

INSTRUMENTOS PARA TESTES ELÉTRICOS

TEST TUTORIAL

EQUIPAMENT: Protection Relay.

BRAND: ZIV.

MODEL: DLF.

FUNCTION: 81R or PFRC – Rate-of-Change Frequency or df/dt .

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

OBJECTIVE: Testing the pickup and operating time of the rate-of-change frequency elements using the Ramp software.

VERSION CONTROL:

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Version	Descriptions	Date	Author	Reviewer
1.0	Initial Version	17/08/2022	M.R.C.	G.C.D.P.

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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 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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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.

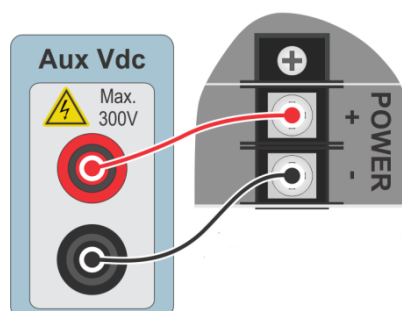


Figure 1

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.

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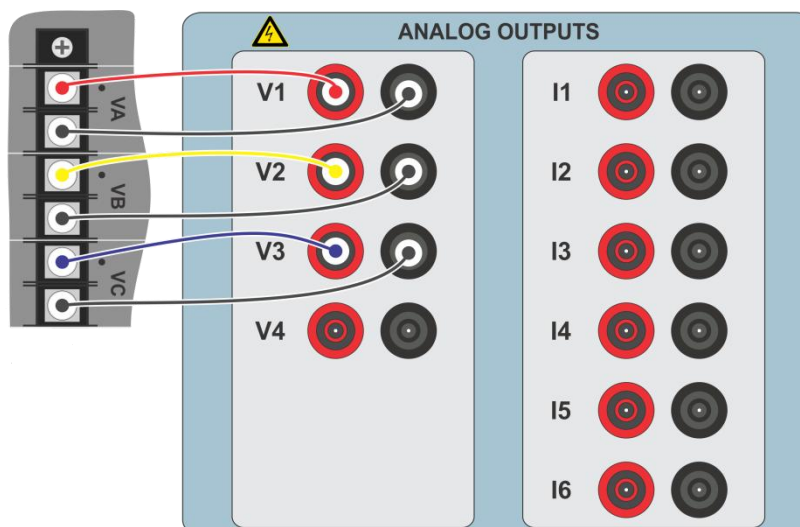


Figure 2

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 (<i>Binary Inputs</i>)	DLF (<i>Slot A</i>)
BI1	OUT 1 (07 and 08)
BI2	OUT 2 (09 and 10)
BI3	OUT 3 (11 and 12)
BI4	OUT 4 (13 and 14)

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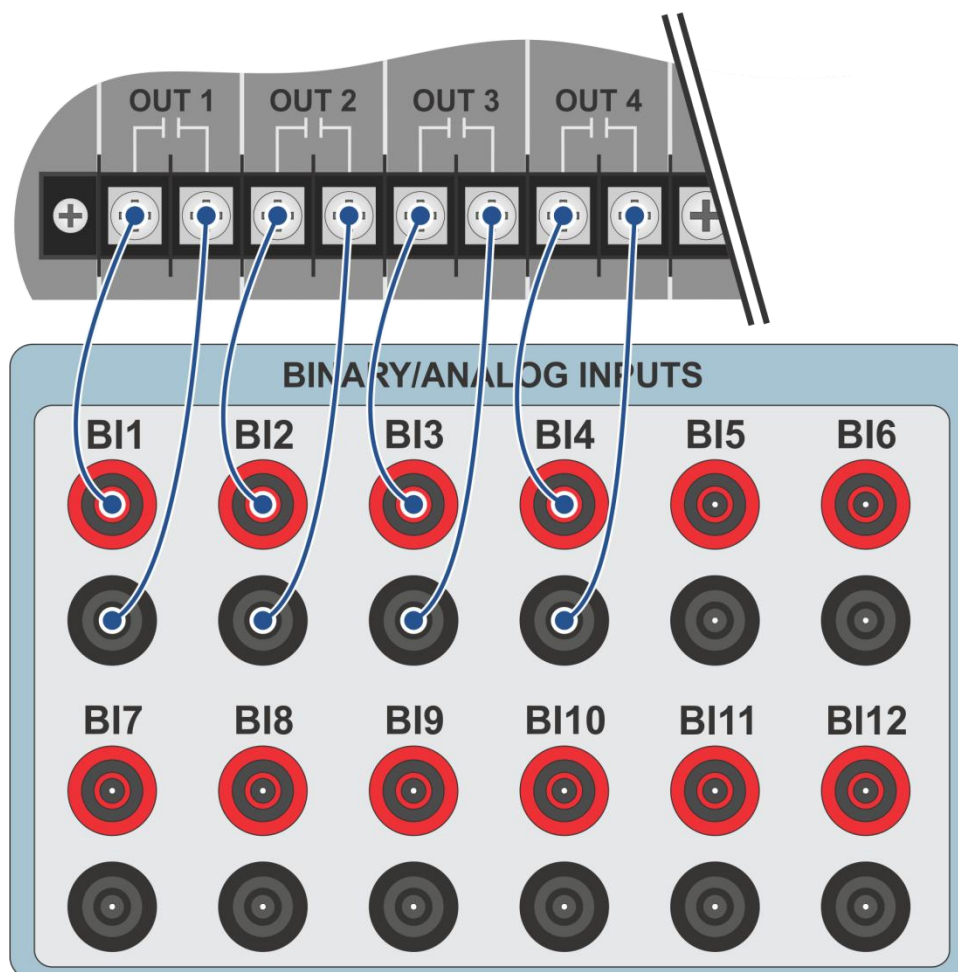


Figure 3

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.

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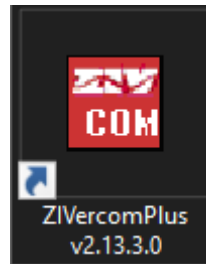


Figure 4

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

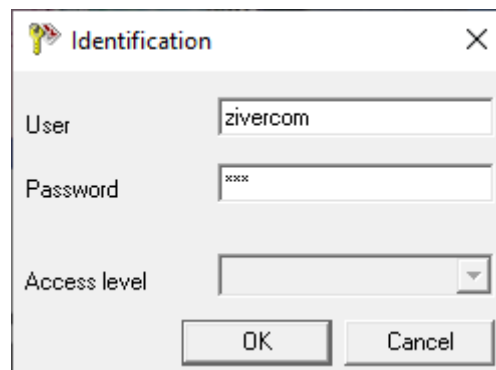


Figure 5

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

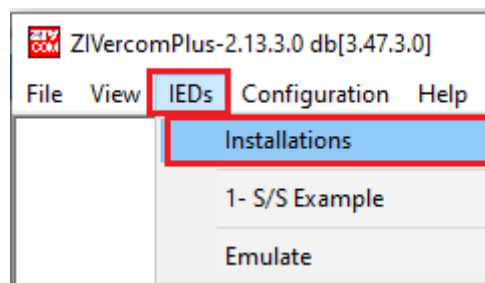


Figure 6

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Select the default file “*SubExamples.sbs*” and click “*Edit*”.

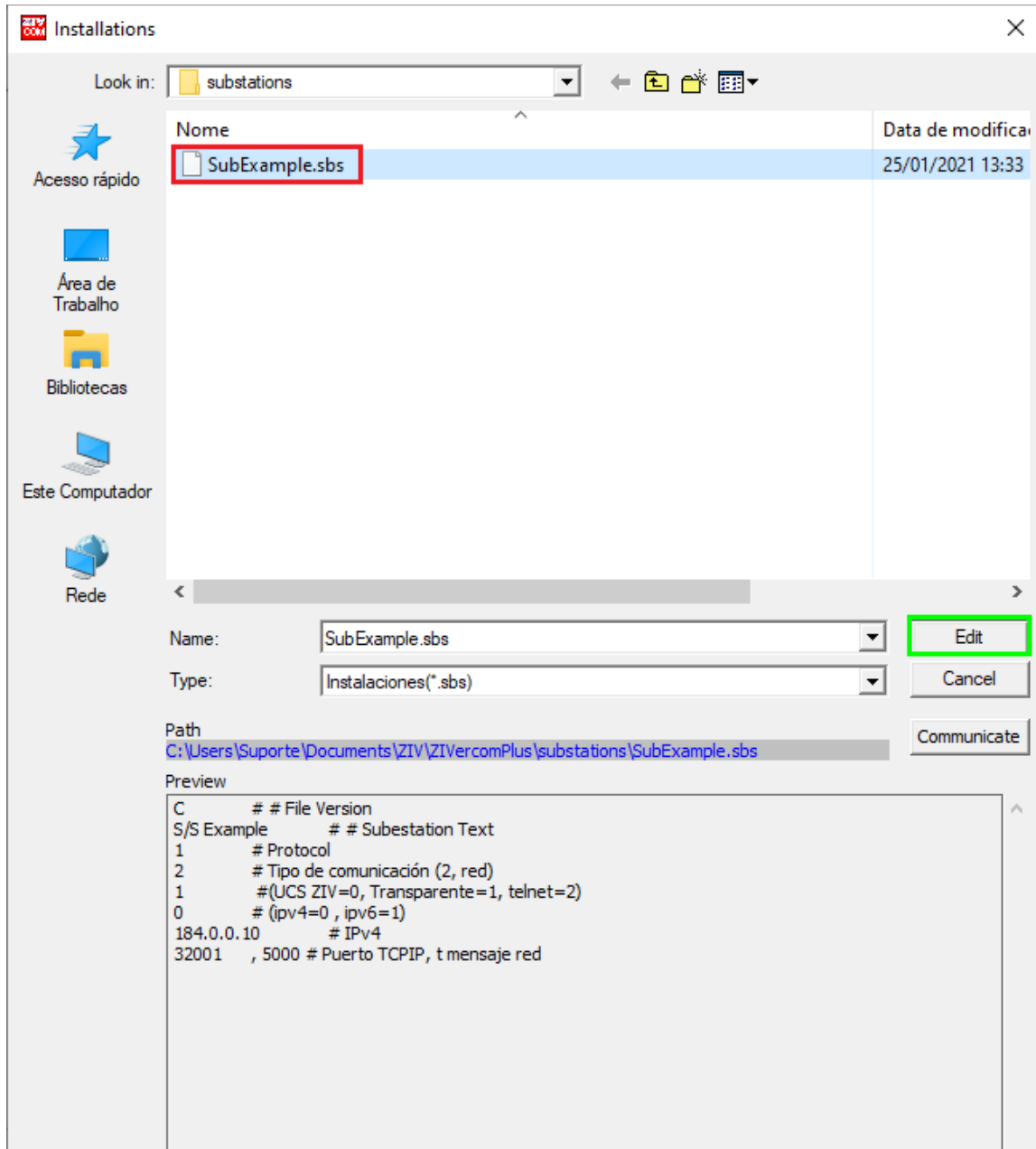
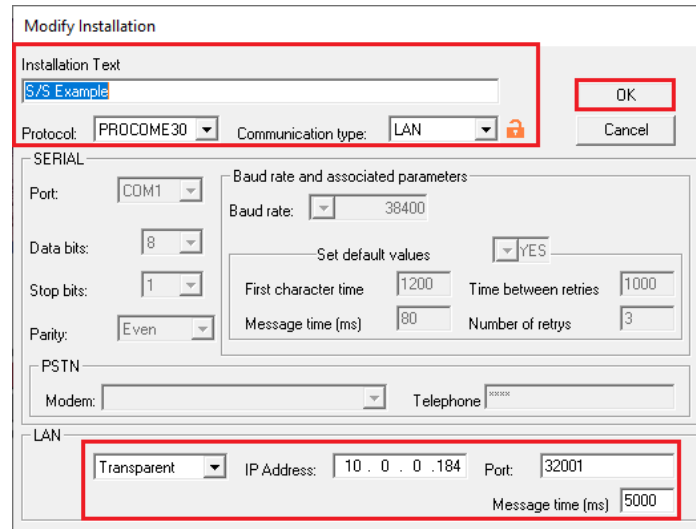


Figure 7

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.

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Modify Installation

Installation Text
S/S Example

Protocol: PROCOME30 Communication type: LAN

SERIAL

Port: COM1 Baud rate and associated parameters
Baud rate: 38400

Data bits: 8 Stop bits: 1 Parity: Even

Set default values YES

First character time 1200 Time between retries 1000
Message time (ms) 80 Number of retrys 3

PSTN
Modem: Telephone:

LAN
Transparent IP Address: 10.0.0.184 Port: 32001
Message time (ms) 5000

OK Cancel

Figure 8

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

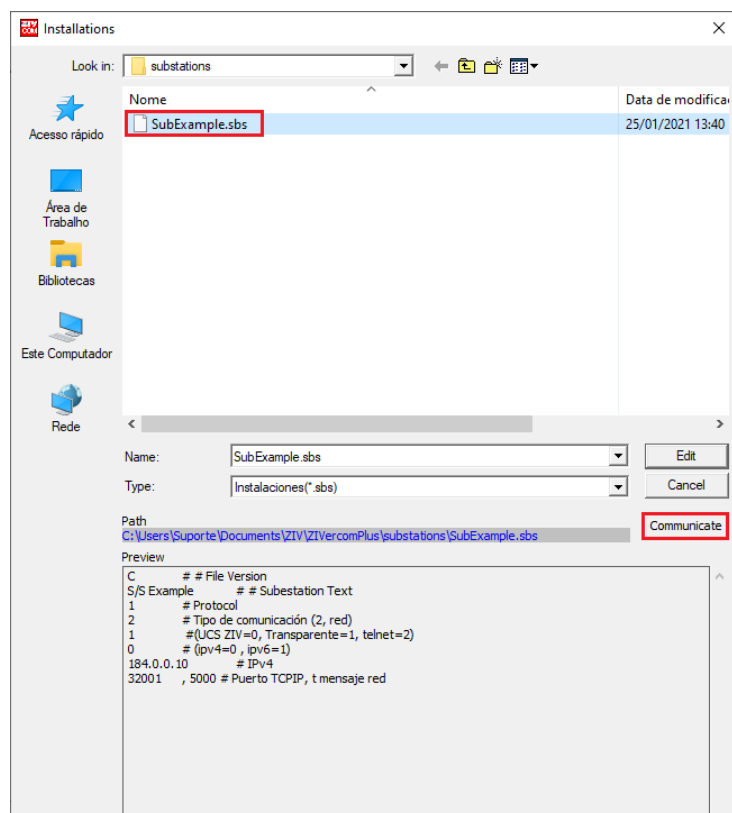


Figure 9

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Click "OK" again.

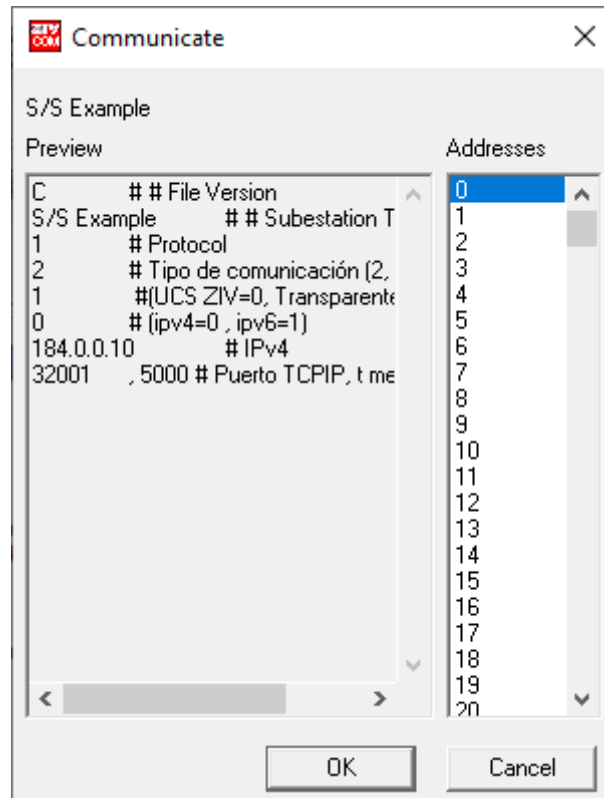


Figure 10

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*".

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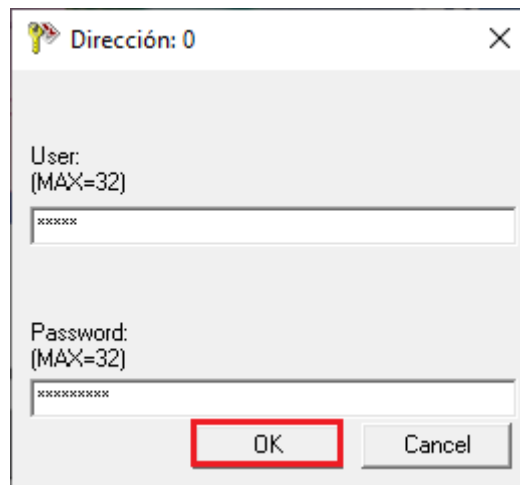


Figure 11

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.

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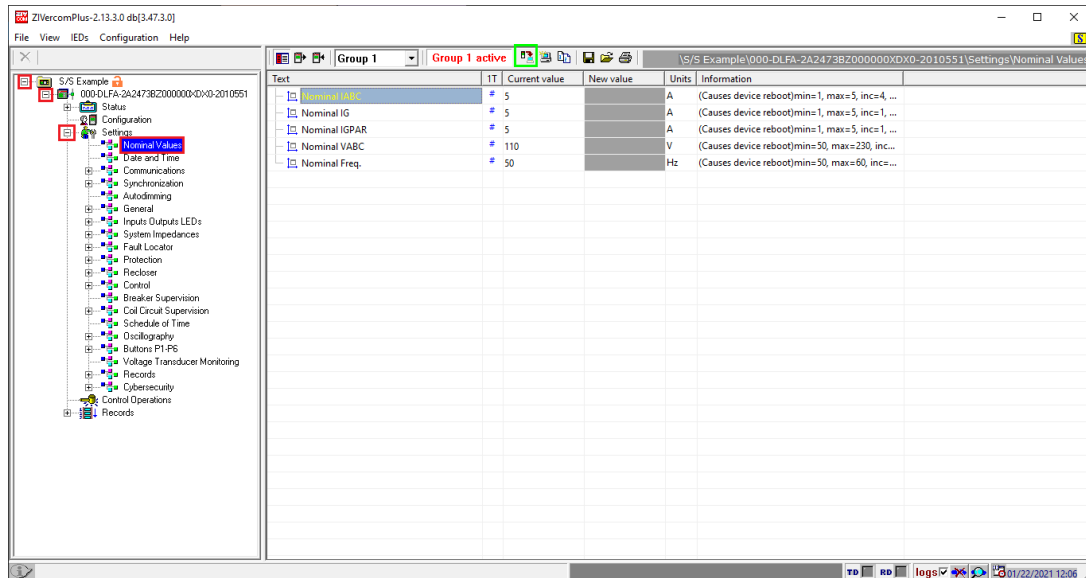


Figure 12

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

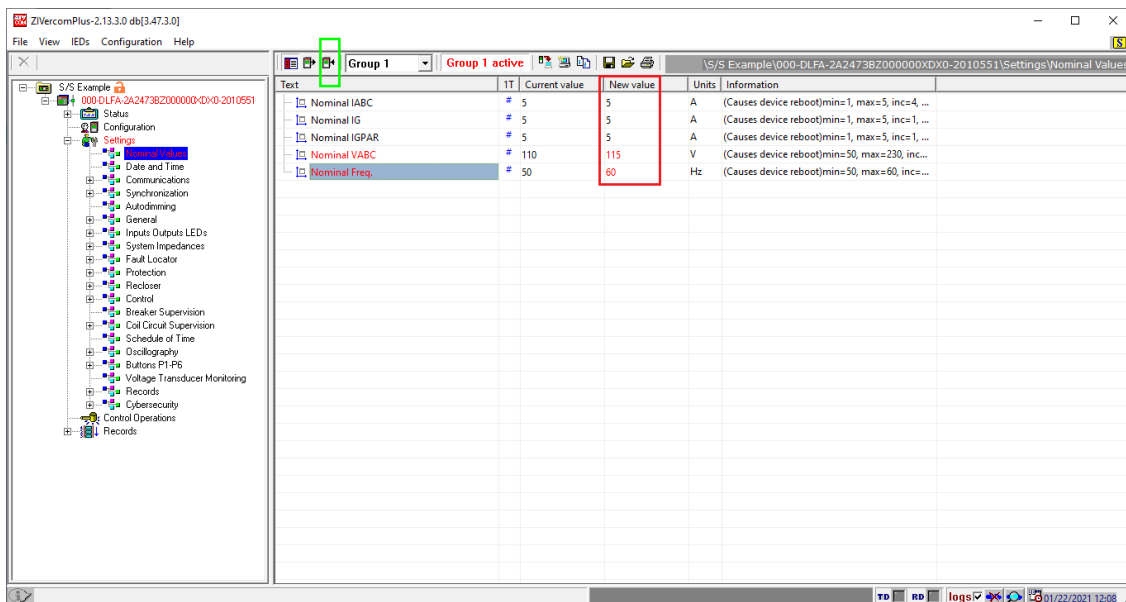


Figure 13

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

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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.

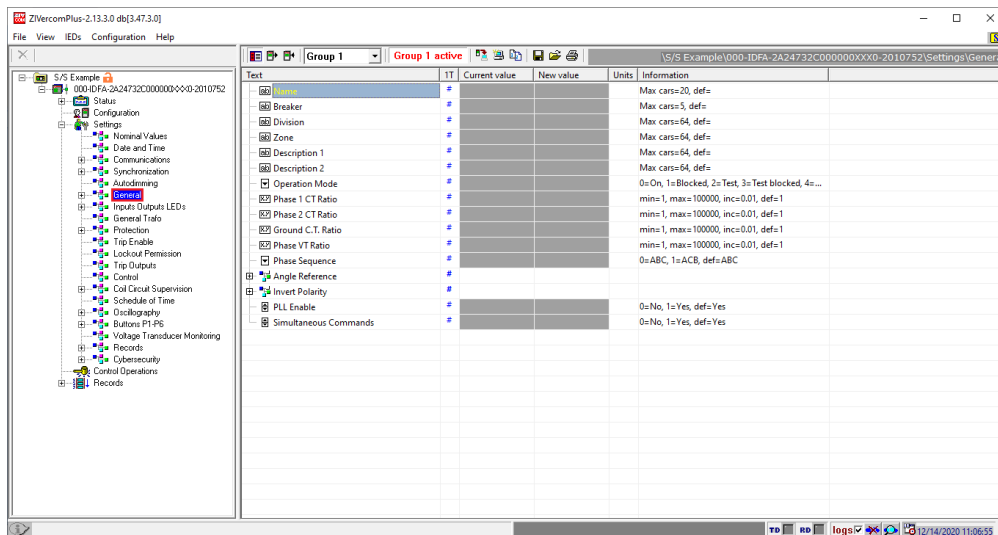


Figure 14

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.

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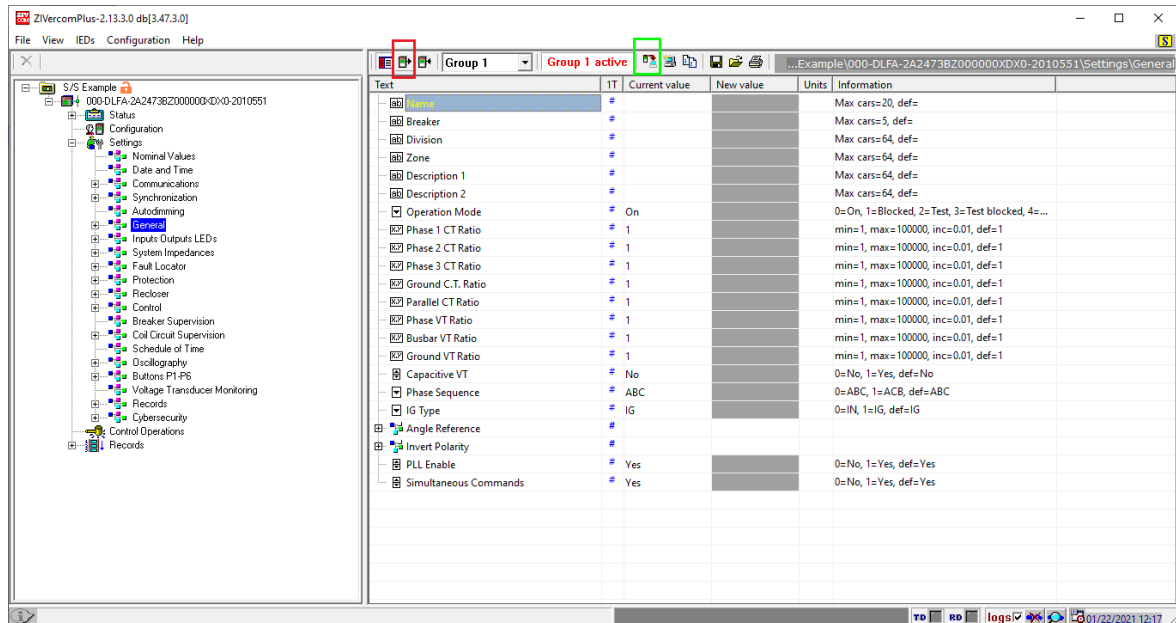


Figure 15

3.3. Frequency

Select the “*Frequency*” option, there are several adjustments that directly impact the timing of the frequency functions. For more details consult the relay manufacturer's manual.

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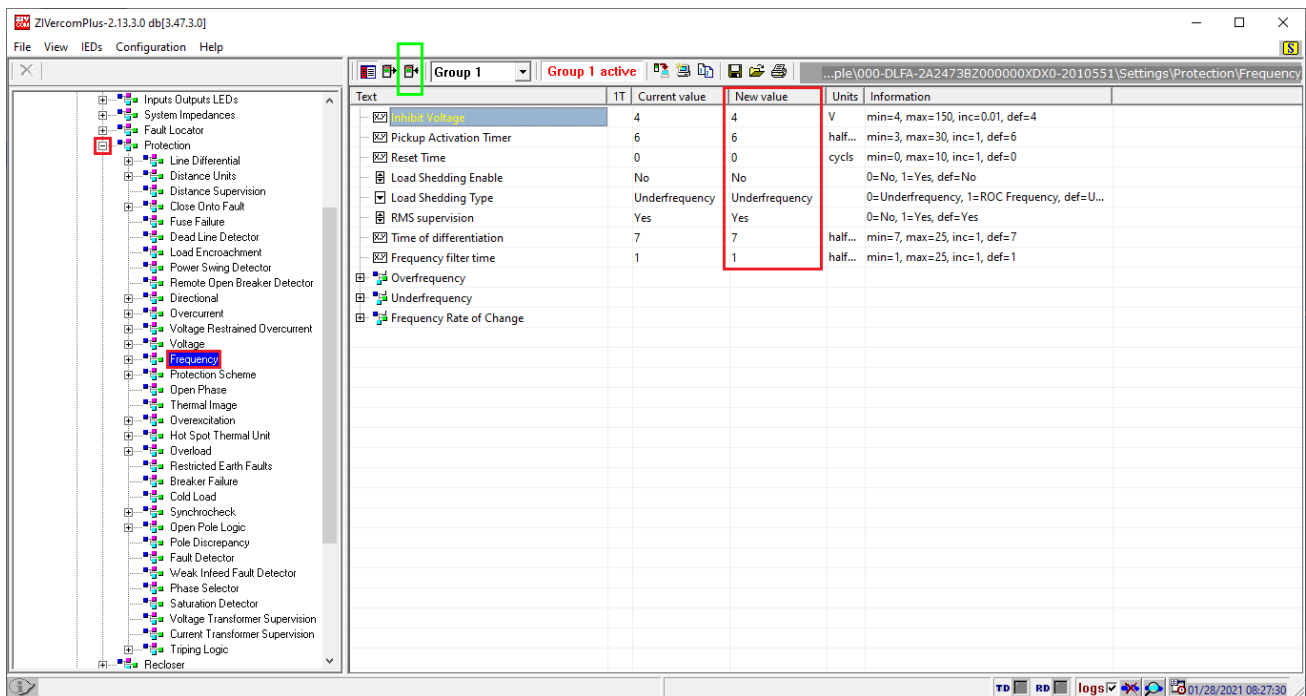


Figure 16

3.4. Frequency Rate of Change > Unit 1

Click on the “+” signs until you reach the “Unit 1” option. In this option, the function must be activated, set the variation as negative or positive, set the pick-up values, the operating time and the reset time. Activate the unit with negative variance, pick-up values of 59.5Hz, 1.5Hz/s operating time of 1.5s and zero reset time (0.0s). Submit the adjustments by clicking on the icon highlighted in green.

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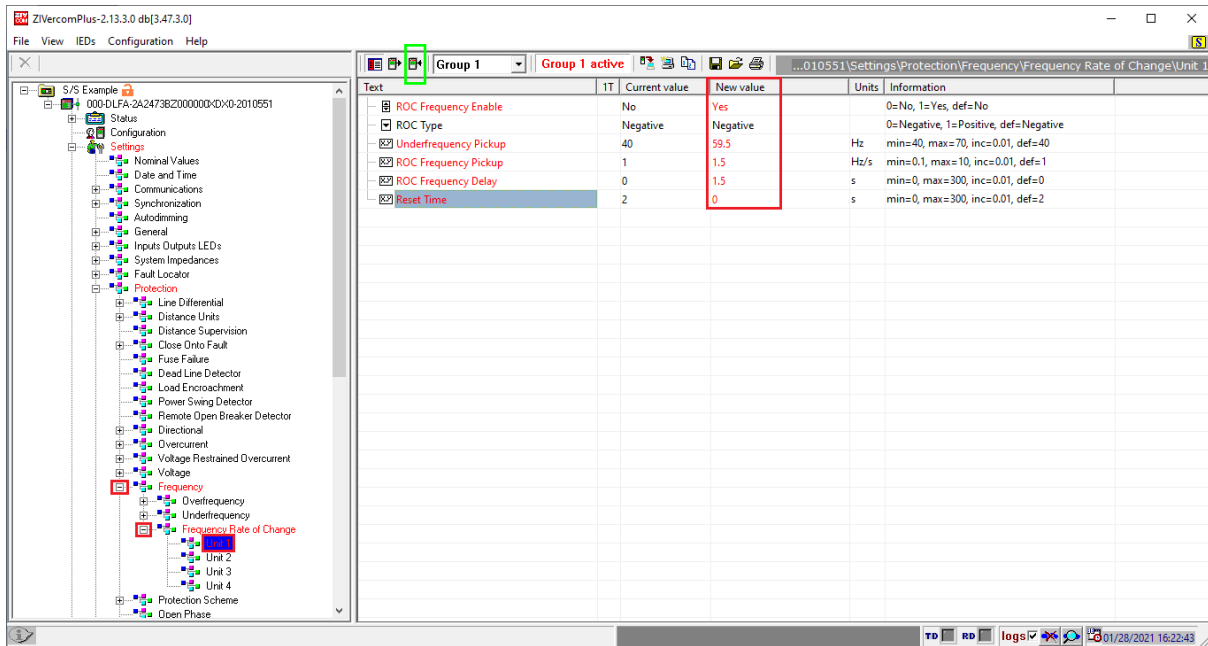


Figure 17

3.5. Frequency Rate of Change > Unit 2

Select the “Unit 2” option, then activate the function, adjust the variation as negative or positive, adjust the pick-up values, the operating time and the reset time. Activate the unit with positive variance, pick-up values of 60.5Hz, 1.5Hz/s operating time of 1.5s and zero reset time (0.0s). Submit the adjustments by clicking on the icon highlighted in green.

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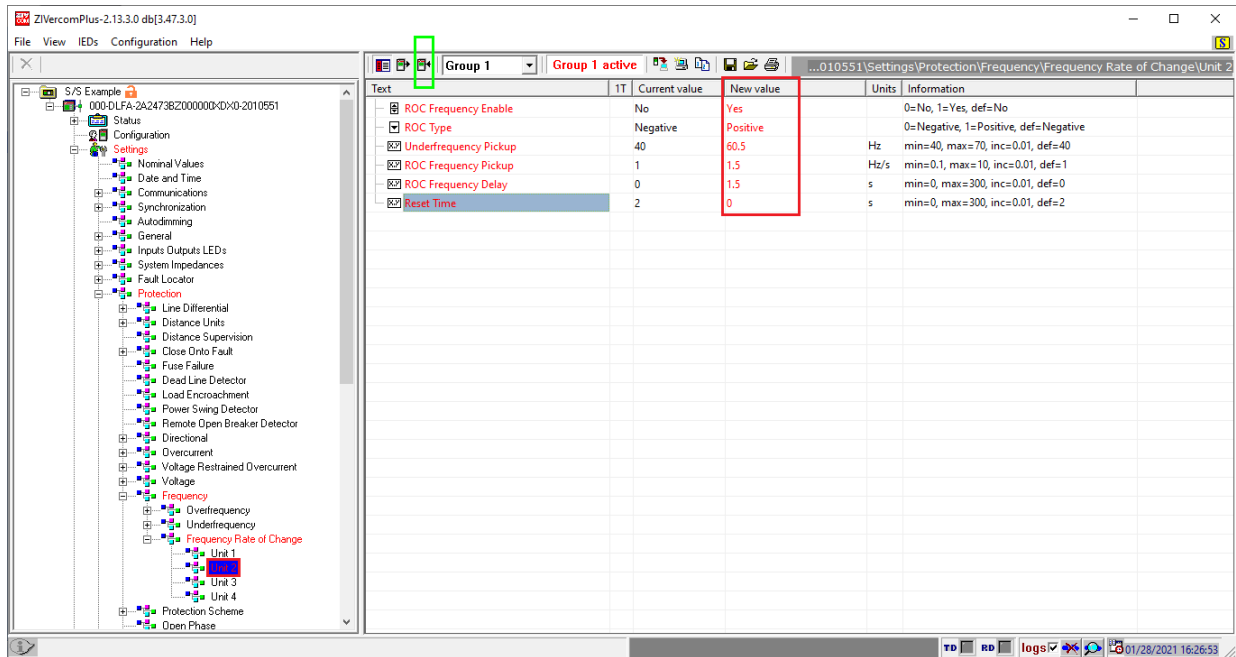


Figure 18

3.6. Outputs

In order to test the pickup and the operating time of the rate-of-change frequency functions, 4 relay output binaries will be used to collect these signals from the test set. In the figure below, configure the first output with the pickup signal of the 81R-1 unit.

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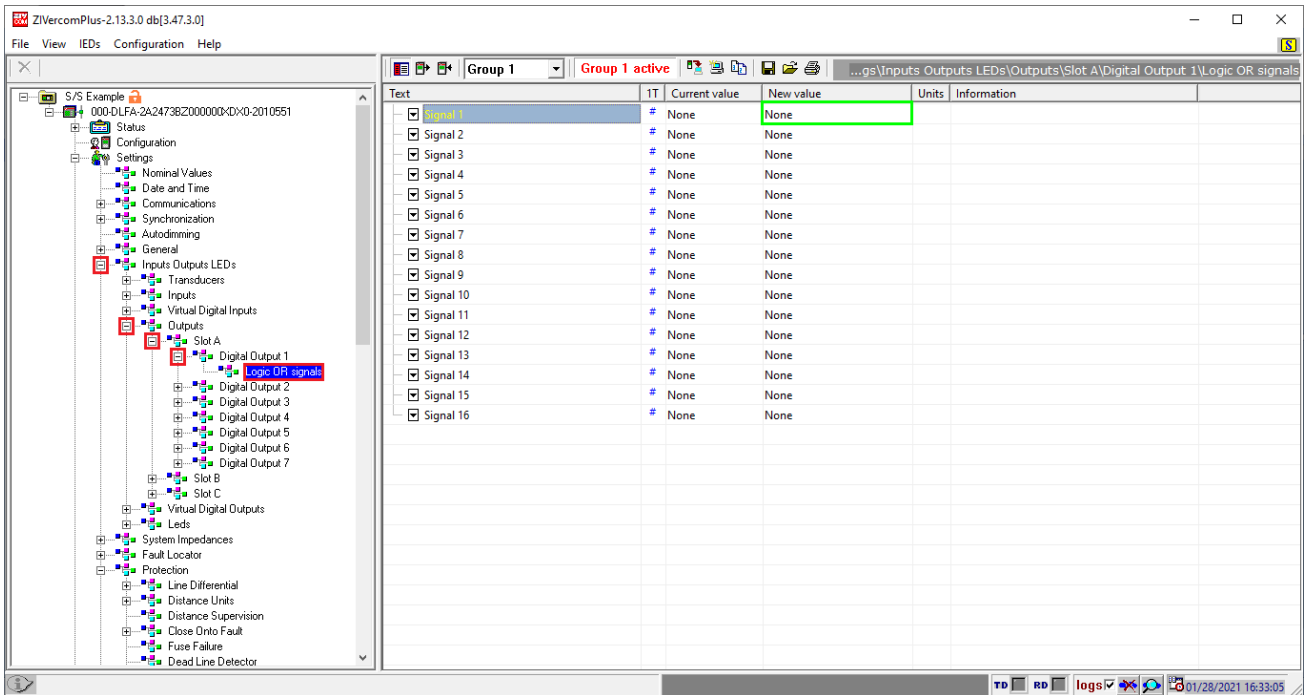


Figure 19

Click on the “None” option highlighted in the previous figure and make the following adjustment.

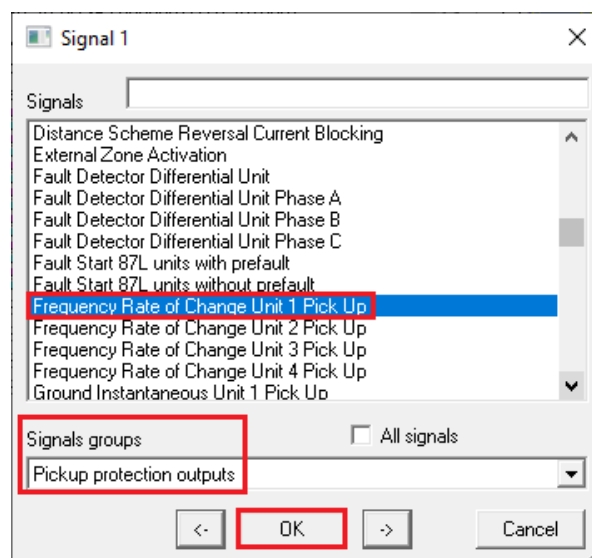


Figure 20

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Send the settings to the relay.

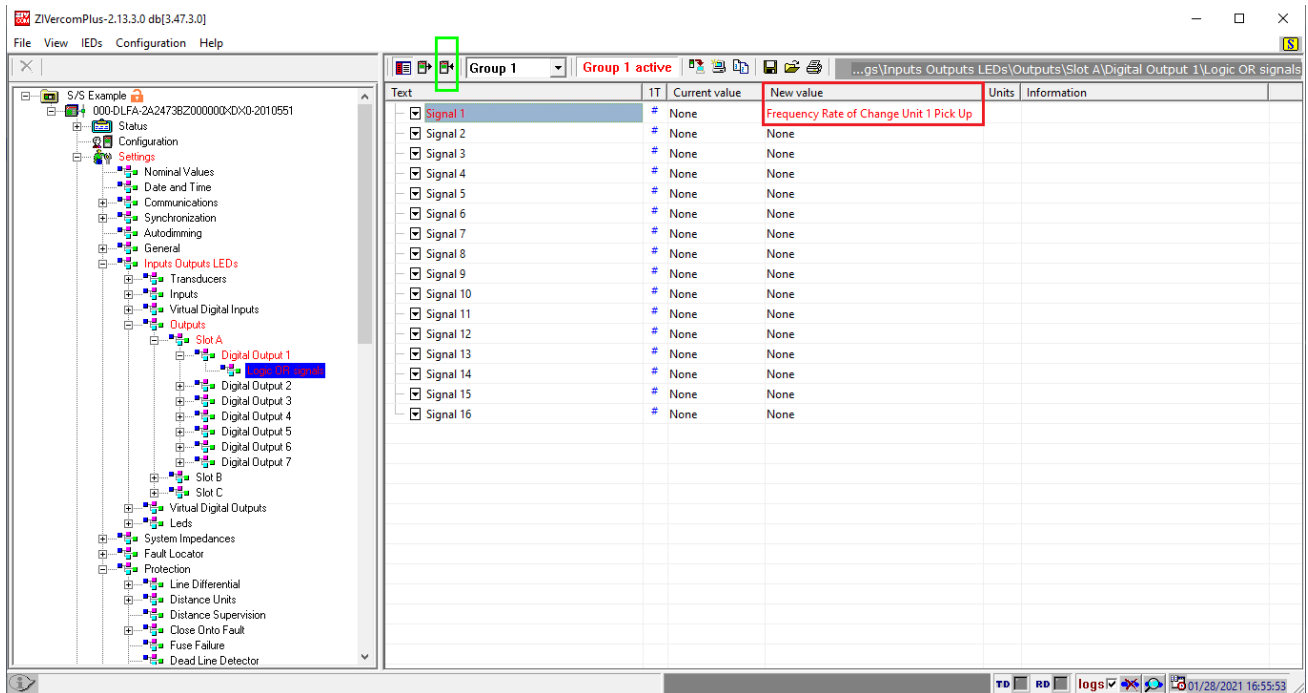


Figure 21

On the second output, configure the trip signal of the 81R-1 unit.

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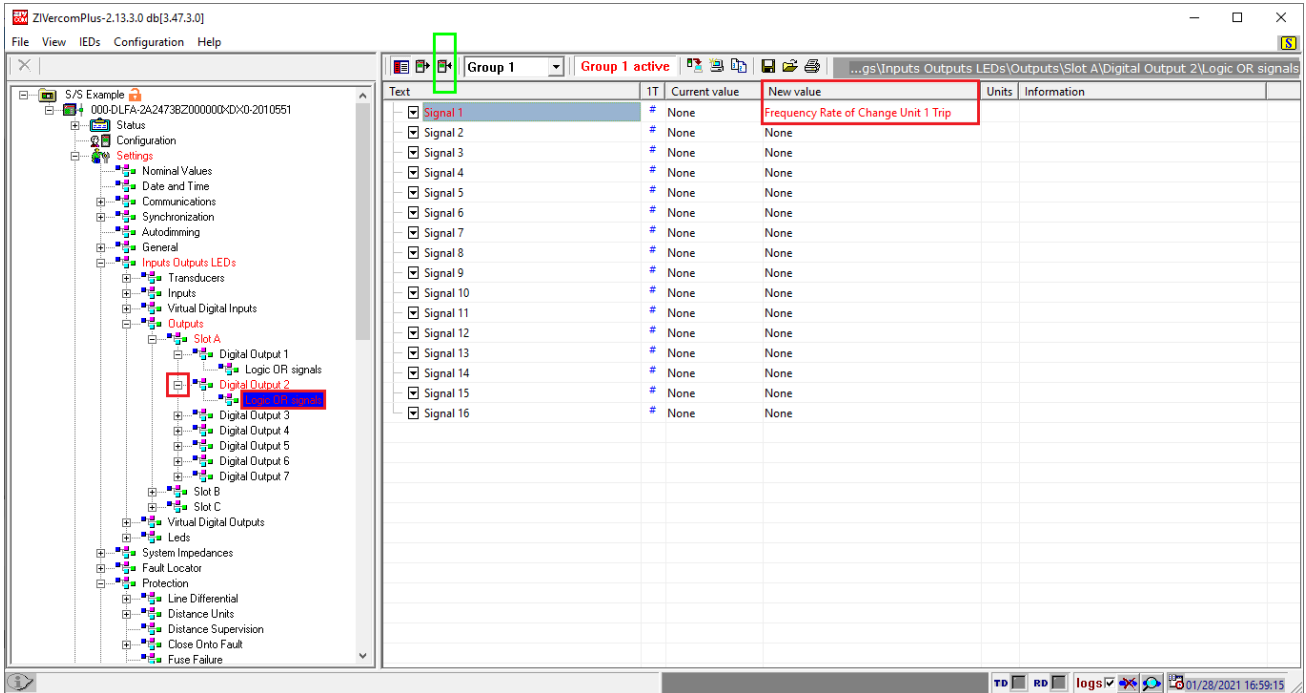


Figure 22

On the third output, configure the pickup signal of the 81R-2 unit.

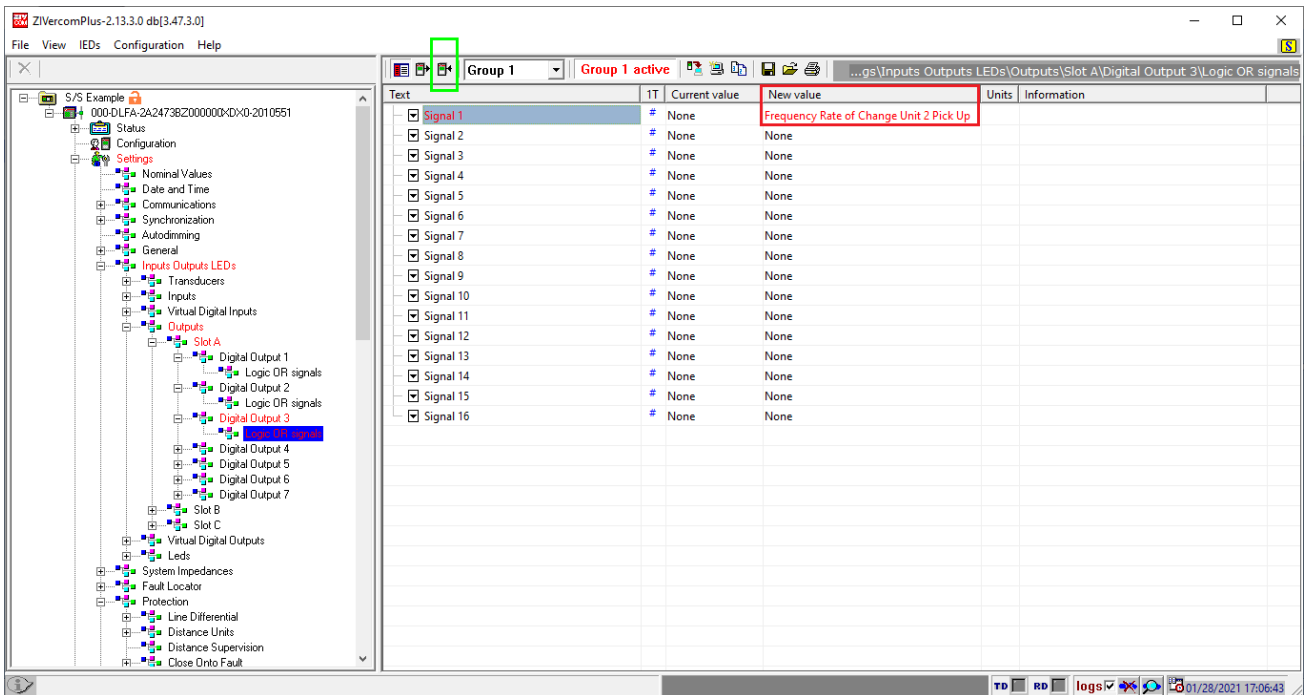


Figure 23

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

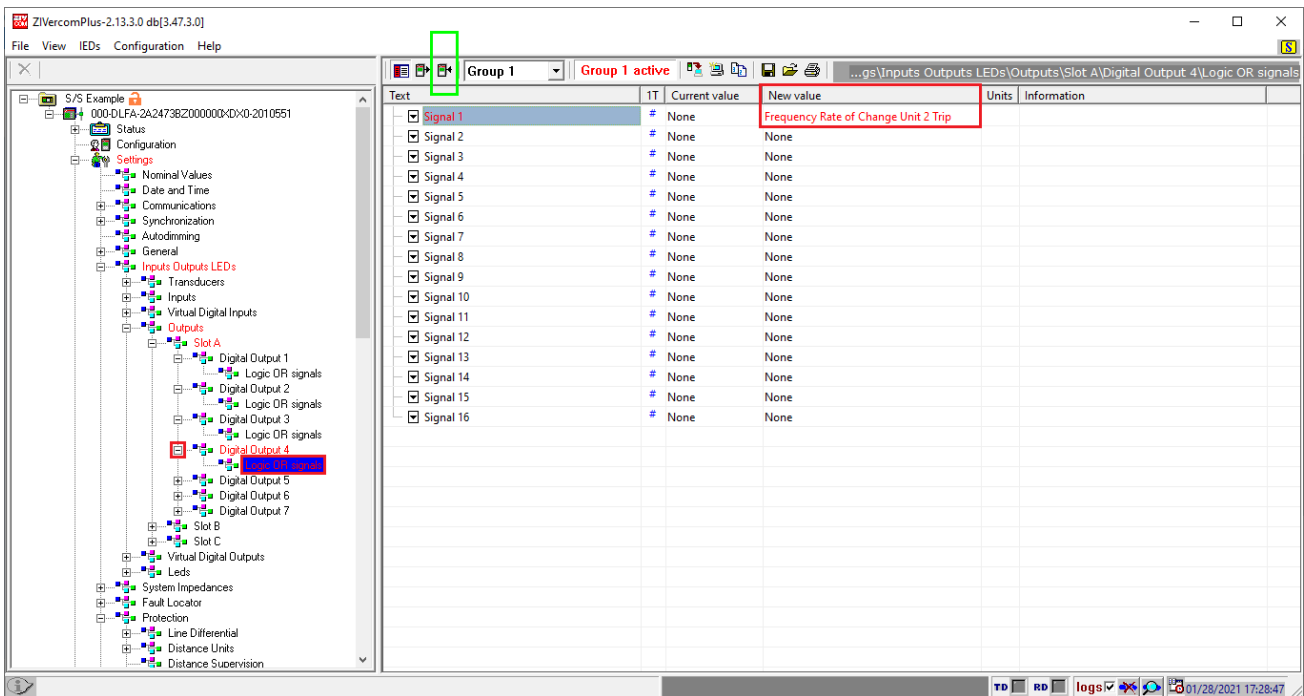


Figure 24

4. Application Manager

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



Figure 25

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4.1. Ramp software adjustments

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



Figure 26

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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.

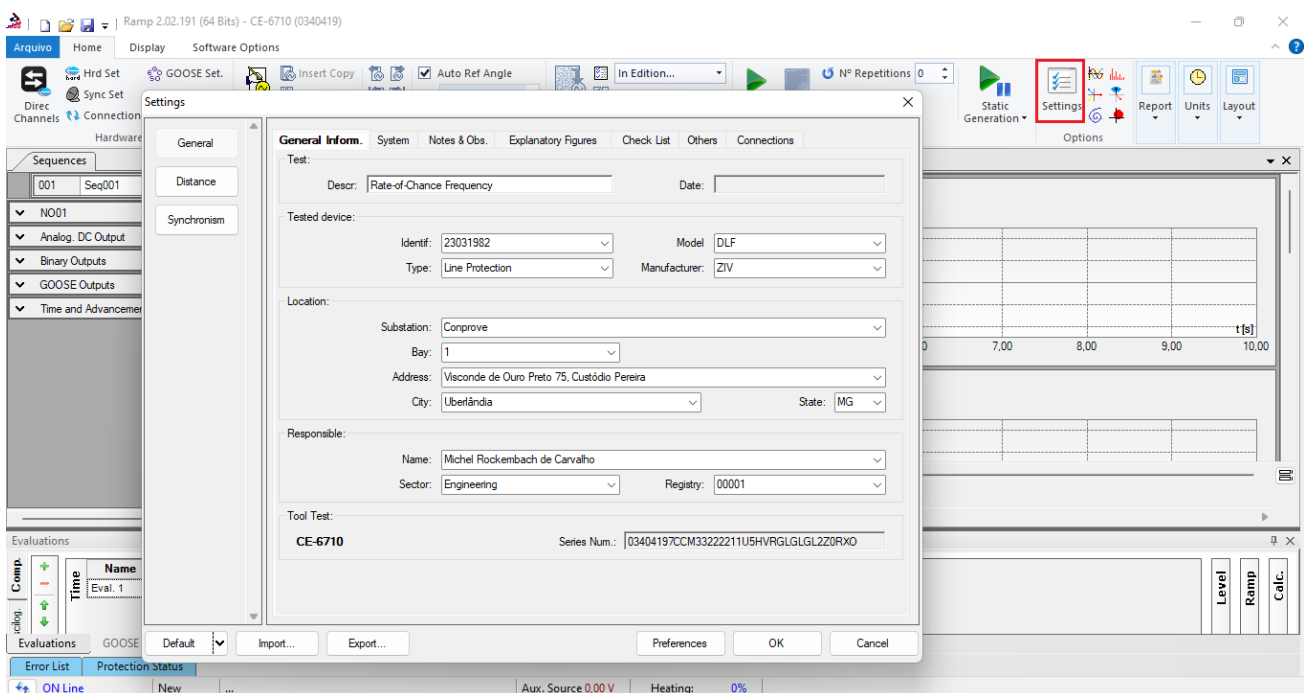


Figure 27

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.

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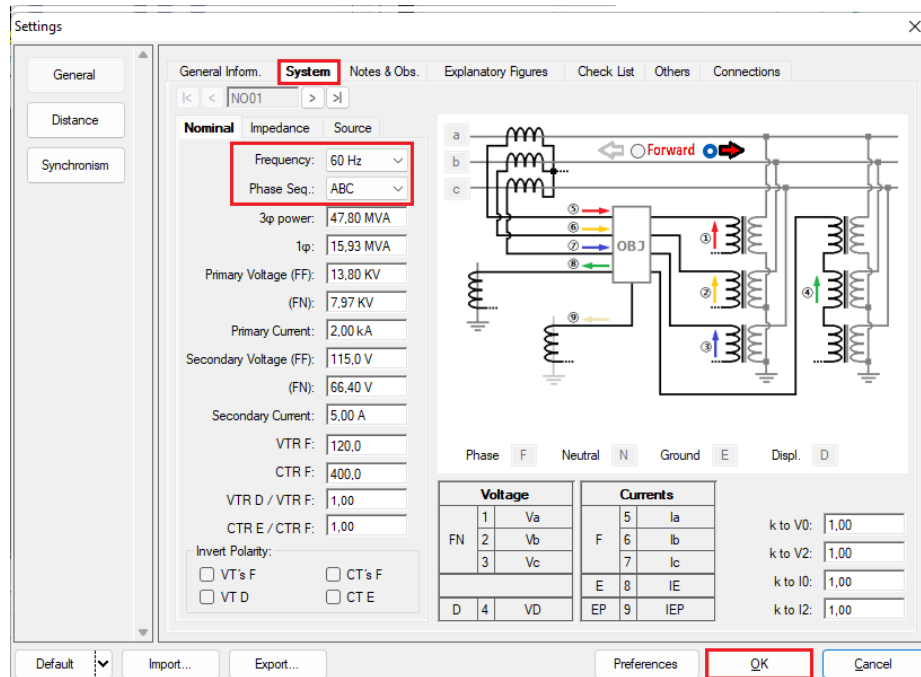


Figure 28

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.

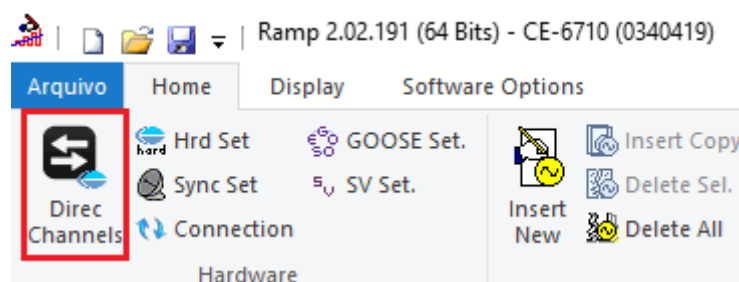


Figure 29

Then click on the highlighted icon to configure the hardware.

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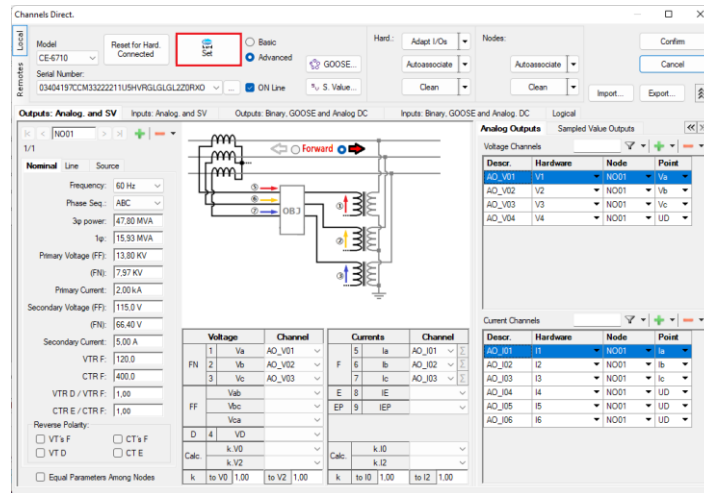


Figure 30

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

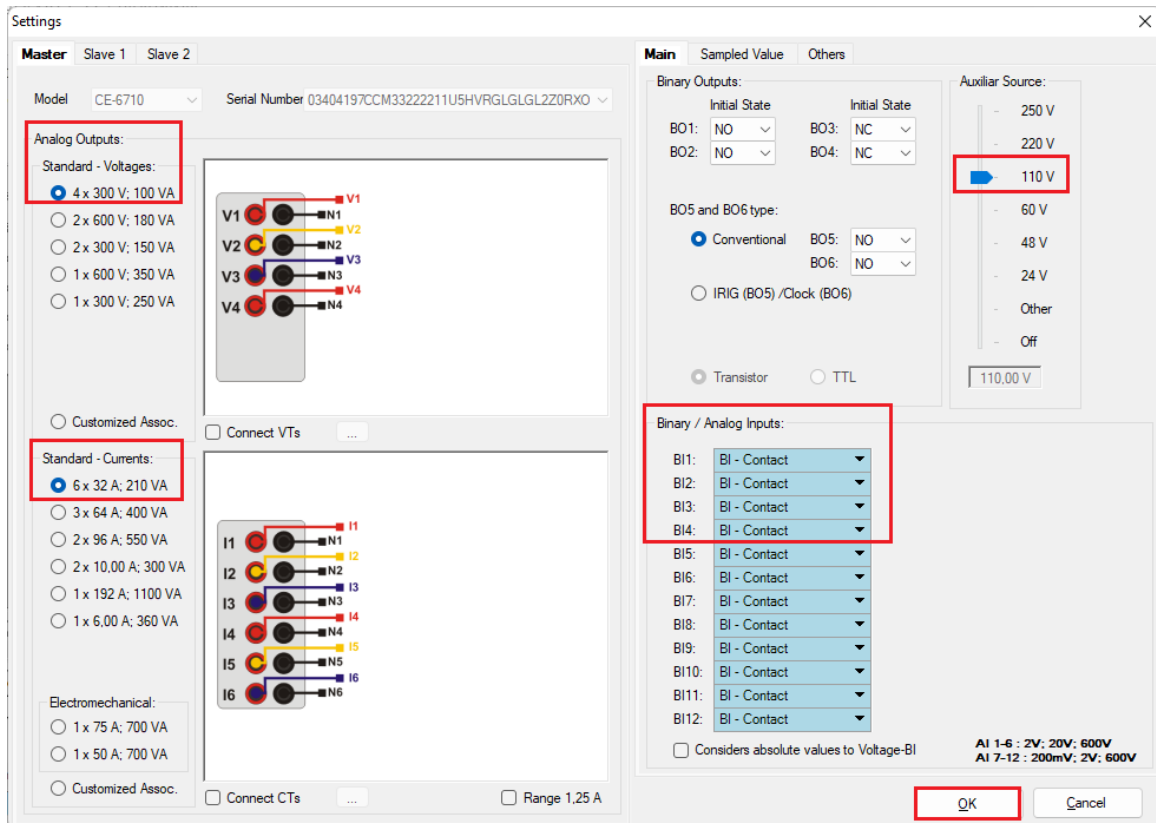


Figure 31

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

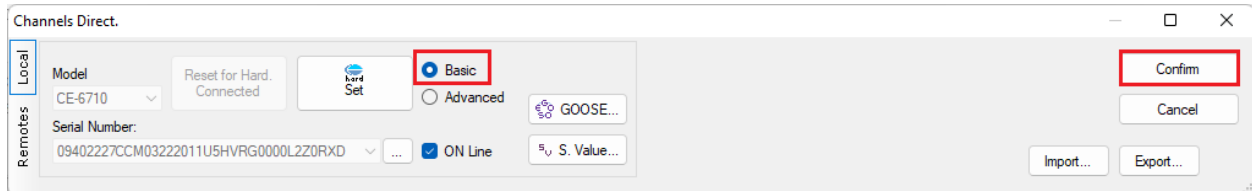


Figure 32

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.

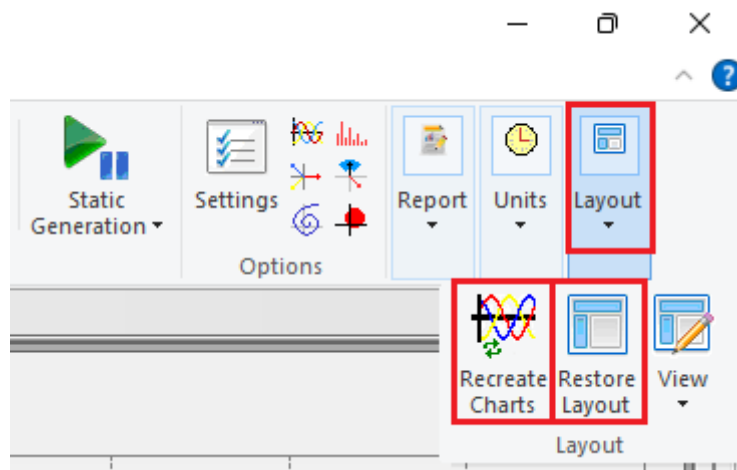


Figure 33

7. Test Structure for function 81R

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Click the highlighted “*Insert New*” button to create a second test sequence.

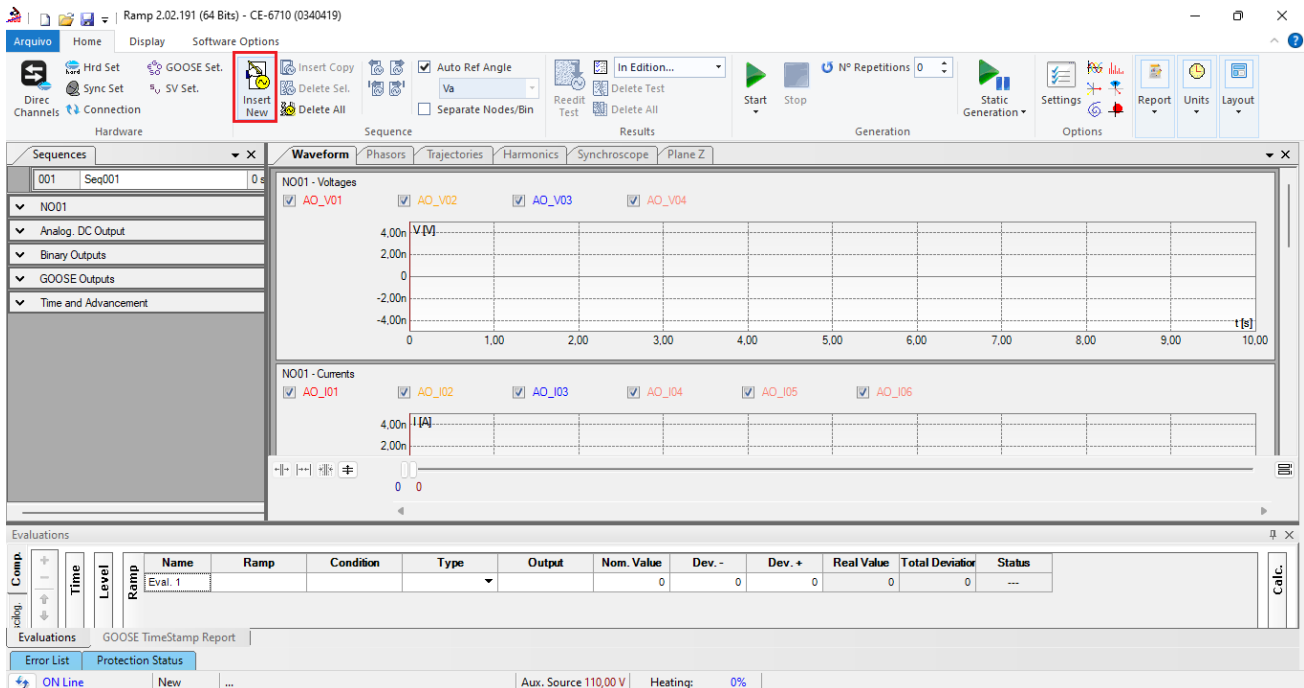


Figure 34

7.1. Main Screen 81R-1

In the first sequence, configure a situation to verify the negative frequency variation of the first element whose adjustment is at 1.5Hz/s and 1.5s. In place of “*Seq 001*” write “*81R-1*” and select the option “*NO01*”. Then click on the “...” button highlighted in the figure below.

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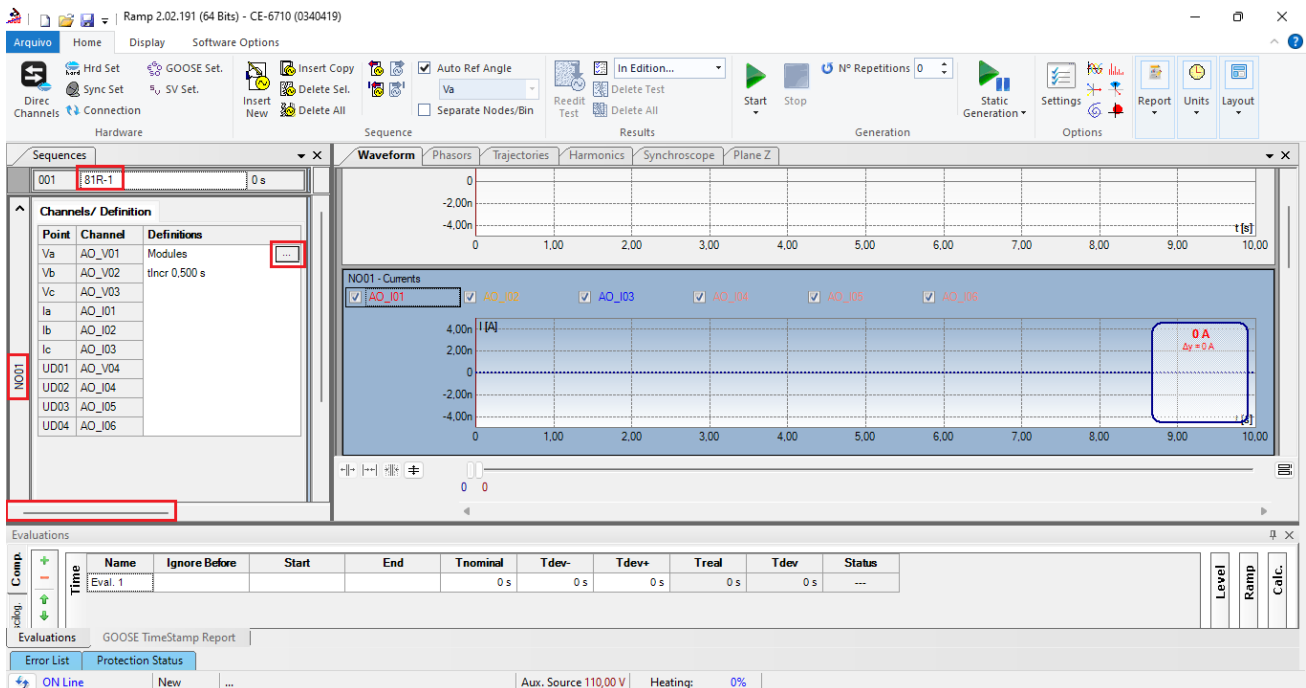


Figure 35

7.2. Screen for incrementing 81R-1

On this screen, in the "Ramp Type" field, choose the "dF/dt" option and then select the "Pulsed" option. For voltage values, both initial or reset, use the nominal voltage of 66.4V three-phase balanced ABC with a frequency of 60.0Hz. For the initial frequency variation use -1.35Hz/s and for the final one -1.65Hz/s with a step of -50.0 mHz/s. 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 2.50 seconds was chosen. "Reset Time" has been set to 0.25 seconds.

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Ramp

Ramp Type: Direct Pulsed

dF/dt:

Generation Time in Each Incr.: Reset Time:

Initial Values

Point	Channel	Mod.	Ang.	Freq.
Va	AO_V01	66,40 V	0 °	60,00 Hz
Vb	AO_V02	66,40 V	-120,0 °	60,00 Hz
Vc	AO_V03	66,40 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

	Start	Limit	Incr.	N Steps	Time
<input checked="" type="checkbox"/> Va	-1,35 Hz/s	-1,65 Hz/s	-50,00 mHz	15,00	19,50 s
<input checked="" type="checkbox"/> Vb	-1,35 Hz/s	-1,65 Hz/s	-50,00 mHz	15,00	19,50 s
<input checked="" type="checkbox"/> Vc	-1,35 Hz/s	-1,65 Hz/s	-50,00 mHz	15,00	19,50 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

Point	Channel	Mod.	Ang.	Freq.
Va	AO_V01	66,40 V	0 °	60,00 Hz
Vb	AO_V02	66,40 V	-120,0 °	60,00 Hz
Vc	AO_V03	66,40 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

Binary Outputs

Channel	Incr.	Reset
<input type="checkbox"/> BO01		
<input type="checkbox"/> BO02		
<input type="checkbox"/> BO03		
<input type="checkbox"/> BO04		
<input type="checkbox"/> BO05		
<input type="checkbox"/> BO06		
<input type="checkbox"/> BO07		
<input type="checkbox"/> BO08		

GOOSE Outputs

Channel	Incr.	Reset

Initial value

Generation Time Every Incr.

Reset Time

Limit

OK Cancel

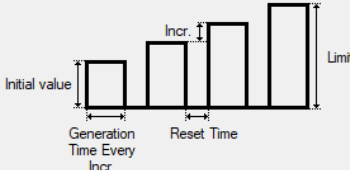


Figure 36

7.3. Main Screen 81R-2

In the second sequence, configure a situation to verify the positive frequency variation of the second element whose adjustment is at 1.5Hz/s and 1.5s. In place of “Seq 002” write “81R-2”. Then click on the “...” button highlighted in the figure below.

INSTRUMENTOS PARA TESTES ELÉTRICOS

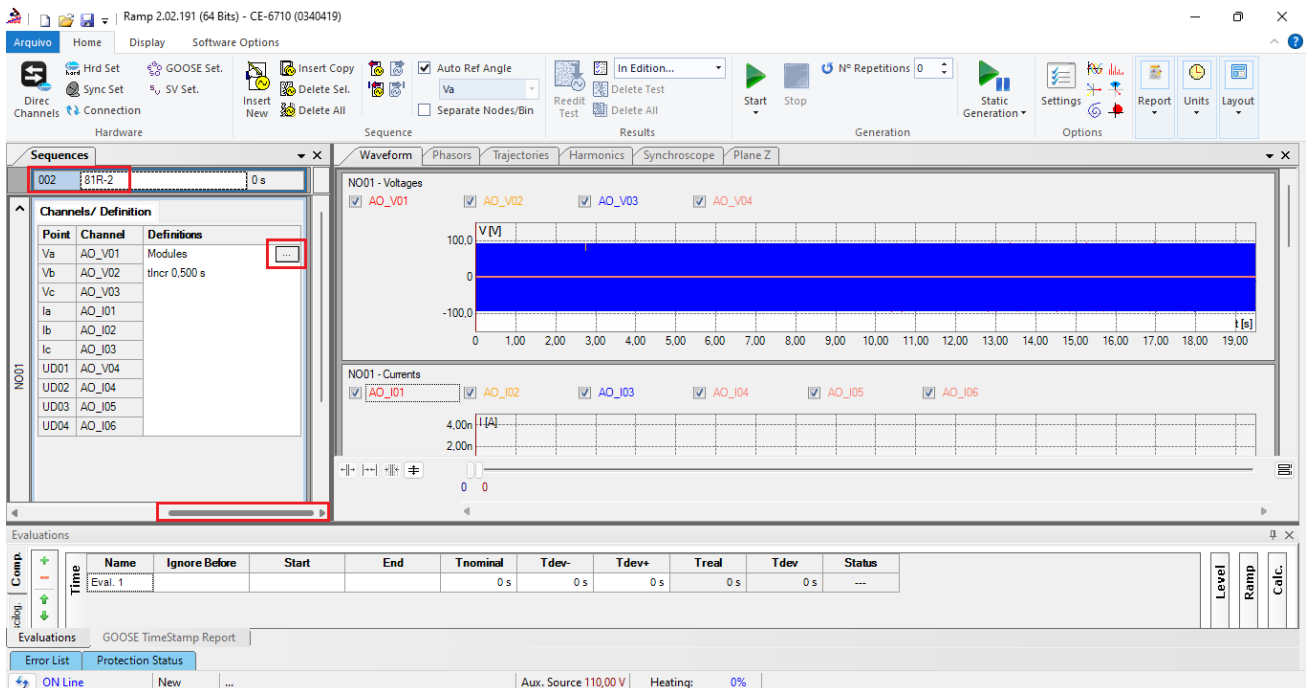


Figure 37

7.4. Screen for incrementing 81R-2

On this screen, in the “*Ramp Type*” field, choose the “*dF/dt*” option then select the “*Pulsed*” option. For voltage values, both initial and reset, use the nominal voltage of 66.4V three-phase balanced ABC with a frequency of 60.0Hz. For the initial frequency variation use 1.35Hz/s and for the final one 1.65Hz/s with a step of 50.0 mHz/s. 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 2.50 seconds was chosen. “*Reset Time*” has been set to 0.25 seconds.

INSTRUMENTOS PARA TESTES ELÉTRICOS

Ramp

Ramp Type: Direct Pulsed
dF/dt:

Generation Time in Each Incr.:
Reset Time:

Initial Values

Point	Channel	Mod.	Ang.	Freq.
Va	AO_V01	66,40 V	0 °	60,00 Hz
Vb	AO_V02	66,40 V	-120,0 °	60,00 Hz
Vc	AO_V03	66,40 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

	Start	Limit	Incr.	N Steps	Time
<input checked="" type="checkbox"/> Va	1,35 Hz/s	1,65 Hz/s	50,00 mHz/	15,00	19,50 s
<input checked="" type="checkbox"/> Vb	1,35 Hz/s	1,65 Hz/s	50,00 mHz/	15,00	19,50 s
<input checked="" type="checkbox"/> Vc	1,35 Hz/s	1,65 Hz/s	50,00 mHz/	15,00	19,50 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

Point	Channel	Mod.	Ang.	Freq.
Va	AO_V01	66,40 V	0 °	60,00 Hz
Vb	AO_V02	66,40 V	-120,0 °	60,00 Hz
Vc	AO_V03	66,40 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

Binary Outputs

Channel	Incr.	Reset
<input type="checkbox"/> BO01		
<input type="checkbox"/> BO02		
<input type="checkbox"/> BO03		
<input type="checkbox"/> BO04		
<input type="checkbox"/> BO05		
<input type="checkbox"/> BO06		
<input type="checkbox"/> BO07		
<input type="checkbox"/> BO08		

GOOSE Outputs

Channel	Incr.	Reset

Initial value

Limit

Generation Time Every Incr.

Reset Time

OK Cancel

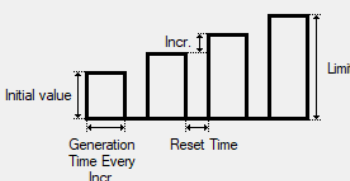


Figure 38

7.5. Pick-ups assessments

Clicking on the “Ramp” field, as shown in the next figure, configure two pick-up evaluations as follows.

INSTRUMENTOS PARA TESTES ELÉTRICOS

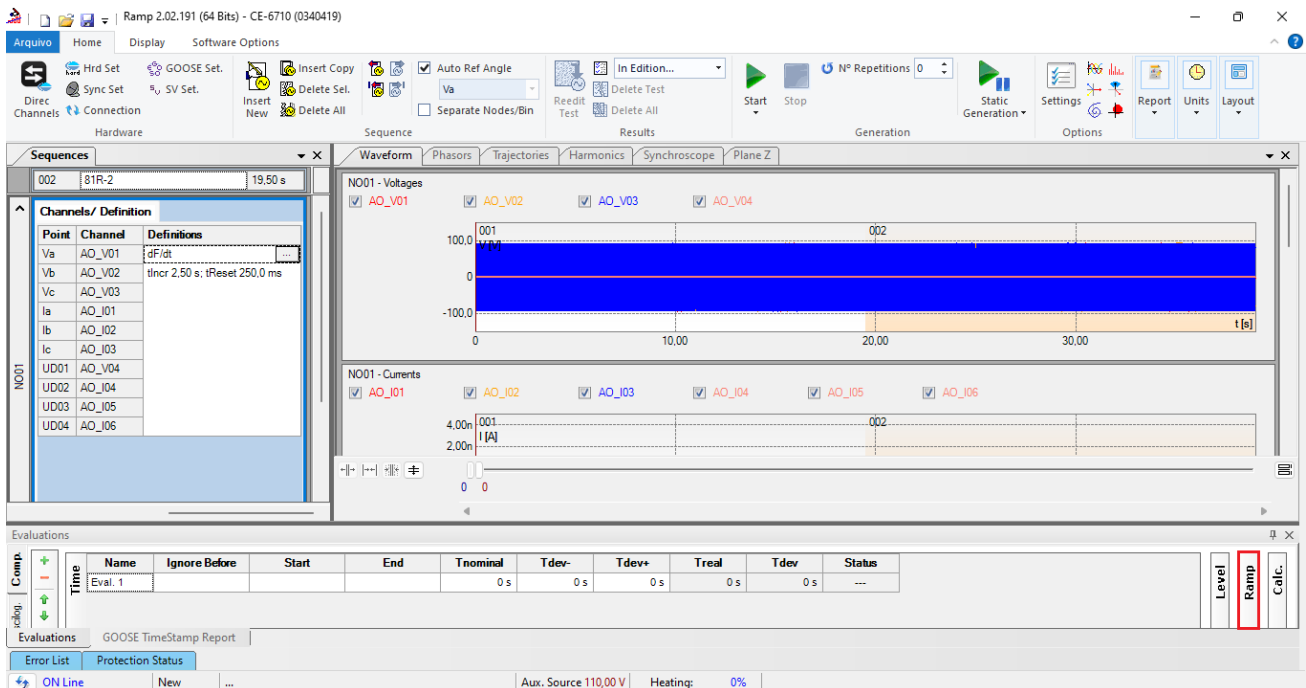


Figure 39

Instead of “Eval.1” write “81R-1”, in Ramp select “81R-1 > NO01” for “Condition” set “BI01 (↑)”, for “Type” choose “dFdt”, for “Output” set “Va”, in the field “Nom Value” set -1.50Hz and in the fields related to deviations set 100mHz/s.

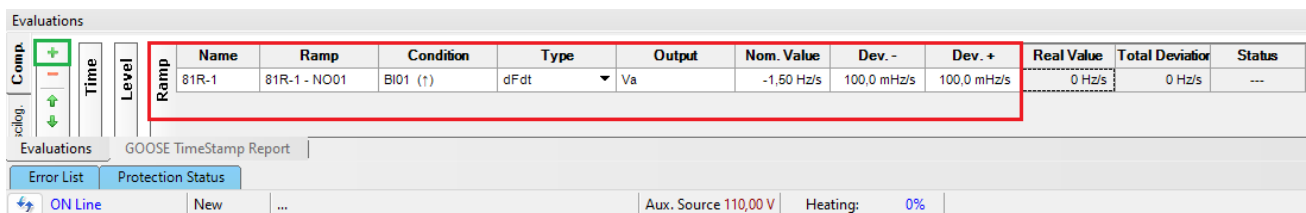


Figure 40

Clicking on the “+” icon in the previous figure inserts one more evaluation. The configuration must be done in a similar way to the first evaluation with changes in the binary and values of the pick-ups.

INSTRUMENTOS PARA TESTES ELÉTRICOS

Evaluations														
Comp.	Time	Level	Ramp	Name	Ramp	Condition	Type	Output	Nom. Value	Dev. -	Dev. +	Real Value	Total Deviator	Status
				81R-1	81R-1 - NO01	BI01 (t)	dFdt	Va	-1,50 Hz/s	100,0 mHz/s	100,0 mHz/s	0 Hz/s	0 Hz/s	---
				81R-2	81R-2 - NO01	BI03 (t)	dFdt	Va	1,50 Hz/s	100,0 mHz/s	100,0 mHz/s	0 Hz/s	0 Hz/s	---

GOOSE TimeStamp Report

Error List Protection Status

ON Line New ... Aux. Source 110,00 V Heating: 0%

Figure 41

7.6. Adjusting Graphics

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

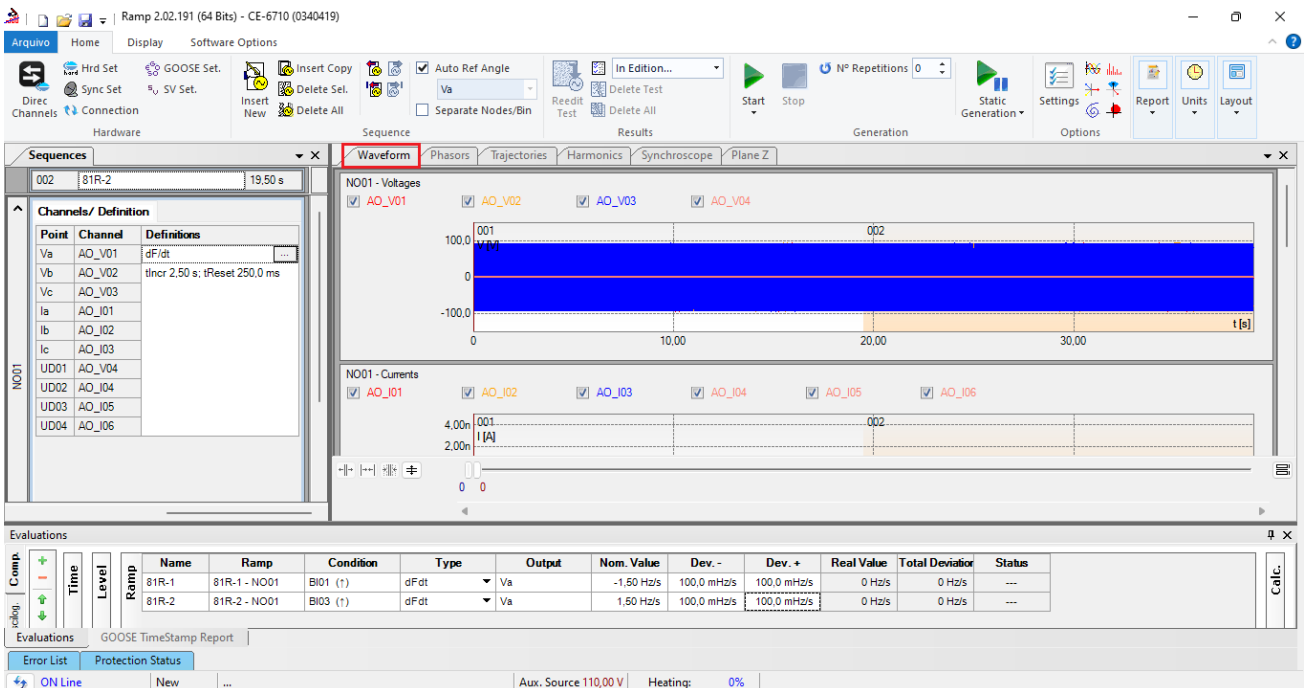


Figure 42

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

INSTRUMENTOS PARA TESTES ELÉTRICOS

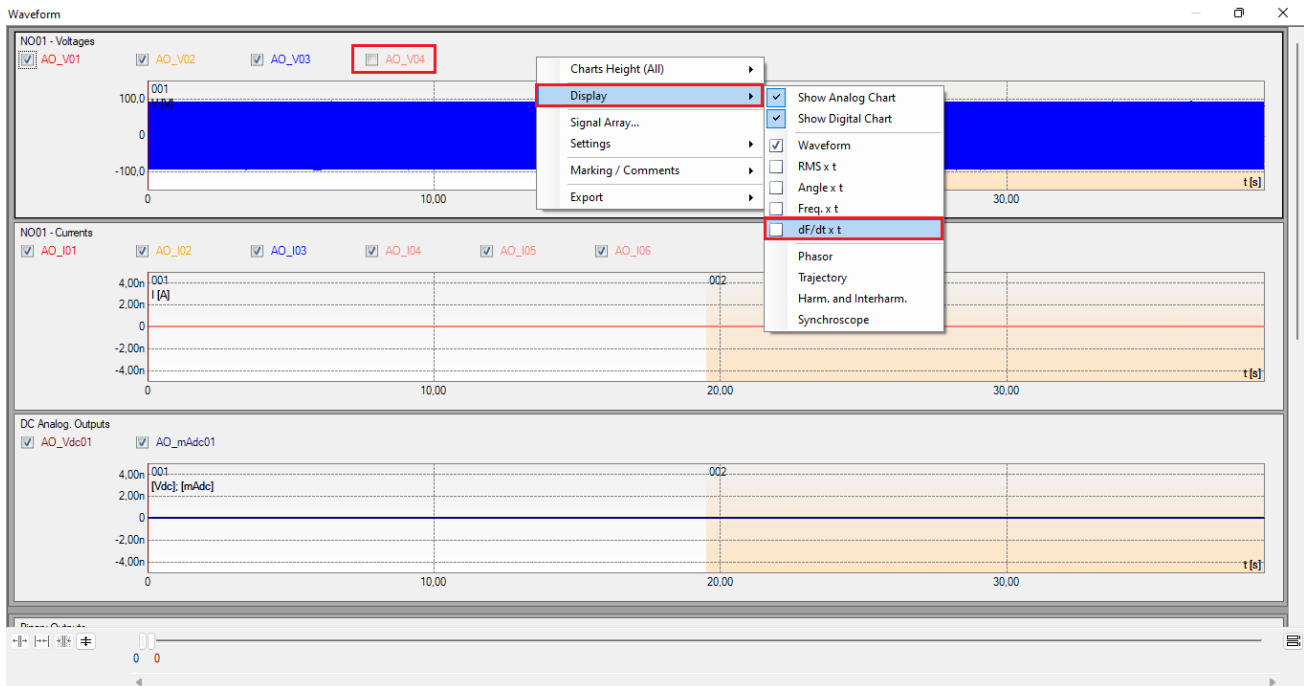


Figure 43

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

INSTRUMENTOS PARA TESTES ELÉTRICOS

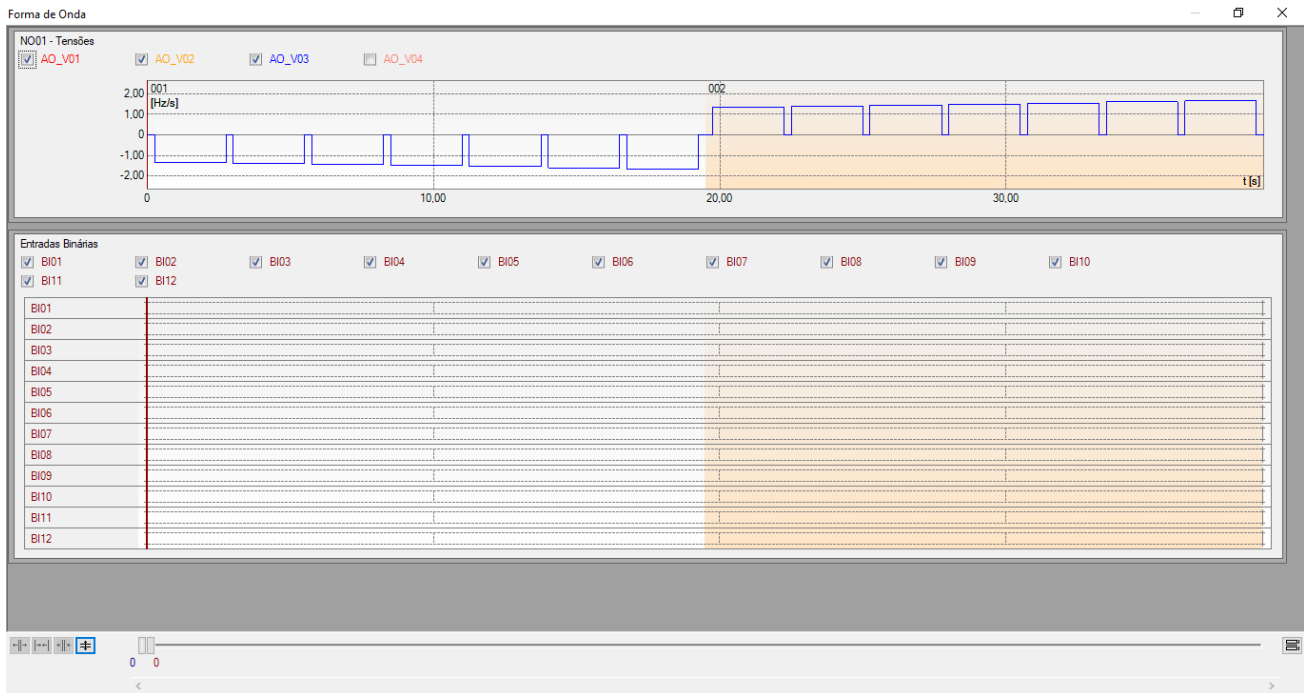


Figure 44

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”.

INSTRUMENTOS PARA TESTES ELÉTRICOS

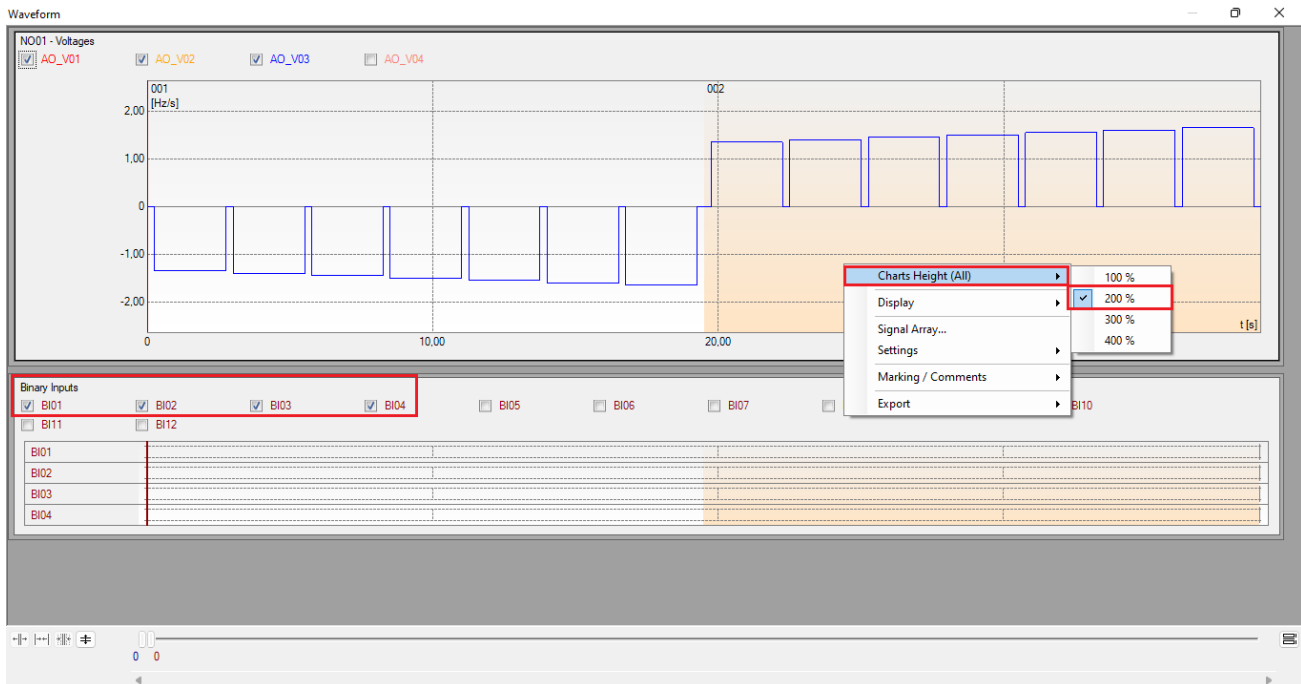


Figure 45

7.7. Time analysis

To evaluate the time, the value of the frequency variation where the last decrement or increment 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 set. To do this, left-click and drag into the desired region. To remove the zoom, just double-click on the graph. The following figure shows the time for the two elements.

INSTRUMENTOS PARA TESTES ELÉTRICOS

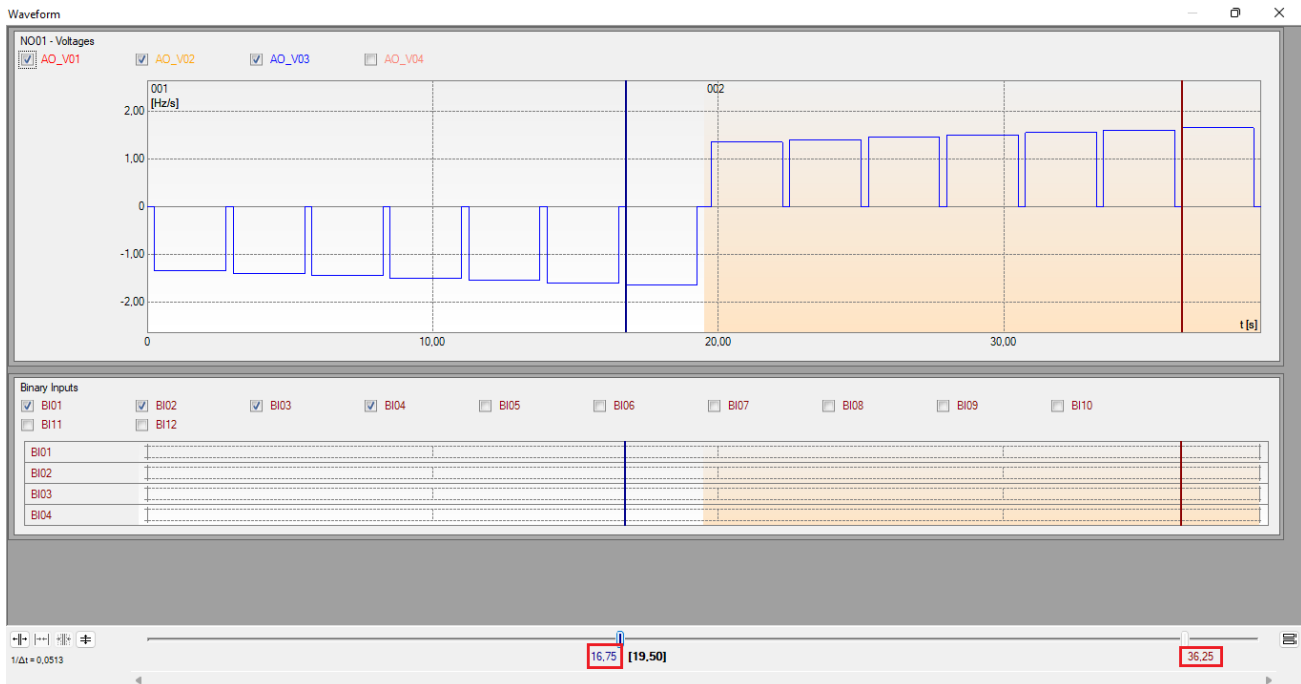


Figure 46

According to the previous figure, it can be concluded that the time required for the first marking is 16.75 seconds and for the second one, 36.25 seconds.

7.8. Inserting markup

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

INSTRUMENTOS PARA TESTES ELÉTRICOS

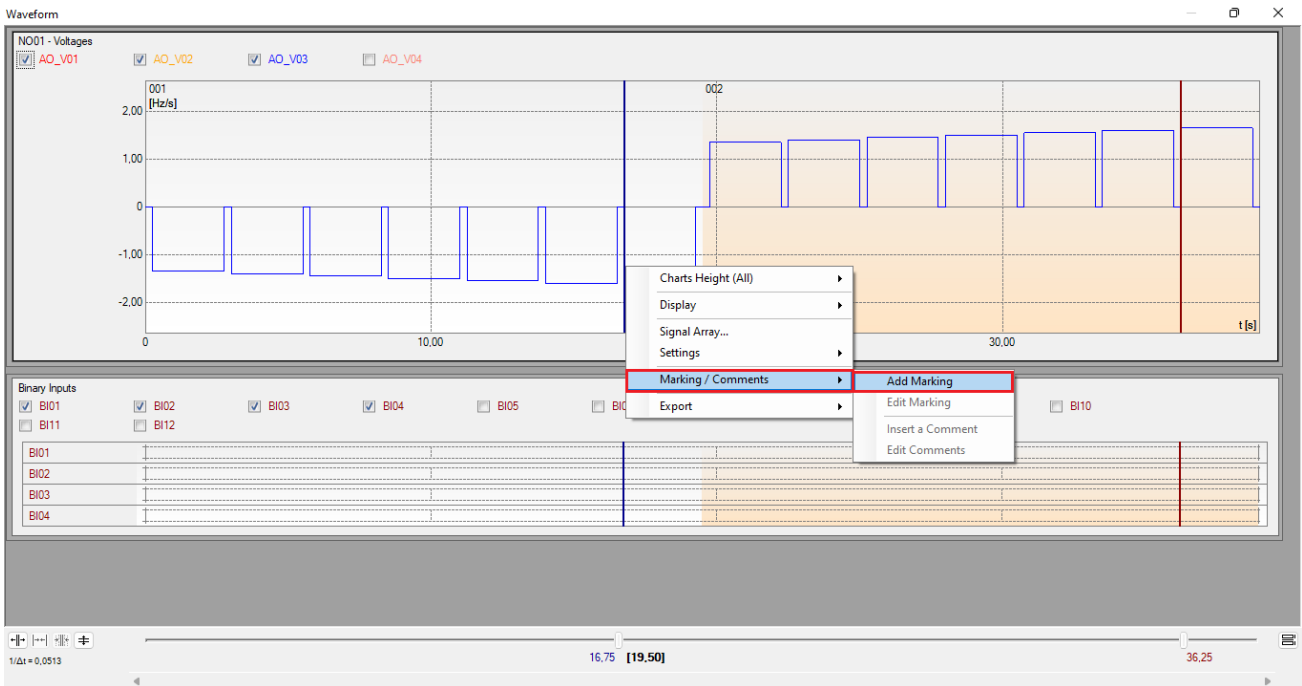


Figure 47

Adjust the first time and repeat the procedure for the second mark.

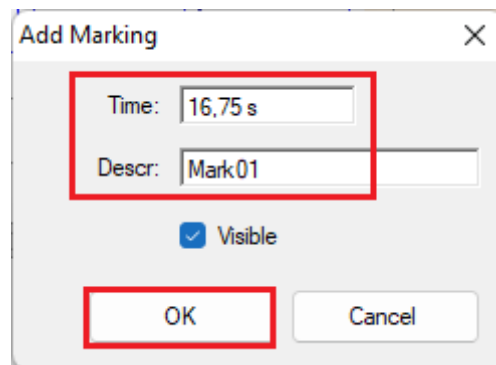


Figure 48

INSTRUMENTOS PARA TESTES ELÉTRICOS

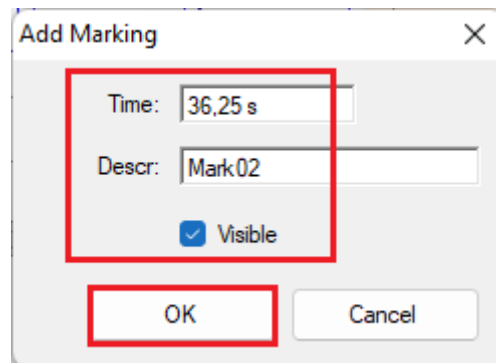


Figure 49

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

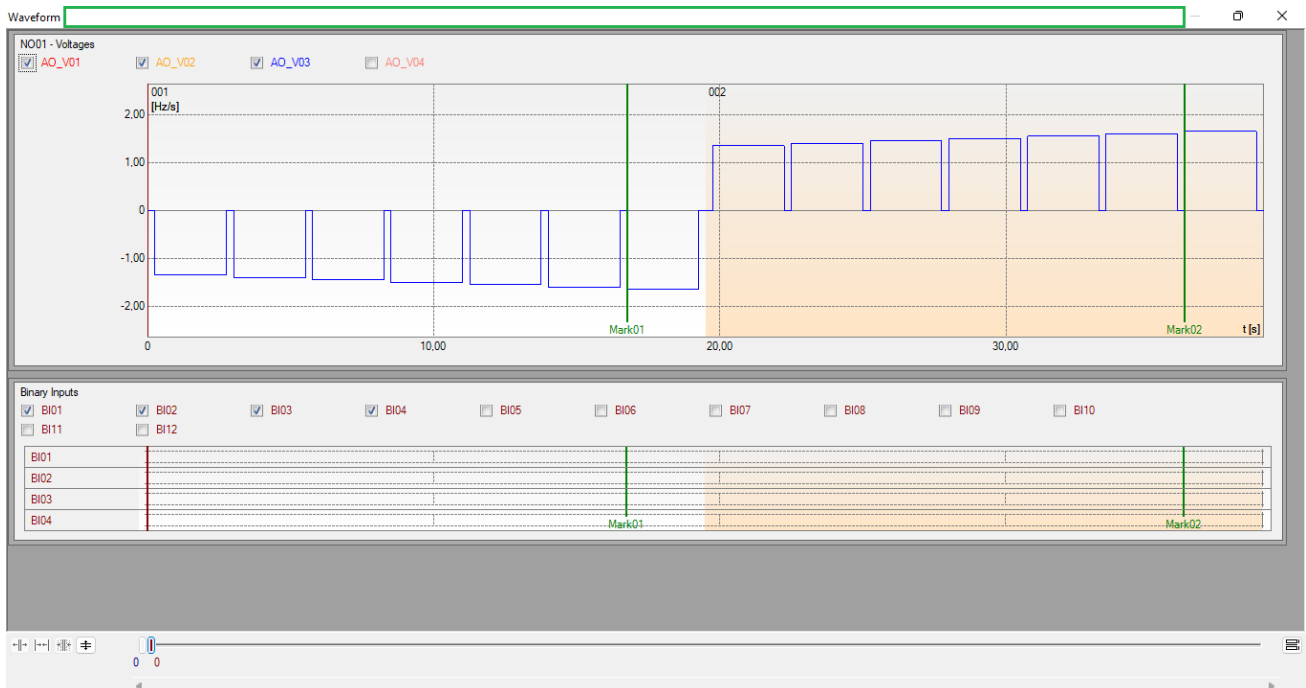


Figure 50

7.9. Time Ratings

By clicking on the “Time” field, as shown in the next figure, two evaluations of operation times can be configured as follows.

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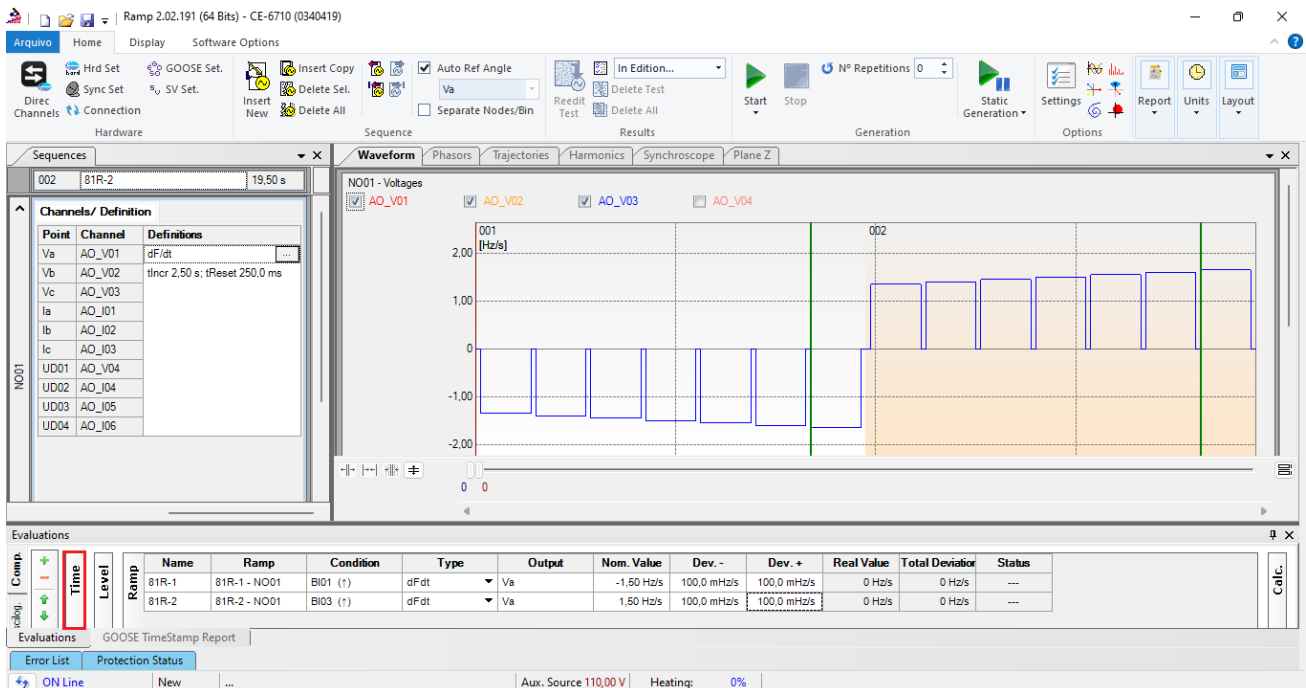


Figure 51

Change the name “Eval. 1” to “81R-1” in the “Ignore first” option choose “Tagging > Mark01” in the “Start” option choose Binary Input “BI01 (↑)”, in the “End” option, choose Binary Input “BI02 (↑)”. In nominal time, set 1.5s with deviations of 50.0ms. The figure below shows these settings.

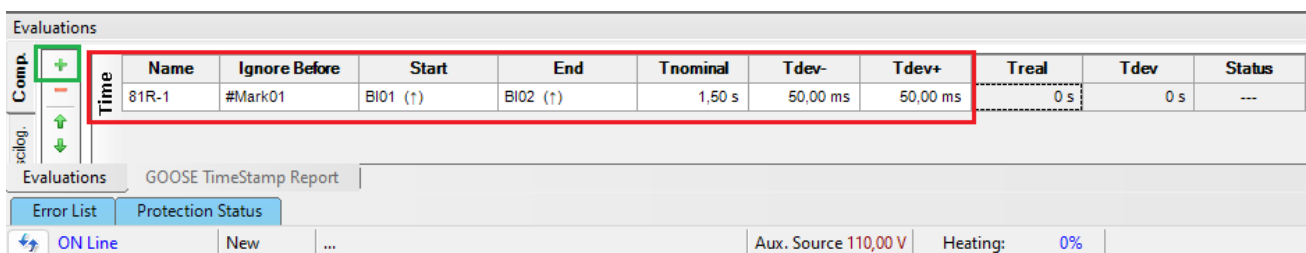


Figure 52

By clicking on the “+” icon, one more evaluation is added and its adjustments are made in a similar way to the first evaluation.

INSTRUMENTOS PARA TESTES ELÉTRICOS

Comp.	Name	Ignore Before	Start	End	Tnominal	Tdev-	Tdev+	Treal	Tdev	Status
	81R-1	#Mark01	BI01 (↑)	BI02 (↑)	1,50 s	50,00 ms	50,00 ms	0 s	0 s	---
	81R-2	#Mark02	BI03 (↑)	BI04 (↑)	1,50 s	50,00 ms	50,00 ms	0 s	0 s	---

Evaluations GOOSE TimeStamp Report

ON Line New ... Aux. Source 110,00 V Heating: 0%

Figure 53

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

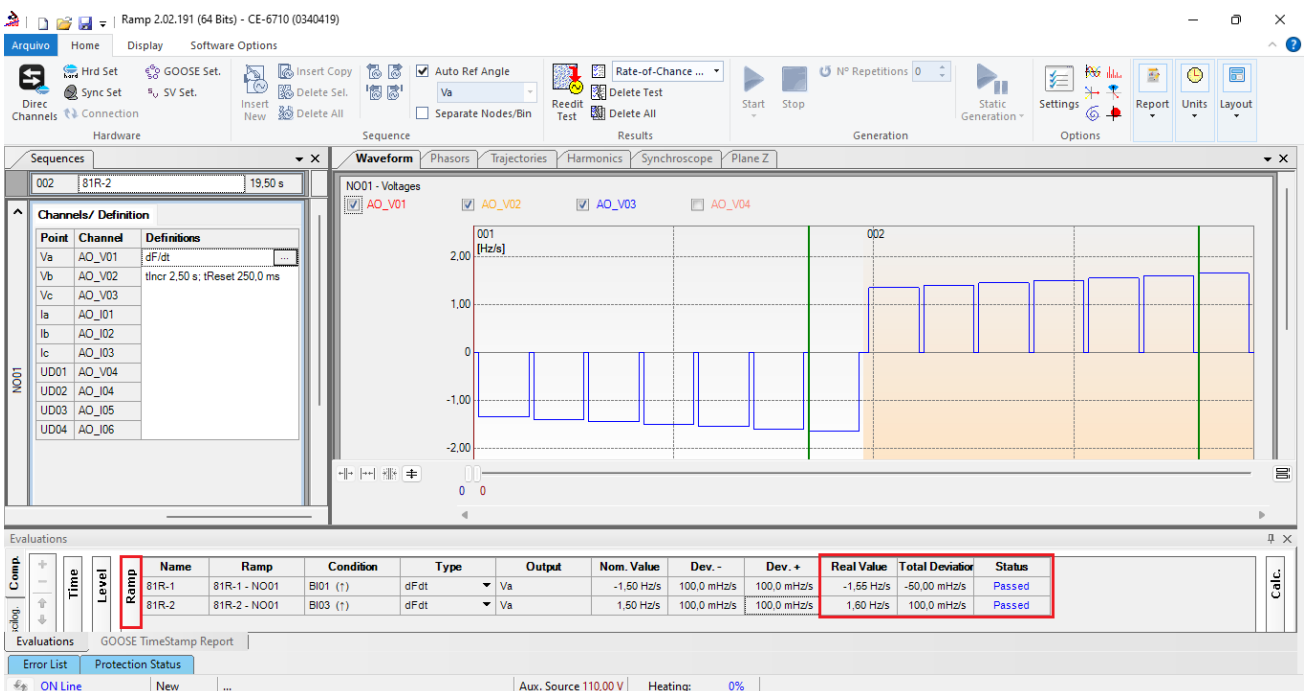


Figure 54

The following figure shows the operating times.

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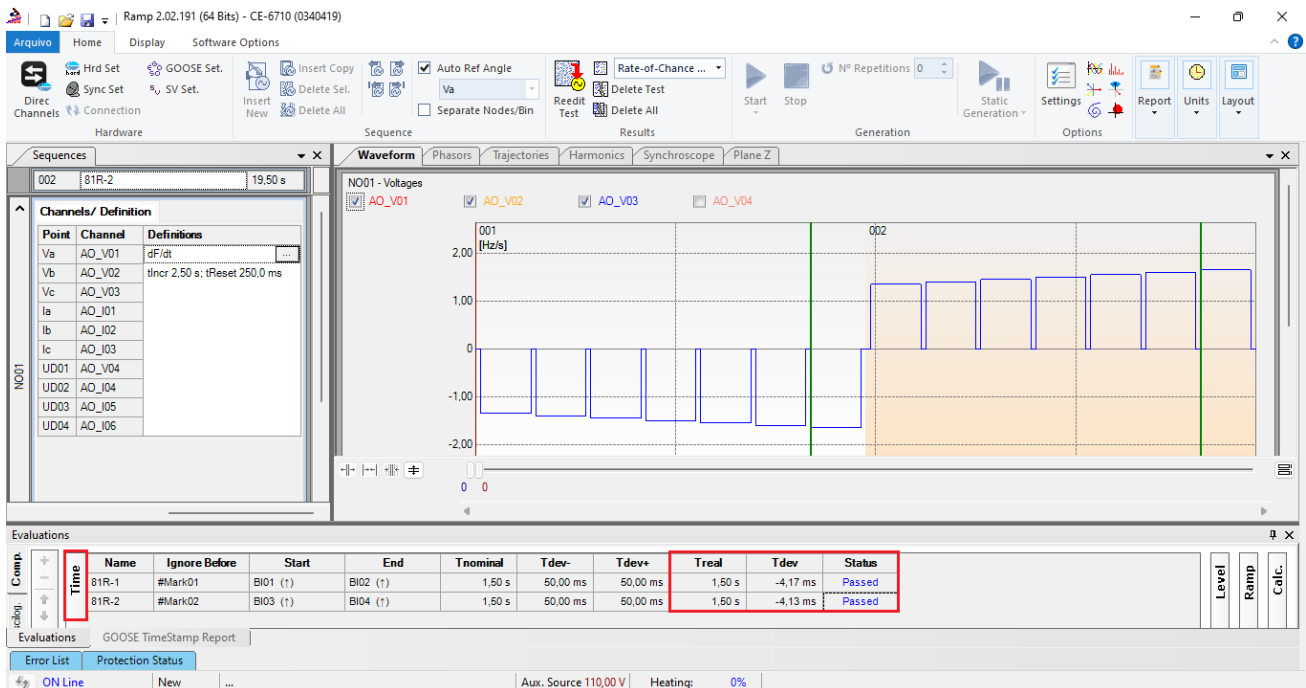


Figure 55

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.

INSTRUMENTOS PARA TESTES ELÉTRICOS

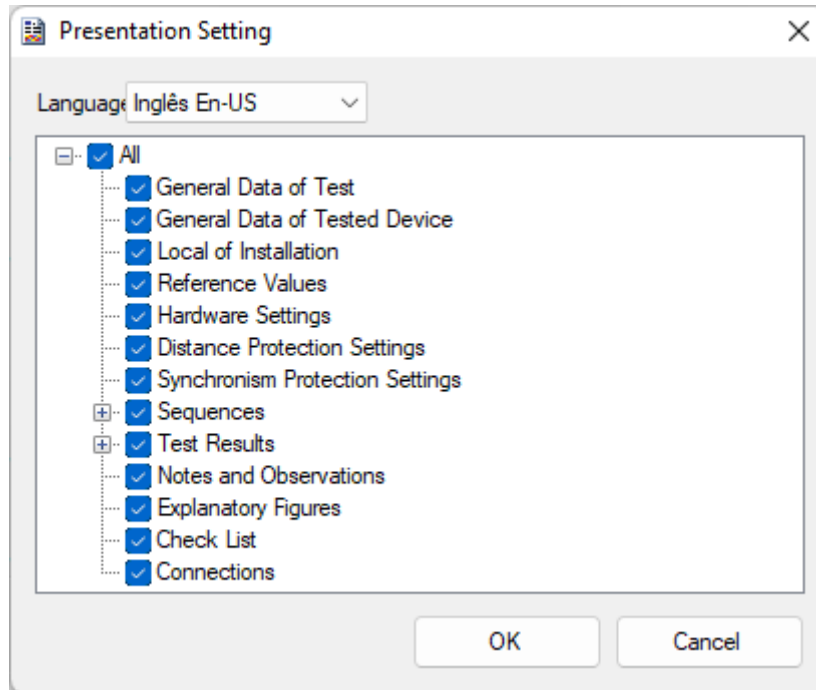


Figure 56

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.

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Figure 57

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INSTRUMENTOS PARA TESTES ELÉTRICOS

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	$\pm 1\%$ of the setting or ± 25 ms (the greater)
<p>Note: The total trip time is equal to the adjusted fixed time plus the time defined in "<i>Activation Half-time</i>" (see Frequency Units).</p>	

Figure 58

INSTRUMENTOS PARA TESTES ELÉTRICOS

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 59

INSTRUMENTOS PARA TESTES ELÉTRICOS

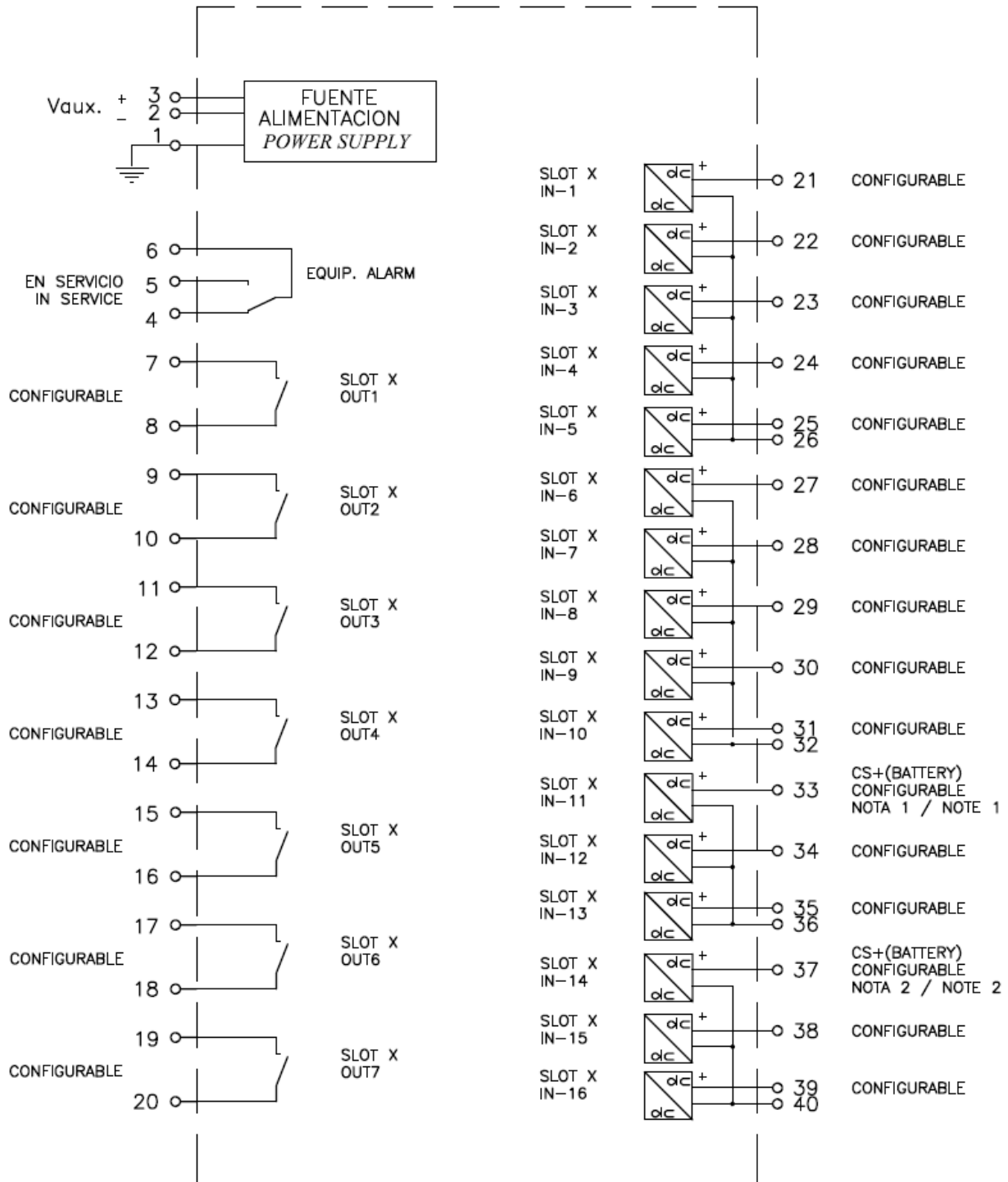


Figure 60

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INSTRUMENTOS PARA TESTES ELÉTRICOS

11. Appendix C - Parameter Equivalence between Relay and Software

Table 2

Ramp Software		ZIV DFL Relay	
Parameter	Figure	Parameter	Figure
Pickups			
81R-1	41	ROC frequency Pickup	17
81R-2	41	ROC frequency Pickup	18
Times			
81R-1	53	ROC frequency Delay	17
81R-2	53	ROC frequency Delay	18