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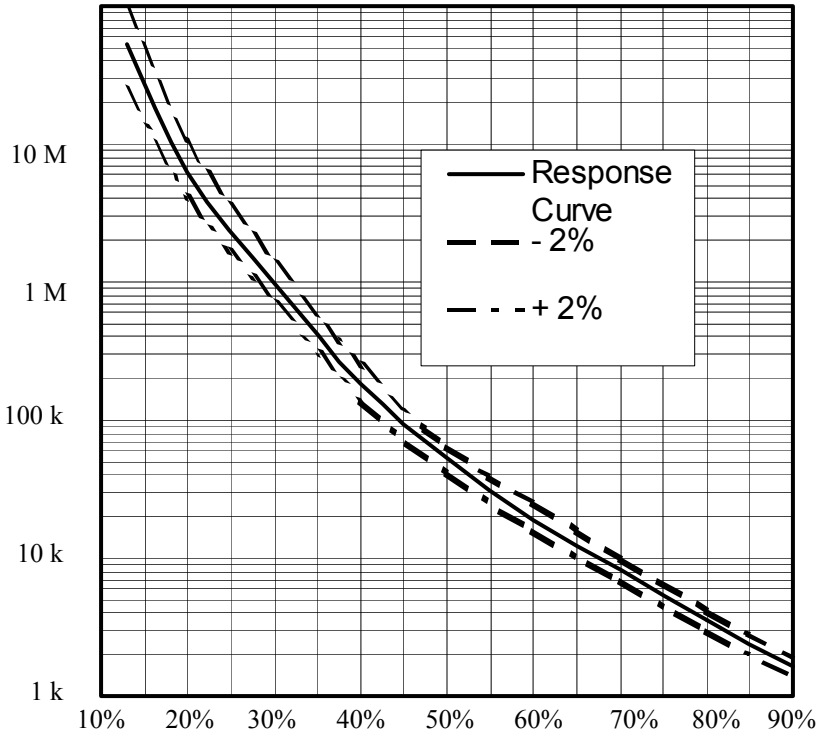
INDUSTRIAL & ENVIRONMENTAL SENSORS, INSTRUMENTS & CONTROLS SINCE 1969

# UPS-600 HUMIDITY SENSOR
## ECONOMICAL RESISTIVE ELEMENT FOR HIGH VOLUME APPLICATIONS


Since the 1970's OHMIC has developed a wide range resistive type humidity sensor, the Model UPS-600. Its condensation tolerance, small size, interchangeability, and long term stability make it a prime choice for commercial and industrial applications. The sensor is very cost effective in OEM quantities. Data charts, RH with temperature compensation equations, and a sample circuit are supplied with the sensor.

Photo shows a UPS-600 sensor enclosed in a protective housing with filter (left) and the sensor only (right). The compact size enables installation in probes and direct soldering to printed circuit boards.

MODEL UPS-600 CONDENSATION -TOLERANT RESISTIVE RELATIVE HUMIDITY SENSOR WAS DESIGNED TO MEET THE REQUIREMENTS OF OEM MANUFACTURERS AND THE HVAC INDUSTRY



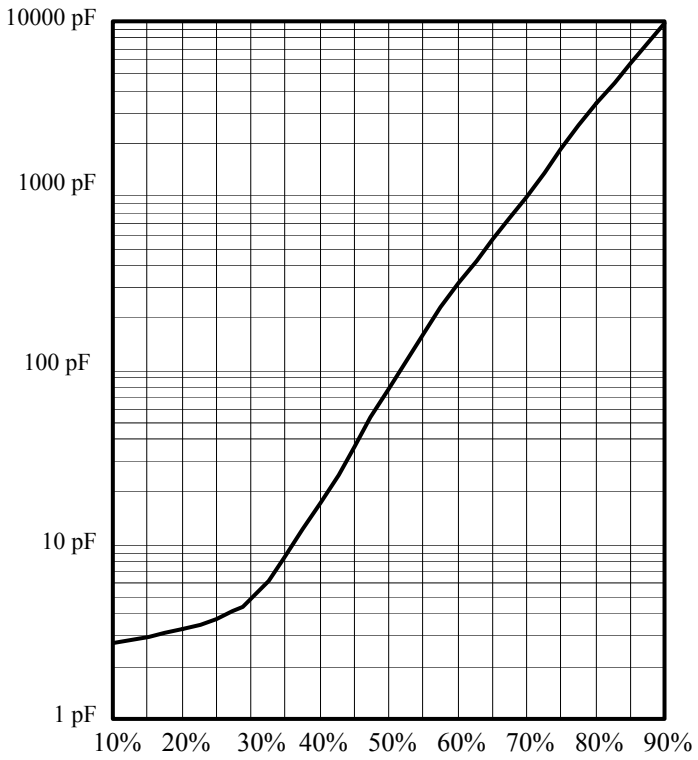

IMPEDANCE vs. %RH AT 25°C

Figure 1

UPS-600 Humidity Sensors overcome the limitations of other resistance-based humidity sensors that utilize water-soluble polymer coatings. Advanced ceramic technology enables these sensors to recover fully from condensation. Engineers rely on the UPS-600's high accuracy and interchangeability at competitive cost. These sensors are ideal for HVAC controls, appliances, humidistats, data loggers and other high volume applications. Figure 1 graph shows the Impedance vs. %RH. Sensor impedance varies from over 10 Meg in the low RH range to less than 2 K in the high RH range. The sensors are verified to OHMIC's NIST traceable humidity standards using a precision environmental chamber. The UPS-500 sensor has a lead spacing of .200" and may be soldered directly to a circuit board or placed in a connector for easy replacement.

### Sensor Excitation Frequency

To measure the sensor's impedance, a sine or square wave of 1 to 3 V rms in the frequency range of 50 Hz to 10 KHz is used. To avoid long-term polarization, the wave shape should be symmetrical, that is, no DC offset. The most commonly used excitation frequency is 1 KHz (see Figure 2, chart Impedance vs. %RH @ 60 Hz, 1 KHz, 50 Hz, 10 KHz). As shown by this chart, in the human comfort range of 40 to 60 %RH, the excitation frequency dependence is negligible.

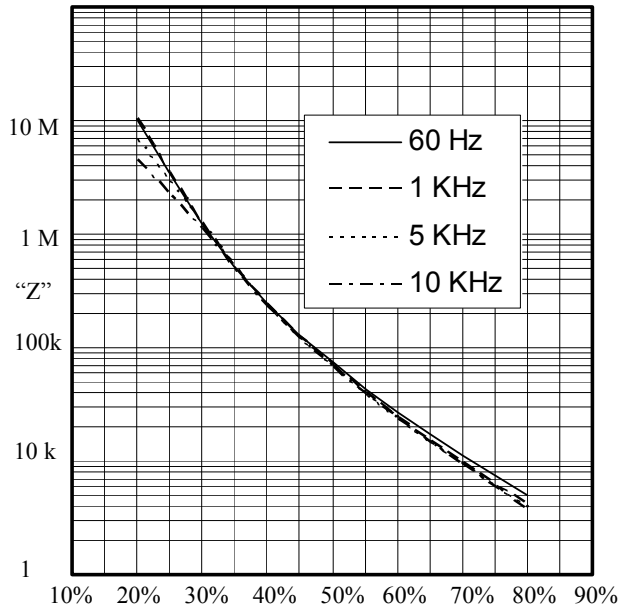



Capacitance vs. %RH, @25ºC kHz

Figure 3

### Sensor Response Time

The UPS-600's response time is expressed in terms of Absorption (the taking in of moisture by the sensor) and Desorption (the freeing of moisture from the sensor). Figure 4 shows the %RH vs. Time in minutes for the sensor changing from 20 to 90% RH and 90 to 20% RH in slow moving air. Absorption is always faster than Desorption. Faster moving air and higher temperature accelerate the response time.

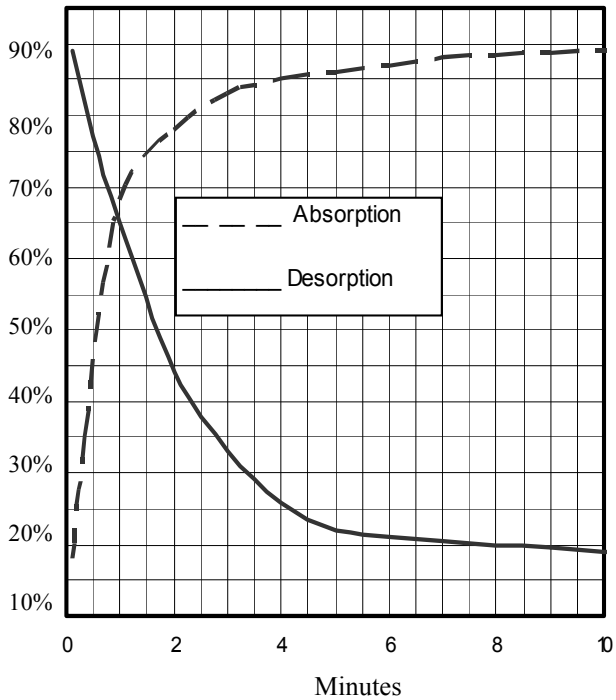



"Z"vs. %RH @ 60 Hz, 1/5/10 KHz @25ºC

Figure 2

### Capacitance

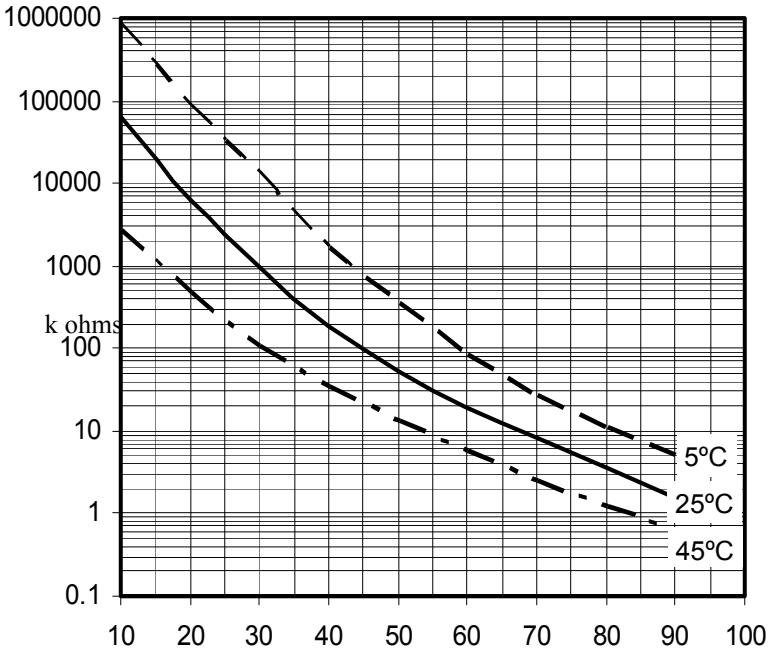
The UPS-600 sensor's impedance includes a capacitive component. This Capacitance vs. RH @ 25ºC. is shown in Figure 3. The logarithmic capacitance varies from 3 to 10,000 picoFarads and covers several decades.




%RH vs. Time in minutes @ 25ºC.

Figure 4

**WARRANTY:** All products manufactured by OHMIC Co. are warranted to be free of defects in material and workmanship for one year after delivery. Any equipment found to be defective within this period will be repaired or replaced free of charge.




Impedance vs. RH at 5ºC, 25ºC, & 45ºC Temperatures

Figure 5

**Temperature Characteristics**

Most resistive type humidity sensors display a negative temperature coefficient due to reduced ion mobility. The sensor's impedance decreases with an increase in temperature. Figure 5 shows the Impedance vs. %RH values for the UPS-600 sensor at 5/25/45 ºC.

The average coefficient for temperature compensation of the UPS-600 sensor works out to -0.7%RH/ºC (-0.4%RH/ºF). The correction factor is computed with the expression:

**C= -0.7(T-25)**

**C**= the correction factor in %RH to be algebraically added.
**T**= the temperature in ºC

**Using Model SC-600 Signal Conditioner with the UPS-600 Sensor**

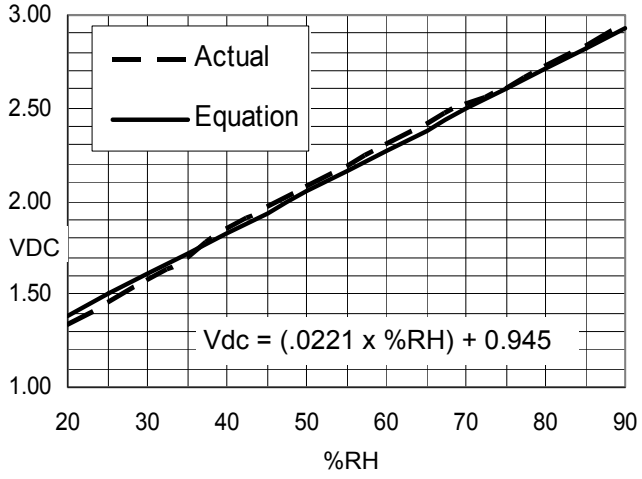
To meet customer requirements, a new temperature-compensated linear-voltage signal conditioning card, the Model SC-600, was developed for the UPS-600 sensor. The SC-600 circuit card, requiring a regulated 5 VDC power supply, is ideal for integration into many OEM applications. The board consists of surface-mounted components and requires no calibration. Contact Ohmic for OEM pricing. Off-shelf delivery. Display and control schematics are provided with the SC-600 signal conditioner.

The SC-600 signal conditioning circuit (Figure 6) uses a sine wave R-C oscillator operating at 440 Hz with 150 mV RMS excitation voltage. It also includes an amplitude stabilizer, logarithmic amplifier, linearizer and temperature compensation to provide a linear output voltage (Figure 7) directly proportional to relative humidity. The Model SC-600 card includes a UPS-600 sensor. See Ohmic's web page for details.

SC-600 Signal Conditioner

(Front) (Back)

Figure 6




Vout vs. %RH @77 Deg. F.

Figure 7

## UPS-600 Equation

**UPS-600 SENSOR EQUATION:**
The general relative humidity equation of the UPS-600 sensor in terms of temperature and impedance is as follows:

**%RH = A{(CZ)^[(T+459.7)/(D(T+459.7)+B)]}**

**A, B, C** & **D** = Constants Related to Specific Ranges
**Z** = Sensor's Impedance in MΩ
**T** = Temperature in °F

| Z in M | A | B | C | D |
|---|---|---|---|---|
| **0.4<Z** | 5.587129 | -5315.366 | 192689.2 | 5.895 |
| **0.005<Z<=0.4** | 2.269574 | -7781.989 | 74643.52 | 9.2477 |
| **Z<=0.005** | 6.385429 | -4788.52 | 189596900 | 2.5813 |

## Applications

- **HVAC Controls**
- **Humidistats**
- **Compressed Air**
- **Medical Instruments**
- **Data Loggers**
- **Ideal for OEM Applications**
- **Industrial Controls**
- **Control Chambers**
- **Building Automation**
- **Humidification**
- **Dehumidification**

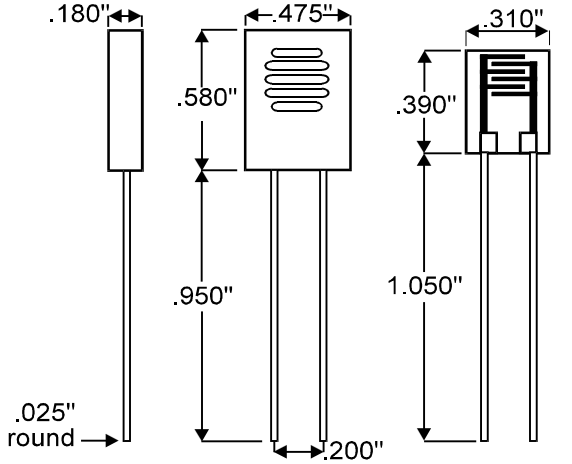
## SPECIFICATIONS - UPS-600

| | |
|---|---|
| Range | 20-90%RH at 77ºF |
| Accuracy | ±2% RH |
| Interchangeability | within 2% RH |
| Hysteresis | +/- 1% RH |
| Long Term Drift | <2%RH/5 Years |
| Response | 15 Seconds/63% Step Change |
| Temp. Coefficient | -0.4%RH/°F (Average at 20-80%RH From 60-100ºF ) |
| Temperature Limits | 32 to +122°F |
| Excitation Voltage | 1 VAC., symmetrical |
| Excitation Frequency | 33-10 KHz |
| Case Construction | Slotted Polycarbonate housing with Internal Porous Filter |

NIST Traceable Certification available

## DIMENSIONS

Dimensions for UPS-600 Sensor




UPS-600 with housing  Sensor only

**ENGINEERING SUPPORT:** OHMIC Instruments Co. designs and manufactures a full line of sensors, environmental and bio-medical instruments and controls. Many of our products are custom designed to meet specific requirements. Ohmic engineers would be pleased to discuss your application.

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