TS

Catalog

Temperature Supervisor for Oil-immersed Transformers

Thermal monitoring of oil-immersed transformers is essential for their safe operation. This is the case for not only for large-scale equipment, but also for medium-sized transformers and distribution transformers, thus allowing maximum return from the investment in these assets to be achieved without jeopardizing their life cycle.

The Temperature Supervisor's competitive cost allows the inclusion of thermal monitoring for small and medium size transformers. The advantage of digital temperature monitoring is no longer reserved for higher power transformers only.

The TS eliminates the need for manual readings taken using electro-mechanical equipment, with significant increase in the level of accuracy, reliability and more efficient use of cooling both in operations and maintenance areas. The monitor features an input for an RTD sensor for measuring the temperature at the top of the oil, and an input for external CT clip-on type (accessory, sold separately), for measuring load current, performing the calculation of the temperature of the winding by thermal imaging.

Optionally, the TS can be equipped with two additional temperature sensor inputs for measuring, for example, ambient temperature, on load tap changer or others.

Main Features:

- IED (Intelligent Electronic Device) designed specifically for substation yard conditions (interference, extreme temperatures);

- Real time temperature reading on display, with programmable display mode: indication of highest temperature, automatic screen roll or fixed channel reading indication;

- High-glow LED type display for easy visualization; and operation in extreme temperatures;

- Serial communication port RS-485 (optional) for integration into supervision or remote monitoring systems. Open communication protocols Modbus RTU or DNP3 level 1;

- Self-calibrating Input for Pt100 Ω at 0 °C RTD type temperature sensors, ensuring high-level accuracy and stability throughout the entire ambient temperature range;

- Programmable analog output (optional) for remote temperature readings. Programmable output range: 0...1, 0...5, 0...10, 0...20 or 4...20 mA;

- Output relays for alarm indications, transformer trip, self-diagnostic and command of two-stage forced cooling with Automatic/Manual selection. Forced activation of cooling in case of lack of auxiliary power, internal fault or fault in temperature sensor (NC relays);

- Internal clock with date and time and non-volatile memory for storage of readings (optional);

- Self-diagnostic for internal fault detection. Total absence of mechanical parts for parameter setting and calibration.

Optional Functions

OPTION 1 – ADDITIONAL TEMPERATURE READINGS

Additional inputs for measuring of up to two additional temperatures (for sensor Pt100 Ω at 0 °C), allowing measuring of the temperature of the on load tap changer, ambient temperature or other;

OPTION 2 – ANALOG OUTPUT

Programmable analog output for remote temperature reading indication, user selectable for display of highest temperature or a pre-defined temperature. Programmable output range: 0...1, 0...5, 0...10, 0...20 or 4...20 mA;

OPTION 3 – SERIAL COMMUNICATION PORT RS-485

Serial communication port RS-485 for integration into remote supervision systems, allowing the establishment of a temperature monitoring network covering the entire facility. User selectable communication protocol in Modbus RTU or DNP3 level 1.

OPTION 4 – MASS MEMORY

Nonvolatile memory for storage of temperature readings and alarm events, trips and activation of forced cooling, based on internal clock with day, month, year, hour, minute and second. A memory recording can be started by:

- User defined time interval between recordings, or;
- Variation of any temperature monitored higher than the dead band selected by users, in °C, or;
- State change in any output relay (control of cooling, alarms, trips or self-diagnostic).

OPTION 5 – PRE-COOLING

Pre-cooling can prolong the life cycle of insulation on transformers subject to overloads, by activating cooling groups whenever previously user selected load levels are reached. Taking advantage of the high thermal inertia of oil, the forced cooling system is activated even before the increase in temperature occurs, this increases the times required to achieve high temperatures, which would cause an accelerated loss of lifetime for the insulation. The following are user programmed:

- Load percentage for activation of the first forced cooling group;
- Load percentage for activation of second forced cooling group;
- Hysteresis for shut down of forced cooling when load level drops.

OPTION 6 – FAN EXERCISING

The Fan Exercising function keeps fans from remaining inactive for long periods of time on transformers operating at low load levels or during periods of low ambient temperatures. This prevents axle blockage from accumulation of dirt or grease dry out and bird nesting. Fans are activated daily, in accordance with the equipment's internal clock and dependent on the selections made by users:

- Time and minute for switching fans on;
- Total daily fan operation, between 0 and 100 minutes.

Technical Specifications

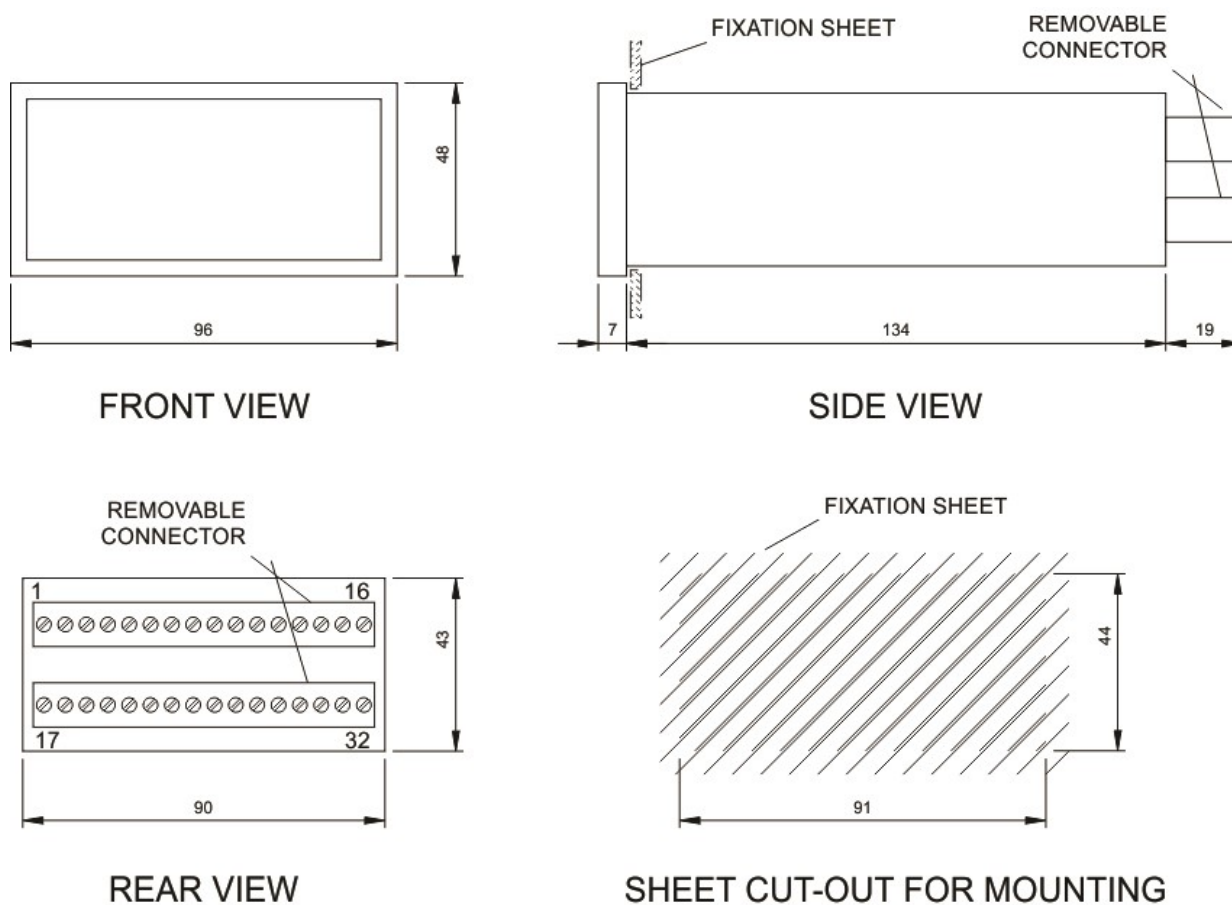| Conditions	Interval/Description
Input Voltage:	38…265 Vac/Vdc, 50/60 Hz
Maximum Consumption:	< 5 W
Operating Temperature:	-40…+85 °C
Degree of Protection:	IP 20
Wire size – removable connectors:	22…12 AWG, 0.3…2.5 mm²
Fixation:	Built in panel
Direct temperature measurements:	One (standard, oil temperature) or three (optional)
Sensor:	Pt100 Ω at 0 °C with continuous self-calibration
Measuring range:	-55...+200 °C
Maximum error at 20 °C:	0.5 % of full scale
Deviation by temperature variation:	20 ppm / °C
Type of connection:	3-wire sensor
Winding temperature measurement:	Calculated
Mathematical models applied:	IEEE C57.91-1995
	IEC 354 - 1991
	ABNT NBR 5416-1997
AC measurement input:	With external clip-on CT (accessory required)
Working range:	0...10 A
Maximum error at 20 °C:	1 % of full scale
Deviation by temperature variation:	50 ppm / °C referred to full scale
Analog output (optional):	One
Maximum error:	0.5 % of full scale
Options (selections) and maximum load:	0...1 mA, 10 kΩ
	0...5 mA, 2 kΩ
	0...10 mA, 1 kΩ
	0...20 mA, 500 Ω
	4...20 mA, 500 Ω
Relay outputs:	Seven dry contacts
Maximum switching power:	70 W / 250 VA (resistive)
Maximum switching voltage:	250 Vdc / 250 Vac
Maximum conduction current:	5 A
Serial Communication Port (optional):	1 RS-485, supervision/monitoring system
Communication protocols:	Modbus RTU or
	DNP3 level 1

Connection Diagram
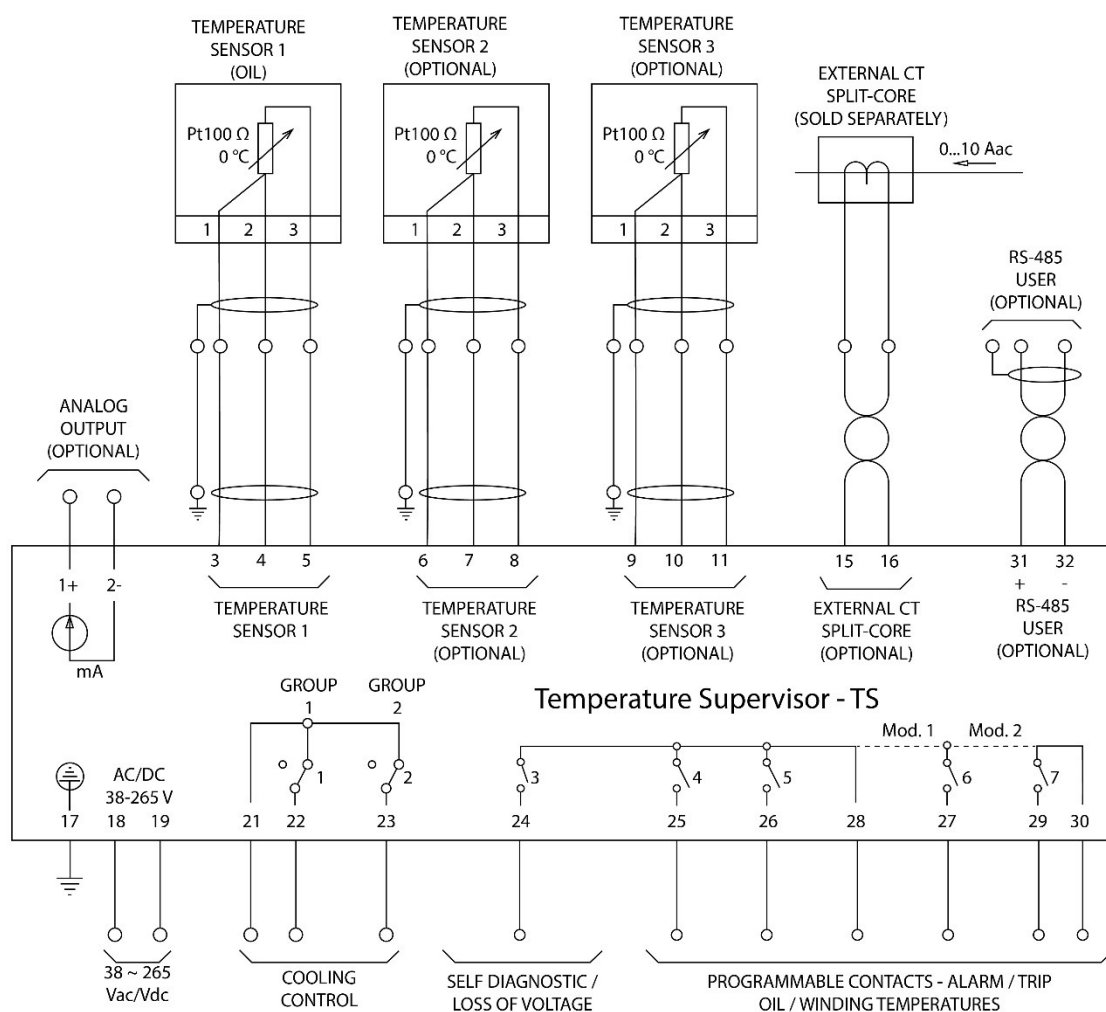
NOTE:
1) PLEASE NOTICE THE FOLLOWING FUNCTIONS ARE OPTIONAL:
ANALOG OUTPUT, SERIAL PORT RS-485, ADITIONAL TEMPERATURE
MEASUREMENT INPUT AND MASS MEMORY

2) ALL CONTACTS SHOWN WITH TS IN DE-ENERGIZED CONDITION

3) OPTION OF CONNECTION CONTACT 27 MUST BE INFORMED ON PURCHASE ORDER:
- MODEL 1: CONTACT 27 WITH COMMON POINT ON THE TERMINAL 28
- MODEL 2: CONTACT 27 WITH COMMON POINT ON THE TERMINAL 30

Dimensions

FIXATION SHEET   REMOVABLE CONNECTOR

48

96

FRONT VIEW

7   134   19

SIDE VIEW

REMOVABLE CONNECTOR

1   16

43

17   32

90

REAR VIEW

FIXATION SHEET

44

91

SHEET CUT-OUT FOR MOUNTING

ALL DIMENSIONS IN mm

Order Specification

The Temperature Supervisors TS are universal devices; its features are selected by using the programming menus. These adjustments can be made directly on the device's front panel or by way of configuration software, using the serial communication port RS-485 (optional). The power supply input is universal (38 to 265 Vac/Vdc, 50/60 Hz).

Therefore, in purchase orders for the equipment the following need to be informed:
- Temperature Supervisor TS
  - Quantity;
  - Option to link to the contact 27: Model 1 and Model 2;
  - Desired optional functions among options 1 to 6 (any optional combination is possible).
- Accessories:
  - Clip-on CT (not included in TS)
    - Quantity.

Accessories

- **External Split Core Clip-on CTs**

External clip-on CTs with a split core is required for the operation of the TS.

This item is supplied in the quantity that is required for the desired application, which should be specified in the purchase order.
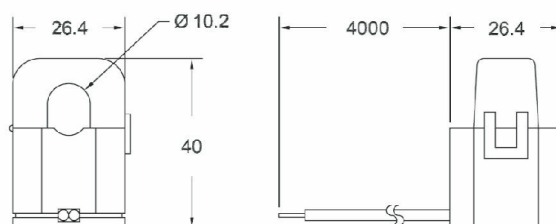

Operating Temperature: -40…+85 °C. Dimensions in mm.

- **Temperature sensor Pt100 Ω at 0 °C**

Usually, a temperature sensor, installed in a thermo-well, at the cover of the transformer, measures the top oil temperature. The sensors must be of the Pt100 Ω at 0 °C type.
If needed, Treetech offers temperature sensors of the Pt100 Ω type with connection head or flexible wiring harness.

Characteristics	
Standard:	ASTM E1137, class B
Alpha Coefficient:	0.3850 Ω/°C
Measurement Range	-100…+300 °C
Head:	Cast Aluminum, painted
Bulb (rod)	Stainless Steel
Cable gland:	Nickel-plated Tin
Chain:	Nickel-plated Tin
Screws:	Nickel-plated Tin or stainless steel
Adapter	Stainless Steel
Insulation:	2.5 kV, 50/60 Hz, 1 min
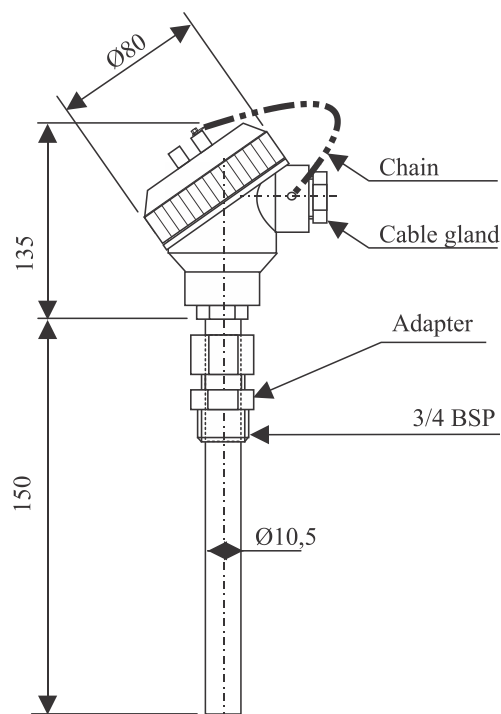
ALL DIMENSIONS ARE IN mm

- **Weather shelter**

  If ambient temperature measurement is desired in unguarded locations, a weather shelter should be used to protect the Pt100 Ω at 0 °C sensor, minimizing errors that sun, rain, wind, etc. could cause in the measurement. Treetech has a suitable weather shelter.

- **Cabinet for Outdoor Installation**

  The TS must always be sheltered from weather conditions. Thus, it is often installed inside some building, like a control room. When it's not convenient, as when retrofitting old transformers, the TS may be supplied in an easy to install weather-proof cabinet.

  CHARACTERISTICS:

- Fastening: Bolted with high load capacity magnets

- TSs fastening: Removable rack

- Wiring connections: Multipolar removable plug at the bottom of the cabinet

- Protection degree: IP55

- Insulation Test: 2 kV, 50/60 Hz, 1 min

Type Testing

Surge Immunity (IEC 60255-22-5):	
Phase-neutral surges:	1 kV, 5 per polarity (+/-)
Phase-ground and neutral-ground surges:	2 kV, 5 per polarity (+/-)
Electrical transients Immunity (IEC 60255-22-1 and IEEE C37.90.1):	
1st cycle peak	2.5 kV
Frequency:	1.1 MHz
Time and repetition rate:	2 seconds, 400 surges/sec
Decay to 50%:	5 cycles
Voltage Impulse (IEC 60255-5):	
Wave form:	1.2 / 50 μs
Amplitude and energy:	5 kV, 0.5 J
Number of pulses:	3 negative and 3 positive, 5 s interval
Insulation Voltage (IEC 60255-5):	
Industrial frequency insulation voltage	2 kV, 60 Hz, 1 min to ground
Irradiated electromagnetic field Immunity (IEC 61000-4-3 / IEC60255-22-3):	
Frequency:	26…1000 MHz
Field intensity:	10 V/m
Conduced electromagnetic perturbations immunity (IEC 61000-22-6):	
Frequency:	0.15…80 MHz
Field intensity:	10 V/m
Electrostatic Discharge (IEC 60255-22-2 and IEEE C37.90.3):	
Air mode:	8 kV, ten discharges per polarity
Contact mode:	6 kV, ten discharges per polarity
Fast electrical transient immunity (IEC60255-22-4 and IEEE C37.90.1):	
Power supply, inputs and outputs:	4 kV
Serial communication port:	2 kV
Climatic test: (IEC 60068-2-14):	
Temperature range:	-40…+85 °C
Total test time:	96 hours
Vibration response: (IEC 255-21-1):	
Application mode:	3 axis (X, Y and Z), sinusoidal
Amplitude:	0.075 mm from 10…58 Hz
	1 G from 58…150 Hz
Duration:	8 min/axis
Vibration resistance: (IEC 255-21-1):	
Application mode:	3 axis (X, Y and Z), sinusoidal
Frequency	10…150 Hz
Amplitude:	2 G
Duration:	160 min/axis
Short duration overload (IEEE C57.109-1993 and NOR 8145/83)	
On AC current measurement input	

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