

# Installation And Operation Instructions

**Electronic Vibraswitch  
Models 375A and 376A**

**Robertshaw**

**Industrial Products Division**

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**Table Of Contents**

**Section I Description** ..... 2  
 1.1 General ..... 2  
 1.2 Model Identification ..... 2  
**Section II Specifications** ..... 2  
 2.1 Environmental Conditions ..... 2  
 2.2 Electrical Conditions ..... 2  
 2.3 Performance ..... 3  
**Section III Installation** ..... 3  
 3.1 Location ..... 4  
 3.2 Vibraswitch Mounting ..... 4  
 3.3 Electrical Connections ..... 4  
 3.4 Solid-State Switch - Models ..... 5  
     375A/376A-A2-XX and 375A/376A-A3-XX  
 3.5 Cover Bolts - Model 375A ..... 5  
**Section IV Operation** ..... 9  
 4.1 General ..... 9  
 4.2 Resetting the Vibraswitch ..... 9  
 4.3 Adjusting Vibraswitch Setpoint ..... 9

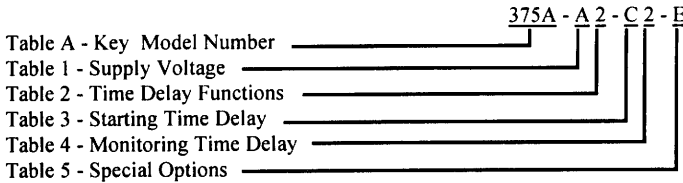
**Section I - Description**

**1.1 General**

The Electronic Vibraswitch, Models 375A and 376A, is an acceleration sensitive vibration instrument containing electronic circuitry to provide maximum protection to rotating and reciprocating machinery from damages resulting from mechanical malfunctions.

**1.2 Model Identification**

Specify and order instrument models in accordance with the description and variations listed in each table. Dashes are used in model number only in those spaces as indicated in the example.



**Table A - Key Model Number**

Key No.	Description
375A	Vibraswitch detector incorporating electronic starting and/or monitoring time delay functions. Explosion-proof enclosure is FM approved for Class I, Division 1, Groups C & D, and Class II, Division 1, Groups E, F and G hazardous locations. Range 0-4.5 G, 10 to 300 Hz.
376A	Same as Model 375A, except designed for non-hazardous locations. Watertight and general purpose enclosure meets NEMA 3, 4 and 5 specifications.

**Table 1 - Supply Voltage**

Designation	Description
A	120 VAC $\pm$ 10%, 50/60 Hz

**Table 2 - Time Delay Functions**

Designation	Description
1	Starting time delay function only. Output: Mechanical switch contacts SPDT (See SPECIFICATIONS for rating)
2	Monitoring time delay function only. Output: Solid-state switch (See SPECIFICATIONS for rating)
3	Combination starting and monitoring time delay function. Output: Solid-state switch (See SPECIFICATIONS for ratings)

**Table 3 - Starting Time Delay**

Designation	Description
A	None - always used with Designation 2 from Table 2.
C	15 seconds
D	30 seconds
E	60 seconds
F	90 seconds

**Table 4 - Monitoring Time Delay**

Designation	Description
0	None - always used with Designation 1 from Table 2.
2	2 seconds
3	5 seconds
4	10 seconds

**Table 5 - Special Options**

Designation	Description
E	Base painted with gray epoxy paint (376A). Encl. Painted with gray epoxy paint (375A).

**SECTION II - SPECIFICATIONS**

**2.1 Environmental**

Ambient Temperature Limits ..... -20°F to +140°F  
 Operating Humidity Range ..... 0% to 95% RH @ 100°F  
 Vibration Measurement Range ..... 0 to 4.5g from 10 to 300 Hz (18,000 rpm)  
 Shock ..... 75g for 11 millisecond maximum.

**Enclosure Classification:**

Model 375A - Explosion-proof, Class I, Division 1, Groups C & D and Class II, Division 1, Groups E, F and G. FM approved.  
 Model 376A - Watertight, meets NEMA 3, 4 and 5 specifications.

**2.2 Electrical**

Input Voltage ..... 120 VAC  $\pm$  10%, 50/60 Hz.  
 Input Power ..... 15W maximum  
 Output signal:

Start time delay only: Model 375A/376A-A1-XX  
 Form - SPDT  
 Contact Rating - 5A @ 120 VAC, 50/60 HZ  
                   5A @ 240 VAC, 50/60 HZ  
                   2.5A @ 440 VAC, 50/60 HZ  
                   5A @ 12 VDC non-inductive  
                   2A @ 48 VDC non-inductive  
                   0.5A @ 120 VDC non-inductive

**Monitor Time Delay or Start and Monitor Time Delay:**

Models 375A/376A-A2-XX or 375A/376A-A3-XX  
 Form - N.C. or N.O. solid state switch, Triac Switch Rating - 120 VAC only @ 2 amperes maximum resistive load. Minimum Load Current 50 ma.

2.3 Performance

Accuracy . . . . . ± 5% of full range from  
 10 to 300Hz (18,000 rpm)  
 Start Time Delay . . . . . 15, 30, 60 and 90 seconds

Monitor Time Delay . . . . . 2, 5 and 10 seconds  
 Accuracy of Time Delay . . . . . ± 30%

Section III - Installation

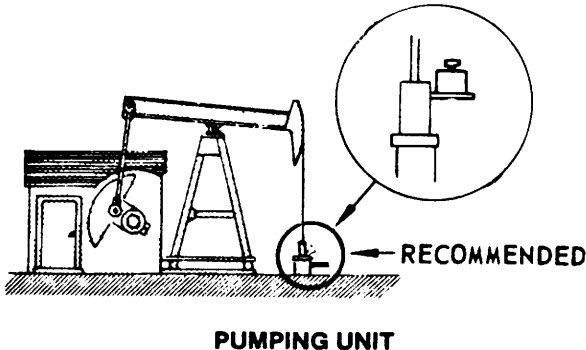
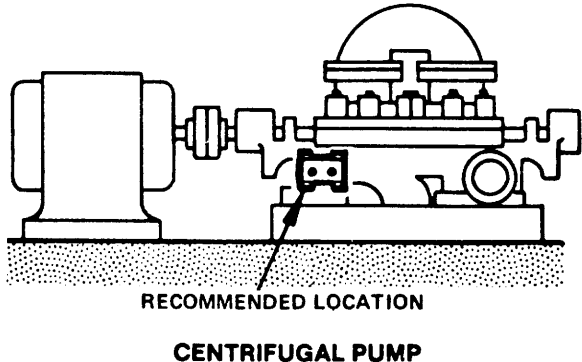
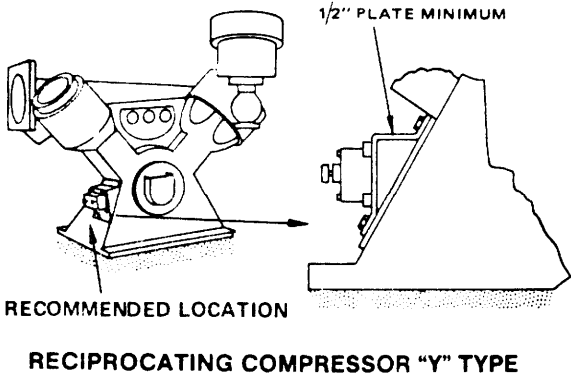
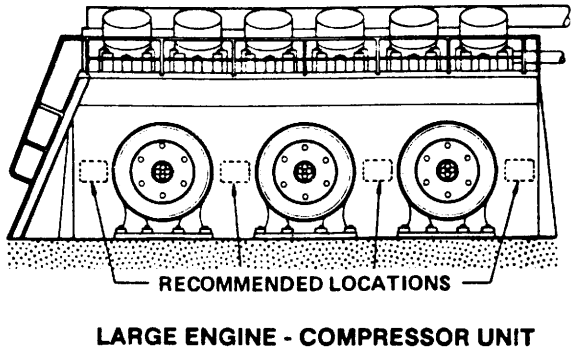
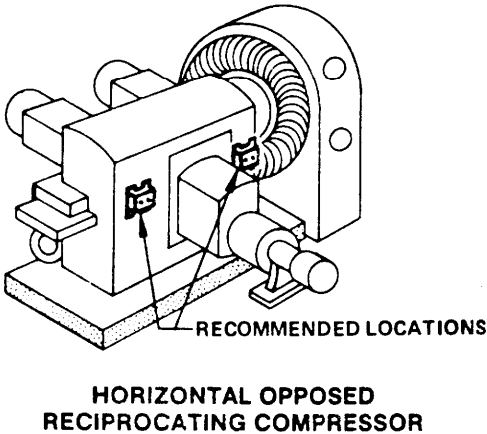
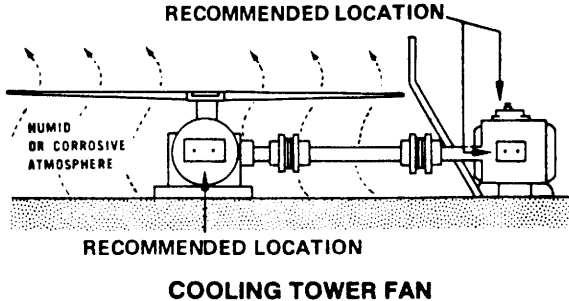
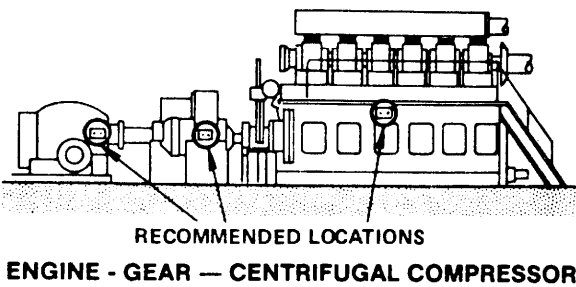


Figure 1 Methods of Mounting the Vibraswitch

**3.1 Location**

The Model 375A Electronic Vibraswitch may be located in any hazardous or nonhazardous area. The Model 376A may be located only in nonhazardous areas either outdoors or indoors. The housing meets NEMA Type 3 (weather-proof), Type 4 (watertight), and Type 5 (dust-tight) construction.

**3.2 Vibraswitch Mounting**

Figures 1, 2 and 3 show the methods of mounting and the mounting dimensions for the Electronic Vibraswitch, Models 375A and 376A.

The vibration sensitive axis of the Vibraswitch is perpendicular to its mounting base. Therefore, the Vibraswitch must be mounted in a plane that will detect the vibratory motion for which protection is desired. The Vibraswitch may be mounted at any location, along the length of machines containing rotating shafts, that is horizontal and parallel to the base of the machine; the preferable location being in line with the rotating shaft. Do not mount the Vibraswitch perpendicular to the end of rotating shafts unless the end-play or end-thrust measurement is desired. Normally, bent shafts, unbalanced on the rotating mass of the shaft, worn bearings, and other anomalies are detected near the bearing housings and at right angles to the shaft.

The Vibraswitch may be mounted in any position between the side (vertical) or the top (horizontal) of bearings or machine housings. It should be noted that when mounting Vibraswitches on top (horizontal position) of equipment the vibration measurement range is as stated in the Specification section. However when the Vibraswitch is mounted on a side position (90° from the horizontal), 1 g is subtracted from the measurement range.

If a mounting bracket assembly is used to mount the Vibraswitch due to an irregular mounting surface, it must be constructed of steel having sufficient thickness and properly reinforced so that mechanical resonances are not introduced; usually 1/2" steel plate is satisfactory if the deminsions of the bracket are minimum. It is extremely important that all four

corners of the Vibraswitch, as well as the mounting assembly, be rigidly secured to the machine. Exact location is not critical as the adjustment procedure of the Vibraswitch automatically accounts for the normal vibration at that location.

The Vibraswitch, properly adjusted, trips on a relative increase in vibration.

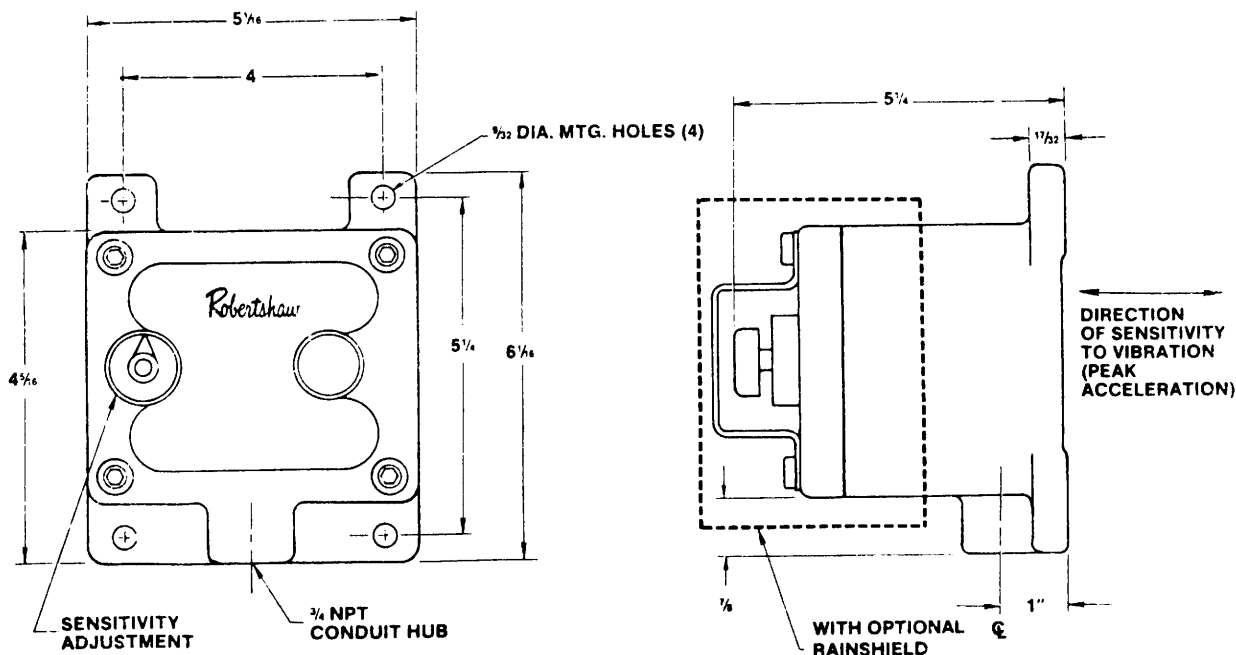
When installing the Vibraswitch on existing equipment and several convenient mounting positions are available, it is advisable to check the existing vibration level at each possible position before permanently mounting. The Vibraswitch can be used to measure existing vibration by holding or clamping it against the running machine and determine the trip point as described in paragraph 4.3 in this manual. Should normal vibration exceed the range of the Vibraswitch, it is recommended that consideration be given to a Robertshaw Model 566 Continuous Monitor Unit.

**3.3 Electrical Connections**

Figures 2 and 3 show the external connections for the various models of the Model 375A/376A Vibraswitch. The Vibraswitches are equipped with a threaded hub for 3/4" conduit. When the vibration amplitude is large (i.e., greater than 5 mils) it is good practice to use short length of flexible conduit to serve as an isolator between the rigid conduit and the Vibraswitch. Wiring into the unit should be done with No. 18 stranded wire, although No. 14 can be used where necessary. However, where necessary to use a heavier wire, a junction box near the Vibraswitch should be used.

Figures 5, 6 and 7 show some typical applications of the various models of the Vibraswitch. In Figures 6 and 7, the circuits shown use relay (R) to provide the contacts for the load. When the Vibraswitch "trips," relay (R) will open to shut down the load.

**NOTE:**  
In figure 6 the jumper plug is connected to the N.C. position.



**Figure 2a - Mounting Dimensions for the Vibraswitch, Model 375A**

### 3.4 Solid State Switch

#### Models 375A/376A-A2-XX and 375A/376A-A3-XX

These models use a solid-state switch to provide the output contact functions. The switch may be either "Normally Open" (N.O.) or "Normally Closed" (N.C.), depending upon the position of the jumper plug on the printed circuit assembly. The solid-state switch is set at the N.O. position when the units are shipped from the factory. The units may be changed to the N.C. position as shown in Figure 4. To obtain "contact closure" of the solid state switch either the N.O. or N.C. positions, power must be applied to terminals 1 and 2 of the Vibraswitch.

### 3.5 Cover Bolts

#### Model 375A

The cover bolts on the explosion-proof model should be tightened to 75-100 inch lbs. Do not add setpoint guard until final adjustments are made.

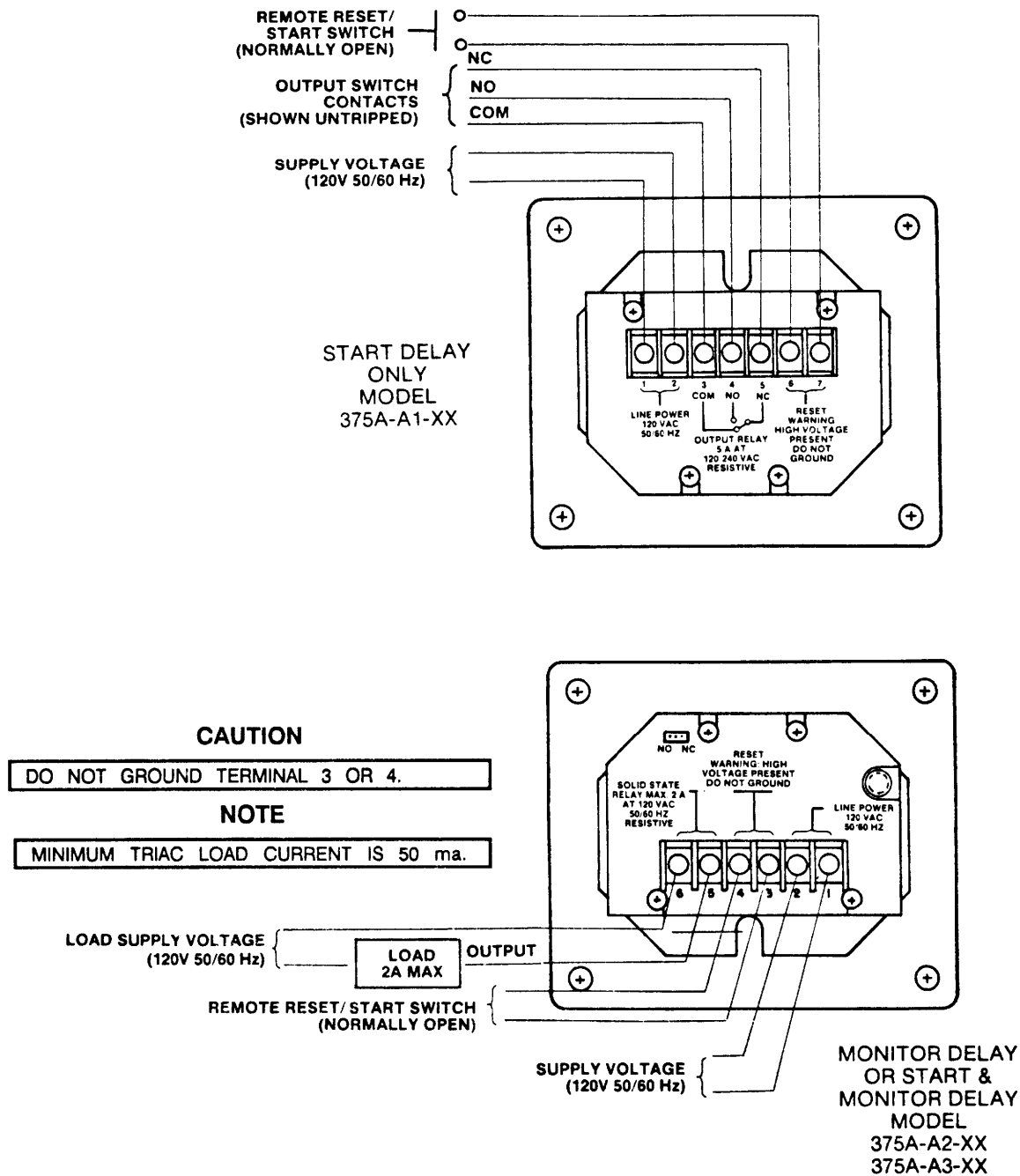
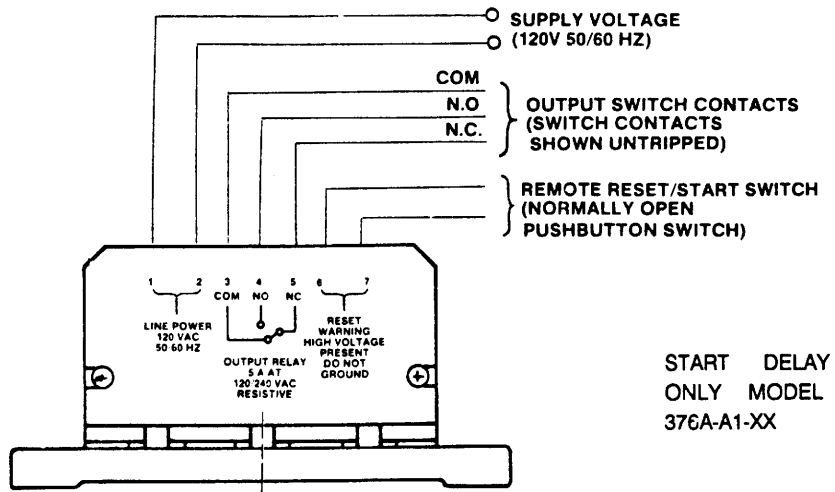
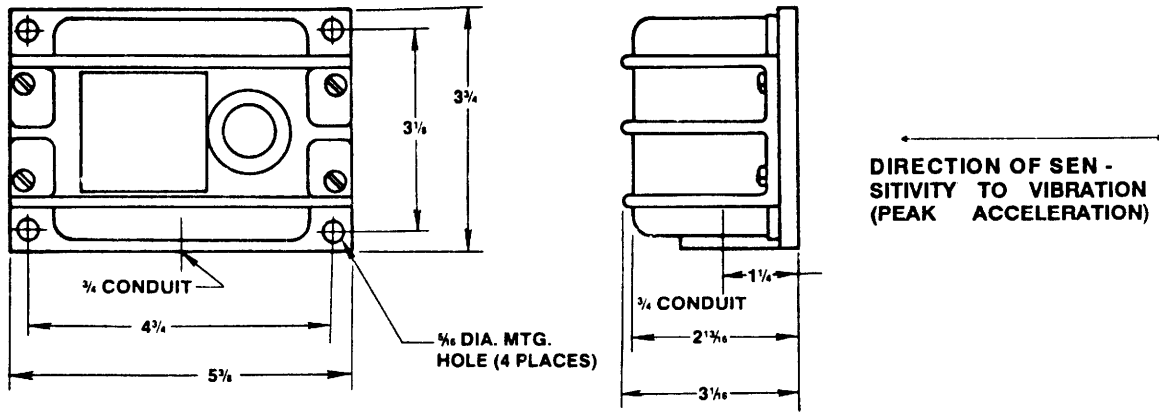
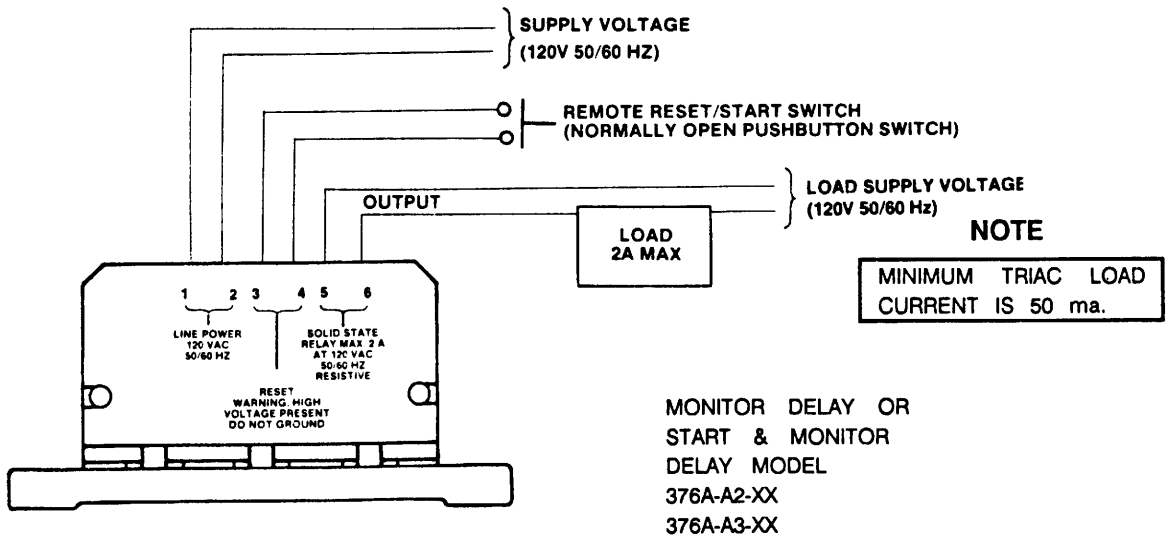


Figure 2b - External Wiring for the Vibraswitch, Model 375A



START DELAY  
ONLY MODEL  
376A-A1-XX

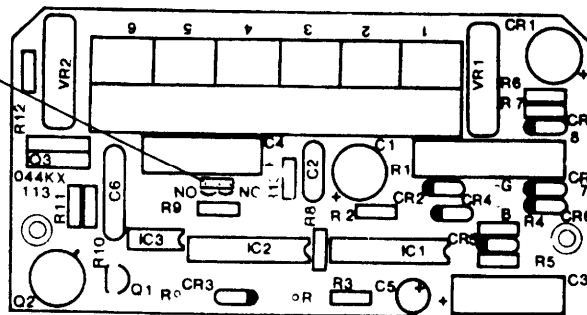
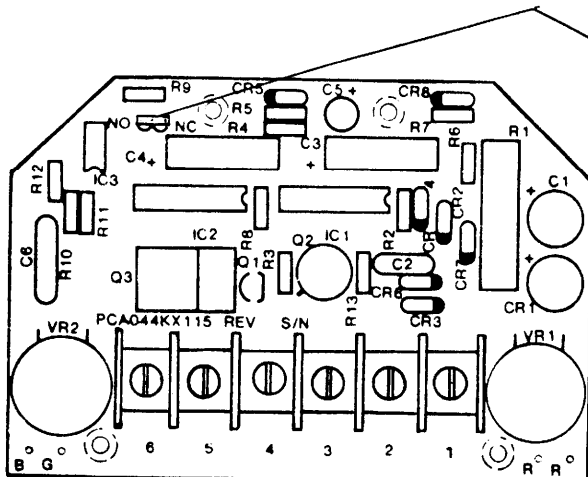


**NOTE**  
MINIMUM TRIAC LOAD  
CURRENT IS 50 ma.

MONITOR DELAY OR  
START & MONITOR  
DELAY MODEL  
376A-A2-XX  
376A-A3-XX

Figure 3 Mounting Dimensions and External Wiring for the Vibraswitch, Model 376A

For "Normally Closed" condition change jumper plug from "NO" to "NC"



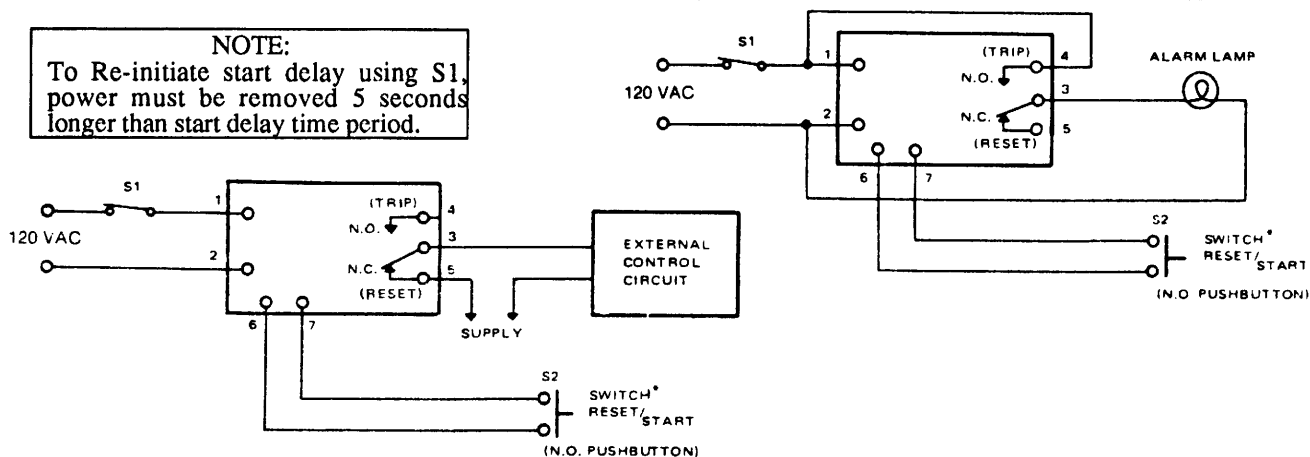
**NOTE**

On the 376A it is necessary to remove the board cover to move the jumper plug.

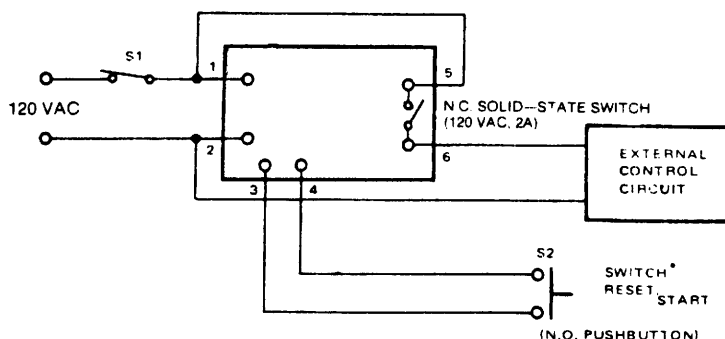
**CAUTION**

REMOVE ALL POWER AND LOAD CONNECTIONS PRIOR TO CHANGING JUMPER PLUG POSITION.

**Figure 4 - "Monitor" or "Monitor with Start Delay" Printed Circuit Assembly**



**Vibraswitch with Start Delay (Model 375/376A-A1-XX)**



**Vibraswitch with Monitor Delay or Start and Monitor Delay (Models 375A/376A-A2-XX or 375A/376A-A3-XX)**

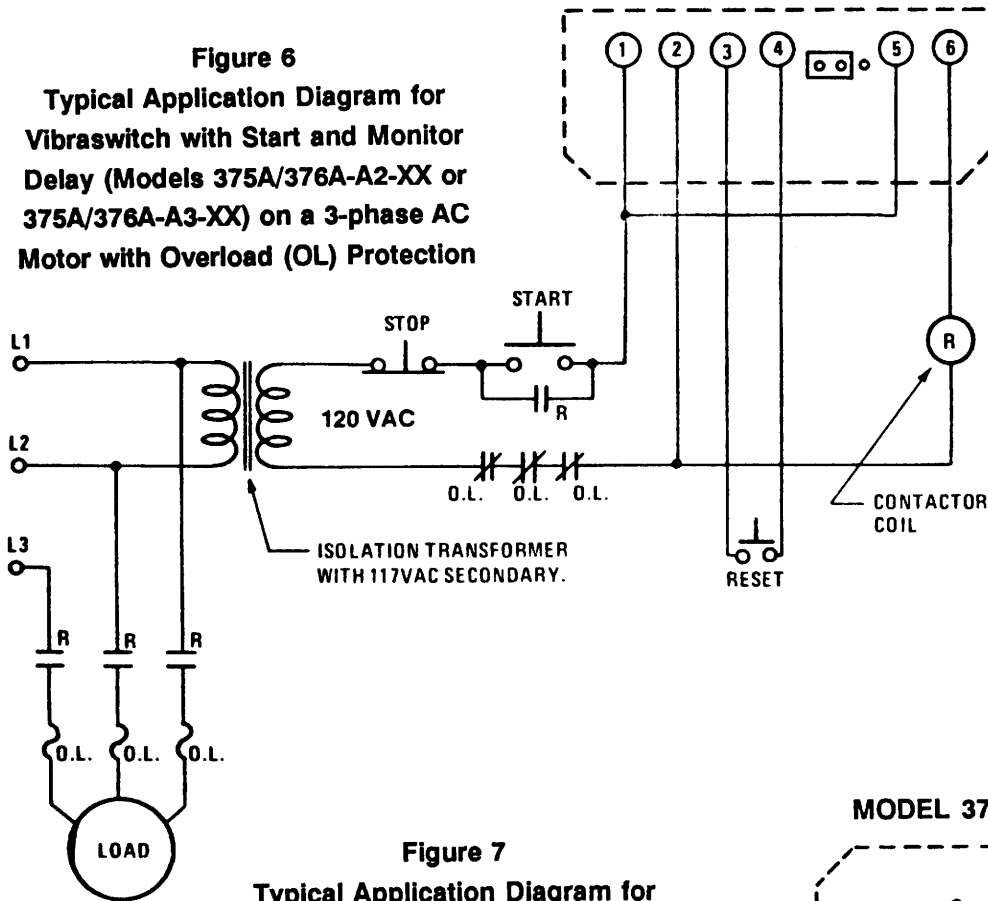
\* Reset may be accomplished by either momentarily opening line switch (S1) or momentarily closing switch (S2). For models with start delay only: When using S1 for reset, power must be removed for at least 5 seconds longer than the start delay time period in order to re-initiate the start delay. Neither S1 or S2 are supplied with unit.

**Figure 5 - Typical Application Diagrams for Model 375A/376A Vibraswitch**

Model 375A/376A-A2-XX or 375A/376A-A3-XX

Figure 6

Typical Application Diagram for Vibraswitch with Start and Monitor Delay (Models 375A/376A-A2-XX or 375A/376A-A3-XX) on a 3-phase AC Motor with Overload (OL) Protection

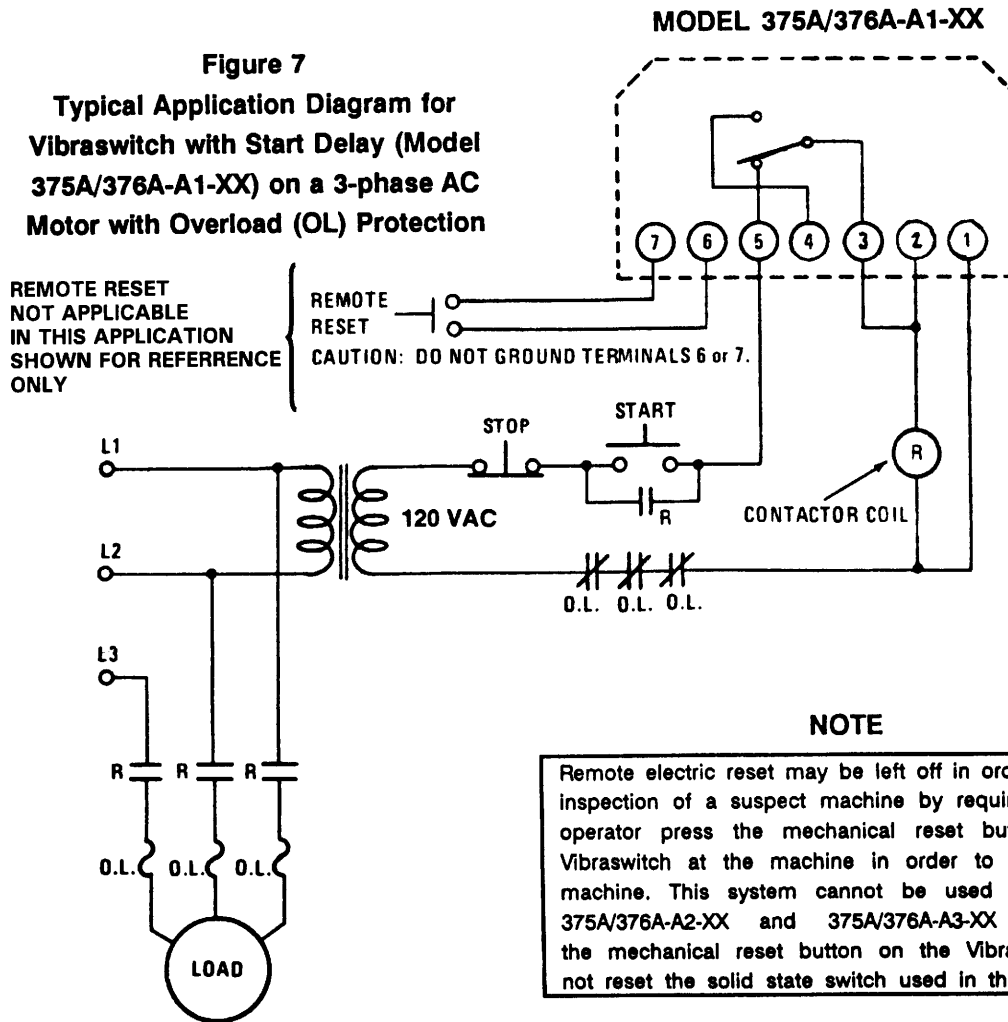


NOTE

Minimum triac load current is 50 ma.

Figure 7

Typical Application Diagram for Vibraswitch with Start Delay (Model 375A/376A-A1-XX) on a 3-phase AC Motor with Overload (OL) Protection



NOTE

Remote electric reset may be left off in order to assure inspection of a suspect machine by requiring that the operator press the mechanical reset button on the Vibraswitch at the machine in order to restart to machine. This system cannot be used with Models 375A/376A-A2-XX and 375A/376A-A3-XX because the mechanical reset button on the Vibraswitch does not reset the solid state switch used in these models.



## Section IV -Operation

### 4.1 General

The Vibraswitch, Model 375A and 376A, is designed to protect rotating reciprocating or similar equipment against serious damage from malfunctions that can be detected as an increase in vibration. These units have "built in" control system options which include Start Delay, Monitor Delay or a combination of both Start and Monitor Delay. All models include provisions for remote electric reset.

"Start Delay only" models hold the Vibraswitch armature in the non-tripped position for a preset length of time after the application of supply voltage to the unit to prevent the Vibraswitch from tripping out during machine start-up. After start-up, the (Vibraswitch) functions normally with control or alarm functions provided by utilizing the mechanical switch contacts in the Vibraswitch.

"Monitor Delay only" models prevent nuisance shutdowns or tripping of the Vibraswitch during normal transient conditions. Under continuing excessive vibration, the Vibraswitch trips, is immediately reset, trips out again and is reset, and continues until the time period has elapsed, after which the Vibraswitch remains tripped out and a solid state AC switch is provided for alarm or shutdown purposes.

The "Start and Monitor Delay" models provide the control functions of both the Start Delay and Monitor Delay using a solid state AC switch output from the Vibraswitch for alarm or shutdown control purposes.

### 4.2 Resetting the Vibraswitch

The Vibraswitch may be reset by either interrupting power to the unit or momentarily actuating an external reset switch. For models with start delay only, power must be interrupted at least 5 seconds longer than the start delay time period in order to re-initiate the start delay.

The mechanical "Reset" pushbutton on the Vibraswitch will only reset the mechanical portion of the Vibraswitch and will not re-initiate the Start and/or Monitor Delay function or reset the solid-state output switch. The mechanical "Reset" is only used when adjusting the setpoint of the Vibraswitch or when the Start Delay only Vibraswitch is used in a system as shown in Figure 7.

### 4.3 Adjusting Vibraswitch Setpoint

The operating setpoint for the Vibraswitch varies with the type of machine and the location on the machine. The setpoint adjustments suggested in this instruction manual are for machines which are functioning in a "good" or "normal" condition.

For example, assume that a relatively new machine is operating as "smooth" or "good" regarding vibration and the Vibraswitch measures this acceleration level to be 0.25 g above its static condition (zero). Experience suggests that a reasonable level for alarm conditions would be a minimum of twice this value or 0.5 g. It must be acknowledged that such a definition of upper vibration limits (alarm condition) on the machine may not have adequately defined the upper tolerance limit of the machine before major repairs or excessive machine damage occurs. It does, however, define a limit which, in our experience will

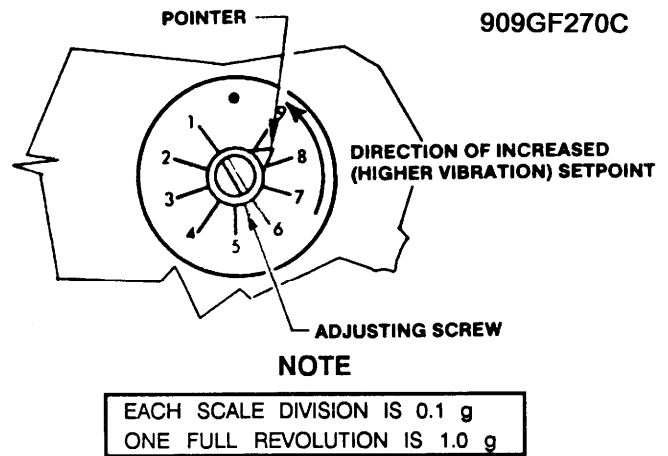


Figure 8 Setpoint Adjustment, Model 375A

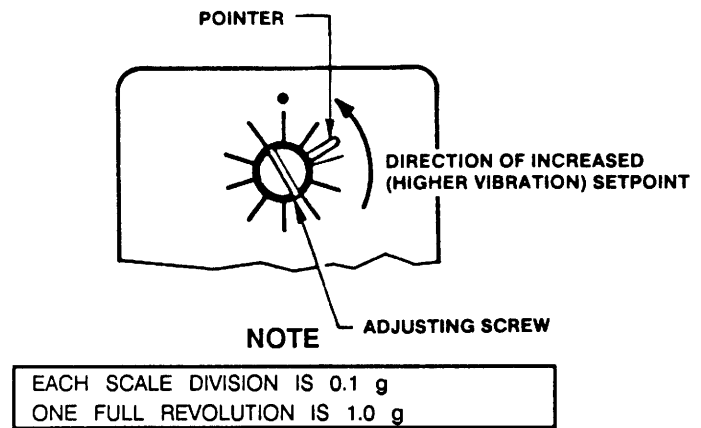


Figure 9 Setpoint Adjustment, Model 376A

dictate a higher setpoint more in keeping with the experience he has gained on the particular machine.

#### 4.3.1 Zero Vibration Level Measurement

Mount the Vibraswitch onto the equipment to be protected when making the setpoint adjustments.

With no power to the Vibraswitch and with the equipment under protection not operating, rotate the Vibraswitch setpoint adjusting screw (Ref. Figures 8 and 9) counterclockwise two turns and press the mechanical RESET button. Then turn the setpoint adjusting screw (Ref. Figures 8 and 9) slowly clockwise until actuation (the armature assembly moves to the "tripped" position) occurs.

Actuation can be detected by one of the following methods: (1) and audible "click," (2) for the Model 376A only, remove the cover and visually verify when the armature moves to the "tripped" position, (3) for the Model 375A, actuation of the armature may be sensed by holding the reset button slightly depressed while adjusting the setpoint screw.

The actuation point is considered to be the zero vibration point with the machine not operating. A mark should be made with a lead pencil or other convenient method to permanently record this zero vibration point. Subsequent measurements are made relative to this point.

**4.3.2 Normal g-Level Measurement**

With power applied only to the equipment under protection, rotate the Vibraswitch setpoint adjusting screw one turn counterclockwise and press the mechanical RESET button. If the Vibraswitch will not reset, rotate the setpoint adjusting screw an additional two turns counterclockwise, or as required to obtain reset. Press the mechanical RESET button - the Vibraswitch should reset. Slowly rotate the setpoint adjusting screw clockwise until actuation occurs (the methods for detecting actuation are explained in paragraph 4.3.1). Mark this position with a lead pencil or other convenient method. The difference between the two actuating points in paragraph 4.3.1 and 4.3.2 is the normal g-level of the operating machine, in scale divisions.

**4.3.3 Final Setpoint Adjustment**

If the "normal" g-level is less than 1.0 g, rotate the setpoint adjusting screw CCW 0.5 g (five graduations) from the point where actuation occurs in 4.3.2. If "normal" g-level is greater than 1.0 g refer to Table 1 for the proper Final Setpoint setting with respect to the "normal g-level vibration point" obtained in 4.3.2. See example on Table 1.

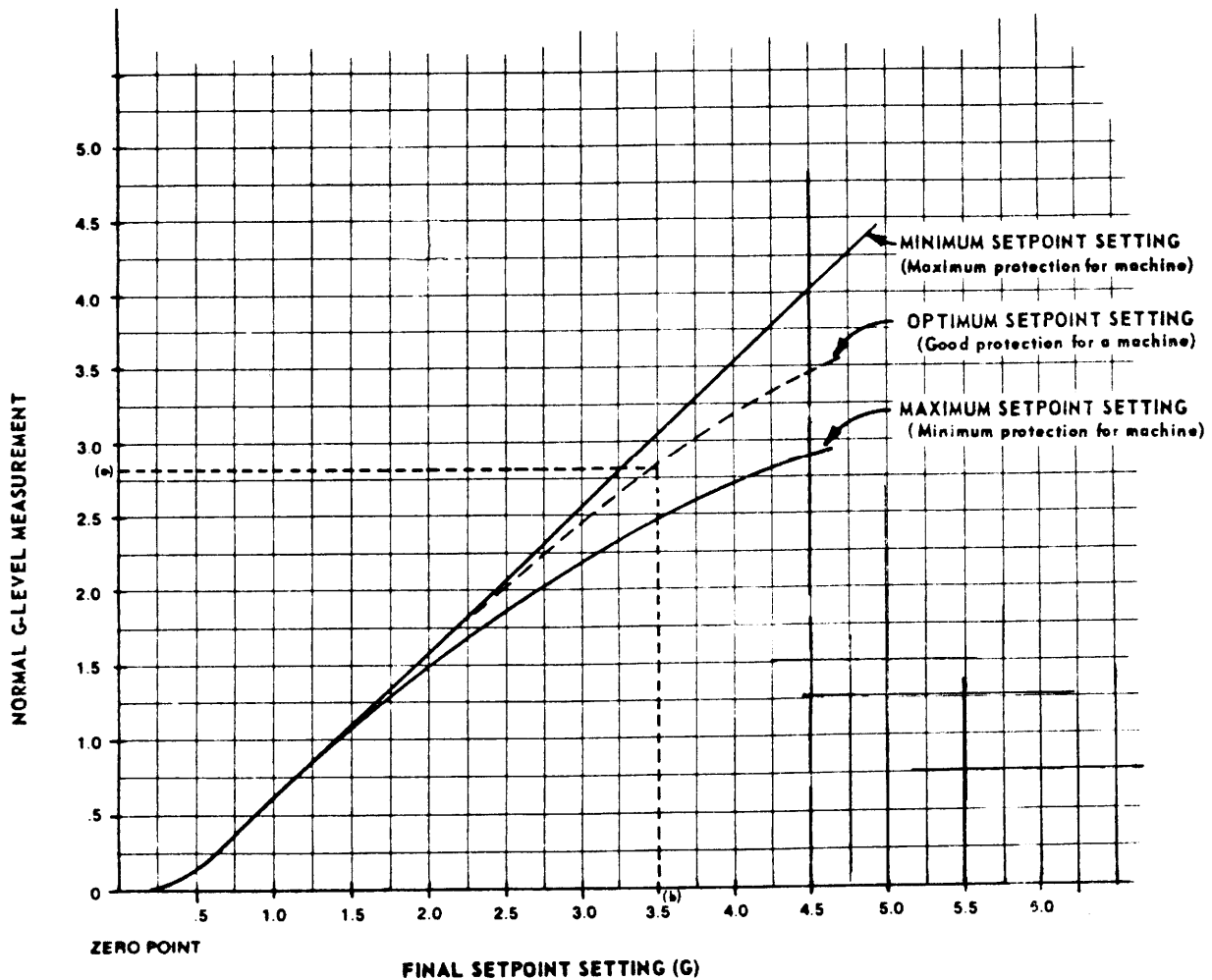
**EXAMPLE**

If the normal g-level (a) is 2.8 g above to zero vibration level, the final setpoint setting (b) should be set at 3.5 g above the zero vibration level. Therefore, advance the setpoint pointer CCW .7 g ( $3.5 \text{ g} - 2.8 \text{ g} = .7 \text{ g}$ ) or 7 divisions (one scale division is .1 g) from the normal g-level.

**Resetting the Vibraswitch**

The Model 375A/376A Vibraswitch may be reset by either interrupting the power to the Vibraswitch or by momentarily connecting the reset terminals together.

The mechanical RESET button on the Vibraswitch resets the mechanical portion of the Vibraswitch only and will not reinitiate the Start and/or Monitor Delay functions nor reset the solid-state output switch. The mechanical RESET is only used when adjusting the setpoint of the Vibraswitch or when the Start Delay only Vibraswitch is used in a system shown in Figure 7.



**Table 1 - Setpoint Alarm Settings**

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