TEST TUTORIAL

EQUIPAMENT: Protection Relay.

BRAND: ZIV.

MODEL: DLF.

FUNCTION: 81u or PTUF – Underfrequency & 81o or PTOF – Overfrequency.

TOOL: CE-6003, CE-6006, CE-6707, CE-6710, CE-7012 or CE-7024.

OBJECTIVE: Testing the pickup and operating time of the underfrequency and overfrequency elements using the Ramp software.

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CONPROVE
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INSTRUMENTOS PARA TESTES ELÉTRICOS

VERSION CONTROL:

Version	Descriptions	Date	Author	Reviewer
1.0	Initial Version	27/07/2022	M.R.C.	G.C.D.P.

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INSTRUMENTOS PARA TESTES ELÉTRICOS

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 is noted that the user must have satisfactory training in maintenance procedures a good knowledge of the equipment under test and still be aware of safety rules and regulations.

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INSTRUMENTOS PARA TESTES ELÉTRICOS

PROCEDURE FOR TESTING THE ZIV DLF RELAY IN THE RAMP SOFTWARE

1. Relay Connection to CE-6710

In this section, all the connections necessary to run the test in question are discussed. In appendix B of this document you can find the terminal designations of the ZIV DLF relay used.

1.1. Auxiliary Source

To power the relay, connect the positive (red) terminal of the Aux Vdc source in the test set to terminal 3 of slot A of the relay and the negative terminal (black) to terminal 2 of slot A, as shown in the following figure.

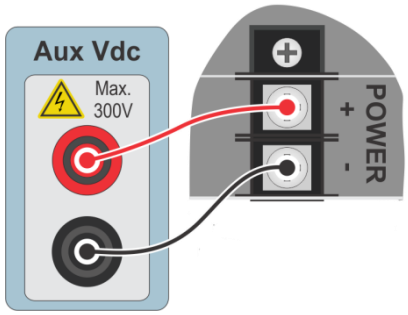

Figure 1

1.2. Analog Outputs

Connect the CE-6710's analog outputs V1, V2 and V3 to terminals 01, 03 and 05 of the relay's D slot and their common to terminals 02, 04 and 06. The figure below shows the procedure.

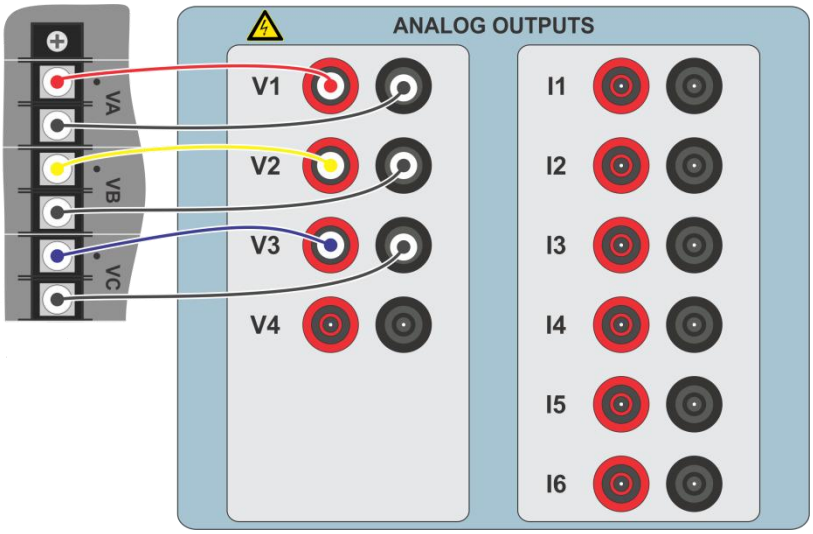

Figure 2

1.3. Binary Inputs

Connect the Binary Inputs to the binary outputs of the relay in slot A as shown in the table and figure below.

Table 1

CE-6710 (*Binary Inputs*)	DLF (*Slot A*)
BI1	OUT 1 (07 and 08)
BI2	OUT 2 (09 and 10)
BI3	OUT 3 (11 and 12)
BI4	OUT 4 (13 and 14)

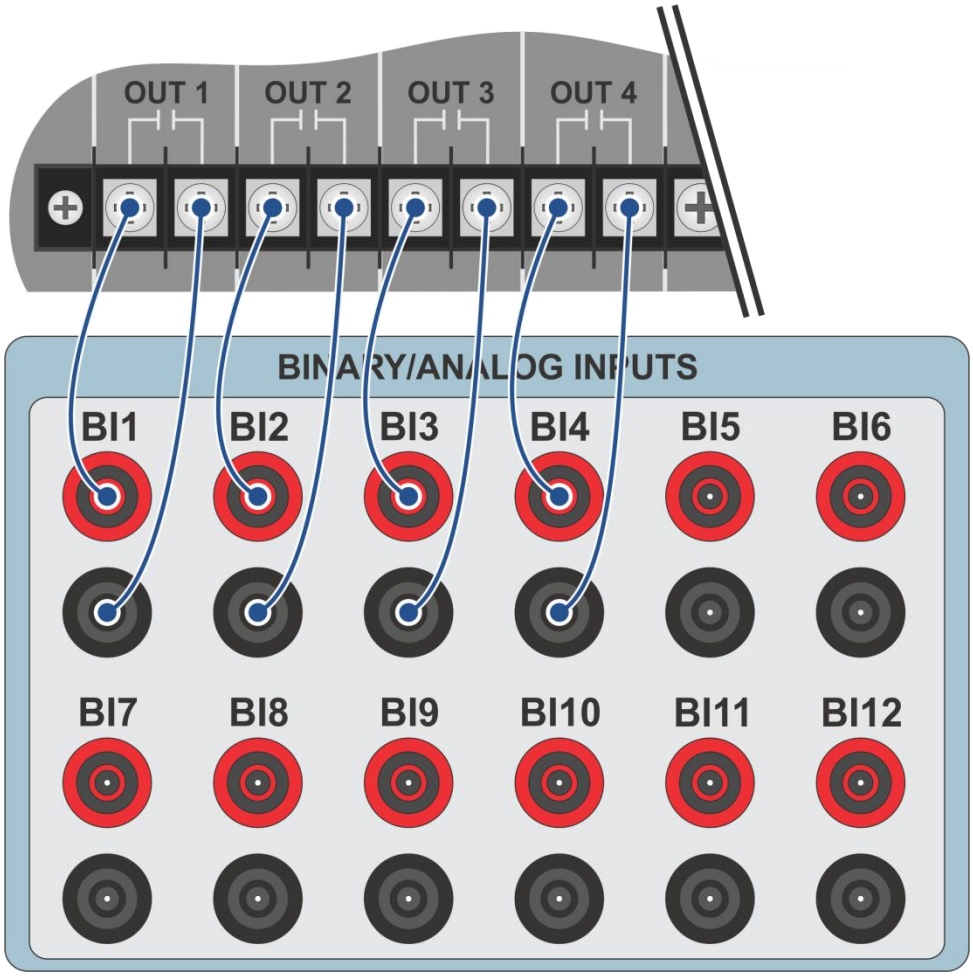

Figure 3

2. First steps with the DLF relay

2.1. Communication between PC and relay

Communication with the relay is done through an Ethernet cable connected between the relay and the computer that has the ZivercomPlus software. Double click on the relay software icon.

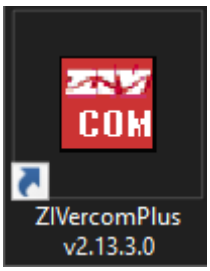

Figure 4

Enter the username and password. To gain access use ***"zivercom"*** and the password ***"ziv".***

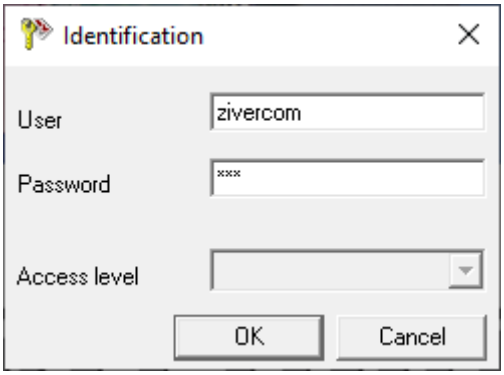

Figure 5

Then, from the main menu, go to *"IEDs" > "Installations".*

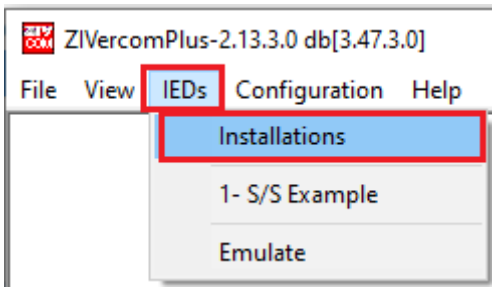

Figure 6

Select the default file *"SubExamples.sds"* and click *"Edit"*.

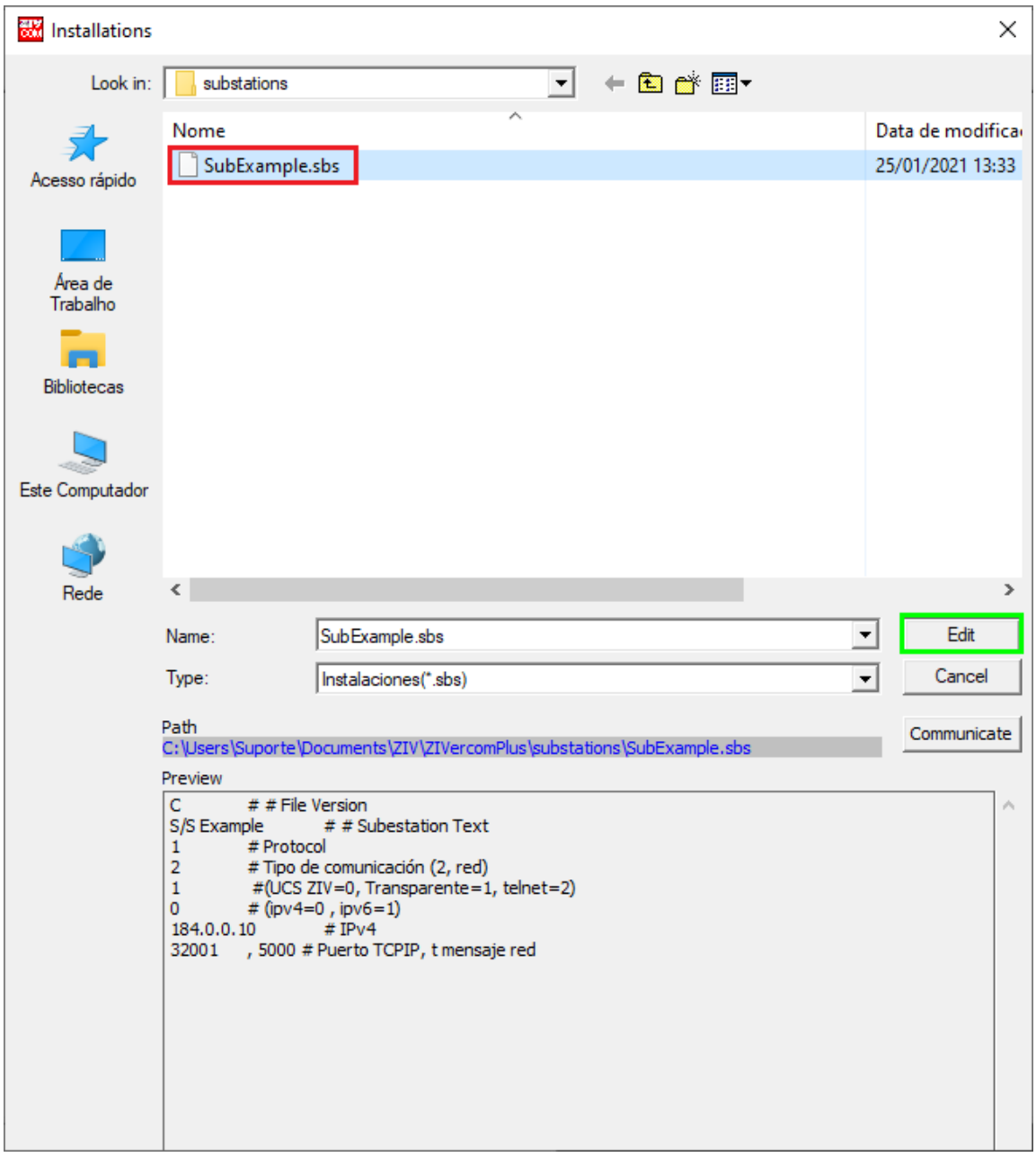

Figure 7

The next step is to check the data set for communication on the relay front panel. This data must be entered into the software for successful communication to occur.

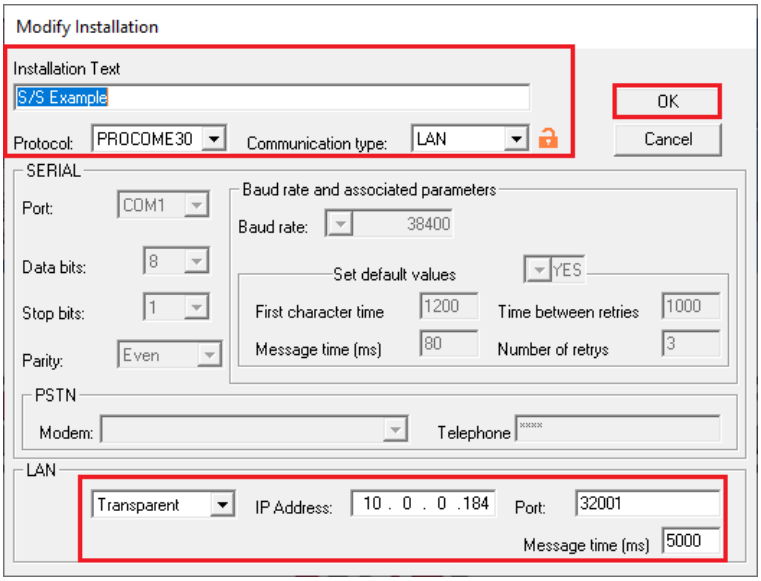

Figure 8

By clicking on the *"OK"* button, you will return to figure 7, select the file again and click on *"Communicate"*.

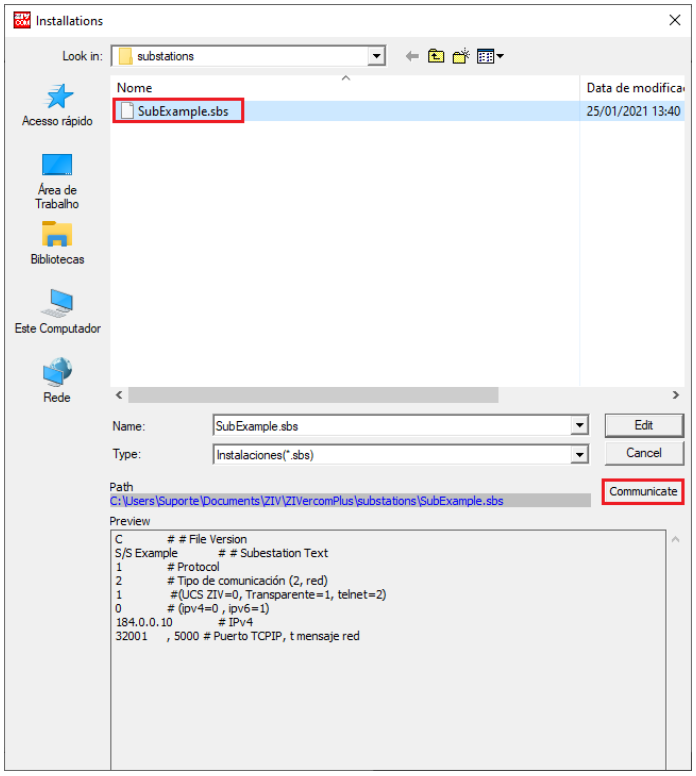

Figure 9

Click *"OK"* again.

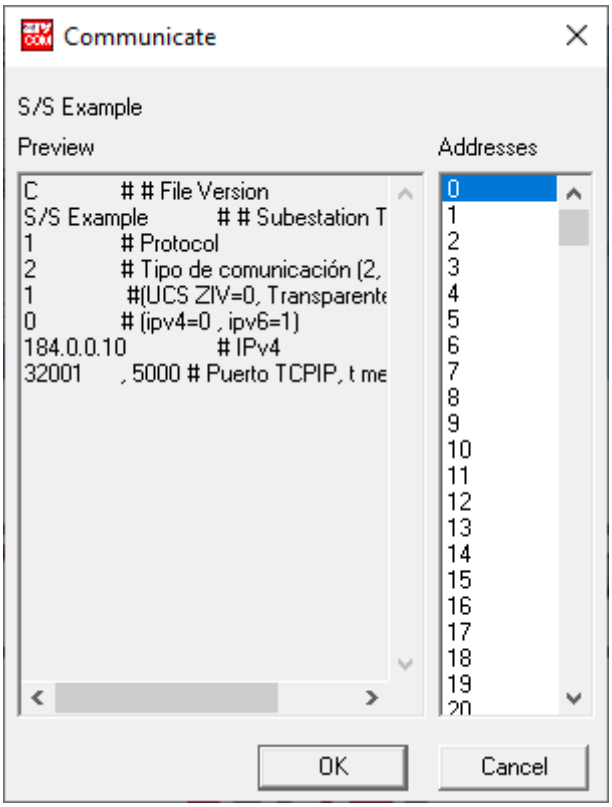

Figure 10

If the field *"Communications type"* is configured as *"LAN-TLS"*, a second level of access will be requested, use the default user ***"admin"*** and the default password ***"Passwd@02".***

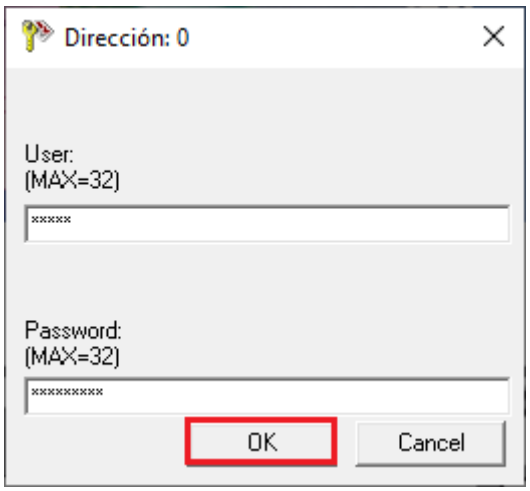

Figure 11

3. Parameterization of the ZIV DLF relay

3.1. Nominal Values

Click on the highlighted *"+"* signs until you reach the *"Nominal Values"* option. In this option, set the nominal voltage as 115.0V, nominal phase current as 5.0A and nominal frequency as 60.00Hz.

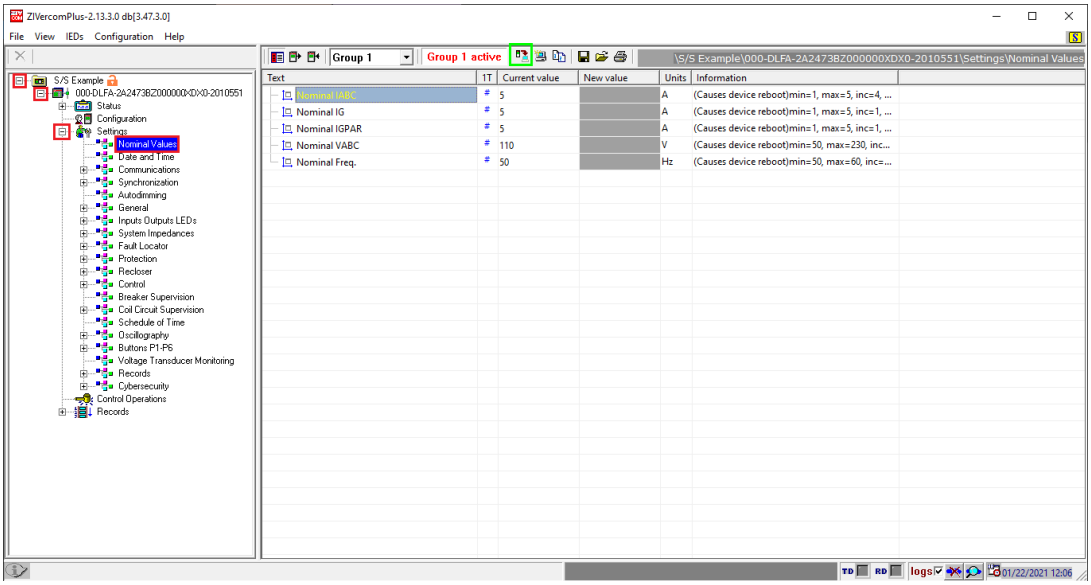

Figure 12

To change the voltage and frequency value, click on the icon highlighted in green in the previous figure.

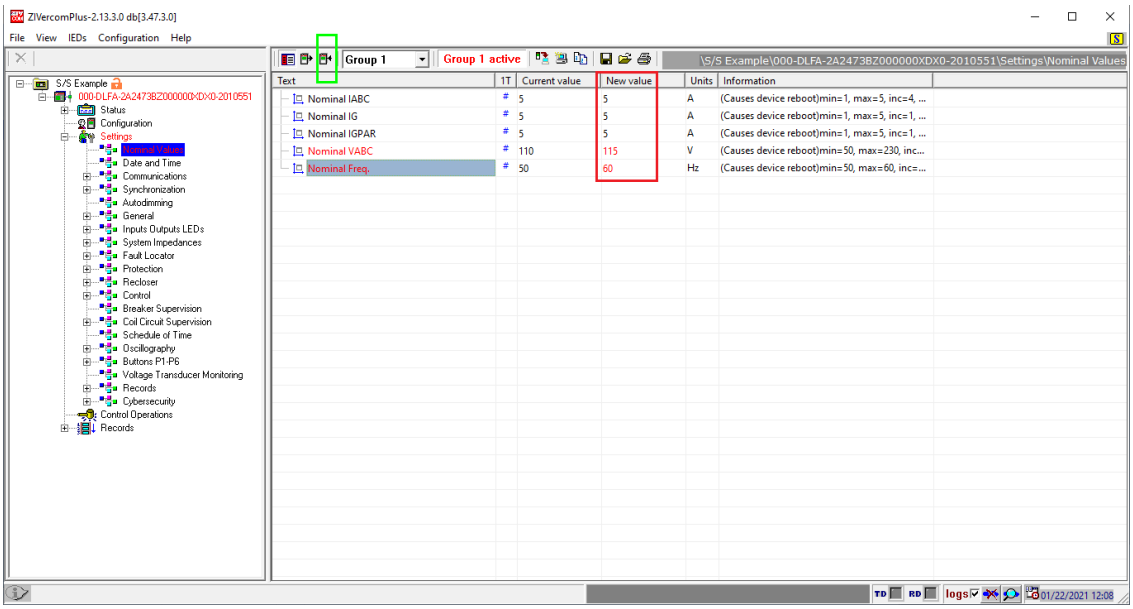

Figure 13

After changing the new values, click again on the icon highlighted in green in the previous figure to send the adjustment to the relay.

3.2. General

Click on the *"General"* option and configure the transformer ratios of the phase, neutral, voltage transformer current transformers and the phase sequence.

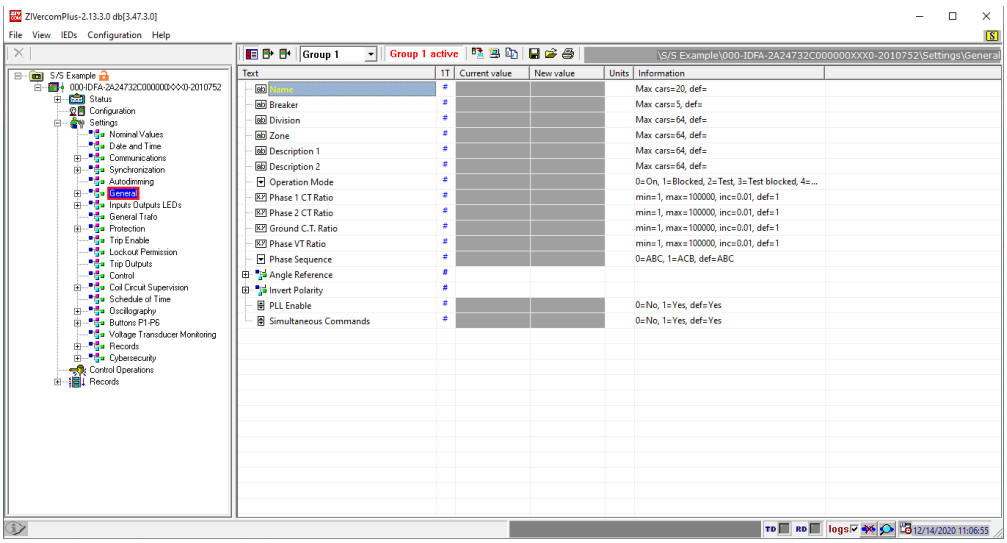

Figure 14

It can be seen in the previous figure that the values in the column *"Current Value"* and *"New value"* are hidden. To allow visualization and configuration click on the buttons highlighted in red and then green.

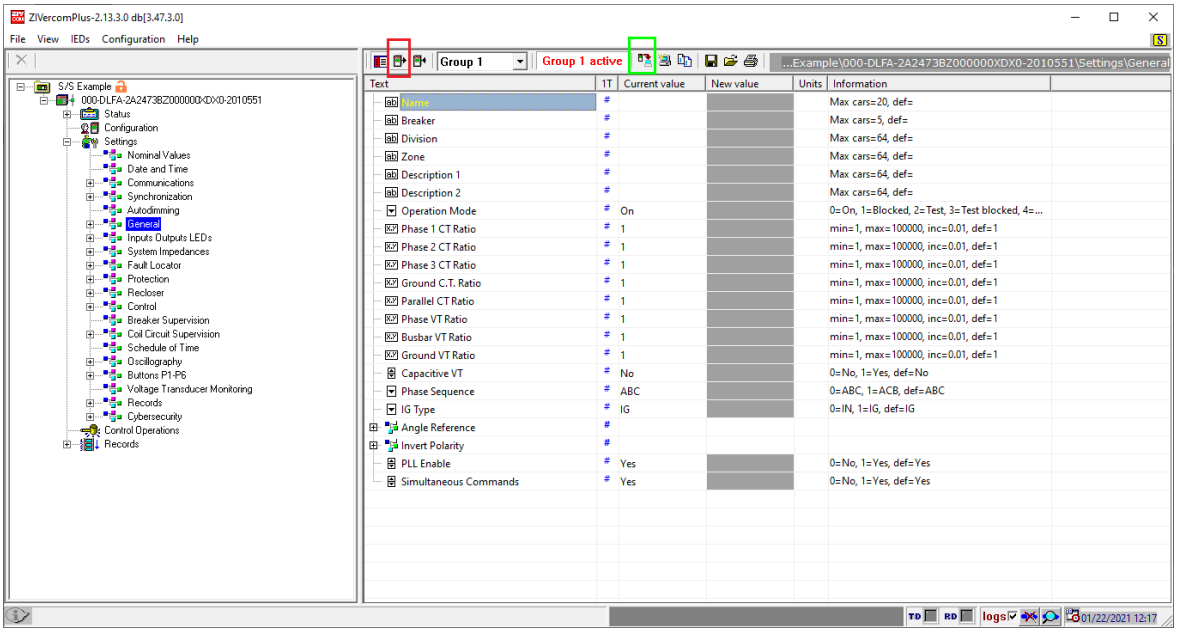

Figure 15

3.3. Frequency

Select the *"Frequency"* option, there are several adjustments that directly impact the timing of the under and overfrequency functions. For more details, consult the relay manufacturer's manual.

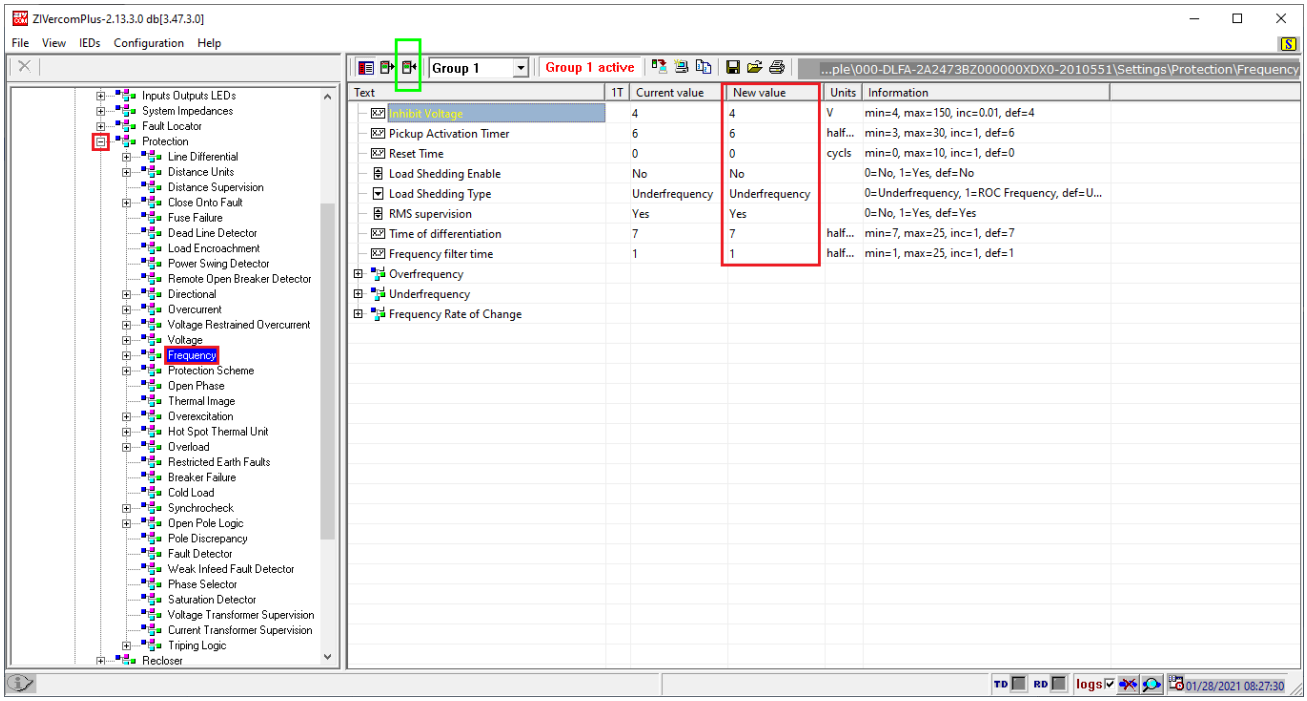

Figure 16

3.4. Overfrequency > Unit 1

Click on the *"+"* signs until you reach the *"Unit 1"* option. In this option, the function must be activated and the pick-up values, the operating time and the reset time must be adjusted. Activate the unit with a pick-up value of 61.0Hz, operation time of 2.0s and zero reset time (0.0s). Submit the adjustments by clicking on the icon highlighted in green.

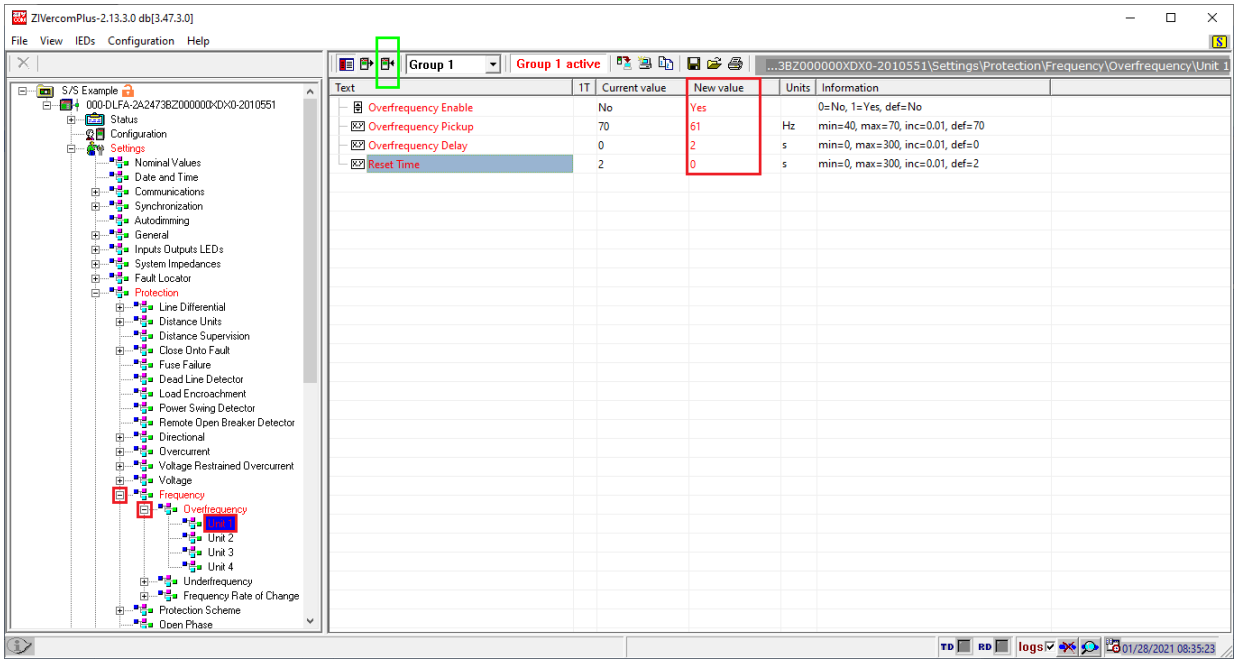

Figure 17

3.5. Overfrequency > Unit 2

Select the *"Unit 2"* option, then activate the function and adjust the pick-up values, operating time and reset time. Activate the unit with a pick-up value of 62.0Hz, operating time of 1.0s and zero reset time (0.0s). Submit the adjustments by clicking on the icon highlighted in green.

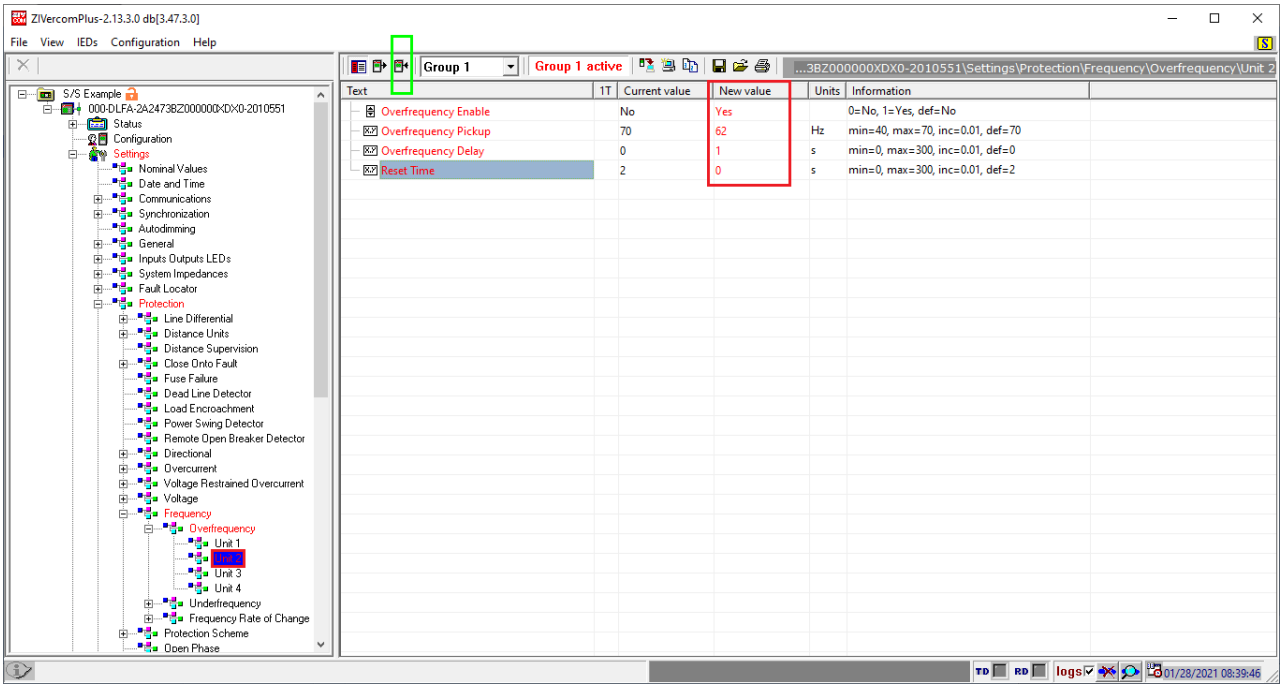

Figure 18

3.6. Underfrequency > Unit 1

Click on the *"+"* signs until you reach the *"Unit 1"* option. In this option, the function must be activated and the pick-up values, the operating time and the reset time must be adjusted. Activate the unit with a pick-up value of 59.0Hz, operating time of 2.0s and zero reset time (0.0s). Submit the adjustments by clicking on the icon highlighted in green.

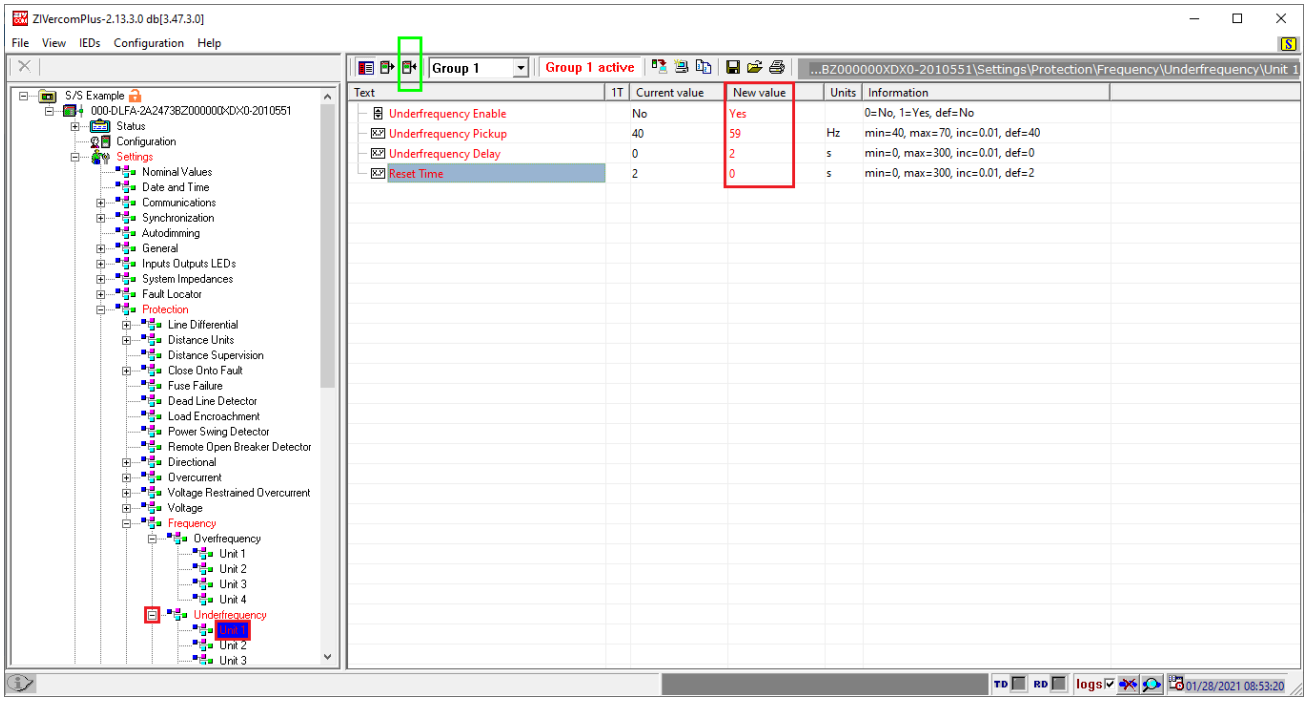

Figure 19

3.7. Underfrequency > Unit 2

Select the *"Unit 2"* option, then activate the function, adjust the pick-up values, the operating time and the reset time. Activate the unit with a pick-up value of 58.0Hz, operating time of 1.0s, and zero reset time (0.0s). Submit the adjustments by clicking on the icon highlighted in green.

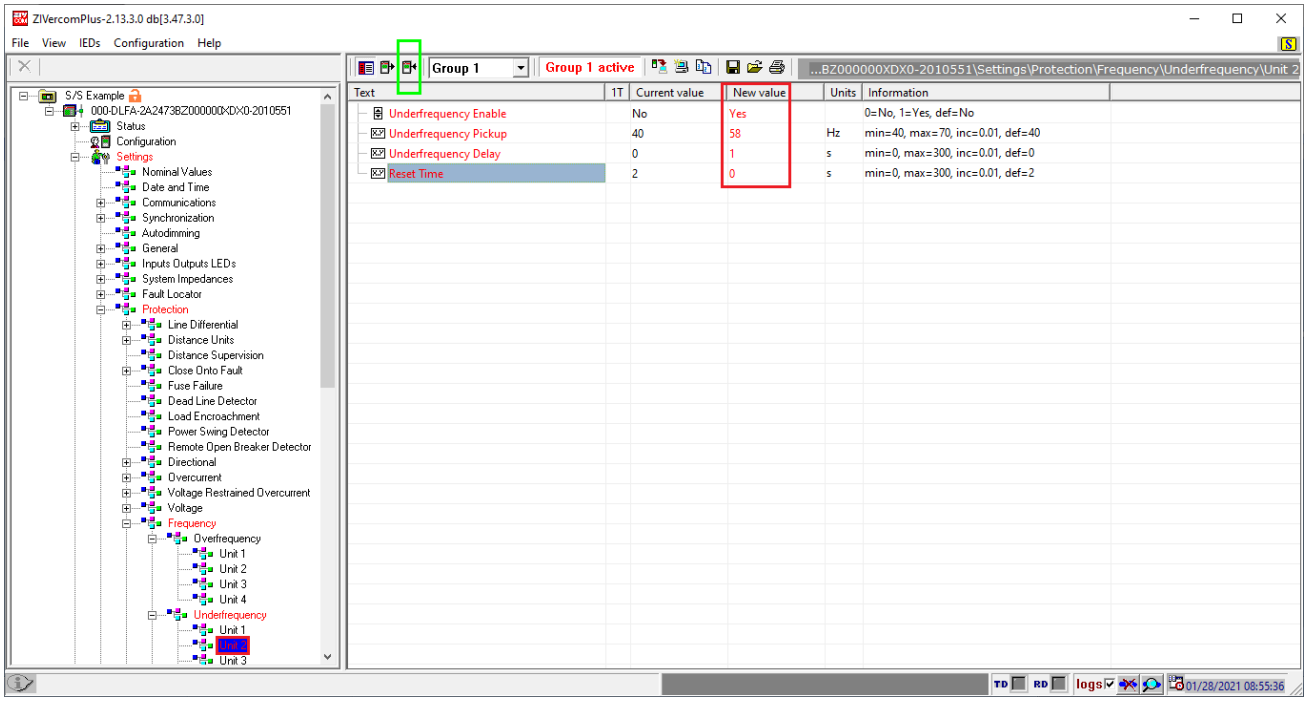

Figure 20

3.8. Outputs

In order to test the pickup and the operating time of the overfrequency and underfrequency functions, 4 relay output binaries will be used to collect these signals by the test set. In the figure below, configure the first output with the trip signals of the 81o-1 unit.

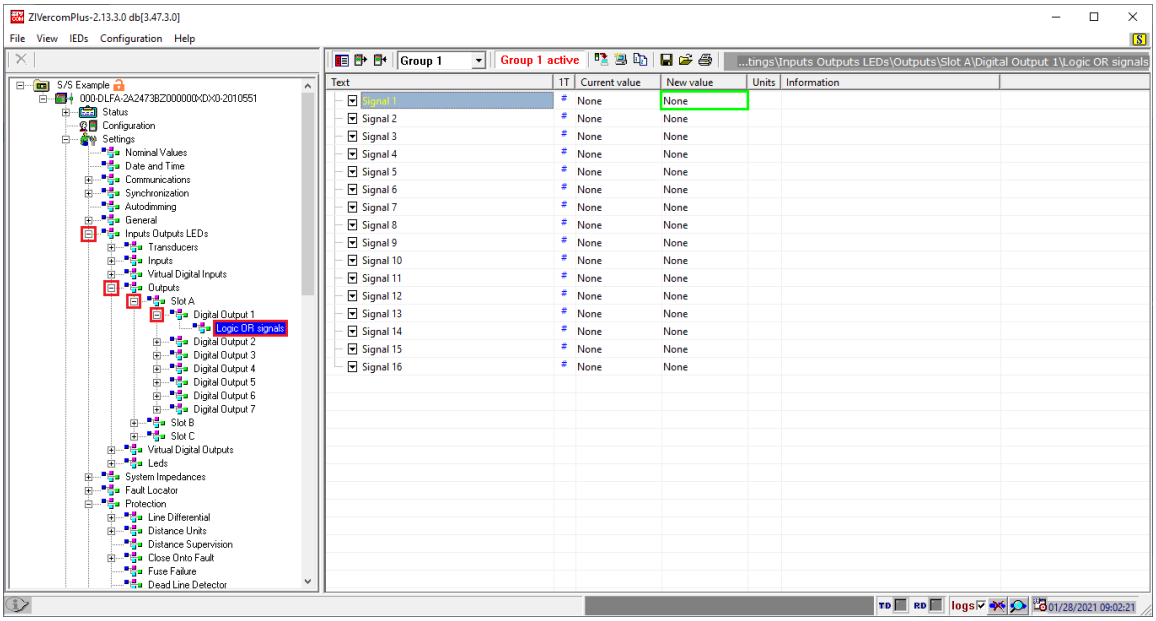

Figure 21

Click on the option *"None"*, highlighted in the previous figure, and make the following adjustment.

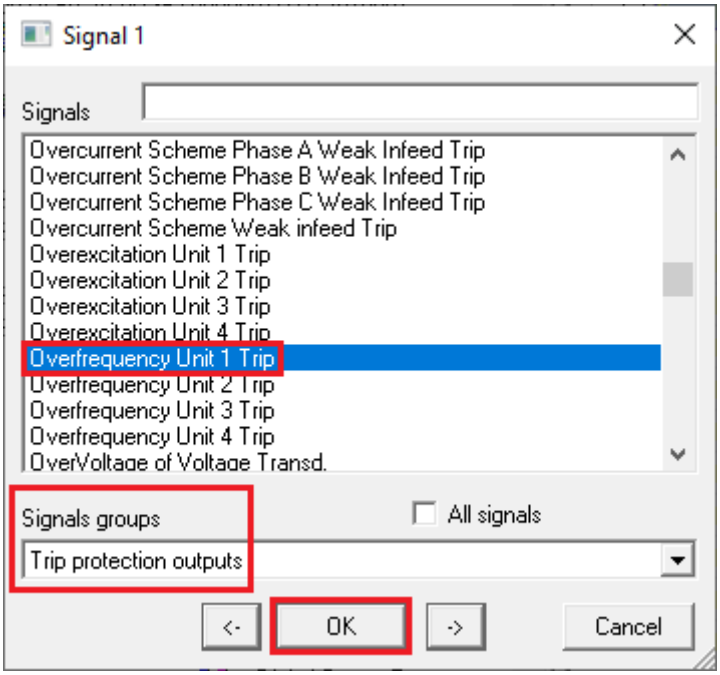

Figure 22

Send the settings to the relay.

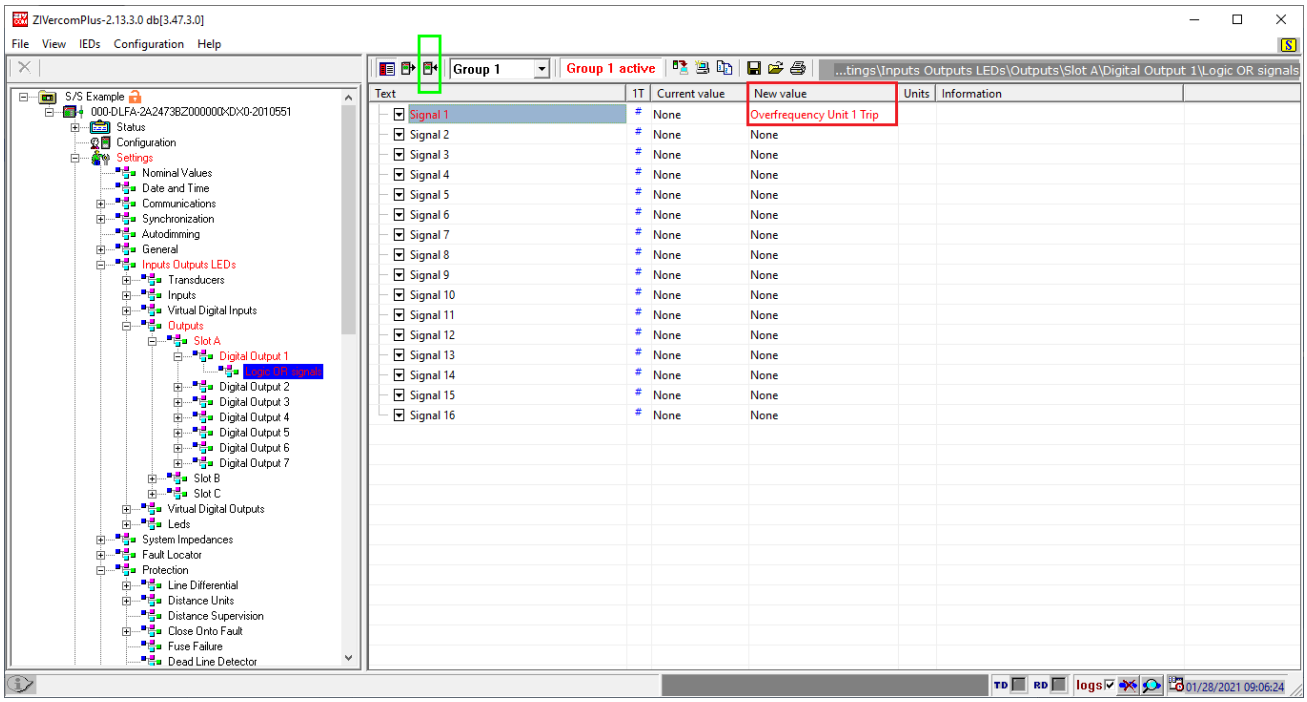

Figure 23

On the second output, configure the trip signal of the 81o-2 unit.

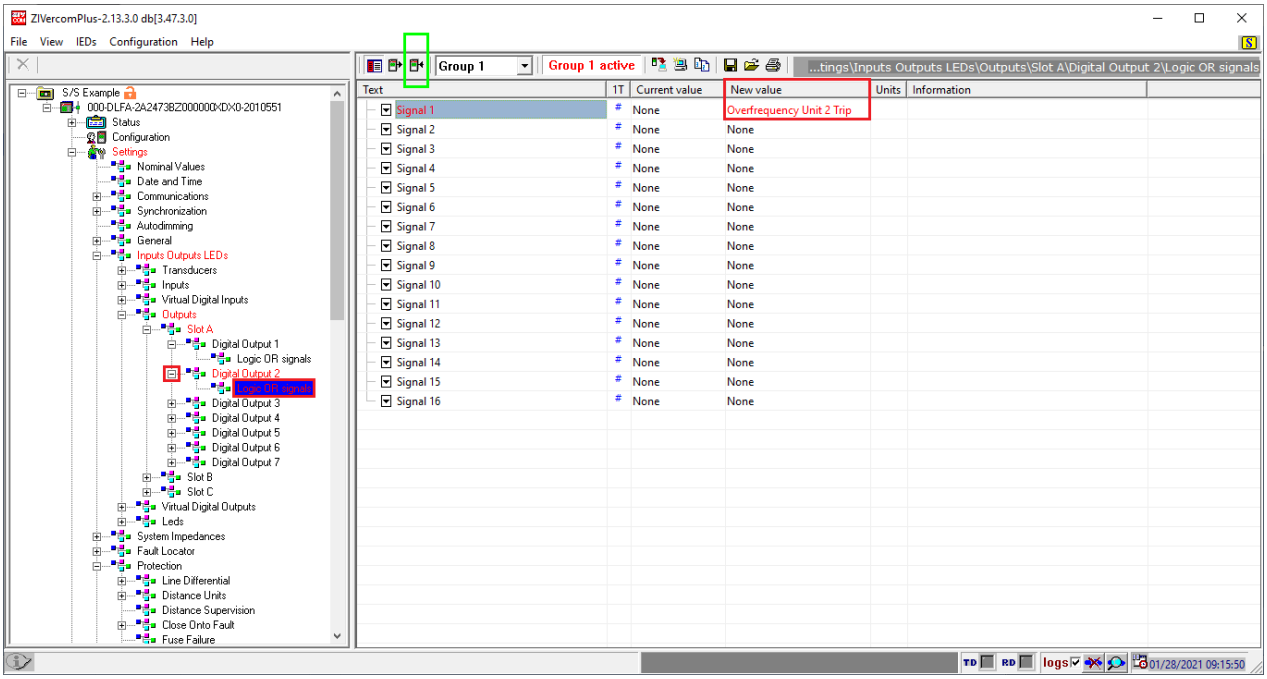

Figure 24

On the third output, configure the trip signal of the 81u-1 unit.

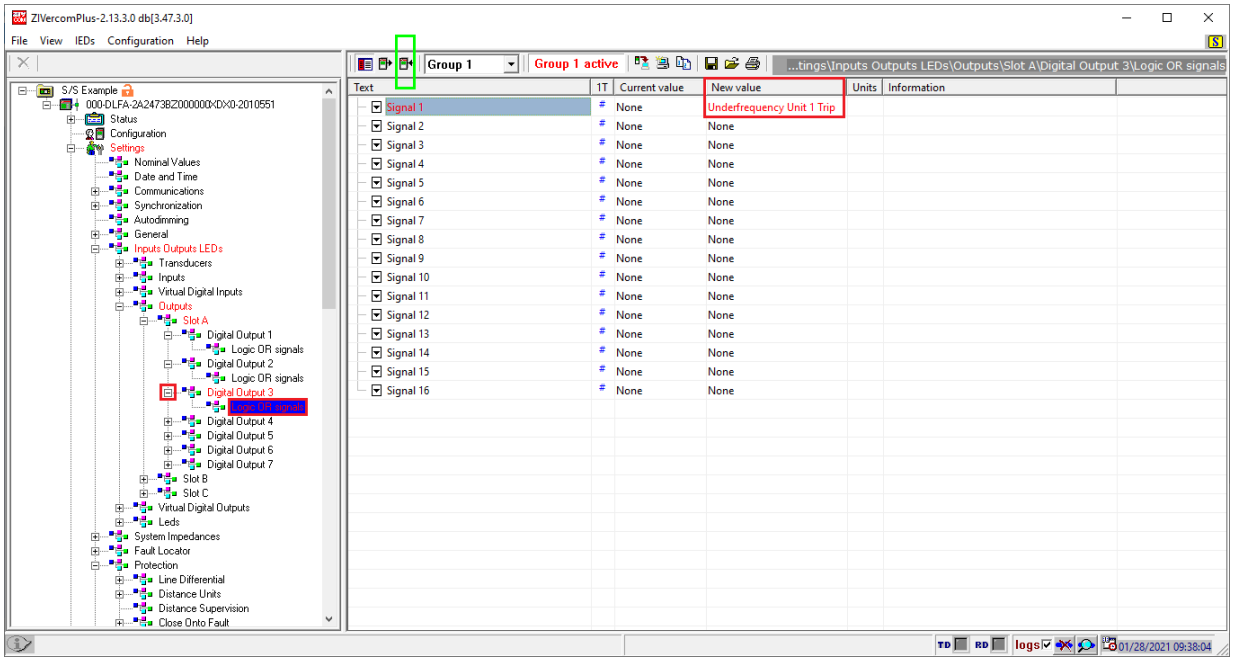

Figure 25

On the fourth output, configure the trip signal of the 81u-2 unit.

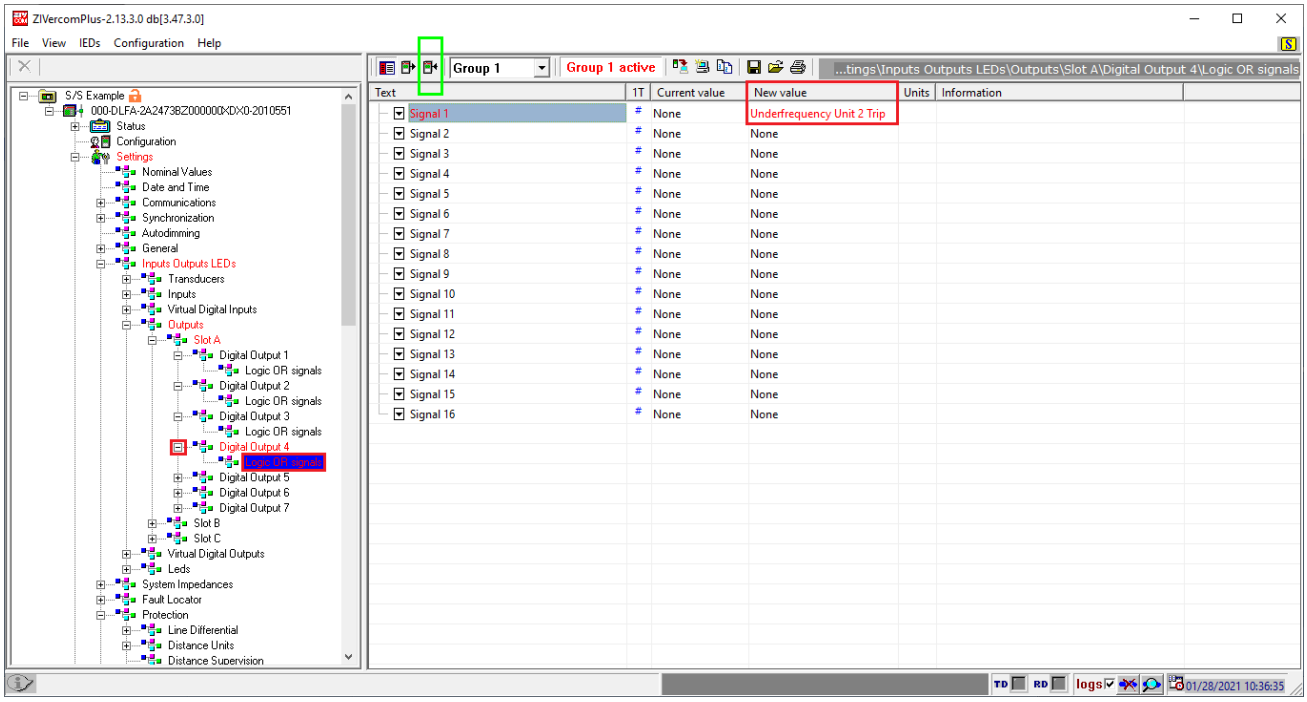

Figure 26

4. Application Manager

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

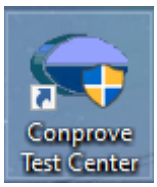

Figure 27

4.1. Ramp software adjustments

Open the Ramp software within the Conprove Test Center (CTC) software area, as shown in the figure below.

Figure 28

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. Fill in the *"General Inform."* with details of the tested device, installation location and the person responsible. This facilitates the preparation of the report, and this tab will be the first to be shown.

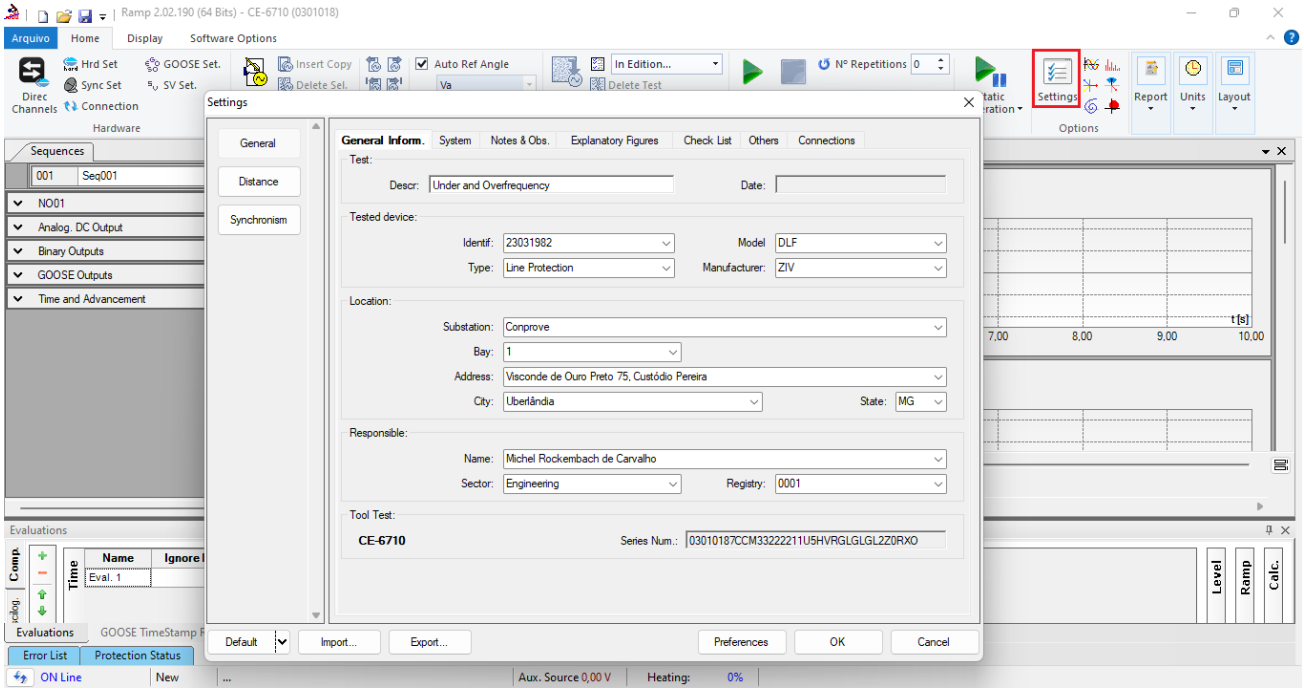

Figure 29

Also in the *"Settings"* area, there are other useful tabs for the user. In the figure below, within the *"System"* tab, the values of frequency, phase sequence, primary and secondary voltages, primary and secondary currents, VTs and CTs transformation ratios are configured. There are two sub-tabs *"Impedance"* and *"Source"*, whose data are not relevant for this test.

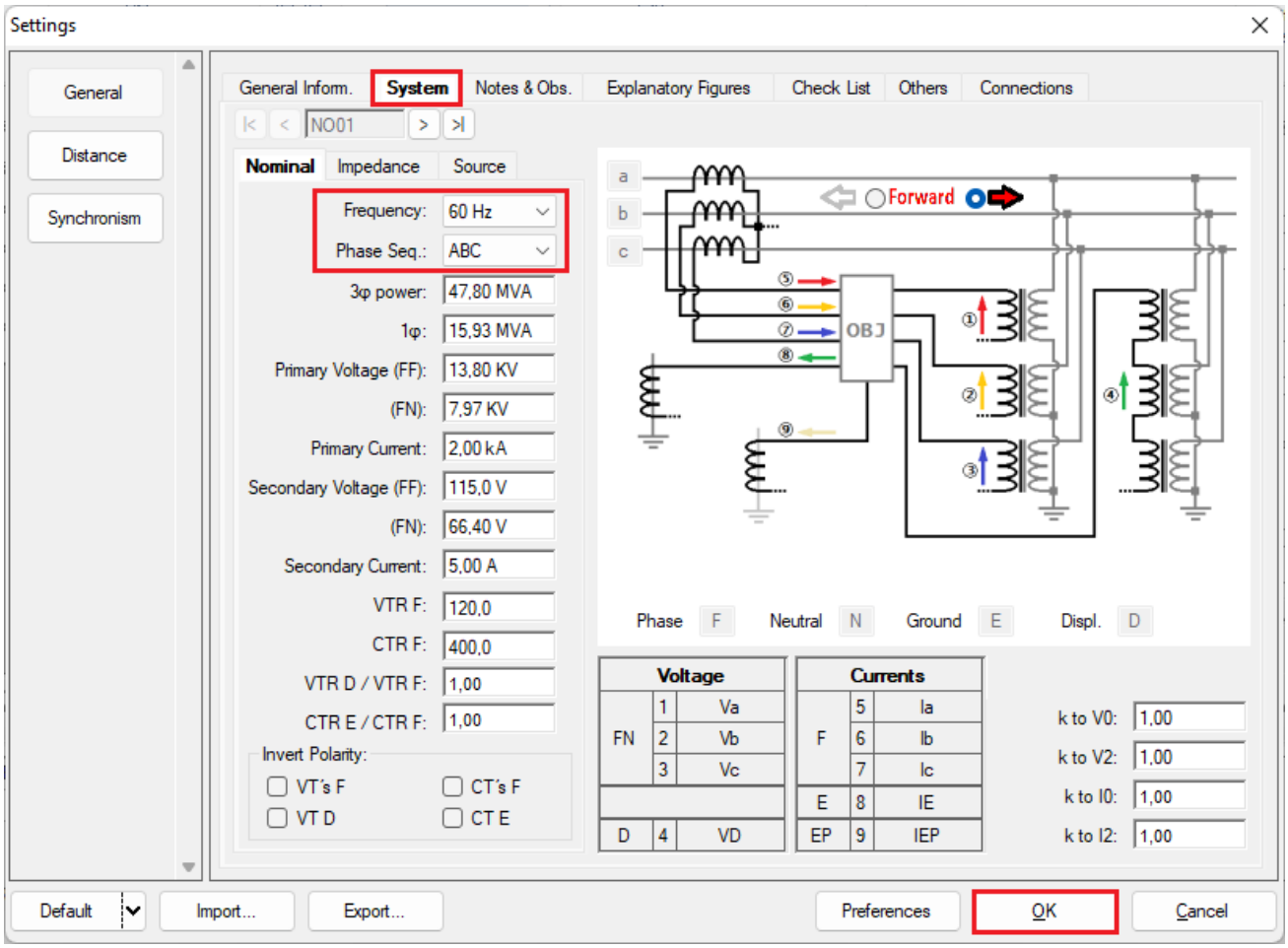

Figure 30

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 also create a schematic of the connections between the test set and the tested equipment.

5. Channel Direction and Hardware Configurations

Click on the icon illustrated below.

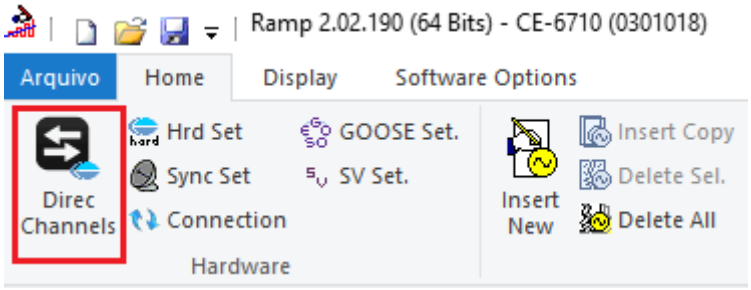

Figure 31

Then click on the highlighted icon to configure the hardware.

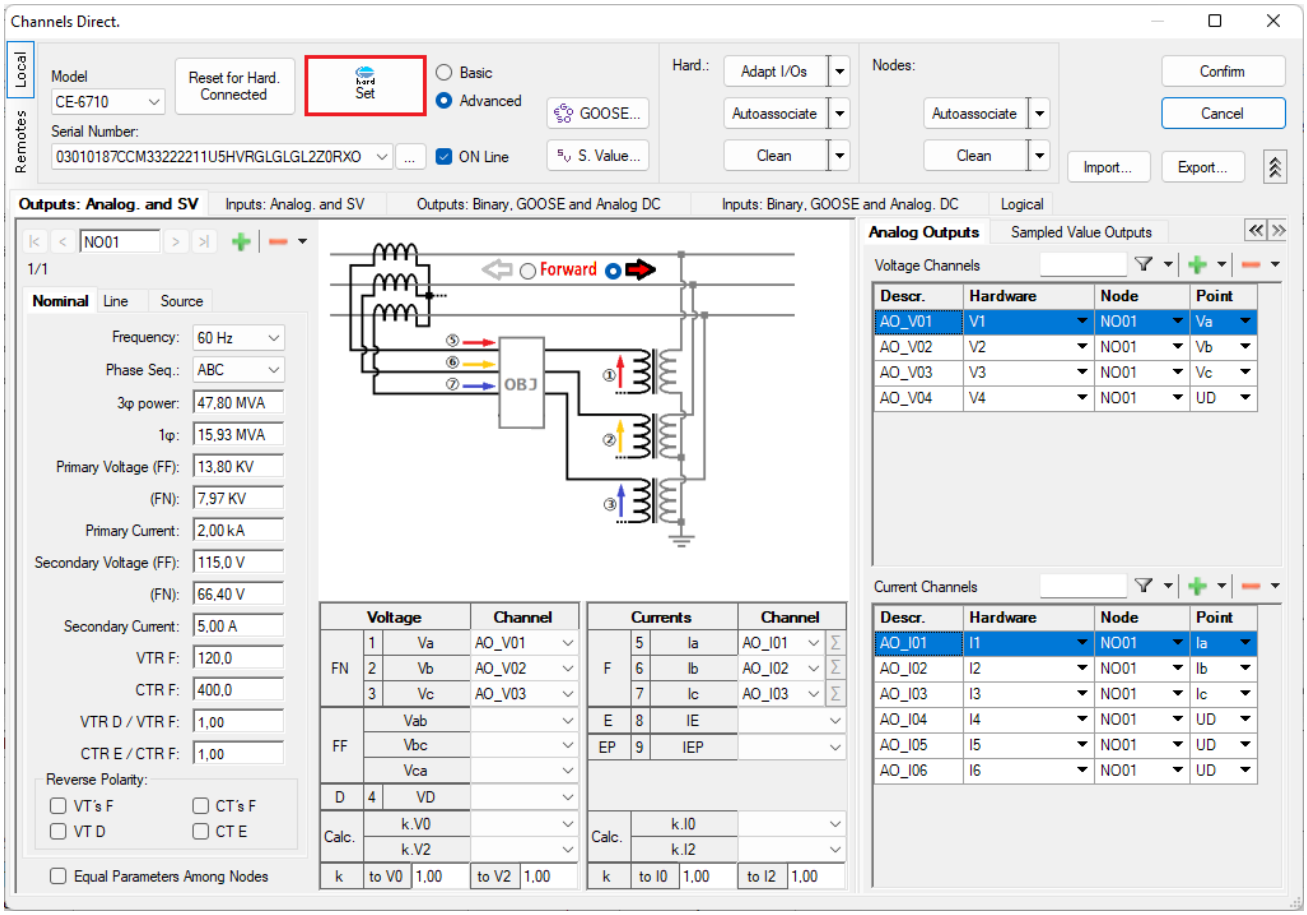

Figure 32

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

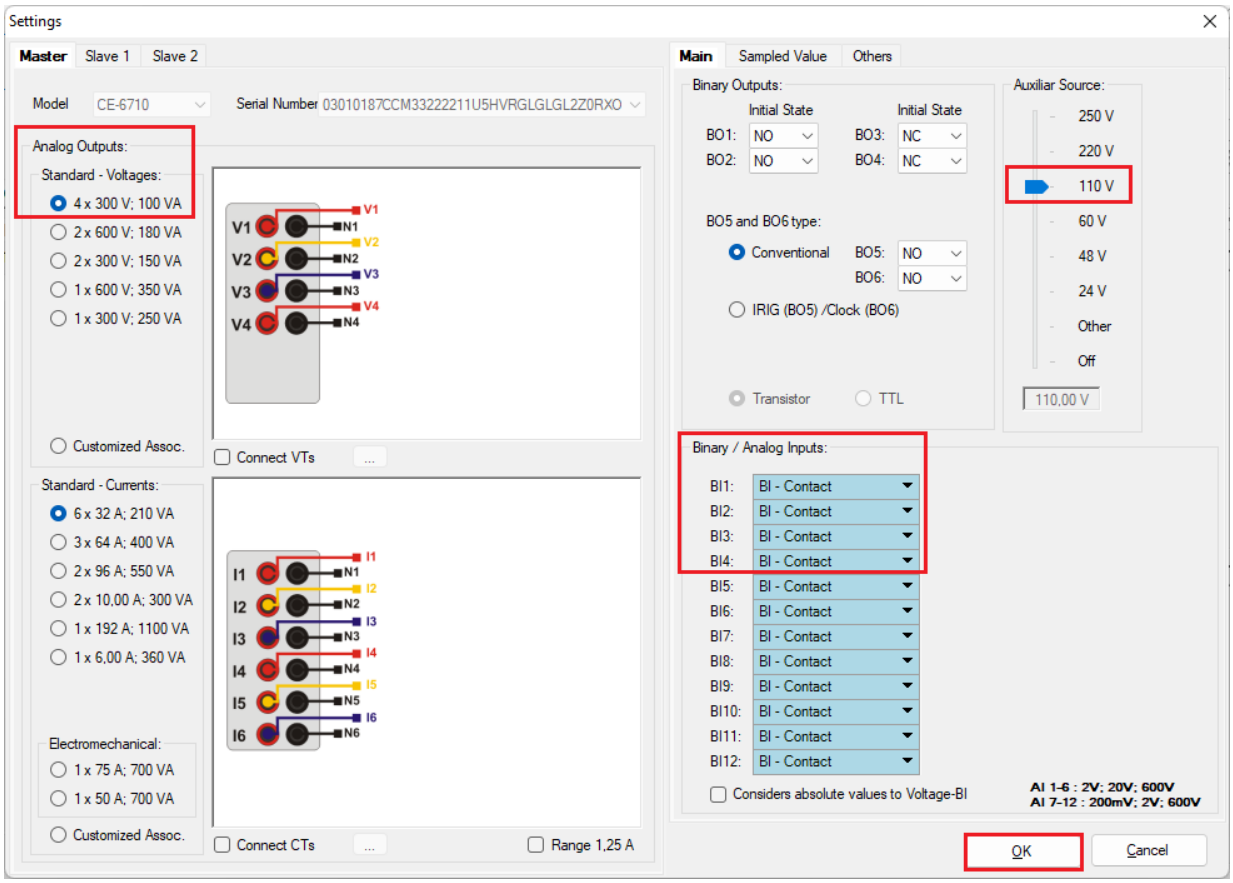

Figure 33

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

Figure 34

6. Restore Layout

Due to the great flexibility that the software presents, allowing the user to choose the windows that will be presented and their positions, the command is used to restore the default settings. Click on the *"Layout"* button and then on *"Recreate Charts"* repeat the process by clicking on *"Layout"* and on *"Restore Layout"*. During the test, irrelevant windows are excluded.

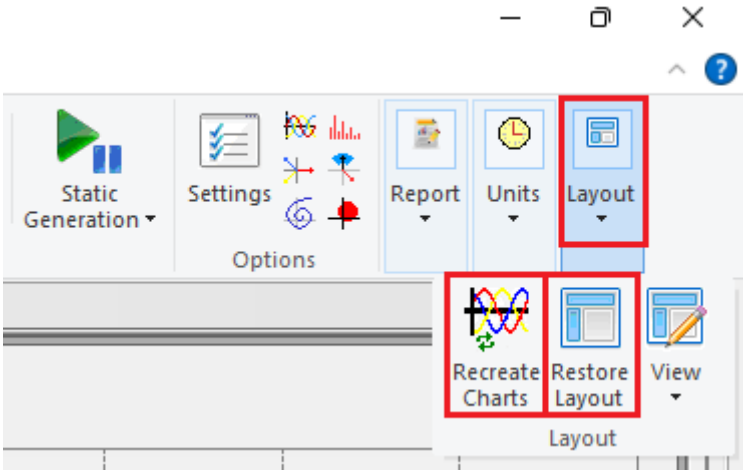

Figure 35

7. Test Structure for function 81

Click on the highlighted *"Insert New"* button until you create 4 test sequences.

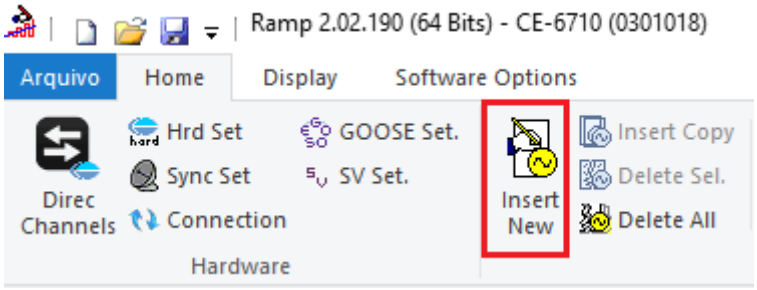

Figure 36

7.1. Main Screen 81o-1

In the first sequence, configure a situation to check the overfrequency of the first element whose adjustment is at 61.0Hz and 2.0s. Instead of *"Seq 001"* write *"81o-1"* and select the option *"NO01"*. Then click on the *"..."* button highlighted in the following figure.

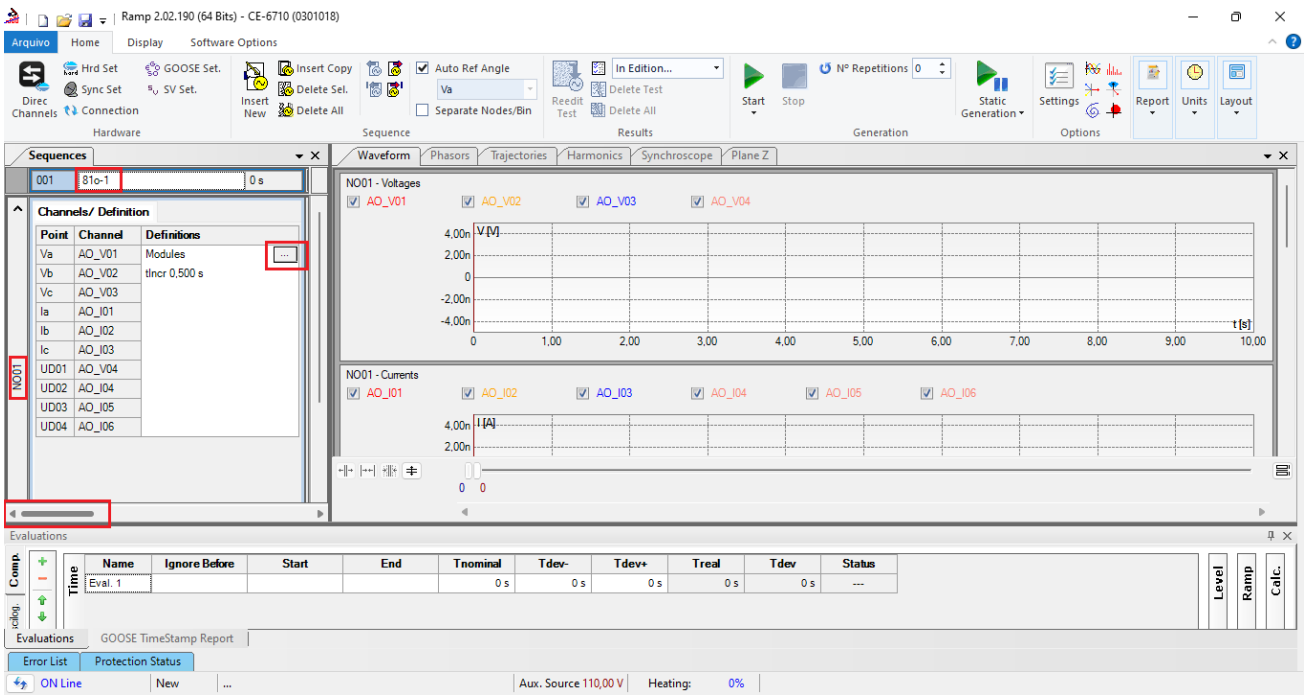

Figure 37

7.2. Screen for 81o-1 increment

On this screen, in the *"Ramp Type"* field, choose the *"Frequency"* option and then select the *"Pulsed"* option. For voltage values, either initial or reset, use the nominal voltage of 66.4V balanced three-phase ABC. For the initial frequency use 60.98Hz and for the final frequency 61.02Hz with a step of 5.0mHz. In the field *"Generation Time in each Incr."* the user must configure a time that is always longer than the actuation time. In this case, a time of 2.25 seconds was chosen. *"Reset Time"* has been set to 0.25 seconds.

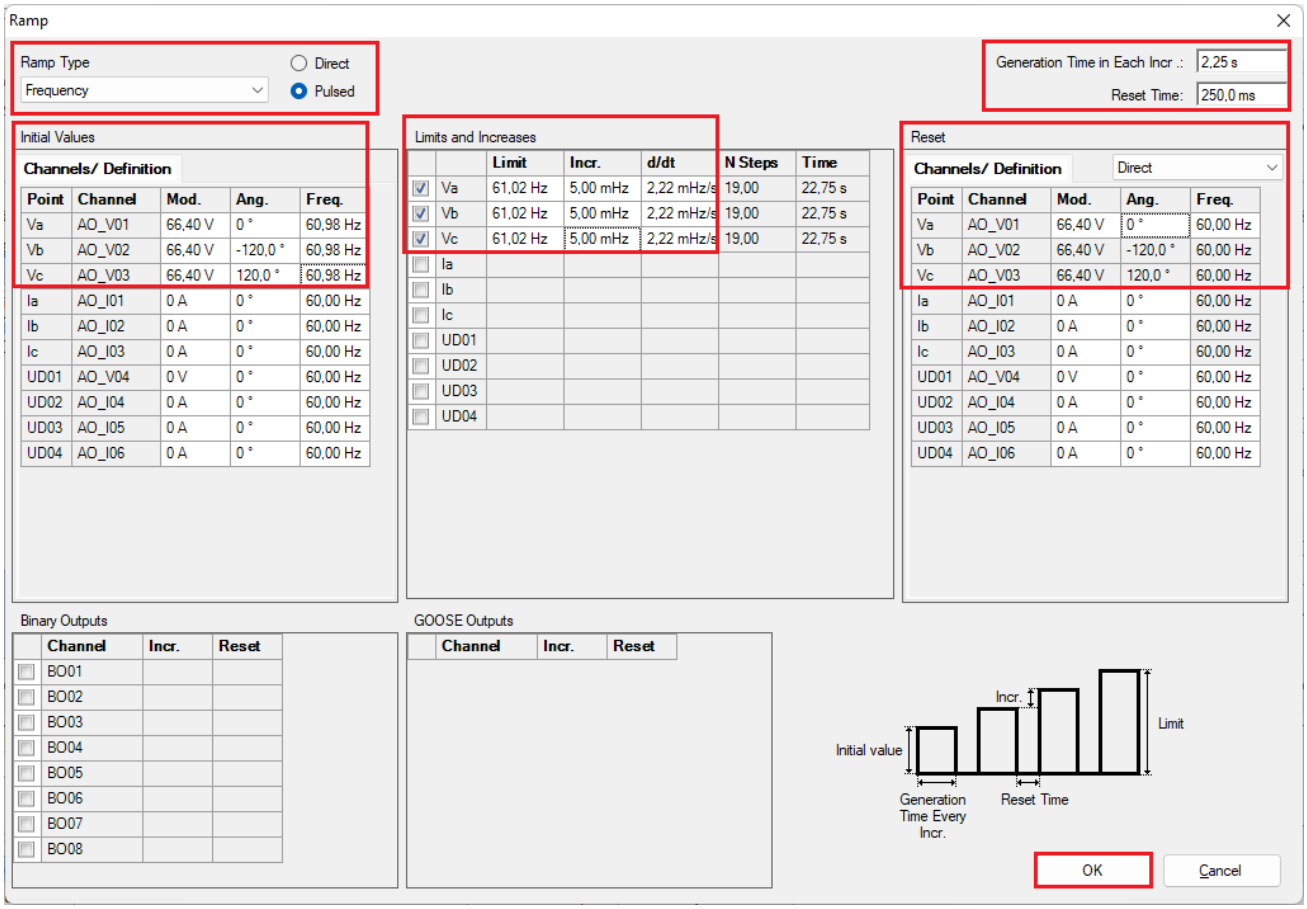

Figure 38

7.3. Main Screen 81o-2

In the second sequence, configure a situation to check the overfrequency of the first element whose adjustment is at 62.0Hz and 1.0s. In place of *"Seq 002"* write *"81o-2"* then click on the *"..."* button highlighted in the figure below.

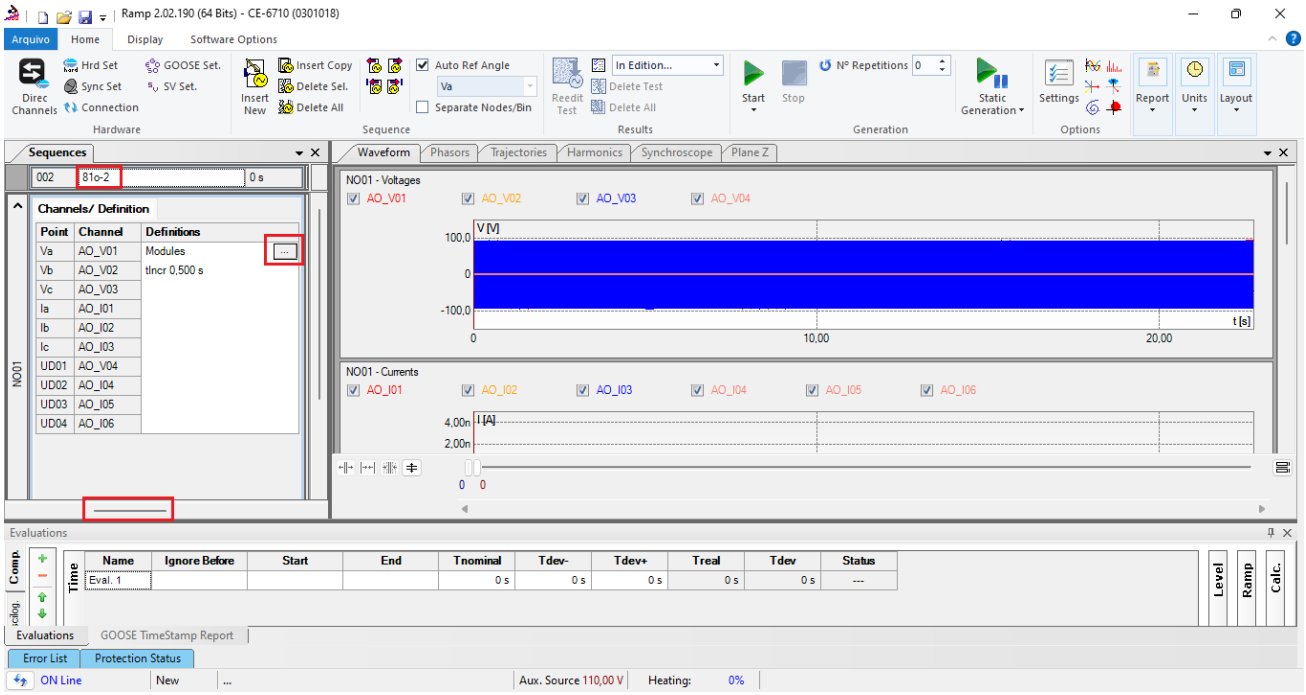

Figure 39

7.4. Screen for incrementing 81o-2

On this screen, in the *"Ramp Type"* field, choose the *"Frequency"* option and then select the *"Pulsed"* option. For voltage values, either initial or reset, use the nominal voltage of 66.4V balanced three-phase ABC. For the initial frequency use 61.98Hz and for the final frequency 62.02Hz with a step of 5.0mHz. In the field *"Generation Time in each Incr."* the user must configure a time that is always longer than the actuation time. In this case, a time of 1.25 seconds was chosen. "Reset Time" has been set to 0.25 seconds.

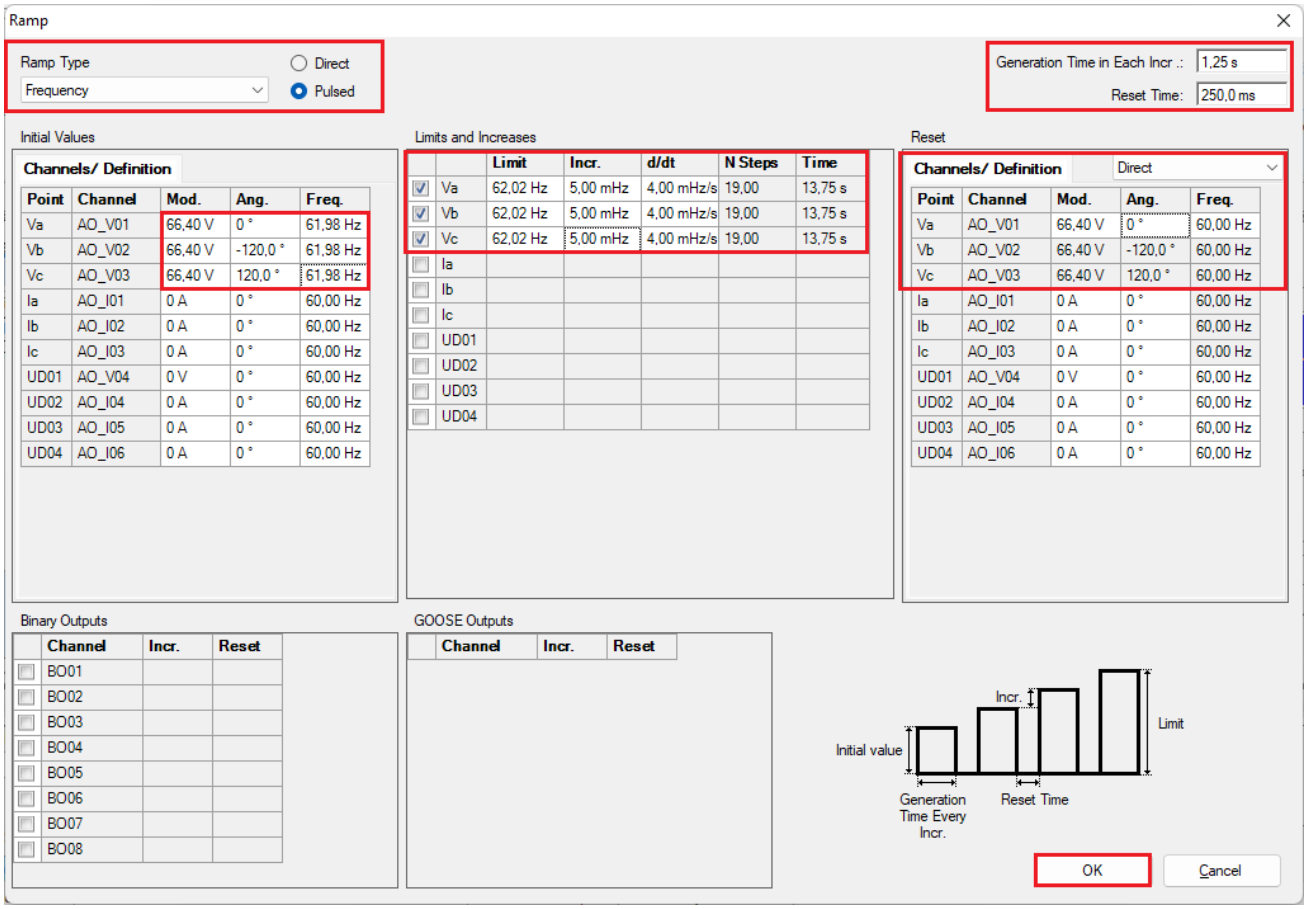

Figure 40

7.5. Main Screen 81u-1

In the third sequence, configure a situation to check the underfrequency of the first element whose adjustment is at 59.0Hz and 2.0s. In place of *"Seq 003"* write *"81u-1"* then click on the *"..."* button highlighted in the figure below.

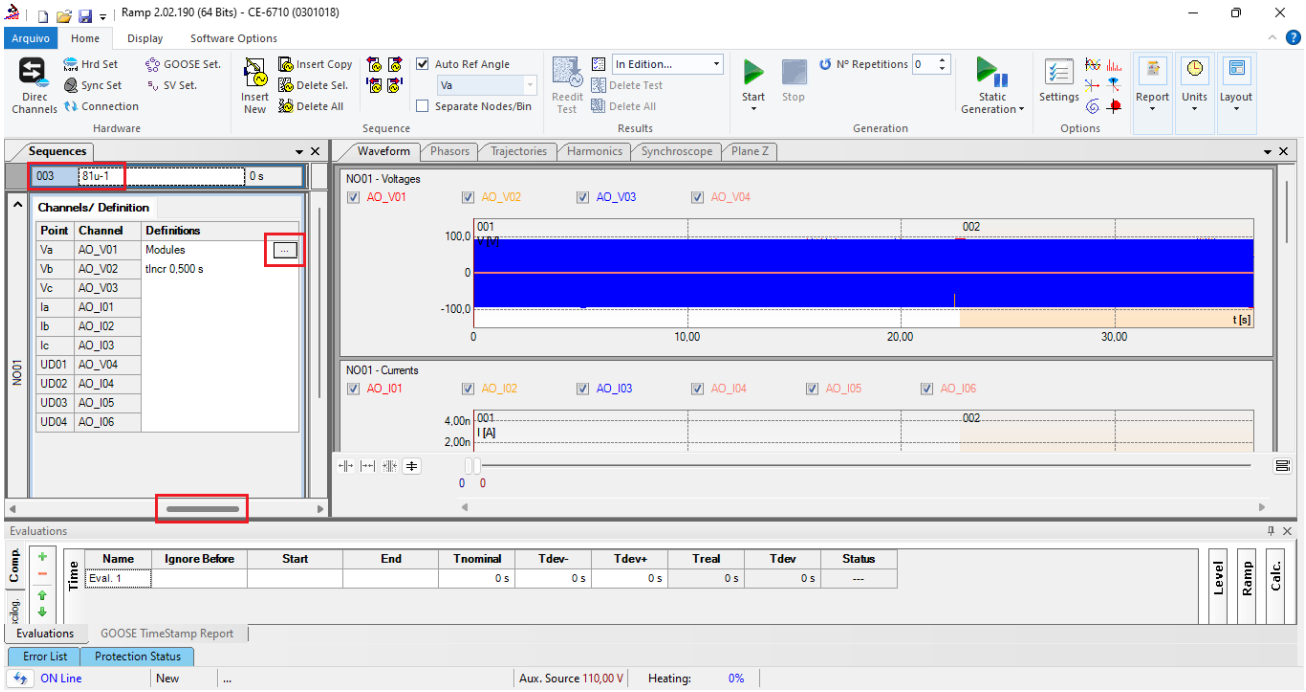

Figure 41

7.6. Screen for 81u-1 increment

On this screen, in the *"Ramp Type"* field, choose the *"Frequency"* option and then select the *"Pulsed"* option. For voltage values, either initial or reset, use the nominal voltage of 66.4V balanced three-phase ABC. For the initial frequency use 59.02Hz and for the final frequency 58.98Hz with a step of 5.0mHz. In the field *"Generation Time in each Incr."* the user must configure a time that is always longer than the actuation time. In this case, a time of 2.25 seconds was chosen. *"Reset Time"* has been set to 0.25 seconds.

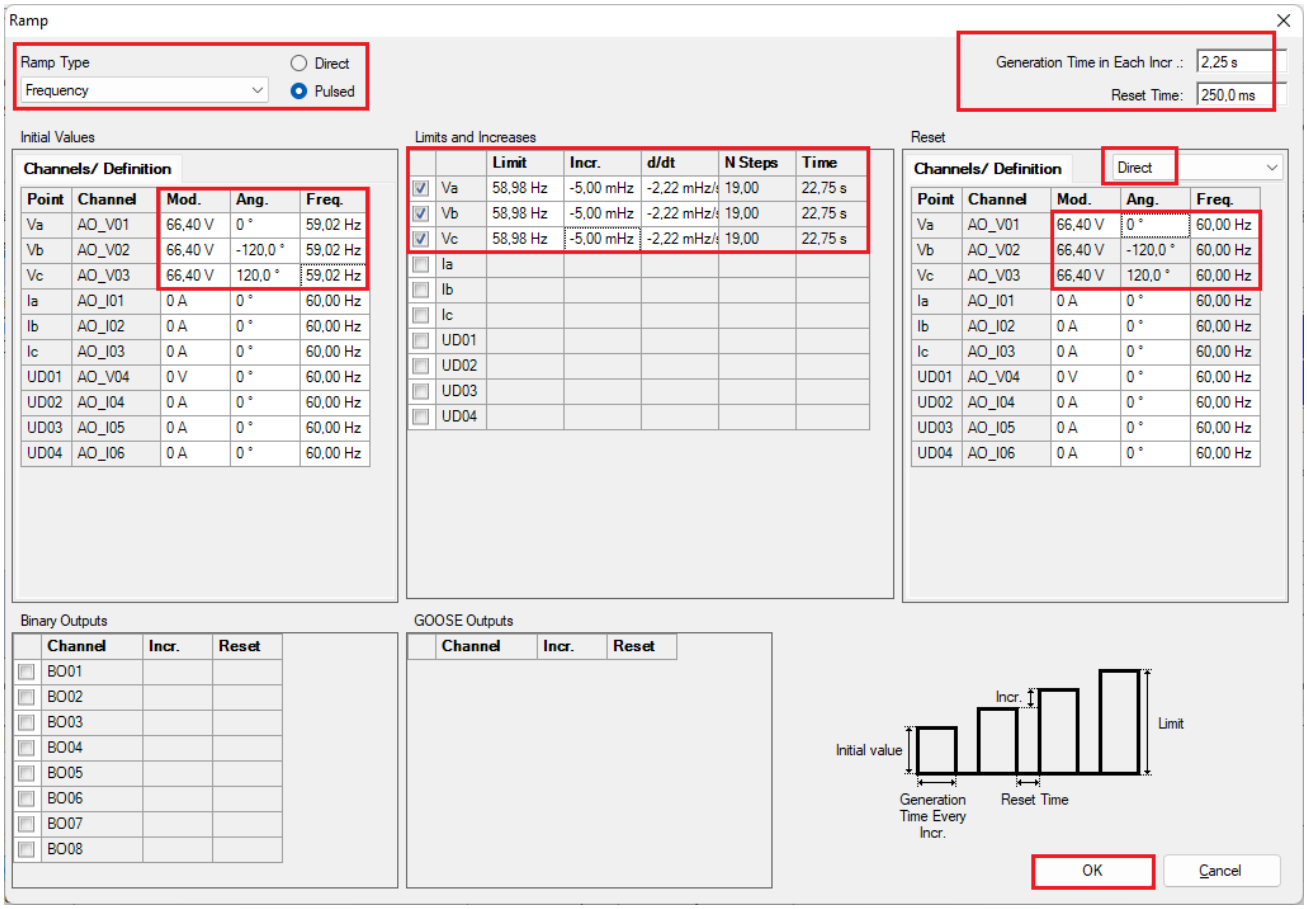

Figure 42

7.7. Main Screen 81u-2

In the fourth sequence, configure a situation to check the underfrequency of the second element whose adjustment is at 58.0Hz and 1.0s. In place of *"Seq 004"* write *"81u-2"* then click on the *"..."* button highlighted in the figure below.

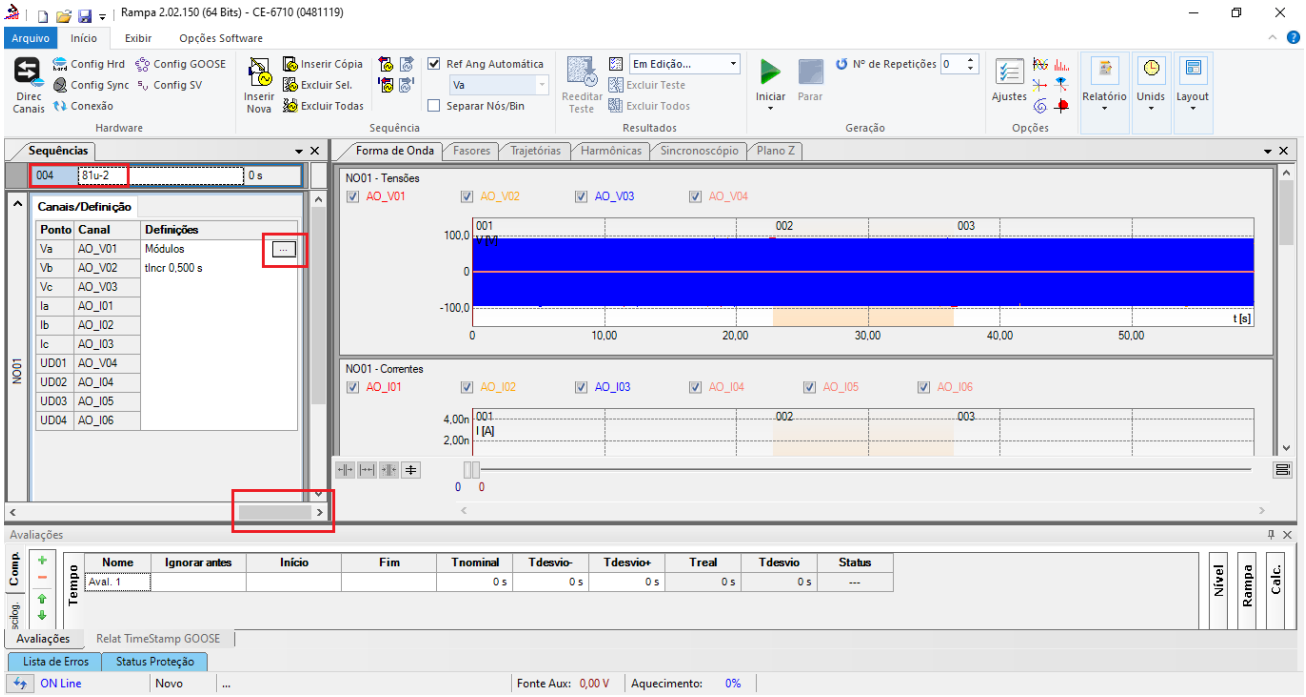

Figure 43

7.8. Screen for 81u-2 incrementation

On this screen, in the *"Ramp Type"* field, choose the *"Frequency"* option and then select the *"Pulsed"* option. For voltage values, either initial or reset, use the nominal voltage of 66.4V balanced three-phase ABC. For the initial frequency use 58.02Hz and for the final frequency 57.98Hz with a step of 5.0mHz. In the field *"Generation Time in each Incr."* the user must configure a time that is always longer than the actuation time. In this case, a time of 1.25 seconds was chosen. *"Reset Time"* has been set to 0.25 seconds.

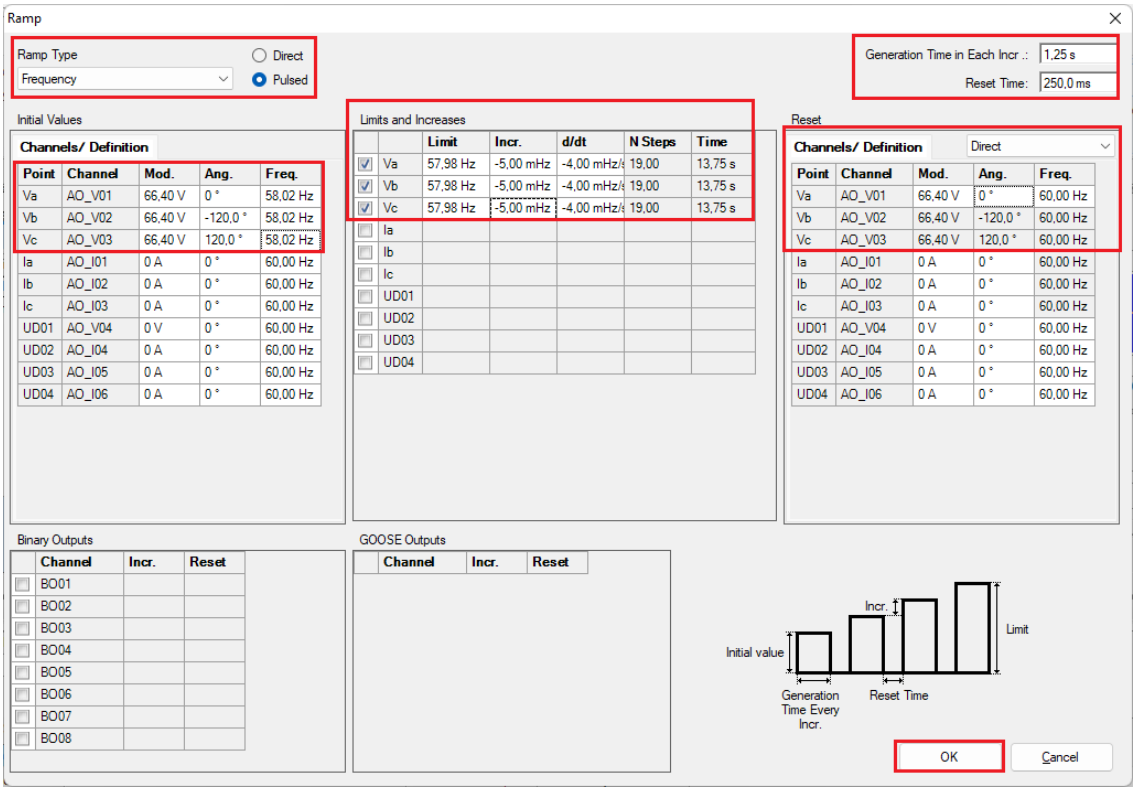

Figure 44

7.9. Pick-ups assessments

By clicking on the *"Ramp"* field, as shown in the next figure, 4 pick-up evaluations can be configured as follows.

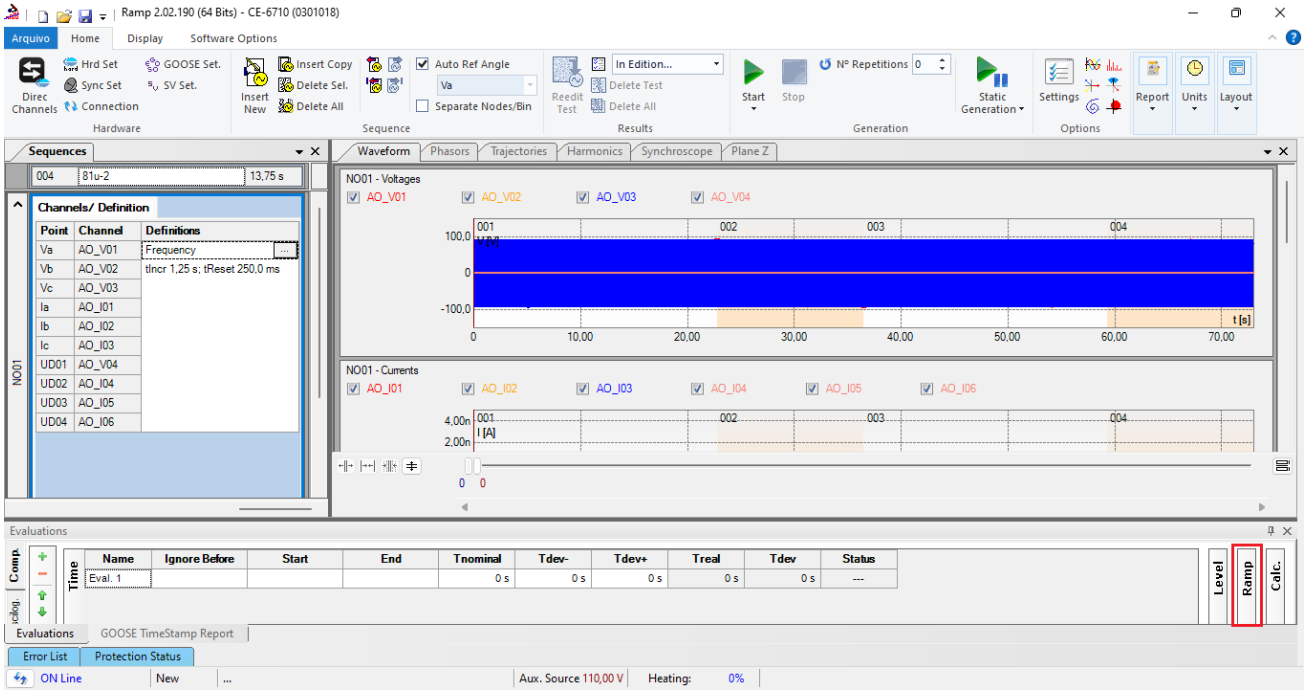

Figure 45

Instead of *"Eval.1"* write *"81o-1"*, in Ramp select *"81o-1 > NO01"* for *"Condition"* set *"BI01 (↑)"*, for *"Type"* choose *"Frequency"*, for *"Output"* adjust *"Va"*, in the *"Nom. Value"* field set 61.00Hz and in the fields related to deviations set 10mHz.

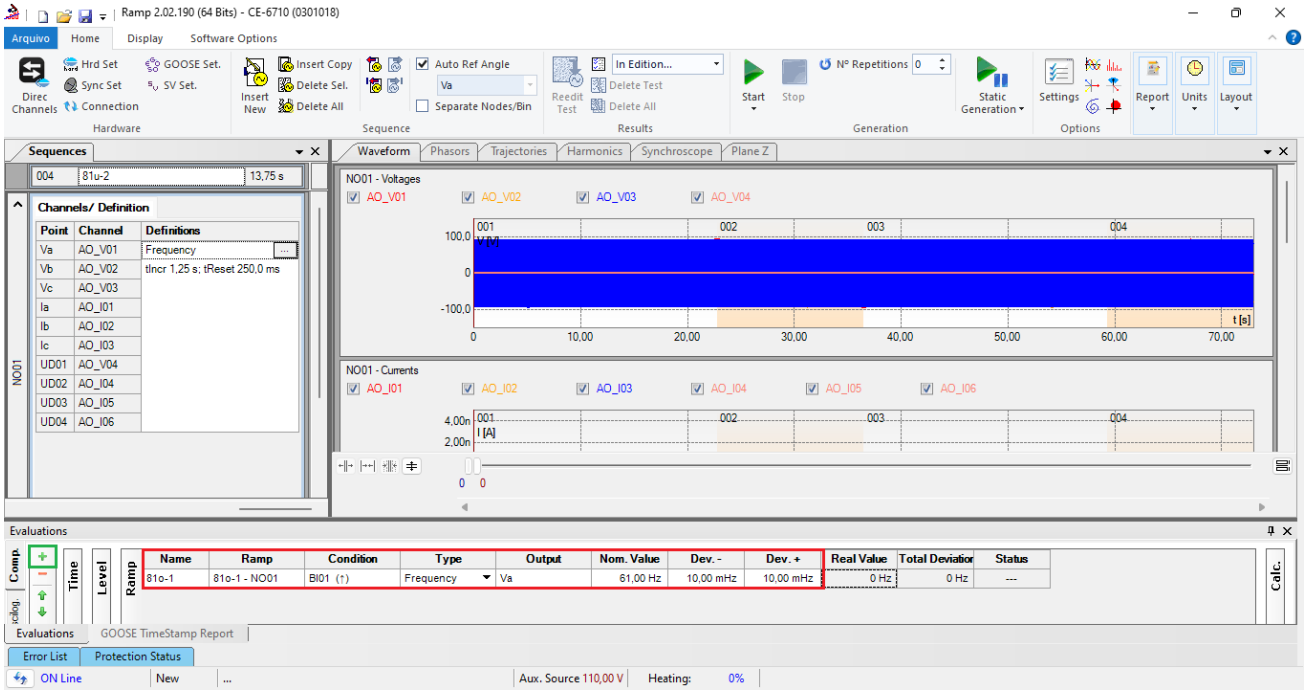

Figure 46

Clicking on the *"+"* icon in the previous figure insert 3 more evaluations. The configuration must be done in a similar way to the first evaluation with changes in the binary and values of the pick-ups.

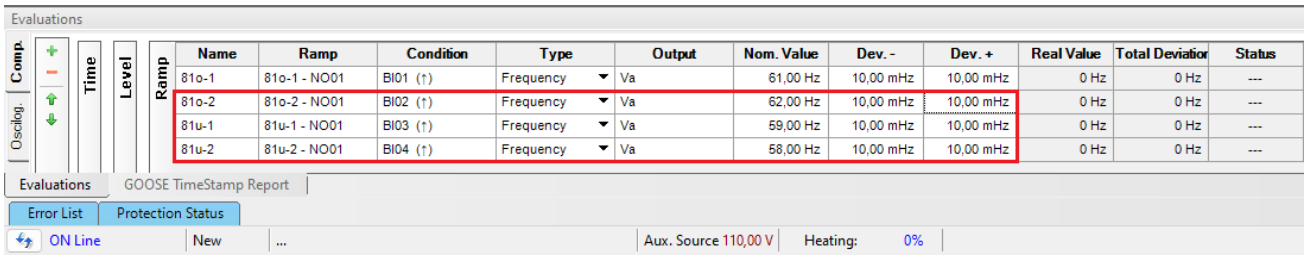

Figure 47

7.10. Adjusting Graphics

Double-click on the *"Waveform"* option and maximize the screen to choose the relevant signals and insert markings for time analysis.

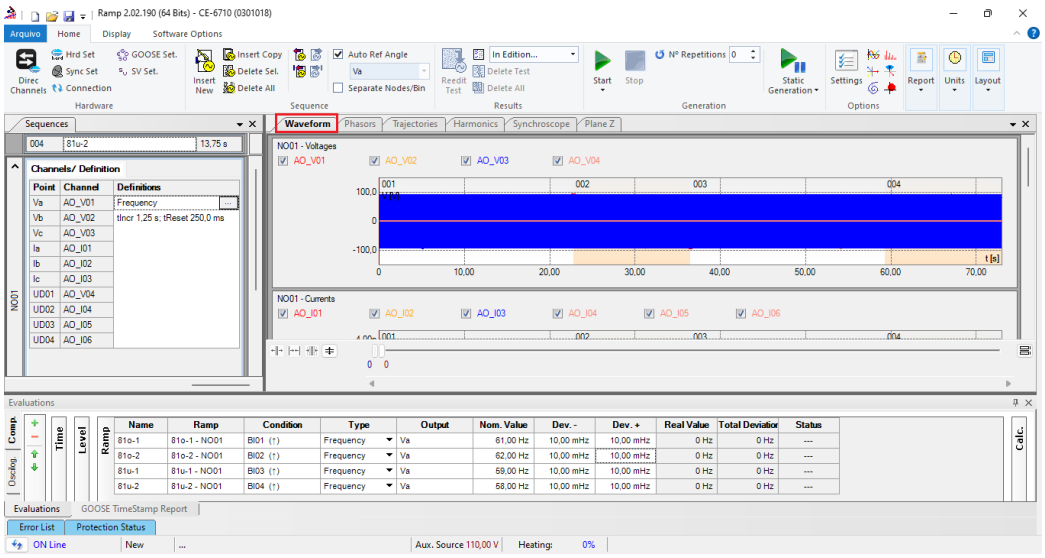

Figure 48

Deselect the channel *"AO_V04"* and right-click on the voltage graph and choose the highlighted option.

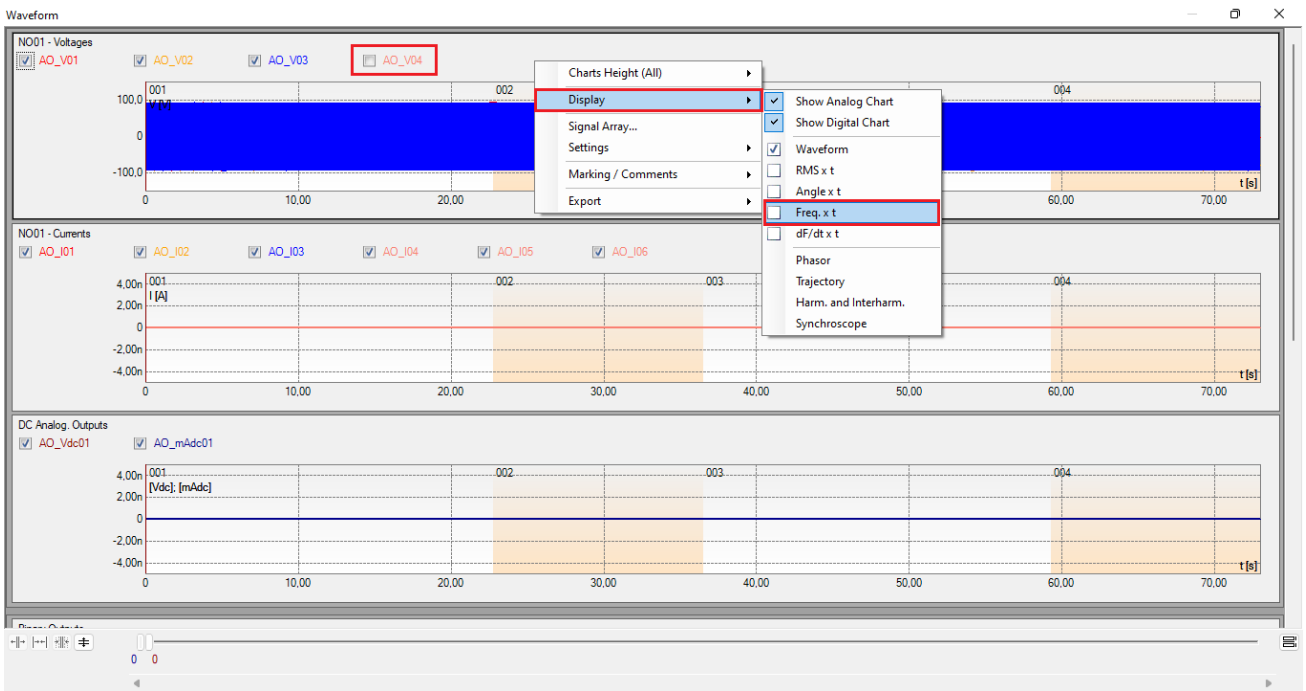

Figure 49

Select the current channels graph and click on the *"Delete"* key. Repeat the procedure for the DC analog outputs and binary outputs graphs.

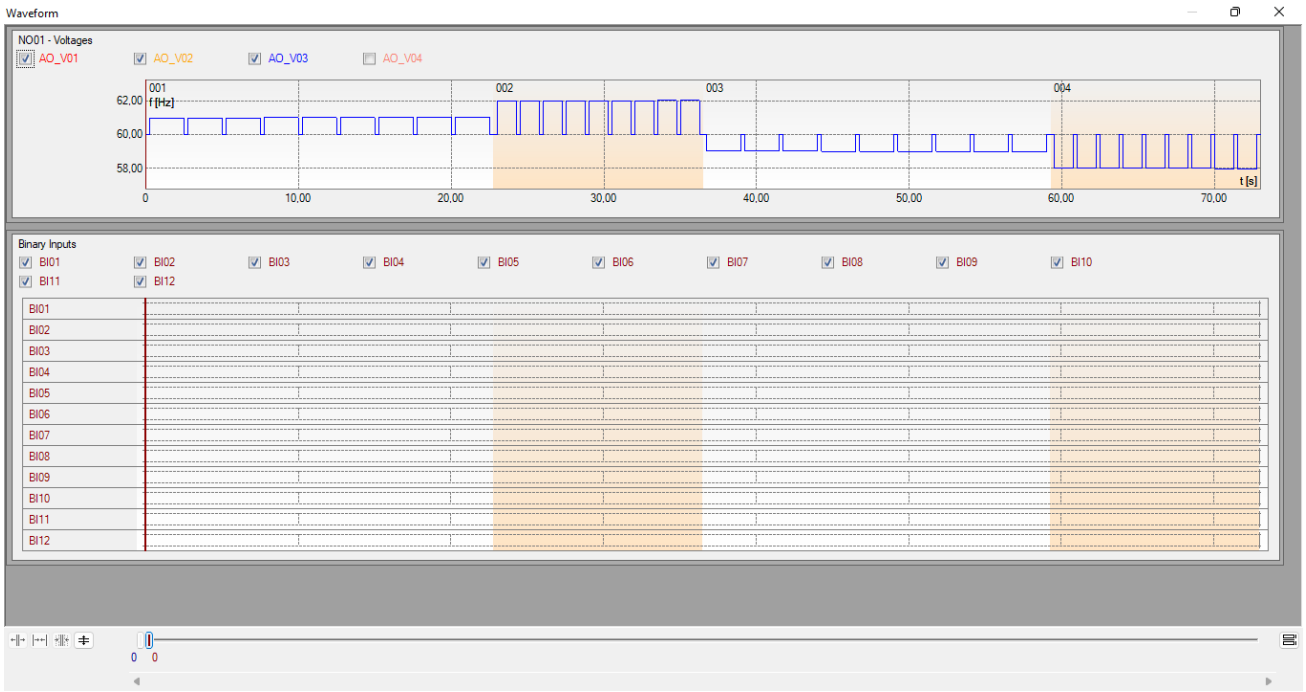

Figure 50

Right-click in the voltage channels window and increase the height of the graphs. The next step is to select only the binaries *"BI01"*, *"BI02"*, *"BI03"* and *"BI04"*.

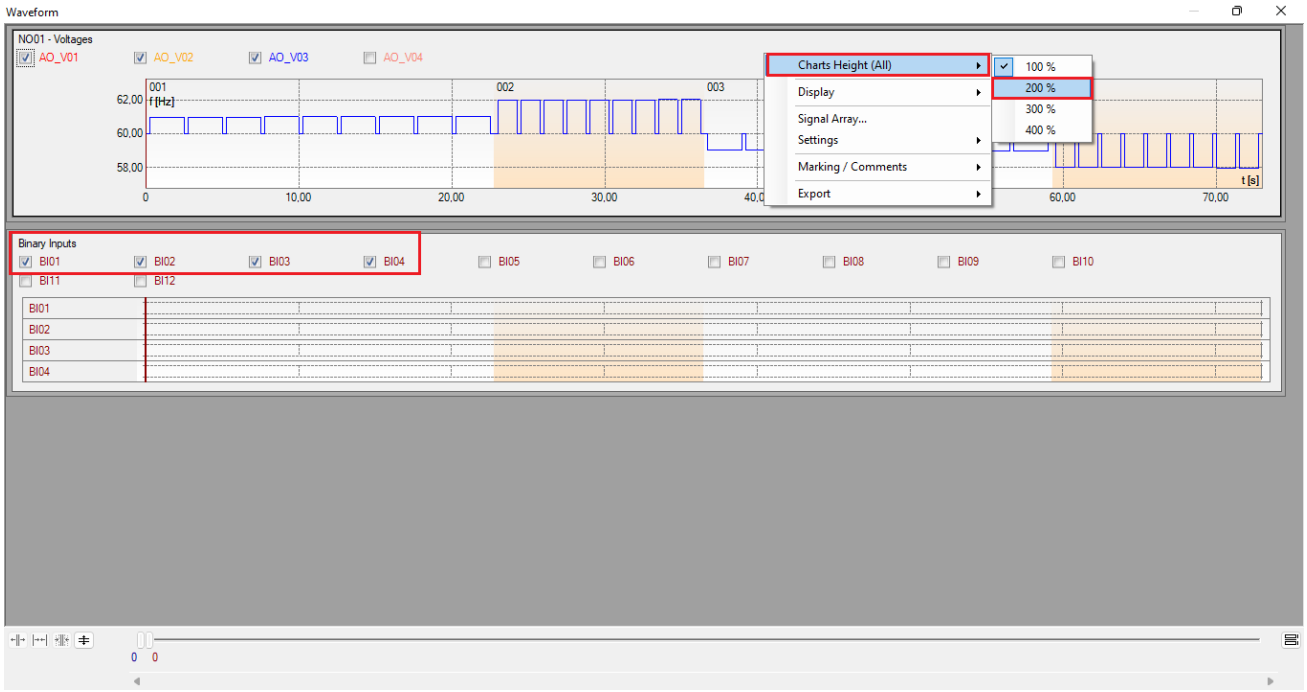

Figure 51

7.11. Time analysis

To evaluate the time, the value of the frequency where the last increment or decrement of each sequence occurs must be marked. To find these values, cursors are used. If necessary, a zoom can be performed to verify the moment of time where the marking must be carried out. To do this, left-click and drag the desired region. To remove the zoom, just double-click on the graph. The following figure shows the time for the first two elements.

Figure 52

According to the previous figure, it can be concluded that the time required for the first marking is 20.25 seconds and for the second, 35.00 seconds. The next figure shows the position of the last two elements.

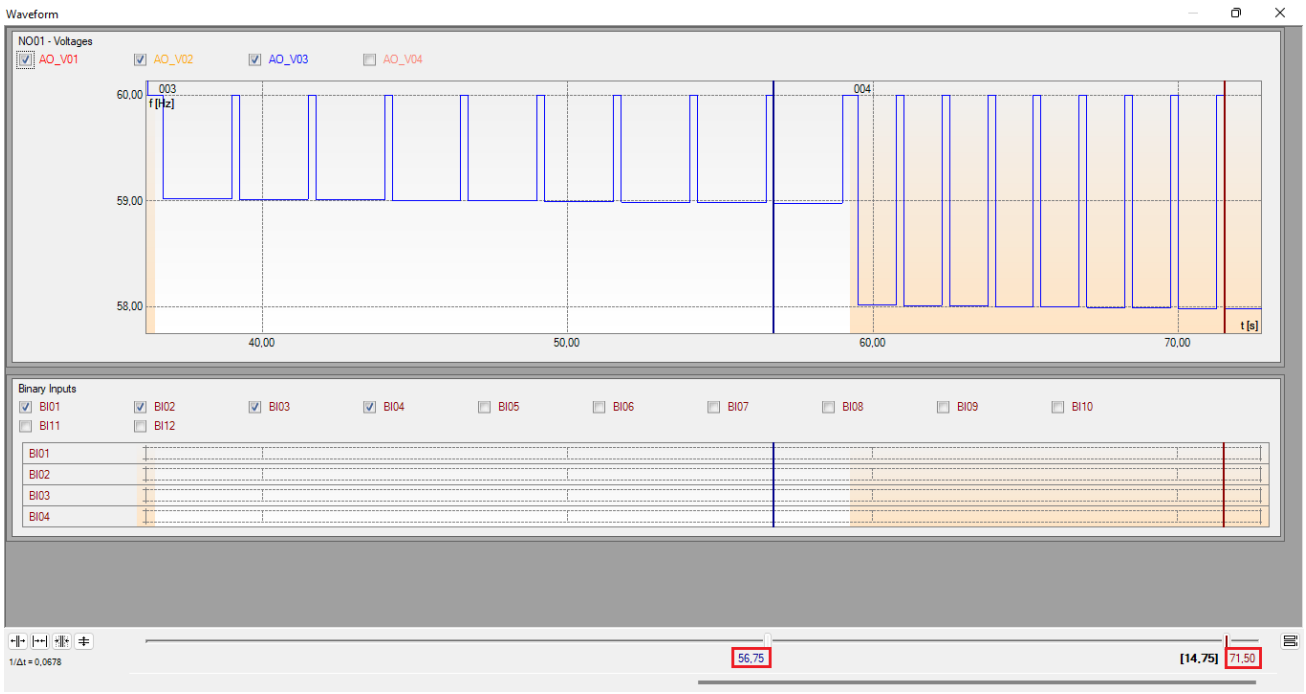

Figure 53

According to the previous figure, it can be concluded that the time for the third marking is 56.75 seconds and for the fourth one, 71.50 seconds.

7.12. Inserting markup

To insert the markup right-click on the graphic and choose the following option.

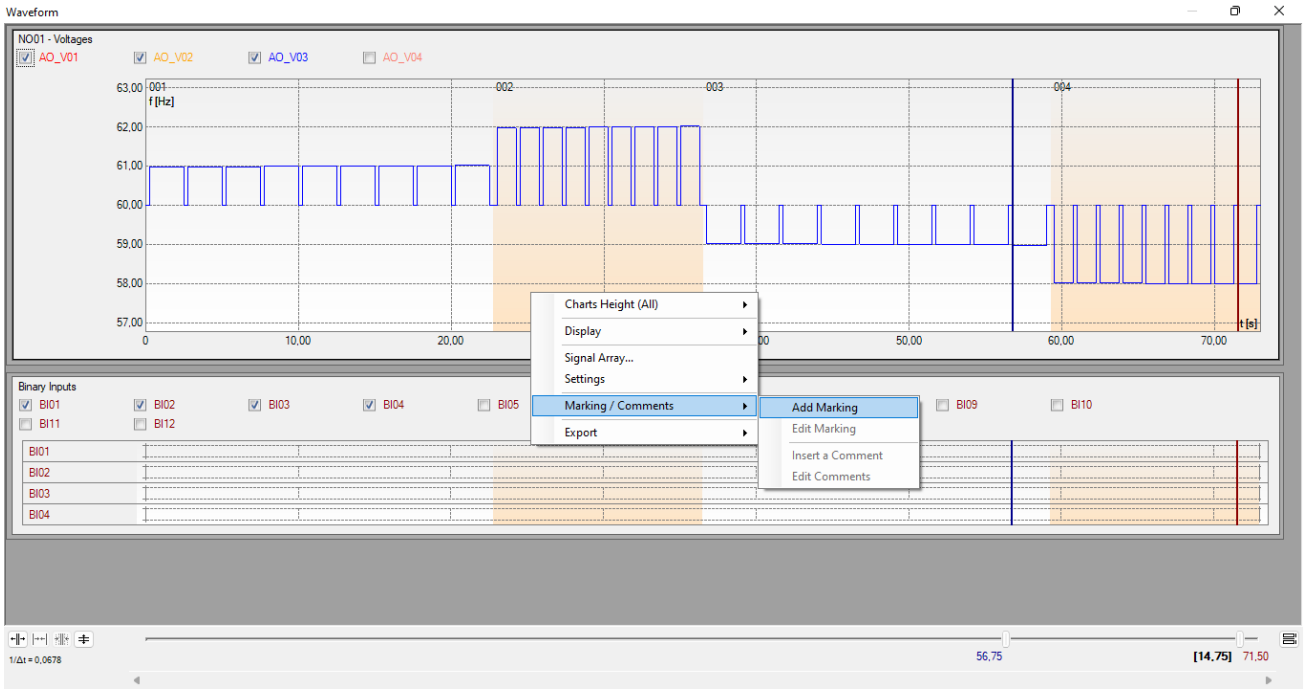

Figure 54

Adjust the first time and repeat the procedure for the other markings.

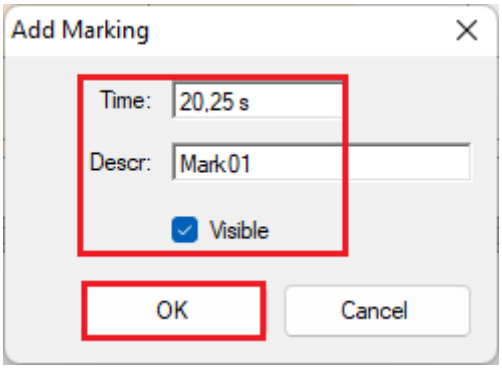

Figure 55

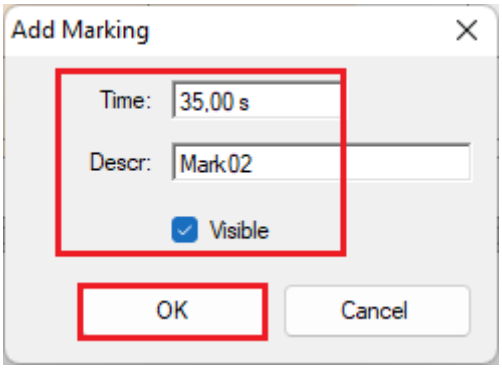

Figure 56

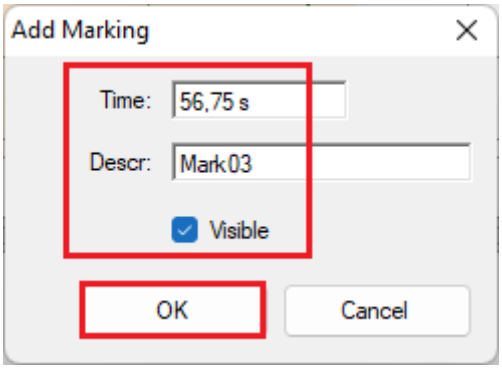

Figure 57

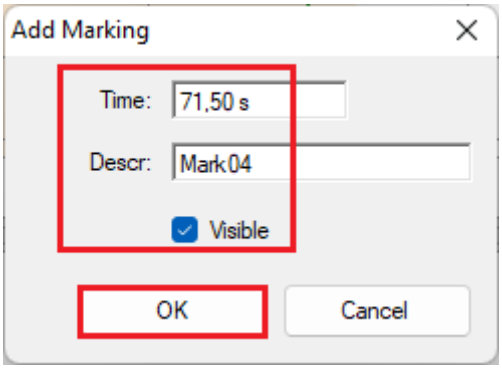

Figure 58

The markings are shown in the following figure. To return this window to the initial position, double click on the top bar (highlighted in green).

Figure 59

7.13. Time Ratings

By clicking on the *"Time"* field, as shown in the next figure, four operation time evaluations can be configured as follows.

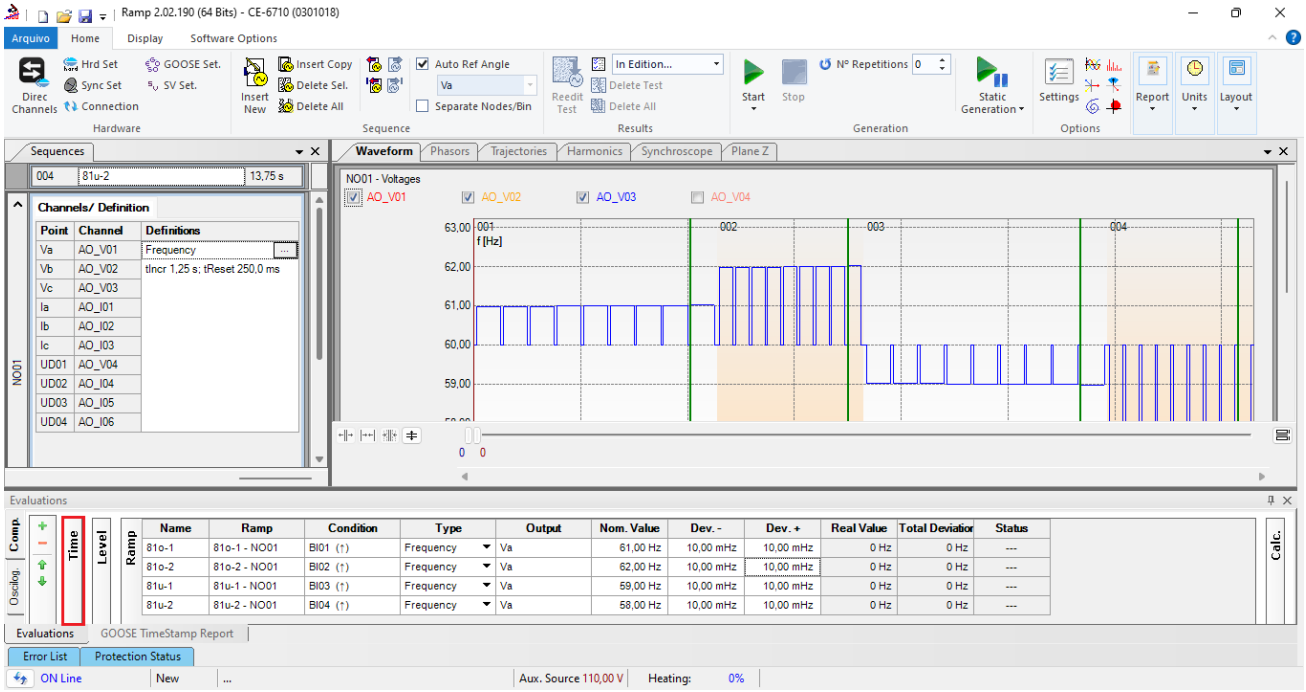

Figure 60

Change the name *"Eval. 1"* to *"81o-1"*, in the *"Ignore Before"* option choose *"Tagging> Mark01"*, in the *"Start"* option choose *"Tagging > Mark01"* in the *"End"* option choose *"Binary Input > BI01 (↑)"*. In nominal time, set 2.0s with deviations of 150ms. The figure below shows these settings.

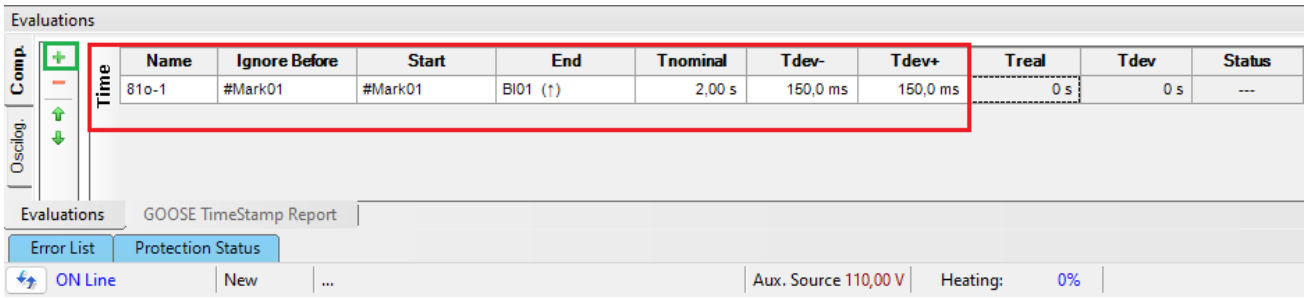

Figure 61

By clicking on the *"+"* icon, three more evaluations are added and their adjustments are made in a similar way to the first evaluation.

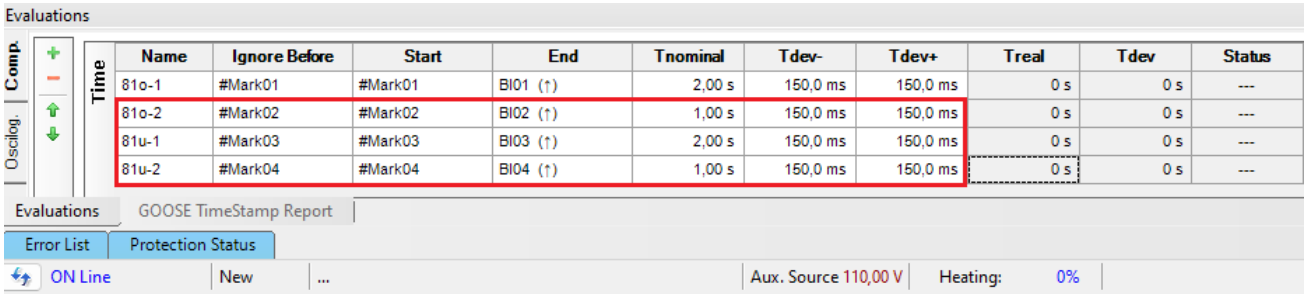

Figure 62

Use the command *"Alt + G"* to start the generation. The next figure shows the result with the pickup values found.

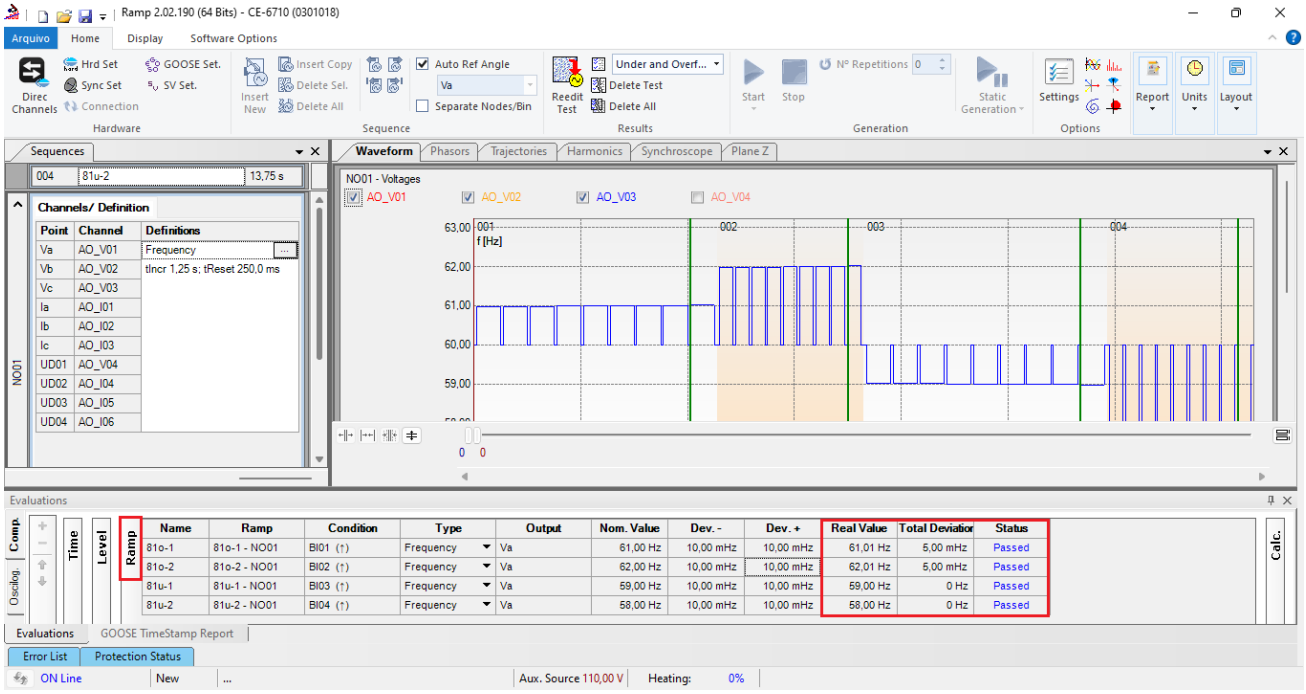

Figure 63

The following figure shows the operating times.

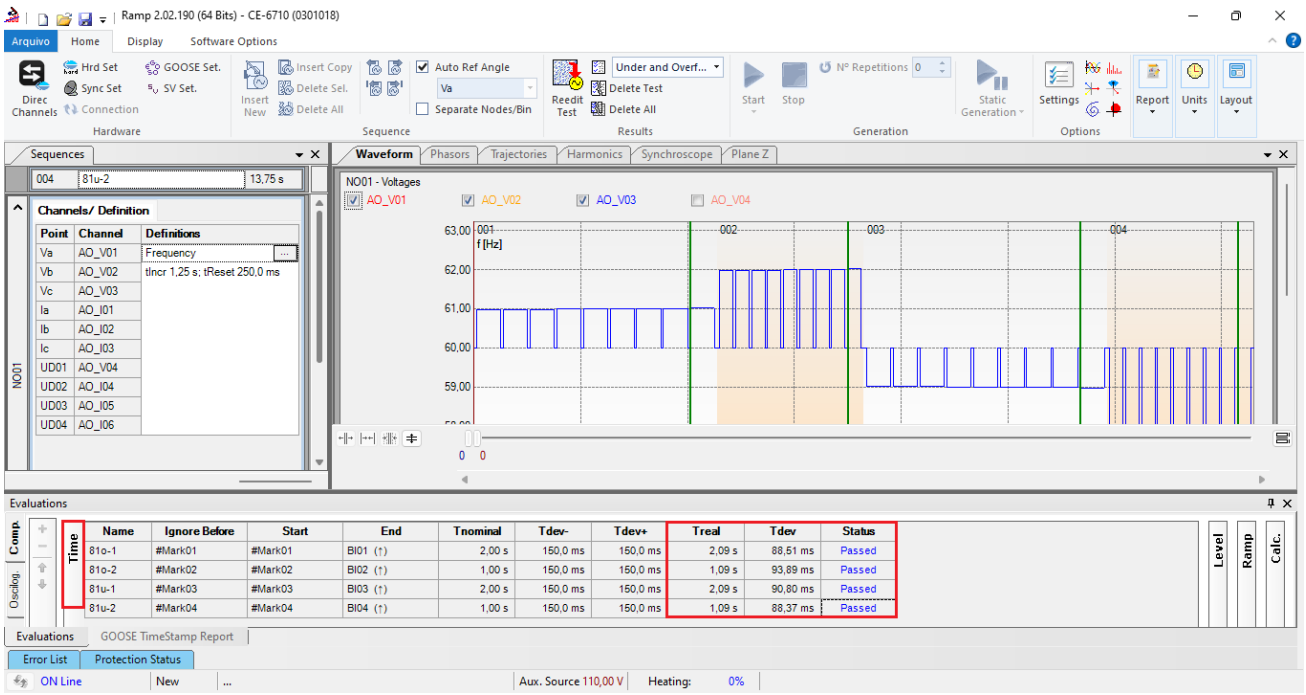

Figure 64

8. Report

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

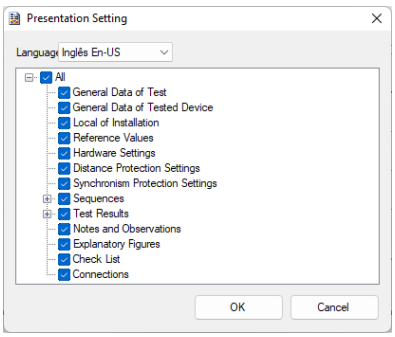

Figure 65

The figure below shows the beginning of a report. It is worth mentioning that within the Conprove Test Center (CTC) there is a tool called *"Preferences",* which allows the user to insert a figure to fill the report header image with the company logo, for example. Furthermore, as the following figure highlights, it is possible to convert the report to .pdf and .rtf, therefore, the latter format allows editing through Microsoft Office Word, although the characteristics that make the report a fully produced document are lost by Conprove software.

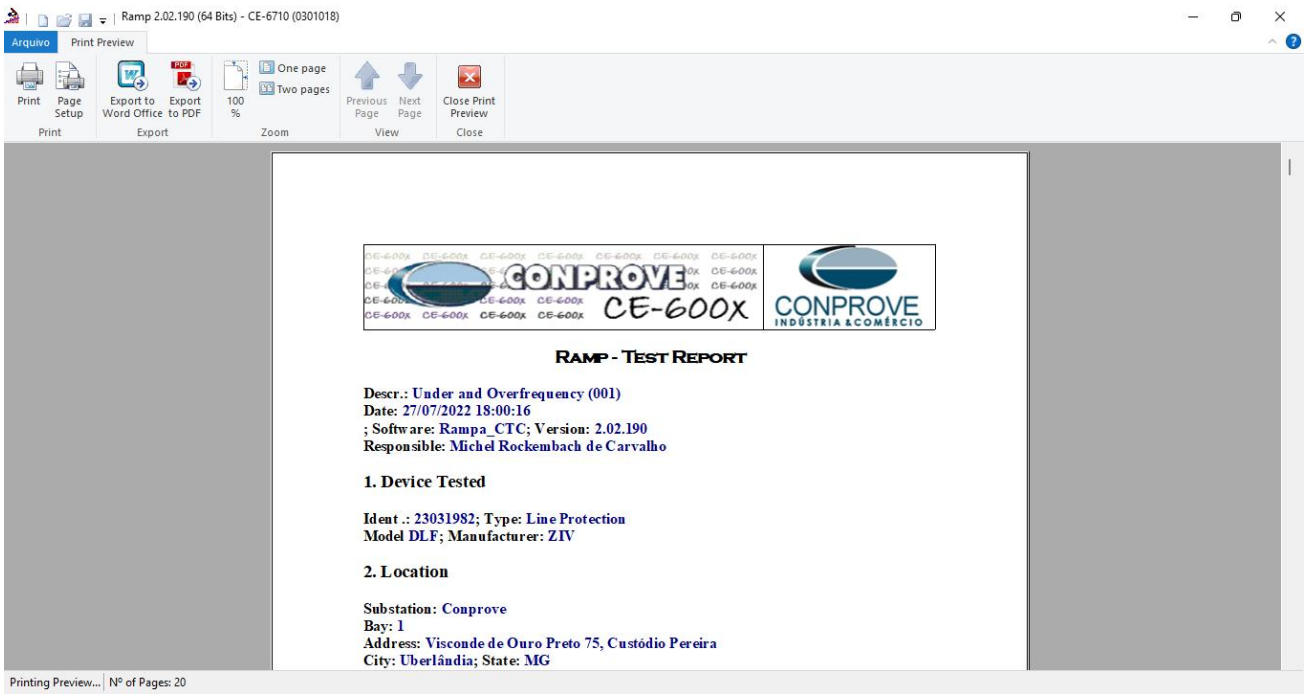

Figure 66

9. Appendix A - Manufacturer Tolerances

Overfrequency Elements	
Pickup and reset	**±0.01 Hz** of the theoretical value
Underfrequency Elements	
Pickup and reset	**±0.01 Hz** of the theoretical value
Time Measurement	
Fixed Time	**±1%** of the setting or **±25 ms** (the greater)

Note: The total trip time is equal to the adjusted fixed time plus the time defined in "*Activation Half-time*" (see Frequency Units).

Figure 67

10. Appendix B - Terminal Diagram

- **Analog Channels DLF-A**

Magnitude	Analog Channels	Analog Channels description	SLOT (1/2 rack)	PINS
PHASE AG VOLTAGE	VA	VOLTAGE INPUT 1	D	1-2
PHASE BG VOLTAGE	VB	VOLTAGE INPUT 2	D	3-4
PHASE CG VOLTAGE	VC	VOLTAGE INPUT 3	D	5-6
SYNCHRONISM VOLTAGE	VSYNC	VOLTAGE INPUT 4	D	7-8
NEUTRAL VOLTAGE	VG	VOLTAGE INPUT 5	D	9-10
PHASE A CURRENT	IA	CURRENT INPUT 1	D	11-12
PHASE B CURRENT	IB	CURRENT INPUT 2	D	13-14
PHASE C CURRENT	IC	CURRENT INPUT 3	D	15-16
PARALLEL LINE NEUTRAL CURRENT	IPAR	CURRENT INPUT 4	D	17-18
GROUNDING CURRENT	IG	CURRENT INPUT 5	D	19-20

Figure 68

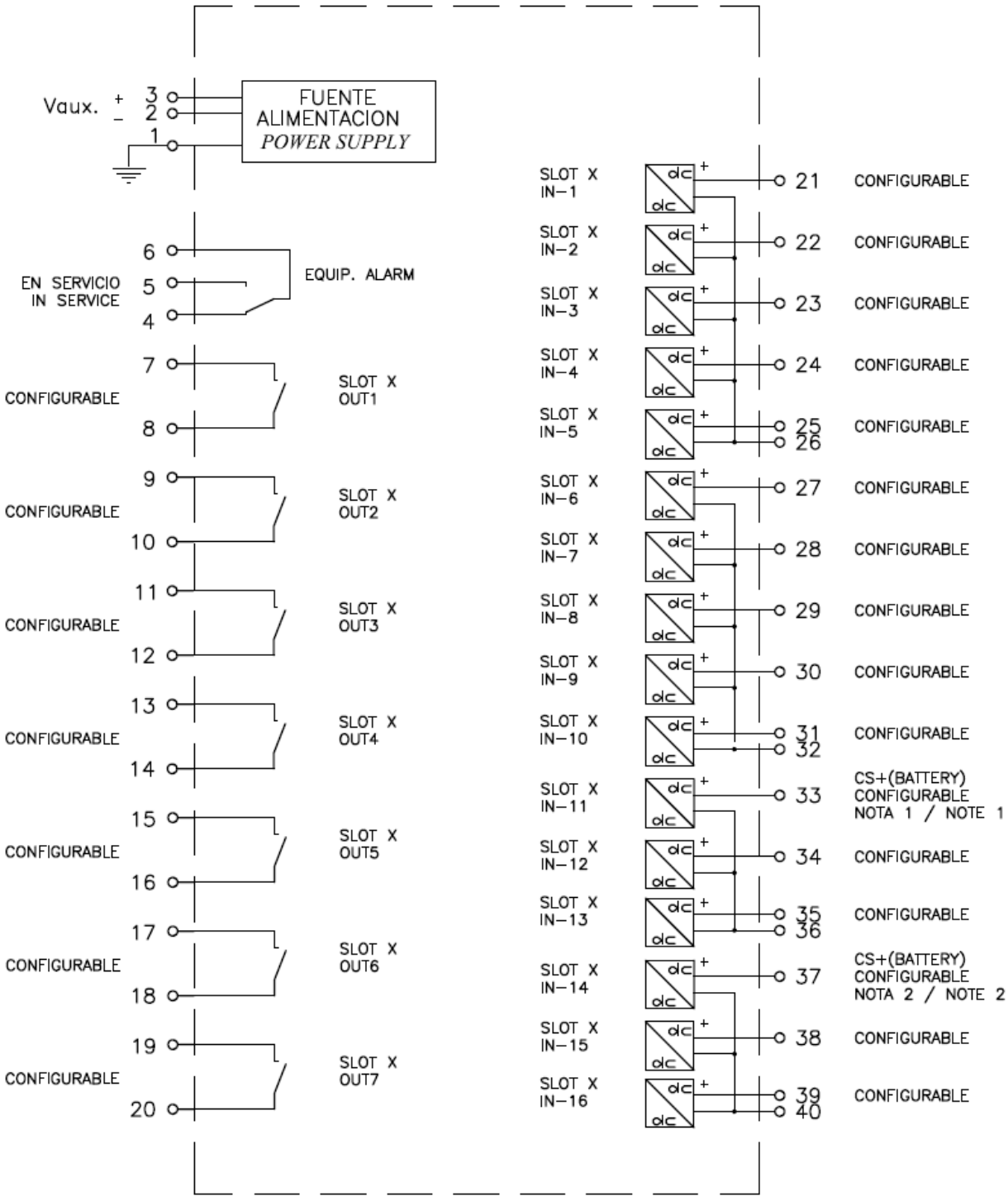
Vaux. + 3
2
– 1
FUENTE ALIMENTACION
POWER SUPPLY
EN SERVICIO
IN SERVICE
6
5
4
EQUIP. ALARM
CONFIGURABLE
7
8
SLOT X OUT1
CONFIGURABLE
9
10
SLOT X OUT2
CONFIGURABLE
11
12
SLOT X OUT3
CONFIGURABLE
13
14
SLOT X OUT4
CONFIGURABLE
15
16
SLOT X OUT5
CONFIGURABLE
17
18
SLOT X OUT6
CONFIGURABLE
19
20
SLOT X OUT7
SLOT X IN–1
21
CONFIGURABLE
SLOT X IN–2
22
CONFIGURABLE
SLOT X IN–3
23
CONFIGURABLE
SLOT X IN–4
24
CONFIGURABLE
SLOT X IN–5
25
26
CONFIGURABLE
SLOT X IN–6
27
CONFIGURABLE
SLOT X IN–7
28
CONFIGURABLE
SLOT X IN–8
29
CONFIGURABLE
SLOT X IN–9
30
CONFIGURABLE
SLOT X IN–10
31
32
CONFIGURABLE
SLOT X IN–11
33
CS+(BATTERY)
CONFIGURABLE
NOTA 1 / NOTE 1
SLOT X IN–12
34
CONFIGURABLE
SLOT X IN–13
35
36
CONFIGURABLE
SLOT X IN–14
37
CS+(BATTERY)
CONFIGURABLE
NOTA 2 / NOTE 2
SLOT X IN–15
38
CONFIGURABLE
SLOT X IN–16
39
40
CONFIGURABLE

Figure 69

11. Appendix C - Parameter Equivalence between Relay and Software

Table 2

Ramp Software		ZIV DLF RELAY	
Parameter	Figure	Parameters	Figure
Pickups			
81o-1	47	Overfrequency Pickup	17
81o-2	47	Overfrequency Pickup	18
81u-1	47	Underfrequency Pickup	19
81u-2	47	Underfrequency Pickup	20
Times			
81o-1	62	Overfrequency Delay	17
81o-2	62	Overfrequency Delay	18
81u-1	62	Underfrequency Delay	19
81u-2	62	Underfrequency Delay	20