



Sensei

IIoT NETWORK SYSTEM

Experience Sensei® IIoT Network System. Harness the power of advanced analytics to detect potential equipment issues before they escalate, ensuring uninterrupted operations. Transform your maintenance strategy with Sensei, where precision meets reliability in industrial equipment care.



(262) 691-6315



inquiries@tricocorp.com



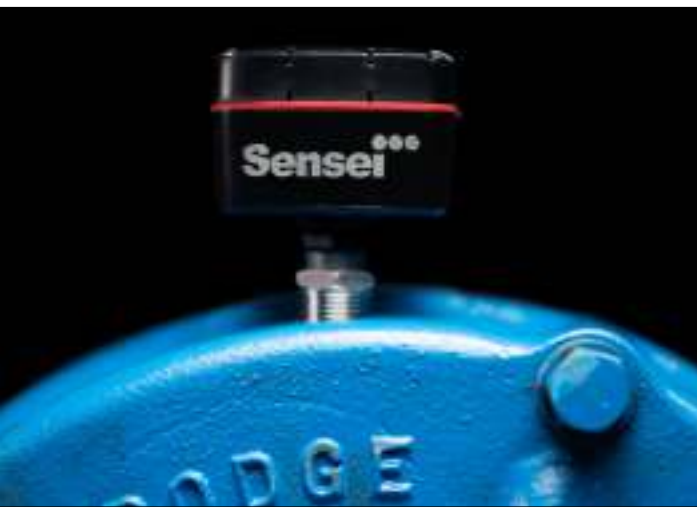
www.tricocorp.com



1235 Hickory Street | Pewaukee, WI 53072

Table of Contents

Insider Perspectives	3	Benefits	20
Transforming Maintenance: The Sensei Approach	4	Features	21
The Sensei Difference	5	Specifications	22
Sensei Components	6	Sensei Enabled Features	23
Sensei Machine Vitals	7	HMI Touch Screen	24
Advanced Monitoring	7	Storage Possibilities	25
Benefits	8	Network Hardware Solutions	26
Key Parameters Monitored	9	Network Hardware Solutions	26
Why Monitor these Parameters	10	Gateway	27
Features	11	Repeater	28
Specifications	12	Sensei Platform	29
Versatile Equipment Monitoring Solution	13	Sensei Platform	29
Sensei Enabled Opto-Matic Oiler	14	Overview	30
Sensei Enabled Oiler	14	Group View	31
Benefits	15	Asset View	32
Features	16	Channel Data View	33
Specifications	17	Trico Mobile App	34
Real-Time Lubrication Intelligence	18	Sensei System: Putting It All Together	35
Spectrum Bulk Oil Storage Intelligent Stack	19	Integrating Sensei Devices and Oil Analysis	36
Spectrum Enabled Intelligent Stack	19		



Insider Perspectives

“Currently, I am in the process of learning the plant. The past maintenance team documented nothing, and I had no idea when any routine maintenance was done.”

(Southern State Paper Plant)

“When I go on vacation or am away from the plant, I have no backup as there is no one to assume my lubrication technician role. It all waits until I return.”

(Canadian Papermill)

“We have 270 pumps and 7-10% of them fail catastrophically every year.”

(Wisconsin Paperboard)

Transforming Maintenance: The Sensei Approach



Change your perspective on predictive maintenance by implementing Sensei at your facility. You'll gain powerful [insights](#) into monitoring, managing, and controlling equipment reliability.

Sensei keeps you continuously informed - so you can stay ahead of potential problems and optimize output, while avoiding unnecessary maintenance. It's an ideal opportunity for your plant to make more proactive, data-driven reliability decisions.

Reduce Equipment Failure

With sensing technology, reduce the frequency of sudden equipment failures by way of accurate and early detection of an issue. Turn unplanned downtime into manageable, predictive maintenance.

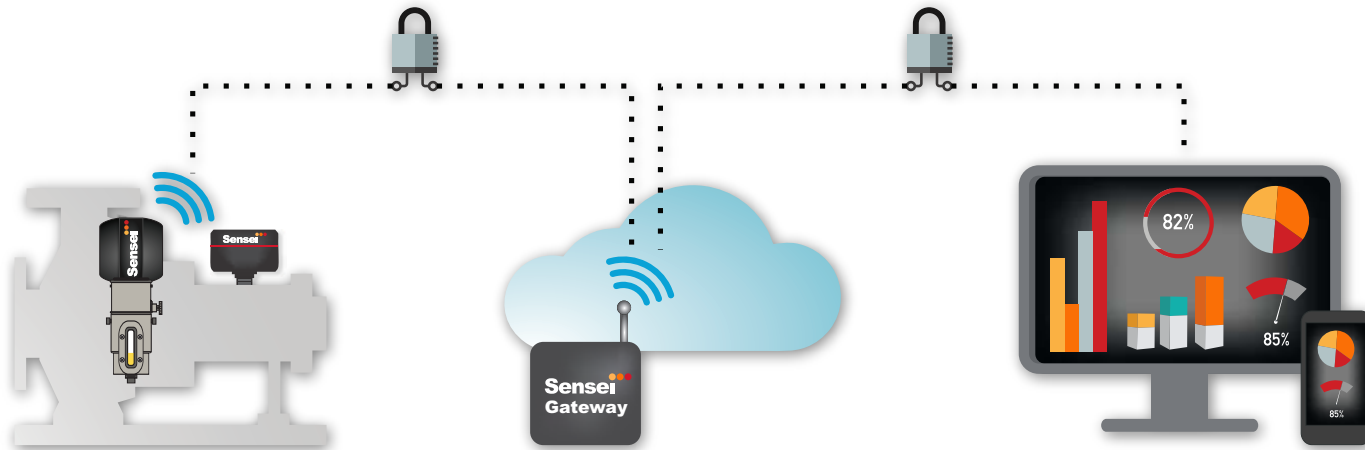
Extend Equipment Life

Provides the data you need to drive an effective predictive maintenance program and make informed decisions.

Improve Reliability Programs

Using Sensei for immediate notifications of an issue, diagnostic reporting, and trending allows you to eliminate the extra costs associated with "reporting by walking around" - and any potential misdiagnosis.

The Sensei Difference...Always on. Always communicating.



Sensei Devices

- ✓ Devices instantly send data streams to the cloud
- ✓ Continuously monitors key parameters
- ✓ Easily connect additional devices to your network

Sensei Network

- ✓ The [gateway/repeater](#) streams data to the cloud
- ✓ Bringing you real-time data from across your facility

Sensei Platform

- ✓ [Intuitive dashboard](#) provides instant access to real-time data
- ✓ Clear guidance to help you take action and ensure reliability and productivity
- ✓ Quickly access data to make insightful decisions

Improve Reliability

Wireless sensor technology helps you know immediately when and where there's an issue - before it turns into a serious problem.

Save Time

With your equipment data at your fingertips, your team no longer has to go from equipment to equipment checking status.

Gain Powerful Insights

Check on key parameters around the clock and use the analytics to recommend preventive steps and drive performance improvements

POWERFUL

Robust dashboard with charts, alerts, trending, and overview

SIMPLE

Quickly access data to make insightful decisions

SECURE

Only allow people you want to have access to your data

INTELLIGENT

Around the clock monitoring, analyzing, and trending of data

FLEXIBLE

Easily connect additional equipment to your network

Sensei Components

1



Sensei Devices

Sensei Devices allow you to connect to the Sensei Platform via the internet. These devices automatically send data to the Sensei Platform for viewing.



Machine Vitals™
(*Sensei Dedicated)



Opto-Matic® Oiler
(**Sensei Enabled)



Intelligent Stack
(**Sensei Enabled)

2



Sensei Network Hardware

The Sensei Network Hardware consists of the Gateway and Repeater. These are used to receive data from the Sensei Devices on the network and transmits the data to the Sensei Platform.



Gateway



Repeater

3



Sensei Platform

The intuitive, web-based [Sensei Platform](#) provides real-time monitoring of data from Sensei Devices on the network.



***Sensei Dedicated:** A device that provides seamless integration and maximum performance for Sensei capabilities.

****Sensei Enabled:** A device that supports Sensei features but is not solely dedicated to Sensei, allowing for a broader range of functionalities alongside Sensei integration.

The Sensei System is made up of 3 independent components creating a Personal Area Network (PAN) across your facility for Sensei Devices to communicate on.

Machine Vitals™: Advance Monitoring

A smart enhancement for any maintenance toolkit, ensuring smooth equipment operation and constant monitoring for peace of mind.

Machine Vitals is designed to redefine how maintenance and reliability personnel approach the monitoring and upkeep of equipment. It is not just another gadget; it's a practical solution.

Machine Vitals provides real time data that equips maintenance teams with the ability to monitor equipment performance continuously, detecting even the subtlest changes that could signal potential issues. This ensures that your equipment's health is always under watch, drastically reducing the likelihood of unforeseen breakdowns.

The device is simple to install and versatile enough to be used in a wide range of environments . It seamlessly integrates with a variety of equipment, providing a straightforward, user-friendly experience. This integration transforms the way maintenance teams interact with their equipment, fostering a more proactive and informed approach to equipment management.



Monitors equipment health in realtime.



Detects potential issues early.



Compatible with various industrial equipment.



Provides actionable data insights.



Enhances maintenance decision making.



Reduces unexpected equipment downtime.

Machine Vitals: Benefits



ELIMINATE NON-VALUE ADDED INSPECTIONS

Machine Vitals eliminates the need for routine, non-value-added inspections. Instead of relying on periodic manual checks, which can be both time-consuming and prone to human error, Machine Vitals ensures a more focused and efficient approach. It allows teams to prioritize their efforts on critical maintenance tasks, optimizing both time and resources while enhancing equipment reliability.



ENABLE CONDITION BASED MAINTENANCE

Machine Vitals shifts the focus from time-based to condition-based maintenance. This approach uses real-time data and analytics to continuously monitor and assess equipment conditions. It detects issues early for timely maintenance, enhancing equipment reliability and optimizing maintenance schedules. This minimizes downtime and extends equipment life, proving more efficient and cost-effective than traditional methods.



ACCES TO NEW DATA

This device allows personnel to see beyond the surface, uncovering insights previously inaccessible. By drilling into dense data sets, it reveals intricate patterns and performance metrics. This deeper level of analysis allows for a more comprehensive understanding of equipment behavior and health. It also aids in post-mortem analysis by providing valuable data that helps pinpoint the exact cause, facilitating learning and preventing future occurrences.



LABOR SHORTAGES

With real-time insights and predictive maintenance alerts Machine Vitals enables teams to proactively manage potential issues, strategically prioritizing maintenance and easing resource constraints. This approach streamlines operations and ensures timely, effective handling of critical tasks.



VALIDATE REPAIRS AND CHANGEOVERS

Continuous monitoring and analysis of equipment performance data before and after maintenance interventions offer valuable insights into the impact of the work done. This feedback validates the effectiveness of maintenance, ensuring optimal equipment operation. It also builds confidence in maintenance strategies and aids in their refinement.



MINIMIZE PERSONNEL RISKS

Proactively monitoring equipment, helps detect issues early to prevent accidents and malfunctions. This allows for timely corrective actions, enhancing safety and reducing risks of injuries. It not only maintains equipment health but also plays a vital role in protecting staff, creating a secure work environment by effectively managing potential hazards.

Machine Vitals enhances equipment maintenance by offering real-time data analysis, predictive alerts, and strategic insights, leading to improved efficiency, reliability, and equipment longevity.

Machine Vitals: Key Parameters Monitored



1. Ambient Temperature

Measures the surrounding temperature, providing insights into environmental conditions that may impact equipment reliability.



2. Headspace Temperature

Monitors the temperature within the equipment, allowing for the detection of abnormal heat generated during operation.



3. Ambient Relative Humidity

Measures the moisture content in the environment, which can be crucial for certain industries to maintain optimal condition and/or provide insight into the effects the environment has on equipment performance.



4. Headspace Relative Humidity

Monitors the humidity level within the equipment, helping identify potential moisture-related issues.



5. Ambient Pressure

Measures the atmospheric pressure, aiding in understanding environmental conditions that may affect equipment performance.



6. Headspace Pressure

Monitors the pressure within equipment or processes, detecting irregularities and leaks that could lead to malfunctions.



7. Acoustics

Captures changes in sound waves generated during operation, enabling the identification of abnormal patterns that could signify equipment issues.



8. Acceleratory Variance

Measures changes in acceleration, detecting vibration or abnormal movement that could indicate potential faults.

Monitoring Multiple Parameters

By monitoring multiple parameters, Machine Vitals provides a thorough insight into the health of your equipment. Here's how it enhances maintenance:

Holistic Understanding

Machine Vitals' ability to measure diverse parameters such as temperature, humidity, pressure, acoustics, and acceleratory variance, provides an in-depth view of your equipment's performance. These parameters are interrelated and monitoring them collectively allows for a holistic understanding of equipment performance.

Early Detection of Issues

By analyzing variations in these parameters, Machine Vitals can detect early signs of abnormalities, allowing you to take preventive action. Early detection enables you to address issues before they cause significant downtime, costly repairs, or potential safety risks.

Discovering Hidden Problems

Some issues may not be apparent through conventional analyses or routine inspections. The combination of various parameters measured by Machine Vitals can uncover hidden problems that may not be known through traditional monitoring or oil analysis alone.

The insights into these critical parameters and their interplay allows you to take a proactive approach to maintenance, ensuring the long-term reliability of your equipment.

Machine Vitals' advanced multi-parameter monitoring capabilities play a crucial role in preventing equipment failures by enabling early detection and intervention of potential issues.

Machine Vitals: Why Monitor these Parameters?

Through the data provided by Machine Vitals, reliability and maintenance personnel can better assess the equipment under their watch. Not by going on time-consuming, or potentially hazardous inspection routes, but right from their laptop. By monitoring individual parameter data and/or a combination of them, many indicators can be observed. You should be able to:

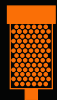
- Determine the factors leading to oil degradation.
- Pinpoint factors contributing to thermal runaway.
- Ascertain situations causing metal-to-metal contact.
- Detect scenarios prone to additive depletion.
- Recognize circumstances leading to viscosity alterations.
- Identify instances of condensation occurrence.
- Detect instances of water ingress contamination.
- Ensure that equipment is appropriately releasing pressure.
- Determine factors causing water contamination.
- Identify components (seals, breathers, vents) failing to release excess pressure adequately.
- Recognize when to incorporate supplemental equipment, such as desiccant breathers, closed system oilers, liquid level gauges, oil sampling tools, expansion chambers, etc.
- Determine when to replace Desiccant Breathers.
- Identify vacuum conditions that may result in particulate ingress.
- Attentively observe your equipment to spot irregularities indicative of poor machine health.
- Regularly monitor machine vibrations for irregularities signaling cavitation or misalignment issues.



TYPICAL ACTION ITEMS



Change your oil



Change your desiccant breather



Take an oil sample for further investigation



A physical inspection is required



Investigating an alert condition



Consider adding desiccant breathers, closed system oilers, etc.



Schedule a maintenance event

Machine Vitals: Features



Batteries

Batteries are replaceable. Minimum 3-year battery life.

Gasket

Prevents ingress of water and contaminants into electronics.

Universal Application

Typically, above a volume of oil, but can be mounted anywhere where internal and external parameters need to be monitored.

Tamper Proof

Magnetic switch prevents inadvertent or incorrect depressing of pairing or power buttons.

Durable Construction

Made of durable material to withstand corrosive environments and the damaging effects of the sun rays.

Plug and Play Deployment

1/2" NPT installs and connects in less than 5 minutes.

Engineered for resilience, Machine Vitals is rugged and durable, making it ideally suited for the demanding conditions of industrial environments.

Machine Vitals: Specifications



Data Transmission

Seamlessly transmits data for real-time monitoring



Continuous Intelligence

Continuously monitors and transmits key parameters to your network



Effortless Set-Up

Easily installs and pairs with your network in minutes

Machine Vitals Device

Provides precise monitoring of industrial equipment health.

Power	
Battery	3.6 Volt D Size Battery
Battery Life	3 years (depending on data & frequency settings)
Mechanical	
Dimensions	3.34"H x 2.63"W x 3.25"L
Material	Cover: Polycarbonate Base: Powder Coated Aluminum
Thread Connection	1/2" NPT
Network	
Wireless	2.4GHz - Low power network based on 802.15.4
Wireless Range	100 m Indoor Line of Sight
Protocols	MQTT
Pairing	Magnetic - Top Cover Clear Circle Area
LED	Provides Feedback on Connection to Network
Environmental	
Installation	Indoor or Outdoor (Designed to IP65)
Operating Temperature	-0° to 175°F (-18° to 79°C)
Wireless Security	
Device Authentication	AES-128 Encrypted Network Joining Scheme Pre-Shared Key and Rotating Session Key
	AES-128 Encrypted Secured Data Transmission

The durability of Machine Vitals makes it ideal for diverse industrial applications.

Machine Vitals: Versatile Equipment Monitoring Solution

Machine Vitals serves a myriad of industries, ensuring reliable and effective monitoring of key equipment. Its versatile nature allows for a broad spectrum of applications, from pumps, gearboxes, hydraulic reservoirs, and many more.

Key industries for Machine Vitals include:

Power Generation

For real-time monitoring of critical machinery, ensuring efficient and uninterrupted energy production.

Pulp & Paper

Aiding in the control and optimization of manufacturing processes, ensuring quality and reducing downtime.

Water and Wastewater Treatment

Essential for overseeing the health of pumps and other equipment, maintaining the integrity of operations.

Metal and Plastic Extrusions

Providing accurate and continuous monitoring to ensure product consistency and the efficient operation of extrusion machinery.



Sensei Enabled Opto-Matic® Oiler



**No more wondering. No more worrying.
No more wasting time.**

Get to know the Sensei Enabled Opto-Matic Oiler - the only system that helps you keep constant watch on the lubricant inside your equipment in real time. Now, instead of doing the typical lube routes, unnecessary maintenance and emergency service...your team can move more proactively and efficiently.

Sensei Enabled Opto-Matic Oiler is quick to install. Easy to expand. And brings you everything you need to quickly identify, solve and optimize lubrication issues and keep your equipment running.



Provides real-time oil level in critical equipment from anywhere



Monitors fluctuations in oil consumption due to unnoticed leaks



Trends historically problematic equipment and alerts on bad actors



Flags concerning conditions to take the necessary corrective action



Predicts days remaining until empty oiler to prevent low levels



Allows your staff to focus on high priority tasks instead of making unnecessary trips

Sensei Enabled Opto-Matic Oiler: Benefits



PREVENT LOW OIL LEVELS

The Sensei Oiler predicts the number of days remaining until your oiler is empty, allowing you to proactively prevent low oil levels. Monitoring oil levels is crucial for ensuring optimal equipment performance. With our predictive capabilities, you can stay one step ahead by knowing exactly how many days are left until your oiler needs refilling. This proactive approach eliminates the risk of running out of oil and helps you maintain uninterrupted operations.



ENVIRONMENTAL RESPONSIBILITY

Every company has an environmental responsibility to ensure they're in control of their process and byproducts. Oil loss through spills or leaks can contaminate soil, groundwater, waterways and wildlife. Monitoring oil use and consumption is more than best practice, it's a moral obligation.



SLIPS, TRIPS, AND FALLS

In the US alone, slips, trips and falls account for 16 million injuries per year. Identifying contributing causes to minimize personnel injuries can start with identifying equipment that constantly needs refilling due to leaks.



LABOR SHORTAGES

Labor shortages in many countries have organizations looking for alternatives to manpower—especially when it comes to non-value-added activities. Routine equipment inspections are one of the most basic elements not requiring skilled labor.



HARD TO REACH LOCATIONS

Production facilities have hard-to-reach locations that may include climbing ladders, descending into pits, crossing catwalks. Why send someone there for routine inspections and risk their safety? With Sensei Enabled Oiler you don't have to unless it is necessary.



MAINTENANCE EFFICIENCY

Deploying labor proactively instead of preventatively or worse, reactively, depends on knowing what needs attention. Quickly assess what equipment is in alert or alarm status to direct personnel to the exact location where their needed.

Sensei Enabled Opto-Matic Oiler can be used to identify bad actors, quantify oil consumption, verify maintenance top-offs and refills, and prioritize labor.

Sensei Enabled Opto-Matic Oiler: Features

Batteries

Minimum 3-year battery life based on data transmission of 4 times per hour. Batteries are replaceable - 2 lithium 2/3 AA 3.6V batteries.

Closed System*

The closed system design prevents ingress of contaminants into the lubricant (vented oiler option available).

Sight Gauge

Two-inch sight gauge for easy viewing of oil level. Oil level can also be viewed through Sensei Platform remotely.



Reservoir

One piece glass reservoir ensures proper constant level function.

Level

Adjustable level setting with 0.68" range. Bottom of adjusting collar indicates actual level setting for easy set-up and maintenance.

*Sensei Enabled Opto-Matic Oiler is also available as a Vented Opto-Matic Oiler.

Tracking oil level over time allows users to identify consumption, low level conditions, personnel performance and activities.

Sensei Enabled Opto-Matic Oiler: Specifications



Lubricant Monitoring

Continuous infrared monitoring of oil level and ambient temperature



Ongoing Insights

Continuously monitors and transmits key parameters to your network



Simple to Integrate

Install in minutes on your equipment



Sensei Enabled Opto-Matic Oiler

Bringing wireless sensing technology to your lubrication processes.

Power	Internal: 2/3 A (replaceable)
Mechanical	
Dimensions	5" x 3.25" x 4"
Material	Housing: PC/ABS, Seal: TPE
Integration	Sensor Mounted to #5 (8 oz) Opto-Matic Oiler
Oil Level Measurement	1/8" Increments
Network	
Wireless	2.4GHz - Low power network based on 802.15.4
Wireless Range	100 m Indoor Line of Sight
Protocols	MQTT
LED	Provides Feedback on Connection to Network
Environmental	
Installation	Indoor or Outdoor (Ingress Protection - IP65)
Operating Temperature	-4° to 122°F (-20° to 50°C)
Wireless Security	
Device Authentication	AES-128 Encrypted Network Joining Scheme Pre-Shared Key and Rotating Session Key
AES-128 Encrypted Secured Data Transmission	
Certifications	
ETL	Class I, Zone 0 ,AEx ia IIC T4 Ga Class I, Division I, Groups A, B, C, D T4 Ex ia IIC T4 Ga -20°C ≤ Ta ≤ 50°C
IECEX	Ex ia IIC T4 Ga -20°C ≤ Ta ≤ 50°C
ATEX	Ex II 1G Ex ia IIC T4 Ga -20°C ≤ Ta ≤ 50°C
UKEX	Ex II 1G Ex ia IIC T4 Ga -20°C ≤ Ta ≤ 50°C

Don't be left in the dark about potential equipment failures or opportunities for performance improvement. Sensei Enabled Opto-Matic Oiler lets you know what's going on in your equipment, 24-7.

Sensei Enabled Oiler: Real-Time Lubrication Intelligence...the Possibilities

Applications

From pumps to any small oil-bathed bearing housings are a good candidate.

Increase Equipment Availability

Identify machines that need attention, so you can directly go to a problem instead of making unnecessary rounds.

Uncover Bad Actors

Uncovering trends, enabling you to continuously fine-tune equipment performance and identify habitual bad actors.

Anticipate Failures

Anticipate failure risks, so you can prevent problems before they occur.

Trend Historical Data

Benchmark and trend data, to hold each other accountable for making real, sustainable improvements.

Efficient Task Management

Sensei Enabled Opto-Matic Oiler saves maintenance personnel valuable time and energy that would otherwise be spent on manual equipment lubrication checks.



Spectrum® Bulk Oil Storage Intelligent Stack

Maintain lubricant integrity.

Gain full control of your lubricant storage and handling practices with the Spectrum Bulk Oil Storage Intelligent Stack. With this Sensei Enabled system you can manage inventory, monitor filter status, track filter activities, lubricant consumption, and lock out unauthorized dispensing.

The system is designed to easily and effectively identify, store, handle, and dispense lubricants. It is an economical way to save space on a plant floor, while keeping lubricants organized and contaminant free.

The Intelligent Stack is Sensei Enabled allowing you to connect to the Sensei Platform. The Sensei Platform operates in real-time to remotely monitor system condition and historical data from your desktop.



Modular system perfect for dedicated lube rooms or satellite locations



Pin protected prevents unauthorized users from cross contaminating oils



Kidney-loop filtration cleans your lubricants before introducing them to your critical assets.



Dry run, overfill, pressure protection to prevent damage by mistake or while operating unattended



Intelligent Stack: Benefits



IMPROVES EFFICIENCY

Allows you to store lubricant close to your work area, keeping it readily available without the need to make multiple trips to and from each machine.



REDUCES SPACE

System is designed to maximize space and eliminated drum clutter in your facility.



PREVENTS CROSS-CONTAMINATION

Consistently identifying lubricant through the use of labels and color-coding system ensures the right oil goes into the correct storage tanks, transfer container, and machine every time.



ELIMINATES SAFETY HAZARDS

Bulk Oil Storage System reduces the risk of work-related injuries caused by moving and stacking 55-gallon drums.



INCREASE PRODUCTIVITY

System allows monitoring of oil usage making sure there is no lubricant shortage.



ECONOMICAL

Cost-effective solution to storing 55-gallon drums and adding more tanks when needed.

ECONOMICAL

Cost-effective solution to storing 55-gallon drums and adding additional tanks when needed

SCALABLE

Accommodates any number of lubricants required for storage and dispensing

SIMPLE

Systems are shipped fully assembled, ready to be used saving valuable time

RELIABLE

Provides proper storage, handling, and dispensing to ensure lubricant cleanliness

MOBILE

Easy to relocate systems where needed around your facility

Intelligent Stack: Features

Convenient Installation

Every system ships fully assembled on a standard pallet and installs in minutes.

Screen

HMI color touch screen communicates system status and provides user control.

Filter

In-line particulate filters provide fluid conditioning both while filling and continual kidney loop status offering superior fluid cleanliness before transferring to your equipment.



Breather

Desiccant breather provides particulate protection down to three microns and color changing desiccant for moisture mitigation.

Level

Three equidistant bulls-eye viewports are tough and eliminate potential of accidental breakage.

Pumps

Independent pump/motor combination for each storage tank preventing any cross-contamination concerns.

Spill Containment

Standard on every system. 73-gallon capacity meets EPA 110.28.4.

No matter the situation, the Intelligent Stack is an easy and reliable solution to organize, store, filter, monitor, and dispense lubricants.

Intelligent Stack: Specifications



Lubricant Monitoring

Continuous monitoring of oil level



Ongoing Insights

Continuously monitors and transmits key parameters to your network



Filter Monitoring

Monitors filter condition and filtering activities



Tank Size	65 Gallons
Tank Material	Powder Coated Steel
Frame Material	Powder Coated Steel
Oil Level Indication	Digital Indication and Viewports
Oil Type Indicator	Digital Indicator & Color Coded Labels
Filtration	Inline and Kidney Loop Filtration
Filter	2 - 10-Micron Filters
Motor	1.5 HP @ 1750 RPM
Pump Type	2 - Industrial Grade Gear Pump
Desiccant Breather	2 - Dedicated Breathers for Each Tank
Wand	2 - 1" ID Stainless Steel Wand
Hoses	1-1/4" ID Heavy Wall Wire PVC
Spill Containment	Yes - 73 Gallons (OSHA Compliant)
Dispensing Valves	Self-Closing Bronze Valves
Emergency Stop	Yes
Power Dispense	Yes
Filter Life Indicator	Pressure Differential & Digital Indicator
Sampling Ports	Pre and Post Filter
Maximum Viscosity	ISO 680 at room temperature (70°F)
Power*	240V 30 Amp (twist lock plug)
Rack Capacity	2500 lbs
Dry Weight	950 lbs
Shipping Skid Size	41" x 58"

* - 50 Hz option available

The Intelligent Stack is a stand-alone unit with two tanks. These systems provide flexibility in expanding with additional stacks.

Intelligent Stack: Sensei Enabled Features

Sensei Enabled

Remotely Monitor Your Intelligent Stacks

The Intelligent Stack is Sensei Enabled allowing you to connect to the [Sensei Platform](#) via the internet. The Sensei Platform operates in real-time to remotely monitor system condition and historical data from your desktop.



OIL

- ✓ Current oil level
- ✓ Oil consumption
- ✓ Low level alert



FILTER

- ✓ Remaining filter life
- ✓ Last filter change
- ✓ Last kidney loop



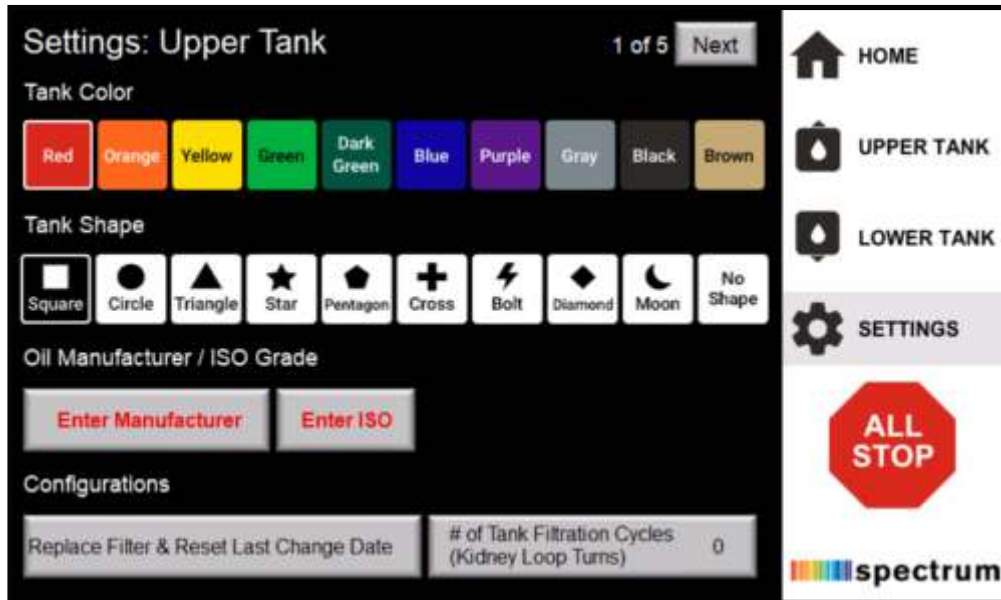
PRESSURE

- ✓ Inlet and outlet pressure
- ✓ Pressure differential



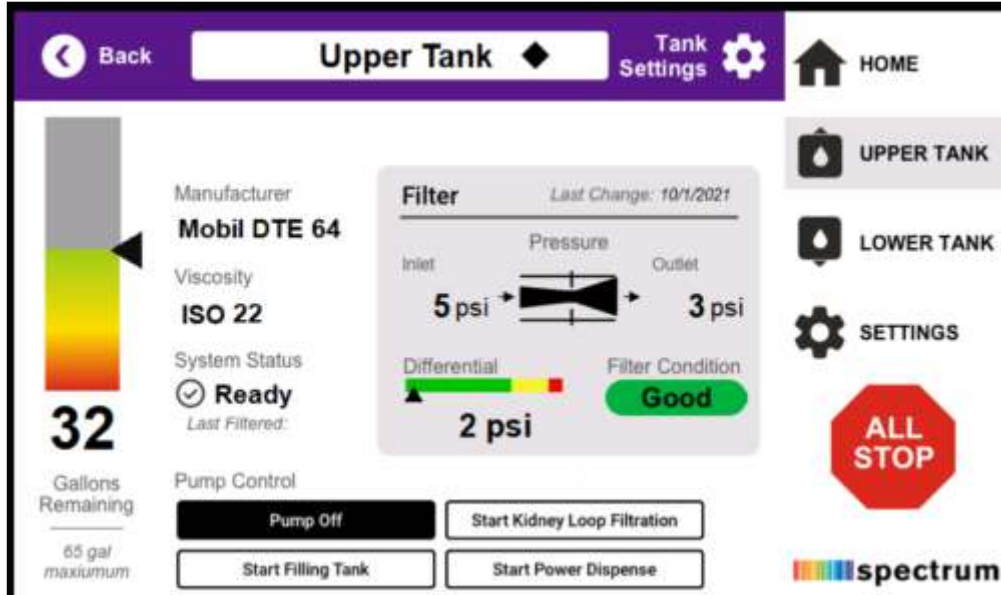
Monitor system condition and historical data on the Sensei Platform with the Intelligent Stack.

Intelligent Stack: HMI Touch Screen



Settings Screen

- Select tank color as part of a visual lubrication management system to ensure the right lubricant goes into the right transfer container and the right equipment
- Optional selection of lubricant shape to identify tank contents for those who cannot distinguish between colors or shape can be used as a secondary identifier as part of a visual lubrication management system
- Identify lubricant type and ISO viscosity grade for each tank
- Configure the number of kidney loops for each tank
- Reset last filter change for each tank
- Screen lock to prevent changes to system settings



Tank Screen

- Identification of lubricants
- Date of last filter change
- Pressure differential for filter
- Filter condition - good, order, and replace
- System status - ready, kidney loop, filling, and dispense
- Pump control - off, kidney loop, tank filling, and power dispense
- Date of last filtration
- Remaining volume of lubricant in gallons

Intelligent Stack features a 7" HMI color touchscreen to communicate system status and user control.

Spectrum Bulk Oil Storage Intelligent Stack...the Possibilities

Applications

The Intelligent Stack is ideal for centralized lube rooms, point-of-use locations (satellite stations), and self-contained lube rooms.



Network Hardware Solutions: Building A Strong Foundation

The Sensei Gateway and Repeater work in tandem to ensure robust and uninterrupted data transmission within the Sensei IIoT Network. This synergy between the Gateway and Repeater guarantees that your Sensei IIoT Network is always connected, facilitating a continuous and seamless stream of data, essential for effective monitoring and maintenance decision-making.

Sensei Gateway

The Communication Hub

The [Sensei Gateway](#) is more than just a device; it's the central communication hub of your Sensei IIoT Network. Designed to gather data from multiple [Sensei Enabled Devices](#) and [Machine Vitals](#), it serves as the primary collector and transmitter of information. Its robust build and advanced technology ensures that data from your equipment is accurately and reliably sent to the [Sensei Platform](#) for analysis. The Gateway supports various connectivity options, including Cellular, Wi-Fi, and LAN, offering flexibility in different industrial environments.

Sensei Repeater

Extending Reach and Reliability

In larger facilities, where equipment is spread over vast areas, the [Sensei Repeater](#) plays a crucial role. It acts as a signal booster, extending the reach of the network and ensuring that data from even the most remotely located devices is captured and transmitted effectively. This is particularly crucial in complex industrial setups where distance and obstructions could compromise data transmission. The Repeater guarantees that every piece of data is accounted for, maintaining the integrity and continuity of your monitoring system.

Seamless Integration for Maximum Data Integrity

Together, the Gateway and Repeater form an integral part of the Sensei System's infrastructure. They work in unison to ensure that the data collected by the Sensei Devices is not only transmitted to the Sensei Platform without loss but is also done so in real-time. This seamless integration is key to maintaining the reliability and timeliness of the data, which in turn, is essential for effective decision-making and maintenance planning.

Enhancing System Scalability and Flexibility

The combination of the Sensei Gateway and Repeater provides scalability and flexibility to your network. Whether you're looking to expand your system to cover more equipment or need to adjust to changing facility layouts, these devices adapt and scale according to your needs, ensuring that your maintenance system grows with your business.



Sensei Network Hardware: Gateway



Real-Time

Collects real-time data from Sensei Devices



Secure

Securely receives data and transmits it to the cloud



Sensei Gateway - The Network

The Gateway is the hub of the system. It receives data from your equipment and transmits the data to the [Sensei Platform](#). It requires an Internet connection through your internal system or packaged with a cellular router.

Power	Source: 12 VDC or 24 VDC Max Current: 1-2 A Max
Mechanical	
Dimensions	6" x 6" x 2"
Material	Powder Coated Steel
Mounting	2" Diameter Magnet
Network	
Ethernet	10/100 Mbps
Wireless	2.4GHz - Low power network based on 802.15.4
Wireless Range	100 m
Devices	250 Supported per Network
Environmental	
Installation	IP54, Pollution Degree 3, Outdoor and Indoor
Operating Temperature	-4° to 104°F (-20° to 40°C)
Wireless Security	Device Authentication AES-128 Encrypted Network Joining Scheme Pre-Shared Key and Rotating Session Key AES-128 Encrypted Secured Data Transmission
Certifications	
ETL	Class I, Zone 2, AEx ec IIC T4 Gc Class I, Division 2, Groups A, B, C, D T4 Ex ec IIC T4 Gc -20°C ≤ Ta ≤ +40°C
IECEX	Ex ec IIC T4 Gc
ATEX	Ex II 3 G Ex ec IIC T4 Gc -20°C ≤ Ta ≤ +40°C
UKEX	Ex II 3 G Ex ec IIC T4 Gc -20°C ≤ Ta ≤ +40°C

The Sensei Gateway is available as WiFi, ethernet/LAN or Cellular connection.

Sensei Network Hardware: Repeater



Expandable

Expands easily to fit any size facility with multiple pieces of equipment



Sensei Repeater - The Network (optional)

Intermediate network point between the Sensei Devices and the Gateway. Only required if you have more than 64 devices on the system and/or the distance from the gateway to any sensor exceeds 250 feet.

Power	Source: 12 VDC or 24 VDC Max Current: 1-2 A Max
Mechanical	
Dimensions	6" x 6" x 2"
Material	Powder Coated Steel
Mounting	2" Diameter Magnet
Network	
Wireless	2.4GHz - Low power network based on 802.15.4
Devices	Connection to 64 Devices
Protocols	MQTT
LED	Indicates Connection to Coordinator
Environmental	
Installation	IP54, Pollution Degree 3, Outdoor and Indoor
Operating Temperature	-4° to 104°F (-20° to 40°C)
Wireless Security	
	Device Authentication
	AES-128 Encrypted Network Joining Scheme
	Pre-Shared Key and Rotating Session Key
Certifications	
ETL	Class I, Zone 2, AEx ec IIC T4 Gc Class I, Division 2, Groups A, B, C, D T4 Ex ec IIC T4 Gc -20°C ≤ Ta ≤ +40°C
IECEX	Ex ec IIC T4 Gc
ATEX	Ⓔ II 3 G Ex ec IIC T4 Gc -20°C ≤ Ta ≤ +40°C
UKEX	Ⓔ II 3 G Ex ec IIC T4 Gc -20°C ≤ Ta ≤ +40°C



Bringing you accurate, real-time data from across your facility.

Sensei Platform: Streamlining Data Analysis



Explore the powerhouse behind the Sensei IIoT System, a platform designed to transform the way you analyze and manage equipment data.

Robust Data Analysis

The Sensei Platform stands out with its robust data analysis capabilities. It doesn't just collect data; it turns data into insights. This platform processes information from Sensei Devices on your network, providing a detailed, yet comprehensible, analysis of your equipment's health. Whether it's trends in lubricant usage, temperature fluctuations, or unusual vibration patterns, the Sensei Platform processes and presents this data in an easily digestible format.

Real-Time Monitoring

In the fast-paced industrial world, real-time information is crucial. The Sensei Platform offers up-to-the-minute monitoring, ensuring you have the latest data at your fingertips. This feature is invaluable for making timely decisions, preventing potential issues, and optimizing maintenance schedules.

Customizable Alert System

One of the most user-centric features of the Sensei Platform is its customizable alert system. You can set parameters and thresholds for alerts based on your specific equipment needs and operational standards. Whether it's an email or text notification, the platform ensures you're always informed and prepared to take action.

Simplifying Maintenance and Decision-Making

The Sensei Platform is more than a data repository; it's a decision-making tool. By presenting data in an organized, accessible manner, it simplifies the process of interpreting information, making it easier for maintenance teams to plan and prioritize tasks. This streamlined approach not only saves time but also enhances the effectiveness of your maintenance strategy.

User-Friendly Interface

Ease of use is at the heart of the Sensei Platform's design. Its interface is intuitive, designed to be navigable by users of all technical levels. From the dashboard to the detailed reports, every aspect of the interface is crafted to enhance user experience, making complex data analysis a less daunting task.

Sensei Platform: Overview

The Intelligence - Sensei Platform

Your intuitive, web-based home for real-time monitoring of data from Sensei Devices on the network.

HTML 5

Built using HTML 5 which allows scalability on any device type, preserving the best user experience.

Permissions

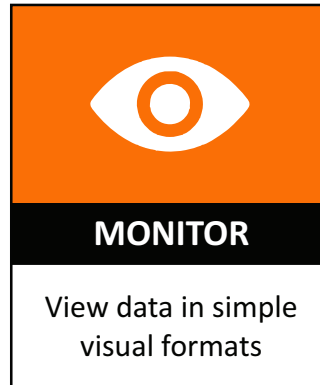
Supports numerous user types with varying permissions and flexible notification policies.

Customization

Flexible entity structure allows for customizable reporting and expansion of presenting data.

Alerts

Allows users to configure alert and alarm parameters and assign notification methods, including text and email.



Helping you understand your data, what it all means for your equipment and how to use it to your advantage.

Sensei Platform: Group View

Group View

View and manage equipment and Sensei Devices in one view. For each asset, see a high level status for Sensei Devices and Oil Analysis data all in one spot.

ALERTS

View alerts that need immediate attention.

DEVICE LIST AND STATUS

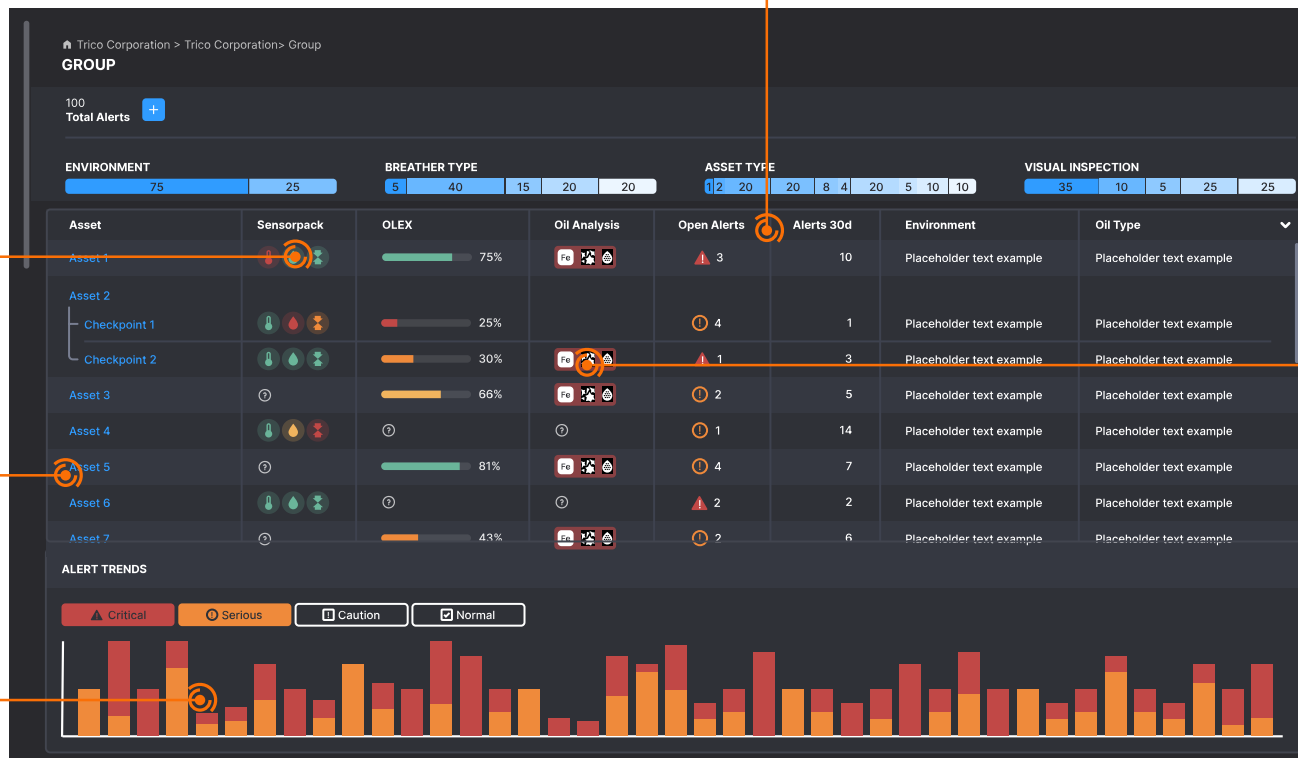
The latest readings from each Sensei Device.

CUSTOMIZE GROUPS

Easily view multiple assets and Sensei Devices in one area.

DAILY STATUS

Daily aggregate overview of status of Sensei Devices.



OIL CONDITION

If you are an oil analysis customer, the platform provides an overview of oil condition along with drill through capabilities to the Orbital Platform.

Obtain a holistic view of your entire facility's performance, allowing you to identify trends, patterns, and areas for improvement.

Sensei Platform: Asset View

Asset View

View detailed information on the selected asset.

PARAMETER DATA

Offers instant updates on present conditions and highlights variations between internal and external ambient environments.

ACTIVITIES AND ALERTS

View the different types of activities recorded and alerts for the asset.

OIL ANALYSIS DATA

If you are an oil analysis customer, your EDS information is displayed.

PHOTO

Include a photo of your equipment.

The screenshot shows the Sensei Platform's Asset View interface. At the top, it displays the breadcrumb 'Trico Corporation > Trico Corporation > Trico Corporation > Asset' and the title 'ASSET'. The current operating status is 'ON' for the period 'APR 1, 2023 - APR 7, 2023', with 'Cycles / Last 7 Days: 10' and a 'View Channel Data' button. The interface is divided into several sections: 1. 'ALERTS & ACTIVITIES' with tabs for 'Activities & Open Alerts' and 'Alert Trends'. It shows 10 activities and 5 alerts. A table lists activities with columns for Date, Activity Type, Checkpoint, and User Name. 2. 'CHECKPOINT 1' and 'CHECKPOINT 2' panels showing real-time data for Current Oil Level (90%, up 2% / 7 days), Current Temperature (81°F Internal, 60°F Ambient, 11°F Diff), Current Pressure (81Mb Internal, 60Mb Ambient, 11Mb Diff), and Current Humidity (81% Internal, 60% Ambient, 11% Diff). 3. 'EDS INFORMATION' panel showing Asset Type, Environment, Criticality, and Operating Schedule. 4. A photo of a blue engine component at the bottom left.

OIL CONDITION

If you are an oil analysis customer, the platform provides an overview of oil condition along with drill through capabilities to the Orbital Platform.

The Sensei Platform's asset view offers a comprehensive and intuitive display of equipment data, enabling users to easily monitor and manage their machinery's health and performance.

Sensei Platform: Channel Data View

Channel Data View

View detailed trending and history data for a specific Sensei Device.

CHANNEL DATA VISUALIZER

Simultaneously view multiple parameters, providing insights into how they interact and influence each other.

TRENDS

Parameter trending and historical data.

ACTIVITIES

Access details on maintenance activities and operating parameters.



ALERTS

Quickly see open alert conditions and instantly identify problems from the alert trends.

The Sensei Platform's channel view offers a comprehensive, user-friendly interface for observing trends and historical data, enabling maintenance and reliability professionals to make informed decisions about equipment condition and performance.

Trico Companion Mobile App: Power Through Convenience

The Trico Companion Mobile App works with Sensei and Orbital Platforms. It simplifies the process of managing and maintaining equipment and lubricant. When used with the Sensei Platform it provides the following functions:

Initiate Pairing Mode

This function allows for effortless and secure pairing of Sensei Devices to the network, ensuring a seamless connection and data transfer.

Add Devices to the Network

Users can easily expand their network by adding new Sensei Devices at any time.

Assign Equipment Attributes

This feature lets users set specific details for each piece of equipment, aiding in customized monitoring and analysis.

Input Pertinent Information

The app enables users to enter important information about their equipment directly, which is crucial for keeping records accurate and current.

Record Maintenance Activities

Maintenance tasks can be logged in real-time, which helps in maintaining an up-to-date record of all such activities.

All information entered and activities recorded in the app are automatically updated and synced with the Sensei Platform. This ensures that the data is accessible not only to the individual user but also to other team members who have access to the Sensei Platform. This feature is particularly useful for coordinating maintenance efforts and keeping track of equipment status and history.



Download and install the TricoMobile App—available for both iOS and Android® devices and available through the Apple App Store or Google Play Store.



*Apple Store and Apple logo are trademarks of Apple Inc.
Google Play and the Google Play logo are trademarks of Google LLC.*

Sensei System: Putting It All Together

Using different Sensei Devices together offers a unified method for managing equipment and predicting maintenance needs. When these devices are combined, they work together, improving the overall success and efficiency of maintaining equipment.

Unified Monitoring Ecosystem

The Sensei System focuses on creating an integrated environment for monitoring equipment. Key devices like Sensei Enabled Opto-Matic Oiler and Machine Vitals are essential in collecting key data on lubrication and equipment conditions, crucial for predictive maintenance.

Centralized Data Analysis and Reporting

The Sensei Gateway gathers data from all the Sensei Devices, funneling it to the Sensei Platform for comprehensive analysis. Here, the platform's advanced tools turn data into actionable insights, crucial for maintenance planning and decision-making.

Enhanced Operational Efficiency

This integrated approach results in a highly efficient maintenance management system. With real-time data and analytics, maintenance teams can swiftly identify potential issues, schedule maintenance activities more effectively, and prevent unplanned downtime. The Sensei System not only enhances the lifespan and performance of equipment but also optimizes the workload of maintenance personnel.

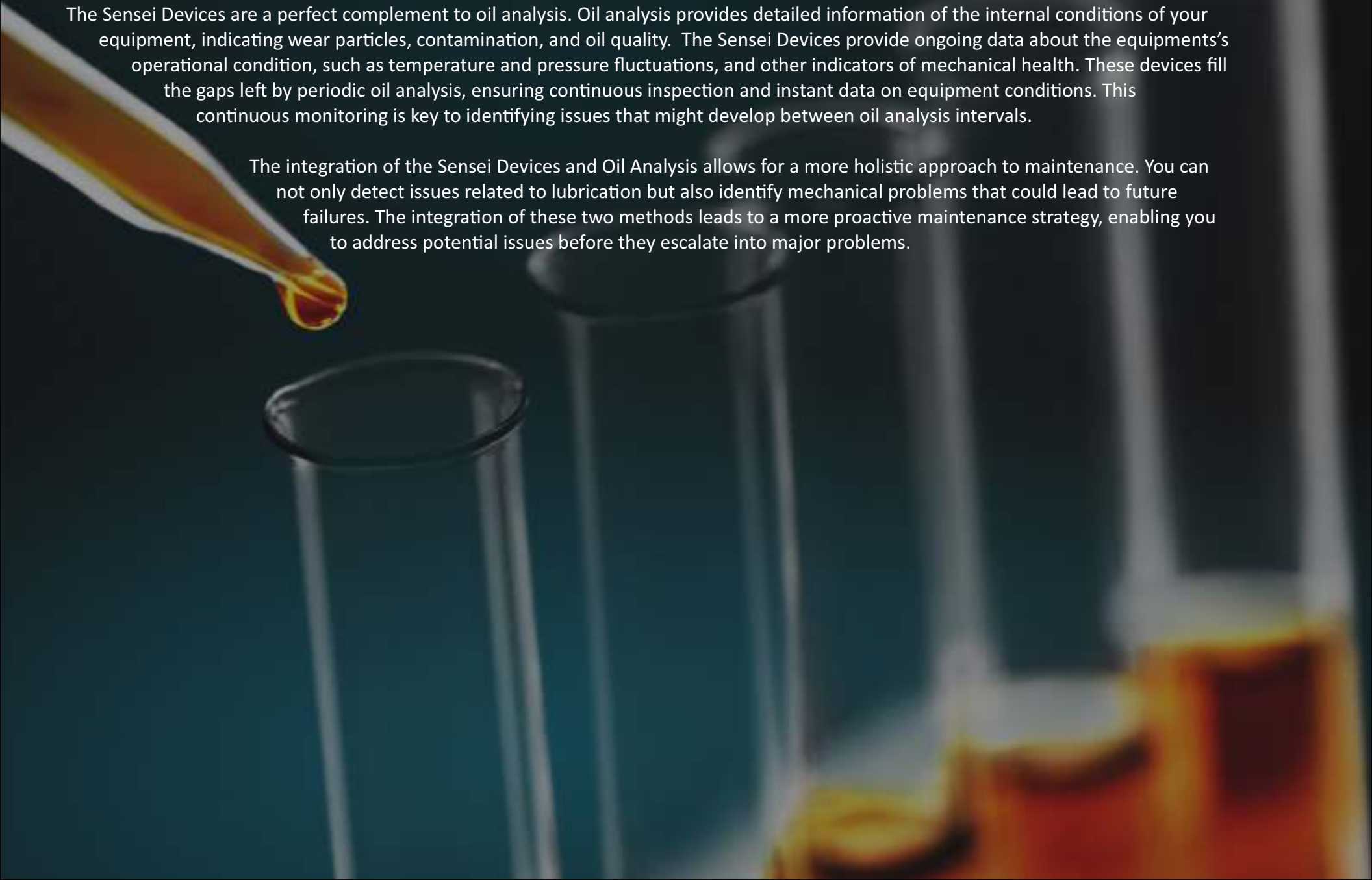


Integrating Sensei Devices and Oil Analysis

Enhancing Equipment Health

The Sensei Devices are a perfect complement to oil analysis. Oil analysis provides detailed information of the internal conditions of your equipment, indicating wear particles, contamination, and oil quality. The Sensei Devices provide ongoing data about the equipments's operational condition, such as temperature and pressure fluctuations, and other indicators of mechanical health. These devices fill the gaps left by periodic oil analysis, ensuring continuous inspection and instant data on equipment conditions. This continuous monitoring is key to identifying issues that might develop between oil analysis intervals.

The integration of the Sensei Devices and Oil Analysis allows for a more holistic approach to maintenance. You can not only detect issues related to lubrication but also identify mechanical problems that could lead to future failures. The integration of these two methods leads to a more proactive maintenance strategy, enabling you to address potential issues before they escalate into major problems.





Trico Corporation
1235 Hickory Street | Pewaukee, WI 53072
Phone: (262) 691-9336
www.tricocorp.com/services/digital-solutions/sensei