TEST TUTORIAL

EQUIPMENT TYPE: Protection Relay.

BRAND: ZIV.

MODEL: IRF.

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

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

OBJECTIVE: Pickup and time testing of definite-time and inverse-curve phase overcurrent elements.

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VERSION CONTROL:

Version	Descriptions	Date	Author	Reviewer
1.0	Initial Version	17/11/2021	M.R.C.	M.P.S

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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 the user to contact us the via email suporte@conprove.com.br.

The tutorial contains knowledge gained from the resources and technical data at the time was writing. Therefore, CONPROVE reserves the right to make changes to this document without prior notice.

This document is intended as a guide only the manual of the equipment under tested should always be consulted.

ATTENTION!

The equipment generates high current and voltage values during its operation. Improper use of the equipment can result in material and physical damage.

Only suitably qualified people should handle the instrument. It is noted that the user must have satisfactory training in maintenance procedures, a good knowledge of the equipment under tested and still be aware of safety rules and regulations.

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PROCEDURE FOR TESTING THE ZIV IRF RELAY ON OVERCURRENT 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 IRF relay used.

1.1. Auxiliary Source

For relay power, connect the positive terminal (red) of the Aux. Vdc Source of 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.

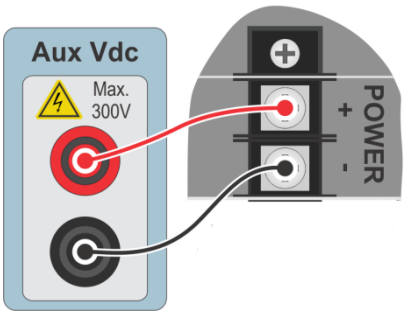

Figura 1

1.2. Analog Outputs

Connect the analog outputs I1, I2 and I3 of the CE-6710 to terminals 11, 13 and 15 of slot E of the relay and their common ones to terminals 12, 14 and 16, respectively. The figure below shows the procedure.

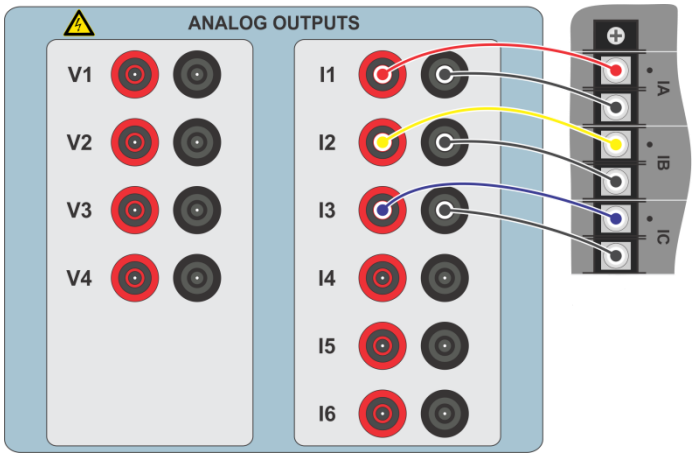

Figure 2

1.3. Binary Inputs

Connect the binary inputs to the binary outputs of the slot A relay as instructed in the table and figure below.

Table 1

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

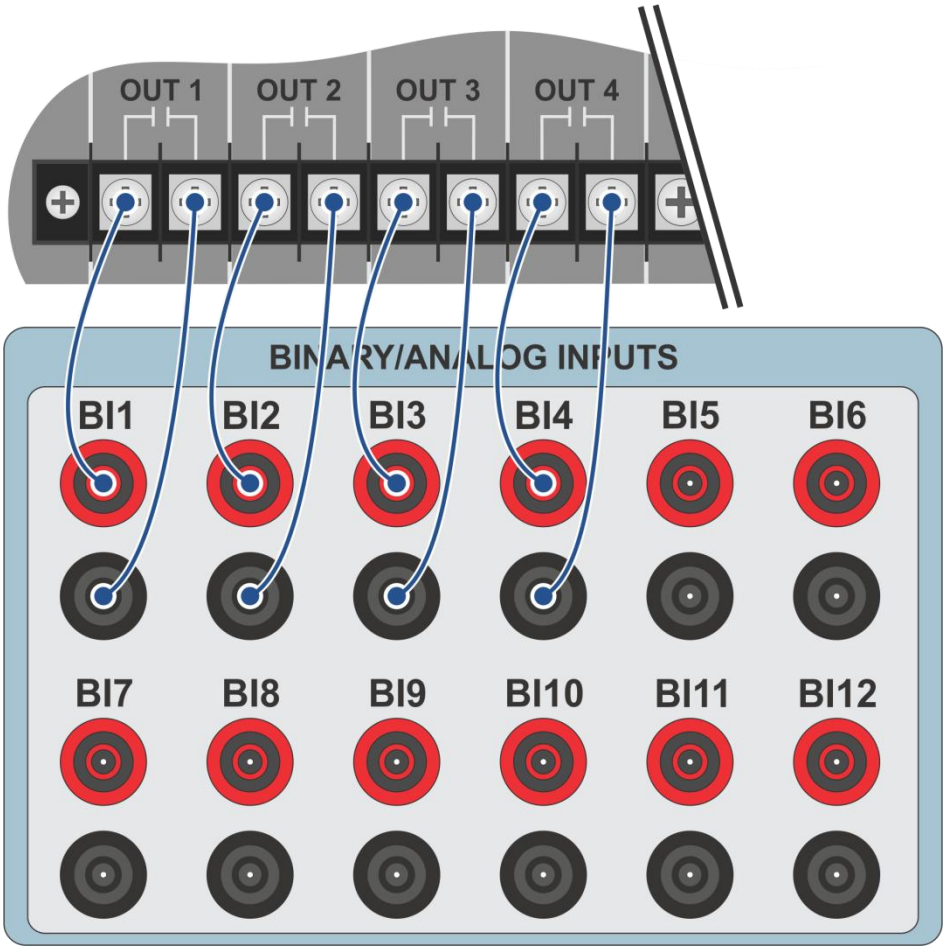

Figure 3

2. First steps with the IRF 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.

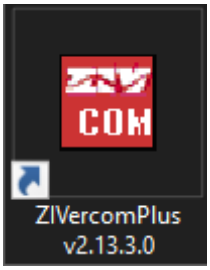

Figure 4

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

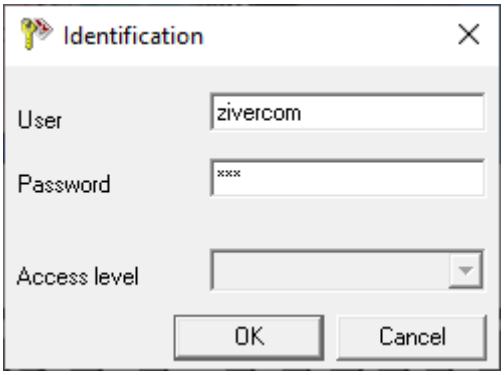

Figure 5

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

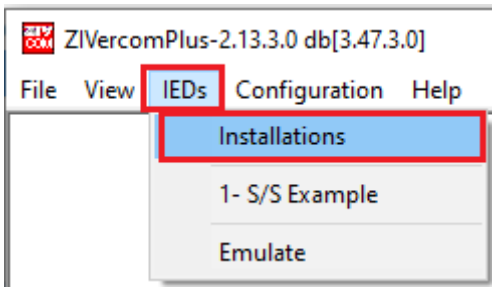

Figure 6

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

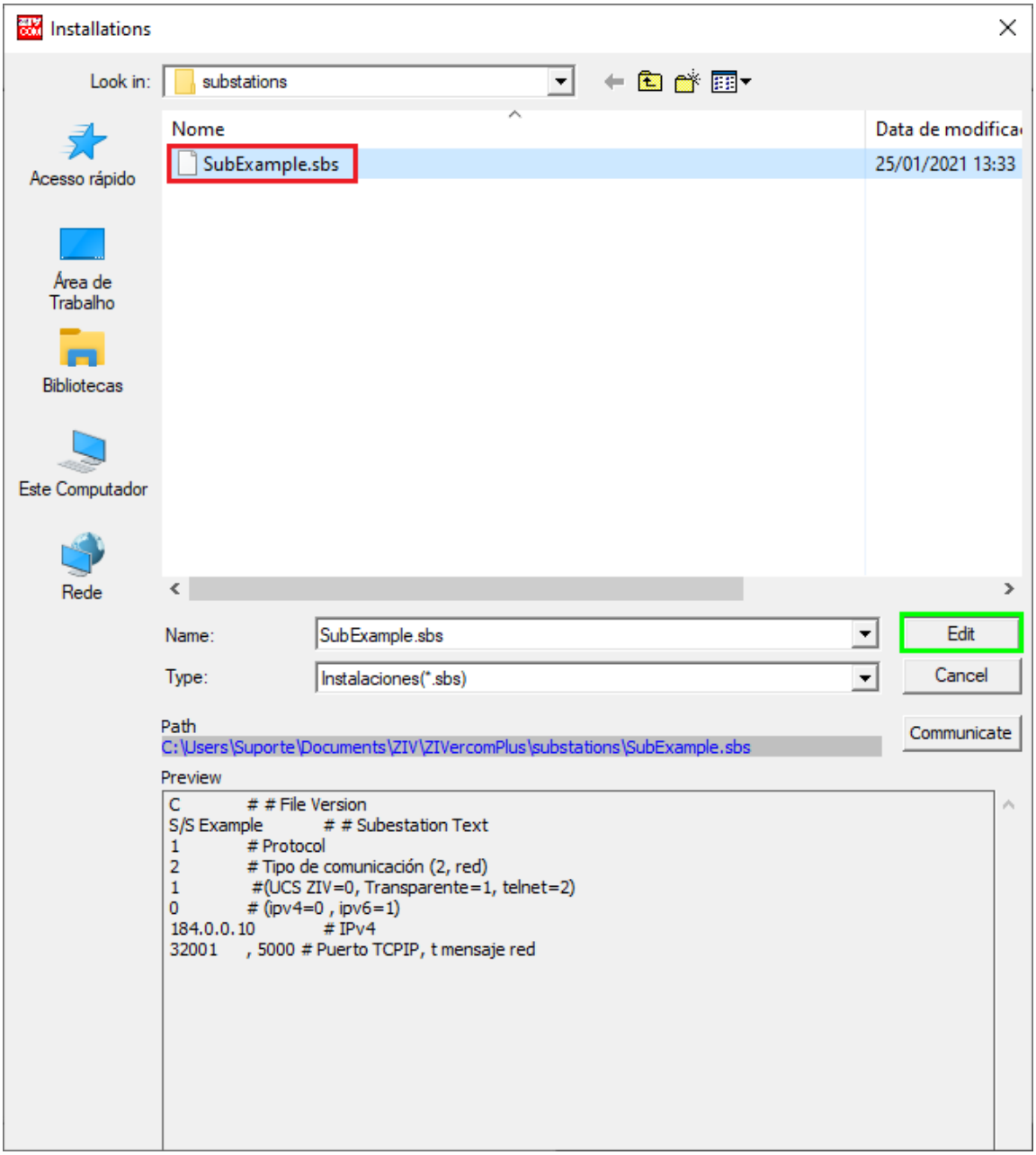

Figure 7

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.

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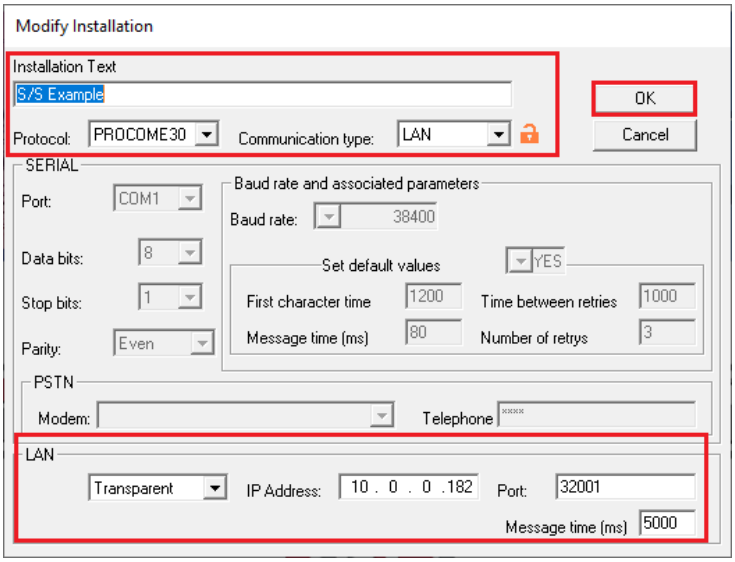

Figure 8

When clicking on the *"OK"* button, figure 7 is returned. Select the file again and click on *"Communicate"*.

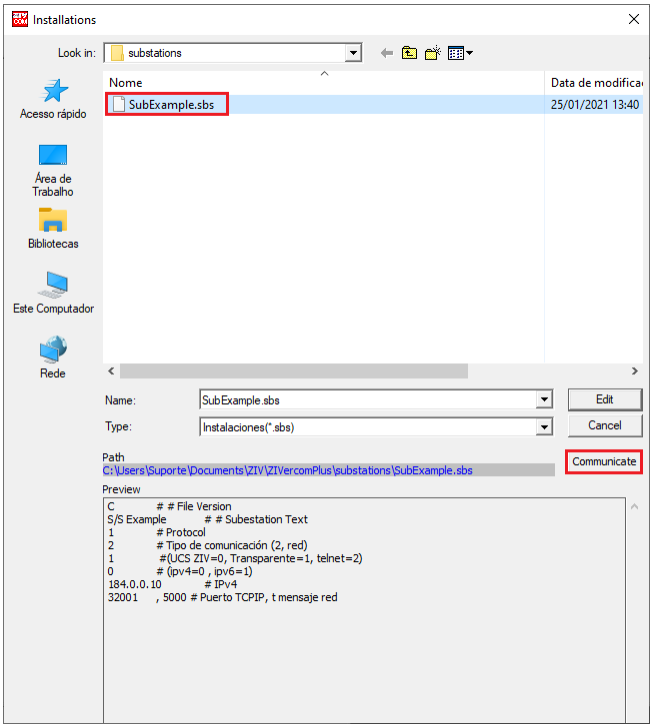

Figure 9

Click *"OK"* again.

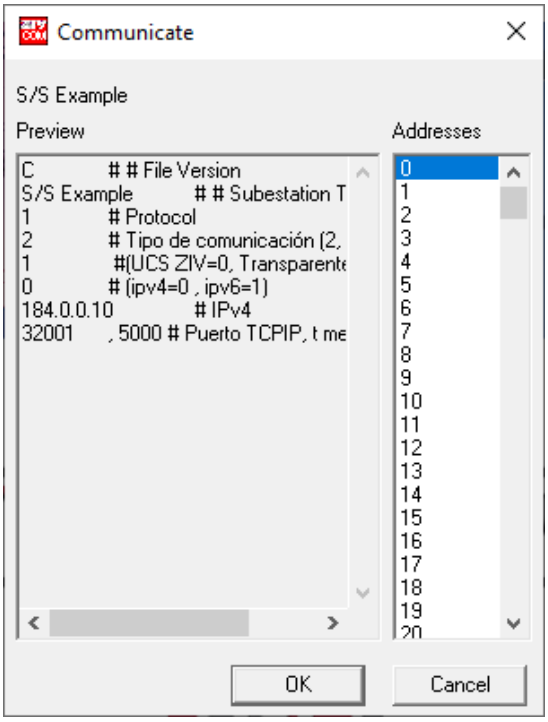

Figure 10

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".***

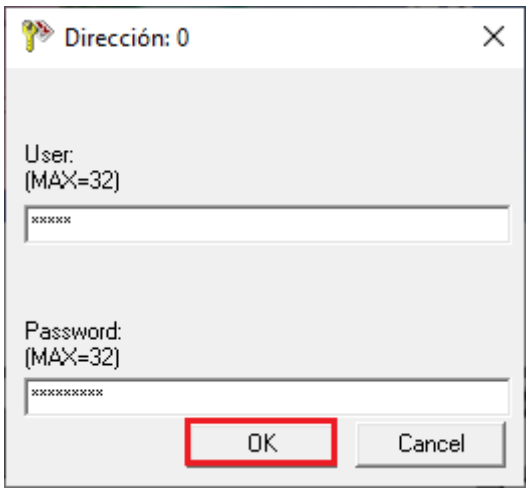

Figure 11

3. Parameterization of the ZIV IRF relay

3.1. Nominal Values

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

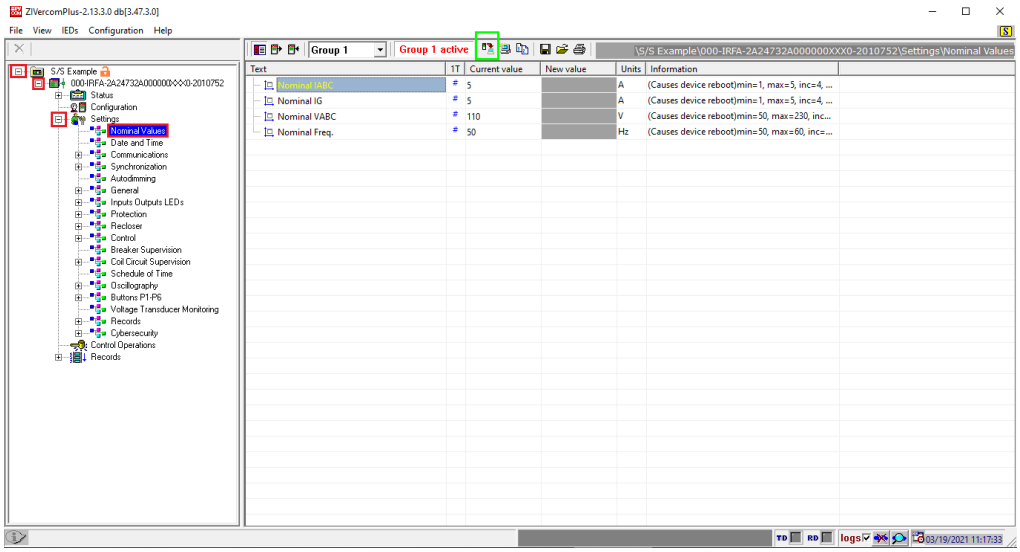

Figure 12

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

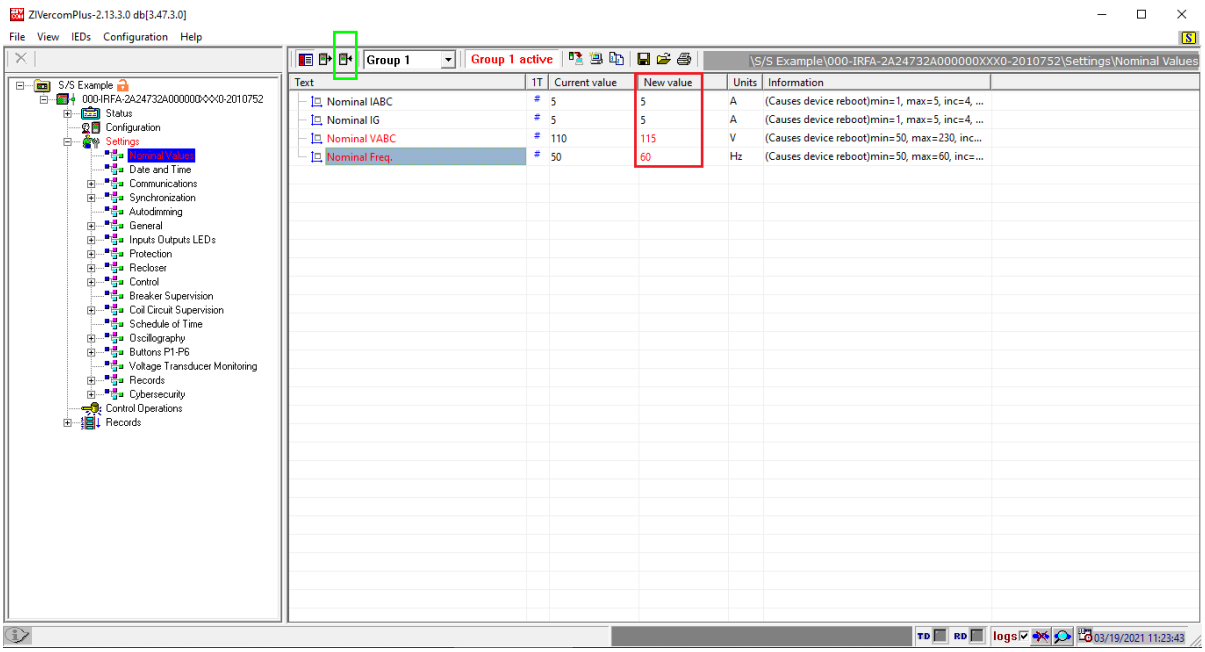

Figure 13

3.2. General

Click on the “General” option and configure the transformer ratios of the phase current, neutral, voltage transformer and phase sequence.

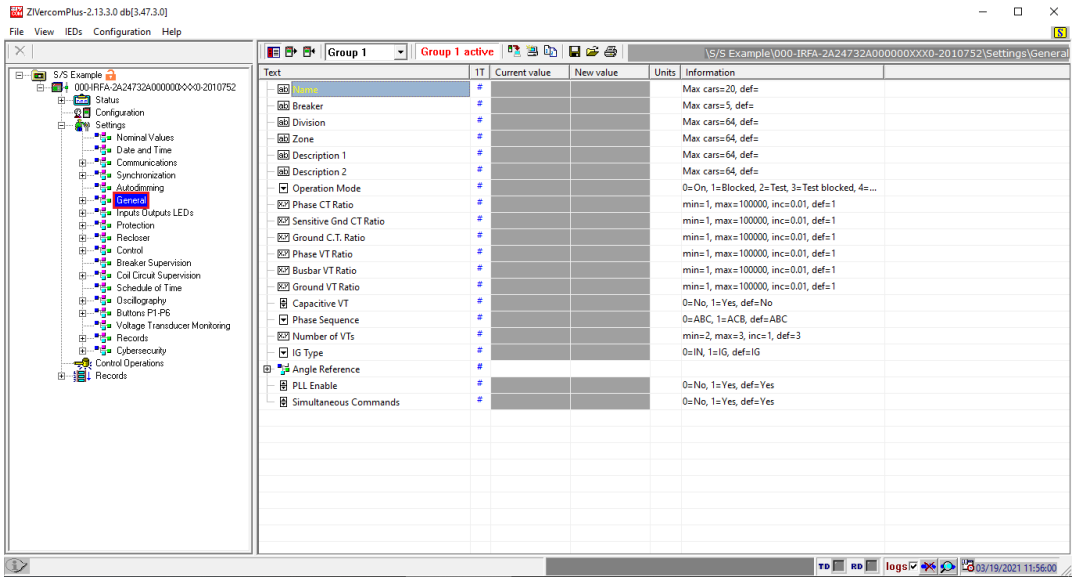

Figure 14

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

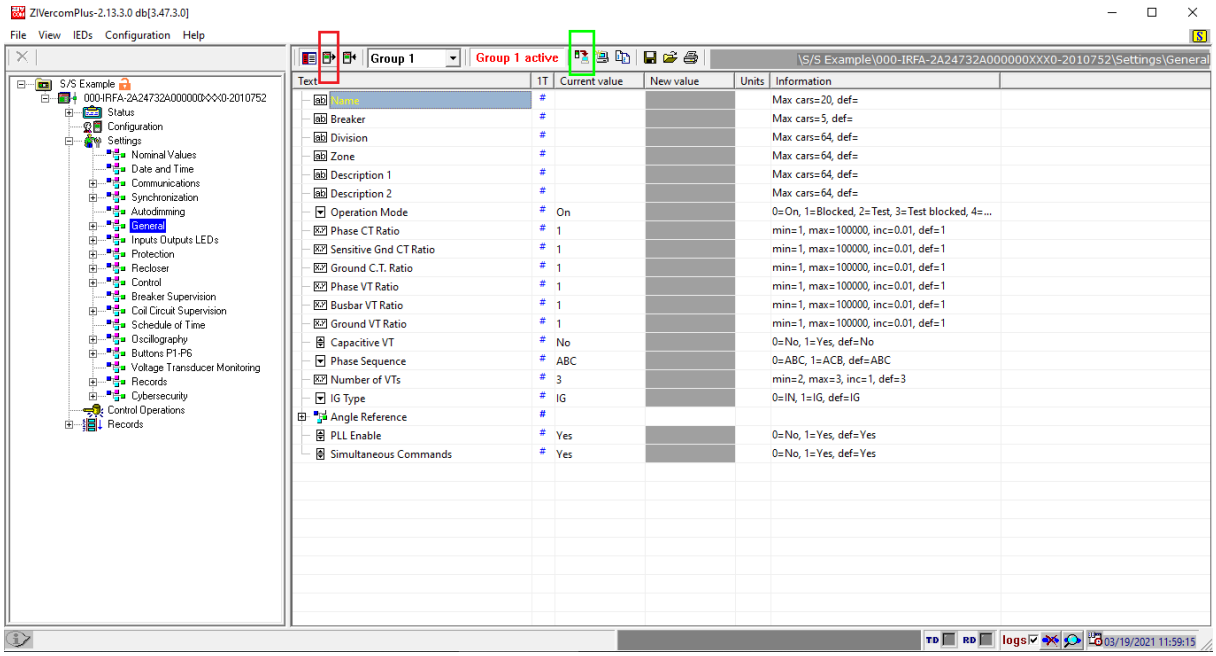

Figure 15

3.3. Phase Instantaneous > 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 and operating time values set. Activate unit 1 with a pick-up value of 16.0A and operating time of 0.5s. Then send the adjustments by clicking on the icon highlighted in green.

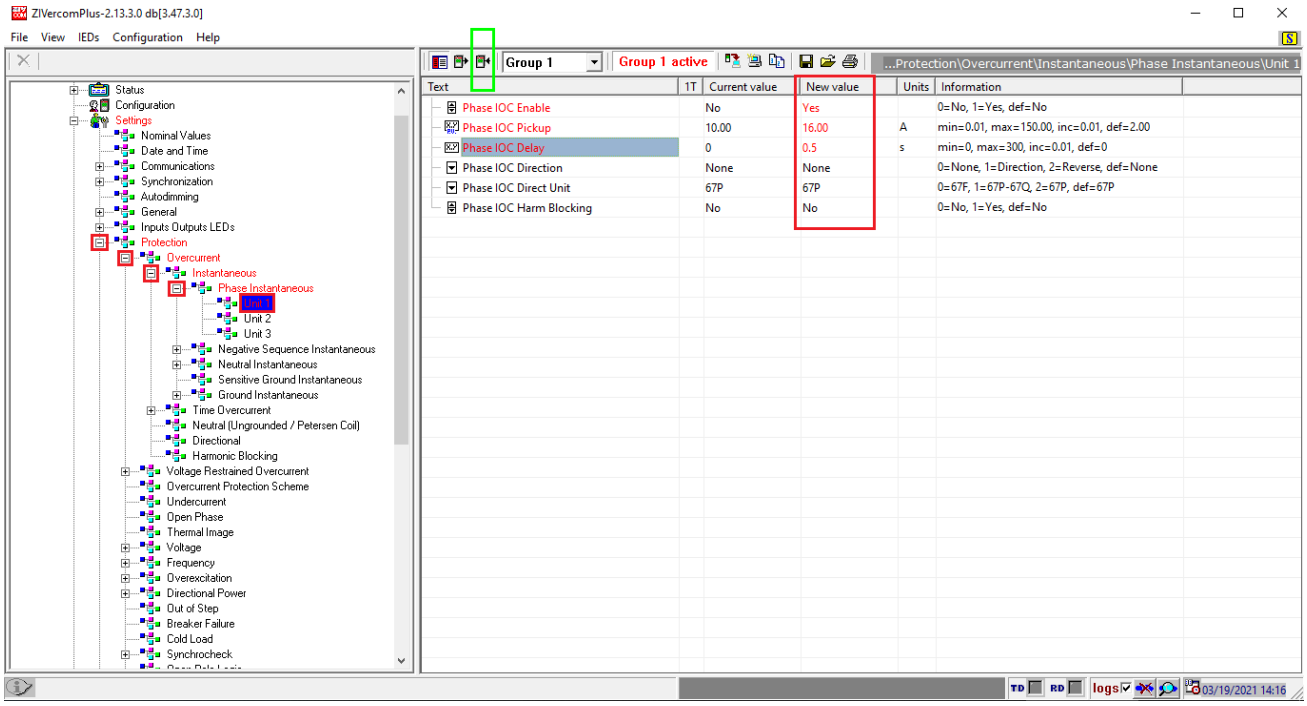

Figure 16

3.4. Phase Instantaneous > Unit 2

Activate *"Unit 2"* with a pick-up value of 24.0A and instantaneous time. Then send the adjustments by clicking on the icon highlighted in green.

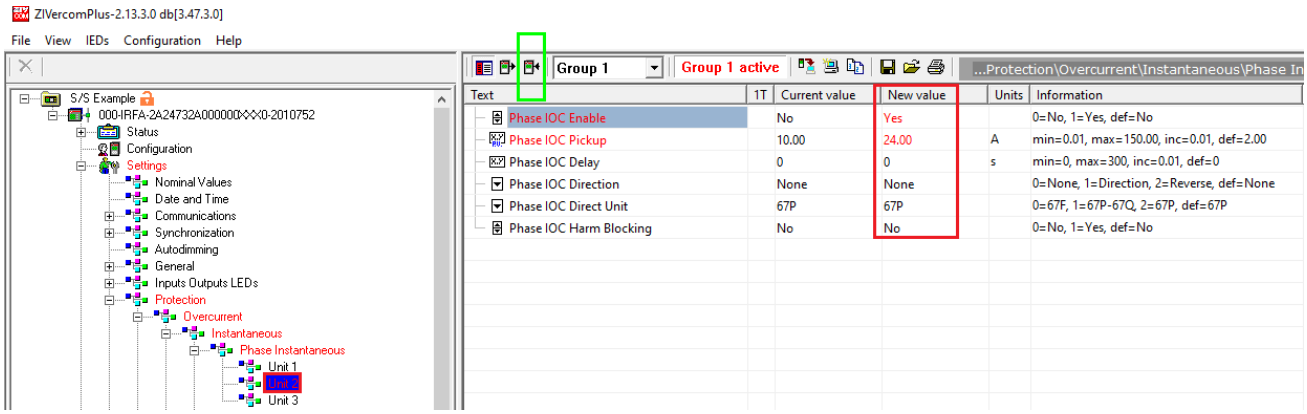

Figure 17

3.5. Phase Time Overcurrent > Unit 1

The next step is to enter the following function 51 settings.

Table 2

Pickup Current	1,6A
Curve Standard	IEC
Curve of Type	Very Inverse
Time Dial	0,8

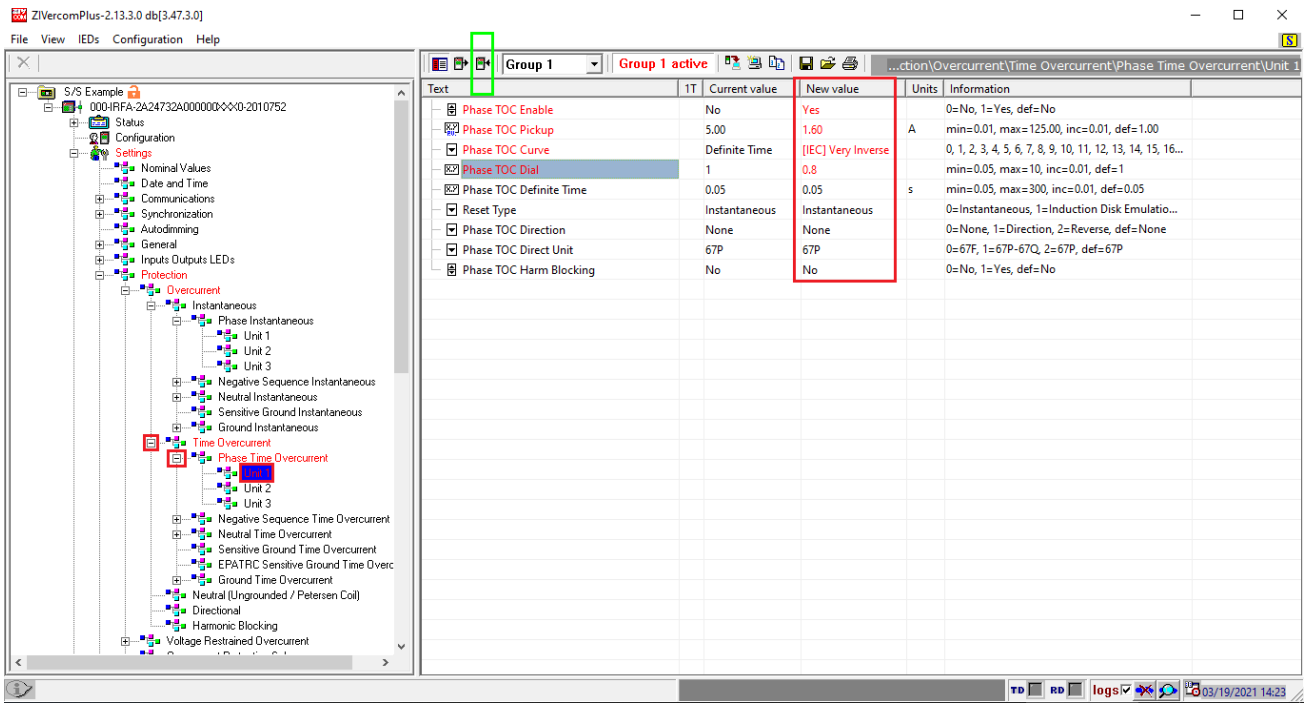

Figure 18

3.6. Outputs

In order to test the pickup and the actuation times of each overcurrent curve, 4 relay output binaries will be used to collect these signals by the test set. In the following figure, configure the first output on it, the pick-up of phases A, B and C of element 50-1 will be configured.

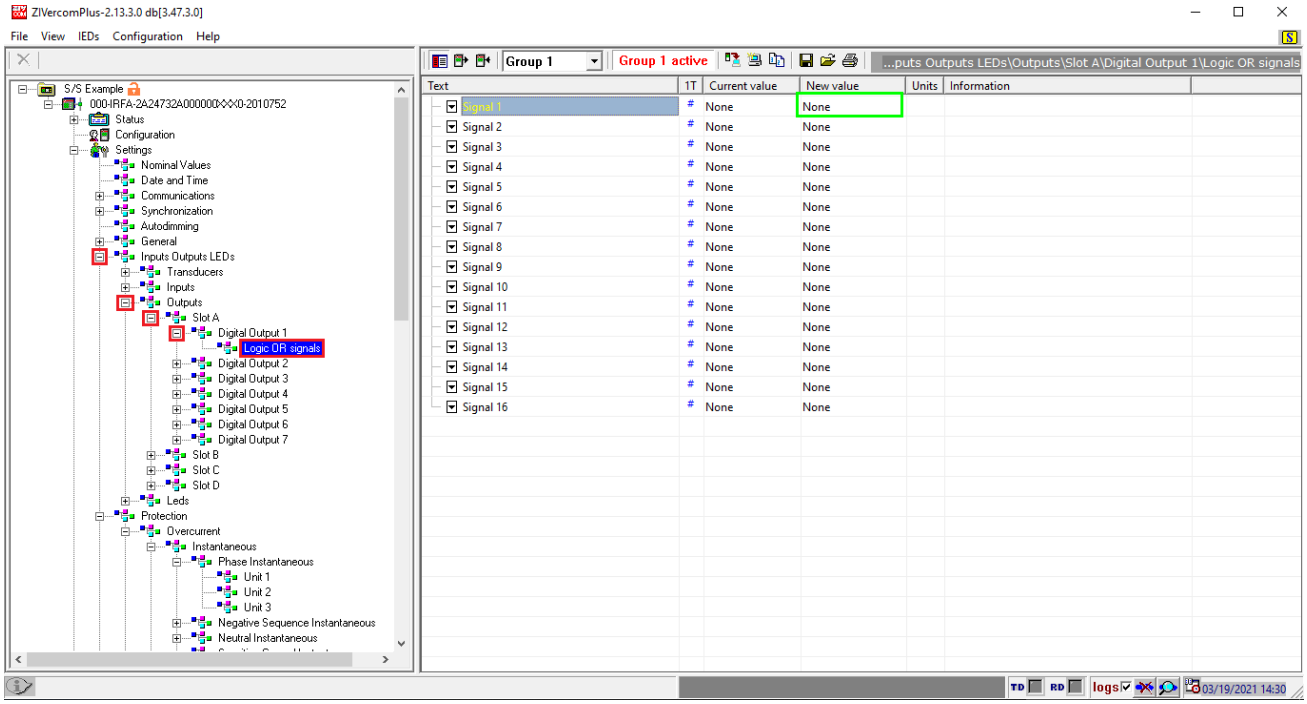

Figure 19

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

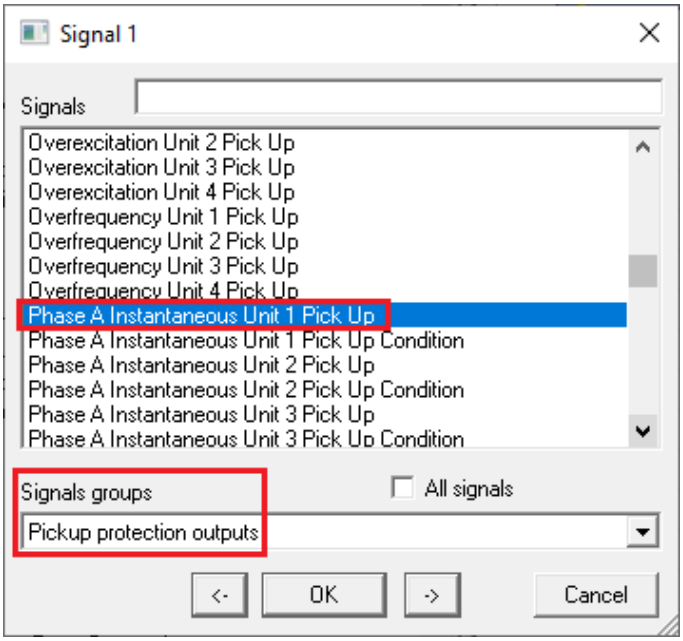

Figure 20

Repeat the previous procedure for phases B and C and send the settings to the relay.

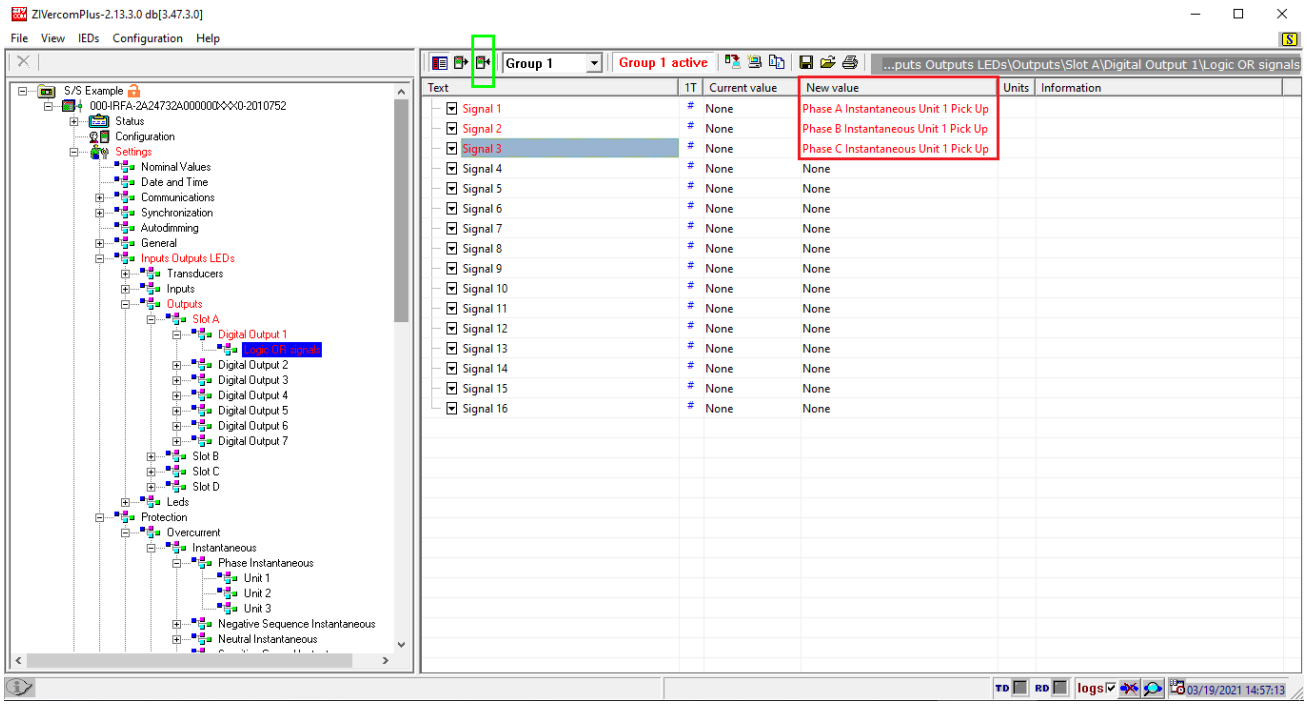

Figure 21

The start of phases A, B and C of element 50-2 will be configured on the second output.

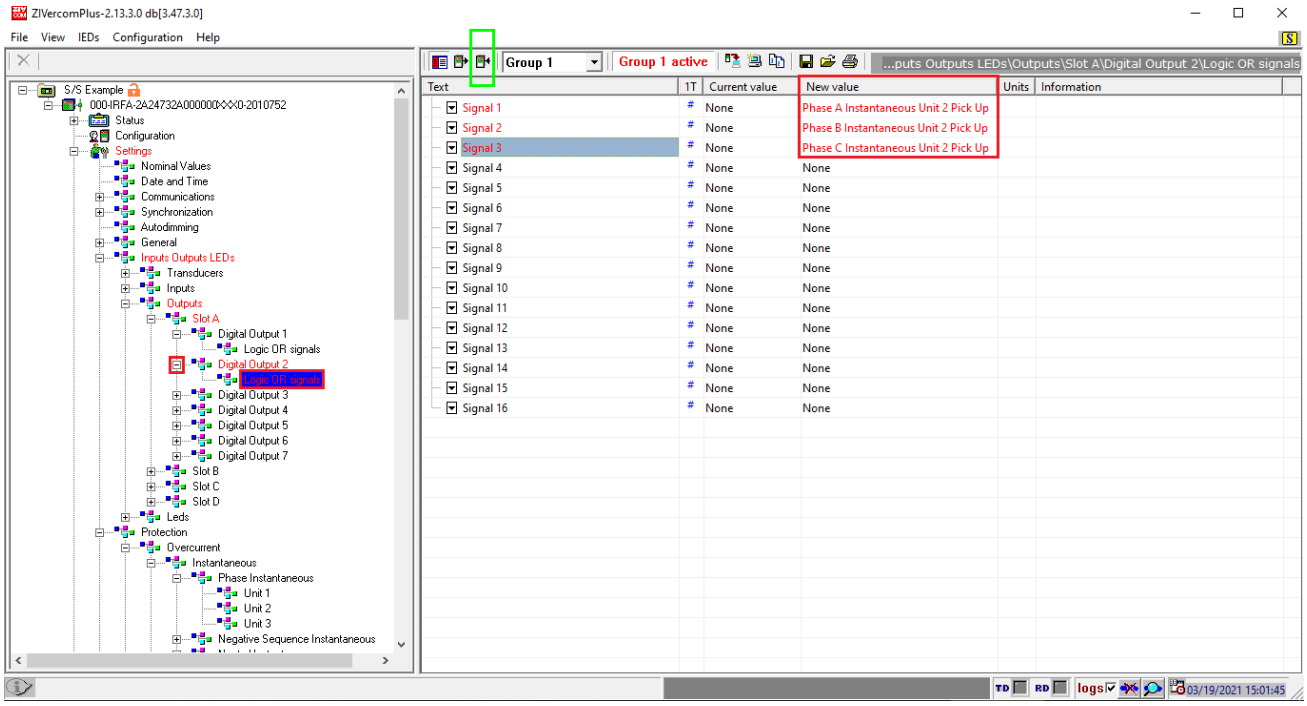

Figure 22

The start of phases A, B and C of element 51-1 will be configured on the third output.

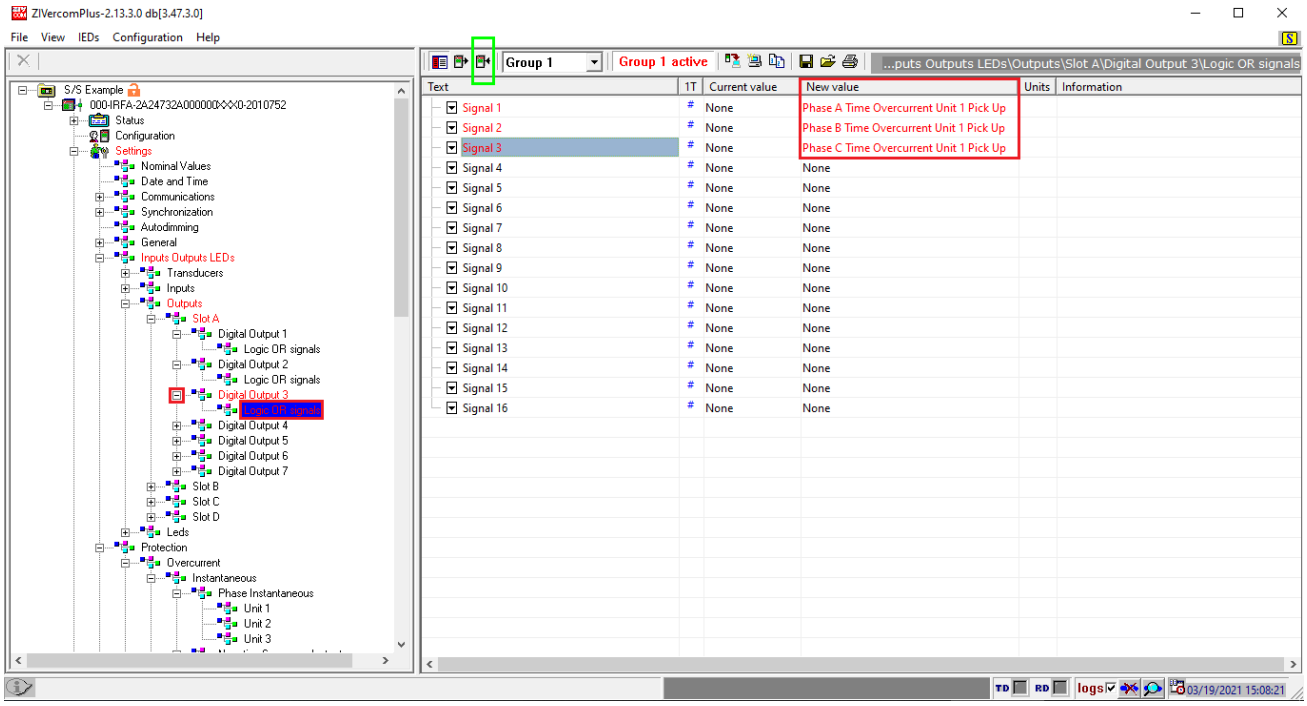

Figure 23

On the fourth output, the trip signals of elements 50-1, 50-2 and 51-1 of phases A, B and C will be configured.

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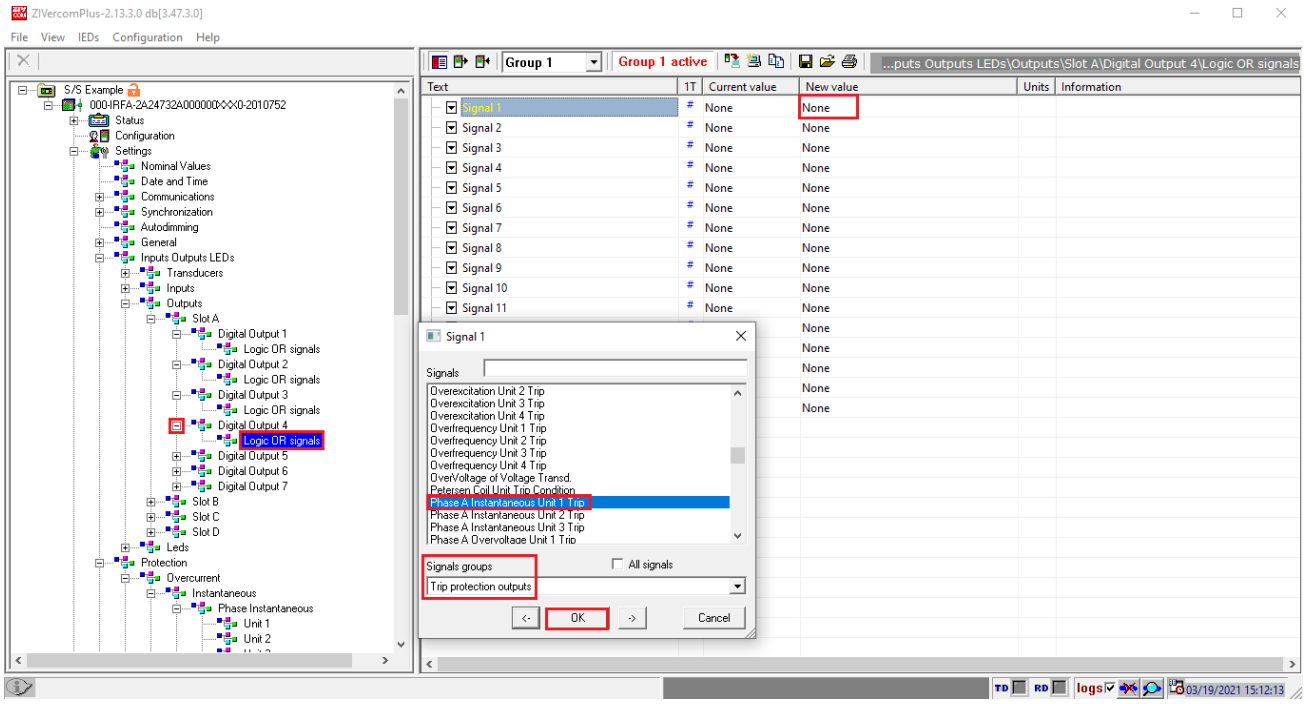

Figure 24

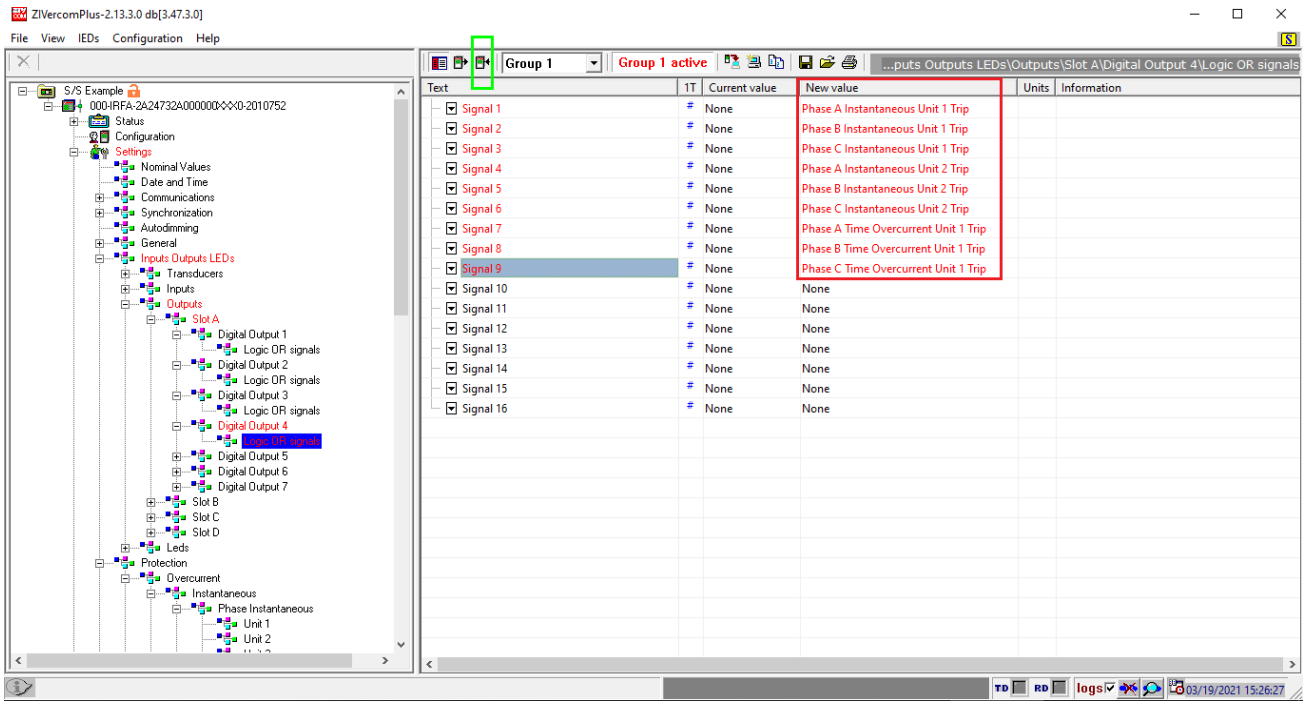

Figure 25

4. Application Manager

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

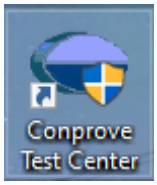

Figure 26

4.1. Overcurrent software adjustments

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

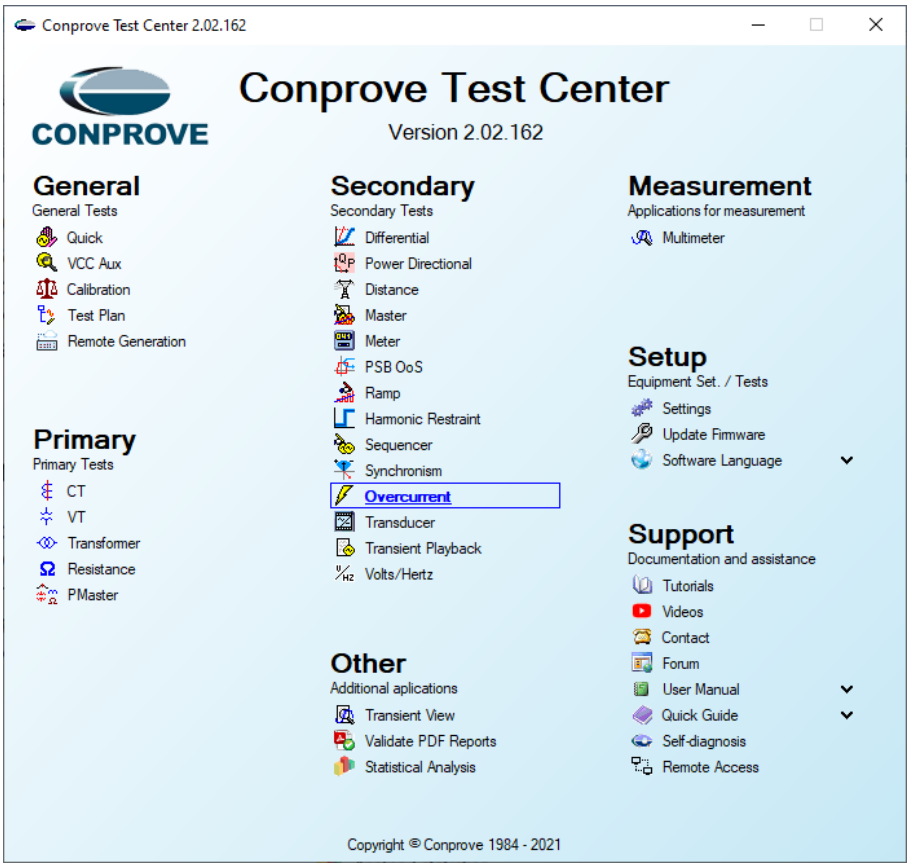

Figure 27

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.

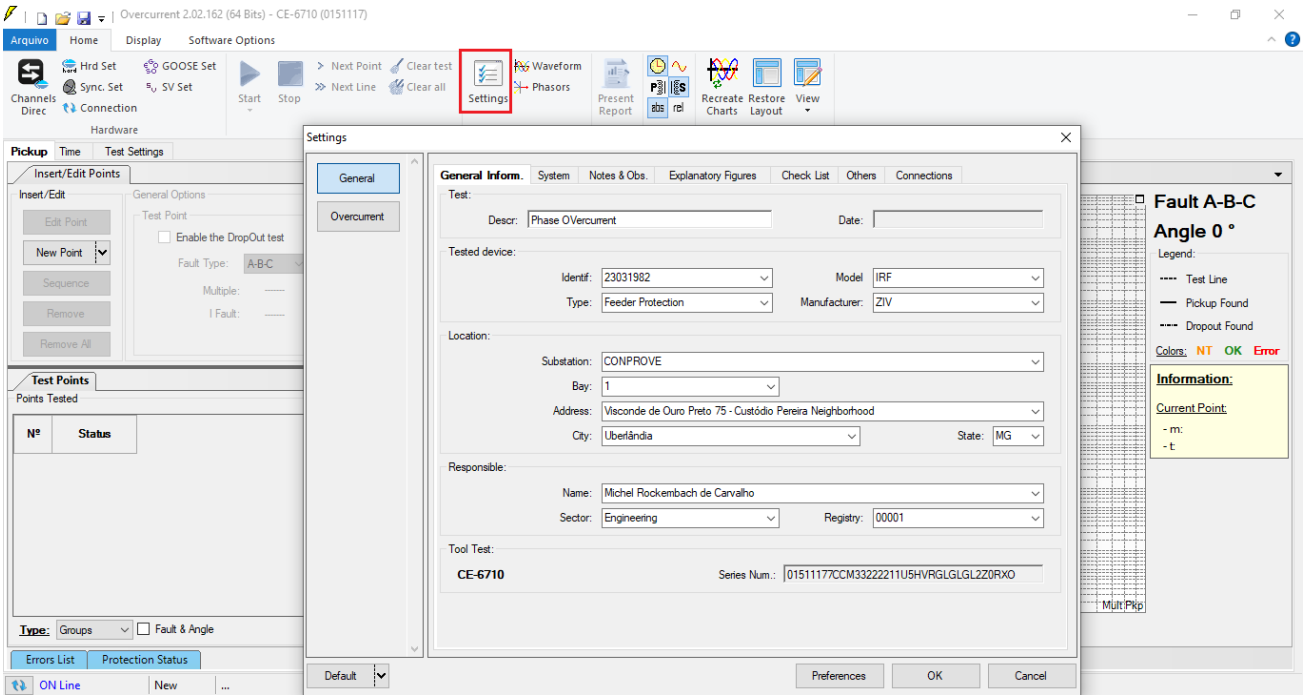

Figure 28

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, transformation ratios of VT's and CT's are configured. There are also two sub tabs *"Impedance"* and *"Source"*, whose data is not used for this test.

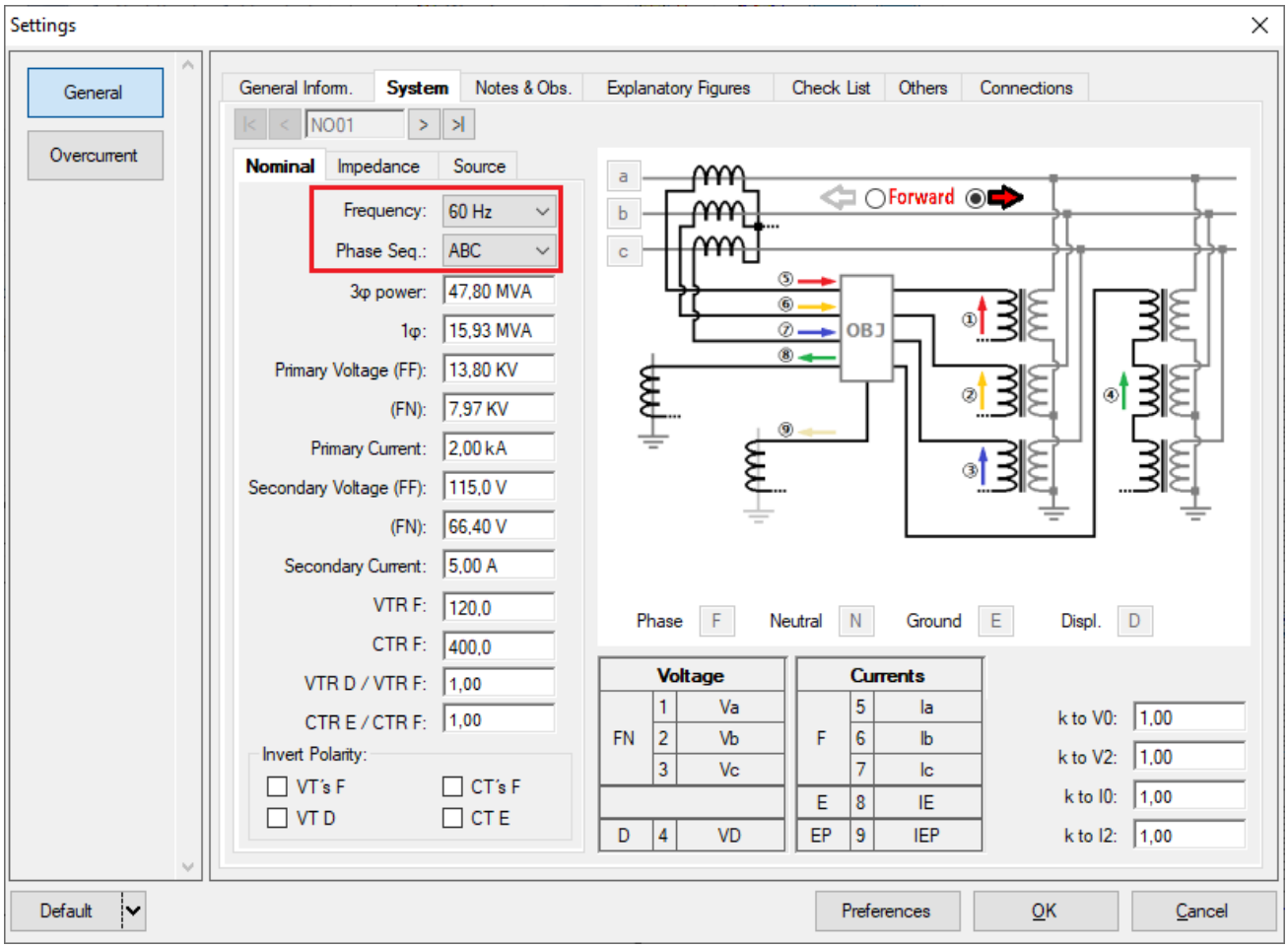

Figure 29

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 test equipment.

4.2. Overcurrent Screen > Definitions

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

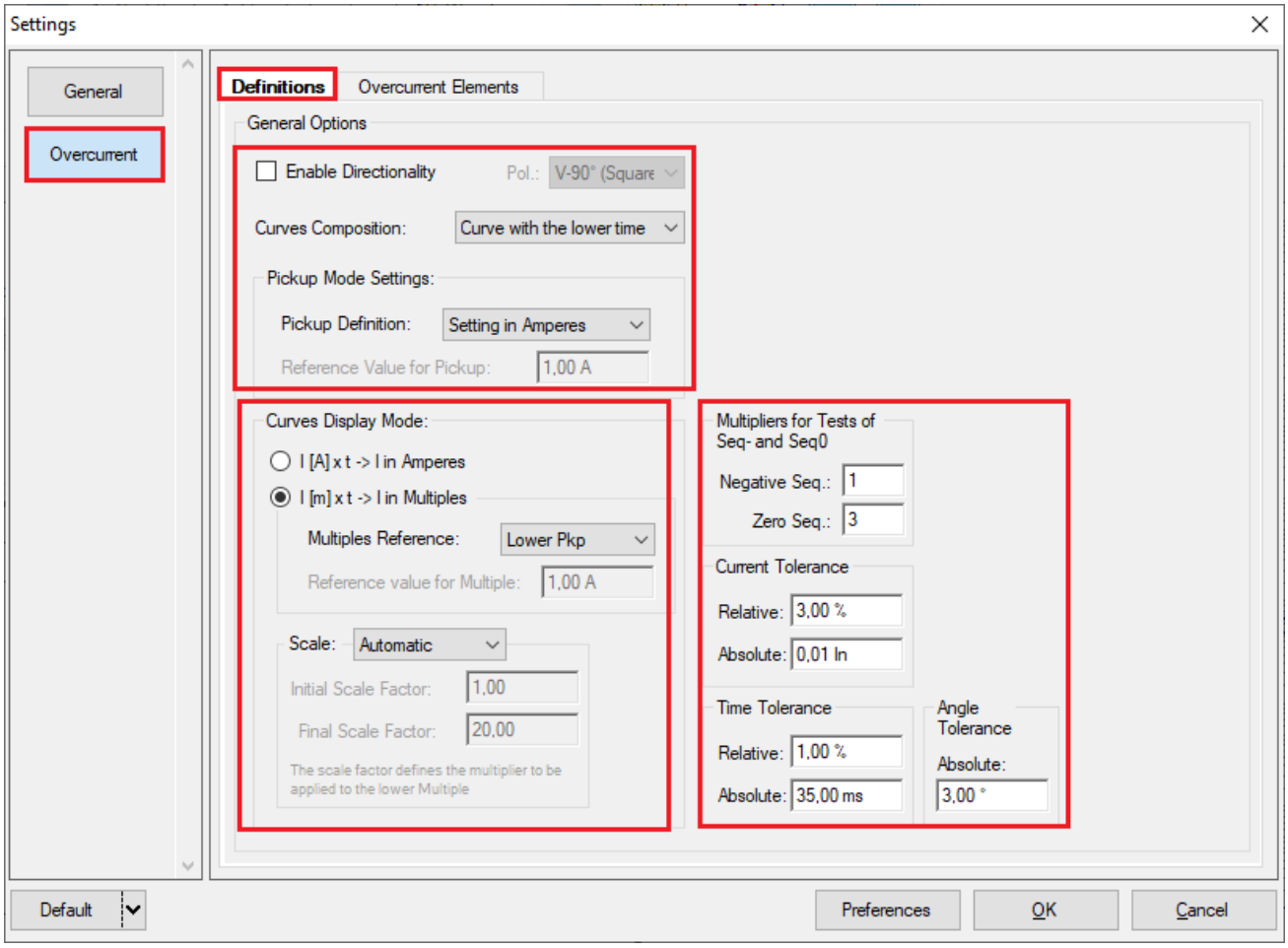

Figure 30

4.3. Overcurrent Screen > Overcurrent Elements > Phase

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

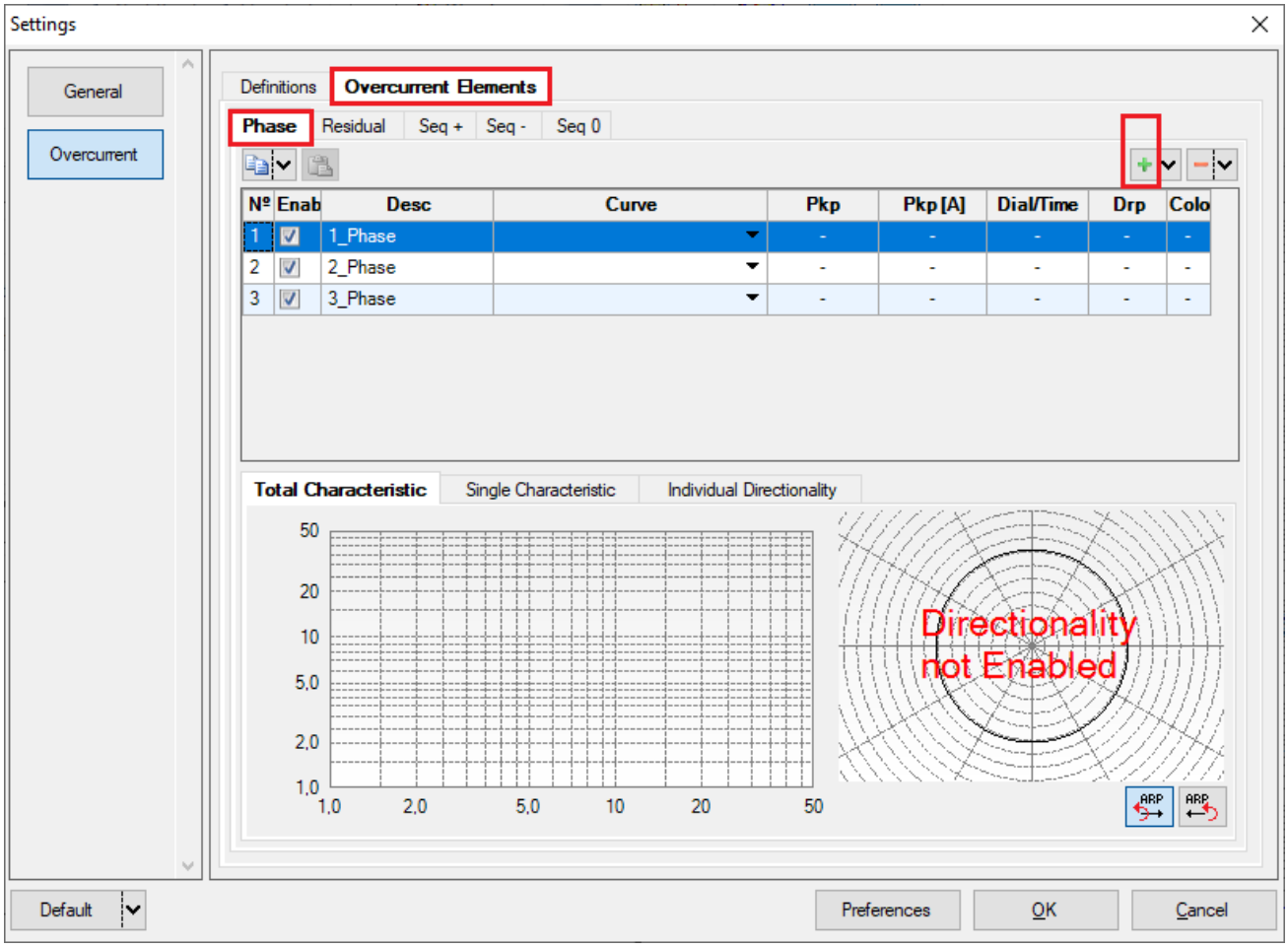

Figure 31

For the first element change the name to 50-1 choose the type of curve like definite time, pickup value, operating time and dropout factor. Repeat the same procedure for the second element changing the name to 50-2. For the third element change the name to 51 choose the curve type, pickup value, time dial and dropout factor.

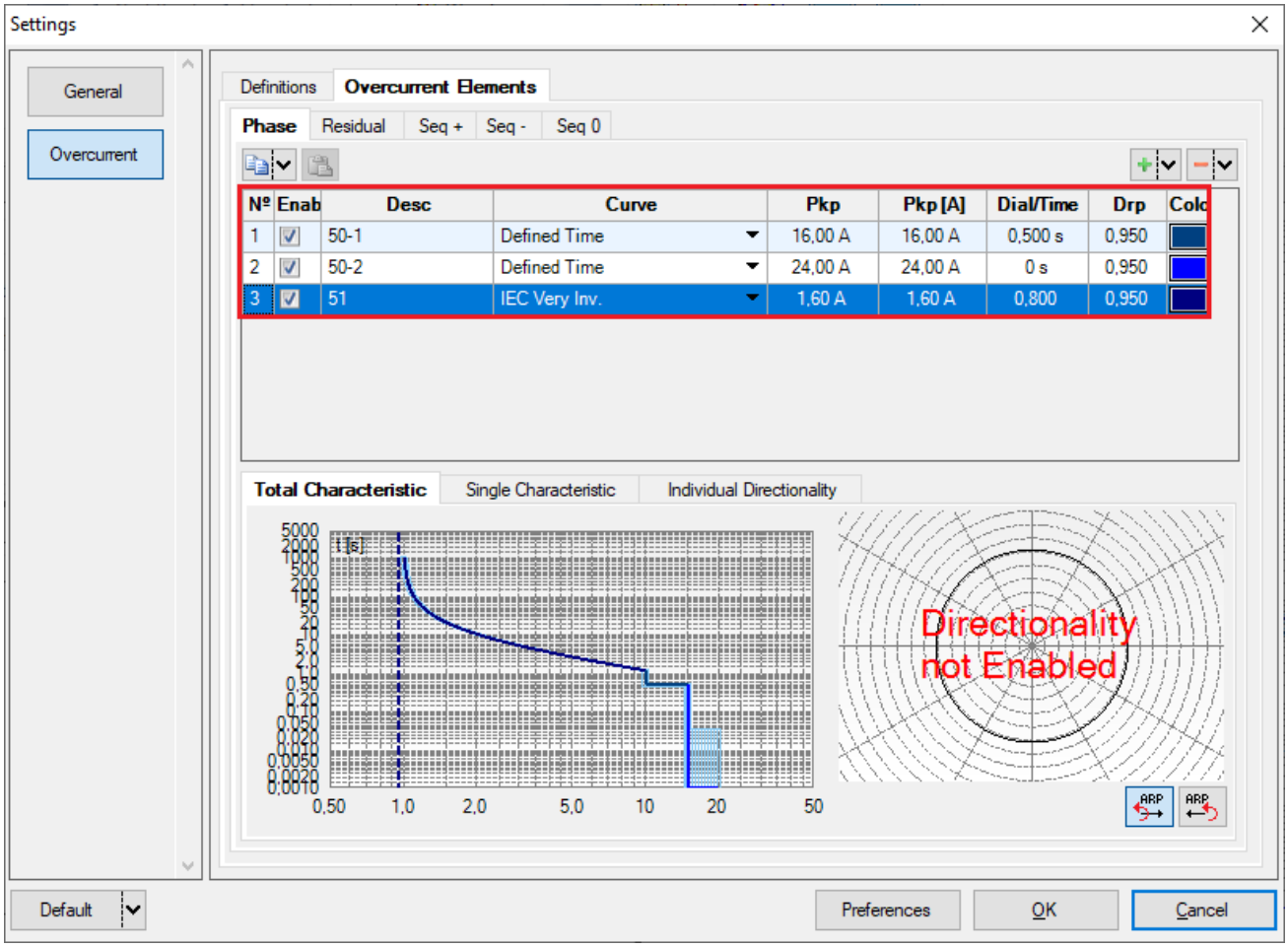

Figure 32

This relay has a particularity for actuating its pick-up that is worth 5% more than the set value (1.05). Select the element *"51"* and then click on the *"Single Characteristics"* tab and make the following adjustment.

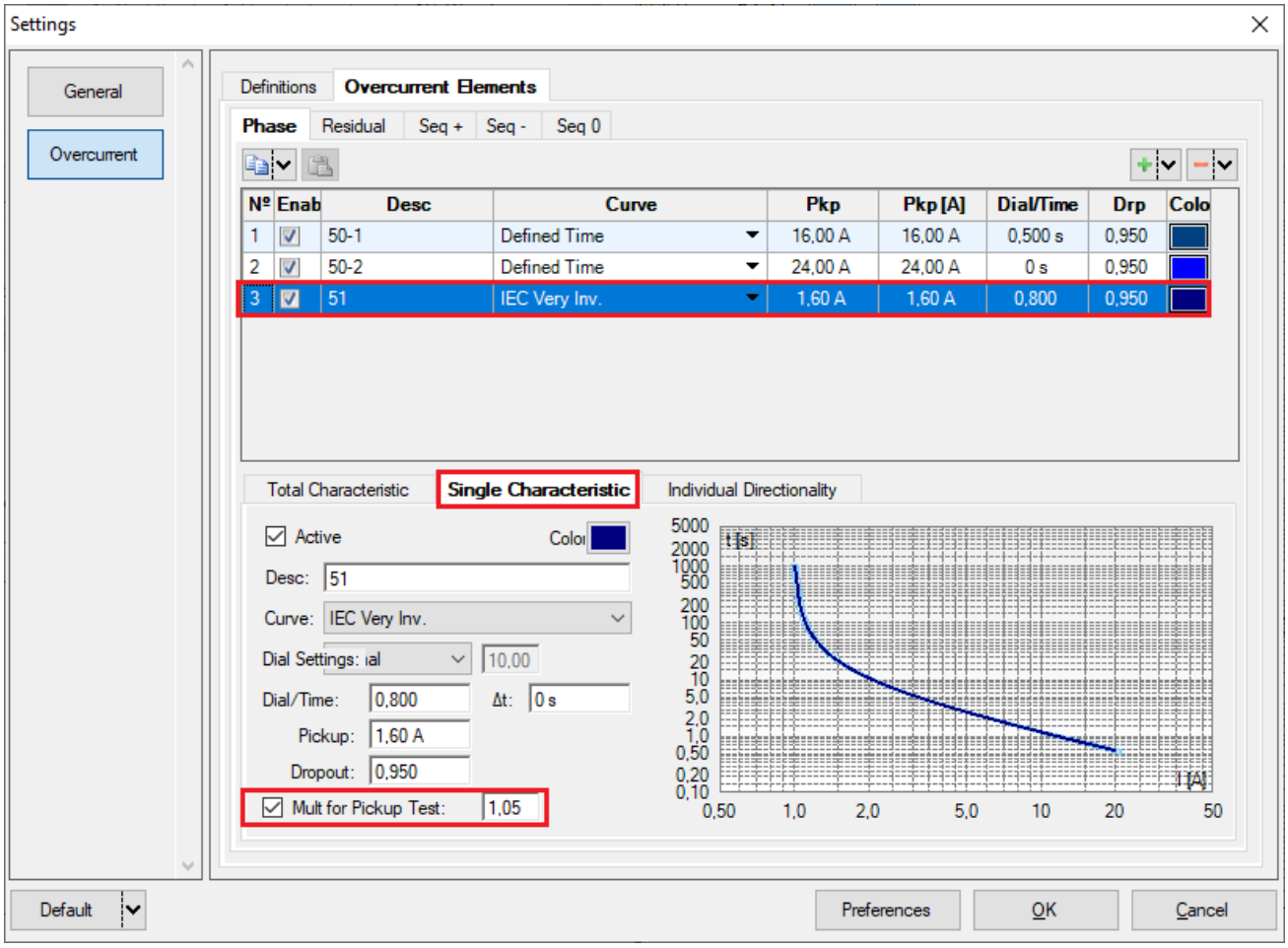

Figure 33

5. Channel Targeting and Hardware Configurations

Click on the icon illustrated below.

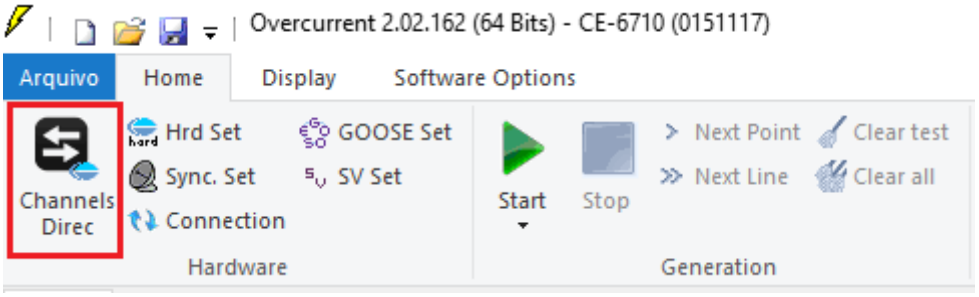

Figure 34

Then click on the highlighted icon to configure the hardware.

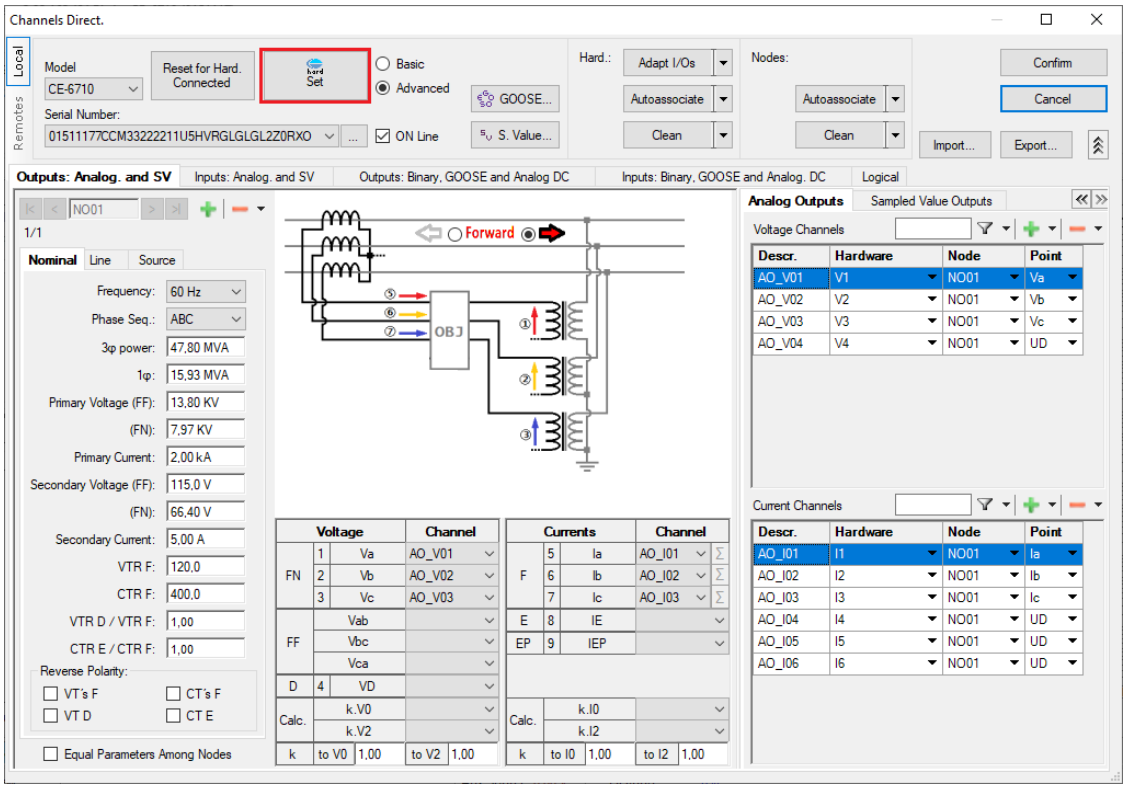

Figure 35

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

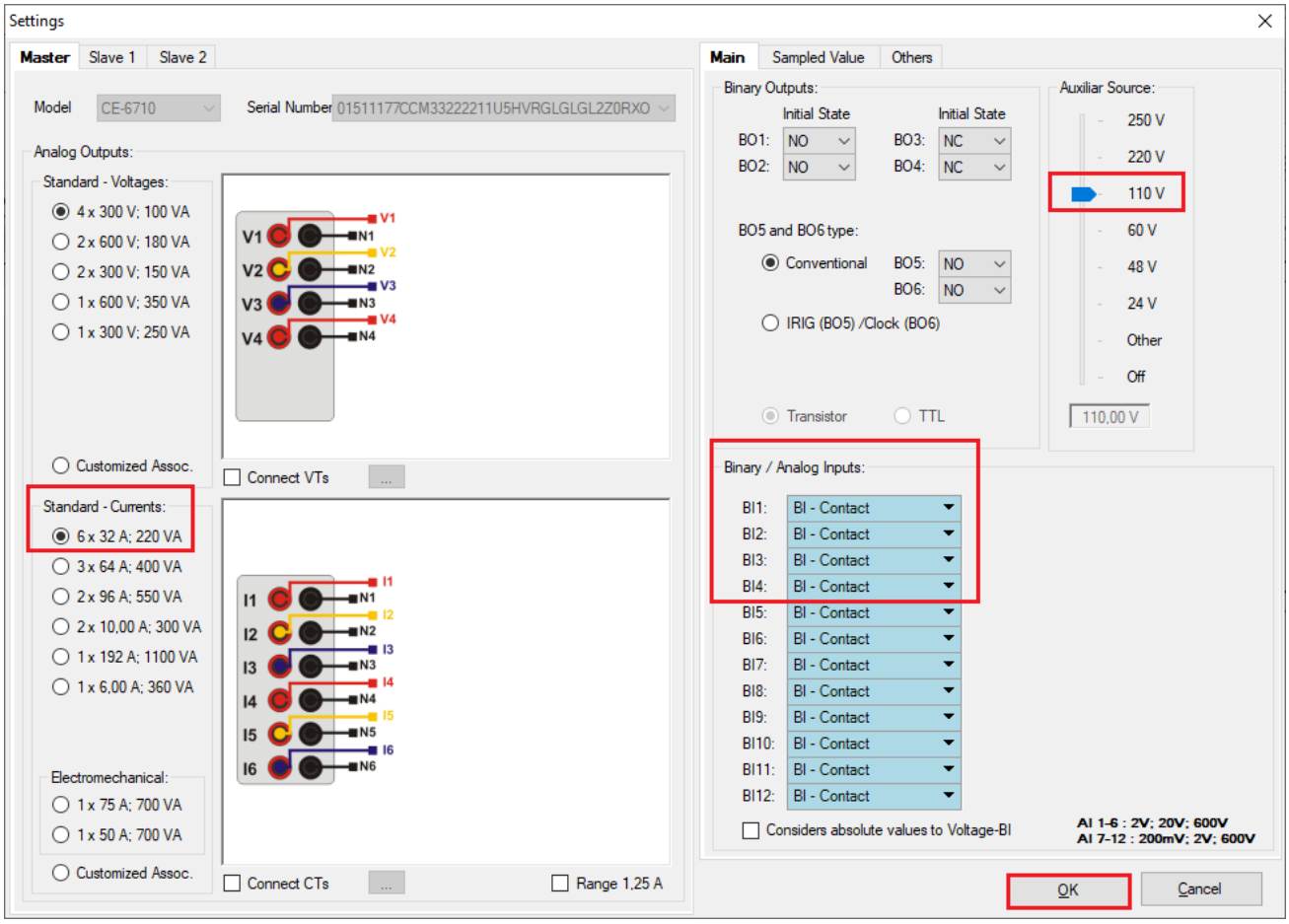

Figure 36

On the next screen choose *"Basic"* and on the next window (didn't show) choose *"YES"*, finally click on *"Confirm"*.

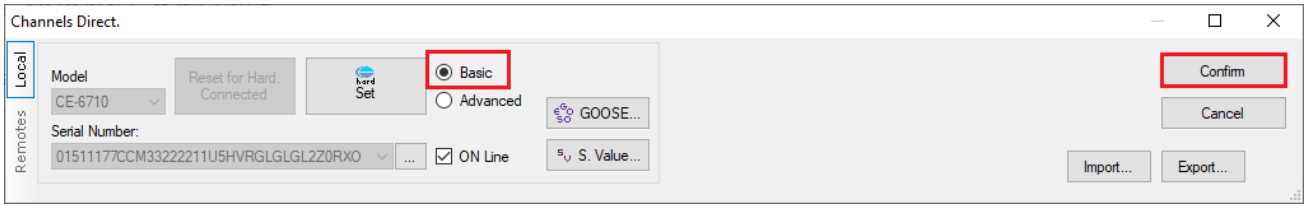

Figure 37

6. Test Structure for 50/51

6.1. Test Settings

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

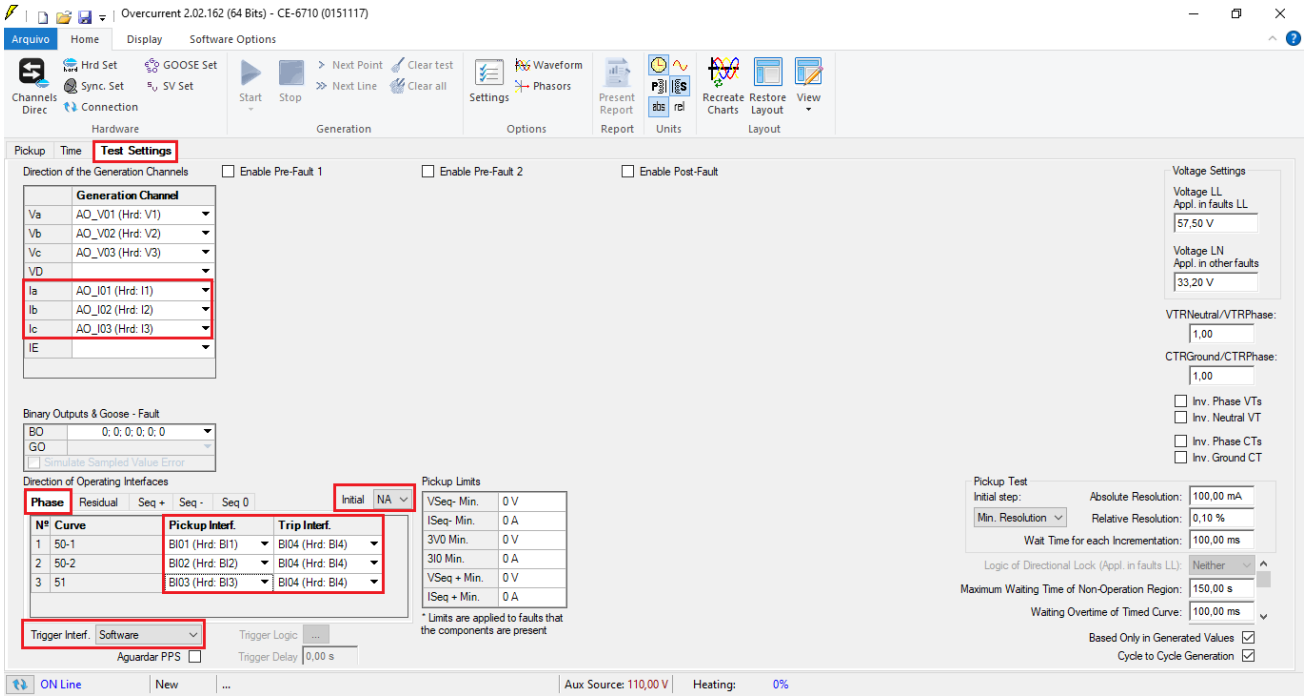

Figure 38

6.2. Pickup screen

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

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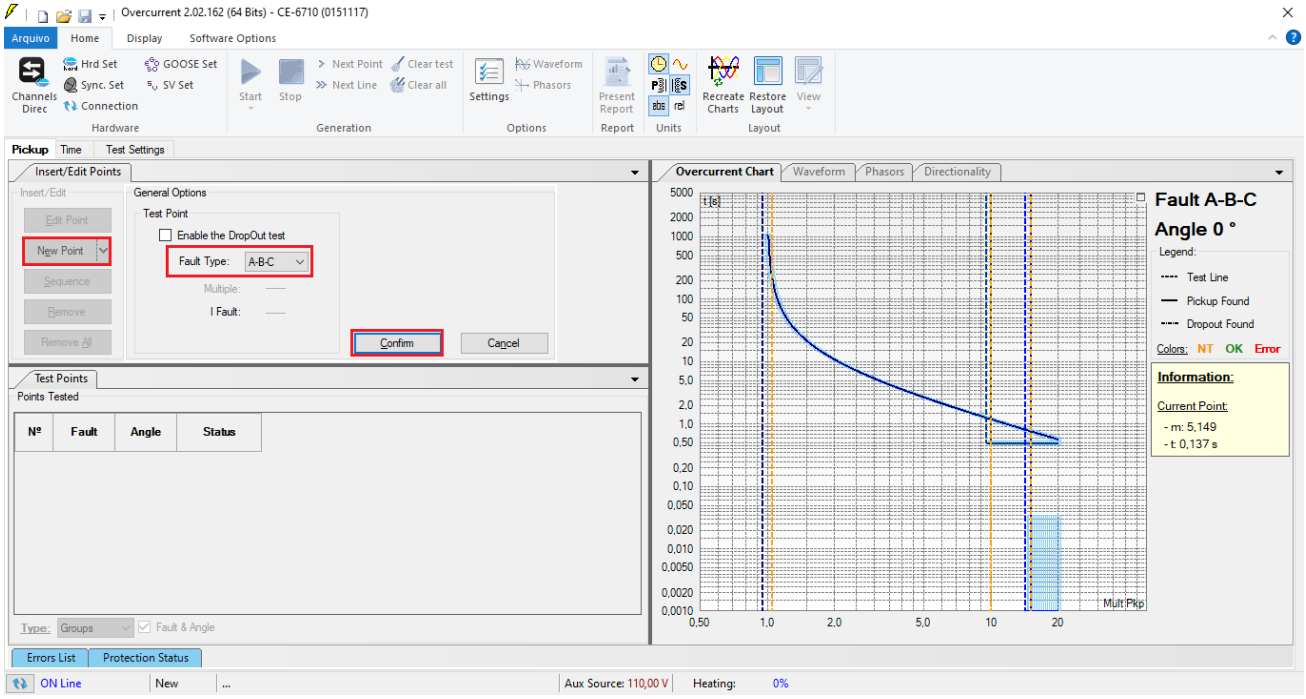

Figure 39

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

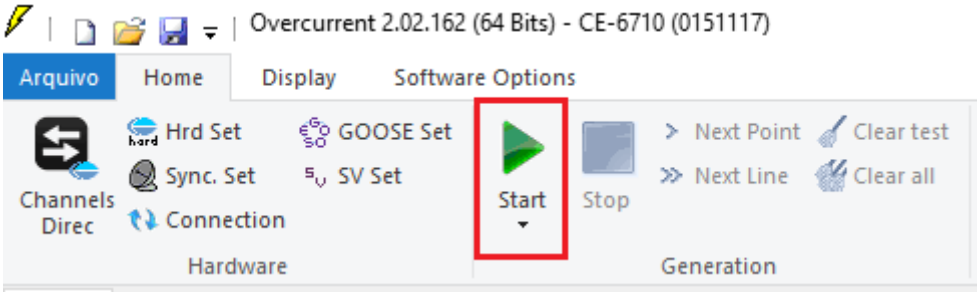

Figure 40

6.3. Pickup Test Final Result

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

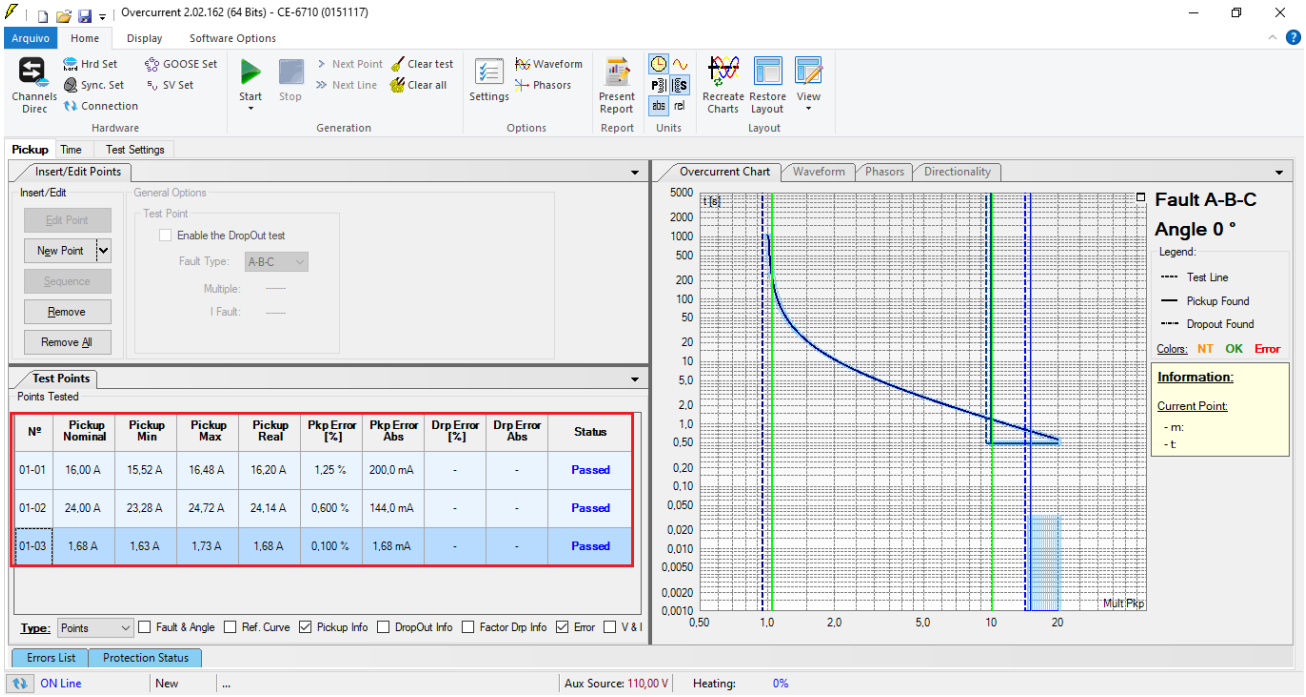

Figure 41

6.4. Time screen

On this tab, the operating times are evaluated. For convenience, a sequence of current values will be inserted for time evaluation. The value 3.20A was chosen as the initial value, 31.20A as the final value and 2.00A as the increment step and the ABC fault.

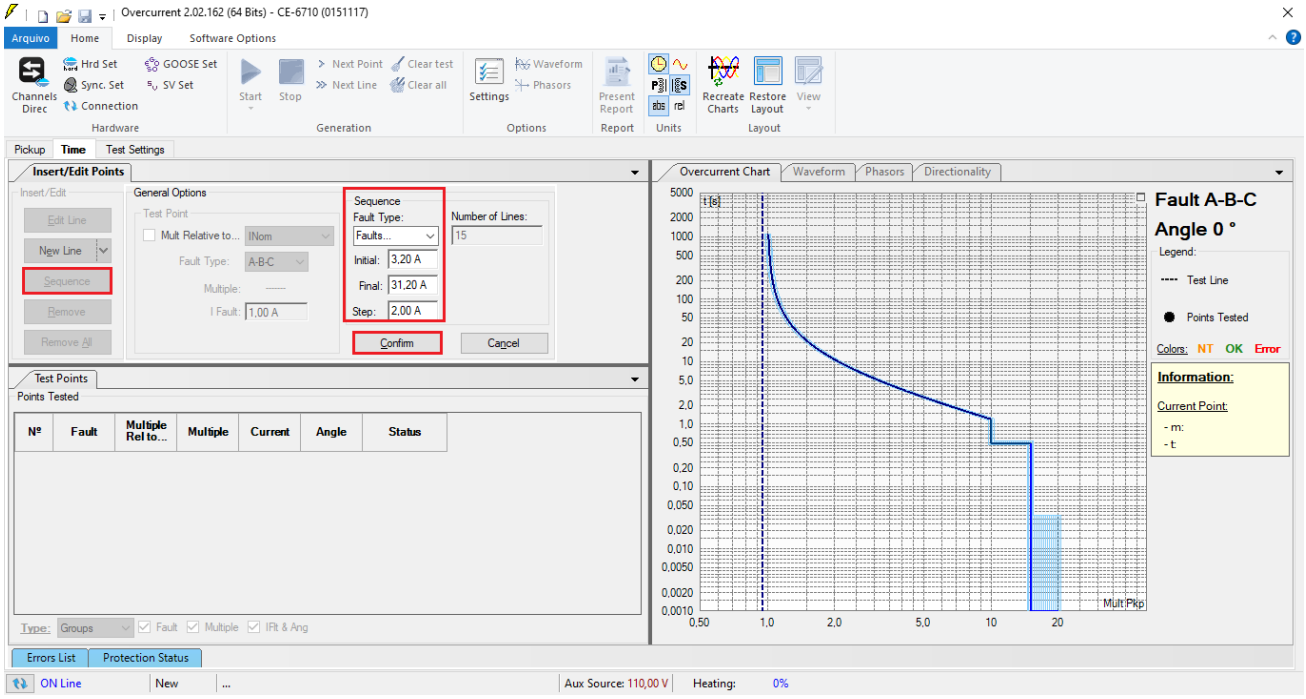

Figure 42

Begin the generation by clicking on the *"Start"* icon or using the command *"Alt +G".*

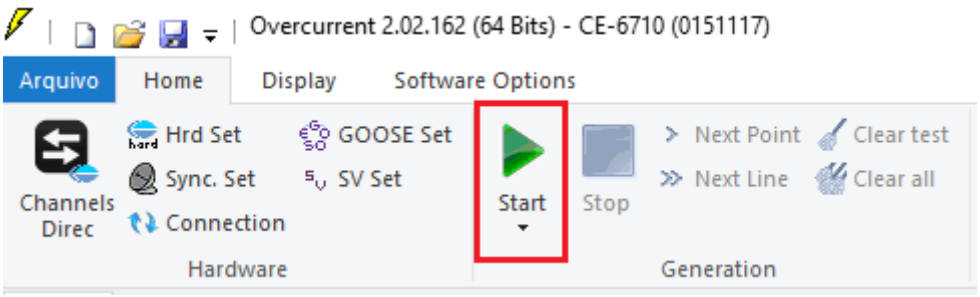

Figure 43

6.5. Final Result of the Test of Time

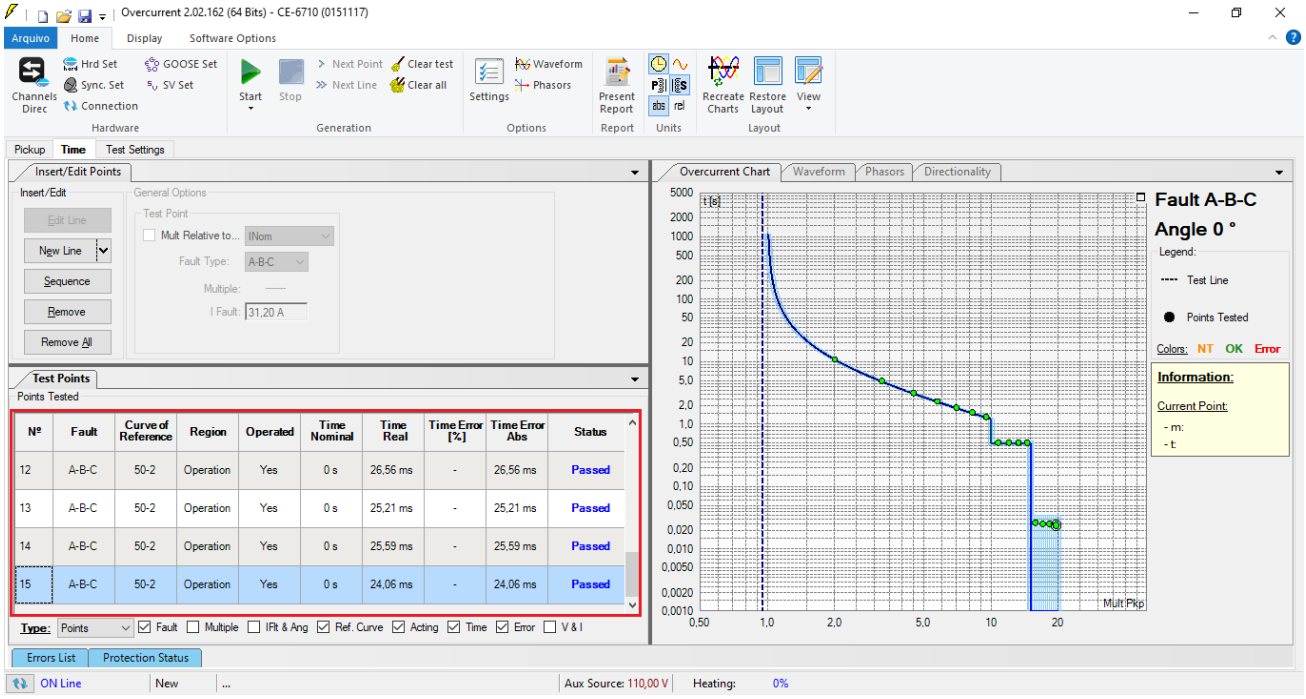

Figure 44

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

7. Report

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

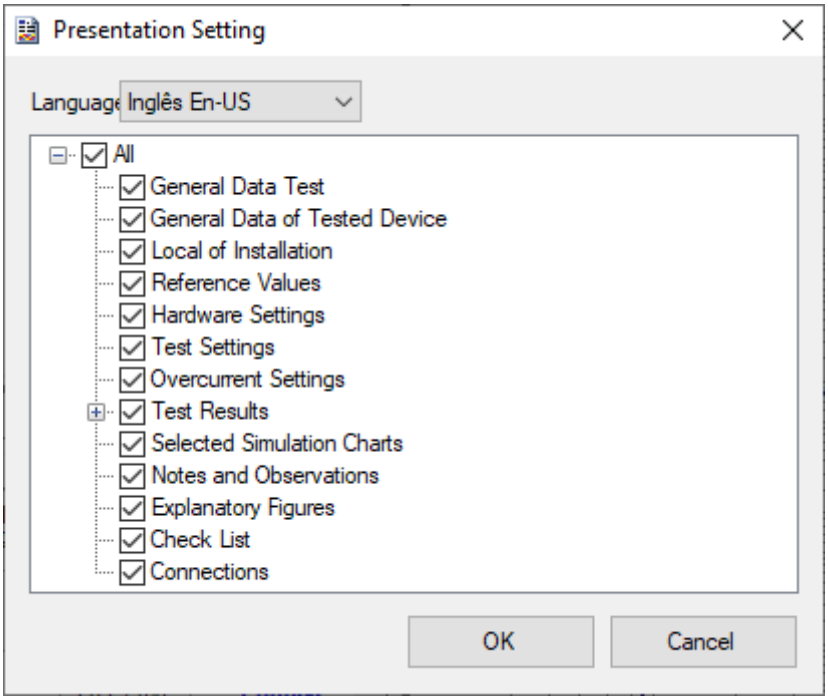

Figure 45

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's logo, for example. In addition, as the figure below highlights, it is possible to convert the report to .pdf and .rtf, therefore, this last format allows editing through Microsoft Office Word, even if the characteristics that make the report a fully produced document are lost by Conprove software.

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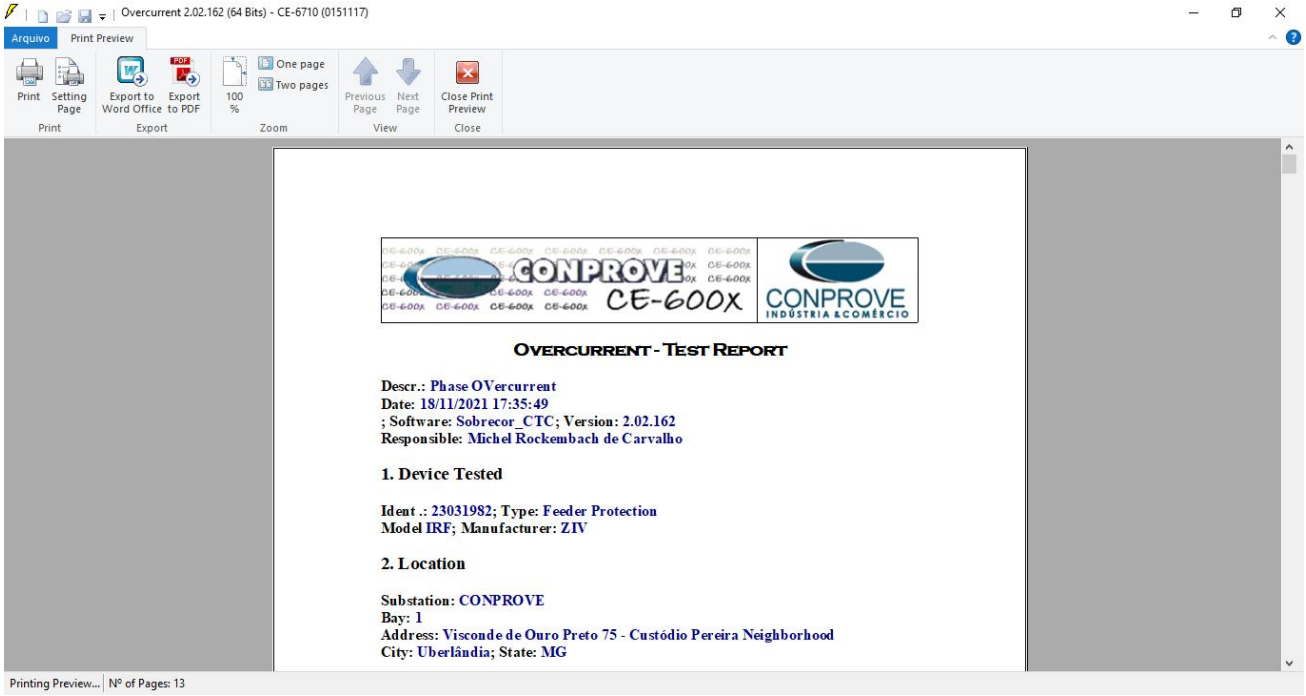

Figure 46

8. Appendix A - Manufacturer Tolerances

Overcurrent Elements

Pickup of Phases, Ground, Neutral and Negative Sequence (static test)	**±3%** or **±10mA** of the theoretical value (the greater) (In = 1A and 5A)
Pickup of Sensitive Ground	**±3 %** or **±1mA** of the theoretical value (the greater)

Note: the pick-up of overcurrent units takes place with a current value equal to 1.05 times the pick-up setting.

Reset of Phases, Ground, Neutral and Negative Sequence	**1.5 cycles** for 50 and 60Hz (*)
Reset of Sensitive Ground	**1.5 cycles** for 50 and 60Hz (*)

(*) If the reset time is measured using electromechanical DOs there will be an extra increment of up to ½ cycle.

Measuring Times

Mode	Torque Control	Time Setting	Times Pick up	Measuring Times*	
				50Hz	60Hz
Fixed Time	NO	0 s	1.5	±25.5 ms	±22 ms
			5	±14.5 ms	±13.5 ms
			15	±13.5 ms	±12.5 ms
Fixed Time	YES	0 s	1.5	±29.5 ms	±25.4 ms
			5	±23.4 ms	±22 ms
			15	±21.5 ms	±21.3 ms
Fixed Time	YES / NO	> 0 s		±1 % of the setting or ±25 ms (the greater)	
Inverse Time				Class 2 (E = 2) or ±35ms (the greater) (UNE 21-136, IEC 255-4) (for measured currents of 100mA or greater)	

Figure 47

9. Appendix B - Terminal Diagram

- **Analog Channels IRF-A**

Magnitude	Analog channels	Description of analogue channels	SLOT (1/3 rack)	SLOT (1/2 rack)	PINS
PHASE VOLTAGE AG	VA	VOLTAGE INPUT 1	C	E	1-2
PHASE VOLTAGE BG	VB	VOLTAGE INPUT 2	C	E	3-4
PHASE VOLTAGE CG	VC	VOLTAGE INPUT 3	C	E	5-6
SYNCHRONISM VOLTAGE	VSYNC	VOLTAGE INPUT 4	C	E	7-8
NEUTRAL VOLTAGE	VG	VOLTAGE INPUT 5	C	E	9-10
PHASE A CURRENT	IA	CURRENT INPUT 1	C	E	11-12
PHASE B CURRENT	IB	CURRENT INPUT 2	C	E	13-14
PHASE C CURRENT	IC	CURRENT INPUT 3	C	E	15-16
GROUNDING CURRENT	IG	CURRENT INPUT 4	C	E	17-18
SENSITIVE GROUND CURRENT	IGs	CURRENT INPUT 5	C	E	19-20

Figure 48

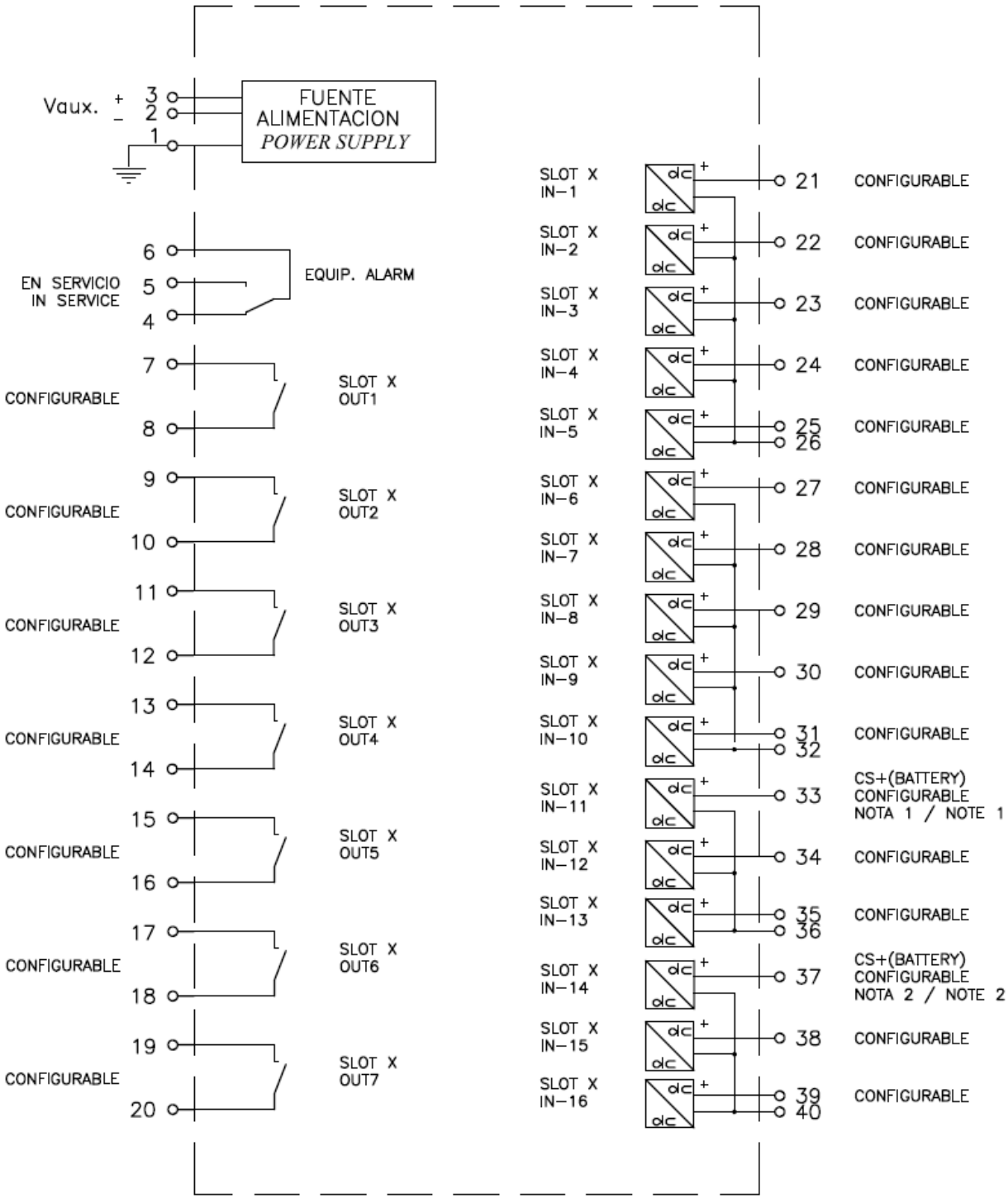
Vaux.
+
3
2
−
1
FUENTE
ALIMENTACION
POWER SUPPLY
6
5
4
EN SERVICIO
IN SERVICE
EQUIP. ALARM
7
8
CONFIGURABLE
SLOT X
OUT1
9
10
CONFIGURABLE
SLOT X
OUT2
11
12
CONFIGURABLE
SLOT X
OUT3
13
14
CONFIGURABLE
SLOT X
OUT4
15
16
CONFIGURABLE
SLOT X
OUT5
17
18
CONFIGURABLE
SLOT X
OUT6
19
20
CONFIGURABLE
SLOT X
OUT7
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
dc
dc

Figure 49

10. Appendix C - Parameter Equivalence between Relay and Software

Table 3

Overcurrent Software		ZIV IRF Relay	
Parameter	Figure	Parameter	Figure
50-1 Pkp	32	Phase IOC Pickup	16
50-1 Dial/Time	32	Phase IOC Delay	16
50-2 Pkp	32	Phase IOC Pickup	17
50-2 Dial/time	32	Phase IOC Delay	17
51 Curve	32	Phase TOC Curve	18
51 Pkp	32	Phase TOC Pickup	18
51 Dial/Time	32	Phase TOC Dial	18