

## RELATIVE HUMIDITY MODULE

HM 1504

Based on the rugged HS1101 capacitive humidity sensor, HM1504 is a dedicated humidity transducer designed for **measurements at high temperature**. Direct interface with a micro-controller is made possible with the module's linear voltage output.

## MAIN FEATURES

- Small size
- Not affected by water immersion
- High reliability and long term stability
- Typical 1 to 4 Volt DC output for 0 to 100 % RH at 5 V DC supply
- Calibrated within +/- 3 % RH @ 55 % RH
- Very low temperature dependence
- Ratiometric to voltage supply within the specified range
- Suitable for 3 to 7 Volts supply voltage

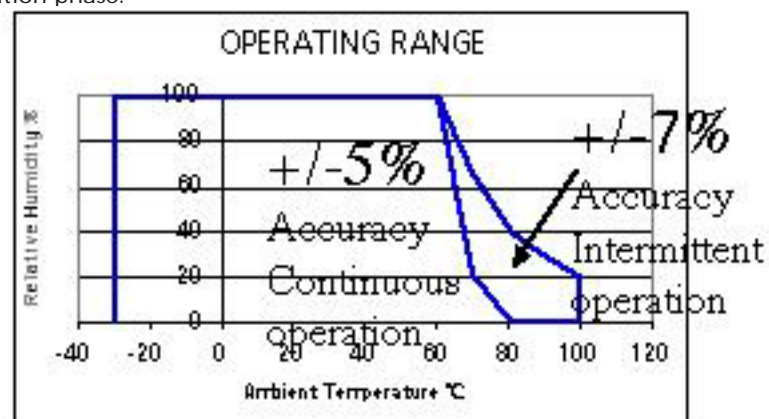


## HUMIDITY SENSOR SPECIFIC FEATURES

- 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	T <sub>stg</sub>	-30 to 85	°C
Supply Voltage (Peak)	V <sub>s</sub>	7	Vdc
Humidity Operating Range	RH	0 to 100	% RH
Temperature Operating Range	T <sub>a</sub>	-30 to 80	°C



Peak conditions up to 100°C : less than 10% of the operational time.

## CHARACTERISTICS

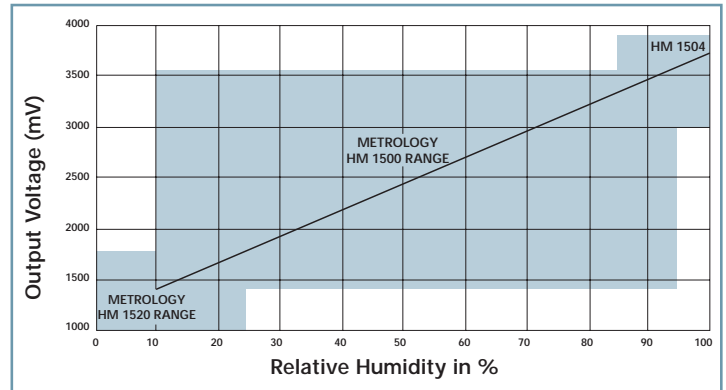
(T<sub>a</sub> = 23°C, V<sub>s</sub> = 5Vdc, R<sub>L</sub> > 1MΩ unless otherwise stated)

Characteristics	Symbol	Min.	Typ.	Max.	Unit.
Humidity measuring range	RH	1		99	% RH
Relative Humidity accuracy (10 to 95 % RH)	RH		+/- 3	+/- 5	% RH
Voltage supply	V <sub>s</sub>	4.75	5.00	5.25	V
Nominal output @ RH = 55 % / T <sub>a</sub> 23°C	V <sub>out</sub>	2.40	2.55	2.70	V
Nominal output @ RH = 30 % / T <sub>a</sub> 90°C	V <sub>out</sub>	1.80	2.00	2.20	V
Temperature coefficient (10 to 50 °C)	T <sub>cc</sub>		+ 0.1		% RH/°C
Averaged Sensitivity from 33% to 75% RH	ΔmV/% RH		+ 25		mV/% RH
Sink current capability (R <sub>L</sub> = 15 kΩ)	I <sub>s</sub>			300	μA
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		10		s
Output impedance	Z		70		Ω

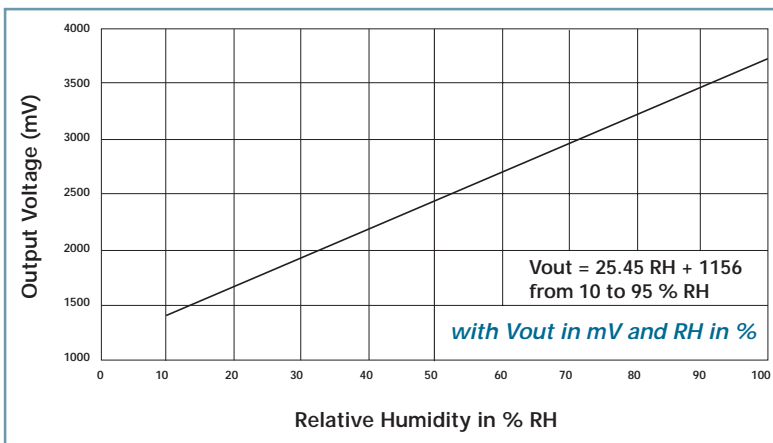
## MEASUREMENT CONDITIONS

- HM1504 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 HM1504 characteristics.

HM 1504 Typical Measuring Ranges in Humidity



## HM1504 MODELLED LINEAR VOLTAGE OUTPUT ( $V_s = 5V$ )



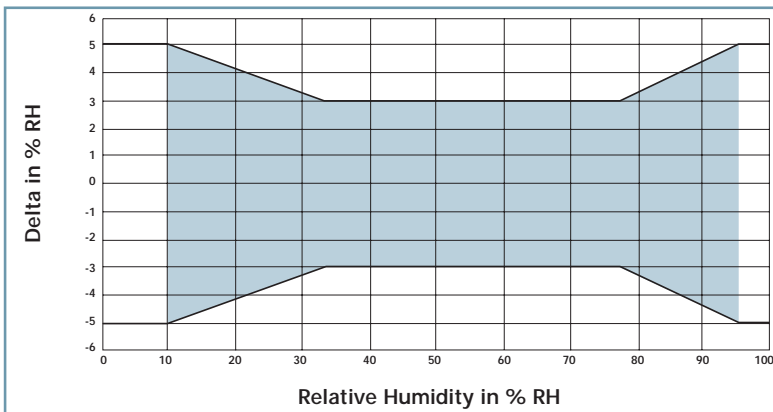
REFERENCE OUTPUT VALUES

RH (%)	$V_{out}(mV)$	RH (%)	$V_{out}(mV)$
10	1400	55	2550
15	1535	60	2675
20	1670	65	2800
25	1800	70	2925
30	1930	75	3055
35	2055	80	3185
40	2180	85	3315
45	2305	90	3455
50	2430	95	3595

### Reversed Polynomial Equation

$$V_{out} = 6.43E^{-4}RH^3 - 9.73E^{-2}RH^2 + 29.6RH + 1112$$

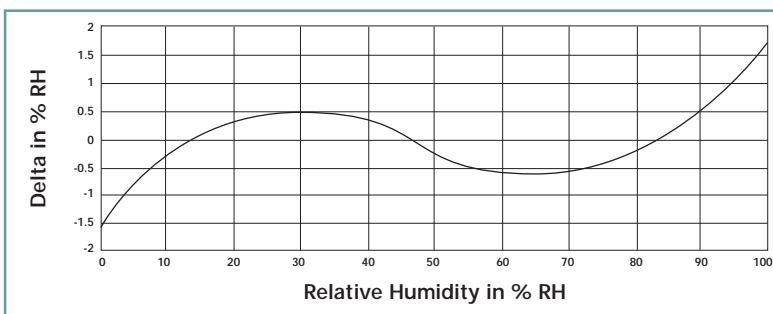
## ERROR BUDGET AT 23°C



HM1504 ERROR LIMITS at 23°C

### Temperature coefficient compensation

$$RH_{Cor}\% = RH\%_{Computed} + (23 - T_a) * 0.15$$



### Non linearity compensation

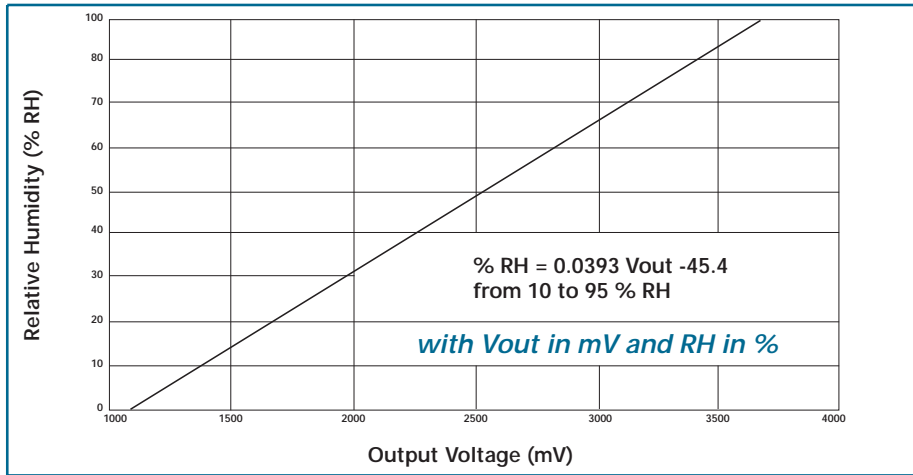
$$RH\% = -1.464E^{-9}V_{out}^3 + 1.072E^{-5}V_{out}^2 + 1.430E^{-2}V_{out} - 27$$

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

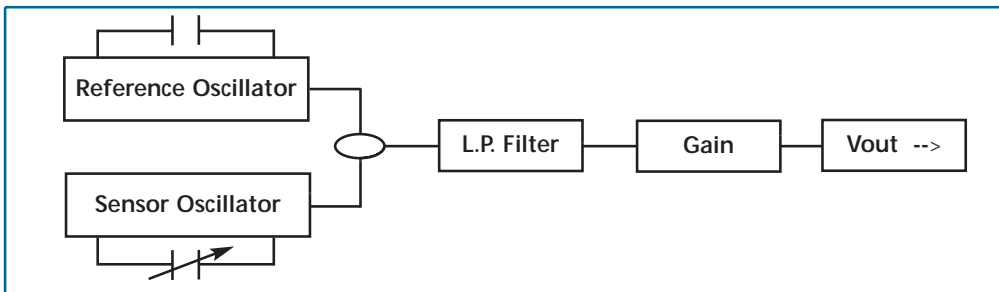
LINEARITY ERROR OF HM1504 MODULE

## HUMIDITY MEASUREMENT USING HM1504

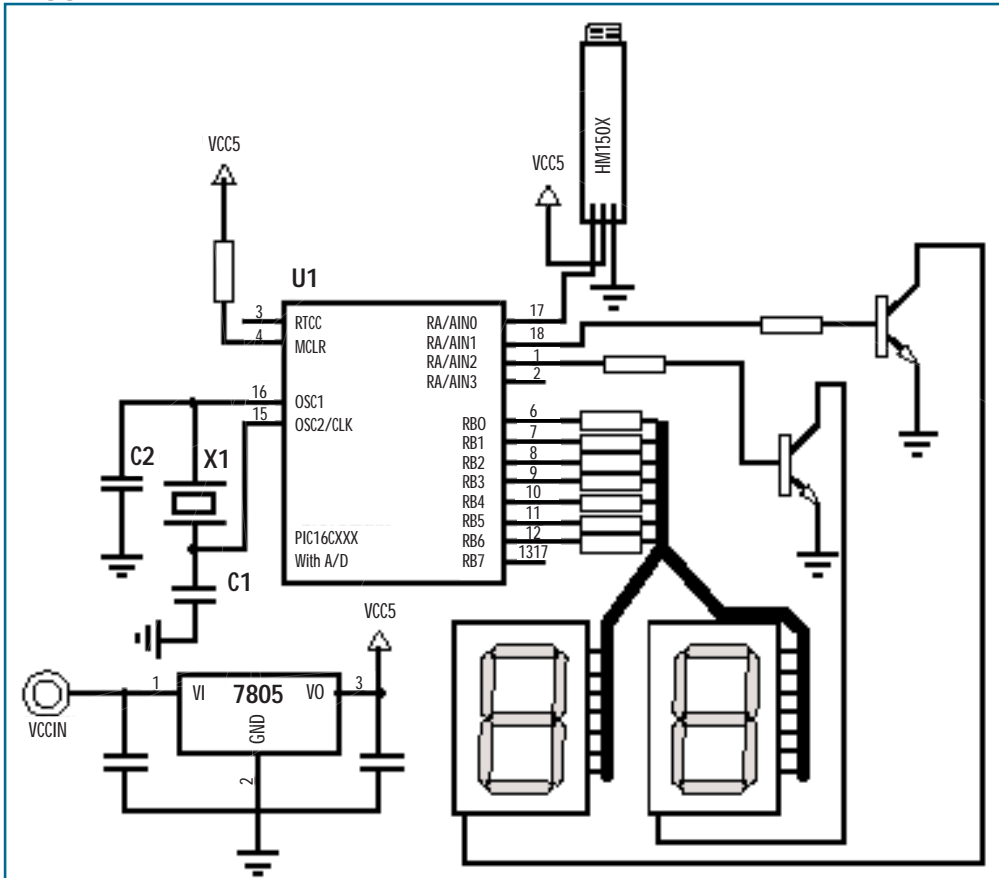
Typical HM 1504 relative Humidity measurement



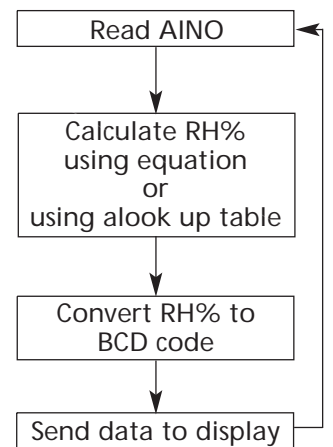
### Internal block diagram of HM1504



### Suggested applications for HM1504



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

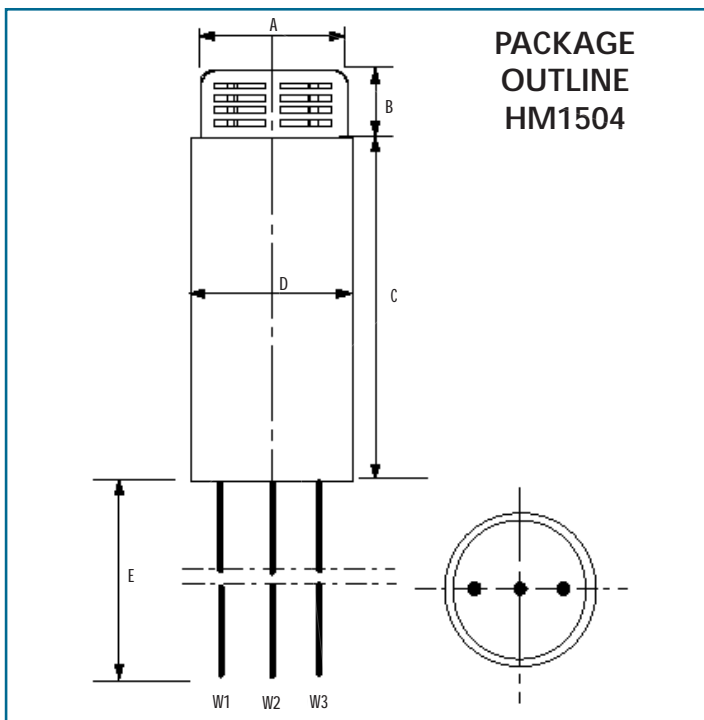


● **RESISTANCE TO PHYSICAL AND CHEMICAL STRESSES**

- HM1504 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.
- HM1500 is not light sensitive.

● **SPECIFIC PRECAUTIONS**

- HM1504 is not protected against reversed polarity - Check carefully when connecting the device.
- If you wish to use HM1504 in a chemical atmosphere not listed above, consult us.



Dim	Min (mm)	Max (mm)
A	9.70	10.20
B	5.00	5.50
C	52	54
D	11.2	11.6
E*	200	250

\* specific length available on request

Wire	Color	Function
W1	White	GROUND
W2	Blue	SUPPLY VOLTAGE
W3	Yellow	OUTPUT VOLTAGE