Electron

MASTERTEMP

Manual

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).

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

As a signal input, **MASTERTEMP®** allows up to 2 (two) PT100 temperature sensors that can be configured for measurement of ambient and top oil temperature, commutator temperature and oil top with configurable alarm for the differential between them, lower tank temperature and oil top temperature or 2 points at the top of the oil for measurement redundancy 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, **MASTERTEMP®** has 5 (five) fully configurable analog outputs that 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, differential of sensor temperature 1 and 2 in a standard of 0 to 1 mA, 0 to 5 mA, 0 to 10 mA, 0 to 20 mA, or 4 to 20 mA.

For the SCADA system or specialist software, all measured quantities, calculations 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 equipment configuration menu, including remote control of drives in real time.

For alarm indication and thermal protection, the **MASTERTEMP®** has 13 isolated, potential-free trigger 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 load percentage and 1 auxiliary relay that is configurable by the user to the activation by any of the measured values.

KEY FEATURES

HUMAN MACHINE INTERFACE (HMI)

- OLED ***display*** with a graphic capacity of 128 x 64 pixels, with contrast adjustment and inversion of background colors and letters, readable in any lighting condition, including directly exposed 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 useful life of the equipment's display, providing a reduction in internal energy consumption and extending the useful life of the entire electronic circuit. The user just needs to approach 1.5 meters away from the equipment and the sensor will detect its presence, and the OLED display will automatically turn on. 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 displaying the selected quantities in SCAN mode on the first line;
- Clock with HMS indication, in case of power outage and or power supply does not lose settings for up to 240 hours, uses super-capacitor for high operating temperatures and never requires replacement;
- 5 keys for navigation;
- 14 Led's on the Front that allow identification even at a distance from the existence of activated output relays;
- Indication of events and faults in writing on the display (Annunciator) and description of the relays that are triggered;
- Intuitive menus for configuration, indication, activations, 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;
- Consult the menu of indications of the operating time of each ventilation group;
- Consultation in the indication menu of the final gradient of each transformer winding;
- Consultation in the indication menu of the percentage load of each transformer winding;
- 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 transformer winding (calculated value);
- Consultation in the loading indication menu of each transformer winding (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 standards;
- Calculation of transformer loading percentage display;
- Calculation of the Final Temperature Gradient for the current load (oil-winding);
- Selectable Insulation life loss calculation for Kraft (55°C), Thermo Stabilized (65°C) and Nomex (95°C) based on Arrhenius' theory, and indication of remaining insulation life in hours and days.
- Calculation of the temperature differential between two PT100 sensors for monitoring switch defects or monitoring cooling efficiency.
- Monitoring of the operating time of the fans (Hour meter) with programmable alarm for maintenance warning;

DIGITAL COMMUNICATION PORTS AND PROTOCOLS

- Front USB 2.0 communication port with Type-A connector for downloading and uploading settings via ***USEEASY software***;
- 2-wire RS485 Digital Output (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 Communication Network Speed);

DATA LOGGER AND DATA STORAGE

- Front slot for 8Gb Micro SD card that allows storage for up to 10 years of data measured and calculated in Mastertemp;
- Storage by time and variation of measurements, with the recording interval being configurable between 5 and 180 minutes, and the variation value that must be disregarded between 1°C to 10°C and 100 mA at 1 A;
- Internal non-volatile memory that stores the maximum temperatures reached in the PT100 sensors and transformer windings;

SENSOR INPUT AND MEASUREMENTS

- 3 Permanent current measurement inputs from 0 to 10 Amperes for the calculation of thermal image, 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 it 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 PT100 type sensor 3 wires (EM 60751 – DIN 43760) for measurement 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. Commutator oil temperature measurement with configurable differential alarm for detection of commutator defects.
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 point of Temperature from the top of the transformer oil with 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 load of the transformer;
5.

DIGITAL RELAY OUTPUTS

- 1 Relay with 6 Ampere driving capacity for Alarm for High Oil Temperature NA – Normally Open (NC – Normally Closed on request);
- 3 Relays with 6 Ampere Driving Capacity for High Temperature Alarm of NA Winding – Normally Open (NC – Normally Closed on request);
- 1 Relay with 6 ampere driving capacity for High Temperature Shutdown of NA Oil – Normally Open (NC – Normally closed on request), with programmable delay timing from 0 to 20 minutes;
- 1 Relay with 6 ampere driving capacity for monitor fault signaling (Watchdog);
- 1 Relay with 6 ampere auxiliary driving capacity that can be programmed to be as alarms, shutdown or temperature differential;
- 3 Relays with a conduction capacity of 6 amperes for activation of ventilation or pump groups NO – Normally Open or NC – Normally Closed, with programmable hysteresis 0 to 30°C and timed interlock of 15 seconds;

TECHNICAL DATA

Transformer Temperature Monitor - MasterTemp	
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
External source rated voltage for analog output	24 V DC / 2 A
Temperature Measurement Input	Up to 2 – PT100 Ohm at 0 °C at 3 wires **(EN 60751 - DIN 43760)**
Measurement Range	-50 to 250 °C
Current Measurement Input	Up to 3 Split-Core CTs from 0 to 10 A (True RMS)
Analog Output and Maximum Load Options	0 ... 1 mA - 8000 Ohms
	0 ... 5 mA - 1600 Ohms
	0 ... 10 mA - 800 Ohms
	0 ... 20 mA - 400 Ohms
	4 ... 20 mA - 400 Ohms
Maximum Error of Measurement Inputs	0.25% of end-of-scale
Maximum Analog Output Error	0.25% of end-of-scale
Relay Outputs	13 – Free of Potential
Maximum Switching Power	70 W / 250 VA
Maximum Switching Voltage	250 Vac/Dc
Maximum Driving Current	6 Amps
Serial Communication Port	RS-485 2-wire standard - (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
Front USB Port (configuration)	Micro-USB
IEC 61554 DIN Box (Cabinet)	98 x 98 x 98 mm – Aluminum
Fastening – steel clip	Flush Panel Mounting
Current Transformer - TC Split Core	
Output Signal and Maximum Load	4 to 20 mA – 400 Ohms
Measurement 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 TRIALS MET

- Applied Voltage (IEC 60255-5): 2kV / 60Hz / 1 min. (against land);
- Voltage Impulse (IEC 60255-5): 1.2/50 µsec. / 5kV / 3 sec. and 3 sec. / 5 sec. Interval;
- Electrostatic Discharges (IEC 60255-22-2): Air mode = 8kV / Counted mode = 6 kV;
- Immunity to radiated electromagnetic disturbance (IEC61000-4-3): 80 to 1000 MHz / 10V/m;
- Immunity to Fast Electrical Transients (IEC60255-22-4): Input/Outputs=4KV/common. 2kV;
- Surge Immunity (IEC60255-22-5): phase/neutral 1kV, 5 per polar. (±) - phase-to-ground/neutral-to-ground 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-axis / 0.075mm-10 at 58 Hz / 1G from 58 to 150 Hz / 8min/axis;

OPERATION CHART TEMPERATURE DRIVE

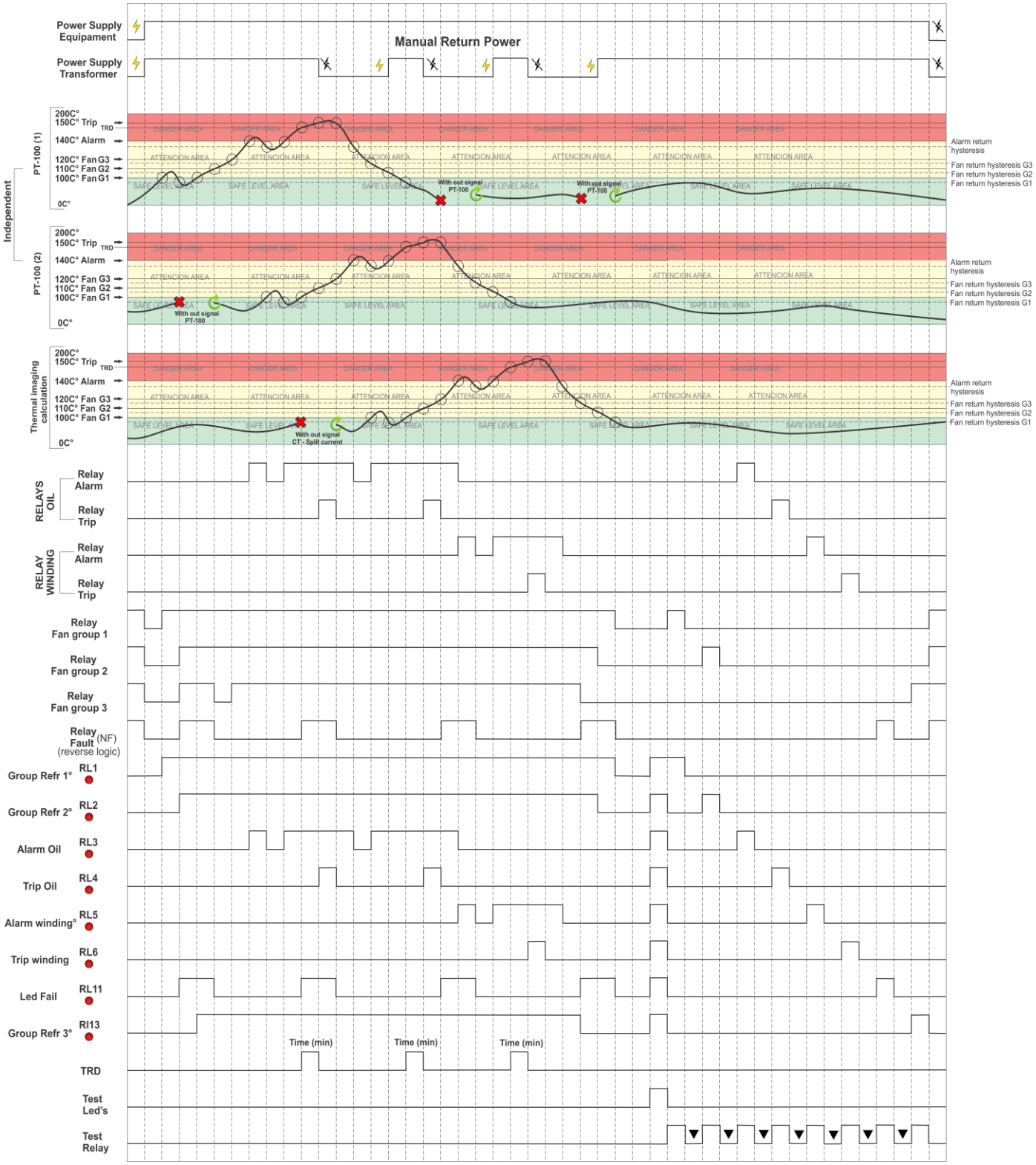


Table 2 – Operating chart, activation by temperature

OPERATION CHART LOADING DRIVE

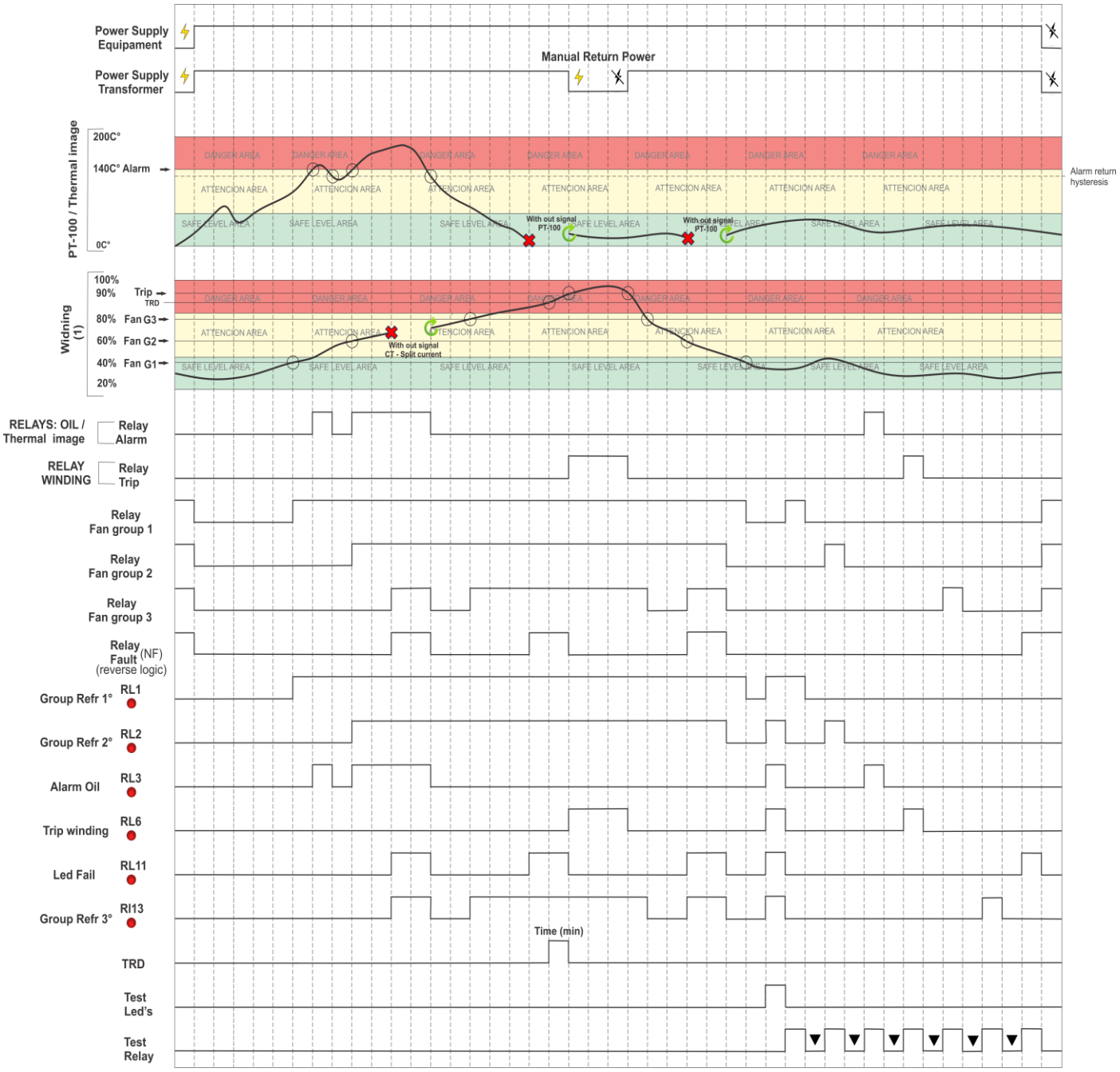


Table 3 – Operation chart, load drive

PREVENTIVE MAINTENANCE

PREVENTIVE AND CORRECTIVE MAINTENANCE							
Items to be checked preventively			Verification Frequency				Corrective action
SHARE	Verification Elements	ACTIVITIES	Every Month	Every 3 Months	Every 6 Months	Every 1 Year	When Needed
VERIFICATION	Fastening clip and snapping to the rail	Fixing to the panel door or panel bottom		X			Retightening, Fitting, Terminal Change, or Screw Change
	Terminal Blocks and Connector Comb	Attachment and attachment to equipment		X			
		Tightening of the screws in the fastening of the conductors		X			
	Sensors	Integrity / Positioning / Fastening			X		Replacement, repositioning and/or fixing of sensors
	Sensor well of oil transformers	Oil level in the well			X		Oil filling to indicated level
TESTS & MEASUREMENTS	Relays and Digital Outputs	Individual drive test			X		Forward to Electron do Brasil technical assistance
	LED's and Displays	Test LED's and display segments			X		
	Navigation buttons	Navigation test of the navigation buttons			X		
	Sensor Input	Gauge sensor inputs using a standard				X	
	Input voltage of equipment supply	Measure Supply Input Voltage			X		Override voltage input values according to equipment model
	RS-485 Communication Outputs	Communication and command testing in the supervisory system			X		Forward to Electron do Brasil technical assistance
	Milliampere Current Signal Inputs	Measure, compare and measure input signal in passive and/or active mode			X		
	Signal Outputs of milliampere current	Measure, compare and measure input signal in passive and/or active mode			X		
CLEANING	Terminal blocks and connector comb and connection box	Debris, Impurities and Moisture	X				Cleaning with a 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) extends the useful life and avoids corrective maintenance.** **2 - The accumulation of dust and impurities in the facilities can cause short-circuiting 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

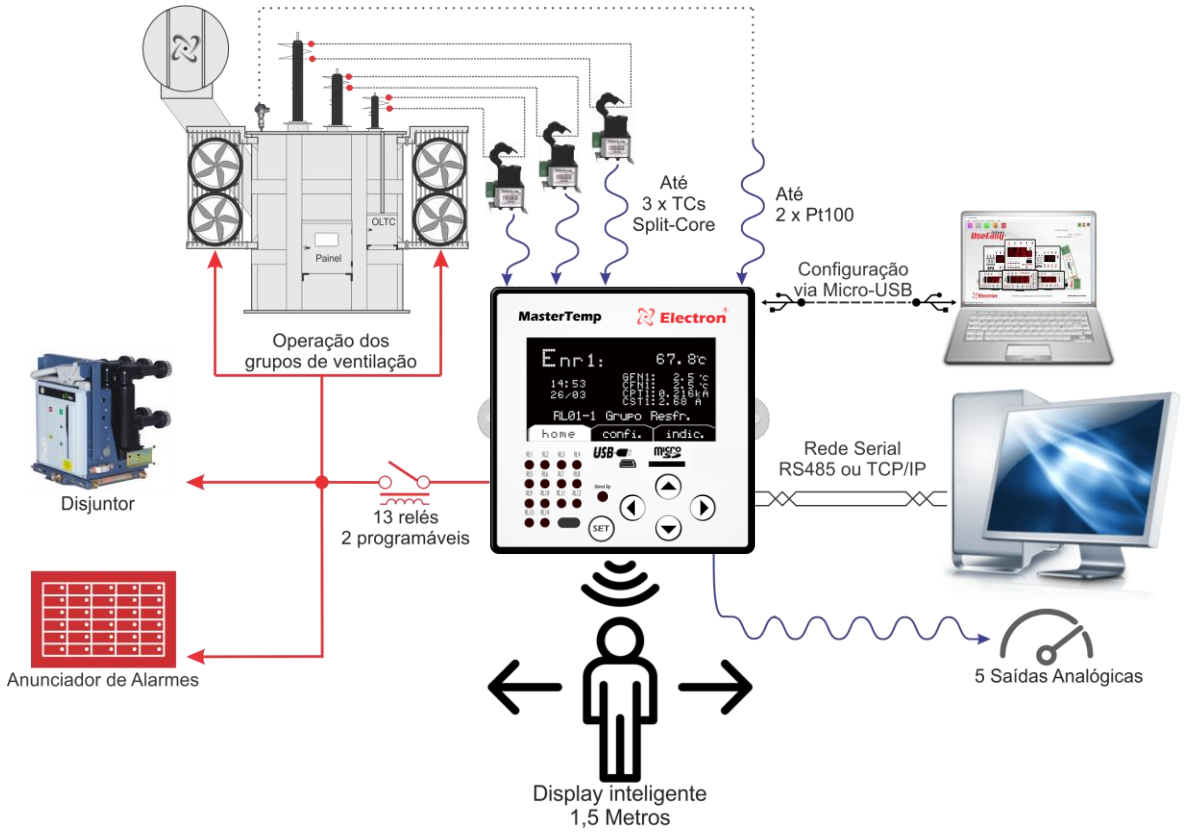


Fig. 1 – Illustrative example of MasterTemp applications

DIMENSIONS

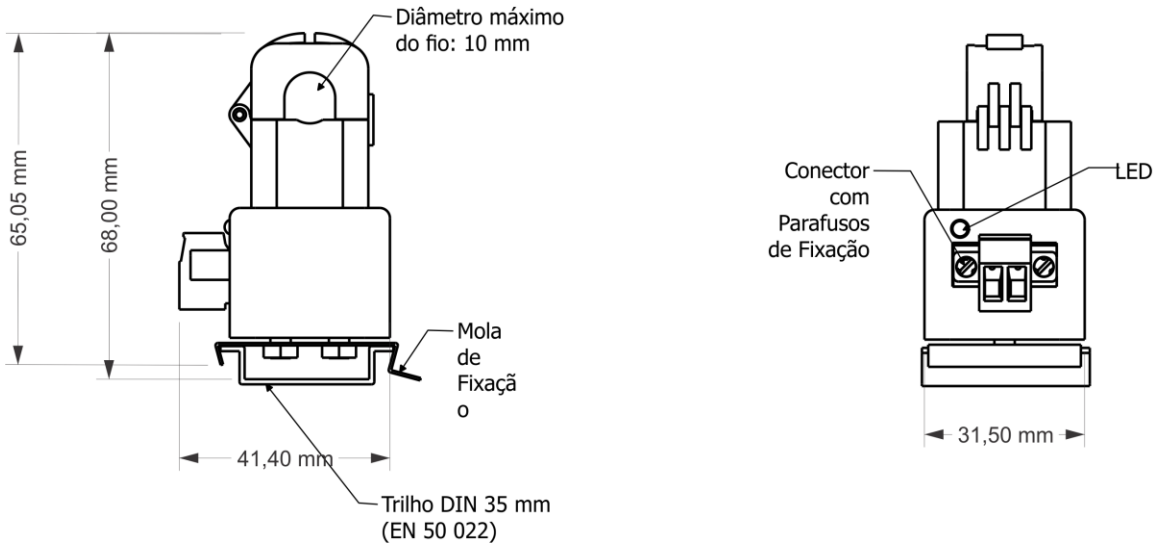


Fig. 2 – Dimensions of the TC-Splitcore

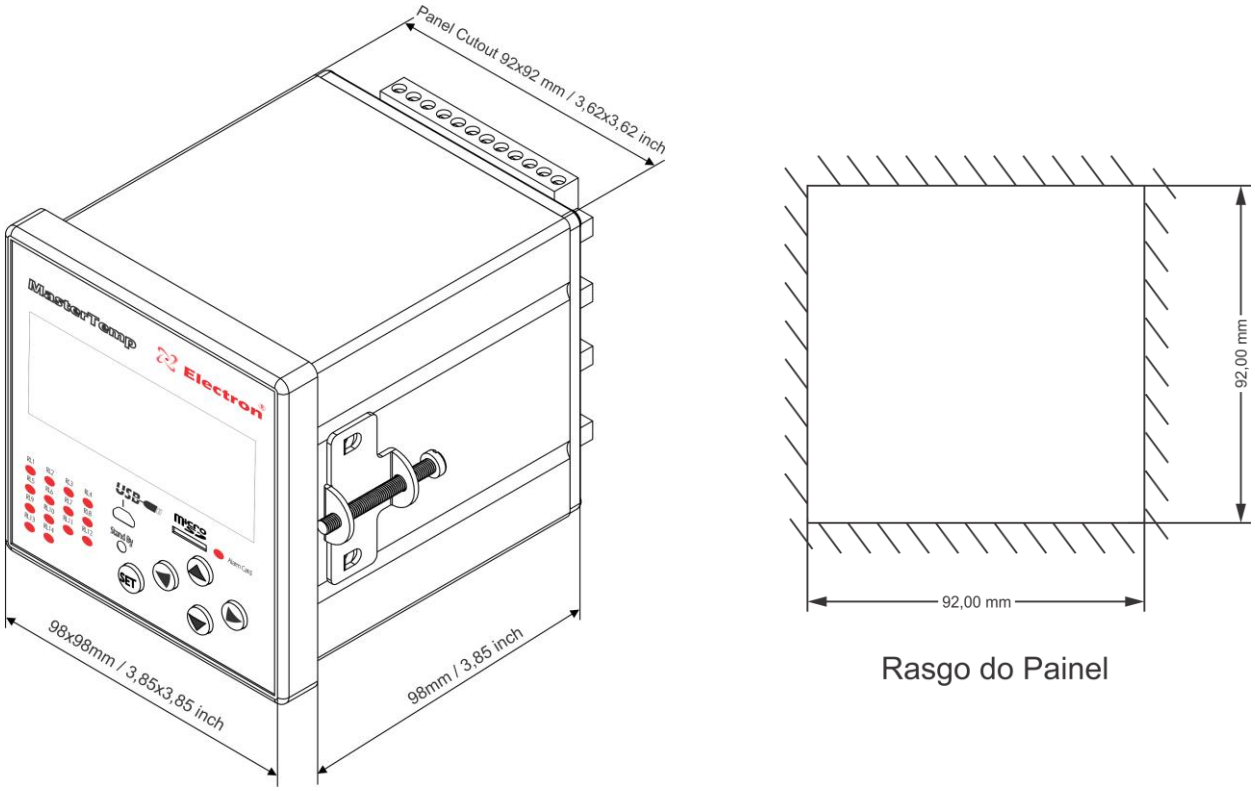


Fig. 3 – MasterTemp dimensions

CONNECTION DIAGRAMS

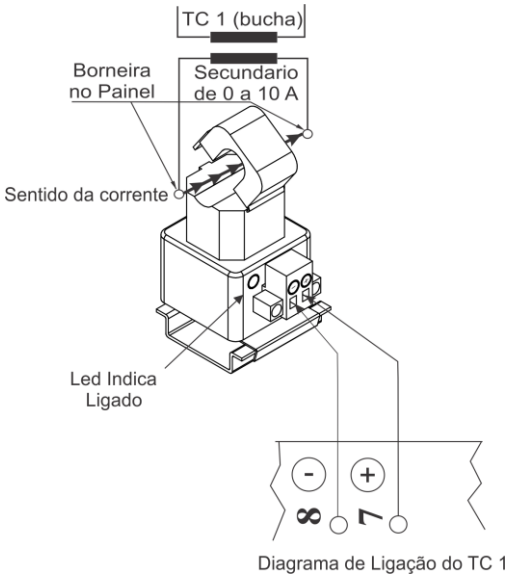
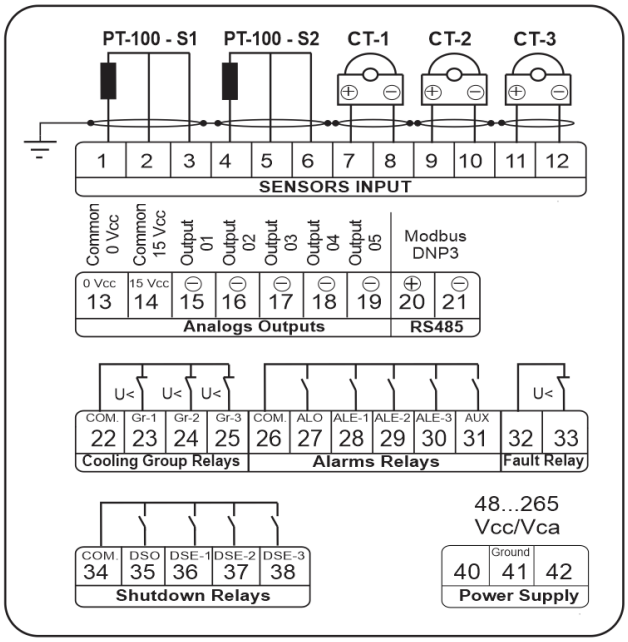


Diagrama de Ligação do TC 1



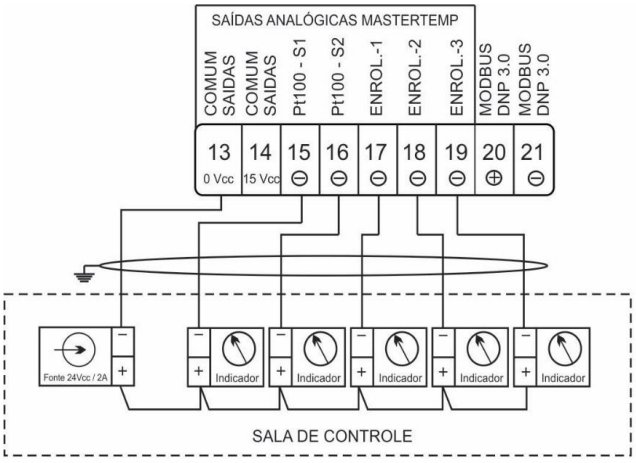


Diagrama para conexões de Indicadores Analógicos com fonte externa.

Fig. 3 – MasterTemp connection diagram

INSTALLATION ACCESSORIES

Electron do Brasil has a line of accessories that can be purchased together aiming 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.

PT100 STE Temperature Sensor: This sensor is constructed with AISI-304 stainless steel bulb, injected aluminum head (IP 65) and adjustable gland with 3/4" and 1/2" BSP threads, or can be manufactured according to design. Its principle is to measure 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 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 PT100 3-wire sensor is widely used in the market, as the possibility of measurement error is greatly reduced due to the compensation principle of the third terminal of the sensor.

Electron PT100 STFE Temperature Sensor Page Link:
https://electron.com.br/site/produtos/rtd-pt100/

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

Dual Port Panel for Outdoor Use – IP 55 Page Link:
https://electron.com.br/site/produtos/painel-para-uso-externo-ip55/

Reference card for PT100 signal: This accessory was developed to verify the temperature value displayed by equipment with 3-wire PT100 RTD sensor input. 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).

Reference Card page link for PT100 signal:
https://electron.com.br/site/produtos/

TCP CONVERTER

Modbus TCP Slave / Modbus Master – Converter:

Fig. 3 – TCP Converter

Key features:

The HD67507 is a Modbus TCP Slave / Modbus Master converter.

It allows the following features:

- Triple isolation between serial – Power Supply, Serial – Ethernet, Power Supply – Ethernet.
- Ethernet 10Base-T/100Base-T, auto-detect for modbus TCP;
- For WI-FI version, access point, or client mode;
- Mountable on 35mm DIN rail;
- Wide power supply input range: 8... 24V AC or 12... 35V DC;
- Wide temperature range: -40°C / 85°C

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

GETTING TO KNOW MASTERTEMP

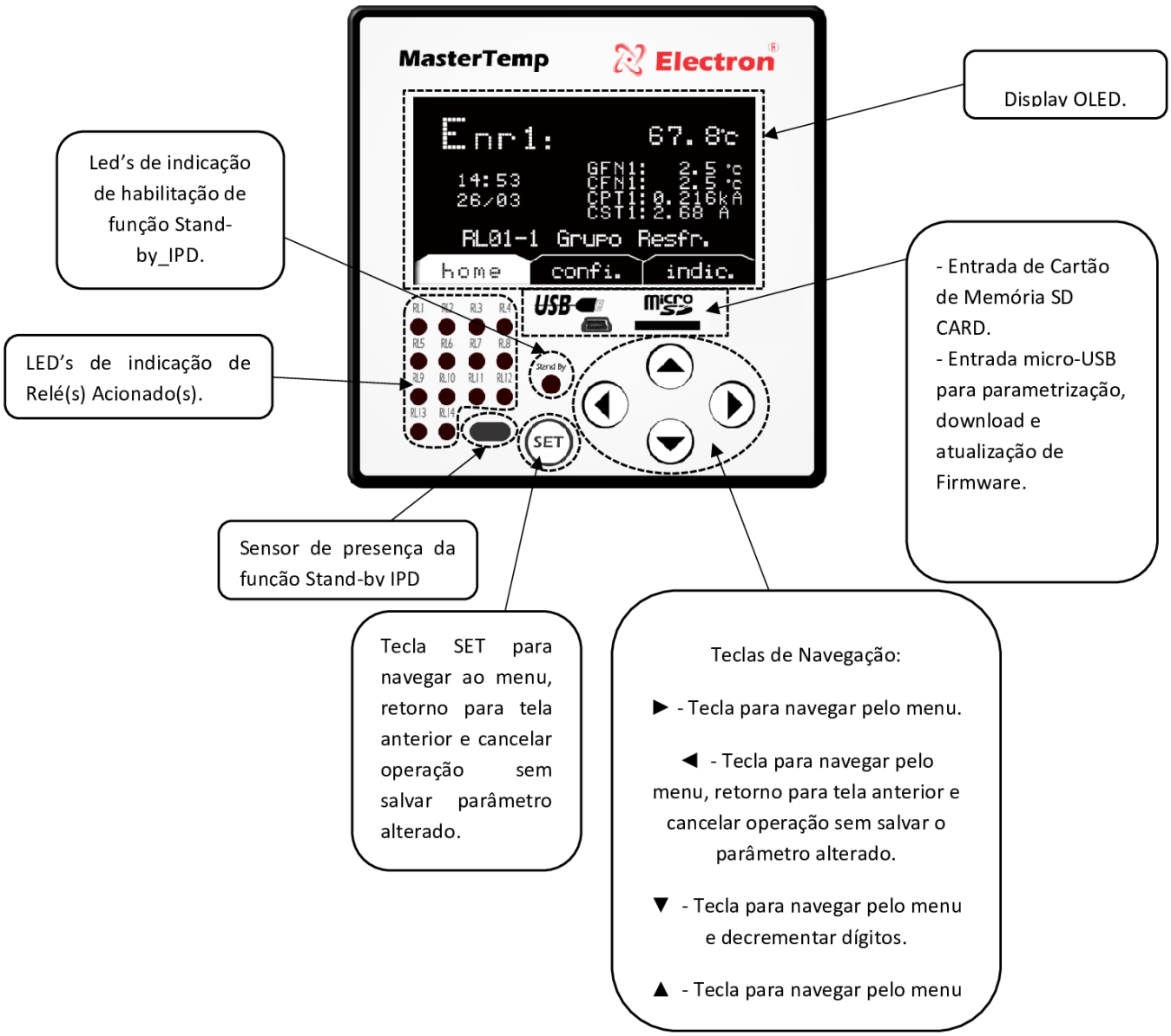


Fig. 5 – MasterTemp front

DISPLAY DISPLAY SETTING

To access the display configuration, it is necessary to be in the mode of presentation of the readings and press the ▼ key to select one of the five fields, with ◄ or ► select the variable that will be presented by the OLED display and confirm it by pressing the **SET** key. To exit the "Display Setup" screen, use the navigation keys (▼ and ▲) to and select the "Back" option and press the SET Key**.**

The Display has 5 fields to indicate the readings, which can be configured to display up to 5 of the following variables.

Variables that can be indicated on the display	Display Way
Room temperature;	SenAmb.: 0.0 °C
Top Oil Temperature;	Oil Top: 0.0 °C
Lower Oil Temperature;	OleoInf : 0.0 °C
Switch Temperature;	OLTC : 0.0 °C
Winding Temperature 1	Enr1 : 0.0 °C
Winding temperature 2	Enr2 : 0.0 °C
Winding temperature 3	Enr3 : 0.0 °C
Final Temperature Gradient of Winding 1	GFN1 : 0.0 °C
Final Winding Temperature Gradient 2	GFN2 : 0.0 °C
Final Winding Temperature Gradient 3	GFN3 : 0.0 °C
Loading Percentage of Winding 1;	CAR1 : 0.0 %
Loading Percentage of Winding 2;	CAR2 : 0.0 %
Loading Percentage of Winding 3;	CAR3 : 0.0 %
Current in the Secondary of the Thermal Imaging CT1	CST1 : 0.0 A
Current in the Secondary of the Thermal Imaging CT2	CST2 : 0.0 A
Current in the Secondary of the Thermal Imaging CT3	CST3 : 0.0 A
Current in Thermal Imaging TC1 Primary	CPT1 : 0.0 kA
Current in Thermal Imaging TC2 Primary	CPT2 : 0.0 kA
Current in Thermal Imaging TC3 Primary	CPT3 : 0.0 kA

NOTE: For variable is available in the display indication, MasterTemp must be configured to read the variable

SETUP MENU

The Configuration Menu or "**confi**" is used to configure the following parameters:

- Sensor reading;
- OLED display;
- RS-485 output;
- Current output;
- Log on the SD Card;
- Date and time;
- Change of password;
- Idioma/language;

To access the confi**.** With the display in reading mode, press the SET key**.** On the display will present the menus at the bottom and with the ► key navigate to the confi option**.** and press the SET key.

The confi**.** It has a password to access the settings, it will present a four-digit number in the upper corner of the display, "Password reminder" and just below it will appear 0000. Use the ▲ or ▼ keys to enter the password, to confirm the chosen number and move to the next number press the ► key, to return to the previous number press the ◄ key. Confirming the four digits, press the SET key will enter the configuration menu showing the submenus. If the password is not correct, the incorrect password message will appear at the bottom of the display and the password 0000 will return.

After entering the password, MasterTemp will only ask for the password again when it returns to its measurement indication screen, if you continue to configure in other menus that have a password, MasterTemp will not ask for the password again.

From the factory the password of MasterTemp is 0000. In case of loss or forgetfulness of the password, contact Electron do Brasil and inform the password reminder.

Navigate through the menus, submenu and parameters with the ▲▼◄ ► keys select the desired submenu or parameter and press the SET key, change the variable with the ▲▼ keys and press the SET key to confirm the change, if variable output without confirming the change the variable automatically returns its previous value.

Menu	Parameter	Variable	Description
Confi. Sensor Reading	**T.Reading**	**Backup**	Sensor 1 and Sensor 2 will read the Top of the Oil temperature and indicate the average for the two Sensors. • If one of the PT100 sensors fails, it will continue the thermal image calculation by the active sensor, indicate "OFF" on the monitor display, signal the sensor that the fault has occurred, and the fault relay will act; Disables the Temperature differential function on the auxiliary relay;
		Indep.	Sensor 1 or Sensor 2 reads the Top of the Oil, according to the user's selection. The other sensor (Non-Top Oil) reads the ambient temperature or lower oil temperature or the commutator temperature. • When it was in **Backup** mode and configured this option, sensor 1 will automatically have room temperature and Sensor 2 will have the Top Oil Temperature; • If the oil top sensor fails, the thermal image calculation will be stopped, indicating on the display "OFF" signaling a failure in the Oil Top sensor, and then the Fault Relays and vent group will be triggered; Enables the Temperature differential option in the Auxiliary Relay;

Menu	Parameter	Variable	Description
Confi. Reading Sensor	Submenu for configuring the reading function of the PT-100, Sensor 1: ***NOTE.*:** Sensor 1 or sensor 2 must be at the Top of the Oil temperature. If the user does not do so, the equipment will do it automatically.		
	Reading Sensor 1	**OFF**	Sensor 1 Off;
		Environment	Sensor 1 reads the Room Temperature;
		Top Oil	Sensor 1 reads the temperature of the Top of the Oil;
		Bot Oil.	Sensor 1 reads the Lower Oil Temperature;
		Commutator	Sensor 1 Reads the temperature of the Commutator tank;
	Submenu for configuring the reading function of the PT-100, Sensor 2: **NOTE.:** Sensor 1 or sensor 2 must be at the Top of the Oil temperature. If the user does not do so, the equipment will do it automatically.		
	Sensor Reading 2	**OFF**	Sensor 2 Off;
		Environment	Sensor 2 reads Room Temperature;
		Top Oil	Sensor 2 reads the temperature of the Top of the Oil;
		Bot Oil.	Sensor 2 reads the Lower Oil Temperature;
		Commutator	Sensor 2 Reads the Temperature of the Commutator tank;
	Wrap. 1 Wrap. 2 Wrap. 3	Submenu to enable or disable sensor input in winding 1, 2 and 3;	
		On	Enable Read on Corresponding Winding;
		Off	Disabled reading in the Corresponding Wind;
	Correction Detour	Submenu to perform the Temperature deviation correction for sensors 1, 2 and perform current correction for Winding 1, 2 and 3;	
Confi. Display OLED	Menu to perform the configuration in the display presentation mode and perform the operation test of the Led's display;		
	Contrast	Submenu to configure the contrast of the OLED display;	
		0 to 255	Display Contrast Setting Value;
	Display Mode	Submenu to configure the display display mode of the OLED screen;	
		Black	Black screen background and white writing;
		White	White screen background and black writing;
	Presentation	**Fixed**	The Display will present a quantity in the 1st row, according to the user's selection.
		Scan	A Rotation of the set of quantities chosen by the user will be performed (To perform the set of these quantities use the UseEasy software).
	LED and Display Testing	Submenu to test the drives of the LEDs and OLED Display screen	
		---	Pressing the **SET** screen will light up all the LEDs and reverse the display writing mode.
	Stand-by IPD	**OFF**	Disables the
		1 – 10 min	Select a value for the OLED Display to remain active.

Menu	Parameter	Variable	Description
Confi. Output RS485	Menu to configure the parameters of the Serial Communication Network (Scada).		
	Protocol	Submenu to configure the type of Communication Protocol;	
		MBUS	Select the MODBUS RTU Communication Protocol;
		DNP	Select DNP3 L2 as the Communication Protocol;
	Address	Submenu to configure the Communication Protocol type:	
		1 to 254	Submenu to configure the Serial Network address. Each equipment connected to the RS485 network (terminal 20 and 21) must have a single address different from the others, so that the supervisor can identify it;
	Baudrate KBps	Submenu to configure the Serial communication speed:	
		Auto	AUTO – Automatically Detects Communication Speed;
		2.4	Fixed communication speed at 2400 bps;
		4.8	Fixed communication speed at 4800 bps;
		9.6	Fixed communication speed at 9600 bps;
		19.2	Fixed communication speed at 19200 bps;
		38.4	Fixed communication speed at 38400 bps;
		57.6	Fixed communication speed at 57600 bps;
	Parity	Submenu to configure communication parity, i.e. last bit to be transmitted in the message to verify data integrity.	
		NONE	No Parity;
		ODD	Last bit of data to be transmitted will be 1;
		PAIR	Last bit of data to be transmitted will be 0;
	Protection	Submenu to configure Serial Network protection;	
		On	Protection System Against Parameter Change turned on. It does not allow changes in the Serial Network parameters, only consultation.
		Off	Protection System Against Parameter Change turned off. In this Condition, parameter changes are enabled.

Menu	Parameter	Variable	Description
Current output	Menu to configure the type and range of the Current Outputs.		
	Scale	Submenu for setting the Current Outputs (Analog Output).	
		0-1 Ma	Sets the current output to 0 to 1 mA;
		0-5 mA	Configures the current output to 0 to 20 mA;
		0-10 mA	Sets the current output to 0 to 5 mA;
		0-20 mA	Sets the current output to 0 to 10 mA;
		4-20 mA	Configures current output to 4 to 20 mA
	Output 1	Submenu to configure which quantity will mirror in analog output 1.	
		OFF	Analog Output 1 off;
		Sen 1	Mirrors the temperature of sensor 1 on Analog Output 1;
		Sen 2	Mirrors the temperature of sensor 2 on Analog Output 1;
		Enr. 1	Mirrors winding temperature 1 on Analog Output 1;
		Enr. 2	Mirrors winding temperature 2 on Analog Output 1;
		Enr. 3	Mirrors winding temperature 3 on Analog Output 1;
		1st TC1	Mirrors the primary current of winding 1 on Analog Output 1;
		1st TC2	Mirrors the primary current of winding 2 on Analog Output 1;
		1st TC3	Mirrors the primary current of winding 3 on Analog Output 1;
		2nd TC1	Mirrors the current of the winding secondary 1 on Analog Output 1;
		2°TC2	Mirrors the secondary current of winding 2 on Analog Output 1;
		2nd TC3	Mirrors the current of the winding secondary 3 on Analog Output 1;
		Car.1	Mirrors the Load percentage of winding 1 on Analog Output 1;
		Car.2	Mirrors the Load percentage of winding 2 on Analog Output 1;
		Car.3	Mirrors the Load percentage of winding 3 on Analog Output 1;
		Delta	Mirrors the Temperature differential at analog output 1;
	Output range color. 1	Sub menu to configure the maximum and minimum range of the analog output 1.	
		Min out	Minimum value for analog output 1 between 0 and 199°C;
		Max out	Maximum value for analog output 1 between 0 and 200°C;

Menu	*Parameter*	Variable	Description
	Exit 2	Submenu to configure which quantity will mirror to analog output 2.	
		OFF	Analog Output 2 off;
		Sen 1	Mirrors the temperature of sensor 1 on Analog Output 2;
		Sen 2	Mirrors the temperature of sensor 2 on Analog Output 2;
		Enr. 1	Mirrors the temperature of winding 1 on Analog Output 2;
		Enr. 2	Mirrors winding temperature 2 on Analog Output 2;
		Enr. 3	Mirrors winding temperature 3 on Analog Output 2;
		1st TC1	Mirrors the primary current of winding 1 on Analog Output 2;
		1st TC2	Mirrors the primary current of winding 2 on Analog Output 2;
		1st TC3	Mirrors the primary current of winding 3 on Analog Output 2;
		2nd TC1	Mirrors the current of the secondary winding 1 on Analog Output 2;
		2°TC2	Mirrors the secondary current of winding 2 on Analog Output 2;
		2nd TC3	Mirrors the current of the winding secondary 3 on the Analog Output 2;
		Car.1	Mirrors the Load percentage of winding 1 on Analog Output 2;
		Car.2	Mirrors the Load percentage of winding 2 on Analog Output 2;
		Car.3	Mirrors the Load percentage of winding 3 on Analog Output 2;
		Delta	Mirrors the Temperature differential on analog output 2;
	Output range color. 2	Submenu to configure the maximum and minimum range of the analog output 1.	
		Min out	Minimum value for analog output 1 between 0 and 199°C;
		Max out	Maximum value for analog output 1 between 0 and 200°C;

Menu	Parameter	Variable	Description
	Exit 3	Submenu to configure which quantity will mirror to analog output 3.	
		OFF	Analog Output 1 off;
		Sen 1	Mirrors the temperature of sensor 1 on Analog Output 3;
		Sen 2	Mirrors the temperature of sensor 2 on Analog Output 3;
		Enr. 1	Mirrors winding temperature 1 on Analog Output 3;
		Enr. 2	Mirrors winding temperature 2 on Analog Output 3;
		Enr. 3	Mirrors winding temperature 3 on Analog Output 3;
		1st TC1	Mirrors the primary current of winding 1 on Analog Output 3;
		1st TC2	Mirrors the primary current of winding 2 on Analog Output 3;
		1st TC3	Mirrors the primary current of winding 3 on Analog Output 3;
		2nd TC1	Mirrors the current of winding secondary 1 to Analog Output 3;
		2°TC2	Mirrors the current of the winding secondary 2 on the Analog Output 3;
		2nd TC3	Mirrors the current of the winding secondary 3 on the Analog Output 3;
		Car.1	Mirrors the Load percentage of winding 1 on Analog Output 3;
		Car.2	Mirrors the Load percentage of winding 2 on Analog Output 3;
		Car.3	Mirrors the Load percentage of winding 3 on Analog Output 3;
		Delta	Mirrors the Temperature differential on analog output 3;
	Output range color. 3	Submenu to configure the maximum and minimum range of the analog output 3.	
		Min out	Minimum value for analog output 1 between 0 and 199°C;
		Max out	Maximum value for analog output 1 between 0 and 200°C;

Menu	Parameter	Variable	Description

	Exit 4	Submenu to configure which quantity will mirror to analog output 4.	
		OFF	Analog Output 1 off;
		Sen 1	Mirrors the temperature of sensor 1 on Analog Output 4;
		Sen 2	Mirrors the temperature of sensor 2 on Analog Output 4;
		Enr. 1	Mirrors winding temperature 1 on Analog Output 4;
		Enr. 2	Mirrors winding temperature 2 on Analog Output 4;
		Enr. 3	Mirrors winding temperature 3 on Analog Output 4;
		1st TC1	Mirrors the primary current of winding 1 on Analog Output 4;
		1st TC2	Mirrors the primary current of winding 2 on Analog Output 4;
		1st TC3	Mirrors the primary current of winding 3 on Analog Output 4;
		2nd TC1	Mirrors the current of winding secondary 1 on Analog Output 4;
		2°TC2	Mirrors the current of the winding secondary 2 on the Analog Output 4;
		2nd TC3	Mirrors the current of the winding secondary 3 on the Analog Output 4;
		Car.1	Mirrors the Load percentage of winding 1 on Analog Output 4;
		Car.2	Mirrors the Load percentage of winding 2 on Analog Output 4;
		Car.3	Mirrors the Load percentage of winding 3 on Analog Output 4;
		Delta	Mirrors the Temperature differential at analog output 4;
	Output range color. 4	Sub menu to configure the maximum and minimum range of the analog output 4.	
		Min out	Minimum value for analog output 1 between 0 and 199°C;
		Max out	Maximum value for analog output 1 between 0 and 200°C;

Menu	Parameter	Variable	Description
Current output	**Exit 5**	Submenu to configure which quantity will mirror to analog output 5.	
		OFF	Analog Output 5 off;
		Sen 1	Mirrors the temperature of sensor 1 on Analog Output 5;
		Sen 2	Mirrors the temperature of sensor 2 on Analog Output 5;
		Enr. 1	Mirrors winding temperature 1 on Analog Output 5;
		Enr. 2	Mirrors winding temperature 2 on Analog Output 5;
		Enr. 3	Mirrors winding temperature 3 on Analog Output 5;
		1st TC1	Mirrors the primary current of winding 1 on Analog Output 5;
		1st TC2	Mirrors the primary current of winding 2 on Analog Output 5;
		1st TC3	Mirrors the primary current of winding 3 on Analog Output 5;
		2nd TC1	Mirrors the current of winding secondary 1 on Analog Output 5;
		2°TC2	Mirrors the current of the winding secondary 2 at Analog Output 5;
		2nd TC3	Mirrors the current of the winding secondary 3 on the Analog Output 5;
		Car.1	Mirrors the Load percentage of winding 1 on Analog Output 5;
		Car.2	Mirrors the Load percentage of winding 2 on Analog Output 5;
		Car.3	Mirrors the Load percentage of winding 3 on Analog Output 5;
		Delta	Mirrors the Temperature differential at analog output 5;
	Output range color. 5	Submenu to configure the maximum and minimum range of the analog output 5.	
		Min out	Minimum value for analog output 4 between 0 and 199°C;
		Max out	Maximum value for analog output 4 between 0 and 200°C;
	Correction of Detour	Submenu to perform deviation correction in the current output,	
		S. Analog 1 **S. Analog 2** **S. Analog 3** **S. Analog 4** **S. Analog 5**	Range from -1.00 mA to 1.00 mA. S. Analog. 1: Set the value to subtract or sum in the output of Current 1; S. Analog. 2: Set the value to subtract or sum in the output of Current 2; S. Analog. 3: Set the value to subtract or sum in the output of Current 3; S. Analog. 4: Set the value to subtract or sum in the Current output 4; S. Analog. 5: Set the value to subtract or sum at the current output 5; **NOTE:** *To correct the deviation in the Current Output, it has to be linear, that is, the same deviation from the beginning to the end of the Scale*.

Menu	Parameter	Variable	Description
Current output	**Exit 5**	Submenu to configure which quantity will mirror to analog output 5.	
		OFF	Analog Output 5 off;
		Sen 1	Mirrors the temperature of sensor 1 on Analog Output 5;
		Sen 2	Mirrors the temperature of sensor 2 on Analog Output 5;
		Enr. 1	Mirrors winding temperature 1 on Analog Output 5;
		Enr. 2	Mirrors winding temperature 2 on Analog Output 5;
		Enr. 3	Mirrors winding temperature 3 on Analog Output 5;
		1st TC1	Mirrors the primary current of winding 1 on Analog Output 5;
		1st TC2	Mirrors the primary current of winding 2 on Analog Output 5;
		1st TC3	Mirrors the primary current of winding 3 on Analog Output 5;
		2nd TC1	Mirrors the current of winding secondary 1 on Analog Output 5;
		2°TC2	Mirrors the current of the winding secondary 2 at Analog Output 5;
		2nd TC3	Mirrors the current of the winding secondary 3 on the Analog Output 5;
		Car.1	Mirrors the Load percentage of winding 1 on Analog Output 5;
		Car.2	Mirrors the Load percentage of winding 2 on Analog Output 5;
		Car.3	Mirrors the Load percentage of winding 3 on Analog Output 5;
		Delta	Mirrors the Temperature differential at analog output 5;
	Output range color. 5	Submenu to configure the maximum and minimum range of the analog output 5.	
		Min out	Minimum value for analog output 4 between 0 and 199°C;
		Max out	Maximum value for analog output 4 between 0 and 200°C;
	Correction of Detour	Submenu to perform deviation correction in the current output,	
		S. Analog 1 **S. Analog 2** **S. Analog 3** **S. Analog 4** **S. Analog 5**	Range from -1.00 mA to 1.00 mA. S. Analog. 1: Set the value to subtract or sum in the output of Current 1; S. Analog. 2: Set the value to subtract or sum in the output of Current 2; S. Analog. 3: Set the value to subtract or sum in the output of Current 3; S. Analog. 4: Set the value to subtract or sum in the Current output 4; S. Analog. 5: Set the value to subtract or sum at the current output 5; **NOTE:** *To correct the deviation in the Current Output, it has to be linear, that is, the same deviation from the beginning to the end of the Scale*.

Menu	Parameter	Variable	Description
Conf. Log. SD Card	Menu to configure the parameters used for recording on the SD Card.		
	Data Log	Submenu menu to enable and/or disable data recording on the SD Card.	
		YES **DON'T**	Yes – Enables Data Logging; No – Disables Data Logging;
	Time Aquisi.	Submenu for Configuration for setting the equipment health log time on the SD Card.	
		Off **5 to 180**	Off - Log by off time 5 min – Writes the log to the SD Card every 5 minutes. Log Increment with 5-minute time step.
	Var. Temp.	Submenu to configure the Temperature variation for recording on the SD Card;	
		1.0 to 10.0	Temperature variation value (°C).
	Var. Current.	Submenu to configure the Current variation for recording on the SD Card;	
		0.1 to 1.0	Value of the Current variation (A).
Date/Time	Menu to configure date and time on the equipment's internal clock		
	Date	Day/Month/Year	Submenu to configure the clock date;
	Hour	HourMinutes	Submenu to configure the clock time;
	Week	---	Submenu to display the day of the clock week; **NOTE:** Automatic submenu according to day, month and year;
Idioma/ Language	Menu for choosing a new password to access the Configuration menu.		
	---	0000 to 9999	The factory password of MasterTemp is **0000**. In case of loss or forgetfulness of password contact Electron do Brasil for password reminder information.
	Menu to set the display language on the MasterTemp display		
	---	Portuguese English	Portuguese – Presentation Language defined in Portuguese; English – Presentation Language defined in English;

INDICATORS MENU

The **menu stated**. Contains the following menus, which present their respective query parameters:

- Date/Time;
- Current Temperature;
- Maximum temperatures;
- Ventilation Group Hour Meter;
- Final Temperature Gradient;
- Percentage load;
- Secondary current;
- Primary current;
- Reset the Drive;
- Aging of Trafo;
- Equipment Version.

To access the menu indic. com the display in reading presentation mode, press the SET key, the display will display the menus at the bottom and with the ► key , navigate to the indicated menu and press the SET key.

Menu	Parameter	Variable	Description
Date / Time	**---**	**---**	Indicates date, time, and day of the week configured on the internal clock. To set the clock use the menu "confi.date/time"
Current temperature	**Sensor 1 and 2 Wrap. 1, 2 and 3**	**-50 to 250**	Indicates the current temperature of the Sensors and Windings.
Temperatur e Maxim	**Sensor 1 and 2 Enrol 1, 2 and 3**	**- 50 to 250**	Indicates maximum temperatures reached by the sensors. To reset the maximum temperatures, select the reset option and navigate with the ▲ and ▼ keys. Select the desired Sensor and press SET.
Hour meter	**Hour meter 1st Group 2nd Group 3rd Group**	**Day Hours Minutes**	Indicates how many days, hours, and minutes the fan has been on. To change the time. Once the edit option is selected and navigate with the ▲e▼ keys, selecting the corresponding variable, with the ▲and▼ keys change the value and press SET to confirm the change.
Final Gradient	**Wrap. 1, 2 and 3**	**- 50 to 250**	Indicates the temperature that the windings have reached after thermal stabilization considering the temperature and load conditions at the time of the consultation.
Carry. Percentage	**Wrap. 1, 2 and 3**	**0 to 300%**	Indicates the current percentage load of the transformer. According to the Current read on the Thermal Image CT and Rated Current of the Transformer.
Current in Secondary	**Wrap. 1, 2 and 3**	**0 to 9.999 A**	Indicates the current in the Secondary of the thermal imaging CT for the three windings.
Current in Primary	**Wrap. 1, 2 and 3**	**0 to 9.99 KA**	Indicates the current in the Thermal Imaging CT Primary for the three windings.

Menu	Parameter	Variable	Description
Reset Drive	**Oil Alarm Off. Oil Alarm Enrol.1 Desli.Enrol.1 Alarm AlarmEnrol.2 Scroll.Slide.2 AlarmEnrol.3 Scroll 3 AlarmFailure Manut.Resf. 1st Group 2nd Group 3rd Group**	---	Submenu for resetting the active alarm. For the reset of the drive, select the active alarm and confirm by pressing the SET key. The alarm will only be reset if the alarm condition has already been reestablished, otherwise the alarm remains triggered. **NOTE:** It is only necessary to reset the alarm if the alarm is set to manual return in the **Trigger Return menu**.
Aging Trafo	**PV Enr. 1 PV Enr.2 PV Enr.3**	**0 to 300%**	Submenu to consult the percentage of elapsed life in Winding 1, 2 and 3 of the transformer.
	Life Extrapolation	**Days or Hours**	Submenu for displaying the estimated life of each transformer winding. Enr1 Days – Number of Days remaining in winding 1, for 100%. Enr1 Hours – Number of hours remaining from winding 1, to 100%. Enr2 Days – Number of Days remaining in winding 2, to 100%. Enr2 Hours – Number of hours remaining from winding 2, to 100%. Enr1 Days – Number of Days remaining in winding 3, to 100%. Enr3 Hours – Numbers of hours remaining from winding 3, to 100%.
Equipment Version	**Version No. Series Calibrated**	---	Screen to consult information about the Equipment Version: Firmware version of the equipment; No. Serie: Equipment Serial Number Calibrated: Date of calibration/measurement of the equipment.

DRIVE MENU

The "**Triggers Menu.**" It is used to configure the drives of MasterTemp and has the following parameters:

- High temperature alarm;
- Disconnection;
- Refrigeration;
- Auxiliary Relay;
- Return of the drive;
- Activation Logic;
- Testing the drives
- Activation of cooling.

To access the **Menu, it activates**. With the display in reading mode and press the SET key, the display will display the menus at the bottom and with the ► key navigate to the menu and press the SET key.

The menu activates. has a password and will show the four-digit number, "password reminder" and just below it will appear 0000. Use the ▲ or ▼ keys to enter the password, to confirm the chosen number and move to the next number press the ► key, to return to the previous number press the ◄ key. Confirming the four digits, press the SET key will enter the configuration menu showing the submenus. If the password is not correct, the incorrect password message will appear at the bottom of the display and will return to password 0000.

After entering the password, MasterTemp will only ask for the password again when it returns to its measurement indication screen, if you continue to configure in other menus that have a password, MasterTemp will not ask for the password again.

From the factory the password of MasterTemp is 0000. In case of loss or forgetfulness of the password, contact Electron do Brasil and inform the password reminder.

Navigate through the menus, submenus and parameters with the ▲▼◄► keys select the desired sub-menus or parameter and press the SET key, change the variable with the ▲▼ keys and press the SET key to confirm the change, if you leave the variable without confirming the change the variable automatically returns its previous value.

Menu	Parameter	Variable	Description
High Temp. Alarm	➢ Menu to configure the temperature for triggering alarms and Hysteresis		
	Oil **Wrap. 1** **Wrap. 2** **Wrap. 2**	❖ Sub menu to configure the trigger temperature of the Alarms	
		-50 to 250	When the corresponding sensor reaches the set temperature, the respective relays and LED on the front of the equipment will be activated, indicating and signaling the active alarm. **Oil –** Oil alarm temperature (relay 3 – terminals 26 and 27). **Winding 1** - Winding alarm temperature1 (relay 5 - terminals 26 and 28). **Winding 2** - Winding alarm temperature 2 (relay 7 – terminals 26 and 29). **Winding 3** - Winding alarm temperature 3 (relay 9 – terminals 26 and 30).

DRIVE MENU

Menu	Parameter	Variable	Description
High Temp. Alarm	**Hysteresis**	❖ Sub menu to configure the Hysteresis of alarm return.	
		0.1 to 10	Hysteresis of alarm return, i.e., temperature difference between the activation and deactivation of the alarms. ***Example***: If the alarm value is set at 90°C and the hysteresis is set at 1°C, the alarm relay will only be triggered when the temperature reaches 88.9°C, i.e. with 1°C below the alarm parameter, this value is valid for the 4 Alarms, oil, Winding1, Winding2 and Winding 3.
Disconnection	➢ Menu to set the temperature or Charging for transformer shutdown.		
	Per charge	❖ Sub menu to enable or disable the activation of the shutdown by charging.	
		ON **OFF**	**ON -** Enables charging shutdown **OFF** – Disables the activation of the shutdown by charging
		❖ Sub menu to configure the charging percentage for transformer shutdown.	
		Wrap. 1 **Wrap. 2** **Wrap. 3**	When the corresponding sensor reaches the set Charging, the respective relays and LED on the front of the equipment will be activated, indicating and signaling the active shutdown. Range from 50 to 200%. **Winding 1** – Sets the load percentage for shutdown in winding 1 (relay 6 - terminals 34 and 36). **Winding 2** – Sets the load percentage for shutdown on winding 2 (relay 8 - terminals 34 and 37). **Coil 3** – Sets the load percentage for shutdown in winding 3 (relay 10 - terminals 34 and 38).
	By Temperature	❖ Sub menu to configure the transformer shutdown temperature.	
		Oil **Wrap. 1** **Wrap. 2** **Wrap. 3**	When the corresponding sensor reaches the set temperature, the respective relays and LED on the front of the equipment will be activated, indicating and signaling the active shutdown. Range from -49.9 to 249.9 °C. ▪ **Oil** – Sets the temperature for shutdown in the Oil (relay 4 - terminals 34 and 35). ▪ **Winding 1** – Sets the temperature for shutdown in winding 1 (relay 6 - terminals 34 and 36). ▪ **Winding 2** – Sets the temperature for shutdown on winding 2 (relay 8 – terminals 34 and 37). ▪ **Winder 3** – Sets the temperature for shutdown at winding 3 (relay 10 - terminals 34 and 38)
	Cont. Des.	❖ Sub menu to set the delay time for transformer shutdown (minutes).	
		0 to 20 min.	When the sensor temperature reaches the shutdown parameter, the count will start and the corresponding sensor led will be flashing and will display the countdown time for the relay activation, if it is **"0"** (zero) the relay of the respective sensor will activate immediately.

DRIVE MENU

Menu	Parameter	Variable	Description
Refrigeration	➢ Menu to set the temperature and or Charging to activate the Ventilation.		
	Per charge	❖ Sub menu for Enables or disables charging cooling.	
		On **Off**	**On -** Enables the activation of cooling by charging. **Off** – Disables the triggering of cooling per charge.
		❖ Sub menu to configure the loading percentage for the activation of the ventilation group.	
		Wrap. 1 **Wrap. 2** **Wrap. 3**	When the corresponding sensor reaches the Adjusted Charging, the respective ventilation group and LED on the front of the equipment will be activated, indicating and signaling active cooling. Range from 50 to 200%. • **Group 1** - Percentage of load for activation of the 1st ventilation group (relay 1 - terminals 22 and 23). • **Group 2** - Percentage of load for activation of the 2nd ventilation group (relay 2 - terminals 22 and 24). • **Group 3** - Load percentage for activation of the 3rd ventilation group (relay 13 - terminals 22 and 25).
	By Temperature	❖ Sub menu to configure the activation temperature of the ventilation group.	
		Oil **Wrap. 1** **Wrap. 2** **Wrap. 3**	When the corresponding sensor reaches the set temperature, the respective ventilation groups and LED on the front of the equipment will be activated, indicating and signaling active cooling. Range from -49.9 to 249.9 °C. ▪ **Sensor:** • **Group 1** - Temperature for activation of the 1st ventilation group (relay 1 - terminals 22 and 23). • **Group 2** - Temperature for activation of the 2nd ventilation group (relay 2 - terminals 22 and 24). • **Group 3** - Temperature for activation of the 3rd ventilation group (relay 13 - terminals 22 and 25).
Refrigeration	**Hysteresis**	❖ Sub menu to configure the ventilation shutdown hysteresis.	
		0 to 30 °C	Temperature difference between turning on and off the chiller. Example: If the cooling is programmed at 65°C and the hysteresis programmed at 5°C, the ventilation will only be turned off when the temperature reaches 59.9°C, i.e. with 5°C below the drive parameter, this value is valid for the 3 groups of fans.

DRIVE MENU

Menu	Parameter	Variable	Description
	Inversion	❖ Sub menu to configure the type of inversion of the fan groups	
		Desab. **Gr.1 and 2** **Gr.1 and 3** **Simul.**	▪ **Disable -** Disables the reversing of the ventilation group. ▪ **Gr.1 and 2 -** Enables the automatic inversion between groups 1 and 2, that is, at each new match of the group an inversion is made, making the group that had previously started first become the 2nd group. ▪ **Gr.1 and 3 -** Enables automatic inversion between groups 1, 2 and 3, that is, at each new start of the group, an inversion is made, alternating between each activation. ▪ **Simul. -** The 3 groups of fans will start simultaneously.
Auxiliary Relay	➢ Menu to disable and/or configure the activation of the Auxiliary Relay:		
	Status	❖ Sub menu to enable or disable auxiliary relay triggering.	
		On **OFF**	On – Enables the function of the auxiliary relay; OFF – Disables the auxiliary relay function.
	Temp.	❖ Sub menu to set the trigger temperature of the auxiliary relay.	
		-49.9 to 249,9	When the corresponding sensor reaches the set temperature, relay 12 (terminals 26 and 31) will be activated and LED on the front of the equipment indicating and signaling the active alarm.
	Delta T.	❖ Sub menu to configure the Temperature differential for auxiliary relay triggering	
		1.0 to 10.0	When the temperature difference between sensor 1 and Sensor 2 reaches the set temperature, relay 12 (terminals 26 and 31) will be activated and the LED on the front of the equipment indicating and signaling the active alarm. **Note.**: The Temperature Diff alarm option is only available when the sensor readout option is Standalone.
	Retar.	❖ Sub menu to enable or disable the auxiliary relay trigger delay;	
		On **Off**	▪ **OFF** – Activation time disabled. ▪ **ON** – Time for activation enabled. **Note.:** The delay time for shutdown is the time configured in the parameter (**shutdown Cont. Des.** delay time for shutdown in minutes). ▪ If the delay is enabled it will disables the relay disables the hysteresis option.

DRIVE MENU

Menu	Parameter	Variable	Description
Auxiliary Relay	**History.**	❖ Sub menu to configure the Auxiliary Relay shutdown hysteresis.	
		0 to 30	Temperature difference between turning the Auxiliary Relay on and off. Example: If the alarm is programmed at 110°C and the hysteresis is programmed at 5°C, the Auxiliary Relay will only be turned off when the temperature reaches 104.9°C, i.e. 5°C below the trigger parameter .
	Relay Triggering	❖ Sub menu to enable and or disable the sensor that will act on the Auxiliary Relay.	
		Sensor 1 Sensor 2 Wrap. 1 Wrap. 2 Wrap. 3 Delta T. Hor. Resf.	▪ **Sensor 1**: Enables or disables the activation of the auxiliary relay by the temperature of sensor 1; ▪ **Sensor 2**: Enables or disables the activation of the auxiliary relay by the temperature of sensor 2; ▪ **Enrol.1**: Enables or disables the activation of the auxiliary relay by the temperature of Winding 1; ▪ **Enrol.2**: Enables or disables the activation of the auxiliary relay by the temperature of Winding 2; ▪ **Enrol.3**: Enables or disables the activation of the auxiliary relay by the temperature of Winding 3; ▪ **Delta t.**: Enables or disables the activation of the auxiliary relay by the temperature differential Sensor 1 and Sensor 2; ▪ **Hor. Resf.**: Enables or disables the activation of the auxiliary relay by the ventilation hour meter;
Return drive	➢ Menu to configure the Relay deactivation mode:		
	Oil Alarm Off. Oil Wind alarm. 1 Off. Wrap. 1 Wind Alarm 2 Off. Wrap. 2 Wind alarm. 3 Off. Wrap. 3 Alarm Failure	**Auto Man.**	Configuration of how the alarm, shutdown and fault relays will return after their activation (ANSI-86 function). If it is in **Man** , it means that the Reset is set to Manual, i.e. the contacts of the respective relays will only return to the normal state after the operator's intervention. You will need to reset, select the reset option with the ▲▼ keys and press the SET key. If the choice is **Auto** , they will automatically return after normalization.

DRIVE MENU

Menu	Parameter	Variable	Description
Trigger Logic	➢ Menu to perform the configuration in the logic of activation of the Relays:		
	RL 01 - 1st Group Refr. **RL 02 - 2nd Group Refr.** **RL 03 - Oil Alarm** **RL 04 – Oil Trip** **RL 05 - Roller Alarm. 1** **RL 06 - Slide. Wrap. 1** **RL 07 - Roller Alarm. 2** **RL 08 - Slide. Wrap. 2** **RL 09 - Roller Alarm. 3** **RL 10 - Slide. Wrap. 3** **RL 11 – Failure relay** **RL 12 Auxiliary Relay** **RL 13 – *3rd Group Refr.***	**Reverse** **Normal**	**Normal:** Initial condition of the Relay Off. **Inverse -** Initial condition of the Activated Relay. **RL 01 - 1st Group Refr. –** Consult the activation logic of the 1st ventilation group. **RL 02 - 2nd Group Refr. –** Consult the activation logic of the 2nd ventilation group. **RL 03 - Oil alarm –** Configures oil alarm activation logic. **RL 04 – Oil Trip –** Configures logic for activating the oil shutoff. **RL 05 - Winding Alarm. 1 –** Configures winding alarm activation logic 1. **RL 06 - Slide. Wrap. 1 –** Configures winding shutdown activation logic 1. **RL 07 - Roller Alarm. 2 -** Configures winding alarm activation logic 2. **RL 08 - Slide. Wrap. 2 –** Configures winding shutdown trigger logic 8 **RL 09 - Winding Alarm 3 -** Configures winding alarm activation logic 3. **RL 10 - Slide. Wrap. 3 –** Configures winding shutdown activation logic 3. **RL 11 - Fault relay -** Consults the fault relay activation logic. **RL 12 - Auxiliary Relay-** Configures the logic of activation of the auxiliary relay. **RL 13 - 3rd Group Refr. –** Logical consultation of activation of the 3rd ventilation group.

MAINTENANCE MENU

Menu	Parameter	Variable	Description
Traffic aging	Menu to configure the Transformer Aging Alarm.		
	PV Enr.1 **PV Enr.2** **PV Enr.3**	Submenu to configure the Winding Insulation Life Percentage Alarm and Enable the Auxiliary Relay activation;	
		0 to 100%	Percentage of insulation life for triggering the Alarm;
		On	Enables the alarm of the Auxiliary Relay;
		Off	Disabled the Auxiliary Relay Alarm;

TRANSFORMER MENU

The Trafo menu is for configuring the transformer parameters in MasterTemp and has the following parameters:

- Temperature gradient;
- Time constant;
- Hot Spot Factor;
- Cooling Type;
- Rated Current;
- Current Ratio;
- Aging of Trafo.

To access the trafo menu with the display in reading presentation mode and press the SET key, the display will present the menus at the bottom and with the ► key, navigate to the trafo menu and press the SET key.

The trafo menu has a password and will show the four-digit number, "password reminder" and just below it will appear 0000. Use the ▲ or ▼ keys to enter the password, to confirm the chosen number and move to the next number press the ► key, to return to the previous number press the ◄ key. Confirming the four digits, press the SET key will enter the setup menu showing the sub-menus. If the password is not correct, the incorrect password message will appear at the bottom of the display and the password 0000 will return.

After entering the password, MasterTemp will only ask for the password again when it returns to its measurement indication screen, if you continue to configure in other menus that have a password, MasterTemp will not ask for the password again.

From the factory the password of MasterTemp is 0000. In case of loss or forgetfulness of the password, contact Electron do Brasil and inform the password reminder.

Navigate through the menus, submenu and parameters with the ▲▼◄► keys select the desired submenu or parameter and press the SET key, change the variable with the ▲▼ keys and press the SET key to confirm the change, if you leave the variable without confirming the change the variable automatically returns its previous value.

Menu	Parameter	Variable	Description
Gradient Temperature	❖ Menu to configure the Winding Temperature gradient.		
	GEO 1	➢ Submenu to configure the Winding Temperature gradient 1;	
		0.1°C to 100.0°C	Difference between the temperature of the top of the oil and the average temperature of the winding 1, after thermal stabilization under rated load conditions.
	GEO 2	➢ Submenu to configure the Winding Temperature gradient 2;	
		0.1°C to 100.0°C	Difference between the temperature of the top of the oil and the average temperature of the winding 2, after thermal stabilization under conditions of rated load.
	GEO 3	➢ Submenu to configure the Winding Temperature gradient 3;	
		0.1°C to 100.0°C	Difference between the temperature of the top of the oil and the average temperature of the winding 3, after thermal stabilization under conditions of rated load.

TRANSFORMER MENU

Menu	Parameter	Variable	Description
Constant of time	❖ Menu to configure the Winding Time Constant (Given in seconds): **NOTE:** If this information is not available, use the value of 300 sec (Used for copper winding).		
	CTE1	➢ Submenu to configure the Winding Time Constant 1;	
		0 to 500 sec	Winding thermal inertia time 1, this value is obtained in the transformer heating test;
	CTE2	➢ Submenu to configure the Winding Time Constant 2;	
		0 to 500 sec	Winding thermal inertia time 2, this value is obtained in the transformer heating test;
	CTE3	➢ Submenu to configure the Winding Time Constant 3;	
		0 to 500 sec	Winding thermal inertia time 3, this value is obtained in the transformer heating test;
Hot Spot Factor	❖ Menu to configure the Transformer Hot Spot factor:		
	Hot Spot ABNT	❖ Submenu to configure the Hot-Spot factor added to the gradient:	
		0.00°C to 20.0°C	Adding to the Temperature gradient according to NBR5416 and IEEE Std C57.91-1995, you find the temperature of the hottest point of the winding. If the IEC standard is used to calculate the hottest point, this parameter must be set to zero.
	Hot Spot IEC	❖ Submenu to configure the Hot-Spot factor multiplied to the gradient:	
		1.0 to 15.0	Multiplied by the tempering gradient according to IEC 354 is the temperature of the hottest point of the winding. If the ABNT standard is used to calculate the hottest point, this parameter must be adjusted to 1.0, range from 1.0 to 1.5.
Cooling Type	❖ Menu to configure the type of cooling used in the Transformer.		
	2M	**1.0 to 2.0**	**1.6** (Natural oil and forced oil); **2.0 (**Directed Oil);
Rated Current	❖ Menu to configure the Rated Transformer current:		
	Wrap. 1	❖ Rated current in winding 1;	
		0.000 to 0.900 kA	Setting value of the rated winding current 1, in kA
	Wrap. 2	❖ Rated current in winding 2;	
		0.000 to 0.900 kA	Setting value of the rated winding current 2, in kA
	Wrap. 3	❖ Rated current in winding 3;	
		0.000 to 0.900 kA	Setting value of the rated winding current 3, in kA

TRANSFORMER MENU

Menu	Parameter	Variable	Description
Current Ratio	❖ Menu to configure the transformation ratio of the thermal imaging CT of the Windings: **Example:** Thermal imaging CT 950/5 A – TC190 ratio.		
	Wrap. 1	❖ Rated current in winding 1;	
		0 to 20,000	Setting value the transformation ratio of winding 1;
	Wrap. 2	❖ Rated current in winding 2;	
		0 to 20,000	Setting value the transformation ratio of winding 2;
	Wrap. 3	❖ Rated current in winding 3;	
		0 to 20,000	Setting value the winding transformation ratio 3;
Aging Trafo	❖ Menu to configure Transformer Aging parameters:		
	Class	➢ Submenu to configure the Thermal Class of Transformer insulation:	
		Kraft **Thermostat.** **Nomex**	**Kraft –** Kraft Paper – Class 55; **Thermostat. –** Thermostabilized Paper – Class 65; **Nomex –** Aramid Paper – Class 95;
	PV Enr. 1	➢ Submenu to configure the insulation loss of life of Winding 1;	
		0 to 100%	Percentage of elapsed life of winding 1;
	PV Enr. 2	➢ Submenu to configure the insulation loss of life of the Winding 2;	
		0 to 100%	Percentage of elapsed life of winding 2;
	PV Enr. 3	➢ Submenu to configure the loss of life of the insulation of the Winding 3;	
		0 to 100%	Percentage of elapsed life of winding 3;

RECOMMENDED SETTINGS

	ABNT		IEC		ANSI	
	55,0° C	65,0° C	55,0° C	65,0°C	55,0°C	65,0°C
Hot Spot - HS+ (ABNT)	10	15	0			
Hot Spot - HS* (IEC)	1,0		1,3			
Expoente 2M	1,6 (ON* e OF**) / 2,0 (OD***)					
Constante de Tempo do Enrolamento, CTE.	300 segs.					
Temperatura de Acionamento do Ventilador - TAR	65ºC 1ºGrupo e 75°C 2º Grupo					
Alarme de Temperatura do óleo - ATA-SEN2	85°C (ON*) / 75°C (OF**)					
Alarme de Temp. dos Enrolamentos- ATA-SEN3	105°C					
Desligamento por Temp. do óleo - DTA-SEN2	110°C					
Desligamento por Temp. dos Enrolamentos - DTA-SEN3	120°C					
Tempo de Retardo de Desligamento – TRD	2 min.					
Histerese de Desligamento Resfriador –HDR	5°C					

*ON=óleo Natural **OF= óleo Forçado ***OD=óleo Dirigido

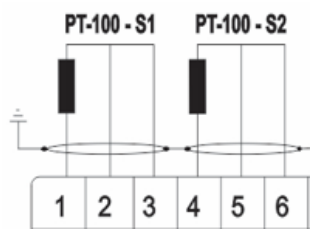
TROUBLESHOOTING

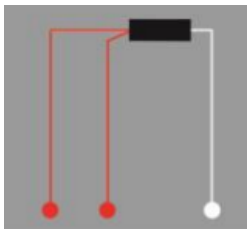
Display	Cause	Solution
OFF	Reliable signal from the sensor does not reach Mastertemp	Check and replace if the sensor cable is not shielded.
		Check the grounding of the sensor cable.
		Check and eliminate possible bad contact.
		Replacing the temperature sensor if it is damaged.

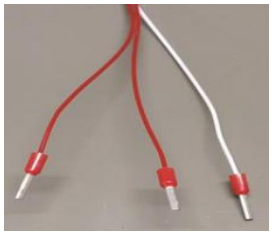
The sensor automatically returns to reading mode when normalized, to reset the Mastertemp press the ► key until the display turns off, then release and the Monitor will reset without losing the previously set parameters.

PT-100 RTD SENSORS TEST

MasterTemp, depending on the model purchased, supports input of up to 2 RTD PT100. The PT100 RTDs used in MasterTem are three-wire, two red wires, and one white wire:



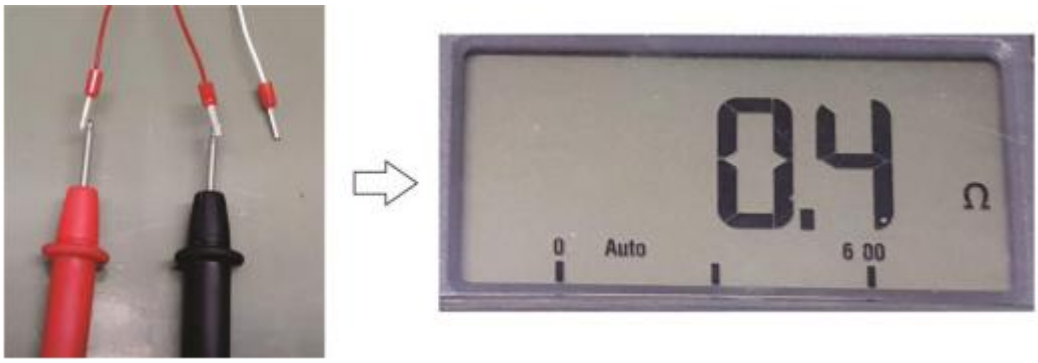




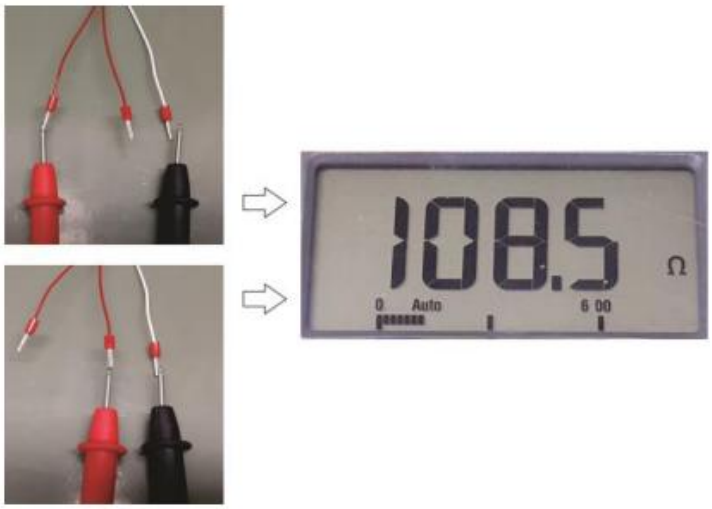
On **Sensor 1 (PT-100 – S1):** The white wire is connected to pin 1 and the red wires are connected to pins 2 and 3.

On **Sensor 2 (PT-100 – S2):** The white wire is connected to pin 4 and the red wires are connected to pins 5 and 6.

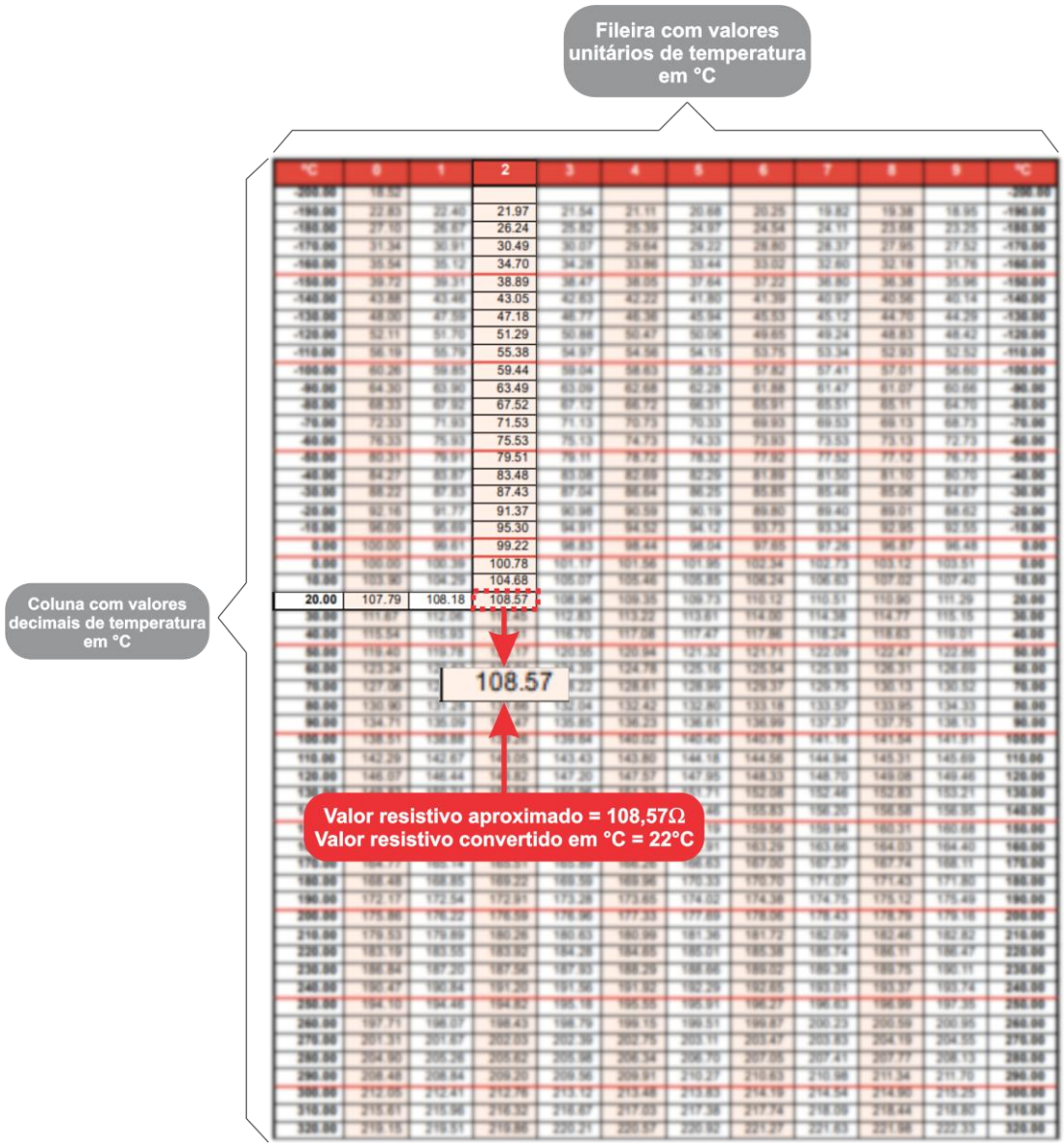
To check the operation of the sensors, take the following measurements with a multimeter on the Ohmic scale. It is worth noting that the sensor must be disconnected from the MasterTemp or the MasterTemp must be turned off, otherwise there will be errors in the measurement of the sensor's resistance.



Between the red hairs, a very low resistance will be observed, close to 1 Ω. There may be upward variations depending on the length of the cable.



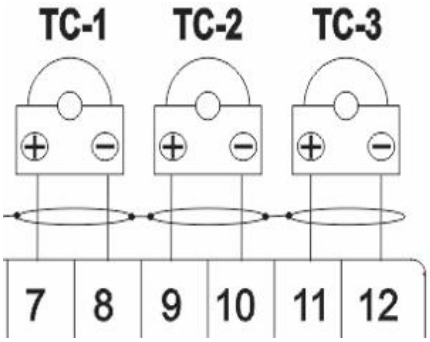
Between the red and white wires, a resistance equivalent to the temperature that the RTD sensor is measuring is measured. In the case below, it is a PT100 measuring a temperature of 22°C, which is equivalent to a resistance of 108.5Ω (according to the thermoresistance table available in https://www.electron.com.br/arquivos/artigos-tecnicos/tabela_pt100.pdf



TEST ON SIGNAL INPUT 4 TO 20 MAAMPS

This test must be done with the MasterTemp energized, so it is not allowed to remove any wires from the MasterTemp power connector. To verify that the current signal arriving at MasterTemp is correct, a multimeter on the current scale (mA) measures the input of the sensor.

The current input to the MasterTemp is made through the pins: TC-1 - pins 7 and 8, TC-2 - pins 9 and 10, TC-3 - Pins 11 and 12. In the example below, the current input on the TC-3 will be measured. Removing the wire that is connected to pin 12 on the input of the TC-3, connect the probe of the black color multimeter to pin 19. With the wire tip removed, connect the probe of the multimeter colored red to the wire terminal. The current measured under these conditions should be between 4 and 20 mA. In the case below, the measured current is 9.33 mA.



IMPORTANT RECOMMENDATIONS

Before putting the equipment into operation, check the following recommendations:

1. All sensors as well as equipment must be grounded.
2. Properly grounded sensors and power prevent malfunctions or damage in cases of disturbances, surges, and inductions in the equipment.
3. Use in the communication network (Rs485) resistors of 120 Ohms at the 2 ends of the transmission line (start and end) in order to generate the potential difference necessary for the correct operation of the communication network.
4. The RS-485 twisted-pair cable must have a minimum gauge of 24 AWG (20mm² section).
5. The RS-485 twisted-pair cable must have a maximum capacitance of 55pF/m.
6. The RS-485 twisted-pair cable must have an impedance greater than 100 Ω.
7. Only use with the Mastertemp the original accessories that come with the equipment (TC Split core), as they have been rigorously tested together to ensure maximum efficiency and performance in the operation of the set.
8. Do not use the Monitor directly on the SUN, whenever it is installed in the field it is important to have a panel with smoked glass, in order to filter the ultraviolet rays that attack the front polycarbonate, in this way the life of the equipment will be prolonged.

WARRANTY TERM

Mastertemp Electron has a warranty period of two years from the date of sale stated on the invoice, with coverage for any manufacturing defects that make it unsuitable or unsuitable for the applications for which it is intended.

Disclaimer of Warranty

The warranty does not cover transportation expenses for technical assistance, freight and insurance for shipment of a product with evidence of defect or malfunction. The following events are also not covered: Natural wear and tear of parts due to continuous and frequent use, damage to the outside caused by falls or improper packaging; attempt to repair/break a seal with damage caused by persons not authorized by Electron and in disagreement with the instructions that are part of the technical description.

Loss of Warranty

The product will automatically lose its warranty when:

- The instructions for use and assembly contained in this manual and the installation procedures contained in the NBR 5410 Standard are not observed;
- Subjected to conditions outside the limits specified in the respective technical descriptions.
- Tampered with or repaired by a person other than Electron's technical staff;
- The damage is caused by a drop or impact;
- Infiltration of water or any other liquid occurs;
- Overload occurs that causes degradation of the components and parts of the product.

Warranty Utilization

To enjoy this warranty, the customer must send the product to Electron along with a copy of the purchase invoice properly packaged so that there is no damage in transport. For emergency care, it is recommended to send as much information as possible regarding the defect detected. This will be analyzed and subjected to full functional tests.

The analysis of the product and its eventual maintenance will only be carried out by the technical team of Electron do Brasil

Available for Downloads on the Website: https://electron.com.br/pt-br/produtos/ep4/

REVISION CONTROL

Review Nº0 June 2015.
-Emission.

RevisNo. 1.0 October 2015
- Added Temperature Scale (Degrees Celsius and Degrees Fahrenheit).

RevisNo. 1.1 October 2015.
- Removed Temperature Scale (Degrees Celsius and Degrees Fahrenheit).

RevisNo. 1.2 April 2016.
- Added serial Communication Speed menu.
- Added load-off menu.
- Added menu for triggering the ventilation group by loading.

Revision No. 3.0 January 2018
- Added Transformer aging option;
- Change of LCD display to Oled;
- Added the Scan / Fixed function on line 1 of the display;
- Added the option to choose the size, when choosing the Scan function;
- Added OF7 function for input bypass of PT100 Sensor and TC Split Core;
- Added OF7 function for current output deviation;
- Added choice of function of sensors 1 and 2;
- Added the option of logic for triggering the relays;
- Added ventilation group maintenance function;
- Added multifunction for auxiliary relays 1 and 2;
- Added a function to choose quantities for current outputs;
- Added temperature deviation value for registration on the SD Card;
- Added current deviation value for the SD Card registration;

Revision No. 4.0 September 2018
- Added the option to disable the Write log;
- Added activation menu for the 3rd Loading Ventilation Group.
- Added activation menu for the 3rd Temperature Ventilation Group.
- Added hour meter in the 3rd Ventilation Group;
- Added Transformer/Fan maintenance tab;
- Added maintenance function of the 3rd Ventilation Group;
- Added to the option to consult the current temperature;
- Added to the option to consult equipment information (Serial No./ version/ Calibration);

Revision No. 4.1 June 2019

- Spelling, formatting and grammar correction;

Revision nº 5.0 September

- Added backlight toggle function and display letters,

Revision No. 6.0 December 2020
- Added presence detection function in the OLED display configuration menu.

Revision nº 7.00 January 2021
- Added illustration of the presence detection function in the OLED display configuration menu.

- Added figure 7.1 – Cable recommendations for RS-485
- Added specifications on cable for RS485 in Important Recommendations.
- Added nominal voltage value in the technical specification table.

Revision nº 7.01 December 2021

- Added chapters for instruction of Testing RTD-PT100 Sensors and 4 to 20mA Signal Transducers.

Revision n°8 – General Revision.

- 09/08/2023