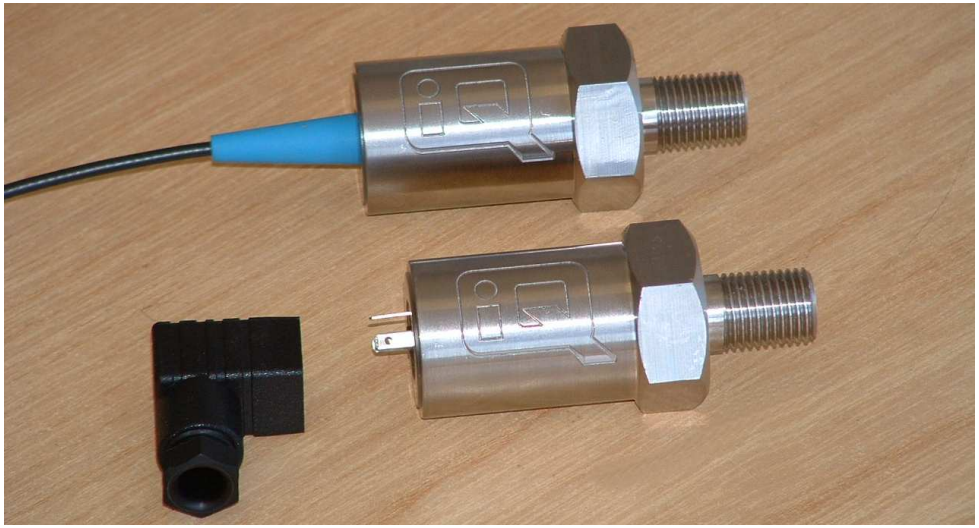
Specifications.

POWER SUPPLY	10~36V DC
OUTPUT SIGNAL	4~20mA
RANGE OPTIONS	0~5mm/sec RMS (0~7.1mm/sec pk.) 0~10mm/sec RMS (0~14.1mm/sec pk.) 0~20mm/sec RMS (0~28.2mm/sec pk.) 0~25mm/sec RMS (0~35.4mm/sec pk.) Others to special order
ACCURACY	± 5% Typical - 10 to 1000Hz
AMBIENT TEMPERATURE	-5 to +60℃
MASS (Approximate)	200g (7oz.) without locknut 60g (2oz.) locknut
PLANE OF VIBRATION	90°to mounting surface (Z - axis)
MOUNTING OPTIONS	M8 x 1.25 x 10mm M12 x 1.75 x 20mm (with locknut)l 1/4" MNPT x 20mm Others to special order
CONNECTOR OPTIONS	Hirschmann Type "C" Industrial Standard (IP65) Moulded cable Others to special order
HOUSING MATERIAL	303 Stainless Steel Others to special order

Model 2400 Vibration Transmitter.



Basic Principle of Operation.

Vibration is detected using an 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 2400 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.

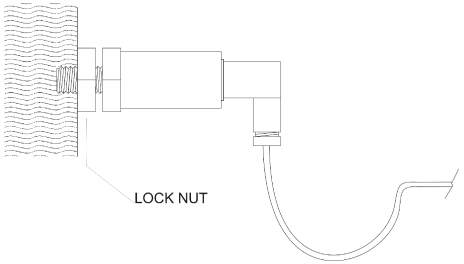
Vibration transmitters are often used in conjunction with temperature monitoring (especially on bearings) for machinery protection.

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).

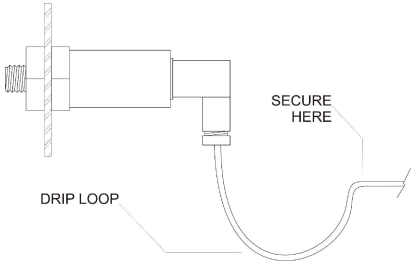
Construction.

The accelerometer and associated electronics are resin encapsulated inside a stainless steel fitting. The front of the fitting has a single male thread for mounting. The rear of the fitting has a connector or moulded cable depending on customer preference.

Mounting.



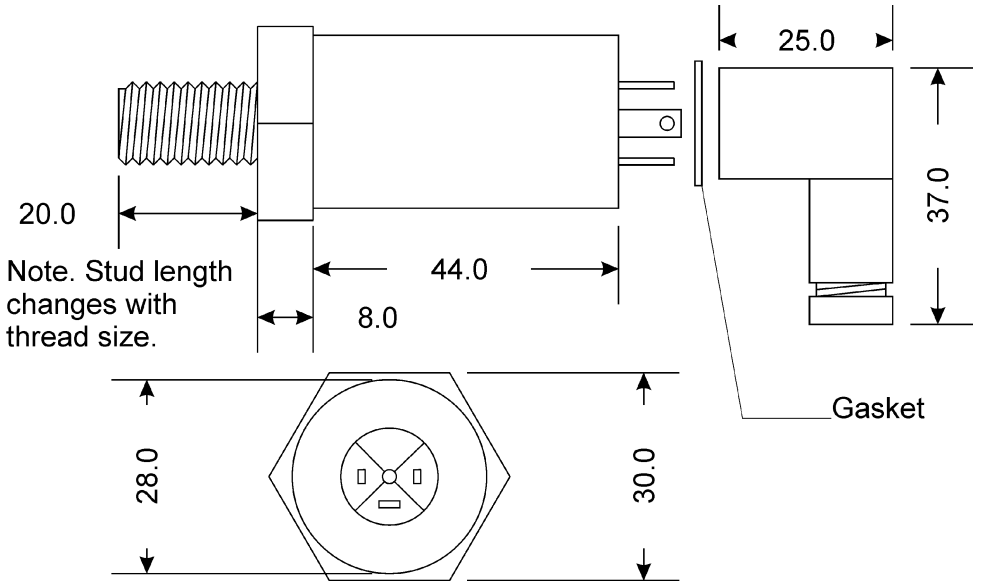
On Bearing



On Plate

The 2400 is designed to screw into a single threaded hole (M8, M12 or 1/4” NPT) usually on a bearing housing. This unit may also be mounted through a hole in a plate using a locknut.

Dimensions



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.

The 2400 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.

Although the internal accelerometer is protected against large acceleration it is still possible to damage it if the unit is dropped onto a hard surface.

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.

Our model IQ4-PC-R2-PSI digital indicator makes a perfect partner for the model 2400 vibration transmitter in stand-alone applications. It features integral 24V loop excitation and two alarm relays with programmable time delays.

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

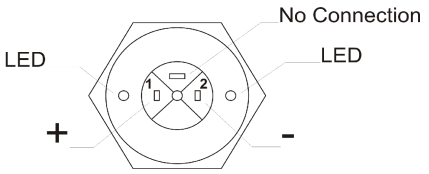
The mounting point should be on a solid part of the machine and should not itself be able to vibrate otherwise accuracy will be compromised.

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 & 7mm in diameter to ensure a watertight seal in the cable gland. A twisted pair is preferred but for short runs to a junction box a normal cabtyre is usually adequate.

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.



Two red LEDs give an indication of correct operation. The LEDs glow brighter as the output current increases.

When power is applied the output of the transmitter is held at 4mA for a few seconds before the unit starts monitoring.

The Hirschmann Type “C” Connector

The centre section of the connector is ejected by inserting a small screwdriver blade in the slot located in one corner. This section can be rotated in 90° increments to allow the cable entry to point in the most convenient direction.

To obtain sealing to IP65 the correct gasket must be fitted between the male and female sections and the centre screw must be tightened firmly.

Moulded cable/connector assemblies are available to special order. The centre sections of these cannot be

rotated.

Earthing.

The electronic components of the model 2400 are totally isolated from the case. The model 2400 will work effectively on grounded and ungrounded machinery.

If a screened cable is used for the 4~20mA signal it should only be earthed at one end.

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.

As standard the output of the model 2400 is arithmetic mean calibrated to RMS.

It is possible to use a portable vibration meter to measure the vibration alongside a model 2400 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 2400 which will give rise to differences between the two readings.
3. The portable unit may have a true RMS circuit whereas the 2400 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 2400.

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.

In practice we are not looking for high accuracies in machine monitoring. What we need is stability, which the 2400 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 2400 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 2400 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	Just tolerable	Allowable
7	Just tolerable	Allowable	Allowable	Good
4.5	Allowable	Good	Good	
2.8	Good			
1.8				
1.1				
0.7				
0.45				
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.