OPERATOR'S MANUAL

438A VIBRATION SWITCH: 24 VDC

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LIST OF FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS

AC	Alternating Current
C1	Circuit 1
C2	Circuit 2
C3	Circuit 3
C4	Circuit 4
F	Fahrenheit
FS	Full Scale
g	Vibration Units of Acceleration
Hz	Hertz, (Cycles per Second)
In/Sec	Inches/Second Vibration Units of Velocity
mA	Milliamp
Mils	Vibration Units of Displacement
mV	Millivolts
mV/g	Millivolt/g Force
PLC	Programmable Logic Controller
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 range and AC out
S2	Switch to field adjust the voltage of the AC power in
sec	Second

List of Acronyms and Abbreviations - continued

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
VAC	Volts Alternating Current
VDC	Volts Direct Current

LIST OF ENGINEERING SYMBOLS AND ABBREVIATIONS

A	Acceleration: g's peak
ALM	Alarm
AMP	Ampere
ANA	Analog
COM	Common
CPM	Cycles Per Minute
D	Displacement: Inches peak to peak
d	Displacement: Mils peak to peak
DC	Direct Current
g	Gravity
GND	Ground
Hz	Cycles per Second
INSTR	Instrument
In/Sec	Inches per Second
MAX	Maximum
NORM	Normally
Ω	Ohm
N	Neutral
∅	Phase
REM	Remote
RPM	Revolutions Per Minute
Shut	Shutdown
Stpt	Setpoint
VDC	Voltage, Direct Current
V	Velocity: Inches per second peak
W	Watt

1.0 INTRODUCTION

The Vitec 438A[(a)] Vibration Switches are an economical approach to accurate and reliable vibration protection for rotating machinery. The 438A 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

2.0 PRODUCT DESCRIPTION

The 438A measures the vibration level of the machine to which it is mounted. It provides two solid state relay (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 438A incorporates a built-in vibration sensing element and electronics to measure the vibration in terms of the velocity of vibration. Those familiar with setpoints given in displacement (mils) can convert to velocity (in/sec) via the Setpoint Conversion Figure and Formulas Chart shown in Figure 1 on page 5.

The 438A 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 signal, switch selectable for either acceleration or velocity, 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.

3.0 ELECTRICAL INSTALLATION

Proper electrical installation is essential. A little care here will assure a trouble-free installation.

Follow the wiring diagram shown in Figure 3 on page 7. Make special note of the following:

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

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 438A 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 7.

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 438A due to incorrect wiring is not covered under warranty.

4.0 MECHANICAL INSTALLATION

Figures 4 and 5 on pages 8 and 9 show mounting dimensions and mounting procedures for the 438A NEMA 4 and Explosion Proof versions, respectively.

The 438A Vibration Switch is sensitive to vibration in one direction only. Make sure the unit is oriented properly to measure the type of vibration being monitored.

If the required mounting location is not known, the vibration switch should generally be mounted to measure the RADIAL vibration, meaning the axis of sensitivity is perpendicular to the rotating shaft. See Figure 6 on page 10 for typical mounting locations. Note that the mounting locations shown are only general in nature. The manufacturer of the equipment being monitored is the best source of mounting location information.

Mounting tips:

1. Be sure the vibration switch is mounted FIRMLY to the machine. A switch that is not mounted firmly to the machine will measure its own vibration, in addition to the vibration of the machine (see Figure 6).

2. 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.

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

4. 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 2 on page 6, 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 a 0 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 2 on page 6, 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. To operate properly, the switched load must operate at 24 VDC, with a maximum current of 1 A.

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 2, on page 6, items identified as S1.

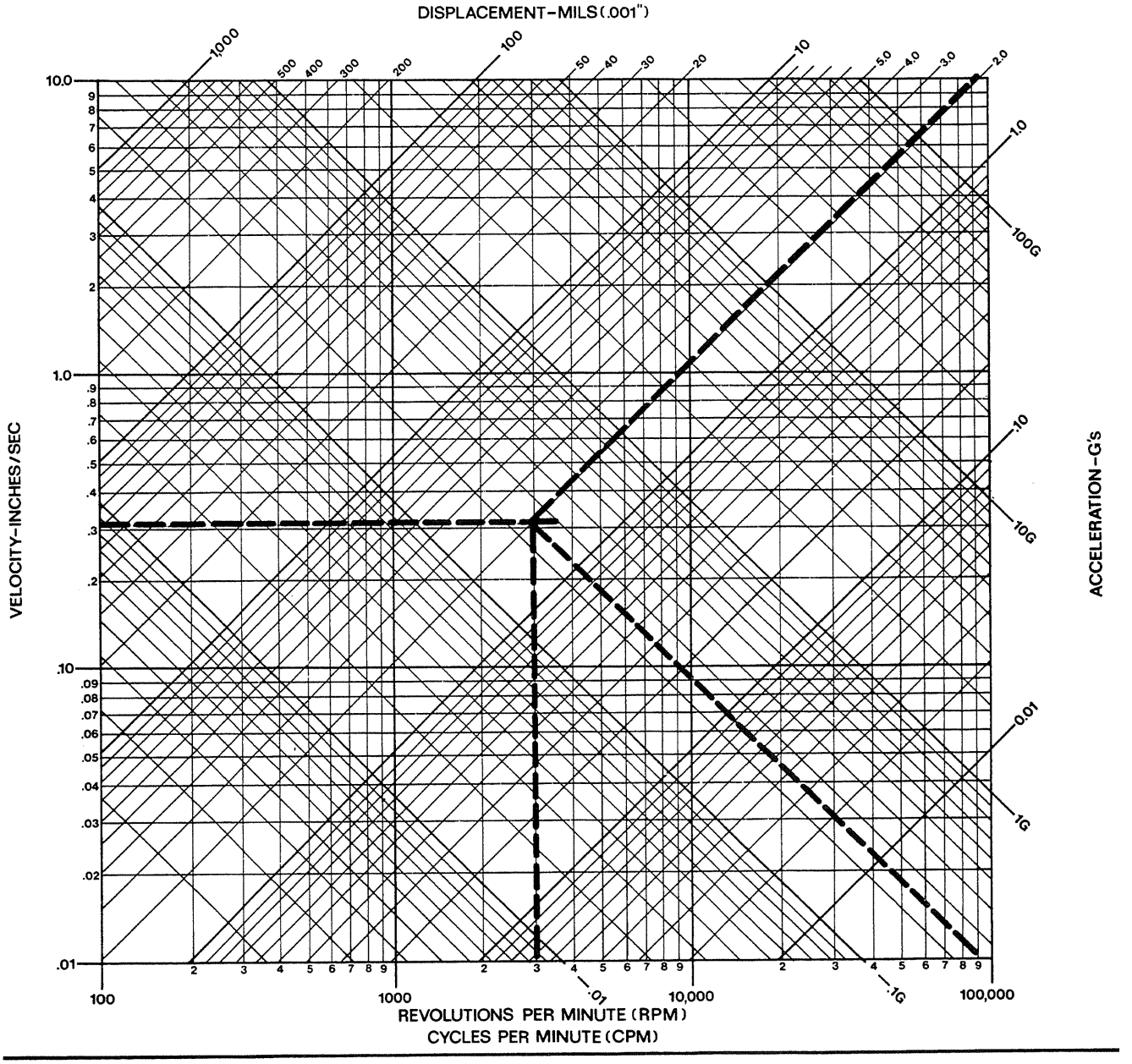
When shipped from the factory, the relays are LATCHING unless wired to be NON-LATCHING at the request of the Customer. Latching means that after the vibration returns to a normal level, the relays will NOT reset themselves. They must be manually reset via a remote reset switch which you, the Customer, must provide, since it does not come with the 438A.

The 438A 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 438A Vibration Switch Specifications are shown in Figure 7 on page 11.



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 1 SETPOINT CONVERSION FIGURE AND FORMULAS

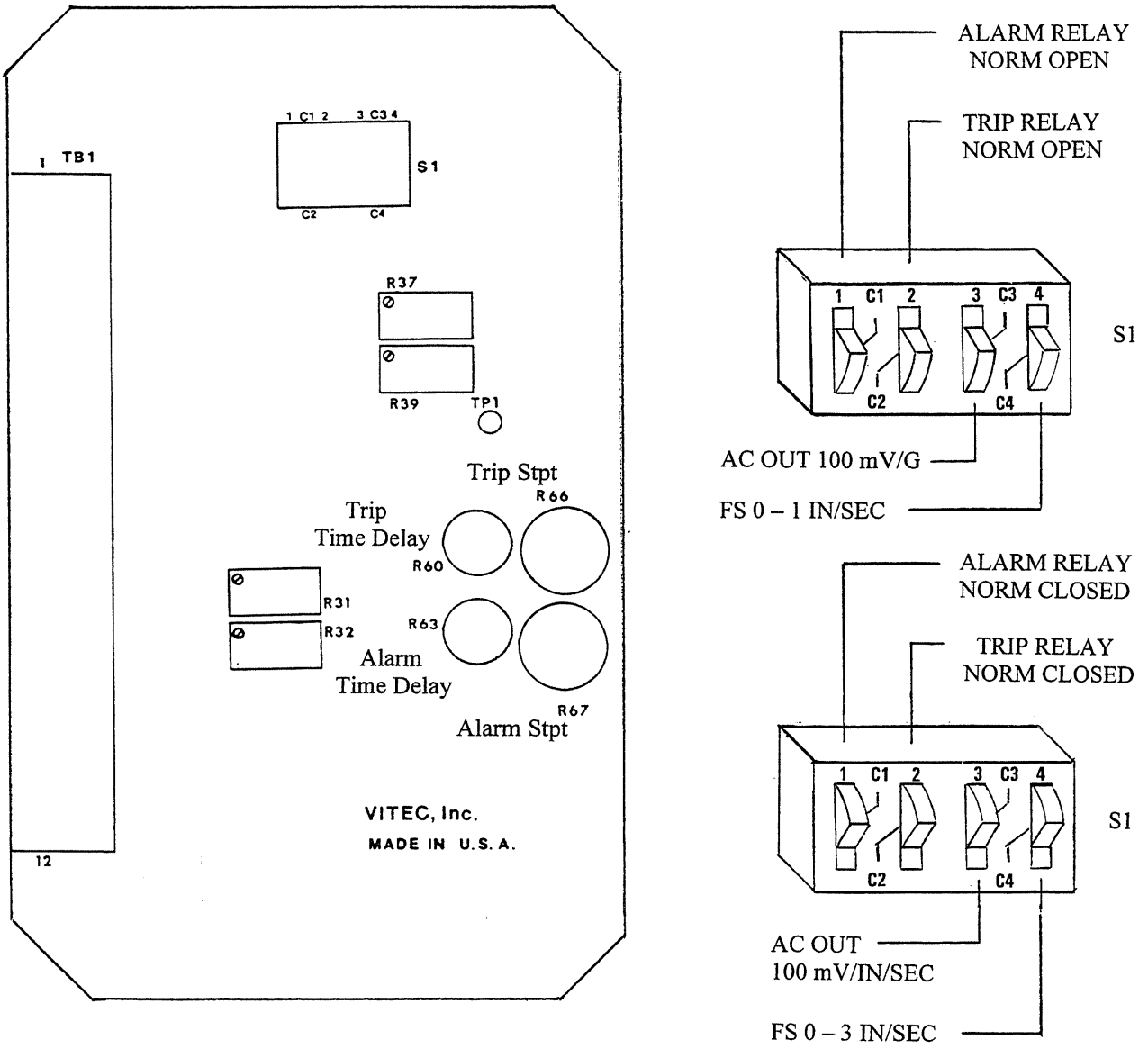
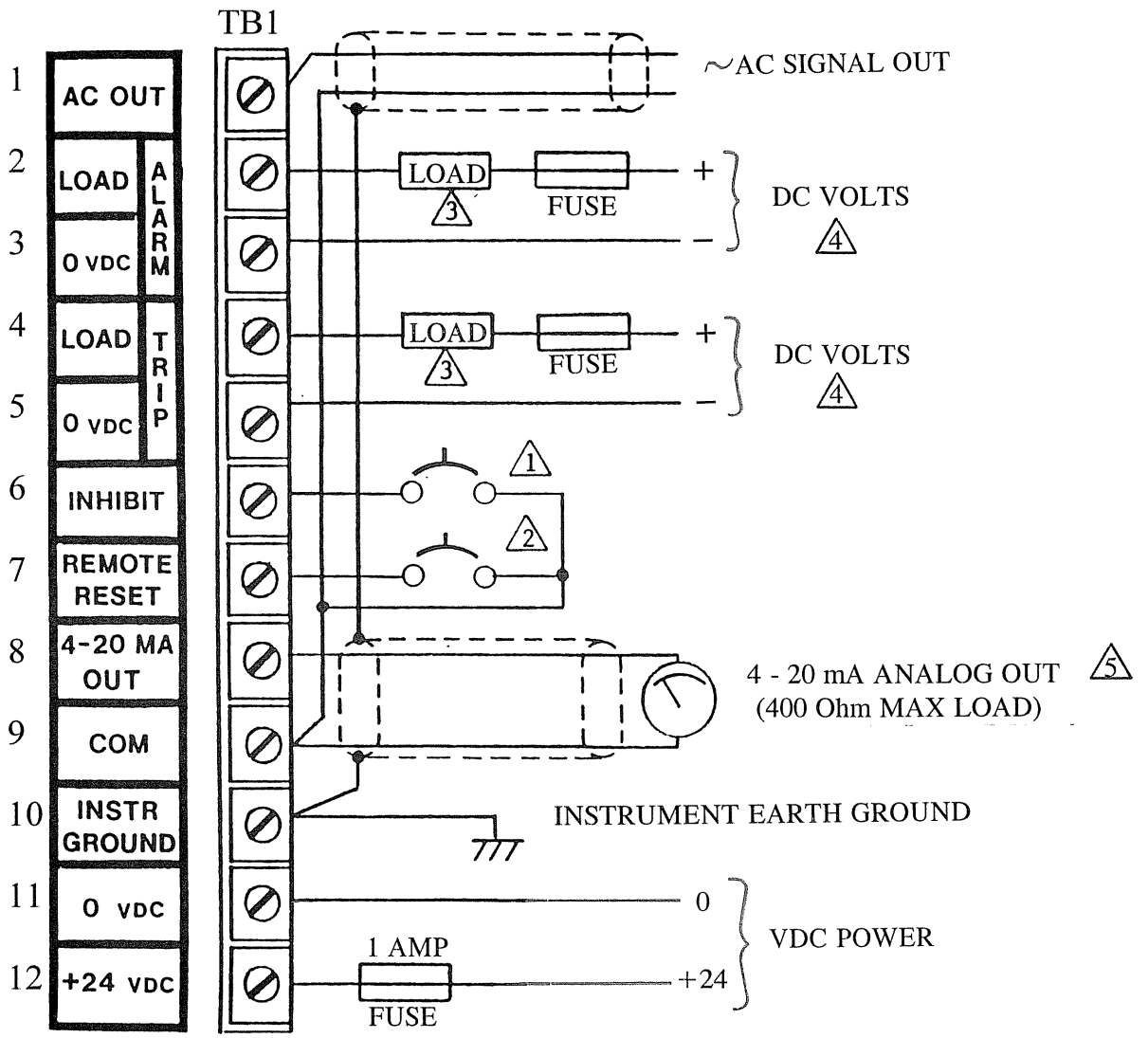


FIGURE 2 COMPONENT LOCATION AND IDENTIFICATION OVERVIEW



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 is 1 amp.
4. Maximum voltage is 24 VDC.
5. If 4 – 20 mA analog output is not used, install a100 Ω ¼ W resistor across TB1-8 and TB1-9.

FIGURE 3 WIRING DIAGRAM FOR 24 VDC 438A VIBRATION SWITCHES

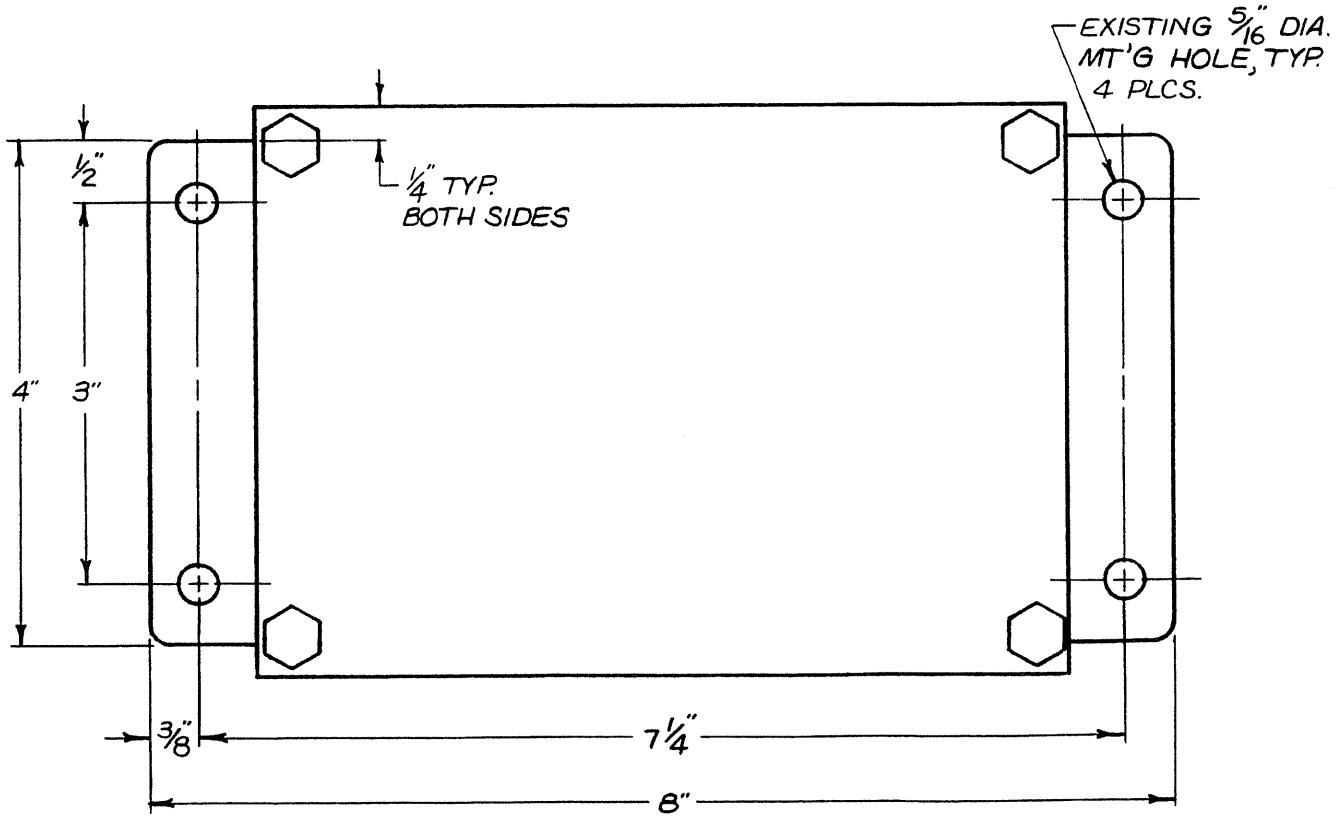
RECOMMENDED MOUNTING

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

2. Drill No. 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 switch 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 438A NEMA 4 VIBRATION SWITCH

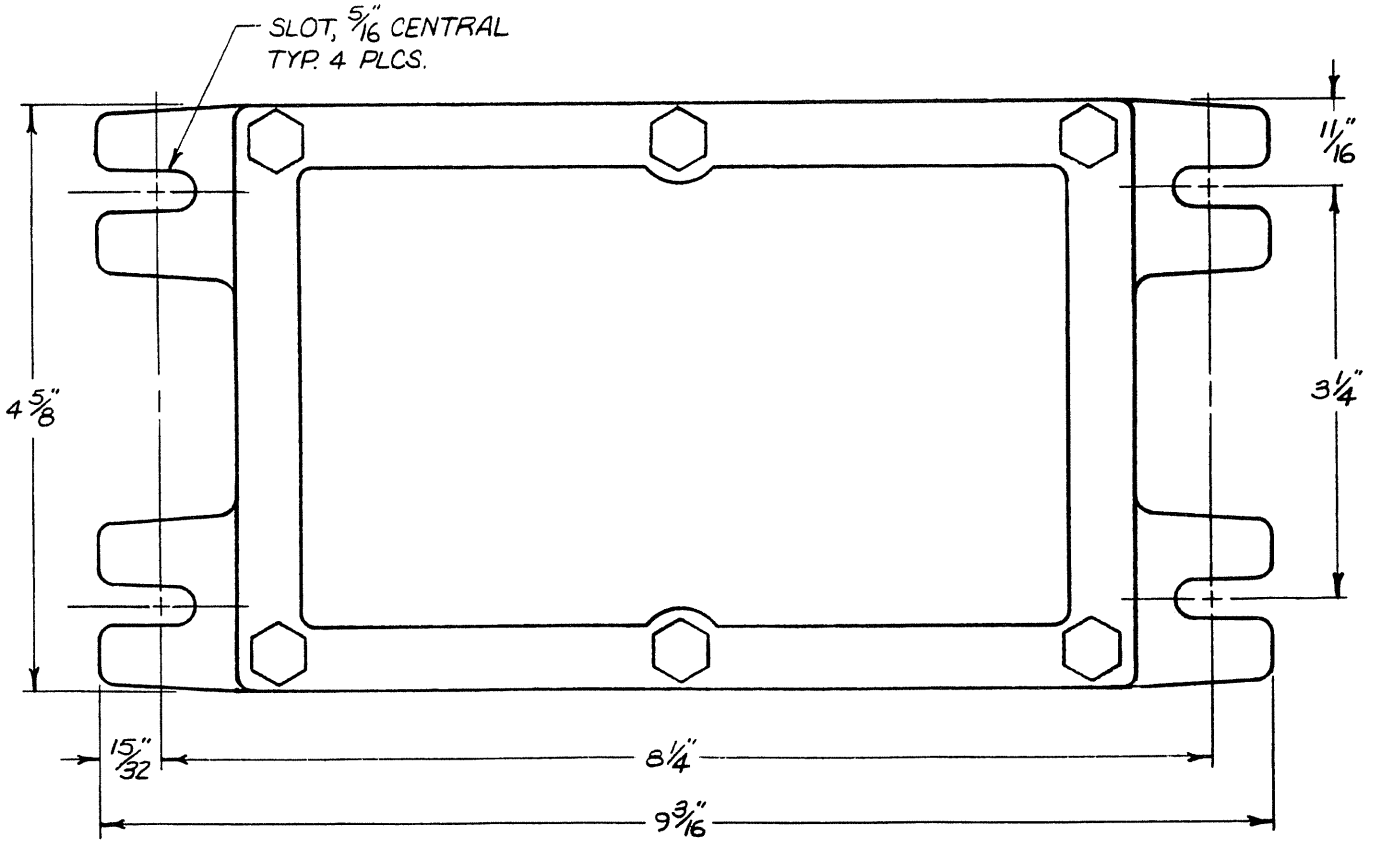
RECOMMENDED MOUNTING

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

2. Drill No. 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

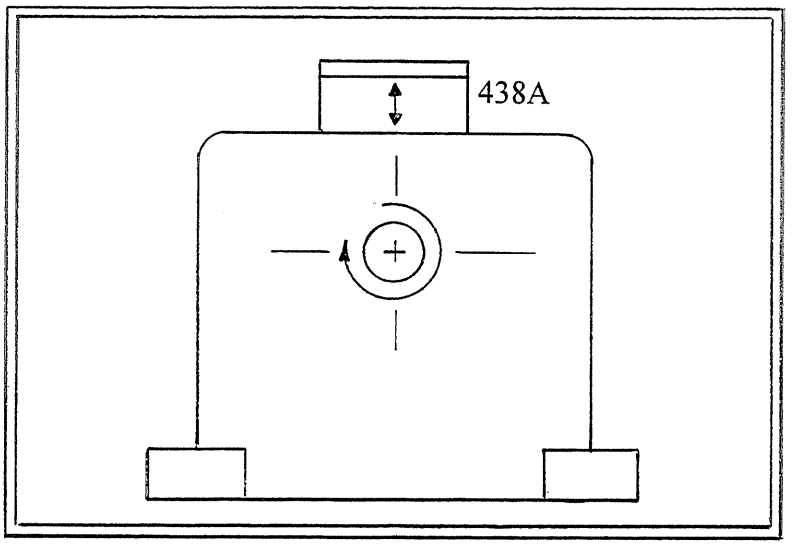
3. Securely fasten switch to mounting surface with four each of 1/4-20 x 9/16 inch HHCS, 1/4 inch flat washer, 1/4 inch split lockwasher.

4. Make all necessary electrical connections.

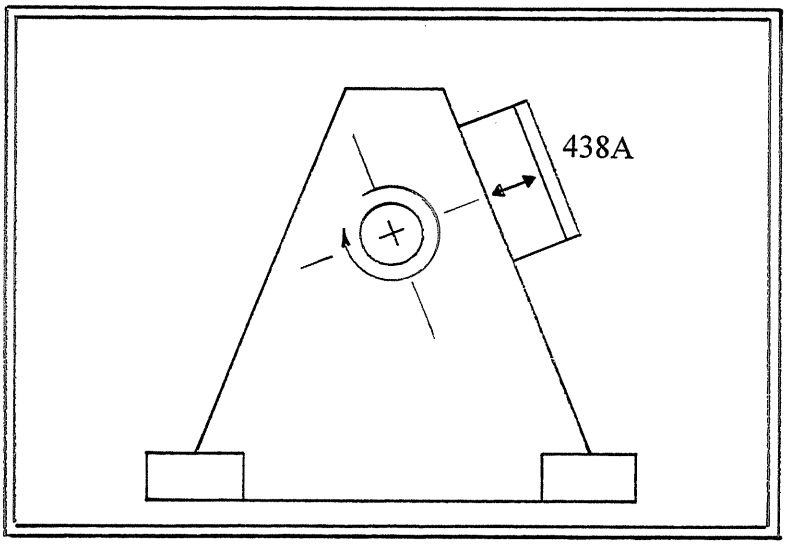


Overall Dimensions: 9 3/16" L x 4-5/8" W x 4-1/4" H

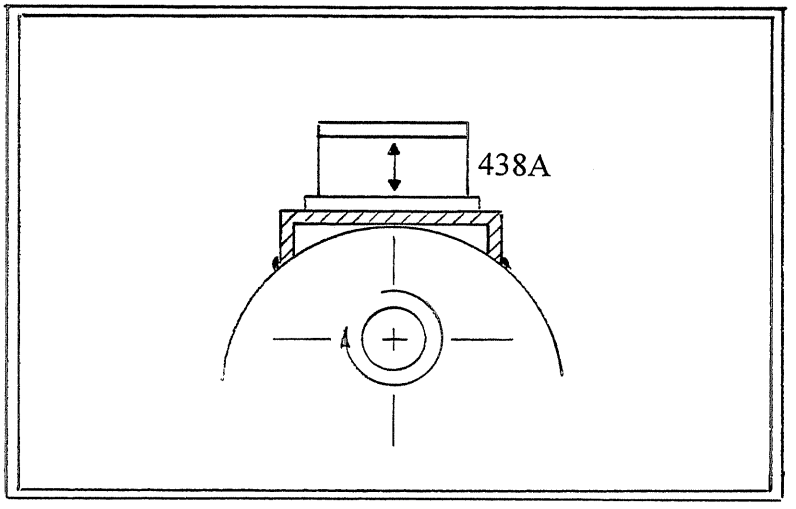
FIGURE 5 MOUNTING PROCEDURE FOR THE 438A EXPLOSION PROOF VIBRATION SWITCH



Flat Mounting, Vertical or Horizontal



Angled Surface Mounting



Small or Curved Surface. Mounting plate to be welded or bolted solidly to curved surface.

FIGURE 6 TYPICAL MECHANICAL MOUNTING LOCATIONS

438A Vibration Switches are shipped from the factory as follows:

Full Scale Range[(a)]	0-1 in/sec (S1 in position 4)
Input Power	24 VDC
Frequency Range	3 to 1,000 Hz
Setpoint Adjustability	5% to 100% of full scale
Time Delay Adjustability	0 to 20 seconds
Setpoint Accuracy	± 5% of full scale
Setpoint Repeatability	± 1% of full scale
Operating Temperature Range	-25 F to +160 F
Analog Output	4 - 20 mA proportional to full scale
AC Signal Output [(a)]	100 mV/g (S1 in position 3)
Solid State Relays [(a)]	Transistors designated as Alarm and Shutdown 1 Amp maximum load current at 24 VDC Normally open below setpoint Closes and latches above setpoint Alarm: S1 in Position 1 Shutdown: S1 in Position 2

a. Field Selectable Options:

1. Full Scale Range	0-3.0 in/sec	S1 in position opposite 4
2. AC Signal Output	100 mV/in/sec	S1 in position opposite 3
3. Solid -State Relays	Alarm normally closed	S1 in position opposite 1
	Shutdown normally closed	S1 in position opposite 2
	Non-latching relays	Install jumper between TB1-7 and TB1-9

FIGURE 7 438A VIBRATION SWITCH SPECIFICATIONS