

# System 1 *Decision Support*

Gain the insights needed to make timely decisions related to the operation and maintenance of your equipment and process





# Preparing for digital transformation in the industrial sector

Process-intensive operators are increasingly looking for ways to streamline production in the face of globalization, a shifting workforce, and an ever-growing amount of data from connected machines and assets. One of the key differentiators for truly optimized efficiency will be gaining a single plantwide digital view of operations. A connected facility supported by a powerful condition monitoring platform turns wide-ranging asset data into focused, actionable insights that help teams across all industries make smarter, proactive maintenance decisions.

Bently Nevada's System 1 software platform empowers Reliability, Operations, and Maintenance teams to proactively improve productivity. System 1's *Decision Support* application takes predictive maintenance to the next level; this helps decrease unplanned downtime, improve operational efficiency, increase personnel safety, and protect against environmental hazards.

As top industrial performers have learned, maintaining a competitive advantage is virtually unachievable without intelligent adoption of technology and cultural acceptance of change. By leveraging System 1 *Decision Support*, digital transformation initiatives are moved forward, empowering your people to do their jobs better than ever before.

## Industries include:

- Refining
- Upstream oil and gas
- Power
- Petrochemical
- Metals
- Pulp and paper
- Mining and aggregate
- Food and beverage
- Pharmaceuticals



## Challenges of modern industrial operations

Expectations for business improvements continue to grow, often spurred by the promises of digital transformation and big data. However, many challenges limit the ability of industrial operators to achieve these productivity goals while minimizing downtime and protecting the integrity of operations.



**Overwhelming quantity of data, making it impossible to continuously monitor and analyze assets for known failure modes, anomalies, and tracking KPIs**



**Lack of central knowledge base for tracking and retaining corporate knowledge related to machinery operations and process improvements**



**Difficult to acquire and deploy proven analytics to support risk mitigation as outlined in plant reliability strategies and/or OEM documentation**



**Aging workforce means losing machine and plant knowledge**



**Complexity of available tools for creating, modifying, and deploying custom algorithms or KPIs to proactively detect evolving asset issues**



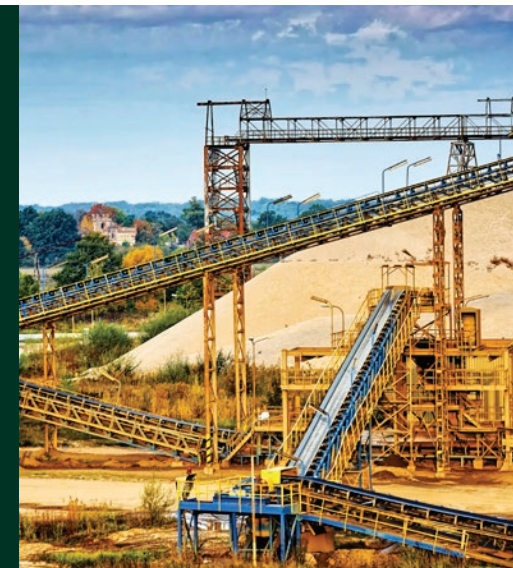
**Limited ability to correlate analytic results with machine/process conditions for root cause analysis, due to disparate historian monitoring platforms**

Time-based maintenance or condition monitoring of only critical assets cannot achieve the reliability and productivity gains your business demands. Top-performing industrial plants know that proactive condition monitoring is the only reliable way forward.

## We have the industry-leading condition monitoring tools you need

Bently Nevada has a rich 60+ year heritage in helping customers solve complex industrial maintenance challenges. Through research in over 20 countries, and with more than 400 end users, we have studied our customers' team dynamics, site processes, and technology suites to determine the best support methods for comprehensive, proactive condition monitoring.

The resulting rich connectivity and visualization capabilities of System 1 and the advanced insights of the *Decision Support* application combine to protect your assets like no other system can.





## Enhancing your condition monitoring program with *Decision Support*

Plants have immeasurable knowledge about their processes and production assets. Combining that knowledge with System 1's *Decision Support* application capabilities will greatly improve your ability to meet production targets while ensuring safe operations.

*Decision Support* Analytics automate diagnostics and provide early detection of mechanical, operational, instrumentation, and process events. The application acquires high resolution data from System 1, analyzes it with model-based logic rules, and feeds the results back to System 1 for notification, visualization, and root-cause diagnostics. A broad range of data types can be processed within a rule, including vibration, process, and emissions data.

### Built-in flexibility

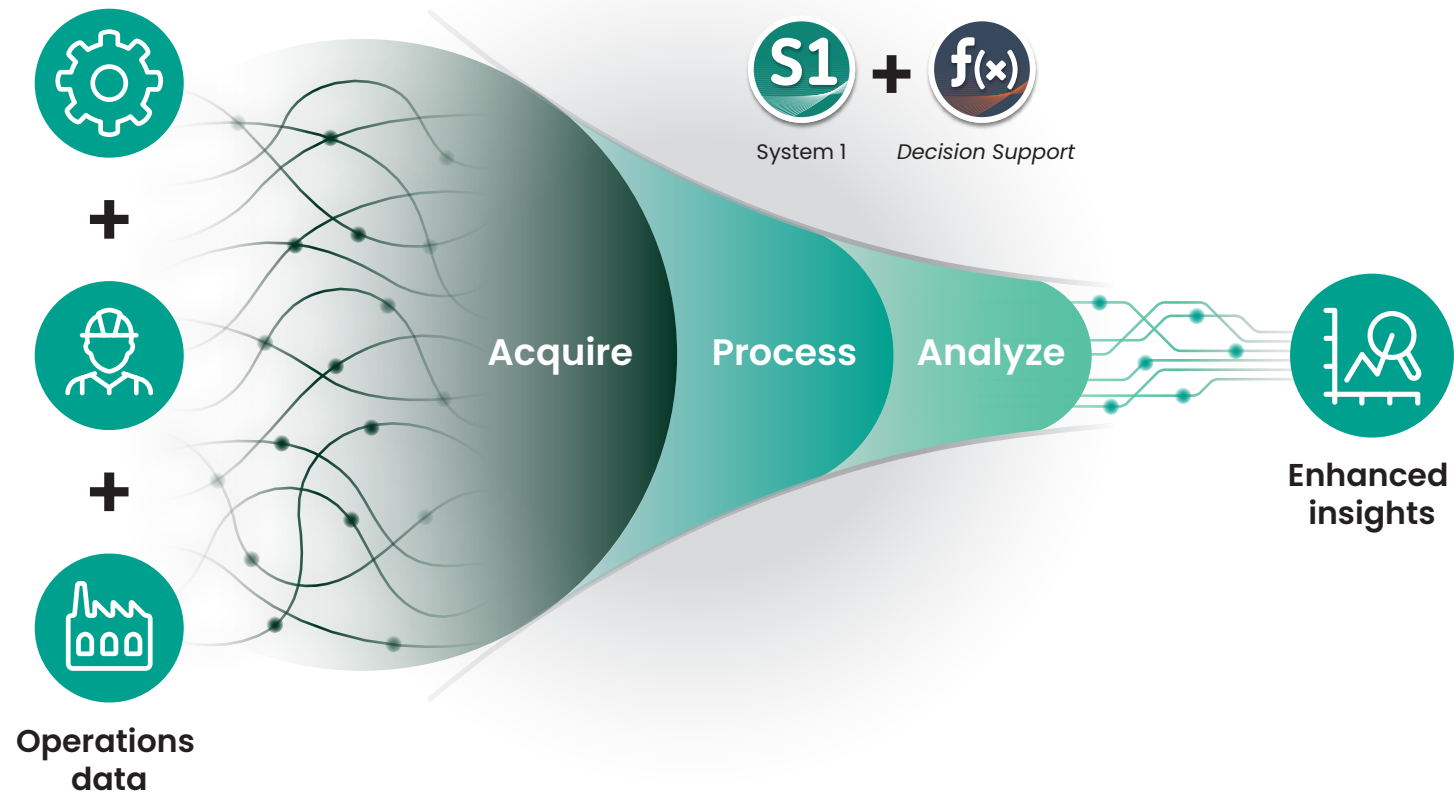
*Decision Support* contains a collection of proven Bently Nevada algorithms, engineered to detect a wide variety of failure modes. They can be easily adjusted to suit the unique operational application of a machine or asset.

You can also use *Decision Support* to design and deploy custom rules that help you capture, disseminate, and leverage knowledge of your equipment, processes, and business solutions. Custom rules preserve operational knowledge in a usable format that can be broadly applied in an easily repeatable and manageable way.



## *Decision Support* delivers advanced insights for all of your operational assets

- Utilize System 1 data to build rules that detect issues with machinery, process, and auxiliary systems
- Develop analytic insights using the simple and intuitive rule-building workspace
- Deploy created rules to multiple assets and quickly modify already deployed rules
- Efficiently share rules between sites and units, achieving consistent fault detection methodology across a global operation
- View resulting insights in the System 1 platform, leveraging its notification, visualization, and diagnostic tools
- Export analytic insights from System 1 to support corporate initiatives



# System 1 *Decision Support* lets you dive deeper into your plantwide machine data

Machines    Devices    Status    Events    Plots    Case History

System1Demo

- Hydrocracker
  - Recycle Compressor
  - Make-Up Compressor
  - Charge Pump
  - Supporting

Hydrocracker Unit    List    Hydrocracker

Hydrocracker [ Highly Critical ]

The diagram illustrates the hydrocracking process. Feedstock enters from the bottom left, passing through a Charge Pump Spare and Charge Pump STG 1. It then flows through a Heat Exchanger and a Heater (3) into the 1st Reactor, which contains three catalyst beds. The effluent from the 1st Reactor passes through a Heat Exchanger and a Cooler (3) before entering the 2nd Reactor, also with three catalyst beds. The 2nd Reactor effluent goes through another Heat Exchanger and Heater (3). The resulting gas stream is processed by an HP Separator (3) and an LP Separator (3). The LP Separator output goes to a Fractionator, which produces Fuel Gas (3), Gas Recovery, Light Gasoline, Naphtha, and Distillate. A Charge Pump STG 2 (1) is used for the distillate stream. Hydrogen gas (H2) is supplied to three reciprocating compressors (Recip A, B, C) with speeds of 270.2 rpm, 7591 rpm, and 1751 rpm respectively. The 7591 rpm compressor is labeled 'H2 Rich Gas - Recycle Compressor'. The system is monitored with various sensors and actuators, indicated by numbered circles (1, 2, 3) and a red '4' in the top left corner.

**1. Failure modes**

- Rotor instability (whip/whirl)
- Rotor imbalance
- Rub
- Bearing wear
- Misalignment

**2. Process**

- Compressor—suction strainer issue
- STG N intercooler problem/fouling
- Pressure and temperature ratio calculation
- Possible liquid carry over compressor
- Compressor—suction drum level high

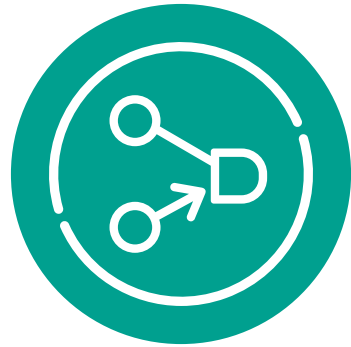
**3. Auxiliaries**

- Dry gas seal problems
- Seal oil problems
- Lube oil pressure and temperature problems
- Lube oil filter problems
- Oil quality



# The complete *Decision Support* process

Providing valuable insights and automating diagnostic analyses



## Build

- Build rules in a graphical user interface that's intuitive and simple to use
- Drag and drop mathematical and logical steps, and connect them to perform desired operations
- Use advanced properties to enforce data and unit constraints to error-proof analytic deployment



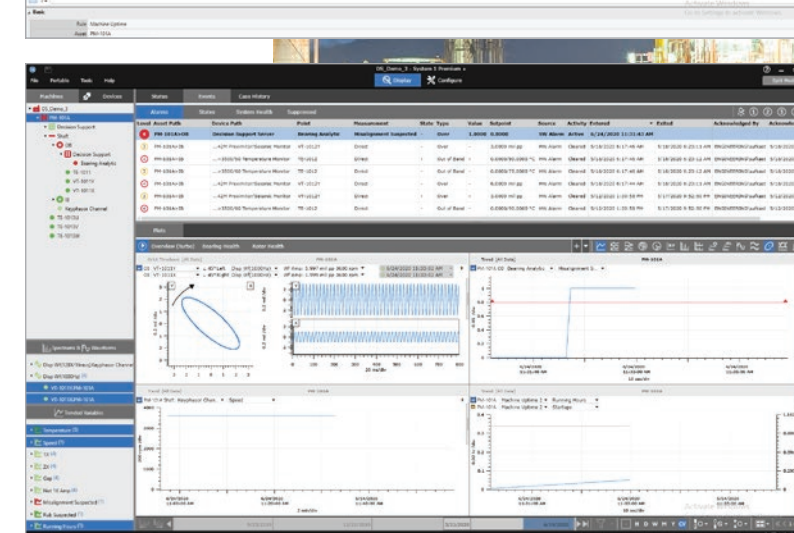
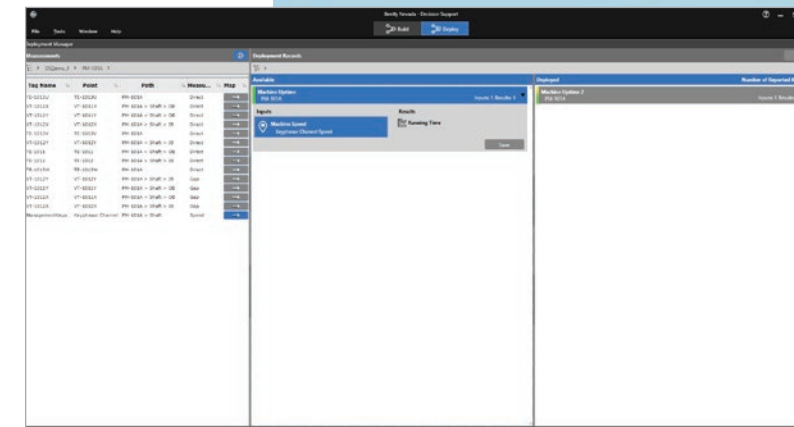
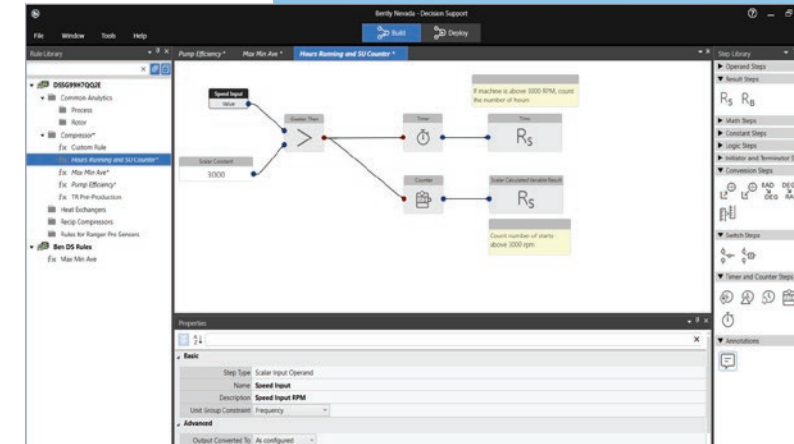
## Deploy

- *Decision Support* analytic results seamlessly integrate with the System 1 data historian
- Measurement properties are inherently understood and smooth the process of mapping measurements to rule inputs
- Rules are applied to System 1 Enterprise and grouped for ease of navigation, visualization, and diagnostics



## Manage

- Easily modify previously deployed rules
- Copy existing custom rules to save time in creating new ones
- Rules can be imported and exported for knowledge sharing and implementation





# Performance spotlights

US refinery uses *Decision Support* to manage machinery below the alert level and avoid unplanned maintenance.

*Decision Support* helps refinery in India avoid severe damage to pump rotor by identifying source of unbalance in critical hydrocracker unit.

Australian facility avoids failure when *Decision Support* identifies rolling element bearing degradation on pump.

*Decision Support* saves \$61,000 USD by detecting crosshead pin and bushing wear at US plant.

And many more examples industry-wide



Want to learn more?

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