ADRE* System

Bently Nevada* Asset Condition Monitoring

Bently Nevada
a Baker Hughes business

The ADRE System

The Professional's Choice

In 1980, we had a revolutionary idea. What if the methods for collecting machinery and process data on tape and then tediously turning it into plots could be automated? It would mean a dramatic reduction in the time needed to diagnose machinery conditions, allowing engineers to spend less time reducing data and more time interpreting it. We called it the ADRE* System—Automated Diagnostics for Rotating Equipment—and it truly revolutionized the industry.

More than 40 years and five successful product generations later, the ADRE System remains globally recognized as the tool of choice for professionals tasked with assessing machinery conditions in the field and on the test stand. It has become the standard against which all others are measured when it comes to on-demand, flexible, field-rugged multi-channel machinery data acquisition.

Our latest generation of the ADRE System is everything you've come to expect from the world's premier data acquisition system while exponentially boosting its power, performance, and ease of use.

Flexible

The ADRE System is designed to handle a broader range of data acquisition tasks than ever before. 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 makes it a perfect fit. Whatever your parameter of interest, if it is available as an electrical signal, the ADRE System can handle it, allowing it to be used for more applications and in more industries than ever before. And, unlike many generic data acquisition systems that—although feature-rich—are difficult to configure and use, you won't spend hours configuring the ADRE System. You can go from "out of the box" to "collecting data" in as little as ten minutes.

It's all about the user

For more than a quarter century, customers just like you have been continually helping us refine the ADRE System to be everything it needs to be. In fact, it's the tool used by our own machinery diagnostics field engineers around the world—"power users" who rely on ADRE Systems every day to do their job. It's also the tool used by the field engineers of many leading machinery manufacturers and consultants around the world. It's found in plants, research labs, test stands, and academic institutions. But no matter where ADRE Systems are found, its users have this in common: they insist upon the very best capabilities and the very best value. In the ADRE System, they've found it.

Applications

Continuous and discrete processing industries	• Pulp and paper • Cement • Food and pharmaceutical	• Water/wastewater • Mining • Machine tools
Transportation	• Aerospace	• Automotive
Consulting	• Rotor dynamics • Bearing design	• Predictive maintenance • Machinery diagnostics
Power generation	• Fossil fuel • Hydro • Wind	• Nuclear • Geothermal
Oil and gas	• Refining • Offshore platforms • Pipelines	• LNG • Chemical/petrochemical processing
Original equipment manufacturers and repair facilities	• Test stands • Research and • Development • Balancing stands	• Field engineering • Start-up assistance • Remote and onsite • Troubleshooting

An instrument and an analyzer

The ADRE system's design philosophy was to provide fully parallel, real-time signal processing of not just every channel, but every configured parameter as well. Unlike devices that rely extensively on recording raw data and then post-processing that data for the parameters of interest, the ADRE System is different. It works as a realtime instrument allowing you to stream not just raw data, but processed data so you can see changes as they happen—not after the fact. With the ADRE System, you don't sacrifice postprocessing flexibility either. It delivers both. Data can be manipulated and processed in many different ways. In addition, the newest version of ADRE includes an analog output replay card and new molded cable to help you playback collected data. ADRE allows you to simultaneously replay up to 32 channels of raw data to external devices.

Enhancing your productivity

Your value is in interpreting data. The less time spent configuring the system, and then gathering and reducing that data, the more time you have to solve problems and deliver information. We understand. Everything about the ADRE system has been designed with this in mind, allowing you to get the data—all the data—quickly, easily, and even remotely when required.

- **Configure simply**
  Drag-and-drop wizard configuration reduces setup time and errors
- **Collaborate easily**
  Simultaneous data sharing via client/server architecture
- **Reduce travel**
  Full remote operation via LAN/WAN—even through corporate firewalls
- **Save time**
  "Out of the box" to data acquisition in minutes
- **Lighten your load**
  Everything you need is in one, easy-tocarry, integrated instrument
- **Automate your testing**
  Flexible, easy-to-change setup and configuration features along with high-resolution data capture make the system ideal for test stand use and factory acceptance testing
- **Import capabilities**
  Import Comma-Separated Values (CSV) static and dynamic data into an ADRE Sxp Database

One device does it all

With the ADRE system, gone are the days of lugging separate instruments—oscilloscope, spectrum analyzer, analog or digital tape recorder, vector filters, signal conditioners, and amp racks. Dramatic advances in digital signal processing make it possible to truly capture all the data, and the latest version comes equipped with Modbus input and output capabilities, so you can make configuration changes and output static data to/from ADRE to MODBUS-compatible devices. For example, users can make configuration changes from a DCS and also receive ADRE data where it can be combined with other process data for detailed analysis in a test cell environment. The ADRE system truly liberates you to the freedom of a single instrument that's easy to use and easy to transport—without sacrificing any of the data

ADRE 408 DSPi Hardware

True client/server ethernet architecture

Multiple ADRE Sxp software clients can access a single 408 simultaneously, or connect to multiple 408s operating independently. Each client has completely independent control of and access to data, just as with any true server.

Convenient user interface

A menu-drive front panel user interface allows you to operate the instrument using preconfigured settings without connecting to a computer—particularly useful for field jobs where connection to a laptop is inconvenient, impractical, or impossible.

Versatile packaging

The 408 DSPi is equally at home achine-side or in the lab via its standard carrying handles or 19-inch EIA rack-mount options.

WAN/LAN enabled

As a hardened network appliance, the 408 DSPi is specially engineered to work across corporate firewalls and networks, allowing you to Move Data, Not People* easily between a 408 server and multiple ADRE Sxp software clients located anywhere on the globe.

Dynamic input cards

Each card accepts up to 8-channels of dynamic waveform inputs and/or static inputs. Up to 32 inputs per 408 DSPi. Robust, convenient, industry-standard SMA connectors are used for all signal inputs, providing compatibility with cabling used in the majority of today's test and measurement devices.

Analog output card

The newest version of ADRE 408 includes an analog output replay card and new molded cable, allowing simultaneously replay of up to 32 channels of raw data to external devices.

Digital replay card

The Digital Replay Card provides simultaneous synchronous and asynchronous internal digital reprocessing and playback of all channels in the 408 DSPi. It maintains exceptional accuracy and precision in the signal reprocessing, far surpassing the capabilities of other equipment and reprocessing techniques.

Flexible speed/phase inputs

The 408 accepts conventional proximity probe, magnetic pickup, and optical sensors for phase and speed measurements. It even provides the necessary power. Also, with the 408's advanced on-board signal conditioning, there's no longer a need for bulky external devices to multiply/divide or condition signals.

Large internal storage capacity

An on-board 480 GB to 960 GB Solid State hard drive captures days—even weeks—of high-resolution data.

Integrated display

The 408's vacuum fluorescent display is bright, easy to see, and features a wide viewing angle, making it visible under varied lighting conditions.

Stand-alone operation

Record all data in "stand-alone" mode without the need for an externally connected computer, making it far easier to leave system machineside for hours, days or weeks while it captures data, limited only by available storage capacity. Ideal for temporary realtime surveillance of problem machines.

Transducer power supply card

The transducer power supply card provides power for a wide variety of displacement, velocity, and acceleration transducers(including ICP devices). It also powers force hammers and other transducer types used in field and test stand applications, and can simultaneously power up to 32 transducers in various combinations. It provides direct physical connections for up to sixteen transducers, eight ± 24 Vdc transducer systems, and eight constant current transducer systems.

Flexible inputs

Channel pairs can be easily configured for true differential measurements. and in addition to standard vibration signals, support process variables, 4–20 mA signals, and custom voltage ranges to accommodate nearly any static or dynamic signal.

Discrete trigger inputs

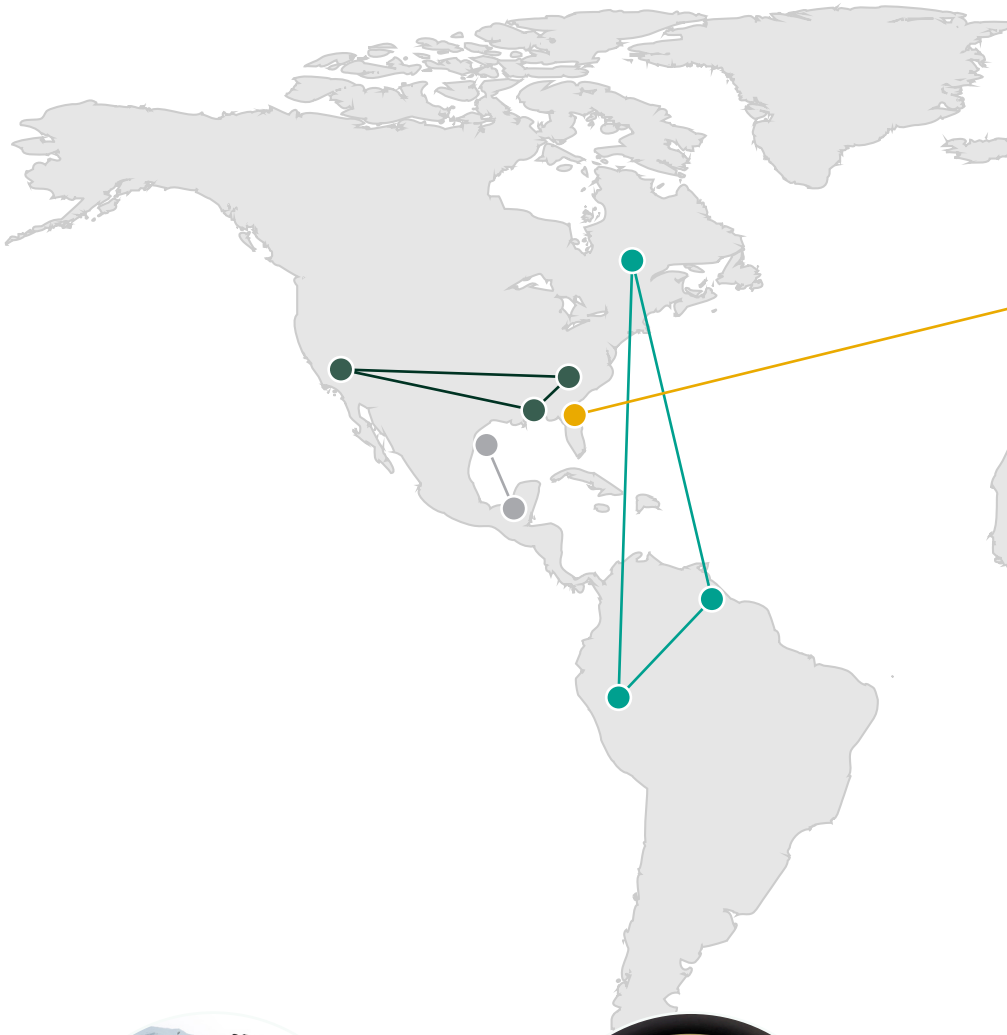
External contact closures, such as from an alarm, machine start, process condition, or other parameter can be used to automatically initiate data acquisition or change from one acquisition mode to another. Two inputs are provided, each independently configurable.

Optical/laser/phase reference/impact hammer Inputs

Up to two Keyphasor* cards can be introduced to one (or an array) of 408 DSPi instrument(s). Each Keyphasor card accepts as many as three inputs, for a total of six phase reference signals. Up to six simulated Keyphasor signals can also be provided in addition to six physical signals. In addition to phase reference signals from proximity probes, optical and laser phase reference inputs are supported. Impact hammer inputs are also supported via these inputs.

Ideal for Service Organizations

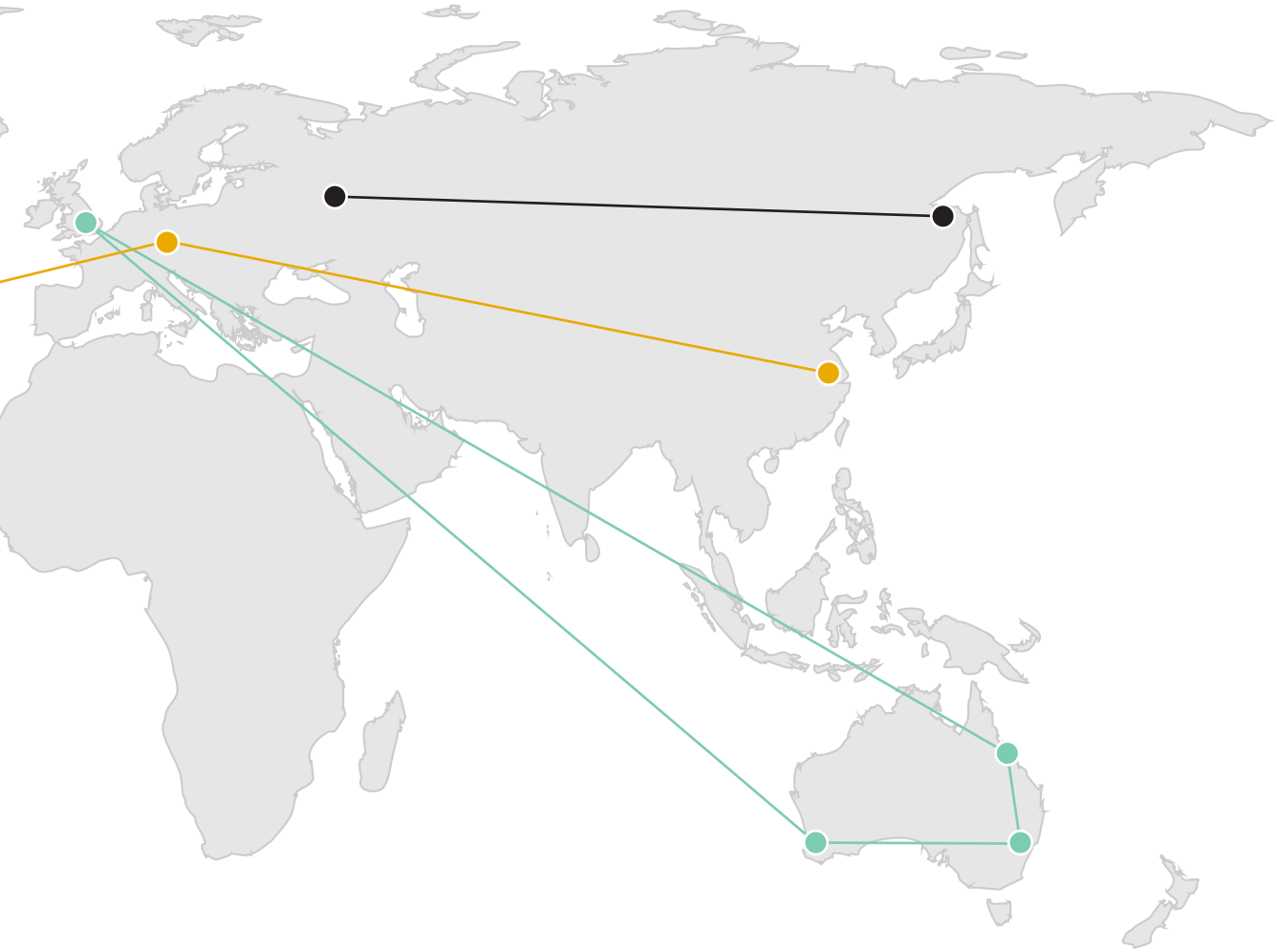
Our experienced Bently Nevada Services team can offer onsite support to collaborate using the extensive Bently network. Or organizations with large services departments can setup their own private networks as needed. The result is virtually unlimited flexibility in where and how you can connect your ADRE hardware and software.



A 408 DSPi is placed on an offshore platform in the Gulf of Mexico to collect data on a machine with intermittent problems. The instrument communicates over a network in the platform's control room, gathering data completely unattended for several months while being viewed securely at the company's headquarters in Mexico via their corporate WAN. Partway through the investigation, the team at headquarters suspects that the problems may be process-induced and remotely reconfigures the 408 DSPi to trigger high-resolution data capture when certain process conditions occur.

A large hydro unit in Colombia needs to be balanced. Plant personnel connect a 408 DSPi to the machine's transducers and a Bently Nevada machinery diagnostics engineer connects remotely via secure VPN to remotely configure the instrument. The machine OEM in North America views the collected data, uses Bently BALANCE* software to compute an optimal balance solution, and provides recommended balance weights and locations back to the customer site. The OEM and the Bently Nevada machinery diagnostics engineer collaborate in real-time to verify the data and the recommended balance shots.

A jet engine manufacturer runs a prototype design for the first time. Employees at the test stand location observe data related to engine efficiency. Military personnel in the South U.S. witness the test remotely. Simultaneously, design engineers at the OEM's west coast office study blade dynamics and ask test stand technicians to prolong the test duration while they remotely adjust frequency spans and tracking filter settings.



A customer in China troubleshoots unwanted process dynamics thought to be related to poorly tuned loops and excessive valve stroking. The valve manufacturer in Europe observes real time test data by connecting to the customer's network using the world wide web and VPN technology. Simultaneously, the customer's process control specialist at a US location connects via the corporate WAN, examining dynamic flow and pressure data, collaborating with the valve manufacturer and site personnel.

A locomotive manufacturer conducts studies of problems in an engine's electric drive units for a customer in eastern Russia. A 408 is carried on-board the engine as it travels, using the railway's WAN infrastructure to provide real time data to the OEM's field office in Moscow where engineers diagnose the problem.

Engineering specialists at a central office support colleagues at two remote plant sites, collaborating in real-time to assist with reviewing start-up data after planned outages on large steam turbine generators. An additional specialist from the company's UK headquarters is consulted to share data from a similar machine that has been archived. The parties collaborate in realtime, each connecting to the same ADRE hardware from four distinct locations

ADRE Quick Configuration Software and Sxp Software

Totally easy

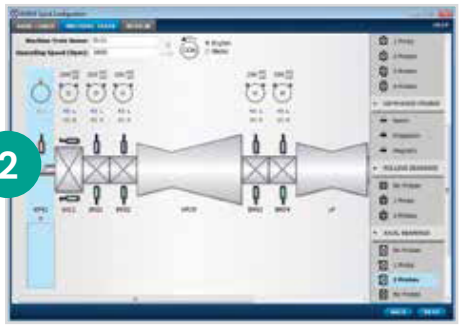
Setting up an ADRE is now as simple as 1, 2, 3.

The ADRE Quick Configuration Software allows even the novice user to create an Sxp-ready database to configure ADRE and start receiving data within minutes. Bently best practices are integrated into the wizard to automatically create data collection parameters and a suite of plots to ensure the full power and productivity of the ADRE system is realized.

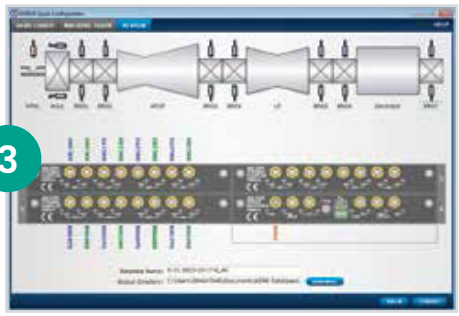
The newest to the most experienced ADRE user can take advantage of the ease, speed, and expertise of the Quick Configuration Software so that more time is spent enhancing productivity utilizing the data, and less time worrying about manually configuring the system.

Arrange the cards. 1

Sketch the machine 2



Plug it in. 3



Totally versatile

ADRE Sxp software is industrial strength, built by people who solve machinery problems every day in settings ranging from the turbine deck to the test stand to the laboratory. And it's not just data analysis and reduction tools that make ADRE software powerful, it's also the extensive attention to detail in its configuration environment, allowing you to spend less time setting up and more time solving problems.

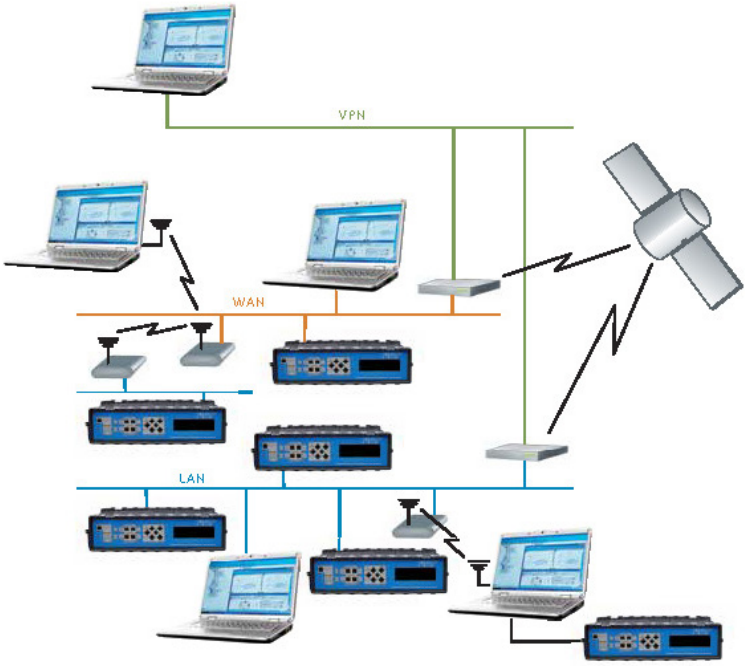
Fast, intuitive, flexible, powerful. That's ADRE Sxp Software.

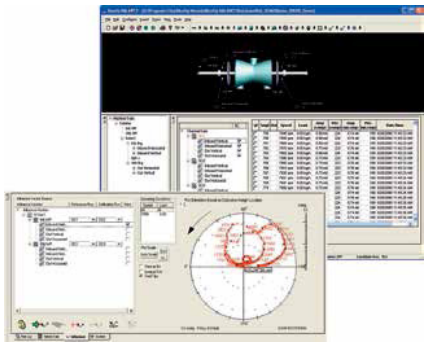
Totally functional

Supported plot types	• Current values • Orbit† • Bode • Trend • Cascade/full cascade • Tabular list • Timebase† • X versus Y • Multi-variable trend • System event list • Orbit/timebase† • Polar • Spectrum/full spectrum† • Waterfall/full waterfall • Shaft average centerline • Free run spectrum • Structural analysis (timebase w/rectangular and exponential windows) • Structural analysis results (w/transfer function, coherence, auto/cross spectrum)
Graphical display of plots	Orbit/Timebase†
Graphics export	jpg, .bmp, .wmf, .gif (by plot, page, or group)

† With option for superposition of baseline data.

Data export (static and dynamic)	Comma-Separated Values (CSV)
Data import (static dynamic)	Comma-Separated Values (CSV)
Client display unit preference	Per-client simultaneously
Balancing Software	Bently BALANCE
View data from multiple runs simultaneously	Yes; virtually unlimited
Keyphasor dynamic display	Per Keyphasor
LAN/WAN support	Yes; specially designed for firewall management
Supported operating systems	Microsoft® Windows 7, Windows 8
Remote 408 DSPi Operation via LAN/WAN	Yes
Test stand automation	Yes; control up to 4 database runs automatically
Modbus read and write	Yes





Totally balanced

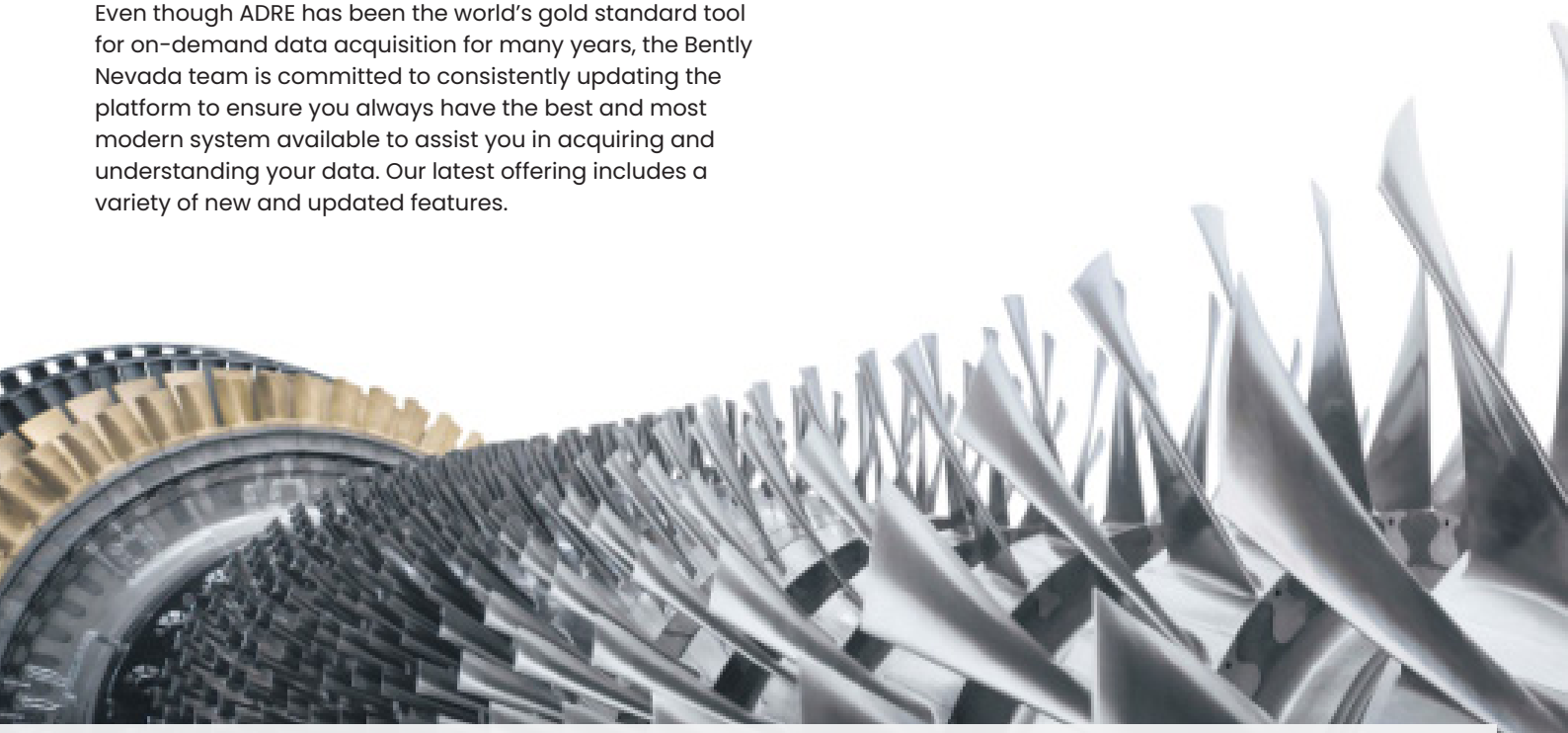
ADRE Sxp software is fully compatible with Bently BALANCE*, the industry's most powerful multi-plane balancing software. Specifically designed for your most complex balancing tasks, Bently BALANCE software addresses even the most difficult balancing scenarios, such as finding optimal solutions for multiple speeds and loads—or when the number of measurement planes does not equal the number of balance planes. Data such as 1X vectors, speed, and transducer locations/orientations can easily be downloaded from your ADRE Sxp software to Bently BALANCE, eliminating the tedious, error-prone practice of manually typing data.

Totally networked

We're connected. You see, the ADRE System was designed with corporate networking in mind, making life easy for both you and your IT department. With integrated 10/100/1000 Mb TCP/IP Ethernet communications, each 408 DSPi can be connected to your LAN or WAN using a variety of topologies and media. We've specifically engineered the client/server architecture of the ADRE System to be a hardened network appliance that works within and through the firewalls and other IT infrastructures common in today's enterprises. The result is secure, trouble-free access to your ADRE System whether you're simply connecting via your LAN across the office, or connecting using technologies such as Virtual Private Networking (VPN) from remote locations.

New ADRE 408 DSPi Features

Even though ADRE has been the world's gold standard tool for on-demand data acquisition for many years, the Bently Nevada team is committed to consistently updating the platform to ensure you always have the best and most modern system available to assist you in acquiring and understanding your data. Our latest offering includes a variety of new and updated features.



Impact hammer

The Impact Hammer Kit is used with our ADRE 408 DSPi and other compatible instruments to determine the transfer function and other response characteristics of rotating machines and mechanical structures. The integration of response information from multiple accelerometers at various points of interest allows for modal analysis (velocity compliance, impedance, mobility).

Redesigned single board computer

The Redesigned Single Board Computer features faster boot speed, lower power requirements, SAS disk drive technology (24/7 industrial server grade drives) as well as a reinforced mounting cage for better shock resistance and a redesigned backplane for stronger connection between system components.

Optional pelican case

An Optional hard shipping case provides a protective chassis system that allows the ADRE 408 to be suspended inside, isolating it from rough exterior handling.

The case also features wheels and a long handle, making our latest version of ADRE a truly mobile monitoring solution.

Solid state hard drives

Select between 480 GB and 960 GB solid state drives to capture days—even weeks—of high-resolution data.

Technical improvements

The latest version of the ADRE system includes a wide variety of technical improvements. A full list is available in the product datasheet, but some of the key features include automatic selection of waveforms for plots, multiple cursors as a default option for all plot types, and the addition of a static/couple vector option on polar plots for balancing needs. Position measurement has also been added for process variables or displacement transducers, which can be used to measure axial position when viewing values on the 408 front panel. Finally, the latest version of ADRE includes a time-saving 3500 rack-based system file importer to ensure seamless communications with our 3500 Series monitoring systems when configuring ADRE.

Training

Whether you need product-specific training to get the most from your ADRE hardware and software, fundamentals of data acquisition, or an in-depth foundation for performing machinery diagnostics, and rotor dynamics, GE Measurement & Control offers a comprehensive selection of training classes to meet your needs.

Contact your local sales or service representative for more information on current available courses, or visit our web site at bently.com and look under Services & Support.

Physical	
Weight @ 32 channels	9.5kg (21 lbs) per 408 DSPi Unit (32 channels with power supply)
Environmental	0° to 50°C; 0 to 95% relative humidity (non-condensing)
Mounting	Benchtop or optional 19" EIA rack mounting kit
Channel status LEDs	Per channel: over-range, NOT OK
Power requirements	110 to 240V 50-60 Hz
Inputs	
Number of dynamic channels	8/16/24/32 per chassis
Throughput rate	Up to 50 MB/sec system throughput
Transducer inputs	Displacement/velocity/acceleration/phase reference/speed
Differential inputs	Selectable: true differential or single-ended
Process inputs	Programmable: +4 to +20 mA; 0 to +10 Vdc; -12 to +12 Vdc; -25 to +25 Vdc
Voltage input range	Programmable lower and upper values from -25 Vdc to +25 Vdc
Gain selections	Auto gain between –25 Vdc and +25 Vdc
Input impedance	> 700 kΩ
Signal to noise ratio (dynamic range)	110 dB
Frequency span (all channels)	Up to 50 kHz – all channels simultaneously
Speed range	1–120k RPM
Speed/trigger input sources	Proximity probes, optical sensors, magnetic pickups
Speed input capacity	3/6 physical, 6 simulated (internal)
Trigger sources	Multiple "or" voting of speed/time/amplitude/external contacts
Keyphasor multiplier/divider/conditioner/power	Integrated (per speed input)
AC/DC coupling	Yes; configurable per channel
Channel bandwidth	Up to 50 kHz (simultaneous, all channels)
Software	
Required software	ADRE Sxp, real-time and post-processing
View data from multiple runs simultaneously	Yes; unlimited
Yes – unlimited	Per keyphasor
Instrument mode display update	100 ms/sample (max)
Communications	Integrated 10/100/1000 Mb Ethernet TCP/IP
LAN/WAN support	Yes; specially designed for firewall management
Remote operation via LAN/WAN	Yes
Security	Administrative/read only/no access
Signal conditioning	
A to D resolution	24 bit
Filtering	High-/low-pass: selectable; Bandpass: 2-, 4-, 6-, 8-pole selectable
Tracking filters	Realtime; up to 6 nX per channel
Tracking filter bandwidth	Configurable: 1.2/12/120 CPM; constant bandwidth auto-switching
Auto switching tracking filters	Selectable
Sub-synchronous nX tracking	Configurable; 0.1 to nX (in .01X increments)
nX vectors	Configurable; up to four different vectors
Sampling	• Simultaneous processed and raw data (all channels) • Multiple simultaneous sampling rates (synch and asynch) • Delta sampling for RPM, time • Synchronous sampling configurable for 2 rates per channel • Continuous and discrete (configurable) • Realtime simultaneous synchronous and asynchronous
Synchronous sampling rates	16/32/64/128/256/360/512/720/1024 samples per revolution
Hardware generated time synchronous averaging	Up to 2048 samples per waveform, up to 512 Averages i.e., (8 revs @ 256 samples/rev), (4 revs @ 512 samples/rev)
Anti-aliasing	FIR Filter (passband @ 50 kHz, – 100 dB @ 64 kHz)
Waveforms	4 per channel simultaneously (user-configurable) + Raw
Spectral resolution	Configurable; up to 6400 lines (all channels simultaneously)
True zoom capabilities	Yes
Recording	
Data storage capacity	Internal: 480 GB or 960 GB solid state drive
Pre- and post-event data capture	Yes; configuration dependant
Vector-to-waveform storage ratio	n:1 configurable
Continuous digital recording	Yes; internal
Outputs	
Speed/trigger outputs	3/6 digital and analog conditioned

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