



Manage and Reduce Your Risk with Condition Monitoring for Motors and Generators

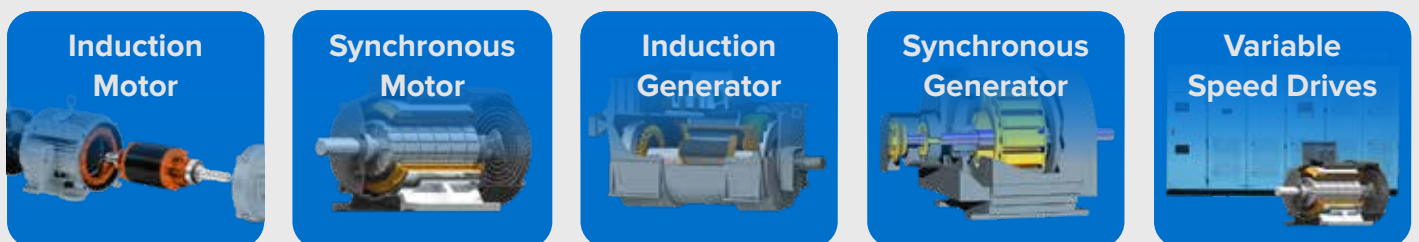
Constantly monitor the critical parameters of your rotating machines now from anywhere

RM's Solution for Motors and Generators

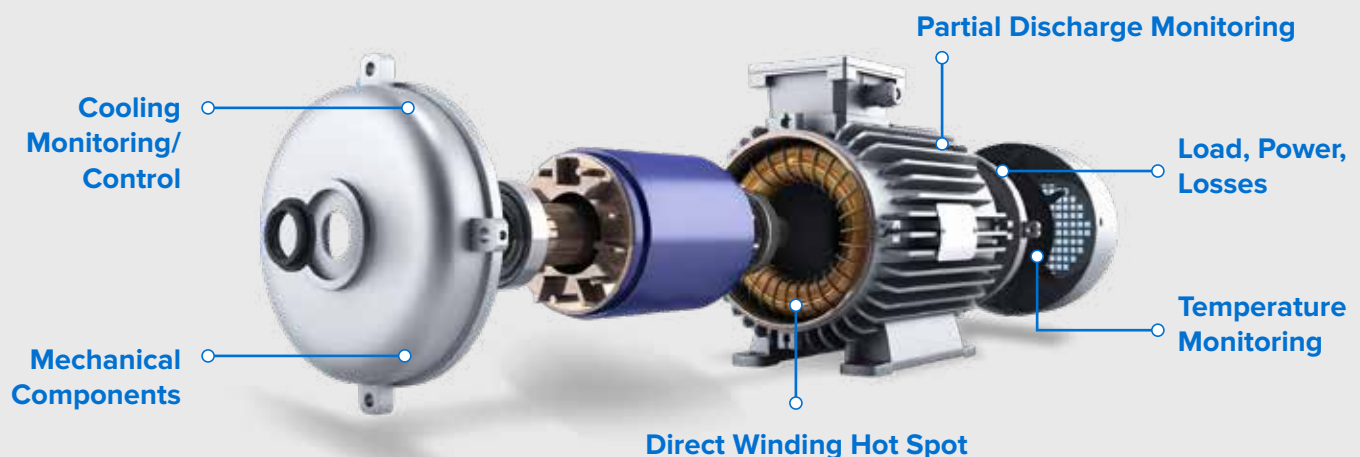


Motors and Generators are complex electro mechanical systems exposed to different stress factors. Condition Monitoring of high voltage motors and generators which are in continuous operation is very important. Any fluctuation in Voltage, Current and Frequency leads to damage of the rotating machine with unplanned outages as well as cost and resources. Continuous monitoring and tracking the performance of heavy-duty motors and generators are important for an efficient and increased asset lifetime.

Rugged Monitoring offers an advanced comprehensive condition monitoring solution for your motors and generators. The specifically designed algorithms analyze the data, providing deeper insights into the condition and performance of the monitored asset. The solution includes precisely designed sensors, monitors and comprehensive monitoring software that provides online, offline data, alarms and analytics. Depending on specific operating requirements and application, we customize our condition monitoring solutions for:



Schematic Diagram of Induction Motor



What Can Be Monitored

Load, Power

- Load/ Over Current
- Active/ Reactive Power
- Power Factor

Temperature Monitoring

- Bearing Temperature
- Ambient Temperature
- Winding Temperature
- Cooling Air Temperature

Partial Discharge Monitoring

- PD Localization
- PD Detection
- PD Severity Analysis

Winding Temperature

- Inlet Temperature
- Outlet Temperature
- Intelligent Cooling Control
- Cooling Efficiency

Direct Winding Hot Spot

- Stator Winding Hot Spot

Mechanical Components

- Machine Vibration
- End Winding Vibration
- Current Signature Analysis
- Flux Monitoring
- Greasing condition of bearings, bearing & driven application vibrations

Customized Online Condition Monitoring Solution for Improved Reliability and Performance



Monitoring will help to identify and to implement the right operation and maintenance strategy consequently preventing any break down of the machine before the end of the design life. The real time monitoring can monitor, diagnose, and predict failures on less critical but widely utilized rotating equipment, such as generators and motors. The system will help in proactive life cycle planning, minimizing maintenance costs & unplanned outages. The detailed trends from the solution help the user to get the deep insight of the system performance and aids in taking actionable decisions before a catastrophic failure occurs.

Features

- Intelligent and customizable solution
- Unique and Reliable Prediction
- Alarms and Alerts for any potential mechanical problems
- Built on well-established remote and cloud-based monitoring technology
- Realtime Process parameters monitoring

Benefits

- Extended Asset Lifecycles
- Turnkey solution with Remote Condition Monitoring
- Capture Trends and Increase Return on Investment
- Different dashboards for different user roles and levels
- Greater diagnostic capability
- Ability to monitor multiple rotating machines with one software

HSENS-CC

Capacitive Coupler
Partial Discharge Sensor



- **Compact Size, Highly Sensitive, Capacitive Coupler for PD Testing and Monitoring**
- **High Dielectric, Rugged, and Reliable design**
- **Built-in overvoltage (transient) protection**
- **Available for wide range of voltage levels 6kV to 45kV**
- **1pC PD Sensitivity (ASTM D1868 and IEC 60270)**
- **Suitable for extreme environment, Hazardous (ATEX) applications**
- **PD Free Sensor: No PD signals because of Sensor**

Capacitive Couplers with wide range of nominal voltage ratings are designed for Partial Discharge (PD) Testing and PD Monitoring as per IEC60270. The sensors are designed for different capacitance levels from 1nF to 80pF meeting requirements of various customers.

HSENS-CC is a Capacitive Coupler specially designed for capturing High Frequency Partial Discharge (PD) signals. The compact size and high dielectric properties of sensor makes it ideal for installation at busbar and within terminal boxes.

The sensor can be installed vertically and horizontally depending on the space limitations. The HSENS-CC sensors come with built-in overvoltage protection with different output connections (BNC/TNC). The sensors can be connected to any HF (High Frequency) PD monitoring system regardless of manufacturers.

Compact sized, Highly dielectric and accurate Partial Discharge sensor for temporary and permanent monitoring of Generators, Motors, Switchgears and Transformers.

Applications

- Continuous Online Partial Discharge Monitoring
- Periodic Partial Discharge Testing and Measurements
- High Voltage Testing during Commissioning
- Generator and Motor PD Testing and Monitoring
- MV Switchgear and Isolated Phase Bus PD Testing and Monitoring
- Transformer PD Testing and Dry Type Transformer PD Monitoring

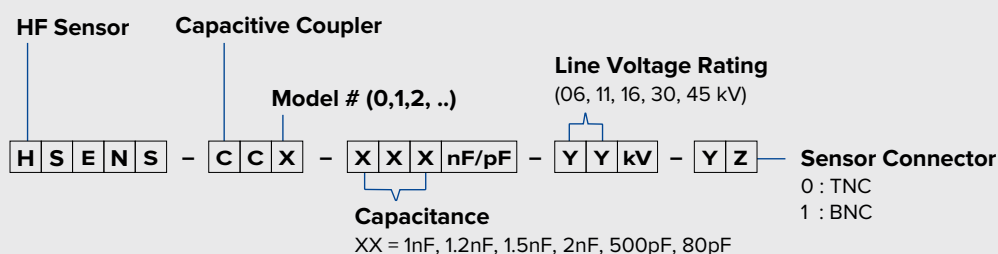
Benefits

- Higher sensitivity 1pC increases accuracy of PD detection
- Allow PD testing and Monitoring without the need for outage
- Easy installable, and High Dielectric strength, Safest Sensors
- Shielded Sensor, Noise Immunity
- Built in overvoltage protection keeps the PDM electronics safer
- Suitable for indoor and outdoor installations
- Wider Nominal Voltage and Capacitance levels for different Applications

Technical Specifications

Capacitance	1nF, 1.2nF, 1.5nF, 2nF, 500pF, 80pF (Custom designed - Optional)
PD Sensitivity	1pC
Line Voltage Rating	6kV, 11kV, 16kV, 30kV, 45kV
Line Voltage Frequency	50Hz - 60Hz
Capacitor Type	Mica and Ceramic
Body Material	Epoxy Resin
Output Connection Type	TNC-Type connector; Customized option available
Vibration Testing	Suitable for Generator, Motor and Transformer applications
Withstand Voltages	20kV, 35kV, 70kV, 120kV
Ambient (Operating Temperature)	-40 °C to +85 °C
Storage Temperature	-40 °C to +85 °C
Operating Humidity	95% humidity at 50 °C
Dimensions (in mm)	As per Line Voltage rating; from 125(W) x 95(D) x 90(H) to 250(W) x 165(D) x 450(H)
Weight	As per Line Voltage rating; from 0.5Kg. to 5.5Kg
Install Position	Installed on the study cast aluminum enclosure and connected to the Busbar
Signal Cable	Very low attenuation Coax cable, RG58

Ordering Code



HSENS-H

Provides automated continuous partial discharge monitoring



- High Frequency Current Transformer
- Rugged, reliable design with IP65 rating
- Split core design for easy installation
- Transient overvoltage protection integrated inside Sensor
- Different options of internal diameter dimensions
- RG223 high noise immunity cable
- TNC connector for reliable connection

Hsens-H is a High Frequency Current Transformer sensor. It is a split core and an inductive type of sensor that can be clamped around the earth (ground) shield to measure PD signals. Based on power cable termination condition, an HFCT sensor can also be clamped around cable insulation without earth shield or around the cable with earth shield looped back for the purpose of PD measurements. For HFCT clamped around the cable insulation without earth shield or cable with earth shield looped back, high current variant can be used for rated load current of cable.

Sensor is IP65 rated and features integrated transient overvoltage protection inside sensor. Transient protection will help in minimizing transients that can be expected during PD monitoring

Applications

- Online periodic partial discharge monitoring
- Online PD measurement during HV AC testing
- Multiple point PD monitoring
- Cables, joints and terminations
- Rotating machines
- AIS/GIS switchgear
- Power transformers

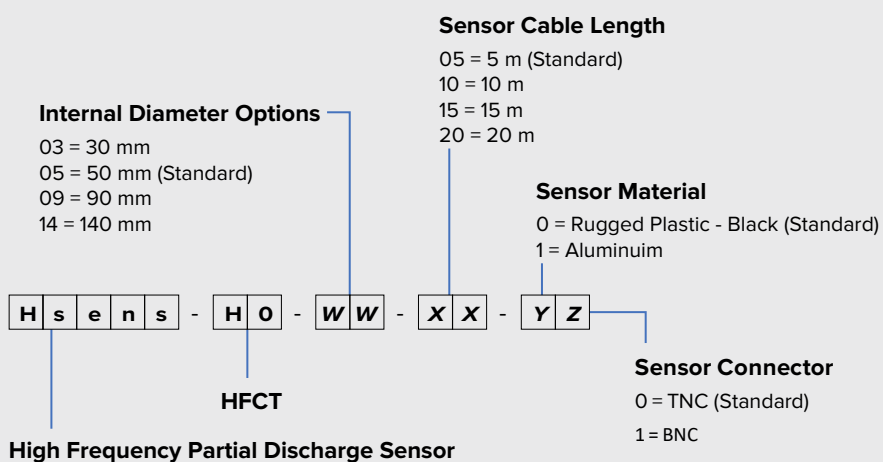
Benefits

- Transient overvoltage protected
- Noise immunity
- IP65 rated
- Rigorously tested
- Split core for easy installation
- Stainless steel robust latch to keep split core closed
- Customizable according to customer specific applications
- Suitable for Online or Online PD measurements

Technical Specifications

SENSOR	Type	Split core
	Frequency Response (-6dB):	100 kHz - 25 MHz
	Material	Rugged Plastic (Black), other options available
	Current Ratings	50A, other options available
MODELS	HFCT-3	220mm (L) x 118mm (W) x 33mm (H) (ID = 30mm)
	HFCT-5	220mm (L) x 163mm (W) x 28mm (H) (ID = 50mm)
	HFCT-9	265mm (L) x 200mm (W) x 38mm (H) (ID = 90mm)
	HFCT-14	330mm (L) x 275mm (W) x 38mm (H) (ID = 140mm)
SIGNAL CABLE	Connectors	RG223
	Type	Cable Gland (Sensor End) and TNC connector (Monitor End), other options available
	Cable Length	5m, other options available
IP RATING	IP65	
TEMPERATURE	Ambient	-30 °C – 70 °C
	Storage	-30 °C – 70 °C
	Customization	For any different requirement, please consult

Ordering Code



HSENS-T

Transient Earth Voltage Sensor



- Transient Earth Voltage Sensor
- Rugged, compact design with IP65 rating
- Strong magnets to attach sensor
- Transient overvoltage protection
- integrated inside Sensor
- RG223 high noise immunity cable
- TNC connector for reliable connection

Hsens-T is a Transient Earth Voltage Sensor that can be used to detect external partial discharges inside metal clad switchgear or power cables termination box of rotating machines and power transformers. An application of HFCT along with TEV can help in PD diagnostic and confirmation of internal versus external PD.

Sensor is IP65 rated and features integrated transient overvoltage protection inside sensor. Transient protection will help in minimizing transients that can be expected during PD monitoring.

TEV sensor has strong magnets that help it to attach to the walls of metal Rotating Machines. TEV forms a capacitive coupling with grounded metal switchgear to detect transients of external PD happening inside metal clad switchgear at termination

Rugged design, IP65 rated, overvoltage protected, PD measurement at Cables (and their accessories), Switchgears, Rotating Machines and Power Transformers

Applications

- Online periodic partial discharge monitoring
- Online PD measurement during HV AC testing
- Multiple point PD monitoring

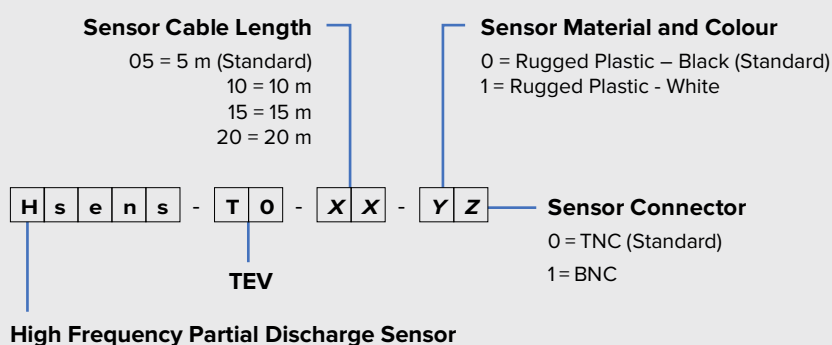
Benefits

- Rugged sensors
- High Noise immunity
- IP65 rated
- Rigorously tested
- Transient overvoltage protected
- Strong magnets to help sensor attach
- Customizable according to customer specific applications
- Suitable for Offline or Online PD measurements

Technical Specifications

SENSOR	Type	Integrated magnets help it to attach to metal clad switchgear
	Frequency Response (-6dB):	1 MHz - 100 MHz
	Material	Rugged Plastic (Black), other options available
SIGNAL CABLE	Type	RG223
	Connectors	Cable Gland (Sensor End) and TNC connector (Monitor End), other options available
	Cable Length	5m as standard, other options available
IP RATING	IP65	
TEMPERATURE	Ambient	-30 °C – 70 °C
	Storage	-40 °C – 85 °C
DIMENSIONS	70mm (L) x 70mm (W) x 33 mm (H)	
CUSTOMIZATION	For any different requirement, please consult	

Ordering Code



LSENS-R

for monitoring temperature
of stator

Recommended for hostile environment where it is exposed to high vibration and immunity to electric fields is mandatory



A multiuse fiber optic temperature sensor designed for a wide range of applications, especially for the use in demanding applications. The sensor offers complete immunity to RFI, EMI, NMR and microwave radiation. The standard temperature sensor has a response time of 0.2 s. With a standard deviation of ± 0.2 °C it allows for precise and repeatable measurements.

The coating of the temperature sensor is made of PTFE, and the fiber tip has a diameter of 1.7 mm with Rugged Polyimide coating and has a stainless steel ST-connector. For mechanical stability and applications e.g. in oil special protective coatings and hoses are available. The fiber optic probe consists of a PTFE protected glass fiber and a GaAs-crystal (Gallium Arsenide) at the sensor tip. It is totally free of metal and immune to external fields, therefore probes are explicitly suitable for the use in high temperature ranges as well as in aggressive operating environments. The sensor cable can be from several meters to kilometers long without influencing the accuracy of the measurement result. Other sensor lengths and connector types are available upon request.

Applications

- Industrial process control and monitoring applications
- High voltage environments
- Harsh and Hazardous environments
- Temperature measurements conducted in confined spaces, hazardous or strong EMI/RFI/MRI environments
- Wood drying industry

Features

- Industrial use with rigid polyimide tip, 1.7 mm diameter
- Rugged tip ideal for industrial application
- Complete immunity to EMI/RFI/lightning
- High vibration environments

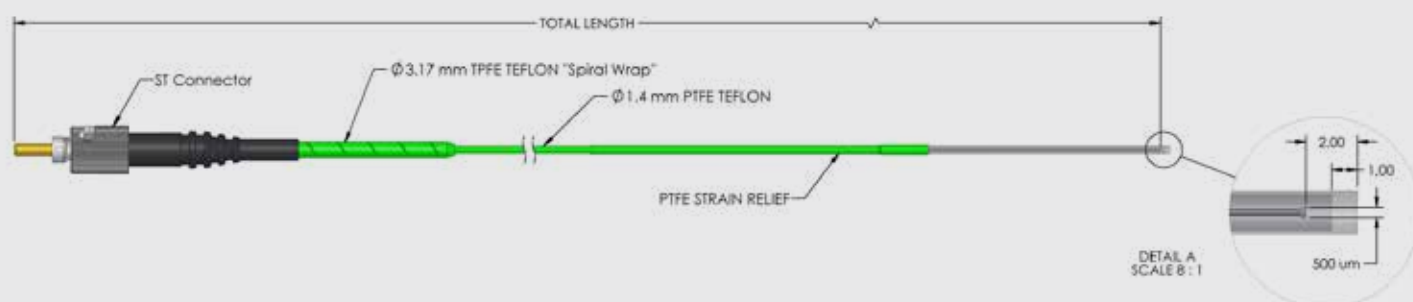
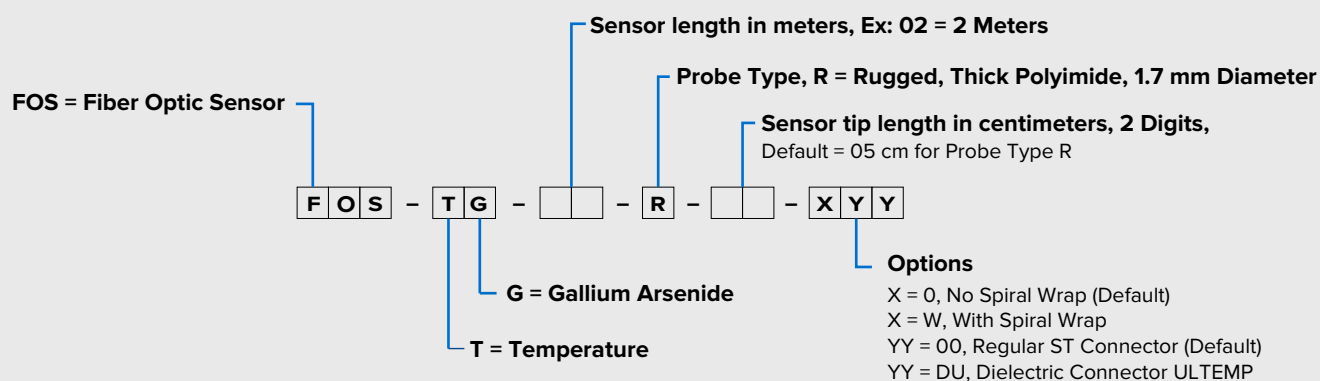
Benefits

- Sensors do not require any recalibration
- No shift over time, high stability
- Robust packaging
- Each sensor comes with a complete test certification
- Robust fiber optic temperature sensor
- Available in different cables and sheath options
- Customizable according to customer specific applications
- Suitable for OEM-type applications.

Technical Specifications

Temperature range	-200 °C to +250 °C
Temperature range (Optional Range extensions)	Down to 4 °K / Up to +300 °C
Repeatability	0.2 °C
Accuracy absolute temperature	+/- 0.8 °C
Accuracy relative temperature	+/- 0.2 °C
Probe sheathing material	Teflon Coated, Rugged Polyimide protection for sensor tip
Connector	Stainless Alloy / Optional - Dielectric
Response time	Up to 0.2 Sec
Probe sensitive area - Diameter	1.7 mm Diameter
Longevity	Probe accuracy & repeatability constant over time

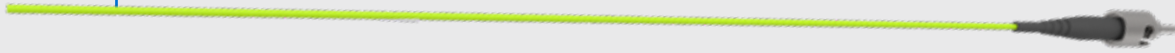
Ordering Code



LSENS-T

Fiber Optic Temperature Sensor

A multiuse fiber optic temperature sensor for measurement in a wide range of demanding applications where immunity to electromagnetic fields and explosion proof requirements are mandatory



A multiuse fiber optic temperature sensor designed for a wide range of applications, especially for the use in R&D and industrial applications. The sensor offers complete immunity to RFI, EMI, NMR, Corrosive and microwave radiation making it the best choice for all demanding applications. The standard temperature sensor has a response time of 0.2s. With a standard deviation of ± 0.2 °C it allows precise and repeatable measurements. The coating of the temperature sensor is made of PTFE, while the fiber tip has a diameter of 1.1mm and has a stainless steel ST-connector. For mechanical stability and applications e.g. in oil special protective coatings and hoses are available. The fiber optic probe consists of a PTFE protected glass fiber and a GaAs-crystal (Gallium Arsenide) at the sensor tip. It is totally free of metal and immune to external fields, therefore probes are explicitly suitable for use in high temperature ranges as well as in aggressive operating environments. The sensor cable can be from several meters to kilometers long without influencing the accuracy of the measurement result. Other sensor lengths and connector types are available upon request.

Applications

- Magnetic, RF and Microwave environments
High voltage environments
- Nuclear and hazardous environments
- Medical applications
- Aggressive Chemical environments
Sterilization applications
- RF and microwave drying applications

Features

- PTFE protected
Outstanding repeatability with high flexibility
- Complete immunity to RFI, EMI, NMR and
microwave radiation
- Does not require recalibration or complex
input to operate
Liquid proof and withstands aggressive
chemical solutions

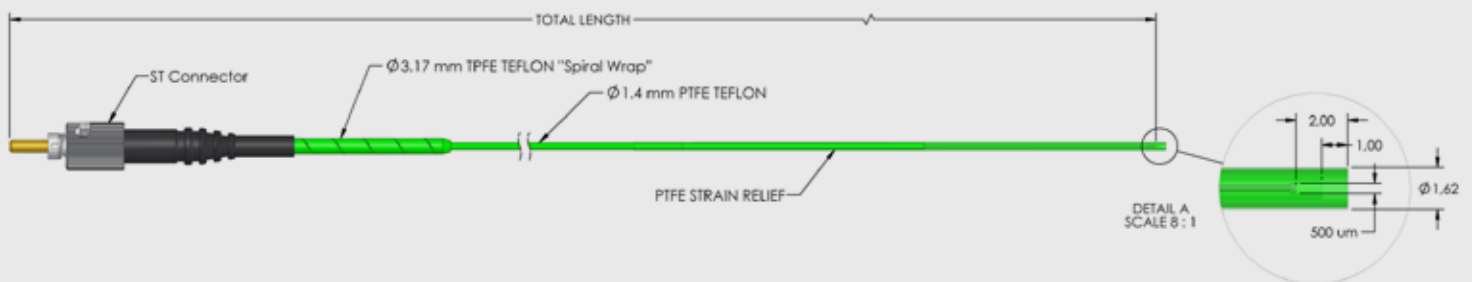
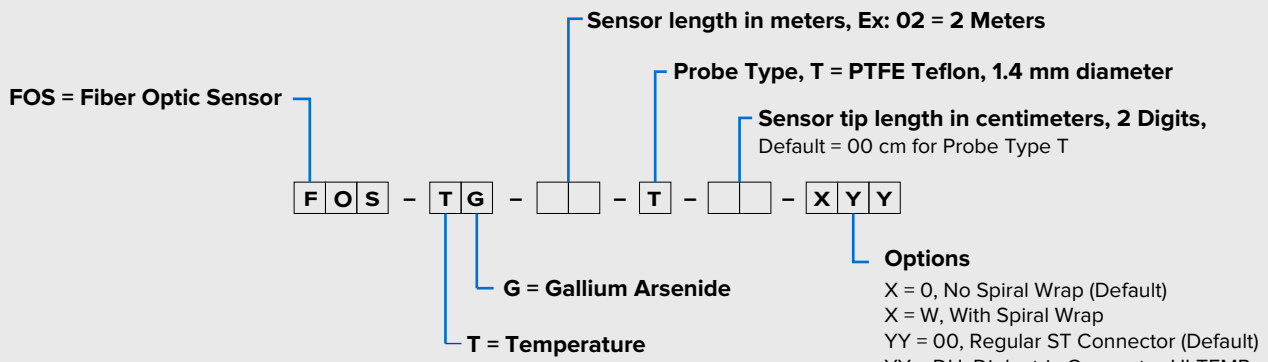
Benefits

- Sensors do not require any recalibration
- No shift over time, high stability
- Optional spiral wrap
- Robust fiber optic temperature sensor
- Available in different cables and sheath options
- Customizable according to customer specific applications
- Suitable for OEM-type applications

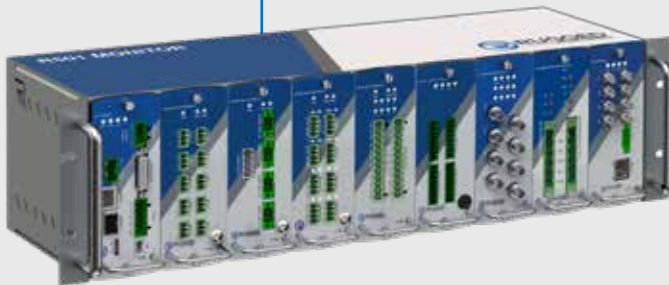
Technical Specifications

Temperature range	-200 °C to +250 °C
Temperature range (Optional Range extensions)	Down to 4 °K / Up to +300 °C
Repeatability	0.2 °C
Accuracy absolute temperature	+/- 0.8 °C
Accuracy relative temperature	+/- 0.2 °C
Probe sheathing material	Teflon Coated
Connector	Stainless Alloy / Optional - Dielectric
Response time	Up to 0.2 Sec
Probe sensitive area - Diameter	1.4 mm

Ordering Code



R501 Rack Mount Comprehensive and Customizable Transformer Monitoring Solution



Rugged, Most Versatile and Multi Channel monitoring solution, Capable of Monitoring One or Multiple Assets: Basic Asset Monitoring, Fibre Optic Temperature Monitoring, Partial Discharge, Bushing, OLTC, Load, Power, and more...

Key Features

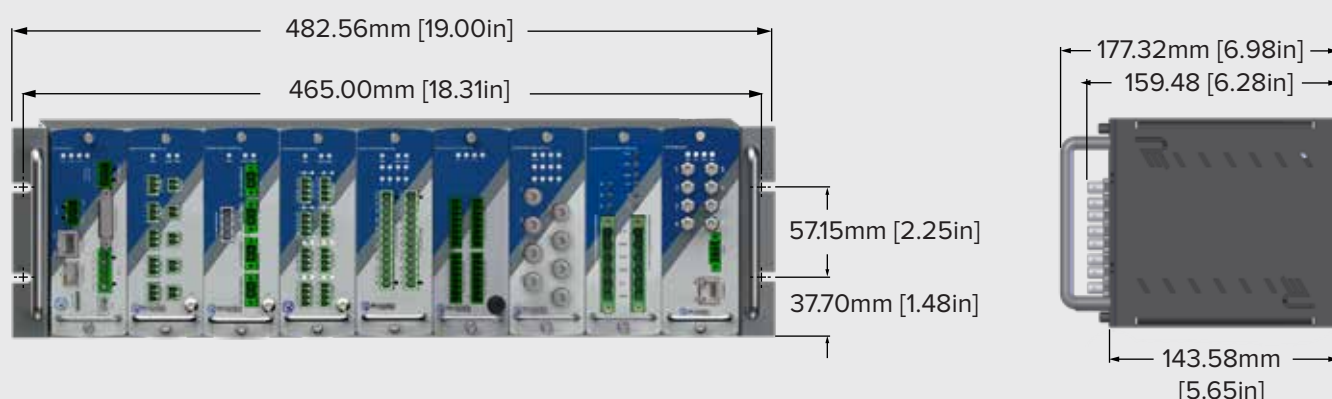
- Fully flexible rack mount and distributed architecture support
- Expandable to add different analog and (or) digital inputs and outputs
- Best in class EMI, ESD Immunity; range of communication options and protocol support
- Range of communication options for third party system integration
- Complies with the latest IEC/IEEE standards for Emission, Immunity, Safety and Environment.

Benefit

- Improved reliability
- Accurate predictive analysis
- Access asset data from anywhere
- One monitoring solution for various parameters
- Increased lifetime
- Highest Return on Investment
- Field upgradable with no device downtime

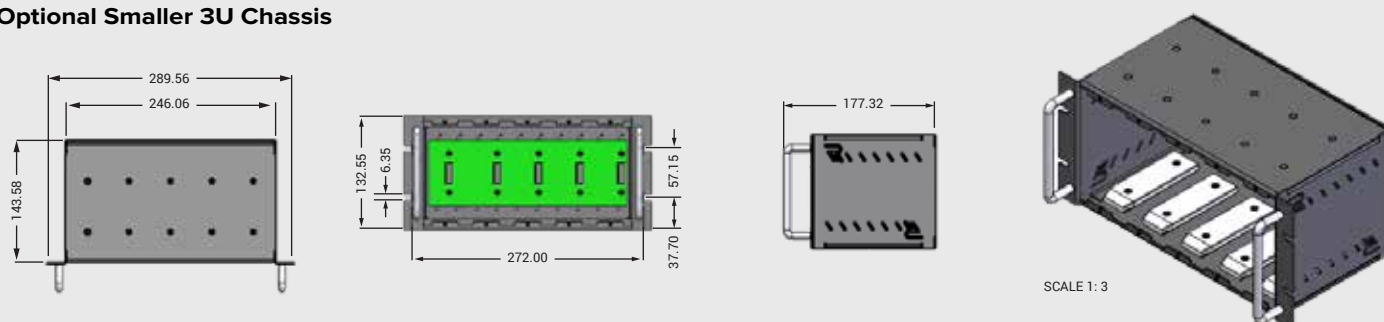


Product Drawing



Weight : 5 Kilograms

Optional Smaller 3U Chassis



Ordering Code

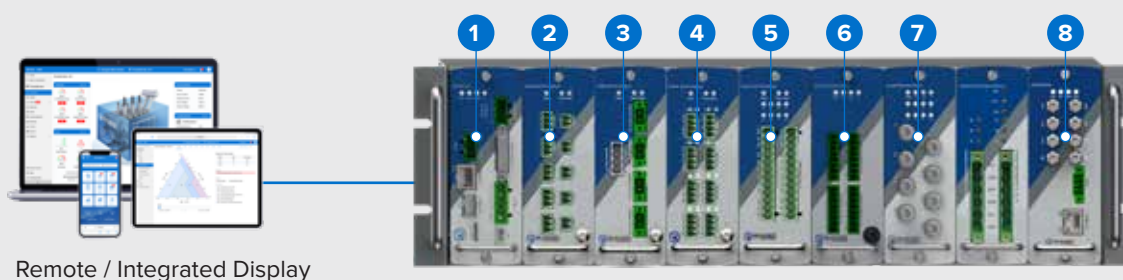
Contact our sales team for Ordering Code

One Solution for Multi-Site Multi Asset Monitoring



R501 Monitoring Modules

Comprehensive Features to Meet Market Demand



Remote / Integrated Display

1. CPU/GTW Module



Option A. CPU Module

- Data Processing & Storage
- System Fault Relay
- 01 x Serial (RS485) ports
- 02 x Ethernet (PRP support)
- Health Assessment Analytics

Option B. CPU with GTW

- Main rack with CPU, Slave rack with GTW
- Provides power to all modules
- Up to 4 Racks can be daisy chained
- 01 x Serial (RS485) ports

Option C. GTW without CPU

- Main rack and slave racks with GTW
- Provides power to all modules
- Supports FOM and FLM modules
- Up to 4 Racks can be daisy chained
- 01 x Serial (RS485) ports

2. Analog Input Module



- 05 or 10 channels
- AC/DC current input
- RTD / Potentiometer
- Built-in LED indicators

3. Power Monitoring Module



- 03 Current & 03 Voltage Inputs
- Active, Reactive & Apparent Power
- Transformer Power Factor
- Through-Fault Monitoring (I2T)
- Current Signature Analysis
- OLTC Motor Torque

4. Digital Input Module



- 08 or 16 channels
- Input Voltage 75 - 250Vdc
- Threshold Voltage > 60V
- Built-in LED indicators

5. Relay Output Module



- 04 or 08 Form C Relays
- Dry contact (NO-C-NC)
- User Programmable
- Built-in LED indicators

6. Analog Output



- 08 or 16 Analog output
- DC Current Loop (4-20mA / 0-1mA)
- Dc Voltage (0-5V / 0-10V)
- User Programmable
- Built-in LED indicators

7. Fiber Optic Module



- 02, 04, 06 and 08 Channels
- GaAs (200u and 62.5u) Module
- Fluro Module
- Built-in LED indicators

8. Partial Discharge Module



- 04 or 08 Channels Continuous Monitoring
- Wide Range (HF and UHF)
- Sampling 100 MS/s
- Vertical Resolution 12bit
- Advanced PD Analysis
- UHF, Acoustic, Bushing PD Sensors available

Technical Specifications

POWER SUPPLY	Input Power Requirement	24 Vdc (Default), Optional 48 Vdc, 125 Vdc, and any other (upon request)
CPU MODULE	Data Storage Capacity	MicroSD external memory slot (up to 2 TB)
	Logging Rate	1 sec interval on USB
	Config port	USB (to use with Rugged connect windows software)
SYSTEM CAPACITY	Maximum number of Channels	Expandable to 256 Channels, Daisy chain up to 32 units (with Modbus, Canbus)
FIBER OPTIC MODULES	# of Channels	2, 4, 6 and 8 channels
	Measurement Range	-80 °C to +300 °C (cryogenic 4 °K range optional)
	Resolution	0.1 °C
	Accuracy	±1.0 °C (±0.2 °C in relative temperature)
	Scan Rate	200 ms / channel (Optional: Faster scanning rates available)
ANALOG INPUT MODULE	# of Input Channels	05 or 10 Channels
	AC Current Input	Clamp-on CT with different ranges: 5Amp, 10Amp, 20Amp, 100Amp and others available
	DC Current Input	4 - 20 mA
	Temperature Input	100 ohm platinum (Pt100)
	Potentiometer	up to 20,000 ohms
POWER MONITORING MODULE	# of Input Channels	03 Current and 03 Voltage
	Current Input Range	0 - 5A
	Voltage Input Range	0 - 250V
	Sampling Rate	32 KS/s
	Measurement Parameters	Power, Through-Fault, Motor Torque etc.
DIGITAL INPUT MODULE	# of Input Channels	08 or 16 Channels
	Dry Contact	Resistance between the contact < 100 Ω
	Powered Contact	75 - 250Vdc
ANALOG OUTPUT MODULE	# of Input Channels	08 or 16 Channels
	Output format	4-20 mA or 0-5V or 0-10V Configurable for any measured / calculated value
BUSHING MONITORING MODULE	# of Input Channels	03 or 06 Channels
	Leakage Current Range	1mA to 200mA
	Monitoring Parameters	Tan Delta (PF), Capacitance, Phase Voltage
PARTIAL DISCHARGE MODULE	# of Input Channels	04 or 08 Channels
	Acquisition Bandwidth	HPM: 0.01 - 100Mhz UPM: 100 MHz - 2 GHz
	Monitoring Parameters	PD Amplitude, Discharge Rate and PRPD
OUTPUT RELAY MODULE	# of Output Channels	04 or 08 Form C relays

T301

Enabling you to remotely monitor the temperature of the rotating machines efficiently



The Rugged Monitoring T301 is a multi-channel fiber optic temperature monitor with precision measurement for Industrial and Laboratory applications. The T301 fiber optic monitor combines compact form factor and user-friendly interface in the monitor and software.

It is designed to operate reliably in extreme EMI, RFI, Microwave and high voltage environments. The T301 has a measuring range from -271°C to +300°C. The system offers complete immunity to RFI, EMI, Chemical, microwave radiation, and high voltages making it an optimal choice for environments where the limitations of conventional temperature sensors / monitors impact usage in extreme conditions. The system is based on proven zero-drift GaAs technology and designed for Plug and Play operation.

The T301 is designed to collect data and to easily integrate into existing systems through serial communication like RS-485 or Gigabit Optical Ethernet. The T301 monitor comes with Rugged Connect software which is designed with the needs of Test Platform or Industrial Process monitoring integration needs. It has the data integration capability of multiple test platforms. Rugged Connect software is designed to collect data from 256 channels simultaneously. Plug and Play functionality provides the flexibility to interchange sensors without the inconvenience / concerns of calibration.

Rugged Monitoring has a dedicated team for application specific customizations for fiber optic sensors, monitor configuration and software integration to simplify the data collection of testing and monitoring applications.

Applications

- Transformer Hot Spot monitoring
- Industrial process control and monitoring
- Electric Vehicle and Battery Testing
- Medical Equipment testing (MRI, PETSCAN, NMR)
- Commercial Grade Microwave Radiation
- Food and Beverage Processes

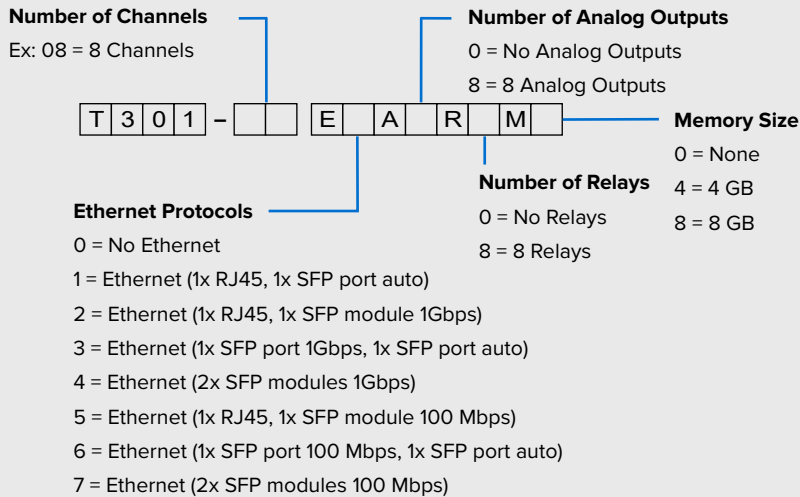
Features

- Rugged, Compact Design
- 4 to 24 Channels, Expandable
- Plug and Play, No field calibration
- Best in class EMI, ESD Immunity
- 8 Programmable relays, Form - C
- Software designed to be interfaced with other testing platforms

Benefits

- No shift over time, high stability
- Robust packaging
- Each Monitor comes with a complete NIST calibration Certificate
- Software designed for integration into test platforms
- Robust datalogging and analytics
- Customizable according to customer specific applications
- Suitable for OEM-type applications.

Ordering Code



Technical Specifications

Measurement Range	-80°C to +300°C (cryogenic 4°K range optional)
Measurement range (<i>Optional Range extensions</i>)	Down to 2°K / Up to +300 °C
Resolution	0.1°C
Accuracy	±1.0°C (±0.2°C in relative temperature)
Scan Rate	200 ms / channel
Memory	MicroSD external memory slot (Up to 2 TB)
Logging	10 years at 10 sec interval rate (8 GB)
Serial Port	RS-485 with Modbus
Ethernet Port	Gigabit RJ-45 or fiber ethernet (with PRP support using Redbox) – Optional
Analog Outputs	8 fully configurable 0-10 V / 4-20 mA optional module available – Optional
Max No. of Channels	256 Channels, Daisy chain up to 32 units (with Modbus)
Relays	8 Programmable Form-C Relays (5A) plus 1 system fault relay – Optional
Operating Temp	-40°C to 72°C
Storage Temp	-40°C to 85°C
Number of Channels	4 - 24 channels
Dimensions	10.5" x 7.4" x 2.8" 26.7W x 18.7D x 7.2H cm
Humidity	95% Non-Condensing

T401 Fiber Optic Temperature Monitors



Recommended for increased asset lifetime with highly reliable performance and reduced operational risks.

The Rugged Monitoring T401 is specifically designed for real time monitoring of electrical assets. The configurable T401 comes with a user-friendly monitor and software interface. With its advanced monitoring functions T401 can provide accurate measurements

for various electrical assets. The system offers complete immunity to RFI, EMI, Chemical, Microwave Radiations, and High Voltages, making it an optimal choice for environments where the limitations of conventional temperature sensors / monitors cannot be used in extreme conditions. It has the data integration capability to integrate with third party systems.

The T401 is designed to collect data and to easily integrate with existing systems through serial communication like RS-485/ SFP (Gigabit Optical Ethernet). The T401 monitor comes with Rugged Connect/RM EYE software which is designed to cater the needs of various commercial, industrial, and utility applications. It allows remote monitoring by sending alert to operators about fault conditions at an early stage and provides vital health information before any serious fault occurs.

We at Rugged Monitoring have a dedicated team for application specific customizations for sensors, monitor configuration and software integration to simplify data collection of testing and monitoring applications.

Features

- Expandable up to 8 channels
- No field calibration
- Plug and play connections
- Compact and rugged design
- Best in class EMI and ESD immunity
- Up to 8 programmable Form-C relays

Applications

- Oil filled Rotating Machines
- Dry type Rotating Machines
- Switchgears
- Cables
- Variable Frequency Drives
- Industrial Process Control and Monitoring

Benefits

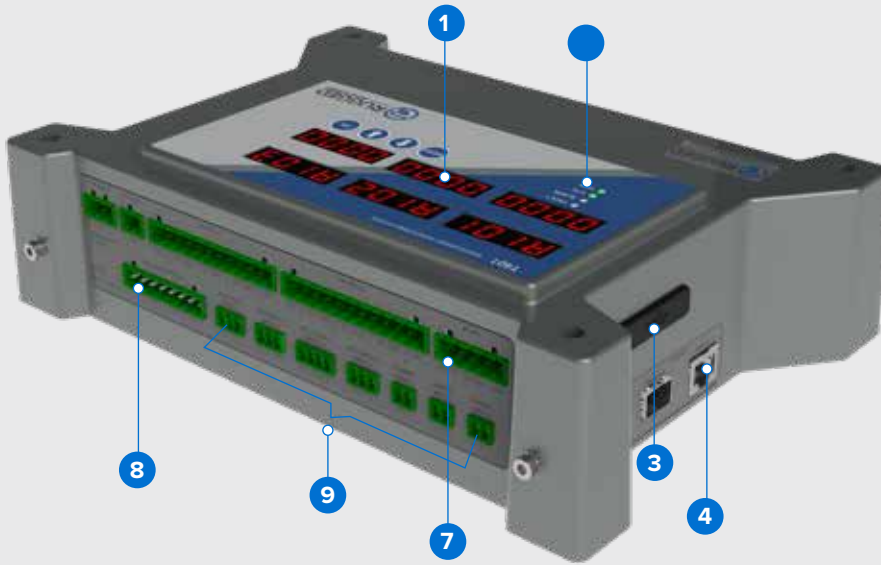
- Avoid unplanned outages
- Reduced risk of catastrophic failure
- Increased asset lifetime
- Reduced Maintenance Costs
- Ensuring reliable operation

Technical Specifications

POWER SUPPLY	Input Power Requirement	24/48 VDC $\pm$ 10%
	Power Consumption	20 Watts
ANALOG/DIGITAL INPUT MODULE	# of Input Channels	08/04 Channels
	Input Channel Types	Configurable from a range of input options, RTD, AC/DC current, AC/DC voltage, Potentiometer, Dry/Powered contact switch
	Accuracy of Channels	$\pm$ 0.5% full scale input range
	Input Channel Sample Rate	1 Hz
ANALOG OUTPUT MODULE	# of Output Channels	04 Channels
	Output format	4-20 mA or 0-5Vdc / 0-10Vdc (Configurable for any measured / calculated value)
OUTPUT RELAY MODULE	# of Output Channels	08 Form C relays (5A)
	User Programmable	Yes, from Rugged Connect Software or webserver, if present
DATA STORAGE & CONFIGURATION	Data Storage Capacity	4 or 8 GB, Industrial Grade micro-SD, extendable to 2TB
	Logging Rate	User Configurable, 1 sec interval on USB
	System Fault Indication	1 System Fault Relay, with Local LED light
	Config port	USB (to use with Rugged connect windows software)
COMMUNICATION	Serial Communication	01 x RS-485 (RS-232 optional converter)
	Ethernet Communication	02 Ethernet Ports, configurable to RJ-45 or SFP (Gigabit Optical)
	Redundancy	Support PRP Redundancy
	Protocol Supported	Modbus, DNP3.0, IEC60870-104, IEC61850, Other protocols provided on request
EMC TYPE TESTING	Conducted & Radiated Emissions	ICES-003 (2016), CISPR32 (2015), CISPR11 (2015)
	ESD and EM Field Immunity	IEC61000-4-2, C37.90-3, IEC61000-4-3, C37.90.2v
	Fast Transient & Surge Immunity	IEC61000-4-4, IEC61000-4-5, C37.90.2
	Magnetic Field Immunity	IEC61000-4-8, IEC61000-4-10
	Immunity from Conducted Disturbances	IEC61000-4-6, IEC61000-4-16
	Ripple, Dips & Damped Oscillatory	IEC61000-4-17, IEC61000-4-18, IEC61000-4-29
	Safety	IEC60255-26 and CE Certified
ENVIRONMENTAL AND MECHANICAL	Operating Temperature	-40 to 72 °C
	Operating Humidity	95% Non Condensing
	Storage Temperature	-40 to 85 °C
	Dimensions	W26.7 cm x H7.2 cm x D18.7 cm (10.5" x 2.8" x 7.4")
	Weight	App. 1.5 to 2.0 Kg. (based on number of configuration)

T401 FEATURES

Comprehensive Features to Meet Market Demand



1. Local Display

- Industrial Grade LED
- Current Values of all Parameters

2. LED Indicators

- Power ON/OFF
- System Fault
- Alarm & Log

3. USB Port

- Configuration & Troubleshooting
- Data Export
- MicroSD Card

4. Ethernet Ports

- 02 x configurable Ports (RJ-45/SFP)
- Full Redundancy
- PRP Protocol
- Modbus, DNP3.0, IEC60870-104 and IEC 61850

5. Power Input

- 24 / 48 Vdc
- Power Supply Unit / Adaptor provided as Accessories (OPTIONAL)

6. Relay Outputs

- 08 x Form C Relay contacts
- NO-C-NC
- Cooling control
- Alerts / Alarms

7. Serial Port (Rs-485)

- Data Input/Output Integration
- Modbus Protocol
- DNP3.0 Protocol
- IEC60870-104 Protocol

9. Analog / Digital Inputs

- 08 x Configurable Inputs
- RTD (PT-100), Potentiometer
- AC Current (Clamp-On CT), DC current (4-20mA)
- Digital (Dry Contacts)
- AC/DC Voltage

8. Analog Outputs

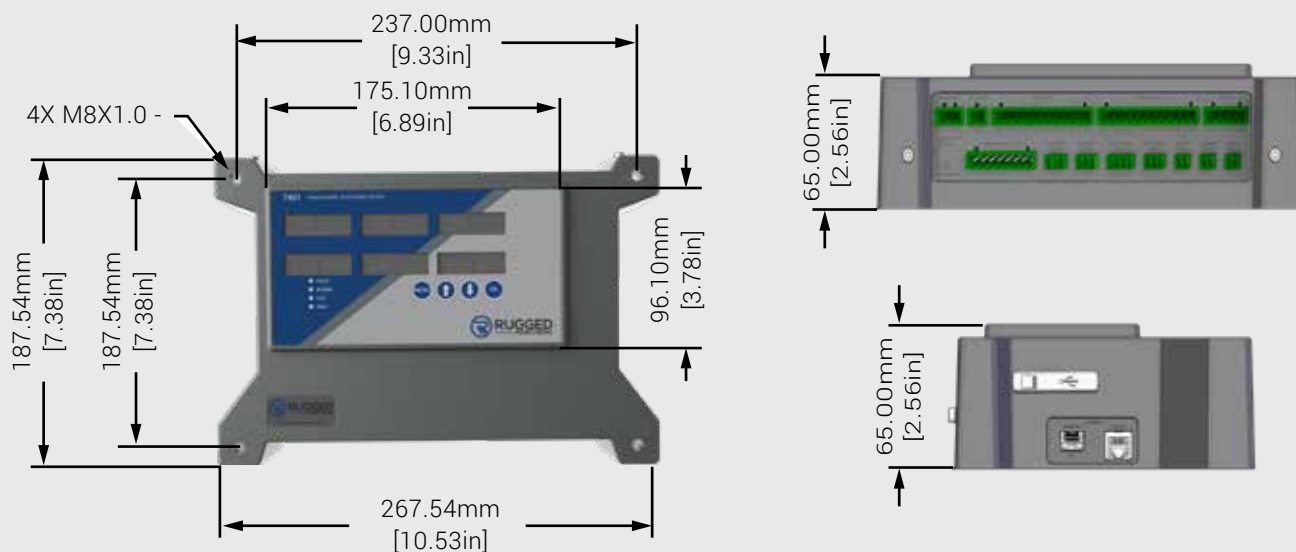
- 04 x User Programmable
- Current Output (4-20mA)
- Voltage Output (0-5V/0-10V)



Rugged Software

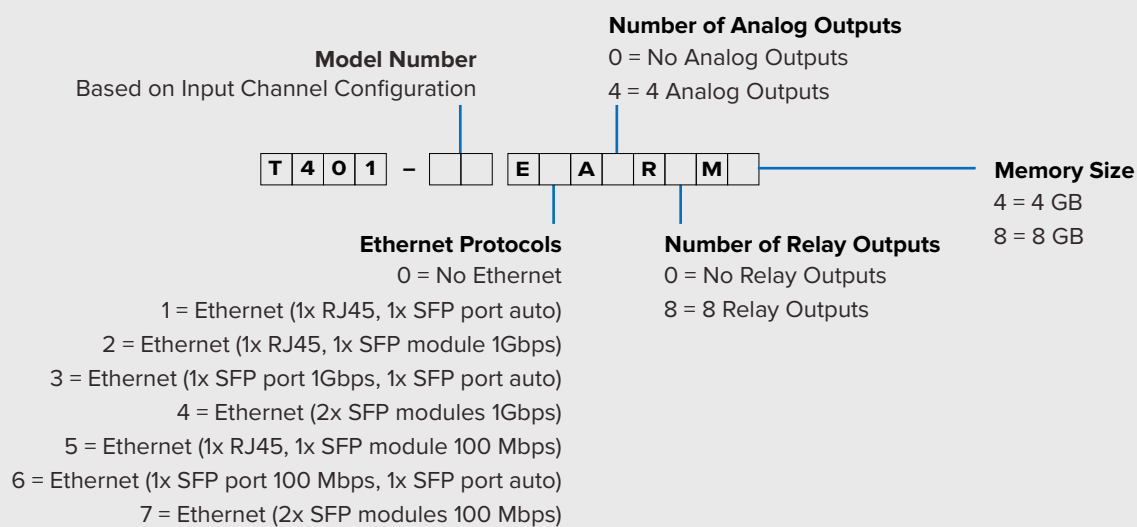
- Desktop and Web Client
- Remote Configuration
- Advanced Visualization
- Data Logging, Reporting
- Supports Industry Standard Protocols
- Customization available on request
- Secure access to data & Configuration
- Multiple Language Support

Product Drawing



Weight : 2 Kilograms

Ordering Code



T501

Rugged Monitoring Temperature Monitor



T501 is the most advanced monitoring solution designed to monitor multiple electrical assets types with its simple and user-friendly interface.

T501 along with customized sensors for specific requirement and software provides condition monitoring of electrical assets by focusing on preventing asset failures and downtime. With our comprehensive monitoring solution, the health of assets can be determined and also maintenance activities can be scheduled. The system along with sensors, monitors, and software (Rugged Connect/ RM EYE) is customizable as per the specifications.

The solution can be used for existing (retrofit applications) or new electrical assets. Our T501 gives state-of-the-art condition monitoring solution for industries with huge electrical infrastructure. It can analyze the data and obtain the predictive diagnostics to detect any serious faults before a major breakdown occurs. T501 is precisely designed to monitor all electrical asset types and to provide a greater visibility into the assets.

Options

- Integrated data logging (up to 20 parameters) and Event recording (up to 8 events)
- Ethernet port and/or fiber optic communications output (RS485)
- Weather proof enclosure with or without heater, 19" rack mount or control cabinet panel mount
- Oil RTD, Ambient RTD, clamp on CT, pressure transducer, oil level transmitter along with various other input modules.

Benefits

- Proactive Risk Monitoring
- Improved asset protection and utilization
- Simplified analysis for condition-based maintenance
- Intervention before failure and Malfunctioning
- Optimize loading and equipment life

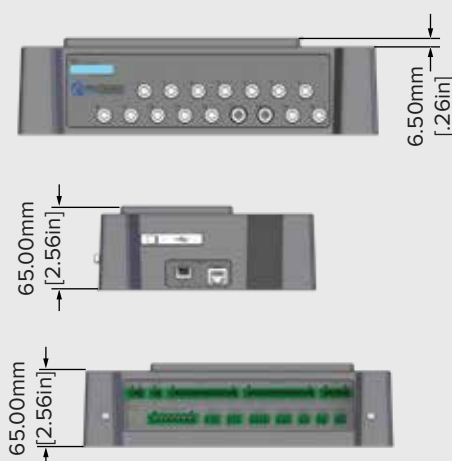
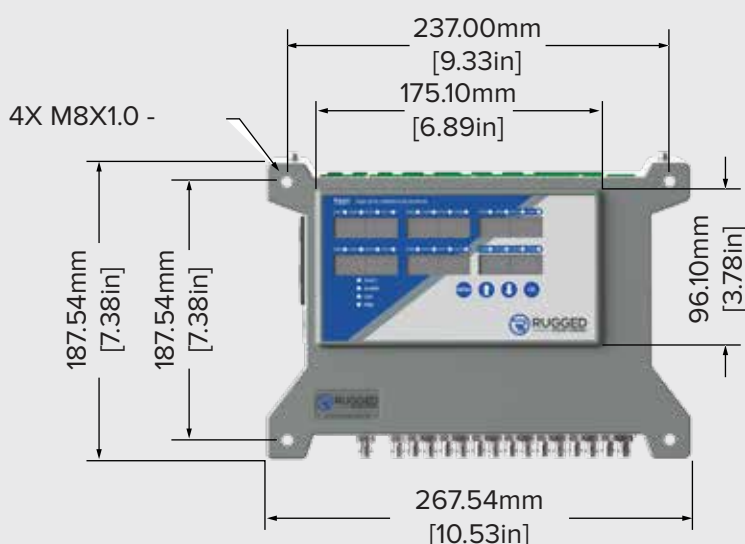
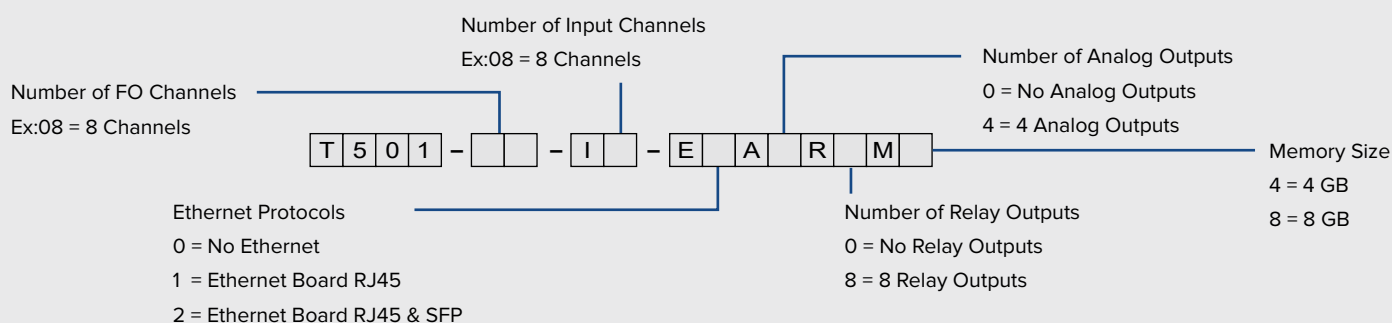
Features

- 8 relays (1 dedicated for system status) for alarm and control based on up to 8 modular inputs of various types.
- RS 485 remote communication, fiber optics (Rs-485) communications and Ethernet ports
- Realtime monitor for condition based, continuous online monitoring of asset health (CBM).
- Interfaces with a variety of Rugged Monitoring and third party smart sensors, as well as traditional gauges to accurately measure transformer parameters vital to asset management.
- Web based software is specifically designed for ease of unit commissioning, setup and daily use.

Applications

- Transformer monitor for condition based, continuous online monitoring of asset health (CBM).
- Interfaces with a variety of smart sensors including third party sensors, as well as traditional gauges to accurately measure transformer parameters vital to asset management.
- Specifically designed web based software for ease of unit commissioning, setup and daily use.

Ordering Code



Weight : 2 Kilograms

O201

Rugged Monitoring Temperature Monitor



Rugged design, designed for reliability, multichannel fiber optic temperature monitor for wide range of Industrial and Laboratory applications.

The Rugged Monitoring O201 is a compact design, designed for reliability to operate in extreme EMI, RFI, Microwave and High voltage environments. The O201 Fiber optic monitor combines reliability and user friendly configuration software. It is a multi-channel fiber optic temperature monitor with precision measurement for Original Equipment manufacturers. The O201 has a measuring range from -271°C to +300°C.

The system offers complete immunity to RFI, EMI, microwave radiation and High Voltages making it an optimal choice for environments where the limitations of conventional temperature sensors/monitors impact usage in extreme conditions. The system is based on proven GaAs technology and designed for Plug and Play operation.

The O201 is designed to collect data and easy to integrate into existing systems through serial communication like RS-485 or analog outputs like 0-10 V / 4-20 mA. The O201 supports Modbus, CANbus protocols and a system fault relay. The module is designed with capability to add additional application logic for customer specific applications. It is designed to cater the requirements of Monitoring, Test platforms or Industrial Process monitoring integration needs. It has the data integration capability of multiple test platforms. Industry standard drivers are available for a quick and easy connect to most popular laboratories softwares.

We at Rugged Monitoring have a dedicated team for application specific customizations for fiber optic sensors, monitor configuration and software integration to simplify the data collection of testing and monitoring applications.

Applications

- Electric Vehicle and Battery Testing
- Medical Equipment testing (MRI, PETSCAN, NMR)
- Commercial Grade Microwave Radiation
- Industrial process control and monitoring applications
- Chemical and process Industries Food and Beverage Processes
- Wood drying industry

Features

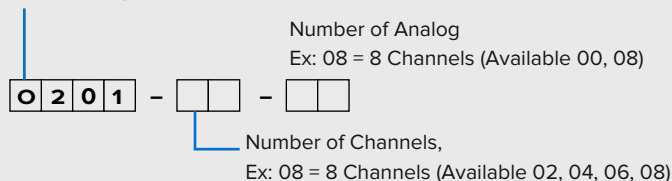
- Rugged, Compact Design
- 1 to 8 Channels, Expandable
- Plug and Play
- Best in class EMI, ESD Immunity
- Software designed to be interfaced with other testing platforms

Benefits

- Suitable for OEM-type applications.
- Sensors do not require any recalibration
- No shift over time, high stability & repeatability
- Robust packaging
- Each Monitor comes with a complete NIST calibration certificate
- Software designed for integration into test platforms
- Robust datalogging and Analytics
- Customizable according to customer specific applications
- Suitable for OEM-type applications

Ordering Code

O201 = Original Equipment Module, 201 Series



Technical Specifications

Measurement Range	-80°C to +300°C (cryogenic 4 °K range optional)
Measurement range (Optional Range extensions)	Down to 4°K / Up to +300°C
Resolution	0.1°C
Accuracy	±1.0°C (+/- 0.2°C in relative temperature)
Number of Channels	1 - 8 Channels
Logging	1 sec interval on USB / Micro SD card
Config port	USB (to use with Rugged connect windows software)
Max # of Channels	Expandable to 256 Channels, Daisy chain up to 32 units (with Modbus, Canbus)
Comunication Ports	RS-485 (RS-232 optional converter) with Modbus , CANbus
Power	24 VDC
Memory	MicroSD external memory slot (up to 2 TB)
Analog output module	Fully configurable eight 0-10 V / 4-20 mA module(Optional)
Dimensions	4.72" x 6.34" x 1.89" 120 x 161 x 48 mm
Scan rate	200 ms / channel (Optional: Faster scanning rates available)
Operating temp	-40 to 72°C
Storage temp	-40 to 85°C
Humidity	95% Non Condensing
Relay	System Fault relay (5A)

HPM601-C High Frequency Partial Discharge Monitor



"Rugged Monitoring High Frequency Partial Discharge (PD) monitoring solution is a platform that enables HV asset owners to keep monitoring PD round the clock due to insulation defects.

System can also be used to perform online PD measurement during HV AC testing. Solution can communicate with its user over IEC61850 or using Rugged Monitoring proprietary Rugged Enterprise software suite. Shielded monitor with small dimensions make it easy to get installed and start.

Enhanced and newly added hardware and software features ensure highly sensitive multi-channel PD measurements for reliable, industry-standard PD testing on a variety of electrical equipment and components. System simple design enables it to get interfaced to third party protocols. Thousands of pulses per second can be transferred to the Server enabling the user to generate fast and reliable Phase Resolved Partial Discharge (PRPD) graphs. PRPD graphs help the user to identify type of PD in HV assets. Monitoring solution is packed with all necessary tools that help to perform effective PD measurements. Integrated variable amplifiers and on-board noise suppression features help during onsite testing even in case of presence of huge noise.

Rugged Monitoring's team of experienced condition monitoring specialists provide innovative testing, Diagnosis and Customized Monitoring Solutions.

Applications

- Online PD measurement during HV AC testing (Resonant test set, VLF, OWTS)
- Multiple point PD monitoring
- Cables and their accessories
- Rotating machines
- AIS/GIS switchgear/switchboards
- Power transformers

Features

- Rugged, simple design
- 4 synchronous input channels allow 3 phase synchronous measurement with additional external synchronous channel to enable the use of other type of sensor
- Rugged Enterprise, a complete software suite for analyzing the data and generating reports
- Indicator LEDs to alert in case of PD alarm or warning
- Gigabit ethernet copper Cat5e or multimode fiber communication link between monitor and server

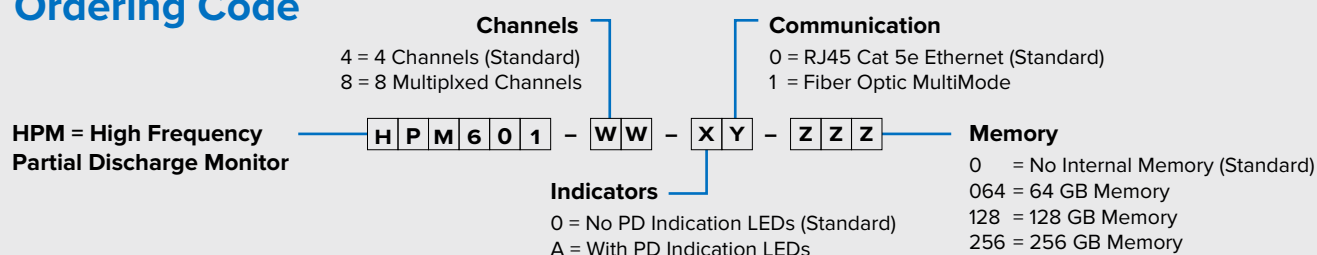
Benefits

- Highly Efficient sensors, monitor and server
- Gigabit ethernet communication between monitor and Server
- Robust design parameters
- Each device is tested rigorously
- Software packed with useful tools for reliable and interactive PD measurements
- Robust recording and analytics
- Customizable according to customer specific applications
- Suitable for Online PD measurements

Technical Specifications

MONITOR	Channels	4 simultaneous channels 8 & 12 channel options available with multiplexer
	Sampling Rate	250 MS/s
	Bandwidth	0.01-100 MHz
	Amplification	up to 28 dB, software selectable
	Filtering	Software configurable band pass filters
MEMORY	SSD	upto 256 GB (Optional)
DATA TRANSFER	High Resolution (Pulses data on simultaneous channels)	10,000 pulses per second for 4 simultaneous channels
	Low Resolution (Pulse amplitude on simultaneous channels)	50,000 pulses per second for 4 simultaneous channels
	Transfer Rate	400 Mbps (depending on operating system and connection)
REMOTE COMMUNICATION	IEC61850 (Optional)	
	Proprietary Rugged Connect for remote communication	
	Customized third party interface on request	
COMMUNICATION LINK	Type	Ethernet Fiber / Copper
	Cable Multimode	Fiber / Cat5e
	IP Rating	IP65
TEMPERATURE RATING	Ambient	-30°C - 60°C
	Storage	-40°C - 85°C
POWER RATING	Input Power	35 W max
SYNCHRONISATION INPUTS	2 Inputs, software	Internal
	Selectable	External
DIMENSIONS	260mm(L)x310mm(W)x120mm(H)	
SOFTWARE	Rugged Enterprise	

Ordering Code



HPM601-P High Frequency Partial Discharge Monitor



Rugged design, designed for reliability, 3 Phase synchronous partial discharge monitoring equipment.

Rugged Monitoring High Frequency Partial Discharge (PD) Portable Monitor is a compact and rugged device enabling the user to perform periodic offline and online PD measurements in power cables and accessories, switchgears and rotating machines. Compact size and rugged enclosure and electronics make it portable, easy to carry and enabling the user to perform PD measurements with less hassle.

Monitor is capable of transferring the data directly to Rugged Enterprise software installed on laptop or data can be temporarily stored (optional) in the device enabling the user to record PD pulses with higher sampling rate. Thousands of pulses per second can be transferred to the laptop enabling the user to generate fast and reliable Phase Resolved Partial Discharge (PRPD) graphs. PRPD patterns help the user to identify type of PD. Monitor and Software are packed with all necessary tools that help to perform effective PD measurements. Integrated variable amplifiers and on board denoising features help during onsite testing in case of presence of huge noise.

There is a dedicated team for application specific customizations for sensors, monitor configuration and software integration to simplify data collection of testing and monitoring applications.

Applications

- Online periodic partial discharge monitoring
- Offline PD measurement during HV AC testing (Resonant test set, VLF, OWTS)
- Multiple point PD monitoring
- Cables and their accessories
- Rotating machines
- AIS/GIS switchgear/switchboards
- Power transformers

Features

- Rugged, compact design
- 4 synchronous input channels allow 3 phase synchronous measurement with additional external synchronous channel to enable the use of other type of sensor
- An interactive and comprehensive software Rugged Enterprise for reliable PD measurement and analysis
- Gigabit ethernet copper Cat5e communication link between monitor and laptop
- Optional rugged laptop with installed software suite IP65 rated

PD201

Rugged Partial Discharge Monitoring Module for OEMs



The Rugged Monitoring PD201 is a compact design, designed for reliability Partial Discharge (PD) Monitoring Module for Transformers, Switchgears, Power Cables and Rotating Machines.

PD201 combines accuracy and easy to use software. It has two variants, 04 channel and 08 channels, that can connect to 4 and 8 PD sensors respectively. The system can be integrated with wide range of PD sensors such as HFCT, TEV, Bushing Adaptors, Capacitive Couplers, Acoustic, and Ultrasonic PD sensors.

The PD201 connects to the HF PD sensors installed at the MV/HV assets. It measures the High Frequency (HF) signals emitted by the PD Faults in HV/MV assets. The HF signals are then analyzed for PD activity and Module categorizes pulses as Internal PD, External PD and Noise Signals. Internal PD signals are captured and stored for further analysis such as PRPD, PD Amplitude, Discharge Rate and trending. The PD amplitude and discharge rate is sent to the third-party system via Modbus (RTU) protocol using built-in serial (RS-485) port. The PRPD data is stored in the module and sent to third party system via CANBUS protocol using built-in CAN port.

Applications

- Online continuous partial discharge monitoring
- Online PD measurement during HV AC testing
- Multiple point PD monitoring
- PD Monitoring in Transformer using Bushing
- Adaptors/Sensors
- PD Monitoring in Dry Type Transformers
- PD Monitoring in MV Switchgear using TEV / HFCT
- PD Monitoring in Power Cables using HFCT
- PD Monitoring in Generators and Motors using
- Capacitive Couplers and HFCT

Features

- Rugged, Compact Design with multiple mounting options - Din-Rail, Direct
- 4 or 8 Synchronous Input Channels for monitoring Partial Discharge
- Monitors Partial Discharge into the Insulation of MV/HV assets
- Best in class EMI, ESD Immunity
- Modbus (Serial-RS485) and Canbus integration with third party systems
- Advance noise gating with built-in filters and software algorithms
- Built-In Fail Safe Relay for System Failure

Benefits

- Suitable for OEM-type applications (TMS, Gateways)
- Multiple mounting options - Din-Rail and Direct (Bare-board)
- Cost optimized solution for Partial Discharge monitoring
- Software designed for integration into monitoring systems / gateways
- Robust datalogging and Analytics
- Customizable according to customer specific applications
- Most accurate PD analysis with advanced noise gating
- Highly robust and safe monitoring systems

Technical Specifications

Number of Channels	04 or 08 (Simultaneous acquisition, No Multiplexing)
Sampling Rate	100 MS/s per channel
Acquisition Bandwidth	0.01 - 100Mhz
Vertical Resolution	12-Bit
Noise Elimination - Bad Pass Filters - Software Noise Gating	User selectable integrated filters with 5Mhz to 25Mhz bandwidth range Advanced denoising algorithms
Data Storage (Memory)	MicroSD external memory slot (Up to 2 TB)
Compatible PD Sensors	Any High Frequency (HF) PD Sensors (Bushing Adaptors, HFCT, TEV, Capacitive Couplers, Acoustic, Ultrasonic etc.)
Synchronization Inputs	2 Inputs (Internal and External)
Serial Port	RS-485 with Modbus RTU and Can Port with CANBUS protocol
Configuration Port	Ethernet Port for configuration
Operating Temperature	-30 to 75 °C
Storage Temperature	-40 to 85 °C
Dimensions	4.92" x 4.92" x 1.89" (125mm x 125mm x 48mm)
Humidity	95% Non Condensing
Power Input	12 - 24V DC (Default)
Power Consumption	15W
# of Relays Outputs	01 x Fail Safe Relay for System Failure

Ordering Code

Number of Channels

04 = 4 Channels;

08 = 8 Channels

P D 2 0 1 -

M x

Memory

0 = No Internal Memory

1 = for 64GB Memory

2 = for 128GB Memory

3 = for 256GB Memory

4 = for 512GB Memory

Asset Monitoring : Enterprise Architecture

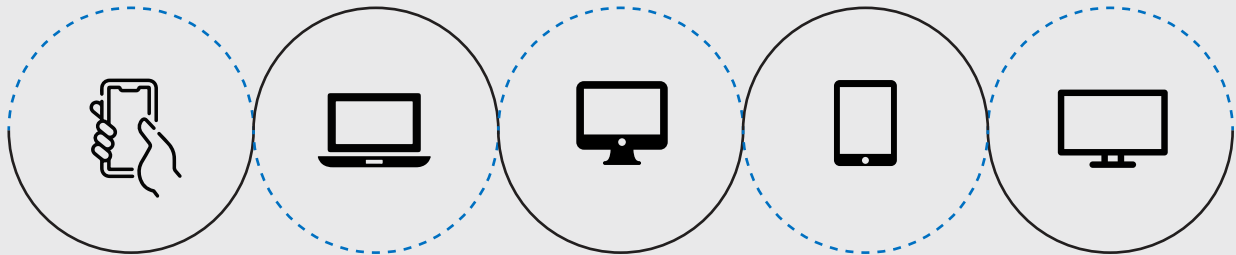
Compatible with Rugged Monitoring Enterprise Solution

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

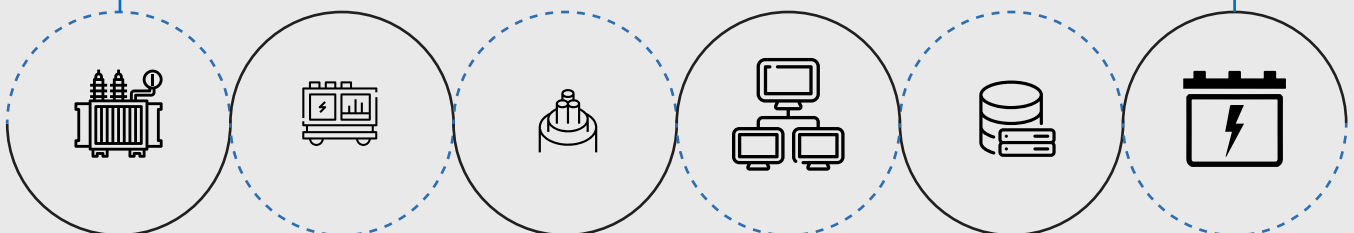
MODBUS

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)

One Solution for Multi-Site Multi Asset Monitoring

Manage different industrial assets on one platform without human intervention

Features

- **Advanced and Exceptional Reporting** Technology with automated alerts
- **Modern remote monitoring solutions** provide valuable insights to Multiple Assets at Multiple Sites on real-time
- **Robust asset health monitoring** with analysis and recommendations support asset effectiveness in addition to maximizing equipment uptime
- **Establish a real time and consistent monitoring** by getting the right information into right hands
- **An efficient, reliable partial discharge monitoring** for all the assets
- **A detailed comprehensive DGA Analysis**
- **Lifetime Consumption details.**
- **Built on well-established remote and cloud-based monitoring technology**
- **Simple user-friendly interface** providing fast access to all the features and commands
- **Quick and easy 1 step configuration setup**
- **Encompasses a secure access to data and configuration**
- **Advanced asset algorithms** based on standard ones with new ideas
- **Systematic fleet management and analysis**
- **Extended multilingual support** to handle product inquires or troubleshoot problems proactively
- **Up System Level Reporting**
- **Industrial IoT**

Features Specific to PD Monitoring

- Partial Discharge monitoring and Analysis
- PRPD : Phase resolve partial discharge
- Partial Discharge Amplitude and Discharge rate trend analysis
- Partial Discharge Fault localization
- Artificial Intelligence based PD fault Identification
- Realtime PD Alarm system
- Get Alarm notifications for individual bushing parameters over Email, sms and push notifications
- Analytics on Online, and offline partial discharge test data

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 Details

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

Our Presence Across the Globe



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