



ONLINE PARTICLE COUNTER - TORONOPC™-OL2

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The ToronOPC™ -OL2 online particle counter delivers continuous, real-time monitoring of solid contamination in hydraulic, lubrication, and insulating oils. It mounts directly into a pressurized fluid line and counts particles across 16 channels without removing samples or interrupting operation. Maintenance teams, reliability engineers, and process operators use the unit to track oil cleanliness against ISO 4406 and NAS 1638 codes around the clock. The instrument reports contamination trends as they develop, so problems surface before they reach a component.

Built around a stabilized 650 nm semiconductor laser, the ToronOPC™ -OL2 detects particles from 1 µm to 100 µm using the light-blocking method. A wide pressure rating of 0.2 to 10 MPa, with an optional range to 70 MPa, lets the counter sit inline on high-pressure circuits. The aluminum-alloy enclosure carries an IP54 rating suited to workshops, plant rooms, and field installations. Operators read live data on the 3.5-inch color display or pull records through Ethernet, RS485, RS232, and 4 to 20 mA outputs.

Each unit ships ready for unattended duty, with onboard storage for more than 100,000 records and sampling intervals from 5 seconds to 24 hours. Configurable alarm thresholds trigger a relay output and buzzer when cleanliness drifts past a set limit. The ToronOPC™ -OL2 suits condition-monitoring programs that need consistent, automated data without sending bottles to a lab.

APPLICATIONS

Online Particle Counter - ToronOPC™ -OL2 Applications

The ToronOPC™ -OL2 serves industries where fluid cleanliness governs equipment uptime, safety, and service life. Its inline design suits both fixed installations and dedicated test rigs.

- Aerospace and Aviation: monitors hydraulic and fuel systems to NAS 1638 and SAE AS4059 cleanliness classes to keep flight systems within set limits
- Military and Defense: tracks contamination in vehicle, weapon, and ground-support hydraulics where downtime carries operational risk
- Electric Power Industry: checks turbine lube oil and transformer insulating oil to flag wear particles and protect rotating machinery
- Marine and Transportation: monitors steering gear, deck machinery, and propulsion hydraulics on vessels operating far from lab support
- Industrial Hydraulics: measures oil cleanliness on presses, injection-molding machines, and servo systems to extend valve and pump life
- Lubrication Systems: tracks circulating oil in gearboxes and bearings so teams can act on trends rather than fixed schedules
- Oil and Gas: monitors hydraulic power units and control fluids on drilling, pipeline, and refinery equipment in demanding conditions
- Laboratory and R&D: provides repeatable particle-count data for fluid development, filtration testing, and cleanliness-code verification



Standards

The ToronOPC™-OL2 reports contamination in the cleanliness codes recognized across the hydraulic and lubrication industries. It supports simultaneous reporting in multiple formats and is calibrated to international reference methods.

- ISO 4406 - Hydraulic fluid power, Fluids, Method for coding the level of contamination by solid particles
- ISO 11171 - Hydraulic fluid power, Calibration of automatic particle counters for liquids
- ISO 4402 - Hydraulic fluid power, Calibration of automatic-count instruments for particles suspended in liquids
- NAS 1638 - Cleanliness Requirements of Parts Used in Hydraulic Systems
- SAE AS4059 - Aerospace Fluid Power, Cleanliness Classification for Hydraulic Fluids

FEATURES

Online Particle Counter - ToronOPC™-OL2 Key Features

The ToronOPC™-OL2 combines automated sampling, multi-standard reporting, and broad connectivity in a compact inline package.

- Continuous Automatic Detection: runs unattended with sampling intervals from 5 seconds to 24 hours, building a constant cleanliness record without manual sampling
- 16 Simultaneous Size Channels: resolves contamination across the full 1 µm to 100 µm range in a single pass for detailed particle distribution
- Wide Inline Pressure Range: handles 0.2 to 10 MPa as standard and up to 70 MPa optionally, so the counter mounts directly on high-pressure circuits
- Multi-Standard Reporting: outputs ISO 4406, NAS 1638, SAE AS4059, and ISO 11171 codes at once, matching whatever format a site or customer requires

- Built-In Calibration Wizard: walks operators through ISO 4402 and ISO 11171 calibration to keep readings traceable and consistent
- Real-Time Flow Compensation: monitors flow rate continuously and corrects the sample volume automatically to protect count accuracy
- Configurable Alarm Thresholds: trigger a relay output and buzzer when cleanliness crosses a set limit, prompting action before damage occurs
- Broad Industrial Connectivity: links to DCS, PLC, and SCADA systems through Ethernet, RS485 Modbus RTU, RS232, and isolated 4 to 20 mA outputs
- Remote Monitoring and OTA Updates: connect over Ethernet with MQTT and Modbus TCP for off-site data access and firmware updates
- Optional Bluetooth 5.0 Logging: streams readings to an Android or iOS app for wireless data capture on the move
- Optional Water-Activity Sensor: measures oil water activity (Aw) alongside particle counts for a fuller picture of fluid health
- High-Capacity Onboard Storage: keeps more than 100,000 records in flash memory, with USB export to FAT32 drives up to 128 GB
- Rugged IP54 Enclosure: protects the electronics in an aluminum-alloy housing rated against dust and splash in plant and field settings
- Low Power Draw: runs on DC 9 V or 12 to 36 V at under 8 W, simplifying integration into existing control cabinets

THEORY & METHOD

Theory and Method

The ToronOPC™-OL2 works on the light-blocking principle, also called light extinction, defined in ISO 11500. Oil flows through a narrow optical cell while a collimated laser beam crosses the flow path and strikes a photodetector. When a particle passes through the beam, it blocks part of the light, and the detector registers a momentary drop in signal. The size

of that drop scales with the projected area of the particle, so larger particles cast deeper shadows.

Electronics convert each light-blocking event into a pulse and sort it by amplitude into one of the size channels. Counting the pulses in each channel over a known sample volume gives the particle concentration at each size, which the firmware translates into ISO 4406 or NAS 1638 cleanliness codes. The 650 nm semiconductor laser holds a stable output, so pulse height stays tied to particle size rather than to source drift.

Accurate counts depend on a known flow through the sensor, so the ToronOPC™-OL2 measures flow in real time and compensates the reported volume automatically. Calibration to ISO 11171 fixes the relationship between pulse amplitude and the (c) particle sizes, using NIST-traceable test dust as the reference. A built-in calibration wizard guides the operator through this step and keeps results comparable across instruments and over time.

TECHNICAL SPECIFICATIONS

Online Particle Counter - ToronOPC™-OL2 Technical Specifications

Parameter	Specification
Detection Principle	Light-blocking (extinction) method per ISO 11500
Light Source	Semiconductor laser, 650 nm, stabilized
Particle Size Range	1 µm to 100 µm (sensor-dependent)

Sensitivity	1 μm ; 4 $\mu\text{m(c)}$ per ISO 11171
Detection Channels	16 simultaneous channels
Counting Volume	10 mL per sample
Counting Accuracy	± 0.5 contamination level
Flow Rate Range	10 to 100 mL/min, real-time monitoring
Online Test Pressure	0.2 to 10 MPa standard; up to 70 MPa optional
Sampling Interval	5 s to 24 h
Display	3.5-inch color TFT-LCD, 320 $\times$ 480 px
Internal Storage	$\geq 100,000$ records (onboard flash)
External Storage	USB Type-A, FAT32, up to 128 GB
Power Supply	DC 9 V or DC 12 to 36 V
Power Consumption	≤ 8 W typical

Sample Temperature	0 °C to 80 °C
Operating Temperature	-20 °C to 60 °C
Storage Temperature	-40 °C to 85 °C
Enclosure	High-strength aluminum alloy, IP54

Communication and Interfaces

Interface	Description
RS485	Modbus RTU, up to 1 Mbps, multi-drop bus up to 32 nodes
RS232	Direct PC connection, DB9, configurable baud 9600 to 115200
4 to 20 mA	Isolated analog output for DCS/PLC, programmable per channel
Ethernet	RJ45, 10/100 Mbps, MQTT and Modbus TCP, remote monitoring and OTA
USB	Type-A host port, data export to FAT32 drive, firmware upgrade

Bluetooth 5.0	Optional wireless logging to Android or iOS app
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Fixed Particle Size Channels

Standard Series	Available Channels
ISO 4402 / NAS 1638 series (select up to 8)	1, 2, 5, 10, 15, 25, 50, 100 µm
ISO 11171 series (“c” calibration)	4, 4.6, 6, 10, 14, 21, 38, 70 µm(c)

Standard Packing List

Each ToronOPC™-OL2 ships as a complete kit ready for installation. The package contains the OL-2 main unit, a 24 V / 2 A power adapter, and a plastic panel-mount bracket secured with four M4 × 10 countersunk screws. Two G1/8 high-pressure test couplings serve the inlet and outlet, and a 3 m high-pressure oil hose connects the unit to the fluid line.

Data and connectivity items include a 16 GB USB flash drive preloaded with the PC software and a 1.5 m CAT5e Ethernet cable for the Ethernet interface. Documentation covers an English and Chinese bilingual instruction manual (printed, plus a PDF on the USB drive), a certificate of conformity, and a warranty card carrying a 24-month warranty. All items ship in an anti-static, foam-lined packaging box.



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