

4-20 mA vibration sensors outperform vibration switches

Newer 4-20 mA technology and products provide and real-time vibration monitoring data, helping protect critical machinery.

Vibration switches can be replaced by 4-20 mA vibration sensors, or with dynamic sensors and a Wilcoxon intelligent transmitter. Either option will increase reliability and provide better machinery health information. An iT alarm can be added to achieve a complete standalone monitoring system and replace antiquated mechanical switches.



Vibration switch weaknesses

Vibration switches typically outperform a “good” or “bad” indicator, and do not offer a vibration signal that can be trended to observe changes in machinery over time. Switches provide no advanced warning of a fault and by the time they alarm, it could be too late.

Equipment start-up typically has high impact or “bump” vibrations, which can cause a switch to trip unless the vibration threshold level is set high. When the trip level is high enough to turn the machine on, it could be set too high to catch faults in advance.

Vibration switches are made of mechanical components, including springs, magnets and lever arms, which can freeze and become inactive. Additionally, calibration of mechanical vibration switches is imprecise. They can be set too high to catch significant vibratory events, or so low that ambient conditions continually trip the switch. In this case, the switch is usually disarmed or bypassed, essentially eliminating any protection at all.

Acceleration monitoring weaknesses

Mechanical vibration switches are sensitive to acceleration only. They do not measure velocity, which is the best measurement for overall machine condition in many applications. Standard ISO 10816 guidelines exist for velocity vibration measurements, but there are no generally accepted thresholds for acceleration monitoring. Velocity measurements do not occur as early as acceleration but tend to increase over time for a better representation of the machine’s condition. Impact levels detected with acceleration *decrease* over time, even though the machine condition does not improve.

Switches only detect high impacts and shock, which may indicate early bearing wear, lack of lubrication in gears or bearings, or cavitation. However, these faults can occur without impact-type vibration. In that case, switches offer little warning of machine problems or impending failure.

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Advantages of 4-20 mA vibration monitoring

- Measure velocity, acceleration or displacement and have dynamic vibration data available for complete failure mode analysis and fault detection
- Trust the precise data from reliable sensor readings
- Reduce nuisance trips caused by high start-up vibrations and non-vibration related events
- ISO 10816 levels can be used to set thresholds (see Table 1)
- Achieve online monitoring with 4-20 mA output, which can be tracked 24/7 through the existing process control system, such as PLC, DCS or SCADA
- Trend data to improve maintenance planning, have confidence in operability, and provide advanced warning of developing faults
- Dynamic vibration data is available for complete failure mode analysis
- Wilcoxon accelerometers are extremely reliable, with a Mean Time Between Failure (MTBF) of 25 years

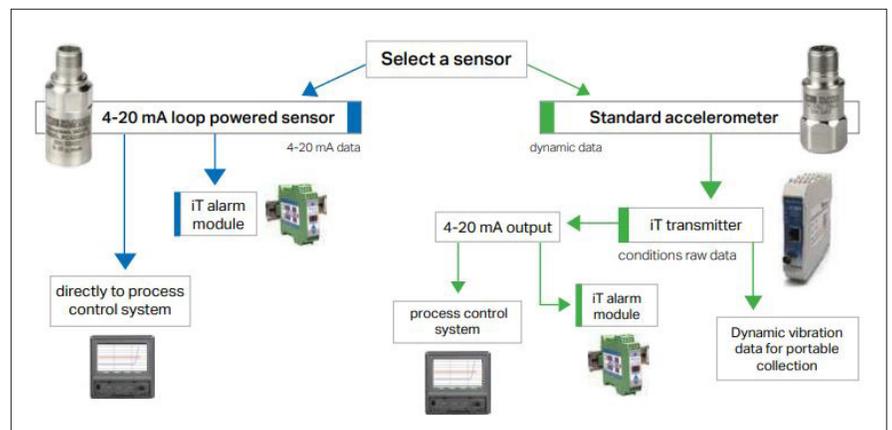
Table 1 ISO 10816		Machinery groups 2 and 4	Machinery groups 1 and 3		
Velocity		Rated power			
in/sec peak	mm/sec rms	Group 2: 20 hp - 400 hp motors (15 kW - 300 kW) 6.2" ≤ H ≤ 12"	Group 1: 400 hp - 67,000 hp motors (300 kW - 50 MW) 12" ≤ H		
		Group 4: pumps ≥ 20 hp (15 kW) integrated driver	Group 4: pumps ≥ 20 hp (15 kW) external driver		
0.61	11	Damage occurs			
0.39	7.1				
0.25	4.5	Restricted operation			
0.19	3.5				
0.16	2.8	Unrestricted operation			
0.13	2.3				
0.08	1.4	Newly commissioned machinery			
0.04	0.7				
0.00	0.0				
Foundation		Rigid	Flexible	Rigid	Flexible

4-20 mA monitoring options

Wilcoxon offers loop powered sensors for 4-20 mA output to an alarm module or directly to an existing process control system (shown on the left of the diagram). This method has a lower total set-up cost, and offers simple trend data for 24/7 monitoring and multiple output types (RMS, peak, true peak).

Where access to dynamic data is needed, a standard accelerometer can be combined with an intelligent transmitter to provide more detailed information on machine condition (shown on the right of the diagram).

Dynamic data can be collected with portable meters for walkaround monitoring programs, in addition to the ability to output to an alarm or directly to a process control system. Because of the wider sensor selection available with this method, it can be adapted successfully to a broader range of applications.



Set-up options for 4-20 mA monitoring