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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.

imagination at work

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Specifications

Inputs

Signal:

Accepts from 1 to 4 proximity probe signals.

Input Impedance:

10 kΩ

Nominal Scale Factor:

Rod Position:

3.94 mV/µm (100 mV/mil) or

7.87 mV/µm (200 mV/mil)

Rod Drop:

3.94 mV/µm (100 mV/mil) or

7.87 mV/µm (200 mV/mil)

Hyper-Compressor:

3.94 mV/µm (100 mV/mil) or

7.87 mV/µm (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

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 Ω

Transducer Power Supply:

-24 Vdc

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

Signal Conditioning

Specified at +25 °C (77 °F)

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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 ±0.33% of full scale typical, ±1.0% maximum

Gap:

Within ±0.33% of full scale typical, ±1.0% maximum

1X Amplitude:

Within ±0.33% of full scale typical, ±1.0% maximum

2X Amplitude:

Within ±0.33% of full scale typical, ±1.0% maximum

Pk-Pk Amplitude:

Within ±0.33% of full scale typical, ±1.0% maximum

Not 1X Amplitude:

Within ±3.0% of full scale typical

Position Crank Angle:

Within ±1° typical, ±3° maximum

Rod Position Angle (paired only):

Within ±1° typical, ±3° maximum

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 ±0.33% of full scale typical, ±1.0% maximum

Average Gap:

Within ±0.33% of full scale typical, ±1.0% maximum

Instantaneous Piston Position:

Within ±0.33% of full scale typical, ±1.0% maximum

Instantaneous Probe Gap:

Within ±0.33% of full scale typical, ±1.0% maximum

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.

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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 ±0.33% of full scale typical, ±1.0% maximum

Gap:

Within ±0.33% of full scale typical, ±1.0% maximum

1X Amplitude:

Within ±0.33% of full scale typical, ±1.0% maximum

2X Amplitude:

Within ±0.33% of full scale typical, ±1.0% maximum

Not 1X Amplitude:

Within ±3.0% of full scale typical

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.

Environmental Limits

Operating Temperature:

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

Operating Temperature:

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

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Storage Temperature:

-40 °C to +85 °C (-40 °F to +185 °F)

Humidity

95%, non-condensing

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

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)

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Certification Number

CSA 1389797 (LR 26744-211)

ATEX

Approval Option (02)

For Selected Ordering Options with ATEX/CSA agency approvals:

⟨Ex⟩ 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

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

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.

List of Options and Part Numbers

Rod Position Monitor

3500/72M-AXX-BXX

A: I/O Module Type

0 1	I/O Module with Internal Terminations
0 2	I/O Module with External Terminations
0 3	I/O Module with Internal Barriers and Internal Terminations

B: Agency Approval Option

0 0	None
0 1	CSA/NRTL/C
0 2	ATEX/CSA (Class 1, Zone 2)

Note: Agency Approval Option B 02 is only available with Ordering Options A 01 and A 03.

External Termination Blocks

125808-08

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

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128015-08

Proximitor / Velomitor External Termination Block (Terminal Strip connectors).

128702-01

Recorder External Termination Block (Euro Style connectors)

128710-01

Recorder External Termination Block (Terminal Strip connectors)

3500 Transducer Signal to External Termination Block Cable

129525 -AXXXX-BXX

A: Cable Length

0 0 0 5	5 feet (1.5 metres)
0 0 0 7	7 feet (2.1 metres)
0 0 1 0	10 feet (3 metres)
0 0 2 5	25 feet (7.5 metres)
0 0 5 0	50 feet (15 metres)
0 1 0 0	100 feet (30.5 metres)

B: Assembly Instructions

0 1	Not Assembled
0 2	Assembled

3500 Recorder Output to External Termination (ET) Block Cable

129529 -AXXXX-BXX

A: Cable Length

0 0 0 5	5 feet (1.5 metres)
0 0 0 7	7 feet (2.1 metres)
0 0 1 0	10 feet (3 metres)
0 0 2 5	25 feet (7.5 metres)
0 0 5 0	50 feet (15 metres)
0 1 0 0	100 feet (30.5 metres)

B: Assembly Instructions

0 1	Not Assembled
0 2	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

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00580434

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

00580441

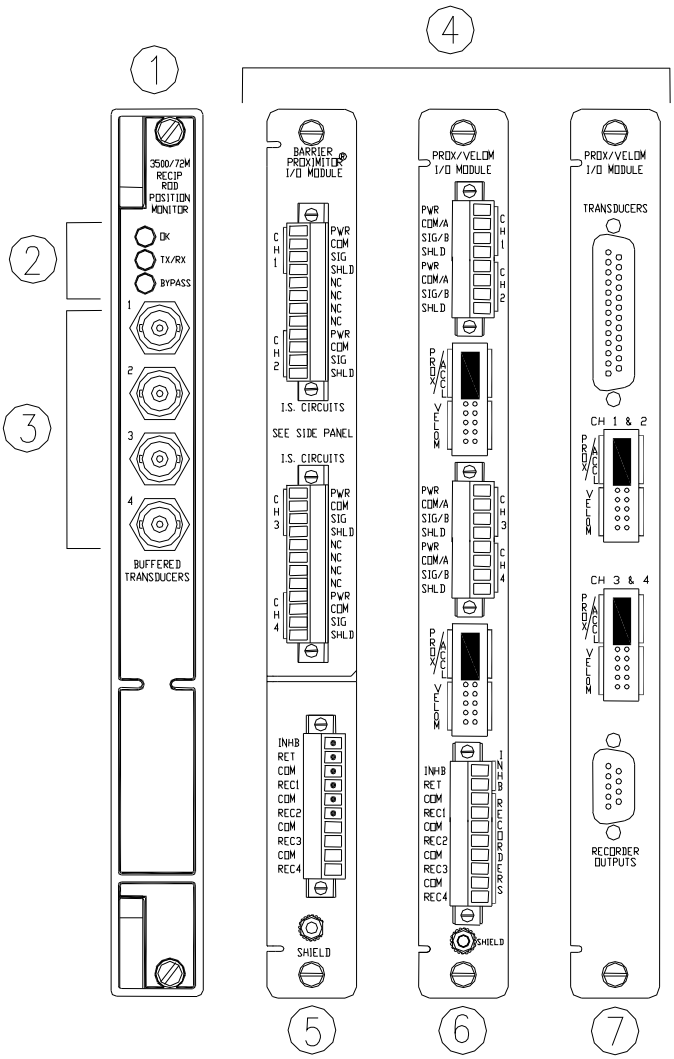
Internal I/O Module connector header, Euro Style, 3-pin, green. Used on I/O modules 135489-01 and 140471-01

00502133

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

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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, ExternalTermination.

Figure 1: Front and Rear View

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