

PRODUCT OVERVIEW

MetalSCAN MS4000 ONLINE OIL DEBRIS MONITORING SYSTEM

Real-time damage detection. Anytime. Anywhere.

MetalSCAN MS4000 oil debris monitoring system detects and analyzes metallic particles generated from rotating equipment due to bearing and gear wear. Optimize equipment availability and proactively plan for required maintenance.



Requirement

The energy, industrial, marine and aerospace markets require condition monitoring that is capable of detecting bearing and gear damage at the earliest stage of progression, and provide insight into the extent of the damage and its impact on the remaining life of the equipment.

Condition monitoring provides the earliest notification of equipment degradation, minimizing damage and extending the life of critical assets.

Managing risk as an equipment operator is based upon proper planning of maintenance action, enabling the following:

- Reduction of lost revenue the equipment can be scheduled to be out of service for the shortest possible time, where the replacement parts, equipment, and maintenance crews are on site at the time of shutdown.
- Reduction of repair costs reduced equipment damage such that the extent of the repair is much less than if the equipment was operated to failure.

An additional benefit of effective risk management is the potential for improved coverage from the insurers, which is delivered in terms of reduced premiums, reduced deductibles and/or reduced depreciation.

Description

MetalSCAN MS4000 is an online debris monitoring system designed to detect the passage of metallic particles in fluid lines. The system, which can be used in any pipe flow situation, is particularly suited to equipment applications where it detects metallic debris in a lubrication oil system and provides early indication of component damage.

The MetalSCAN MS4000 system consists of the following major components:

- A non-intrusive flow-through sensor which is fitted to the fluid line to be monitored.
- An Electronic Control Unit (ECU) which processes the raw signal from the sensor and extracts information about the size and type (ferromagnetic or non-ferromagnetic) of the metallic debris detected.
- A custom low-noise sensor cable which connects the sensor to the ECU.
- A host monitoring system which displays the current equipment status, debris counts, and trends. Equipment health indicators, warnings and alarms can be displayed on existing monitoring system host or by a dedicated standalone PC.

The MetalSCAN MS4000 system is available in two basic configurations defined by the ECU option:

- 1) MS4000 Multi-Sensor System which includes from one to six sensors and sensor cables, each connected to a multi-sensor ECU.
- 2) MS4110 Single-Sensor System which includes one sensor, one sensor cable, and a singlesensor ECU.

Features and Benefits

Features

- 100% detection of ferromagnetic (Fe) and non-ferromagnetic (NFe) metal particles
- Easy to install
- Easy to interpret
- Rugged, solid-state with no moving parts
- Full function continuous Built-in-Test (BIT)
- Proven reliability in harsh machinery environments
- Proven reliability in high temperature environments
- Proven reliability in hazardous environments

Benefits

- Earliest reliable detection of component damage
- Monitor damage progression and estimate remaining life
- Avoid unplanned outages
- Avoid equipment secondary damage

Specifications

| System | MS4110 Single-Sensor | MS4000 Multi-Sensor |
|-------------------------|-------------------------|-------------------------|
| Power Requirement | 24 VDC | 24 VDC |
| Rated Current | 0.3A | 0.8A |
| Communication Interface | RS485 Modbus | RS485 Modbus |
| Cabling Distance | up to 4000 ft. / 1200 m | up to 4000 ft. / 1200 m |

MS4110 SINGLE-SENSOR SYSTEM



MS4000 MULTI-SENSOR SYSTEM



Compliance

Conforms to ASTM D7685 IEC 60529 Rating of IP66 FCC Part 15B Class A



Hazardous Area Certifications

Canada and USA Canada: Class I, Div 2, Groups C & D USA: Class I, Zone 2, Groups C & D

Europe and International IECEx: Ex ec IIB T4 Gc IP66 ATEX: CC II 3G



MS4000 Sensors

The MS4000 sensors are welded stainless steel assemblies designed to be installed directly into the fluid line with fluid flowing in either direction. The sensors are designed to operate in severe industrial and/or hazardous environments with large temperature extremes and high vibration levels. They are available in three sizes: 3/8", 3/4" and 1-1/4" nominal line diameter. The sensing element consists of three internal coils. The two outside field coils are oppositely wound and are driven by an alternating current source so that their respective magnetic fields are opposed and cancel at the centre point between the field coils. The centrally positioned sense coil measures the disturbances in the magnetic fields caused by metallic particles as they pass through the sensor. The magnitude of the disturbance measured as a voltage defines the size of the particle and the phase shift of the signal defines whether the metallic particle is ferromagnetic (Fe) or non-ferromagnetic (NFe).



Specifications

| Sensor Nominal Line Size | 3/8 inch | 3/4 inch | 1-1/4 inch |
|------------------------------|--------------------|---------------------|---------------------|
| Bore | 0.30" / 7.6 mm | 0.70" / 17.8 mm | 1.06" / 26.9 mm |
| Plumbing Connection (Female) | -6 SAE O-ring Boss | -12 SAE O-ring Boss | -20 SAE O-ring Boss |
| Minimum Ambient Temperature | -40°F / -40°C | -40°F / -40°C | -40°F/-40°C |
| Maximum Ambient Temperature | 375°F / 190°C | 375°F / 190°C | 375°F / 190°C |
| Weight | 1.5 lbs / 0.7 kg | 2.0 lbs / 0.9 kg | 5.5 lbs / 2.5 kg |
| Electrical Connector | MIL-DTL-38999 | MIL-DTL-38999 | MIL-DTL-38999 |

Minimum Detectable Particle Size

| Fe (ESD*/sphere) | 65µm / 100µm | 130µm / 200µm | 180µm / 275µm |
|--------------------------|---------------|---------------|---------------|
| NFe silver (ESD*/sphere) | 200µm / 305µm | 270µm / 415µm | 345µm / 530µm |

*The Equivalent Spherical Diameter (ESD) of an irregular-shaped object is the diameter of a sphere of equivalent volume.

Fluid Conditions

| Maximum Temperature | 375°F / 190°C | 375°F / 190°C | 375°F / 190°C |
|---------------------|---------------------------|-------------------------|------------------------|
| Maximum Pressure | 500 psi / 3500 kPa | 500 psi / 3500 kPa | 200 psi / 1400 kPa |
| Minimum Flow Rate | 0.056 USGPM 0.21 L/min | 0.50 USGPM 1.9 L/min | 2.1 USGPM 8.0 L/min |
| Maximum Flow Rate | 4.3 USGPM 16.2 L/min | 48 USGPM 180 L/min | 175 USGPM 665 L/min |









Electronic Control Unit

The Electronic Control Unit (ECU) houses the modular electronics for the MetalSCAN system and is available as either a multi-sensor unit with capacity for up to six sensors or a single-sensor unit designed for one sensor. In either case, the enclosure is designed for back side mounting on a bulkhead or plate.

The MS4000 multi-sensor ECU includes separate modules for power input, power supply, control, and sensor interface, each plugged into a backplane chassis. The chassis has a capacity for six separate sensor modules with all interconnecting cables entering through the bottom of the enclosure. The MS4110 single-sensor ECU is an integrated and compact design capable of interfacing through a bulkhead connector to a single sensor.

Communication to the host is via industry standard Modbus RS485 serial communications which supports multiple separate ECU's (single or multi) which can be linked together to a single host monitoring system communication port.

| | MS4110 Single-Sensor ECU | MS4000 Multi-Sensor ECU |
|------------------------------|--|--|
| Material & Finish | Corrosion Resistant Stainless Steel 316 L | Painted Mild Steel (Blue) |
| Material & Finish (optional) | | Corrosion Resistant Stainless Steel 316 L |
| Minimum Ambient Temperature | -40°F / -40°C | -40°F / -40°C |
| Maximum Ambient Temperature | 131°F / 55°C | 131°F / 55°C |
| Environmental Conditions | IEC 60529 Rating of IP66. Indoor or Outdoor Installations | IEC 60529 Rating of IP66. Indoor or Outdoor Installations |
| Enclosure Size | 10.2 w x 8.2 h x 2.4 d (in) - 259 w x 208 h x 61 d (mm) | 16w x 20.5h x 8.33d (in) 406w x 521h x 212d (mm) |
| Weight | 5.5 lbs / 2.5 kg | 36.0 lbs / 16.3 kg (6 sensors) |

Specifications









MS4000 Sensor Cable

MS4000 sensors are connected to the Electronic Control Unit (ECU) using the sensor cables provided as part of the MetalSCAN system. The inductive coils of the sensor assembly are designed to achieve maximum sensitivity to particles present in the flow. The cabling and connectors play a significant part in achieving the level of sensitivity necessary for the system to operate properly. The cables are factory assembled and available in the standard 20-ft. length, or in other lengths as required.

A double shield is provided on each of the four coaxial cables within the cable assembly. The coaxial cables are further shielded by a tinned copper braid covering and then mechanically contained by a high temperature silicone impregnated fibreglass sleeve. The result is an extremely robust cable connection system that provides assurance of the required detection performance and sensitivity.

Specifications

| | MS4110 Single-Sensor Cable | MS4000 Multi-Sensor Cable |
|-----------------------------|----------------------------|---------------------------|
| Sensor Cable Length | 20-ft. / 6.1 m | 20-ft. / 6.1 m |
| Connector (Sensor End) | MIL-DTL-38999 Series III | MIL-DTL-38999 Series III |
| Connector (ECU End) | MIL-DTL-38999 Series III | 4x BNC |
| Minimum Ambient Temperature | -40°F / -40°C | -40°F / -40°C |
| Maximum Ambient Temperature | 375°F / 190°C | 375°F/190°C |
| Weight | 3 lbs / 1.4 kg | 4 lbs / 1.8 kg |



MS4000 SENSOR CABLE





Sensor Brackets

The sensors can be installed in any orientation with fluid flowing in either direction. The recommended location for the sensors is directly downstream of the wear elements in the lubrication system. There must be no debris traps or filters between the sensor and the oil-wetted components being monitored.

The sensors can be supported by brackets attached to the ends of the body as shown below, or by the fluid line, provided that the fluid line is well supported. The sensor body is not designed to support mechanical loads.

Sensor bracket material: Anodized aluminum (clamps) and stainless steel (bolts and washers).

Specifications

| Sensor Bracket Dimensions | A in mm | B in mm | C in mm | D in mm | E Bolt (Hex Socket) |
|---------------------------|------------|-------------------|------------|-------------------|-------------------------------|
| 3/8 Inch Sensor | 1.88 48 | 2.25 57 | 0.63 16 | 1.75 44 | 1/4-20UNC x 3 in |
| 3/4 Inch Sensor | 2.60 66 | 2.75 70 | 0.75 19 | 2.19 56 | 1/4-20UNC x 3 in |
| 1-1/4 Inch Sensor | 3.75 95 | 4.00 102 | 1.00 25 | 3.00 76 | 3/8-16UNC x 4.5 in |



MetalSCAN Monitor Software

MetalSCAN Monitor is a PC software application that runs under Microsoft Windows designed to interface with one or more MetalSCAN systems and provides a user interface for tracking the health of the machine(s) being monitored. The software provides the capability to continuously record and display MetalSCAN data, to annunciate warnings and alarms when debris accumulation exceeds user-defined limits. MetalSCAN Monitor also features industry standard Modbus and OPC data servers to enable direct interfacing to external data acquisition or monitoring systems via standard Modbus and OPC protocols.

MetalSCAN Monitor includes several display pages, which can be selected using the dedicated pushbutton controls located on the application toolbar. The three primary pages are the Equipment Status, Counts, and Trends pages.

The Equipment Status page displays a summary of the debris accumulation measurements and operational health of the channel for the selected equipment. This page enables the operator to quickly assess the condition of the monitored equipment. The display features bar charts that compare the accumulated debris (Fe counts, Fe mass or NFe counts) against set limits.

The Equipment Status page also provides the capability to visibly annunciate alarm, warning and system conditions. Whenever MetalSCAN Monitor detects a new alarm or warning condition, it automatically changes the display page to annunciate the system or equipment health condition by displaying a colored contour around the affected channel.



MetalSCAN Monitor Software (continued)

The Counts page provides high resolution current information of the accumulated debris including ferromagnetic (Fe) and non-ferromagnetic (NFe) count totals, categorized by size and by type, either Fe or NFe. It also provides a graphical display of size distribution by counts or mass, for any selected sensor.



The Trends page displays the time history of debris accumulation data along with the user-defined warning or alarm limits for the selected parameter, allowing the user to assess the current severity of the equipment condition, to review the time history, and to estimate the remaining operating life of the equipment.

MetalSCAN Monitor Software is available preconfigured on a standard desktop PC, laptop or a high reliability industrial PC. An existing PC can also be used providing it meets the following minimal platform requirements:



- 2.0 GHz processor speed
- 4.0 GB RAM
- 60 GB available disk space
- CD-R drive (required for installation from disk media)
- 1152 x 864 minimum screen resolution
- One available USB port for RS485 communications, or an RS485 port
- Peripherals pointing device and keyboard
- Microsoft Windows 7, 8.1 or 10, 64-bit operating systems
- Microsoft Windows .NET Framework

An optional analog and relay kit connected to non-digital control systems such as external warning lights and alarm signals, is available to annunciate warnings when debris accumulation exceeds user-defined limits.

Ordering Information

To place an order or request a quote, email us at sales@gastops.com or call +1 613 744 3530.

| Product | Order Code |
|--|---------------------|
| One-Sensor MS4110 System (Single) Includes 24 VDC Single-Sensor Electronic Control Unit, 1 x 3/4" MetalSCAN sensor, 1 x 20-ft. sensor cable, USB/RS485 converter, MetalSCAN Monitor Software, user's manual. | Order: MS4110 |
| One-Sensor MS4000 System (Multi) Includes 24 VDC Multi-Sensor Electronic Control Unit, 1 x 3/4" MetalSCAN sensor, 1 x 20-ft. sensor cable, USB/RS485 converter, MetalSCAN Monitor Software, user's manual. | Order: System - 01M |
| Two-Sensor MS4000 System Includes 24 VDC Multi-Sensor Electronic Control Unit, 2 x 3/4" MetalSCAN sensors, 2 x 20-ft. sensor cables, USB/RS485 converter, MetalSCAN Monitor Software, user's manual. | Order: System - 02M |
| Three-Sensor MS4000 System Includes 24 VDC Multi-Sensor Electronic Control Unit, 3 x 3/4" MetalSCAN sensors, 3 x 20-ft. sensor cables, USB/RS485 converter, MetalSCAN Monitor Software, user's manual. | Order: System - 03M |
| Four-Sensor MS4000 System Includes 24 VDC Multi-Sensor Electronic Control Unit, 4 x 3/4" MetalSCAN sensors, 4 x 20-ft. sensor cables, USB/RS485 converter, MetalSCAN Monitor Software, user's manual. | Order: System - 04M |
| Five-Sensor MS4000 System Includes 24 VDC Multi-Sensor Electronic Control Unit, 5 x 3/4" MetalSCAN sensors, 5 x 20-ft. sensor cables, USB/RS485 converter, MetalSCAN Monitor Software, user's manual. | Order: System - 05M |
| Six-Sensor MS4000 System Includes 24 VDC Multi-Sensor Electronic Control Unit, 6 x 3/4" MetalSCAN sensors, 6 x 20-ft. sensor cables, USB/RS485 converter, MetalSCAN Monitor Software, user's manual. | Order: System - 06M |

Options

| Product | Order Code |
|---|---|
| MS4000 Sensor - 3/8" Substitute 3/8" sensor (per sensor). | Order: Option - 13 |
| MS4000 Sensor - 1-1/4" Substitute 1-1/4" sensor (per sensor). | Order: Option - 05 |
| Power/COM Cable 20-ft. 20-ft. power communication cable for single-sensor ECU. | Order: Option - 20 |
| Power/COM Cable 40-ft. 40-ft. power communication cable for single-sensor ECU. | Order: Option - 21 |
| Power/COM Cable 60-ft. Substitute 60-ft. power communication cable for single-sensor ECU. | Order: Option - 22 |
| MS4000 Multi-Sensor Stainless Steel Enclosure Substitute corrosion-resistant stainless steel 316L ECU. | Order: Option - 07 |
| Computer with pre-configured MetalSCAN Monitor Software | Order: Option - 01Ax (Tower or laptop computer) Order: Option - 01Bx (Industrial Din rail mount computer) |
| MS4000 Analog and Relay Interface Module Note: Option - 20x only available when ordered with Option - 19x, maximum of 2x expansion modules. | Order: Option - 19x (4 analog outputs & 4 relay outputs) Order: Option - 20x (additional 4 analog outputs) |

About Gastops

Gastops is the world's leading provider of intelligent condition monitoring solutions used in Aerospace, Defence, Energy, and Industrial applications to optimize the availability, performance, and safety of critical assets. We offer peace of mind to our customers with innovative online monitoring sensors, at-line analysis, complex modeling and simulation, world class laboratory testing, engineering, design, and MRO services that predict performance to enable proactive operating decisions. Gastops has been providing powerful insights into the condition of critical equipment since 1979.



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