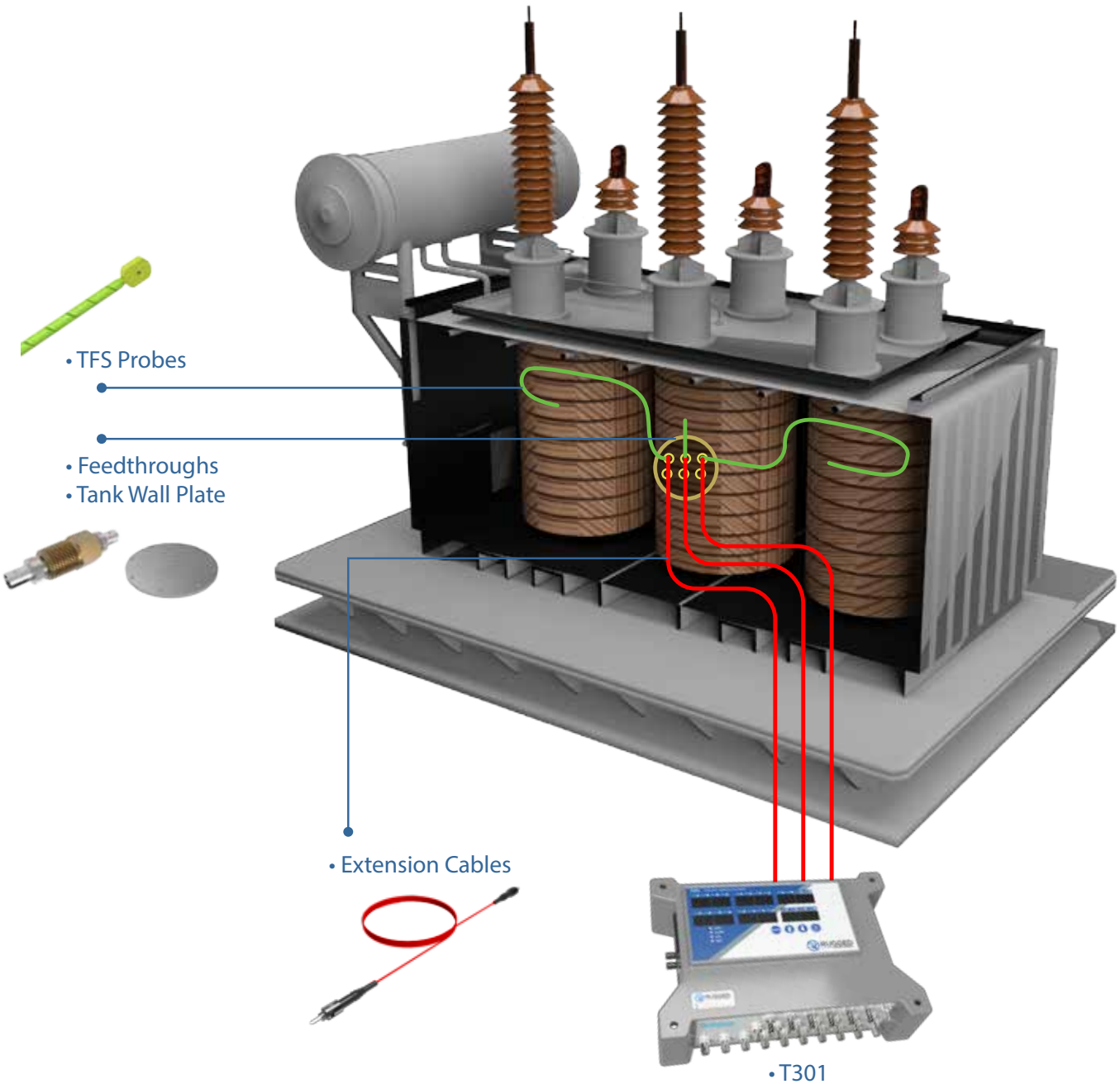
RUGGED MONITORING

Transformer Hot Spot Monitoring System



- **Increase Accuracy of "Heat Run" Tests**
- **Transformer Performance Optimization**
- **Detect Early Life Failures**
- **Thermal Model Reflects Operating Conditions**
- **Transformer Dynamic Loading Response**
- **Enable Preventive Maintenance**

Fiber Optic Transformer Sensor (Tsens)

Features

- Suitable for dry-type and oil-filled tranformers
- Compatible with all types of transformer oil, including ester type
- Meets and surpasses ASTM D3426 and D-149 standards
- Extremely low PD performance
- Compatible with kerosene vapor drying process

Specifications

- Improved design (patent pending)
- Measuring range: -80 °C to 250 °C
- Response time of ~ 1 sec
- Available in any lengths, up to 25 meters
- With industry standard ST connector
- Solid Torlon disk tip, diameter 9 mm
- Designed to exceed Transformer life

Ordering Code

Length in Meters, Ex: 02 = 2 Meters

Transformer Probe Cable Diameter
X = 3 for 3 mm

TFS = Transformer Fiber Sensor

Options
YY = 00, Metal ST Connector (Default)
YY = DT , Dielectric Connector TORLON

T F S – T G – [ ][ ] – X – Z [ ][ ]

G = Gallium Arsenide
T = Temperature

Options
Z = 1, for 9 mm Disc 2.2mm thickness (Default)
Z = 0, for no retaining Disc

Feedthrough

Features

- Easy installation, No O-rings design
- Optional pre-installation in TWP
- Designed to reduce loss of light, critical to reliability

Specifications

- Zirconia connector: Better optical transmission
- Stainless steel 316L construction
- Wide temperature and pressure ranges

Ordering Code

T F F T – [ ][ ][ ]

014 = 1/4" NPT Feedthrough, SS 316

TFFT = Transfomer Feedthrough

Tank Wall Plate

Features

- With O-Ring or customer supplied gasket
- Compatible with RM Interface Box (optional bolting provision)

Specifications

- Diameter of 275 mm
- Stainless steel 316L construction
- Up to 25 feedthroughs

Ordering Code

Assembly Options
0 = Welded
1 = Bolted with Viton O-ring
2 = Bolted and Flat for gasket seal

Number of OFT's
Example: 08 = 8 OFT's

Interface Box (i-Box)
0 = No i-Box
1 = With i-Box (bolting provision)

T P L T – [ ][ ] – A [ ] – I B [ ]

TPLT = Transformer Tank Wall Plate

Extension Cable

Features

- PVC sheathing (outside transfomer)
- Teflon sheathing is mandotory with dielectric connector (inside transformer)

Specifications

- 3 mm OD
- Maximum temperature: +85 °C
- Available in any lengths, up to 500 meters

Ordering Code

Length in Meters, Ex: 02 = 2 Meters

Cable Sleeve
P = PVC (Default)
T = PTFE Teflon

F O X T – [ ][ ] – P – S T X X

XX = ST, Metal Connector (Default)
XX = DC, Dielectric Connector at one end

FOXT = Fiber Optic Extension Cable

Interface Box

Features

- Leak proof design (IP66)

Specifications

- Size 200 x 200 mm, 150 mm high
- With neoprene gasket
- Stainless steel 316L construction throughout

Ordering Code

T I B X – A C C

Transformer Interface Box

Dielectric Connector

Features

- Designed to be used inside transformers
- Great to repair probes on site
- Used to extend short probes inside transformer

Specifications

- Suitable for HV/EHV applications

Rack-Mount Temperature Monitor (R501)

Features

- Fully flexible and expandable rack mount unit
- Support different types of plug and play modules (Analog and Digital I/O)
- Best in class EMI, ESD Immunity
- Built-In Transformer Analytics: Dynamic Loading, Thermal Modeling, Transformer Life
- Range of communication options for third party system integration

Specifications

- Input Power requirement: 24Vdc
- Expandable to 256 Channels
- Accuracy of ±1 °C, Resolution of 0.1 °C
- Operating Temperature: -40°C to +72°C
- Operating Humidity: 95% Non Condensing
- Standard USB, RS-485, Ethernet interfaces
- Modbus, IEC61850, DNP 3.0, IEC60870-5-104

Ordering Code

Please Contact Factory for Quotation

Rugged Temperature Monitor (T301)

Features

- Based on market leading GaAs technology for long term reliability
- System Integrity Self Check
- Dedicated system fault relay
- 8 fully configurable Analog Outputs
- 8 Programmable Form-C Relays (5A)
- Light sources have an estimated life of 300 years

Specifications

- Input Power Supply: 24 to 48 VDC
- 4 to 24 Channels, Expandable
- Accuracy of ±1 °C, Resolution of 0.1 °C
- Operating temperature range, -40 °C to 72 °C
- Expandable Industrial Grade Memory (4/8GB)
- Standard USB, RS-485, Ethernet interfaces
- Modbus, IEC61850, DNP3.0, IEC60870-5-104

Ordering Code

Number of Channels
Ex: 08 = 8 Channels

Number of Analog Outputs
0 = No Analog Outputs
8 = 8 Analog Outputs

T 3 0 1 – [ ][ ] E [ ] A [ ] R [ ] M [ ]

Memory Size
4 = 4 GB
8 = 8 GB

Ethernet Protocols
0 = No Ethernet
1 = Ethernet Board RJ45
2 = Ethernet Board RJ45 & SFP

Number of Relays
0 = No Relays
8 = 8 Relays

Handheld Temperature Monitor (H201)

Features

- Rugged, Compact Design for quick temperature reading and testing
- Easy to use, Handheld, Plug and Play
- Suitable for HV applications and best in class EMI, ESD Immunity
- Built-in display with Remote Client software for advance visualizations
- Battery operated

Specifications

- 2 to 8 Channels, Expandable
- Accuracy of ±1 °C, Resolution of 0.1 °C
- Operating Temperature: -40°C to +72°C
- Operating Humidity: 95% Non Condensing
- Standard USB, RS-485 (Modbus)

Ordering Code

H201 = Handheld, 201 series

H 2 0 1 – [ ][ ]

Number of Channels,
Ex: 08 = 8 Channels (Available 02, 04, 06, 08)

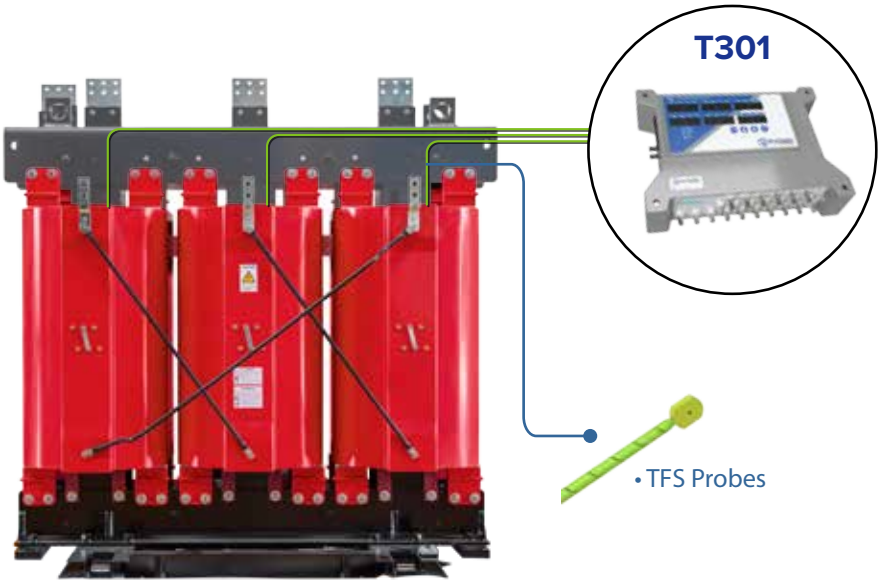
Rugged Connect Software and Webserver

Features

- Web client based real time data visualization
- Historic trending for user selectable duration
- Easily customizable dashboards to meet different applications
- Fiber Optic signal strength monitoring for easy troubleshooting
- Flexibility to Enable / Disable Channels remotely
- Support for multiple languages
- Industry standard protocols (Modbus, IEC61850, DNP 3.0, IEC60870-5-104
- Easy to use programable interface for analog and digital I/Os

OTHER APPLICATIONS

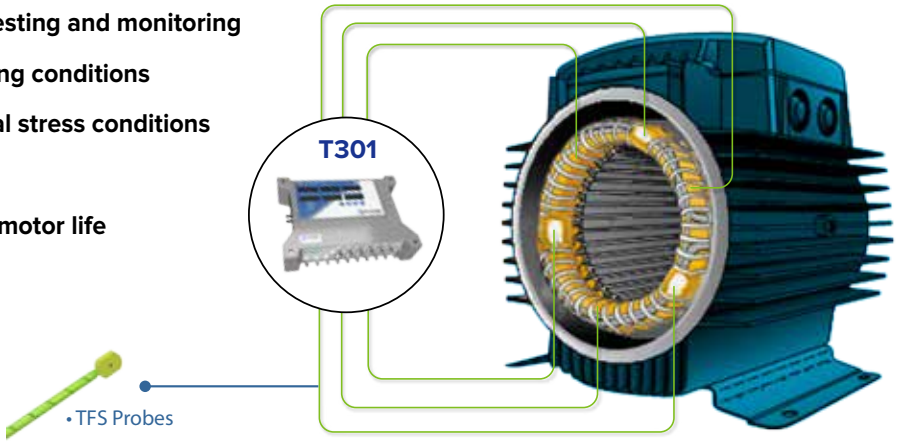
Fiber Optic Temperature Sensors and Monitor for Dry Type Transformers



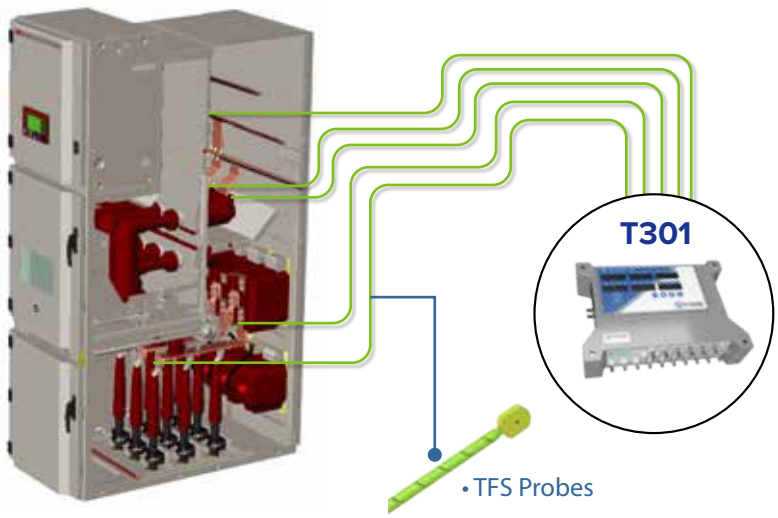
- Most accurate hot spot measurement (better than IR Camera and RTD)
- Maintenance Free Sensors and Monitors
- Safe from Partial Discharge unlike RTDs
- Peace of mind about getting sensor lenses cleaned and setting IR sensors
- Most accurate heat run test with the same FO temperature sensors

Fiber Optic Temperature Sensors and Monitor for AC Motors

- Safest, most accurate and reliable thermal testing and monitoring
- Design efficient motors to suit harsh operating conditions
- Quick detection of overload and high thermal stress conditions
- Maximize Motor efficiency
- Prevent unexpected shutdowns and extend motor life



Fiber Optic Temperature Sensors and Monitor for Switchgears



- Quick detection overload and fault conditions (Corrosion, Loose contacts / joints etc.)
- Smart grid temperature monitoring
- Maximize load efficiency and balance thermal stresses
- Identify developing hotspots in switchgear contacts, bus bars, connection points develop
- Eliminate corrosion of busbars and contacts due to hot spots

Typical Oil-Filled Transformer Configurations

	Equipment	Non Critical Transformers	Standard Transformers	Critical Transformers
Probe Positions	Central Windings - LV	2	2	6
	Central Windings - HV	2	2	6
	Lateral Windings - LV	1 per Phase	1 per Phase	2 per Phase
	Lateral Windings - HV	1 per Phase	1 per Phase	2 per Phase
	Top Yoke Core		1	1
	Top Oil		1	1
	Spare		2	2
	Total Probes	8	12	24
	Optical Feedthroughs	8	12	24
	Tank Wall Plate	8 hole version	12 hole version	24 hole version
	Interface Box(i-Box)	1	1	1
	Extension Cables	8	12	24
	Number of Channels in the monitor	8	16	24

We are an industry leading team of fiber optic experts with 100+ years of combined experience, and are committed to deliver customizable solutions for challenging applications. Our team of experts leads through product innovation to deliver best in class reliability. We deliver reliable, high performance, precision sensors and monitoring solutions. Our mission is to:

• **Customer Service**	At Rugged Monitoring customers come first. Deliver best in class customer service, be first in mind and choice for customers.
• **Rugged Design**	Deliver Rugged, intrinsically safe sensors / solutions for the toughest applications.
• **Innovation**	Leading next generation product innovations with patented technologies.
• **Fiber Optic Experts**	Our team has extensive knowledge of Power Transformer Industry and viewed as leaders in fiber optic sensing technology.
• **Quality Focus**	Provide peace of mind to our customers by delivering quality products consistently.

Rugged Monitoring Services

Rugged Monitoring provides customization of sensors, monitors & software. In addition we offer on-site commissioning services, maintenance contracts and technical support to all customers worldwide.

About Rugged Monitoring

Industry leading team of fiber optic experts with 100+ years of combined experience committed to delivering customizable solutions for challenging applications. We offer a range of reliable, high performance, customizable sensors and monitoring solutions that are immune to external influence.

+1-418-767-0111 info@ruggedmonitoring.com www.ruggedmonitoring.com