CATALOG

Transformer Termperature Monitor – MasterTemp

SUMMARY

INTRODUCTION

The Temperature Monitor **MASTERTEMP®** was designed to monitor up to 3 windings oil temperature, to command the cooling system, and to protect distribution and power transformers (ANSI 49I and ANSI 49);

The **MASTERTEMP®** was built obeying to rigorous quality patterns and it uses last generations electronic components (SMD type), its hardware was designed to stand against severe working conditions, all of this protected by a aluminum cabinet in conformation with DIN IEC 61554 norm, this features allows to do its installation directly on Power Transformer and Reactor panels, on substation halls, maritime platforms and Chemical Plants.

As input signal, the **MASTERTEMP®** allows up to 2 (two) Temperature Sensors PT-100 that can be set to: Environment temperature measurement and to the transformer main tank oil top measurement, TAP Changer oil Temperature and Oil Top with configurable alarm or two measurement points for redundancy and backup in case of measure loss from one of ths PT-100 Sensors.

It also has 3 (three) electrical current measurement input from the Thermal Image CT to calculate the winding temperature using a precision transductor CT Split Core Type.

For remote transmission of these quantities, the **MASTERTEMP®** has 5 (five) analog outputs totally configurable being able to transmit any quantity measured or calculated, such as; Oil Temperatures, Winding Temperatures, Primary windings electrical current, Secondary windings electrical current, windings percentual loading, Temperature differential between sensors 1 and 2 with selectable pattern as 0 to 1 mA, 0 to 5 mA, 0 to 10 mA, 0 to 20 mA and 4 to 20 mA.

To the SCADA or Specialist Software all the measured quantities, calculated and Setting parameters, beyond the engineering patterns that are available on **MASTERTEMP®** that can be accessed through a RS-485 digital output with 2 standards communication protocols, Modbus RTU and DNP 3.0 (Level 2) chosen by the use on **Configuration Set** equipment parameter, including real-time electric drives remote commands.

For Alarm indication and thermal protection, the **MASTERTEMP®** has 13 isolated and potential free driving relays with configurable setpoints to alarms and shutdowns by oil and winding temperature levels, temperature differential alarms and sensors failure and 1st 2nd and 3rd ventilation groups activation that can also be driven through the power transformer percentual loading and 1 auxiliary relay that is configurable by the user for actuation by any measured value.

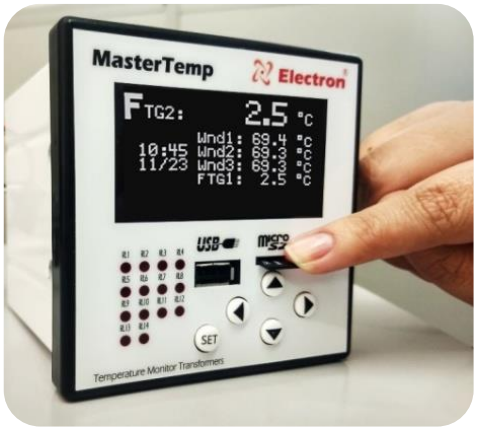


Fig. 1 – Entrada para cartão de memória Micro SD Card

Fig. 2 – Entrada USB para Parametrização via Software UseEasy

The MASTERTEMP® display presentation mode is totally configurable, being possible to introduce the measured quantities in 5 lines and on the 1st one is possible to configurate the SCAN mode all the selected quantities by the user.

The display shows measured and calculated indications, written messages of the events and its activated relays, as well as a watcher with hours/minutes/seconds indication used in a datalogger timestamp that stores its information in a Micro SD Card all MASTERTEMP® events and measurement by a uninterrupted 10 years with a 5 minutes recording interval.

MAIN FEATURES

HUMAN MACHINE INTERFACE (HMI)

- **OLED** display with 128 x 64 pixels graphic capacity, with contrast adjustment and background color and letters inversion, legible under any illumination condition, including directly sun exposure;
- Main Screen with simultaneous indication of 5 selected quantities in SCAN mode;
- HMS watcher indication, in case of energy breaks it doesn't lose its configuration until 240 hours, it uses a super-capacitor as an energy backup for high operation temperatures and it will never require replacement;
- 5 Silicon navigation keys with smooth touch;
- 14 LED's on frontal that allows the identification, even over long distances, of driven outputs relays;
- Failure and Events written indication on the OLED display (Announcer) and driven relays describing;
- Intuitive Configuration Sets, indication, actuation, maintenance and transformer parameters, protected by an access password and in 2 languages (Portuguese and English);
- Consult menu for maximum temperature indication reached by the sensors;
- Consult menu for working time indication of each cooling group;
- Consult menu of final gradient indication of each power transformer winding;
- Consult menu for percentual loading of each power transformer winding;
- Consult menu of measured currents by the external CT (Split Core / Clamp);

- Consult menu of winding currents indication of the power transformer (Calculated Value);
- Consult menu of life loss of each winding and the remaining life of each winding;

ENGINEERING ALGORITHMS FOR MONITORING

- Thermal image calculation (Hot Spot) based on IEC 60076-7, IEEE C57.91 and NRB 5356-7:2017 normative;
- Power Transformer loading percentage calculation;
- Temperature Final Gradient Calculation for the current load (Oil-winding);
- Life loss calculation of the selectable insulation for Kraft (55°C), stabilized term (65°C) and Nomex (95°C) based on Arrhenius Theory and insulation remaining working life in hours and days;
- Temperature differential calculation between two PT-100 Sensors in order to monitor TAP Changer defects or Cooling efficiency monitoring;
- Time Monitoring of the ventilators actuation (Hour meter) with programmable Alarm for Maintenance Warning;

COMMUNICATION PROTOCOLS AND DIGITAL COMMUNICATION PORTS

- USB 2.0 Frontal communication port with type A connector for configuration upload or download through ***USEEASY*** software;
- 2 wires RS-485 digital output (ANSI/TIA/EIA-485-A) with 2 available protocols, ***Modbus RTU*** and ***DNP3*** (Level 2) for remote monitoring through SCADA software and access to all measured parameters and digital outputs activations
- Auto Baud Rate of 2.400 to 57.600 bps (It automatically detects the communication network speed);

DATA STORAGE AND DATA LOGGER

- Frontal 8GB Micro SD card input that stores up to 10 years of the MasterTemp of the calculated and measured data;
- Stores by time and measuring variations, the recording interval can be configurable between 5 to 180 minutes, and the variation value can be disposable between 1°C to 10°C and 100mA to 1 A;
- The non-volatile internal memory that stores the higher temperatures from the PT-100 sensor reading and from the transformer windings;

SENSORS AND MEASUREMENT INPUTS

- 3 digital inputs of electrical current measurement up to 0 to 10 Amperes for the thermal image calculation, it uses an external CT (Split Core / Clamp) and an electrical current transductor that makes available an amplified 4 to 20 mA pattern analog output that allows it to be installed over 500 meter distance between from the monitor without precision loss (1%) and signal quality;

- 2 inputs for temperature Reading through 3 wires PT-100 sensors (EM 60751 – DIN 73760) with -50°C to 250°C measurement range with 0,25% (FS) and with 1 decimal place indication, one of the inputs is mandatorily used for oil top temperature measurement of the transformer and the other sensor can be configured as:

1. TAP Changer oil temperature measurement with configurable differential alarm for Operation defects detection;
2. Main Tank inferior level temperature measurement or the radiator output with temperature differential indication between the top oil temperature, used to measure the transformer cooling system efficacy;
3. A second top oil temperature measuring point of the transformer with average temperature indication between two PT-100 and automatic backup in sensor for failure cases;
4. Environment Temperature measurement to use it on the transformer admissible loading calculation;

RELAY DIGITAL OUTPUTS

- 1 NO (Normally Open) Relay with 6 amperes conduction capacity to trigger the High Oil Temperature Alarm (NC Relay only by requesting);
- 3 NO's (Normally Open) relays with 6 Amperes conduction capacity to trigger the winding high temperature alarm (Normally Closed Relay only by request);
- 1 NO (Normally Open) Relay with 6 amperes conduction capacity to trigger the transformer TRIP with 0 to 20 minutes programmable delay;
- 1 NO (Normally Open) Relay with 6 amperes conduction capacity to Fail signalization of the Watchdog monitor;
- 1 NO (Normally Open) auxiliary Relay with 6 amperes conduction capacity that can be programmed to work like the alarms, TRIP and as a temperature differential;
- 3 NO's (Normally Open) relays with 6 Amperes conduction capacity to trigger the transformer cooling system or NC Pump – Normally Open or Normally Closed – with programmable hysteresis with timing lock of 15 seconds;

TECHNICAL DATA

MasterTemp	
Operation Voltage	48 to 265 Vdc/Vac 50/60 Hz (-20 % / +10%)
Operation Temperature	-40°C to 85°C
Storage Temperature	-50°C to 50°C
Consuption	< 15 W
Temperature measurement input	2– PT-100 Ohm to 0°C to 3 fios **(EN 60751 - DIN 43760)**
Measurement Range	-50 to 250°C
Electrical Current Measurement input	3 – CT´s Split Core of 0 to 10A (True RMS)
Maximum load and analog outputs options	0 ... 1mA - 8000 Ohms
	0 ... 5mA - 1600 Ohms
	0 ... 10mA - 800 Ohms
	0 ... 20mA - 400 Ohms
	4 ... 20mA - 400 Ohms
Measurement inputs maximum errors	0,25% end of scale
Analog Output maximum error	0,25% end of scale
Output Contacts	13– Potential Free
Maximum Power Switching	70 W / 250 VA
Maximum Voltage Switching	250 Vac/Vdc
Electrical current maximum Conduction	6,0 A
Serial Communication Port	RS 485 – 2 fios - (ANSI/TIA/EIA-485-A)
Communication Protocol	Modbus RTU and DNP 3 Level 2 (Slave)
Network Speed – Auto Baud Rate	2.400 to 57.600 bps
USB Frontal port (configuration)	USB Serial 2.0 – Tipo A
Box DIN IEC 61554 (cabinet)	98 x 98 x 98 mm – Aluminum
Fixation – Steel Clips	On Panel
Electrical Current Transformer - TC Split Core	
Analog Output	4 to 20mA
Measurement Range	0 to 10 A
Erro Máximo das Entradas de Medição Measurement input maximum error	1% end of scale
Linearity	1% end of scale
Operation Temperature	-40 to +85°C

TYPE TESTS ATTENDED

- Applied Voltage (IEC 60255-5): 2kV / 60 Hz / 1 min. (Against earth);
- Voltage Impulse (IEC 60225-5): 1,2/50 µseg. / 5kV / 3 neg. and 3 pos. / 5 sec; interval;
- Electrostatic Discharge (IEC 60255-22-2): Air Mode = 8 kV / Counted Mode = 6 kV;
- Irradiated Electromagnetic Disturbance immunity (IEC 61000-4-3): 80 to 1000 MHZ / 10V/m;
- Fast Electrical transients' immunity (IEC 60255-22-4): Power.Supply/input/output = 4KV/common 2kV;
- Surges immunity (IEC 60255-22-5): phase/neutral 1kV, 5 per polar. (±) – phase-earth/neutral-earth 2kV, 5 per polar. (±)
- Conducted electromagnetic disturbances immunity (IEC61000-4-6): 0,15 to 80 MHz / 10V/m;
- Climatic test (IEC 60068-21-14): -40°C +85°C / 72 hours;
- Vibration Resistance (IEC 60255-21-1): 3 axis / 10 to 150Hz / 2G / 160 minutes/axis;
- Vibration response (IEC 60255-21-1): 3 axis / 0,075 mm-10 to 58 Hz / 1G of 58 to 150 Hz / 8 min/axis;

APPLICATION EXAMPLE

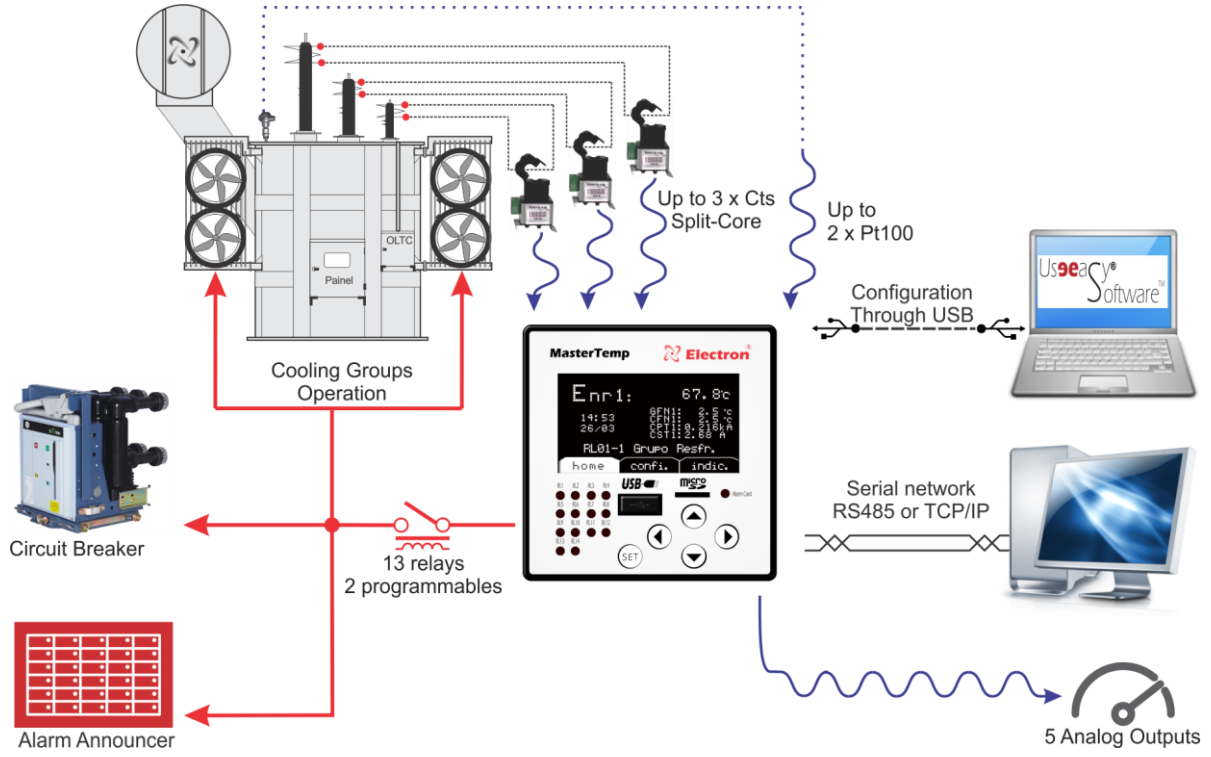
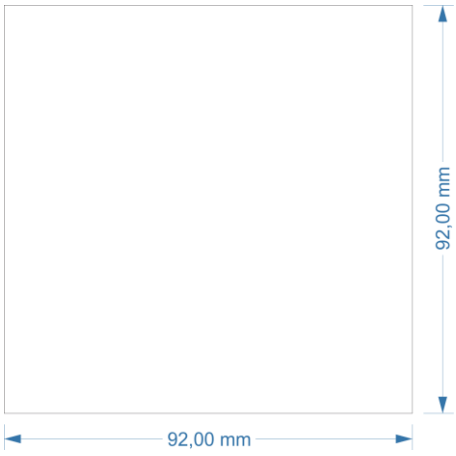


Fig. 3 – MasterTemp Application Example

DIMENSIONS



Panel cutout

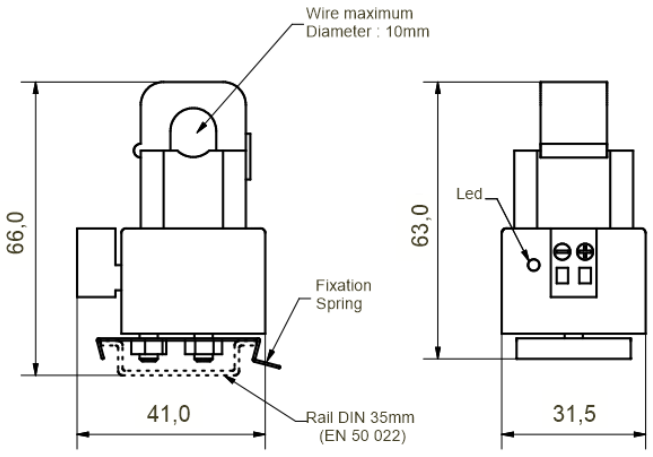


Fig. 6 – MASTERTEMP DIMENSIONS

DIMENSIONS

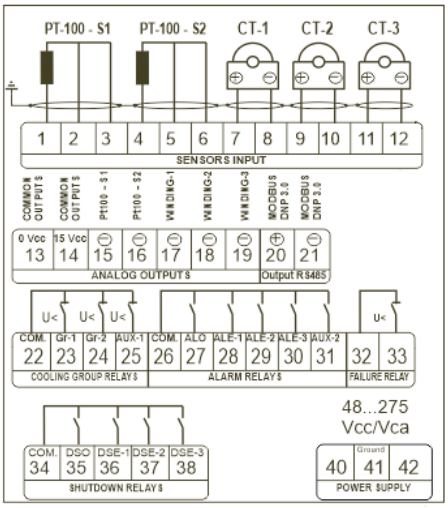


Fig. 7 – MasterTemp Connections Diagram

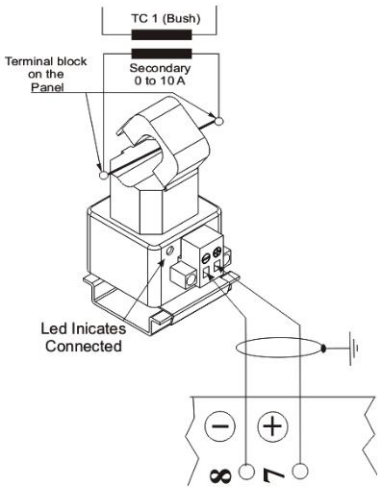
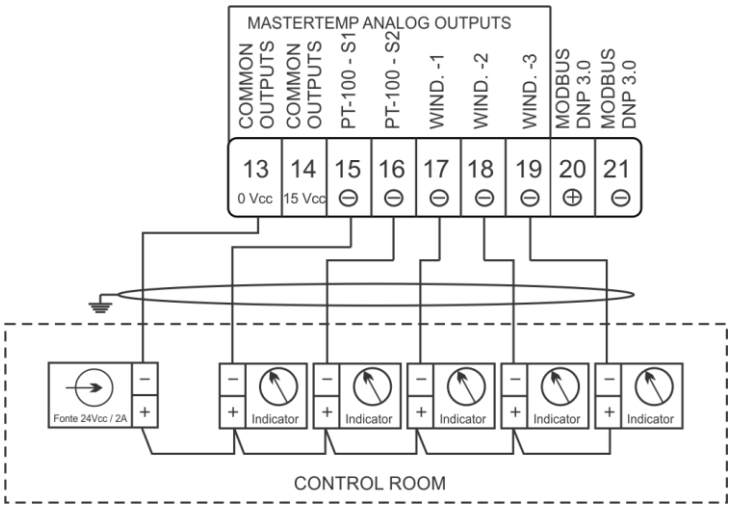


Fig. 8 – Connections Diagram CT 1



Connection Diagram for analog indicators with external power supply.

ORDER SPECIFICATION