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## IPTP - TRANSFORMER PARALLELISM INDICATOR AND CONTROLLER

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Manual

**INDEX**

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## INTRODUCTION

The IPTP TAP Position Indicator and Parallelism Control is intended for Remote TAP Position Indication of Transformers using potentiometric crown on-load exchangers. Manages parallelism through the Master-follower method in three-phase and single-phase transformers with up to 32 networked equipment where only 1 (one) is listed as MASTER and this supervises all the others through an intelligent communication protocol that is capable of detecting and indicating which of the networked equipment has failures and even making autonomous decisions, as well as providing information to automatically generate a self-diagnosis of the entire system, in order to speed up possible operator intervention or maintenance.

IPTP was built to strict quality standards and designed to withstand severe working conditions. It can be installed in power substation yards, offshore platforms and chemical industries. Meets the levels of demands, supportability and reliability according to **IEC, DIN, IEEE, ABNT standards.**

The IPTP has an input that is intended to receive the signal from a potentiometric crown, in this way it is possible to indicate on the instrument display the current TAP position in a simple numerical (1...51) or bilateral (-24...0...24) way, programmable, and it is also possible to provide the indication through an analog universal output that can be from 0 to 1, 0 to 5, 0 to 10, 0 to 20 or 4 to 20mA (or other as requested) and or digital output (RS485) with Modbus RTU and DNP 3(L1) protocol that allows to remotely access all configuration parameters as well as commands to raise and lower TAP, change the Status of Automatic / Manual and Remote / Local. The IPTP is also equipped with a resource to indicate a failure to read the signal that occurs if the TAP change has a time of more than 10 seconds or there is some type of failure in the reading of the potentiometric crown, such as cable breakage, resistor burnout, etc.

## KEY FEATURES

- High-brightness 3-digit display, 20mm height and 13mm decimal place;
- Measurement range from 0 to 50 Positions (0 to 5000 Ohms) maximum pitch of 100 Ohms;
- Potentiometric (mA or Resistive) Signal Input;
- Universal power supply 48 to 265 Vdc/Vac;
- RS485 Digital Output (**ANSI/TIA/EIA-485-A**) with Modbus RTU and DNP 3 (Level 1) protocol for remote access to all measured parameters;
- Analog output from 0 to 1, 0 to 5, 0 to 10, 0 to 20 and 4 to 20 mA configurable via front;
- Front USB 2.0 for parameterization via UseEasy™ software;
- Stores in memory the maximum and minimum TAP reached in the period;
- Contact for Failure Indication (Watchdog);
- Activation to raise and lower TAP directly on the front or via RS485;
- 2 NA contacts to go up and down TAP;
- 3 Contacts for remote indication of the status of the Monitor;
- 2 Contacts for remote access programming;
- High mechanical resistance case, built entirely in aluminum;
- IP20 degree of protection (**NBR IEC 60529**);
- Auto Baud Rate from 2400 to 57,600 bps (Automatically Detects Communication Network Speed);
- High mechanical strength housing, built entirely in DIN IEC **61554 standard aluminum**;
- Reduced size 98x98x52mm;
- 2 years warranty;

## TECHNICAL DATA

| TAP AND PARALLELISM POSITION INDICATOR – IPTP |                                                                            |
|-----------------------------------------------|----------------------------------------------------------------------------|
| Operating Voltage                             | 48 to 265 Vdc/VAC 50/60 Hz                                                 |
| Operating Temperature                         | -40 to +85°C                                                               |
| Consumption                                   | < 15 W                                                                     |
| Tap Measurement Input                         | Resistive Crown from 0 to 5000 Ohms<br>0 to 20 mA or 4 to 20 mA transducer |
| Measurement Range                             | -50 to 50 TAP's – Programmable (50 pos.)                                   |
| 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 Analog Output Error                   | 0.25% of end-of-scale                                                      |
| Outgoing Contacts                             | 4 – Free of potential                                                      |
| Maximum Switching Power                       | 70 W / 250 VA                                                              |
| Maximum Switching Voltage                     | 6.0 A                                                                      |
| Maximum Driving Current                       | RS485 ( <b>ANSI/TIA/EIA-485-A</b> )                                        |
| Serial Communication Port                     | Modbus RTU and DNP 3 Level 1                                               |
| Auto Baud Rate                                | 2,400 to 57,600 bps                                                        |
| Housing (DIN IEC 61544)                       | 98 x 98 x 52 mm - Aluminum                                                 |
| Equipment Attachment                          | Flush Panel Mounting                                                       |
| Degree of Protection (NBR IEC 60529)          | IP 20                                                                      |

Table 1 – IPTP technical data

## TYPE TESTS PERFORMED

- Applied Voltage (IEC 60255-5): 2kV / 60Hz / 1 min. (against land);
- Immunity and Electrical Transients (IEC 60255-22-1): 2.5kV / 1.1MHz / 2 sec. / 400 outbreaks/sec;
- 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): Alim /Entr./ Outputs =4KV/ common 2kV;
- Surge Immunity (IEC60255-22-5): phase/neutral 1KV, 5 per polar. ( $\pm$ ) - 2KV phase-to-ground/neutral-to-ground, 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 + 80°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;

## DIMENSIONS

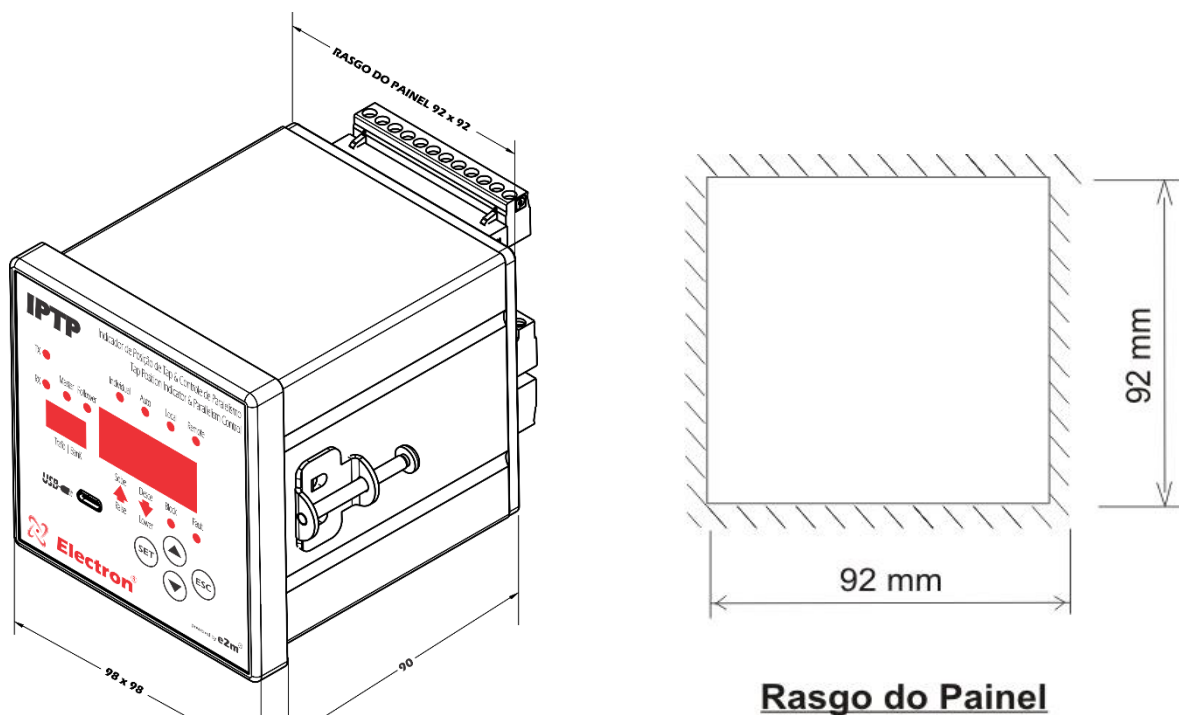


Figure 1 – IPTP Dimension

## CONNECTION DIAGRAM - IPTP

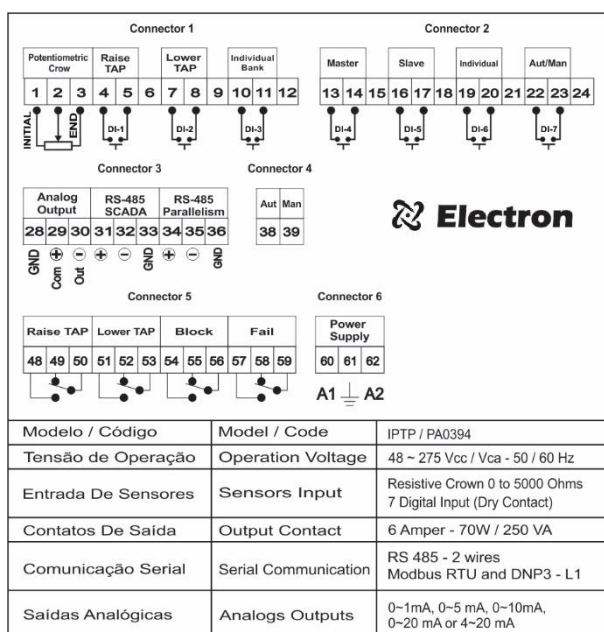


Figure 2 – IPTP Connection Diagram

## 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           |
|                                                                                                            | Led's and 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 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                      |                |                |              |                                                              |
| <div><br/>ATENÇÃO</div> | 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 2 – Preventive maintenance

APPLICATION EXAMPLES

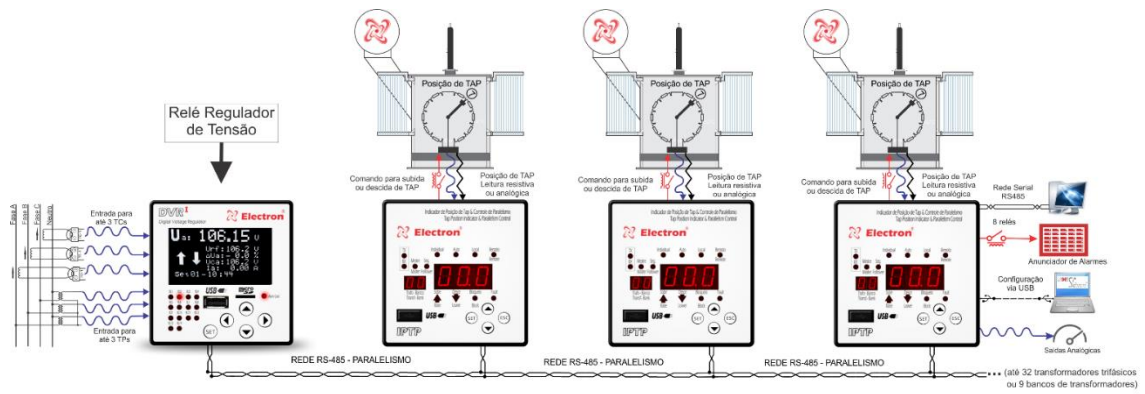


Figure 3 – Application example 1

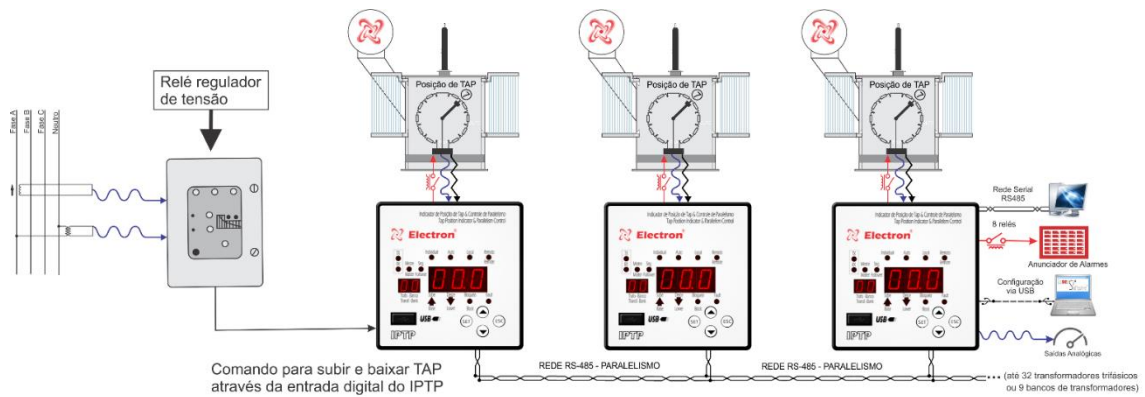


Figure 4 – Application example 2

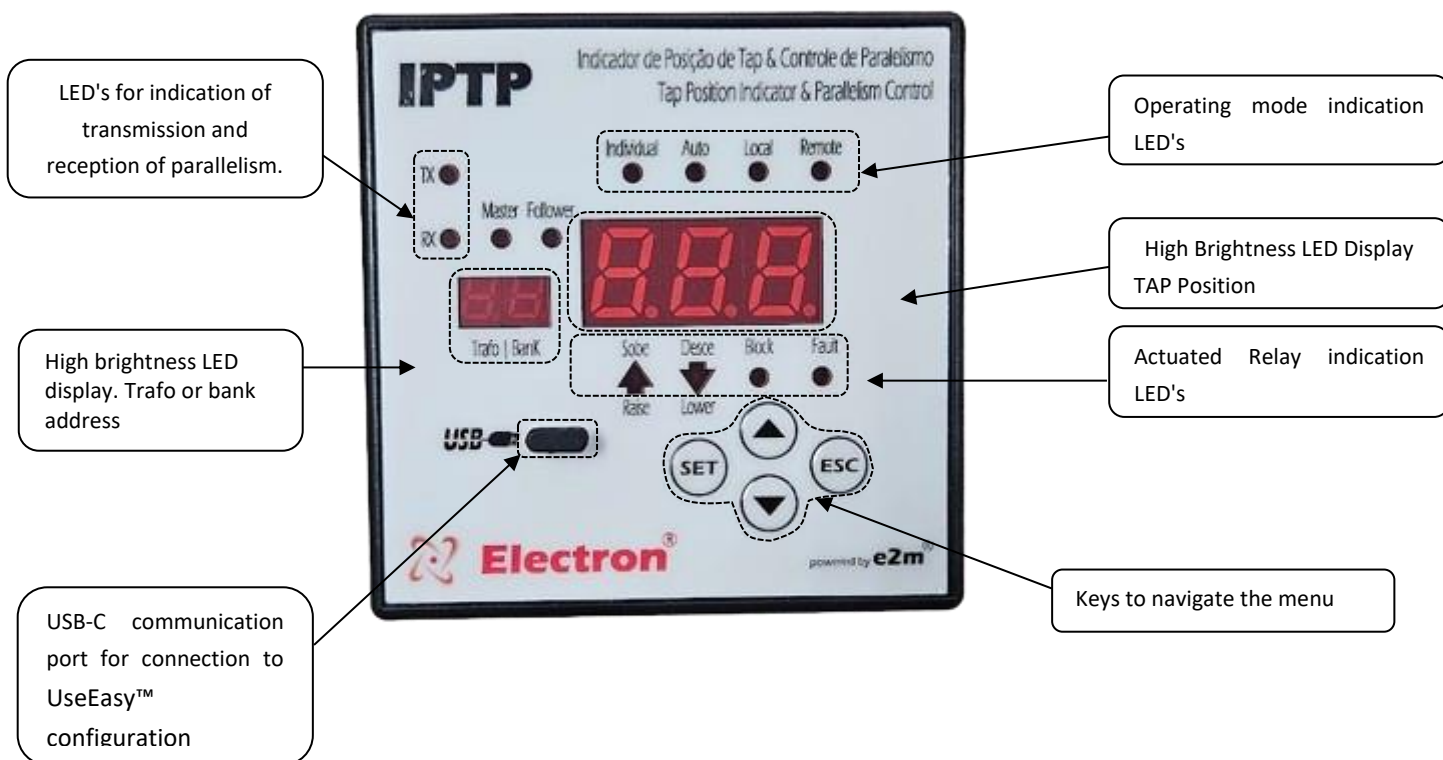
## ACCESSORIES

## MÓDULO TRANSMISSOR DE ATÉ 35 POSIÇÕES



Figure 5 – transmission module of up to 35 positions

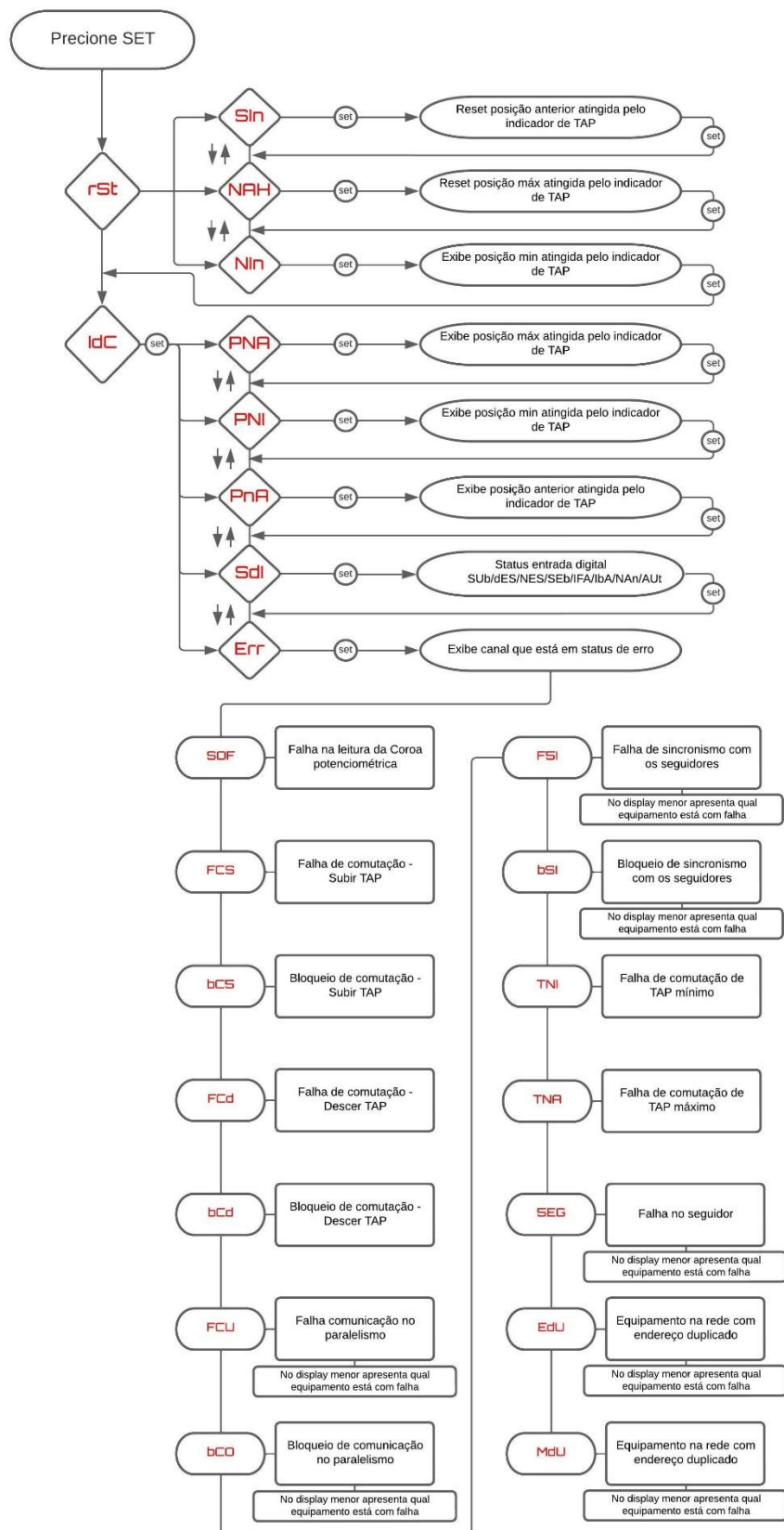
## GETTING TO KNOW IPTP



Note: when configured in individual bank in the topology of the Transformer Bank, the individual led is flashing.

Figure 6 – getting to know the IPTP

## QUERY MENU FLOWCHART

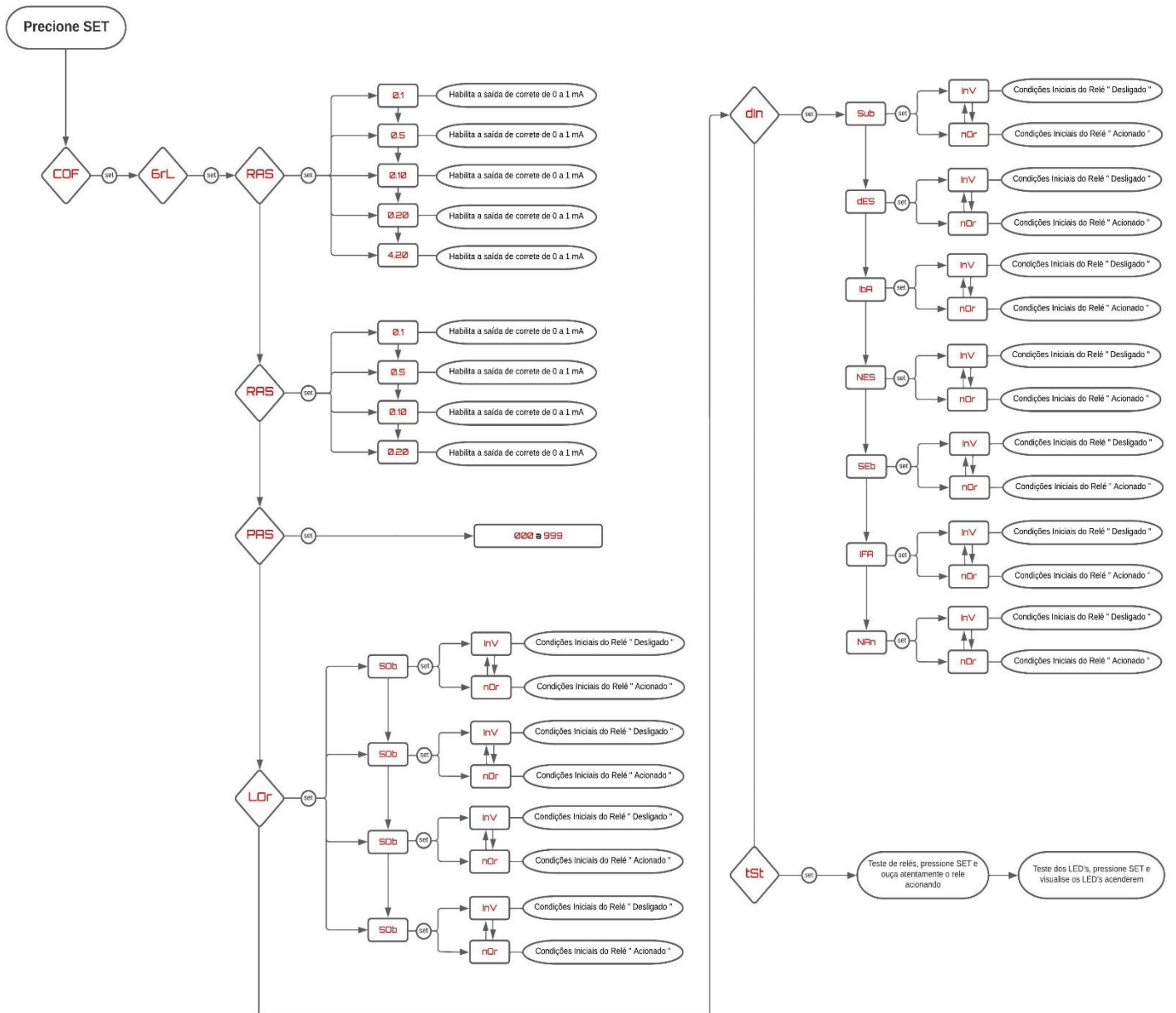


## CONSULTATION MENU

To access this menu, press the **SET** key. Use the increment and/or decrement keys to select the desired menu. Then press the **SET** key to query the desired parameters and to return to the previous menu, press the **ESC** key.

| MENU       | PARAMETER                                                                    | VARIABLE                                                           | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|------------|------------------------------------------------------------------------------|--------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>COF</i> | ---                                                                          | <i>000 - 999</i>                                                   | <p>Access menu to the configuration submenus.</p> <p>Pressing the <b>SET</b> key in the COF <i>menu</i> will display the 3-digit number, this is the password reminder that is configured on the equipment. Soon after, the display will display <i>000</i>. Use the increment and/or decrement keys to enter the password, to confirm the chosen number and go to the next square, press the <b>SET</b> key. Confirming the 3 digits, and the password entered is the correct one, the display will display the acronym <i>9rL</i>. Otherwise, the display will display <i>000</i> again.</p> <p><b>NOTE:</b> The manufacturing password is <i>000</i> and the password reminder number is <i>783</i>, if the user registers a new password in the PAS menu and forgets the new password he registered, send the reminder number (<i>783</i>) to ELECTRON DO BRASIL and the product password will be reset;</p> |
| <i>Idc</i> | → Menu for consulting IPTP indicators.                                       |                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|            | <i>PMA</i>                                                                   | Screen to check the Maximum Position reached by the TAP indicator; |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|            | <i>PMI</i>                                                                   | Screen to check the Minimum Position reached by the TAP indicator; |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|            | <i>Pan</i>                                                                   | ---                                                                | Screen to consult the previous position of TAP;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|            | <i>Err</i>                                                                   | → Menu to check the fault(s) that have occurred in the indicator.  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|            |                                                                              | <i>SOF</i>                                                         | Failure to read the potentiometric crown;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|            |                                                                              | <i>FCS</i>                                                         | Switching Failure – Ascend TAP;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|            |                                                                              | <i>Bcs</i>                                                         | Switching Lock – Up TAP;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|            |                                                                              | <i>FCD</i>                                                         | Switching Failure – Descend TAP;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|            |                                                                              | <i>bcd</i>                                                         | Switching Lock on TAP Down;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|            |                                                                              | <i>FCU</i>                                                         | Communication Failure in Parallelism; (display indication)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|            |                                                                              | <i>bCO</i>                                                         | Communication Blocking in Parallelism; (display indication)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|            |                                                                              | <i>FSI</i>                                                         | Failure to synchronize with followers; (display indication)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|            |                                                                              | <i>Bsi</i>                                                         | Synchronization blocking with followers; (display indication)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|            |                                                                              | <i>ENI</i>                                                         | Minimal TAP Switching Failure;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|            |                                                                              | <i>Tma</i>                                                         | Maximum TAP Switching Failure;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|            |                                                                              | <i>MON</i>                                                         | Follower Failure;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|            |                                                                              | <i>EDU</i>                                                         | Duplicate network address;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|            |                                                                              | <i>MDU</i>                                                         | More than one master on the network.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <i>rSt</i> | → Reset Menu. Select the variable and press <b>SET</b> to perform the reset. |                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|            | ---                                                                          | <i>MAX</i>                                                         | Reset of the maximum TAP reached;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|            | ---                                                                          | <i>Min</i>                                                         | Reset of the minimum TAP reached;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|            | ---                                                                          | <i>S In</i>                                                        | Reset lock due to timing failure.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

## CONFIGURATION MENU FLOWCHART



## SETUP MENU

Pressing the **SET** key on the **LOF** option will appear on the display a three-digit number that is the reminder of the password that is configured on the equipment and soon after **000** will appear. Use the increment and/or decrement key to enter the password, to confirm the chosen number and move to the next square press the **SET** key, to return to the previous number press the **ESC** key. Confirming the three digits if the password is correct will enter the configuration menu presenting the acronym **CnF on the display**. Otherwise it will come back on the **000 display**.

**NOTE:** The manufacturing password is **000** and the reminder number is **783**, if the user changes this password in **the PAS** menu and forgets, just send the reminder number to **ELECTRON** and the product's password will be reset.

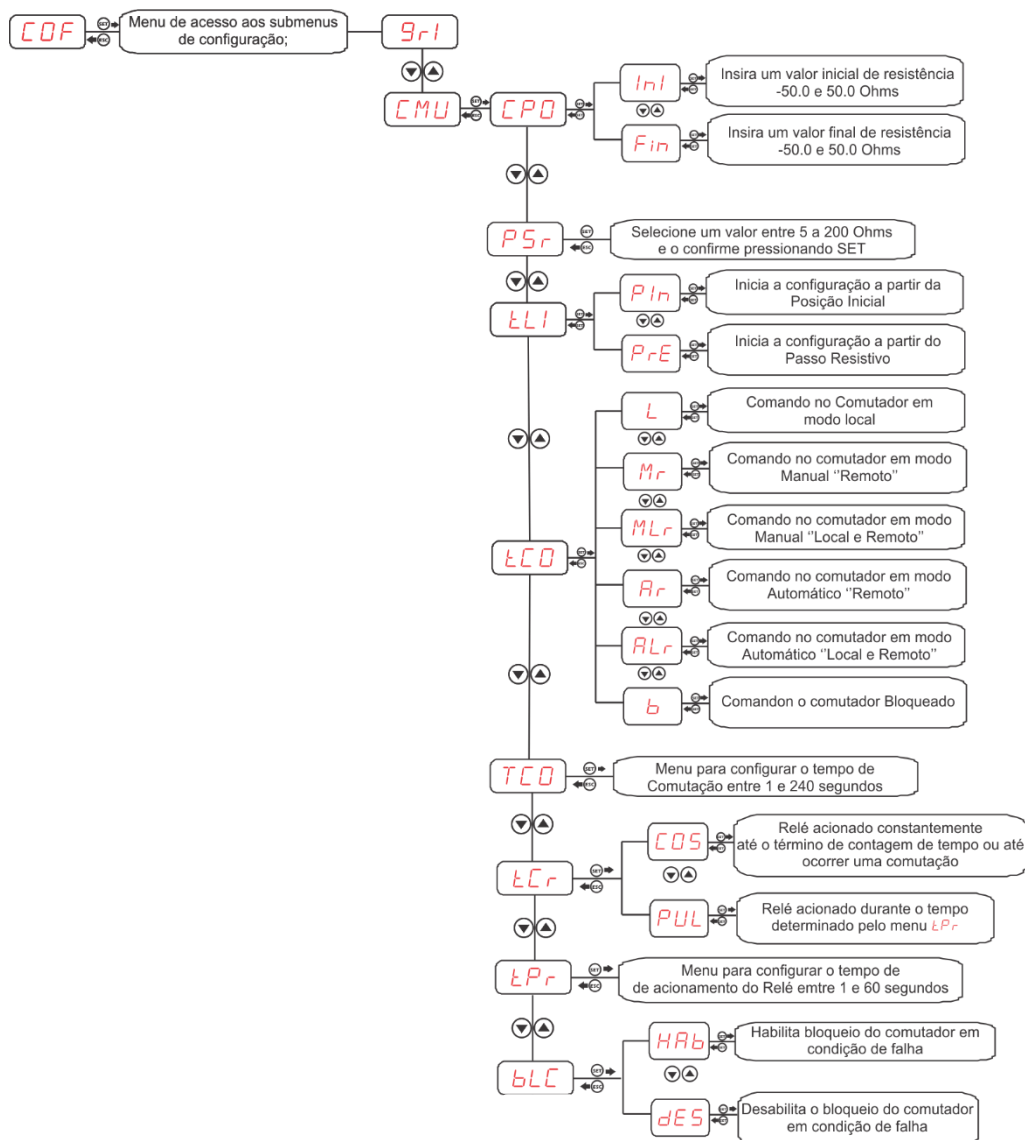
The menu **9r1** is a configuration menu for the parameters of the current output, relays and test drives and has the following Submenus:

| MENU       | PARAMETER                                                                                                              | VARIABLE          | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|------------|------------------------------------------------------------------------------------------------------------------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Ras</b> | → Menu for choosing the current output value on terminal 31 and 32                                                     |                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|            | ---                                                                                                                    | <b>0.1</b>        | Enables current output to 0 to 1 mA;                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|            | ---                                                                                                                    | <b>0.5</b>        | Enables current output to 0 to 5 mA;                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|            | ---                                                                                                                    | <b>0.10</b>       | Enables current output to 0 to 10 mA;                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|            | ---                                                                                                                    | <b>0.20</b>       | Enables current output to 0 to 20 mA;                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|            | ---                                                                                                                    | <b>4.20</b>       | Enables current output for 4 to 20 mA;                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>PAS</b> | ---                                                                                                                    | <b>000 to 999</b> | Menu to change the 3-digit password. This password will be used to access the equipment configuration menu. To change the numbers use the increment or decrement key, to confirm the chosen digit and move on to the next one, press the <b>SET</b> key, to return to the previous digit, press the <b>ESC</b> key.<br><br>Factory the password of Monitor <b>000</b> . In case of loss or forgetfulness of the password, contact Electron do Brasil and inform the password reminder. |
| <b>Lor</b> | → Menu to test the Relay activations and LED lighting in order to check the installation and indication of the IPTP's. |                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|            | <b>Under</b>                                                                                                           | <b>nOr</b>        | Initial Conditions of the Normal "Off" Relay;                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|            |                                                                                                                        | <b>Inv</b>        | Initial Conditions of the Normal "Triggered" Relay;                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|            | <b>dec</b>                                                                                                             | <b>nOr</b>        | Initial Conditions of the Normal "Off" Relay;                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|            |                                                                                                                        | <b>Inv</b>        | Initial Conditions of the Normal "Triggered" Relay;                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|            | <b>Blo</b>                                                                                                             | <b>nOr</b>        | Initial Conditions of the Normal "Off" Relay;                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|            |                                                                                                                        | <b>Inv</b>        | Initial Conditions of the Normal "Triggered" Relay;                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|            | <b>FAL</b>                                                                                                             | <b>nOr</b>        | Initial Conditions of the Normal "Off" Relay;                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|            |                                                                                                                        | <b>Inv</b>        | Initial Conditions of the Normal "Triggered" Relay;                                                                                                                                                                                                                                                                                                                                                                                                                                    |

## SETUP MENU

| MENU | PARAMETER                                                                                                                       | VARIABLE | DESCRIPTION                                                        |
|------|---------------------------------------------------------------------------------------------------------------------------------|----------|--------------------------------------------------------------------|
| LES  | → Menu to test the Relay activations and lighting of the LED's in order to check the installation and indication of the IPTP's; |          |                                                                    |
|      | Under                                                                                                                           | ---      | Activates Relay 1 (Tap Raise) by pressing the <b>SET key</b> ;     |
|      | dEC                                                                                                                             | ---      | Activates Relay 2 (Down TAP) by pressing the <b>SET key</b> ;      |
|      | BlO                                                                                                                             | ---      | Activates Relay 3 (Lockout) by pressing the <b>SET key</b> ;       |
|      | FAL                                                                                                                             | ---      | Activates Relay 4 (Fault) by pressing the <b>SET key</b> ;         |
|      | LED                                                                                                                             | ---      | Test of all the equipment's LED's by pressing the <b>SET key</b> ; |

## SWITCH CONFIGURATION MENU FLOWCHART

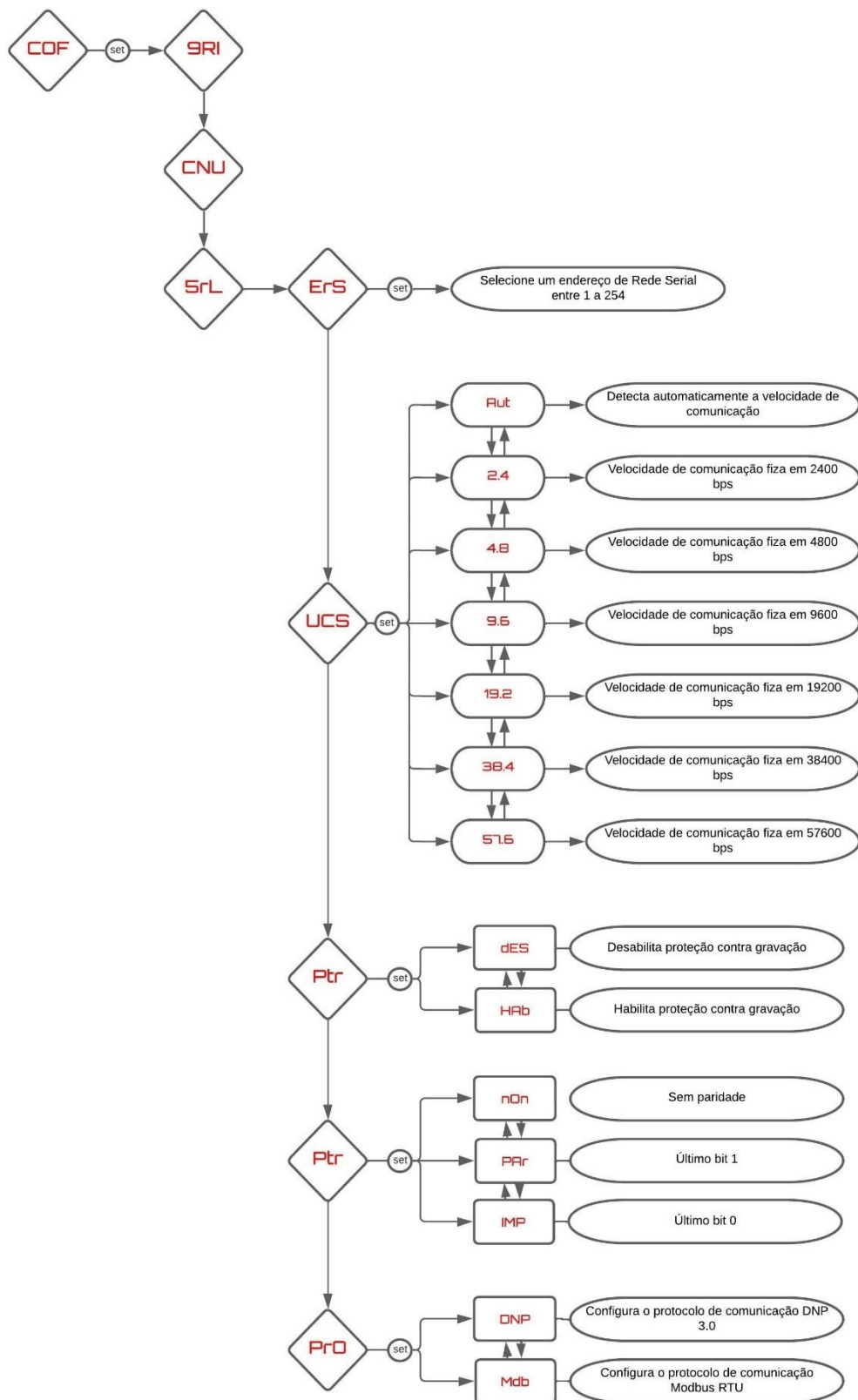


## SWITCH CONFIGURATION MENU

The *CMU* menu is for setting switch parameters and contains the following submenus:

| MENU       | PARAMETER                                                                                                                                                                                                                                                                                                                     | VARIABLE      | DESCRIPTION                                                                                                               |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------|
| <i>CPD</i> | → Menu to configure the range of positions for indications, use the <b>increment</b> and <b>decrement</b> button to configure the initial value of the position and then press the SET key, the menu to configure the final position of indication, according to the parameterized value, will automatically appear, pressing |               |                                                                                                                           |
|            | <i>Ini</i>                                                                                                                                                                                                                                                                                                                    | -50 to 50     | Set the initial position value;                                                                                           |
|            | <i>Fin</i>                                                                                                                                                                                                                                                                                                                    | -50 to 50     | Set the final position value;                                                                                             |
| <i>Psr</i> | ---                                                                                                                                                                                                                                                                                                                           | 5 to 200 Ohms | Menu to configure the resistance pitch of the potentiometric crown or Transmission Module (MTCS).                         |
| <i>Tli</i> | → Menu for choosing the initialization mode of the potentiometric ring reading                                                                                                                                                                                                                                                |               |                                                                                                                           |
|            | ---                                                                                                                                                                                                                                                                                                                           | <i>PIn</i>    | Indicator starts the indication from the Home Position configured in the <i>CPD menu</i> ;                                |
|            | ---                                                                                                                                                                                                                                                                                                                           | <i>Pre</i>    | The indicator starts the indication from the Resistive Step, i.e. one more position than the configured initial Position; |
| <i>Qcd</i> | → Menu for choosing the command mode on the switch.                                                                                                                                                                                                                                                                           |               |                                                                                                                           |
|            | ---                                                                                                                                                                                                                                                                                                                           | <i>L</i>      | Switch command in Local mode;                                                                                             |
|            | ---                                                                                                                                                                                                                                                                                                                           | <i>Mr</i>     | Switch control in Manual "Remote" mode;                                                                                   |
|            | ---                                                                                                                                                                                                                                                                                                                           | <i>MLr</i>    | Command on the switch in Manual mode "Local and Remote";                                                                  |
|            | ---                                                                                                                                                                                                                                                                                                                           | <i>Air</i>    | Command on the switch in Automatic "Remote" mode;                                                                         |
|            | ---                                                                                                                                                                                                                                                                                                                           | <i>ALr</i>    | Control on the switch in automatic mode "Local and remote"                                                                |
|            | ---                                                                                                                                                                                                                                                                                                                           | <i>b</i>      | Command on the Locked switch;                                                                                             |
| <i>Tcr</i> | → Menu to configure the type of Relay activation to raise and lower the TAP position;                                                                                                                                                                                                                                         |               |                                                                                                                           |
|            | ---                                                                                                                                                                                                                                                                                                                           | <i>CDS</i>    | Relay will be activated constantly until there is a switching or the end of the switching time occurs;                    |
|            | ---                                                                                                                                                                                                                                                                                                                           | <i>PUL</i>    | Relay will be activated for the time determined in the <i>LPt menu</i> ;                                                  |

## SERIAL NETWORK CONFIGURATION MENU FLOWCHART

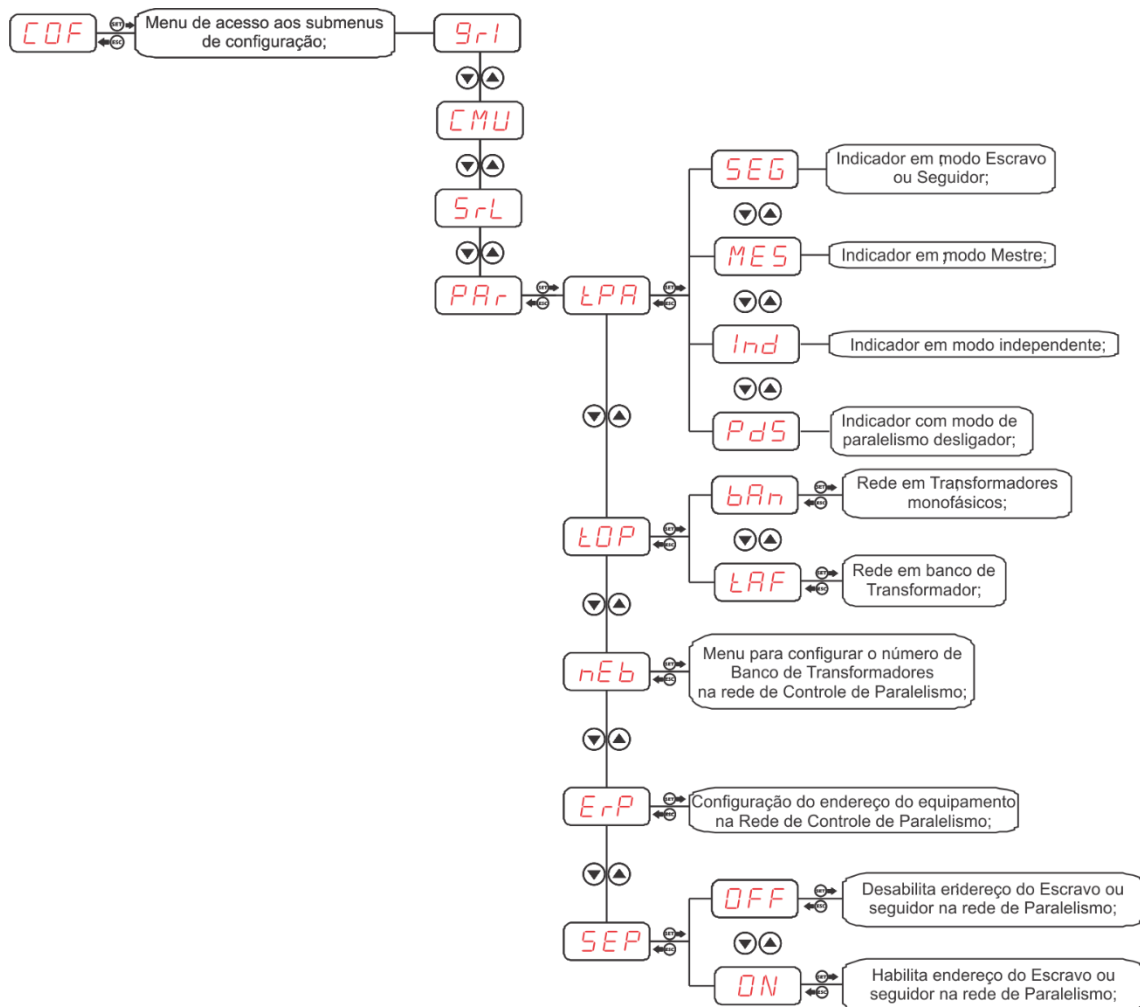


# SERIAL NETWORK CONFIGURATION MENU

The **SrL** menu is a configuration menu for communication parameters and has the following submenus.

| Menu       | Parameter                                                                                                                                                                         | Variable         | Description                                                                                      |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|--------------------------------------------------------------------------------------------------|
| <b>Ers</b> | → the menu to adjust the Serial Network Address, each device connected to the RS485 network must have a different numerical address from the others so that it can be identified. |                  |                                                                                                  |
|            | ---                                                                                                                                                                               | <b>OFF</b>       | Disables Serial networking;                                                                      |
|            |                                                                                                                                                                                   | <b>1 to 254</b>  | Select a single address for the equipment on the network and confirm it by pressing <b>SET</b> ; |
| <b>UCS</b> | → Menu to configure the Serial Communication Speed;                                                                                                                               |                  |                                                                                                  |
|            | ---                                                                                                                                                                               | <b>AUT</b>       | Automatically detects Serial Communication Speed;                                                |
|            |                                                                                                                                                                                   | <b>2.4</b>       | Fixed serial communication speed at 2,400 bps;                                                   |
|            |                                                                                                                                                                                   | <b>4.8</b>       | Fixed serial communication speed at 4,800 bps;                                                   |
|            |                                                                                                                                                                                   | <b>9.6</b>       | Fixed serial communication speed at 9,600 bps;                                                   |
|            |                                                                                                                                                                                   | <b>19.2</b>      | Fixed serial communication speed at 19,200 bps;                                                  |
|            |                                                                                                                                                                                   | <b>38.4</b>      | Fixed serial communication speed at 38,400 bps;                                                  |
|            |                                                                                                                                                                                   | <b>LIFE 57.6</b> | Fixed serial communication speed at 57,600 bps;                                                  |
| <b>Plr</b> | → Parameter Recording Protection Menu;                                                                                                                                            |                  |                                                                                                  |
|            | ---                                                                                                                                                                               | <b>dGr</b>       | Disables write protection;                                                                       |
|            | ---                                                                                                                                                                               | <b>hGr</b>       | Enables write-protect                                                                            |
| <b>Pri</b> | → Menu for choosing parity, that is, the last bit to be transmitted in the message for data integrity checking;                                                                   |                  |                                                                                                  |
|            | ---                                                                                                                                                                               | <b>Non</b>       | No Parity;                                                                                       |
|            | ---                                                                                                                                                                               | <b>Pair</b>      | Last bit of the message to be transmitted will be 0;                                             |
|            | ---                                                                                                                                                                               | <b>IMP</b>       | Last bit of the message to be transmitted will be 1;                                             |
| <b>Pro</b> | → Menu to choose the type of Communication Protocol;                                                                                                                              |                  |                                                                                                  |
|            | ---                                                                                                                                                                               | <b>dnp</b>       | Configures DNP 3.0 (L1) as the communication protocol;                                           |
|            | ---                                                                                                                                                                               | <b>MODB</b>      | Configures the MODBUS RTU as a communication protocol;                                           |

# PARALLELISM CONFIGURATION MENU FLOWCHART



NOTE: in the "ind" menu the smaller display on the equipment will indicate "FA and BA"

# PARALLELISM CONFIGURATION MENU

The *PAR* menu is a configuration menu for parallelism parameters and has the following submenus:

| Menu       | Parameters                                                                                                                                                                                                                     | Variable                                              | Description                                                                                                    |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| <i>LPR</i> | → Parallelism Control mode selection menu.<br><b>NOTE:</b> If the configuration with jumper of the parallelism control mode performed on the IPTP connector will always prevail over the configuration performed in this menu. |                                                       |                                                                                                                |
|            | ---                                                                                                                                                                                                                            | <i>MON</i>                                            | Indicator in Slave or Follower mode;                                                                           |
|            |                                                                                                                                                                                                                                | <i>MONTH</i>                                          | Indicator in Master mode;                                                                                      |
|            |                                                                                                                                                                                                                                | <i>Ind</i>                                            | Indicator in independent mode, on the smaller display it will indicate FA and bA for (Phase / Bank indicator); |
|            |                                                                                                                                                                                                                                | <i>Pds</i>                                            | Set the parallelism type and confirm by pressing the SET key ;                                                 |
| <i>LOP</i> | → Menu for choosing Parallelism Network Topology type.                                                                                                                                                                         |                                                       |                                                                                                                |
|            | ---                                                                                                                                                                                                                            | <i>Ban</i>                                            | Network in single-phase transformers;                                                                          |
|            |                                                                                                                                                                                                                                | <i>LAF</i>                                            | Network in Transformer bank;                                                                                   |
| <i>Nzb</i> | → Menu to configure the number of Transformer Bank in the Parallelism Control network.<br><b>NOTE:</b> Menu available when the equipment is configured as Master                                                               |                                                       |                                                                                                                |
|            | ---                                                                                                                                                                                                                            | <i>1 - 9<br/>years</i>                                | Available Transformer Bank menu in the Parallelism Control network.                                            |
| <i>Nep</i> | → Menu to configure the equipment number in the Parallelism Control network.<br><b>NOTE:</b> Menu available when the equipment is set to Master.                                                                               |                                                       |                                                                                                                |
|            | ---                                                                                                                                                                                                                            | <i>1 - 31<br/>months</i>                              | Configure the amount of equipment in the Parallelism Control Network;                                          |
| <i>Erp</i> | → Menu for configuring the address of the equipment in the Parallelism Control network.                                                                                                                                        |                                                       |                                                                                                                |
|            | ---                                                                                                                                                                                                                            | <i>1A 1B<br/>1C ...<br/>until...<br/>9A 9b<br/>9C</i> | Configure the address of the equipment in the Parallelism Control network;                                     |

### PARALLELISM CONFIGURATION MENU

| Menu | Parameters                                                                                                                                                                                                                                                                                                                                                                                                                                    | Variable | Description                                                           |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-----------------------------------------------------------------------|
| SEP  | → Configuration Menu of the status of the Slave or Follower in the Control and Parallelism network;<br><b>NOTE:</b> Menu available when the equipment is set to Master. And "Bank" network topology. The addresses of the slaves or followers will be represented by the letter X and the bank phase by the letter W.<br>Configure the status of the equipment in the Parallelism Control Network and confirm by pressing the <b>SET</b> key. |          |                                                                       |
|      | 1A 1B 1C .<br>..until...<br>9A 9b<br>9C                                                                                                                                                                                                                                                                                                                                                                                                       | ON       | Address of the slave or follower in the Parallelism Enabled network;  |
|      | 1A 1B 1C .<br>..until...<br>9A 9b<br>9C                                                                                                                                                                                                                                                                                                                                                                                                       | OFF      | Address of the Slave or follower in the Disabled parallelism network; |

### ERROR DESCRIPTION

| DISPLAY | ERROR DESCRIPTION                                                                |
|---------|----------------------------------------------------------------------------------|
| SDF     | Error failure in the reading of the potentiometric crown;                        |
| FCS     | Switching Failure – Climb TAP;                                                   |
| FCD     | Switching Failure – Descend TAP;                                                 |
| FCU     | Communication Failure in Parallelism; (equipment indication on the display)      |
| FSI     | Failure of Synchronization with Followers; (equipment indication on the display) |
| Bsi     | Blocking due to Synchronism failure; (equipment indication on the display)       |
| bcd     | Switching Lock – Down TAP;                                                       |
| Bcs     | Switching Lock – Up TAP;                                                         |
| bCD     | Communication failure blocking;                                                  |
| TMMI    | Switching Failure – Minimum TAP;                                                 |
| TMA     | Switching Failure – Maximum TAP;                                                 |
| EdU     | Duplicate address failure;                                                       |
| Mdu     | Double metre failure.                                                            |

## ERROR DESCRIPTION

| Display | Cause                                                   | Solution                                                   |
|---------|---------------------------------------------------------|------------------------------------------------------------|
| OFF     | Reliable signal from the sensor does not reach the IPTP | Check and replace if the power ring cable is not shielded. |
|         |                                                         | Check the grounding of the potentiometric ring cable.      |
|         |                                                         | Check and eliminate possible bad contact.                  |

The IPTP automatically returns to the reading mode when normalized, to reset the IPTP press the **SET key** for approximately 5 seconds, until the word rSt appears on the display, then release and the equipment will restart.

The IPTP has a fault contact (relay 4), it will act in case of **FAILURES** or if there is a power supply.

## 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 so that there is no difference in potential.

Properly grounded sensors and power prevent malfunctions or damage in cases of disturbances, surges, and inductions in the equipment.

2. 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.

3. Do not use the IPTP directly on the SOL, 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

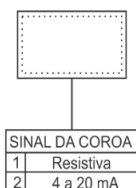
The TAP POSITION INDICATOR & PARALLELISM CONTROL – IPTP Electron has a warranty period of two years from the date of sale stated on the invoice, with coverage for any manufacturing defects that make it unsuitable or unsuitable for the applications it is intended for.

### 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.

## PROCUREMENT SPECIFICATION

# INDICADOR E CONTROLADOR DE PARALELISMO IPTP -



# IMPORTANT RECOMMENDATIONS CABLING

| Recommended Cabling for connection (NBR-5410 and NBR-14039 Standards) |                                       |                                                                         |
|-----------------------------------------------------------------------|---------------------------------------|-------------------------------------------------------------------------|
| Connection                                                            | Material                              | Quality                                                                 |
| Grounding                                                             | NU Copper                             | High Electrical Conductivity.                                           |
|                                                                       | Tinned Copper                         | Corrosion resistance.                                                   |
|                                                                       | Copper Tape                           | Lightning Protection.                                                   |
|                                                                       | Grounding Mesh                        | Uniform fault current distribution.                                     |
|                                                                       | Grounding Rod                         | Creates a path of Low resistance to the earth.                          |
| RS-485 Communication                                                  | Belden 9841 (24AWG)                   | Twisted pair, shielded and Low Capacitance.                             |
|                                                                       | Alpha Wire (22AWG)                    |                                                                         |
| Feeding                                                               | EPR                                   | Resistance to heat, humidity, chemical agents and withstand up to 90°C. |
|                                                                       | XLPE                                  |                                                                         |
| Sensors                                                               | PT-100 Shielded (3x24 AWG) - Electron | Mechanical resistance and noise protection.                             |
| Relay Output                                                          | Shielded Multi-Way Cable              | Mechanical resistance and noise protection.                             |

| Cabling Recommended for connecting current inputs/outputs |                          |          |           |          |                             |
|-----------------------------------------------------------|--------------------------|----------|-----------|----------|-----------------------------|
| Connection                                                | Material                 | Range    | Impedance | Distance | Minimum Gauge               |
| Analog Outputs / TC / Tap Inputs                          | Shielded Multi-Way Cable | 0...1mA  | 8kΩ       | <100m    | 0.14 to 0.25mm <sup>2</sup> |
|                                                           |                          |          |           | >100m    | 0.35 to 0.5mm <sup>2</sup>  |
|                                                           |                          | 0...5mA  | 1.6kΩ     | <100m    | 0.2 to 0.35mm <sup>2</sup>  |
|                                                           |                          |          |           | >100m    | 0.5 to 0.75mm <sup>2</sup>  |
|                                                           |                          | 0...10mA | 800Ω      | <100m    | 0.25 to 0.5mm <sup>2</sup>  |
|                                                           |                          |          |           | >100m    | 0.75 to 1.0mm <sup>2</sup>  |
|                                                           |                          | 0...20mA | 400Ω      | <100m    | 0.5 to 0.75mm <sup>2</sup>  |
|                                                           |                          |          |           | >100m    | 1.0 to 1.5mm <sup>2</sup>   |
|                                                           |                          | 4...20mA | 400Ω      | <100m    | 0.5 to 0.75mm <sup>2</sup>  |
|                                                           |                          |          |           | >100m    | 1.0 to 1.5mm <sup>2</sup>   |

Table 2 – Cabling Recommendation

**WARRANTY TERM*****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.

***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 emergency care, it is recommended to send as much information as possible regarding the defect detected. It 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 of Electron do Brasil at its headquarters.