



INSTRUMENTOS PARA TESTES ELÉTRICOS

Test Tutorial

Equipment Type: Protection Relay

Brand: SCHNEIDER (AREVA)

Model: P545

Function: 67 or PTOC - Directional Overcurrent

Tool Used: CE-6006; CE-6707; CE-6710; CE-7012 or CE-7024

Objective: Perform tests on the directional overcurrent function to prove the operating time and its directionality

Version control:

Version	Descriptions	Date	Author	Reviewer
1.0	Initial release	25/05/2022	M.R.C.	G.C.D.P.

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Statement of responsibility

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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.

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INSTRUMENTOS PARA TESTES ELÉTRICOS
Sequence for testing the P545 relay in the Overcurrent 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 M2 on the relay terminal and the negative (black terminal) of the Aux Source Vdc to pin M1 of the relay terminal.

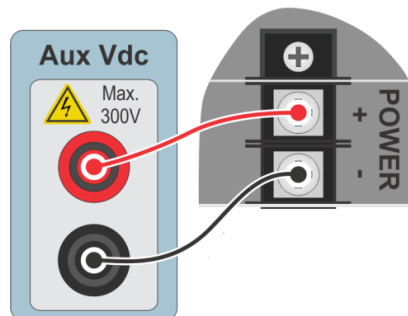


Figure 1

1.2 Current and Voltage Coils

To establish the connection of voltage coils, connect channels V1, V2 and V3 with pins D19, D20 and D21 of the relay terminal and common to pin D22. To establish the connection of the current coils, connect channels I1, I2 and I3 with pins D1, D4 and D7 of the relay terminal and common to pins D2, D5 and D8. If these last three points are short-circuited, connect all commons to this point.

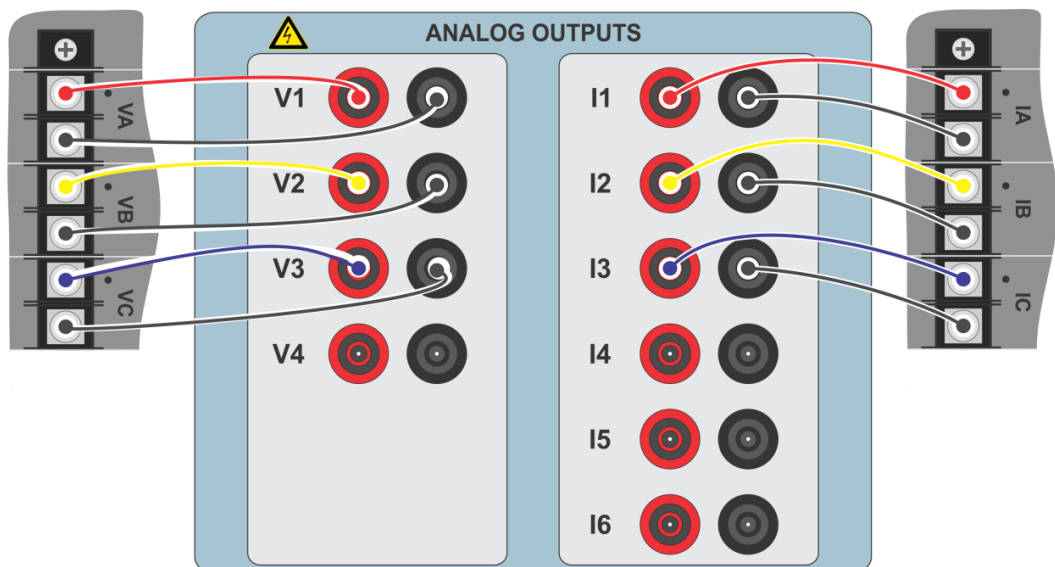


Figure 2

1.3 Binary Inputs

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

- BI1 to pin L1 and its common to pin L2 of the relay.

The figure below shows the details of the connections.

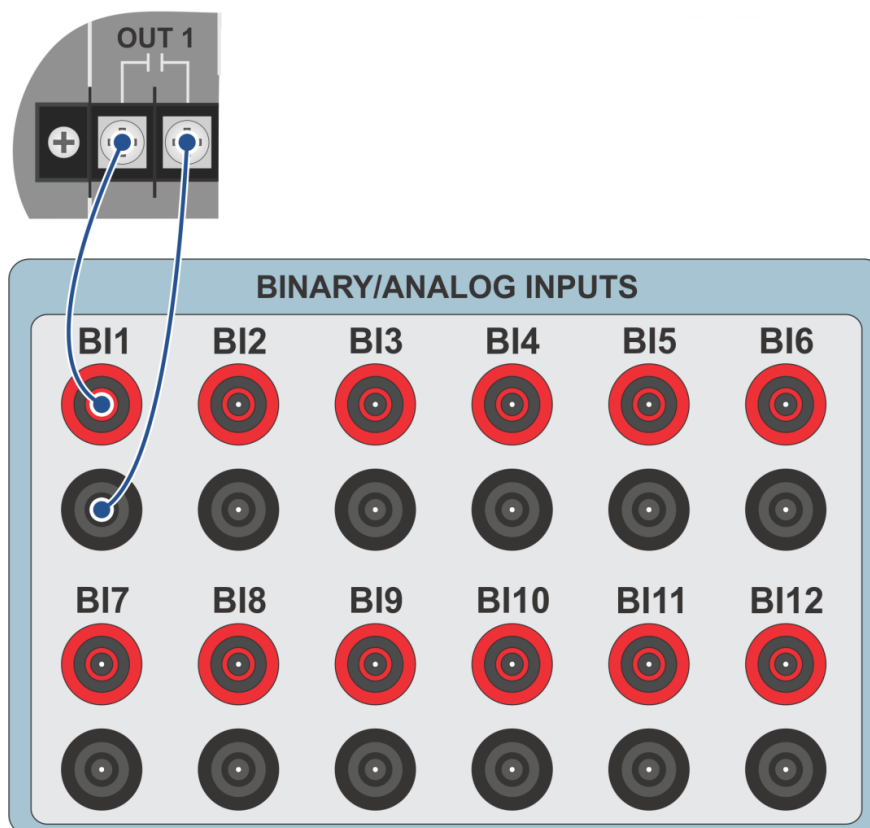


Figure 3

2. Communication with the Schneider P545 relay

First, open the *Schneider Electric MICOM S1 Studio* and connect a serial cable from the notebook to the relay. Then double click on the software icon.



Figure 4

Then click on the “*Quick Connect*” option. The relay software will automatically fetch the settings.

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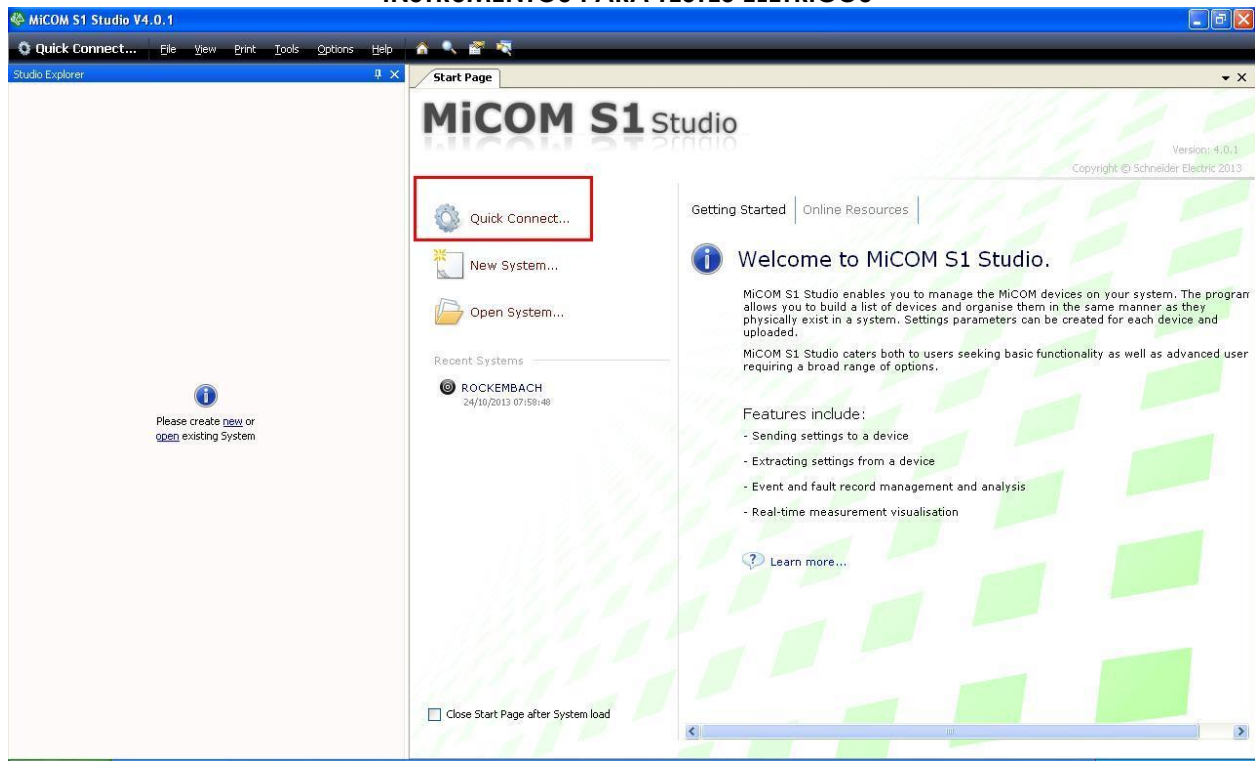


Figure 5

The next step is to create a new project and name it.

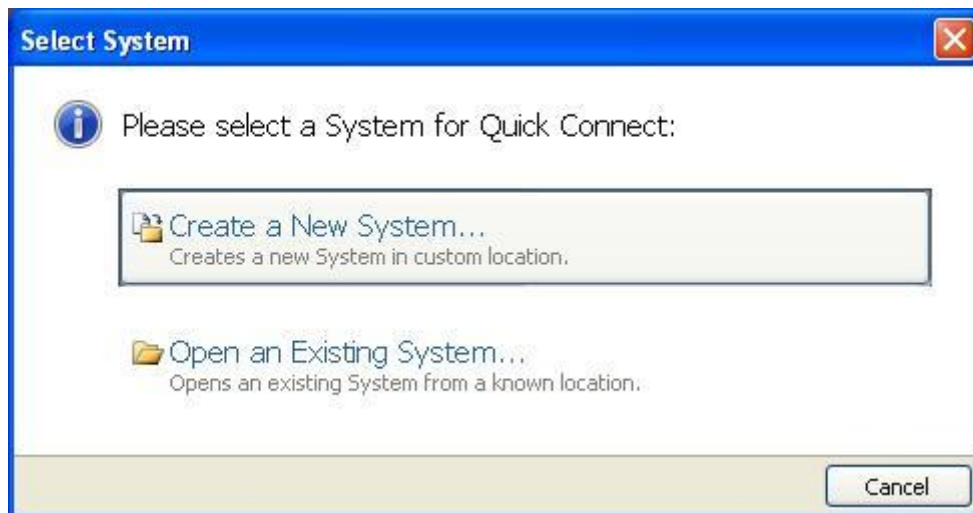


Figure 6

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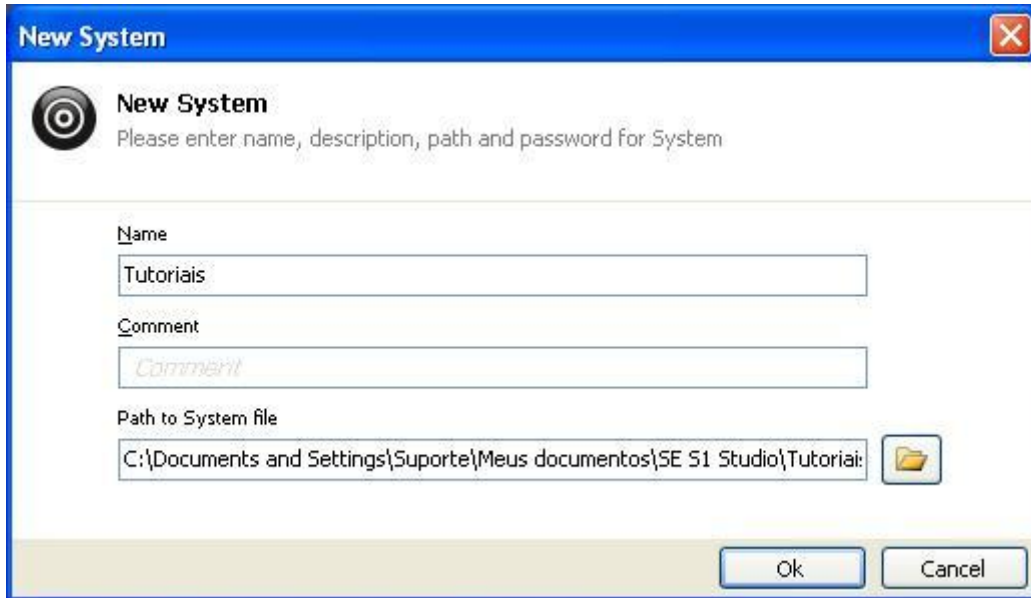


Figure 7

In the next window, choose the relay model. If you do not have the model, use the “Data Model Manager” software (installed together with MiCOM) to download it.



Figure 8

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Choose the way to communicate whether by serial port (rear or front), by Ethernet or even via modem.

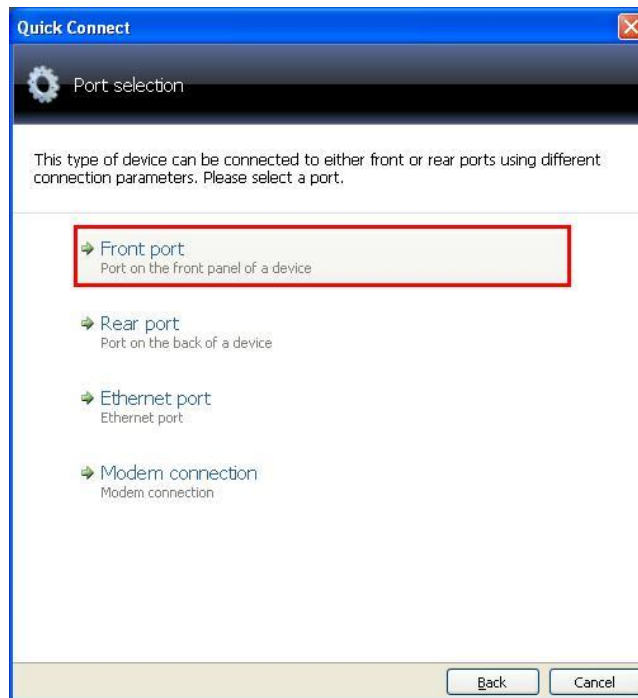


Figure 9

In the next window make sure which serial port (COM) is being used especially if you are using a USB/SERIAL converter and click on “Finish”.

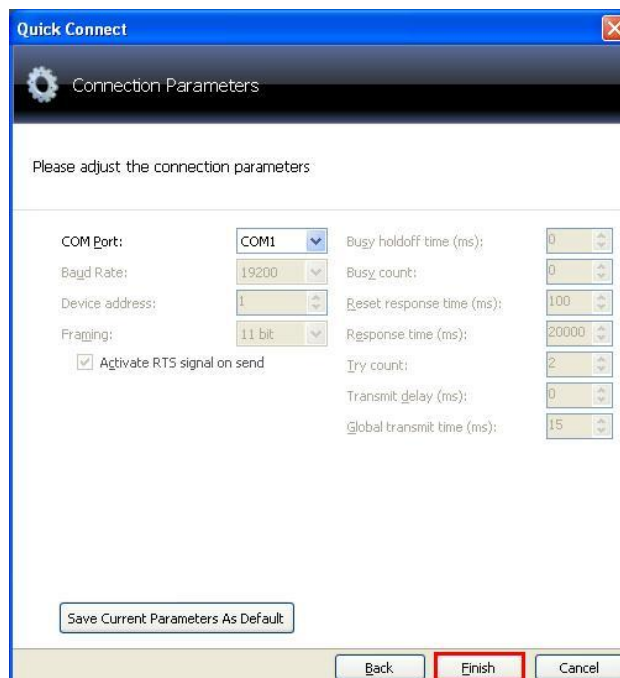


Figure 10

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The next screen shows that the connection was made successfully showing the relay type, model and serial number.

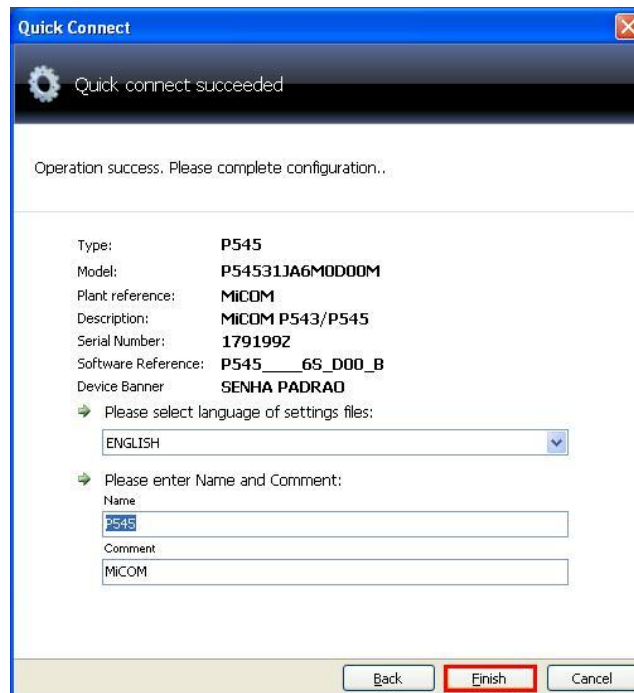


Figure 11

The next step is to extract all the information set in the relay. Right click on “Settings” and left click on “Extract Settings”.

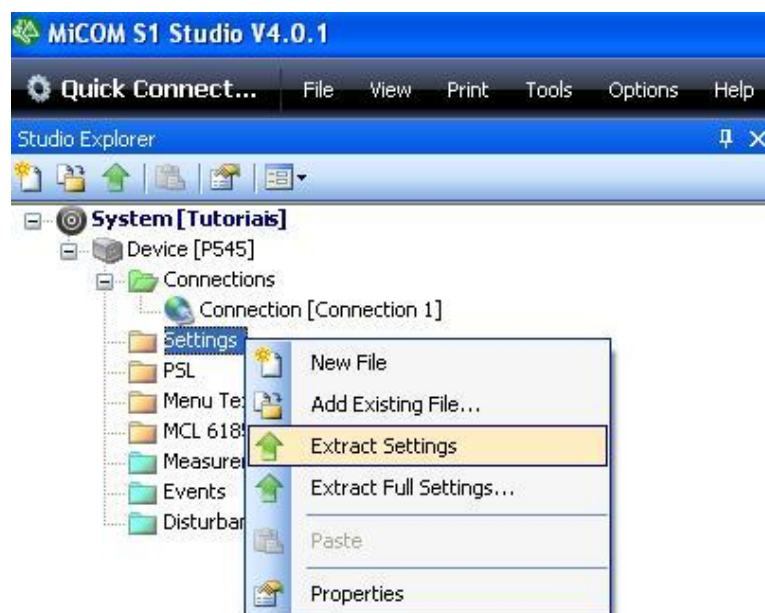


Figure 12

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Enter the relay password, default value “AAAA”.



Figure 13

The reading of the settings will appear with the name of “000” and can be modified if necessary. In this case the file name was changed to “*Direcional de Sobrecorrente*”.

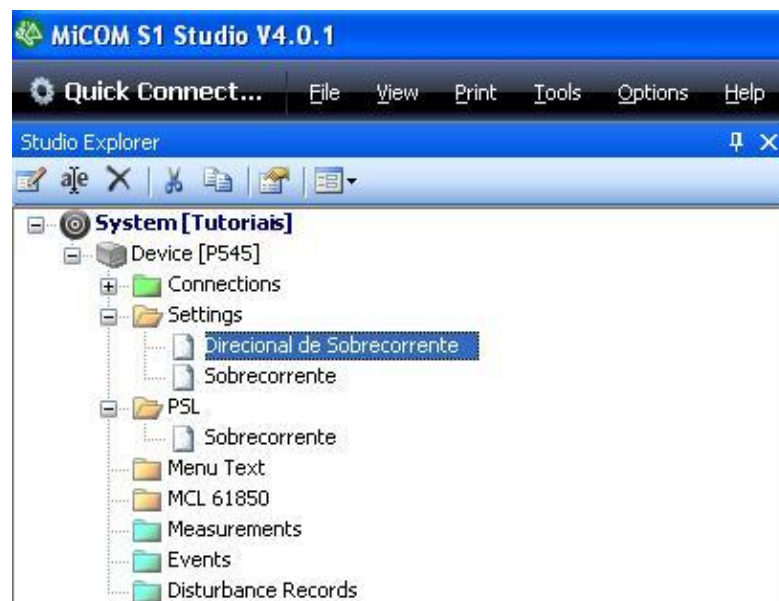


Figure 14

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3. Parameterization of the Schneider P545 relay

3.1 Frequency

After making a double click on the “Direcional de Sobrecorrente” file, enter “SYSTEM DATA”, and then “Frequency”. Make sure the value set is 60Hz.

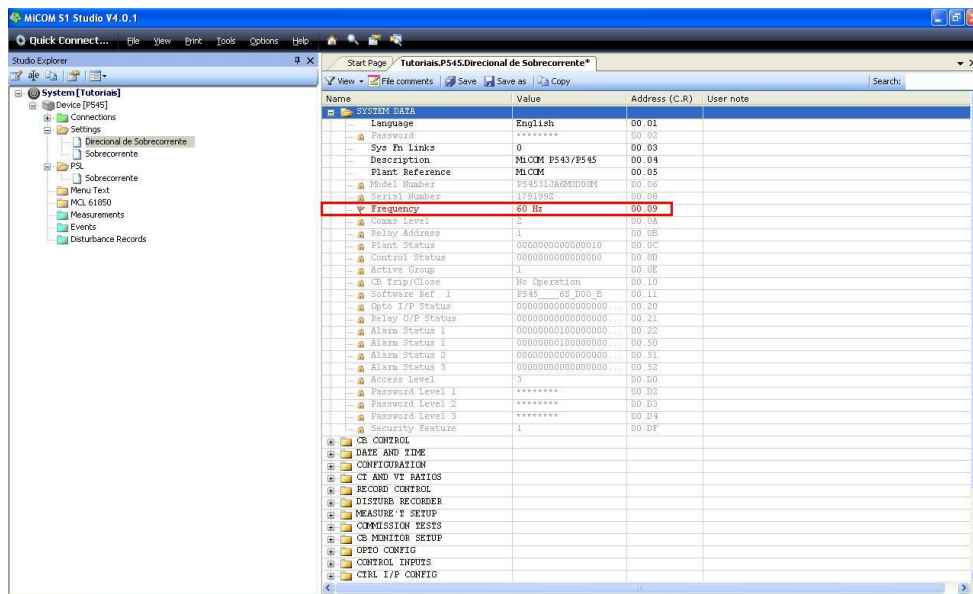


Figure 15

3.2 CONFIGURATION

Within the “CONFIGURATION” folder, group 1 and the overcurrent function are enabled. NOTE: **All other functions must be disabled.**

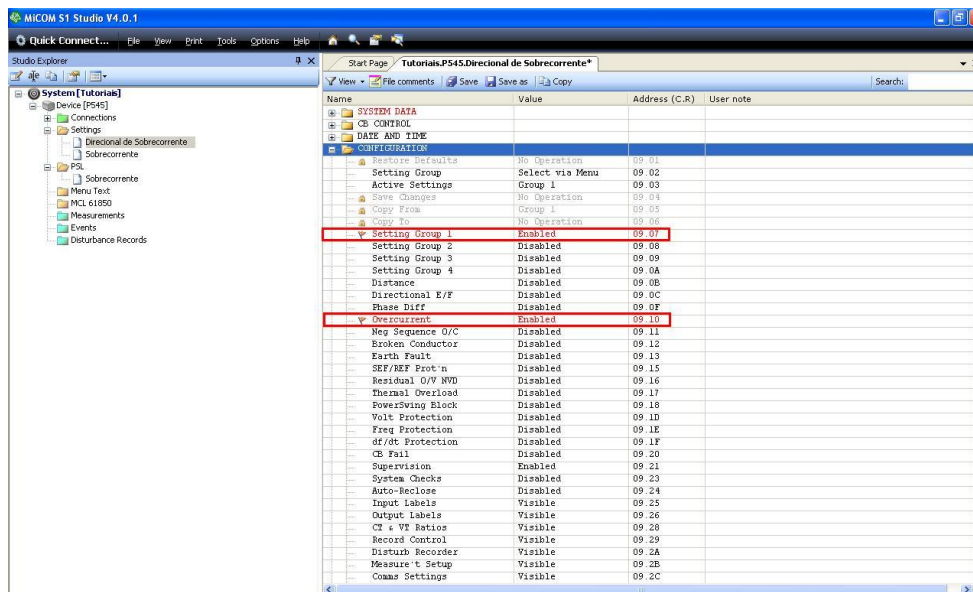


Figure 16

3.3 Setting Values

All parameterization will be done with values referenced to the secondary.

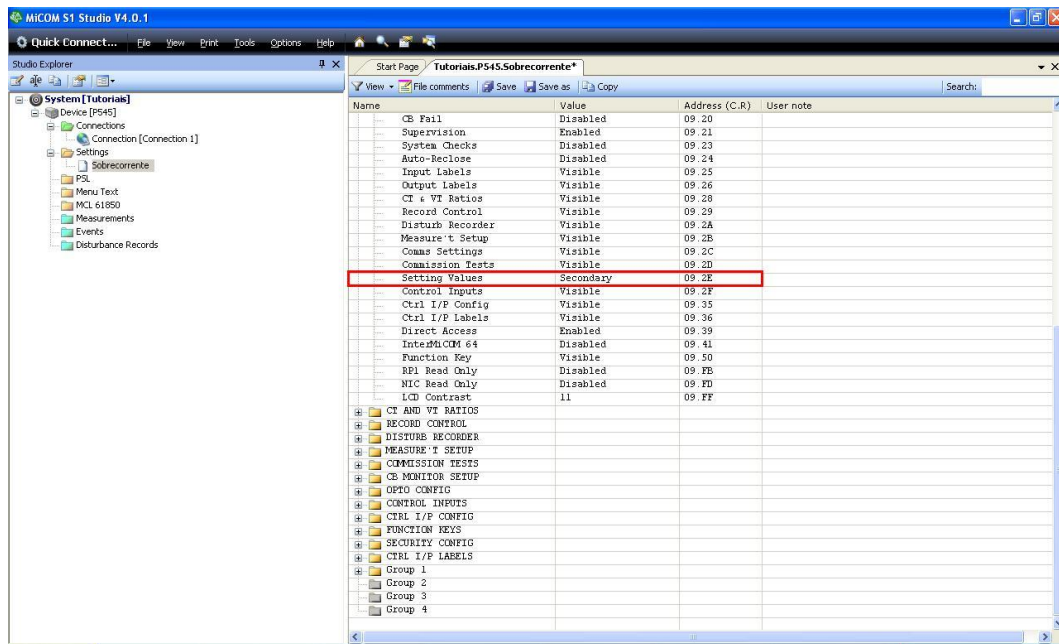
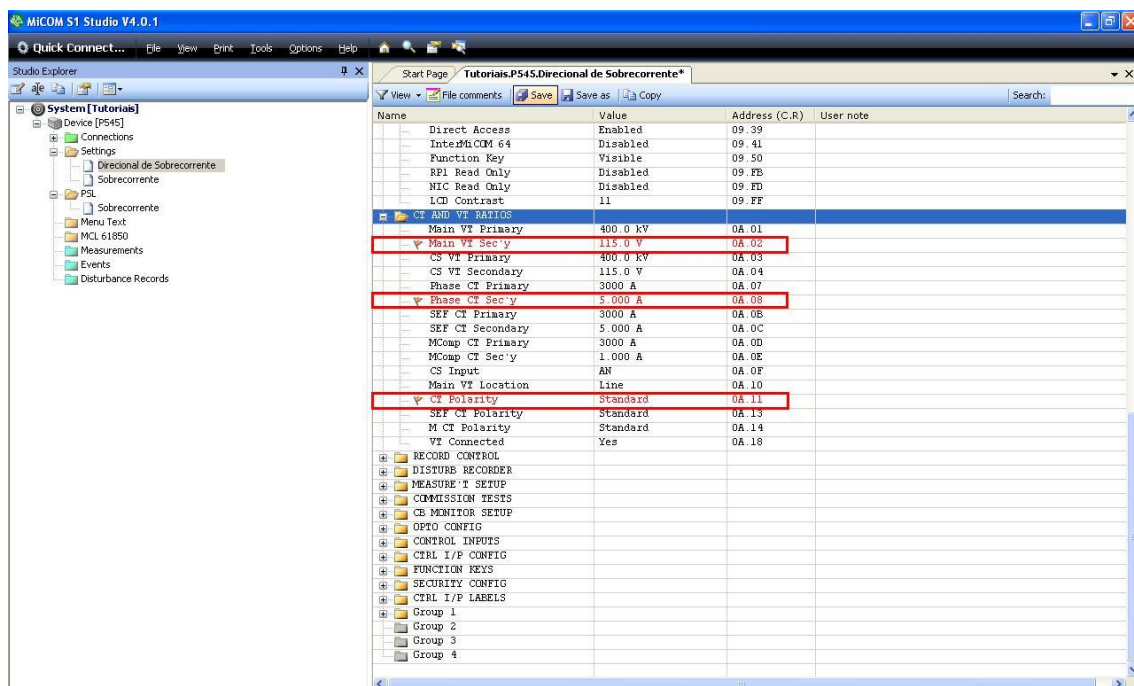


Figure 17

3.4 CT AND VT RATIOS

Adjust the values of primary and secondary voltages and currents and the polarity of the CT.



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Figure 18

3.5 Phase Sequence

Click the “+” sign under “GROUP” and “GROUP 1 LINE PARAMETERS”. In the “Phase Sequence” option, set the positive sequence (ABC).

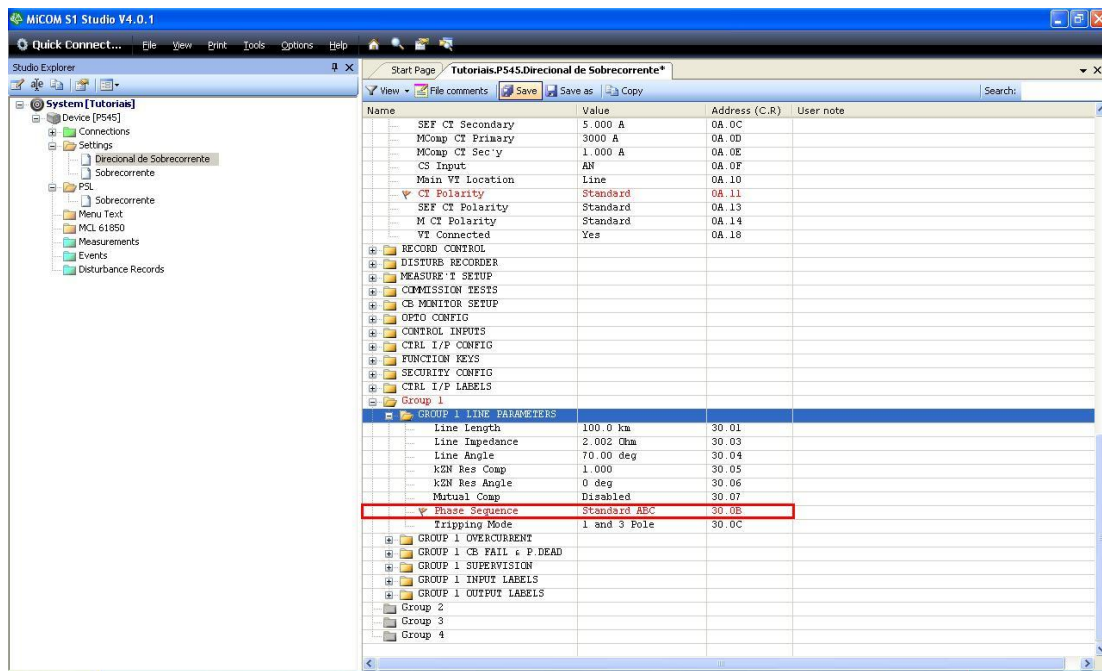


Figure 19

3.6 GROUP 1 OVERCURRENT

In this field, the directional overcurrent function is configured.

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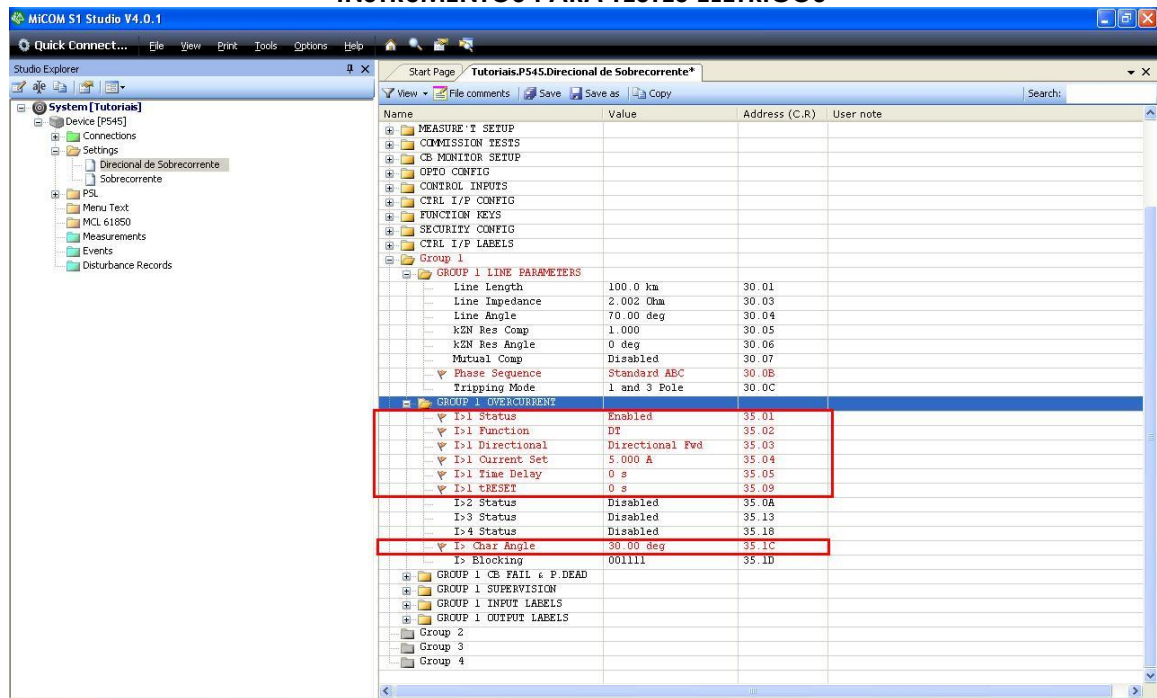


Figure 20

The next step is to click on “Save” to save the configuration.

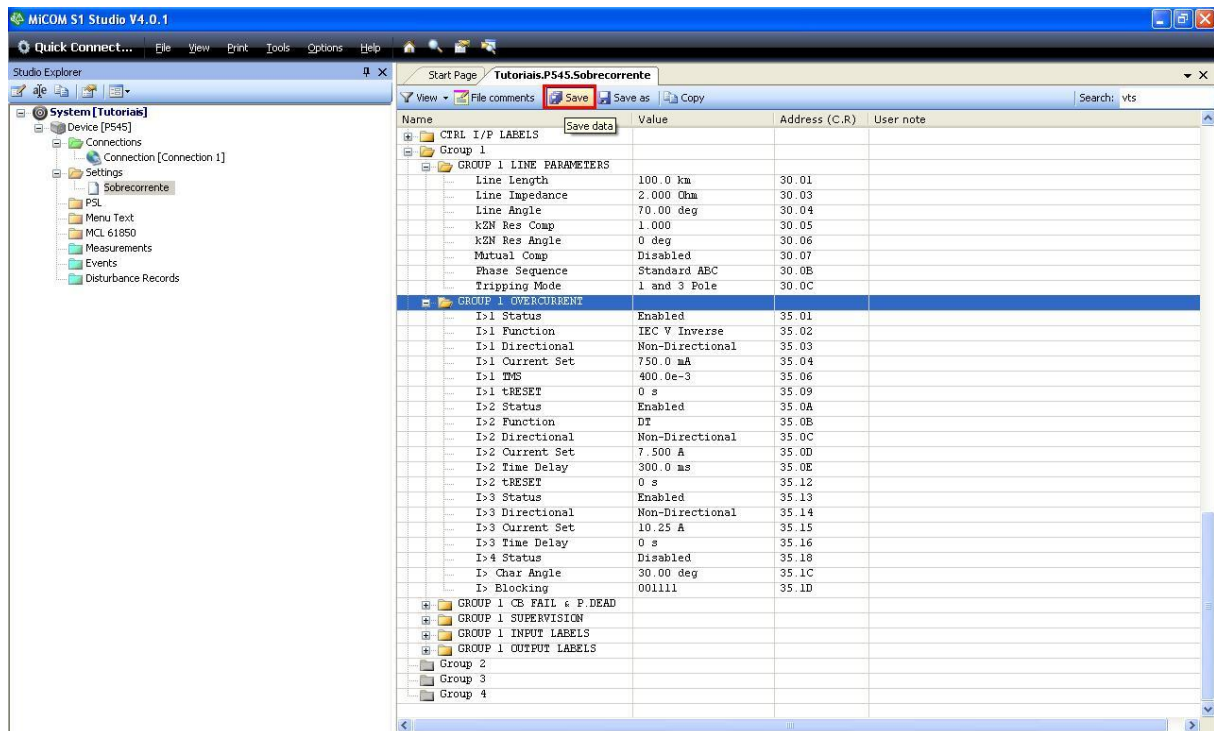


Figure 21

3.7 PSL

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The configurations of the binary outputs are done through logic blocks being configured in another file. Right click on the “PSL” folder and then on “New File”.

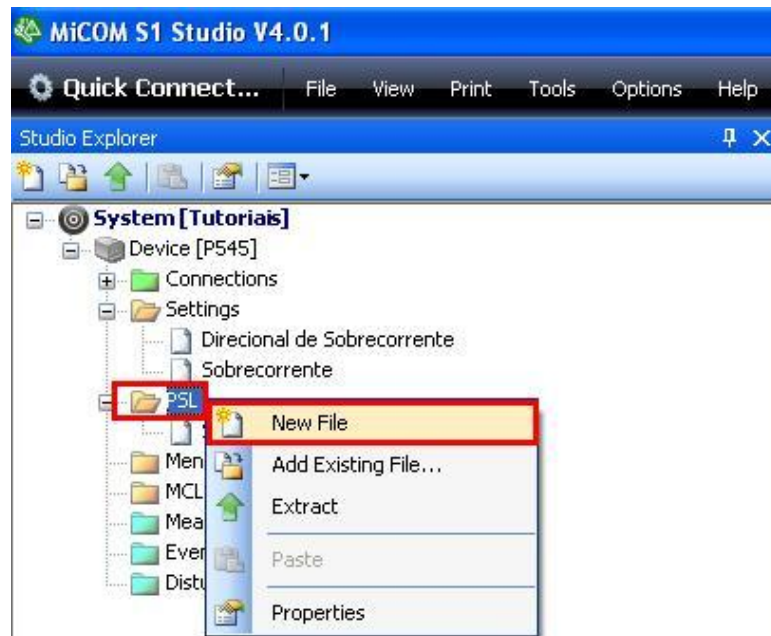


Figure 22

The name of the file name appears as “000”, change it to “*Direcional de Sobrecorrente*”.

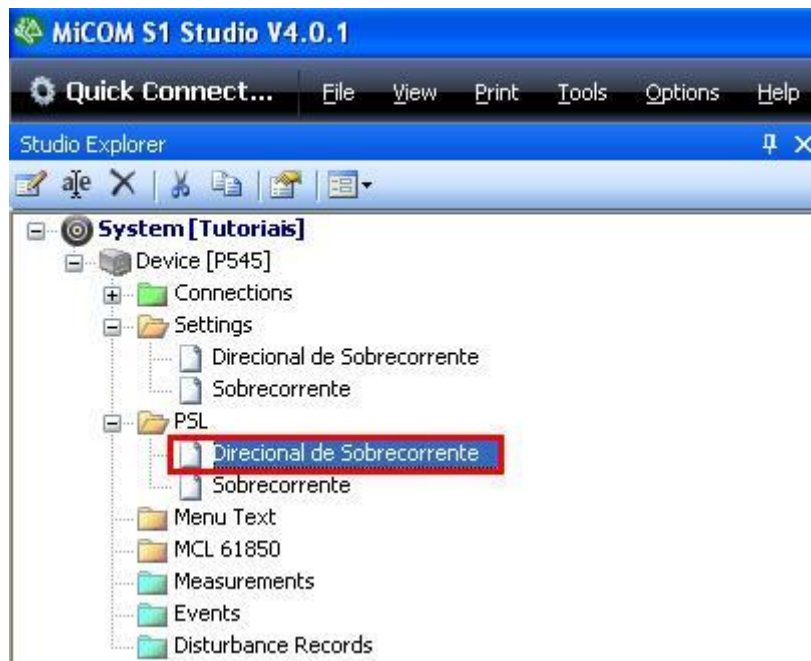


Figure 23

Double-click on this file to gain access to the logical blocks. Then click on the tool highlighted in red and zoom in on the region highlighted in green.

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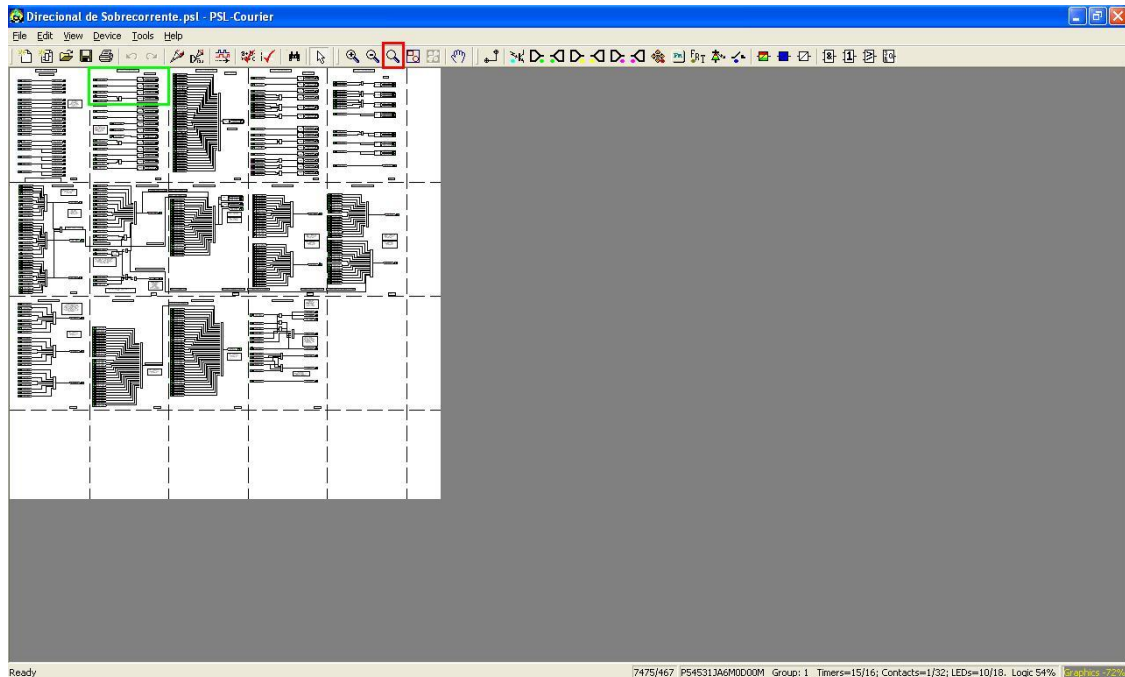


Figure 24

Note that the first output appears in the figure below (highlighted in red). This output must be associated with a non-directional overcurrent signal.

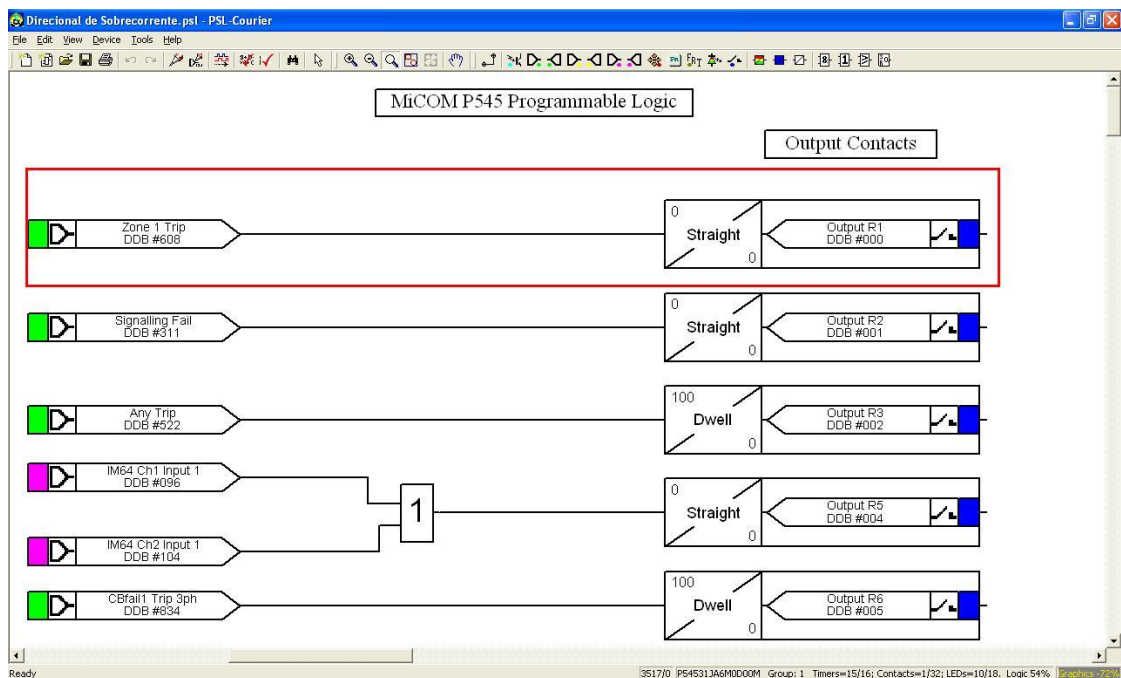


Figure 25

Click on the highlighted arrow and then on the “Zone 1 Trip” block with the right button and then “Delete”. To delete this block.

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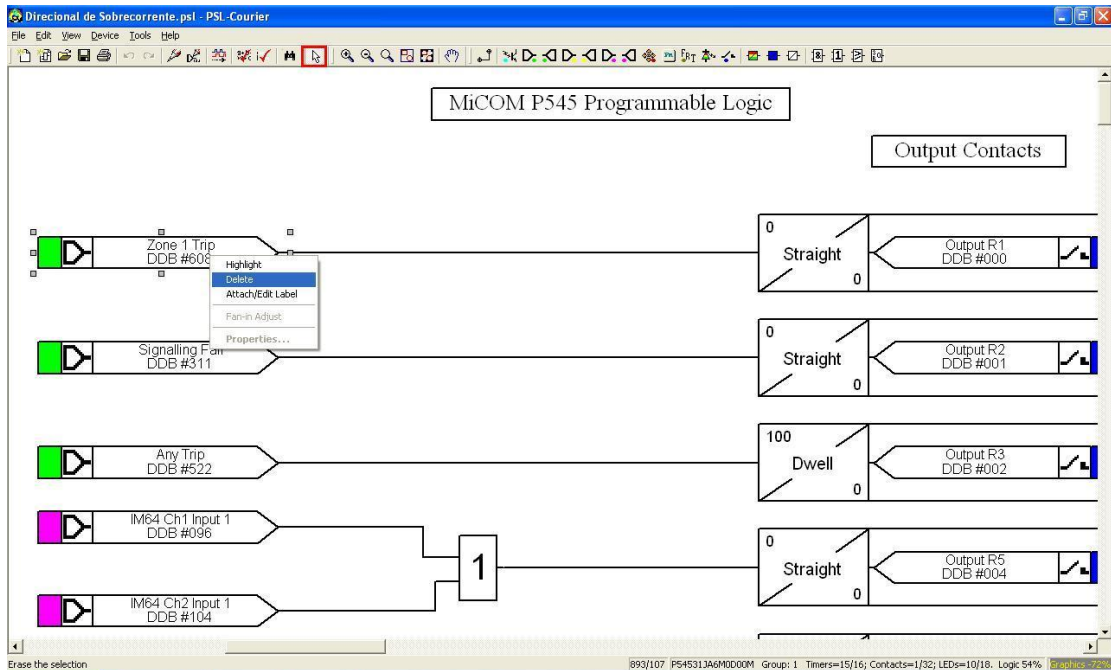


Figure 26

Click on the R1 block and change the “Mode” to “pickup” and in the “Pickup Value(ms)” option, set the value to zero.

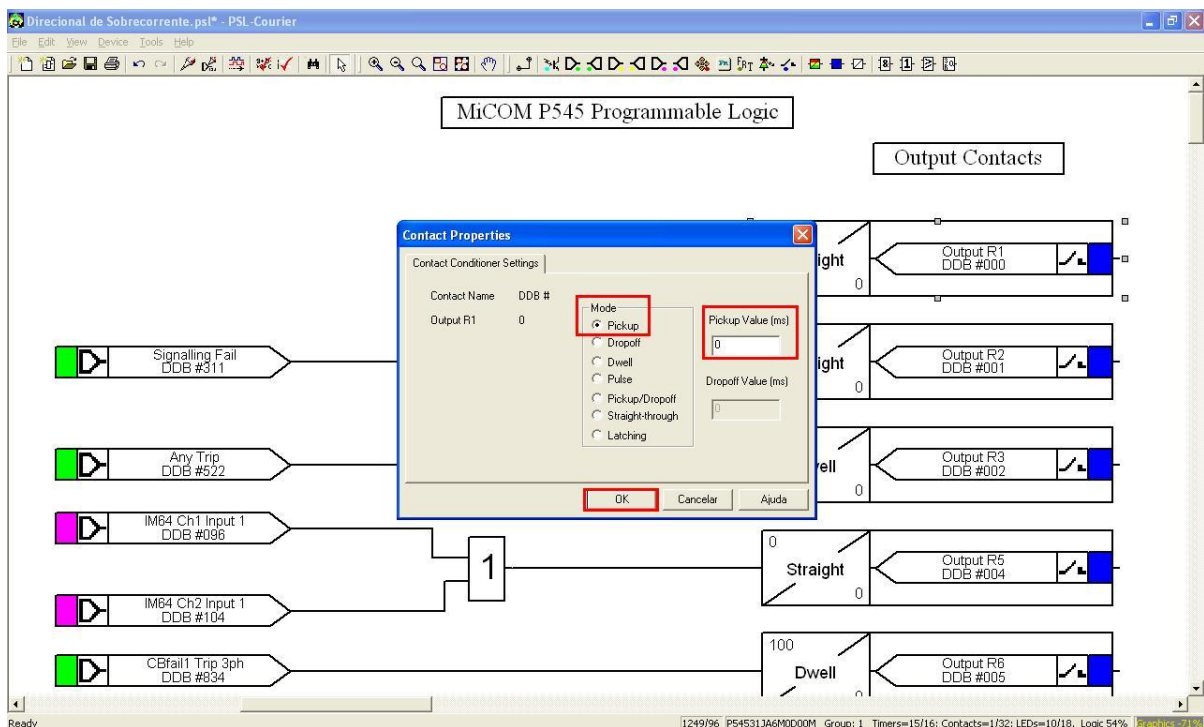


Figure 27

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The next step is to associate the signal to be monitored with the output block R1. Click the button highlighted in red and choose the following signal.

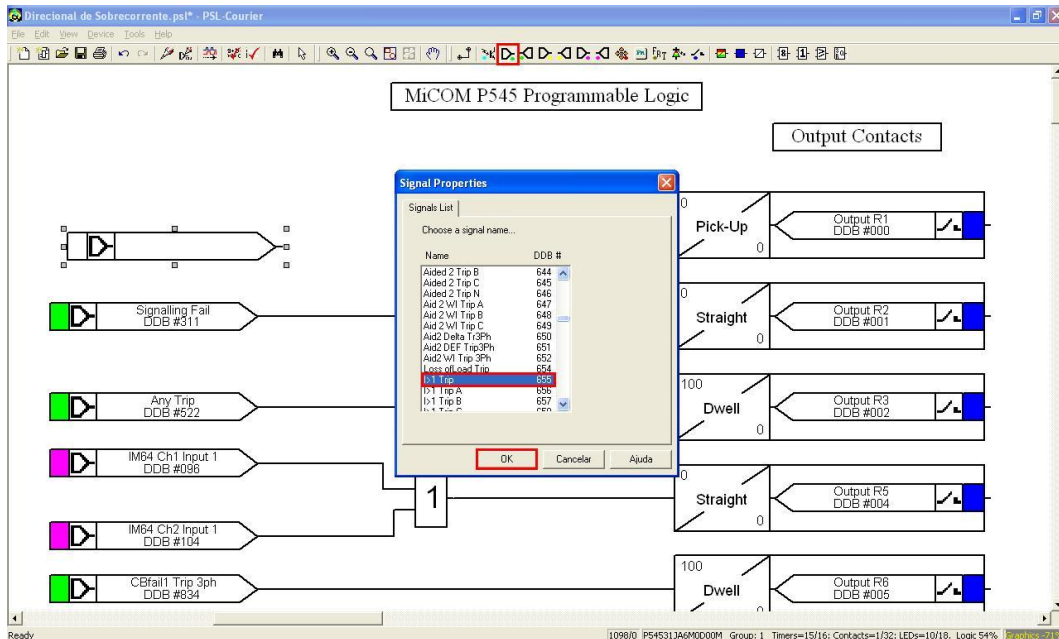


Figure 28

Now click on the icon highlighted in red and connect the blocks.

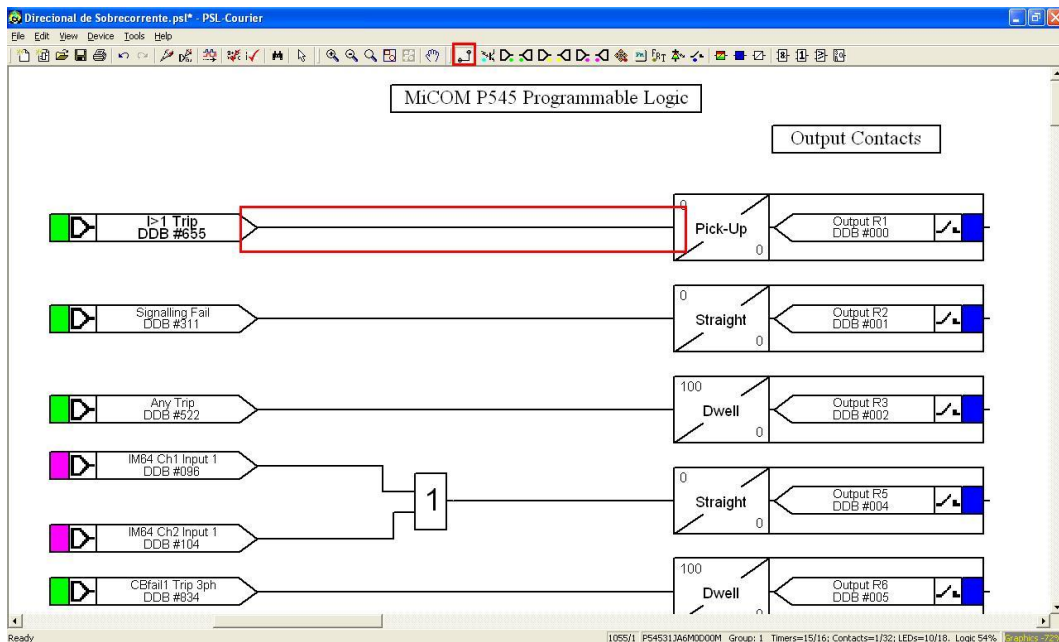


Figure 29

Click on the highlighted icon to save the file, then close the logic block editor and return to the “MiCOM” software.

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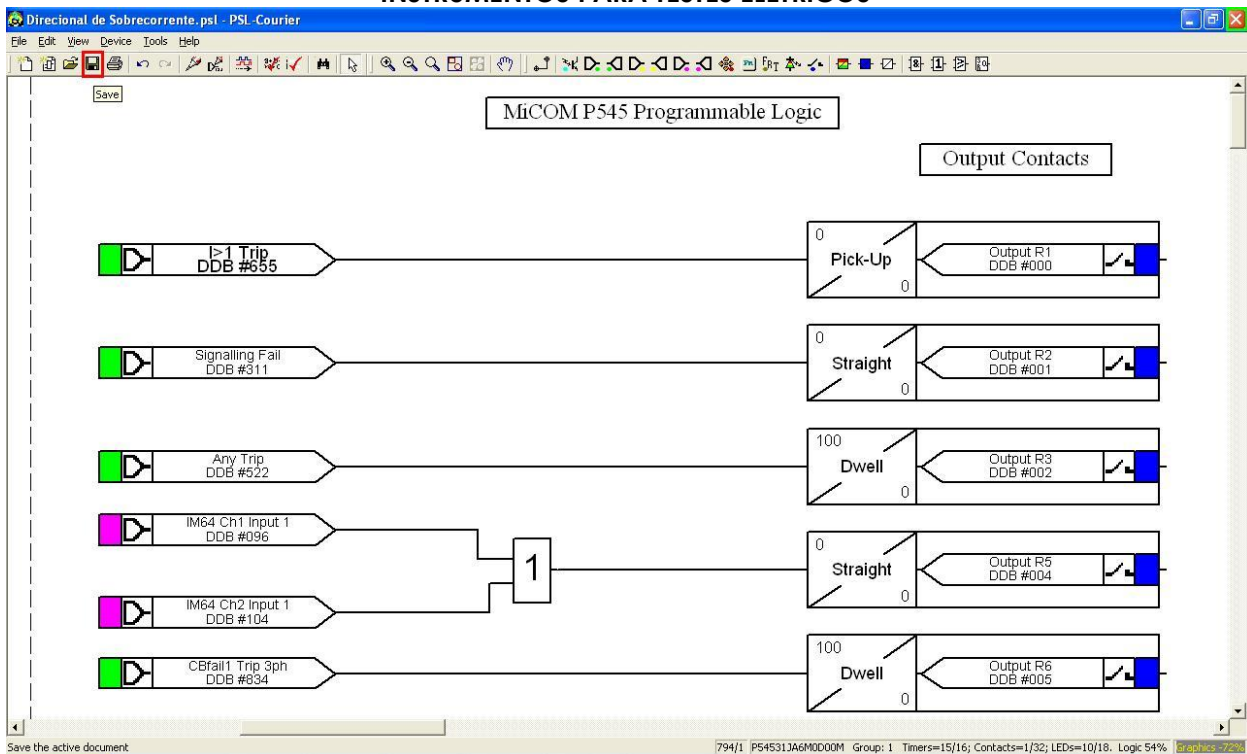


Figure 30

3.8 Sending Settings to the Relay

Click the “*Device [P545]*” icon then the icon highlighted in green.

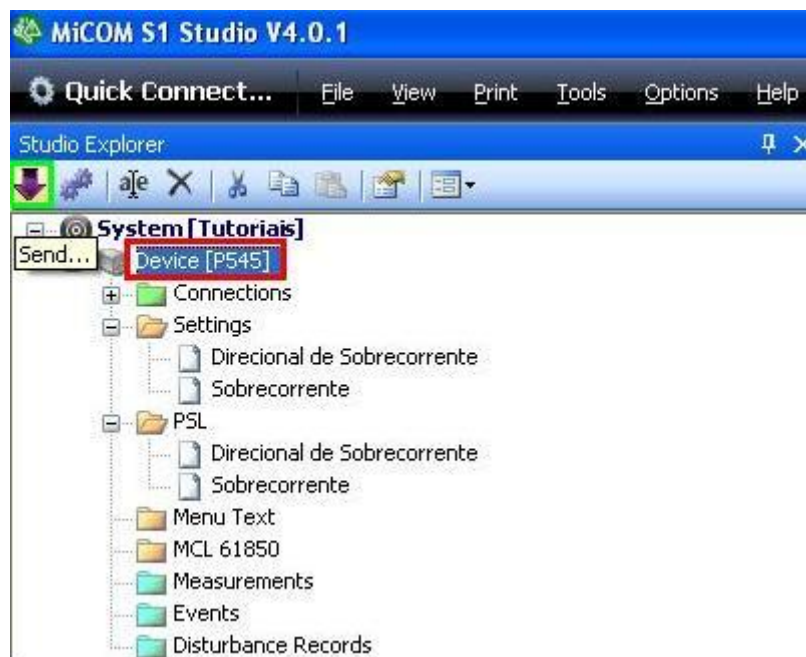


Figure 31

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Send both the function settings and the logic block group 1 of the “*Direcional de Sobrecorrente*”.

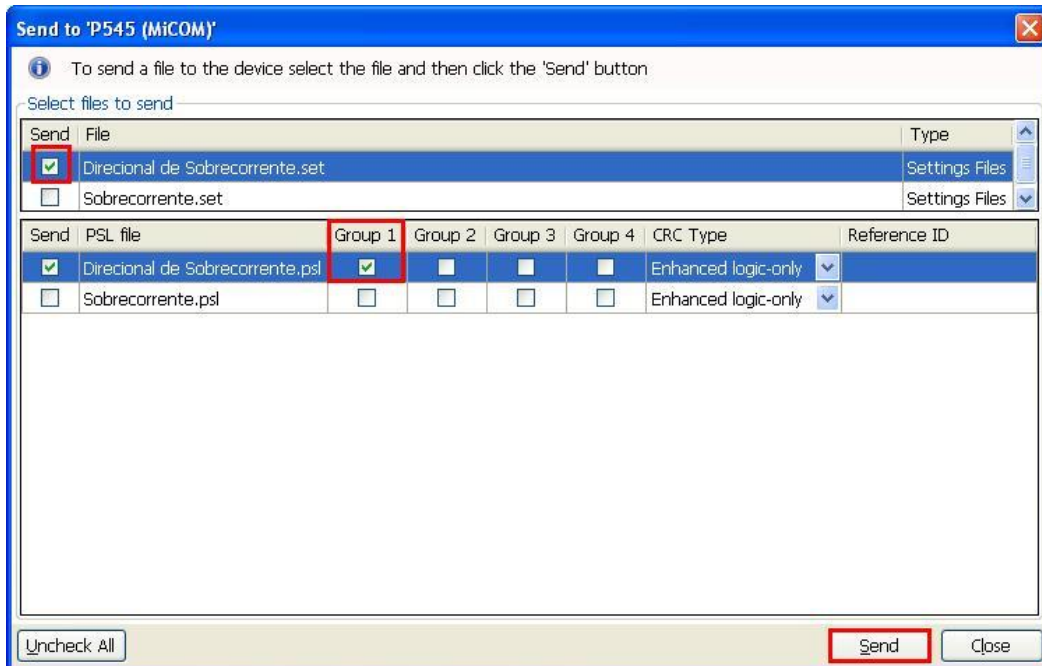


Figure 32

4. Overcurrent software adjustments

4.1 Opening the Overcurrent

Click on the “*Conprove Test Center*” application manager icon.



Figure 33

Click the Overcurrent software icon.

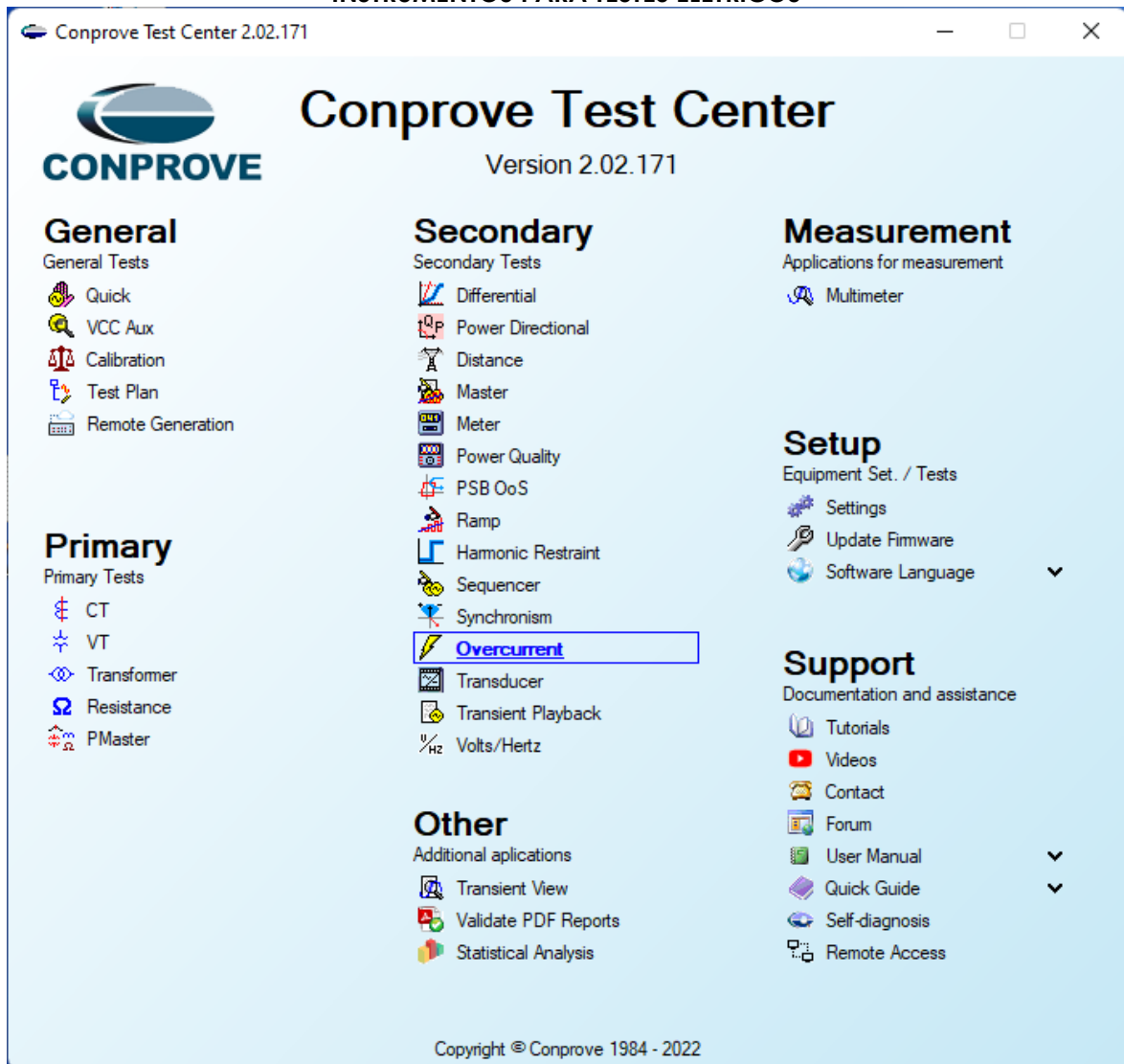


Figure 34

INSTRUMENTOS PARA TESTES ELÉTRICOS

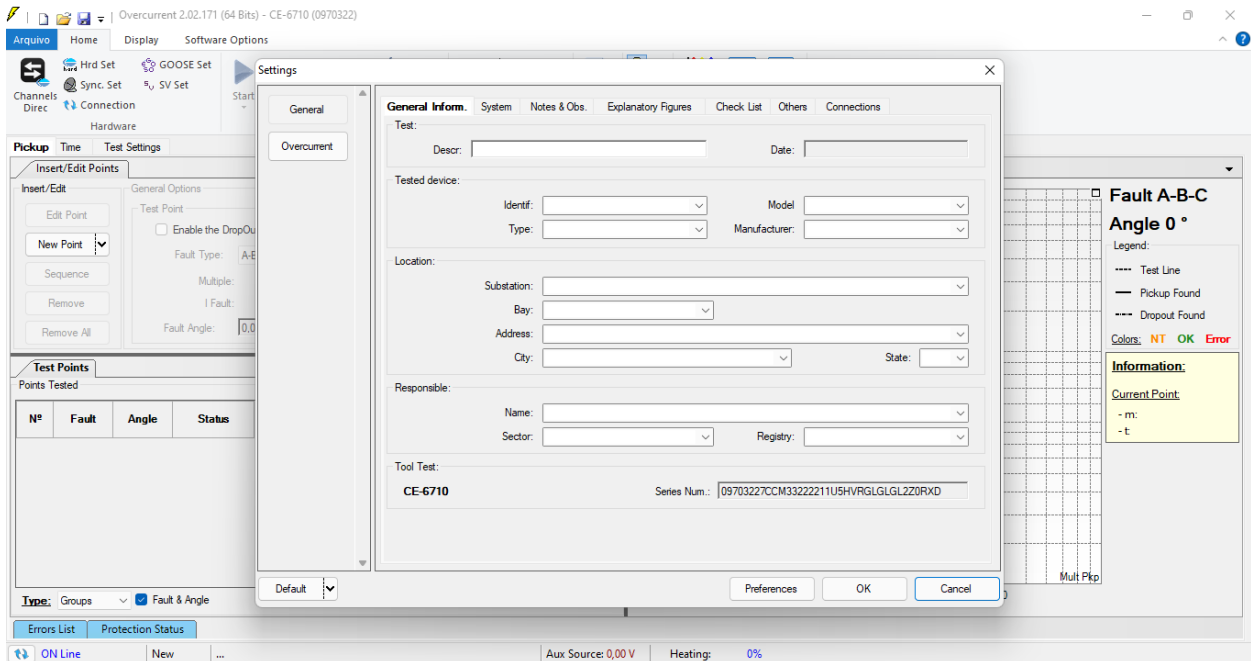


Figure 35

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.

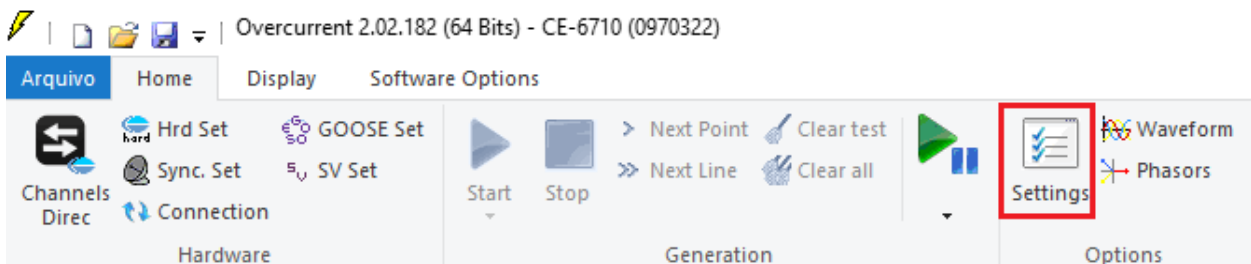


Figure 36

Inside the “*Settings*” screen, fill in the “*General Inform.*” with details of the tested device, installation location and the person responsible. This makes reporting easier, as this tab will be the first to be shown.

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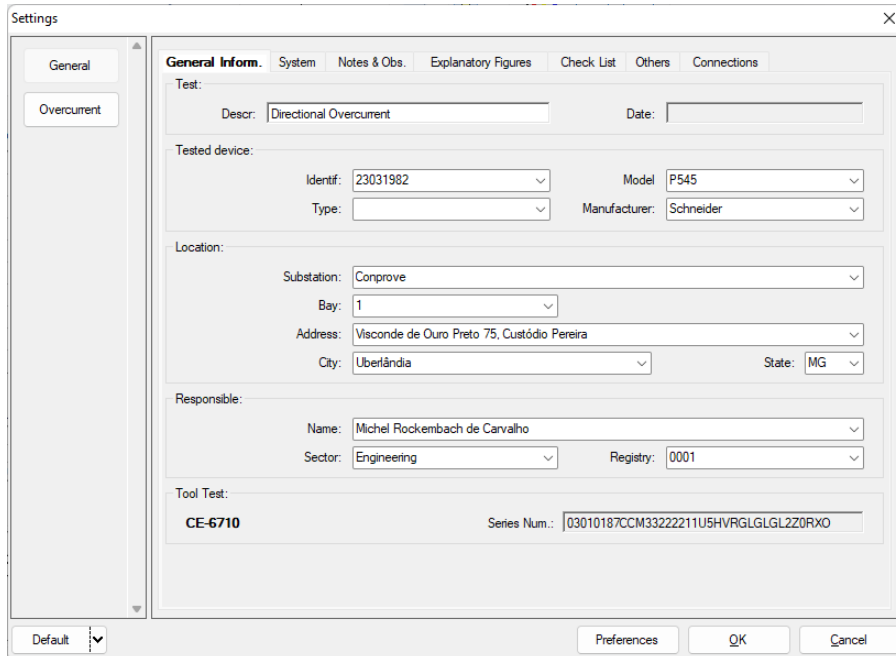
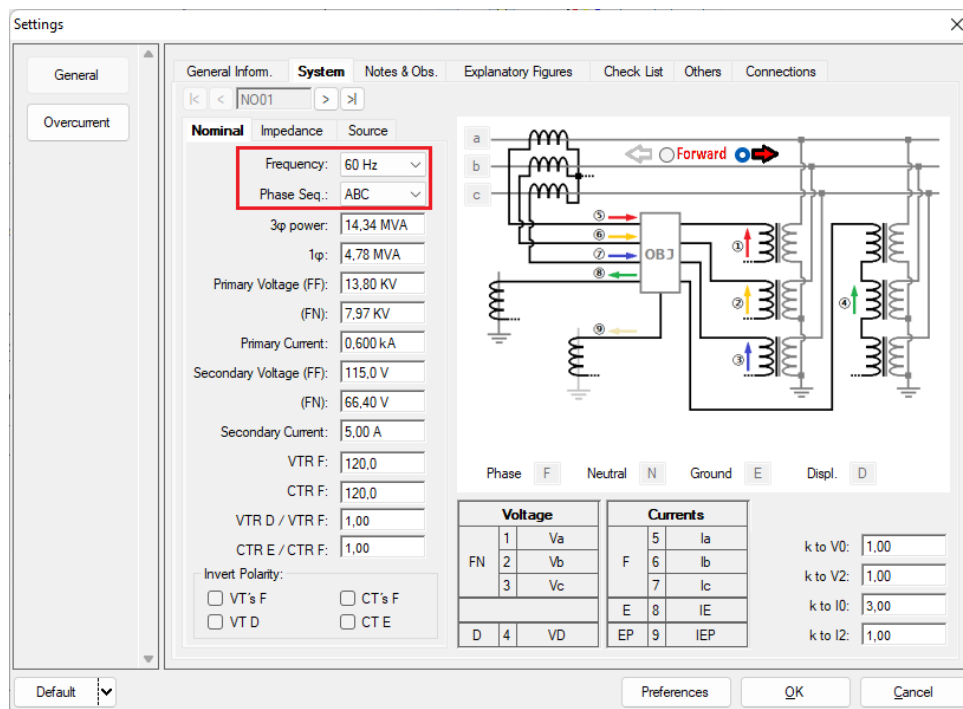


Figure 37

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 are not relevant for this test.



Voltage		Currents	
1	Va	5	Ia
2	Vb	6	Ib
3	Vc	7	Ic
FN		E	IE
D		EP	IEP

Figure 38

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There are other tabs where the user can insert “Notes & Obs.”, *Explanatory Figures*, and “Check List” of the procedures for carrying out the test and even create a diagram with all the schematic of the connections between the test set and the test equipment.

5. Directional Overcurrent Adjustment

5.1 Overcurrent Screen > Definitions

In this you must enable the directionality, the curves display mode, the scale used and the time, current and angle tolerances. These tolerances should be taken from the relay manufacturer's manual (Appendix A).

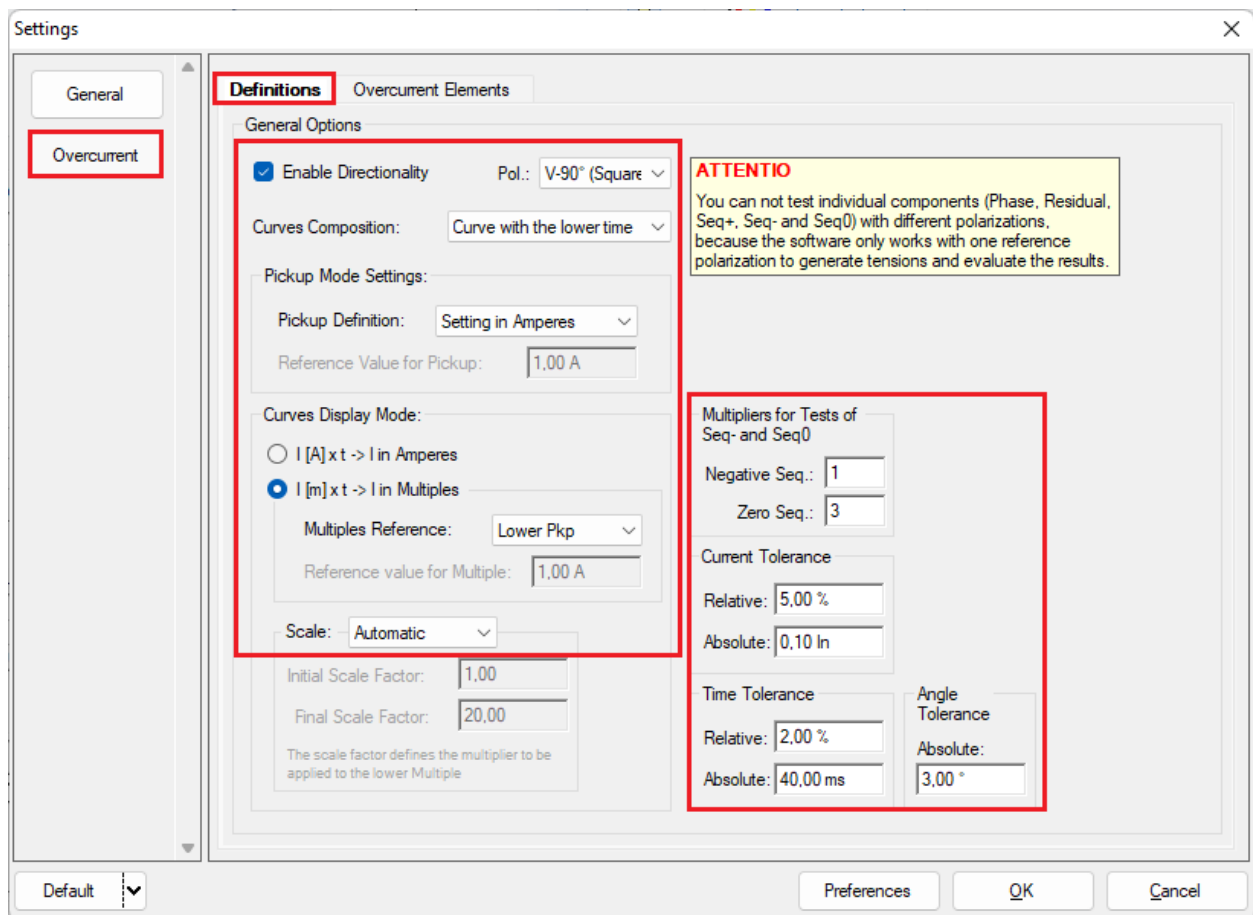


Figure 39

5.2 Overcurrent Screen > Overcurrent Elements > Phase

Here the overcurrent element must be configured. To do this, click on “Phase” and once on the highlighted icon.

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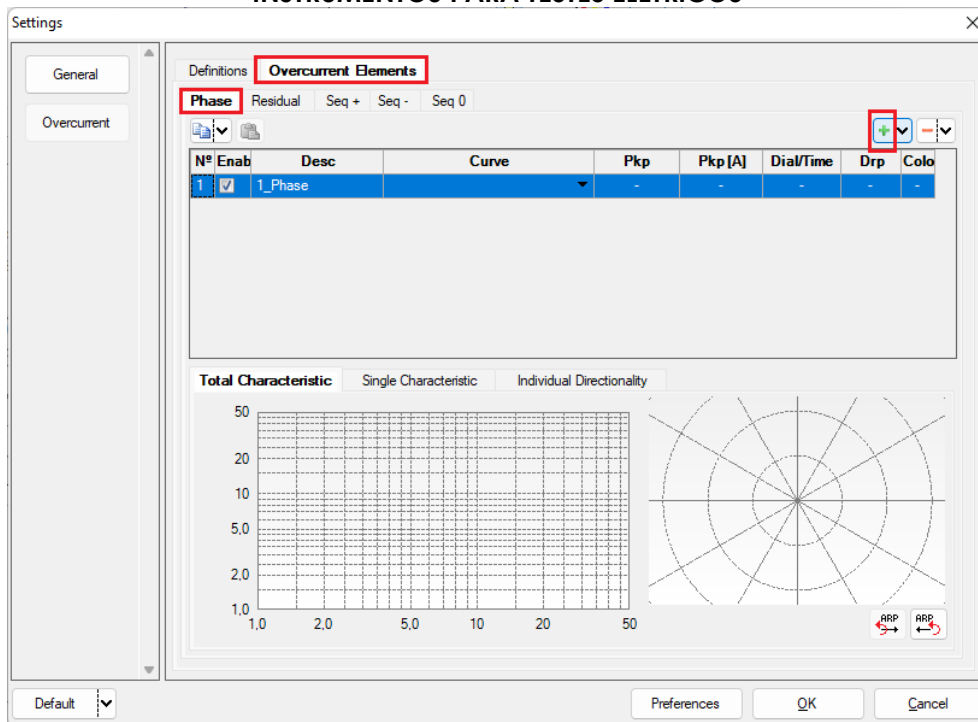


Figure 40

For the element choose the type of curve equal to defined time, pickup value equal to 5.0A, time to 0.0 seconds and dropout factor equal to 0.95.

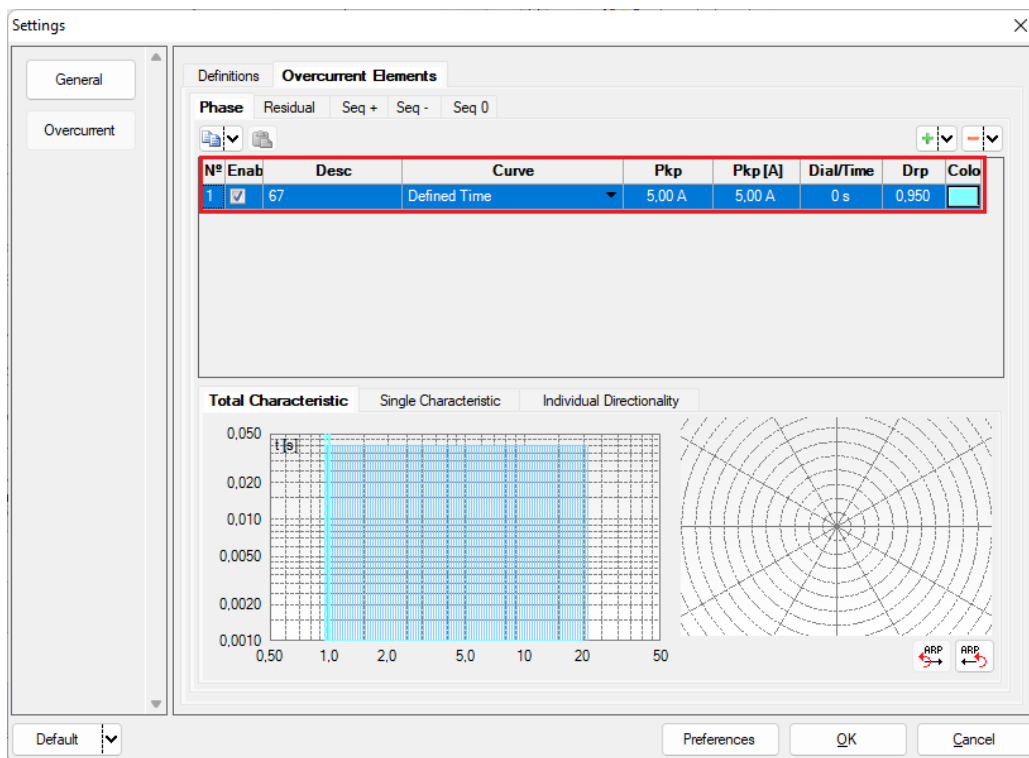


Figure 41

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Choose the “*Individual Directionality*” tab and set the “*Forward*” option, the maximum torque angle (ATM) must be set to 30°. Set the angles as 90° and – 90°.

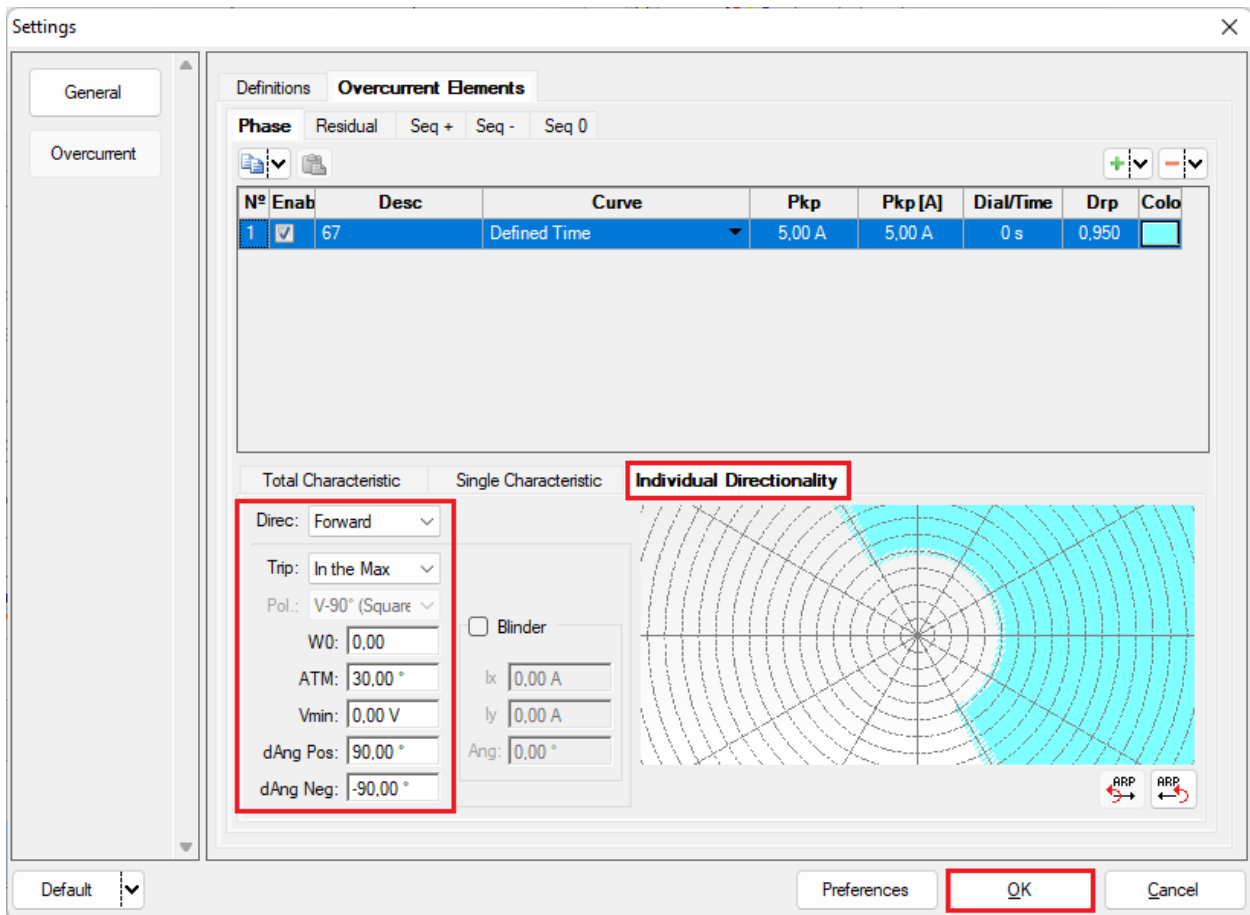


Figure 42

6. Channel Direction and Hardware Configurations

Click on the icon illustrated below.

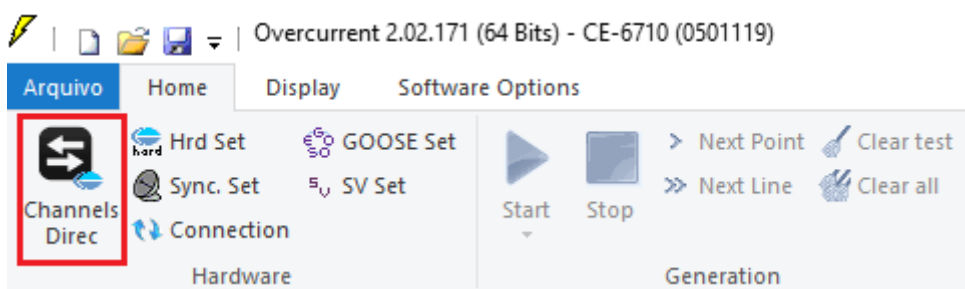


Figure 43

Then click on the highlighted icon to configure the hardware.

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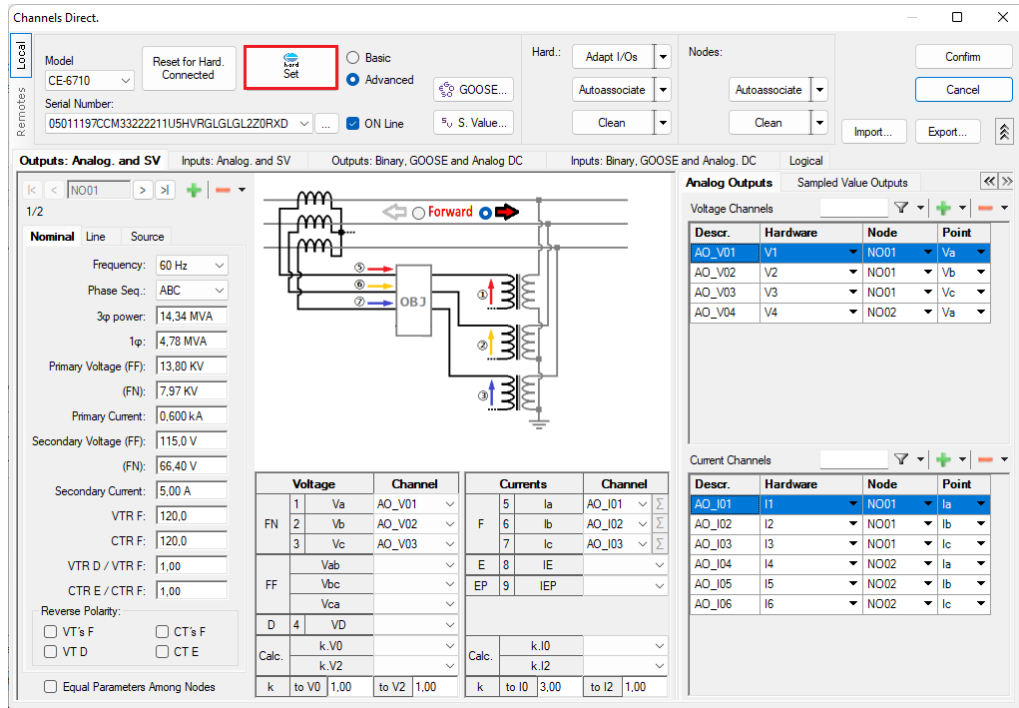


Figure 44

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

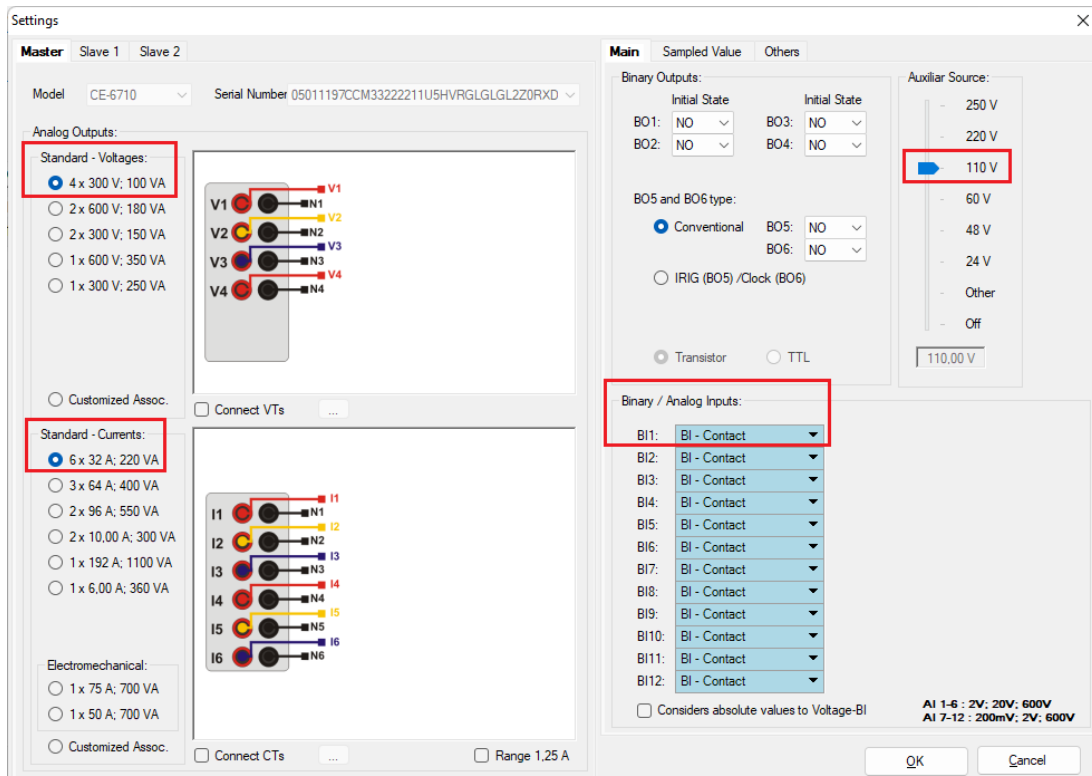


Figure 45

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

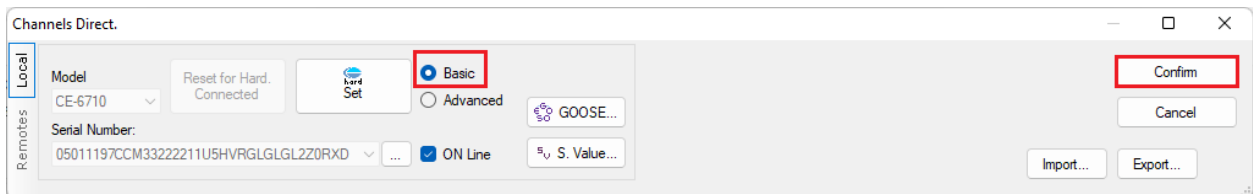


Figure 46

7. Test structure for function 67

7.1 Test Settings

On this tab you must configure the pickup and trip signals with the binary inputs. If necessary, it is possible to enable up to two pre-fault conditions and one post-fault condition. The only test that will be performed is the time test and consequently the directionality test.

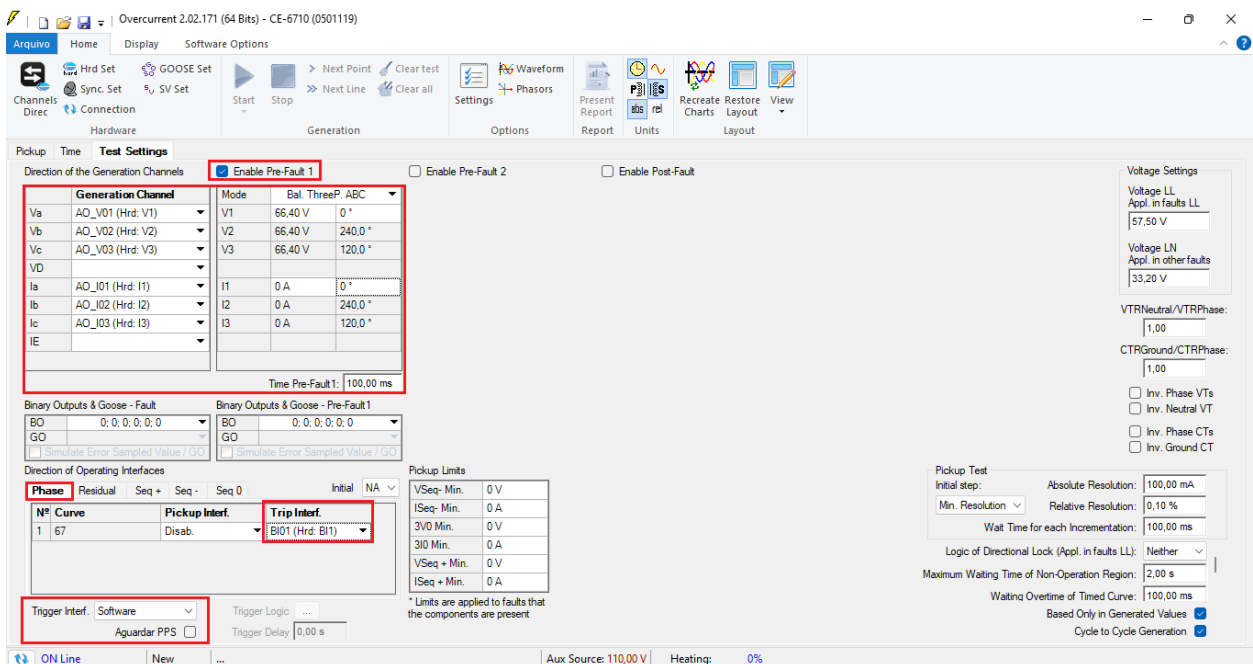


Figure 47

7.2 Time Screen

In this tab, the operating time and directionality are evaluated. For convenience, a sequence of values will be inserted. The value 10.00A was chosen as the initial value, 15.00A as the final value and 5.0A as the increment step and the AE, BE, CE and ABC fault. In the angles choose 0.0° as initial value, for the step choose 35° and final value choose 360.0°. Choose the “Directionality” tab.

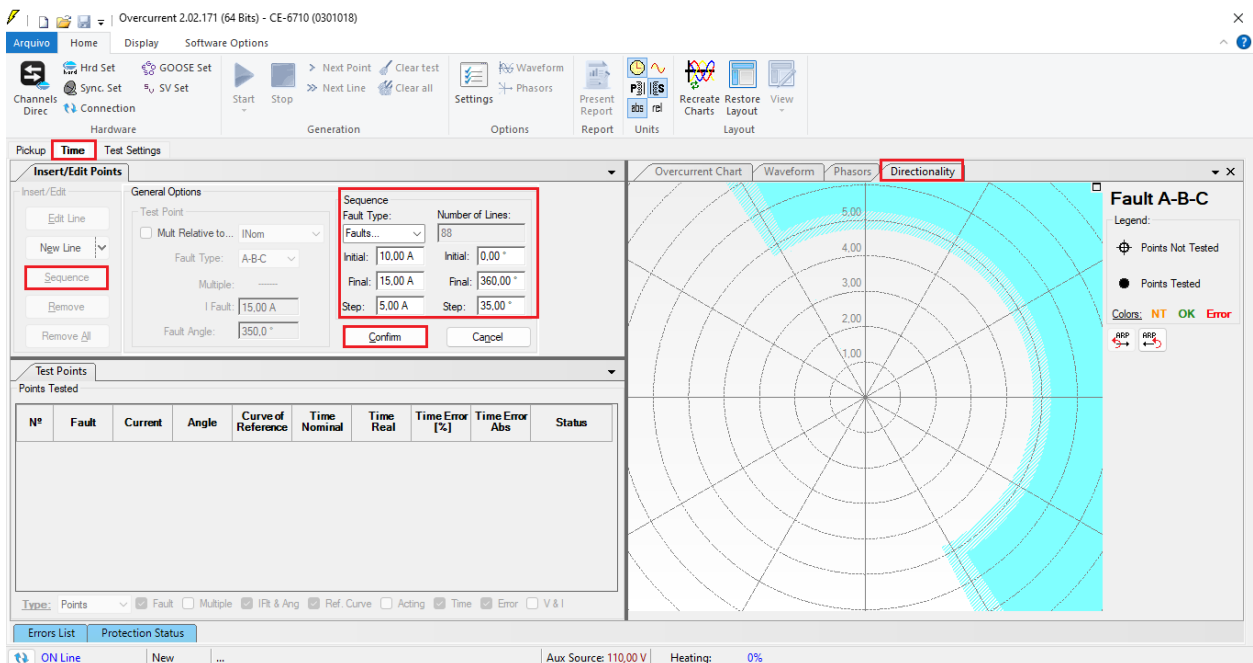


Figure 48

Start the generation by clicking on the icon highlighted below or using the command “Alt +G”.

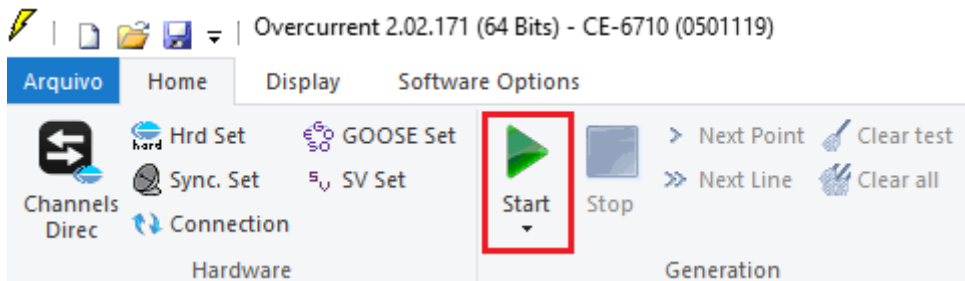


Figure 49

7.3 Final Result of the Time Test

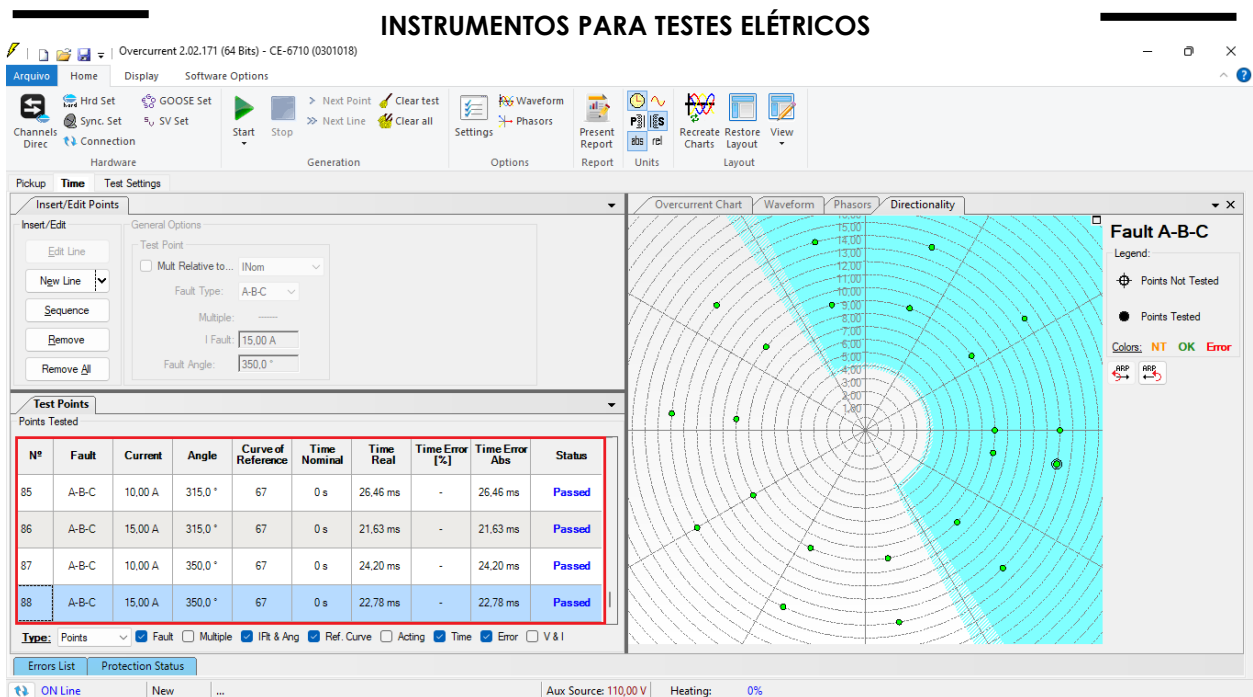


Figure 50

It is verified that all points in the operating region acted with times within the tolerance given by the relay manufacturer.

8. Report

After finishing the test, click on the “*Present Report*” icon in the previous figure or using the “*Ctrl + R*” command to call up the report pre-configuration screen. Choose the desired language as well as the options that should be part of the report.

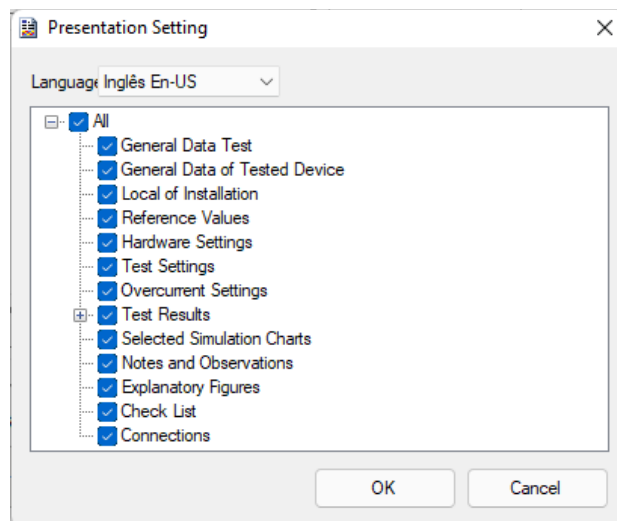


Figure 51

INSTRUMENTOS PARA TESTES ELÉTRICOS

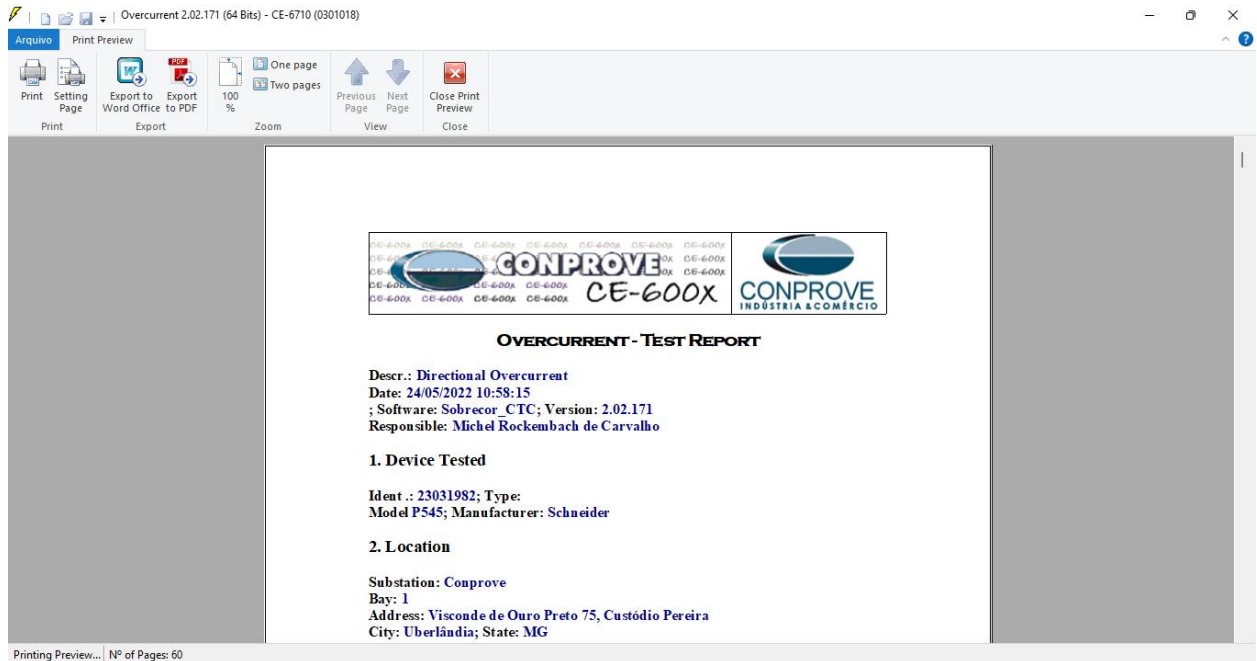


Figure 52

INSTRUMENTOS PARA TESTES ELÉTRICOS

APPENDIX A

A.1 Terminal Designations

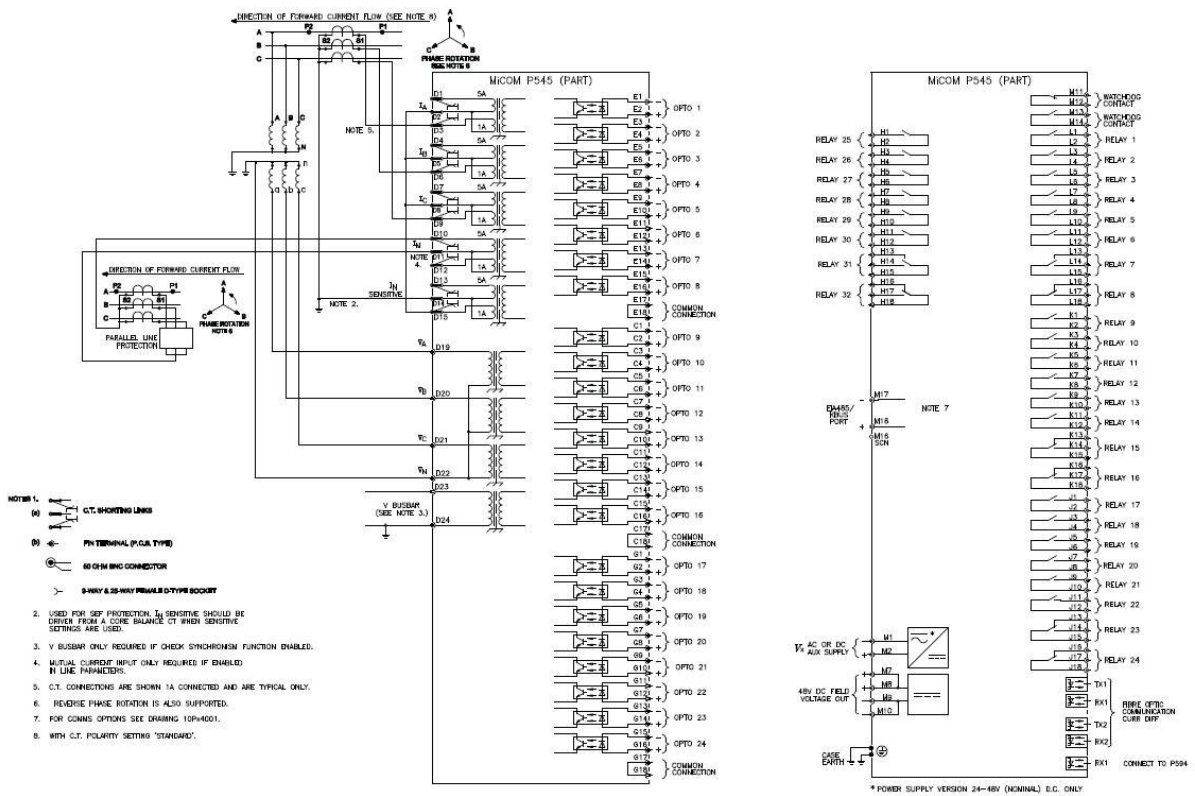


Figure 53

Three phase overcurrent protection

Accuracy

Additional tolerance X/R ratios:

$\pm 5\%$ over X/R 1...90

Overshoot: <30 ms

Inverse time characteristic

Accuracy

Pick-up: Setting $\pm 5\%$

Drop-off: 0.95 x setting $\pm 5\%$

Minimum trip level for IDMT elements:

1.05 x Setting $\pm 5\%$

Inverse time stages:

± 40 ms or 5%, whichever is greater

Definite time stages:

± 40 ms or 2%, whichever is greater

Repeatability: 5%

Directional boundary accuracy:

$\pm 2^\circ$ with hysteresis $< 3^\circ$

Additional tolerance due to increasing X/R ratios:

$\pm 5\%$ over the X/R ratio from 1 to 90.

Overshoot of overcurrent elements: <30 ms

APPENDIX B

Equivalence of software parameters and the relay under test.

Table 1

Overcurrent Software		Schneider P545 Relay	
Parameter	Figure	Parameter	Figure
Direc	42	I>1 Directional	20
Pkp	41	I1> Current Set	20
Time/dial	41	I1> Time Delay	20
ATM	42	I > Char Angle	20