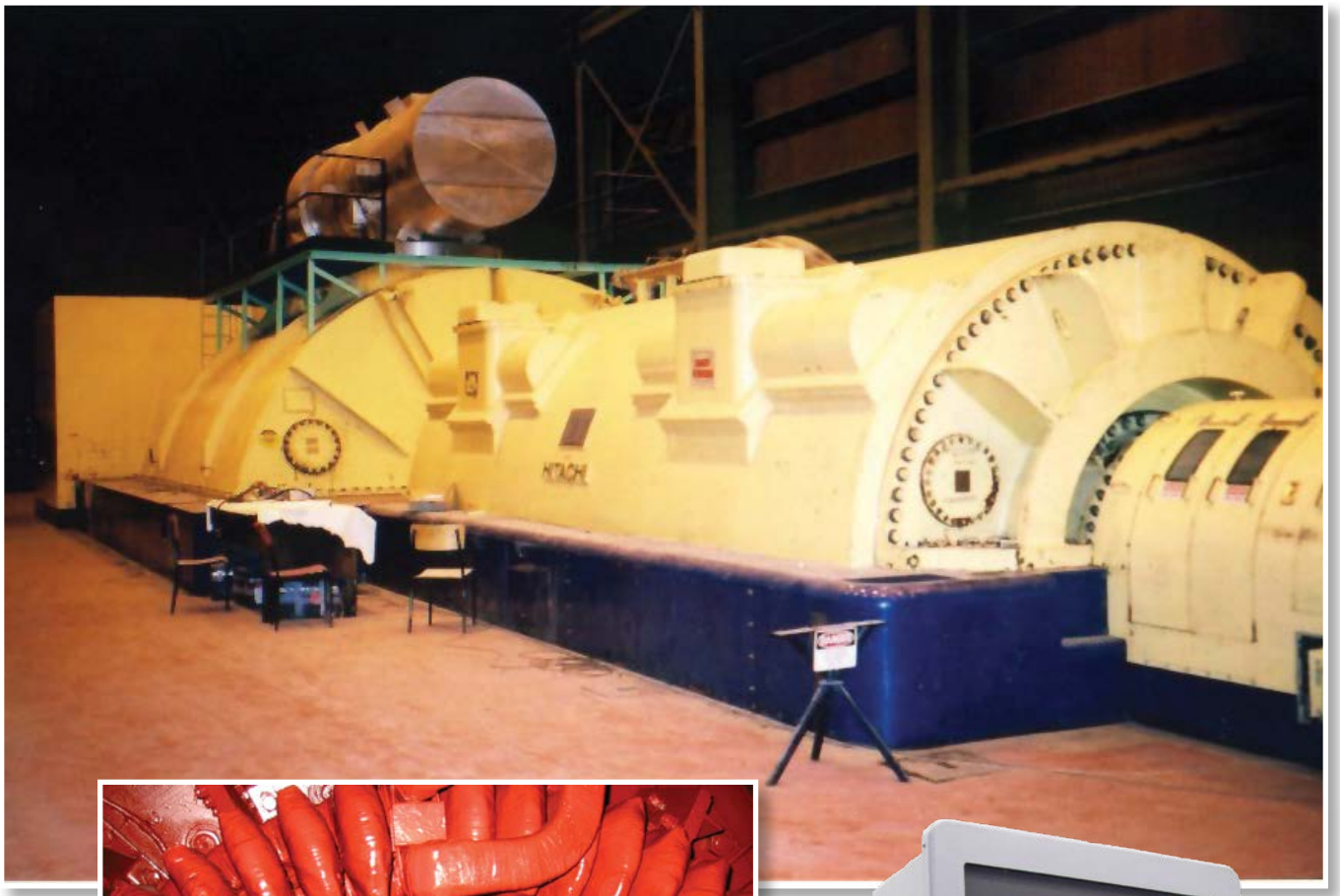
QUALITROL-IRIS POWER IS THE WORLD'S LARGEST PROVIDER OF MONITORING AND TESTING EQUIPMENT FOR MOTOR AND GENERATOR WINDINGS

IRIS POWER
A QUALITROL Company

Iris Power EVTracII™

Continuous On-Line Stator Endwinding Vibration Monitor

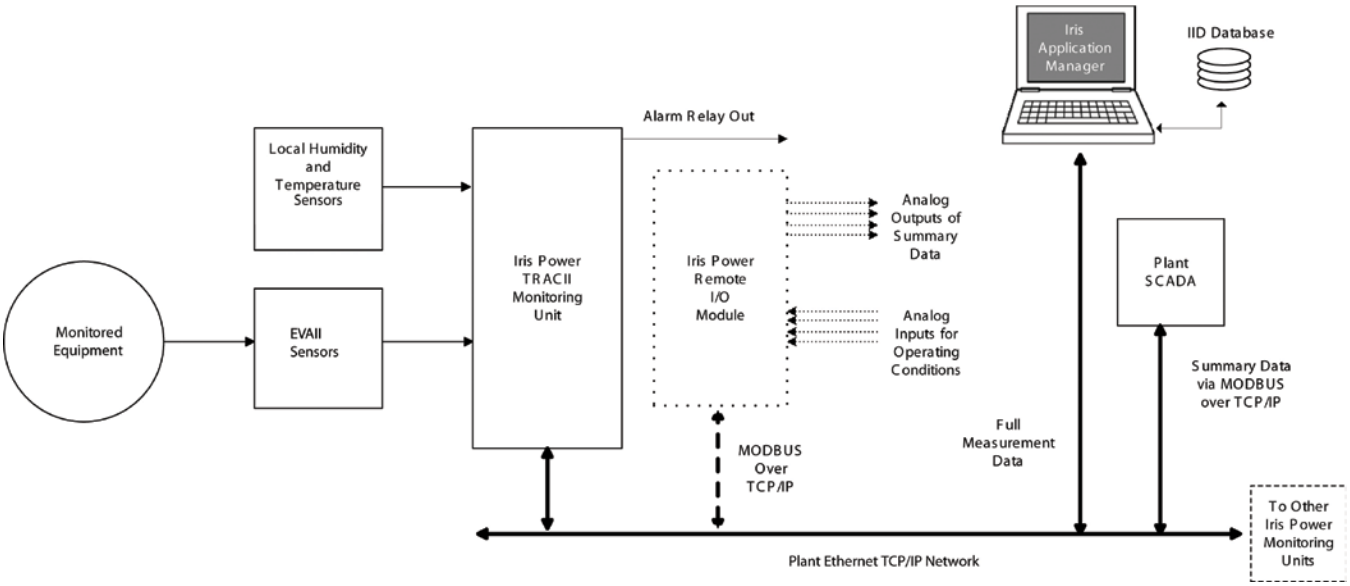


IRIS POWER ON-LINE PRODUCTS

QUALITROL
Defining Reliability

IRIS POWER EVTracII SYSTEM

Iris Power EVTrac technology is a robust and cost effective continuous on-line stator endwinding vibration monitor that revolutionizes the detection and alarming of the presence of endwinding looseness and vibration in motor and generator stator windings. This system collects and analyzes vibration data from fiber optic accelerometers in real time, providing maintenance staff with a tool to collect and trend endwinding vibration conditions. Utilizing state-of-the-art electronics and high-speed acquisition, the system processes the vibration signal and displays the displacement across the frequency range of interest. Once configured, the Iris Power EVTracII requires no user intervention, will alarm when significant vibration levels are detected, and is ideal for fingerprinting and trending the vibration as the endwinding and support system loosens with aging.



SYNCHRONOUS GENERATOR AND MOTOR ENDWINDINGS

The part of motor and generator stator windings outside of the stator core is referred to as the endwinding. The endwinding is at high-voltage and requires support against mechanical vibration driven by electrical and mechanical forces. Machine endwindings are designed so that under normal circumstances these mechanical stresses are controlled enough to prevent damage. However, the endwinding can be damaged due to:

- Looseness of the endwinding support and tie structure due to mechanical aging and thermal expansion.
- Poor design of the endwinding bracing with natural frequency conditions close to the primary mechanical forces of rotational frequency and twice line frequency (100/120 Hz).
- Abnormal operating events such as short circuits resulting in stress and deflection of components beyond their mechanical limits.
- Relative motion between one component and another which can abrade the high voltage insulation on the coils.

Endwinding vibration can lead to cracking of the coil/bar insulation just outside of the stator slot and, in severe cases, may cause the copper conductors to fatigue crack leading to high arcing currents. Eventually, any of these issues can lead to stator winding ground faults.

IRIS POWER EVTracII

The purpose of endwinding vibration monitoring is to directly measure if the stator endwindings are vibrating excessively during normal operation, so that any incipient vibration can be detected (and corrected) at an early stage, well before failure. The monitoring system consists of four components:

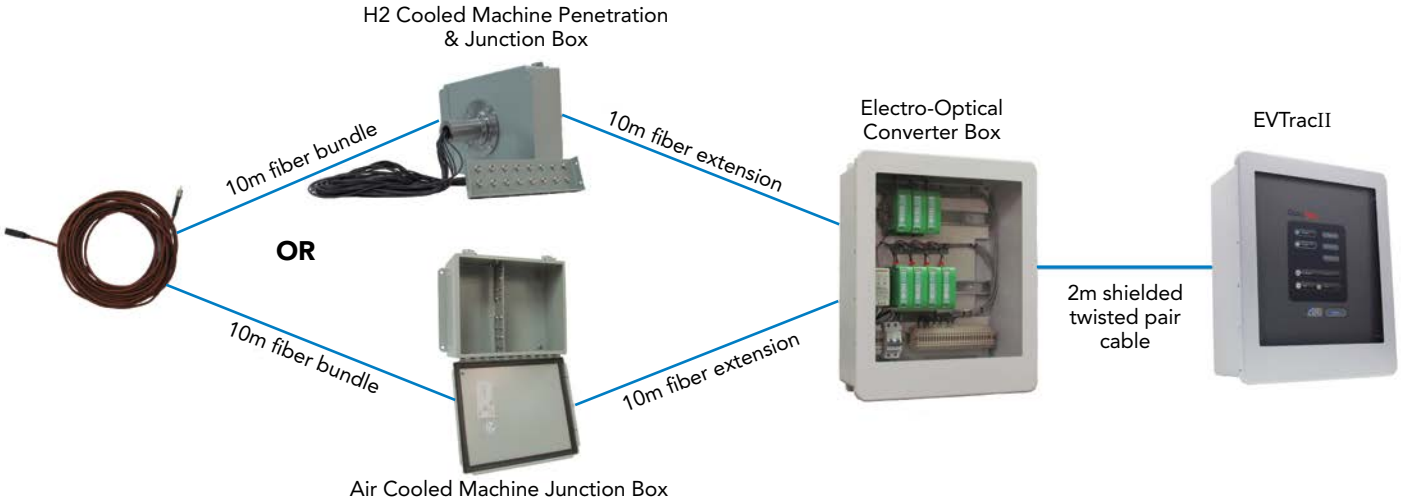
- endwinding vibration accelerometers mounted at critical locations in the endwinding,
- fiber optic cable to connect the sensors outside of the motor or generator frame,
- electro-optical unit to convert the optical signals to millivolts which are proportional to the acceleration,
- EVTracII monitor to digitize, process and store the vibration data,
- In addition a penetration is needed to bring the fiber optic cables outside of the generator frame for hydrogen-cooled machines.

FEATURES

- Accepts signals from Iris Power EVAII or any third party 100mV/g accelerometer.
- Monitors up to 12 dual axis or 1 single axis sensors.
- One input available for a single axis core vibration which is used to gauge the effect of core/frame vibration on the endwinding.
- Provides relay contact to alert user of high vibration levels.
- Up to 2 years of storage for archiving daily vibration data and trending at user selectable intervals.
- Multiple communication ports: USB, Ethernet.
- Measurements can be downloaded, locally or remotely, to a computer with Iris Power Application Manager™ software.
- Optional Modbus over TCP/IP protocol available for built-in server and client capability, for collecting operating data relevant to the vibration signals and to provide displacement to third party software.
- User-friendly Windows™ based software for data display and analysis.

CAPABILITIES

- Analysis of up to 12 dual axis endwinding and 1 single axis core sensor including high vibration alarms.
- Analyze tests and trend at different operating conditions for a more certain prediction of stator endwinding vibration conditions.
- Perform a spot measurement, or automatically acquire results over months and years during normal generator load changes, without user intervention.
- Combine endwinding vibration monitoring with Iris Power on-line partial discharge testing to provide a complete diagnostic for stator winding condition monitoring.
- Vibration vs frequency spectrum, vibration vs time waveform, overall vibration trend, specific frequency trend, operating parameter trend, historical statistics display.



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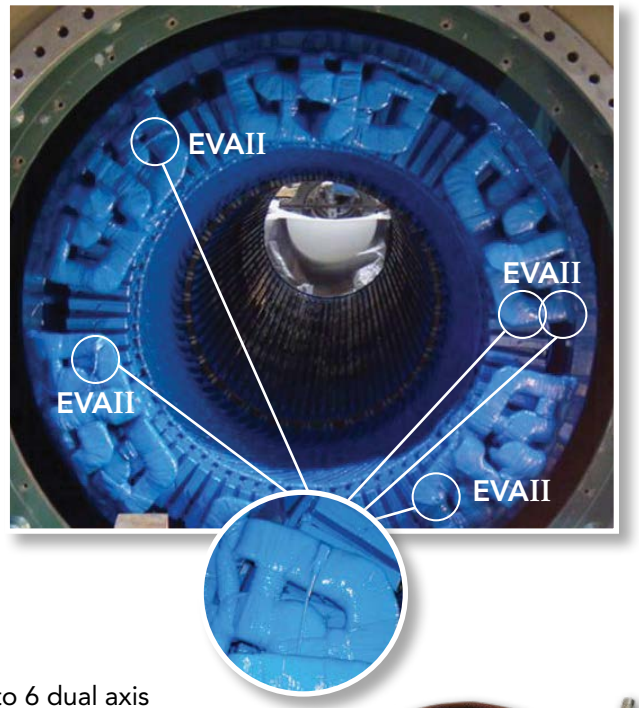
IRIS POWER EVTracII

ENDWINDING VIBRATION MONITORING

On-line measurements require the permanent installation of accelerometers on the stator endwinding to measure the vibration levels. These sensors can be retrofitted during a machine outage after some disassembly, or installed on new machines in the factory. The Iris Power EVAII sensors are application-specific fiber optic accelerometers that are ideal for installation in air- or hydrogen-cooled machines. The sensors have been qualified using rigorous laboratory accelerated aging tests to demonstrate accuracy, reliability and robustness. The sensors come in single or dual axis configuration allowing users to monitor either radial, or radial/tangential acceleration.



The optical signal from the sensor is converted to an electrical signal via an EOD (electro-optical driver) which is independent of the sensor and located in a NEMA4X enclosure external to the machine. This increases system reliability as the electronics can be directly accessed for repair/calibration with no machine disassembly. Unlike other technologies any EVAII sensor can be paired with any OED.

In the case of hydrogen-cooled machines, the leads from up to 6 dual axis and 1 single axis core sensor can be routed out of the machine through a hermetically sealed feed-through. The optional hydrogen penetration kit consists of a comprehensive penetration requiring only 1 hole in the generator casing, nitrogen gas pressure tested to 400 psi (2800 kPa).

In general each EVAII should be located according to the level of concern for any particular area of the endwinding and ideally based on off-line impact (bump) testing and a modal analysis. Typically, phase connections and jumpers exhibit more significant vibrations and are therefore locations of concern. In addition, sensors should be installed on chosen coil ends and connections circumferentially around the endwinding to detect global patterns of vibration. Iris Power provides a service to help users identify the best location for the sensors.

Regardless of the accelerometer technology, data from permanently installed endwinding accelerometers can be measured continuously on-line with the Iris Power EVTracII. Once the data are acquired, the EVTracII automatically processes the vibration signal and an alarm is triggered where significant vibration levels are detected. Periodically the waveform and spectra are stored as well as overall and key frequency trend data.

EVAII sensor with 10m of fiber optic cable

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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