

BRIEF INFORMATION

OPS+T (oil pressure and temperature sensor)

- 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 CO₂ 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.

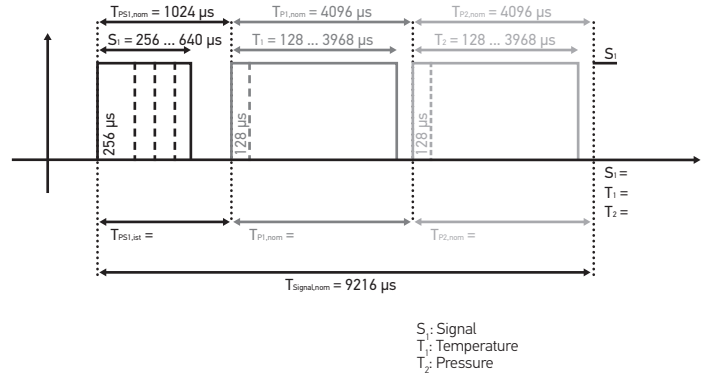
Design and function

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.

OUTPUT SIGNAL

General information for evaluating the PWM communication:

Due to the setting precision of the oscillator and its temperature dependency, the length of a PWM frame is subject to a maximum tolerance of $\pm 10\%$. Serious hardware errors in the program sequence of the ASIC cancel the PWM communication and can be detected on the control unit by a permanent high level.



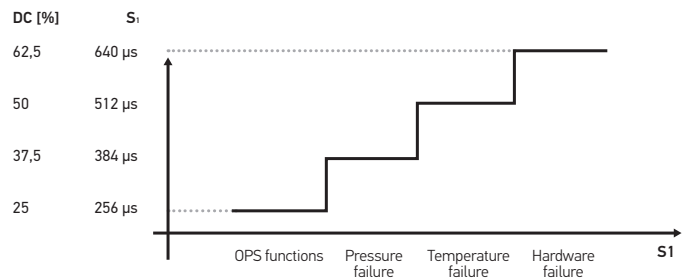
S1: Diagnosis signal

DC = 0,25 ($S_1 = 256 \mu s \pm 25 \mu s$) => OPS functional state

DC = 0,375 ($S_1 = 384 \mu s \pm 25 \mu s$) => Pressure failure

DC = 0,5 ($S_1 = 512 \mu s \pm 25 \mu s$) => Temperature failure

DC = 0,625 ($S_1 = 640 \mu s \pm 25 \mu s$) => Hardware failure

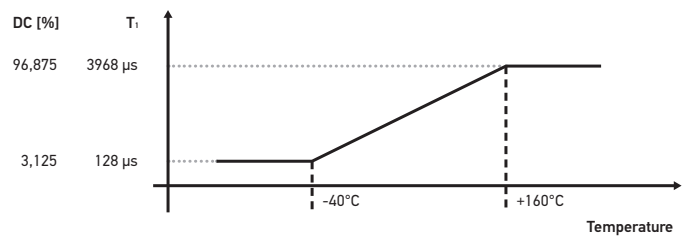


T1: Temperature evaluation

96.9% of the PWM blocking period T_1 (3968 μs) corresponds to the highest point of the measuring range of 160°C.

3.1% of the PWM blocking period T_1 (128 μs) corresponds to the lowest point of the measuring range of -40°C.

$$T_{1|\mu s} = 19,2 \frac{\mu s}{^\circ C} \cdot \text{Temp} + 896 \mu s$$

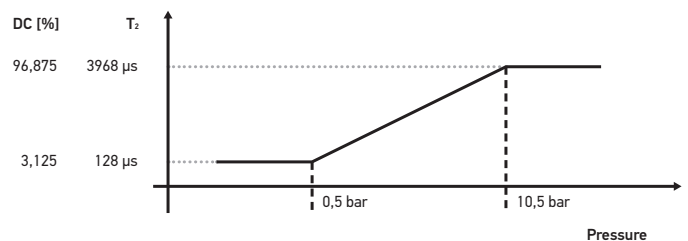


T2: Pressure evaluation (T2 Level)

96.9% of the PWM blocking period T_2 (3968 μs) corresponds to the highest point of the measuring range of 10,5 bar.

3.1% of the PWM blocking period T_2 (128 μs) corresponds to the lowest point of the measuring range of 0,5 bar.

$$T_{2|\mu s} = 384 \frac{\mu s}{\text{bar}} \cdot \text{Pressure} - 64 \mu s$$



ECU calculation

$$\text{Temperature} = \left(\frac{4096 \mu s}{T_{P1,est|\mu s}} \cdot T_{1|\mu s} - 128 \mu s \right) \cdot \frac{1}{19,2} \frac{^\circ C}{\mu s} - 40^\circ C$$

$$\text{Pressure} = \left(\frac{4096 \mu s}{T_{P2,est|\mu s}} \cdot T_{2|\mu s} - 128 \mu s \right) \cdot \frac{1}{384} \frac{\text{bar}}{\mu s} + 0,5 \text{ bar}$$

$$\text{Diagnostics} = \left(\frac{1024 \mu s}{T_{PS1,est|\mu s}} \cdot S_{1|\mu s} \right)$$

TECHNICAL DETAILS

Technical specifications

Temperature range	-40°C to 150°C
Max. temperature	160°C (max. 100 h)
Supply voltage	4.75 to 5.25 V
Output signal	PWM
Response time	2 ms
Sampling frequency	< 3 kHz
Max. operating pressure	40 bar
Overpressure	60 bar
Pressure measurement range	0.5 to 10.5 bar
Temperature measuring range	-40°C to 160°C
Protection class	IP 69K

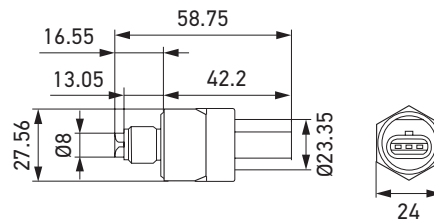
Tolerance band for pressure measurement

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

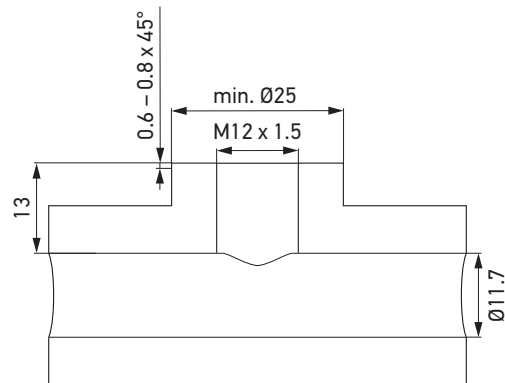
Tolerance band for temperature measurement

Temperature	Accuracy
135–160°C	+/- 1 K
20–135°C	+/- 2 K
-40–20°C	+/- 3 K

Technical drawing

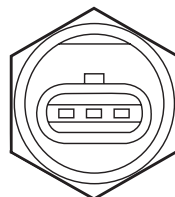


Installation space




Pin assignment

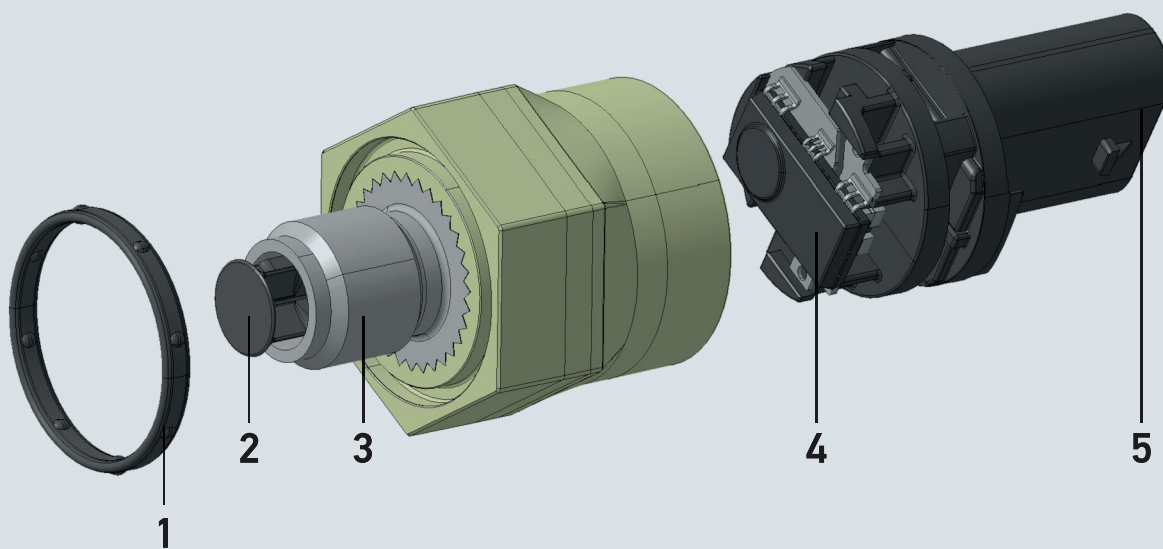
Pin 1	Supply
Pin 2	Ground
Pin 3	Output



RANGE OVERVIEW

Product image	Part number	Description	Packaging unit
	6PR 010 378-207	Oil pressure and temperature sensor	120 pieces

STRUCTURE



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