



INSTRUMENTOS PARA TESTES ELÉTRICOS

Test Tutorial

Equipment Type: Protection Relay

Brand: General Electric -GE

Model: SR 469

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	29/06/2022	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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Sequence for testing the SR 469 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 pin H12 on the relay terminal and the negative (black terminal) of the Auxiliary Source pin H11 of the relay terminal.

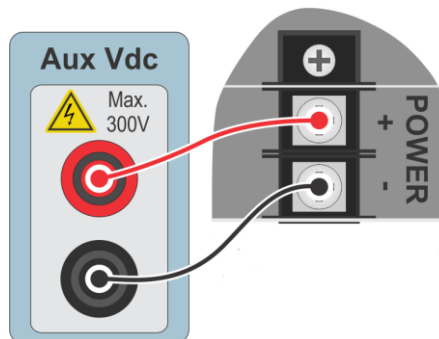


Figure 1

1.2 Voltage Coils

To establish the connection of the voltage coils, connect the voltage channels V1, V2 and V3 to the relay pins G2, H1 and H2 respectively, connecting the three common ones to the G1 pin.

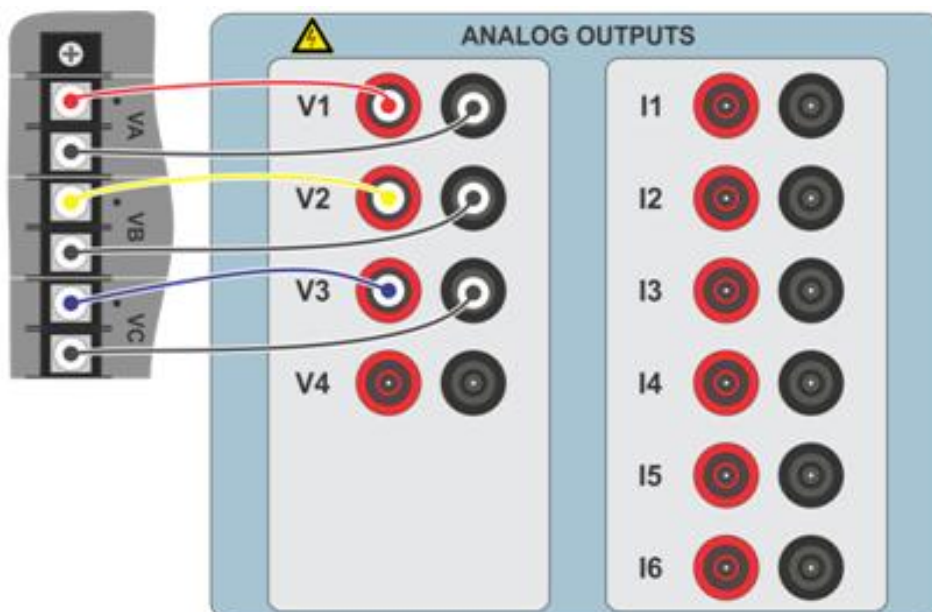


Figure 2

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1.3 Binary Inputs

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

- BI1 to pin E2 and its common to pin F1.
- BI2 to pin F5 and its common to pin E6.

The figure below shows the detail of this connection.

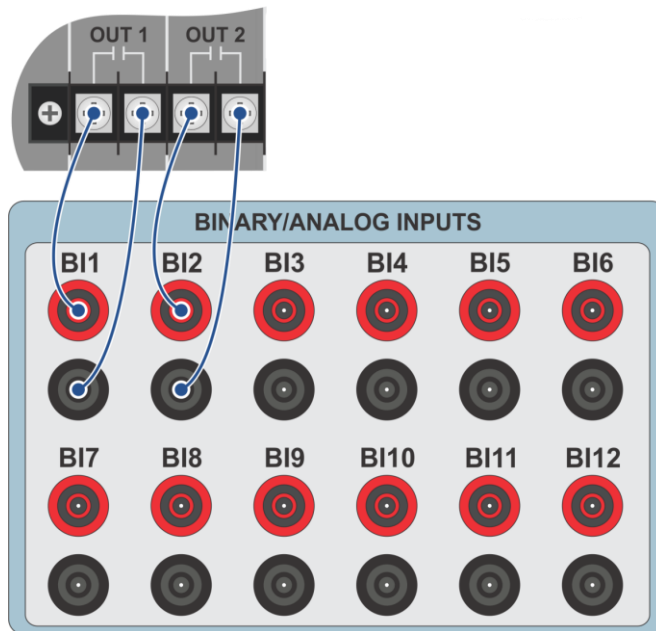


Figure 3

1.4 Access

To gain access to the relay parameters without the need to use a password, short circuit pins C1 and C2.

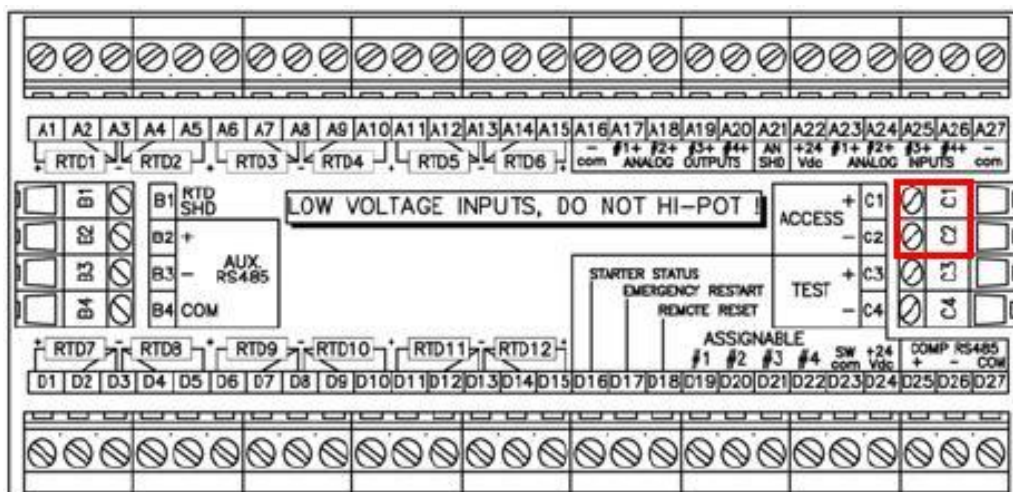


Figure 4

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2. Communication with the SR 469 relay

Before starting the test, open the “EnerVista” software and download the SR 469 relay software, if you already have it, click on the icon below:



Figure 5

In the “EnerVista SR 469” software select: “Communications → Quick Connect”.



Figure 6

On the next screen choose the serial option, check which port is being used (in this case COM 1) and “Baud Rate” choose 9600.

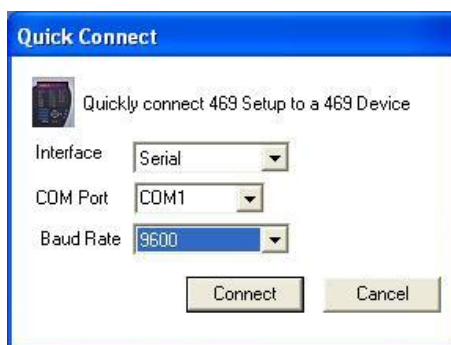


Figure 7

Then click on “Connect”. The following figure shows the message after connecting.

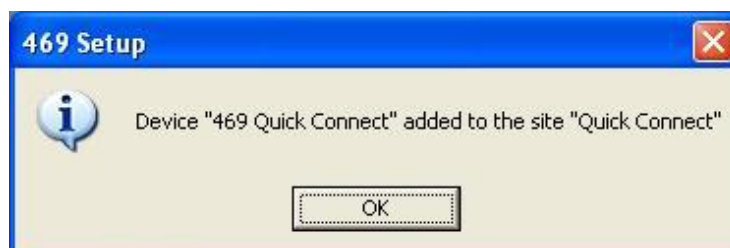


Figure 8

3. SR 469 Relay Settings

3.1 469 Quick Connect

General relay settings will be available after clicking the “+” signs next to “Quick Connect” and “469 Quick Connect” as shown below.

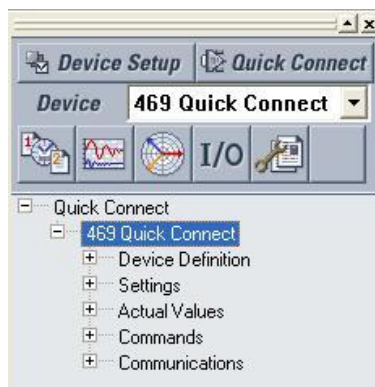


Figure 9

3.2 System Setup

The next step is to configure the voltage, current, rated frequency, potential and current transformer transformation ratio as well as the phase sequence. To do this click on the “+” signs next to “Settings” and “System Setup”.

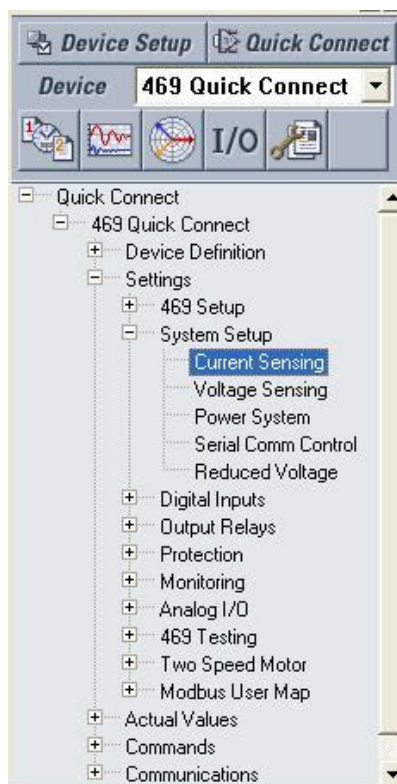


Figure 10

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3.3 Current Sensing

With a double click on “*Current Sensing*” the window below will open. In this screen, the values of the CT, the rated current of the motor are adjusted and the option to enable two speeds for the motor must be turned off.

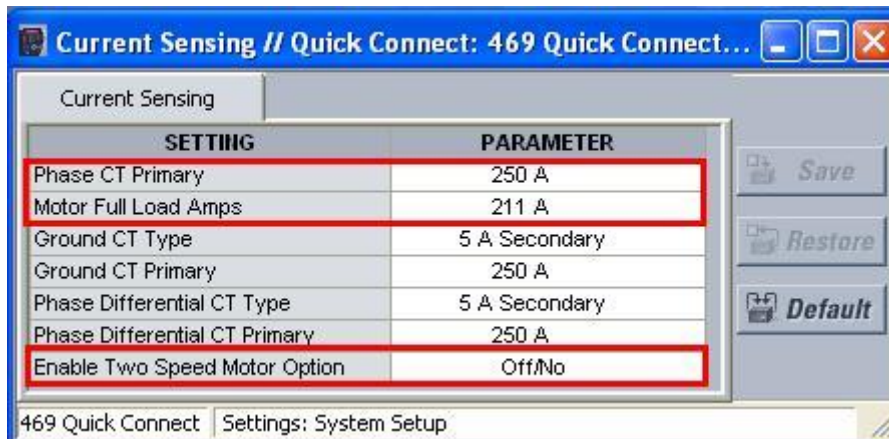


Figure 11

After the necessary modifications click on “*Save*” and in the following message click on “*Yes*”. (This process must be repeated whenever a change is made to any parameter).

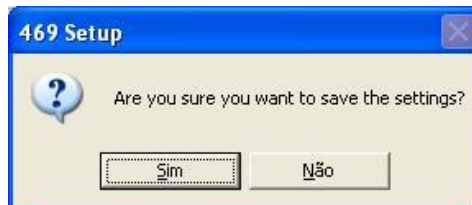


Figure 12

3.4 Voltage Sensing

Now double click on “*Voltage Sensing*” the following screen should be adjusted. In this screen, the type of connection with the PT, the transformation ratio (3300/115 = 28.69) and finally the rated voltage of the motor are set.

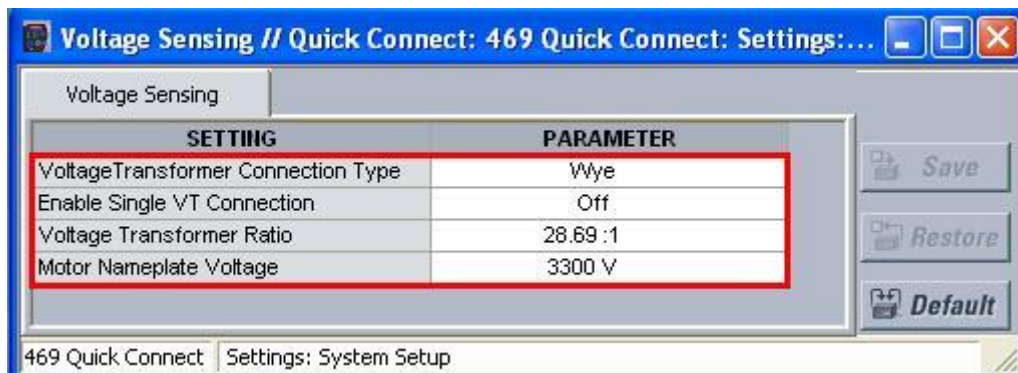


Figure 13

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3.5 Power System

With a double click on “*Power System*” the nominal frequency and the phase sequence can be adjusted.

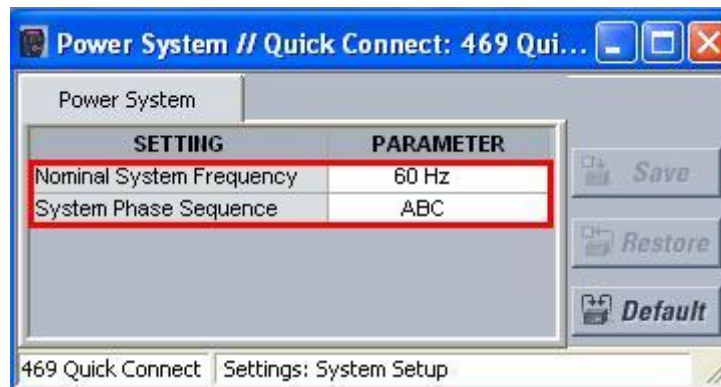


Figure 14

3.6 Voltage Elements

The next step is to configure the voltage protection data for the motor. To do this click on the “+” signs next to “*Protection*” and “*Voltage Elements*”.

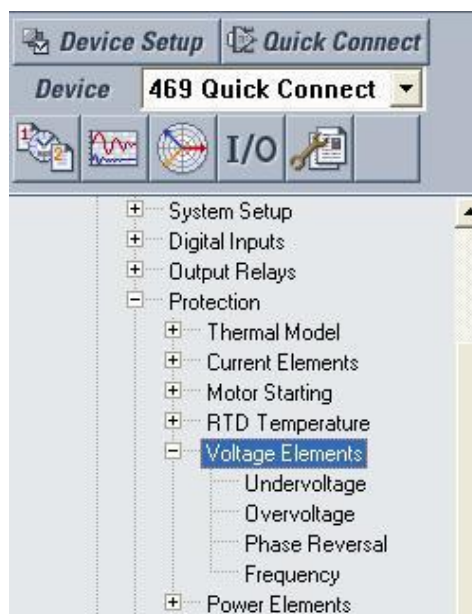


Figure 15

3.7 Undervoltage

With a double click on “*Undervoltage*”, the pick-up values of the two undervoltage elements and the actuation time of each one are adjusted.

- Element 27-1 with adjustment of 0.85 x Rated, that is, $0.85 \times 66.4 = 56.44\text{V}$ with actuation time of 2.0 seconds and with the binary output set to ALARM.
- Element 27-2 with setting of 0.70 x Rated, that is, $0.70 \times 66.4 = 46.48\text{V}$ with actuation time of 1.0 second and binary output set to TRIP.

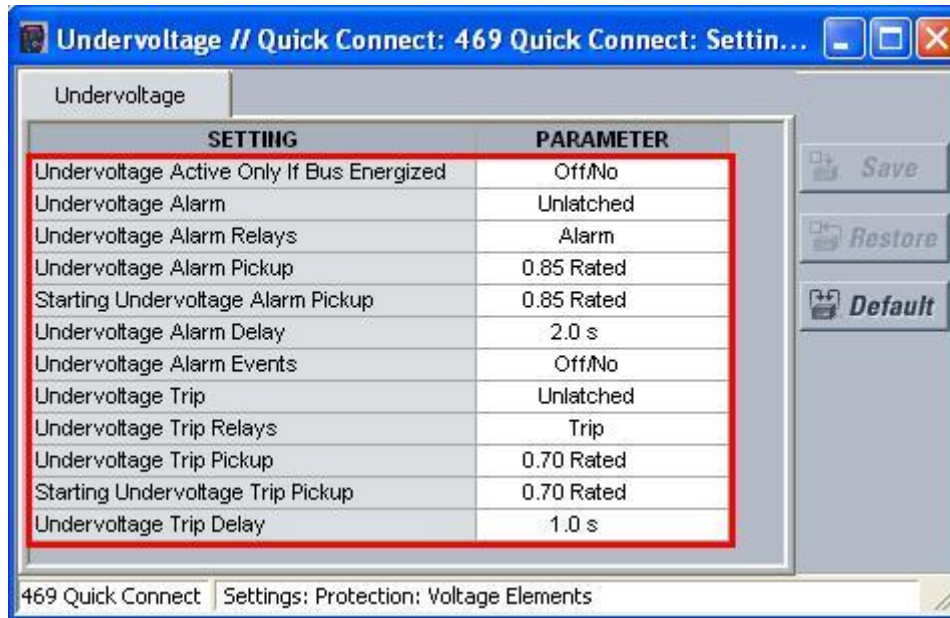


Figure 16

3.8 Overvoltage

With a double click on “Overvoltage” the pick-up values and the binaries responsible for the stopwatch are adjusted.

- Element 59-1 with setting of 1.05 x Rated, that is, $1.05 \times 66.4 = 69.72\text{V}$ with actuation time of 2 seconds and with the binary output set to ALARM.
- Element 59-2 with a setting of 1.20 x Rated, that is, $1.20 \times 66.4 = 79.68\text{V}$ with an actuation time of 1 second and the binary output set to TRIP.

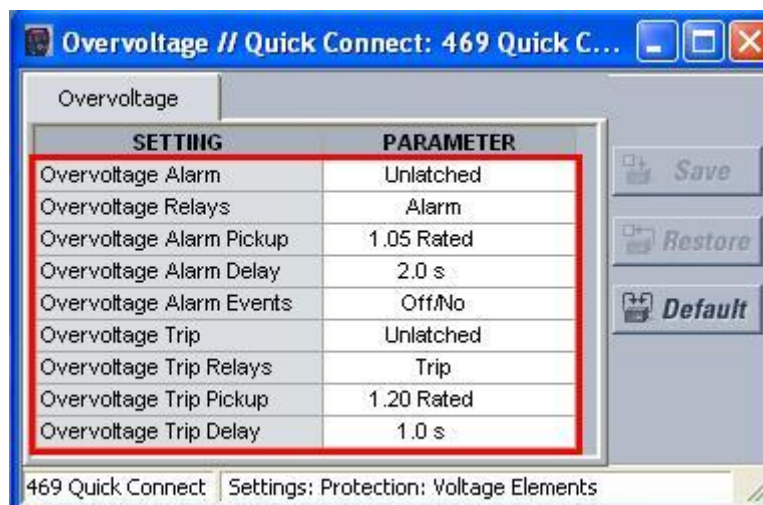


Figure 17

4. Quick software adjustments

4.1 Opening Quick

Click on the CTC application manager icon.

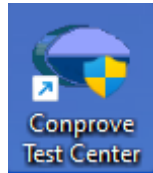


Figure 18

Click the Quick software icon.



Figure 19

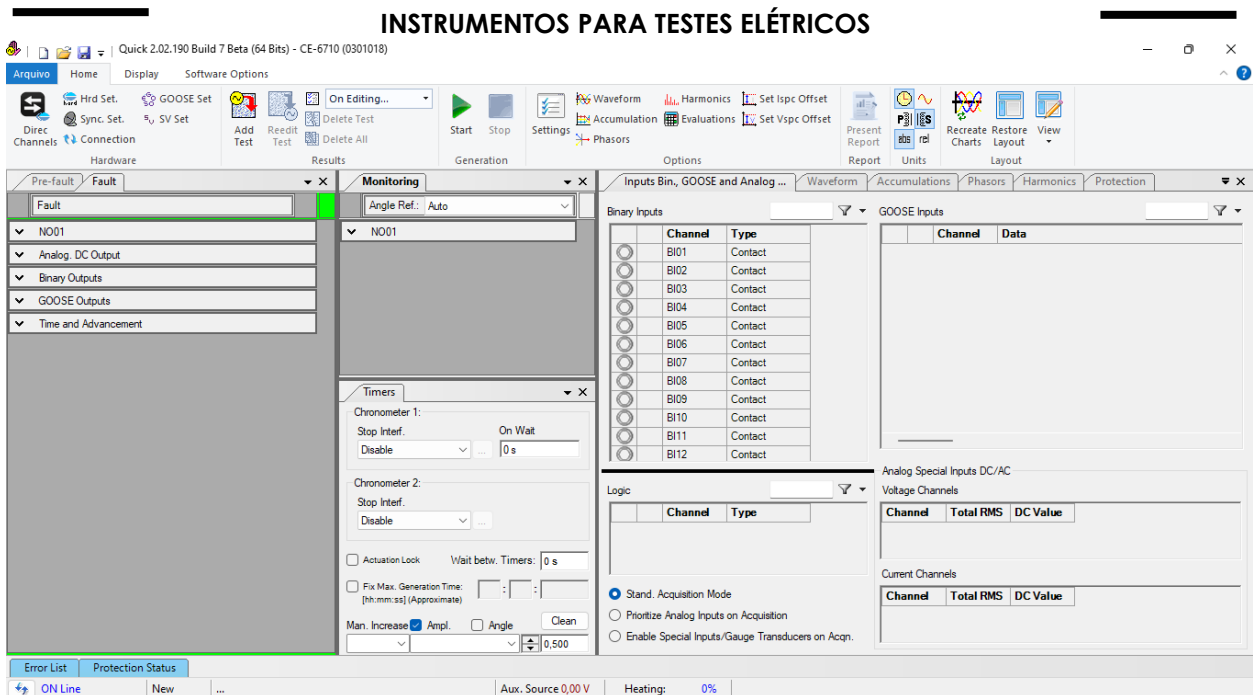


Figure 20

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.

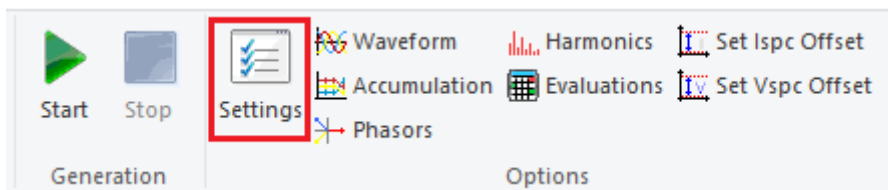


Figure 21

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.

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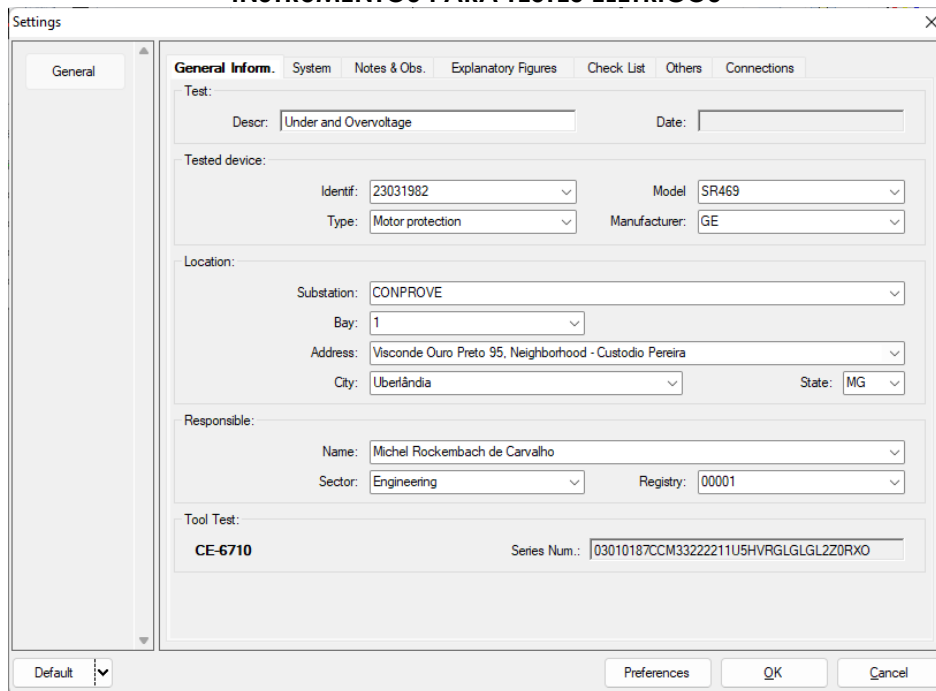


Figure 22

4.3 System

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

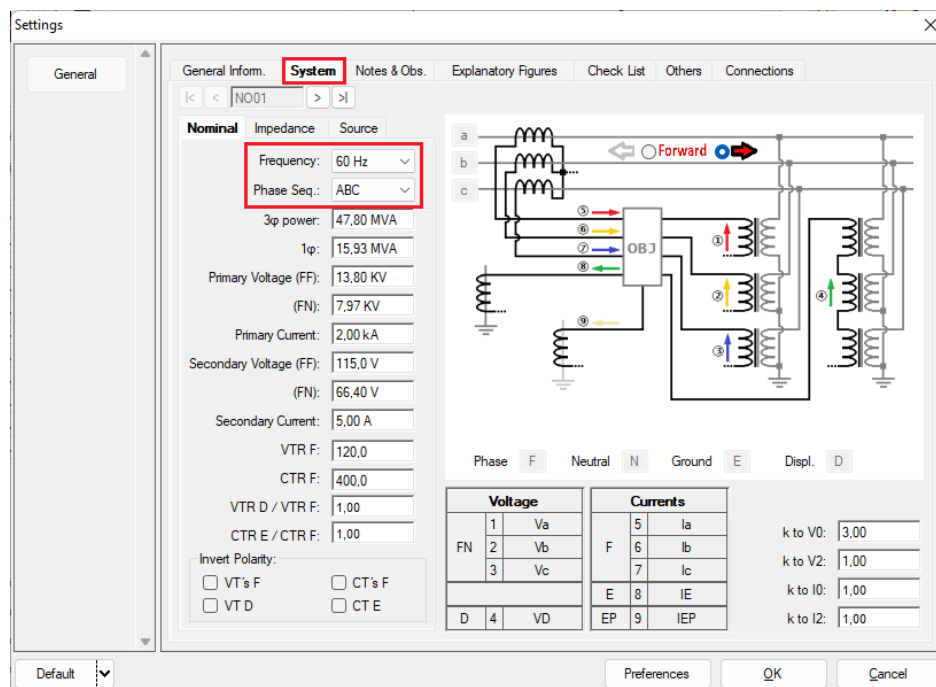


Figure 23

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

5. Channel Direction and Hardware Configurations

Click on the icon illustrated below.

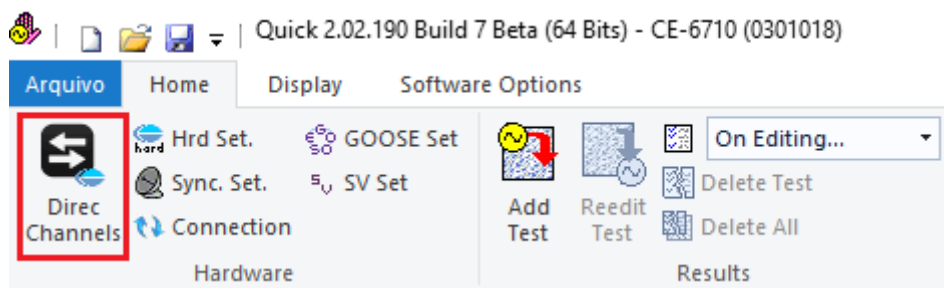


Figure 24

Then click on the highlighted icon to configure the hardware.

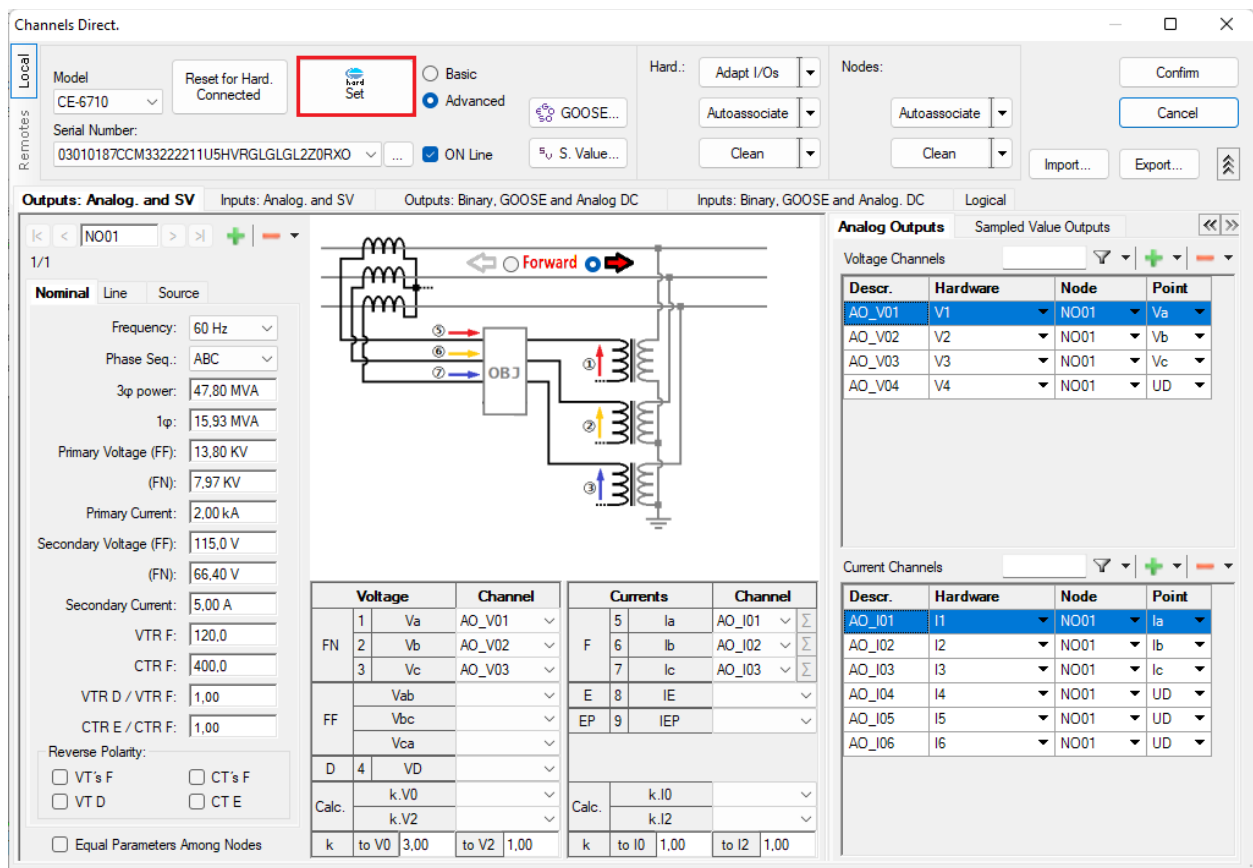


Figure 25

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

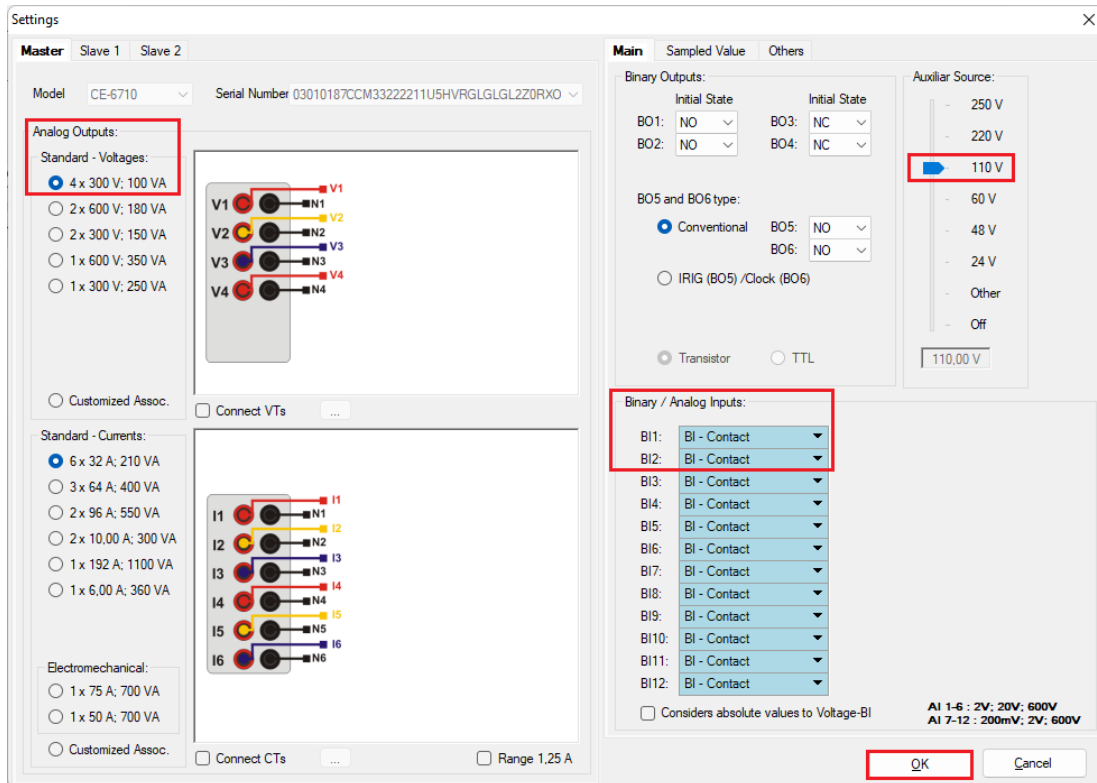


Figure 26

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

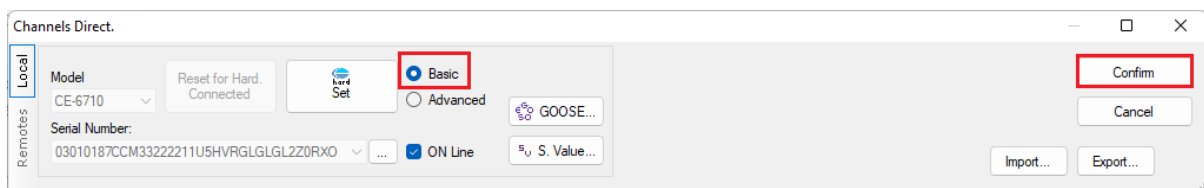


Figure 27

6. Test structure for function 27/59

6.1 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 node are the fields for setting function 59 active.

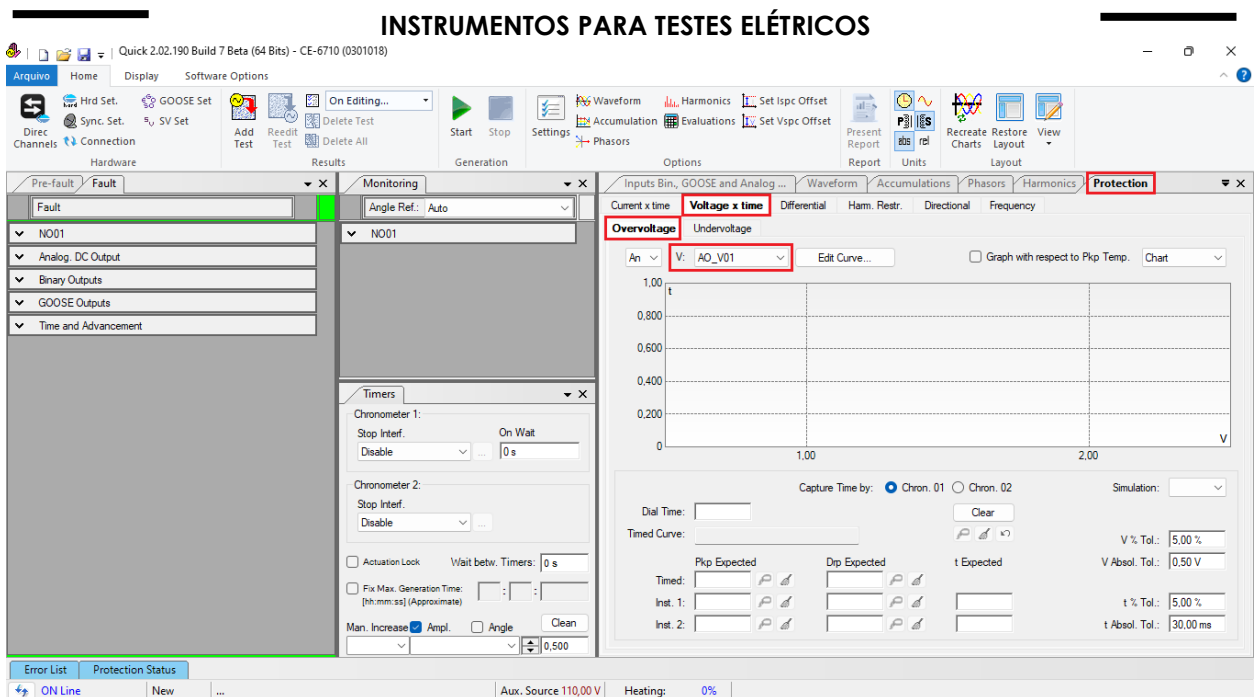


Figure 28

6.2 General Adjustments 59

According to the relay software settings, these values are entered in the “Quick” software. Element 59-1 pick-up equals 69.72V with actuation time equal to 2.0s and element 59-2 pick-up equals 79.68V with actuation time equal to 1.0s. Adjust the absolute and relative tolerances for both voltage and time. 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.

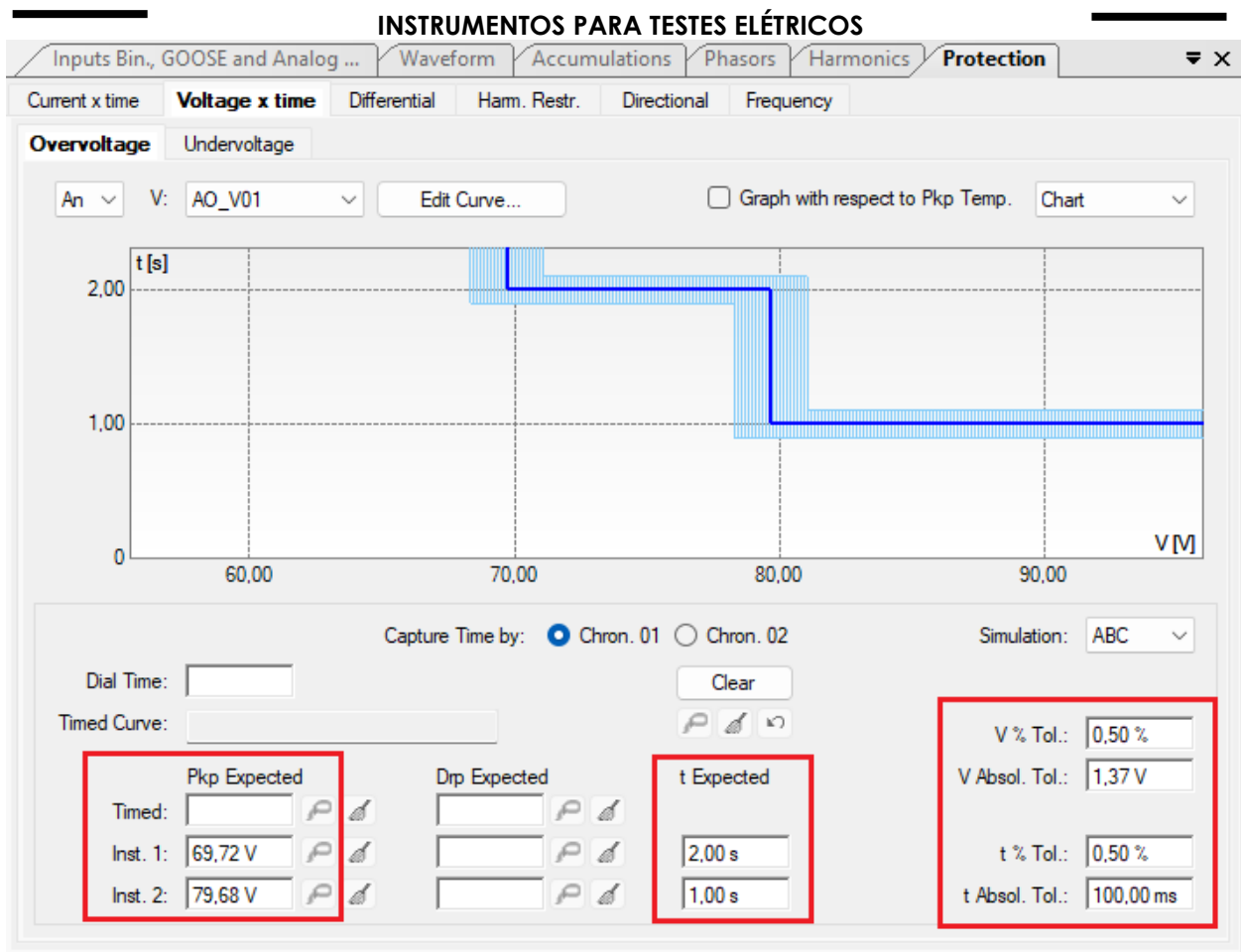


Figure 29

6.3 Timed Element 59-1 Pick-up Test

For the pick-up test, a ramp is used to increase the voltage value. To do this, change the stop binary to “BI02”, choose the “Ramp” option on the “Fault > N01” tabs and click on the highlighted icon.

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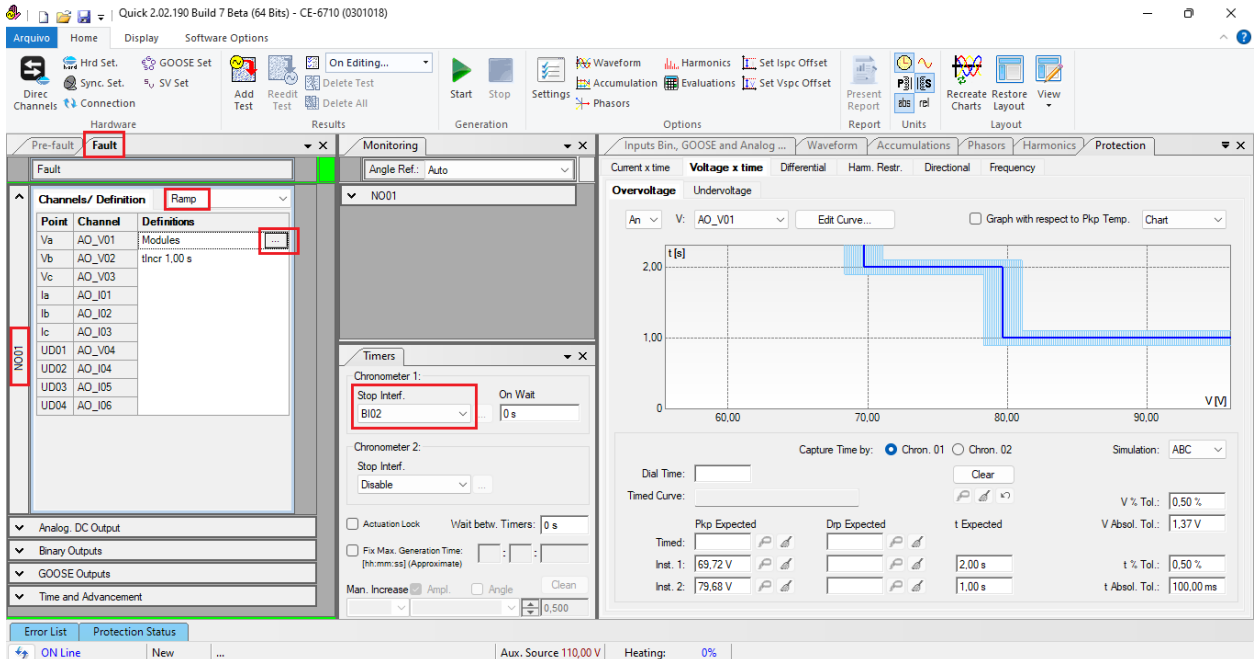


Figure 30

For the initial value, set 69.22V, for limit value set 70.22V, with an increment of 100mV and a time of each increment as 3.0s.

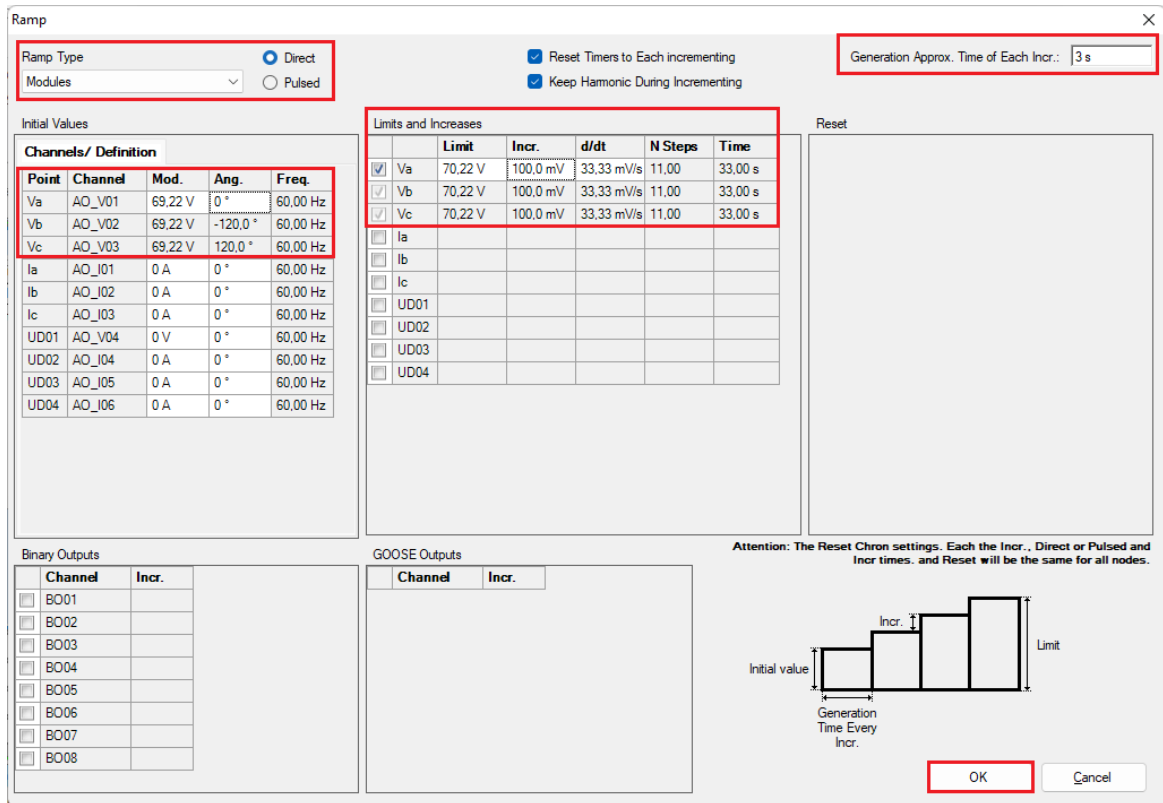


Figure 31

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NOTE: An important detail is that pre-fault voltage must be entered so that the relay performs the drop-out. For this, click on “Actuation Lock”.

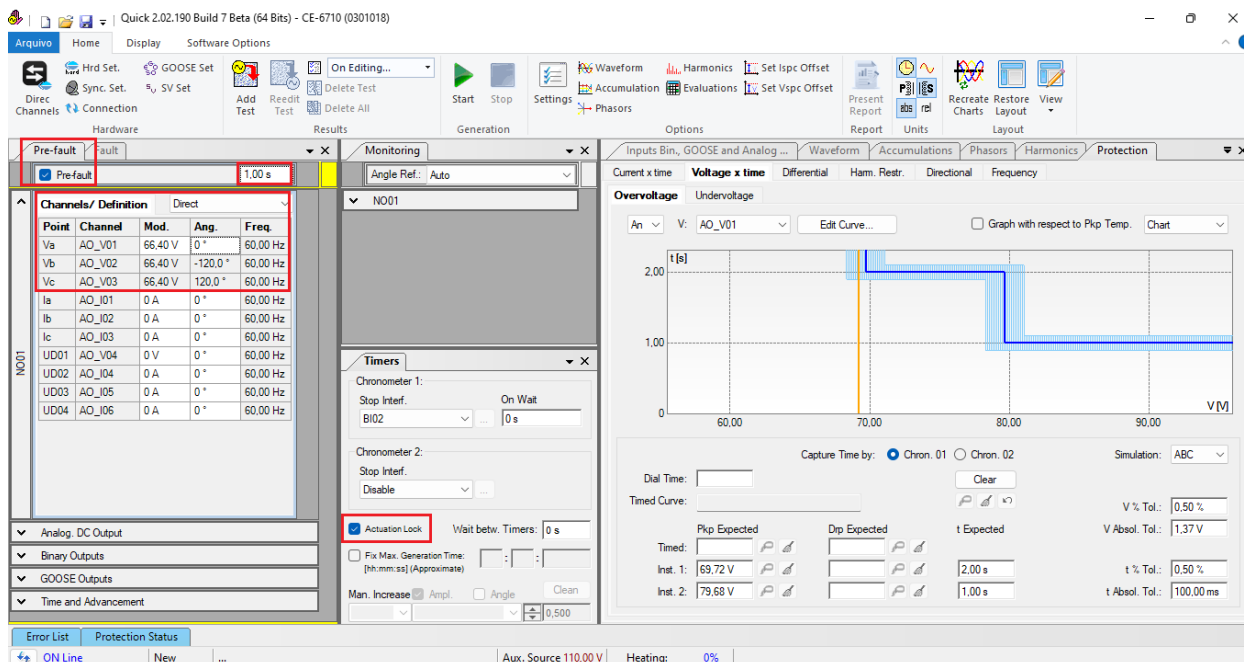


Figure 32

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

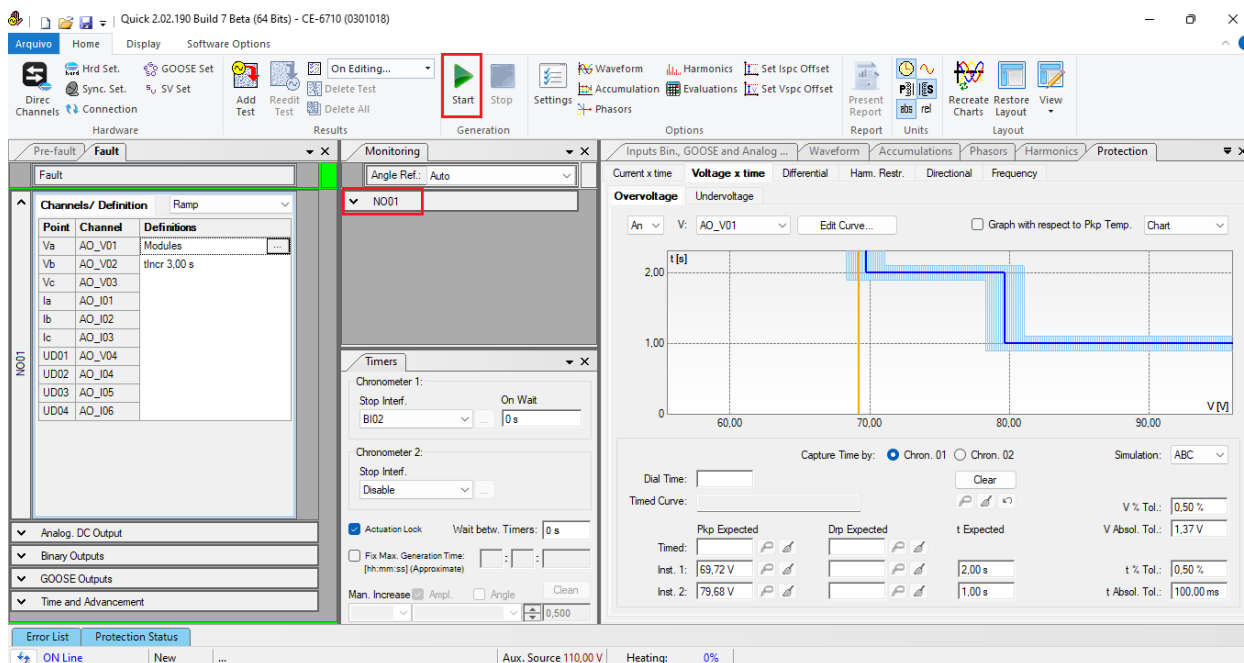


Figure 33

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

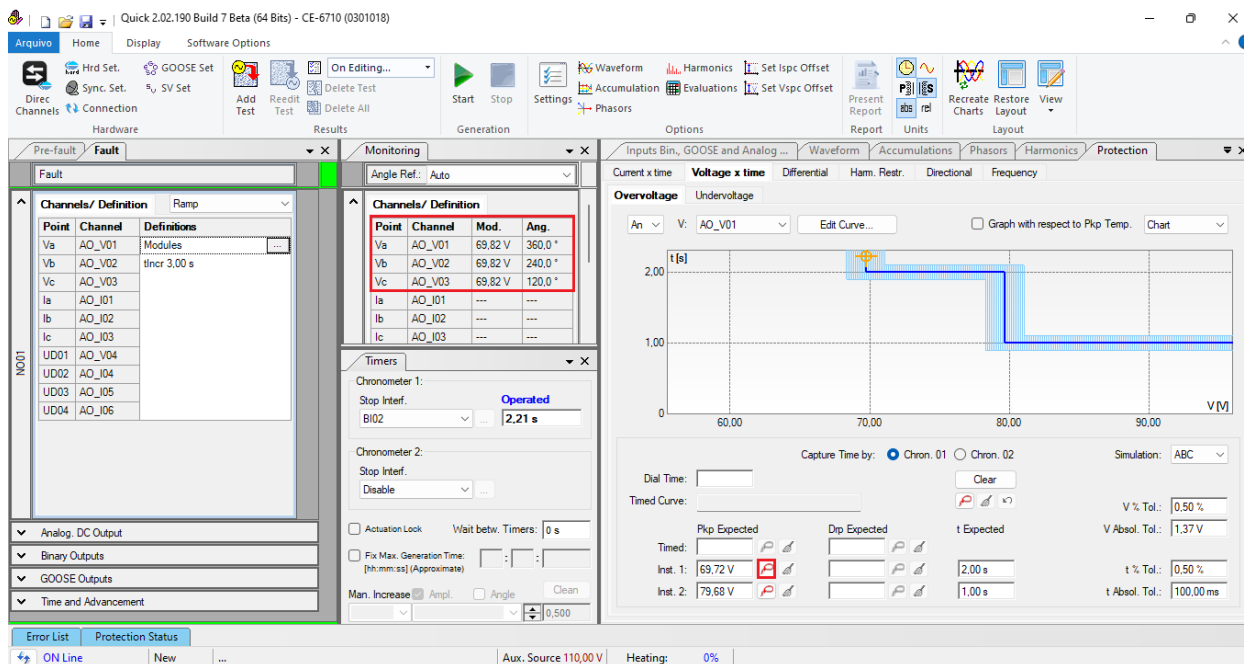


Figure 34

In this case, the pickup found was 69.82V, being within the tolerance provided by the manufacturer.

6.4 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. Keep the stop interface at “BI02”. The following figure shows the value of 72.00V already captured and the value of 78.00V to be captured.

NOTE: Remember to always block the first actuation.

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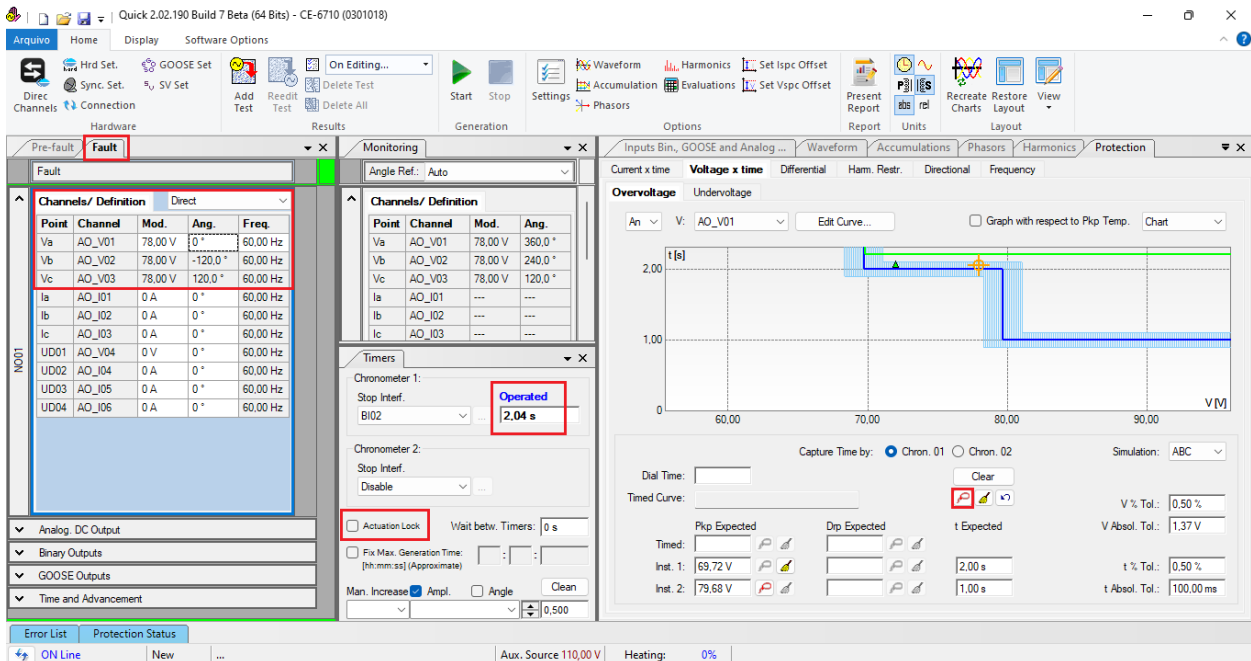


Figure 35

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

6.5 Timed Element 59-2 Pick-up Test

Click on the “Fault” tab, choose the “Ramp” option and the “...” icon and enter an initial value of 79.18V, limit value of 80.18V, with an increment of 100.0mV and a time of each increment as 2.0s.

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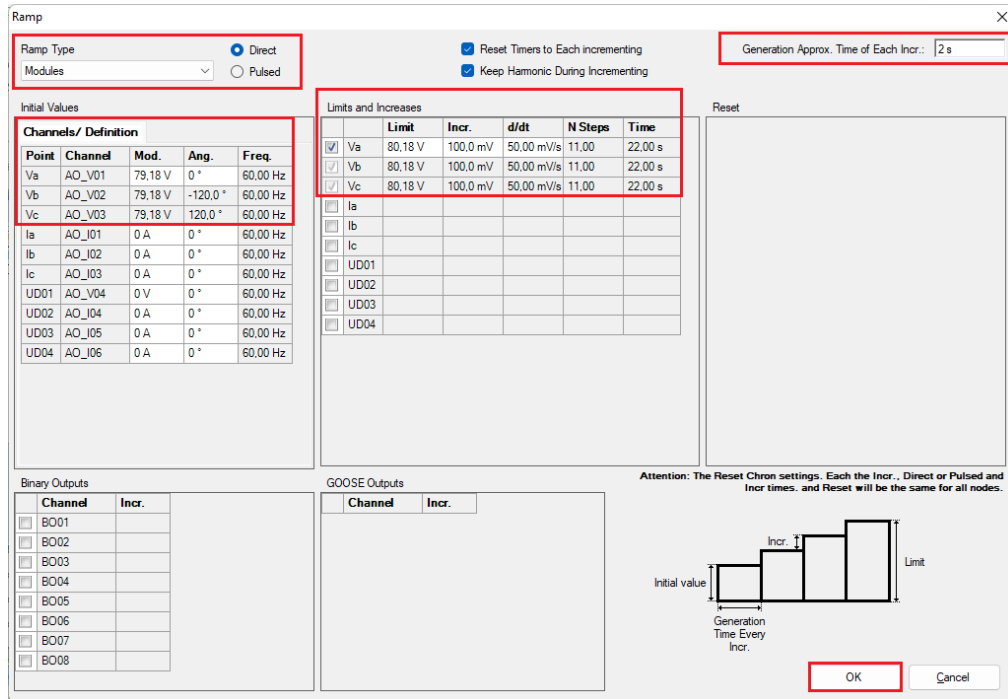


Figure 36

Change the interface to “BI01” and start the generation through the shortcut “Alt + G”.

NOTE: Remember to always block the first actuation.

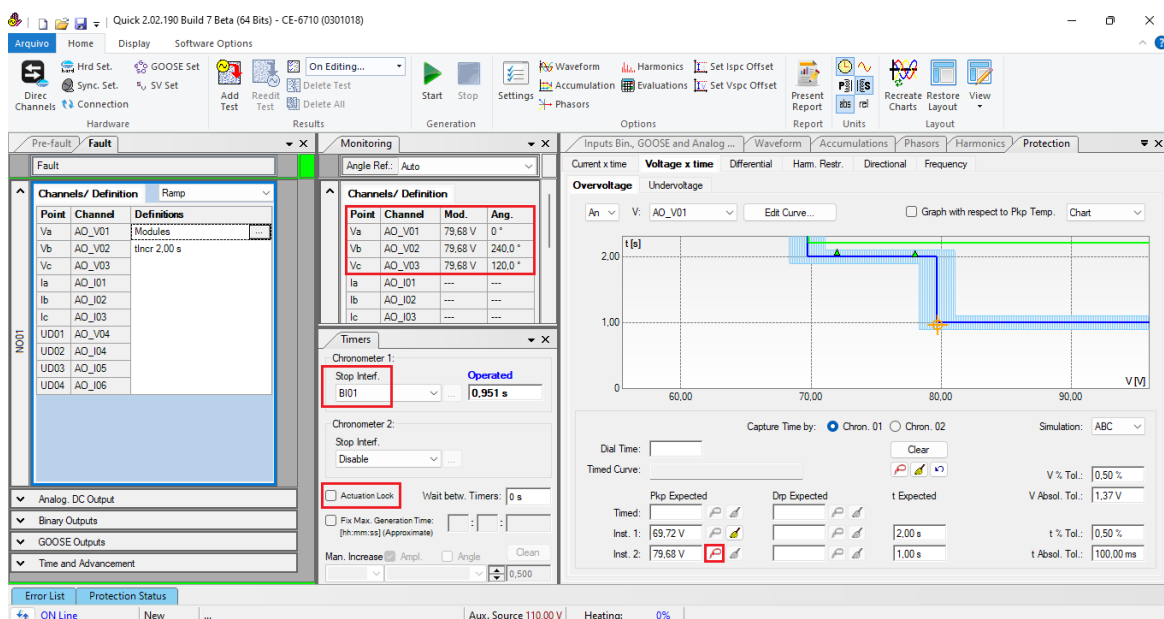


Figure 37

The pick-up value found for element 59-2 was 79.68V, being exactly the parameterized value.

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6.6 Element 59-2 point test

Return the “Channels/Definition” field to “Direct” to check the operating time of element 59-2. Points with voltage values above the pick-up must be tested. The figure below shows the value of 82.00V already captured and the value of 88.00V not yet captured.

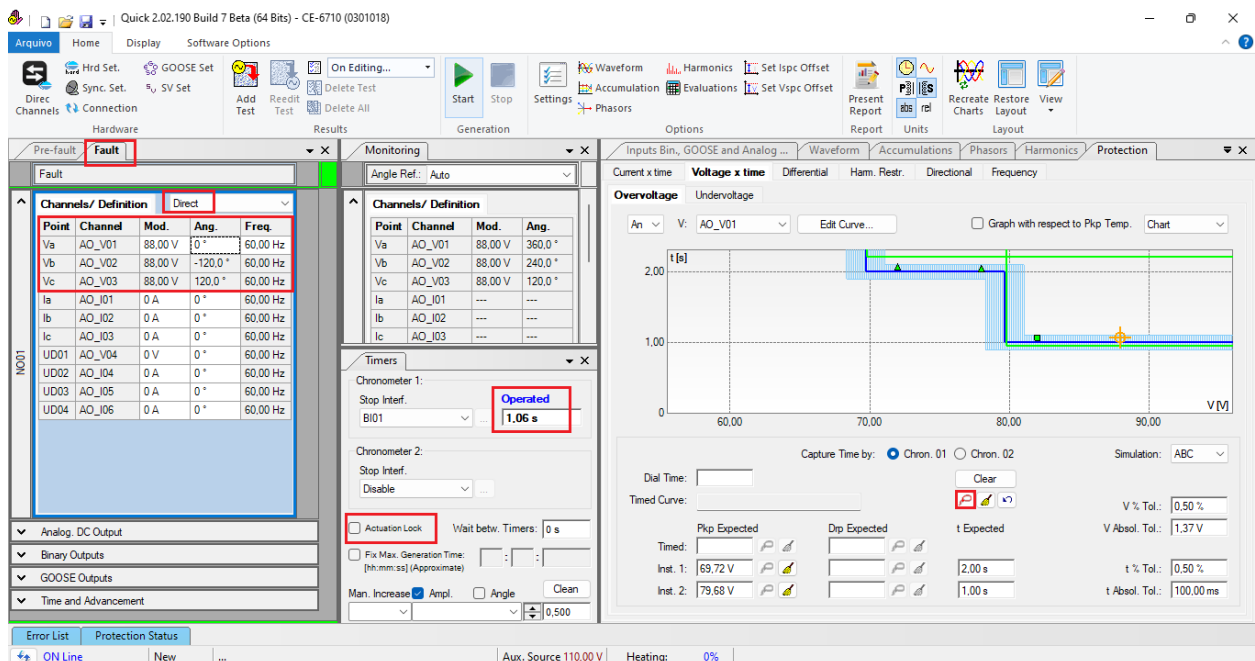


Figure 38

NOTE: Remember to always block the first actuation.

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

6.7 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. Next to the voltage “V” chooses a node as a reference, in this case “AO_V01”. Only after choosing the node are the fields for setting function 27 active.

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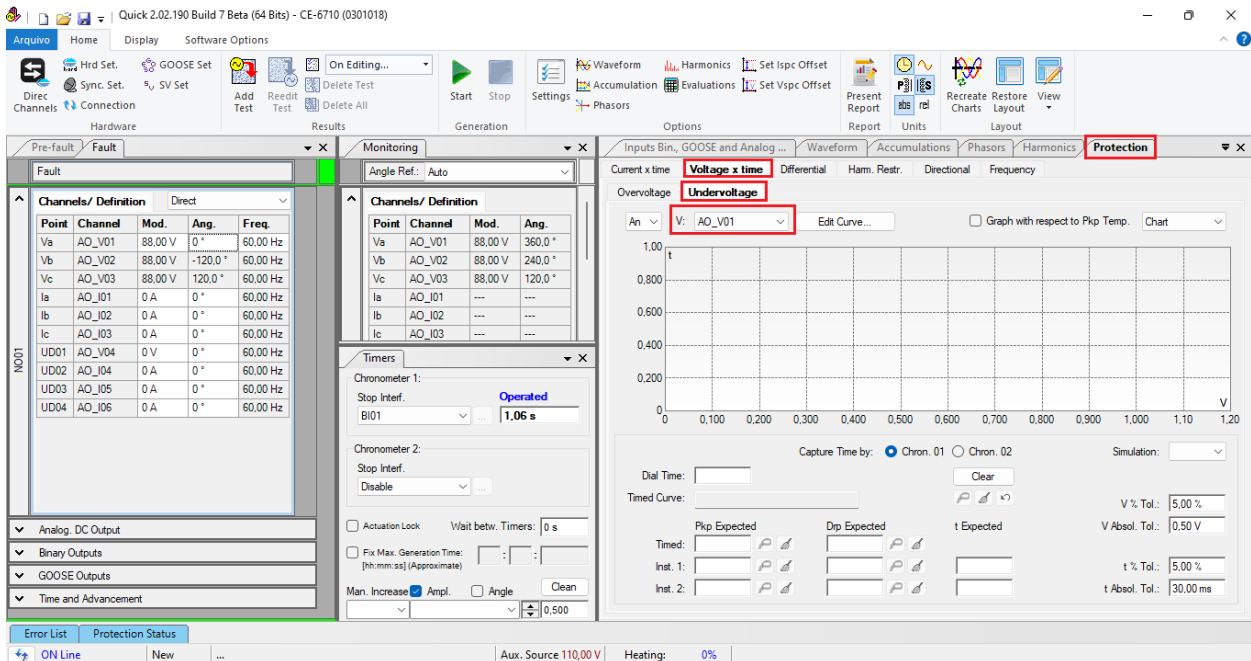


Figure 39

6.8 General Adjustments 27

According to the relay software settings, these values are entered in the Quick software. Element 27-1 pick-up equals to 56.44V with actuation time equal to 2.0s and element 27-2 pick-up equals to 46.48V with actuation time equal to 1.0s. There are also fields where absolute and relative tolerances for both voltage and time must be entered. These values are taken from Appendix A.2.

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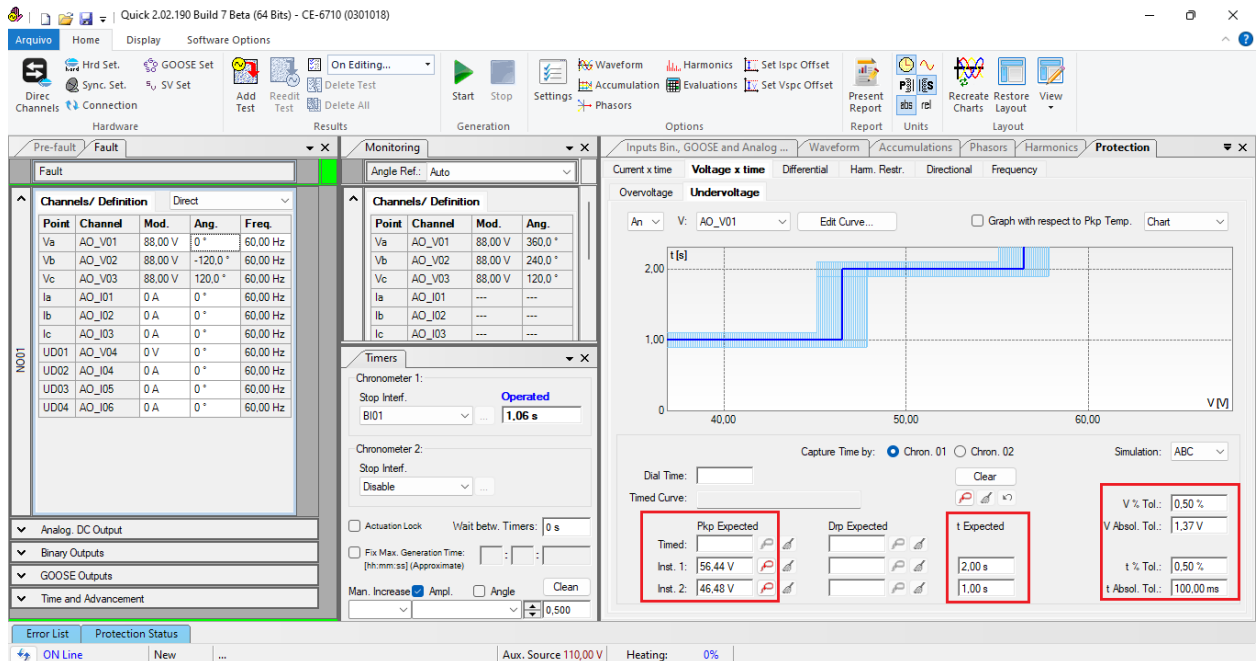


Figure 40

6.9 Timed Element 27-1 Pick-up Test

First change the stop binary to “BI02”. For the pick-up test, a ramp is used to decrease the voltage value. To do this, choose the “Ramp” option on the “Fault > NO1” tabs and click on the highlighted icon.

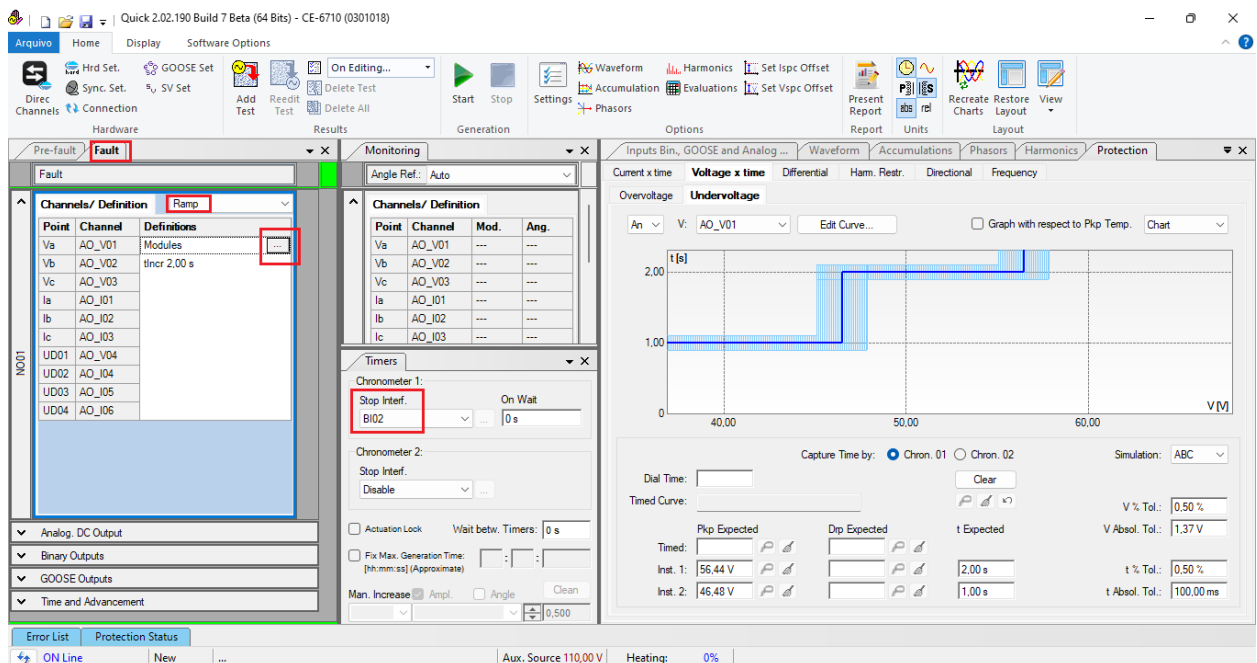
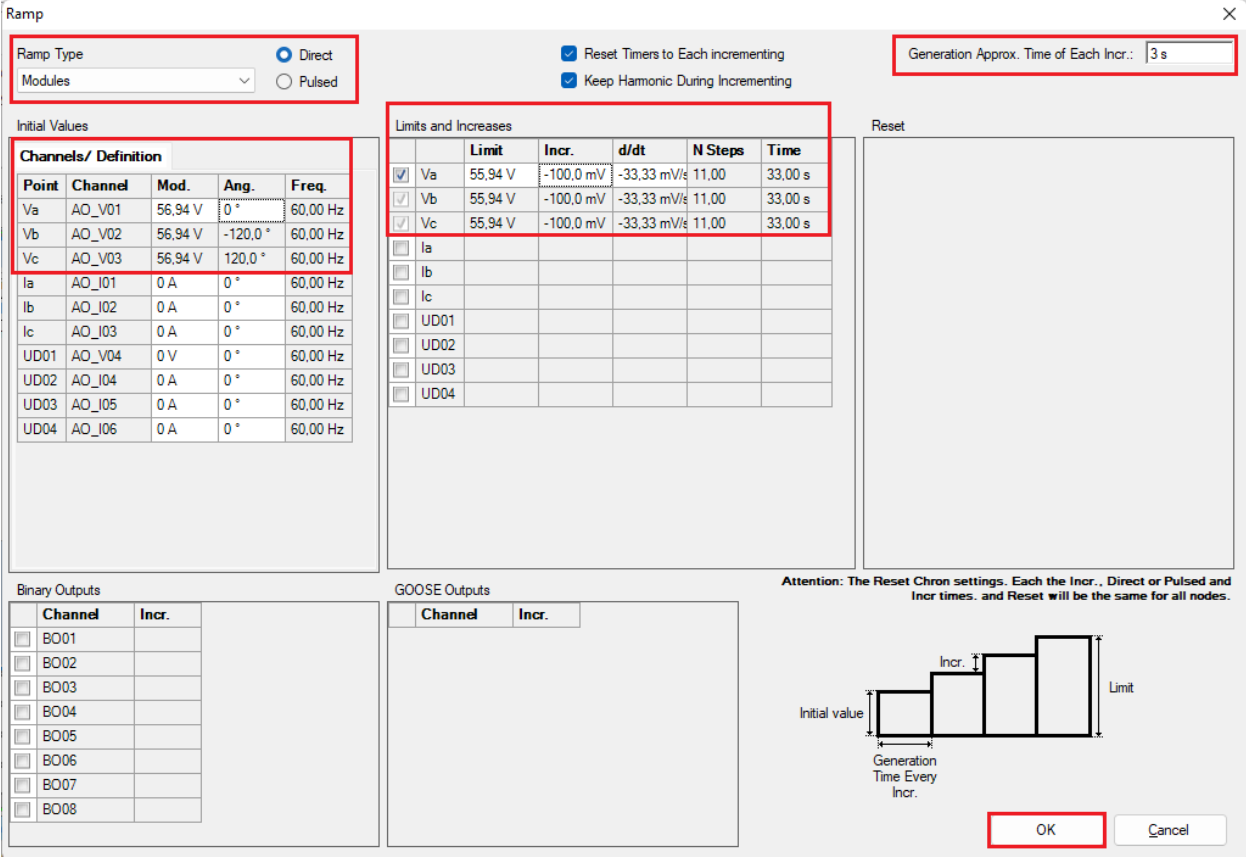


Figure 41

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Enter an initial value of 56.94V, limit value of 55.94, with a decrement of 100.0mV and a time of each decrement as 3.0s.



Initial Values

Point	Channel	Mod.	Ang.	Freq.
Va	AO_V01	56.94 V	0 °	60.00 Hz
Vb	AO_V02	56.94 V	-120.0 °	60.00 Hz
Vc	AO_V03	56.94 V	120.0 °	60.00 Hz
Ia	AO_I01	0 A	0 °	60.00 Hz
Ib	AO_I02	0 A	0 °	60.00 Hz
Ic	AO_I03	0 A	0 °	60.00 Hz
UD01	AO_V04	0 V	0 °	60.00 Hz
UD02	AO_I04	0 A	0 °	60.00 Hz
UD03	AO_I05	0 A	0 °	60.00 Hz
UD04	AO_I06	0 A	0 °	60.00 Hz

Limits and Increases

	Limit	Incr.	d/dt	N Steps	Time	
<input checked="" type="checkbox"/>	Va	55.94 V	-100.0 mV	-33.33 mV/s	11,00	33,00 s
<input checked="" type="checkbox"/>	Vb	55.94 V	-100,0 mV	-33,33 mV/s	11,00	33,00 s
<input checked="" type="checkbox"/>	Vc	55.94 V	-100,0 mV	-33,33 mV/s	11,00	33,00 s
<input type="checkbox"/>	Ia					
<input type="checkbox"/>	Ib					
<input type="checkbox"/>	Ic					
<input type="checkbox"/>	UD01					
<input type="checkbox"/>	UD02					
<input type="checkbox"/>	UD03					
<input type="checkbox"/>	UD04					

Reset

Generation Approx. Time of Each Incr.: 3 s

Reset Timers to Each Incrementing

Keep Harmonic During Incrementing

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

Initial value: [Diagram showing a step-wise ramp from an initial value to a limit, with 'Generation Time Every Incr.' and 'Limit' labels.]

OK Cancel

Figure 42

NOTE: An important detail is that pre-fault voltage must be entered so that the relay performs the drop-out. For this, click on “Actuation Lock”.

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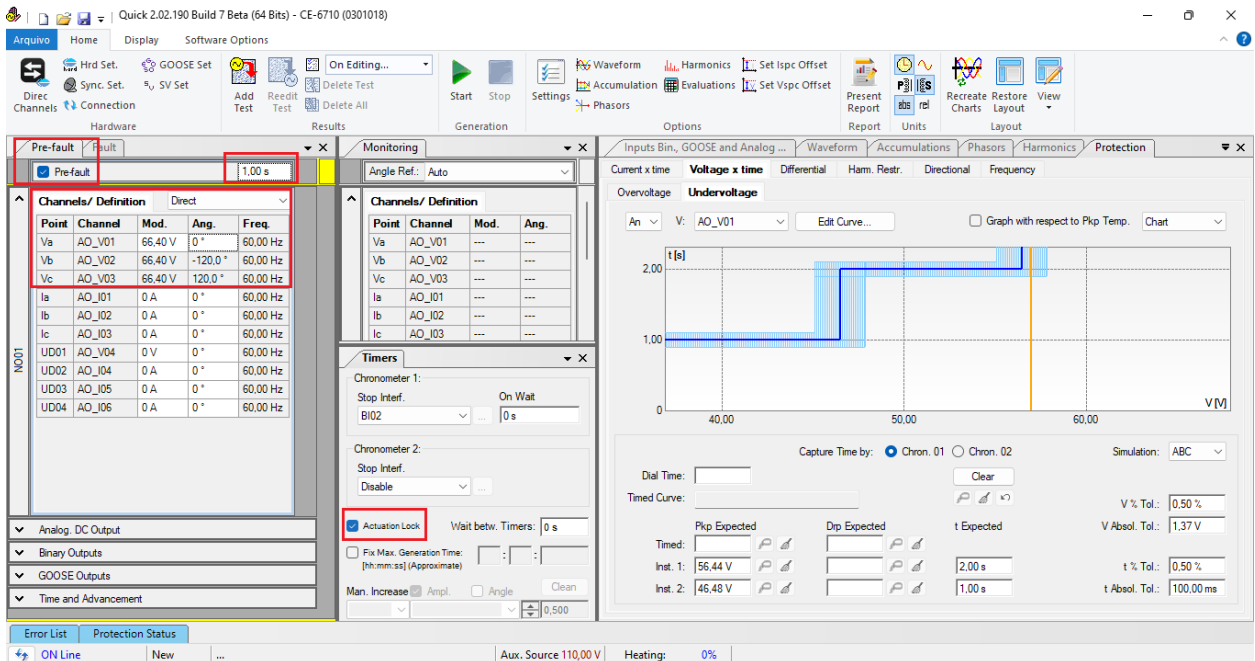


Figure 43

Start the generation by clicking on the “Start” icon or via the shortcut “Alt + G”.

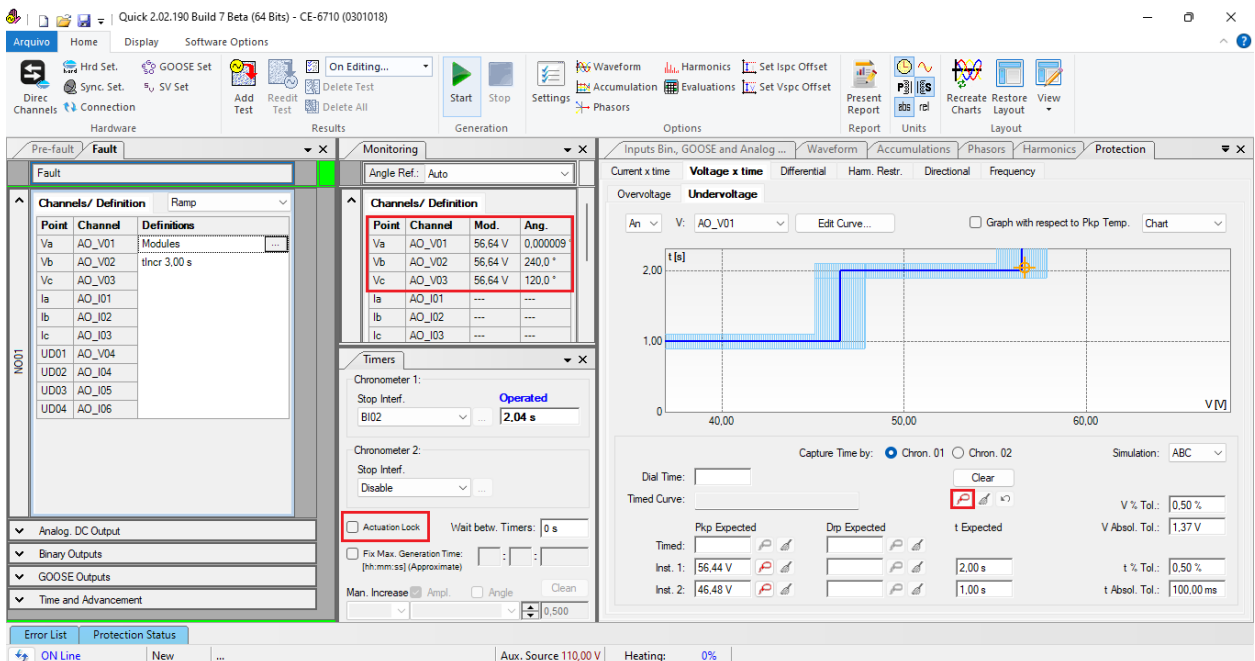


Figure 44

In this case, the pick-up found was 56.64V, being within the tolerance provided by the manufacturer.

INSTRUMENTOS PARA TESTES ELÉTRICOS

6.10 *Element 27-1 point test*

Return the “Channels/Definition” field to “Direct” to check the operating time of element 27-1. Points with voltage values below the pick-up must be tested. The figure below shows the value of 55.00V already captured and the value of 48.00V not yet captured.

NOTE: Remember to always block the first actuation.

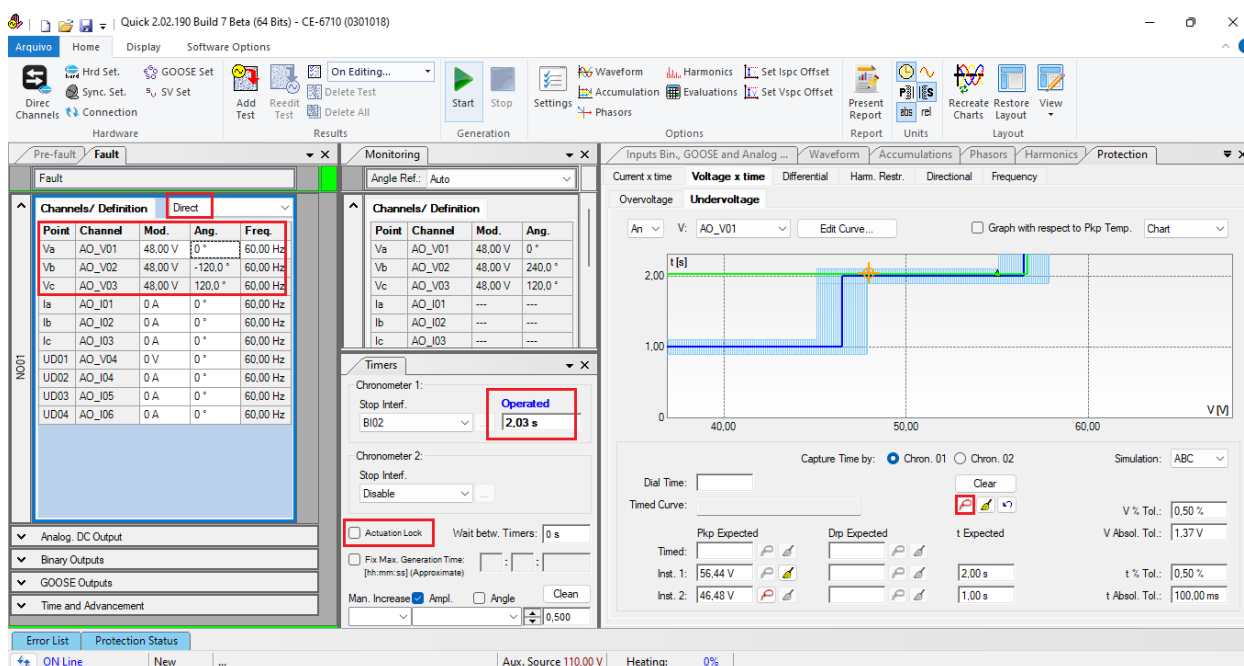


Figure 45

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

6.11 *Timed Element 27-2 Pick-up Test*

Change the binary to “BI01”, click on the “Fault” tab, choose the “Ramp” option and the “...” icon and enter an initial value of 46.98V, limit value of 45.98V, with a decrement of - 100.0mV and the time of each increment as 2.0s.

INSTRUMENTOS PARA TESTES ELÉTRICOS

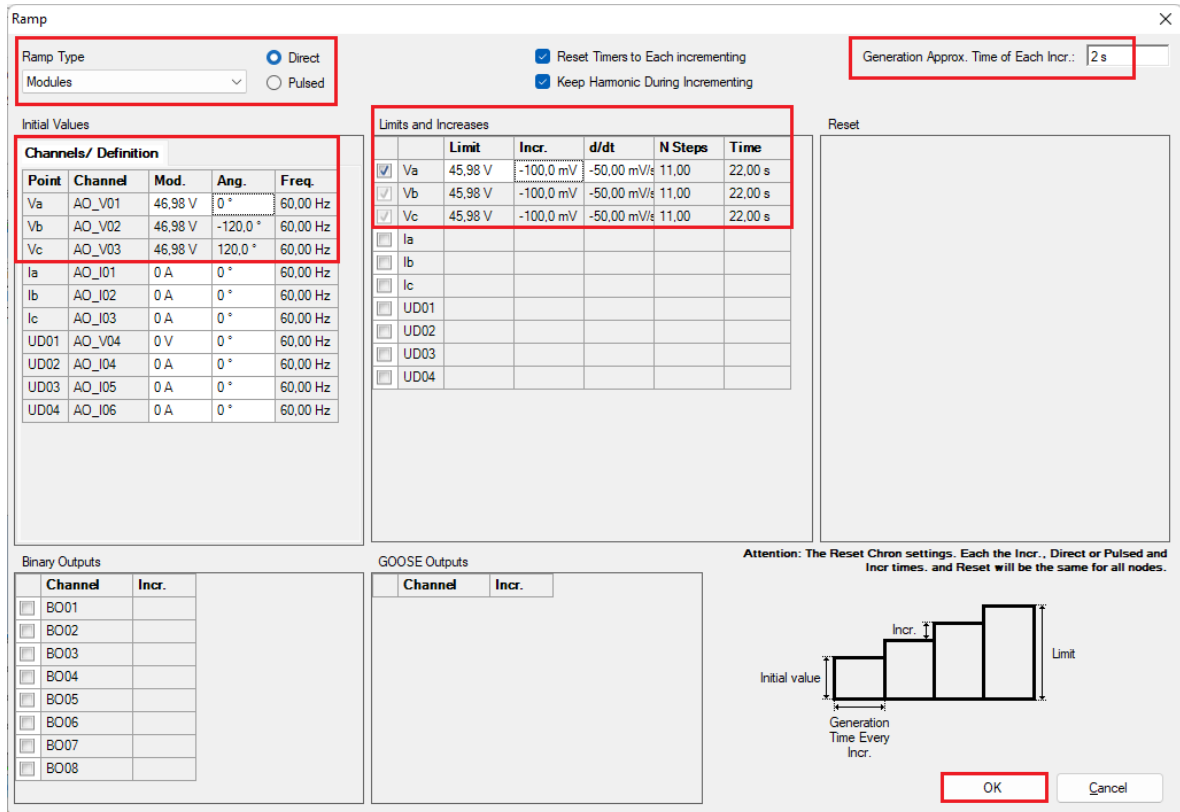


Figure 46

Check the field “Actuation Lock” and start the generation through the shortcut “Alt + G”.

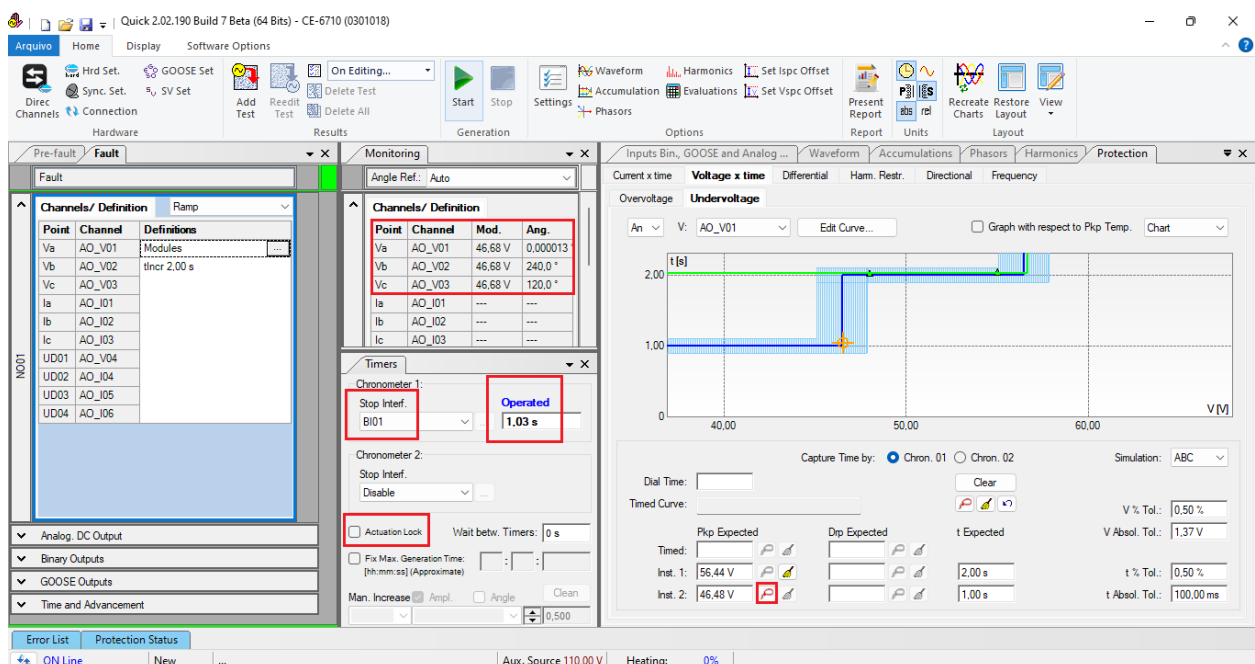


Figure 47

INSTRUMENTOS PARA TESTES ELÉTRICOS

The pick-up found for element 27-2 was 46.68V, being within the tolerance provided by the manufacturer.

6.12 Element 27-2 point test

The following figure shows the value of 45.00V already captured and the value of 40.00V not yet captured.

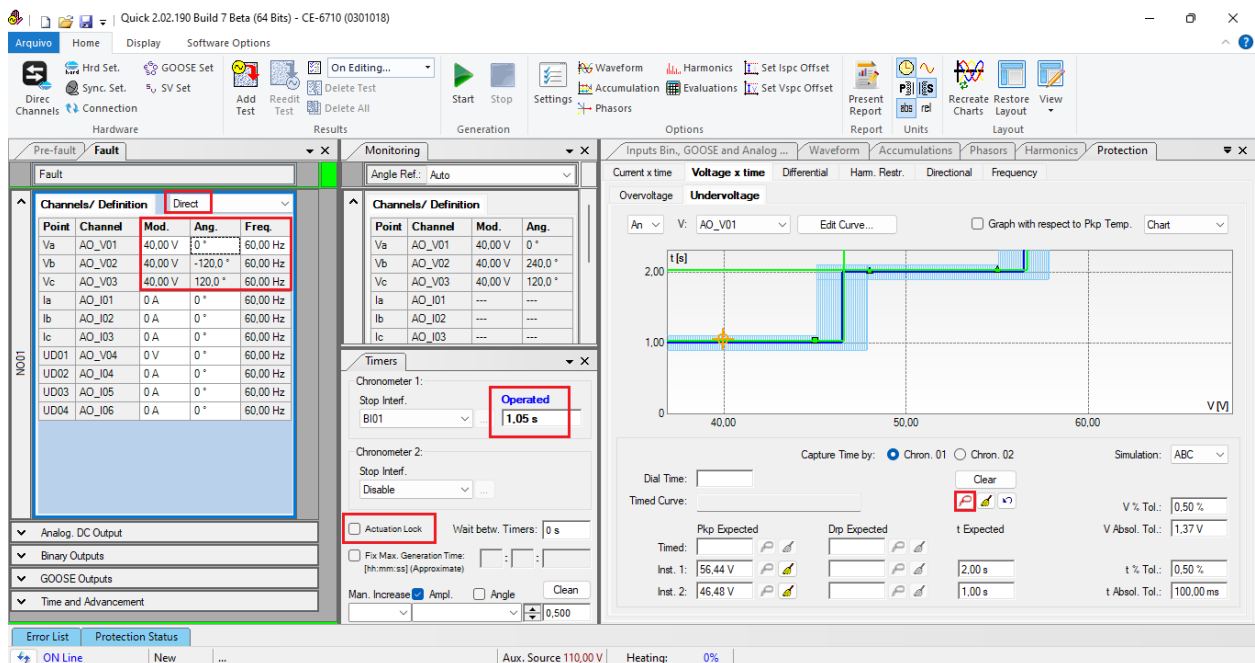


Figure 48

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

7. Report

After finishing the test, click on the icon “Present Report” in the previous figure or through the command “Ctrl +R” to call up 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

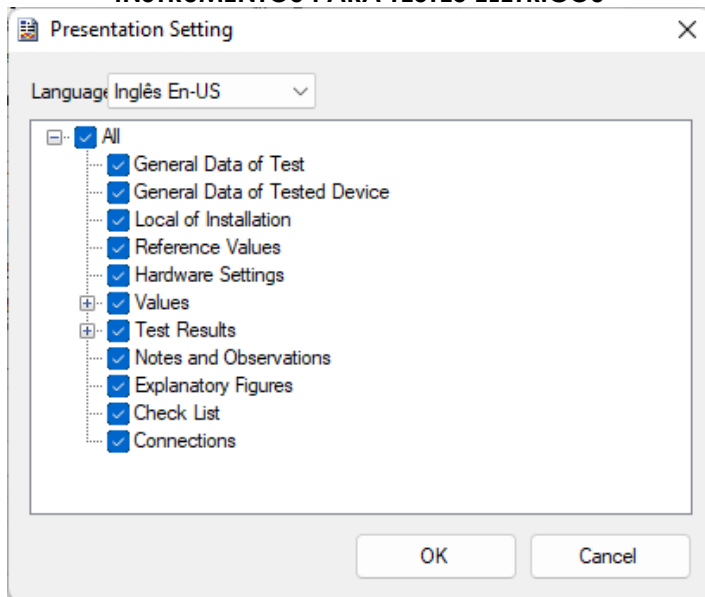


Figure 49

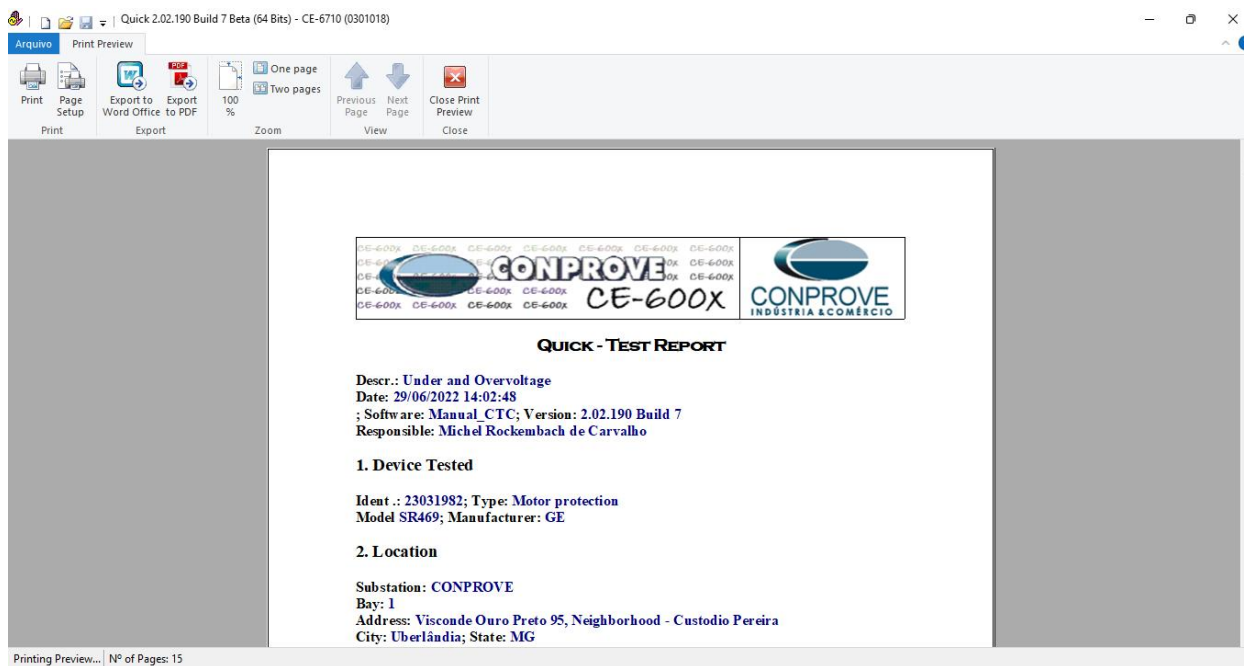


Figure 50

INSTRUMENTOS PARA TESTES ELÉTRICOS

APPENDIX A

A.1 Terminal Designations

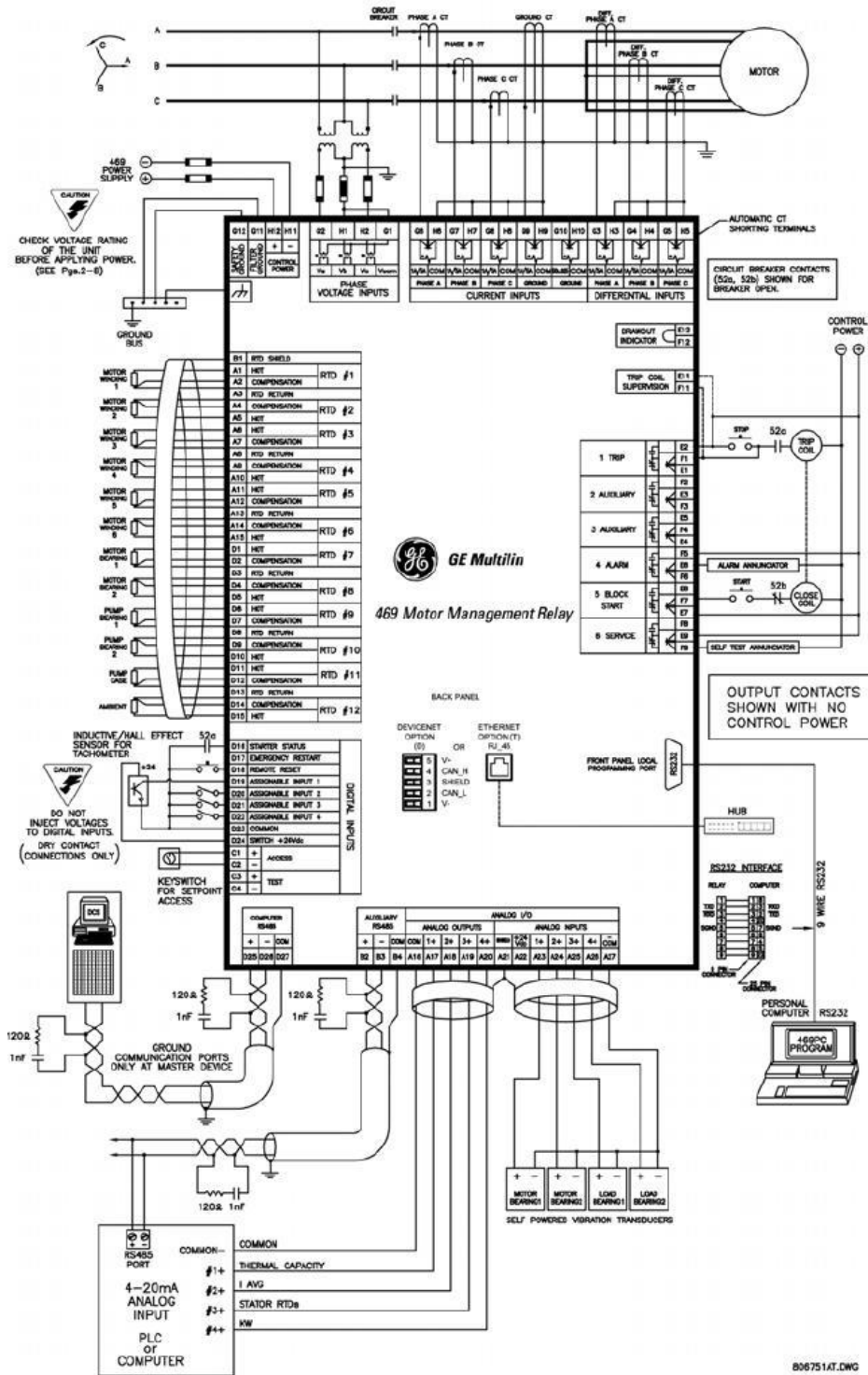


Figure 51

A.2 Technical data

VOLTAGE INPUTS

VT ratio:.....1.00 to 300.00:1 in steps of 0.01
VT secondary:273 V AC (full-scale)
Conversion range:0.05 to 1.00 × full scale
Nominal frequency:20 to 70 Hz
Frequency range:20 to 120 Hz
Accuracy:±0.5% of full scale
Max. continuous:280 V AC
Burden:.....>500 kΩ
Sensor supply:+24 V DC at 20 mA max.

UNDERVOLTAGE

Pickup Level:
Motor starting:0.60 to 0.99 × Rated in steps of 0.01
Motor running:0.60 to 0.99 × Rated in steps of 0.01 of any one phase
Time delay:.....0.1 to 60.0 s in steps of 0.1
Pickup accuracy:as per voltage inputs
Timing accuracy:<100 ms or ±0.5% of total time
Elements:.....Trip and Alarm

OVERVOLTAGE

Pickup level:1.01 to 1.10 × rated in steps of 0.01 of any one phase
Time delay:.....0.1 to 60.0 s in steps of 0.1
Pickup accuracy:as per voltage inputs
Timing accuracy:±100 ms or ±0.5% of total time
Elements:.....Trip and Alarm

APÊNDICE B

Equivalência de parâmetros do software e o relé em teste.

Table 1

Quick Software		GE SR 469 Relay	
Parameter	Figure	Parameter	Figure
Undervoltage			
Pkp_ Instant.1	40	Undervoltage Alarm Pickup	16
Time_ Instant.1	40	Undervoltage Alarm Delay	16
Pkp_ Instant.2	40	Undervoltage Trip Pickup	16
Time_ Instant.2	40	Undervoltage Trip Delay	16
Overvoltage			
Pkp_ Instant.1	29	Overvoltage Alarm Pickup	17
Time_ Instant.1	29	Overvoltage Alarm Delay	17
Pkp_ Instant.2	29	Overvoltage Trip Pickup	17
Time_ Instant.2	29	Overvoltage Trip Delay	17