

# Cost-effective predictive maintenance solutions

## Condition monitoring is critical to machine reliability

Using condition monitoring technologies to track machine health is an industry-proven best practice. Predictive maintenance saves money by increasing plant uptime, reducing outages and avoiding unscheduled downtime, resulting in improved control of spare inventory.

Vibration monitoring plays an essential role in predictive maintenance by providing an early warning of impending machinery faults, such as looseness, imbalance, bearing wear and gearbox failures.

Using 4-20 mA vibration transmitters establishes a cost-effective condition-based maintenance program that can improve manufacturing reliability - for vibration experts and non-experts alike. Trending vibration data offers 24/7 online monitoring of more production assets, without the need or cost of detailed spectrum analysis.

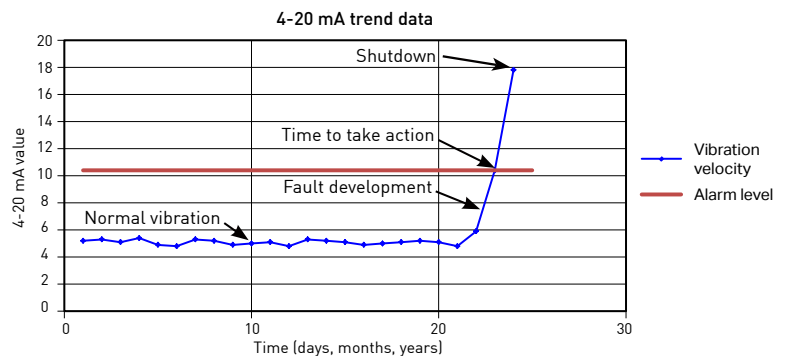
## Process monitoring plus simplified condition monitoring

Vibration trending is not a new concept, just a practical approach.

- >> Changes in overall vibration levels provide a warning before equipment failures
- >> 4-20 mA data goes right to a process control system, where trends are easy to see
- >> Simple alarm and trip limits can be set
- >> Spectrum analysis is not necessary, but available on demand
- >> Improves the reliability of critical assets when no vibration monitoring program exists, or for balance of plant machinery that is not currently being monitored
- >> Maximize resources and reduce walk around time by focusing only on problem machines

The overall level of vibration is represented by a loop current of 4-20 mA, where 4 mA represents zero vibration, and 20 mA represents a sensor's full-scale vibration level. This loop current indicates changes in machine health when compared against standard vibration guides, without requiring complex analysis. [ISO 10816-3 standards](#) set forth guidelines for monitoring machines at their bearing positions and include suggested alarm and trip levels for various machines.

Since many process control systems already accept 4-20 mA inputs, vibration data can be easily incorporated and provide a new level of protection with around-the-clock machinery health monitoring. It can also increase the effectiveness of condition monitoring programs that already track 4-20 mA process parameters such as pressure, temperature or flow.



# Process monitoring options

Depending on the existing plant infrastructure and the machinery to be monitored, there are several options for a vibration monitoring setup.

## 4-20 mA data for vibration trending

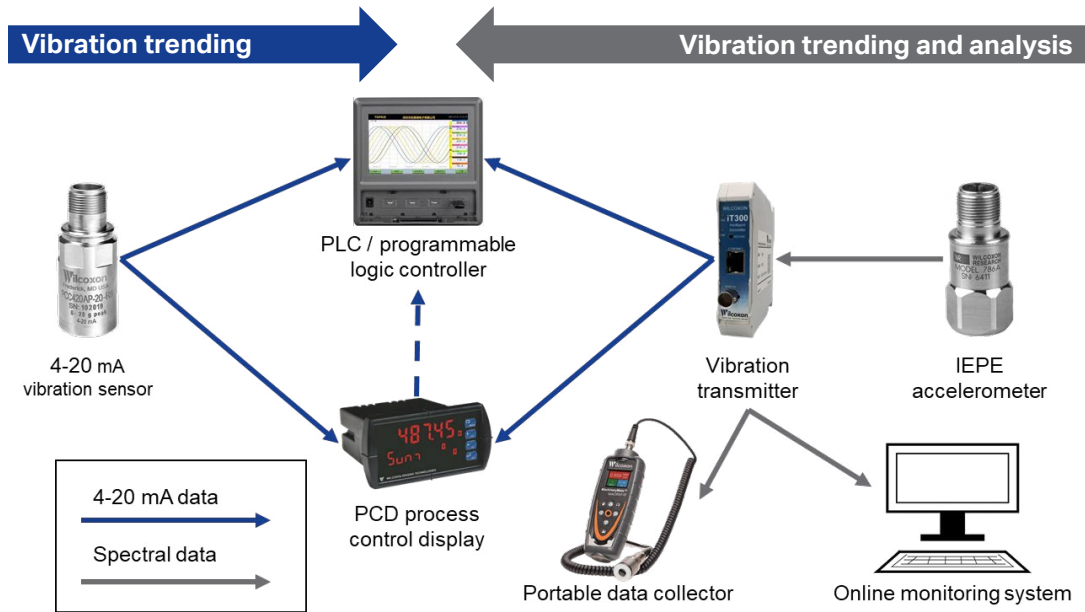
For plants already using PLC, DCS, or SCADA systems, the most cost-effective option is the use of 4-20 mA sensors that output directly to the process control system. It's simple to do with existing infrastructure and provides 24/7 monitoring at the lowest relative cost per data point.

A 4-20 mA sensor used with a local display and alarm module is a good choice for plants without control systems in place.

## Dynamic data for vibration trending and analysis

While vibration trending is useful and effective, dynamic vibration data (the time waveform and frequency spectrum) provides the highest level of data in determining the cause of increased vibration. Low-frequency measurements, HFD, and transient spikes in vibration from loose components or impacting are best monitored with accelerometers or velocity transducers in combination with a vibration transmitter for trending data.

This allows 4-20 mA data to be sent to a control system or local display and alarm module, without losing the raw vibration data necessary for diagnosing complex machine problems with a portable data collector or online monitoring system.



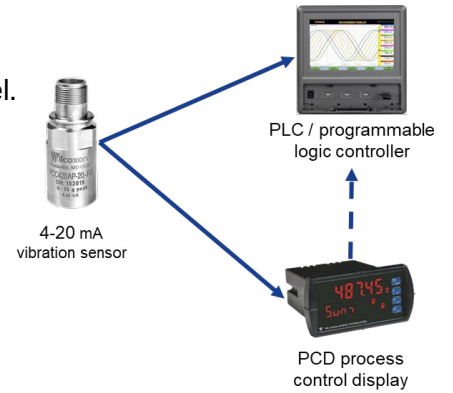
CBM approach	Relative cost per data point	Dynamic data	24/7 continuous monitoring	Required		Advance warning
				PLC/DCS/SCADA	Programming/Training	
PC420 to control system	\$	no	yes	yes	yes/no	1-3 months
PC420 + iT401 alarm module or PCD	\$\$	no	yes	no	no/no	1-3 months
IEPE sensor + iT300	\$\$	yes	yes	yes	yes/no	1-4 months
IEPE sensor + iT300 + iT401 or PCD	\$\$\$	yes	yes	optional	yes/no	1-4 months
Portable data collection	\$\$\$\$\$	yes	no	no	yes/yes	1-6 months
Traditional online monitoring	\$\$\$\$\$\$\$\$	yes	yes	no	yes/yes	3-18 months

# 4-20 mA loop powered sensors

Loop powered sensors (LPS) house an accelerometer, signal conditioner, and processor, to output a 4-20 mA signal proportional to the overall vibration level.

A 4-20 mA sensor can feed data directly to most process control systems, including PLCs, DCSs and SCADA systems. A local display and alarm module is a good choice for plants without control systems in place.

- >> Selectable full-scale values
- >> Monitor acceleration, velocity or displacement, with output signals representative of RMS, peak or peak-to-peak levels
- >> Custom banded sensors with true peak detection for cavitation detection or reciprocating engine monitoring
- >> Hazardous area certifications available
- >> Compatible with localized alarm and display modules



## Upgraded plug-and-play PCC420s are smaller, lighter and lower price

Our best-selling 4-20 mA vibration sensors are configured to the monitoring requirements at Wilcoxon's factory. Our knowledgeable team can assist in determining the ideal configuration for every application.

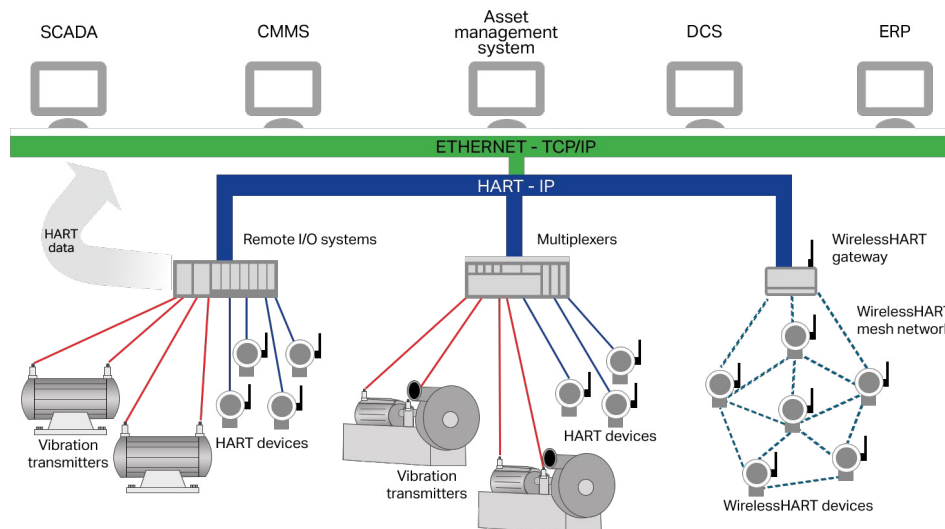
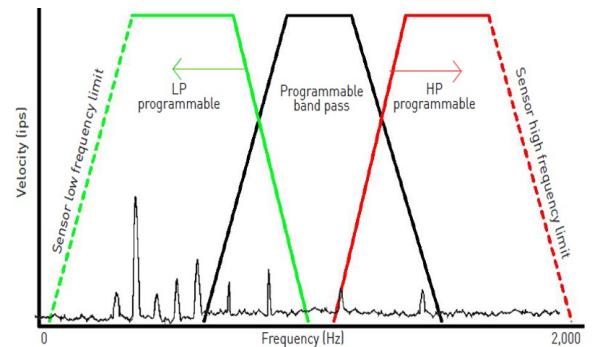
- >> Top- or side-exit sensors, with or without an integral cable
- >> Metric scaling options available for velocity measurements
- >> 2-pin MIL-C-5015 or 4-pin M12 connectors



## Field-configurable digital sensors with HART® protocol

PCH420V series velocity sensors output 4-20 mA vibration data with the added capability of digital communication via HART 7.0 protocol. The HART functionality allows field configuration of three separate vibration bands, multi-drop installations and direct connection with existing HART-enabled plant infrastructure.

- >> May be configured for many types of monitoring applications; one part number is a 'universal' 4-20mA transmitter
- >> User configurable in the field or on the bench
- >> Three independently configurable vibration bands allow multi-targeted fault detection from a single sensor
- >> Configurable upper and lower frequency limits provide the ability to filter unwanted frequencies from the band results
- >> Multi-drop wiring option reduces cabling and installation costs
- >> "Smart sensor" provides more data than traditional 4-20 mA vibration sensors, reports sensor health and status



# Enhanced machine health monitoring with vibration analysis

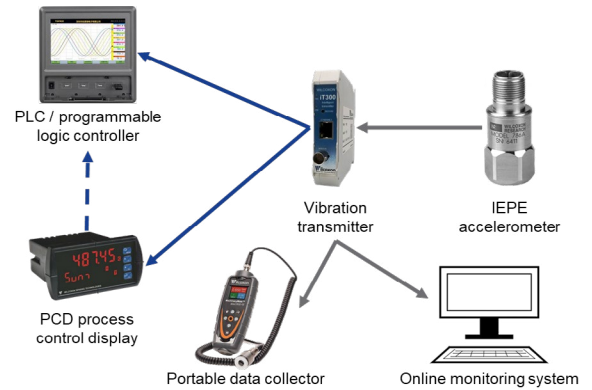
Wilcoxon's iT series intelligent vibration transmitters process dynamic vibration signals to produce a 4-20 mA output. They are a powerful means to connect standard accelerometers and velocity sensors to process control systems for 24/7 online monitoring, allowing machine health to be trended over time without walkaround data collection.

## Raw vibration data for extensive analysis

The iT transmitter's BNC connector provides access to raw vibration data that can be used for detailed spectrum analysis when vibrations trend upward or after a 4-20 mA alarm level has been triggered. This AC signal can be captured by handheld data collectors for routine measurements or connected to an online vibration monitoring system.

## Custom vibration monitoring solutions

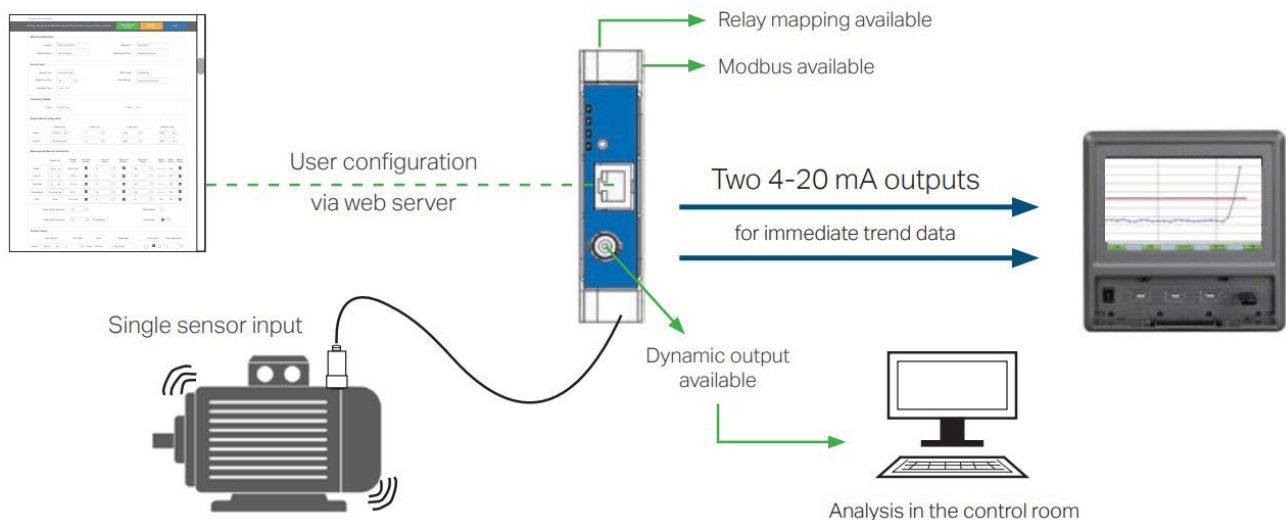
Two separate 4-20 mA outputs can be tailored to meet unique plant monitoring requirements, including desired output and full-scale range. Wilcoxon offers both user-specified, factory-configured transmitters (iT150) and field-configurable transmitters (iT300 series) allowing more precise control over fault monitoring and increased flexibility.



## Intelligent transmitters series comparison

Feature	iT150	iT300	iT301
DIN-rail mountable	X	X	X
Accepts accelerometers, dual-output (vibration + temperature), velocity sensors	X	X	X
20V peak-peak sensor input	X	X	X
Primary and secondary 4-20mA outputs	X	X	X
0.2 Hz - 20 kHz bandwidth	X	X	X
24-bit A/D converter	X	X	X
Multiple pre-configured units, tailored to the most common applications	X		
Plug-and-play, factory configured to monitoring requirement	X		
User configuration via web page		X	X
Field-configurable full-scale range		X	X
Field-configurable vibration bands (2X)		X	X
Modbus TCP/RS-485 communications			X
Configurable high/low alarms for better control over fault monitoring			X
Relay/alarm source mapping			X

## How iT works



# Process control displays and alarms

Wilcoxon's PCD digital panel meters are among the most versatile on the market and are used in a wide variety of process and temperature applications. They are field programmed to accept process voltage (0-5V, 1-5V,  $\pm 10V$ ) and current (0-20 mA, 4-20 mA) inputs, 100  $\Omega$  RTDs, and the four most common thermocouples.

They are compatible with loop powered vibration sensors, like the PCC420 series, and vibration transmitters, like iT transmitters, and can provide 24 VDC to power the transmitter's 4-20 mA signal and sensor. The 4-20 mA output provides an isolated retransmission of the input signal for temperature inputs. PCD meters can be programmed via external button contacts on the front panel or remotely with the included PC-based software.

## PCD100 series with 4-digit display

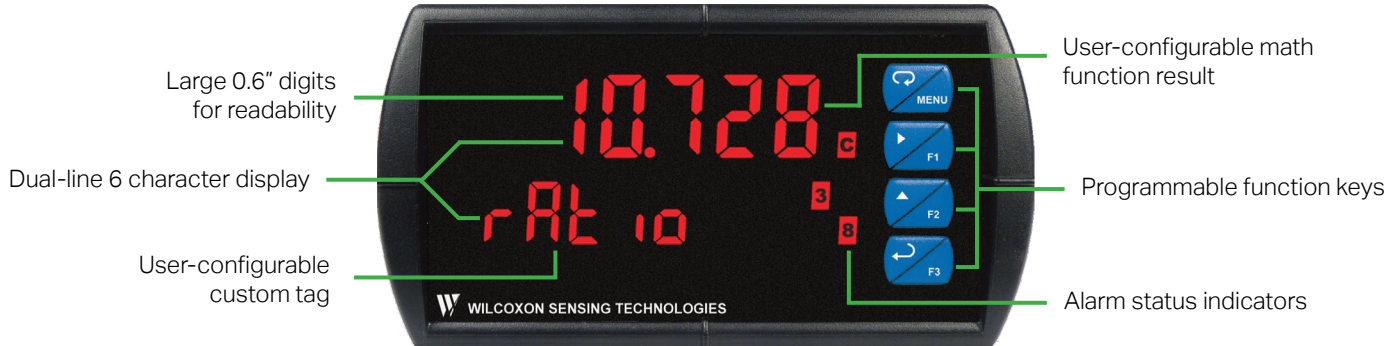
- >> Has two alarm points with front panel red LEDs to indicate alarm conditions, useful for applications utilizing visual-only indications
- >> Can be equipped with 2 relays
- >> Optionally includes isolated 4-20 mA output for alarm or control applications



## PCD200 series 1/8 DIN digital panel meters with dual-line, 6-digit display

- >> Accept two inputs
- >> Can be customized to quickly display the most relevant variables, including two inputs at the same time with tags, or the result of math functions performed on one or both of the inputs
- >> Modbus® RTU serial communications
- >> Can be equipped with optional SunBright® sunlight-readable LEDs, up to 4 internal relays, and a 4-20 mA analog output for connecting to a process control system

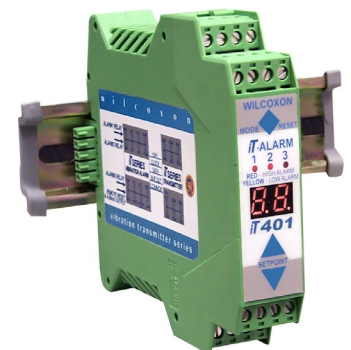
Rugged NEMA 4X / IP65 front panel



UV-resistant SunBright sunlight readable models for outdoor applications

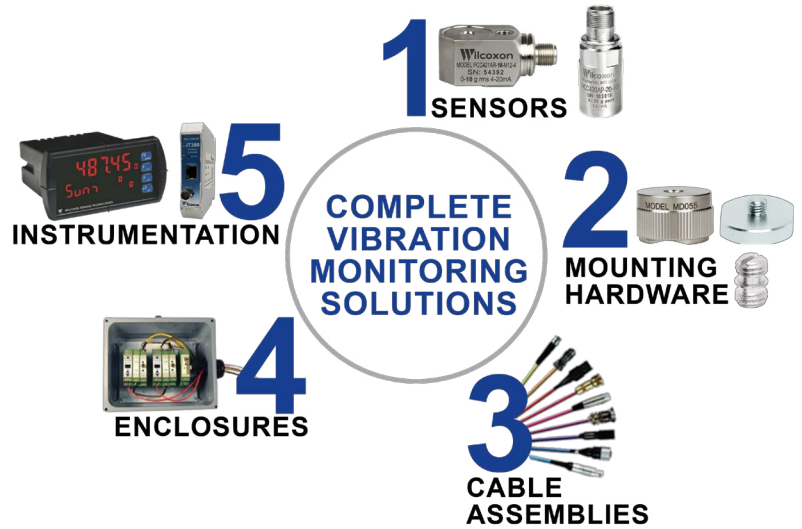
## iT401 programmable relay alarm monitor with front LED readout

- >> Compares 4-20 mA input against preset alarm limits to provide local notification of potential problems
- >> Is compatible with any iT transmitter or 4-20 mA sensor, including pressure, temperature, flow or speed
- >> Displays real time 4-20 mA data in mA or percentage of full-scale output
- >> Can be set with three alarm levels - high or low setpoints with time delay - to achieve optimal notifications including early warning or high alarm of shutdown notifications
- >> Has three independently adjustable relays with user-established time and hysteresis delays to minimize false alarms and account for start-up conditions
- >> Indicates the condition of each relay via LED lamps



# Complete vibration monitoring solutions

Wilcoxon offers all the equipment to complete the monitoring chain, including mounting bases, cable assemblies, and enclosures.



## Mounting bases

The accuracy of vibration signals is dependent on appropriate contact between the sensor and the machine. Wilcoxon offers a wide range of mounting bases to suit the machine, location and monitoring frequency.



SF6 mounting stud,  
1/4-28 both ends



SF8 cementing pad,  
1/4-28 integral stud,  
1" diameter



MD055 magnetic mounting base,  
55 lb force, 1/4-28 tapped hole,  
non-isolated, 1.25" diameter

## Cable assemblies

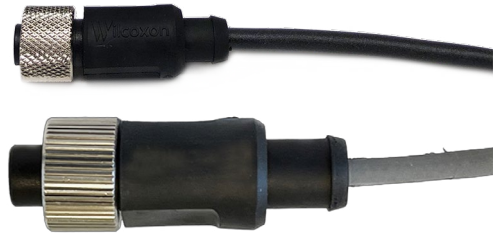
Configure the best assembly for every monitoring location with Wilcoxon's variety of cable and connector options.

- >> Ranging from IP50- to IP68-rated
- >> Threaded or boot-style connectors, molded or metallic, temperature ratings up to 200°C
- >> Shielded, twisted pair, multi-conductor and coaxial cable offerings
- >> Exterior stainless-steel braid, armor or flexible conduit coverings

## Featured cable assembly upgrades

Wilcoxon has released two new connector options and re-engineered two user favorites. The budget-friendly R6W and R6WR have been refreshed, while the R6WP and RM12W add to an impressive array of permanent and portable options. All come with faster delivery on standard or custom lengths.

- >> RM12W cable assemblies for vibration analysis or process monitoring applications and with 4- or 5-pin M12 connector vibration sensors
- >> R6W, R6WR or R6WP cable assemblies for vibration analysis or process monitoring applications with 2-pin MIL connector vibration sensors



## Enclosures

The iT series of NEMA 4/4X corrosion-resistant enclosures are IP66-rated and DIN rail mountable, for easy storage of signal conditioning, alarm, and power supply modules.

- >> iT051: standard enclosure
- >> iT051C: with clear viewing window on door (pictured)
- >> iT052: holds approximately 25 iT modules



# 4-20 mA applications



## Pumps

Pump conditions such as imbalance, misalignment, bearing health, and vane pass faults can be detected with 4-20 mA monitoring. Wilcoxon's specialized acceleration true peak sensor provides a quick-response 4-20 mA output signal when destructive cavitation conditions begin, to minimize damage and reduce downtime and repair costs.



## Motors

As primary components of industrial processes, motors offer the best opportunity for plants to minimize unscheduled downtime and reduce maintenance costs. A single PCC420V velocity output sensor mounted on each bearing can warn of a change in condition that, unchecked, could ultimately lead to damage of coupled machinery.



## Fans

4-20 mA vibration sensors located on pillow blocks of forced draft, induced draft, or HVAC fans can monitor bearing conditions including normal wear, early-stage bearing fault, foundation looseness, and fan imbalance. Detecting failures before damage to surrounding ductwork occurs can save in repair costs.



## Cooling towers

Selection of the appropriate 4-20 mA vibration sensor can help to monitor fan balance, gear mesh frequencies, or bearing condition and warn of increasing vibration long before catastrophic failure. Fans running below 300 RPM are best monitored using low-frequency accelerometers and iT transmitters.



## Compressors

Shaft speed, turbo, and gear mesh frequencies can all be present in compressors, posing complex monitoring challenges. Because monitoring compressors requires both low and high-frequency information, an IEPE sensor coupled to multiple iT transmitters offers the best protection.



## Gearboxes

PCC420A series 4-20 mA sensors are the most effective alternative for high-frequency components because of their ability to include up to the third harmonic of the gear mesh frequencies in the overall value. A dynamic sensor with an appropriate transmitter should be used for gearbox monitoring when dynamic signal analysis is anticipated.



Wilcoxon Sensing Technologies offers vibration monitoring products, which have been used to monitor critical plants and equipment for nearly 60 years. Our state-of-the-art facility is certified to ISO 9001 standards, ensuring the highest quality of manufacturing.

Our sensors are successfully used in a wide range of industries where rotating machinery is critical to plant operation and represents a major asset. Wilcoxon products monitor thousands of machines worldwide, providing data on machine condition to help users identify developing faults early and avoid machine failure and unscheduled downtime.

Vibration monitoring adds value to any predictive maintenance program. Wilcoxon offers the highest quality solutions to help you protect your investment, and reach higher levels of reliability, machine availability and output.



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