



AEInnova
Alternative
Energy Innovations

AEInnova

IA Predictive maintenance

2026

SENSING A MORE
SUSTAINABLE INDUSTRY



LESS
DOWNTIME



LOWER
EMISSIONS



A MORE
RELIABLE
INDUSTRY



FROM
INDUSTRY RISKS
TO A MORE
EFFICIENT
TOMORROW

InduEye™ VibroSense 3

IA Predictive maintenance

Advanced vibration monitoring for industrial rotating equipment using AI, enabling early fault detection and more reliable, efficient and sustainable operations.



6 KHz
Bandwidth



3-Axis
Vibration
measurement



Quasi-Real time
Data processing
and alerts



1 × PT100
Temperature
input



**Heat
Powered**
Energy harvesting
(thermoelectric)



ATEX / IECEx
For hazardous
areas



Waveform
Raw signal
acquisition



Acceleration
RMS and spectral
analysis



Velocity
Overall velocity
metrics



Kurtosis
Early fault
detection indicator



**LoRaWAN
(2 Km)**
Long-range
wireless
communication

PRODUCT PORTFOLIO: InduEye™ VibroSense 3

✓ **Proactive maintenance:** Predicts bearing defects, misalignments, unbalancing, lack of lubrication, cavitation...



Best in class **3-axis vibration (6 kHz BW) + temperature (-100°C to 350°C)** for machinery defects early detection



Standard LoRaWAN
or NB-IoT
(not commercial)



Real edge computing
for proactive maintenance
(RMS velocity, full waveform,
full spectrum (0 Hz to 6 kHz),
Kurtosis, crest factor,
waveform, p2p...)



Quasi-real time
1 minute cadence



AEI cloud platform
(DAEVIS) or
Viking Analytics (with AI)



3rd part integration
in HMI (AVEVA, SCADA...)
with ModBus TCP/IP,
OPC-UA, WINCC...



Early detection of
machinery issues



Reduce unplanned downtime
and maintenance costs



Extend equipment lifetime
and reliability



Improve safety and
operational efficiency

ROTATING EQUIPMENT MONITORING SOLUTIONS COMPARISON

Same insight. Very different approach.

FEATURE		InduEye™ VibroSense 3 		Conventional wireless battery-powered solutions 	
	Energy source	✓	Heat Powered (thermoelectric)	✗	Battery (1–3 years) or wired (mains power)
	Sensor	✓	6 kHz Bandwidth, 3-Axis + 1 × PT100	–	1 kHz – 3 axes (limited bandwidth)
	Integration	✓	Cloud or on-site HMI (SCADA, OPC-UA, MQTT, Modbus...)	–	Cloud / PC software (proprietary / mobile app)
	Maintenance cost	✓	No	✗	Yes (250–400 US\$ yearly battery & labour)
	Certifications	✓	ATEX, IECEx, CE, MIC, FCC, ANATEL...	–	ATEX, CE, MIC, ANATEL... (depending on supplier)
	Wireless range	✓	LoRaWAN (2 Km) (long-range, SF12)	✗	Short range (Bluetooth / WirelessHART < 50 m)
	Computing	✓	Edge	✗	Cloud (no edge analytics)
	Data transmission	✓	Quasi-Real time (~ 1 min)	✗	1 hour – 1 day (periodic)

KEY MEASUREMENTS



Waveform
Raw signal acquisition



Acceleration
RMS and spectral analysis



Velocity
Overall velocity metrics



Kurtosis
Early fault detection indicator

MAIN BENEFITS



Early fault detection



Less downtime



Lower maintenance costs



More efficient and sustainable operations

MACHINE CONDITION ASSESSMENT ACCORDING TO ISO 10816

Vibration severity evaluation based on machine type, power and mounting condition, using vibration velocity (RMS).

APPLICABLE MACHINES (ISO 10816-1)



Pumps

Centrifugal,
positive displacement



Electric motors

Induction,
synchronous



Compressors

Reciprocating, rotary,
centrifugal



Fans

Industrial fans,
blowers



Gearboxes

With separate shaftings

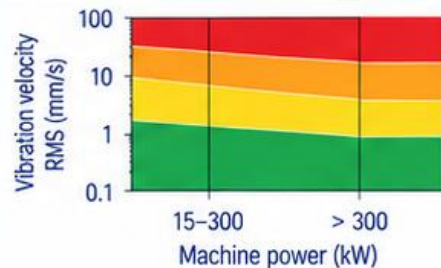


Other rotating equipment

Turbines, generators, etc.

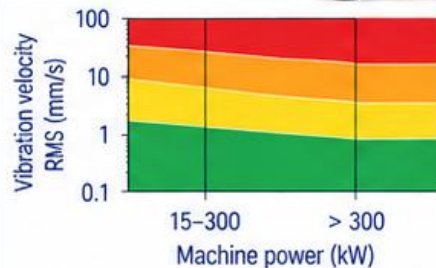
RIGID MOUNTING

Machines directly mounted
on a rigid foundation



FLEXIBLE MOUNTING

Machines mounted on
resilient supports
(e.g. rubber mounts)



HOW TO APPLY ISO 10816?

1



Identify
machine type

e.g. pumps, motors,
compressors, fans...

2



Check power range

Group 1: 15–300 kW
Group 2: > 300 kW

3



Determine
mounting condition

Rigid (directly on foundation)
or Flexible (on resilient mounts)

4



Measure vibration
velocity (RMS)

Compare with ISO 10816
limits to assess condition.

CONDITION INTERPRETATION (ISO 10816-1)

Vibration velocity (RMS)		Machine group 4		Machine group 3		Machine group 2		Machine group 1	
		Integral driver		External driver		Motors		Motors	
mm/s	in/sec	Pumps > 15 kW Radial, axial, mixed flow		160 mm ≤ H ≤ 315 mm 15 kW < P ≤ 300 kW		315 mm ≤ H 300 kW < P < 50 MW			
		Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible
11	0.44	Red	Red	Red	Red	Red	Red	Red	Red
7.1	0.28	Red	Red	Red	Red	Red	Red	Red	Red
4.5	0.18	Red	Red	Red	Yellow	Red	Yellow	Red	Yellow
3.5	0.11	Red	Yellow	Red	Yellow	Red	Yellow	Red	Yellow
2.8	0.07	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
2.3	0.04	Yellow	Green	Yellow	Green	Yellow	Green	Yellow	Green
1.4	0.03	Yellow	Green	Yellow	Green	Yellow	Green	Yellow	Green
0.71	0.02	Green	Green	Green	Green	Green	Green	Green	Green
Foundation		Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible

A

New machine condition

B

Unlimited long-term
operation allowable

C

Short-term
operation allowable

D

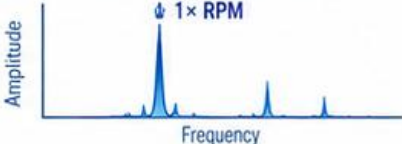
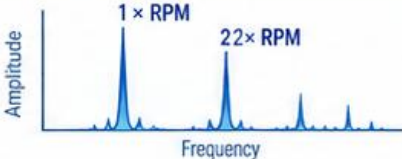
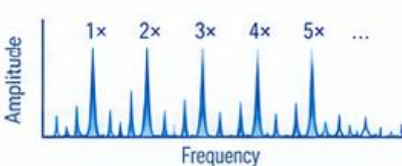
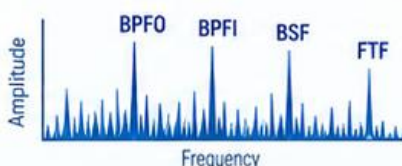
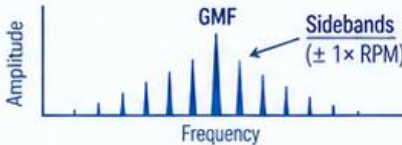
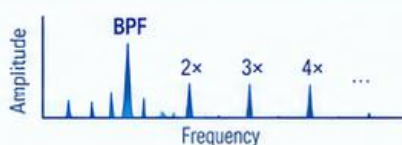
Vibration causes
damage



- Limits correspond to ISO 10816-1 for industrial machines (Group 1 and 2).
- Vibration is measured as overall RMS velocity (10 – 1,000 Hz).
- Evaluation at main bearings in radial direction.
- For special cases or critical machines, more detailed analysis (spectrum, envelope, trends) is recommended.

COMMON FAULTS IN ROTATING EQUIPMENT AND HOW TO DETECT THEM

Characteristic vibration patterns, key indicators and typical frequency signatures.

FAULT TYPE	DESCRIPTION	TYPICAL MACHINES	VIBRATION SIGNATURE		KEY INDICATORS		
			TIME WAVEFORM	FREQUENCY SPECTRUM			
 UNBALANCE	Uneven mass distribution causes excessive vibration at the rotational speed.	 Pumps, fans, compressors			 High 1× RPM amplitude	 RMS (Overall vibration)	
 MISALIGNMENT	Angular or parallel misalignment between shafts generates 1× and 2× RPM components.	 Pumps, compressors, motors, gearboxes			 High 1× and 2× RPM	 RMS (Overall vibration)	 Peak-to-peak (increased)
 MECHANICAL LOOSENESS	Loose components cause multiple harmonics and broadband vibration.	 Pumps, fans, compressors, motors			 Multiple harmonics (1×, 2×, 3× ...)	 High RMS and peak-to-peak	 High Crest Factor (> 3–4)
 BEARING DEFECTS	Defects in rolling elements, inner/outer race or cage generate high-frequency impacts.	 Pumps, motors, compressors, gearboxes			 High-frequency impacts	 High Kurtosis (> 3)	 High Crest Factor and peak-to-peak
 GEAR FAULTS	Worn or damaged gear teeth produce vibration at the gear mesh frequency (GMF) and sidebands.	 Gearboxes, fans, compressors			 High GMF and sidebands	 RMS (increase)	 Sideband analysis (modulation)
 PULLEY / BELT PROBLEMS	Belt wear, tension issues or pulley misalignment generate harmonics at the belt-passing frequency.	 Fans, pumps			 High BPF (belt frequency)	 RMS (increase)	 Harmonic content (2×, 3× ...)

THE REAL COST OF ROTATING EQUIPMENT FAILURES

Unplanned failures are expensive. Predictive monitoring prevents them.

IMPACT OF A FAILURE



Unplanned downtime
1–3 days
or longer



High direct costs
10k – 500k €
depending on the asset



Secondary damage
Bearings, shafts,
couplings, seals...
can escalate quickly



Lost production
50k – 1M €
per day
(industry dependent)



Safety &
environmental risks
Leaks, fires, injuries,
regulatory impact

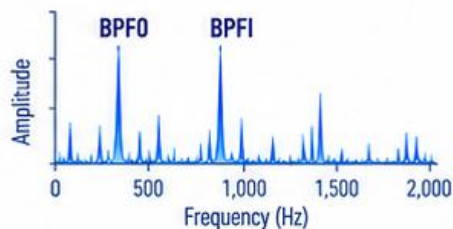


Higher emissions
and energy consumption
Inefficient operation
and process instability

CASE 1: CENTRIFUGAL PUMP BEARING FAILURE

Chemical plant
200 kW

EARLY STAGE – BEARING DEFECT



REACTIVE (FAILURE)

- Unexpected stoppage: 2.5 days
- Replace bearings + seal: 38,000 €
- Lost production: ~200,000 €
- Total estimated cost: ~240,000 €



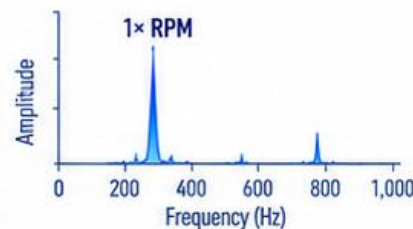
PREDICTIVE (EARLY DETECTION)

- Detected 6 weeks in advance
- Planned intervention (4 h)
- Replace bearings during planned stop
- Total cost: ~8,000 €

CASE 2: INDUCED DRAFT FAN IMBALANCE

Power plant / kiln
500 kW

IMBALANCE SIGNATURE



REACTIVE (FAILURE)

- Unplanned stoppage: 1.0 day
- Rotor damage + balancing: 65,000 €
- Lost production: ~120,000 €
- Total estimated cost: ~185,000 €



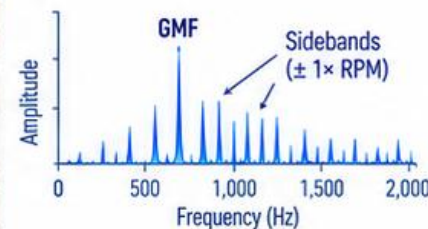
PREDICTIVE (EARLY DETECTION)

- Detected increasing 1x RPM trend
- Corrected imbalance during scheduled maintenance
- Cost (balancing): 12,000 €
- Avoided ~170,000 € in losses

CASE 3: GEARBOX GEAR WEAR

Cement plant
750 kW

GEAR MESH FREQUENCY (GMF)



REACTIVE (FAILURE)

- Catastrophic failure: 4 days
- Gearbox replacement: 250,000 €
- Lost production: ~800,000 €
- Total estimated cost: ~1,050,000 €



PREDICTIVE (EARLY DETECTION)

- Detected gear wear trend (GMF + sidebands) 3 months in advance
- Change during planned shutdown
- Total cost: 60,000 €
- Avoided ~990,000 € in losses

WHY PREDICTIVE MAINTENANCE?



Lower
total cost
of ownership



Minimize
unplanned
downtime



Plan maintenance
efficiently



Extend asset
lifetime

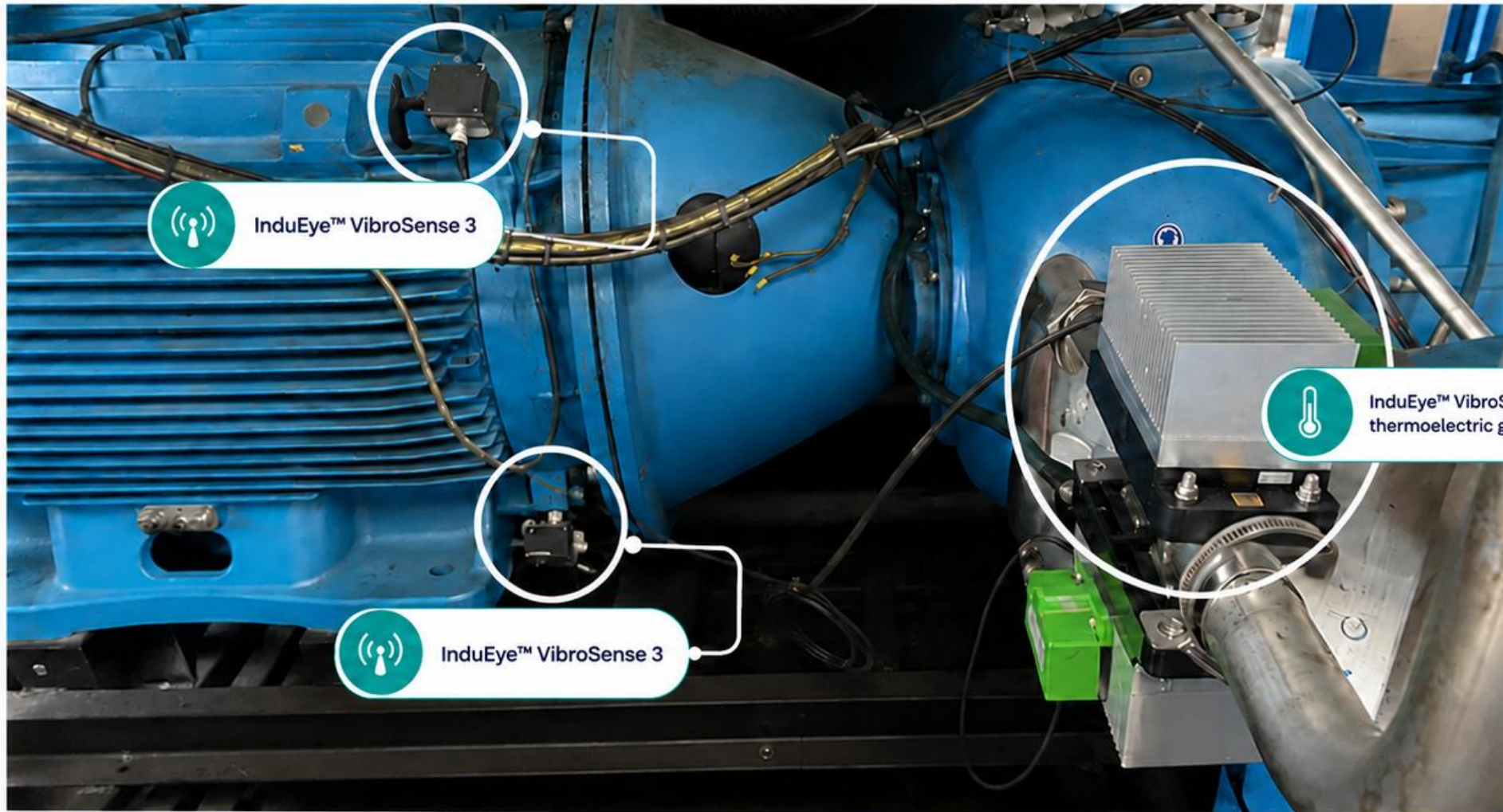


Improve
safety and
reliability



Reduce energy
consumption
and emissions

EXAMPLE IN FOOD INDUSTRY / VIBRATIONS ON A MIXER



100% batteryless operation



Powered by waste heat (thermoelectric)



Wireless IIoT connectivity (LoRaWAN)



Continuous machine health monitoring



Rugged & industrial grade design



Zero battery replacement & maintenance



Harvests waste heat from the machine for clean energy



Early detection of anomalies & protection



Reduces downtime & maintenance costs



Designed for harsh industrial environments

EXAMPLE IN CEMENT INDUSTRY / VIBRATIONS ON A MILL



100% batteryless operation



Powered by waste heat (thermoelectric)



Wireless IIoT connectivity (LoRaWAN)



Continuous machine health monitoring



Rugged & industrial grade design



Zero battery replacement & maintenance



Harvests waste heat from the machine for clean energy



Early detection of anomalies & protection

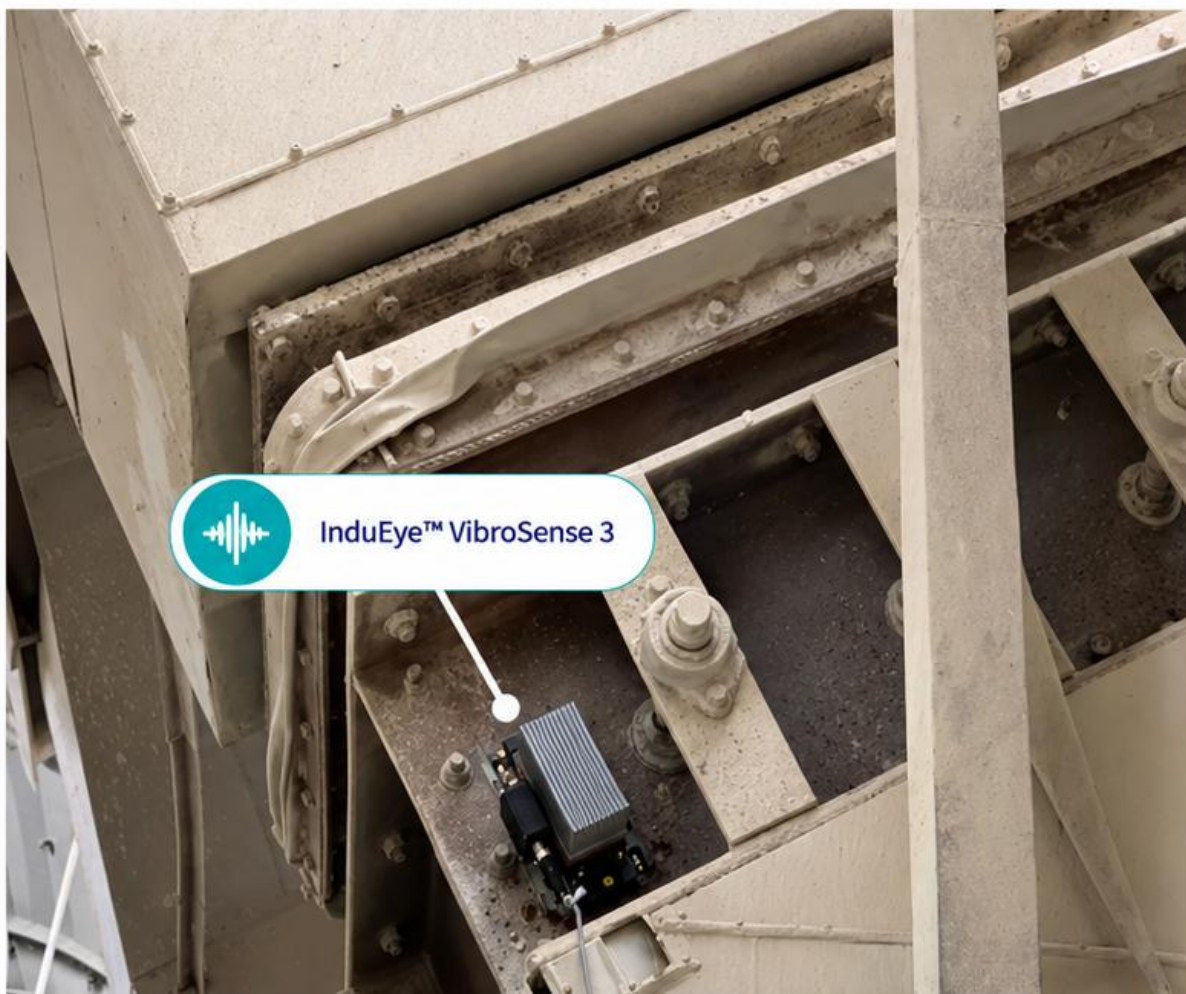


Reduces downtime & maintenance costs



Designed for harsh industrial environments

EXAMPLE IN CEMENT INDUSTRY / VIBRATIONS ON A FAN



100% batteryless operation



Powered by waste heat (thermoelectric)



Wireless IIoT connectivity (LoRaWAN)



Continuous machine health monitoring



Rugged & industrial grade design



Zero battery replacement & maintenance



Harvests waste heat from the machine for clean energy



Early detection of anomalies & protection



Reduces downtime & maintenance costs



Designed for harsh industrial environments

EXAMPLE IN OIL & GAS INDUSTRY / PUMP



Thermoelectric
generator



InduEye™
VibroSense 3



100% batteryless
operation



Powered by waste heat
(thermoelectric)



Wireless IIoT connectivity
(LoRaWAN)



Continuous machine
health monitoring



Rugged & industrial
grade design



Zero battery
replacement
& maintenance



Harvests waste heat
from the machine
for clean energy



Early detection
of anomalies
& protection



Reduces downtime
& maintenance
costs



Designed for
harsh industrial
environments

EXAMPLE IN TYRE RECYCLING INDUSTRY / RASPER



100% batteryless operation



Powered by waste heat (thermoelectric)



Wireless IIoT connectivity (LoRaWAN)



Continuous machine health monitoring



Rugged & industrial grade design



Zero battery replacement & maintenance



Harvests waste heat from the machine for clean energy



Early detection of anomalies & protection



Reduces downtime & maintenance costs



Designed for harsh industrial environments

AI-POWERED PREDICTIVE MAINTENANCE: Viking Analytics Multiviz



From data to diagnosis. Anticipate failures, optimize maintenance and maximize the availability of your assets.



Real-time failure diagnosis

AI helps identify the root cause of problems in equipment.



Intelligent alarms

Reduces false alarms and prioritizes what really matters.



Periodic and detailed reports

Complete and actionable information for better decision-making.



More than 15 functionalities

Waveforms, spectrum, fault detection, modulation, trends and much more.



Changes Symptoms Data quality

Detected symptoms

The possible anomalies are NOT a diagnosis. An analyst must verify the failures.

Show/Hide possible anomalies



Dominant harmonics 2x

A rotational speed of 48 Hz is assumed. The 2x component is stronger than the 1x and presents higher harmonics.

Possible anomalies:

Misalignment Secondary resonance
Coupling issue

Last seen: 3/24/2024, 2:00:00 AM



Component at impact frequency

Impact detected at 2 Hz.

Possible anomalies:

Bearing damage (outer race)
Mechanical looseness
Process-related impacts

Last seen: 3/24/2024, 7:00:00 AM

AI-FREE PREDICTIVE MAINTENANCE: DAEVIS

Example in the food industry / mixer vibrations. Critical machine data powered by DAEVIS.



Powered by *AEInnova*



SaaS platform for IIoT

Secure, scalable and accessible from anywhere.



Customizable alarms

Set intelligent thresholds and receive real-time alerts.



Automated learning (in-process)

Advanced analytics to detect anomalies and predict failures.



Integration with third-party HMIs

Easy integration with SCADA, CMMS and industrial systems. No DAEVIS license required.



Better cost-benefit ratio

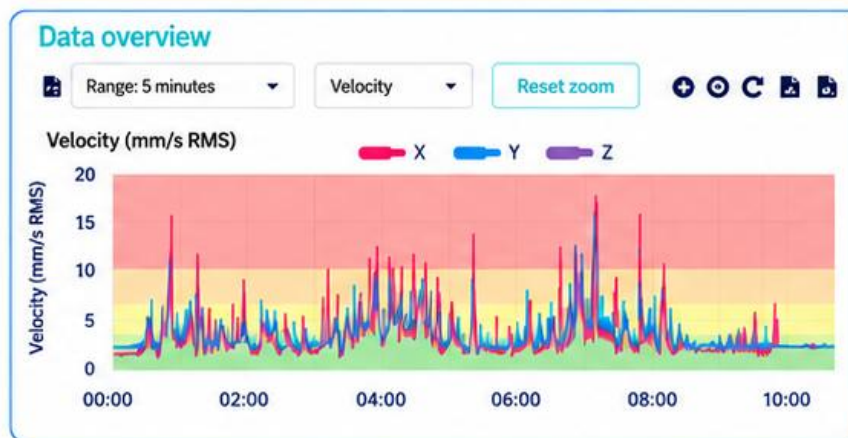
Battery-free technology, low TCO and high return on investment (ROI).

A screenshot of the 'Edit vibration range' configuration window in the DAEVIS application. The window has a dark sidebar with navigation links: Control Panel, Assets, Devices, Live Data, Analytics, Alarms, Reports, and Configuration. The main area shows fields for ISO name (ISO 10816-3), ISO type (Extended machine group 3), and ISO foundation (Flexible). Below these are four color-coded rows for vibration ranges: Green (0 to 3.5 mm/s RMS), Yellow (3.5 to 7.1 mm/s RMS), Orange (7.1 to 11 mm/s RMS), and Red (11 to infinity mm/s RMS). Each row has 'From' and 'To' input fields and a unit label 'mm/s RMS'. At the bottom are 'Accept' and 'Cancel' buttons.

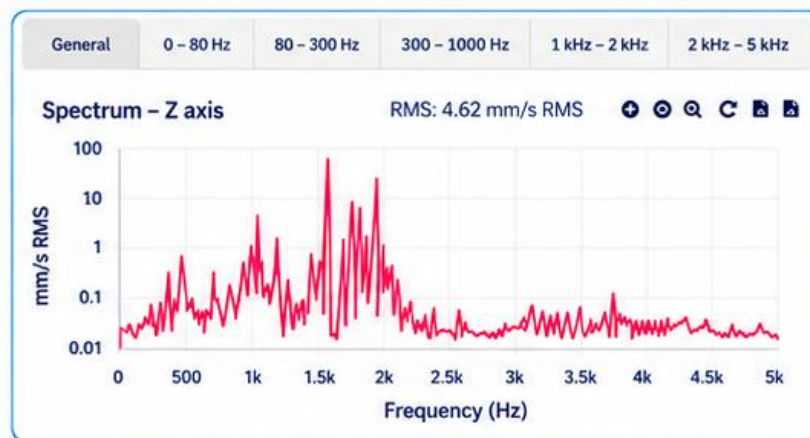
ISO 10816 configuration

A screenshot of the 'Edit device enabled variables' configuration window. It shows 'IIoT device configuration' with a note to select the desired operating mode. The 'Current mode' is 13. There are six mode cards: Mode 01 (Basic vibration measurement), Mode 02 (Misalignment, looseness, bearing failure and blade passage), Mode 12 (Misalignment, looseness, blade passage and valves), Mode 13 (Rolling element and bearing faults), Mode 14 (Rolling element faults), and Mode 15 (Rolling element faults, lubrication and cavitation). Each card shows its frequency range and available variables (X Y Z). At the bottom, there are 'Working axes' (X, Y, Z) and 'Accept' and 'Cancel' buttons.

Full spectrum (FFT) for precise failure analysis



Real-time asset monitoring



Detailed spectrum visualization



AEInnova

Alternative
Energy Innovations

HARVESTING
INDUSTRY'S
POTENTIAL

THANK YOU

LET'S BUILD A MORE SUSTAINABLE INDUSTRY TOGETHER

Batteryless Industrial IoT.
Real impact. No maintenance.



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NO BATTERIES.
NO LIMITS.



HIGHER
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A MORE
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INDUSTRIAL IOT POWERED BY HEAT