WIRED VS. WIRELESS SENSORS
WHEN TO USE EACH FOR OPTIMAL PERFORMANCE

As condition monitoring continues to evolve alongside the push for smarter, connected industrial systems, the choice between wired and wireless sensors has become more nuanced. Both wired and wireless sensors play important roles in asset reliability programs, but the right option depends heavily on your application, environment, and monitoring goals.

This guide will help you determine when to choose wireless sensors over wired, and vice versa, to ensure both cost efficiency and data integrity.

WHEN TO USE WIRELESS SENSORS

Wireless sensors are transforming how we collect data, especially in locations where wired installation is complex, costly, or unsafe. They're best suited for:

Cost-Sensitive Installations
When the cost of conduit, long cable runs, or labor for route-based data collection makes traditional installation prohibitive, wireless sensors offer a lower cost, yet effective way to bring important equipment into your monitoring program.

Temporary or Short-Term Monitoring
Wireless sensors are ideal for short-duration data collection, such as troubleshooting, diagnostic evaluations, or pilot programs, where flexibility and fast deployment matter.

Remote or Spread-Out Areas
For equipment in remote or widely-distributed locations, such as pumps in outdoor tanks or assets across large facilities, wireless solutions reduce the need for expensive infrastructure.

Supplemental Monitoring
Wireless sensors are a great way to expand an existing wired network, allowing you to monitor additional assets without reconfiguring the entire system.

Note: Wireless sensors are typically MEMS based and best suited for monitoring frequency ranges under 10 kHz. For high-speed machinery or applications requiring broad bandwidth analysis, wired sensors are more appropriate.

Non-Stationary or Mobile Equipment
Wireless sensors are an excellent solution for assets that move during operation or are not fixed in one location, such as cranes, AGVs (automated guided vehicles), rail-mounted machinery, or portable compressors. Because there's no need to manage trailing cables, wireless systems provide a clean, safe, and reliable way to capture data from equipment in motion. They also simplify maintenance and minimize wear associated with cable drag or entanglement.

WHEN TO USE WIRED SENSORS

Wired sensors remain the preferred choice for applications requiring the highest data fidelity, broad frequency response, and uninterrupted power. Choose wired if your application calls for:

High-Speed or High-Frequency Applications
For assets like turbines, spindles, and other high-speed rotating equipment, wired piezoelectric sensors can capture the wide bandwidth and high-frequency vibration data often missed by MEMS-based wireless alternatives.

Commissioning and Acceptance Testing
Wired sensors are essential during machine commissioning and acceptance testing. They provide detailed data across broader frequency ranges, ensuring that assets meet operational performance criteria before being put into service.

Continuous or Real-Time Monitoring
Wired systems enable continuous, high-resolution data streaming, ideal for mission-critical assets where real-time analysis is essential for detecting early machinery faults.

Stable, Interference-Free Performance
In environments prone to electromagnetic interference (EMI), or with dense metallic infrastructure, wired sensors provide a more reliable signal compared to wireless transmission.

Regulated or High-Security Environments
Wired sensors are often required in highly-regulated industries, like nuclear, pharmaceutical, and oil and gas, due to their security, stability, and compliance with industry standards.

No Battery Constraints
Because they're powered directly through cabling, wired sensors are preferred for long-term monitoring without the need for battery replacement or power management.

HYBRID SYSTEMS: GETTING THE BEST OF BOTH WORLDS

Many facilities now take a hybrid approach, using wired sensors for critical assets requiring continuous, high-resolution data, and wireless sensors for less critical or hard-to-access equipment. This approach helps balance budget, reliability, and safety.