BRIEF INFORMATION

Oil pressure and temperature sensor (OPS+T)

- Continuous measurement of the oil pressure
- Continuous measurement of the oil temperature
- Rugged and reliable design

PRODUCT FEATURES

Application
The oil pressure and temperature sensor OPS+T is used to measure the absolute oil pressure and the oil temperature directly in the main oil channel behind the oil filter.

It uses the pressure value for demand-responsive control of mechanical or electrical oil pumps. This minimizes CO_2 emissions and reduces fuel consumption. Recording the temperature is used as input data for thermal management of the engine. The two signals are evaluated in the higher-level control unit.

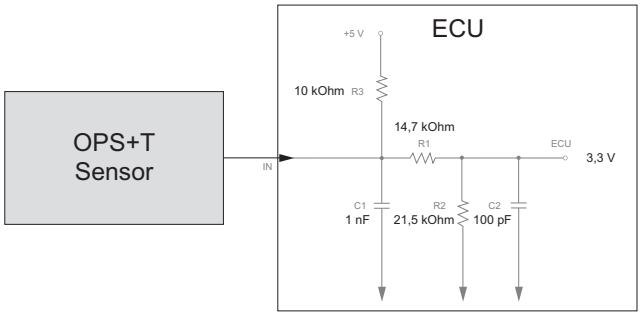
Usable in harsh environments thanks to the integration of the multi-chip module.

Design and function
The OPS+T is based on a multi-chip module (MCM), consisting a piezo-resistive cell for measuring the absolute pressure as well as an ASIC for the digital evaluation and further processing of the information. The oil temperature can also be established using a diode which is integrated in the MCM. The PWM output signal is used to transmit both the oil pressure as well as the oil temperature. The engine control unit (ECU) evaluates the PWM output signal from the sensor. The patented technology guarantees leak tightness in view of oils.

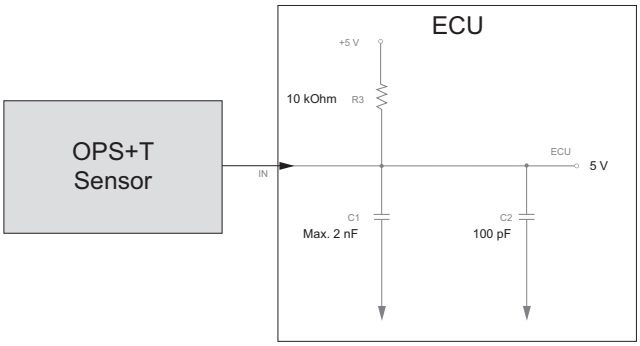
EXTERNAL CIRCUITRY IN THE CONTROL UNIT

A 10 kΩ pull-up resistor should be integrated in the ECU of the vehicle in order to define an idle mode. For optimum reading of the PWM signal, a capacitance of max. 2.2 nF should be integrated so as to compensate for the oscillations.

For ECU with 3.3 V



For ECU with 5 V

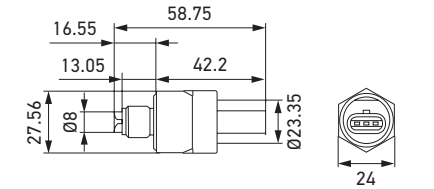


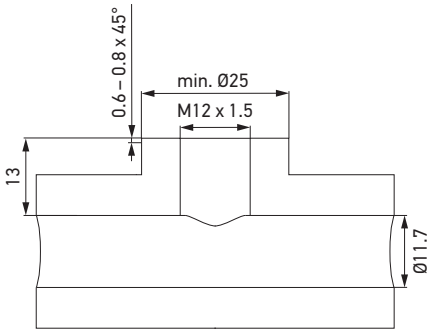
TECHNICAL DETAILS

Technical data	
Operating voltage range	Single-voltage (4.75 – 5.25 V)
Rated voltage	5 V
Supply voltage	4.75 to 5.25 V
Pressure measuring range	0.5 to 10.5 bar
Temperature measuring range	- 40 °C to +160 °C
Temperature range	- 40 °C to +150 °C
Max. temperature	160 °C (max. 100 h)
Output signal	PWM
Response time	2 ms
Sampling frequency	< 3 kHz
Max. operating pressure	40 bar
Protection class	IP 69K
Overpressure	60 bar
Mating connector[1)]	Hirschmann 872-858-541 or TE Connectivity 1-1670917-1
Approved	ECE-R10

[1)] This accessory is not included in the scope of delivery.
Available from Hirschmann Automotive or TE Connectivity.

Dimensional sketch





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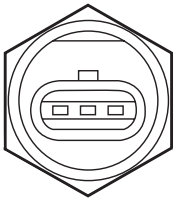
Pin assignment / electrical connection

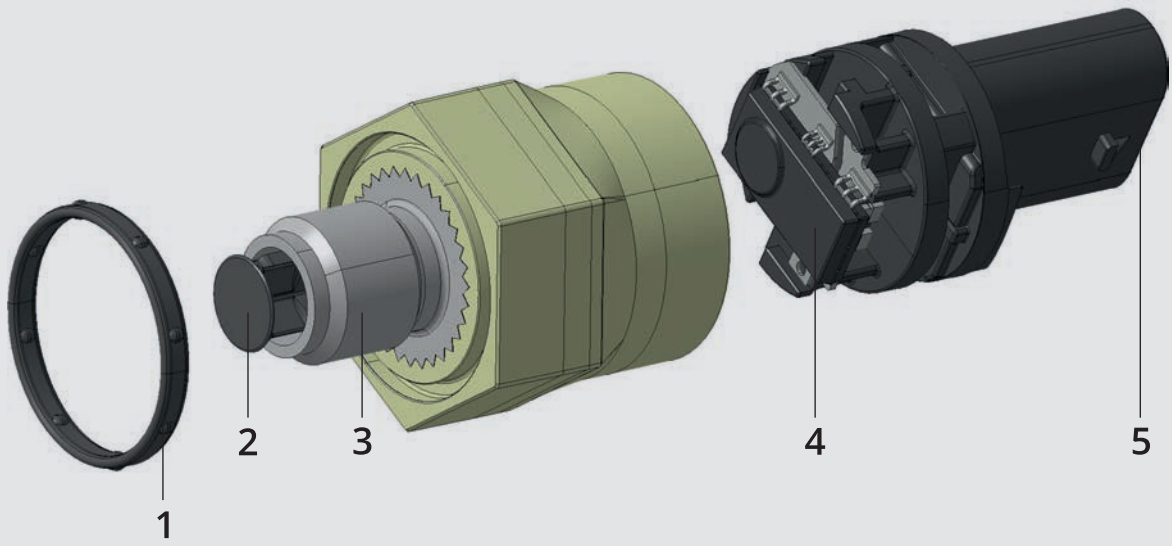


Pin 1: Supply
Pin 2: Ground
Pin 3: Output

Tolerance band for pressure measurement			
Temperature	**0.50 – 3.00 bar**	**3.00 – 5.50 bar**	**5.50 – 10.50 bar**
70 – 160°C	± 0,15 bar	± 0,20 bar	± 0,30 bar
20 – 70°C	± 0,15 bar	± 0,20 bar	± 0,30 bar
0 – 20°C	± 0,20 bar	± 0,25 bar	± 0,35 bar
-40 – 0°C	± 0,40 bar	± 0,40 bar	± 0,50 bar

Tolerance band for temperature measurement	
Temperature	**Accuracy**
135 – 160°C	± 1 K
20 – 135°C	± 2 K
-40 – 20°C	± 3 K

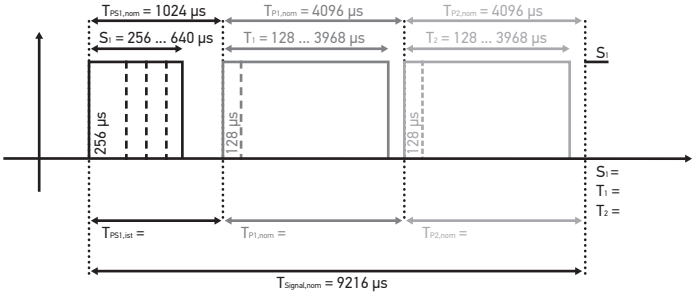
STRUCTURE



1 – Seal
2 – Diffusor
3 – Thread
4 – Electronics with multi-chip modulel
5 – Plug

OUTPUT SIGNAL

A pulse width modulated signal (PWM) is used to provide temperature, pressure and diagnostic information. All the information is sent every 9,216 µs. The higherlevel control unit must be able to measure the different pulse widths of the three square wave signals, which can vary from 128 µs to 3,958 µs. The control unit must provide a suitable sampling frequency and logic for measuring and recording the signals.

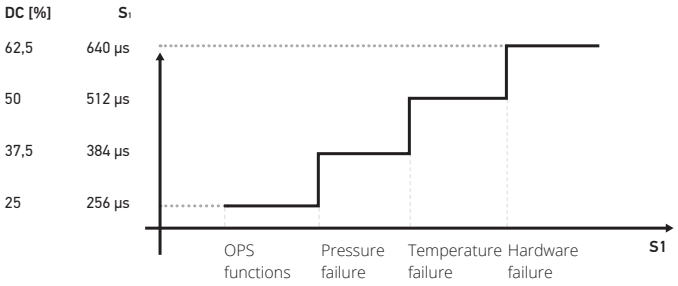


S_1: Signal, T_1: Temperature, T_2: Pressure

General information on the evaluation of PWM communication: Because of the adjustment accuracy of the oscillator and its temperature dependence, the length of a PWM frame is subject to a maximum tolerance of ± 10 %. Serious hardware errors in the program sequence of the ASIC cancel the PWM communication and are then detectable by the control unit on account of a permanent high level.

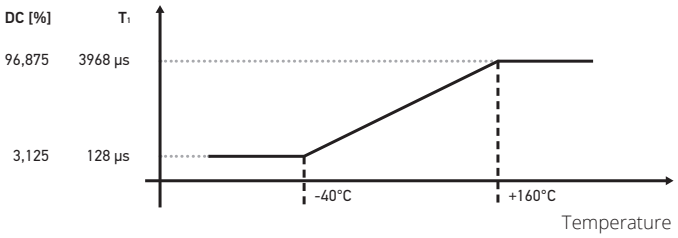
S_1: Diagnosis signal

DC = 0,25 (S1 = 256 µs ± 25 µs) => OPS functional state
DC = 0,375 (S1 = 384 µs ± 25 µs) => Pressure failure
DC = 0,5 (S1 = 512 µs ± 25 µs) => Temperature failure
DC = 0,625 (S1 = 640 µs ± 25 µs) => Hardware failure



T_1: Temperature evaluation

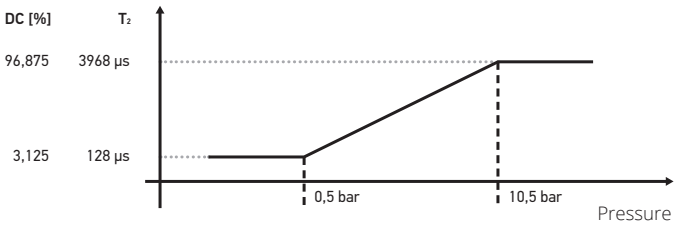
96.9% of the PWM blocking period T1 (3968 µs) corresponds to the highest point of the measuring range of 160 °C.
3.1% of the PWM blocking period T1 (128 µs) corresponds to the lowest point of the measuring range of -40 °C.



$$T_1|_{\mu s} = 19{,}2\,\frac{\mu s}{°C} \cdot \text{Temp} + 896\ \mu s$$

T_2: Pressure evaluation (T_2 Level)

96.9% of the PWM blocking period T2 (3968 µs) corresponds to the highest point of the measuring range of 10.5 bar.
3.1% of the PWM blocking period T2 (128 µs) corresponds to the lowest point of the measuring range of 0.5 bar.



$$T_2|_{\mu s} = 384\,\frac{\mu s}{bar} \cdot \text{Pressure} - 64\ \mu s$$

ECU calculation

$$\text{Temperature} = \left(\frac{4096\ \mu s}{T_{P1,\,ist}|_{\mu s}} \cdot T_1|_{\mu s} - 128\ \mu s\right) \cdot \frac{1}{19{,}2}\,\frac{°C}{\mu s} - 40°C$$

$$\text{Pressure} = \left(\frac{4096\ \mu s}{T_{P1,\,ist}|_{\mu s}} \cdot T_2|_{\mu s} - 128\ \mu s\right) \cdot \frac{1}{384}\,\frac{bar}{\mu s} + 0{,}5\ bar$$

$$\text{Diagnostics} = \left(\frac{1024\ \mu s}{T_{PS1,\,ist}|_{\mu s}} \cdot S_1|_{\mu s}\right)$$

PROGRAM OVERVIEW

Product picture	Description
	Oil pressure and temperature sensor

* Packaging unit