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# Thermal Protection Relay – EPU-IoT

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Catalogue

## INDEX

INDEX.....	2
INTRODUCTION .....	3
MAIN FEATURES .....	4
TECHNICAL DATA .....	6
TYPE TESTS ATTENDED .....	7
DIMENSIONS AND CONNECTION DIAGRAM .....	8
EPU CONNECTION DIAGRAMS .....	9
SENSOR INPUT - SENSOR CIRCUIT (EM 60751 – DIN 43760) .....	13
APPLICATION EXAMPLE WITH 4 TEMPERATURE CHANNELS – DRY TRAFFIC.....	14
APPLICATION WITH UP TO 16 TEMPERATURE CHANNELS – INDUCTION MOTOR.....	14
APPLICATION WITH UP TO 16 TEMPERATURE CHANNELS – CCM .....	15
APPLICATION WITH UP TO 16 TEMPERATURE CHANNELS – GENERATORS.....	15
APPLICATION WITH UP TO 16 TEMPERATURE CHANNELS – HYDROELECTRIC TURBINE..	16
APPLICATION WITH UP TO 16 TEMPERATURE CHANNELS – BOW THRUSTERS .....	16
Data monitrafo.com.....	17
OPERATION CHART .....	18
PREVENTIVE MAINTENANCE .....	19
INSTALLATION ACCESSORIES.....	20
SPECIFICATION FOR ORDER .....	22
IMPORTANT RECOMMENDATIONS .....	22
WARRANTY TERM.....	22
<i>Disclaimer of Warranty.....</i>	<i>22</i>
<i>Loss of Warranty.....</i>	<i>22</i>
<i>Use of the warranty.....</i>	<i>22</i>

## INTRODUCTION

The **EPU IOT Thermal Protection Relay** is designed to simultaneously supervise up to four (4) temperature channels. It is used to protect and monitor dry transformers, motors, bearings, machinery, and industrial processes as specified in the **ANSI table**. The **EPU IoT** is a high-precision and reliable 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 IEC, DIN, IEEE and ABNT standards.

With signal inputs, the **EPU IOT** allows the connection of up to 4 PT100 temperature sensors (EN60751-DIN 43760) and up to 1 universal and configurable 2-wire 15 VDC active analog output, with a range of 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 analogue output also features the SCAN function, which simultaneously reflects all temperature channel values. This configuration can be carried out directly on the EPU IOT panel or **via the EPU IOT™ software with BLUETOOTH or USB connection**.

The **EPU IOT Thermal Protection Relay** has a built-in WiFi **modem** with a built-in 3 dBi antenna. When **enabled by the user**, this feature allows the connection to the Internet. 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 sign up, choose the plan that best suits their needs, and set up projects with one or multiple substations or transformers.

In this way, you get full control to monitor in real time all measured quantities, drives, 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 EPU 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, MACHINE LEARNING, DATABASE, PROGRAMMABLE FUNCTIONS, CALCULATIONS AND NOTIFICATIONS, MAINTENANCE SCHEDULE tools**. In case of loss of Internet connection, the **EPU IOT** stores all measurements for the period in which communication was unavailable. When the connection is restored, the data is sent to the **MONITRAFO.com** and stored in a database for queries, calculations, and more.

It is also possible to use the API available on the platform to integrate the **EPU 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 the transformer's 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 of which are isolated, independent and potential-free drive relays (NO) that can be used for alarms, shutdowns (TRIP) and FAN (ventilation) triggering, and 1 isolated, independent and potential-free relay (NC) to indicate faults (watchdog).

The display mode on the display 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 indicative LEDs and the data communication port

They 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 housing, with measurements of 98x98x37mm, following DIN IEC 61554 standards for panel fixing.

## MAIN FEATURES

### Communication Protocols

- MQTT – TLS/SSL;
- DNP3 – Level 1;
- Modbus-RTU;

### Communication Ports

- **Built-in WIFI modem**
  - Standards: 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 (isotropic decibel) recessed antenna;
  - Transmit Power up to 21 dBm (decibel milliwatt);
- **Bluetooth**
  - Class 2 – 2.5 mW (4 dBm);
  - FIPS-type cryptography;
  - Version 4.2 BR / EDR and BLE (Low Energy);
- **USB**
  - Version 2.0;
  - Transfer rate 480 Mbps;
  - Micro-B type connector;
- **RS-485**
  - Standard ANSI/TIA/EIA-485-A;
  - Max. 32 equipments;
  - Half Duplex;
  - Multipoint;
  - Distance: Max.1,200 meters;
  - 2 metal wires;
  - Automatic speed from 1,200 to 57,600 bps;

### Dimensions & Power Supply

- 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 order);
- Intuitive menus for consultation and parameterization;

**Measurement Input**

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

**Digital Outputs to Relays**

- 01 Relay (NAF) with a capacity of 10 amps for Temperature Alarm
- Up to 02 Relays (NAF) with a capacity of 10 amperes for FAN (cooling) with programmable trigger timing;
- 01 Relay (NAF) with a capacity of 10 amperes for TRIP (shutdown) with programmable trigger timing;
- 01 Relay (NAF) with a capacity of 10 amperes for FAULT (Fault) with programmable trigger 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;

**TYPE Tests Attended**

- Applied Voltage (IEC 60255-5): 2 kV / 60 Hz / 1 min. (Against the ground);
- Voltage Impulse (IEC 60255-5): 1.2/50  $\mu$ sec. / 5 kV / 3 neg. and 3 pos. / 5 sec. 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;
- Immunity to Fast Electrical Transients (IEC60255-22-4): Alim/Input/Outputs = 4 kV/common 2 Kv;
- Surge Immunity (IEC 60255-22-5): phase/neutral 1 kV, 5 per polar ( $\pm$ ) – phase-ground/neutral-ground 2 kV, 5 per polar ( $\pm$ );
- 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 (IEC 60255-21-1): 3-axis / 10 to 150 Hz / 2 G / 160 min/axis;
- Vibration Response (IEC60255-21-1): 3-axis / 0.075mm -10 to 58 Hz / 1 G from 58 to 150 Hz / 8min / axis.

## TECHNICAL DATA

EPU - UNIVERSAL THERMAL PROTECTION RELAY	
Operating Voltage	24 to 275 Vdc/VAC 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.
Measuring 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 Input Measurement Error	0.5 % end-of-scale
Maximum Analog Output Error	0.5 % end-of-scale
Output 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	Micro USB
Serial Communication Port	RS 485 – 2-wire (ANSI/TIA/EIA-485A)
WI-FI	Standards 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
Bluetooth	Version 4.2 BR / EDR and BLE (Low Energy)
Communication Protocol	Modbus RTU, DNP 3.0-L1 and MQTT – TLS/SSLok
Auto Baud Rate	1,200 to 57,600 bps
Caixa DIN IEC 61554	98 x 98 x 98 mm
Fixation	Panel Door with Steel Cleat
Protection	IP40 (front), IP 20 (connectors)

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

## TYPE TESTS ATTENDED

- Applied Voltage (**IEC 60255-5**): 2 kV / 60 Hz / 1 min. (against the ground);
- Voltage Impulse (**IEC 60255-5**): 1.2/50  $\mu$ sec. / 5 kV / 3 neg. and 3 pos. / 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;
- Surge Immunity (**IEC60255-22-5**): phase/neutral 1 KV, 5 per polar ( $\pm$ ) - phase-to-ground/neutral-to-ground 2KV, 5 per polar ( $\pm$ );
- 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-axis / 10 to 150Hz / 2G / 160min / axis;
- Vibration Response (**IEC60255-21-1**): 3-axis / 0.075mm -10 to 58Hz / 1G from 58 to 150Hz / 8min/axis;

DIMENSIONS AND CONNECTION DIAGRAM

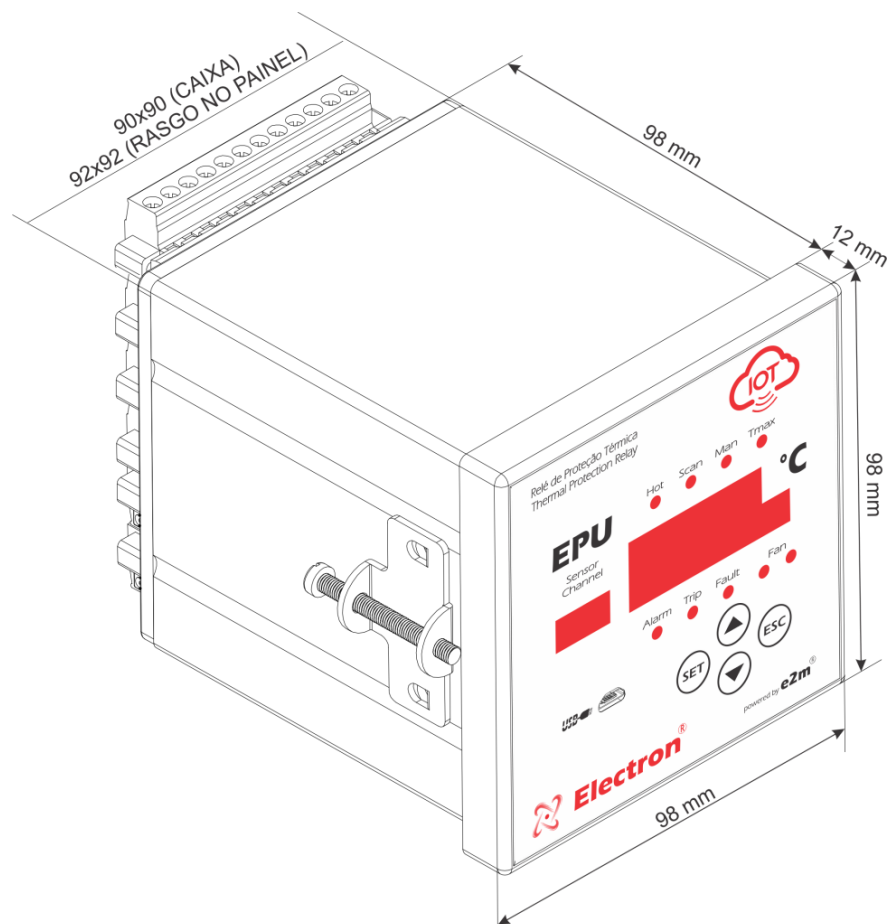


Figure 1 - EPU Dimensions

## EPU CONNECTION DIAGRAMS

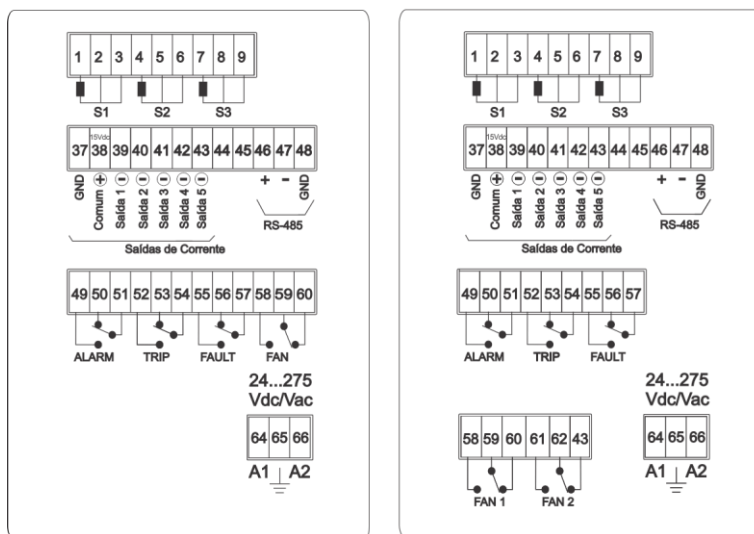


Figure 2 - EPU with 3 temperature inputs with up to 5 analog outputs, 1 analog output, and 1 and up to 2 ventilation groups

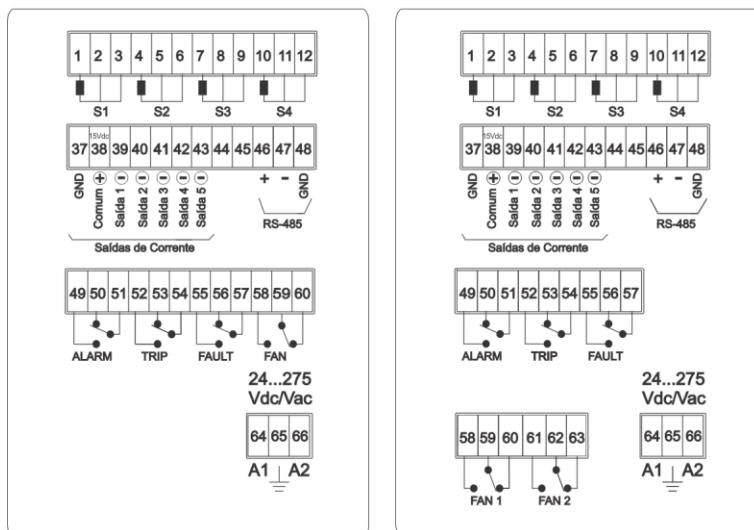


Figure 3 - EPU with 4 temperature inputs with up to 5 analog outputs, 1 RS485 output and 1 and up to 2 ventilation groups

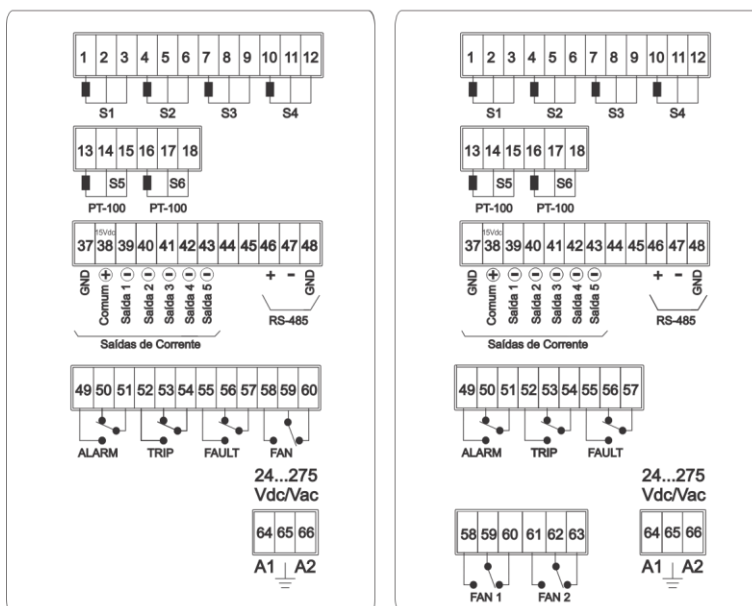


Figure 4 - 6-input EPU with up to 5 analog outputs, 1 RS485 output and 1 and up to 2 ventilation groups

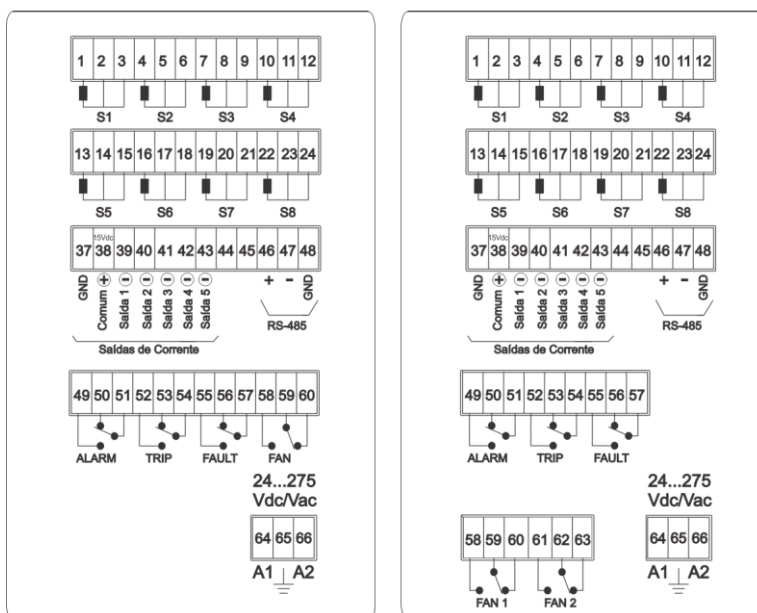


Figure 5 - EPU with 8 temperature inputs with up to 5 analog outputs, 1 RS485 output and 1 and up to 2 ventilation groups

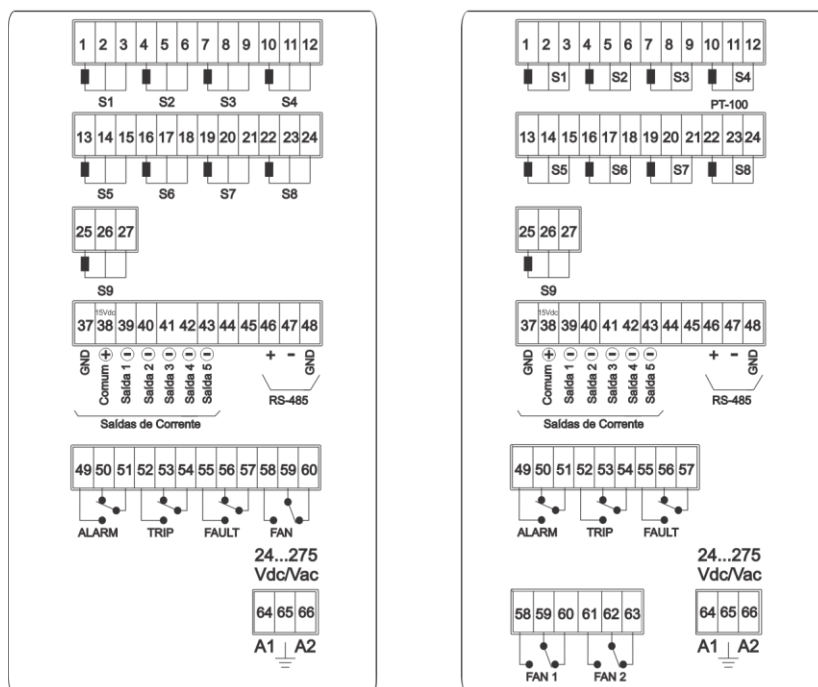


Figure 6 - EPU with 9 temperature inputs, 1 RS485 output and 1 and up to 2 ventilation groups

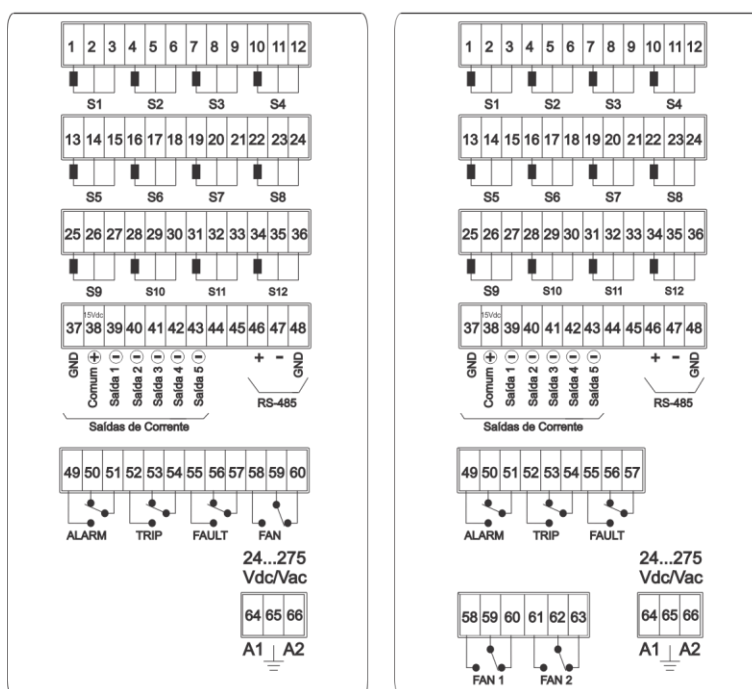


Figure 7 - EPU with 12 temperature inputs, 1 RS485 output and 1 and up to 2 ventilation groups

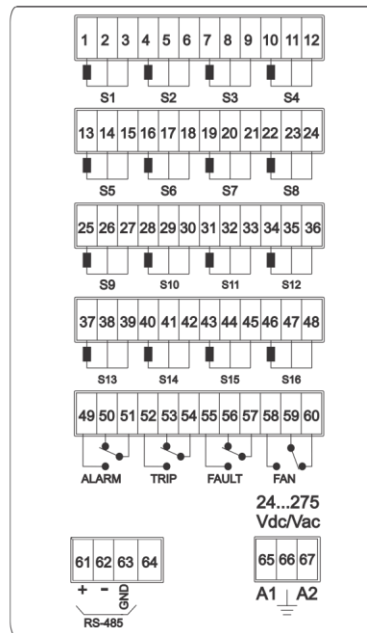


Figure 8 - EPU with 16 Temperature inputs, 1 RS485 output and 1 ventilation group.

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

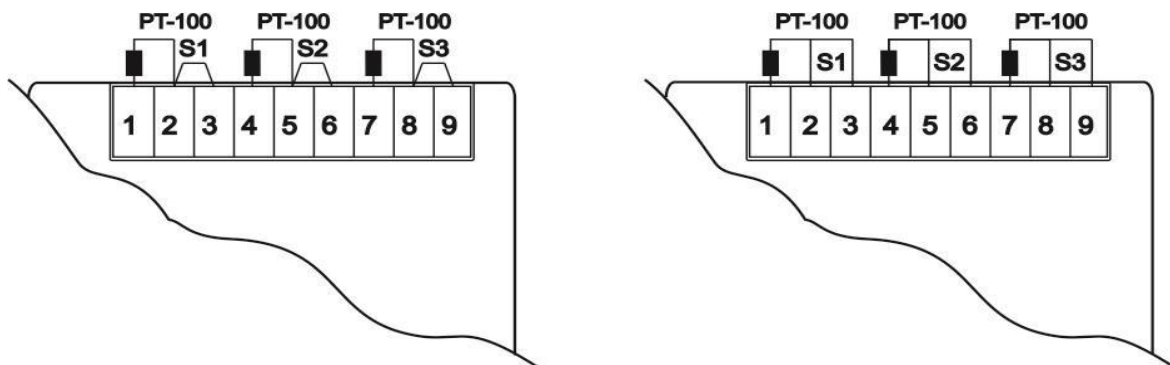


Figure 9 - Diagram with 2-Wire Sensor and 3-Wire Sensor Connections

APPLICATION EXAMPLE WITH 4 TEMPERATURE CHANNELS – DRY TRAFFIC

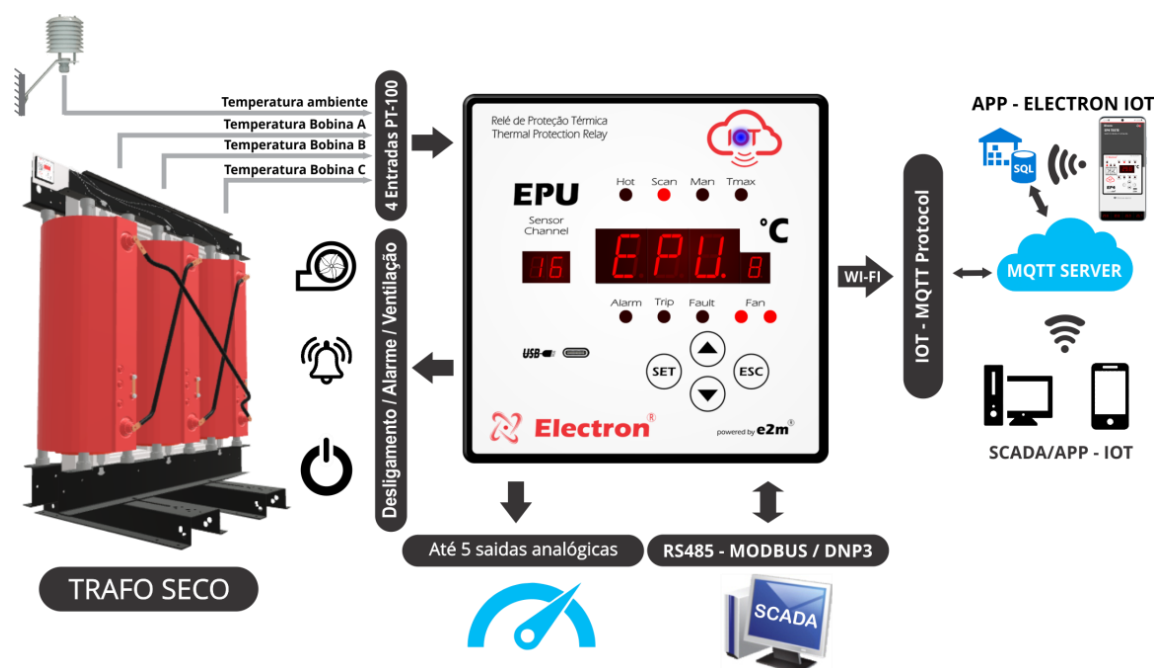


Fig. 10 – EPU monitoring dry transformer

APPLICATION WITH UP TO 16 TEMPERATURE CHANNELS – INDUCTION MOTOR

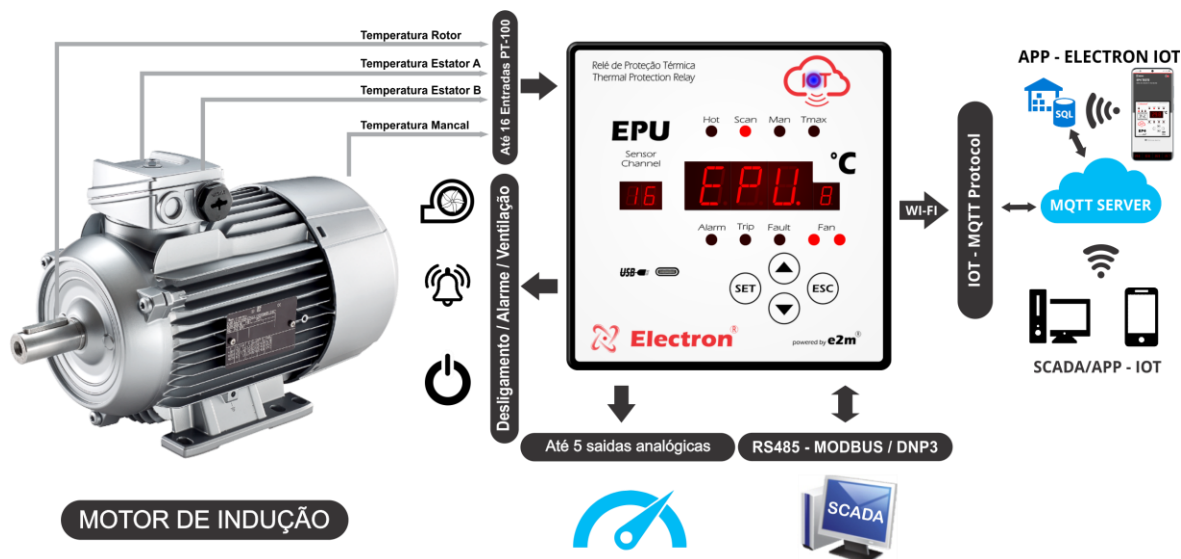


Figure 11 - EPU with up to 16 temperature channels monitoring induction motor

APPLICATION WITH UP TO 16 TEMPERATURE CHANNELS – CCM

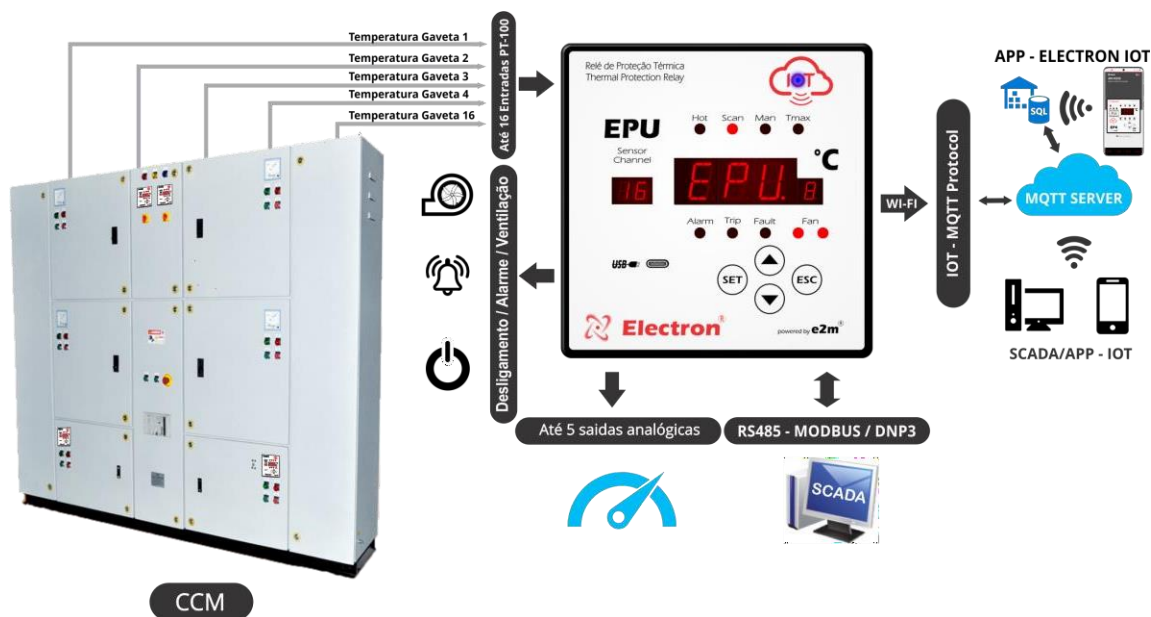


Figure 12 - EPU with up to 16 temperature channels monitoring Engine Control Center (MCC)

APPLICATION WITH UP TO 16 TEMPERATURE CHANNELS – GENERATORS

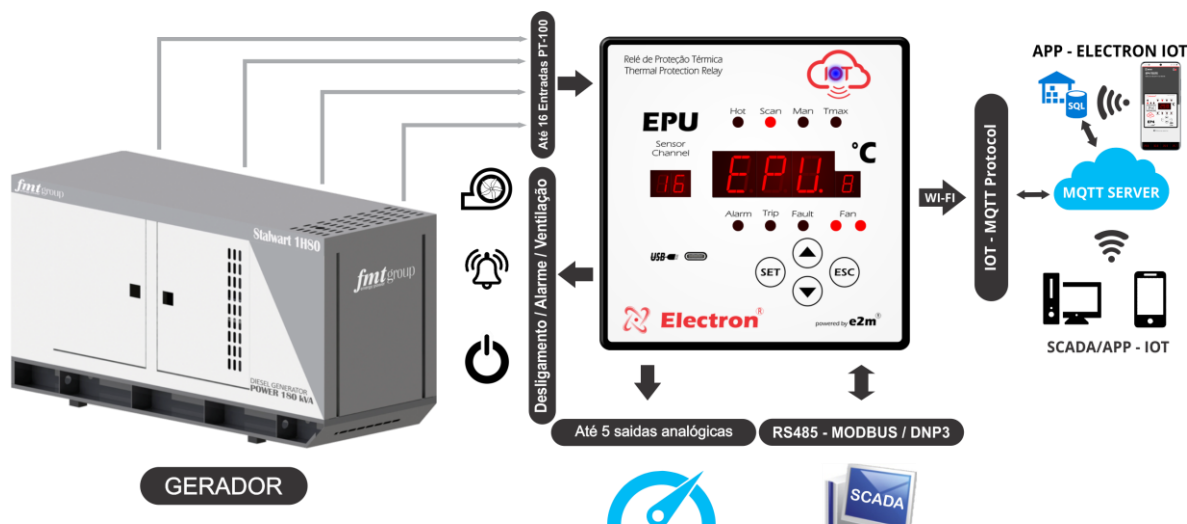


Figure 13 - EPU with up to 16 temperature channels monitoring generator

APPLICATION WITH UP TO 16 TEMPERATURE CHANNELS – HYDROELECTRIC TURBINE

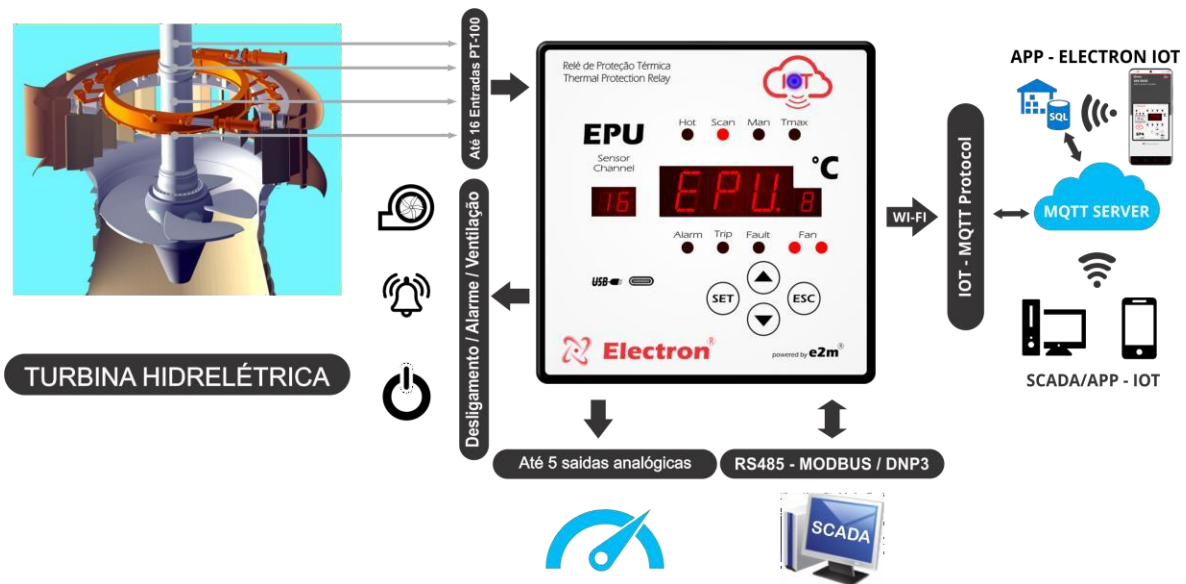


Figure 14 - EPU with up to 16 temperature channels monitoring Hydroelectric Turbine

APPLICATION WITH UP TO 16 TEMPERATURE CHANNELS – BOW THRUSTERS

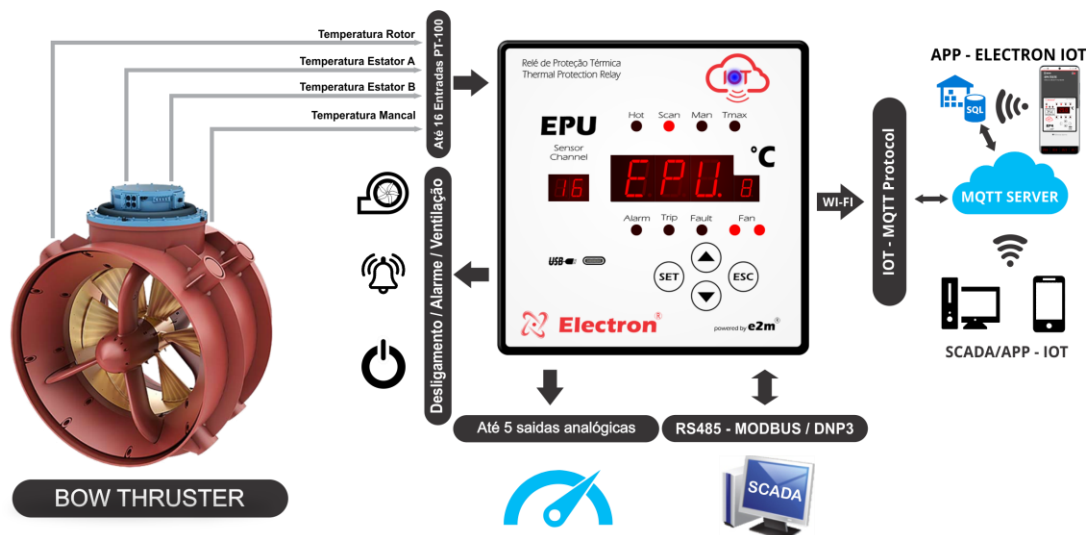


Figure 15 - EPU with Up to 16 Temperature Channels Monitoring Bow Thruster



Fig. 16 – Application Example Sending Data to MONITRAFO.com

## OPERATION CHART

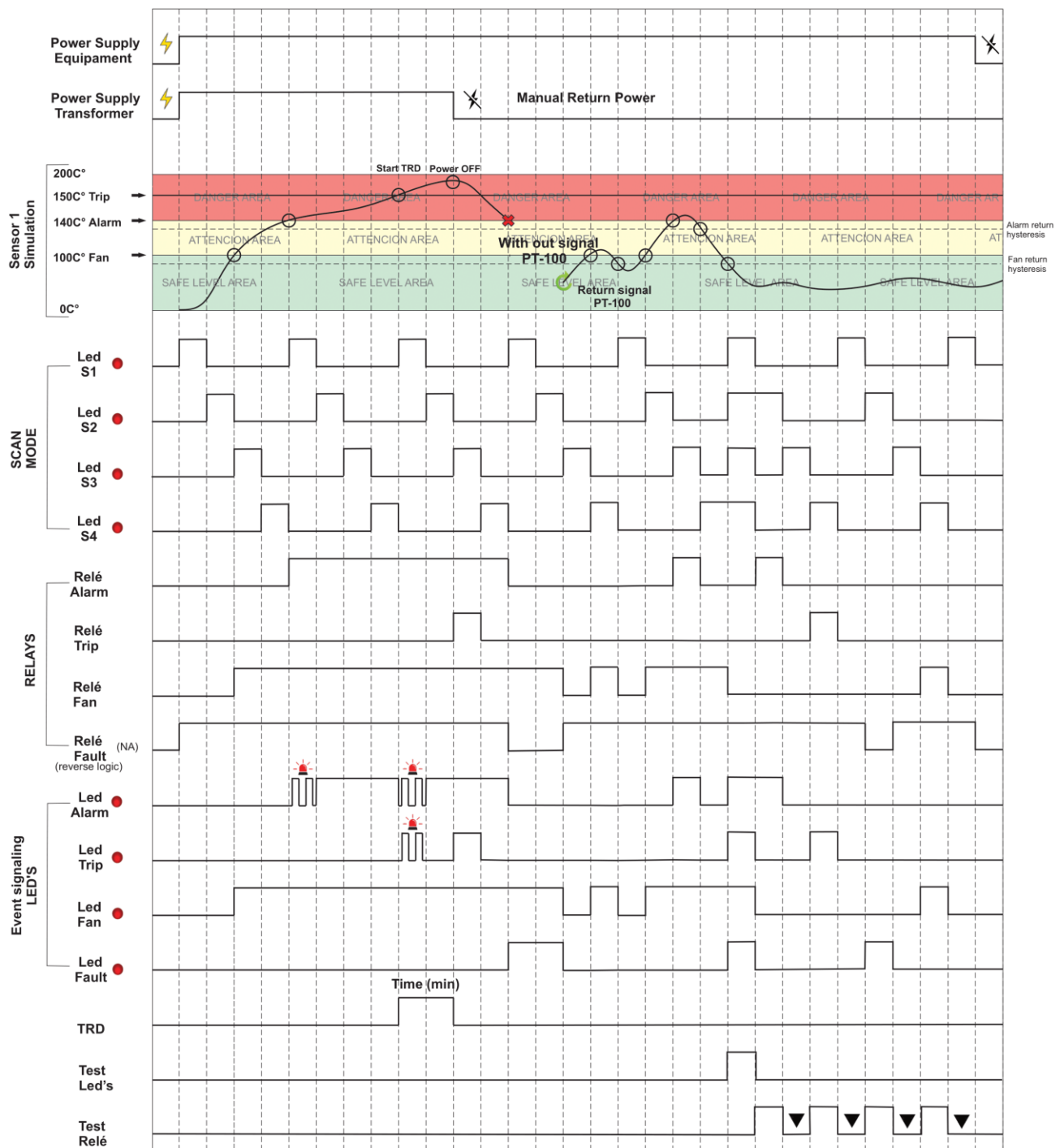


Fig. 17 – Operation Chart

PREVENTIVE MAINTENANCE


PREVENTIVE AND CORRECTIVE MAINTENANCE							
Items to be checked preemptively			Frequency of Verification				Corrective action
SHARE	Verification Elements	ACTIVITIES	Every Month	Every 3 Months	Every 6 Months	Every 1 Year	When Needed
VERIFICATION	Fastening clip and snap to the rail	Fixing to the panel door or panel bottom		X			Retightening, Fitting, changing terminals or changing screws
	Terminal blocks and connector comb	Attachment and attachment to the equipment		X			
		Tightening the screws in fixing the conductors		X			
	Sensors	Integrity / Positioning / Fixation			X		Replacement, Repositioning and/or Attachment of Sensors
	Sensor Well in Oil Transformers	Oil level in the well			X		Filling with oil to the indicated level
TESTS & MEASUREMENTS	Digital Relays and Outputs	Individual drive test			X		Refer to technical assistance from Electron do Brasil
	Led's e Displays	Test Lead Led's and Display Segments			X		
	Navigation buttons	Navigation test of navigation buttons			X		
	Two-Sensor Input	Benchmarking sensor inputs using a standard				X	
	Input voltage Supply equipment	Measure Power Input Voltage			X		Override voltage input values according to equipment model
	RS-485 communication outputs	Communication and command testing in the supervisory system			X		Refer to technical assistance from Electron do Brasil
	Milliampere Current Signal Inputs	Measuring, comparing, and gauging input signal in passive and/or active mode			X		
	Signal outputs of milliampere current	Measuring, comparing, and gauging input signal in passive and/or active mode			X		
CLEANING	Terminal blocks and connector comb and junction box	Debris, Impurities and Moisture	X				Cleaning with a dry cloth, compressed air and vacuum cleaner
	Aluminum Equipment Enclosure		X				
	Front Display of the equipment		X				
<div> ATENÇÃO</div>	<div><p>1 - Keeping the equipment within the ideal working temperature (50°C to 60°C) prolongs the useful life and avoids corrective maintenance.</p><p>2 - The accumulation of dust and impurities in the installations can cause short circuits and burnout of equipment and sensors.</p><p>3 - After 10 years of use, it is recommended to replace the equipment.</p></div>						

Table 2 – Preventive maintenance

**INSTALLATION ACCESSORIES**

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



**PT-100 STFE Temperature Sensor:** This sensor can be constructed with silicone, stainless steel or Teflon bulb. With a choice of 2 kV, 10 kV or 15 kV electrical insulation capacity. The PT-100 STFE temperature sensor has as its measuring principle the evaluation of the variation of electrical resistance with temperature using the temperature coefficient of pure platinum (0.385 Ohm/K) in accordance with IEC 751 (DIN 43760). Ideal for temperature monitoring of dry-type transformer windings 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 head (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 inclement weather and electrical disturbances for temperature monitoring of transformers and machines that require high measurement accuracy in environments subject to electrical noise and weathering. 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/>



**Double Door Panel for Outdoor/Outdoor Use:** Box for external use with double door for mounting instruments, accessories and passing control and power wires 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 weather resistant and its degree of protection is IP 55, as per NBR IEC 60529:2017.

Outdoor Dual Door Panel Page Link – IP 55:

<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 a fixed and constant equivalent 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/>

**SPECIFICATION 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 equipment must be grounded, do not use the same grounding point for power and for the sensor if used ensure that there is no potential difference between them. Correctly grounded sensors and power prevent malfunctions or damage in cases of disturbances, surges, and inductions in the equipment.
2. Do not use the **IOT EPU** directly in the sun, whenever it is installed in the field it is important that it has 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 **EPU 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 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/breach 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 team;
- The damage is caused by a fall or impact;
- Water or any other liquid infiltrates;
- Overload occurs that causes degradation of the components and parts of the product.

**Use of the warranty**

To take advantage of this guarantee, the customer must send the product to Electron along with a copy of the purchase invoice, properly packaged, so that no damage occurs during transport. For an emergency service, it is recommended to send as much information as possible regarding the detected defect. This will be analysed and subjected to full functional testing.

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.