

USERS MANUAL

TAP POSITION INDICATOR & PARALLELISM

CONTROL – IPTP



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INTRODUCTION

The position indicator and parallelism control **IPTP** is intended to control, supervise, and indicate the TAP position remotely on transformers that use on-load tap changers.

The **IPTP** was built in compliance with strict quality standards, using state-of-the-art electronic components (SMD), has a high-brightness LED display with 3-digit and is designed to withstand harsh working conditions. It can be installed in energy substation yards, offshore platforms, and chemical industries. It meets the requirements, support, and reliability levels according to IEC, DIN, IEEE, ABNT standards. The **IPTP** aluminum enclosure has high mechanical resistance and creates a Faraday cage that elevates the immunity of electronic circuits in case of noise induction and electric discharge shocks. The enclosure also acts as a heatsink, extending the life of the IED and meets DIN standards for panel mounting, with dimensions 96x96x52mm. The enclosure has a degree of protection IP20 according to NBR IEC 60529.

As a signal input, the **IPTP** receives information from the resistances of the potentiometer crown or current input from 0 to 20 mA or 4 to 20 mA, in this way it is possible to program the indication on the display to the front panel, the TAP position of the on load tap changer by the numeric simple (1 ... 51), bilateral (-24 ... 0 ... 24) or alphanumeric (L16 ... N ... R16) or other, as requested by the customer.

For universal analog signal output, the IPTP has an output that can be 0..1, 0..5, 0..10, 0..20 or 4..20mA (or other as required) and digital output with Modbus RTU and DNP 3 (L1) protocols that remotely allow access to all configuration parameters as well as TAP upload and download commands, change the status of Automatic/Manual and Remote/Local (a dedicated RS485 output for parallelism and another RS485 output for Scada system).

The **IPTP** is also equipped with features to indicate signal read failure, which occurs in the change of TAP position, if it has a time greater than 10 seconds or some type of failure in the potentiometer crown reading, such as cable rupture, resistor burning, etc.

There is also the storage function in memory of the maximum TAP and the minimum TAP reached in the period.

It also has the following contacts: 1 NOC relay to command the TAP rise and 1 NAF relay to control the TAP decrease; 1 NOC relay in case of OLTC lock; 1 NOC relay for fault indication (Watchdog); 1 digital output RS485 for communication with supervisory system; 1 configurable analog output (0..1, 0..5, 0..10, 0..20 or 4..20 mA) for TAP indication; 1 digital output dedicated RS485 for the parallelism function; 2 digital inputs for rise/decrease TAP; and 4 digital inputs for selection of the working mode.

There is a USB 2.0 front for parameterization through the software UseEasy™ (free for download on Electron's website). This allows the user to enter the default values in the transformer calculation, programming the **IPTP**, or verify that the parameterized values in the **IPTP** are correct. A much simple way and without the need to access these values through the equipment screen. It has another facility that is the AUTO DIAGNOSIS. In case of an error, alarm, or shutdown, the **IPTP** itself will perform an analysis on the parameters entered and will alert you to the possible causes of the event. As a result, the unplanned downtime will be lower compared to competitor equipment.

MAIN FEATURES

- High-brightness 3-digit display height of 20 mm and decimal place of 13 mm;
- Measurement range from 0 to 50 Positions (0 to 5000 Ohms) maximum step of 100 Ohms;
- Potentiometric 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 0 to 1, 0 to 5, 0 to 10, 0 to 20 and 4 to 20 mA configurable via the front;
- Front USB 2.0 for parameterization through UseEasy™ software;
- Stores the maximum and minimum TAP achieved in the period in memory;
- Fault Indication Contact (Watchdog);
- Drive to raise and lower TAP directly on the front or via RS485;
- 2 NA contacts for raising and lowering TAP;
- 3 Contacts for remote indication of the Monitor status;
- 2 contacts for remote access programming;
- Box of high mechanical resistance, built entirely in aluminum;
- Degree of protection IP20 (NBR IEC 60529);
- Auto Baud Rate from 2400 to 57,600 bps (Automatically detects the speed of the Communication network);
- Box of high mechanical resistance, built entirely in aluminum standard DIN IEC 61554;
- Small size 48x96x140mm;
- 2 year warranty;

TECHNICAL DATA

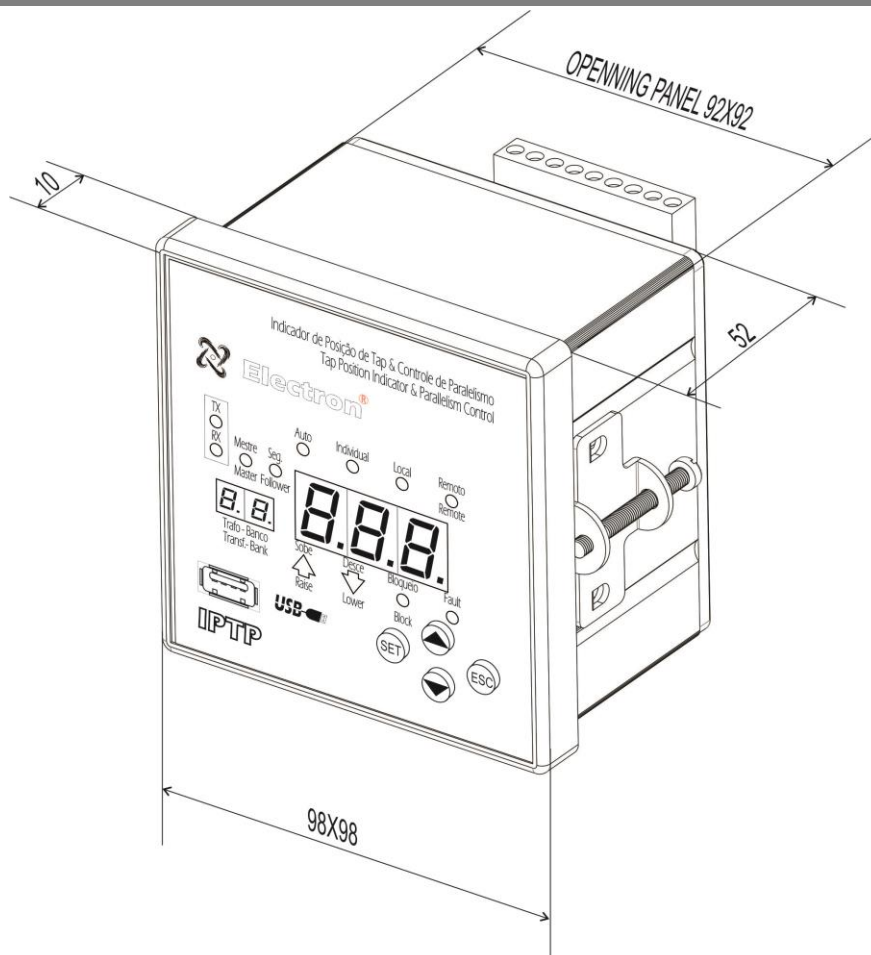
POSITION INDICATOR & PARALLELISM CONTROL - IPTP	
Power Supply	48 to 265 Vdc/Vca 50/60 Hz
Temperature Operation	-40 to + 85°C
Consumption	<15 W
Position Measurement Input	Potentiometer Crown 0 to 5000 Ohms Transducer 0 to 20 mA or 4 to 20 mA
Measurement Range	-50 to 50 TAP's – Programable (50 pos.)
Analog Outputs and Maximum Load Options	0 ... 1mA - 8000 Ohms
	0 ... 5mA - 1600 Ohms
	0 ... 10mA - 800 Ohms
	0 ... 20mA - 400 Ohms
	4 ... 20mA - 400 Ohms
Maximum Analog Output Error	0,25% end of scale
Output Contacts	4 - Potential Free
Maximum Switching Power	70 W / 250 VA
Maximum Switching Voltage	250 Vcc/Vca
Maximum Conduction Current	6,0 A
Serial Network Communication Port SCADA	RS 485(ANSI/TIA/EIA-485-A)
Communication protocol	Modbus RTU and DNP 3 L1
Auto Baud Rate	2400 to 57.600 bps
Enclosure (DIN IEC 61554)	96 x 96 x 52 mm – Aluminium

Fixing	Panel Mounting
Protection Degree	IP 20

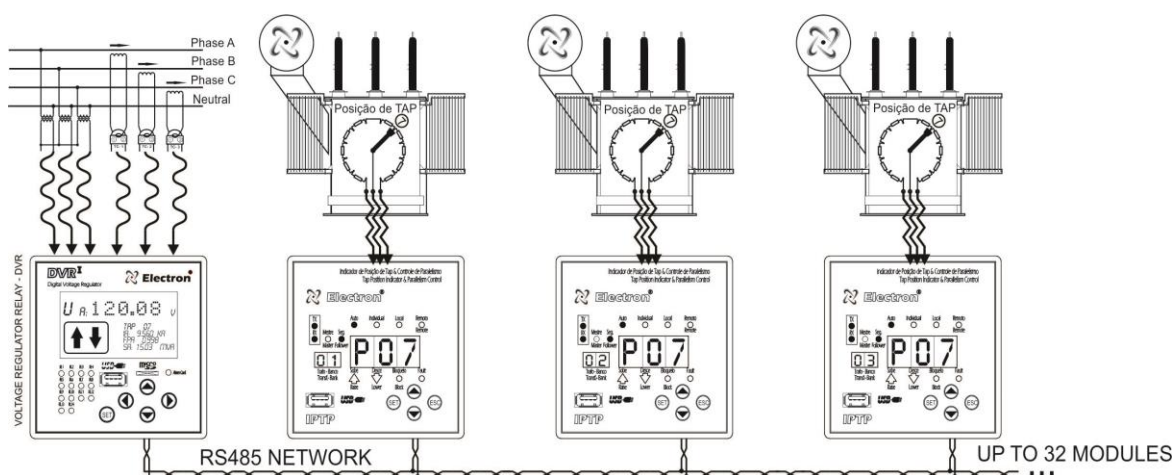
TYPE TESTS PERFORMED

- Insulation Voltage (**IEC 60255-5**): 2kV / 60Hz / 1 min. (to ground);
- Voltage impulse (**IEC 60255-5**): 1.2/50 μ seg. / 5kV / 3 neg. and 3 pos. / 5 segs. Interval;
- Voltage impulse (**IEC 60255-5**): 1.2/50 μ seg. / 5kV / 3 neg. and 3 pos. / 5 segs. Interval;
- Irradiated electromagnetic field immunity (**IEC 61000-4-3**): 80 to 1000 MHz / 10V/m;
- Fast electrical transient immunity (**IEC 60255-22-4**): Power./Input./Output=4KV/Serial port. 2kV;
- Surge immunity (**IEC 60255-22-5**): phase/neutral 1kV, 5 per polar. (\pm) - phase-ground/neutral-ground 2kV, 5 per pole (\pm);
- Conducted electromagnetic perturbations immunity (**IEC 61000-4-6**): 0,15 to 80 MHz / 10V/m;
- Climatic test (**IEC 60068-21-14**): -40°C + 85°C / 72 hours;
- Vibration resistance (**IEC 60255-21-1**): 3 axis / 10 to 150Hz / 2G / 160min/axis;
- Vibration response (**IEC 60255-21-1**): 3 axis / 0,075mm-10 to 58 Hz / 1G of 58 to 150 Hz / 8min/axis.

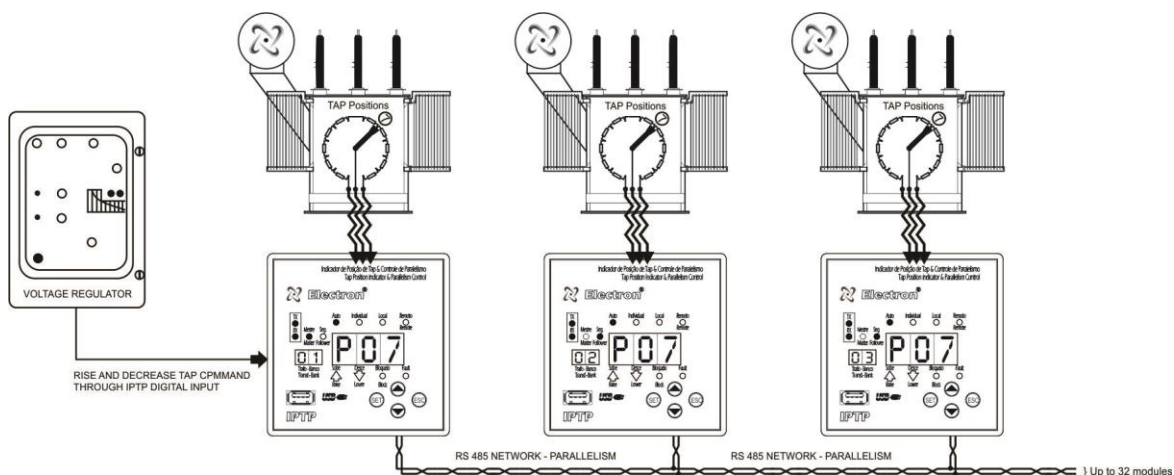
DIMENSIONS



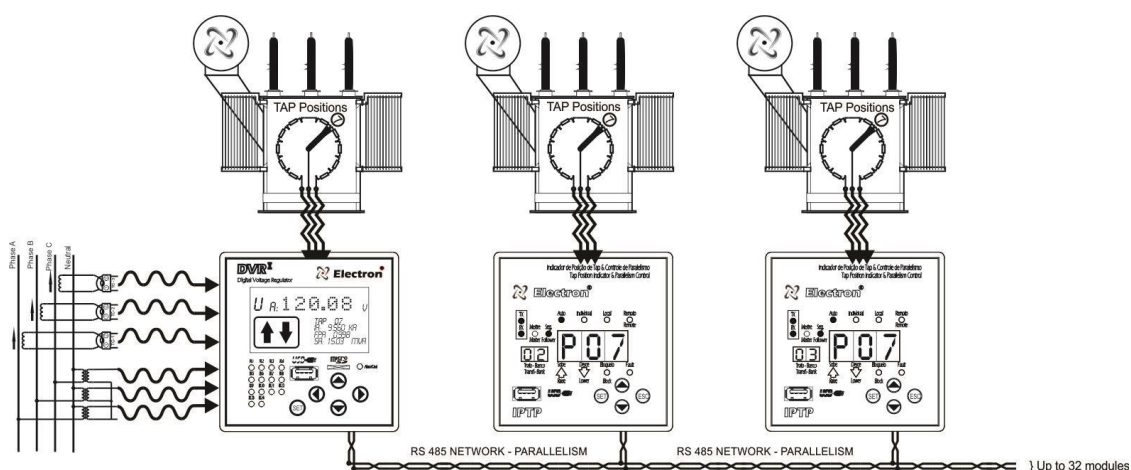
APPLICATION EXAMPLES



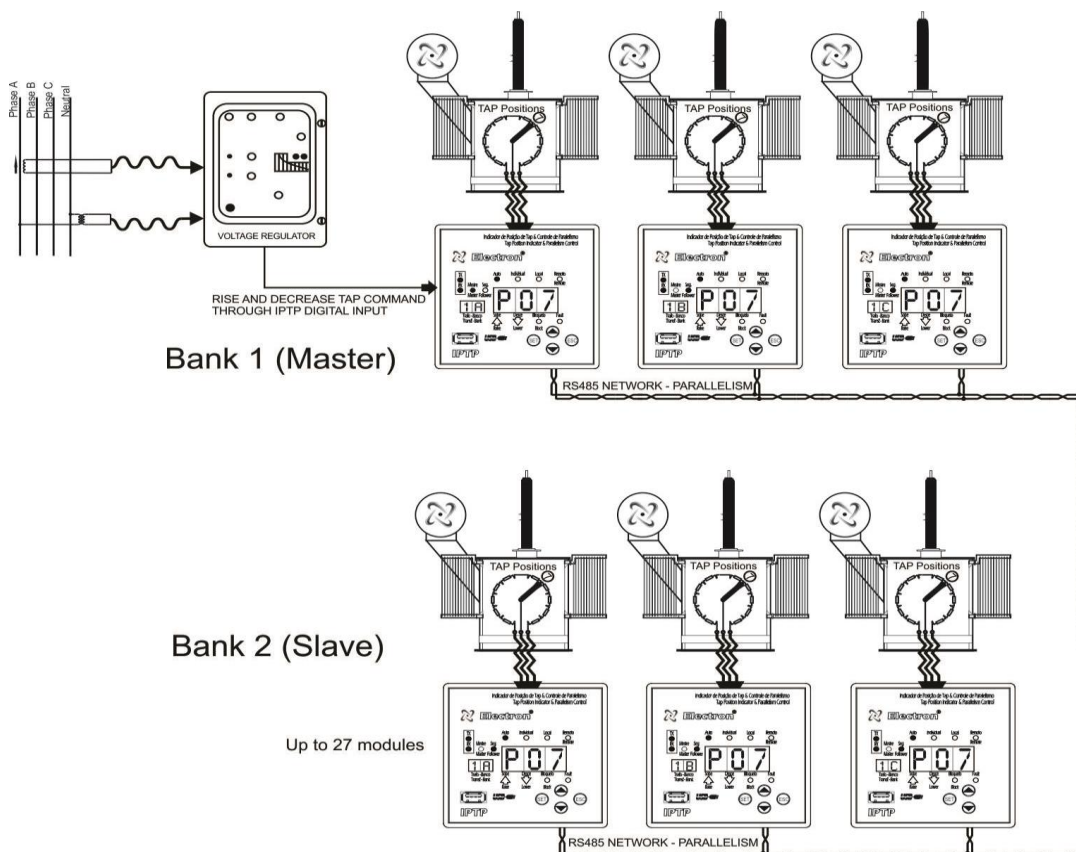
EXAMPLE 1 - Three-phase transformers bank operating in parallel connected by dedicated RS485 port commanded by the DVR



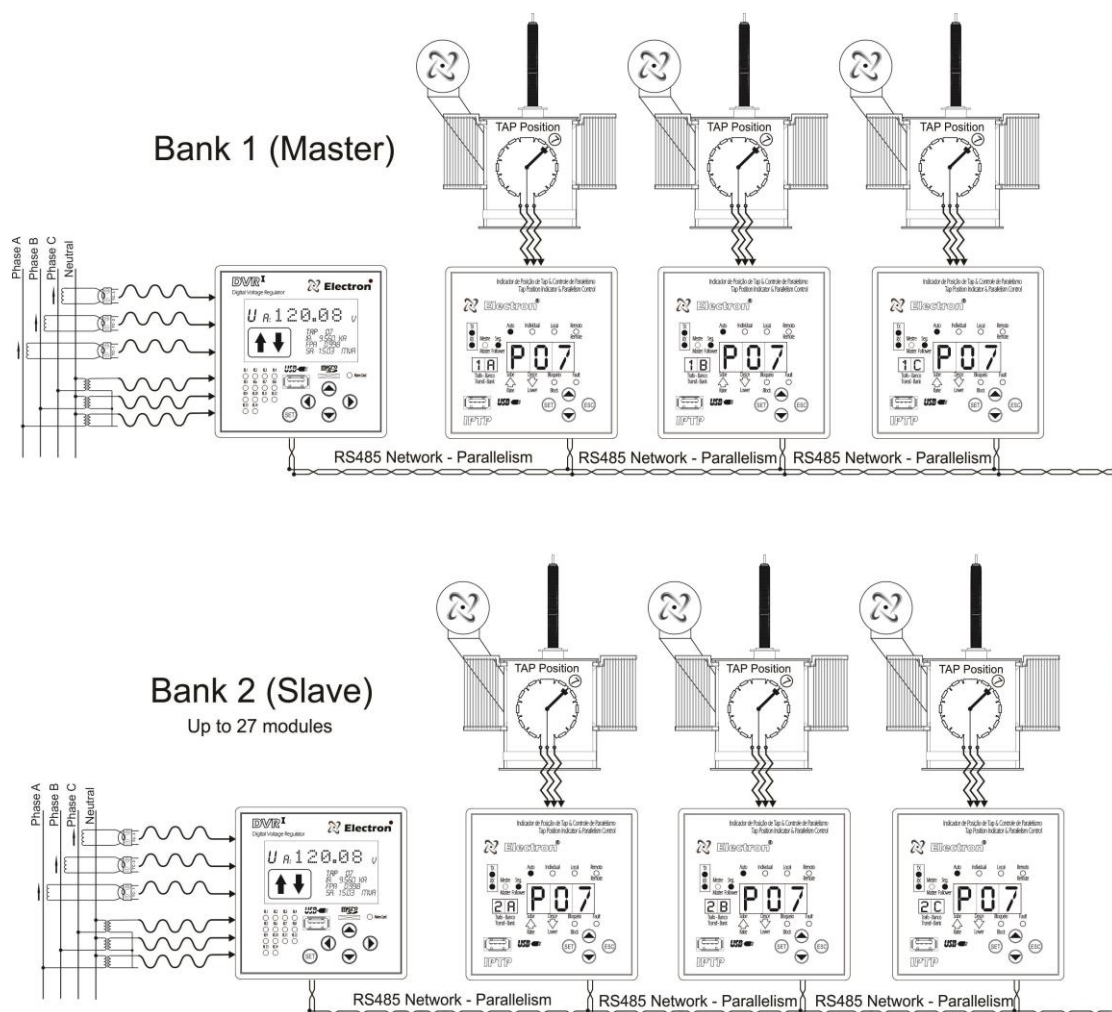
EXAMPLE 2 - Three-phase transformers bank operating in parallel, connected by the dedicated RS485 port controlled by the voltage regulator through the digital input of the IPTP



EXAMPLE 3 - Three-phase transformers bank operating in parallel connected by the dedicated RS485 port commanded by the voltage regulator (DVR) installed in the master transformer

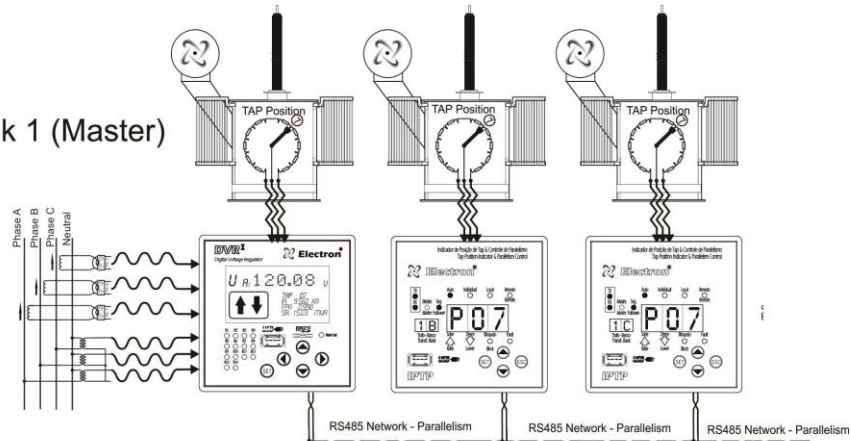
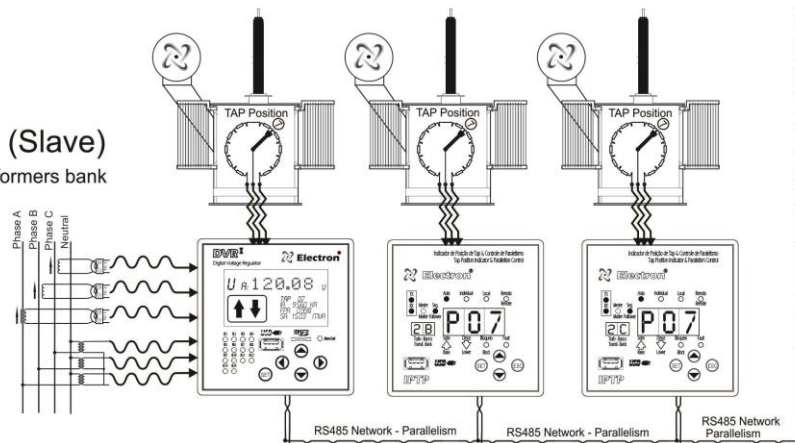


EXAMPLE 4 - Single-phase transformer bank operated in parallel connected by the dedicated RS485 port controlled by voltage regulator MK20 through the digital input of the IPTP



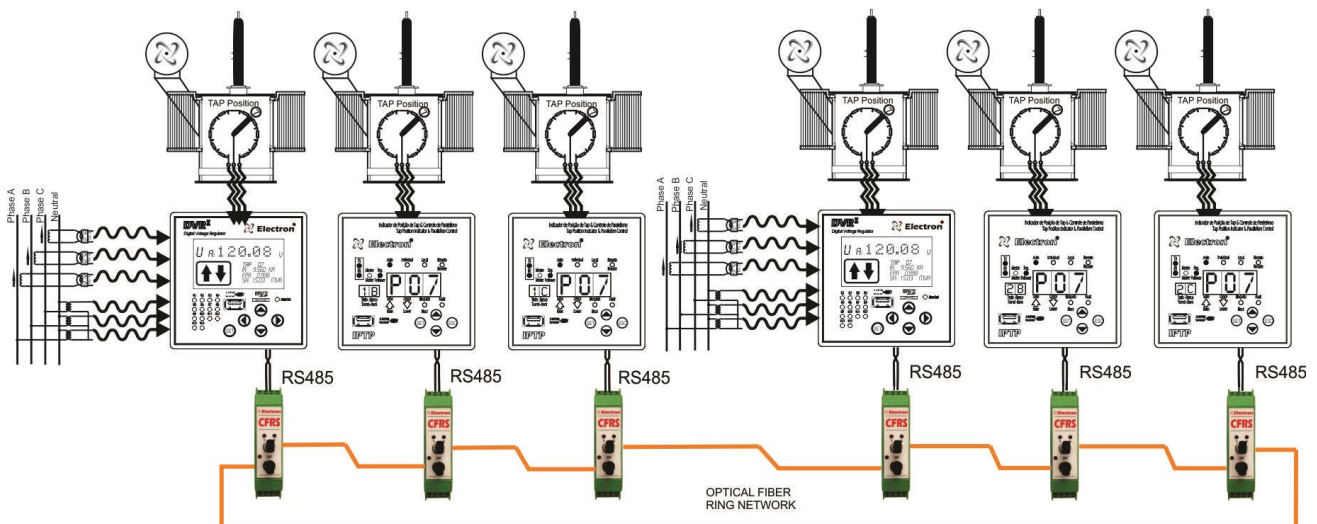
EXAMPLE 5 - Single-phase transformers bank operating in parallel connected by the dedicated RS485 port controlled by the voltage regulator (MASTER x SLAVE bank)

Bank 1 (Master)


Bank 2 (Slave)
Up to 9 transformers bank


Bank 1 (Master)

Bank 2 (Slave)



EXAMPLE 7 - Single-phase transformers bank operating in parallel connected by RS485 network x fiber optic converter (Electron recommends using fiber-optic network in situations where there may be electromagnetic inductions, electrical noise, atmospheric discharges or surges of voltages)

ACCESSORIES

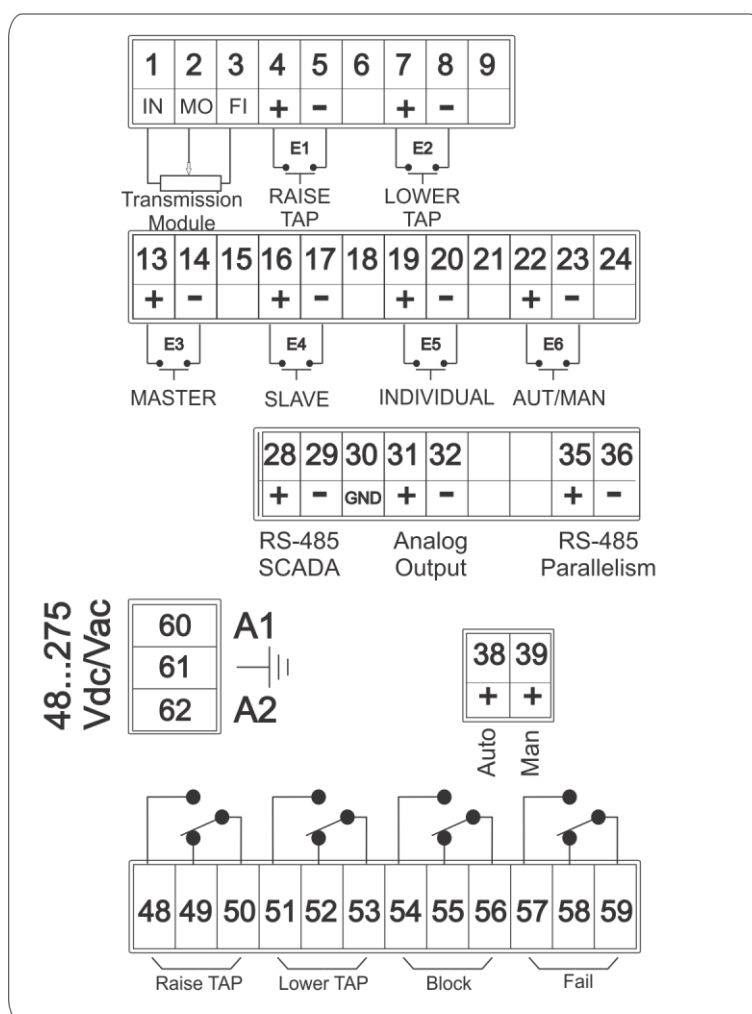


DRY CONTACT TRANSDUCER MODULE
UP TO 35 POSITIONS PA0374




BOX FOR EXTERNAL USE
PA0223

CONNECTION DIAGRAM



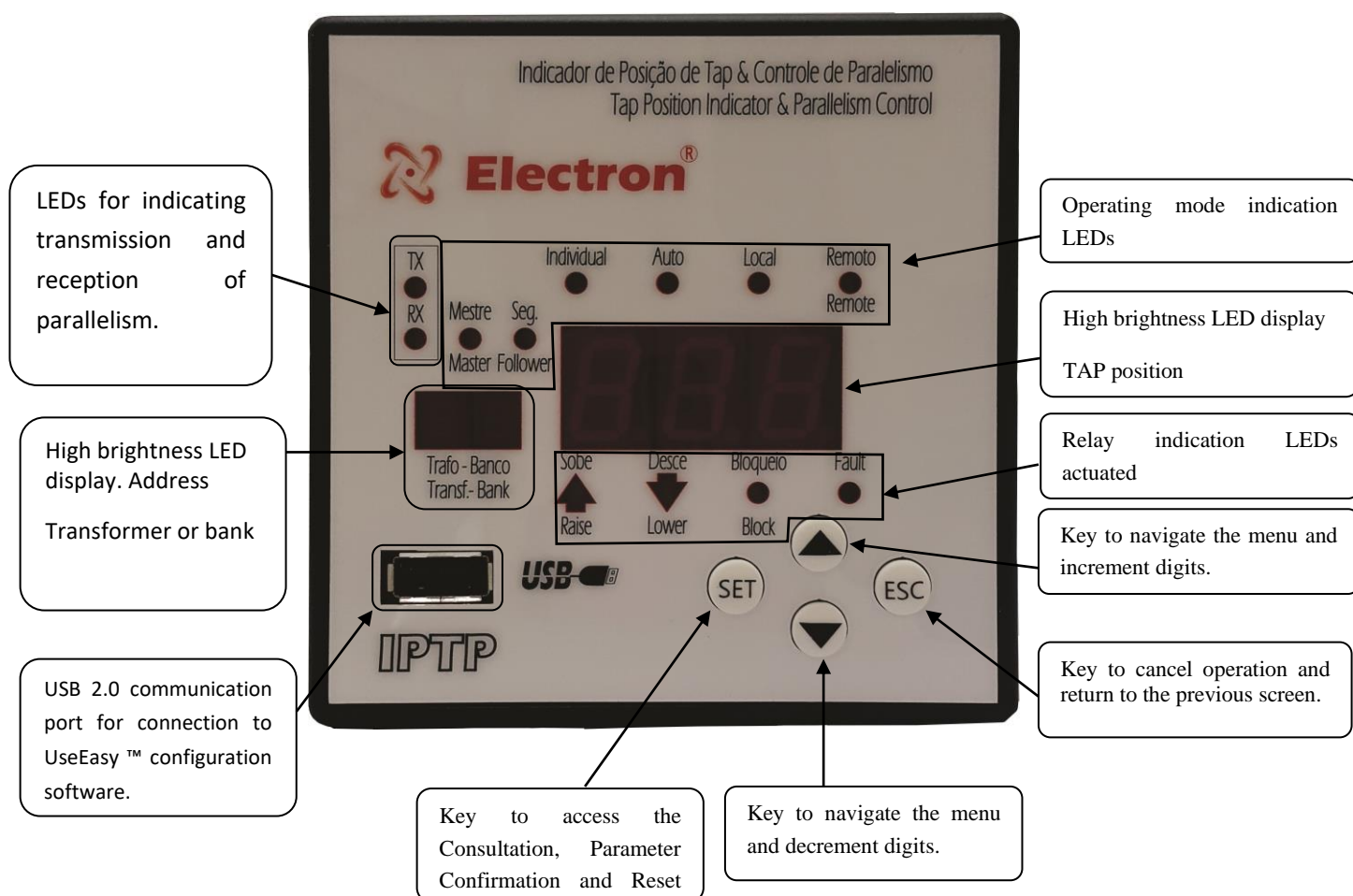
IPTP - TAP POSITION INDICATOR & PARALLELISM CONTROL

ORDER SPECIFICATION

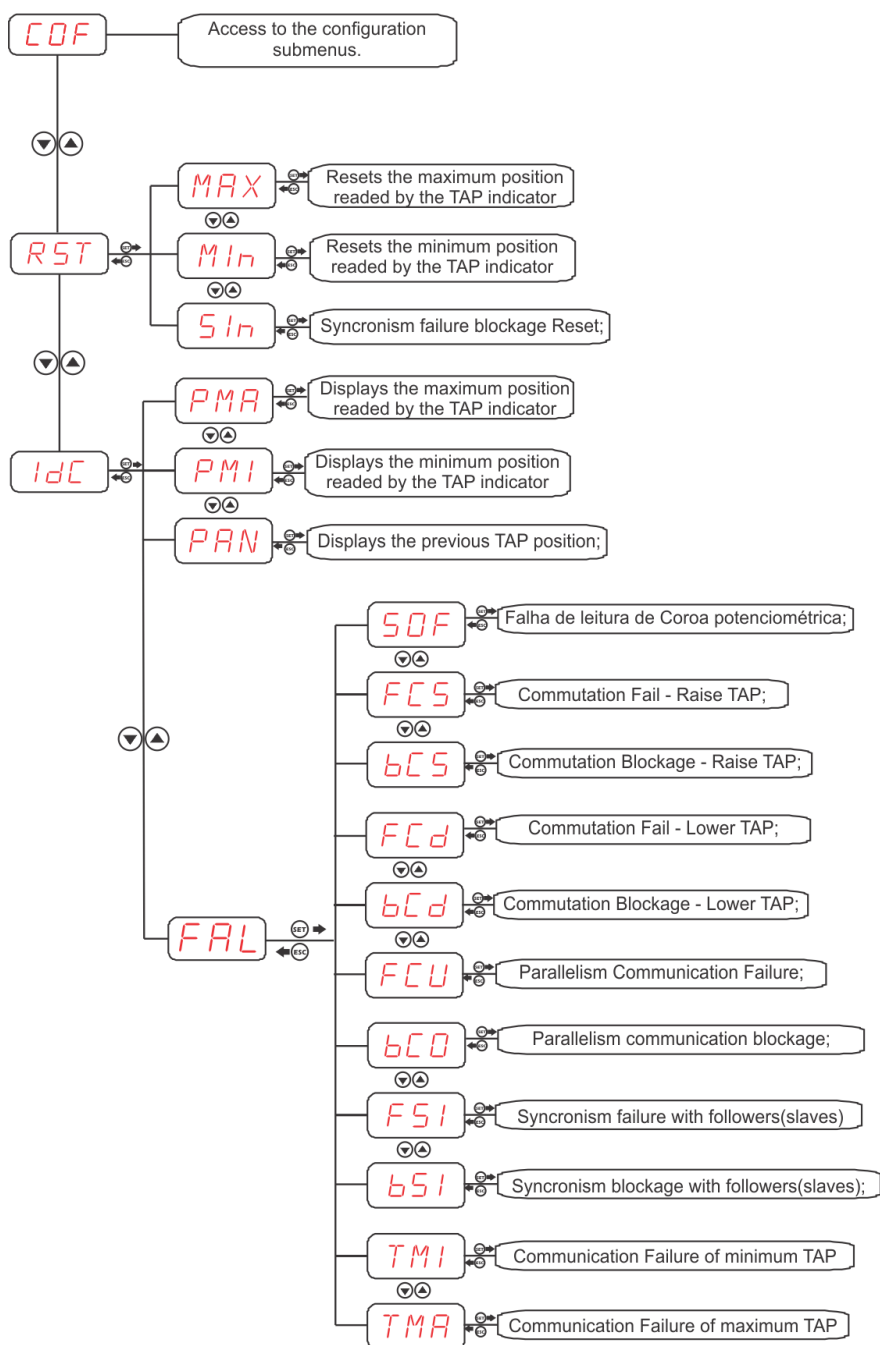
IPTP - 

TAP Changer Signal	
1	4 ... 20mA
2	Resistive

KNOWING THE IPTP



CONSULT MENU FLOWCHART

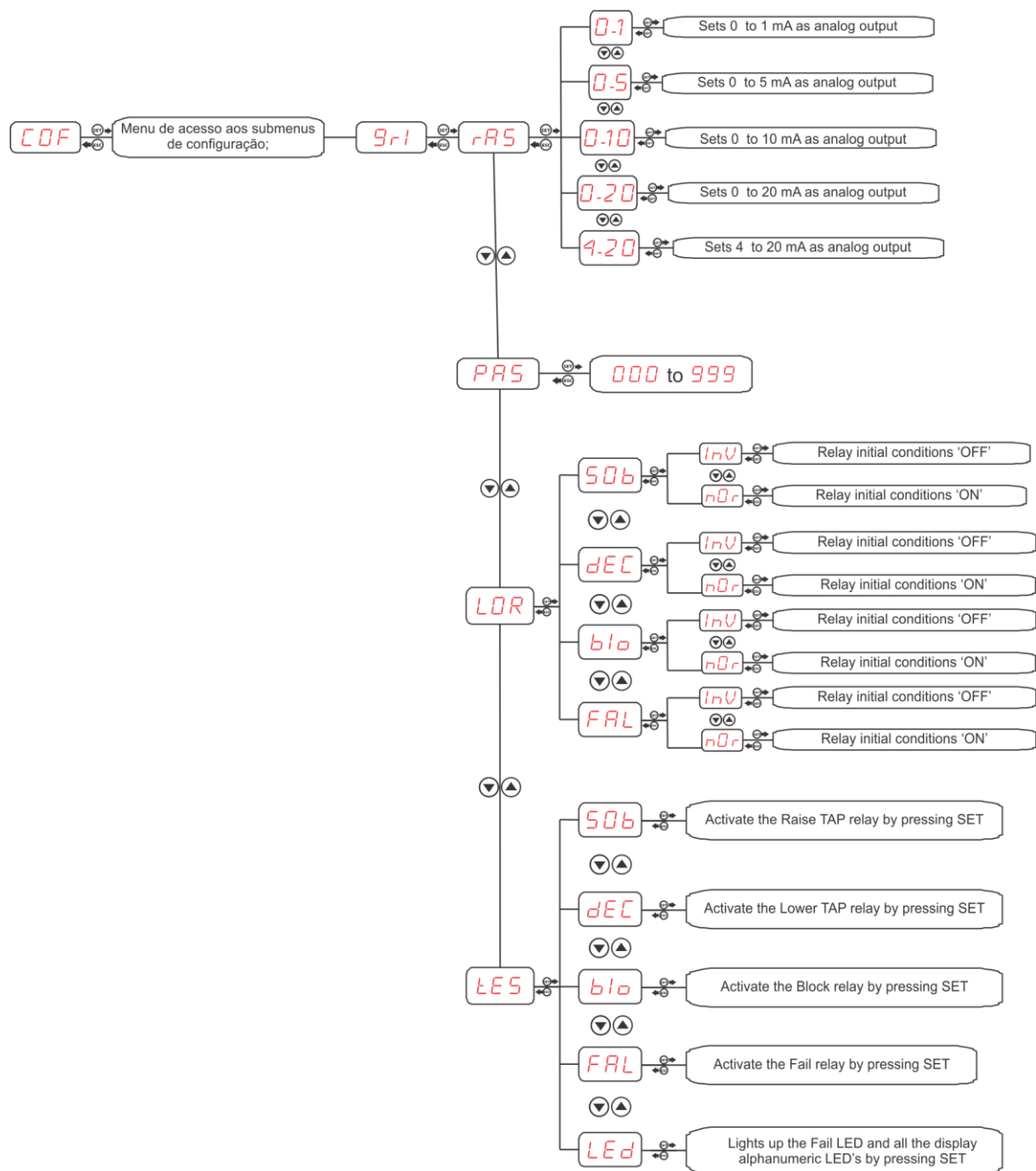


CONSULT MENU

To access this menu, press **SET**. Use the arrow buttons to navigate and select the desired menu. Next, press **SET** to check parameters and, to return to the previous menu, press **ESC**.

MENU	PARAMETER	VARIABLE	DESCRIPTION
<i>COF</i>	---	<i>000 - 999</i>	<p>Access menu to the configuration submenus</p> <p>Press SET on <i>COF</i> display will show a three digits number, it is your configured equipment password reminder. Next, the display will show <i>000</i>. Use the arrow buttons to change the numbers and just press SET, repeat this operation on every digit to carry on to the next session. Confirm the 3 digits of the correct password and the LED display will show <i>LnF</i>. Otherwise, the LED display will show <i>000</i> again.</p> <p>NOTE: The default password is <i>000</i> and the password reminder number <i>783</i>. Use the <i>PAS</i> menu to create a new three digits password. In forgetting cases, the user must contact ELECTRON DO BRASIL informing the password reminder number (<i>783</i>) and the password will be reset into the default password again.</p>
<i>IdC</i>	→ Menu for IPTP indicators checking.		
	<i>PMA</i>	---	Displays the maximum position reading by the TAP indicator
	<i>PMI</i>	---	Displays the minimum position reading by the TAP indicator
	<i>PAh</i>	---	Displays the previous TAP position;
	<i>FAL</i>	→ Menu to check the failures registered on the indicator	
		<i>SOF</i>	Falha de leitura da coroa potenciométrica;
		<i>FCF</i>	Commutation Failure – Raise TAP;
		<i>bCS</i>	Commutation Blockage – Raise TAP;
		<i>FCU</i>	Commutation Fail – Lower TAP;
		<i>bCO</i>	Parallelism Communication Blockage;
		<i>FSI</i>	Parallelism Communication Failure;
		<i>bSI</i>	Communication Blockage with the followers;
		<i>LMI</i>	TAP Minimum Communication Fail;
		<i>LMA</i>	TAP Maximum Communication Fail;
<i>rSt</i>	→ Menu. Select between <i>MAX</i> , <i>Min</i> , <i>SLn</i> and press SET to execute the RESET on the selected option.		
	---	<i>MAX</i>	Max TAP reached RESET;
	---	<i>Min</i>	Min TAP reached RESET;
	---	<i>SLn</i>	Blockage Reset by synchronism failure;

CONFIGURATION MENU FLOWCHART



CONFIGURATION MENU

Press **SET** on **COF** display will show a three digits number, it is your configured equipment password reminder. Next, the display will show **000**.

Use the arrow buttons to change the numbers and just press **SET**, repeat this operation on every digit to carry on to the next session. Confirm the 3 digits of the correct password and the LED display will show **CONF**. Otherwise, the LED display will show **000** again.

NOTE: The default password is **000** and the password reminder number **783**. Use the **PAS** menu to create a new three digits password. In forgetting cases, the user must contact ELECTRON DO BRASIL informing the password reminder number (**783**) and the password will be reset into the default password again.

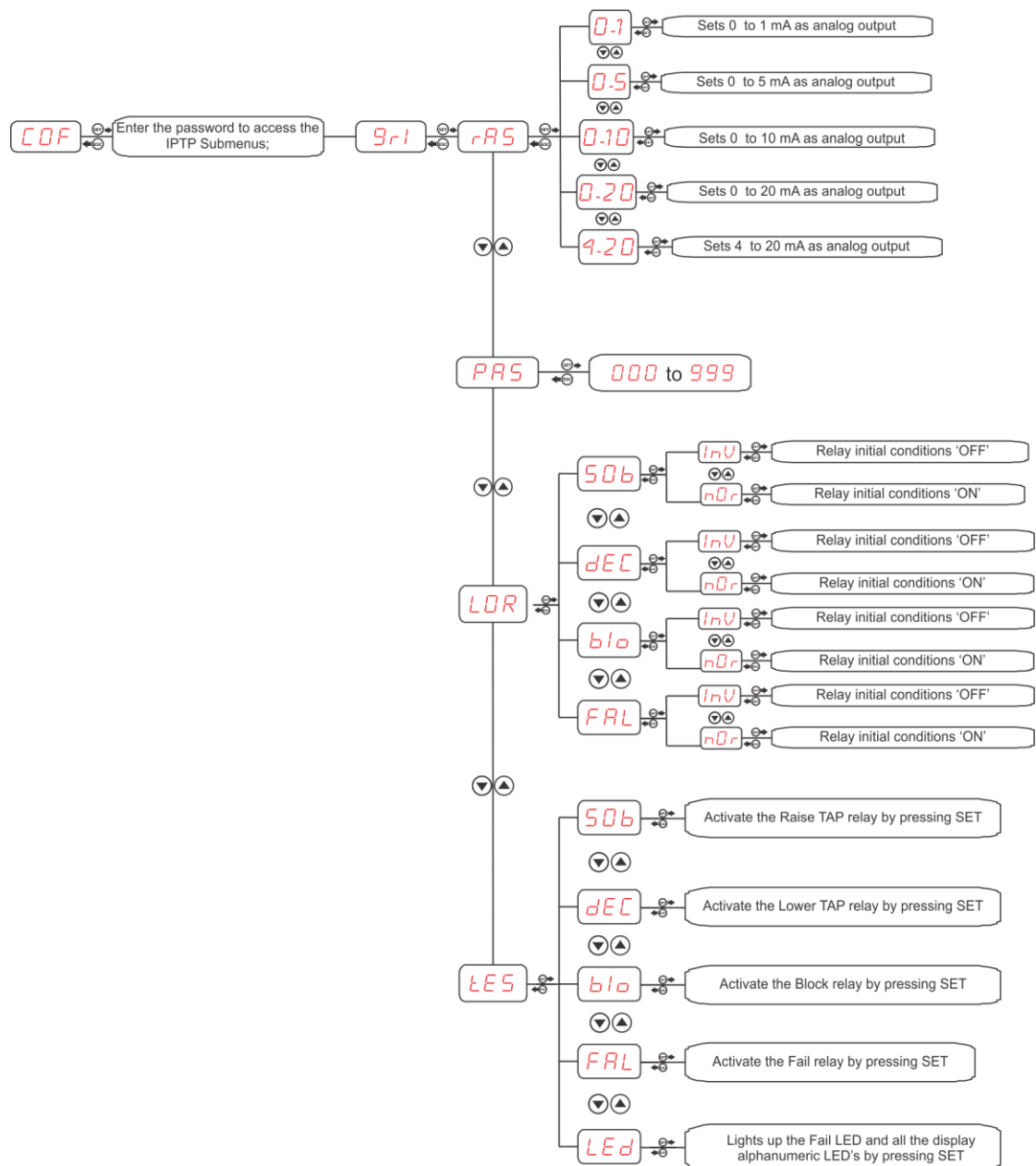
The **9r1** is a configuration menu electric of the current output, Relays, and activation tests parameters and it has the following submenus:

SUBMENU	PARAMETER	VARIABLE	DESCRIPTION
9r5	→ Menu for current output value on 31 and 32 contacts.		
	---	0.1	Enables 0 to 1 mA on the current output;
	---	0.5	Enables 0 to 5 mA on the current output;
	---	0.10	Enables 0 to 10 mA on the current output;
	---	0.20	Enables 0 to 20 mA on the current output;
	---	4.20	Enables 4 to 20 mA on the current output;
PAS	---	000 to 999	<p>Menu to change the 3 digits password.</p> <p>This password will be used to access the IPTP configuration menu. To change the numbers, use the arrow buttons, to confirm the chosen digit and go to the following digit press SET. To return to the previous digit, press ESC.</p> <p>The default password is 000 and the password reminder number 783. In forgetting cases, the user must contact ELECTRON DO BRASIL informing the password reminder number (783) and the password will be reset into the default password again.</p>
9r1	→ Menu to test the relays activation and the LEDs activations to check the IPTP installation and indication		
	SOB	NOF	Relay initial conditions "OFF" Normal;
		INV	Relay initial conditions "ON" Inverse;
	DEC	NOF	Relay initial conditions "OFF" Normal;
		INV	Relay initial conditions "ON" Inverse;
	blo	NOF	Relay initial conditions "OFF" Normal;
		INV	Relay initial conditions "ON" Inverse;
	FAL	NOF	Relay initial conditions "OFF" Normal;
		INV	Relay initial conditions "ON" Inverse;

CONFIGURATION MENU

SUBMENU	PARAMETER	VARIABLE	DESCRIPTION
LES	→ Menu to test the relays activation and LEDs operation, to check the IPTP installation and indication.		
	SOB	---	Activate Relay 1 (Raise TAP) by pressing the SET key;
	DEC	---	Activate Relay 2 (Lower TAP) by pressing the SET key;
	blo	---	Activate Relay 3 (Lock) by pressing the SET key;
	FAL	---	Activate Relay 4 (Fault) by pressing the SET key;
	LEd	---	Test all the equipment's LEDs by pressing the SET key;

TAP CHANGER CONFIGURATION MENU FLOWCHART

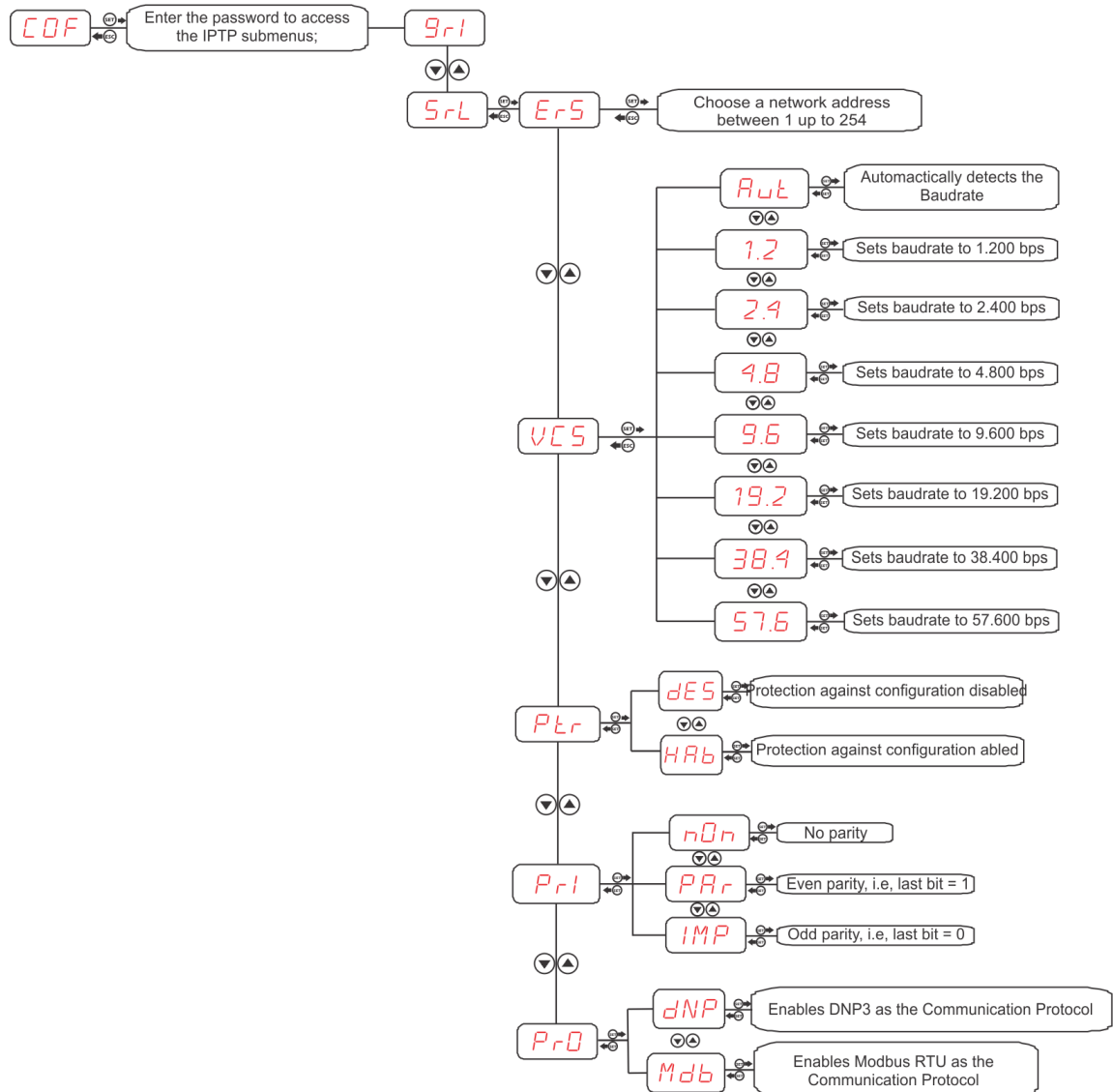


TAP CHANGER CONFIGURATION MENU

O menu **CMU** é de configuração de parâmetros do comutador e contém os seguintes submenus:

SUBMENU	PARAMETER	VARIABLE	DESCRIPTION
CPD	→ Menu to Set the indication position range, use the arrow buttons to configurate the initial position value and press SET . And the menu to set the final indication TAP position, according with the parametrize value.		
	Ini	-50 to 50	Set the initial position value;
	Fin	-50 to 50	Set the final position value;
PSr	---	5 to 200 Ohms	Menu configurate the resistive top or transmission module;
LLI	→ Menu to Reading initialization mode choice of the transmission module.		
	---	PIn	It indicates from the configured initial position on the CPD submenu;
	---	PrE	The indicator starts an indication from the resistive step, i.e, one position ahead than the initial position;
LOC	→ Choose the TAP Changer command mode.		
	---	L	TAP Changer command in local mode;
	---	Mr	TAP Changer command in “remote” Manual mode;
	---	MLr	TAP Changer command in “Local and Remote” Manual mode;
	---	Ar	TAP Changer command in “remote” automatic mode;
	---	ALr	TAP Changer command in “Local and Remote” Automatic mode;
	---	b	TAP Changer command blocked;
TCr	→ Configure the relay activation type to raise and low the TAP position;		
	---	COS	The relay will be constantly activated until a commutation to happen or if occurs a commutation time counting;
	---	PUL	The relay will remain activated by the determined time at the LP_r menu;
LCS	→ TAP Changer Successive command selection submenu, until occurs a synchronism failure;		
	---	bCC	It blocks Commands on TAP Changer;
	---	rbC	Returns to the previous position and blocks the TAP Changer;

SERIAL COMMUNICATION CONFIGURATION MENU FLOWCHART

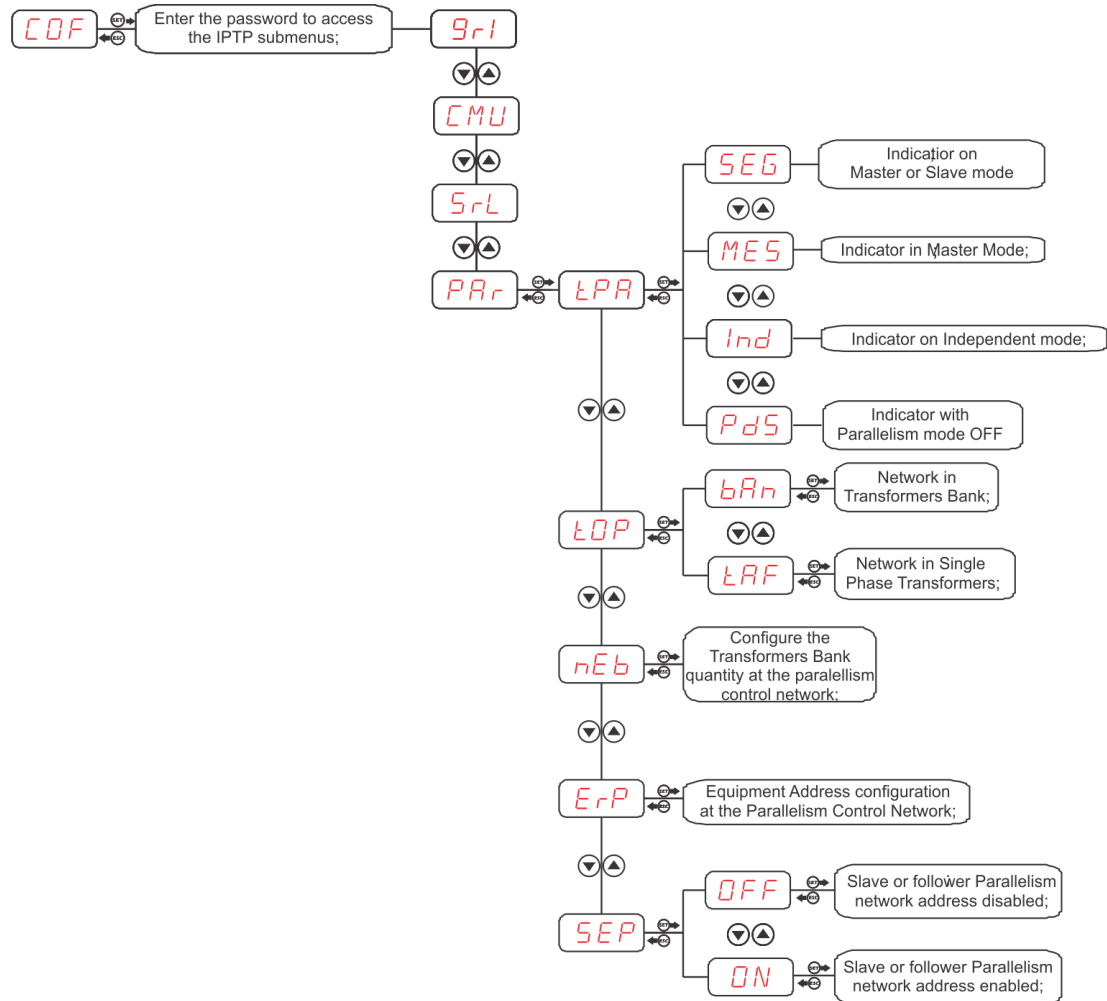


SERIAL COMMUNICATION CONFIGURATION MENU

SrL is a communication parameters configuration and it has the following submenus:

Submenu	Parameter	Variable	Description
<i>ErS</i>	→ Menu to adjust the equipment serial network communication address. Each equipment connected in a RS485 network must have a different numeric address than the others, to be identified.		
	---	<i>OFF</i>	Serial network disabled;
		<i>1 to 254</i>	Enter a single address and confirm it pressing SET ;
<i>UCS</i>	→ Submenu to configure the Serial communication speed;		
	---	<i>AUT</i>	Automatically detects the Baudrate;
		<i>2.4</i>	Sets baudrate to 2.400 bps;
		<i>4.8</i>	Sets baudrate to 4.800 bps;
		<i>9.6</i>	Sets baudrate to 9.600 bps;
		<i>19.2</i>	Sets baudrate to 19.200 bps;
		<i>38.4</i>	Sets baudrate to 38.400 bps;
<i>PLr</i>	→ Parameters configuration protection submenu;		
	---	<i>dGr</i>	Configuration protection disabled;
	---	<i>hGr</i>	Configuration protection abled;
<i>PrI</i>	→ Choose the bit parity, i.e, the last transmitted bit to verify data integrity.;		
	---	<i>nOn</i>	No parity;
	---	<i>Par</i>	Even parity, the last transmitted message bit will be 0;
<i>PrO</i>	→ Choose the communication protocol;		
	---	<i>dnp</i>	Sets the DNP3.0 as communication protocol;
	---	<i>Mdb</i>	Sets the Modbus RTU as communication protocol;

PARALLELISM CONFIGURATION MENU FLOWCHART



PARALLELISM CONFIGURATION MENU

PAR Parallelism parameters configuration has the following submenus:

Submenu	Parameter	Variable	Description
<i>LPA</i>	→ Parallelism Control mode selection. NOTE: If there is a configuration with jumper of the parallelism control mode at the IPTP connector, this submenu configured parameter will always prevail.		
	---	<i>SEG</i>	Indicator in Slave or Follower mode;
		<i>MES</i>	Indicator in Master mode;
		<i>Ind</i>	Indicator in Independent mode
		<i>Pds</i>	Configure the Parallelism type and confirm it pressing SET ;
<i>LOP</i>	→ Choose the topology type of the Parallelism network;		
	---	<i>bAn</i>	Network in Transformer Bank;
		<i>LAF</i>	Network in Single Phase Transformer;
<i>nEb</i>	→ Select the Transformers bank quantity at the network parallelism. NOTE: This submenu will be only available when the IPTP is set as the Master.		
	---	<i>1 - 9</i>	Enter the Transformer bank quantity in a range between 1 up to 9
<i>nEP</i>	→ Select the equipment's quantity at the network parallelism NOTE: This submenu will be only available when the IPTP is set as the Master.		
	---	<i>1 - 31</i>	Configure the equipment quantity at the parallelism control network between 1 up to 31 range.
<i>ErP</i>	→ Menu for setting the equipment address in the Parallel Control network. NOTE: Submenu not available when the IPTP is set as Master.		
	---	<i>1A 1B</i> <i>1C ... up</i> <i>to...</i> <i>9A 9B</i> <i>9C</i>	Select the equipment's address at the parallelism control network;

PARALLELISM CONFIGURATION MENU

Submenu	Parameter	Variable	Description
	→ Parallelism Control Network Master or slave status configuration Submenu. NOTE: This submenu will be only available when the IPTP is set as the Master and the Topology type is in 'Bank". The slaves address or followers will be represented by the "X" letter and the bank phase is represented by the "W" letter. Set the equipment status on the parallelism control network and confirm it pressing SET		
SEP	1A 1B 1C ...up to... 9A 9B 9C	ON	Address of the slave or follower in the Enabled Parallelism network;
	1A 1B 1C ...up to... 9A 9B 9C	OFF	Slave or follower address on the parallelism network Disabled;

ERROR DESCRIPTIONS

DISPLAY	ERROR DESCRIPTION
SDF	Transmission module Reading failure;
FCS	Commutation Failure – Raise TAP;
FCd	Commutation Failure – Lower TAP;
FCU	Parallelism communication failure;
FSI	Synchronism failure with Followers;
BSI	Block by synchronism failure;
BCd	Commutation blockage – Lower TAP;
BcS	Commutation blockage – Raise TAP;
BCO	Communication failure blockage;
LMI	Commutation Failure – TAP Minimum;
TMA	Commutation Failure – TAP Maximum;

TROUBLESHOOTING

DISPLAY	CAUSE	SOLUTION
OFF	There is no reliable sign coming to IPTP	Check and replace in case if the transmission module is not shielded
		Check the transmission module grounding
		Check and eliminate possible bad contact.

The IPTP returns automatically to the reading more when normalized. To RESET the IPTP, press and hold **SET** for nearly 5 seconds until **rsL** shows up to the LED screen, then, release the **SET** button and the equipment will RESET. The IPTP has a fail contact (relay 4), and it will activate in **FAILURES** cases or power supply failures.

IMPORTANT RECOMENDATIONS

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

1. Both sensors and equipment must be grounded. Do not use the same grounding point for power and sensor, so that there is no potential difference.
2. Utilizar na rede de comunicação (Rs485) resistores de 120 Ohms nas 2 extremidades da linha de transmissão (início e fim) a fim de gerar diferença de potencial necessária para o correto funcionamento da rede de comunicação.

Use 120 Ohm resistors at the communication network (RS-485) at the transmission line both ends (End and beginning), to generate a needed potential difference to ensure the communication network stability.

3. Do not expose the IPTP under direct sun rays. It is recommended that 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 IPTP frontal polycarbonate are filtered, in this way the life of the equipment will be extended

WARRANTY TERM

TAP & PARALLEL CONTROL POSITION INDICATOR - IPTP Electron has a warranty period of two years from the date of sale set out in the invoice, with coverage for any manufacturing defects that make it inappropriate or inappropriate for the intended applications.

WARRANTY EXCLUSION

The warranty does not cover transportation costs for technical assistance, freight, and insurance for product shipments with indications of defects or malfunctions.

The following events are also not covered:

- Natural wear of parts due to continuous and frequent use, damage to the outside caused by falls or improper packaging.
- attempted to repair/breach of the seal with damage caused by people unauthorized by Electron and in disagreement with the instructions that are part of the technical description.

WARRANTY TERM

Warranty Loss

The product automatically loses its warranty when:

- The instructions for use and assembly contained in this manual and the installation procedures contained in NBR 5410 are not observed.
- Subject to conditions outside the limits specified in the respective technical specifications.
- Violated or repaired by someone other than Electron's technical staff.
- The damage is caused by a fall or impact.
- Infiltration of water or any other liquid occurs.
- Overload occurs which causes degradation of product electronic components and parts.

Warranty Utilization

To take advantage of this guarantee, the customer must send the product to Electron together with a copy of the purchase invoice, properly packaged so that there will be no damage during transportation. For prompt assistance, it is recommended to send as much information as possible regarding the detected defect. The equipment analyzed and subjected to complete functional tests. A Product analysis and eventual maintenance will only be carried out by the Electron do Brasil technical team at its headquarters.

CONFORMITY CHART

Download link:

UPDATING CONTROL

Revision Nº 0 – 2020/June

- User's Manual New English Version;