



Technical & Commercial Proposal

Customer	TURBOENERGY POWER SRL
End User	TERMoeLECTRICA S.A.
Project	Achiziționarea SACVVM pentru turbogeneratorul Nr.2

Proposal Number	BUCH2320147 Rev1
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Submitted by	Emerson Process Management Romania SRL

Revision History

Rev	Description	Date	Developed By	Reviewed By
0	Achiziționarea SACVVM pentru turbogeneratorul Nr.2	15.06.2023	Angela Nastiuc	Bogdan Neagoe
1	Achiziționarea SACVVM pentru turbogeneratorul Nr.2	30.04.2024	Angela Nastiuc	Bogdan Neagoe

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1 SCOPE AND ASSUMPTIONS

1.1 Customer Referenced Documents

This proposal is based on the following documents:

Table 1: Refenced Documents

Nº.	Title
1	CAIET DE SARCINI: pentru achiziționarea sistemului automatizat de control al vibrației și valorilor mecanice (SACVVM) și lucrările de instalare a acestuia la turbogeneratorul Nr.2.

1.2 Design Basis

1.2.1 System sizing and Spares

1.2.1.1 Input / Output Count

Emerson proposal is based on the following I/O counts, mentioned in the section **6.4.4**.

Bearing vibration measuring channels (12 sets + 2 spare sets);
Measuring channels for rotor axial displacement (3 sets + 1 spare set)
Measurement channels of relative rotor expansion (2 sets + 1 spare set);
Turbine thermal expansion measurement channels (2 sets + 1 spare set);
Rotor shaft deformation measuring channels (1 set + 1 spare set);
Channels for measuring linear displacement of servomotors (3 sets + 1 spare set);
TG rotor speed measuring channels (1 set + 1 spare set);

1.2.2 System Redundancy

The proposed system is designed according to the specification requirements. The following system components are offered:

Table 2: System Redundancy

Component	Type
Relay Card	Simplex
Communication Card	Redundant
Power Supply	Redundant

1.3 Architecture and System Scope

1.3.1 Hardware Scope of the Supply:

The Machine Monitoring System consists of:

1.3.1.1 Machinery Health Monitoring System Hardware, Software and Licenses:

- AMS 6500 ATG protection system
- System Cabinet
- Server Cabinet
- Servers + SQL License
- AMS Machine Works 1 year Software
- Sensors & Spare parts
- Calibration stands

1.3.1.2 Field Enclosures Summary

The system and marshalling cabinets for installing MMS equipment are included. Following are the type of cabinets offered in this project.

Table 3: Cabinets and Field Enclosures Summary

Cabinet Description	Qty	Dimension (mm WDH)	IP/Zone
System cabinet	1	600x600x2000	Safe
Server cabinet	1	600x600x2000	Safe

1.3.2 Documents to be supplied

- IO Database.
- Bill of Materials.

- c) System Architecture.
- d) Network Diagram.
- e) System Design Package, which includes:
 - a. Cabinet layout drawings.
 - b. Cabinet wiring drawings.
 - c. Full measurement loops connection drawings (including sensors, junction box terminals, cabinet terminals and AMS6500 backplane connections).
Depending on project requirements or delivered solution, the services mentioned above could be supplied into one package or in separate documents.
- f) Project Schedule.
- g) Document Control List.
- h) Project Management Plan.
- i) Quality Plan.

1.4 Bill of Materials

Table 4: Bill of Materials

Item No	Qty	Model Number	Description
System cabinet			
1	1	PN-SYSCAB1	System Cabinet, Technical Passport included
2	2	MHM-VE5126-PBF	POWER SUPPLY,100-240 VAC TO 24VDC,20A
3	1	MHM-VE5135-PBF	POWER SUPPLY REDUNDANCY MODULE,12-28V, 40A
4	1	IC758CSWA10PC-PSS	10 RXi - Panel PC Emerson, Widescreen
5	1	GXT5	GXT5 3000VA 120V UPS GXT5-3000LVRT2UXL
Server cabinet			
6	1	PN-SERCAB1	Server Cabinet,
7	3	PowerEdge R550	Servers for AMS Machine Works + SQL License
8	1	7920 Rack	Workstation Precision 7920 Rack XCTO Base
9	1	SE2820	24-inch MST LED monitor - Dell UltraSharp 24 Monitor
10	1	KB216+MS116	Dell Multimedia Keyboard+Optical Mouse
11	1	C315V_DNI	Multifunctional laser color Xerox WorkCentre
AMS 6500 ATG			
12	2	A6500-RR	AMS 6500 ATG - REDUNDANT RELAY RACK, 9UM, 2RC, 2CC SLOTS
13	14	A6500-UM	AMS 6500 ATG - UNIVERSAL MEASUREMENT CARD, SPEED, VIB, POS
14	4	A6500-RC	AMS 6500 ATG - SYSTEM RELAY CARD, 16 OUTPUT RELAYS SPDT
15	2	A6500-CC	AMS 6500 ATG-SYSTEM COMCARD, MODBUS RTU/TCP, OPC UA
16	1	A6500-PER	AMS 6500 ATG - PREDICTION EXTENSION LICENSE REDUNDANT (2 LICENSES)
17	1	MHM-6XXX-RC-CABLE	AMS 6500 ATG - RACK CONNECTION CABLE, SUB-D CON, 9-P, 1M
18	1	A6910	CONFIGURATION KIT
Software			
19	1	A43-0	AMS MACHINE WORKS SOFTWARE SUBSCRIPTION
19.01	1	A43USER-1-0	AMS MACHINE WORKS 1 USER LICENSE
19.02	1	A43TAGS-100-0	AMS MACHINE WORKS 100 TAGS LICENSE
19.03	1	A43-SYSTEM-0	AMS Machine Works Server License -Subscription
Sensors			
Vibratia lagarelor			

20	12	PR9270V-EX	VELOCITY 100MV +/-10% TOP EXIT C5015 CONN 3 TO 9000HZ IP68 CE EX
21	12	A612-AR-09-0	SENSOR CABLE C5015 2PIN PUSH ON BOOT 9M/30FT ARM 9M/30FT BLUNT
Deplasarea axiala a rotorului			
22	3	EZ1161-08-00-100	ECS 16MM, M18X1.5, 80MM, NO UTL, ARMOR, 10M, CAB
23	3	EZ1000-FCAL	EZ1000 CONVERTER, FACTORY CALIBRATED
Dilatarea relativa a rotorului			
24	2	PR6426/010-041	ECS 32MM, ARMOR, MOUNTINGPLATE, 1+9M CAB, OPEN
25	2	CON041/916-120	*SPARE* SIGNAL CONVERTER (PR6426) RANGE 12.0MM, DIN RAIL
Dilatarea termica a turbinei			
26	2	K20-315/03-S	INDUCTIVE DISP PROBE PR9350/02, 8M CABLE, ARMOR, OPEN
27	2	A6500-LC	AMS 6500 ATG - LVDT CONVERTER FOR A6500-UM, DIN-RAIL
Deformarea arborelui rotorului			
28	1	EZ1051-08-00-100	ECS 5MM, M8X1, 80MM, NO UTL, ARMOR, 10M, CAB
29	1	EZ1000-FCAL	EZ1000 CONVERTER, FACTORY CALIBRATED
Deplasarea liniara a diafragmei rotative			
30	1	PR9350/08	INDUCTIVE DISP PROBE ±100MM, HOUSING-PLUG/-SOCKET
31	1	A6500-LC	AMS 6500 ATG - LVDT CONVERTER FOR A6500-UM, DIN-RAIL
32	1	K20-315	K20315 CONNECT CABLE-PR9530/K20315/MMS3410 3M W/PLUG,ARMOR
33	2	PR9350/12	INDUCTIVE DISP PROBE ±150MM, HOUSING-PLUG/-SOCKET
34	2	A6500-LC	AMS 6500 ATG - LVDT CONVERTER FOR A6500-UM, DIN-RAIL
35	2	K20-315	K20315 CONNECT CABLE-PR9530/K20315/MMS3410 3M W/PLUG,ARMOR
Spare set			
36	4	PR9270V-EX	VELOCITY 100MV +/-10% TOP EXIT C5015 CONN 3 TO 9000HZ IP68 CE EX
37	4	A612-AR-09-0	SENSOR CABLE C5015 2PIN PUSH ON BOOT 9M/30FT ARM 9M/30FT BLUNT
38	2	EZ1161-08-00-100	ECS 16MM, M18X1.5, 80MM, NO UTL, ARMOR, 10M, CAB
39	2	EZ1000-FCAL	EZ1000 CONVERTER, FACTORY CALIBRATED
40	1	PR6426/010-041	ECS 32MM, ARMOR, MOUNTINGPLATE, 1+9M CAB, OPEN
41	1	CON041/916-120	*SPARE* SIGNAL CONVERTER (PR6426) RANGE 12.0MM, DIN RAIL
42	1	K20-315/03-S	INDUCTIVE DISP PROBE PR9350/02, 8M CABLE, ARMOR, OPEN
43	1	A6500-LC	AMS 6500 ATG - LVDT CONVERTER FOR A6500-UM, DIN-RAIL
44	1	EZ1051-08-00-100	ECS 5MM, M8X1, 80MM, NO UTL, ARMOR, 10M, CAB
45	1	EZ1000-FCAL	EZ1000 CONVERTER, FACTORY CALIBRATED
46	1	PR9350/08	INDUCTIVE DISP PROBE ±100MM, HOUSING-PLUG/-SOCKET
47	1	A6500-LC	AMS 6500 ATG - LVDT CONVERTER FOR A6500-UM, DIN-RAIL
48	1	K20-315	K20315 CONNECT CABLE-PR9530/K20315/MMS3410 3M W/PLUG,ARMOR
49	1	PR9350/12	INDUCTIVE DISP PROBE ±150MM, HOUSING-PLUG/-SOCKET
50	1	A6500-LC	AMS 6500 ATG - LVDT CONVERTER FOR A6500-UM, DIN-RAIL
51	1	K20-315	K20315 CONNECT CABLE-PR9530/K20315/MMS3410 3M W/PLUG,ARMOR
Calibration stands			

52	1	394C06	Handheld Shaker
53	1	SP-02	Displacement simulator for testing and calibration of sensors

2 TECHNICAL SOLUTION

2.1 Emerson Solutions Advantages

One of the main reasons why clients select to work with Emerson in today's very competitive market is the market leading technology and field-based intelligence seen in all Emerson product ranges. All Emerson technologies are part of Plantweb™ Optics improving communication between devices, ease of integrating and significantly reducing integration costs.

The AMS Suite: AMS MACHINE WORKS is the single place for Machinery health data coming in from the largest single source provider of machinery health solutions: online vibration monitoring and protection, portable data analyzer, Wired and wireless transmitters as well as online condition monitoring.

Access to wider analytics and machine learning packages is available via Emerson's Plantweb™ Optics portal, delivering a holistic asset health and performance view at site level or across the enterprise, interfacing with remote experts and resource planning systems.

The proposed solution uses following key technology enablers that bring significant value:

2.1.1 AMS 6500 ATG Overview

Predictive intelligence is the key to increasing availability and improving the reliability of plant assets. Emerson's AMS 6500 ATG is a stand-alone machinery protection solution that also allows users to cost effectively introduce prediction monitoring of critical assets from the same system.



With four reconfigurable cards the AMS 6500 ATG can be setup in the field for a wide range of protection measurements (including all the required TSI measurements, which include embedded prediction capabilities, such as impacting or peak-to-peak data used in Emerson's PeakVue™ methodology). Prediction data

from PeakVue technology cuts through the complexity of machinery analysis to provide a simple, reliable indication of equipment health, working through a single trend that filters out traditional vibration signals to focus exclusively on impacting. With the addition of this impact data, users can monitor the start-up and coast down of critical turbo machinery for safe operation and receive the earliest indications of developing faults in gearboxes and bearings.

With the AMS 6500 ATG protection system users benefit with prediction monitoring of critical assets from the same cards, without the additional cost of another system, and production impact is virtually non-existent. Greater flexibility of the cards will help with fewer inventory spares, as well.

The AMS 6500 ATG presents all available information about the critical machine such as main value, trending data, and status data. Part of Emerson's digital architecture,

the AMS 6500 ATG provides enterprise-wide information needed for real-time decision making.

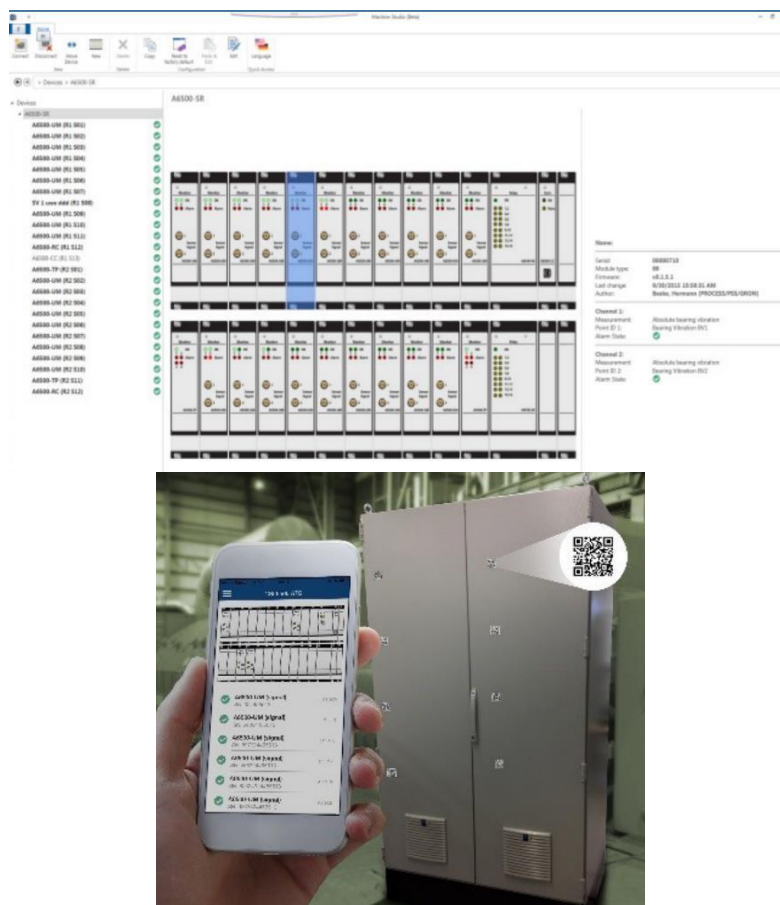


Figure 1: Machine Studio features a more intuitive interface & ATG View delivers asset health information to the user anywhere on plant network

2.1.2

AMS Machine Works Overview

AMS Machine Works is Emerson's next generation software solution that greatly simplifies the fault diagnosis and analysis process by combining predictive maintenance techniques with comprehensive analysis tools to provide easy and accurate assessment of machinery health in your facility.

Supports a variety of Emerson's monitoring technologies, including:

- AMS Wireless Vibration Monitor,
- AMS 9420 Wireless Vibration Transmitter,
- AMS 6500 ATG for online vibration monitoring,
- Native Ovation™ Machinery Health™ Monitor for online vibration monitoring.

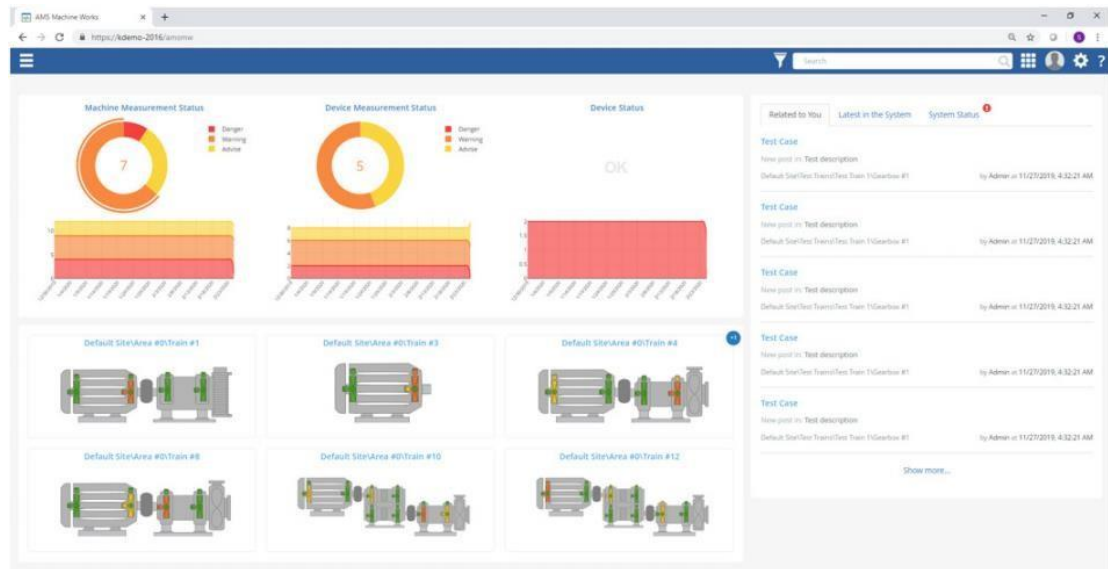


Figure 2: AMS Machine Works Dashboard

With the AMS Machine Works dashboard you are no longer required to search through alarm logs or dig through hierarchies to find out what machines need your attention. The Machine Journal utility enables you to keep track of your analysis activities and record information to be used for asset management. The flexible interface allows you to add documents, images, and add data directly from the Vibration Analyzer application. It is also persona-specific.

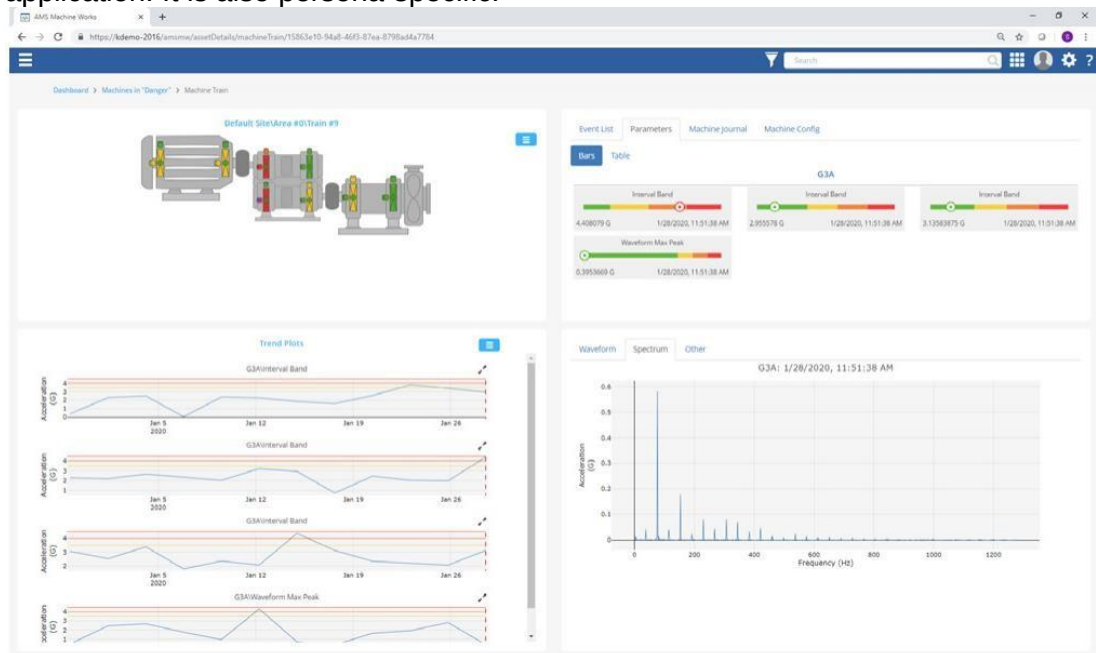


Figure 3: Vibration Spectrum

2.1.3 Sensors

Built on SQL and utilizing thin clients, Plantweb Optics Portal installation and maintenance processes are simple and non-intrusive. The platform allows for flexible installations within complex network architectures.



Improving the reliability of your mechanical assets requires advanced yet easy-to-use technology for analysing all kinds of data. But in the end, the analysis can only be as good as the data it relies on. Whatever kind of measurement is required – acceleration, velocity, displacement, speed or pressure – must be counted on for quality and accuracy to avoid “garbage in, garbage out”. The smallest item in your technology investment could be the most important purchase you make for increasing availability and reducing downtime. Quality sensors from your technology provider mean one source of responsibility for the entire measurement chain. Emerson offers a full line of quality sensors to complement its machinery health systems. Working with a leading third-party sensor supplier, Emerson has introduced a variety of specialized sensors to improve the accuracy of the measurement as well as the ability to physically capture early stage asset failure data. Technology improvements include:

- Better sensor mounting connectivity
- Special sensor filtering
- Optimized sensor measurements
- Reduced voltage sensors for longer-lasting battery-powered wireless requirements

By implementing these sensor innovations, Emerson is able to impact asset reliability by optimizing data collection and providing the best measurement possible.

Non-contact sensor designed for critical turbomachinery applications such as steam, gas and hydro turbines, compressors, gearboxes, pumps and fans to measure radial and axial shaft dynamic displacement; position, eccentricity and speed.

Emerson’s broad sensors portfolio includes:

- Accelerometers:

Accelerometers are inertial measurements converting mechanical motion to electrical signal

Characteristics vary from accelerometer to accelerometer:

- Mechanical;
 - Electrical;
 - Environmental;
 - Dynamic Velocity Sensors.
- Displacement Sensors, Converters & Transmitters:



Non-contact sensor designed for critical turbomachinery applications such as steam, gas and hydro turbines, compressors, gearboxes, pumps and fans to measure radial and axial shaft dynamic displacement; position, eccentricity and speed.

Main Applications

PR6422	PR6423	PR6424	PR6425	PR6426	CON011	CON021	CON041
Shaft vibration Thrust position Key/phase reference Speed	Shaft vibration Thrust position Key/phase reference Speed	Shaft vibration Thrust position Differential expansion Key/phase reference Speed	Shaft vibration Thrust position Differential expansion Key/phase reference Speed	Differential expansion	For field installation	For installation into a field housing	For Din-Rail field installation into a housing or cabinet



LVDT (Linear Variable Differential Transformer) Displacement Sensor

- motion sensor
- electromechanical sensor used to convert mechanical motion or vibrations, specifically rectilinear motion, into a variable electrical current, voltage or electric signals, and the reverse.
- determine whether you need to measure a relative current: C-in, AC-out, DC-in, DC-out; or measuring resonant frequencies of coils as a function of coil position, frequency-based devices.

Sensor Accessories: Eddy Current Sensor Cable Armoured Jacket, PR6470 Probe Pendulum, PR6480 Probe Holder, 2 Pin Sensor Cables.



AMS EZ 1000

Traditional eddy current measurement chains consist of virtually hundreds of part numbers and are factory pre-calibrated to specific sensors, cable lengths, measurement ranges and target materials. Having the right spare on hand when you need it is either very expensive or simply impossible. Receiving the right spare from the factory can cost you weeks of expensive downtime and lost production. You need the replacement parts when and where you need it.

With Emerson's AMS EZ 1000 eddy current sensor and converter you always have the part you need when you need it. With one converter that is compatible with a range of sensors and cables, you'll be able to mix-and-match your spares to your application while reducing your converter inventory. And with an easy-to-use procedure for field calibrations, you'll be back to work sooner. A simple three-step, pushbutton process powered by Emerson's Machine Studio software makes changing out sensors following a shutdown or replacing sensors during turnarounds/maintenance quick and painless.

Instrumentation

AMS EZ 1000 Eddy- Current Sensor series components (Shown in the graphic below):



Improving the reliability of your mechanical assets requires advanced yet easy-to-use technology for monitoring health condition and protection against catastrophic failure.

EZ1000 Converter

- DIN-Rail mount
- Configurable (USB)
- Sensor types configurable
- System cable length configurable
- Measurement range configurable
- Configurable sensor target material

EZ105x Sensor

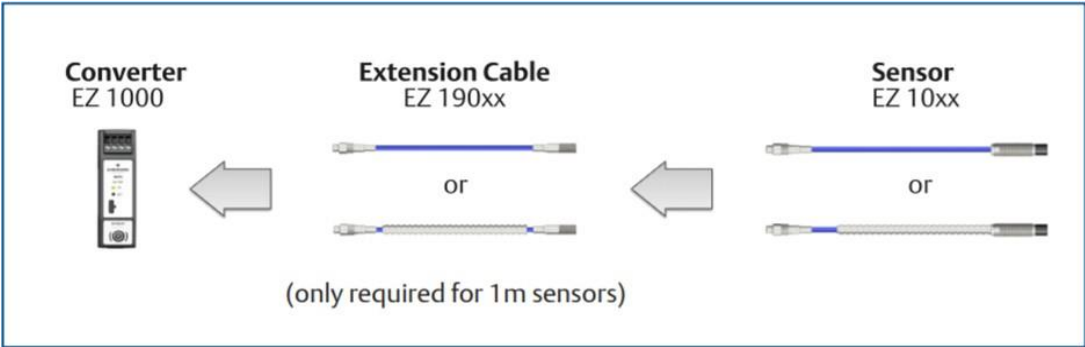
- 5mm Tip Size
- 1mm (40mils) Standard Measuring Range
- M8x1 and 1/4"-28UNF Case Thread options
- Unthreaded Length options
- Standard & Armoured Cable options
- 1, 5 & 10m cable options
- Oil proof
- Lemo Connector

EZ108x Sensor

- 8mm Tip Size
- 2mm (80mils) Standard Measuring Range
- M10x1 and 3/8"-24UNF Case Thread options
- Unthreaded Length options
- Reverse Mount options
- Standard & Armoured Cable options
- 1, 5 & 10m cable options
- Oil proof
- Lemo Connector

EZ190x Extension Cable

- Standard & Armoured Cable options
- 3 to 9m cable options
- Lemo Connector



3 APPENDICES

3.1 Appendix A – Datasheets

[AMS 6500 ATG Product Data Sheet](#)

[AMS Machine Works Product Data Sheet](#)

[PR9270V-EX - Safety Rated Velocity Sensor](#)

[C5015 2-Pin Sensor Cable](#)

[16mm Eddy Current Sensor](#)

[Eddy Current Converter](#)

[32mm Eddy Current Sensor](#)

[AMS PR9350 Inductive Sensor](#)

[A6500-LC, LVDT Converter](#)

[5mm Eddy Current Sensor](#)

AMS 6500 ATG

- API 670 compliant TSI protection system
- Embedded predictive diagnostics including PeakVue™ technology, order analysis, band analysis and energy in bands
- Interface with other applications through OPC UA, Modbus TCP/IP, or Modbus RTU
- SNTP time synchronisation
- 42-Month warranty
- Airborne contaminants resistance class G3 according to ISA-S71.04

Overview

Five percent of the rotating machines in every plant have the ability to impact production if they fail. Although your critical machines have vibration shutdown protection systems in place to prevent catastrophic failure, is your plant really protected?

Predictive intelligence is the key to increasing availability and improving the reliability of plant assets. Emerson's AMS 6500 ATG is a stand-alone machinery protection solution that also allows users to cost effectively introduce prediction monitoring of critical assets from the same system.

With four reconfigurable cards the AMS 6500 ATG can be setup in the field for a wide range of protection measurements, including all the required TSI measurements, which include embedded prediction capabilities, such as impacting or peak-to-peak data used in Emerson's PeakVue™ methodology.

Prediction data from PeakVue technology cuts through the complexity of machinery analysis to provide a simple, reliable indication of equipment health, working through a single trend that filters out traditional vibration signals to focus exclusively on impacting.



Real-time machinery health feedback integrates to digital control systems so you can run your plant with confidence.

With the addition of this impact data, users can monitor the start-up and coast down of critical turbo machinery for safe operation and receive the earliest indications of developing faults in gearboxes and bearings.

What about the shocking repair costs, missed production goals, and unfulfilled customer commitments associated with a trip or a missed trip?

With the AMS 6500 ATG protection system users benefit with prediction monitoring of critical assets from the same cards, without the additional cost of another system, and production impact is virtually non-existent. Greater flexibility of the cards will help with fewer inventory spares, as well.

Real-time machinery health feedback integrates to digital control systems so you can run your plant with confidence.

As many as 50% of machinery malfunctions that lead to downtime are process induced, and 90% are predictable – even controllable.

With the focus on impact data, users will experience a lot fewer “process induced” failures because they will have a much better indicator of overall asset health on pumps, fans, motors, and other types of rolling-element bearing machines, which are most often the reason for downtime.

The AMS 6500 ATG presents all available information about the critical machine such as main value, trending data, and status data. Part of Emerson's digital architecture, the AMS 6500 ATG provides enterprise-wide information needed for real-time decision making.

Emerson is a global leader of combined technologies for integration to digital control systems and plant-wide predictive technologies for managing both fixed and rotating assets.

Protection System You Can Count On

The AMS 6500 ATG provides API 670 protection on the industry's most critical equipment: steam turbine generators, gas turbines, boiler feed pumps, offshore compressors, pipeline turbo compressors, chemical industry compressors, turbo exhausters, blowers, and boosters. Missed trips, false trips, and running blind are not acceptable in your plant.

The AMS 6500 ATG helps prevent missed trips by using module self-health checking, instrumentation health monitoring and hot swappable, external, redundant power. External power removes heat and user "touches" away from the rack. The same architecture is used in all Emerson integration to digital controls systems and critical SIS systems.

False trips are addressed through features such as 2oo3 voting logic for increased decision accuracy and limiting channel count to two-channel modules. Two channel modules mean that swapping a protection module will affect no more than two channels – an API 670 requirement. Redundant communications ensure that the operator is never blind to machinery health information.

AMS 6500 ATG provides new communication protocol with embedded OPC Unified Architecture (UA) technology.

There are five key features that OPC UA delivers to the end-users:

- Ease-of-use
- Plug-and-play
- High reliability and redundancy
- Enhanced performance
- Multiplatform support

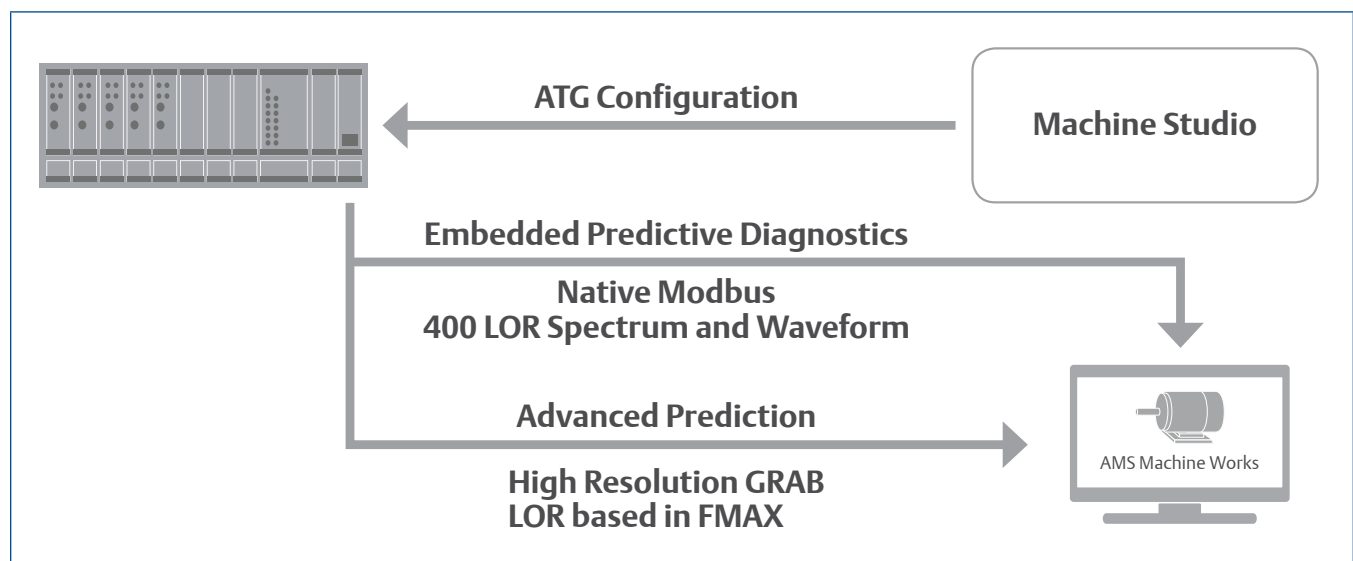
OPC UA ensures easy integration of relevant system status and values without a huge effort.

Instrumentation

While the AMS 6500 ATG delivers field-based intelligence, accurate information starts with quality instrumentation.

Eddy current displacement sensors are the preferred method for monitoring sleeve-bearing machines. These displacement sensors penetrate the machine case and directly monitor the motion and position of the shaft without contacting the shaft surface.

Accelerometers and velometers are the industry accepted sensors for monitoring the health of gearboxes and rolling element bearings. Although temperature sensors are sometimes used to measure health, temperature alone is only a small part of the machinery health picture.



AMS 6500 ATG provides new communication protocol with embedded OPC UA technology.

When a shaft begins to rub the bearing as a result of misalignment, a displacement probe can directly track the misalignment behavior. By the time the rub is severe enough to trigger a temperature alarm, the damage is already done.

Mounting location and instrumentation bracket design are both critical for quality data.

A complete range of sensors, adapters, cables, connectors, converters, and fittings are available for new installations, retrofits, or replacement of sensors during an overhaul.

AMS 6500 ATG components (Shown in the graphic below):

A6500-UM

- Shaft vibration
 - (Displacement 0-Peak, Peak-Peak, RMS, Smax, SmaxPP)
- Case vibration
 - Displacement (0-Peak, Peak-Peak, RMS, Smax, SmaxPP)
 - Velocity (0-Peak, Peak-Peak, RMS, Smax, SmaxPP)
 - Acceleration (0-Peak, Peak-Peak, RMS, Smax, SmaxPP)
- Position
 - Distance (Single, tandem, cone)
 - Rod gap
 - Rod drop (Average, Triggered)
 - Eccentricity (Peak-Peak, Min, Max)
- Speed/Key
- Pressure
 - Dynamic (0-Peak, Peak-Peak, RMS)
 - Cylinder (0-Peak, Peak-Peak, RMS)

A6500-TP

- Temperature measurement
- Process parameter input

A6500-RC

- 16 output relays SPDT-type
- 16 logic layers
- 66 logic inputs
- Graphical logic engine (drag and drop)

A6500-CC

- Rack communication (USB and TCP)
- MODBUS TCP/IP
- Modbus RTU
- OPC UA
- 32GB SD- Card

A6500-SR

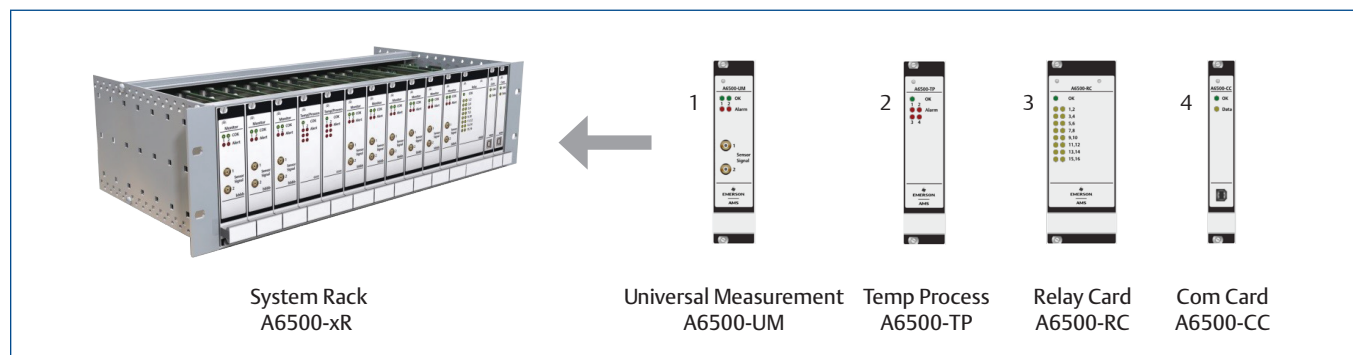
- 19" 3U-system rack
- 11 measurement cards
- 1 relay card
- 2 communication cards (for redundancy)

A6500-RR

- 19" 3U- redundant relay rack
- 9 measurement cards
- 2 relay card
- 2 communication cards (for redundancy)

A6500-FR

- 12.25" 6U- front termination short rack
- 6 measurement cards
- 1 relay card
- 1 communication card



Embedded Predictive Diagnostics

The AMS 6500 ATG features embedded predictive diagnostic capabilities, including the ability to view the following data in real-time:

- Order Analysis including Peak and Phase
- Band Analysis with up to eight programmable filter bands
- Energy in bands
- Time Waveform
- Frequency spectrum
- Trend
- PeakVue technology

PeakVue is something Emerson offers in all its vibration technologies, because PeakVue provides a unique and better methodology for early identification of rolling element bearing and gearbox problems. When used in online monitoring, it can be particularly valuable in catching turbomachinery cracks in real-time before harm to personnel, property, and the environment can occur.

Advanced Prediction

Emerson offers licensed Advanced Prediction functionality on top of the embedded predictive diagnostic capabilities within AMS 6500 ATG.

This prediction capability allows the AMS Machine Works software to communicate directly over Ethernet to the ATG to provide high resolution waveform and spectrum analysis and special “transient” recordings of data, based on demand, alert or schedule.

Just with activating the optional Prediction License within the Machine Studio configuration and no hardware change, the Advanced Prediction can be included to the entire AMS 6500 ATG Protection system. This gives the whole installation a more streamlined profile.

ATG Prediction provides a rich trend, spectrum, waveform history for an analyst to use to evaluate machinery health status. AMS Machine Works is available including the Advanced Analysis Tools which provides:

- Orbit Plot
- Bode Plot
- Nyquist Plot

- Waterfall Plot
- Cascade Plot
- Spectrum Plot
- Full Spectrum Plot
- Shaft Centerline Plot

This now makes it simple to extend this prediction/protection monitoring from critical assets to include BOP (balance of plant) assets in a comprehensive monitoring solution. ATG is the perfect choice to provide advanced prediction and shutdown protection to such BOP assets as ID and FD fans and BFP (boiler feedwater pumps). For more common BOP assets which have dangerous environments requiring agency approved monitoring solutions this monitoring combination of ATG and AMS Machine Works couldn't be better. And this solution can be a part of plant-wide reliability solution.

Putting things together

AMS 6500 ATG advanced prediction is a read only application using AMS Machine Works. The actual setup of the waveform and spectral prediction data is done only in Machine Studio to ensure security. Alerts used to trigger “transient” recordings are also setup in Machine Studio AMS Machine Works reads the waveform and spectral data from the ATG and then treats it the same way it would treat data from AMS 2140. Capabilities of AMS Machine Works can be applied such as bearing and gear analysis.

The AMS 6500 ATG is a versatile condition monitoring performer; with built in logic for special measurement setup, OPC UA communications, modbus data trending in AMS Machine Works, “transient” recordings, multiple agency approvals and the ATG View wireless APP. Sowhether ATG prediction is deployed as a full online protection system or a full prediction system it can deliver everything you need for asset or process protection and health analysis.

AMS 6500 ATG Prediction, General	
Analog Channels	up to 44 (2 full ATG racks)
Tachometer Channels	Same
Sampling Rate	48 kHz
ADC Resolution/Fmax	24 bit / 18.75 kHz
Lines of Resolution (via Modbus)	400
Waveform samples (via Modbus)	1024
Input Type	See A6500-UM specifications
Channel Scan	2 up to 44 Channel simultaneous
High Frequency Detection	PeakVue, PeakVue Waveform (OPC-UA, Modbus TCP)
Communication with AMS Machine Works	Ethernet (Data Transfer Service to database)

Transient “GRAB” Recordings	
Maximum Sampling Rate	96 kHz
Resolution/Fmax	24 bit / 37.5 kHz Fmax (User selectable)
Lines of Resolution	User selectable
Channel Scan	All channels simultaneous
“Transient” Recordings Length @ Fmax	320s @ 1172 Hz 160s @ 2344 Hz 80s @ 4688 Hz 40s @ 9375 Hz 20s @ 18750 Hz 10s @ 37500 Hz
“Transient” Trigger	Event, Schedule, Manual

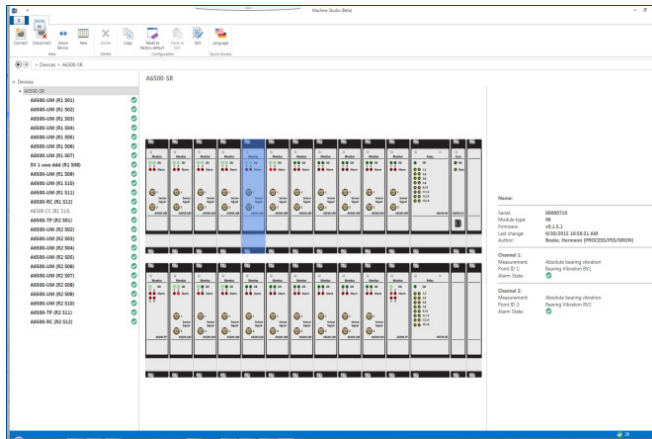
Machine Studio Configuration Software

The user interface for Machine Studio configuration software is designed based on human-centered design to be intuitive and easy. The software helps to configure the system, define functionality for a UM module, and develop trip logics. While connected, the user has access to the integrated prediction functionality, which is used to configure the ATG cards. Results of the prediction functionality are displayed in the configuration software.

ATG View Mobile Application

With ATG View it is no longer necessary to return to the control room or to open cabinets in the field to view or analyze data from your AMS 6500 ATG system. Simply use a mobile device to scan a quick response code (QRC) located on the cabinet and data from the associated rack is viewable on your device screen. Buffered outputs are still available on the rack for access to prediction data; however, users no longer risk tripping a machine offline since plugging into these buffered outputs is now optional.

The reliability professional can look at all available information about a critical machine – including the overall health of his system, the status of alarms, external inputs such as bypasses, and outputs such as trips and whether they are active or not.

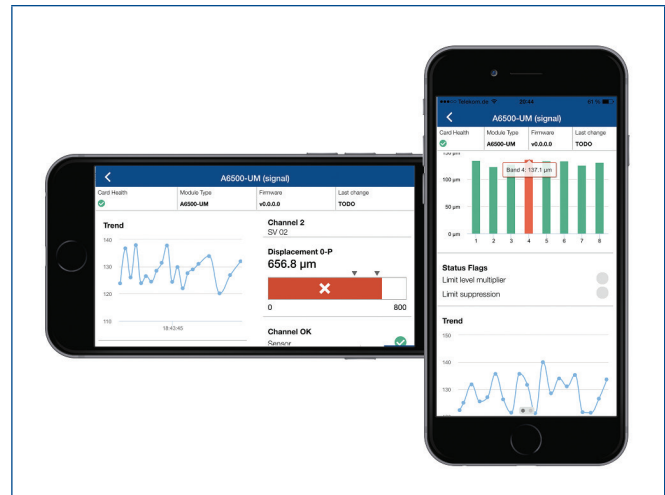


Machine Studio configuration software features a familiar, more intuitive user interface.

A technician can watch on his mobile device the status and health of all cards and measurements, such as:

- Universal measurement card
 - Monitor over speed
 - Monitor vibrations, eccentricity, positions and more than a 100 different measurements.
 - Be directly informed about alert and danger alarms.
 - Watch trend curves and visualize all kind of vibration, position, and speed data, etc.
- Temp/Process card
 - Monitor temperature of the machine and other process values you want to monitor
 - Be directly informed about alert and danger alarms
 - Watch trend curves, etc.
- Relay Card
 - Monitor all digital inputs and relay outputs
- Com Card
 - Enable OPC UA, Modbus TCP, Modbus RTU
 - Machine Studio and ATG View clients and general settings of the card

Be informed about module types, firmware versions, serial numbers, and date of the last change of configuration, etc., with ATG View. Use the list view or simply tap on a visualized card to get detailed information.



ATG View delivers asset health information to the user anywhere on the plant network.



ATG View delivers asset health information to the user anywhere on the plant network.

Emerson Support reduces downtime

Guardian™ Support is the core element of our Lifecycle Services program. It proactively delivers risk management, lifecycle management and incidence management through relevant, system-specific information and 24x7x365 expert technical support.

Guardian Support + Repair for AMS Machinery Health Monitors provides system content-specific technical support and system management for Emerson price book hardware, included in the service are normal Wear and Tear repair, advanced exchange, priority handling and discounts on accessory items and training classes.

Scheduled System Maintenance for Online Machinery Protection

Scheduled System Maintenance is a Lifecycle Services offering for Online Machinery Protection systems. During the visit, services engineers will perform maintenance tasks focuses on the six core categories.

During each service visit, service engineers will log all findings and observations. A standardized report summarizes the activities performed, an Action Plan needed to correct issues and expert recommendations to prevent potential problems in the system. The benefits of the service include improved process availability, reduced operations and maintenance costs, improved safety health and environment compliance.

AMS Spare Parts Optimization

Emerson recognizes that having spare parts available when they are needed is critical to attaining necessary system availability. Emerson's Spare Parts Optimization Tool for AMS products can be used in a collaborative process with the customer to define availability and operational goals.

The tool allows the service or sales engineer to create a list of spare parts the customer needs to reach their availability goals.

Based on statistical data and coverage targets, the tool calculates the optimal number of spare parts for each part in the list. Manual changes to the calculated figures can be used to tweak the coverage ratio or to take already stocked parts into consideration.

For further information on Emerson's lifecycle services, please contact your local Emerson Sales Office / representative for quotation.

Ordering Information

Please see individual monitoring module spec sheets for specific functionality of the ATG Parts.

Model Number	Product Description
A6500-UM	Universal Measurement Card, Speed, VIB, POS
A6500-TP	Temperature / Process Card
A6500-RC	System Relay Card, 16 output relays SPDT
A6500-CC	System Communication Card, MODBUS RTU/TCP, OPC UA
A6500-PE	Prediction Extension License
A6500-CC-P	Package A6500-CC & A6500-PE
A6500-SR	System Rack, 11 UM, 1 RC, 2 CC SLOTS
A6500-RR	Redundant Relay Rack, 9 UM, 2 RC, 2 CC Slots
A6500-FR	Front Termination Rack, 6 UM, 1 RC, 1 CC Slots

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AMS Machine Works v1.7

- Full suite of tools for analysis and tracking machine health
- Supports a variety of Emerson's monitoring technologies, including:
 - AMS Wireless Vibration Monitor
 - AMS 9420 Wireless Vibration Transmitter
 - AMS Asset Monitor for online condition monitoring
 - AMS 6500 ATG for online vibration monitoring
 - Ovation™ Machinery Health™ Monitor for online vibration monitoring
- Intuitive dashboard makes keeping up with day-to-day activities and machinery health possible at a glance
- Part of the Plantweb Digital Ecosystem



AMS Machine Works provides both familiar and next generation tools for tracking and analyzing rotating machinery faults.

Overview

In the past when a problem arose with one of your critical assets you might have had to comb through tons of data, and potentially even different software and databases to identify what's important to you at that moment. Unfortunately, time isn't always on your side in these scenarios. You need relevant information fast, and you need the right tools there to diagnose faults as fast as possible.

AMS Machine Works is a comprehensive software solution that greatly simplifies the fault diagnosis and analysis process by combining predictive maintenance techniques with comprehensive analysis tools to provide easy and accurate assessment of machinery health in your facility.

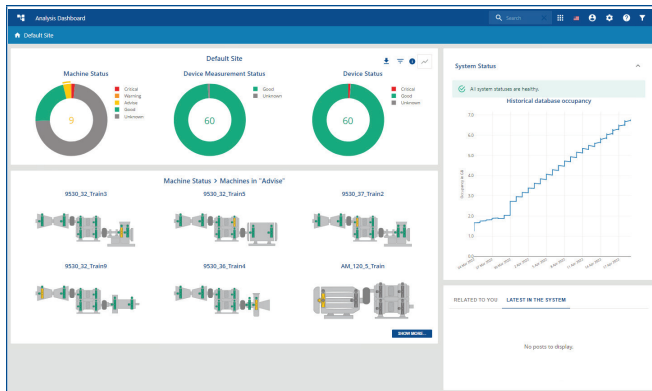
- One software application and database for all Emerson vibration hardware
- Easy to get started and understand, but contains the power tools necessary for experts
- Scalable and flexible deployment models

Powerful Tools in an Intuitive Interface

AMS Machine Works includes a vibration analysis module with familiar, easy-to-use analytical tools such as:

- Scalar value trending
- 1x, 2x, Nx, peak/phase trending, energy in a band trending
- Waveform
- Spectrum
- Spectrum Waterfall and Cascade
- PeakVue™ measurements including overall, waveform*, spectrum*
- Fault frequencies
- Standard, harmonic, and sideband cursor
- Circular plot
- Orbit
- Bode/Nyquist
- Harmonic family detection
- Sideband frequency detection
- Shaft centerline

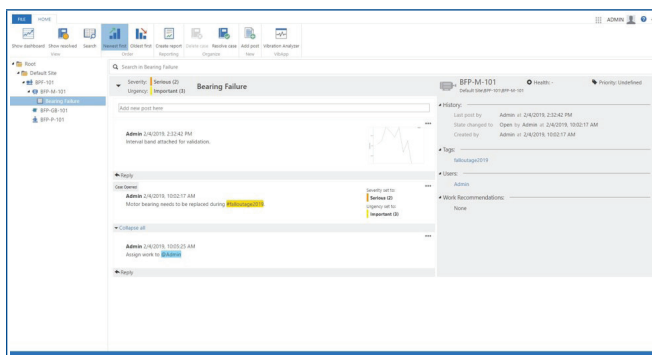
**PeakVue waveform and spectrum are not supported with Ovation Machinery Health Monitor*



The AMS Machine Works Analysis Dashboard allows users to easily identify what's important.

Easily Document Machine History and Recommendations

The Machine Journal utility enables you to keep track of your analysis activities and record information to be used for asset management. The flexible interface allows you to add documents, images, and add data directly from the Vibration Analyzer application. It is also persona-specific, so you see what's important to you, but you can also tag other users when necessary. When it's time to take action, you can generate work recommendations, which when connected to Plantweb Optics can be published to your CMMS.



Machine Journal enables users to document analysis activities and pending faults.



Intuitive user interface makes diagnosing faults easier than ever.

Machine Health at a Glance

With the AMS Machine Works Analysis Dashboard you are no longer required to search through alarm logs or dig through hierarchies to find out what machines need your attention. Nor are you required to look through notes and emails to find out what predictive maintenance activities are taking place and what machines need repair.

With one glance at the Analysis Dashboard you can see:

- Machine health
- Device/system health
- Machines that need your immediate attention
- Machine Journal activity
- Work recommendations and status

Selecting any of the items on the dashboard allows you to quickly focus in on what's important, greatly improving workflow and optimizing user experience.

AMS Wireless Vibration Monitor and AMS 9420 Wireless Vibration Transmitter

Emerson's AMS Wireless Vibration Monitor and AMS 9420 Wireless Vibration Transmitter's are integrated into AMS Machine Works through the Emerson Smart Wireless Gateway (1410 and 1420 models). AMS Machine Works then utilizes that data to perform in-depth vibration analysis of the monitored rotating assets.

AMS Machine Works provides wireless vibration users with all of the necessary tools and functionality needed to utilize the wireless vibration transmitters to their full potential. This includes complete vibration data including overall levels, energy bands, high resolution spectra, and waveforms.

Also included is Emerson's unique PeakVue technology that filters out traditional vibration signals to focus exclusively on impacting, a more reliable indication of asset health in specific types of equipment. PeakVue can visualize distress signals on a machine that are simply not visible with other vibration measurements.

The AMS Wireless Vibration Monitor also supports Emerson's new PeakVue Plus technology which automates analysis and presents the information in a color-coded graphic so that users can, at a glance, identify not only a machinery issue but its severity.



Emerson's wireless vibration solutions provide best-in-class wireless vibration data and capabilities.

AMS Asset Monitor

With this release, Emerson's AMS Asset Monitor communicates directly with AMS Machine Works. Now it's possible to store process and vibration data from the AMS Asset Monitor in order to perform in-depth analysis of your important assets.

It accommodates up to 12 CHARMs including several Vibration CHARMs as well as DeltaV CHARMs for process inputs. Predicates can be configured to optimize collection of high resolution waveforms and spectra.



Up to the moment process and condition monitoring results with Store on Alert for automated fault detection.

AMS 6500 ATG

Emerson's AMS 6500 ATG communicates directly over Ethernet to AMS Machine Works to provide high resolution waveform and spectrum analysis and "transient" recordings of data, all available on demand, by alert or scheduled.

This now makes it simple to extend this prediction/protection monitoring from critical assets to include BOP (balance of plant) assets in a comprehensive monitoring solution.



Real-time machinery health feedback integrates to digital control systems so you can run your plant with confidence.

Ovation Machinery Health Monitor

Emerson's Ovation Machinery Health Monitor communicates directly with AMS Machine Works to store high resolution vibration data and perform advanced condition monitoring securely outside of your Ovation network.

This solution supports a firewall, DMZ or data diode for hardware-enforced, one-way communications from the Ovation control system to AMS Machine Works, even at a remote operations or diagnostics center.



The Ovation Machinery Health Monitor combines Ovation control with precise vibration protection & advanced analysis capabilities.

System Requirements: AMS Machine Works Server	
AMS Machine Works Version	1.7
Operating System	Windows Server 2016 Datacenter Windows Server 2016 Standard Windows Server 2019 Datacenter Windows Server 2019 Standard
CPU Architecture	64-bit
Internet Information Services (IIS)	v8.5, v10 (supplied with OS)
Microsoft SQL Server	MS SQL Server 2017 / 2019 Full (must be purchased separately) (recommended) MS SQL Server 2017 Express (included with product, 10GB limit) (proof of concept)
Browsers	Google Chrome (latest version) Microsoft Edge (latest version)
Processor	3.2 GHz, 8-core processor, Intel Xeon-scalable (Gold) or faster (recommended) 2.4 GHz, 4-core processor, Intel Xeon-scalable (Gold) or faster (minimum)
RAM	64 GB (recommended) 16 GB (minimum)
Hard Drive	SSD drive (recommended) SAS hard drive (10K RPM) (supported)
Available Disk Space	1 TB (recommended) 500 GB (minimum) 100 GB (for wireless-only setup)
Screen Resolution	4K UHD (3840 x 2160 pixels) (maximum) SXGA (1280 x 1024 pixels) (minimum)
Network	2 x 1 GB NIC (use 2 NICs to isolate Level 3 traffic from Level 2 traffic) (recommended) 1 x 1 GB NIC (supported)
Data Diodes (Ovation Machinery Health Monitor only)	OWL data diodes are supported. For data diode support with Ovation Machinery Health Monitor, two servers are required for replication of data across the diode.

System Requirements: AMS Machine Works Client	
Operating System	Windows Server 2016 Standard Windows Server 2019 Standard Windows 10 Pro or Enterprise
CPU Architecture	64-bit
Internet Information Services (IIS)	v8.5, v10 (supplied with OS)
Processor	2.2 GHz, 4-core processor Intel Xeon, Intel Core i5 6th Gen (i5 6400T) or better
RAM	16 GB (recommended) 8 GB (minimum)
Hard Drive	SAS hard drive (10K RPM)
Available Disk Space	100 GB
Screen Resolution	4K UHD (3840 x 2160 pixels) (maximum) SXGA (1280 x 1024 pixels) (minimum)

Supported Device Quantities	
AMS 6500 ATG	Up to 1,100 channels or 50 AMS 6500 ATGs on a single AMS Machine Works system
AMS Wireless Vibration Monitor	Up to 4,000 devices connected across 120 Emerson Wireless Gateways
AMS 9420	Up to 600 devices across 50 Emerson Wireless Gateways
Ovation Machinery Health Monitor	Up to 800 channels or 100 Ovation MHM Modules on a single AMS Machine Works system
AMS Asset Monitor	Up to 3,600 channels or 300 AMS Asset Monitors on a single AMS Machine Works system

Ordering and Licensing Information

AMS Machine Works can be licensed on a subscription basis. The length of the subscription and renewal terms will be three years unless otherwise set forth in the applicable Emerson proposal. Each license must include an AMS Machine Works Server and a purchased quantity of users and vibration tags. The purchaser may not use the AMS Machine Works software with more than the purchased number of users and vibration tags, all of which as set forth in the applicable Emerson proposal.

License Options	Subscription Part Number
AMS Machine Works Server	A43-SYSTEM
Users (combine for desired amount, max of 25 total per system)	
1 User	A43USER-1
5 Users	A43USER-5
15 Users	A43USER-15
25 Users	A43USER-25
Vibration Tags (combine for desired amount, max of 12000 total per system)	
100	A43TAGS-100
500	A43TAGS-500
1000	A43TAGS-1000
2000	A43TAGS-2000
5000	A43TAGS-5000
10000	A43TAGS-10000
12000	A43TAGS-12000
Add-on Licenses	
OPC UA	A43-OPCUA

AMS Machine Works Cloud Hosted Solution

Emerson has partnered with Microsoft to offer **AMS Machine Works Cloud Hosted Solution** in the Azure cloud platform. This eliminates the need for customers to deploy and maintain on-premise installations of the software along with costly infrastructure investment. AMS Wireless Vibration Monitor and AMS 9420 Wireless Vibration Transmitters are easily integrated into AMS Machine Works in the cloud through the Emerson Smart Wireless Gateway and a secure VPN connection established via Cisco Industrial 4G routers.

Having your system on the cloud means that authorized staff can securely access information and data anytime and anywhere. This translates into enhanced mobility, flexibility and collaboration within your teams, with your corporate analyst pool, or even with Emerson experts.

Asset Condition Monitoring Services

Emerson's team of machinery monitoring experts can supplement plant programs with **Asset Condition Monitoring Services**. Specialists are available to monitor and analyze data from Emerson's route-based vibration analyzers, wireless vibration devices, and online systems. They follow up with easy-to-read, actionable periodic reports for your maintenance department.

Software Support

Standard support including 24x7 call support, hotfixes, and updates to the software is included for the current and previous major software versions.

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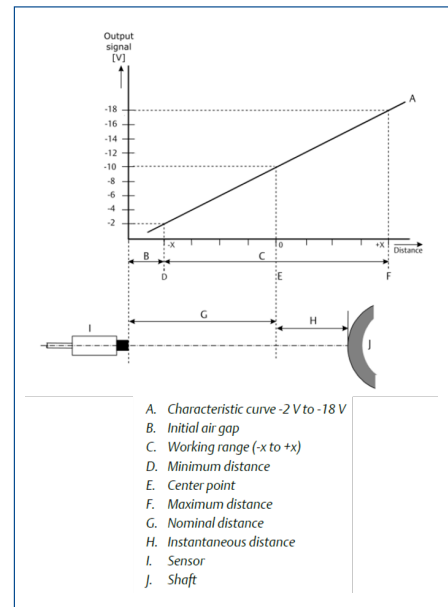
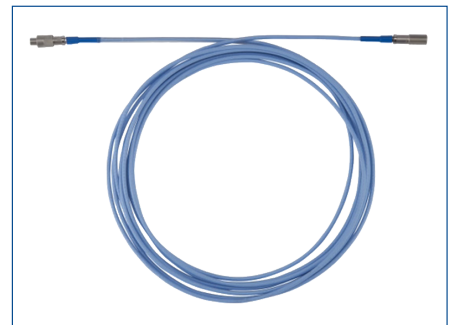
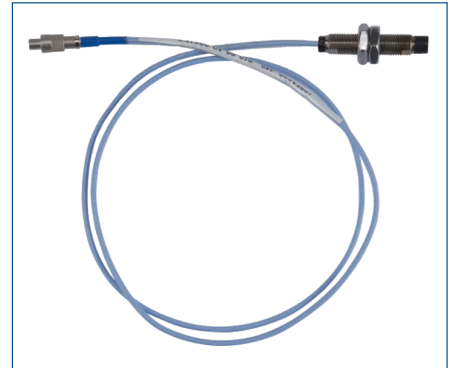
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8mm Eddy Current Sensor

Non-contact sensor designed for critical turbomachinery applications such as steam, gas and hydro turbines, compressors, gearboxes, pumps and fans to measure radial and axial shaft dynamic displacement; position, eccentricity and speed/key.

Performance	
Linear Measurement Range	2 mm (80 mils)
Initial Air Gap	0.5 mm (20 mils)
Incremental Scale Factor (ISF)	API: 7.87 V/mm (199.9 mV/mil) $\pm$ 5% or ISO: 8 V/mm (203.2 mV/mil) $\pm$ 5% @ temperature range 0 to 45°C (+32 to +113°F)
Deviation from best fit straight line (DSL)	$\pm$ 0.025 mm ($\pm$ 1 mil) @ temperature range 0 to 45°C (+32 to +113°F)
Measuring Target	
Minimum Target Size	Minimum: 14mm (0.55") Recommended Minimum: 20mm (0.79"), additional failure <1%
Minimum Shaft Diameter	Minimum: 20mm (0.79") Recommended Minimum: 25mm (0.98")
Target Material (Ferromagnetic Steel)	42CrMo4 (AISI/SAE 4140) P235S C35 (AISI/SAE 1035) 34CrMo4 (AISI/SAE 4337, 4340) 26NiCrMoV14 ST 37, S235JR X35CrMo17 CK1500590 ASTM A276 Type 410 30CrNiMo8 18CrNiMo7-6 Other (On Request)



Environmental, General	
Protection Class	IP67, IEC 60529 IP68 (if DOC-TEST is assigned to delivered sensor)
Operating Temperature Range	Sensor incl. 1m Cable: -35 to +180°C (-31 to 356°F) Cable & Connector: -35 to +150°C (-31 to 302°F)
Differential Pressure & Sealing	10000 hpa (145 psi) @ up to 120°C (248°F) AMS EZ 1000 sensors are designed to seal differential pressure between sensor tip and case & oil leakage. Sensors are not pressure & leakage tested prior to shipment. Please order Test Certificate (DOC-TEST) separately, if you require a test of the pressure seal for your application.
Material	Sensor Tip (GF30 – glass- fiber reinforced PEEK Polyether Ether Ketone) Case (Stainless Steel) Cable (FEP <i>Fluorinated Ethylene Propylene</i>), Connector (Brass, nickel-plated)
Weight (Sensor with 1m Cable)	Approx. 100 grams (3.53 oz)

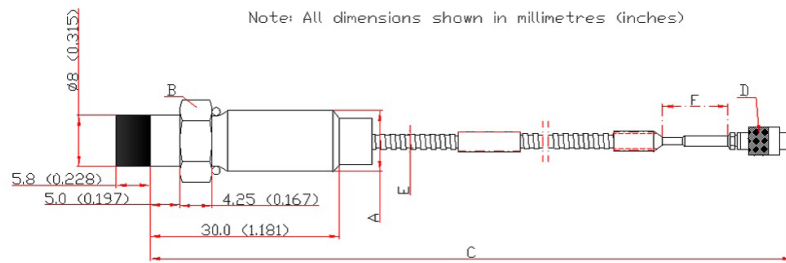
Compliance and Certifications

CE	2014/30/EU (EN 61326-1) 2014/34/EU 2014/65/EU (EN IEC 63000)
ATEX	EN IEC 60079-0:2018 EN IEC 60079-7:2015 + A1:2018 EN IEC 60079-11:2012
IEC-Ex KTL Korea	IEC 60079-0:2017 IEC 60079-7:2017 IEC 60079-11:2011
CSA	CAN/CSA-C22.2 NO. 0-10 CAN/CSA-C22.2 NO. 61010-1-12 CAN/CSA-C22.2 NO. 60079-0:19 CAN/CSA-C22.2 NO. 60079-11:14 CAN/CSA-C22.2 NO. 60079-7:16 UPD1:2015; UPD2:2016; AMD1:2018 UL 61010-1 UL 60079-0:19 UL 60079-11:13 UL 60079-7:2017
EAC	TP TC 012/2011 ГОСТ 31610.0-2014 ГОСТ 31610.15-2014
CCC	GB 3836.1-2010 GB 3836.4-2010 GB 3836.8-2014
CCOE PESO India	IEC 60079-0:2011 IEC 60079-11:2011 IEC 60079-15:2010
CML Japan	JNIOH-TR-46-1:2020 JNIOH-TR-46-6:2015 JNIOH-TR-46-8:2015
Marine	DNV GL rules for classification – Ships and offshore units
Safety (SIL): SC 2 (SIL 2 Capable)	IEC 61508:2010

Hazardous Area Approvals

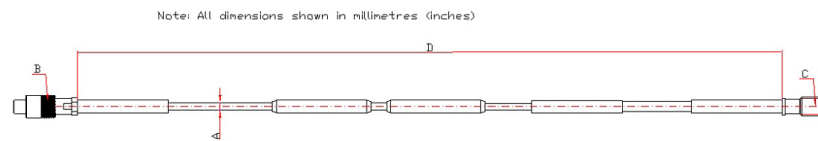
Intrinsic Safety (ia)	
ATEX	Area classification depends on converter, see converter documentation for details. Sensor temperature classification: T6: $-35^{\circ}\text{C} \leq T_a \leq 55^{\circ}\text{C}$ T4: $-35^{\circ}\text{C} \leq T_a \leq 130^{\circ}\text{C}$ T2: $-35^{\circ}\text{C} \leq T_a \leq 200^{\circ}\text{C}$
IEC-Ex	
CSA	
EAC-Ex	
CCC-Ex	
CCOE PESO India	
KTL Korea	
CML Japan	
Increased Safety (ec)	
ATEX	Area classification depends on converter, see converter documentation for details. Sensor temperature classification: T6: $-35^{\circ}\text{C} \leq T_a \leq 55^{\circ}\text{C}$ T4: $-35^{\circ}\text{C} \leq T_a \leq 130^{\circ}\text{C}$ T2: $-35^{\circ}\text{C} \leq T_a \leq 200^{\circ}\text{C}$
IEC-Ex	
CSA	
EAC-Ex	
CCC-Ex	
CCOE PESO India	
KTL Korea	
CML Japan	

EZ1081-RM-00-xxx & EZ1083-RM-00-xxx



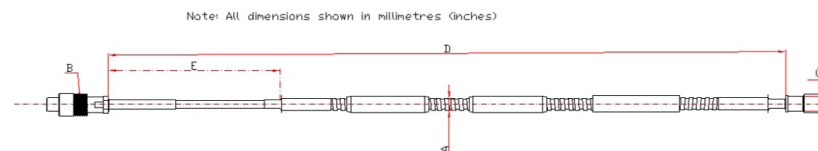
- A. Case thread, M10x1 or 3/8-24UNF
- B. SW 11 mm for M10 threads, SW 7/16 in for 3/8-24UNF threads
- C. Cable Length (Tolerances 0...+10%)
- D. Lemo connector (male), 8.3 mm (0.328 in) diameter
- E. Armored cable diameter 6 mm (0.236 in), minimum bending radius 35 mm (1.378 in)
- F. Length without armor < 30 mm at 1m, < 300 mm at 5m and 10m cable length

EZ1900-xxx



- A. Standard cable diameter 2.8 mm (0.110 in), minimum bending radius 25 mm (0.984 in)
- B. Lemo connector (male), 8.3 mm (0.328 in) diameter
- C. Lemo connector (female), 7.0 mm (0.276 in) diameter
- D. Cable Length (Tolerances 0...+10%)

EZ1901-xxx



- A. Armored cable diameter 6 mm (0.236 in), minimum bending radius 35 mm (1.378 in)
- B. Lemo connector (male), 8.3 mm (0.328 in) diameter
- C. Lemo connector (female), 7.0 mm (0.276 in) diameter
- D. Cable Length (Tolerances 0...+10%)
- E. Length without armor < 300 mm

Ordering Information Sensor

Case Threads	Armored Cable	Model No.
M10x1	No	EZ1080
	Yes	EZ1081
3/8"-24 UNF	No	EZ1082
	Yes	EZ1083

Model No.	Case Length XX	Unthreaded Length XX	Cable Length XXX
EZ1080	02 20mm (Minimum)	00 0mm, No UTL	005 0.5m
EZ1081	I 25 250mm (Maximum) Order in increments of 10mm RM Reverse Mount Note: 20mm Case is only available with EZ1080	05 50mm (Minimum) I 20 200mm (Maximum) Note: Remaining threaded Length must be either 50mm or 100mm	010 1.0m 015 1.5m 020 2.0m 050 5.0m 100 10.0m 150 15.0m 300 30.0m Note: 15.0m and 30.0m on request (non-standard).
EZ1082	08 0.8in	00 0.0in, No UTL	Note: Usage of EZ190x Extension Cable possible with 0.5m, 1.0m, 1.5m & 2.0m option only. Note: While using sensors in combination with extension cable, overall system length must be 4.0m, 5.0m, 6.0m, 7.0m, 8.0m, 9.0m, 10.0m, 15.0m or 30.0m.
EZ1083	10 1.0in (Minimum) I 95 9.5in (Maximum) Order in increments of 0.5in RM Reverse Mount Note: 0.8in Case is only available with EZ1082	20 2.0in (Minimum) I 75 7.5in (Maximum) Note: Remaining threaded Length must be either 2.0in or 4.0in	

Example:

EZ1080-02-00-050

ECS 8mm, M10X1, NO ARMOR, 20MM SLEEVE, 0MM UNTHREADED, 5M CABLE

Special Versions

Part Number	Description
EZ1xxx-xx-xx-xxx-001	Sensor option with special short armor.
EZ1xxx-xx-xx-xxx-002	Sensor option with FEP covered stainless steel armor.
EZ1xxx-xx-xx-xxx-003	Sensor option with special sealing.
EZ1xxx-xx-xx-xxx-004	Sensor option with special big Lemo connector.

Special Versions

Model No.	Armored Cable X	Cable Length XXX
EZ190	0 No	020 2.0m
EZ190	1 Yes	025 2.5m
		030 3.0m
		035 3.5m
		040 4.0m
		045 4.5m
		050 5.0m
		055 5.5m
		060 6.0m
		065 6.5m
		070 7.0m
		075 7.5m
		080 8.0m
		085 8.5m
		090 9.0m
		095 9.5m
		140 14.0m (On request)
		290 29.0m (On request)

Example:

EZ1900-040

ECS EXTENSION CABLE, NO ARMOR, 4M CABLE

Product Accessories

Model Number	Product Description
MPT 064	Metal Protection Tube
EZ 1600	ECS Probe Holder

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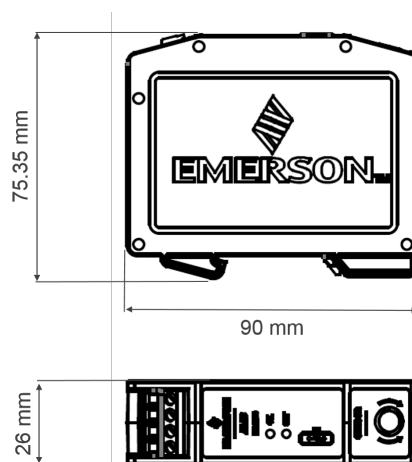
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Eddy Current Converter

Sensor Signal Converter designed for critical turbomachinery applications such as steam, gas and hydro turbines, compressors, gearboxes, pumps and fans to measure radial and axial shaft dynamic displacement; position, eccentricity and speed.

Compatible Sensors (Configurable)

Sensor Type	Measuring Range
AMS EZ105x (5mm Sensor)	1.0mm (Standard Range) 1.5mm & 2.0mm (Extended Range)
AMS EZ108x (8mm Sensor)	2.0mm (Standard Range) 3.0mm & 4.0mm (Extended Range)
AMS EZ116x (16mm Sensor) Emerson PR6424 (w/ adaptation)	4.0mm (Standard Range) 8.0mm & 12.0mm (Extended Range)
Emerson PR6425 (w/ adaptation)	4.0mm (Standard Range) 8.0mm & 12.0mm (Extended Range)
Emerson PR6426 (w/ adaptation)	8.0mm (Standard Range) 16.0mm & 24.0mm (Extended Range)
Third Party Sensors (w/ adaptation)	Range depending on Sensor, currently only BN 3300 XL supported
Performance	
Frequency Range	0 to 20 kHz
Sensor Target Material (Configurable)	42CrMo4 (AISI/SAE 4140) P235S C35 (AISI/SAE 1035) 34CrMo4 (AISI/SAE 4337, 4340) 26NiCrMoV14 ST 37, S235JR X35CrMo17 CK1500590 ASTM A276 Type 410 30CrNiMo8 18CrNiMo7-6 Other (On Request)
Sensor Excitation Frequency	Three (Configurable)



Environmental, General	
Protection Class	IP20, IEC 60529
Supply Voltage Range	-21V to -32V (Output Range -2V to -18V)
Operating Temperature Range	-35 to +85°C (-31 to 185°F)
Relative Humidity	5 to 95%, non-condensing
Shock and Vibration	5g @ 60Hz @ 25°C (77°F)
EMR Resistance	EN 61326-1
Material	Housing Material: Polycarbonate (PC)
Weight	Approx. 100 grams (3.53 oz)
Mounting	DIN Rail
Connections	Sensor: Lemo-Plug Supply/Output: Screw Type (max. 1.5mm ²) Configuration: Micro-USB

Compliance and Certifications

Model Number	Product Description
CE	2014/30/EU (EN 61326-1) 2014/34/EU 2014/65/EU (EN IEC 63000)
ATEX	EN 60079-0:2018 EN IEC 60079-7:2015 + A1:2018 EN IEC 60079-11:2012
IEC-Ex KTL Korea	IEC 60079-0:2017 IEC 60079-7:2017 IEC 60079-11:2011
CSA	CAN/CSA-C22.2 NO. 0-10 CAN/CSA-C22.2 NO. 61010-1-12 CAN/CSA-C22.2 NO. 60079-0:19 CAN/CSA-C22.2 NO. 60079-11:14 CAN/CSA-C22.2 NO. 60079-7:16 UPD1:2015; UPD2:2016; AMD1:2018 UL 61010-1 UL 60079-0:19 UL 60079-11:13 UL 60079-7:2017
EAC	TP TC 012/2011 ГОСТ 31610.0-2014 ГОСТ 31610.15-2014
CCC	GB 3836.1-2010 GB 3836.4-2010 GB 3836.8-2014
CCOE PESO India	IEC 60079-0:2011 IEC 60079-11:2011 IEC 60079-11:2011

CML Japan	JNOSH-TR-46-1:2020 JNOSH-TR-46-6:2015 JNOSH-TR-46-8:2015
Marine	DNV GL rules for classification – Ships and offshore units
Safety (SIL): SC2 (SIL 2 Capable) [EZ1000-SIS only]	IEC 61508:2010

Hazardous Area Approvals

Intrinsic Safety (ia)		
ATEX	II 1G Ex ia IIC T6, T4, T2 Ga	Tamb: T6 (-35°C ≤ Tamb ≤ 50°C) T4 (-35°C ≤ Tamb ≤ 80°C) T2 (-35°C ≤ Tamb ≤ 80°C)
IEC-Ex	Ex ia IIC T6, T4, T2 Ga	
CSA	Ex ia IIC T2/T4/T6 Ga Class I, Zone 0, AEx ia IIC T2/T4/T6 Ga	
EAC-Ex	0Ex ia IIC T6/T4/T2 Ga X	
CCC-Ex	Ex ia IIC T6/T4/T2 Ga	
CCOE PESO India	Ex ia IIC T6, T4, T2 Ga	
KTL Korea	Ex ia IIC T6, T4, T2 Ga	
CML Japan	Ex ia IIC T6, T4, T2 Ga	

Increased Safety (ec)		
ATEX	II 3G Ex ec [ic] IIC T6, T4, T2 Gc	Tamb: T6 (-35°C ≤ Tamb ≤ 50°C) T4 (-35°C ≤ Tamb ≤ 80°C) T2 (-35°C ≤ Tamb ≤ 80°C)
IEC-Ex	Ex ec [ic] IIC T6, T4, T2 Gc	
CSA	Ex ec [ic] IIC T2/T4/T6 Gc Class I, Zone 2, AEx ec [ic] IIC T2/T4/T6 Gc	
EAC-Ex	2Ex nA [ic] IIC T6/T4/T2 Gc X	
CCC-Ex	Ex nA [ic] IIC T6/T4/T2 Gc	
CCOE PESO India	Ex nA [ic] IIC T6, T4, T2 Gc	
KTL Korea	Ex nA [ic] IIC T6, T4, T2 Gc	
CML Japan	Ex nA [ic] IIC T6, T4, T2 Gc	

Ordering Information

Model Number	Product Description
EZ1000	EZ1000 – Eddy Current Converter
EZ1000-FCAL	EZ1000 Converter, Factory Calibrated
EZ1000-SIS	EZ1000 Converter, Safety Rated

Product Accessories

Model Number	Product Description
MHM-9500-00187	DIN Rail to Panel Mount Adapter 98x70mm
MHM-9199-00142	EZ 1000 Mounting Adapter DIN Rail for Horizontal Mount
EZ1900-003-ADAP-1	ECS Cable Adapter PR642X/XXX-XX0, No Armor, 0.35m CAB
EZ1900-003-ADAP-2	ECS Cable Adapter BN, No Armor, 0.35m CAB
EZ1900-ADAP-90	ECS Cable Adapter, 90 Degree for EZ1000
EZ1000-JB	EZ1000 Junction Box for up to six EZ1000 Converters, Stainless Steel
EZ1000-JB2	EZ1000 Junction Box for up to six EZ1000 Converters, Plastic

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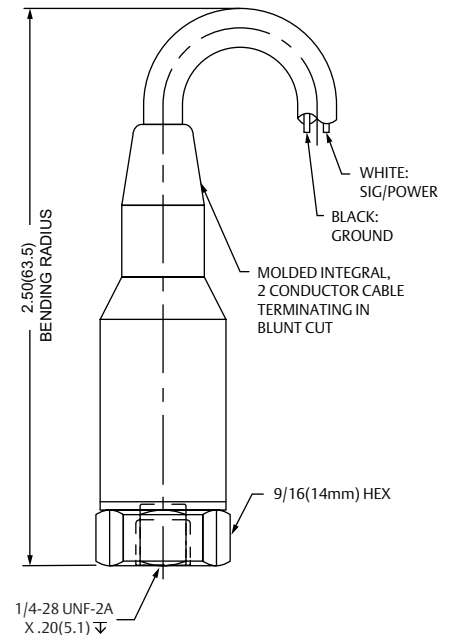
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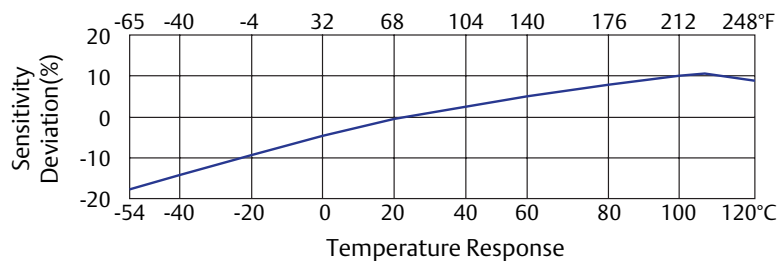
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Industrial Accelerometer

Dynamic Performance	
Sensitivity ($\pm 10\%$)	100 mV/g (10.2 mV/m/s ²)
Measurement Range	± 50 g (± 490 m/s ²)
Frequency Range (± 3 dB)	0.50 to 10,000 Hz (30 to 600,000 cpm)
Mounted Resonant Frequency	22 kHz Nominal
Amplitude Linearity	$\pm 1\%$ (0 Based, Least Squares, Straight Line)
Transverse Sensitivity	$\leq 7\%$
Environmental	
Shock Limit	5,000g pk (49,050 m/s ²)
Temperature Range	-54 to 121°C (-65 to 250°F)
Temperature Response	See Graph
Sealing / Rating	Molded / IP68
Electrical	
Settling Time	≤ 2.0 sec (Within 1% of Bias)
Discharge Time Constant	≥ 0.3 sec
Excitation Voltage / Current	18 to 24 VDC / 2.0 to 20 mA
Output Bias	8 to 12 VDC
Output Impedance	< 150 ohms
Broadband Resolution (1 to 10 KHz)	350 μ g (3,434 μ m/s ²) Electrical Noise
Case Isolation	$> 10^8$ ohms
Mechanical	
Weight	99.3 grams (3.5 oz) Sensor & Stud Only
Mounting Stud / Torque	1/4-28 UNF-2B / 2.7 to 6.8 Nm (2 to 5 lb ft)
Sensor Element / Geometry	Ceramic / Shear
Case Material	Stainless Steel
Connector Type (Top)	Molded Integral Cable (See Versions)



CE



Supplied Accessories	
Three Point Calibration	
¼-28 Mounting Stud	
Versions	
1. A0322LC	Yellow Jacket 3 m (10') Cable
2. A0322LC-1	Yellow Jacket 9 m (30') Cable
3. A0322LC-2	Yellow Jacket 15 m (50') Cable
4. A0322LC-1-EX	Yellow Jacket, 9 m (30') Cable, Hazardous Area Approved

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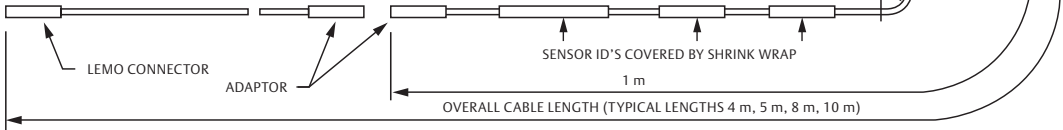
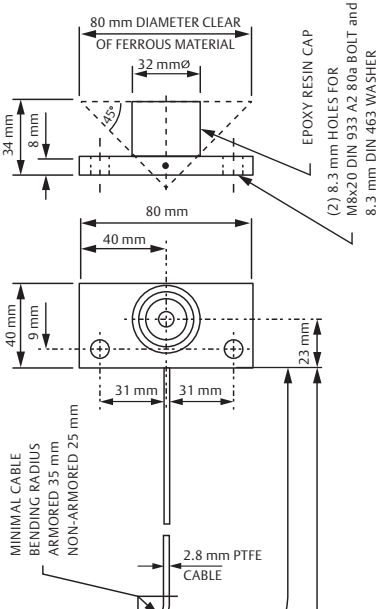
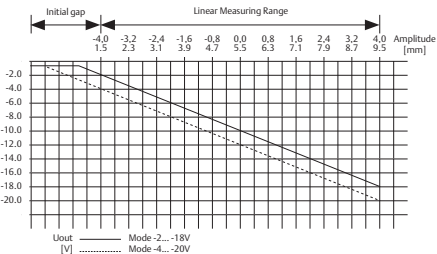
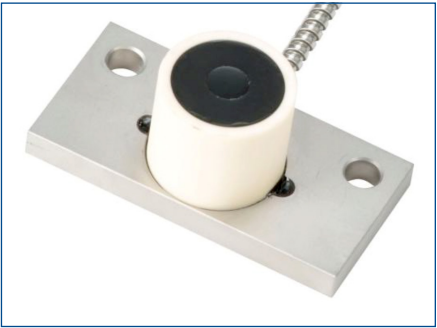
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32mm Eddy Current Sensor

Non-contact sensor designed for critical turbo machinery applications such as steam, gas and hydro turbines, compressors, pumps and fans to measure radial and axial shaft displacement: position, eccentricity and motion.

Dynamic Performance	
Sensitivity	2 V/mm (50.8 mV/mil) ≤ ±1.5% max
Air Gap (Center)	Approx. 5.5 mm (0.22") Nominal
Long Term Drift	< 0.3%
Range	Static ±4.0 mm (0.157")
Target	
Target/Surface Material	Ferromagnetic Steel (42 Cr Mo 4 Standard)
Maximum Surface Speed	2,500 m/s (98,425 ips)
Shaft Diameter	≥200 mm (7.87")
Environmental	
Operating Temperature Range	-35 to 180°C (-31 to 356°F)
Temperature Excursions <4 Hours	200°C (392°F)
Maximum Cable Temperature	200°C (392°F)
Temperature Error (at +23 to 100°C)	-0.3%/100°K Zero Point <0.15%/10°K Sensitivity
Pressure Resistance To Sensor Head	6,500 hpa (94 psi)
Shock and Vibration	5g (49.05 m/s²) @ 60Hz @ 25°C (77°F)
Physical	
Material	Sleeve – Stainless Steel, Cable – PTFE
Weight (Sensor & 1M Cable, no Armor)	~800 grams (28.22 oz)



Compliance and Certifications	
CE	2014/30/EU (EN 61326-1) 2014/34/EU 2011/65/EU
ATEX	EN 60079-0 EN 60079-11
IEC-Ex	IEC 60079-0 IEC 60079-11 IEC 60079-26
CSA	CAN/CSA-C22.2 NO. 0-M91 CAN/CSA-C22.2 NO. 157-92 CAN/CSA-C22.2 NO. 213-M1987 CAN/CSA-E60079-15-02 (R2006) CAN/CSA-C22.2 NO. 25-1966 CAN/CSA-C22.2 NO. 61010-1-04 ANSI/UL Standard 913-2004 ANSI/UL Standard 1604-1995 UL 60079-15 2002 UL 61010-1

Hazardous Area Approvals

Intrinsic Safety (iA)	
ATEX / IEC-Ex	Area classification depends on converter, see converter documentation for details, sensor temperature classification: T6: $T_a \leq 84^{\circ}\text{C}$ T4: $T_a \leq 114^{\circ}\text{C}$ T3: $T_a \leq 160^{\circ}\text{C}$
CSA	Area classification depends on converter, see converter documentation for details, sensor temperature classification: T6: $T_a \leq 64^{\circ}\text{C}$ T4: $T_a \leq 114^{\circ}\text{C}$ T3: $T_a \leq 160^{\circ}\text{C}$
Non-sparking (nA)	
CSA	Area classification depends on converter, see converter documentation for details, sensor temperature classification: T6: $T_a \leq 64^{\circ}\text{C}$ T4: $T_a \leq 114^{\circ}\text{C}$ T3: $T_a \leq 160^{\circ}\text{C}$

Order Matrix		PR6426 /	X	X	X	-	X	X	X
Sleeve Thread	NO THREAD	0							
Armored Cable	WITH WITHOUT		1 0						
Total Sensor Length	Mounting Plate 80 mm x 40 mm			0					
Adaptor Plug	WITH WITHOUT					0 1			
Total Cable Length	0(4 m), 1(5 m), 2(6 m), 3(8 m), 4(10 m)						X		
Cable End	LEMO OPEN							0 1	

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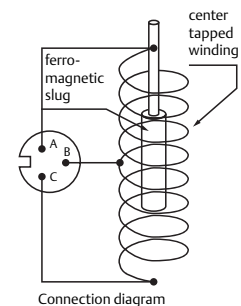
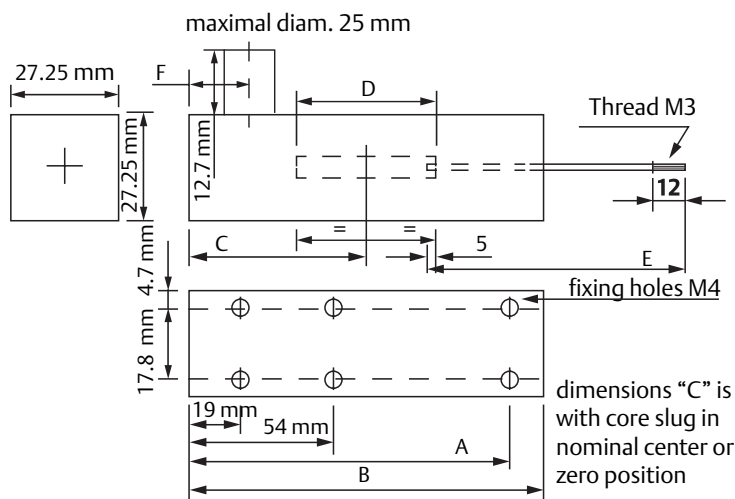
Inductive Sensor

Surface contact sensor designed for critical turbomachinery applications such as steam, gas and hydro turbines, compressors, pumps and fans to measure radial and axial shaft dynamic displacement, position and eccentricity. The PR9350 is designed to work under tough environmental conditions.

Dynamic Performance	Range	Sensitivity	Linearity Error
PR9350/01	±12 mm	110 mV/V	3.5%
PR9350/02	±25 mm	270 mV/V	3.5%
PR9350/04	±50 mm	270 mV/V	2.5%
PR9350/06	±75 mm	310 mV/V	2.0%
PR9350/08	±100 mm	310 mV/V	2.0%
PR9350/12	±150 mm	340 mV/V	1.5%
Environmental			
Operating Temperature Range		-20 to 100°C (-4 to 212°F)	
Temperature Error		<3%	
Power & Electrical			
Supply Voltage		5 V _{rms}	
Carrier Frequency		3 to 5 kHz	
Capacitance		250 pF (each winding)	
Accessories			
Includes Solenoid plunger with M3 threaded rod, Connector Cannon CA06COME10SL3S44 ITT Can			



Physical							
	Grams	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)
PR9350/01	170	N/A	76.6	39.2	60.3	85.1	16
PR9350/02	255	108	127	65.4	76.2	123.2	25.4
PR9350/04	370	197	229	112	150	144.1	25.4
PR9350/06	510	311	330	169.5	200	238.1	25.4
PR9350/08	660	413	432	218.8	247.7	292.1	25.4
PR9350/12	860	616	635	319.9	342.9	311.2	25.4



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