**RMM MONITOR**

Dynamic Ratings’ Rotating Machine Monitor (RMM) helps industrial facilities improve reliability, leading to increased uptime and maintenance savings. We design, manufacture and integrate innovative sensors, monitors, and controls for data collection, analysis, and diagnostics. With the use of our asset management tools, our customers realize maximum benefit from online and partial discharge monitoring.

Motors are critical assets in many industrial manufacturing processes. Studies by IEEE and EPRI (Electric Power Research Institute) indicate that up to 40% of electrical failures on rotating machine are attributable to failures in the stator insulation systems. Motor failures are caused primarily through winding circuit and cable faults caused by insulation failure.

**Did You Know?**

There are three methods for monitoring partial discharge: Electrical, UHF, and Ultrasonic. Electrical PD Measurement is the only method that uses IEEE and IEC factory testing standards for PD calibration. The unique advantage of Electrical is that the charge content in a PD pulse can be related to a known reference. For more information, request our white paper Review of Online PD Measurements.

**Case Study**

**Challenge:** A US hydro producer was performing partial discharge measurements on a periodic basis for over 10 years. Their measuring equipment and technology was obsolete.

**Solution:** They decided to implement continuous PD monitoring from Dynamic Ratings on two generators because it was less expensive than purchasing a new portable analyzer. Since their existing coupling capacitors only provided 10-15% winding coverage, the system was upgraded to reuse six existing RTDs as additional PD sensors. The RMM monitor was able to detect PD that occurred deeper into the winding. This was a breakthrough for making better decisions as to the health of their equipment. The customer decided they also wanted to monitor the isolated phase bus duct and transformer by installing the Dynamic Ratings DTM Monitor.

**Result:** This complete system now monitors the generator, bus duct, and transformer which has significantly reduced their offline maintenance costs for their critical assets.
SENSORS FOR PARTIAL DISCHARGE MONITORING

**Coupling Capacitors**
The Coupling Capacitor is a versatile partial discharge sensor commonly used to detect PD in many applications. We offer three voltage levels: 8, 16, and 28 kV.

**RTD-PD Sensor**
The RTD-PD sensor module provides detection of PD activity which occurs deep within the windings of a generator or motor. This sensor expands the zone of coverage of the machine windings.

**GPCS Sensor**
The Ground Path Current Sensor (GPCS) provides non-invasive, directionally sensitive Partial Discharge (PD) detection in electrical equipment.

**RFCT Sensor**
The Radio Frequency Current Transformers (RFCT) provides non-invasive, directionally sensitive PD detection on electrical equipment by detecting activity in the ground connection.

**Bushing Sensors**
The BAU bushing sensors have over 50 custom adapters to choose from for various test tap styles. BAU sensors have three layers of protection built-in with a safety factor of 2.

**Rogowski Coil (RC)**
An RC is a polarity sensitive air-core high frequency current transformer used on high voltage power transformer applications. Partial discharge (PD) activity and many noise signatures are found in the high frequency range.
The engineered to order E Series monitor provides a configurable hardware platform for custom solutions. It provides reliability and maintenance savings leading to optimal transformer performance.

The user configurable C50 Series monitor provides continuous monitoring of operational and performance data of your transformer which allows for better utilization and longer life.

The DM Series Monitor provides advanced partial discharge and bushing monitoring for transformers. It is scalable allowing customers to extend monitoring coverage to suit their needs.

The cost effective B100 Electronic Temperature Monitor provides accurate asset control, measurement and secure communications for large power transformers.
Case Study

Challenge: Following several high voltage transformer bushing failures, a utility operating a 400kV network performed offline power factor (PF) and capacitance testing of similar bushings to try to identify bushings that were in a deteriorated state. The offline testing did not always detect a problem with the bushings, leading the utility to investigate alternative testing techniques. The utility decided to investigate online monitoring options. Online electrical partial discharge measurements can provide an early warning of incipient failure conditions in a bushing. These warning signals are available before changes in bushing leakage currents occur and before the problems are evident in power factor and capacitance measurements.

Solution: The utility installed a Dynamic Ratings bushing monitor and sensors. Within days after installing the bushing and electrical PD monitor on the transformer, the PD monitor went into alarm. The data was downloaded and sent to Dynamic Ratings for analysis. The PD monitor showed discharge activity on two of the three phases. At the same time, a main tank DGA sample was taken and data from a two gas DGA monitor installed on the main tank was downloaded. Both the online and offline DGA data indicated the gases were stable in the main tank and were not increasing. Analysis of the PD signatures indicated the discharges did not appear to be coming from the main tank. Since the bushings had been recently tested, a decision was made to continue monitoring the transformer. Over the next few weeks, data from the monitor was downloaded on a regular basis and analyzed by DR. During this time, the monitor reported periods of high activity and low activity which is typical during the beginning stages of a failure.

Result: Finally, following a series of alarms from the monitor, the equipment was removed from service so that they could take a DGA sample from the bushings. The information from the monitor, combined with the DGA and offline test data indicated there were some serious defects in two of the three bushings. For more details, reference case study Online Monitoring Detects Electrical PD Activity in 420 kV Bushings then Confirmed by DGA.

Did You Know?

Bushing failures caused 27% of transformer failures from 2000 to 2014. The Cigré Technical Brochure 642, reveals that “Windings, tap changer and bushing related failures were the major contributors, followed by lead exit related failures, irrespective of application or manufacturing period,” and “Failures originating in the bushings most often lead to severe consequences such as fires and explosions,” further bushing failures lead to catastrophic failure and/or fire in 38% of the cases.”
### iBridge Communications

#### iBridge Device
The iBridge allows you to create a TCP/IP network over any existing wire, connecting remote devices with computers, gateways, routers, and more. The iBridge can also convert DNP or Modbus data from a serial format to the same protocol in TCP/IP.

#### Gateway Device
The Gateway device facilitates multi-point connectivity. Additionally, Gateway devices allow for the configuration and monitoring of an iBridge system and the associated IP ingress/egress of communication through a LAN and chosen signal wire.

#### eXtender Device
The eXtender is an amplifier available to extend the range of transmissions. This can be installed in situations where the communications distance between iBridge devices is limited due to the quality or layout of wiring.

#### Inductive Couplers
The iBridge Networking and Communications Solution uses snap-on inductive signal couplers to transmit data over existing wires. Signal couplers are conveniently available in 9, 13, 18, or 25mm core sizes.

### Switchgear and Cable

#### Switchgear and Cable Monitor
The Switchgear and Cable Monitor is a continuous partial discharge monitor which monitors, stores and correlates PD and other operating dynamics. It provides information as to the health of the medium voltage insulation systems, of switchgear, cables and bus ducts.
Did You Know?

At Dynamic Ratings, asset management is at the core of our business. Early in our process, we work closely with our customers to create and define standards to ensure that their monitoring solution is implemented in a consistent manner regardless of the age, make or model of electrical assets being monitored. This consistent approach makes the installation, support and use of the system easier.

Services

Our team assists in the foundational elements of your asset health programs. We offer services such as:

• Program and process planning
• Engineering Design
• Configuration and set up of IEDs
• Site walks
• Project Management
• Site specific installation drawings
• Drawing redlines
• Installation
• Commissioning
• End-to-end system testing
• And more...

DynamicMetrix®

DynamicMetrix® is a sophisticated web-based monitoring solution for your power generation assets. Using this software, we help utilities collect and use condition-based monitoring information on their high voltage electrical equipment to improve their business performance. Situational awareness and prioritization of issues throughout the systems supports your team to make intelligent decisions regarding investment levels and timing.

• Real time analysis of condition data
• Integrated system information maximizes performance
• Geo-spatial views and the ability to drill down to look at specific assets
• Optimized maintenance planning improves safety and situational awareness

Training & Support

Once you deploy your asset health program, we offer training and support to help you get the most out of monitoring.

• Subject matter experts – our subject matter experts can assist with condition assessment reports, diagnostic support, and customized training classes
• Technical Support – We have a team ready to help you with any real time technical support questions you have.
• Customer Trainings – Dynamic Ratings offers several training programs for users. Users can customize trainings to meet their needs.
• User Group Meetings – These meetings allow users to come together to discuss best practices, compare notes, and offer feedback to Dynamic Ratings.
We are the industry **Responsive Asset Health Solutions** provider. We use comprehensive end-to-end products and services to improve customers business performance.