

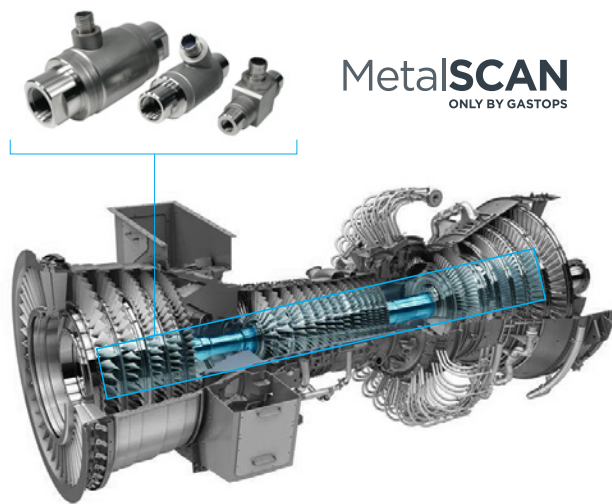


APPLICATION GUIDE

# **MetalSCAN MS4000 SERIES FOR GE LM1600 GAS TURBINES**

# Real-time damage detection. Anytime. Anywhere.

MetalSCAN enables gas turbine operators to maximize equipment availability by providing the industry's earliest advance warning of potential damage events.



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## Overview

Designed for the GE LM1600 gas turbine engine, the MetalSCAN online oil debris system easily installs into the Gas Generator (GG) and Power Turbine (PT) oil scavenge lines.

MetalSCAN is a full flow, nonobstructive, online debris detection system designed to detect the onset of surface fatigue of bearings and gears. It is used as a condition monitoring device to determine the condition of the gas generator, accessory gearbox and Power Turbine (if fitted).

MetalSCAN oil debris monitoring system is available in two variants, either as an MS4000 Multi-Sensor system installed upstream of the scavenge pump in the individual oil scavenge lines; or as an MS4110 Single-Sensor system installed into a common line before the filter, downstream of the scavenge pump.

The engine and accessories are monitored continuously, allowing for early detection and tracking of the progressive deterioration of any damaged bearings or gears in real time.

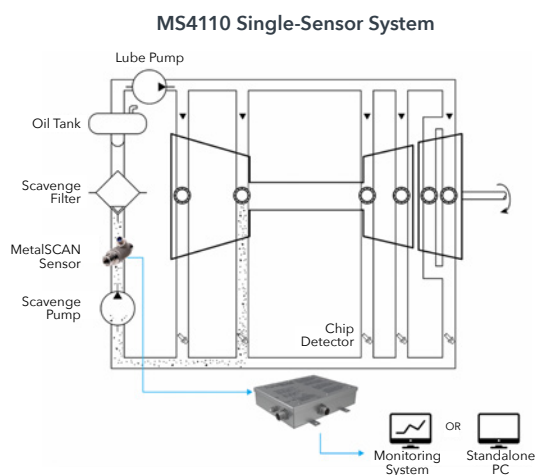
The sensors are installed in the lubrication oil lines with standard flanges and fittings adapted to the turbine configuration. Users can select either the simpler MS4110 Single-Sensor or the full MS4000 Multi-Sensor solution for enhanced coverage.

Several convenient data communication options are available to suit specific needs including direct connection to the engine controller, an existing Host Monitoring System, or by a fully standalone PC connection.

## Physical Installation

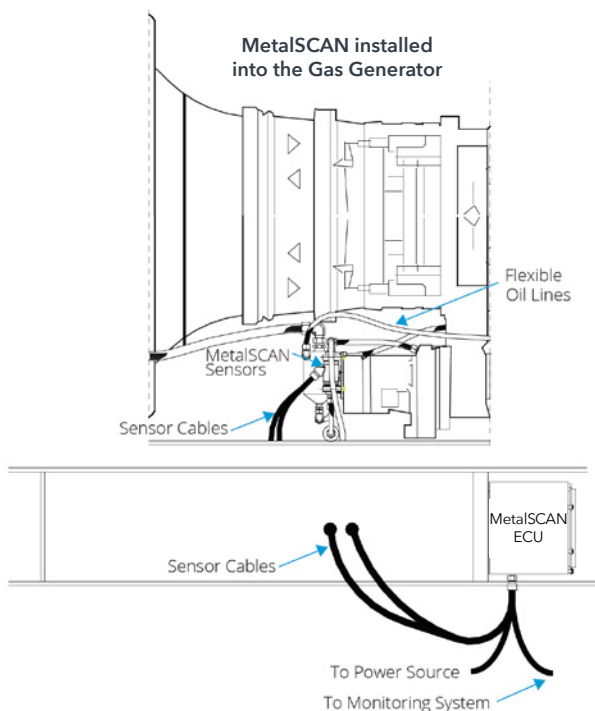
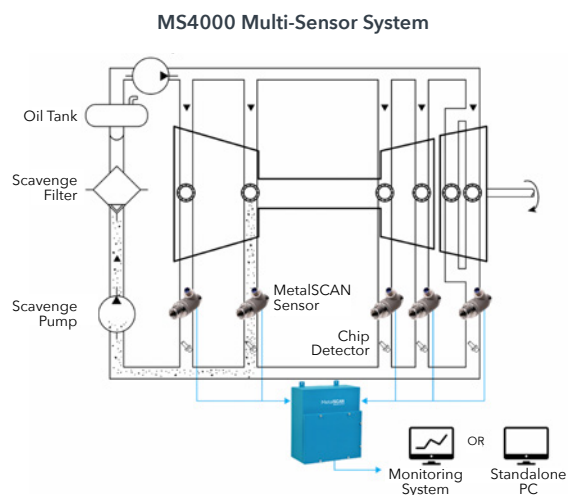
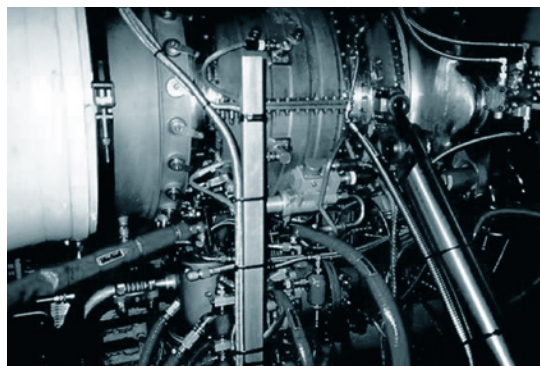
### MS4110 Single-Sensor System

A single MetalSCAN sensor is plumbed downstream of the oil scavenge pump combining the lines from the A-Sump, B-Sump, C-Sump, Accessory Gearbox and the Power Turbine (D-Sump), if fitted. The sensor is mounted using a standard mounting bracket to the engine enclosure and connects to the MetalSCAN Electronic Control Unit (ECU) mounted to the outside of the engine enclosure via a 20-ft. sensor cable.



### MS4000 Multi-Sensor System

A total of three MetalSCAN sensors are plumbed into separate oil scavenge lines; two on the Gas Generator (GG) and one on the Power Turbine, if fitted. The GG has one sensor placed on the C-sump to monitor the #4 bearing, and the other is installed on the common scavenge discharge to monitor all sumps. The third, on the Power Turbine, is placed on the common scavenge discharge. Each sensor is mounted on a stand which is secured inside the engine enclosure. They connect individually to the MetalSCAN ECU mounted to the outside of the engine enclosure via 20-ft. sensor cables.





## Physical Installation

The ECU is connected via RS485 Modbus protocol serial communication to a host PC computer or directly to the facility control system.

The entire installation of the MetalSCAN system can typically be completed in less than two days with Field Service Support for installation supervision and commissioning available from Gastops. The installation hardware, warning and alarm settings are included with the installation kit options and are available for the LM1600 turbine.

**Proven and adapted solutions  
for the LM1600 turbine,  
MetalSCAN oil debris sensors  
install easily into the Gas  
Generator and Power  
Turbine lubrication lines.**



Option 1  
Direct  
Integration



Controller

OR



Monitoring System

Option 2  
Gastops  
Integration



> MetalSCAN Monitor  
> Connect Monitoring Services

## MetalSCAN Selection Guide

Guideline		Multi-Sensor	Single-Sensor	Benefit Summary
Data	Individual sump debris detection	★★★	☆☆☆	Allows for individual sump isolation
	Earliest indication	★★★	★★★	Damage particles reach sensor immediately
	Trending & limits	★★★	★★☆	Trend to sump alarm or combined alarm
	Remote monitoring	★★★	★★☆	Less local involvement
Actions	Active load adjustment	★★★	★★☆	Load reduction to augment RUL trend projection
	Troubleshooting	★★★	★★☆	Early detection enhances advanced troubleshooting
	Proactive planning	★★★	★★☆	Early detection and trending supports planning
	Peaker operation	★★☆	★★★	Opportunity for a more affordable and easy retrofit
ROI	Savings delivered	★★★	★★☆	User feedback: \$100k to \$1M+ per detection event
	Repair benefits	★★★	★★☆	Damage has been isolated early and did not spread
	Cost	\$\$\$	\$	Installation < 1 day (single) vs 2 days (multi)

☆☆☆ N/A

★★☆ Base solution

★★★ Good solution

★★★★ Optimal solution

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## Condition Monitoring

Once installed, the sensors detect the presence of metallic particles to provide early detection, identify severity, and provide remaining life indication of the bearings and gears located deep within the equipment.

The MetalSCAN sensors detect metal particles above the minimum size threshold and provide particle data, equipment condition and self-diagnostic information to the engine controller, an existing Host Monitoring System, or via an optional standalone PC.

The information collected by each sensor is compared to pre-established machinery condition indicators. These condition indicators are based upon simple criteria which determine whether the equipment is healthy. When damage is detected, condition indicator models help determine how much damage there is and how much longer the equipment can be operated before a potential failure. All analysis is performed locally to the ECU and subsequently transmitted to a host monitoring system.

Increased insight and visibility into the health of the equipment allows for proactive health assessment, enabling effective maintenance planning and empowering operators with real-time knowledge of equipment health.



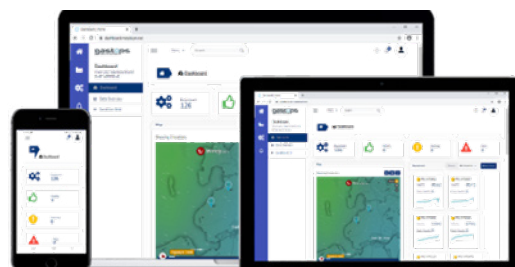
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## Software and Services

When connected through the local RS-485 network, MetalSCAN can be interfaced to a MetalSCAN Monitor, a completely client-hosted stand-alone software platform that enables operators to host, monitor and analyse the data locally. MetalSCAN Monitor is a user-friendly software that lends itself to operators with all levels of experience and is designed for monitoring all types of gas turbines and fleet sizes. MetalSCAN Monitor also allows operators to interface to external data acquisition or monitoring systems.

MetalSCAN Monitor can be connected to Gastops Connect Monitoring Services Web-portal, enabling a complete Condition Assessment and Analytics Monitoring Service. The portal provides users with detailed health indicators for each asset, a customisable watchlist for the entire fleet and fully customizable warning, alarm and event notifications. Data is posted on the portal near real-time and allows for customized reporting and cross comparisons of assets by type, location, or any other key characteristic. Operators can also import data and reports in several supported formats or interface to 3<sup>rd</sup> party systems via a Rest API.

Users can easily subscribe and renew their MetalSCAN Support Service Package which includes monitoring by the Gastops analytics team along with monthly reporting on key health indicators for each turbine, as well as observations and recommendations for the entire fleet.



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## Ordering Information

### MetalSCAN System and Installation Kit Order Codes

To place an order or request a quote, email us at [sales@gastops.com](mailto:sales@gastops.com) or call **+1 613 744 3530**.

Turbine Type Order Code	MetalSCAN System	Installation Kit Order Code
LM1600 GG	MS4000 System - 02M	Contact Gastops
LM1600 GG w/ PT	MS4000 System - 03M	Contact Gastops

### Options and Accessories

To help you integrate the MetalSCAN MS4000 or MS4110 System into your equipment, we offer options and accessories such as computers, ATEX barrier kits, junction boxes, stainless steel enclosures, as well as software and remote services.

Product	Order Code
MetalSCAN Computer (PC or Laptop)	Option - 01A
MetalSCAN Industrial Computer (CPU only)	Option - 01B
Field Support Services for Installation	Option - 03
MS4000 Stainless Steel Enclosure	Option - 07
MetalSCAN Performance Test Kit	Option - 11
MetalSCAN Support Service Package	Option - 12
ATEX Barrier Kit	Option - 17
MS4110 Junction Box	Option - 21
MetalSCAN Monitor Software	Option - 22



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