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INDUSTRIAL & ENVIRONMENTAL SENSORS, INSTRUMENTS & CONTROLS SINCE 1969

UPS-500 HUMIDITY SENSOR
ECONOMICAL RESISTIVE ELEMENT FOR HIGH VOLUME APPLICATIONS



Since the 1970s, OHMIC has developed a wide range resistive type humidity sensor, the Model UPS-500. Its 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-500 sensor enclosed in a protective housing with mesh filter (left) and the sensor only (right). The compact size enables installation in probes and direct soldering to printed circuit boards.

MODEL UPS-500 RESISTIVE RELATIVE HUMIDITY SENSOR WAS DESIGNED TO MEET THE REQUIREMENTS OF OEM MANUFACTURERS AND THE HVAC INDUSTRY

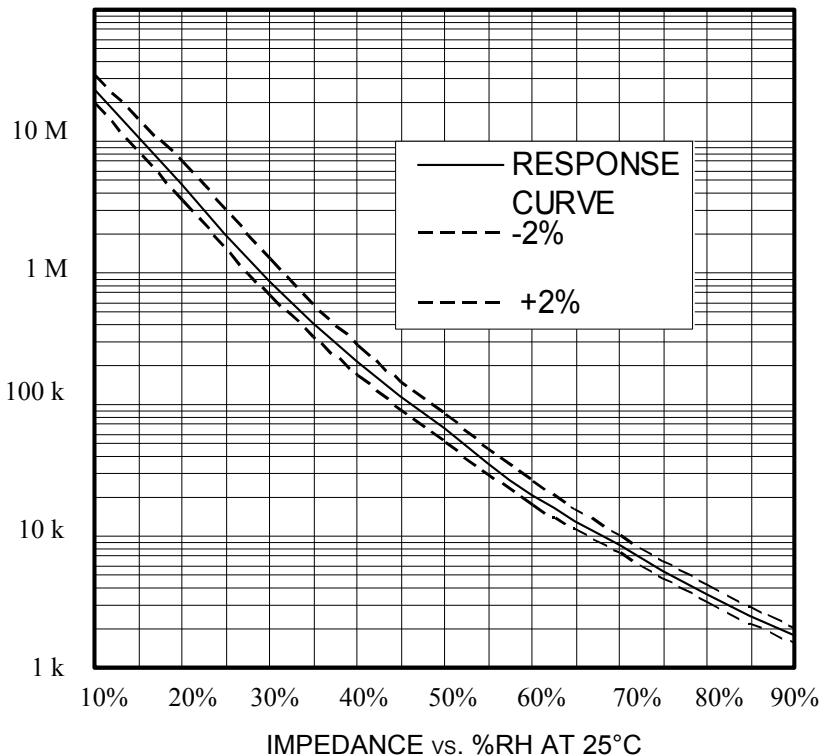


Figure 1

The UPS-500 sensor consists of a ceramic substrate having interleaved noble metal electrodes coated with a hygroscopic polymer. When excited by a low level symmetrical AC signal, the sensor's impedance varies in an inverse logarithmic function proportional to the relative humidity. A low AC signal, typically less than 1 VAC, is used to prevent polarization or self-heating of the sensor.

Figure 1 graph shows the RH from 10% to 90% vs. the Impedance. The sensor's response varies from over 10 Meg in the low RH range to less than 2 K in the high RH range. The +/- 2% accuracy is shown by the dotted lines. 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 60 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, Impedance vs. %RH @ 60 Hz, 1 KHz, 5 KHz, 10 KHz). As shown by this chart, in the human comfort range of 40 to 60 %RH, the excitation frequency dependence is negligible.

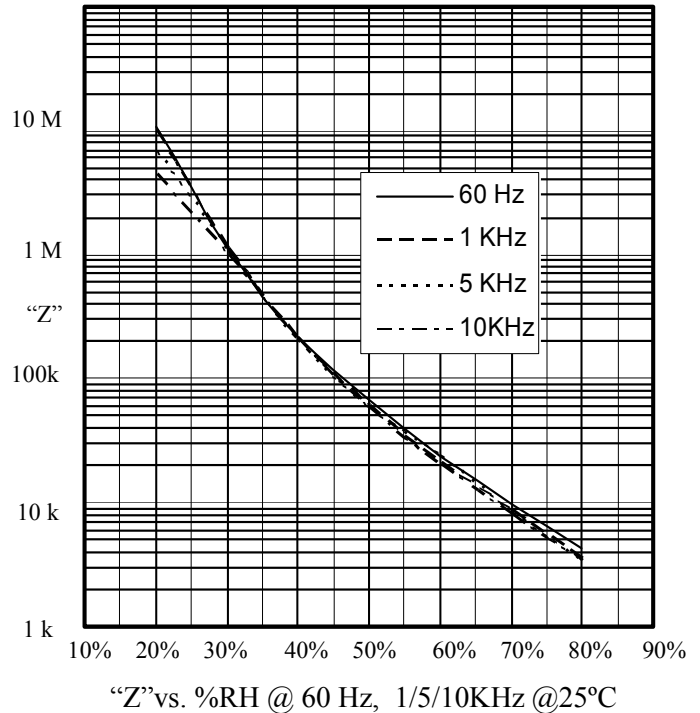
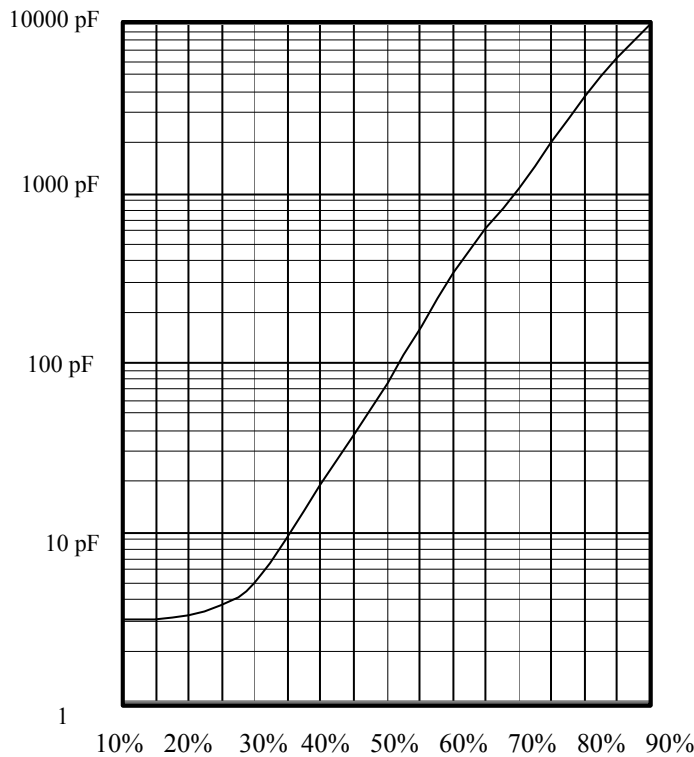


Figure 2

Capacitance

The UPS-500 sensor's impedance includes a capacitive component. This Capacitance vs. RH @ 25°C. is shown in Figure 3. The logarithmic capacitance varies from 10 to 10,000 picoFarads and covers several decades.

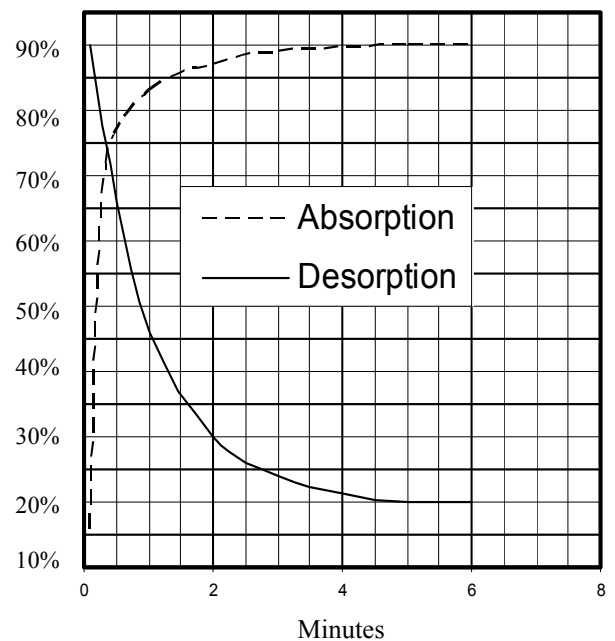


Capacitance vs. %RH, @25°C 1KHz

Figure 3

Sensor Response Time

The UPS-500'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.



%RH vs. Time in minutes @ 25°C.

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.

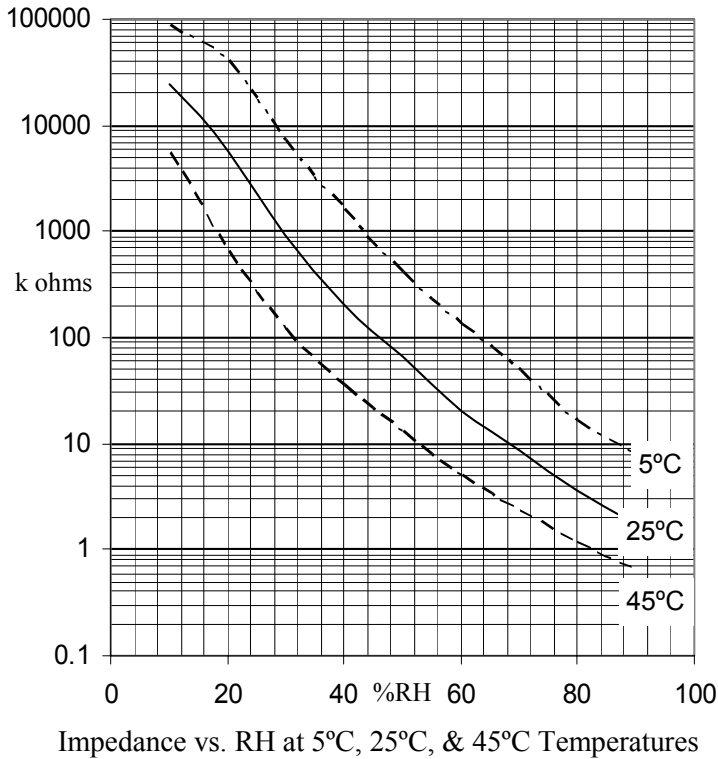


Figure 5

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-500 sensor at 5/25/45 °C.

The average coefficient for temperature compensation of the UPS-500 sensor works out to $-0.7\%RH/^{\circ}C$ ($-0.4\%RH/^{\circ}F$). 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 °C

Using Model SC-500 Signal Conditioner with the UPS-500 Sensor

To meet customer requirements, a new temperature-compensated linear-voltage signal conditioning card, the Model SC-500, was developed for the UPS-500 sensor. The SC-500 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-500 signal conditioner.

The SC-500 signal conditioning circuit (Figure 6) uses a sine wave R-C oscillator operating at 3.8 KHz with 150 mV output. 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-500 card includes a UPS-500 sensor. See Ohmic's web page for details.

SC-500 Signal Conditioner



(Front)

(Back)

Figure 6

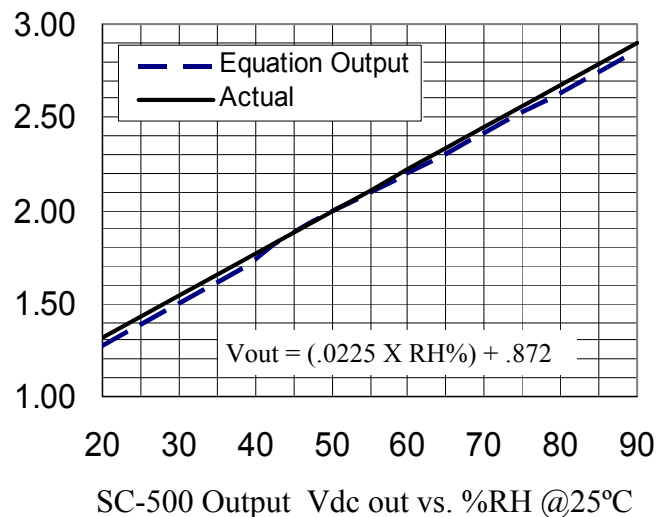


Figure 7

UPS-500 Equation

UPS-500 SENSOR EQUATION:

The general relative humidity equation of the UPS-500 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
30<Z	2.795953	-2346.986	0.1299848	4.067295
12<Z<=30	10.8334	-2368.839	28.18587	3.016073
5<Z<=12	29.29039	-2426.034	49399.25	1.993527
0.05<Z<=5	2.79711	-7813.2	100848.4	9.437572
0.005<Z<=0.05	5.0729313	-5357.106	1934420	4.242907
Z<=0.005	3.158756	-6368.854	1247857	5.748199

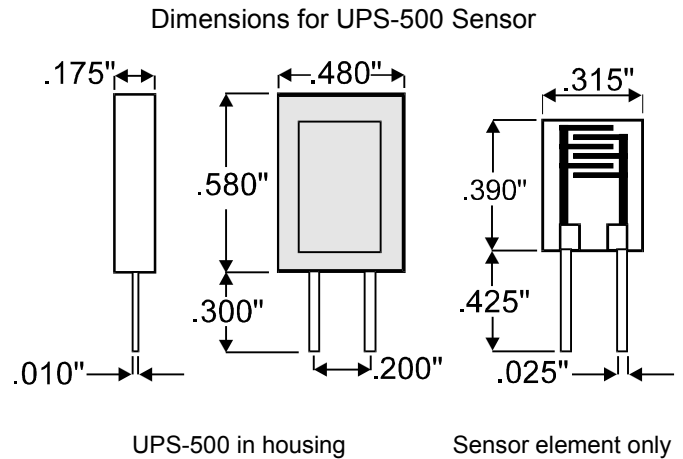
Applications

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

SPECIFICATIONS - UPS-500

Range	20-90%RH at 77°F
Accuracy	±2% RH
Interchangeability	within 2% RH
Hysteresis	+/- 1% RH
Long Term Drift	<2%RH/5 Years
Response	5 Seconds/63% Step Change
Temp. Coefficient	-0.4%RH/°F (Average at 20-80%RH From 60-100°F)
Temperature Limits	-4 to +140°F
Excitation Voltage	1 VAC., symmetrical
Excitation Frequency	33-10 KHz
NIST Traceable Certification is available	

DIMENSIONS



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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