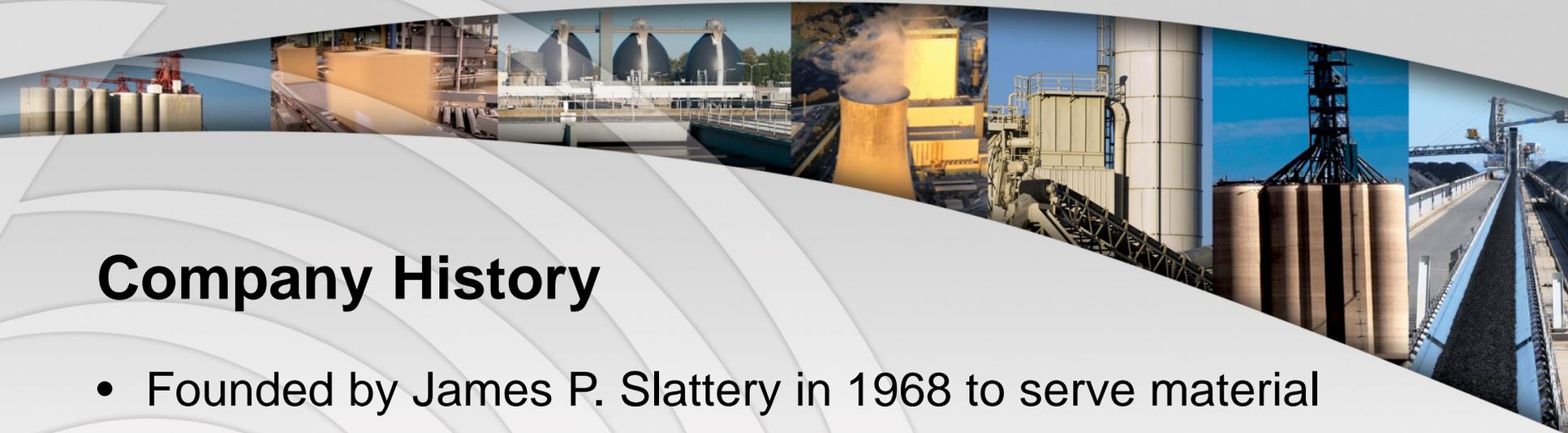




Electro-Sensors, Inc.

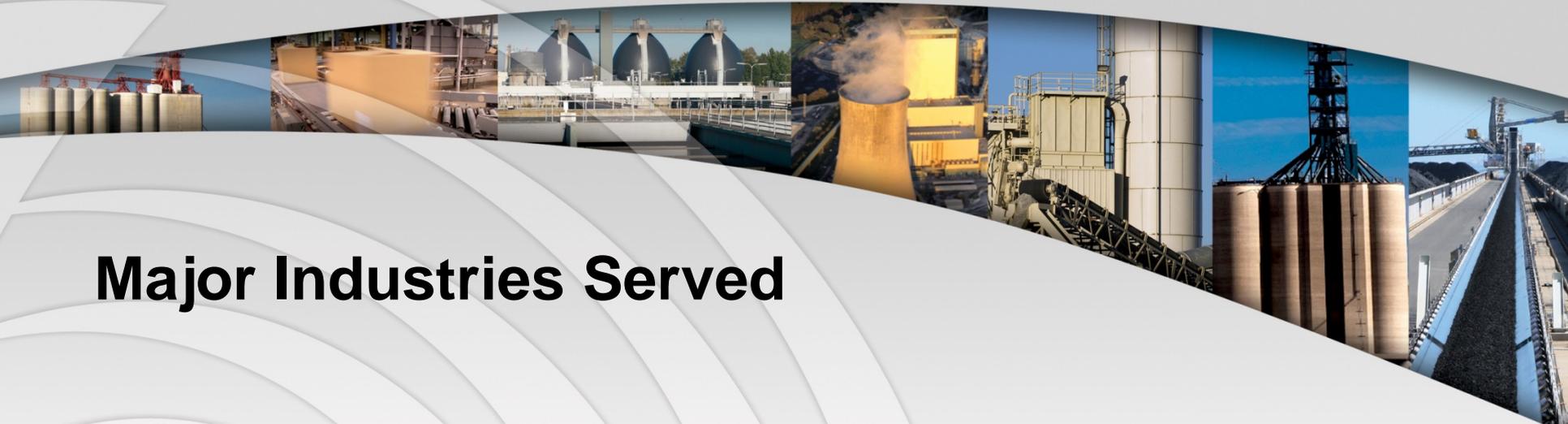
Machine Monitoring Sensors & Hazard Monitoring Systems





Company History

- Founded by James P. Slattery in 1968 to serve material handling & process control applications in industrial plants
- Products designed & manufactured at our facility
- Located in Minnetonka, MN
- \$7.6M revenue (2015)
- 36 employees
- Publically held company NASDAQ Symbol ELSE



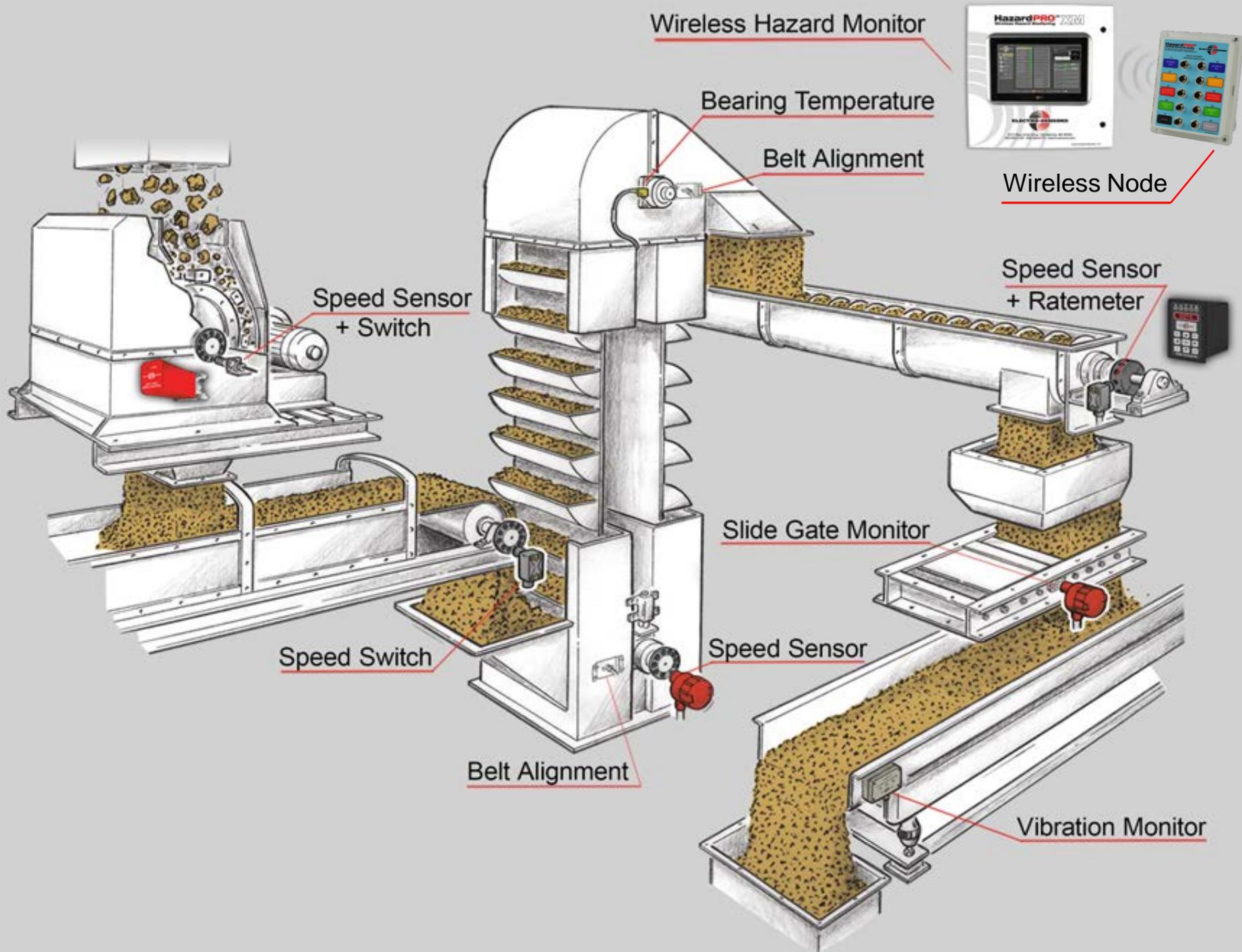
Major Industries Served

- Grain, Feed & Milling
- Ethanol and Bio-Fuels
- Water Utilities
- Waste Management
- Power Generation
- Mining & Aggregates
- Food Processing
- Packaging
- Bulk Materials Handling
- Pulp & Paper



Core Business Applications

- Belt, Screw, Drag & Vibratory Conveyors
- Crushers/Hammer mills
- Rotary Airlocks
- Fans/Blowers
- Packaging Machines
- Bucket Elevators
- Pumps
- Centrifuges
- Turbines
- Slide Gates & Valves



Wireless Hazard Monitor

Bearing Temperature

Belt Alignment



Wireless Node

Speed Sensor + Switch

Speed Sensor + Ratemeter

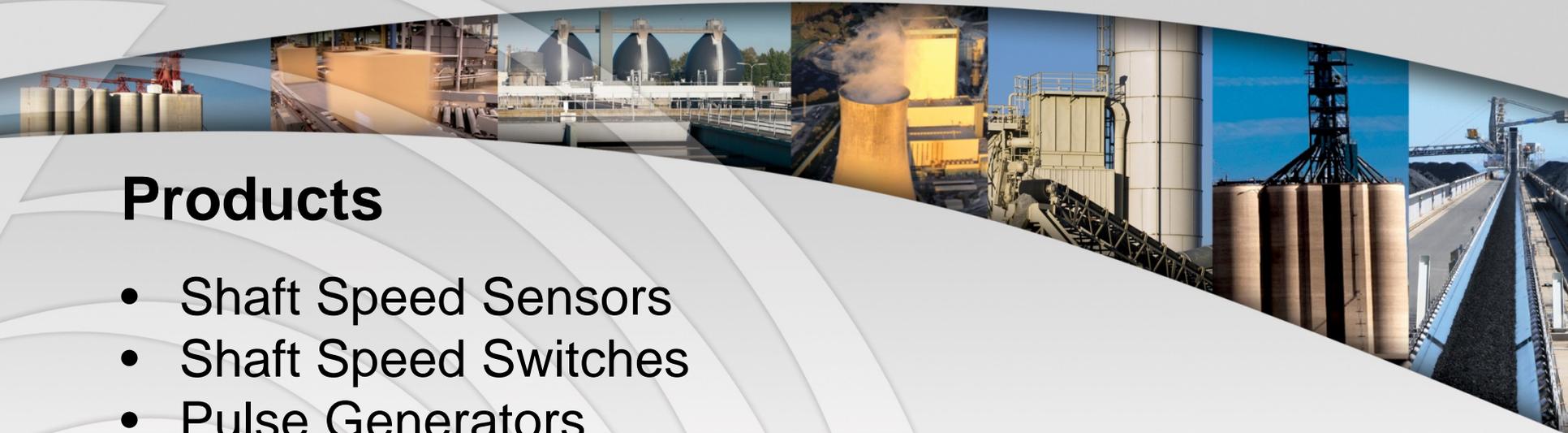
Speed Switch

Slide Gate Monitor

Speed Sensor

Belt Alignment

Vibration Monitor



Products

- Shaft Speed Sensors
- Shaft Speed Switches
- Pulse Generators
- Bearing, Belt Alignment & Temperature Sensors
- Hazard Monitors (Wireless and Wired)
- Tachometers, Counters & Displays
- Slide Gate & Angle Position
- Signal Conditioners & Interface
- Vibration & Tilt
- Closed Loop Motor Control
- Motrona Products for Automation & Motor Control



Speed Sensors, Switches & Pulsers

- Non-contact Hall Effect & Magnetoresistive sensors
- Large gap distance (up to 1/2")
- Flexible sensor system
- Explosion proof & water resistant sensors
- Pulsers discs & split collar wraps
 - Variety of materials & configurations
- NEMA C face motor ring kits available
- Encoders & traction wheel assemblies

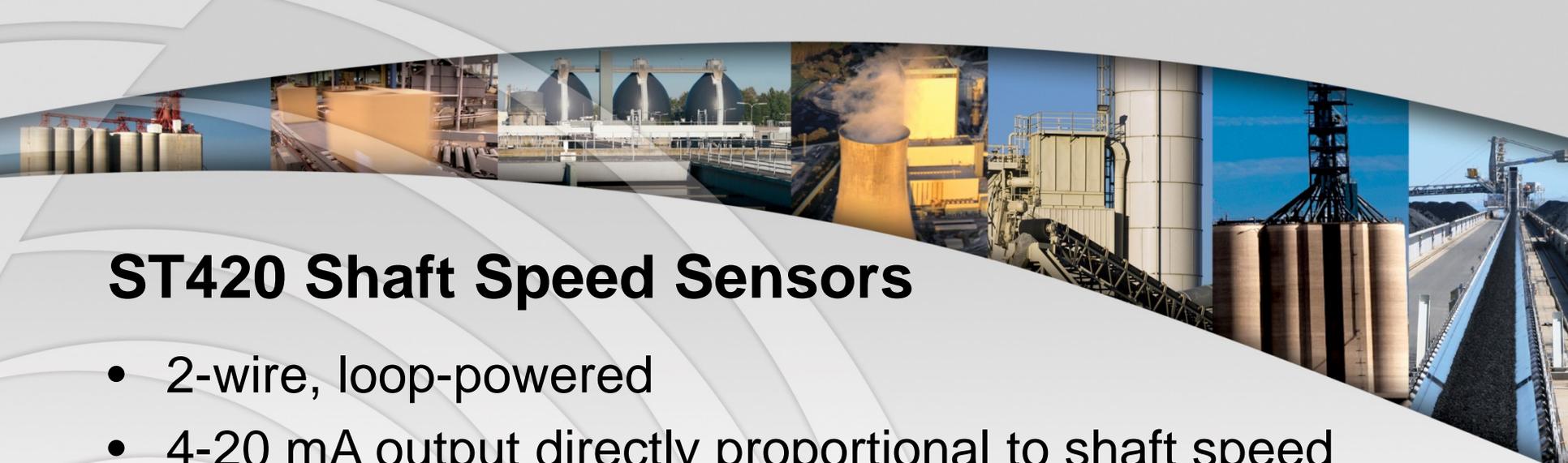


Shaft Speed Sensors

- Hall Effect or Magneto-resistive
- Pulse (NPN, PNP) or 4-20 mA output
- Single channel or quadrature
- Large sensing gap distance
- DC powered
- Explosion proof housing options
- IS Approvals



Shaft Speed Sensors



ST420 Shaft Speed Sensors

- 2-wire, loop-powered
- 4-20 mA output directly proportional to shaft speed
- No user calibration – easy to install or retrofit
- Stainless steel M18x1 housing, NEMA 4X/IP67, Dust Ignition proof & Intrinsically Safe models

ST420-LT
Sensors



EZ-18mm
Mounting Bracket

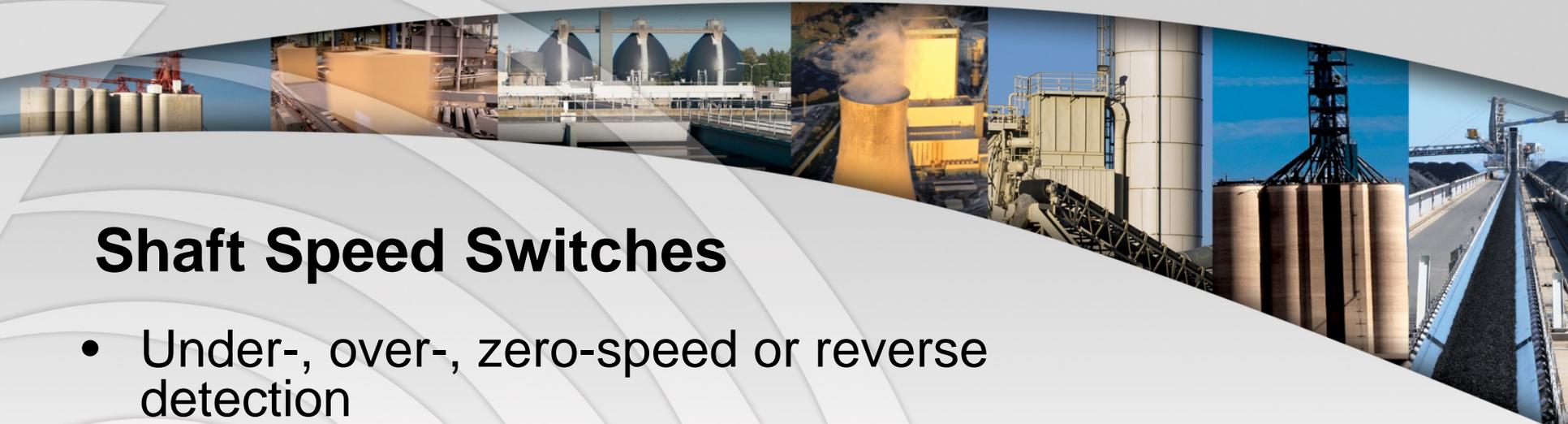




EZ-18mm & EZ-3/4in Easy Mount for Barrel Sensors

- For use with 906, 932, ST420, Series 18
- Mounts directly to the tapped shaft or can be used with optional mounting magnet if shaft is not tapped
- Pulser disc is included with assembly
- Fully-enclosed to protect against dirt, debris & misuse



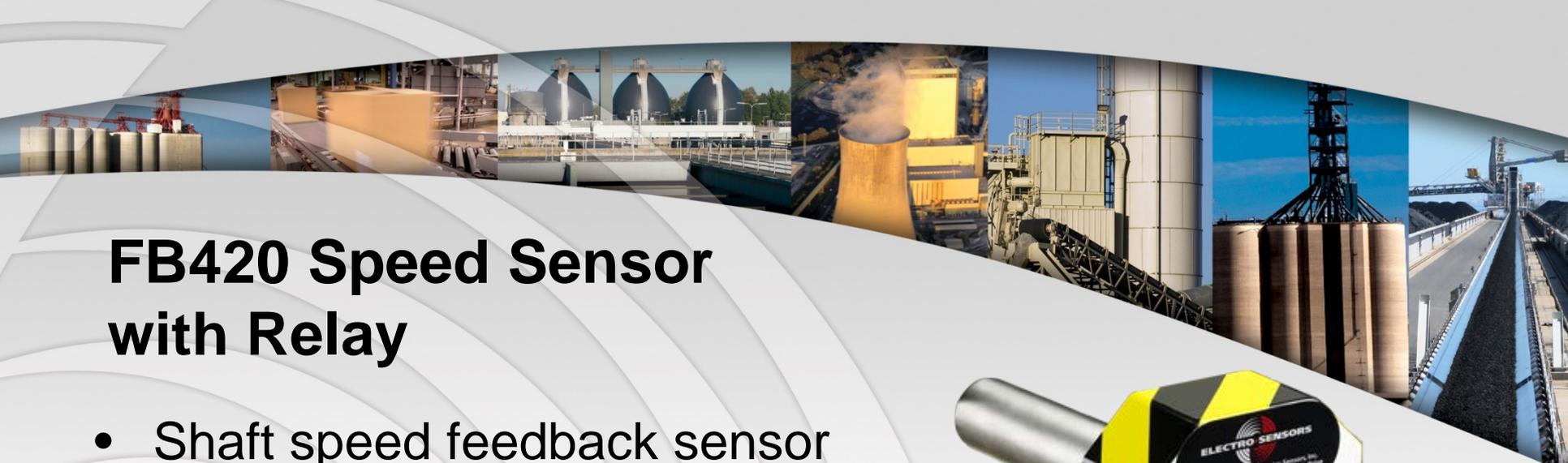


Shaft Speed Switches

- Under-, over-, zero-speed or reverse detection
- Analog or digital electronics
- Many output options
- Number of setpoints
- Failsafe
- Integrated or discrete sensor
- Input power (DC, AC)
- Explosion proof or enclosure install with easy mount options



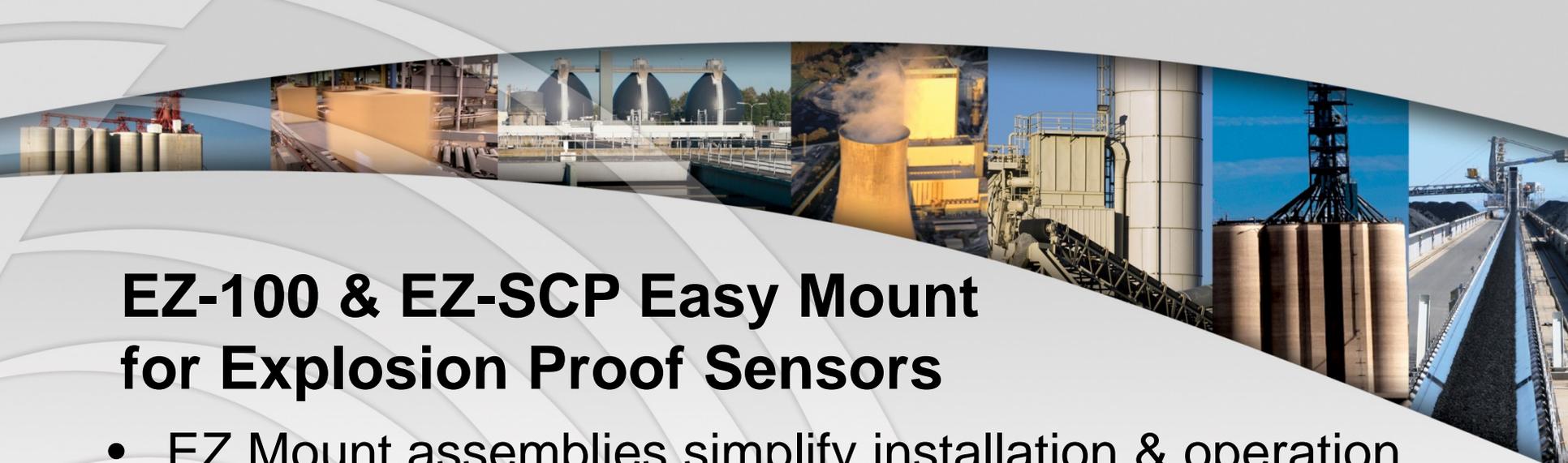
Shaft Speed Switches



FB420 Speed Sensor with Relay

- Shaft speed feedback sensor
- Outputs a 4-20mA signal across the RPM range of the shaft
- 1 relay with 2 programmable functions (over or under speed)
- Housed in a rugged, XP housing
- Compatible with standard PLCs, meters & data acquisition systems





EZ-100 & EZ-SCP Easy Mount for Explosion Proof Sensors

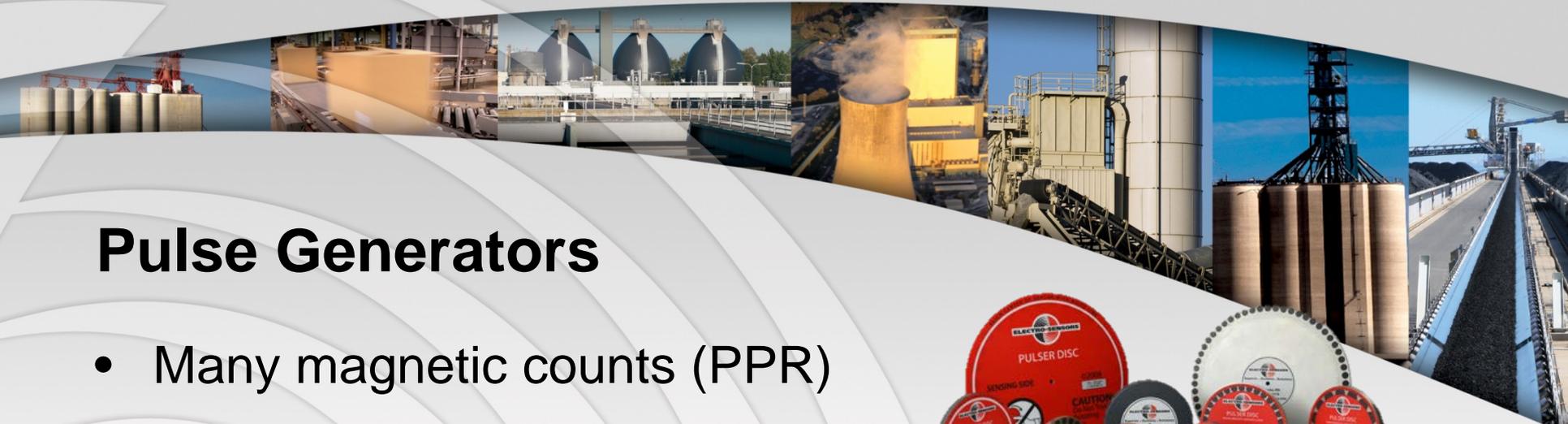
- EZ Mount assemblies simplify installation & operation
- No additional hardware required
- EZ-100 for use with the M-Series, FB420, 907 XP
- EZ-SCP for use with SCP-Series switches
- Rated for use up to 300 rpm

EZ-100 with
M100T



EZ-SCP with
SCP1000





Pulse Generators

- Many magnetic counts (PPR)
- Sensor face or edge read
- Material: Nylon, PVC, Stainless Steel, Aluminum
- Narrow
- High speed
- Custom – special



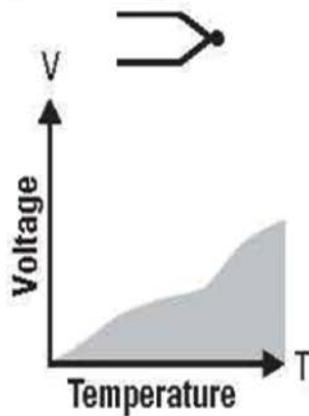
Pulser Discs



Split Collar Pulser Wraps

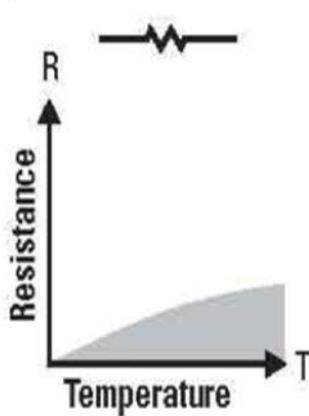
Temperature

Thermocouple



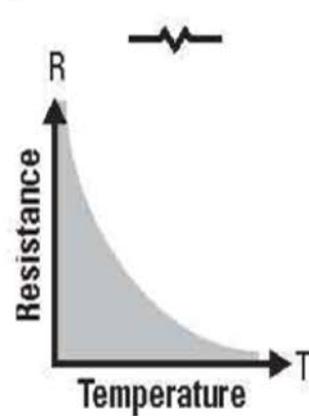
- Self-powered
- Many forms
- Wide temp. range
- Expensive
- Non-linear output

RTD



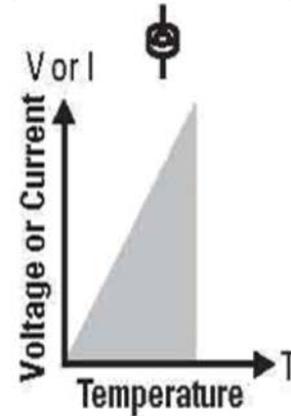
- Stable signal
- Accurate
- Non-linear output
- Expensive

Thermistor



- High output
- Relatively fast
- 2-wire resistance measurement
- Non-linear output

I. C. Sensor



- **Electro-Sensors**
- **Most linear**
- **Very accurate**
- **Noise immune**

Temperature Sensors

- Flange, stud, probe, magnetic & lug styles
- 2-wire loop-powered – eliminates expensive thermocouple wires
- 4-20 mA output calibrated -40 °F to 248 °F
- Compatible with any PLC or data acquisition system



TT420



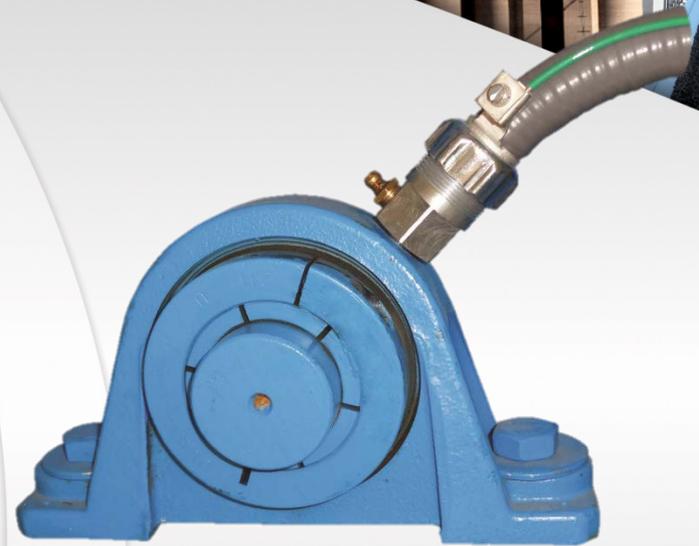
TT420-LT

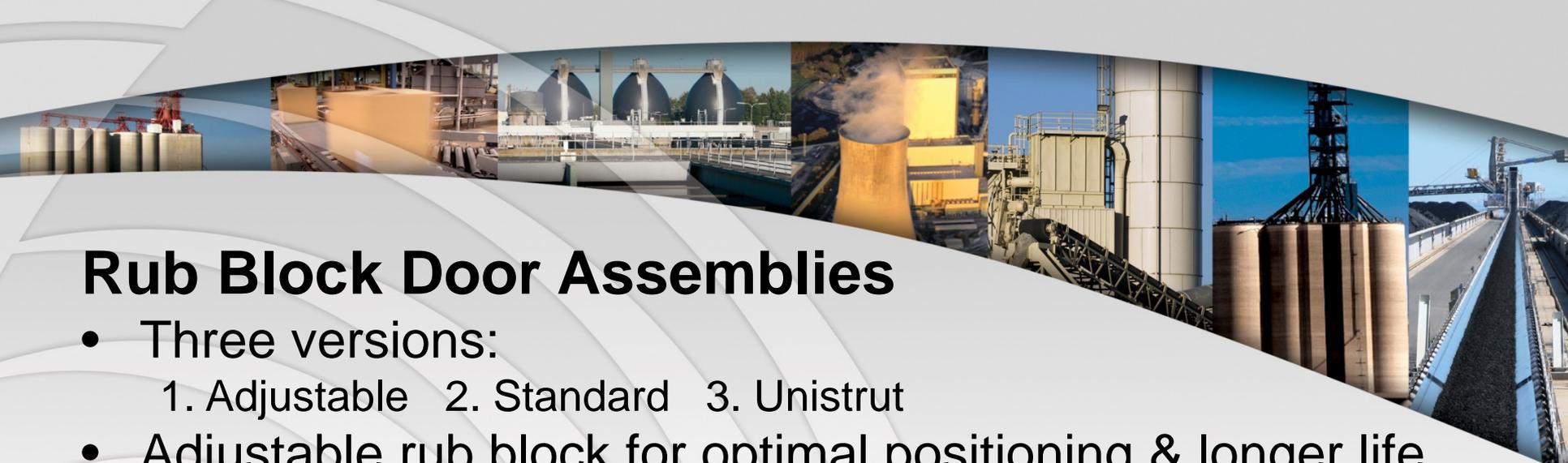


Magnet Mount

Bearing Temperature

- Easy to install 2-wire device
- 4-20 mA Output factory calibrated -40 °F to 248 °F (-40 °C to +120 °C)
- 1/8" or 1/4" NPT grease fitting permits lubrication
- Adjustable probe depth for accurate measurement





Rub Block Door Assemblies

- Three versions:
 1. Adjustable
 2. Standard
 3. Unistrut
- Adjustable rub block for optimal positioning & longer life
- Now all white epoxy finish minimizes heating
- Unistrut mounts almost anywhere



SG1000 Position Sensors

- Absolute encoder-based feedback
- Interface to PLC or Display
- 4-20 mA output
- 2- or 3-point, push-button calibration
- Rugged NEMA 4X/XP housing



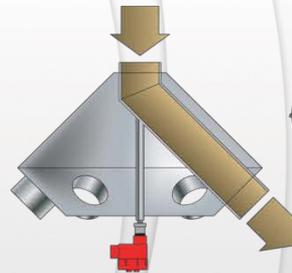
- ✓ Slide Gate
- ✓ Distributors
- ✓ Valves
- ✓ Dampers
- ✓ Clam Shell Buckets



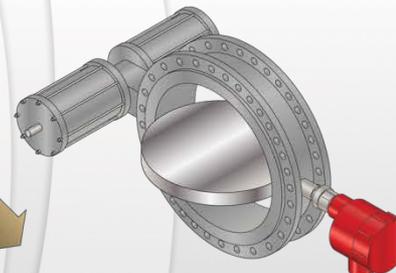
SG1000A



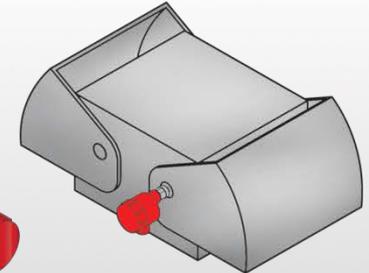
SG1000B



SG1000C



SG1000D



SG1000E

Tachometer & Counter Products

- Rate metering
- Product, sum, or difference
- Process, batch, or total counting
- Highly programmable (PLC-like)
- Relay & analog outputs



TR400 System



CT6000 System

Signal Conditioning & Interface Products

- Remote Modbus RTU connectivity & control
- Pulse to 4-20 mA conversion
- Pulse to frequency conversion
- DeviceNet



ION Network Nodes



SA420 System

Vibration & Tilt Products

- Vibration Switch
 - Over- or under-vibration
 - Explosion proof available
- Tilt indicator for presence or absence of bulk material



VS1



MTS Tilt Switch +
SCU-200 Control Unit



Wired Hazard Monitors

Targeted at grain, feed & milling as required by OSHA (USA)

Electro-Sentry 1 Single-Leg Hazard Monitor

- Monitor speed, belt alignment & bearing temperature

Electro-Sentry 16 Hazard Monitor

- Monitors 16 bearing and/or belt alignment sensors



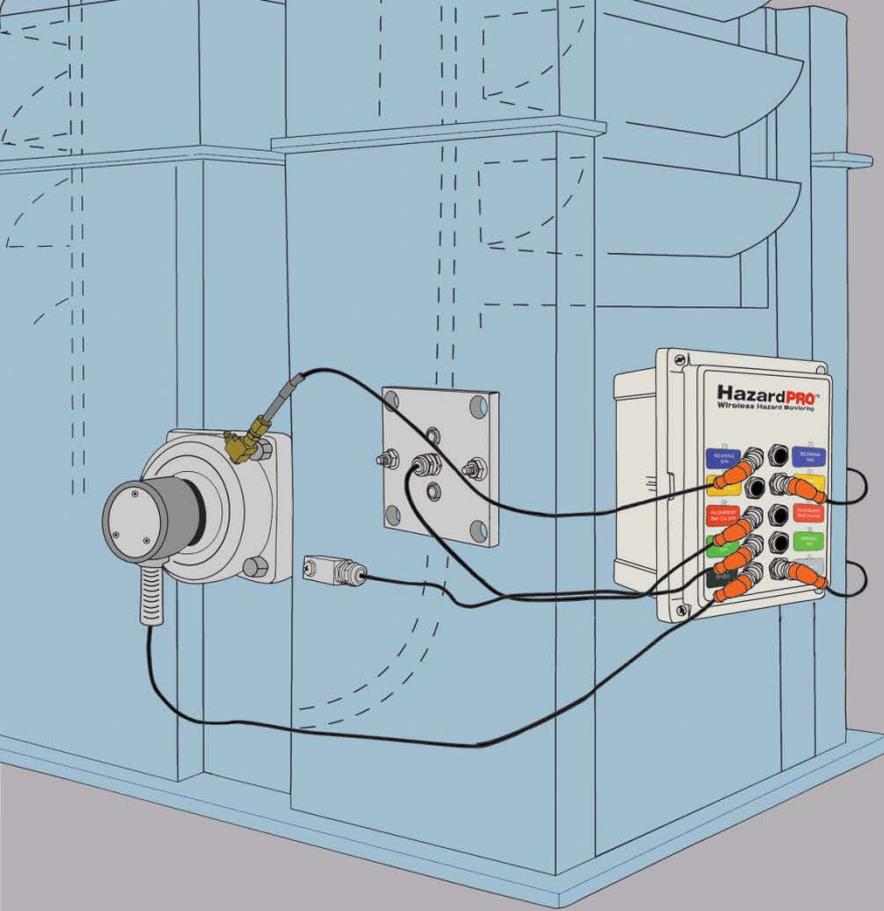
Electro-Sentry 1



Electro-Sentry 16

HazardPRO™

Wireless Hazard Monitoring



Shaft
Speed



Bearing
Temperature



Ambient
Temperature



Belt
Alignment



Transmitter
Node



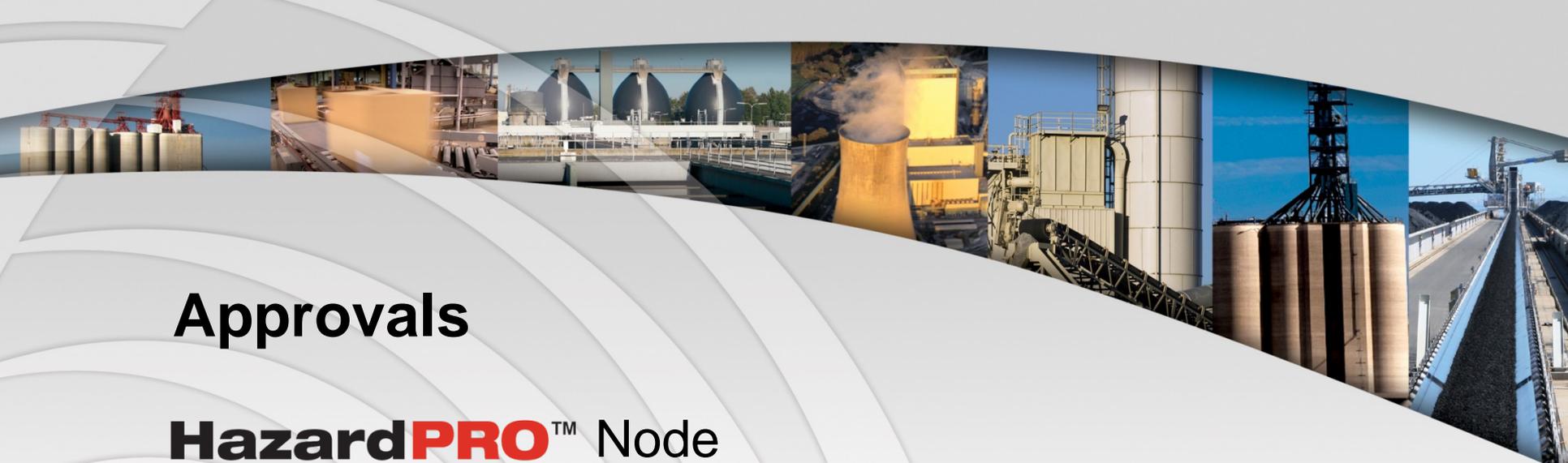
System
Manager



HazardPRO™ Features

- Designed for hazardous locations
- Field-proven reliability
- Intuitive touchscreen display
- Lower total installed cost
- Real-time display of system data
- Remote access via email & web
- Continuous system self-check routines
- ETL Class II, Div. 1 approvals





Approvals

HazardPRO™ Node

- Intrinsically Safe (I.S.) apparatus located in:
 - **Class II, Div. 1, Groups E, F, G; Class III**
- Providing Intrinsically Safe (I.S.) connections for use in:
 - **Class II, Div. 1, Groups E, F, G; Class III**

HazardPRO™ Sensors

- Intrinsically Safe (I.S.) in:
 - **Class II, Div. 1, Groups E, F, G; Class III**



Transmitter Node

- Transmit-on-change keeps data current & lengthens battery life
- No external power
- 5+ year battery life
- Quick connect sensors for easy installation & equipment maintenance
- 6 inputs for bearing/alignment/ancillary equipment, 2 inputs for ambient temperature, 1 input for speed, 1 input for contact

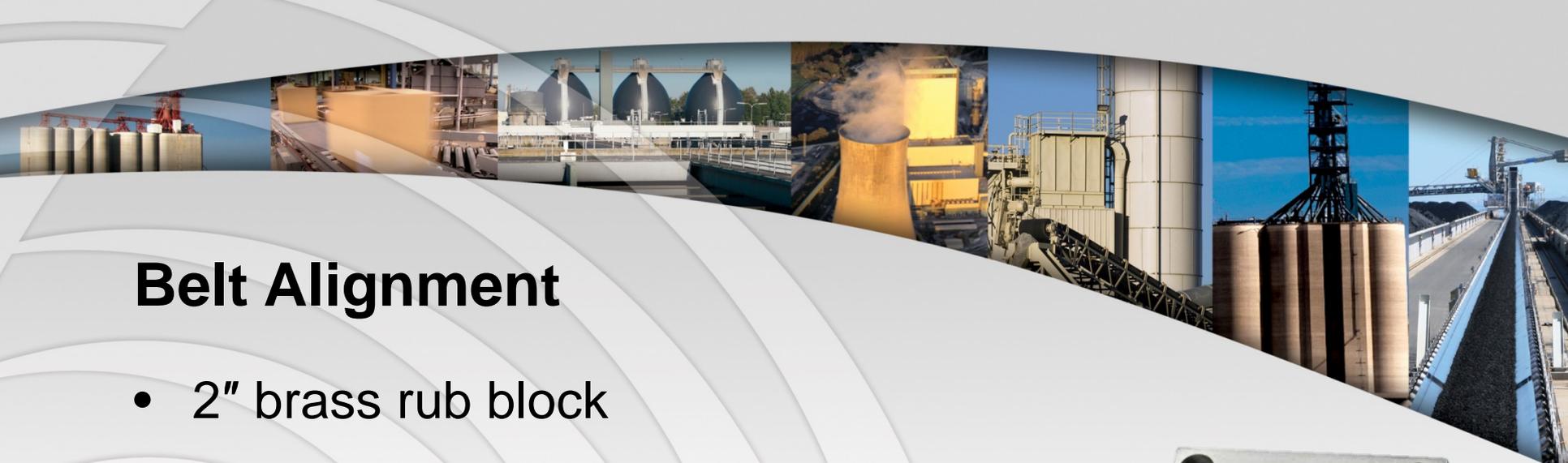


Offering Class II, Div.1 &
Class II, Div. 2 models

Shaft Speed Sensor

- Automatically calibrates setpoint to 10% & 20%
- Multiple mounting configurations
- Optional mounting magnet, ideal for bucket elevators
- Flexible stainless steel jacketed cable available





Belt Alignment

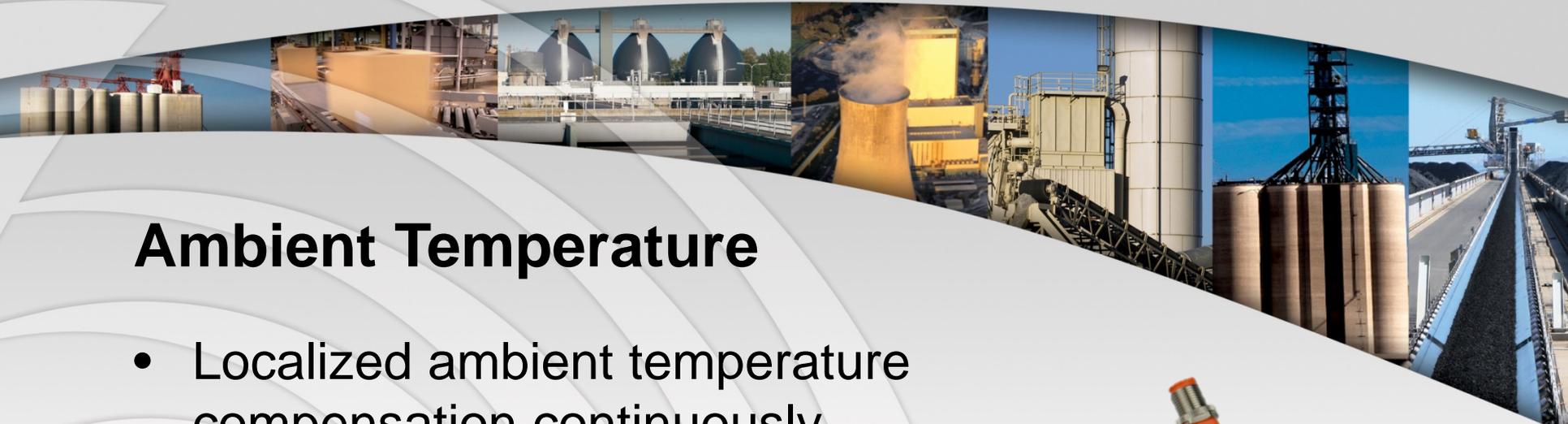
- 2" brass rub block
- No calibration required
- Built-in wear detect feature notifies user when the block needs to be replaced
- Flexible stainless steel jacketed cable available



Bearing Temperature

- No calibration required
- 4" & 6" stainless steel probe with 1/8" & 1/4" NPT Zerk (grease) fitting
- Grease around the probe
- Flexible stainless steel jacketed cable available

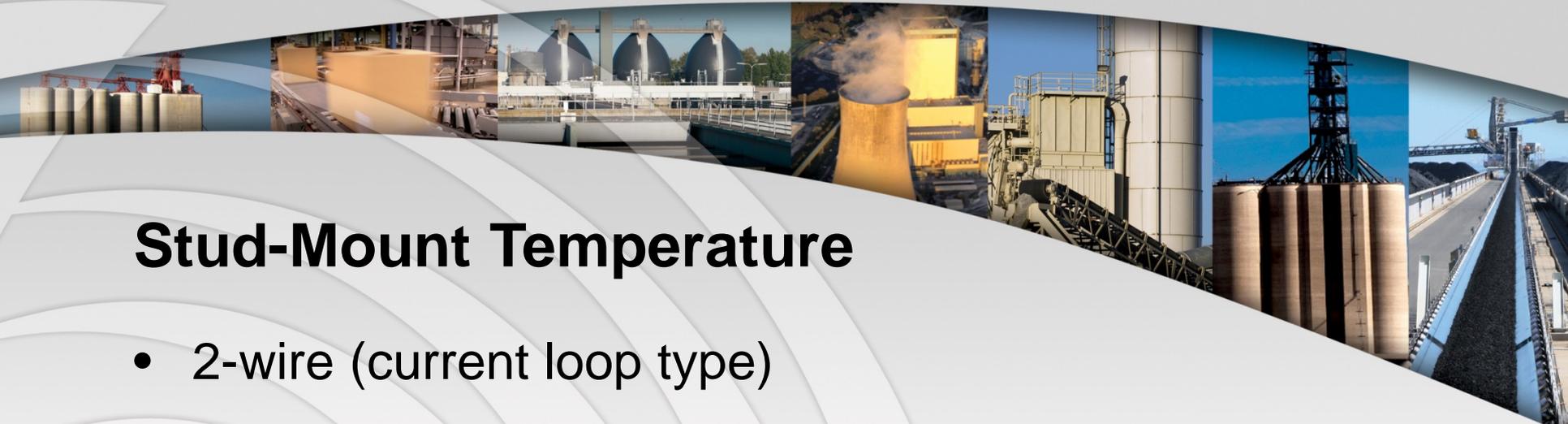




Ambient Temperature

- Localized ambient temperature compensation continuously adjusts setpoints
- Multi-point placement on each side of equipment for highly accurate tracking
- Flexible, stainless steel jacketed cable available





Stud-Mount Temperature

- 2-wire (current loop type)
- 3/8"-16 threaded stud for mounting
- Optional brass block magnet mount adapter
- Flexible stainless steel jacketed cable available





System Sizes



- **XS**
 - 1-4 pieces of equipment
 - 15" touchscreen
- **XM**
 - Up to 16 pieces of equipment
 - 15" touchscreen
- **XL**
 - Up to 32 pieces of equipment
 - 21" touchscreen



System Manager

- TCP/IP Modbus communication
- Relay outputs
- Controlled levels of authority
- Data & history logging
- Testing reports
- Real-time information & live charting





- Touchscreen is easy to use & understand
- Explanations in plain English, not code
- Color coded status
- Customer-specified equipment names
- Users with the proper authority can close events & record the cause & resolution

ELECTRO-SENSORS

Running ● Normal ■ Warning ■ Forced Shutdown ■ Alarm ! Bypassed ■ Unused ■

North Receiving Belt	Tank 5 Top Drag
North Receiving Leg	Wet Leg
West Receiving Drag	Dryer Reclaim
West Receiving Leg	Dryer Leg
Main Shipping Belt	Equipment Name X
Main Tanks Shipping Belt	Equipment Name X
West Transfer Belt	Equipment Name X
Tank 1 Bottom Belt	Equipment Name X
Tank 1 Top Drag	Equipment Name X
Tank 2 Bottom Belt	Equipment Name X
Tank 2 Top Drag	Equipment Name X
Tank 3 Bottom Belt	Equipment Name X
Tank 3 Top Drag	Dust North Reclaim
Tank 4 Bottom Belt	Dust North Blower
Tank 4 Top Drag	Dust West Reclaim
Tank 5 Bottom Belt	Dust West Blower

North Receiving Belt

Status: Equipment is stopped. All sections are normal.

2052.6 Running Hours

0.0 RPM

Silence Alarm | Reset Forced Shutdown

Sections:

A: Tail ■ ■ ■ ■ ■ ■
Status: Tail Section is normal.

B: Head ■ ■ ■ ■ ■ ■
Status: Head Section is normal.

C: Unassigned
Status: N/A

D: Unassigned
Status: N/A

E: Unassigned
Status: N/A

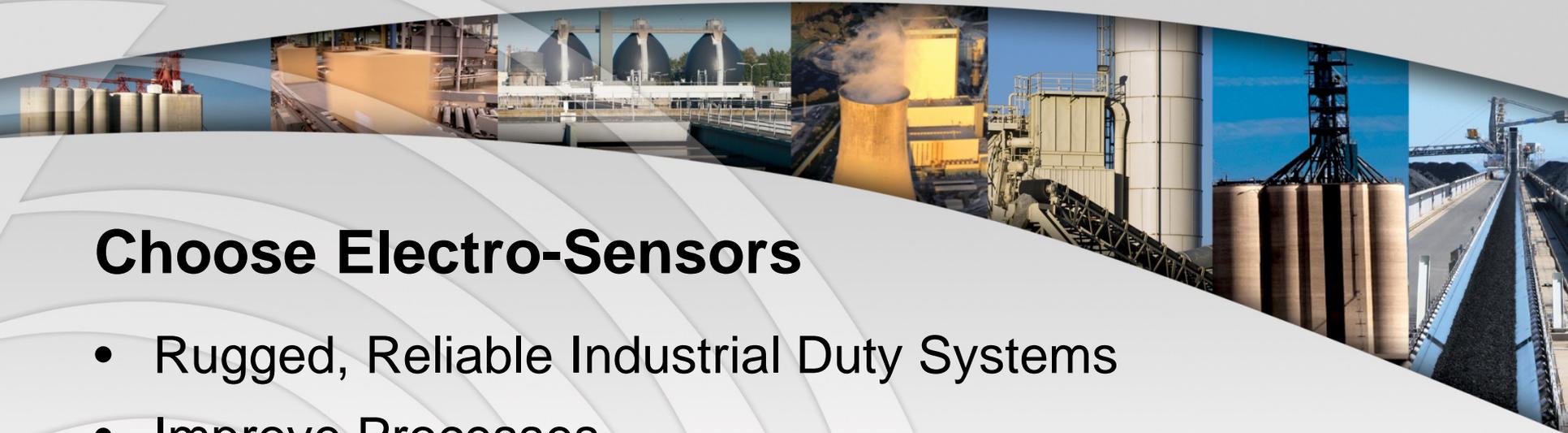
F: Unassigned
Status: N/A

User: System Integrator
Facility: ESI Minnetonka
Time: 08/02/2016 15:44:41

Next Steps

1. Assessment of project needs
2. Configure a solution
3. Conduct a site survey
4. Prepare a quotation



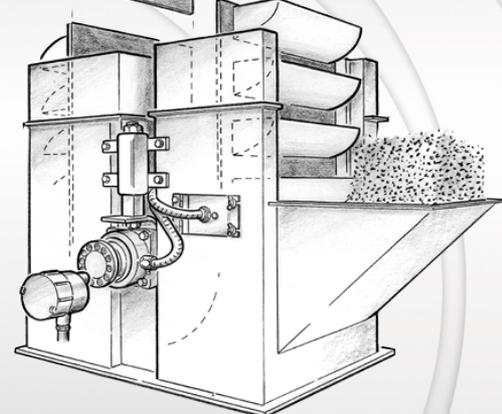
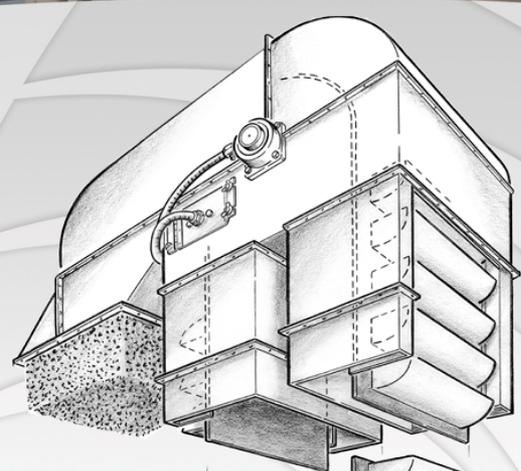


Choose Electro-Sensors

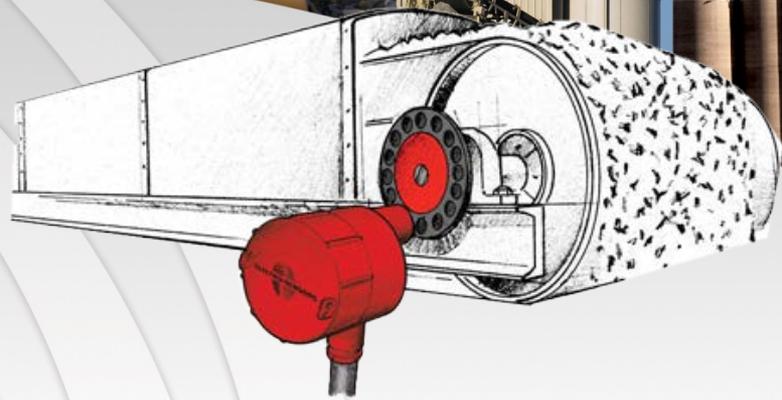
- Rugged, Reliable Industrial Duty Systems
- Improve Processes
 - Safeguard Systems, Reduce Downtime, Prevent Waste
- Most Standard Products Ship within Two Days
- 5-Year Limited Warranty on Most Products
- Top Notch Customer Service & Technical Support
- 45+ Years of Industry Experience
- ISO9001:2008 Quality Certified



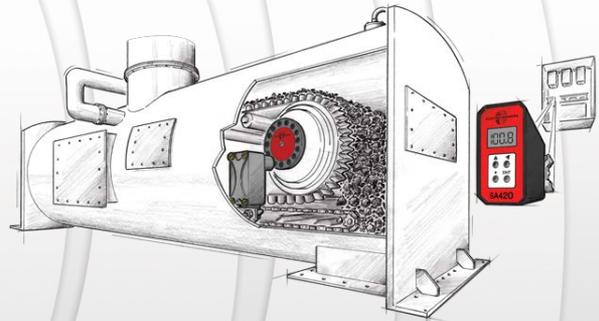
APPLICATIONS



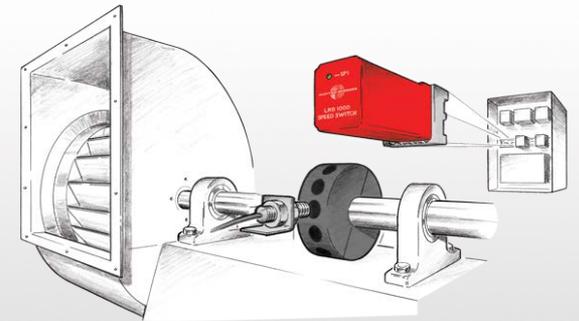
Bucket Elevator



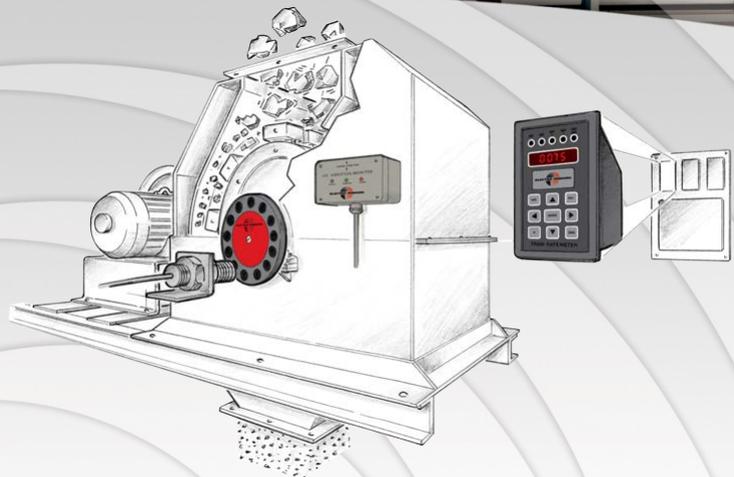
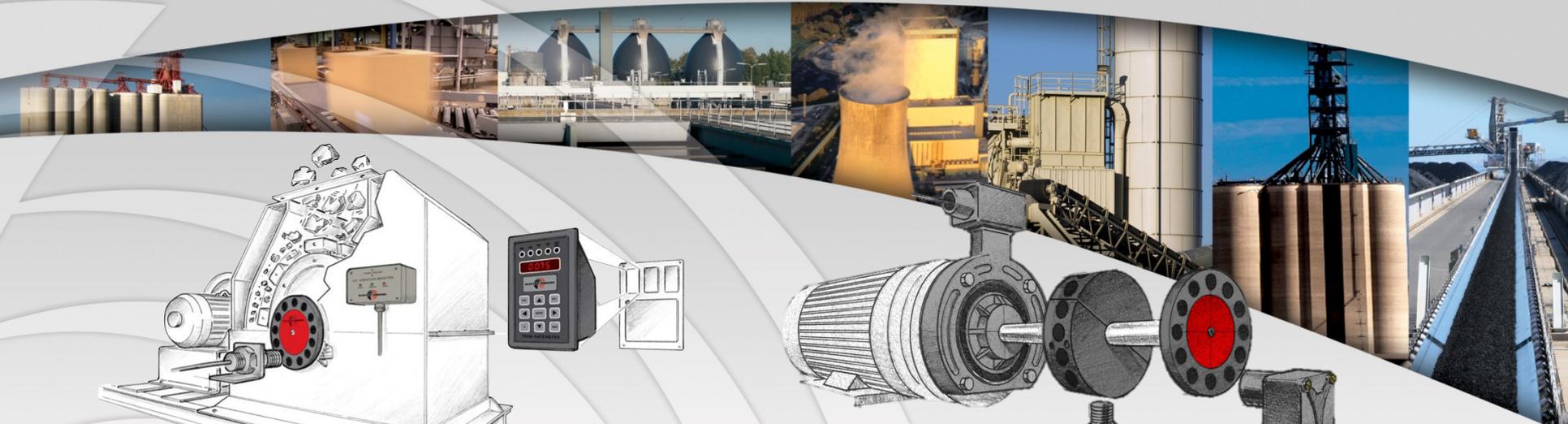
Conveyor Speed



Coal Feeder



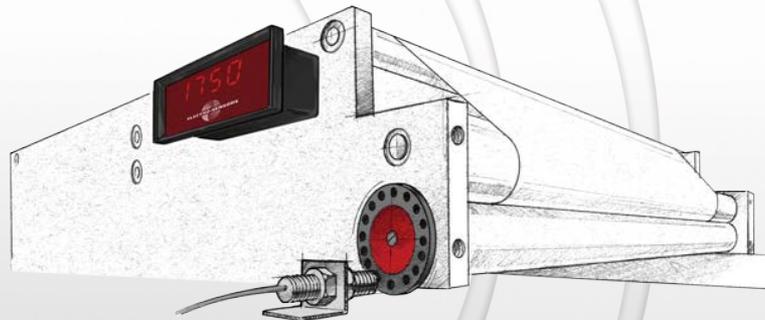
Blower Speed



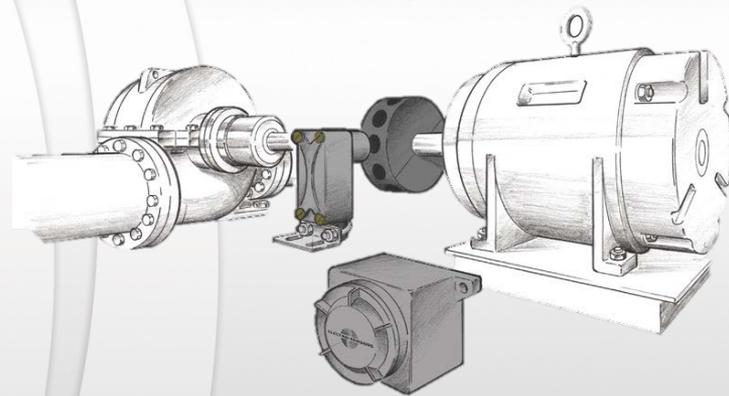
Hammer Mill



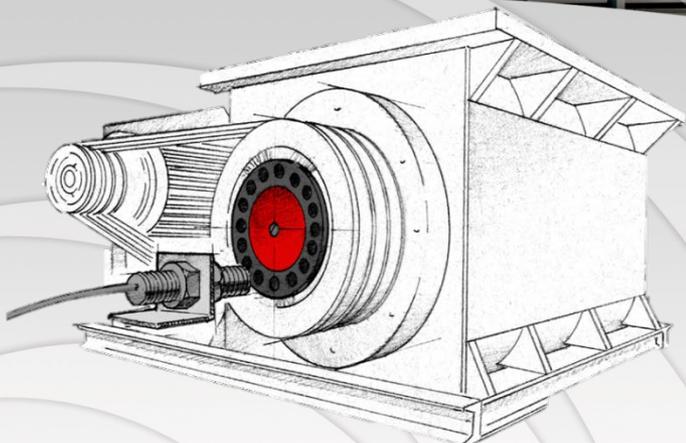
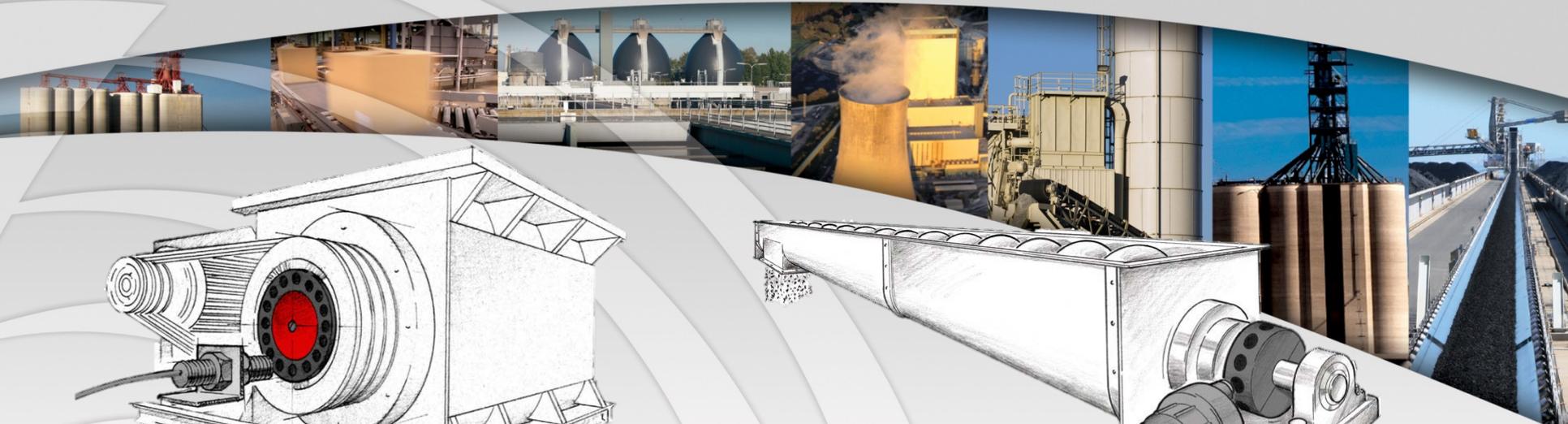
Motor Speed



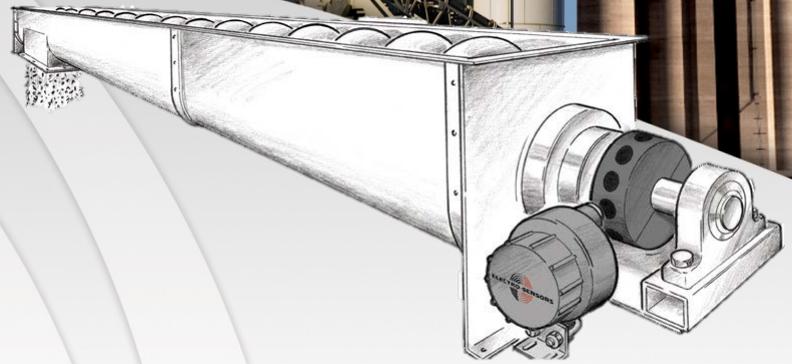
Print Web



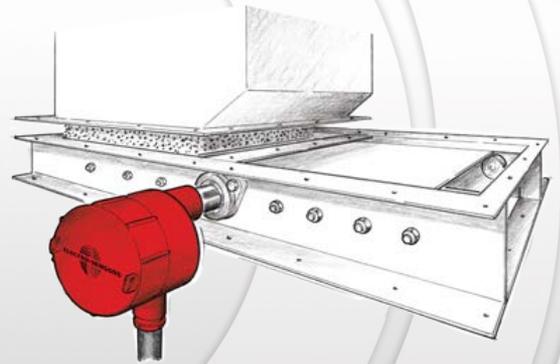
Pump



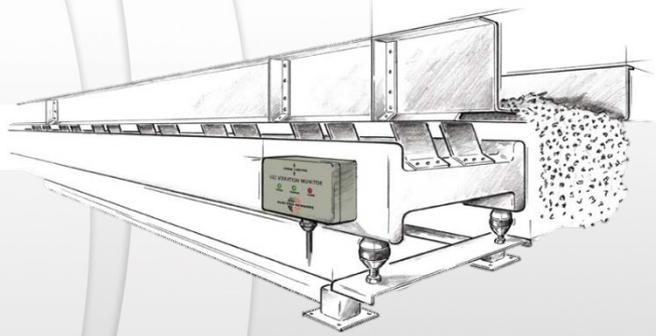
Rotary Airlock



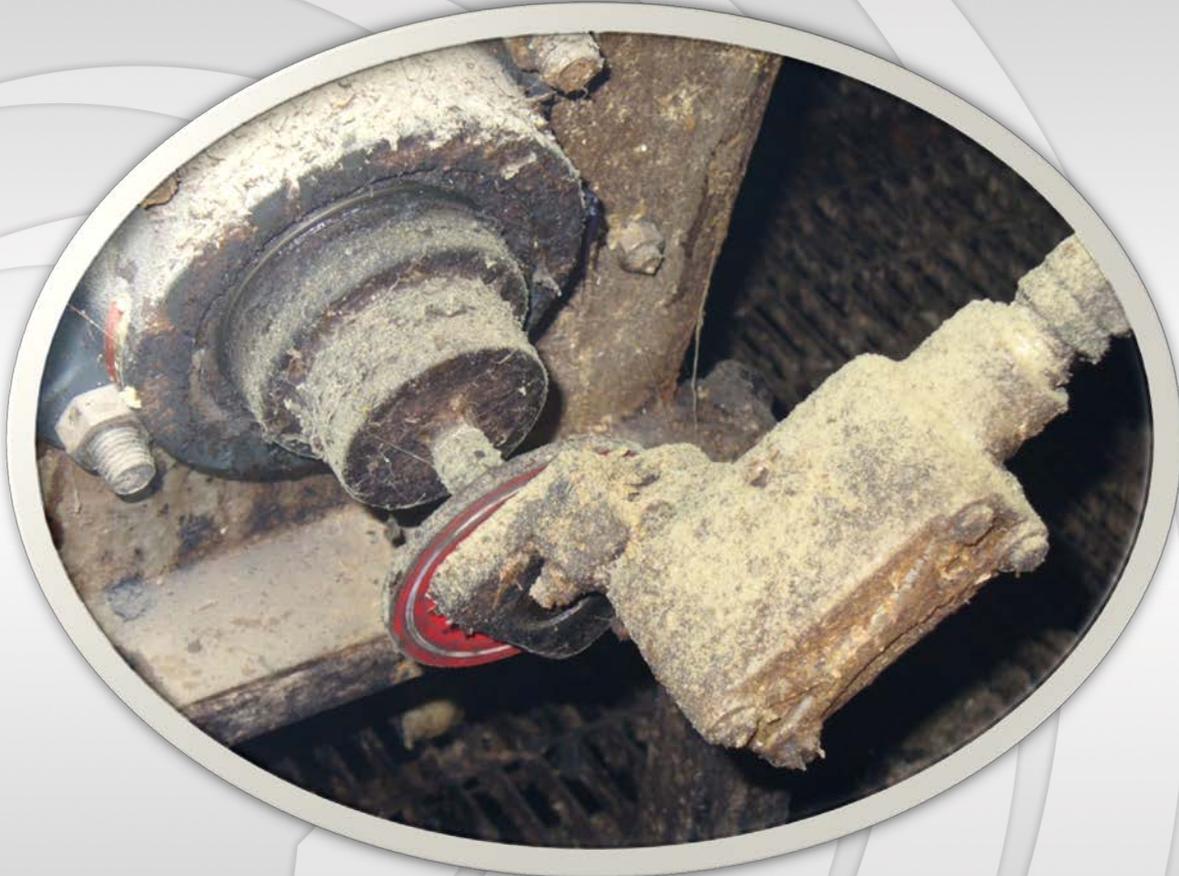
Screw Conveyor



Slide Gate Position



Vibratory Conveyor



- **907 XP Sensor**
- **EZ-100 Bracket**
- **EZ-255 Disc**



SG1000A Slide Gate Position Sensor Monitoring Grain Bucket Elevator



- **M100T Speed Switch**
- **EZ-100 Mount**
- **EZ-255 Disc**
- **Disc Guard**



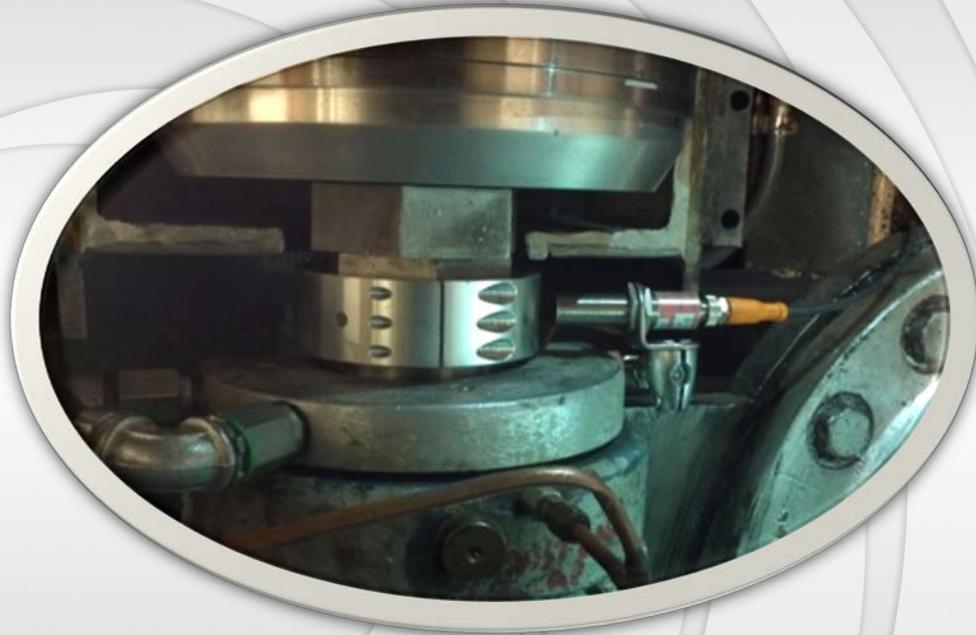
SCP1000 Speed Switch Monitoring a Conveyor Roller



- **Belt Alignment Monitoring**
- **TT420S Temperature Sensor & Right Angle Conduit Fitting**
- **Standard Rub Block Door Assembly**



SG1000E Position Sensor on a Clam Shell Bucket



- **Chemical Processing**
- **Series 18 Speed Sensor**
- **Stainless Steel Wrap**



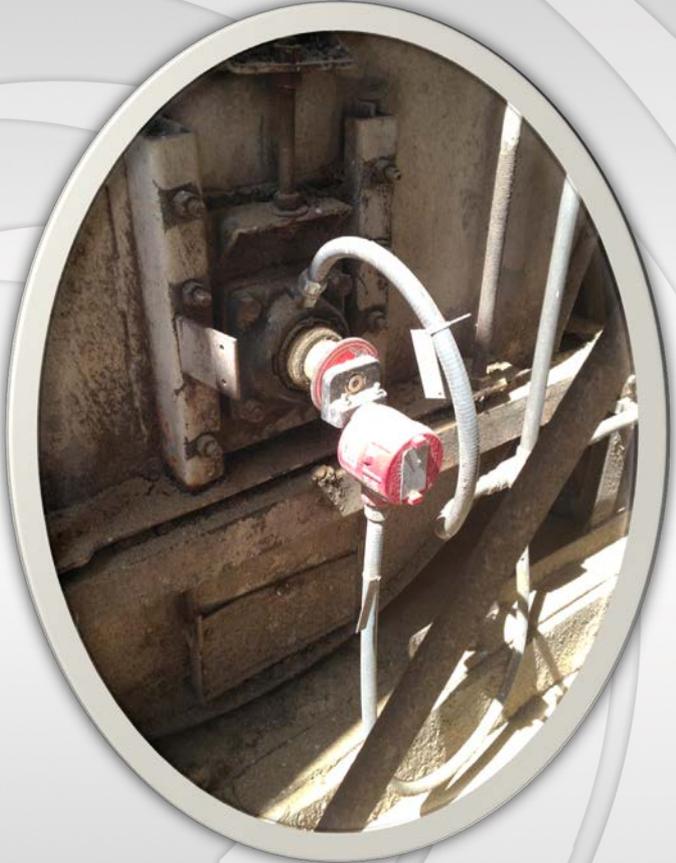
- **TT420Z-LT Bearing Temperature Sensor**
- **TT420S-LT Right-Angle Temperature Sensor**
- **Standard Rub Block Door Assembly for Belt Alignment**



- **BA-100 Monitoring Belt Alignment on Exposed Coal Conveyor**



- **VS1 Vibration Monitor**



- **FB420 Speed Sensor with relay monitoring speed on a grain elevator (with EZ-100 Mount and EZ-255 Pulser Disc)**
- **TT420Z-LT Bearing Temperature Sensor**



- **SG1000B Monitoring a Truck Dumping Station**



- **TR400 Tachometers & Explosion Proof Enclosure Option**

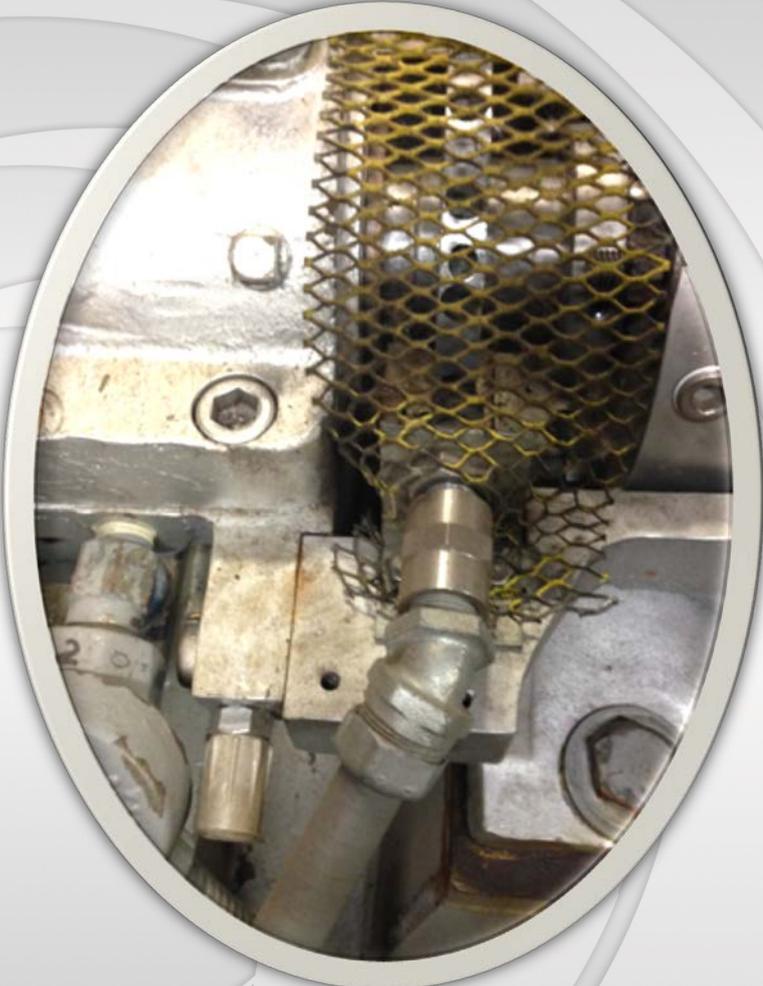




- **SCP1000 Speed Switch monitoring speed in a power plant application**
- **EZ-SCP Mount**
- **EZ-255 Pulse Disc**



- **M100T Speed Switch monitoring feed drag conveyor**



- **Boiler Pump Application**
- **906B Quadrature Speed Sensor**
- **Narrow Aluminum Split Collar Pulser Wrap**



- **906 Speed Sensor**
- **EZ-3/4in Mounting Bracket Assembly**



Thank You for Your Interest in Electro-Sensors!