INSTRUMENTOS PARA TESTES ELÉTRICOS

Test Tutorial

Equipment Type: Protection Relay

Brand: Schweitzer (SEL)

Model: 311C

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	27/06/2022	M.R.C.	G.C.D.P.

Summary

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

Sequence for testing the SEL 311C relay in the Quick software

1. Relay Connection to CE-6710

Appendix A-1 shows the relay terminal designations.

1.1 *Auxiliary Source*

Connect the positive (red terminal) of the Aux Source. Vdc to the *"Power +"* (Z25) pin of the relay, connect the negative (black terminal) of the Aux Vdc Source to the *"Power -"* (Z26) pin of the relay.

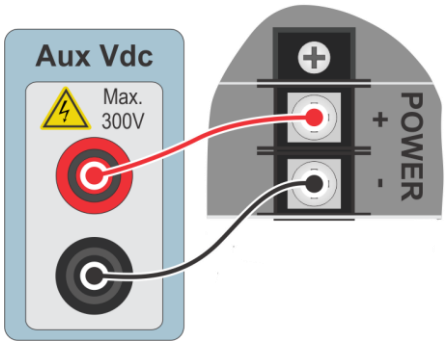

Figure 1

1.2 *Voltage Coils*

To establish the connection of voltage coils, connect current channels V1, V2 and V3 to pins Z09, Z10 and Z11 of the relay terminal and connect the commons of voltage channels to pin Z12 of the relay.

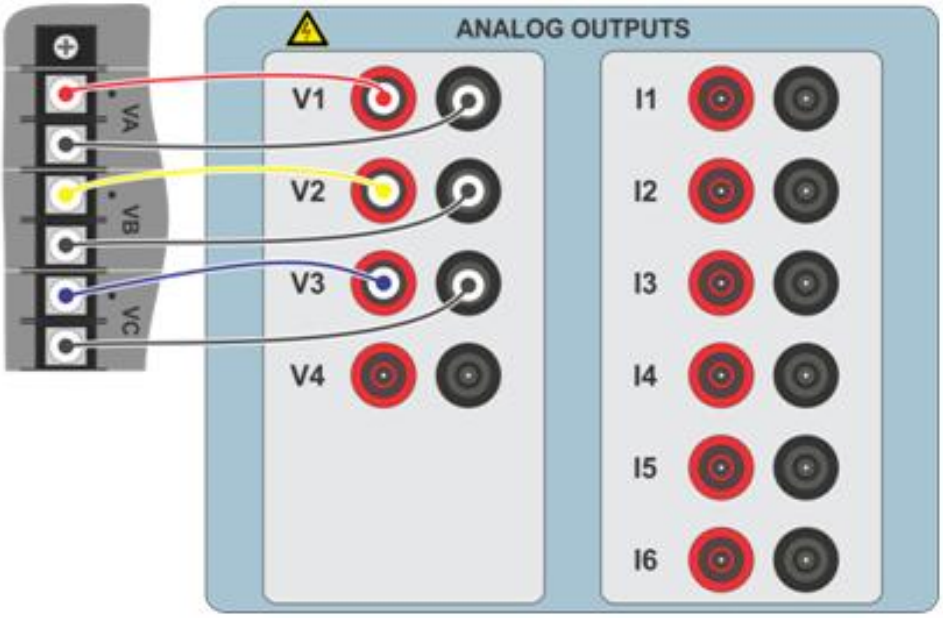

Figure 2

1.3 *Binary Inputs*

Connect the binary inputs of the CE-6710 to the binary outputs of the relay.

- BI1 to pin B01 and its common to pin B02.
- BI2 to pin B03 and its common to pin B04.

The following figure shows the details of these connections.

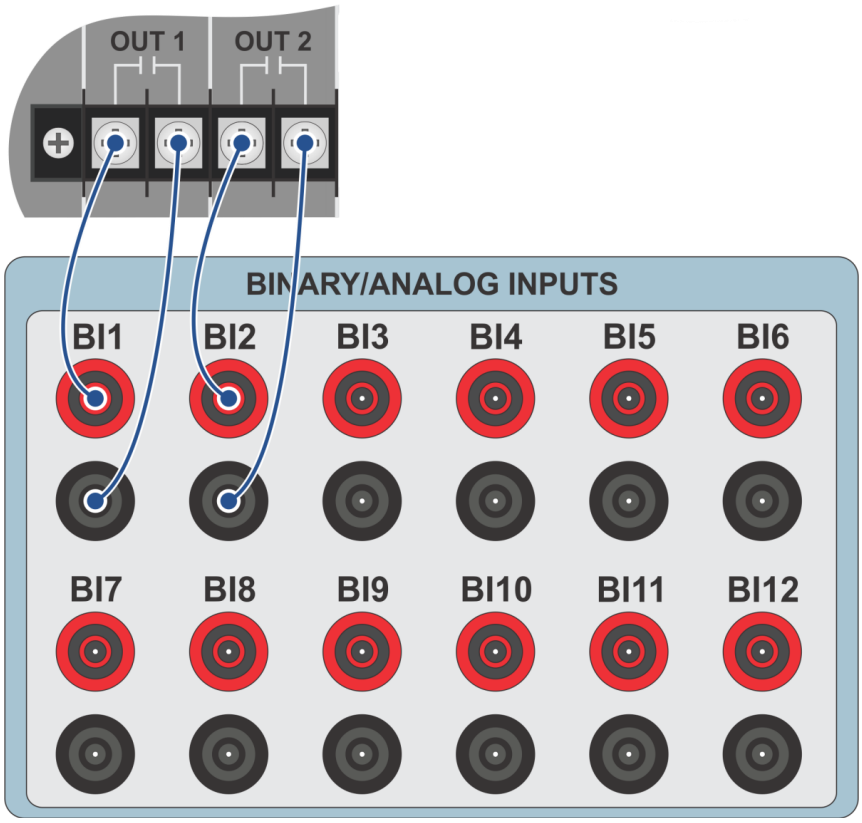

Figure 3

2. Communication with the 311C relay

First, open the *"AcSELerator QuickSet"* and connect an Ethernet (or serial) cable from the notebook to the relay. Then double click on the software icon.

Figure 4

When opening the program, the relay file is selected if the communication has already been carried out. Otherwise click on *"New"*.

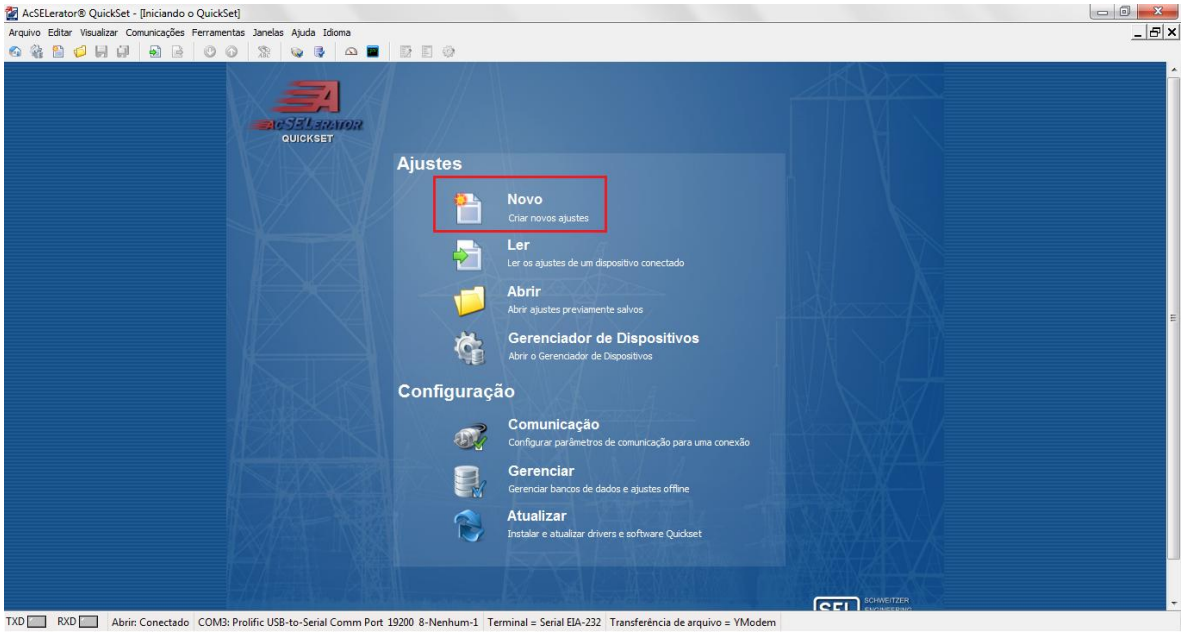

Figure 5

On the next screen, the model and version of the tested relay are set. Check on the front panel by pressing the *"Status"* key.

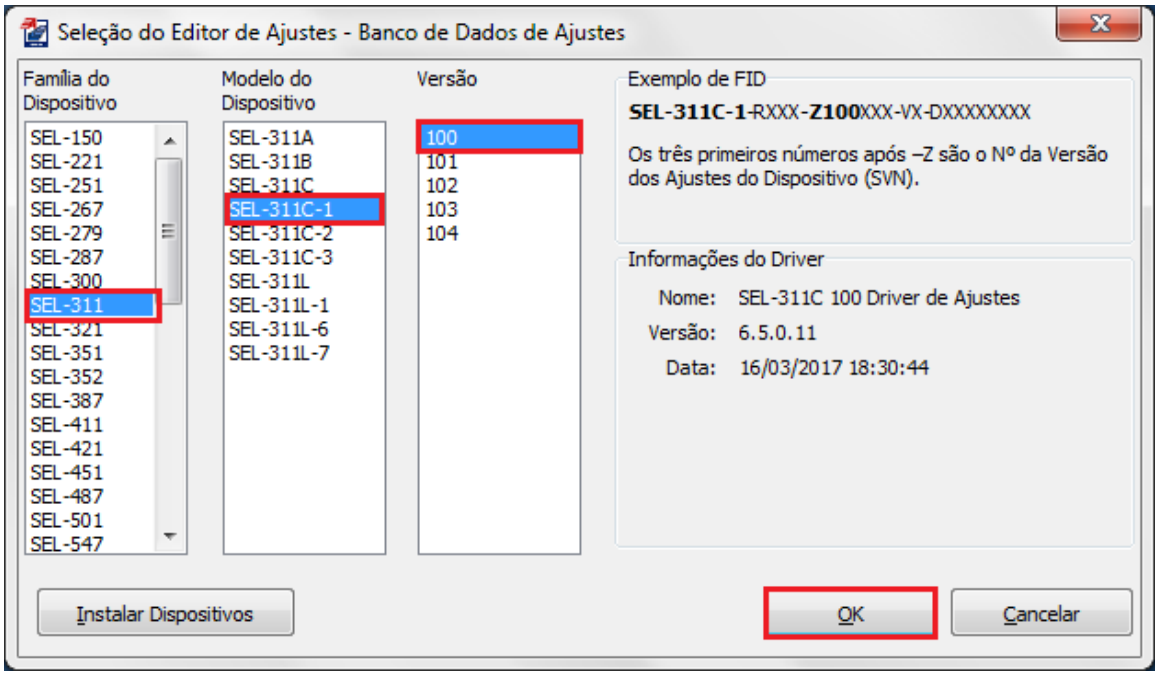

Figure 6

Then the *"Part Number"* must be set. This number appears on a stamp affixed to the back of the relay.

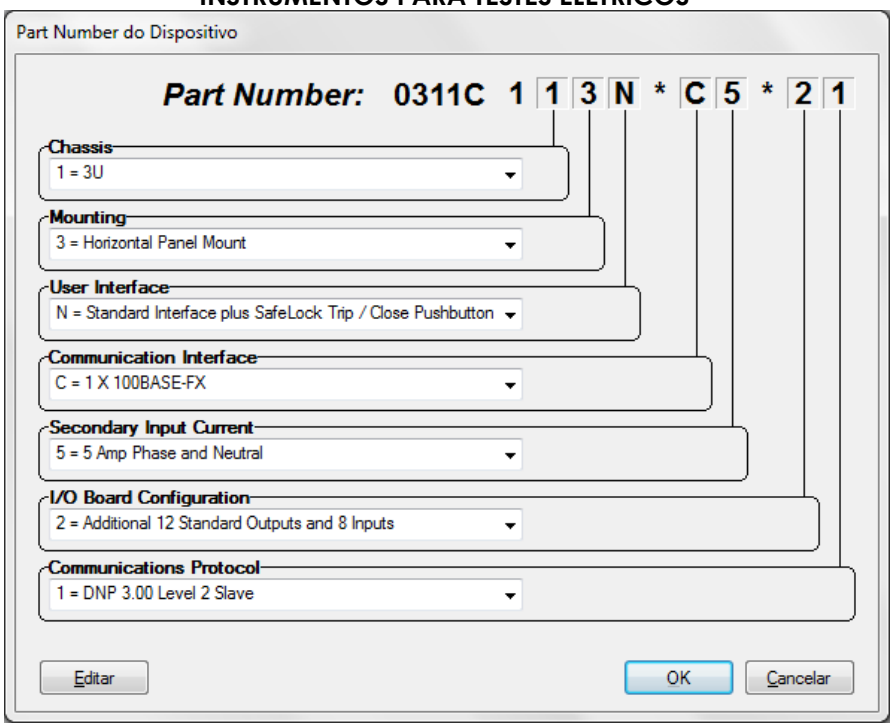

Figure 7

Then click on the highlighted icon according to the figure below:

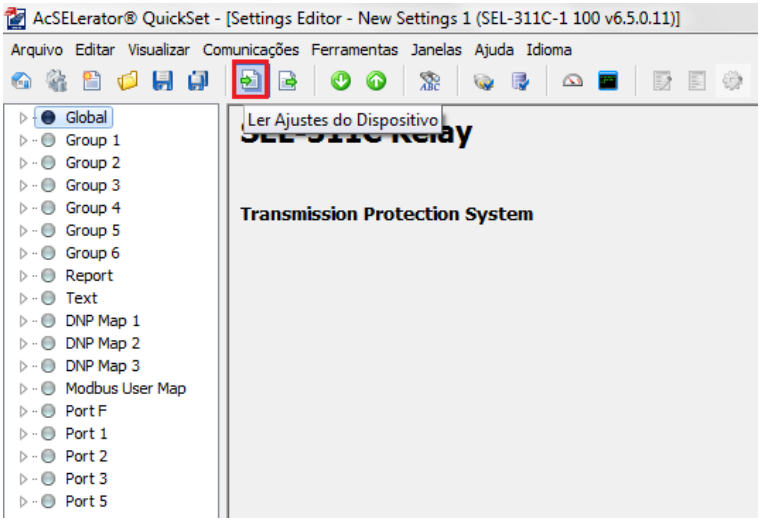

Figure 8

3. Parameterization of the SEL 311C relay

3.1. *General*

After the connection has been established, click next to *"Global"* and *"General"* and adjust the connection of the voltage channels, the frequency value and the phase sequence.

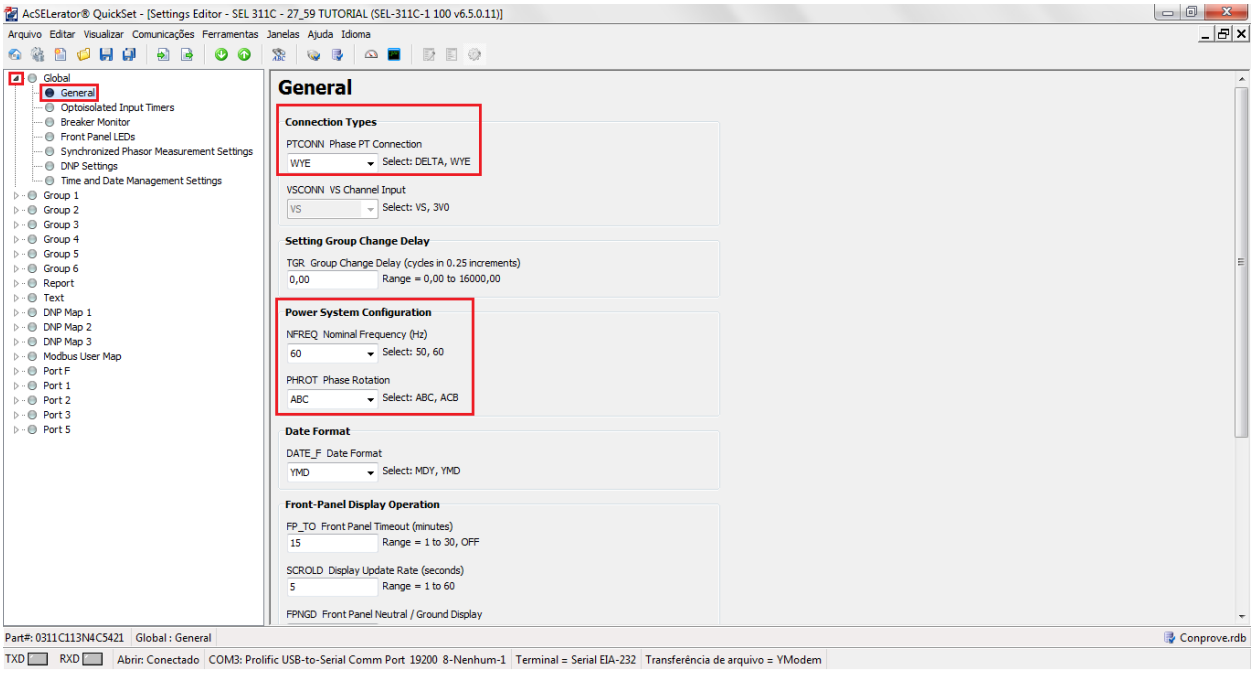

Figure 9

3.2. *General Settings*

Click next to *"Group1 > Set 1"* then *"General Settings"*. In this window, the identification of the relay and its terminal, the current and voltage transformation ratios are adjusted. Configure the nominal secondary phase voltage and leave the last two settings disabled.

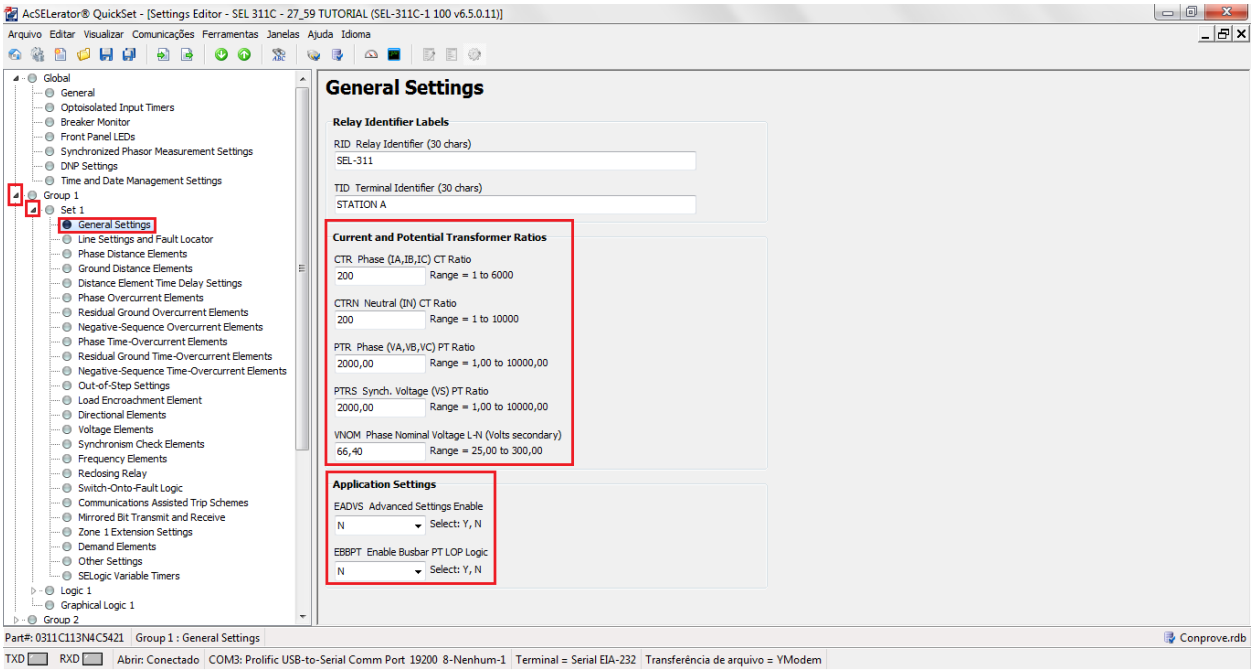

Figure 10

3.3. *Voltage Elements*

Click on *"Voltage Elements"* and set the value of the undervoltage element to 59.0V and the overvoltage element to 69.0V. The other elements are all deactivated and the way to test them is done in a similar way.

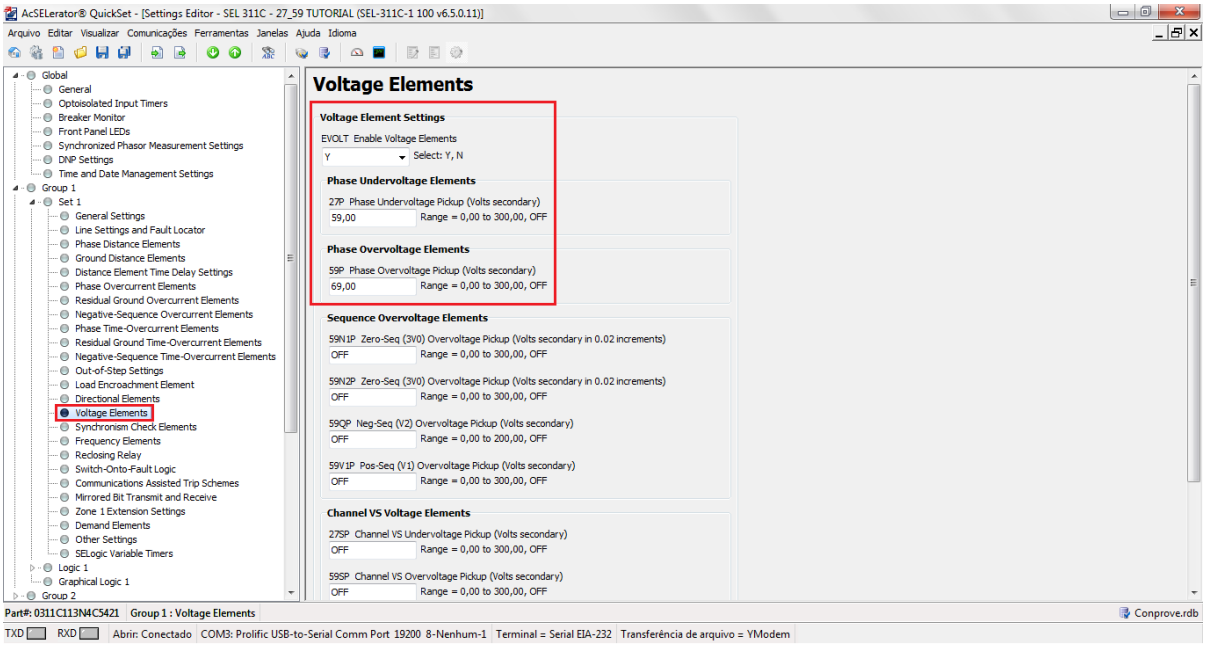

Figure 11

3.4. *SELogic Variable Timers*

Click on *"SELogic Variable Timers"* and enable two variables with a pick-up time of 60 cycles that will be the timing of elements 59 and 27 respectively.

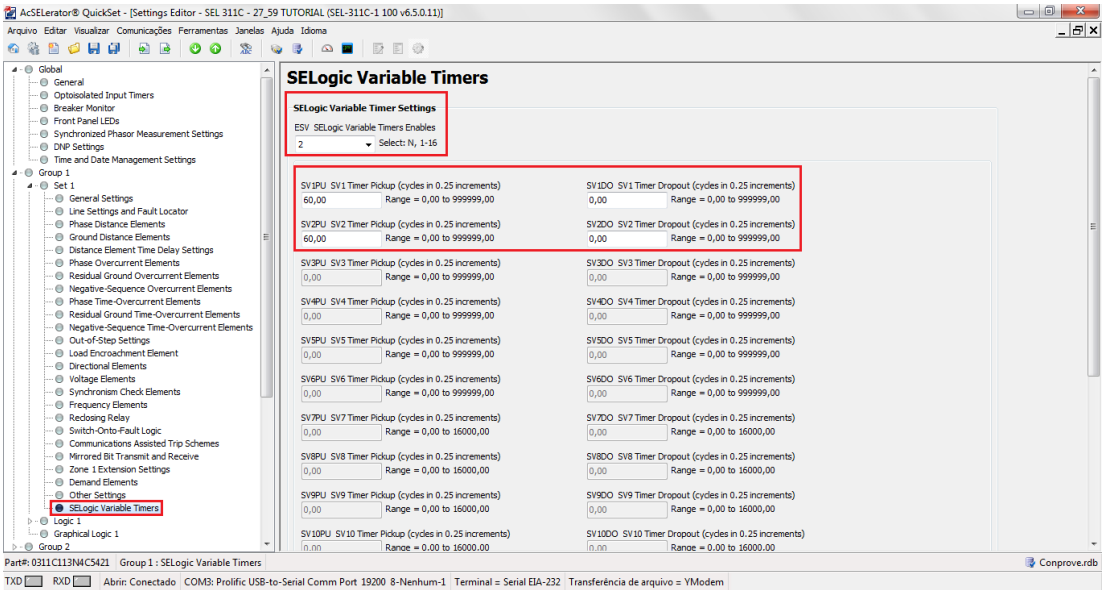

Figure 12

3.5. *SELogic Variable Timer Inputs*

Click next to *"Logic 1"* and select *"SELogic Variable Timer Inputs"* and adjust the signals *"3P59"* and *"3P27"* so that they are associated with the times set in the previous screen.

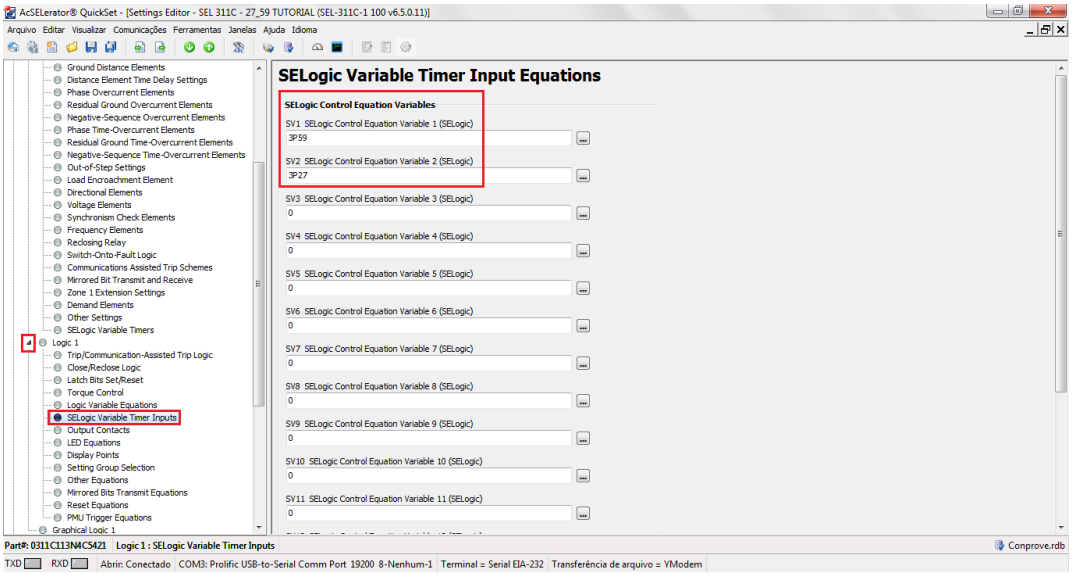

Figure 13

4. Binary Output Adjustments

4.1. *Output Contacts*

Select the *"Output Contacts"* option and make the following adjustments. At output 201 set the signal *"SV1T"* and at output 202 set the signal *"SV2T"*.

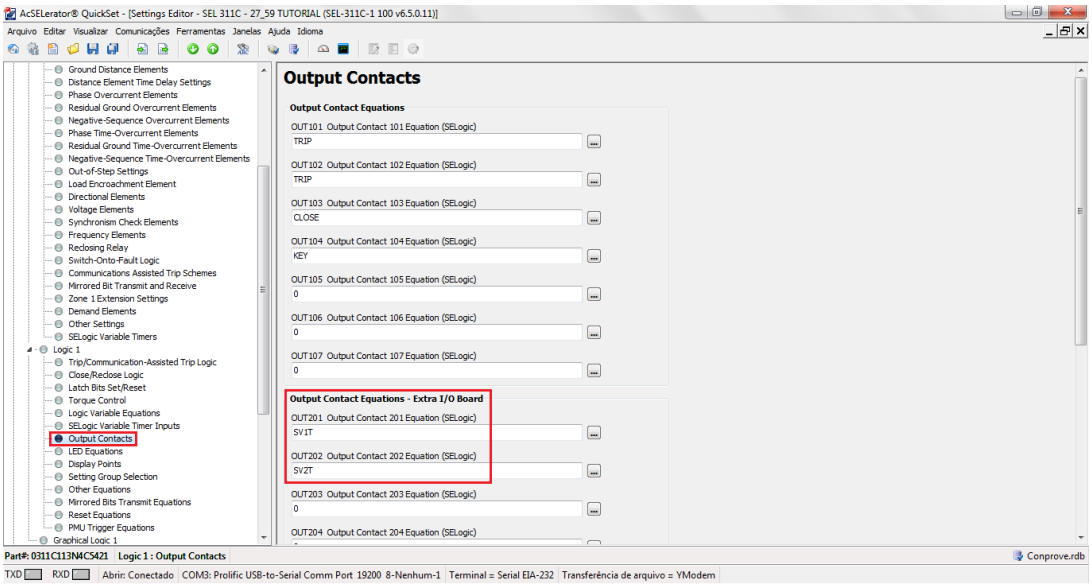

Figure 14

4.2. *Submitting the Settings*

Click the selected icon and submit at least the following adjustments.

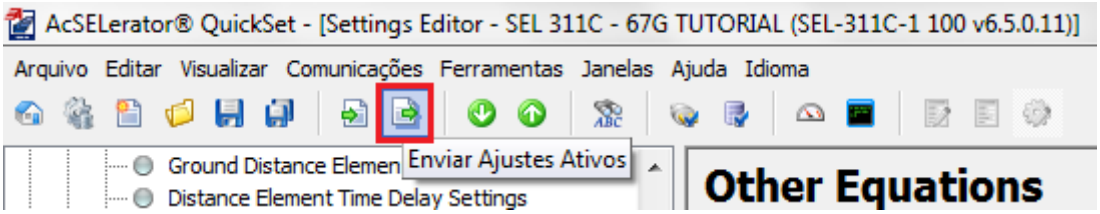

Figure 15

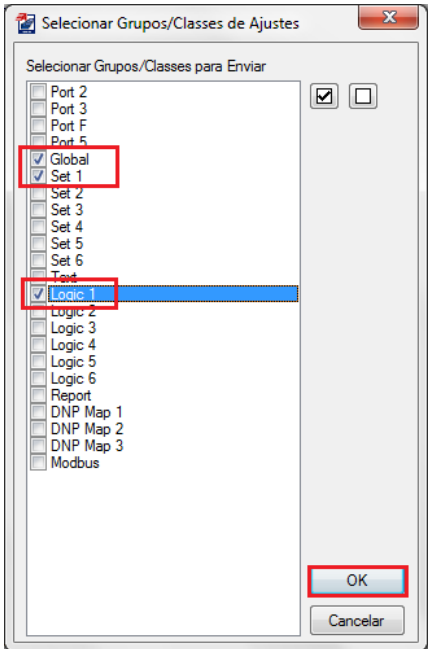

Figure 16

5. Quick software adjustments

5.1. *Opening Quick*

Click on the CTC application manager icon.

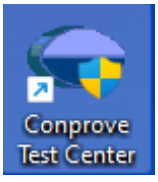

Figure 17

Click the Quick software icon.

Figure 18

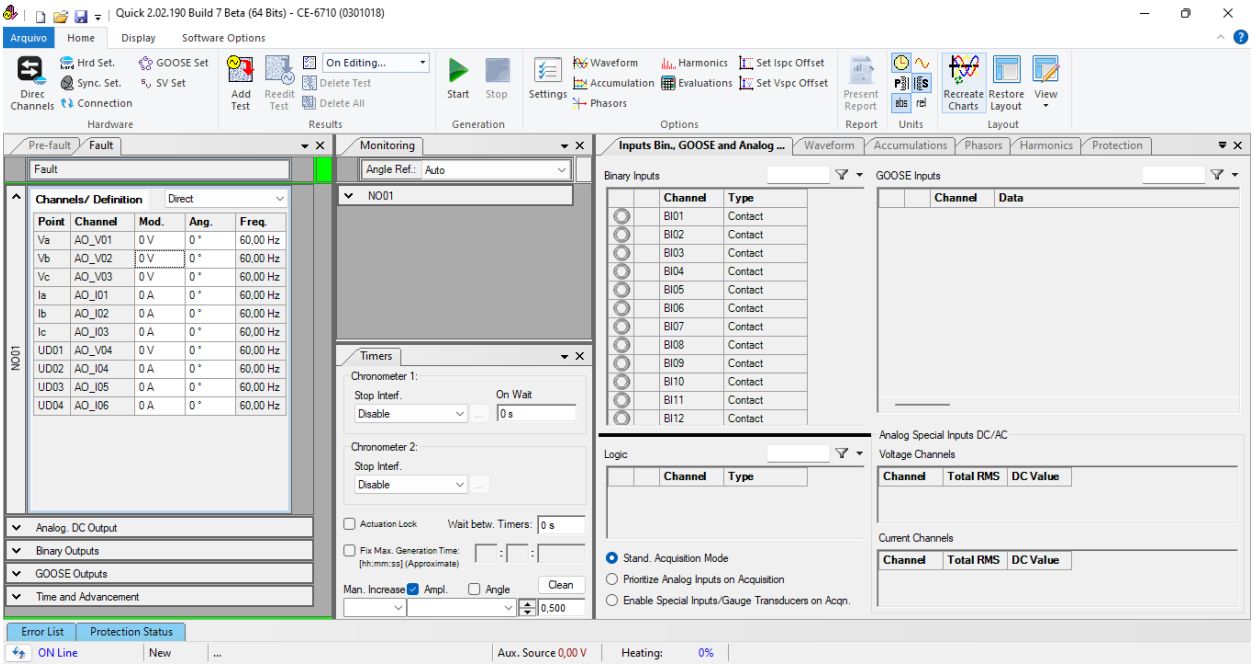

Figure 19

5.2. *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.

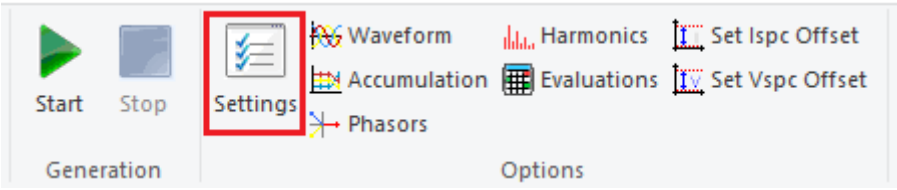

Figure 20

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.

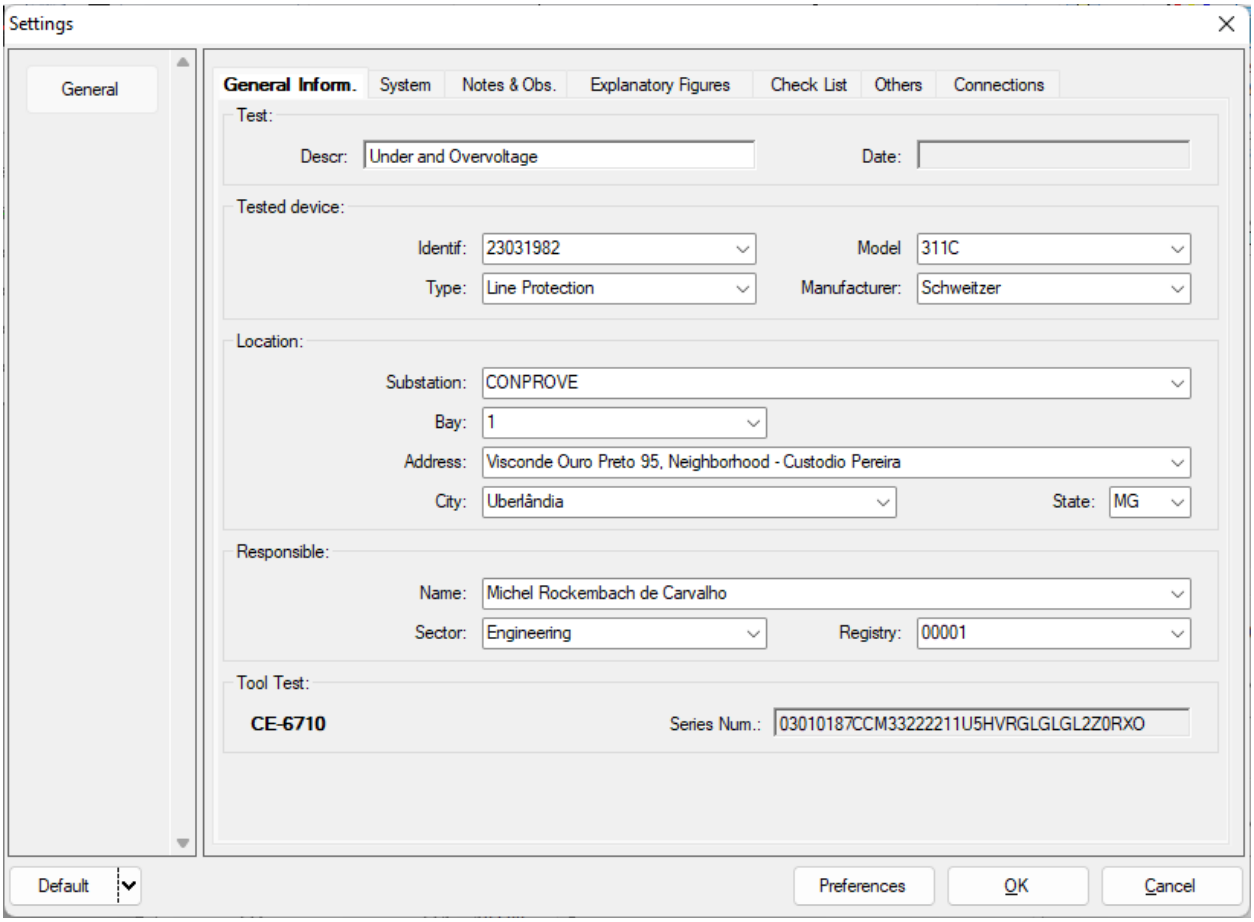

Figure 21

5.3. *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.

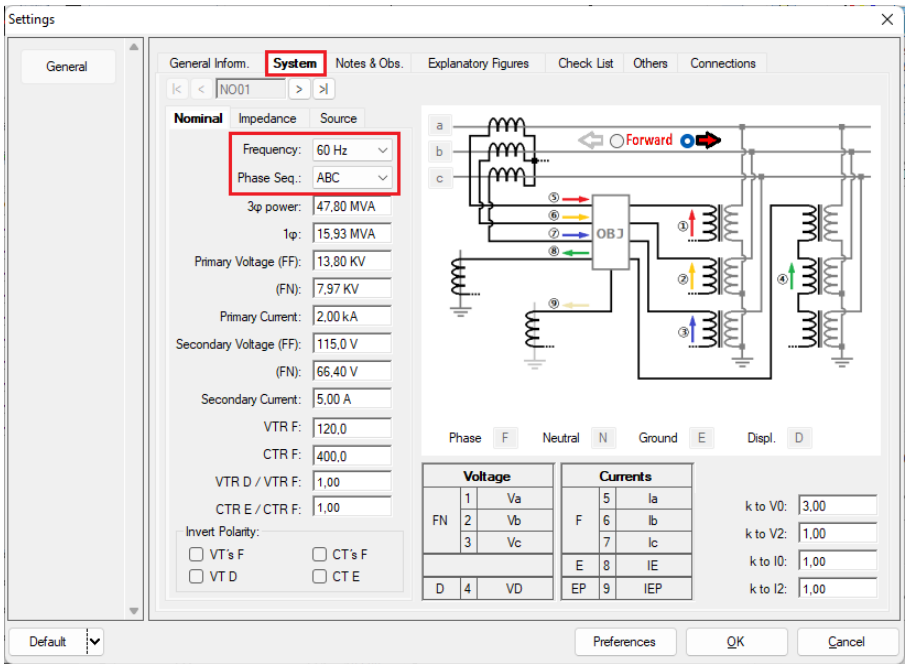

Figure 22

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.

6. Channel Direction and Hardware Configurations

Click on the icon illustrated below.

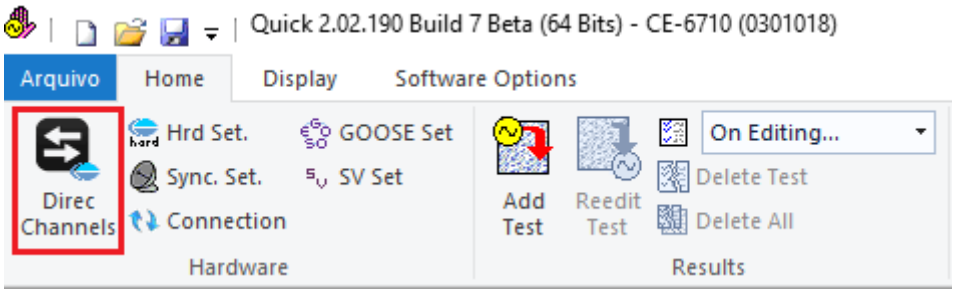

Figure 23

Then click on the highlighted icon to configure the hardware.

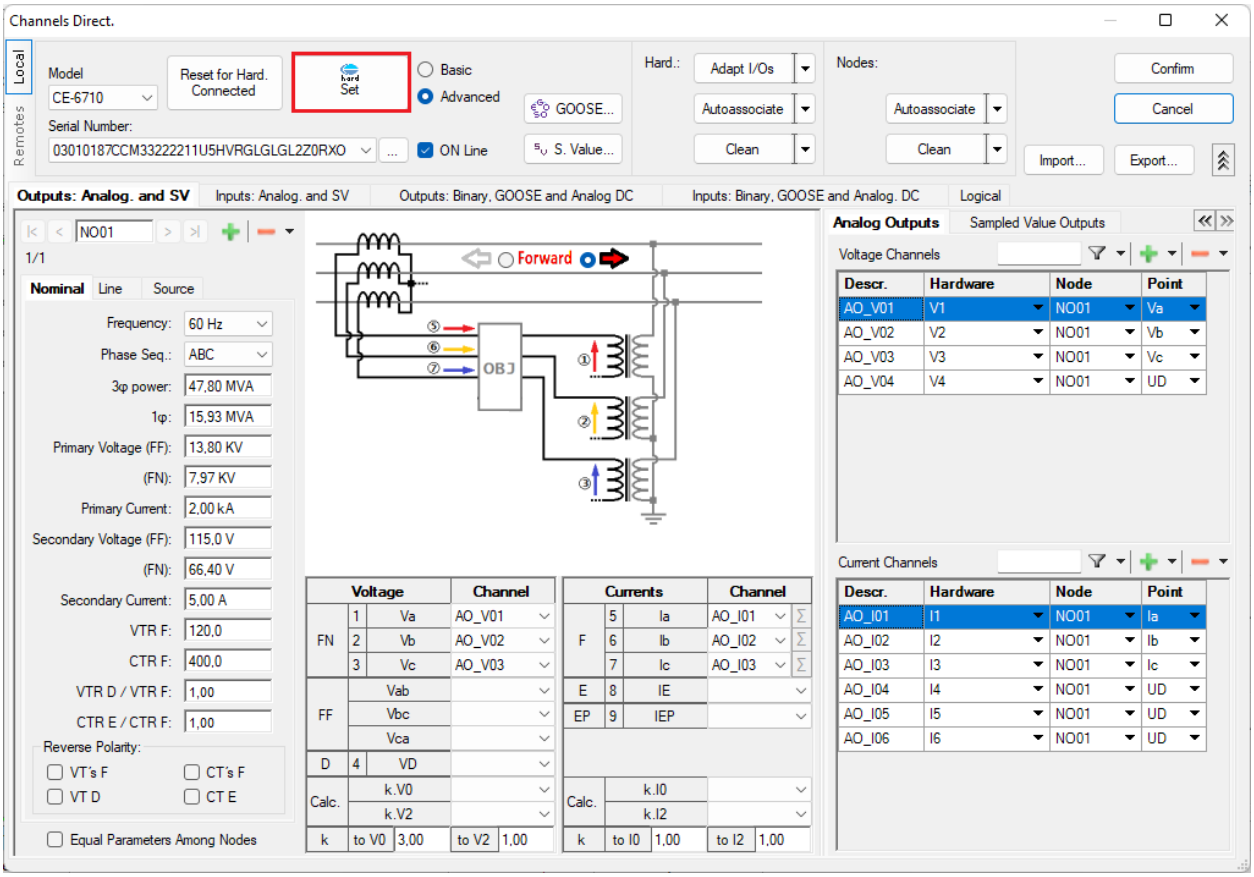

Figure 24

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

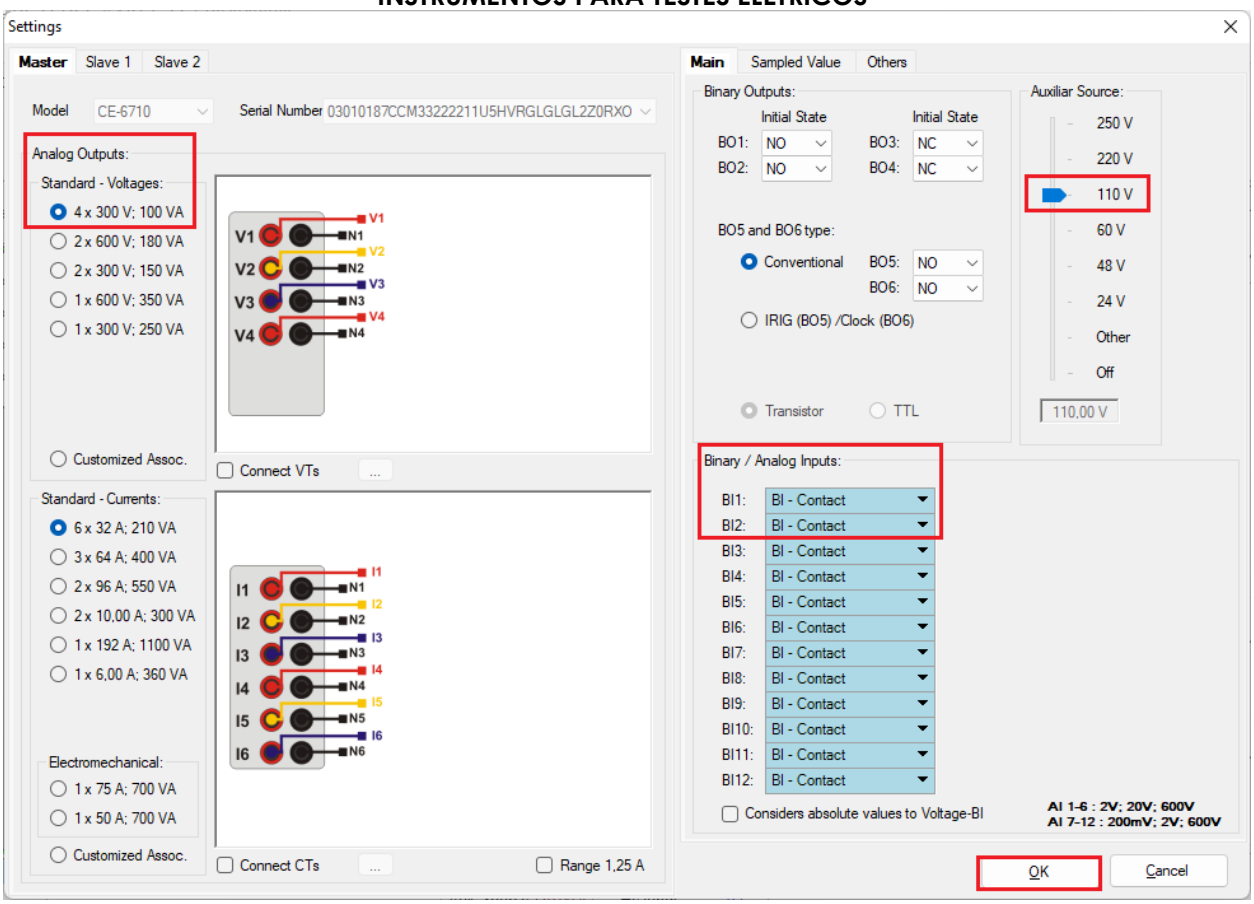

Figure 25

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

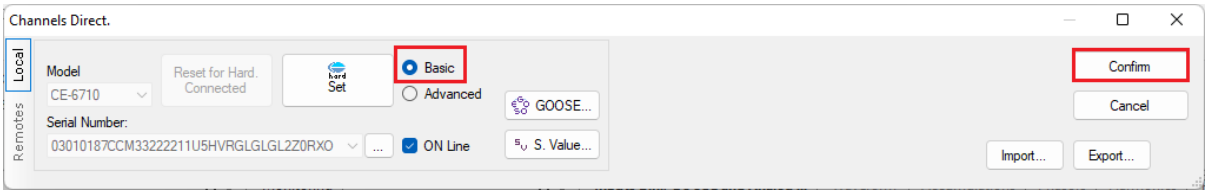

Figure 26

7. Test structure for function 27/59

7.1. *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.

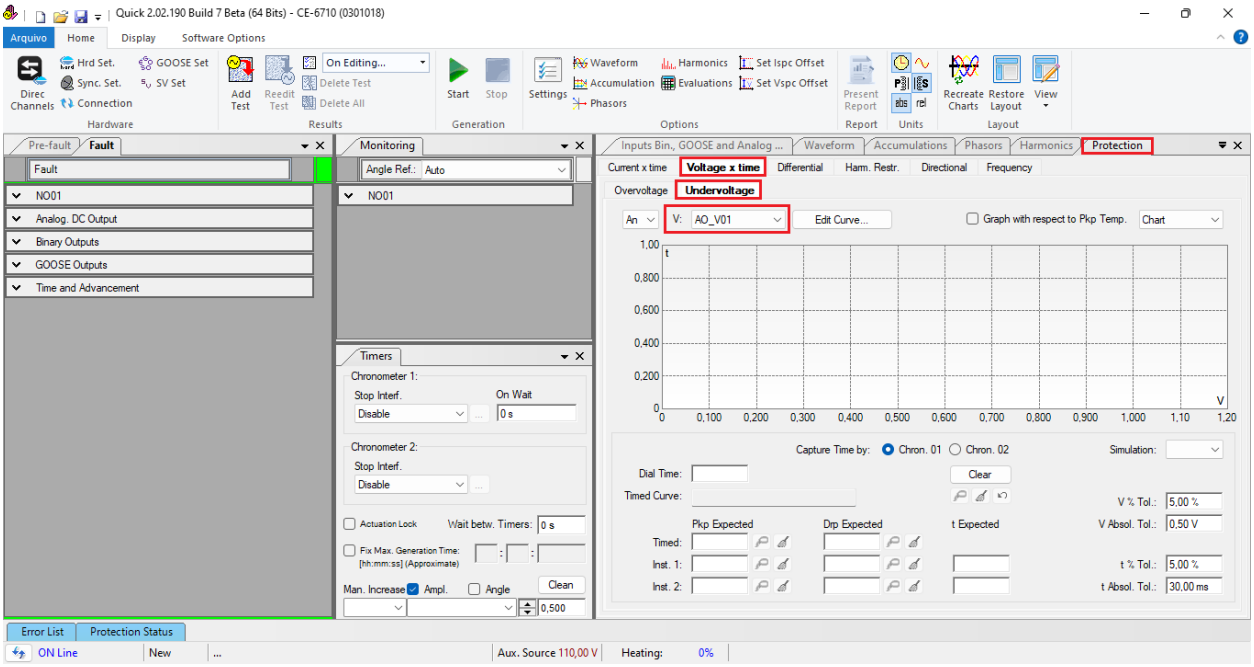

Figure 27

7.2. *General Settings 27*

According to the *"AcSELerator"* software settings, these values are entered in the *"Quick"* software. The adjustment of the pick-up of the element 27-1 is equal to 59.00V with actuation time equal to 1.0s. 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 faults.

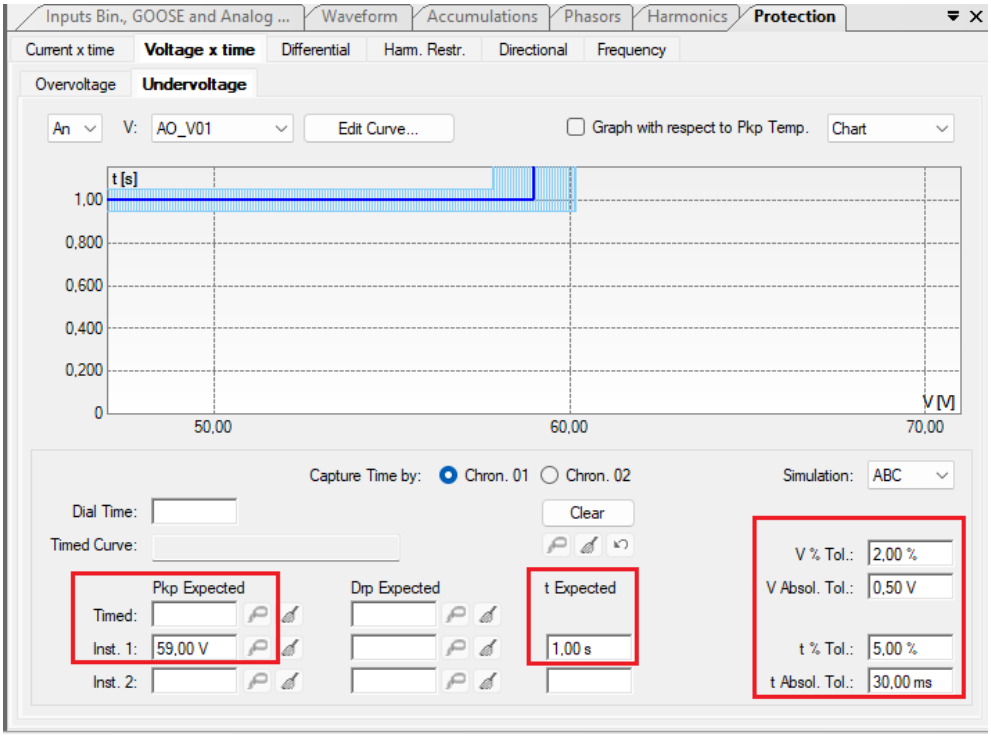

Figure 28

7.3. *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.

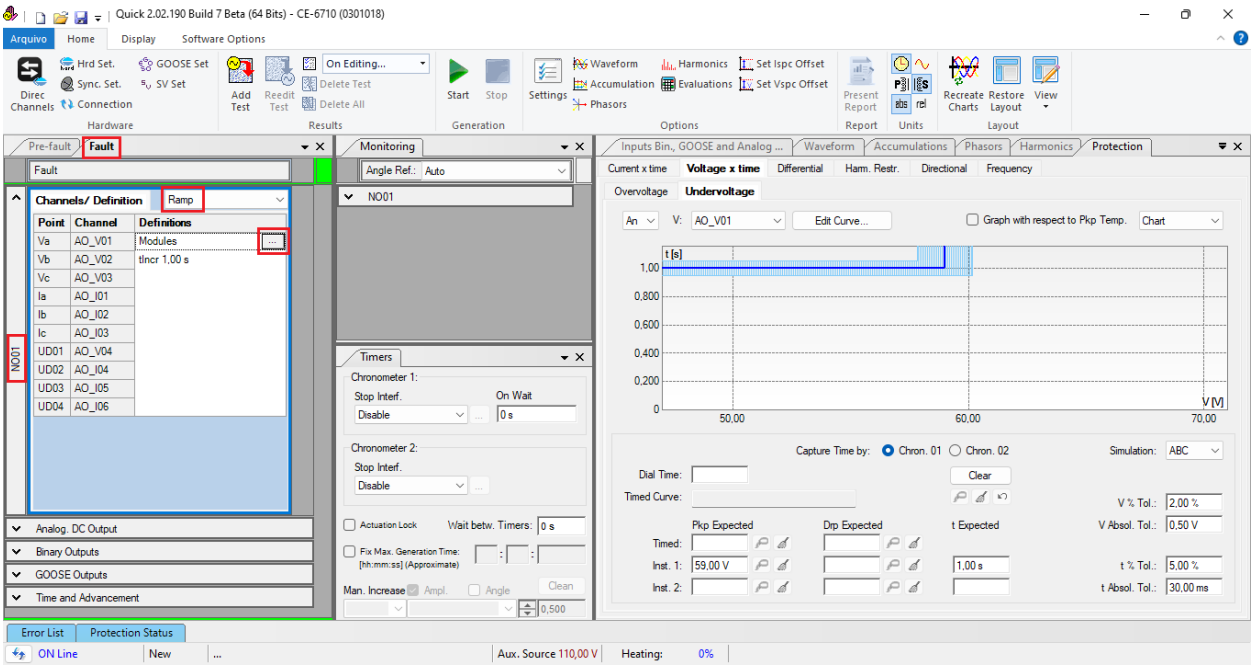

Figure 29

For the first channel, set the value of 59.6V, then right-click and choose the following options to configure the voltages as balanced three-phase with nominal rotation.

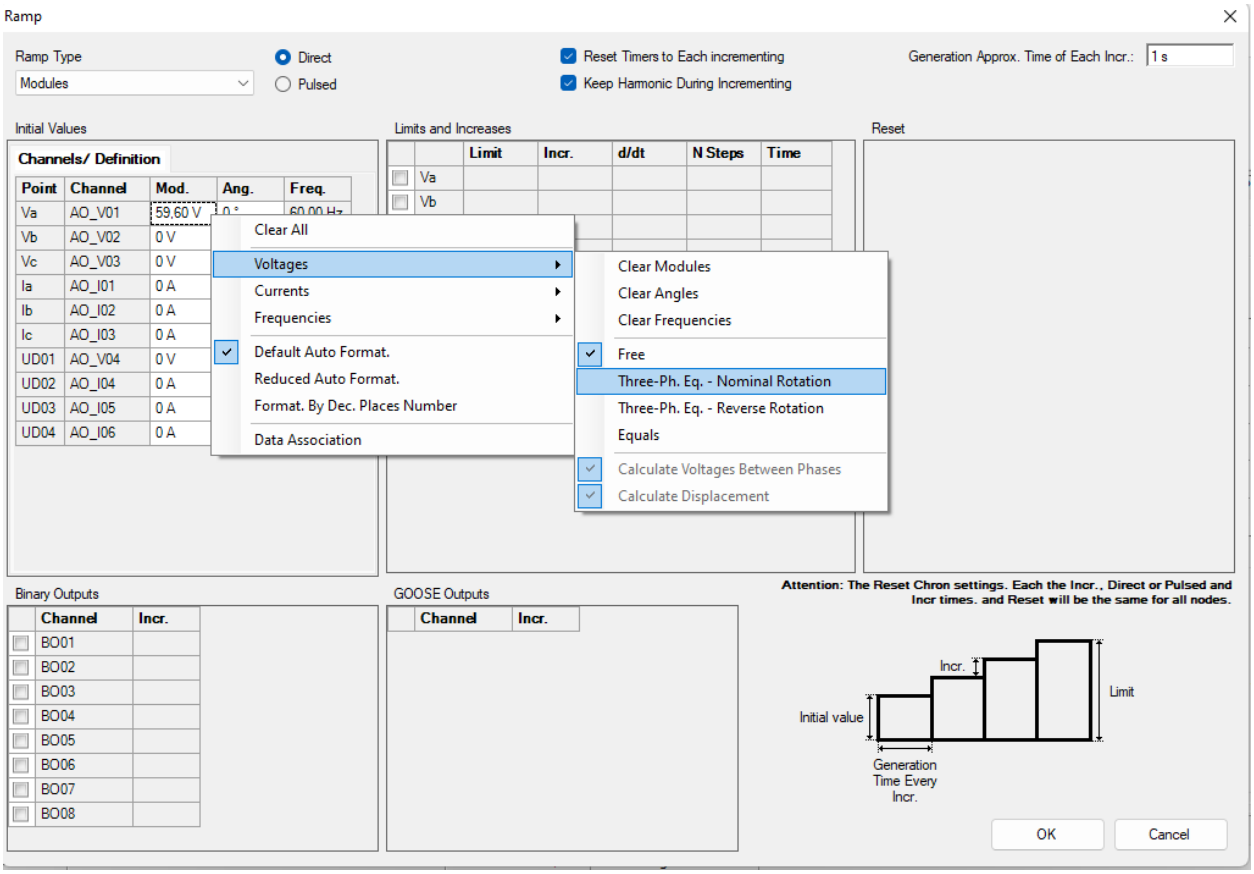

Figure 30

Select the *"Va"* channel and set the following threshold and decrement values. Change generation time for each increment to 2.0s.

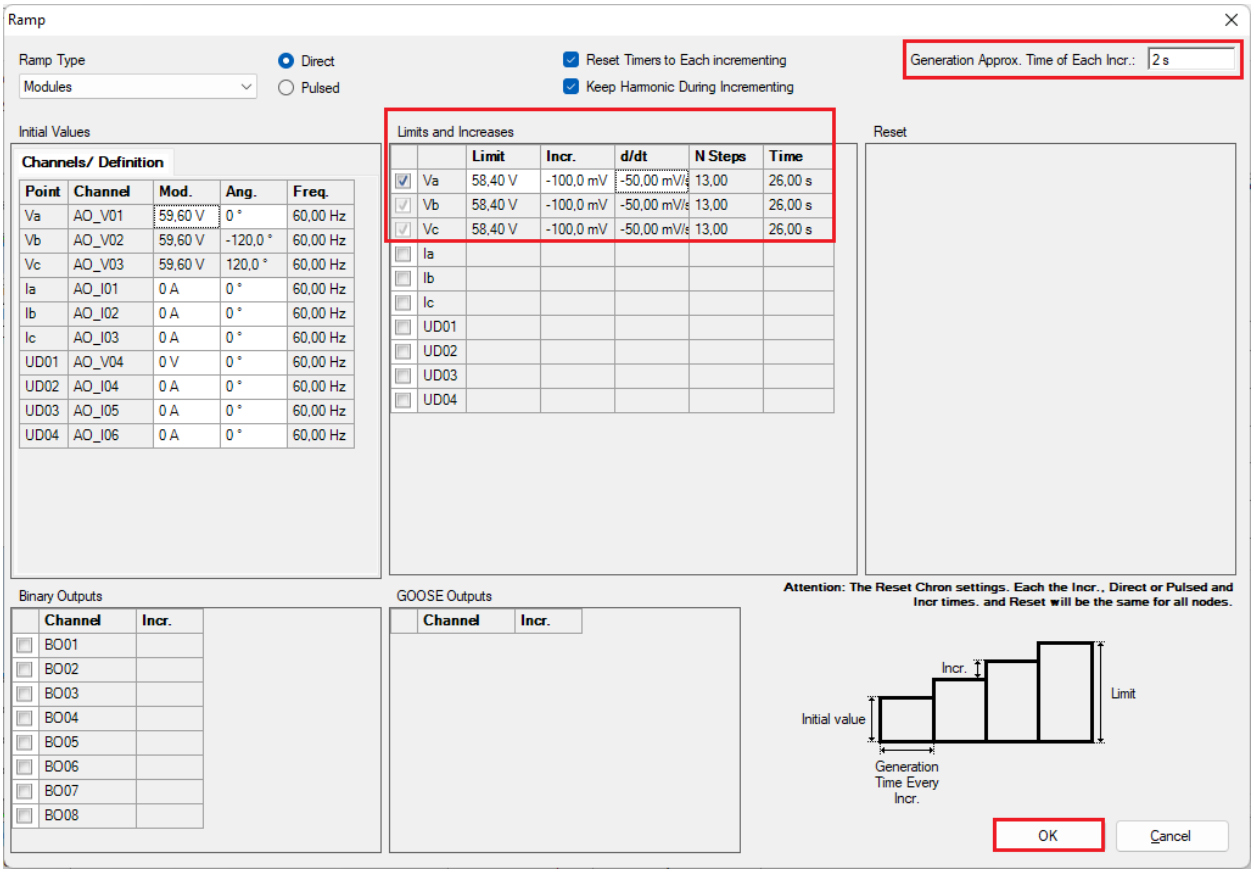

Figure 31

NOTE: An important detail is that pre-fault voltage must be entered so that function 27 drop-out 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.

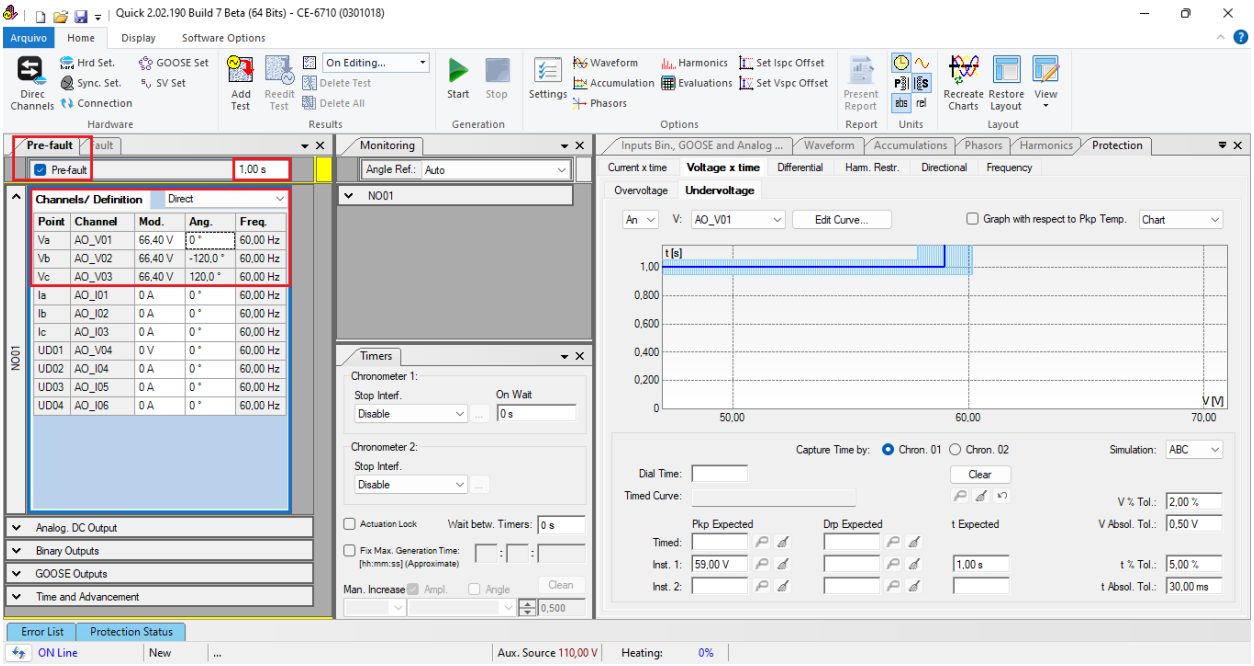

Figure 32

Choose the stop interface, which in this case is *"BI02"* and block the first actuation. Start the generation via the *"Start"* icon or using the shortcut *"Alt + G"*.

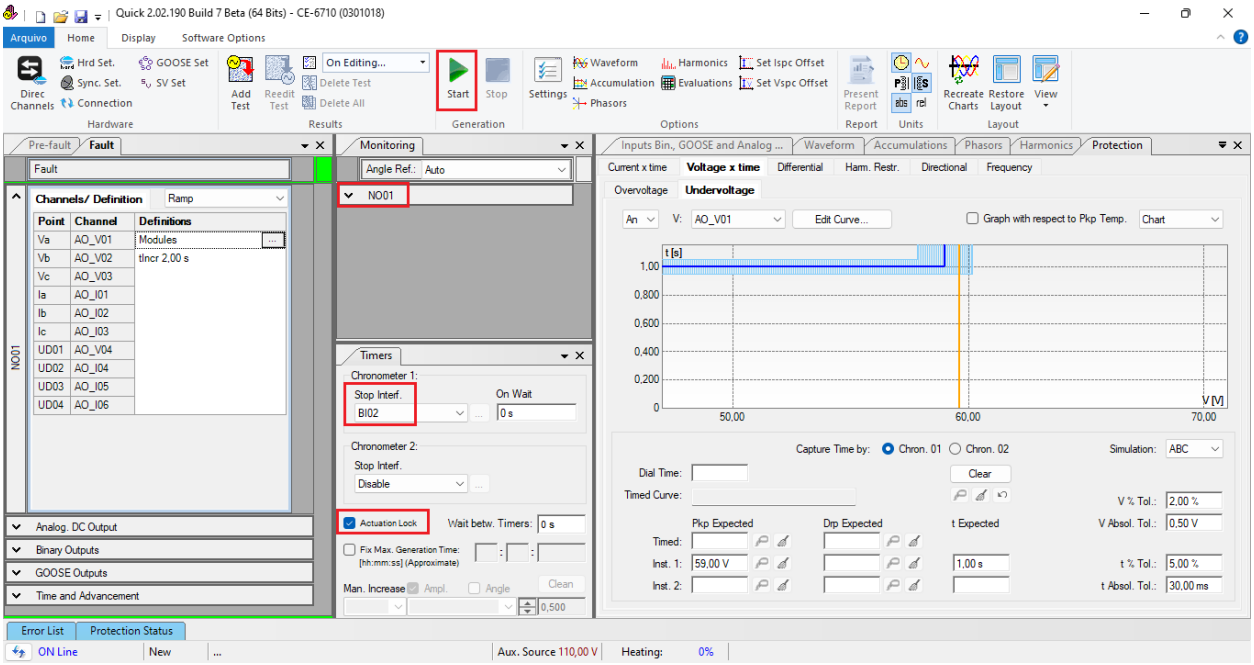

Figure 33

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.

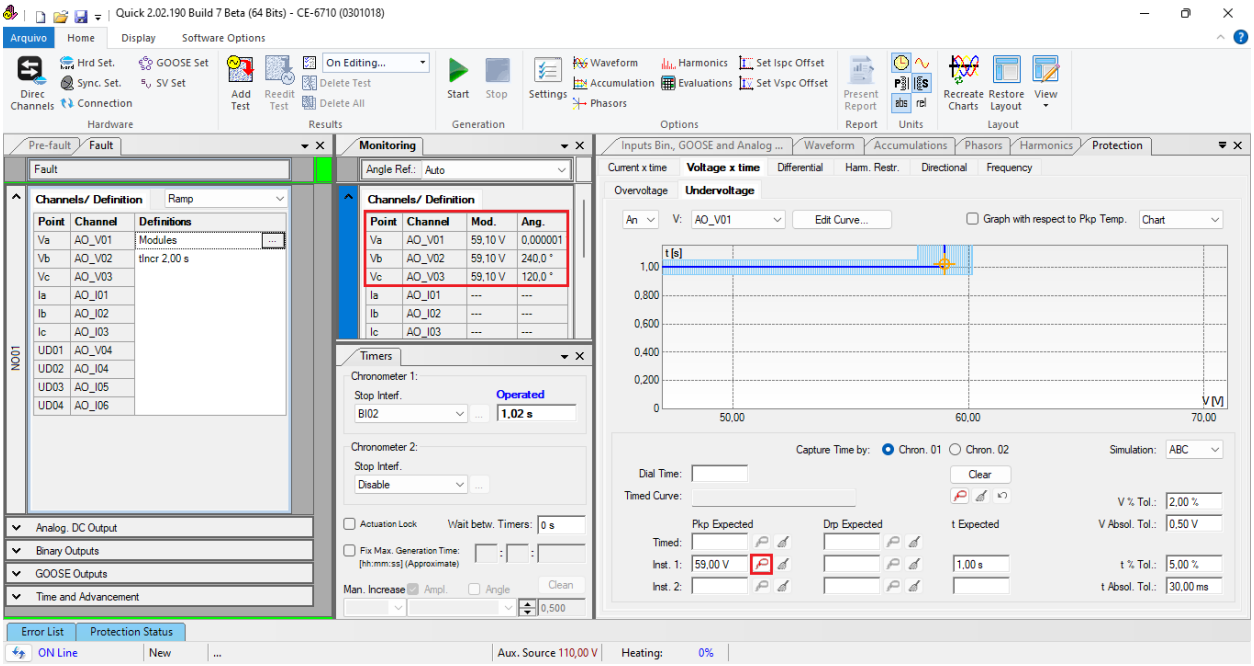

Figure 34

In this case, the pickup found was 59.10V, being within the tolerance range given by the relay manufacturer.

7.4. *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. The figure below shows the value of 55.00V already captured and the value of 50.00V to be captured. **NOTE: Remember to always block the first actuation**.

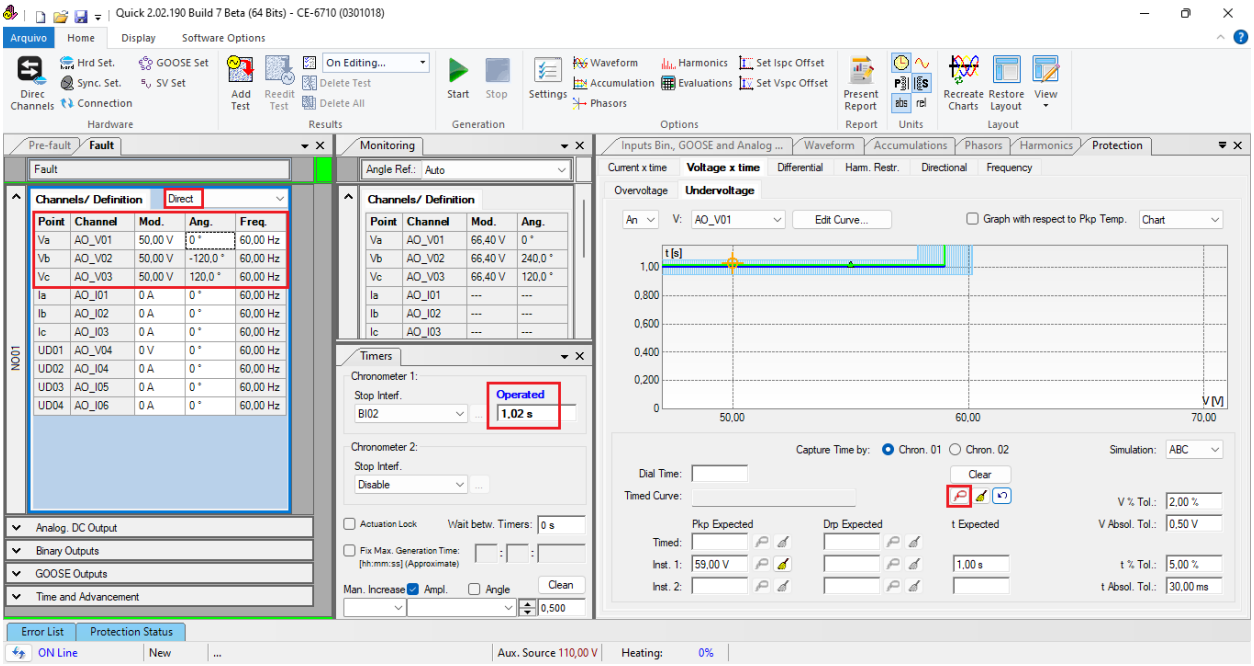

Figure 35

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

7.5. *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"* choose a node as a reference, in this case *"AO_V01"*. Only after choosing the channel the fields for setting function 59 become active.

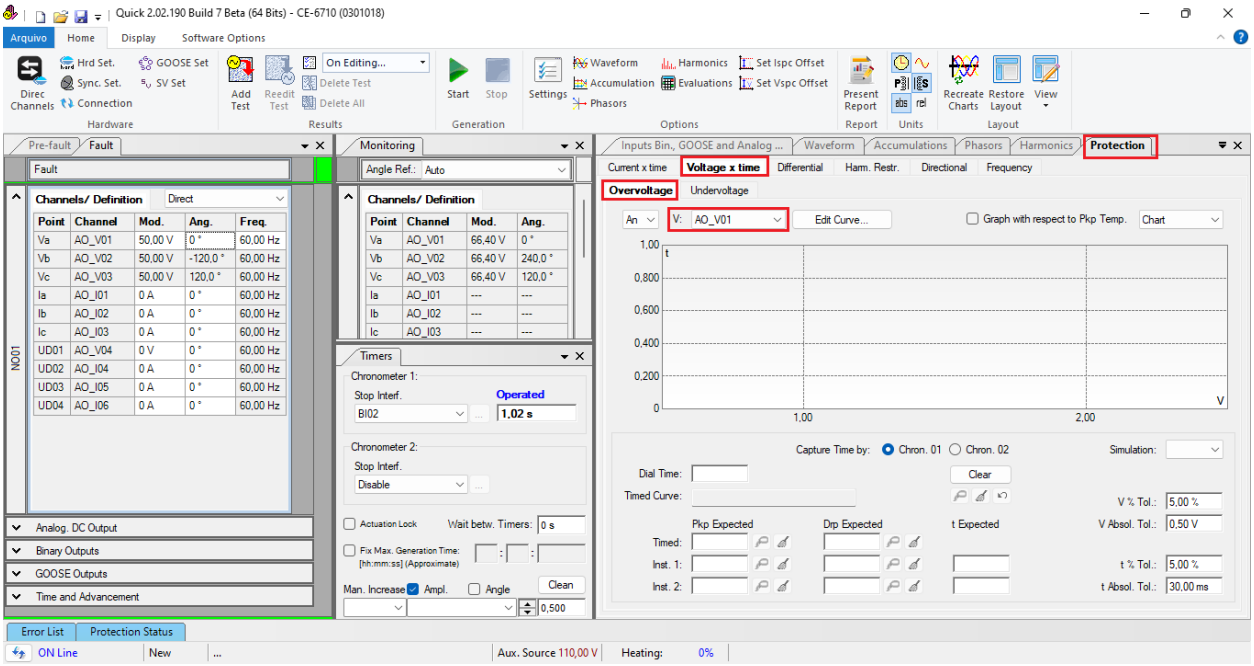

Figure 36

7.6. *General Adjustments 59*

According to the *"AcSELerator"* software settings, these values are entered in the *"Quick"* software. Adjust the pick-up of element 59-1 equal to 69.00V with actuation time equal to 1.0s.

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.

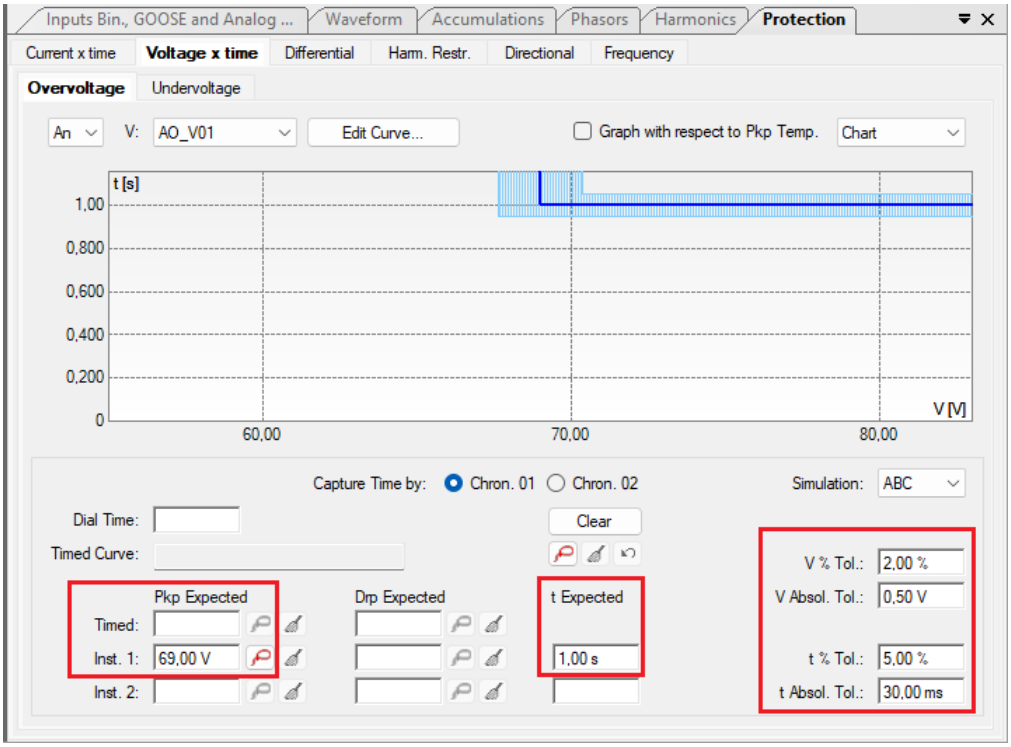

Figure 37

7.7. *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 > N01"* tabs and click on the highlighted icon.

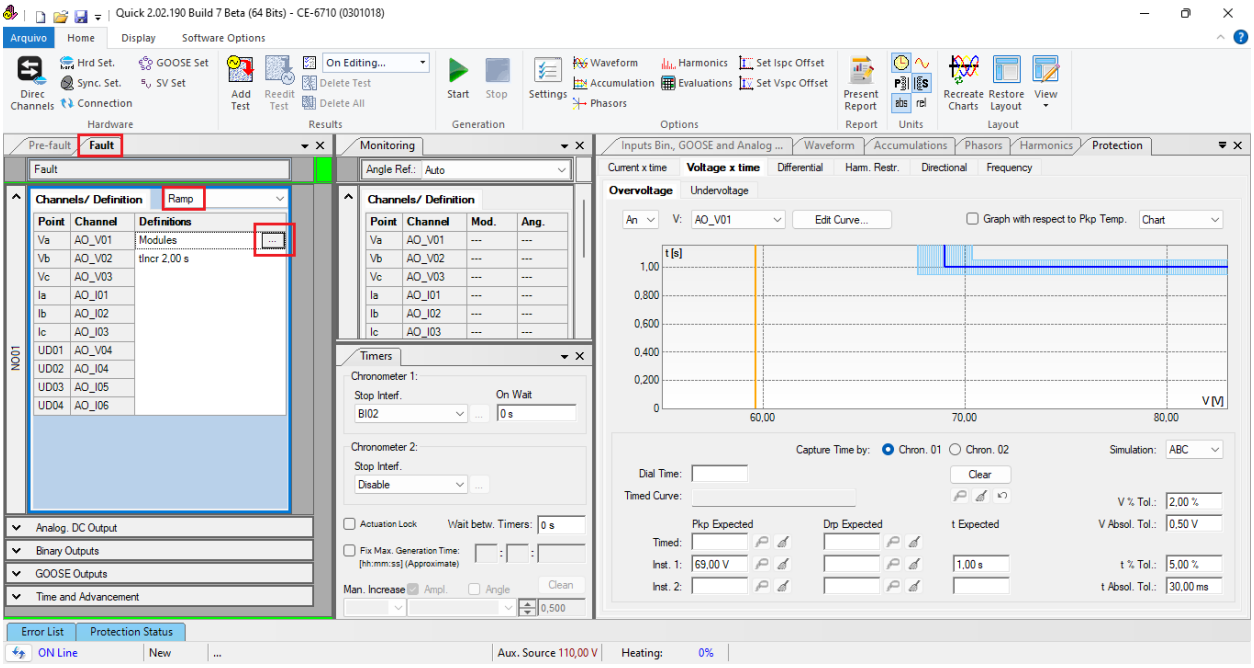

Figure 38

For the initial value, set 68.40V, for limit value 69.60V, with an increment of 100mV and a time of each increment as 2.0s.

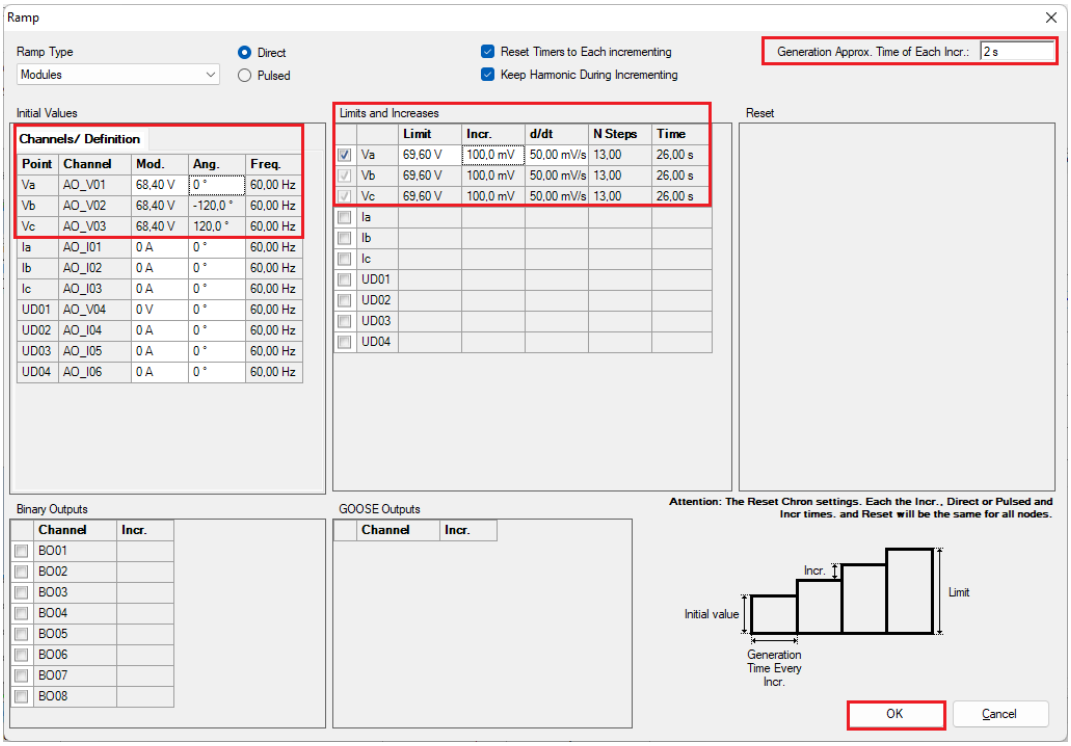

Figure 39

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"*.

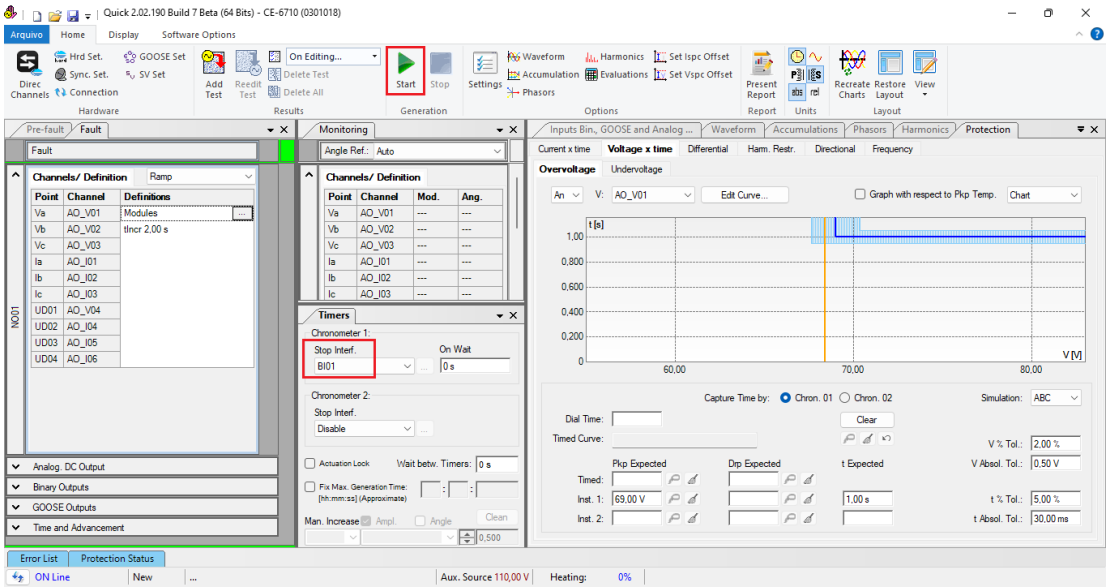

Figure 40

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

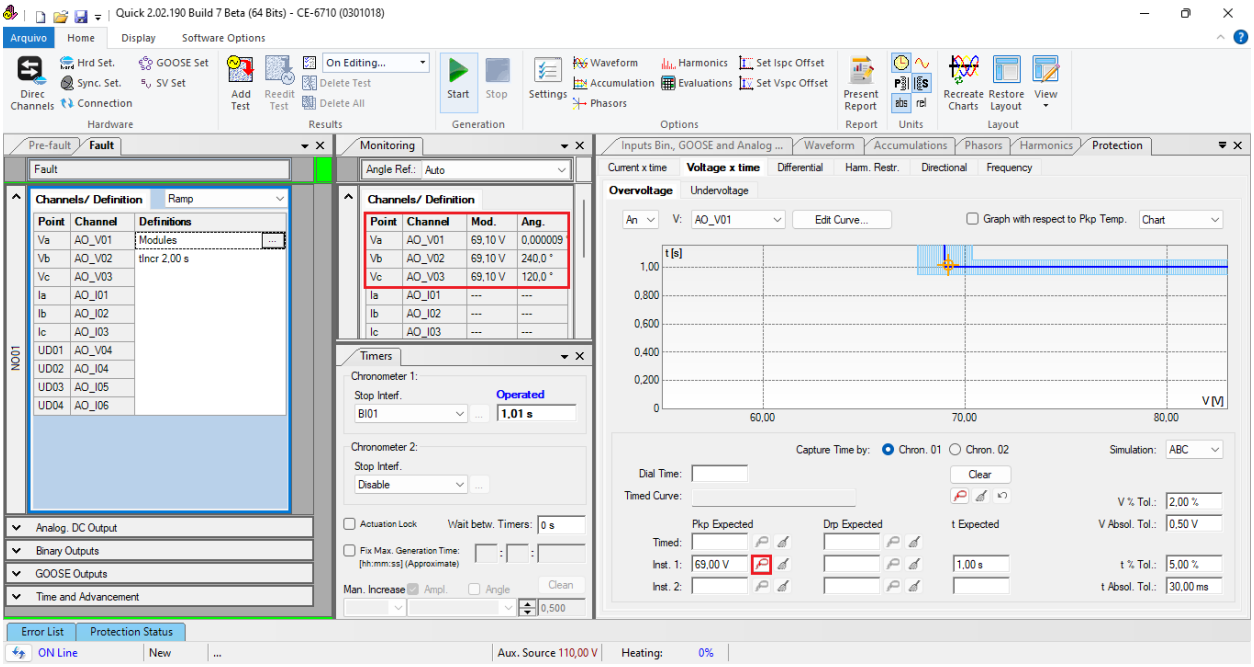

Figure 41

In this case, the pickup found was 69.10V, being within the tolerance range given by the relay manufacturer.

7.8. *Element 59-1 point test*

To check the operating time of element 59-1, remove the *"Ramp"* by choosing the *"Direct"* option and inject voltage values above the pick-up value. The figure below shows the value of 75.00V already captured and the value of 80.00V to be captured.

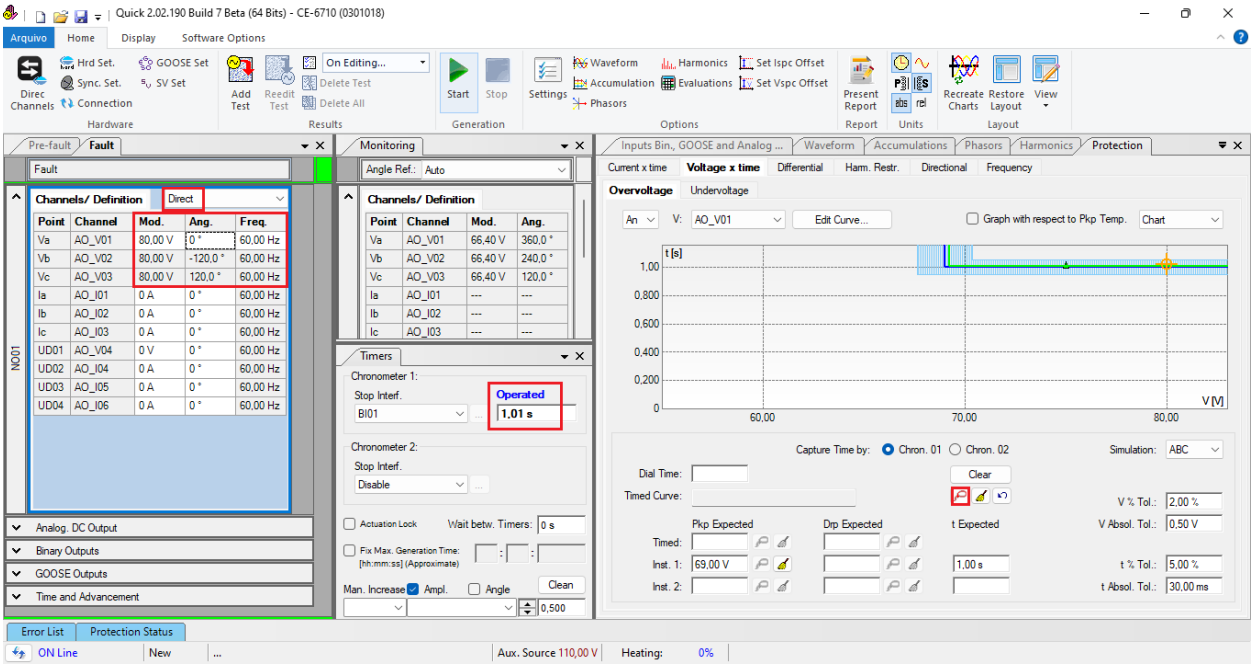

Figure 42

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

8. 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"*.

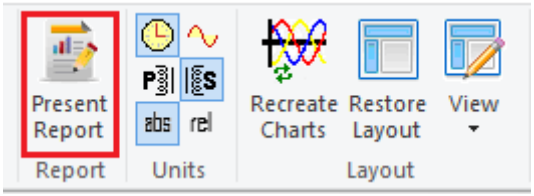

Figure 43

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

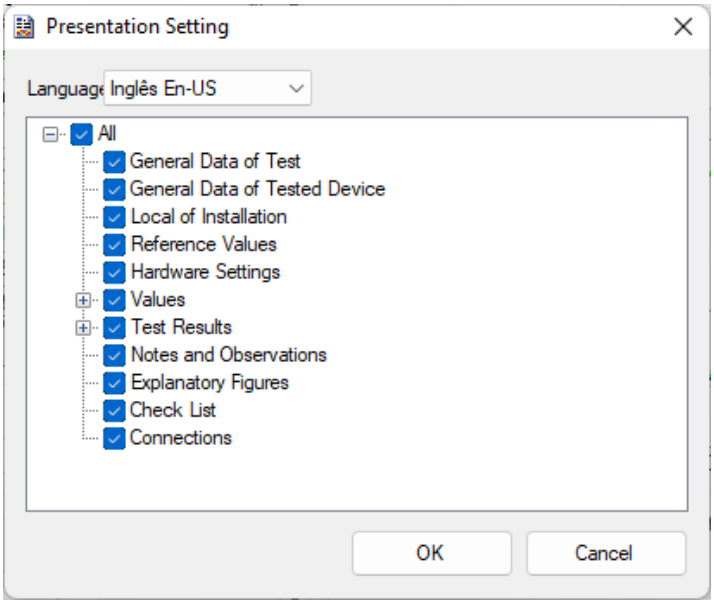

Figure 44

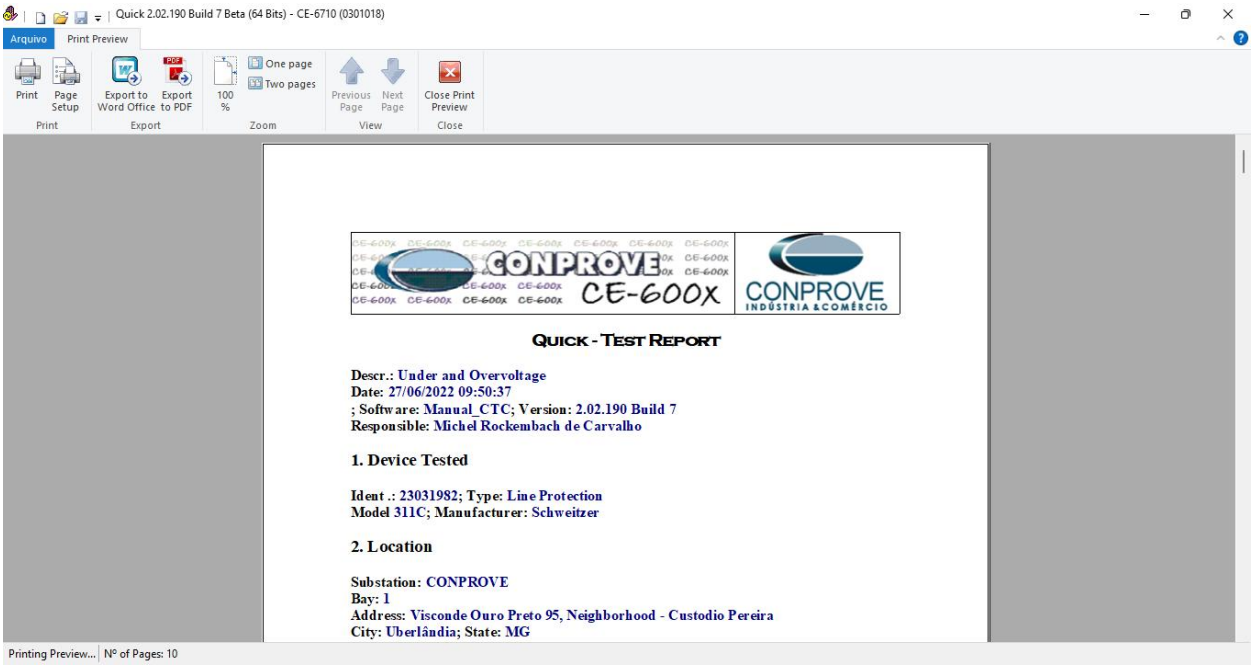

Figure 45

APPENDIX A

A.1 Terminal Designations

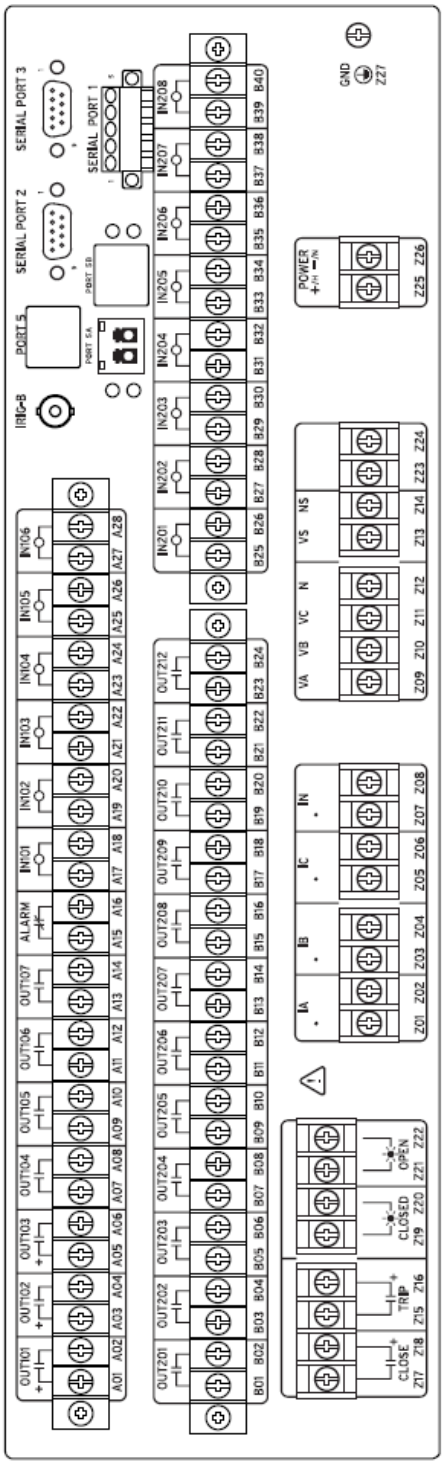

Figure 46

A.2 Technical data

Under- and Overvoltage Elements

Pickup Ranges

Wye-Connected (Global setting PTCONN = WYE):	0.00–200.00 V, 0.01 V steps (negative-sequence element) 0.00–300.00 V, 0.01 V or 0.02 V steps (various elements) 0.00–520.00 V, 0.02 V steps (phase-to-phase elements)
Open-Delta Connected (when available, by Global setting PTCONN = DELTA):	0.00–120.00 V, 0.01 V steps (negative-sequence elements) 0.00–170.00 V, 0.01 V steps (positive-sequence element) 0.00–300.00 V, 0.01 V steps (various elements)
Steady-State Pickup Accuracy:	±0.5 V plus ±1% for 12.5–300.00 V (phase and synchronizing elements) ±0.5 V plus ±2% for 12.5–300.00 V (negative-, positive-, and zero-sequence elements, phase-to-phase elements)
Transient Overreach:	±5% of pickup

APPENDIX B

Equivalence of software parameters and the relay under test.

Table 1

Quick Software		SEL 311C Relay	
Parameter	**Figure**	**Parameter**	**Figure**
Overvoltage			
Pkp_Instant. 1	37	59P Phase Overvoltage Pickup	11
Time_ Instant. 1	37	SV1PU SV1 Timer Pickup	12
Undervoltage			
Pkp_Instant. 1	28	27P Phase Undervoltage Pickup	11
Time_ Instant. 1	28	SV2PU SV2 Timer Pickup	12