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OMS-300 Series Integrated Oil Online Monitoring Sensor

(By-pass Type) V 2.0.1

High-Speed, Precise, Robust

The OMS-300 Series Integrated Oil Online Monitoring Sensor integrates multiple detection probes for wear debris (ferromagnetic and non-ferromagnetic), kinematic viscosity, density, trace moisture, water activity (relative saturation), dielectric constant, water content, and temperature, thereby accomplishing an integrated detection of the oil's wear condition and physicochemical properties.

The device is compact and robust, making it highly suitable for oil condition monitoring in gearboxes and other heavy-duty industrial equipment. It is a reliable product for predictive maintenance and advanced manufacturing.

The OMS-300 is equipped with an industry-leading high-precision and high-stability wear debris detection module. This module employs an advanced multi-coil magnetic field disturbance detection principle, combined with a high-performance data sampling and processing unit, to achieve real-time capture and cumulative output of ferromagnetic particles ≥40μm and non-ferromagnetic particles ≥150μm.

The OMS-300 also features built-in internal temperature measurement and oil flow velocity measurement, enabling self-diagnosis of the sensor's operating environment and judgment of oil circuit flow. This ensures the sensor always operates in an optimal detection state and guarantees the representativeness of the oil sample being monitored.

The introduction of the OMS-300 enables real-time monitoring of the wear condition of large industrial equipment. By continuously monitoring the generation of wear debris and the oil's physicochemical indicators, it can alert users to perform maintenance at the earliest stages of equipment failure. Compared to traditional maintenance schedules, this allows for lower-cost maintenance measures and helps prevent larger, more serious accidents.

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Key Features

- Detection capability for 40μm Ferromagnetic & 150μm Non-ferromagnetic wear debris.
- Wear debris count statistics and material analysis.
- Detection of multiple physicochemical indicators including viscosity, density, and trace moisture.
- Flow velocity estimation to ensure the representativeness of the measurement.
- Early detection of abnormal wear to protect valuable assets.
- Measurement is immune to interference from external metals and magnetic fields.
- Measurement is unaffected by bubbles and moisture in the oil.
- Fast response, with adjustable data accumulation cycles.
- Excellent chemical corrosion resistance and pressure tolerance.
- No moving parts or consumables, designed for a 10-year lifespan.
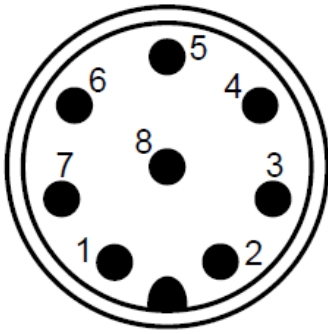- 2.5 kV isolated RS485 Modbus communication.

Applications

The OMS-300 can be widely applied in lubricating oil and hydraulic oil monitoring for industries such as wind power, thermal power, hydropower, railways, shipping, mining, metallurgy, and various industrial manufacturing sectors.

Technical Parameters

Ferromagnetic & Non-ferromagnetic Particles, Kinematic Viscosity, Density, Trace Moisture, Water Activity, Temperature, Flow Velocity Optional: Dielectric Constant, Free Water Ferromagnetic & Non-ferromagnetic Wear Debris Detection		
Detection Capability	Ferromagnetic Particles (Fe)	> 40 μm (ESD), Five Bands
	Non-ferromagnetic Particles (NFe)	> 150 μm (ESD), Five Bands
Particle Passage Diameter	Φ 8 mm	
Detection Rate	> 90%	
Ferromagnetic Statistics	40~99μm, 100~199μm, 200~299μm, 300~399μm, ≥ 400μm	
Non-ferromagnetic Statistics	150~199μm, 200~299μm, 300~399μm, 400~499μm, ≥ 500μm	
Statistics Cycle	Startup self-test 30 seconds (first time), counting interval 300~3600 seconds adjustable	
Particle Count	Max 100 particles/second	
Oil Property Detection		

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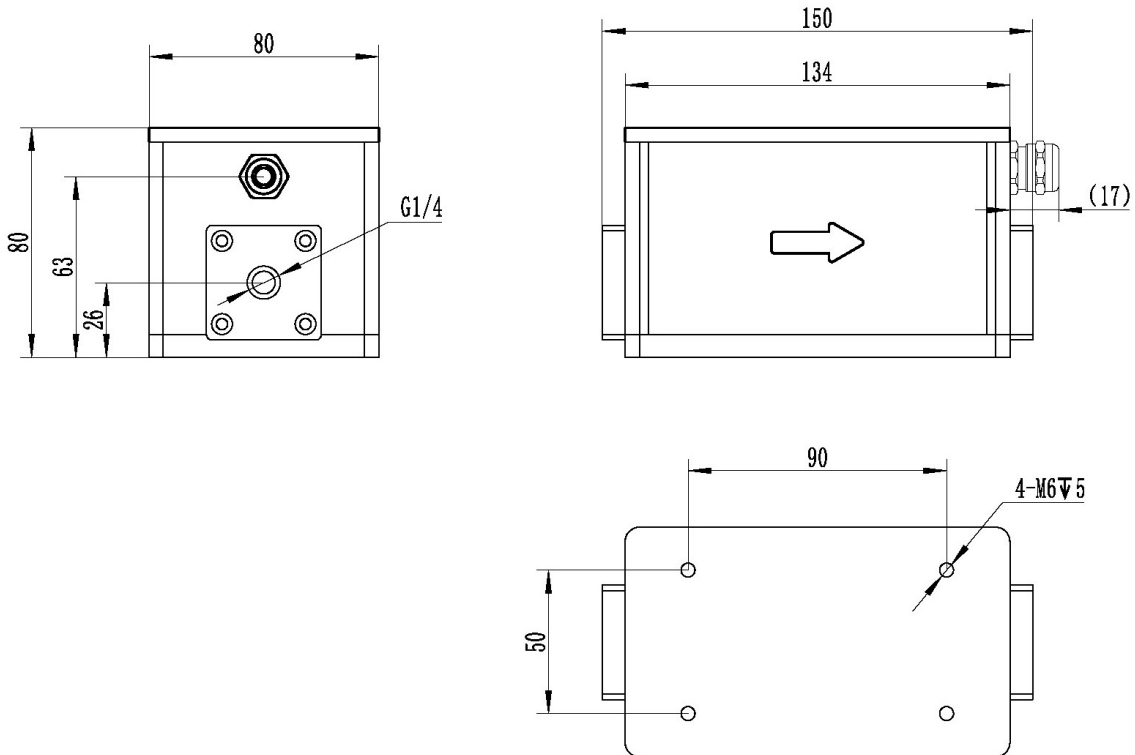|	
Viscosity Detection	Range: 1…1000cSt (larger ranges available upon request)
	Accuracy: 5% or 5cSt, whichever is greater
	Resolution: 0.1cSt
Density Detection	Range: 600…1250 kg·m⁻³
	Accuracy: 2% or 5 kg·m⁻³, whichever is greater
	Resolution: 0.1 kg·m⁻³
Trace Moisture	Range: 1…5000ppm (calibrated based on oil type)
	Accuracy: 10% or 10ppm
	Resolution: 1ppm
Water Activity	Range: 0…1aw
	Accuracy: 3%
	Resolution: 0.001aw
Temperature	Range: -40…85℃
	Accuracy: 0.5℃
	Resolution: 0.1℃
Dielectric Constant (Optional)	Range: 1…6εr
	Accuracy: 0.2εr
	Resolution: 0.1εr
Free Water (Optional)	Range: 0-20%
	Accuracy: 0.5%
	Resolution: 0.1%
Other Parameters	
Permissible Flow Rate	0.3…9L/min
Equivalent Inner Diameter	Φ8 mm (customizable)
Digital Output	RS485 MODBUS RTU, isolation voltage 2.5kV
Operating Power	DC9~30V, Max 5W
Permissible Oil Pressure	Max 1.0MPa
Applicable Fluids	Lubricating oils and hydraulic oils (synthetic and mineral-based), etc.
Fluid Temperature	-40 … 80 ℃
Ambient Temperature	-40 … 85 ℃
Storage Temperature	-50 … 120 ℃
Housing Material	Stainless Steel, Anodized Aluminum, Polycarbonate
Dimensions	150 × 80 × 80 mm (L × W × H)
Oil Port Interface	G1/4" (customizable)
Weight	< 4 kg
Protection Rating	IP66
Connection Cable	Standard: 2-meter 5-core cable, M12*1.5 straight connector, or optional M12 waterproof gland
Electromagnetic Compatibility	EN61000, EN61326-1, EN61326-2, EN61326-4
Explosion-Proof Rating (Optional)	Ex ib IIC T6 Gb

Pin Definition (M12 Female Flange Socket)

Pin	Cable Color	Definition
8)	Red	V+
5)	Gray	V-
1)	Yellow	RS485 + / A
3)	Green	RS485 - / B

Note: If an M12 gland is used, wiring must be done by opening the cover according to the markings in the user manual.

Dimensions (mm)

Important Notes

◆ The sensor should be installed in series within the circulation oil circuit, and the oil flow direction must be consistent with the arrow direction on the sensor body.

◆ It is recommended to install the sensor at a relatively low position in the entire oil circulation loop to ensure the detection unit is fully immersed in the oil.

Measurement Principles

Metal Wear Debris Measurement:

The OMS-300 incorporates multiple sets of high-performance coils operating in resonance. When metal particles pass through the tubing, they disturb the magnetic field of the coil array. This disturbance signal is captured and processed in real-time through a high-sensitivity sampling unit, a band-pass filter unit, a phase and amplitude comparison unit, a signal amplification unit, a low-pass filter unit, and a signal extraction unit, culminating in the statistical reporting of the metal particles. The OMS-300 achieves a detection capability for

40μm ferrous particles (Fe) and 150μm non-ferrous particles (NFe).

Viscosity and Density Measurement:

This method uses piezoelectric excitation in a vibration mode. Energy compensation is used to maintain a stainless-steel sensing element in a constant state of resonance. As the oil's viscosity and density change, the feedback vibration signal (parameters such as frequency and quality factor) from the element is captured by a signal acquisition circuit. The relevant parameters are then calculated and output using built-in calibration coefficients.

The vibration period (T) is related to the liquid density (ρ):

$$\rho = K_0 + K_1 * T + K_2 * T^2 \text{ (where } K_0, K_1, K_2 \text{ are calibration parameters)}$$

The vibration quality factor (Q) is related to the viscosity (η):
$$\eta = C_0 + C_1 * Q + C_2 * Q^2 \text{ (where } C_0, C_1, C_2 \text{ are calibration parameters)}$$

Viscosity and density detection and calibration are performed in the laboratory using NIST-authorized standard fluids.

Trace Moisture (Dissolved Water), Water Activity (Relative Saturation), and Temperature Measurement:

A high-molecular polyimide film capacitor is used to measure water activity in the oil, paired with a Class A PT100 platinum resistor. This setup enables real-time detection of dissolved water activity in the oil. By leveraging multiple sets of oil-specific dissolution coefficients, it achieves real-time, ppm-level detection of trace moisture. This ensures the moisture level in the operating oil remains below the saturation point, providing a solid diagnostic and monitoring basis for heavy-duty equipment.

Dielectric Constant and Water Content Measurement:

The OMS-300 uses interdigitated gold electrodes, combined with a 24-bit high-resolution capacitive sampling chip, to perform real-time diagnostics on the subtle changes in the oil's electrical properties. This enables real-time detection of oil quality, dielectric constant, and water content.