



INSTRUMENTOS PARA TESTES ELÉTRICOS

Test Tutorial

Equipment Type: Protection Relay

Brand: SCHNEIDER

Model: P545

Function: 25 or RSYN – Synchronism Check

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

Objective: Test when two systems can connect, respecting voltage, frequency and angle limits, that is, if they are in synchronism.

Version control:

Version	Descriptions	Date	Author	Reviewer
1.0	Initial Version	10/12/2021	M.R.C.	M.P.S



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

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Sequence for testing the Schneider P545 relay in the Synchronism software

1. Relay connection to CE-6006

Appendix A-1 shows the relay terminal designations.

1.1 Auxiliary Source

Connect the positive (red terminal) of the Vdc Aux. Source to pin M2 on the relay terminal and the negative (black terminal) of the Vdc Aux. Source to pin M1 on the relay terminal.

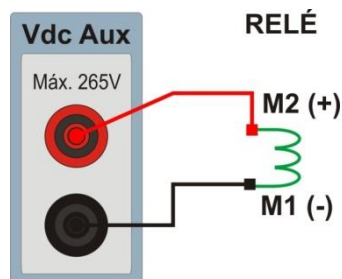


Figure 1

1.2 Voltage Coils

To establish the voltage coil connection, connect channels V1, V2 and V3 with the relay terminal pins D19, D20 and D21 and the common ones to pin D22. Then connect channel V4 with pin D23 of the relay terminal and common to pin D24.

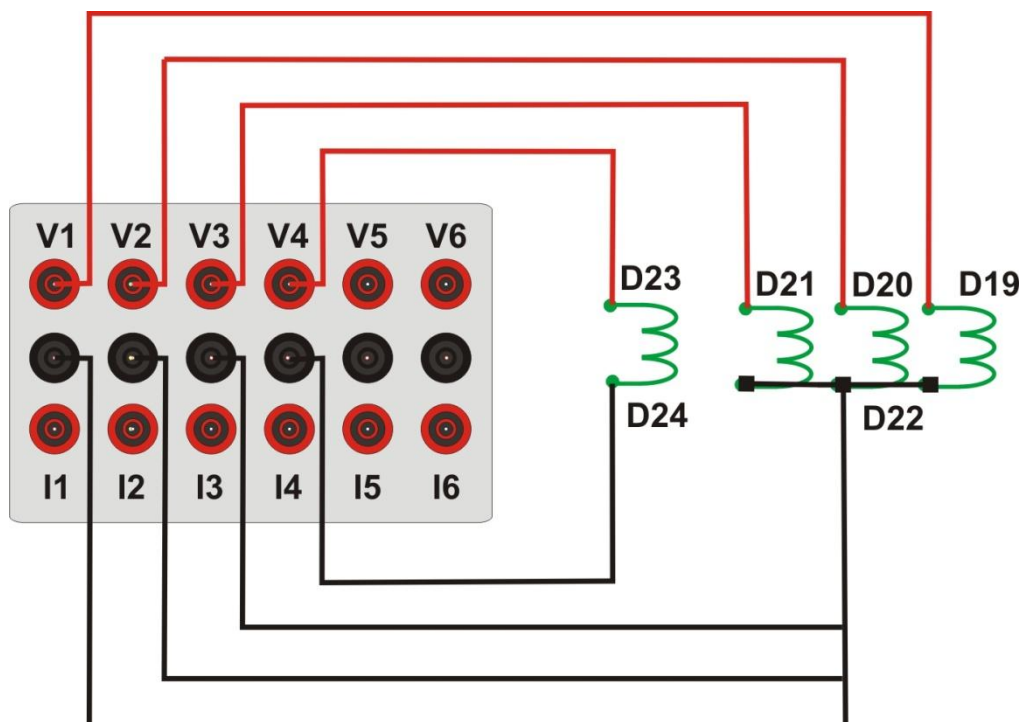


Figure 2

1.3 Binary Inputs

Connect CE-6006 binary input to relay binary output.

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

The figure below shows the details of the connections.

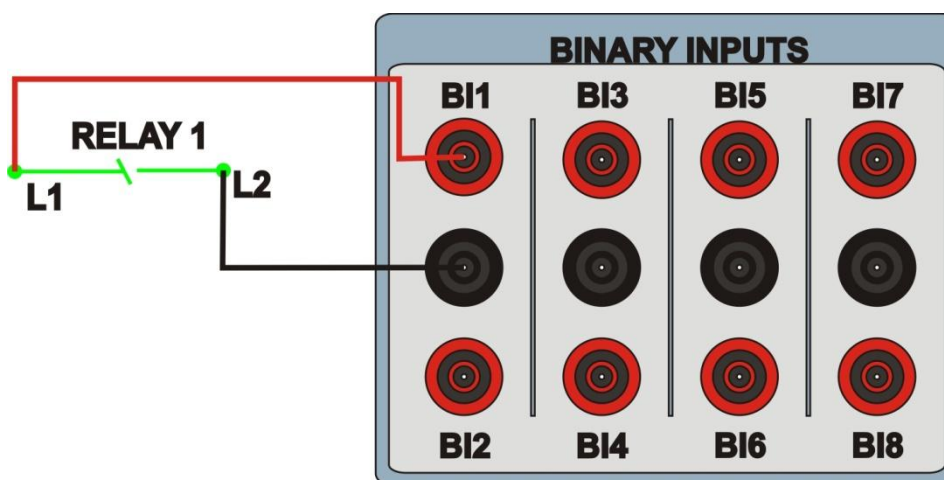


Figure 3

2. Communication with 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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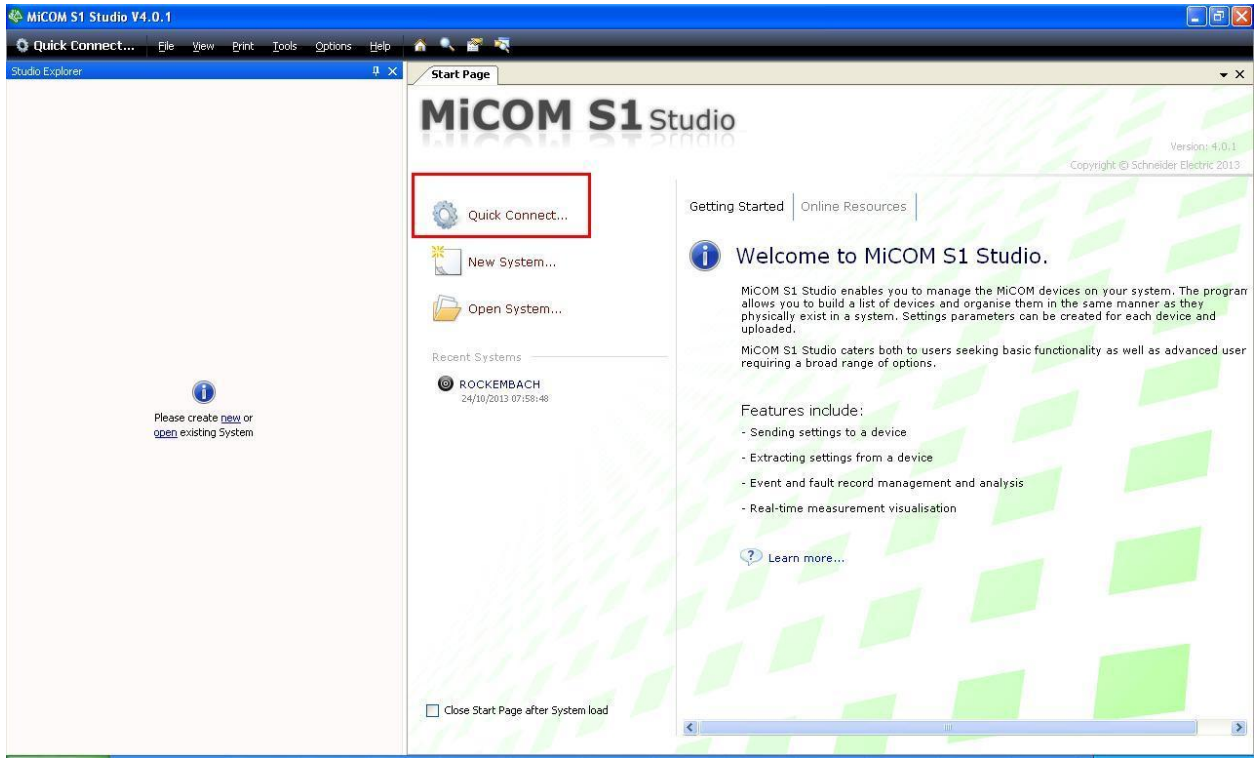


Figure 5

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

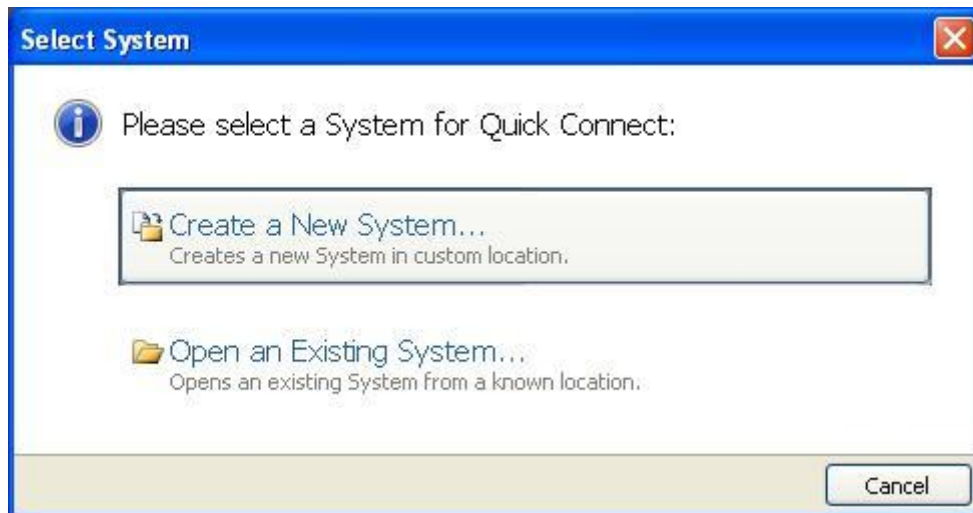


Figure 6

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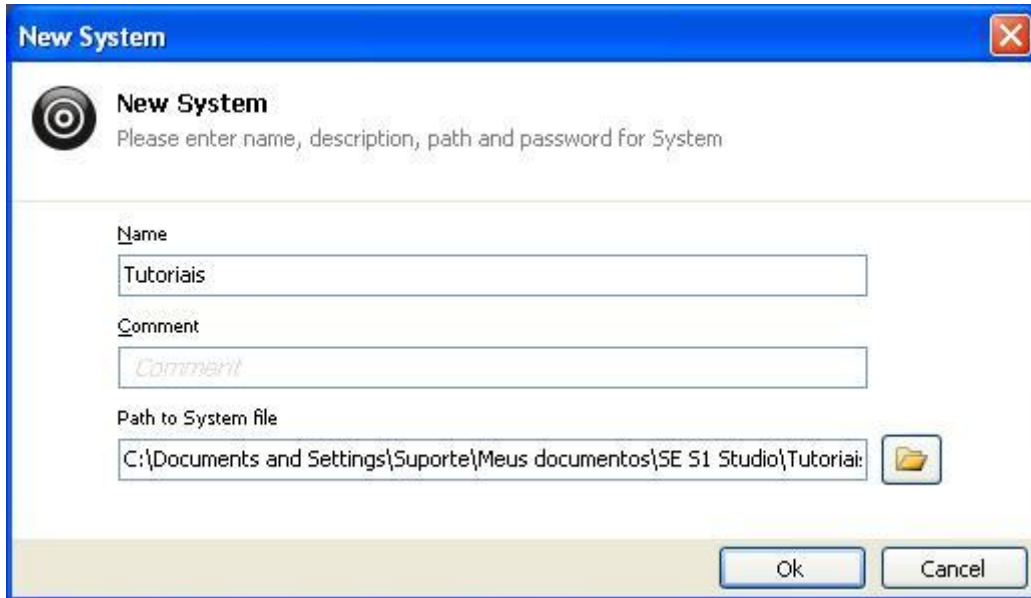


Figure 7

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



Figure 8

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

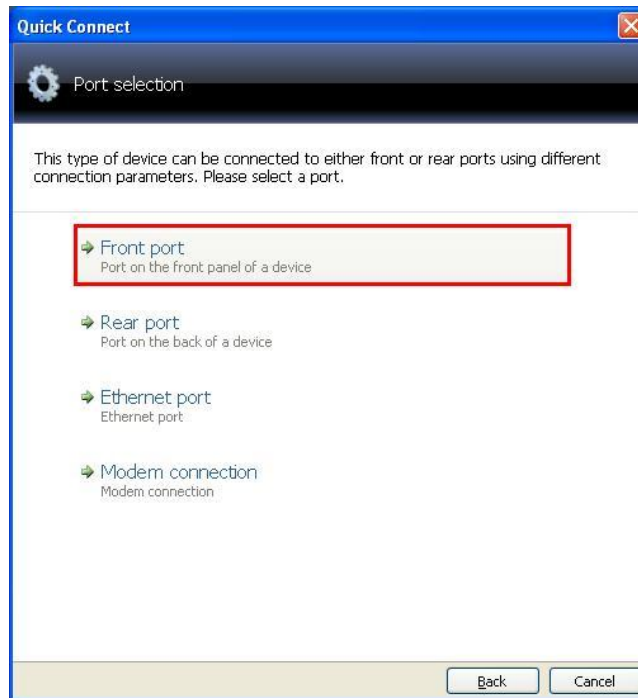


Figure 9

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

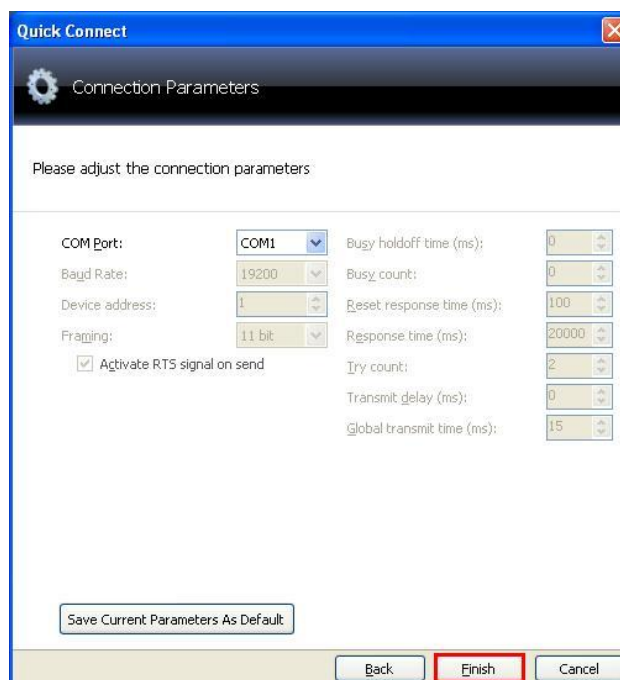


Figure 10

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

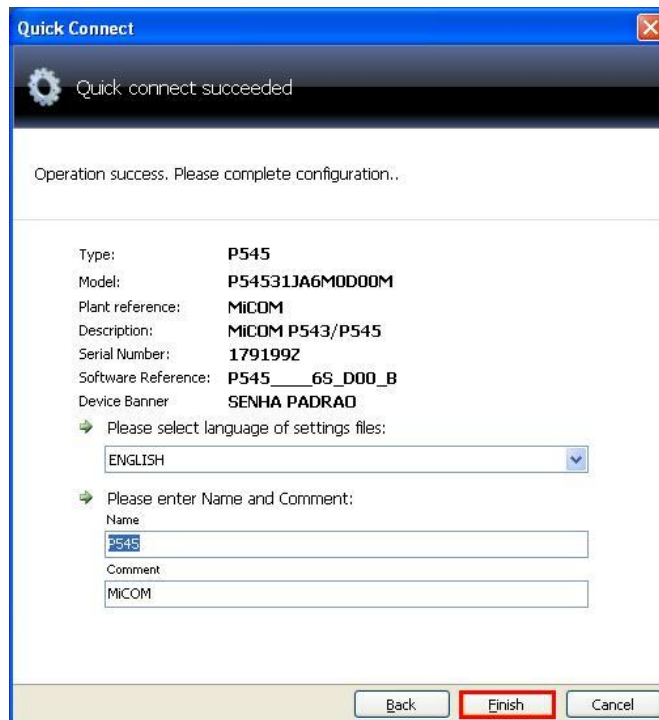


Figure 11

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

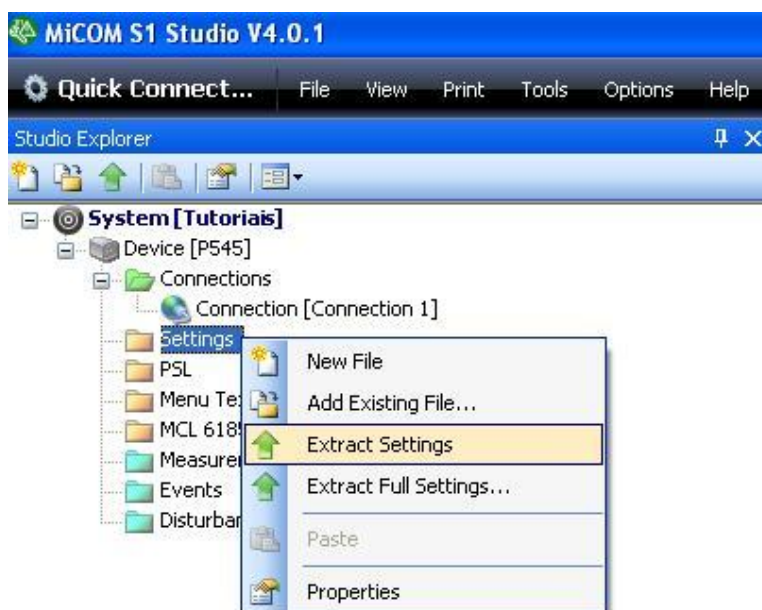


Figure 12

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Enter the relay password with the default value of “AAAA” for this relay.



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 “Sincronismo”.



Figure 14

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3. Schneider P545 relay parameterization

3.1 Frequency

After double-clicking the “Sincronismo” file, enter “SYSTEM DATA”, and then “Frequency”. Make sure the set value is 60Hz.

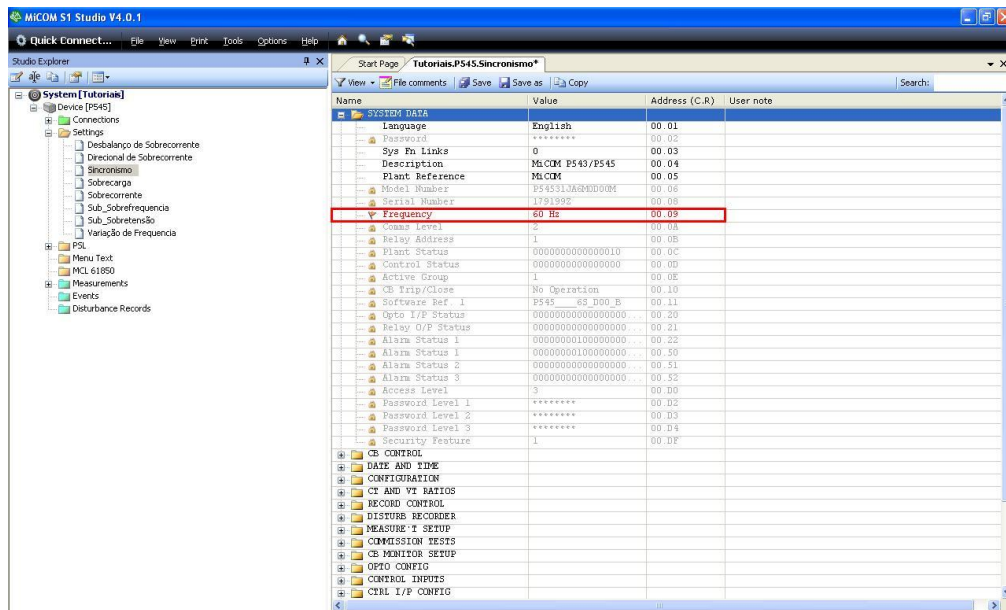


Figure 15

3.2 CONFIGURATION

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

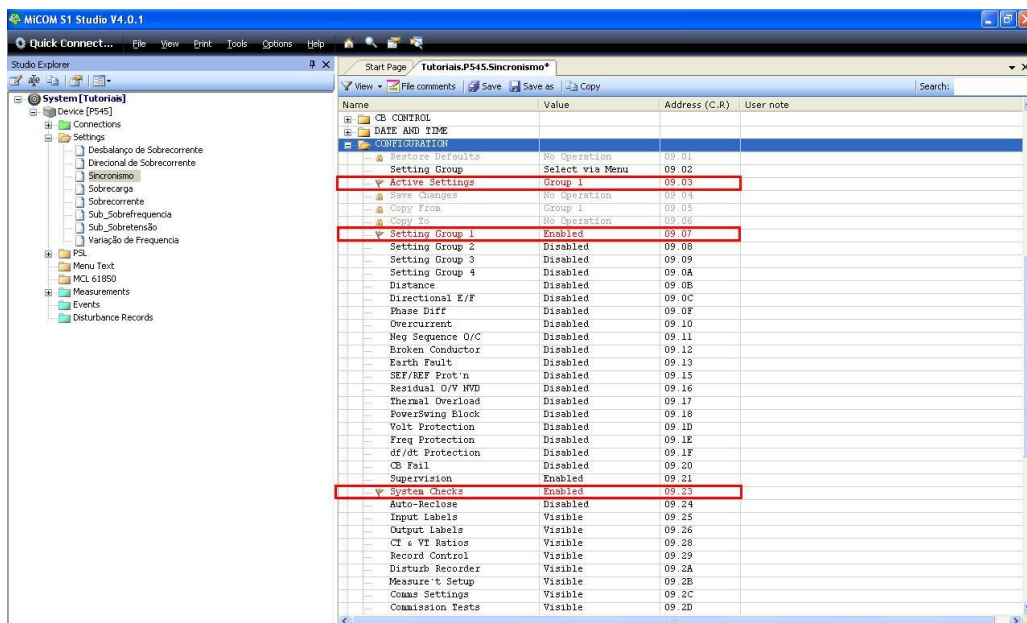


Figure 16

3.3 Setting Values

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

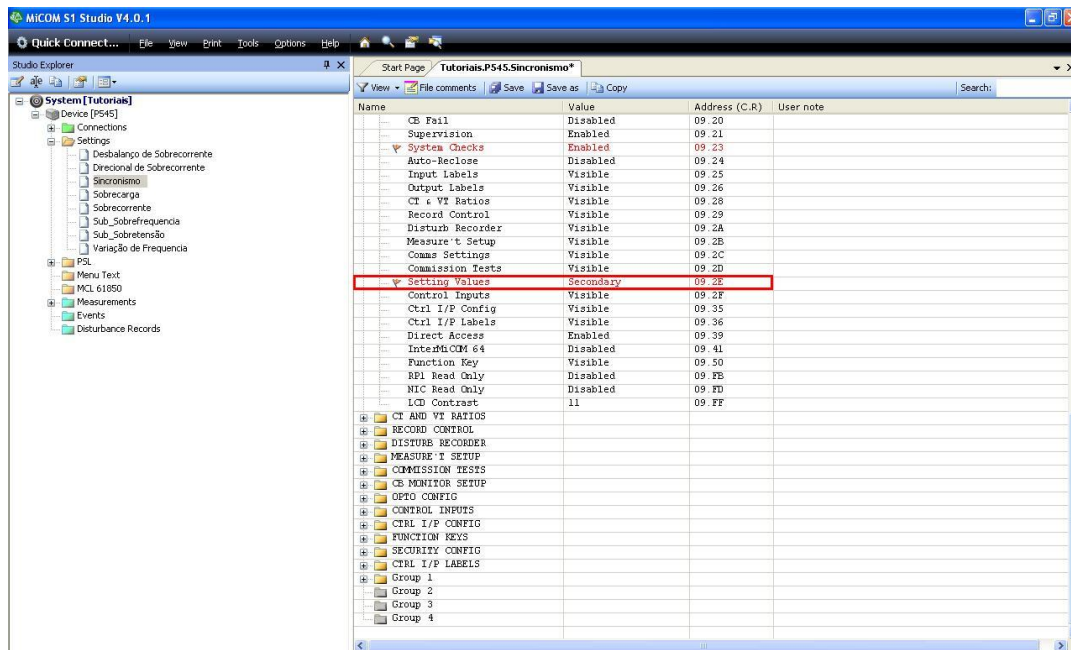


Figure 17

3.4 CT AND VT RATIOS

Adjust the VT primary and secondary voltage values. And choose phase A as reference voltage.

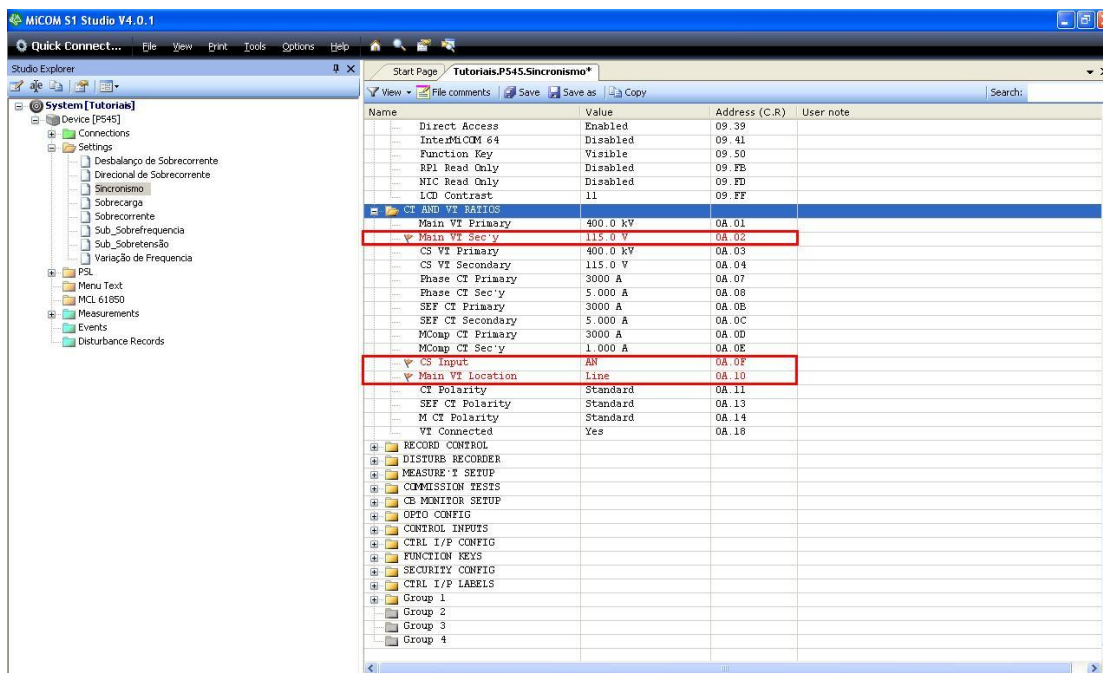


Figure 18

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3.5 Phase Sequence

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

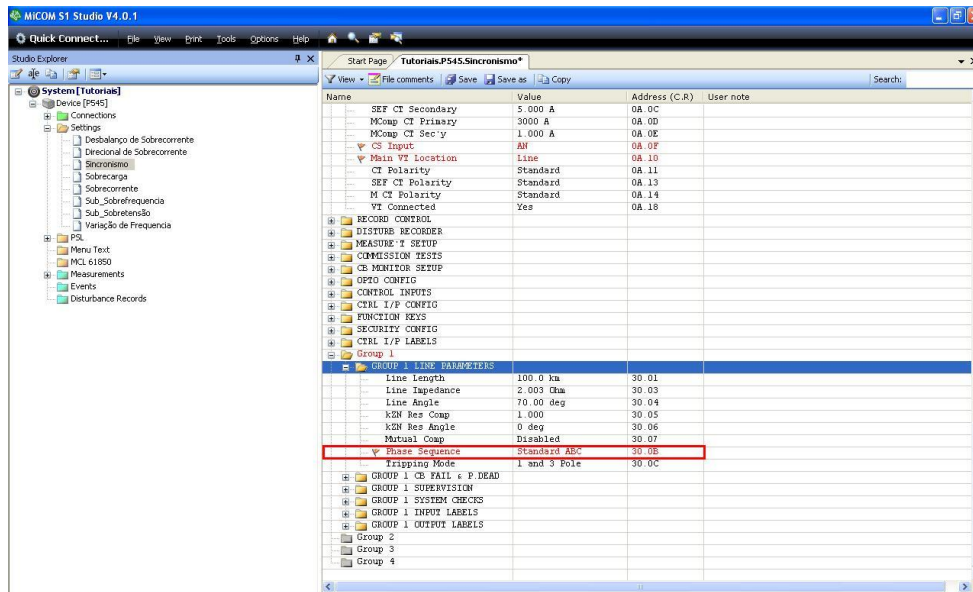


Figure 19

3.6 GROUP 1 SYSTEM CHECKS

In this field, the synchronism function is parameterized.

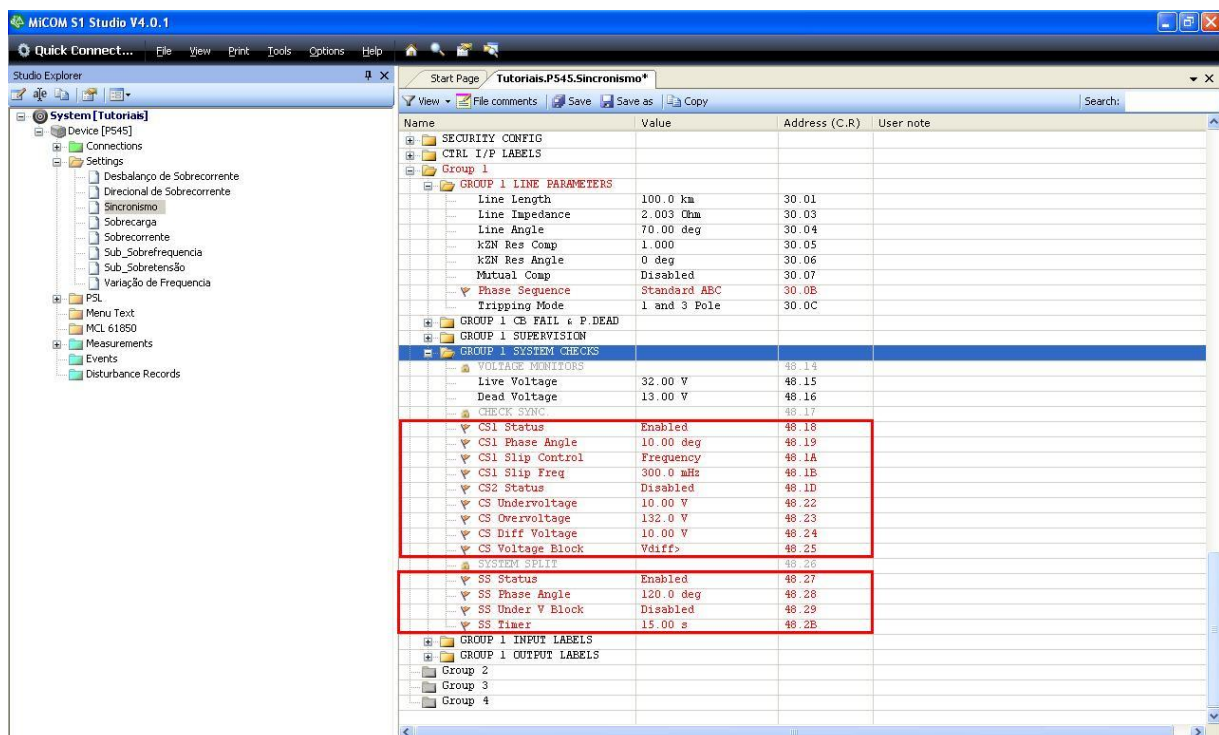


Figure 20

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Click on the highlighted icon to save the adjustments.

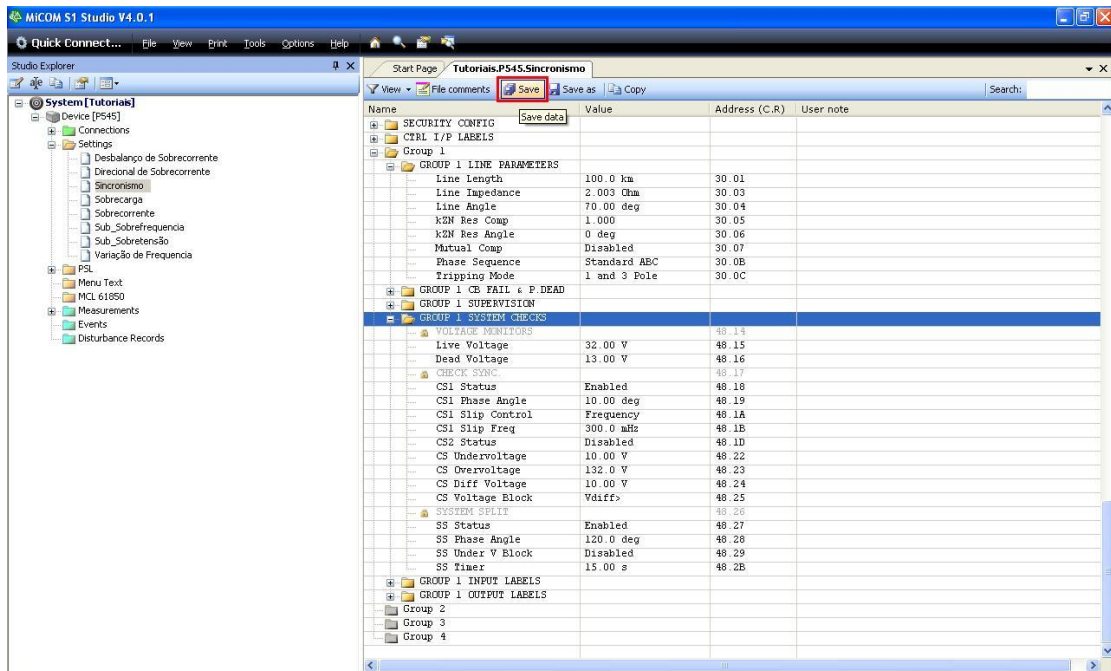


Figure 21

3.7 PSL

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

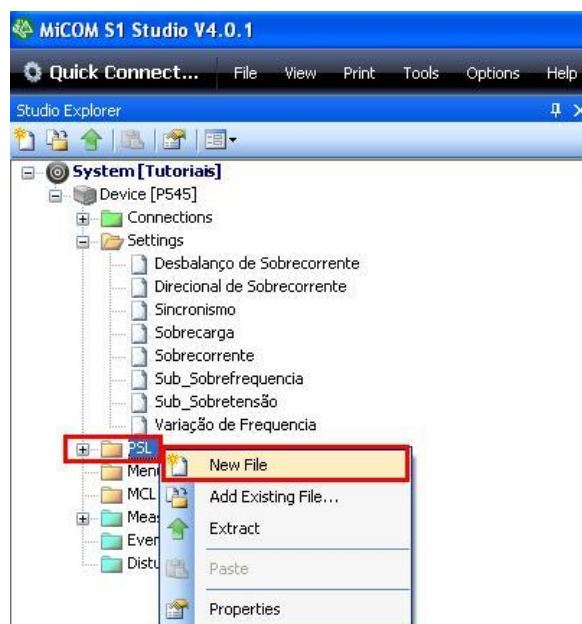


Figure 22

The file name appears as “000” change the name to “Sincronismo”.

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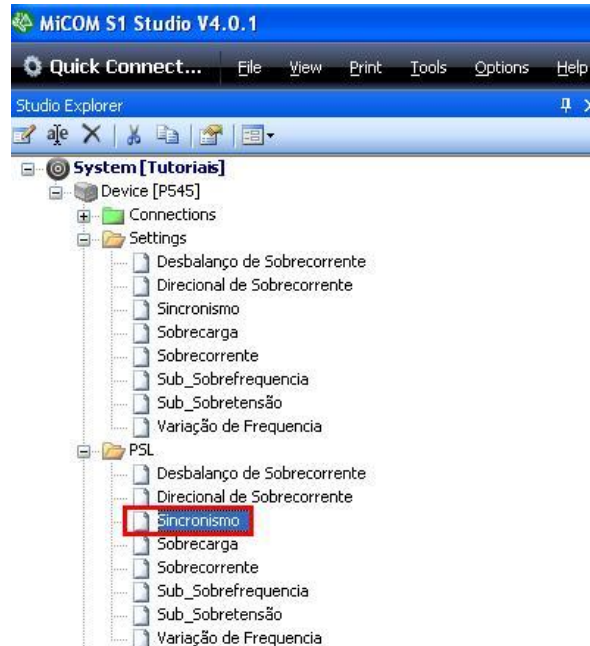


Figure 23

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

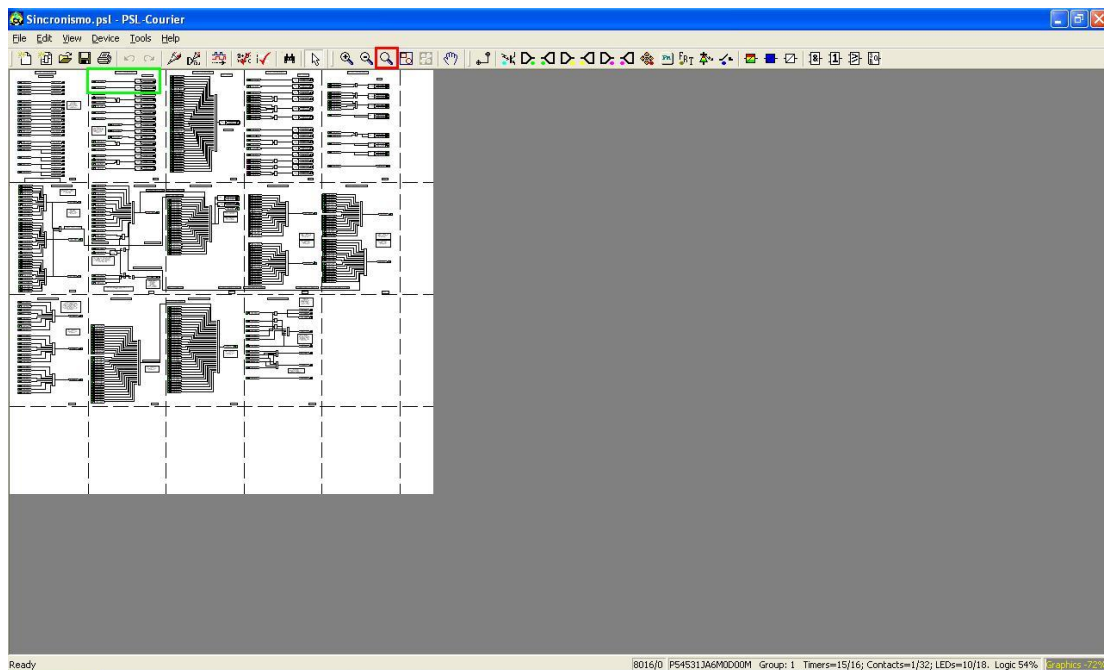


Figure 24

Note that the first output appears in the figure below (highlighted in red). Associated with a signal other than sync.

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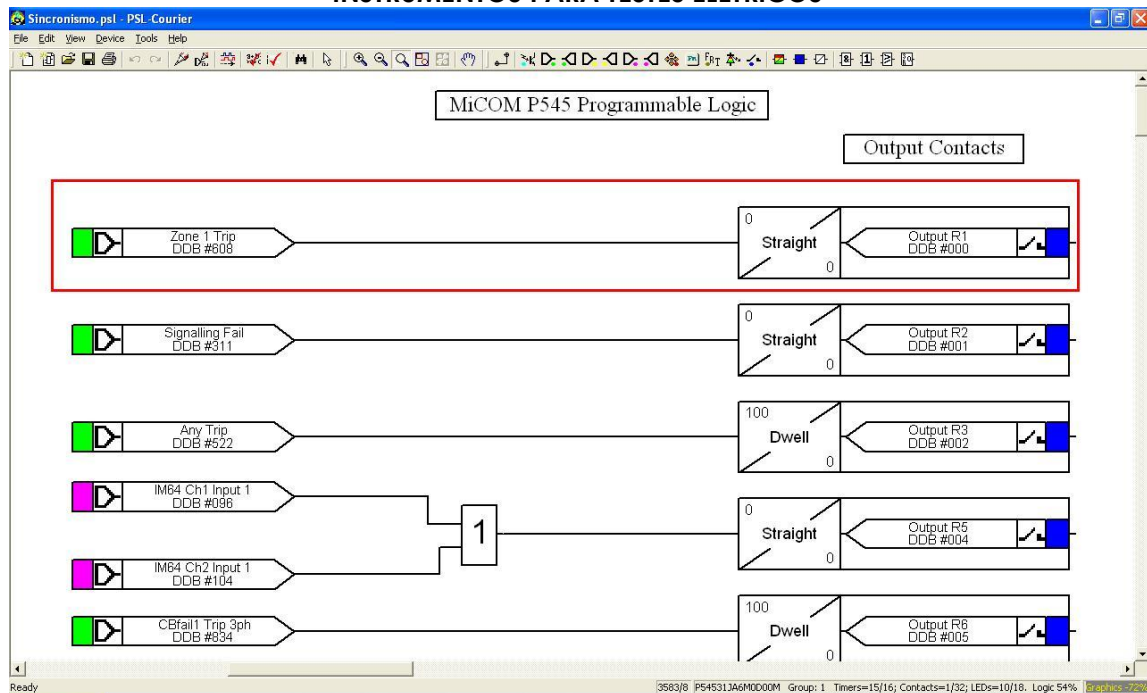


Figure 25

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

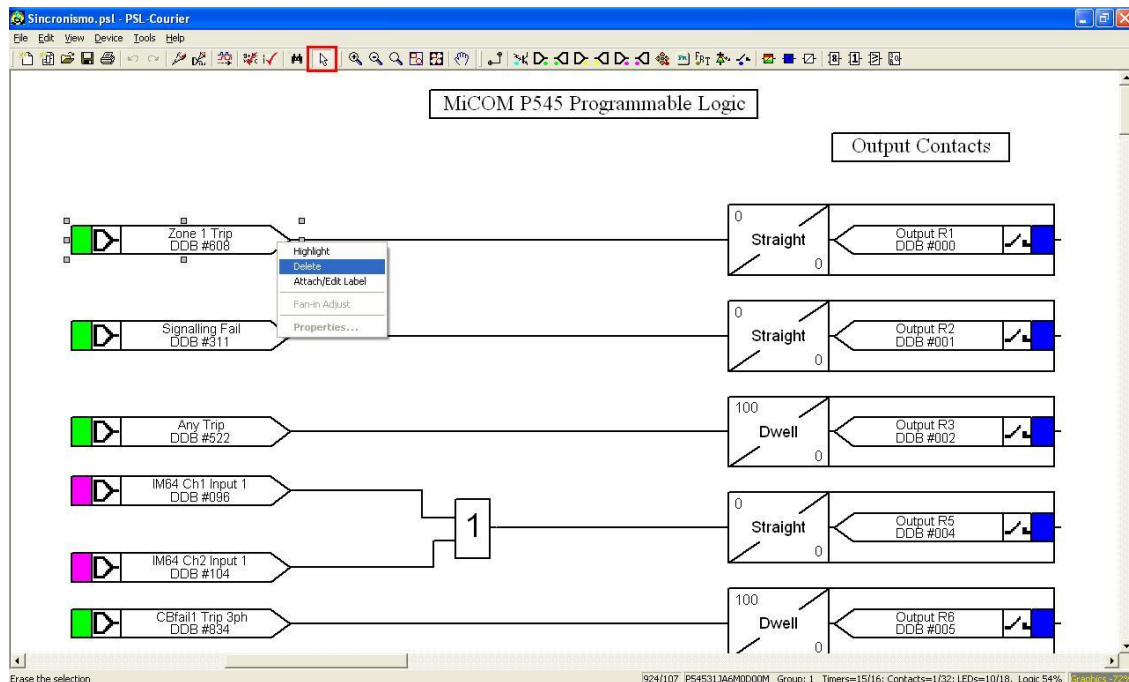


Figure 26

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

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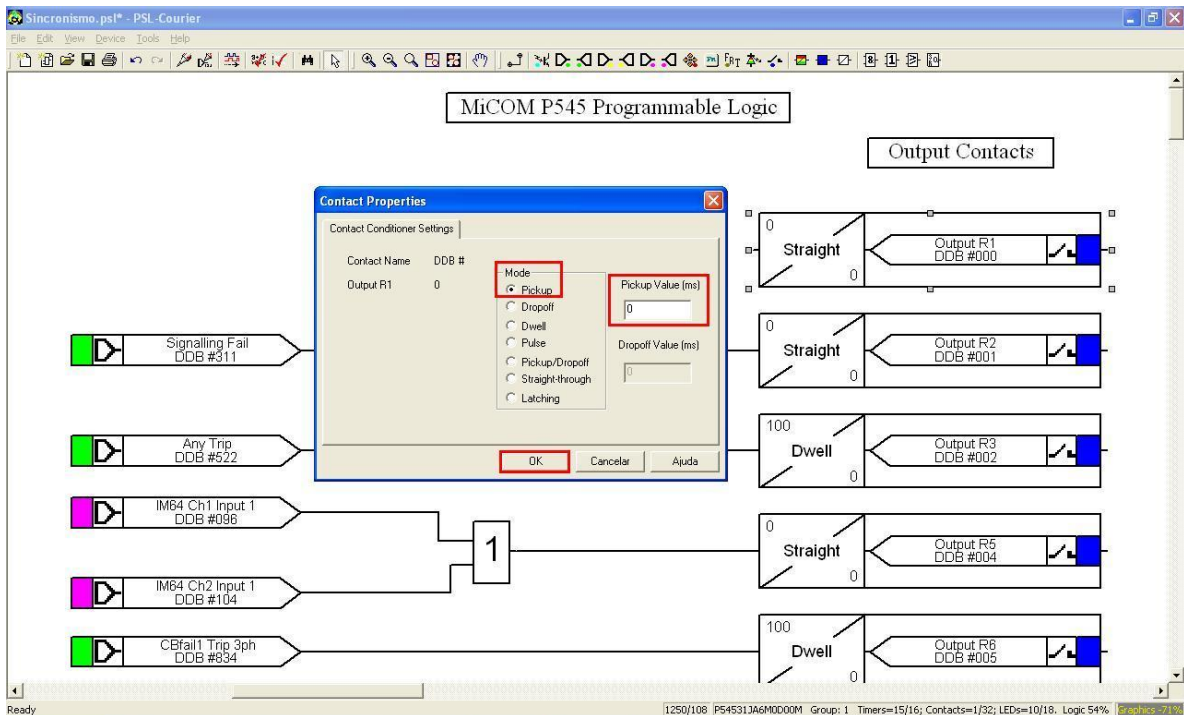


Figure 27

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

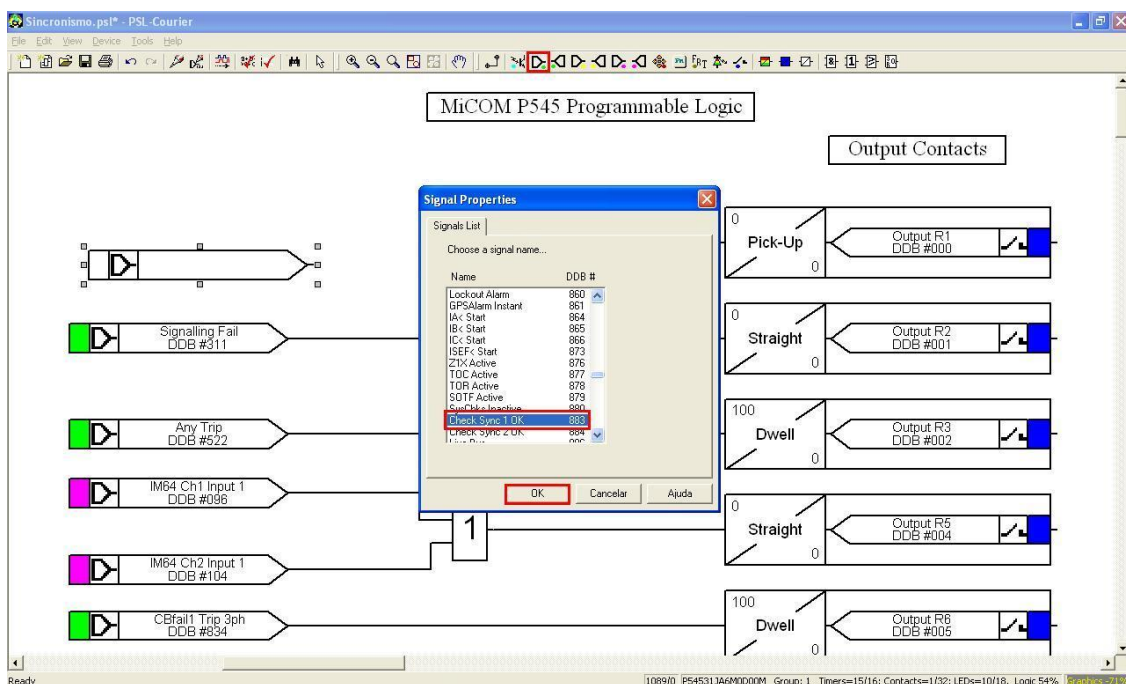


Figure 28

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

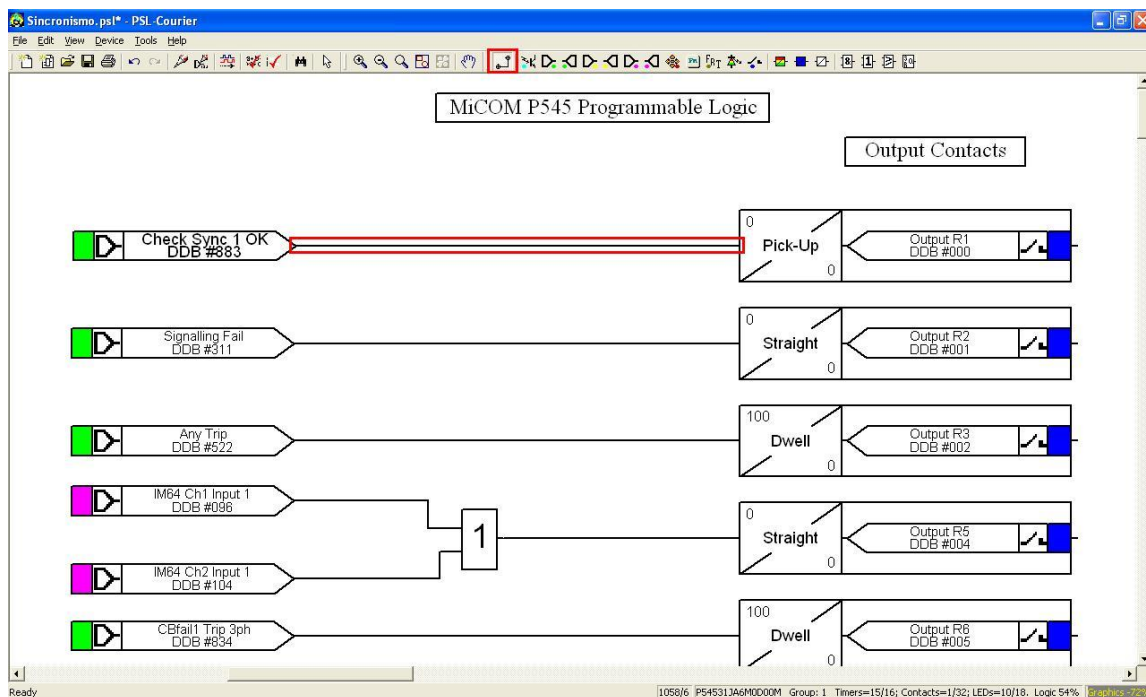


Figure 29

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

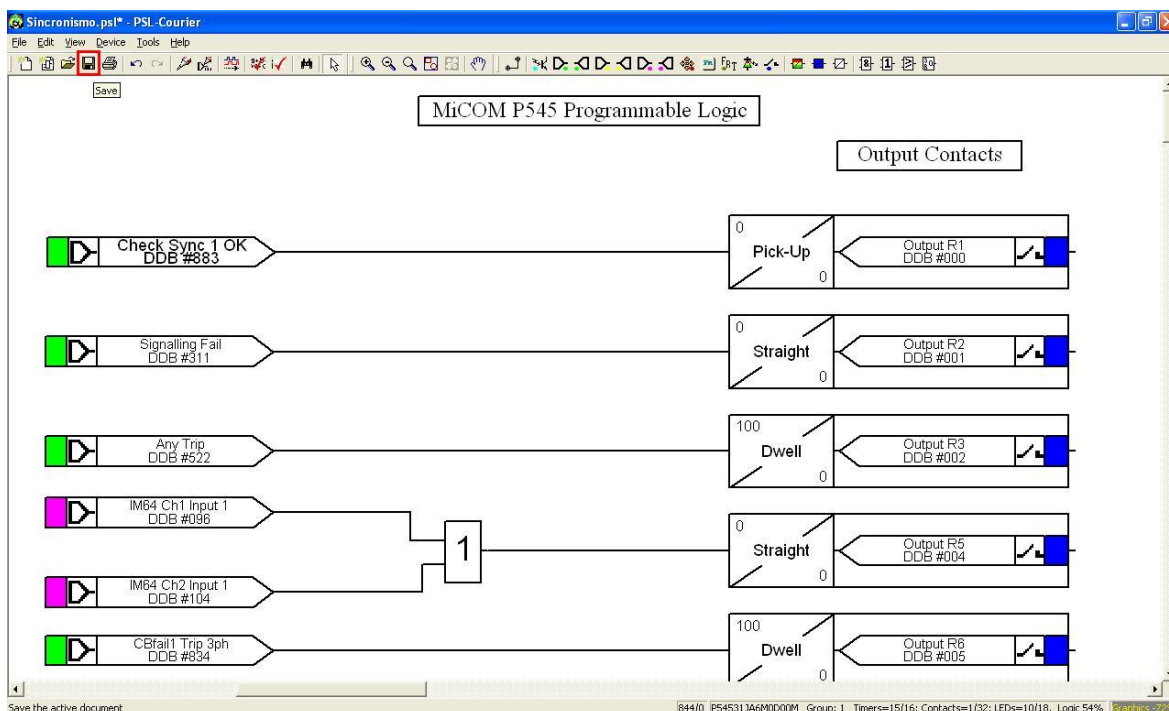


Figure 30

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3.8 Sending Settings to the Relay

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

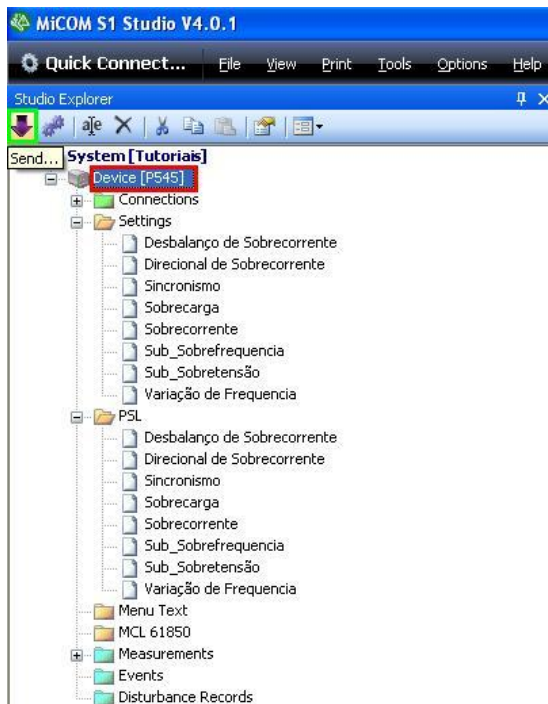


Figure 31

Send both the function settings and group 1 of the Sync logic block.

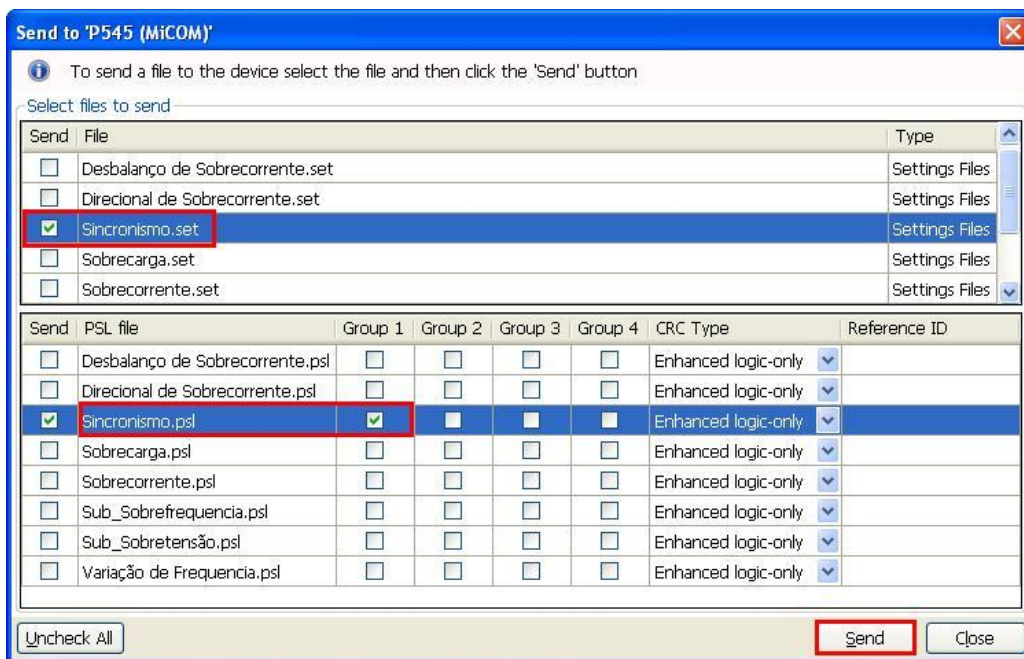


Figure 32

4. Synchronism software adjustment

4.1 Opening the software

Open the Conprove Test Center (CTC) software, shown in the figure below.

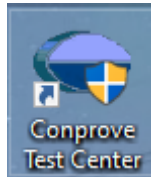


Figure 33

Click on the Synchronism software icon.

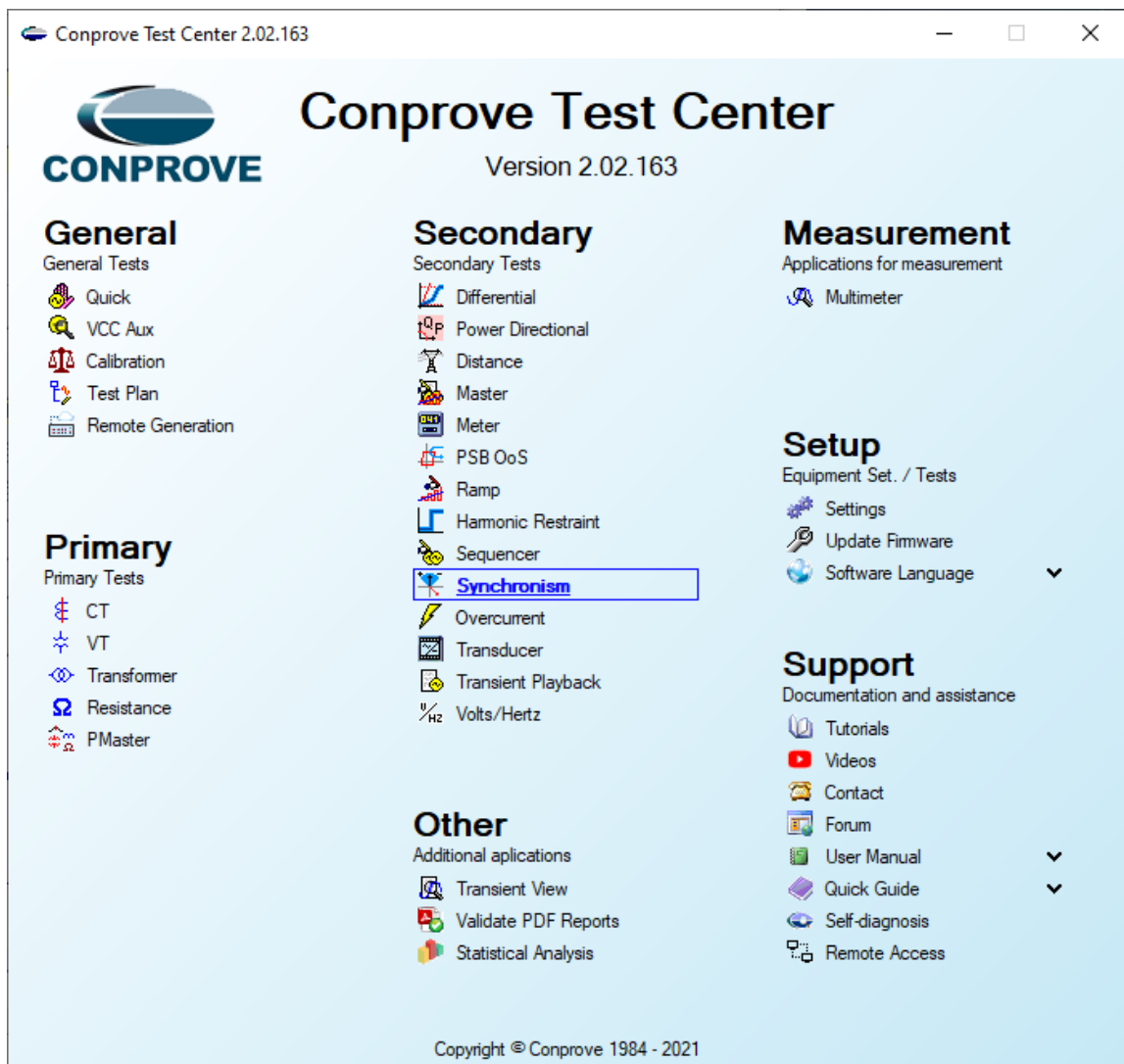


Figure 34

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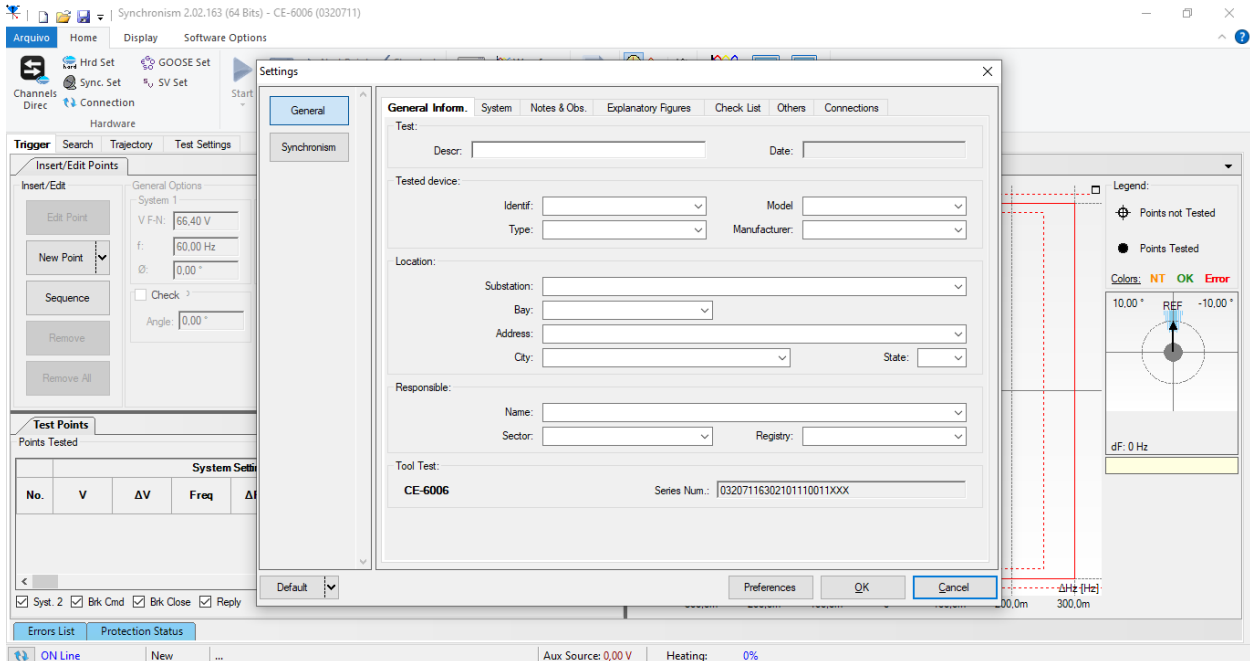


Figure 35

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.

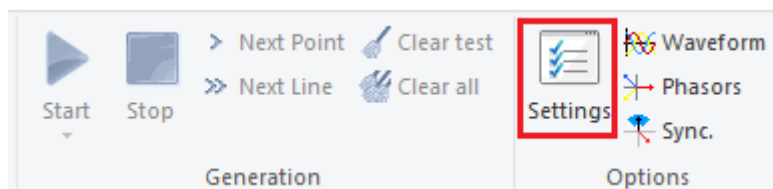
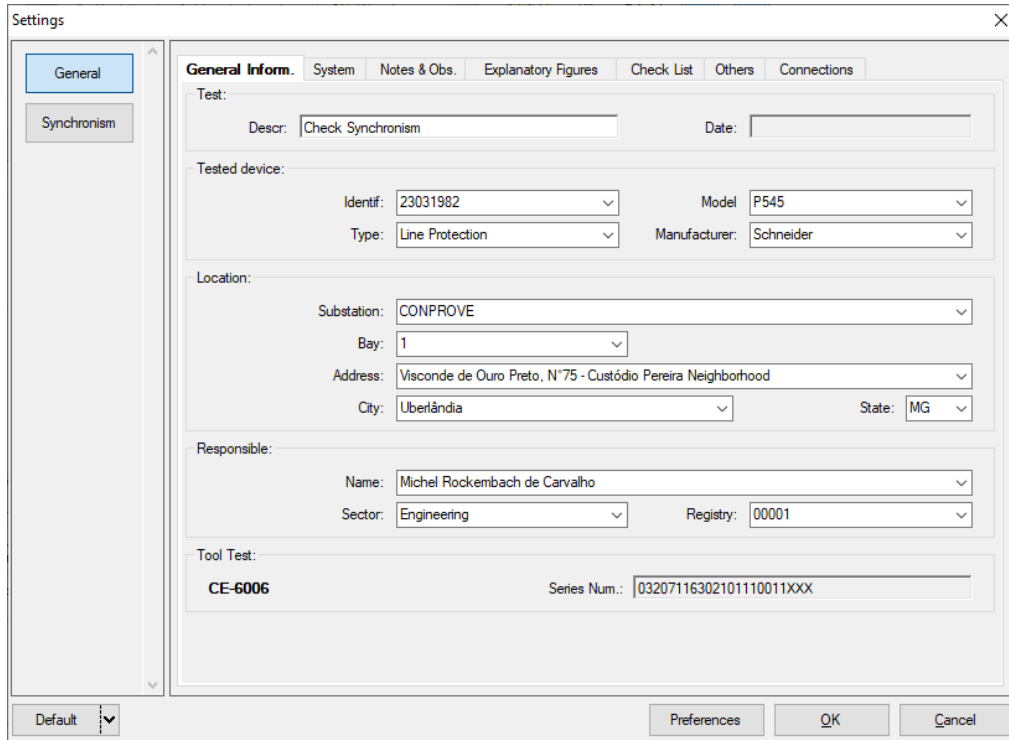


Figure 36

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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Settings

General Inform. System Notes & Obs. Explanatory Figures Check List Others Connections

Test:
 Descr: Check Synchronism Date:

Tested device:
 Identif: 23031982 Model: P545
 Type: Line Protection Manufacturer: Schneider

Location:
 Substation: CONPROVE
 Bay: 1
 Address: Visconde de Ouro Preto, N°75 - Custódio Pereira Neighborhood
 City: Uberlândia State: MG

Responsible:
 Name: Michel Rockembach de Carvalho
 Sector: Engineering Registry: 00001

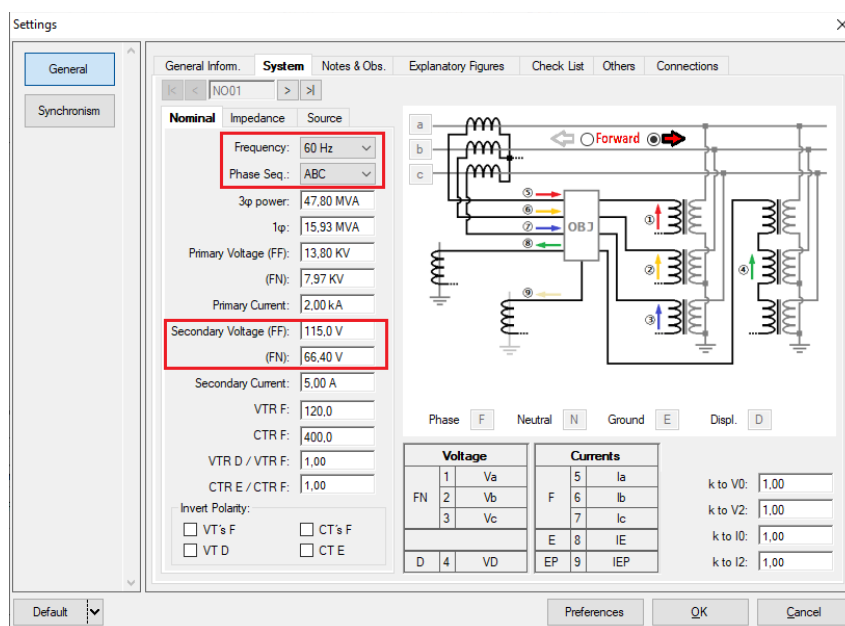
Tool Test:
CE-6006 Series Num.: 03207116302101110011XXXX

Default Preferences OK Cancel

Figure 37

4.3 System

In the following screen, within the Nominal sub tab, the frequency values, 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.



Settings

General Inform. **System** Notes & Obs. Explanatory Figures Check List Others Connections

NO01

Nominal Impedance Source

Frequency: 60 Hz
 Phase Seq.: ABC

3φ power: 47.80 MVA
 1φ: 15.93 MVA
 Primary Voltage (FF): 13.80 KV
 (FN): 7.97 KV
 Primary Current: 2.00 kA

Secondary Voltage (FF): 115.0 V
 (FN): 66.40 V

Secondary Current: 5.00 A
 VTR F: 120.0
 CTR F: 400.0
 VTR D / VTR F: 1.00
 CTR E / CTR F: 1.00

Invert Polarity:
 VT's F CT's F
 VT D CT E

Phase F Neutral N Ground E Displ. D

Voltage			Currents			k to V0:	
1	Va	5	Ia	1	1.00		
2	Vb	6	Ib	1	1.00		
3	Vc	7	Ic	1	1.00		
4	VD	8	IE	1	1.00		
		9	IEP	1	1.00		

Default Preferences OK Cancel

Figure 38

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There are other tabs where the user can enter “Notes & Obs.”, *Explanatory Figures*”, can create a “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 tested equipment.

5. Channel Targeting and Hardware Configurations

Click on the icon illustrated below.

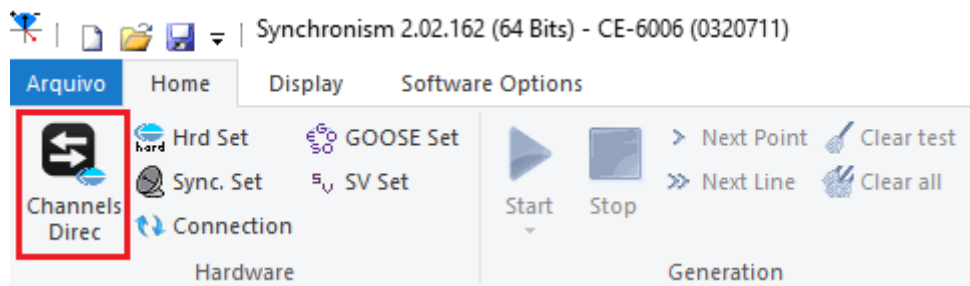


Figura 39

Then click on the highlighted icon to configure the hardware.

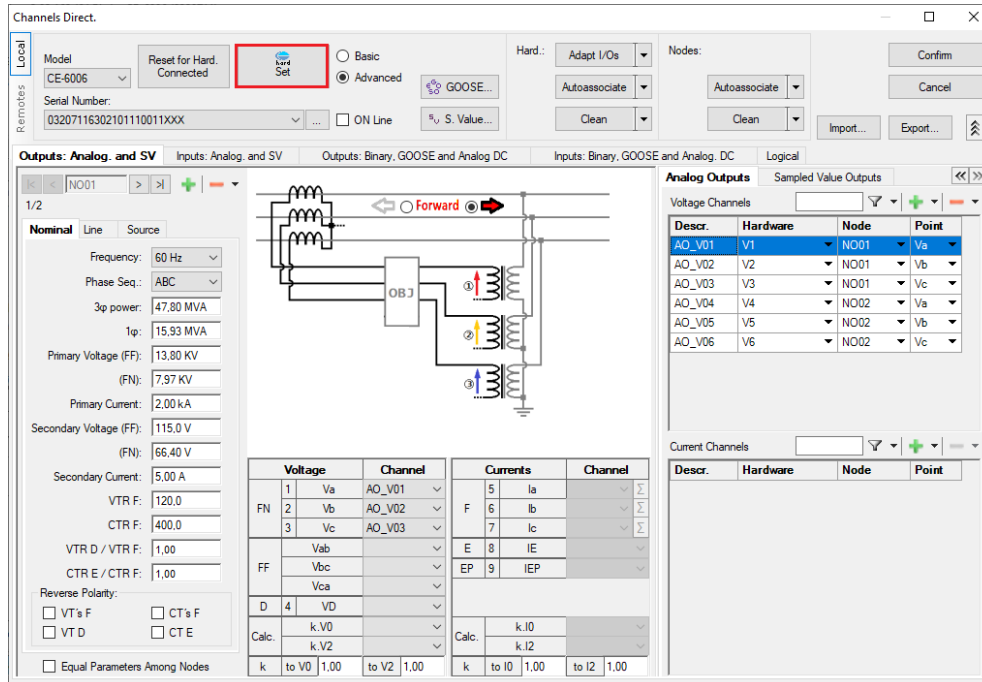


Figure 40

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

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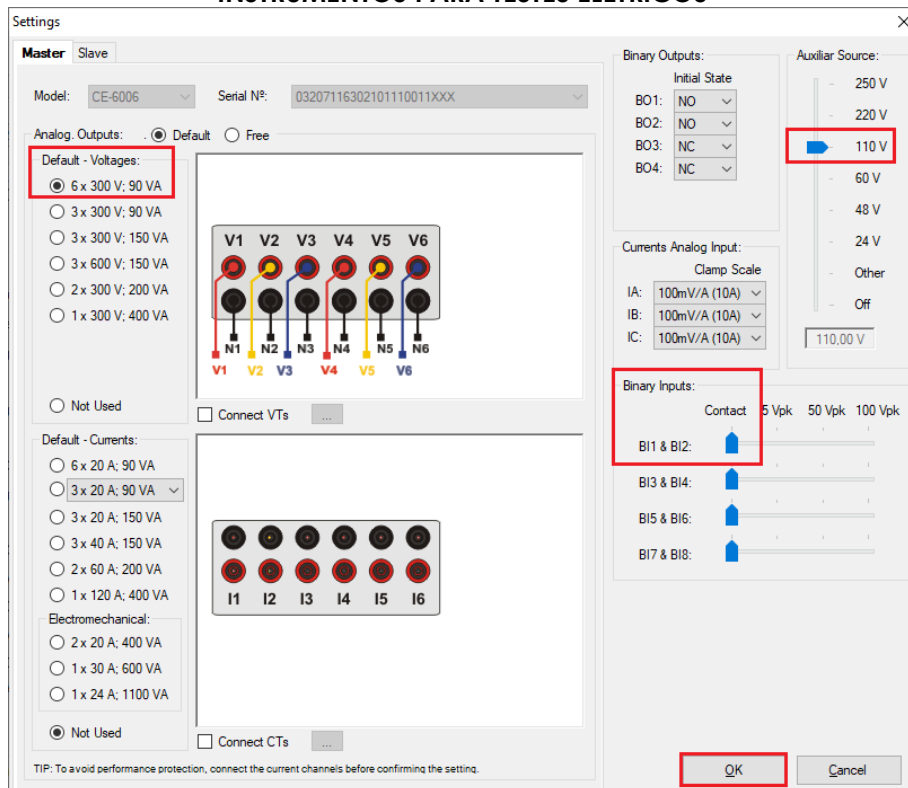


Figure 41

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

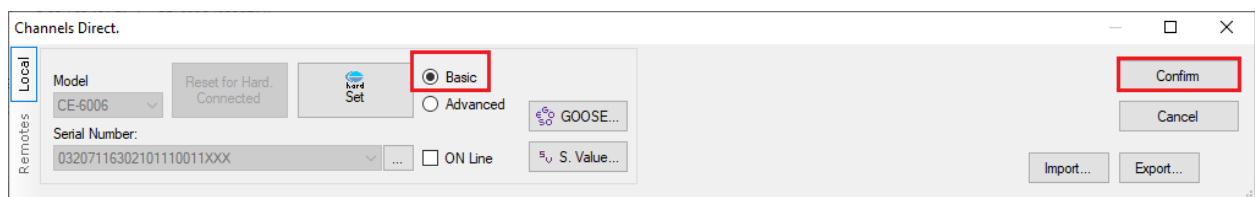


Figure 42

6. Synchronism Adjustments

6.1 Synchronism > Systems Screen

Click again on the “Settings” icon and then “Synchronism > Systems”. In this tab, the data of system 1 must be inserted, specifying its composition: Single-phase, Three-phase FN or Three-phase FF. The reference voltage must be adjusted, and depending on the case, it is necessary to compensate for the phase shift inserted by the transformer.

For system 2, it must be configured similarly to system 1 regarding its composition and reference voltage. In this same screen, the primary and secondary voltage values are adjusted, in addition to the primary and secondary currents. For the circuit breaker, the time value for its effective closing must be entered. There is also the

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“Equal Levels of System 1” field, which when selected, equals the voltages of system 2 to system 1.

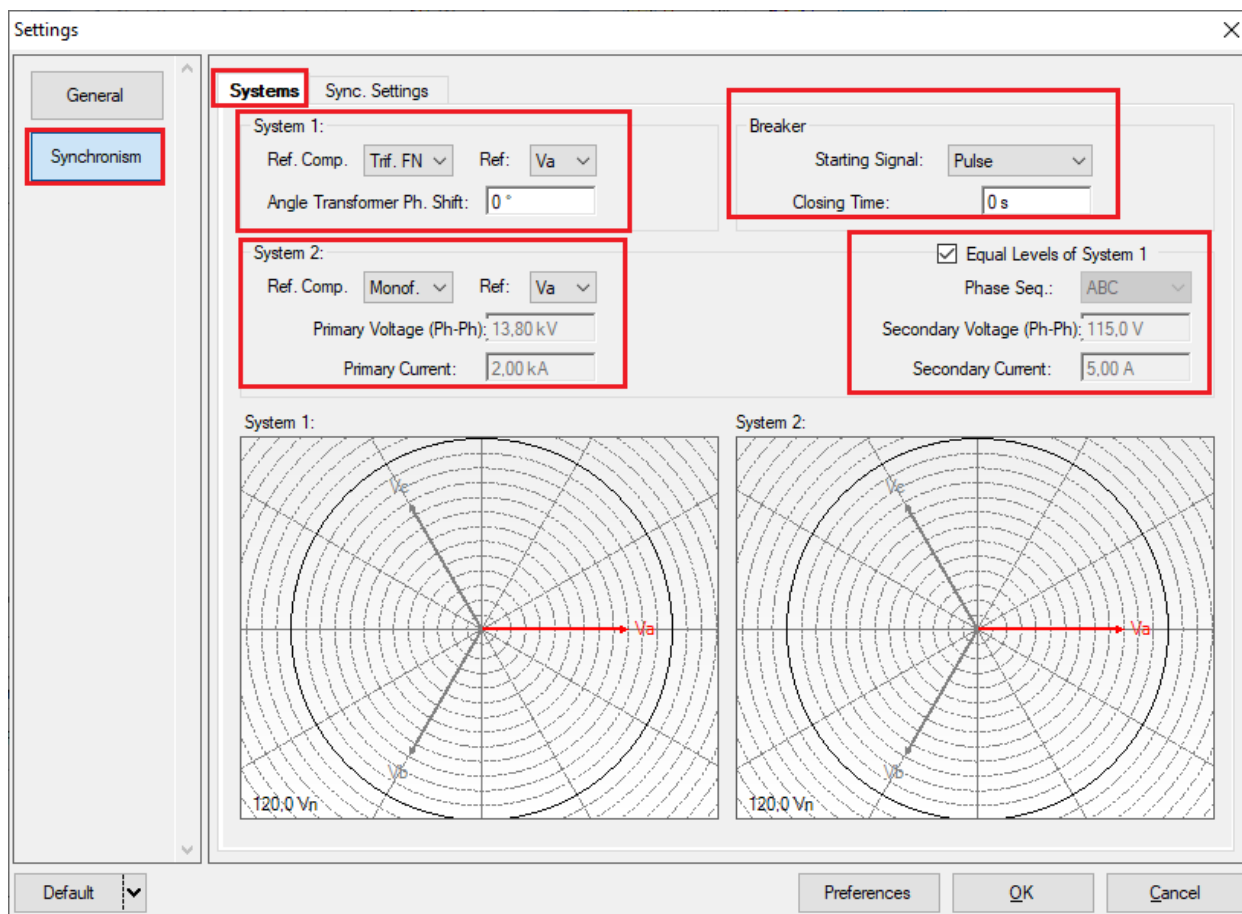


Figure 43

6.2 Synchronism > Sync. Settings

This screen stipulates the differences in voltage, frequency and the maximum tolerable angle for synchronism to occur. The maximum and minimum permitted voltage and frequency values are also adjusted so that synchronism occurs. These values are adjusted in percentage referring to the nominal values of the system 1. Also set the maximum time for synchronism to occur (adopted 15.0s) and the relative and absolute tolerances for voltage, frequency, time and the absolute tolerance for the angle. Tolerances are adjusted according to the values in Appendix A.

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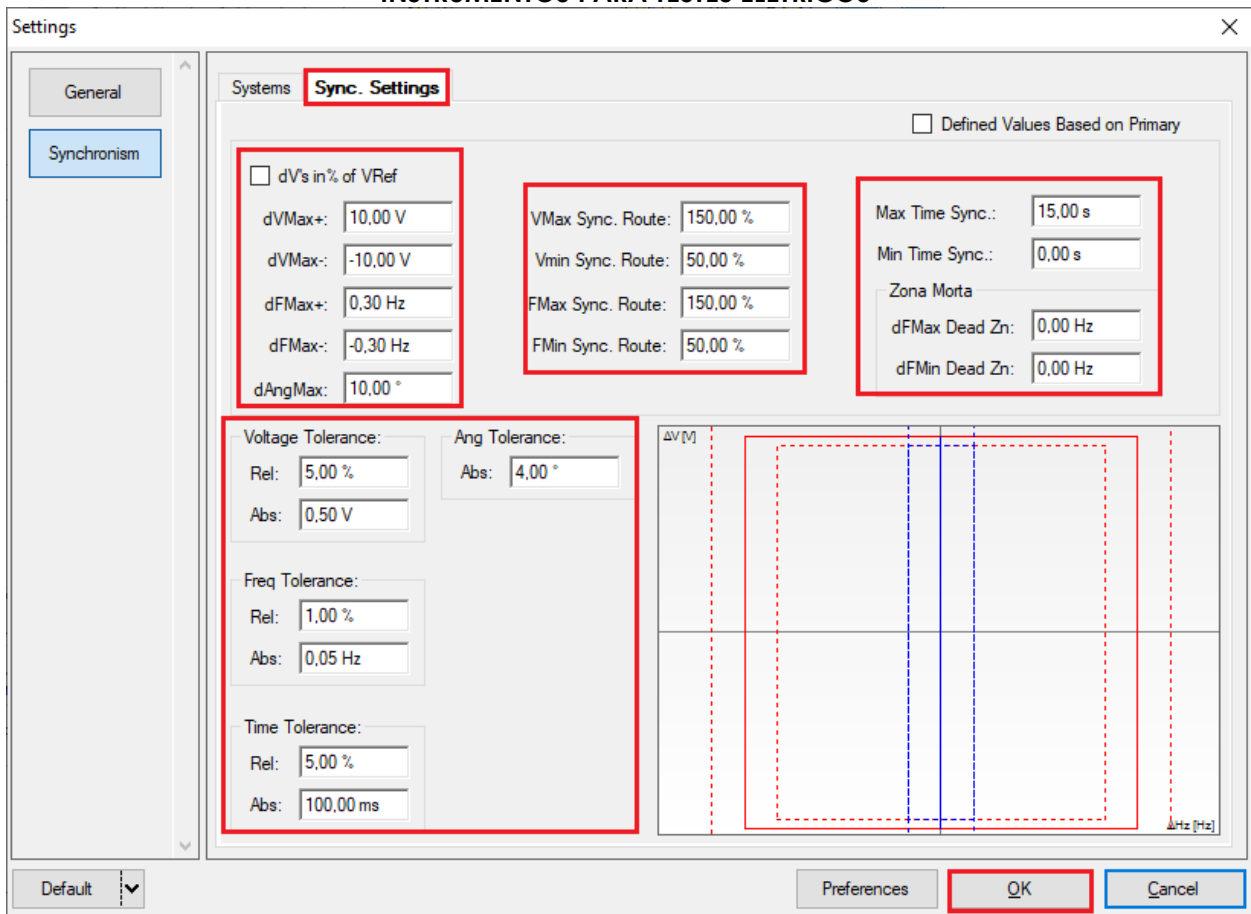


Figure 44

7. Test Settings

In the “*Test Settings*” tab, the correct direction of the voltage generation channels and the stopwatch interface must be done. The binary input responsible for the synchronism function is BI01. Check the option “*Enable Pre-Simulation 1*” in the “*Not Sync.*” mode for 100ms.

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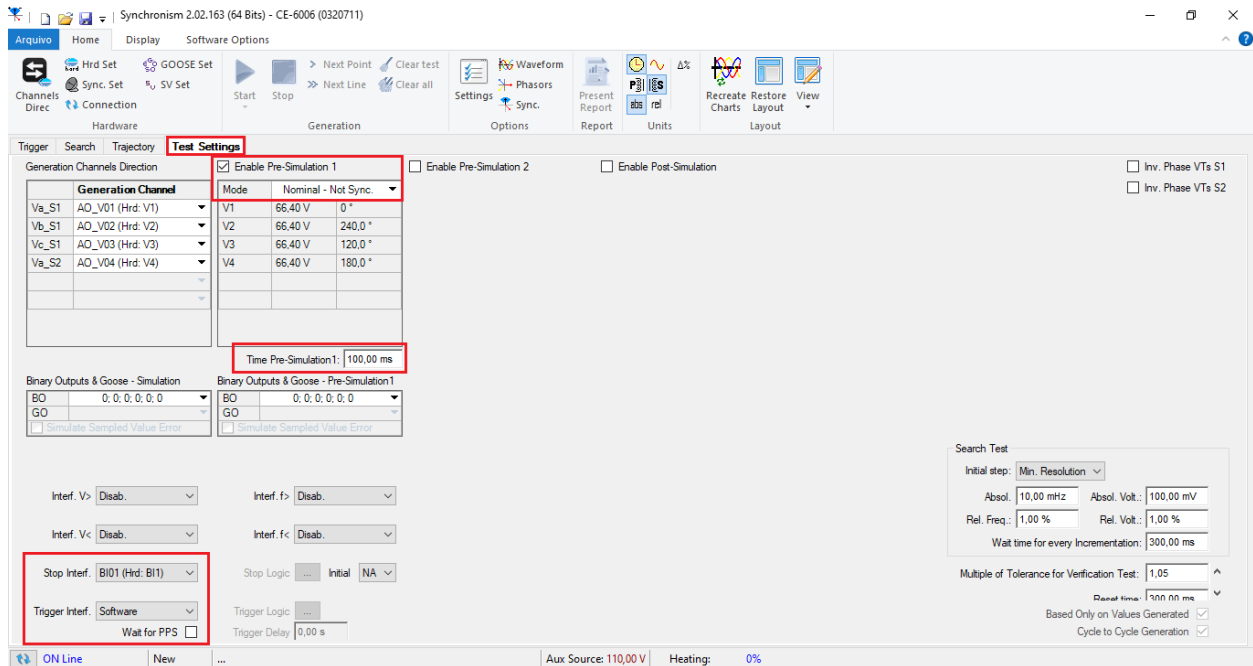


Figure 45

8. Trigger Test

In the trigger test, points inside and outside the synchronism zone are verified. The points represent the difference in voltage and frequency with respect to system 1. You can also specify an angle difference for the two systems. To insert the points click on “*New Point*” and choose a point directly on the graph and then on the item “*Confirm*”. Another option is to choose the voltage, frequency and angle difference values by writing these values in their respective fields. The last option would be to click on the “*Sequence*” option and choose an angle step so that several points are automatically created on the edges of the sync zone. The nominal values of voltage and frequency of system 1 must be adjusted. The figure below illustrates this situation.

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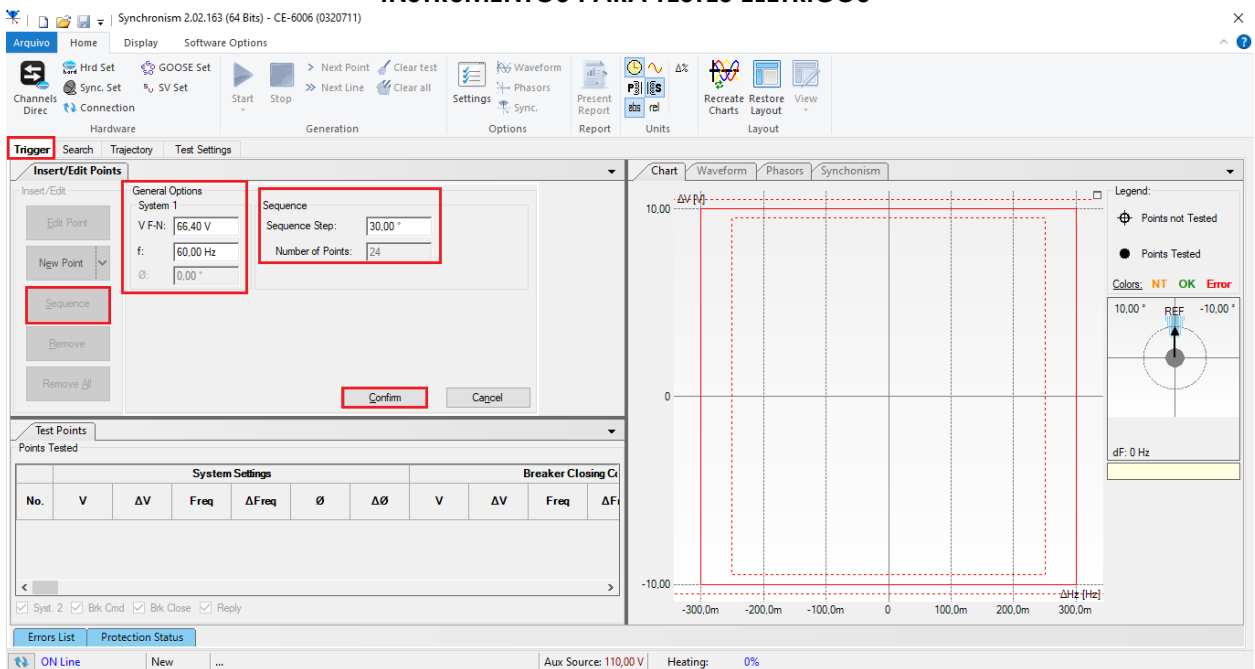


Figure 46

Choosing the sequence with a step of 30.00° , phase-neutral voltage of 66.40 volts, frequency of 60.00Hz and clicking on the button “*Confirm*” the following points are create:

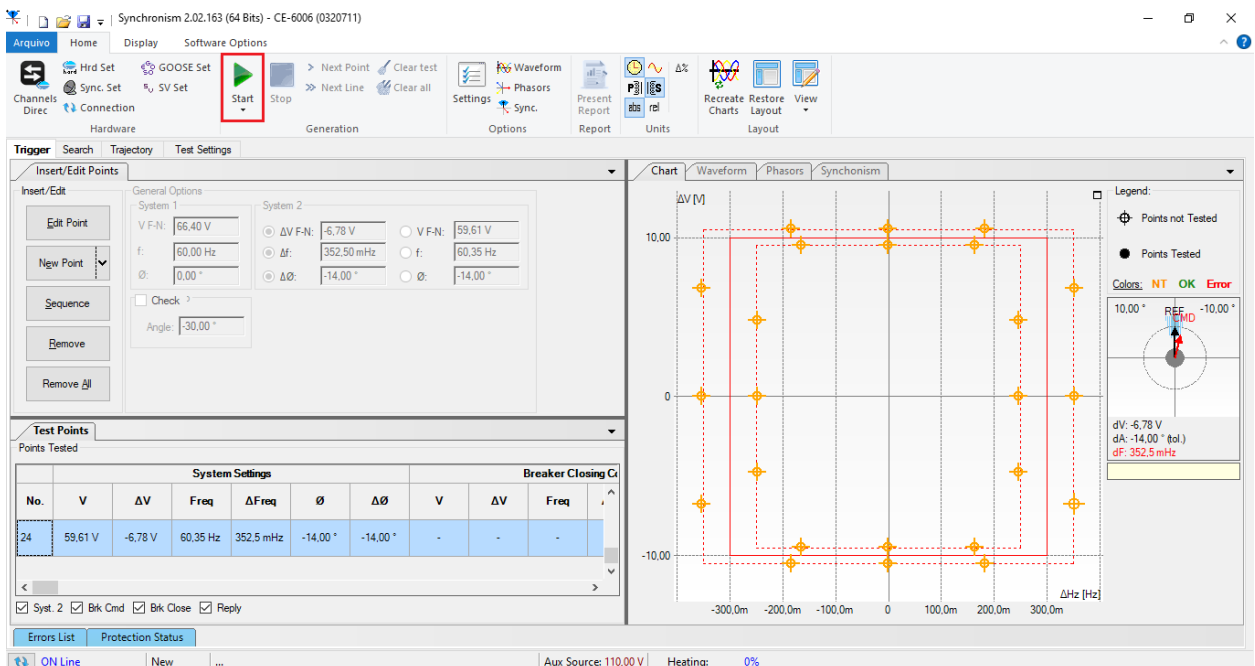


Figure 47

The next step is to start the generation through the “*Start*” button or the shortcut “*Alt + G*”. The figure below shows the final test result.

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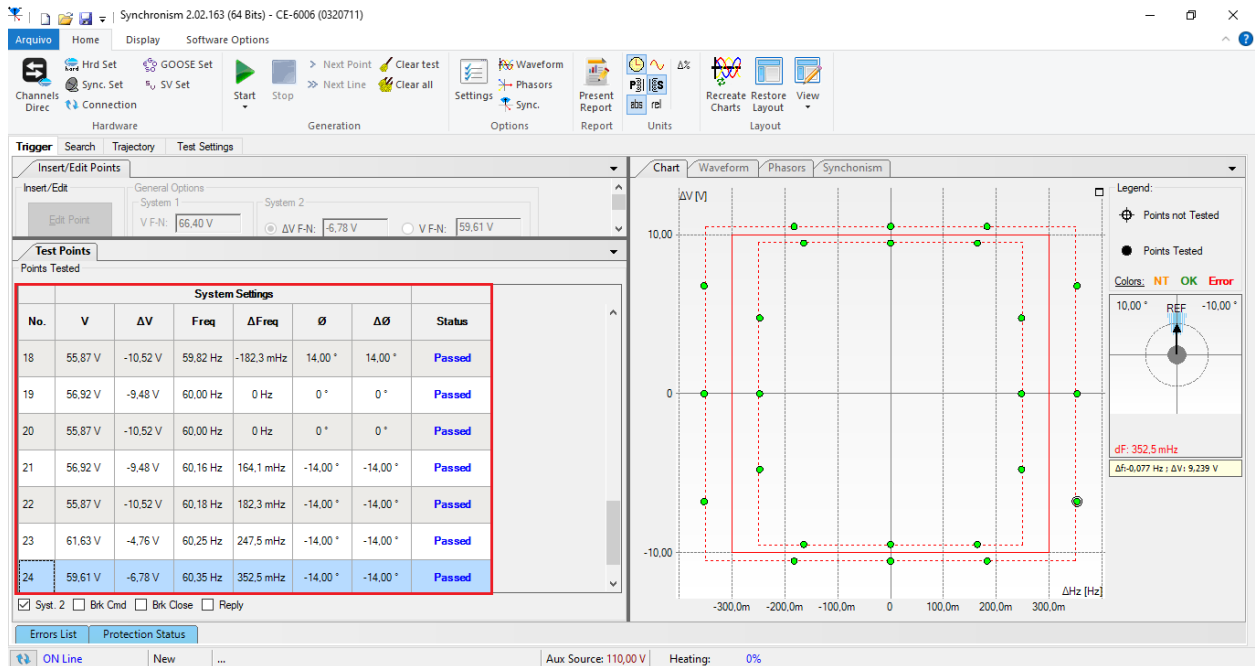


Figure 48

9. Search Test

This test will not be performed as the relay does not have the necessary resources.

10. Trajectory Test

This test has the same objective as the “*Trigger Test*”, finding the moment of synchronism, however the big difference is that the voltage and current values of system 2 vary over time. Differently from what happens in the “*Trigger Test*” where these values are fixed. To perform the test, use the “*Sequence*” option with the step equal to 30.0° reaching the following screen.

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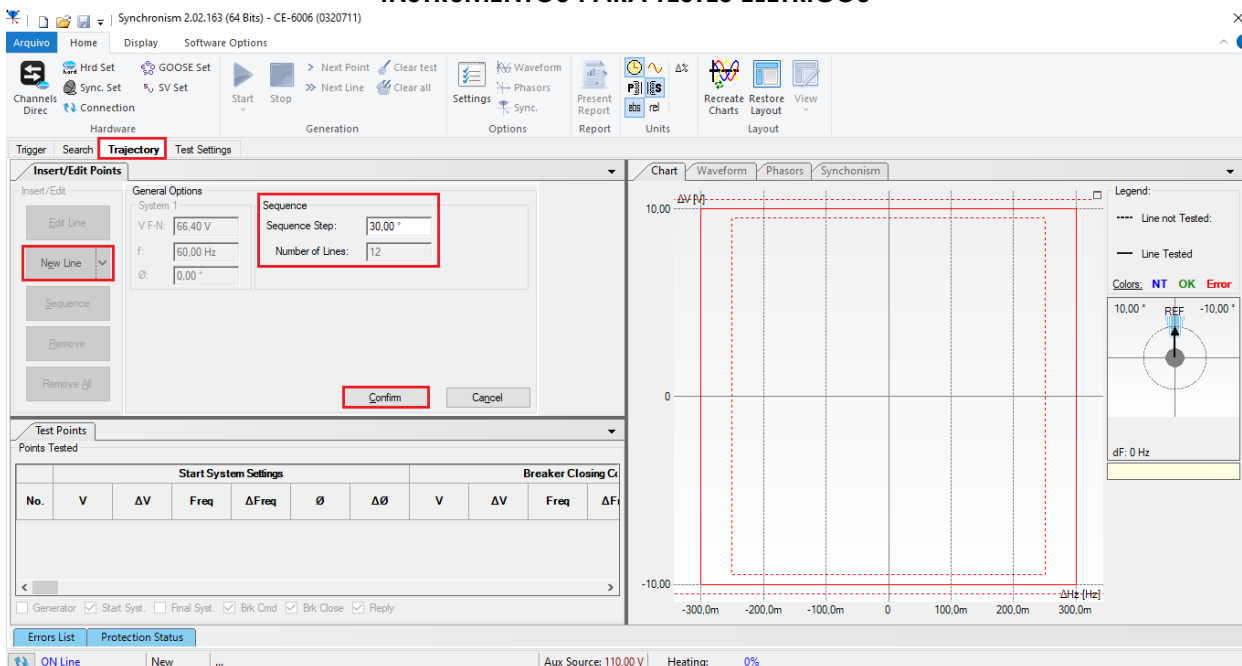


Figure 49

Clicking the “*Confirm*” button automatically creates the lines shown below:

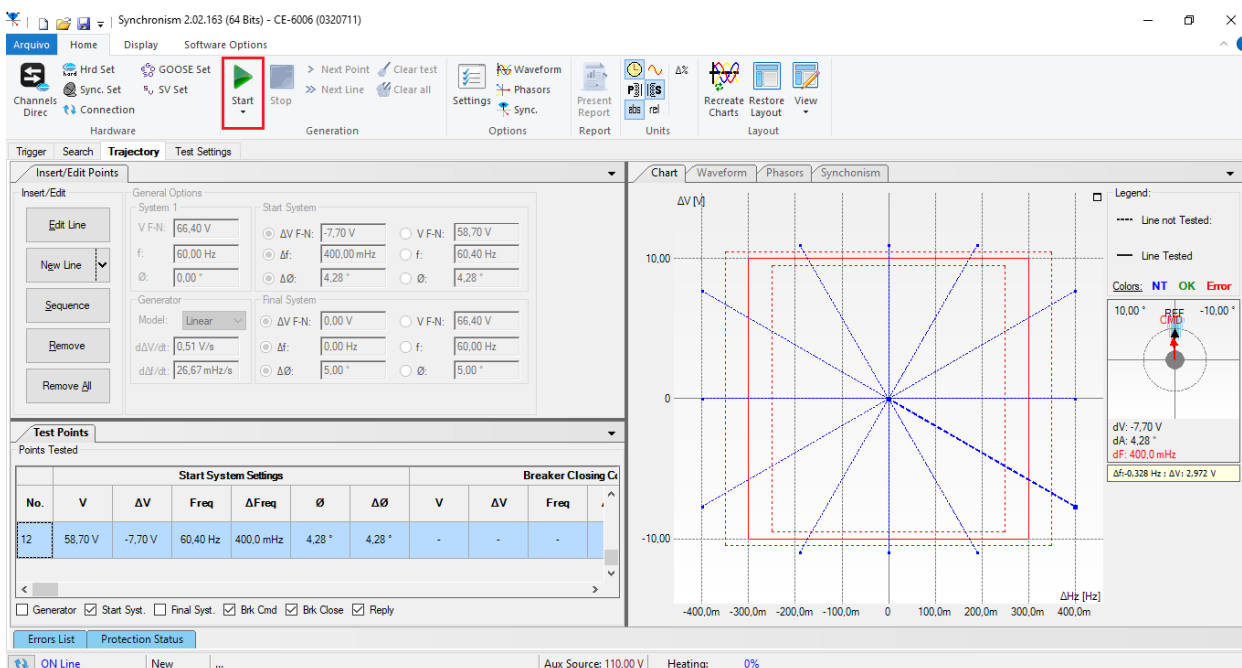


Figure 50

The next step is to start the generation through the “*Start*” button or the shortcut “*Alt + G*”. The figure below shows the final test result.

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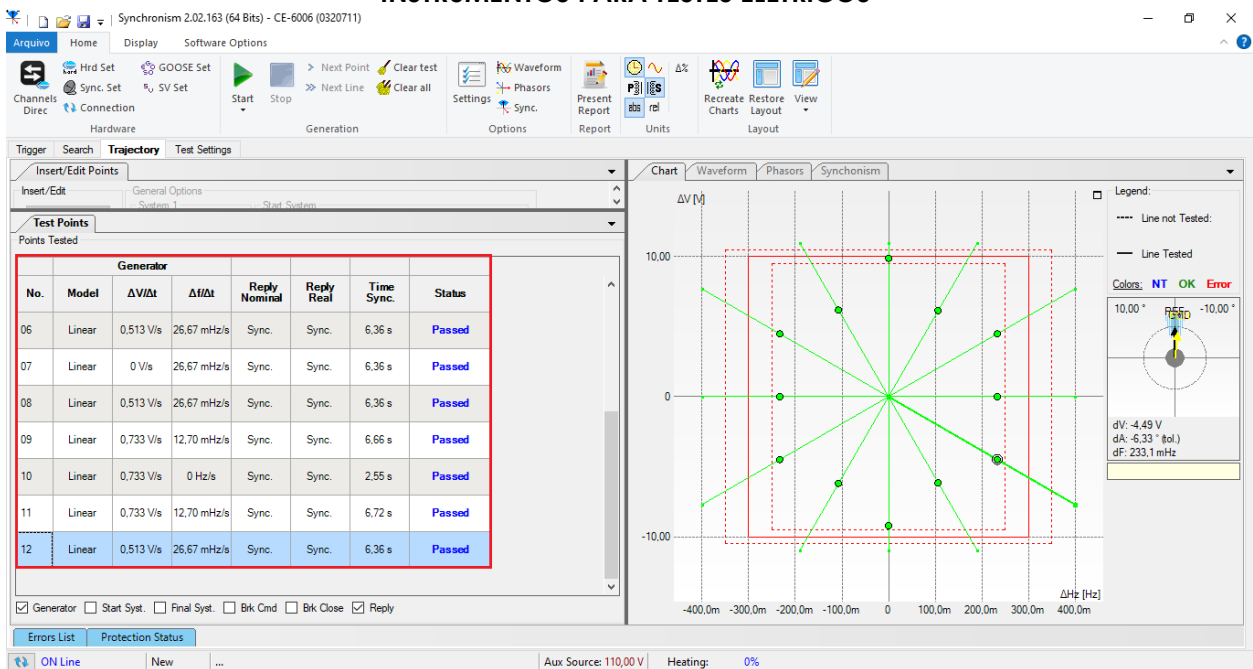


Figure 51

11. Report

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

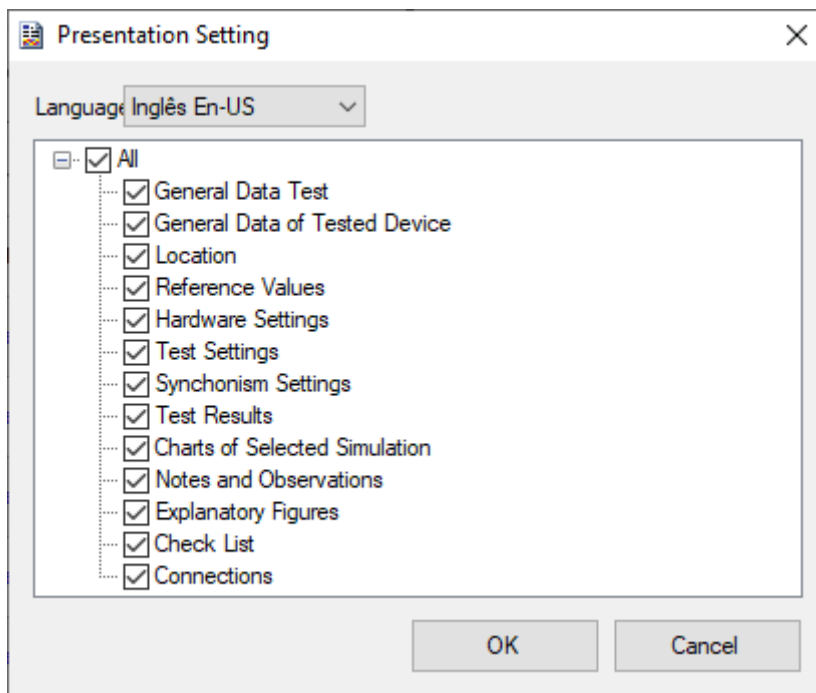


Figure 52

INSTRUMENTOS PARA TESTES ELÉTRICOS

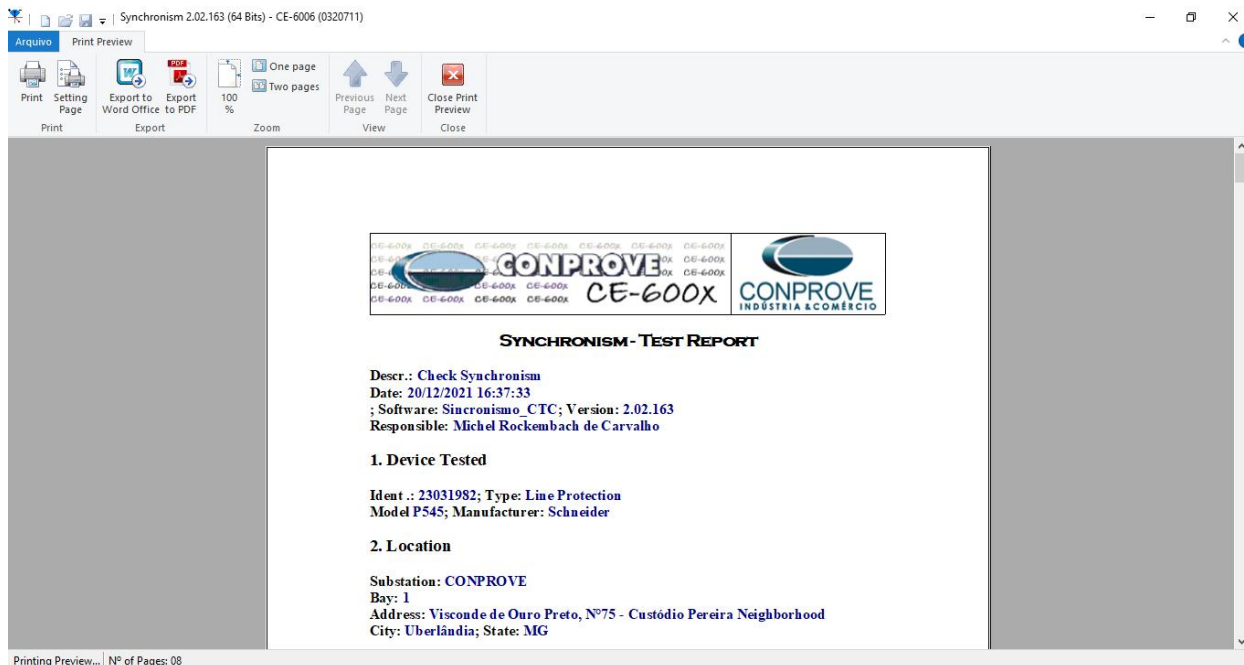


Figure 53

APPENDIX A

A.1 Terminal Designations

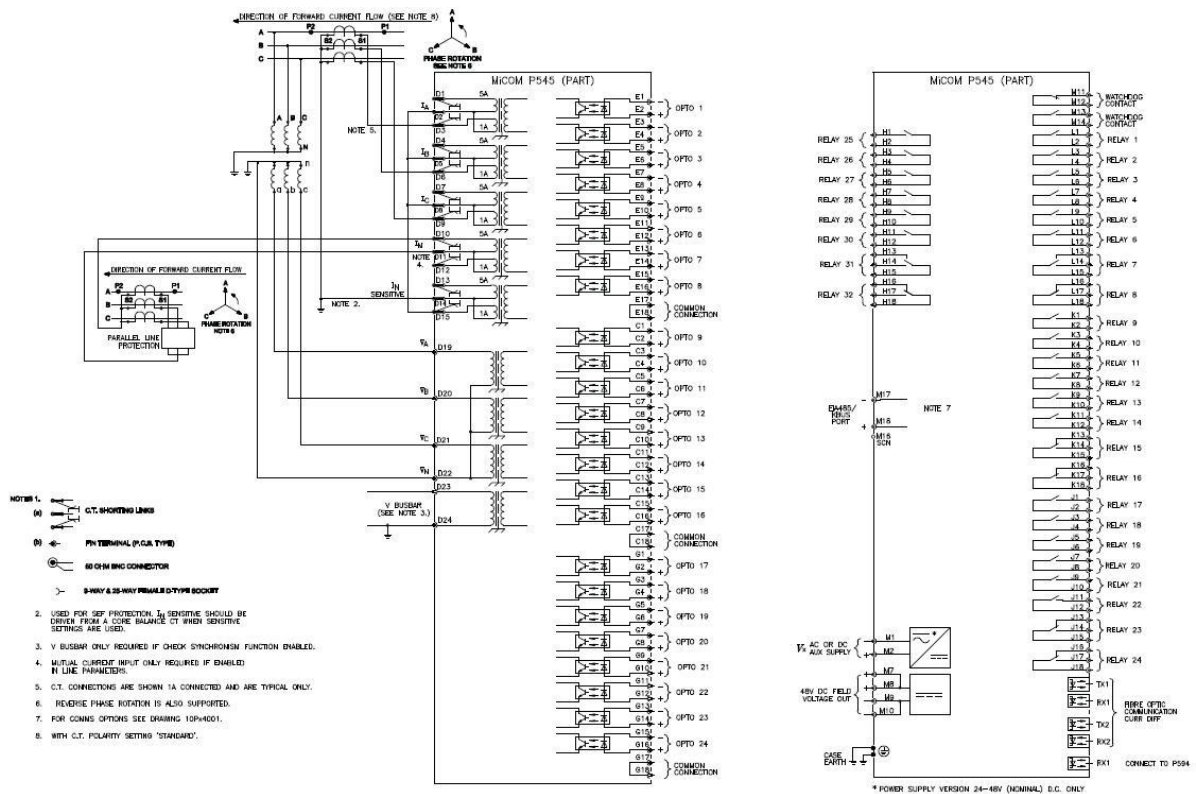


Figure 54

A.2 Technical Data

Auto-reclose and check synchronism

Accuracy

Timers:

Setting ± 20 ms or 2%, whichever is greater

APPENDIX B

Equivalence of software parameters and the relay under test.

Table 1

Synchronism Software		Schneider P545 Relay	
Parameter	Figure	Parameter	Figure
Secondary Voltage (FF)	38	Main VT Sec'y	18
Secondary Voltage (Ph-Ph)	43	CS Input	18
dVMax+	44	CS Diff Voltage	20
dVMax-	44	CS Diff Voltage (negative sign)	20
dFMax+	44	CS1 Slip Control	20
dFMax-	44	CS1 Slip Control (negative sign)	20
dAngMax	44	CS1 Phase Angle	20