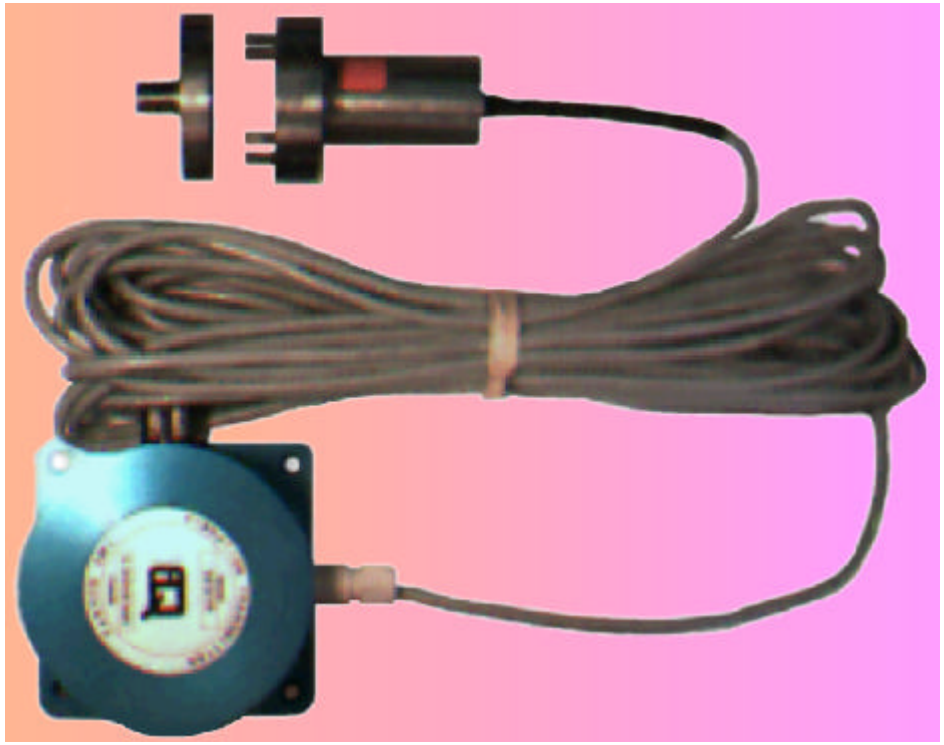
Model 2212VR Vibration Transmitter.



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.

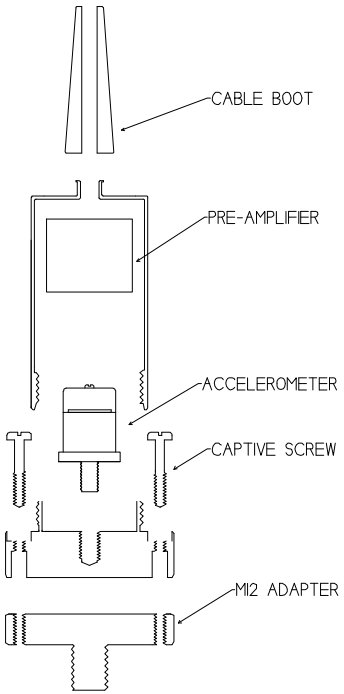
Purpose.

The 2212VR 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).

The 2212VR is recommended for applications such as cooling tower fans where corrosion is a problem.

Construction.

The 2212VR is supplied in two sections, a stainless steel pickup assembly containing the accelerometer and pre-amplifier, and an anodized aluminium housing containing the main amplifier. These are connected by a four core flexible cable. This cable may be shortened or extended without affecting calibration however we recommend a maximum length of 10 metres to minimize interference from electrical noise.

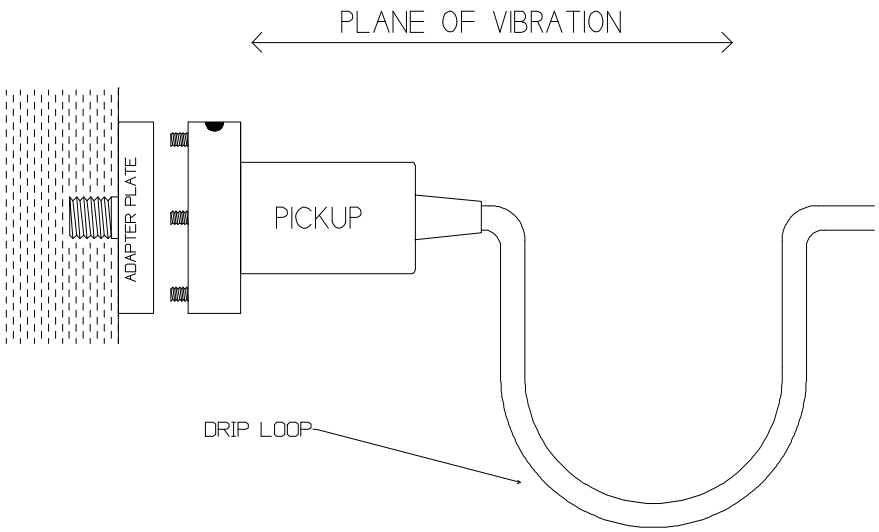
The 4~20mA loop is connected to the main amplifier section by a non-reversible weatherproof plug & socket.

The pickup assembly is in two sections, the main assembly and an adapter plate with a M12C stud. The main assembly bolts to the adapter plate using 4 captive M4 stainless steel machine screws. The adapter has 8 holes which allows the main assembly to be mounted in different positions with an increment of 45°.

Because of manufacturing tolerances each amplifier is calibrated to its own pickup assembly. This means that the amplifiers are not interchangeable without degradation of calibration accuracy. We recommend that faulty units are returned to the factory as an assembly for repair or re-calibration. In the event that it is necessary to dismantle a unit on site it is important to make sure that the amplifier and pickup assembly are correctly matched for reassembly.

Mounting.

The 2212VR is designed to screw into a single threaded hole (M12C) from the side of the machine (usually on a bearing housing).



The pickup assembly should be separated from the adapter plate, and the adapter plate mounted tightly on the machine. Note the position of the small

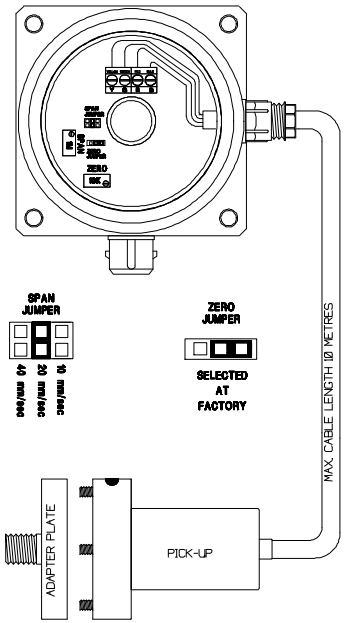
round coloured label on the pickup assembly. The pickup assembly should then be mounted using the four screws so that the label is to the top.

It is important that the two sections are separated during installation or removal to prevent unnecessary stress on the accelerometer which could adversely 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.

Mounting in any other orientation may affect accuracy.

Electrical Connection.



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

The four core cable from the pickup assembly is colour coded and the terminal block in the amplifier is marked to match. Make sure the cable gland and lid are properly tightened to ensure a weatherproof seal.

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.

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.

Referring to the drawing above, the original colour codes for the four wire cable were (from left to right) yellow (signal), green (common), red (V+), black (V-).
Later models and repaired units are fitted with a more flexible cable and the colours are now (from left to right) yellow, green, white, brown.

Using the common terminal (green wire) as a reference the approximate voltages expected on the other terminals are V+ = 5 volts DC, V- = -3.5 volts DC, signal = 10mVAC per mm/sec vibration.

Earthing.

The 2212VR uses a grounded accelerometer to 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. An isolator will eliminate this error 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 2212VR 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 2212VR which will give rise to differences between the two readings.
3. The portable unit may have a true RMS circuit whereas the 2212VR 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 2212VR.

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

Fortunately we are not looking for high accuracies in machine monitoring. What we need is stability, which the 2212VR 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.

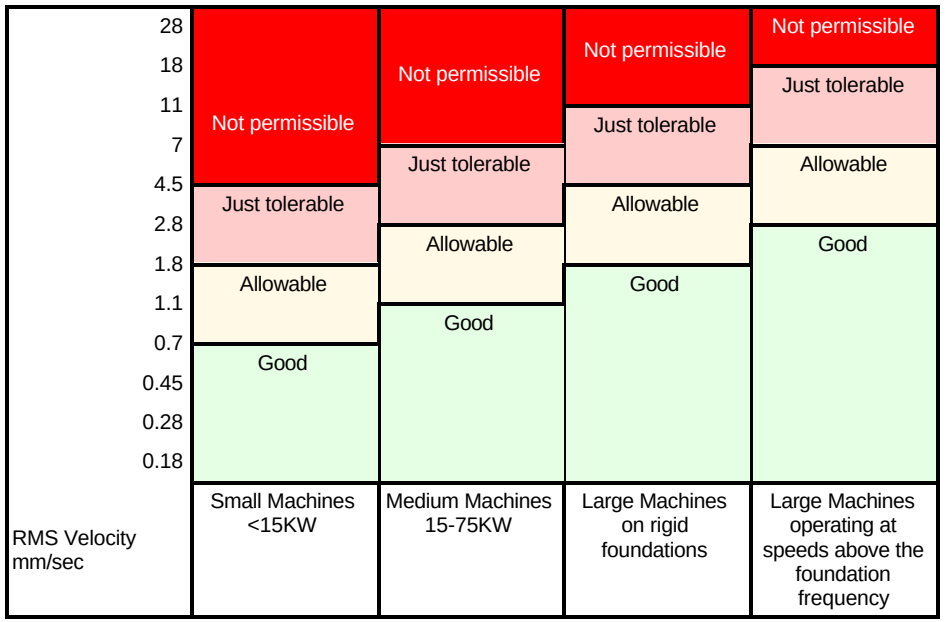
The 2212VR provides a 4~20mA signal which may represent different vibration levels depending on its calibration. The most popular ranges are 0~20mm/sec and 0~10mm/sec.

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 2212VR is attached, or by someone with intimate knowledge of the machine.

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

Vibration Criterion Chart (from VDI 2056)



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.

Notes.

Because the transmitter drives upscale for a few seconds when power is connected it may be necessary to implement a time delay to bypass monitoring circuits during this time.

The 2212VR has a time constant of approximately 2 seconds which provides a smooth response for small changes in vibration but is still sufficiently fast to prevent damage from large changes. It may however sometimes be necessary to add some extra time delays into the system.

Many machines exhibit higher vibration during starting. A start up time delay may be useful to prevent false alarms.

Some machinery may exhibit short bursts of vibration such as a shudder with changing load or when another machine nearby is started or stopped. A short delay on the alarm and/or trip circuitry may be useful to prevent spurious tripping. This should usually not be more than 1 or 2 seconds.

Piezoelectric transducers can generate very high voltages when subject to sudden impacts. Although protection is provided in the electronics, the pick up assembly can be damaged if the unit is dropped with no power connected.

To avoid spurious alarms and trips we recommend that two way radios should not be used closer than 1 metre from the transmitter or the 4~20mA wiring.

Specifications.

POWER SUPPLY		10-32V DC
OUTPUT SIGNAL		4-20mA
RANGE OPTIONS		0-5mm/sec 0-10mm/sec 0-20mm/sec 0-50mm/sec 0-100mm/sec Or to customer specification
FREQUENCY RANGE		10 to 1000Hz
ACCURACY		± 5% Typical When mounted from side with label at top.
AMBIENT TEMPERATURE		-5 to +60°C
MASS		Amplifier: 575g Pickup assembly: 625g
PLANE OF VIBRATION		90° to mounting surface
MOUNTING		M12 x 1.75
HOUSING	Amplifier Pickup Assembly	Weatherproof anodized aluminium Stainless steel

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