Bently Nevada
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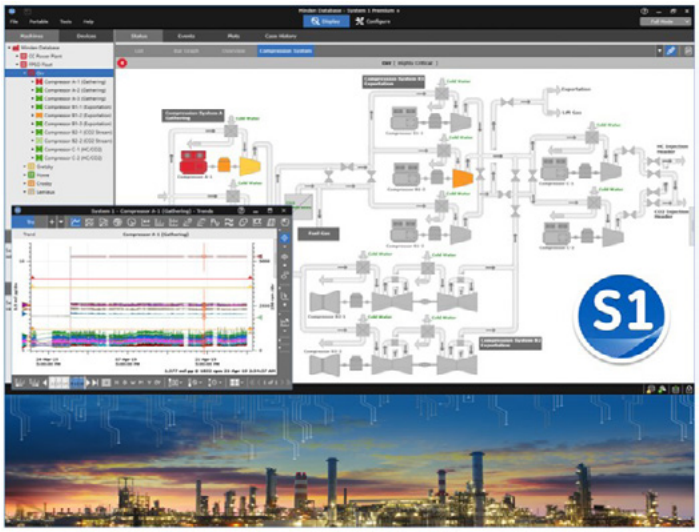
New technology: reciprocating compressor monitoring solution

Introduction



Process-intensive Industrial Operators are increasingly wading into the digital transformation revolution to streamline production in the face of globalization, a shifting workforce, and heightened cyber security threats. Delivering safe, reliable, and environmentally friendly operations while maintaining a competitive advantage over peers is virtually unachievable without intelligent adoption of technology and cultural acceptance of changes to long standing processes.

Bently Nevada has been partnering with customers to help solve these challenges. Through user research in 25 countries with more than 500 end users, we have studied our customers' team dynamics, site processes, and technology suites to determine how System 1 can best support plant-wide machinery management. The resulting platform meets 11 unique customer use cases, with each use case leveraging a subset of System 1's **connectivity, analytics, and visualization** capabilities.

With System 1's advanced toolset, it is often deployed on critical and highly critical machines. However, less critical reciprocating compressors assets still needing monitoring often don't get proper visibility due to their remote locations and budgetary concerns. An example of these assets is reciprocating compressors for midstream and upstream applications.

Bently Nevada has introduced a new technology specifically for this application and this Orbit article explores the new **reciprocating compression monitoring** application for real-time and proactive machine monitoring.

Challenge

Traditionally, operators use a time-based approach to maintain their compressors which can ignore current conditions and other factors that influence compressor health. The Upstream and Midstream Oil & Gas markets use compressors in a variety of applications:

- Small compressors used for vapor recovery or compressed air to operate valves and other instrumentation
- Medium compressors used for gas injection, gas lift and small gather systems
- Large compressors used in compressor stations to move gas along interstate pipelines

Unplanned or extended compressor outages can result in considerable business impacts for operators who seldom know when or why an asset failure is about to occur. In addition, the high maintenance costs associated with reciprocating compressors makes condition monitoring extremely important on these compressors.

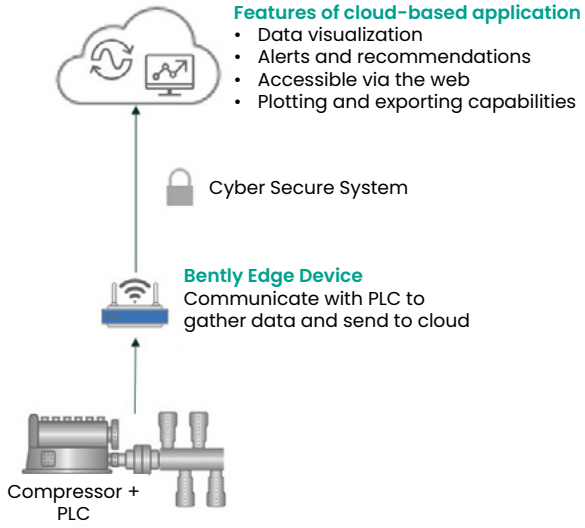
Bently Nevada solution

For small to medium-sized reciprocating compressors, Bently Nevada has introduced a new Remote Monitoring & Diagnostic (RM&D) offering aimed at providing health and performance insights using existing instrumentation typically found on reciprocating compressors in the Midstream and Upstream Oil & Gas markets.

Our Reciprocating Compression Monitoring solution is an application built to monitor compressor health and performance remotely. It calculates compressor fleet utilization and efficiency and provides intelligent feedback through predictive analytics, which enables reciprocating compressor fleet managers to increase efficiency and optimize their maintenance priority and plan. The continuous monitoring and real-time performance analysis and diagnostics can increase asset run time and reduce health, safety and environmental (HSE) risk by providing visibility to remote assets and decreasing trips to site.

The combination of **connectivity, analytics, and visualization capabilities** that this application utilizes are detailed in the following sections.

Pillar 1: Connectivity



Bringing compressor operational data and alarm statuses into the cloud

Our Reciprocating Compressor Analytics Solution leverages data from common (and normally existing) instrumentation on reciprocating compressors. This data yields valuable insights when analyzed properly and monitored by a compression expert. Data is collected from a compressor programmable logic controller (PLC) and sent to the cloud via existing connectivity or by deploying Bently Edge hardware on site, which communicates with the compressor PLC via MODBUS. The data is captured and sent to the cloud every 30 seconds to provide real-time visibility to compressor health and operation. Any tag collected by the PLC can be captured, including:

• Stage suction and discharge pressures

• Engine run speed

• Compressor or throw discharge temperatures

• Suction and discharge line pressures.

In addition to operational data, the PLC alarm statuses are sent to the cloud, allowing users to see what PLC alarms have been tripped and when shutdowns are initiated due to PLC thresholds.

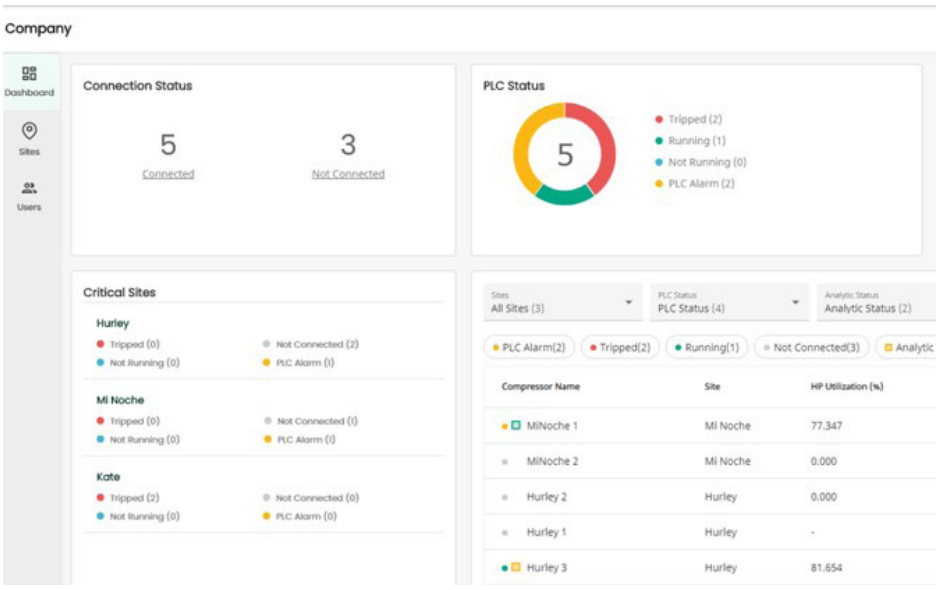
Pillar 2: Analytics

Once data is collected and sent to the cloud, the data is validated and run through a series of analytics. The analytics combine math and physics to calculate operational key performance indicators (KPIs) and detect cylinder issues associated with consumables, such as valve failures, process related issues, cooler inefficiencies. The physics-based analytics calculate an ideal model or digital twin of the asset in order to compare current operation with an ideal base case. This model allows flow efficiency and horsepower utilization rates to be calculated, giving the user visibility to the general health of their asset at any time. RM&D Engineers review the results and provide insightful recommendations, as timely exception reports or monthly summary reports. These insights and recommendations help owners and operators to understand the health of their compressors and to make smart operational and maintenance decisions, which maximizes availability and reduces unplanned downtime.

Elements of reciprocating compressor monitoring solution

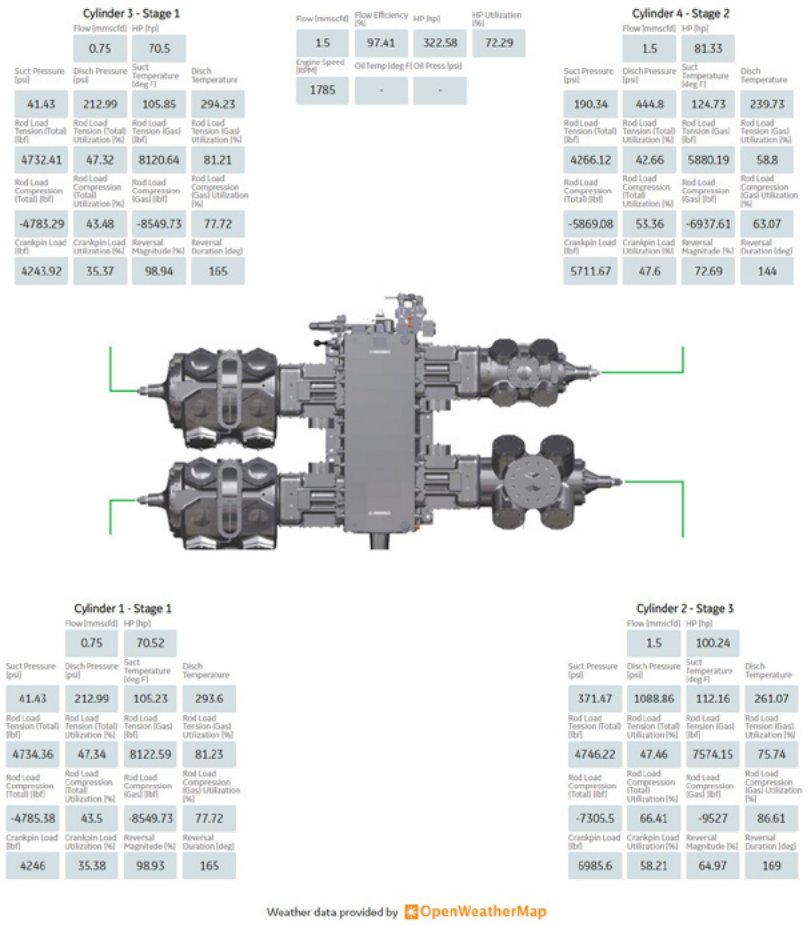
Pillar 3: Visualization

The web-based interactive dashboard provides comprehensive visualization of all the process tags being collected at the programmable logic controller (PLC) or historian. Upon login, the dashboard provides a high-level view of the assets being monitored by providing connectivity status and alarm status of both PLC alarms and alarms generated by the analytics. The assets are organized by site and can be accessed by selecting a particular site or the individual asset name on the home page.



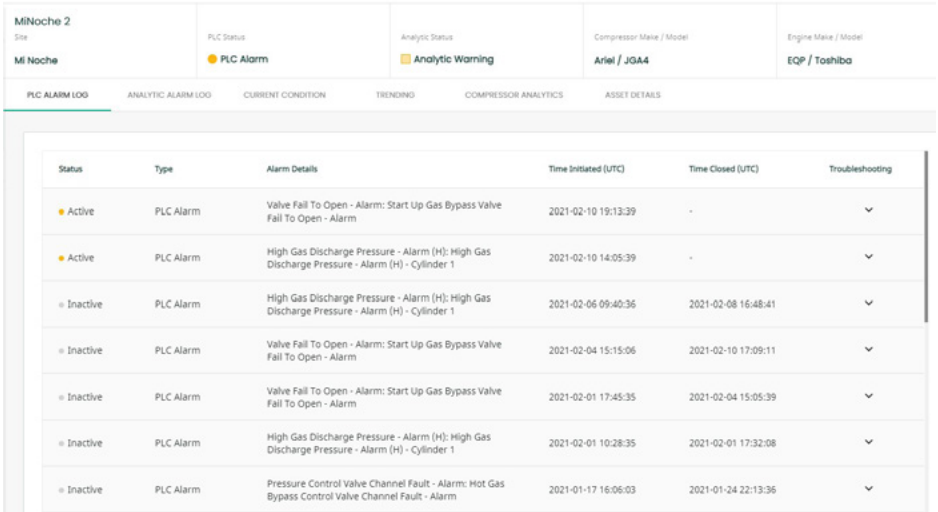
Reciprocating compressor monitoring solution application dashboard

The Compressor Analytics tab provides a graphic of the compressor throws and the data associated with each, including analytic outputs like flow efficiency and horsepower utilization.



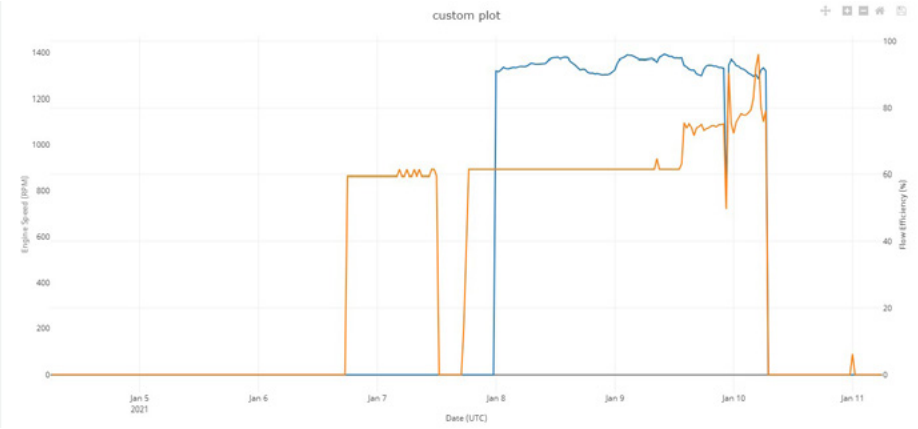
Compressor visualization inside of application

In addition, historical logs of alarms that have been triggered – both by the PLC and the analytics can be seen by down selecting to a particular asset.



Historical log of PLC alarms in the application

An accessible Trending tab provides timeseries plots of several key parameters, such as compression suction pressure, discharge pressure, and engine speed. In addition, the application allows users to create custom plots and easily export data from custom time ranges for additional analysis in external asset management applications.



Custom plot created in application

Connectivity + analytics + visualization = a complete solution

Our reciprocating compressor monitoring solution combines connectivity, analytics, and visualization capabilities to enhance the Bently Nevada software portfolio and its reputation as the premier edge historian and condition monitoring platform of all industrial operators. To recap:

The solution is simple. Data is collected from a compressor PLC and sent to the cloud via existing connectivity or by deploying edge hardware on site. The data is then validated, run through a series of analytics, and visualized within a web interface. RM&D Engineers review the results and provide insightful recommendations, as timely exception reports or monthly summary reports. These insights and recommendations help owners and operators understand the health of their compressors and make smart operational and maintenance decisions, which maximize availability and reduce unplanned downtime.

What's next?

As this reciprocating compressor application continues to evolve, the main goal is to integrate the capabilities of this technology into System 1. Integration will include a fully on-premise solution where the analytics described herein will be available as Decision Support rules. This will allow customers with cybersecurity concerns to achieve the same results without sending their data out of their network.

In addition, the application will have custom HMIs inside of System 1, which eliminates the need for two software programs and allows existing System 1 customers to expand their asset monitoring. The ability to run advanced analytics on the cloud and bring the results back into System 1 for visualization and additional analysis expands the opportunities for System 1 as a software platform and further enables Bently Nevada's digital transformation journey.

Upcoming System 1 Orbit Articles

The deep capabilities of the System 1 Platform will be explored in upcoming releases of Orbit magazine. Planned articles include:

- **Q1 2021:** System 1 Use Case: Turbomachinery Monitoring
- **Q2 2021:** Monitoring Hydro Generation Assets with System 1
- **Q3 2021:** The System 1 Ecosystem – Connected Asset Management from Breadth to Depth
- **Q3 2021:** Roll Monitoring in Pulp & Paper and Steel Manufacturing with System 1
- **Q4 2021:** Introducing System 1 Web
- **Q4 2021:** System 1 Advanced Analytics

With many more to come…

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