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PREDICTIVE MAINTENANCE
CONDITION-BASED MONITORING

Sensors vs. Managed Monitoring

Can we just buy sensors, or do we need someone to watch the data?



TECHNICAL GUIDANCE PAPER

A practical guide for maintenance and reliability leaders deciding whether to run predictive maintenance (PdM) and condition-based monitoring (CBM) in-house with their own sensors and analysts, or as a managed service, from installation to work order.

NOVEMBER 2026 · WWW.SMS-INC.NET

Sensors collect data. Someone still has to decide what it means.

THE SHORT ANSWER

Sensors alone give you **data, not decisions**. A wireless vibration sensor can show that a bearing is changing, but someone still has to confirm the fault, judge how urgent it is, and get a work order to the right technician in time.

You can build that capability in-house with certified vibration analysts, tuned alerting, and CMMS integration, or buy it as a **managed predictive maintenance service**. For most plants without an established condition monitoring program, a managed service is the faster, lower-risk path to real downtime reduction.

Up to 50%	24/7	1,000+
LESS UNPLANNED DOWNTIME	ANALYST-CONFIRMED MONITORING	PROJECTS DELIVERED
SMS PdM deployments	*Certified SMS analysts*	*Since 1999*

FIVE THINGS TO KNOW BEFORE YOU BUY

01 **The value is in the decision, not the data.** Savings come from failures converted from unplanned to planned work, which requires a confirmed diagnosis and a work order.

02 **Timing decides everything.** A fault is only worth detecting if the warning arrives early enough to plan the repair. Monitoring frequency must be set against the P-F interval of each failure mode.

03 **Generic thresholds create noise.** Untuned alarms produce false positives that erode trust; alarms must be baselined to each asset and its criticality.

04 **Self-run programs carry hidden costs.** Certified analysts, coverage for nights and vacations, IT/OT networking, cybersecurity, and integration are real line items, not extras.

05 **Most plants should start managed.** Self-run, co-managed, and fully managed programs each fit a different team, but without certified analysts on staff, a managed pilot is the fastest route to proven results. The readiness check in Section 10 shows where you stand.

INSIDE THIS PAPER

§	SECTION	§	SECTION
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02	Timing is everything: the P-F interval	08	Special case: slow- and variable-speed assets
03	Managed PdM: signal to work order	09	Build, buy, or share the work
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05	The core distinction	11	Designing a pilot that proves value
06	The business case	12	The bottom line

01 — SENSORS ALONE

Sensors Alone: Data Without Decisions

A sensor-only program answers one question: *"Is this machine's vibration or temperature changing?"* Industrial wireless sensors mount on motors, pumps, compressors, gearboxes, fans, conveyors, and robots, and stream condition data to a gateway and dashboard around the clock. What they don't do is tell you what the change means, how serious it is, or what to do about it. That work still falls to your team.

Where sensor-only programs stall

Alerts with no owner

Threshold alarms land in an inbox or dashboard nobody is assigned to watch, so early warnings go unread until the asset fails.

Alert fatigue

Generic, untuned thresholds create false alarms, and teams learn to ignore the system, including the alarm that mattered.

No diagnosis

A rising vibration trend can mean imbalance, misalignment, looseness, or bearing wear, and each needs a different fix. Telling them apart takes spectrum and waveform analysis skills most maintenance teams don't have in-house.

No path to the work order

Data that never reaches the CMMS or EAM never becomes scheduled work, so the program produces charts instead of avoided failures.

Blind spots in the data itself

A battery-powered sensor captures short snapshots on a schedule. If the capture window, sample rate, or interval doesn't match the machine, the fault can be missed entirely.

A fleet to maintain

Batteries, gateways, firmware, and wireless coverage all need upkeep. Without an owner, sensor health quietly degrades and gaps open in coverage.

> **Each of these gaps is a job, not a feature.** A managed service makes someone accountable for every one of them, which is the subject of Section 03.

What a wireless sensor actually sees

Wireless sensors trade data for battery life. Every measurement draws power, so sensors take periodic snapshots rather than continuous recordings, and battery life depends heavily on how often they sample and whether full waveforms are transmitted. Vendor battery claims are often quoted under conditions that aren't clearly stated.

Specification matters. Industrial-grade triaxial sensors sample at 25 kHz or more, cover roughly 0.5 Hz to 10 kHz, and resolve thousands of spectral lines, enough for early bearing analysis. Lower-cost sensors may cap bandwidth near 1 kHz, missing the high-frequency bands where bearing defects first appear.

Slow equipment needs longer capture windows. On low-speed machines, fault impacts occur once per revolution and are spaced far apart; a short capture can miss them.



FIG. 1 — A WIRELESS GATEWAY ENCLOSURE MOUNTED ON A PLANT ROOF.

Placement and mounting quality directly affect data quality. SMS field technicians handle sensor placement, mounting, and gateway commissioning as part of every install.

02 — WHY TIMING MATTERS

Timing Is Everything: The P-F Interval

Detect early enough to plan, not just to watch.

Reliability engineers describe failure with the **P-F curve**. Point P is the earliest moment a developing defect can be detected; point F is functional failure, when the asset can no longer do its job. The time between them, the **P-F interval**, is the window in which a problem can still become planned work. Each detection method sits at a different point on the curve: high-frequency vibration and envelope analysis detect bearing defects earliest, while heat and audible noise appear only near the end.

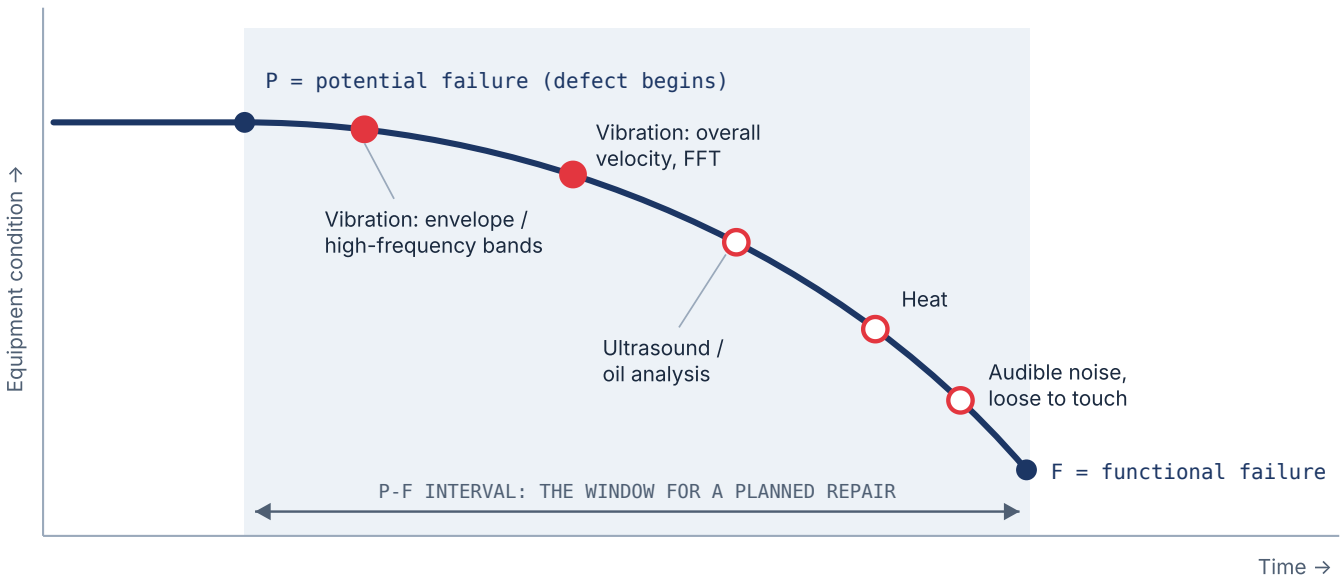


FIG. 2 — CONCEPTUAL P-F CURVE. ACTUAL INTERVALS VARY BY FAILURE MODE, SPEED, LOAD, AND LUBRICATION.

TWO PRACTICAL RULES FOLLOW

01 **The monitoring interval must fit inside the warning window.** Published reliability guidance recommends checking at roughly one-half to one-third of the P-F interval, and one-quarter to one-fifth for critical assets, so there are at least two chances to catch the fault before failure.

02 **Detection is only half the window.** Confirming the fault, ordering parts, and scheduling the repair consume the rest, which is why the speed of analyst confirmation and work-order creation matters as much as the sensor. This is the half of the window a managed service is built to protect: flagged data is reviewed continuously by analysts, so the diagnosis and work order follow the alert instead of waiting for someone to notice it.

Why generic thresholds misfire

Many sensor platforms ship with default alarm limits based on ISO 20816, the international standard for evaluating machine vibration, which replaced the ISO 10816 series. ISO 20816-3 sorts industrial machines

above 15 kW into severity zones by broadband RMS velocity. These zones are a sound starting point, but they are machine-class averages:

MACHINE GROUP (RIGID SUPPORT)	ZONE A/B	ZONE B/C	ZONE C/D	WHAT THE ZONES MEAN
Group 1: above 300 kW	**2.3 mm/s**	**4.5 mm/s**	**7.1 mm/s**	A: new condition. B: acceptable for long-term operation. C: plan corrective action. D: damage likely.
Group 2: 15 to 300 kW	**1.4 mm/s**	**2.8 mm/s**	**4.5 mm/s**	Flexibly mounted machines use higher limits; the group and support type must be set correctly.

A single overall number cannot say *which* component is failing, and an early bearing defect can sit well inside Zone B while the damage progresses. ISO 20816-3 itself treats a step change of more than 25% of the Zone B/C boundary as significant even when the machine is still in an acceptable zone. Effective programs therefore combine ISO zones with asset-specific baselines, spectral band alarms, and envelope alarms, and they have a person confirm what the alarm means.

03 — MANAGED PDM AND CBM

Managed Predictive Maintenance: From Signal to Work Order

Closing the loop.

Predictive maintenance delivered as a managed service answers a broader question: *"Which assets are developing a fault, what is it, and what should we do about it this week?"* It starts with the same sensors, then adds the people and processes that turn data into action: certified vibration analysts, alerting tuned to asset criticality, and automatic work orders in IBM Maximo or your CMMS.

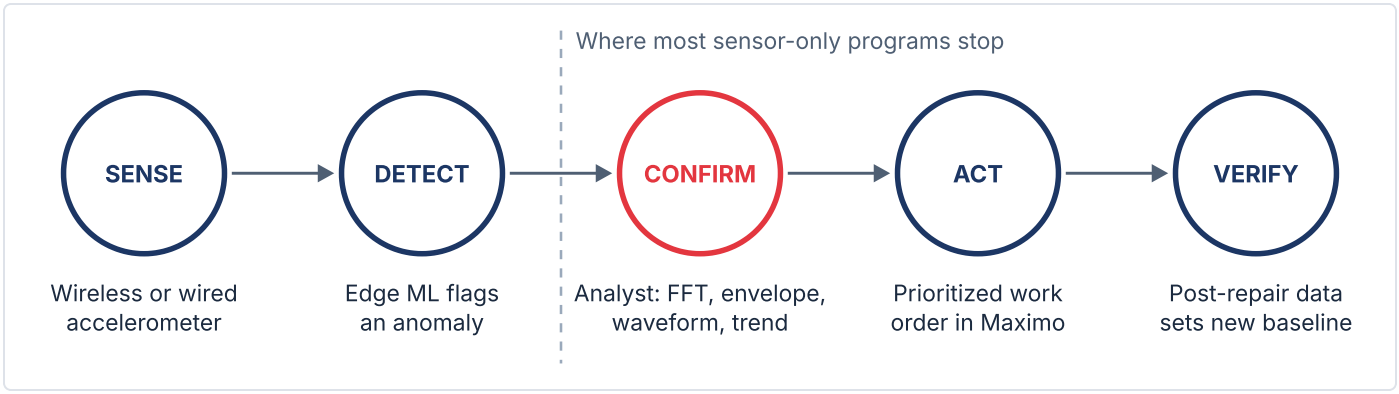


FIG. 3 — THE CLOSED LOOP. SENSOR-ONLY PROGRAMS TYPICALLY STOP AFTER DETECTION; MANAGED MONITORING CARRIES THE SIGNAL THROUGH TO A VERIFIED REPAIR.

The SMS approach

- **Scope by criticality.** An asset criticality review identifies the equipment whose failure costs the most, and the failure modes that matter on each, so sensors go where they pay back first.
- **Install it right.** SMS field technicians handle sensor placement and mounting, gateway and network commissioning, and panels and enclosures, with full as-built documentation.
- **Match the sensor to the machine.** Wireless sensors cover most assets; wired, continuous online systems with simultaneous multi-channel acquisition protect critical assets with short P-F intervals.
- **Confirm before you alert.** Edge machine learning flags anomalies, then an SMS analyst confirms the diagnosis with FFT spectrum, envelope, and trend analysis. Your team only sees what requires action.
- **Close the loop in Maximo.** A prioritized work order is created automatically with failure codes and recommended corrective actions. After the repair, fresh vibration data confirms the fix and sets a new healthy baseline.

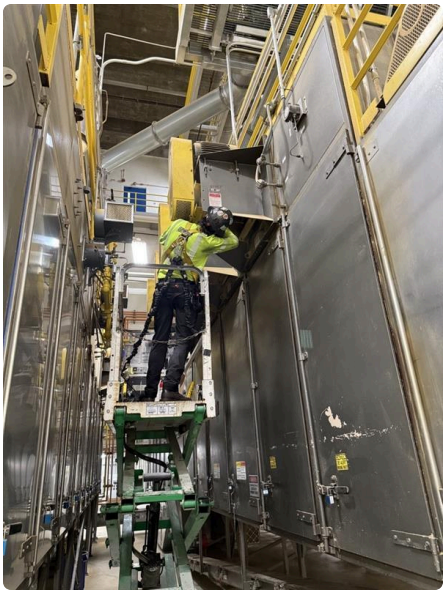


FIG. 4 — INSTALLING MONITORING HARDWARE ON A PRODUCTION ROBOT.

Equipment covered

A managed program covers the rotating and production assets that drive most unplanned downtime, including legacy equipment, across single or multiple sites:

ASSET	TYPICAL FAILURE MODES MONITORED
Motors	Bearing wear, imbalance, misalignment, looseness
Pumps	Bearing wear, cavitation, impeller wear, seal degradation
Compressors	Bearing faults, valve wear (rotary and reciprocating)
Gearboxes	Gear mesh, tooth wear, pitting, spalling
Fans and blowers	Imbalance, blade fouling, misalignment
Conveyors	Drive pulley bearings, tensioner and idler wear
Industrial robots	Joint reducer wear, servo motor health
Custom and legacy assets	Retrofit monitoring scoped to the failure modes that matter

What you receive, every month

DELIVERABLE	WHAT IT MEANS FOR YOUR TEAM
Analyst-confirmed findings	Each alert names the failing component, the failure mode, its severity, and the recommended fix.
Prioritized work orders	Created in Maximo or your CMMS, ranked by asset criticality and urgency.
Repair verification	Post-repair data confirms the fix worked and resets the baseline.
Program reviews	Regular reviews with cost avoidance, open findings, and system health, ready to share with leadership.
A team behind the data	Direct access to the SMS analysts who know your assets, for questions and troubleshooting during production.

> ***"Tony and his team have done a fantastic job keeping us on top of our other robotic health issues. We have been able to continuously plan, monitor, schedule and avoid these wear related failures."***
>
> RYAN SPEISER, SENIOR RELIABILITY ENGINEER · STELLANTIS, STERLING HEIGHTS

The analyst's toolkit

No single technique catches every fault. SMS analysts combine deterministic vibration methods with AI-driven pattern recognition:

TECHNIQUE	WHAT IT REVEALS	BEST FOR
FFT spectrum analysis	Converts the time signal into frequencies; each component has a signature (imbalance at 1× running speed, misalignment often at 2×, bearing defects at their own fault frequencies).	**Identifying which component is failing on rotating equipment**
Envelope / Hilbert demodulation	Isolates repetitive impacts riding on high-frequency carrier signals, exposing defects invisible in a standard spectrum.	**Early bearing spalling, pitting, cracks; gear mesh faults**
Time waveform analysis	Shows the raw signal shape and periodicity over time.	**Slow-speed and reciprocating machines, impacting, cracked gear teeth**
Wavelet transform	Time-frequency view of non-stationary signals.	**Transient impulses and variable-speed machines such as robots**
Trend and degradation forecasting	Correlates vibration with age, load cycles, and maintenance history.	**Scheduling repairs weeks or months ahead**

One engagement, five phases

01 **SCOPE**
Criticality review
Asset criticality and the failure modes that matter.

02 **DESIGN**
Sensors & sampling
Sensor type, placement, sampling, integration.

03 **BUILD**
Configure
Sensors, gateways, connectors configured.

04 **DEPLOY**
Install & baseline
Install, commission, baseline, validate.

05 **MANAGE**
24/7 analysis
Analyst-confirmed alerts and Maximo work orders.

04 — AT A GLANCE

Sensors Alone vs. Managed Monitoring at a Glance

DIMENSION	SENSORS ALONE (SELF-RUN)	MANAGED MONITORING (SMS)
Core question	Is vibration changing?	What is failing, and what do we do about it?
Who reads the data	Your team, if it has trained analysts	Certified SMS vibration analysts
Analyst qualification	Varies; ISO 18436-2 Category II is the usual working minimum	Certified analysts, with senior review for complex faults
Alerts	Generic thresholds; high false-alarm risk	Analyst-confirmed, tuned to asset criticality
Diagnosis	Trend or alarm only	Specific failure mode with a recommended fix
Coverage	Business hours, unless you staff nights and holidays	24/7 monitoring
Work orders	Entered manually, if anyone acts	Created automatically in Maximo or your CMMS
Sensor and gateway health	Your team tracks batteries and connectivity	Monitored as part of the service
Cybersecurity and networking	Your IT/OT team designs and secures it	Designed in from the start; reviewed with your IT team
Proof of results	Rarely measured	Cost avoidance and ROI reported at every review
Time to value	Months: hire or train, tune alarms, integrate	Weeks: scoped pilot on critical assets
In-house skills needed	Vibration analysis, IIoT networking, integration	Acting on confirmed recommendations
Recurring cost	Lower: hardware and software only	Higher: includes ongoing analyst service

Rows in the middle of the table (qualification, coverage, sensor health, security, time to value) are where self-run programs most often under-budget, and exactly the work a managed service takes on.

05 — THE CORE DISTINCTION

A sensor-only program tells you something has changed. A managed monitoring program tells you what is failing and how urgent it is, then puts the work order in front of the right technician, turning condition data into avoided downtime.

06 — THE BUSINESS CASE

Why It Matters: The Business Case

From alarms to avoided failures.

The value of condition monitoring comes from the failures you prevent, not the data you collect. The stakes are rising: Siemens' *True Cost of Downtime 2024* found that unplanned downtime now costs the world's 500 largest companies about $1.4 trillion a year, roughly 11% of revenue, and that an hour of downtime in automotive plants costs about $2.3 million.[1]

$1.4T	11%	$2.3M	8–12%
ANNUAL DOWNTIME COST, FORTUNE GLOBAL 500	OF REVENUE LOST TO UNPLANNED DOWNTIME	PER HOUR OF DOWNTIME IN AUTOMOTIVE	SAVINGS OF PREDICTIVE OVER PREVENTIVE
Siemens, 2024	*Siemens, 2024*	*Siemens, 2024*	*U.S. DOE / PNNL*

What managed programs deliver in the field

BUSINESS LEVER	IMPACT	REAL-WORLD / FIELD EVIDENCE
Unplanned downtime	**↓ up to 50%**	SMS PdM deployments deliver up to a 50% reduction in unplanned downtime; manufacturing sites typically see 40–60%.
Maintenance cost	**↓ 25–35%**	Manufacturing deployments typically cut maintenance costs by 25–35%.
Maintenance efficiency	**↑ 30%**	Condition-based scheduling raises maintenance efficiency about 30%. At Honda's Lincoln, Alabama plant, it reduced technicians' PM workload by eliminating time-based grease sampling, freeing them for higher-value work.
Repair timing	**Planned, not unplanned**	At Stellantis' Sterling Heights plant, early alerts on critical robots let the team repair reducers during scheduled downtime, for a return several times the cost of the service.

BUSINESS LEVER	IMPACT	REAL-WORLD / FIELD EVIDENCE
Faster troubleshooting	**Mechanical vs. electrical, remotely**	At Cleveland-Cliffs, SMS analysts remotely ruled out a mechanical failure on a robot during production and pointed the team to the electrical fault that was the real cause.
Lost revenue avoided	**$2.3M**	At a power generation site, early bearing detection prevented $2.3M in lost generation revenue.

What these results share: an SMS analyst confirmed each fault and a work order closed the loop. The sensors made them possible; the managed service made them happen.

Build the case on defensible numbers

Finance teams discount headline figures they can't trace. The most conservative, well-sourced benchmarks are a good floor for your business case: the U.S. Department of Energy's *O&M Best Practices Guide* puts predictive maintenance savings at 8–12% over a preventive program and 30–40% over reactive maintenance,[2] and Deloitte estimates that predictive maintenance raises equipment uptime and availability by 10–20% and cuts maintenance planning time by 20–50%.[3] Use these for the base case, then add your own failure history: every past failure on a monitored asset that could have been planned is a line item in the return.

> ***"Right after the initial deployment, [the monitoring program] revealed several robots that were in various stages of failure that we were unaware of. This allowed our team to plan for the repairs and order the parts needed to keep our production floor running."***
>
> DAVID DEW, REGIONAL MANAGER · CLEVELAND-CLIFFS INC.

07 — TOTAL COST OF OWNERSHIP

The Real Cost of Running It Yourself

What the sensor quote leaves out.

Comparing a sensor price list with a managed-service subscription is not a like-for-like comparison. A self-run program needs everything the managed service includes; the cost simply sits in other budgets. Use the checklist below to price both options honestly.

COST ELEMENT	SELF-RUN: YOU OWN IT	MANAGED: SMS OWNS IT
Analyst staffing	At least one ISO 18436-2 Category II analyst; Category III for program design and complex faults. Certification requires classroom training, documented field experience, and an exam.	Included
Coverage and continuity	Backup for vacations, nights, and turnover; knowledge leaves when an analyst does.	Included, 24/7
Baselining and alarm tuning	Setting and maintaining asset-specific baselines and alarm bands as operating conditions change.	Included
Networking and cybersecurity	Gateway placement, wireless coverage, segmentation, firewall rules, and security reviews with IT.	Designed and documented by SMS
CMMS / EAM integration	Building and maintaining the Maximo or CMMS interface, failure codes, and work-order templates.	Included (IBM Platinum Business Partner)
Fleet upkeep	Battery replacement, firmware updates, failed sensors, and gateway outages.	Monitored; SMS field service
Software and data	Platform licenses, data storage, and user management.	Included in subscription
Reporting	Building the cost-avoidance case for leadership.	ROI reported at every review

The talent gap is real

Analyst skills are scarce and getting scarcer. Deloitte and The Manufacturing Institute project that U.S. manufacturers may need as many as 3.8 million new workers between 2024 and 2033, and that about 1.9 million of those jobs could go unfilled without significant change.[4] A program built around one or two experienced analysts is exposed to that market.

1.9 MILLION

U.S. manufacturing jobs that could go unfilled between 2024 and 2033 without significant

Price these line items honestly and the gap between a sensor quote and a managed subscription narrows quickly, before counting the failures an understaffed program misses. For many plants, that makes the managed path the lower-risk choice, not just the faster one.

change, according to Deloitte and The Manufacturing Institute.

A SIMPLE ROI WORKSHEET

Avoided cost per event = (emergency repair - planned repair) + (unplanned downtime hours × cost per hour) + secondary damage avoided

Annual value = avoided cost per event × failures converted from unplanned to planned per year

ROI = (annual value - annual program cost) ÷ annual program cost

Tip: use your own CMMS failure history for the last two to three years on the assets in scope, and count only failure modes the monitoring can actually detect.

08 — SLOW- AND VARIABLE-SPEED ASSETS

Special Case: Slow- and Variable-Speed Assets

Where generic sensors struggle most.

Most off-the-shelf vibration programs assume a machine runs at a steady, moderate speed. Many critical assets don't: low-speed gearboxes, conveyors, mixers, and rolls turn slowly, while industrial robots and indexing machines change speed and direction many times per cycle under varying loads.

On slow machines, a bearing or gear defect produces an impact only once per revolution, so impacts are spaced far apart and a short capture window can miss them entirely. On variable-speed machines, fault frequencies move with every speed change, smearing a standard spectrum. Research on robot joint reducers illustrates the point: vibration analysis is the most widely used and mature diagnostic method, but variable-speed operation produces non-stationary signals that fixed-speed spectra handle poorly.[10]



FIG. 5 — INSPECTING ROBOT JOINT REDUCERS.

How a managed program handles it

These assets are where analyst expertise matters most, and where self-run programs most often produce noise instead of findings. A managed program addresses them by design:

Configured for the machine

Sensors are set up with low-frequency response and longer capture windows suited to slow rotation.

The right techniques

Analysts rely on time-waveform, envelope, and time-frequency methods such as wavelets rather than overall levels alone.

Context from operations

Speed, load, and cycle information is used to compare like with like, so normal process changes aren't mistaken for faults.

Actionable outcomes

On robot fleets, SMS clients have used early findings to replenish grease at the first sign of reducer wear, separate mechanical from electrical faults during production, and plan spare parts ahead of failure.

> *"[The program] helped us to predict these failures, plan and schedule for the replacements, and create a better robotic health maintenance program."*
>
> KENNY CASPERSON, PLANT 2 MESD LEAD · HONDA, LINCOLN, ALABAMA

09 — BUILD OR BUY

Honest Trade-Offs: Build, Buy, or Share the Work?

The case for running it yourself

Organizations with an established reliability team, certified vibration analysts on staff, and IT support for industrial networks can run a sensor program in-house. Recurring cost is lower, the expertise stays inside the company, and the team controls thresholds and priorities directly.

The case for a managed service

Most maintenance teams weren't built for data analysis, and hiring or training vibration analysts takes time most plants don't have. The common failure mode is a pilot that produces alerts nobody acts on until the program loses credibility and stalls. A managed service removes that risk: analysts are in place from day one, alerts arrive already confirmed, and results are reported in terms leadership cares about.

The middle path: co-managed

Many plants fit neither extreme. Your team owns routine data review and first-line response, while SMS analysts handle 24/7 coverage, complex diagnoses, and escalations, and mentor your staff toward certification. It builds internal capability without leaving critical assets uncovered.

	SELF-RUN	CO-MANAGED	FULLY MANAGED
Best when	Certified analysts on staff and a mature reliability program	Some in-house skill; want to grow it with expert backup	**No vibration program yet, or analysts are stretched thin**
Your team does	Everything	Routine review, first response, repairs	**Repairs on confirmed recommendations**
SMS does	Installation and integration (optional)	After-hours coverage, complex diagnosis, coaching	**The full loop, scope to verified repair**
Cost profile	Lowest recurring; highest internal labor	Moderate	**Highest recurring; lowest internal labor**

RECONCILING THE PATHS

All three paths work, for different teams. If you already have certified analysts and a mature reliability program, buy sensors and integrate them yourself. If you have some capability, share the work. For most plants we work with, though, the right first step is **a managed pilot on the highest-risk assets**: it proves the value quickly, and you can bring more of the work in-house as your team grows.

10 — READINESS CHECK

Readiness Self-Assessment

Which path fits your plant today?

Answer each question honestly for the assets you plan to monitor. Tick every statement that is true today, then count your ticks.

- ☐ 01 We have at least one ISO 18436-2 Category II (or higher) vibration analyst with time dedicated to this program.
- ☐ 02 Someone is assigned to review alerts daily, including weekends and holidays.
- ☐ 03 We can tell imbalance, misalignment, looseness, and bearing wear apart from a spectrum and waveform.
- ☐ 04 We have a current asset criticality ranking and known failure modes for the assets in scope.
- ☐ 05 Our CMMS or EAM can receive condition-based work orders automatically.
- ☐ 06 IT/OT has agreed on how sensor data will be networked, segmented, and secured.
- ☐ 07 We have a process for replacing sensor batteries and fixing gateway outages.
- ☐ 08 We measure and report cost avoidance from condition-based repairs today.

YOUR SCORE

____/ 8

0–2

Start with a managed pilot

Begin on your most critical assets, and build internal capability as results come in.

3–5

Co-managed, or managed to start

Keep what your team does well; let SMS cover analysis depth and after-hours coverage.

6–8

Self-run is viable

Consider SMS for installation, integration, and periodic program audits.

Every "no" is work a managed service takes on from day one.

11 — START RIGHT

Designing a Pilot That Proves Value

Small scope, clear success criteria.

A pilot should answer one question for leadership: *did monitoring convert failures that would have been unplanned into planned work, at a cost that makes sense?* Agree on how that will be measured before the first sensor is installed. SMS runs pilots as managed engagements, so your team spends the pilot judging results rather than building infrastructure.



FIG. 6 — COMMISSIONING MONITORING ON A PRESS-LINE ROBOT.

01

WEEKS 0–2

Scope

Criticality review; select 10–30 assets with high failure cost and vibration-detectable failure modes; pull CMMS failure history; agree on KPIs.

02

WEEKS 2–4

Design and build

Sensor selection and placement; gateway and network plan reviewed with IT; Maximo or CMMS integration configured.

03

WEEKS 4–6

Deploy and baseline

Install and commission; capture healthy baselines; set alarm bands by asset and criticality.

04

WEEKS 6–12+

Manage and review

Analyst-confirmed alerts and work orders; monthly reviews; a results readout with cost avoidance and a scale-up plan.

Measure what matters

KPI	WHAT IT SHOWS	TARGET
Confirmed findings	Number of analyst-confirmed faults, by failure mode and severity	**Set at kickoff**
Alert precision	Share of alerts that led to a confirmed, actionable finding (the inverse of alert fatigue)	**Set at kickoff**
Detection lead time	Days between first alert and the planned repair date	**Inside the P-F window**
Work-order closure	Recommended work orders completed, and how many were verified fixed by follow-up data	**Set at kickoff**
Failures avoided and cost avoidance	Events converted from unplanned to planned, valued with the ROI worksheet in Section 07	**Reported at every review**
System health	Sensor and gateway uptime; data completeness	**Set at kickoff**

Settle security and data questions up front

Every connected sensor and gateway extends the plant's attack surface, so bring IT/OT security into scoping, not commissioning. The ISA/IEC 62443 series is the international reference for securing industrial automation and control systems, and its zone-and-conduit model is a practical way to frame the conversation.[11] Questions to answer in week one:

- **Network path.** Will sensor data travel on a segmented OT network, a dedicated cellular gateway, or the plant network? Which firewall rules are needed?
- **Encryption and authentication.** Is data encrypted from sensor to gateway to platform, and are devices and users authenticated?
- **Data ownership.** Who owns the raw data and the diagnoses, can it be exported, and how long is it retained?
- **Access.** Which plant, corporate, and SMS users can see which assets, and how is access reviewed?

What a managed pilot includes

INCLUDED	DETAIL
Criticality review	Asset selection and failure-mode review with your reliability team
Installation	Sensors, gateways, and enclosures installed and commissioned by SMS technicians
24/7 monitoring	Analyst-confirmed alerts with a specific diagnosis and recommended fix
Work orders	Prioritized work orders in IBM Maximo or your CMMS
Results readout	Cost avoidance, findings, and a plan to scale, ready for leadership

12 — THE BOTTOM LINE

Data is cheap. Decisions prevent failures.

Sensors are the starting point, not the result. Downtime falls only when someone confirms the fault, sets the priority, and gets a work order to a technician in time. If your team can't do that today, **buy the outcome**: start with a managed pilot on your most critical assets and let the results make the case.

PARTNER WITH SMS

As an **IBM Platinum Business Partner** and an authorized **Siemens Senseye** implementer, with 25+ years of engineering and maintenance expertise, 1,000+ projects delivered, and more than 50,000 assets monitored across six continents, **Strategic Maintenance Solutions** helps organizations move from raw sensor data to a fully managed predictive maintenance program, from the first pilot to enterprise scale.

Start with a criticality review: talk to an SMS reliability engineer about a managed pilot. Contact sales@sms-inc.net or +1 207-854-9400.

A — APPENDIX

Glossary and References

Glossary

TERM	MEANING
CBM	Condition-based maintenance or monitoring: performing maintenance based on the measured condition of an asset rather than a fixed schedule.
CMMS / EAM	Computerized maintenance management system / enterprise asset management system, such as IBM Maximo, where work orders are planned and tracked.
Envelope analysis	A demodulation technique that isolates repetitive impacts from bearing or gear defects that are hidden in a standard spectrum.

TERM	MEANING
FFT	Fast Fourier transform: converts a vibration signal over time into a spectrum of frequencies.
ISO 18436-2	International standard for qualifying vibration analysts, in four categories (I to IV) of increasing skill and responsibility.
ISO 20816	International standard series for measuring and evaluating machine vibration, with severity zones A to D. Replaces ISO 10816.
ISA/IEC 62443	International standard series for cybersecurity of industrial automation and control systems.
PdM	Predictive maintenance: using condition data and analysis to forecast failures and schedule repairs before they occur.
P-F interval	Time between the first detectable sign of a defect (P) and functional failure (F).

References

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