OPERATOR'S MANUAL

438R VIBRATION SWITCH: 24 VDC

TABLE OF CONTENTS

Vitec, Inc.

Cleveland, OH 44122

Phone: 216-464-4670 Fax: 216-464-5324

412537-347 Rev. A

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ACRONYMS, ABBREVIATIONS, AND ENGINEERING SYMBOLS AND UNITS OF MEASURE

A	Acceleration: g's peak
A	Amp
AC	Alternating Current
ALM	Alarm
AMP	Ampere
ANA	Analog
C1	Circuit 1
C2	Circuit 2
C3	Circuit 3
C4	Circuit 4
COM	Common
CPM	Cycles Per Minute

continued -

a. The 4034 Velocity Transducer Installation and Specifications is also applicable to the 4034-350, the only difference being the upper temperature limit of 350F for the 4034-350 versus 160F for the 4034.

List of Acronyms, Abbreviations, and Engineering Symbols and Units of Measure - continued

D	Displacement: Inches peak to peak
d	Displacement: Mils peak to peak
DC	Direct Current
F	Fahrenheit
FS	Full Scale
g	Gravity
GND	Ground
Hz	Hertz (Cycles per Second)
INSTR	Instrument
in/sec	Inches per Second Vibration Units of Velocity
MAX	Maximum
mA	Milliamp
Mils	Vibration Units of Displacement
mV	Millivolts
mV/g	Millivolt/g Force
NORM	Normally
PLC	Programmable Logic Controller
REM	Remote
RPM	Revolutions Per Minute
R31	Potentiometer No. 31 to adjust the 20 mA DC
R32	Potentiometer No. 32 to adjust the 4 mA DC
R37	Potentiometer No. 37 to adjust the gain
R39	Potentiometer No. 39 to adjust the AC Output
R60	Potentiometer No. 60 to adjust shutdown time delay
R63	Potentiometer No. 63 to adjust alarm time delay
R66	Potentiometer No. 66 to adjust shutdown setpoint
R67	Potentiometer No. 67 to adjust alarm setpoint
S1	Switch to field adjust the state of the relays, full scale and AC Output
sec	Second
Shut	Shutdown
Stpt	Setpoint
TB	Terminal Block
TB1-1	Terminal Block 1 Location 1
TB1-7	Terminal Block 1 Location 7
TB1-8	Terminal Block 1 Location 8
TB1-9	Terminal Block 1 Location 9
UNC	Unified National Course
V	Velocity: Inches per second peak
VAC	Volts Alternating Current
VDC	Volts Direct Current
W	Watt

1.0 INTRODUCTION

The Vitec 438R[a] Vibration Switches are an economical approach to accurate and reliable vibration protection for rotating machinery. The 438R is a sophisticated vibration monitoring system and, therefore, requires some care during installation.

Installation and operation of this unit will be simple and easy if the instructions are followed.

READ THIS MANUAL THOROUGHLY TO AVOID ANY INSTALLATION-RELATED PROBLEMS

1.1 Receiving and Handling

This section covers acceptance and warranty.

1.1.1 Acceptance

Inspect this equipment thoroughly before accepting from the transportation company. If any of the goods are missing or damaged, have the express agent make the proper notation on the freight bill or express receipt. Request the carrier to make an inspection. Claims for loss or damage in shipment must not be deducted from the Vitec invoice, nor should payment of the Vitec invoice be withheld awaiting adjustment of such claims since the carrier guarantees safe delivery.

If definite damage has been incurred in your shipment, contact Customer Service at Vitec for assistance.

1.1.2 Warranty

The seller warrants that the goods manufactured by it will be free from defects in material or workmanship for one year from the date of the invoice for the material. For this warranty to be in effect, the specific item claimed to be defective must be returned to the seller, transportation prepaid, no later than five days after the expiration of the warranty period. The seller's liability for incidental and consequential damages is expressly excluded. This warranty shall not apply to any goods that have been subjected to misuse, improper installation, repair, alteration, neglect, accident, use exceeding the published maximum ratings, or damage during shipment. The foregoing warranty is in lieu of all other warranties, expressed or implied, including those of merchantability or fitness for any purpose not expressly set forth herein.

---

a. In this Manual, the Vitec 438R means the 24 VDC version.

2.0 PRODUCT DESCRIPTION

The 438R consists of a transducer, an interconnecting cable assembly and electronics enclosure, as shown in Figure 1 on page 6. The 438R measures the vibration level of rotating equipment using a velocity or acceleration transducer mounted to your machine and located up to 1,000 feet from the 438R electronics enclosure. Refer to the Transducer Installation and Specifications in Appendices 1 through 6 for the maximum allowable cable length for specific transducers. The 438R is ideally suited for applications where the electronics should be easily accessible but the point to be monitored is in a dangerous or inconvenient area, such as a cooling tower fan, overhead conveyor or remote pumping station. The 438R is also used in applications where the point to be monitored has a rounded surface such as a bearing block. Enclosures are available for wet, corrosive or explosive environments and transducers for temperatures up to 550 F.

The 438R provides two solid state relay, or transistor, closures when preset vibration levels are exceeded, thereby offering protection from excessive vibration. One provides an alarm or warning, the second provides for shutdown or "trip".

The 438R measures vibration in terms of the velocity of vibration. Those familiar with setpoints given in displacement (mils) can convert to velocity (in/sec) via the Displacement, Velocity and Acceleration Conversion Chart and Formulas shown in Figure 2 on page 7.

The 438R also includes two electrical outputs that are very useful. A 4 - 20 mA signal proportional to the overall vibration level will allow the unit to be connected to a remote device for purposes of reading or recording the vibration level. Common applications include connections to meters, data loggers, recorders or Programmable Logic Controllers (PLC's).

An AC output signal is also provided. This signal is proportional to the actual vibration being measured by the transducer. Common applications for this signal include connection to an oscilloscope to view the raw transducer signal or connection to a real-time analyzer for analysis of the vibration being measured. For Velocity Transducer input units the AC output signal is 100 mV/in/sec. For Acceleration Transducer input units the AC output signal is switch selectable for 100mV/in/sec or 100 mV/g.

3.0 ELECTRICAL INSTALLATION

Proper electrical installation is essential. A little care here will assure a trouble-free installation. Follow the wiring diagram in Figure 3 on page 8. Make special note of the following:

1. The system requires a good instrument earth ground. Do not use the machine itself as a ground, as it normally will not provide proper grounding.

Do not use a ground that is common to other large pieces of electrical machinery. Electrical noise or surges from these machines can feed back into the 438R and cause false tripping.

2. The alarm and shutdown outputs are completely isolated from the monitor electronics. One or two separate sources of DC power can be used because of the isolation. The maximum load current is 1.0 Amp with a 24 Volt DC supply. There is no minimum current required for switch operation.

3. Make sure that the voltage input lines and the relay output lines are fused as noted on the wiring diagram in Figure 3 on page 8.

4. If the AC output signal is utilized, use a good grade of shielded twisted cable. Be sure to keep the cable separated from other AC or power cables.

Reread this section to ensure the electrical installation conforms to the Figure 3 wiring diagram. Any damage to the 438R due to incorrect wiring is not covered under warranty.

4.0 MECHANICAL INSTALLATION

The 438R is available with NEMA 4, NEMA 4X, or Explosion Proof housings for the electronics enclosures. In addition, the 438R is supplied with either a Velocity Transducer or an Acceleration Transducer.

Confirm your enclosure and transducer type and refer to the appropriate Figure and Appendix.

Figures 4 and 5 on pages 10 and 11 show mounting dimensions and mounting procedures for the 438R electronic enclosure, NEMA 4 and NEMA 4X, and Explosion Proof versions, respectively.

Appendices 1 through 3 show the installation and specifications for the 4033-400, 4033-500 and 4034 Velocity Transducers, respectively.

Appendices 4 through 6 show the installation and specifications for the 4060, 4064 and 4073 Acceleration Transducers, respectively.

The vibration transducer is sensitive to vibration in one direction only. Make sure the transducer is oriented properly to measure the type of vibration being monitored.

If the required mounting location is not known, the vibration transducer should generally be mounted to measure the RADIAL vibration, meaning the axis of sensitivity is perpendicular to the rotating shaft. The manufacturer of the equipment being monitored is the best source of mounting location information.

Mounting tips:

1. Be sure the transducer is mounted FIRMLY to the machine. A transducer that is not mounted firmly to the machine will measure its own vibration, in addition to the vibration of the machine. (See Appendices 1 through 6 for installation requirements of specific transducers.)

2. The 438R electronics enclosure can be mounted at any location up to 1,000 feet from the vibration transducer. The cable assembly length is Customer-specified, and should be sized accordingly.

3. Be sure to replace the cover AND gasket after installation. Water or moisture in the electronics will cause FAILURE of the unit! Water entry through the 3/4 inch cable entry hole due to condensation or other reasons can be just as catastrophic. Use proper procedures to seal the cable entry hole. Failures caused by improper sealing are NOT covered under warranty.

4. Try to orient the electronics enclosure so that the alarm setpoint adjustments are accessible after the unit is mounted. Someone may want to change the setpoints in the future.

5. Make sure that the electrical connections are not putting excessive force on the terminal block or printed circuit card. Don't try to stuff excess wire into the box; trim the cable to proper length.

5.0 SETPOINT ADJUSTMENT

The ALARM and SHUTDOWN setpoints are adjusted via two potentiometers located on the printed circuit card, see Figure 6 on page 12, items marked R66 and R67. For alarm setpoint adjust R67; for shutdown setpoint adjust R66. Do not attempt to adjust the small square potentiomers that are also located on the printed circuit card; these potentiometers are used for calibration of the unit.

The setpoint adjustments are calibrated for 0 to 100% of full scale selected, meaning of the selected range, 0.0 to 1.0 or 0.0 to 3.0. Simply turn the potentiometer until the arrow lines up with the required setpoint level. Do not use excessive force. Do not try to turn the potentiometers beyond their stops. Both are single-turn potentiometers.

A 0 to 20 second adjustable time delay is built into the alarm and shutdown circuits to help avoid false trips. The unit is shipped with zero second time delay, but can be adjusted in the field for up to 20 seconds. Turn the potentiometer clockwise to increase the time delay. Adjust R63 for alarm time delay and R60 for shutdown time delay, see Figure 6 on page 12, items marked R63 and R60.

6.0 RELAYS

Both the alarm and shutdown solid-state relays (transistors) are set at the factory to be normally open below the setpoint. Think of them as single pole light switches that are normally off, or open, but turn on, or close, when the vibration level gets too high. The relays are not dry contacts. To operate properly, the switched load must operate at 24 VDC, with maximum current of 1A.

The relays can be changed to normally closed below setpoint (open when the vibration setpoints are exceeded) using switch S1. When switch S1 is in positions 1 and 2, alarm and shutdown relays are normally open. Switching S1 to the opposite position makes the relays normally closed, see Figure 6, on page 12, items identified as S1.

When shipped from the factory, the relays are LATCHING unless wired to be NON-LATCHING at the request of the Customer. Latching means that after the vibration returns to a normal level, the relays will NOT reset themselves. They must be manually reset via a remote reset switch which you, the Customer, must provide, since it does not come with the 438R. The 438R can be changed to a NON-LATCHING configuration in the field by installing a jumper between terminal block points TB1-7 and TB1-9. With this jumper installed, the relays will automatically reset themselves when the vibration returns to a level less than the setpoint.

If desired, the relay action can be inhibited by connecting terminal points TB1-6 and TB1-9. This feature is normally only used during machine tests or repair procedures. BE AWARE that when you use this feature it totally eliminates operation of the relays. No vibration protection is available while this feature is in use.

7.0 SPECIFICATIONS

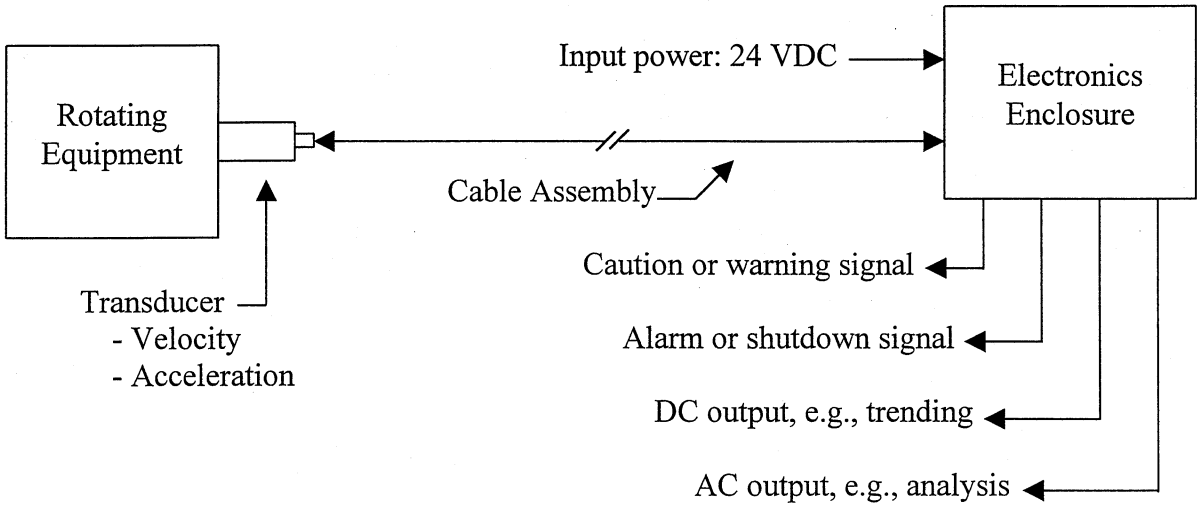
The 438R Vibration Switch Specifications are shown in Appendix 7.

438R VIBRATION SWITCH

The 438R Vibration Switch consists of three components:

1. Transducer
2. Cable Assembly
3. Electronics Enclosure

438R Block Diagram

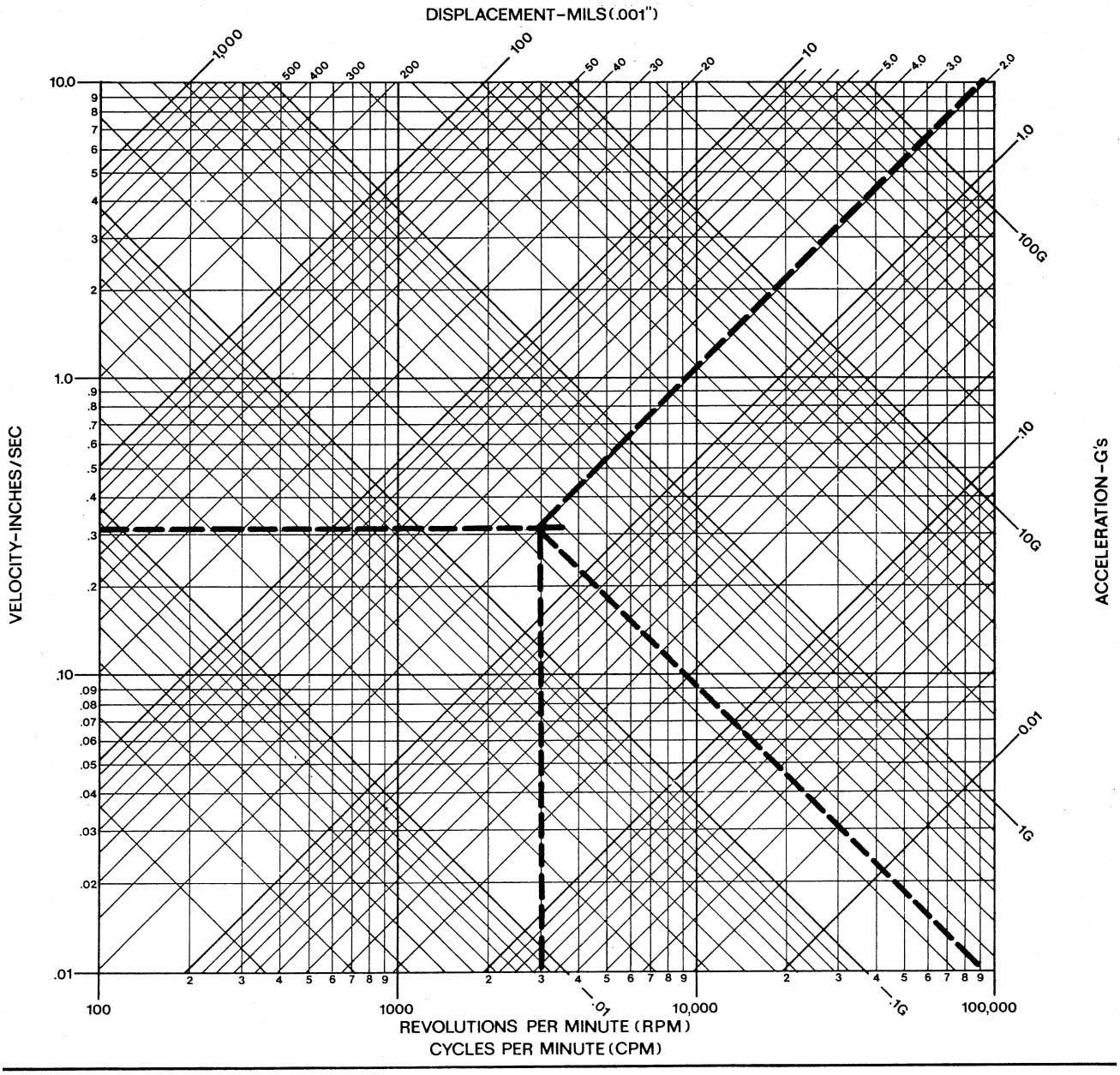


1. Transducer
   Selection based on:
   1. Measurement mode, velocity or acceleration
   2. Frequency range
   3. Operating temperature range up to 250 F

2. Cable Assembly
   Selection based on:
   1. Cable type and length
   2. Operating temperature range up to 250 F
   3. Environment: Indoor, outdoor, wet and/or corrosive
   4. Transducer connector type

3. Electronics Enclosure
   Selection based on:
   1. Signal conditioning for selected transducer
   2. High-pass, bandpass or low-pass filters
   3. Operating temperature range of -25 to 160 F
   4. Environment:
      NEMA 4
      NEMA 4X, exterior epoxy painted
      Explosion proof

FIGURE 1 438R VIBRATION SWITCH COMPONENTS



CONVERSION FORMULAS

Symbols:

D = Displacement: Inches peak to peak
d = Displacement: Mils peak to peak
V = Velocity: Inches per second peak
A = Acceleration: G's peak
Hz = Cycles per second
CPM = Cycles per minute

$D = 0.318 \frac{V}{Hz}$

$D = 19.607 \frac{A}{(Hz)^2}$

$V = \pi(Hz)(D)$

$V = 61.440 \frac{A}{Hz}$

$A = 0.051 (Hz)^2 (D)$

$A = 0.016 (V) (Hz)$

$d = (1.910)(10^4) \frac{V}{CPM}$

$d = (7.059)(10^7) \frac{A}{(CPM)^2}$

$V = (5.236)(10^{-5})(CPM)(d)$

$V = (3.696)(10^3) \frac{A}{CPM}$

$A = (1.417)(10^{-8})(CPM)^2 (d)$

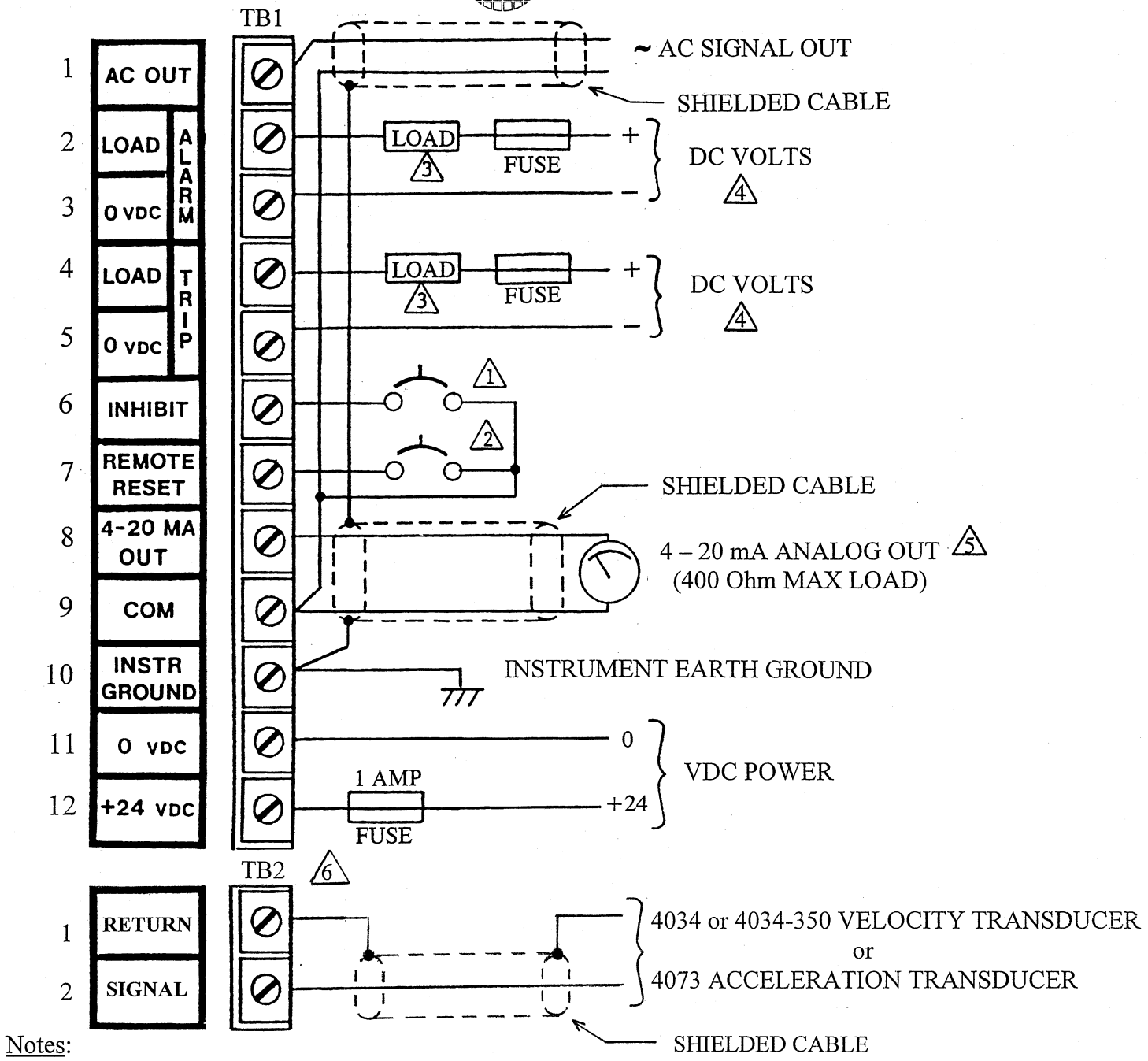
$A = (2.704)(10^{-4})(CPM)(V)$

EXAMPLE: 2.00 Mils at 3000 RPM

By Chart V = 0.3 inches per second
A = 0.25 G's

By Formula $V = (5.236)(10^{-5})(3000)(2.00) = 0.31$ inches per second
$A = (1.417)(10^{-8})(3000)^2 (2.00) = 0.26$ G's

FIGURE 2 DISPLACEMENT, VELOCITY AND ACCELERATION CONVERSION CHART AND FORMULAS



Notes:

1 Relays inhibited while momentary switch is activated.
2 Latching relays reset when momentary switch is activated. For non-latching relays, Customer to install jumper between TB1-7 and TB1-9.
3 Maximum load current ≤ 1 AMP.
4 Maximum voltage ≤ 24 VDC.
5 If 4 - 20 mA analog output is not used, install a 100 Ohm 1/4 W resistor across TB1-8 and TB1-9.
6 TB2 is used in the Explosion Proof version only. The cable assembly is soldered directly to the printed circuit card in the NEMA 4 and NEMA 4X versions.

continued –

FIGURE 3 WIRING DIAGRAM FOR 24 VDC 438R VIBRATION SWITCHES

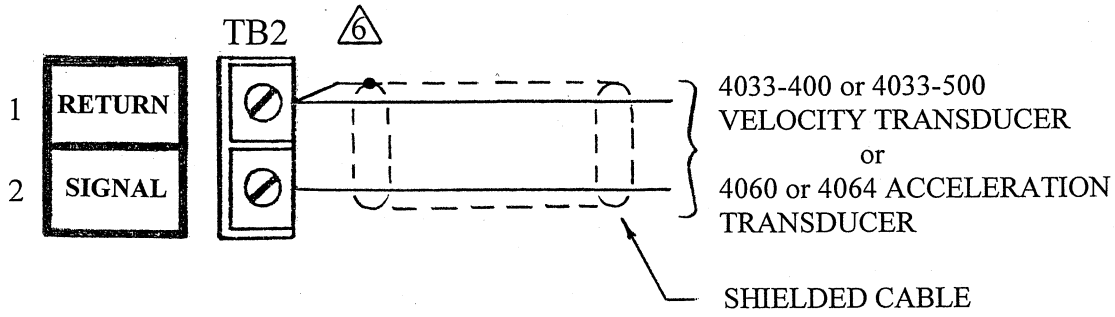


Figure 3 – continued

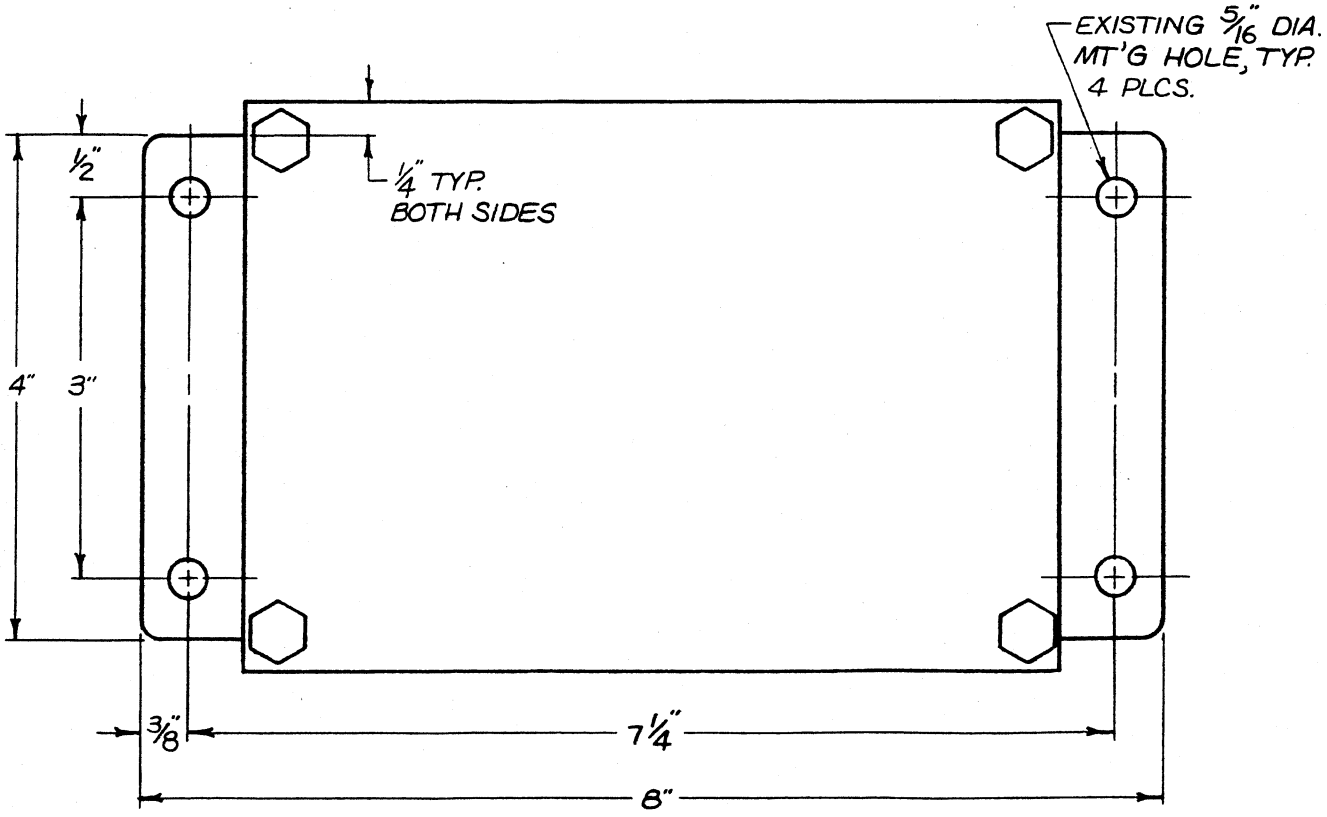
RECOMMENDED MOUNTING

1. Locate an easily accessible mounting surface for the electronics enclosure. Points of contact with the base plate should be reasonably flat and smooth.

2. Drill #6 (.2040) approximately 9/16 inches deep (7/16 inches deep for bottoming tap) and tap 1/4 - 20 approximately 5/16 inches deep, typical four places.

3. Securely fasten electronics enclosure to mounting surface with four each of 1/4-20 x 9/16 inch HHCS, 1/4 inch flat washer, 1/4 inch split lockwasher.

4. Make all necessary electrical connections.



Overall Dimensions: 8"L x 4-1/2"W x 3-5/16" H

FIGURE 4 MOUNTING PROCEDURE FOR THE 438R VIBRATION SWITCH NEMA 4 AND NEMA 4X ELECTRONICS ENCLOSURES

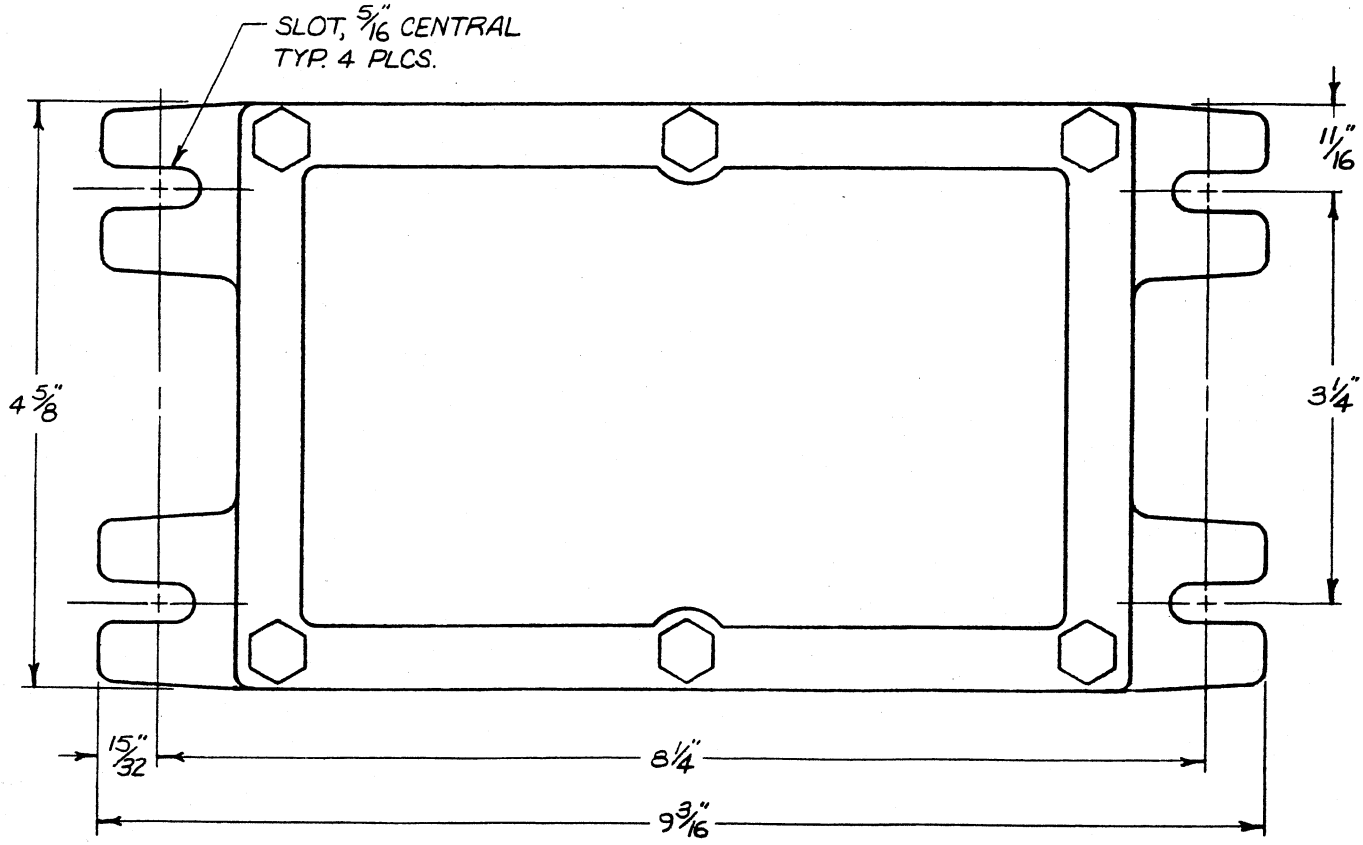
RECOMMENDED MOUNTING

1. Locate an easily accessible mounting surface for the electronics enclosure. Points of contact with the base plate should be reasonably flat and smooth.

2. Drill #6 (.2040) approximately 9/16 inches deep (7/16 inches deep for bottoming tap) and tap 1/4 - 20 approximately 5/16 inches deep, typical four places.

3. Securely fasten electronics enclosure to mounting surface with four each of 1/4-20 x 9/16 inch HHCS, 1/4 inch flat washer, 1/4 inch split lockwasher.

4. Make all necessary electrical connections.



Overall Dimensions: 9-3/16" L x 4-5/8"W x 4-1/4" H

FIGURE 5 MOUNTING PROCEDURE FOR THE 438R VIBRATION SWITCH EXPLOSION PROOF ELECTRONICS ENCLOSURE

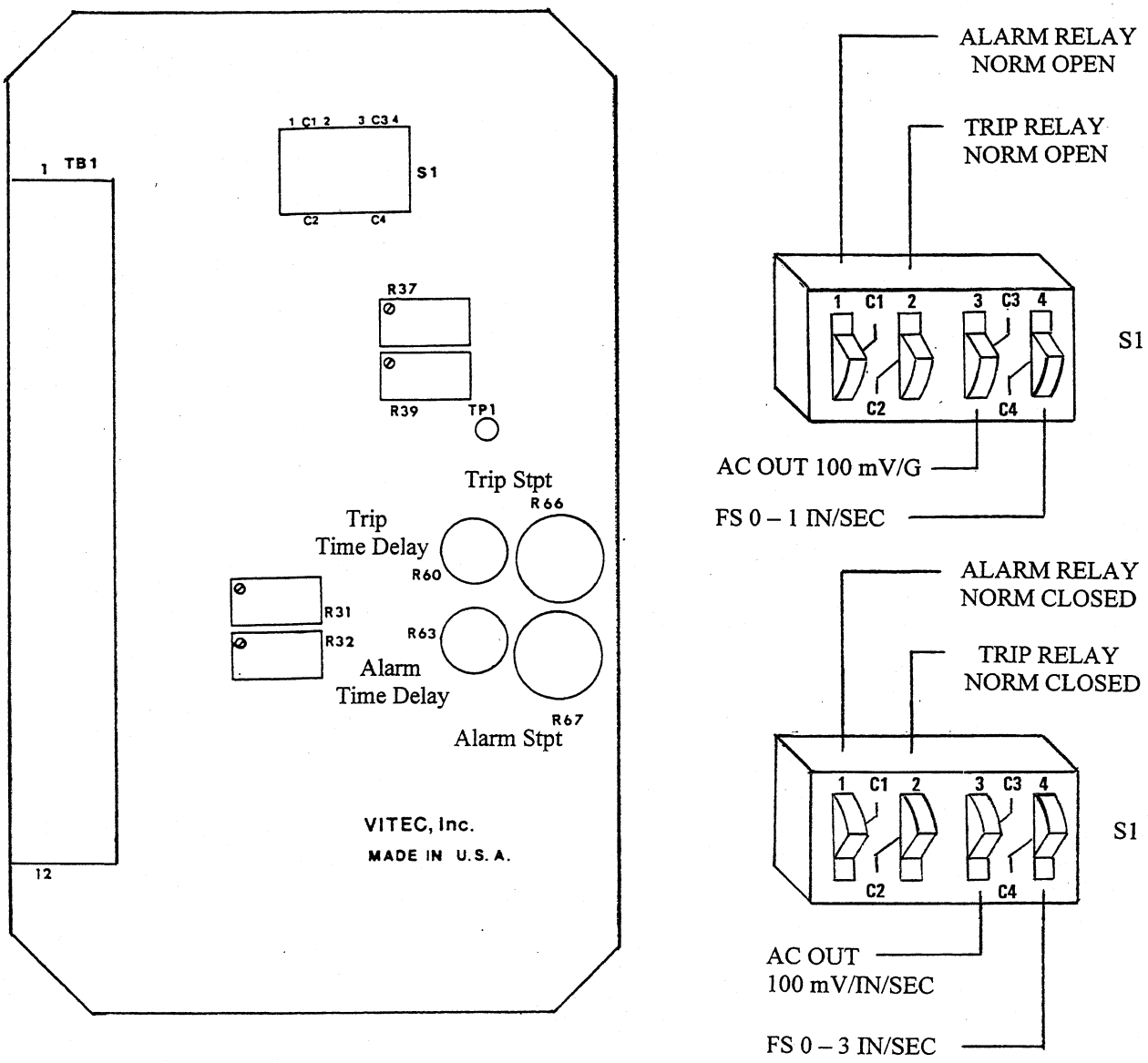


FIGURE 6 FIELD ADJUSTABLE PROVISIONS OF THE 438R

Vitec, Inc.

4033-400 VELOCITY TRANSDUCER INSTALLATION AND SPECIFICATIONS

APPLICATION

The 4033-400 Velocity Transducer is a high quality transducer used for general purpose machine vibration measurement. It is a self-powered device, capable of being used with cable runs of up to 1,000 ft. The 4033-400 is for use in applications up to 400°F.

INSTALLATION, ELECTRICAL

Cable Type: Use high quality, twisted, shielded cable between the transducer terminals and monitor terminals. Use of Vitec supplied cable assemblies is recommended.

Cable Length: Transducer to monitor cable length should not exceed 1,000 ft.

Cable Splicing: If cable splices are made, complete shielding must be maintained.

Cable Routing: Proper cable routing is required to avoid false signals being introduced into the measuring device (monitor). Avoid running transducer wires adjacent to, or parallel to, AC power lines. Where possible, provide a separate, grounded conduit to enclose the transducer cable. Route cable away from radio transmission equipment, motors, generators, and transformers. Avoid running cable through areas prone to ESD (Electro Static Discharge) or EMI (Electromagnetic Interference).

Cable Grounding: Connect the cable shield to a good, earth ground connection, at one end only (preferably at the monitor end of the cable). Vitec monitors provide this connection as a terminal block connection point.

INSTALLATION, MECHANICAL

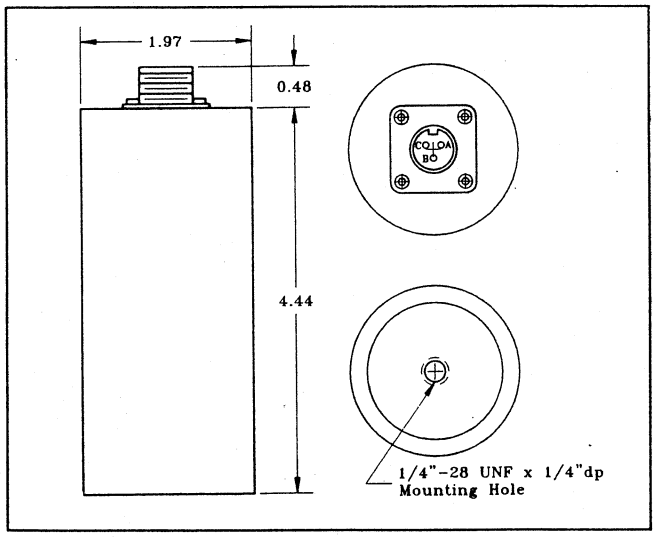
Location: Mount on, or as close as possible to, the bearing being monitored. Preferable mounting location is on the bearing cap.

Direction: The 4033-400 is only sensitive to vibrations that are occurring in the direction of the transducer's axis (the imaginary line running through the center of the connector and the mounting stud). Therefore, mount the transducer in a direction that will sense the vibrations to be measured.

Operating Position: The 4033-400 is limited to a mounting position of +/- 110 degrees off of vertical, with vertical being defined as the connector in the "up", or 12:00 position. Operating the transducer out of this mounting range can cause irreparable damage.

Surface Preparation: The mounting surface must be flat and smooth. For best results, mounting surface should be flat to within 0.001 in TIR (Total Indicated Runout) over the full base dimension of the transducer, with a minimum 63 µin finish.

Stud Mounting: Drill and tap the mounting point for a 1/4-28 UNF stud, with a minimum thread depth of 3/8 in.



continued -

SPECIFICATIONS

Dynamic:	
Output, mV peak, +/- 3%, for 1.0 in/sec peak into a 10K ohm resistive load at 100 Hz	200
Linearity, %: from 0.2 to 8.0 in/sec peak from 0.1 to 10.0 in/sec peak	 +/- 2 +/- 3
Frequency Response, %, 20 to 1,500 Hz	+/- 5
Natural Frequency, Hz, approximate	20
Transverse Axis Sensitivity, % at 100 Hz	5
Temperature Sensitivity, % change in output from 20 to 1,000 Hz with a temperature range of: 25 - 400°F	+/- 5
Amplitude Range, inches: minimum maximum	 0.0002 0.100
Operating Gs, maximum	17
Damping	Electro-Magnetic

Electrical:	
Power Requirements	None, Self Generating
Sensing Element Impedance, ohms, +/- 10% at at 75°F 4033 - 400	230
Grounding, Sensing Element	Internally Ungrounded
Connections (Connector): Pin A Pin B Pin C	 Signal Open Signal Return

Environmental:	
Temperature Range, °F 4033 - 400	 -20 to 400
Hazardous Area Rating, when installed per Vitec drawing 623813-137	Intrinsically Safe for Class 1, Group D, Div. 1
Operating Position, degrees from vertical, connector up	+/- 110

Physical:	
Vitec Part No.: 4033 - 400	 602885-49R
Weight, ounces	28
Case Material	2024-T3 Aluminum with Satin Anodized Finish
Dimensions: Height, inches Body Diameter, inches Center Mounting Hole	 4.92 1.97 1/4-28 UNF x 1/4 in Deep
Mating Cable Assembly	Varies with application, contact factory

Vitec, Inc.
24755 Highpoint Rd.
Cleveland, OH 44122
Phone: 216-464-4670
Fax: 216-464-5324

Vitec, Inc.

4033-500 VELOCITY TRANSDUCER INSTALLATION AND SPECIFICATIONS

APPLICATION

The 4033-500 Velocity Transducer is a high quality transducer used for general purpose machine vibration measurement. It is a self-powered device, capable of being used with cable runs of up to 1,000 ft. The 4033-500 is for use in applications up to 500°F.

INSTALLATION, ELECTRICAL

Cable Type: Use high quality, twisted, shielded cable between the transducer terminals and monitor terminals. Use of Vitec supplied cable assemblies is recommended.

Cable Length: Transducer to monitor cable length should not exceed 1,000 ft.

Cable Splicing: If cable splices are made, complete shielding must be maintained.

Cable Routing: Proper cable routing is required to avoid false signals being introduced into the measuring device (monitor). Avoid running transducer wires adjacent to, or parallel to, AC power lines. Where possible, provide a separate, grounded conduit to enclose the transducer cable. Route cable away from radio transmission equipment, motors, generators, and transformers. Avoid running cable through areas prone to ESD (Electro Static Discharge) or EMI (Electromagnetic Interference).

Cable Grounding: Connect the cable shield to a good, earth ground connection, at one end only (preferably at the monitor end of the cable). Vitec monitors provide this connection as a terminal block connection point.

INSTALLATION, MECHANICAL

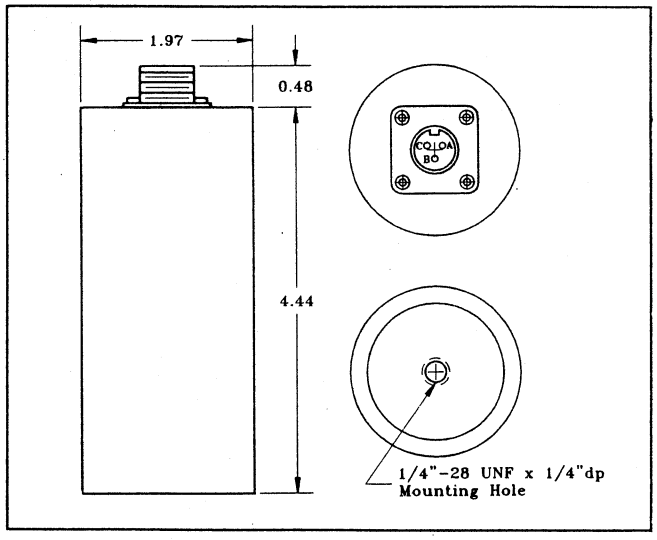
Location: Mount on, or as close as possible to, the bearing being monitored. Preferable mounting location is on the bearing cap.

Direction: The 4033-500 is only sensitive to vibrations that are occurring in the direction of the transducer's axis (the imaginary line running through the center of the connector and the mounting stud). Therefore, mount the transducer in a direction that will sense the vibrations to be measured.

Operating Position: The 4033-500 is limited to a mounting position of +/- 110 degrees off of vertical, with vertical being defined as the connector in the "up", or 12:00 position. Operating the transducer out of this mounting range can cause irreparable damage.

Surface Preparation: The mounting surface must be flat and smooth. For best results, mounting surface should be flat to within 0.001 in TIR (Total Indicated Runout) over the full base dimension of the transducer, with a minimum 63 µin finish.

Stud Mounting: Drill and tap the mounting point for a 1/4-28 UNF stud, with a minimum thread depth of 3/8 in.



continued -

SPECIFICATIONS

Dynamic:	
Output, mV peak, +/- 3%, for 1.0 in/sec peak into a 10K ohm resistive load at 100 Hz	200
Linearity, %: from 0.2 to 8.0 in/sec peak from 0.1 to 10.0 in/sec peak	 +/- 2 +/- 3
Frequency Response, %, 20 to 1,500 Hz	+/- 5
Natural Frequency, Hz, approximate	20
Transverse Axis Sensitivity, % at 100 Hz	5
Temperature Sensitivity, % change in output from 20 to 1,000 Hz with a temperature range of: 400 - 500°F	 +/- 10
Amplitude Range, inches: minimum maximum	 0.0002 0.100
Operating Gs, maximum	17
Damping	Electro-Magnetic

Electrical:	
Power Requirements	None, Self Generating
Sensing Element Impedance, ohms, +/- 10% at at 75°F 4033 - 500	 320
Grounding, Sensing Element	Internally Ungrounded
Connections (Connector): Pin A Pin B Pin C	 Signal Open Signal Return

Environmental:	
Temperature Range, °F 4033 - 500	 -20 to 500
Hazardous Area Rating, when installed per Vitec drawing 623813-137	Intrinsically Safe for Class 1, Group D, Div. 1
Operating Position, degrees from vertical, connector up	+/- 110

Physical:	
Vitec Part No.: 4033 - 500	 602885-49Y
Weight, ounces	28
Case Material	2024-T3 Aluminum with Satin Anodized Finish
Dimensions: Height, inches Body Diameter, inches Center Mounting Hole	 4.92 1.97 1/4-28 UNF x 1/4 in Deep
Mating Cable Assembly	Varies with application, contact factory

Vitec, Inc.
24755 Highpoint Rd.
Cleveland, OH 44122
Phone: 216-464-4670
Fax: 216-464-5324

Vitec, Inc.

4034 VELOCITY TRANSDUCER INSTALLATION AND SPECIFICATIONS

APPLICATION

The 4034 Velocity Transducer is a good quality transducer used for general purpose machine vibration measurement. It is self-powered device, capable of being used with cable runs of up to 1,000 ft.

INSTALLATION, ELECTRICAL

Cable Type: Use high quality, co-axial, or twisted, shielded cable between the transducer terminals and monitor terminals. Use of Vitec supplied cable assemblies is recommended.

Cable Length: Transducer to monitor cable length should not exceed 1,000 ft.

Cable Splicing: If cable splices are made, complete shielding must be maintained.

Cable Routing: Proper cable routing is required to avoid false signals being introduced into the measuring device (monitor). Avoid running transducer wires adjacent to, or parallel to, AC power lines. Where possible, provide a separate, grounded conduit to enclose the transducer cable. Route cable away from radio transmission equipment, motors, generators, and transformers. Avoid running cable through areas prone to ESD (Electro Static Discharge) or EMI (Electromagnetic Interference).

Cable Grounding: Connect the cable shield to a good, earth ground connection, at one end only (preferably at the monitor end of the cable). Vitec monitors provide this connection as a terminal block connection point.

INSTALLATION, MECHANICAL

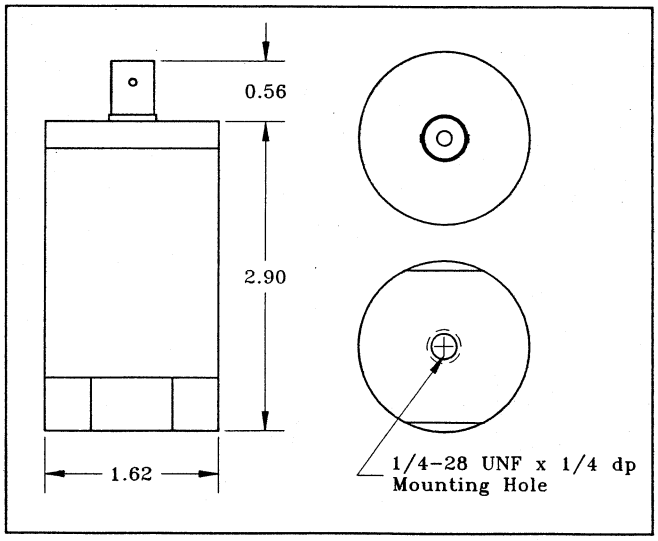
Location: Mount on, or as close as possible to, the bearing being monitored. Preferable mounting location is on the bearing cap.

Direction: The 4034 is only sensitive to vibrations that are occurring in the direction of the transducer's axis (the imaginary line running through the center of the connector and the mounting stud). Therefore, mount the transducer in a direction that will sense the vibrations to be measured.

Operating Position: The 4034 can be mounted in a position of +/- 180 degrees off of vertical, with vertical being defined as the connector in the "up", or 12:00 position.

Surface Preparation: The mounting surface must be flat and smooth. For best results, mounting surface should be flat to within 0.001 in TIR (Total Indicated Runout) over the full base dimension of the transducer, with a minimum 63 µin finish.

Stud Mounting: Drill and tap the mounting point for a 1/4-28 UNF stud, with a minimum thread depth of 3/8 in.



continued -

SPECIFICATIONS

Dynamic:	
Output, mV peak, +/- 10%, for 1.0 in/sec peak at 100 Hz	460
Frequency Response, %, 12 to 1,000 Hz	+/- 10
Natural Frequency, Hz, +/- 10%	10
Transverse Axis Sensitivity, %	10
Amplitude Range, inches, maximum: Horizontal Position Vertical and Inverted Position	 0.100 0.075
Operating G's, maximum	12.98
Damping	Shunt Resistor

Electrical:	
Power Requirements	None, Self Generating
Sensing Element Impedance, ohms, +/- 5%, at 77°F	215
Connections (Connector): Center Pin Shell	 Signal Signal Return

Environmental:	
Temperature Range, °F	30 to 160
Operating Position, degrees from vertical, connector up	+/- 180

Physical:	
Vitec Part No.:	412585-159A
Weight, oz.	14
Case Material	Aluminum, Anodized
Dimensions: Height, inches Body Diameter, inches Center Mounting Hole Wrench Flats, inches, at Bottom	 3.46 1.62 1/4-28 UNF x 1/4 in Deep 1-1/2
Mating Cable Assembly	Varies with application, contact factory

Vitec, Inc.
24755 Highpoint Rd.
Cleveland, OH 44122
Phone: 216-464-4670
Fax: 216-464-5324

Vitec, Inc.

4060 ACCELEROMETER INSTALLATION AND SPECIFICATIONS

APPLICATION

The 4060 Accelerometer is used primarily with Vitec monitoring systems. It has an unamplified, charge output that limits cable run distances to 100 ft or less, and can be used in applications to 400 °F.

INSTALLATION, ELECTRICAL

Cable Type: Use high quality, twisted, shielded cable between the transducer terminals and monitor terminals. Use of Vitec supplied cable assemblies is recommended.

Cable Length: Transducer to monitor cable length should not exceed 100 ft.

Cable Splicing: If cable splices are made, complete shielding must be maintained.

Cable Routing: Proper cable routing is required to avoid false signals being introduced into the measuring device (monitor). Avoid running accelerometer wires adjacent to, or parallel to, AC power lines. Where possible, provide a separate, grounded conduit to enclose the accelerometer cable. Route cable away from radio transmission equipment, motors, generators, and transformers. Avoid running cable through areas prone to ESD (Electro Static Discharge) or EMI (Electromagnetic Interference).

Cable Grounding: Connect the cable shield to a good, earth ground connection, at one end only (preferably at the monitor end of the cable). Vitec monitors provide this connection as a terminal block connection point.

Cable Anchoring: Cable should be clamped at regular intervals to keep it from twisting or flexing. Cable motion will induce electrical noise into the monitoring system, causing inaccurate readings.

INSTALLATION, MECHANICAL

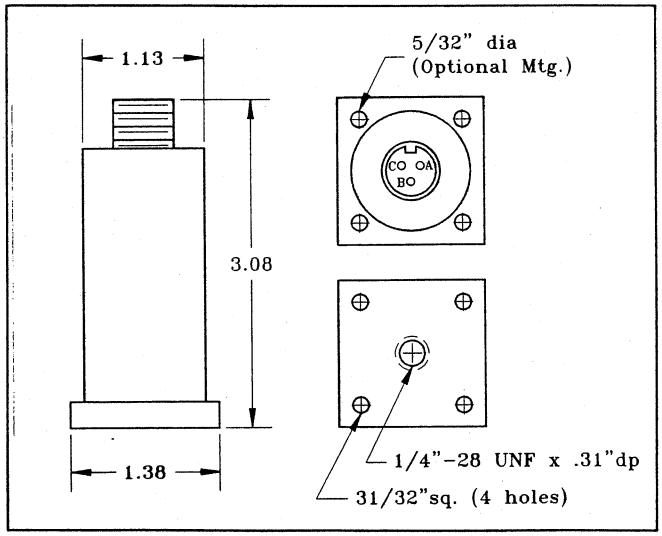
Location: Mount on, or as close as possible to, the bearing being monitored. Preferable mounting location is on the bearing cap.

Direction: The accelerometer is only sensitive to vibrations that are occurring in the direction of the transducer's axis (the imaginary line running through the center of the connector and the mounting stud). Therefore, mount the transducer in a direction that will sense the vibrations to be measured.

Surface Preparation: The mounting surface must be flat and smooth. For best results, mounting surface should be flat to within 0.001 in TIR (Total Indicated Runout) over the full base dimension of the transducer, with a minimum 63 µin finish.

Stud Mounting: If stud mounting is used, drill and tap the mounting point for a 1/4-28 UNF stud, with a minimum thread depth of 3/8 in.

Square Base Mounting: If the four hole mounting base is used, drill and tap the mounting point for four, No. 6-32 UNF screws, with a minimum thread depth of 1/4 in.



continued -

SPECIFICATIONS

Dynamic:	
Output, pico-coloumbs/G, +/- 5%	1,050
Frequency Response, Hz, +/- 5%	1 to 1,500
Dynamic Range, Gs	0.001 to 500.0
First Mounted Resonant Frequency, KHz	5 - 7
Transverse Axis Sensitivity, % max., 50 to 800 Hz	5
Temperature Sensitivity, % change in output, -100 to 400°F	+/- 5
Linearity, % over dynamic range	+/- 3

Electrical:	
Power Requirements	None, Self Generating
Internal Capacitance, µf, +/- 20%	0.012
Grounding, Sensing Element	Internally Ungrounded and Shielded
Connections (Connector): Pin A Pin B Pin C	 Signal Shield Signal Return
Element Isolation from Case, dB min. at 60 Hz	60

Environmental:	
Temperature Range, °F	-100 to 400

Physical:	
Vitec Part No.:	602885-46RA
Weight, oz.	10
Case Material	Stainless Steel
Dimensions: Height, inches Base, inches square Body Diameter, inches Center Mounting Hole Base Mounting Holes	 3.08 1.38 1 1/8 1/4-28 UNF x 5/16 in Deep 0.156 in Dia., on 1.38 in Dia. Bolt Hole Circle (21/32 in square).
Mating Cable Assembly, (Optional) Vitec Part No.: 180°F 400°F 850°F (XXX = Cable Length in Feet)	 412585-79-XXX 412585-65-XXX 412585-87-XXX

Vitec, Inc.
24755 Highpoint Rd.
Cleveland, OH 44122
Phone: 216-464-4670
Fax: 216-464-5324

Vitec, Inc.

4064 ACCELEROMETER INSTALLATION AND SPECIFICATIONS

APPLICATION

The 4064 Accelerometer is used primarily with Vitec monitoring systems. It has an unamplified, charge output that limits cable run distances to 100 ft or less, and can be used in applications to 550 °F.

INSTALLATION, ELECTRICAL

Cable Type: Use high quality, twisted, shielded cable between the transducer terminals and monitor terminals. Use of Vitec supplied cable assemblies is recommended.

Cable Length: Transducer to monitor cable length should not exceed 100 ft.

Cable Splicing: If cable splices are made, complete shielding must be maintained.

Cable Routing: Proper cable routing is required to avoid false signals being introduced into the measuring device (monitor). Avoid running accelerometer wires adjacent to, or parallel to, AC power lines. Where possible, provide a separate, grounded conduit to enclose the accelerometer cable. Route cable away from radio transmission equipment, motors, generators, and transformers. Avoid running cable through areas prone to ESD (Electro Static Discharge) or EMI (Electromagnetic Interference).

Cable Grounding: Connect the cable shield to a good, earth ground connection, at one end only (preferably at the monitor end of the cable). Vitec monitors provide this connection as a terminal block connection point.

Cable Anchoring: Cable should be clamped at regular intervals to keep it from twisting or flexing. Cable motion will induce electrical noise into the monitoring system, causing inaccurate readings.

INSTALLATION, MECHANICAL

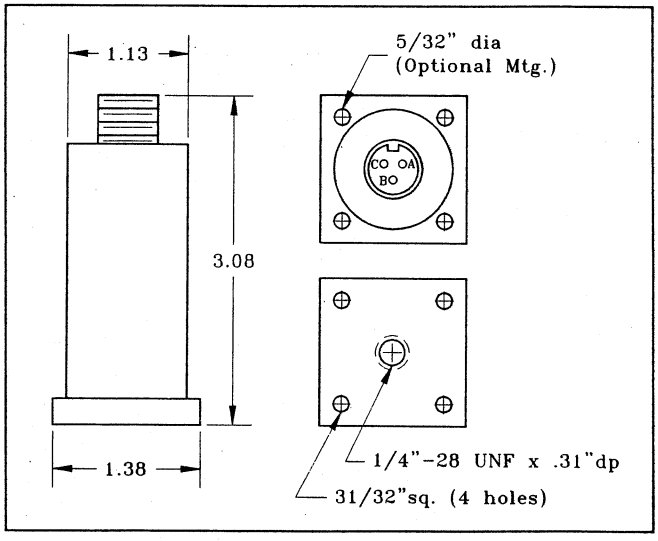
Location: Mount on, or as close as possible to, the bearing being monitored. Preferable mounting location is on the bearing cap.

Direction: The accelerometer is only sensitive to vibrations that are occurring in the direction of the transducer's axis (the imaginary line running through the center of the connector and the mounting stud). Therefore, mount the transducer in a direction that will sense the vibrations to be measured.

Surface Preparation: The mounting surface must be flat and smooth. For best results, mounting surface should be flat to within 0.001 in TIR (Total Indicated Runout) over the full base dimension of the transducer, with a minimum 63 µin finish.

Stud Mounting: If stud mounting is used, drill and tap the mounting point for a 1/4-28 UNF stud, with a minimum thread depth of 3/8 in.

Square Base Mounting: If the four hole mounting base is used, drill and tap the mounting point for four, No. 6-32 UNF screws, with a minimum thread depth of 1/4 in.



continued -

SPECIFICATIONS

Dynamic:	
Output, pico-coloumbs/G, +/- 5%	1,050
Frequency Response, Hz, +/- 5%	1 to 600
Dynamic Range, Gs	0.001 to 500.0
First Mounted Resonant Frequency, KHz	5 - 7
Transverse Axis Sensitivity, % max., 50 to 800 Hz	5
Temperature Sensitivity, % change in output, -100 to 550°F	+/- 10
Linearity, % over dynamic range	+/- 3

Electrical:	
Power Requirements	None, Self Generating
Internal Capacitance, µf, +/- 20%	0.012
Grounding, Sensing Element	Internally Ungrounded and Shielded
Connections (Connector): Pin A Pin B Pin C	 Signal Shield Signal Return
Element Isolation from Case, dB min. at 60 Hz	60

Environmental:	
Temperature Range, °F	-100 to 550

Physical:	
Vitec Part No.:	602885-46RR
Weight, oz.	10
Case Material	Stainless Steel
Dimensions: Height, inches Base, inches square Body Diameter, inches Center Mounting Hole Base Mounting Holes	 3.08 1.38 1 1/8 1/4-28 UNF x 5/16 in Deep 0.156 in Dia., on 1.38 in Dia. Bolt Hole Circle (21/32 in square).
Mating Cable Assembly, (Optional) Vitec Part No.: 180°F 400°F 850°F (XXX = Cable Length in Feet)	 412585-79-XXX 412585-65-XXX 412585-87-XXX

Vitec, Inc.
24755 Highpoint Rd.
Cleveland, OH 44122
Phone: 216-464-4670
Fax: 216-464-5324

Vitec, Inc.

4073 ACCELEROMETER INSTALLATION AND SPECIFICATIONS

APPLICATION

The 4073 Accelerometer is a good quality transducer used for general purpose machine vibration measurement. It is a constant current type accelerometer that has a 100 mV/G output suitable for cable runs of up to 2,300 feet. The 4073 is rated for use in temperatures up to 250°F.

INSTALLATION, ELECTRICAL

Cable Type: A high quality, twisted, shielded cable, or co-axial cable can be used between the transducer terminals and monitor terminals. Use of Vitec supplied cable assemblies is recommended.

Cable Length: When the 4073 Accelerometer is connected to a Vitec monitoring or measurement device, cable lengths are limited by the type of cable used, and the maximum frequency of vibration to be measured as defined below:

Cable Type Used	Maximum Frequency of Interest, KHz	Maximum Recommended Cable Length, ft
Coaxial	1.0	2,000
	5.0	400
	10.0	200
Twisted, Shielded	1.0	2,300
	5.0	460
	10.0	230

Cable Splicing: If cable splices are made, complete shielding must be maintained.

Cable Routing: Proper cable routing is required to avoid false signals being introduced into the measuring device (monitor). Avoid running transducer wires adjacent to, or parallel to, AC power lines. Where possible, provide a separate, grounded conduit to enclose the transducer cable. Route cable away from radio transmission equipment, motors, generators, and transformers. Avoid running cable through areas prone to ESD (Electro Static Discharge) or EMI (Electromagnetic Interference).

Cable Grounding: Connect the cable shield to a good, earth ground connection, at one end only (preferably at the monitor end of the cable). Vitec monitors provide this connection at the cable termination point . When co-axial cable is used, the center conductor carries the signal and power while the outer braid provides shielding and signal return.

INSTALLATION, MECHANICAL

Location: Mount on, or as close as possible to, the bearing being monitored. Preferable mounting location is on the bearing cap.

Direction: The accelerometer is only sensitive to vibrations that are occurring in the direction of the transducer's axis (the imaginary line running through the center of the connector and the mounting stud). Therefore, mount the transducer in a direction that will sense the vibrations to be measured.

Operating Position: The 4073 Accelerometer can be mounted in any position, there are no mounting position restrictions.

Surface Preparation: The mounting surface must be flat and smooth. For best results, mounting surface should be flat to within 0.001 in TIR (Total Indicated Runout) over the full base dimension of the transducer, with a minimum 63 µin finish.

If frequencies above 3.0 KHz are of interest, a coupling fluid such as machine oil or vacuum grease should be used between the mating surfaces.

Stud Mounting: Drill and tap the mounting point for a 1/4-28 UNF stud, with a minimum thread depth of 1/4 in.

continued -

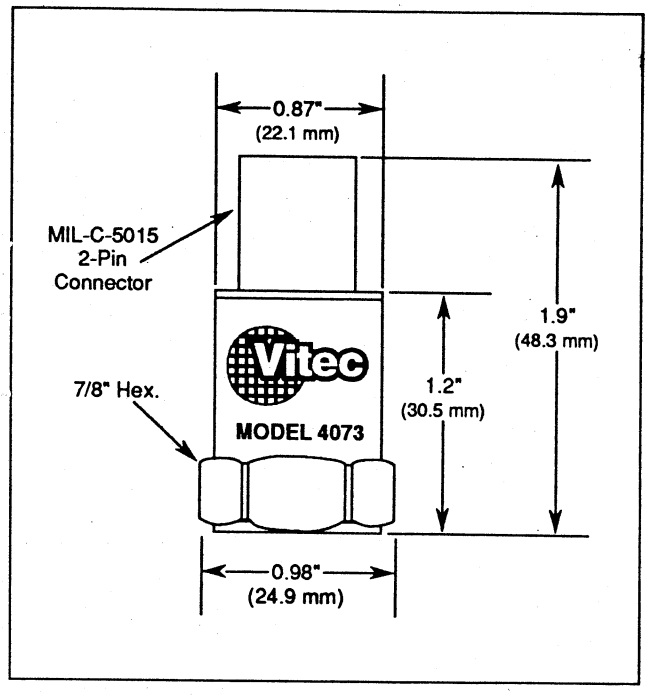
SPECIFICATIONS

Dynamic:	
Output, mV/G, +/- 10%, at 77°F	100
Dynamic Range, Gs peak	50
Frequency Response, Hz: +/- 10% +/- 3db	 1.7 to 6,000 0.8 to 10,000
First Mounted Resonant Frequency, KHz nominal	20
Transverse Axis Sensitivity, % max.	5
Shock Level, Gs maximum, peak	5,000

Electrical:	
Power Requirements, volts DC	18 to 30
Current Draw, mA	2 to 20
Bias Output Voltage, volts DC	8 to 11
Connections (Connector): Pin A Pin B	 Signal Signal Return
Grounding, Sensing Element	Internally Ungrounded and Shielded

Environmental:	
Temperature Range, °F	-65 to 250
Humidity Limit, % relative	100

Physical:	
Vitec Part No.:	412790-77A
Weight, oz.	3.1
Case Material	316 Stainless Steel
Dimensions: Height, inches Body Diameter, inches Center Mounting Hole Wrench Flats, inches, at bottom	 1.9 0.98 1/4-28 UNF x 1/4 in Deep 7/8
Mating Cable Assembly	Varies with application contact factory



Vitec, Inc.
24755 Highpoint Rd.
Cleveland, OH 44122
Phone: 216-464-4670
Fax: 216-464-5324

438R VIBRATION SWITCH[(a)] SPECIFICATION OPTIONS

Performance Characteristics

1. Vibration Ranges: 0 to 1.0 or 0 to 3.0 in/sec and field selectable
2. Frequency Response Range and Accuracy:
   - 20 to 1,500 Hz ±5% with the 4033-400 velocity transducer
   - 20 to 1,500 Hz ±5% with the 4033-500 velocity transducer
   - 12 to 1,000 Hz ±10% with the 4034 velocity transducer
   - 12 to 1,000 Hz ±10% with the 4034-350 velocity transducer
   - 1.0 to 1,500 Hz ±5% with the 4060 acceleration transducer
   - 1.0 to 600 Hz ±5% with the 4064 acceleration transducer
   - 1.7 to 6,000 Hz ±10% with the 4073 acceleration transducer
3. Repeatability: ±2%
4. Temperature Range:
   - -25 to 160 F for the electronics enclosure
   - -20 to 400 F for the 4033-400 velocity transducer
   - -20 to 500 F for the 4033-500 velocity transducer
   - -30 to 160 F for the 4034 velocity transducer
   - -30 to 350 F for the 4034-350 velocity transducer
   - -100 to 400 F for the 4060 acceleration transducer
   - -100 to 550 F for the 4064 acceleration transducer
   - -65 to 250 F for the 4073 acceleration transducer
5. Axis Orientation: Any
6. Relay Quantity: 2
7. Number of Relay Setpoints: 2
8. Function of Relay Setpoints: Alarm and trip, both field adjustable
9. Range of Setpoint Limits: 5 to 100% of full scale
10. Relay Configuration:
    - Nonlatching or latching and field selectable
    - Energized or de-energized and field selectable
11. Relay Inhibit: Manually initiated
12. Relay Time Delay: 0 to 20 Seconds and field adjustable

Physical Characteristics

1. Size:
   - 3.5 x 4.5 x 8.0 Inches for NEMA 4 and NEMA 4X
   - 4.3 x 4.6 x 9.2 Inches for explosion proof
2. Weight:
   - 5.5 Pounds for NEMA 4 and NEMA 4X electronics enclosures
   - 7.5 Pounds for explosion proof electronics enclosure

a. With transducer located at machine and connected by cable assembly to electronics located remotely.

continued -

Physical Characteristics (continued)

28 Ounces 4033-400 and 4033-500 velocity transducers
14 Ounces 4034 and 4034-350 velocity transducer
10 Ounces 4060 and 4064 acceleration transducer
3.1 Ounces 4073 acceleration transducer

3. Mounting:
   Four 0.25 inch-20 UNC, 3.0 x 7.25 inches bolt pattern for NEMA 4 and NEMA 4X
   Four 0.25 inch-20 UNC, 3.25 x 8.25 inches bolt pattern for explosion proof
   0.25 Inch-28 UNF for 4033-400, 4033-500, 4034 and 4034-350 velocity transducers or 4073 acceleration transducer
   0.25 Inch-28 UNF or four 6-32 UNF on a 31/32 x 31/32 square bolt pattern for the 4060 and 4064 acceleration transducers.
4. Environmental Rating:
   NEMA 4, weatherproof
   NEMA 4X, weatherproof and corrosion resistant
   Explosion proof and dust-tight
5. Hazardous Rating: Class I, Divisions 1 and 2, Groups C and D, and Class II, Divisions 1 and 2, Groups E, F and G for explosion proof
6. Calibration Requirements: None

Material Characteristics

Material:
   Cast aluminum housing with plated steel baseplate for NEMA 4
   Epoxy coated cast aluminum housing with stainless steel baseplate for NEMA 4X
   Cast aluminum for explosion proof
   Anodized aluminum for the 4033-400, 4033-500, 4034 and 4034-350 velocity transducers
   303 Stainless steel for the 4060 and 4064 acceleration transducers
   316 Stainless steel for the 4073 acceleration transducer

Electrical Characteristics

1. Supply Voltage: 120 or 220 VAC, 50/60 Hz and field selectable or 24 VDC
2. Relay Type and Rating: Solid state, single pole single throw and a 10 A rating at 120 or 220 VAC, or 1 A rating at 24 VDC
3. Input Transducer:
   4033-400 Velocity transducer
   4033-500 Velocity transducer
   4034 Velocity transducer
   4034-350 Velocity transducer
   4060 Acceleration transducer
   4064 Acceleration transducer
   4073 Acceleration transducer
4. Analog Output: 4 to 20 mA DC

continued -

Electrical Characteristics (continued)

5. AC Signal Output:
   100 mV/in/sec with the 4033-400, 4033-500, 4034 and 4034-350 velocity transducers
   100 mV/g with the 4060, 4064 and 4073 acceleration transducers or field selectable to velocity, 100 mV/in/sec
6. Electrical Connections for Electronics Enclosure: 12 Point terminal block for AWG no. 12 wire with the electronics enclosure
7. Electrical Connections for Transducers:
   8003, 3 pin connector with the 4033-400 and 4033-500 velocity transducers
   BNC connector with the 4034 and 4034-350 velocity transducer
   8003, 3 pin connector with the 4060 and 4064 acceleration transducers
   MIL-C-5015, 2 pin connector with the 4073 acceleration transducer

Options

1. Transducer Housings: Explosion proof with stud or flange mounting
2. Cable Assemblies:
   Transducer to electronics enclosure lengths up to 1,000 feet
   Temperatures up to 850 F
   Connectors for indoor, outdoor, wet and corrosive environments
3. Remote meter, reset switch and/or alarm