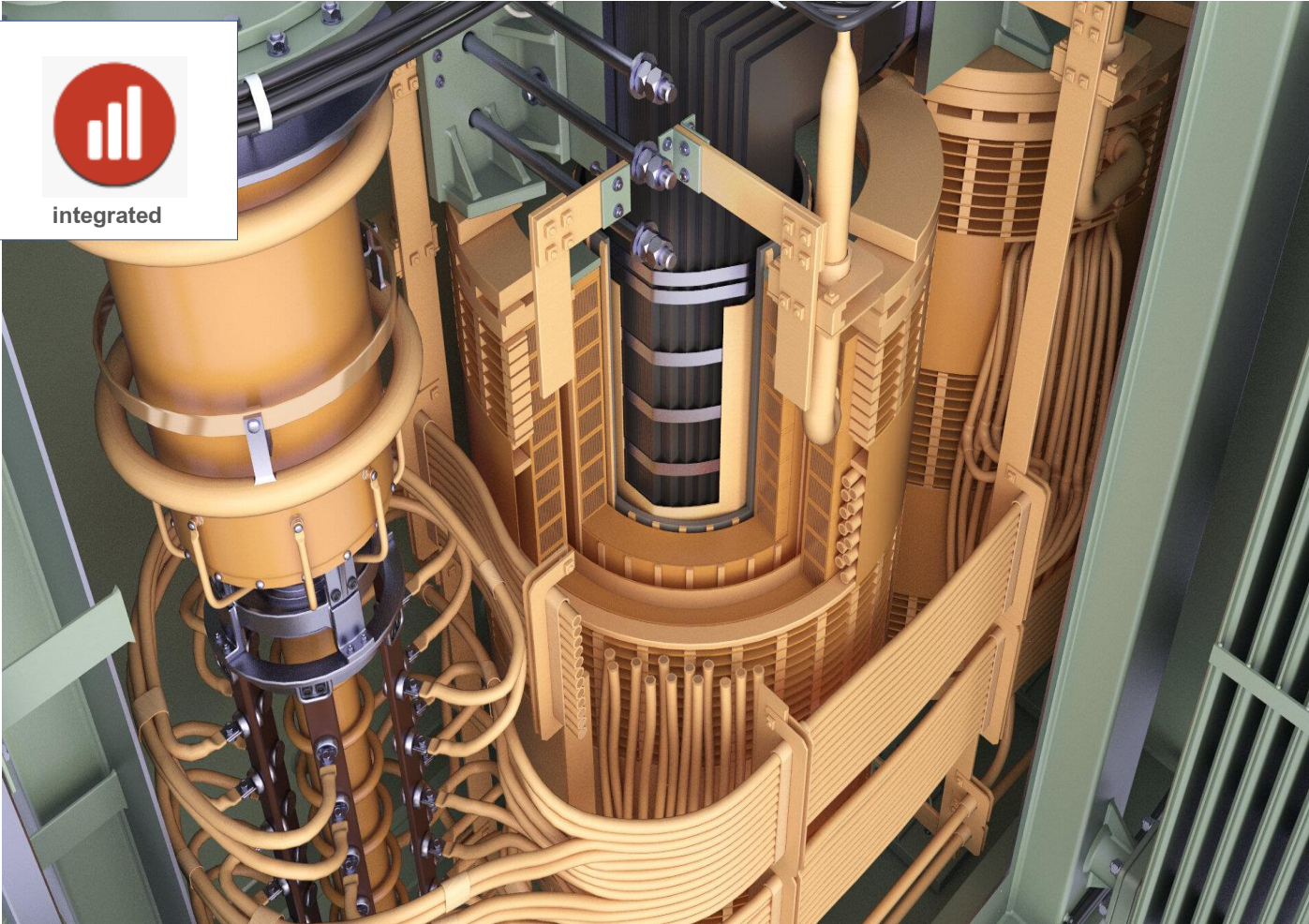


# Transformer Optical Windings temperature monitoring



integrated



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*Pioneering the future of power testing and monitoring*

## Transformer windings optical temperature monitoring

**ASTM D149 and IEC 60076-2 compliant**

**Highest Electromagnetic Immunity and high accuracy**

**Durable FBG technology with no need for maintenance and calibration**

Power transformers are critical components in electrical systems, and accurate temperature monitoring of their windings is essential to ensure reliable operation and prevent overheating. The technology used leverages fiber-optic sensors to provide real-time and accurate temperature measurements, overcoming the limitations of traditional methods such as RTDs (Resistance Temperature Detectors) and thermocouples, have limitations in terms of accuracy, sensitivity, and susceptibility to electromagnetic interference.

The Optical Temperature Monitoring technology employs fiber-optic sensors based on the principle of Fiber Bragg Grating (FBG). FBGs are periodic variations in the refractive index of an optical fiber that act as wavelength-specific reflectors. Temperature changes induce strain in the fiber, altering the wavelength of reflected light, which correlates with temperature variations. The sensors are embedded in the transformer winding to provide distributed temperature data along the entire length.

The system has very high accuracy with deviations as low as  $\pm 0.5^{\circ}\text{C}$ .

The distributed nature of FBG sensors allows for fine spatial resolution, detecting hotspots and localized temperature variations.

**Electromagnetic Immunity:** Unlike traditional methods, FBG sensors are immune to electromagnetic interference, ensuring accurate readings in high-voltage environments.

**Real-time Monitoring:** The technology provides real-time temperature data, enabling prompt response to temperature anomalies.

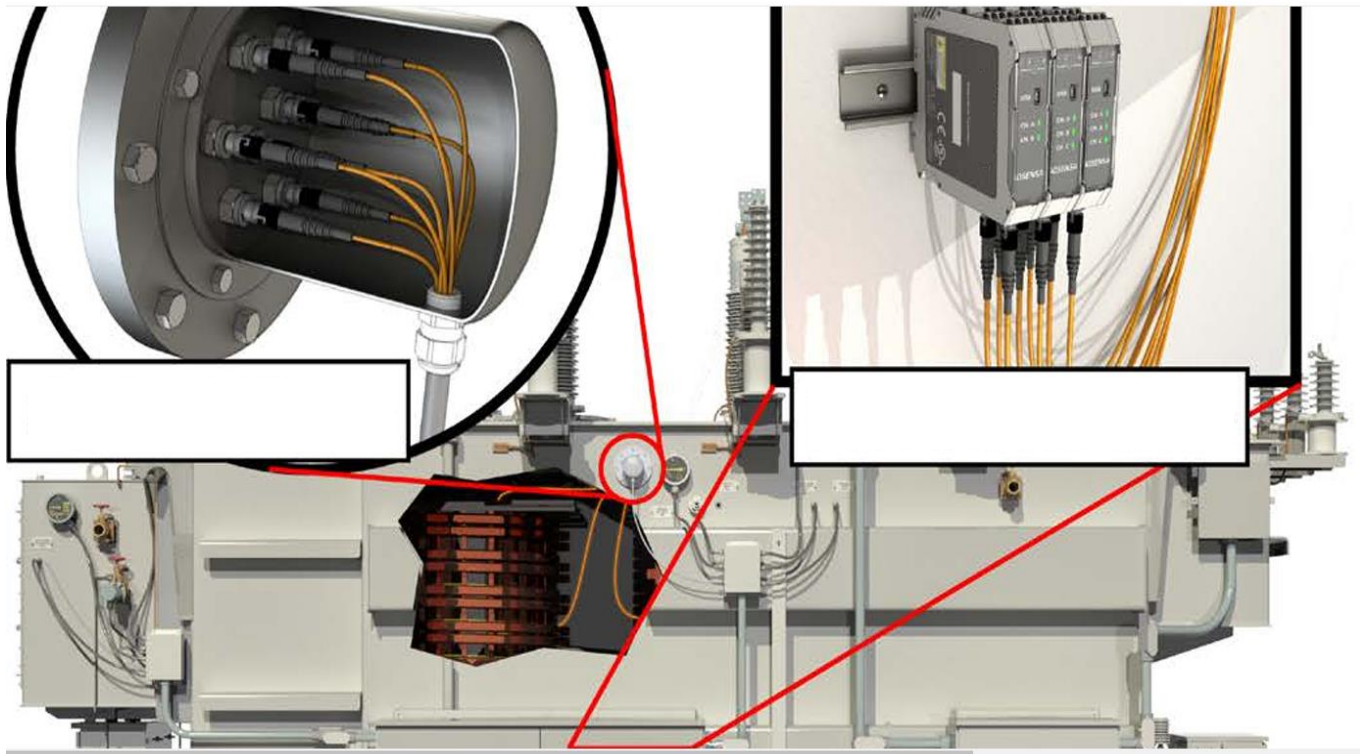
Optical fibers are robust and can withstand harsh environmental conditions, ensuring long-term reliability.

**Maintenance:** The non-intrusive nature of FBG sensors eliminates the need for frequent maintenance.

Multiple sensors can be multiplexed on a single fiber, enabling comprehensive temperature mapping.

It showcases the benefits gained, such as early fault detection, improved asset management, and enhanced system reliability.

Durable solution for accurate and real-time temperature monitoring of power transformer windings. Its advantages in terms of accuracy, immunity to electromagnetic interference, and distributed temperature sensing make it a valuable tool for ensuring the reliability and longevity of power transformers.



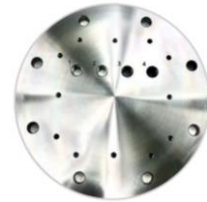
## Transformer windings optical temperature monitoring

Feedthrough is a hermetically sealed stainless steel ¼ inch male NPT fitting designed for use with the fiber optic temperature sensing systems. The feedthrough can provide a leak-free optical path between the tank walls of power transformers. The ST-to-ST connection provides a reliable, vibration resistant connection for the fiber optic temperature sensing probes.

Tank Wall Feedthrough



Tank Wall Plate allows for up to 25 optical feedthroughs to pass through an oil-filled transformer tank wall. The tank wall plate can be mounted to the transformer either by welding (CRS) or bolting (stainless steel with O-Ring). Optional mounting holes can be added for an IP rated junction box.



- PRB-730 fiber optic temperature probes are specifically designed for oil-filled transformer applications where long life and accuracy are paramount. Not only are these probes stable and repeatable over the life of the transformer (no calibration required), they also offer industry leading accuracy, precision, and reliability. The PRB-730 style probes are fully compatible with all transformer oil types and kerosene desorption processes. PRB-730 temperature probes, together with the EXT-730 extension cables, can support installation lengths up to 50m.

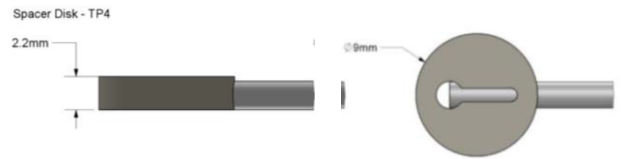
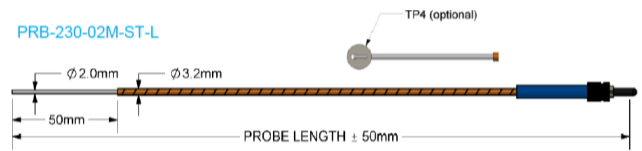
PWTX is fiber optic temperature transmitters in a compact 35mm DIN-rail mountable format. Each transmitter accepts from one to six optical fiber sensor inputs. The PWTX transmitters are powered by 12-24V DC and include isolated RS-485 serial connectivity over industry standard Modbus RTU protocol. Multiple 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



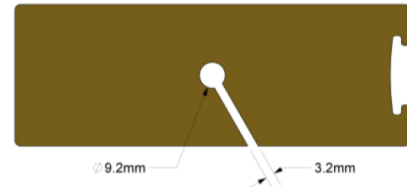
HMI-RELAY touch panel additionally includes 8 standard user programmable form C relay outputs, one configurable fail-safe system relay, and 12 analog outputs. The intuitive touch interface enables easy configuration of the relays for alarms and hardware control.

# Temperature Sensors Specifications

<b>Optical Sensor</b>	
Range	-40°C to 230°C
Accuracy	± 1.0°C
Dielectric Strength	10 kV/mm
Compliance	ASTM D149 - 10 kV/mm, IEC 60270 – less than 10pC
<b>Expected sensor lifetime</b>	Min 50 years
<b>Chassis 1</b>	
RTD Inputs	7
Optical Inputs	16
Analog Outputs	X
Analog Inputs	MAX 32
Digital Inputs	MAX 84
Programmable Relay Output	MAX 16
OLTC Analysis	✓
Loss of Life analysis	✓
GIC Core Saturation	✓
Hotspot Diagnostics	✓
Smart Cooling	✓
Maximum Voltage	765 kV
Power Supply	38 VDC to 290 VDC or 120 VAC
Event Logging	✓
email notification	✓
Protocols	DNP 3.0 or MODBUS TCP/IP Wired RS-485 for DNP 3.0 or MODBUS RS-232 and USB B Serial Communications
<b>Chassis 2</b>	
Conditioner	
Channel Numbers	6
Range	-50°C to 250°C
Resolution	0.1°C
Accuracy	±2.0°C
Communication	MODBUS RTU
HMI	
Touch Screen	✓
Analog Outputs	12
Programmable Relay Output	8
Communication	RS-232, RS-485
Conditioner connectivity	Modbus Slave (over TCP/IP, RS485,USB)
SD Card Memory	16 GB
RAM	1 GB
Power Supply	24 V



Spacer Disk Cutout



Protection Relay



3-rd party RTD Sensor typically delivered with the system



2416 Main Street  
Vancouver  
BC V5T 3E2  
Canada



Tel: + [1\(778\) 8194363](tel:17788194363)  
Fax: + [1\(778\) 8194363](tel:17788194363)  
Email: [info@powerview-energy.com](mailto:info@powerview-energy.com)  
Web: [www.powerview-energy.com](http://www.powerview-energy.com)