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

- Tough and ruggedized sensors
- No gage factor or calibration required
- RS-232, RS-485, Ethernet or Modbus communication
- Voltage or current output
- Accuracy of ±1°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
The Qualitrol™ 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.

Qualitrol T/Guard gives the exact temperature of optical probes in 200 milliseconds per channel. Peak load or emergency overloads are thus detected almost instantaneously.

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 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 time stamps that come 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 Qualitrol OptiLink™ software on the serial port, the T/Guard becomes an indispensable monitoring instrument.
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 300-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.

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. No O-rings are used.

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 should be routed into protective conduits or tracks.

Up to 16 feedthroughs can be mounted on a tank wall mounting plate. The plate is made with carbon or stainless 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. As an option, the mounting plate comes with the JBox™ protective 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.

OptiLink is available to interface a T/Guard system to a PC computer via a serial port. OptiLink adds the following capabilities to your T/Guard system:
- Supports up to 4 T/Guards and up to 64 channels
- Does data logging, directly to Excel (DDE)
- Displays and graphs up to 64 channels in real time on your PC
- And much more
# TECHNICAL SPECIFICATIONS

<table>
<thead>
<tr>
<th>System</th>
<th>Details</th>
</tr>
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<tbody>
<tr>
<td>Model: T/Guard™ System</td>
<td>Number of channels: Available with 1 to 16 channels</td>
</tr>
<tr>
<td>Resolution:</td>
<td>0.1°C (0.2°F)</td>
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<tr>
<td>Accuracy:</td>
<td>±1°C (1.6°F)</td>
</tr>
<tr>
<td>Response time:</td>
<td>250 milliseconds; probe dependent</td>
</tr>
<tr>
<td>Operating temperature:</td>
<td>-40 to 70°C; non-condensing</td>
</tr>
<tr>
<td>Storage temperature:</td>
<td>-40 to 85°C; non-condensing</td>
</tr>
<tr>
<td>Display:</td>
<td>4 lines X 20 Characters LCD display</td>
</tr>
<tr>
<td>Units:</td>
<td>User selectable; Metric or Imperial</td>
</tr>
<tr>
<td>Datalogging:</td>
<td>1 Gigabytes internal memory (optional)</td>
</tr>
<tr>
<td>Communication port:</td>
<td>RS-232, RS-485 Modbus; Ethernet optional</td>
</tr>
<tr>
<td>Operating Mode:</td>
<td>RS-232/485: Qualitrol™ OptiLink™ PC Software or ASCII commands; Modbus</td>
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<tr>
<td>Analog outputs:</td>
<td>Standard: 4-20 mA, Optional: 0-10 Volts</td>
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<tr>
<td>Calibration:</td>
<td>No system recalibration needed over lifespan to remain within specifications</td>
</tr>
<tr>
<td>Light source MTBF:</td>
<td>&gt; 300 years of use</td>
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<tr>
<td>Probe compatibility:</td>
<td>T2™ temperature probes</td>
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<tr>
<td>Power requirements:</td>
<td>24 VDC</td>
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<tr>
<td>Power consumption:</td>
<td>8 Watts Max (up to 8 channels) / 16 Watts Max (9 to 16 channels)</td>
</tr>
<tr>
<td>Dimensions:</td>
<td>Width: 170 mm; Height: 60 mm; Length: 280 mm</td>
</tr>
<tr>
<td>Weight:</td>
<td>2.1 Kg</td>
</tr>
<tr>
<td>Warranty:</td>
<td>5 years Limited International warranty; Extended warranty available</td>
</tr>
</tbody>
</table>

## Ordering Codes:

- **Analog Output:**
  - 1 = 0-10V (Optional)
  - 2 = 4-20 mA (standard)

- **Ethernet (Serial Bridge):**
  - 0 = None (standard)
  - 1 = Ethernet (Optional; order with C1 only)

- **On-board 1GB Datalogging Memory:**
  - 0 = none (standard)
  - 1 = Datalogging (optional)

- **Communication:**
  - 1 = RS-232
  - 2 = RS-485 Half Duplex
  - 3 = RS-485 Full Duplex
  - 4 = Modbus Half Duplex
  - 5 = Modbus Full Duplex

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### 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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