

## 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 10k  $\Omega$**   
**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                  | $\Delta V_{out}/ aw$ |      | 3    |       | mV   |
| Sink Current Capability (R <sub>L</sub> =15kΩ) | I <sub>s</sub>       | 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    |

## HTM2500B3C4OIL - Water Content in Oil & Temperature Sensor

### TYPICAL PERFORMANCE CURVES

#### WATER CONTENT IN OIL SENSOR

- Water content in oil measurement

The water content in oil can be described by:

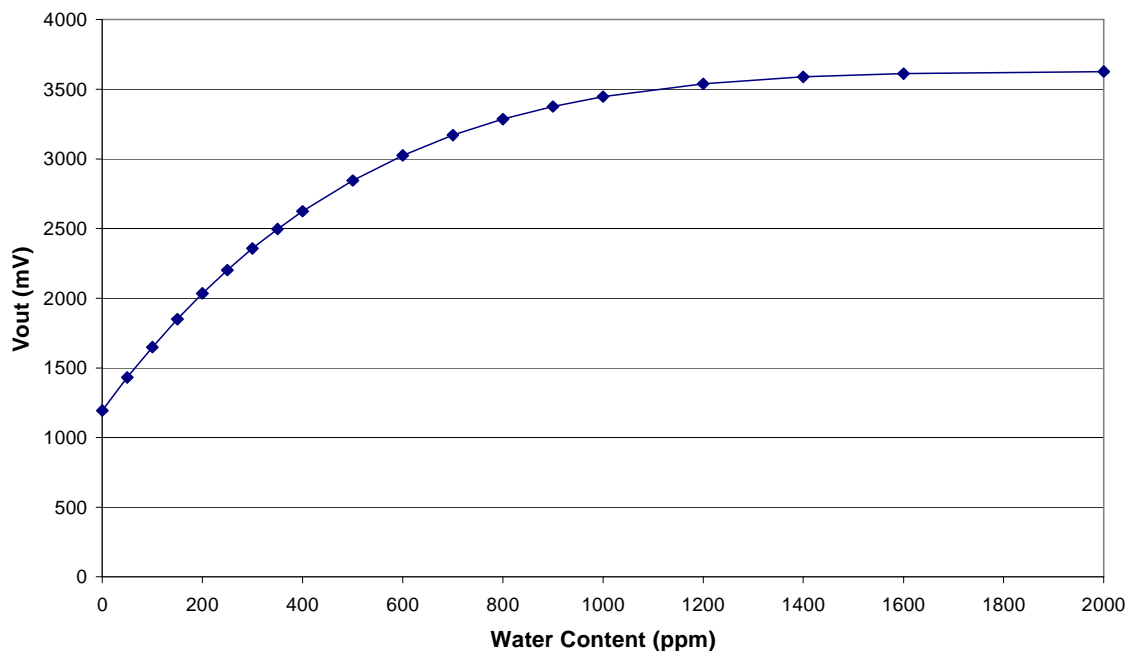
Absolute value in ppm (Volume of water / Volume of oil)

Water activity  $a_w$  (Water content / Water content in the saturated oil)

- 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) |
|------------|----------|-------------|-----------|
| <b>50</b>  | 1430     | <b>600</b>  | 3024      |
| <b>100</b> | 1649     | <b>700</b>  | 3170      |
| <b>150</b> | 1850     | <b>800</b>  | 3285      |
| <b>200</b> | 2034     | <b>900</b>  | 3376      |
| <b>250</b> | 2202     | <b>1000</b> | 3447      |
| <b>300</b> | 2356     | <b>1200</b> | 3540      |
| <b>350</b> | 2496     | <b>1400</b> | 3589      |
| <b>400</b> | 2624     | <b>1600</b> | 3612      |
| <b>500</b> | 2845     | <b>2000</b> | 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)).

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### 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       |
| $R_N$    | 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           |

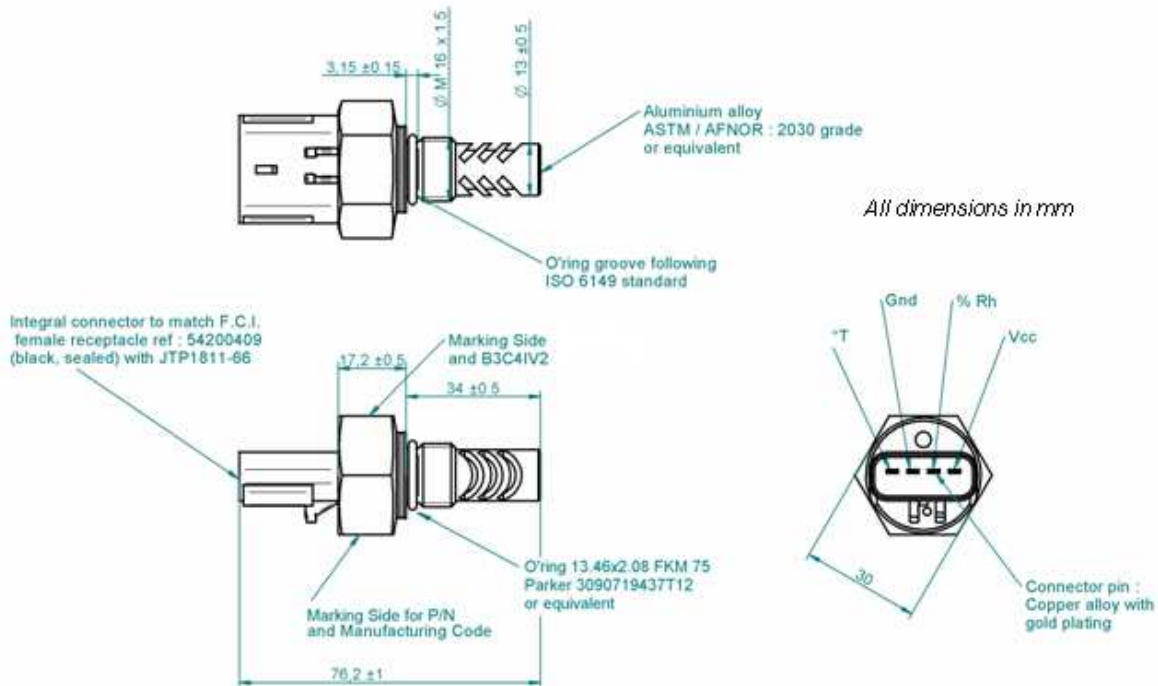
## QUALIFICATION

### 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.

## HTM2500B3C4OIL - Water Content in Oil & Temperature Sensor

### CONNECTING & MECHANICAL PACKAGING



### ORDERING INFORMATION

#### HPP809C050 FOR HTM2500B3C4OIL

#### Customer Service contact details

Measurement Specialties, Inc.  
105 av. du Général Eisenhower  
BP 23705 31037 TOULOUSE CEDEX 1  
FRANCE

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Sales: [fluid.sales@meas-spec.com](mailto:fluid.sales@meas-spec.com)

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