

Model 2212V & 2212IV Vibration Transmitter.



Basic Principle of Operation.

Vibration is detected using a piezoelectric accelerometer. The signal from this is amplified, integrated, filtered, and rectified to give a 4~20mA output which is the average of the vibration velocity between 10Hz and 1KHz.

Vibration velocity gives a good indication of the condition of a machine and can be used to provide alarm and trip conditions as well as providing information for trend analysis.

The 4~20mA signal is an industry standard which can be used with simple alarm circuitry or sophisticated PLC and computer monitoring systems. 4~20mA signals have three advantages over voltage signals for industrial applications.

1. Better noise immunity.
2. Longer cable runs because cable resistance does not affect calibration.
3. Only two wires are required to provide both power and signal.

Purpose.

The 2212V/IV has been designed to be permanently installed on rotating machinery as an economical method to provide a warning in the event of increased vibration caused by deterioration or catastrophic failure. In conjunction with suitable 4~20mA instrumentation it may provide alarms or automatic shut down depending on the severity of the vibration.

This unit provides an averaged value of the vibration velocity over its designed frequency bandwidth which will show when vibration is increasing, but not specifically what is causing the increase. This needs to be determined either by a vibration analyzer or by physically stripping the machine.

Trend analysis of the gradual increase in vibration of a machine can be used to schedule routine maintenance so that the machine can be taken out of service at the most convenient time. This can be a big cost saver in production.

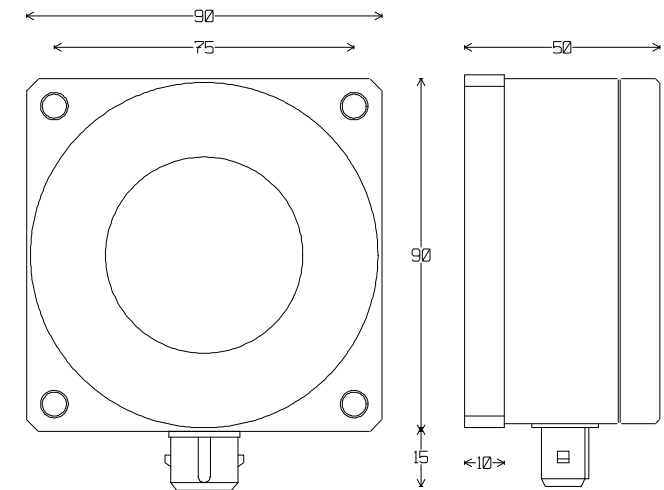
Vibration transmitters are often used in conjunction with temperature monitoring (especially on bearings) for machinery protection.

Some other applications for which vibration transmitters have been used include crushers, vibrating screens, coal locks (vibration decreases when there is a blockage), and industrial spin driers (the vibration level can be adjusted to determine the correct moisture content of the cloth).

Construction.

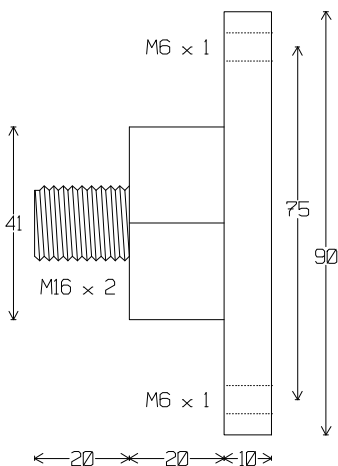
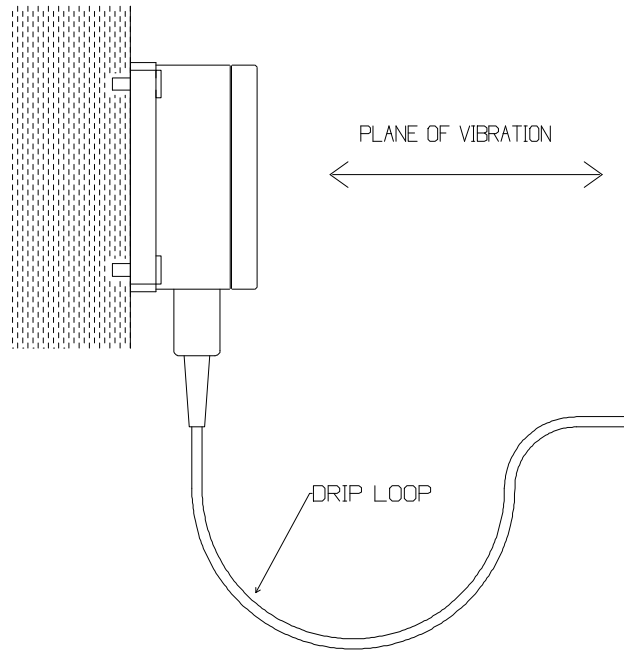
The 2212V/IV is supplied in a weatherproof anodized aluminium housing which contains the accelerometer and the amplifier.

The 4~20mA loop is connected to the 2212V/IV by a non-reversible weatherproof plug & socket.



Mounting.

The 2212V/IV is designed to mount on a flat surface and is secured by a machine screw at each corner.



An adapter plate is available which converts the 2212V/IV mounting to a single M16C stud.

The 2212V/IV is calibrated for vertical mounting with the cable entry at the bottom. Mounting in any other orientation may affect accuracy.

The mounting point should be on a solid part of the machine and should not itself be able to vibrate otherwise accuracy will be compromised.

Electrical Connection.

Observe polarity when connecting the 4~20mA. The red wire on the cable provided is positive. A protection diode is fitted to prevent damage should the 4~20mA cable be connected incorrectly.

A loop of wire should be made near the pickup to provide a drip point for moisture and to minimize cable strain.

When power is applied the output of the transmitter will drive upscale past 20mA for a few seconds before falling back to the correct value.

Earthing.

The 2212IV has an isolated accelerometer which means it can be used with PLCs and other distributed systems without introducing ground loop problems.

In applications where there is excessive electrical noise the 2212V with a grounded accelerometer can reduce errors introduced by 50Hz hum. When used with PLC's and computer systems we recommend the use of a 4~20mA isolator such as the model 1120 to prevent problems with ground loops.

Sometimes the casing of a badly earthed machine may have a substantial voltage relative to ground. This can be tested using an ordinary multimeter. In this case a 50Hz voltage can be injected giving erroneous readings. Disconnecting the ground link may help in this situation but it is far safer to ensure that the machine casing is properly grounded, preferably using an earth spike or underground water pipe.

Calibration and Testing.

It is just about impossible to calibrate vibration equipment accurately on site but there is no reason that this should become necessary given the long term stability of this design. Zero and span trimmers are fitted for factory calibration. These are sealed and we do not recommend user adjustment. Some versions of the 2212 have range jumpers which may be changed on site. These are usually 0~10, 0~20, & 0~40 mm/sec but custom units are made with other ranges. Please check the range information supplied with the unit.

We calibrate in the factory on a vibration table whose vibration amplitude and frequency are easily adjustable.

It is possible to use a portable vibration meter to measure the vibration alongside a model 2212 in situ, and this will give a fair indication of whether the

unit is reading correctly, however there are a few things to take into consideration.

1. Unless the two vibration units are mounted back to back there will always be a slight difference between the vibration levels measured by each.
2. The portable monitor may measure a different frequency bandwidth to the 2212V/IV which will give rise to differences between the two readings.
3. The portable unit may have a true RMS circuit whereas the 2212V/IV has an averaging circuit. For pure sine wave oscillations the two will agree but as normal vibrations are not pure sine there will be a difference.
4. If the portable unit is calibrated to peak or peak-to-peak instead of RMS it will read 1.4 or 2.8 times the signal from the 2212V/IV.

Vibration measurements can not be made to the same degree of accuracy as parameters such as temperature and pressure. Typically $\pm 5\%$ accuracy is regarded as good and $\pm 10\%$ is regarded as acceptable.

Fortunately we are not looking for high accuracies in machine monitoring. What we need is stability, which the 2212V/IV provides. It is not important if our normal vibration level reads 1mm/sec or 1.2mm/sec. What is important is that we can recognize when that figure starts to deteriorate.

Setting Alarm and Trip Levels.

The 2212V/IV provides a 4~20mA signal which may represent different vibration levels depending on its calibration. The most popular ranges are 0~20mm/sec and 0~10mm/sec.

The vibration levels at which action is to be taken are set by hardware or software on the instrument to which it is connected.

Levels for alarm and trip settings can only be safely determined by the manufacturer of the machine to which the 2212V/IV is attached, or by someone with intimate knowledge of the machine.

The following chart provides a guide if you do not have specific information about your particular application, but bear in mind this is only a guide and should be treated as such.

Vibration Criterion Chart (from VDI 2056)

RMS Velocity mm/sec	28	Not permissible	Not permissible	Not permissible	Not permissible
	18			Just tolerable	Just tolerable
	11	Not permissible	Just tolerable	Just tolerable	Just tolerable
	7				
	4.5	Just tolerable	Just tolerable	Allowable	Allowable
	2.8				
	1.8	Allowable	Allowable	Allowable	Good
	1.1				
	0.7	Good	Good	Good	Good
	0.45				
0.28	Good	Good	Good	Good	
0.18					
		Small Machines <15KW	Medium Machines 15-75KW	Large Machines on rigid foundations	Large Machines operating at speeds above the foundation frequency

A machine which normally runs at 1mm/sec may be able to run at 10mm/sec before it needs servicing whereas another machine which normally runs at 2mm/sec may suffer catastrophic failure at 4mm/sec.

A very rough rule of thumb to use as a starting point is to measure the vibration level on the machine under normal conditions (assuming it is in good condition) and set an alarm for an increase of 50% and a trip for an increase of 100%. As the machine vibration increases with age these points can be gradually extended upwards if the machine is seen to be running safely at the higher vibration levels.

