Product info sheet no. A1
Application notes for humidity sensing elements

Mechanical sensitivity
The layered structure of the sensing element includes the thin polymer layer as well as a wafer-thin layer of gold, both of which are very sensitive to external mechanical influences. Even the finest scratches damage the sensing element. Therefore, never touch the surface of the sensing element. Particles carried along in the airflow (such as sand) can also destroy the sensing element. The element can be protected by using an appropriate filter made from sintered metal or PTFE.
Some types of MELA®-humidity sensing elements (FE 09/1, FE 09/1000) have a protective layer which reduces their mechanical sensitivity.
Most MELA®-humidity sensing elements also can be supplied with a protective frame in order to protect the sensitive surface, making it easier to handle.

Connection conditions
The maximum voltage measured at the element is 3 V, and the measured frequency should be between 5 kHz and 200 kHz; this frequency should be between 5 kHz and 100 kHz in the case of the FE 09/1000. Avoid connecting a DC voltage supply.

Linearity
The deviation in linearity across the entire measuring range is less than 1.5% RH. There is generally no need for linearisation by means of the evaluation circuit.

Temperature-dependence
The temperature-dependence of the humidity sensing elements is less than 0.1% RH/K; this is negligible in an average temperature range of between 10 and 40°C. At temperatures outside this range, the measuring accuracy can be improved by means of temperature compensation in the evaluation circuit.
The following correction algorithm can be specified for the temperature-dependence of the humidity sensing elements.

\[ K = \left[ A + a(T - 25) \right] + \sum b_i \cdot T^i \]

\[ K = \text{corrected value} \]
\[ A = \text{output signal (0...100% rh)} \]
\[ T = \text{temperature in °C} \]
\[ a = 0.04 \text{ (for } T \geq 25°C) \]
\[ a = 0 \text{ (for } T < 25°C) \]
\[ b_i = 0.98125 \]
\[ b = 6 \cdot 10^{-4} \]

This information is based on current knowledge and is intended to provide details of our products and their possible applications. It does not, therefore, act as a guarantee of specific properties of the products described or of their suitability for a particular application. It is our experience that the equipment may be used across a broad spectrum of applications under the most varied conditions and loads. We cannot appraise every individual case. Purchasers and/or users are responsible for checking the equipment for suitability for any particular application. Any existing industrial rights of protection must be observed. The perfect quality of our products is guaranteed under our General Conditions of Sale. Issue: February 2003 A1_E. Subject to modifications.
Dynamic behaviour and hysteresis

**MELA®-humidity sensing elements** react instantly to changes in ambient humidity. The response time (T90) is less than 10 seconds. Recovery of the final value (approx. 1% RH) depends on the air speed and on the length of time the previous humidity remains for. In a humidity range of 20...90% RH, the hysteresis is less than 1% RH. The hysteresis may be up to 2% RH if the sensing elements are exposed to extremely dry or humid conditions (relative humidity < 20% or > 90% RH) for a long period of time.

Storage influences

If the sensing elements are stored for weeks at a time in conditions of extremely low humidity (<25% RH) or high humidity (>90% RH), the gradient of the sensing elements changes. However, this returns to its original value by running through the entire humidity range a number of times. Before the humidity sensing elements are ultimately put into use and before calibration with an evaluation circuit, they should be stored for at least 48 hours at a relative humidity of 60...80%.

Dirt

Non-hygroscopic deposits, such as dust, on the active surface do not impair the function of the humidity sensing elements, although they can hamper the dynamic performance if the deposits are too large.

Hygroscopic deposits, such as salts, affect the function of the humidity sensing elements by raising conductivity and causing measuring errors, which can sometimes prove to be significant, in particular within the range of high humidity. Dry dust can simply be blown off. Elements with hygroscopic deposits can only be cleaned by washing them with distilled water. In the case of humidity sensing elements with an additional protective layer (FE 9/1, FE09/1000), stubborn dirt can be removed by brushing with distilled water and a very soft brush.

The elements can be used again after cleaning, provided they have sustained no mechanical damage.

Influence of harmful substances

Harmful substances can have very different effects on humidity sensing elements. Many harmful substances, such as acids have no affect on the element.

Some harmful substances are not damaging to the element, however they can corrupt measurement readings; this occurs, in particular, in high humidity but disappears again when atmospheric conditions return to normal.

Other harmful substances bring about a change in the gradient of the characteristic curve, which can only be reversed by thermal treatment (heating up), whereby the molecules of the harmful substances are drained out (formaldehyde, carbon dioxide, alcohol etc.).

There are a few harmful substances, however, which bring about irreversible changes in the characteristic curve or damage the element (ammonia, bases, etc.). We advise you not to use the sensing elements in these conditions.

Unfortunately it is not possible for us to test all harmful substances and the effect they have on our elements. The database of tested substances we have at our disposal is continuously being expanded and made more precise. If you have any applications subject to pollution, please contact us.

Application circuits with a frequency output

**Discrete circuit:**

- **Humidity sensing elements:**
  - types FE09/1, FE09/2, FE09/4
  - 5 ... 95%rh correspond to approx. 54...47 kHz

VCC max = 9V DC

Higher voltages may destroy the sensor element!

**Circuit with 555**

- **Humidity sensing elements:**
  - types FE09/1000
  - 5...95%rh correspond to approx. 3...2 kHz

VCC max = 9V DC

Higher voltages may destroy the sensor element!