

## HTM2500B3C4OIL – Water Content in Oil & Temperature Sensor



- Water Content in Oil – Typical 0 to 1000ppm
- Voltage Output – Typical 1 to 4 Volt DC
- Temperature: NTC Resistance Output – Nominal 25°C 10kΩ Accuracy +/- 1°C

### DESCRIPTION

Based on the combined miniature humidity / temperature sensor, HTM2500B3C4OIL is a very cost effective dedicated water content in oil and temperature transducer designed for industrial, transformers, truck and automotive applications where a reliable and accurate measurement of water in oil content is needed. Direct interface with a micro-controller is made possible with the module's water content voltage output. Customized versions are available upon request.

### FEATURES

- Full interchangeability
- High reliability and demonstrated long term stability in oil
- Ratiometric to voltage supply
- Sensitive elements with unique mechanical and chemical robustness

#### **HUMIDITY SENSOR SPECIFIC FEATURES**

- Instantaneous de-saturation after long periods in saturation phase
- Fast response time
- High resistance to truck and automotive chemicals
- Patented solid polymer structure
- Accurate and repeatable Oil Humidity Sensitivity.

#### **TEMPERATURE SENSOR SPECIFIC FEATURES**

- Stable
- High sensitivity

### APPLICATIONS

- Industrial
- Transformers
- Truck
- Automotive

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## PERFORMANCE SPECS

### MAXIMUM RATINGS

Ratings	Symbol	Min	Typ	Max	Unit
Storage Temperature	Tstg	-40		125	°C
Storage Humidity	RHstg	0		100	% RH
Supply Voltage (Peak*)	Vs			7	Vdc
Water Content in Oil–Water Activity** Operating Range	aw	0		1	
Temperature Operating Range	Ta	-40		85	°C
Pressure	P	1		5	bar

\* **Peak:** less than 10% of the operating time

\*\***Water Activity:** (Water content / Water content in the saturated oil)

### ELECTRICAL CHARACTERISTICS

(Ta=23°C, Vs=5Vdc +/-5%, R<sub>L</sub>>1MΩ unless otherwise stated)

Water Content Characteristics	Symbol	Min	Typ	Max	Unit
Measuring Range	aw	0		1	
Accuracy	aw			0.025	
Supply Voltage	Vs	4.75	5.00	5.25	Vdc
Current consumption	Ic		1.2	1.5	mA
Sensitivity from 25% to 75%FS	ΔVout/ aw		3		mV
Sink Current Capability (R <sub>L</sub> =15kΩ)	Is	300			μA
Output Impedance	Z		70		Ω

Temperature Characteristics	Symbol	Min	Typ	Max	Unit
Nominal Resistance (25°C)	R		10		kΩ
Beta value: B25/100	β	3600	3730	3800	
Temperature Measuring Range	Ta	-40		105	°C
Nominal Resistance Tolerance (25°C)	R <sub>N</sub>		2	3	%
Beta Value Tolerance	β		3		%
Response Time	τ		10		s

## TYPICAL PERFORMANCE CURVES

### WATER CONTENT IN OIL SENSOR

- **Water content in oil measurement**

The water content in oil can be described by:

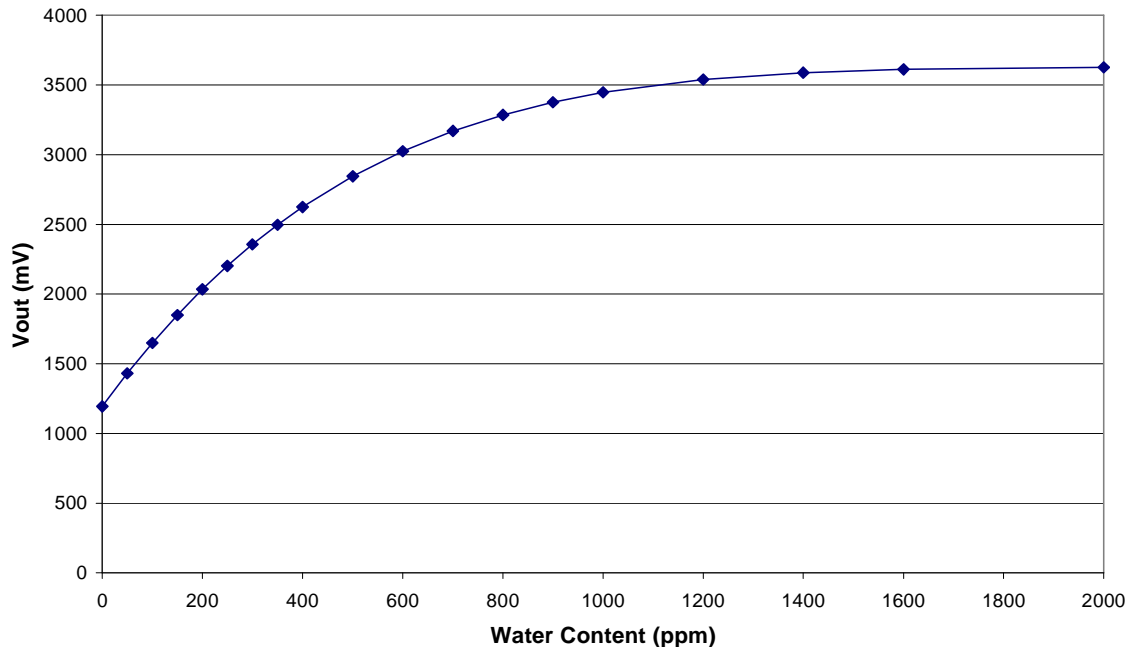
Absolute value in ppm (Volume of water / Volume of oil)

Water activity aw (Water content / Water content in the saturated oil)

## HTM2500B3C4OIL – Water Content in Oil & Temperature Sensor

- Typical response in hydraulic oil (new ISO32 grade) at 60°C

The form factor of the response curve is a function of oil nature and temperature.  
The curve below is only valid for new ISO32 grade oil at 60°C.



- Typical response look-up table in hydraulic oil (new ISO32 grade) at 60°C

aw (ppm)	Vout(mV)	aw (ppm)	Vout (mV)
50	1430	600	3024
100	1649	700	3170
150	1850	800	3285
200	2034	900	3376
250	2202	1000	3447
300	2356	1200	3540
350	2496	1400	3589
400	2624	1600	3612
500	2845	2000	3626

- Specific sensor calibration

Upon request MEAS laboratory is available to study response curve related to your application.  
Please contact MEAS fluid application team ([fluid.sales@meas-spec.com](mailto:fluid.sales@meas-spec.com)).

### 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  $\Omega$  at temperature T in K

## HTM2500B3C4OIL – Water Content in Oil & Temperature Sensor

$R_N$  NTC resistance in  $\Omega$  at rated temperature T in K  
 $T, T_N$  Temperature in K  
 $\beta$  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  $\beta$  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 Application Note HPC106 “Low power NTC measurement”.

- **Temperature look-up table**

Temp (°C)	R ( $\Omega$ )	Temp (°C)	R ( $\Omega$ )
-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

## QUALIFICATION

### RESISTANCE TO PHYSICAL AND CHEMICAL STRESSES

- HTM2500B3C4OIL has passed through qualification processes of MEAS-FRANCE and engine manufacturers including vibration, shock, storage, high temperature and humidity, ESD.
- Additional tests based upon customer specifications may be implemented on request.