

# Humidity Sensor Elements

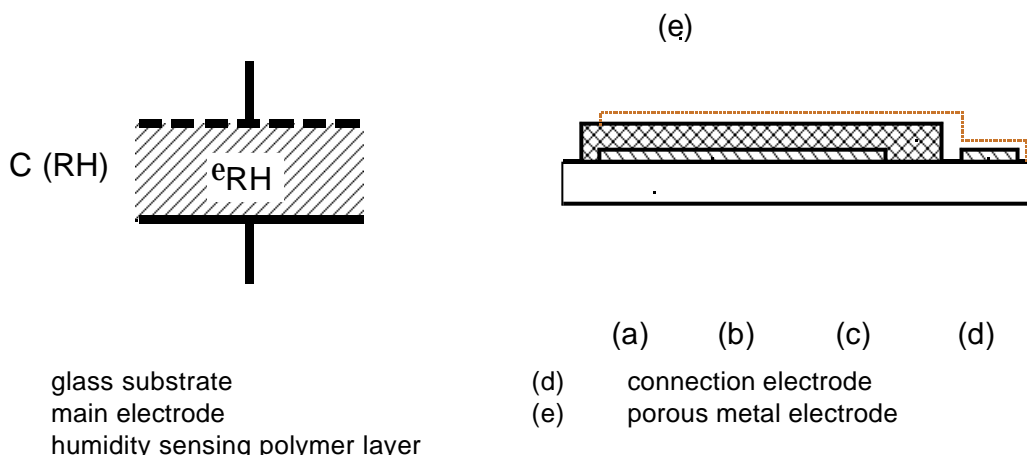
**HC103, HC104  
 HC201**

The HC Series of E+E Elektronik are capacitive humidity sensors produced in thin film technology. Due to careful selection of materials, to state-of-the-art production technology and to long experience of E+E in thin film technology, all HC humidity sensors show an excellent long term stability, highest reproducibility of the sensor characteristic, are wettable and very resistant to pollutants. They are used in all E+E standard transmitter series, as well as in a large number of customised and OEM products from mass- to high-end applications. The excellent linearity enables the use of a simple, cost-effective oscillator circuitry with an easy and accurate calibration procedure. Extensive evaluation results such as from various long term tests or resistance to most chemicals of practical importance are available.

## Construction

A capacitive humidity sensor is in fact a plate capacitor. A polymer layer is placed between a metal electrode and a coated glass substrate. The dielectric permittivity  $\epsilon$  of the polymer depends on its water content.

### schematic construction of an E+E humidity sensor



For an optimal humidity exchange between the polymer layer and the surrounding air, the metal electrode is a porous layer of 0.1 to 1  $\mu\text{m}$  produced by a special production process. The absence of additional insulation layers leads to a high sensitivity. (refer to characteristics of E+E humidity sensors).

The capacity of the sensor:

- C sensor capacity at relative humidity RH
- $\epsilon_{RH}$  relative dielectric permittivity, depending on humidity  
 $\epsilon_{RH} = 3$  (at 0%RH)...3.9 (at 100%RH)
- $\epsilon_0$  permittivity of vacuum
- A area of the electrodes
- d distance between the electrodes
- RH relative humidity

$$C(RH) = \frac{\epsilon_{RH} \cdot \epsilon_0 \cdot A}{d}$$



## Definitions

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### Working Range

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The working range is the maximum range for humidity and temperature wherein specified data and tolerances are valid. The interdependence of humidity and temperature is of importance. (refer to data for working range).

### Nominal Capacitance

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The nominal capacitance is the capacity of the sensor at a certain relative humidity, at temperatures of 20degC or 30degC and operating frequency of 20kHz.

### Sensitivity

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The sensitivity is the variation of the capacitance per % RH. It is measured at 33% RH and 76% RH.

### Linearity Error

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The linearity error is the maximum deviation of the sensor characteristic from the best linear approximation.

### Hysteresis

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The hysteresis is the maximum difference between two cycles 15 - 95% RH and 95 - 15% RH. The cycles are performed in steps of 10% RH with a stabilisation time of 1 hour after each step.

### Temperature Dependence

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The temperature dependence is the deviation in % RH per degC at different humidity and temperature values.

### Response Time $t_{90}$

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The response time  $t_{90}$  is the time the sensor needs to reach 90 % of the final value for a 0 - 80 % step of relative humidity.

### Loss Tangent

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The loss tangent quantifies the resistive value of the impedance. It is measured at 25 degC, 76%RH and at operating frequency 20 kHz.

### Maximum Supply Voltage

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It is given as peak to peak voltage. DC voltage components on the sensing element are not allowed.

### Operating Frequency

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The HC sensors can operate within the specified frequency limits. For best results we recommend an operating frequency of 20 kHz.  
All specified technical data are measured at an operating frequency 20kHz.

## General Info HC Sensors

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## HC1000 / HC101 - High-End Humidity Sensors

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The HC1000 and HC101 humidity sensors fulfil the highest quality demands in the field of humidity measurement.

The excellent linearity of the sensor characteristic over the whole range of 0 ... 100% RH reduces the cost for circuitry and calibration.

Highest reproducibility of the key parameters like characteristic, temperature dependence, loss tangent and response time enable the use of the HC1000 and HC101 for high performance applications. They set new standards for long term stability, hysteresis and resistance to pollutants.

The versions with plastic housings HC1000/H/L and HC100/H allow easy handling and easy manual mounting on PCB.



HC1000 / HC101

## HC103-SMD Version

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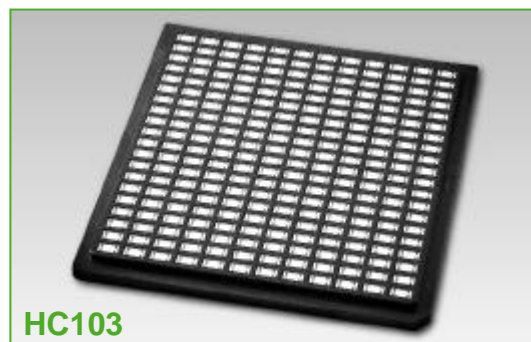
Based on the high-end HC1000 and HC101, HC103 was developed to meet the demands of automatic assembly lines for mass production at a competitive price.

Typical applications are automotive or home appliances.

HC103 sensors are positioned on the PCB at the same time as other SMD components and soldered using the reflow soldering method. Their small dimensions allow an easy and space saving design.

They show the same advantages as HC1000 and HC101, such as high reproducibility of the sensor data and outstanding linearity over the whole humidity range.

The temperature dependence is also highly reproducible and allows software temperature compensation. This means high accuracy over a wide temperature range, which is essential for instance to calculate dew point temperature.

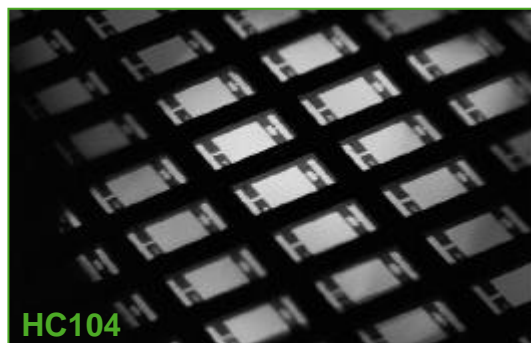


HC103

## HC104-Interchangeable SMD Version

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HC104 is the latest development of the well proven HC103 SMD-mounted sensor. Additionally to the HC103 features, the dispersion of nominal capacity of HC104 is reduced to a minimum by a special laser trimming process in a lot of applications. Time consuming humidity calibration is not necessary any longer. The result is an interchangeable sensor with excellent price/performance ratio, ideal for mass production in automatic assembly lines.



HC104

## HC201 - For Cost-Effective Applications

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With the HC201 offers E+E Elektronik a high-quality and cost-effective humidity sensor in thin layer technology. Mass applications in indoor climate controls are only one of many possible applications of the HC201 series.

HC201/H is a version with a plastic housing which offers easy mounting on PCBs.



HC201