

Test Tutorial

Equipment Type: Protection Relay

Brand: Siemens

Model: 7SL86

Function: 50 or PIOC- Instantaneous Overcurrent and 51 or PTOC – Time Overcurrent

Tool Used: CE- 6003; CE-6006; CE6707; CE-6710; CE-7012 or CE-7024

Objective: Timed pickup test of the units of Phase (51), timed curve survey, instantaneous pickup test of phase units (50).

Version control:

Version	Descriptions	Date	Author	Reviewer
1.0	Initial Version	16/09/2021	M.R.C.	M.P.S

Statement of responsibility

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Suggestions for improvement of this material are welcome, just user contacting us the 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 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 tested and also be aware of safety standards and regulations.

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INSTRUMENTOS PARA TESTES ELÉTRICOS
Sequence for 7SL86 relay tests in Overcurrent software

1. Relay connection to CE-6006

The relay terminal designations are shown in Appendix A.

1.1 Auxiliary Source

Connect the positive (red terminal) of the Vdc Aux. Source to pin B1 of “slot 2B” of the relay and the negative (black terminal) of the Vdc Aux. Source to pin B2 of “slot 2B”.

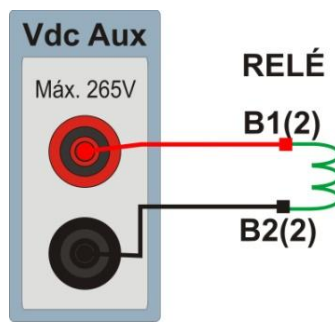


Figure 1

1.2 Current Coils

Connect I4, I5 and I6 current channels of the equipment to pins A1, A3 and A5 of “slot 1A” of the relay respectively, connect the three common ones to pins A2, A4 and A6 of the relay.

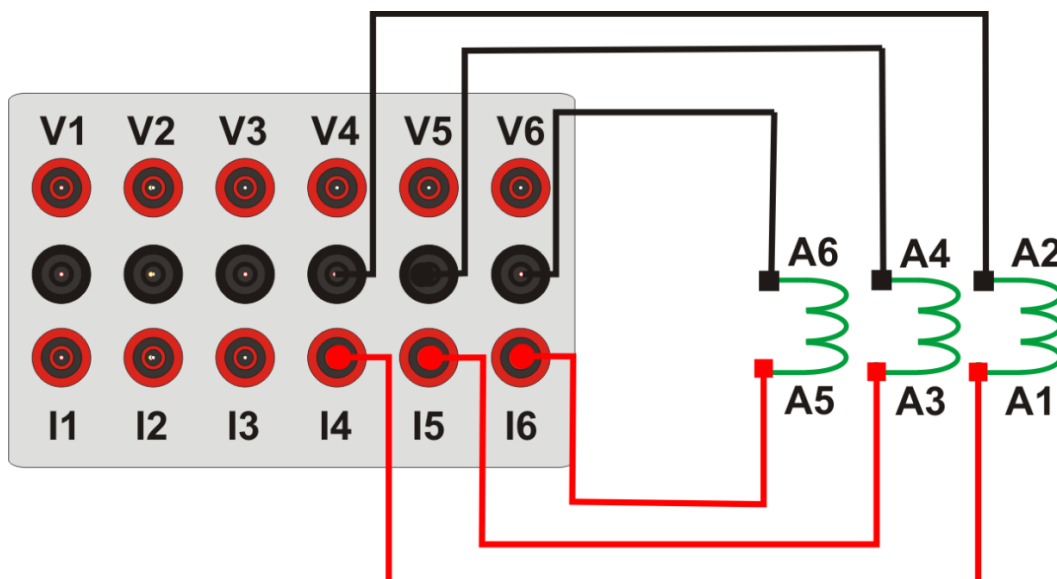


Figure 2

1.3 Binary Inputs

Connect the CE-6006 binary inputs to the binary outputs in “slots 1B and 1C” of the relay terminal.

- BI1 to pin B09 and its common to pin B10;
- BI2 to pin B11 and its common to pin B12;
- BI3 to pin B13 and its common to pin B14;
- BI2 to pin C01 and its common to pin C02.

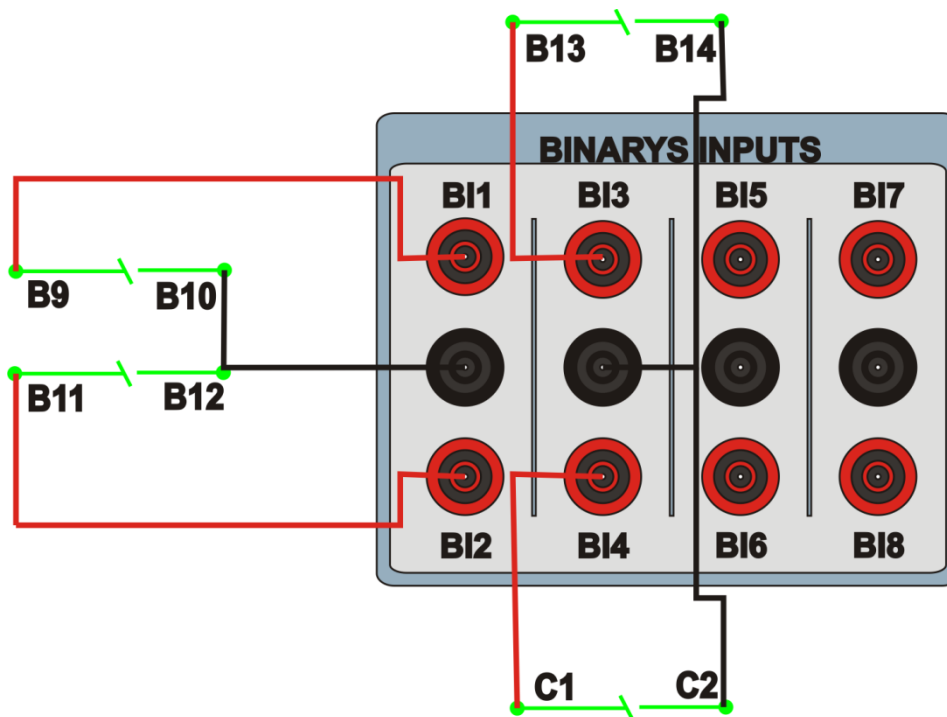


Figure 3

2. Communication with 7SL86 relay

First connect a USB cable from the notebook with the relay. Then double-click on the relay software icon.



Figure 4

When opening the program, click on the “Project” option and choose the “New” option.

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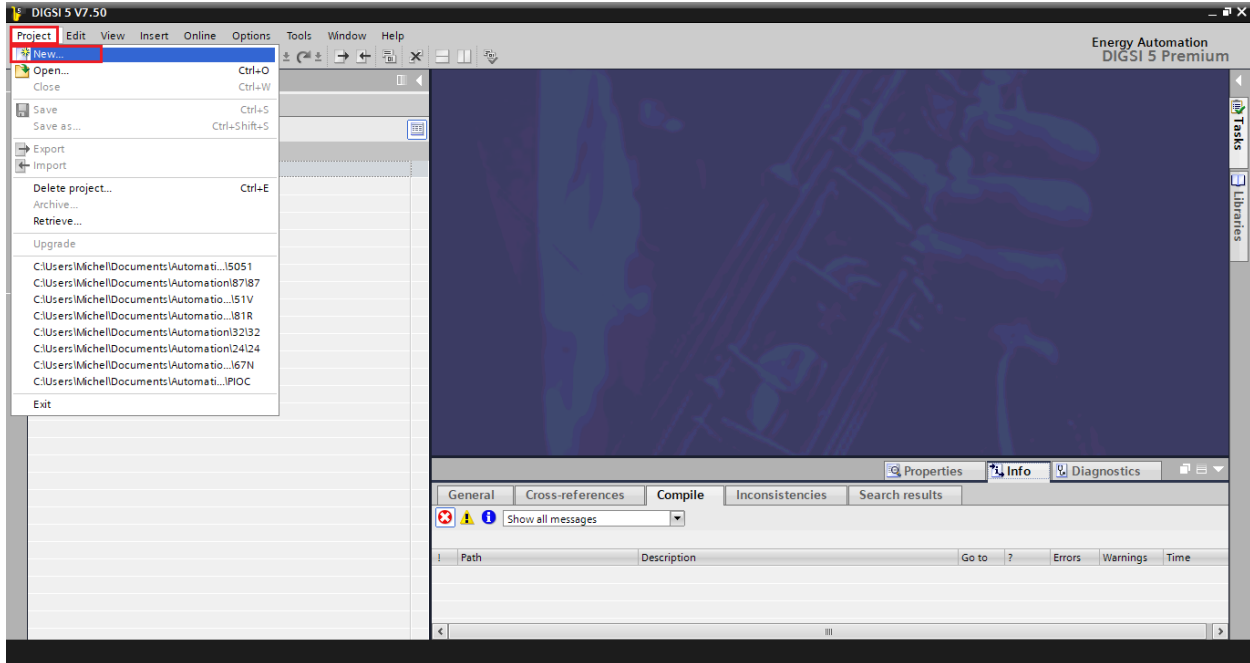


Figure 5

Enter a name for the project and then click “*Create*” as highlighted below.

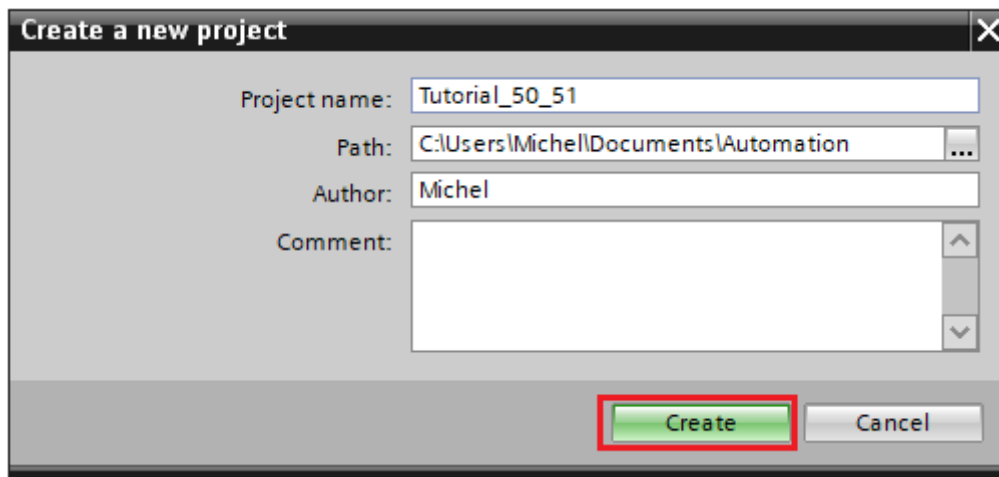


Figure 6

When creating the project, add the relay that will be tested, double-click on “*Add New Device*” as highlighted below.

INSTRUMENTOS PARA TESTES ELÉTRICOS

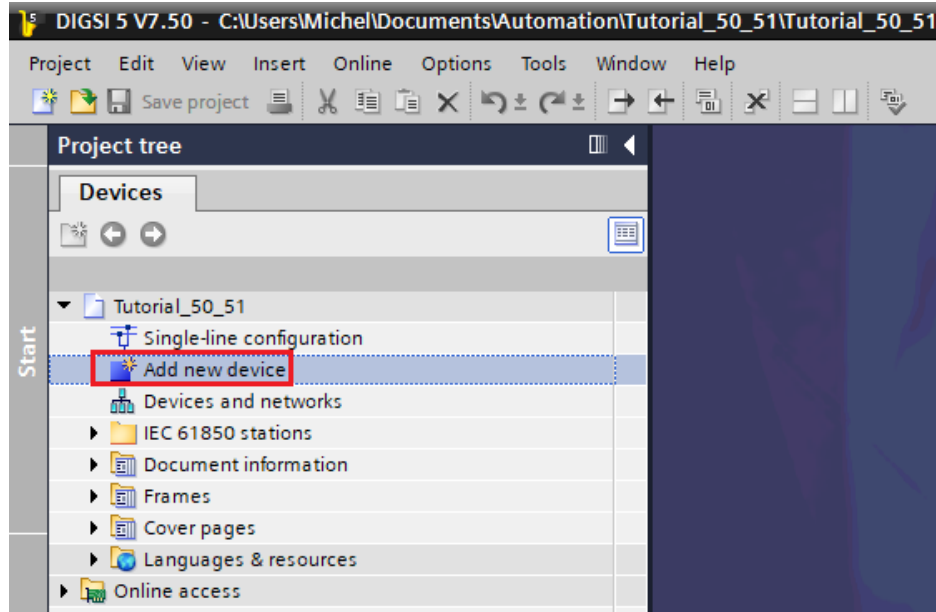


Figure 7

Enter the relay short code located on its side, then click “*Verify*” as highlighted below.

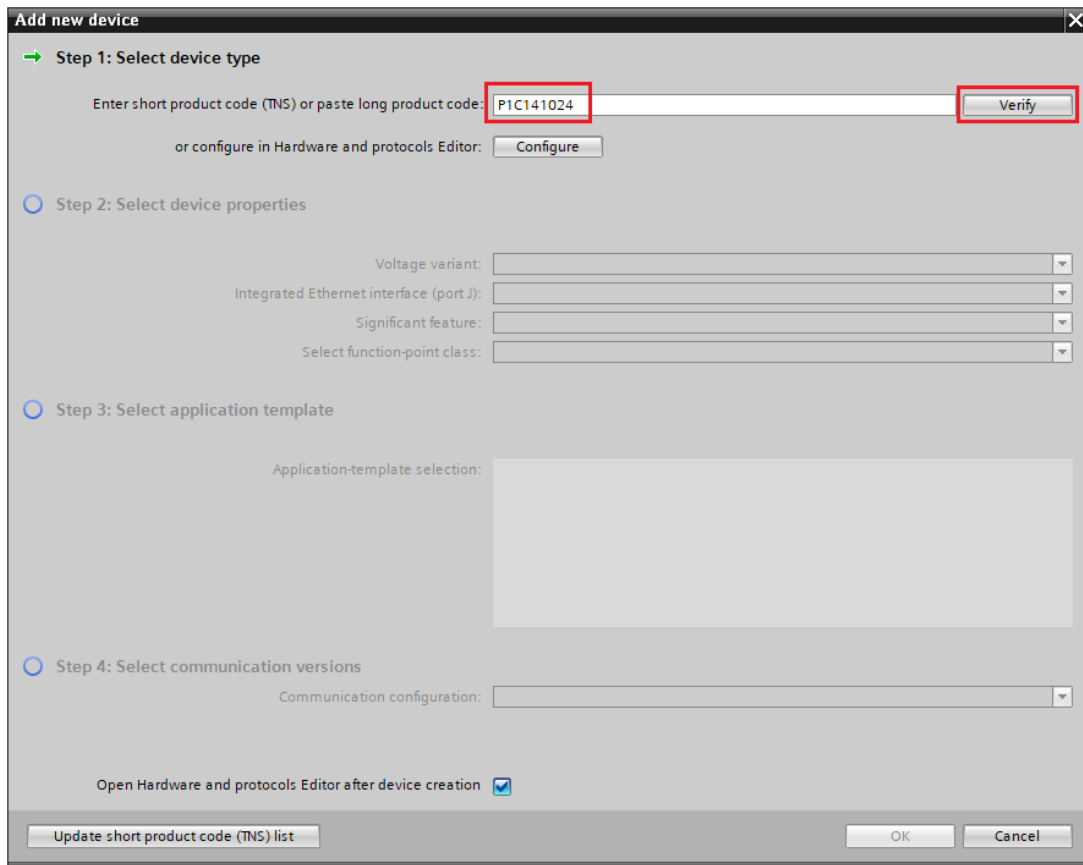


Figure 8

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Select the basic “*Template*” whose firmware version is consistent with that of the relay (To verify, just look at the relay HMI when it is turned on). Then click “*OK*”.

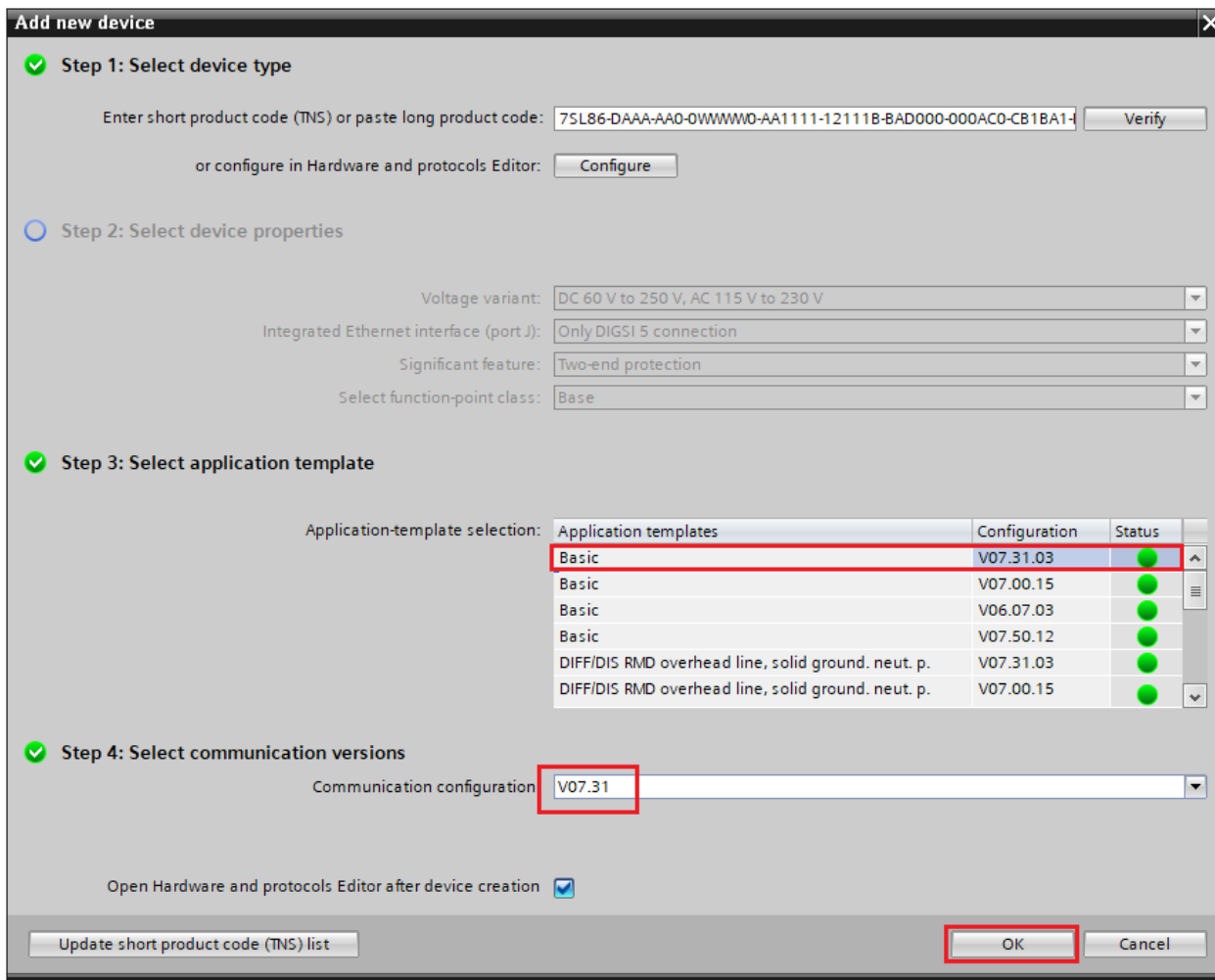


Figure 9

Note that a generic relay has been added (highlighted in green below). The next step is to establish communication with the equipment, for that go to the “*Online*” menu and choose the option “*Connect to device and retrieve data*”.

INSTRUMENTOS PARA TESTES ELÉTRICOS

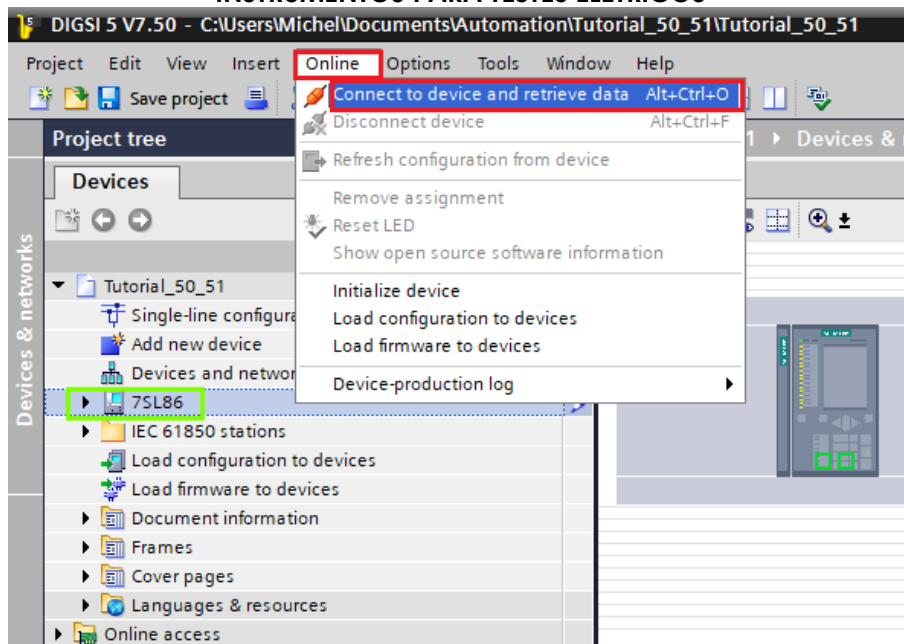


Figure 10

After establishing communication with the relay, it is necessary to read the parameterized settings. Right-click on the relay icon (highlighted in green in the previous figure) and choose the option “*Update configuration from target device*”.

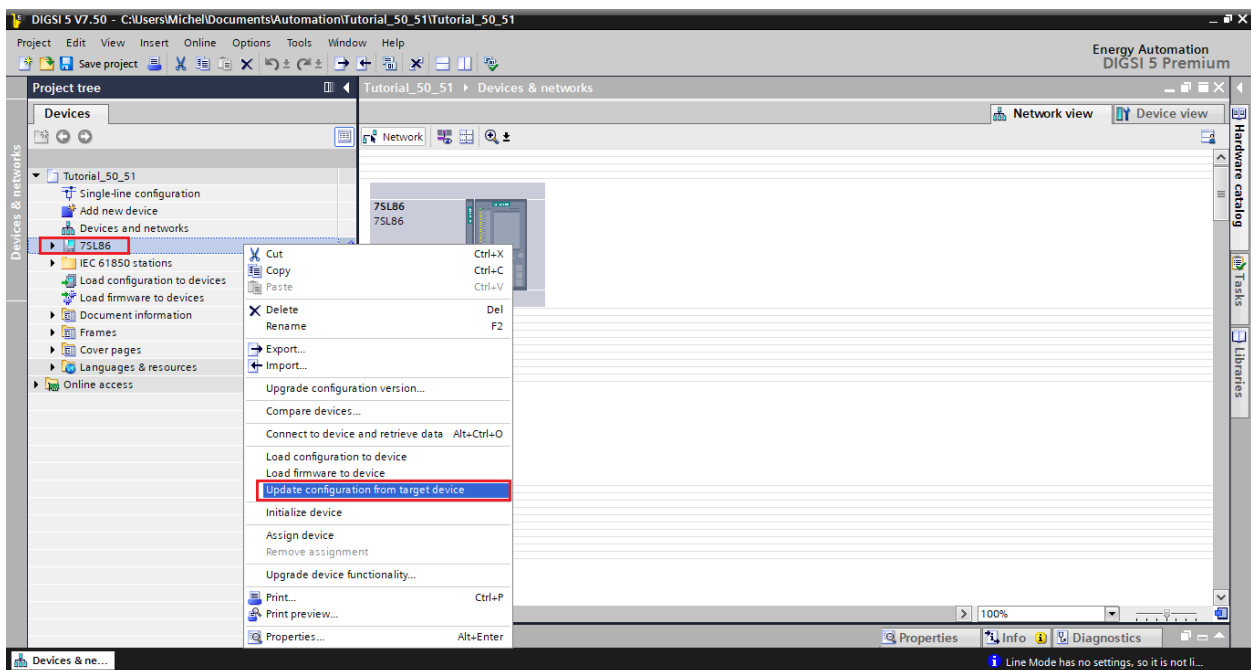


Figure 11

Click “Yes” to the following message:

INSTRUMENTOS PARA TESTES ELÉTRICOS

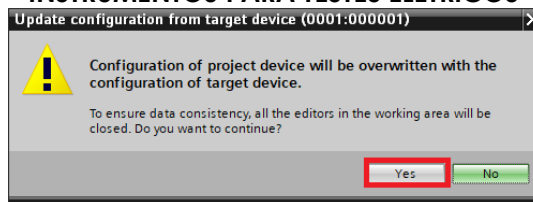


Figure 12

There will be other warning messages (didn't shown), click "Yes" on all. If the procedure is carried out properly, the following screen appears.

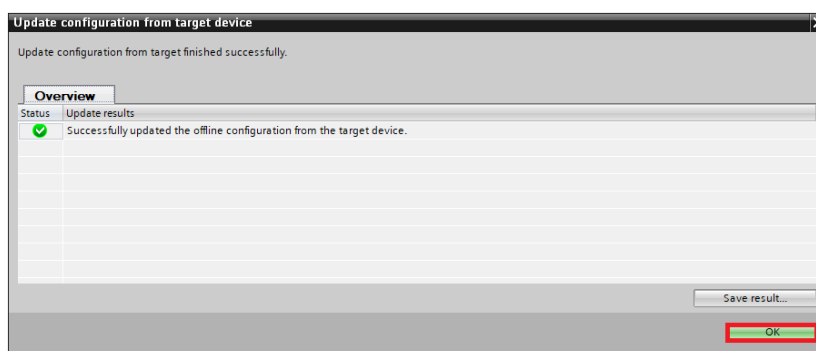


Figure 13

Export the created file in .dex5 format in order to have a backup of the settings. Right-click on the relay icon and choose the "Export..." option.

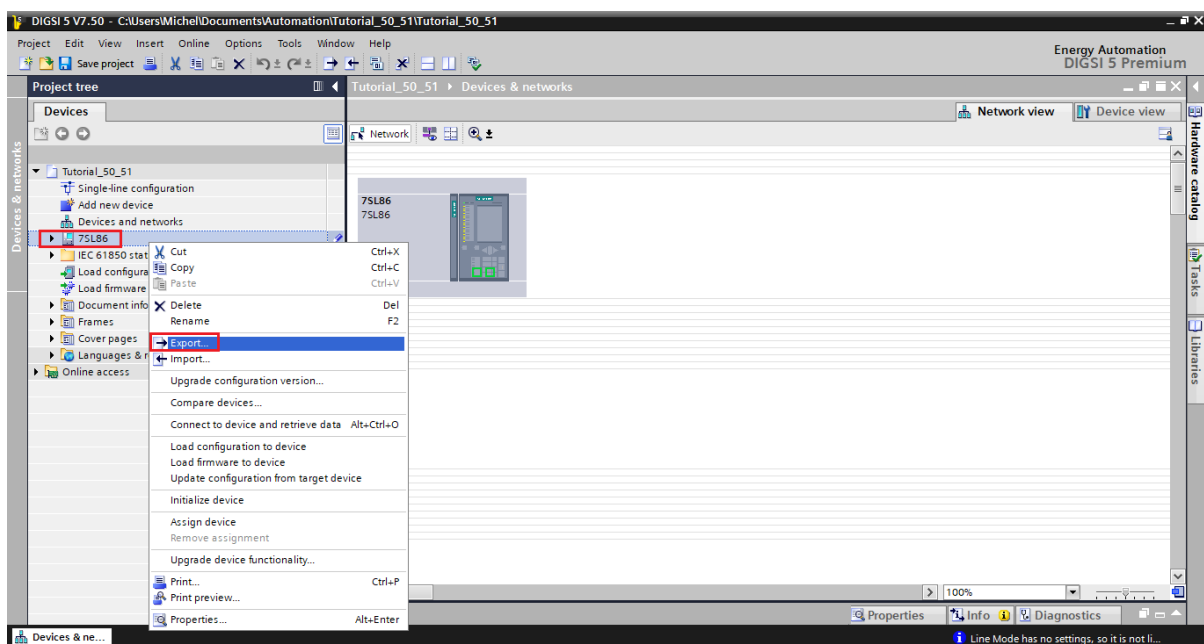


Figure 14

INSTRUMENTOS PARA TESTES ELÉTRICOS

There are other ways to extract information from Siemens Siprotec 5 relays, but the way is practical for those who will commission a relay already parameterized and installed in a panel.

3. Parameterization of the relay 7SL86

3.1 Device Settings

After the connection has been established, open the device section “7SL86”. Then open the “Settings” section, finally choose the “Device Settings” option. Check that group 1 is active, that the nominal frequency is 60Hz and that the minimum operating time is zero seconds.

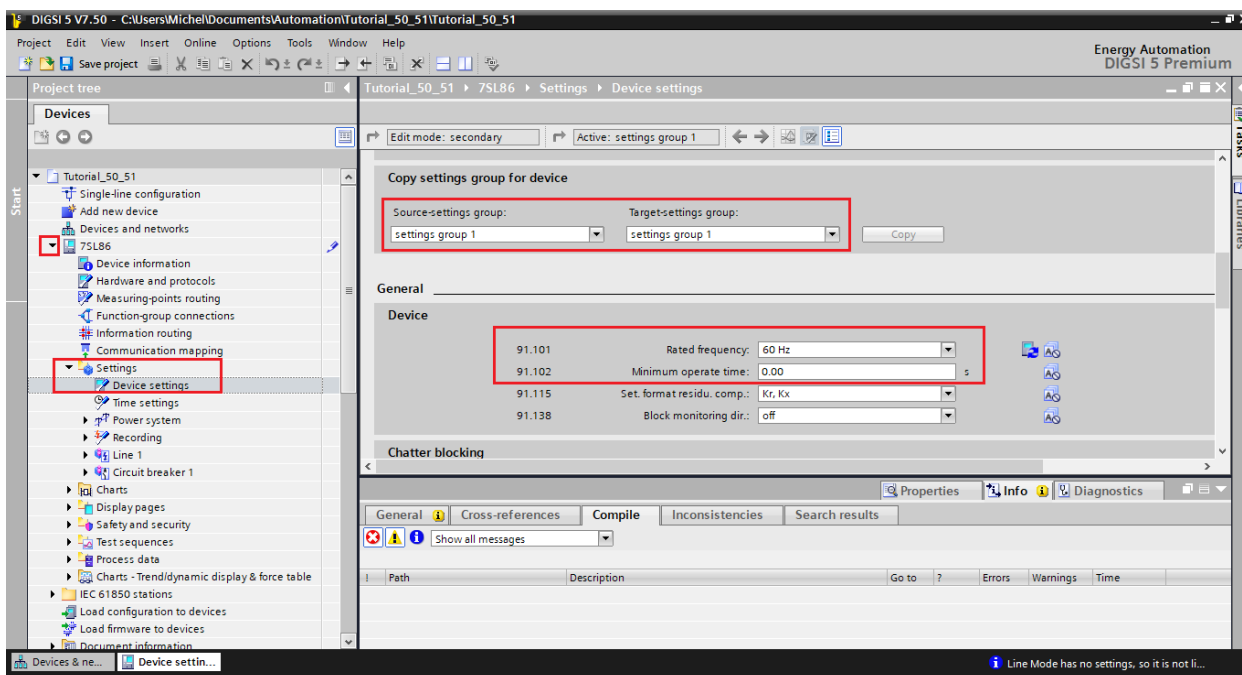


Figure 15

3.2 General

Open the “Power System” section and select the “General” option. Check the parameterized phase sequence.

INSTRUMENTOS PARA TESTES ELÉTRICOS

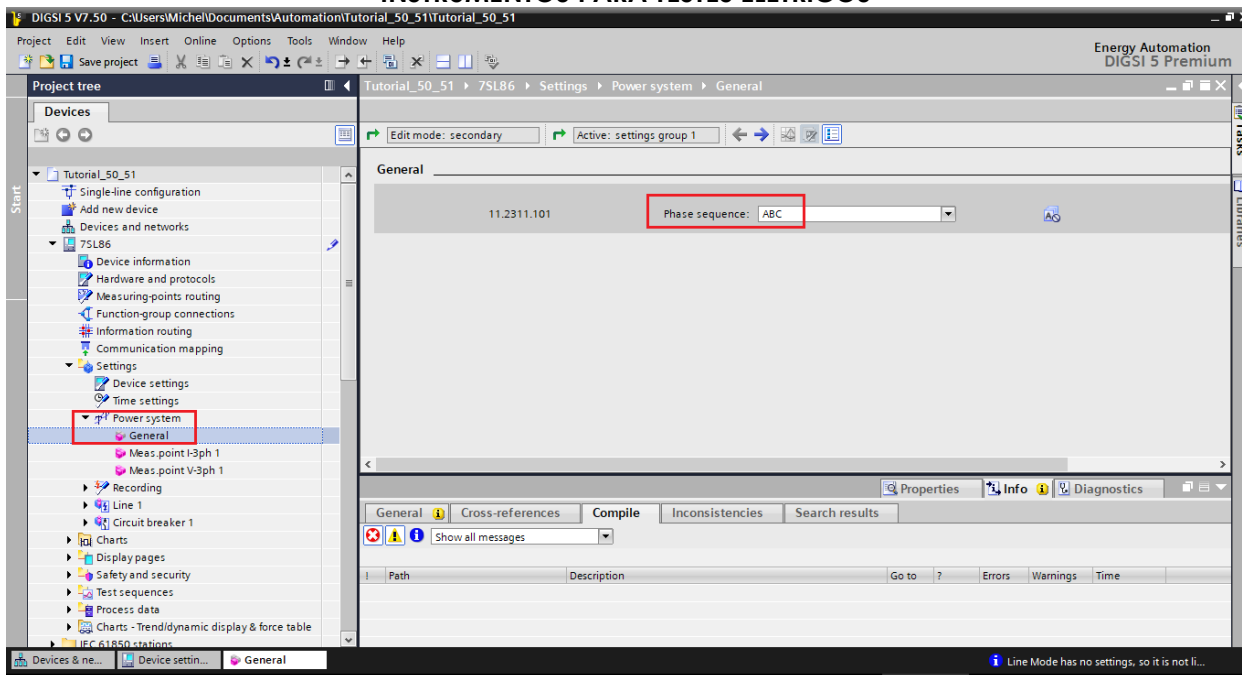


Figure 16

3.3 Meas. Point I-3ph 1

Select the option “*Meas. Point I-3ph 1*”. Adjust primary and secondary current values, magnitude compensation factors, and disable supervision functions,

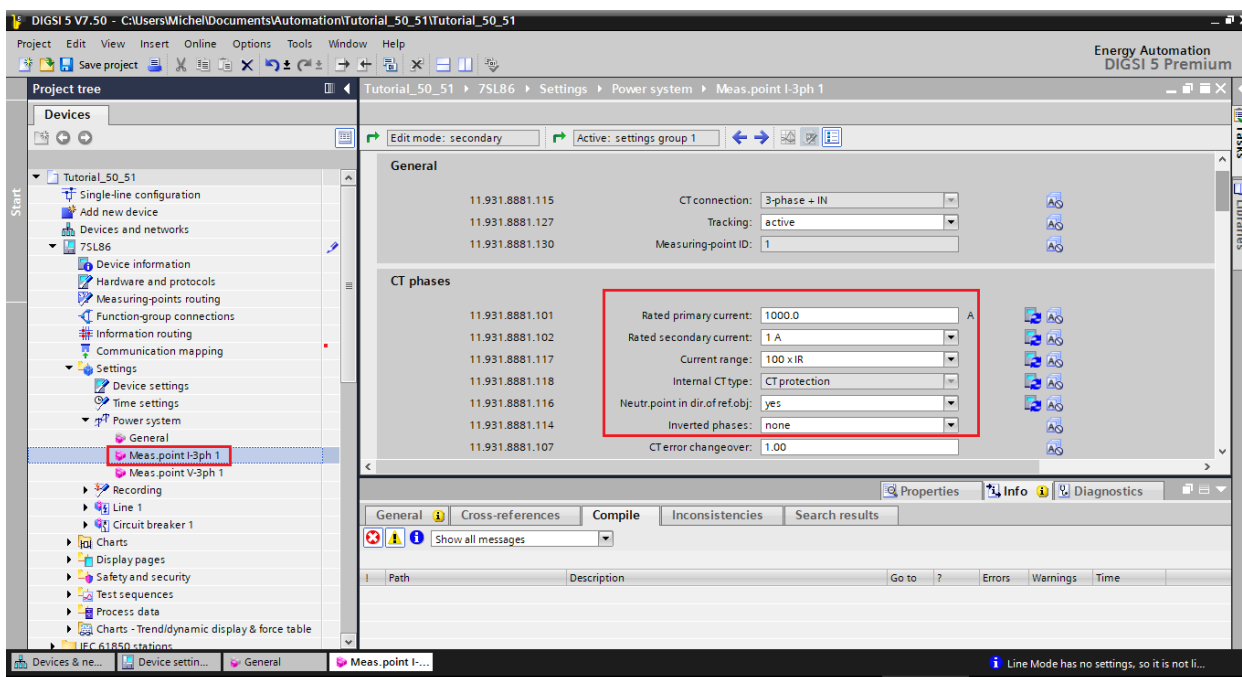


Figure 17

INSTRUMENTOS PARA TESTES ELÉTRICOS

Click on the “Info” tab to hide it and enlarge the settings window.

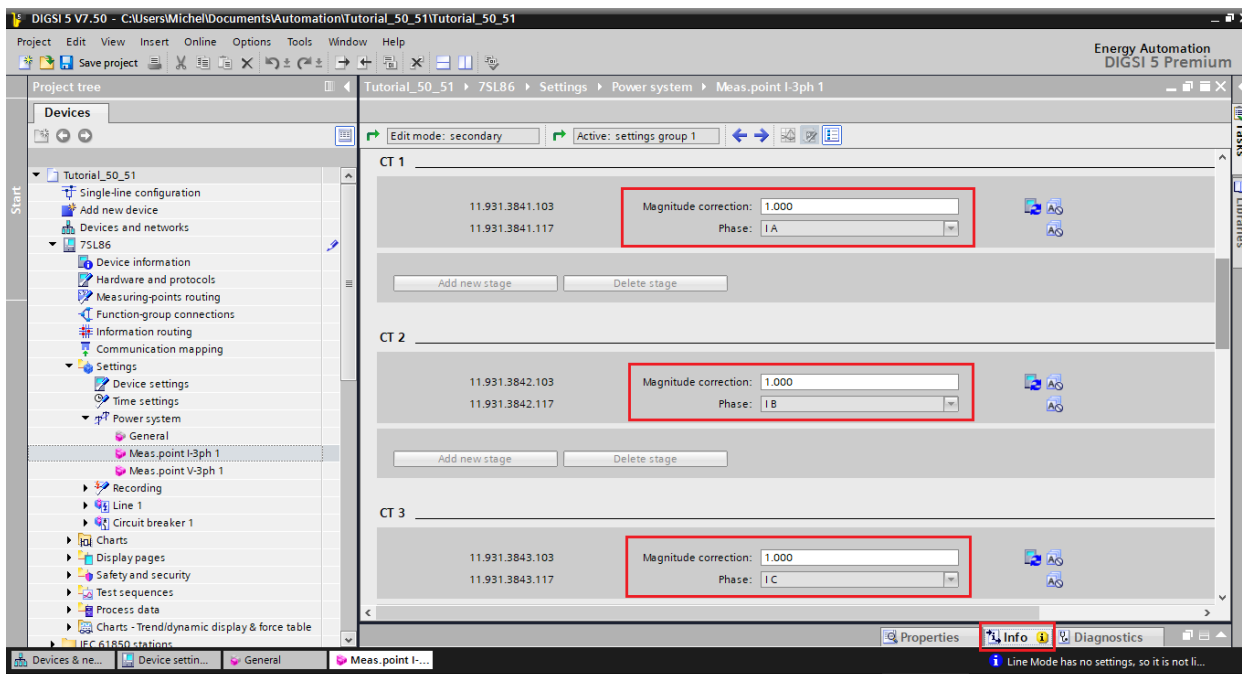


Figure 18

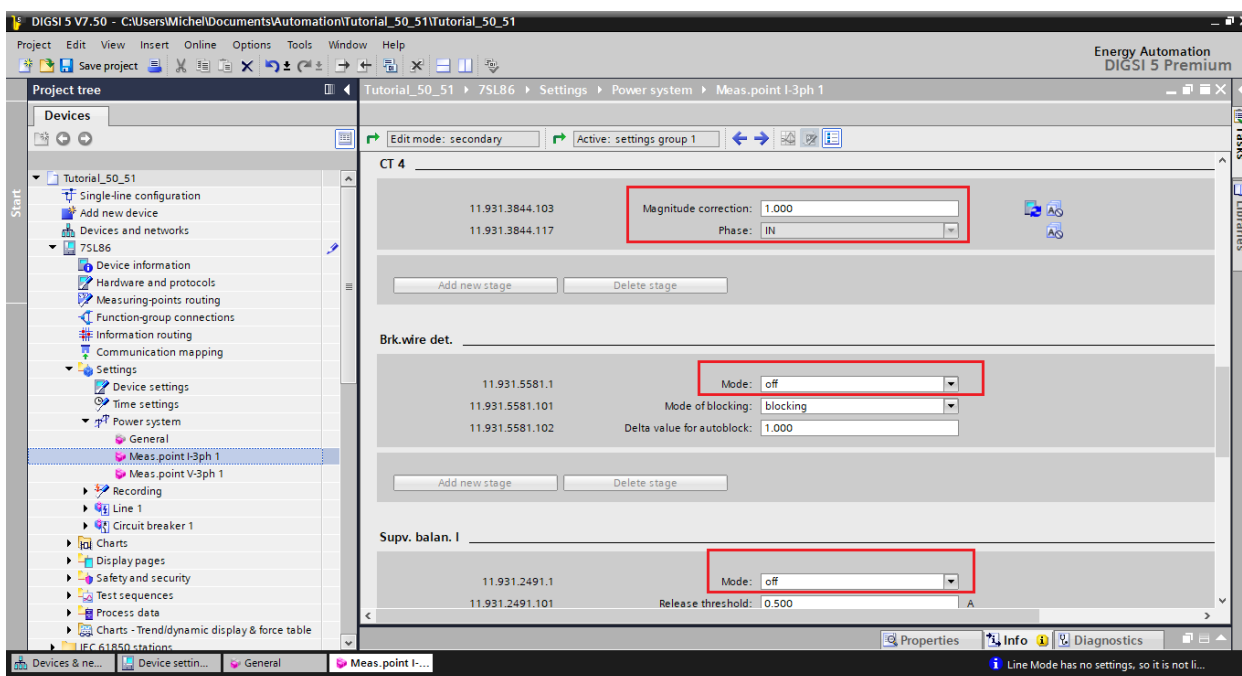


Figure 19

INSTRUMENTOS PARA TESTES ELÉTRICOS

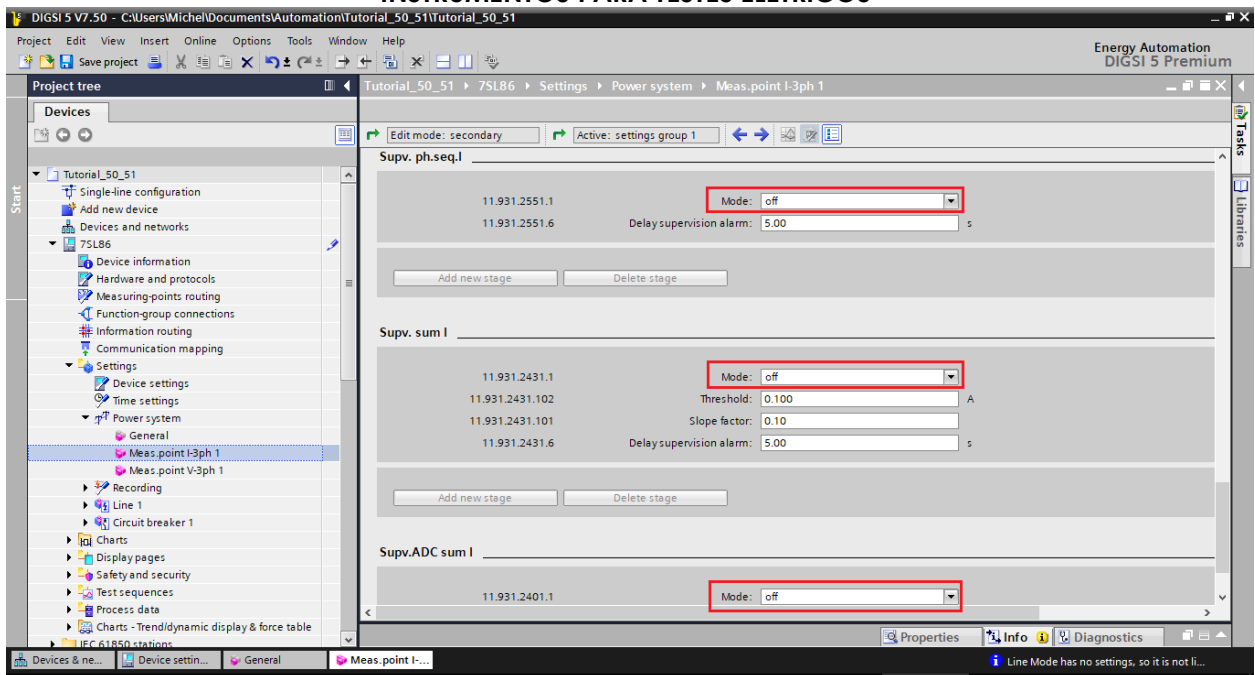


Figure 20

3.4 50/51 OC-3ph-A1

Open the “Line 1” option and double-click the “50/51 OC-3ph-A1” option to adjust the definite time overcurrent and inverse curve functions.

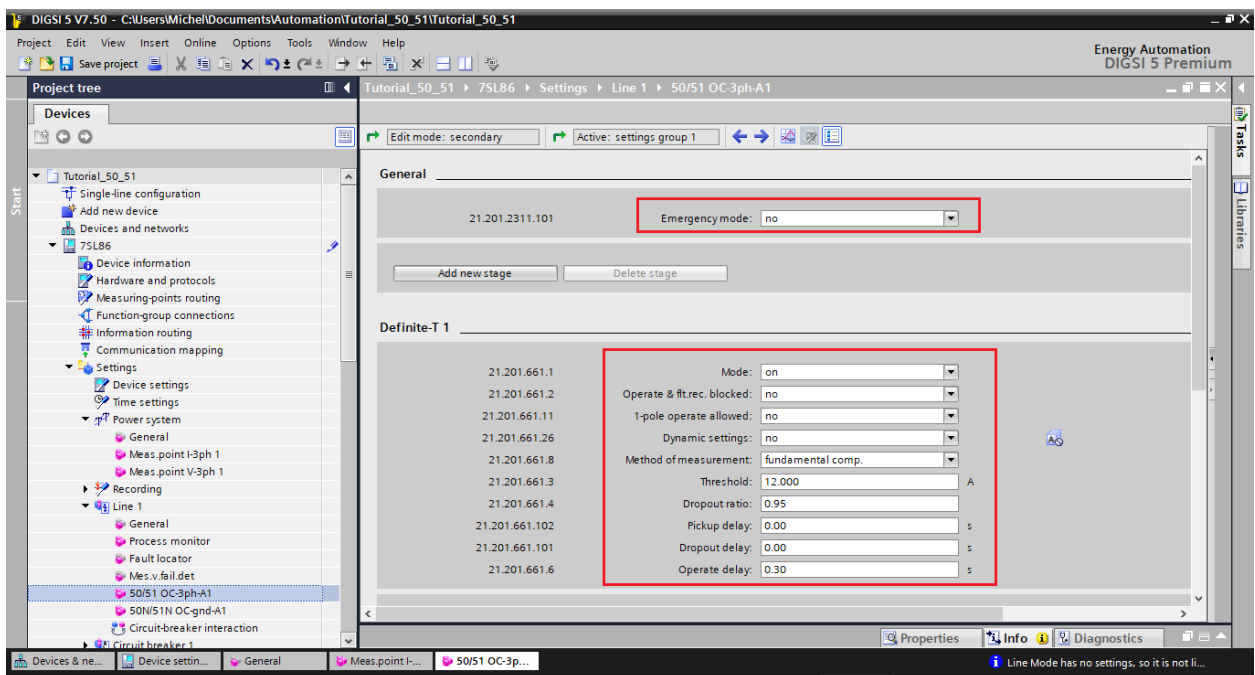


Figure 21

INSTRUMENTOS PARA TESTES ELÉTRICOS

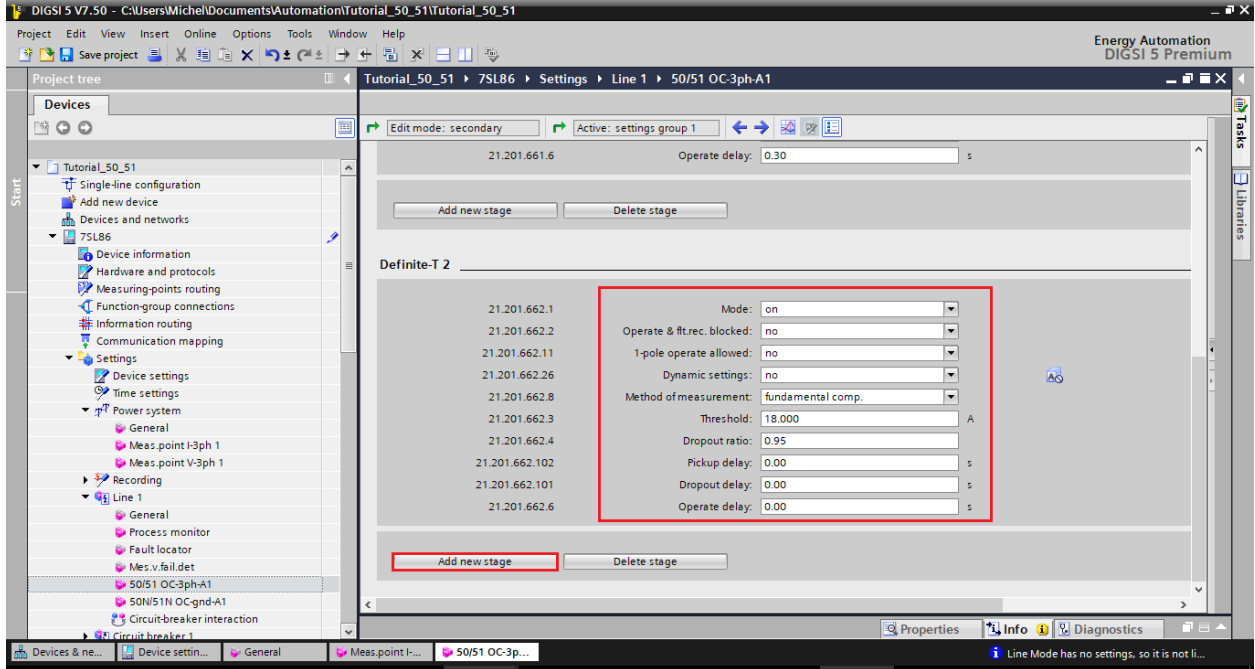


Figure 22

Click on the “Add new stage” option and choose the “Inverse-T #” option to add the time overcurrent element (51).

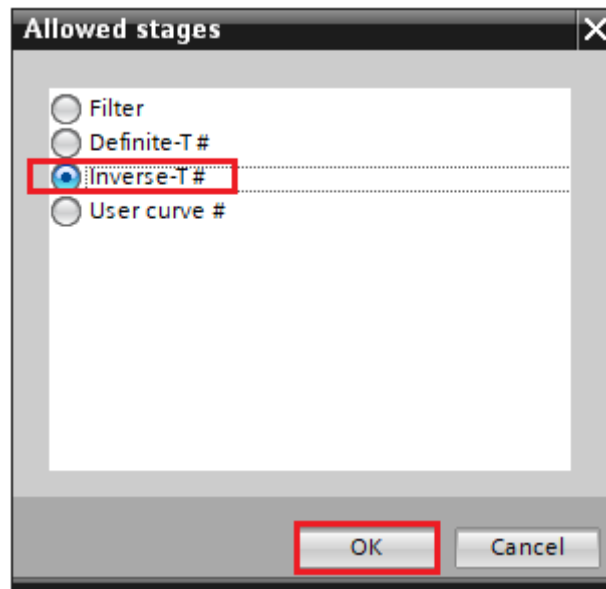


Figure 23

INSTRUMENTOS PARA TESTES ELÉTRICOS

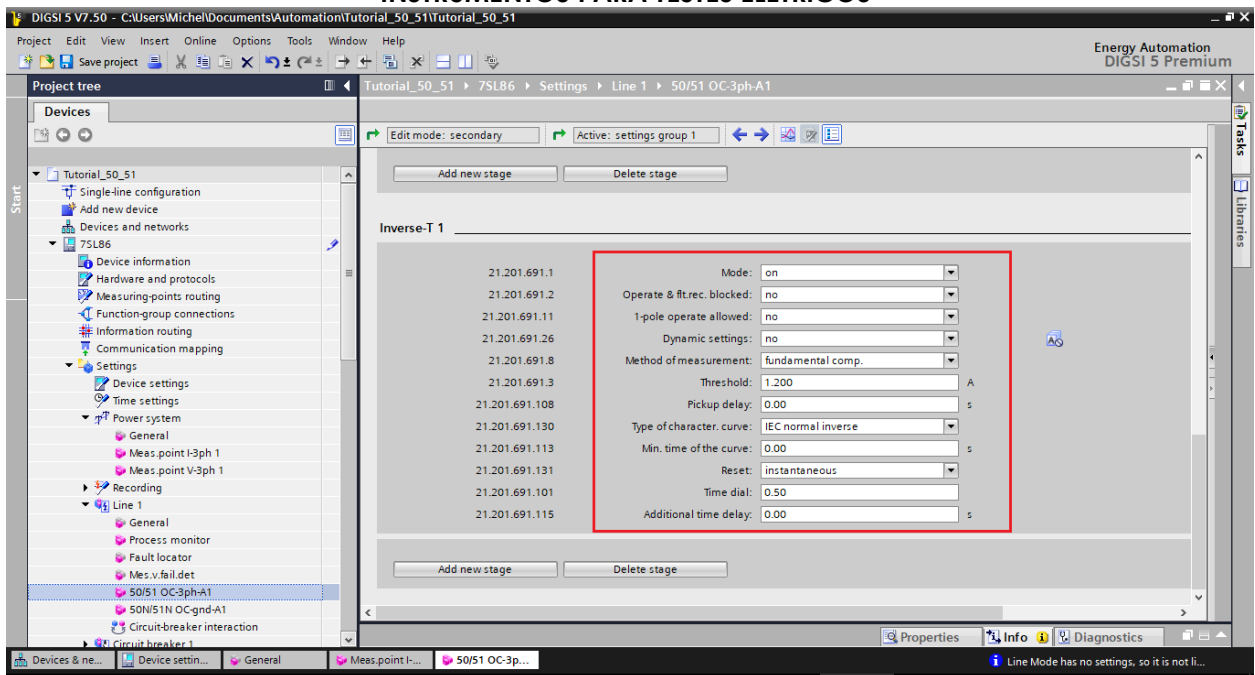


Figure 24

3.5 Information Routing

In the “*Information Routing*” option, the trip and pick-up signals of the overcurrent functions are associated with the physical outputs. For easier viewing maximize the window.

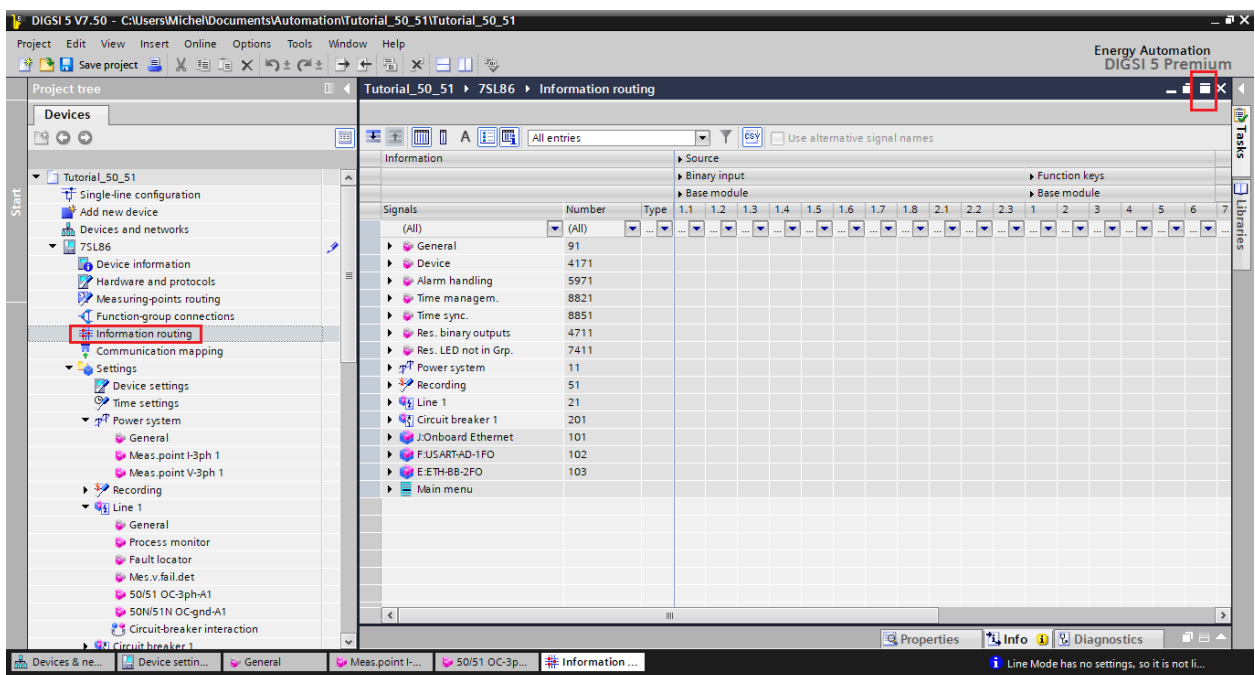


Figure 25

INSTRUMENTOS PARA TESTES ELÉTRICOS

The first columns are associated with the binary inputs of the relay. In that case they will not be used. Double click on the “Source” option to hide these adjustments.

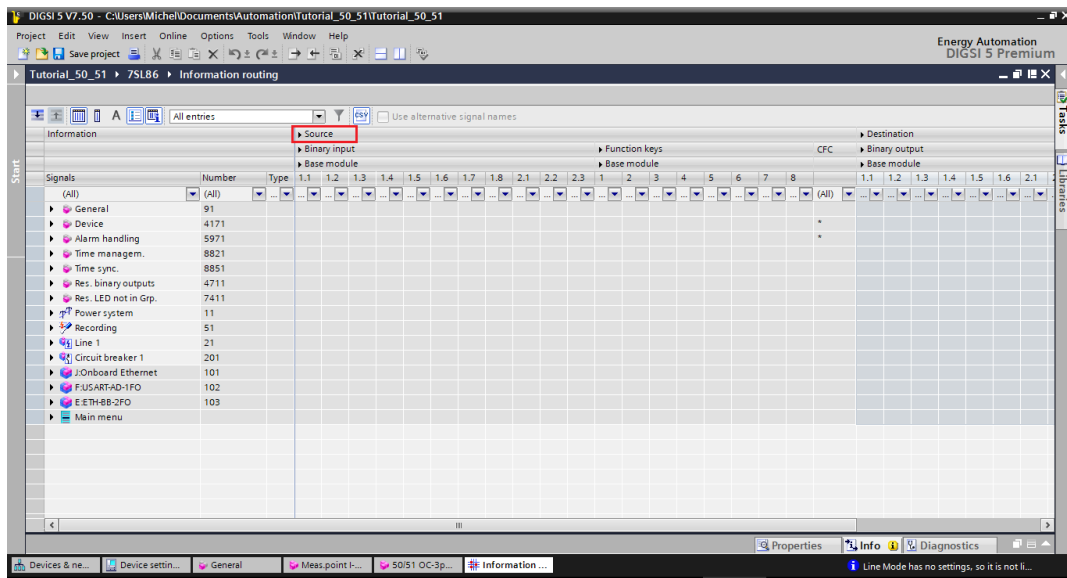


Figure 26

Enter the options “Line 1 > 50/51 OC-3phA1 > Definite-T1”.

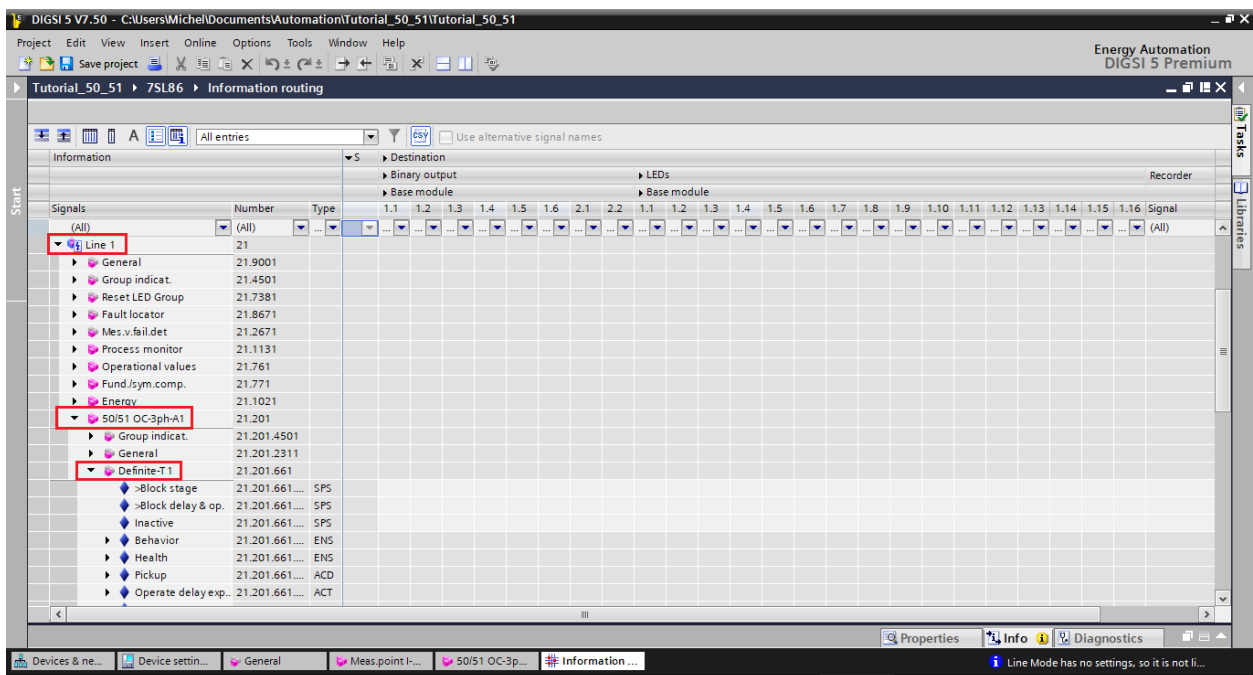


Figure 27

INSTRUMENTOS PARA TESTES ELÉTRICOS

Associate the “*general*” signal within “*Pickup*” to output 1.1 and the “*general*” signal within “*Operate delay expired*” to output 1.4. Look at the columns for these signals “*Destination > Binary output > Base module*”.

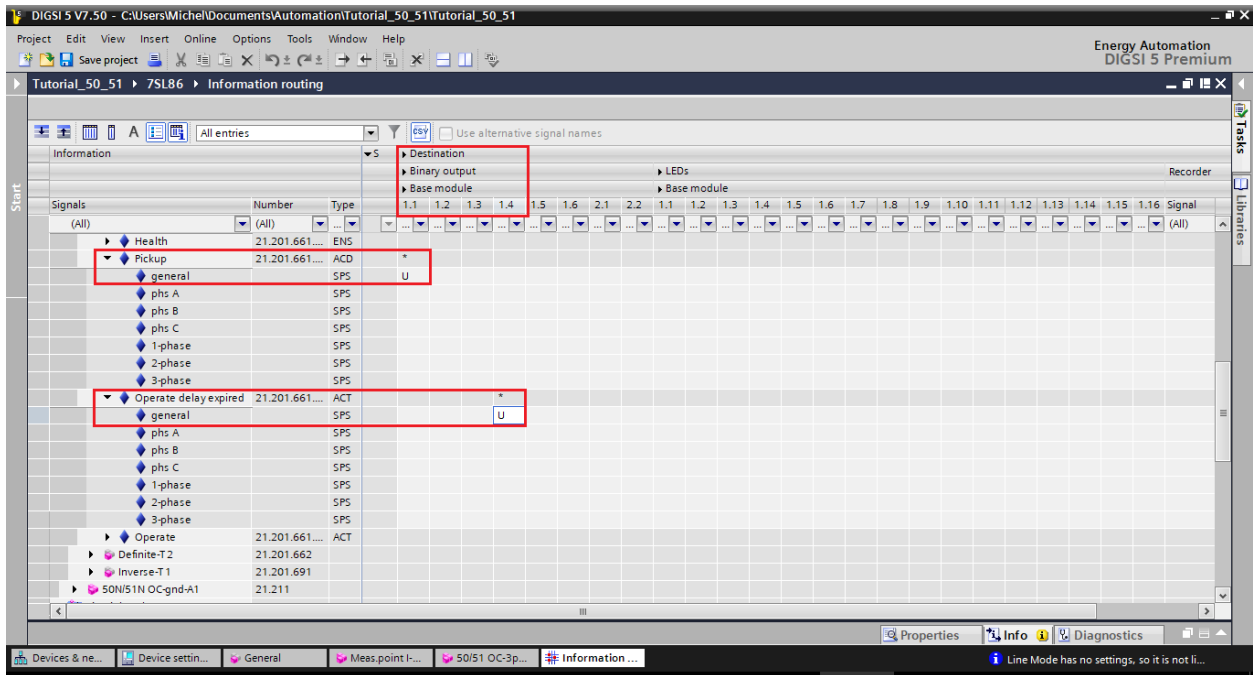


Figure 28

The option “*U*” must be used, which means “*Unlatched*”, that is, the relay activates and when the fault ceases, it automatically returns to the initial binary state. If the user chooses the “*L*” or “*Latched*” option, the relay activates and remains activated even if the fault has been extinguished. (This option is not suitable for testing).

In the “*Definite-T2*” option, associate the “*general*” signal within “*Pickup*” to output 1.2 and the “*general*” signal within “*Operate delay expired*” to output 1.4.

INSTRUMENTOS PARA TESTES ELÉTRICOS

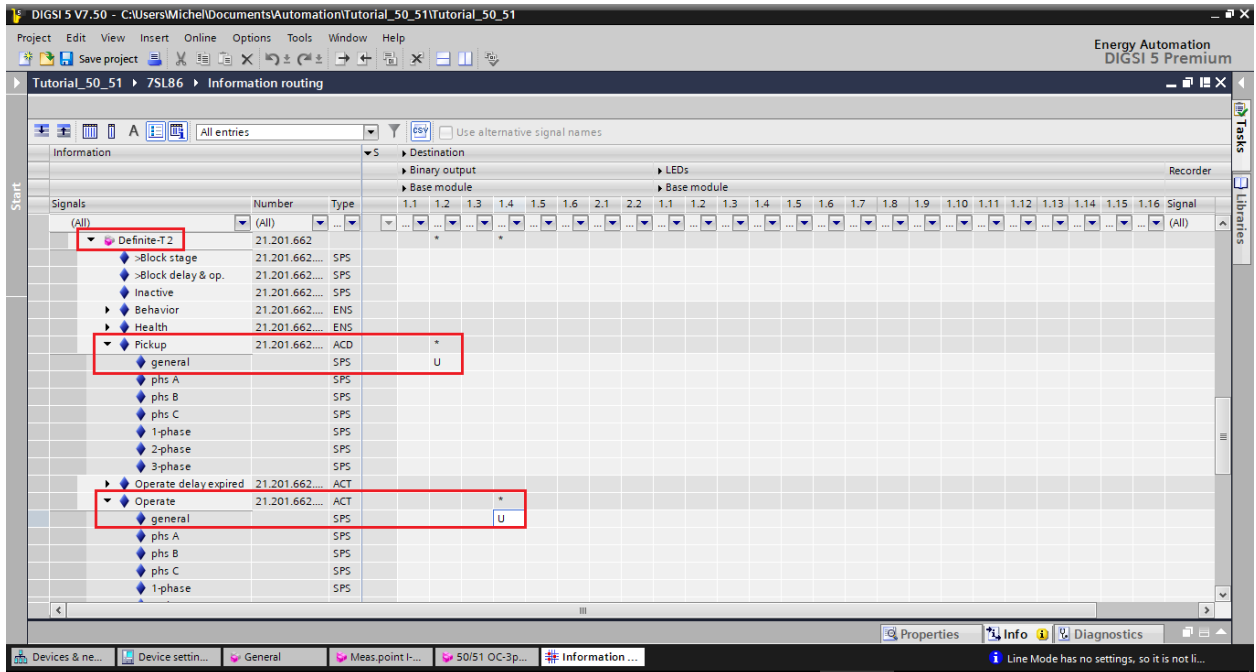


Figure 29

For option “Inverse-T1” associates the signal “general” inside “Pickup” to output 1.3 and the signal “general” inside “Operate delay expired” to output 1.4.

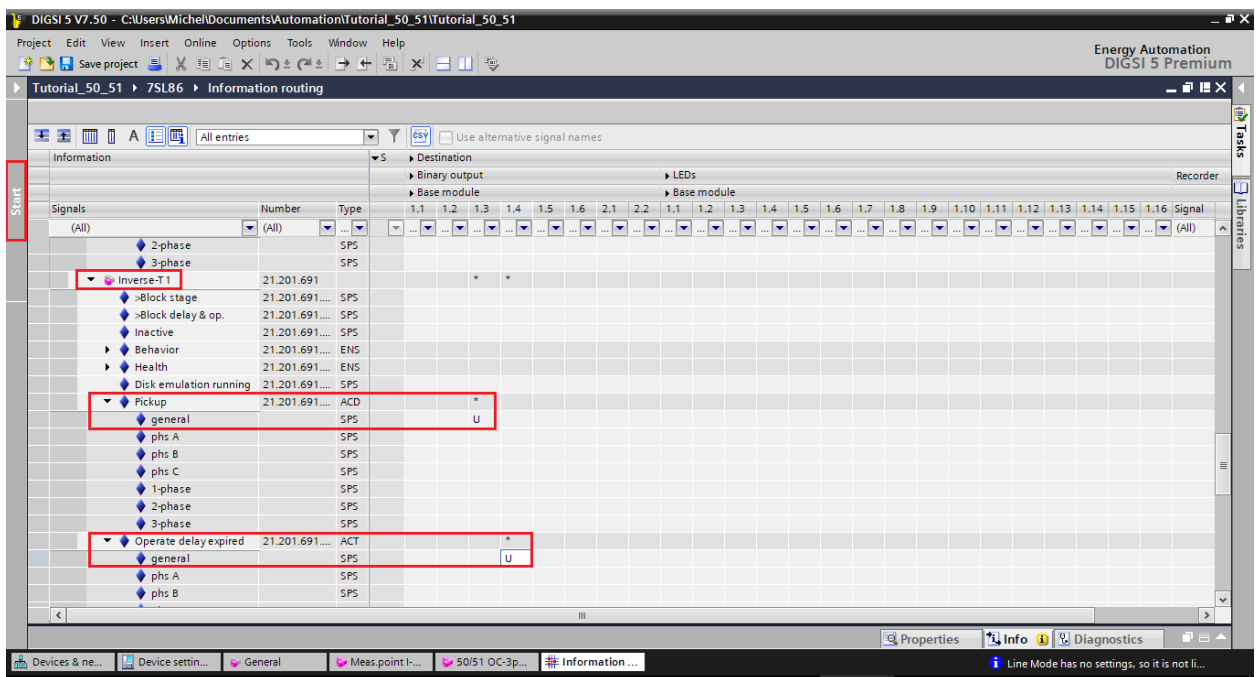


Figure 30

Click on the “Start” option to show the main window again.

INSTRUMENTOS PARA TESTES ELÉTRICOS

3.6 Sending adjustments

To send the parameterization changes, right-click on the “7SL86” relay icon and choose the “Load configuration to device” option.

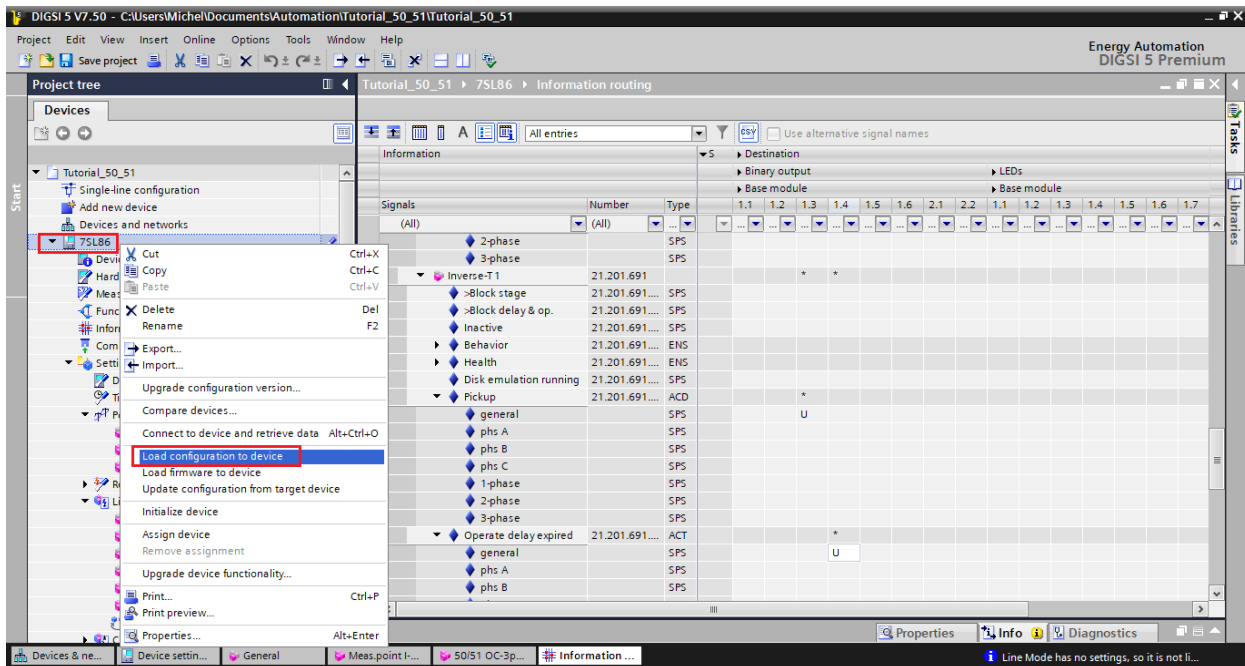


Figure 31

Remembering the default password of Siemens SIPROTE 5: “222222”.

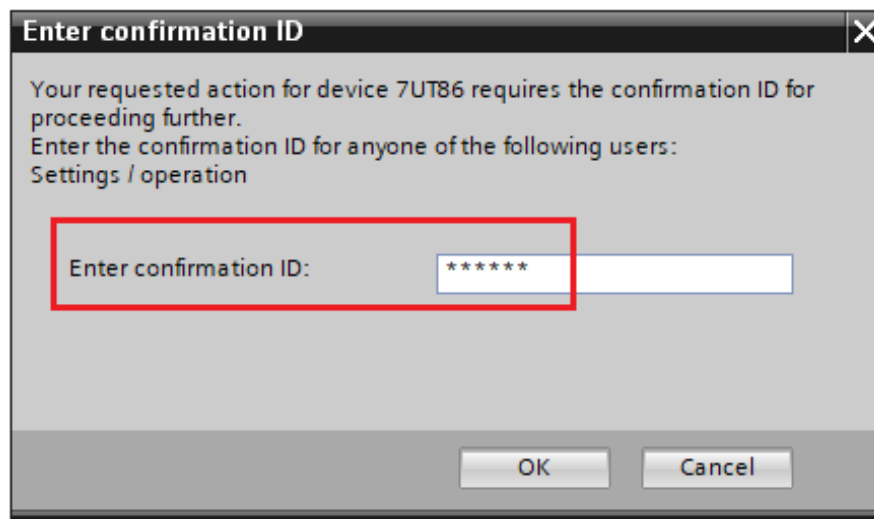


Figure 32

In the two windows not shown, choose the option “Yes”.

4. Overcurrent software adjustments

4.1 Opening the Overcurrent

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

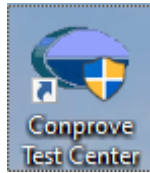


Figure 33

Make a click on the “Overcurrent” software icon.

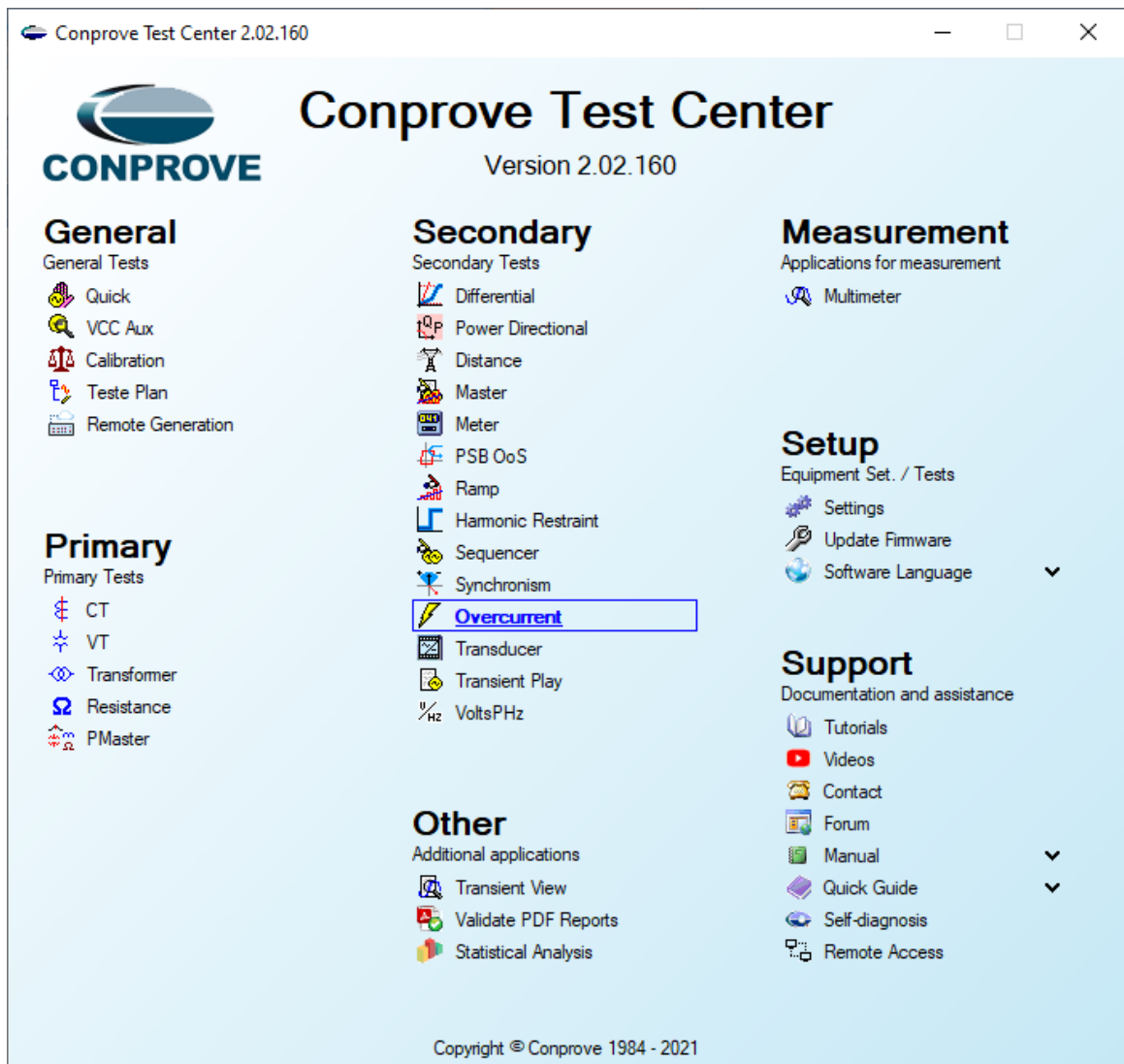


Figure 34

INSTRUMENTOS PARA TESTES ELÉTRICOS

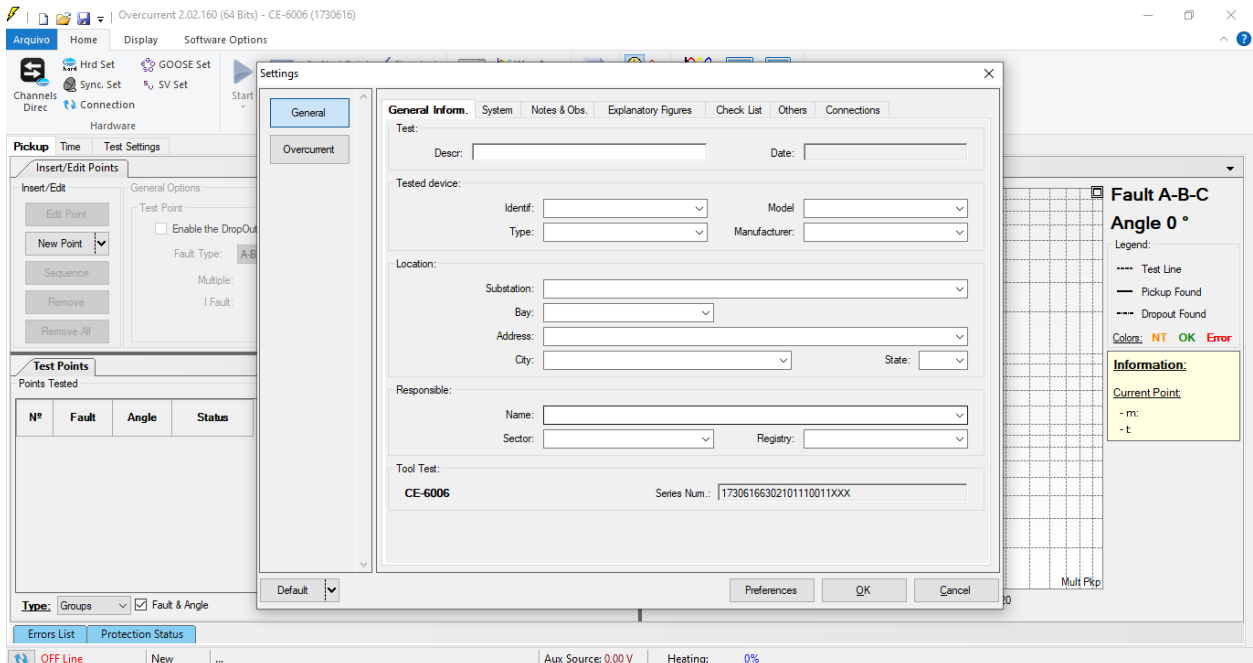


Figure 35

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.

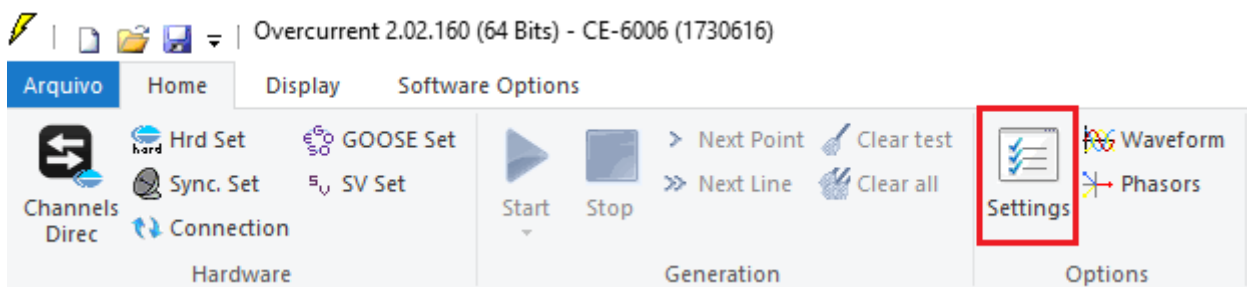


Figure 36

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.

INSTRUMENTOS PARA TESTES ELÉTRICOS

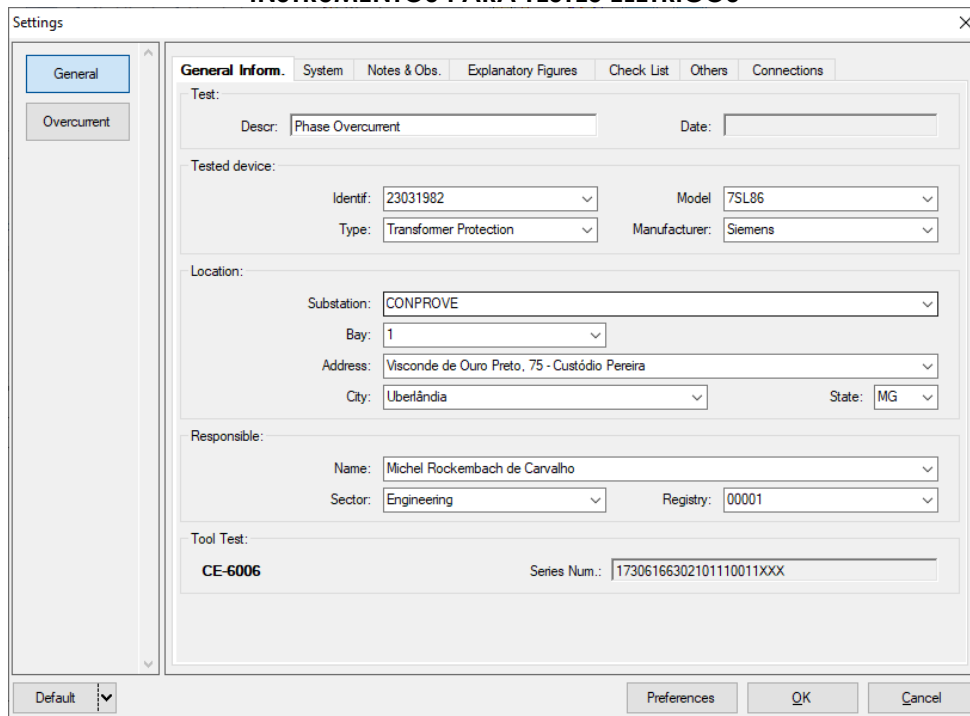
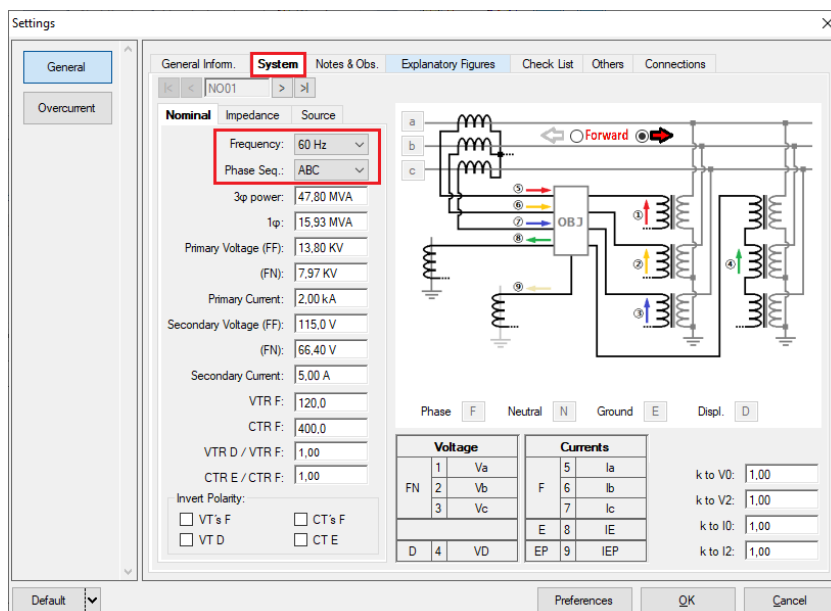


Figure 37

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			k to V/I:	
1	Va	5	Ia	k to V0:	1.00		
2	Vb	6	Ib	k to V2:	1.00		
3	Vc	7	Ic	k to I0:	1.00		
4	VD	8	IE	k to I2:	1.00		
		9	IEP				

Figure 38

INSTRUMENTOS PARA TESTES ELÉTRICOS

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 test equipment.

5. Overcurrent Adjustments

5.1 Overcurrent Screen > Settings

This tab adjusts whether the function has directionality, the way to view the current graph by time, the scale used and the tolerances for time, current and angle. These tolerances should be referred to in the relay manufacturer's manual (shown in Appendix A).

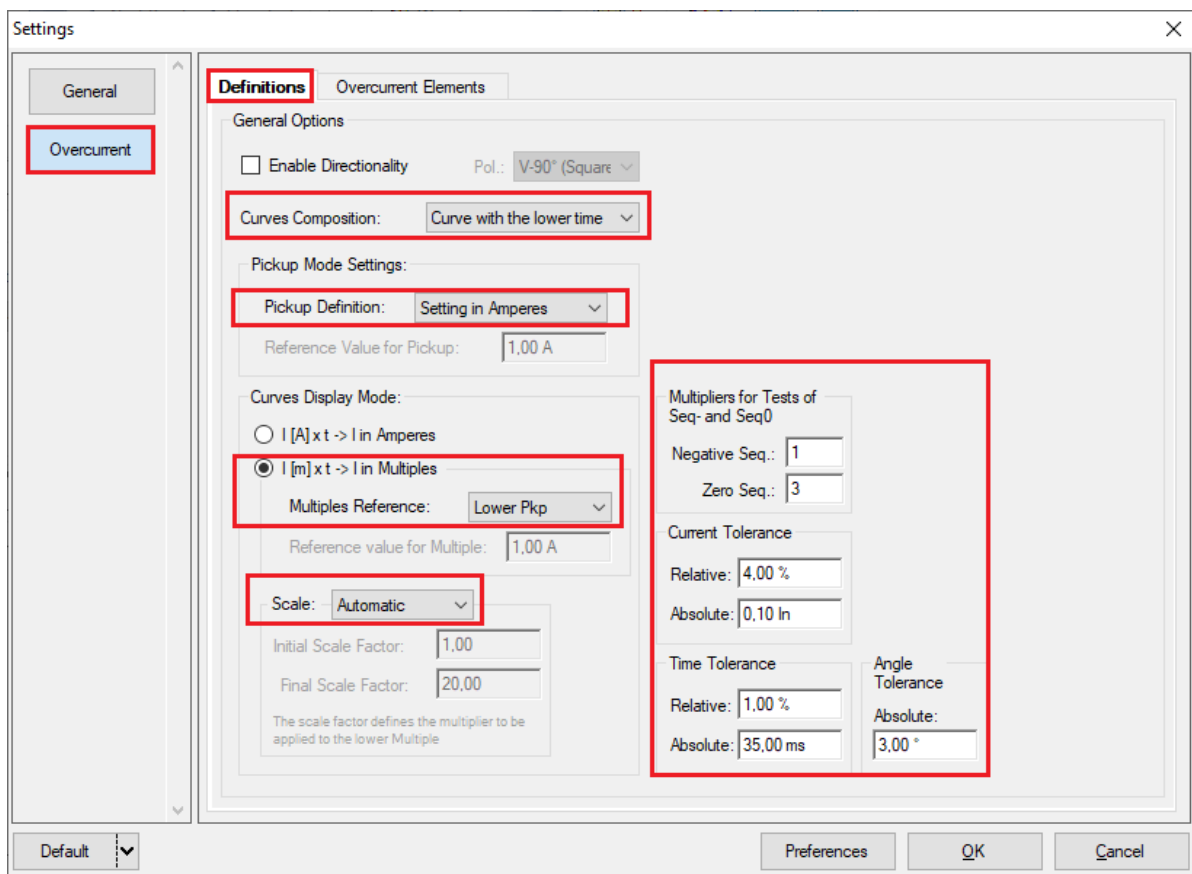


Figure 39

5.2 Overcurrent Screen > Overcurrent Elements > Phase

Here, configure the overcurrent element for inverse time, definite time and instantaneous time. To do this click three times on the highlighted icon.

INSTRUMENTOS PARA TESTES ELÉTRICOS

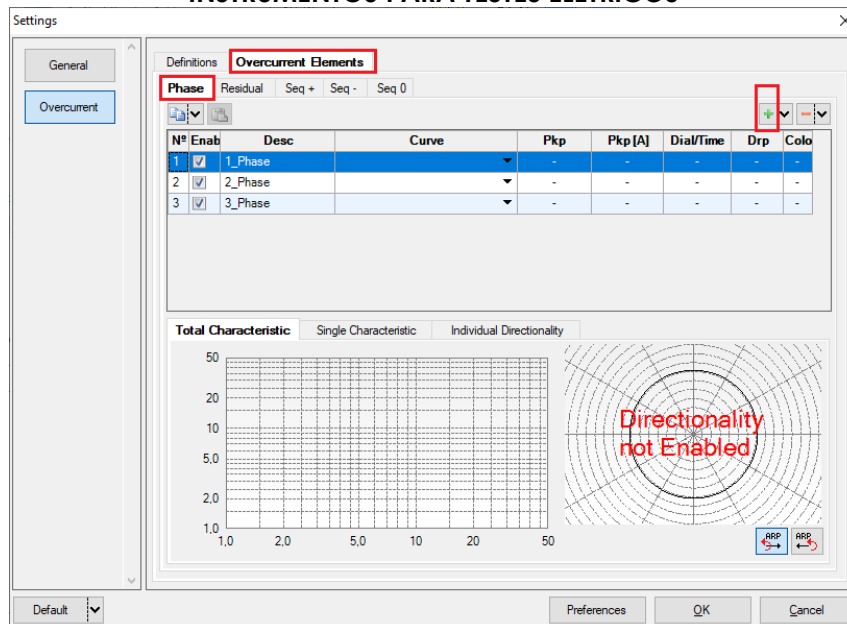


Figure 40

For the first and second elements change the name to “50-1 and 50-2”, choosing definite time and parameterizing the values of “Pkp”, “Tmp” and “Drp”. Repeat the same procedure for the third element changing the name to “51” choose the curve type, pickup value, time dial and dropout factor.

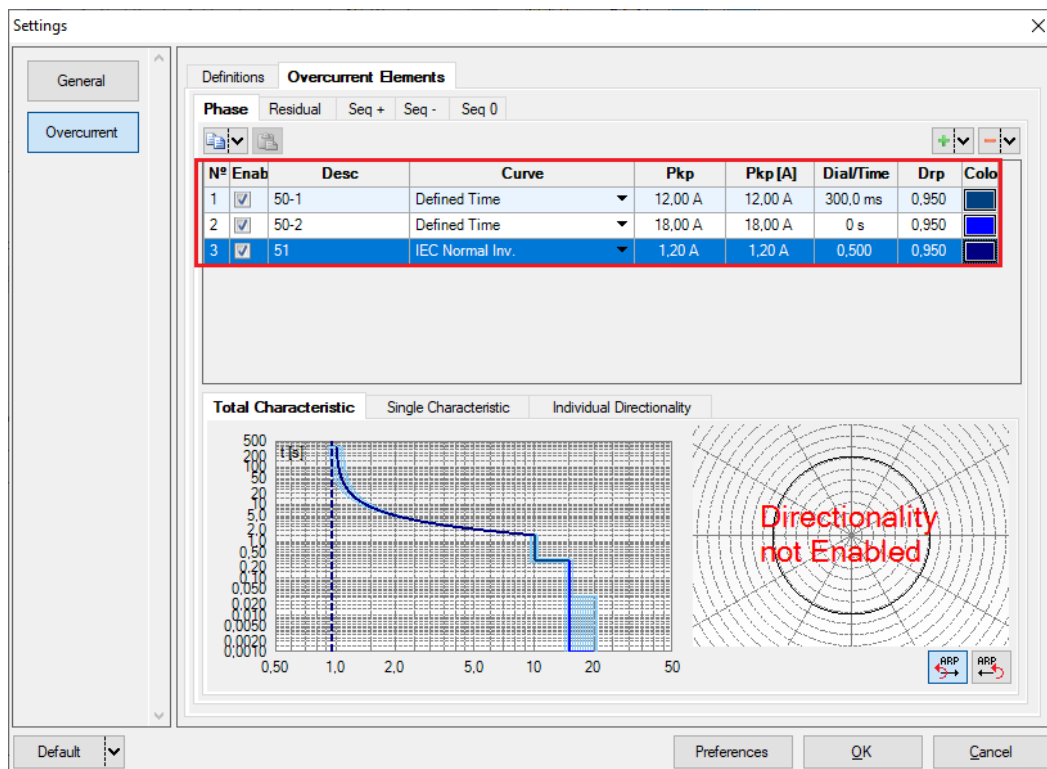


Figure 41

INSTRUMENTOS PARA TESTES ELÉTRICOS

This relay has a particularity for actuating its pick-up that is worth 10% more than the set value. Select the element “51” and then click on the “Single Characteristic” tab and make the following adjustment.

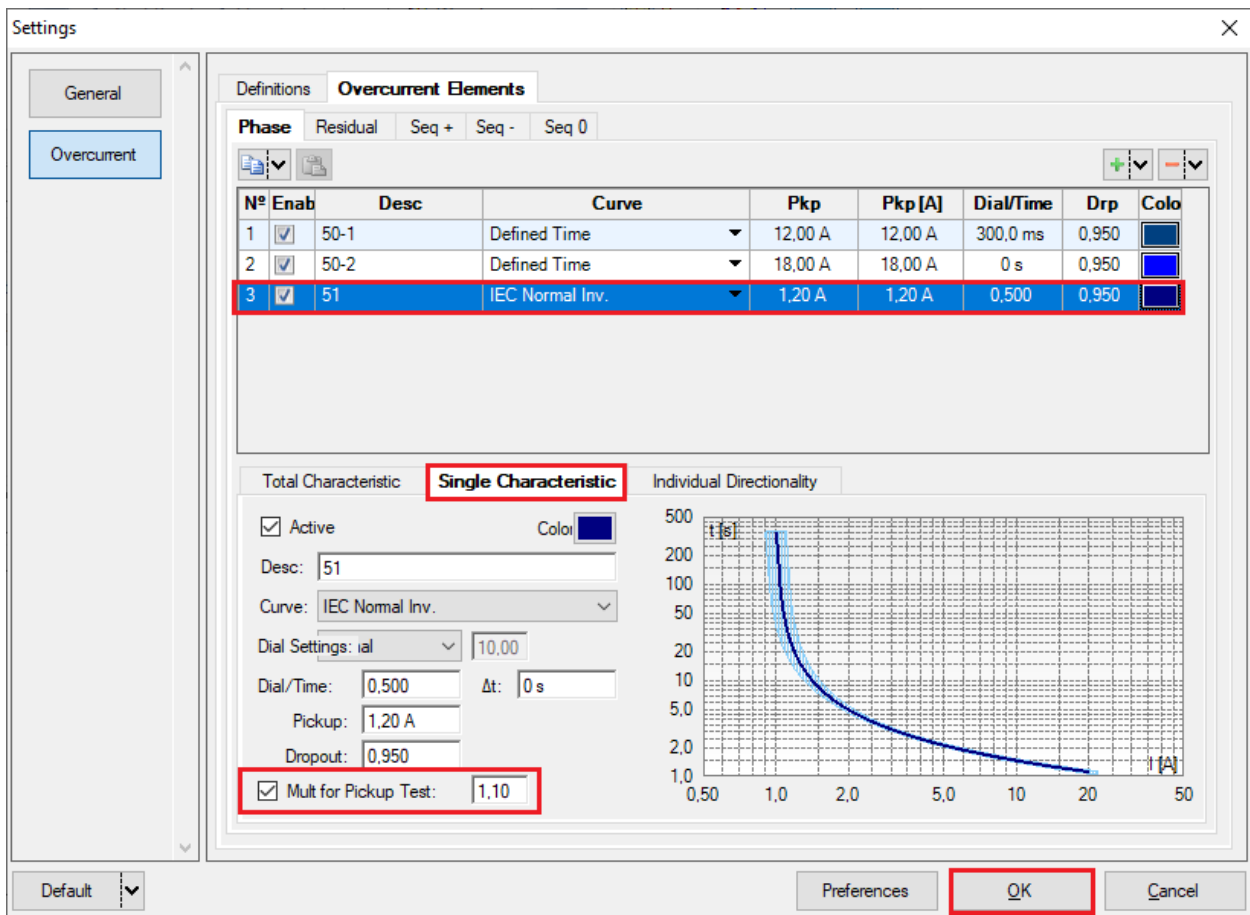


Figure 42

6. Channel Targeting and Hardware Configurations

Click on the icon illustrated below.

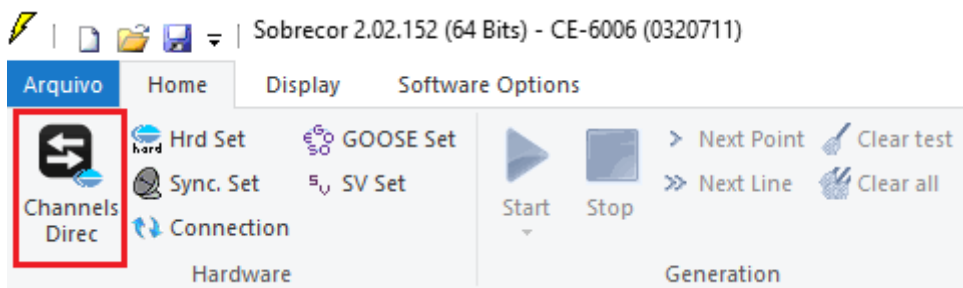


Figure 43

INSTRUMENTOS PARA TESTES ELÉTRICOS

Then click on the highlighted icon to configure the hardware.

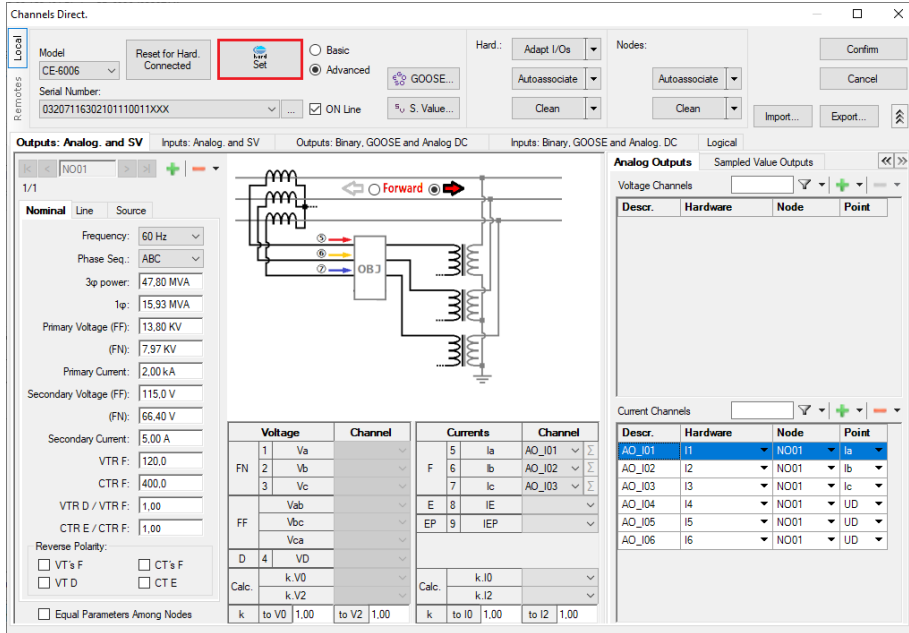


Figure 44

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

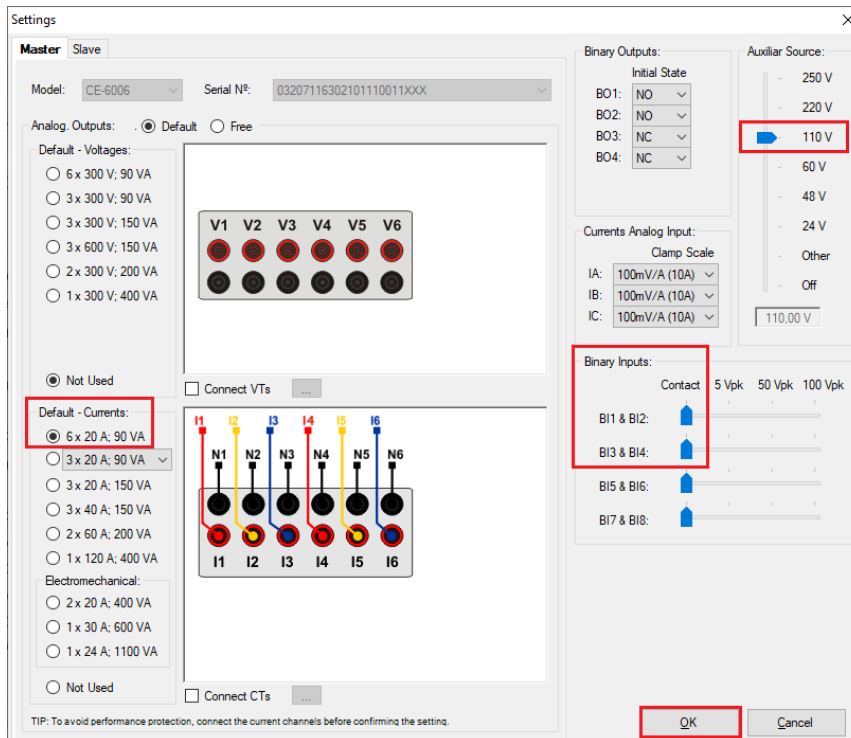


Figure 45

INSTRUMENTOS PARA TESTES ELÉTRICOS

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

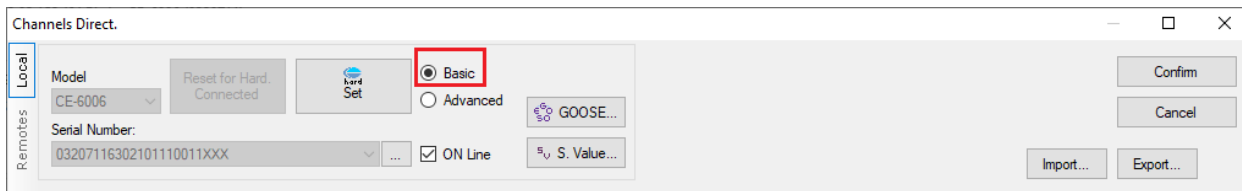


Figure 46

7. Test Structure for Function 50/51

7.1 Test Settings

On this tab you must configure the direction of pickup and trip signals with the binary inputs, in addition to configuring the generation channels. You can configure pre-faults and post-faults if necessary.

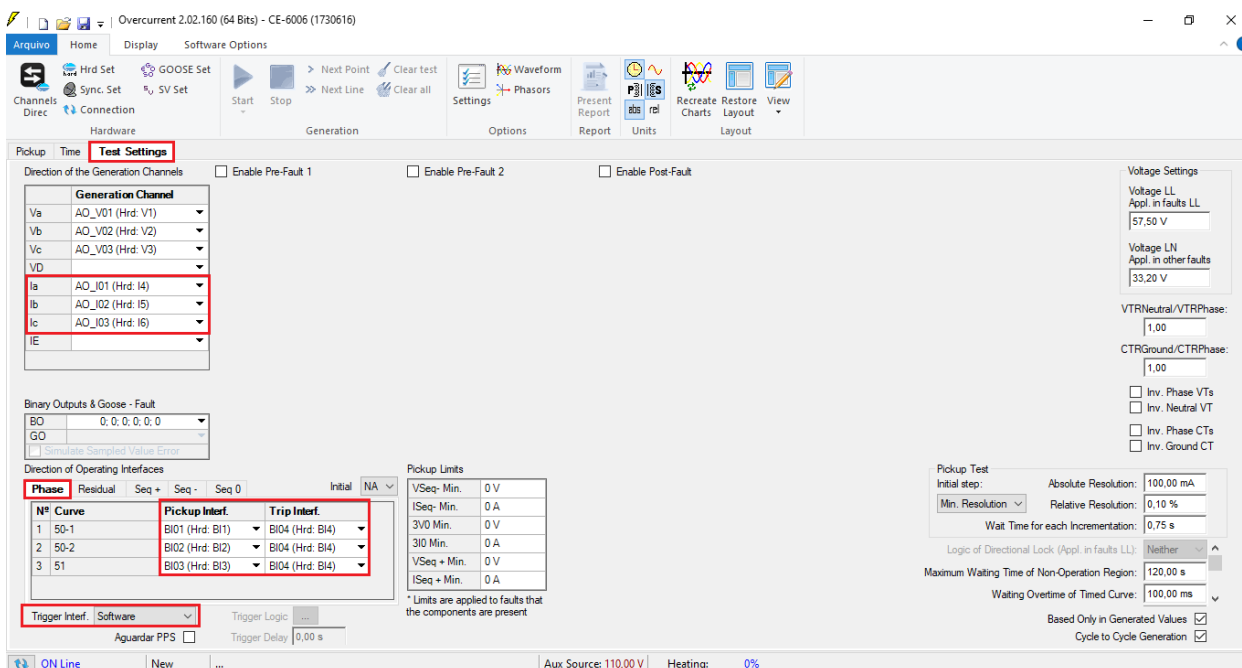


Figure 47

7.2 Pickup Screen

On this tab click on “New Point” and choose the type of fault (it has all types), if you want to test dropout and the software searches for pickup and dropout fully automatically. In the figure below, the “Fault Type” ABC was chosen.

INSTRUMENTOS PARA TESTES ELÉTRICOS

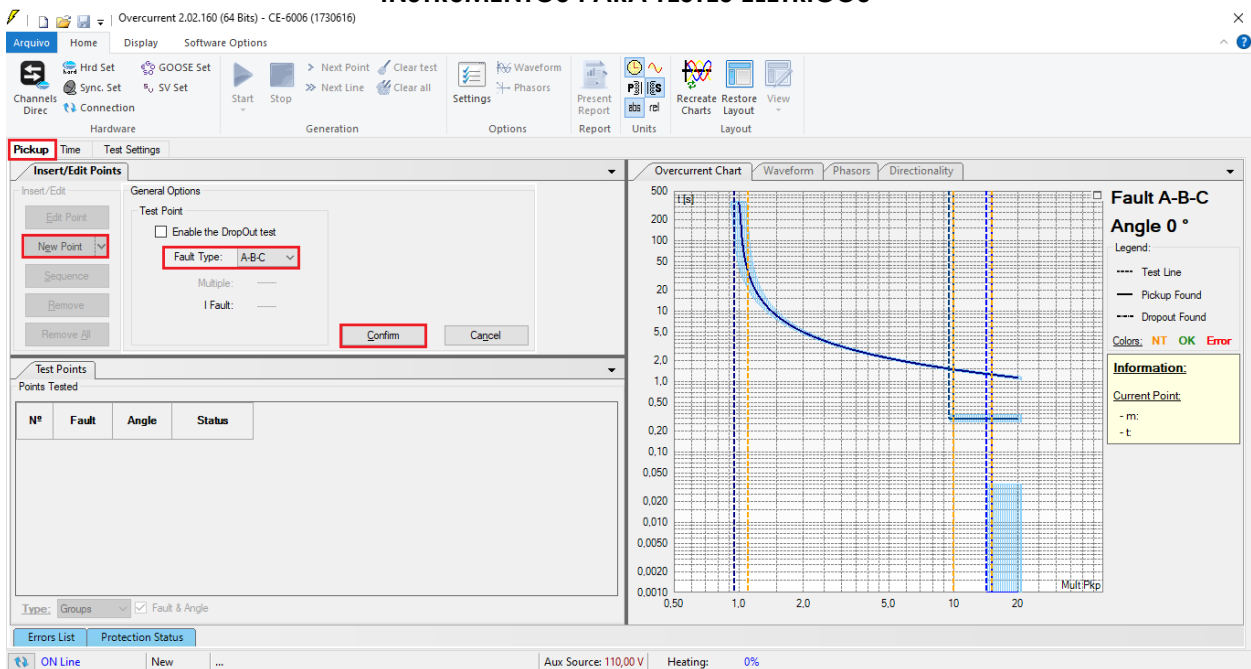


Figure 48

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

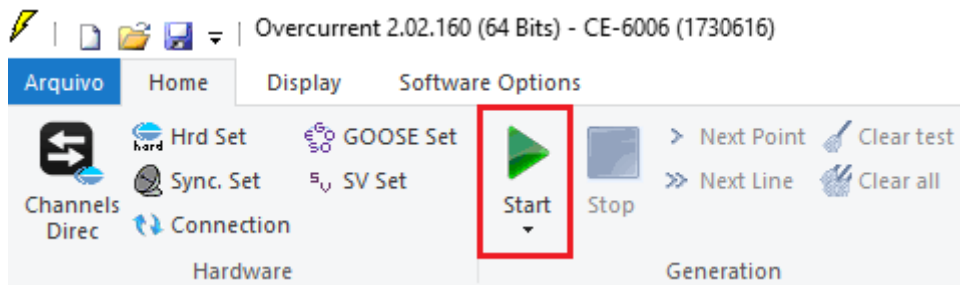


Figure 49

7.3 Final Result of the Pickup Test

In this test, the values found for pickup, dropout, and percentage and absolute errors can be viewed in order to pass or fail the test. Other options are generated values, dropout factor, reference curve, angle and fault.

INSTRUMENTOS PARA TESTES ELÉTRICOS

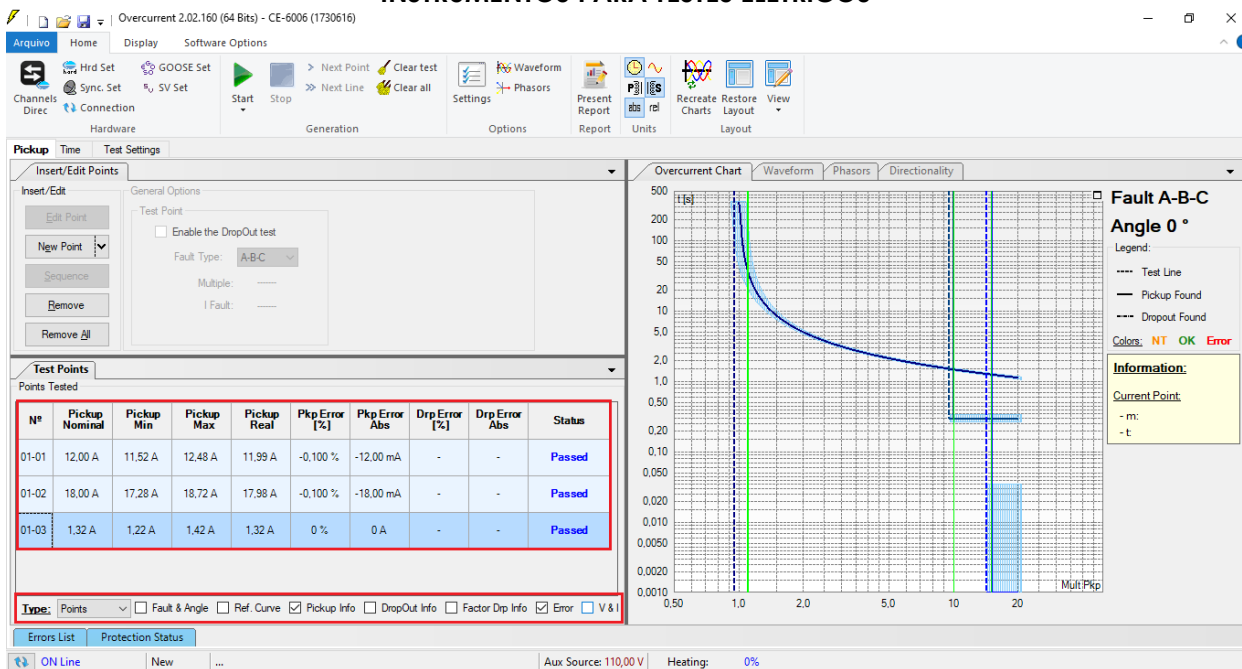


Figure 50

7.4 Time Screen

On this tab, the operating times are evaluated. For convenience, a sequence of current values will be inserted for time evaluation. The value 2.40A was chosen as the initial value, 20.00A as the final value and 1.00A as the increment step and the ABC fault.

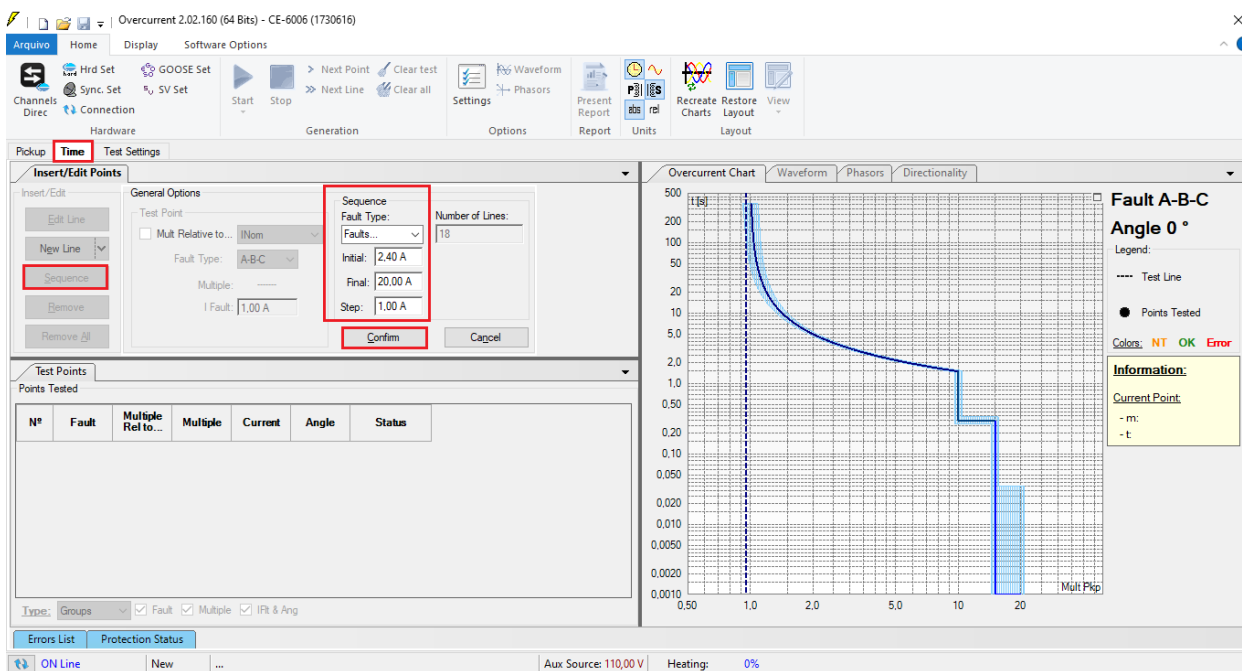


Figure 51

INSTRUMENTOS PARA TESTES ELÉTRICOS

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

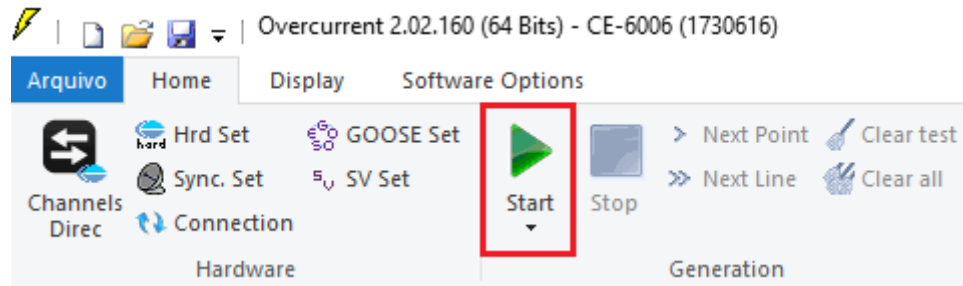


Figure 52

7.5 Final Result of the Time Test

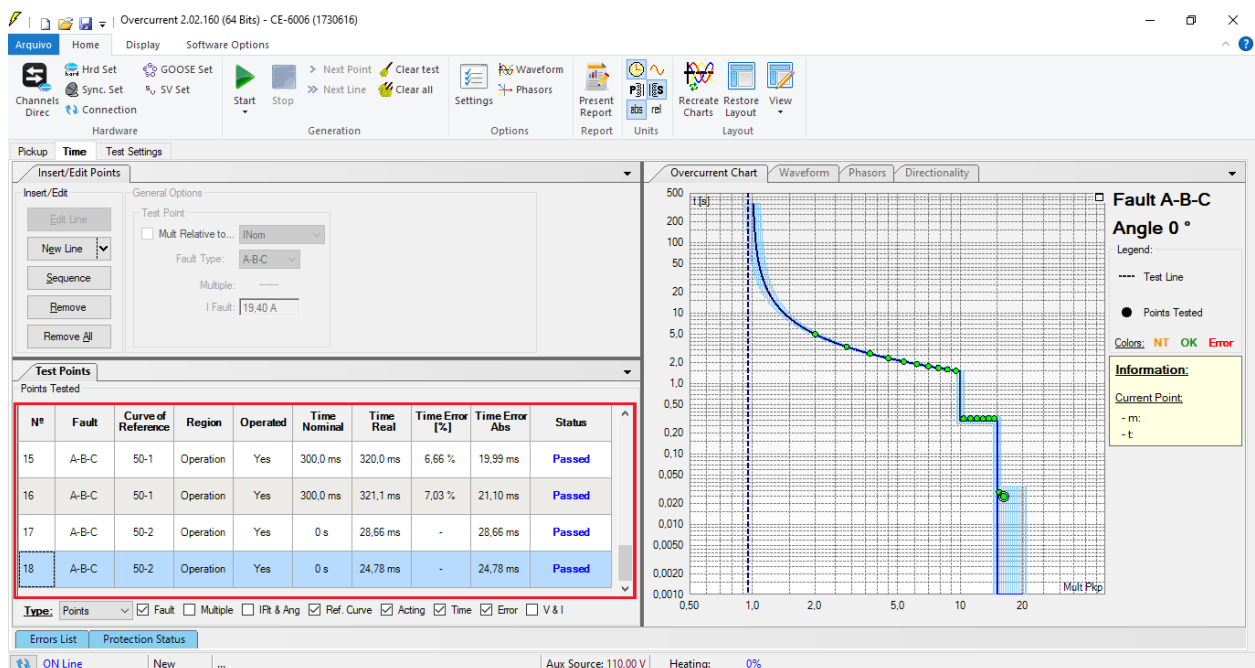


Figure 53

It is verified that all operating times are within the range allowed by the relay manufacturer.

8. 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.

INSTRUMENTOS PARA TESTES ELÉTRICOS

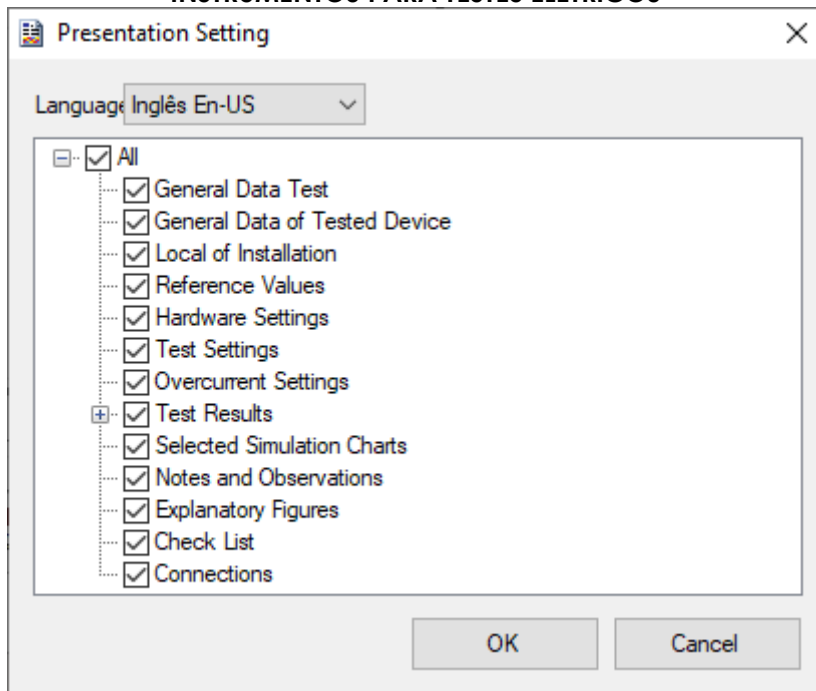


Figure 54

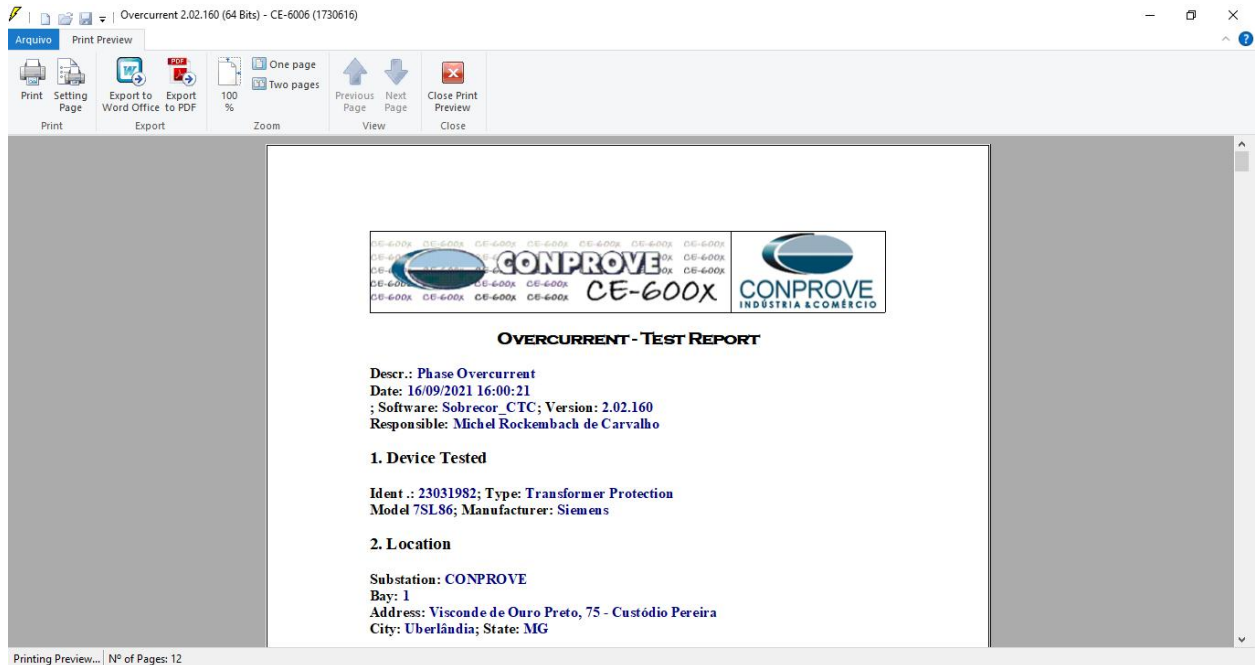


Figure 55

APPENDIX A

A.1 Terminal Designations

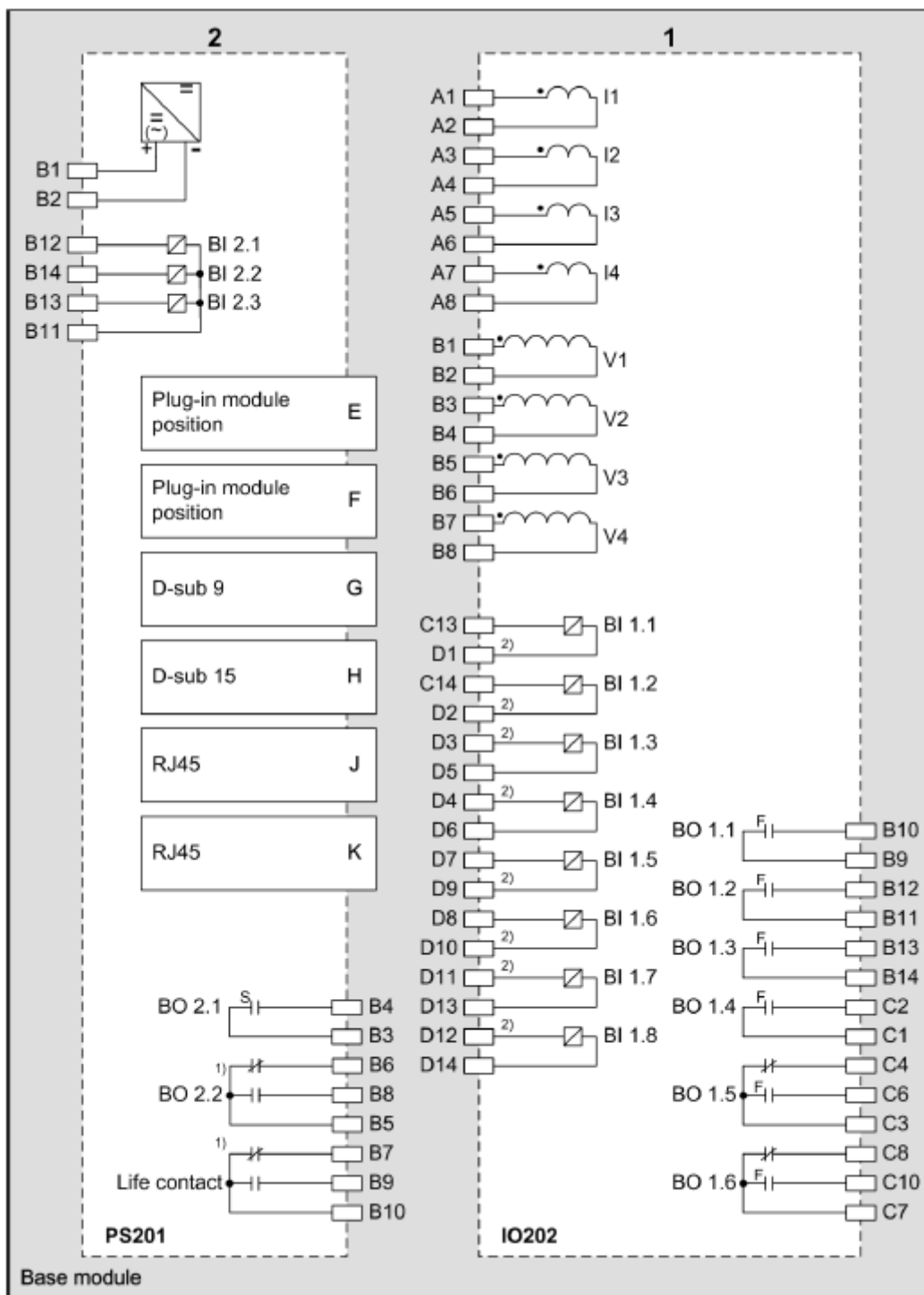


Figure 56

INSTRUMENTOS PARA TESTES ELÉTRICOS

A.2 Technical data

Operate time with time delay = 0 ms	Approx. 25 ms + OOT ⁶⁸ at 50 Hz Approx. 22 ms + OOT at 60 Hz
Extension of the operate time during operation with transformer inrush-current detection	Approx. 10 ms
Dropout time	Approx. 20 ms + OOT

Currents, method of measurement = fundamental component	1 % of the setting value or 5 mA ($I_{rated} = 1\text{ A}$) or 25 mA ($I_{rated} = 5\text{ A}$), ($f_{rated} \pm 10\%$)
Currents, method of measurement = RMS value, no filter applied (33 % harmonics, in relation to fundamental component)	
Up to 30th harmonic	1 % of the setting value or 5 mA ($I_{rated} = 1\text{ A}$) or 25 mA ($I_{rated} = 5\text{ A}$), ($f_{rated} \pm 10\%$)
Up to 50th harmonic, $f_{rated} = 50\text{ Hz}$	3 % of the setting value or 20 mA ($I_{rated} = 1\text{ A}$) or 100 mA ($I_{rated} = 5\text{ A}$), ($f_{rated} \pm 10\%$)
Up to 50th harmonic, $f_{rated} = 60\text{ Hz}$	4 % of the setting value or 20 mA ($I_{rated} = 1\text{ A}$) or 100 mA ($I_{rated} = 5\text{ A}$), ($f_{rated} \pm 10\%$)
Currents, method of measurement = RMS value with filter for the compensation of the amplitude attenuation due to the anti-aliasing filter (33 % harmonics, in relation to the fundamental component)	
Up to 30 harmonic	1 % of the setting value or 5 mA ($I_{rated} = 1\text{ A}$) or 25 mA ($I_{rated} = 5\text{ A}$), ($f_{rated} \pm 10\%$)
Up to 50th harmonic, $f_{rated} = 50\text{ Hz}$	2 % of the setting value or 10 mA ($I_{rated} = 1\text{ A}$) or 50 mA ($I_{rated} = 5\text{ A}$), ($f_{rated} \pm 10\%$)
Up to 50th harmonic, $f_{rated} = 60\text{ Hz}$	3 % of the setting value or 20 mA ($I_{rated} = 1\text{ A}$) or 100 mA ($I_{rated} = 5\text{ A}$), ($f_{rated} \pm 10\%$)
Currents, method of measurement = RMS value with filter for the gain of harmonics (including compensation of the amplitude attenuation ⁶⁹) (33 % harmonics, in relation to the fundamental component)	
Up to 30 harmonic	1.5 % of the setting value or 10 mA ($I_{rated} = 1\text{ A}$) or 50 mA ($I_{rated} = 5\text{ A}$), ($f_{rated} \pm 10\%$) ⁷⁰
Up to 50th harmonic, $f_{rated} = 50\text{ Hz}$	3% of the setting value or 20 mA ($I_{rated} = 1\text{ A}$) or 100 mA ($I_{rated} = 5\text{ A}$), ($f_{rated} \pm 10\%$) ⁷¹
Up to 50th harmonic, $f_{rated} = 60\text{ Hz}$	4 % of the setting value or 20 mA ($I_{rated} = 1\text{ A}$) or 100 mA ($I_{rated} = 5\text{ A}$), ($f_{rated} \pm 10\%$) ⁷²
Time delays	1 % of the setting value or 10 ms

APÊNDICE B

Equivalence of software parameters and the relay under test.

Table 1

Overcurrent Software		Siemens 7SL86 Relay	
Parameter	Figure	Parameter	Figure
50-1 Pkp	41	Threshold	21
50-1 Dial/Time	41	Operate delay	21
50-2 Pkp	41	Threshold	22
50-2 Dial/Time	41	Operate delay	22
51 Dial/Time	41	Time Dial	24
51 Curve	41	Type of character. curve	24
51 Pkp	41	Threshold	24