System 1* Condition Monitoring and Diagnostic Software

Bently Nevada* Asset Condition Monitoring

**Premium Package**

The System 1 Premium Package represents GE Bently Nevada’s flagship online condition monitoring (CM) solution with seamless integration to our industry leading line of online machinery protection & CM devices. This package enables online CM at your facility for equipment whose health is best managed through permanently installed monitoring devices like Bently Nevada’s 3500 and Adapt platforms.

**System 1 Solution Packages**

Establishing and maintaining a best-in-class CM program at your facility requires equipment knowledge with an understanding of failure modes and operational criticality combined with a cross functional team, process rigor, and enabling technology. Bently Nevada offers flexible solutions ranging from product delivery with deployment services to complete solution coverage through a supporting service agreement where we partner with your facility to manage the CM program.

**Keys to a Successful CM Program**

Bently Nevada Solution Scope

- People
- Process
- Technology
The Evolution of System 1

System 1 software represents the core of Bently Nevada’s CM solution and the Premium Package represents a refreshed approach in our mission to provide users with a single ecosystem for plant-wide machinery management.

Leverage CM alarms, long term trended data, and diagnostics to understand the health of your equipment. Combine this with people and process to enable strategic data driven maintenance planning and decision making.

User Experience

Modern consumer software applications have pushed the envelope when it comes to user experience; we believe the same expectations apply for industrial CM applications

- Modern and Intuitive Interface
- Continuous User Involvement
- User Driven CM and Diagnostic Workflows

Capability

The Premium Package provides scale when it comes to database management, diagnostics, and work prioritization

- High resolution trend, alarm, & startup/shutdown data
- Short-term black box flight recorder for trend data
- Anti-Friction & Hydrodynamic Bearing Diagnostics
- Diagnostic Reporting

Accessibility

Successful CM programs require collaboration between departments and controlled access to the tools

- Distributed Client/Server Deployment Model
- Remote Portable Data Transfer
- 2X/Citrix® Enabled
- User Security Profiles

Embedded Expertise

Bently Nevada differentiates itself by providing equipment focused solutions and best practice configuration & diagnostics

- Equipment State Based Data Collection & Alarming
- Equipment Models drive best practice configuration
- Embedded TA, ISO 10816-3, 10816-7, & 14694 Wizards
Software Package Ordering

3071/10 System 1 Software Premium Package
3071/10-AA-BB-CC

AA: Software Package
01 – Premium Package
02 – Premium Package [Includes Fundamental]

BB: Quantity of Users [Display Clients]
01 – Single Client Package
05 – Small Package [6 Clients]
10 – Medium Package [11 Clients]
15 – Unlimited Clients

CC: Quantity of Server Licenses
### – Numeric Entry [1→n]

(AA) What is included in a System 1 Premium Package?
The System 1 Premium Package includes the core components (Configuration, Display, & Diagnostic capabilities) required to enable an online CM program at your facility. Ordering the -01 option provides the capability to connect to any online device supported.

If one or more portable vibration analyzers will be utilized for general purpose CM, then the Fundamental Package is also required, which can be purchased separately (3071/01) or as a bundle through the -02 option.

(BB) What is a Display Client?
A System 1 Display Client connects to the System 1 Server locally (same computer) or remotely via network access. These clients can have full access to the CM database; however, remote clients can only display the CM database when direct or networked access to the server is available.

(CC) What is a Server?
A System 1 Server contains one or more CM databases, which can be accessed from one or more display clients. Historical data and configuration structure is contained on the server, so the CM databases are always available.

3500 Series Device Import Ordering

3071/11 System 1 3500 Series Device Import
3071/11-AA-BB

AA: Quantity of “Full” 3500 Racks
### – Numeric Entry [1→n]

BB: Quantity of “Mini” 3500 Racks
### – Numeric Entry [1→n]

(AA) What is a 3500 Full Rack?

/22, /25, /32, /33, /40, /42, /44, /45, /50, /60, /61, /64, /65

Standard & M series monitors
✓ 14 monitor slots
✓ Continuous online CM
✓ High resolution alarm data capture
✓ High resolution startup/shutdown data capture
✓ High resolution trend data

(BB) What is a 3500 Mini Rack?

Same monitors as Full Rack
✓ 7 monitor slots
✓ Continuous online CM
✓ High resolution alarm data capture
✓ High resolution startup/shutdown data capture
✓ High resolution trend data

Distributed Series Device Import Ordering

3071/12 System 1 Distributed Device Import
3071/12-AA

AA: Quantity of ADAPT Monitoring Systems
### – Numeric Entry [1→n]

(AA) What is an ADAPT Monitoring System?
/40, /44, /46
✓ 12 monitoring points
✓ Continuous online CM
✓ High resolution trend data
Equipment Based Configuration

- **Configure** State Based Collection Group Configuration (Off, Slow Roll, Startup/Shutdown (SUSD), Running)
- **Leverage** State Based Condition Monitoring Alarming & data collection
- **Facilitate** Best Practice Configuration facilitated through Instrument to Equipment Model Mapping
- **Enable** High Resolution Alarm & SUSD data collection triggered by any point mapped to the equipment

Manual Configuration

- **Leverage** spreadsheet style configuration to apply broad changes to configuration structure

Controlled Access

- **Limit** configuration access to defined Administrator and Advanced users based on Windows credentials
- **Provide** read only configuration access basic users

Equipment Library

- **Build** comprehensive databases starting with: Centrifugal/Screw Compressors, Centrifugal Fans, Gearboxes, Generators, Motors, Overhung/Between Bearing/Vertical Pumps, Cooling Tower Fans, Axial Compressors, Gas Turbines, Steam Turbines
- **Leverage** Embedded Anti-Friction Bearing Database

General Navigation & Work Identification

- **Prioritize** work through equipment alarm level status sorting
- **Navigate** from the hierarchy or graphically in the primary workspace to drill down and identify equipment health issues
- **Select** an alarm from the historical list to automatically present appropriate supporting evidence in the form of meaningful plots

Condition Monitoring & Diagnostics

- **Evaluate** condition using diagnostic plots: Trend, Spectrum, Waterfall, Waveform, Orbit, Bode, Bar Graph
- **Understand** changing condition by comparing data: Previous Samples, Baselines, Machine A to Machine B, Bearing A to Bearing B, Point A to Point B, etc.
- **Pinpoint** frequencies of interest with standard, harmonic, and sideband cursoring
- **Link** trend cursor position with associated waveform & spectrum plots to efficiently facilitate root cause identification

Reporting

- **Generate** context sensitive quick diagnostic report from plotting & alarming workspaces
- **Copy/paste** view from any workspace using standard interactions to build external report
General Capabilities & Specifications

Distributed Client/Server Deployment

- TCP/IP Client to Server Communication
- Clients can connect to 5 different CM databases simultaneously on a server (one “Online” Database per server + “Offline” Databases)
- System performance tested with 5 simultaneous client connections to one online database

User Security Profiling

- Leverages Windows Domain & Local Accounts
- Administrator Profile (Read, Write, Database Management)
- Advanced Profile (Read, Write)
- Basic Profile (Read Only)

Database & Server Capacity

- The System 1 Server can run one “Online” (Premium) CM database connected to devices like 3500 and ADAPT
- The System 1 Server can contain multiple “offline” (Fundamental) databases in addition to the “online” database
- GE Historian for data storage & management

Display Unit Preferences

- Effortlessly switch between “as configured”, Imperial, and SI unit systems from Display

Portable Device Data Transfer (Fundamental)

- Remote Communication Transfer via WiFi, controlled from Portable Device [Simplified Work Practice]
- TCP/IP Ethernet Transfer, controlled from Software
- USB Transfer, controlled from Software
- XML File Mode Transfer, controlled from Portable Device & Software

Supported Languages (1)

System 1 has been designed for internationalization and is supported in the following languages

- English
- Spanish
- Russian
- Simplified Chinese
- Japanese
- Brazilian Portuguese

System Specifications

Server

- G9 Intel Xeon™ E5-2620v3 6-Core™ (2.40GHz 15MB L3 Cache) Processor
- 64 GB RAM or above
- Operating System Hard Disk: RAID 0 & 500 GB
- Historian Hard Disk: RAID 5 (see Table 3)
- Available USB port (if this method required for portable data transfer)
- DVD-ROM drive

Client

- 2.40 GHz Intel Xeon processor or above
- 16 GB RAM or above
- 500 GB hard disk drive
- Available USB port (if this method required for portable data transfer)
- DVD-ROM drive

Operating Systems:

- Microsoft Windows 2012 Server Standard Edition 64 bit
- Microsoft Windows 2012 Server R2 Standard Edition 64 bit
- Microsoft Windows 2008 Server Standard Edition 32 bit and 64 bit
- Microsoft Windows 2008 Server R2 Standard Edition 64 bit
- Microsoft Windows 7 Professional 32 bit and 64 bit
Database Specifications

System 1 specifications ensure maximum application performance, designed to meet the user experience expectations of the Bently Nevada user base.

The following tables provide system guidelines to facilitate server selection based on the anticipated database size.

Device Configuration [Table 1]

In order to provide database size estimates, configuration assumptions are provided in Table 1 for each supported device. All vibration and thrust points contain two waveforms and eight trended variables configured for full Startup/Shutdown (SUSD) & Alarm data capture analysis and storage.

Data Storage Rates [Table 2]

System 1 captures several classifications of data, which have been designed to provide best-in-class machinery management with unfiltered short term data combined with long term summarized data. The trend data storage is determinant, so minimal database optimization effort is required when compared to similar offerings that utilize change filtering.

Significant machinery event data are captured in the form of high resolution Alarm & SUSD files when triggered by the system. When these events are triggered, high-resolution data is stored for every monitoring point configured for the affected machine, regardless of source (3500 or ADAPT when applicable). The storage duration of these data capture files are indeterminate, so a guideline has been provided in Table 2 based on the number of files that can be stored per one Terabyte (TB) of space.

Estimated Database Size [Table 3]

Approximate database size estimates are provided in Table 3 based on the reference device configurations established in Table 1. A mix of 3500 and ADAPT monitoring systems can be established using a 1:2 ratio between 3500 racks and ADAPT monitors. Given this rule, a system configured with 6 3500 racks and 12 ADAPT monitors would consume roughly 3.6 TB of hard disk space.

Table 1: Device Configuration Assumptions

<table>
<thead>
<tr>
<th>Point Type</th>
<th>Quantity</th>
<th>Waveforms Per Point</th>
<th>Trended Variables Per Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>3500 Rack Configuration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radial Vibration</td>
<td>16</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Thrust Position</td>
<td>6</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Acceleration</td>
<td>2</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Speed</td>
<td>2</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Temperature</td>
<td>16</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>ADAPT Configuration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radial Vibration</td>
<td>12</td>
<td>2</td>
<td>8</td>
</tr>
</tbody>
</table>

Table 2: Default Data Storage & Duration Rates

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Highest Data Resolution</th>
<th>Storage Duration</th>
<th>Quantity of files</th>
</tr>
</thead>
<tbody>
<tr>
<td>Database Storage Rates</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short Term Trend Data</td>
<td>20 s [2]</td>
<td>30 Days</td>
<td>-</td>
</tr>
<tr>
<td>Long Term Trend Data</td>
<td>10 min</td>
<td>5 Years</td>
<td>-</td>
</tr>
<tr>
<td>Waveform Data</td>
<td>10 min</td>
<td>5 Years</td>
<td>-</td>
</tr>
<tr>
<td>Alarm Data</td>
<td>0.1 s</td>
<td>Varies</td>
<td>1 TB = ~63,000 Files</td>
</tr>
<tr>
<td>SUSD Data</td>
<td>0.1 s</td>
<td>Varies</td>
<td>1 TB = ~75,000 Files</td>
</tr>
</tbody>
</table>

Table 3: Database Size Estimates (5 Year)

<table>
<thead>
<tr>
<th>Data Import</th>
<th>Standard Database</th>
<th>Large Database</th>
<th>Extra Large Database</th>
</tr>
</thead>
<tbody>
<tr>
<td>Database Device &amp; Point Import Guidelines</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3500 Monitoring Systems</td>
<td>12</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>OR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adapt Monitoring Systems</td>
<td>24</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>OR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibration Monitoring Points</td>
<td>360</td>
<td>600</td>
<td>900</td>
</tr>
<tr>
<td>Database Storage Requirement Guidelines</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trend Data (60%)</td>
<td>2.2 TB</td>
<td>3.5 TB</td>
<td>5.0 TB</td>
</tr>
<tr>
<td>Alarm Data (30%)</td>
<td>1.0 TB</td>
<td>1.5 TB</td>
<td>2.0 TB</td>
</tr>
<tr>
<td>SUSD Data (10%)</td>
<td>0.4 TB</td>
<td>0.7 TB</td>
<td>1.0 TB</td>
</tr>
<tr>
<td>Database Total</td>
<td>3.6 TB</td>
<td>5.7 TB</td>
<td>8.0 TB</td>
</tr>
</tbody>
</table>
Deployment Diagram Options (Coming)

Footnotes:
1. Language translations will be available in Q4 2015
2. Short Term (High Resolution) Storage Rate will be 1 Second for Subsequent Release

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