



Bently Nevada

a Baker Hughes business



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تجهیز انرژی باختر

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Introduction

The company was founded in 1961 by Don Bently. Bently Nevada is headquartered in Minden, Nevada, about one hour south of Reno. Don Bently was the first to manufacture a commercially successful eddy-current proximity probe which measured vibration in high-speed turbomachinery by allowing the direct observation of the rotating shaft. The company also performed research in the field of rotordynamics, furthering knowledge of machinery malfunctions such as shaft cracks and fluid-induced instabilities. Its research also helped refine the equations used to describe vibratory behavior in rotordynamic systems.

Bently Nevada was privately held until 2002 when it was acquired by General Electric and became part of GE Oil and Gas.

<p>Current Logo</p> 	<p>Logo after Baker Hughes got the ownership before 2019</p> 
<p>Logo as when GE got the ownership</p> 	<p>Oldest logo</p> 

In 2017 GE purchased Baker Hughes and merged this with the GE Oil and Gas division to form Baker Hughes, a GE company (BHGE). GE retained a 62.5% share of the merged company.

In 2019, GE announced plans to reduce its ownership in Baker Hughes from 50.4% to 38.4% losing majority control. In October, 2019, GE sold a portion of its 62.5% stake in BHGE, reducing its ownership below 50%, and BHGE was rechristened as Baker Hughes Company. Bently Nevada remained a Baker Hughes Business after GE's sale of its interest in the company.

The result is a solution called Machine Health, an end-to-end machine monitoring and diagnostic solution that combines Internet of Things (IoT) hardware, software, and services enabled through purpose-built Artificial Intelligence (AI). It is designed to deliver prescriptive insights and help customers reduce downtime. With full-stack sensing, outcome-focused AI, and customer success, it doesn't just flag a machine issue before it leads to downtime or failure - it diagnoses the problem and prescribes a solution. Machine Health is part of Cordant, a new integrated suite of solutions for asset performance management and process optimization.

Products:-

1. Condition, Machinery and Protection Systems

- A. [Online Condition Monitoring](#)
- B. [Machinery Protection](#)
- C. [Distributed Protection Systems](#)
- D. [Portable Vibration Testers & Diagnostic Systems](#)

2. Sensors

- A. [Acceleration Velocity Sensors](#)
 - [AM Series Accelerometers](#)
 - [330400/330425 Accelerometers](#)
 - [330450 High Temperature Accelerometers](#)
 - [350900 High Temperature Velocity & Acceleration Sensor](#)
 - [370300 Accelerometer](#)
- B. [Hydro Sensors](#)
- C. [Pressure Sensors](#)
- D. [Proximity Sensors](#)
- E. [Transmitters](#)
- F. [Velocity Sensors](#)
- G. [Wireless Condition Monitoring Sensors](#)
- H. [Sensors Accessories](#)



3. System 1 Software



باختار
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Application:

A. Bearing Condition Monitoring	B. Complex Gear Box Monitoring	C. Wind Turbine Condition Monitoring
D. Vibration and Dynamic Measurement	E. Air Compressors	F. Turbines
G. Pumps	H. agitators	I. extruders
J. blowers	K. fans and conveyors	L. Ball Mills
M. Centriguges	N. Cooling tower fans and pumps	O. ID,FD fans
P. Mixers	Q. Motors	R. Screw Compressors
S. hydro turbine generators	T. Pulverizers	

Industry:

- A. power generation,
- B. oil and gas,
- C. Petrochemical
- D. mining,
- E. pulp and paper,
- F. metal processing
- G. Cement
- H. Water Treatment



Competitors: -

A. Metrix	B. Honeywell	C. SHINKAWA Electric
D. SKF	E. National Instruments	F. Siemens
G. Rockwell Automation	H. Meggitt	I. RION
J. Emerson (wireless)	K. SPM Instrument (wireless)	L. Bruel & Kjaer
M. Schaeffler AG	N. Fluke(Danaher)	O. Cemb
P. PVTVM	Q. MTS (portable)	R. P+F

Clients in Iran:

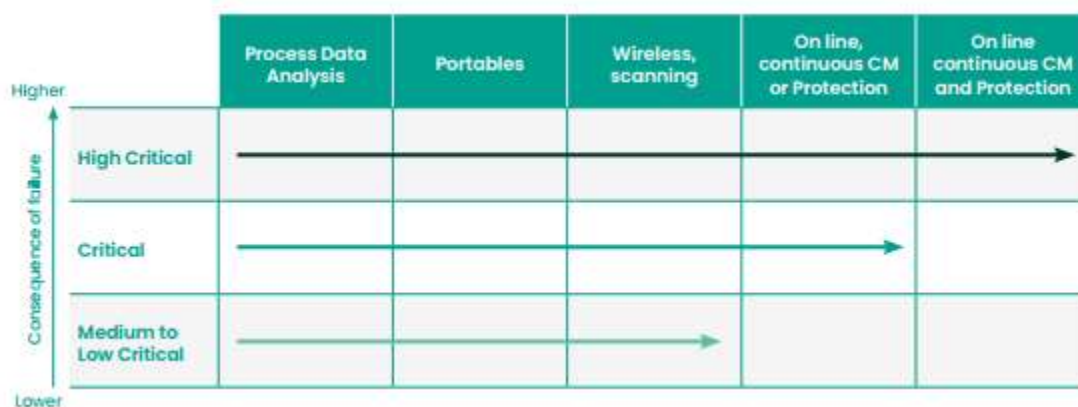
A. Pars Petro	B. SPGC-P4	C. SPGC-P10 , 12	D. Razi Petro
E. Maroun Petro	F. Jam Petro	G. Khorasan Petro	H. Ilam gas ref
I. Isfahan Oil ref	J. Iranian offshore Oil Company	K. Arya Sasol Petro	L. Gas Transition
M. National Iranian South Oilfields Company	N. Shazand Petro	O. BuAlisina Petro	P. Karun Oil & Gas
Q. SPEC	R. NICICO	S. Pardis Petro	T. Tabriz Petro
U. Kharg Petro	V. Aqajari Oil & Gas	W. Arvandan Oil & Gas	X. Setareh Khalij Fars Oil

<https://youtube.com/@bentlynevadaabakerhughesbu6013?si=29KlaBD0SiL-gpM1>

Products details:-

Applicable across all critical levels of rotating machinery...

Criticality is defined by assessing consequence of failure for each piece of equipment in 5 key areas of impact including, Staff and Public Safety, Regulatory and Environmental Compliance, Production, Operations and Maintenance Costs (O&M), and Product Quality. This understanding of equipment criticality along with your maintenance strategy drives the proper monitoring strategy



1. Condition, Machinery and Protection Systems



Bently Nevada offers condition monitoring systems for plantwide machine monitoring protection.

- A. **Condition Monitoring:** online condition monitoring systems allow you to perform long-term monitoring of your assets' health, enabling planning for timely & cost-effective intervention, before faults occur.

- **Continuous Vibration Monitoring System:** **Trendmaster**

The **Trendmaster Pro online condition monitoring system** is ideal for your medium criticality machines:



- ✓ **Dynamic Scanning Modules** - Strategically placed throughout your plant, DSMs accept one to six sensor bus cables to produce a distributed network of condition monitoring sensors.
- ✓ **Frequently polled** - Sensors on each bus are polled sequentially every few minutes, allowing the system to collect data from thousands of connected sensor points.

- ✓ **Low installation and hardware costs** - innovative architecture utilizes point-to-point wiring rather than running all field wiring all the way back to a central location.

A wide range of sensor types are supported, including vibration (Acceleration, Velocity, Displacement), temperature (RTD & K thermocouple), Pressure, Process Variables (20mA, 5V), Rack Buffered outputs. Each Transducer Interface Module provides 2 channels of measurement.

Compatible hardware:-

- ✓ VBONLINE PRO
 - ✓ WIRELESS - RANGER PRO
 - ✓ PORTABLES
- **Wireless Condition Monitoring: Ranger Pro** offers a wireless vibration sensor and condition monitoring system that allows users to collect exceptional condition monitoring data from hard-to-reach machines or hazardous areas, without the need for expensive field wiring.



The Ranger Pro can be used for vibration measurement and to gather important machine-health data from a broad range of industrial applications, including power generation, oil and gas, mining, pulp and paper, metal processing, and more.

- ✓ Cost-Effective
 - ✓ Easy to Install
 - ✓ Long Battery Life upto 5 years
 - ✓ Expandable
 - ✓ Condition Monitoring Software- compatible with system 1
- **vbOnline Pro Plantwide Condition Monitoring:** it provides economic vibration monitoring for mid- and low-level criticality assets. It is also used For WIND TURBINE CONDITION MONITORING. The device is easy to install and configure.



A. Portable Vibration Analyzers & Data Collectors:

handheld vibration analyzers, vibration testers, vibration meters, vibration sensors, and vibration data collectors, combined with the ADRE 408 advanced diagnostics system, allow you to take Bently Nevada’s powerful diagnostic capabilities virtually anywhere, supporting the walk-around component of today’s condition monitoring. They are integral to proactive condition-based maintenance (CBM) program, as well as predictive maintenance.

vb and SCOUT+ series of portable vibration data collectors and vibration analyzers will meet all condition-monitoring needs for both real-time route-based machine data collection and for calibration and vibration analysis of the vibration frequency of problem machines. A vibration analyzer from Bently Nevada is light, quick, and easy to use. Our vibration analyzers store their data in the same modern System 1 vibration monitoring analysis software that is used by Bently customers globally to chart, alarm, and analyze machine health using vibration analysis and vibration frequency.

The ADRE 408 analysis tool is optimized to provide the most advanced rotating equipment diagnostics. It is specifically designed for multichannel signal processing and data acquisition on your large critical machines. Specialized ADRE Sp analysis software provides the powerful charting, condition monitoring, vibration testing, vibration measurement, and analysis tools to diagnose even the most challenging machinery faults.

✓ **ADRE - Data Acquisition & Machine Diagnostics System:**



The Single Board Computer offers faster boot speed, lower power requirements, SAS disk drive technology, and a reinforced mounting case for better shock resistance. This highly portable monitoring system is as useful for machine asset condition monitoring and assessment tasks on the test stand as well as in the field in real-time.

✓ **Scout :**



The **SCOUT100**, **SCOUT200**, and **vbSeries** vibration analysis monitors SCOUT200 series got 2019 oil and gas eng award.

- ✓ **On-route & Off-route** - for all measurement types: waveforms, spectra, orbits, accel/veloc/displ/demod, process/keypad entry.
- ✓ **Analysis at Machine** - Bump test, Time Sync Averaging, Order tracking/Sync sampling, Coast-down/Run-up (Interval Capture).
- ✓ **Rugged** - drop tests (1.2m), waterproof (IP65+), long battery life (10+ hrs), light ($\leq 1.2\text{kg}$)
- ✓ **Fast data collection** - with automatic settling algorithm, optimized sequencing, and 6Pack superquick measurements.
- ✓ **Multi-Channel** - Our portable hardware monitoring devices supports multi-channel vibration data collection, analysis, and balancing. Between 1 and 4 channels simultaneous data acquisition, plus tach/keyphasor speed input.
- ✓ **Advanced Analytics** - As applicable, includes a complete suite of advanced recording and analysis capabilities, including 6Pack recordings, coast down and long time waveform capture.
- ✓ **Hazardous Area Certified** - SCOUT models certified for ATEX Zone 2 hazardous rating while vbSeries models rated for CSA Class 1, Division 2. Neck strap with integrated Sensor Keeper restrains the device while walking or climbing to reach other machines.
- ✓ **Intrinsically Safe (IS)** - Options include Intrinsically Safe hazardous-rated portable data collectors certified for ATEX Zone 1 and CSA Class 1 Zone 1 hazardous areas.

- ✓ **Offers Channel Options** - Available in 2 channel (SCOUT220-IS) or 4 channel (SCOUT240-IS) configurations.
- ✓ **Connects with Bluetooth** - The data collector uses Bluetooth to communicate with the industrial handheld smartphone or tablet that are rated for hazardous environments.

✚ **SCOUT100 & vbSeries Product Features:**



- ✓ **Classic** - single purpose, single piece instrument
- ✓ **Haz/Ex ratings** - CSA Class 1 Div 2 (vb Series), IECEx/ATEX zone 2 (SCOUT100 series)
- ✓ **Multiple Models** - Balancers, Data collectors, Analyzers. You choose.
- ✓ **Balancing** - for in field imbalance correction, 1 & 2 balance planes
- ✓ **Advanced Analysis** - Cross Channel Phase, Long Time Waveform, Modal Impact Testing, Cross Channel FRF for ODS...

+ SCOUT200 Series Product features



Bently Nevada's SCOUT200 series is comprised of easy to use, small form-factor portable vibration data collectors. The SCOUT220-IS (2 channel) and SCOUT240-IS (4 channel) is Intrinsically Safe (IS) hazardous-rated portable data collector designed for ATEX Zone 1 and CSA Class 1 Zone 1 hazardous areas.

The SCOUT200 series represents the next generation of smarter, intrinsically safe portable data collectors from Bently Nevada.

- ✓ **Modern** - de-couples data acquisition and display, uses rugged industrial Android handhelds
- ✓ **Flexible** - choose compact 5" screen for data collection, or large 8" tablet for analysis
- ✓ **Connected** - WiFi, Bluetooth, Cellular, Internet, other apps...
- ✓ **Intrinsically Safe** - Full IS-rated SCOUT200, with same full performance as non-rated COMMTTEST200

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- B. **Machinery Protection** : continually monitor the vibration levels of your critical assets, alerting you or even shutting down equipment if predetermined levels are exceeded.



○ **3500 MACHINERY PROTECTION AND MONITORING SYSTEM**

- **3500/94M VGA Touchscreen Display Module:** with color Touch Screen and I/O module displays. Vibration levels, system and alarm event lists along with module, channel and alarm data and nine custom display options. Pre-built “custom” screens for Direct, 1X, Gap, and alarms with no need to configure make set up easy. There 2 sizes available (10” and 15”) and you can view data from up to four separate 3500 racks at just one display. There are also mount options for the display module, including the hinged and latched Face Mount. Hazardous Area certifications are available for the displays.



<https://www.youtube.com/watch?v=JKGxtj8lFtg>

▪ **3500 Machinery Protection System Speed Monitors:**



- **TACH100 Digital Tachometer:** speed indicator. The compact unit contains its own power supply, it provides a local display indicating machine speed on the machine deck. When double-hearing protection is required, the Digital Tachometer provides a visual indication. Wires can connect in parallel with Keyphasor Proximity Probe input on the monitor rack or directly to the Keyphasor Proximity Probe.



- **3500/25 Keyphasor Module:** provides phase reference information in a 3500 rack (you can employ up to four Keyphasors per 3500 rack). It receives input signals from proximity probes or magnetic pickups and converts the once-per-turn or multiple-event-per-turn pulse signals to a precise digital timing measurement. Used specially in steam turbine or other turbines



- **3500/50M Tachometer Module:** features 2 channels which accept input from Proximitor probes or magnetic pickups to measure shaft rotating speed, rotor acceleration, or reverse rotation.

▪ **3500 Machinery Protection System Relay Monitors:**



- **3500/32M 4-Channel Relay Module** offers four relay outputs, with a highly-configurable relay logic interface. Each of the four outputs can be independently programmed to enable voting by configuring the Alarm Drive Logic for each relay.
- **3500/33 16-Channel Relay Module** offers 16 relay outputs with a highly-configurable relay logic interface. Each of the sixteen outputs can be independently programmed to enable voting by configuring the Alarm Drive Logic for each relay.

▪ **3500 Machinery Protection System Vibration Input Monitors:**

- **3500/40M Proximitor+ Monitor:** accepts input from Bently Nevada 3300XL series of Proximitor and seismic transducers conditions the signal to provide various vibration and position measurements, and compares the conditioned signals with



user-programmable setpoints that can drive alarms and relay logic in the 3500 relay modules.

- **3500/42M Proximitor/Seismic Monitor:** offers four programmable channels for the 3500 system, accepting input from Proximitors and seismic transducers. The 3500/42M then conditions the signal to provide various vibration and position measurements and compares the conditioned signals with user-programmable alarms. Additionally, each channel can be programmed using the 3500 Rack Configuration Software to protect machinery and monitor conditions for Radial Vibration, Thrust Position, Differential Expansion, Eccentricity, Acceleration, Velocity, Shaft Absolute, and Circular Acceptance Region parameters.
- **3500/44M Aero-derivative Gas Turbine Monitor:** four channel Aero-derivative Gas Turbine (GT) Vibration Monitor for the 3500 system. The Vibration Monitor accepts four channels of vibration. Each channel pair can apply its own tracking filter based on up to four different Keyphasor inputs from the 3500 rack.
- **3500/46M Hydro Monitor:** it protects and monitor hydro turbine generators. The 3500/46M Processes signals from Proximitors, seismic, dynamic pressure, and air gap sensors. Discreet Input contacts can identify machinery modes such as Rough Load Zone and automate data acquisition and alarms. External terminations are also available. The 3500/46M Hydro Monitor also conditions input and compares signals with alarm setpoints for Hydro Radial Vibration (RV), Hydro Air Gap, Hydro Velocity, Hydro Acceleration, Hydro Thrust, Hydro Stator End Winding (SEW) Vibration; and Dynamic Pressure. Multimode settings are available for all available channel types.

3500 Machinery Protection System Position Monitors:

- **3500/45 Position Monitor:** processes signals from the Bently Nevada 3300XL series of Proximitor transducers, Rotary Position Transducers (RPTs), and AC and DC Linear Variable Differential Transformers (LVDTs). The 3500/45 conditions the input and compares the conditioned signals with user-programmable alarms for Axial (thrust) Position, Differential Expansion (single ramp, dual ramp, or complementary), Case Expansion, and Valve Position.



▪ **3500 Machinery Protection System Temperature Monitors:**

- **3500/60 (without recorders):** six-channel 3500/60 (without recorders) processes the signals from RTDs (resistance temperature detectors) and TCs (thermocouples). The 3500/60 is capable of monitoring temperature or temperature differentials and is typically used for radial bearing or thrust bearing metal temperature in accordance with API670, but can also be used for key process temperatures such as compressor suction and discharge temperatures, steam temperature, motor stator temperatures, among others.



- **3500/61 (with recorders):** six-channel 3500/61 (with recorders) processes the signals from RTDs (resistance temperature detectors) and TCs (thermocouples). The 3500/61 is capable of monitoring temperature or temperature differentials and is typically used for radial bearing or thrust bearing metal temperature in accordance with API670, but can also be used for key process temperatures such as compressor suction and discharge temperatures, steam temperature, motor stator temperatures, among others. **The 3500/60 and 3500/61 provide identical functionality, with the 3500/61 offering additional 4-20mA recorder outputs for each of its six channels.**

- **3500/65 16-Channel Temperature Monitor:** processes the signals from RTDs (resistance temperature detectors) and TCs (thermocouples). The 3500/65 is capable of monitoring temperature or temperature differentials and is typically used for radial bearing or thrust bearing metal temperature in accordance with API670, but can also be used for key process temperatures such as compressor suction and discharge temperatures, steam temperature, motor stator temperatures, among others.



▪ **3500 Machinery Protection System Process & Pressure Monitors**

- **3500/62 Process Variable Monitor:** six-channel 3500/62 Process Variable Monitor accepts transmitter 4 to 20 mA current inputs or -10 Vdc to +10 Vdc voltage sensor inputs, and then conditions the input and compares the conditioned signals with user-programmable alarm setpoints that can drive alarms and relay logic in the 3500 relay modules. The 3500/62 can also be used for key process measurements such as fluid pressure,

compressor suction and discharge pressures, steam pressure, motor current, flow, Megawatts and virtually any other process variable that can then be correlated via vibration.

- **3500/64 Dynamic Pressure Monitor:** four-channel 3500/64 Dynamic Pressure Monitor accepts input from gas turbine dynamic pressure (combustion) transducers and uses this input to drive alarms. The monitor produces band-passed dynamic pressure measured variables.

- **3500 Machinery Protection System Process & Pressure Monitors**

- **3500/70M Recip Impulse/Velocity Monitor :** 4-channel 3500/70M Recip Impulse/Velocity Monitor:Receives input on both acceleration and velocity from seismic transducers such as the Bently Nevada 330400, 330425 and Velomitor CT. Conditions signals to receive vibration measurements and compares the measured variables to user-programmable alarms. Sets up Impulse Acceleration, Acceleration 2, Recip Velocity and Low Frequency Recip Velocity channel functions as needed.



- **3500/72 Recip Rod Position Monitor:** 4-channel 3500/72 Recip Rod Position Monitor processes signals from Bently Nevada Proximitor transducers to create measurements optimized for piston rod position monitoring. Provides vital insight into the condition of reciprocating compressors. Additionally, each channel can be programmed to perform rod position measurement, rod drop measurement and hyper-compressor measurement.

- **3500/77M Recip Cylinder Pressure Monitor:** 4-channel 3500/77M Recip Cylinder Pressure Monitor Optimizes monitoring - Accepts input from the unique Bently Nevada 165855-approved cylinder pressure transducers to generate a range of measurements optimized for monitoring the condition of a reciprocating compressor in API-618 service. Offers multiple measurement variables - Measured cylinder operation variables of the 3500/77M include Maximum and Minimum Pressures, Discharge Pressure, Suction Pressure, Compression Ratio, Peak Rod Compression, Peak Rod Tension and Degrees of Rod Reversal.

- **3500 Machinery Protection System Communication Gateways**



- **3500/91M EGD Communication Gateway** Integrates process control and other automation systems using both Ethernet TCP/IP and serial (RS232 / RS422 / RS485) communications capabilities. Permits Ethernet communications with 3500 Rack Configuration Software. The 3500/91 also supports proprietary Bently Nevada protocol along with Modicon Modbus and Modbus/TCP protocols.
- **3500/92 Communication Gateway** integrates easily with process control networks and other automation systems using both Ethernet TCP/IP and serial (RS232 / RS422 / RS485) communications capabilities. Permits communications via Modbus using 3500 Rack Configuration Software. The 3500/92 can be configured using the 3500 Rack Configuration software to produce a custom or condensed Modbus map for communications using fixed or configurable registers.



▪ **3500 Machinery Protection System Isolators & Barriers**

- **3500 Galvanic Isolators** - For machinery protection and condition monitoring in a hazardous area with a potentially flammable atmosphere, 3500 Galvanic Isolators provide Intrinsically Safe (IS) interfaces to Bently Nevada transducers. The Isolators come with a safe installation and a safe interface. They also offer accessories such as earth rails and backplanes.

- **3500 Internal Barriers** are Intrinsically Safe interfaces that provide explosion protection for transducer systems connected directly to the 3500 Machinery Protection System. Unlike external barriers, 3500 Internal Barriers integrate with the 3500 System while maintaining the System's performance.



▪ **3500 Machinery Protection System Cabinets & Housings**

- provide robust protection for all 3500 racks and the infrastructure they require. The cabinets simplify site installation, provide protection for installed instrumentation and facilitate ongoing ease-of-use and maintenance and include instrumentation options.
- **3500/06 Weatherproof Housing** protects the 3500 System against adverse environmental conditions such as excessive moisture, dirt, grime and unclean air. An optional purging



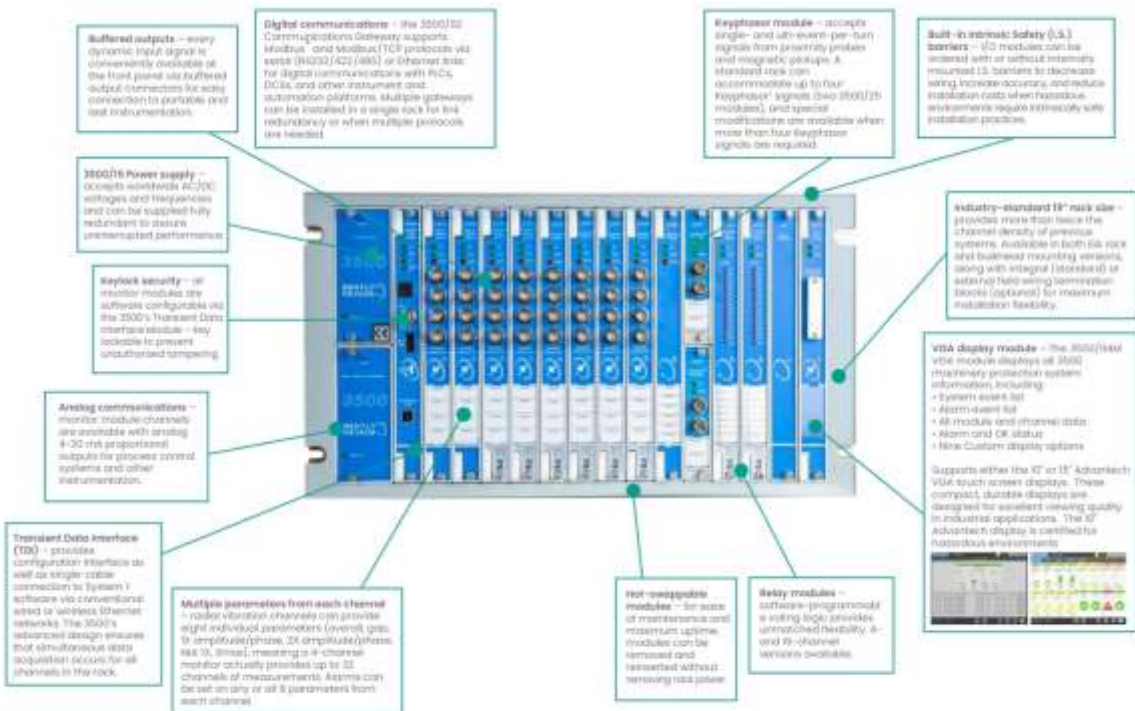
system protects the rack from outside elements. The housing is available in epoxy-coated steel or 304 stainless steel and as a SIL 2 rated system with multiple Hazardous Area and country-specific approvals.

▪ **3500 Machinery Protection System Rack, Supply, TDI**

- The **3500/15 AC and DC Power Supplies** are half-height modules and must be installed in designated slots on the left side of the rack. The 3500 rack can contain one or two power supplies with any combinations of AC and DC. Either supply can power a full rack.
- **3500/05 System Rack** holds all 3500 monitor modules and rack power supplies, allowing modules to communicate with each other, with System 1 software and power supplies to distribute power to each module as needed.
- **3500/22M, Transient Data Interface Module (or TDI)**: The TDI is equipped with a USB port on the front for easy access for configuration, and a 10/100 Ethernet connection on the rear I/O module for communicating with System 1.



Advan Technology Group



	Monitor modules														
	3500/25	3500/32/33	3500/42M	3500/44M	3500/45	3500/46M	3500/50	3500/60/61/65	3500/62	3500/64M	3500/70M	3500/72M	3500/77M	3500/91/92	
Measurements	Phase reference	●													
	Radial vibration (proximity probes)			●											
	Radial position (proximity probes)			●											
	Axial position (proximity probes)			●		●									
	Eccentricity (proximity probes)			●											
	Seismic vibration (velocity transducers/accelerometers)			●											
	Shaft absolute (proximity and seismic)			●											
	Aeroderivative gas turbine casing vibration				●										
	Differential expansion			●		●									
	Ramp differential expansion					●									
	Complementary differential expansion					●									
	Case expansion					●									
	Valve position					●									
	Hydro turbine/generator vibration						●								
	Hydro generator air gap						●								
	Machine operating state (discrete input)						●								
	Rotor speed	●						●							
	Rotor speed rate-of-change (acceleration)							●							
	Rotor zero speed (turning gear engagement)							●							
	Reverse rotation							●							
	Relays		●												
	Temperature (direct/average/differential)								●						
	Process variable signals (4-20 mA, 1-5 Vdc, etc.)									●					
	Gas turbine combustor instabilities										●				
	Reciprocating compressor impulse/velocity											●			
	Reciprocating compressor rod position												●		
	Reciprocating compressor cylinder pressure													●	
	Communication gateway														●

1. The 3500/60 and /61 are 6-channel monitors. The 3500/65 is a 16-channel monitor.

C. Distributed Protection Systems

- **ADAPT OVERSPEED ESD - EMERGENCY SHUTDOWN SYSTEM**



ADAPT (Advanced Distributed Architecture Technology) Emergency Shutdown Device Provides Automatic Protection Value

- **1900/65A GENERAL PURPOSE EQUIPMENT MONITOR**



specifically designed to continuously monitor and protect essential and balance-of-plant equipment assets in a wide range of industries including: Oil & Gas, Power Generation, Water Treatment, Pulp & Paper, Manufacturing, Mining, Cement, and others. The 1900/65 Monitor is suitable for monitoring and protecting cooling tower fans, pumps, blowers, motors, pulverizers, air compressors, small reciprocating compressors, small electric motors, small hydro turbines, centrifuges, and other equipment assets



- **2300 VIBRATION MONITOR**

The 2300 Vibration Monitors deliver vibration monitoring and high vibration level alarming. They include two channels of vibration measurement inputs from various accelerometer and proximity-type sensors, a speed input channel, and outputs for relay contacts. Any channel may be used for process parameter sensor inputs.

- **ORBIT 60 SERIES**



2020 Product of the Year Silver Award Winner: Machinery protection, condition monitoring system. there are cases where it makes sense to consider the Orbit 60 versus a revision to your existing 3500 fleet.

Input Cards includes:-

PAS –This card is the only card that accepts moving coil velocity sensors, which historically have been used with proximity probes to develop a shaft absolute value. In most modern instances, the moving coil sensors have been replaced with solid state velomitors. In addition to the moving coil sensors, this card can also take in proximity probes and accelerometers.

AC LVDT – as its name implies, this card allows up to four AC LVDTs in either 4, 5 or 6 wire configurations. These measurements are most often used for case expansion or valve position

measurements. DC LVDT's, which are uncommon, use the PAD input card, which will be available later.

PVT – Positive Voltage Transducers. While this card can take input from proximity and velomitor sensors, it was specifically designed to be compatible with most industrial accelerometers. These accels are typically powered with a positive voltage, whereas our monitors have traditionally provided a negatively biased power. The PVT will standardize these measurements and will not require a phase correction. We foresee this card helping you monitor your ancillary machines that utilize Rolling Element Bearings.

PVD – Process Variable and Discrete Inputs. Much like the PVT card above, this new card is not TSI specific either. The PVD card allows us to take in 4-20 mA, 0-10VDC or 1-5VDC signals (actually any voltage between +10 and -10 VDC), as well as Dry or Wet contacts.

PAD – This input card is very similar to the PAV card introduced in the original release. While the PAD can bring in negatively biased sensor such as proximity probes, 3-wire accels, 330500 Dynamic Pressure sensors, 350501 accelerometers, and proximity based Keyphasors, it is the sole card that can bring in DC LVDT's, which are of course, of great importance to TSI installations.

6U Chassis – This double height chassis (same height as a standard 3500 rack) is able to accommodate 29 slots, or 10 more than our 3U chassis. Since most machine trains that require TSI functionality have many bearings (typically up to a dozen), having extra slots cuts down on the need for multiple racks.

Part of our core Orbit 60 design philosophy is to design full capabilities into the hardware, and then turn them on later with firmware and software upgrades as they become available. To this end, this second phase has enabled us to enhance Orbit 60's capabilities with the following firmware enhancements:

Case, Differential Expansion and Valve Position Measurements – These are some key TSI related measurements. With the addition of the hardware noted above, our new PPM, Protection Processor Module, firmware can process and provide values for Case differential Expansion and valve position measurements like those available on a 3500/45 monitor.

Shaft Absolute Measurements – These measurements have long been a standard for large steam turbines and have been available all the way back to our 7200 monitoring systems. They are generated by summing the shaft relative (proximity probe) and Casing Absolute (Velocity integrated to displacement) measurements to develop Shaft absolute. There are multiple papers available that discuss this measurement type, and its associated design considerations.

Acceleration Enveloping – This sampling methodology is specifically geared (pun not intended) towards Rolling Element (Anti-Friction Bearings). This is a new trended variable available in System 1[®] for accelerometers.

Amplitude Extraction – Amplitude extraction is another new trended variable In System 1[®] made possible by Orbit 60. Amplitude extraction is an efficient way of using spectral data to quantify the amount of energy around a center frequency, given a user defined bandwidth.

EGD Communications – This communication protocol is largely used with General Electric control systems such as the Mark V or VI.

Zero Speed – Again, another standard TSI function. If a large steam turbine rotor is allowed to sit still, it starts to sag or bow. This could make for a very rough startup. Zero speed allows an operator to engage the turning gear or alerts them to a stopped condition.

Eccentricity – Along with zero speed, eccentricity provides information on the amount of bow the rotor has incurred. Typically, an operator will consult the eccentricity measurement prior to starting the turbine up. If eccentricity is too high, the unit should remain on turning gear until it is safe to start.

Relay Reflash – This feature allows an operator to acknowledge an alarm without clearing it. If another, separate, alarm comes in, the reflash will deactivate the relay briefly, and when it is reactivated it will cause the annunciation to blink. This keeps operations informed of the current condition, even if a point has been in alarm for a period of time.

There is catalogue comparison of 3500 vs orbit 60

1. Industrial Sensors for Condition Monitoring



a. Acceleration Velocity Sensors

- **20015x Accelerometers** : general-purpose, wide frequency, case-mounted seismic transducers designed for use with Trendmaster
- **AM Series Accelerometers:** general-purpose, case-mounted seismic transducers designed for use with Trendmaster Pro Constant Current Direct Input Card, part number 149811-02 and the Seismic Direct Input Card, part number 164746-01.
- **Seismoprobe Velocity Transducer Systems** are designed to measure absolute (relative to free space) bearing housing, casing, or structural vibration.
 1. **9200:** two-wire transducer suitable for continuous monitoring or for periodic measurements in conjunction with a test or diagnostic instrument. the 9200 has excellent resistance to corrosive environments without the need for additional protection.
 2. **74712:** The 74712 is a high-temperature transducer model of the 9200.

3. **370300 accelerometers:** provide high electrical isolation between the base of the transducer and its internal electronics.
4. **350900 High-Temperature Velocity and Acceleration Sensor (HTVAS)** provides a continuous acceleration and velocity output, allowing the customer to protect their machine with a velocity signal while simultaneously capturing the acceleration signal for machinery diagnostics. Its design is primarily for use with the 3500/42M and 3500/44M monitors. When attaching the HTVAS to a 3500/42M or 3500/44M monitor you must use the acceleration and velocity signals from the transducer on a separate channel pair (such as channels 1 and 3) or on separate monitors.

- **Velocity Sensors:**

1. **190501 Velomitor CT (Cooling Tower):** low-frequency velocity sensor modeled off standard 330500 Velomitor, with a sensor for use in hazardous areas.
2. **330500 Velomitor:** rugged, 2-pin, integrating piezo-accelerometer that is especially suited for condition monitoring of machines with rolling-element bearings and where vibration measurements in units of velocity are most useful.
3. **330505 Low-Frequency Velocity Sensor:** 2-pin moving coil design with onboard signal processing circuitry to measure bearing casing vibration on slow-speed hydroelectric turbines. The sensor is optimized to measure vibration below 4 Hz with a high degree of sensitivity
4. **330525 Velomitor XA Piezo-Velocity Sensor:** more robust version of our 330500 Velomitor - for when you need to data from harsher environments. The 330525 offers a 316L stainless steel case, unique weatherproof connector and cable assembly permit mounting without housing. Designed to withstand various hazardous environments while still offering a great degree of sensitivity
5. **330530 Radiation Resistant Velomitor:** , 2-pin integrating accelerometer that blocks gamma radiation with a performance guarantee to a maximum absorbed dose of 12.0 Mrad while offering sensitivity in the range of 3.94mV/mm/s (100 mV/in/s) \pm 5%.
6. **330750 and 330752 High-Temperature Velocity Sensors:** unique design with the sensing element segregated from the signal conditioning electronics. Due to this design, the Sensing head can be installed on surfaces up to 400°C (752°F) with signal conditioning electronics installed in a cooler location thus still offering sensitivity in the range of 5.7 mV/mm/s (145 mV/in/s) \pm 5%. These high-temp velomitor sensors

can operate with a maximum cable length of 305 m (1,000 ft) with no signal degradation, and offer a broad frequency range: 15 Hz to 2000 Hz ± 3.0 dB or 20 to 1000 Hz ± 0.9 dB.

b. Hydro Sensors



- **4000 Series Air Gap Sensor System** provides monitoring and diagnostic capability for all new and existing hydro generators and motor/generators and fully integrates with the 3500/46M Hydro Monitor and System 1+ software.
- **350300 Hydro-Dynamic Pressure Sensor:** directly connects to the 3500/46M monitor to provide static and dynamic pressures from the same monitor channel

c. **Pressure Sensors: Industrial Pressure Sensors & Transducers:** can detect both static and dynamic pressure, come with a long operational lifetime (over 50 million cycles)

applications. :- ENERGY BAKHTAR



- ✓ hydro turbine
- ✓ centrifugal pumps
- ✓ reciprocating compressor cylinders

- **Static Pressure sensors : Trendmaster 200132 Pressure Transducer System :** provide static (average) pressure measurements from general process monitoring to the Trendmaster system



Appropriate sensors allow the system to monitor a variety of machine conditions including:

- ✓ vibration
- ✓ temperature
- ✓ seal leaks
- ✓ pressure

- **Dynamic Pressure sensors**

- **Cylinder Pressure Sensors & Transducers:** optimized for measuring the cyclic absolute pressure changes inside a reciprocating compressor cylinder. It integrates with 3500/77M Cylinder Pressure Monitor
- **Piezoresistive Pressure Sensors (Pressure Pulsation):** 350300 Dynamic Pressure Sensor provides dynamic (high-frequency waveform) measurements for hydro turbine or pump monitoring.

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d. Proximity Sensors : Proximity Probes, Sensors & Transducer Systems



Inductive proximity sensors, magnetic proximity sensors, ultrasonic proximity sensors, photoelectric sensors, or capacitive proximity sensors, these sensor types can help with object detection, automation, and robotics.

- **3300 5mm Proximity Probe. Sensor and Transducer System:** smaller probe diameter while interfacing with XL 8mm extension cable and 5mm proximity sensor. The system provides an output voltage that is directly proportional to the distance between the probe tip and the observed conductive surface. The system can measure both static (position) and dynamic (vibration) data. Its primary use is in vibration and position measurement applications on fluid-film bearing machines, as well as Keyphasor measurement and speed measurement applications.

The 3300 5mm Proximity Transducer System includes:

- ❖ 3300 5mm probe
- ❖ 3300 XL 5mm extension cable
- ❖ 3300 XL 5mm proximity sensor

- **3300 XL 8mm Proximity Probe, Sensor and Transducer System:** The standard 3300 XL 8mm 5-meter system also fully complies with the American Petroleum Institute's (API) 670 Standard (4th Edition) for mechanical configuration, linear sensing range, accuracy, and temperature stability.

The 3300 XL 8mm Proximity Transducer System includes:

- ❖ 3300 XL 8mm proximity probe
- ❖ 3300 XL 8mm extension cable
- ❖ 3300 XL 8mm proximity sensor

- **3300 XL 11mm Proximity Probe, Sensor and Transducer System:** It accommodates a variety of applications with a linear measurement sensing range of 4 mm (160 mil) and provides a 3.94 V/mm (100 mV/mil) output to measure vibration and displacement. The 11 mm tip gives this Transducer System a longer linear sensing range when the standard 8 mm lacks sufficient

reach. With both European and North American approvals, the 330 XL 11mm allows for installation in Hazardous Areas.

3300 11mm Proximity Transducer System consists of:

- ❖ 3300 XL 11mm probe
- ❖ 3300 XL 11 mm extension cable
- ❖ 3300 XL 11mm proximity sensor

- **3300 XL 16mm High-Temperature Turbine Sensor System:** 3300 XL High-Temperature Proximity System (HTPS) withstands extreme temperatures (rated for +350°C or +662°F). This high-temperature sensor is suitable for use inside gas turbines, steam turbines and other types of rotating machinery.

The 16mm system measures:

- ✓ Vibration
- ✓ Thrust position
- ✓ Differential expansion
- ✓ Mode shape analysis
- ✓ Seal clearance
- ✓ Labyrinth seals
- ✓ Bearing housing struts in steam turbines
- ✓ Exhaust path in gas turbines.

- **3300 XL 25mm Turbine Sensor and Transducer System:** provides an extended linear measurement range of 12.7 mm (500 mil) and is ideal for use in steam turbine TSI. The 3300 XL 25 mm Transducer System measures differential expansion (DE) on mid-size to large steam turbine generators caused by the difference in growth rates between the turbine rotor and the machine stator (casing). The 25mm probe can survive in the harshest steam turbine differential expansion environments. The 25mm Proximitor Sensor has RFI/EMI immunity to achieve European CE mark approvals without special mounting considerations.
- **3300 XL 50mm Turbine Sensor and Transducer System:** offers the longest linear measurement of all of our eddy current proximity sensor systems with a sensing range of 27.9 mm (1100 mil). The 3300 XL 50 mm system measures the differential expansion (DE) between the rotor and stator of large steam turbine generators and is a vital input for Turbine Supervisory Instrumentation (TSI) systems. The 50 mm system is capable of withstanding the harshest steam turbine environment. The RFI/EMI immunity of our 50 mm Proximitor sensor enables its European CE mark approvals without special mounting considerations.
- **Specialty Proximity Sensor Systems:**

1. **3300 XL Ceramic Probe:** to monitor machinery in corrosive, chemical, or high-pressure environments. the 3300 XL Ceramic Capped probe provides robust protection for applications in anhydrous ammonia or other extreme pH environments. While the 3300 XL CCP is rated to 34 Bar (500 psi), it can be modified for applications with higher pressures. Compatible with the 8 mm 3300 XL Proximitor Sensor and its extension cable.



2. **3300 XL NSv Compressor Sensors:** Suitable for centrifugal air compressors, refrigeration compressors, process gas compressors and other machines with tight installation requirements, the 3300 XL NSv is also ideal for small targets such as measuring radial vibration on shafts smaller than 51 mm (2 in) or an axial position on flat targets smaller than 15 mm (0.6 in). Additionally, this sensor serves tachometer, zero speed and Keyphasor applications.

3. **3300 XL Underwater Probe:** for applications involving constant exposure to liquids, such as those in hydroelectric plants or sewage treatment facilities. These designs also seal the probes against gases. All our underwater probes are rated to 500 psi (34 Bar) on the interface between the tip and probe casing.



- **Proximity Probe Housing Assemblies:** 3300 PROXPAC XL Transducer Assembly integrates our Proximitor sensor with a specially-designed probe housing to create a compact, self-contained, all-in-one proximity probe system. The housing cover contains its own 3300 XL Proximitor sensor connector, thus eliminating the need for an extension cable. Rated Type 4X and IP66 – the 3300 PROXPAC XL provides extra protection in severe environments.

- e. **Transmitters:** These new technologies are consistently dependable for process control: automation that safeguards your system's centrifugal air compressors, small pumps, motors, and fans, as our vibration radio system transmitters work with Bently Nevada 3300 NSv (narrow side view) proximity probes. These compact yet durable automation transmitters are wireless transmitter telemetry for installation in small spaces with minimal clearance – where other types of transmitters, amplifiers, and connectors won't fit.



- **990 (Vibration) and 991 (Thrust) Transmitters** are intended for original equipment manufacturers (OEMs) of centrifugal air compressors or small pumps, motors, or fans who prefer to provide a simple 4 to 20 mA proportional vibration or axial displacement (thrust) signal as the input

to their machinery control system. The 990 and 991 transmitters work with our 3300 narrow side view (NSv) proximity probes.

- **177230 Seismic Transmitter** is a self-contained piezo-accelerometer that offers condition monitoring of general-purpose machinery with rolling element bearings. The 177230 produces 4 to 20 mA primary signal outputs to a control system and a secondary dynamic signal for diagnostics. It is suitable for motors, pumps and small reciprocating compressors where accelerometer monitoring is appropriate. Bently Nevada offers CSA/NRTL/C, ATEX/IECEX certifications for Hazardous Areas with potentially flammable atmospheres

f. **Wireless Condition Monitoring Sensors**

- [Ranger Pro](#)

g. **Sensor Accessories**



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- **Transducer Cables and Instrument Wiring** provide a range of reliable options to accommodate a variety of installations. Bently Nevada offers cables and wiring for velocity sensors (which come in convenient length increments), proximity transducers (which are customized to match your system's 'electrical length'), accelerometer transducers (which also come in convenient lengths), and more.
- **Housing for accelerometers and velocity sensors** depend on protection from adverse physical and environmental conditions by dependable water-tight and dust-resistant housings. An opening in the

accelerometer's base enables it to be mounted directly on the machine's surface for optimal frequency response and all housings mate with flexible or rigid conduits. The sensor's housings are available in application-specific materials and a variety of configurations to accommodate the sensors.

- **3300 XL Multi-Purpose and Weather-Resistant Lockable Stainless Steel Water-Resistant Housings:** When Proximity Sensors need protection from harsh environments we offer a variety of protective housings in various sizes. Our certified 3300 XL Multi-Purpose and Weather-Resistant Lockable Stainless Steel Water-Resistant Housings meet environmental ratings. Our explosion-proof North American-certified explosion-proof housings are approved for use in specified hazardous areas. Our water and corrosion-resistant fiberglass housings protect against corrosive, wet, and dusty environments.
- **TK-3E test kit :** The TK-3 Proximity System Test Kit simulates shaft vibration and position for calibrating Bently Nevada monitors. It verifies the operating condition of the monitor readouts as well as the condition of the proximity transducer system.

The user can then compare a vibration monitor's reading to the known mechanical vibration signal input viewed by the proximity probe. The mechanical vibration signal from the TK-3 can range from 50 to 254 μm (2 to 10 mils) peak-to-peak.



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2. System 1 Software

- **Machine Health:**

Machine Health analyzes millions of condition monitoring sensor outputs 24/7— alerting your team well in advance of failure, diagnosing root causes, and prescribing fixes, so your team does not have to worry about emergency downtime on a weekend, overnighting spare parts, or being constantly overwhelmed with alarm fatigue.

Bently Nevada and Augury joined forces to combine the 60+ years of BN's leadership in energy and heavy industry with Augury's leadership in AI-driven machine health in manufacturing. Together we deliver the world's most effective and scalable Machinery Health coverage of your plantwide assets.

How it works:



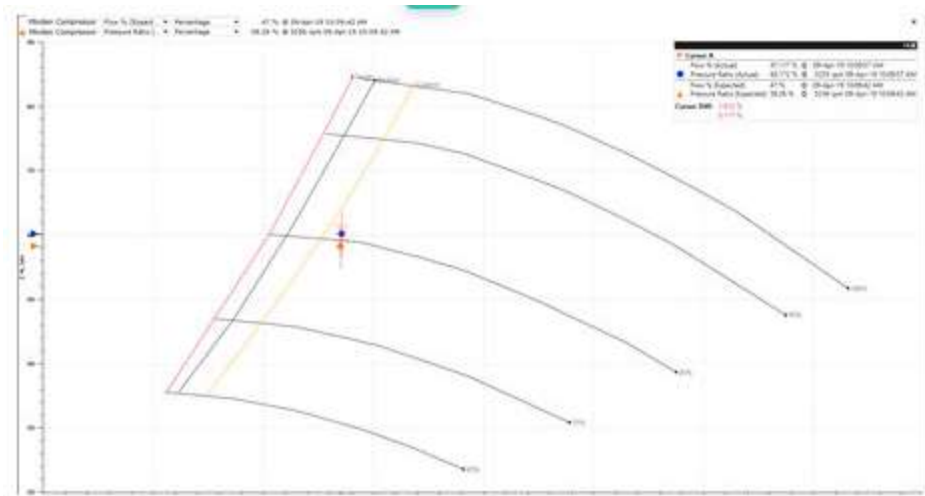
1. Monitor : A range of compatible sensors like Ranger Pro and Augury Halo capture and transmit data into System 1 Machine Health, 24/7/365

2. Diagnose: Using purpose-built AI trained on tens of thousands of machines, Machine Health uses vibration trend data to detect early signs of machine failure, diagnose root cause and prescribe fixes for the maintenance team

3. Guide: Machine Health's platform and AI, paired with expert support helps users to plan, and prioritize maintenance activities.

- **System 1 Performance Monitoring**

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Bently Performance when added to your System 1 installation provides insights into:

- Equipment efficiency changes over time and likely causes
- Overall production efficiencies and the potential impact on revenues
- Maintenance scheduling

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Summary of Products:-



Transducers:

Don Bently pioneered the first commercially successful use of Proximity Probe systems (for direct rotor vibration and position measurements within journal bearing machines)—to the application of accelerometers and Velomitors to measure casing vibration on rolling element bearing (REB) machines

Orbit 60 Series



Latest condition monitoring, protection and data Integration platform Orbit 60 Series is built on a innovative and fully distributable architecture that allows you to monitor all assets regardless of complexity or location and is intrinsically cyber secure with a built in data diode.

3500 Series



Machinery monitoring and protection Anticipate and prevent mechanical failures with continuous, online machinery protection and asset condition monitoring. The 3500 Series solution represents our most capable and flexible system in a traditional rack-based design and offers numerous features and advantages not provided by competitor systems.

ADAPT Series



Advanced Distributed Architecture Platform Technology

This distributed architecture monitoring technology is well suited to support essential rotating equipment across multiple industries. The growing application-based ADAPT product family offers an easy, user-defined configuration that is skid-mountable, flexible, and optimized for hydro, aero, wind, emergency shut down (ESD), and general purpose applications.

2300 Series

Vibration monitor



The 2300 vibration monitors delivers cost-effective vibration monitoring and protection capabilities for small machinery. It is designed specifically to provide continuous monitoring and protection. With the 2300/20 monitor, you can perform condition based maintenance of your assets in a wide range of industries—including oil and gas, power generation, water treatment, pulp and water, manufacturing, food & beverage, pharmaceutical, mining, and cement.

1900/65A

Vibration monitor



The Bently Nevada 1900/65 General Purpose Equipment Monitor is a flexible, cost-effective system specifically designed to continuously monitor and protect assets in a wide range of industries This monitor has four vibration inputs that can accept proximitors, accelerometers and velocity measurements as well as four temperature inputs. The ease of configuration, local display, 4-20mA and BNC Outputs have made this monitor very popular across the industry

Trendmaster* Pro System

Online condition monitoring



The Bently Nevada Trendmaster Pro System is specifically designed to address critical and non critical assets that require more frequent surveillance. Using a single cable that can host hundreds of permanently mounted sensors ranging from pressure to vibration and temperature.

AnomAlert

Motor monitoring



The AnomAlert general industrial motor monitoring system is well suited to almost any motor as well as motor-driven loads such as pumps, fans, compressors, and blowers

vbOnline Pro

Next generation of economical simultaneous scanning condition monitoring



Targeted for the hundreds of important pumps, motors, blowers, fans, fixed and mobile equipment and other assets that populate a typical plant. vbOnline Pro's innovative parallel/sequential architecture delivers the right level of cost-effective condition monitoring for these machines

SCOUT* and VBX Series

Portable data collection and analysis



The SCOUT and VBX platform brings BHGE's industry-leading Bently Nevada condition monitoring expertise to the world of portable data collection and analysis, giving you access to a dependable, efficient, and cost-effective condition monitoring solution that is deployable across your entire plant.

Ranger Pro

ISA100.11a wireless vibration sensor



The Ranger Pro wireless platform is targeted to low to medium criticality machines with rolling element bearings (REB), allowing customers to take more frequent data, while reducing installation costs for an online system. This innovative platform (single or tri-axial w/ casing temperature) provides static data collection through a ISA100/11a gateway and/or diagnostics through System 1 software.

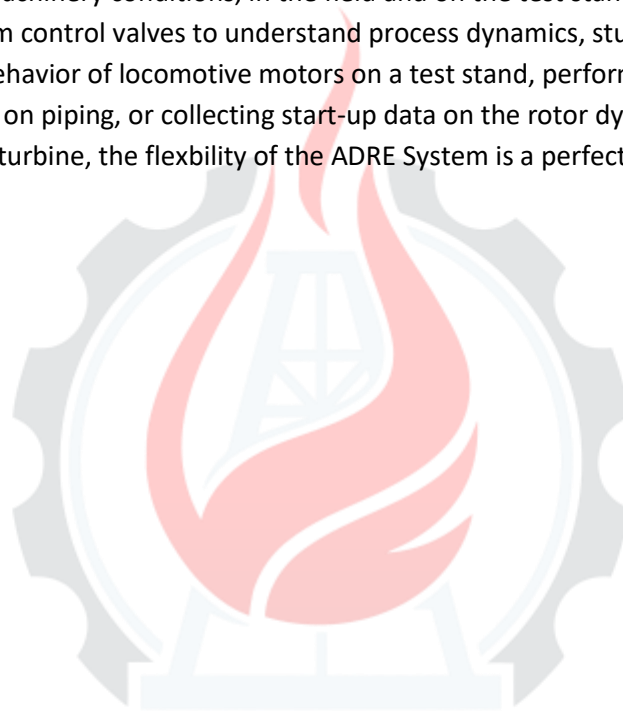
Ranger Pro provides quality, performance, System 1 connectivity, environmental ruggedness at a low cost.

ADRE

Machinery diagnostic instrument



As the world's premier rotating equipment data acquisition system, ADRE enables professionals to quickly assess machinery conditions, in the field and on the test stand. Whether you are collecting data from control valves to understand process dynamics, studying the electromagnetic behavior of locomotive motors on a test stand, performing structural analysis and impact testing on piping, or collecting start-up data on the rotor dynamics of a recently overhauled steam turbine, the flexibility of the ADRE System is a perfect fit.



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