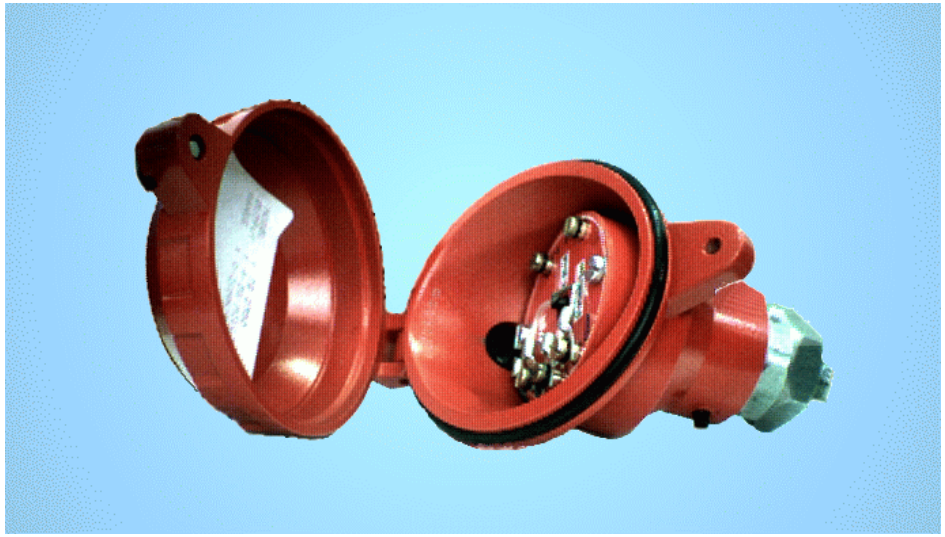
Specifications.

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
AMBIENT TEMPERATURE	-5 to +60°C
MASS	510g
PLANE OF VIBRATION	90° to mounting surface
MOUNTING OPTIONS	M12 x 1.75 303 Stainless Steel M16 x 2 303 Stainless Steel Others to special order
HOUSING	Weatherproof Cast Aluminium - Epoxy Coated

Model 2300 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 2300 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.

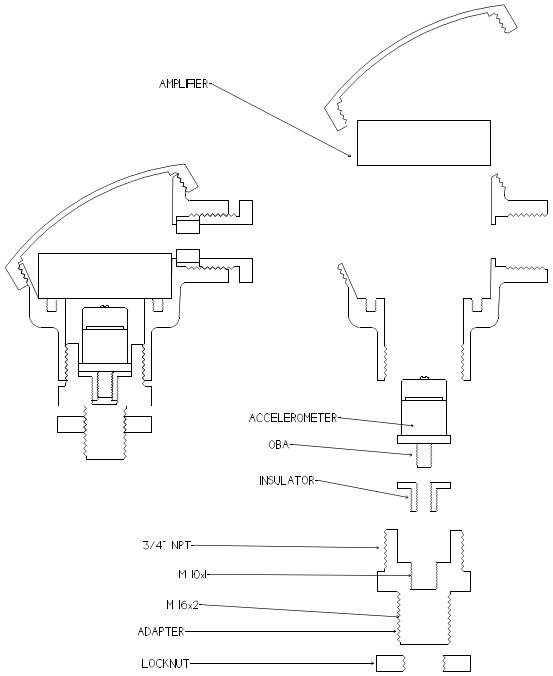
Vibration transmitters are often used in conjunction with temperature monitoring (especially on bearings) for machinery protection.

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 piezoelectric accelerometer is mounted in the stainless steel fitting under the head in an insulated bush. It is connected by a short length of screened cable to the amplifier which is mounted above it in a “hockey puck” style plastic housing.

The components of the transmitter are encapsulated in a polyurethane resin for protection from vibration, dust, and moisture.



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 2300 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 amplifier circuit, the amplifier 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.

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 2300 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)

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

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.

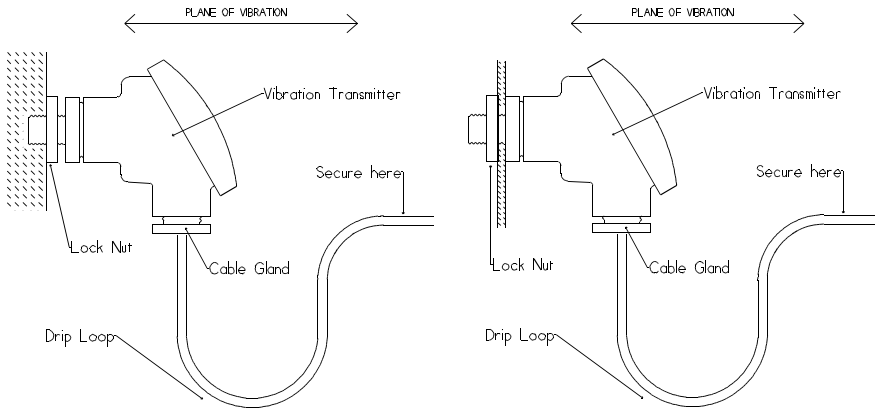
A very rough rule of thumb to use as a starting point is to measure the vibration level on the machine under normal conditions (assuming it is in good condition) and set an alarm for an increase of 50% and a trip for an increase of 100%. As the machine vibration increases with age these points can be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

The terminal screws have shake-proof washers and all other threads are sealed with a thread locking compound during assembly.

Because of manufacturing tolerances each amplifier is calibrated to its own accelerometer. 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 transmitter and accelerometer are correctly matched for reassembly. It is also important to use a thread locking compound on the transmitter mounting screws to prevent them working loose in operation.

Mounting.

The 2300 is designed to screw into a single threaded hole (usually M12 or M16) from the side of the machine (usually on a bearing housing). The cable entry should be pointing *downwards*. A lock nut is provided to enable this. This unit may also be mounted through a hole in a plate using the locknut.



We recommend that a spring washer or thread locking compound be used with either mounting method.

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.

The cable used to connect to the 4~20mA loop should be a 2-wire flexible, double insulated cable, with a circular cross section and should be between 5mm & 8mm in diameter to ensure a watertight seal in the cable gland. The terminal studs on the 2300 electronic assembly have shake-proof washers which allow the wire to be tightly gripped when wrapped around the terminal screw. Cable lugs with a 3.2mm hole may be soldered or crimped onto the wire if preferred.

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

Observe polarity when connecting. A protection diode is fitted to prevent damage should the 4~20mA cable be connected incorrectly.

A red LED gives an indication of correct operation. The LED glows brighter as the output current increases.

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 transmitter has an earth (ground) terminal mounted between the accelerometer terminals. This is linked as standard to one of the transmitter mounting screws. This terminal connects to the common rail of the electronics through a capacitor providing an AC ground for the electronics without introducing the possibility of a DC ground loop, which could cause a problem with the 4~20mA loop.

Normally the vibration unit is mounted on to a grounded metal surface which grounds this terminal minimizing 50Hz noise errors.

If the machine is not well grounded, but there is a good ground on the 4~20mA loop, better results may be obtained if the earthing wire is disconnected. This is indicated if the transmitter reads an abnormally high or erratic vibration level.

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 via the earthing capacitor and give 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. No user adjustments are provided.

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 2300 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 2300 which will give rise to differences between the two readings.
3. The portable unit may have a true RMS circuit whereas the 2300 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 2300.

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 2300 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 2300 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.