Relative Humidity Sensor

(Order Code RH-BTA)

The Relative Humidity Sensor can be used to measure relative humidity in the air as part of a weather station, or to do any of the following:

- Monitor indoor humidity for health reasons
- Optimize conditions in a greenhouse or terrarium
- Determine when static electrical discharges will be a problem
- Study transpiration rates of plants by monitoring relative humidity in sealed jars containing plants

Collecting Data with the Relative Humidity Sensor

This sensor can be used with the following interfaces to collect data:

- Vernier LabQuest® 2 or original LabQuest® as a standalone device or with a computer
- Vernier LabQuest® Mini with a computer
- Vernier LabPro® with a computer or TI graphing calculator
- Vernier Go!®Link
- Vernier SensorDAQ®
- Vernier EasyLink®
- CBL2™
- TI-Nspire™ Lab Cradle

Here is the general procedure to follow when using the Relative Humidity Sensor:

1. Connect the Relative Humidity Sensor to the interface.
2. Start the data-collection software.
3. The software will identify the Relative Humidity Sensor and load a default data-collection setup. You are now ready to collect data.

Data-Collection Software

This sensor can be used with an interface and the following data-collection software.

- **Logger *Pro* 3** This computer program is used with LabQuest 2, LabQuest, LabQuest Mini, LabPro, or Go!Link
- **Logger Lite** This computer program is used with LabQuest 2, LabQuest, LabQuest Mini, LabPro, or Go!Link
- **LabQuest App** This program is used when LabQuest 2 or LabQuest is used as a standalone device.
- **EasyData App** This calculator application for the TI-83 Plus and TI-84 Plus can be used with CBL 2™, LabPro, Vernier EasyLink, CBR 2, and CBR. We recommend version 2.0 or newer, which can be downloaded from the Vernier web site, www.vernier.com/easy/easydata.html, and then transferred to the calculator. See the Vernier web site, www.vernier.com/calc/software/index.html for more information on the App and Program Transfer Guidebook.
- **DataMate program** Use DataMate with LabPro or CBL 2™ and TI-73, TI-83, TI-84, TI-86, TI-89, and Voyage 200 calculators. See the LabPro and CBL 2™ Guidebooks for instructions on transferring DataMate to the calculator.
- **DataQuest™ Software for TI-Nspire™** This calculator application for the TI-Nspire can be used with the EasyLink or TI-Nspire Lab Cradle.
- **LabVIEW** National Instruments LabVIEW™ software is a graphical programming language sold by National Instruments. It is used with SensorDAQ and can be used with a number of other Vernier interfaces. See www.vernier.com/labview for more information.

NOTE: Vernier products are designed for educational use. Our products are not designed nor recommended for any industrial, medical, or commercial process such as life support, patient diagnosis, control of a manufacturing process, or industrial testing of any kind.

Specifications

Range:	0% to 95%
Power:	200 µA @ 5 VDC
Response Time (time for a 90% change in reading)	
In still air:	60 minutes (typical)
With vigorous air movement:	40 seconds (typical)
Resolution	
13-bit (with SensorDAQ)	0.02% RH
12-bit (with LabPro, LabQuest 2, LabQuest, LabQuest Mini, TI-Nspire™ Lab Cradle, Go!Link, ULI, or SBI)	0.04% RH
10-bit (with CBL 2™)	0.16% RH
Stored calibration	
Slope	30.43%/V
Intercept	–25.81%
Specifications for the IH-3602-L Integrated Circuit Humidity Sensor (at 25°C and 5.0 VDC) are given below	
Total Accuracy (with saturated salt calibration):	±2% RH
Total Accuracy (with standard calibration):	±10% RH
Operating Temperature Range:	0 to 85°C
Temperature Effect on 0%RH voltage:	±0.007% RH/°C (negligible)
Temperature Effect on 50%RH voltage:	–0.11% RH/°C
Temperature Effect on 95%RH voltage	–0.22% RH/°C

How the Relative Humidity Sensor Works

The heart of this sensor is the Hy-Cal Engineering IH-3602-L Integrated Circuit Humidity Sensor, which uses a capacitive polymer to sense humidity. An integrated circuit then produces an output voltage which varies with relative humidity. The response time of the unit in moving air is much shorter than in still air. In some cases, you may want to create air currents (by moving the sensor or using a fan) to speed up the response of the sensor.

The sensor is slightly light sensitive. The housing is designed to minimize the amount of light that can penetrate the sensor opening. The calibration of the sensor is somewhat affected by temperature. This effect is negligible at the low relative humidity readings, but increases at high humidities. If you want to correct for this error, you can create different calibration files for different temperatures. In most cases, this is unnecessary.

This sensor is equipped with circuitry that supports auto-ID. When used with LabQuest 2, LabQuest, LabQuest Mini, LabPro, Go! Link, SensorDAQ, EasyLink, TI-Nspire™ Lab Cradle, or CBL 2™, the data-collection software identifies the sensor and uses pre-defined parameters to configure an experiment appropriate to the recognized sensor.

Optional Calibration Procedure

You do not need to perform a new calibration on the Relative Humidity Sensor. We have set each Relative Humidity Sensor to match the stored calibration before shipping it. You can simply use the appropriate calibration file that is stored in your data-collection program from Vernier.

For greatest accuracy, this Relative Humidity Sensor can be calibrated. Calibration can be done by comparison to another instrument that measures relative humidity (hygrometer or psychrometer). Another way is to use salt solutions. You would do a two-point calibration as you probably have done with other sensors such as pH sensors. The salt solutions are used to maintain environments with different known relative humidities. If you place moist salts in a sealed container, the air above it will reach a known relative humidity. A table of values is shown on the next page. The relative humidity above the salt depends slightly on the temperature, so the table also lists temperature.

Here is a step-by-step procedure,

1. Place a handful of salt in the bottom of a jar (quart or liter size is fine).
2. Add a little water to the jar so that the salt is wet. The goal is to end up with wet salt, not to totally dissolve the salt.
3. Place the Relative Humidity Sensor in a jar. Do not get the salt or salt solution on the sensor.
4. Seal the jar. We usually use plastic wrap and rubber bands.
5. Start the program and allow some time (2 to 6 hours) for the air inside the sensor to reach the proper relative humidity level.
6. Go through the procedure for the first point of calibration. Type in the relative humidity for the salt you used, as determined from the table.

7. Repeat the procedure for the second calibration point using a different salt. Be sure to allow enough time for the Relative Humidity Sensor to adjust for the change in humidity.

Even though none of the salts listed here is especially dangerous, use normal precautions with these chemicals.

Here are the relative humidity readings to use when calibrating with salts. These numbers were taken from Hy-Cal Engineering IH-3602-L data sheets.

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 Iodide	70.98	69.90	68.86	67.89	66.96
Sodium Chloride	75.61	75.47	75.29	75.09	74.87
Ammonium Sulfate	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

Warranty

Vernier warrants this product to be free from defects in materials and workmanship for a period of five years from the date of shipment to the customer. This warranty does not cover damage to the product caused by abuse or improper use.

Measure. Analyze. Learn.™
Vernier Software & Technology
13979 S.W. Millikan Way • Beaverton, OR 97005-2886
Toll Free (888) 837-6437 • (503) 277-2299 • FAX (503) 277-2440
info@vernier.com • www.vernier.com

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