# 3500/40M Proximitor Monitor

## Datasheet

Bently Nevada Machinery Condition Monitoring


## Description

The Proximitor Monitor is a four-channel monitor that accepts input from Bently Nevada proximity 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 3500/40M with the 3500 Rack Configuration Software to perform any of the following functions:

- Radial vibration
- Thrust position
- Differential expansion
- Eccentricity
- REBAM

The primary purpose of the Proximitor Monitor is to provide the following:

- Machinery protection by continuously comparing monitored parameters against configured alarm setpoints to drive alarms
- 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**. You can configure **alert setpoints** for each active static value and **danger setpoints** for any two of the active static values.

**NOTE**

You program the monitor channels in pairs. The monitor channels can perform up to 2 of these functions at a time. Channels 1 and 2 can perform one function, while channels 3 and 4 perform another (or the same) function.

# Specifications

## Inputs

| | |
|---|---|
| Signal | Accepts from 1 to 4 proximity transducer signals |
| Power consumption | 7.7 watts, typical |
| **Input Impedance** | |
| Standard I/O | 10 kΩ<br>(Proximitor and acceleration inputs |
| TMR I/O | The effective impedance of three bussed TMR I/O channels wired in parallel to one transducer is50 kΩ |

## Sensitivity

| | |
|---|---|
| Radial Vibration | 3.94 mV/µm (100 mV/mil) or<br>7.87 mV/µm (200 mV/mil) |
| Thrust | 3.94 mV/µm (100 mV/mil) or<br>7.87 mV/µm (200 mV/mil) |
| Eccentricity | 3.94 mV/µm (100 mV/mil) or<br>7.87 mV/µm (200 mV/mil) |
| Differential Expansion | 0.394 mV/µm (10 mV/mil) or<br>0.787 mV/µm (20 mV/mil) |
| REBAM | 40 mV/µm (1000 mV/mil) or<br>80 mV/µm (2000 mV/mil) |

## Outputs

| **Front Panel LEDs** | |
|---|---|
| OK LED | Indicates when the 3500/40M SIL Proximitor is operating properly. |
| TX/RX LED | Indicates when the 3500/40M SIL Proximitor is communicating with other modules in the 3500 rack. |
| Bypass LED | Indicates when the 3500/40M SIL Proximitor is in Bypass Mode. |
| Buffered Transducer Outputs | The front of each monitor has one coaxial connector for each channel.<br>Each connector is short-circuit protected. |
| Output Impedance | 550 Ω |
| Transducer Power Supply | -24 Vdc |

## Signal Conditioning

**NOTE:** Specified at +25 ºC (+77 ºF) unless otherwise noted.

## Radial Vibration

| **Frequency Response** | |
|---|---|
| Direct filter | User-programmable<br>Single-pole<br>4 Hz to 4000 Hz or<br>1 Hz to 600 Hz |
| Gap filter | -3 dB at 0.09 Hz |
| Not 1X filter | 60 cpm to 15.8 times running speed<br>Constant Q notch filter<br>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<br>Minimum rejection in stopband of -57.7 dB |

**NOTE:** 1X and 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<br>Within ±0.33% of full-scale typical<br>±1% maximum |
| 1X and 2X | Within ±0.33% of full-scale typical<br>±1% maximum |
| Smax | Within ±5% maximum |
| Not 1X | ±3% for machine speeds less than 30,000 cpm<br>±8.5% for machine speeds greater than 30,000 cpm |

## Thrust and Differential Expansion

| | |
|---|---|
| Accuracy | Within ±0.33% of full-scale typical<br>±1% maximum |
| **Frequency Response** | |
| Direct filter | -3 dB at 1.2 Hz |
| Gap filter | -3 dB at 0.41 Hz |

## Eccentricity

| | |
|---|---|
| Accuracy | Within ±0.33% of full-scale typical<br>±1% maximum |
| **Frequency Response** | |
| Direct filter | -3 dB at 15.6 Hz |
| Gap filter | -3 dB at 0.41 Hz |

## REBAM

| Frequency Response | |
|---|---|
| Spike | User-programmable from 0.152 to 8678 Hz |
| Element | User-programmable for BPFO ranging from 0.139 to 3836 Hz<br>High-pass corner is 0.8x BPFO. Low-pass corner is 2.2x BPFO. |
| Rotor | User programmable from 0.108 to 2221 Hz |
| Direct | Programmable from 3.906 to 14.2 Hz<br>Selection is determined by Spike and Rotor filters. |
| Gap | Programmable from 0.002 to 1.0 Hz<br>Selection is determined by the Rotor filter. |
| 1X vector filter | The range of shaft speeds for which the value is valid depends on the nominal shaft speed for which the channel is configured. |

### Table 1: Relationship Between Nominal Shaft Speed and the Valid Speed Range

| Nominal Shaft Speed (Hz) | Valid Speed Range (Hz) |
|---|---|
| 10 to <126 | 0.071 to 160 |
| 126 to <252 | 0.133 to 330 |
| 252 to <504 | 0.25 to 660 |
| 504 to 584 | 0.50 to 750 |

**NOTE:** If a multi-event gear or speed wheel generates the speed input, the upper limitation of the resultant input signal is approximately 20 KHz.

| Filter Quality | |
|---|---|
| Spike high-pass | 6-pole Elliptic (155 dB per decade, minimum)<br>Corner frequency is -0.1 dB. |
| Element bandpass | 8-pole Butterworth (155 dB per decade minimum)<br>Corner frequency is -3 dB. |
| Rotor low-pass | 6-pole Elliptic (155 dB per decade, minimum)<br>Corner frequency is -0.1 dB. |
| Rotor, direct high-pass | 1-pole Butterworth (18 dB per decade, minimum)<br>Corner frequency is -3 dB. |
| Spike, direct low-pass | Corner is -0.3 dB maximum. |
| Gap low-pass | 1-pole Butterworth (18 dB per decade, minimum)<br>Corner frequency is -3 dB. |
| 1X amplitude | Constant Q of 16.67<br>Stopband frequencies are 0.91 and 1.09 times the running speed.<br>Stopband attenuation is -51 dB minimum. |

| Accuracy | |
|---|---|
| Amplitude | Within ±0.33% of full scale typical<br>±1% maximum when input signal is at the center frequency of the measured value's passband |
| Phase | 3 degrees error, maximum |
| Channels enabled | Certain configurations allow the user to enable only one channel of a channel pair. |

| Filter Tracking / Stepping (Requires a valid speed signal) | |
|---|---|
| Initial condition | Nominal filter set used |
| Switch from nominal to lower filter set | Current shaft speed ≤ 0.9 x (nominal shaft speed) |
| Switch from lower to nominal filter set | Current shaft speed ≥ 0.95 x (nominal shaft speed) |
| Switch from nominal to higher filter set | Current shaft speed ≥ 1.1 x (nominal shaft speed) |
| Switch from higher to nominal filter set | Current shaft speed ≤ 1.05 x (Nominal Shaft Speed) |
| Shaft speed error condition | Nominal filter set used |

## Physical

| **Monitor Module (Main Board)** | |
|---|---|
| Dimensions (Height x Width x Depth) | 241.3 mm x 24.4 mm x 241.8 mm (9.50 in x 0.96 in x 9.52 in) |
| Weight | 0.91 kg (2.0 lb) |
| **I/O Modules (non-barrier)** | |
| Dimensions (Height x Width x Depth) | 241.3 mm x 24.4 mm x 99.1 mm (9.50 in x 0.96 in x 3.90 in) |
| Weight | 0.20 kg (0.44 lb) |
| **I/O Modules (barrier)** | |
| Dimensions (Height x Width x Depth) | 241.3 mm x 24.4 mm x 163.1 mm (9.50 in x 0.96 in x 6.42 in) |
| Weight | 0.46 kg (1.01 lb) |

## Rack Space Requirements

| | |
|---|---|
| Monitor | 1 full-height front slot |
| I/O Modules | 1 full-height rear slot |

## Barrier Parameters

The following parameters apply to CSA-NRTL/C and ATEX / IECEx approvals.

| **Proximitor Barrier** | |
|---|---|
| Circuit Parameters | Vmax (PWR) = 26.25V<br>(SIG) = 13.65 V<br>Imax (PWR) = 110.48 mA<br>(SIG) = 2.74mA<br>Rmin (PWR) = 237.6 Ω<br>(SIG) = 4985 Ω |
| Channel Parameters (entity) | Vmax = 27.45 V<br>Imax = 113.24 mA<br>Rmin (PWR) = 237.6 Ω<br>(SIG) = 4985 Ω |

## Alarms

| | |
|---|---|
| Alarm Setpoints | Use Rack Configuration Software to set alert levels for each value measured by the monitor and Danger setpoints for any two of the values measured by the monitor.<br>Alarms are adjustable from 0 to 100% of full-scale for each measured value. However, when the full-scale range exceeds the range of the transducer, the range of the transducer will limit the setpoint. |
| Accuracy of alarm setpoints | Within 0.13% of the desired value |

### Alarm Time Delays

You can program alarm delays using **Rack Configuration Software.**

| **Radial vibration, thrust, differential expansion and eccentricity** | |
|---|---|
| Alert | From one to 60 seconds in one second intervals |
| Danger | 0.1 seconds or from one to 60 seconds in 0.5 second intervals |
| **REBAM** | |
| Alert | From the calculated minimum value to 400 seconds in one second intervals |
| Danger | From the calculated minimum value to 400 seconds in 0.5 second intervals |

## Static Values

Static values are measurements used to monitor the machine. The Proximitor 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 |
| REBAM | Spike, Element, Rotor, Direct, Gap, 1X Amplitude, 1X Phase Lag |

# Compliance and Certifications

## FCC

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

## EMC

European Community Directive:

EMC Directive 2014/30/EU

Standards:

EN 61000-6-2 Immunity for Industrial Environments

EN 61000-6-4 Emissions for Industrial Environments

## Electrical Safety

European Community Directive:

LV Directive 2014/35/EU

Standards:

EN 61010-1

## RoHS

European Community Directive:

RoHS Directive 2011/65/EU

## Maritime

ABS - Marine and Offshore Applications

DNV GL Rules for Classification – Ships, Offshore Units, and High Speed and Light Craft

# Hazardous Area Approvals

For the detailed listing of country and product specific approvals, refer to the *Approvals Quick Reference Guide* (108M1756) available from **www.Bently.com**.

## CSA/NRTL/C

| | |
|---|---|
| When used with I/O module ordering options without internal barriers | Class I, Zone 2: AEx/Ex nA nC ic IIC T4 Gc;<br>Class I, Zone 2: AEx/Ex ec nC ic IIC T4 Gc;<br>Class I, Division 2, Groups A, B, C, and D;<br><br>T4 @ Ta= -20˚C to +65˚C (-4˚F to +149˚F)<br>When installed per drawing 149243 or 149244. |
| When used with I/O module ordering options with internal barriers | Class I, Zone 2: AEx/Ex nA nC ic [ia Ga] IIC T4 Gc;<br>Class I, Zone 2: AEx/Ex ec nC ic [ia Ga] IIC T4 Gc;<br>Class I, Division 2, Groups A, B, C, and D (W/ IS Output for Division 1)<br><br>T4 @ Ta= -20˚C to +65˚C (-4˚F to +149˚F)<br>When installed per drawing 138547. |

## ATEX/IECEx

| | |
|---|---|
| When used with I/O module ordering options without internal barriers | Ⓔx II 3 G<br><br>Ex nA nC ic IIC T4 Gc;<br>Ex ec nC ic IIC T4 Gc;<br><br>T4 @ Ta= -20˚C to +65˚C (-4˚F to +149˚F)<br>When installed per drawing 149243 or 149244. |
| When used with I/O module ordering options with internal barriers | Ⓔx II 3(1) G<br><br>Ex nA nC ic [ia Ga] IIC T4 Gc;<br>Ex ec nC ic [ia Ga] IIC T4 Gc;<br><br>T4 @ Ta= -20˚C to +65˚C (-4˚F to +149˚F)<br>When installed per drawing 138547. |

# Ordering Information

For the detailed listing of country and product specific approvals, refer to the *Approvals Quick Reference Guide* (108M1756) available from **www.Bently.com**.

## General

The 3500/40M Module requires the following (or later) firmware, and software revisions:

3500/01 Software – Version 2.50
3500/02 Software – Version 2.20
3500/03 Software – Version 1.21

When ordering I/O Modules with External Terminations the External Termination Blocks and Cable must be ordered separately for each I/O Module.

External Termination Blocks cannot be used with Internal Termination I/O Modules.

Bussed External Termination Blocks are to be used with TMR I/O Modules only.

### Internal Barrier I/O Modules

Consult the 3500 Internal Barrier specification sheet (Document 141495) if the Internal Barrier Option is selected.

### REBAM

The REBAM channel type requires the following (or later) firmware, and software revisions:

3500/40M Module Firmware – Revision 2.1
3500/01 Software – Version 3.30
3500/02 Software – Version 2.40
3500/03 Software – Version 1.40
DM2000 Software - Version 3.40.

Requires the M version of the 3500 Proximitor Monitor.

## Proximitor Monitor 3500/40M - AA-BB

| **A: I/O Module Type** | |
|---|---|
| **01** | Proximitor I/O Module with Internal Termination |
| **02** | Proximitor I/O Module with External Terminations |
| **03** | Proximitor I/O Module with Internal Barriers and Internal Terminations |
| **04** | TMR Proximitor I/O Module with External Termination |
| **B: Hazardous Area Approval Option** | |
| **00** | None |
| **01** | CSA / NRTL / C (Class 1, Division 2) |
| **02** | ATEX / IECEx / CSA (Class 1, Zone 2) |

## External Termination Blocks

| | |
|---|---|
| 125808-01 | Proximitor ET Block<br>Euro Style Connectors |
| 128015-01 | Proximitor ET Block<br>Terminal Strip Connectors |
| 132242-01 | Proximitor/ Seismic TMR ET Block<br>Euro Style Connectors |
| 132234-01 | Proximitor/Seismic TMR ET Block<br>Terminal Strip Connectors |

## Cables

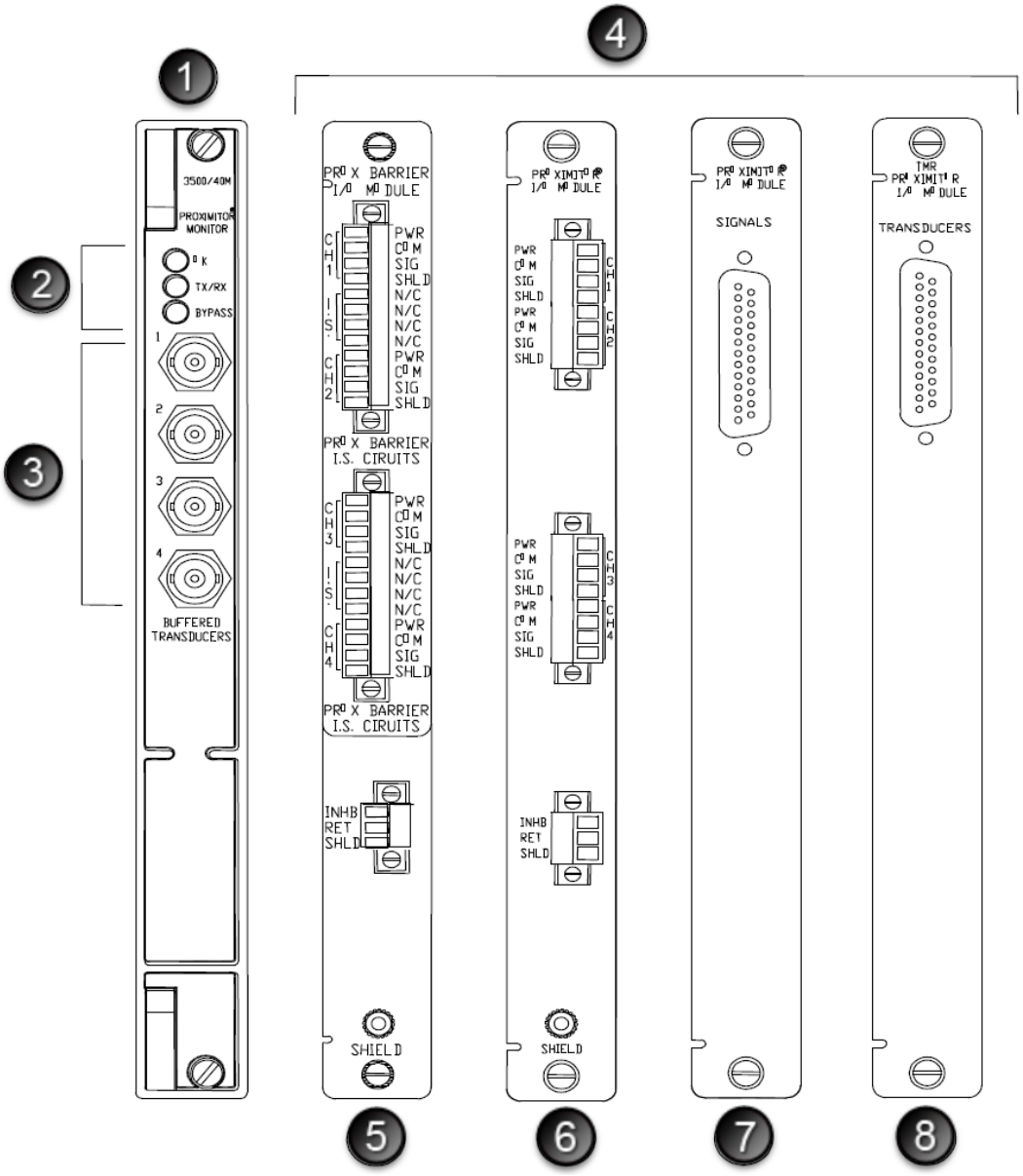
### 3500 Transducer XDCR signal to External Termination (ET) Block Cable 129525 - AAAA-BB

| **A: I/O Cable Length** | |
|---|---|
| **0005** | 5 feet 1.5 metres) |
| **0007** | 7 feet(2.1 metres) |
| **0010** | 10 feet(3.0 metres) |
| **0025** | 25 feet(7.6metres) |
| **0050** | 50 feet(15.2 metres) |
| **0100** | 100 feet(30.5 metres |
| **B: Assembly Instructions** | |
| **01** | Not assembled |
| **02** | Assembled |

## Spares

| | |
|---|---|
| 176449-01 | 3500/40M Proximitor Monitor |
| 125680-01 | Proximitor I/O Module with Internal Terminations |
| 126615-01 | Proximiotr I/O Module with Extrnal Terminations |
| 135489-04 | Proximitor I/O Module with Internal Barriers and Internal Terminations |
| 149716-01 | TMR Proximitor I/O Module with External Terminations |
| 143488 | 3500/40M Monitor User Guide |
| 00580434 | Internal I/O Module connector header, Euro style, 8-pin |
| 00502133 | Internal I/O Module connector header, Euro style, 12-pin |

## Graphs and Figures




1. Main Module Front View
2. Status LEDs.
3. Buffered Transducer Outputs.
4. I/O modules
5. Barrier I/O module, Internal Termination.
6. I/O Module, Internal Termination.
7. I/O Module, External Termination.
8. I/O Module, External Termination.

**Figure 1: Assorted Proximitor Monitor Views**

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