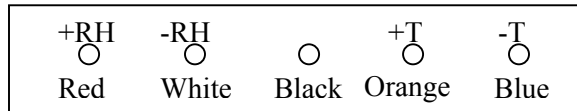


SOP 7. Humidity Measurements

HMW61Y Humidity Transmitter

Electrical Cable Connection



Measurement Instructions

The probe of the transmitter should always point downwards when installed.

Supply voltage: 10 ... 35 VDC (RL = 0 Ω)
20 ... 35 VDC (RL = 500 Ω)
RH range: 0 ... 100% (Output 4...20mA)
T range: -20°C ... +80°C (Output 4...20mA)

Temperature (°C)	-20	-10	0	10	20	30	40	50	60	70	80
Output (mA)	4	5.6	7.2	8.8	10.4	12	13.6	15.2	16.8	18.4	20

Reference

HMW61U/Y Humidity Transmitter Operating Manual, March 2000.

HMK15 Humidity Calibrator

Introduction

The functioning of the HMK15 is based on the fact that certain salt solutions generate a certain relative humidity in the air above them. The salt solutions suitable for the HMK15 calibrator are e.g. lithium chloride LiCl (11% RH), magnesium chloride MgCl₂ (33% RH), sodium chloride NaCl (75% RH) and potassium sulphate K₂SO₄ (97% RH). For calibration, the sensor head is inserted into a salt chamber containing a saturated salt solution. The probe/transmitter reading is then adjusted to the correct value. Calibration is usually performed at least at two different humidities to ensure the sensor accuracy over the entire humidity range (0-100 % RH).

Description of the solutions

Salt Name	RH	Usage
LiCl	11%	Used as the dry end reference
MgCl ₂	33%	Used as a check point if calibration is performed at more than two points.
NaCl	75%	Used as the wet end reference for probes measuring in applications with normal humidities.
K ₂ SO ₄	97%	Used as the wet end reference for probes measuring in applications with very high humidities.

NOTE: Never add water to dry LiCl salt.

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

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

Solution Preparation Procedure

1. Take the calibrator out of the box. Open the transit cover of the chamber. Remove the measurement cover from the chamber holder and press the transit cover on the holder.
2. Pour ion exchanged water into the chamber; the required amounts are given below:

LiCl	14 ml of water
MgCl ₂	3 ml of water
NaCl	10 ml of water
K ₂ SO ₄	10 ml of water

3. Sprinkle the contents of a salt package in small quantities into the chamber, stirring constantly. When measuring with the measurement cup, make sure that the cup is clean and dry. Rinse and dry the cup after every use.

LiCl	15 g or 18 ml
MgCl ₂	30 g or 30 ml
NaCl	20 g or 15 ml
K ₂ SO ₄	30 g or 20 ml

4. When all salt has been sprinkled into the chamber, the saturated salt solution should have the ratio of 60-90% undissolved salt to 10-40% liquid.
5. Close the chamber with the chamber cover. Fasten the salt chamber on the base plate and close the measurement holes with rubber plugs. Make sure that chamber covers and plugs are carefully closed.
6. Write the preparation date on a sticker and mark the chamber with it.
7. Allow approximately 24 hours for stabilization before use.

Notices for Avoiding Errors Introduced by Temperature Difference

Usually, the errors during humidity calibration are due to temperature differences. In laboratory, the calibrator should be stored in that part of the room where the temperature at most stable and must be kept out of direct sunlight and away from localized heat sources.

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.

During calibration, the thermometer is inserted into the 13.5 mm 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.

When the thermometers are not in use or the calibrator is transformed from one place to another, place the thermometer in holders.

Calibration procedure

(If the probe/transmitter is checked against several humidity references, the checking must first be made at the dry end.)

1. 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 the room temperature.
2. In the temperature range of 25-30 °C, lithium chloride humidity changes only very slightly, thus it is not necessary to use the thermometer. However, we may use it to ensure that the sleeve is in the correct place.
3. Take off the grid or filter protecting the sensor. Insert the probe into a suitable hole of the LiCl salt chamber. Press it downwards till it passes through the O-rings. Wait until the humidity reading stabilizes; this will take about 10-30 minutes. The shorter the time the hole stays open before inserting the probe; the shorter the stabilization time required.
4. Read the salt chamber temperature from the thermometer; then read the closest humidity value from the Greenspan's calibration table. Adjust the dry end to the correspond value given in the table.
5. Then use the NaCl as the wet reference. If calibrating probes that are being used for a long time in high humidities (90-100RH). Use the K₂SO₄ as the wet reference.
6. Then repeat step 4-6 for the wet reference. Note that in high humidities the risk for errors increases and the stabilization time should be longer (about 20-40 min).

Greenspan's calibration table

°C	LiCl	MgCl ₂	NaCl	K ₂ SO ₄
0	*	33.7±0.3	75.5±0.3	98.8±1.1
5	*	33.6±0.3	75.7±0.3	98.5±0.9
10	*	33.5±0.2	75.7±0.2	98.2±0.8
15	*	33.3±0.2	75.6±0.2	97.9±0.6
20	11.3±0.3	33.1±0.2	75.5±0.1	97.6±0.5
25	11.3±0.3	32.8±0.2	75.3±0.1	97.3±0.5
30	11.3±0.2	32.4±0.1	75.1±0.1	97.0±0.4
35	11.3±0.2	32.1±0.1	74.9±0.1	96.7±0.4
40	11.2±0.2	31.6±0.1	74.7±0.1	96.4±0.4
45	11.2±0.2	31.1±0.1	74.5±0.2	96.1±0.4
50	11.1±0.2	30.5±0.1	74.4±0.2	95.8±0.5

Transportation Instructions

1. Turn the protective sleeve on the thermometer and place the thermometer in the holder.
2. Replace chamber covers with transit covers. Press the chamber covers on vacant chamber holders for transportation.
3. During transportation, keep the chamber as upright as possible.
4. The closer the transportation temperature is to the temperature of the calibration site, the shorter the stabilization time will be. If the transportation is below 18°C, the LiCl should transport separately to keep the solution warm.
5. When the calibrator is at the calibration site, remove the transit covers and fasten the chamber covers on salt chambers.
6. Clean the transit covers with a damp cloth and press them on vacant chamber holders.
7. Repeat the calibration procedures.

Quality control

Depending on the frequency of use and the general operating conditions, the salt solutions should be replaced after about 6-12 months. A visual check should be performed at intervals of 2-3 months. There must be a minimum of approximately 10% of undissolved salt at the bottom of the chamber and the salt must be clean.

Note: LiCl may crystallize on the surface. But it may still have solution under the surface. In such case, stir the solution and check the next day.

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

Operating temperature range is 0-50°C.

Accuracy of salt solution humidities

Lithium chloride LiCl

±1.0%RH + Greenspan's uncertainty

Magnesium chloride MgCl ₂	±1.0%RH + Greenspan's uncertainty
Sodium chloride NaCl	±1.4%RH + Greenspan's uncertainty
Potassium sulphate K ₂ SO ₄	±1.5%RH + Greenspan's uncertainty

Accuracy of the thermometer

With mercury	±0.3°C
With red capillary liquid	±1°C

Reference

HMK15 Humidity Calibrator Operating Manual, June 1998.

HMI41 Indicator and HMP46 Probe

Operation Procedure

1. Turn the power on. If the screen shows “noProb”, check if the probe is correctly installed.
2. After a few seconds, if the screen shows “Lo bat”, then change the battery.
3. Relative humidity and temperature values will automatically shown after battery checking.
4. Press “MODE” to display the dewpoint temperature(Td).
5. Press “HOLD” to freeze the display the display the current reading. Then press “MODE” or “ENTER” to return to the normal mode.
6. Press “HOLD” under the HOLD-mode, then the minimum reading after power on will show.
7. Press “HOLD” under the MIN-mode will show the maximum reading. Then press any button to return to the normal mode.

Calibration Procedure

The calibration is not needed unless the adjustment has been changed. The probe must always be recalibrated when the sensor is changed.

A. Probe calibration with the trimmer potentiometer:

The potentiometer marked “T” is for factory use only. “D” is for the dry end, and “W” is for the wet end. Calibration can be performed with the HMK15.

1. Leave the HMK15 calibrator and the probe at the calibration site for at least 30 minutes to stabilize before starting the calibration.
2. Insert the probe into the measure hole of the LiCl solution. Wait until the humidity reading stabilizes, this will take about 10-30 minutes. Then use a suitable wrench to adjust the “D” of the trimmer potentiometer to the humidity value on the Greenspan's calibration table.

3. Then use the NaCl or K₂SO₄ as the wet reference depends on the humidity we need to use. If calibrating probes that are being used for a long time in high humidities (90-100RH), use the K₂SO₄. Otherwise, use the NaCl. Adjust the “W” of the trimmer potentiometer to the humidity value on the Greenspan’s calibration table. (Note that in high humidities the risk for errors increases. Therefore the stabilization time should be longer (about 20-40 min).)

B. Calibration with HMI41 Software Commands:

This method is useful only when one probe is used, otherwise, we should use the probe potentiometers.

Data Collecting

Refer to page 20 of the manual.

Data transferring

Refer to page 26 of the manual.

Changing the settings

Refer to page 33 of the manual.

Reference

HMI41 Indicator and HMP41/45/46 Probes Operating Manual, March 1998.

