

QUALITROL-IRIS POWER IS THE WORLD'S LARGEST PROVIDER OF MONITORING
AND TESTING EQUIPMENT FOR MOTOR AND GENERATOR WINDINGS



Iris Power FluxTracII-R™

Continuous On-line Rotor Flux Monitor: a second generation continuous monitor to find rotor winding shorted turns, during service, in round rotor motors and turbogenerators



IRIS POWER ON-LINE PRODUCTS

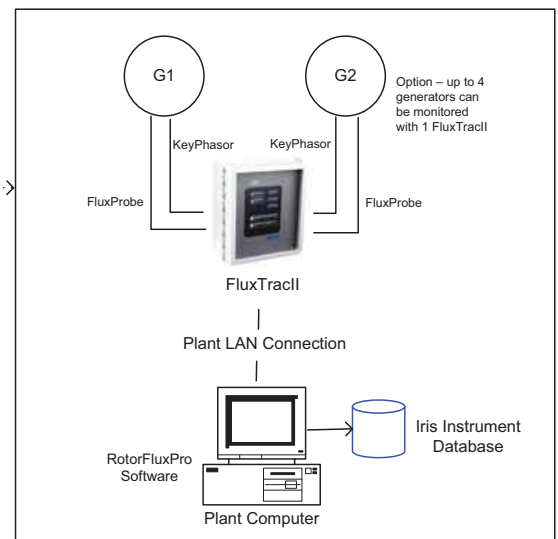
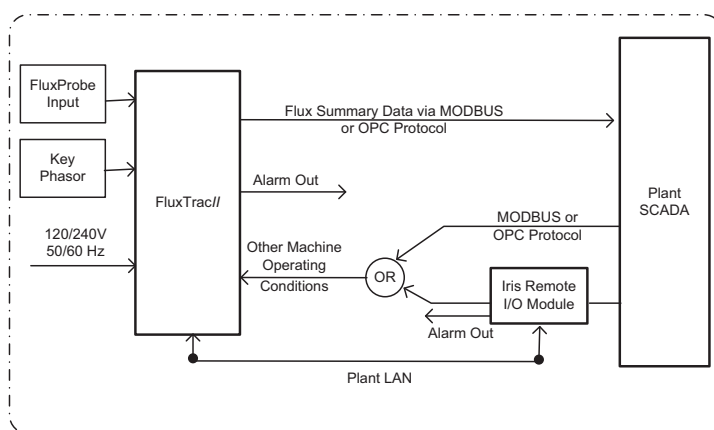
IRIS POWER FluxTrac//R

The Iris Power FluxTrac//R technology is a second generation continuous on-line rotor magnetic flux monitoring system that revolutionizes the detection and alarming of the presence of shorted rotor turns in 2 and 4 pole rotors. This system collects and analyzes flux data

from any flux probe in real time, providing maintenance staff with the coil location and severity of any shorted turns. Furthermore, the high-speed acquisition, high resolution capability and totally new analysis algorithms allow it to collect and analyze data during normal operation as well as over

an entire unit shut-down or start-up (with the shaft sync signal connected). Once configured, the Iris Power FluxTrac//R requires no user intervention, will alarm when shorted turns are detected, and is ideal for profiling the rotor turn insulation condition before a machine outage or after a refurbishment.

CONTINUOUS ON-LINE FLUX MONITORING



FEATURES

- Accepts signals from TFProbe and wedge-mounted flux probes
- Inputs for shaft sync sensor (Keyphasor) for slot determination when shorts are detected
- Monitors up to four machines (option)
- Provides relay contact to alert user of shorts
- Compatible with Iris Power RFA//R™ portable instrument
- Storage for base line, latest set of non-alerted measurements and the latest set of alerted measurements
- 10 load points with history of 26 measurements each
- Multiple communication ports: USB, Ethernet
- Measurements can be downloaded, locally or remotely, to a computer with RotorFluxPro™ software
- Modbus TCP/IP protocol available for built-in server and client capability, for data interchange with third party software
- User-friendly Windows™-based software for data display
- Analysis software capable of reading and analyzing data files from other manufacturers' portable instruments.



Iris Power TFProbe glued to a turbine generator stator tooth

SYNCHRONOUS GENERATOR AND MOTOR ROTOR WINDINGS

The insulation in round rotors must withstand severe electrical, mechanical and environmental stresses. Insulation failures can result from many factors including:

- mechanical wear, especially that caused by frequent load cycles
- distortion, breakage and migration due to centrifugal mechanical loading and thermally induced expansion/contraction cycles
- overheating due to overloading/over excitation or inadequate or diminished cooling
- local overheating at high resistance brazed joints and at shorted turns
- contamination in cooling gas or copper dusting resulting in surface tracking between turns or to ground
- overvoltages induced from system events or from firing circuits in static exciters.

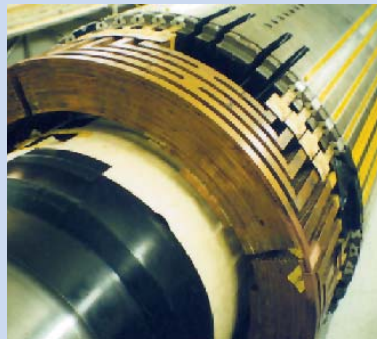
A turn insulation failure can translate into electrical connections between turns, and eventually a catastrophic winding to ground fault.

A turn-to-turn short is the most frequent rotor insulation deterioration mechanism. Turn shorts can result in:

- Thermal imbalance of the rotor leading to mechanical vibrations

- Magnetic imbalance in the flux resulting in mechanical vibration of the rotor
- Increased rotor temperature and subsequent insulation degradation
- Overheating resulting in insulation failure and a ground fault with the potential for a second catastrophic ground fault
- Inability to reach the rated MVA rating for the machine

Magnetic flux monitoring via permanently mounted air gap flux probes is a proven technology in synchronous machines to determine if turn-to-turn shorts have occurred in the rotor winding. Flux measurement provides the most direct means of monitoring the condition of rotor windings on-line, yielding the information on the integrity of coils' interturn insulation. This information is critical in planning maintenance, diagnosing abnormal vibrations, and verifying new and rewound rotor integrity.



TFProbe

On-line measurements require the permanent installation of a flux probe on the stator to measure the slot leakage flux. Most machine OEM's offer a flux probe which is attached to a stator winding wedge protruding into the airgap. An alternative probe is the Iris Power TFProbe™, which is a small, thin, flexible, printed circuit board transducer affixed to a tooth of the stator. This probe measures the total airgap flux, rather than just the leakage flux as do older style probes. The Iris Power TFProbe is easy to install, and requires no invasive drilling of stator wedges. Frequently, it can be **installed with the rotor still in place!**

In the case of hydrogen-cooled machines, the leads from the flux probe are routed out of the machine through a hermetically sealed feedthrough. The optional hydrogen penetration kit consists of a comprehensive penetration requiring only 1 hole in the generator casing, nitrogen gas pressure tested to 2700 kPa or 4000 PSI.

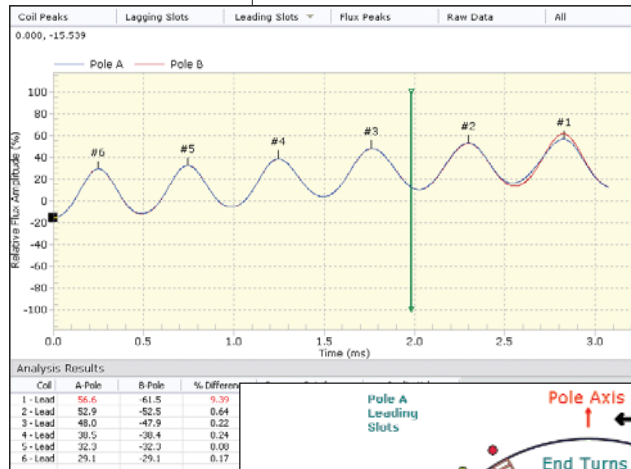
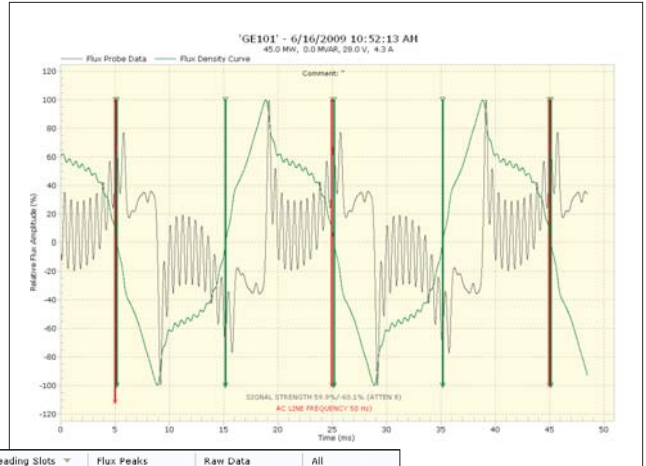
Regardless of the probe technology, data from permanently installed flux probes can be measured continuously on-line with the Iris Power FluxTrac//R. Once the data are acquired, the FluxTrac//R automatically analyzes the data and compares the flux measurements across various rotor slots to determine if turn shorts are present. An alert is given when shorts are detected.

IRIS POWER FluxTracII-R

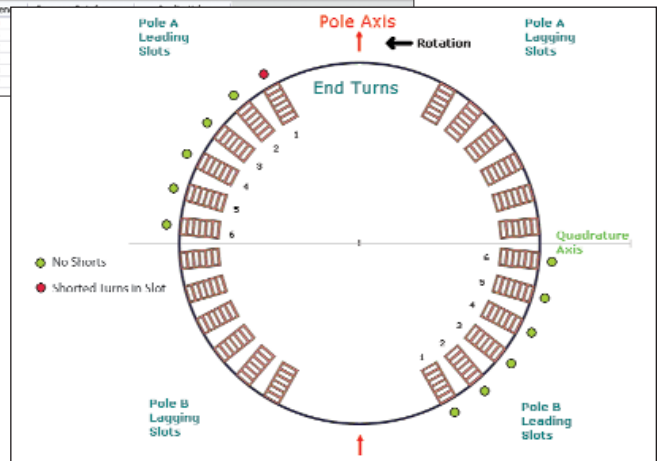
IRIS POWER FluxTracII-R CAPABILITIES

- Instant analysis of all slots in a round rotor winding usually at a fixed operating load.
- Where needed, ability to analyze tests and trend at different loads for a more certain prediction of rotor winding condition.
- Able to perform a spot measurement, or automatically acquire results over days during normal generator load changes, without test operator intervention.
- Works with conventional wedge-mounted flux probe, or the Iris stator tooth-mounted Iris Power TFProbe™, which can often be retrofitted with the rotor in-place.

Typical voltage waveform from a flux probe



Comparison of data between poles A and B



Summary graph indicating slots with shorted turns

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QUALITROL-IRIS POWER HAS BEEN THE WORLD LEADER IN MOTOR AND GENERATOR WINDING DIAGNOSTICS SINCE 1990, PROVIDING A FULL LINE OF ON-LINE AND OFF-LINE TOOLS, AS WELL AS COMMISSIONING AND CONSULTING SERVICES.



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