

# T/Guard System

Fiber Optic Power Transformer Winding Temperature Monitoring System



## A multichannel fiber optic system for high voltage and transformer hot spot temperature measurement

- Tough and ruggedized sensors
- No gage factor or calibration
- RS-232, RS-485, Ethernet or MODBUS communication
- Voltage or current output
- Accuracy of  $\pm 1^{\circ}\text{C}$
- Available with 1 to 16 channels
- Detachable connector blocks
- On-board 1 GB memory (optional)

### Product Summary

**Description** The T/Guard is multichannel fiber optic transformer windings hot spot monitoring system. It has up to 16 optical channels and offers MODBUS serial communication.

**Application** Direct transformer windings hot spot monitoring

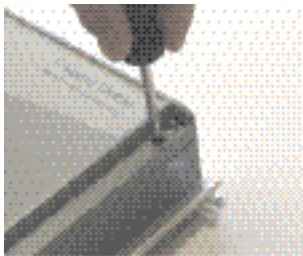


Fibers by 

**QUALITROL**<sup>®</sup>  
Defining Reliability

## T/Guard System Fiber Optic Power Transformer Winding Temperature Monitoring System

- The Neoptix™ t/Guard™ is a multi-channel fiber optic temperature monitoring system for power transformer hot spot measurements. The t/Guard™ system has been developed with long-term performance and stability in mind. This fiber-optic temperature monitoring system for power transformers offers accuracy, toughness and long-term resistance to failure.
- Coupled with the T/Guard system, the Neoptix™ T2™ fiber-optic temperature probe provides accurate and direct temperature monitoring of transformer windings. This solution provides a realistic, real-time view of winding conditions that is quicker and more accurate than top oil thermocouple measurements, and greatly complements indirect measurements based on thermal models.
- Neoptix™ T/Guard give the exact temperature of optical probes in 165 milliseconds per channel. Peak load or emergency overloads are thus detected almost instantaneously. With Neoptix technology, you have a new tool to optimize high-voltage transformer performance and life expectancy.
- The T/Guard system is specifically designed to meet power transformer industry requirements: extended intervals between servicing, low maintenance, rugged components and the ability to withstand the harshest conditions. All components have been specifically selected for long term performance, including the light source that has an MTBF superior (>300 years of use) to the expected life of the transformer. Moreover, compared to other technologies available on the market, like fluorescent decay, our sensor, based on solid state semi-conductor, do not fade or drift over time, allowing a constant and absolute temperature measurement of your transformer windings over the lifespan of the equipment.
- Our fiber-optic probes are made only with dielectric materials and are designed to withstand initial manufacturing conditions, including kerosene desorption and heat runs, as well as long term oil immersion and vibration. Moreover, the Neoptix™ temperature probes are interchangeable and no calibration or inconvenient gage factors are required when changing sensors.
- The system is based on the proven GaAs technology. An original algorithm is used to analyze the signal and provides repeatable and reproducible measurements. The T/Guard System is available with 1 to 16 optical channels and comes standard with an LCD display with LED based backlight. Power consumption of the system is 8 watts.
- The mounting brackets are integrated directly into the T/Guard enclosure, which allow a clean and robust installation into your control cabinet or substation. It is optionally available mounted in a NEMA4-12 enclosure. Automatic cooling and heating could be ordered with this protective enclosure.



The T/Guard™ has built-in mounting screw sockets allowing an easy and clean installation

- The T/Guard™ system can be delivered with a 1 Gigabytes on-board datalogging memory that allows Utilities and transformer operators to record temperature data points and alarm status information directly into their T/Guard temperature monitoring system, without the need for permanent connection to a remote acquisition system. The T/Guard option is delivered with a 1 GB memory size, which is sufficient to log over 24 millions data points. This represents more than forty years of data logging for a transformer instrumented with eight temperature transducers. The T/Guard system is a completely independent monitoring solution and the logged file can be retrieved by a PC using RS-232 serial communication. Data points are saved with a time stamp that comes from the internal real-time clock of the T/Guard System.
- The T/Guard system is easy to interface to an existing marshaling or substation system via its 4-20 mA analog outputs (0-10 Volts optional) or its MODBUS communication interface. It also has RS-232 or RS-485 communication and features an optional TCP/IP bridge. When used with the optional Neoptix NeoLink™ software on the serial port, the T/Guard becomes an indispensable monitoring instrument.



## Accessories

### T2™ Temperature probe

This temperature probe is designed to withstand initial manufacturing conditions, including kerosene desorption and heat runs, as well as long term oil immersion and vibration. The T2 probe consists of a 400-microns OD solid-state crystal and optical fiber sheathed with an oil permeable protective PTFE Teflon sheath. Only chemical resistant dielectric materials are used for these temperature probes. The temperature range is -80°C to +250°C. The probes can be embedded in a standard spacer or attached directly onto any other location inside power transformer copper windings. All T2 optical temperature probes are available in custom lengths from 1 to 25 meters.

### Tank wall optical feedthrough

Specifically designed for tank wall transformers, this feedthrough has a simple design that provides both toughness and long-term leak-free operation. It is made from 316 stainless steel and relies on proven glass-to-metal bonding techniques. The feedthrough uses 1/4" NPT ANSI threads and can be installed directly into the tank wall or on a tank wall mounting plate.

### NEMA-4 Enclosure

The T/Guard system can be mounted in a NEMA-4 enclosure that houses and protects the instrument for long-term exterior use. All fiber-optic extension cables are connected inside this enclosure. The NEMA-4 enclosure includes a clear polycarbonate window-door and is compliant with NEMA/EEMAC Type 4 and 12 standards.

### External fiber-optic extension cables

These cables are made with a polyurethane jacket reinforced with Kevlar threads and are designed to withstand the harshest conditions. External fiber-optic extension cables come in standard 5 or 10 meter lengths. Custom lengths are also available from 1 meter to 1 kilometer. The temperature range is -50°C to +85°C. Cables can be routed into protective conduits or tracks.

### Tank wall mounting plate

Up to 12 feedthroughs can be mounted on a tank wall mounting plate. The plate is made with carbon steel and has a standard size of 25.4 cm (10 inches) diameter. Tank wall mounting plates can be customized in size or material according to customer specifications, with larger plates allowing more feedthroughs. The mounting plate comes with the JBox™ (patent pending) protective enclosure.






The tank wall mounting plate shown with JBox™ protective enclosure

## TECHNICAL SPECIFICATIONS

|               |                        |  |
|---------------|------------------------|--|
| <b>System</b> | Model:                 | T/Guard™ System                        |
|               | Number of channels:    | Available with 1 to 16 channels        |
|               | Resolution:            | 0.1°C (0.2°F)                          |
|               | Accuracy:              | ±1°C (1.6°F)                           |
|               | Response time:         | 165 milliseconds; probe dependent      |
|               | Operating temperature: | -40 to 70°C; non-condensing            |
|               | Storage temperature:   | -40 to 70°C; non-condensing            |
|               | Display:               | 4 lines X 20 Characters LCD display    |
|               | Units:                 | User selectable; Metric or Imperial    |
|               | Datalogging:           | 1 Gigabytes internal memory (optional) |



| TECHNICAL SPECIFICATIONS |                           |   |
|--------------------------|---------------------------|---|
| <b>System</b>            | Communication port:       | RS-232, RS-485; Ethernet and MODBUS optional  |
|                          | Operating Mode:           | RS-232/485: Neoptix™ NeoLink™ PC Software or ASCII commands; MODBUS if installed  |
|                          | Analog outputs:           | Standard: 4-20 mA, Optional (no cost) : 0-10 Volts  |
|                          | Calibration:              | No system recalibration needed over lifespan to remain within specifications  |
|                          | Light source MTBF:        | > 300 years of use  |
|                          | Probe compatibility:      | T2™ temperature probes  |
|                          | Power:                    | 18 to 24 VDC, 8 Watts   |
|                          | Dimensions:               | Width: 170 mm; Height: 60 mm; Length: 280 mm  |
|                          | Weight:                   | 2.1 Kg  |
|                          | Ordering Codes:           | <div style="display: flex; justify-content: space-between;"> <div style="text-align: center;"> <br/>  </div> <div style="text-align: center;"> <p>Analog Output:<br/>1 = 0-10V (Optional)<br/>2 = 4-20 mA (standard)</p> </div> <div style="text-align: center;"> <p>Ethernet (Serial Bridge)<br/>0 = None (standard)<br/>1 = Ethernet (Optional; order with C1 only)</p> </div> <div style="text-align: center;"> <p>On-board 1GB Datalogging Memory:<br/>0 = none (standard)<br/>1 = Datalogging (optional)</p> </div> </div> <p style="text-align: center;"><b>TGD -</b> <input type="checkbox"/><input type="checkbox"/> <b>-A</b> <input type="checkbox"/> <b>-C</b> <input type="checkbox"/> <b>-E</b> <input type="checkbox"/> <b>-D</b> <input type="checkbox"/></p> <div style="display: flex; justify-content: space-between;"> <div style="text-align: center;"> <p>Number of channels:<br/>1 = 1 channel<br/>n = n channels<br/>16 = 16 channels</p> </div> <div style="text-align: center;"> <p>Communication<br/>1 = RS-232<br/>2 = RS-485 Half Duplex<br/>3 = RS-485 Full Duplex<br/>4 = MODBUS Half Duplex<br/>5 = MODBUS Full Duplex</p> </div> </div> |
| <b>Probes</b>            | Model:                    | T2™ Fiber Optic Temperature Sensor  |
|                          | Temperature range:        | -80 to 250 °C (-112 to 350 °F)  |
|                          | Accuracy:                 | ±1 °C   |
|                          | Response time             | ≤500 milliseconds   |
|                          | Probe length:             | Any length up to 25 meters by 1 meter increment   |
|                          | Connector type:           | ST  |
|                          | Probe material:           | Chemically resistant, inert and dielectric material; Quartz optical fiber   |
|                          | Probe sheathing material: | Oil permeable optical cable sheath and supplementary spiral wrap reinforcement made out of PTFE Teflon™<br>Kevlar inner reinforcement available on T2K version  |
|                          | Probe dimensions:         | 1.21 mm O.D. for the first 1 cm;<br>3.10 mm O.D. spiral wrap protection afterwards  |
|                          | Probe sensitive area:     | Direct point measurement with a sensitive area of 400 microns O.D.  |
|                          | Probe permeability:       | Longitudinal continuous slit (patent pending) on cable insures perfect oil flow into the sheath   |
|                          | Certification:            | ASTM-D 149 and ASTM-D 2413  |
|                          | Probe compatibility:      | Compatible with all Neoptix signal conditioners   |
|                          | Ordering codes:           | <div style="display: flex; justify-content: space-between;"> <div style="text-align: center;"> <p>Uncovered length:<br/>01 cm (standard)<br/>XX = n cm</p> </div> <div style="text-align: center;"> <p>Fibers by </p> </div> </div> <p style="text-align: center;"><b>T2S -</b> <input type="checkbox"/><input type="checkbox"/> <b>-</b> <input type="checkbox"/><input type="checkbox"/> <b>-</b> <input type="checkbox"/><input type="checkbox"/> <b>-</b> <input type="checkbox"/><input type="checkbox"/></p> <div style="display: flex; justify-content: space-between;"> <div style="text-align: center;"> <p>Total length:<br/>XX = n meters</p> </div> <div style="text-align: center;"> <p>Bonded spiral wrap:<br/>0 = Free to move<br/>1 = Bonded (standard)</p> </div> </div>  |

**QUALITROL® Field Services**

QUALITROL® provides on-site commissioning/ start-up and comprehensive maintenance contracts to all customers worldwide. To further improve reliability, an extended warranty is available on selected products commissioned by QUALITROL®.

**About QUALITROL®**

QUALITROL® manufactures substation and transformer monitoring and protection devices used by electric utilities and manufacturing companies. It is the global leader in sales and installations of transformer asset protection equipment, fault recorders, and fault locators. Established in 1945, QUALITROL® produces thousands of different types of products on demand, each customized to customers' unique requirements.

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