

## RELATIVE HUMIDITY AND TEMPERATURE MODULE

## HTM1505

Based on the rugged HS1101 humidity sensor, HTM1505 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 and direct NTC outputs. HTM1505 is designed for an optimized board to board connection.

## MAIN FEATURES

- Suitable for direct board assembly
- Not affected by repeated condensations
- Full interchangeability
- High reliability and long term stability
- Typical 1 to 4 Volt DC output for 0 to 100% RH at 5 V DC supply
- Humidity calibrated within +/- 2% RH @ 55% RH
- Temperature measurement through NTC 10 kohm +/- 3% direct output
- Ratiometric to voltage supply within the specified range

## HUMIDITY SENSOR SPECIFIC FEATURES

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

## MAXIMUM RATINGS

Ratings	Symbol	Value	Unit
Storage Temperature	Tstg	-40 to 85	°C
Supply Voltage (peak)	Vs	7	Vdc
Humidity Operating Range	RH	0 to 100	% RH
Temperature Operating Range	Ta	-30 to 85	°C

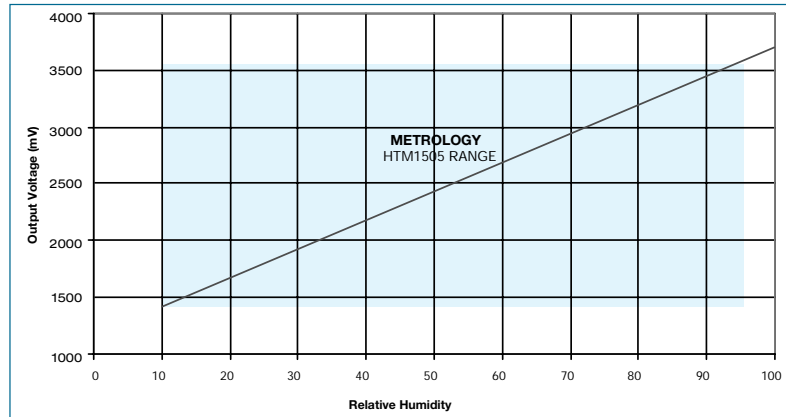
## CHARACTERISTICS

(Ta = 23°C, Vs = 5Vdc, RL > 1MΩ otherwise stated)

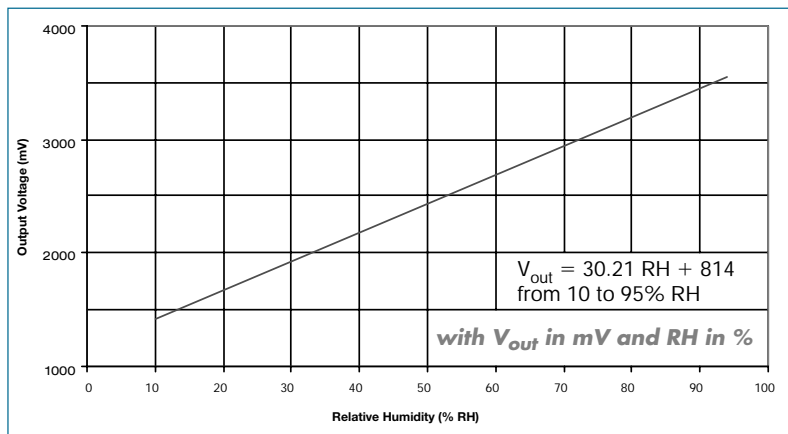
Characteristics	Symbol	Min	Typ	Max	Unit
Humidity measuring range	RH	1		99	% RH
Relative Humidity accuracy (10 to 95% RH)	RH		+/-5		% RH
Voltage supply	Vs	4.75	5.00	5.25	V
Nominal output @ RH = 55%	Vout	2.42	2.48	2.54	V
Current consumption	Ic		0.4	0.8	mA
Temperature coefficient (10 to 50 °C)	Tcc		+ 0.1		% RH/°C
Averaged Sensitivity from 33% to 75% RH	ΔmV/% RH		+25		mV/% RH
NTC Nominal output @ 25°C / Tolerance +/-3%	Ta		10		kohm
Recovery time after 150 hours of condensation	t		10		s
Humidity Hysteresis			+/-1.5		% RH
Long term stability			0.5		%RH/yr
Response time (33 to 76% RH, static, @ 63%)	τ		5		s
Output impedance	Z		70		Ω
Sink current capability (RL = 15 kΩ)	Is			300	μA

## MEASUREMENT CONDITIONS

- HTM1505 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 HTM1505 characteristics.
- Dedicated HTM15XX Product are available for extreme RH conditions (as HTM1525 for low dewpoints) - Consult HUMIREL for further information.



## HTM1505 MODELLED LINEAR VOLTAGE OUTPUT ( $V_S = 5V$ )



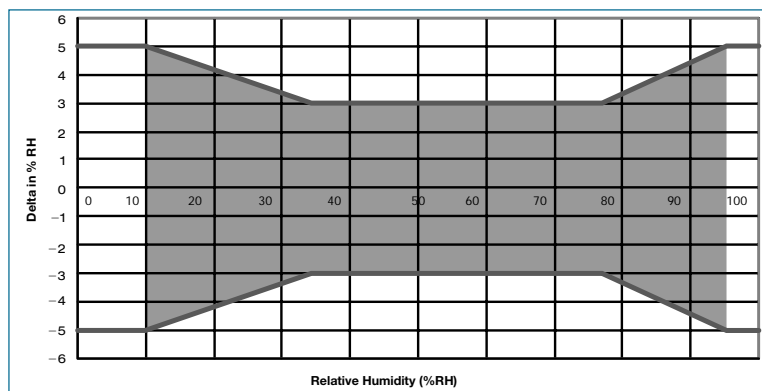
### REFERENCE OUTPUT VALUES

RH (%)	$V_{out}$ (mV)	RH (%)	$V_{out}$ (mV)
10	1080	55	2480
15	1250	60	2625
20	1420	65	2770
25	1580	70	2920
30	1735	75	3065
35	1890	80	3220
40	2040	85	3375
45	2190	90	3530
50	2335	95	3695

### Reversed Polynomial Equation

$$V_{out} = 9.23E^{-4}RH^3 - 1.57E^{-1}RH^2 + 37.9RH + 715$$

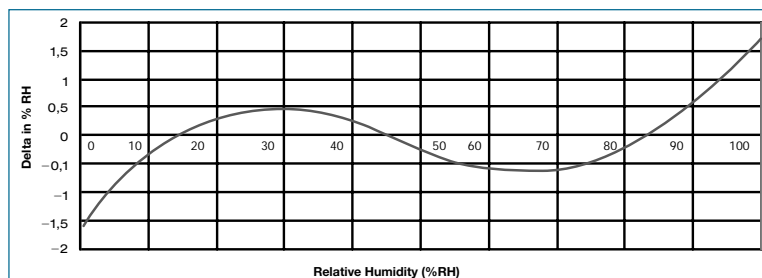
## ERROR BUDGET AND COMPENSATIONS AT 23°C



### HTM1505 ERROR LIMITS

### Temperature coefficient compensation

$$RH_{Cor} \% = RH_{Read} \% * (1 - (Ta - 23) * 2.4E^{-3})$$



### Non linearity and temperature compensation

$$RH\% = \frac{-1.0388E^{-9}V_{out}^3 + 7.8530E^{-6}V_{out}^2 + 1.45251E^{-2}V_{out} - 13.5}{1 + (Ta - 23) * 2.4E^{-3}}$$

All equations  $V_{out}$  in mV, RH in %,  $Ta$  in °C.

### LINEARITY ERROR OF HTM1505 MODUL

## CHARACTERISTICS

### Temperature sensor (T<sub>a</sub> = 25°C)

Characteristics	Symbol	Min.	Typ.	Max.	Unit.
Nominal resistance @ 25°C			<b>10</b>		<b>kΩ</b>
Beta value : B25/100	<b>B</b>	<b>3600</b>	<b>3730</b>	<b>3800</b>	
Temperature measuring range	<b>T<sub>a</sub></b>	<b>- 30</b>		<b>80</b>	<b>°C</b>
Nominal Resistance Tolerance	<b>R<sub>n</sub></b>		<b>2</b>	<b>3</b>	<b>%</b>
B value tolerance	<b>B</b>		<b>3</b>		<b>%</b>
Response Time	<b>τ</b>		<b>10</b>		<b>s</b>

### Typical temperature output

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

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

**R<sub>T</sub>** NTC resistance in Ωat temperature T in K

**R<sub>N</sub>** NTC resistance in Ωat rated temperature in K

**T, T<sub>N</sub>** Temperature in K

**B** B value, material-specific constant of the NTC thermistor

**e** Base of natural logarithm (e = 2.71828)

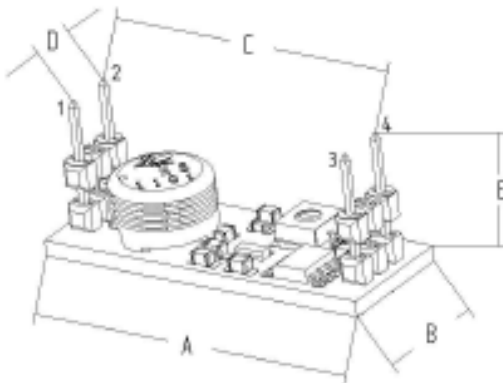
The actual characteristic of an NTC thermistor can, however, only be roughly described by the exponential relation, as the material parameter B in reality also depends on temperature. So this approach is only suitable for describing a restricted range around the rated temperature or resistance with sufficient 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 tabulated form. The below table has been experimentally determined with utmost accuracy for temperature increments of 1 degree.

Temperature °C	Resistance (ohm)	Max. Deviation	Temperature °C	Resistance (ohm)	Max. Deviation	Temperature °C	Resistance (ohm)	Max. Deviation	Temperature °C	Resistance (ohm)	Max. Deviation
-30	144790	16636	-2	33100	2230	26	9600	300	54	3360	213
-29	136664	15444	-1	31557	2078	27	9218	300	55	3237	208
-28	129054	14343	0	30029	1932	28	8853	299	56	3126	204
-27	121925	13325	1	28627	1799	29	8506	297	57	3019	200
-26	115243	12383	2	27299	1675	30	8178	296	58	2917	197
-25	109030	11516	3	26042	1560	31	7866	294	59	2819	193
-24	103115	10705	4	24852	1452	32	7568	292	60	2720	189
-23	97565	9953	5	23773	1355	33	7283	290	61	2629	185
-22	92354	9257	6	22708	1261	34	7011	287	62	2542	182
-21	87460	8612	7	21698	1174	35	6734	284	63	2458	178
-20	82923	8020	8	20739	1093	36	6484	281	64	2378	175
-19	78581	7463	9	19829	1017	37	6244	278	65	2304	171
-18	74497	6947	10	18959	946	38	6015	275	66	2229	168
-17	70655	6468	11	18128	879	39	5796	271	67	2158	165
-16	67039	6023	12	17338	817	40	5575	267	68	2089	161
-15	63591	5606	13	16588	759	41	5373	264	69	2022	158
-14	60381	5222	14	15876	705	42	5180	260	70	1960	155
-13	57356	4865	15	15207	654	43	4995	257	71	1898	152
-12	54503	4533	16	14569	607	44	4817	253	72	1839	149
-11	51813	4225	17	13962	563	45	4636	248	73	1782	146
-10	49204	3932	18	13384	522	46	4473	245	74	1727	143
-9	46767	3662	19	12834	484	47	4316	241	75	1673	140
-8	44467	3411	20	12280	447	48	4166	237	76	1622	138
-7	42296	3177	21	11777	413	49	4021	233	77	1573	135
-6	40247	2960	22	11297	382	50	3874	229	78	1526	132
-5	38279	2756	23	10840	353	51	3737	225	79	1480	130
-4	36455	2568	24	10404	325	52	3606	221	80	1432	127
-3	34731	2393	<b>25</b>	<b>10000</b>	<b>300</b>	53	3481	217			

- RESISTANCE TO PHYSICAL AND CHEMICAL STRESSES.
  - HTM1505 has passed through qualification processes of HUMIREL including vibration, shock, storage, high temperature and humidity, ESD.
  - Additional tests under harsh chemical conditions demonstrate good operation in presence of salt atmosphere, SO<sub>2</sub> (0.5%), H<sub>2</sub>S (0.5%), O<sub>3</sub>, NO<sub>x</sub>, NO, CO, CO<sub>2</sub>, Softener, Soap, Toluene, acids (H<sub>2</sub>SO<sub>4</sub>, HNO<sub>3</sub>, HCl), HMDS, Insecticide, Cigarette smoke, a non exhaustive list.
  - HTM1505 is not light sensitive.
- SPECIFIC PRECAUTIONS
  - HTM1505 is not protected against reversed polarity - Check carefully when connecting the device.
  - If you wish to use HTM1505 in a chemical atmosphere not listed above, consult us.

TYPICAL PACKAGE  
OUTLINE OF HTM1505



DIm	Min (mm)	Max (mm)
A	34	36
B	12.5	13.5
C	30.35 Typical	
D	5.08 Typical	
E	13.1 Typical	

Pin out Assignment	
1	NTC - Temperature
2	GROUND
3	Vcc - Voltage Supply
4	Vout - Humidity

ORDERING INFORMATION (MULTIPLE PACKAGE QUANTITY OF 10 PIECES).  
HTM 1505 HUMIDITY ANALOG VOLTAGE OUTPUT MODULE.

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