Bently Nevada 12237-01

# 7000 Series Proximitor

$2595.00

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# 3000 and 7000 Series Proximity Transducer Systems

## Technical/Ordering Information



### Radial vibration and thrust position measurements on machines requiring a small linear measuring range

The 3000 and 7000 Series Proximity Transducer Systems are ideal for measuring radial vibration and thrust position movements on machines that require only 40 to 50 mils linear range.

Operating on the same principle as Bently Nevada 7200 Series proximity probes, the 3000 Series Proximity Probes have no moving parts. They are not subject to mechanical wear that occurs on other types of transducers, such as shaft riders, Linear Variable Differential Transformers (LVDT), and potentiometers.

The 3000 and 7000 Series Proximity Transducers are not designed for used in API 670 type installations.

The 3000 and 7000 Series Proximity Transducer Systems provide vibration and position information for diagnostics as well as monitoring. You receive measurements of vibration amplitude, frequency, phase angle, and other rotor characteristics for determining specific machine malfunctions. The typical response of 0 Hz to 10 kHz enables you to measure static shaft position as well as dynamic motion.

The 3000 Series transducer systems utilize the 190 or 300 probes. The 7000 Series transducer systems use the 300 probe.

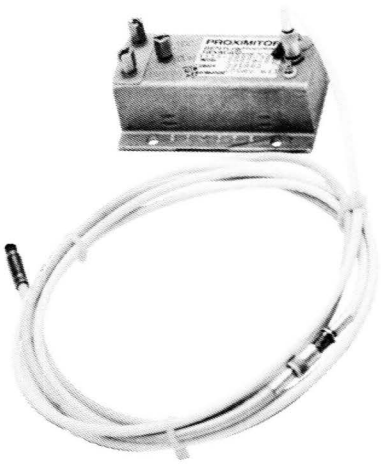
Each transducer system consists of a proximity probe, extension cable, and Proximitor.® All 3000 and 7000 Series transducer systems can be used in conjunction with the 7200 Series and 9000 Series Monitoring Systems.

### Types of measurements obtained with a 3000 and 7000 Series Proximity Transducer System

Whether used in static, low rpm, or rapidly-changing conditions, the 7000 Series Proximity Transducer Systems provide accurate linear, gap-to-voltage measurements. They can be used on virtually all types of rotating machines, including turbines, compressors, generators, pumps, and centrifuges, to make the following types of measurements:

☐ Radial vibration for indicating bearing condition, rotor unbalance, and misalignment.

☐ Thrust or axial position for determining bearing wear and potential bearing failure. (3000 Series probes only.)



**3000 and 7000 Series Proximity Transducer System**

☐ Shaft attitude angle or axial position, an indicator of rotor stability.

☐ Vibration amplitude and phase angle for plotting diagnostic information in polar and Bodé formats.

☐ Eccentricity to measure the amount of rotor bow and the steady-state position of the rotor in the journal bearing.

☐ Peak-to-peak eccentricity to indicate bearing wear, heavy preloads caused by misalignment, lube oil breakdown, and electrostatic discharge.

### 190 and 300 Proximity Probes

The 190 and 300 Proximity Probes are offered in 12 configurations. You have a choice of fiberglass or Tonox® construction. Tonox versions are designed for use in high pH environments, but are not recommended for use in pressurized ammonia.

The 300 Proximity Probe is available in two linear measuring ranges: 50 mils with a scale factor of 200 mV/mil using a 3000 Proximitor and 60 mils with a scale factor of 100 mV mil using a 7000 Proximitor.

The 190 Proximity Probe has a linear measuring range of 40 mils with a scale factor of 200 mV/mil when used with a 3000 Proximitor. It is the smallest standard probe that Bently Nevada offers.

### 3000 and 7000 Proximitors

A three-conductor, shielded cable provides the signal output and power source input interface between the Proximitor and a Bently Nevada monitor. The 3000 and 7000 Proximitors can be placed up to 1,000 feet from standard Bently Nevada monitors without degradation of performance.

The 3000 Proximitor is available in four configurations. The 7000 Proximitor is offered in two configurations.

The 3000 and 7000 Proximitors can be used with the 300 Proximity Probes. The 190 Proximity Probe is used with the 3000 Proximitor.

### Extension Cables

The combination of a probe lead and extension cable is designed to achieve a system length of either 15 or 20 feet. The extension cable is ordered in six-inch increments. It is available with or without protective armor.

Tonox® is a registered trademark of Uniroyal Corporation.

### Specifications

#### OUTPUTS

**Calibrated Range:**

**With 3000 Proximitor:** 50 mils for 300 probe; 40 mils for 190 probe. Range begins at approximately 20 mils from target surface.

**With 7000 Proximitor:** 60 mils, for 300 probes only. Range begins at approximately 30 mils from target surface.

**Scale Factor:**

**With 3000 Proximitors:** 200 mV/mil (8 V/mm).

**With 7000 Proximitors:** 100 mV/mil (3.94 V/mm).

**Frequency Response:** 0 to 600,000 cpm ± 1%

**Power Requirements:**

**With 3000 Proximitors:** -18 Vdc at 8.0 mA nominal.

**With 7000 Proximitors:** -24 Vdc at 8.0 mA nominal.

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# 3000 and 7000 Series Proximity Transducer Systems

## ENVIRONMENTAL

**Operating Temperature Range:**

**3000 Proximitor:** -29 °C to +66 °C (-20 °F to +150 °F).

**7000 Proximitor:** -51 °C to +100 °C (-60 °F to +212 °F).

**Probe and extension cable:** -56 °C to +177 °C (-50 °F to +350 °F).

Tonox version probe specifications available upon request.

## DIMENSIONS

**Height:**

**3000 Proximitor:** 1.60 inches (40.6 mm).

**7000 Proximitor:** 2.00 inches (50.8 mm).

**Width:**

**3000 Proximitor:** 2.14 inches (54.4 mm).

**7000 Proximitor:** 2.38 inches (60.4 mm).

**Length:**

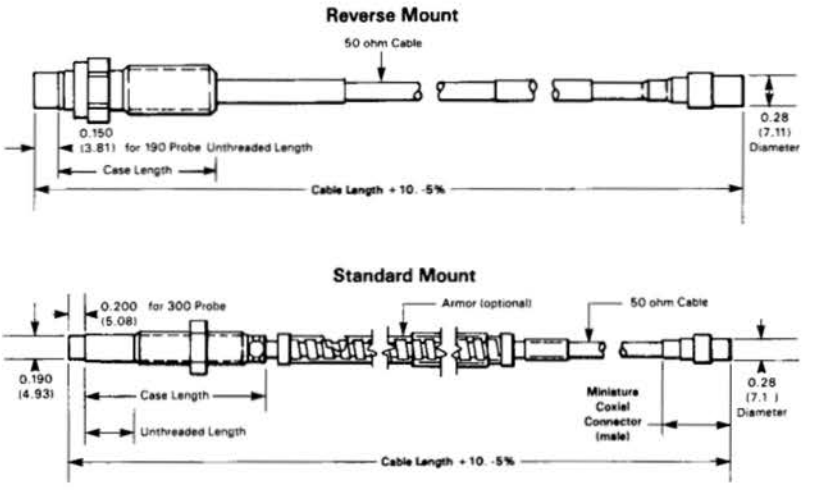
**3000 and 7000 Proximitor:** 3.14 inches (79.8 mm).

**Weight:**

**3000 Proximitor:** 7.2 ounces (204 grams).

**7000 Proximitor:** 6.4 ounces (181 grams).

## 3000 and 7000 Series Probe Configurations




## Ordering Information

### Standard Mount Probe

A B C D E
□□□□□-□□-□□-□□-□□

**Option Description**

**A** Probe Catalog Number Option
**B** Unthreaded Length Option
**C** Case Length Option
**D** Cable Length Option
**E** Connector Option

**A □□□□□ Probe Catalog Number Option**

Select from Table 1.

**B □□ Unthreaded Length Option**

Order in increments of 0.1 inches [0][1] for English thread, 10 mm [0][1] for metric threads.

**English thread configurations:**

Maximum unthreaded length: 9.0 inches [9][0]

Minimum unthreaded length: 0.0 inches [0][0]

**Metric thread configuration:**

Maximum unthreaded length: 900 mm [9][0]

Minimum unthreaded length: 0.0 mm [0][0]

**C □□ Case Length Option**

Order in increments of 0.1 inches [0][1] for English thread, 10 mm [0][1] for metric thread.

**English thread configurations:**

Maximum case length: 9.8 inches [9][8]

Minimum case length: 1.0 inches [1][0]

**Metric thread configurations:**

Maximum length: 250 mm [2][5]

Minimum length: 20 mm [0][2]

**D □□ Cable Length Option**

Order in increments of 6.0 inches [0][6] (152 mm). Total length must exceed case length by a minimum of 4.75 inches (120.6 mm).

Maximum cable length: 36.0 inches [3][6] (914 mm).

Minimum cable length: 6.0 inches [0][6] (152 mm).

**E □□ Connector Option**

00 Without connector.

02 With miniature male coaxial connector.

### Reverse Mount Probe

A B C
Fiberglass -□□□-04-02-12-□□-□□

A B C
Tonox -□□□□□-02-12-□□-□□

**Option Description**

**A** Probe Catalog Number Option
**B** Cable Length Option
**C** Connector Option

**Note:** The unthreaded length and case length are supplied in standard, pre-set lengths.

**A Probe Catalog Number Option**

□□□ Fiberglass or □□□□□ Tonox

Select from Table 1.

**B □□ Cable Length Option***

Order in increments of 6.0 inches [0][6] (152 mm). Total length must exceed case length by a minimum of 4.75 inches (120.6 mm).

Maximum cable length: 36.0 inches [3][6] (914 mm).

Minimum cable length: 6.0 inches [0][6] (152.40 mm).

* To obtain the electrical length, multiply the cable length by 2.

# 3000 and 7000 Series Proximity Transducer Systems

**C □□ Connector Option**

00 Without connector.

02 With miniature male coaxial connector.

**Proximitors**

**20929 – □□ 3000 Series Proximitor**

□□

01 For combined system electrical length of 15 feet, with 300 tip transducer.

02 For combined system electrical length of 15 feet, with 190 tip transducer.

03 For combined system electrical length of 20 feet, with 300 tip transducer.

04 For combined system electrical length of 20 feet, with 190 tip transducer.

**12237 – □□ 7000 Series Proximitor**

□□

01 For combined system electrical length of 15 feet, with 300 probe tip.

02 For combined system electrical length of 20 feet, with 300 probe tip.

**Extension Cable**

**4454 – □□□ Extension cable with armor**

**2789 – □□□ Extension cable without armor**

**□□□ Cable Length Option**

Order in increments of 12 inches [0][1][2] (304.8 mm).

Maximum cable length: 468 inches [4][6][8] (11.89 meters).

Minimum cable length: 12 inches [0][1][2] (305 mm).

**TABLE 1**

| TIP | | | CASE | | LEAD |
|---|---|---|---|---|---|
| CATALOG NUMBER | | | | | |
| FIBERGLASS | TONOX | TYPE | CONFIGURATION | THREADS | ARMOR |
| 300-00 | 28407 | 300 | Standard | 3/8-24 | No |
| 300-01 | 28408 | 300 | Standard | 3/8-24 | Yes |
| 300-04-02-12* | 28411 | 300 | Reverse | 3/8-24 | No |
| 300-06 | 28413 | 300 | Pressure | 3/8-24 | No |
| 300-11 | 28416 | 300 | Standard | M10X1 | No |
| 300-12 | 28417 | 300 | Standard | M10X1 | Yes |
| 190-00 | 28400 | 190 | Standard | 1/4-28 | No |
| 190-01 | 28401 | 190 | Standard | 1/4-28 | Yes |
| 190-04-02-12* | 28402 | 190 | Reverse | 3/8-24 | No |
| 190-06 | 28404 | 190 | Pressure | 1/4-28 | No |
| 190-07 | 28405 | 190 | Standard | M8X1 | No |
| 190-08 | 28406 | 190 | Standard | M8X1 | Yes |

*The unthreaded length and case length are set on the reverse mount probe.

**TABLE 2**
**Required Extension Cable Lengths for Proximitor**

| CATALOG NUMBERS | PROBE LEAD LENGTHS | | | | | |
|---|---|---|---|---|---|---|
| | 6 Inches | 12 Inches | 18 Inches | 24 Inches | 30 Inches | 36 Inches |
| 20929-01, 20929-02, and 12237-01 | 168 Inches | 156 Inches | 144 Inches | 132 Inches | 120 Inches | 108 Inches |
| 20929-03, 20929-04, and 12237-01 | 228 Inches | 216 Inches | 204 Inches | 192 Inches | 180 Inches | 168 Inches |

**Note:** Other cable lengths—up to 25 feet—not listed in Table 2 may be ordered, but are not recommended. Lengths are critical to obtain the correct system performance.

# Acceleration Transducer System

## Technical/Ordering Information

### High frequency measurements for determining overall machine condition

The Acceleration Transducer System is most suited for measuring high frequency vibration on the machine case or bearing housing. Under certain conditions, it also is useful for evaluating the overall mechanical condition of some machines.

The Acceleration Transducer System is easy to install. The transducer is mounted on the machine case, or when feasible, the bearing housing.

The Acceleration Transducer System consists of an accelerometer, interconnect cable, and interface module. It can be used in conjunction with the 7200 Series and 9000 Series Monitoring Systems.

### Applications recommended for acceleration measurements

The Acceleration Transducer System normally should not be used in place of direct shaft vibration measurement, except in specific applications, such as:

☐ When a supplementary casing measurement may provide pertinent information about the mechanical condition of rotating machinery. Supplemental casing measurements are typically required for measuring gear mesh frequencies and turbine blade passage frequencies.

☐ When the machine housing, piping, or foundation are suspected of being the source of significant vibration.

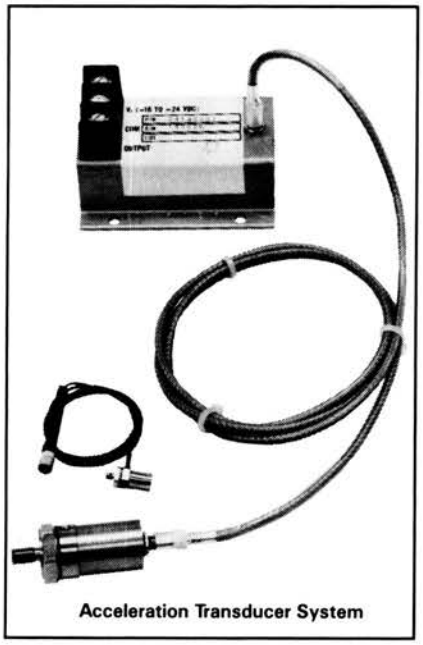
### How an acceleration transducer system works

Acceleration is the measurement of the time rate of change of velocity. To make this measurement, the accelerometer uses a piezoelectric crystal situated between the accelerometer base and an inertial reference mass.

When compression or a tension force excites the crystal, the crystal acts as a precision spring to oppose the compression or tension force. It generates a displaced electric charge. An integral amplifier converts the charge to a voltage, which is transmitted via the interconnect cable to the interface module.

The interface module supplies a constant current to the accelerometer. It also amplifies the signal from the accelerometer.

The interface module has an output sensitivity of 100 mV/g.



Acceleration Transducer System

### Accelerometer

Two versions of the accelerometer are offered: a standard version for measuring vibration frequencies up to 20 kHz and a high frequency version for measuring vibration frequencies up to 30 kHz.

### Interface Module

The standard accelerometer uses a 23733-03 interface module. The high frequency version utilizes a 24145-02 interface module.

### Interconnect Cable

The interconnect cable is offered with or without armor. It is ordered in one-foot increments.

The standard accelerometer utilizes a 18622 interconnect cable. A radiation-resistant option is available for the 18622 interconnect cable for use in radiation environments.

The high frequency accelerometer uses a 21165 interconnect cable. Both the 21165 and 18622 interconnect cables are available with a stainless steel protective armor.

**NOTE:** If casing acceleration measurements are being made for the overall protection of a machine, thought should be given to the usefulness of the measurement for each application. Most common machine malfunctions, such as unbalance, misalignment, etc., occur on the rotor and originate as an increase (or at least a change) in rotor vibration.

For any casing measurement alone to be effective for overall machine protection, a significant amount of rotor vibration must be faithfully transmitted to the machine casing or mounting location of the transducer.

In addition, care should be exercised in the physical installation of the acceleration transducer on the bearing housing or machine casing. Improper installation may result in a decrease of the transducer amplitude and frequency response and/or the generation of false signals that do not represent actual vibration. For more information, please refer to the appropriate Instruction Manuals and Application Notes.

## Specifications

### Accelerometer

#### OUTPUT SENSITIVITY

**Standard:** 25 mV/g ± 5% (2.55 mV/m/sec.²).

**High Frequency:** 10 mV/g + 10% (1.02 mV/m/sec.²).

**Acceleration Range:** 50 g's peak (490 metres/sec.²).

**Frequency Response:**

**Standard:** 2 Hz to 20 kHz ± 3 dB, 5 Hz to 10 kHz ± 5%.

**High Frequency:** 2 Hz to 30 kHz ± 3 dB, 7 Hz to 14 kHz ± 5%.

**Mounted Resonant Frequency:**

**Standard:** 30 kHz minimum.

**High Frequency:** 55 kHz minimum.

**Amplitude Linearity:** ± 1% to 50g's (490 metre/sec.²).

#### ELECTRICAL ISOLATION

Case is internally connected to system common. Isolation from machine case is provided by a built-in isolator.

### Interface Module

#### OUTPUT SENSITIVITY

**Standard:** 100 mV/g (10.2 mV/metre/sec.²).

**High Frequency:** 100 mV/g (10.2 mV/metre/sec.²).

#### POWER REQUIREMENTS

**Standard:** -18 to -24 Vdc at 15 mA maximum; 10 mA typical.

**High Frequency:** -22 to -26 Vdc at 30 mA maximum; 21 mA typical.

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# Acceleration Transducer System

## ENVIRONMENTAL

**Accelerometer Operating Temperature Range:** −20 °F to +250 °F (−29 °C to +121 °C).

**Accelerometer Shock Survivability:**

**Standard:** ±5000g's (±49,050 m/sec.$^2$) peak.

**High Frequency:** ±10,000g's (+98,100 m/sec.$^2$) peak.

**Interface Module Operating Temperature Range:** −40 °F to +212 °F (−40 °C to +100 °C).

**Interface Module Storage Temperature Range:** −60 °F to +302 °F (−51 °C to +150 °C).

## Ordering Information

### Accelerometer

**23732-01** Standard Accelerometer

**24147-01** High Frequency Accelerometer

### Interface Module

**23733-03** Standard Interface Module

**24145-02** High Frequency Interface Module

### Extension Cable

**18622** − □□ − □□ Standard Extension Cable (A B)

**21165** − □□ − □□ High Frequency Extension Cable

### Option Description

**A** Cable Length Option
**B** Armor Option

**A □□** **Cable Length Option**

Order in increments of 1 foot.

Minimum: 1 foot 01

Maximum: 30 feet 30

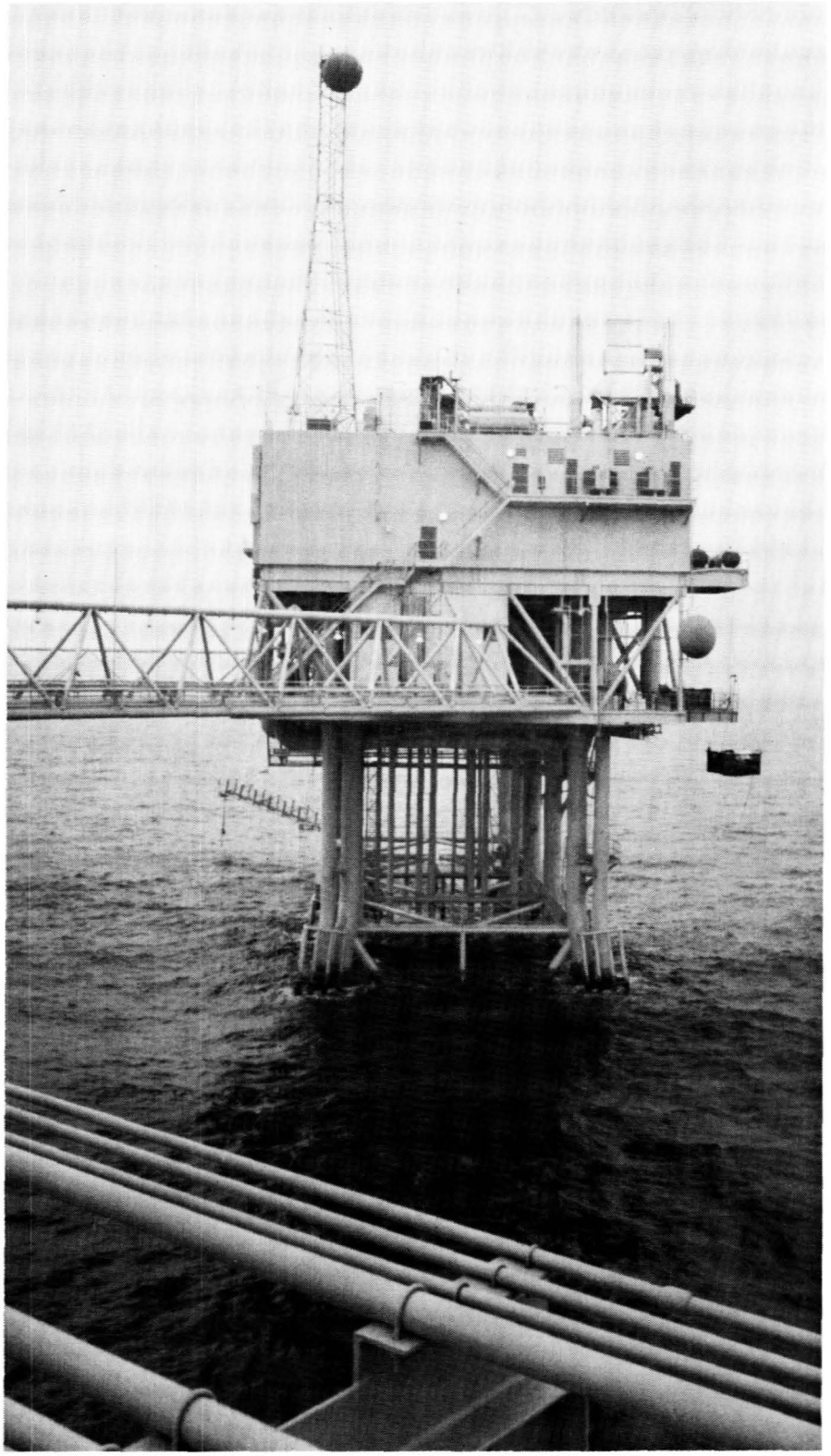
**B □□** **Armor Option**

00 For 18622 and 21165 cables, without armor.

01 For 18622 and 21165 cables, with armor.

02 For 18622 cable used in radiation environments, without armor.

03 For 18622 cable used in radiation environments, with armor.





**Data Subject to Change**

# ADRE®

## Technical/Ordering Information



### Reduces data reduction time for machinery behavior analysis

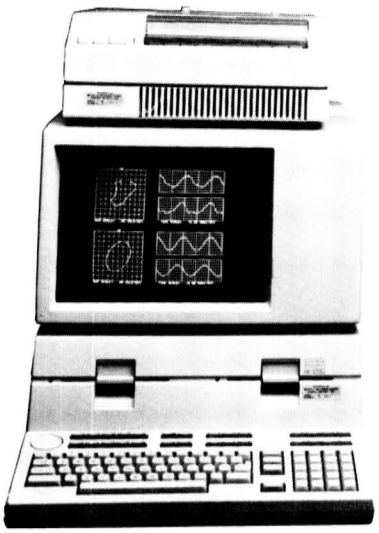
Bently Nevada's ADRE system (Automated Diagnostics for Rotating Equipment) significantly reduces the time required to analyze and diagnose machinery behavior. A computer-based data acquisition and reduction system, ADRE eliminates the time-consuming task of hand logging and reducing steady-state and transient dynamic vibration data.

Automated reduction of dynamic vibration data, including startup and shutdown information, enables you to analyze and document the mechanical condition of rotating machinery and troubleshoot machine malfunctions. The information received from the ADRE also can be used to balance machines, determine mechanical impedances and multiple resonances, and assist with stability studies.

Transient dynamic vibration data collected during startup and shutdown is presented in Bodé, polar, and cascade plots. These plots provide insight into the rotating system's margin of stability and reveal synchronous, sub-, and super-synchronous vibration components.

Steady-state dynamic vibration data is presented in orbit, time base, and comparative spectrum plots. This information can be used to examine magnitude, frequency, phase angle, and the shape or path of dynamic motion as well as to track change in spectral content over a period of time.

ADRE is available in a variety of hardware and software options to meet your machinery information needs and budget requirements. The hardware consists of a choice of two Hewlett-Packard (HP) computers, a Bently Nevada Digital Vector Filter (DVF 2), and a spectrum analyzer. Recommended additional hardware includes a multichannel FM tape recorder and a Recorder Amplifier System.



Hewlett-Packard computer with Bently Nevada software

Digital Vector Filter 2 (top)
Spectrum Analyzer (bottom)

### Software packages for machine analysis

The heart of the ADRE system is software. Developed by Bently Nevada's engineering staff from years of field experience, the software is tailored for efficient behavior analysis and diagnosis.

Five software packages are available. Transient, Steady-State, Shaft Centerline, and Hardware Diagnostics software packages are supplied as standard components of the ADRE system. An additional package — Snapshot Predictive Maintenance — is available as an option and requires additional memory and hardware.

Designed for personnel with minimal computer training, the ADRE software packages are easy to use. Operator input prompts written in simple English make program execution quick and easy.

**Transient package**

The Transient package enables you to acquire data for identifying rotor and structural resonances and their amplification factors, instabilities, misalignment, rubs, and other malfunctions. Data is plotted in polar, Bodé, or cascade formats or in tabular listings.

**Steady-State package**

The Steady-State package gives you information on the on-line condition of your machinery at operating speed. Data can be plotted in orbit, time base, or comparative spectrum formats.

**Shaft Centerline package**

The Shaft Centerline package provides information that can be used to determine the margin of stability on rotating machinery and the position of the shaft within its bearing. It also can be used to identify thin-film oil thickness, bearing wear, and the presence of shaft preloads. Data can be plotted as a function of machine speed or elapsed time.

**Hardware Diagnostics package**

The Hardware Diagnostics package makes it possible to diagnose potential ADRE hardware failures. A series of diagnostic programs allows you to test and verify the correct operation of the instruments and peripheral devices in theADRE system. The program ensures that all hardware is connected and operating properly.

**Snapshot Predictive Maintenance (PM) package**

The optional Snapshot PM package, used in conjunction with Bently Nevada's Snapshot,® reduces, stores, and plots data for a large number of machine points. This capability enables you to increase the number of machines in your vibration monitoring or predictive maintenance program. Information is presented in trend, spectrum, and time base plots.

The software package requires additional memory. The Snapshot system, when used with the ADRE computer, does not require a DVF 2 or spectrum analyzer for data collection and reduction.

For more details on the Snapshot PM package and the Snapshot system see data sheets L0546 and L0559.

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# ADRE®

Software packages operate on the specified computers when they are accompanied by specific hardware and a specific operating system. No claims to software compatibility are expressed or implied for any other computer, hardware, or operating system revision. Call your Bently Nevada representative for details of computer requirements.

## Hardware

Two hardware system models, using the HP Series 200 computer, are available.

The Model 10 system uses the HP Series 200 Model 16S computer.

The Model 10 system consists of:

- Hewlett-Packard Series 200 Model 16S computer with a nine-inch CRT, HP-IB and RS-232 interfaces, RAM BASIC with extensions, and 512 Kbytes of RAM.
- Dual 3 1/2-inch microfloppy disk drive.
- Thermal graphics line printer.
- Bently Nevada DVF 2 with carrying case.
- Spectrum analyzer with carrying case.
- Bently Nevada Transient, Steady-State, Shaft Centerline, and Hardware Diagnostics software packages.

The Model 30 system uses an HP Series 200 Model 36CS computer.

The Model 30 system consists of:

- HP Series 200 Model 36CS with a 12-inch color CRT; an HP-IB interface; built-in, dual 5 1/4-inch microfloppy disk drives; RAM BASIC with extensions and RAM Pascal language systems and 540 Kbytes of RAM.
- Thermal graphics line printer.
- Bently Nevada DVF 2 with carrying case.
- Spectrum analyzer with carrying case.
- Bently Nevada Transient, Steady-State, Shaft Centerline, and Hardware Diagnostics software packages.

## Specifications

### INPUTS

**Power:** 90-125 Vac or 180-250 Vac, 48-66 Hz.

**Consumption:**

**Model 10:** 80 Watts.

**Model 30:** 300 Watts.

### OUTPUTS

**Display:**

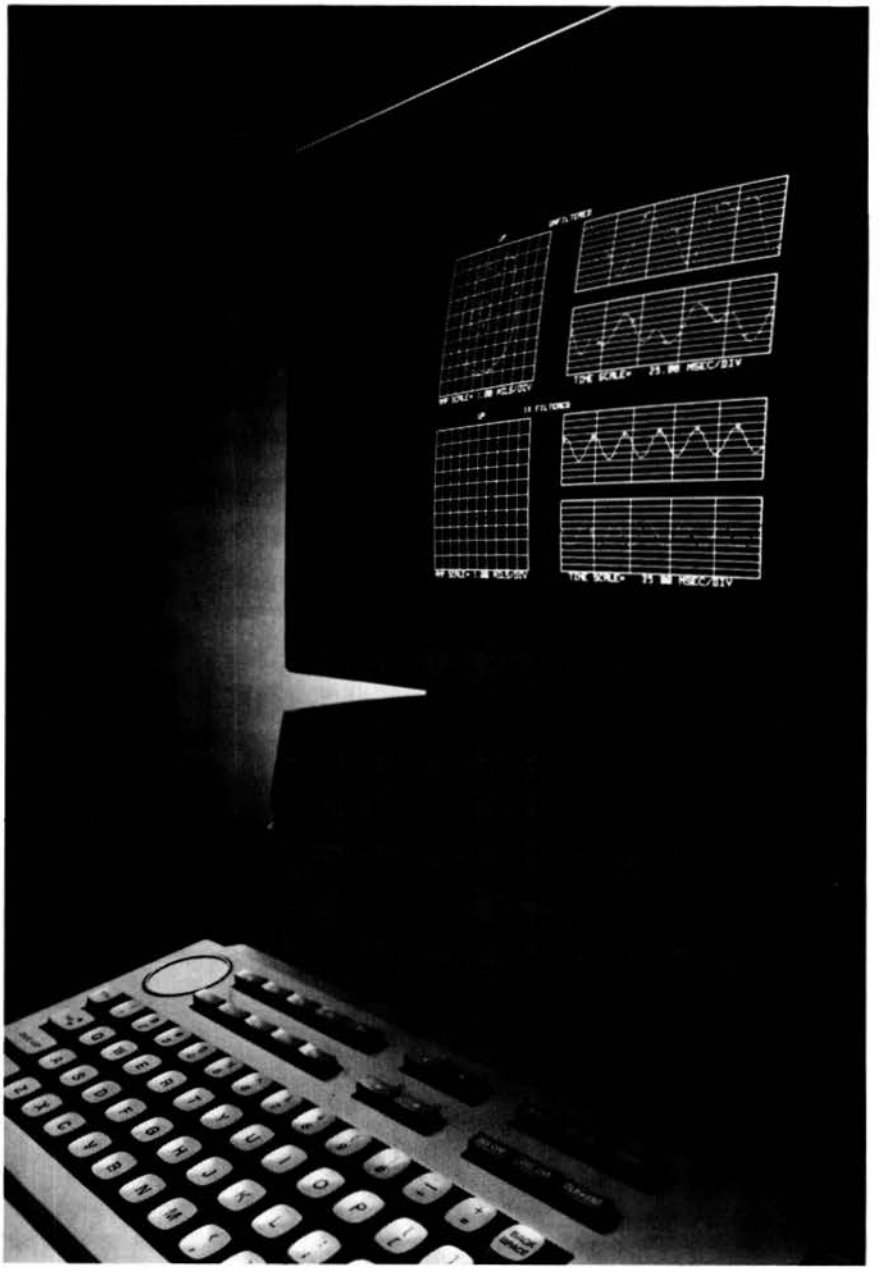
**Model 10:** 9-inch diagonal (229 mm).

**Model 30:** 12.2-inch diagonal (309 mm).

### STORAGE

**Capacity (Mass Storage):** 540 Kbytes.

**Data Sheet Number:** L0453.



**The heart of the ADRE is software. Developed by Bently Nevada's engineering staff from years of field experience, the software is tailored for efficient behavior analysis and diagnosis.**

# ADRE®

## Ordering Information

### Model 10

A B C D
44163 -□□-□-□-□□

**Option Description**

**A** Computer Option
**B** Peripheral Device Option
**C** Instrumentation Option
**D** Software Option

**A □□ Computer Option**
10 Standard offering
11 With ROM BASIC
12 With HP 9836 Keyboard
13 With ROM BASIC and HP 9836 Keyboard

**B □ Peripheral Device Option**
0 Standard offering
1 Without standard printer
2 Without standard disk drive
3 Without standard printer and standard disk drive

**C □ Instrumentation Option**
0 Standard offering
1 Without standard DVF 2
2 Without standard spectrum analyzer
3 Without DVF 2 and spectrum analyzer

**D □□ Software Option**
Ordering ADRE software requires assistance from your Bently Nevada sales representative. The following software packages are available:
- Steady-State Package
- Shaft Centerline Package
- Transient Package
- Snapshot Predictive Maintenance (PM) Package
- Hardware Diagnostics Package

### Model 30

A B C D
44165 -□□-□-□-□□

**Option Description**

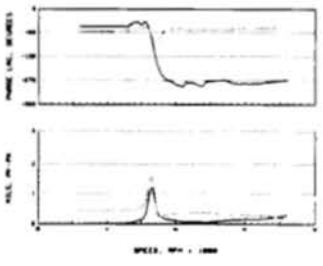
**A** Computer Option
**B** Peripheral Device Option
**C** Instrumentation Option
**D** Software Option

**A □□ Computer Option**
10 Standard offering
11 With ROM BASIC
12 Without color CRT
13 With ROM BASIC and without color CRT

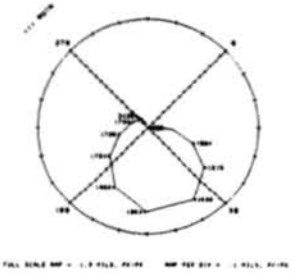
**B □ Peripheral Device Option**
0 Standard offering
1 Without standard printer

**C □ Instrumentation Options**
0 Standard offering
1 Without standard DVF 2
2 Without standard spectrum analyzer
3 Without DVF 2 and spectrum analyzer

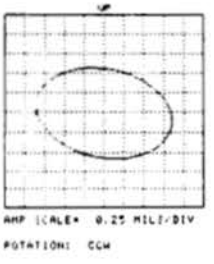
**D □□ Software Option**
Ordering ADRE software requires assistance from your Bently Nevada sales representative. The following software packages are available:
- Steady-State Package
- Shaft Centerline Package
- Transient Package
- Snapshot Predictive Maintenance (PM) Package
- Hardware Diagnostics Package



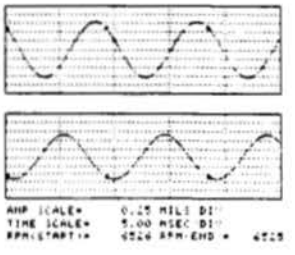
**Bode'**



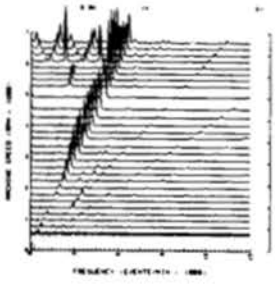
**Polar**



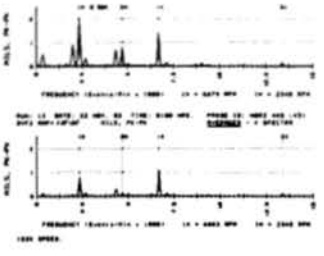
**Filtered Orbit**



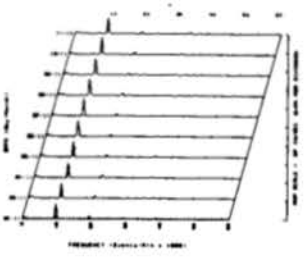
**Time Base Spectrum**



**Cascade**



**Spectrum**



**Dynamic Trend**

**Shaft Centerline**

The heart of the ADRE is software. Developed by Bently Nevada's engineering staff from years of field experience, the software is tailored for efficient behavior analysis and diagnosis. The software packages require minimal computer training to operate and are easy to use.

# 24000 Digital Vector Filter 2

## Technical/Ordering Information

DIAGNOSTICS AND TEST KITS

### In-place diagnostic and balancing data for rotating machinery

The Digital Vector Filter 2 (DVF 2) gives you amplitude, phase, and speed data for diagnosing, balancing, and detecting shaft cracks on all types of rotating machinery.

Two versions of the DVF 2 are available. One version processes 1/2X, 1X, and 2X rotative speed signals.

The second version processes 1X, 2X, 3X, and 4X rotative speed data. The ability to analyze 1X, 2X, 3X, and 4X rotative speed data is vital for detecting and diagnosing shaft cracks on turbine generators and other rotating machinery.

The DVF 2 can be interfaced with a computer, such as Bently Nevada's ADRE® (Automated Diagnostics for Rotating Equipment) system, via its IEEE 488 computer interface. When used with the ADRE, data can be presented in Bodé, polar, cascade, orbit, time base, and comparative spectrum plots.

### Applications for the DVF 2

The ability to accurately measure amplitude, phase, and speed data helps answer the questions: What is happening on the machine, when, where, and how? This information can be used on steam, gas, or hydroelectric turbines; electric motors; centrifugal, reciprocating, or screw compressors; generators; pumps; and fans for some of the following applications:

- Detecting and diagnosing shaft cracks, using data on the 1X, 2X, 3X, and 4X rotative speed behavior of turbine generators and other rotating machinery.
- Determining the balance condition of a machine and locating the residual unbalances on a rotor.
- Determining the rpm location of the natural rotor balance resonances, or "criticals," on a machine.
- Establishing the machine response for documenting acceptance tests and for evaluating and diagnosing current and future machine behavior.

The DVF 2 provides two continuous channels of amplitude and phase data, which is filtered at running speed, and one channel of speed data.

Triggering signals from a Keyphasor® and signals from proximity, velocity, or acceleration transducers are converted by the digital circuitry in the DVF 2 to display rotor rpm, vibration amplitude, and phase angle.

Digital Vector Filter 2

## Specifications

### INPUT

**Power:** 95-125 Vac or 190-250 Vac, rear panel switch selectable. 50-60 Hz 1 phase.

**Nominal power consumption:** 100 watts.

### VIBRATION INPUT

**Scale Factors:**

**Displacement:** 200 or 100 mV/mil (8 or 4 V/mm) fixed. 100 to 1,000 mV/mil (4 to 40 mV/mm) variable.

**Velocity:** 100 to 1,000 mV/inch/second (4 to 40 mV/mm/second) variable.

**Acceleration:** 100 to 1,000 mV/G (10 to 100 mV/M/second²) variable.

**Input Impedance:** 1.1 M ohms minimum at AC signal frequencies; 2.4 M ohms at DC signal frequencies.

### KEYPHASOR INPUT

**Threshold Range:** ± 15 Vdc.

**Hysteresis:** 0.5V typical (internally adjustable from 0.2 to 2.0V).

### VIBRATION OUTPUT

**Scale Factors:**

**Displacement:** 200 mV/mil (8V/mm) or 100 mV/mil (4 V/mm) for fixed input of 200 mV/mil or 100 mV/mil respectively. For variable input scale factors, an output of 200 mV/mil is standard.

**Velocity:** 500 mV/inch/second (20 mV/mm/second).

**Acceleration:** 100 mV/G (10 mV/M/second²).

**Output Impedance:** 100 ohms.

**Manual Sweep Oscillator Ranges:**

**Low:** 100-10,000 rpm.

**High:** 1,000-100,000 rpm.

**Computer Interface:** DVF 2 output data is available through an IEEE 488 compatible interface.

### ENVIRONMENTAL

**Temperature Range:**

**Operating:** 0 °C to +65 °C (+32 °F to +149 °F).

**Storage:** −40 °C to +85 °C (−40 °F to +185 °F).

**Humidity:** To 95% noncondensing.



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# 24000 Digital Vector Filter 2

## DIMENSIONS

| | Bench Mounted (includes handle) | Rack Mounted |
|---|---|---|
| **Height** | 8 inches (203 mm) | 8 inches (203 mm) |
| **Width** | 18 inches (457 mm) | 19 inches (483 mm) |
| **Depth** | 18 7/8 inches (479 mm) | 18 7/8 inches (479 mm) |

**Weight:**

**DVF:** 33 pounds (15 kg) nominal.

**Case:** 28.5 pounds (12.9 kg) nominal.

## Ordering Information

**Digital Vector Filter 2**
1/2X, 1X, and 2X Version

**24000 – □□**

**□□ Mounting Option**
01 Bench Mount (includes case).
02 19-inch EIA Rack Mount.

**Digital Vector Filter 2**
1X, 2X, 3X, and 4X Version

**24000 – □□**

**□□ Mounting Option**
03 Bench Mount (includes case).
04 19-inch EIA Rack Mount.

**The DVF 2 enables you to accurately measure amplitude, phase, and speed for determining the balance condition of rotating machinery, locating the residual unbalances on a rotor, and diagnosing shaft cracks and other machine malfunctions.**

# Digital Vector Filter 3

## Technical/Ordering Information

### The solution for balancing and diagnosing rotating machinery problems at a competitive price

The Digital Vector Filter 3 (DVF 3) provides amplitude, phase, and shaft rotative speed data for detailed vibration analysis including balancing, rotor response evaluation and shaft crack detection on all types of rotating machinery. The instrument's primary application is for documentation of vibration data during machine transient (runup and coastdown) and steady-state (constant speed) conditions.

The DVF 3 accommodates two signal inputs for vibration transducers and a third for a Keyphasor® transducer. Vibration inputs can be from either displacement (proximity), velocity, or acceleration transducers. The Keyphasor input represents a once-per-revolution pulse from either a proximity probe, an optical pickup, or a strobe light. This provides the measurement of shaft rotative speed, and the reference point for measuring phase lag angle. It also provides a trigger signal to tune the tracking filter in each vibration channel to shaft rotative speed.

The instrument provides excellent reliability and outstanding performance in a rugged, lightweight package. Its alphanumeric display and menu-driven setup make the instrument easy to operate. It provides the information accuracy required to make sound decisions regarding machine condition. The DVF 3 can be ordered in several packages, which enables you to select the components best suited for your specific applications without the expenditure for unnecessary functions.

ORIGINAL PAGE
BLACK AND WHITE PHOTOGRAPH


Digital Vector Filter 3

### Easy-to-use functional features

The DVF 3's streamlined design incorporates the features our customers have found most useful from years of experience and adds new features which assist in solving today's machinery problems.

Two channels are simultaneously displayed on the large, highly visible readout, showing vibration amplitude, phase angle, and shaft rotative speed. The display also shows status of instrument setup parameters, such as filter mode and hold.

### Bodé/Polar Plots

A GP-IB interface is provided for connection to a computer or directly to one or up to two digital plotters depending on the type of DVF 3. The DVF 3 is programmed to produce high quality Bodé and polar plots on-site with the accessory digital plotter(s). These plots can be generated "real-time", on full size blank paper (8½ x 11 in. or A4) with full annotation.

Alternatively, the accessory DVF 3 software package may be used to produce these plots on an IBM AT or compatible computer. See DVF 3 Storage and Plotting Application Software product data sheet L6030.

Bodé and polar plots are useful for evaluating vibration response during machine transient conditions. These plots reveal balance resonances (critical speeds), synchronous amplification factors, and other characteristics for evaluating machine condition.

### Sweep Frequency Plots

For machinery operation under steady-state conditions the DVF 3 will produce sweep frequency spectrum plots. Frequency analysis provides useful additional information for complete evaluation of machinery vibration characteristics.

***Automatic signal sweep*** allows:

- Frequency spectrum plotting within user-defined start and end frequencies.
- Frequency component search; instrument pauses at components above a user-defined amplitude threshold.
- Manual (coarse/fine) tuning to pinpoint frequencies of interest.

### Other Features

***Keyphasor error indication*** appears when:

- Shaft rotative speed is outside the operating range (50 to 100,000 rpm)
- Consecutive Keyphasor pulses (shaft rotative speed measurements) vary more than 12.5%
- Trigger threshold is set too low or high.

***Peak Hold*** stores the maximum vector (for both channels) since the last time the memory was reset; a useful feature for identification of peak amplitudes from transient data.

***Variable Transducer Input*** scale factors (0.1 to 9999.9 millivolts per engineering unit) allow connection of virtually all available proximity, velocity and acceleration transducers. Scale factors between input and output are equal, providing convenient interface with other diagnostic instruments.

***Hold*** function freezes the display for easy reading and interpretation of the values; useful for identifying 1X vectors at a particular balancing speed.

***Multiple Full Scale Ranges*** enhance the accuracy of measured variables and make the instrument extremely useful for a variety of applications.

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# Digital Vector Filter 3

***Signal Integration*** from acceleration to velocity or from velocity to displacement is available independently on each channel.

***Metric or English Units*** can be used for display of measured variables. Displacement values are shown in pk-pk units; velocity and acceleration units can be 0-pk or RMS.

***DC Gap Voltage*** measurements are available for both channels. The high resolution of this data allows the determination of shaft average radial position relative to the bearing clearance.

***Triggering in Two Modes*** is possible. In the AUTOMATIC mode, the threshold level is determined by the DVF 3; ideal for triggering on a noise-free Keyphasor pulse. In the MANUAL mode, the threshold level is selected by the user, which allows triggering on a poor quality Keyphasor pulse. In addition, the manual mode allows Keyphasor indexing. The index function identifies the location of the Keyphasor reference mark when visual observation is impossible. Indexing, indicated by an asterisk on the display, is performed on the negative slope of the Keyphasor pulse, which for a notch, relates to the leading edge, and for a projection or optical pickup, the trailing edge.

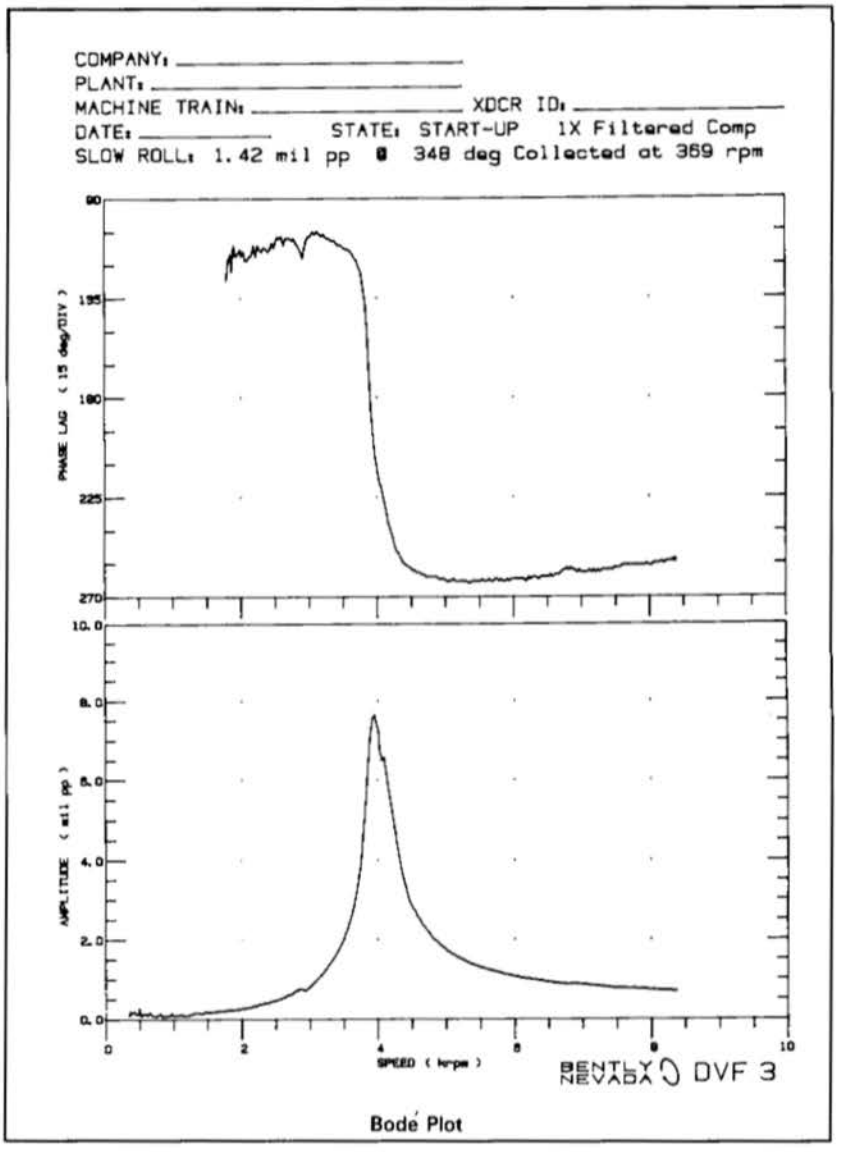
***Amplitude Over/Underrange*** conditions are indicated on the display to ensure data integrity.

***Tracking Filter Bandwidth*** is selectable between 12 and 120 cpm to provide accurate measurements for low and high speed applications.

***Filtered 1/2X, 1X and 2X*** signal outputs are available. These dynamic signals may be used for display on an oscilloscope (e.g. for filtered orbits) or connected to other diagnostic instruments.

***Slow Roll Compensation*** is provided in order to eliminate the effects of shaft runout. The runout vectors may be stored automatically with the rotor at slow roll speed, or the previously documented vectors can be entered manually.

***Coaxial Connectors*** on the front and rear panel inputs and outputs provide a reliable interface for transducers and other instruments.




Bode Plot

## Useful for a Wide Variety of Applications

The extended operating range of the DVF 3 (50 to 100,000 rpm) allows it to be used on virtually all types of rotating machinery.

- Steam, gas, and hydroelectric turbines
- Electric motors and generators
- Centrifugal, reciprocating, and screw compressors
- Vertical and horizontal pumps
- Gearboxes
- Fans and blowers
- Centrifuges
- Paper machine rollers
- Propulsion systems

## Using the DVF 3 for balancing

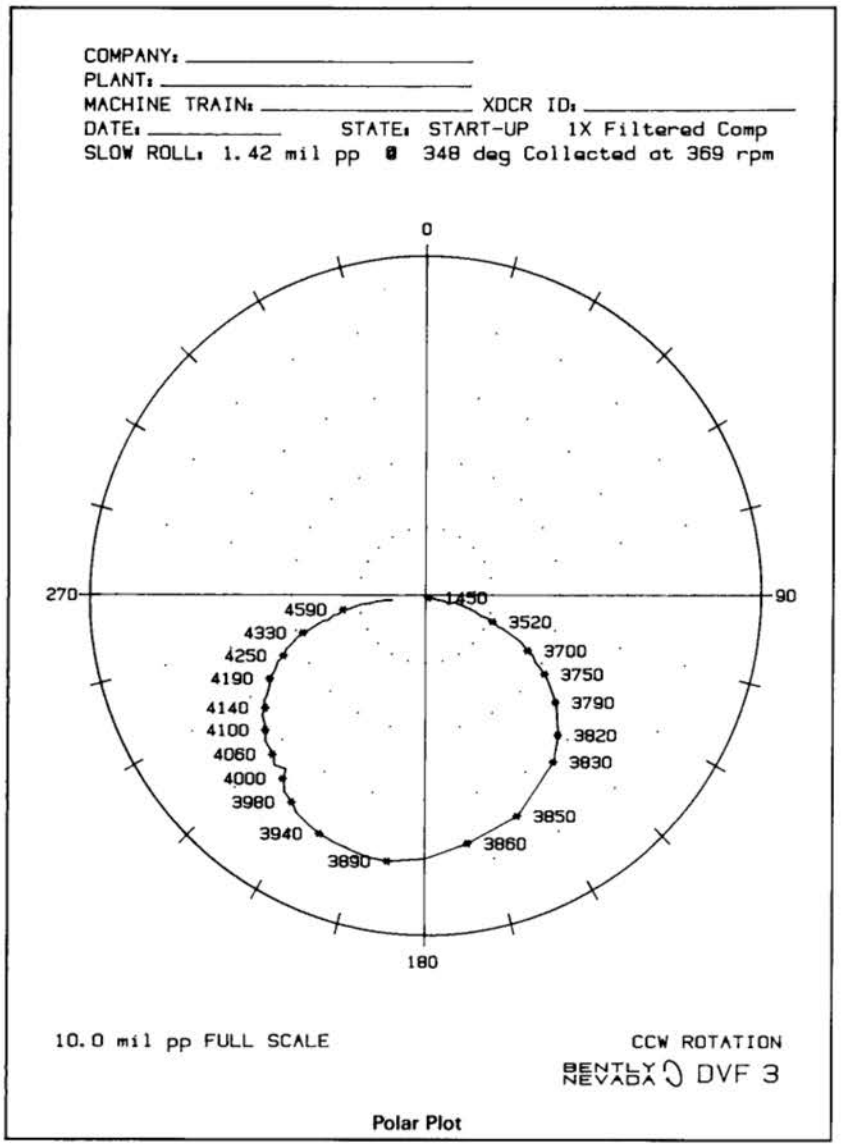
The DVF 3 is ideal for balancing rotating machinery due to it's ability to track the 1X vibration response of the machine. The 1X vector on each channel can be slow roll compensated for shaft runout effects to display the true 1X dynamic motion. The slow roll compensation vectors can be automatically sampled or manually entered by the user. The HOLD function enables the user to freeze the displayed data for easy interpretation at the balancing speed.

The Field Balancing Package option provides a programmable handheld HP 41 CV calculator and Bently Nevada software for multiplane balancing solutions, up to four planes.

## Using the DVF 3 for REAL TIME Bode and Polar Plotting.

The DVF 3 and the accessory digital plotter(s) can produce Bode or polar plots in "real time"; a useful feature for the engineer faced with deciding whether a machine start-up should continue or not.

# Digital Vector Filter 3




Polar Plot

The polar plots are automatically annotated with rpm tic marks at rotative speed increments. This plot is extremely useful for structural resonance and mode shape identification, particularly on balancing exercises where modal consideration is required.

The Bode plot scaling is user-selectable in terms of amplitude, rpm and phase lag angle. This plot allows the exact frequency of resonances to be accurately determined. The damping characteristics of a system resonance can be evaluated by calculating synchronous amplification factors from the presented data.

Both the Bode and polar plots can be made using the 1X or 2X vectors. The 2X plot is very useful in the detection of shaft cracks where lateral stiffness asymmetry due to a crack is to be evaluated.

## Using the DVF 3 with a tape recorder.

Multi-channel tape recording of a startup or shutdown can be easily reduced in the field into report-quality Bode and polar plots for each channel. The DVF 3 and its accessory plotter(s) can produce these quality plots from blank (8 1/2 x 11 inch or A4) paper or previously prepared graph paper. The DVF 3 firmware is programmed to fully label these plots. Plot correlation is possible by replaying data from other transducers or channels and plotting on the same sheet. The multi-pen, multi-color plotter(s) facilitates this feature.

## Using the DVF 3 for Pre- and Post-Maintenance checks.

When a long running machine is being shutdown for planned maintenance, the DVF 3, digital plotter(s) and a tape recorder can be used to provide quick documentation of the transient characteristics during shutdown. This data can be used either as a baseline transient response curve or compared with the last response curve plotted for that machine. Indications of changes in balance condition, system dynamic stiffness and damping effects can be quickly pinpointed using such methods.

Plots generated from shutdown data can be compared to those made during startup in order to evaluate the effects of any maintenance performed on the machine during shutdown. In addition, the post-maintenance transient response can be used as a reference for the next scheduled maintenance.

## Using the DVF 3 for Acceptance Testing.

A typical acceptance test may include the documentation of measured balance resonances, calculation of synchronous amplification factors (Q), shaft mode shapes and frequency spectra. It may also call for casing measurements which are specified in either 0-to-peak or RMS units. The DVF 3 and its accessories can document and display all of this information, making it an ideal test stand instrument.

## Using the DVF 3 with Low Speed Machinery.

The tracking filters on the DVF 3 can operate down to 50 rpm, making the instrument useful for low speed applications. Hydroturbines and cooling tower fans can be balanced accurately using 1X vector information. The 12 cpm bandwidth selection is useful for low speed applications.

The low speed DVF 3 response is also useful for measuring shaft runout at slow roll speeds for eliminating runout effects from subsequent vibration data and detection of shaft cracks.

## Using the DVF 3 with the ADRE II System.

The DVF 3 can be used in place of the DVF 2 with the ADRE II system. When DVF 3 is used with the ADRE II system, one additional useful feature is the ability to manually enter slow roll compensation vectors at the instrument's front panel. This eliminates having to sample real slow roll data from tape recordings before compensation can be performed on any plot.

# Digital Vector Filter 3

## Specifications

The following specifications are intended to provide basic information only.

Specifications provided are at 73 °F (23 °C) with a sine wave input, at input scale factor greater than 3 mV/mil and with a full scale setting of 10 mils. Where required, input signal level is the full scale selection. Specifications given are for a shaft rotative speed of 3600 rpm and with the tracking filter set for 12 cpm bandwidth.

### INPUTS

**Power:** 90-132 Vac or 180-264 Vac, (switch selectable), 47 to 63 Hz, 1 phase. Nominal power consumption 30 Watts.

**Vibration Signals:**

**Sensitivity:** Selectable in 0.1 mV per engineering unit increments from 0.1 to 9,999.9 mV/unit.

**Range:** From one to six full scale ranges are available depending on sensitivity and units selected. For example 2, 5, 10, 20 and 50 mil ranges are available with an input sensitivity of 200 mV/mil.

**Probe Gap Voltage:** ± 25 Vdc.

**Impedance:** 1 MΩ.

**Keyphasor Signal:**

**Input impedance:** 100 kΩ.

**Transducer:** 7200, 7000 or 3000 series transducer system, optical pickup, or stroboscope; one event per shaft revolution.

**Threshold range:** ± 18 Vdc.

**Hysteresis:** Factory set at 0.5 volts. Internally adjustable for 0.2, 0.5 and 1.5 volts.

### OUTPUTS

**Display Accuracy:** Input to front panel display

**Amplitude (non-integrating):**

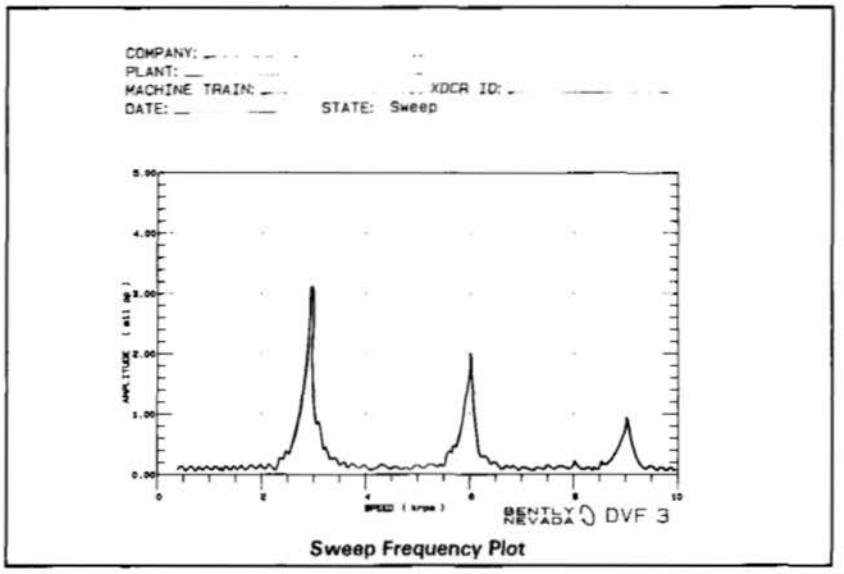
**Direct Mode:** pk-pk and 0-pk; within +2.9%, -3.2% (maximum).

**RMS Mode:** Within +2.8%, -3.1% (maximum).

**Filtered Mode:** Within +2.0%, -2.4% (maximum).

**Phase:**

**Filtered Mode:** Within +0.6%, -2.1% (maximum).




**Sweep Frequency Plot**

**Output Accuracy:**

**Input to front/rear outputs**

**Amplitude:**

**Direct Mode:** Within +1.3%, -1.7%.

**Filtered Mode:** Within +4.9%, -5.3%.

**Phase:**

**Direct Mode:** Within +0.2°, -1.3°.

**Filtered Mode:** 1X phase shift within +2.1°, -3.6°.

**RPM:**

**50 to 3600 rpm:** Within ± 1 rpm

**3601 to 10,000 rpm:** Within ± 3 rpm

**10,001 to 25,000 rpm:** Within ± 20 rpm

**25,001 to 99,900 rpm:** Within ± 100 rpm

**Probe Gap Voltages:**

**Accuracy:** ± 1.5%.

**Resolution:**

| Range | Resolution |
|---|---|
| -25.0 Vdc to -10.0 Vdc | 0.1 Vdc |
| -9.99 Vdc to +9.99 Vdc | 0.01 Vdc |
| +10.0 Vdc to +25.0 Vdc | 0.1 Vdc |

**Trigger Signal:**

**Impedance:** 220 Ω.

**Drive Capacity:** 1 TTL load.

### SIGNAL PROCESSING

**Operating Range:** 50 rpm to 99,900 rpm.

**Integration:**

**0 dB frequencies:**

**Velocity:** 63.9 Hz ± 1.1 Hz.

**Acceleration:** 305 Hz ± 5.0 Hz.

**Amplitude:** Within +1.5%, -2.5% of input signal in addition to vibration measurement deviation.

**Output Signal Scale Factors:**

**Velocity to Displacement:** 0.4 times the input scale factor, ± 1.6%.

***Example:*** *Input of 500 mV/in/s provides output of 200 mV/mil, ± 1.6%.*

**Acceleration to Velocity:** 5.0 times the input scale factor, ± 1.4%.

***Example:*** *Input of 100 mV/g provides output of 500 mV/in/s, ± 1.4%.*

**Filter:**

**Bandwidths:**

**120 ± 10 cpm (2.0 Hz).**

**12 ± 1 cpm (0.2 Hz).**

**Response Time to 99% of Final Value:**

**120 cpm:** 0.65 second.

**12 cpm:** 7.30 seconds.

***Note:*** *Add 0.4 second for RMS measurements*

**Signal Frequency Sweep:**

**Range:** 100 (± 2.0) cpm to 99,900 (± 100) cpm.

**Increments:** 25 cpm increments.

### COMPUTER INTERFACE

The DVF 3 is equipped with a GP-IB and an ADRE II interface.

# Digital Vector Filter 3

## ENVIRONMENTAL LIMITS

**Temperature Range:**

**Operating:** +32 °F to +122 °F (0 °C to +50 °C).

**Storage:** −40 °F to +185 °F (−40 °C to +85 °C).

**Relative Humidity:** Up to 90%, noncondensing.

## HAZARDOUS AREA APPROVALS

**CSA:** Certified safe for general purpose use in laboratory environments.

## PHYSICAL

**Width:** 17.40 in. (440 mm).
**Depth:** 17.25 in. (430 mm).
**Height:** 5.18 in. (130 mm).
**Weight:** 22 lbs. (10 kg).
Rack mountable (19 inches - 482.6 mm) with optional EIA rack-mount kit

# Ordering Information

The DVF 3 and commonly-used accessories comprise the DVF 3 Field Packages. You can design your package by using the accessories list for maximum flexibility.

## BASIC FIELD PACKAGES

**81496-01**
**Includes:**
1 DVF 3 Type 77581-01
1 DVF 3 soft carrying case
1 Digital plotter
1 Set of interconnect cables

**81496-02**
**Includes:**
1 DVF 3 Type 77581-02 ⚠5
1 DVF 3 soft carrying case
2 Digital plotters
1 Set of interconnect cables

## BALANCING PACKAGE

**82246-01**
**Includes:**
1 HP-41CV calculator with card reader and printer
1 HP Infrared printer with interface module
1 Bently Nevada Multiplane Balancing software package (4-plane maximum)

## ENGINEERING UNITS

| User Selection: | Abbreviation: |
|---|---|
| mils peak-to-peak | (mil pp) |
| micrometres peak-to-peak | (µm pp) |
| inches per second peak | (in/s pk) |
| inches per second rms | (in/s rms) |
| millimetres per second peak | (mm/s pk) |
| millimetres per second rms | (mm/s rms) |
| velocity integrated to displacement in mils peak-to-peak | (int mil pp) |
| velocity integrated to displacement in micrometres peak-to-peak | (int µm pp) |
| g's peak | (g pk) |
| g's rms | (g rms) |
| metres per second per second peak | (m/ss pk) |
| metres per second per second rms | (m/ss rms) |
| acceleration integrated to velocity in inches per second peak | (int in/s pk) |
| acceleration integrated to velocity in inches per second rms | (int in/s rms) |
| acceleration integrated to velocity in millimetres per second peak | (int mm/s pk) |
| acceleration integrated to velocity in millimetres per second rms | (int mm/s rms) |

## TRANSDUCER FIELD PACKAGE

**82705-01**
**Includes:**
1 Proximitor® panel.
4 Proximity probes and cables.
2 Velocity transducers and mounting accessories.
1 Optical Keyphasor® and mounting accessories.
Co-axial to Banana adapters.
Co-axial cables
Banana cables
1 TK15 Keyphasor Conditioner/Power Supply.
2 Manuals
1 Hard carrying case.

## ACCESSORIES

| | |
|---|---|
| 77581-01 | DVF 3 |
| 77581-02 | DVF 3 ⚠5 |
| 79981-01 | DVF 3 test cable kit ⚠4 |
| 76285-01 | DVF 3 hard transit case |
| 78858-01 | DVF 3 soft carrying case |
| 75237-01 | DVF 3 rack-mount kit |
| 82292-01 | DVF 3 Users Guide ⚠1 |
| 02198937 | DVF 3 power cord ⚠1 |
| 83194-01 | DVF 3 Storage and Plotting Application Software ⚠6 |
| 02290871 | Tektronix HC100 digital plotter ⚠1 |
| 04160166 | HC100 Hard carry case |
| 02290003 | HP-IB Computer Interface card |
| 02260372 | HP-IB Cable |
| 02290381 | HP 7440A digital plotter |
| 9200-09-01-01 | Velocity transducer ⚠5 |
| 80705-02 | Velocity interconnect cable, 6 ft (2 m) |
| 16707-01 | Adapter (3 to 2 wire) ⚠5 |
| 46000-01 | Super Mag 100 magnetic base |
| 7989-01 | Extension rod, for use with 9200 velocity transducer |
| 10798-03 | Optical pickup |
| 20545-25 | Optical pickup cable (25ft) |
| 20211-05 | Optical pickup mounting package (Includes: locking pliers, magnetic base, gooseneck transducer holder) |
| 81769-01 | Reflective tape roll |
| 02290947 | HP 41CV programmable calculator |

# Digital Vector Filter 3

| | |
|---|---|
| 43980-01 | Bently Nevada multiplane balancing software (HP 41CV or CX) |
| 02290948 | HP card reader |
| 02290951 | HP infrared printer |
| 02290949 | Printer interface module |
| 76131-01 | Stroboscope kit with 12 Vdc battery pack and 240 Vac, 50/60 Hz charger |
| 76131-02 | Stroboscope kit with 12 Vdc battery pack and 120 Vac, 50/60 Hz charger |
| 76131-04 | Stroboscope kit with 120 Vac, 50/60 Hz power supply |
| 76131-03 | Stroboscope kit with 240 Vac, 50/60 Hz power supply |
| 73783-01 | Keyphasor Multiplier/Divider |
| 81663-01 | Keyphasor Conditioner/ Power Supply |

*(1) Supplied with DVF 3 and all packages*

*(2) Other velocity transducers are available.*

*(3) For use with Bently Nevada 16699 3-wire velocity transducers.*

*(4) Test cable kit consists of a set of short coaxial cables with BNC connectors for use with the DVF 3 self test function.*

*(5) DVF 3 type 77581-02 has additional features; −18, −24 Vdc power supply to drive Proximitors and the ability to drive two digital plotters simultaneously.*

*(6) See product data sheet L6030 for details on DVF 3 software for IBM AT and compatible computers.*

*(7) US style plug, 110 V ac. Other power and mains plug configurations available for UK, European, Swiss, Australian and North American users.*

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L6021 (01/89) **Data Subject to Change**

# ADRE® 3

## Technical/Ordering Information

### Fast acquisition and reduction of dynamic vibration data for rotating machinery behavior analysis

The ADRE® 3 system (Automated Diagnostics for Rotating Equipment) provides affordable, fast and simple acquisition and reduction of vibration data for diagnostics on rotating machinery.

The system's ability to simultaneously capture eight channels of dynamic vibration data during machine transient conditions (startup or shutdown), or while the machine is operating at a constant speed, makes ADRE 3 essential for rotating equipment specialists.

An ADRE 3 data acquisition and reduction system consists of:

- One (or up to ten) Bently Nevada 108 Data Acquisition Instrument(s)
- Bently Nevada ADRE 3 application software
- Computer system

With ADRE 3's application software, dynamic waveform records and static data records (vector and scalar values) are retrieved from the 108 Data Acquisition Instrument (108 DAI) or floppy disk, and reduced in a variety of plotting formats suitable for diagnosis of rotating machinery malfunctions.

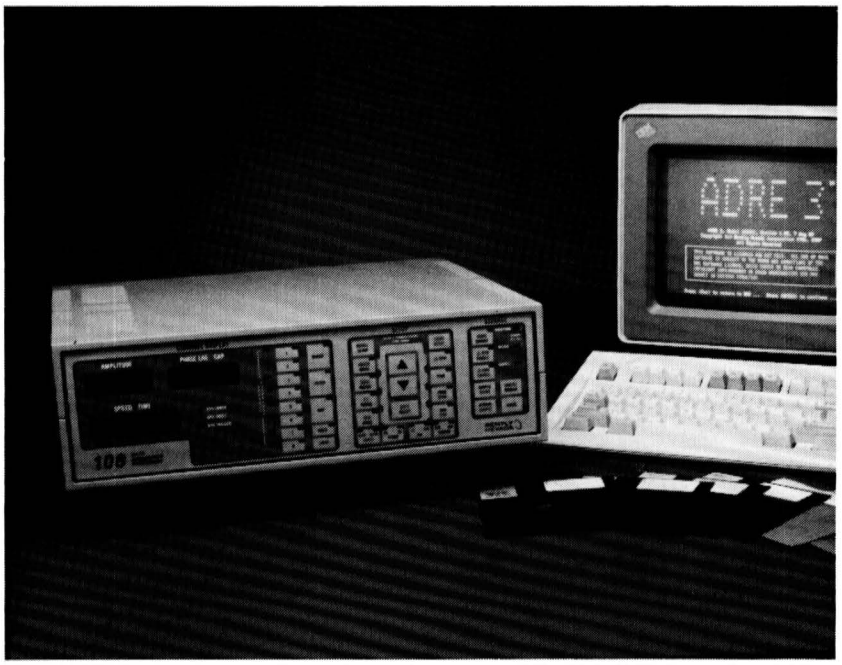
Ease of use and low cost make it economical to utilize ADRE 3 as part of a (predictive) vibration analysis program. Its ease of operation enables acquisition and reduction of vibration data for analysis with minimal training.

Low weight and compact size make the ADRE 3 system (with "portable" computer) the ideal setup for "in the field" work, on acceptance test and balancing stands, control rooms and laboratories.

ADRE 3 is specifically designed to analyze rotating machinery; in particular, steam and gas turbines, electric motors, centrifugal and screw compressors, vertical and horizontal pumps, turbogenerator sets, hydroturbine-generator sets, turbo expanders, ship propulsion systems, aircraft engines, fans, blowers, reciprocating engines and compressors.

### 108 Data Aquisition Instrument

The 108 DAI is a highly versatile instrument with many features aimed at application flexibility and easy user interface.




**The ADRE 3 system consists of one (or up to 10) 108 DAI Data Acquisition Instrument(s) (left) and computer system with ADRE 3 software (right).**

- Vibration input signals can be from acceleration, velocity and displacement transducers.
- Scale factors are user selectable (default values or manual entry).
- Single integration may be performed on each of the eight channels.
- English and metric engineering units can be displayed in pk-pk values for displacement and 0-pk or RMS for velocity and acceleration.
- Independent channel overload and Keyphasor® error LEDs ensure that the user is alerted of irregularities during data collection.

Setup keys on the 108 DAI make it simple to configure the instrument to acquire data. Selections which can be made using the clearly labeled keys include the transducer units, scale factor, full scale range, trigger mode, filter mode (1X or 2X) and bandwidth. The user selects whether data will be acquired based on elapsed time (ΔTIME), change in shaft rotative speed (ΔRPM), or both.

For ease of use and efficiency, the 108 DAI enables the user to configure and store (in non-volatile EEPROM) up to seven instrument setup configurations. Eight setup configurations can be recalled. The eighth is a factory programmed setup.

For complete system integrity, the user can initiate nine different self tests simply by pressing two dedicated keys simultaneously. The 108 DAI display indicates completion and results of a performed self test. Individual channels can be tested, using the test signal at the rear panel.

Automatic data collection can be preprogrammed, based on elapsed time (ΔTIME), changes in machine speed (ΔRPM), or both.
Data also can be acquired manually, by pressing the MANUAL SAMPLE key on the 108 DAI front panel, or by a (remote) contact closure.

Each channel on the 108 DAI can store up to 32 dynamic waveform records and 320 static data records. Under ΔTIME or ΔRPM control, a waveform record is sampled concurrently with each tenth static data record.

When using MANUAL SAMPLE, both a waveform record and a static data record are sampled and stored.

A dynamic waveform record consists of 512 data samples and represents the "real time" vibration waveform from the measured points. The first 256 samples are used for orbit and time base waveform reconstruction and presentation. Antialiasing filters are not used when these samples are taken because such filters introduce phase errors in the data.

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