



Winding Temperature Indicator Vs Fiber Optic Hot Spot Monitoring System: A Comparative Analysis

Transforming Project Management with
Real-Time Condition Monitoring of Electrical Assets.

Understanding the Differences

In transformers, a Winding Temperature Indicator (WTI) is a crucial instrument for monitoring the temperature of the windings, which are the coils of insulated wire that carry electrical current.

Traditional WTIs have been serving in the industry for a very long time but, they highly rely on indirect methods that limit accuracy and hot spot detections. They are also susceptible to several factors such as vibration, moisture, environmental factors, etc., and require periodic maintenance, which introduces potential human errors. Such limitations can impact the reliability and efficiency of your operations.



Indirect Temperature Measurement

WTIs measure oil temperatures, which indirectly estimate winding temperatures, leading to potential inaccuracies.



Limited Accuracy

Especially when detecting hot spots, which are critical for preventing failures.



Environmental Susceptibility

WTIs are sensitive to vibration, moisture, and other environmental factors that affect their reliability.



Human Error

Installation and maintenance errors can lead to incorrect readings and compromised safety.

While WTIs are widely used, FOS represents a more advanced technology for transformer temperature monitoring. FOS employs fiber optic cables embedded within the transformer windings. These cables contain sensors that convert temperature variations into changes in the light signal traveling through the fiber.

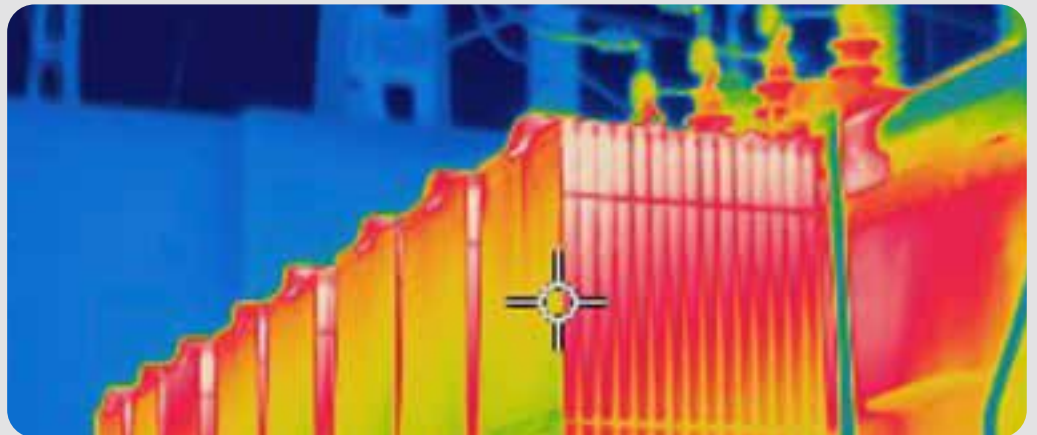
FOS is particularly well-suited for large power transformers where precise temperature monitoring is critical for ensuring reliability and preventing costly outages. FOS is also gaining traction in transformers used in demanding applications, such as renewable energy integration, where accurate thermal management is essential.





Introducing Rugged Monitoring's FO HSM System

At Rugged Monitoring, we have concisely designed a revolutionary approach to WTIs.



Our Fiber Optic Health and Safety Monitoring (FO HSM) system uses fiber optic cables embedded within transformers. The light signal from our IoT sensors is transmitted to a remote unit, enabling real-time, continuous monitoring of the winding temperature from a safe distance, even in hazardous environments like substations. These cables can directly measure temperature throughout the winding taking transformer monitoring to a new level and, providing:



Unmatched Reliability

Precisely identifies and measures the hottest points within the windings, ensuring early detection of potential issues.



Direct and Continuous Monitoring

Real-time insights into the transformer winding performance and health, 24/7.



Rugged Design

Unaffected by electromagnetic interference, chemical, RF, microwave, and high voltage making it reliable in all conditions



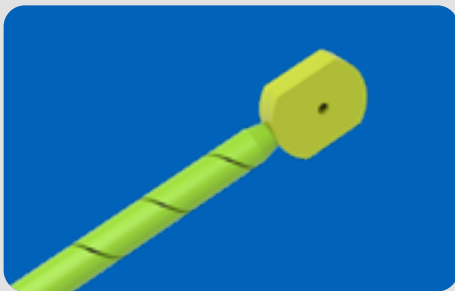
Easy Installation & Maintenance

Designed for straightforward installation with minimal ongoing maintenance requirements.

What is the difference between Traditional WTIs and RM's FO HSM?

Feature	WTIs	FO HSM
Measurement Principle	Indirect Measurement using thermal imaging	Direct measurement using Fiber optic sensors
Sensor Placement	Sensor bulb placed in oil-filled pocket in transformer tank top cover	Fiber optic sensors are inserted directly into the transformer windings
Accuracy	Variable up to $\pm 2.0^{\circ}\text{C}$	Variable up to $\pm 1^{\circ}\text{C}$
Temperature Range	0 to 150°C	0°C to $\geq 300^{\circ}\text{C}$
Monitoring Capability	Limited to a single-point measurement	Ability to monitor multiple locations/hotspots
Response Time	Slow, minutes to hours	Fast, within seconds
Electromagnetic Interference	Susceptible to EMI	Complete immunity to EMI, RF, Microwave, Chemical, and High Voltage
Monitoring & Detection	Limited detection with periodic readings	Superior detection with continuous real-time monitoring
Installation & Re-calibration	Complex installation which requires periodic maintenance	Easier installation with minimal ongoing maintenance. Sensor will last 100+ years without recalibration
Risk of Human Error	Potential for errors during installation or maintenance	Minimal risk of human error
Environmental Sensitivity	Susceptible to vibration, moisture, and harsh environments	Unaffected by harsh environments
Alarm and Trip Settings	Typically includes alarm and trip settings	Includes advanced alarm and trip settings
Cost	Lower initial cost	Higher cost due to advanced technology
Data Acquisition	Manual or automated readings	Real-time automated data acquisition
Thermostatic lag effects of transformer oil	Significant	Negligible

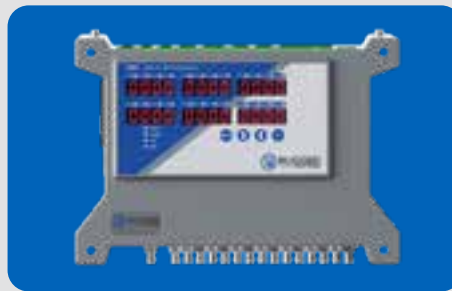
Rugged Monitoring's FO HSM system provides a modular approach to transformer temperature monitoring, allowing you to select the solution that best suits your specific requirements and budget.



TSENS

Precision Temperature Sensors

These ruggedized fiber optic sensors are embedded directly within your transformers, providing accurate and reliable temperature data.



T301

Dedicated Temperature Monitors

It receives signals from the TSENS sensors and provides real-time temperature readings.



T501

Comprehensive Condition Monitor

T501 is the most advanced solution, offering a comprehensive suite of condition monitoring features beyond temperature.

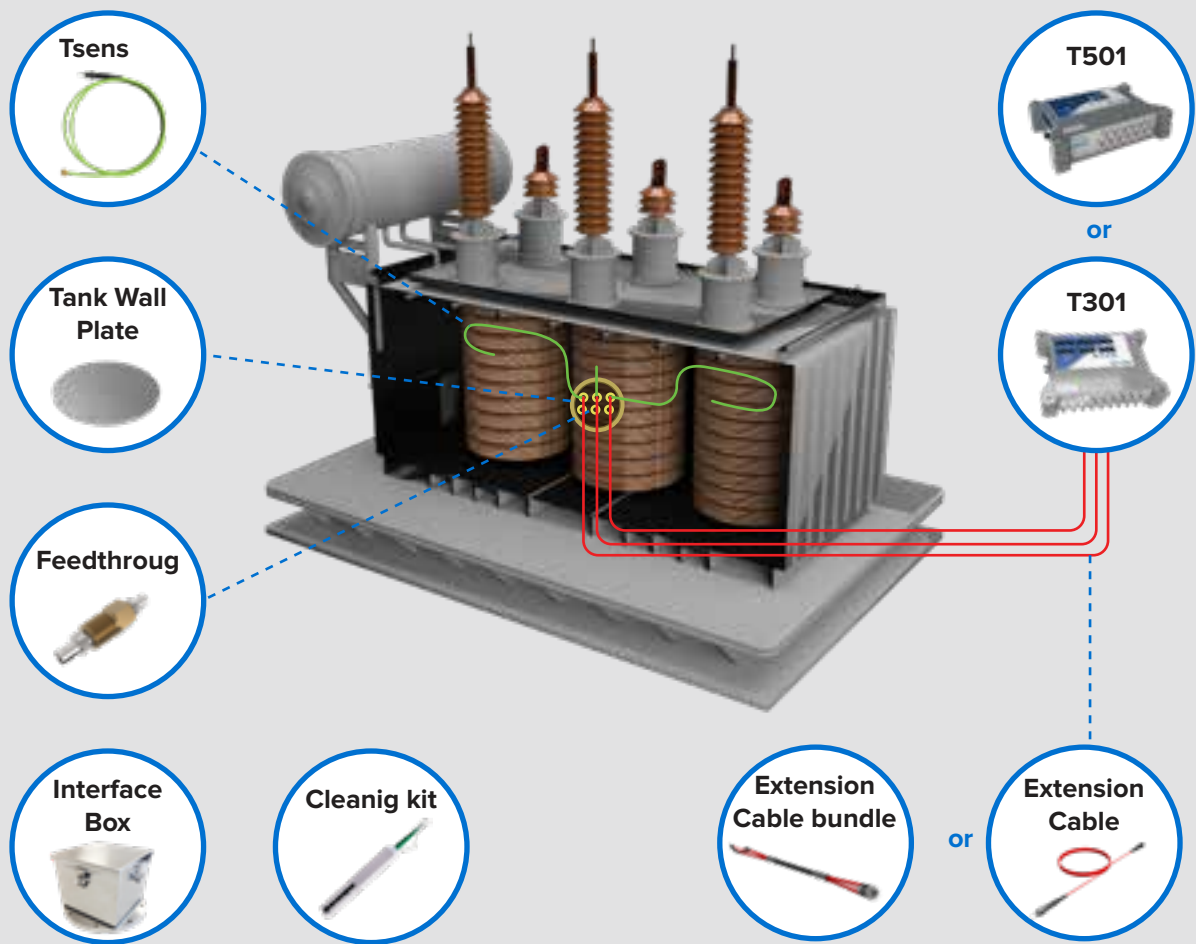


FIGURE: A Typical Transformer Hot Spot Monitoring System

Value Proposition of FO HSM

Transform your transformer monitoring strategy with the superior capabilities of FO HSM:

Improved Transformer Health and Lifespan

Accurate, real-time monitoring helps prevent overheating and other issues, extending the life of your transformers.

Enhanced Safety for Personnel and Equipment

Reliable monitoring ensures safer operating conditions, protecting both personnel and critical equipment.

Reduced Risk of Costly Outages and Failures

Early detection of hot spots and other potential issues reduces the likelihood of unexpected failures and costly downtimes.

Optimized Maintenance Planning and Decision-Making

Access to precise, real-time data enables better maintenance scheduling and more informed decisions.

Benefits of using Rugged Monitoring's FO HSM

- Minimized risk and extended lifespan
- Optimized Maintenance
- Enhanced Safety
- Minimized downtime with Proactive maintenance
- Real-time insights
- Data-driven decision making
- Accurate and robust design
- No recalibration

R501 Rack Mount Comprehensive and Customizable Asset Monitoring Solution

R501, the customizable, rack mount, comprehensive electrical asset condition monitor is designed to monitor multiple electrical assets and its parameters enables a simple and user-friendly interface. R501 provides condition monitoring of electrical assets by focusing on preventing asset failures and reduce downtime. With our comprehensive monitoring solution, the health of assets can be determined, and maintenance activities can be scheduled. The R501, our versatile rack-mounted monitor, with its customizable features allow you to monitor multiple assets simultaneously, providing a user-friendly interface and an extensive range of parameters to track. The R501 focuses on preventing asset failures and minimizing downtime, empowering you to take proactive maintenance actions.



Features of R501

- Expandable with daisy chain & Field Upgradable to add different monitoring modules.
- Highly secure, web server-based visualization and configuration software
- Simple visualization & easy to configure.
- Equipped with most accurate & advance health assessment analytics.
- Range of communication options and protocol support; ethernet redundancy (PRP)

Benefits of R501

- Improved asset reliability
- Accurate predictive analysis
- Access asset data from anywhere
- One monitoring solution for multiple assets
- Increased asset lifetime
- Highest return on investment
- Field upgradable with no device downtime

RM EYE: Multi Site, Multi Asset Condition Monitoring Solutions

We at Rugged Monitoring have developed an AI based comprehensive electrical asset condition monitoring system “RM EYE” with multiple analytical capabilities in asset condition monitoring that stands way apart in technological advancement.





RM EYE is a versatile condition monitoring solution that can offer comprehensive analysis on various electrical assets spread across multiple industries. It considers every aspect in condition monitoring of different assets like transformer, cable, GIS, AIS, motor, generator, UPS, VFD, MV panel, battery, relays, etc and users to give the best recommendation for longer and better health of the assets.



Features

- **Advanced asset health monitoring** with analysis and recommendations to increase asset effectiveness in addition to maximizing equipment uptime
- **Modern remote monitoring solutions** provide valuable insights to Multiple Assets at Multiple Sites from time to time
- **Establish a real time and consistent monitoring** by getting the right information into right hands
- **Simple and user-friendly interface** providing easy and fast access to all the features
- **Everything about the asset at one place**
The raw data, analysis and recommendations
- **Advanced asset algorithms** for electrical assets to evaluate asset health
- **Advanced reporting technology with automated alerts**
- **An efficient, reliable partial discharge monitoring for all the assets**
- **A detailed comprehensive DGA analysis**
- **Built on well-established remote and cloud-based monitoring technology**
- **Quick configuration** so that you are not required to configure separately.
- **Protocols: IEC 61850, MODBUS, MQTT**
- **Robust integration with 3rd party systems and devices** with industry standard protocols
- **Bulk configuration imports for fast deployment**
- **Encompasses a secure access to data and configuration**
- **QR code scanner on mobile devices**
- **Accessible on web browser and mobile app**
- **Historical data storage and on demand access** via export feature
- **Extended multilingual support** to handle product inquires or troubleshoot problems proactively
- **Systematic fleet management analysis**
- **Offline test data integration and analysis**

Benefits

- | | |
|--|--|
| <p> Company</p> <ul style="list-style-type: none">✓ Single monitoring solutions for multiple assets✓ Avoid unscheduled outages and increase asset utilization✓ Extend asset life, with proper maintenance✓ Reduce insurance premium with most advanced monitoring✓ 24 x 7 remote monitoring, accessible from anywhere | <p> Manager</p> <ul style="list-style-type: none">✓ Decision support system for short term and long term planning✓ Company, region, substation analysis on your fingertips✓ Effective management and tracking of monitoring KPIs✓ Identify problem areas with interactive dashboards✓ Advanced and automatic management/regulatory reports |
| <p> Asset Experts</p> <ul style="list-style-type: none">✓ Deep analysis of diagnosed faults with advanced analytical tools✓ Complete asset data at one location✓ Customise and generate automatic reports for subscribed assets✓ Ready access to historical data for root cause analysis | <p> Operators</p> <ul style="list-style-type: none">✓ Quick identification of problematic assets in the network✓ Get real time alarm/ alert notifications✓ Realtime updates about the assets on mobile, desktop and emails✓ Quick access to assets with QR code scan on handheld devices |

Asset Monitoring : Enterprise Architecture

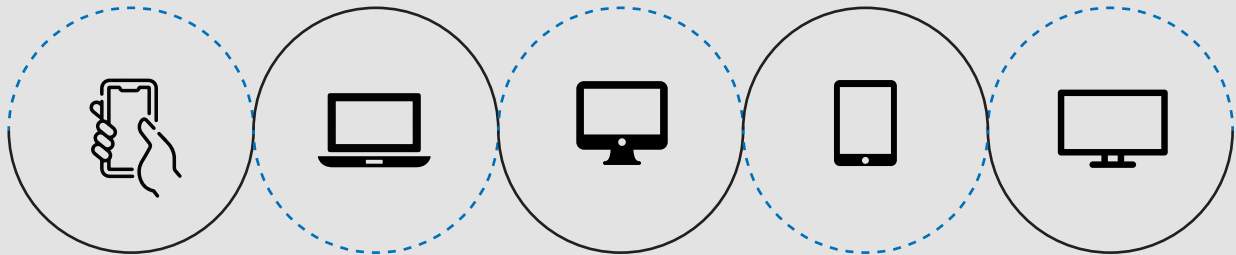
Compatible with Rugged Monitoring Enterprise Solution

UI/UX



- Data Layer
- Analytics
- User Interface
- Custom Dashboards
- Reporting
- Email/SMS Notifications

RM EYE



Private Cloud (Customer Cloud),
Rugged Monitoring Cloud

IEC 60870-104

IEC 61850

FTP/SFTP

- XML, JSON

- CSV, COMTRADE

Data Collection

ODBC

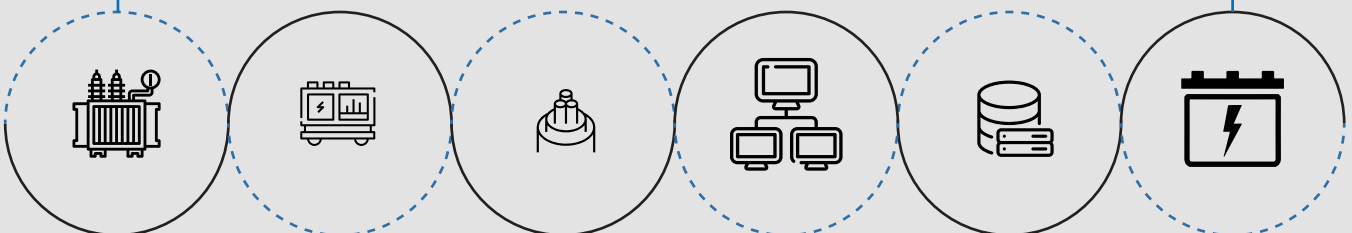
MODBUS

DNP 3.0

HTTPS

MQTT

Asset Data



Transformer
Monitoring
System

Switchgear
Monitoring
System

Power Cable
Monitoring
System

- Offline Test Results
- Inspection Records
- Name Plate

- Historian
- CMMS
- SCADA/ DCS

Power Electronics
(Battery, UPS,
VFD, Relay)

Why Customers Choose Us?

RM solution, the trusted monitoring solution for over 10000+ assets across 50+ countries. We are a leading High Value Electrical Asset Monitoring Company integrating fibre optic technology to the assets.



Attention to Detail

It's our attention to the small stuff, scheduling of timelines and keen project management that makes us stand out from the rest.



A plan for Success

Our Customers are well satisfied with the advisory services that we offer to help them with best in class technological performance and a long durable life.



Experts only

We bring in our diversified experienced team with over 100+ years of experience in Asset Monitoring



Meeting Deadlines

Work with us, and you'll work with seasoned professionals – vigilant of deadlines, and committed to exceeding client expectations.



Money Matters

We protect you against currency fluctuation with competitive and fair market prices



Rugged Monitoring Services

Rugged Monitoring provides customization of sensors, monitors & software. In addition we offer on-site commissioning services, maintenance contracts and technical support to all customers worldwide.

About Rugged Monitoring

Industry's leading team of asset condition monitoring experts with 100+ years of combined experience committed to delivering customizable solutions for challenging applications. We offer a range of reliable, high performance, customizable sensors and monitoring solutions that are immune to external influence.

Certification



ISO 9001



ISO 14001



ISO 45001/
OHSAS 18000



Lloyd's
Register



ATEX
Certification

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