



INSTRUMENTOS PARA TESTES ELÉTRICOS

Test Tutorial

Equipment Type: Protection Relay

Brand: ABB

Model: RET670

Functions: 27 or PTUV – Undervoltage & 59 or PTOV – Overvoltage

Tool Used: CE-6003, CE-6006, CE-6707, CE-6710, CE-7012 or CE-7024

Objective: Test the pick-up and actuation time of the undervoltage and overvoltage elements using the Quick software

Version Control:

Version	Descriptions	Date	Author	Reviewer
1.0	Initial Version	30/06/2022	M.R.C.	G.C.D.P.

INSTRUMENTOS PARA TESTES ELÉTRICOS

Summary

1. Relay connection to CE-6710	5
1.1 <i>Auxiliary Source</i>	5
1.2 <i>Voltage Coils</i>	5
1.3 <i>Binary Inputs</i>	6
2. Configuration of the RET670 relay	6
2.1 <i>Creating a new file</i>	7
2.2 <i>Configuring Communication</i>	10
2.3 <i>TRM_9I_3U_3I</i>	13
2.4 <i>SETGRPS: 1</i>	15
2.5 <i>PRIMVAL: 1</i>	15
2.6 <i>AISVBAS: 1</i>	16
2.7 <i>Application Configuration</i>	16
2.8 <i>SMAII (Voltages)</i>	17
2.9 <i>OV2PTOV (Overvoltage)</i>	22
2.10 <i>UV2PTUV (Undervoltage)</i>	24
2.11 <i>Binary Outputs</i>	25
3. Parameterization of the ABB RET670 relay	29
3.1 <i>RET 670 Parameter Setting</i>	29
4. Quick software adjustments	34
4.1 <i>Opening the Quick</i>	34
4.2 <i>Configuring the Settings</i>	35
4.3 <i>System</i>	36
5. Channel Direction and Hardware Configurations	37
6. Test structure for function 27/59	39
6.1 <i>Voltage x Time > Undervoltage screen</i>	39
6.2 <i>General Settings 27</i>	39
6.3 <i>Timed Element 27-1 Pick-up Test</i>	40
6.4 <i>Timed Element 27-2 Pick-up Test</i>	44
6.5 <i>Element 27-1 point test</i>	46
6.6 <i>Element 27-2 point test</i>	46
6.7 <i>Voltage x Time > Overvoltage screen</i>	47
6.8 <i>General Adjustments 59</i>	48
6.9 <i>Timed Element 59-1 Pick-up Test</i>	49



INSTRUMENTOS PARA TESTES ELÉTRICOS	
6.10	<i>Timed Element 59-2 Pick-up Test</i> 51
6.11	<i>Element 59-1 point test</i> 53
6.12	<i>Element 59-2 point test</i> 54
7.	Report..... 54
APPENDIX A 56	
A.1	Terminal Designations 56
A.2	Technical data..... 58

Statement of responsibility

The information contained in this tutorial is constantly verified. However, differences in description cannot be completely excluded; in this way, CONPROVE disclaims any responsibility for errors or omissions contained in the information transmitted.

Suggestions for improvement of this material are welcome, just user contacts us via email suporte@conprove.com.br

The tutorial contains knowledge gained from the resources and technical data at the time was writing. Therefore, CONPROVE reserves the right to make changes to this document without prior notice.

This document is intended as a guide only; the manual of the equipment under test should always be consulted.



ATTENTION!

The equipment generates high current and voltage values during its operation. Improper use of the equipment can result in material and physical damage.

Only suitably qualified people should handle the instrument. It should be noted that the user must have satisfactory training in maintenance procedures a good knowledge of the equipment under test and also be aware of safety standards and regulations.

Copyright

Copyright © CONPROVE. All rights reserved. The dissemination, total or partial reproduction of its content is not authorized, unless expressly permitted. Violations are punishable by law.

INSTRUMENTOS PARA TESTES ELÉTRICOS
Sequence for testing the RET670 relay in the Quick software

1. Relay connection to CE-6710

Appendix A shows the relay terminal designations.

1.1 Auxiliary Source

Connect the positive (red terminal) of the Aux Source. Vdc to pin 4 on the relay terminal X11 and the negative (black terminal) of the Aux Source Vdc to pin 5 of the relay terminal X11.

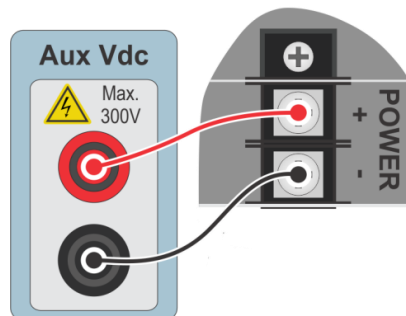


Figure 1

1.2 Voltage Coils

To establish the connection of the voltage coils, connect channels V1, V2 and V3 with pins 19, 21 and 23 of the relay terminal X401 and the common ones to pins 20, 22 and 24. If these last three points are short-circuited, connect all common to that point.

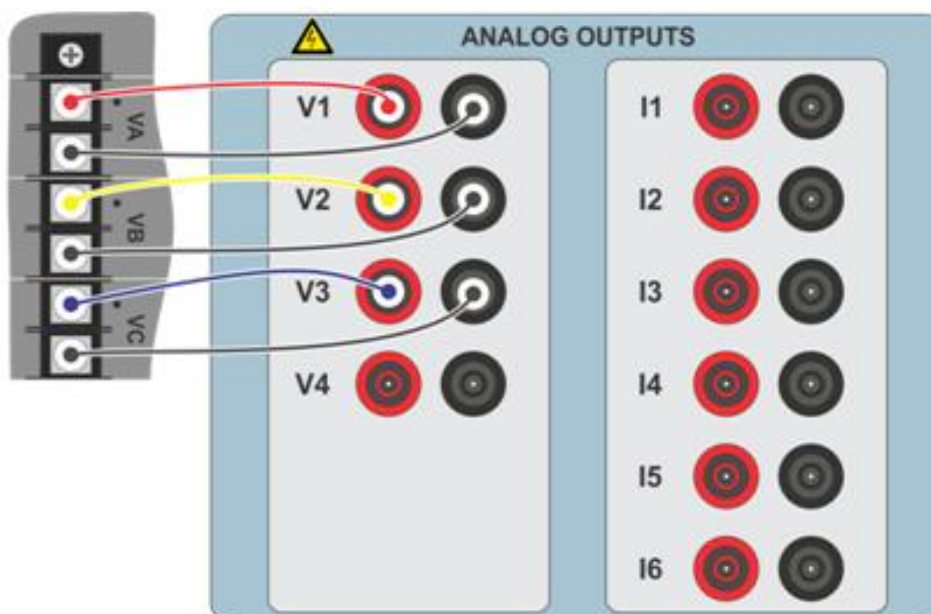


Figure 2

1.3 Binary Inputs

Connect the binary input of the CE-6710 to the binary output of the relay slot X31.

- BI1 to pin 01 and its common to pin 02.
- BI2 to pin 03 and its common to pin 02.
- BI3 to pin 04 and its common to pin 05.
- BI4 to pin 06 and its common to pin 05.

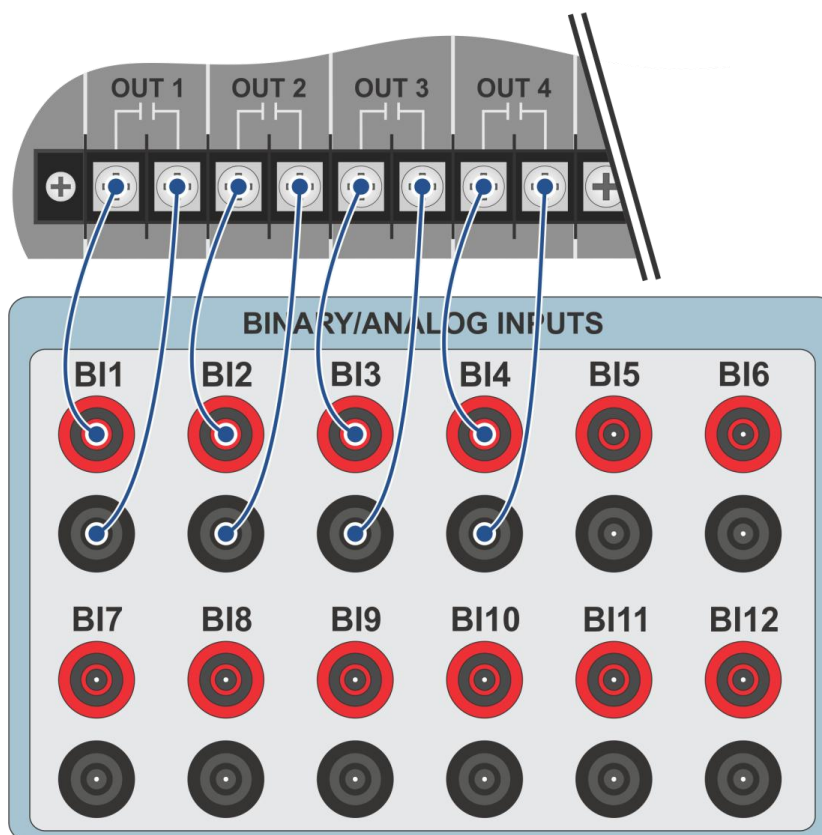


Figure 3

2. Configuration of the RET670 relay

Connect a notebook Ethernet cable to the relay. Then open PCM600 by double clicking on the software icon.



Figure 4

Note: In this tutorial, it is considered that there is no configuration in the relay, so that all parameterization will be inserted in the relay.

2.1 Creating a new file

First, a new project must be added. Click on “File” and then “New Project...”.

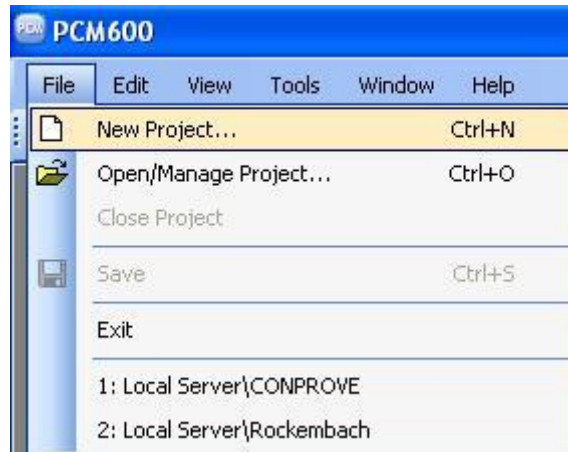


Figure 5

Choose a name for the project, in which case “PTOV_PTUV” was used and then click on “Create”.

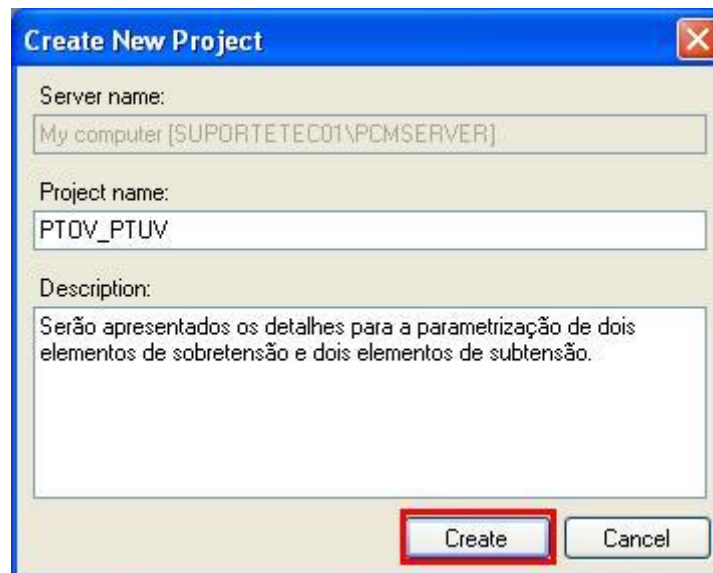


Figure 6

Right click on the created plant and insert a substation.

INSTRUMENTOS PARA TESTES ELÉTRICOS

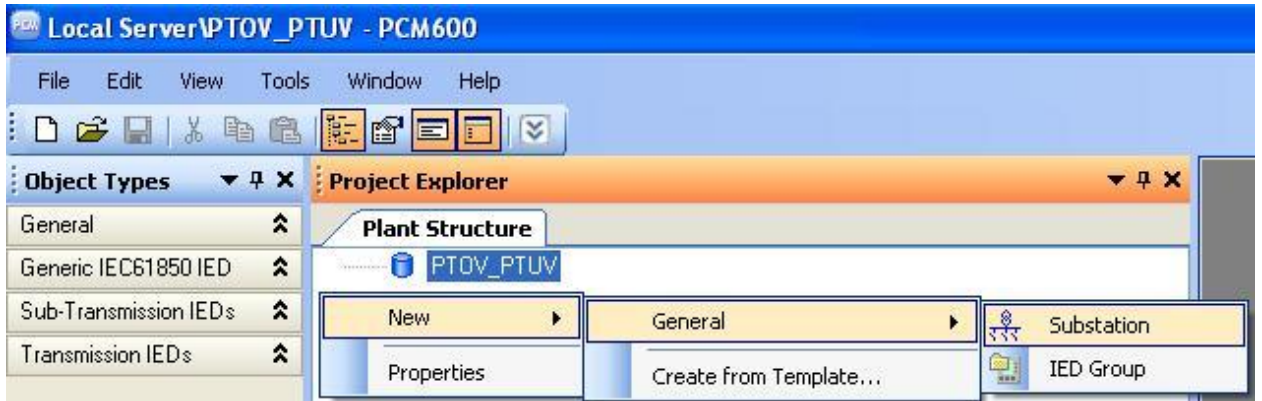


Figure 7

Inside the created substation, enter the voltage level according to the following figure:

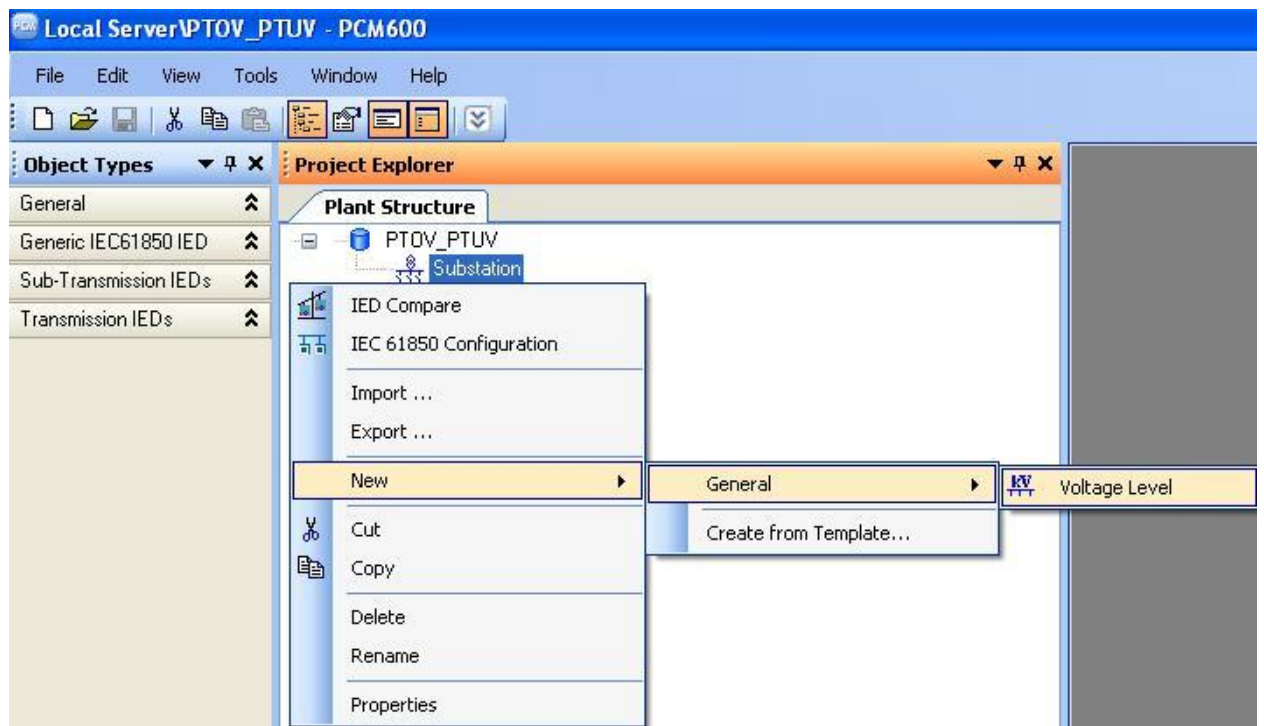


Figure 8

Within the voltage level, insert a bay.

INSTRUMENTOS PARA TESTES ELÉTRICOS

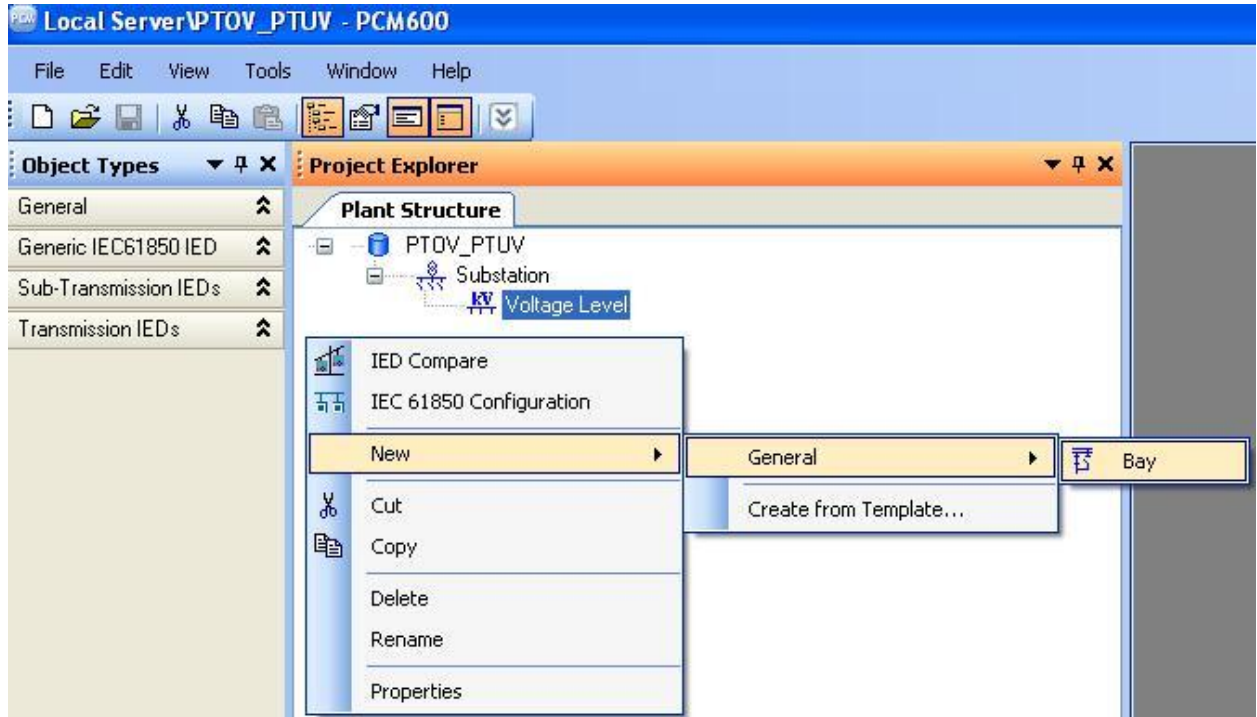


Figure 9

The RET670 relay is inserted inside the bay.

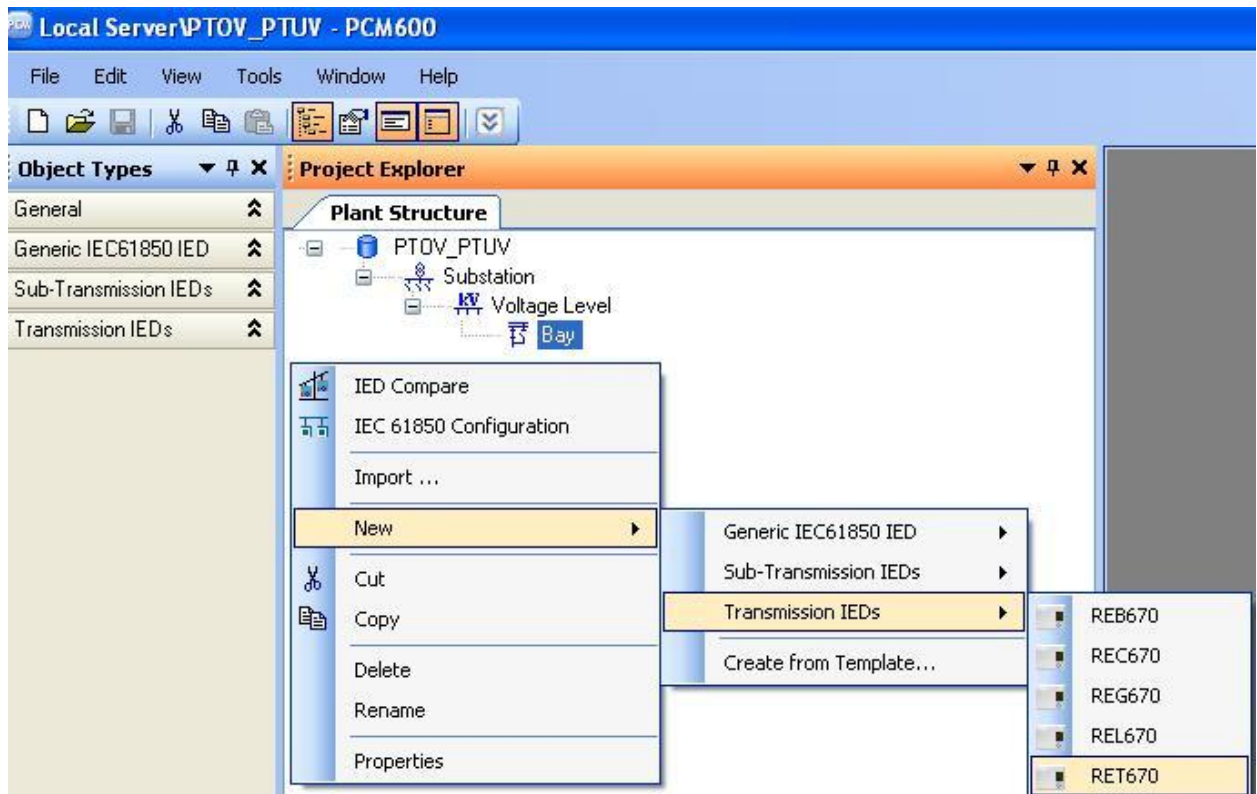


Figure 10

2.2 Configuring Communication

Choose the option “*Online Configuration*” and click “*Next >*”.

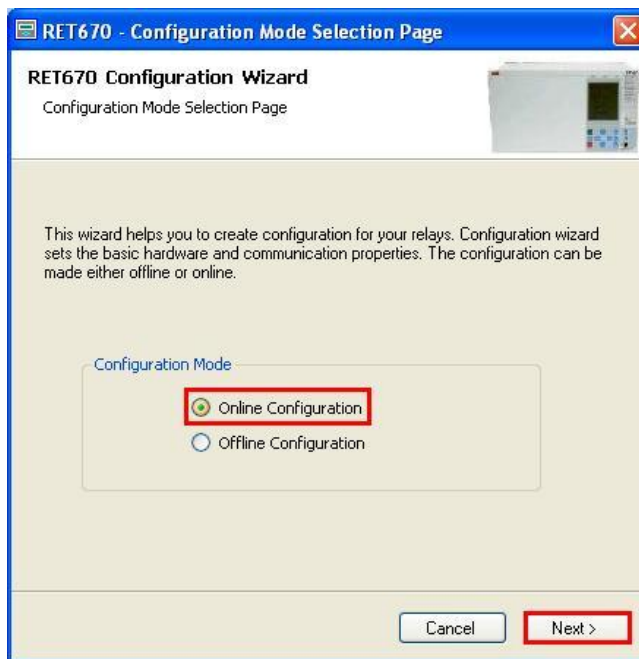


Figure 11

Choose the “*Next >*” option again.

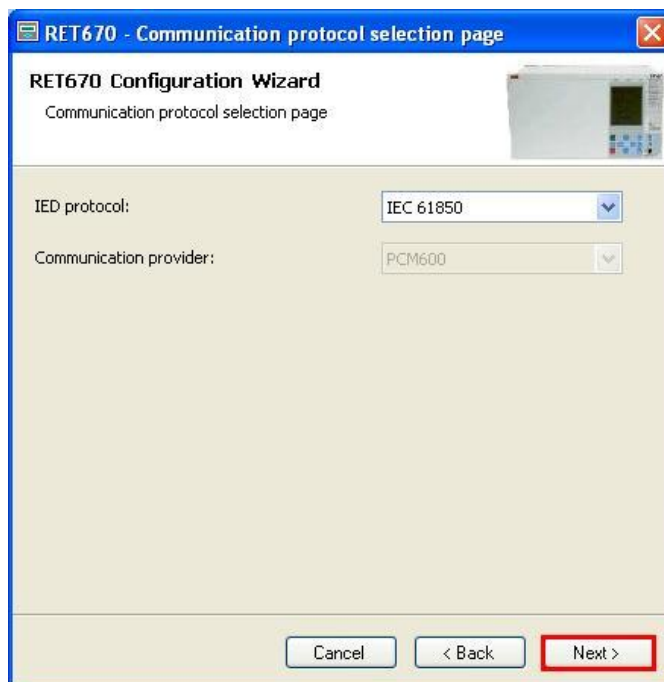


Figure 12

INSTRUMENTOS PARA TESTES ELÉTRICOS

On the next screen, the user chooses between two options “LAN1” or “Front Port” and then the IP is configured on the relay itself. To do so, go to the relay’s display and search for “Settings > General settings > Communication > Ethernet configuration” and view the desired IP. Adjust this value in the PCM and in this tutorial the “Front Port” option was chosen.

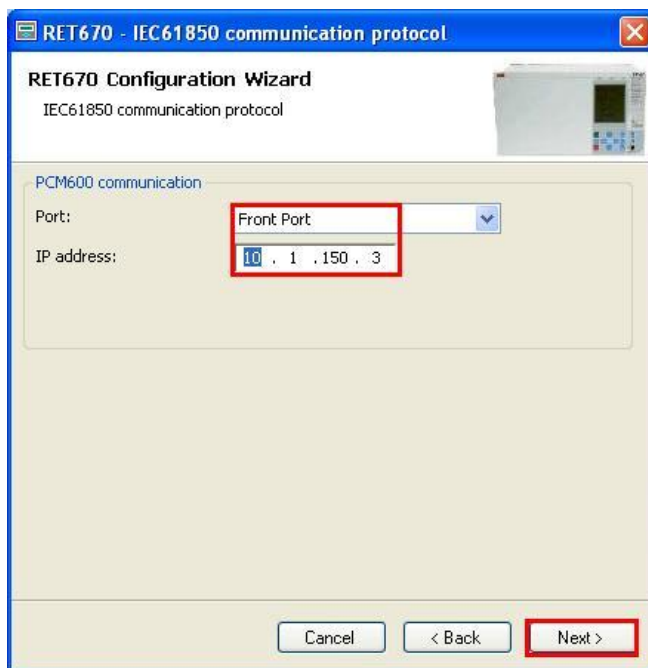


Figure 13

Then click “Next >” and on the next screen click “Scan”.

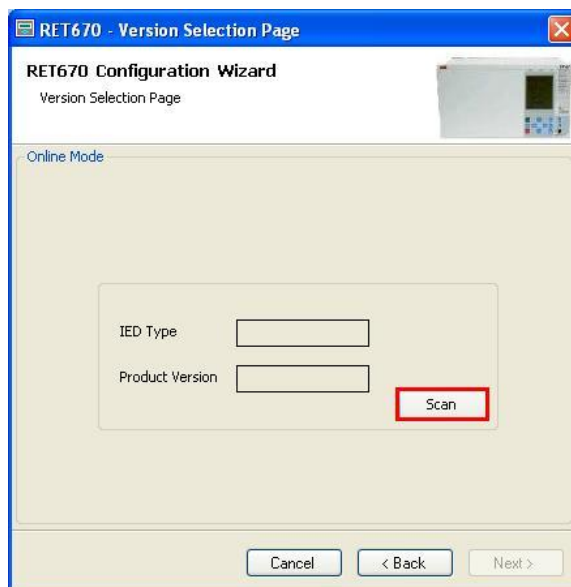


Figure 14

INSTRUMENTOS PARA TESTES ELÉTRICOS

If the settings are correct, the software identifies the relay model and its version according to the following screen.

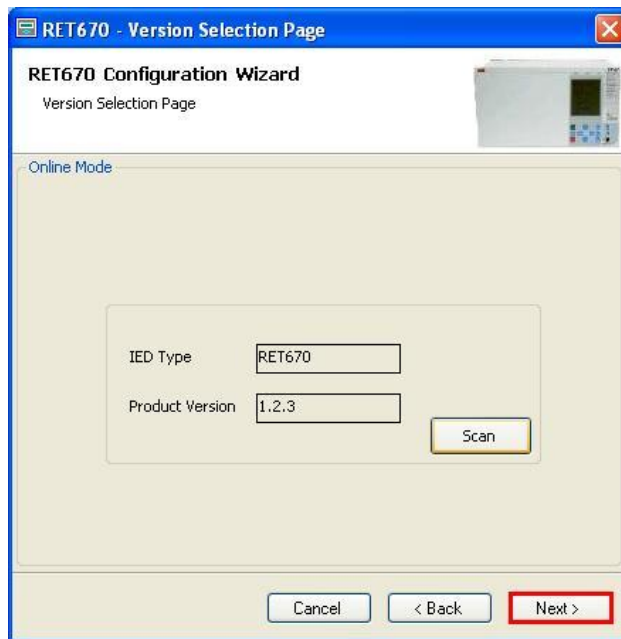


Figure 15

On the next screen, the relay identifies the type of rack and display.

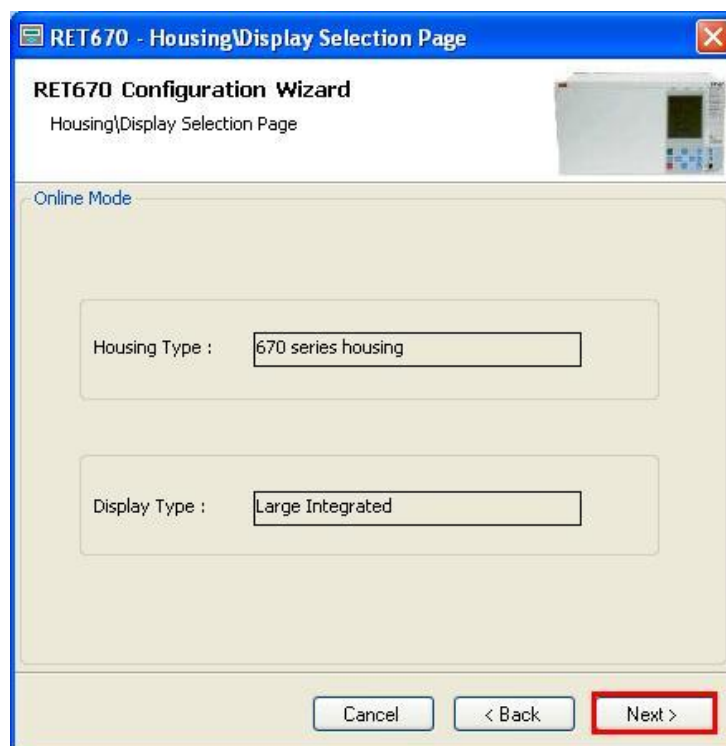


Figure 16

INSTRUMENTOS PARA TESTES ELÉTRICOS

Finally the complete relay information.

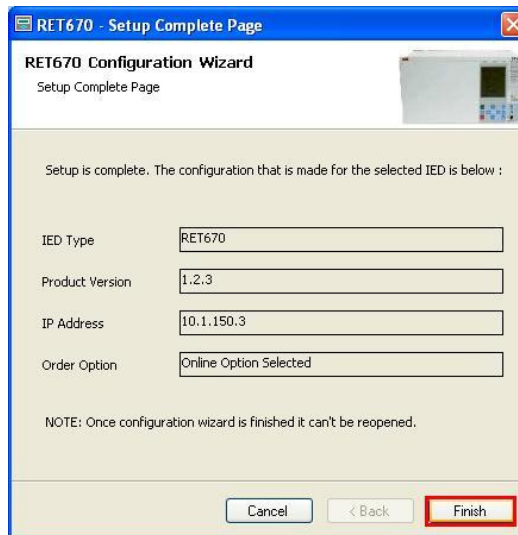


Figure 17

2.3 TRM_9I_3U_31

Click on the “+” signs next to “IED Configuration” and “HW Configuration”. Within the last option the relay shows all the slots that are inserted in the relay. Right-click on the “TRM_9I_3U_31” option and select “Parameter Setting”.

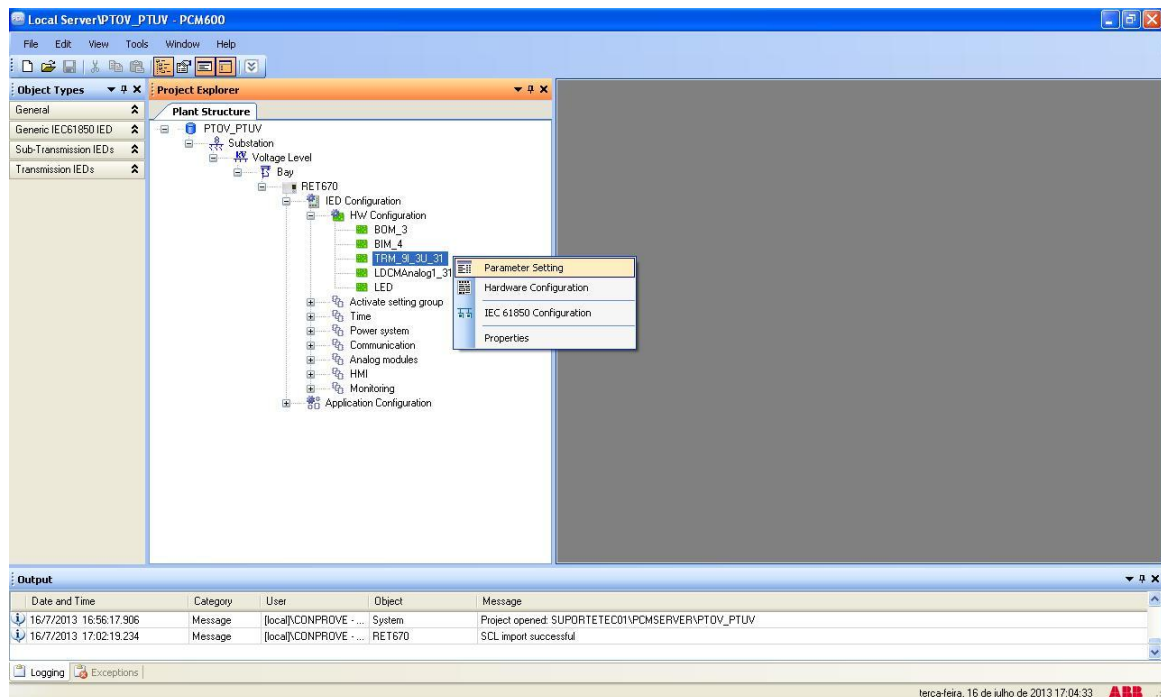


Figure 18

INSTRUMENTOS PARA TESTES ELÉTRICOS

In this window, the current and voltage transformation relationships must be configured. In this case, only channels 10, 11 and 12 will be configured since the protections to be analyzed are undervoltage and overvoltage.

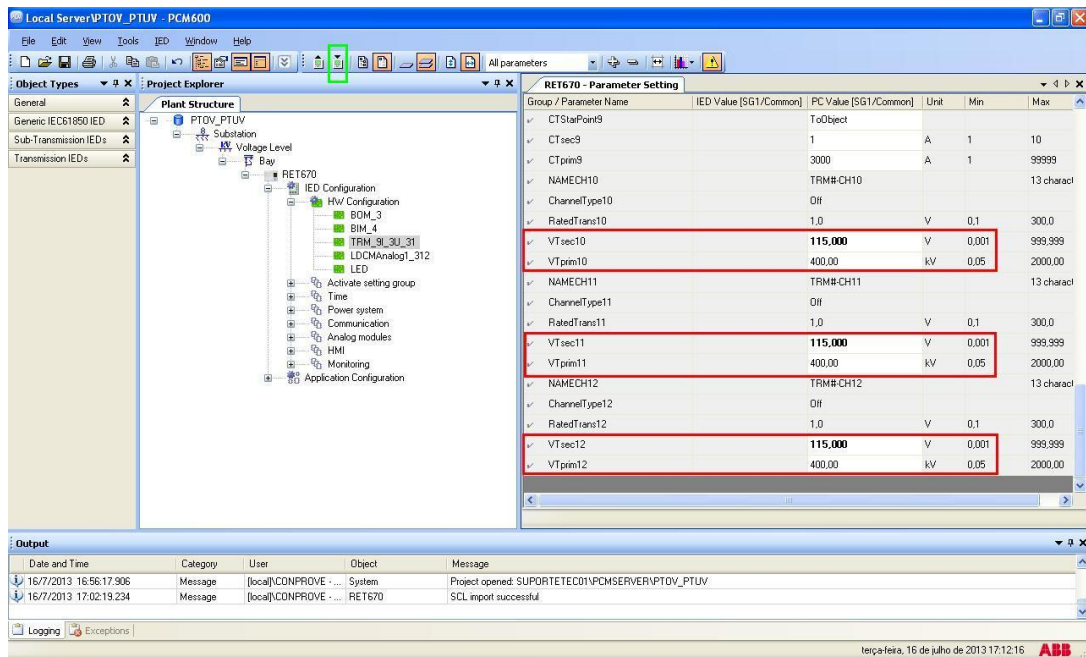


Figure 19

In the icon highlighted in green in the previous figure, the changes are sent to the relay. There are three shipping options:

1. Send only a specific value.
2. Submit all changes made within a settings group.
3. Send all parameterized settings within the group.

In this case, only the settings that have been changed are sent.

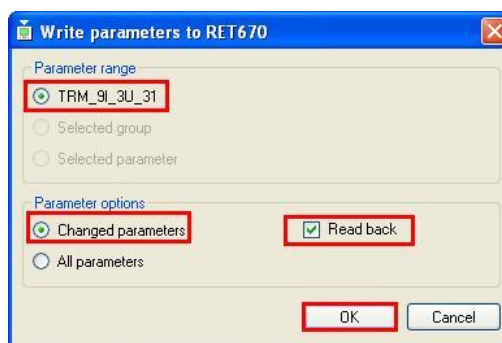


Figure 20

NOTE: Whenever the user makes a change in any adjustment group, this procedure must be repeated.

2.4 SETGRPS: 1

Click the “+” sign next to “*Activate setting group*” and then “*SETGRPS: 1*” and make sure that group one is active.

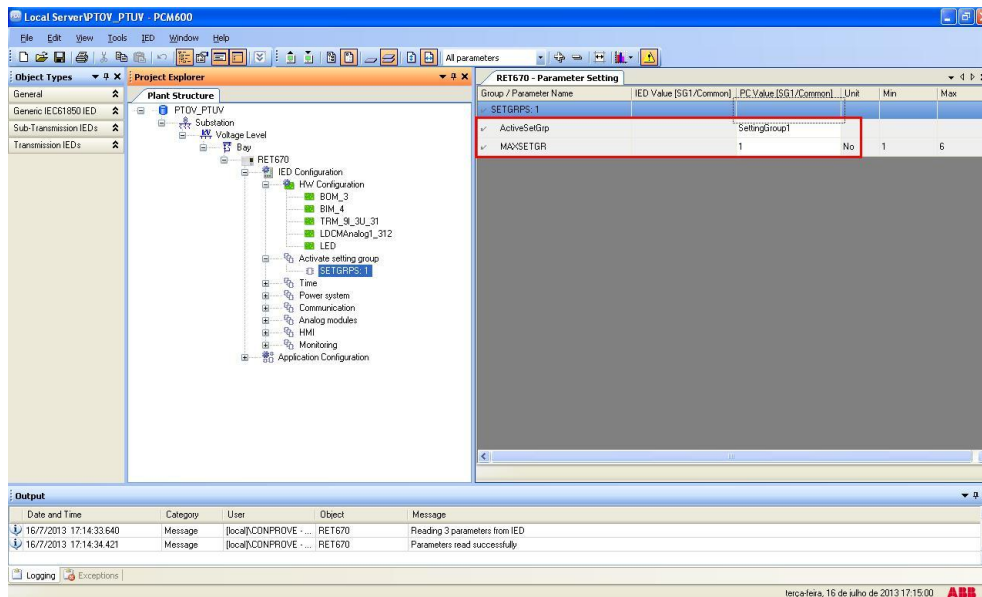


Figure 21

2.5 PRIMVAL: 1

Click the “+” sign next to “*Power System*” and select the “*PRIMVAL:1*” option. In this group, the frequency value is adjusted and the standard value in this relay is 50.0Hz. Change the value to 60.0Hz and send the settings to the relay.

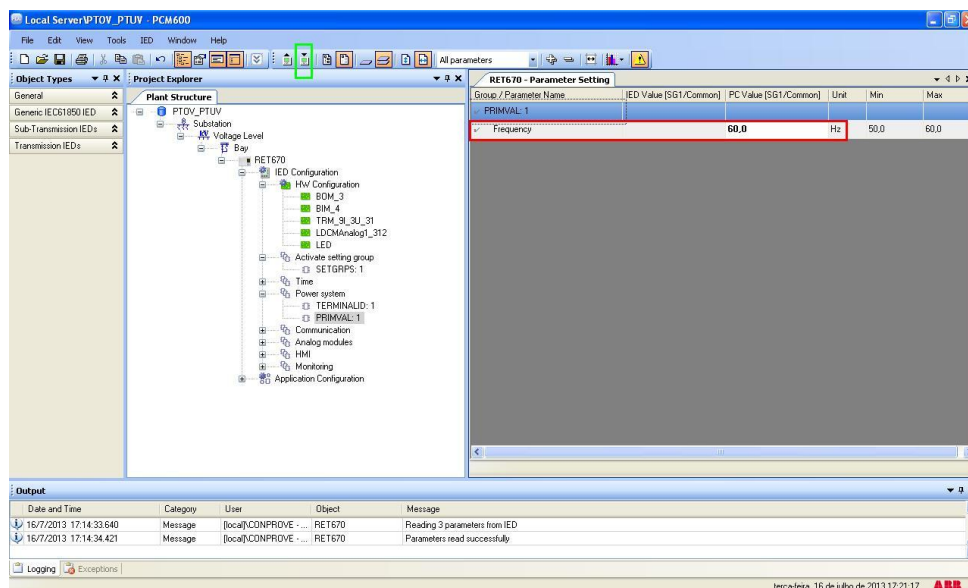


Figure 22

2.6 AISVBAS: 1

Click on the “+” signs next to “*Analog modules*” and select the option “*AISVBAS: 1*” and set the channel “*TRM40-Ch10*” as the reference channel, which is equivalent to the voltage phase A. Send these settings to the relay.

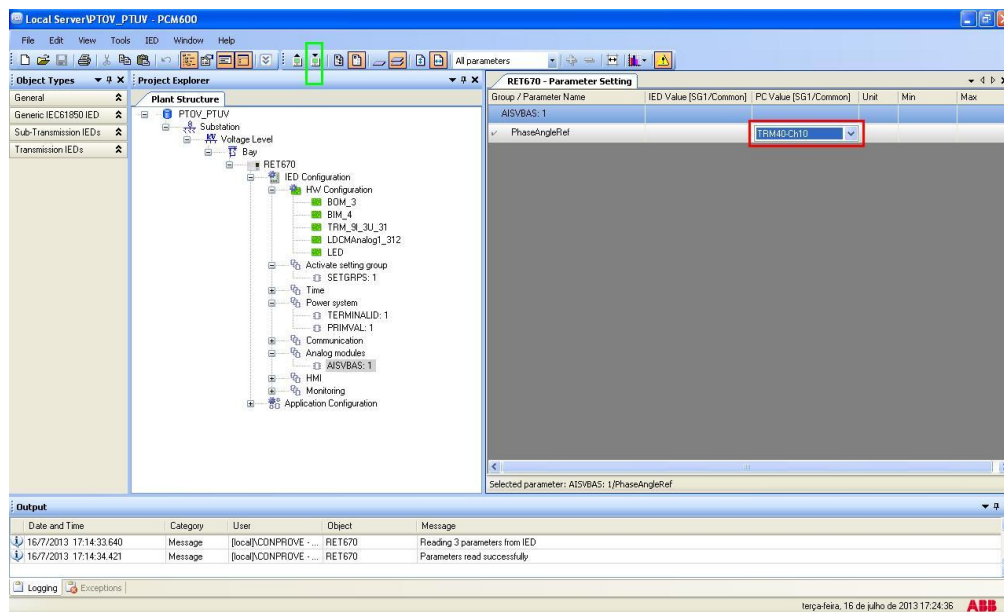


Figure 23

2.7 Application Configuration

Select the “*Application Configuration*” option, right-click and choose “*Application Configuration*” again. In this field, insert the protection logic blocks.

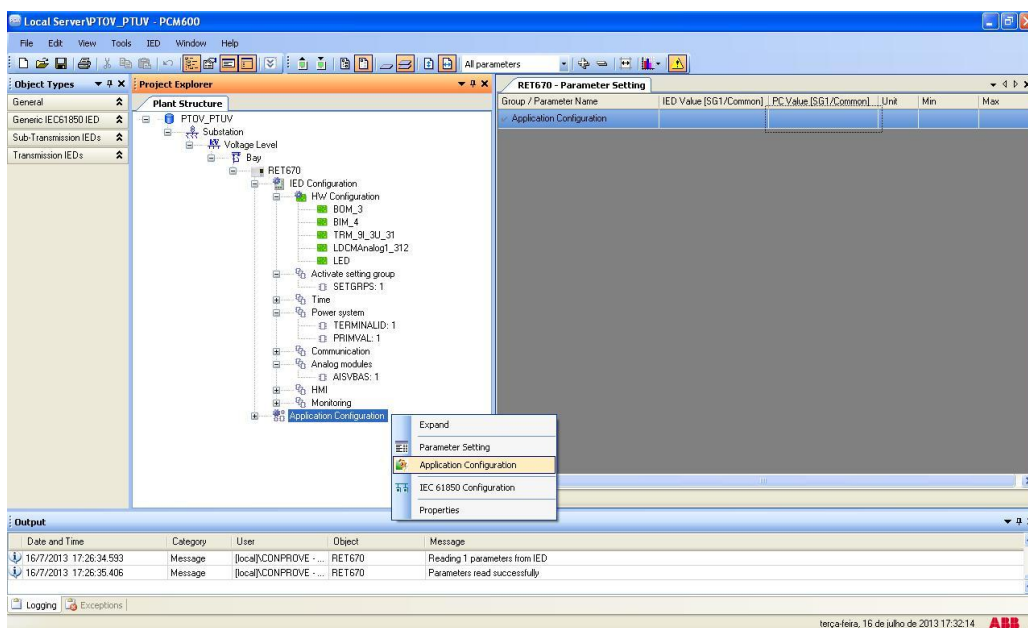


Figure 24

INSTRUMENTOS PARA TESTES ELÉTRICOS

On the screen that opens right-click and then choose the “*Insert FunctionBlock*” option.

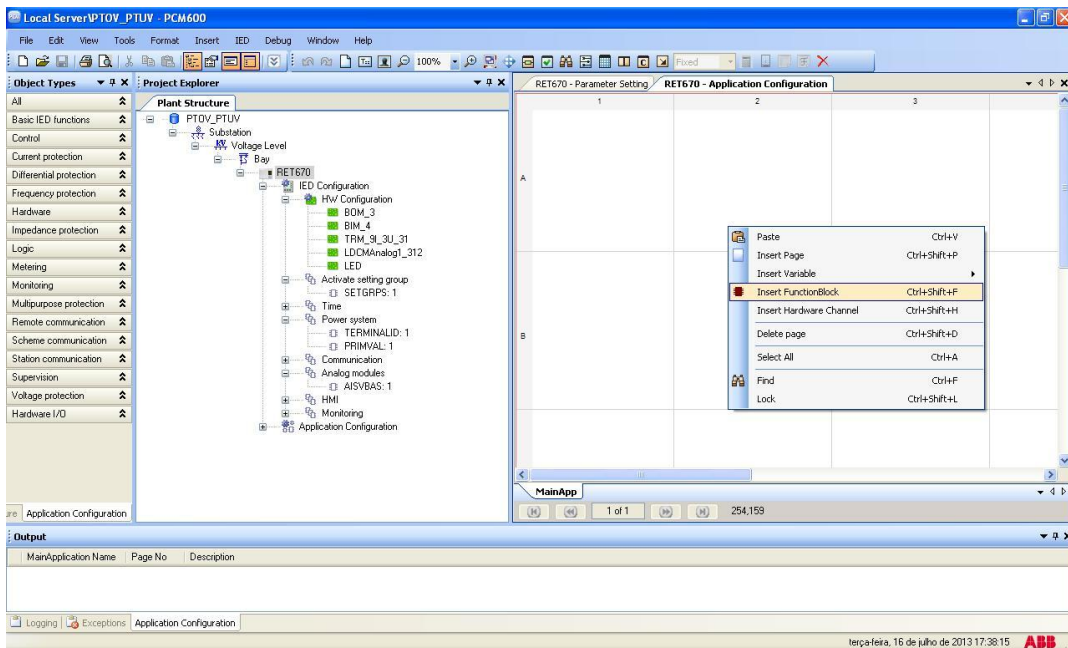


Figure 25

2.8 SMAII (Voltages)

Click on the “+” sign next to “*Basic IED functions*” and insert the “*SMAII*” block that will be responsible for the voltage channels. To understand the perfect functioning of the different blocks, consult the “*RET 670*” manual.

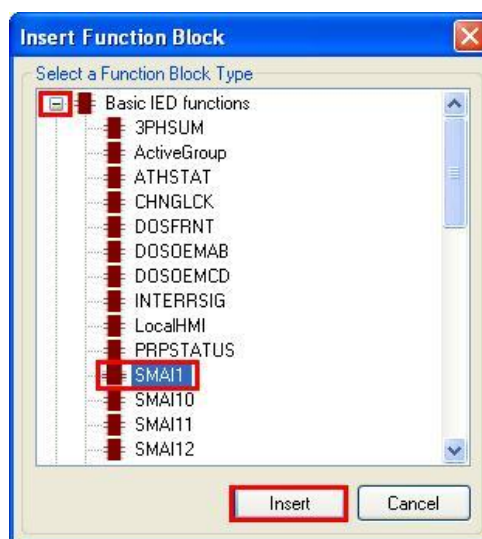


Figure 26

On the next screen set the “*Cycle Time*” to 8.

INSTRUMENTOS PARA TESTES ELÉTRICOS

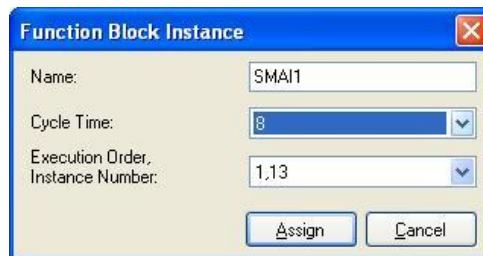


Figure 27

The next step is to route the channel input of the function block with its physical channel. To do this, right-click outside the block and choose the following option.

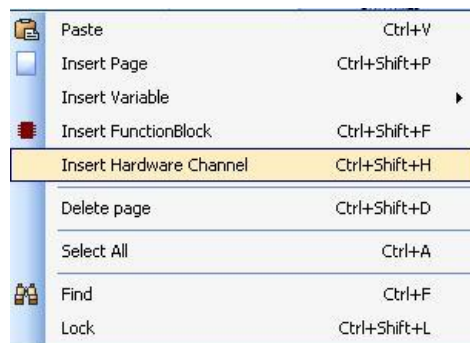


Figure 28

Choose the “*Analog Input*” option and click on “*Insert*”.



Figure 29

INSTRUMENTOS PARA TESTES ELÉTRICOS

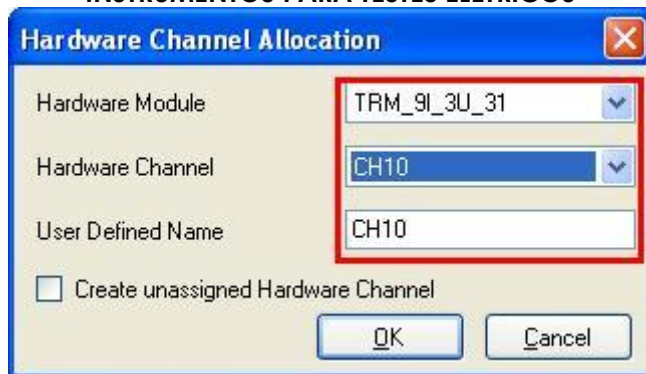


Figure 30

Repeat the procedure of the 3 previous figures changing the option from “*Hardware Channel*” to “*CH11*” and “*CH12*”. Then make the connections with the block.

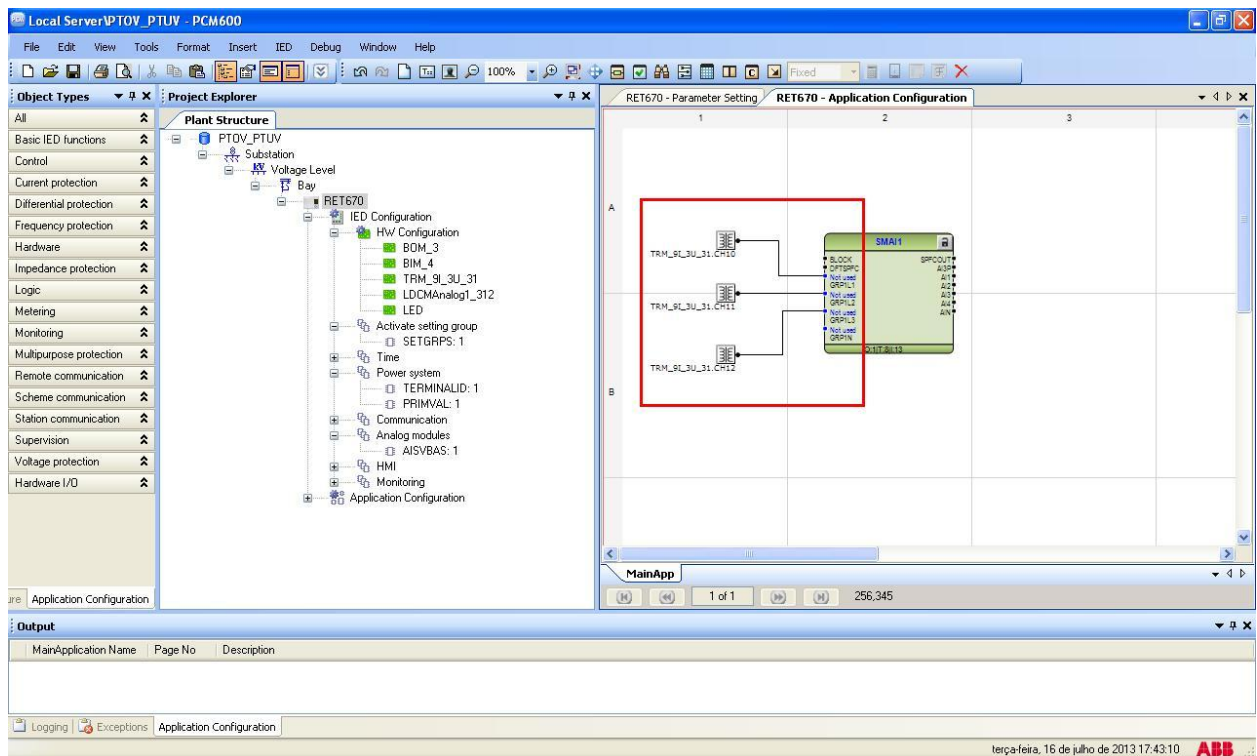


Figure 31

Assign an output to the “*AI3P*” option. To do so, right-click and choose “*Insert Variable > Output*”.

INSTRUMENTOS PARA TESTES ELÉTRICOS

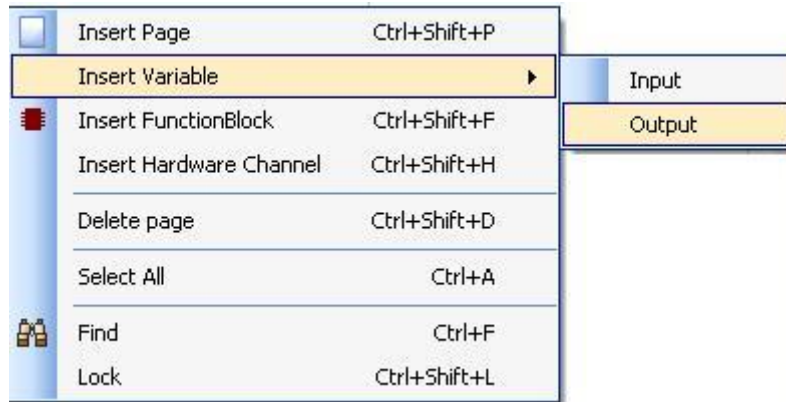


Figure 32

Choose a name for this variable, in this case “*AI3P_TP_08ms*” and connect with the output “*AI3P*”.

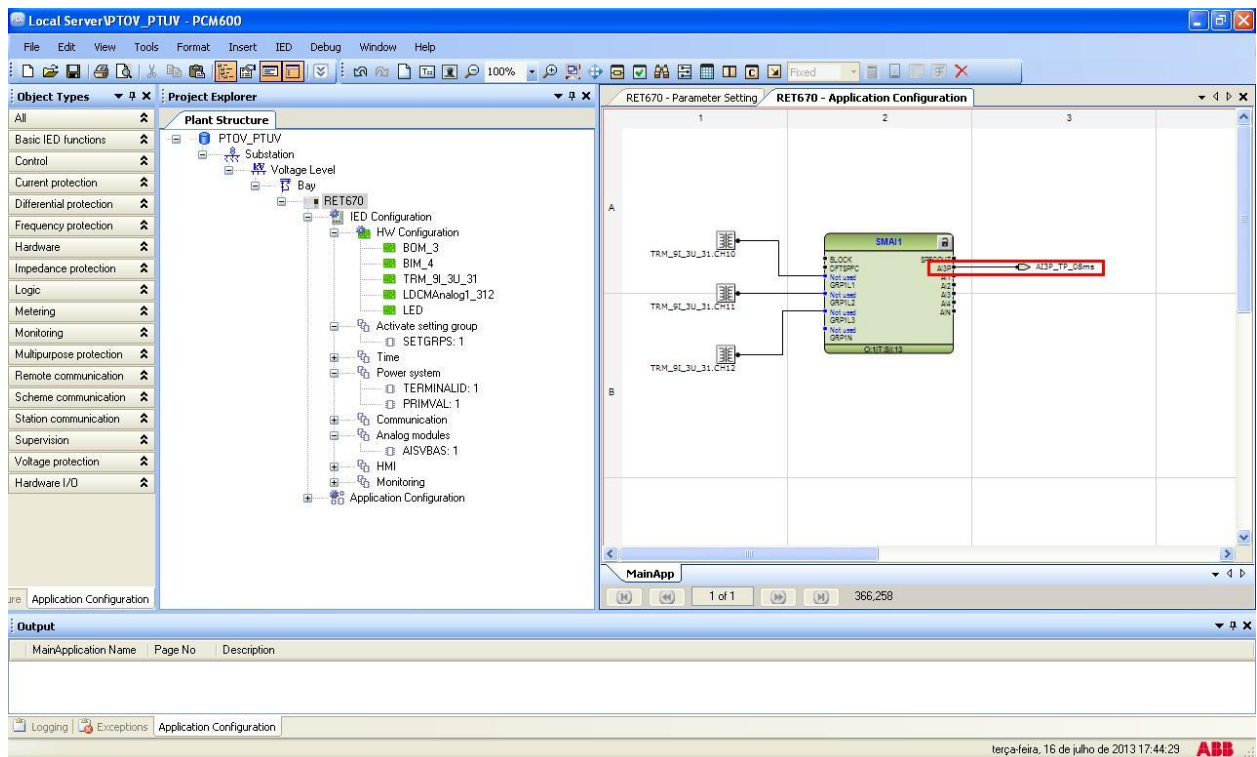


Figure 33

By clicking on the icon highlighted in green and on the “*MainApp*” tab, then the name of the tab is changed to “*CANAIS_TENSÃO*”, for example.

INSTRUMENTOS PARA TESTES ELÉTRICOS

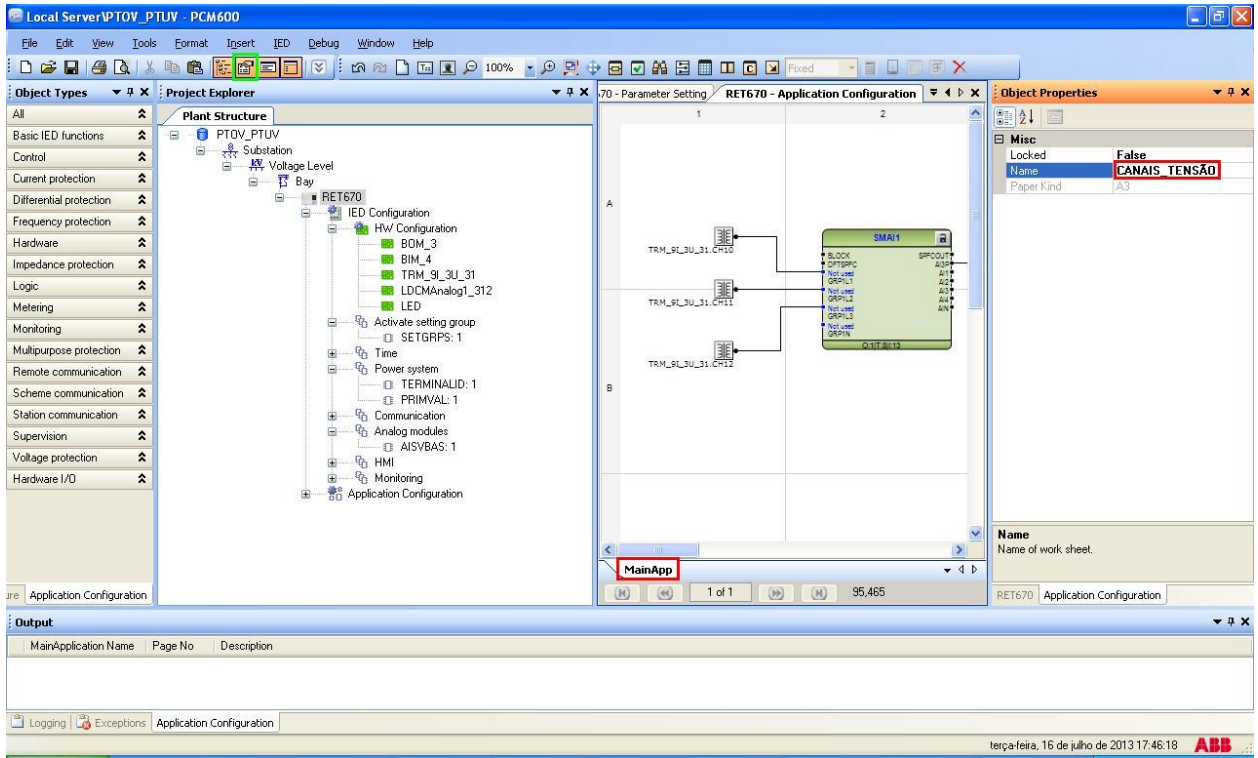


Figure 34

Close the “Object Properties” window then click on “Insert > MainApplication”.

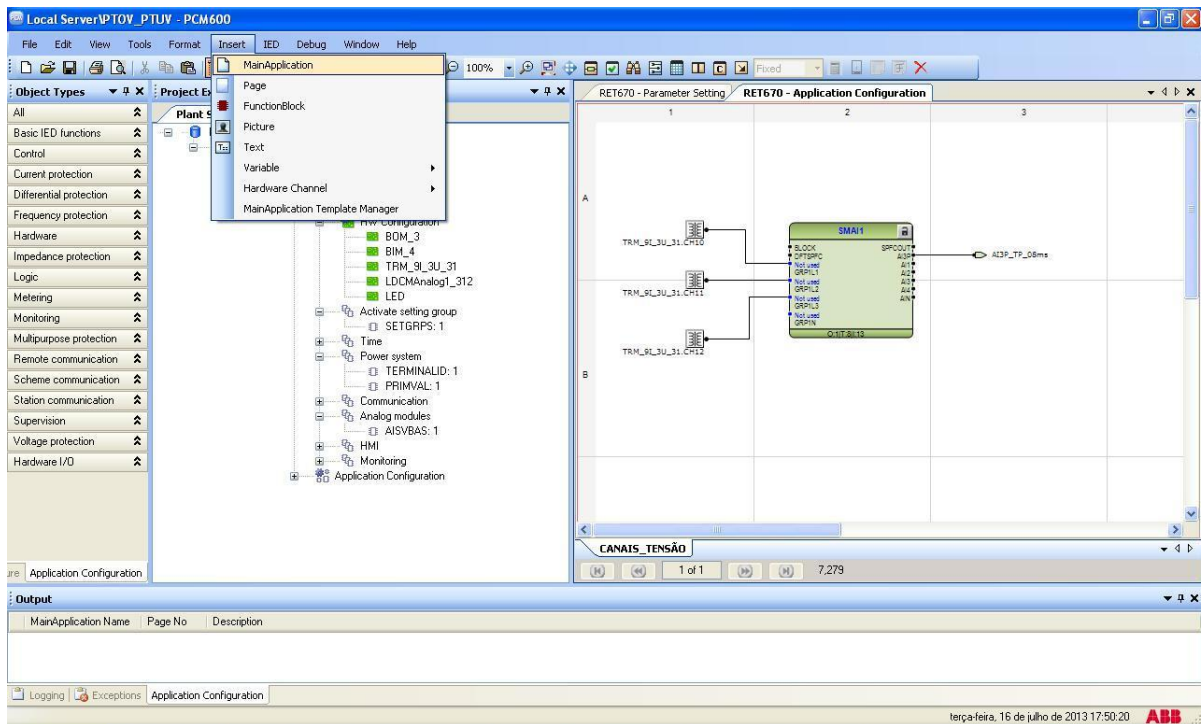


Figure 35

INSTRUMENTOS PARA TESTES ELÉTRICOS

2.9 OV2PTOV (Overvoltage)

Right-click on the new tab, choose the “*Insert Function Block*” option, click on the “+” sign next to “*Voltage protection*” and finally choose the “*OV2PTOV*” block.

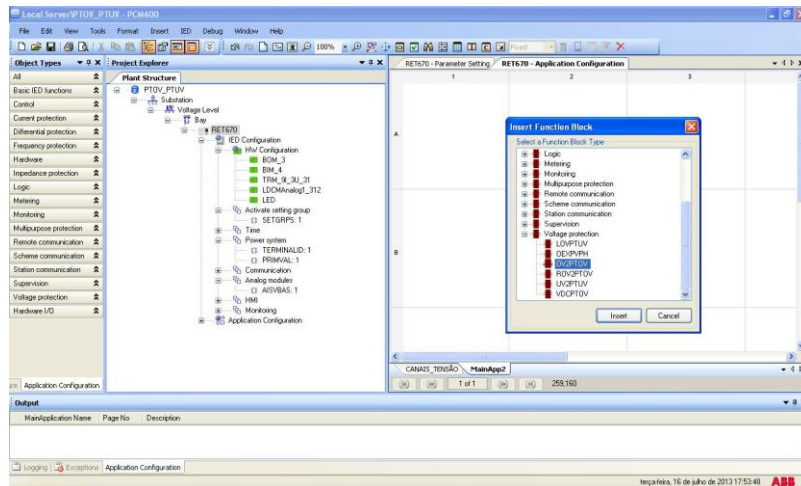


Figure 36

Click on “*Assign*” (picture not shown). Insert an input variable using the same name given for the voltage output and connect with the voltage inputs “*AI3_TP*”. Create two output variables and use the following nomenclature.

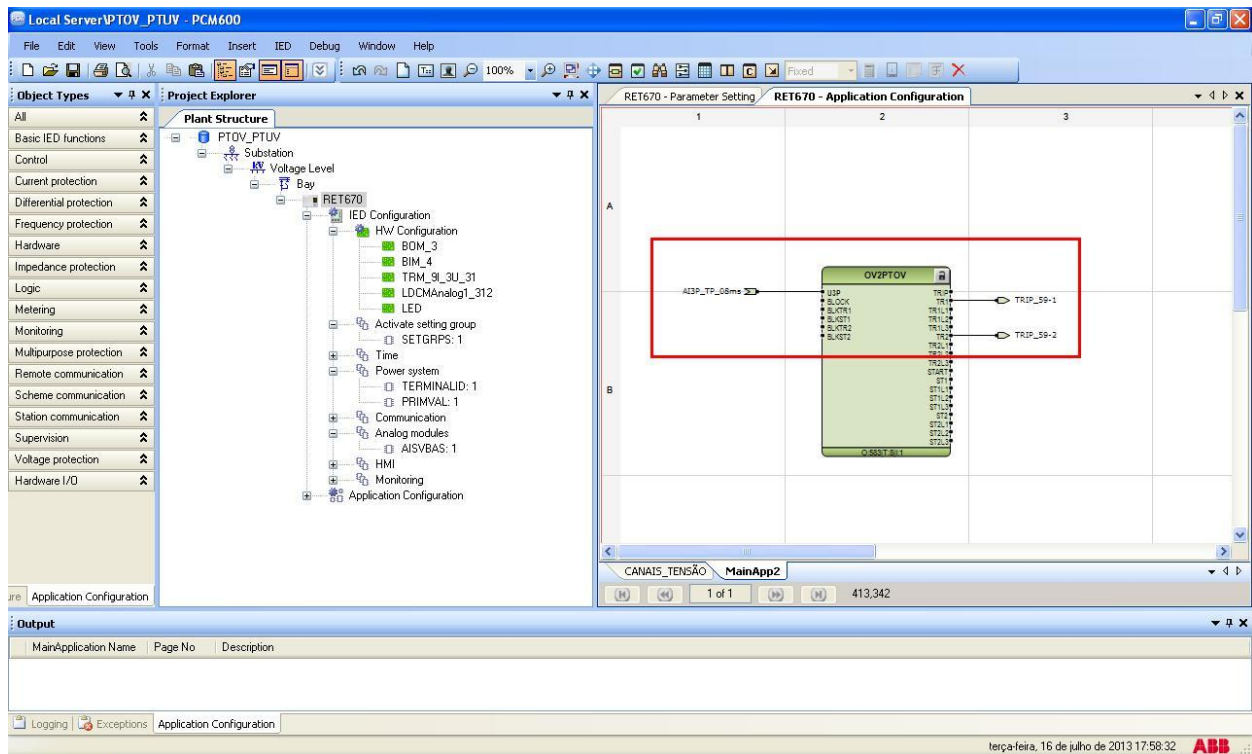


Figure 37

INSTRUMENTOS PARA TESTES ELÉTRICOS

Change the name of the tab to “SOBRETENSÃO”.

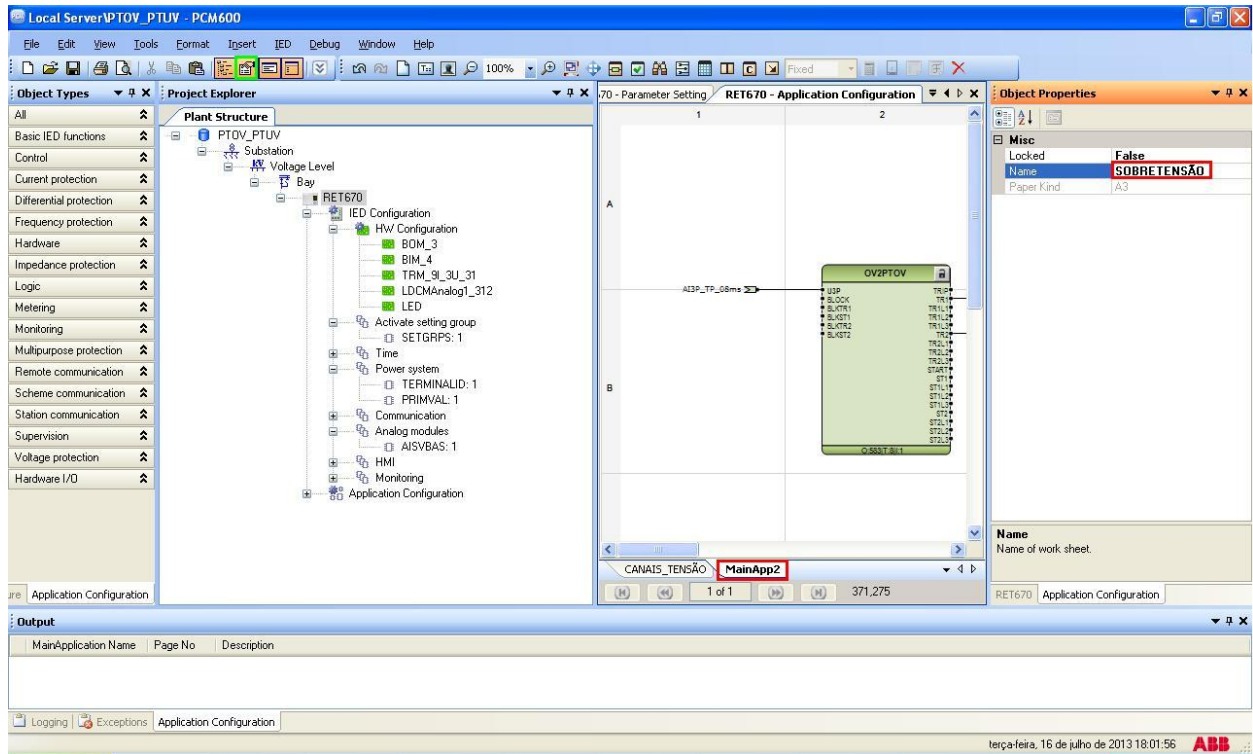


Figure 38

Close the “Object Properties” window and insert a new tab to create the undervoltage function block.

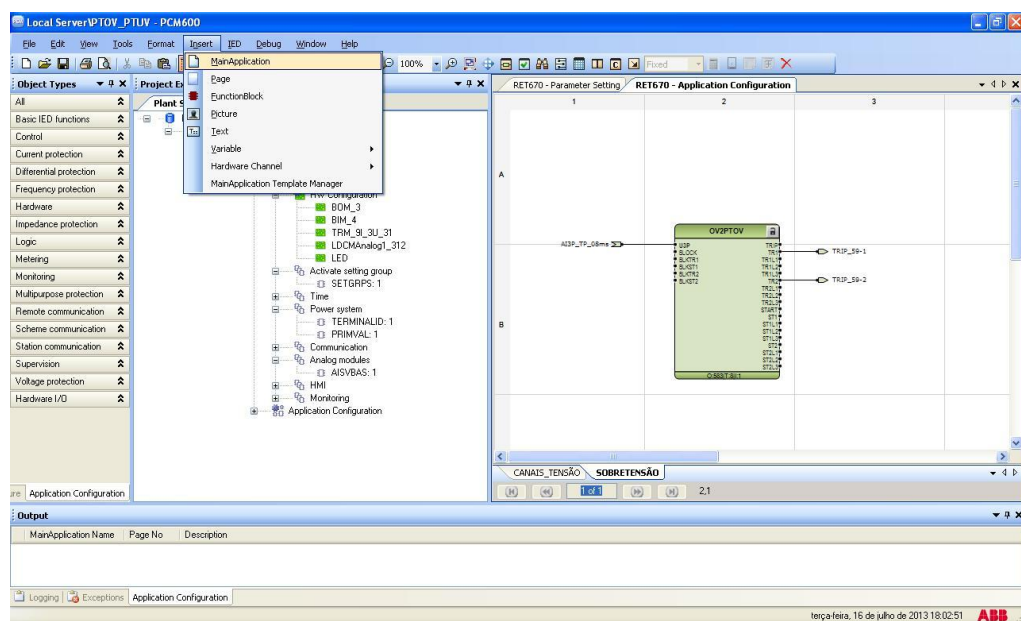


Figure 39

INSTRUMENTOS PARA TESTES ELÉTRICOS

2.10 UV2PTUV (Undervoltage)

Right-click on the new tab, choose the “Insert Function Block” option, click on the “+” sign next to “Voltage protection” and finally choose the “UV2PTUV” block. On the next screen (not shown) click on “Assign”.

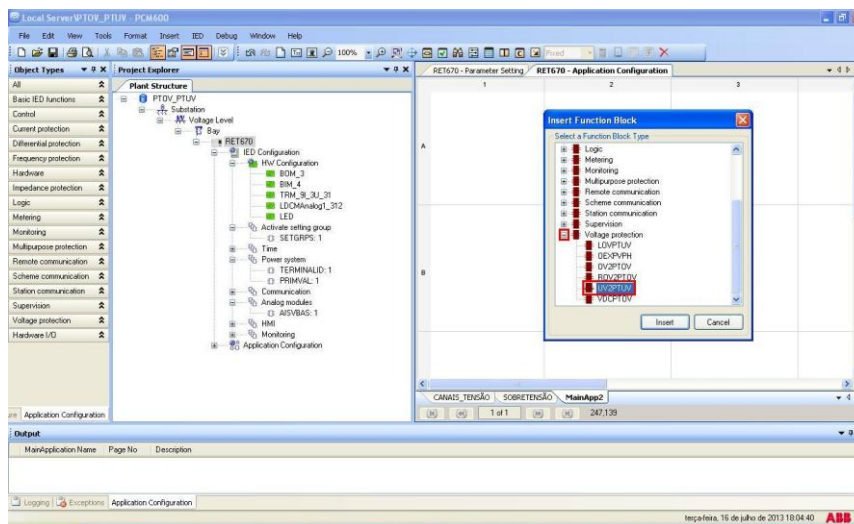


Figure 40

Insert an input variable using the same name given for the output on the “CANAIS_TENSÃO” tab and connect it with the voltage input “A13_TP”. Create two output variables and use the following nomenclature.

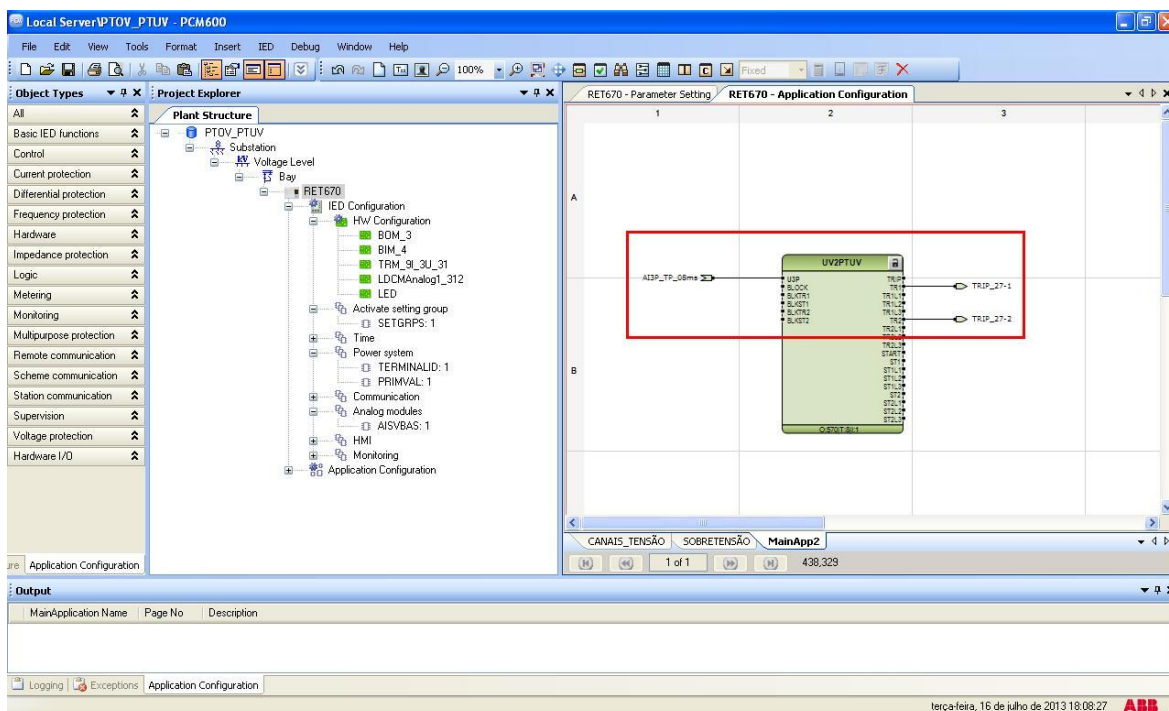


Figure 41

INSTRUMENTOS PARA TESTES ELÉTRICOS

Change the tab name to “SUBTENSÃO”.

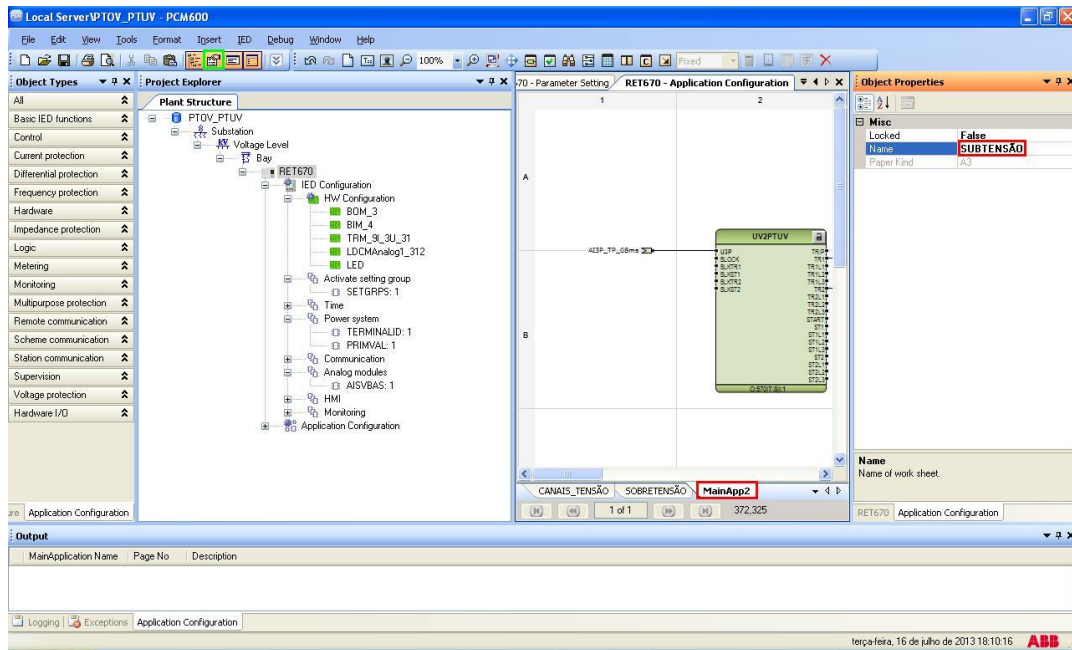


Figure 42

2.11 Binary Outputs

The last block to be created is the one for the binary outputs. So create a new tab as shown below.

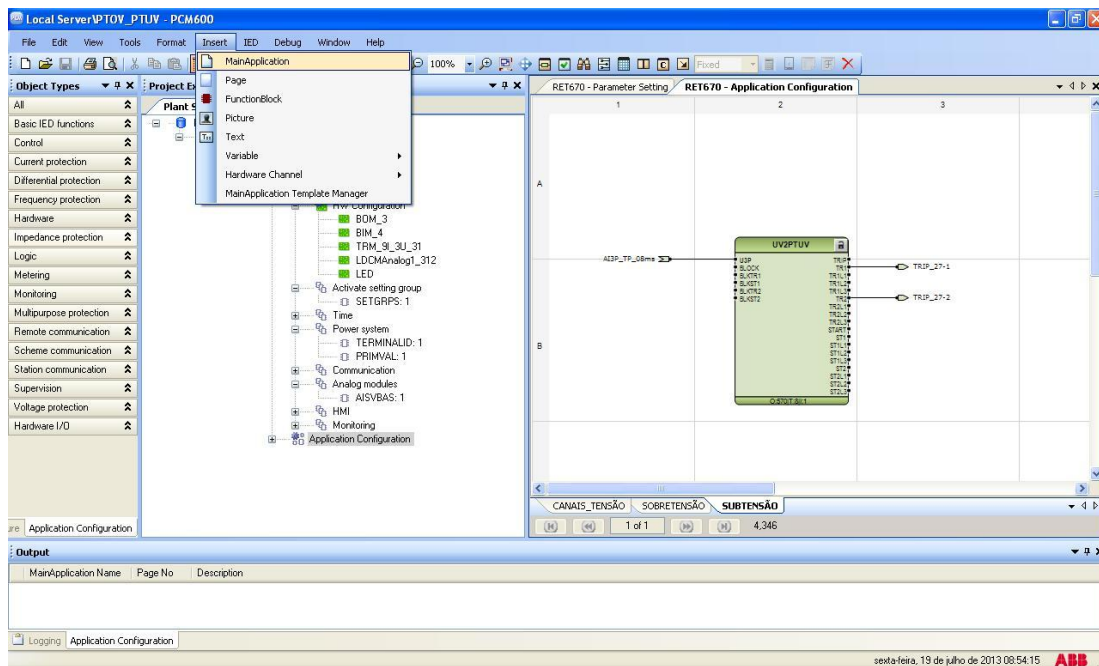


Figure 43

INSTRUMENTOS PARA TESTES ELÉTRICOS

Right-click inside the new tab and choose “*Insert Hardware Channel*”, then “*Binary Output*” and “*Insert*”.

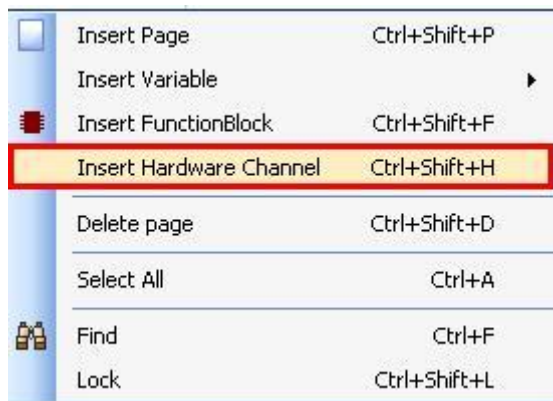


Figure 44

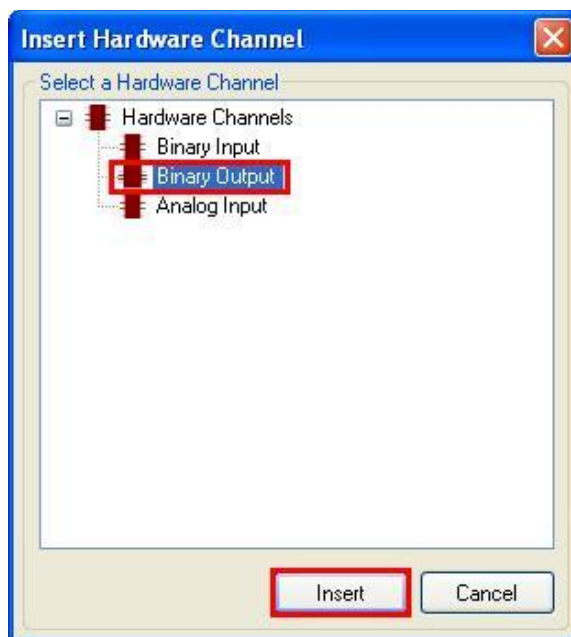


Figure 45

The next step is to choose the channel module “*BOM_3*” and the binary output “*BO1*”.

INSTRUMENTOS PARA TESTES ELÉTRICOS

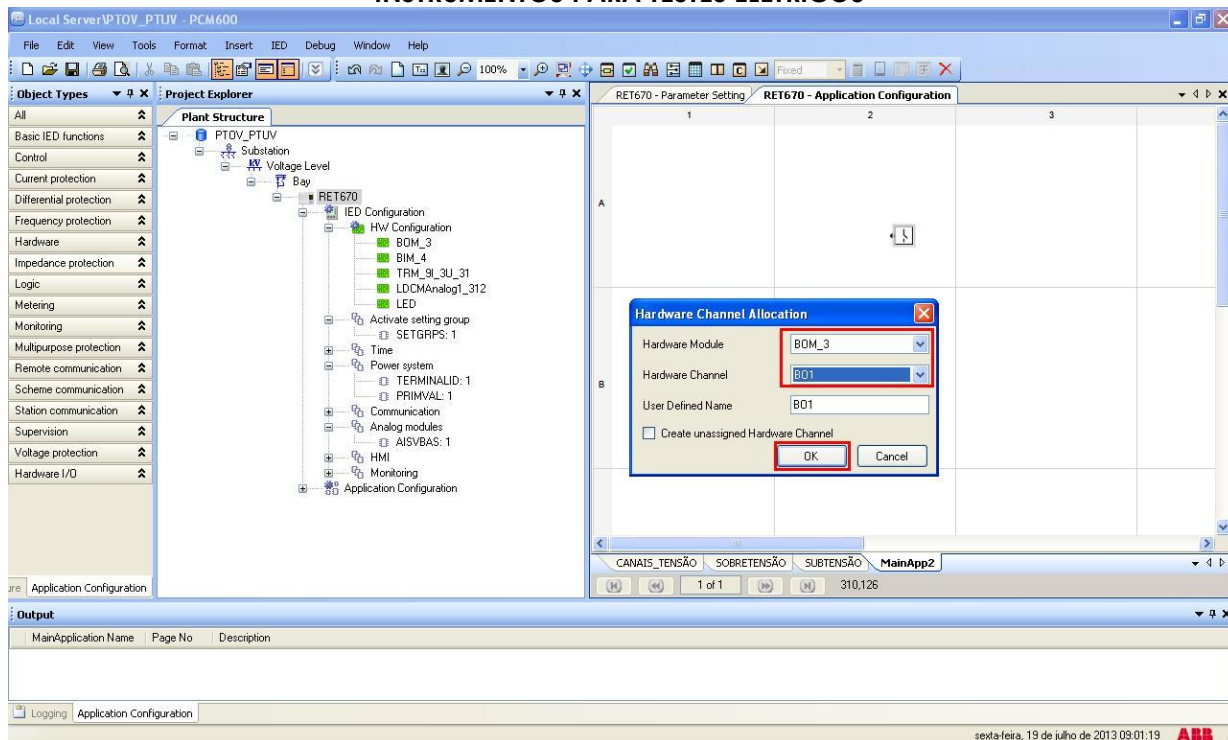


Figure 46

Insert three more outputs keeping the module “BOM_3” and changing the outputs to “BO2”, “BO3” and “BO4”.

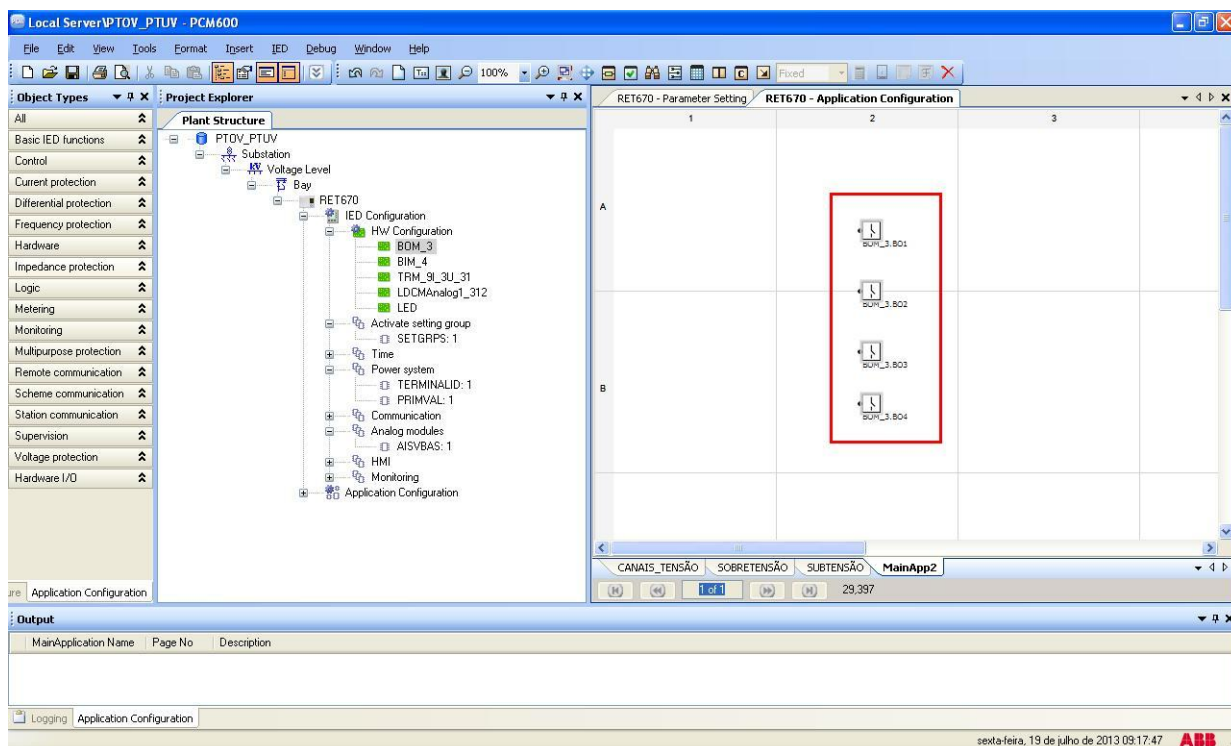


Figure 47

INSTRUMENTOS PARA TESTES ELÉTRICOS

Create four input variables using the same names as the overvoltage and undervoltage block output variables and assign them to each binary output. Change the name of the tab to “SAÍDAS_BINÁRIAS”.

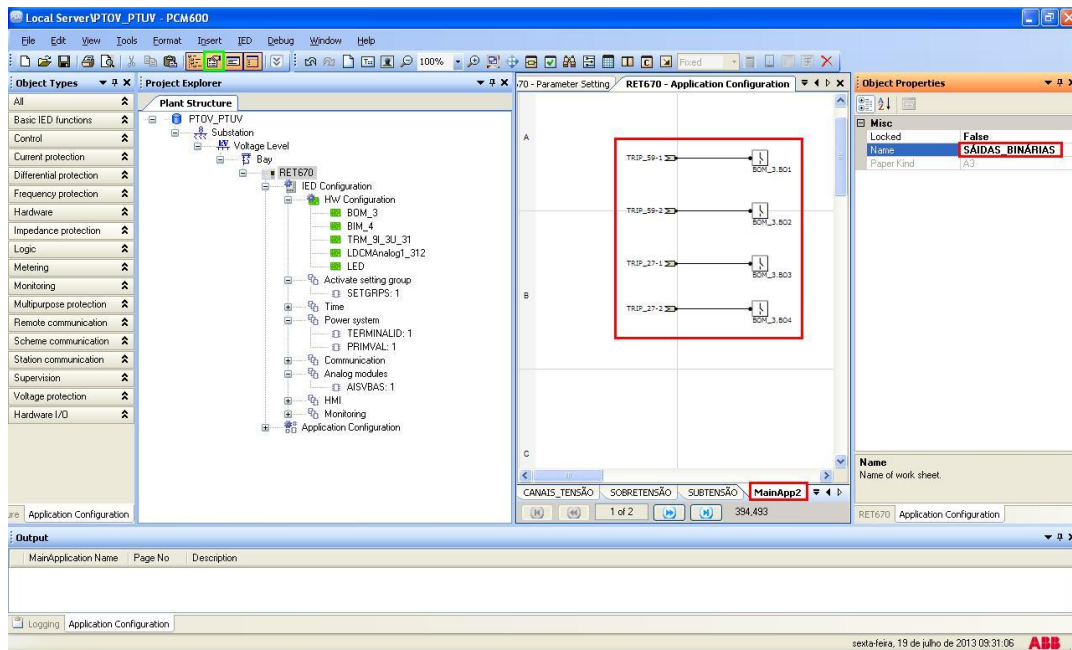


Figure 48

Click on the icon highlighted in green to validate the configuration, then on “OK” and save the configuration.

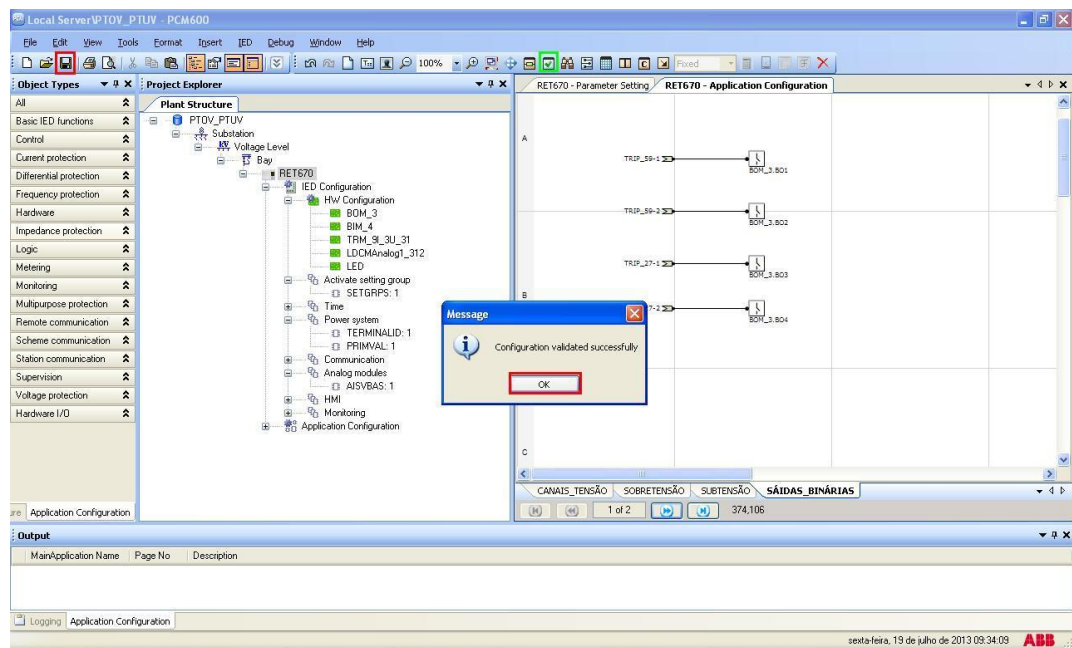


Figure 49

INSTRUMENTOS PARA TESTES ELÉTRICOS

3. Parameterization of the ABB RET670 relay

3.1 RET 670 Parameter Setting

Choose the upper tab “RET 670 Parameter Setting” and click on the “+” signs next to “Application Configuration > SOBRETENSÃO > Voltage protection > OverVoltageStep(PTOV,59)” and finally “OV2PTOV:1”.

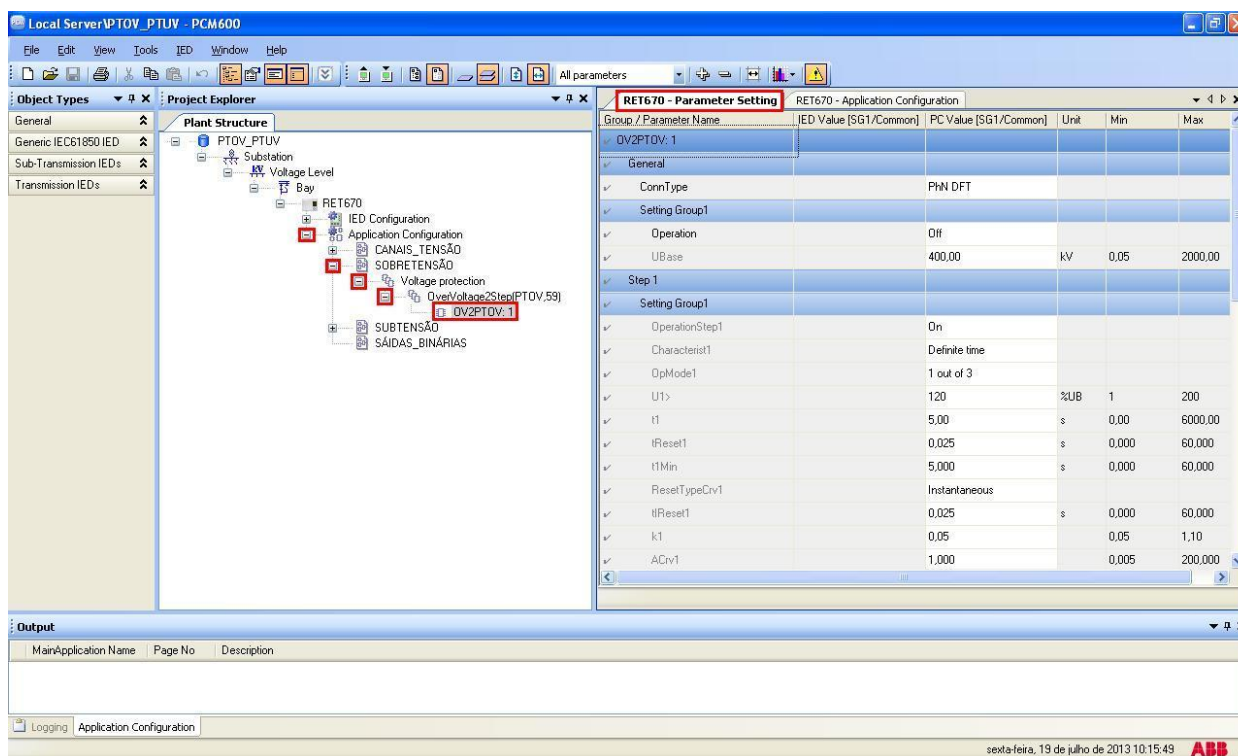


Figure 50

Activate the function and make the following adjustments, with “Step 1” being responsible for element 59-1. The RET 670 allows adjustments for both line voltage and phase voltage. Another option is regarding the voltage used, if it is only the fundamental, the “DFT” option is used, if the harmonics are considered, the “RMS” option is used, the latter being adopted in this test. The settings use the nominal phase voltage (66.4V) as a base.

INSTRUMENTOS PARA TESTES ELÉTRICOS

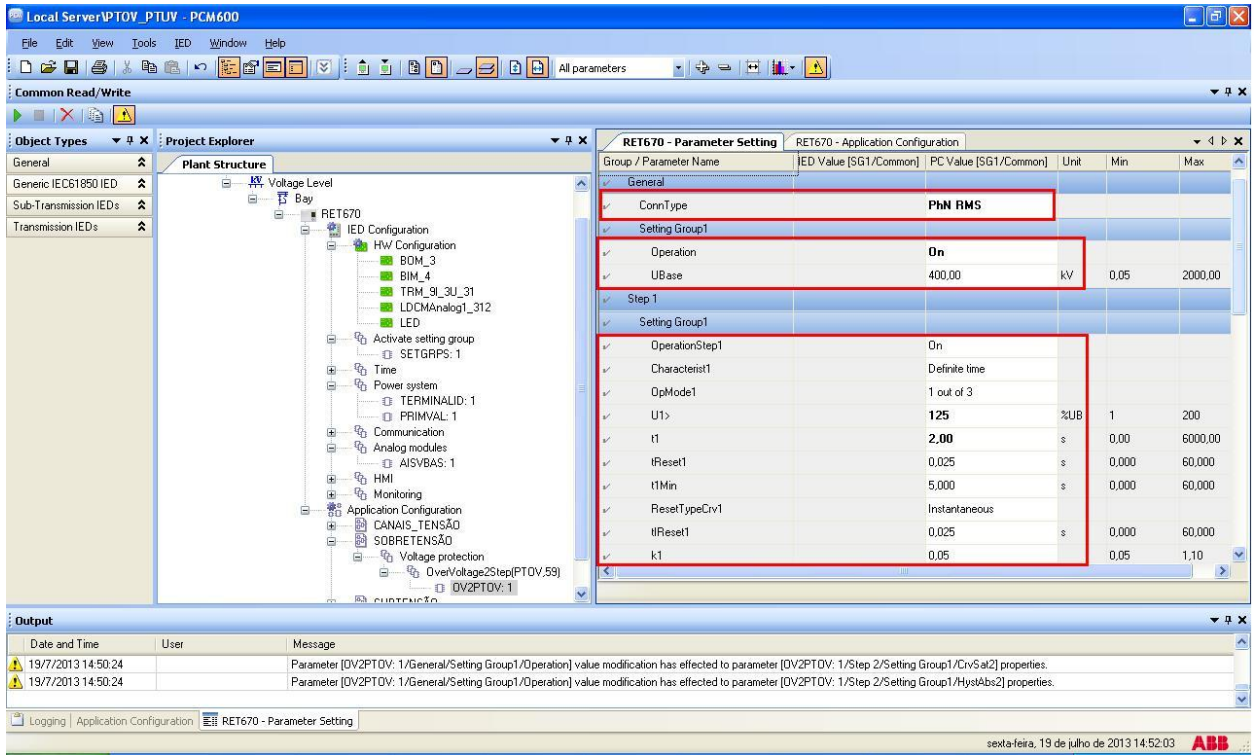


Figure 51

Then “Step 2” is configured, being equivalent to element 59-2.

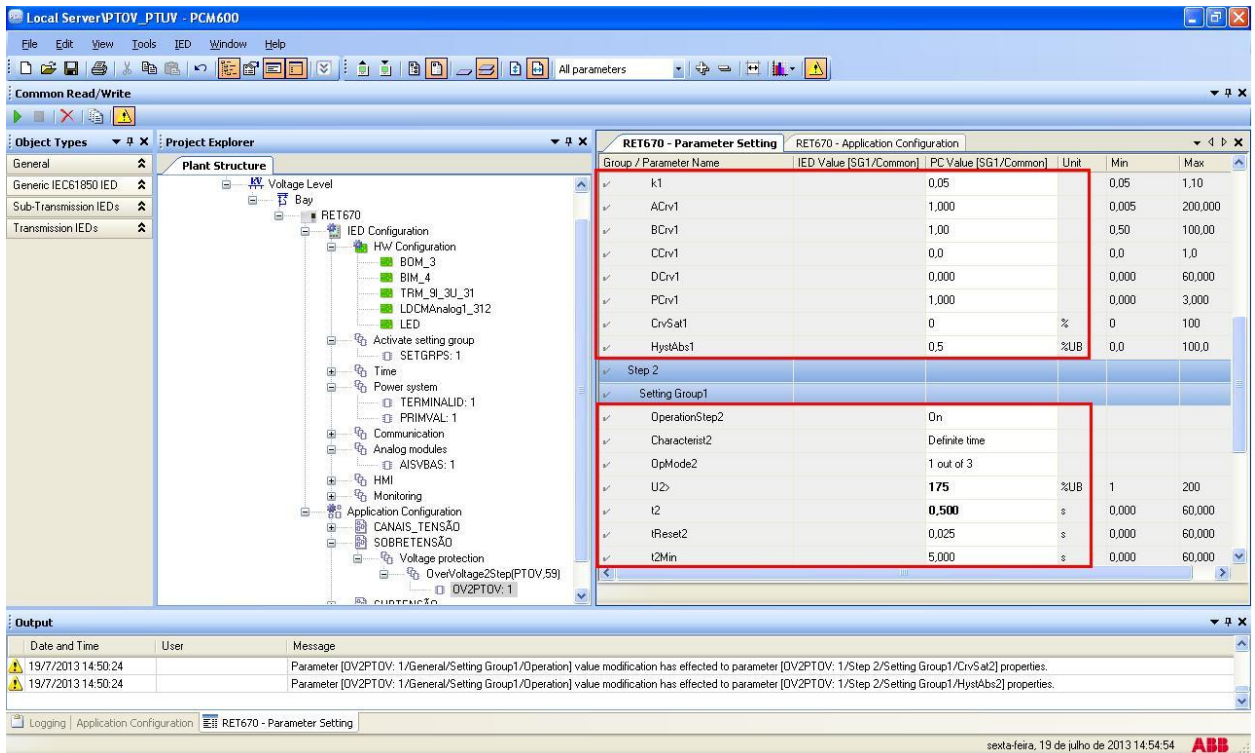


Figure 52

INSTRUMENTOS PARA TESTES ELÉTRICOS

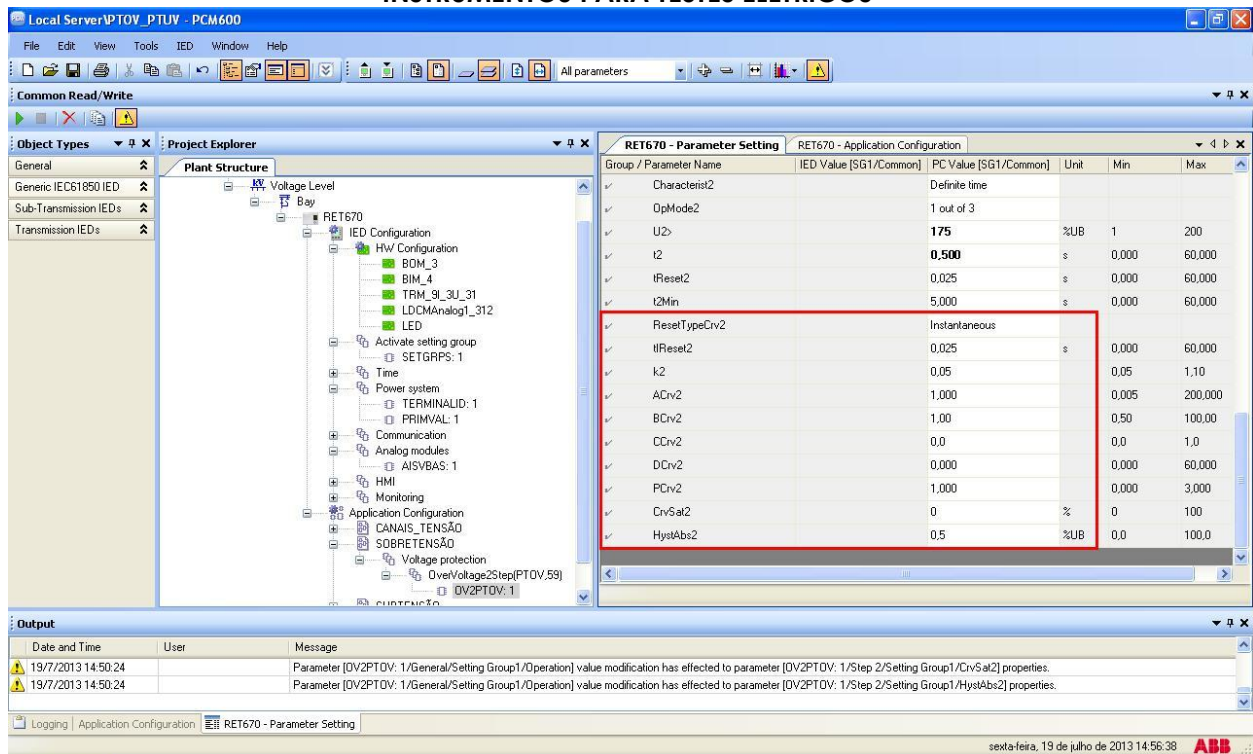


Figure 53

Click on the “+” sign next to “SUBTENSÃO > Voltage Protection > UnderVoltageStep (PTUV,27)” and finally “UV2PTUV:1”

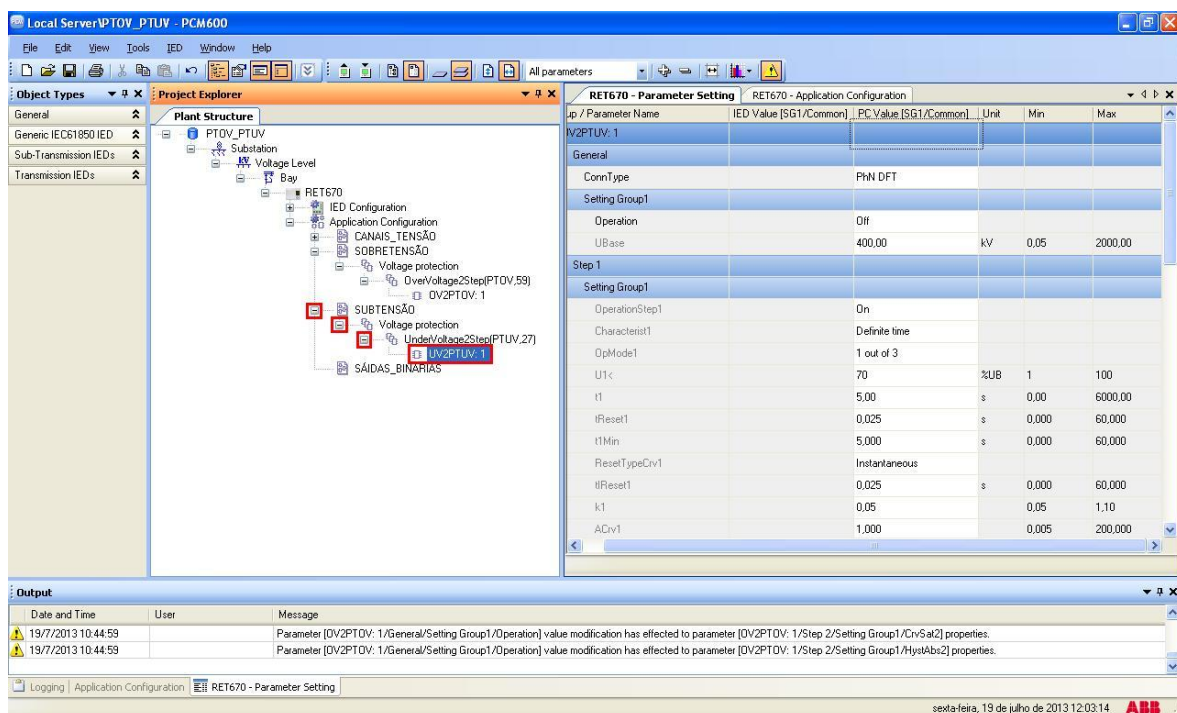


Figure 54

INSTRUMENTOS PARA TESTES ELÉTRICOS

Activate the function and make the following adjustments, with “Step 1” being responsible for element 27-1. The RET 670 allows adjustments for both line voltage and phase voltage. In this case, the phase voltage value (66.4V) is used.

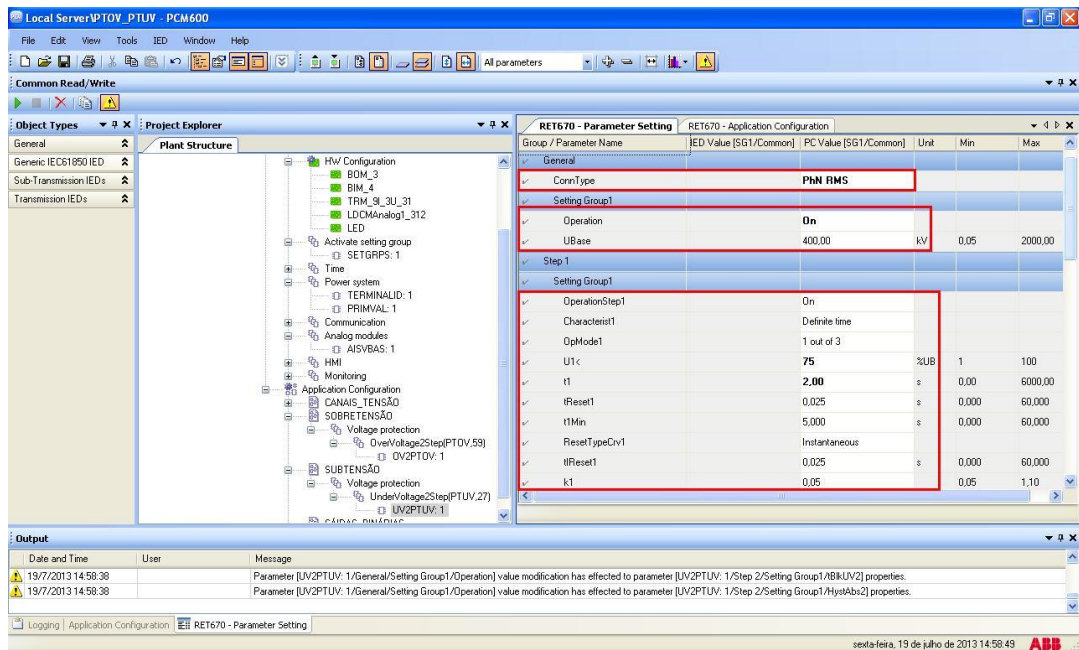


Figure 55

Then configure “Step 2” being equivalent to element 27-2.

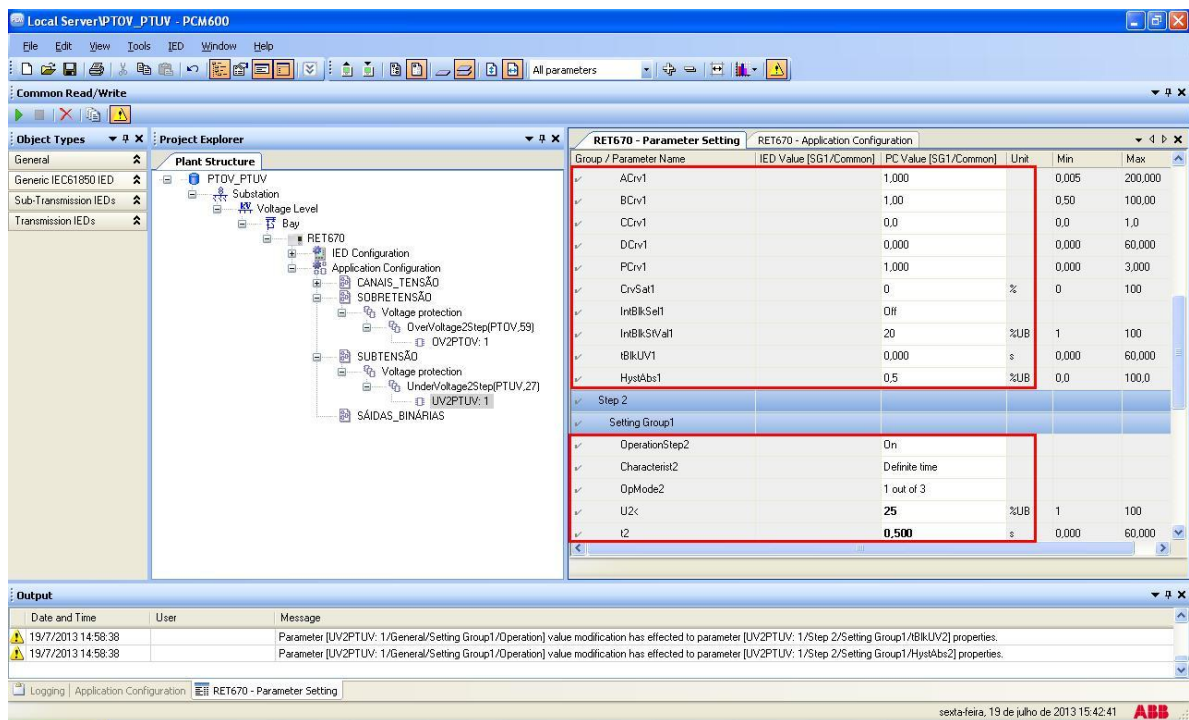


Figure 56

INSTRUMENTOS PARA TESTES ELÉTRICOS

Click the highlighted icon to save the settings.

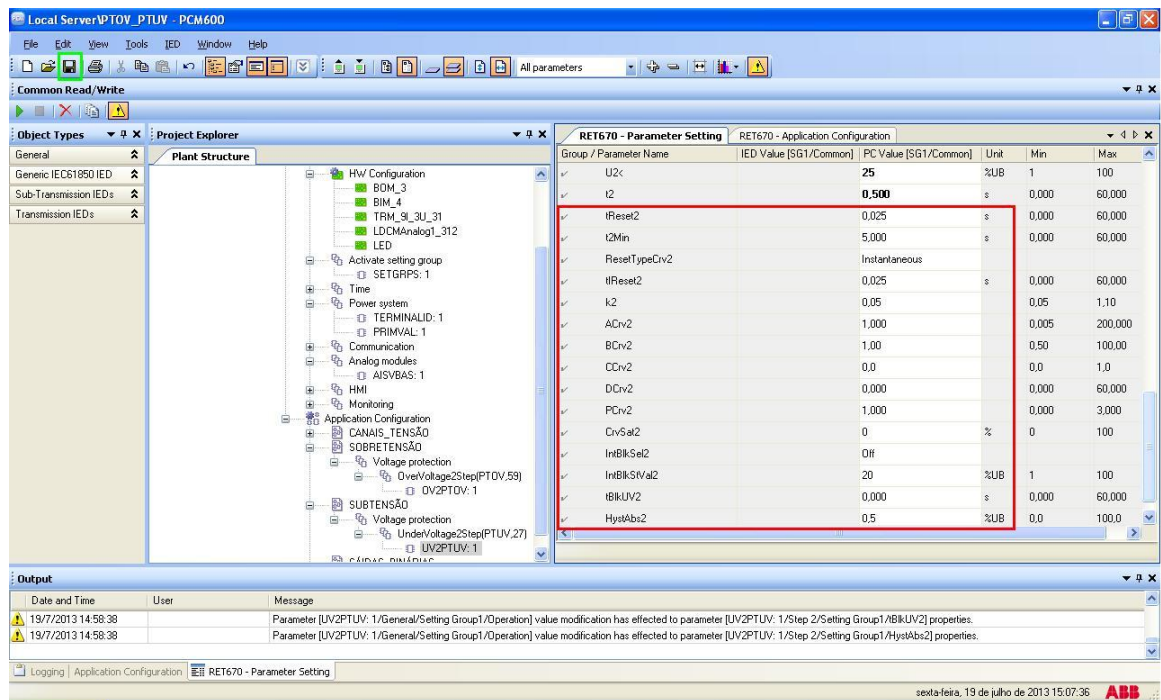


Figure 57

Right-click on the relay icon and submit the changes. In the following message click on “Yes”.

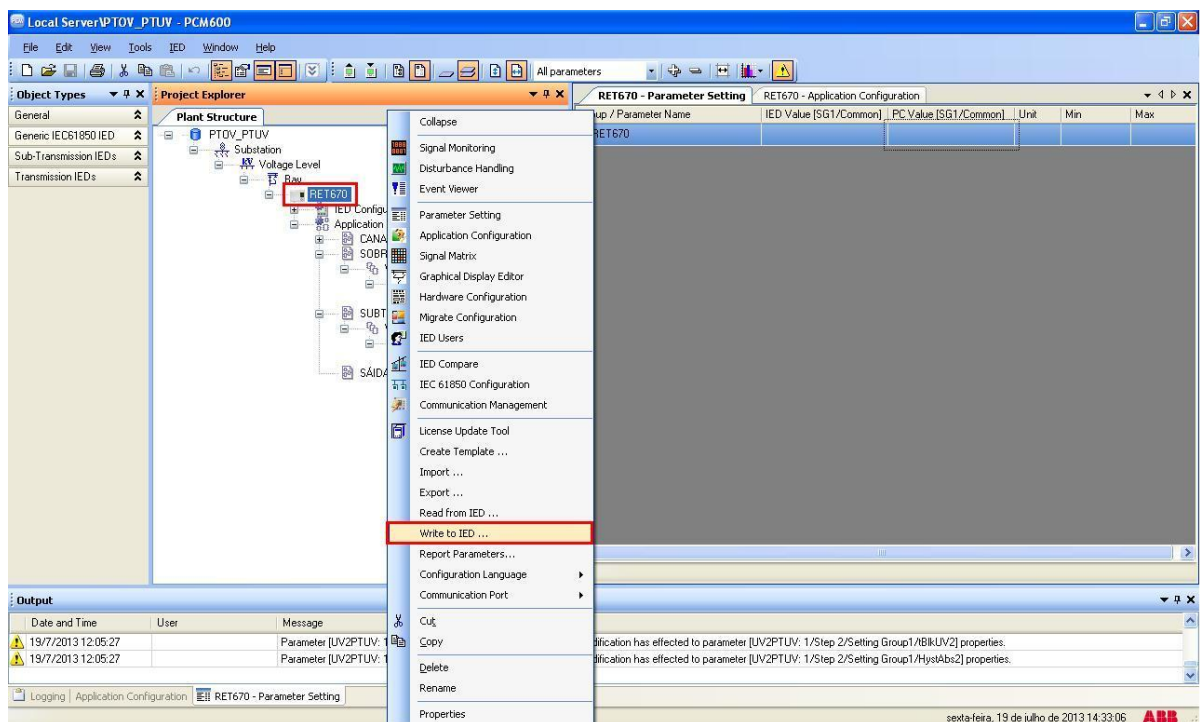


Figure 58

INSTRUMENTOS PARA TESTES ELÉTRICOS

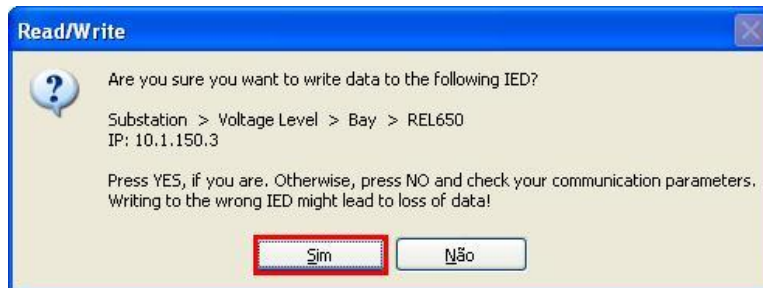


Figure 59

4. Quick software adjustments

4.1 Opening the Quick

Click on the “CTC” application manager icon.

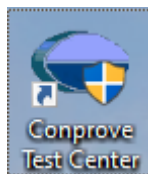


Figure 60

Click on the “Quick” software icon.

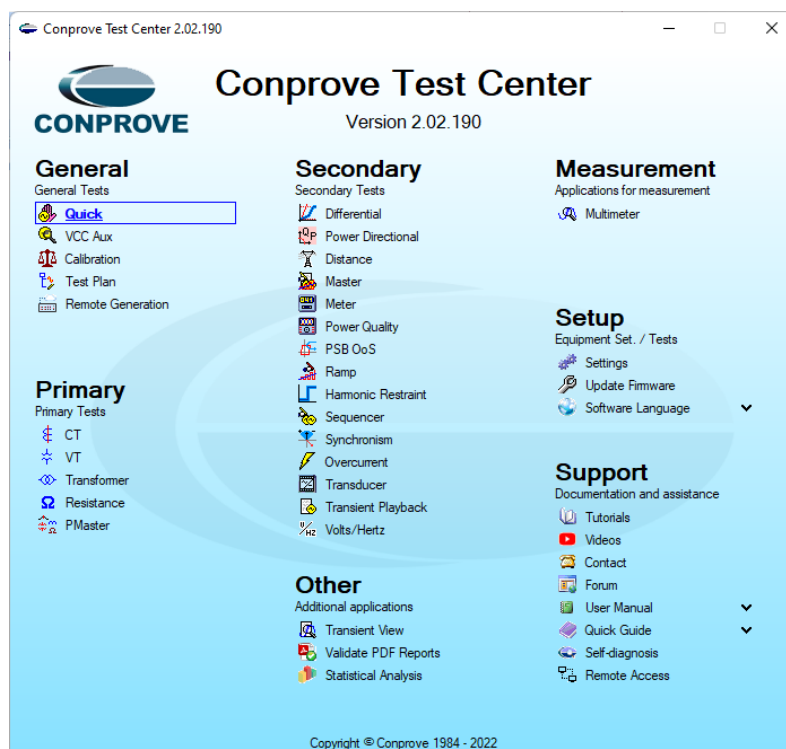


Figure 61

INSTRUMENTOS PARA TESTES ELÉTRICOS

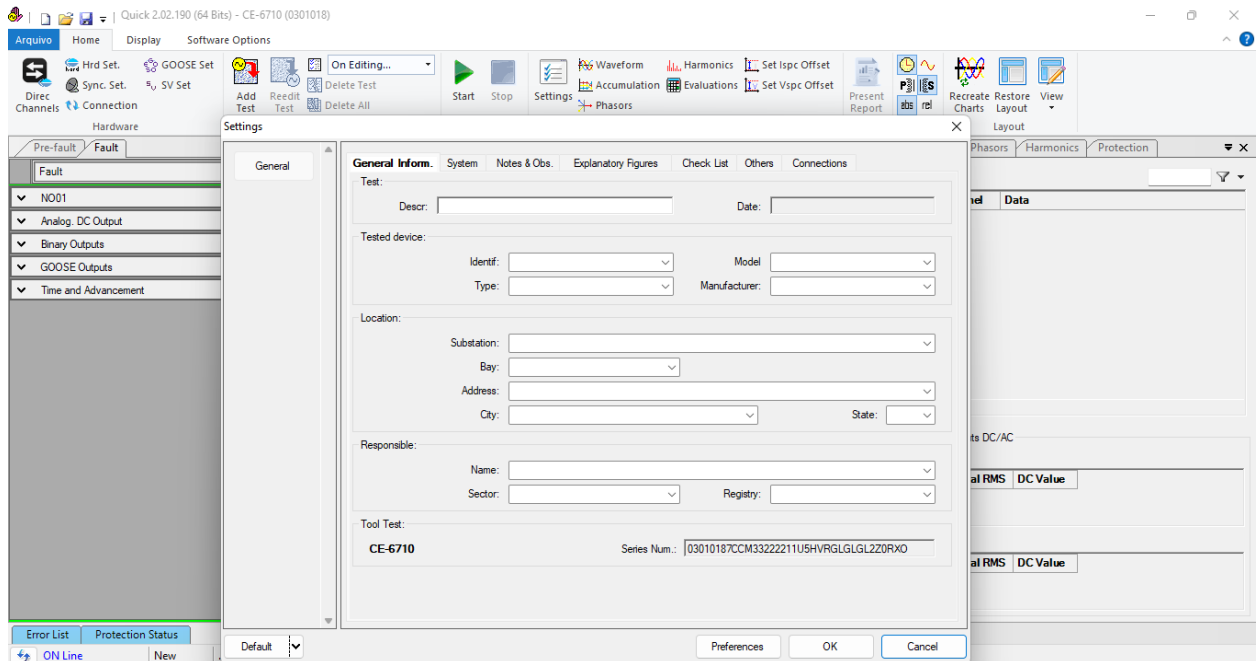


Figure 62

4.2 Configuring the Settings

When opening the software the “*Settings*” screen will open automatically (provided that the option “*Open Settings when Start*” found in the “*Software Options*” menu is selected). Otherwise click directly on the “*Settings*” icon.

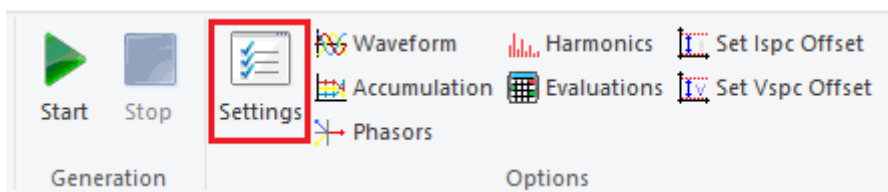


Figure 63

Inside the “*Settings*” screen, fill in the “*General Inform.*” with data from the “*Tested device*”, “*Installation location*” and the “*Responsible*”. This makes reporting easier, as this tab will be the first to be shown.

INSTRUMENTOS PARA TESTES ELÉTRICOS

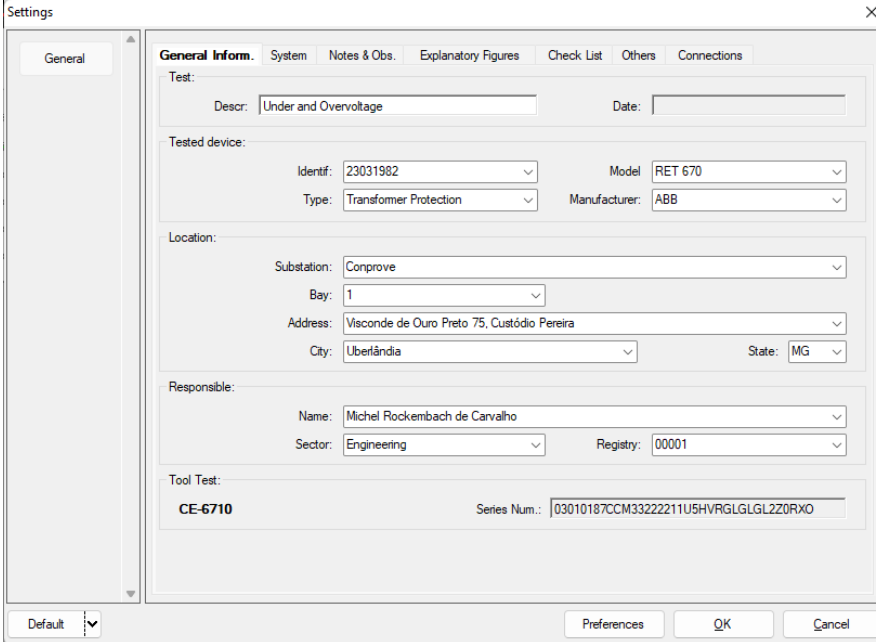
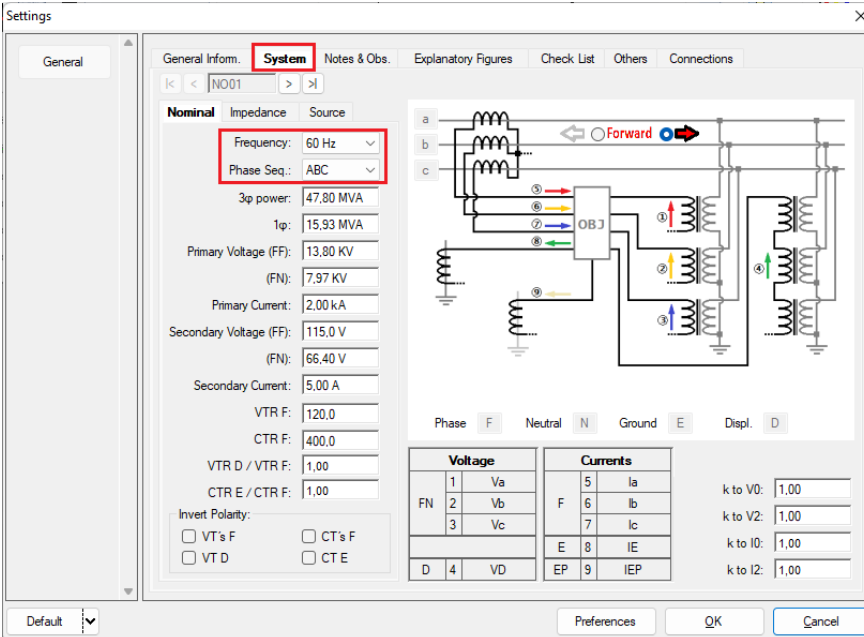


Figure 64

4.3 System

In the following screen, within the “Nominal” sub tab, the values of frequency, phase sequence, primary and secondary voltages, primary and secondary currents, transformation ratios of VTs and CTs are configured. There are also two sub tabs “Impedance” and “Source” whose data is not relevant for this test.



Voltage		Currents	
1	Va	5	Ia
2	Vb	6	Ib
3	Vc	7	Ic
		8	IE
D	VD	9	IEP

Figure 65

INSTRUMENTOS PARA TESTES ELÉTRICOS

There are other tabs where the user can enter notes and observations, explanatory figures, can create a “check list” of the procedures for carrying out the test and even create a schematic with all the schematic of the connections between the test set and the test equipment.

5. Channel Direction and Hardware Configurations

Click on the icon illustrated below.

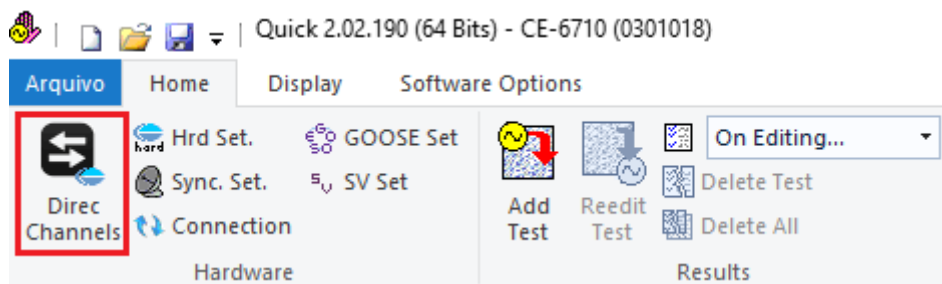


Figure 66

Then click on the highlighted icon to configure the hardware.

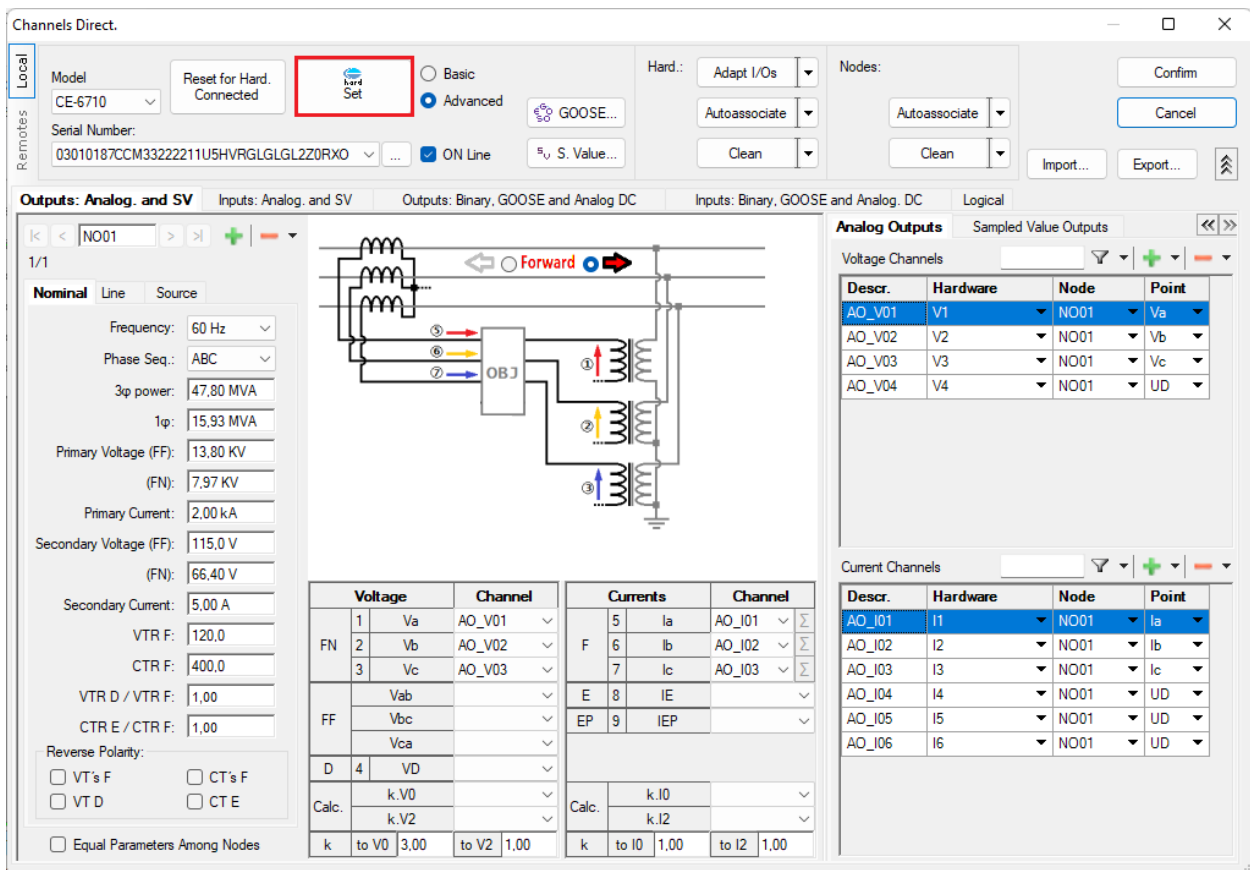


Figure 67

INSTRUMENTOS PARA TESTES ELÉTRICOS

Choose the channel configuration; adjust the auxiliary source and the method of stopping the binary inputs. To finish click on “OK”.

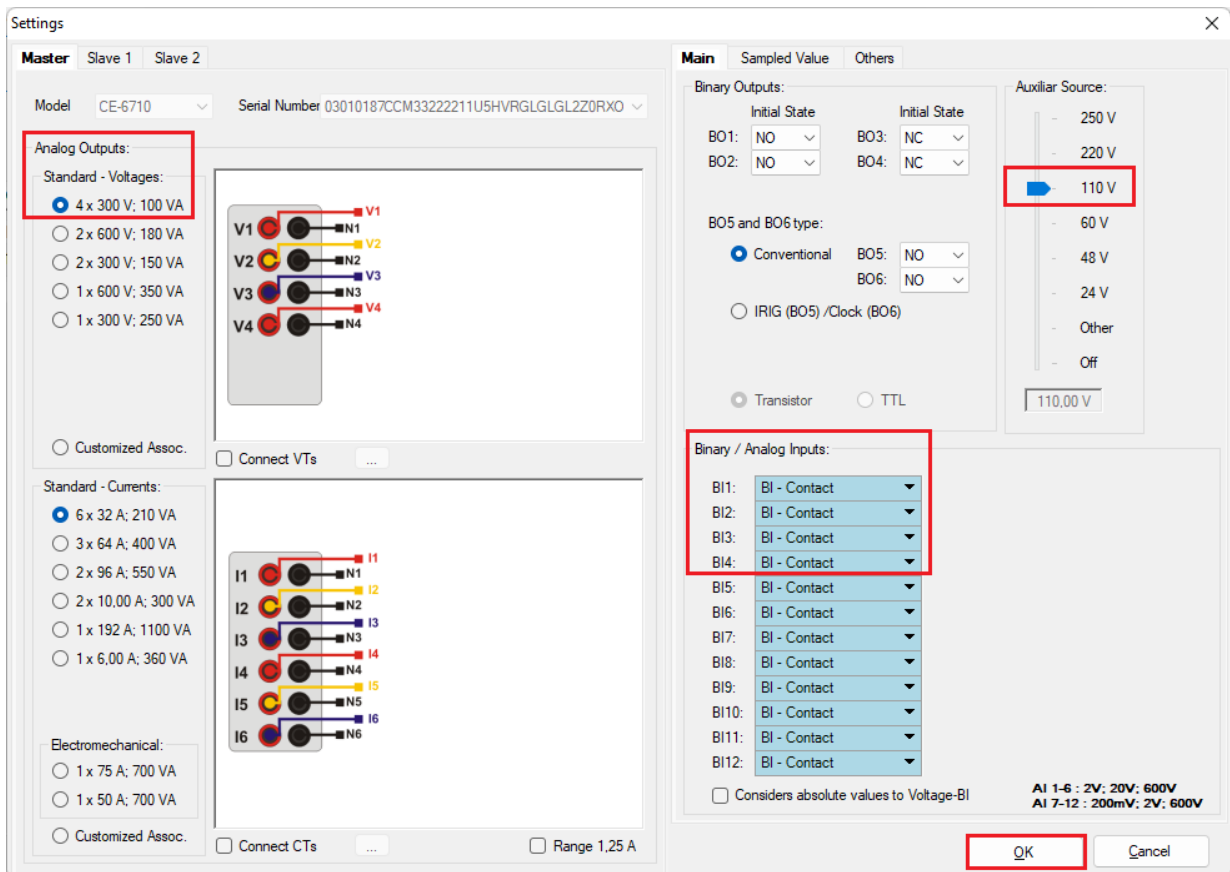


Figure 68

On the next screen choose “Basic” and on the next window (not shown) choose “YES”, finally click on “Confirm”.

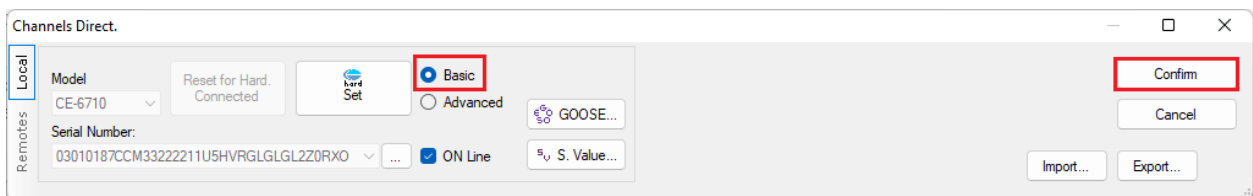


Figure 69

INSTRUMENTOS PARA TESTES ELÉTRICOS

6. Test structure for function 27/59

6.1 Voltage x Time > Undervoltage screen

First, click on the tab “Protection > Voltage x time > Undervoltage” so that the data set in the relay are configured in the software. Then, next to the voltage “V”, choose a channel as a reference, in this case “AO_V01”. Only after choosing the node are the fields for setting function 27 active.

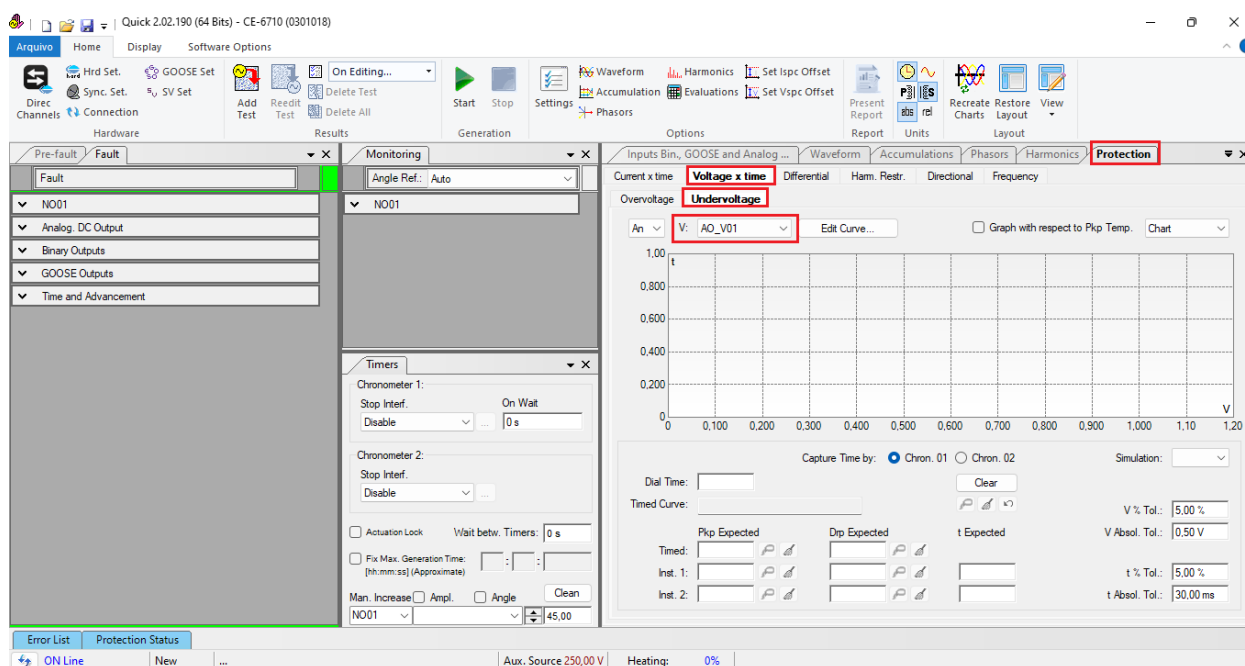


Figure 70

6.2 General Settings 27

According to the relay software settings, these values are entered in the “Quick” software. The 27-1 element pick-up is equal to 49.80V ($0.75 \cdot V_{\text{nominal}} / 1.73$) with actuation time equal to 2.0s and pick-up of element 27-2 equal to 16.60V ($0.25 \cdot V_{\text{nominal}} / 1.73$) with actuation time equal to 500.0ms.

There are also fields where the absolute and relative tolerances for both voltage and time must be entered. These values are taken from Appendix A.2. There is also a field where the type of simulation is required, being possible single-phase-ground, two-phase and three-phase.

INSTRUMENTOS PARA TESTES ELÉTRICOS

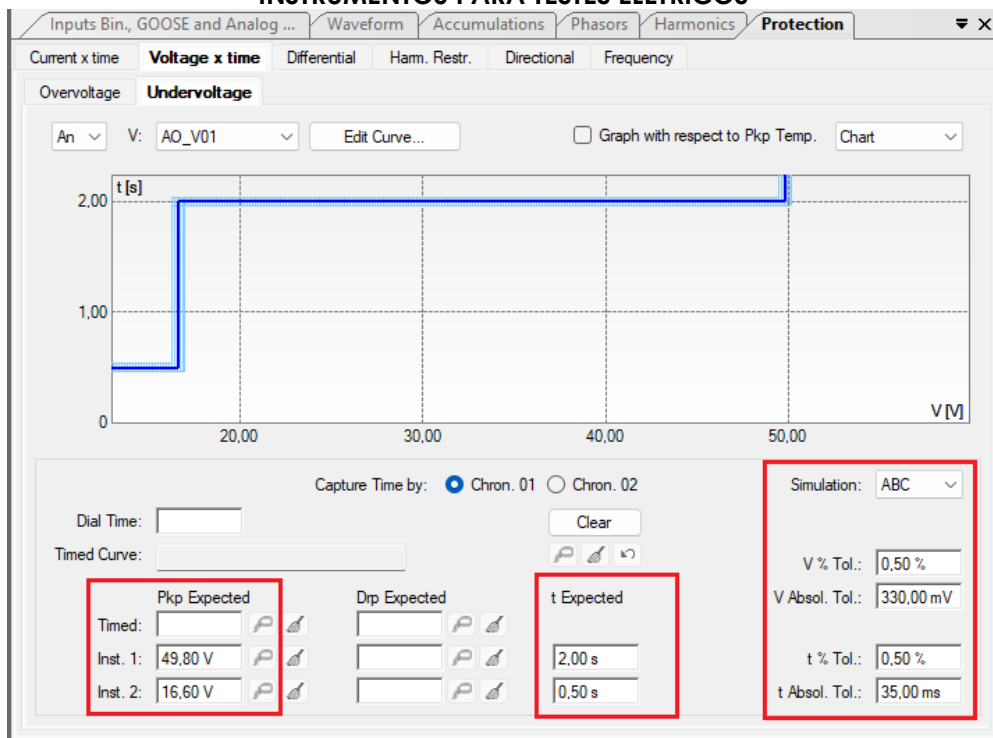


Figure 71

6.3 Timed Element 27-1 Pick-up Test

For the pick-up test, a ramp is used to decrease the voltage value. To do this, choose the “Ramp” option on the “Fault > N01” tabs and click on the highlighted icon.

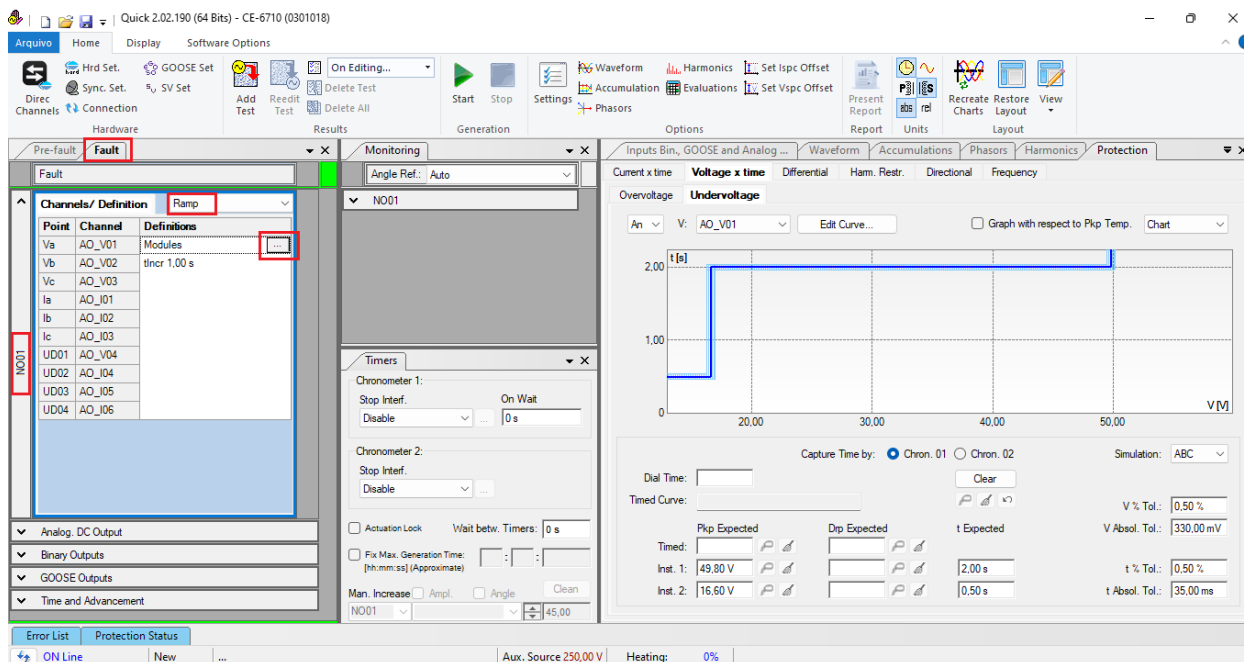


Figure 72

INSTRUMENTOS PARA TESTES ELÉTRICOS

For the first channel, set the value of 50.80V, then right-click and choose the following options to configure the voltages as balanced three-phase with positive rotation.

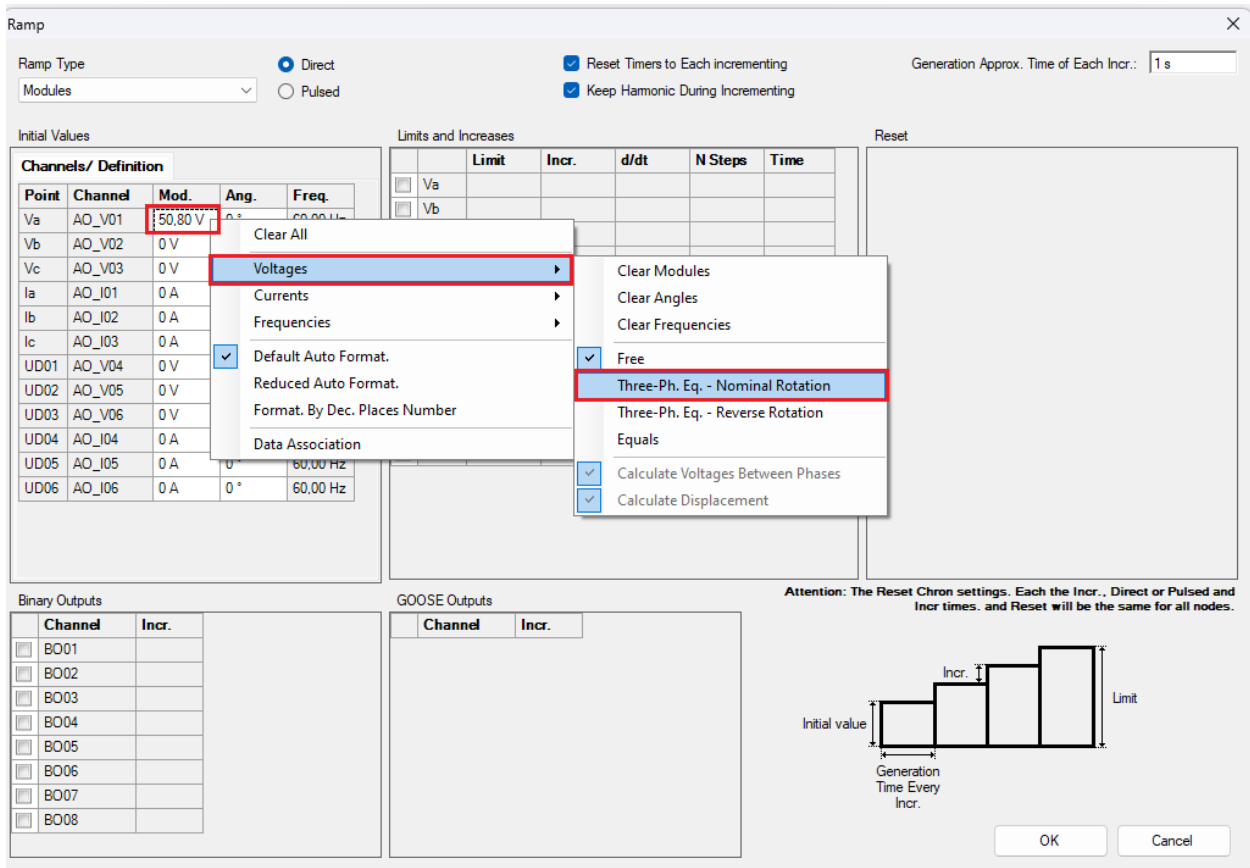


Figure 73

Select the “Va” channel and set the following limit and decrement values. Change generation time for each increment to 3,0s.

INSTRUMENTOS PARA TESTES ELÉTRICOS

Ramp

Ramp Type: Direct Pulsed

Modules:

Reset Timers to Each Incrementing
 Keep Harmonic During Incrementing

Generation Approx. Time of Each Incr.:

Initial Values

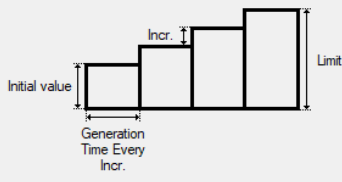
Point	Channel	Mod.	Ang.	Freq.
Va	AO_V01	50,80 V	0 °	60,00 Hz
Vb	AO_V02	50,80 V	-120,0 °	60,00 Hz
Vc	AO_V03	50,80 V	120,0 °	60,00 Hz
Ia	AO_I01	0 A	0 °	60,00 Hz
Ib	AO_I02	0 A	0 °	60,00 Hz
Ic	AO_I03	0 A	0 °	60,00 Hz
UD01	AO_V04	0 V	0 °	60,00 Hz
UD02	AO_I04	0 A	0 °	60,00 Hz
UD03	AO_I05	0 A	0 °	60,00 Hz
UD04	AO_I06	0 A	0 °	60,00 Hz

Limits and Increases

	Limit	Incr.	d/dt	N Steps	Time
<input checked="" type="checkbox"/> Va	48,80 V	-100,0 mV	-33,33 mV/s	21,00	63,00 s
<input checked="" type="checkbox"/> Vb	48,80 V	-100,0 mV	-33,33 mV/s	21,00	63,00 s
<input checked="" type="checkbox"/> Vc	48,80 V	-100,0 mV	-33,33 mV/s	21,00	63,00 s
<input type="checkbox"/> Ia					
<input type="checkbox"/> Ib					
<input type="checkbox"/> Ic					
<input type="checkbox"/> UD01					
<input type="checkbox"/> UD02					
<input type="checkbox"/> UD03					
<input type="checkbox"/> UD04					

Reset

Attention: The Reset Chron settings. Each the Incr., Direct or Pulsed and Incr times, and Reset will be the same for all nodes.



Binary Outputs

Channel	Incr.
<input type="checkbox"/> BO01	
<input type="checkbox"/> BO02	
<input type="checkbox"/> BO03	
<input type="checkbox"/> BO04	
<input type="checkbox"/> BO05	
<input type="checkbox"/> BO06	
<input type="checkbox"/> BO07	
<input type="checkbox"/> BO08	

GOOSE Outputs

Channel	Incr.

OK Cancel

Figure 74

NOTE: An important detail is that pre-fault voltage must be entered so that function 27 dropout occurs, because before injecting voltage, the function is already operated. Therefore, use the “Pre-fault” tab with rated voltage and time equal to 1.0s.

INSTRUMENTOS PARA TESTES ELÉTRICOS

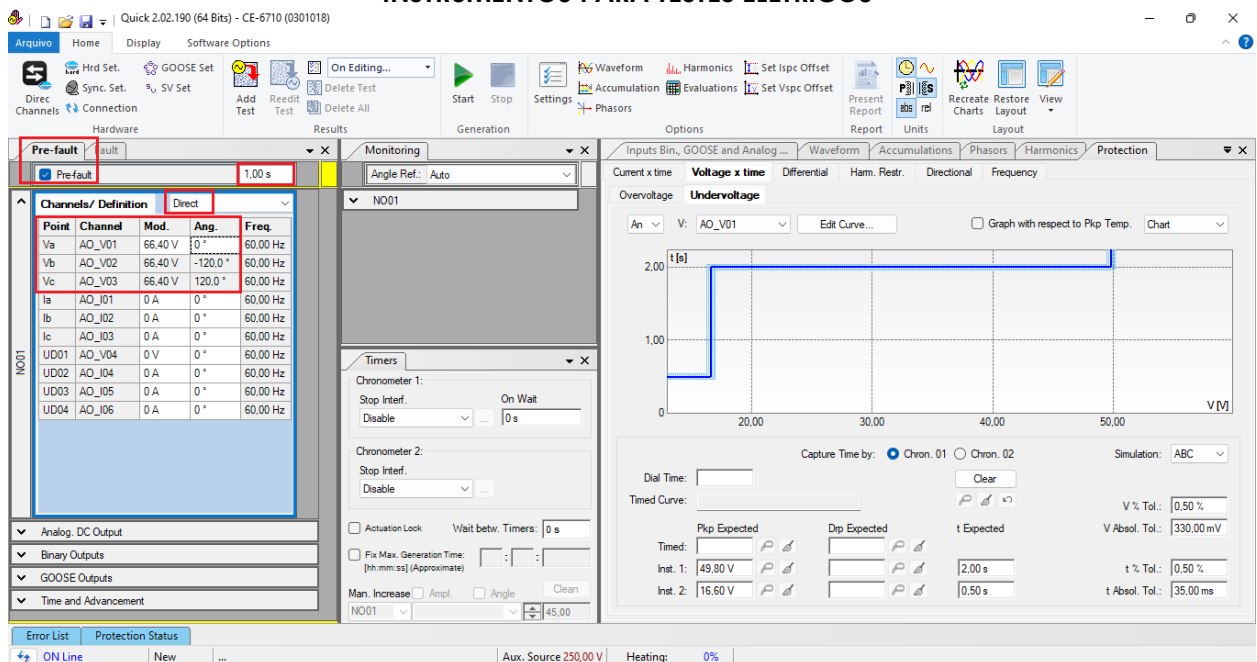


Figure 75

Choose the stop interface, which in this case is “BI03” and block the first actuation. Start the generation by clicking on the icon below or through the shortcut “Alt + G”.

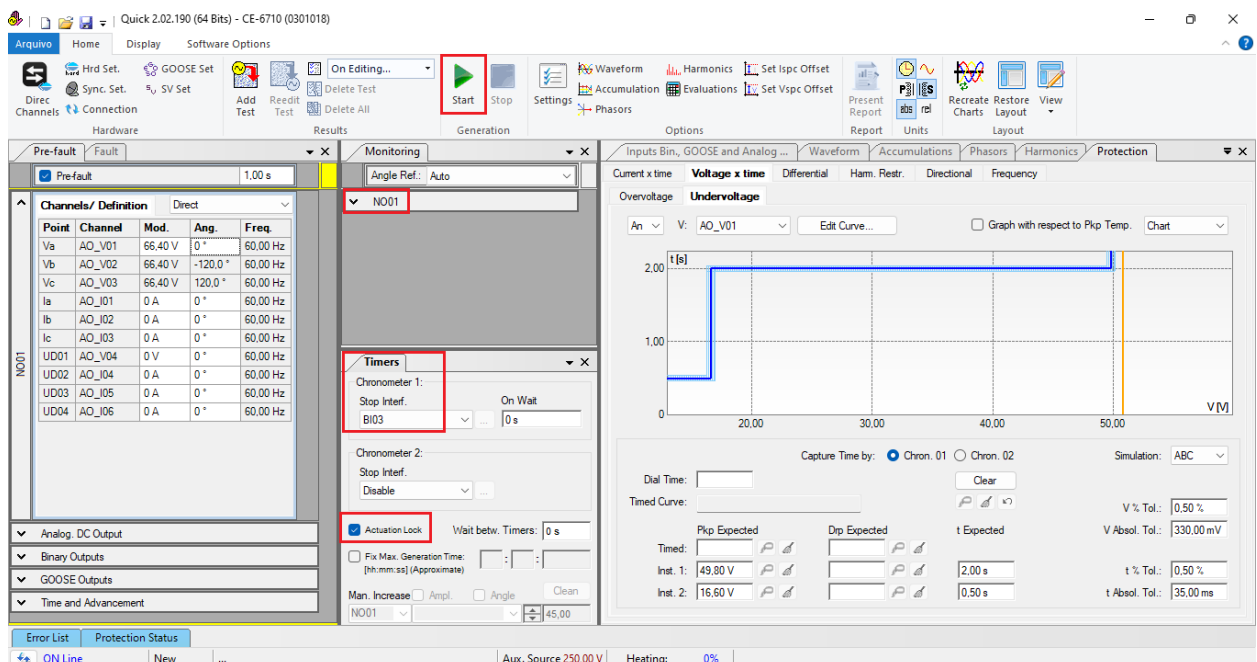


Figure 76

To view the values being generated, click on “N01” within the “Monitoring” tab. After the actuation, click on the highlighted icon to capture the tested point.

INSTRUMENTOS PARA TESTES ELÉTRICOS

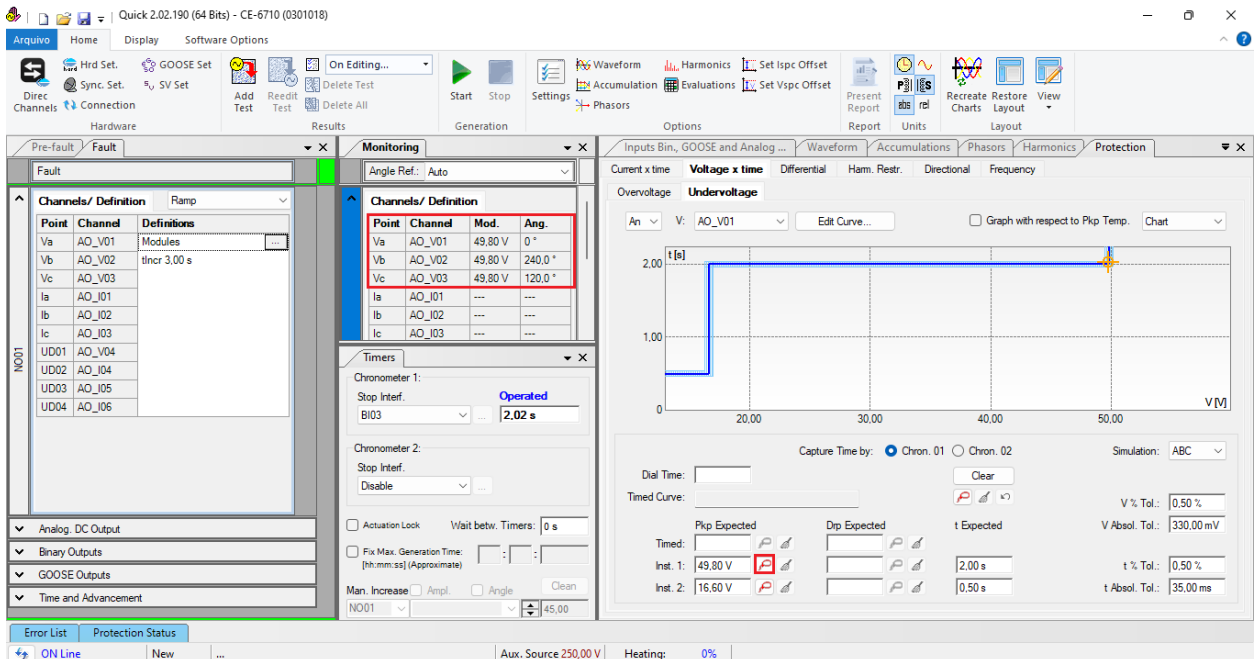


Figure 77

In this case, the pickup found was 49.80V, being exactly the value set in the relay.

6.4 Timed Element 27-2 Pick-up Test

Click on the “Fault” tab and the “...” icon and enter an initial value of 17.60V, limit value of 15.60V, with a decrement of -100.0mV and a time of 1.0s.

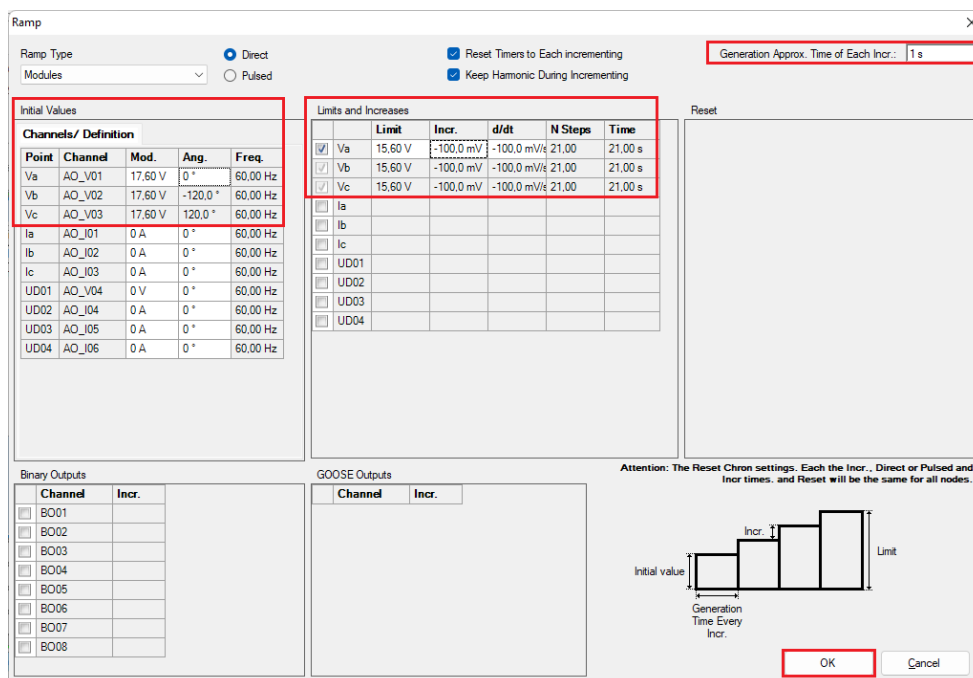


Figure 78

INSTRUMENTOS PARA TESTES ELÉTRICOS

The next step is to choose the stop interface, which in this case is “*BI04*” and block the first actuation. Start the generation by clicking on the icon below or through the shortcut “*Alt + G*”.

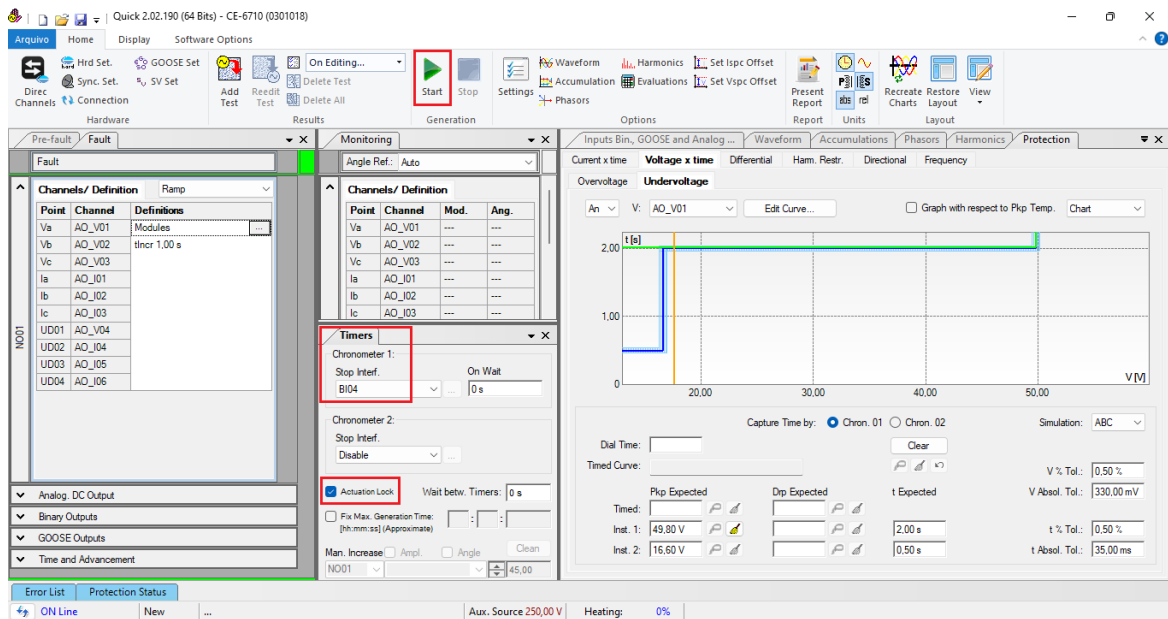


Figure 79

The pick-up found for element 27-2 was 16.60V, being exactly the value set in the relay.

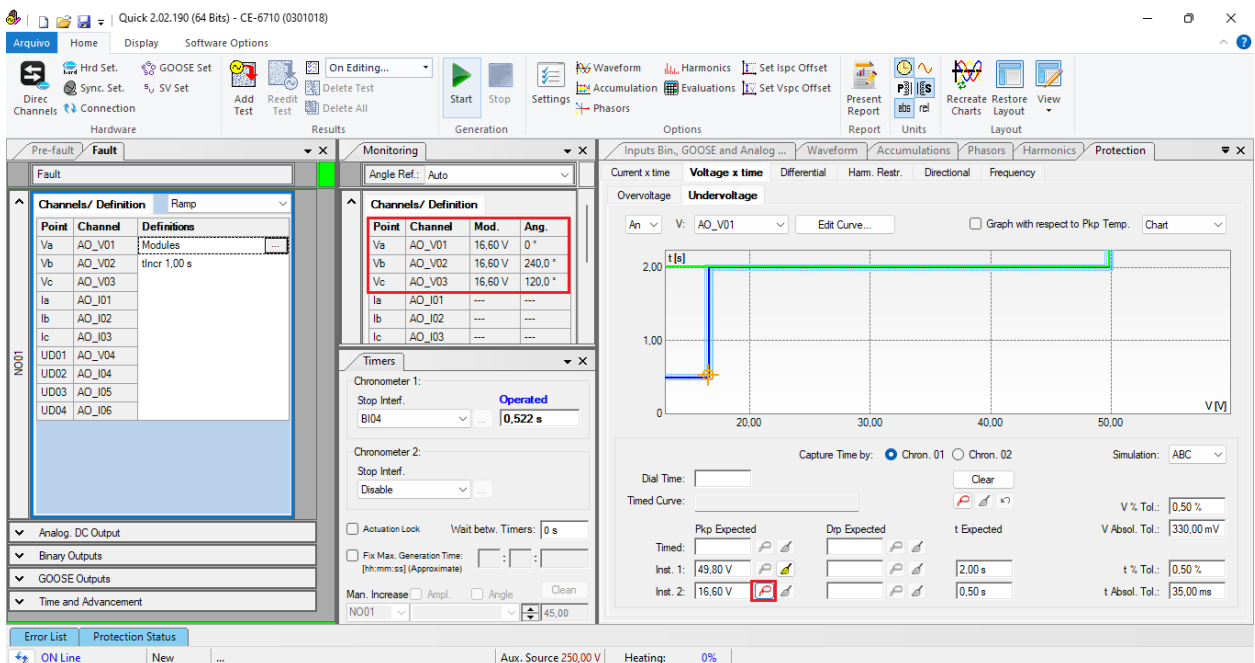


Figure 80

INSTRUMENTOS PARA TESTES ELÉTRICOS

6.5 Element 27-1 point test

To verify the operating time of element 27-1, remove the “Ramp” by choosing the “Direct” option and inject voltage values below the pick-up value. Change the stop interface to “BI03” and block the first actuation. The figure below shows the value of 48.00V already captured and the value of 18.00V to be captured.

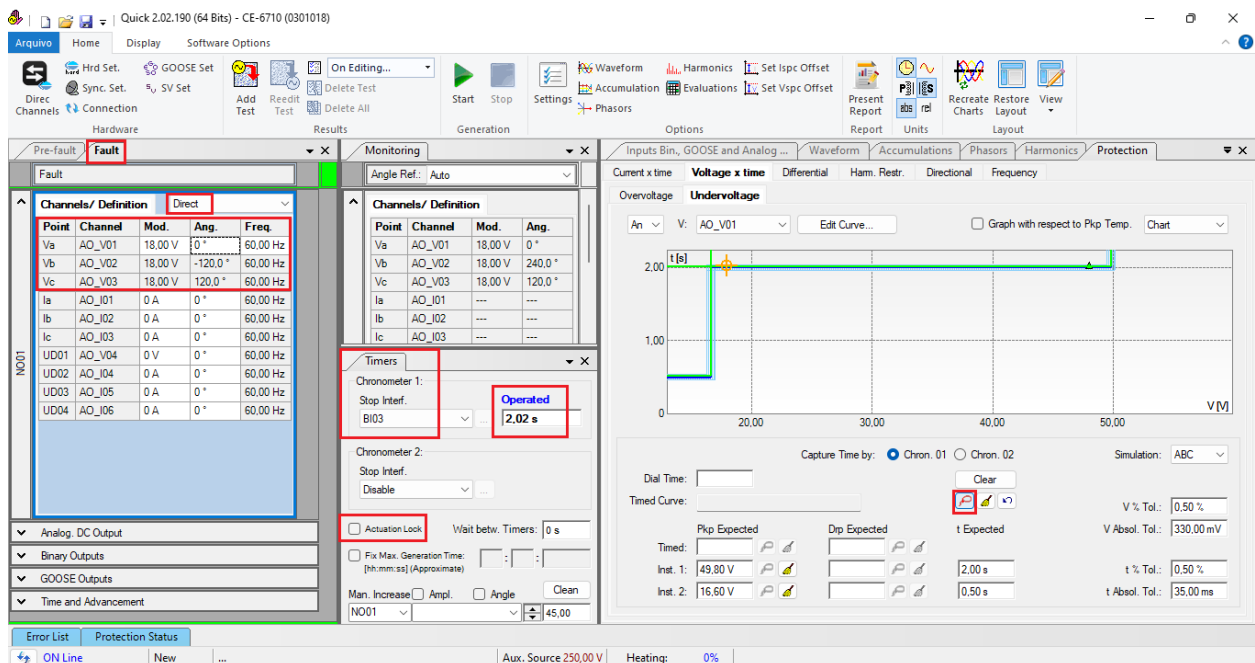


Figure 81

It is verified that the operating times are within the tolerance provided by the manufacturer.

6.6 Element 27-2 point test

To verify the operating time of element 2, choose “BI04” and test points with voltage values below the pick-up. The figure below shows the value of 14.00V already captured and the value of 4.00V not yet captured.

NOTE: Remember to always block the first actuation.

INSTRUMENTOS PARA TESTES ELÉTRICOS

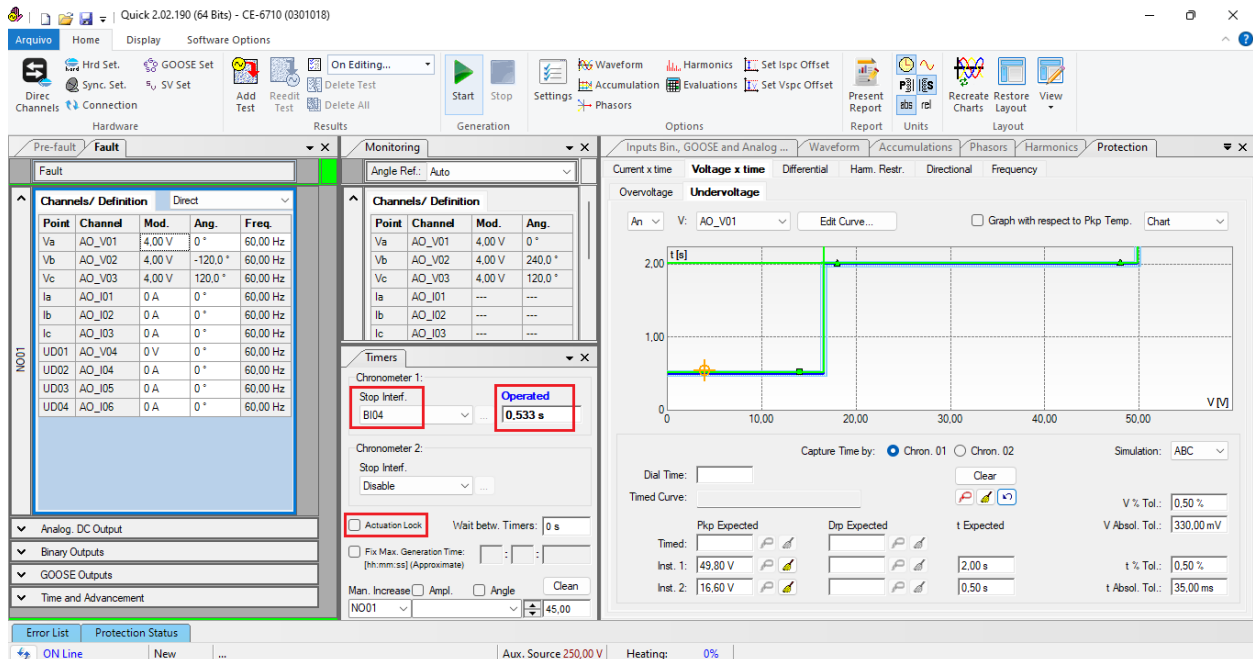


Figure 82

It is verified that the operating times are within the tolerance given by the manufacturer.

6.7 Voltage x Time > Overvoltage screen

Click on the tab "Protection > Voltage x time > Overvoltage" so that the data set in the relay are configured in the software. Next to the voltage "V" chooses a node as a reference, in this case "AO_V01". Only after choosing the node are the fields for setting function 59 active.

INSTRUMENTOS PARA TESTES ELÉTRICOS

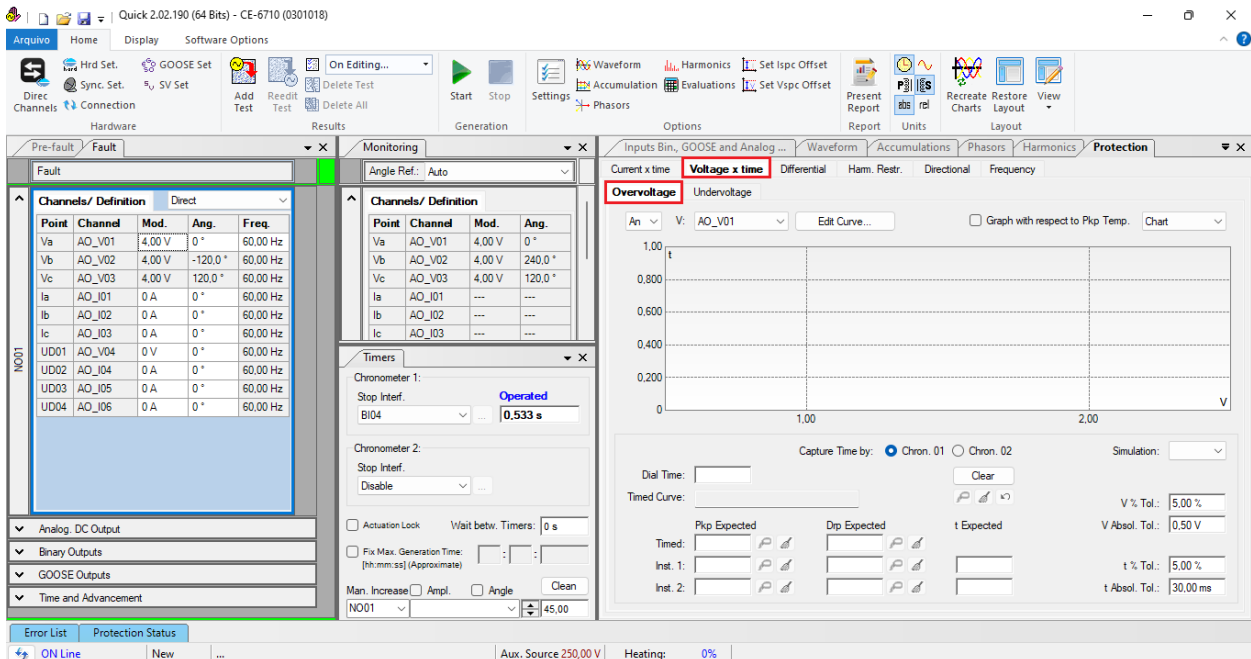


Figure 83

6.8 General Adjustments 59

According to the relay software settings, these values are entered in the Quick software. The 59-1 element pick-up is equal to 83.00V ($1.25 * V_{\text{nominal}} / 1.73$) with actuation time equal to 2.0s and pick-up of element 59-2 equal to 116.20V ($1.75 * V_{\text{nominal}} / 1.73$) with actuation time equal to 500.0ms.

There are also fields where the absolute and relative tolerances for both voltage and time must be entered. These values are taken from Appendix A.2. There is also a field where the type of simulation is required, being possible single-phase-ground, two-phase and three-phase.

INSTRUMENTOS PARA TESTES ELÉTRICOS

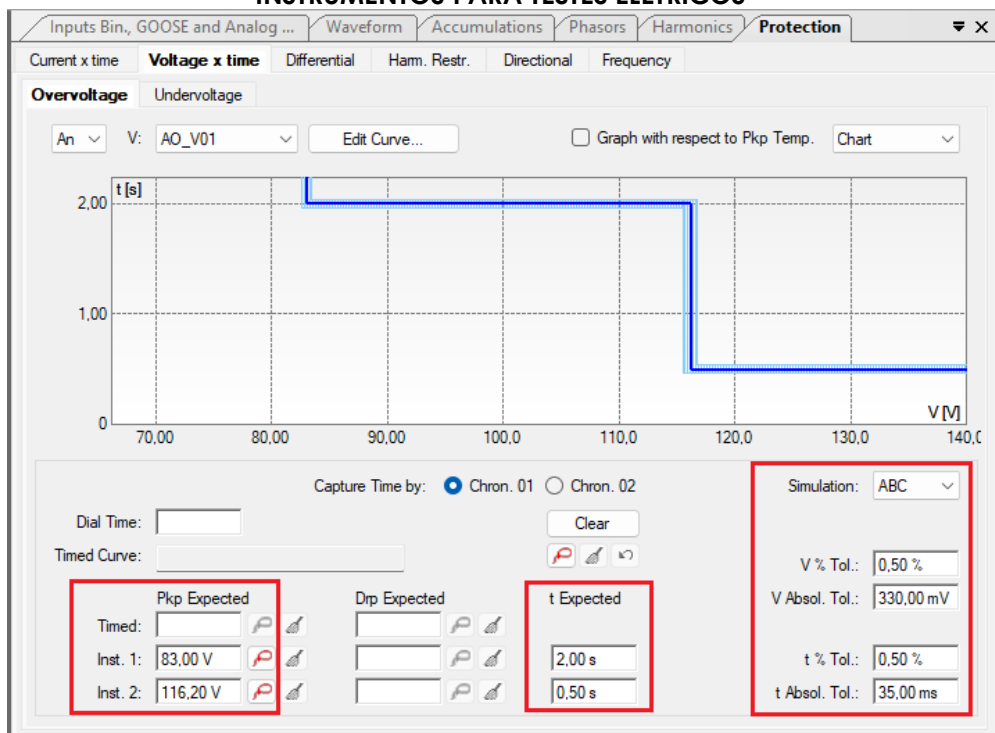


Figure 84

6.9 Timed Element 59-1 Pick-up Test

For the pick-up test, a ramp is used to increase the voltage value. To do this, choose the “Ramp” option on the “Fault > NO1” tabs and click on the highlighted icon.

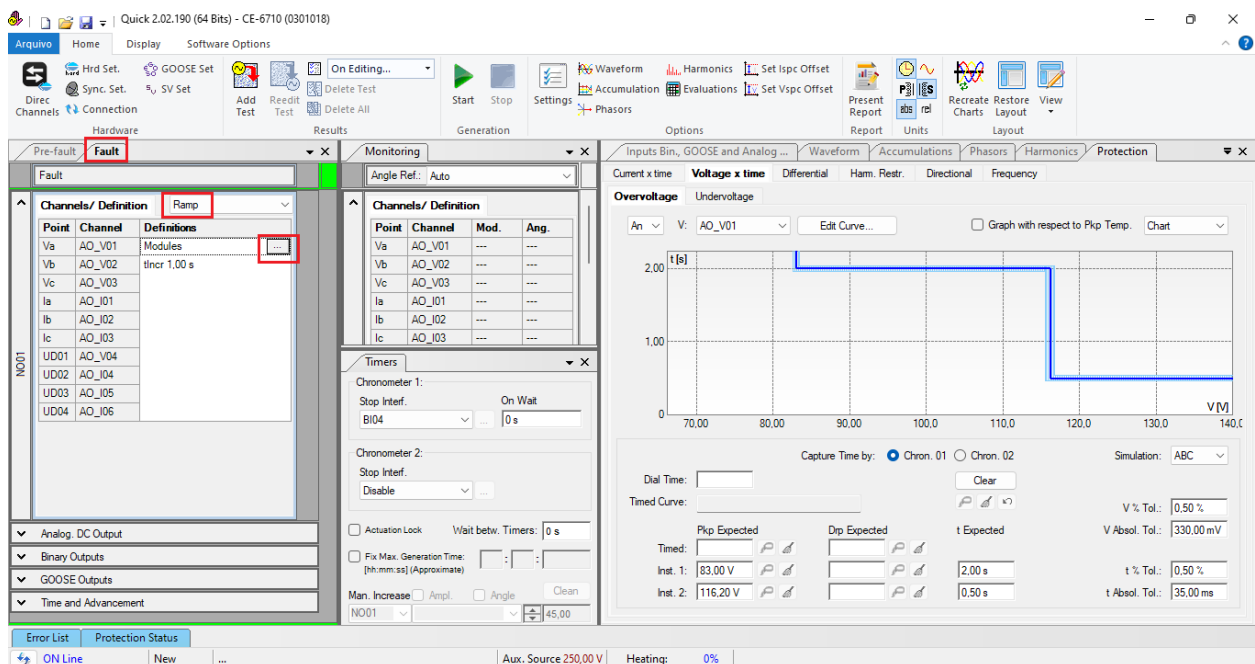


Figure 85

INSTRUMENTOS PARA TESTES ELÉTRICOS

For the initial value, set 82.00V, for limit value set 84.00V, with an increment of 100mV and a time of 3.0s.

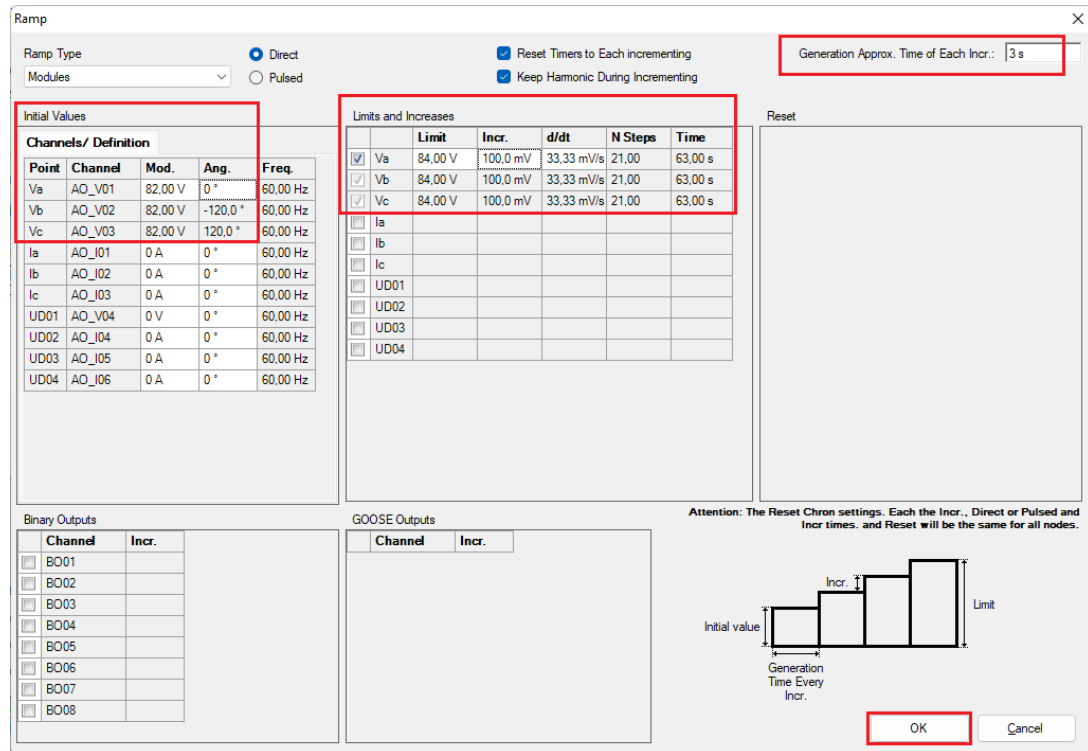


Figure 86

Change the stop interface, which in this case is "BI01" and start the generation by clicking on the icon below or using the shortcut "Alt + G".

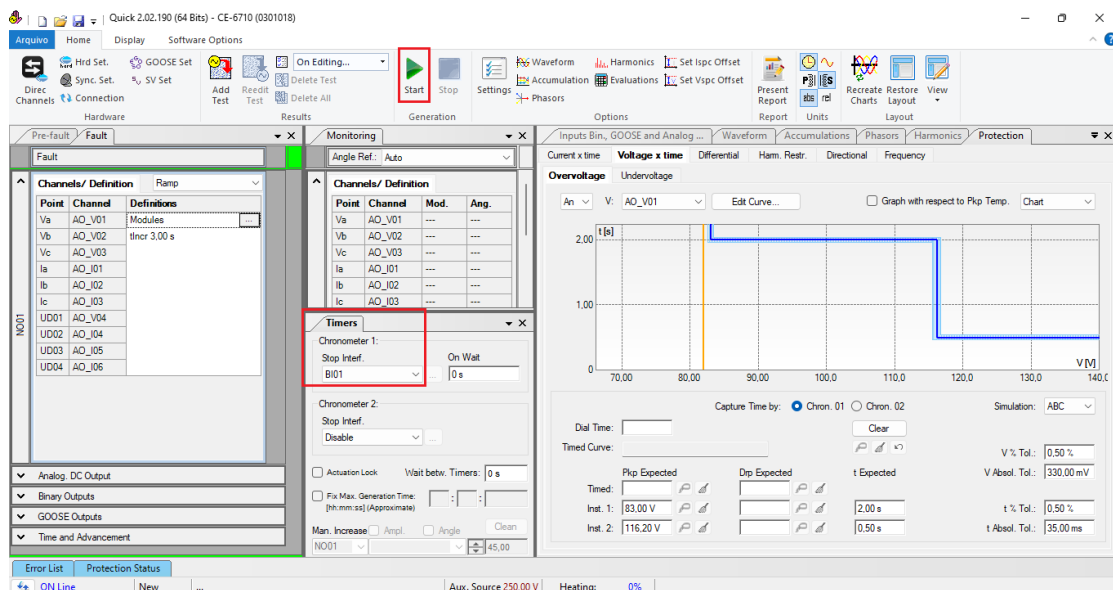


Figure 87

INSTRUMENTOS PARA TESTES ELÉTRICOS

To view the values being generated, click on “NO1” within the “Monitoring” tab. After the actuation, click on the highlighted icon to capture the point.

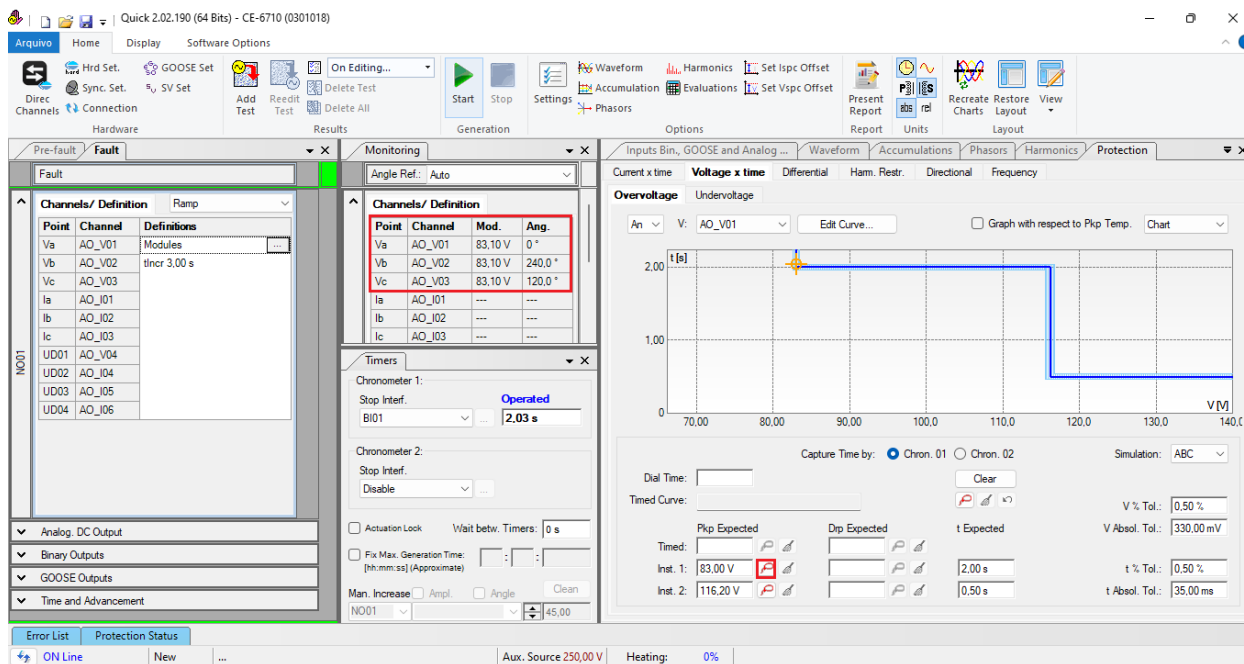


Figure 88

In this case, the pickup found was 83.10V, within the range of values provided by the manufacturer.

6.10 Timed Element 59-2 Pick-up Test

Click on the “Fault” tab and the “...” icon and enter an initial value of 115.20V, limit value of 117.20V, with an increment of 100.0mV and a time of 1.0s.

INSTRUMENTOS PARA TESTES ELÉTRICOS

Ramp

Ramp Type: Direct Pulsed

Reset Timers to Each Incrementing: Keep Harmonic During Incrementing:

Generation Approx. Time of Each Incr.: 1 s

Initial Values

Point	Channel	Mod.	Ang.	Freq.
Va	AO_V01	115,2 V	0 °	60,00 Hz
Vb	AO_V02	115,2 V	-120,0 °	60,00 Hz
Vc	AO_V03	115,2 V	120,0 °	60,00 Hz
Ia	AO_I01	0 A	0 °	60,00 Hz
Ib	AO_I02	0 A	0 °	60,00 Hz
Ic	AO_I03	0 A	0 °	60,00 Hz
UD01	AO_V04	0 V	0 °	60,00 Hz
UD02	AO_I04	0 A	0 °	60,00 Hz
UD03	AO_I05	0 A	0 °	60,00 Hz
UD04	AO_I06	0 A	0 °	60,00 Hz

Limits and Increases

	Limit	Incr.	d/dt	N Steps	Time	
<input checked="" type="checkbox"/>	Va	117,2 V	100,0 mV	100,0 mV/s	21,00	21,00 s
<input checked="" type="checkbox"/>	Vb	117,2 V	100,0 mV	100,0 mV/s	21,00	21,00 s
<input checked="" type="checkbox"/>	Vc	117,2 V	100,0 mV	100,0 mV/s	21,00	21,00 s
<input type="checkbox"/>	Ia					
<input type="checkbox"/>	Ib					
<input type="checkbox"/>	Ic					
<input type="checkbox"/>	UD01					
<input type="checkbox"/>	UD02					
<input type="checkbox"/>	UD03					
<input type="checkbox"/>	UD04					

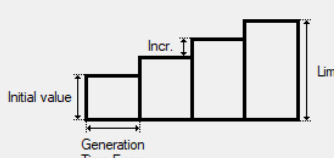
Binary Outputs:

Channel	Incr.
<input type="checkbox"/> BO01	
<input type="checkbox"/> BO02	
<input type="checkbox"/> BO03	
<input type="checkbox"/> BO04	
<input type="checkbox"/> BO05	
<input type="checkbox"/> BO06	
<input type="checkbox"/> BO07	
<input type="checkbox"/> BO08	

GOOSE Outputs:

Channel	Incr.

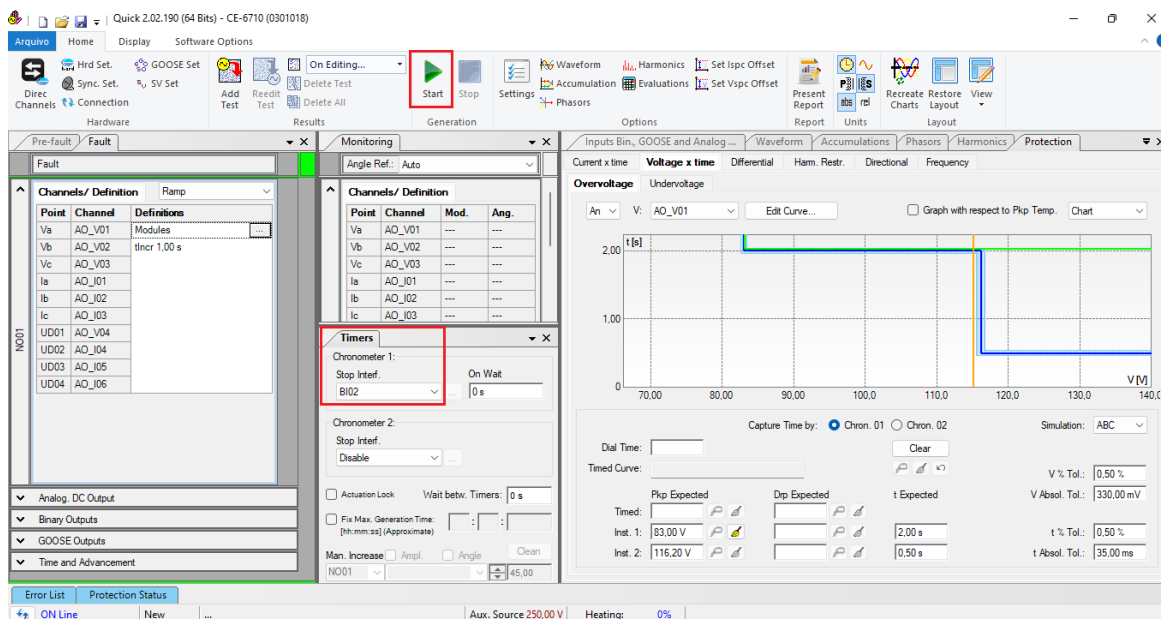
Attention: The Reset Chron settings. Each the Incr., Direct or Pulsed and Incr times, and Reset will be the same for all nodes.



OK Cancel

Figure 89

The next step is to choose the stop interface, which in this case is "BI02" and start the generation by clicking on the icon below or using the shortcut "Alt + G".



Quick 2.02.190 (64 Bits) - CE-6710 (0301018)

Start Stop Settings Phasors

Channels/ Definition Ramp

Point	Channel	Definitions
Va	AO_V01	Modules
Vb	AO_V02	tincr 1,00 s
Vc	AO_V03	
Ia	AO_I01	
Ib	AO_I02	
Ic	AO_I03	
UD01	AO_V04	
UD02	AO_I04	
UD03	AO_I05	
UD04	AO_I06	

Timers

Chronometer 1: Stop Interf. BI02 On Wait 0 s

Chronometer 2: Stop Interf. Disable

Man. Increase Amp. Angle Clean

NO01

Overvoltage Undervoltage

An V: AO_V01

Graph with respect to Pkp Temp. Chart

2.00

1.00

0

70.00 80.00 90.00 100.00 110.00 120.00 130.00 140.00

V[M]

Capture Time by: Chron. 01 Chron. 02

Dial Time: Clear

Timed Curve: V % Tol.: 0.50 % V Absol. Tol.: 330.00 mV

Inst. 1: 83.00 V Pkp Expected Dip Expected t Expected

Inst. 2: 116.20 V 2.00 s t % Tol.: 0.50 % t Absol. Tol.: 35.00 ms

Aux. Source 250,00 V Heating: 0%

Figure 90

INSTRUMENTOS PARA TESTES ELÉTRICOS

The pick-up value found for element 59-2 was 116.30V, within the range of values provided by the manufacturer.

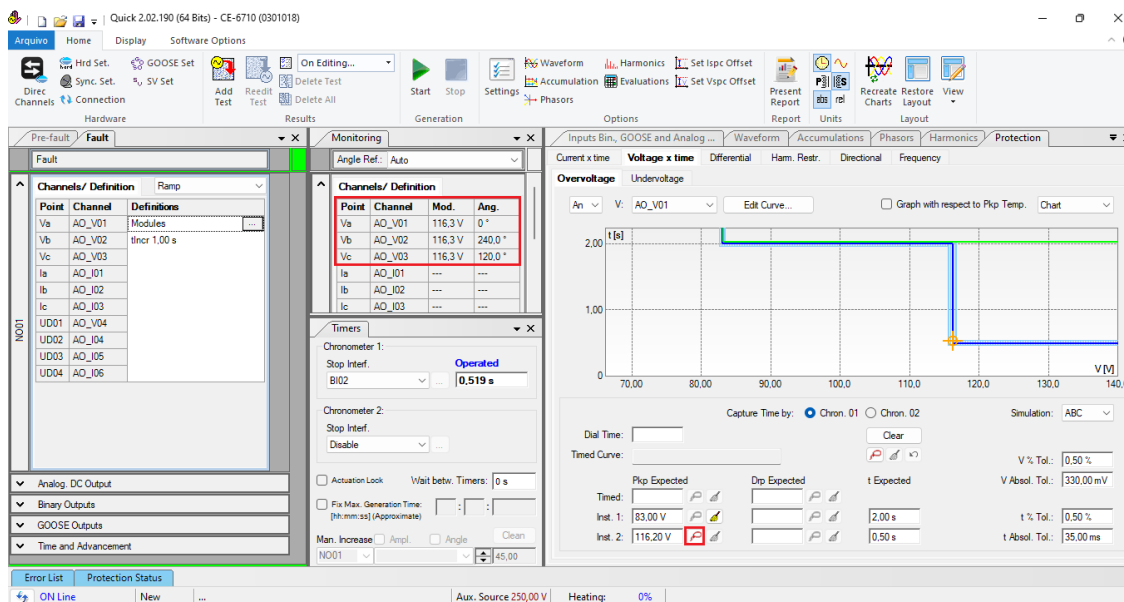


Figure 91

6.11 Element 59-1 point test

To verify the operating time of element 59-1, remove the “Ramp” by choosing the “Direct” option and inject voltage values above the pick-up value. Change the stop interface to “BI01” and block the first actuation. The following figure shows the value of 85.00V already captured and the value of 115.00V to be captured.

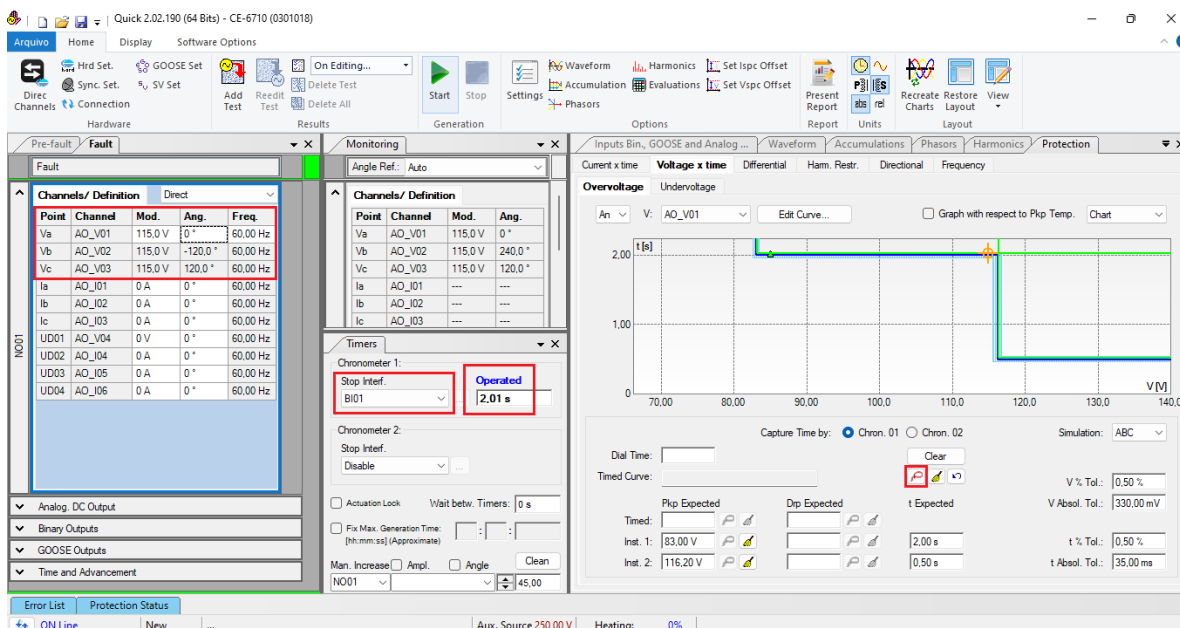


Figure 92

INSTRUMENTOS PARA TESTES ELÉTRICOS

It is verified that the operating times are within the tolerance provided by the manufacturer.

6.12 *Element 59-2 point test*

To verify the operating time of the 59-2 element, choose “BI02” and test points with voltage values above the pick-up. The following figure shows the value of 120.00V already captured and the value of 135.0V not yet captured.

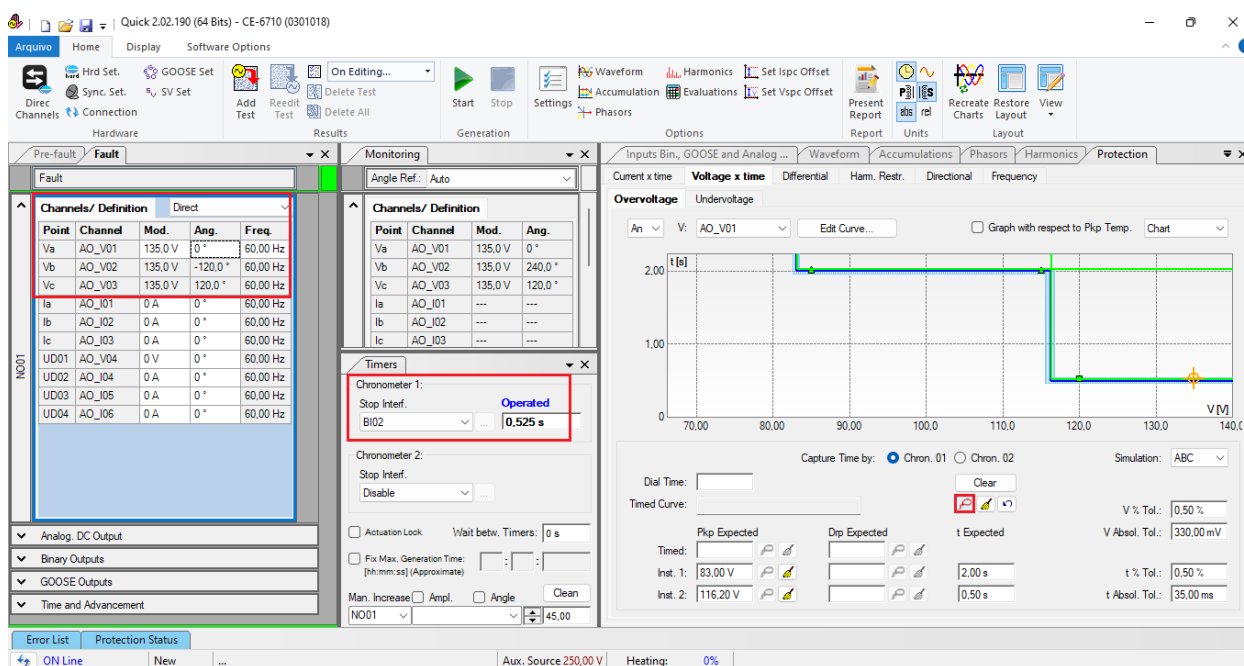


Figure 93

It is verified that the operating times are within the tolerance provided by the relay manufacturer.

7. Report

At the end of the test, you can request an automatic report, just click on the icon illustrated below or use the shortcut “Ctrl + R”.

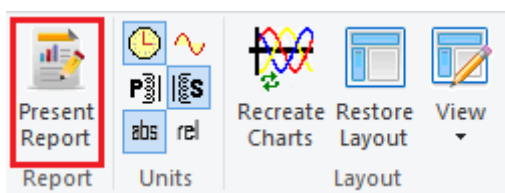


Figure 94

INSTRUMENTOS PARA TESTES ELÉTRICOS

When requesting the report, a screen opens where the user chooses the information that should be shown in the report.

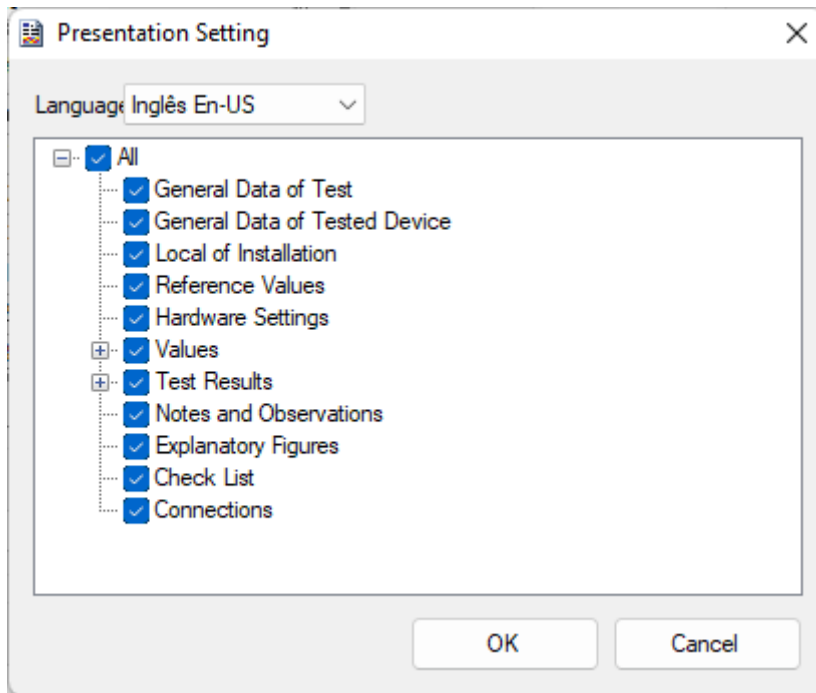


Figure 95

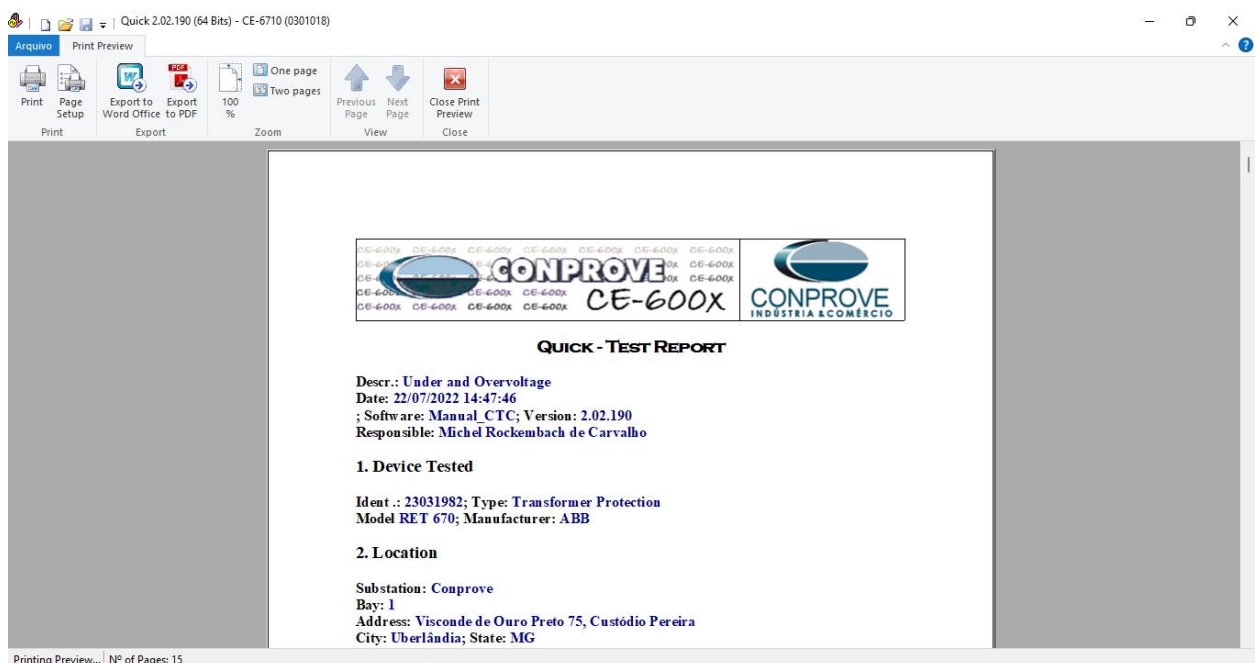
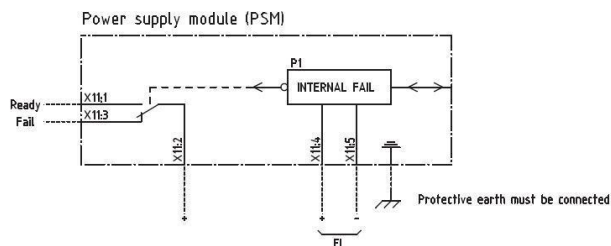


Figure 96

APPENDIX A

A.1 Terminal Designations



Power supply module (PSM)

Figure 97

Transformer input module (TRM)

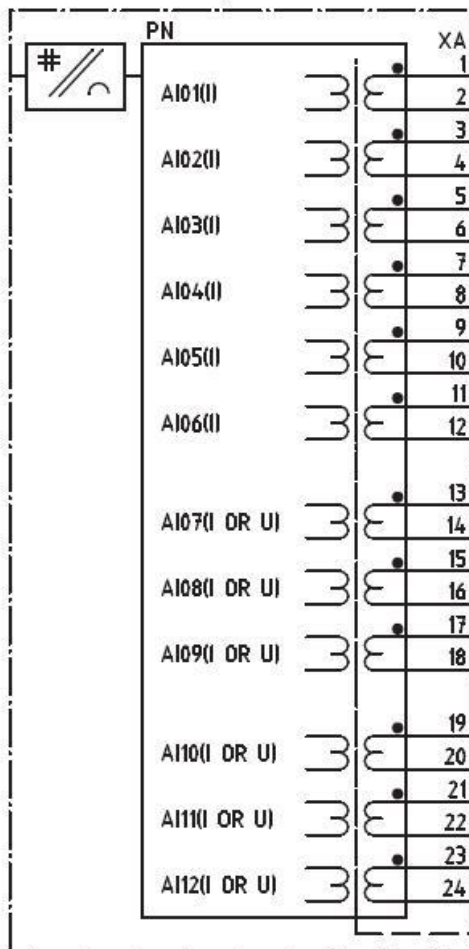
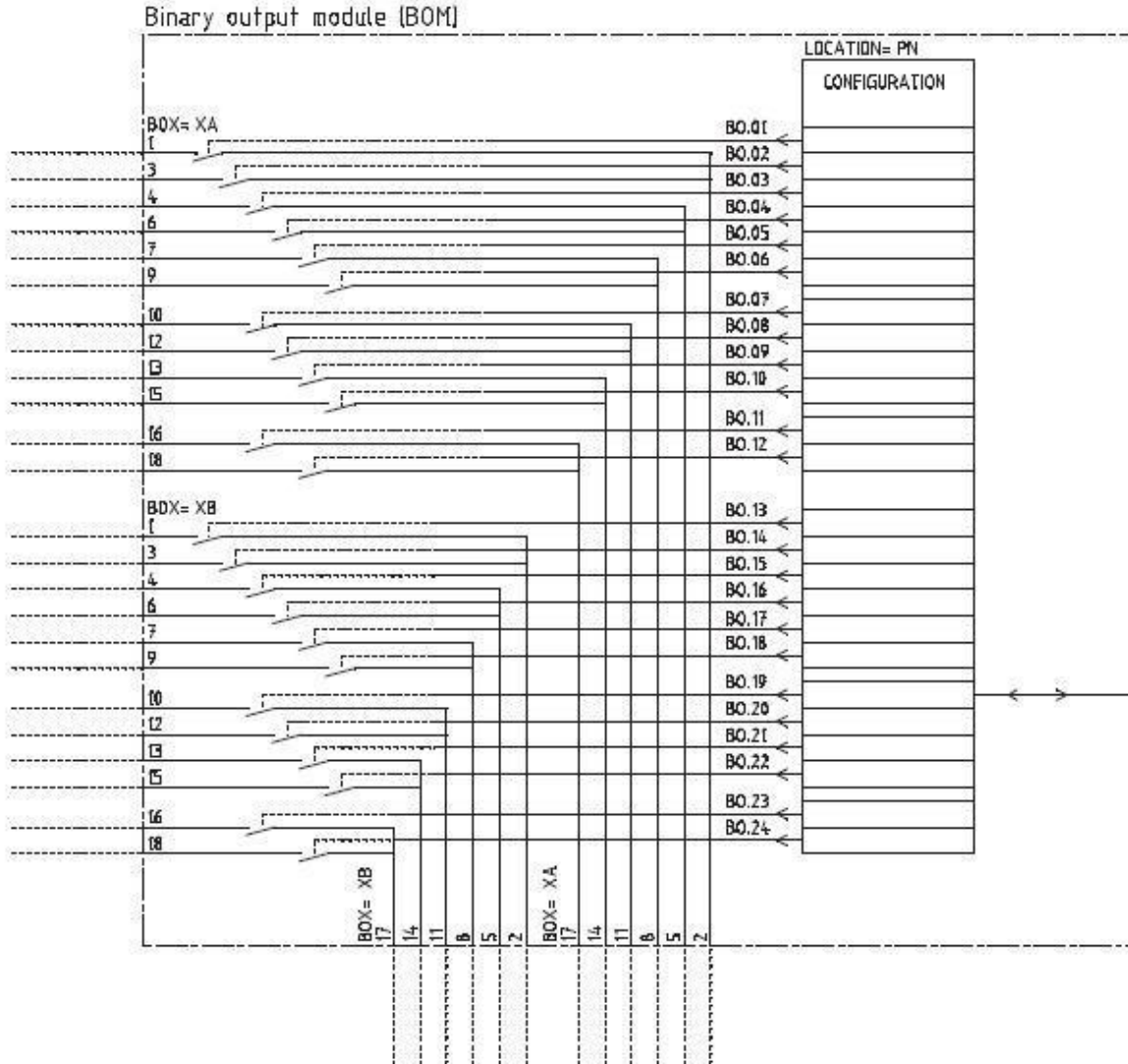


Figure 98

INSTRUMENTOS PARA TESTES ELÉTRICOS



INSTRUMENTOS PARA TESTES ELÉTRICOS

A.2 Technical data

OV2PTOV technical data

Function	Range or value	Accuracy
Operate voltage, step 1 and 2	(1-200)% of U_{Base}	$\pm 0.5\%$ of U_r at $U < U_r$ $\pm 0.5\%$ of U at $U > U_r$
Absolute hysteresis	(0-100)% of U_{Base}	$\pm 0.5\%$ of U_r at $U < U_r$ $\pm 0.5\%$ of U at $U > U_r$
Inverse time characteristics for steps 1 and 2, see table 675	-	See table 675
Definite time delay, step 1	(0.00 - 6000.00) s	$\pm 0.5\% \pm 10$ ms
Definite time delays	(0.000-60.000) s	$\pm 0.5\% \pm 10$ ms
Minimum operate time, Inverse characteristics	(0.000-60.000) s	$\pm 0.5\% \pm 10$ ms
Operate time, start function	25 ms typically at 0 to $2 \times U_{set}$	-
Reset time, start function	25 ms typically at 2 to $0 \times U_{set}$	-
Critical impulse time	10 ms typically at 0 to $2 \times U_{set}$	-
Impulse margin time	15 ms typically	-

UV2PTUV technical data

Function	Range or value	Accuracy
Operate voltage, low and high step	(1-100)% of U_{Base}	$\pm 0.5\%$ of U_r
Absolute hysteresis	(0-100)% of U_{Base}	$\pm 0.5\%$ of U_r
Internal blocking level, step 1 and step 2	(1-100)% of U_{Base}	$\pm 0.5\%$ of U_r
Inverse time characteristics for step 1 and step 2, see table 676	-	See table 676
Definite time delay, step 1	(0.00 - 6000.00) s	$\pm 0.5\% \pm 10$ ms
Definite time delays	(0.000-60.000) s	$\pm 0.5\% \pm 10$ ms
Minimum operate time, inverse characteristics	(0.000-60.000) s	$\pm 0.5\% \pm 10$ ms
Operate time, start function	25 ms typically at $2 \times U_{set}$ to 0	-
Reset time, start function	25 ms typically at 0 to $2 \times U_{set}$	-
Critical impulse time	10 ms typically at $2 \times U_{set}$ to 0	-
Impulse margin time	15 ms typically	-

APPENDIX B

Equivalence of software parameters and the relay under test.

Table 1

Quick Software		ABB RET670 Relay	
Parameter	Figure	Parameter	Figure
Overvoltage			
Pkp_ Instant.1	84	U1>	51
Tempo_ Instant.1	84	t1	51
Pkp_ Instant.2	84	U2>	52
Tempo_ Instant.2	84	t2	52
Undervoltage			
Pkp_ Instant.1	71	U1<	55
Tempo_ Instant.1	71	t1	55
Pkp_ Instant.2	71	U2<	56
Tempo_ Instant.2	71	t2	56