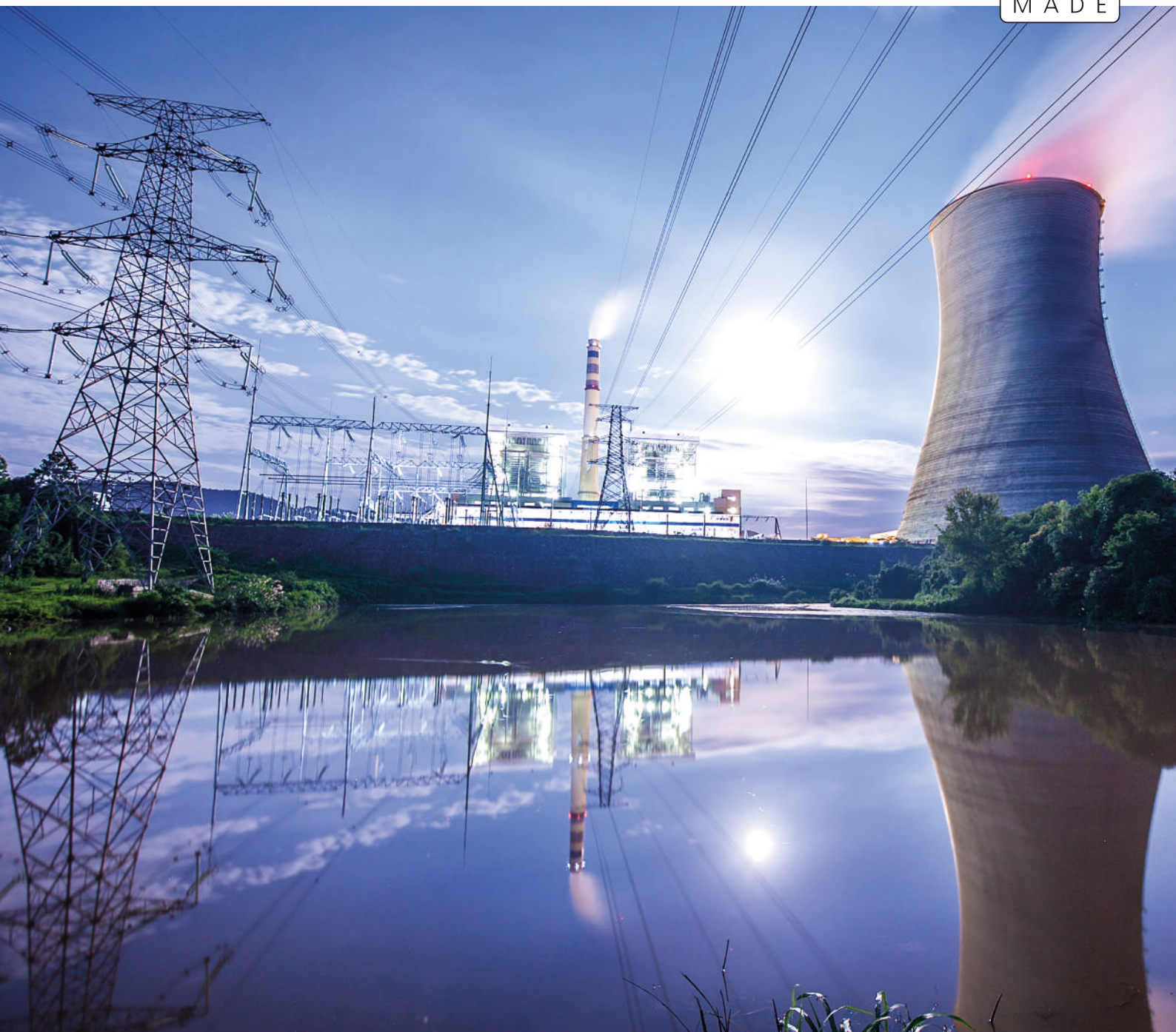




# Rotating machinery Protection, Condition Monitoring and Diagnostic systems

MC-monitoring your solution provider  
for assets integrity and efficiency

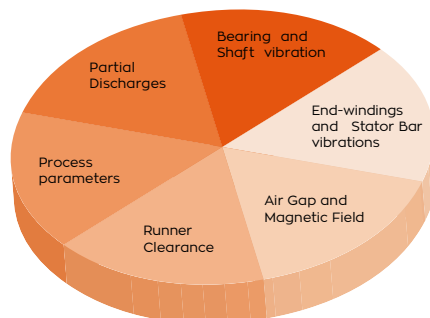




# Solution provider for rotating machine monitoring

## MC-MONITORING

MC-monitoring SA is a Swiss company providing protection, monitoring and diagnostics systems for rotating machines used in the power generation industry. Founded in 1993, the company is now renowned worldwide for the reliability and quality of its products. Today, MC-monitoring is an approved supplier of major OEMs such as ABB, Alstom, Andritz, Ansaldo, BHEL, Dongfang Electric, Doosan Heavy Industries & Construction, General Electric, Siemens, Voith Hydro and many other manufacturers. The company is also very proud to serve a large amount of end-users, as well as engineering, consulting and service companies.



The company provides monitoring solutions for hydroelectric machines, large turbo-generators, gearless mill drives, gearless windmills and other industrial rotating machines. MC-monitoring's domain of expertise covers the

condition monitoring of parameters such as bearing and shaft vibrations, end-winding vibrations, stator core and stator bar vibrations, magnetic flux monitoring, air gap, partial discharge as well as other electrical and process parameters. For more than two years, MC-monitoring, in collaboration with its sister company Sparks Instruments, has been developing a PD product family able to cover online basic, expert and portable PD analysis.

A wide experience and knowledge of machinery coupled with high quality products and services enable MC-monitoring to offer cost effective systems meeting high-level customer requirements. Thanks to its innovative spirit, MC-monitoring offers original and effective future oriented solutions in its domain of expertise.

## PERMANENT OBJECTIVE

Our permanent objective is to provide customers with comprehensive and innovative solutions based on proven and leading technologies. Our sensors and systems are applied in very demanding and harsh environments. Therefore, each product is designed, manufactured and controlled to meet the highest standards of quality required by the application. Our customer oriented culture drives us towards product excellence.





# Your Partner for reliable and cost effective condition monitoring

## PROVIDING TAILOR MADE CONDITION MONITORING SOLUTIONS

### GLOBAL SUPPORT AND SERVICE

With our headquarters in Switzerland, MC-monitoring is a global company supported by a strong international network of qualified partners. All our partners are experts in the field of Condition Monitoring and are able to provide local services and support.



### TOWARDS INNOVATION AND EXCELLENCE

Our core competences are focused on the engineering, manufacturing and commercialization of sensors and monitoring systems.

Our sensor technology is covered by several patents and is well recognized worldwide. Our airgap sensors have been exclusively selected by several customers for many years. Continuously driven by our customer partnership, we jointly develop many innovations such as airgap sensors for wind-

mills and variable speed generators, rotating air-gaps for bulb generators, runner clearance probes for hydrogenerators or submersible probes for tidal stream generators. Driven by excellence, we commercialize continuously enhanced products such as airgap transmitters with digital conditioners allowing higher accuracy and long term stability.

Our monitoring systems are designed for each application to provide the best value-for-money systems. This approach allows our customers costs saving over the whole procurement process: project specification and definition; detailed engineering; parameterization; documentation; installation; commissioning and maintenance. All our monitoring systems are supplied as standard with all common interfaces for easy integration into existing automation architecture.

### QUALITY MANAGEMENT

Since its creation in 2001 MC-monitoring is applying systematic methods to understand, control, and improve overall customer and partners satisfaction. Our continuous improvement approach focuses on achieving and exceed distinctive customer value proposition. Our robust quality management system guide and govern our operations from top to bottom and is assuring that customers continue to receive the very best in quality and service. Our company is ISO 9001:2015 certified. This certification is the confirmation of our ability to deliver highest quality products and services, and the evidence of our strong commitment to excellence.



# Product range for integral solutions

## SENSORS & CONDITIONERS



### RELIABLE PERFORMANCE

Trust in the reliability and performance of our sensors and conditioners.

Rigorously tested and built with quality in mind, our solutions are designed to withstand demanding environments and deliver consistent results.

Rely on our products to provide accurate measurements and dependable performance, ensuring confidence in your data-driven decision-making processes.

**AGT** Air Gap Transmitters



**PAS/PVS** Piezoelectric Acceleration/Velocity Sensors



**RCP** Runner Clearance Probes



**PPT** Proximity Probes Transmitters



**PDC** Partial Discharge Coupler



**Eagle PPT Smart Series**



**FAS** Fiberoptic Acceleration Sensors



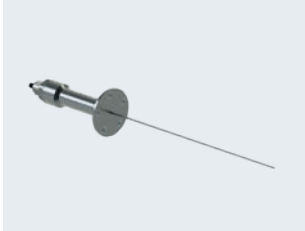
**MFT** Magnetic Flux Monitoring



**LVS** Linearized Vibration Velocity Sensors



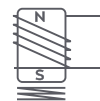
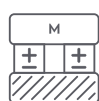
**RTM** Rotor Temperature Monitor



**CPP** Capacitive Proximity Probe



**SPP** Submersible Proximity Probe

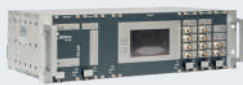


# Product range for integral solutions

**PMM-300P** Vibration  
& Airgap Monitoring  
Module



**PMS-300P** 3U/6U  
Process Monitoring  
System



**PMM-305** Process  
Monitoring Module



**TMS-6141** Portable  
Partial Discharge  
Analyzer



**UDL-8000** PD,  
Endwinding, Rotor Flux  
& Shaft Voltage/  
Current Monitoring



## PROCESSING MODULES & DATA ACQUISITION SYSTEMS



### HARNESS THE POWER OF DATA

The future is data-driven, and our processing modules and data acquisition systems position you at the forefront of this revolution. Embrace the transformative power of data and unlock new possibilities for your business. Experience streamlined processes, improved efficiency, and unparalleled decision-making capabilities that propel your organization towards growth and success.

Our advanced processing modules are meticulously engineered to handle complex data streams with unrivaled precision. With lightning-fast processing capabilities, they transform raw data into actionable insights, unlocking the true potential of your operations. Seamlessly integrate our modules into your existing infrastructure to enhance your data processing capabilities and achieve unprecedented efficiency.

# Product range for integral solutions

## CMS-500P ORCA SOFTWARE



### HARNESS PREDICTIVE INSIGHTS

Our advanced condition monitoring software leverages the power of predictive analytics to provide real-time insights into the health of your assets. By continuously monitoring critical parameters, analyzing trends, and detecting anomalies, our software enables you to anticipate potential failures, prevent costly downtime, and make data-driven decisions with confidence.

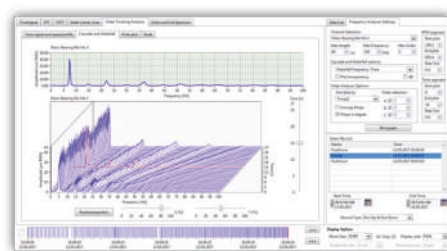
### SEAMLESS INTEGRATION

Our condition monitoring software seamlessly integrates with a wide range of data sources and monitoring systems, ensuring compatibility and ease of implementation. Connect multiple devices, sensors, and data streams to create a comprehensive monitoring ecosystem. Achieve full visibility of your equipment health by consolidating data from various sources into one unified platform.

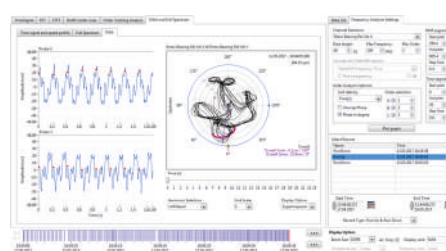
CMS-500P Orca is dedicated condition monitoring, diagnostic and optimization software platform that enables the predictive methods which can be used to help improve the effectiveness of industrial machinery. The advanced diagnostic and intelligent set of tools provided by the software, combined with dedicate robust

and flexible PMS-300P Rhino hardware platform, enables operators to optimize efficiency and extend the life of machinery while facilitate consistent and reliable decision making. Fully featured and easy to use set of diagnostic plots to evaluate condition.

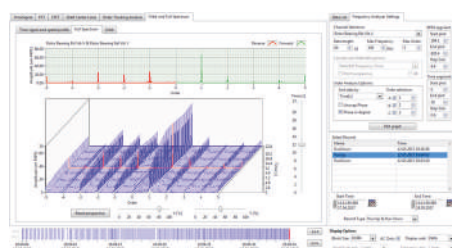
FFT Mingap Signature Orbit Pole Profile Flux Signature Order Tracking  
Stator Profile Full Spectrum Bode Frequency Analyzer  
Polar View Time Signal Flux Deviation Polar Diagram  
Shaft Center Line Flux Profile Cascade/Waterfall



TRACKING ANALYSIS -  
WATERFALL AND CASCADE



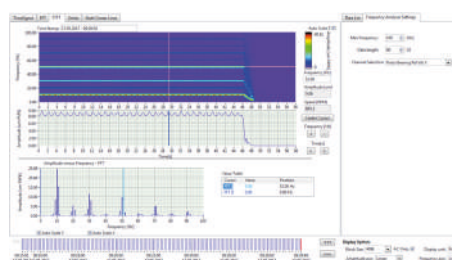
ORBIT



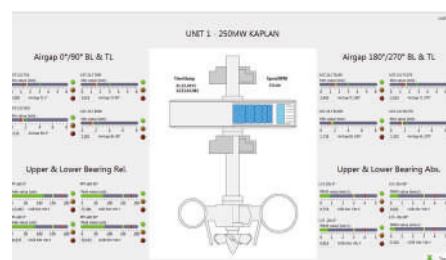
FULL SPECTRUM



FLUX PROFILE



FFT & STFT SPECTRUM



MACHINERY MIMIC



# Solutions overview

## HYDRO TURBINE COMPREHENSIVE MONITORING

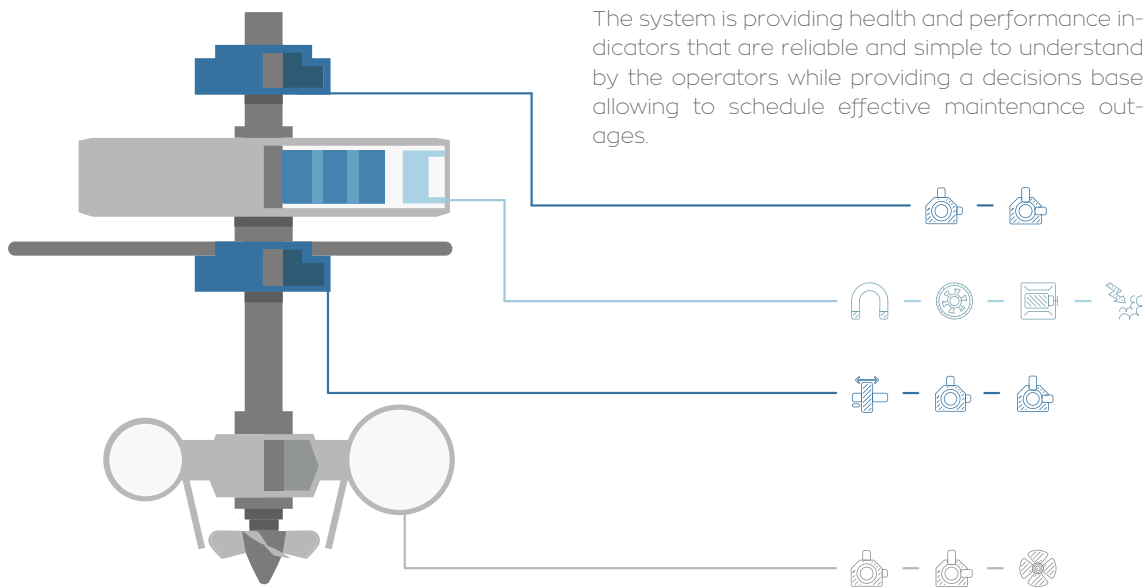
MC-monitoring is proposing a state-of-the-art properly engineered protection and condition monitoring system specifically tailored for hydroelectric machinery. The comprehensive solution is addressing the nova day power generation operating practices where peak demand puts considerable mechanical and electrical stress on hydroelectric machinery.

### BETTER INFORMATION FOR PLANTS OPERATORS










Continuous condition monitoring system that can deliver consistent mechanical and electrical condition information become a compelling element contributing to decrease operational costs while simultaneously improve the operational performance by reducing scheduled and unscheduled downtime.

### ADVANCED TECHNIQUES FOR EQUIPMENT HEALTH CHECKS AND FAILURE ROOT ANALYSIS.

The MC-monitoring's expertise, gained over the past several decades, regarding malfunctions and failure modes on hydro units and the appropriate measurements to detect these problems, was used to drive the development of most comprehensive condition based monitoring system.



### MONITORING SOLUTIONS

-  Shaft & Bearing Vibration
-  Magnetic Flux Monitoring
-  Endwinding Monitoring
-  Axial Thrust Position Monitoring
-  AirGap Monitoring
-  Partial Discharge Monitoring
-  Runner Clearance Monitoring
-  Rotor Poles Temperature
-  Creep Detector

### SENSORS

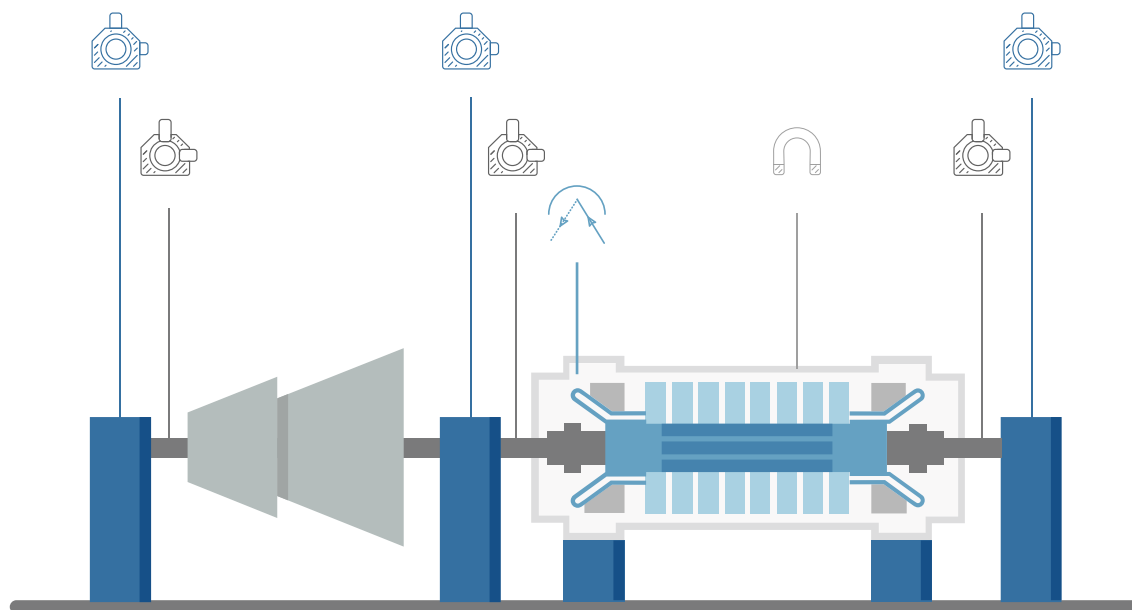
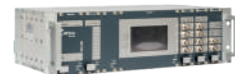
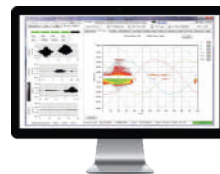
-  Airgap
-  Fiberoptic
-  Magnetic Field Transducers
-  Partial Discharge Couplers
-  Runner Clearance Probes
-  Smart Proximity Probes Ppt-280
-  Piezo Acceleration
-  Linearized Velocity

# Solutions overview

## GAS & STEAM TURBINES SOLUTIONS OVERVIEW

### PROTECTION, CONDITION MONITORING AND DIAGNOSTIC SYSTEMS FOR HEAVY DUTY GAS AND STEAM TURBINES

The solution for online monitoring system, proposed by MC-monitoring is based on the Rhino PMS-300P platform, which offers modularity, scalability and high flexibility to easily realize advanced protection and condition monitoring. Combined with high reliability and accuracy transducers, for online supervision of critical assets, extend their life cycles and reduce total cost of ownership.



#### MONITORING SOLUTIONS



Shaft & Bearing Vibration



Shaft & Bearing Vibration



Endwinding Monitoring



Interturn Short Circuits

#### SENSORS



Proximity Probes



Piezo Acceleration



Linearized Velocity



Magnetic Flux Probe



Endwindings



# Solutions overview

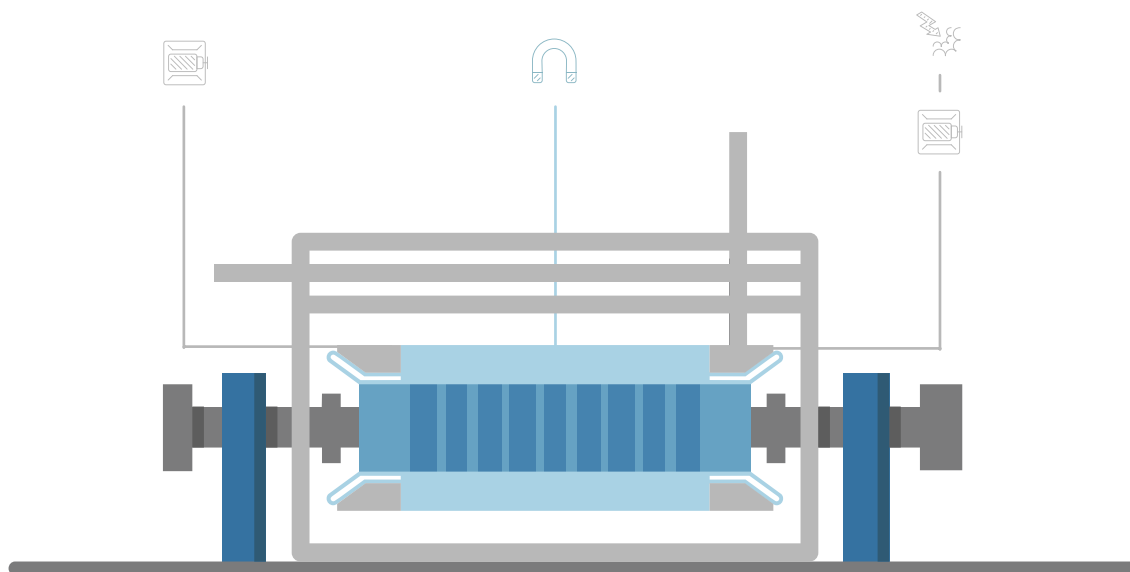
## TURBOGENERATORS SOLUTIONS OVERVIEW

TURBOGENERATORS ONLINE CONDITION MONITORING, AN ESSENTIAL TOOL TO FACILITATE CONDITION BASE MAINTENANCE AND MINIMISE THE LOSS OF REVENUE.

A turbo generator is the combination of a turbine directly connected to an electric generator for the generation of electric power. Large steam-powered turbo generators provide most of the world's electricity. A power plant availability depends crucially on the reliability of the major high voltage components such as the generator, isolated phase bus and transformer. Electrical or mechanical failure

of these components can lead to serious damage with long shutdown period.




MC-monitoring provides comprehensive systems that can early detect and prevent abnormal condition of the electrical insulation, stator winding vibration and interturn short circuits within the rotor windings.



### MONITORING SOLUTIONS

-  Endwinding Monitoring
-  Partial Discharge Monitoring
-  Interturn Short Circuits

### SENSORS

-  Fiberoptic
-  Magnetic Flux Probe
-  Partial Discharge Couplers

# Solutions overview

## PUMPS, FANS, COOLING TOWER,... SOLUTIONS

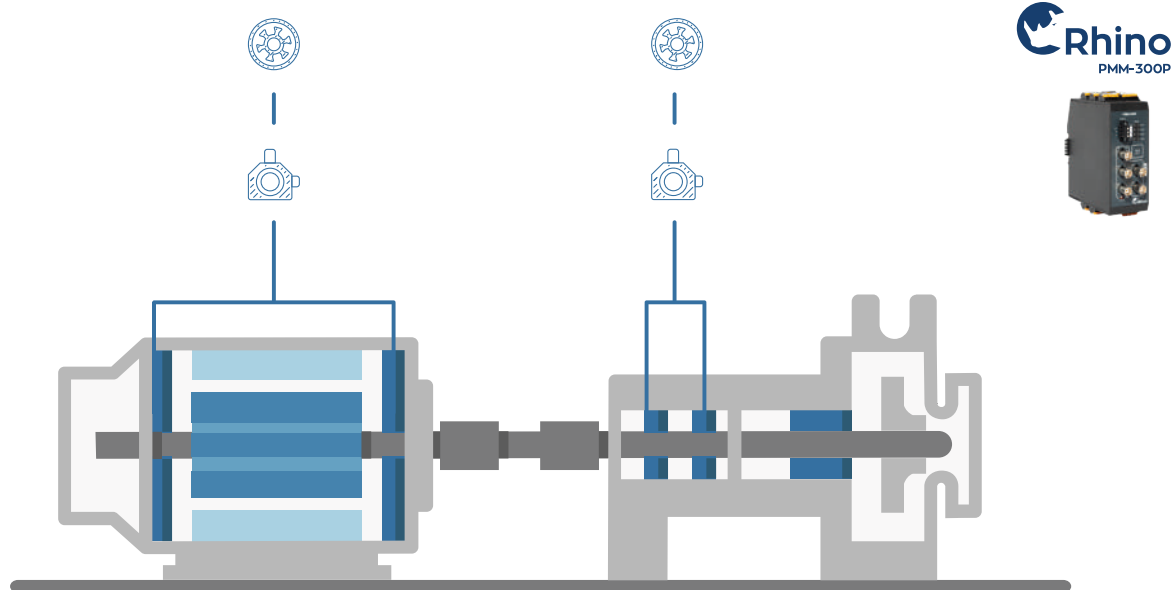
### PUMPS, FANS, COOLING TOWER, SOLUTIONS

MC-monitoring provides a wide range of online monitoring solutions for industrial equipments such as pumps, fans and cooling towers.

Our monitoring solutions are able to detect typical failures such as mechanical misalignment, unbalance and wear of sleeve bearings and roller bearings. These solutions are developed according to international standard such as ISO-10816 for the

absolute bearing vibration, ISO-7919 for the relative shaft vibration and VDI-3832 for roller bearing.




Our solutions include sensors, data acquisition units and software. Our proximity probes and piezoelectric sensors are specifically designed for the application and monitoring requirements. Our acquisition units Rhino PMS-300P and PMM-300P are compatible with all our sensors, are able to process sensors signals according to a wide range of monitoring solutions. Our software is able to record trending and raw data for monitoring and analysis.



### MONITORING SOLUTIONS

-  Shaft & Bearing Vibration
-  Shaft & Bearing Vibration
-  AirGap monitoring

### SENSORS

-  Proximity probes PPT-280
-  Piezo acceleration
-  Linearized velocity

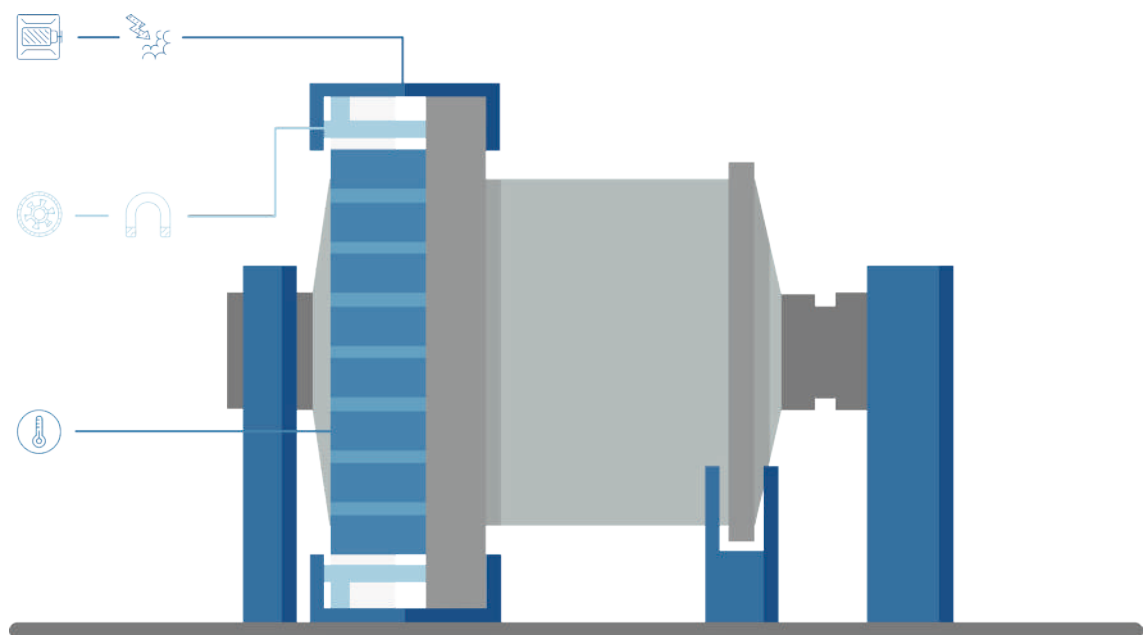


## GEARLESS MILLS DRIVES SOLUTIONS OVERVIEW






**REACH THE ULTIMATE TARGET OF AVAILABILITY AND PRODUCTIVITY TO MEET YOUR BUSINESS OBJECTIVES FOR PROCESSING PLANT.**

Increasing demand for higher productivity and energy efficiency requires constant innovation. MC-monitoring is proposing the online highly integrated monitoring system combined with robust sensing technologies fulfilling the requirement of the mining harsh environment.

Our reliable diagnostic system helps to implement a cost effective predictive maintenance strategy based on earlier detection of electrical and mechanical failures in Gearless Mill Drives. The potential risks of damage such as stator winding insulation, rotor and stator airgap, rotor winding over temperature are continuously acquired during machinery operation providing to plant owner both an insight assets health and the ability to make better decisions.



### MONITORING SOLUTIONS

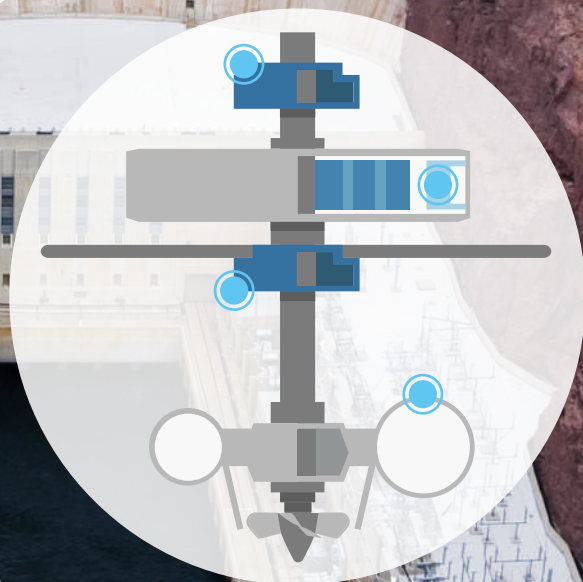
-  Magnetic Flux Monitoring
-  Endwinding Monitoring
-  Airgap Monitoring
-  Partial Discharge Monitoring
-  Rotor Winding Temperature

### SENSORS

-  Airgap
-  Fiberoptic
-  Magnetic Field Transducers
-  Partial Discharge Couplers
-  Contact Less Temperature



# Application field





FOR ALL YOUR MEASURING,  
MONITORING AND DIAGNOSTICS PROJECTS,  
MC-MONITORING FOCUSES ON THE BEST  
SOLUTION TO SUIT YOUR REQUIREMENTS.

# Application fields

## Airgap Airgap sensors



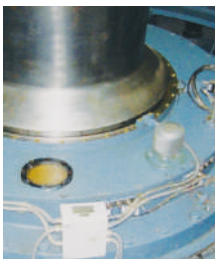
Large low-speed hydro-generators have a very small air-gap stator bore diameter ratio making it impossible for elements to be perfectly centred during the assembly process. This results in machines operating with a small but relevant misalignment due to a large rotating mass. This can lead to unwanted effects such as considerably unbalanced magnetic pull forces, vibrations and additional losses. It is therefore important to assess the following items: misalignment; minimum and maximum air-gaps; stator and rotor shape; the magnetic flux of each pole; and, crucially, to check the machine's trend to guarantee safe operation and prevent any serious damage.

## EM Endwinding monitoring



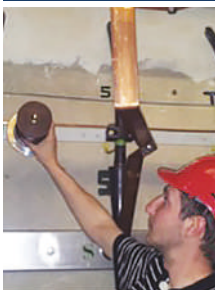
Current operating practices impose severe thermal and mechanical stresses on the rotors and stators of large pump storage hydro-generators and turbo-generators. One such practice involves multiple daily run-ups and run-downs of machines which can lead to premature ageing and cycle-related stator winding deterioration. Pump storage, hydro-generator and nuclear turbo-generator designs feature extremely long end-winding mechanisms and complex bracing systems which are subjected to strong mechanical and electrical stress. Life extension and increased availability can only be achieved through the continuous monitoring of end-winding structures and stator bars for expected deterioration.

## RBM Roller bearing monitoring



Shaft radial vibration amplitude and radial position are primary indicators of the overall mechanical condition of rotating machinery. It is possible to detect many machine malfunctions including: rotor imbalance; misalignment; bearing wear; and rubs with such measurements. Some machine types produce vibrations that are not easily detected by measuring shaft relative dynamic motion in relation to the bearing. Depending on the bearing stiffness, vibrations can be transmitted directly onto the bearing housings. This may also occur at displacement amplitudes which cannot be detected by shaft measurement methods. In such cases, a piezoelectric accelerometer or seismic velocimeter is used to measure the absolute bearing vibration severity.

## PD Partial discharge monitoring



Online partial discharge measurements are the only available technology on the market to qualify stator winding insulation while the machine is in service. The big advantage is that all thermal, electrical, ambient, and mechanical forces are present. The online partial discharge measurement requires one partial discharge sensor (often referred to as coupling capacitors) at each phase exit. Once partial discharge sensors are installed, online measurements can be taken either periodically with a portable partial discharge analyzer or continuously with a permanently installed monitoring system. As well as the partial discharge signals, this also acquires, operation parameters such as winding temperatures and load conditions for correlation with the measured partial discharge results.

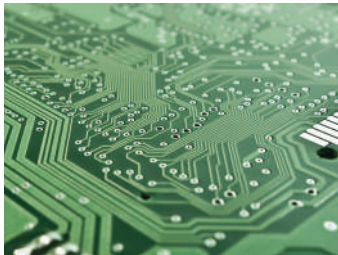
## RCP Runner Clearance Probes



The runner blade clearance sensor measures distance variations between the turbine blade tip in relation to the throat ring surface. The surface of the turbine blade tip consists of NiCr conductive material absorbing high frequency eddy currents generated by the measuring probe in order to provide an electrical signal proportional to the water gap. The probe itself is flush mounted on the throat ring at the turbine centreline and measures static and dynamic distances in harsh hydraulic environments such as propeller or Kaplan turbines in large hydroelectric generators.

# Our Expertise

## SENSOR & ELECTRONIC DESIGN AND MANUFACTURING



Our multi-disciplinary and highly-skilled engineering and manufacturing teams develop and manufacture the main sensors and conditioners in our plant located in Switzerland.

## SOFTWARE DEVELOPMENT



MC-monitoring's condition monitoring software is based on the most efficient software development platforms and tools available today. Several years of experience in various condition monitoring projects using different generations of monitoring systems as well as accumulated customer requirements have enabled us to design and market an efficient and cost-effective condition monitoring software for hydroelectric power plants and large electrical motors. The company market and install specific software solutions for end-windings, air gaps and vibration and rotating air gap monitoring in large production plants.

## PROJECT MANAGEMENT



MC-monitoring offers tailor made solutions for comprehensive protection, monitoring and diagnostic systems for hydroelectric machine sets and other industrial machines in accordance with customer requirements. Our project engineers have gained a wide and in-depth experience through our work with large OEM companies around the world. Several projects already undertaken in Africa, Brazil, China, Europe, India and South Korea demonstrate the company's ability to manage important projects on a turnkey basis.

## TRAINING AND SUPPORT



Our training services enable customers to ensure that their systems are productive very quickly. We have developed various methods in order to train our customers more effectively, such as courses led by our experienced instructors, on-site maintenance, product support, operator training and the use of CD-ROMs and manuals.

## INNOVATION



Continuously driven by innovation, MC-monitoring has applied for several patents on fiber optic accelerometers and air gap sensors. Since its foundation, MC-monitoring has launched a number of worldwide innovations on the market such as the rotating air gap, the runner clearance probe, monitoring software for ring motors and many other innovative solutions. We always listen carefully to our customers, in order to transform their needs into new products. Research is crucial in remaining at the forefront of technology.



# Application fields

## Monitoring



## Solutions



## Applications



## References





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