Reliability Solutions for **Power Generation**

Intelligent Field Device Management | Machinery Health Management | Workflow & Collaboration

Field-Proven, State-of-the-art Reliability Solutions

Emerson's AMS reliability portfolio helps the world's power producers improve reliability of every asset throughout their value chains.

AMS

EMERSON

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Recognize the Challenges

Power generation is not what it used to be. Aging infrastructure and growing market demands due to population shifts, data centers, and electric vehicles are making the grid even more vital than ever. Global pressures to deliver an increasing percentage of power from renewable sources has ironically placed even greater pressure on conventional fossil-fueled sources. Suddenly, assets that were designed and used for base load are being used for peaking and intermittent duties instead, coming up and down several times a day or week rather than in intervals measured in months or years. As a result, assets that were never originally intended to endure the cyclic stresses of multiple starts and stops suddenly find themselves having to cope.

At the same time, cleaner sources like nuclear, geothermal and hydro must be more reliable than ever due to the quasi-sporadic nature of solar and wind sources that simply cannot be available 24/7/365, nor presently comprise sufficient capacity to power the world.

And, for much of the world that must still rely heavily on simple-cycle coal plants, their power generation assets must likewise be more reliable than ever to meet the needs of their growing populations and growing economies.

For all of these reasons, now – more than ever – you simply cannot afford to be operating with anything less than top-quartile performance when it comes to your assets:

> 97% reliability
> 95% of faults detected well in advance of asset functional failure
< 1% unplanned downtime

Nearly 90% of failures cannot be predicted by calendar- or running hour-based approaches[1], necessitating a different approach – in many cases, condition-based.

Grid cybersecurity continues to increase in importance; the average cost of a cyber incident is now nearly $5 million USD[2].

Nearly 87% of the world's power still comes from sources besides solar and wind[3].

1. **Nowlan and Heap**
2. **Cybersecurity – is the power system lagging behind? – Analysis – IEA**
3. **Electricity Mix - Our World in Data**

Stay Ahead of the Challenges

Emerson helps position your maintenance, reliability, and operations teams to anticipate and successfully meet challenges. Armed with monitoring and prediction, diagnostics and intelligent design, comprehensive understanding and planning, you have tools to reduce downtime, improve safety everywhere, and alleviate concerns about staff, resources, and costs.

Optimize equipment operation while reducing unplanned downtime

- Uncover developing faults to move from unplanned to planned downtime
- Leverage real-time data to make more effective/efficient business decisions – both onsite and remotely
- Optimize operations by creating a comprehensive picture of machinery health
- Increase overall equipment effectiveness and mean time between failure while enabling better outage planning based on measurable asset health and needs
- Easily and economically address every piece of applicable equipment with right-sized monitoring technology

Improve safety and compliance even in remote locations

- Meet challenges using actionable machinery health information
- Comply with regulations more easily by using applications set for purpose
- Create a safe environment through remote access to production equipment
- Activate remote condition monitoring to reduce exposure to isolated locations

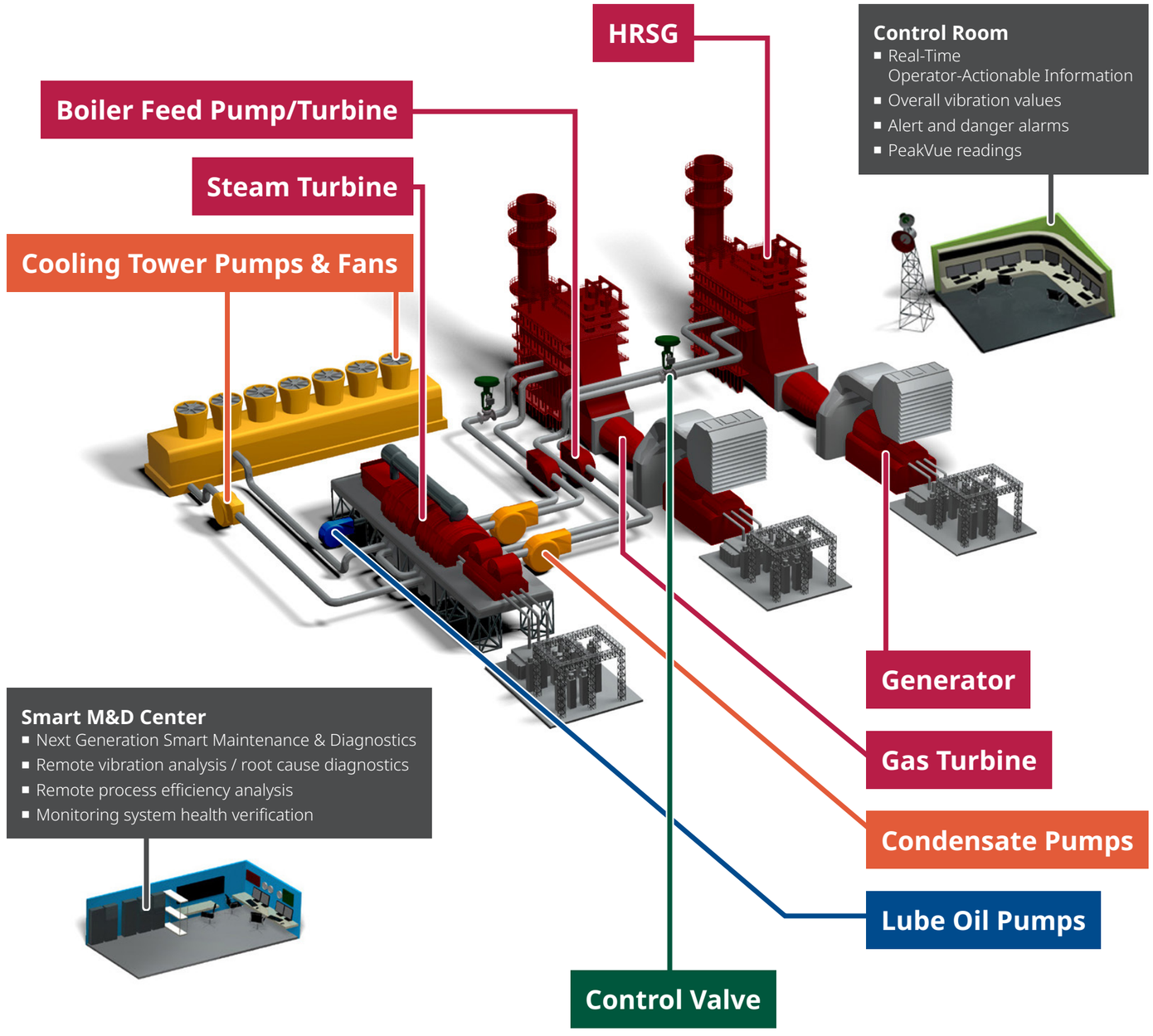
Ease staff, resource, and cost concerns

- Automate processes to assist staff
- Detect faults early to reduce costs
- Address water, fuel, and other resource costs
- Reduce operational costs

Plant-wide Solutions

Combined-Cycle is just one of the many types of plants we can address*

	Assets & Components	Root Causes	Reliability Solutions
Critical	Turbines	Bearing failures, misalignment, bowing, imbalance, rubs, oil availability or instabilities, transient events during startup/shutdowns/changes in load	AMS 6500 ATG Ovation™ Machinery Health™ Monitor
	Heat Exchanger and the associated instrumentation	Premature wear, discrepancies in actual and expected louver position, pressure and flow issues	AMS Asset Monitor Ovation Machinery Health Monitor AMS Trex and/or AMS Device Manager
	Feedwater pump and the associated instrumentation	Bearing failures, misalignment, bowing, imbalance, rubs, oil availability or instabilities strainer plugging, seal and pressure issues, leaks	AMS 6500 ATG Ovation Machinery Health Monitor AMS Trex and/or AMS Device Manager
	Turbine Overspeed	Grid failures and sudden load throw off	AMS 6300 SIS
Essential	Circulating Water System including: cooling tower fans, cooling tower water pumps, traveling screens, water circulating pumps and the associated instrumentation	Bearing loads, abrasive conditions, lubrication contamination, misalignment, imbalance, cavitation, broken gear teeth overflow/undersupply conditions, seal and pressure issues, premature wear, and leaks	AMS Asset Monitor or AMS Wireless Vibration Monitor AMS Trex and/or AMS Device Manager
	Compressed Air Systems including: compressors and drive motors	Bearing loads, corrosive conditions, lubrication contamination, misalignment, imbalance, broken gear	
	Fuel Gas Compressors	Bearing loads, corrosive conditions, lubrication contamination, misalignment, imbalance	
Balance-of-Plant	Fans	Bearing loads, abrasive conditions, lubrication contamination, misalignment, imbalance	AMS Wireless Vibration Monitor or AMS 2140 AMS Trex and/or AMS Device Manager
	Lube oil pump and the associated instrumentation	Bearing loads, abrasive conditions, lubrication contamination, misalignment, imbalance, cavitation strainer plugging, seal and pressure issues, leaks	
	Gearboxes	Bearing loads, abrasive conditions, lubrication contamination, misalignment, imbalance, broken gear teeth	
Field Device Management	Valves and Instrumentation	Emission loss, mechanical issues, valve positioning, increased friction/stiction, leaks	AMS Trex and/or AMS Device Manager



*Refer to page 10 for a comprehensive list of plant types

No Plant Left Behind

Emerson's comprehensive AMS portfolio addresses all your valuable power generation assets – no matter how you produce power

SIMPLE CYCLE

- Steam turbine generators
- FD, ID, PA, SA Fans
- Boiler Feed Pumps
- Coal Crushers / Pulverizers
- Condensate Pumps
- Conveyors
- Valves / Actuators
- Controls
- Field Devices

CONCENTRATED SOLAR

- Steam Turbine Generators
- Pumps
- Heat Exchangers
- Fans
- Valves / Actuators
- Controls
- Field Devices

COMBINED CYCLE / CHP

- Steam Turbine Generators
- Gas Turbine Generators (aeroderivative and industrial)
- HRSGs
- Heat Exchangers
- Condensate Pumps
- Cooling Tower Fans
- Boiler Feed Pumps
- Valves / Actuators
- Controls
- Field Devices

GEOTHERMAL

- Steam Turbine Generators
- Turbo-Expanders
- Pumps
- Heat Exchangers
- Fans
- Valves / Actuators
- Controls
- Field Devices

NUCLEAR

- Steam Turbine Generators
- Reactor Coolant Pumps
- Reactor Recirculation Pumps
- Containment Air Fans
- Feedwater Pumps
- Cooling Water Pumps
- Seawater Pumps
- Heat Exchangers
- Cooling Tower Fans
- Condensate Pumps
- Circulating Water Pumps
- Valves / Actuators
- Controls
- Field Devices

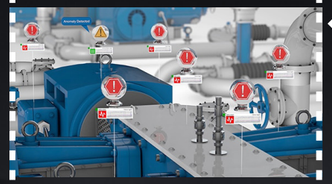
HYDRO

- Hydraulic Turbine Generators
- Motors / Pumps (Pumped Storage)
- Wicket Gates
- Penstocks
- Spillway Gates
- Valves / Actuators
- Controls
- Field Devices

No Asset Left Behind

The right technology with the right balance of features to economically address every asset – whether machinery or instrumentation

AUTOMATED DIAGNOSTICS



aspentech | EMERSON

EAM / CMMS

IBM MAXIMO

SAP

OPEN, BI-DIRECTIONAL, REAL-TIME INTERFACES

SOFTWARE

AMS OPTICS

AMS MACHINE WORKS

AMS DEVICE MANAGER

HARDWARE

ONLINE, CONTINUOUS PROTECTION AND PREDICTION

AMS 6500 ATG

OVATION™ MACHINERY HEALTH™ MONITOR

ONLINE, CONTINUOUS PREDICTION

AMS ASSET MONITOR

AUTOMATED, INTERMITTENT PREDICTION

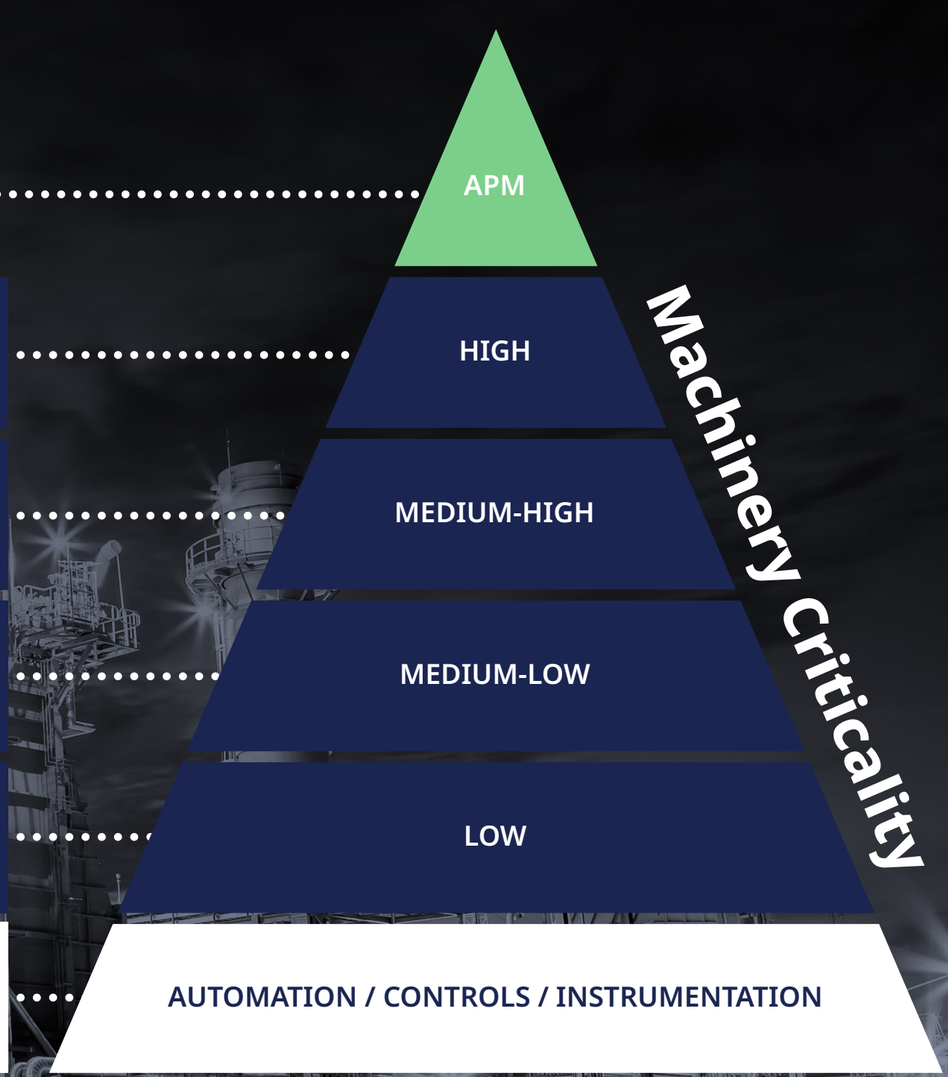
AMS WIRELESS VIBRATION MONITOR

OFFLINE, ROUTE-BASED PREDICTION

AMS 2140

ONLINE & OFFLINE FIELD DEVICE DATA

- AMS TREX
- CALIBRATORS
- CONTROLLERS
- MODEMS
- WIRELESS GATEWAYS



Watch Video

Technology: PeakVue for Machinery Analysis

For anyone who has ever looked at a vibration waveform, spotting the subtle bearing condition indicators within the complex signal can be like listening for the sound of a wind chime amidst a hurricane.

Enter our PeakVue technology.

Emerson pioneered PeakVue technology to help ensure the information you're after doesn't get swamped by noise and other parts of the vibration signal, meaning you can pick that proverbial needle out of the haystack with ease.

The result is a single, trend-able variable that relies on impacting occurring in the bearing – a far better indicator of health than other methods – but requiring sophisticated signal processing to extract. Signal processing that we pioneered and perfected. And signal processing that we've now made even better with PeakVue *Plus*.

PeakVue has proven itself over the last two decades across thousands of customers that use it daily to assess bearing health. You'll now find the technology across our entire portfolio, whether in our portable data collection solutions, our AMS Asset Monitor, our 6500 ATG platform, or our wireless solutions.

Peruse our rich library of resources to learn more about this amazing technology and why Emerson remains at the forefront of innovation and ease-of-use in products that cut through the complexity of machinery analysis, making improved machinery health accessible to everyone.

Landing Page: All things PeakVue

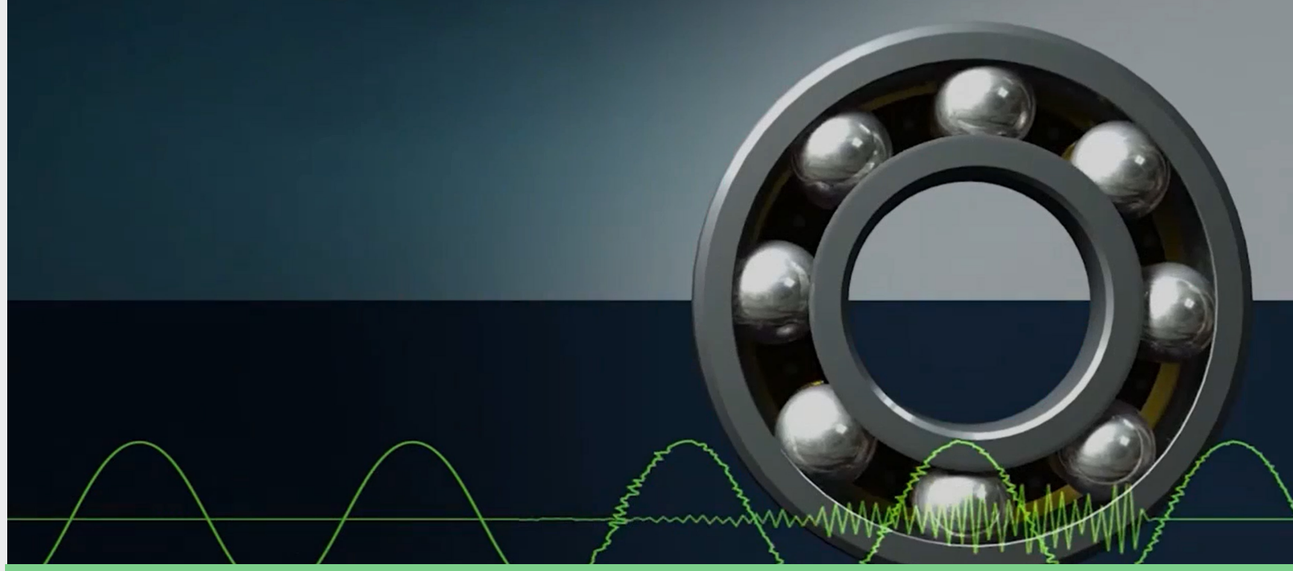
Whitepaper: PeakVue Plus

Video: What is PeakVue?

Video: PeakVue and PeakVue Plus

Video: PeakVue Signal Processing Demonstration

PeakVue in Action: 10 Case Histories across multiple industries



CASE HISTORY

Asset: Atomizers
Products: Vibration Transmitter

A power plant had been experiencing frequent bearing failures on an atomizer – about every 3 months. Finding a solution called for a collaborative approach between the plant's Operations and Maintenance teams. The decision was made to install accelerometers on each of the machine's bearings, routed to vibration transmitters capable of PeakVue measurements. The readings could then be continuously monitored by operators in the control room.

After installation, the machine was started. Although conventional vibration readings were all normal or below normal, the PeakVue readings immediately showed a problem at one of the bearings. Shortly thereafter, elevated readings also began to appear at an adjacent bearing and a decision was made to immediately shut down. The bearing was replaced, but root cause was not investigated. The machine was then restarted and problems again began to manifest almost immediately. Maintenance was again called to investigate, this time to determine root cause. The culprit was found to be a clogged grease fitting that was not allowing aequate lubricant to reach the bearing, resulting in continual, premature failure. The fitting was replaced and the machine has now run without incident for more than two years.

READ STORY

Earlier Warning: PeakVue technology allowed personnel to see problems long before they would manifest in conventional vibration readings and when more extensive bearing damage would have occurred. Intervention can thus occur before catastrophic failure and costly downtime ensues.

Operator Visibility: By putting asset information in front of operators, asset condition could be more easily watched in a simple, easy-to-understand trend indicating severity. No special machinery analytical skills were required.

Emissions Compliance: Atomizers are used to scrub SOx from power plant flue gas. Excessive emissions translate to fines. Keeping atomizers running at all times is thus critical to ensuring the plant can generate at full capacity and is available when needed.

Product Application: Critical Machinery

Critical Assets are typically those that represent not only large repercussions in terms of process downtime, but very large repair costs, very long lead times for parts or repairs, and safety implications for personnel and/or the environment due to the materials being handled and the entrained energies involved.

These assets warrant the most comprehensive protection systems available – capable of acting within milliseconds – and very sophisticated condition monitoring, allowing issues to be predicted before they progress to the need for the safety shutdown functionality to act.

- To achieve adequate lead-time and detection of problems, critical assets warrant **online monitoring**.

- To assure safety of the environment and personnel, and to constrain collateral damage and economic losses, critical assets warrant **protection system functionality**.

- Because problems must be spotted before they progress to the need for a trip, critical assets warrant **prediction system functionality** that never misses important data and maintains a continuous record of conditions.

- Our **AMS 6500 ATG** is designed specifically for these assets, accompanied by AMS Machine Works software.

- Our companion **AMS 6300 SIS** is designed for those assets that also require overspeed protection, providing overspeed in a separate and distinct system as required by API 670.

CASE HISTORY

Asset: Large AC Motors
Products: AMS 6500 and software

When a midwestern energy cooperative's FD Fans were installed in the 1970s, they were driven by a unique and now-discontinued motor design – so unique that a true form/fit/function replacement would be impossible. The best they could hope for was to locate something partially compatible and then heavily modify it. This meant a developing failure had to be detected and tracked many, many months (perhaps even several years) in advance to allow time for a suitable motor replacement to be secured and then successfully modified.

When early signs of problems began to manifest, the plant fealized that it could no longer rely on periodic, route-based data collection to track the progressing failure. That approach simply could not deliver adequate advance warning and a rapid, undetected failure progression could shut down the entire plant for several weeks at a cost of millions of dollars as the plant obtained power from other sources. A continuous monitoring system from Emerson was chosen and the fan was successfully monitored for more than 2 years, delivering a high level of confidence in bearing condition while a suitable replacement motor was eventually found and replaced in a planned fashion, avoiding any costly unplanned downtime.


POWER

Online Vibration Monitoring Gives Power Cooperative Time to Replace Rare Motor

RESULTS

- Saved more than $400,000 by preventing unplanned downtime.
- Enabled predictive maintenance of critical machinery.
- Improved reliability of critical motor/fan units.

APPLICATION

"That fan motor might have run for another 16 months, but we couldn't afford to take the risk. It's been very close to a catastrophic failure costing thousands of dollars in downtime and equipment damage."

CUSTOMER

CHALLENGE

AMS

EMERSON

READ STORY

Product Application: Essential Machinery

Essential assets are typically those that don't necessarily present safety issues to the environment or personnel, but they do present significant implications to the process if they cannot run – or run at reduced capacity. While the asset itself may be quite expensive, it is often the repercussions on lost or curtailed production that are of primary concern.

The key with these assets is that problems must be spotted well enough in advance to ensure that production will not be impacted waiting for spare parts to arrive or because the failure has progressed to the point that the asset must operate at reduced capacity – or be taken offline. Even if the asset is redundant, there is often no guarantee that the standby asset will run when called upon.

- To achieve adequate lead time and detection of problems, essential assets warrant **online monitoring**.

- Those that are "most essential" (but still essential) will typically warrant an approach as embodied in our **AMS Asset Monitor** where sensors are wired and local signal conditioning, signal processing, predictive analytics, and alarming is done – without any reliance on connections to the cloud or distant AI/ML. Instead, **all processing and intelligence occurs at the edge**. Polling of all inputs occurs continuously and developing issues can be spotted in seconds – not minutes, hours, or days.

- Those that are "less essential" (but still essential) will often warrant an approach as embodied in our **AMS Wireless Vibration Monitor** where the sensors are wireless and the polling of conditions and alarming occurs less frequently – but still multiple times per day.

CASE HISTORY

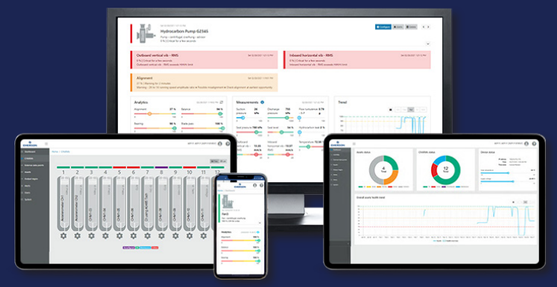
Asset: Fans
Products: AMS Asset Monitor

A customer monitors six essential fans via our AMS Asset Monitor. During startup, all six alarmed on lubrication-related issues based on the edge analytics within the device. The issue was checked, confirmed, remedied, and all fans returned to acceptable conditions, averting premature failures.

Later, one of the fans was in distress and root cause was found to be a frozen intake duct. Other intakes throughout the facility were inspected as a proactive measure and also found to be frozen, averting the need to curtail the process.

Still later, it was found that a fan was operating too close to a resonance condition. New guidelines were established for operators to avoid running the fan in that region.

The system was so successful that it is now being extended to the customer's other facilities.



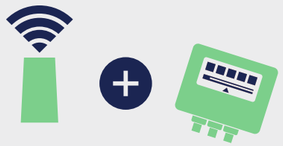
Product Application: Balance-of-Plant Machinery

Balance-of-Plant assets generally mean those that are monitored not so much because them have large process impacts, but because they collectively represent large maintenance costs if simply allowed to run to failure. Because they are often so many such assets, it can become “death by a thousand cuts.”

The key to such assets is identifying the correct maintenance strategy. If a condition-based maintenance strategy is the right approach, based on risk of failure, probability of failure, and mechanism of failure, then the choice becomes one of which technology to use: online or offline.

Emerson’s AMS portfolio offers world-class solutions for each scenario.

- The primary reason for monitoring BoP assets is to **reduce maintenance costs** associated with poor reliability. A mix of **online and offline** approaches are used for this class of assets.



- For those assets that are difficult or dangerous to access, or which have failure mechanisms that occur faster than can be addressed with a route-based approach, or you want to automate data collection and use your personnel for higher value functions, our **AMS Wireless Vibration Monitor** is an ideal solution. It collects data at intervals measured in hours – not days or weeks – and delivers the same high-quality data (including PeakVue Plus) that is available from our manual, route-based solution.

- For those assets that can be adequately addressed by a route-based, manual approach, there is simply no better solution than the **AMS 2140**. Our route-based products have led the industry ever since we introduced them in the 1980s and pioneered the approach.

CASE HISTORY

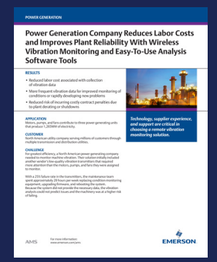
Asset: Fans, Pumps, Motors
Products: AMS Wireless Vibration Monitor | AMS Machine Works

Numerous balance-of-plant assets are used at a customer’s plant producing more than 1.2 GW of electricity across three large turbine-generator trains.

Adopting a mix of online and offline approaches for these BoP assets, their offline approach used our AMS 2140 data collector/analyzer. However, their online approach initially used another vendor’s vibration transmitters. Unfortunately, the poor quality of the devices resulted in a transmitter failure rate of 25%, ultimately requiring more attention for the transmitters than for the assets they monitored. This resulted in an unacceptable situation necessitating 20 hours per week of instrument maintenance.

Also, because the devices were incapable of proving the necessary dynamic waveform data needed for diagnostics and predicting failures, the machinery remained at an elevated risk of failing.

As an existing AMS 2140 customer, they turned to us for a solution: our AMS Wireless Vibration Monitor along with AMS Machine Works. Through extensive testing and side-by-side comparison, they found that the wireless solution delivered similar capabilities as their AMS 2140, but with quasi-continuous data updated every few hours. The result was effectively the same data and diagnostic capabilities as with a route-based approach, but with collection intervals 50-100 times more frequent. This allowed them to deploy a right-sized approach of technologies to cover all of their BoP assets effectively.


POWER GENERATION

Power Generation Company Reduces Labor Costs and Improves Plant Reliability With Wireless Vibration Monitoring and Easy-To-Use Analysis Software Tools

RESULTS

- Reduced labor cost associated with collection of vibration data
- Improved overall situation data for improved monitoring of conditions or rapidly developing new problems
- Reduced risk of incurring costly contract penalties due to plant derating or shutdown

Technology, supplier experience, and support are critical in choosing a remote vibration monitoring solution.

APPLICATION

DEVELOPMENT

EMERSON

READ STORY

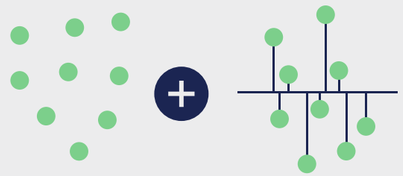
Product Application: Valves and Field Devices

While the machinery engineers of the world are understandably focused on rotating assets like turbines and fixed assets like heat exchangers and piping, there's another very important category of assets in your power plant: instrument and control apparatus.

The interaction between instruments and machinery can be very impactful. For example, think about the issues caused by over-firing a boiler and the costs this represents over time – along with unnecessarily premature aging of the asset – all caused by a faulty valve or transmitter.

Just like machinery engineers rely on Emerson for solutions to assess and manage machinery health, instrument and control professionals can likewise rely on us for solutions that assess the health of their automation and field device assets.

- Assuring the health of I&C assets requires a mix of **online and offline** approaches. Smart devices can typically communicate continuously over wired and wireless networks, and simply need a server that can poll and store the data they provide. In contrast, other devices not accessible via a network can be addressed with portable instruments such as AMS Trex to collect data, upload/download device configuration details, valve diagnostics, and more.



- **AMS Device Manager** is a comprehensive package that commissions and collects data from a large variety of devices, allowing you to perform predictive maintenance and manage those asset in much the same way you manage your machinery – but tailored to the unique needs of I&C professionals.

- **AMS Trex** is a ruggedized, portable communicator designed for testing and managing intelligent field devices, regardless of manufacturer.

CASE HISTORY

Asset: Valves
Products: AMS Device Manager

A North American 120 MW combined-cycle plant has approximately 150 valves. As part of a conversion from simple-cycle gas-fired steam turbine operation to combined-cycle operation in 2001, a gas turbine and HRSG were added to quintuple power output while lowering emissions by 50%. The plant engineering manager challenged maintenance personnel to investigate the economic case for a valve management/valve health solution and whether it should be included in the repowering project's budget/scope. The business case was made, and AMS Device Manager was ultimately included in the project, delivering value ever since.

Time Reduction: 600 hours per year have been saved that were previously spent manually assessing and diagnosing valve health issues.

Easier Device Data Access: Valves in hard-to-reach locations can have their status and health ascertained remotely in just minutes versus the 30-60 minutes required previously.

Efficiency Improvement: With limited staff, every hour saved on non-essential activities is important. The time to troubleshoot a faulty valve was cut in half through adoption of Emerson's valve health/valve management solution.


POWER

Gainesville Regional Utility Improves Productivity with AMS Suite: Intelligent Device Manager

RESULTS

APPLICATION

CUSTOMER

CHALLENGE

"This was money well spent; the AMS Device Manager has exceeded our expectations. Increased operational confidence, less software patching increases productivity, and that's the bottom line in any business."

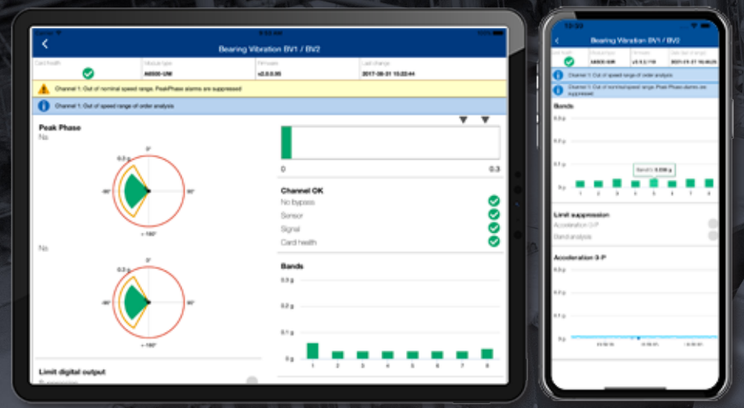
AMS

EMERSON

READ STORY

AMS 6500 ATG

Integrated protection and prediction for your most critical assets



The protection you need. The condition monitoring you rely on.

The AMS 6500 platform has been protecting the world's most important machinery for more than two decades, establishing a rock-solid track record of reliability. With the release of the next-gen AMS 6500 ATG enhancements, we've made a great product even better with all the functionality needed by power generation operators.

Features such as a universal monitoring card reduce your spare parts burden from many cards to just a handful. Our embedded "flight recorder" means you never miss capturing full-fidelity, critical event data during alarms or shutdowns – even if network connectivity is intermittent or missing entirely.

With embedded PeakVue capabilities, your critical machinery with rolling element bearings can be addressed just as capably as your fluid-film bearing machinery.

But you also need more than just protection for your critical machinery and with the AMS 6500 ATG platform, you're getting the very best the industry has to offer: world-class protection and world-class condition monitoring with world-class cybersecurity thanks to all-new, embedded data diode capabilities.

And, for assets that need the advanced condition monitoring capabilities of AMS 6500 ATG but without protection, the system can be easily configured and deployed for CM-only applications when functionality beyond our AMS Wireless Vibration Monitor and AMS Asset Monitor are required.

Learn More

- **Landing Page: AMS 6500 ATG**
- **Catalog Page: AMS 6500 ATG**
- **Article: Feel the Pulse**
- **Video: Scalable Prediction Opportunities**
- **Video: Protection System Modernization**
- **Video: 6500 ATG Protection System Embedded Prediction**
- **Case Study: AMS 6500 for FD Fans**
- **Product Data Sheet: Protection + Prediction**
- **Product Data Sheet: Prediction-Only**
- **Connect with an Expert**

AMS 6300 SIS Digital Overspeed System

Rapid, redundant, and highly reliable overspeed detection that meets API 670

When the stakes couldn't be higher.

Nothing can ruin your day quite like an overspeed event. Unlike other types of vibration-related events, an unrestrained overspeed event doesn't just have the potential to destroy the machine – the collateral damage can be severe, endangering both property and personnel as blades are liberated, components become projectiles – and for steam turbines – the pressure vessel that is the turbine case releases high-temperature, high-pressure steam with potentially catastrophic effects.

API 670 requirements take this fully into account by mandating systems that must be lightning fast – capable of responding in less than the time it takes to blink your eye: 40 milliseconds. And to ensure no missed trips while also minimizing false trips, steam and gas turbines require redundancy of not just sensors, but protective tachometers dedicated to the overspeed measurement and not used for speed control.

The AMS 6300 Safety Instrumented System (SIS) was designed specifically for overspeed detection and specifically to fully address the requirements of API 670, resulting in a modern, reliable, 2-out-of-3 voting system backed by the expertise and strength of one of the strongest names in the business: Emerson. And, it carries a SIL3 certification from TÜV, a recognized global leader in Safety Integrity Level (SIL) certification.

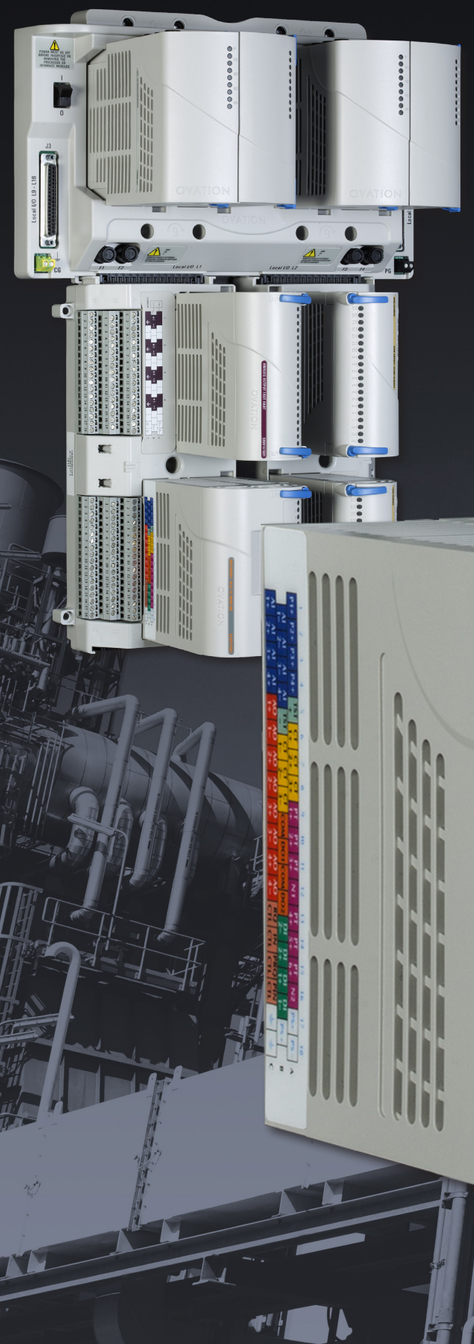
The system is designed for use on gas and steam turbines, variable frequency drives, and any asset that can enter overspeed conditions. This is especially critical on machines in power generation service that can incur instantaneous loss of load, such as a main generator breaker opening.

Learn More

- **Catalog Page: AMS 6300 SIS**
- **Video: AMS 6300 SIS**
- **Product Data Sheet**
- **Connect with an Expert**

Ovation™ Machinery Health™ Monitor

Fully integrated protection and prediction with your Ovation™ DCS



The power and performance of a stand-alone vibration monitoring platform in the convenience of an Ovation™ module.

Emerson's Ovation™ Automation Platform is a very popular choice for plant distributed control in the power generation sector – embodying six decades of Emerson's expertise in the control of power generation facilities. The Ovation platform features capabilities vital to the power sector – like world-class cybersecurity, integrated Safety Instrumented System (SIS) functionality, integrated machine control for gas, steam, and hydro turbines – and now, integrated vibration monitoring.

In the past, an integrated solution often meant sacrificing functionality – particularly easy connectivity to condition monitoring. With our Ovation Machinery Health Monitor (MHM), you not only get the same machinery protection functionality that you've come to trust in the AMS 6500 ATG platform, but the same connectivity to AMS Machine Works software as well. Easier, seamless integration to your control system without stranding yourself from being part of a powerful asset management ecosystem like AMS Machine Works, AMS Device Manager, and AMS Optics.

Ovation MHM truly delivers the best of both worlds: integrated API 670-compliant protection with your DCS and connectivity to the asset management software you need as part of a plantwide asset health ecosystem.

Learn More

- **Landing Page: Ovation™ Machinery Health™ Monitor**
- **Catalog Page: Ovation™ Machinery Health™ Monitor**
- **Overview Brochure: Ovation™ for Control, Protection, and Condition Monitoring**
- **Video: Ovation Machinery Health Monitor**
- **Video: Automated Rotating Equipment Diagnostics with Ovation**
- **Case Study: Combined Cycle Plant, Indiana USA**
- **Brochure: Ovation for Control and Monitoring of Cooling Towers**
- **Product Data Sheet**
- **Connect with an Expert**

AMS Asset Monitor

Embedded, real-time analytics at the edge

Online protection and prediction for essential machinery.

Our award-winning AMS Asset Manager is revolutionizing the industry by putting analytics at the edge rather than in the cloud. This approach allows real-time, intelligent condition monitoring that can instantly notify you of developing problems on your power plant's fixed equipment such as heat exchangers as well as rotating equipment such as pumps, fans, motors, gearboxes, pulverizers, blowers, and more. A library of more than a dozen templates allow AMS Asset Manager to go to work right out of the box, with minimal configuration. And, for machinery with rolling element bearings, embedded PeakVue technology ensures that you have the industry's most innovative and reliable detection capabilities at your disposal.

Because the AMS Asset Monitor is based on Emerson's innovative CHARMS architecture, the same I/O modules as used in our award-winning DeltaV™ Distributed Control System are at your disposal. In addition to vibration and speed, choose from temperature, discrete, and analog inputs as well as discrete outputs for alarming and even machinery protection where the cost of an API 670-compliant architecture – such as our AMS 6500 ATG – isn't warranted: lower-criticality assets that still benefit from continuous monitoring.

AMS Asset Monitor takes the hard work of analyzing data and does it for you with a simple 5-level alarming scheme that uses the embedded, predictive analytics to tell you not just that a problem is present, but what it is.

AMS Asset Monitor is also designed to seamlessly connect* to our AMS Machine Works software, ensuring it can be part of your plantwide asset health ecosystem and available to your AMS Optics dashboard.

*A connection to AMS Machine Works is entirely at the user's discretion. It is not required for AMS Asset Monitor to perform automatic analytics and produce intelligent advisories.

Learn More

- **Landing Page: AMS Asset Monitor**
- **Catalog Page: AMS Asset Monitor**
- **Video: AMS Asset Monitor Overview**
- **Video: AMS Asset Monitor – Emerson's New Edge Analytics Device**
- **Video: More Monitoring Benefits for More Assets**
- **Video: Improved Reliability at the Industrial Edge**
- **Case Study**
- **Brochure**
- **Connect with an Expert**

AMS Wireless Vibration Monitor

More than an IIoT sensor – a complete monitoring solution for your less-critical assets

Taking a greater percentage of your assets online – affordably.

As a pioneer in the wireless vibration space nearly two decades ago, we're not newcomers to the crowded IIoT sensing space. But unlike many others, we deeply understand power plant machinery – not just wireless communications and sensors. That means we understand what you need in a wireless sensor to truly diagnose problems and get to root cause, without constantly running to your data collector for more data. After all, what's the point of wireless sensing if you can only detect problems – not diagnose them?

With the AMS Wireless Vibration Monitor, we've advanced the industry with not just a sensor, but a true monitor. It delivers its functionality in not only a smaller footprint with longer battery life, but through dramatically improved capabilities, putting everything you need into a compact, rugged package that's barely larger than a salt shaker.

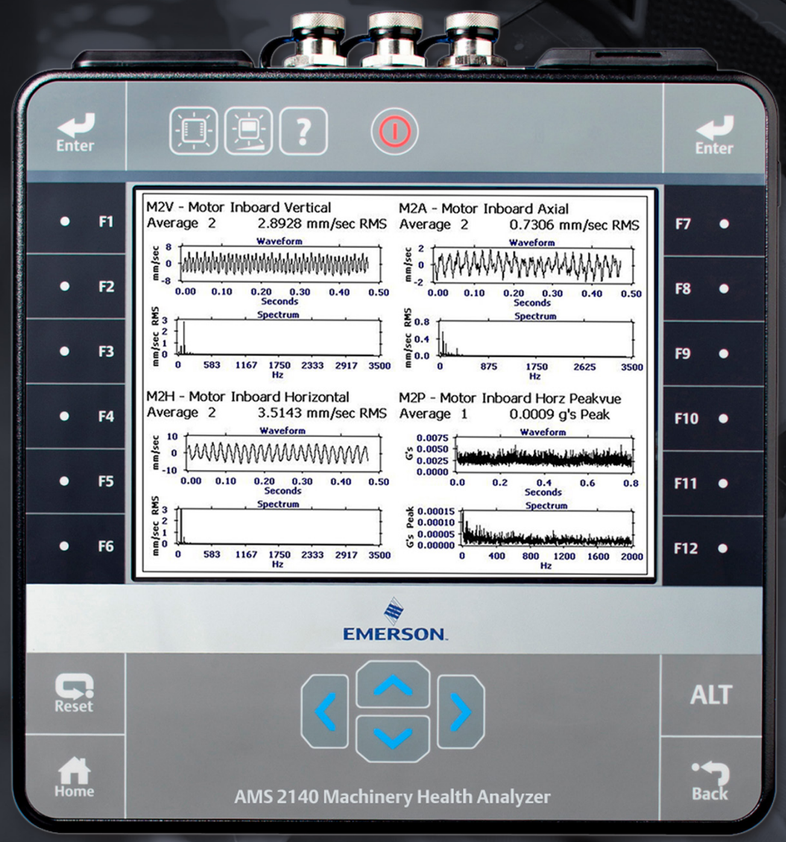
- Embedded Prescriptive Analytics
- Embedded PeakVue Plus Technology
- More Comprehensive Data Acquisition
- Easier Installation
- Field-Replaceable Battery
- Hazardous Area Approvals
- User Configurable
- Backward Compatibility with Existing **AMS 9420** Installations and ***Wireless*HART** Networks

Learn More

- **Landing Page: AMS Wireless Vibration Monitor**
- **Catalog Page: AMS Wireless Vibration Monitor**
- **Video: Innovation in Wireless Vibration**
- **Video: AMS Wireless Vibration Monitor Overview**
- **Video: Easy Installation of the AMS Wireless Vibration Monitor**
- **Brochure: AMS Wireless Vibration Monitor**
- **Article: Vibration Monitor Delivers Reliable Data**
- **Case History: Replacing Unreliable Wireless Vibration Sensors with the AMS Wireless Vibration Monitor**
- **Whitepaper: PeakVue Plus**
- **Product Data Sheet**
- **Connect with an Expert**

AMS 2140

Best-in-Class portable analyzer / data collector



The industry's gold standard for portable data collection, diagnostics, and troubleshooting.

For more than 40 years, our route-based portable data collectors and analyzers have led the industry with the most advanced features, a rich legacy of patented innovations that continue to deliver faster and more accurate data collection/fault detection, and the ergonomics and battery life that let you collect data all day across a power plant without strain.

Available in both 2- and 4-channel versions, plus tach/phase, the AMS 2140 goes where you need it to go and does what you need it to do, whether in-situ diagnostics, bump testing, transient data collection, or simply garden-variety route-based data collection that's fast and easy – particularly when triaxial accelerometers are used to dramatically cut data collection time.

Its power doesn't stop at vibration, either. The AMS 2140 features integrated balancing, laser shaft alignment, and motor current analysis capabilities.

The AMS 2140 also featured Integrated expert analytics, allowing even novice-level practitioners to conduct sophisticated troubleshooting and data analysis right at the machine.

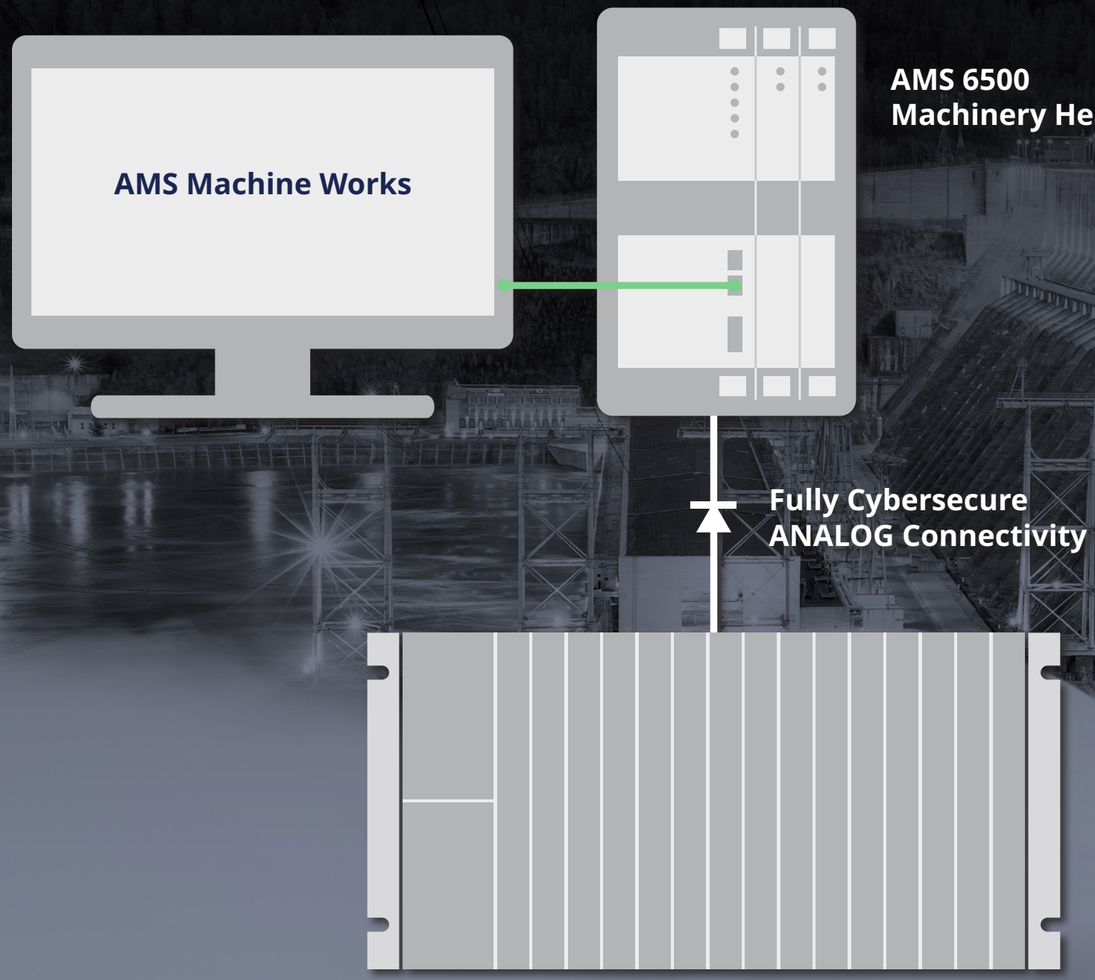
And – like all of our condition monitoring hardware – it seamlessly connects to AMS Machine Works, including wirelessly so you can be online while collecting data.

Learn More

- **Landing Page: AMS 2140**
- **Catalog Page: AMS 2140**
- **Overview Flyer: AMS 2140**
- **Whitepaper: PeakVue Analysis**
- **Video: PeakVue Technology Provides Earlier Indication of Developing Faults**
- **Video: Meet a 2140 Customer**
- **Video: 2140 Durability**
- **Article: Tuscon Electric Power**
- **Cost Saving Calculator**
- **Product Data Sheet**
- **Connect with an Expert**

AMS 6500

Secure condition monitoring connectivity with **any** underlying protection system



AMS Machine Works connectivity – no matter what you're starting with.

Let's face it. Your power plant can't afford to rip and replace non-Emerson machinery protection systems just because you need a common, plant-wide software platform for condition monitoring.

Fortunately, you don't have to.

With our AMS 6500 Machinery Health Monitor, you can simply add another hardware layer to your existing protection system – both insulating it from the outside world in cybersecure fashion while gaining full access to its raw signals for world-class condition monitoring with AMS Machine Works.

The AMS 6500 Machinery Health Monitor means you can have protection in your existing platform – no matter the manufacturer – while entrusting your condition monitoring to the power, flexibility, and precision of Emerson's AMS Machine Works.

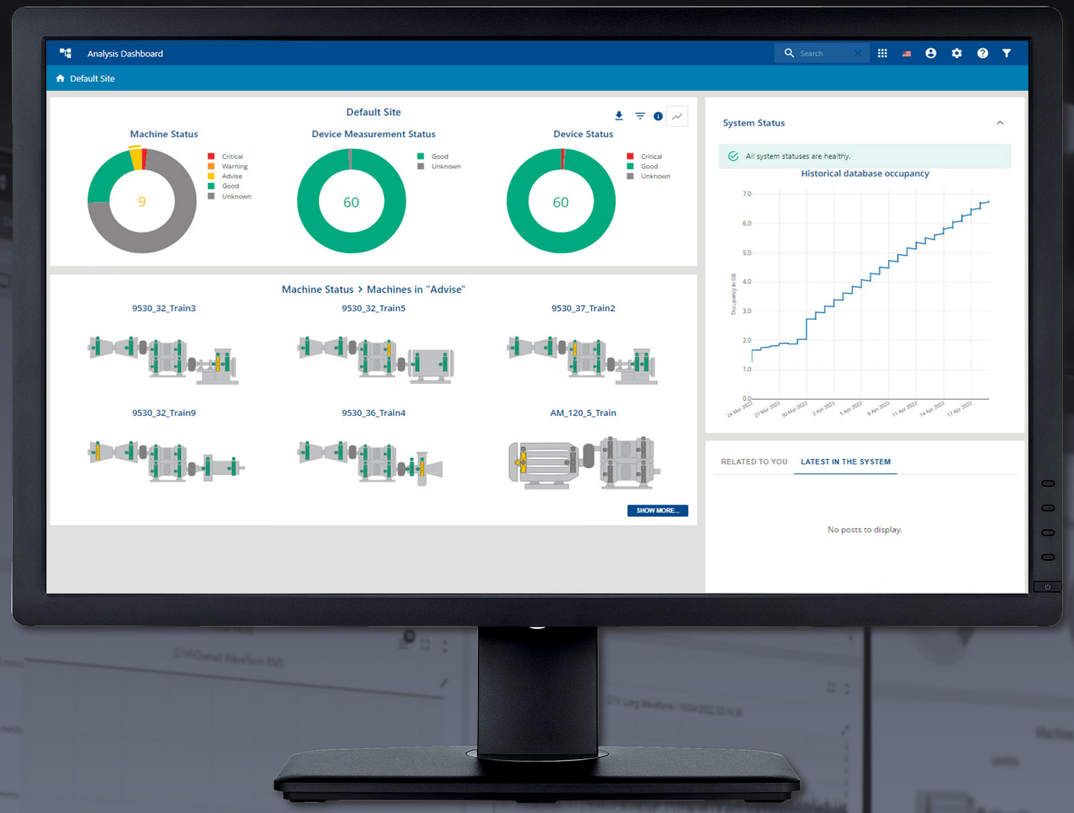
Get the AMS 6500 MHM to go.

The AMS 2600 is Emerson's portable version of the AMS 6500.

While the 4-channel version of our AMS 2140 provides an adequate number of channels for many machines, there may be times when you need more channels. Perhaps it's a large machine train with only protection and you aren't quite ready to purchase permanent condition monitoring hardware. Or perhaps the machine is partially monitored but you need to supplement it with more channels for in-depth diagnostics. Whatever the reason, our AMS 6500 MHM is available in a ruggedized case with a handle – allowing you to take the power of AMS 6500 everywhere for on-demand, temporary data acquisition of up to 24 channels – with full connectivity to AMS Machine Works.

AMS Machine Works

Plant-wide condition monitoring for every rotating asset



One application. Every machinery asset.

AMS Machine Works reimagines your machinery condition monitoring because it delivers everything you've come to expect from Emerson in the way of award-winning, industry-leading tools for data visualization and analytics, but in an entirely new user interface that is as powerful as it is modern.

With AMS Machine Works, every machinery asset you monitor is brought together in one pane of glass, regardless of where the data originates in your power plant: AMS 6500, AMS 2140, AMS Wireless Vibration Monitor, AMS Asset Monitor, or process control systems/historians.

AMS Machine Works combines predictive maintenance techniques with comprehensive, **patented analysis tools** to provide easy and accurate assessment of machinery health. And, it's part of our larger asset management ecosystem including **AMS Device Manager** for your automation and field device assets, and **AMS Optics** to provide a holistic, enterprise-wide Asset Performance Management dashboard that integrates asset health, EAM/CMMS datas, and advanced, AI/ML-powered diagnostics from **Aspen Mtell** – now a powerful **member of Emerson's family of solutions**.

Learn More

- Landing Page: AMS Machine Works
- Catalog Page: AMS Machine Works
- Video: Condition Monitoring using AMS Machine Works
- Tutorials: AMS Machine Works
- Product Data Sheet
- Connect with an Expert

DATA SOURCES

- AMS 6500 ATG
- 3RD PARTY SYSTEMS*
- AMS ASSET MONITOR
- AMS Wireless Vibration Monitor
- AMS 2140
- PROCESS DATA

*via AMS 6500 MHM

AMS Trex

Portable field device management, diagnostics, and configuration

AMS Trex. The industry's gold standard.

When it comes to portable communicators for configuring, diagnosing, and managing field devices, AMS Trex stands alone. With more than a quarter million units delivered, AMS Trex can be found in virtually every E&I department across the globe.

So why do CONTROL Magazine readers consistently rank us #1 year after year after year?

Maybe it's because AMS Trex can talk to more device types from more manufacturers than anyone else in the industry: 2,500 and counting.

Maybe it's because we've made AMS Trex equally convenient to use in the field and on the benchtop with the ability to power devices, not just communicate with them.

Maybe it's because AMS Trex is ruggedized to withstand the rigors of use in the real world – lasting 50% longer than generic tablet-based approaches and with a 56% lower total cost of ownership.

Maybe it's the large, intuitive touchscreen.

Maybe it's the AMS Trex legacy of quality and capability, refined with innovations and usability across more than three decades.

Or maybe it's all of these things.

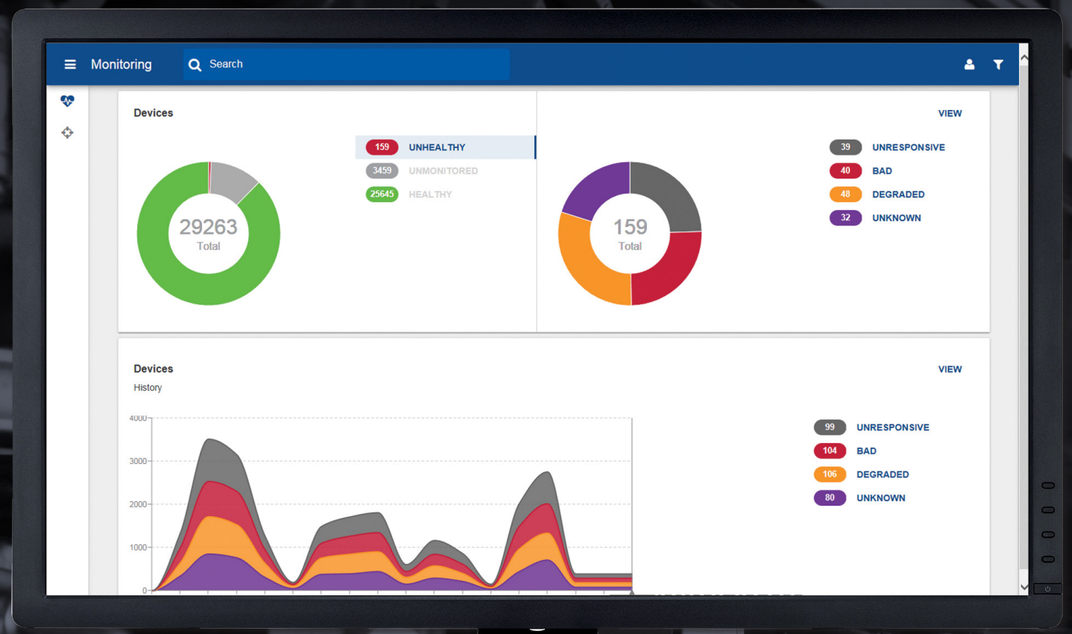
Trex puts you in control of your field devices by allowing a single, universal communicator to work agnostically across all of your installed field devices. Whether you need to configure a device, update it with new firmware, check that it's operating properly, diagnose problems, or simply gather its embedded information for archival, AMS Trex lets you carry less and do more.

Learn More

- **Landing Page: AMS Trex**
- **Catalog Page: AMS Trex**
- **Brochure**
- **Demonstrations and Videos**
- **Video: Streamline Field Maintenance with One Tool**
- **Video: Managing Device Configurations with AMS Trex**
- **Video: Performing Loop Diagnostics with AMS Trex**
- **Whitepaper: 5 Strategies to Drive Reliability**
- **Article: Power the Loop Technology**
- **Product Data Sheet**
- **Connect with an Expert**

AMS Device Manager

Full-featured management and health of automation systems and field devices



Because healthy I/O means more reliable power.

Emerson is unique in the industry in that we provide a fully integrated solution for not just your machinery assets, but your valuable automation assets as well – assets like transmitters, actuators, valves, controls, and more.

Work by EPRI nearly 50 years ago showed conclusively that valve reliability is a huge issue for the power generation industry. The ability to proactively monitor valves is just one way that the power industry finds value in AMS Device Manager. It also allows operators to help ensure compliance by managing calibration intervals for field devices and serving as a repository for calibration routines.

AMS Device Manager connects both directly to devices and to systems that use field devices – systems like turbine controls, **PLCs**, **ESDs**, **SCADAs**, and **DCSs**. This connectivity, in turn, allows AMS Device Manager to communicate with connected field devices like transmitters, actuators, and valves serving as I/O to these systems. With one connection to the system, suddenly all its compatible I/O is accessible, meaning the thousands of field devices that make up a typical power plant can be viewed and managed in one convenient and powerful application. And because AMS Device Manager is fully compatible with AMS Optics, you can bring both automation device and rotating machinery information together in a single dashboard, allowing you to manage all your assets while determining whether an issue is fundamentally due to a machine problem, a process problem, or a device controlling a machine or process.

Learn More

- **Landing Page: AMS Device Manager**
- **Catalog Page: AMS Device Manager**
- **Interactive Demo: AMS Device Manager**
- **Flyer: AMS Device Manager**
- **Video: AMS Device Manager**
- **Playlist: AMS Device Manager Videos**
- **Article: As Industry Changes, so Must Device Management**
- **ROI Calculator**
- **Product Data Sheet**
- **Connect with an Expert**

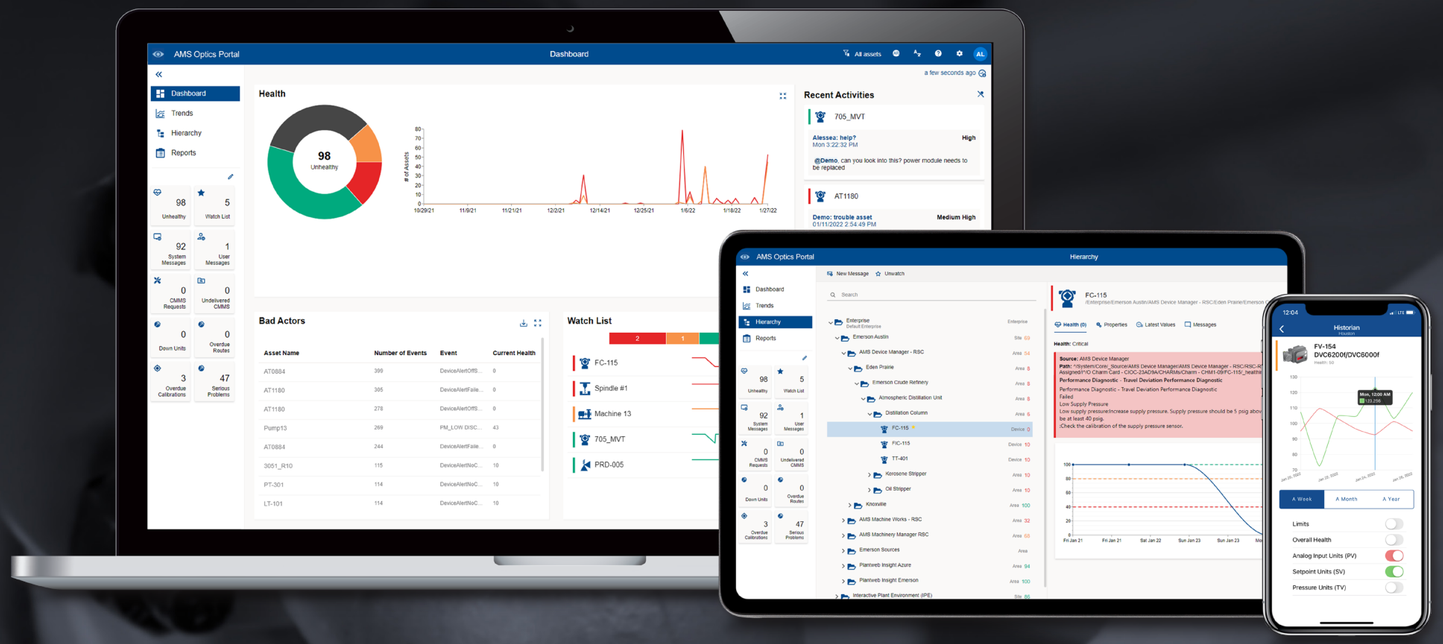
DATA SOURCES

EMERSON DELTAV DCS | EMERSON OVATION DCS | EMERSON CONTROL SYSTEMS | EMERSON WIRELESS GATEWAYS | CALIBRATORS | AMS TREX | MODEMS | 3RD PARTY SYSTEMS | MUX & FIELDBUS GATEWAYS

HART COMMUNICATION PROTOCOL | FOUNDATION fieldbus | HART-IP | WirelessHART | PROFIBUS

AMS Optics

Enterprise-wide asset performance management



Moving beyond just asset health.

Today, power generation operators are looking for more than just isolated asset health solutions. They're looking for enterprise-wide solutions that span every asset across the entire generation portfolio to ensure improved availability, reliability, and overall equipment effectiveness. They're looking for the ability to make operational decisions based on asset health – not just maintenance decisions. They're looking for the ability to integrate all available data sources. And, their looking for the ability to augment human knowledge with AI/ML, freeing personnel from the tedium of looking for problems instead of anticipating problems and staving them off – before they can get out of control.

AMS Optics is designed to deliver all of these things by knitting your asset performance management activities together under a common umbrella, viewable in a single pane of glass.

Learn More

- **Landing Page: AMS Optics**
- **Connectivity List: AMS Optics**
- **Video: Enterprise-Level Integrated Workflow and Collaboration Software**
- **Brochure: Mobile Collaboration with AMS Optics**
- **Podcast: Closing the Loop on Maintenance & Reliablity**
- **Product Data Sheet: AMS Optics + AMS Machine Works**
- **Product Data Sheet: AMS Optics + AMS Device Manager**
- **Product Data Sheet: AMS Optics**
- **Connect with an Expert**

- ☑ Connect to all of your operations data through a single, unified management interface.
- ☑ Organize multiple forms of data in context to the asset and its place in the overall enterprise so that it's ready for use.
- ☑ Conduct safer, more efficient data aggregation by optimizing the load on OT systems to prevent disruption to operations.
- ☑ Securely deliver prioritized content such as health alerts and KPIs to relevant personnel, on- or off-premise.
- ☑ Gain enhanced visibility into operational health and performance and generate real-time actionable insights.
- ☑ Collaborate with experts, on demand, to accelerate work and guide procedures.
- ☑ Transform traditional workflow practices to fully digital, automated procedures that include creating, tracking, prioritizing, executing and validating actions.

Aspen Mtell®

Actionable, powerful, and fully customizable automated diagnostics

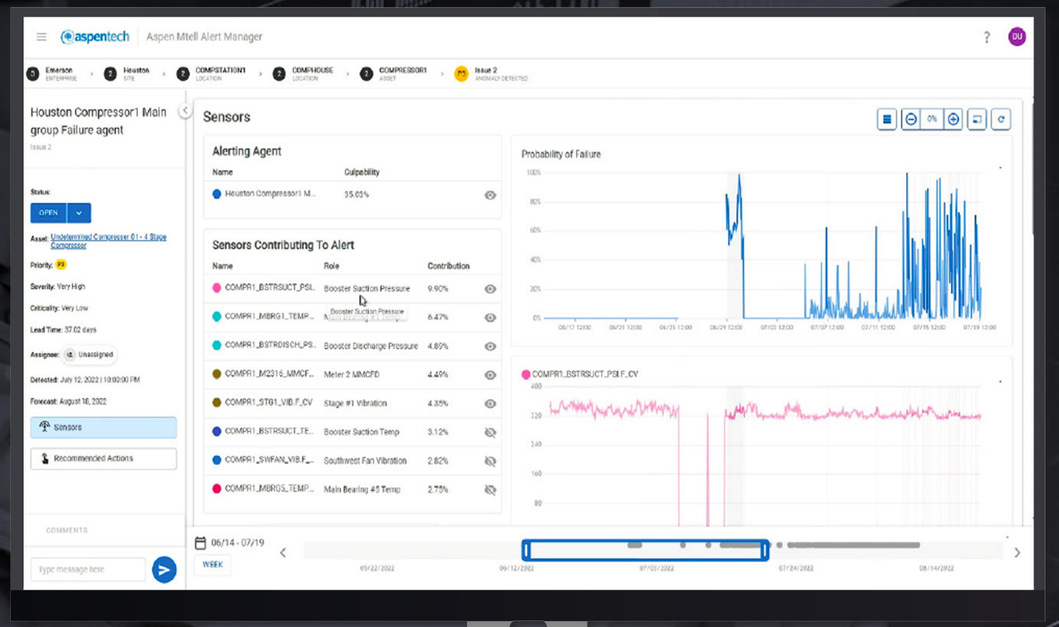
Get early and accurate warning of when an equipment failure will occur, how the failure will occur and what to do about it.

Aspen Mtell® delivers best-in-class automated diagnostics using intelligent agents that ingest data from AMS Machine Works, AMS Device Manager, process controls systems and historians, and other relevant data sources in your power generation facilities.

These agents run continuously to detect anomalies and predict failures, notifying users with intelligent advisories through the AMS Optics dashboard and driving appropriate actions in systems such as EAM/CMMS platforms.

Users can build agents using full AI/ML approaches, advanced first principles approaches, simple rules/conditional logic, and hybrids models using multiple methods.

Aspen Mtell® frees your power generation organization to move away from reliance on tedious threshold-based alarming as the primary basis for your asset health program, leveraging the power of AI/ML and first principles rules to review data, detect issues, and notify users. The result is improved detection of developing problems, longer lead times to respond to those problems, better use of personnel who no longer have to manually review data and tweak alarm settings, less unplanned downtime, better outage planning, and ultimately shorter outages because you know exactly what to work on and what can be left alone.



Learn More

- **Landing Page: Aspen Mtell**
- **Video: Improve Reliability with Aspen Mtell**
- **Video: What is an Agent?**
- **Whitepaper: Delivering on the Promise of Prescriptive Maintenance**
- **Article: Practical Asset Analytics for Reliability Engineers**

Machinery Health Sensors

Displacement, acceleration, velocity, speed – and so much more

Comprehensive coverage. Time-saving innovations.

Physically, sensors are typically the smallest element in the chain from the asset to your computer screen. But small doesn't mean unimportant. If you can't rely on the quality of your data, you simply can't make informed decisions – and it all starts with the quality of your sensors.

While our solutions are designed to work agnostically with sensors from any manufacturer, it's good to know that you can rely on Emerson for the **complete** solution. It's why when we say "sensor to boardroom" we mean just that.

Emerson's AMS portfolio comprises one of the largest selections of piezo-electric, electrodynamic, and eddy-current vibration sensors and the industry. And our quality is unrivaled. For example, our eddy-current products are designed and built in our **Gronau, Germany center of excellence** with five decades of proven expertise in building sensors and vibration systems such as our AMS 6500 and AMS 6500 ATG.

We're constantly improving, too. For example, our new AMS EZ 1000 universal signal conditioner means you no longer need different signal conditioners for eddy-current proximity probe systems – one size truly fits all for fewer spares and the confidence that you'll never be caught unprepared, forced to limp along without the critical measurements you need.

And because we're Emerson, our sensor portfolio doesn't end with vibration. You can turn to us for nearly any measurement in your plant – fully confident that we've been there, done that.

Learn More

- **Landing Page: Machinery Health Sensors**
- **Tutorial: Types of Measurements and Choosing the Right Sensor**
- **Proximity Probe Configuration Tool**
- **Video: Introducing the AMS EZ 1000**
- **Video: Gronau, Germany – More than 50 Years of Global Engineering Excellence**
- **Connect with an Expert**

AMS Asset Performance Services

SaaS, installation services, solution design, system commissioning, remote monitoring, product training, and more

The expertise to deliver results – not just technology.

Let's face it. Not every task in your power plant needs to be done by your own employees. For some customers, condition monitoring is viewed as a necessary core competence – too important to outsource. But for others, it makes perfect sense to purchase not technology, but outcomes and thus fully outsourced monitoring services. For still others, the right mix is a hybrid of in-house and outsourced with some tasks assumed by your technology provider and some by you.

Wherever you find yourself along that continuum, Emerson is there to help with expertise that understands instrumentation, vibration, machinery behavior, reliability – and the practical realities of making real decisions about real machinery under real operating and process constraints in real time.

We offer training for those parts of your program that you prefer to do in-house. We offer services for those parts you want to outsource. We even offer cloud-hosting when your own IT environment is simply not the ideal approach, allowing you to use our AMS software solutions without the burden of servers, networks, updates, security, and maintenance – not to mention the gauntlet of internal IT policies that often accompanies on-prem installations rather than hosted.

Learn More

- Landing Page: AMS Asset Performance Services
- AMS Condition Monitoring Services
- AMS Machine Works Cloud-Hosted Solution
- AMS Training
- Connect with an Expert

Go Boldly™

CONNECT WITH A POWER INDUSTRY RELIABILITY EXPERT

Request a consultation to discover how Emerson's team of power industry condition monitoring experts can help you initiate, expand, or improve your current program or projects.

Contact Us

Contact Us
www.emerson.com/contactus

AMS

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