HTM2500 – Temperature and Relative Humidity Module

- **Hermetic Housing**
- **Humidity calibrated within +/-2% @55%RH**
- **Temperature measurement through NTC 10kOohms +/-3% direct output**
- **Small size product**
- **Typical 1 to 4 Volt DC output for 0 to 100%RH at 5Vdc**

DESCRIPTION

Based on the rugged HTS2010 humidity / temperature sensor, HTM2500 is a dedicated humidity and temperature transducer designed for OEM applications where a reliable and accurate measurement is needed. Direct interface with a micro-controller is made possible with the module's humidity linear voltage output.

FEATURES

- Full interchangeability
- High reliability and long term stability
- Not affected by water immersion
- Ratiometric to voltage supply
- Suitable for 3 to 10 Vdc supply voltage

Humidity Sensor Specific Features

- Instantaneous de-saturation after long periods in saturation phase
- Fast response time
- High resistance to chemicals
- Patented solid polymer structure

Temperature Sensor Specific Features

- Stable
- High sensitivity

APPLICATIONS

- Industrial
- Process control
- Hygrostat
- Data logger

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深圳市新世联科技有限公司

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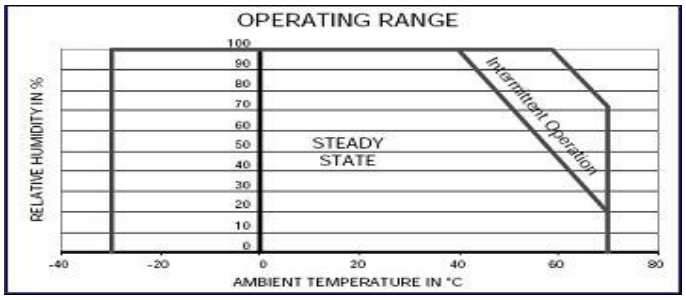
PERFORMANCE SPECS

MAXIMUM RATINGS

Ratings	Symbol	Value	Unit
Storage Temperature	Tstg	-40 to 85	℃
Storage Humidity	RHstg	0 to 100	% RH
Supply Voltage (Peak)	Vs	12	Vdc
Humidity Operating Range	RH	0 to 100	% RH
Temperature Operating	Ta	-30 to 70	℃

Peak conditions: less than 10% of the operating time



ELECTRICAL CHARACTERISTICS

(Ta=23℃, Vs=5Vdc +/-5%, R_L>1MΩ unless otherwise stated)

Humidity Characteristics	Symbol	Min	Typ	Max	Unit
Humidity Measuring Range	RH	1		99	%RH
Relative Humidity Accuracy (10 to 95% RH)	RH		+/-3	+/-5	%RH
Supply Voltage	Vs	4.75	5.00	5.25	Vdc
Nominal Output @55%RH (at 5Vdc)	Vout	2.42	2.48	2.54	V
Current consumption	Ic		0.4	08	mA
Temperature Coefficient (10 to 50℃)	Tcc		+0.1		%RH/℃
Average Sensitivity from 33% to 75%RH	ΔVout/ΔRH		+25		mV/%RH
Sink Current Capability (R_L=15kΩ)	Is			300	μA
Recovery time after 150 hours of condensation	tr		10		s
Humidity Hysteresis			+/-1.5		%RH
Long term stability	T		+/-0.5		%RH/yr
Time Constant (at 63% of signal, static) 33% to 76%RH	τ		5		s
Output Impedance	Z		70		Ω

(Ta=25℃)

Temperature Characteristics	Symbol	Min	Typ	Max	Unit
Nominal Resistance @25℃	R		10		kΩ
Beta value: B25/100	β	3600	3730	3800	
Temperature Measuring Range	Ta	-40		85	℃
Nominal Resistance Tolerance @25℃	R_N		2	3	%
Beta Value Tolerance	β		3		%
Response Time	τ		10		s

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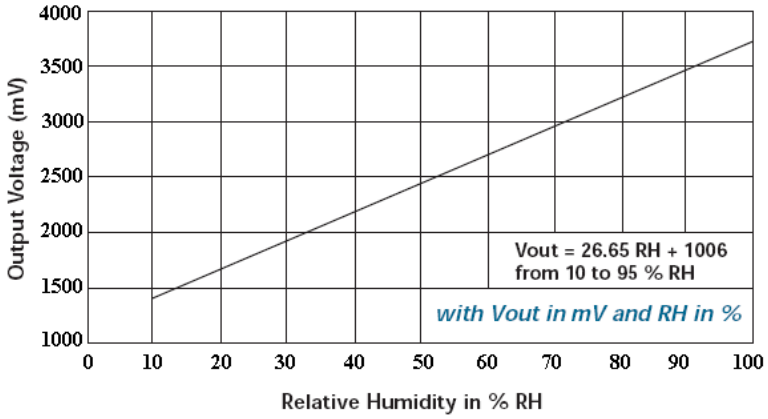
TYPICAL PERFORMANCE CURVES

HUMIDITY SENSOR

- **Modeled linear voltage output (Vs = 5V)**



- **Polynomial Equation**

$$Vout = 1.05E^{-3}RH^3 - 1.76E^{-1}RH^2 + 35.2RH + 898.6$$ with Vout in mV and RH in %

- **Typical response look-up table**

RH (%)	Vout (mV)	RH (%)	Vout (mV)
10	1235	55	2480
15	1390	60	2605
20	1540	65	2730
25	1685	70	2860
30	1825	75	2990
35	1960	80	3125
40	2090	85	3260
45	2220	90	3405
50	2350	95	3555

- **Measurement Conditions**

HTM2500 is specified for accurate measurements within 10 to 95% RH.

Excursion out of this range (<10% or >95% RH, including condensation) does not affect the reliability of HTM2500 characteristics.

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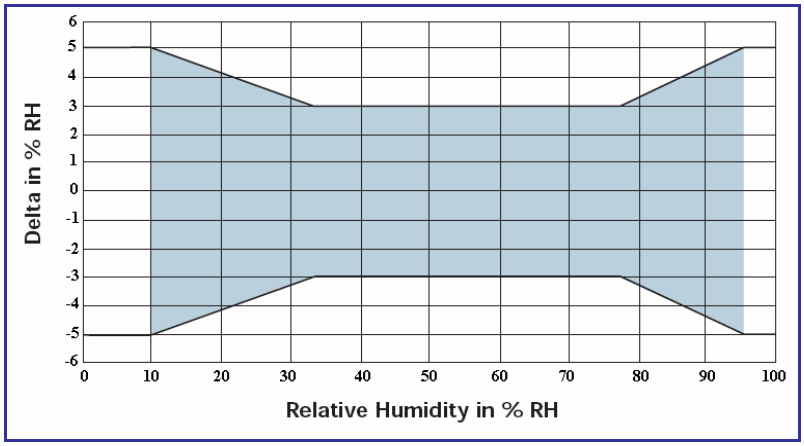
- **Error Budget at 23℃**

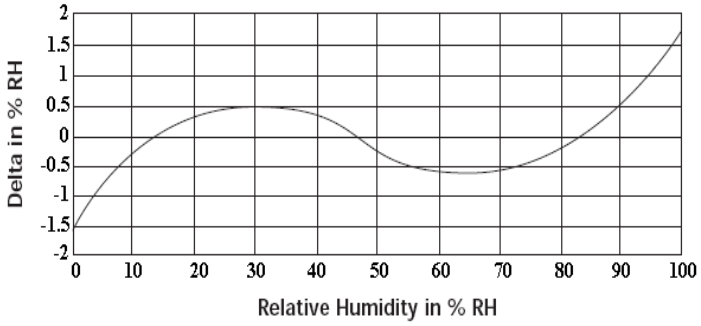
HTM2500 Error Limits:



Temperature coefficient compensation:

$$RH_{Cor}\% = RH_{read}\% \times \left(1 - (T_a - 23) \times 2.4\, E^{-3}\right)$$

HTM2500 Linearity Error:



Non-linearity and temperature compensation:

$$RH\% = \frac{-1.9206\, E^{-3} V_{out}{}^{3} + 1.437\, E^{-5} V_{out}{}^{2} + 3.421 E^{-3} V_{out} - 12.4}{1 + (T_a - 23) \times 2.4\, E^{-3}}$$

All equations Vout in mV, RH in % and Ta in ℃

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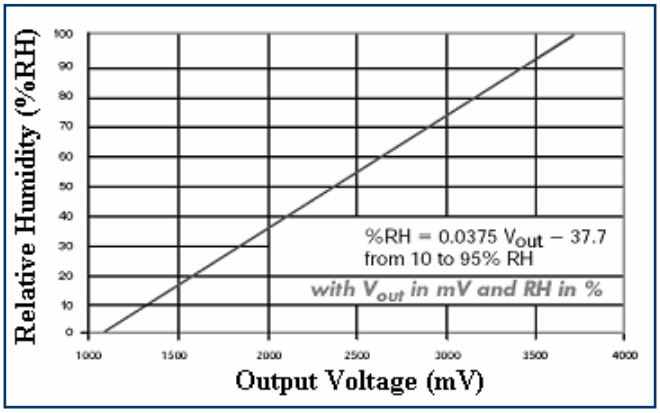
- **Humidity Measurement using HTM2500**



TEMPERATURE SENSOR

- **Typical temperature output**

Depending on the needed temperature measurement range and associated accuracy, we suggest two methods to access to the NTC resistance values.

$$R_T = R_N \times e^{\beta\left(\frac{1}{T}-\frac{1}{T_N}\right)}$$

R_T	NTC resistance in Ω at temperature T in K
R_N	NTC resistance in Ω at rated temperature T in K
T, T_N	Temperature in K
β	Beta value, material specific constant of NTC
e	Base of natural logarithm (e=2.71828)

① The exponential relation only roughly describes the actual characteristic of an NTC thermistor can, however, as the material parameter β in reality also depend on temperature. So this approach is suitable for describing a restricted range around the rated temperature or resistance with sufficient accuracy.
② For practical applications, a more precise description of the real R/T curve may be required. Either more complicated approaches (e.g. the Steinhart-Hart equation) are used or the resistance/temperature relation as given in tabulation form. The below table has been experimentally determined with utmost accuracy for temperature increments of 1 degree.

Actual values may also be influenced by inherent self-heating properties of NTCs. Please refer to MEAS-France/Humirel Application Note HPC106 “Low power NTC measurement”.

- **Temperature look-up table**

Temp (℃)	R (Ω)	Temp (℃)	R (Ω)
-30	169149	20	12474
-25	125546	25	10000
-20	94143	30	8080
-15	71172	35	6569
-10	54308	40	5372
-5	41505	45	4424
0	32014	50	3661
5	25011	55	3039
10	19691	60	2536
15	15618	65	2128

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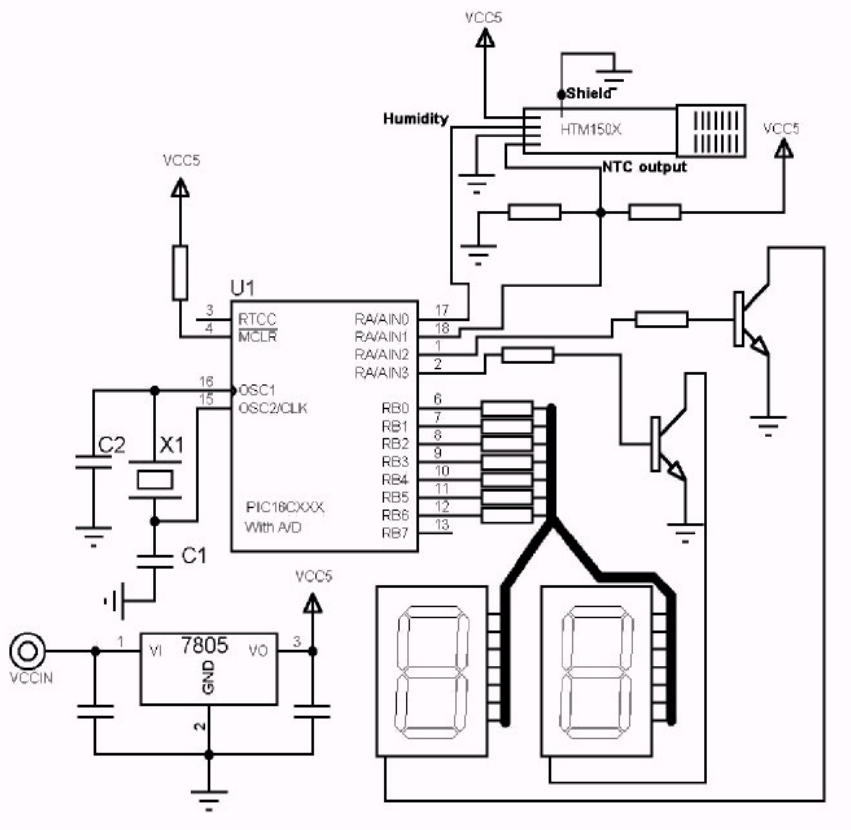
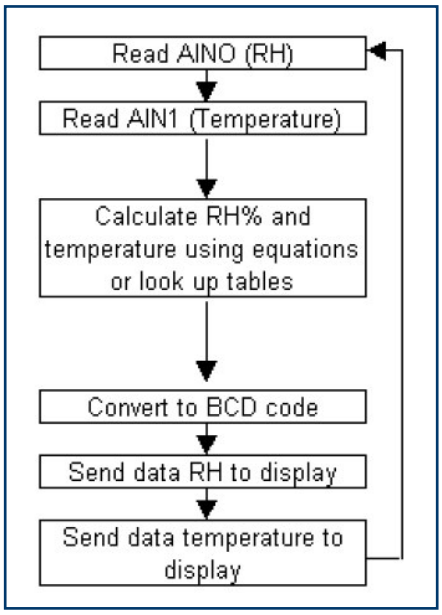
SUGGESTED APPLICATION



Steps of 1% RH are achievable by using 8-bit A/D.
If more resolution is required, a 10-bit A/D needs to be used and a third display will be added, giving steps of 0.2% RH.



QUALIFICATION PROCESS

RESISTANCE TO PHYSICAL AND CHEMICAL STRESSES

- HTM2500 has passed through qualification processes of MEAS-FRANCE/HUMIREL including vibration, shock, storage, high temperature and humidity, ESD.
- Additional tests under harsh chemical conditions demonstrate good operation in presence of salt atmosphere, SO2 (0.5%, H2S (0.5%), 03, NOx, NO, CO, CO2, Softener, Soap, Toluene, acids (H2SO4, HNO3, HCI), HMDS, Insecticide, Cigarette smoke, this is not an exhaustive list.
- HTM2500 is not light sensitive.

SPECIFIC PRECAUTIONS

- HTM2500 is not protected against reversed polarity - Check carefully when connecting the device.
- If you wish to use HTM2500 in a chemical atmosphere not listed above, consult us.

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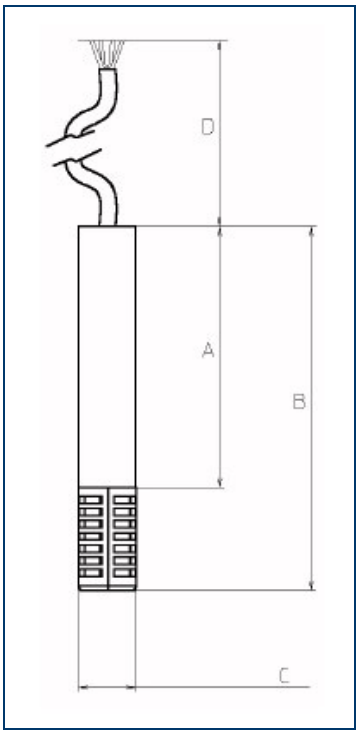
PACKAGE OUTLINE



Dim	Min (mm)	Max (mm)
A	53	55
B	74.3	76.3
C	11.2	11.6
D*	200	250

** Specific lenght available on request*

Wire	Color	Function
W1	Brown	Ground
W2	White	Supply Voltage
W3	Yellow	Humidity Voltage Output
W4	Green	NTC Resistance Output
W5	Black	Shield

ORDERING INFORMATION

HPP809A001 (MULTIPLE PACKAGE QUANTITY OF 10 PIECES)

HTM2500 – HUMIDITY VOLTAGE OUTPUT + NTC (TEMPERATURE DIRECT OUTPUT)

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