted to the humidity value that the specific salt solution generates at that particular temperature.

To ensure the sensor accuracy over the entire humidity range (0  $\dots$  100 %RH), calibration is usually performed at least at two different humidities.

HMK15 is suitable for both laboratory and field use. The chambers can be tightly closed for transportation with custom-designed transit covers. The optional transit bag (item code HM27032) allows the calibrator to be transported in vertical position or to be housed during calibration.

Accessories include additional salt chambers, ion exchanged water, transit bag, and ready-dosed salt packages (LiCl 11 %RH, MgCl<sub>2</sub> 33 %RH, NaCl 75 %RH, KCl (85 %RH), and  $K_2SO_4$  97 %RH).

#### More information

- Related manuals (page 5)
- Spare parts and accessories (page 27)
- HMK15 chamber cover options (page 28)

### 2.2 Salt package calibration certificates

The ready-dosed salt packages available from Vaisala are delivered with calibration certificates given on the basis of a batch check. In other words, a sample of packages is taken from a batch and salts are prepared according to the instructions given in this manual. These salt solutions are then checked at the Vaisala Measurement Standards Laboratory (a calibration laboratory accredited by FINAS, a member of the European Cooperation for Accreditation of Laboratories). The calibration certificate certifies that the equilibrium humidities generated by these salt solutions correspond to Greenspan's calibration table within the specified accuracy.

<sup>1)</sup> Vaisala item codes 230914 and 253277SP.

More information

- Greenspan's calibration table (page 20)
- HMK15 specifications (page 26)

## 2.3 Safety

This product has been tested for safety. Note the following precautions:



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



**CAUTION!** Remember to check from the user guide of your device if the adapter fitting is needed. If the sensor accidently soaks in salt liquid, remove it quickly and rinse with clean water. Let it dry before taking into use again.



**CAUTION!** Never add water to dry LiCl salt; the salt may heat up so rapidly that it splashes out of the chamber.



CAUTION! LiCl is harmful when swallowed; the solution is also corrosive.

# 3. Preparing salt solutions

### 3.1 Before preparation

Prepare the salts using the equipment provided with the calibrator or make sure that all accessories used are suitable for preparing salt solutions and are absolutely clean. If necessary, wash them carefully and rinse several times before preparing the salt solutions. The last rinse must be made with distilled or ion exchanged water.

The salts are quick and easy to prepare with the ready-dosed salt packages available from Vaisala. If you do not use ready-dosed salt packages, measure the salts using the measurement cup provided. Make sure that the cup is clean before measuring the salts. The salt solutions must be prepared from pro analysis grade salts, which are available in agencies selling industrial chemicals. Note that the water must be distilled or ion exchanged (conductivity < 0.25  $\mu$ S/cm). You can order ion exchanged water as an accessory for the HMK15 calibrator (item code 19767HM).

Handle the salts and equipment carefully and keep them absolutely clean so that the salts are not contaminated. Make sure that the salts do not mix.

There must not be more than 10 mm (0.39 in) of undissolved salt and liquid at the bottom of the salt chamber. Otherwise, the sensor to be calibrated may get immersed into the solution. If necessary, verify the amount, for example, with the measurement spoon.

The use of saturated salt solutions is covered by several standards, including ASTM E104 - 20a and JIS Z 8806.



Some salts in the ready-dosed salt packages, especially potassium chloride, may harden slightly over time. This may happen even with the vacuum bag intact. Before using a salt bag with hardened salt inside, break up the salt with, for example, a small rubber mallet. Shelf life of unopened salt bags is 2 years.

## 3.2 Salt properties

• Lithium chloride generates a reference humidity of approximately 11 %RH. It is normally used as the dry end (offset) reference.



**CAUTION!** Never add water to dry LiCl salt; the salt may heat up so rapidly that it splashes out of the chamber.

CAUTION! LiCl is harmful when swallowed; the solution is also corrosive.



If the LiCl solution is used or stored in temperatures below +18 °C (+64 °F), its equilibrium humidity changes permanently.

- **Magnesium chloride** generates a reference humidity of approximately 33 %RH. It is often used as a checkpoint if calibration is performed at more than two points.
- **Sodium chloride** generates a reference humidity of approximately 75 %RH. It is used as the wet end reference (gain) for probes measuring in applications with normal humidities.
- Potassium chloride generates a reference humidity of approximately 85 %RH.
- **Potassium sulphate** generates a reference humidity of approximately 97 %RH. Potassium sulphate is used as the wet end reference (gain) for probes measuring in applications with very high humidities, 90 ... 100 %RH (for example, outdoor and concrete measurements).

## 3.3 Preparing solutions

Prepare the salt solutions according to the following instructions. The required amounts are given in grams and milliliters. Measure the salts carefully if you do not use the ready-dosed packages.

- 1. Take the calibrator out of the box and place it on a clean, even surface.
  - 2. Remove the transit cover of the salt chamber.
  - 3. Remove the chamber cover from the chamber holder and put it aside.

4. Press the transit cover on the chamber holder.



5. Pour the required amount of ion exchanged water into the salt chamber.



- LiCI: 12 ml
- **MgCl<sub>2</sub>**: 3 ml
- NaCI: 10 ml
- KCI: 10 ml
- K<sub>2</sub>SO<sub>4</sub>: 10 ml

6. Sprinkle the contents of a salt package (or measure the required amount of salt <sup>1)</sup>) in small quantities into the chamber, stirring constantly.



- LiCl: 15 g / 18 ml
- MgCl<sub>2</sub>: 30 g / 30 ml
- NaCl: 20 g / 15 ml
- KCI: 30 g / 30 ml
- K<sub>2</sub>SO<sub>4</sub>: 30 g / 20 ml

When measuring with the measurement cup, make sure that the cup is clean and dry. Rinse and dry the cup after every use.

7. When all the salt has been sprinkled into the chamber, the saturated salt solution should have a ratio of 60 ... 90 % undissolved salt to 10 ... 40 % liquid.

<sup>1)</sup> The liquid volumes given in ml are approximations. Vaisala recommends that you use the masses when measuring the salts.

8. Close the salt chamber with the chamber cover.



9. Fasten the salt chamber on the holder in the base plate and close the measurement holes with rubber plugs.

The chambers can also be used as individual checkers without the base plate.



The plugs have three steps, each of which is suitable for a certain hole diameter: the first step for the 12 mm (0.47 in), the second step for the 13.5 mm (0.53 in), and the third step for the 18.5 mm (0.73 in) hole. Keep the holes always closed when not calibrating.

10. Write the preparation date on a sticker and use it to mark the chamber. If you use a readydosed salt package, use the sticker with the batch code. Mark all parts of the salt chamber (chamber, chamber cover, and transit cover) with stickers. This way, the covers and different salts do not get mixed.



11. Allow approximately 24 hours for stabilization before use so that the salt solution reaches the equilibrium humidity.



If you do not use the instrument for a longer period of time, close the chambers with the transit covers.

#### More information

- Maintenance (page 25)
- HMK15 chamber cover options (page 28)

# 4. Calibration of humidity instruments

Errors during humidity calibration are commonly due to temperature differences. A temperature difference of  $\pm 1$  °C at  $\pm 20$  °C ( $\pm 68$  °F) between the air in the chamber and the sensor causes an error of  $\pm 3$  %RH at 50 %RH and an error of  $\pm 6$  %RH at 97 %RH. The length of the stabilization time depends on how great the difference is between the transportation or process temperature and the calibration site temperature. In laboratory use, the calibrator should be stored where the room temperature is most stable. The calibrator must be kept out of direct sunlight and away from localized heat sources, such as spot lights, heaters, and soldering irons. If the probe or transmitter is checked against several humidity references, the checking must first be made at the dry end. For more information, see the respective transmitter or probe user guide at www.vaisala.com.

Handle the probe as little as possible. Do not hold the salt chamber or other parts of the calibrator in your hand during calibration as they warm up and cause errors in the readings.



Even the smallest water drop on the probe near the sensor distorts the readings. Make sure that the chamber covers and rubber plugs are carefully closed.



#### Figure 2 Salt chamber

- 1 Humidity probe
- 2 O-rings
- 3 Sensors
- 4 Max. depth 10 mm (0.39 in)
- 5 Thermometer
- 6 Saturated salt solution
- 7 Undissolved salt

### 4.1 Thermometer

The calibrator comes with a thermometer containing red capillary liquid, and a factory calibration certificate by the thermometer manufacturer.

When adjusting temperature readings, Vaisala recommends using a mercury thermometer for its superior accuracy and stability compared to a thermometer with red capillary liquid.

You can use the sleeve at the end of the thermometer's protective tube in two different positions. The thermometer is delivered with the sleeve protecting the part containing the capillary liquid (left image). When you turn the sleeve the other way around (right image), it acts as an adapter when the thermometer is inserted into the 13.5 mm (0.53 in) hole.





Figure 3 Using thermometer sleeve

During calibration, the thermometer is inserted into the 13.5 mm (0.53 in) hole of a salt chamber. Press it downwards until it passes the O-rings. The thermometer is correctly in place when you can feel a resistance while pressing it downwards.



Figure 4 Inserting thermometer

When the thermometer is not in use or the calibrator is transferred from one place to another, place it in the thermometer holders.





### 4.2 Calibration

Leave the HMK15 calibrator and the probe at the calibration site for at least 30 minutes before starting the calibration in order to let the probe temperature stabilize to room temperature.

With lithium chloride, it is not necessary to use the thermometer, as the humidity reading changes only very slightly in temperature range  $+25 \dots +30$  °C ( $+77 \dots 86$  °F). However, if you use the thermometer, make sure that the sleeve is in the correct position and insert it into the 13.5 mm (0.53 in) hole of the LiCl salt chamber.

See also HMK15 chamber cover options (page 28).



Handle the thermometer as little as possible and do not touch the measuring end. Press the thermometer downwards until it passes the O-rings. The thermometer is correctly in place when you feel a resistance while pressing it downwards.

1. Remove the grid or filter protecting the sensor. Take care not to damage the sensor.



When calibrating HPP271 or HPP272 probes, or when using cover 253277SP with any 12 mm diameter probe, **leave the grid or filter on**.

 Some 12 mm (0.47 in) probes need an adapter fitting if used in the 13.5 mm (0.53 in) hole of the HMK15 standard chamber cover. The adapter fitting prevents the sensor from soaking in the salt liquid.

In case you need an adapter fitting, remove the grid or filter and replace it with the adapter fitting. Two adapter fittings are provided on the base plate of the HMK15.



**CAUTION!** Remember to check your device's user guide if the adapter fitting is needed.

If the sensor accidently soaks in salt liquid, remove it quickly and rinse with clean water. Let it dry before taking into use again.

- 3. Insert the probe into a suitable hole of the LiCl salt chamber. Press it downwards until it passes the O-rings. The shorter the time the hole stays open before inserting the probe, the shorter the stabilization time required.
- 4. Wait until the humidity reading stabilizes; this takes about 10 ... 30 minutes.
- 5. Read the salt chamber temperature from the thermometer and then read the closest humidity value from the calibration table (Greenspan's Calibration, LiCl solution).
- 6. Adjust the dry end (DRY, offset) to correspond to the value given in the calibration table.
- 7. Insert the thermometer into the 13.5 mm (0.53 in) hole of the NaCl salt chamber.



When calibrating probes that are being used for long term measurements (over 1 hour) in high humidities (90 ... 100 %RH), use the  $K_2SO_4$  salt as the high end reference.

- 8. Insert the probe into a suitable hole of the NaCl (or  $K_2SO_4$ ) salt chamber. The shorter the time the hole stays open before inserting the probe, the shorter the stabilization time required.
- 9. Wait until the humidity reading stabilizes; this takes about 10 ... 30 minutes. Note that in high humidities the risk for errors increases. Therefore, the stabilization time should be longer (approximately 20 ... 40 minutes).
- 10. Read the salt chamber temperature from the thermometer and then read the closest humidity value from the calibration table (Greenspan's Calibration Table, NaCl or  $K_2SO_4$  solution).
- 11. Adjust the wet end (WET, gain) to correspond to the value given in the calibration table.

## 4.3 Greenspan's calibration table

The number on the right in each column indicates the uncertainty of the reference humidity of the salt in that temperature.

°C	LiCl	MgCl <sub>2</sub>	NaCl	ксі	K <sub>2</sub> SO <sub>4</sub>
0		33.7 ± 0.3	75.5 ± 0.3	88.6 ± 0.5	98.8 ± 1.1
5		33.6 ± 0.3	75.7 ± 0.3	87.7 ± 0.5	98.5 ± 0.9
10		33.5 ± 0.2	75.7 ± 0.2	86.8 ± 0.4	98.2 ± 0.8
15		33.3 ± 0.2	75.6 ± 0.2	85.9 ± 0.3	97.9 ± 0.6
20	11.3 ± 0.3	33.1 ± 0.2	75.5 ± 0.1	85.1 ± 0.3	97.6 ± 0.5
25	11.3 ± 0.3	32.8 ± 0.2	75.3 ± 0.1	84.3 ± 0.3	97.3 ± 0.5
30	11.3 ± 0.2	32.4 ± 0.1	75.1 ± 0.1	83.6 ± 0.3	97.0 ± 0.4
35	11.3 ± 0.2	32.1 ± 0.1	74.9 ± 0.1	83.0 ± 0.3	96.7 ± 0.4
40	11.2 ± 0.2	31.6 ± 0.1	74.7 ± 0.1	82.3 ± 0.3	96.4 ± 0.4
45	11.2 ± 0.2	31.1 ± 0.1	74.5 ± 0.2	81.7 ± 0.3	96.1 ± 0.4
50	11.1 ± 0.2	30.5 ± 0.1	74.4 ± 0.2	81.2 ± 0.3	95.8 ± 0.5

#### Table 3 Greenspan's calibration table

Greenspan, L.: Journal of Research of the National Bureau of Standards - A Physics and Chemistry Vol. 81A, No. 1 January-February 1977, pp. 89-95

### 4.4 Transportation

You can easily transfer HMK15 from one place to another. Two O-rings seal the transit cover on the chamber. The optional transit bag helps to transport the calibrator so that the chambers stay in vertical position. The bag can also be used for housing the calibrator during calibration.



Figure 6 Optional transit bag for HMK15

When transferring the calibrator from one place to another:

- 1. Place the protective sleeve on the thermometer and place it in the thermometer holders.
  - 2. Replace the chamber covers with transit covers. Press the chamber covers on the vacant chamber holders for transportation.
  - 3. Place the calibrator so that the chambers stay as upright as possible. This way, very little salt solution gets on transit covers and cleaning is easier. The closer the transportation temperature is to the temperature of the calibration site, the shorter the time required for temperature stabilization. If the transportation temperature is below +18 °C (+64 °F), the LiCl salt chamber should be transported separately to keep the solution warm.

4. When the calibrator has been transported to the calibration site, remove the transit covers and fasten the chamber covers on the salt chambers. Close the holes with plugs.



The plugs have three steps, each of which is suitable for a certain hole diameter: the first step for the 12 mm (0.47 in), the second step for the 13.5 mm (0.53 in), and the third step for the 18.5 mm (0.73 in) hole.

- 5. Clean the transit covers with a damp cloth and press them on vacant chamber holders.
- 6. Take the thermometer off the holder, turn the sleeve the other way around and perform the calibration.

More information

Calibration (page 19)

### 4.5 On-site calibrations

In on-site calibrations, it is important to allow enough time for the calibrator and probe temperatures to stabilize. A two point calibration takes about 30 minutes ... 2 hours, depending on the difference between transportation or process temperature (with probes removed from the process) and the calibration site. If there are several instruments at the same site needing frequent calibration, it is useful to know the respective stabilization times.

In the following temperature and humidity stabilization example, a humidity probe is transferred from an oven temperature of 75 °C (167 °F) to a suitable hole in the NaCl salt chamber, which is at room temperature. After 40 minutes, the humidity reading differs by 0.2 %RH from the final reading.



Figure 7 Stabilization time when probe is removed from process

In the following example, the calibrator (without the LiCl) is brought in from a transportation temperature of +5 °C (41 °F) to room temperature. A humidity probe stored at room temperature is then inserted into a suitable hole in the NaCl salt chamber. After 40 minutes, the reading differs by 1.4 %RH from the final reading.



Figure 8 Stabilization time when transportation and calibration site temperatures are different

More information

Calibration (page 19)

# 5. Maintenance

Depending on the frequency of use and the general operating conditions, the salt solutions maintain their characteristics for 6 ... 12 months, after which they must be replaced. Perform a visual check every 2 ... 3 months. There must be a minimum of 10 % of undissolved salt at the bottom of the chamber (max. 90 %). The salt must be clean, otherwise it must be reprepared.



LiCl solution may crystallize on the surface, but there may still be solution under the surface. In this case, stir the solution and check it again the next day.

It is advisable to log the dates when salt solutions are prepared and other maintenance procedures are performed.

For correct calibration, it is essential that the salt chambers are tightly closed. Check the Orings at each salt replacement. If they are damaged, replace them with new ones.

#### Table 4 O-rings used in HMK15

O-ring location	Dimensions	Туре
Measurement hole 12 mm (0.47 in)	12 × 2.5 mm	NBR70
Measurement hole 13.5 mm (0.53 in)	13.5 × 2.5 mm	NBR70
Measurement hole 18.5 mm (0.73 in)	18.3 × 2.4 mm	NBR70
Transit cover	41.2 × 3.0 mm	NBR70
Chamber	50 × 2.0 mm	NBR70

More information

Spare parts and accessories (page 27)

# 6. Technical data

## 6.1 HMK15 specifications

#### Table 5 HMK15 measurement performance

Property	Description/Value	
Response time (with probe and calibrator at the same temperature)	With Vaisala sensors typically 10 min (deviation of the final value < $\pm 1$ %RH)	
Accuracy of thermometer	±1 °C	
Accuracy of salt solutions		
Lithium chloride LiCl	±1.0 %RH + Greenspan's uncertainty <sup>1)</sup>	
Magnesium chloride MgCl <sub>2</sub>	±1.0 %RH + Greenspan's uncertainty <sup>1)</sup>	
Sodium chloride NaCl	±1.4 %RH + Greenspan's uncertainty <sup>1)</sup>	
Potassium chloride KCl	±1.5 %RH + Greenspan's uncertainty <sup>1)</sup>	
Potassium sulphate K <sub>2</sub> SO <sub>4</sub>	±1.5 %RH + Greenspan's uncertainty <sup>1)</sup>	

 The uncertainty given in Greenspan's calibration table at the calibration temperature. For example, the accuracy of LiCl salt at +20 °C (+68 °F) is ±(1.0 + 0.3) %RH = ±1.3 %RH.

#### Table 6 HMK15 operating environment

Property	Description/Value
Operating temperature range	+0 +50 °C (+32 +122 °F)

#### Table 7 HMK15 mechanical specifications

Property	Description/Value
Dimensions (H × W × L)	90 × 230 × 200 mm (3.54 × 9.06 × 7.87 in)
Weight	1 kg (2.20 lb) without salt solutions
Material (metal parts)	Anodized aluminum

## 6.2 Spare parts and accessories

#### Table 8 HMK15 spare parts and accessories

Description	Item code
Rubber plug set	19746HM
O-ring set	218096
Salt chamber	19766HM
Ion exchanged water	19767HM
Adapter fitting for 12 mm probes	211302SP
Thermometer with red capillary liquid	25130HM
Transit bag	HM27032
Cover set for DMT132 and HMP60/HMP110 with filter	230914
HMK15 chamber lid for 4 × HMP110 with filter	253277SP
HMP9 calibration adapter for HMK15	ASM213801
Adapter for HMP42 probe	HM37067
Certified and ready dosed salts <sup>1)</sup>	
Ready-dosed LiCl salt package	19729HM
(LiCl salt 11 %RH, total uncertainty ±1.3 %RH) <sup>2)</sup>	
Ready-dosed MgCl <sub>2</sub> salt package	19730HM
(MgCl <sub>2</sub> salt 33 %RH, total uncertainty $\pm$ 1.2 %RH) <sup>2)</sup>	
Ready-dosed NaCl salt package	19731HM
(NaCl salt 75 %RH, total uncertainty ±1.5 %RH) $^{2)}$	
Ready-dosed KCI salt package	251377HM
(KCl salt 85 %RH, total uncertainty $\pm 2.0$ %RH) <sup>2)</sup>	
Ready-dosed K <sub>2</sub> SO <sub>4</sub> salt package	19732HM
(K <sub>2</sub> SO <sub>4</sub> salt 97 %RH, total uncertainty ±2.0 %RH) $^{2)}$	

1) Calibration certificate included with each salt package.

2) Uncertainties given at +20 °C (+68 °C).

#### 6.2.1 HMK15 chamber cover options

Check the diameter of your probe from the probe's user documentation, available at www.vaisala.com.



- HMK15 standard chamber cover with four measurement holes
- For 12, 13.5, and 18.5 mm diameter probes
- Ø18.5-mm hole for HPP270 series probes
- Suitable for use with a wide variety of Vaisala humidity products, including older ones



- Cover with four measurement holes for DMT132 and HMP60/HMP110 probes with filter, or other 12 mm diameter probes
- Topmost hole for DMT132 probe with filter on
- Item code of cover: 230914



- Cover with four measurement holes for HMP110 probes with filter on
- Topmost hole (Ø13.5 mm) for the thermometer delivered with HMK15
- Suitable for most current 12 mm diameter probe models, especially when calibration with the filter on is required
- Item code of cover: 253277SP

## Maintenance and calibration services

Vaisala offers comprehensive customer care throughout the life cycle of our measurement instruments and systems. Our factory services are provided worldwide with fast deliveries. For more information, see www.vaisala.com/ calibration.

- Vaisala Online Store at store.vaisala.com is available for most countries. You
  can browse the offering by product model and order the right accessories,
  spare parts, or maintenance and calibration services.
- To contact your local maintenance and calibration expert, see www.vaisala.com/contactus.

### Technical support



Contact Vaisala technical support at helpdesk@vaisala.com. Provide at least the following supporting information as applicable:

- Product name, model, and serial number
- Software/Firmware version
- Name and location of the installation site
- Name and contact information of a technical person who can provide further information on the problem

For more information, see www.vaisala.com/support.

#### Warranty

For standard warranty terms and conditions, see www.vaisala.com/warranty.

Please observe that any such warranty may not be valid in case of damage due to normal wear and tear, exceptional operating conditions, negligent handling or installation, or unauthorized modifications. Please see the applicable supply contract or Conditions of Sale for details of the warranty for each product.

## Recycling



Recycle all applicable material.



Follow the statutory regulations for disposing of the product and packaging.





tel: +34 915 679 700 www.alavaingenieros.com | alava@grupoalava.com



www.vaisala.com