Electron

MASTERTEMP

Catalogue

INDEX

INTRODUCTION

The MASTERTEMP® **Temperature Monitor** was developed to monitor the temperature of oil and up to 3 windings, control ventilation, protect power and distribution transformers (ANSI 49I and ANSI 49).

The **MASTERTEMP®** was built obeying strict quality standards and uses state-of-the-art electronic components (SMD), its hardware was designed to withstand severe working conditions, all this protected by a cabinet made of aluminum within the standards of DIN IEC 61554, these characteristics allow to carry out its installation directly on the panel of power transformers and reactors, in panels in the yard of power substations, offshore platforms and chemical industries.

As signal input the **MASTERTEMP®** allows up to 2 (two) PT-100 temperature sensors that can be configured for measurement of the ambient temperature and top of the oil, temperature of the switch and top of the oil with configurable alarm for the differential between them, lower temperature of the tank and temperature of the top of the oil or 2 points at the top of the oil for redundancy of the measurement and backup in case of loss of one of the sensors. It also has 3 (three) inputs for measuring the current coming from the Thermal Imaging CT to calculate the temperature of the windings using a precision transducer type TC Split core.

For remote transmission of these quantities **the MASTERTEMP®** has 5 (five) fully configurable analog outputs and can transmit any of the measured and/or calculated quantities; oil temperatures, winding temperature, Current in the primary of the windings, Current in the secondary of the windings, percentage loading of the windings, Temperature differential of the sensor 1 and 2 in a standard of 0a1mA, 0a5mA, 0a10mA, 0a20mA or 4a20mA.

For the SCADA system or specialist software all the measured and calculated quantities and configuration parameters, in addition to the engineering models that are available **in MASTERTEMP®** can be accessed through a digital output (RS485) with standard protocols such as Modbus RTU and DNP 3 (L2) chosen by the user in the configuration menu of the equipment, including remote control of drives in real time.

For alarm indication and thermal protection **MASTERTEMP®** has 13 isolated and potential-free drive relays with configurable setpoints for alarms and shutdowns by oil and winding temperature levels, temperature differential alarms and sensor failures and activation of the 1st, 2nd and 3rd ventilation group that can also be triggered through the transformer loading percentage and 1 auxiliary relay that is configurable by the user to the drive by any of the measured values.

The presentation mode on the MASTERTEMP® **display is** fully configurable, being possible to present in 5 lines the measured quantities and in the 1st line it is possible to configure in SCAN mode all the measurements selected by the user.

The display presents, in addition to the measured and calculated indications, written messages of the events and the relays triggered by them, as well as a clock with hour/minute and second indication that is used in the time stamp of the datalogger that stores on a micro SD card all the events and measurements of the **MASTERTEMP®** for a period of approximately 10 uninterrupted years with a recording interval of 5 minutes.

MAIN FEATURES

HUMAN MACHINE INTERFACE (HMI)

- Display of ***OLED*** With graphic capacity 128 x 64 pixels, with contrast adjustment and inversion of background colors and letters, readable in any lighting condition, including exposed directly to the sun.
- Stand-by IPD (Intelligent Presence Detector) **function** that detects the user's presence and automatically lights up the high-resolution OLED display. This function increases the life of the display of the equipment, providing a reduction of internal energy consumption and extending the life of the entire electronic circuit. It is enough for the user to approach 1.5 meters away from the equipment that the sensor will detect its presence, and the OLED display will turn on automatically. This function is factory default, however, the user can disable it in the "Configuration" menu.
- Main screen with simultaneous indication of 5 monitored quantities and with the possibility of presenting in the first line highlighted the selected quantities in SCAN mode;
- Clock with HMS indication, in case of power failure and or power does not lose the settings for up to 240 hours, uses for backup of super-capacitor power for high operating temperatures and never requires replacement;
- 5 keys for navigation in Silicone with soft touch;
- 14 Led's in the Front that allow identification even at a distance from the existence of output relays triggered;
- Indication of events and failures in writing on the display (Annunciator) and description of the relays that are triggered;
- Intuitive menus for configuration, indication, drives, maintenance and transformer parameters, protected by access password and in 2 languages (Portuguese and English);
- Consultation in the menu of indications of the maximum temperatures reached by the sensors;
- Consultation in the menu of indications of the operating time of each ventilation group;
- Query in the menu of indications of the final gradient of each winding of the transformer;
- Consultation in the menu of indications of the percentage loading of each winding of the transformer;
- Consultation in the menu of indications of the currents measured by the external CT external CT (Split core / Clamp);
- Consultation in the menu of indications of the currents in the winding of the transformer (calculated value);
- Consult in the menu of indications of the loading of each winding of the transformer (calculated value);
- Consultation in the menu of indications of the loss of life 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 NBR 5356-7:2017;
- Display calculation of transformer charging percentage;
- Calculation of the Final Temperature Gradient for the current load (oil-winding);
- Calculation of loss of life of the selectable insulation for Kraft (55°C), Stabilized Term (65°C) and Nomex (95°C) based on Arrhenius theory, and indication of remaining life of the insulation in hours and days.
- Calculation of the temperature differential between two PT100 sensors for monitoring of defects in the switch or monitoring of cooling efficiency.
- Monitoring of the operating time of the fans (hourmeter) with programmable alarm for maintenance warning;

DIGITAL COMMUNICATION PORTS AND PROTOCOLS

- USB 2.0 front communication port with *type A connector* for downloading and uploading settings through USEEASY software;
- Digital output RS485 2 wires (ANSI / TIA / EIA-485-A) with 2 protocols available, ***Modbus RTU*** and ***DNP3*** (Level2) for remote monitoring through SCADA software and access to all measured parameters and activation of digital outputs;
- Auto Baud Rate from 2,400 to 57,600 bps (Automatically Detects the speed of the Communication network);

DATA LOGGER AND DATA STORAGE

- Front slot for Micro SD card type 8Gb that allows the storage of up to 10 years of the data measured and calculated in Mastertemp;
- Storage by time and variation of measurements, and the recording interval between 5 and 180 minutes can be configured, and the variation value that should be discarded between 1°C to 10°C and 100 mA to 1 A;
- Non-volatile internal memory that stores the maximum temperatures reached in the PT100 sensors and transformer windings;

INPUT OF SENSORS AND MEASUREMENTS

- 3 Permanent inputs of current measurement from 0 to 10 Amps for the calculation of thermal imaging, uses external CT (Split Core / Clamp) of the type and current transducer that provides in the secondary a standard analog output of 2 wires at 4 20 mA amplified that allows to be installed at a distance of up to 500 meters from the monitor without loss of precision (1%) and signal quality;
- 2 inputs for temperature measurement with sensor type PT-100 3 wires (EM 60751 – DIN 43760) for measuring range from -50°C to 250°C with accuracy of 0.25% (FS) and indication of 1 decimal place, one of the inputs is mandatorily used for temperature measurement of the top of the Transformer oil and the other can be configured to:

1. Switch oil temperature measurement with configurable differential alarm for detection of defects in the switch.
2. Measurement of the lower Temperature of the Tank or Radiator Outlet with indication of the differential between the temperature of the top of the oil, used to measure the efficiency of the transformer cooling system;
3. Measurement of a second Temperature point of the top of the transformer oil om indication of the average temperature between the two sensors and automatic backup in case of failure of one of the sensors;
4. Ambient Temperature Measurement for use in the calculation of permissible transformer loading;

DIGITAL RELAY OUTPUTS

- 1 Relay with conduction capacity of 6 Amperes for High Temperature Alarm of NA Oil – Normally Open (NF – Normally Closed on request);
- 3 Relays with conduction capacity of 6 Amperes for High Temperature Alarm of the NA Winding – Normally Open (NF – Normally Closed on request);
- 1 Relay with conduction capacity of 6 amperes for High Temperature Shutdown of NA Oil – Normally Open (NF – Normally Closed on Request), with programmable delay timing from 0 to 20 minutes;
- 1 Relay with 6 amp driving capacity for monitor fault signaling (Watchdog);
- 1 Relay with 6 auxiliary amp conduction capacity that can be programmed to be as alarms, shutdown or temperature differential;
- 3 Relays with conduction capacity of 6 amperes for drive of ventilation groups or pump NA – Normally Open or NF – Normally Closed, with programmable hysteresis 0 to 30°C and timed interlocking of 15 seconds;

TECHNICAL DATA

Temperature Monitor	
Operating Voltage	48 to 265 Vdc/Vac 50/60 Hz (-20 % / +10%)
Operating Temperature	-40°C to 85°C
Storage Temperature	-50°C to 50°C
Consumption	< 15 W
Temperature Measurement Input	2– PT-100 Ohm at 0°C at 3 wires **(EN 60751 - DIN 43760)**
Measuring Range	-50 to 250°C
Input for Current Measurement	3 – TC's Split Core from 0 to 10A (True RMS)
Analog Outputs and Maximum Load Options	0 ... 1mA - 8000 Ohms
	0 ... 5mA - 1600 Ohms
	0 ... 10mA - 800 Ohms
	0 ... 20mA - 400 Ohms
	4 ... 20mA - 400 Ohms
Maximum Error of Measurement Inputs	0.25% of the end of the scale
Maximum Analog Output Error	0.25% of the end of the scale
Outgoing Contacts	13 – Free of Potential
Maximum Switching Power	70 W / 250 VA
Maximum Switching Voltage	250 Vac/Vdc
Maximum Driving Current	6.0 A
Serial Communication Port	RS 485 – 2 wires - (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 Front Port (configuration)	USB Serial 2.0 – Type A
IEC 61554 DIN Box (Chassis)	98 x 98 x 98 mm – Aluminium
Fastening – steel clip	Built-in Panel Mount
Current Transformer - TC Split Core	
Output Signal	4 to 20mA
Measuring Range	0 to 10 A
Maximum Error of Measurement Inputs	1% of the end of the scale
Linearity	1% of the end of the scale
Operating Temperature	-40 to +85°C

Table 1 – Technical data of the Mastertemp thermal protection relay.

TYPE TESTS ATTENDED

- Applied Voltage (IEC 60255-5): 2kV / 60Hz / 1 min. (against land);
- Voltage Impulse (IEC 60255-5): 1.2/50 μ sec. / 5kV / 3 neg. and 3 pos. / 5 sec. Interval;
- Electrostatic Discharges (IEC 60255-22-2): Air Mode = 8kV / Counted Mode = 6 kV;
- Immunity to irradiated electromagnetic disturbance (IEC61000-4-3): 80 to 1000 MHz / 10V/m;
- Immunity to Fast Electrical Transients (IEC60255-22-4): Alim./Enter/Outputs=4KV/common. 2kV;
- Surge Immunity (IEC60255-22-5): phase/neutral 1kV, 5 per polar. (±) - phase-earth/neutral-earth 2kV, 5 per polar (±);
- Immunity to Conducted Electromagnetic Disturbances (IEC61000-4-6): 0.15 to 80 MHz / 10V/m;
- Climate Test (IEC60068-21-14): -40ºC + 85ºC / 72 hours;
- Vibration Resistance (IEC60255-21-1): 3 axes / 10 to 150Hz / 2G / 160min/axis;
- Vibration Response (IEC60255-21-1): 3 axes / 0.075mm-10 to 58 Hz / 1G from 58 to 150 Hz / 8min/axis;

TEMPERATURE DRIVE OPERATION CHART

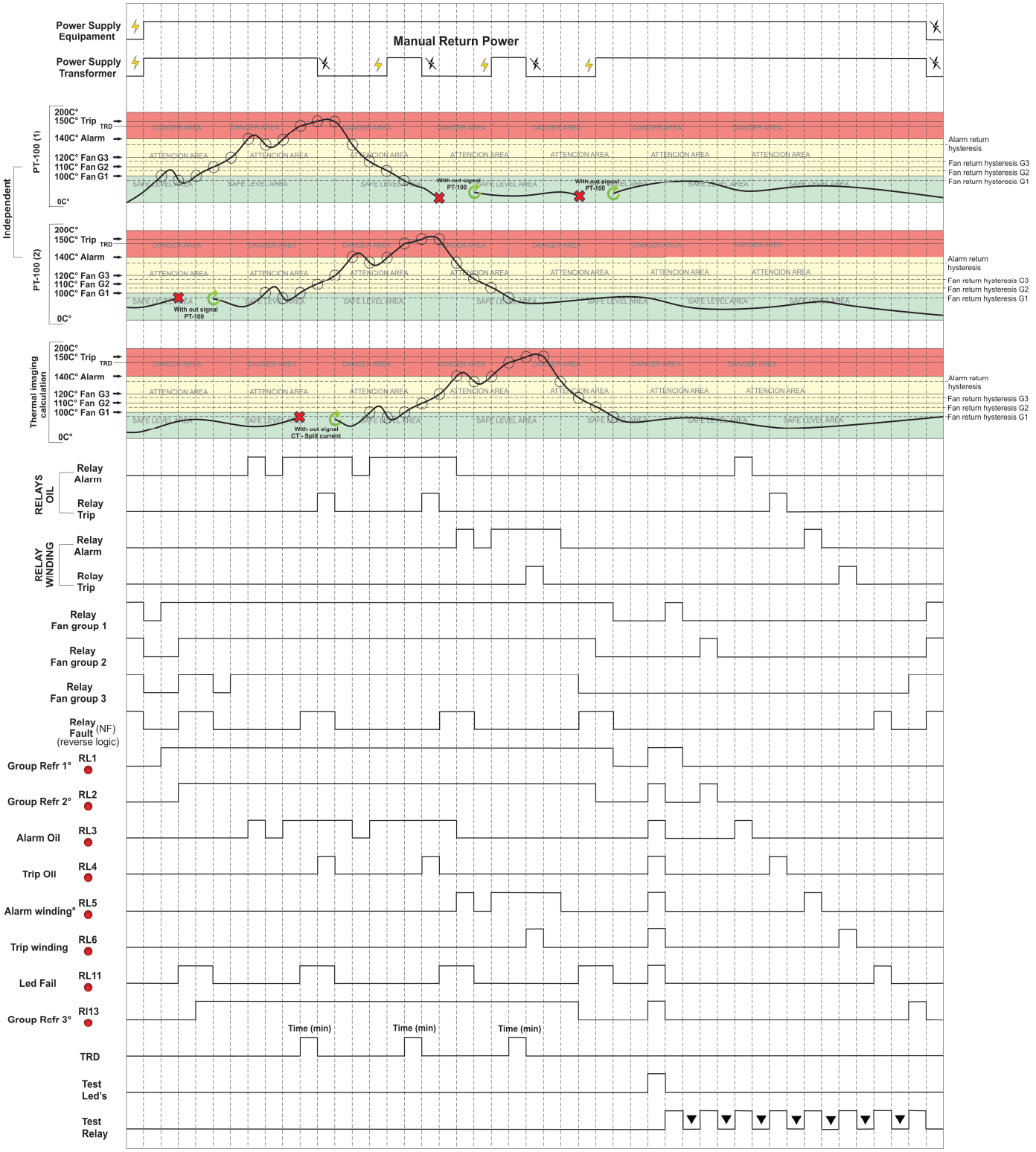


Table 2 – Graph of operation, drive by temperature

LOADING DRIVE OPERATION CHART

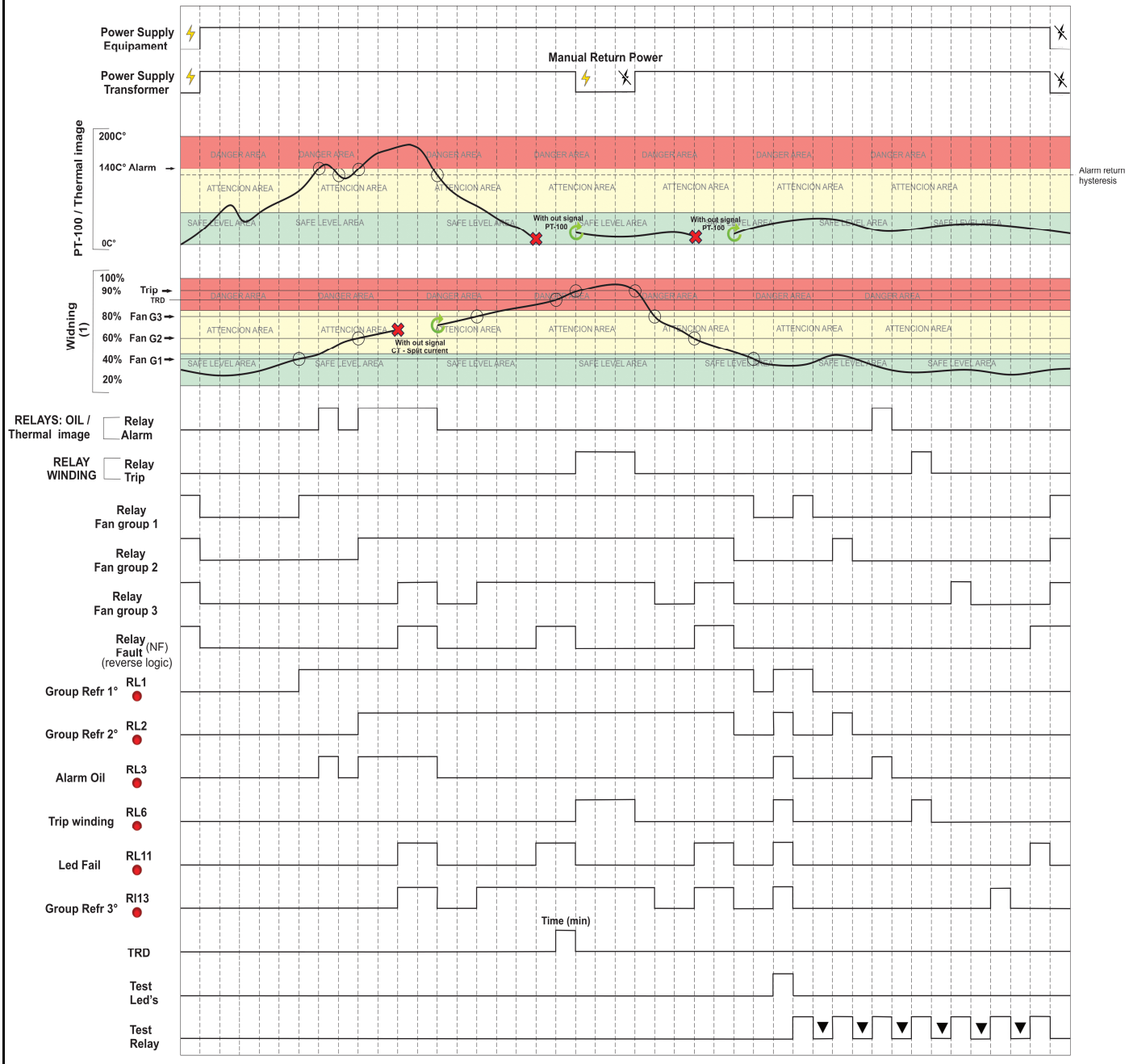


Table 3 – Operation chart, load drive

PREVENTIVE MAINTENANCE

PREVENTIVE AND CORRECTIVE MAINTENANCE							
Items to be checked preemptively			Scan Frequency				Corrective action
SHARE	Verification Elements	ACTIVITIES	Every Month	Every 3 Months	Every 6 Months	Every 1 Year	When Needed
VERIFICATION	Fastening and fitting clip on the rail	Attachment to panel door or panel bottom		X			Retightening, Fitting, terminal exchange or screw exchange
	Terminals and Connector Comb	Fastening and fitting into the equipment		X			
		Tightening of the screws in the attachment of the conductors		X			
	Sensors	Integrity / Positioning / Fastening			X		Replacement, Repositioning and/or Fixing of Sensors
	Sensor well in Oil Transformers	Oil level in the well			X		Filling with oil up to the indicated level
TESTS & MEASUREMENTS	Relays and Digital Outputs	Individual drive test			X		Forward to technical assistance of Electron do Brasil
	Led's and Displays	Test drive Led's and display segments			X		
	Navigation buttons	Navigation test of navigation buttons			X		
	Sensor Input	Measure sensor inputs using a pattern				X	
	Input Supply Voltage of the equipment	Measure Power Input Voltage			X		Replace voltage input values according to equipment model
	RS-485 communication outputs	Communication and command testing in the supervisory system			X		Forward to technical assistance of Electron do Brasil
	Milliampere Current Signal Inputs	Measure, compare, and measure input signal in passive and/or active mode			X		
	Milliampere Current Signal Outputs	Measure, compare, and measure input signal in passive and/or active mode			X		
CLEANING	Terminals and Comb of connectors and connection box	Debris, Impurities and Moisture	X				Cleaning with dry cloth, compressed air and vacuum cleaner
	Aluminum equipment enclosure		X				
	Front of the Equipment Display		X				
ATENÇÃO	**1 - Keeping the equipment within the ideal working temperature (50°C to 60°C) prolongs the service life and avoids corrective maintenance.** **2 - The accumulation of dust and impurities in the installations can cause short circuit and burning of equipment and sensors.** **3 - After 10 years of use it is recommended to replace the equipment.**						

Table 4 – Preventive maintenance

APPLICATION EXAMPLE

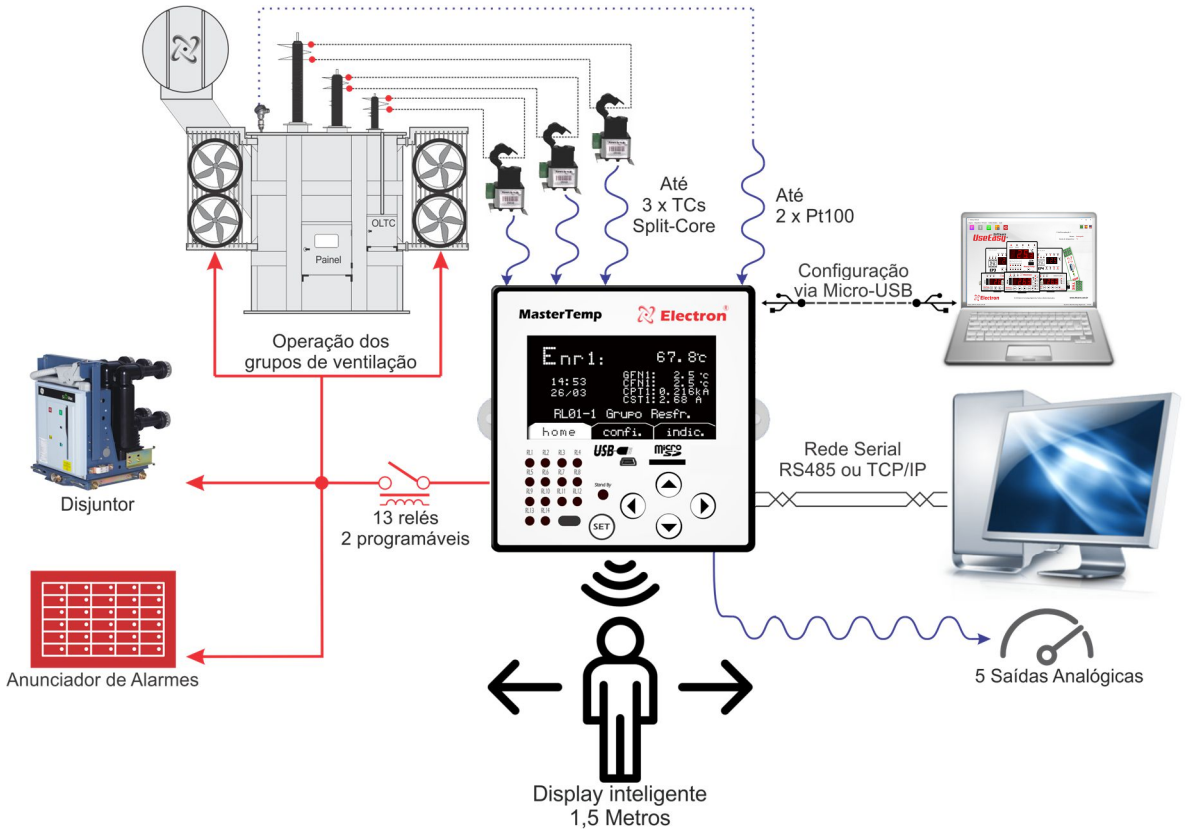


Fig. 1 – Illustrative example of MasterTemp applications

DIMENSIONS

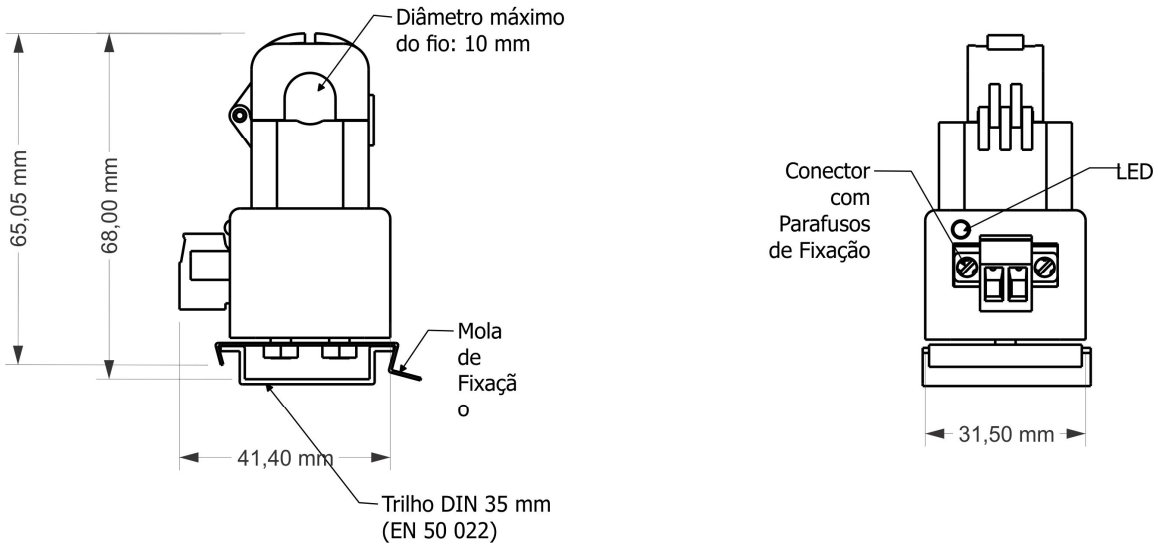


Fig. 2 – Dimensões do TC-Splitcore

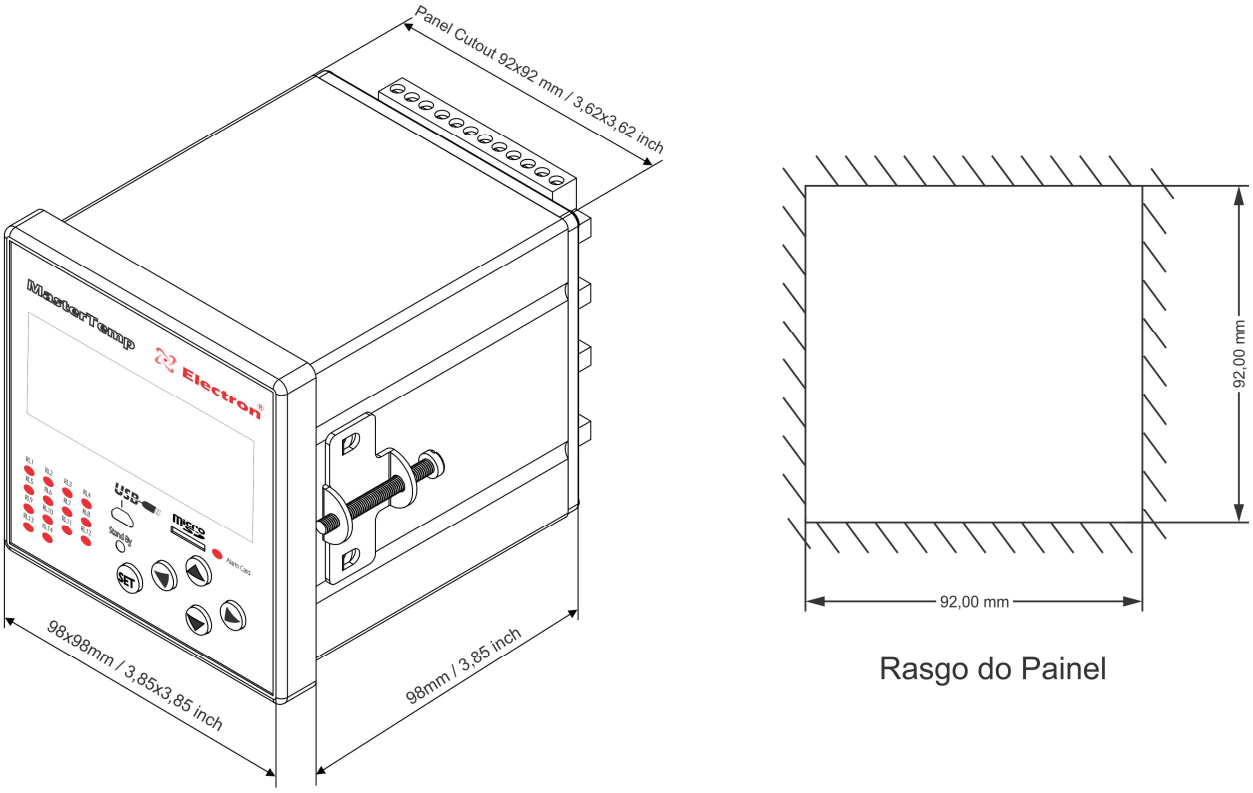


Fig. 3 – MasterTemp dimensions

CONNECTION DIAGRAMS

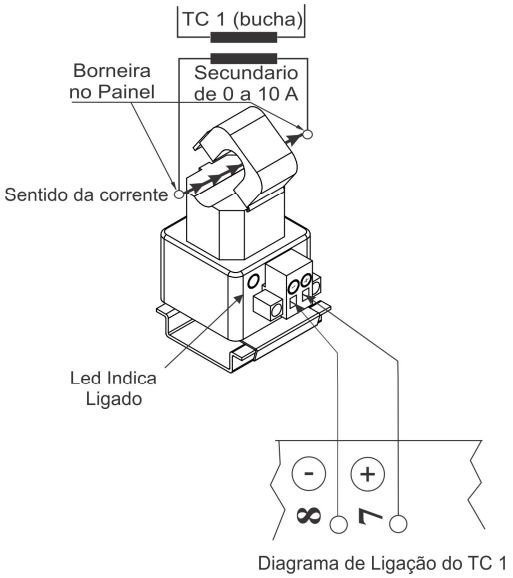
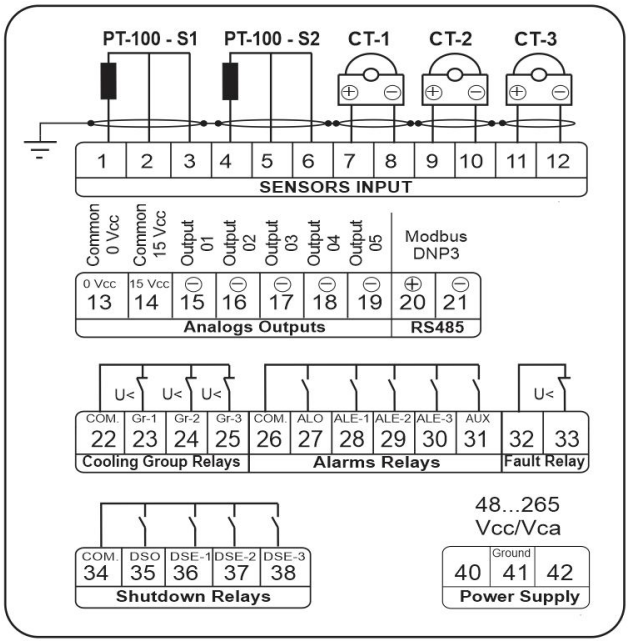


Diagrama de Ligação do TC 1



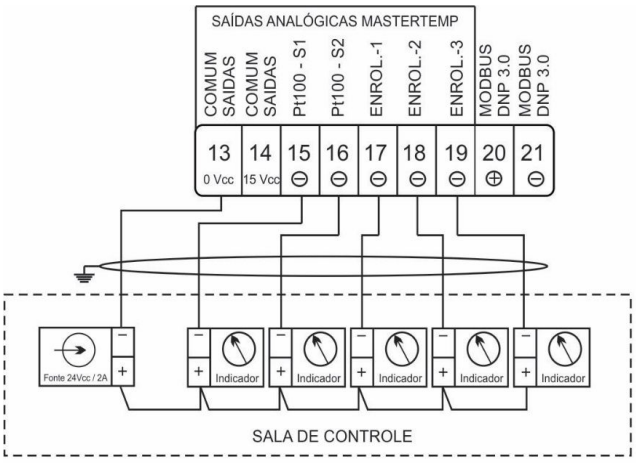


Diagrama para conexões de Indicadores Analógicos com fonte externa.

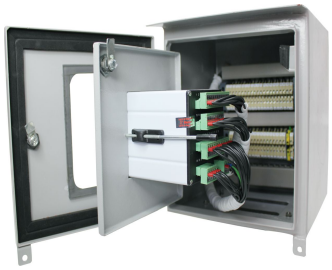
Fig. 4 – MasterTemp connection diagram

INSTALLATION ACCESSORIES

Electron do Brasil has a line of accessories that can be purchased together in order to offer a complete solution to meet your application with practicality. We have listed some of the main accessories that can be used for Mastertemp operation.

PT-100 STE temperature sensor: This sensor is built stainless steel bulb AISI-304 injected aluminum head (IP 65) and adjustable bucim with BSP 3/4" and 1/2" threads or can be manufactured according to design. Its measuring principle is to evaluate the variation of electrical resistance with temperature using the temperature coefficient of pure platinum (0.385 Ohm/K), according to IEC 751 (DIN 43760). Ideal for installations subject to inclement weather and electrical disturbances for temperature monitoring of transformers and machines that require high measurement accuracy in environments subjected to electrical noise and weathering. The PT-100 3-wire sensor is widely used in the market, as it greatly reduces the possibility of measurement error due to the compensation principle of the third sensor terminal.

Link to Electron's PT100 STFE temperature sensor page:
https://electron.com.br/site/produtos/rtd-pt100/



Double door panel for outdoor/outdoor use: Box for external use with double door for mounting instruments, accessories and passage of control wires and power of the power transformer. The external door contains glass display with UV protection for viewing the quantities measured by the temperature monitor and the panel contains special paint that is weather resistant and its degree of protection is IP 55, as NBR IEC 60529:2017.

Link to the page of the double port panel for external use – IP 55:
https://electron.com.br/site/produtos/painel-para-uso-externo-ip55/

Reference card for PT-100 signal: This accessory was developed to perform the verification of the temperature value displayed by equipment with input of RTD PT-100 sensors of 3 wires. It consists of precision resistors that send an equivalent fixed and constant resistance signal for selection between 3 different ranges, 0 °C (100 Ohms), 26 °C (110.9 Ohms) and 200 °C (175.86 Ohms).

Link to the Reference Card page for PT-100 sign:
https://electron.com.br/site/produtos/

SPECIFICATION FOR ORDER

MONITOR DE TEMPERATURA DIGITAL MASTERTEMP

MTTP - ☐

Medição de Corrente	
0	Sem TC split core
1	1 TC Splitcore
2	2 TC's Splitcore
3	3 TC's Splitcore