

**RUGGED**  **MONITORING**

MONITORING SIMPLIFIED

A wide-angle photograph of a solar farm with rows of solar panels in the foreground and several wind turbines in the background under a blue sky with scattered clouds.

# Condition Monitoring System for Solar and Wind Farms

We help delivering enhanced reliability and security to renewable energy installations like solar and wind farms. From delivering insightful monitoring to providing Higher ROI, RM's Condition Monitoring System plays an ever-increasing role within renewable energy installations.

# Our Solution

**The increasing numbers on Renewable Energy Power Plants (Solar, Wind) are putting more stress into the electrical assets of current infrastructure.** Higher transients and harmonics from converted power supply of ESS (Energy Storage Systems), Increasing supply related fluctuations from Wind Farms are some of the major issues that impact the long-term sustainability of our transmission and distribution network.

RM's Condition Monitoring Systems perform more efficiently to cater the needs of wind and solar power industry, It also facilitates planned maintenance with deep insight into the

component failures before they affect energy production. Ensuring that the integrity of processed data is be compromised by severe and extreme climates, We at Rugged Monitoring have developed wide range of products with deep understanding of the stress and strain placed on renewable energy applications.

Delivering several advantages over conventional equipment, the popularity of condition monitoring solutions in solar and wind farm has gathered much attention than yester years.

## Renewable Energy Condition Monitoring System Benefits

**Reduces expensive emergency repairs by detecting problems early, avoiding unplanned downtime and optimizing the planned outage cost with planned maintenance.**

- Real time monitoring of electrical assets
- Detailed diagnosis of the faults in different assets
- Root cause analysis of damage event
- Data trending
- Operational and economic benefits are realized through reduced downtime
- Seamless communication among multiple systems



## Features of Condition Monitoring System

- High precision modular design
- Accurate measurement
- Multiple Digital and Analog Outputs
- Plug and Play, No Re-Calibration
- Accessible Installation and Commissioning
- Data integration with high level systems

# Flexible solutions for Renewable Energy Applications

## Solar Power Plants

	Solar Panel	Ess/Battery	Power Cables	Inverter/ Power Electronic	Switchgear	GIS	Transformer
Temperature	✓	✓	✓	✓	✓	✓	✓
Voltage	✓	✓	✓	✓	✓	✓	✓
Current	✓	✓	✓	✓	✓	✓	✓
Gas Density Monitoring					✓	✓	
Moisture			✓	✓	✓	✓	✓
UHF PD			✓		✓	✓	✓
HF PD			✓		✓		✓
Breaker Condition Monitoring					✓	✓	
Vibration Sensor							✓

## Wind Power Plants

Our Condition Monitoring System for wind turbines is specifically designed to detect and prevent generator, gearbox and rotor bearing failure, with highly accurate real-time monitoring, and analysis.

	Wind Farm Structure/ Blades	Turbine	Generator	Transformer	ESS/ Battery	Power Cables	Inverter/ Power Electronics	Switchgear	GIS
Temperature		✓	✓	✓	✓	✓	✓	✓	✓
Voltage			✓	✓	✓	✓	✓	✓	✓
Current			✓	✓	✓	✓	✓	✓	✓
DGA				✓					
Moisture			✓	✓		✓	✓	✓	✓
UHF PD				✓		✓		✓	✓
HF PD				✓		✓		✓	
Breaker Condition Monitoring								✓	✓
Vibration Sensor	✓	✓	✓	✓					
CSA			✓						

# R501 Rack Mount Comprehensive and Customizable Asset Monitoring Solution



**Most Versatile, Multi-Channel, Multi Asset Comprehensive Monitoring Solution**

## Key Features

- Widest range of monitoring available in 1 chassis with an option to expand
- Completely configurable system as per customer requirement
- Simple visualization & easy to configure
- Faster installation & lower maintenance cost
- Ethernet redundancy
- Easy to integrate with third party systems
- Supports multiple protocols: Modbus, DNP3.0, IEC 60870-5-104, IEC61850

## Benefit

- 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

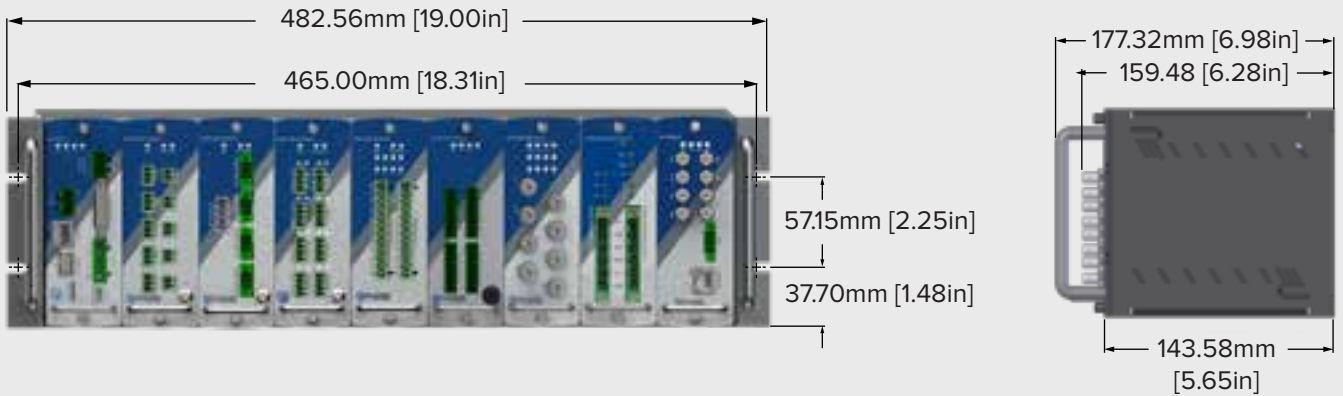




## Sensors that can be connected to R501

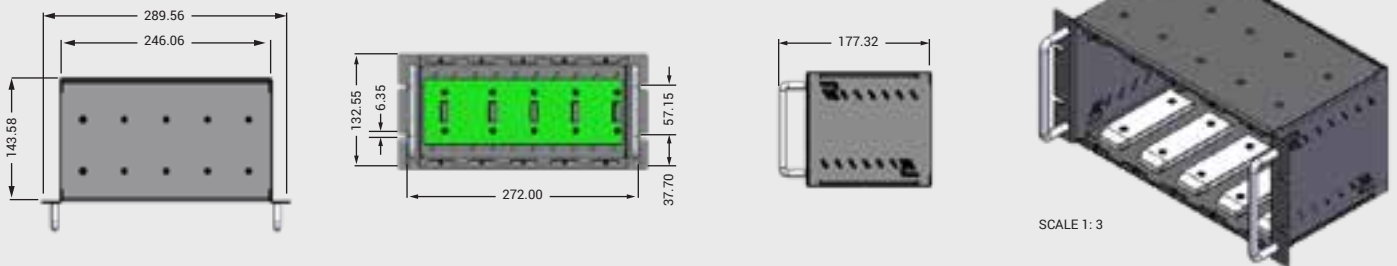
1. OTI,WTI, RTD, PRD, Breather, Buchholz Relay, LLG/OLI, Pressure Sensor etc.
2. Direct winding Hot Spot Monitor
3. Cooling System and Control Cabinet
4. Dissolved Gas Analyzer
5. Bushing Monitoring
6. Partial Discharge Monitor

## Product Drawing



Weight : 5 Kilograms

### Optional Smaller 3U Chassis



## Ordering Code

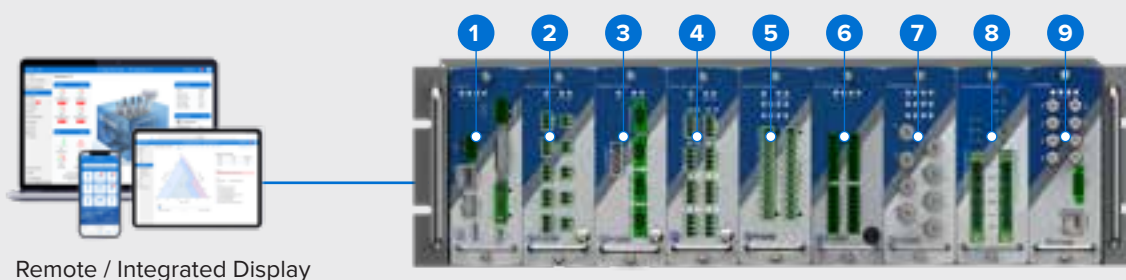
Contact our sales team for Ordering Code

# Fiber Optics

## Based Solutions Continue to Expand Renewable Technology

# R501 FEATURES

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. Bushing Monitoring Module

- 03 or 06 Channels
- Leakage Current
- Tan Delta / Power Factor
- Capacitance
- Phase Voltage
- Custom Tap Adaptor for Different Bushing



HF



UHF

## 9. 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

<b>POWER SUPPLY</b>	Input Power Requirement	24 Vdc (Default), Optional 48 Vdc, 125 Vdc, and any other (upon request)
<b>CPU MODULE</b>	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)
<b>SYSTEM CAPACITY</b>	Maximum number of Channels	Expandable to 256 Channels, Daisy chain up to 32 units (with Modbus, Canbus)
<b>FIBER OPTIC MODULES</b>	# 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)
<b>ANALOG INPUT MODULE</b>	# 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
<b>POWER MONITORING MODULE</b>	# 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.
<b>DIGITAL INPUT MODULE</b>	# of Input Channels	08 or 16 Channels
	Dry Contact	Resistance between the contact < 100 Ω
	Powered Contact	75 - 250Vdc
<b>ANALOG OUTPUT MODULE</b>	# of Input Channels	08 or 16 Channels
	Output format	4-20 mA or 0-5V or 0-10V Configurable for any measured / calculated value
<b>BUSHING MONITORING MODULE</b>	# of Input Channels	03 or 06 Channels
	Leakage Current Range	1mA to 200mA
	Monitoring Parameters	Tan Delta (PF), Capacitance, Phase Voltage
<b>PARTIAL DISCHARGE MODULE</b>	# 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
<b>OUTPUT RELAY MODULE</b>	# of Output Channels	04 or 08 Form C relays

# T501

## Rugged Monitoring Temperature Monitor



Power transformers play a vital role in the electrical system and undergo critical stress most of the times. Rugged Monitoring T501 offers a whole range of functions designed to let the utilities use their transformers to the greatest limit by accurately monitoring all parameters required to calculate health index in order to maximize asset life.

Our advanced transformer monitoring system T501 is capable to perform but not limited to data logging, event recording, dynamic loading analysis, remote communication including IEC 61850. Keeping an eye on your transformer, the monitoring system can be integrated with various fiber optic sensors for direct winding temperature monitoring, H2Sens and any other third party online dissolved Gas Analyzer for measurement of gas in oil.

A monitoring system must be Robust, Reliable and Responsive, Our system meets all these features and is competent to perceive.

### 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.
- 4 magnetically isolated current loop outputs (0-1 or 4-20mA selectable)
- RS 485 remote communication, fiber optics (Rs-485) communications and Ethernet ports
- Transformer 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.



## Technical Specifications

<b>POWER SUPPLY</b>	Input Power Requirement	24/48 VDC $\pm$ 10%
	Power Consumption	20 Watts
<b>ANALOG/DIGITAL INPUT MODULE</b>	# 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
<b>FIBER OPTIC MODULES</b>	Measurement Range	-80°C to +300°C (cryogenic 4°K range optional)
	Resolution	0.1°C
	Accuracy	$\pm$ 1.0 °C ( $\pm$ 0.2°C in relative temperature)
	Scan Rate	200 ms / channel ( Optional: Faster scanning rates available)
	Number of Channels	2 to 24 channels
<b>ANALOG OUTPUT MODULE</b>	# of Output Channels	04 Channels
	Output format	4-20 mA or 0-5Vdc / 0-10Vdc (Configurable for any measured / calculated value)
<b>OUTPUT RELAY MODULE</b>	# of Output Channels	08 Form C relays (5A)
	User Programmable	Yes, from Rugged Connect Software or webserver, if present
<b>DATA STORAGE &amp; CONFIGURATION</b>	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)
<b>COMMUNICATION</b>	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
<b>EMC TYPE TESTING</b>	Conducted & Radiated Emissions	ICES-003 (2016), CISPR32 (2015), CISPR11 (2015)
	ESD and EM Field Immunity	IEC61000-4-2, C37.90-3, IEC61000-4-3, C37.90.2
	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
<b>ENVIRONMENTAL AND MECHANICAL</b>	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)

# T301 Rugged Monitoring Temperature Monitor



**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

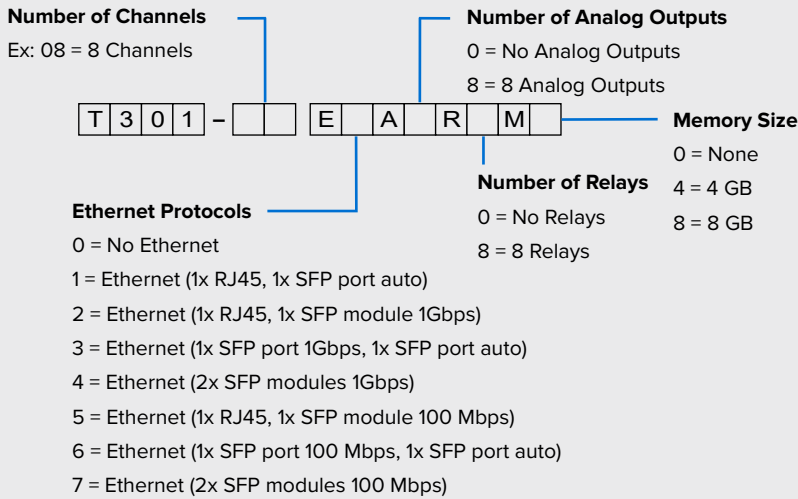
## Features

- 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

# O201

## Rugged Monitoring Temperature Monitor



**Rugged design, designed for reliability, multichannel fiber optic temperature monitor for 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  $-271^{\circ}\text{C}$  to  $+300^{\circ}\text{C}$ .

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

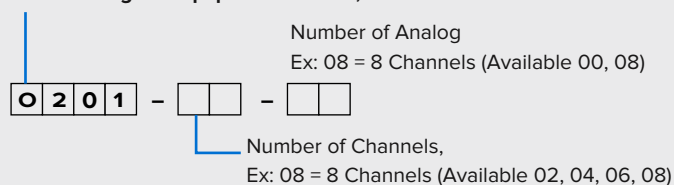


## Benefits

- 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)
Communication 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 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. Compact size and rugged enclosure of monitor make it easy to get installed and get started. Solution can communicate with its user over IEC61850 or using Rugged Monitoring proprietary Rugged Enterprise software suite.

System simple design enables it to get interfaced to third party protocols. Each Monitor is capable of transferring data directly to Rugged Enterprise software installed on Server or data can be temporarily stored in the device in case of communication loss between server and monitor. 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 denoising features help during onsite testing even in case of presence of huge noise.

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

## Applications

- Online continuous partial discharge monitoring
- 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 analysing 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
- IP65 rated

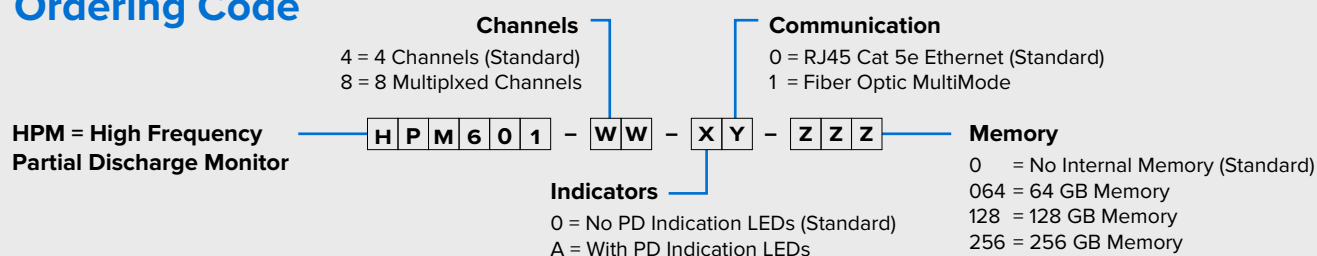
## Benefits

- Rugged sensors, monitor and Server
- Gigabit ethernet communication between monitor and Server
- Robust design
- 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

<b>MONITOR</b>	Channels	4 simultaneous channels
	Sampling Rate	250 MS/s
	Bandwidth	0.01-100 MHz
	Amplification	up to 28 dB, software selectable
	Filtering	Software configurable band pass filters
<b>MEMORY</b>	SSD	upto 256 GB (Optional)
	Dynamic Range	50dB
<b>DATA TRANSFER</b>	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)
<b>REMOTE COMMUNICATION</b>	IEC61850 (Optional)	
	Proprietary Rugged Connect for remote communication	
	Customized third party interface on request	
<b>COMMUNICATION LINK</b>	Type	Ethernet Fiber / Copper
	Cable Multimode	Fiber / Cat5e
	IP Rating	IP65
<b>TEMPERATURE RATING</b>	Ambient	-30°C - 60°C
	Storage	-40°C - 85°C
<b>POWER RATING</b>	Input Power	35 W max
<b>SYNCHRONISATION INPUTS</b>	2 Inputs, software	Internal
	Selectable	External
<b>DIMENSIONS</b>	260mm(L)x310mm(W)x120mm(H)	
<b>SOFTWARE</b>	Rugged Enterprise	

## Ordering Code



# CPM601 Comprehensive Partial Discharge Portable Monitor



**Rugged Monitoring presents state of the art Partial Discharge Monitor CPM601 to perform PD measurements in dual frequency range of 0.01MHz - 100MHz as well as 300MHz - 2GHz.**

With the help of advanced electronics embedded inside CPM601, user can perform PD measurement using variety of sensors without the need of using external frequency down converters. This presents All-in-One solution to perform PD measurements using Acoustic, Ultrasonic, HFCT, TEV, Coupling Capacitors as well as UHF Sensors on all assets, GIS, Power Transformers, Rotating Machines and Power Cables.

Compact and sturdy enclosure with electronics make it portable, easy to carry, enabling the user to perform PD measurements with less hassle. Monitor is capable of transferring the data directly to PD Connect 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 onboard denoising features help during onsite testing in case of presence of huge noise.

**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.**

## Applications

- Online periodic partial discharge monitoring
- 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, compact design
- Dual Frequency Ranges; 0.01MHz - 100MHz as well as 300MHz - 2GHz
- Compatible with Acoustic, Ultrasonic, HFCT, TEV, Coupling Capacitors as well as UHF Sensors
- An interactive and comprehensive software PD Connect 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



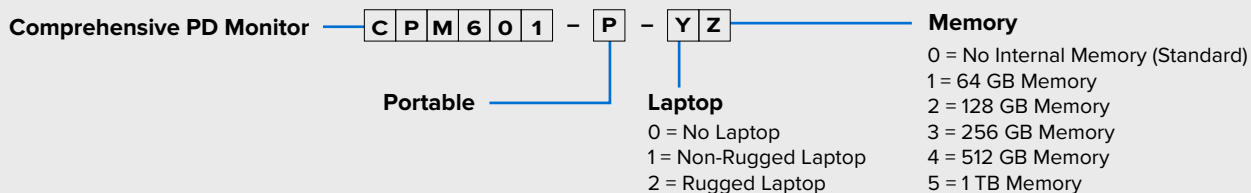
## Benefits

- Rugged sensors, monitor and laptop
- Gigabit ethernet communication between monitor and laptop
- Enhanced noise rejection
- Realtime denoising
- Rugged sensors, monitor and laptop
- Gigabit ethernet communication between monitor and laptop
- Enhanced noise rejection
- Realtime denoising

## Technical Specifications

<b>INPUT CHANNELS</b>	Channels	8 Multiplexed (4x HF and 4x UHF)
	Sampling Rate	250 MS/s
	Amplification	up to 50 dB, software selectable
	Filtering	Software configurable band pass filters
<b>HF CHANNELS</b>	Bandwidth	0.01 - 100 MHz
	Sensitivity	-50dBm
	Dynamic Range	50dB
<b>UHF CHANNELS</b>	Bandwidth	300 MHz - 2 GHz
	Sensitivity	-80 dBm
	Dynamic Range	70 Db
<b>DATA TRANSFER</b>	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)
<b>MEMORY</b>	SSD	up to 1 TB (Optional)
<b>COMMUNICATION LINK</b>	Type	Ethernet Copper
	Cable	Cat5e
<b>SYNCHRONISATION INPUTS</b>	2 Inputs, software	Internal
	External	selectable
<b>IP RATING</b>	IP 65	
<b>TEMPERATURE RATING</b>	Ambient	-30°C - 60°C
	Storage	-40°C - 85°C
<b>POWER RATING</b>	Input Power	45 W
<b>DIMENSIONS</b>	260mm(L)x310mm(W)x120mm(H)	
<b>LAPTOP</b>	Rugged Laptop	(Optional)

## Ordering Code



# 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.**

The PD201 PD Monitor combines reliability and user-friendly configuration 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.

**We at Rugged Monitoring have a dedicated team of experts available for customizing partial discharge monitoring solutions to meet specific customer needs.**

## 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	User selectable integrated filters with 5Mhz to 25Mhz bandwidth range
- Software Noise Gating	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

# PD211

## Rugged Partial Discharge Monitoring Module for OEMs



**Rugged Monitoring PD211 is a compact design, designed for reliable Partial Discharge (PD) Monitoring Module for Transformers, Switchgears, GIS and Power Cable Terminations.**

PD211 is based on the UHF (Ultra High Frequency) technology for PD signal acquisition and analysis. The Monitor is a combination of reliability and user-friendly configuration software. It has two variants with 04 channel and 08 channels, that can connect to 4 and 8 UHF-PD sensors respectively. The system can be integrated with any UHF PD sensors that are having response between 100MHz to 2000MHz.

The PD211 connects to the UHF PD sensors installed at the MV/HV assets. It measures the Ultra High Frequency (UHF) signals emitted by the PD Faults in HV/MV assets. The UHF signals are then analyzed for PD activity and categorization of 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 into 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 UHF PD Sensors
- PD Monitoring in GIS using UHF PD Sensors
- PD Monitoring in MV Switchgear using UHF PD Sensors
- PD Monitoring in Power Cables Terminations UHF PD Sensors

### 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

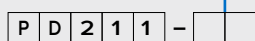


## Technical Specifications

Number of Channels	04 or 08 (Simultaneous acquisition, No Multiplexing)
Sampling Rate	125 Ms/s
Acquisition Bandwidth	300Mhz - 2000Mhz
Vertical Resolution	12-Bit
PD Sensitivity	-80dBm
Noise Elimination	
- Bad Pass Filters	Tuneable for different frequencies including but not limited to 440Mhz, 800Mhz, 1100Mhz, and 1600Mhz
- Software Noise Gating	Advanced denoising algorithms
Data Storage (Memory)	MicroSD external memory slot (Up to 2 TB)
Compatible PD Sensors	Any Ultra High Frequency (UHF) PD Sensors with sensitivity 100Mhz - 2000MHZ.
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

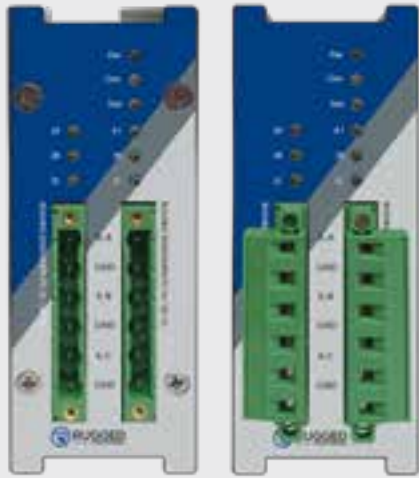
Number of Channels  
 04 = 4 Channels;  
 08 = 8 Channels



**Memory**

- 0 = No Internal Memory
- 1 = for 64GB Memory
- 2 = for 128GB Memory
- 3 = for 256GB Memory
- 4 = for 512GB Memory

# BM201 Rugged Bushing Monitoring Module for OEMs



The Rugged Monitoring BM201 is a compact design, designed for reliability Bushing Monitoring Module that can operate under High voltage substation environments.

The BM201 Bushing Monitor combines reliability and user-friendly configuration software. It has two variants, 03 channel and 06 channels, that can monitor 3 and 6 bushing respectively.

The system is based on proven Balance Current (Sum of Current) method for measuring Tan Delta (Power Factor - PF), and Capacitance of Condensing Type Bushings.

The BM201 connects to the Bushing Adaptors installed at the Voltage / Test taps of the condensing (Capacitive) type bushing. It measures the leakage current from the three phases and calculates the changes in the Tan Delta and Capacitance of the bushings. The measured and calculated values are then sent to the third-party system via Modbus (RTU) protocol using built-in serial (RS-485) port. The BM201 also captures the hourly average of the Tan Delta, Capacitance, Voltage for absolute and rate of change. It has the data integration capability of multiple monitoring platforms.

**We at Rugged Monitoring have a dedicated team of experts available for customizing bushing monitoring solutions to meet specific customer needs.**

## Benefits

- Suitable for OEM-type applications (TMS, Gateways)
- Multiple mounting options - Din-Rail and Direct (Bare-board)
- Cost optimized solution for bushing monitoring
- Software designed for integration into monitoring systems / gateways
- Robust datalogging and Analytics
- Customizable according to customer specific applications
- Sensors and Monitors do not require complex recalibration
- Highly robust and safe monitoring systems

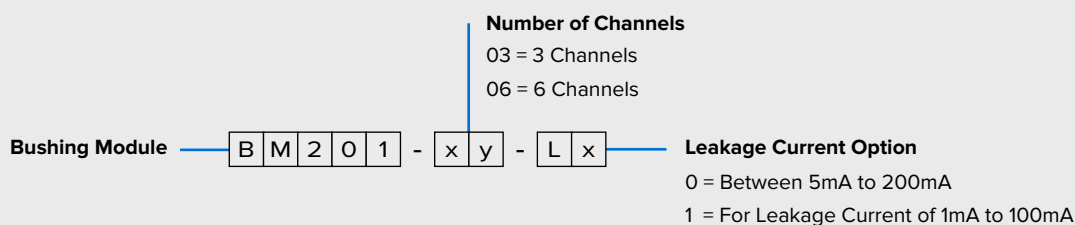
## Applications

- Online monitoring of condensing / capacitive type bushings
- Online Monitoring of Transformer Bushings
- Online Monitoring of Breaker Bushings

## Technical Specifications

Measurement Range Leakage Current	1mA to 200mA
Measurement Accuracy	
Leakage Current	± 0.5%
Tan Delta (PF)	± 0.5%
Capacitance	± 0.1%
Voltage	± 0.5%
Scan Rate	-200 ms / channel
Memory	MicroSD external memory slot (Up to 2 TB)
Logging	1 sec interval on USB
Serial Port	RS-485 with Modbus RTU
Configuration Port	USB (to use with Rugged Connect windows software)
Operating Temperature	-25 °C to 75 °C
Storage Temperature	-40 °C to 85 °C
Number of Channels	03 and 06 channels
Dimensions	4.92" x 4.92" x 1.89" (125mm x 125mm x 48mm)
Humidity	95% Non-Condensing
Power Input	12 - 24V DC (Default)
# of Relays Outputs	01 x Fail Safe Relay for System Failure

## Ordering Code



# Asset Monitoring : Enterprise Architecture

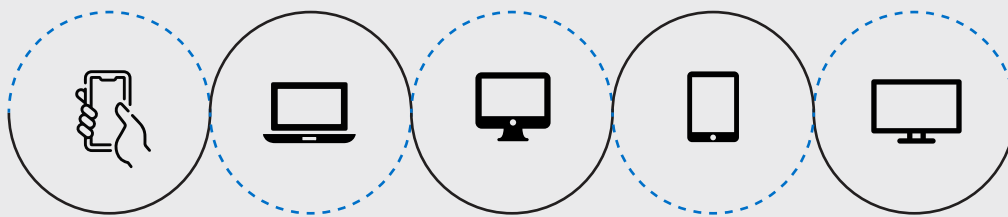
Compatible with Rugged Monitoring Enterprise Solution



## 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**

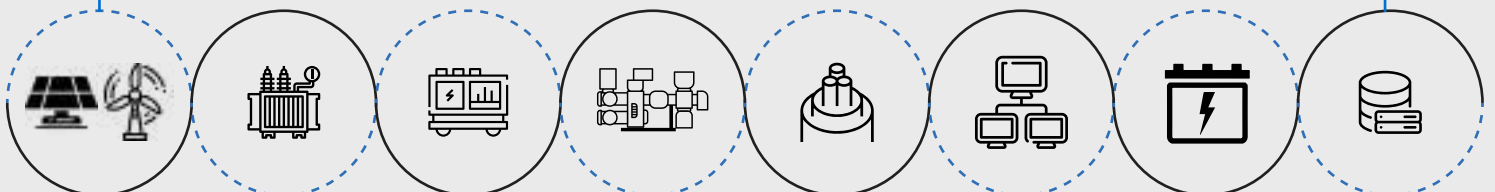
**MQTT**

## Monitoring System

**T301, O201, H201, T501, R501,**

**HPM601, CPM601, PD201, PD211, BM201**

## Asset Data



Solar Panels  
& Wind mills  
Monitoring  
System

Transformer  
Monitoring  
System

Switchgear  
Monitoring  
System

GIS  
Monitoring  
System

Power Cable  
Monitoring  
System

Offline Data/  
Inspection  
Test Results

Ess/ Battery

- Historian  
- CMMS  
- SCADA/ DCS

# 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**

# 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 9000



ISO 14000



ISO 45001/  
OHSAS 18000



Lloyd's  
Register



ATEX  
Certification


# Our Presence Across the Globe



## Head Office

 **Canada**

1415 Frank-Carrel, Suite  
230, Quebec, QC - G1N  
4N7, CANADA

 +1-418-767-0111

[Asia Pasific](#) | [India](#) | [Europe](#) | [Latin America](#) | [Middle East](#) | [North America](#)



[in](#) [f](#) [@](#) [t](#) [v](#) [ruggedmon](#)

 [info@ruggedmonitoring.com](mailto:info@ruggedmonitoring.com)

 [www.ruggedmonitoring.com](http://www.ruggedmonitoring.com)

©2021 Rugged Monitoring Company. All rights reserved. Information subject to change without notice. All trademarks are properties of their respective companies, as noted herein.