

A large industrial machine, possibly a lathe or mill, is shown in a dark, industrial setting. The machine is illuminated with a green glow. Overlaid on the machine are several semi-transparent data visualizations, including a line graph, a bar chart, and a pie chart, suggesting data analysis and monitoring. A bright, glowing arc of light curves around the machine, adding a sense of motion and technology.

FROM BALLPARK TO BENCHMARK

White Paper | July 2020

Should you Trust your Technology?

Choosing the Most Accurate Asset Performance Monitoring Solution

Table of Contents

Executive Summary 3

Introduction 3

 Self-monitoring of Machinery 3

 Retrofitting Connectivity Using Tower Lights 3

 3d Signals APM 5

The Sensors Don't Lie 5

Production Discrepancies 5

From Visibility to Productivity 6

A Growing Value 6

Added Value of Sensor-Based APM 6

Summary 7

About 3d Signals 7

Executive Summary

Through our research, the 3d Signals Asset Performance Monitoring (APM) solution has been proven to be more accurate than tower light technology and machine 24V controls. We compared our sensor-based technology with tower-lights, and found that in 25% of cases, the tower-lights were incorrect, while the 3d Signals solution was 100% accurate. In some cases, machine controls showed production when the machines were actually idle or in setup, and failed to note production during times of activity in other cases.

Visualization of this data has allowed customers of 3d Signals to make data-driven decisions that have shown extremely quick time to value, improving machine availability by over 30%.

Introduction

Industry 4.0 is a target for many manufacturers, as new opportunities for digital transformation attempt to leverage the benefits of IoT and connectivity for the industrial arena. From data analytics and machine learning, to predictive maintenance and remote support – the opportunities for operational improvement are huge.

In order for this to happen, there is a connectivity leap to be made, and it's larger than one might imagine. In fact, Cisco reports that "92% of 64 million manufacturing machines in worldwide operation are unconnected to any network." ^[1] Despite everyone talking about the value of the latest technologies, less than 10% of machines are built to allow manufacturers to realize these benefits across their production floor.

Retrofitting is the process of adding new technology or additional features to legacy machines, in this case to address the connectivity issue. More cost-effective than buying new machines, and without the issues of a steep learning curve and interference with manufacturing workflows, the vast majority of manufacturers rely on retrofitting, either through the vendors that supply the machines, or using their in-house resources.

This white paper will discuss different retrofit options to measure performance and bridge the connectivity gap. We then review the 3d Signals approach to dealing with these challenges and compare its accuracy to alternative solutions, discovering a new way to enable asset performance monitoring and embrace the benefits of Industry 4.0.

1. Self-monitoring of Machinery

Some companies approach retrofitting by connecting their machines to a central server and extracting the data themselves. With the help of controllers and in-depth knowledge of machine computing, manufacturers have had limited success in developing solutions that provide them with metrics on asset performance. From this, they can collect datasets and make a step forward towards Industry 4.0.

This approach enables the benefits of connectivity without the expense of new hardware or even new machines altogether, and without the limitation of commitment to a particular third-party solution provider.

The downsides of this alternative include:

- **Integration:** With proprietary software and machine protocols, integration can be complex. Knowing how to get the best results from a 'home-made' solution can take time and relies on trial and error. When considering the need for a different method for each model of machine, the effort can be more hassle than it's worth.
- **Expertise:** Factories are meant to manufacture, while software houses are built to create applications and software. Expanding business capabilities to include data engineers, developers and technical staff for the self-monitoring of machinery will need to be maintained long-term, and is not a core competency of a manufacturing plant.
- **Sub-par solution:** Even with the right staff in place, an after-the-fact solution for asset performance monitoring may never measure up to a product that was built for purpose. This solution also doesn't provide the benefits of patches, upgrades or new features that could be providing other manufacturers a competitive edge.

2. Retrofitting Connectivity Using Tower Lights

The most popular way for retrofitting performance measurement on the production floor is using tower light technology, also known as signal towers, which run on 24V controls. A checkbox item that either comes with machinery or can be bought separately.

Think of a tower light like a traffic light system. On top of each machine, there is a tower light with red, yellow, green and sometimes blue lights. Each light represents machine status, for example, green for running as usual, yellow for idle or waiting, and red to show an alert on certain issues. Some machines have additional light combinations to give more nuanced information, such as showing a difference between idle and switched off, or for a surge in production.

The simplest versions give staff greater insight into machines that need their attention, and managers the ability to see at a glance the productivity of their environment. More sophisticated products connect to dashboards and data analytics platforms so that factories can leverage insights and statistics to optimize business needs.

In theory at least, tower lights can allow businesses to reach their goal of seeing exactly what their machines are doing, regardless of vendor, machine type, or machine model with one unified view. In practice, however, it's not so simple, since machine controls were developed to control machines and not to monitor them or report their status.



Here are some of the common myths about the tower light method:

1. "It's easy to set up"

Many tower light solutions will require an integrator to connect to machines of varying make and model. Adapting their function differs from one controller to another, posing a greater challenge for the integrator.

2. "It's a low cost option"

Connecting tower light technology to legacy machines might cause a breach of protocol or warranty unless it is coordinated with the vendor. Vendors often have additional charges for accessing the controller or using third-party hardware with their equipment. As factories will need approval from multiple vendors to cover different types of machinery, this 'low cost' option starts being anything but.

3. "It's a cutting-edge solution"

However advanced a tower light system is, it will be based on PLC programming, a solution that was not built for monitoring machines. Tower lights can only show whether a machine is working or not, and give real-time information. There are no additional layers of data that can be added, no Business Intelligence, and no Artificial Intelligence, and businesses cannot use tower light data for analysis of trends or larger issues.

4. "It's simple to use"

As there is no uniform system to tower light technology, the color scheme changes between vendors. Red might mean 'off' for one machine, and 'idle' or 'error' for another. In some cases, combinations of lights might mean something, too. Engineers on the production floor will need to memorize this information for each machine to be able to get a clear understanding of floor status. Even if a manager memorizes all the color codes, it is difficult to get a full picture of an entire production floor based on dispersed lights.

5. "It's accurate"

The truth is, without a viable alternative it has traditionally been difficult for manufacturers to assess the accuracy of the tower light model. However, many managers on the floor feel that there are discrepancies between the light and the actual status of the machine. Without the pulls and pressures of digital transformation, it also mattered far less whether APM tools varied by a few percent here and there. In contrast, today's managers and decision makers are using the data output from machines to make strategic decisions and plan the future of the company. Accuracy needs to be guaranteed.

3. 3d Signals APM: Proven to be more Accurate than Tower Lights

Comparing our sensor-based asset performance monitoring technology to tower lights, we've discovered discrepancies in 25% of the cases, all of which proved to be errors of the 24V controls.

3d Signals uses non-invasive sensors (acoustic, vibration, current, etc.) to monitor individual machines. The signals from the sensors are processed and uploaded to the cloud in real-time, and displayed on an intuitive dashboard, providing information on current and historic status, customized reports and comparisons. Notifications and alerts can be sent to the relevant personnel, highlighting actions that need to be taken to resolve bottlenecks and improve productivity.

The Sensors Don't Lie

Technicians know their machines. They are the people best placed to identify the behavior of each machine, simply by listening to what's going on in real-time. Our technology mimics this, using sensors to 'feel the machines' and taking this further than the human ear and eye with the support of AI and algorithms.

To verify that our solution was more accurate than traditional tower-lights, we recorded the signals of the two technologies, as shown below and used real people on the production floor to validate the status.

Production Discrepancies

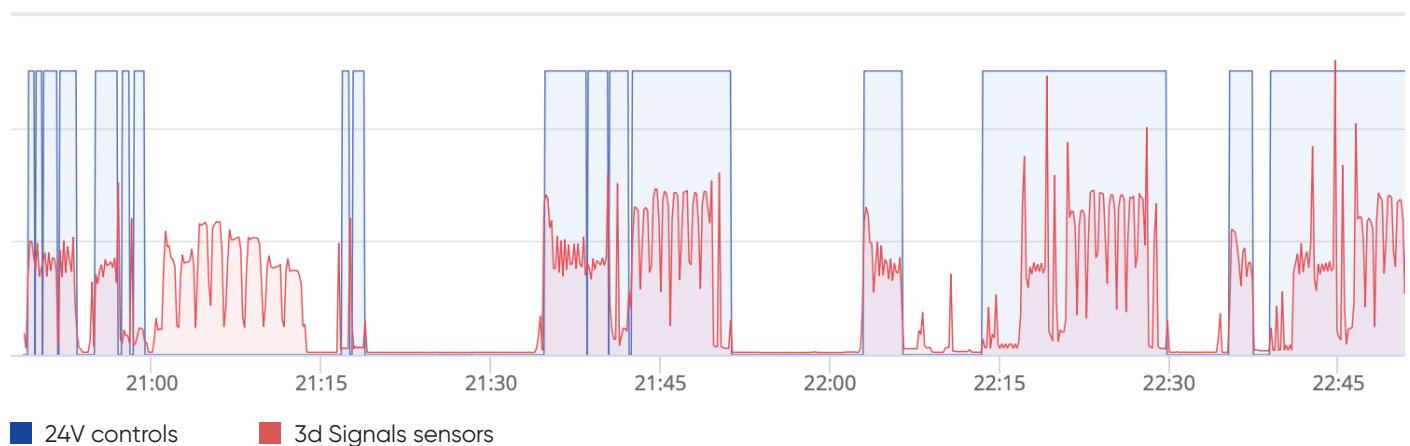


Fig. 1. Presentation of data recorded by machine's 24V controls (blue) and 3d Signals sensors (red)

Figure 1 shows both the sensor data collected by the 3d Signals solution and the machine's control signal. In a few cases, notably around 9:00pm, the sensors have picked up machine activity which the tower lights have failed to track. The machine operator confirmed that the machine was indeed working in this timeframe.

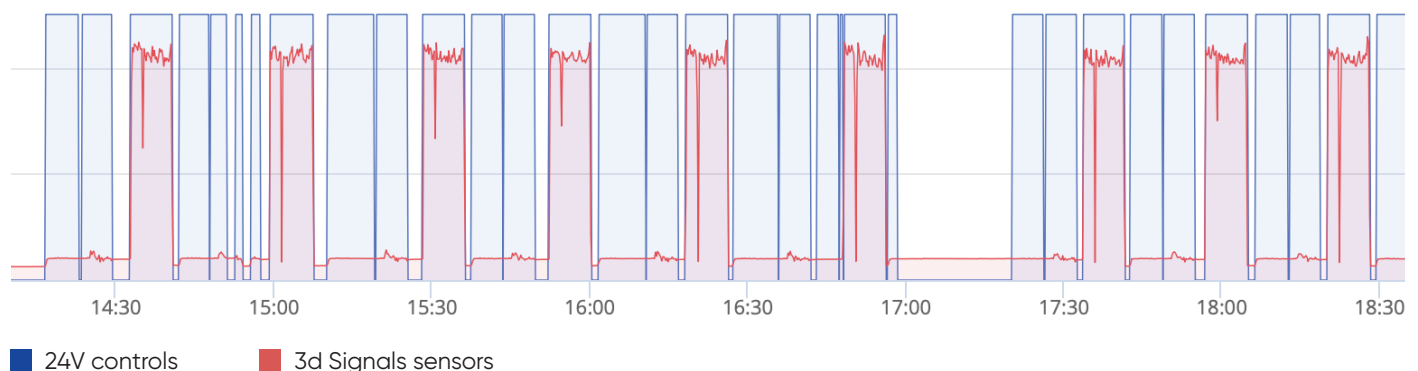


Fig. 2. Presentation of data recorded by machine's 24V controls (blue) and 3d Signals sensors (red)

In Figure 2, the results are inverted. While the sensor-based monitoring has picked up on 10 cycles of production (shown in red) the 24V controls have identified additional production cycles which did not occur, for example, at around 5:30pm. These are actually dry runs, that have been misinterpreted by the tower lights as machine operation.

From Visibility to Productivity

According to McKinsey, "Digital performance management tools, like digital dashboards [have been seen to] support performance dialogues [and] achieve as much as a 20 to 50 percent OEE improvement within three months by increasing engagement of frontline operators and management around data." [2]



Simply put, with accurate insights into the production of a machine, optimization can improve the output and sync performance.

When data is being used to make strategic business decisions, and manufacturers are relying on it to realize the improvement benefits of Industry 4.0 – isn't 100% accuracy essential?

A Growing Value

Leveraging the benefits of connectivity allows 3d Signals to go further than monitoring, moving towards improving performance with deep learning and artificial intelligence.

Connectivity and digitalization are just the first step. First, manufacturers can understand the information in real-time, and act upon it to improve processes and workflows. Then, historical data can be aggregated, giving another layer of information which allows comparison of the data shift to shift, or even week to week and month to month. After this, baselines can be created, alerting stakeholders to when production is low in comparison to previous periods of time.

Manufacturers can also utilize this data to improve the process of planning, with 'actual vs plan' insights and trends, and can incorporate AI and algorithms to act on their data, accessing smart recommendations for optimizing production. Integration with additional software tools like ERP systems, can enable end-to-end visibility and optimization across the entire manufacturing process from purchase order to fulfillment.

Added Value of Sensor-Based APM

- **Full Coverage**
Vendor, age and type agnostic, sensor-based APM works with any machine, providing visibility factory-wide, as well as specific to line, machine, or floor.
- **Best in Class Security**
No connection required with the machine controllers means no chance of cyber attack and no fear of voiding warranties.
- **Operational Analysis**
From damage and malfunction, to optimum processing, identify granular detail on each machine.
- **Zero Integration**
No support or agreement needed from vendors. Doesn't rely on PLC programming like 24V controls
- **Collaborative and Simple to Use**
Features a mobile-friendly web-application and a user-friendly dashboard.
- **Quick Time to Value**
Without any integration requirements, start seeing results in minutes, and generating value from data in a matter of weeks.
- **Flexible and Scalable**
More and more capabilities can be added based on a one-time installation of the hardware.

Summary

Trust is foundational for benefiting from an APM solution. If employees and executives do not trust the data they are receiving, it makes it impossible to use the information as a baseline for critical business decisions. As a result, accuracy is the most important element to track when it comes to manufacturing, and tower lights have been proven to fall short of accurate time and time again.

With 3d Signals' sensor-based APM, the data that businesses use to make data-driven decisions is unquestionable. This allows stakeholders from the boardroom to the production floor to trust the information they are receiving, to make smart decisions based on its accuracy, and to create a new culture of transparency and communication that takes the factory to new heights.

About 3d Signals

Named "2020 top 100 Europe winner" by Red Herring and selected as "TechPioneer" by the World Economic Forum, 3d Signals accelerates the digital transformation of manufacturers to the Industry 4.0 era. Our APM solution enables real-time visibility into production floors, through the quick, non-invasive, and machine agnostic deployment of highly accurate sensors, resulting in improved machine availability and OEE, and reduced labor and energy costs, within 3 months of installation. For more information, visit www.3dsignals.com.

Sources

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