Humidity Sensor

(Product No. 3145)

Range: 0 to 100%RH
Resolution: 0.1%RH
Accuracy: ±2.5%RH @ 55%RH,
±5%RH between 10 and 95%RH

DATA HARVEST

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DS 028 No 4

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Introduction

The Smart Q Humidity Sensor is designed for monitoring relative humidity.

The slots in the end cap allow for circulation of air. The response times of this Sensor will vary considerably with the amount of air circulation i.e. it will respond more quickly with an increase in movement of air.

The Smart Q Humidity Sensor is equipped with a micro controller that greatly improves the accuracy, precision and consistency of readings. They are supplied calibrated and the stored calibration (in %RH) is automatically loaded when the Humidity sensor is connected.

Connecting

- Push one end of the sensor cable (supplied with the **EASY**SENSE unit) into the hooded socket on the adaptor with the locating arrow on the cable facing upwards.
- Connect the other end of the sensor cable to an input socket on the **EASY**SENSE unit.
- The **EASY**SENSE unit will detect that the Humidity sensor is connected and display values using the currently selected range. If the range is not suitable for your investigation, set to the correct range.

Practical information

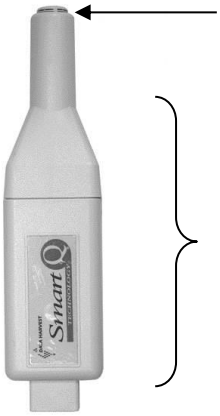
Temperature operating range: -30 to 60°C

Temperature coefficient (10 to 50°C): 0.1% RH/°C

Response time: 5 seconds for 63% response to a step change 33 to 75% RH

Storage Temperature: -30 to 70°C

- If high humidity levels are possible, do not place your **EASY**SENSE unit in the same environment as the Humidity sensor as this may result in damage or malfunction.



- The humidity transducer will not be damaged by incidental condensation, but should not be immersed in liquid. If condensation has formed, the Humidity sensor will not be able to give a reliable measurement for a lower humidity until all the droplets have evaporated. Evaporation may be speeded up by movement of the Sensor through the air or by using a fan.
- The electronic circuit inside the Sensor itself cannot be completely sealed from the atmosphere. If the Sensor is to be used in an environment where there is a risk of condensation, precautions must be taken to ensure that liquid cannot enter this part of the Sensor.

- The response time of this Sensor will vary considerably with air circulation i.e. it will respond more quickly in a moving current of air.
- If used in a dirty environment, protect the Sensor from dirt using a piece of nylon stocking mesh.
- The humidity transducer is not light sensitive.
- Do not expose to chemical vapours such as acetone, organic solvents, or chlorine, which are harmful to the Sensor.

Theory

The warmer the air is, the more water vapour it can "hold". Humidity is an expression used to describe the amount of water vapour in the air. 'Relative Humidity (RH)' is the term used most often in weather information meant for the public.

Relative humidity is the amount of water vapour actually in the air compared with the amount of vapour needed to make the air saturated at the air's current temperature. It is expressed as a percentage and can be computed in a variety of ways.

e.g. $\%RH = 100 \times P_w / P_s (t)$

Where P_w = partial water pressure
P_s = water vapour's saturation pressure
t = ambient temperature in C

Example:

1. The air temperature is 30 degrees and the air has 9 grams of water vapour per cubic meter of air. Divide 9 by 30 and multiply by 100 to get a relative humidity of 30% - the air has 30% of the water vapour it could hold at its current temperature.
2. The air temperature drops to 20 degrees. Divide 9, the vapour actually in the air, by 17, the vapour it could hold at its new temperature, and multiply by 100 to get a relative humidity of 53%.
3. The air cools down to 10 degrees, divide 9 by 9 and multiply by 100 to get a relative humidity of 100% - the air now has all the vapour it can hold at its new temperature.

Useful Definitions

Absolute humidity: The mass of water vapour in a given volume of air.

Actual vapour pressure: The partial pressure exerted by the water vapour present.

Dewpoint: The temperature air would have to be cooled to in order for saturation to occur.

Mixing Ratio: The mass of water vapour divide by the mass of the dry air.

Saturation of air: The condition under which the amount of water vapour in the air is the maximum possible at the existing temperature and pressure.

Saturation vapour pressure: The maximum partial pressure that water vapour molecules would exert if the air were saturated with vapour at a given temperature.

Specific humidity: The mass of water vapour divided by the total mass of the air.

Applications

The humidity of the atmosphere affects many things including:

Comfort - Humans and animals control their body temperature by sweating. The best humidity for human beings is 40 – 60%. At high humidity sweating is less effective so we fell hotter. Dry air feels colder at room temperature leading to discomfort, lower productivity and demands for more heating. When relative humidity is ideal, temperatures in buildings can be lowered without causing discomfort to the people in them.

Plant and mould growth – Plants have a preference for a particular humidity level e.g. low for Cacti and high for Tropical Rainforest plants. Fungi mould and microbes thrive on high humidity.

Materials in Storage – Materials decay more quickly in high humidity e.g. wood rots. Rust and corrosion of metals increases above 60%RH. Vegetables have high water content. If stored in dry conditions their value evaporates!

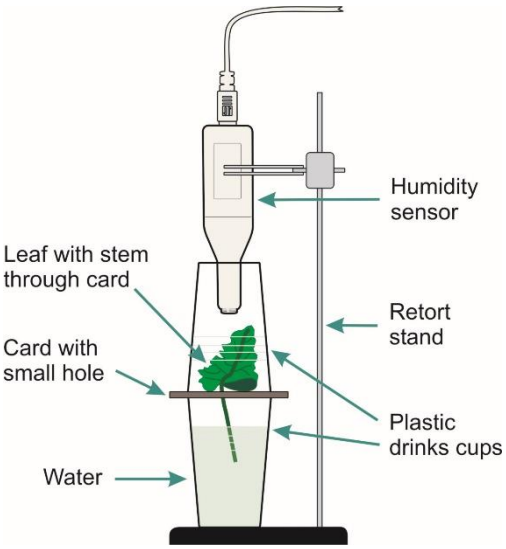
Static Electricity – In low humidity, static electricity increases because dry air is a better insulator than moist air. This can cause: electric shocks to grounded objects after walking on synthetic carpets, problems with copying machines, risks of sparking and explosions of gases and vapours, damage to electronic integrated circuits. Humidity in the range 40 – 60% reduces this problem.

Health – At low humidity the number of dust particles in the air increases. Bacteria and viruses have a longer lifetime, and can become part of the floating dust. At high humidity fungi and microbes increase causing: Legionnaires/s disease and Farmers Lung, allergic and asthmatic reactions.

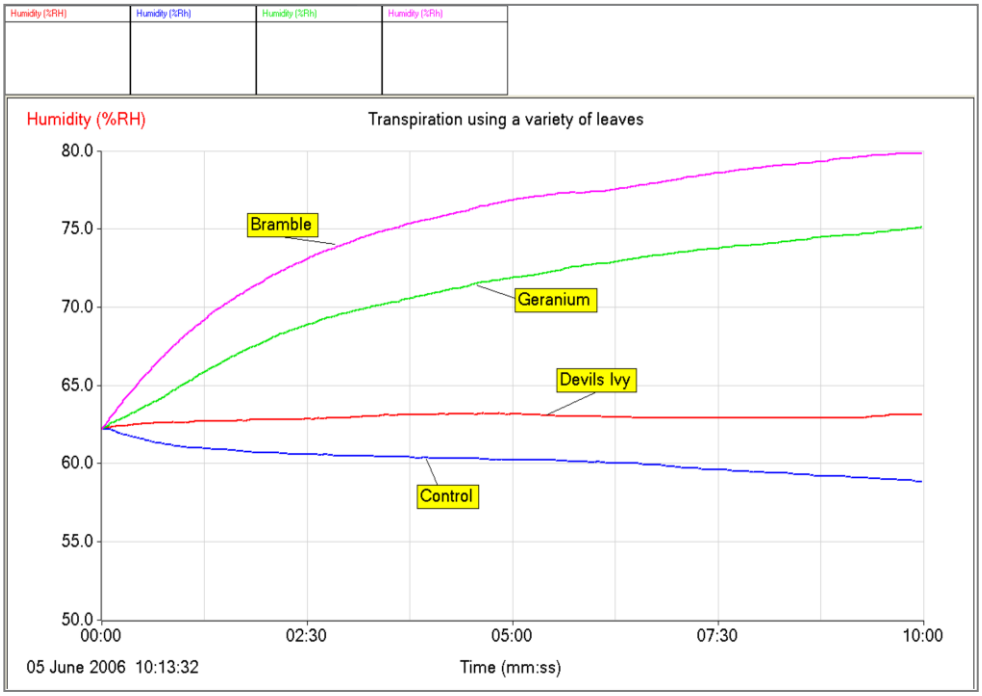
Process control – The physical properties of materials change with humidity and must therefore be controlled in manufacturing processes for consistent results e.g. paper, powders, textiles and plastics.

Investigations

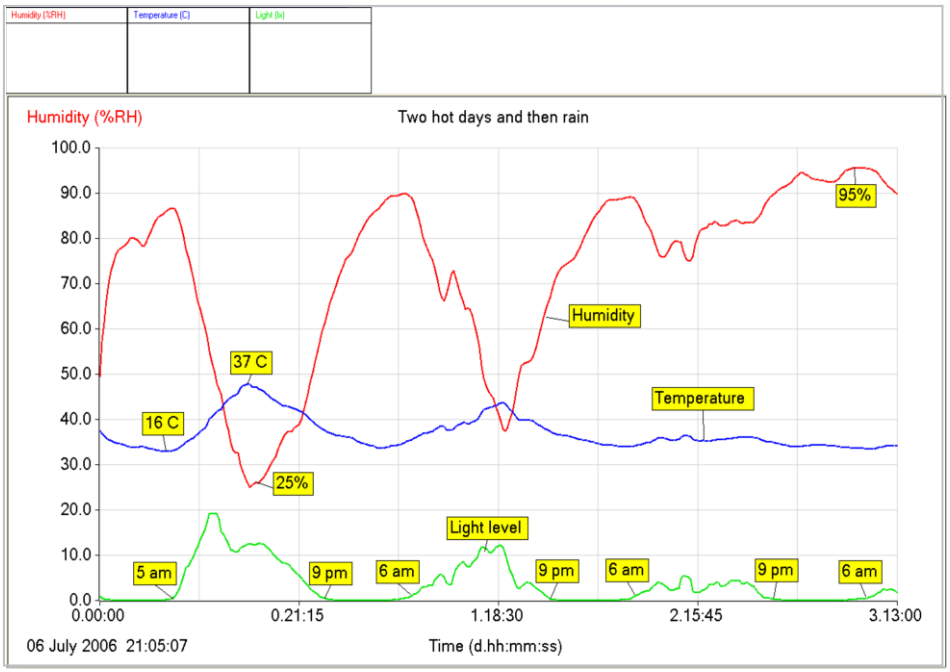
- *Plant Transpiration*



This data was collected using the set up described in the 5 minute activity worksheet, **Transpiration – Water loss from a plant.**



- *Greenhouse or Terrarium studies*
- *Combustion*
- *Moisture in Exhaled air*
- *Hygrometry*
- *Determining Dew point*
- *Examining different Habitats*
- *Regulation of Body temperature*
- *Effect on Static electricity*
- *Weather monitoring*



In this graph, weather conditions were monitored when the forecast was for rain after a hot spell.

Limited warranty

For information about the terms of the product warranty, see the Data Harvest website at: https://data-harvest.co.uk/warranty.

Note: Data Harvest products are designed for **educational** use and are not intended for use in industrial, medical or commercial applications.

(**W**aste **E**lectrical and **E**lectronic **E**quipment) Legislation

Harvest Group Ltd is fully compliant with WEEE legislation and is pleased to provide a disposal service for any of our products when their life expires. Simply return them to us clearly identified as 'life expired' and we will dispose of them for you.