

# Thermal Protection for Generators and Motors

## The Need for Continuous Monitoring

Fiber optic temperature sensors are now routinely installed into large motor and power generator equipment to provide real-time monitoring and thermal protection of critical stator windings, circuit rings and bearing hot spots.

Today's utility-sized generators and large industrial motors are critical infrastructure assets. Any premature or sudden failure in this class of equipment would result in significant financial loss which is why continuous thermal monitoring is essential. Thermal runaway conditions can develop anywhere there is a physical joint between electrical conductors such as between windings, bus bars, and circuit rings. Vibrations induced from the rotating machinery slowly weaken support ties and bolted connection points leading to increased contact



resistance and local hot spots where the insulation becomes compromised. Partial discharge then further degrades the insulation, to the point where a catastrophic event occurs, taking the equipment offline for weeks or months and posing a serious safety risk to personnel. Periodic thermal imaging scans rarely catch these failure sites in time, which is why continuous thermal monitoring is recommended.

*On August 13, 2017, a 202 MVA, 13.8kV generator failed at Quebec Hydro and forced the evacuation of a power house. The cause was a bad junction in the circuit ring that went undetected by conventional means. The generator was down for 3 months. It was concluded that continuous thermal monitoring would have enabled early detection of such faults.*



### **Circuit ring and stator bar damage**

Source:

*Joël Pedneault-Desroches, P. Eng.*

*Major Fault Caused by Stator Winding Circuit Ring*

Until recently, RTD's (resistance temperature detectors) were typically embedded into windings to provide continuous monitoring. However, high-voltage and alternating electromagnetic fields pose problems and inaccuracies for traditional RTD winding sensors. Now, OSENSA's innovative technology has enabled the deployment of low-cost fiber optic temperature sensors for generators and motors. OSENSA's fiber sensors can be inserted between the windings of motors and generators, and on critical joints and bonds on circuits rings and other locations. With OSENSA's optical temperature sensors installed, operators can monitor load conditions in real-time, enabling early fault detection and extending service life and costly repairs.

## OSENSA's Generator and Motor Temperature Monitoring Solutions Meet the Challenge

OSENSA's PWR+ Temperature Monitoring Solutions provide continuous, real-time temperature monitoring of windings and connection points in generators and motors. The rugged and inherently safe temperature probes accurately and instantaneously measure temperatures up to 200°C and will last the life of the generator or motor without replacement. Typical utility-sized generators or motors may contain as dozens of measurement points. Temperatures can be monitored and logged real-time with either the HMI-100 Display and Control Module, or with the TCU-300 Temperature Control Unit, with alarms for identifying temperature concerns and alerting appropriate personnel. Alternatively, the temperature transmitters can be embedded into an RTU, PLC or other control or monitoring system.



OSENSA's PWR+ solutions for generators and motors include the following components:

- Temperature Transmitter - FTX-602/302/301-PWR+
- Temperature Probes and Extension Cables – PRB-GB3, EXT-100
- Display and Control Module – HMI-100-PWR+, or
- Industrial PC – TCU-300

### Temperature Transmitters (Signal Conditioners)

The FTX-602/302/301-PWR+ are fiber optic temperature transmitters in a compact 35mm DIN-rail mountable format. Each transmitter accepts from one to six optical fiber sensor inputs. The FTX-602/302/301-PWR+ transmitters are powered by 12-24V DC and include isolated RS-485 serial connectivity over industry standard Modbus RTU protocol. The FTX-301-PWR+ model includes three isolated 4-20mA analog outputs. Multiple transmitters can be connected in series on a standard 35mm DIN rail with power and RS-485 communication supplied by the five-pin T-Bus connector.



### Temperature Probes

The PRB-GB3 temperature probes install in generators and motors to provide reliable 24/7 thermal monitoring with noise-free performance for temperature monitoring up to 200°C. The probes are constructed from durable, high dielectric strength materials and have been tested to safely operate on equipment rated up to 38 kV (3 phase). The PRB-GB3 temperature probes have been tested against, and exceed, the IEEE C37.23-2003 "IEEE Standard for Metal-Enclosed Bus" standard. OSENSA's PRB-GB3 temperature probes, together with the EXT-100 extension cables, can support installation lengths up to 30m.

#### PRB-GB3-02M-ST-L



#### PRB-GB3-02M-ST-L-TP1



#### PRB-GB3-02M-ST-L-TP2



#### CONNECTOR RING MOUNTING OPTIONS (for -TP2 version)



## Display and Control Module

OSENSA's HMI-001-PWR+ touch panel display provides remote ethernet connectivity, real-time display and data logging for up to 27 fiber optic channel inputs. The intuitive touch interface enables easy configuration of external relays for alarms and hardware control. Plug in a USB stick for virtually unlimited data logging capability. An additional relay board is available to expand system control capabilities.



## Industrial PC

OSENSA's TCU-300 is a small form-factor Industrial PC that easily integrates with OSENSA's FTX-series fiber optic temperature transmitters providing internet connectivity, alarms, data logging, and control. It supports up to 256GB of micro SD card storage, and a full-size HDMI connector for local HMI display. It also features 8 programmable outputs for driving external relays, in addition to three USB ports for removable storage, keyboard, or wireless LAN connectivity. There are also two isolated RS-485 ports for master and slave Modbus communications. Other protocols supported include DNP3 and Modbus over TCP/IP.



## Contact Us

**OSENSA INNOVATIONS CORP.**

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

info@osensa.com

Tel: 1-888-732-0016 (Toll-free Canada/USA)

1-604-259-7177 (International)

Fax: 1-778-355-0796

### Office Address

8672 Commerce Ct.

Burnaby, BC, Canada V5A 4N7