machinemetrics

The Machine Builders' Guide to Remote Machine Monitoring

BY GRAHAM IMMERMAN, DIRECTOR OF MARKETING, MACHINEMETRICS

Table of Contents

PART ONE
3 Ways Machine Builders Can Leverage IIoT
PAGE 3–6

PART TWO
How to Capture the Right Type of Data
PAGE 7–10

PART THREE
How Edge Devices Are Enabling a New World Of Analytics
PAGE 11–13

PART FOUR
Remote Machine Monitoring: A Game Changer for Equipment Builders
PAGE 14–18

PART FIVE: A CASE STUDY
MachineMetrics Service for Machine Builders and Distributors
PAGE 19–22

PART ONE

3 Ways Machine Builders Can Leverage IIoT

Machines can last a long time and manufacturers don't take kindly to the notion of planned obsolescence. With IoT, OEMs can improve the quality of their products and services, as well as open up new avenues for business that they've never had before. It's a brave new world, with Industry 4.0!

Monitoring Data for Improved Machine Quality

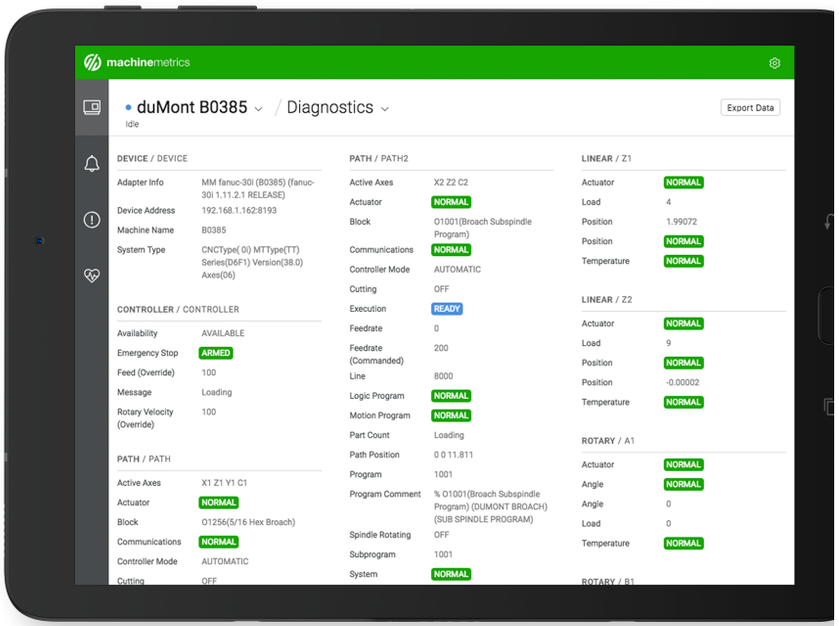
Having access to machine data is the best and smartest way for OEMs to improve their own manufacturing processes and machines. If they can build better machines, that are improved because the engineers have access to performance data, the OEM stands to benefit.

EFFECTIVE PREDICTIVE MAINTENANCE

While an engineer may have created models to figure out how a machine SHOULD perform, access to real data from actual machines can give them insight into how they DO perform. The engineer is then far better equipped to look at what are reasonable parameters for each machine and enable far more effective predictive maintenance.

An example of how an OEM can improve their standing with any manufacturer is by ensuring they can upgrade legacy system s with adequate controls. A reliable machine, and the company that provided it and maintains it, is more valuable than looking for the 'best deal'. Any manufacturer knows that and the OEMs that keep that in mind will benefit.

> *"The machine builders do not have data on how good their repeatability is, if they've never recorded it…once they start adding sensors in there to record it, the OEMs can actually improve the quality of the machine they built. If you record the motion data and the data analytics tells you, 'the signature of this is completely different,' you can ascertain that it could be due to improper torque on a bolt, for example."*
>
> —**Isaac Maw**, Associate Editor Manufacturing, Engineering.com



Remote Machine Monitoring as a New Machine Service Option

REMOTELY DETECT ISSUES

Servicing machines has historically been a costly and time consuming process. It would usually require an on-site visit for visual inspection of any issues, which might include extensive travel time, adding further to the delays to getting a machine operational again. A service team would not necessarily be able to detect which parts were malfunctioning, resulting in a manual —and lengthy—process of checking each part that could be involved. Instead, a remote monitoring system allows OEMs to troubleshoot the issues via the data from anywhere.

REDUCE UNPLANNED DOWNTIME

Beyond service response, reducing unplanned downtime by proactively monitoring and detecting issues is a huge cost savings, in manufacturing. With remote machine monitoring, an OEM can collect data about the operations of any given unit and not only react faster to any impending issue but even predict issues based on that data. That ability to engage in predictive maintenance from a distance is in fact an excellent unique selling proposition that OEMs can offer to their clients, as part of their service package.

Without leaving their own location, an OEM can detect any exceptions or activity that is falling outside of acceptable parameters, service the machines in advance of a problem, and therefore virtually eliminating the impact of any issue, for their client.

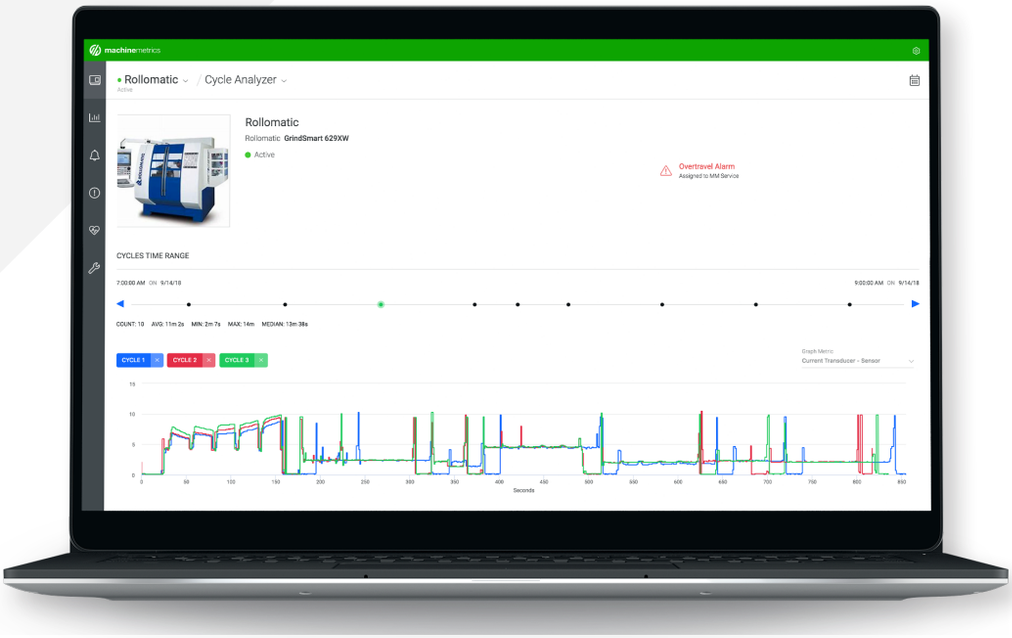
DATA COLLECTION

In addition, if there is an unexpected failure, the OEM is able to use the data collected from the machine to determine what was occurring prior to the problem. An operations person may not have that knowledge: they might not have been present when it failed, or they simply might not know that they were using the machine in a way that it wasn't meant to be. (Source)

> *"We can open that data up to the producers of the assets, because they run a little bit blind, too. For example, they build a compressor, ship it out and get it back for repair. The OEM says, 'what were you doing to it when you broke it?' and the producer would just say, 'I don't know, just fix it.' With data collected from the assets, we can obtain a better picture of what's going on."*
>
> **—Isaac Maw**, Associate Editor Manufacturing, Engineering.com

OEMs Can Get Future Design Ideas From Data.

OEMs will not only be able to improve their own designs but will be able to leverage the data that they receive from their customers to create different machines and designs, with less simulation and modelling required.



Using the real data from existing infrastructure, the options for finding new designs or even new uses for machine designs will be unlimited and could open up new markets and new lines for the OEM. This presents a huge opportunity for the OEM to ensure that they stay ahead of their competition.

Industrial IoT is all about data and knowledge. When it comes to staying ahead in very competitive industries, the only real leverage any company has is data. With it, they can find new ways to operate or add to their existing offerings to ensure that their current and future customers are satisfied.

PART TWO

How to Capture the Right Type of Data

When it comes to collecting data with industrial IoT within the world of manufacturing, it isn't just about quantity. It's also about the quality of the information that you are gathering from various machines; data that enables you to analyze it and make decisions now, and for the long term.

What is Deep Data Vs. Big Data?

Read about the industrial IoT and you'll find a lot of information on the usefulness of big data and predictive analytics. This is absolutely true.

The author, in this case, was referring to HR processes in his piece, but his assertions are just as valid for the factory floor as they are for the hiring department.

BIG DATA…

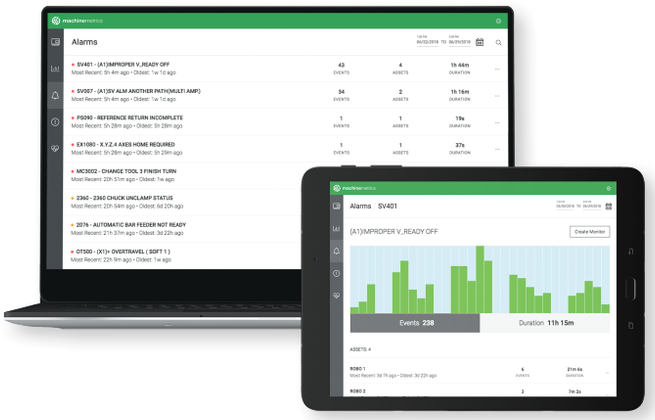
Big data is about capturing the vast quantities of data that is already available and analyzing it; in other words, looking at the data in a different way. Some of the data won't be helpful, nor will some of the results, but many will.

DEEP DATA…

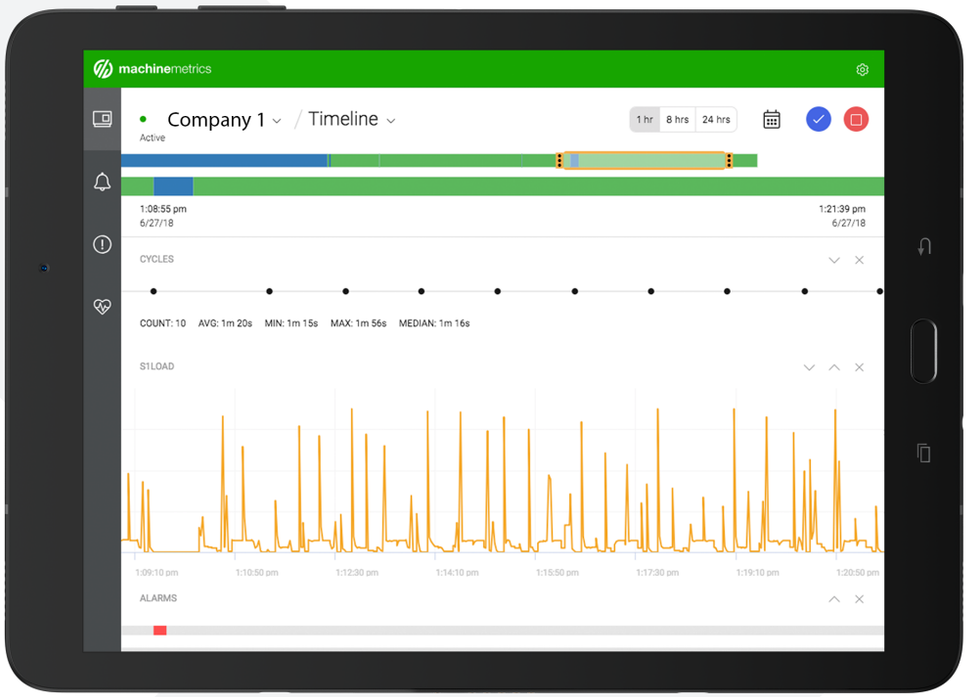
Deep data takes that analysis down to a more granular level. By eliminating data that isn't relevant to a certain course of investigation, and focusing on streams that will provide richer information, deep data provide analysis that is more detailed and specific. The predictive trends that result from analyzing deep data are likely to be more accurate overall.

"While the volume, speed, and variety that Big Data provide can no doubt unveil important effects that escape both the human eye and traditional methods of empirical research, that is simply the first step in the process of creating valuable insights that derive in evidence-based interventions. Predicting outcomes is helpful, but explaining them—understanding their causes—is far more valuable, both from a theoretical and practical perspective."

—Tomas Chamorro-Premuzic, Professor of Business Psychology at University College London (UCL) and Columbia University



What's the Difference Between Sensor Data and Plc Data?



SESOR DATA

Sensor data is all data from a specific sensor on a machine, within a designated time frame. It is designed to monitor something specific, like a vibration, which might tell the operator that a machine is on vs. off. That data may or may not be meaningful when reviewed or analyzed.

PLC DATA

A PLC—a Programmable Logic Controller—is able to pull a large amount of data items that, together with the sensor data, give you a fuller picture of what's going on with any given machine. It can monitor inputs and outputs to and from a machine, and can make logical decisions when necessary, based on programming.

Why Having Both Sets of Data is Optimal.

The key to high quality analytics and results is to be able to have a platform that can both capture deep PLC data AND the data from sensors, which monitor more specific items that might not be available via the PLC.

PLC DATA BENEFITS

For example, as noted above, while a sensor may provide the vibration limits on a certain machine or part of a machine, the PLC data from that machine might include parameters to signal that a fault is in the process of occurring in production. With PLC data comes the ability to control for operations, including the sequence of activity that a machine might be engaged in, timing for certain tasks and so on. When the data returns that one of these programmed elements is out of line, the operator can respond more quickly than if they had to manually investigate an issue with the output.

OPTIMAL MACHINE FUNCTION AND DATA ANALYSIS

Logic can be programmed into a PLC, to ensure that the data being returned matches what is desired and the machine if functioning at an optimal level. This is more 'in depth' than the notion of whether or not a machine is on or off, vibrating or not.

Having both sets of data analyzed and returned to the user provides much more information than sensors on their own would, allowing the operator the flexibility of collecting the necessary data in a timely fashion so as to avoid costly downtime and maintenance issues. Instead, planned downtime and proactive, predictive maintenance can take place, increasing efficiency and boosting the bottom line.

PART THREE

How Edge Devices Are Changing the Connectivity Landscape in Manufacturing

Gathering monumental amounts of data, storing it and analyzing it to create actionable results for different levels of operation in manufacturing is the the why industrial IoT exists now. Ultimately, productivity gains for manufacturers can only come from one place: big data.

If the point of IoT in manufacturing is to have a comprehensive view of every process on the factory floor, in real time, it's essential that the framework for doing this includes a solid, secure and speedy network through which to process data.

What Is an Edge Device?

Managing the flow of data between a local network and the cloud is the purpose of an edge device, when referring to IoT. It is hardware that acts as a gateway between the machines and sensors and the software platform that is used to analyze the date. It's also translates otherwise incompatible data so that everything is being stored in one format.

> *"Gartner defines edge computing as solutions that facilitate data processing at or near the source of data generation. For example, in the context of the Internet of Things (IoT), the sources of data generation are usually things with sensors or embedded devices. Edge computing serves as the decentralized extension of the campus networks, cellular networks, data center networks or the cloud."*
>
> **—Robert van der Meulen,**
> Senior PR Manager, Gartner

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> **—J-P De Clerck,** Founder i-SCOOP

In the context of smart manufacturing, edge devices provide so much more than a link between separate networks. They include functionality for security and analytics conversion service as well. If machine learning and AI are the way of the future, the speed with which data can be stored and analyzed is vital.

Physical distance with a traditional network means longer transmit times for large data packets. Edge devices permit the data networks coming from the machines to be that much closer to where the data is stored and analyzed. This permits a much faster return of information to the user, which is essential when we're talking about real-time predictive analytics. Edge devices and edge computing are placing more storage and analytic power to consume and act on the data, right at the machine location.

Changing the Connectivity Landscape in Manufacturing

We know the point of the industrial IoT is to apply advanced analytics to vast quantities of machine data, all in the aim of reducing unplanned downtime and other inefficiencies, reducing the overall cost of machine maintenance and contributing to machine learning, which can create new ways of doing business previously not know or considered. The cloud has been instrumental in making this kind of massive data acquisition, transfer and analysis possible.

Edge devices are simply taking this concept to a new level by reducing the physical distance between the machines and the data analysis itself. For companies that are spread over distance and acquiring data from many sources, this proximity helps deal with several realities:

Connectivity issues related to distance as well as the cost of massive ongoing data transfer to a centralized location.

Availability of the analytics at an operational level, permitting users at multiple levels to make decisions quickly.

Similarly, availability of the data in real time, for the same reason as above.

Ensuring security of the data and the integrity of the network.

All of these realities, when dealt with by edge computing, permit manufacturers to reduce their costs and increase their efficiency by engaging in predictive maintenance; have a reliable data transfer with few errors and risks to security; enable customization and small run manufacturing, with the same value as large scale production; flexible and simplified maintenance of all devices.

REAL-TIME VISUALIZATIONS AND PREDICTIVE NOTIFICATIONS

When data speed is the order of the day and connectivity needs to be solid, edge devices are the solution that manufacturers should look to. Applying AI and machine learning algorithms to visualize, diagnose, and predict problems in real time based on collected data is the goal that can be more readily accomplished with proximity, speed and a solid network. Real-time visualizations and predictive notifications enable your team to take immediate corrective action and keep your machines up and running without fear of missing crucial data. It's the future of Industry 4.0 and industrial IoT manufacturing.

PART FOUR

Industrial IoT Creates a New Value Stream for OEMs

Industrial IoT and Industry 4.0 are enabling new value streams for OEM and machine service contracts.

Remote Machine Monitoring: A Game-Changer for Equipment Builders

An issue in manufacturing that is singular to OEM's is the speed with which they can respond with service to the machines, in the case of a failure. In the past, this has usually meant an actual failure has taken place, resulting in a delayed order, scrapped parts, and potentially days of downtime.

When customers require after-sales service, they expect their problem to be solved with minimum delay. Too many service calls require expensive and time-consuming on-site visits.

Service teams are dispatched and repairs / replacement of parts are made, but all of this takes time and creates more delay. As far as being able to predict the need for maintenance, traditional systems meant using the historical information about the machine, or simply establishing maintenance schedules, whether or not they were needed.

Now imagine a world where machines can be monitored remotely, providing an unprecedented service level. The ability to gather real-time data and alert customers about impending issues, before any damage is done to an order is valuable. Thus, equipment providers require remote access to monitor and assist with user operations to troubleshoot problems, resolve service events and monitor preventative maintenance tasks, all without leaving their office.

> ***"Industry 4.0 software provides analytical tools that help OEMs understand the mechanical factors and environmental conditions that lead to machine failures. Whether it's vibration, temperature, pressure or other performance indicators, OEMs can use this software to analyze the machine data gathered from their IoT-enabled machines to perform predictive maintenance."***
>
> **—Willem Sundblad,** CEO and Co-founder, Oden Technologies

Remote Machine Monitoring as an Extension of Machine Service Options

In fact, remote machine monitoring, enabled by industrial IoT, is the unique selling proposition that OEM and other equipment providers can offer to their clients, as part of the post sale service package.

> *"…equipment manufacturers can transform their approach to service with the ability to see, understand and take action on their customer's real-time machine data from anywhere at any time."*
>
> —**Graham Immerman,** Director of Marketing, MachineMetrics

Reducing downtime, particularly unplanned downtime, is an essential part of keeping costs down and manufacturing levels up. Remote machine monitoring can collect data about the operations of any given unit and transmit that data back via the cloud, enabling OEMs to provide peak level service response time.

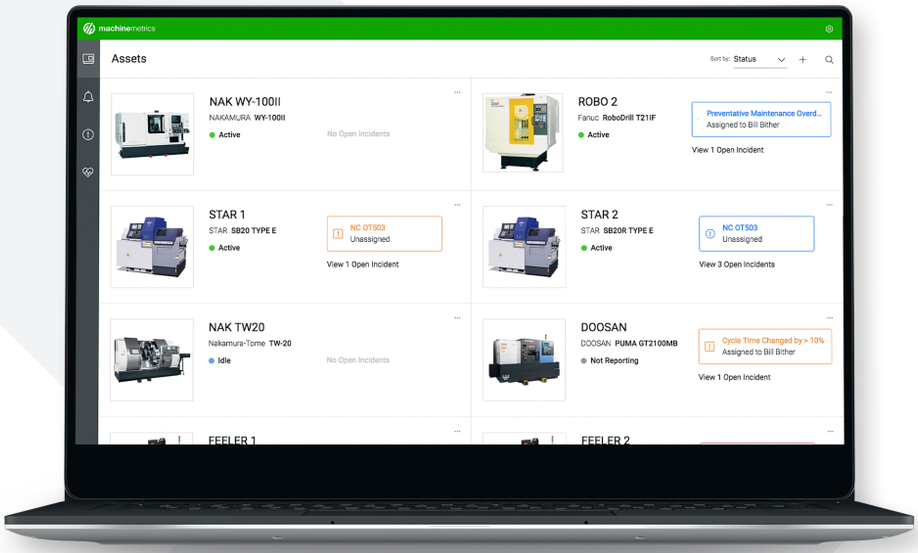
While historically, this servicing would require a lengthy and costly on-site visit and possible investigation as to the issues being experienced. A maintenance team would not necessarily be able to detect at a glance which parts were malfunctioning, resulting in a manual process of checking each part. Instead, a remote monitoring system enables OEMs to visualize the issues via the data from anywhere. Troubleshooting even the slightest alteration in a tool path can be done quickly and easily.

Beyond service response is the ability to predict and even prevent breakdowns that severely impact a manufacturer's production cycle by reviewing and analyzing the data produced. With predictive maintenance, OEMs can review available data, detect any exceptions or historical patterns and service the machines in advance of a problem occurring, limiting the impact. It also ensures that a manufacturer need not maintain an extensive inventory of replacement parts, but rather work on a just in time basis.

> *"Service departments can use data to gain insight into customers' equipment health and condition, identify maintenance opportunities with analytics and reporting, predict and deliver early warning of potential equipment failures, highlight elevated risk areas that lead to machine downtime, or even take preventative action before it impacts a customer's machine performance."*
>
> —**John Hitch,** Senior Technology Writer, New Equipment Digest

Challenges with Remote Monitoring

Industry 4.0, and its vast changes to the way legacy processes such as what many manufacturers will have, bring challenges to the forefront. This is particularly true when dealing with data across organizations.



Data integrity due of the remote access.

Cybersecurity for the network.

The ability of the software to work with different machines; manufacturers being unwilling to entertain different IoT solutions for different machines, to say nothing of inaccuracy in discovering the root cause of a problem should it be in a related machine that is not monitored.

SaaS PLATFORMS

SaaS platforms—such as MachineMetrics—address all of these issues, including the ability to encrypt data before transfer and an easy self-installed interface with a range of machines, enabling manufacturers to limit their concern about having to use different monitoring solutions on their factory floors.

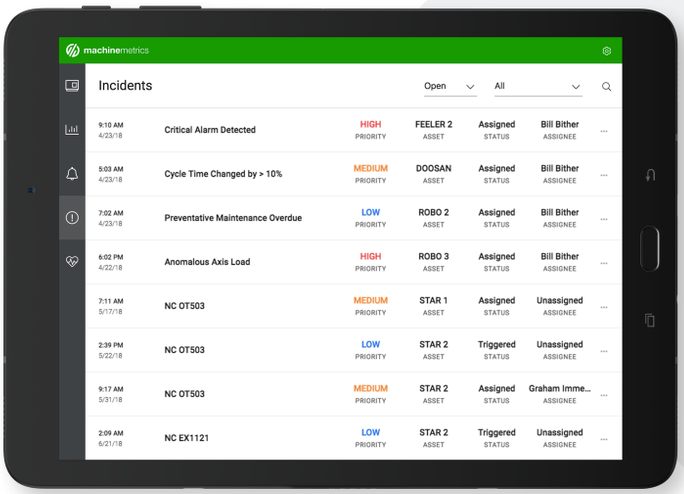
The Future Opportunities for OEMS, Beyond Predictive Maintenance

The ability to identify service opportunities and measure ongoing process improvements, such as ongoing machine health monitoring, is important to after sales service but take innovation a step beyond into the realm of future design specifications!

OEM and equipment manufacturers will be able to leverage the data that they receive from their customers to improve on their existing designs or even create better, more enhanced machines because they will have easy access to the data that shows them how the equipment is being used.

This presents a huge opportunity for the OEM to ensure that they stay ahead of their competition.

With industrial IoT in the mix, the OEM/equipment manufacturing industry has an amazing opportunity to provide real value-add to their service packages, making them indispensable to the manufacturers they service.



PART FIVE: A CASE STUDY

MachineMetrics Service for Machine Builders and Distributors

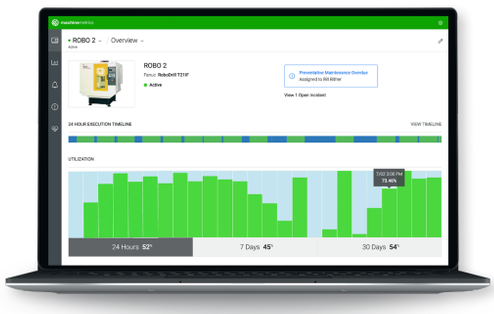
MachineMetrics Launches industry's first AI-driven remote machine monitoring solution for Machine Builders and Equipment Providers

What if you could stop a machine before a catastrophic failure? What if you could detect a bearing wearing faster than expected, before it was scheduled for maintenance and before it causes downtime? What if you could diagnose and resolve machine downtime for your customers without sending a technician on site?

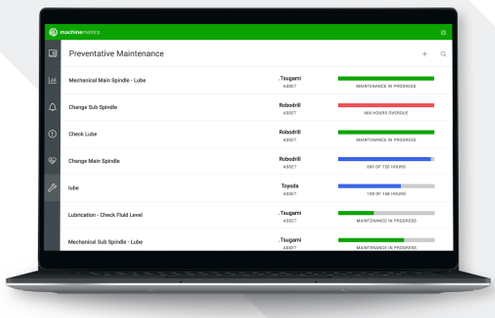
MachineMetrics is answering these questions with the release of their latest application: MachineMetrics Service. MachineMetrics Service is the industry's first AI-driven remote machine monitoring solution designed for CNC machine builders, providers, and distributors; a predictive analytics application on the MachineMetrics Industrial IoT platform that allows service teams to remotely monitor and manage machine assets in the field and at customer sites

Transform Your Approach to Service.

Using MachineMetrics Service, equipment manufacturers can transform their approach to service with the ability to see, understand and take action on their customer's real-time machine data from anywhere at any time. The results? Faster service when customers have machine problems, reduction of on-site service visits by 10-20%, optimization of preventative maintenance plans, validation of warranty claims, and identification of new service opportunities through predictive maintenance pre and post-warranty period.



When customers require after-sales service, they expect their problem to be solved with minimum delay. Too many service calls require expensive and time-consuming on-site visits. Thus, equipment providers require remote access to monitor and assist with user operations to troubleshoot problems, resolve service events and monitor preventative maintenance tasks, all without leaving their office.



The historical and real-time machine data collected from MachineMetrics allows equipment manufacturers to gain insight into customers' equipment health and condition, identify new service opportunities with analytics and reporting, predict and deliver early warning of potential equipment failures, highlight elevated risk areas that lead to machine downtime, or even determine to take preventative action before it impacts a customer's machine performance.

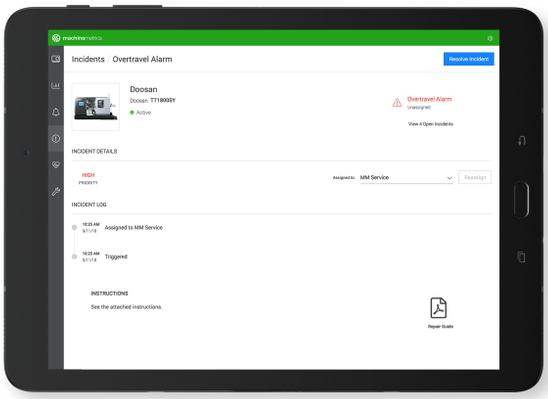
Optimize the Performance of Your Machines

How it works is actually quite simple: Any equipment provider, OEM or distributor, can install MachineMetrics Edge device on a new machine sold to a customer or retrofit any machine currently in the field. MachineMetrics Edge has the ability to connect to the machine's PLC and any additional sensors into the electrical cabinet of the machine and allows for the data to be visible to the customer and shared with the equipment provider.

There's no need to install on customer's internal IT infrastructure as MachineMetrics Edge comes with included cellular support. Once installed, the provider can add the device to a list of machine assets accessible via the MachineMetrics Service app and associate that machine with the location of the customer. Once the customer receives the machine and powers it on, that machine will appear active on the provider's list of assets.

Encrypted data is then streamed to the secure MachineMetrics cloud where the data is structured and aggregated to enable visualizations and analytics for service teams to monitor. Access to the historical and real-time data is available through open APIs. Real-time dashboards, historical analysis, and integrations with other systems can be built with these APIs.

The MachineMetrics AI analytics engine will monitor any connected machine's conditions and



other manufacturing data points and initiate a workflow action or text notifications when a monitor is triggered such as an alarm state, a threshold is exceeded, a preventative maintenance task is due, or an anomaly is detected.This ability can prevent thousands of dollars of equipment replacement costs and days of downtime, not to mention unearth new service opportunities that were never visible to service teams before.

Leverage the Power of Industrial IoT.

Data from thousands of connected machines allow the MachineMetrics Data Science team to work with service teams to identify trends and develop standard preventative maintenance and repair schedules that benefit both the service team and the customers. So while service teams are focusing on addressing issues that may immediately impact their customers, MachineMetrics can help identify big-picture issues that benefit both the equipment provider and the end-user. OEM's are already experiencing the benefits of implementing MachineMetrics Service:

"For years now we have been working directly with manufacturers to improve manufacturing equipment uptime, OEE and productivity with real-time machine monitoring and analytics. By allowing machines to be monitored remotely and in real-time, we are enabling OEM's to extend these benefits to their customer base while providing them with faster, better service. Our data science team is working closely with the data to deliver optimized preventative and predictive maintenance specific to their machines to improve machine uptime."

—**Bill Bither,** CEO of MachineMetrics

"Tsugami/Rem Sales is thrilled to be working with MachineMetrics, bringing cutting edge, disruptive technology directly into our end-users' businesses. The addition of MachineMetrics Service to our Swiss-turn machine platform packages allows users to collect data on machine health, production status, down-time, and so much more that they may never have known existed—bettering businesses across the industry."

—**Michael Mugno,** Vice President, Tsugami/Rem Sales

machinemetrics

COMPANY DESCRIPTION

MachineMetrics is an award-winning predictive analytics platform for discrete manufacturers. Our Industry 4.0-ready solutions work out-of-the-box to increase productivity through edge connectivity, real-time visibility, deep manufacturing analytics and AI driven predictive notifications. We've simplified Industrial IoT to digitize your factory and enable your team to drive decisions with machine data.

AWARD WINNING

- Smart Manufacturing Solution of the Year 2018

IMPRESSIVE PARTNERS

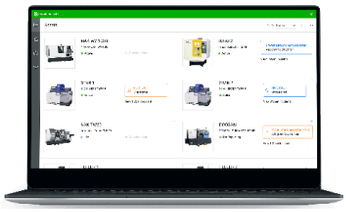
- SECO Tools
- CAT
- Gardner Denver
- Tsugami
- Snap-On
- Autodesk

Our IIoT platform currently features three out-of-the-box solutions:

MachineMetrics Production

FOR PRODUCTION MANAGERS AND EXECUTIVES

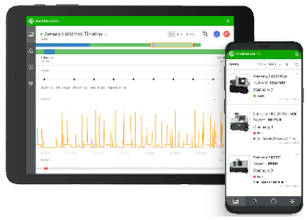
- Track OEE and manufacturing efficiency
- Identify production bottlenecks
- Take action with real-time notifications
- Measure process improvements
- Enhance shop floor communication



MachineMetrics Health

FOR MAINTENANCE MANAGERS AND PROCESS ENGINEERS

- Manage your machine assets and view real-time equipment status and conditions
- Diagnose problems with deep alarm analytics and AI-driven predictive notifications
- Manage preventative maintenance tasks based on usage or machine conditions
- Track utilization of equipment over time to understand current and potential capacity
- Predict equipment failures and prescribe solutions to prevent costly downtimes



MachineMetrics Service

FOR MACHINE BUILDERS AND EQUIPMENT DISTRIBUTORS

- Allows remote monitoring and improved service for all your machines in the field
- Enables your service team to diagnose and resolve equipment problems in real time
- Track utilization of equipment over time to understand current and potential capacity
- Work with customers to predict equipment failures and prescribe solutions before they occur
- No need to install on customer's internal IT infrastructure with included cellular support

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MARKETING MATERIALS

BROCHURES

MachineMetrics Production

MachineMetrics Health

MachineMetrics Service

CASE STUDIES

Carolina Precision Manufacturing
SWISS CNC

Fastenal
PRECISION METALWORKING

Carlson Products
METAL STAMPING AND FABRICATION

EBOOKS

Digital Transformation

The Cloud Advantage

Why most IIoT implementations Fail

MARKETING

MachineMetrics Presentation Slides

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