



Industry 4.0 hype have  
your head spinning?

**Relax**  
The spin stops here

PREDICTIVE MAINTENANCE AND ANALYTICS TECHNOLOGY



Welcome to the 4.0 No-Spin Zone

## More success, production, and profits with the equipment you own today

Does Industry 4.0 hype have your head spinning about the factory of the future and connectivity of tomorrow's equipment? Tired of suppliers trying to pitch you new, interconnected 4.0 equipment that operates the same way, same speed? Welcome to the 4.0 No-Spin Zone. Our solutions all non-invasively upgrade today's equipment today, so you can monitor and be aware of upcoming service issues within critical factory systems including power, vacuum, compressed air, dehumidified air, HVAC and more.

We make it super simple and inexpensive to upgrade your existing equipment with easily attached component and electrical sensors that monitor critical systems and assets. With MachineSense, you'll know exactly what's going on with today's machines, so you'll avoid unplanned downtime and dramatically increase productivity and profits.

EASY TO AFFORD  
EASY TO INSTALL  
EASY TO UNDERSTAND  
EASY TO SECURE

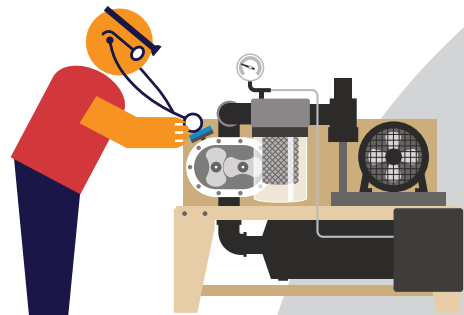


Maximum uptime. Maximum profits.

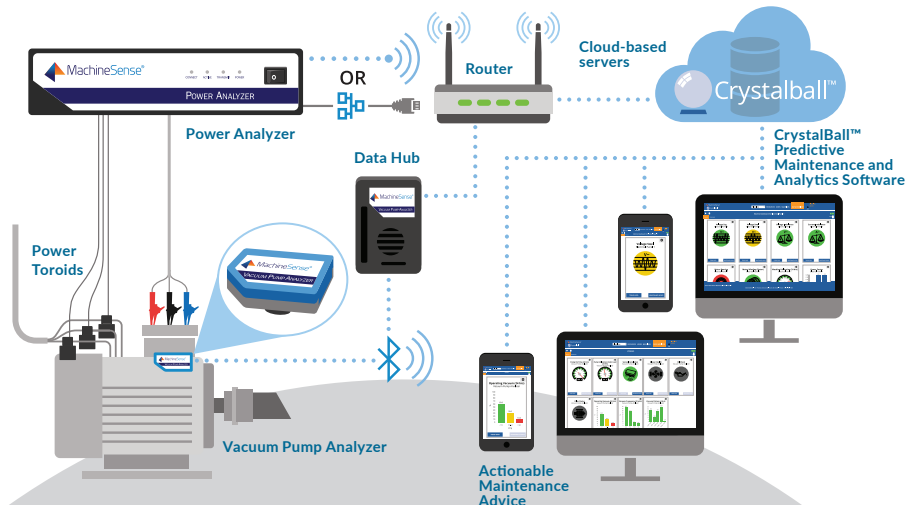
## Eliminate unplanned machine downtime

MachineSense's affordable and patented solutions let you look into the future to predict machine malfunction and failure.

MachineSense sensors are placed directly on your machines or components to automatically monitor condition. The sensor data transmits to an easy-to-install gateway and is then sent to cloud-based servers running powerful analytic software. Results are transmitted from the server to a user-friendly app, where you will view real time machine condition and maintenance advice.



### How it WORKS



### Monitoring is not predictive maintenance

Far beyond the monitoring capabilities and trending packages being touted by new entrants to the field of predictive maintenance and analytics, MachineSense products 'listen' to key assets and components to detect changing health and operating conditions long before the machine controller issues a warning or alarm condition. Machine control data typically only shows process data, whereas MachineSense actually analyzes the data from vital machine components, such as gearboxes, heaters, pumps and more. The MachineSense prescriptive maintenance solution provides actionable maintenance advice and allows you to schedule maintenance at a convenient time rather than suffer a costly shut down.

Optimize your operations. Quick and easy.

## Economical packaged solutions

MachineSense's Industry 4.0 solution is proprietary and patent pending engineered technology.

It includes easy-to-install machine condition sensors and powerful, secure cloud-based, analytic software to provide affordable predictive and prescriptive maintenance solutions for manufacturing equipment.



### Wearable Sensors

Non-invasive, machine sensors easily attach to the machine or components to be monitored using existing power.



### Data Hub Middleware

Wi-Fi and Ethernet enabled data hub can connect to multiple sensors. Plus, it's Edge computing enabled for at-site storage and analytics.



### Data Analytics

Patent pending advanced Meta-Data Analytics Engine provides deep machine learning and statistical analysis.



## IoT Cloud

MachineSense cloud infrastructure for real time sensor data analytics and historical data storage.

Only encrypted sensor data is sent to the cloud and analyzed. MachineSense never senses or records process data, and never takes control of the machine or component, avoiding potential security threats.



### CrystalBall™ Desktop Software

Proprietary plantwide software packages provide an easy-to-understand factory dashboard of all connected assets. Includes analytics, Maintenance, Repair and Operations (MRO) actionable advice, trend data, histograms and more.



### Mobile App

Local machine intelligence is provided to smart devices through a user-friendly app, featuring easy-to-read gauge graphics and corrective action alerts.

### Taking you to the EDGE

MachineSense products use new and advanced **EDGE** technology.

**DEVICE EDGE** processes large amounts of real-time data, analyzes it at the sensor, and applies our advanced vertical analytics in the data hub, so only the stats and completed analysis needs to be transferred to the cloud.

**EDGE** technology can replace the public cloud with an on-premises **EDGE CLOUD** (i.e.: factory installed server). This will eliminate the need to send data over the internet, to the cloud, and back.

Faster, better, smarter advantages for you:

- Bypass IT security concerns with the current IoT approach.
- Reduce potential subscription fees related to data transfer and possibly storage.
- Improve data integrity.
- Real-time and quasi real-time analytics without internet and cloud latency.

Diagnose electrical issues. Optimize energy usage.

# Power Analyzer

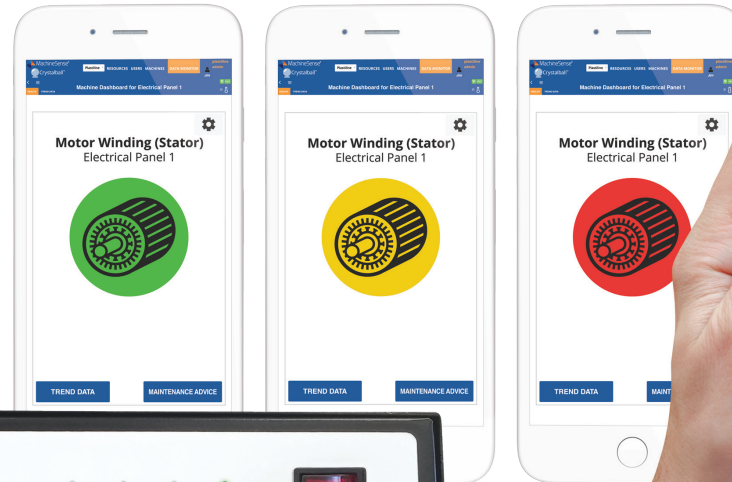
- 24/7 power analysis for industrial applications, no manual measurements.
- Real time and historic electrical power consumption data.
- Available in single and multiport variations, and for VFD applications.

Power Analyzer diagnoses everyday electrical problems including costly issues that can result in lengthy downtime such as motor burnout, control and display memory loss, and failing transformers, VFD drives, capacitors and more.

MachineSense's Power Analyzer uses patented local EDGE and cloud-based analytics technology to capture, interpret and diagnose the data obtained from electrical components and internal power distribution. Easy-to-understand dashboard gauges warn users of pending failure of stator windings, motor bearings and heaters as well as all common power line issues such as sag, swell, harmonics, ground faults and imbalances. The data is presented in a manner that it is easily understood by plant personnel regardless of any electrical engineering experience.

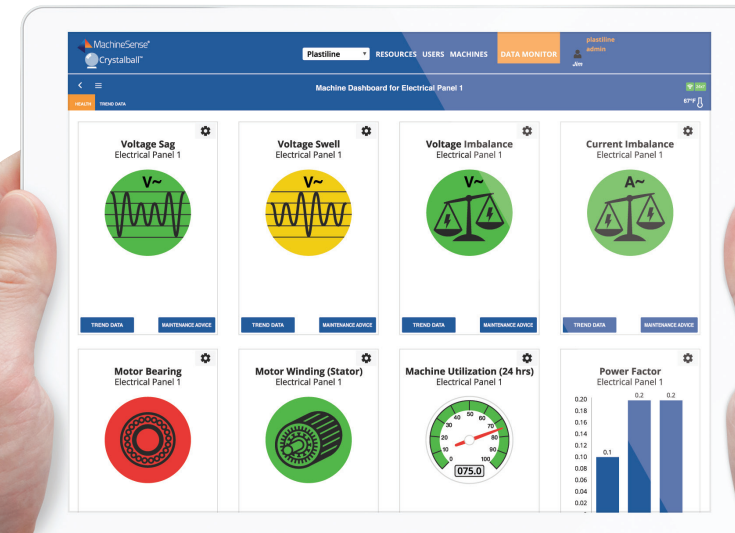
## Power Analyzer measures and tracks:

- Average three-phase voltage
- Average three-phase current
- Power factor
- Active “working” power
- Power waveforms
- Cumulative active energy
- Ground faults
- Power quality harmonic distortion for current and voltage
- All values needed for energy optimization
- Reports phase imbalance
- Machine on-time



Every manufacturer has electrical issues. These issues can, and will, affect productivity, machine performance and electrical costs.

MachineSense, and our proprietary Power Analyzer technology, is designed to help diagnose everyday electrical issues and present them in a way that can be easily understood by plant maintenance and management alike, regardless of experience on electrical components and related issues.



All MachineSense products work in conjunction with Crystalball™, a powerful software package that provides a factory dashboard of all connected assets. Through the software the user can set up alarms and alarm recipients. Six months of historic data is available through equipment performance trend lines. And, a streamlined dashboard interface delivers a clear summary of the powerful analytics for all monitored equipment, neatly organized by department and location. Crystalball offers easy-to-understand diagnostic and actionable maintenance advice via text or email messages and handheld or desktop dashboards, in advance of machine or component failure. No manual data analysis is required.

## Installed Power Analyzer

Designed for quick install, with simple, graphic-based instructions included.



Know the condition of your pump. Avoid unplanned downtime.

# Vacuum Pump Analyzer

- Tracks operating conditions and trend health of vacuum conveying pumps 24/7.
- Cloud based analytics and easy-to-understand dashboard gauges require no advanced training or expertise.
- Continuous monitoring enables early detection of symptoms that appear under varying load conditions.

The MachineSense Vacuum Pump Analyzer monitors operating condition and trend health of pumps and blowers in various industrial applications. The Vacuum Pump Analyzer sensors easily attach to the pump exterior and constantly measure vibration and vacuum, plus ambient temperature and pressure. A plug-in connection reliably powers the sensor, unlike competitive units that rely on batteries for power.

MachineSense's Vacuum Pump Analyzer proprietary analytics algorithm tracks and compares the collected data against a baseline to determine overall pump health. Filter status, oil status, pump utilization and vacuum or pressure level trends are all constantly monitored. Visualization of valuable operating metrics is delivered through easy-to-understand mobile and desktop dashboards.

## Measures and predicts:

- Filter condition
- Vacuum analytics
- Oil condition
- Bearing condition
- Pump health



Increase productivity with continuous monitoring and analysis of rotating components.

# Component Analyzer

- Tracks trend health and ambient operating conditions of rotating machinery components 24/7.
- Local EDGE analytics enable continuous high speed data monitoring, reduce data transfer, and increase data integrity.
- Continuous monitoring enables early detection of symptoms that appear under varying operating conditions.
- Cloud-based dashboard gauges summarize advanced analytics into easy-to-understand results that require no advanced training or expertise.

The easy-to-install MachineSense™ Component Analyzer constantly tracks the operating condition and trend health of rotating components in industrial machinery.

Easy-to-understand icons direct users to view component health trends displaying up to six months of operating history. Customizable threshold values allow users to identify preferred maintenance conditions, unhealthy operating conditions, or deteriorated component health.

Patented time-domain data sampling methods enable continuous trend monitoring to spot anomalies and repeatable events that occur under changing process or operating conditions, allowing early detection of developing component health issues, and the operating trends that may be causing them.

Traditional Frequency-Domain data and analytics (coming soon) add enhanced diagnosis capabilities for bearing and gearbox faults initially, with other device libraries being added each month.

Visualization of key operating and analytic results are conveniently delivered 24/7 via web browser or mobile app in easy-to-understand dashboard gauges, and via email / text alerts. No advanced training or expertise is needed.

Status – 03/01/2018 – 05:32:02  
Building 1, Machine #2  
Gauge: Bearing Health  
Detail: Bearing fault detected.  
Corrective Action: Please inspect bearing for cage, race or ball / roller damage.  
Verify proper shaft alignment and lubricant to avoid excessive wear.



## Measures and predicts:

- Machine utilization
- Ambient operating conditions
- Bearing health
- Belt-drive misalignment
- Abnormal vibration
- Sensor installation

# Understanding the Value of Predictive Maintenance

In the manufacturing world, improving the utilization of assets and increased productivity are among the most important goals. Reliable assets reduce downtime, improve production quality and get product out the door faster.

## Two types of downtime

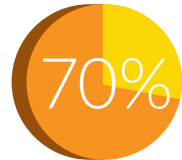


**Scheduled:**  
Routine maintenance and cleaning, installing updates, etc.

**Unscheduled:**  
Repairs to equipment that has stopped performing its assigned function or is performing its function inadequately.



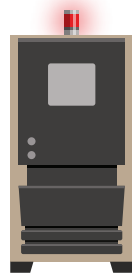
## Don't bring me down



70% or more companies lack awareness of when equipment is due for maintenance, upgrade or replacement.



46% of downtime is due to machinery failure/malfunction.

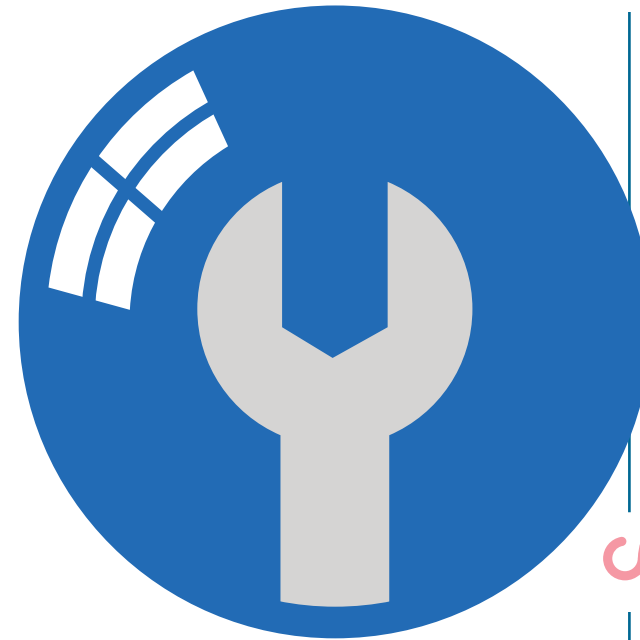


40% of downtime is due to software failure/malfunction.



## Tell me where it hurts

Poorly maintained equipment results in lost production time and lost profits. Unscheduled repairs are costly. Some studies indicate that repairs account for 15% of total expenses.



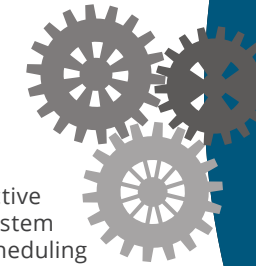
## Predictive maintenance...

tell me something good

Installing predictive maintenance equipment helps to determine the condition of your process. The right system provides actionable intelligence, which warns of impending failure if reported issues are not addressed.

## Does it really work?

The ideal predictive maintenance system will allow for scheduling of maintenance prior to equipment failure, which will help to eliminate unplanned downtime, reduce repair costs and equipment failures and slow asset deterioration.



## Does it really save money?

Not only is a predictive maintenance program far less expensive than a reactive program – some studies claim up to 40%

less expensive, but for every \$1 spent to improve equipment there is a \$5-10 return to the bottom line.

## But, is it really easy to install?

MachineSense's wearable-solutions all non-invasively upgrade today's equipment today. We make it super simple and inexpensive to upgrade your existing equipment with easy-to-attach component and electrical sensors that monitor critical systems and assets.



# Start me up

The most effective approach is to use a predictive maintenance solution that readily installs to your existing equipment and has a powerful analytics software package that will collect data from your monitored equipment in real time, compare the data with established baselines, assess the condition of the equipment and use analytics to effectively manage maintenance activities.



With MachineSense, you'll know exactly what's going on with your machines so that you can avoid unplanned downtime and dramatically increase productivity and profits. Ask us how we can help implement a predictive maintenance program for you today!



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