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## Thermal Protection Relay – EPU-IoT

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CATALOGUE

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## INTRODUCTION

The EPU IOT **Thermal Protection Relay** was developed to simultaneously supervise up to 16 (sixteen) temperature channels. It is used to protect and monitor dry transformers, motors, bearings, machinery, and industrial processes, as specified in the **ANSI table**. The IOT **EPU** is a high precision and reliability instrument, controlling transformer ventilation (ON/OFF), alarms and shutdowns (TRIP), with timing options.

The EPU IOT **Thermal Protection Relay** has been built following strict quality standards and uses high-quality electronic components and state-of-the-art technology (SMD). Its hardware is designed to withstand harsh working conditions and can be installed directly in transformers, panels in power substation yards, offshore platforms and chemical industries. It meets the levels of demand, supportability and reliability established by the IEC, DIN, IEEE and ABNT standards.

With signal inputs, the **EPU IOT** allows the connection of up to 16 PT100 temperature sensors (EN60751-DIN 43760), or up to 9 PT100 temperature sensors (EN60751-DIN 43760) in the version with RJ-45 input (Ethernet) and up to 5 15 VDC 2-wire active analog output universal and configurable, with range 0 to 1mA, 0 to 5mA, 0 to 10mA, 0 to 20mA, or 4 to 20mA. This output can be used to reflect the highest temperature recorded at the time. The analog output also has the SCAN function, which simultaneously reflects all the values of the temperature channels. This configuration can be performed directly on the **EPU IOT dashboard** or via the **EPU IOT™ software** with **BLUETOOTH** or **USB connection**.

The EPU IOT **Thermal Protection Relay** has an RJ-45 (Ethernet) input for Wi-Fi connection and an integrated **Wi-Fi** modem with a built-in 3 dBi antenna for wireless connection. When **enabled by the user**, this feature allows the Internet connection. Once the connection is established, the **EPU IOT** immediately makes the collected and measured data available on an **MQTT Broker Server**. This is accessible through the **MONITRAFO.com** monitoring platform, where users can easily register, choose the plan that best suits their needs, and set up projects with one or multiple substations or transformers. In this way, you get total control to monitor in real time all measured quantities, triggers, alarms, maintenance, transformer health status, among other measures. This can be done using the platform in any internet browser or through the **MONITRAFO APP**, available on the **Play Store** (Android) and the **App Store** (iOS).

The **IOT EPU** uses the **MQTT** communication protocol, integrating with the **MONITRAFO.com** platform to enable complete online monitoring of your transformer. In addition, it integrates **ARTIFICIAL INTELLIGENCE TOOLS, MACHINE LEARNING, DATABASE, PROGRAMMABLE FUNCTIONS, CALCULATIONS AND NOTIFICATIONS, MAINTENANCE SCHEDULE**. In the event of a loss of internet connection, the **IOT EPU** stores all measurements for the period when communication was unavailable. When the connection is restored, the data is sent to the **MONITRAFO.com** and stored in a database for querying, calculating, and more.

It is also possible to use the API available on the platform to integrate the **IOT EPU** with other platforms, such as **Azure, Google Cloud, AWS, IBM, SAP**, among others.

Thanks to the implementation of these advanced technologies, the **transformer becomes a smart device** capable of identifying changes in transformer behavior within its standard operating cycle and sending notifications via email, SMS, and apps whenever the system detects these abnormal variations. This provides you with a robust tool that significantly enhances your ability to make effective decisions.

In addition, the **EPU IOT Thermal Protection Relay** also has an RS-485 digital output with Modbus-RTU protocol and DNP 3\* (L1), which allows access to all parameters, including remote commands for real-time triggers using a SCADA supervisory. 3 independent temperature setpoints are available for each sensor and 4 relays, 3 isolated, independent and potential-free actuation relays (NO) that can be used for alarms, shutdowns (TRIP) and FAN activation (ventilation), and 1 isolated, independent and potential-free relay (NC) to indicate faults (watchdog).

The display mode is fully user configurable, allowing you to maintain the highest temperature on the display at the time, any of the temperatures selected by the operator or use the SCAN function that features a continuous scan of all temperature channels. The front indicator LEDs and the data communication port make it possible to identify the channel that caused the alarm, shutdown or activation of the fans. All functions and parameterizations can be easily configured directly on the device panel or via the **EPU IOT™ software** with **BLUETOOTH** or **USB connection**.

The EPU IOT **Thermal Protection Relay** is built in a high mechanical strength aluminum box, with measurements of 98x98x37mm, following DIN IEC 61554 standards for panel fixing.

## KEY FEATURES

### Communication Protocols

- Modbus RTU
- DNP3
- DNP3 over TCP/IP over IP networks
- Modbus TCP/IP
- MQTT

### Communication Ports

- **Built-in WIFI modem**
  - Padrões 802.11 b/g/n/e/i;
  - WPA/WPA2/WPA-Enterprise security protocol;
  - AES/RSA/ECC/SHA encryption;
  - Data rate up to 150 Mbps;
  - 3 dBi recessed antenna (isotropic decibel);
  - Transmit Power up to 21 dBm (decibel milliwatt);
- **Bluetooth**
  - Class 2 – 2.5 mW (4 dBm);
  - FIPS encryption;
  - Version 4.2 BR / EDR and BLE (Low Energy);
- **USB**
  - Version 2.0;
  - Transfer rate 480 Mbps;
  - Type-C connector.
- **RS-485**
  - ANSI/TIA/EIA-485-A standard;
  - Max. 32 equipments;
  - Half Duplex;
  - Multipoints;
  - Max. Distance: 1,200 meters;
  - 2 metallic wires;
  - Automatic speed from 2,400 to 57,600 bps.
- **RJ-45 TCP/IP**
  - TIA/EIA-568-B standard;
  - ISO/IEC 11801 standard;
  - 8 pins;
  - 100 Ohms impedance;
  - Standard 10BASE-T, 100BASE-TX.
  - Max. Distance Cat 5e/6/6a/7: Up to 100 meters for Ethernet.
  - Max. Distance Cat 8: Up to 30 meters for high-speed Ethernet.
  - Return Loss: -18dB minimum @ 1-30MHz -16dB minimum @ 30-60MHz-12dB minimum @ 60-90MHz;
  - Common Mode Rejection Rate: -30dB Minimum @ 1-100MHz;
  - Insulation: 1.5 kV / 60Hz / 1 minute.

### Dimensions and Power

- Compact Equipment with a depth of 37 mm;
- Universal Power Supply 24-275 Vdc / Vac;

**Human Machine Interface (HMI)**

- 4 Navigation keys;
- 9 or 10 LEDs on the front for event indications (see request);
- Intuitive menus for consultation and parameterization;

**Measurement input**

- Up to 16 temperature measurement inputs for sensor type PT100, 100  $\Omega$  0 °C (EN60751 – DIN43760) or Temperature Sensors type Cu10, 10  $\Omega$  to 25 °C;
- 0.5% accuracy (FE);
- Intuitive menus for consultation and parameterization;

**Digital Relay Outputs**

- 01 Relay (NAF) with 10 ampere capacity for Temperature Alarm
- Up to 02 Relays (NAF) with a capacity of 10 amperes for FAN (cooling) with programmable drive timing;
- 01 Relay (NAF) with a capacity of 10 amperes for TRIP (shutdown) with programmable activation timing;
- 01 Relay (NAF) with a capacity of 10 amperes for FAULT with programmable drive timing;
- Intuitive menus for consultation and parameterization.

**Analog Outputs**

- Supports up to 05 (five) analog outputs (Active 15 Vdc) with range options of: 0 to 1 mA, 0 to 5 mA, 0 to 10 mA, 0 to 20 mA and 4 to 20 mA;

**TIPO trials met**

- Applied Voltage (IEC 60255-5): 2 kV / 60 Hz / 1 min. (Against land);
- Voltage Impulse (IEC 60255-5): 1.2/50  $\mu$ sec. / 5 kV / 3 neg. and 3 posts. / 5 secs. Interval;
- Electrostatic Discharges (IEC 60255-22-2): Air mode = 8 kV / Counted mode = 6 kV;
- Immunity to radiated electromagnetic disturbance (IEC61000-4-3): 80 to 1000 MHz / 10 V/m;
- Fast Electric Transient Immunity (IEC60255-22-4): Input/Outputs = 4 kV/comum 2 kV;
- Immunity to Surtos (IEC 60255-22-5): phase/neutral 1 kV, 5 per polar ( $\pm$ ) – phase-earth/neutral-earth 2 kV, 5 per polar ( $\pm$ );
- Immunity to conducted Electromagnetic disturbances (IEC61000-4-6): 0.15 to 80 MHz / 10V/m;
- Climate Ensaio (IEC60068-21-14): – 40 °C + 85 °C / 72 hours;
- Vibration Resistance (IEC 60255-21-1): 3-axis / 10 to 150 Hz / 2 G / 160 min/axis;
- Vibration Response (IEC60255-21-1): 3-axis / 0.075 mm -10 to 58 Hz / 1 G from 58 to 150 Hz / 8min / axis.

**TECHNICAL DATA**

EPU - UNIVERSAL THERMAL PROTECTION RELAY	
Operating Voltage	24 a 275 Vcc/Vca 50/60 Hz
Operating Temperature	-40 °C to + 85 °C / -10 °C to +70 °C
Power Consumption	< 15 W
Temperature Measurement Input	Up to 16 Sensors - PT100 Ohm at 0°C, 2 and 3 wires (EN 60751 - DIN 43760) / Cu10 10 Ω at 25 °C.
Measurement Range	-50 °C to 250 °C
Active Analog Output 15 Vdc and Maximum Load.	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 Measurement Input Error	0.5 % end of scale
Maximum Analog Output Error	0.5 % end of scale
Outgoing Contacts	4 (NAF) – Potential Free
Maximum Switching Power	70 W / 250 VA
Maximum Switching Voltage	250 Vac/125 Vdc
Maximum Driving Current	10 Amps
Front Communication Port	Type-C connector
Serial Communication Port	RS 485 – 2 fios (ANSI/TIA/EIA-485A)
WI-FI	Padrões b/g/n/e/i
	WPA/WPA2/WPA - Enterprise
	Up to 150 Mbps data rate
	3 dBi recessed antenna
	Up to 21 dBm transmit power
	RJ-45 TIA/EIA-568-B Standard
Bluetooth	Version 4.2 BR/EDR and BLE (Low Energy)
Communication Protocol	Modbus RTU; DNP3; DNP3 over TCP/IP over IP networks; Modbus TCP/IP; MQTT
Auto Baud Rate	2,400 to 57,600 bps
IEC 61554 DIN Box	98 x 98 x 98 mm
Fixation	Panel Door with Steel Clip
Relative humidity	10 to 95%, non-condensing
Protection	IP54 (Frontal)

Table 1 – Technical Data of the EPU-IOT Thermal Protection Relay

## TYPE TRIALS MET

- Applied Voltage (IEC 60255-5): 2 kV / 60 Hz / 1 min. (against land);
- Voltage Impulse (IEC 60255-5): 1.2/50  $\mu$ sec. / 5 kV / 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 / 10 V/m;
- Immunity to Fast Electrical Transients (IEC60255-22-4): Alim/Input/Outputs=4 KV/common 2Kv;
- Immunity to Surtos (IEC60255-22-5): phase/neutral 1 KV, 5 by polar ( $\pm$ ) - phase-earth/neutral-earth 2KV, 5 by polar ( $\pm$ );
- Immunity to conducted electromagnetic disturbances (IEC61000-4-6): 0.15 to 80 MHz / 10V/m;
- Climate Ensaio (IEC60068-21-14): - 40 °C + 85 °C / 72 hours;
- Vibration Resistance (IEC60255-21-1): 3-axis / 10 to 150 Hz / 2G / 160min/axis;
- Vibration Response (IEC60255-21-1): 3-axis / 0.075 mm -10 to 58 Hz / 1G from 58 to 150 Hz / 8min/axis;

## DIMENSIONS

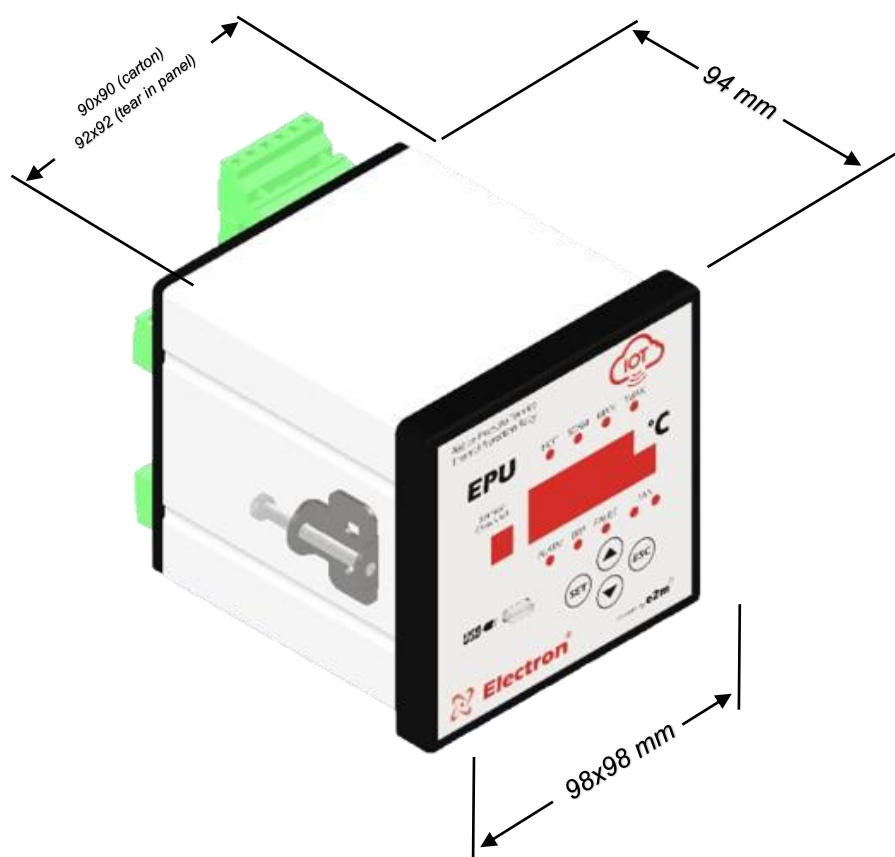
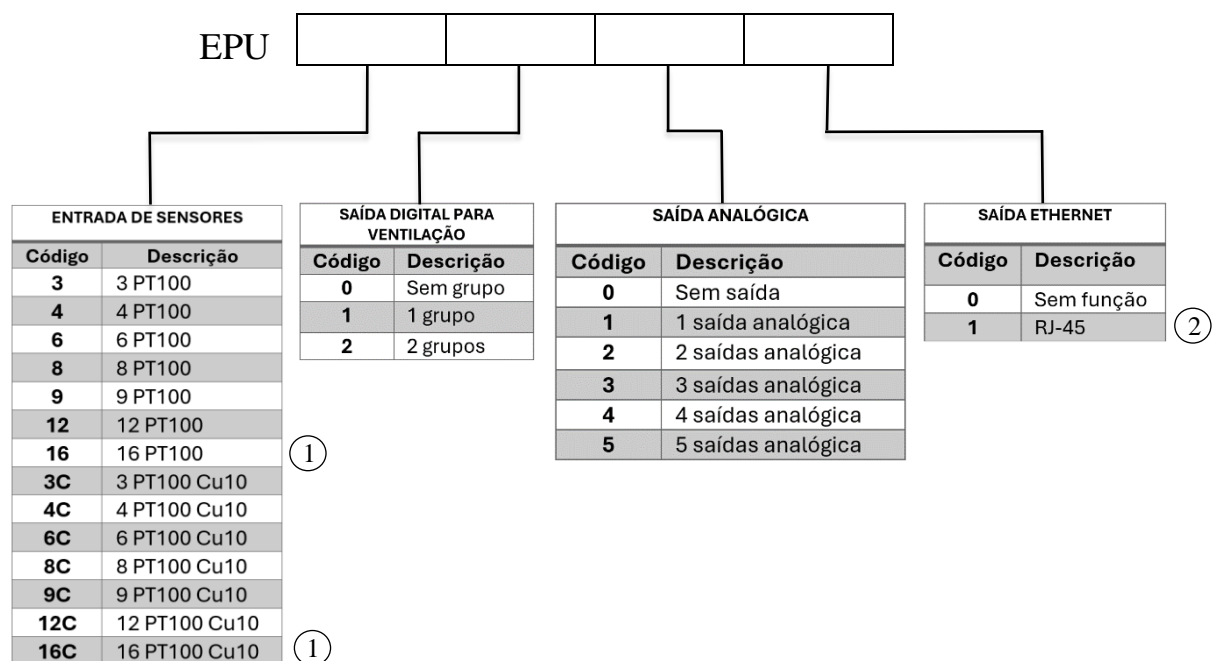


Fig. 1 - EPU Dimensions

## PURCHASE ORDER GUIDE



① For 16 sensors, you can only choose up to 1 fan group and it is not possible to choose an analog output and RJ45 port (Ethernet).

② For all cases where there is an RJ45 (Ethernet) output, only 1 analog output and a maximum of 9 sensors will be possible.



EPU CONNECTION DIAGRAM WITHOUT ETHERNET (RJ-45)

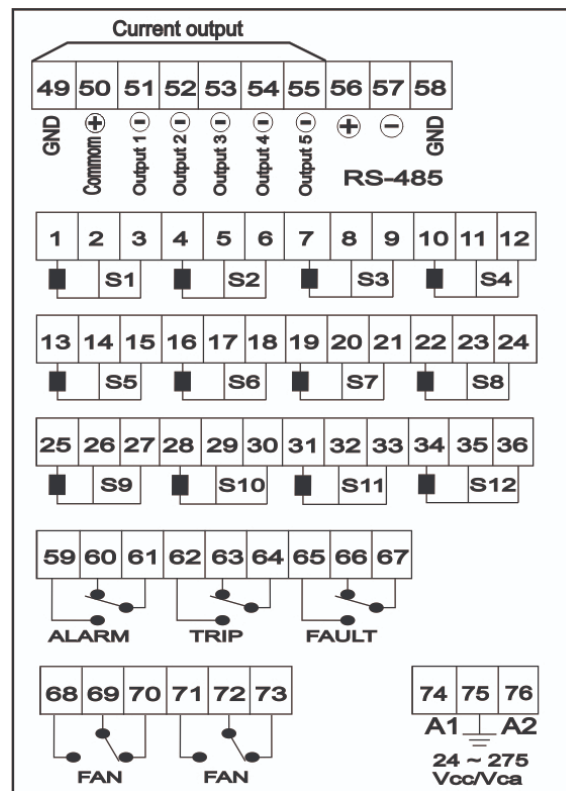


Figure 2 – Diagram of 3 to 12 PT100 sensor inputs with all EPU options

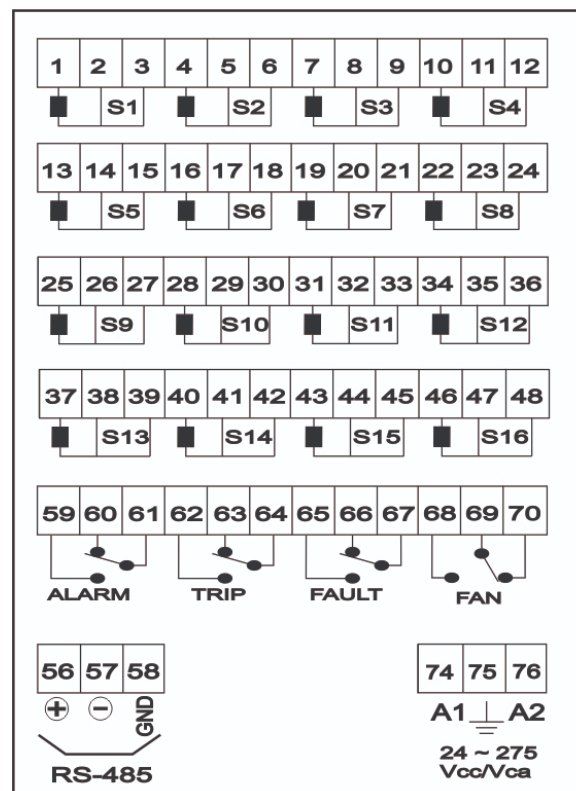


Figure 3 – Diagram of 16 PT100 sensor inputs

### EPU CONNECTION DIAGRAM WITH ETHERNET (RJ-45)

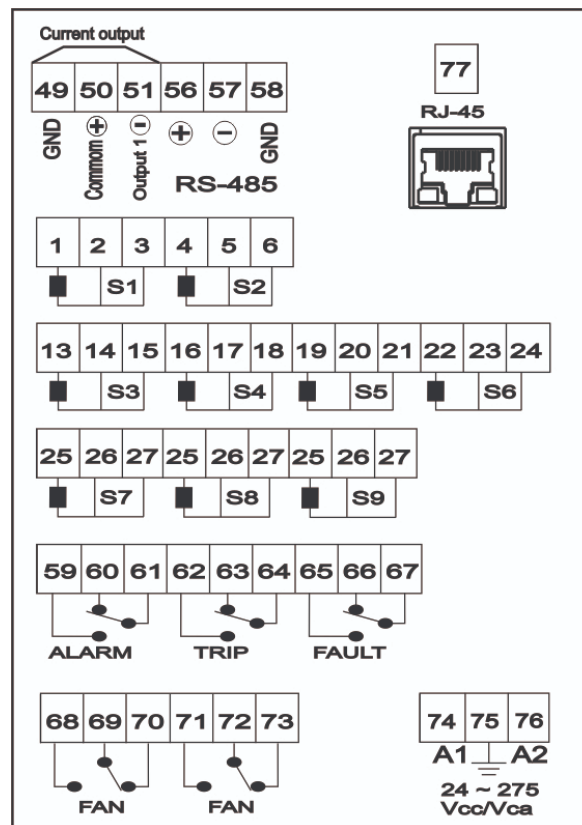


Figure 4 – 3 to 9 PT100 sensor inputs EPU with all optional

### SENSOR INPUT - SENSOR CIRCUIT (IN 60751 – DIN 43760)

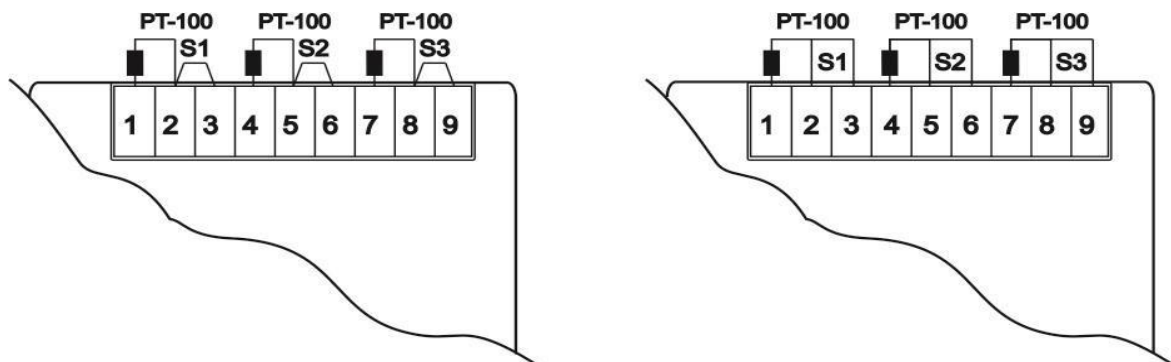


Figure 5 - Diagram with 2-wire sensor and 3-wire sensor connections

### APPLICATION EXAMPLE WITH 4 TEMPERATURE CHANNELS – TRAFÓ SECO

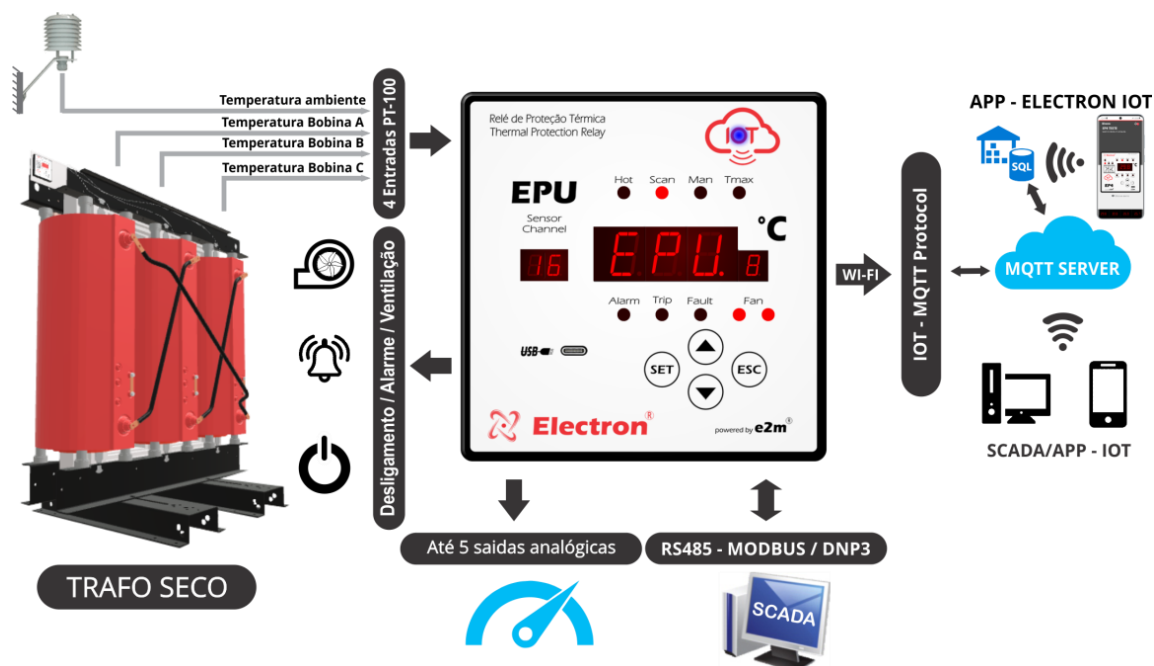


Figure 6 – EPU monitoring dry transformer

### APPLICATION WITH UP TO 16 TEMPERATURE CHANNELS – INDUCTION MOTOR

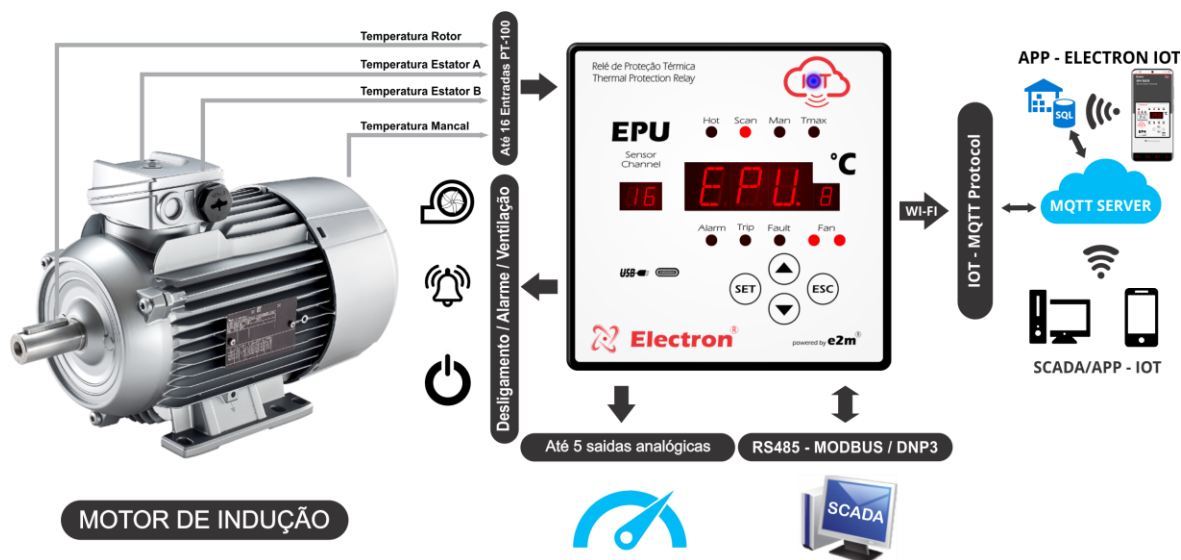


Figure 7 – EPU with up to 16 Temperature Channels Monitoring Induction Motor

### APPLICATION WITH UP TO 16 TEMPERATURE CHANNELS – CCM

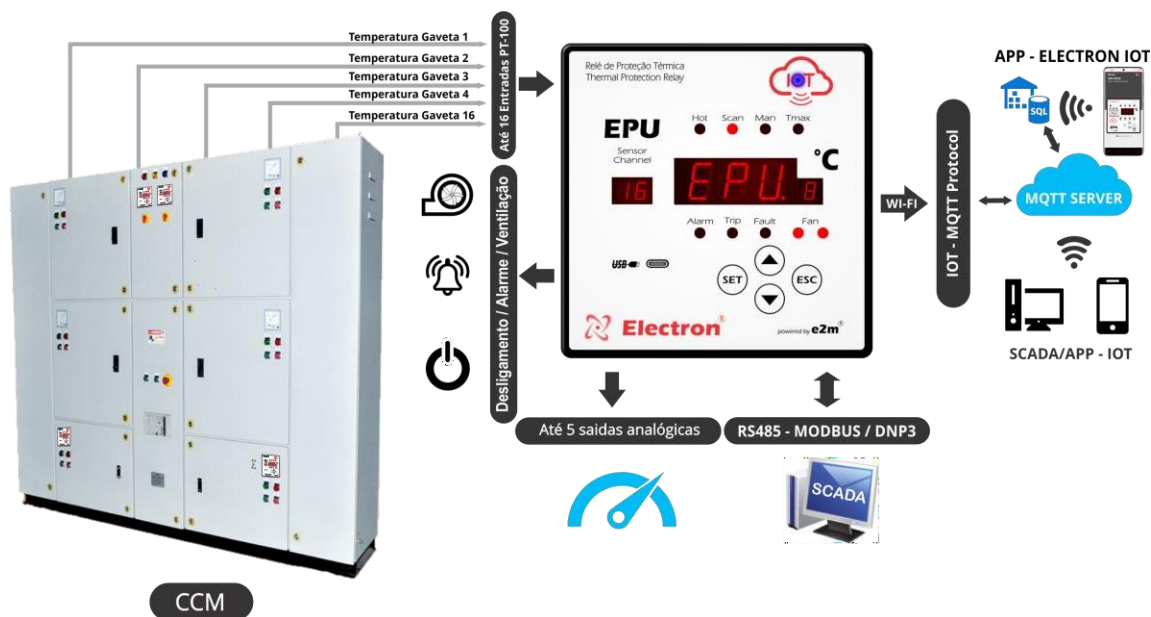


Figure 8 - EPU with up to 16 temperature channels monitoring Central Motor Control (MCC)

### APPLICATION WITH UP TO 16 TEMPERATURE CHANNELS – GENERATORS

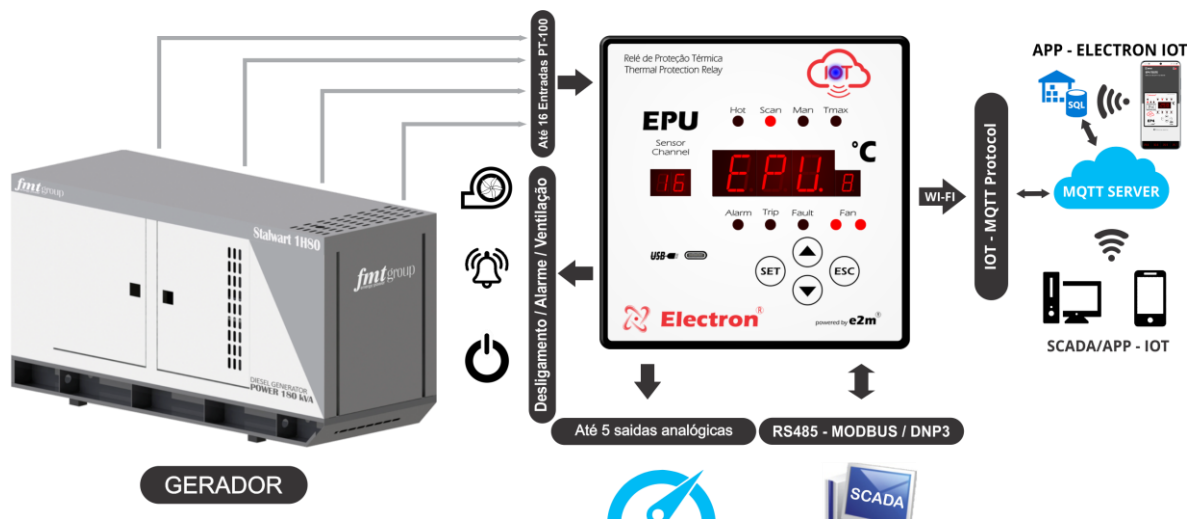


Figure 9 – EPU with up to 16 channels of temperature monitoring generator

APPLICATION WITH UP TO 16 TEMPERATURE CHANNELS – HYDROELECTRIC TURBINE

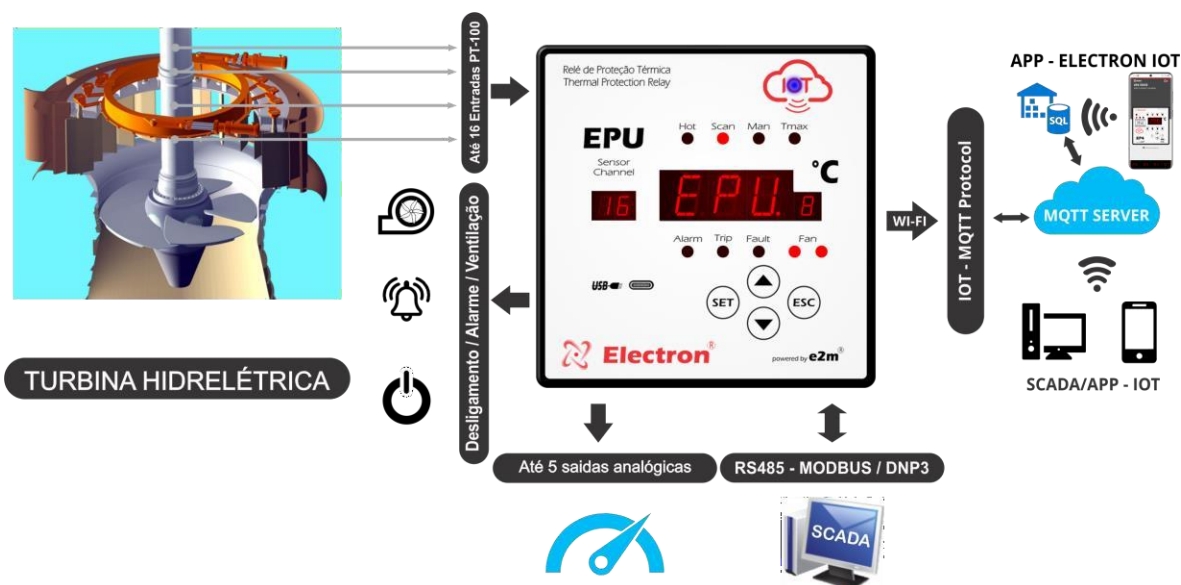


Figure 10 – EPU with up to 16 temperature channels monitoring Hydroelectric Turbine

APPLICATION WITH UP TO 16 TEMPERATURE CHANNELS – BOW THRUSTERS

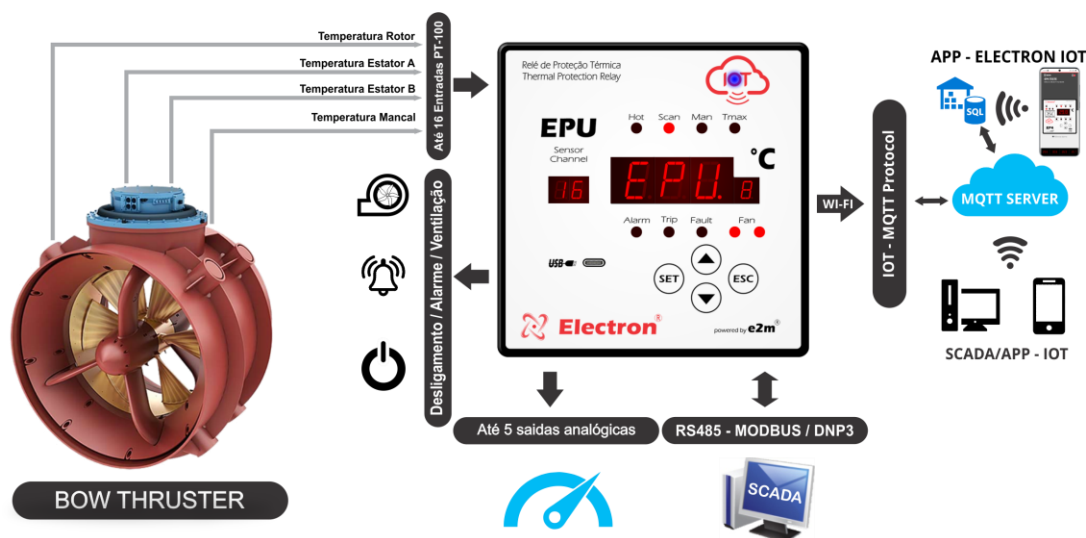


Figure 11 – EPU with up to 16 temperature channels monitoring Bow Thruster



Figure 12 – Data MONITRAFO.com



## OPERATION CHART

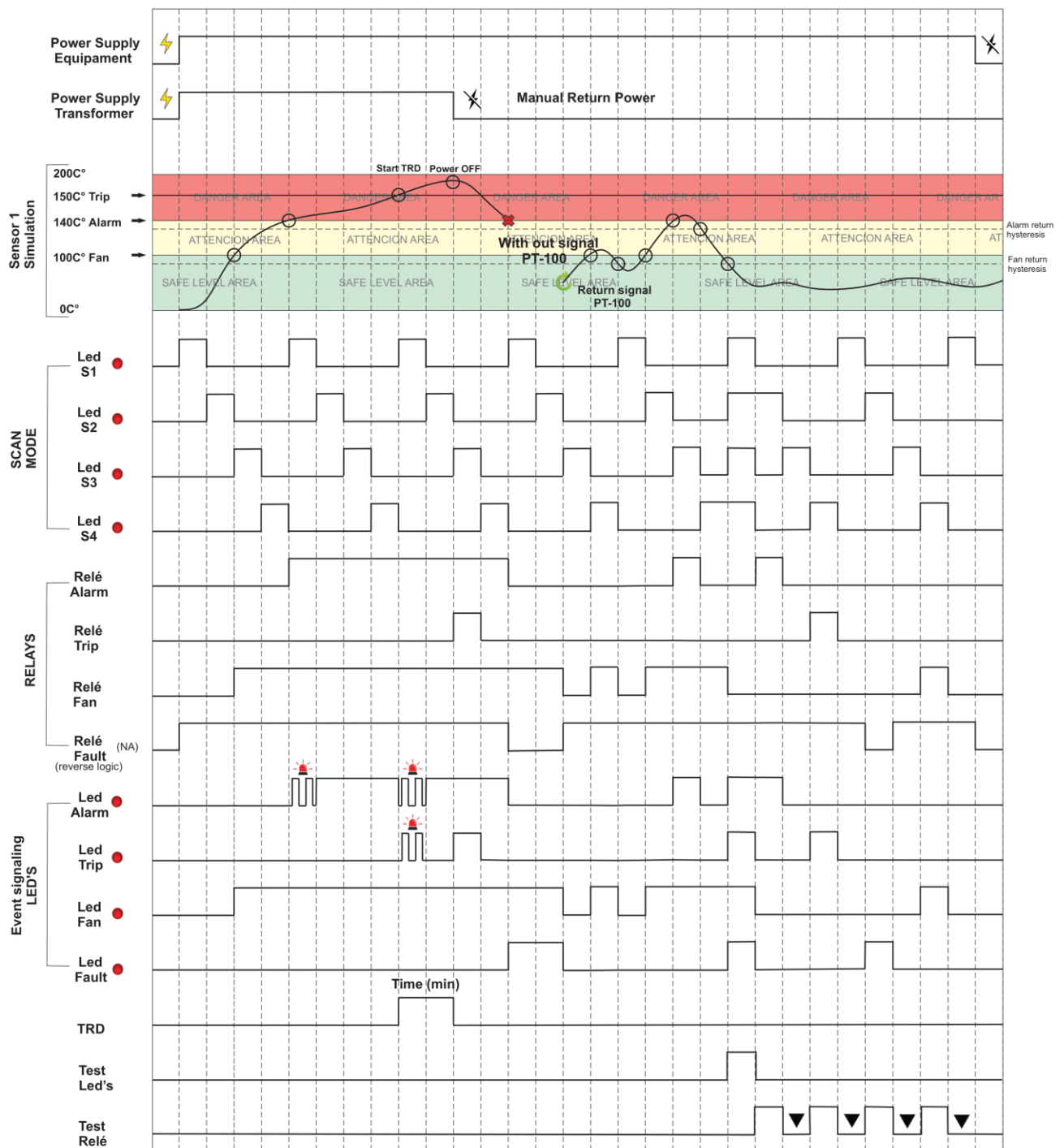



Figure 13 – Operation Chart

**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 penta	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 in 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 e Displays	Test Triggering 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 running Sinal 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	<div><div>1 - Keeping the equipment within the ideal working temperature (50°C to 60°C) extends the useful life and avoids corrective maintenance.</div><div>2 - The accumulation of dust and impurities in the facilities can cause short-circuiting and burning of equipment and sensors.</div><div>3 - After 10 years of use, it is recommended to replace the equipment.</div></div>						



**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 **EPU-IoT operation**.



**PT-100 STFE Temperature Sensor:** This sensor can be constructed with silicone, stainless steel, or Teflon bulb. With electrical insulation capacity options of 2 kV, 10 kV or 15 kV. The PT-100 STFE temperature sensor has as its measurement principle to evaluate the variation of electrical resistance with temperature using the temperature coefficient of pure platinum (0.385 Ohm/K), according to IEC 751 (DIN 43760). Ideal for temperature monitoring of windings of dry-type transformers due to its high precision and quality of materials, the PT-100 3-wire sensor is widely used in the market, as it greatly reduces the possibility of measurement error due to the compensation principle of the third terminal of the sensor.

Electron PT100 STFE Temperature Sensor Page Link:  
<https://electron.com.br/site/produtos/rtd-pt100-2/>



**PT-100 STE Temperature Sensor:** This sensor is constructed of AISI-304 stainless steel bulb, injected aluminum pumphead (IP 65) and adjustable gland with 3/4" and 1/2" BSP threads, or can be manufactured according to design. Its measurement principle is to evaluate the variation of electrical resistance with temperature using the temperature coefficient of pure platinum (0.385 Ohm/K), according to IEC 751 (DIN 43760). Ideal for installations subject to weather and electrical disturbances for temperature monitoring of transformers and machines that require high measurement accuracy in environments subjected to electrical noise and weather. The PT-100 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/>



**Outdoor/Outdoor Double Door Panel:** Outdoor box with double door for mounting instruments, accessories and power transformer control and power wires. The external door contains a glass viewer 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, according to 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/>



**PT-100 signal reference card:** This accessory was developed to verify the temperature value displayed by equipment with PT-100 3-wire 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 PT-100 signal:  
<https://electron.com.br/site/produtos/>

## GETTING TO KNOW THE EPU

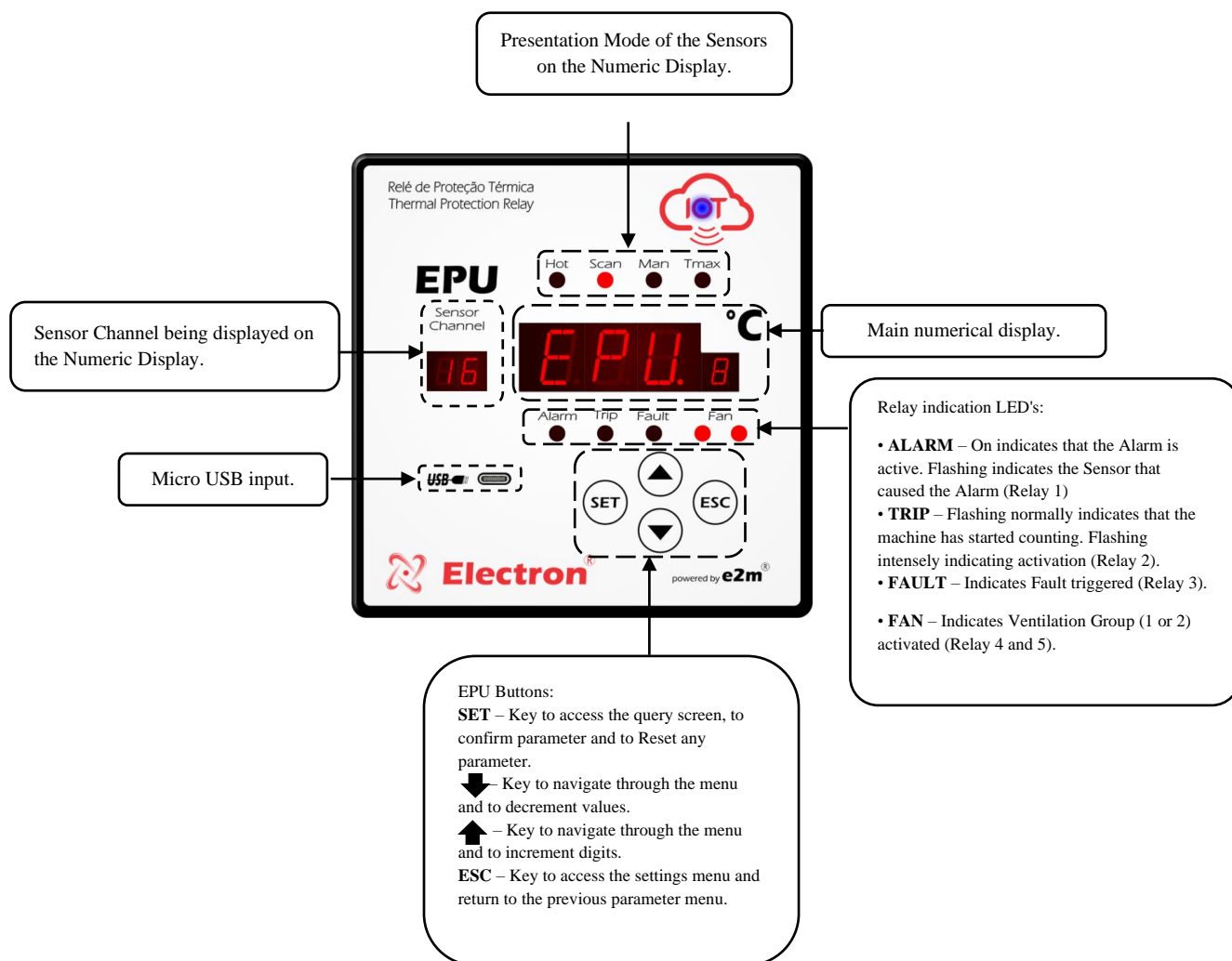


Figure 14- Human-Machine Interface

## SPECIFICATIONS FOR ORDER

- Temperature Monitor for Dry Type Transformer model : **EPU-IOT**

## IMPORTANT RECOMMENDATIONS

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

1. All sensors as well as the equipment must be grounded, do not use the same grounding point for power supply and for the sensor if it is used, ensure that there is no potential difference between them. Properly grounded sensors and power prevent malfunctions or damage in cases of disturbances, surges, and inductions in the equipment.
2. Do not use the Universal Thermal Protection Relay **EPU** directly in the sun, whenever it is installed in the field it is important to have a panel with smoked glass, so that the ultraviolet rays that attack the front polycarbonate are filtered, in this way the life of the equipment will be prolonged.

## WARRANTY TERM

The EPU **Electron Universal Thermal Protection Relay** 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 it is intended for.

### **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;
- Violated or repaired by a person other than Electron's technical team;
- The damage is caused by a fall 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**

The warranty of Electron do Brasil's technical assistance only includes the equipment repair service. That is, the costs of sending and receiving the equipment are borne by the customer.

To take advantage of 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 an emergency service, it is recommended to send as much information as possible, regarding the defect detected. The equipment will be analyzed and subjected to complete functional tests.

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

## DECLARATION OF CONFORMITY

Available for download at the following electronic address:

<https://electron.com.br/pt-br/produtos/epu>