IPTP - TAP AND PARALLELISM INDICATOR AND CONTROLLER

Manual

INDEX

INTRODUCTION

The IPTP TAP Position Indicator and Parallelism Control is intended for the remote indication of the TAP position of Transformers using potentiometric crown on-load changers. Manages parallelism Manages parallelism using 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 there is a change in the TAP for more than 10 seconds or if 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 chorus signal input (mA or resistive);
- 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 Type-C 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 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 **(ANSI/TIA/EIA-485-A)**
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 /Input. / Outputs =4KV/ common 2kV;
- Surge Immunity (IEC60255-22-5): phase/neutral 1KV, 5 per polar. (±) - 2KV phase-to-ground/neutral-to-ground, 5 per polar (±);
- Immunity to conducted Electromagnetic disturbances (IEC61000-4-6): 0.15 to 80 MHz / 10V/m;
- Climate Test (IEC60068-21-14):- 40ºC + 80ºC / 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

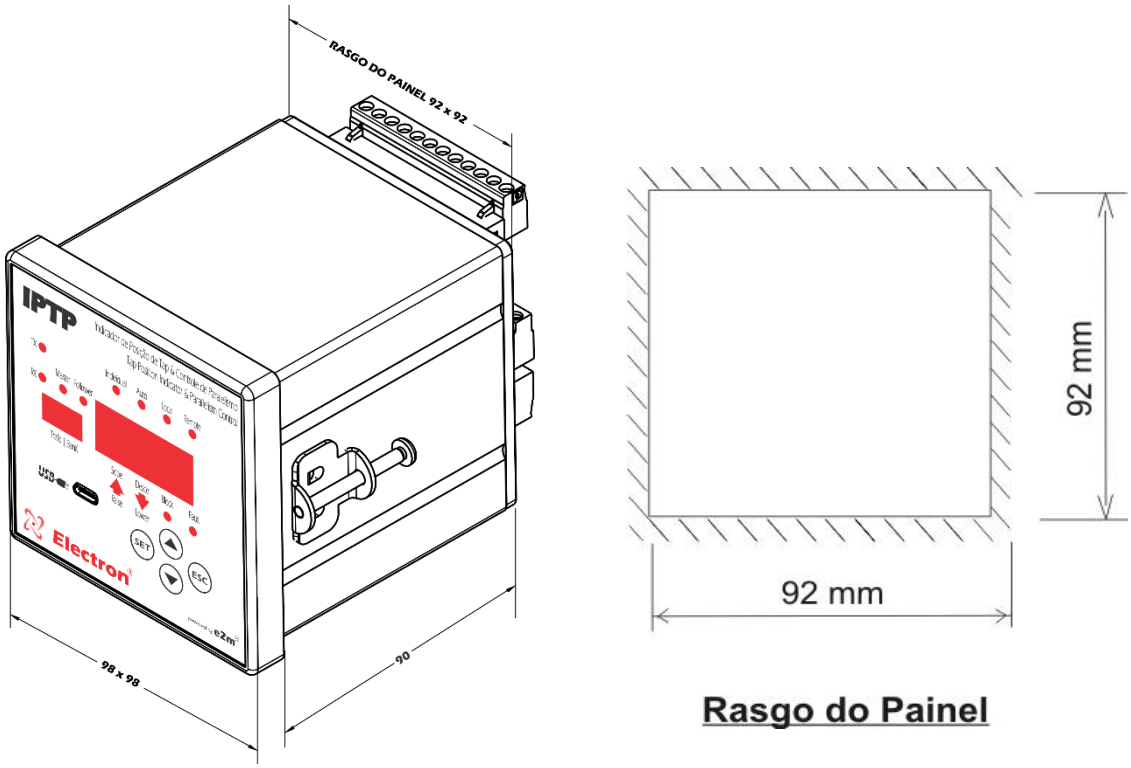
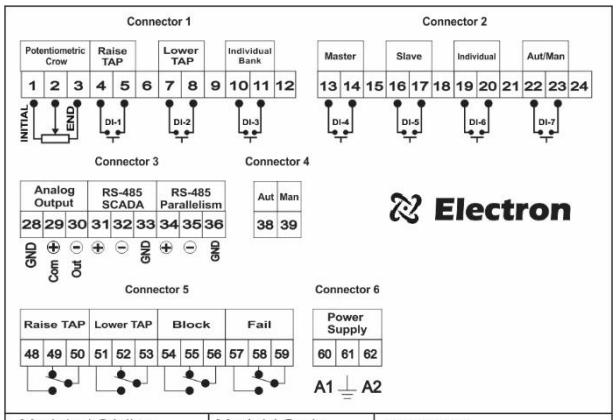


Figure 1 – IPTP Dimension

CONNECTION DIAGRAM - IPTP



Modelo / Código	Model / Code	IPTP / PA0394
Tensão de Operação	Operation Voltage	48 ~ 275 Vcc / Vca - 50 / 60 Hz
Entrada De Sensores	Sensors Input	Resistive Crown 0 to 5000 Ohms 7 Digital Input (Dry Contact)
Contatos De Saída	Output Contact	6 Amper - 70W / 250 VA
Comunicação Serial	Serial Communication	RS 485 - 2 wires Modbus RTU and DNP3 - L1
Saídas Analógicas	Analogs Outputs	0~1mA, 0~5 mA, 0~10mA, 0~20 mA or 4~20 mA

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
	LEDs and Displays	Test drive LEDs 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
	RS485 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				
	**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

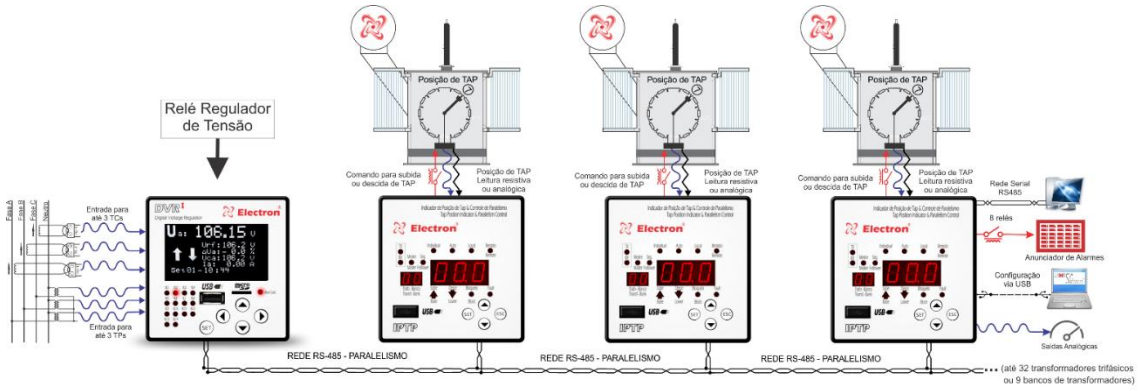


Figure 3 – Application example 1

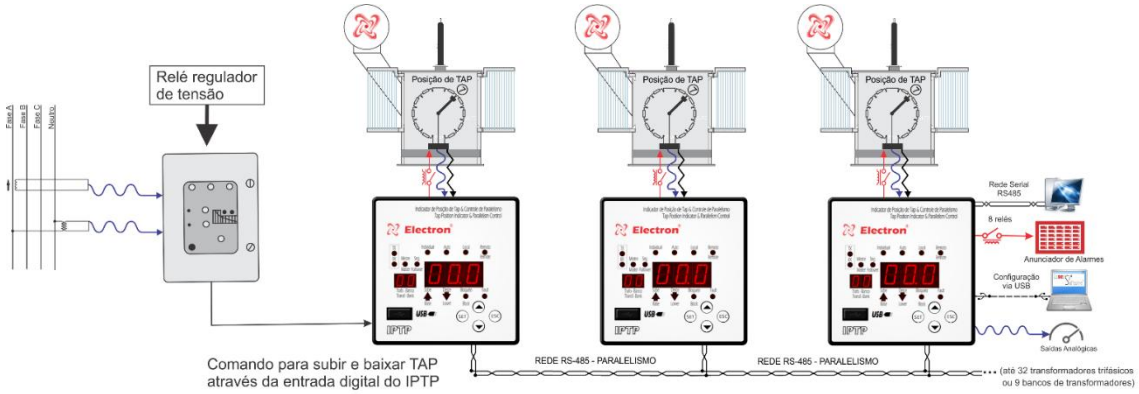


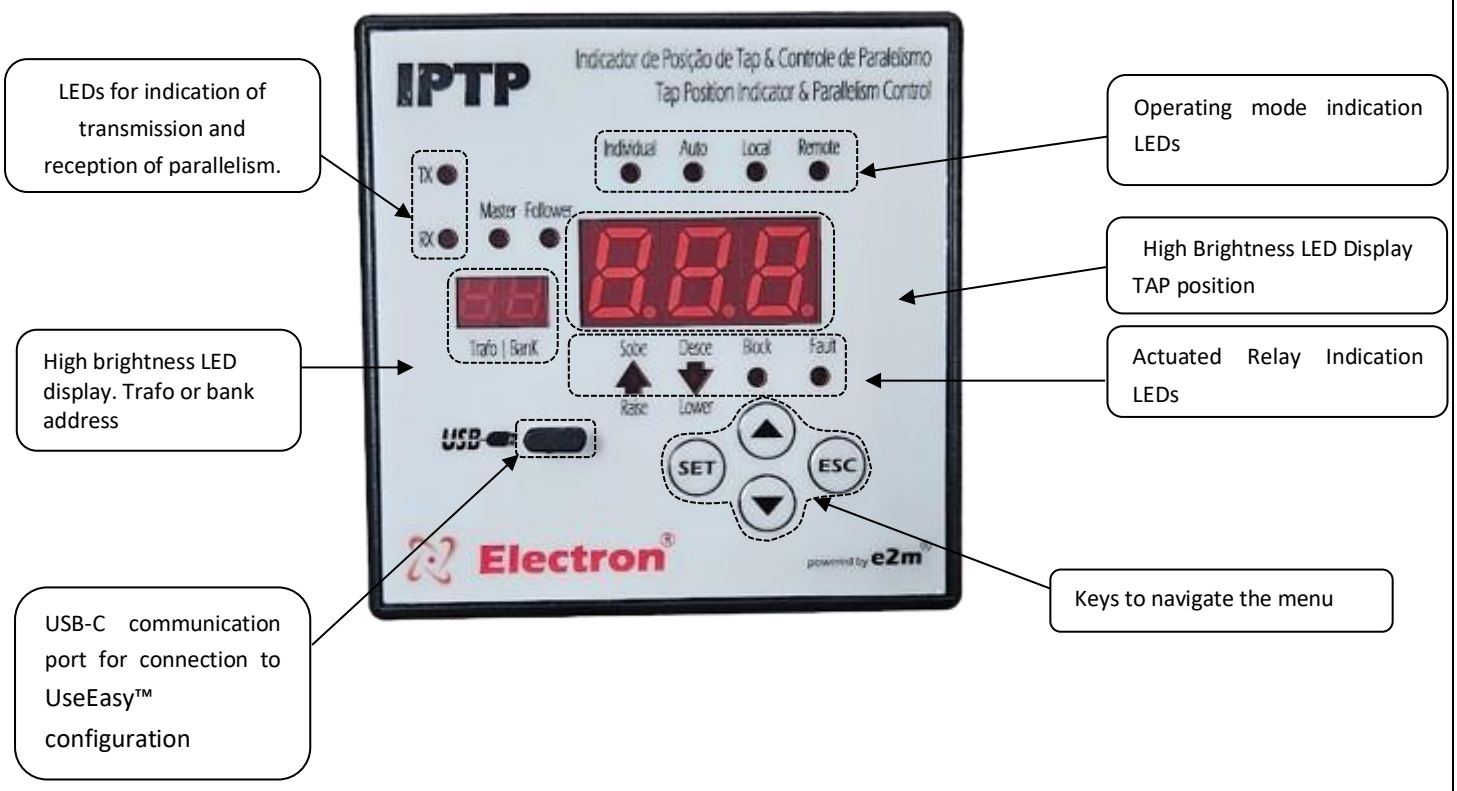
Figure 4 – Application example 2

ACCESSORIES

MÓDULO TRANSMISSOR DE ATÉ 35 POSIÇÕES

Figure 5 – Position Transmission Module (up to 35 tap positions)

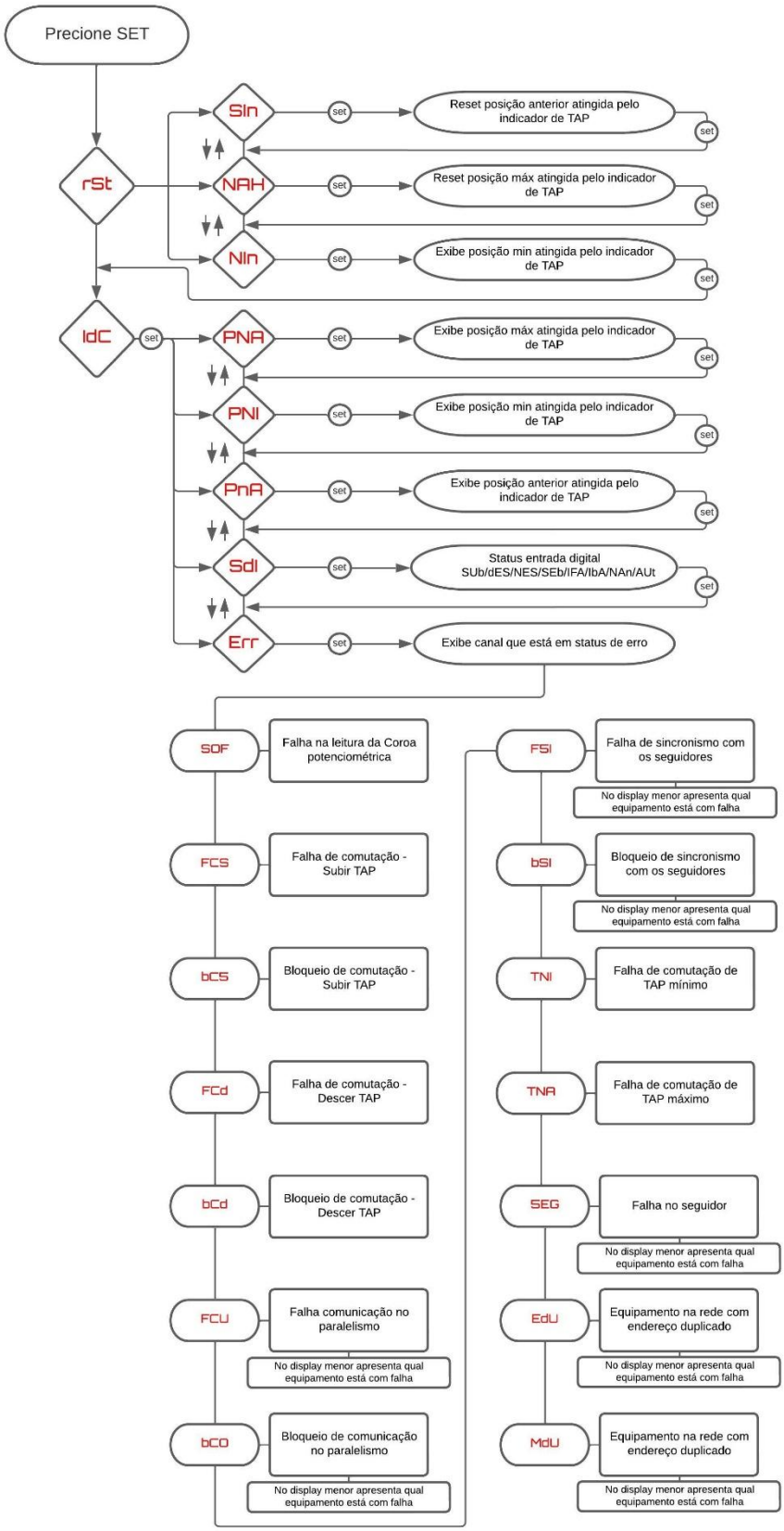
GETTING TO KNOW IPTP



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

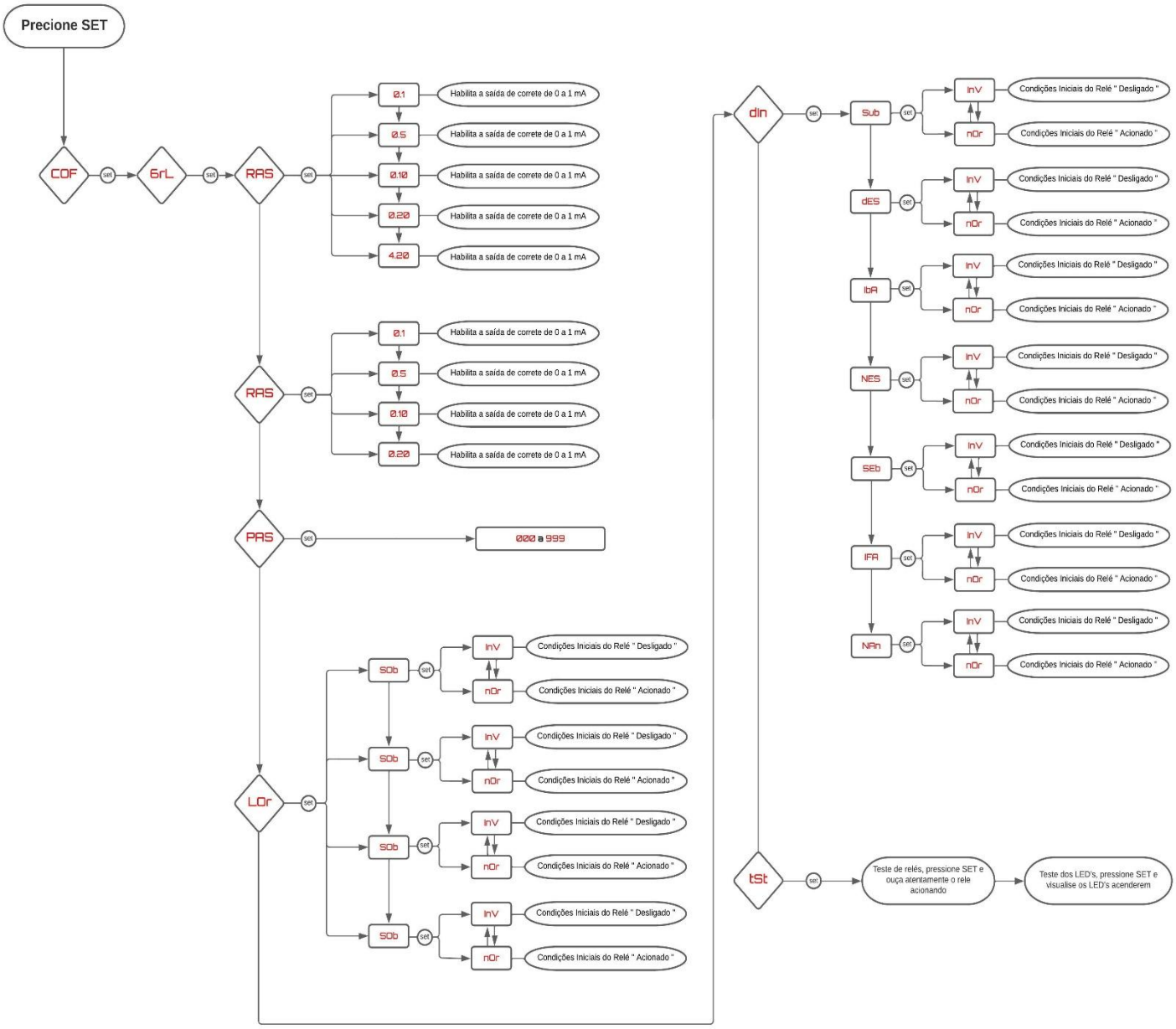


CONSULTATION MENU

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
COF	---	0O0 - 999	Access menu to the configuration submenus. Pressing the **SET key in the** COF menu will display the 3-digit number, this is the password reminder that is configured on the equipment. Soon after, the display will show 0O0. Use the increment and/or decrement keys to enter the password, to confirm the chosen number and go to the next square, press the **SET key**. Confirming the 3 digits, and the password entered is the correct one, the display will show the acronym 9rL. Otherwise, the display will show 0O0 again. **NOTE:** The manufacturing password is 0O0 and the password reminder number is 783, if the user registers a new password in the PAS menu and forgets the new password he registered, send the reminder number (783) to ELECTRON DO BRASIL and the product password will be reset;
Idc	→ Menu for consulting IPTP indicators.		
	PMA	Screen to consult the Maximum position reached by the TAP indicator;	
	PMI	Screen to check the Minimum position reached by the TAP indicator;	
	Pan	---	Screen to consult the previous position of TAP;
	Err	→ Menu to check the fault(s) that have occurred in the indicator.	
		SOF	Failure to read the tap changer's potentiometric input;
		FCS	Switching Failure – Ascend TAP;
		Bcs	Switching Lock – Up TAP;
		FCd	Switching Failure – Lower TAP;
		bcd	Switching Lock on TAP Down;
		FCU	Communication Failure in Parallelism; (display indication)
		bCO	Communication Blocking in Parallelism; (display indication)
		FSI	Failure to synchronize with followers; (display indication)
		Bsi	Synchronization blocking with followers; (display indication)
		tNI	Minimal TAP Switching Failure;
		Tma	Maximum TAP Switching Failure;
		MON	Follower Failure;
		EdU	Duplicate network address;
		Mdu	More than one master on the network.
rSt	→ Reset Menu. Select the variable and press **SET** to perform the reset.		
	---	MAX	Reset of the maximum TAP reached;
	---	Min	Reset of the minimum TAP reached;
	---	S.In	Reset lock due to timing failure.

CONFIGURATION MENU FLOWCHART



SETUP MENU

Pressing the **SET** key on the COF 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 0O0 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 0O0 display.

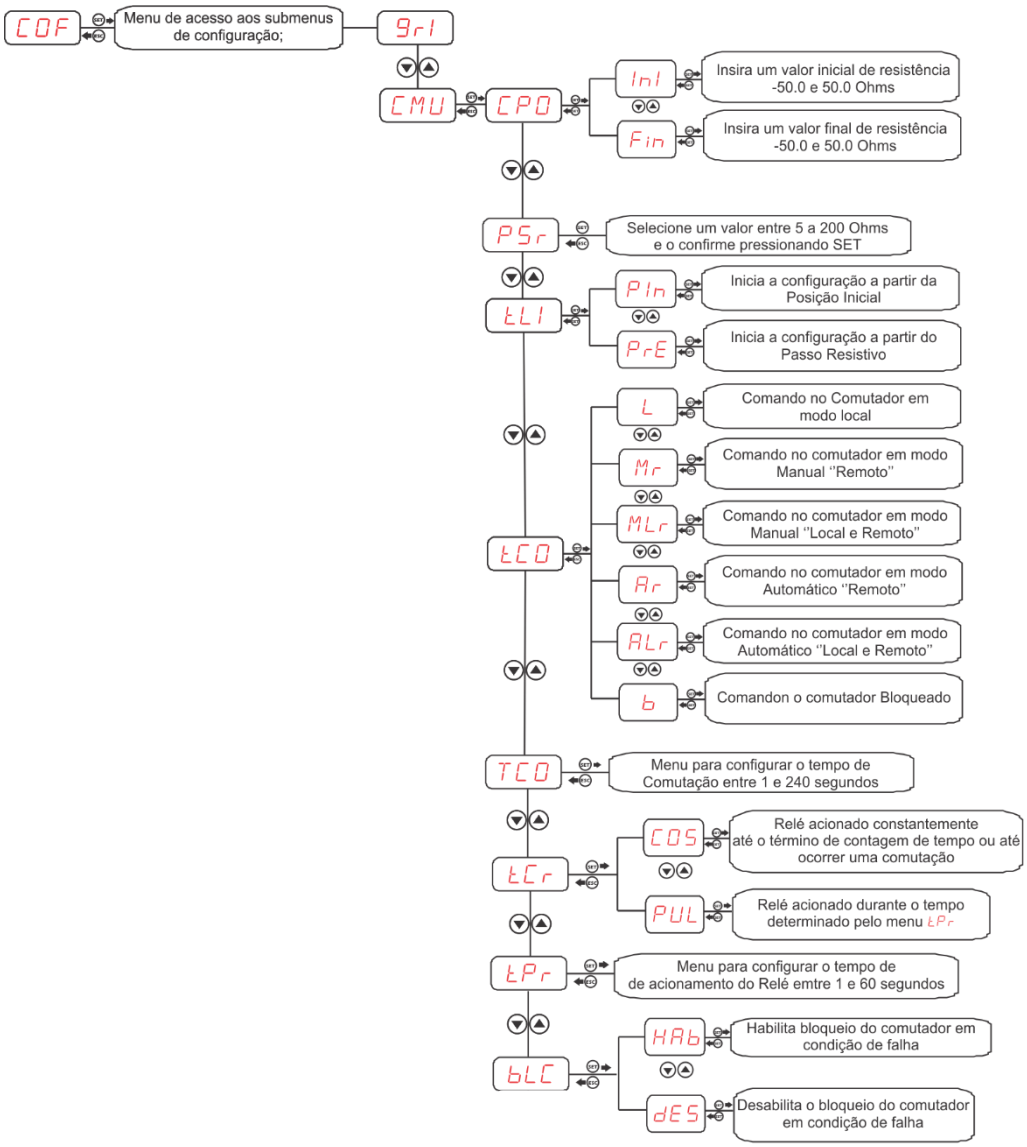
NOTE: The manufacturing password is 0O0 and the reminder number is 783, if the user changes this password in the PAS menu and forgets, just send the reminder number to **ELECTRON** and the product's password will be reset.

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

MENU	PARAMETER	VARIABLE	DESCRIPTION
Ras	→ Menu for choosing the current output value on terminal 31 and 32		
	---	0.1	Enables current output to 0 to 1 mA;
	---	0.5	Enables current output to 0 to 5 mA;
	---	0.10	Enables current output to 0 to 10 mA;
	---	0.20	Enables current output to 0 to 20 mA;
	---	4.20	Enables current output for 4 to 20 mA;
PAS	---	0O0 to 999	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 **SET** key, to return to the previous digit, press the **ESC key**. Factory the password of Monitor 0O0. In case of loss or forgetfulness of the password, contact Electron do Brasil and inform the password reminder.
Lor	→ Menu to test the Relay activations and LED lighting in order to check the installation and indication of the IPTP's.		
	Under	nOr	Initial Conditions of the Normal "Off" Relay;
		Inv	Initial Conditions of the Normal "Triggered" Relay;
	dEC	nOr	Initial Conditions of the Normal "Off" Relay;
		Inv	Initial Conditions of the Normal "Triggered" Relay;
	Blo	nOr	Initial Conditions of the Normal "Off" Relay;
		Inv	Initial Conditions of the Normal "Triggered" Relay;
	FAL	nOr	Initial Conditions of the Normal "Off" Relay;
		Inv	Initial Conditions of the Normal "Triggered" Relay;

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

SWITCH CONFIGURATION MENU FLOWCHART

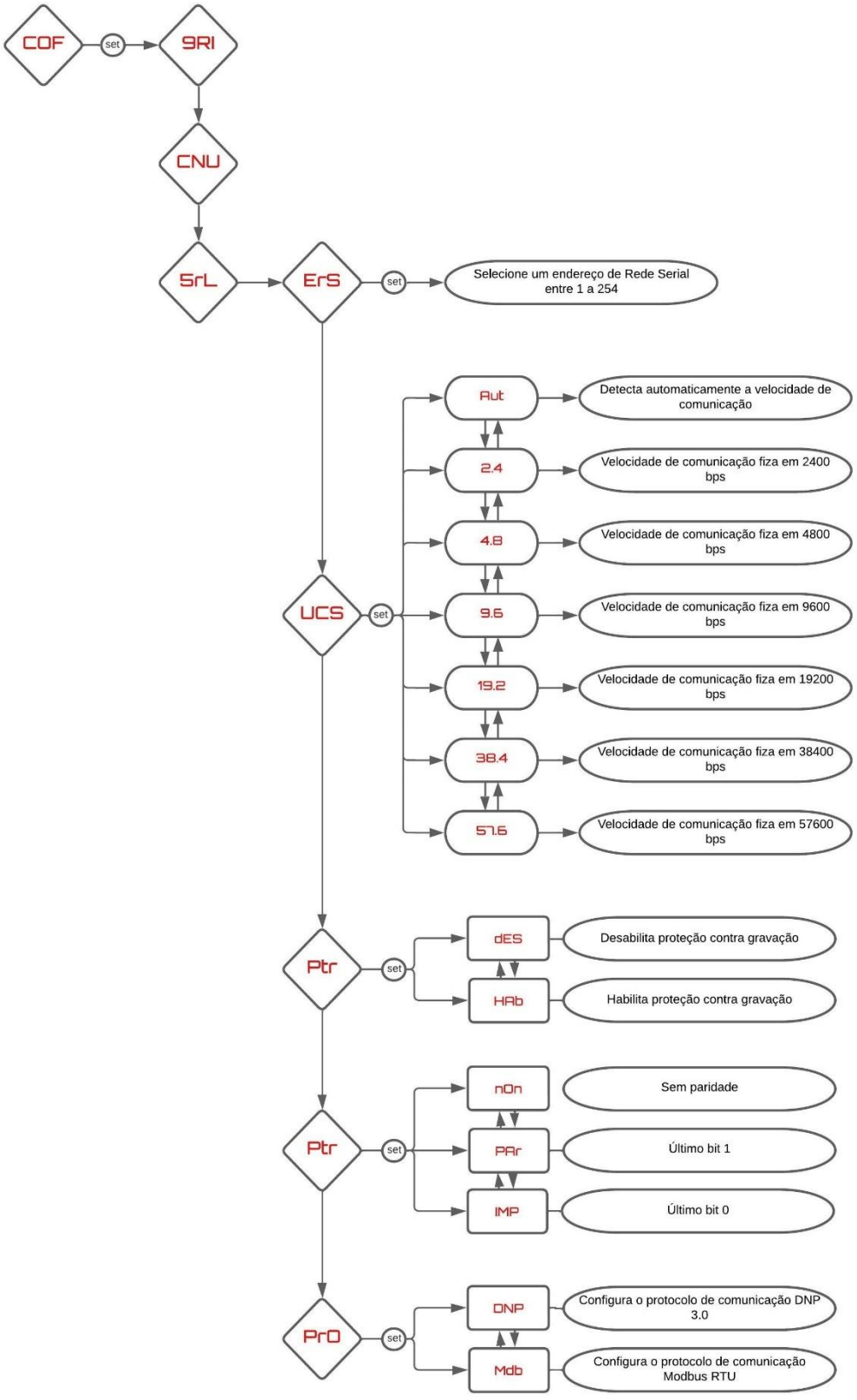


SWITCH CONFIGURATION MENU

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

MENU	PARAMETER	VARIABLE	DESCRIPTION
CPO	→ Menu to configure the range of positions for indications, use the **increment** and **decrement** 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		
	InI	-50 to 50	Set the initial position value;
	Fin	-50 to 50	Set the final position value;
Psr	---	5 to 200 Ohms	Menu to configure the resistance pitch of the potentiometric crown or Transmission Module (MTCS).
Tli	→ Menu for choosing the initialization mode of the potentiometric ring reading		
	---	P.In	Indicator starts the indication from the initial position configured in the DMW menu;
	---	Pre	The indicator starts the indication from the Resistive Step, i.e. one position more than the initial configured position;
Ocd	→ Menu for choosing the command mode on the switch.		
	---	L	Switch command in Local mode;
	---	Mr	Switch control in Manual "Remote" mode;
	---	MLr	Command on the switch in Manual mode "Local and Remote";
	---	Air	Command on the switch in Automatic "Remote" mode;
	---	ALr	Control on the switch in automatic mode "Local and remote"
	---	b	Command on the Locked switch;
Tcr	→ Menu to configure the type of Relay activation to raise and lower the TAP position;		
	---	COS	Relay will be activated constantly until there is a switching or the end of the switching time occurs;
	---	PUL	Relay will be activated for the time determined in the tPr menu;

SERIAL NETWORK CONFIGURATION MENU FLOWCHART

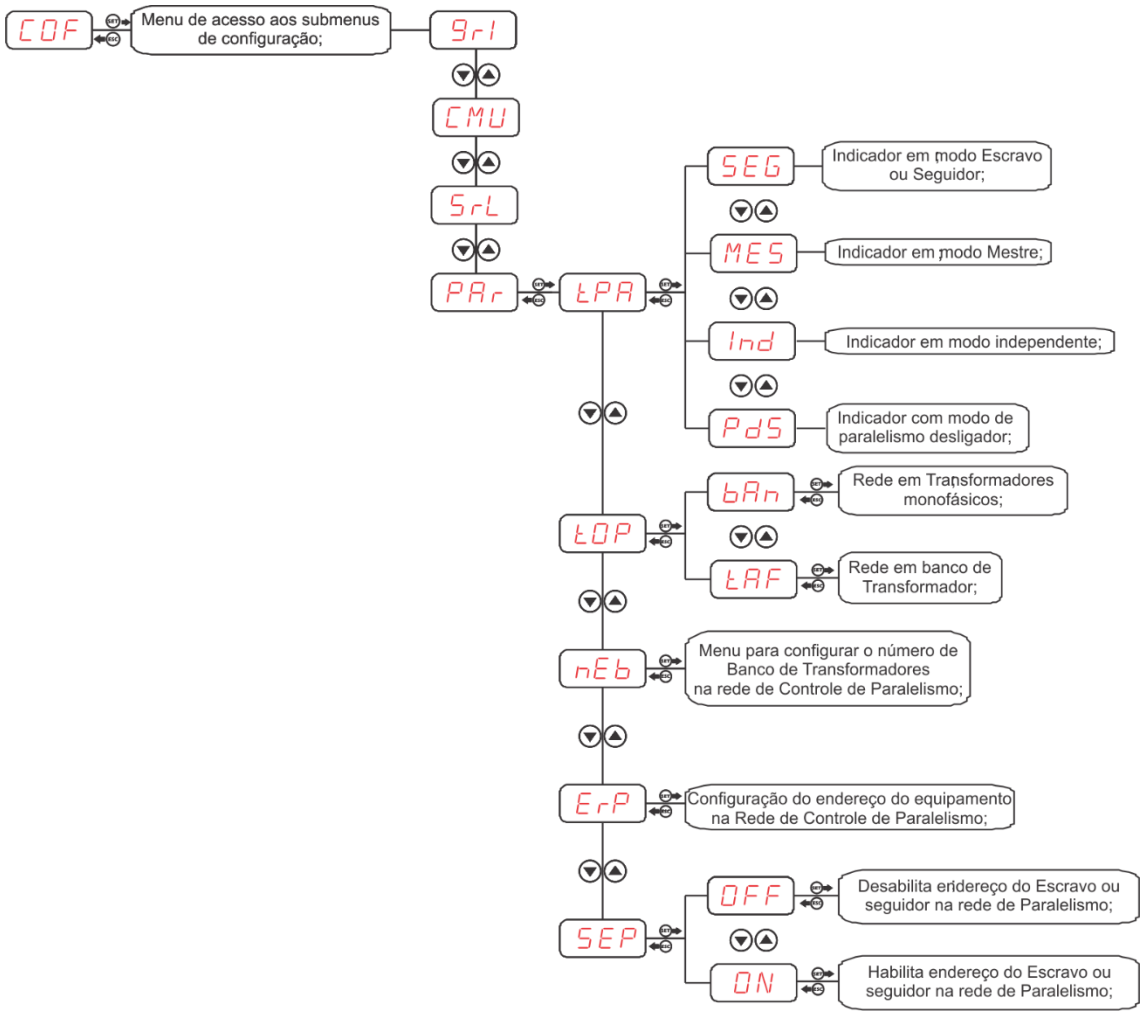


SERIAL NETWORK CONFIGURATION MENU

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

Menu	Parameter	Variable	Description
Ers	→ 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.		
	---	OFF	Disables Serial networking;
		1 to 254	Select a single address for the equipment on the network and confirm it by pressing **SET**;
UCS	→ Menu to configure the Serial Communication Speed;		
	---	AUT	Automatically detects Serial Communication Speed;
		2.4	Fixed serial communication speed at 2,400 bps;
		4.8	Fixed serial communication speed at 4,800 bps;
		9.6	Fixed serial communication speed at 9,600 bps;
		19.2	Fixed serial communication speed at 19,200 bps;
		38.4	Fixed serial communication speed at 38,400 bps;
		LIFE 57.6	Fixed serial communication speed at 57,600 bps;
Ptr	→ Parameter Recording Protection Menu;		
	---	d6r	Disables write protection;
	---	hGr	Enables write-protect
Pri	→ Menu for choosing parity, that is, the last bit to be transmitted in the message for data integrity checking;		
	---	Non	No Parity;
	---	Pair	Last bit of the message to be transmitted will be 0;
	---	IMP	Last bit of the message to be transmitted will be 1;
Pro	→ Menu to choose the type of Communication Protocol;		
	---	dnP	Configures DNP 3.0 (L1) as the communication protocol;
	---	MDB	Sets MODBUS RTU as the 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
tPA	→ Parallelism Control mode selection menu. **NOTE:** 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.		
	---	MON	Indicator in Slave or Follower mode;
		MONTH	Indicator in Master mode;
		Ind	Indicator in independent mode, on the smaller display it will indicate FA and bA for (Phase / Bank indicator);
		Pds	Set the parallelism type and confirm by pressing the SET key;
top	→ Menu for choosing Parallelism Network Topology type.		
	---	Ban	Network in single-phase transformers;
		tAF	Network in Transformer bank;
Neb	→ Menu to configure the number of Transformer Bank in the Parallelism Control network. **NOTE**: Menu available when the equipment is configured as Master		
	---	1 - 9 years	Available Transformer Bank menu in the Parallelism Control network.
Nep	→ Menu to configure the equipment number in the Parallelism Control network. **NOTE:** Menu available when the equipment is set to Master.		
	---	1 - 31 months	Configure the amount of equipment in the Parallelism Control Network;
Erp	→ Menu for configuring the address of the equipment in the Parallelism Control network.		
	---	1A 1B 1C . . . until... 9Aª9b 9C	Configure the address of the equipment in the Parallelism Control network;

Menu	Parameters	Variable	Description
SEP	→ Configuration Menu of the status of the Slave or Follower in the Control and Parallelism network; **NOTE:** 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. Configure the status of the equipment in the Parallelism Control Network and confirm by pressing the **SET key**.		
	1A 1B 1C . . .until... 9Aª9b 9C	ON	Address of the slave or follower in the Parallelism Enabled network;
	1A 1B 1C . . .until. . . 9Aª9b 9C	OFF	Address of the Slave or follower in the Disabled parallelism network;

ERROR DESCRIPTION

DISPLAY	ERROR DESCRIPTION
SOF	Error failure in the reading of the potentiometric crown;
FCS	Switching Failure – Raise TAP;
FCd	Switching Failure – Lower 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;
bCO	Communication failure blocking;
TMMI	Switching Failure – Minimum TAP;
TMA	Switching Failure – Maximum TAP;
EdU	Duplicate address failure;
Mdu	Failed Double Master.

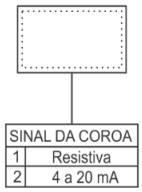
Display	Cause	Solution
OFF	Reliable signal from the sensor does not reach the IPTP	Check and replace if the power ring cable is not shielded.
		Check the grounding of the potentiometric ring cable.
		Check and eliminate possible bad contact.

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.

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.
RS485 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 0.25mm²
				>100m	0.35 to 0.5mm²
		0...5mA	1.6kΩ	<100m	0.2 to 0.35mm²
				>100m	0.5 to 0.75mm²
		0...10mA	800Ω	<100m	0.25 to 0.5mm²
				>100m	0.75 to 1.0mm²
		0...20mA	400Ω	<100m	0.5 to 0.75mm²
				>100m	1.0 to 1.5mm²
		4...20mA	400Ω	<100m	0.5 to 0.75mm²
				>100m	1.0 to 1.5mm²

Table 2 – Cabling Recommendation

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 IPTP directly on the SUN, whenever it is installed in the field it is important to have a panel with smoked glass, so that the ultraviolet rays that attack the front polycarbonate are filtered, in this way the life of the equipment will be prolonged.

WARRANTY TERM

The 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.

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.