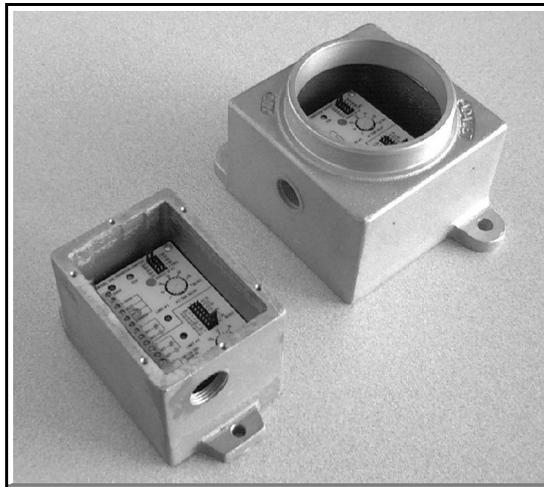


# OPERATION MANUAL

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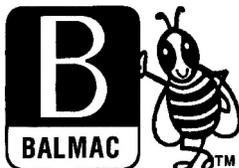
## Model 550 Series Vibration Switches



**Includes:**

**550  
550M**

**550-X  
550M-X**



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Balmac assumes no responsibility for errors or omissions. Neither is any liability assumed for damages resulting from the use of the information contained herein. See Balmac Warranty and Terms at [www.balmacinc.com](http://www.balmacinc.com).

Specifications are subject to change without prior notice. Specially modified units are supplied with individual documentation.

WARNING: Exercise extreme caution when performing any task on rotating machinery. Failure to do so may result in equipment damage or personal injury. Familiarize yourself with the equipment before attempting to perform any operation.

This manual is for Balmac Vibration Switches Model 550, 550M, 550-X, 550M-X.

## SECTION 1 - INTRODUCTION

### Description

The Balmac Series 550 (includes 550, 550M, 550-X and 550M-X) Vibration Switches are stand-alone electronic vibration detection limit switches for monitoring rotating machinery. They help prevent expensive downtime and costly equipment repairs by providing a warning limit for increasing vibration and equipment shutdown on high vibration. They guard all types of rotating machinery against excessive vibration.

The 550's provide user adjustable vibration limits, limit trip and power indicators, limit test function, solid state circuitry and a SPDT relay for each vibration limit. A 4-20 mA output signal is provided for remote metering. The 550's have an internal, single-axis vibration sensor. 550's are typically mounted directly on the machinery. The axis of sensitivity can be mounted in any direction (horizontal or vertical). Model 550's feature NEMA 4 enclosures. Model 550-X enclosures are rated for hazardous locations.

### Operation

An integral piezoelectric vibration sensor (accelerometer) provides an electrical signal when distorted by vibration. The circuit converts this signal to a calibrated vibration velocity (inches per second peak) (or millimeters per second peak for Metric units - 550M).

The 550 mounts directly to the machinery at the monitoring point in the direction of vibration measurement (vertical, horizontal, axial). The 550 is sensitive to vibration that is perpendicular to the housing's mounting base. See "Axis of Sensitivity" label on the outside of the switch enclosure.



## SECTION 2 - FEATURES

1. GROUND - Terminal screw for ground (green).
2. 4-20mA - Connect 4-20mA meter circuit between this terminal and the COMMON terminal. 4-20 mA output source.
3. MUTE - Circuit closure between this terminal and COMMON disables Limit #1 and #2 operation.
4. LATCH - Circuit closure (jumper) between this terminal and COMMON will automatically reset limit relays. An open circuit latches the tripped relays. Connect remote reset switch at this terminal.
5. COMMON - Common for 4-20mA, MUTE, and LATCH circuits.

6. C, N/C, N/O (Limit #1) - Common (C), Normally Closed (N/C) and Normally Open (N/O) terminals for Limit #1 (Alarm) relay.

7. C, N/C, N/O (Limit #2) - Common (C), Normally Closed (N/C) and Normally Open (N/O) terminals for Limit #2 (Shutdown) relay.

8. L2, L1 - Terminals for AC power input.

9. POWER INDICATOR LED - Green Power LED illuminates during operation when AC power is supplied at L1 and L2.

10. TEST - Test button allows operator to verify operation. When held depressed, trips Limit #1 and Limit #2 Relays and activates Red Limit LEDs.

11. #1 VIBRATION LIMIT - (Alarm) 10 available settings from 10% to 100%. Settings represent a percentage of Limit #2 (Shutdown). Push-on jumper is placed between the center row pin and the selected percentage.

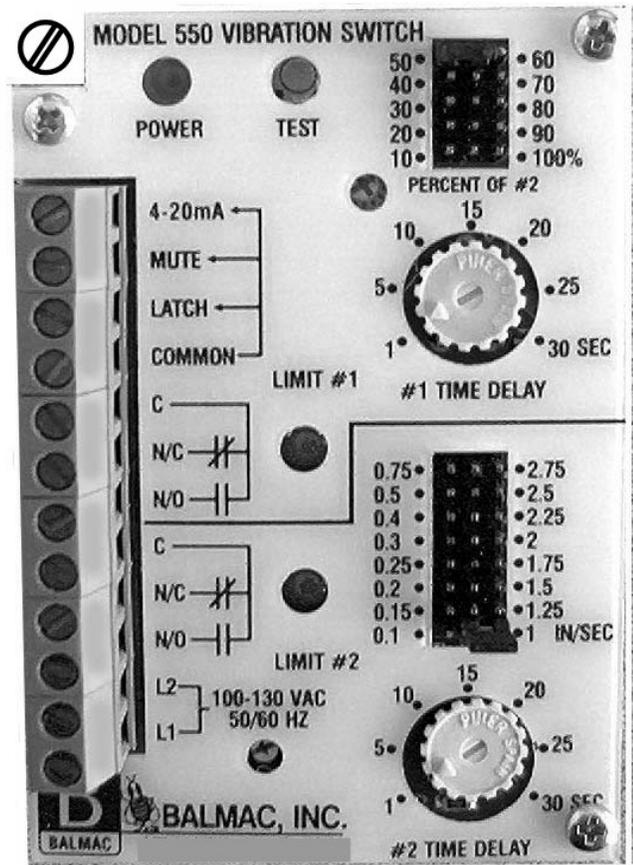
12. #1 TIME DELAY - Delays Limit #1 (Alarm) for up to 30 seconds to prevent nuisance tripping due to transient vibration. Adjust delay setting from 1 to 30 seconds.

13. #1 VIBRATION LIMIT LED - Red LED illuminates when Alarm vibration limit trips.

14. #2 VIBRATION LIMIT - (Shutdown) 16 available settings from 0.1 to 2.75 inches per second. Settings represent maximum vibration level setpoints. Push-on jumper is placed between center row pin and selected vibration limit.

15. #2 VIBRATION LIMIT LED - Red LED illuminates when SHUTDOWN vibration limit trips.

16. #2 TIME DELAY - Delays Limit #2 (Shutdown) for up to 30 seconds to prevent nuisance tripping due to transient vibration. Adjust delay setting from 1 to 30 seconds.



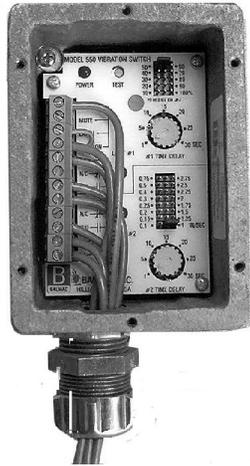
### SECTION 3 - WIRING

**WARNING: STOP MACHINE AND DISCONNECT POWER BEFORE INSTALLATION.**

#### WIRING ACCESS -

Wiring access is through a 3/4" NPS cable entry on the side of the Series 550 and a 3/4" NPT cable entry on the 550-X.

**JAM NUT -** A Jam Nut must be used on the conduit to prevent threads from penetrating the enclosure.



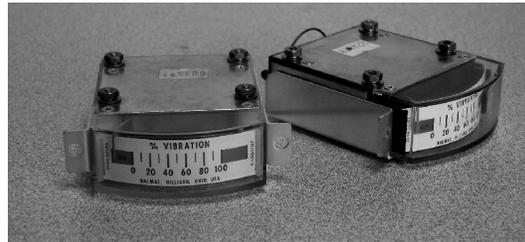
Example of fully wired 550 - shown: 4-20 mA output, automatic reset (jumper), Normally Open Limit #1 and Limit #2 and 120 VAC connection.

**TERMINAL STRIP -** Terminal connections accept 18 gauge AWG wires. Do not exceed the voltage or current ratings of the connectors.

**CONDUIT -** Customer external wiring subject to physical damage should be adequately protected. Use a short length (12") of flexible conduit between the vibration switch and external junction box when installing electrical conduit. This provides some vibration insulation in the conduit line. Conduit and fittings should conform to the environment of the switch location. Rated fittings should be used with the 550-X and 550M-X in hazardous locations. Weather resistant or rain-tight fittings should be used to protect the switch wiring in humid or corrosive atmospheres. Use switch covers and metal conduit to shield circuits from RFI (Radio Frequency Interference) and EMI (Electro-Magnetic Interference)

### SECTION 4 - ANALOG METER

The Balmac Part Number A-11347 Remote Read-Out Panel Meter makes it easy to monitor the 550's overall vibration readings using the vibration switch 4-20 mA output signal.



### SECTION 5 - TESTING

**WARNING: MAKE THE AREA NON-HAZARDOUS BEFORE OPENING THE EXPLOSION-PROOF (-X) ENCLOSURE.**

**WARNING: REMOVE ALL POWER BEFORE OPENING THE ENCLOSURE. DO NOT ADJUST SETTINGS WHILE MACHINERY IS OPERATING. ONLY QUALIFIED PERSONNEL MAY PERFORM TESTING.**

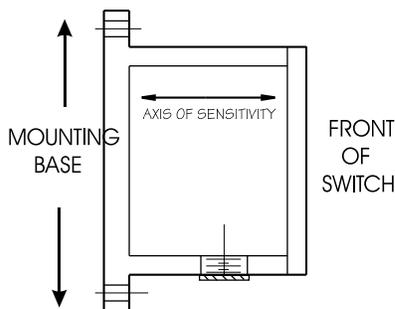
Two methods are available for testing the operation of the 550 Series Vibration Switch:

1. With cover removed, depress and hold the TEST button. The limits should trip after the set time delay.
2. Set limits to minimum values. In this position, any vibration will cause a trip condition. Monitor the 4-20 mA output for the vibration measurement response. Note: the switch must be vibrated longer than the time delay. The limit LED lights should glow once the limits have tripped and remain glowing until the limits are reset.

## SECTION 6 - INSTALLATION

**WARNING: STOP MACHINE AND DISCONNECT POWER BEFORE INSTALLATION.**

1. Select mounting location. If possible, survey the machine with a vibration meter to determine the best location - direction of strongest vibration. The 550 axis of sensitivity is perpendicular to the mounting base. This means the arrow on the switch label should point in the same direction as the vibration measurement.



2. Mount the 550 in the horizontal, vertical or axial plane close to the centerline of the rotating shaft. This location varies from machine to machine. Example - worn bearings or unbalance can be detected near the bearing housings and at right angles to the rotating shaft axis.

3. Install the 550 enclosure on a flat surface area. Use 1/4" hardware. Mounting surface must be rigidly attached to the area where the vibration is to be monitored. Arrow on switch enclosure side should be in the direction of vibration motion (point in same direction).

4. Mounting plates should be used if the vibration switch cannot be mounted on a flat surface of the machine. Plates should be rigid and small as possible. Use half inch thick reinforced plate. Ensure that the resonant frequency of the mounting plate is not within the frequency range of the unit. Make sure the 550 and mounting plate are securely attached to the machinery monitoring point.

**WARNING: DO NOT ADJUST SETTINGS WHILE MACHINERY IS OPERATING. ONLY QUALIFIED PERSONNEL SHOULD PERFORM ADJUSTMENTS.**

5. Set vibration limits. Set jumper on Limit #2 (Shutdown) to maximum vibration level. Example for a 0.5 IN/SEC limit. Jumper is connected to center pin row and pin at the 0.5 marking.

6. Set jumper on Limit #1 (Alarm) as a percentage of Limit #2. Example for a value of 0.25 IN/SEC limit: place jumper on the center row pin and pin closest to 50 (50%) marking. This setting represents 50% of Limit #2. ( $0.5 \text{ IN/SEC} \times 50\% = 0.25 \text{ IN/SEC}$ ).

7. Set Time Delays. Adjust Time Delays controls for the Limit #1 and #2 (1 to 30 seconds). The delay is used to avoid nuisance trips due to transient vibrations during machinery startup and from other temporary vibration sources.

## SECTION 7 - LATCHING

The 550's are provided with a jumper (wire connector) connecting the LATCH and COMMON terminals. The 550 relays are in the NON-LATCHING mode (automatic reset) with the jumper connected. If the jumper is removed, the 550's relays are in the LATCHING mode.

**NON-LATCHING Example** - When vibration exceeds the Limit setting, after the time delay, the relay will trip and light the limit LED indicator. As soon as the vibration drops below the set limit, the Limit relay will automatically reset (LED off).

**LATCHING Example** - With jumper removed, when vibration exceeds Limit setting, after the time delay, the Limit relay will trip and light the limit LED indicator. An open circuit between LATCH and COMMON maintains the relay latching operation until the switch relays are manually reset by using a connected remote reset switch, or by powering off the 550.

**SECTION 8 - VIBRATION SETTINGS - LIMIT #1 & LIMIT #2**

Setting Vibration Limits - Example: Set Limit #2 (Shutdown) vibration setpoint at 1 inch per second. Set Limit #1 (Alarm) at 50%. Follow Row labeled 50% across until it intersects with Column labeled "#2@1.0." Result is "0.5."

Limit #1	#2@ 0.1	#2@ 0.15	#2@ 0.2	#2@ 0.25	#2@ 0.3	#2@ 0.4	#2@ 0.5	#2@ 0.75	#2@ 1.0	#2@ 1.25	#2@ 1.5	#2@ 1.75	#2@ 2.0	#2@ 2.25	#2@ 2.5	#2@ 2.75
10%	0.01	.015	0.02	.025	0.03	0.04	0.05	.075	0.1	.125	0.15	.175	0.2	.225	.025	.275
20%	0.02	0.03	0.04	0.05	0.06	0.08	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55
30%	0.03	.045	0.06	.075	0.09	0.12	0.15	.225	0.3	.375	0.45	.525	0.6	.675	0.75	.825
40%	0.04	0.06	0.08	.01	0.12	0.16	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1
50%	0.05	.075	0.1	.125	0.15	0.2	0.25	.375	0.5	.625	0.75	.875	1.0	1.12	1.25	1.37
60%	0.06	0.09	0.12	0.15	0.18	0.24	0.3	.45	0.6	0.75	0.9	1.05	1.2	1.35	1.5	1.65
70%	0.07	.105	0.14	.175	0.21	0.28	0.35	.525	0.7	.875	1.05	1.22	1.4	1.57	1.75	1.92
80%	0.08	0.12	0.16	0.2	0.24	0.32	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2
90%	0.09	.135	0.18	.225	0.27	0.35	0.45	.625	0.9	1.12	1.35	1.57	1.8	2.02	2.25	2.47
100%	0.1	0.15	0.2	0.25	0.3	0.4	0.5	0.75	1.0	1.25	1.5	1.75	2.0	2.25	2.5	2.75

**SECTION 9 - VIBRATION LIMITS**

Several standards for acceptable vibration limits are available. The chart below may be used as a general guideline to acceptable and non-acceptable vibration levels for various classes of machinery. Contact your machinery manufacturer for recommended vibration limits.

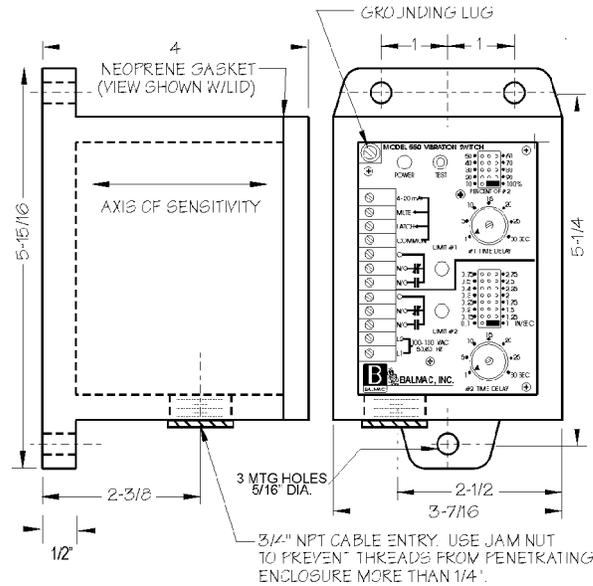
VIBRATION VELOCITY	MACHINERY CLASS			
Vibration (ips)	Class 1	Class 2	Class 3	Class 4
0.01 ips	GOOD	GOOD	GOOD	GOOD
0.02 ips	GOOD	GOOD	GOOD	GOOD
0.03 ips	GOOD	GOOD	GOOD	GOOD
0.06 ips	FAIR	GOOD	GOOD	GOOD
0.08 ips	FAIR	FAIR	GOOD	GOOD
0.1 ips	ROUGH	FAIR	FAIR	GOOD
0.2 ips	N/A	ROUGH	FAIR	FAIR
0.4 ips	N/A	N/A	ROUGH	FAIR
0.6 ips	N/A	N/A	N/A	ROUGH
0.8 ips	N/A	N/A	N/A	N/A
1.0 ips	N/A	N/A	N/A	N/A

VIBRATION SEVERITY CHART : Class 1: Individual components, integrally connected with the complete machine in its normal operating condition. Small electric motors, Precision Machines, Turbines.  
 Class 2: Medium size machinery without special foundations, rigidly mounted engines, or machines on special foundations. Gear boxes, Pumps, M-G sets, Fans.  
 Class 3: Large prime movers mounted on heavy, rigid foundations. Compressors, Blowers, Hammer mills, Engines.  
 Class 4: Large prime movers on relatively soft, light weight structures. Crushers, Reciprocating Machinery, Vibrating Conveyors.

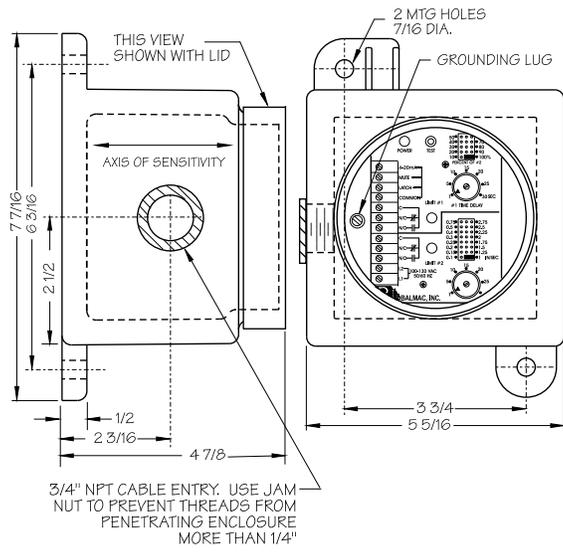


### SECTION 10 - ENCLOSURES

Model 550, calibrated in English units, is shown below. The Model 550M is calibrated in metric units of vibration (not shown). The Model 550 and 550M housing is a cast aluminum enclosure. This rugged, water-tight and dust-tight box meets portions of NEMA 3, 4 and 12 classifications. The 550 and 550M cast aluminum box includes cover (held in place with 6 screws) and rubber gasket.



The MODEL 550-X (in English units) is shown below. The Model 550M-X is in Metric units. The 550-X and 550M-X have a cast aluminum housing with threaded screw type cover and gasket. These enclosures are rated for use in hazardous locations for Class I, Groups C & D; Class II, Groups E, F, & G. See housing specifications supplied with the 550-X and 550M-X enclosures. CAUTION: Always disconnect 550-X and 550M-X from energized circuits before opening the enclosure in a hazardous atmosphere. Keep cover tightly closed when circuits are energized. See enclosure label for rated specifications.

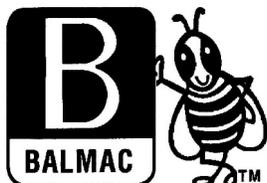


**SECTION 11 - SPECIFICATIONS - 550, 550-X, 550M & 550M-X**

FEATURE	DESCRIPTION
Velocity Range 550 & 550-X	0.1 to 2.75 in/sec Peak (English Units) 0.1, .15, .2, .25, .3, .4, .5, .75, 1.25, 1.5, 1.75, 2, 2.25, 2.5, 2.75 in/sec
550M & 550M-X	2.5 to 70 mm/sec Peak (Metric Units) 2.5, 4, 5, 6.5, 7.5, 10, 13, 19, 25.5, 32, 38, 44.5, 51, 57, 63.5, 70 mm/sec
Frequency Range	2 to 1,000 Hz (120 to 60,000 RPM)
Limits	Two user adjustable limits Push-on Jumpers Limit #1 (Warning) Range: 10% to 100% of Limit #2 (Shutdown) Limit #2 (Shutdown) Range: 0.1 to 2.75 in/sec (2.5 to 70 mm/sec)
Limit Outputs	Industrial Sealed Form-C Type Relay (Dry Contact) SPDT. Each limit has one normally-open (N/O) and one normally closed (N/C) 5A@125 VAC, 5A@ 28 VDC
Limit Indicator	LED (red) energize on Limit trip (one indicator for each Limit)
Time Delay	Limit trip time delay of 1 to 30 seconds Labeled Selections: 1, 5, 10, 15, 20, 25, 30
Limit Latch (Remote Reset) & Mute	Circuit closure between Latch and Common terminals resets Limits An open circuit maintains (latches) the Limit relays Circuit closure between Mute and Common disables Limits
Analog Output	4-20 mA DC into 500 ohms. Optional remote panel meter #A-11347
Sensitive Axis	Perpendicular to mounting base. Omni-directional mounting.
Input Power	100-130 VAC 50/60 Hz. (190-250 VAC optional) Power LED (green)
Enclosure 550 & 550M	Cast Aluminum box with cover and gasket. Water, dust-tight NEMA 3, 4 and 12
550-X & 550M-X	Cast Aluminum box with threaded screw type cover and gasket. Class I, Groups C & D; Class II, Groups E, F, & G; Class III
Mounting 550	1/4" hardware - 3 places mounting bolt hole lugs (bosses)
Mounting 550-X	1/4" hardware - 2 places mounting bolt hole lugs (bosses)
Electrical	3/4" NPS (550) / NPT (550-X). Conduit Fitting Entry. Terminals for #18 AWG Wire.
Size 550 & 550M	3.44" x 5.94" x 4" (8.74 x 15.09 x 10.16 cm) Weight: 3.75 lb (1.7 kg)
Size 550-X & 550M-X	4.81" x 6.75" x 4.5" (12.22 x 17.15 x 11.43 cm) Weight 5.5 lb (2.5 kg)

**SECTION 12 - WARRANTY**

Our complete Warranty and Service information is listed on our Website at [www.balmacinc.com](http://www.balmacinc.com).



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