OPERATOR'S MANUAL

480 VIBRATION SWITCH: 120 or 220 VAC

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CAUTION

Vitec Vibration Switches are shipped from the factory with the Input Power Switch set to **120 VAC**, 50/60 Hz.

For **220 VAC**, 50/60 Hz applications, the Input Power Switch must be changed prior to applying power to the unit or **damage will occur**.

Switches damaged by incorrect power applied to the unit, are not covered under Factory Warranty.

-Customer Service

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

LIST OF FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS

AC	Alternating Current
FS	Full Scale
mA	Milliamp
Min	Minimum
mV/g	Millivolt/g Force
PLC	Programmable Logic Controller
R59	Potentiometer No. 59 to adjust the time delay for the alarm
R60	Potentiometer No. 60 to adjust the alarm setpoint
R65	Potentiometer No. 65 to adjust the shutdown time delay
R70	Potentiometer No. 70 to adjust the shutdown setpoint
Sec	Second
S1	Switch to field adjust the state of the relays
S2	Switch to field adjust the voltage of the AC power in
TBl-5	Terminal Block Location 5
TBl-6	Terminal Block Location 6
TB1-8	Terminal Block Location 8
TBl-9	Terminal Block Location 9
UNC	Unified National Coarse
VAC	Voltage, Alternating Current

LIST OF ENGINEERING SYMBOLS AND ABBREVIATIONS

A	Acceleration: g's peak
ALM	Alarm
AMP	Ampere
ANA	Analog
COM	Common
CPM	Cyles Per Minute

List of Engineering Symbols and Abbreviations - cont'd

D	Displacement: Inches peak to peak
d	Displacement: Mils peak to peak
F	Fahrenheit
FS	Full Scale
g	Gravity
GND	Ground
Hz	Cycles per Second
In/Sec	Inches per Second
MAX	Maximum
m/V	Millivolt
mV/g	Millivolts per gravity
Ω	Ohm
N	Neutral
∅	Phase
REM	Remote
RPM	Revolutions per Minute
Shut	Shutdown
VDC	Voltage, Direct Current
V	Velocity: Inches per second peak
W	Watt

1.0 INTRODUCTION

The Vitec 480[(a)] Vibration Switch is an economical approach to accurate and reliable vibration protection for rotating machinery. The 480 is a sophisticated vibration monitoring system and, therefore, requires some care during installation.

Installation and operation of this unit will be simple and easy when these instructions are followed.

READ THIS MANUAL THOROUGHLY TO
AVOID ANY INSTALLATION-RELATED PROBLEMS

1.1 Receiving and Handling

This section covers acceptance, storage 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 to 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 480 means the 120 VAC version.

2.0 PRODUCT DESCRIPTION

The 480 measures the vibration level of a machine to which it is mounted. It provides two solid-state relay, or triac, 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 480 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 vibration conversion chart shown in Figure 1 on page 6.

The 480 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 connection 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 2 on page 7. 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 480 and cause false tripping.

2. The relays used in the alarm and shutdown circuits are electronic solid-state relays (triacs). A **minimum** load of at least 50 mA (approximately 7 watts) must be present at all times. The relays must be used to switch AC voltage only. Triacs cannot be tested for proper operation with a voltmeter. They must be connected such that they switch a load for testing purposes.

3. Make sure that the voltage input lines and the relay output lines are fused as noted on the wiring diagram shown in Figure 2 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.

5. Do not use oversized cable, as space inside the housing is limited. Trim the cable to its proper length, so that excessive cable is not packed into the housing. Route the cable so as to avoid physical contact with the sensing element attached to the base of the housing. Unless

this is done it may cause noise and false alarms or shutdowns. Make sure that the electrical connections are not putting excessive force on the terminal block or printed circuit board.

Reread this section to ensure the electrical installation conforms to the Figure 2 wiring diagram. Any damage to the 480 due to incorrect wiring is not covered under warranty.

4.0 MECHANICAL INSTALLATION

The 480 Vibration Switch is sensitive to vibration in one direction only. Make sure the unit is oriented as described in Section 7.1 on page 4.

If the required mounting location is not known, the vibration switch should generally be mounted to measure the RADIAL vibration, meaning axis of sensitivity perpendicular to the rotating shaft. Note that the mounting location shown is 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 Section 7.1 on page 4.

2. Water or moisture in the electronics will cause failure of the unit! Be sure to seal all threads with the thread sealing tape supplied with the unit. 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 setpoint adjustments are accessible after the unit is mounted. Someone may want to change the setpoints in the future.

5.0 SETPOINT ADJUSTMENT

The ALARM and SHUTDOWN setpoints are adjusted via two potentiometers located on the printed circuit card, see Figure 3 on page 8. For alarm setpoint adjust R60; for shutdown setpoint adjust R70. Do not attempt to adjust the small square potentiometers also located on the printed circuit board. These potentiometers are used for calibration of the unit.

The setpoint adjustments are calibrated for 0 to 100% to full scale selected, meaning of the selected range, 0.0 to 1.0 or 0.0 to 3.0 in/sec. 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 potentiometer beyond its stops. Both potentiometers are single-turn potentiometers.

A 0 to 20 second adjustable time delay is built into the alarm and shutdown circuits to help avoid false shutdowns. The unit is shipped with a zero second time delay, but can be adjusted in the field for up to 20 seconds. Turn the potentiometers provided clockwise to increase the time delay, adjust potentiometer R59 for alarm time delay and R65 for shutdown time delay, see Figure 3 on page 8.

6.0 RELAYS

Both the alarm and shutdown solid-state relays (triacs) 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 load current must be 50 mA minimum.

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 3 on page 8.

When shipped from the factory, the relays are LATCHING unless wired to be NON-LATCHING by 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 480. The 480 can be changed to a NON-LATCHING configuration in the field by installing a jumper between terminal block points TB1-5 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.

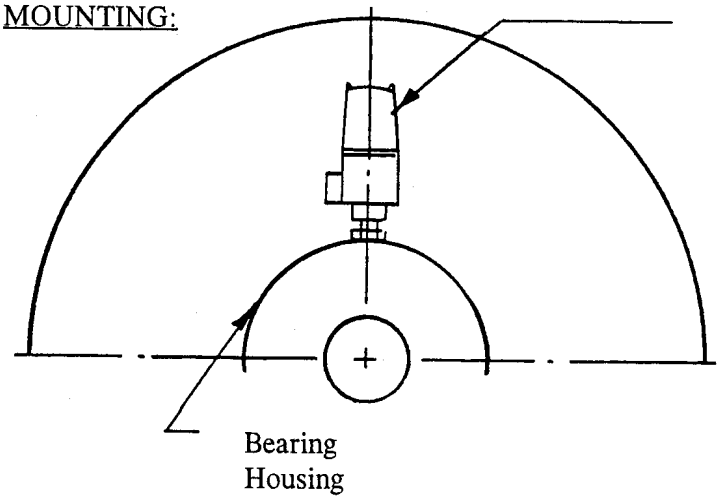
7.0 TYPICAL INSTALLATION

This section covers mounting and electrical installation and checkout.

7.1 Vibration Switch Mounting

Mount the 480 perpendicular to shaft for radial vibration applications and parallel to shaft for axial vibration applications. Unit may be mounted in any position perpendicular to the direction of vibration to be monitored.

MOUNTING:



Mount 480 on or as close as possible to the bearing housing. A 0.75 inch-10 UNC tapped hole, or a 0.75 inch spot welded nut, with a minimum 0.75 inch full thread depth required.

Run the jam nut, by hand, to the body of the 480, then thread the 480 into the tapped hole or welded nut by turning the body. When a minimum engagement of 3/4 inch has been attained, continue to turn until desired cable direction is reached, then tighten jam nut against bearing housing or welded nut.

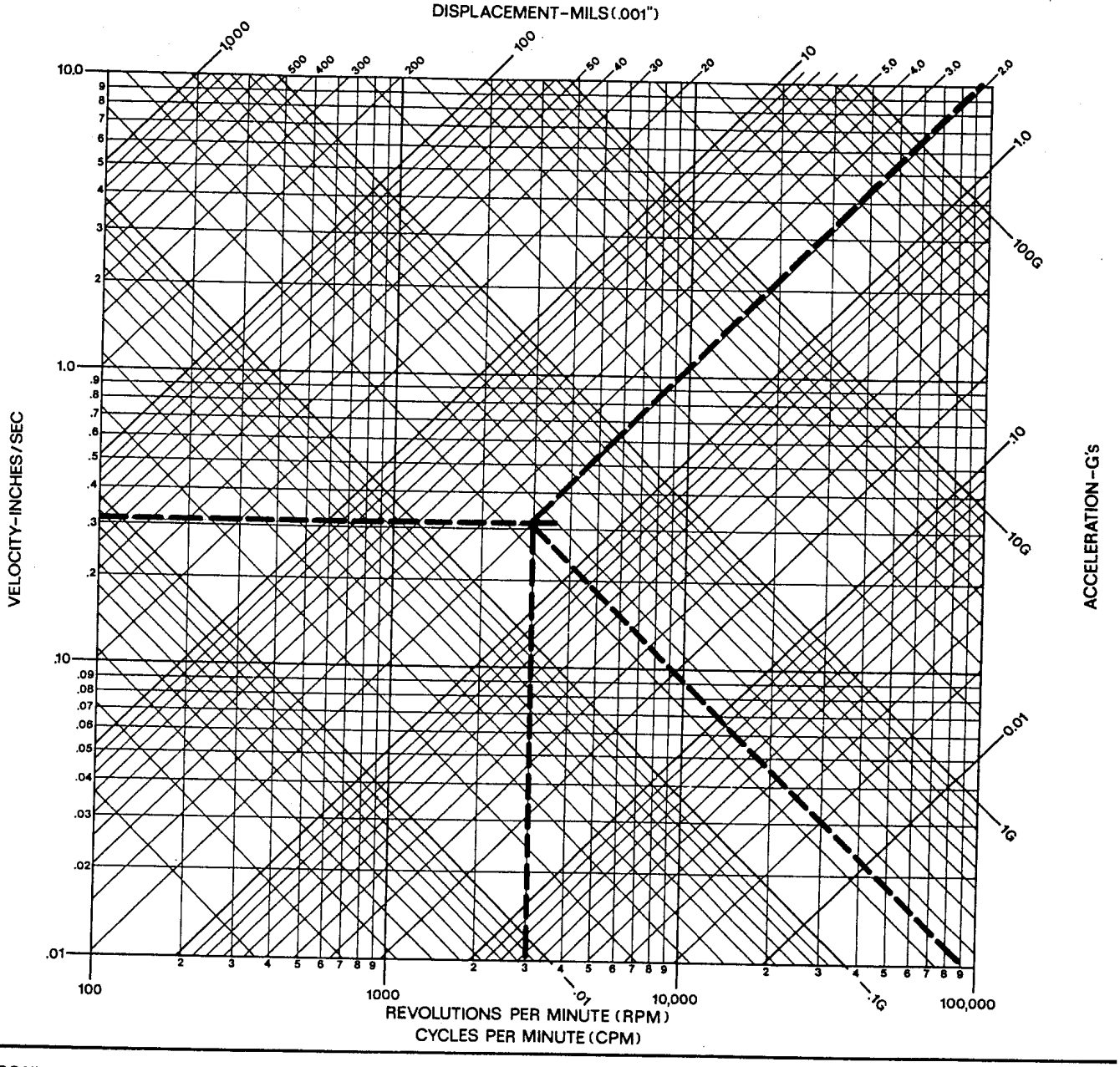
NOTE: DO NOT ATTEMPT TO TURN THE STUD RELATIVE TO THE BODY.

7.2 Electrical Installation and Checkout

Remove the top cover of the 480, make electrical connections as shown in Figure 2 on page 7. Adjust the setpoint potentiometer(s) for the desired alarm and/or shutdown point(s). Replace the cover, using pipe tape on the threads of body to insure a watertight seal of the unit. Tighten the cover securely.

8.0 SPECIFICATIONS

Figure 4 on page 9 presents the 480 Vibration Switch's specifications.



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

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

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

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

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

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

$A = 0.016 (V) (Hz)$

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

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

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

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

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

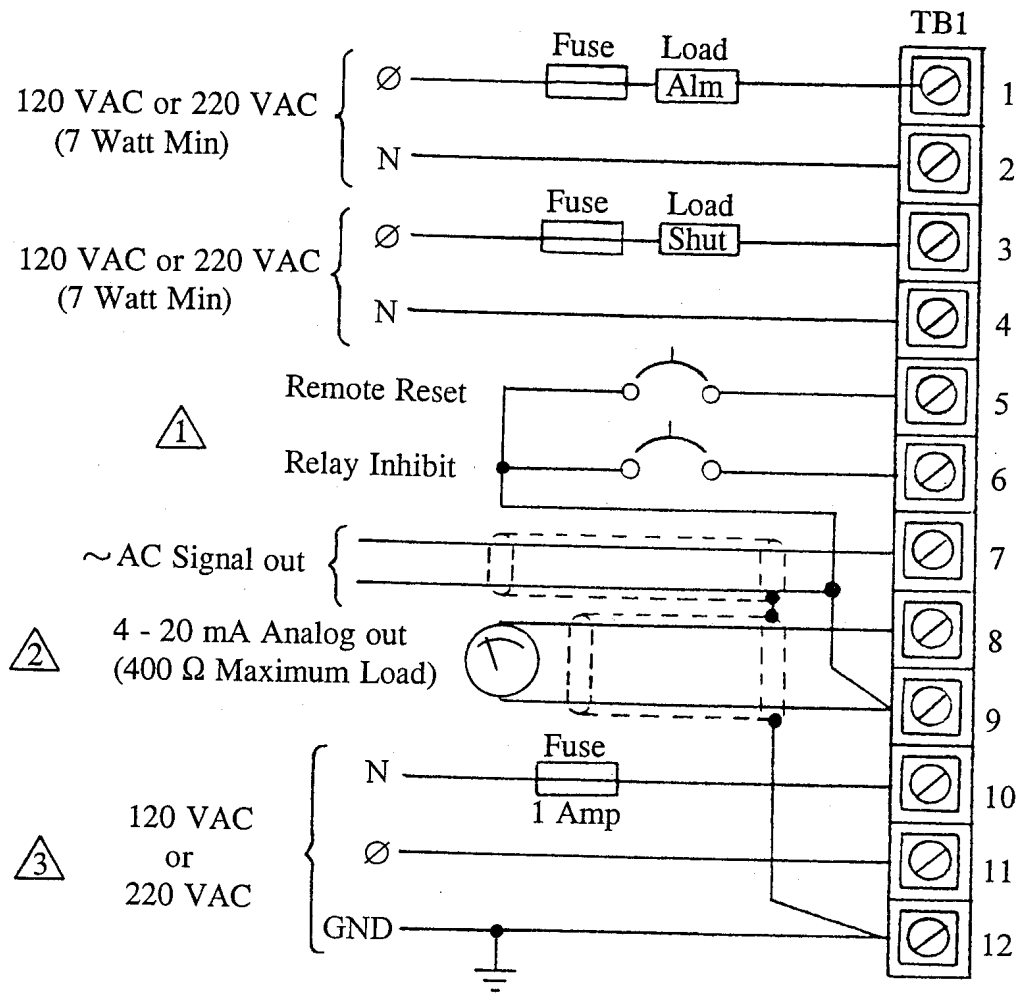
$A = (2.704)(10^{-4})(CPM)(V)$

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 DISPLACEMENT, VELOCITY, AND ACCELERATION CONVERSION CHART AND FORMULAS



Note:

1. Relays inhibited while momentary switch is activated. Latching relays reset when switch is activated. For non-latching relays, Customer to install jumper between TB1-5 (Rem. Reset) and TB1-9 (Com.)

2. If 4 - 20 mA analog output is not used, install a 100 Ω 1/4 W resistor across TB1-8 and TB1-9.

3. Be sure Switch S2 is set to proper voltage prior to connecting power to unit.

FIGURE 2 WIRING OF THE 480 VIBRATION SWITCH

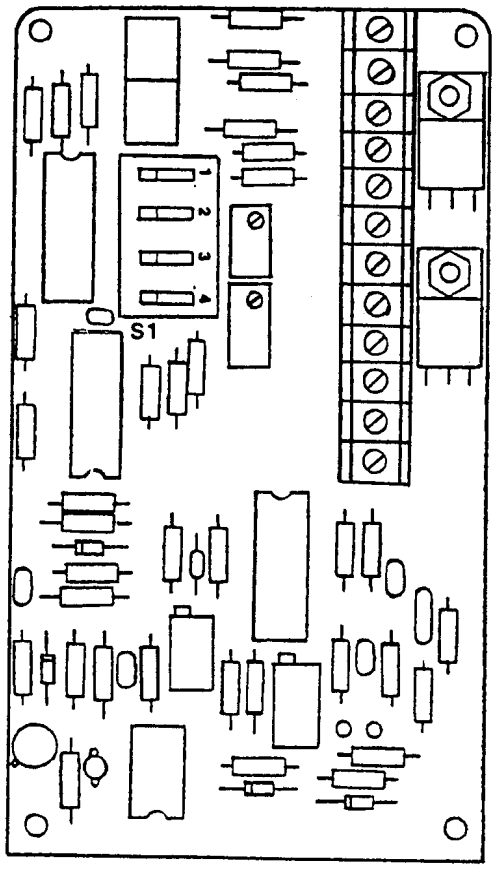


FIG. 1

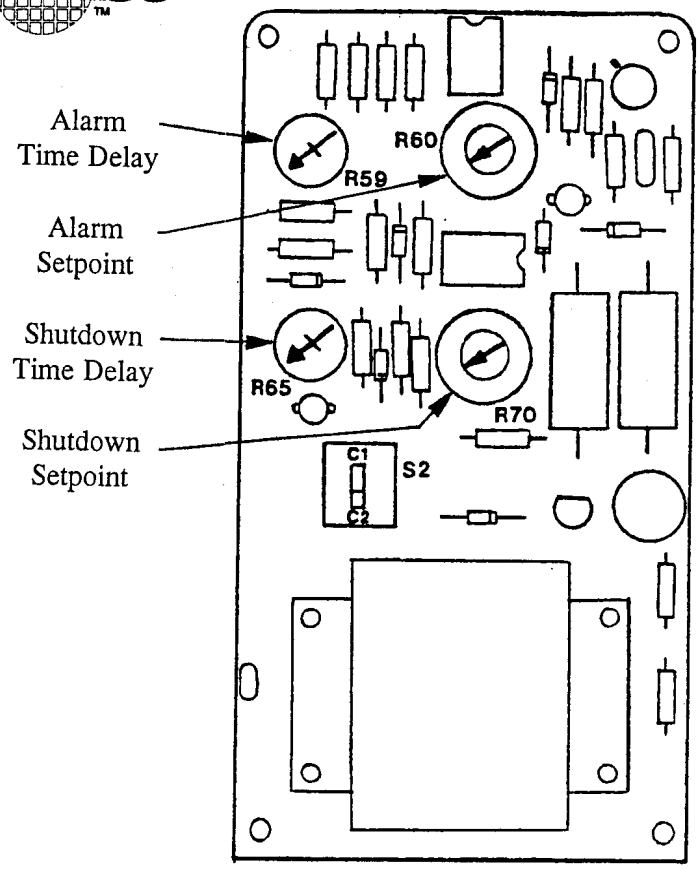
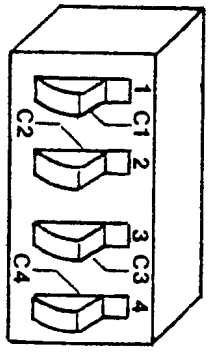


FIG. 2

S1

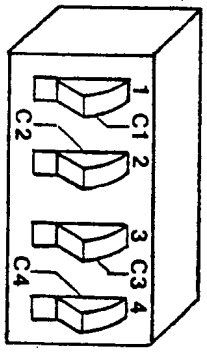


Alarm Relay
Normally Open

Shutdown Relay
Normally Open

AC Output 100 mV/G

FS 0-1 in/sec



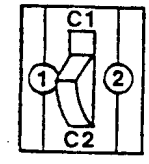
Alarm Relay
Normally Closed

Shutdown Relay
Normally Closed

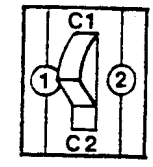
AC Output 100 mV/in/sec

FS 0-3 in/sec

S2



120 VAC



220 VAC

FIGURE 3 FIELD ADJUSTABLE PROVISIONS OF THE 480

480 Vibration Switches are shipped from the factory as follows:

Full Scale Range[(a)]	0-1.0 in/sec (S1 in position 4)
Input Power[(a)]	120 VAC, 50/60 Hz (S2 in position C1)
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)]	Triacs designated as Alarm and Shutdown 1 A maximum load current at 120/220 VAC 50 mA minimum load current 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. Input Power	220 VAC, 50/60 Hz	S2 in position C2
3. AC Signal Output	100 mV/in/sec	S1 in position opposite 3
4. 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 TB1-5 and TB1-9

FIGURE 4 480 VIBRATION SWITCH SPECIFICATIONS