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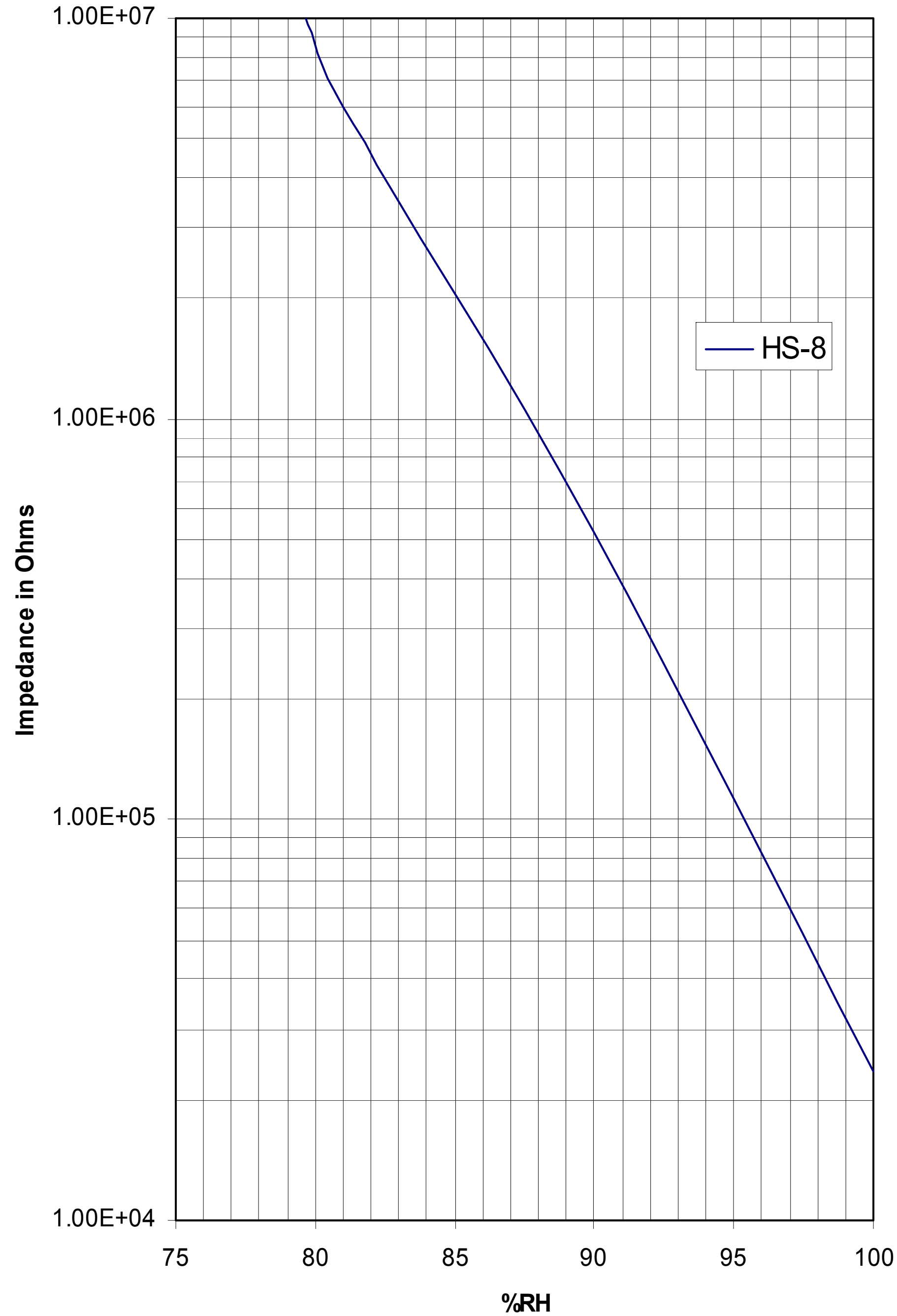
ohmico

RELATIVE HUMIDITY SENSOR DATABOOK

Models HS-00-1 Through HS-8

SENSORBOOK.PUB Rev. 1 1/17/07 JN

HS-8 Gray Sensor



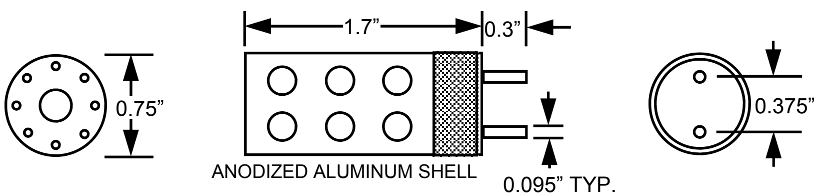
HUMIDITY SENSOR SPECIFICATIONS

Sensor Model No: HS-8 | Color Code: GRAY

ELECTRICAL:

Dynamic Resistance Range (10-95 dial) w/ 909K Load:	8 Megohms to 50 Kilohms (80% to 97% RH @ 80°F)
Dynamic Resistance Range (10-95 dial) w/ 20K Load:	200 Kilohms to 1 Kilohm (93% to 100% RH @ 80°F)
Maximum RMS Operating Current:	100 Microamperes, A.C.
Operating Frequency Range:	10Hz to 400Hz (60Hz Typ.)
Accuracy:	± 1% R.H.
Resolution:	± 0.1% R.H.
Hysteresis:	None
Interchangeability:	Direct Replacement with No Calibration Required
Response Time:	5 seconds Max. for 63% of the Total Humidity Change
Long Term Stability:	±1% for One Year
Operating Temperature Range:	40° F to 160°F
Temperature Coefficient:	± 1% R.H. for ± 5° F Change
Operating Pressure:	No Effect

MECHANICAL:



Room-type shell (shown) is used in normal convection air flow applications.
Duct-type shell (not shown) does not have ventilation holes on side view and is used in forced-air duct applications.

GENERAL SENSOR EQUATION:

$$\%R.H. = A\{(CZ)^{\left[\frac{(t + 459.7)}{D(t + 459.7) + B}\right]}\}$$

Where:
A, B, C, D = CONSTANTS (See chart below) Z = SENSOR RESISTANCE IN MEGOHMS
t = TEMPERATURE IN °F

```
Computer Equation in BASIC:  %R.H. = A*(C*Z)^((t+459.7)/(D*(t+459.7)+B))
```

CONSTANTS FOR SPECIFIC RESISTANCE RANGES

Sensor Resistance Z	A	B	C	D
> 2.7 Megohm	161.433	-21555	1.39842 E+08	10.1113
0.9 Meg to 2.7 Meg	170.976	-12677	9.71970 E+05	2.8854
0.4 Meg to 0.9 Meg	237.327	-7430.14	1.86922 E+09	-7.60472
0.2 Meg to 0.4 Meg	34.0913	5769.93	2.20074 E-09	-31.9561
0.1 Meg to 0.2 Meg	64.1701	14798.2	4.10403 E-04	-52.3304
< 0.1 Meg	84.7889	47666.3	0.214566	-119.545

RELATIVE HUMIDITY SENSOR DATABOOK
Models HS-00-1 to HS-8

Contents

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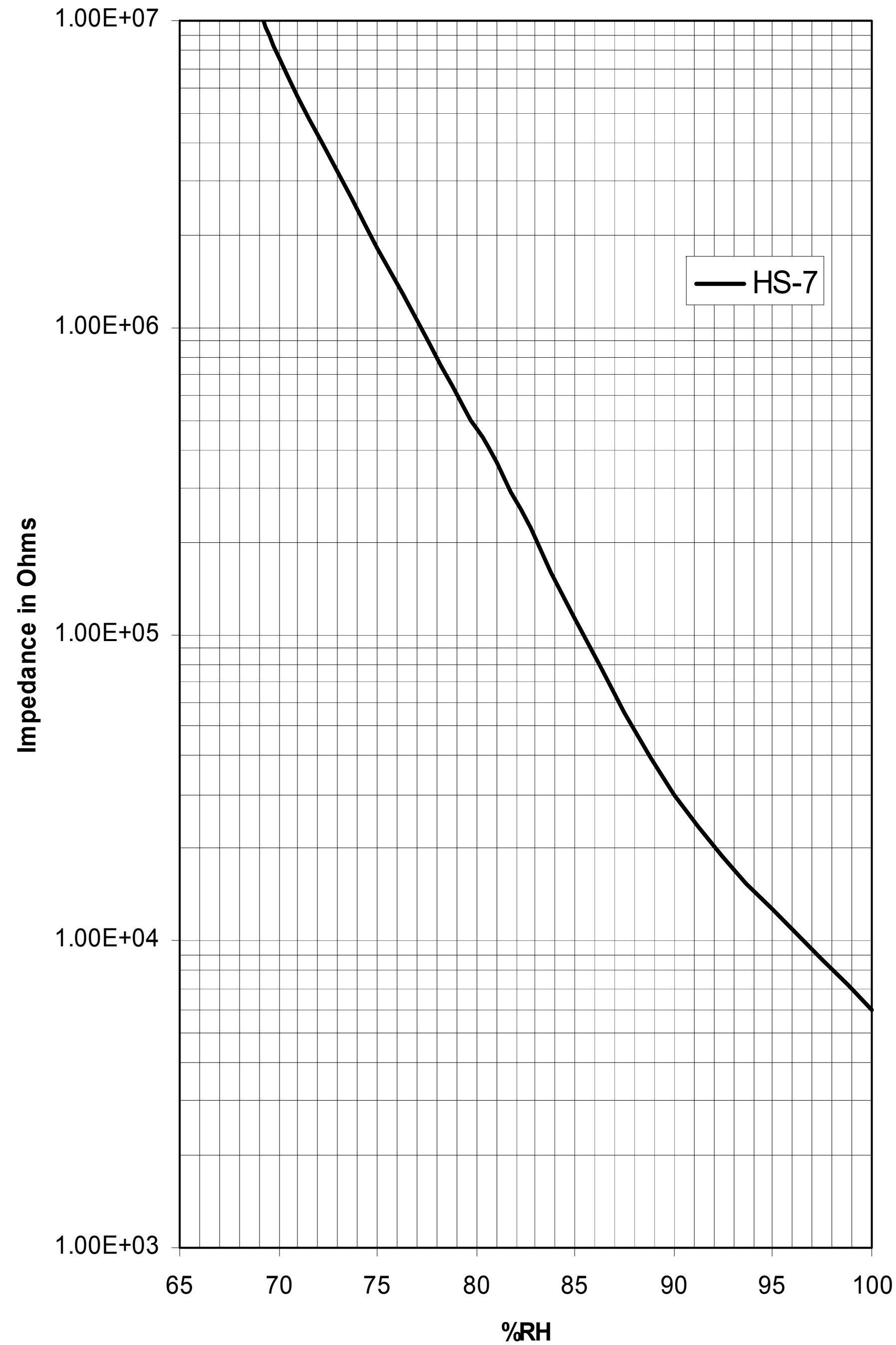
HS-7 Brown Sensor



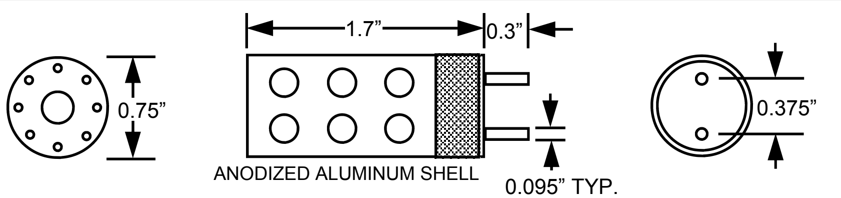
HUMIDITY SENSOR SPECIFICATIONS

Sensor Model No: HS-7 Color Code: VIOLET

ELECTRICAL:

Dynamic Resistance Range (10-95 dial) w/ 909K Load:	8 Megohms to 50 Kilohms (70% to 88% RH @ 80°F)
Dynamic Resistance Range (10-95 dial) w/ 20K Load:	200 Kilohms to 1 Kilohm (82% to 99% RH @ 80°F)
Maximum RMS Operating Current:	100 Microamperes, A.C.
Operating Frequency Range:	10Hz to 400Hz (60Hz Typ.)
Accuracy:	± 1% R.H.
Resolution:	± 0.1% R.H.
Hysteresis:	None
Interchangeability:	Direct Replacement with No Calibration Required
Response Time:	5 seconds Max. for 63% of the Total Humidity Change
Long Term Stability:	±1% for One Year
Operating Temperature Range:	40° F to 160°F
Temperature Coefficient:	± 1% R.H. for ± 5° F Change
Operating Pressure:	No Effect

MECHANICAL:



Room-type shell (shown) is used in normal convection air flow applications. Duct-type shell (not shown) does not have ventilation holes on side view and is used in forced-air duct applications.

GENERAL SENSOR EQUATION:

$$\%R.H. = A\{(CZ)^{\left[\frac{(t + 459.7)}{D(t + 459.7) + B}\right]}\}$$

Where:
A, B, C, D = CONSTANTS (See chart below) Z = SENSOR RESISTANCE IN MEGOHMS
t = TEMPERATURE IN °F

```
Computer Equation in BASIC:  %R.H. = A*(C*Z)^((t+459.7)/(D*(t+459.7)+B))
```

CONSTANTS FOR SPECIFIC RESISTANCE RANGES

Sensor Resistance Z	A	B	C	D
> 5 Megohm	430.734	-8760.55	3.42486 E+18	-8.41276
0.5 Meg to 5 Meg	177.533	-13885.1	7.49378 E+07	3.99684
< 0.5 Megohm	218.373	-11127.4	2.26689 E+10	-2.31495

RELATIVE HUMIDITY SENSORS
Model HS Series

OHMIC Company's **Model HS Series Relative Humidity Sensors** are a standard series of eleven improved Dunmore-type sensors designed to cover the 1% to 99% R.H. range. This type of humidity sensor, developed by the U.S. Bureau of Standards, is the most accurate and reliable relative humidity sensor available today and OHMIC Company is the world's largest manufacturer of Dunmore-type sensors. Millions of these sensors are in use today, some of which have been in normal service for over ten years.

The OHMIC relative humidity sensor offers many advantages over capacitive or polymer type sensors, such as ±1% NBS traceable accuracy, interchangeabllity with no recalibration requirements, clearly defined resistance vs. relative humidity response, no hysteresis shift errors after wide humidity changes, and low cost with a long life expectancy.

Each of the color-coded HS Series sensors responds to a specific humidity range and gives a resistance change from 1 kilohm to 10 Megohms. Figure 1 shows the HS Series model numbers, the identifying model color, and the corresponding relative humidity response over the full resistance change of 1 Kilohm to 10 Megohms. The Model HS-00-1 White sensor is a special shifted HS-00 white sensor used by many dryer manufacturers.

This databook gives curves and specifications for each sensor. The resistance vs. relative humidity response curves are given at operating temperatures of 40°, 80°, 80°, 100°, and 120° Fahrenheit. Each sensor specification sheet details the electrical and mechanical characteristics of the sensor and provides a general mathematical equation with specific sensor constants for use with computerized systems.

Model Number	Sensor Color	R.H. Range (10M to 1K)
HS-00-1	White	0.5% to 18%
HS-00	White	1.5% to 20%
HS-0	Black	3% to 25%
HS-1	Brown	5% to 35%
HS-2	Red	10% to 50%
HS-3	Orange	20% to 60%
HS-4	Yellow	30% to 70%
HS-5	Green	40% to 80%
HS-6	Blue	55% to 99%
HS-7	Violet	70% to 99%
HS-8	Grey	80% to 99%

Figure 1: The HS Series Humidity Sensors

FEATURES

- 11 sensors cover the 1% to 99% RH range
- NBS traceable ± 1% RH accuracy
- High resolution: ± 0.1% RH
- Complete interchangeability
- Long term stability
- Low temperature coefficient: ±0.15% per ±1°F
- Clearly defined Resistance vs. Humidity response
- Fast humidity response
- No hysteresis shift after large humidity changes
- No field calibrations required
- Operates at temperatures up to 160°F
- Low cost, long life

TECHNICAL INFORMATION

GENERAL CHARACTERISTICS AND CONSTRUCTION

The HS Series are humidity-sensitive variable conductance transducers which produce clearly defined resistance values over a narrow range of ambient relative humidity. The sensing element consists of two parallel palladium wires wound on a polystyrene bobbin and terminated at two male pins which are molded into the plastic bobbin. The palladium wires are then coated with a thin hygroscopic compound. When exposed to humidity conditions, the resistance between the coated palladium wires will decrease with humidity increases and vice versa. The response is repeatable and predictable with no hysteresis deviation over wide humidity changes. A resistance variation of 10 megohms to 1 kilohm will occur for an average relative humidity difference of about 30% R.H. To cover the entire 1% to 99% range, eleven narrow range sensors are manufactured, each with a different hygroscopic composition.

A perforated anodized aluminum shell is used to cover the sensor element for protection from damage due to handling. There are two styles of perforated shells available. The standard or room-type shell has perforated ventilation holes completely around and on the top of the shell for maximum sensor exposure to the ambient air flow. The other cover is a duct-type shell which has perforated ventilation holes only on the top of the shell to provide sensor element protection as well as sufficient air flow exposure when used in forced-air duct systems.

In high humidity applications, where water condensation may occur, or in HVAC applications where airborne particles may contaminate the surface of the sensor, a weatherproof protective porous teflon sleeve can be installed at an additional cost of $12. This protection will significantly lengthen sensor life during exposure to these damaging conditions. Weatherproofing can be ordered by specifying a "-W" suffix on the sensor model number.

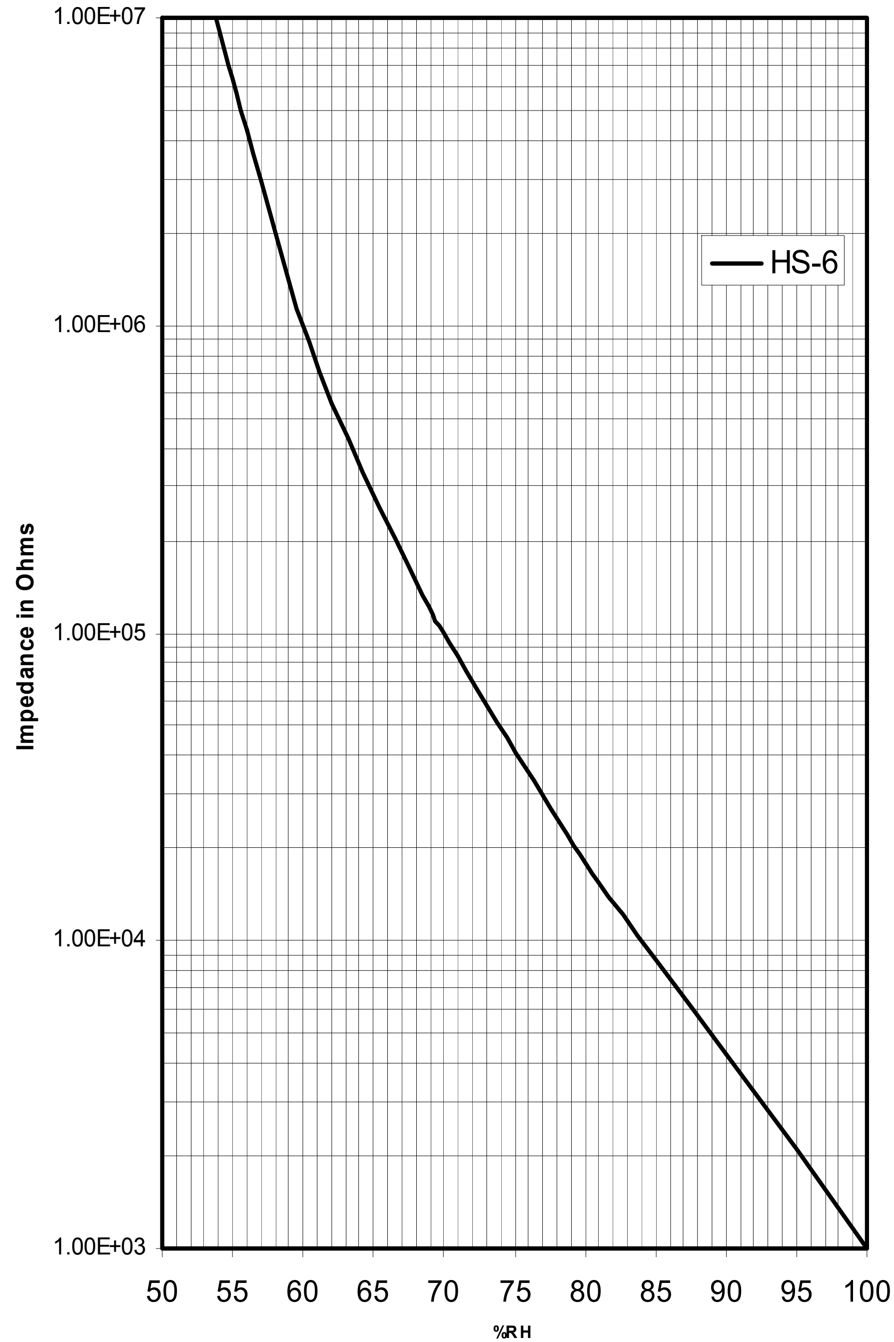
All OHMIC sensors are aged and calibrated to a ±1% accuracy according to NBS traceable standards and each sensor is color-code labeled and marked with a computer-recorded serial number.

PRODUCING AN ANALOG OUTPUT

The humidity signal which is produced directly by the OHMIC Dunmore-type sensor is in the form of an ohmic resistance. Generally, current or voltage signals are preferred analog signals in electronic instrumentation systems. This requires that some type of signal conditioning be used with the humidity sensor. However, two factors must be considered during this signal conditioning process. First, the humidity sensor must never be connected to a voltage source which has a DC voltage component (i.e., pure DC, or DC mixed with AC). DC voltages will permanently polarize the moisture-sensitive compound and will significantly change the humidity vs. resistance response of the sensor. The sensor must therefore be driven (or "excited") by a pure AC sine or square source. RMS values will always be used to measure this AC excitation.

The second factor to be considered involves the maximum RMS current that should be allowed to flow through the sensor. To prevent permanent deterioration of the hygroscopic compound and to eliminate any "self-heating" effects, the maximum RMS AC current should not exceed 100 microamperes.

HS-6 Blue Sensor



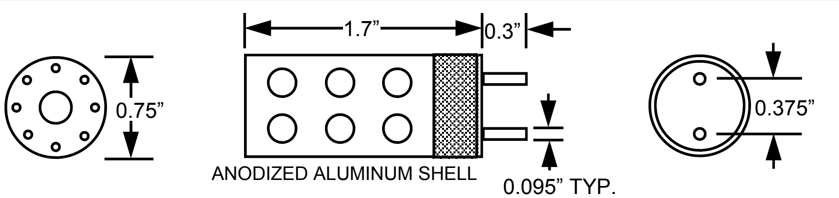
HUMIDITY SENSOR SPECIFICATIONS

Sensor Model No: HS-6 Color Code: BLUE

ELECTRICAL:

Dynamic Resistance Range (10-95 dial) w/ 909K Load:	8 Megohms to 50 Kilohms (54% to 73% RH @ 80°F)
Dynamic Resistance Range (10-95 dial) w/ 20K Load:	200 Kilohms to 1 Kilohm (67% to 99% RH @ 80°F)
Maximum RMS Operating Current:	100 Microamperes, A.C.
Operating Frequency Range:	10Hz to 400Hz (60Hz Typ.)
Accuracy:	± 1% R.H.
Resolution:	± 0.1% R.H.
Hysteresis:	None
Interchangeability:	Direct Replacement with No Calibration Required
Response Time:	5 seconds Max. for 63% of the Total Humidity Change
Long Term Stability:	±1% for One Year
Operating Temperature Range:	40° F to 160°F
Temperature Coefficient:	± 1% R.H. for ± 5° F Change
Operating Pressure:	No Effect

MECHANICAL:



Room-type shell (shown) is used in normal convection air flow applications.
Duct-type shell (not shown) does not have ventilation holes on side view and is used in forced-air duct applications.

GENERAL SENSOR EQUATION:

$$\%R.H. = A\{(CZ)^{\left[\frac{(t + 459.7)}{D(t + 459.7) + B}\right]}\}$$

Where:
A, B, C, D = CONSTANTS (See chart below) Z = SENSOR RESISTANCE IN MEGOHMS
t = TEMPERATURE IN °F

Computer Equation in BASIC: %R.H. = A*(C*Z)^((t+459.7)/(D*(t+459.7)+B))

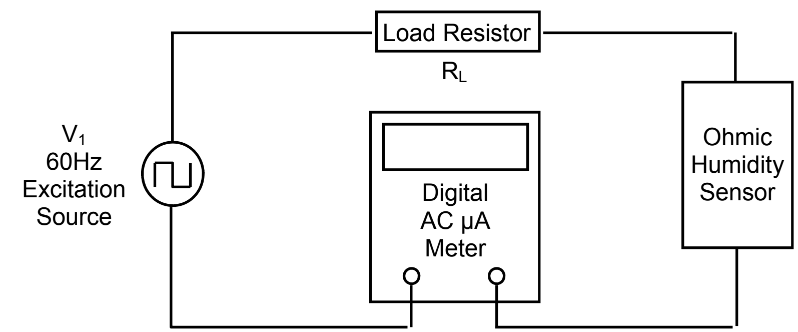
CONSTANTS FOR SPECIFIC RESISTANCE RANGES

Sensor Resistance Z	A	B	C	D
> 1.7 Megohm	132.411	-21879.6	2.69537 E+05	24.2417
0.3 Meg to 1.7 Meg	138.741	-19980.5	1.21137 E+06	19.9205
< 0.3 Megohm	164.759	-13945.3	4.45569 E+06	10.5117

A SIMPLE SIGNAL CONDITIONING METHOD

A simple series circuit, as shown in Figure 2, can be used to measure humidity. The sensor is connected in series with a load resistor, an AC microammeter, and an AC sine or square wave voltage excitation source. The RMS current flowing through the sensor represents the percent relative humidity as interpreted using a particular sensor's response curves.

The load resistor value is chosen to be equal to the mid-range resistance value of the sensor response curve. Since the sensor resistance varies from 10 Megohms to 1 Kilohm, no single load resistance value will allow use of the full sensor response. Therefore, two different load resistance values are commonly used. A 909 Kilohm load resistor provides good sensor response over a resistance change of 10 Megohms to 50 Kilohms. This will be referred to as the "high dial" response. The other commonly used load resistor provides good sensor response over the lower portion of the curve from about 200 Kilohms to 1 Kilohm. This range will be referred to as the "low dial' response. Other load resistance values can be chosen for special applications; however, the 909K and 20K loads are the industry standards.



Procedure:

1. Choose load resistor R_L to be 20K or 909K, depending on the sensor resistance range. Use 20K load for sensor resistance changes between 1K and 200K, or use 909K load for sensor resistance changes between 50K and 10 Megohms.

2. Set the AC excitation source (V_1) for 2 volts RMS with 20K load or 91 volts RMS with 909K load.

3. Short across sensor. The maximum current should be 100μA.

4. Remove short, read current and find the sensor resistance using the following formula:

$$R_S = R_L\,[(100/\mu A\ \text{Reading}) - 1]$$

5. Obtain the relative humidity by finding this resistance value on the response curve for the sensor and temperature being used.

Figure 2: A simple humidity measuring circuit

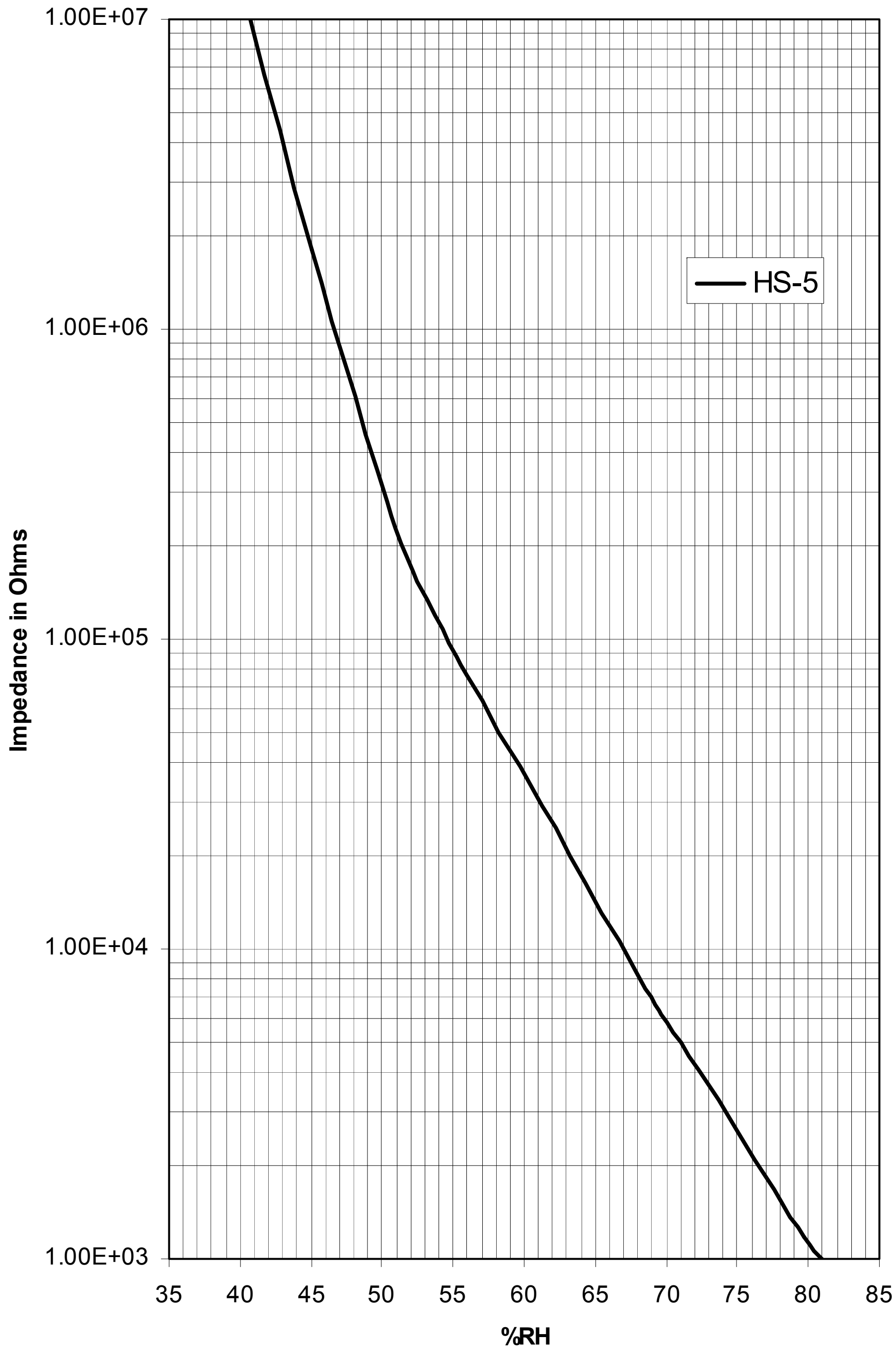
The AC excitation voltage is chosen so that the maximum sensor current of 100 microamps cannot be exceeded when the sensor resistance is at its minimum value with a particular load resistor in place. For the 909K load, the RMS excitation should be 91 volts RMS. For the 20K load, the RMS excitation should be 2 volts. This excitation voltage must be regulated for good circuit performance. A bi-lateral zener diode clamping circuit will work well for this purpose.

The RMS current signal is monitored by a conventional digital AC ammeter. This current will vary between 0 and 100 microamps when the correct load resistor and AC excitation are used. The 100 microamp value represents the full 100% output span of the circuit and will be referred to as "100 dial". This terminology avoids confusion between the use of percent (%) for both humidity and the output span reading. A dial reading (or span) of 50 will correspond to a sensor resistance equal to the value of the load resistor (909K or 20K). A zero (0) dial reading corresponds to a sensor resistance of infinity (open circuit). A reading of 100 dial corresponds to a sensor resistance of zero ohms (short circuit). Figures 3 and 4 (Page 9) show tables to convert dial readings to sensor resistance values. From these tables and the sensor curves, the humidity can be interpreted. For example, if a yellow sensor (HS-4) is being used with a 909K load and the current reading is 75 microamps (also called “75 dial"), the sensor resistance (from Figure 4) would be 303K. Using the 80°F. response curve for the HS-4 sensor, this 303K reading converts to a relative humidity of 36%.

More efficient electronic signal conditioning using operational amplifiers can be used to change the sensor resistance directly into an analog D.C. voltage signal. The non-linearity of a single sensor, the narrow R.H. range, and the dial vs. %R.H. offsets can be eliminated by combining two or more sensors into a multi-element resistive sensor network which is computer-designed for an optimum ±2% typical accuracy. Using these sensor networks, 0 to 100 microamps corresponds to 0% to 100% R.H. and each 1μA = 1% R.H. This eliminates a considerable amount of the "look-up table" work which is required when using a single sensor.

Ohmic Instruments Company manufactures a variety of humidity measurement and control products using the HS Series humidity sensors and also offers field-proven signal conditioning and humidity control cards for OEM applications. Many multi-element wide-range sensor networks, probes, and accessories are available to fit any humidity application. Call Ohmic toll-free at 1-800-626-7713 and ask for an applications engineer to discuss your humidity measurement application.

HS-5 Green Sensor



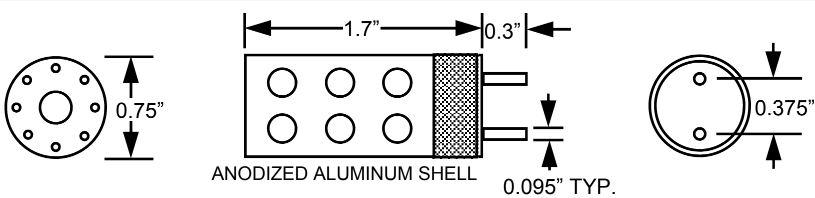
HUMIDITY SENSOR SPECIFICATIONS

Sensor Model No: HS-5 Color Code: GREEN

ELECTRICAL:

Dynamic Resistance Range (10-95 dial) w/ 909K Load:	8 Megohms to 50 Kilohms (41% to 58% RH @ 80°F)
Dynamic Resistance Range (10-95 dial) w/ 20K Load:	200 Kilohms to 1 Kilohm (52% to 81% RH @ 80°F)
Maximum RMS Operating Current:	100 Microamperes, A.C.
Operating Frequency Range:	10Hz to 400Hz (60Hz Typ.)
Accuracy:	± 1% R.H.
Resolution:	± 0.1% R.H.
Hysteresis:	None
Interchangeability:	Direct Replacement with No Calibration Required
Response Time:	5 seconds Max. for 63% of the Total Humidity Change
Long Term Stability:	±1% for One Year
Operating Temperature Range:	40° F to 160°F
Temperature Coefficient:	± 1% R.H. for ± 5° F Change
Operating Pressure:	No Effect

MECHANICAL:



Room-type shell (shown) is used in normal convection air flow applications.
Duct-type shell (not shown) does not have ventilation holes on side view and is used in forced-air duct applications.

GENERAL SENSOR EQUATION:

$$\%R.H. = A\{(CZ)^{\left[\frac{(t + 459.7)}{D(t + 459.7) + B}\right]}\}$$

Where:
A, B, C, D = CONSTANTS (See chart below) Z = SENSOR RESISTANCE IN MEGOHMS
t = TEMPERATURE IN °F

Computer Equation in BASIC: %R.H. = A*(C*Z)^((t+459.7)/(D*(t+459.7)+B))

CONSTANTS FOR SPECIFIC RESISTANCE RANGES

Sensor Resistance Z	A	B	C	D
> 3.6 Megohm	233.768	-14825.5	1.33141 E+14	7.54567
0.4 Meg to 3.6 Meg	183.086	-13218.8	2.41656 E+09	8.66632
< 0.4 Megohm	175.861	-9973.59	2.10510 E+07	5.94564

SENSOR RESISTANCE vs. LOW DIAL READING (20K Load Resistor)

% of FS Output	0	1	2	3	4	5	6	7	8	9
0		1.98M	980.0K	646.6K	480.0K	380.0K	313.3K	265.7K	230.0K	202.2 K
10	180.0K	161.8K	146.6K	133.8K	122.8K	113.3K	105.0K	97.64K	91.11K	85.26 K
20	80.0K	75.23K	70.9K	66.95K	63.33K	60.0K	56.92K	54.07K	51.42K	48.96 K
30	46.66K	44.51K	42.50K	40.60K	38.82K	37.14K	35.55K	34.05K	32.63K	31.28 K
40	30.0K	28.78K	27.61K	26.51K	25.45K	24.44K	23.47K	22.55K	21.66K	20.81 K
50	20.0K	19.2K	18.5K	17.7K	17.0K	16.4K	15.7K	15.1K	14.5K	13.9K
60	13.3K	12.8K	12.3K	11.7K	11.3K	10.8K	10.3K	9.9K	9.4K	9.0K
70	8.6K	8.2K	7.8K	7.4K	7.0K	6.7K	6.3K	6.0K	5.6K	5.3K
80	5.0K	4.7K	4.4K	4.1K	3.8K	3.5K	3.3K	3.0K	2.7K	2.5K
90	2.2K	2.0K	1.7K	1.5K	1.3K	1.1K	0.8K	0.6K	0.4K	0.2K

Figure 3: 20K Load Dial Chart

SENSOR RESISTANCE vs. HIGH DIAL READING (909K Load Resistor)

% of FS Output	0	1	2	3	4	5	6	7	8	9
0		89.99M	44.54M	29.39M	21.81M	17.27M	14.24M	12.07M	10.45M	9.19M
10	8.18M	7.35M	6.66M	6.08M	5.58M	5.15M	4.77M	4.43M	4.14M	3.87M
20	3.63M	3.41M	3.22M	3.04M	2.87M	2.72M	2.58M	2.45M	2.33M	2.22M
30	2.12M	2.02M	1.93M	1.84M	1.76M	1.68M	1.61M	1.54M	1.48M	1.42M
40	1.36M	1.30M	1.25M	1.20M	1.15M	1.11M	1.06M	1.02M	984.7K	946.1K
50	909.0K	873.3K	839.0K	806.0K	774.3K	743.7K	714.2K	685.7K	658.2K	631.6K
60	606.0K	581.1K	557.1K	533.8K	511.3K	489.4K	468.2K	447.7K	427.7K	408.3K
70	389.5K	371.2K	353.5K	336.2K	319.3K	303.0K	287.0K	271.5K	256.3K	241.6K
80	227.2K	213.2K	199.5K	186.1K	173.1K	160.4K	147.9K	135.8K	123.9K	112.3K
90	101.0K	89.9K	79.0K	68.4K	58.0K	47.8K	37.9K	28.1K	18.5K	9.2K

Figure 4: 909K Load Dial Chart

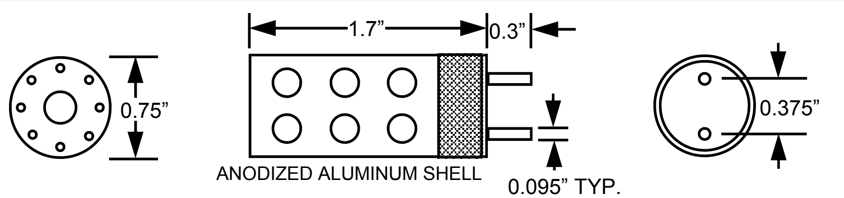
HUMIDITY SENSOR SPECIFICATIONS

Sensor Model No: HS-00-1 Color Code: WHITE

ELECTRICAL:

Dynamic Resistance Range (10-95 dial) w/ 909K Load:	8 Megohms to 50 Kilohms (0.7% to 4.4% RH @ 80°F)
Dynamic Resistance Range (10-95 dial) w/ 20K Load:	200 Kilohms to 1 Kilohm (2.7% to 17% RH @ 80°F)
Maximum RMS Operating Current:	100 Microamperes, A.C.
Operating Frequency Range:	10Hz to 400Hz (60Hz Typ.)
Accuracy:	± 1% R.H.
Resolution:	± 0.1% R.H.
Hysteresis:	None
Interchangeability:	Direct Replacement with No Calibration Required
Response Time:	5 seconds Max. for 63% of the Total Humidity Change
Long Term Stability:	±1% for One Year
Operating Temperature Range:	40° F to 160°F
Temperature Coefficient:	± 1% R.H. for ± 5° F Change
Operating Pressure:	No Effect

MECHANICAL:



Room-type shell (shown) is used in normal convection air flow applications.
Duct-type shell (not shown) does not have ventilation holes on side view and is used in forced-air duct applications.

GENERAL SENSOR EQUATION:

$$\%R.H. = A\{(CZ)^{\left[\frac{(t + 459.7)}{D(t + 459.7) + B}\right]}\}$$

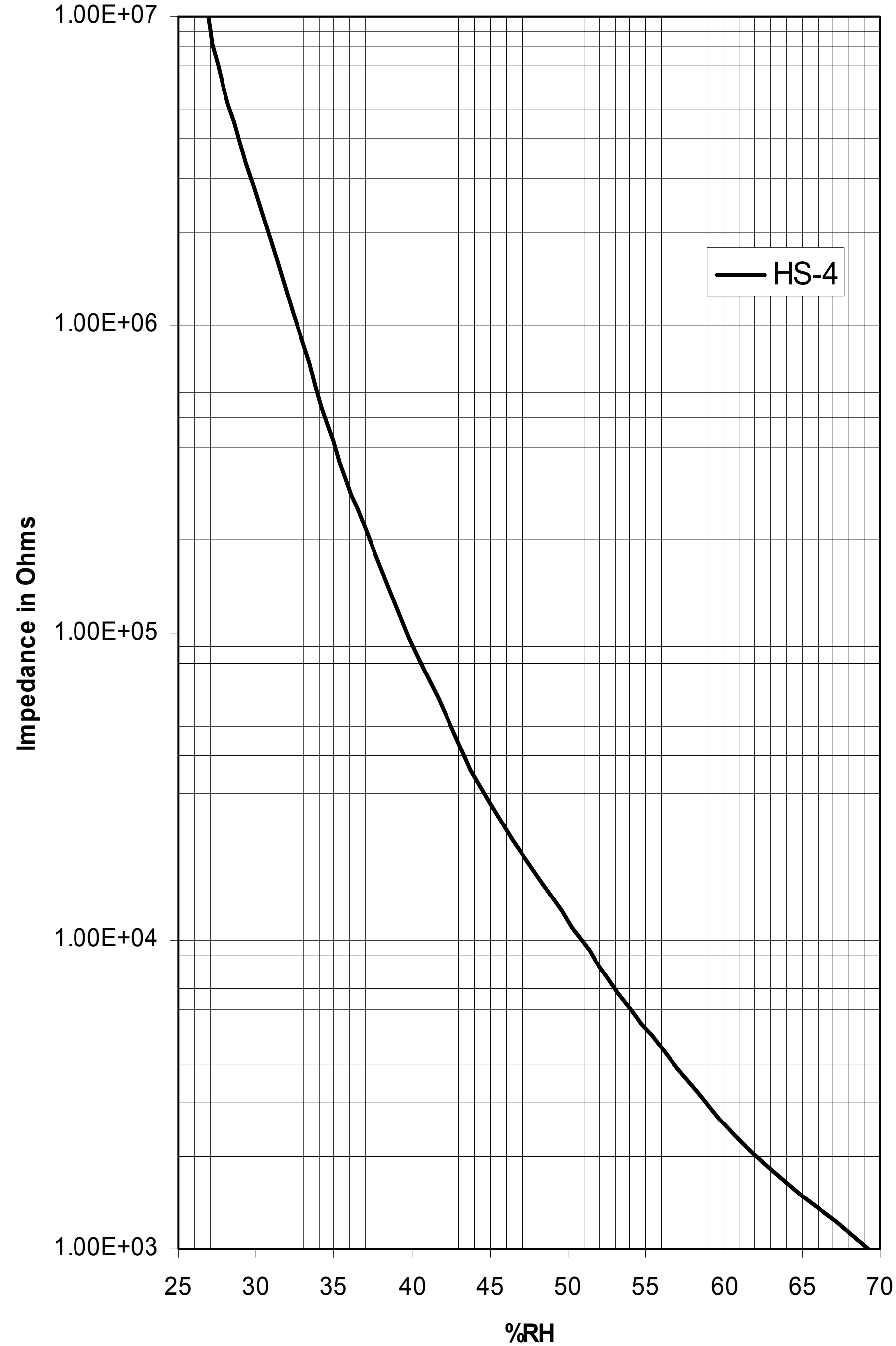
Where:
A, B, C, D = CONSTANTS (See chart below) Z = SENSOR RESISTANCE IN MEGOHMS
t = TEMPERATURE IN °F

```
Computer Equation in BASIC:  %R.H. = A*(C*Z)^((t+459.7)/(D*(t+459.7)+B))
```

CONSTANTS FOR SPECIFIC RESISTANCE RANGES

Sensor Resistance Z	A	B	C	D
> 0.74 Megohm	52474.86	-988.8326	2.55773 E+12	-0.8993676
0.23 Meg to 0.74 Meg	239.5719	-2322.036	2214727	1.423486
< 0.23 Megohm	33.72195	-3549.287	4605.344	3.891261

HS-4 Yellow Sensor



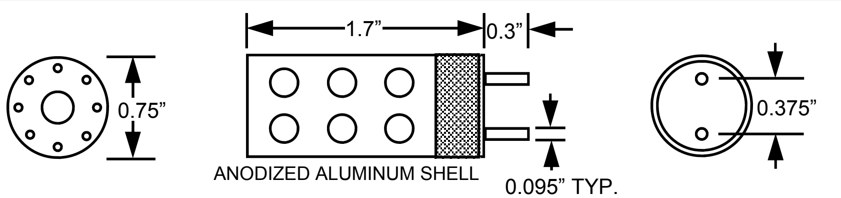
HUMIDITY SENSOR SPECIFICATIONS

Sensor Model No: HS-4 Color Code: YELLOW

ELECTRICAL:

Dynamic Resistance Range (10-95 dial) w/ 909K Load:	8 Megohms to 50 Kilohms (27% to 42% RH @ 80°F)
Dynamic Resistance Range (10-95 dial) w/ 20K Load:	200 Kilohms to 1 Kilohm (37% to 70% RH @ 80°F)
Maximum RMS Operating Current:	100 Microamperes, A.C.
Operating Frequency Range:	10Hz to 400Hz (60Hz Typ.)
Accuracy:	± 1% R.H.
Resolution:	± 0.1% R.H.
Hysteresis:	None
Interchangeability:	Direct Replacement with No Calibration Required
Response Time:	5 seconds Max. for 63% of the Total Humidity Change
Long Term Stability:	±1% for One Year
Operating Temperature Range:	40° F to 160°F
Temperature Coefficient:	± 1% R.H. for ± 5° F Change
Operating Pressure:	No Effect

MECHANICAL:



Room-type shell (shown) is used in normal convection air flow applications.
Duct-type shell (not shown) does not have ventilation holes on side view and is used in forced-air duct applications.

GENERAL SENSOR EQUATION:

$$\%R.H. = A\{(CZ)^{\left[\frac{(t + 459.7)}{D(t + 459.7) + B}\right]}\}$$

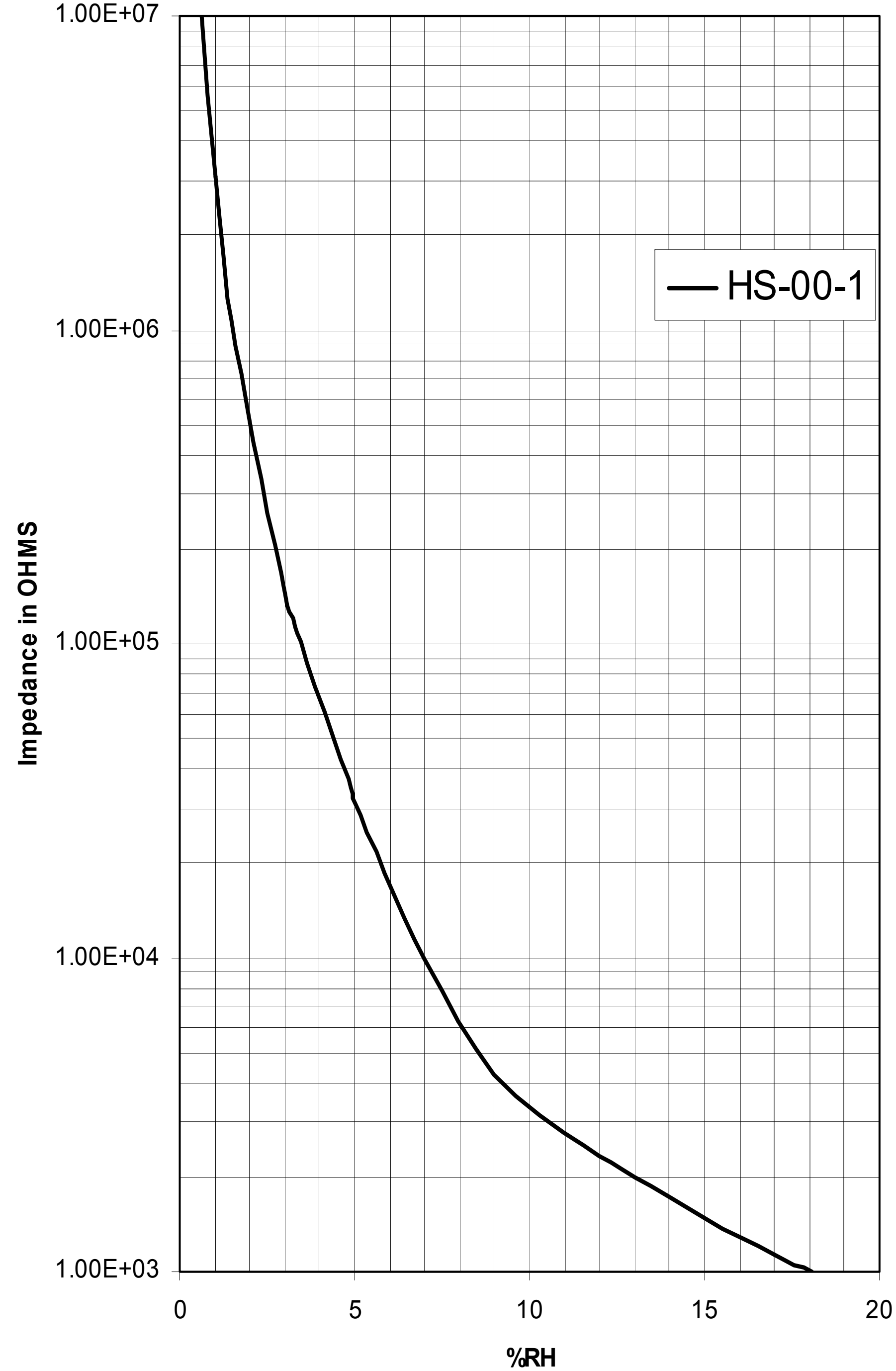
Where:
A, B, C, D = CONSTANTS (See chart below) Z = SENSOR RESISTANCE IN MEGOHMS
t = TEMPERATURE IN °F

Computer Equation in BASIC: %R.H. = A*(C*Z)^((t+459.7)/(D*(t+459.7)+B))

CONSTANTS FOR SPECIFIC RESISTANCE RANGES

Sensor Resistance Z	A	B	C	D
> 2.7 Megohm	1087.93	-6235.42	6.42900 E+22	-3.26563
0.5 Meg to 2.7 Meg	597.19	-5851	5.75047 E+14	-0.783194
0.1 Meg to 0.5 Meg	367.035	-6159.57	5.75453 E+10	1.27052
< 0.1 Megohm	5008.42	-3090.39	2.34799 E+25	-5.88291

HS-00-1 Low White Sensor



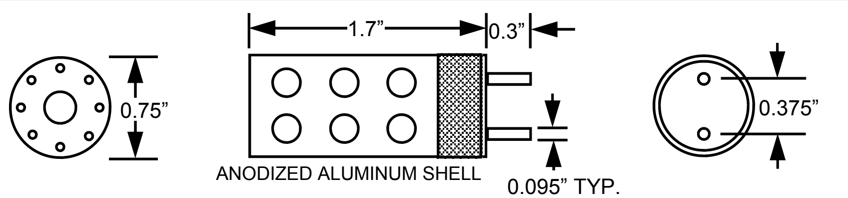
HUMIDITY SENSOR SPECIFICATIONS

Sensor Model No: HS-00 — Color Code: WHITE

ELECTRICAL:

Dynamic Resistance Range (10-95 dial) w/ 909K Load:	8 Megohms to 50 Kilohms (2% to 6% RH @ 80°F)
Dynamic Resistance Range (10-95 dial) w/ 20K Load:	200 Kilohms to 1 Kilohm (4% to 20% RH @ 80°F)
Maximum RMS Operating Current:	100 Microamperes, A.C.
Operating Frequency Range:	10Hz to 400Hz (60Hz Typ.)
Accuracy:	± 1% R.H.
Resolution:	± 0.1% R.H.
Hysteresis:	None
Interchangeability:	Direct Replacement with No Calibration Required
Response Time:	5 seconds Max. for 63% of the Total Humidity Change
Long Term Stability:	±1% for One Year
Operating Temperature Range:	40° F to 160°F
Temperature Coefficient:	± 1% R.H. for ± 5° F Change
Operating Pressure:	No Effect

MECHANICAL:



Room-type shell (shown) is used in normal convection air flow applications. Duct-type shell (not shown) does not have ventilation holes on side view and is used in forced-air duct applications.

GENERAL SENSOR EQUATION:

$$\%R.H. = A\left\{(CZ)^{\left[\frac{(t + 459.7)}{D(t + 459.7) + B}\right]}\right\}$$

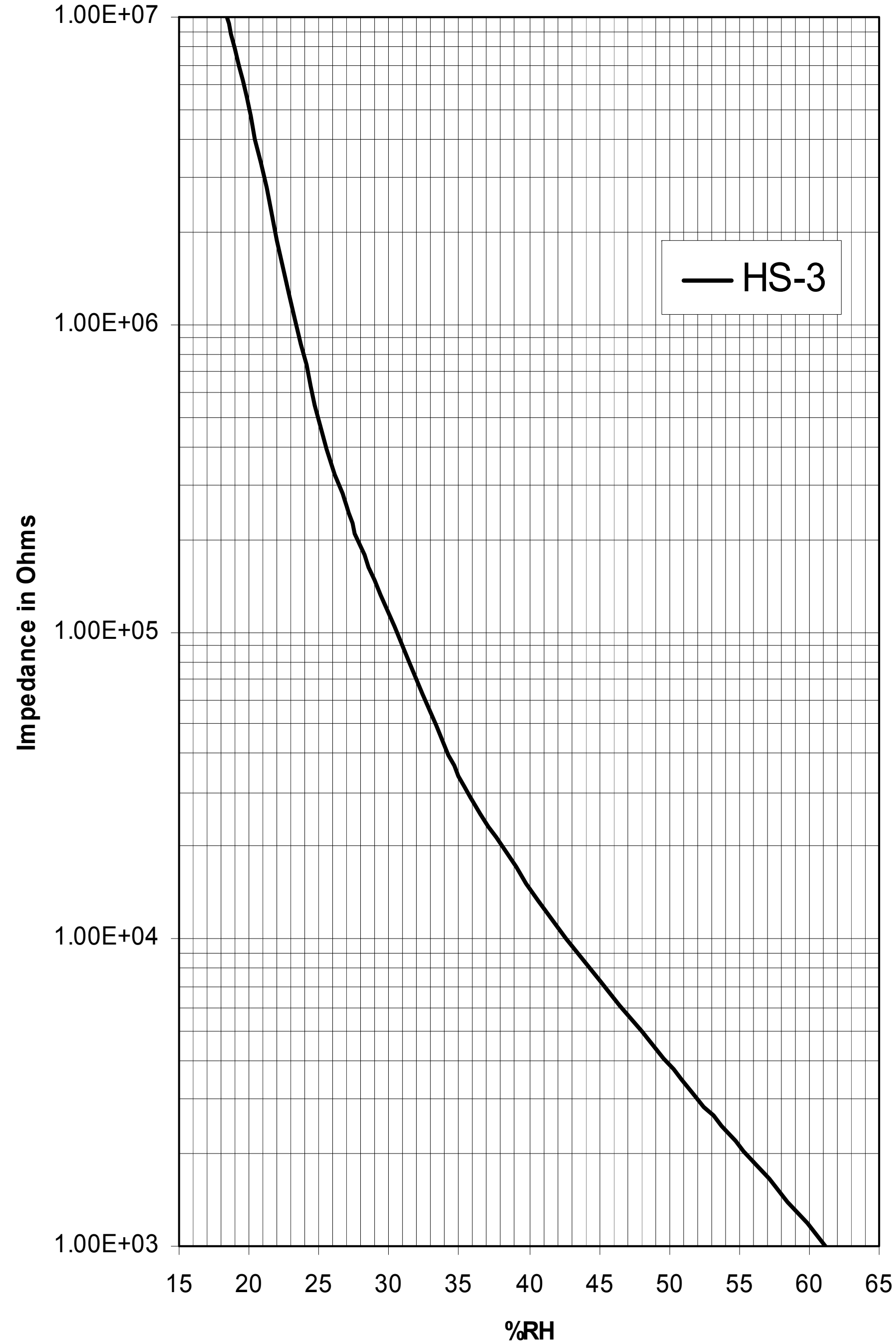
Where:
A, B, C, D = CONSTANTS (See chart below) Z = SENSOR RESISTANCE IN MEGOHMS
t = TEMPERATURE IN °F

```
Computer Equation in BASIC:  %R.H. = A*(C*Z)^((t+459.7)/(D*(t+459.7)+B))
```

CONSTANTS FOR SPECIFIC RESISTANCE RANGES

Sensor Resistance Z	A	B	C	D
> 0.3 Megohm	0.228634	4827.88	4.19399 E-06	-14.1642
≤ 0.3 Megohm	5383.11	-1058.05	2.50559 E+10	-1.09785

HS-3 Orange Sensor



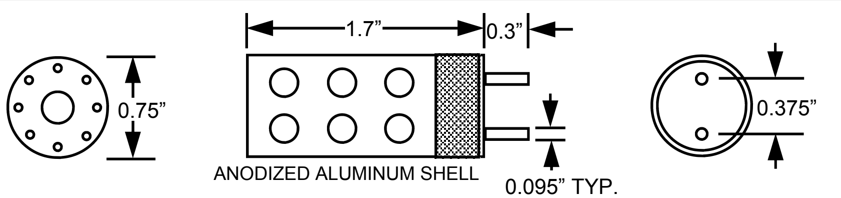
HUMIDITY SENSOR SPECIFICATIONS

Sensor Model No: HS-3 Color Code: ORANGE

ELECTRICAL:

Dynamic Resistance Range (10-95 dial) w/ 909K Load:	8 Megohms to 50 Kilohms (19% to 32% RH @ 80°F)
Dynamic Resistance Range (10-95 dial) w/ 20K Load:	200 Kilohms to 1 Kilohm (26% to 61% RH @ 80°F)
Maximum RMS Operating Current:	100 Microamperes, A.C.
Operating Frequency Range:	10Hz to 400Hz (60Hz Typ.)
Accuracy:	± 1% R.H.
Resolution:	± 0.1% R.H.
Hysteresis:	None
Interchangeability:	Direct Replacement with No Calibration Required
Response Time:	5 seconds Max. for 63% of the Total Humidity Change
Long Term Stability:	±1% for One Year
Operating Temperature Range:	40° F to 160°F
Temperature Coefficient:	± 1% R.H. for ± 5° F Change
Operating Pressure:	No Effect

MECHANICAL:



Room-type shell (shown) is used in normal convection air flow applications.
Duct-type shell (not shown) does not have ventilation holes on side view and is used in forced-air duct applications.

GENERAL SENSOR EQUATION:

$$\%R.H. = A\{(CZ)^{\left[\frac{(t + 459.7)}{D(t + 459.7) + B}\right]}\}$$

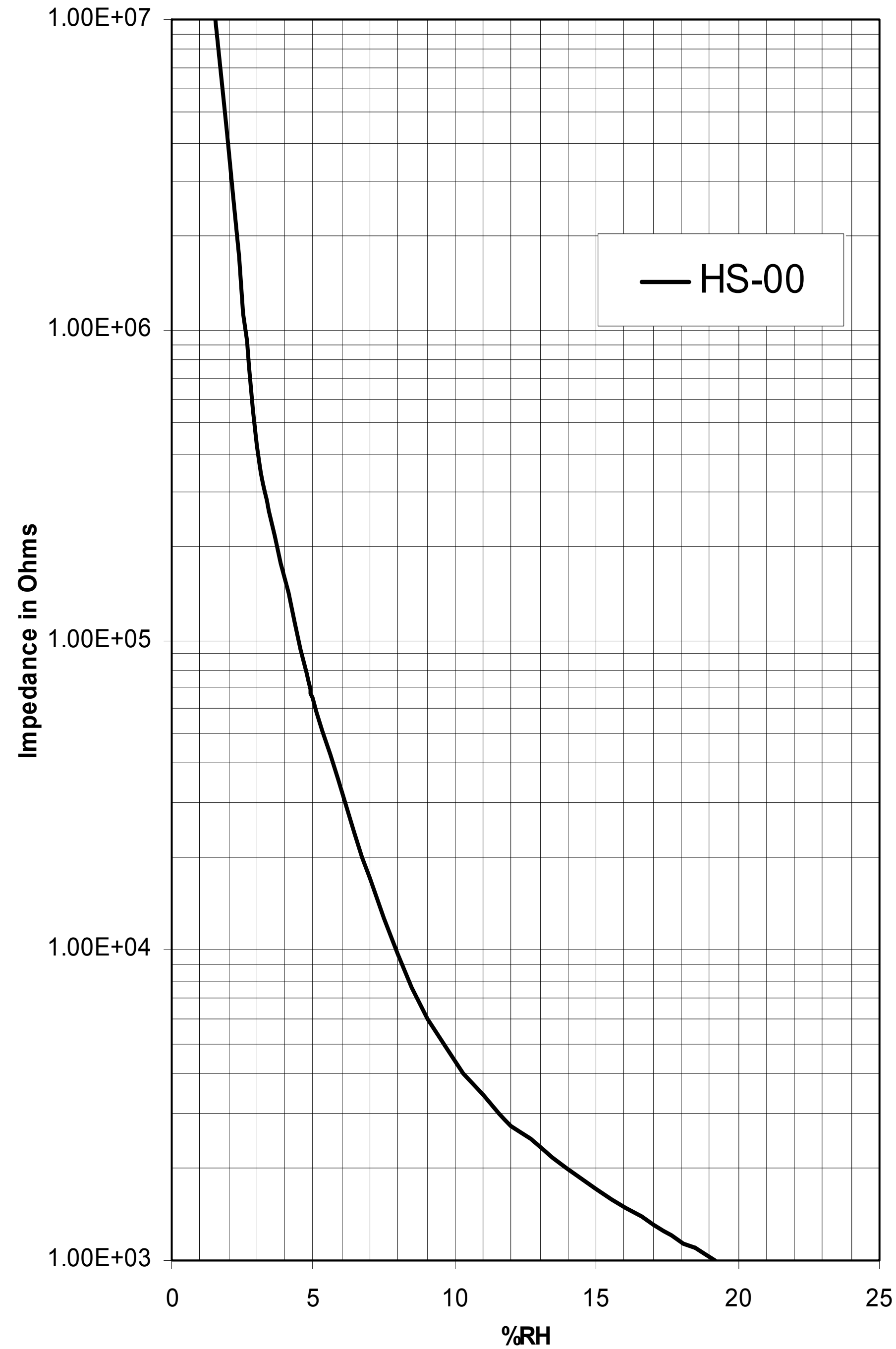
Where:
A, B, C, D = CONSTANTS (See chart below) Z = SENSOR RESISTANCE IN MEGOHMS
t = TEMPERATURE IN °F

Computer Equation in BASIC: %R.H. = A*(C*Z)^((t+459.7)/(D*(t+459.7)+B))

CONSTANTS FOR SPECIFIC RESISTANCE RANGES

Sensor Resistance Z	A	B	C	D
> 0.9 Megohm	162.692	-7798.04	1.09275 E+09	3.82539
≤ 0.9 Megohm	494.047	-4106.08	1.22166 E+11	-0.709388

HS-00 High White Sensor



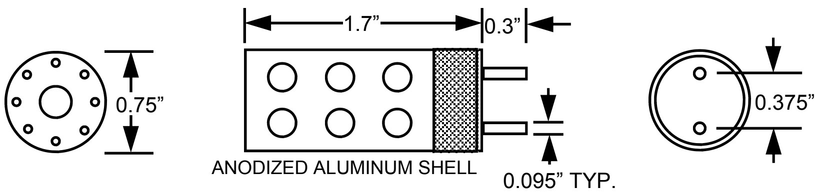
HUMIDITY SENSOR SPECIFICATIONS

Sensor Model No: HS-0 — Color Code: BLACK

ELECTRICAL:

Dynamic Resistance Range (10-95 dial) w/ 909K Load:	8 Megohms to 50 Kilohms (3.5% to 9% RH @ 80°F)
Dynamic Resistance Range (10-95 dial) w/ 20K Load:	200 Kilohms to 1 Kilohm (8% to 28% RH @ 80°F)
Maximum RMS Operating Current:	100 Microamperes, A.C.
Operating Frequency Range:	10Hz to 400Hz (60Hz Typ.)
Accuracy:	± 1% R.H.
Resolution:	± 0.1% R.H.
Hysteresis:	None
Interchangeability:	Direct Replacement with No Calibration Required
Response Time:	5 seconds Max. for 63% of the Total Humidity Change
Long Term Stability:	±1% for One Year
Operating Temperature Range:	40° F to 160°F
Temperature Coefficient:	± 1% R.H. for ± 5° F Change
Operating Pressure:	No Effect

MECHANICAL:



Room-type shell (shown) is used in normal convection air flow applications. Duct-type shell (not shown) does not have ventilation holes on side view and is used in forced-air duct applications.

GENERAL SENSOR EQUATION:

$$\%R.H. = A\{(CZ)^{\left[\frac{(t + 459.7)}{D(t + 459.7) + B}\right]}\}$$

Where:

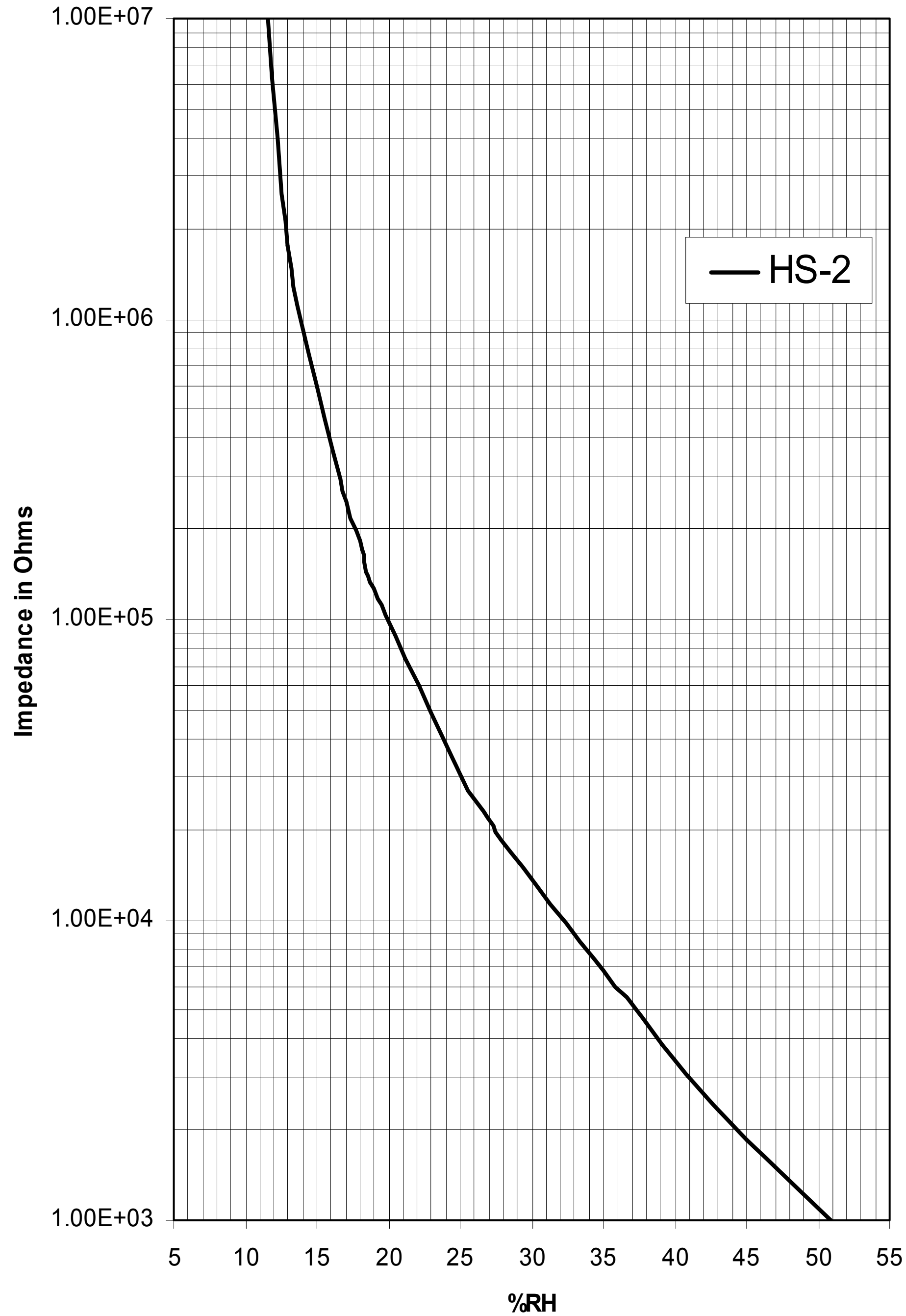
A, B, C, D = CONSTANTS (See chart below) Z = SENSOR RESISTANCE IN MEGOHMS
t = TEMPERATURE IN °F

```
Computer Equation in BASIC:  %R.H. = A*(C*Z)^((t+459.7)/(D*(t+459.7)+B))
```

CONSTANTS FOR SPECIFIC RESISTANCE RANGES

Sensor Resistance Z	A	B	C	D
> 3.6 Megohm	1.87617 E-02	2744.16	2.56664 E-14	-10.7022
0.9 Meg to 3.6 Meg	0.201625	3893.05	8.76395 E-08	-12.2786
0.6 Meg to 0.9 Meg	0.656889	4843.81	1.81598 E-04	-13.2788
0.4 Meg to 0.6 Meg	0.69162	4469.11	3.92666 E-04	-12.3528
<0.4 Megohm	1.76933 E-02	1534.62	1.23116 E-10	-6.92589

HS-2 Red Sensor



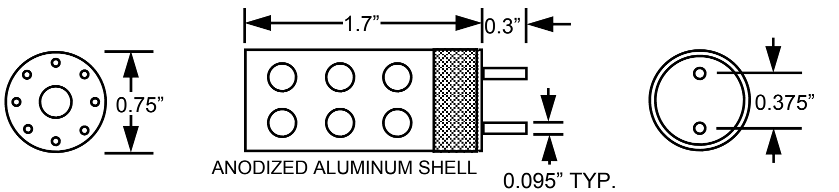
HUMIDITY SENSOR SPECIFICATIONS

Sensor Model No: HS-2 Color Code: RED

ELECTRICAL:

Dynamic Resistance Range (10-95 dial) w/ 909K Load:	8 Megohms to 50 Kilohms (10.5% to 22% RH @ 80°F)
Dynamic Resistance Range (10-95 dial) w/ 20K Load:	200 Kilohms to 1 Kilohm (17% to 51% RH @ 80°F)
Maximum RMS Operating Current:	100 Microamperes, A.C.
Operating Frequency Range:	10Hz to 400Hz (60Hz Typ.)
Accuracy:	± 1% R.H.
Resolution:	± 0.1% R.H.
Hysteresis:	None
Interchangeability:	Direct Replacement with No Calibration Required
Response Time:	5 seconds Max. for 63% of the Total Humidity Change
Long Term Stability:	±1% for One Year
Operating Temperature Range:	40° F to 160°F
Temperature Coefficient:	± 1% R.H. for ± 5° F Change
Operating Pressure:	No Effect

MECHANICAL:



Room-type shell (shown) is used in normal convection air flow applications.
Duct-type shell (not shown) does not have ventilation holes on side view and is used in forced-air duct applications.

GENERAL SENSOR EQUATION:

$$\%R.H. = A\{(CZ)^{\left[\frac{(t + 459.7)}{D(t + 459.7) + B}\right]}\}$$

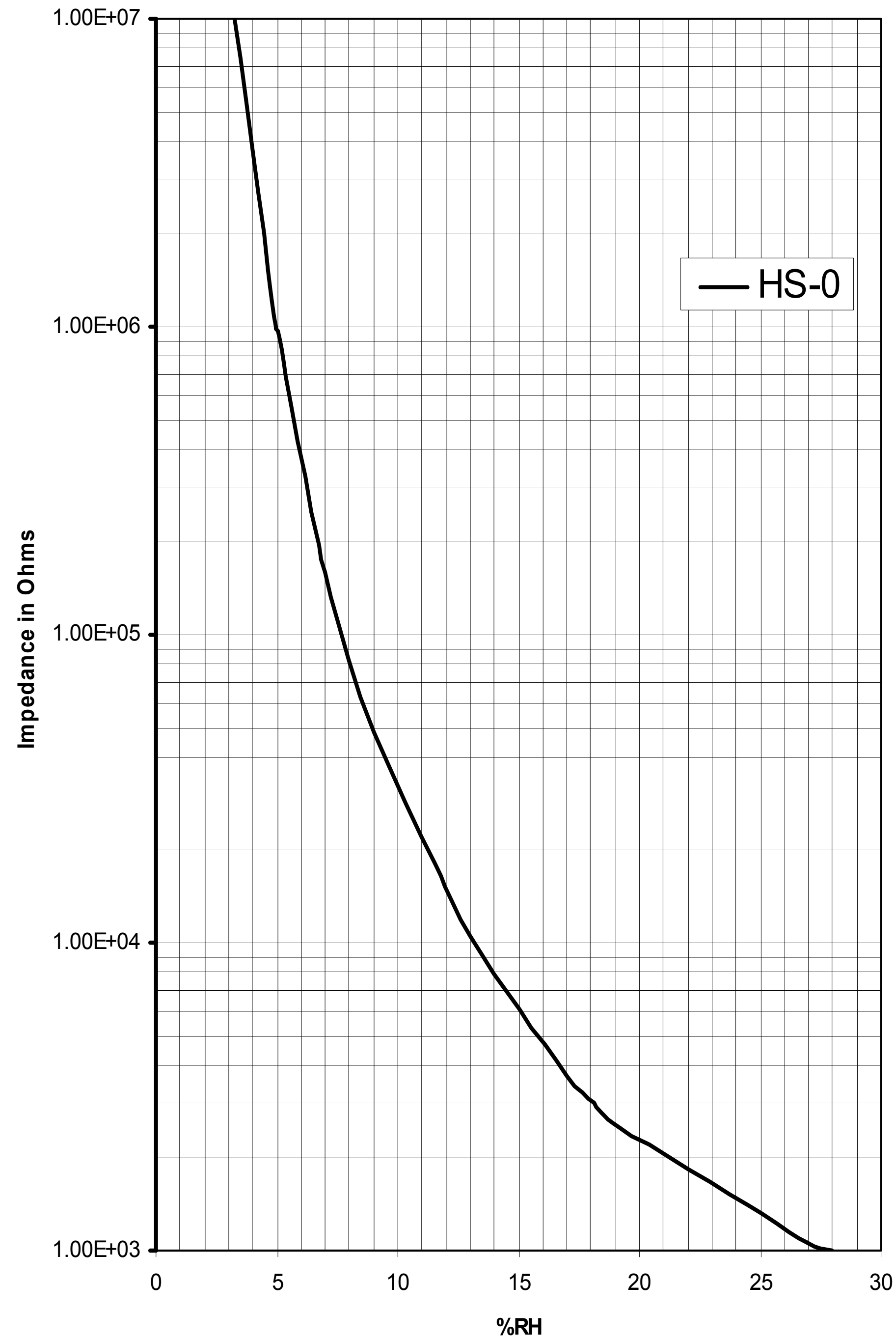
Where:
A, B, C, D = CONSTANTS (See chart below) Z = SENSOR RESISTANCE IN MEGOHMS
t = TEMPERATURE IN °F

Computer Equation in BASIC: %R.H. = A*(C*Z)^((t+459.7)/(D*(t+459.7)+B))

CONSTANTS FOR SPECIFIC RESISTANCE RANGES

Sensor Resistance Z	A	B	C	D
> 2.7 Megohm	0.501024	6642.43	4.00773 E-20	-25.8843
0.5 Meg to 2.7 Meg	0.195718	2816.71	4.84854 E-16	-13.4637
0.1 Meg to 0.5 Meg	2.73642 E-02	1376.77	1.13105 E-17	-8.82778
< 0.1 Megohm	7.35925 E-03	892.883	1.09295 E-18	-7.18156

HS-0 Black Sensor



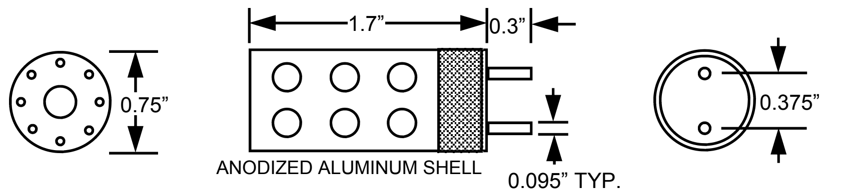
HUMIDITY SENSOR SPECIFICATIONS

Sensor Model No: HS-1 Color Code: BROWN

ELECTRICAL:

Dynamic Resistance Range (10-95 dial) w/ 909K Load:	8 Megohms to 50 Kilohms (5% to 15% RH @ 80°F)
Dynamic Resistance Range (10-95 dial) w/ 20K Load:	200 Kilohms to 1 Kilohm (10% to 36% RH @ 80°F)
Maximum RMS Operating Current:	100 Microamperes, A.C.
Operating Frequency Range:	10Hz to 400Hz (60Hz Typ.)
Accuracy:	± 1% R.H.
Resolution:	± 0.1% R.H.
Hysteresis:	None
Interchangeability:	Direct Replacement with No Calibration Required
Response Time:	5 seconds Max. for 63% of the Total Humidity Change
Long Term Stability:	±1% for One Year
Operating Temperature Range:	40° F to 160°F
Temperature Coefficient:	± 1% R.H. for ± 5° F Change
Operating Pressure:	No Effect

MECHANICAL:



Room-type shell (shown) is used in normal convection air flow applications.
Duct-type shell (not shown) does not have ventilation holes on side view and is used in forced-air duct applications.

GENERAL SENSOR EQUATION:

$$\%R.H. = A\{(CZ)^{\left[\frac{(t + 459.7)}{D(t + 459.7) + B}\right]}\}$$

Where:
A, B, C, D = CONSTANTS (See chart below) Z = SENSOR RESISTANCE IN MEGOHMS
t = TEMPERATURE IN °F

Computer Equation in BASIC: %R.H. = A*(C*Z)^((t+459.7)/(D*(t+459.7)+B))

CONSTANTS FOR SPECIFIC RESISTANCE RANGES

Sensor Resistance Z	A	B	C	D
> 0.9 Megohm	1.13564 E+03	-2448.19	6.12150 E+11	-0.875417
≤ 0.9 Megohm	2.20004 E+05	-1011.3	1.28894 E+20	-2.62613

HS-1 Brown Sensor