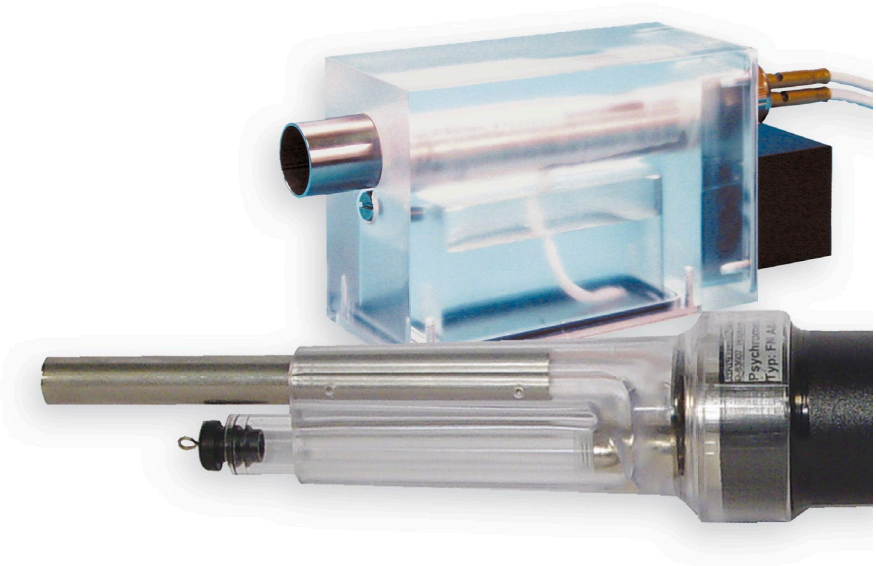
Air humidity



The Right Humidity Sensor for Any Measuring Task

- For humidity measurements various methods are used that differ from each other mainly with regard to their accuracy and their suitability for long term measurements and the substance used for the measurement:
- Capacitive Air Humidity Measurement,
- Psychrometric Air Humidity Measurement,
- Hygrometric Air Humidity Measurement,
- Dielectric Measurement of Moisture in Materials,
- Measurement of the Moisture in Materials According to the Principle of Conductivity,
- Dew Point Determination with CCC Dew Point Probes,
- Dew Point Determination with Dew Point Mirrors.

Capacitive Air Humidity Measurement

Capacitive sensors contain a glass substrate with a moisture sensitive polymer layer between two metal layers. By absorption of water, corresponding to the relative humidity, the dielectric constant and, as a result, the capacity of the thin-film capacitor are changing. The measuring signal is directly proportional to the relative humidity and does not depend on the atmospheric pressure.

Advantage:
- maintenance-free measurement over longer periods,
- can withstand temperatures below 0°C
- atm. pressure-independent, works when pressure is applied
- flexible use of the sensor

Disadvantage:
- limited long term stability
- sensitive to dewing and certain aggressive substances

Psychrometric Air Humidity Measurement

Psychrometers are precision devices containing a dry and a moistened temperature sensor. As a result of the evaporation the humidity sensor cools down, with a wind velocity of a minimum of 2m/s being required for the cool down process. The humidity values are calculated from the temperature difference (psychrometric difference). The calculation formulae for ALMEMO® devices correspond to those used by the German Weather Authority related to 1013mbar. Differences regarding to the atmospheric pressure can be corrected to achieve precise measurements.

Advantage:
- no ageing of the sensor -
- exception: contamination of the wick
- high accuracy
- high quality regarding the measuring technology
- usable without problems up to 100% r.H. in all substances

Disadvantage:
- long term measurement limited by the required water reserve and wick maintenance
- difficult to use with temperatures below 0°C and with low humidities
- depending on the atmospheric pressure

Hygrometric Air Humidity Measurement

Hygrometric sensors are equipped with a measuring strip, which lengthens or tightens depending on the humidity. The measuring strip consists of many single fibers (measuring harp), which are made from organic or synthetic material.

Advantage:
- simple and low cost measuring technology, also usable for contaminated environments
- easy to clean

Disadvantage:
- limited accuracy
- limited measuring range
- slow measurement

Dielectric Measurement of Moisture in Materials

The measurement of the moisture in materials is performed indirectly via the determination of the dielectric constant. This is performed by using a capacity measurement via a high-frequency electrical field, which penetrates the material without disturbances.

Advantage:
- simple and fast measuring technology
- non-destructive contact measurement
- long term use is possible

Disadvantage:
- limited accuracy

Measurement of the Moisture in Materials according to the Principle of Conductivity

The measurement of the moisture in materials is performed indirectly via the determination of the electrical resistance, which depends on the moisture content of the material.

Advantage:
- simple and fast measuring technology

Disadvantage:
- limited accuracy
- probe insertions
- only for short term control measurements
- measured values depend on various material parametersMaterialparametern

Dew Point Determination with CCC Dew Point Probes

The dew point sensor is equipped with an integrated sensor chip (CCC dew point principle according to Heinze), which is mounted on a cooling element. The sensor unit is also connected to a control circuit that regulates the operating current of the cooling element so that a defined condensate is established. The resulting dew point temperature will be directly measured within the sensor and can be output in a format, which allows for an evaluation.

Advantage:
- high accuracy, reliability and reproducibility
- wide measuring range

Disadvantage:
- high-sophisticated measuring method
- not suitable for quick control measurements
- cannot be used at temperatures below 0°C

Dew Point Determination with Dew Point Mirrors

An optically monitored mirror is mounted on a cascaded Peltier element. The sensor unit is also connected to a control circuit that regulates the operating current of the cooling element so that a defined condensate is established. The dew point temperature will be directly measured within the sensor and can be output in a format, which allows for an evaluation.

Advantage:
- high accuracy, reliability and reproducibility
- independent from atmospheric pressure
- wide measuring range
- suitable for temperatures below 0°C

Disadvantage:
- high sophisticated measuring method
- high current consumption
- risk of contamination

Small Glossary for Humidity/Moisture Measurement Variables

Absolute Humidity	The absolute humidity indicates the weight of the water vapour contained in one m^3 of a mixture of air and water vapour.
Enthalpy	The enthalpy indicates how much heat is stored within the humid air. This value is important for calculating the cooling and heating performance, e.g. when checking heat exchangers.
Mixture Ratio	The absolute humidity related to 1kg dry air.
Relative Humidity	The relative humidity indicates the percentage of air, which is saturated with water vapour, i.e. how much percent of the maximum possible amount of water vapour is currently contained in the air. Owing to the dependence on temperature the relat. humidity can only ever be indicated for one specific temperature.
Saturation Vap. Pressure	Air can only ever contain a certain maximum amount of water vapour. This is called the saturation vapour pressure, specified as g water vapour per kg of humid air. The saturation vapour pressure strongly depends on the air temperature. At low temperatures it will be low and at high temperatures it will be high. Therefore, warm air can accept large amounts of vapour pressure and cold air only small amounts.
Dew Point	The dew point is the temperature where the relative humidity equals 100%. If the dew point is not reached the water vapour will start condensing.
Water Vap. Partial Press.	The total pressure in the room determined by the water vapour.