



Maintenance+

Standalone Asset Performance Management (APM)

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If you're looking for ways to reduce downtime and enhance the performance of operations and assets, GE Power Conversion's simple suite of clever software applications can help. Its flexibility includes 'on-prem' and cloud-based options which help to optimize operations and energy, and enable predictive maintenance and cyber-secure service solutions. GE Power Conversion's digital suite is based on a straightforward, modular range of digital apps, tools and services, connecting data with the right people. Already, more than 500 sites are benefiting from Power Conversion's digital solutions. Each of our three easy-to-navigate modules focuses on a key area of improvement: Operations+, Maintenance+ and Services+ tools and app.

Maintenance+ is your Asset Performance Management range of tools, protecting your investment in valuable equipment by helping to improve its availability. It provides a view on the health of your critical assets with early warnings of developing issues to help you take timely, corrective actions. This can unlock a shift from unplanned to planned downtime, or even contribute to avoidance of downtime altogether.

Asset Performance Management (APM) transforms equipment maintenance with unique analytical techniques and support. GE's Maintenance+ APM tools evaluate asset health by analyzing data from key systems, like rotating electrical machines and power electronics, using KPI analysis and Electrical Signature Analysis (ESA). Our tools assess asset health and monitor for performance degradation, providing an early warning system and helping you to reduce unplanned downtime.

Maintenance+ APM for Rotating Machines using the standalone APM is a on-prem analytic solution that analyzes high frequency data and Key Performance Indicators (KPIs) with predefined algorithms to provide early warning information of potential failures and help reduce unplanned downtime.

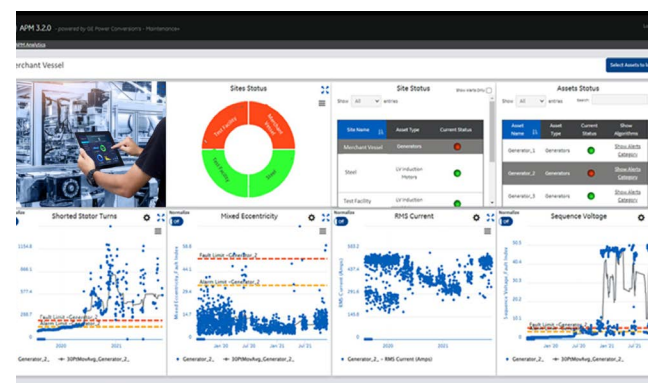
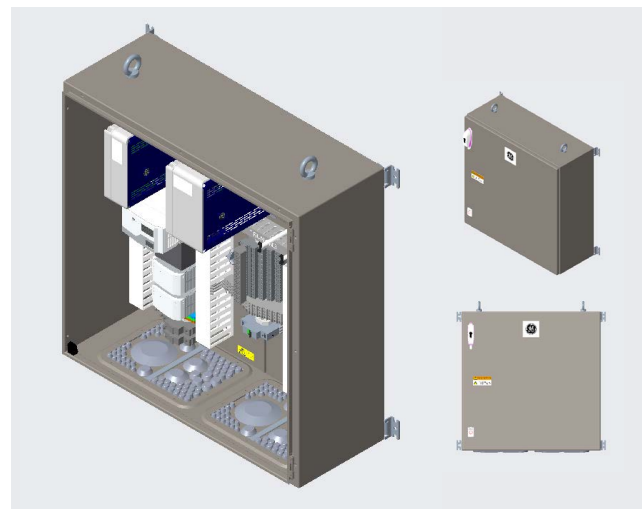
USE CASE: Many organizations already benefit from our **Maintenance+ APM for Rotating Machines** and Drives solutions, which collect indepth data when applied to drives manufactured by GE as well as rotating machines manufactured by GE or third parties. With extensive expertise in variable frequency drives and more than 100 years of experience engineering motors, generators and control equipment, our specialists put their software, data and domain expertise to work. We can provide early warning information of potential failures—with input from high-frequency sampling, Electrical Signature Analysis (ESA) and Machine Learning (ML)—to help you shift from unplanned to planned maintenance, thereby enabling reduced downtime.

Supporting Maintenance Management and Reducing Unplanned Downtime

GE's **APM for Rotating Machines** specifically targets rotating machine assets including medium voltage (MV), low voltage (LV) generators and motors that are either fixed speed or variable speed converter fed. **APM for Rotating Machines** can provide particular benefit where the failure of any one of these machines or their associated equipment can cause unplanned downtime, loss of production, loss of product quality or a combination of all three.

Our **APM for Rotating Machines** solution uses Electrical Signature Analysis (ESA), coupled with advanced algorithms and machine learning (ML) to provide a wide range of failure mode detection versus conventional vibration and temperature monitoring.

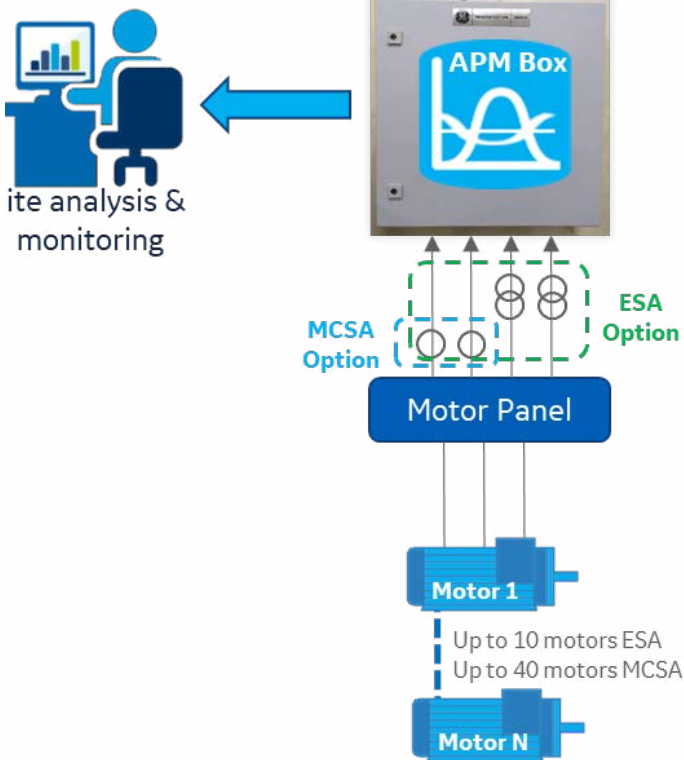
Applying Electrical Signature Analytics (ESA) can help to increase the range of potential failures that can be predicted well before they actually happen.



Maintenance+ APM - Overview Dashboard

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Solution Implementation



Analytics

Fault Category/Trend	Fault Type	ESA	MCSA
BEARING FAULTS (BALL / ROLLER BEARINGS)	Outer Race Defect	✓	✓
	Inner Race Defect	✓	✓
	Ball Defect	✓	✓
STATOR FAULTS	Shorted Stator Turns	✓	✓
ROTOR FAULTS	Broken Rotor Bars	✓	✓
MECHANICAL FAULTS	Mixed eccentricity (applicable when number of poles in motor/generator >2)	✓	✓
	Coupled Wind Gear Box issues	✓	
	Mechanical issues - through generic FFT (e.g. Coupling/Bearing/Vibration)	✓	✓
ELECTRICAL SUPPLY-FAULTS*	Negative Sequence Current	✓	
	Negative Sequence Voltage	✓	
ELECTRICAL SUPPLY - KPI TRENDS*	Voltage THD	✓	
	Current THD	✓	✓
	KPI-frequency, Estimated speed, Current RMS, Active power, Reactive power, Total power, pf, Voltage RMS, dv/dt at the point of sampling	✓	
ANOMALY DETECTION (ML)	Asset anomaly detection with individual asset baselining	✓	✓
	Asset anomaly detection in comparison to a good asset	✓	✓

*Values at point of sampling and calculated offline - for trending purposes only
Note: Analytics are applicable to Induction and Synchronous machines.

Abbreviations:

ESA - Electrical Signature Analytics

THD - Total Harmonic Distortion

MCSA - Motor Current Signature Analysis

KPI - Key Performance Indicator

ML - Machine Learning

Customer Success Story

The solution has been implemented across various industries including steel rolling mills, cruise ships and wind farms, and APM for drives has been implemented on solar farms.

Maintenance+ APM was deployed in a steel plant to monitor 20 process motors controlled by a customer owned, non-GE variable frequency drive (VFD).

The customer saved an unplanned shutdown thanks to the **Maintenance+ APM for Rotating Machines** solution. An increasing trend of outer race defect algorithm and mixed eccentricity was observed indicating an alignment issue. The misalignment was detected in advance and corrective actions taken, thereby avoiding an unplanned outage.



Datasheet - Standalone APM

Sensor Input	RMDM4001 – 005010 [^]	RMDM4001 – 005040 [^]	RMDM4001 – 025010 [^]	RMDM4001 – 025040 [^]
Voltage Transducer1	20	0	20	0
Current Transducer1	20	40	20	40
15V DC Transducer Supply	2			
SAMPLING				
	Sampling frequency + resolution			
Voltage	5kHz @16 bit resolution	5kHz @16 bit resolution	25kHz @16 bit resolution	25kHz @16 bit resolution
Current	5kHz @16 bit resolution	5kHz @16 bit resolution	25kHz @16 bit resolution	25kHz @16 bit resolution
ELECTRICAL DATA				
Input Power Supply	120/240V, 50/60Hz			
Max Power consumption	6A			
Analytics	ESA ²	MCSA ³	ESA ²	MCSA ³
CONNECTIVITY				
Video	DP/DVI-D			
Keyboard/mouse input	USB 2.0			
ENVIRONMENTAL DATA				
Temperature	Operational: 0 - +58°C			
	Storage/Shipping: -40°C -+70°C			
Altitude	Up to 2000m			
Humidity	Operating 10 to 90% rH, non-condensing			
MECHANICAL DATA				
Ingress Protection	IP 54			
Dimensions	760 mm(H) x 760 mm(W) x 300 mm(D)			
Approx. weight	70 kg	70 kg	75 kg	75 kg
Mounting	Wall Mounted			
Access	Front access & bottom cable entry			

Notes:

¹ Input +/- 10 VDC or 4-20mA with external burden resistor

² ESA = Electrical Signature Analysis

³ MCSA = Motor Current Signature Analysis

[^] Model numbers

Conceived for Operators

GE Power Conversion's Digital Suite is built on GE's industry wide expertise in IT, OT (operating technology) and IIoT (the industrial internet of things). Above all we believe it should be intuitive, visual and customized for your operational needs. Featuring simple, clear interfaces it provides organizations of all sizes with access to GE's powerful data analytics, made accessible and usable by providing better intel and situational awareness. Genuine performance improvements are within reach, to help your organization work with increased efficiency and profitability.

To find out more:
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