

Wilcoxon Sensing Technologies

an Amphenol Company

Helping you succeed >



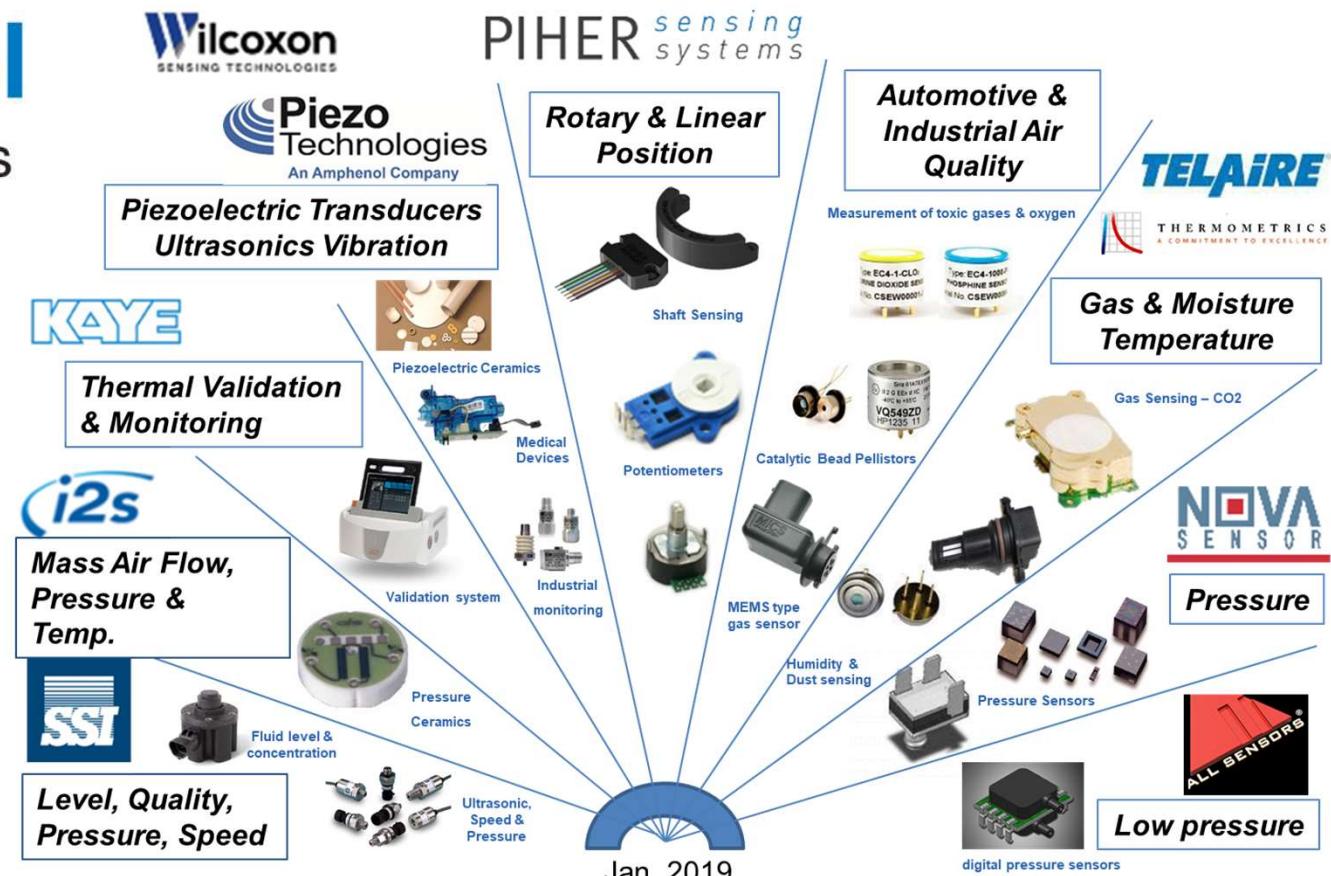
VIBRATION MONITORING SOLUTIONS



APTP position within Amphenol

- Amphenol 2021 Revenue >\$10.8B
- Amphenol Employees >80,000
- Amphenol Piezo Technology Products (APTP): Wilcoxon + Piezo Technologies

Amphenol Advanced Sensors



OVERVIEW, MARKETS, PRODUCTS



Markets

Industrial

Industrial condition monitoring

- » Accelerometers
 - » General purpose
 - » High-temperature
 - » Tri-axial
- » Hand-held instruments
- » Cable assemblies
- » Enclosures
- » Mounting accessories



Wind and power gen

- » Accelerometers
 - » Low-frequency
 - » High-temperature
 - » High EMI resistant
 - » Radiation resistant
 - » Hazardous areas
- » Velocity sensors



Process automation

- » HART vibration sensor
- » MODBUS vibration transmitter
- » 4-20 mA sensor
- » Vibration transmitter
- » Cable assemblies



Marine

Underwater sensing

- » Hydrophones
- » Seismic sensors
- » Vector sensors
- » Tonpilz



Wilcoxon Sensing Technologies

Product lines

IEPE accelerometer	Loop powered vibration sensor	Underwater sensors	Transmitters	Handheld instruments	Cables	Accessories
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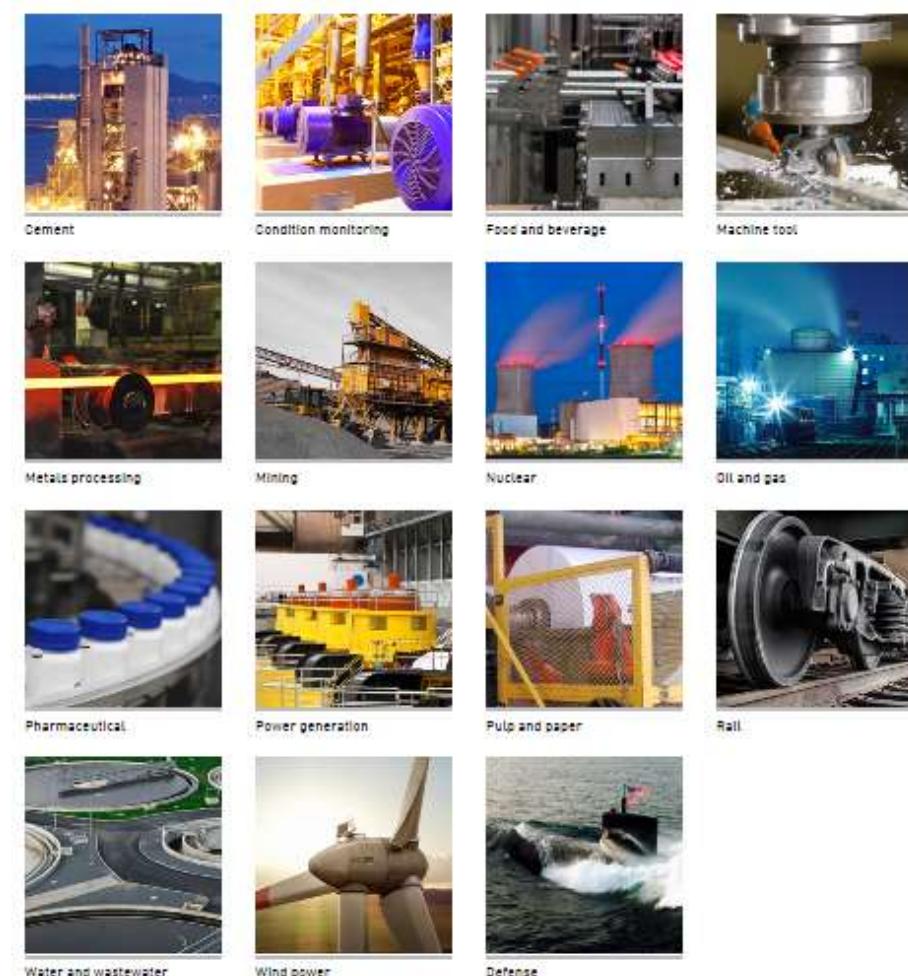
- » General purpose
- » Low frequency
- » Extended temperature
- » Triaxial
- » Radiation resistant
- » Hazardous area certified
- » Low power, low voltage
- » High EMI resistant



- » Hydrophone
- » Seismic sensor
- » Vector sensor
- » Tonpilz
- » IEPE to 4-20
- » Alarm modules
- » Communicaiton modules
- » Vibraiton transmitters
- » Vibration meters
- » Sensor interface cables for M12 and Mil-5015
- » Specialty cables
- » Enclosures
- » Shakers
- » Mounting hardware

Industries that use vibration sensors

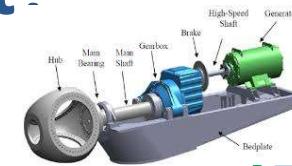
- Wind
- Paper + Pulp
- Oil & Gas
- Food and Beverage
- Mining
- Nuclear
- Pharmaceutical
- Power Generation
- Rail
- Process and Industrial Automation
- Water & Wastewater





What types of rotating equipment?

- Motors – AC, DC, VFD controlled
- Fans/Blowers – forced draft, induced draft, air handlers
- Pumps – horizontal, vertical, underwater
- Gearboxes – speed reducers/increasers, low speed/high speed
- Cooling towers – direct drive, gearbox, belt driven
- Compressors – screw, reciprocating (piston)
- Chillers
- Turbines – gas, steam
- Mixers – chemical, food processing
- Centrifuges

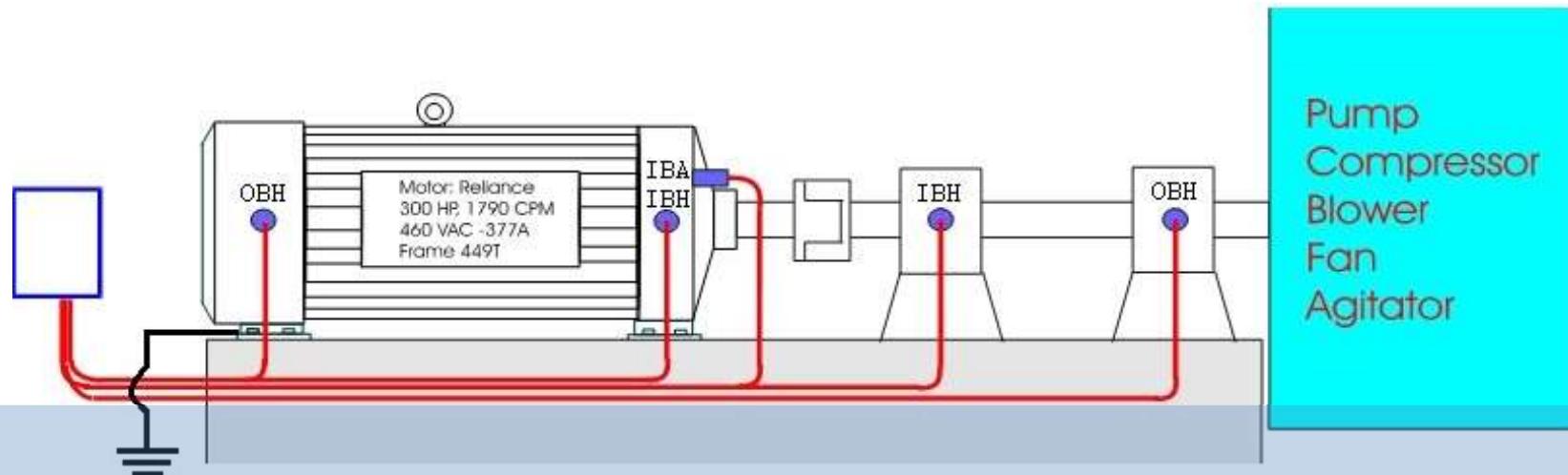






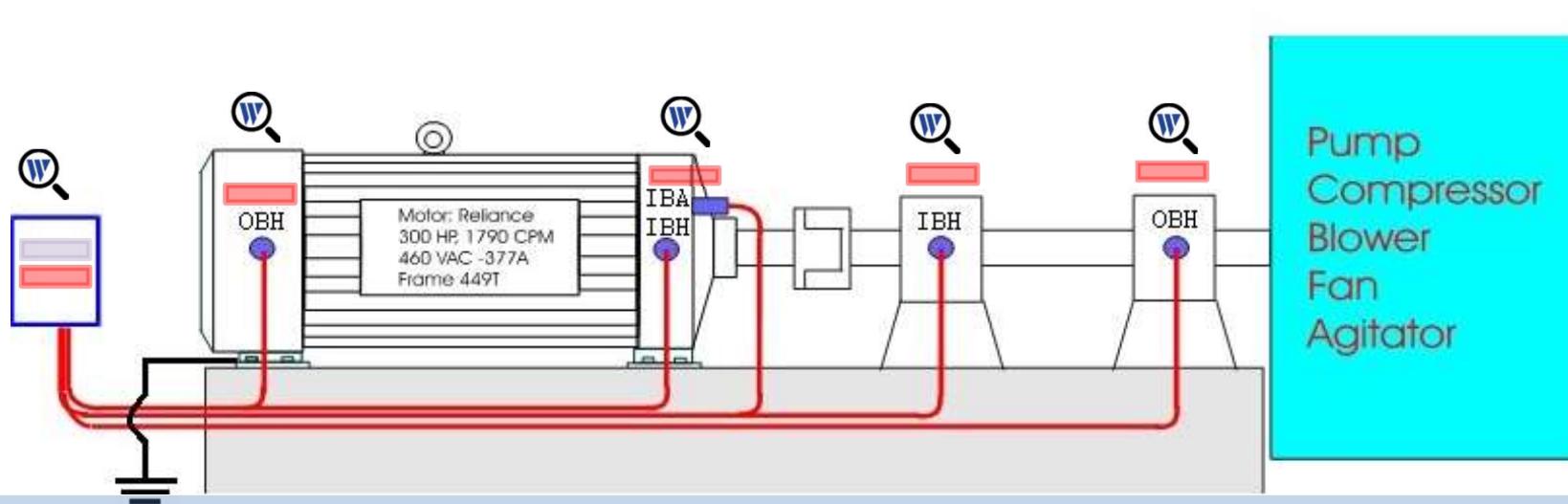
Who benefits most from our technology

- **Continuous operating plants**
 - Tier 1
 - Pulp & paper
 - Oil & gas
 - Petrochemical
 - Steel manufacturing
 - Power generation/Power house
- **Batch processing operations**
 - Tier 2
 - Food processing
 - Pharmaceutical
 - Machine tool plants (automotive)
 - Machine builders as OEM





What does an actual application look like?



Typical application

- Vibration sensors are placed on critical rotating machinery
- Vibration sensors provide a “signature” analysis that can be used to determine the health and useful life of an asset



Pump



Fan



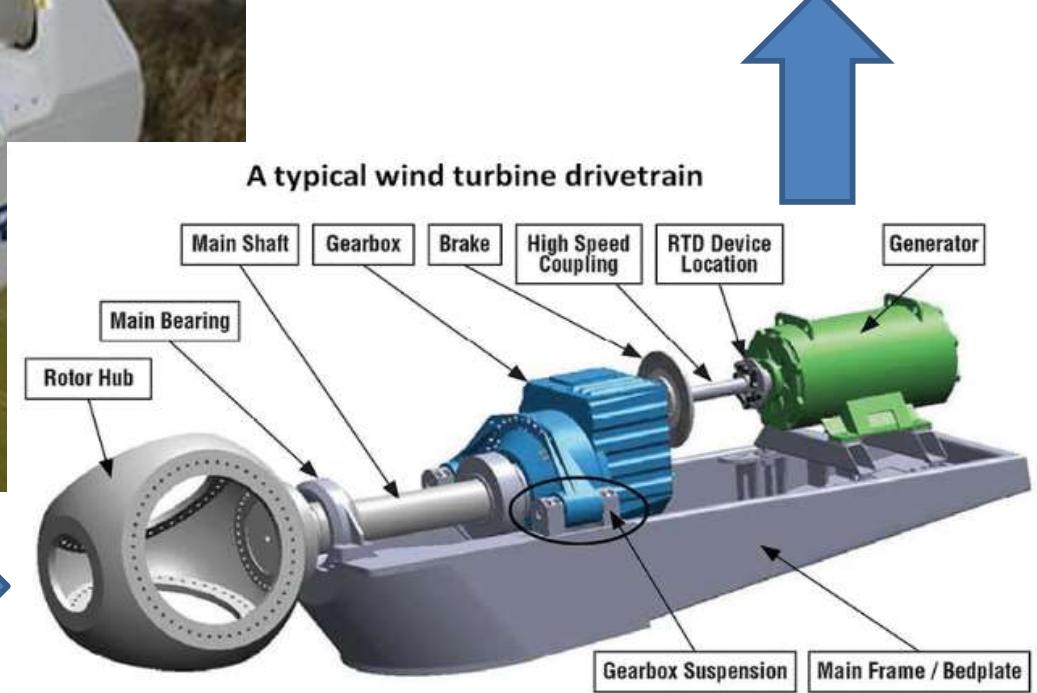
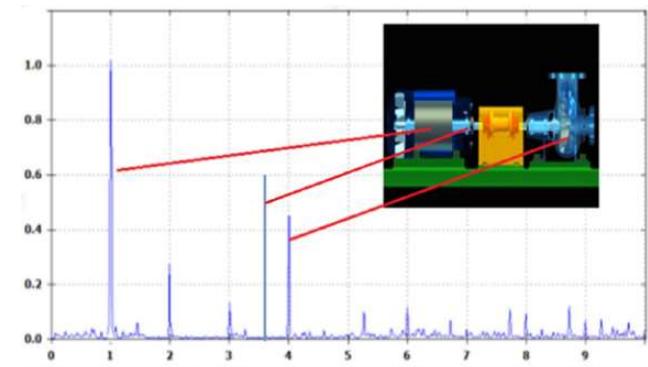
Motor



Gearbox

Typical application

- Wind turbines have 5-7 sensors





High temperature accelerometer – rated to 150°C



Top exit sensor – 100 mV/g



HT786A
Stocked

Side exit sensor – 100 mV/g



HT787A
Stocked

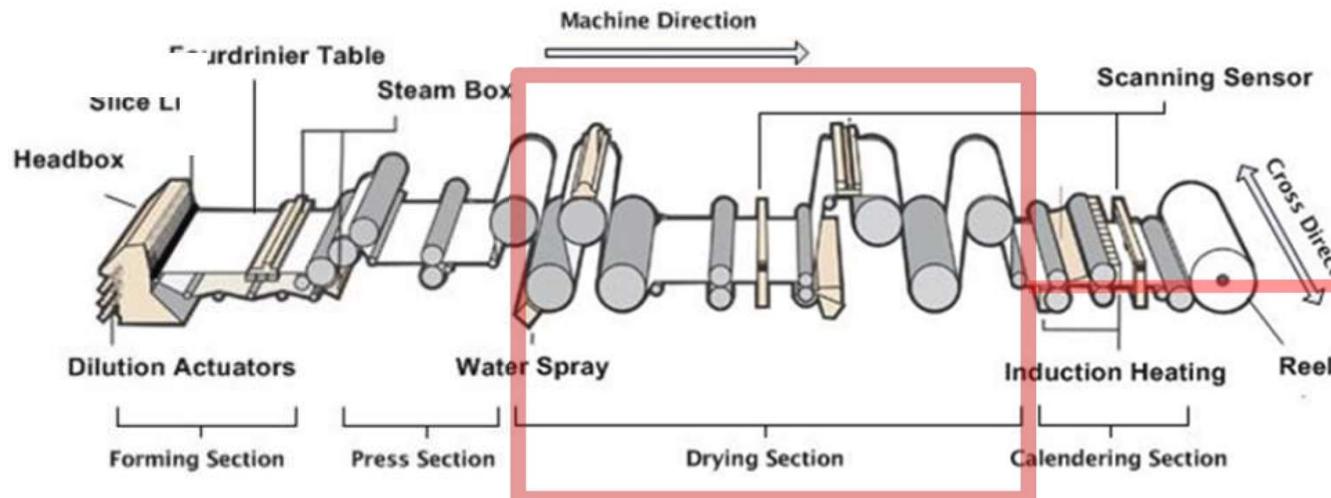
Cables



R6W-0-J9T2A-xx where
xx equals cable length in
feet. 10 ft, 16 ft, 32 ft
Stocked

High temperature sensor

Most common application is dryer section of paper mill



Dryer section of paper mill presents opportunity for multiple sales (100s of units)

Possible terminations for cable – All items stocked



CB2



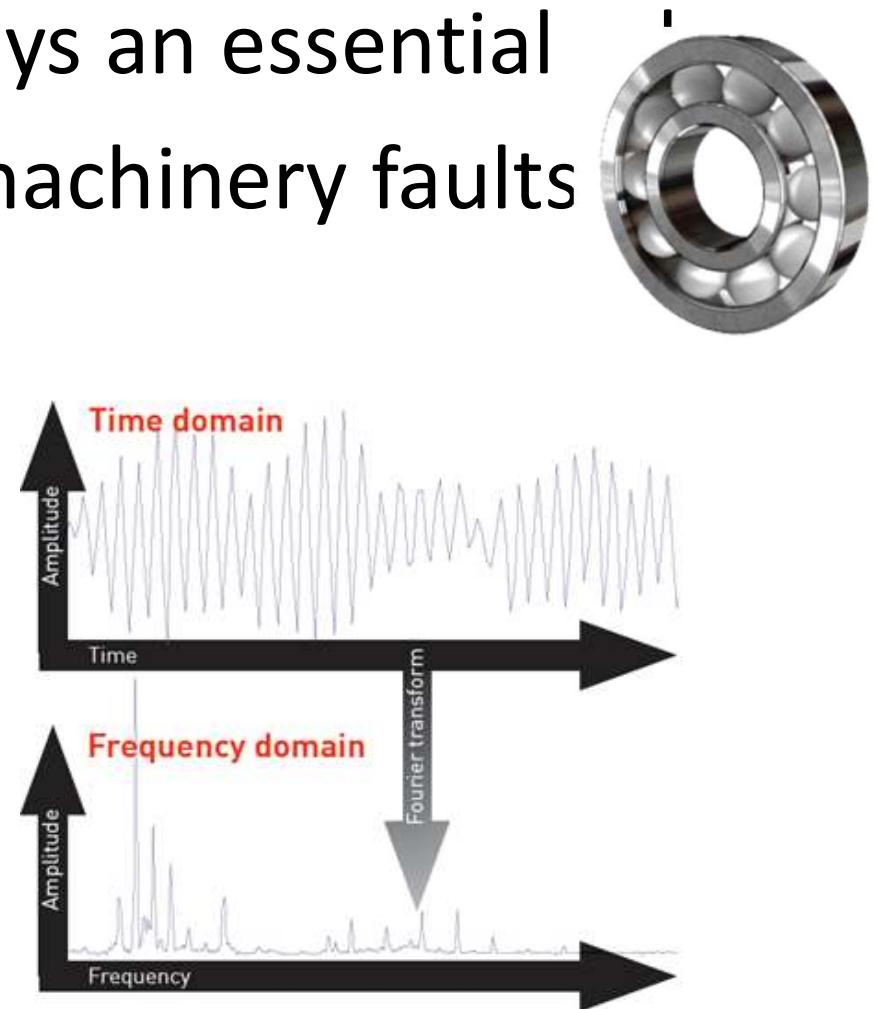
CB4



VLL12BF-C-N-S – stocked

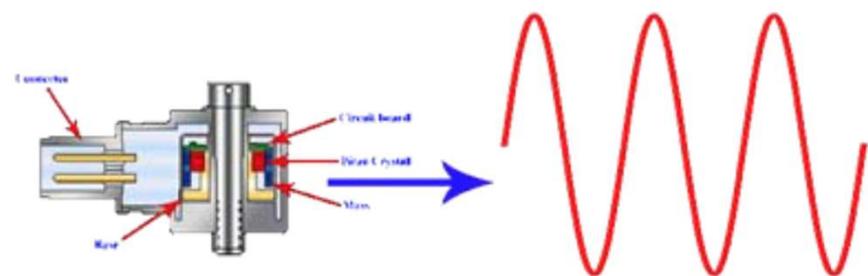
Condition Monitoring using Vibration

- Vibration monitoring plays an essential role in condition monitoring
- Detection of the many machinery faults including
 - Shaft misalignment
 - Rotor balance
 - Gear failure
 - Bearing failure

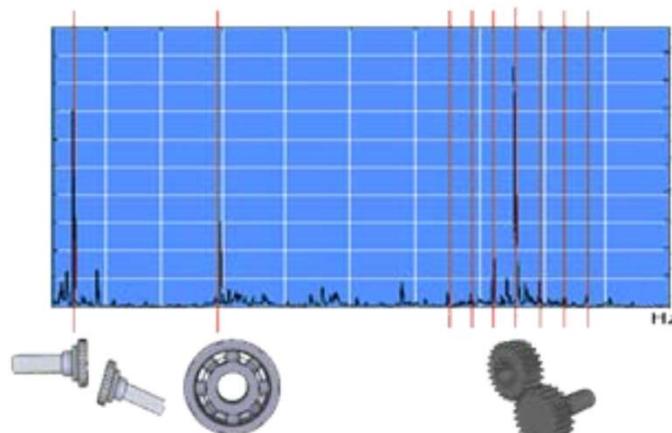
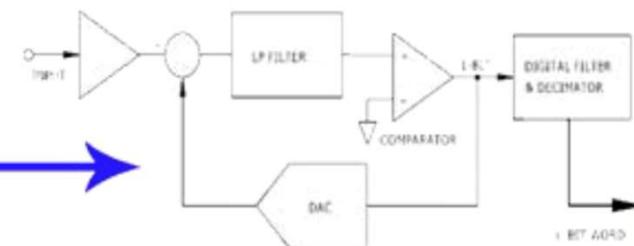


Condition Monitoring using Vibration

Raw signal from accelerometer



A/D conversion and
signal processing

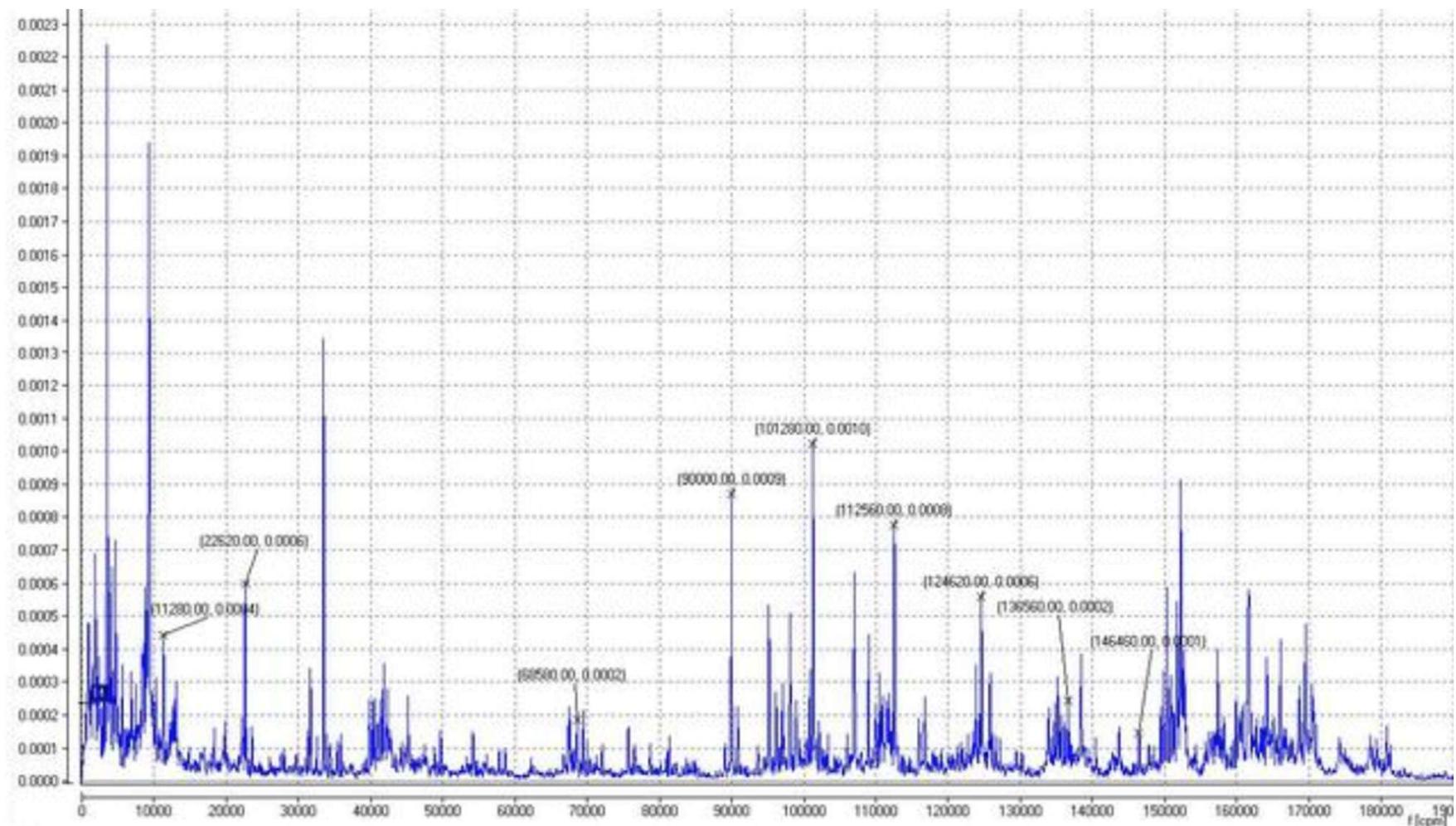


FFT or spectrum



Digitized waveform

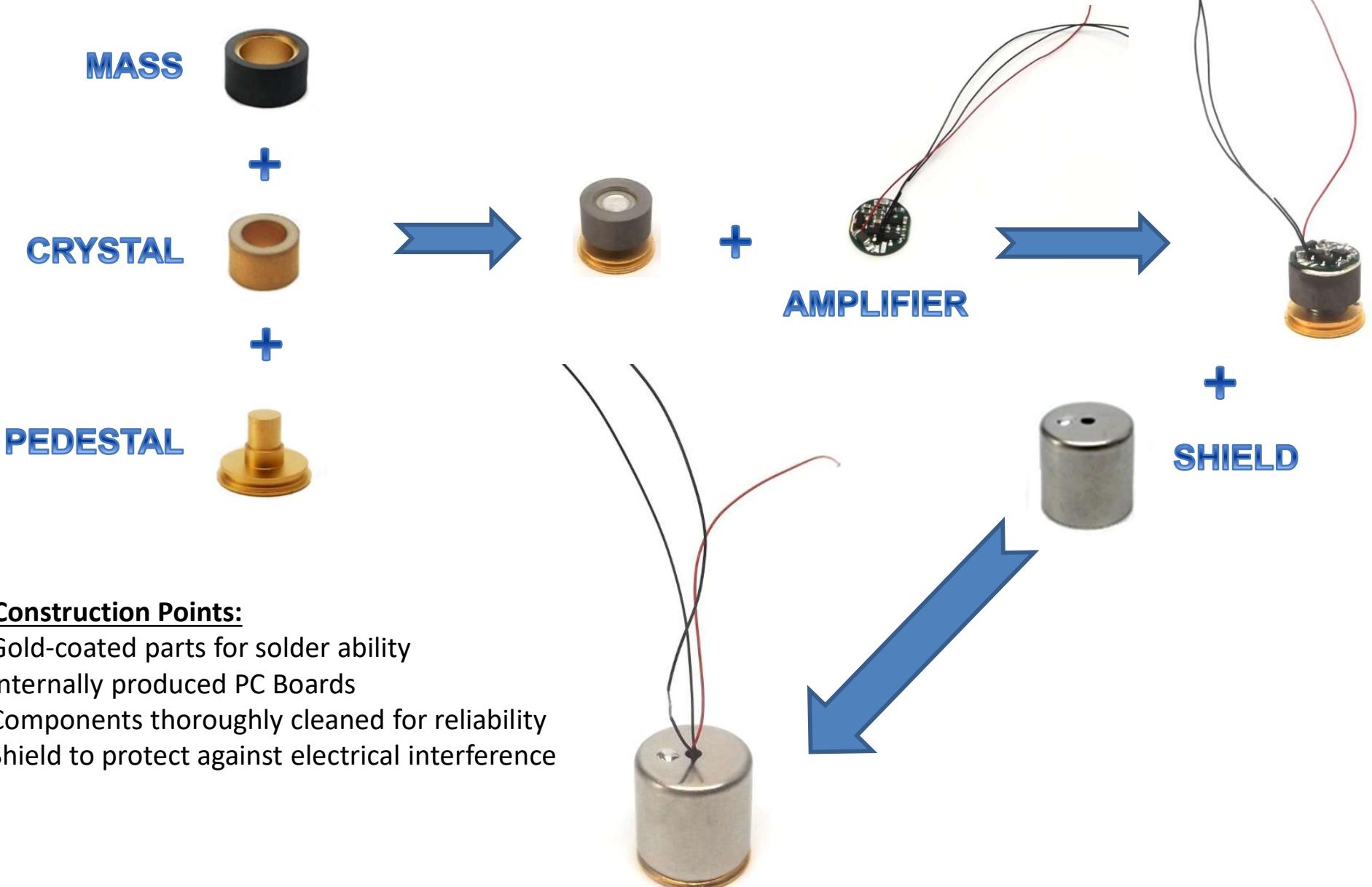
Condition Monitoring using Vibration



Basic Vibration Sensor Construction



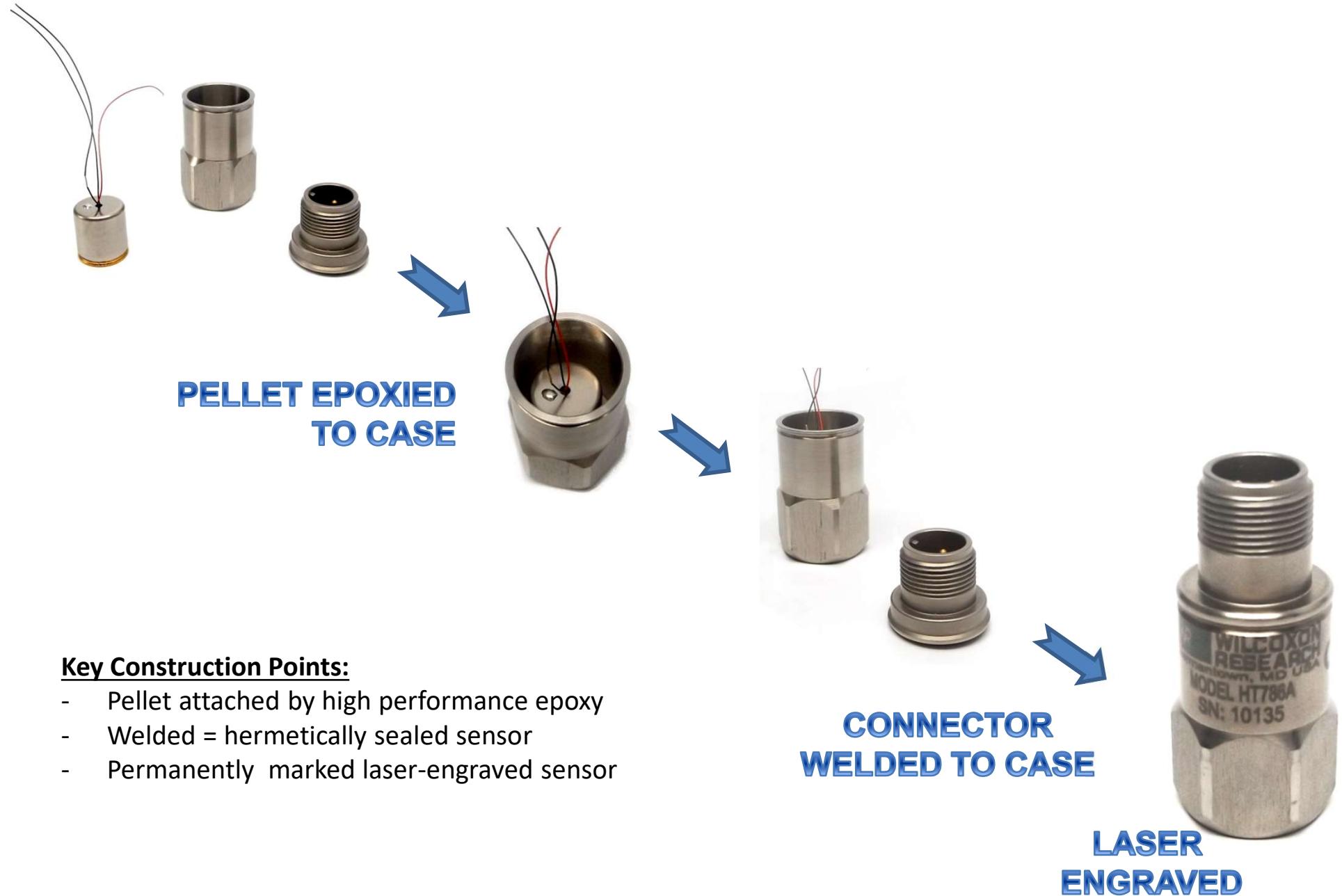
Sensor Pellet Construction



Key Construction Points:

- Gold-coated parts for solder ability
- Internally produced PC Boards
- Components thoroughly cleaned for reliability
- Shield to protect against electrical interference

Final Sensor Construction



How our system works (typical industrial applications)

Permanent Installation



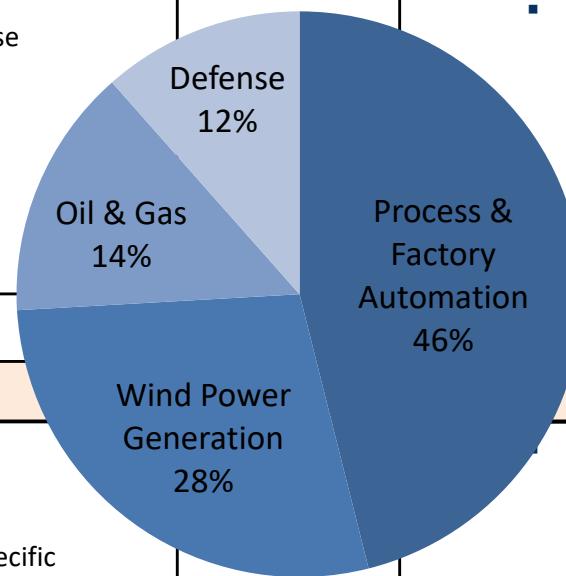
Portable Monitoring



Key Customers

Process & Factory Automation

- Process and factory automation frequently takes place over significant distances in remote areas that would be inefficient to physically monitor
- Includes a wide range of end markets, including pulp and paper, food & beverage and pharmaceuticals
- Industrial production is expected to continue to increase



Wind Power Generation

- Wind power generators can cause serious, costly damage if they malfunction and thus require high quality sensors
- Strong demand in the U.S. and globally, as China in particular continues to build large scale wind farms
- Wind turbines are frequently financed and equipment lenders require stringent standards of maintenance



Defense

- Underwater acoustic products for classified defense based work
- Program-based business where products are tied to specific platforms and typically last several years
- U.S. defense budget is expected to continue to increase under the new presidential administration
- Defense market has opened up with two major competitors exiting their U.S. defense business



Oil & Gas

- Oil & gas industry demands higher reliability given cost of downtime, as well as environmental / human safety issues
- Strong demand for digital / engineered sensing products such as Wilcoxon's HART line of sensors and iT300 transmitters
- Positive industry tailwinds as commodity prices rebound



Sensors & Intelligent Transmitters



IEPE Sensors

- **General purpose 100 mV/g:**
 - Applications
 - Motors, fans, pumps, air compressors
 - Moderate speed gearboxes
 - Conveyers, belt-driven equipment, chain-driven equipment
- **Low Frequency 250, 500 mV/g sensors: measure down to 0.1 Hz**
 - Applications
 - Machines with <500 rpm running speed
 - Slow speed agitators, mixers
 - Cooling towers, Dryers etc.
- **High frequency accelerometers to 29 kHz**
 - Applications
 - Gearboxes & high-speed turbines
 - High-speed machine tool spindles
 - Turbo compressors



IEPE Sensors

- **High Temperature** accelerometers 150°C (IEPE) to 260°C (Charge Outputs)

- Applications

- Dryer section of a paper machine



- **Piezo Velocity transducers** output a vibration signal relative to velocity

- Applications

- Paper machines/ Pumps
 - For vibration analysts who prefer velocity signals



- **Triaxial accelerometers**, multi-directional data for additional analysis

- Applications

- Multi-channel data at a single mounting location
 - Faster data collection



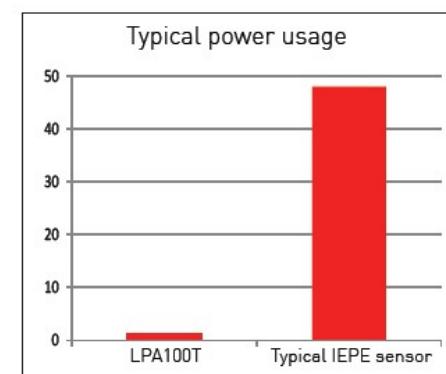
IEPE Sensors - Hazardous area certified

- CSA
- FM
- IS
- Class I Div I
- Class I Div 2
- IECEx
- ATEX



IEPE Sensors- Wilcoxon Unique solutions

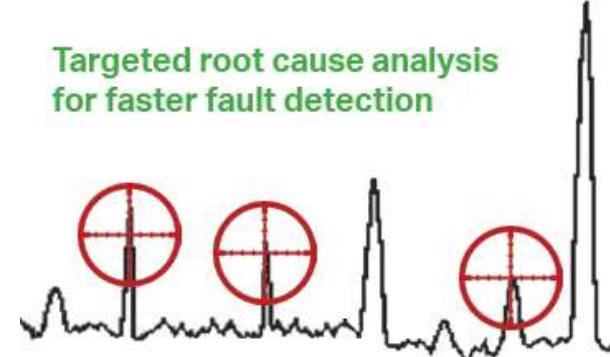
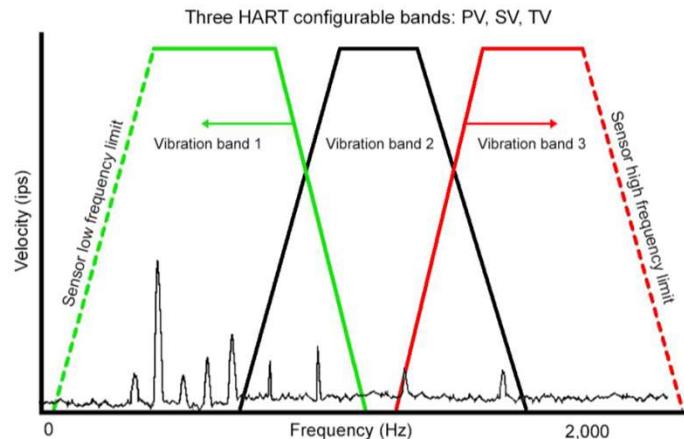
- **High voltage sensors**
 - High electrical isolation between the sensor and machine
 - Withstand arcing between sensor base and internal electronics up to 6,000 volts
 - Applications
 - Wind turbines
 - Railway systems
 - High-voltage generators
- **Low Power/Low Voltage sensors**
 - Fast settling time of <10 ms
 - Ultra low power consumption
 - Built in temperature sensor
 - Applications
 - Wireless sensors
 - Hazardous area certified model



IEPE Sensors- Wilcoxon Unique solutions

- **HART sensors**

- 4-20 mA + **HART 7.0** output
- **Three programmable frequency bands** provide enhanced root cause analysis
- Frequency range **3-2 kHz (-3dB)**, **continuous monitoring**
- **ATEX Zone II** certified

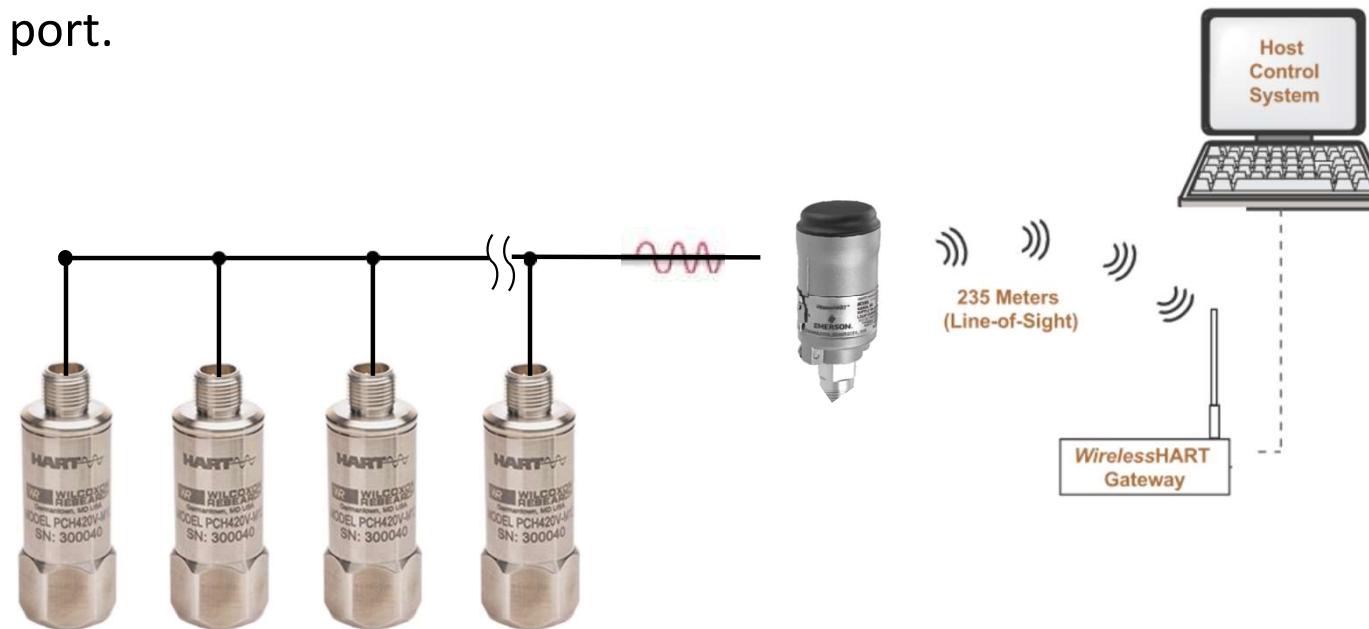


- **Pinpointing the specific causes (e.g. cavitation, misalignment, unbalance etc.)** of abnormal vibration enables time- and cost-effective maintenance decisions and eliminates any guesswork.

IEPE Sensors- Wilcoxon Unique solutions

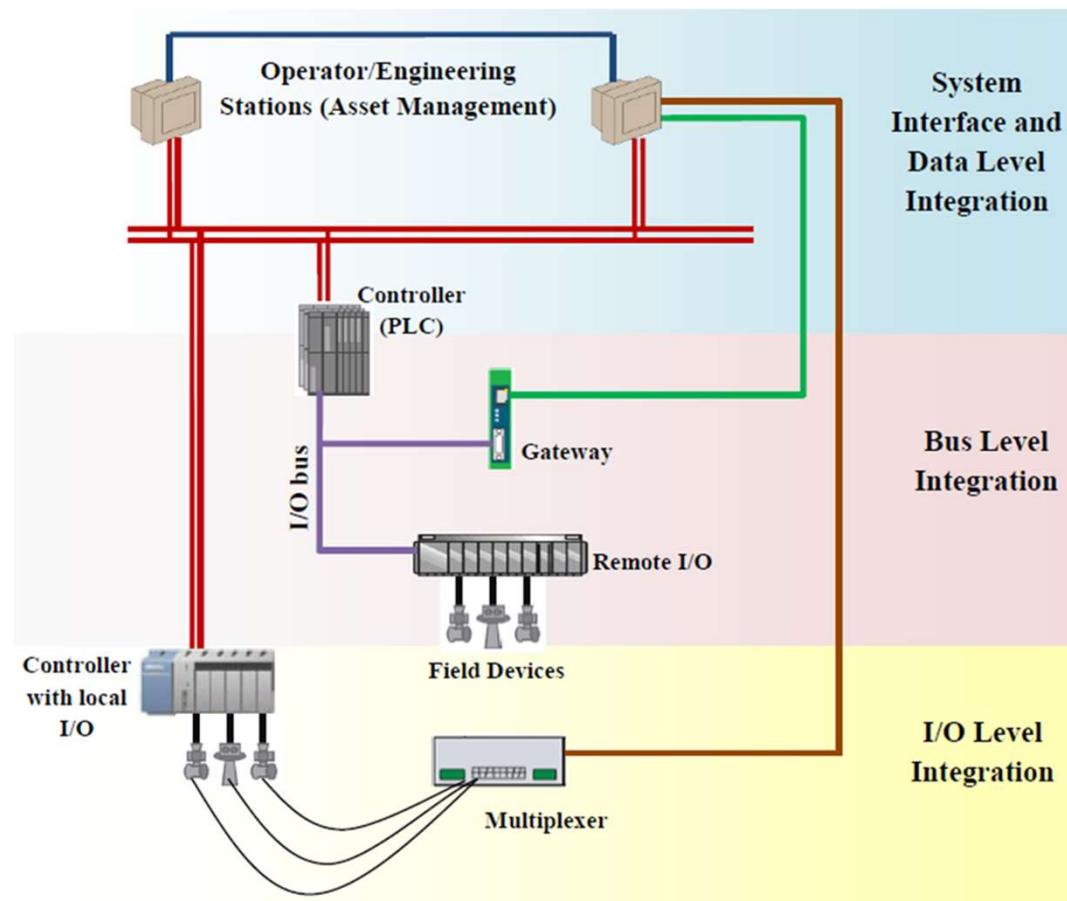
- **HART sensors**

- Operators will need **(limited) knowledge of the trend data**, possibly this can be processed in the texts that come with an alarm
- PCH420 sensors offer **seamless integration to host automation systems** enabling **low-cost installations** and **remote monitoring** capabilities.
- The need for **lengthy and costly cable runs** is eliminated through HART integration and **Multi-drop installations** enable up to **16 sensors** to be monitored through a single address port.



IEPE Sensors- Wilcoxon Unique solutions

- **HART sensors**
 - PCH420 sensors offer **seamless integration to host automation systems** enabling **low-cost installations** and **remote monitoring** capabilities.



iT Transmitters- Wilcoxon Unique solutions

- **iT150/300/301 series**

- Converts traditional IEPE sensor signals to 4-20 mA output in terms of acceleration, velocity or displacement
- Output RMS, peak or Wilcoxon's exclusive true peak signal
- English or metric units
- Custom ordered with low pass and high pass filters to suit your application
- Buffered dynamic output for extensive online system compatibility
- BNC front panel connector supports portable vibration analyzers
- CE approved



iT Transmitters- Wilcoxon Unique solutions

- iT 301 model: Web Browser- Operator interface

Machine Information

Location: Machine Location Machine ID: Machine ID

Machine Name: Machine Name Measurement Point: Measurement Point

MACHINE INFORMATION

User entry of machine identity

Sensor Input

Sensor Type: Acceleration IEPE Power: Enabled

Sensitivity (mV/g): 100 Serial Number: Sensor Serial Number

Averaging Time: 1 sec

SENSOR INPUT

User entry of sensor parameters

Frequency Range

F max: 5 kHz F min: 5 Hz

FREQUENCY RANGE

Easily select frequency range

Sensor Band Configuration

	Output Type	F start (Hz)	F stop (Hz)	Detector Type
Band 1	Velocity	5	5000	RMS
Band 2	Acceleration	5	5000	RMS

SENSOR BAND CONFIGURATION

User-configurable analysis band type and frequency limits

Measurement Results and Alarms

	Result Unit	Present Level	Low Limit Enable	Low Limit Value	High Limit Enable	High Limit Value	Result Status	Alarm Status	Map to Relay
Band 1	in/sec	1.000 in/sec	<input type="checkbox"/>	0	<input type="checkbox"/>	500	Disabled	OK	<input type="checkbox"/>
Band 2	g	1.000 g	<input type="checkbox"/>	0	<input type="checkbox"/>	500	Disabled	OK	<input type="checkbox"/>
True Peak	g	1.417 g	<input type="checkbox"/>	0	<input type="checkbox"/>	500	Disabled	OK	<input type="checkbox"/>
Temperature	Fahrenheit	32.0 °F	<input type="checkbox"/>	32	<input type="checkbox"/>	248	Disabled	OK	<input type="checkbox"/>
BOV	Volts	12.0 Volts	<input checked="" type="checkbox"/>	5	<input checked="" type="checkbox"/>	16	OK	OK	<input type="checkbox"/>

Alarm Delay Time (sec): 10 Relay Status:

Alarm Hold Time (sec): 10 Clear Alarms:

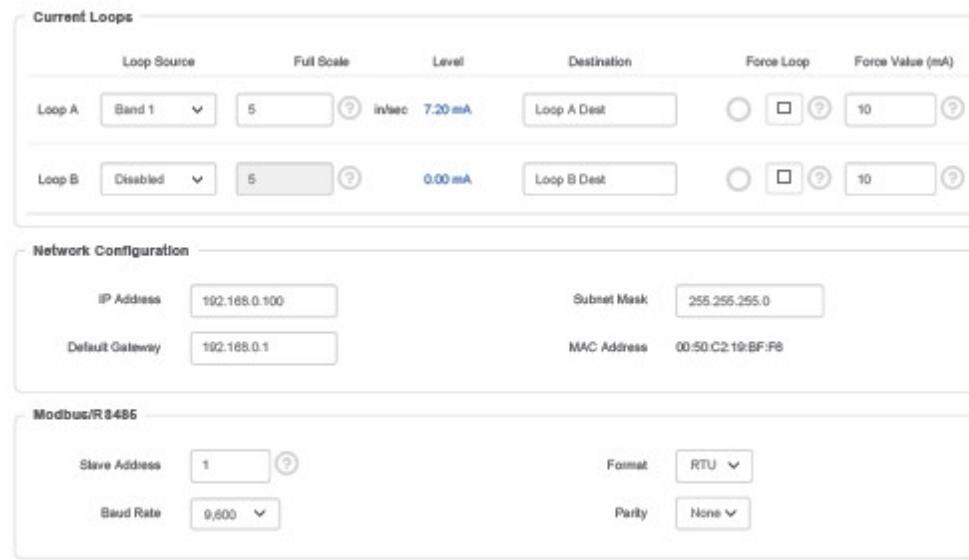
Force Relay:

MEASUREMENT RESULTS AND ALARMS

Measurement results from all bands, selectable alarm levels, and continuous monitoring of alarms

iT Transmitters- Wilcoxon Unique solutions

- iT 301 series: Web Browser- Operator interface



CURRENT LOOPS
4-20 mA mapping

NETWORK CONFIGURATION

MODBUS/RS485
Multiple communication methods:
Modbus TCP, Modbus Serial, RS485

IEPE Sensors- Wilcoxon Unique solutions

- iT Transmitter - iT150/300/301 series

Feature	iT150	iT300	iT301
DIN-rail mountable	X	X	X
Accepts accelerometers, velocity sensors	X	X	X
20V peak-peak sensor input	X	X	X
Primary 4-20mA output	X	X	X
0.2 Hz – 20 kHz bandwidth	X	X	X
Factory configured	X		
24-bit A/D converter	X	X	X
Accepts dual output (vibration + temperature) sensors	X	X	X
Secondary 4-20mA output	X	X	X
Field configurable full-scale range		X	X
Field configurable vibration bands (2X)		X	X
Modbus TCP/RS-485			X
Low alarm limits (5X)			X
High alarm limits (5X)			X
Relay/alarm source mapping			X
List Price	\$	\$\$	\$\$\$



Instrumentation



Portable reference source - Vibration meters

- ReferenceMate 2510R
 - Verifies sensor operational condition
 - Set to one of three frequencies to optimize calibration procedures
 - By having a known vibration source in the field, users can easily verify the sensor performance and the integrity of the cabling between the sensor and the online system
- Handheld units quickly take vibration readings in the field
- MAC200: easy to use meter with probe-tip sensor
- MAC800: advanced capabilities for data trending and analysis
 - Sensor with magnetic mount
 - DataMate software
 - Bluetooth connected headphones
 - Strobe/flash light attachment
 - New intrinsically safe certified version MAC800-IS



6 | Enclosures



Enclosures

- Industry exclusive **data ready LEDs**
- Innovative design for rapid production
 - Single printed circuit board
- Spacious interior for easy connectivity
- Online connectivity
 - Single enclosure can be used for route based or online monitoring
- Available up to 48 channels
 - Base unit for 6, 8 or 12 channels
 - Larger box for 12, 24, 36 and 48 channels
- Lifetime warranty

