

# Thermal Protection Relay – EP4 - Manual

ANSI – 23/ 26/49



## Instruction Manual



**Electron**

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Tel. +55 11 4496-3627

Cel. +55 11 94133 7472 (vivo)

[www.electron.com.br](http://www.electron.com.br)

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## INSTRUCTION MANUAL

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## INTRODUCTION

The Thermal Protection Relay was designed to control up to four (4) temperature channels at the same time, it is used to protect and monitor dry transformer as define in the table ANSI 23, 26 and 49. The Thermal Protection Relay it is a high protection instrument, control heating (on/off), alarms and shutdown.

The EP4 was built with high quality standards with the best technology electronics components (SMD). Your hardware was designed to withstand harsh working conditions and can be directly installed in dry transformers in substations or power panels. Meets requirement levels, supportability and reliability in accordance with standards IEC, DIN, IEEE and ABNT.

The EP4 has four temperature sensors Pt100, one universal configurable analog output from 0 to 10, 0 to 20 or 4 to 20 mA, reflects the higher temperature in the moment or any channels. For this, just directly set in display or through digital output (RS485) with Modbus RTU or DNP 3.0 that too allows access to all parameters and command remote relays in real time. Also has three independent temperature setpoints for each sensor, three independents Thermal Protection Relays (NAF) can be used for alarm, shutdown, drive fans, pumps and has one (one) Thermal Protection Relay for fails (watchdog).

The type exhibition in EP4 display it is totally configurable, can be show the most higher temperature in the moment, also you could be assign the channel temperature, or operate the mode scan, that it is do complete check all channels continuously.

Through indicative Led's front door and also through the data communication is possible to identify which of the channels caused the alarm, shutdown or actuation of fans, all functions and parameterizations are easily configured directly in the instrument panel or by RS485 communication port.

The Relay Thermal Protection EP4 is built in aluminum enclosure highly resistant measuring 98x98x98mm, within the standards DIN for panel mounting.

## MAIN FATURES

- Display 3-digit high brightness LED (red);
- Accuracy of 0.5% (FS);
- Measure range of temperature from 0 to 200 ° C;
- Input for Pt100 sensors with 3 wires;
- Universal power supply 48-275 Vdc / Vac or 24 Vdc;
- Digital output with Modbus RTU RS485;
- Analog Output (Active 15 Vdc) of 0A1, 0a5, 0a10, 0a20 and 4a20 mA configurable to any of the channels measured;
- Drive directly in front of fans;
- Stores in memory the maximum temperatures reached;
- Alarm contact for NAF temperature reaches the set value;
- NAF Contact Shutdown Timer for temperature to reach the set value;
- NAF Contact ventilation drive with hysteresis;
- Contact for Fault Indication (watchdog);
- Easy to use and parameterization;
- 2 year warranty



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## THECNICAL DATA

Temperature Monitor	
Operation of Tension	48 a 275 Vdc/Vac 50/60 Hz ou 24 Vcc
Operation of Temperature	-10 a + 70°C
Energy Consumption	< 15 W
Input Temperature Medition	4 - Pt100 Ohm to 0°C with 3 cables
Average Temperature	0 a 200°C
Options Analog Inputs (on) and Maximum Load*	0 ... 1mA - 8000 Ohms
	0 ... 5mA - 1600 Ohms
	0 ... 10mA - 800 Ohms
	0 ... 20mA - 400 Ohms
	4 ... 20mA - 400 Ohms
Maximum Error Measurement	0,5% range end
Maximum Error Analog Output	0,5% ranges end
Relay Outputs	4 – Free Eletric Potential
Maximum Switching Power	70 W / 250 VA
Maximum Switching Voltage	250 Vac/Vac
Maximum Conduction Current	10 A
Serial Comunication Ports	RS 485
Comunication Protocol	Modbus RTU or DNP 3.0
Baud Rate	9.600 bps
Enclousure	98 x 98 x 98 mm
Fixation	Fixed In Display

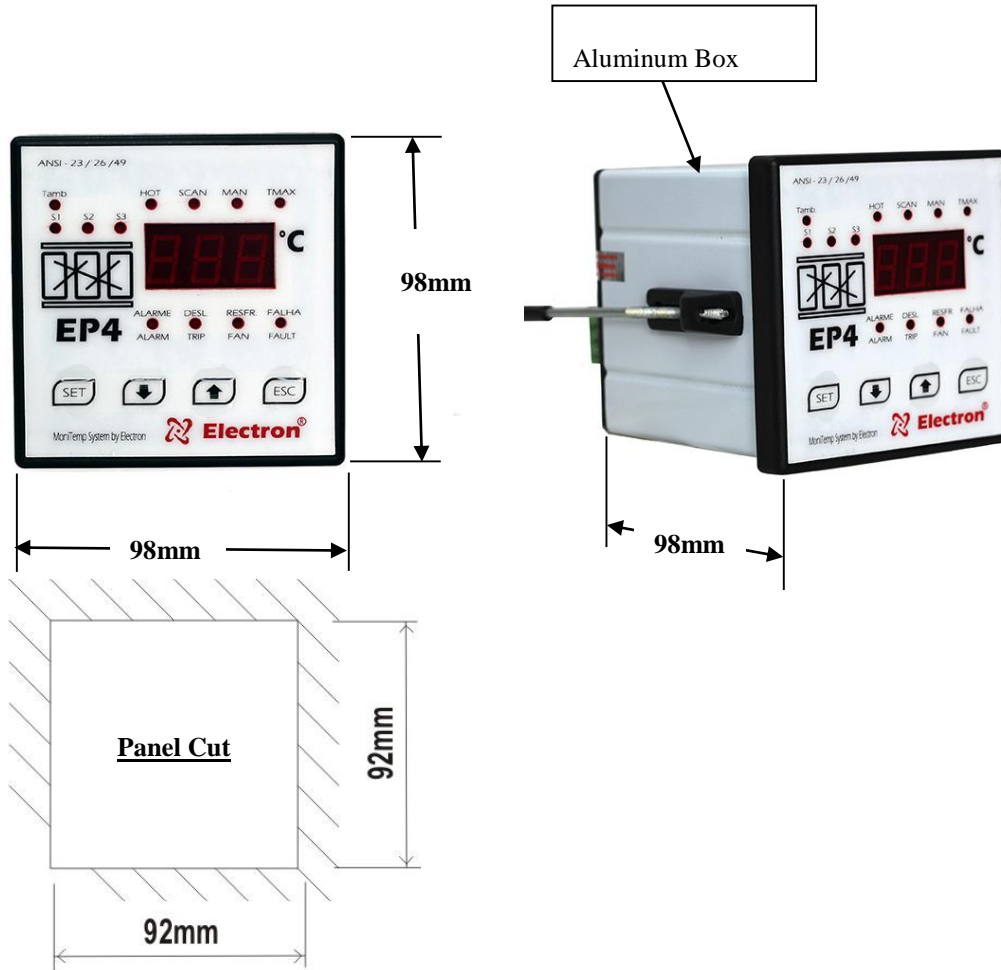
## TYPE TESTS PERFORMED

- Insulation Voltage (IEC 60255-5): 2 kV 60Hz 1 min. to ground;
- Voltage Impulse (IEC 60255-5): 1,2 / 50µs. / 5kV / 3 neg. e 3 pos / 5 seg. Interval;
- Electrostatic Discharge (IEC 60255-22-2 and IEEE C37.90.3): Air mode = 8kV / Contact mode = 6 kV;
- Irradiated electromagnetic field Immunity (IEC 60255-22-3 / IEC 61000-4-3): 80 a 1000 Mhz / 10V/m;
- Fast electrical transient immunity (IEC60255-22-4):Power/Input/Output=4Kv/Serial Port 2Kv;
- Surge Immunity (IEC 60255-22-5): phase/neutral 1Kv, 5 per polar. (+/-) - Phase-ground/neutral-ground 2Kv, 5 per polar. (+/-);
- Conduced electromagnetic perturbations immunity IEC 60255-22-6): 0,15 a 80 Mhz / 10V/m;
- Climatic test: (IEC 60068-2-14):-10°C + 70°C / 72 hours;
- Vibration resistance: (IEC 60255-21-1): 3 axis / 10 a 150Hz / 2G / 160min/axis;
- Vibration response: (IEC 60255-21-1): 3 axis / 0,075mm-10 a 58 Hz / 1G de 58 a 150 Hz / 8min/axis;

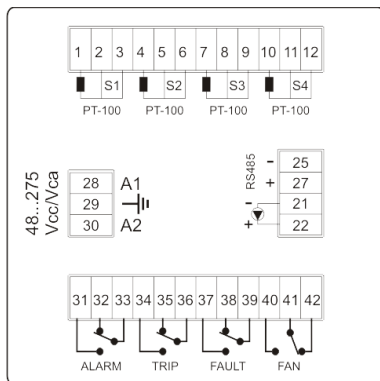
# Thermal Protection Relay – EP4 - Manual

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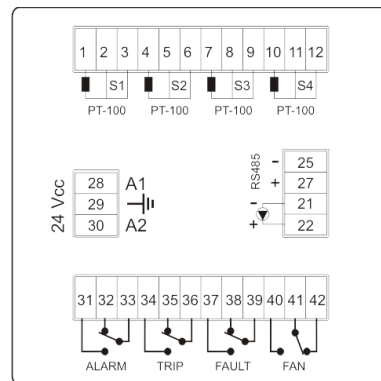
## MEASUREMENT



## CONNECTION DIAGRAMS



**DIAGRAM EP4-11 (4 RELAYS)**

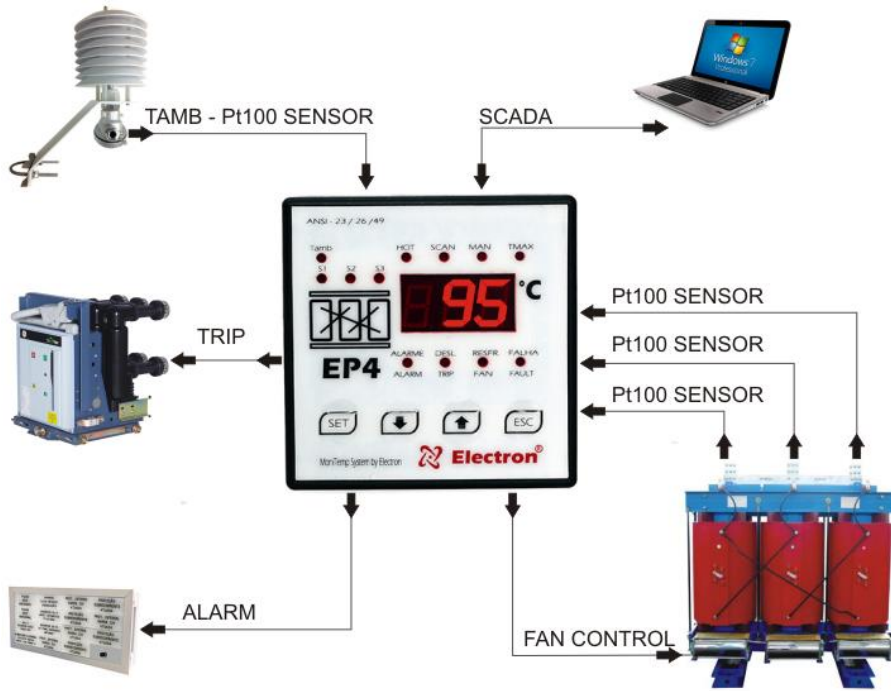


**DIAGRAM EP4-12 (4 RELAYS)**

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## APPLICATION EXAMPLE



## REQUEST ESPECIFICATION

Thermal Protection Relay – EP4 -

	<b>FAN</b>	<b>Tension</b>
1	1 GROUP OF FAN	48..275 Vdc / Vac
2	2 GROUP OF FAN	24 Vdc

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## ACCESSORY FOR INSTALLATION

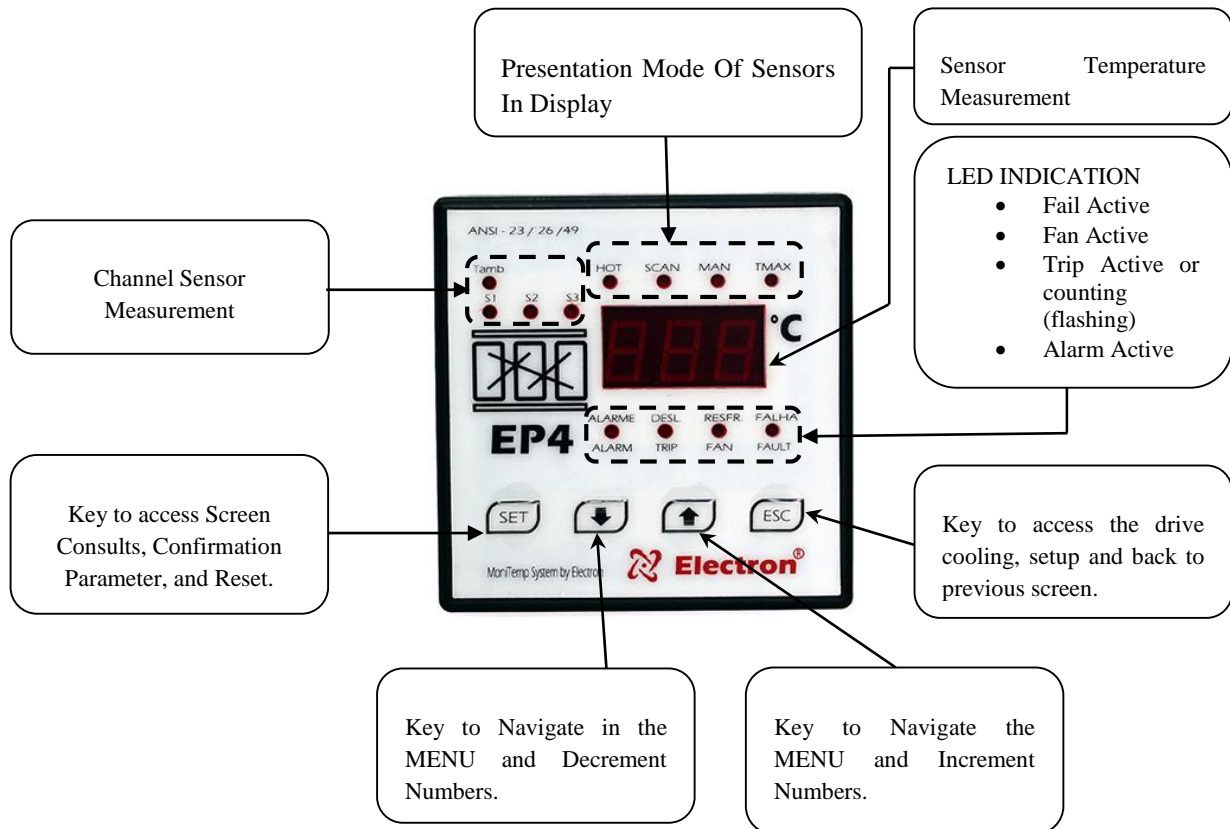


*Temperature Sensor Pt100 Inox or Teflon Bulb*



*Box for External Use*

## KNOWING EP4

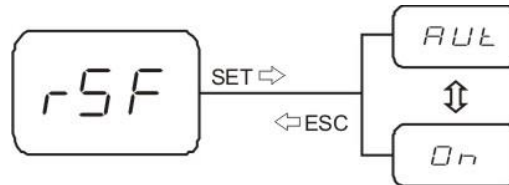


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## FLOWCHART DRIVE MENU

Pressing once the ESC key will appear on the display rSF to choose the mode of operation of the cooling; Press SET to enter the submenu and use the increment or decrement buttons to modify the parameters. ON configures the cooler drive manual and AUT configure automatic drive, after the choice of the parameter, always press the SET option to register.



## FLOWCHART CONSULT OF MENU

To view the maximum temperatures reached in each sensor, press the SET key and then use the increment or decrement buttons to navigate the menu, refer to the desired parameter press SET key once to return to the previous menu, press the ESC key.



## FLOWCHART CONFIGURATION MENU

Press the SET key for 5 seconds until appear in display the message Sem, then release the key and use the increment and decrement key to navigate the menu according to the sequence show. To enter the parameter you want to configure press SET key.

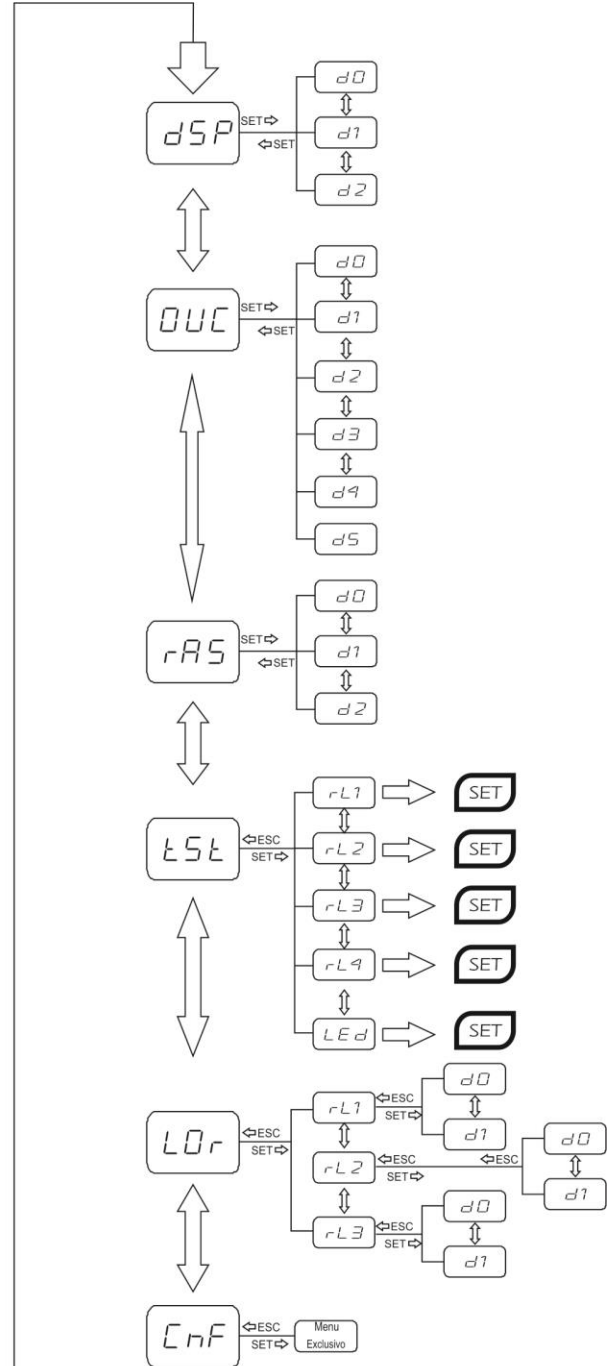
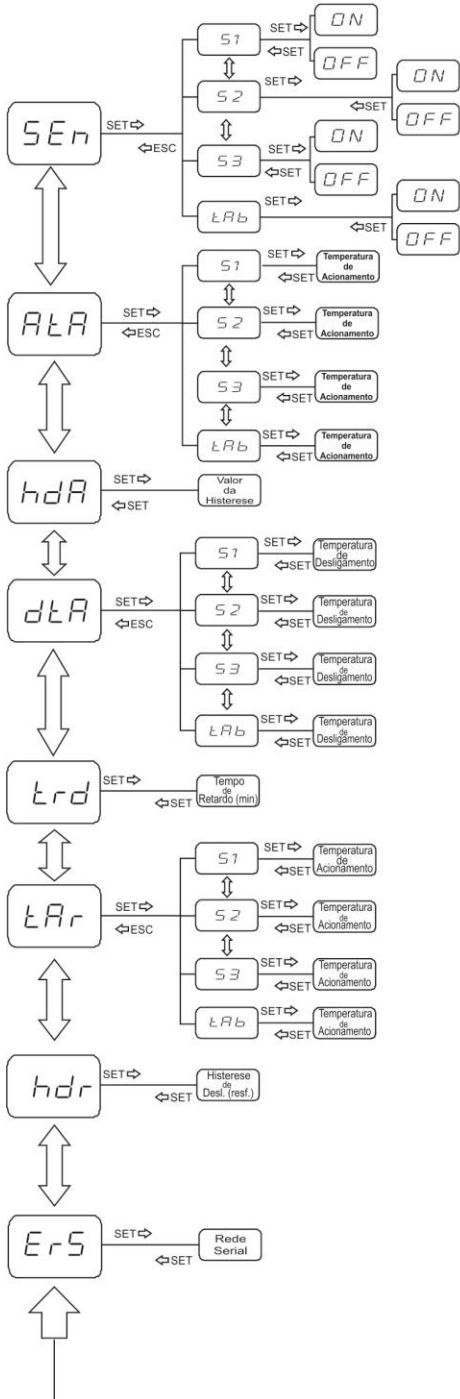
To navigate the submenu and modify the values, use increment and decrement buttons. To confirm your choices press the Set key, to return previous menu or exit the parameters without saving modifications press ESC key.



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## FLOWCHART CONFIGURATION MENU



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## CONFIGURATION MENU EP4

Menu	Parameter	Variable	Description
SEN	S1 S2 S3 TAB	ON / OFF	Enable or disable input. Select option ON or OFF in menu and confirm pressing the SET key.
ATA	S1 S2 S3 TAB	0...200 °C	Setting Menu. To adjust the temperature of the drive alarm when reach the set temperature sensor is triggered ALARM relay (terminals 31, 32 and 33), red led lights in the front of the machine indicating active alarm "when the sensor that caused the alarm the LED is blinking." Set the temperature alarm for each sensor and confirm pressing SET key.
HDA	—	0...10°C	Menu for setting hysteresis, temperature difference between connect and disconnect the alarm. Example: If ATA is programmed to 90 ° C and HDA programmed with 5 ° C, the alarm will only be turn off when the temperature reach 84 ° C, at 5 ° C below the parameter. Set the alarm hysteresis and confirm pressing SET key.
DTA	S1 S2 S3 TAB	0...200°C	Menu for adjust shutdown temperature, when the sensor reach set temperature it is started the timing TRD, timing red led "TRIP" will be flashing. In the end the red led "TRIP" will stop flash "When the cause it is the sensor, the red led is flashing" and TRIP relay (terminal 34,35 and 36) is activated. When timing it is zero in TRD, TRIP relay instantly activated after reach temperature set value. Configure Shutdown temperature in each sensor and confirm pressing SET key.
TRD	—	0..20 MIN	Menu to adjust time Shutdown , when temperature of sensor S1,S2 or S3 reach the value of DTA setup start the time count, if time setup is 0 the relay immediately active. Configure Shutdown Timing and confirm pressing SET key
TAR	S1 S2 S3 TAB	0...200°C	Menu to adjust the temperature to drive the coolers (fans) when reach the value set in this parameter the respective sensor triggered the FAN relay (terminal 40, 41 and 42), and the red LED lights on the front of the instrument show active cooler. Configure the temperature desired to drive the cooler (fan) and confirm pressing the SET key.



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<i>HDR</i>	—	0...30°C	<p>Menu to setting hysteresis, temperature difference between turn on the fan and off.</p> <p>Example: If the <i>TAR</i> is set at 65°C and programmed with <i>HDR</i> 5°C, the fan is only switched off when the temperature reach 59°C, at 5°C below the parameter <i>TAR</i>.</p> <p>Set the hysteresis shutdown fan and confirm pressing the SET button.</p>
<i>ERS</i>	—	1...254	<p>Menu to set the network address, each device connected to the network RS 485 (terminal 25 and 27) must have a unique address and different from the others, this way the computer can identify it.</p> <p>Configure Network address and confirm pressing SET key.</p>
<i>DSP</i>	D0 D1 D2	—	<p>Menu to adjust the presentation mode about measurement temperatures in display, can be also navigate between sensors using key to navigate or D0 “Display shows the high temperature (HOT).” D1 “Display shows sequencialy sensors (SCAN)”. D2 “Display shows Manually sensors (MAN)”.</p> <p>Select the Presentation mode and confirm pressing SET key.</p>
<i>OUC</i>	D0...D5	—	<p>Menu to adjust the channel will be transmited in analog output <b>(terminal 21 and 22).</b></p> <p>D0 “Disable analog output of temperature transmisson.”</p> <p>D1 “Enable temperature of Sensor 1 in analog output.”</p> <p>D2 “Enable temperature of Sensor 2 in analog output.”</p> <p>D3 “Enable temperature of Sensor 3 in analog output.”</p> <p>D4 “Enable Ambient temperature in analog output.”</p> <p>D5 “Enable high temperature in analog output.”</p> <p>Confirm pressing SET key.</p>
<i>RAS</i>	D0 D1 D2	—	<p>Menu for choise output value of terminal output current 21 and 22.</p> <p>D0 “Enable current output 0 to 10mA”.</p> <p>D1 “Enable current output 0 a 20mA.”</p> <p>D2 “Enable current output para 4 a 20mA.”</p> <p>Select the option of Analog Output and confirm pressing SET key.</p>
<i>TST</i>	RL1 RL2 RL3 RL4 LED	—	<p>Attention when using this menu, The relays is active output and the led’s in the same time. This way, the operator can verify the functions, connections and display segments, but will be attention if the TRIP relay (shutdown) is connected in system protection will trigger and transformer will be turn off or the machine it is was protection.</p>



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			RL1 “Trigger relay 1 after press SET button .” RL2 “Trigger relay 1 after press SET button .” RL3 “Trigger relay 1 after press SET button .” LEDES “Trigger all Leds in display after press SET button”.
<i>LOR</i>	<i>RL1</i> <i>RL2</i> <i>RL3</i> <i>RL4</i>	<i>D0</i>  <i>D1</i>	Menu for choice about Relays Logic. D0 – Initials Conditions “deenergized coil” Relay. D1 – Initials Conditions “energized coil” Relay. Select the Logic and confirm pressing SET.
<i>CNF</i>	—	—	Exclusive Menu from Electron Brazil. Exit menu pressing SET key.

## SERIAL COMMUNICATION EP4

Protocol: *MODBUS RTU*Bits to second: **9.600**Bits Data: **8**Parity: **No one**Parade Bits: **1**

Adress	Value	Write Read	Function Variable
1	0-2000	W/R	Maximum temperature sensor alarm 1*
2	0-2000	W/R	Maximum temperature sensor alarm 2*
3	0-2000	W/R	Maximum temperature sensor alarm 3*
4	0-2000	W/R	Maximum temperature sensor alarm 4 (environment)*
9	0-100	W/R	Value Hysteresis Alarm**
10	0-2000	W/R	Maximum temperature turn off sensor 1*
11	0-2000	W/R	Maximum temperature turn off sensor 2*
12	0-2000	W/R	Maximum temperature turn off sensor 3*
13	0-2000	W/R	Maximum temperature turn off sensor 4 (environment)*
18	0-20	W/R	Shutdown delay in minutes
19	0-2000	W/R	Maximum temperature refrigeration sensor 1*



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20	0-2000	W/R	Maximum temperature refrigeration sensor 2*
21	0-2000	W/R	Maximum temperature refrigeration sensor 3*
22	0-2000	W/R	Maximum temperature refrigeration sensor 4 (environment)*
27	0-300	W/R	Valor de Histerese da refrigeração **
29	0-2000	R	Temperature Of Sensor 1 *
30	0-2000	R	Temperature Of Sensor 2 *
31	0-2000	R	Temperature Of Sensor 3 *
32	0-2000	R	Maximum Temperature Sensor 4 (environment) *
37	0-2000	R	Maximum Temperature Sensor 1 *
38	0-2000	R	Maximum Temperature Sensor 2 *
39	0-2000	R	Maximum Temperature Sensor 3 *
40	0-2000	R	Maximum Temperature Sensor 4 (environment)*
45		R	<p>When 1 it is ON</p> <ul style="list-style-type: none"> <li>• Bit 0: Alarm of high temperature sensor 1</li> <li>• Bit 1: Alarm of high temperature sensor 2</li> <li>• Bit 2: Alarm of high temperature sensor 3</li> <li>• Bit 3: Alarm of high temperature sensor 4 (environment)</li> </ul> <p>Bit 8: Alarm relay of high temperature activated</p>
46		R	<p>When 1 it is ON</p> <ul style="list-style-type: none"> <li>• Bit 0: Counting time for shutdown by the high temperature sensor 1</li> <li>• Bit 1: Counting time for shutdown by the high temperature sensor 2</li> <li>• Bit 2: Counting time for shutdown by the high temperature sensor 3</li> <li>• Bit 3: Counting time for shutdown by the high temperature sensor 4 (environment)</li> <li>• Bit 8: Counting time for shutdown</li> </ul> <p>This adress it is clean after operation of Shutdown.</p>
47		R	<p>When 1 it is ON</p> <ul style="list-style-type: none"> <li>• Bit 0: Shutdown relay activated by high temperature sensor 1</li> <li>• Bit 1: Shutdown relay activated by high temperature sensor 2</li> <li>• Bit 2: Shutdown relay activated by high temperature sensor 3</li> <li>• Bit 3: Shutdown relay activated by high temperature sensor 4 (environment)</li> <li>• Bit 8: Shutdown relay activated</li> </ul>
48		R	<p>When 1 it is ON</p> <ul style="list-style-type: none"> <li>• Bit 0: Cooling relay activated by temperature sensor 1</li> <li>• Bit 1: Cooling relay activated by temperature sensor 2</li> <li>• Bit 2: Cooling relay activated by temperature sensor 3</li> <li>• Bit 3: Cooling relay activated by temperature sensor 4 (environment)</li> <li>• Bit 8: Cooling relay activated</li> </ul>

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49		R	When 1 it is ON <ul style="list-style-type: none"> <li>• Bit 0 - Sensor Fault 1 SOFF</li> <li>• Bit 1 - Sensor Fault 2 SOFF</li> <li>• Bit 2 - Sensor Fault 3 SOFF</li> <li>• Bit 3 - Sensor Fault 4 (Ambient) SOFF</li> <li>• Bit 8 - Sensor Fault Active</li> </ul>
50	1-254	R	Serial Adress

\* 1000 = 100.0

\* \*100 = 10.0

## DEFECT SOLUTION

Display	Cause	Solution
<b>OFF</b>	Not enough to signal reliable sensor	Check and replace if the sensor cable is not shielded.
		Check grounding of the sensor cable.
		Check and eliminate possible bad contact.

The sensor automatically returns to read mode when normalized, to reset the EP4 press the SET button for about 5 seconds until appear in display the word rSt, then release and Relay Protection EP4 restart. The EP4 will do FAUT relay active (terminal 37, 38 and 39) in case shutdown or if the fall feeding.

## IMPORTANT RECOMMENDATIONS

Before placing into operation the equipment, make the following recommendations:

1. All sensors and the equipment must be grounded, do not use the same grounding point for supply and for the sensor in order that there be no potential difference.

The sensors Power properly grounded and there prevent malfunction or damage in cases of disturbances, outbreaks, and induction equipment.

2. Using the communication network (RS485) 120-ohm resistors in the two extremities of transmission line (beginning and end) to generate potential difference necessary for the proper functioning of the communication network

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## WARRANTY

Monitor EP4 Electron has warranty period of two years from the date of sale recorded on the invoice, with coverage for any defects that it unfit or unsuitable for its intended applications.

### *Disclaimer of Warranty*

The warranty does not cover transportation expenses for technical assistance, freight and insurance for the shipment of product with evidence of malfunction. The warranty does not cover normal wear of parts of use continuous, damage caused by dropping or improper packaging, and attempt to repair, disruption warranty seal violated by unauthorized persons for Electron and use in disagreement with the operating instructions that accompanies the product.

### *Loss warranty*

The product will void the warranty automatically when:

Are not observed the instructions for use and installation in this manual and the installation procedures contained in the IEC Standards for electrical installation;

Subjected to conditions outside the limits specified in the respective technical descriptions.

Infringing or repaired by person other than the technical team from Electron;

The damage is caused by impact or fault;

Occur infiltration of water or other liquid;

Overload occur that causes the degradation of components and parts of the product.

## TERMS AND CONDITIONS

Available in Our Website

<http://electron.com.br/downloads/artigos-tecnicos/>

## REVISION CONTROL

Revision Nº 0 - 2011, August.

- Issuing Manual

Revision Nº 1.0 – 2012, September.

- Changing pictures, Inverted position numbering of input terminals, output Serial number changed from 26 to 25, changed numbering of the analog output of 43 and 44 to 21 and 22.