

# 3500/70M Recip Impulse/Velocity Monitor

Bently Nevada™ Asset Condition Monitoring

## Description

The 3500/70M Recip Impulse Velocity / Monitor is a 4-channel monitor that can be used as part of the reciprocating compressor solutions package for monitoring compressor crankcase and crosshead vibration. The monitor accepts input from seismic transducers, conditions the signal to derive various vibration measurements, and compares the conditioned signals with user-programmable alarms. Each channel of the 3500/70M can be programmed using the 3500 Rack Configuration Software to perform one of the following functions:

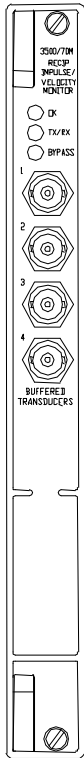
- Impulse Acceleration
- Recip Acceleration
- Recip Velocity

**Note:** The monitor channels are programmed in pairs and 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 purposes of the 3500/70M monitor are to provide:

1. machinery protection by continuously comparing monitored parameters against configured alarm set points to drive alarms, and
2. essential machine information for both operations and maintenance personnel.

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



imagination at work

Specifications and Ordering Information  
Part Number 166766-01  
Rev. C (11/08)

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## Specifications

Specified at 25 °C (77 °F), voltages referenced to monitor common unless specified otherwise.

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### Inputs

#### Signal

Accepts from 1 to 4 velocity or acceleration transducer signals.

#### Input Impedance

10 k  $\Omega$  (Acceleration Input),  
>1 M $\Omega$  (Velocity Input).

#### Sensor Compatibility

330500 Velomitor® Piezo-Velocity Sensor  
330525 Velomitor XA Piezo-Velocity Sensor  
190501 Velomitor CT Velocity Transducer  
330400 Accelerometer Acceleration Transducer  
330425 Accelerometer Acceleration Transducer

#### Special Inhibit

Contact closure, 5 Vdc @ 390 $\mu$ A typical.

#### Power Consumption

7.7 watts, typical

#### Sensitivity

#### Impulse Acceleration

10 mV/(m/s<sup>2</sup>) (100 mV/g), or  
user-selected 0.51 – 11.72  
mV/(m/s<sup>2</sup>) (5 – 115 mV/g).

#### Recip Acceleration

10 mV/(m/s<sup>2</sup>) (100 mV/g), or  
user-selected 0.51 – 11.72  
mV/(m/s<sup>2</sup>) (5 – 115 mV/g).

#### Recip Velocity

3.94 mV/(mm/s) (100 mV/(in/s)), or  
user-selected 3.54 – 22.64  
mV/(mm/s) (90 – 575 mV/(in/s)).

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### Outputs

#### Front Panel LEDs

##### OK LED

Indicates the 3500/70M is operating properly.

##### TX/RX LED

Indicates the 3500/70M is communicating with other modules in the 3500 rack.

##### Bypass LED

Indicates the 3500/70M is in Bypass Mode.

#### Transducer Power Supply

##### Voltage

-22 Vdc minimum

##### Current

40 mA maximum; (15 mA maximum on startup to guarantee no fold back)

##### Output Impedance

20  $\Omega$  typical operating; 1000  $\Omega$  typical under fold back conditions.

##### Protection

Foldback current 15.4 to 24.9 mA

#### Buffered Transducer Outputs:

The front of each monitor has one coaxial connector for each channel.

##### Output Impedance

550  $\Omega$  typical.

**Protection**

Each connector is short-circuit protected.

**Recorder:**

+4 to +20 mA proportional to monitor full-scale. The user selects one static data value from each channel to be used for that channel's recorder value.

**Voltage Compliance**

+12 Vdc maximum.

**Load Resistance**

600  $\Omega$  maximum

**Resolution**

0.3662  $\mu$ A maximum

**Update rate**

<100 msec.

**Accuracy**

Within  $\pm 0.05$  mA,  
 $\pm 0.14$  mA over temperature range.

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**Signal Conditioning****Impulse Acceleration****Accuracy**

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

**Band start**

0 to 359 $^\circ$ , 1 $^\circ$  resolution.

**Band duration**

1 to 360 $^\circ$ , 1 $^\circ$  resolution.

**Frequency Response***Bias Filter*

-3 dB at 0.01 Hz, 1-pole, Low-Pass

*Not OK Filter*

-3 dB at 2400 Hz, 1-pole, Low-Pass

*Static values*

Smoothing filter, 8-revolution average value.

**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).

| Corner selection: | Peak 3 db corner | RMS 3 dB corner |
|-------------------|------------------|-----------------|
| High-Pass         | 3-3000 Hz        | 10-3000 Hz      |
| Low-Pass          | 30-30000 Hz      | 40-30000 Hz     |

**Recip Acceleration****Accuracy**

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

**Frequency Response***Bias Filter*

-3 dB at 0.01 Hz, 1-pole, Low-Pass

*Not OK Filter*

-3 dB at 2400 Hz, 1-pole, Low-Pass

*Peak static values*

-3 dB at 0.3 Hz, 1-pole, Low-Pass

*RMS static values*

-3 dB at 0.1 Hz, 1-pole, Low-Pass

## 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).

### Corner selection

Peak 3 db corner  
Integrate and/or RMS 3 dB corner

### High-Pass

3-3000 Hz  
10-3000 Hz

### Low-Pass

30-30000 Hz  
40-30000 Hz

## Recip Velocity

### Accuracy

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

### Velomitor

Additional accuracy degradation occurs when full scale signal levels are low:

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

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

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

## Frequency Response

### Bias filter

-3dB at 0.09 Hz, 1-pole, Low Pass

### Not OK filter

-3 dB at 2400 Hz, 1-pole, Low Pass

### Integration filter

-3 db at 0.34 Hz, 1-pole, Low-Pass

### RMS static values

-3 dB at 0.1 Hz, 1-pole, Low-Pass

### Peak static values

-3 dB at 0.3 Hz, 1-pole, Low-Pass

### 1X & 2X Vector Filter

Constant Q filter with bandwidth =  $\pm 3\%$  running speed (Q=16.7).

### Filter Quality High-Pass

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

### Low-Pass:

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

| Corner selection: | Non-RMS 3 dB corner       | RMS 3 dB corner |
|-------------------|---------------------------|-----------------|
| High-Pass         | 3-400 Hz<br>1-400 Hz (CT) | 10-400 Hz       |
| Low-Pass          | 40-5500 Hz                | 60-5500 Hz      |

## Alarms

### Alarm Set points:

Users can set Alert levels for each value measured by the monitor. In addition, users can set Danger set points for any two of the values measured by the monitor. All alarm set points are set using the 3500 Rack Configuration Software. Alarms are adjustable and can normally be set 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 software will limit the setpoint to the range of the transducer. Accuracy of alarms is within 0.13% of the desired value.

### Alarm Time Delays:

Alarm delays can be programmed using software, and can be set as follows for all channel types: