Thermal Protection for Cast Resin Transformers

Monitoring Winding Temperature.

Cast-resin dry-type transformers (CRTs) are ideally suited for applications where safety is paramount. Unlike oil-filled transformers, CRTs are non-flammable and much lighter, making them attractive for residential, light-industrial and hospital installations.

One challenge, however, is the limited cooling capacity of air and the relatively weak thermal conductivity of resin, which makes CRTs vulnerable to overheating. As these transformer types operate at considerably high temperatures (90°C to 125°C above ambient), close and accurate monitoring of their winding and core temperatures is critical. Overloading of the transformer increases winding temperatures, prematurely breaking down the insulation and decreasing transformer life. Destructive events such as partial discharge can also damage insulating epoxy, resulting in hot spots. The epoxy is also susceptible to cracking as a result of mechanical and electrical loading. As aging of the transformer is directly related to the winding temperature during operation, continuous temperature monitoring enables efficient loading and extends service life.

Many cast-resin transformers are equipped with resistance temperature detectors (RTDs) for monitoring temperatures in the low-voltage windings. RTDs, however, cannot be inadequately insulated for use in high voltage windings. OSENSA's PWR+ cast resin fiber optic temperature sensors are inherently safe and rated for transformer monitoring up to 38kV.

OSENSA's Cast Resin Transformer Temperature Monitoring Solutions Meet the Challenge

OSENSA's PWR+ CRT Temperature Monitoring Solutions provide continuous, real-time temperature monitoring of transformer windings up to 38kV, enabling efficient loading and extending service life. The rugged and inherently safe temperature probes accurately and instantaneously measure temperatures up to 200°C, and will last the life of the transformer without replacement. 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 include the following components:

- Temperature Transmitter - FTX-910/610/310-PWR+
- Temperature Probes – PRB-910-L
- Display and Control Module – HMI-100-PWR+, or
- Industrial PC – TCU-300

Temperature Transmitters (Signal Conditioners)

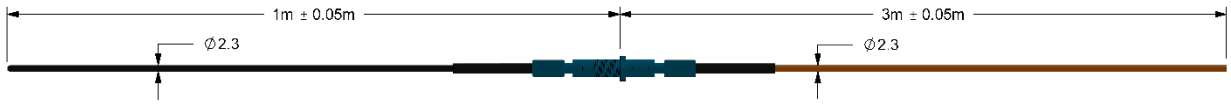
The FTX-910/610/310-PWR+ are fiber optic temperature transmitters in a compact 35mm DIN-rail mountable format. Each transmitter accepts from three to nine optical fiber sensor inputs and includes one programmable relay output for alarms. The FTX-910/610/310-PWR+ transmitters are powered by 12-24V DC and include isolated RS-485 serial connectivity over industry standard Modbus RTU protocol. 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-910-L temperature probes install in cast resin transformers 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). OSENSA's CRT temperature probes have been tested against, and exceed, the IEEE C37.23-2003 "IEEE Standard for Metal-Enclosed Bus" standard.

OSENSA's CRT temperature probes are easily cut to length at time of installation with a supplied cutter and then simply inserted into the FTX-910/610/310-PWR+ temperature transmitters. For installation in the CRT, provisions can be made at the time of coil assembly by installing a tube into the insulation at the top of the coil, or with a pin that is removed after the epoxy casting step. As the winding hot spots are typically near the top few windings, the tube or pin length is typically less than 10cm. The fiber optic temperature sensor can be inserted into the tube or pin-hole after assembly of the transformer and sealed with silicon or epoxy. Alternatively, a hole can be drilled into the insulation after assembly. This method is also used for retrofitting fiber optic temperature sensors into previously assembled or installed CRTs.

PRB-910 (200°C max. temperature for 1m probe length)



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.

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