

3500/42E Vibration Monitor

Bently Nevada* Asset Condition Monitoring

Description

The 3500/42E Vibration Monitor is a 4-channel monitor that accepts input from proximity and seismic transducers, conditions the signal to provide various vibration and position measurements, and compares the conditioned signals with user-programmable alarms. The user can program each channel of the 3500/42E using the 3500 Rack Configuration Software to perform any of the following functions:

- Radial Vibration
- Thrust Position
- Differential Expansion
- Shaft Absolute
- Eccentricity
- Acceleration
- Velocity



3500 ENCORE series is available in two configurations:

3500 ENCORE Rack Upgrade: In this configuration the 3500/42E is installed as part of a 3500 ENCORE upgrade of a 3300 Monitor System where the 3300 chassis and IO remain in place. When used in a rack upgrade the monitor is limited to two channels and uses the pre-existing 3300 series IO Module and the relays located on the 3300 series IO.

3500 ENCORE System: In this configuration there will be a 3500 ENCORE System Rack with 3500 ENCORE IO modules. 3500/42Es that are used in a 3500 ENCORE rack have all four channels available. Monitor channels are programmed in pairs and can perform up to two of the monitoring functions at a time. Channels 1 and 2 can perform one function, while channels 3 and 4 perform another (or the same) function.

Monitors in 3500 ENCORE Systems use a logic programmable Relay Module to drive alarm relays.

The primary purpose of the 3500/42E monitor is to provide:

1. Machinery protection by continuously comparing monitored parameters against configured alarm setpoints to drive alarms.
2. Essential machine information for both operations and maintenance personnel.

Each channel, depending on configuration, typically conditions its input signal to generate various parameters called "static values". The user can configure Alert setpoints for each active static value and Danger setpoints for any two of the active static values.



Specifications

Inputs

Signal

Accepts from 1 to 4 proximity, velocity or acceleration transducer signals.

Input Impedance

10 k Ω (Proximitors and Acceleration Inputs).

Power Consumption

6.8W Typical

Sensitivity

Radial Vibration

3.94 mV/ μ m (100 mV/mil), or

7.87 mV/ μ m (200 mV/mil).

Thrust

3.94 mV/ μ m (100 mV/mil), or

7.87 mV/ μ m (200 mV/mil).

Eccentricity

3.94 mV/ μ m (100 mV/mil), or

7.87 mV/ μ m (200 mV/mil).

Differential Expansion

0.394 mV/ μ m (10 mV/mil), or

0.787 mV/ μ m (20 mV/mil).

Acceleration

10 mV/(m/s²) (100 mV/g).

Velocity

20 mV/(mm/s) pk (500 mV/(in/s) pk), or

5.8 mV/(mm/s) pk (145 mV/(in/s) pk), or

4 mV/(mm/s) pk (100 mV/(in/s) pk).

Outputs

Front Panel LEDs

OK LED

Indicates when the 3500/42E is operating properly.

DANGER LED

Indicates the 3500/42E has detected a danger condition and is driving the danger alarm.

ALERT LED

Indicates the 3500/42E has detected an Alert condition and is driving the alert alarm.

Bypass LED

Indicates when the 3500/42E is in Bypass Mode.

Buffered Transducer Outputs

The front of each monitor has one coaxial connector for each channel. Each connector is short-circuit protected.

Output Impedance

499 Ω

Relay Contacts

In the case of a 3500 ENCORE Rack Upgrade, the 3500/42E will drive the relays for the various 3300 SIRM options.

Transducer Power Supply

-24 Vdc

Recorder

+4 to +20 mA. Values are proportional to monitor full-scale. The monitor provides individual recorder values for each channel. Monitor operation is unaffected by short circuits on recorder outputs.

Voltage Compliance (current output)

0 to +12 Vdc range across load. Load resistance is 0 to 600 Ω .

Resolution

0.3662 μ A per bit
 \pm 0.25% error at room temperature
 \pm 0.7% error over temperature range.
Update rate 100 ms or less.

Signal Conditioning

Note: Specified at +25 $^{\circ}$ C (+77 $^{\circ}$ F) unless otherwise noted.

Radial Vibration

Frequency Response

Direct filter

User-programmable, single-pole, -3db at 4 Hz to 4000 Hz or 1 Hz to 600 Hz, \pm 1% accuracy.

Gap filter

-3 dB at 0.09 Hz.

Not 1X filter

60 cpm to 15.8 times running speed. Constant Q notch filter. Minimum rejection in stopband of -34.9 dB.

Smax

0.125 to 15.8 times running speed.

1X and 2X Vector filter

Constant Q Filter. Minimum rejection in stopband of -57.7 dB.

Note: 1X & 2X Vector, Not 1X, and Smax parameters are valid for machine speeds of 60 cpm to 60,000 cpm.

Accuracy

Direct and Gap

Exclusive of filtering, within \pm 0.33% of full-scale typical, \pm 1% maximum.

1X and 2X

Within \pm 0.33% of full-scale typical, \pm 1% maximum.

Smax

Within \pm 5% maximum.

Not 1X

\pm 3% for machine speeds less than 30,000 cpm.

\pm 8.5% for machine speeds greater than 30,000 cpm.

Thrust and Differential Expansion

Frequency Response

Direct filter

-3 dB at 1.2 Hz.

Gap filter

-3 dB at 0.41 Hz.

Accuracy

Within \pm 0.33% of full-scale typical, \pm 1% maximum.

Eccentricity

Frequency Response

Direct filter

-3 dB at 15.6 Hz.

Gap filter

-3 dB at 0.41 Hz.

Accuracy

Within \pm 0.33% of full-scale typical, \pm 1% maximum.

Acceleration II

Frequency Response

Bias filter

-3 dB at 0.01 Hz

Not OK filter

-3 dB at 2400 Hz

1X and 2X
Vector filter

Valid for machine speeds of 60 cpm to 100,000 cpm.

The following table represents the frequency ranges for the 3500/42E under different options using the Acceleration II Channel Type.

Output Type	Without Filter, Low- or High-Pass Filter	With Integration
RMS	10 to 30,000 Hz	10 to 20,000 Hz
Peak	3 to 30,000 Hz	10 to 20,000 Hz

Filter Quality

High-Pass

4-pole (80 dB per decade, 24 dB per octave).

Low-Pass

4-pole (80 dB per decade, 24 dB per octave).

Accuracy

Within $\pm 0.33\%$ of full scale typical, $\pm 1\%$ maximum, exclusive of filters.

Velocity II

Frequency Response**

Bias

-3dB at 0.01 Hz

Not OK filter

-3 dB at 40 Hz

RMS

10 to 5,500 Hz, -3 dB.

Peak or Peak-to-Peak

3 to 5,500 Hz, -3 dB

1X and 2X
Vector filter

Valid for machine speeds of 60 to 100,000 cpm. (Velocity II only)

**This does not include the filtering implemented on the 3300 Velomitor and HTVS I/O modules that will be present in the case of a 3500 ENCORE Rack Upgrade.

Filter Quality

High-Pass

2-pole (40 dB per decade, 12 dB per octave).

Low-Pass

4-pole (80 dB per decade, 24 dB per octave).

Accuracy

Within $\pm 0.33\%$ of full scale typical, $\pm 1\%$ maximum. Exclusive of filters.

Velomitor Sensor Accuracy

Full Scale 0-0.5: $\pm 3\%$ Typical

Full Scale 0-1.0: $\pm 2\%$ Typical

Full Scale 0-2.0: $\pm 1\%$ Typical

Alarms

Alarm setpoints

The user can use software configuration to set Alert levels for each value measured by the monitor and Danger set points for any two of the values measured by the monitor. Alarms are adjustable from 0 to 100% of full-scale for each measured value. The exception is when the full-scale range exceeds the range of the transducer. In this case, the range of the transducer will limit the set points. Accuracy of alarms are to within 0.13% of the desired value.

Alarm Time Delays

Note: Applies to Radial Vibration, Thrust, Differential Expansion, Eccentricity, Acceleration, Velocity, Acceleration2, Velocity2

The user can program alarm delays using software as follows:

Alert

From 1 to 60 seconds in 1 second intervals.

Danger

0.1 seconds or from 1 to 60 seconds in 0.5 second intervals.

Static Values

Static values are measurements used to monitor the machine. The Proximito/Seismic Monitor returns the following static values:

Radial Vibration

Direct, Gap, 1X Amplitude, 1X Phase Lag, 2X Amplitude, 2X Phase Lag, Not 1X Amplitude, and Smax Amplitude.

Thrust Position

Direct, Gap

Differential Expansion

Direct, Gap

Eccentricity

Peak-to-peak, Gap, Direct Minimum, Direct Maximum.

Shaft Absolute Radial Vibration

Direct, Gap, 1X Amplitude, 1X Phase.

Shaft Absolute Velocity

Shaft Absolute Direct, Shaft Absolute 1X Amplitude, Shaft Absolute 1X Phase, Direct, Gap, 1X Amplitude, 1X Phase.

Acceleration II

Direct, 1X Amplitude, & 2X Amplitude; defined as one of the following:

RMS Acceleration, **or**

peak Acceleration, **or**

RMS Velocity, **or**

peak Velocity, **or**

Band-pass peak Acceleration, **or**

Band-pass peak Velocity.

1X Phase, 2X Phase and Bias Voltage.

Velocity II

Direct, 1X Amplitude, & 2X Amplitude; defined as one of the following:

RMS Velocity, **or**

peak Velocity, peak-to-peak Displacement, **or**

Band-pass peak Velocity, **or**

Band-pass, **or**

peak-to-peak Displacement.

Additionally, 1X Phase, 2X Phase and Bias Voltage¹.

Barriers

The 3500/42E supports the external and internal barriers when used in a 3300 system retro fit only.

Environmental Limits

Operating Temperature

-20°C to +65°C (-4°F to +150°F)

Storage Temperature

-40°C to +85°C (-40°F to +185°F).

Humidity

95%, noncondensing.

¹ The I/O Module modifies the Velomitor's bias voltage. For these signals, the bias voltage is intended for trending purposes only.

Compliance and Certifications

EMC

European Community Directives:
EMC Directive 2004/108/EC

Standards:
EN 61326-1:2006
Emissions and Immunity
EN 61000-6-2 (2005) +C1
EN 61000-3-2 (2006) +A1, +A2
EN 61000-3-3 (2008)
EN 61000-6-4 (2007) +A1

Electrical Safety

Standards:
EN 61010-1: 2010

European Community Directive:
2006/95/EC Low Voltage

For further certification and approvals information please visit the following website:

www.ge-mcs.com/bently

Hazardous Area Approvals

North American:

Class I, Div 2.

Groups A, B, C, D.

T4 @ Ta = -20 °C to +65 °C.

(-4 °F to +150 °F).

Note: When installed as a retrofit monitor for a 3300 System, hazardous area approval is valid only if the existing 3300 System has the same type of approval.

For further certification and approvals information please visit the following website:

<http://www.ge-mcs.com/en/bently-nevada.html>

Physical

Monitor Module (Main Board)

Dimensions (Height x Width x Depth)

228mm (8.97 in) x 50mm (1.98 in) x
289mm (11.39 in)

Weight

1.27kg (2.8 lb)

I/O Module (4 channel)

Dimensions (Height x Width x Depth)

208.28 mm (8.2 in) x 48.26 mm (1.9
in) x 127 mm (5 in)

Weight

0.68 kg (1.5 lb)

Rack Space Requirements

Monitor Module

1 full-height front slot.

I/O Modules

1 full-height rear slot (for 4-channel
I/O).

Ordering Information

General

The 3500/42E Module requires the following (or later) firmware, and software revisions:

3500/01 Software – Version 4.6

Ordering Options

Proximator Seismic Monitor

3500/42E-AXX-BXX

A: I/O Module Type

- 00** none, uses currently installed 3300 SIM or SIRM.
- 01** Proximator/Seismic I/O module.

B: Agency Approval Option

- 00** None
- 01** CSA/NRTL/C (Class 1, Div 2)

Note: For installation as a retrofit monitor for a 3300 System as in a 3500 ENCORE Rack Upgrade, Agency Approval Option B01 should be ordered only if the existing 3300 System has the same type of approvals. Installation of a retrofit monitor in a system without approvals will invalidate the approvals of the monitor.

Spares**285691-01**

3500/42E Proximitor/Seismic Monitor

289837-01

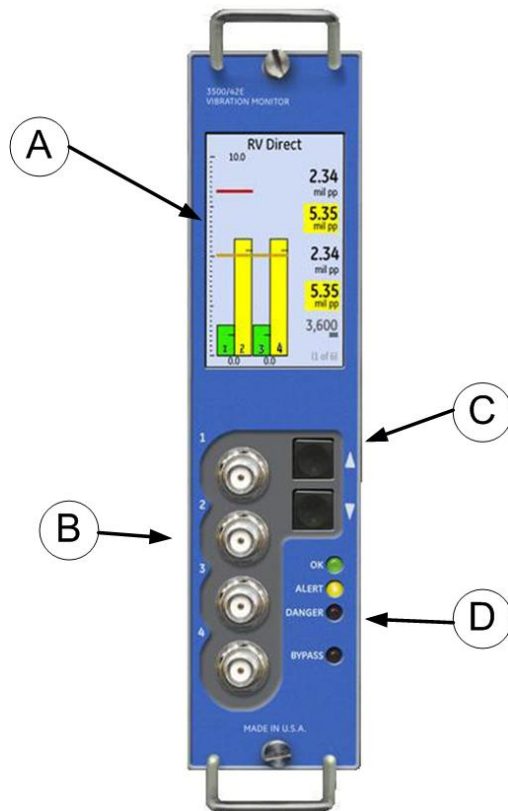
Proximitor/Seismic I/O Module

2871993500/42E Vibration Monitor
connector shunt**287546-01**

3500/42E Monitor Manual

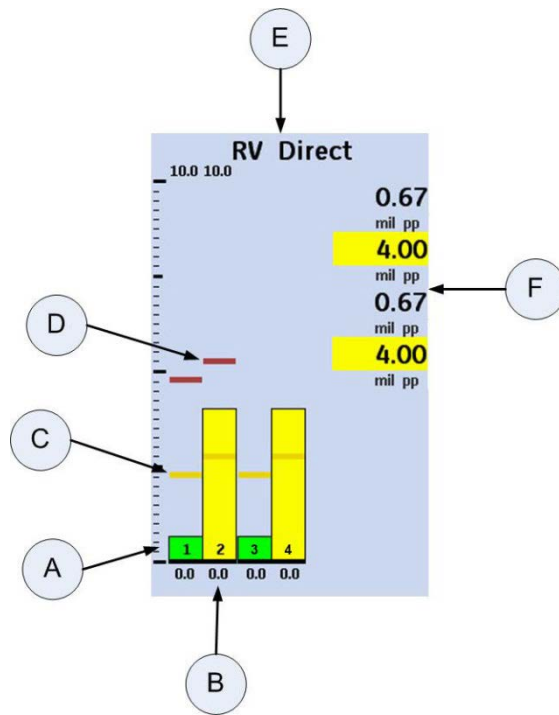
287199

Jumper, 18 Pin, 2 x 9



- A. Color LCD Display
- B. Buffered Transducer Outputs
- C. Display Control Switches
- D. Status LEDs

Figure 1: Front view of the Proximator*/Seismic Monitor



- A. Channel A Bargraph – Show Channel not in alarm
- B. Channel B Bargraph – Shows Channel in alert
- C. Alert Setpoint
- D. Danger Setpoint
- E. Channel Type
- F. Channel Values

Figure 2: LCD Display for the Proximator/Seismic Monitor

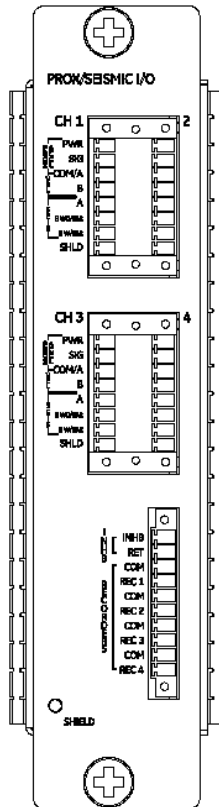


Figure 3: Proximito/Seismic IO Module for use in a 3500 ENCORE System

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