



Thermal Protection Relay – EP3-IoT

Manual

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INTRODUCTION

The EP3 IOT **Thermal Protection Relay** was developed to simultaneously supervise up to 3 (three) temperature channels. It is used to protect and monitor dry transformers, motors, bearings, machinery, and industrial processes, as specified in the **ANSI table**. The EP3 IOT is a highly accurate and reliable instrument, controlling alarms and shutdowns (TRIP), with timing options.

The EP3 IOT **Thermal Protection Relay** was built following strict quality standards and uses high-quality electronic components and state-of-the-art technology (SMD). It's 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.

The EP3 IOT **Thermal Protection Relay** has a built-in WiFi modem with a 3 dBi antenna. When **enabled by the user**, this feature allows the Internet connection. Once connected, the EP3 IOT makes the data immediately available on an **MQTT Broker Server**. This is accessible through the MONITRAFO.com monitoring platform, where users can easily sign up, choose the plan that best suits their needs, and set up projects with one or multiple substations or transformers.

This way, you get full control to monitor in real time all measured quantities, triggers, alarms, maintenance, transformer health status and much more. 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 EP3 IOT 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 EP3 IOT 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 EP3 IOT 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 EP3 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 3 relays, 2 isolated, independent and potential-free actuation relays (NO) that can be used for alarms, shutdowns (TRIP), 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 or shutdown. All functions and parameterizations can be easily configured directly on the device panel or via the EP3 IOT™ software with **BLUETOOTH** or **USB connection**.

The EP3 IOT **Thermal Protection Relay** is built in a high mechanical strength aluminum case, measuring 98x98x37mm, following DIN IEC 61554 standards for panel fixing.

KEY FEATURES**Communication Protocols**

- MQTT – TLS/SSL - WIFI
- DNP3 – Level 1 (SERIAL)
- DNP3 – Level 1 (TCP/IP) - WIFI
- Modbus-RTU (SERIAL)
- Modbus-RTU (TCP/IP) - WIFI

Communication Ports

- **Built-in WIFI modem**
 - 802.11 b/g/n/e/i standards;
 - WPA/WPA2/WPA-Enterprise security protocol;
 - AES/RSA/ECC/SHA encryption;
 - Data rate up to 150 Mbps;
 - Built-in 3 dBi (isotropic decibel) antenna
 - 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 480Mbps;
 - Type-C connector
- **RS 485**
 - ANSI/TIA/EIA-485-A standard;
 - Max. 32 equipments;
 - Half duplex;
 - Multipoint;
 - Max. distance 1,200 meters;
 - 2 metallic wires;
 - Auto speed from 1,200 to 57,600 bps

Dimensions and Power

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

Human Machine Interface (HMI)

- Red high-brightness numeric display with 3 digits;
- Simultaneous indication of the 3 monitored temperatures;
- 4 Navigation keys;
- 11 LEDs on the front for event indications;
- Intuitive menus for consultation and parameterization

Measurement Input

- 3 inputs for temperature measurement with PT100 type sensor 3 wires (EN60751-DIN43760);
- 0.5% Accuracy (FS)
- Temperature measurement range 0°C to 200°C;

Digital Relay Outputs

- 01 Relay (NAF) with a capacity of 10 amperes for Temperature Alarm;
- 01 Relay (NAF) with a capacity of 10 amperes for TRIP (shutdown);
- 01 Relay (NAF) with a capacity of 10 amperes for Fault Indication (watchdog);
- Intuitive menus for consultation and parameterization.

TIPO 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 / Contact mode = 6 KV;
- Immunity to radiated electromagnetic disturbance (IEC61000-4-3): 80 to 1000 MHz / 10V/m;
- Immunity to Fast Electric Transients (IEC60255-22-4): Alim/Entr. /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): – 40°C + 85°C / 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.

TECHNICAL DATA

THERMAL PROTECTION RELAY EP3-IoT	
Operating Voltage	24 to 275 Vdc/VAC 50/60 Hz
Operating Temperature	-40°C to + 85°C
Power Consumption	< 15 W
Temperature Measurement Input	Up to 3 Sensors - PT100 Ohm at 0°C, 2 and 3 wires (EN 60751 - DIN 43760)
Measurement Range	0°C to 200°C
Maximum Measurement Input Error	0.5% end of scale
Maximum Analog Output Error	0.5% end of scale
Outgoing Contacts	3 (NAF) – Potential Free
Maximum Switching Power	70 W / 250 VA
Maximum Switching Voltage	250 Vac/125Vdc
Maximum Driving Current	10 Amps
Front Communication Port	USB 2.0 - Type-C Connector
Serial Communication Port	RS 485 – 2 wires (ANSI/TIA/EIA-485A)
WI-FI	Standards B/G/N/E/I
	WPA/WPA2/WPA-Enterprise;
	Up to 150Mbps data rate
	Built-in 3dBi antenna
Bluetooth	Up to 21dBm Transmit Power
Communication Protocol	Version 4.2 BR/EDR and BLE (Low Energy)
Auto Baud Rate	Modbus RTU, Modbus TCP (WI-FI), DNP3 L1, DNP3 L1 – TCP (WI-FI) and MQTT TLS/SSL – (WIFI)
IEC 61554 DIN Box	1,200 to 57,600bps
Fixation	98 x 98 x 37 mm or 98 x 98 x 57 mm
Protection	Panel Door with Steel Clip
	IP40 (Front), IP 20 (Connectors)

Table 1 – Technical Data of the EP3-IOT Thermal Protection Relay

DIMENSIONS AND CONNECTION DIAGRAM

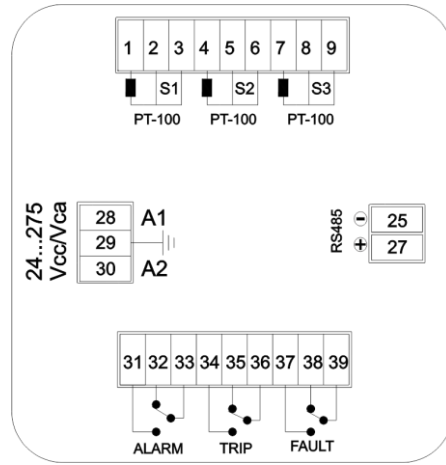
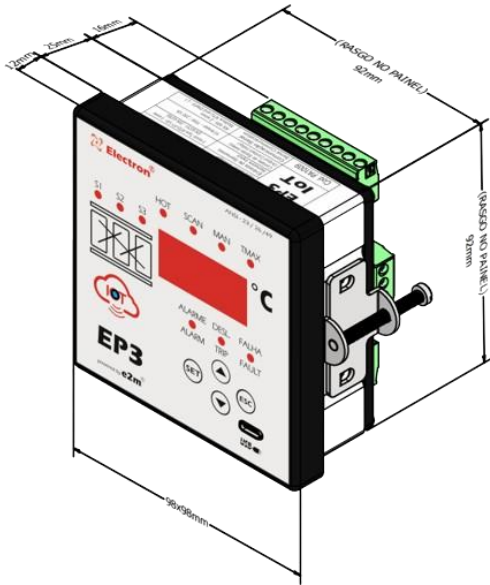


Fig. 1 – EP3-IoT Dimensions Fig. 2 – EP3-IoT IoT Connection Diagram

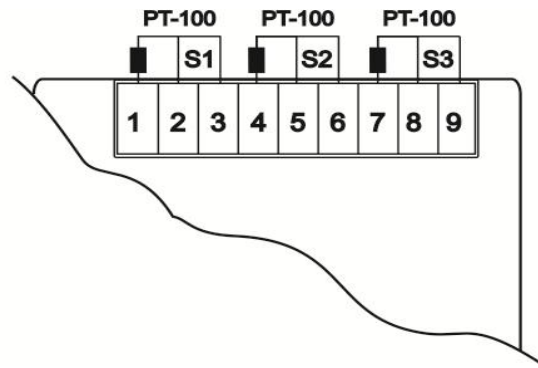
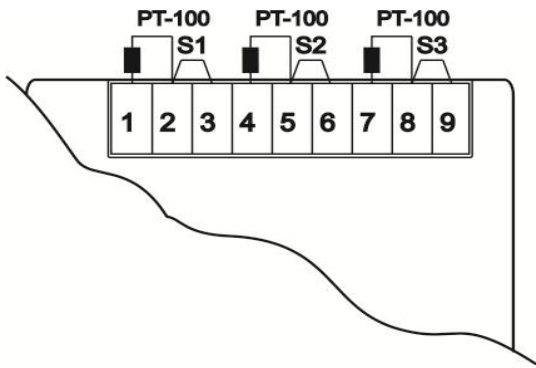


Fig. 3 – Diagram 2-wire connection sensors Fig. 4 – Diagram 3-wire connection sensors

APPLICATION EXAMPLE

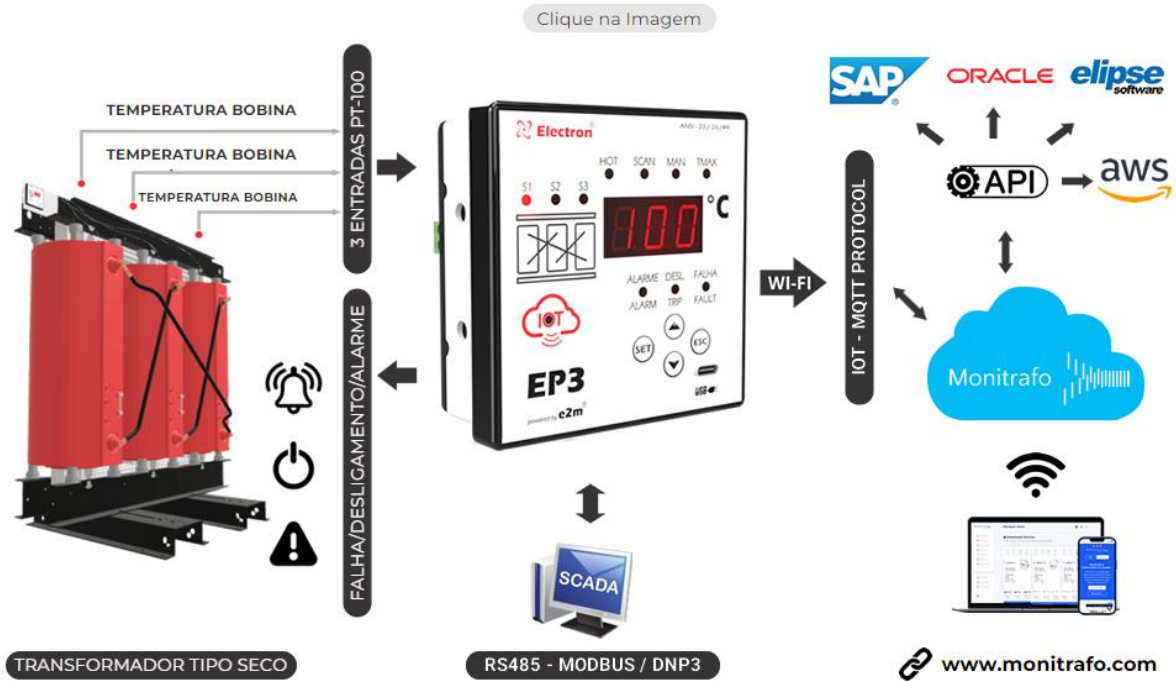


Fig. 5 – Example of Application sending data to MONITRAFO.com

OPERATION CHART

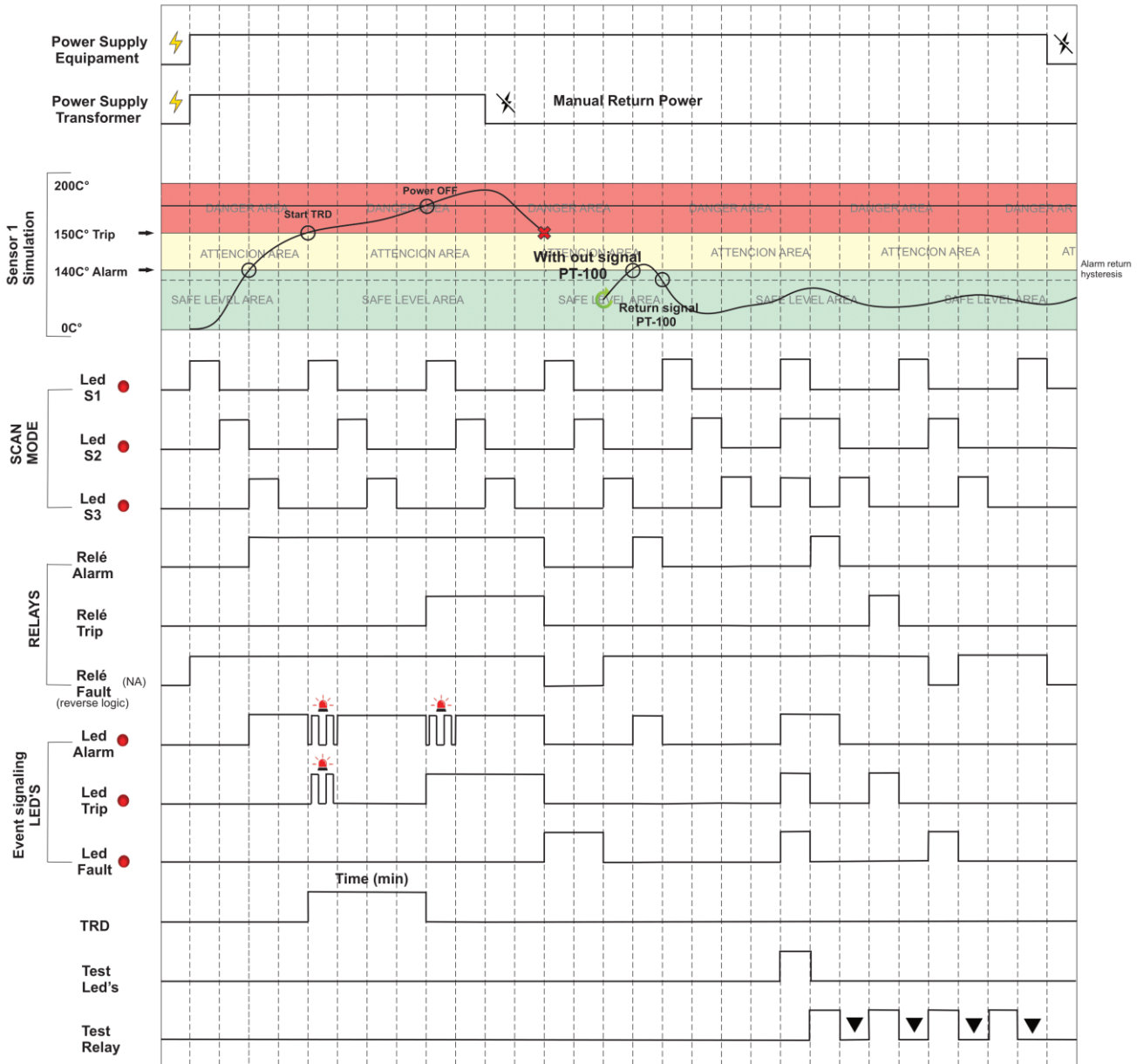


Fig. 6 – Operation Chart

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 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 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
	Leds and Displays	Test drive LEDs and display segments			X		
	Navigation buttons	Navigation test of the navigation buttons			X		
	Sensor Input	Verify sensor inputs using a reference source				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
	Milliamperere Current Signal Inputs	Measure, compare and measure input signal in passive and/or active mode			X		
	Signal Outputs of milliamperere 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	<p>1 - Keeping the equipment within the ideal working temperature (50°C to 60°C) extends the useful life and avoids corrective maintenance.</p> <p>2 - The accumulation of dust and impurities in the facilities can cause short-circuiting and burning of equipment and sensors.</p> <p>3 - After 10 years of use, it is recommended to replace the equipment.</p>						

Table 2 – Preventive maintenance

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 **EP3-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 (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 STE 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/>



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/>

SPECIFICATIONS FOR ORDER

- Temperature Monitor for Dry Type Transformer Model : **EP3-IOT**

GETTING TO KNOW EP3 IOT

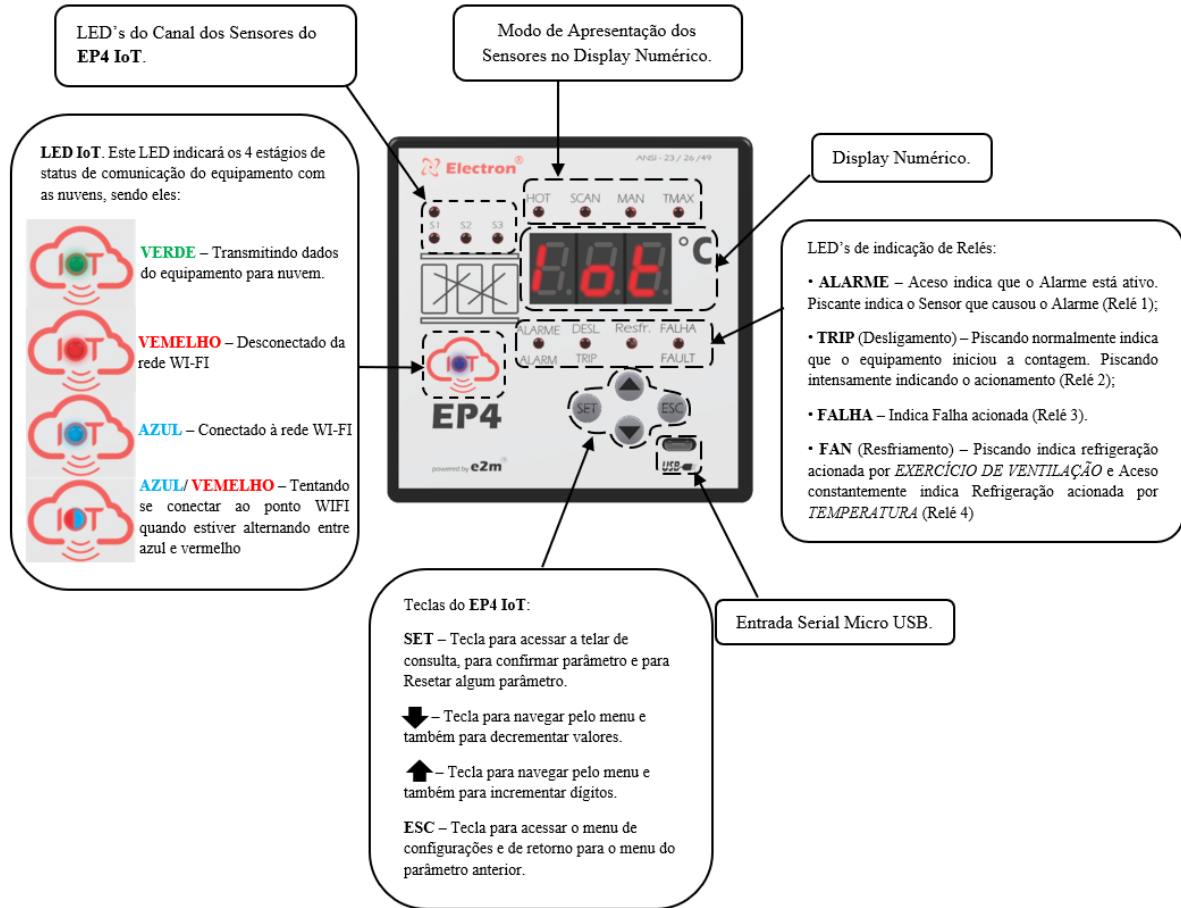


Fig. 7 – Front EP3-IoT

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 **EP3 IoT** directly in 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

The **EP3 IoT** 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 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.

Use of the warranty

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 an emergency service, 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 at the headquarters of Electron do Brasil.