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# 3500/72M Rod Position Monitor

Bently Nevada™ Asset Condition Monitoring

## Description

The 3500/72M Rod Position Monitor is a 4-channel monitor that accepts input from our proximity transducers, conditions the signal to make various dynamic and static position measurements, and compares the conditioned signals with user-programmable alarms. The 3500 Rack Configuration software can program each channel of the 3500/72M to perform any of the following functions:

- Rod Position Measurement
- Rod Drop Measurement
- Hyper-Compressor Measurement

**Note:** Monitor channels are programmed in pairs. The monitor can perform up to two 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.



The primary purpose of the 3500/72M monitor is to provide:

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

Depending on configuration, each channel typically conditions its input signal into various parameters called “proportional values”. Users can configure Alert setpoints for each active proportional value and Danger setpoints for any two of the active proportional values.



Specifications and Ordering Information  
Part Number 146478-01  
Rev. C (11/08)

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## Specifications

### Inputs

#### Signal:

Accepts from 1 to 4 proximity probe signals.

#### Input Impedance:

10 k $\Omega$

#### Nominal Scale Factor:

#### Rod Position:

3.94 mV/ $\mu$ m (100 mV/mil) or  
7.87 mV/ $\mu$ m (200 mV/mil)

#### Rod Drop:

3.94 mV/ $\mu$ m (100 mV/mil) or  
7.87 mV/ $\mu$ m (200 mV/mil)

#### Hyper-Compressor:

3.94 mV/ $\mu$ m (100 mV/mil) or  
7.87 mV/ $\mu$ m (200 mV/mil)

**Note:** Configuration allows a wide range of adjustment to accommodate transducer sensitivity for different rod materials.

#### Power Consumption:

7.7 watts, nominal

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## Outputs

### Front Panel LED's:

#### OK LED:

Indicates when the 3500/72M is operating properly.

#### TX/RX LED:

Indicates when the 3500/72M is communicating with other modules in the 3500 rack.

#### Bypass LED:

Indicates when the 3500/72M 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:

550  $\Omega$

#### Transducer Power Supply:

-24 Vdc

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## Data Values

The Rod Position Monitor returns the following data values from measurements used to monitor the machine:

### Rod Position – Single

Position Magnitude, Position Angle, Crank Angle, Pk-Pk Amplitude, Gap, 1X Amplitude, Not 1X Amplitude, and 2X Amplitude

### Rod Position – Pair

Position Magnitude, Position Angle, Crank Angle, Pk-Pk Amplitude, Gap, 1X Amplitude, Not 1X Amplitude, and 2X Amplitude

### Rod Drop

Average Piston Position, Average Probe Gap, Instantaneous Piston Position, and Instantaneous Probe Gap

### Hyper Channel

Pk-Pk Displacement, Gap, 1X Amplitude, Not 1X Amplitude, and 2X Amplitude

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## Signal Conditioning

Specified at +25 °C (77 °F)

## Rod Position – Single & Pair:

### Frequency Response:

**Note:** 1X and 2X vector and Not 1X parameters are valid for machine operation of 60 cpm to 2000 cpm.

#### Peak-Peak Filter:

Fixed 1 Hz to 600 Hz

#### Gap Filter:

-3 dB at 0.09 Hz

#### Not 1X Filter:

Constant Q notch filter with minimum rejection in stop-band of 34.9 dB over frequency range of 60 cpm to 15.8 times running speed.

#### 1X Vector Filter:

Constant Q filter with minimum rejection in stop-band of 57.7 dB

#### 2X Vector Filter:

Constant Q filter with minimum rejection in stop-band of 57.7 dB

## Accuracy

#### Position Magnitude (direct):

Within  $\pm 0.33\%$  of full scale typical,  $\pm 1.0\%$  maximum

#### Gap:

Within  $\pm 0.33\%$  of full scale typical,  $\pm 1.0\%$  maximum

#### 1X Amplitude:

Within  $\pm 0.33\%$  of full scale typical,  $\pm 1.0\%$  maximum

#### 2X Amplitude:

Within  $\pm 0.33\%$  of full scale typical,  $\pm 1.0\%$  maximum

#### Pk-Pk Amplitude:

Within  $\pm 0.33\%$  of full scale typical,  $\pm 1.0\%$  maximum

#### Not 1X

#### Amplitude:

Within  $\pm 3.0\%$  of full scale typical

#### Position Crank

#### Angle:

Within  $\pm 1^\circ$  typical,  $\pm 3^\circ$  maximum

#### Rod Position

#### Angle (paired

#### only):

Within  $\pm 1^\circ$  typical,  $\pm 3^\circ$  maximum

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## Rod Drop:

### Frequency

### Response:

#### Average Piston Position (direct):

Fixed 1 Hz to 600 Hz

#### Average Gap:

-3 dB at 0.09 Hz

## Accuracy

#### Average Piston Position (direct):

Within  $\pm 0.33\%$  of full scale typical,  $\pm 1.0\%$  maximum

#### Average Gap:

Within  $\pm 0.33\%$  of full scale typical,  $\pm 1.0\%$  maximum

#### Instantaneous Piston Position:

Within  $\pm 0.33\%$  of full scale typical,  $\pm 1.0\%$  maximum

#### Instantaneous Probe Gap:

Within  $\pm 0.33\%$  of full scale typical,  $\pm 1.0\%$  maximum

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## Hyper-Channel:

### Frequency

### Response:

**Note:** 1X and 2X vector and Not 1X parameters are valid for machine operation of 60 cpm to 2,000 cpm.

**Peak-Peak Filter:**

Fixed 1 Hz to 600 Hz

**Gap Filter:**

-3 dB at 0.09 Hz

**Not 1X Filter:**

Constant Q notch filter with minimum rejection in stop-band of 34.9 dB over frequency range of 60 cpm to 15.8 times running speed.

**1X Vector Filter:**

Constant Q filter with minimum rejection in stop-band of 57.7 dB

**2X Vector Filter:**

Constant Q filter with minimum rejection in stop-band of 57.7 dB

**Accuracy**

**Peak-Peak Magnitude (direct):**

Within  $\pm 0.33\%$  of full scale typical,  $\pm 1.0\%$  maximum

**Gap:**

Within  $\pm 0.33\%$  of full scale typical,  $\pm 1.0\%$  maximum

**1X Amplitude:**

Within  $\pm 0.33\%$  of full scale typical,  $\pm 1.0\%$  maximum

**2X Amplitude:**

Within  $\pm 0.33\%$  of full scale typical,  $\pm 1.0\%$  maximum

**Not 1X Amplitude:**

Within  $\pm 3.0\%$  of full scale typical

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**Alarms**

**Alarm Setpoint Values:**

Alert levels can be set for each value measured by the monitor. In addition, Danger setpoint

values can be set for any two of the monitor's measured values All alarm setpoint values are set using software configuration. Alarms are adjustable and can be set from 0 to 100% of full-scale for each measured value. Accuracy of an alarm setpoint is to within 0.13% of the desired value.

**Alarm Time Delays:**

Alarm delays can be programmed using software, and can be set as follows:

**Alert:**

From 1 to 60 seconds in 1 second intervals.

**Danger:**

From 1 to 60 seconds in 1 second intervals or 0.1 seconds (nominal)

**Timed Ok Channel Defeat:**

Ok Channel defeat is disabled for all rod position configurations. When used as a hyper-compressor monitor the action of both transducers going NOT OK will cause the immediate issue of a Danger alarm.

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**Environmental Limits**

**Operating Temperature:**

-30 °C to +65 °C (-22 °F to +150 °F) when used with Internal/External Termination Proximator®/Seismic I/O Module

**Operating Temperature:**

0 °C to +65 °C (32 °F to +150 °F) when used with Proximator/Seismic Internal Barrier I/O Module (Internal Termination)

**Storage  
Temperature:**

-40 °C to +85 °C (-40 °F to +185 °F)

**Humidity**

95%, non-condensing

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**CE Mark Directives**

**EMC Directives**

**EN50081-2**

*Radiated  
Emissions*

EN 55011, Class A

*Conducted  
Emissions*

EN 55011, Class A

**EN50082-2**

*Electrostatic  
Discharge*

EN 61000-4-2, Criteria B

*Radiated  
Susceptibility*

ENV 50140, Criteria A

*Conducted  
Susceptibility*

ENV 50141, Criteria A

*Electrical Fast  
Transient*

EN 61000-4-4, Criteria B

*Surge  
Capability*

EN 61000-4-5, Criteria B

*Magnetic Field*

EN 61000-4-8, Criteria A

*Power Supply  
Dip*

EN 61000-4-11, Criteria B

*Radio  
Telephone*

ENV 50204, Criteria B

**CE Mark Low Voltage Directives**

**EN 61010-1**

Safety Requirements

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**Hazardous Area Approvals**

**CSA/NRTL/C**

**Approval Option  
(01)**

Class I, Div 2

Groups A, B, C, D

T4 @ Ta = -20 °C to +65 °C

(-4 °F to +150 °F)

*Certification  
Number*

CSA 150268-1002151 (LR 26744)

**Approval Option  
(02)**

**When used with I/O module  
ordering options without  
internal barriers:**

A/Ex nC[L] IIC

Class I, Zone 2

Class I, Div 2, Groups A,B,C,D

T4 @ Ta = -20 °C to +65 °C

(-4 °F to +150 °F)

*Certification  
Number*

CSA 1389797 (LR 26744-211)

**When used with I/O module  
ordering options with internal  
barriers:**

A/Ex nC[ia] IIC

Class I, Zone 2/(0)

Class I, Div I, Groups A,B,C,D

T4 @ Ta = -20 °C to +65 °C

(-4 °F to +150 °F)


Certification  
Number

CSA 1389797 (LR 26744-211)

## ATEX

### Approval Option (02)

For Selected Ordering Options  
with ATEX/CSA agency  
approvals:

 II 3/(3) G

EEx nCAL[L] IIC

T4 @ Ta = -20 °C to +65 °C

(-4 °F to +150 °F)

Certification  
Number

LCIE 04 ATEX 6161X

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## Physical

### Monitor Module

#### 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 Module

1 full-height front slot

### I/O Modules

1 full-height rear slot

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## Ordering Information

### Ordering Considerations

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

The 3500 Internal Barrier Specification sheet 141495-01 should be consulted if the Internal Barrier Option is selected.

This product requires Version 3.20 or higher of the 3500 Rack Configuration Software.

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## List of Options and Part Numbers

### Rod Position Monitor

#### 3500/72M-AXX-BXX

##### A: I/O Module Type

- 01** I/O Module with Internal Terminations
- 02** I/O Module with External Terminations
- 03** I/O Module with Internal Barriers and Internal Terminations

##### B: Agency Approval Option

- 00** None
  - 01** CSA/NRTL/C
  - 02** ATEX/CSA (Class 1, Zone 2)
- Note:** Agency Approval Option B 02 is only available with Ordering Options A 01 and A 03.

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## External Termination Blocks

### 125808-08

Proximitor / Velomitor® External Termination Block (Euro Style connectors).

**128015-08**

Proximito / Velomito External Termination Block (Terminal Strip connectors).

**128702-01**

Recorder External Termination Block (Euro Style connectors)

**128710-01**

Recorder External Termination Block (Terminal Strip connectors)

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**3500 Transducer Signal to External Termination Block Cable**
**129525 -AXXX-BXX****A:** Cable Length

**0005** 5 feet (1.5 metres)  
**0007** 7 feet (2.1 metres)  
**0010** 10 feet (3 metres)  
**0025** 25 feet (7.5 metres)  
**0050** 50 feet (15 metres)  
**0100** 100 feet (30.5 metres)

**B:** Assembly Instructions

**01** Not Assembled  
**02** Assembled

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**3500 Recorder Output to External Termination (ET) Block Cable**
**129529 -AXXX-BXX****A:** Cable Length

**0005** 5 feet (1.5 metres)  
**0007** 7 feet (2.1 metres)  
**0010** 10 feet (3 metres)  
**0025** 25 feet (7.5 metres)  
**0050** 50 feet (15 metres)  
**0100** 100 feet (30.5 metres)

**B:** Assembly Instructions

**01** Not Assembled  
**02** Assembled

**Spares****176449-08**

3500/72M Rod Position Monitor

**140471-01**

I/O Module with Internal Terminations

**140482-01**

I/O Module with External Terminations

**135489-01**

I/O Module with Internal Barriers and Internal Terminations

**146479-01**

3500/72M Rod Position Manual

**00580434**

Internal I/O Module connector header, Euro Style, 8-pin, green. Used on I/O modules 140471-01

**00580441**

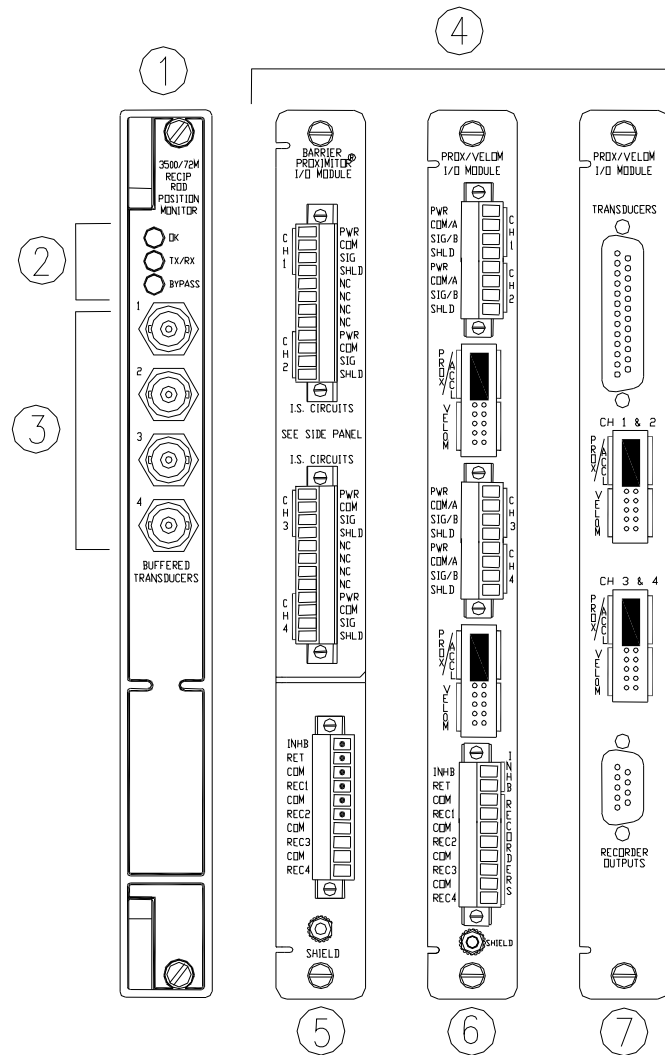
Internal I/O Module connector header, Euro Style, 3-pin, green. Used on I/O modules 135489-01 and 140471-01

**00502133**

Internal I/O Module connector header, Euro Style, 12-pin, blue. Used on I/O modules 135489-01



# Graphs and Figures



- (1) Main 3500/72M Rod Position Monitor Module (front view)
- (2) Status LEDs.
- (3) Buffered transducer outputs, provide an unfiltered output for each of the four transducers. All are short circuit protected.
- (4) I/O module rear views.
- (5) Barrier I/O module, Internal Termination.
- (6) I/O module, Internal Termination.
- (7) I/O module, External Termination.

**Figure 1: Front and Rear View**

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