RELATIVE HUMIDITY SENSOR
BT72i

USER'S GUIDE

CENTRE FOR MICROCOMPUTER APPLICATIONS

http://www.cma-science.nl

Short description

The CMA Relative Humidity Sensor BT72i measures relative humidity in a range between 0 and 100%. The sensor consists of an integrated circuit, which uses a thermoset capacitive polymer to sense humidity. The integrated circuit then produces an output voltage, which varies with relative humidity.
The sensor is placed in a plastic box with holes, which provide air circulation. The typical response time of the unit is 15 seconds in slowly moving air at 25 °C. The box not only protects the sensor, but also shields it from light. The sensor is slightly light sensitive if the light strikes it in just the right way. For best results, shield the sensor from bright light.
The Humidity sensor can be directly connected to the analog BT inputs of the CMA interfaces. The sensor cable BT - IEEE1394 needed to connect the sensor to an interface is **not** supplied with the sensor and has to be purchased separately (CMA Order Code BTsc_1).

Sensor recognition

The Humidity sensor BT72i has a memory chip (EEPROM) with information about the sensor: its name, measured quantity, unit and calibration. Through a simple protocol this information is read by the CMA interfaces and the sensor is automatically recognized when it is connected to these interfaces. If your Humidity sensor is not automatically detected by an interface you have to manually set up your sensor by selecting it from the Coach Sensor Library.

Calibration

The CMA Relative Humidity sensor BT72i is supplied calibrated. The output of the sensor is linear with respect to the measured humidity:

$$RH\ (\%) = 32.26 * V_{out}\ (V) - 25.81$$

The Coach software allows selecting the calibration supplied by the sensor memory (EEPROM) or the calibration stored in the Coach Sensor Library.

For better accuracy you can calibrate the sensor. Calibration can be done by comparison to another instrument that measures relative humidity (hygrometer).
Another calibration method is based upon the use of saturated salt solutions as the humidity generation source. If you place a saturated salt solution in a sealed container, the air above it will reach a known relative humidity. The relative humidity above the salt depends slightly on the temperature. A list of saturated salts and their humidity values in different temperatures are shown in the table[1].

[1] Even though none of the salts listed here is especially dangerous, use normal cautions with these chemicals.

All data in %	15 °C	20 °C	25 °C	30 °C	35 °C
Lithium Bromide	6.86	6.61	6.37	6.16	5.97
Lithium Chloride	11.3	11.31	11.3	11.28	11.25
Potassium Acetate	23.40	23.11	22.51	21.61	–
Magnesium Chloride	33.3	33.07	32.78	32.44	32.05
Potassium Carbonate	43.15	43.16	43.16	43.17	–
Magnesium Nitrate	55.87	54.38	52.89	51.4	49.91
Potassium Iodine	70.98	69.90	68.86	67.89	66.96
Sodium Chloride	75.61	75.47	75.29	75.09	74.87
Ammonium Sulphate	81.70	81.34	80.99	80.63	80.27
Potassium Chloride	85.92	85.11	84.34	83.62	82.95
Potassium Nitrate	95.41	94.62	93.58	92.31	90.79

Calibration procedure:

- Place about 3 cm of saturated salt solution in a glass container that is approximately 10 cm high[2]. The air above the solution will have a fixed humidity.
- Place the humidity sensor in the container. The sensor must be suspended in the saturated air above the salt solution. Do not get the salt or salt solution on the sensor.
- Seal the container. It takes some time (2 to 6 hours) for the air inside the sensor to reach the proper relative humidity level.
- Determine the first calibration point. Take the relative humidity for the salt you used as determined from the table.
- Repeat above procedure for the second calibration point using a different saturated salt solution. Be sure to allow enough time for the sensor to adjust for the change in humidity.

Suggested experiments

The Relative Humidity sensor can be used to measure relative humidity in air as part of a weather station, or to:

- study transpiration rates of plants by monitoring relative humidity in sealed jars containing plants,
- optimize conditions in a greenhouse or terrarium,
- determine good days for static electric demonstrations.

[2] If you do not have a saturated salt solution you can place a handful of salt on the bottom of a glass container and add a little water to the container so that the salt is wet. The goal is to end up with wet salt, not to totally dissolve the salt. Accuracy of such measurement is ±10 RH.

Technical Specifications

Sensor kind	Analog, generates an output voltage 0 – 5 V
Measurement range	0 - 100%
Resolution using 12 bit AD converter	0.04 % RH
Calibration function	RH (%) = 32.26 * V_{out} (V) - 25.81
Supplied current	0.5 mA
Response time (for 90% change in reading)	15 s in slowly moving air at 25 °C
Specification for Honeywell HIH 4000 Integrated Circuit Humidity Sensor at 25°C and 5 VDC	
RH Accuracy *RH Interchangeability* *RH Linearity* *Operating temperature* *Temperature compensation* *Effect at 0% RH* *Effect at 100% RH*	± 2% RH (after individual calibration) ± 5% RH, 0-60% RH; ± 8% RH @ 90% RH typical (with stand. cal.) ± 0.5% RH typical 0 - 85 °C True RH=(Sensor RH)/(1.0546-0.00216T) T in °C ± 0.007% RH/°C (negligible) - 0.22% RH/°C
Connection	IEEE1394 connector for BT-IEEE1394 sensor cable. Sensor cable **not** delivered with the sensor.

Warranty:

The Relative Humidity sensor BT72i is warranted to be free from defects in materials and workmanship for a period of 12 months from the date of purchase provided that it has been used under normal laboratory conditions. This warranty does not apply if the sensor has been damaged by accident or misuse.

Note: *This product is to be used for educational purposes only. It is not appropriate for industrial, medical, research, or commercial applications.*

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