TEST TUTORIAL

EQUIPAMENT: Protection Relay.

BRAND: ZIV.

MODEL: DLF.

FUNCTION: 67 or PIOC - Directional Overcurrent.

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

OBJECTIVE: tests on the directional overcurrent function to prove the operating time, pickup and its directionality.

VERSION CONTROL:

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CONPROVE
INDÚSTRIA & COMÉRCIO

INSTRUMENTOS PARA TESTES ELÉTRICOS

Version	Descriptions	Date	Author	Reviewer
1.0	Initial Version	31/05/2022	M.R.C.	G.C.D.P.

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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 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.

Copyright

PROCEDURE FOR TESTING THE ZIV DLF RELAY IN 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 DLF relay used.

1.1. Auxiliary Source

For the relay power supply, 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.

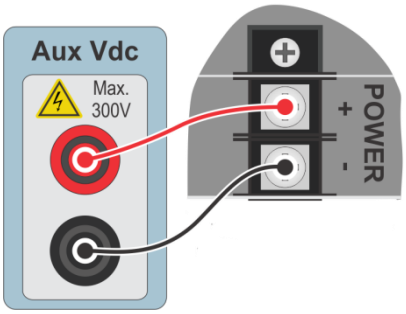

Figure 1

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. Then I1, I2 and I3 go to terminals 11, 13 and 15 of the relay and their common to terminals 12, 14 and 16, respectively. The figure below shows the procedure.

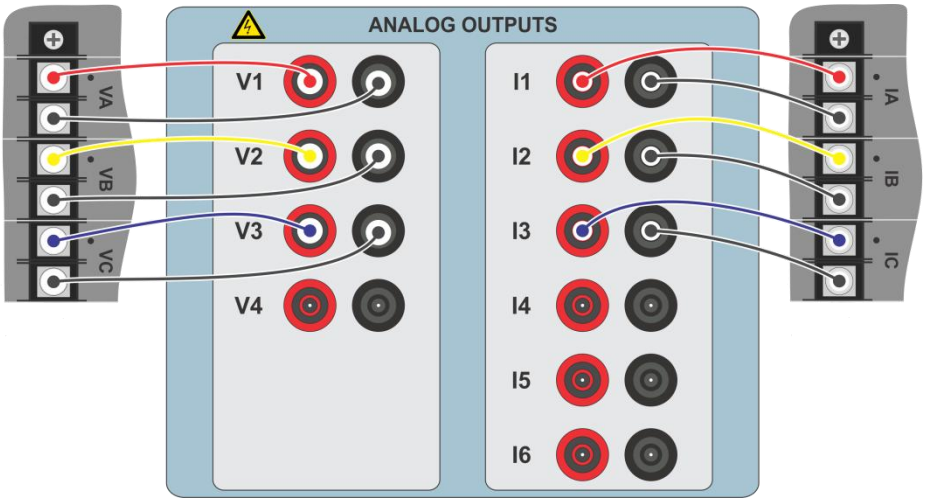

Figure 2

1.3. Binary Inputs

Connect the Binary Inputs to the binary outputs of the 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 e 08)
BI2	OUT 2 (09 e 10)

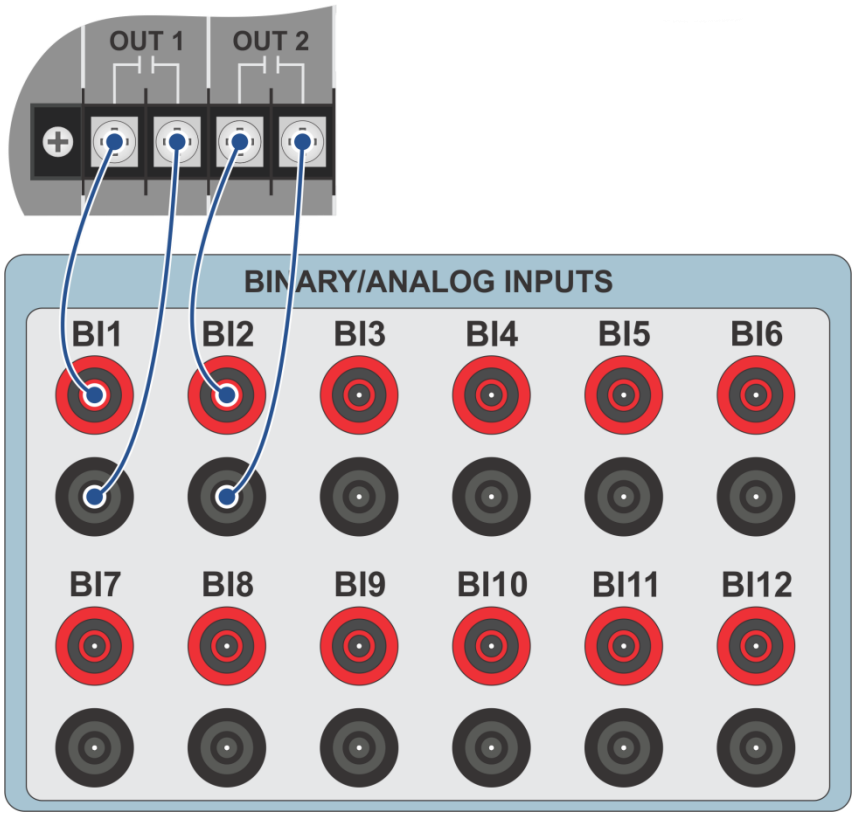

Figure 3

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.

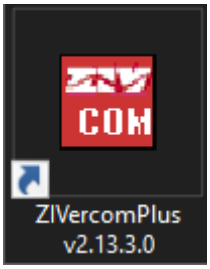

Figure 4

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

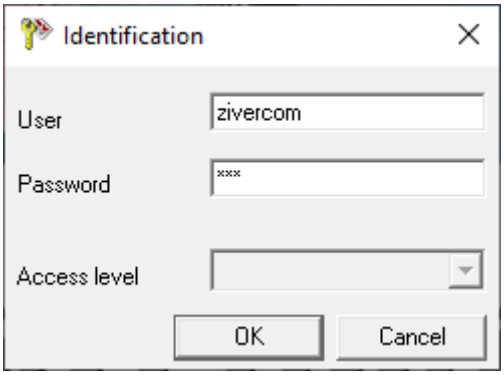

Figure 5

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

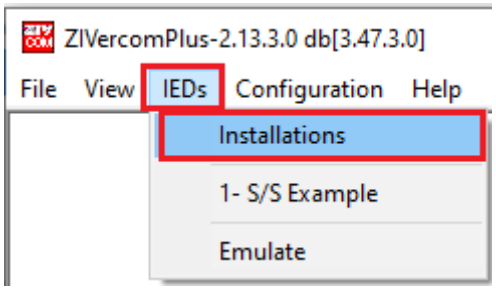

Figure 6

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

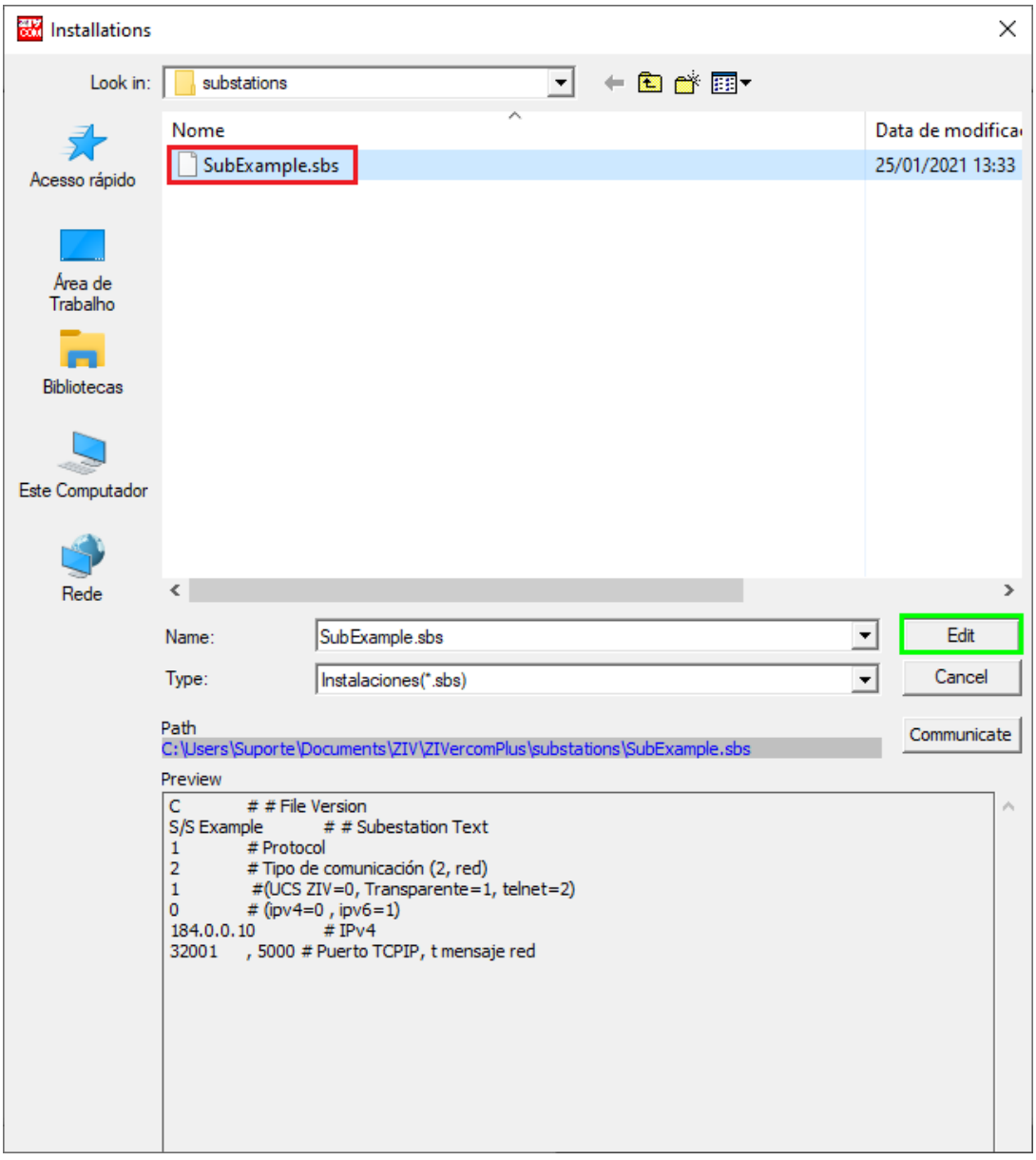

Figure 7

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.

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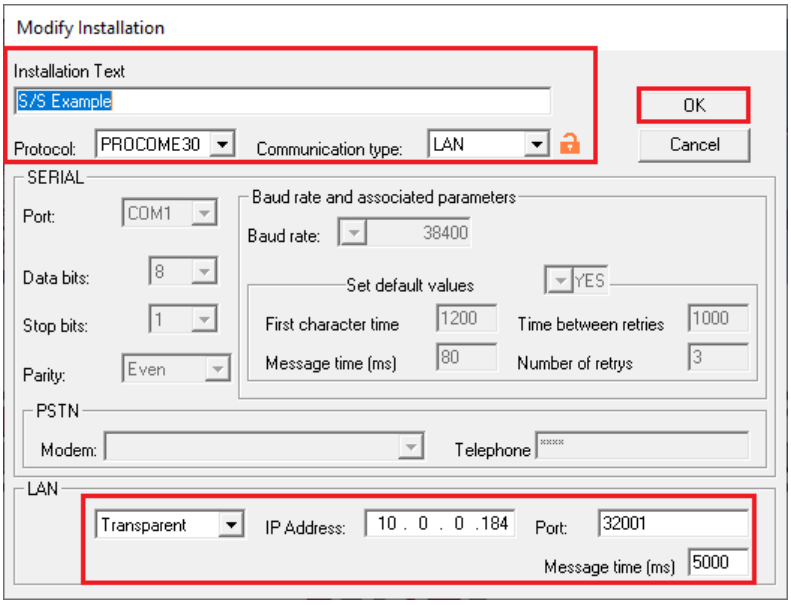

Figure 8

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

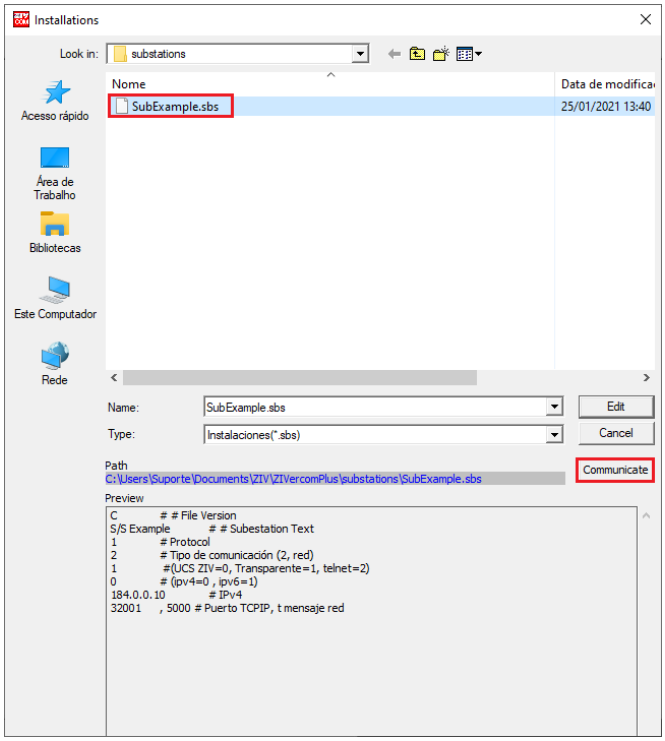

Figure 9

Click *"OK"* again.

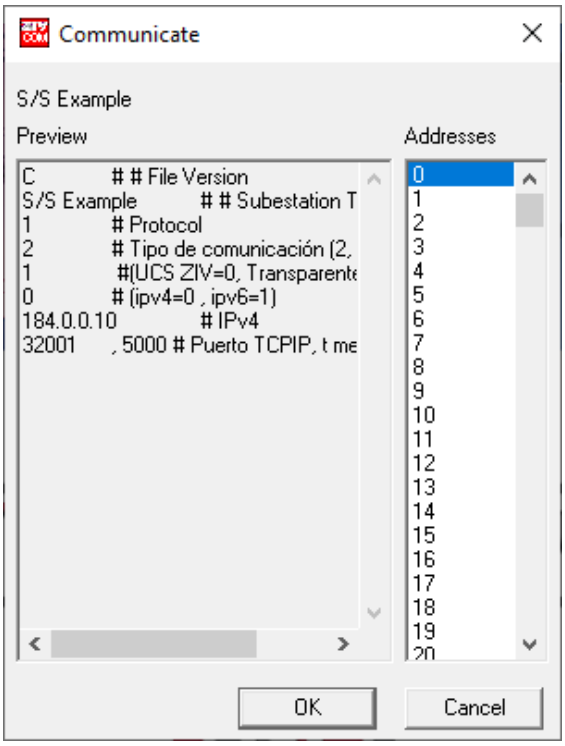

Figure 10

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".***

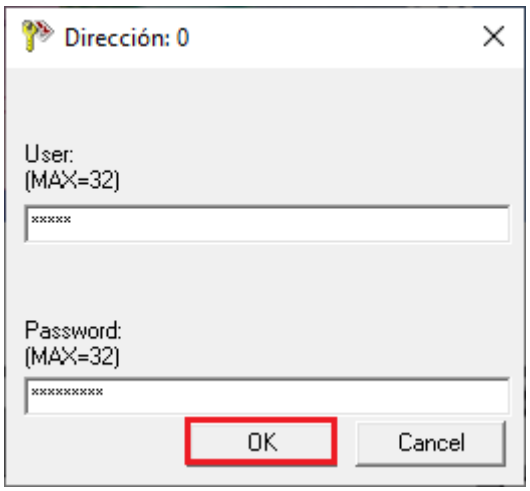

Figure 11

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, nominal voltage as 115.0V, nominal phase current as 5.0A and nominal frequency as 60.00Hz must be set.

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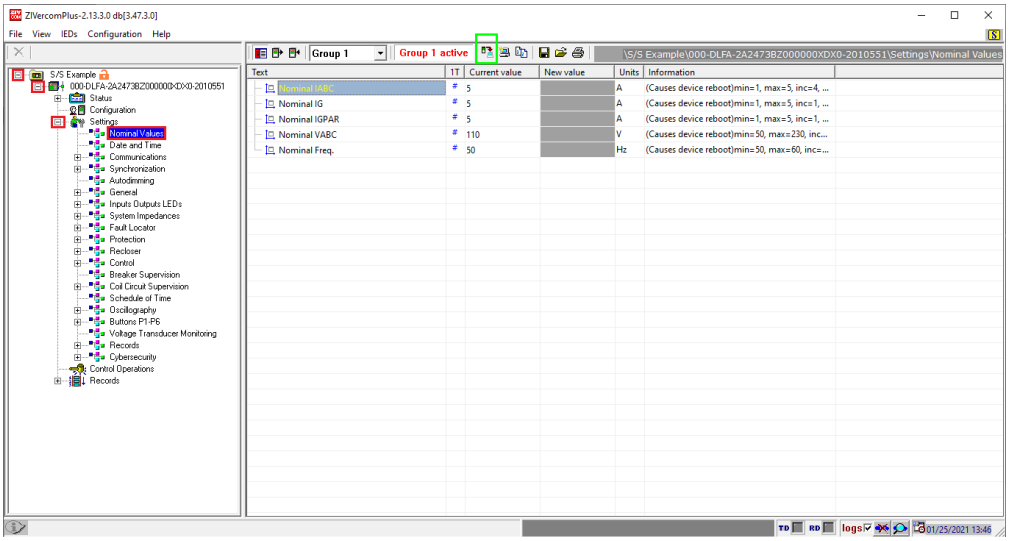

Figure 12

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

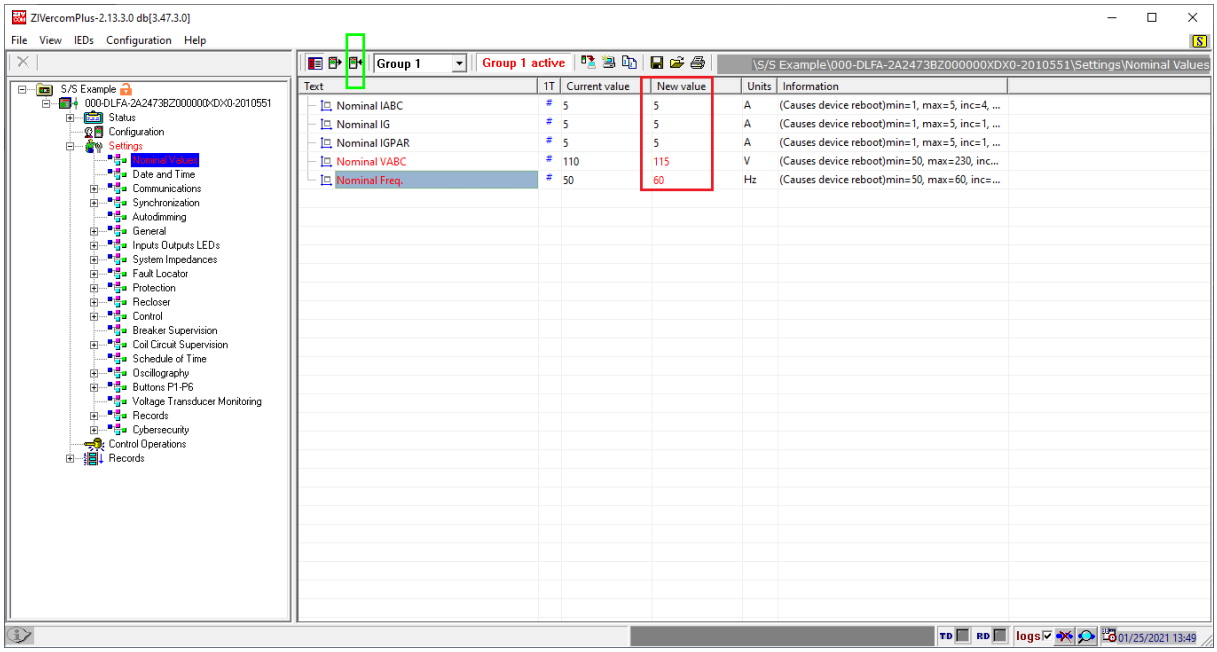

Figure 13

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

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.

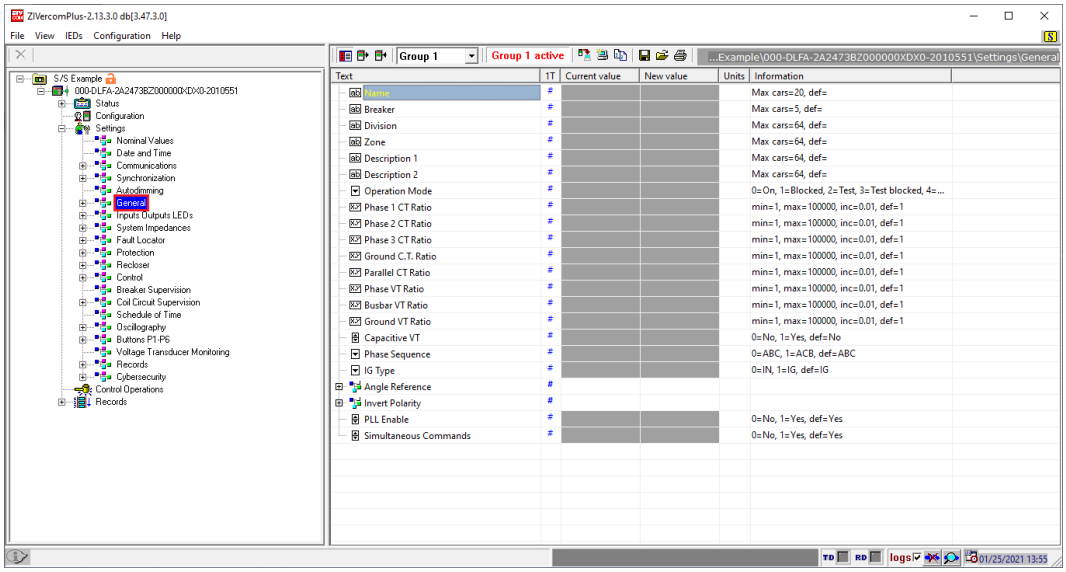

Figure 14

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.

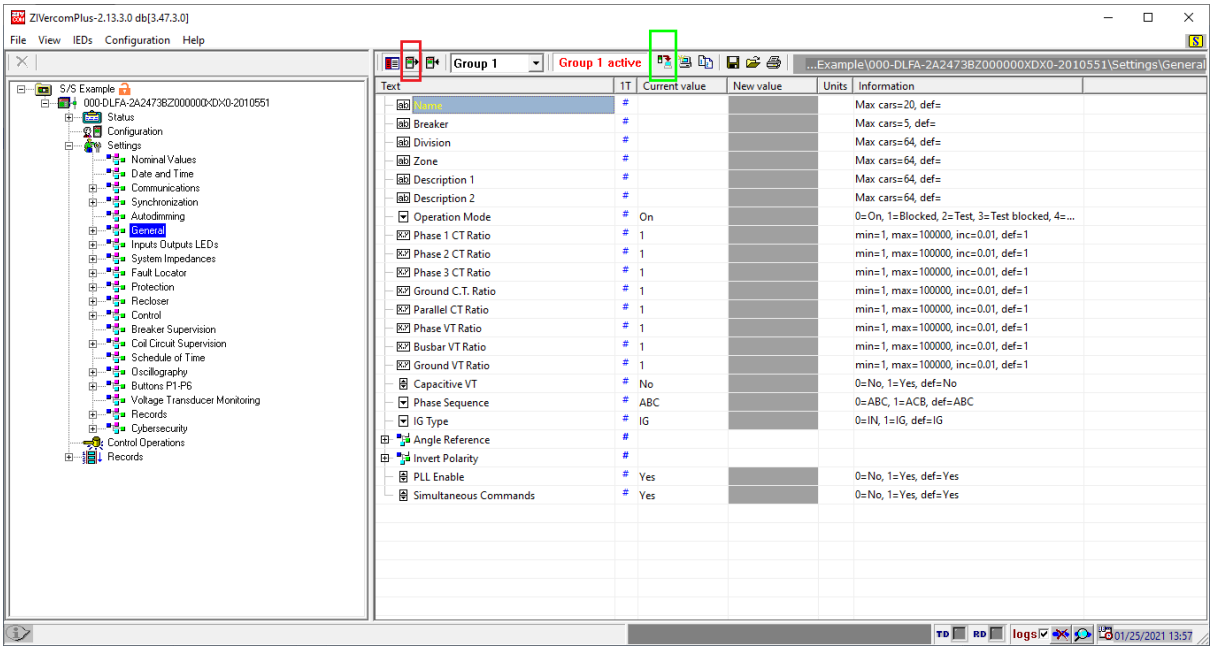

Figure 15

3.3. 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 adjusted. Activate unit 1 with a pick-up value of 8.0A, operating time of 1.5s, choose *"Direction"* and *"67F"*. Then send the adjustments by clicking on the icon highlighted in green.

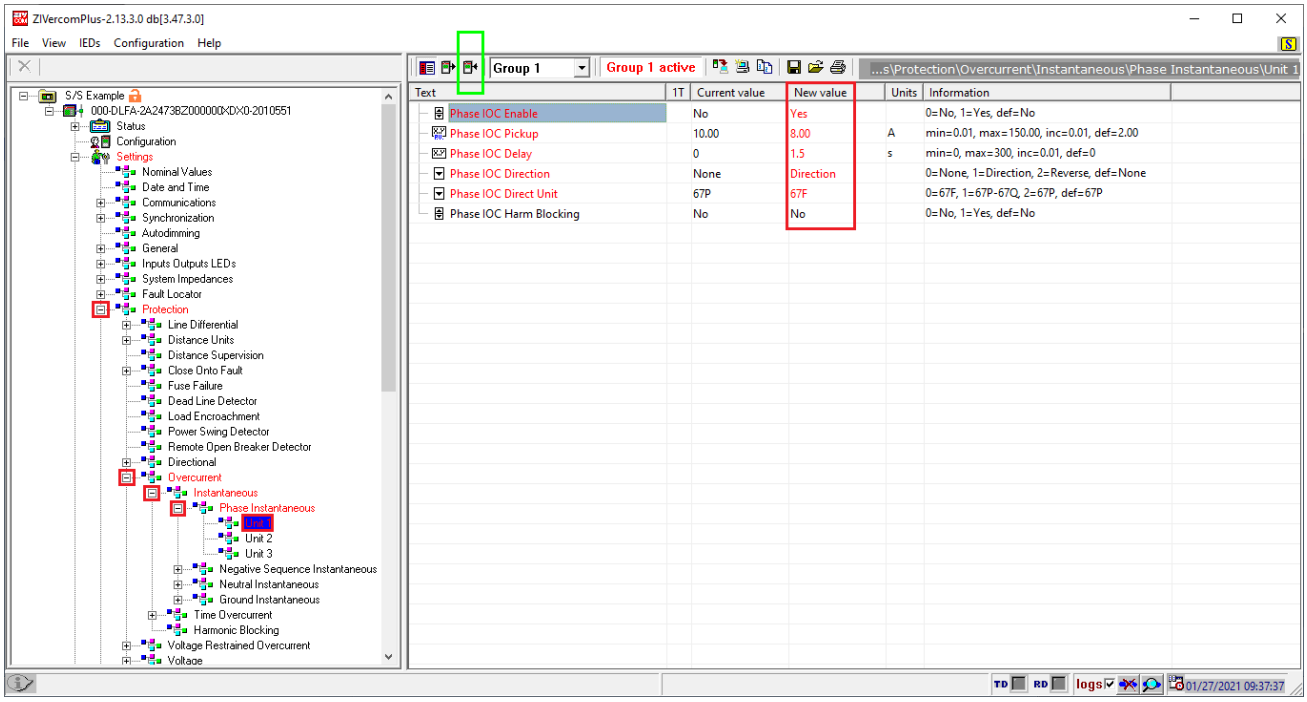

Figure 16

Note: The relay has three polarization modes through the *"Phase IOC Direct Unit"* field.

1. **67F** = Quadrature Voltage Polarization;
2. **67P – 67Q =** For three-phase faults, it uses polarization by positive-sequence voltage and for other types of faults, it uses negative-sequence voltage;
3. **67P =** Positive sequence voltage polarization.

3.4. Current Directional

Click on the highlighted *"+"* sign until you reach the *"Current Directional"* option. Set the maximum phase torque angle in the *"Phase Characteristic Angle"* field.

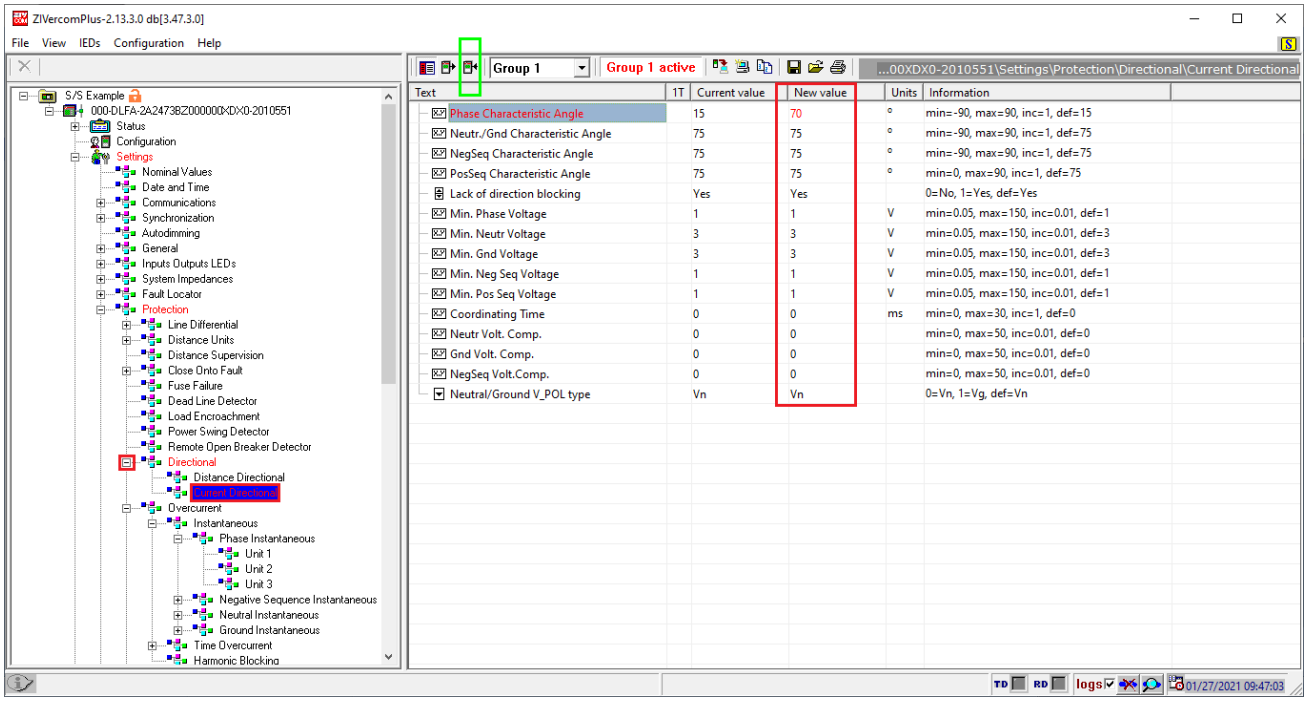

Figure 17

3.5. Outputs

In order to test both the pickup and the overcurrent directional actuation time, 2 relay output binaries will be used to collect these signals by the test set. In the following figure, configure the first output as the start of phases A, B and C of instantaneous unit 1.

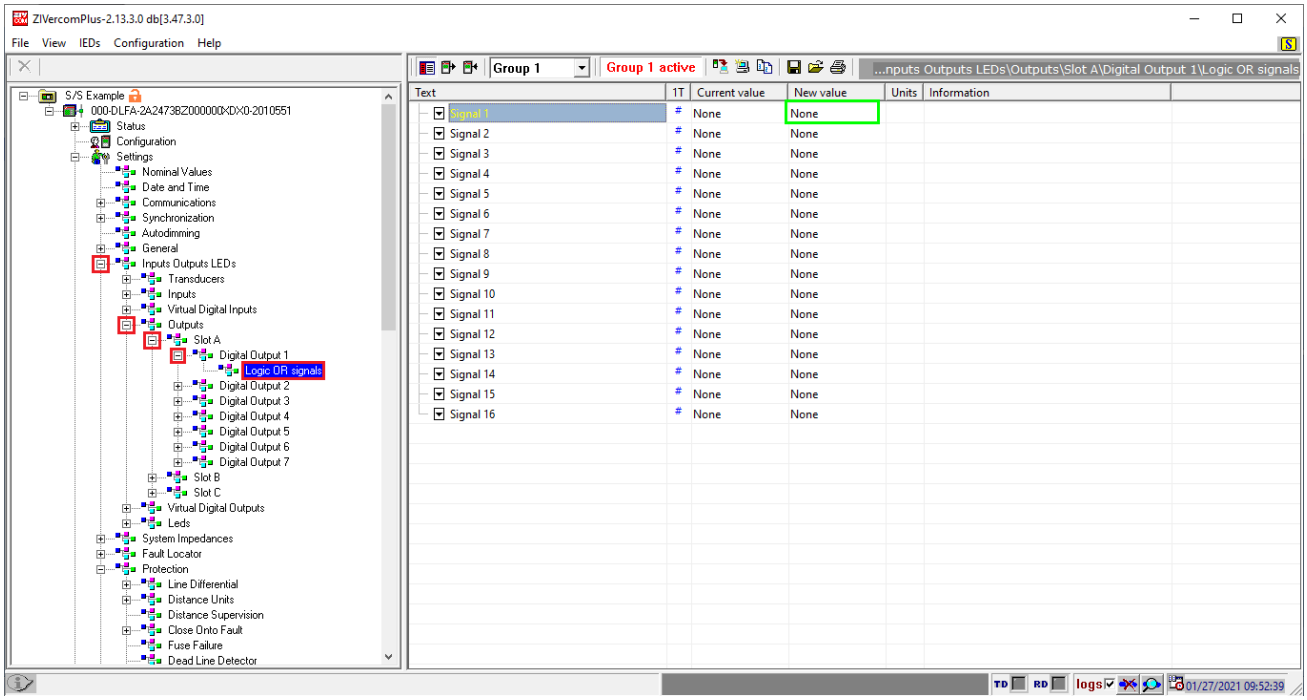

Figure 18

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

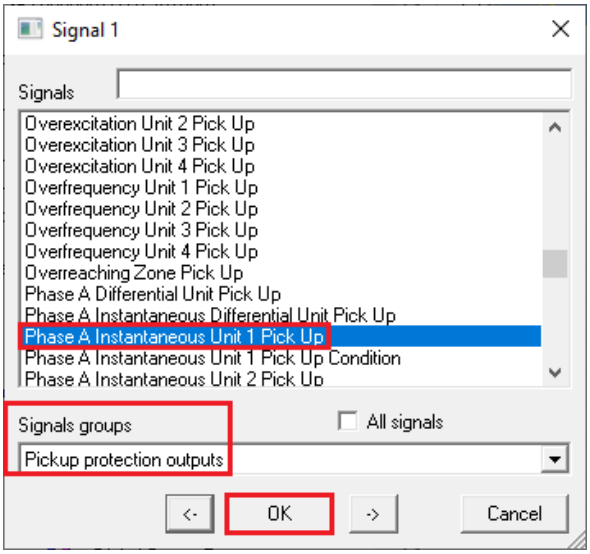

Figure 19

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

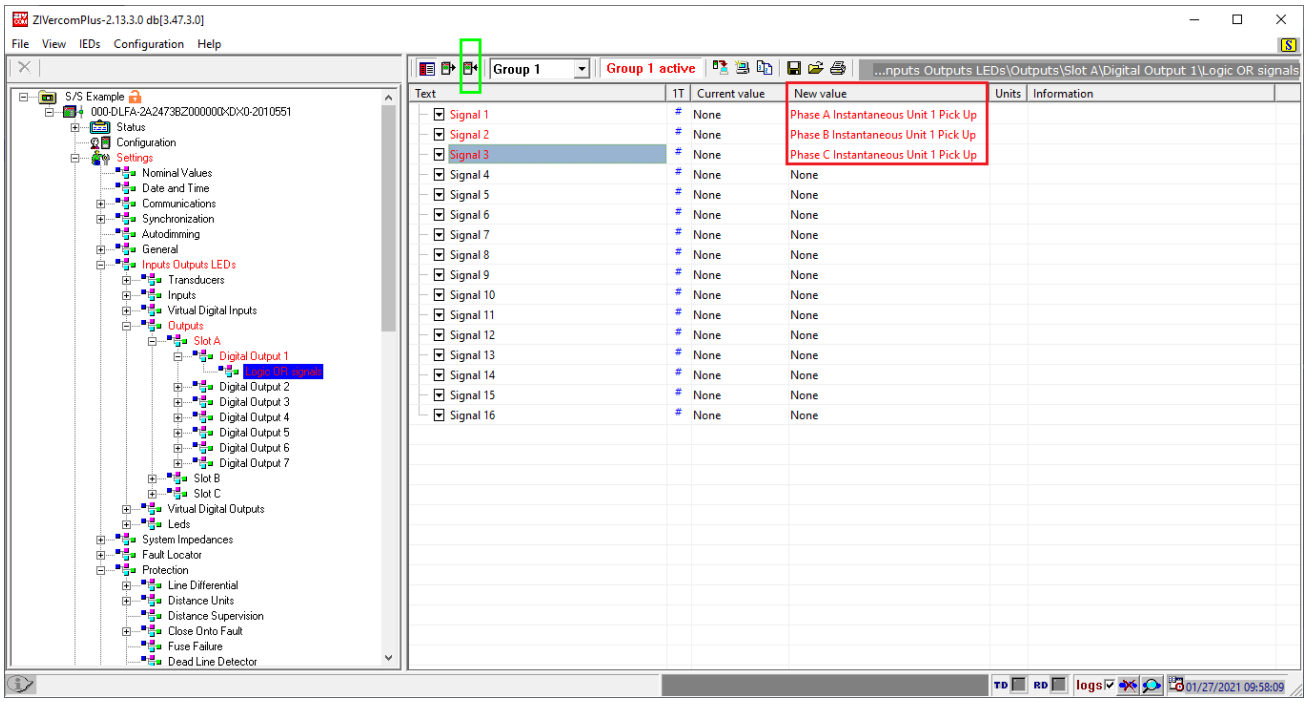

Figure 20

On the second output, the tripping signals of phases A, B and C of instantaneous unit 1 will be configured.

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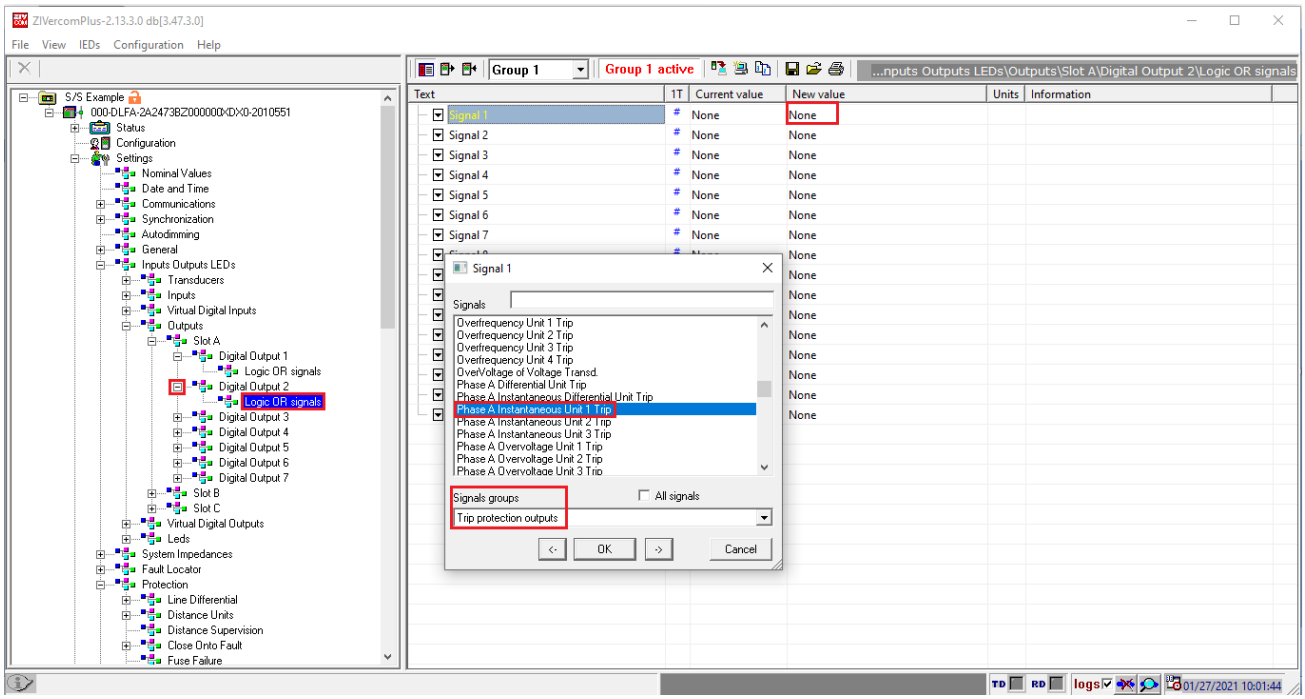

Figure 21

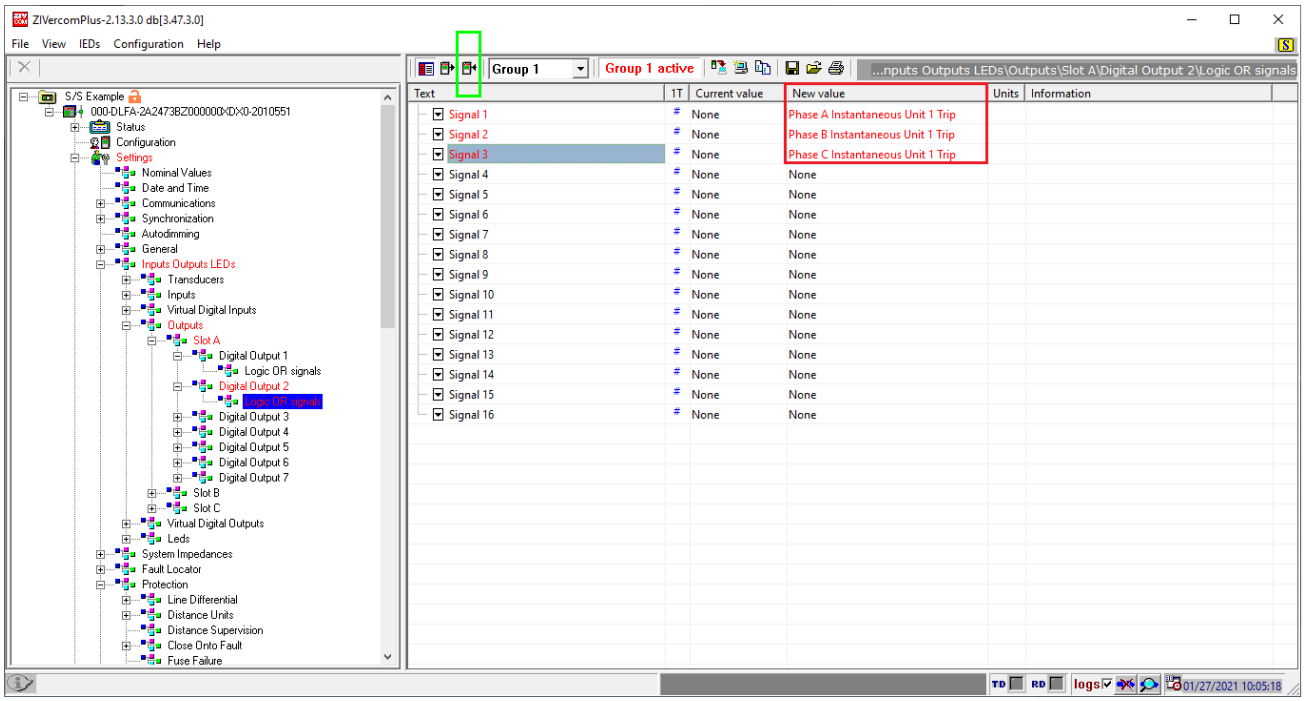

Figure 22

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4. Application Manager

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

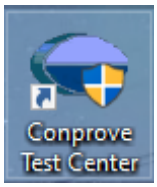


Figure 23

4.1. Overcurrent software adjustments

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

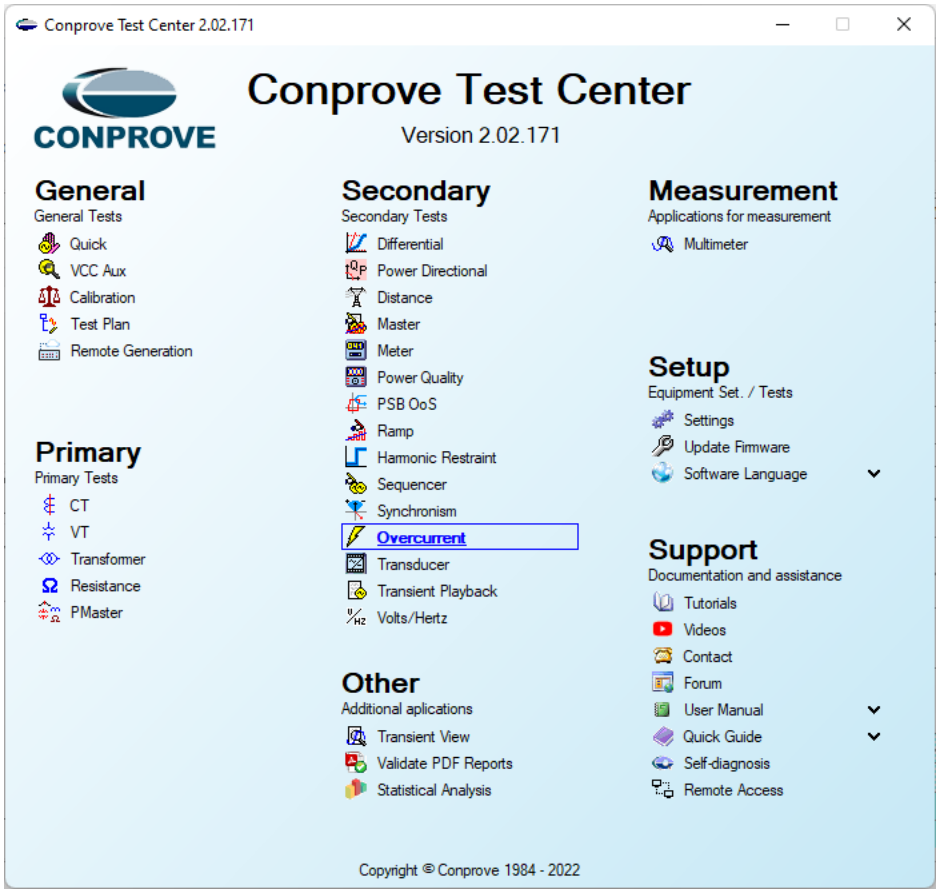


Figure 24

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.

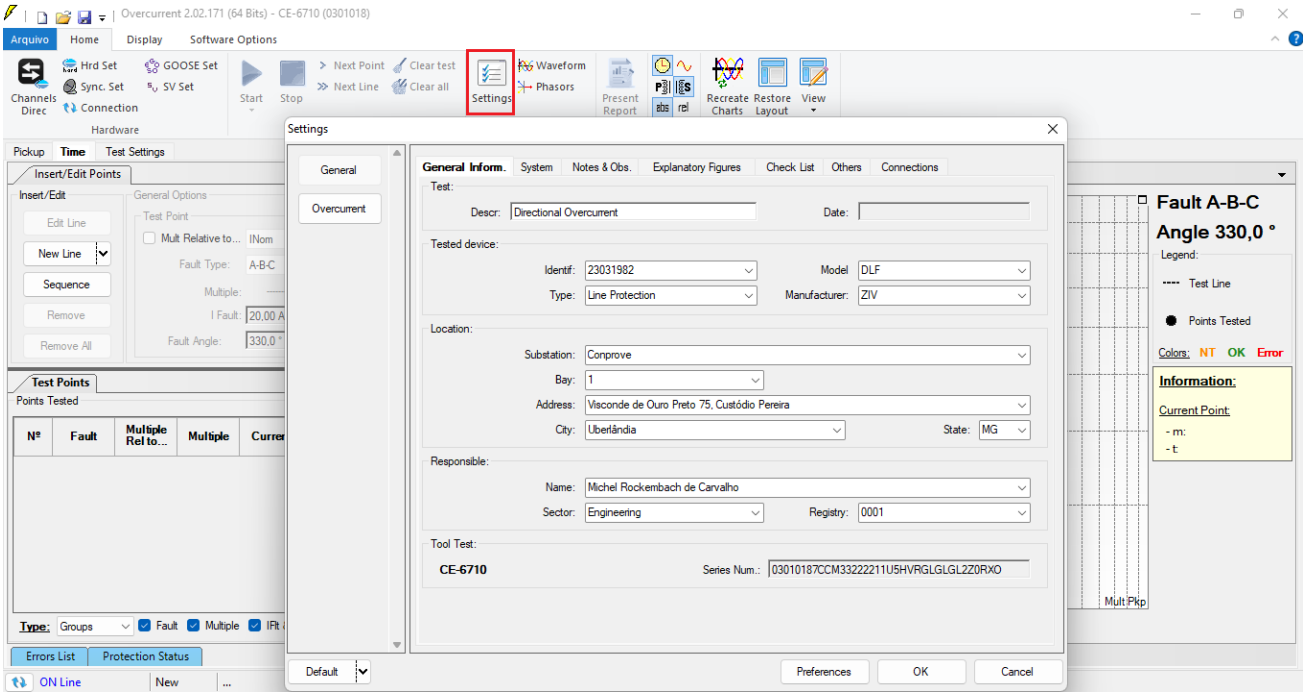


Figure 25

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 VTs and CTs are configured. There are also two sub tabs *"Impedance"* and *"Source"*, whose data is not used for this test.

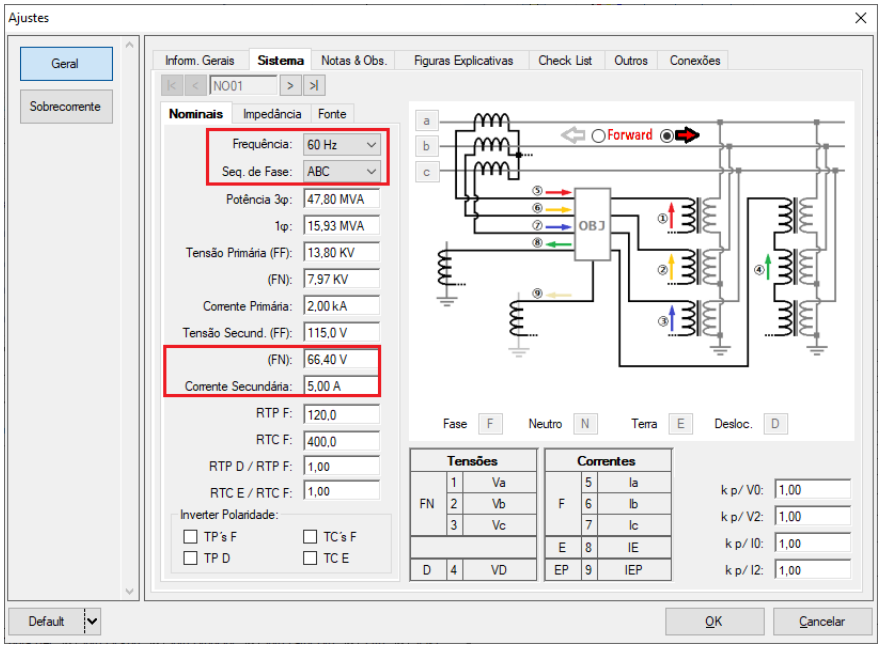


Figure 26

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.

4.2. Overcurrent Screen > Definitions

In this tab you can adjust the directionality, the type of polarization, the curves display mode, the scale used and the time, current and angle tolerances. These tolerances should be consulted in the relay manufacturer's manual (available in Appendix A).

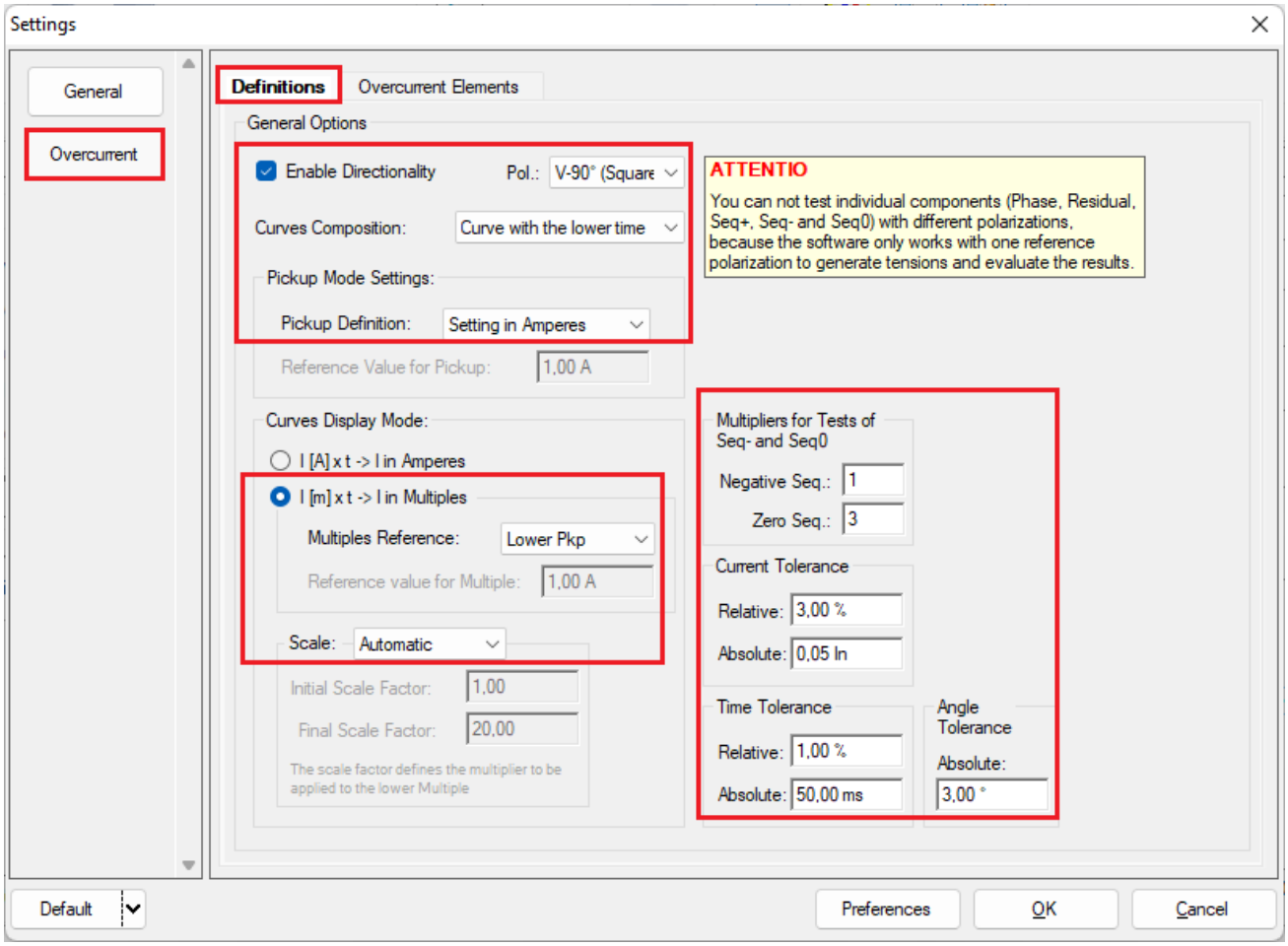


Figure 27

4.3. Overcurrent Screen > Overcurrent Elements > Phase

Here the overcurrent directional element is configured. To do this click once on the highlighted *"+"* icon.

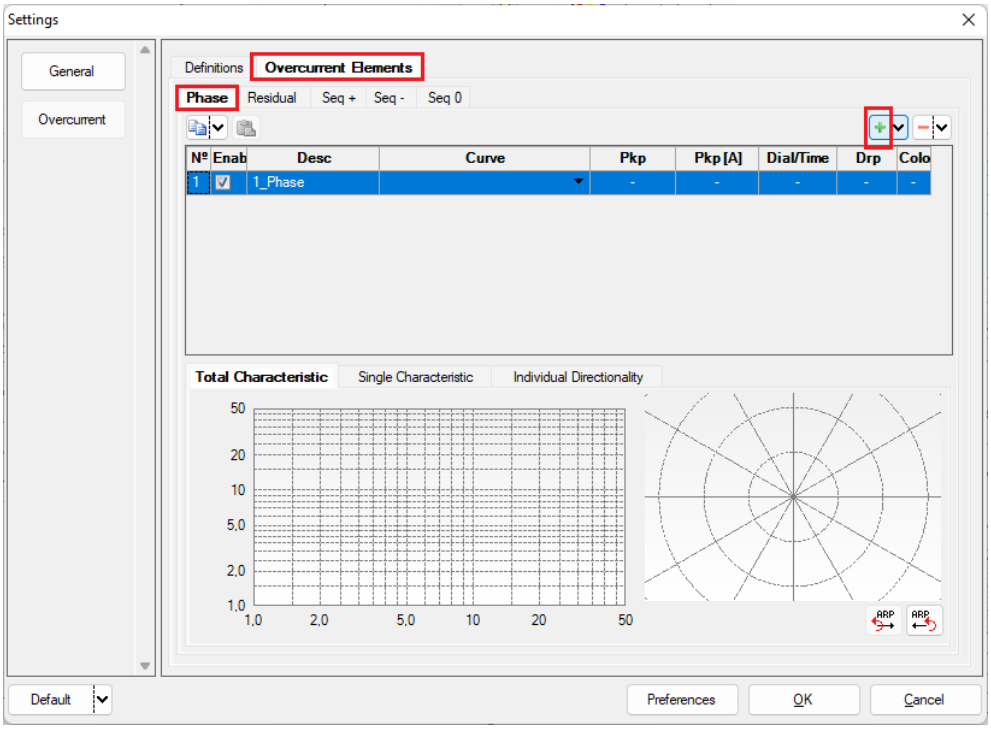


Figure 28

For the first element change the name to 67, choose the type of curve like definite time, pickup value, operating time and dropout factor.

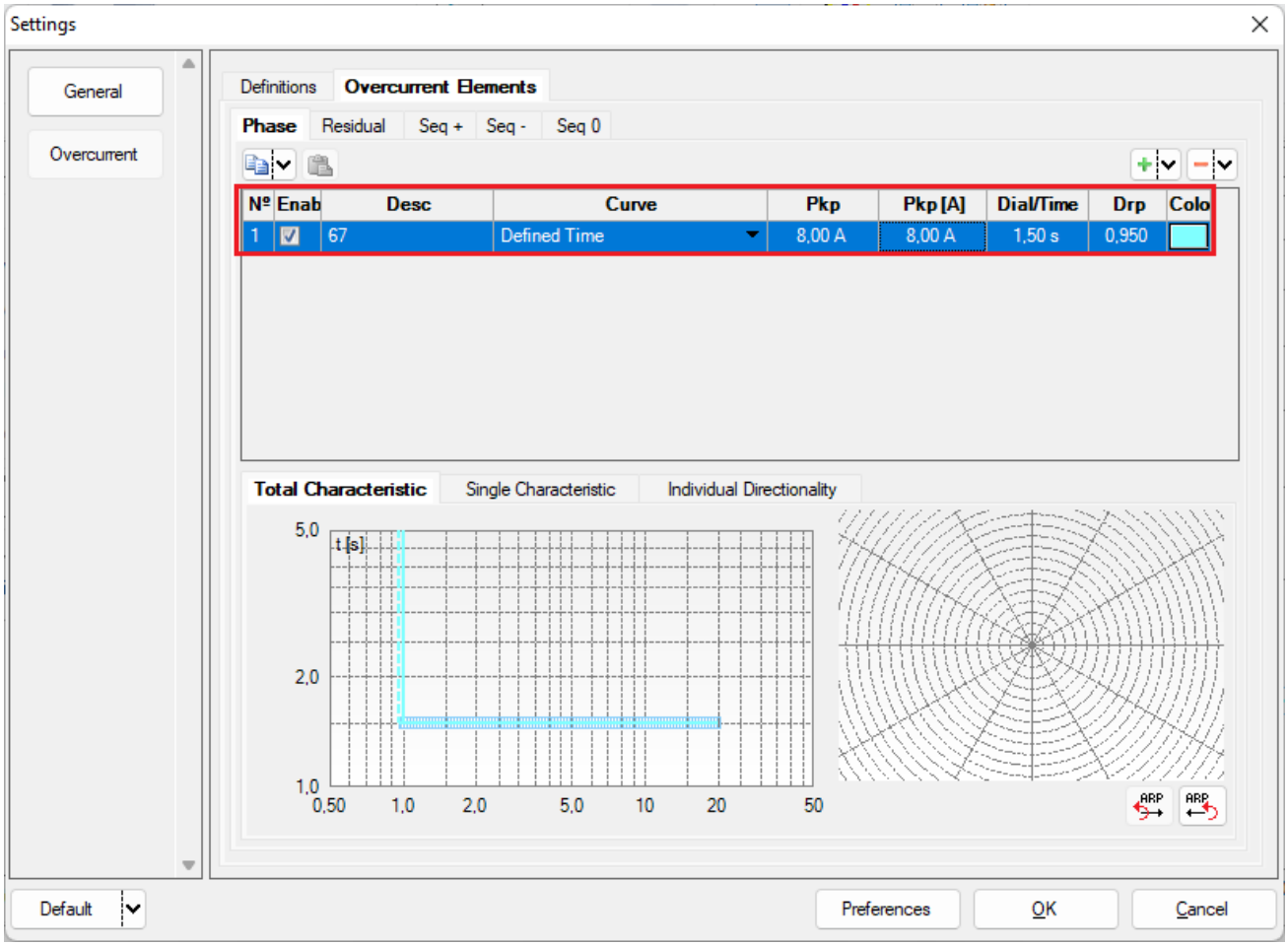


Figure 29

This relay has a particularity for actuation of your pick-up that is worth 5% more than the adjusted value (1.05), click on the *"Single Characteristic"* tab and make the following adjustment.

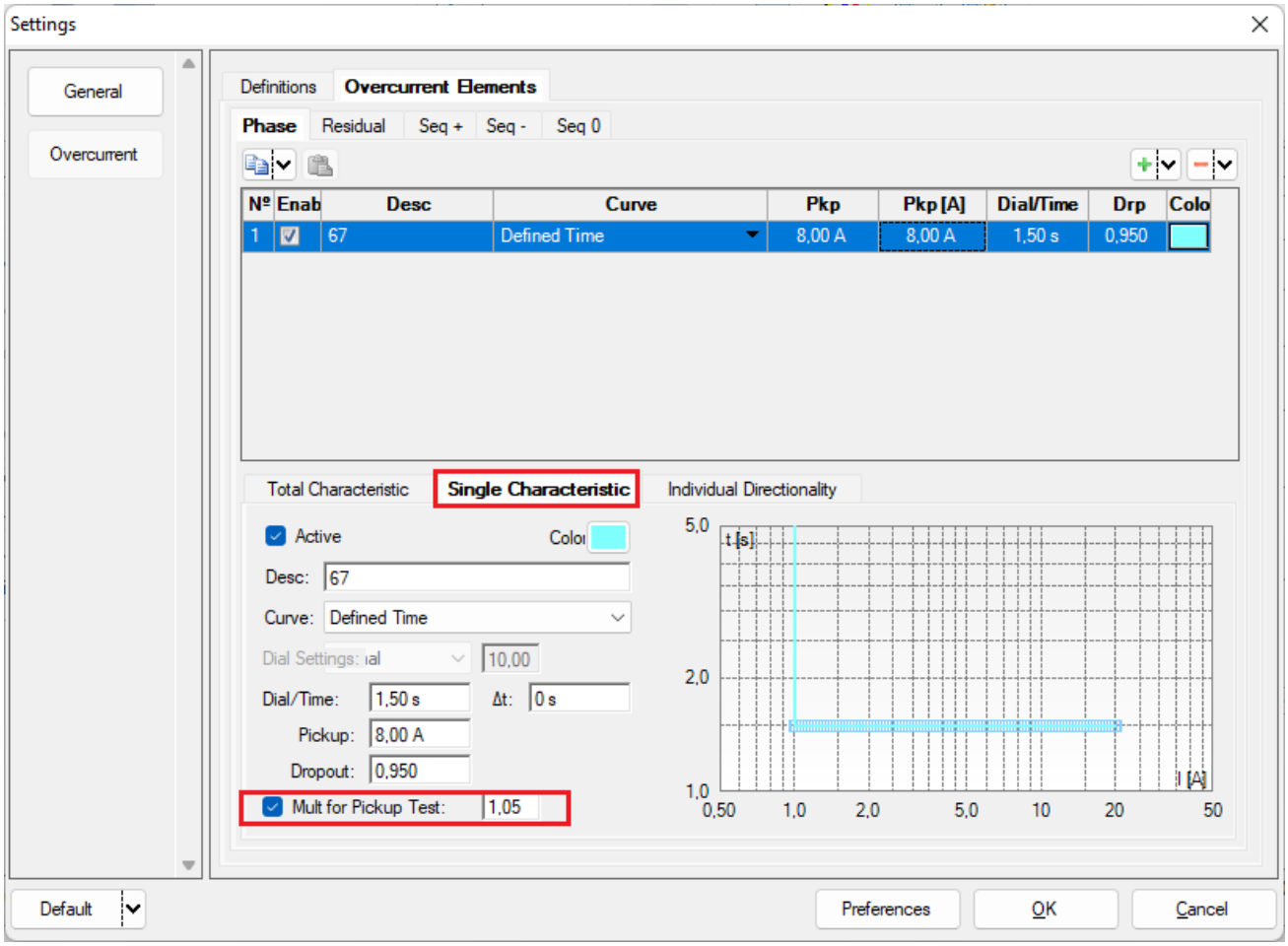


Figure 30

Click on the *"Individual Directionality"* tab and make the following adjustment.

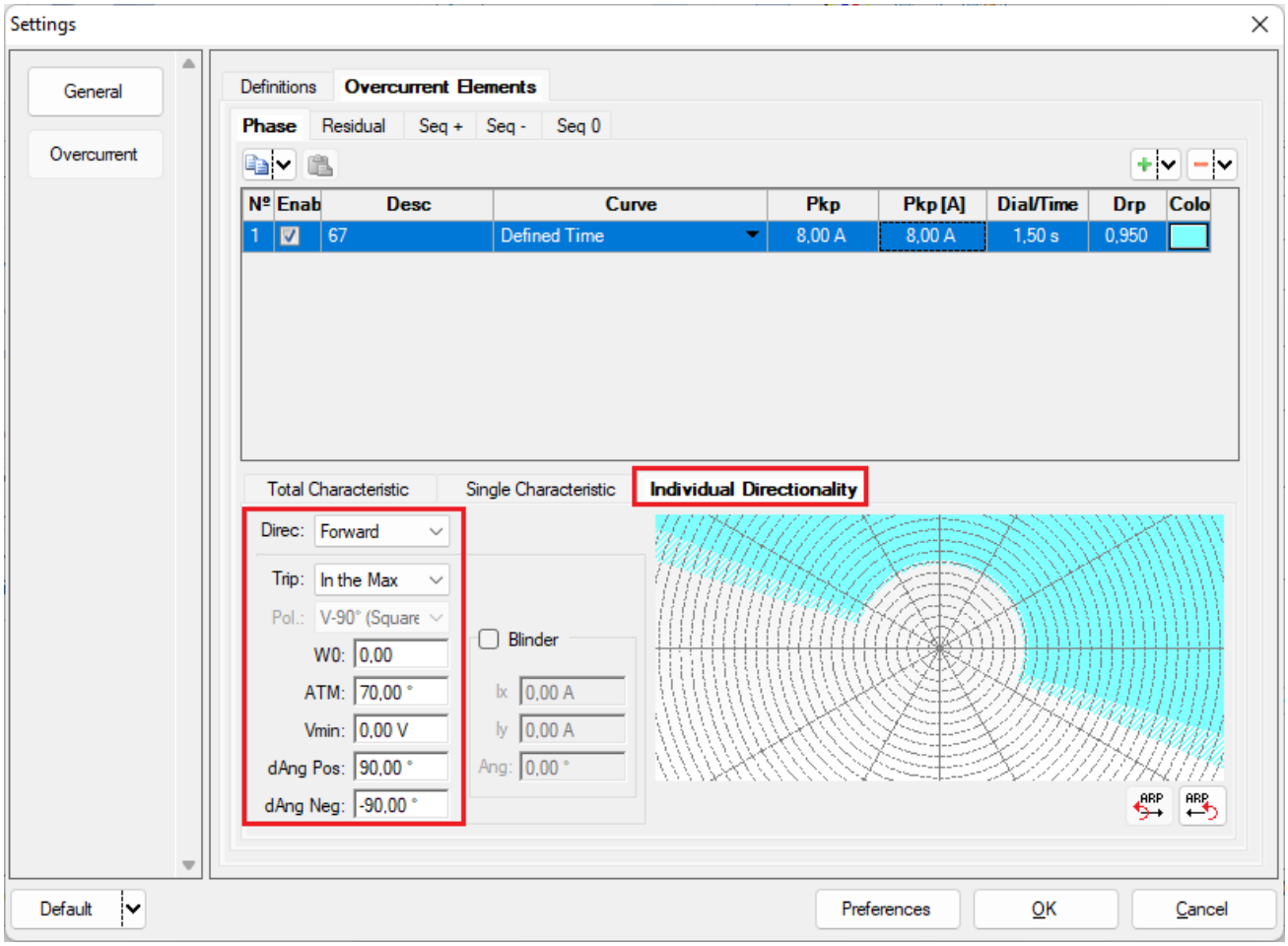


Figure 31

5. Channel Direction and Hardware Configurations

Click on the icon illustrated below.

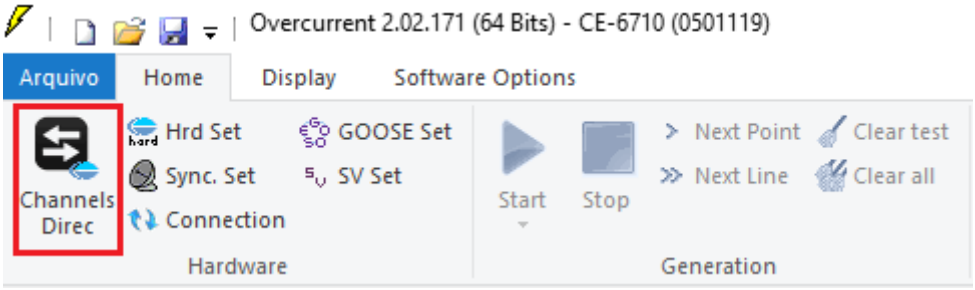


Figure 32

Then click on the highlighted icon to configure the hardware.

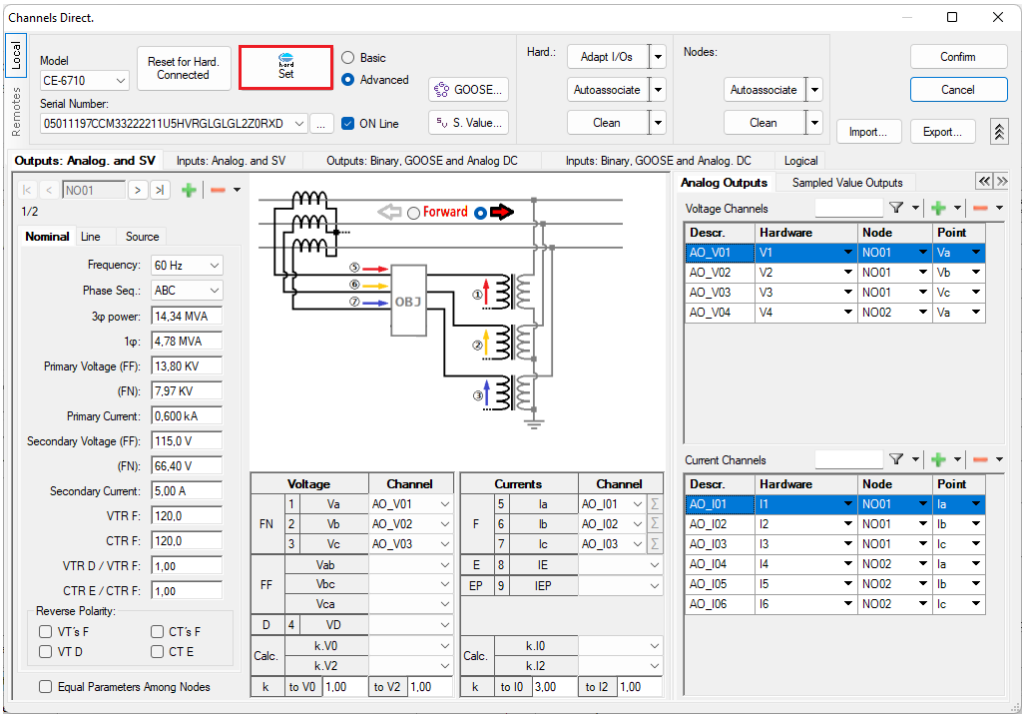


Figure 33

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

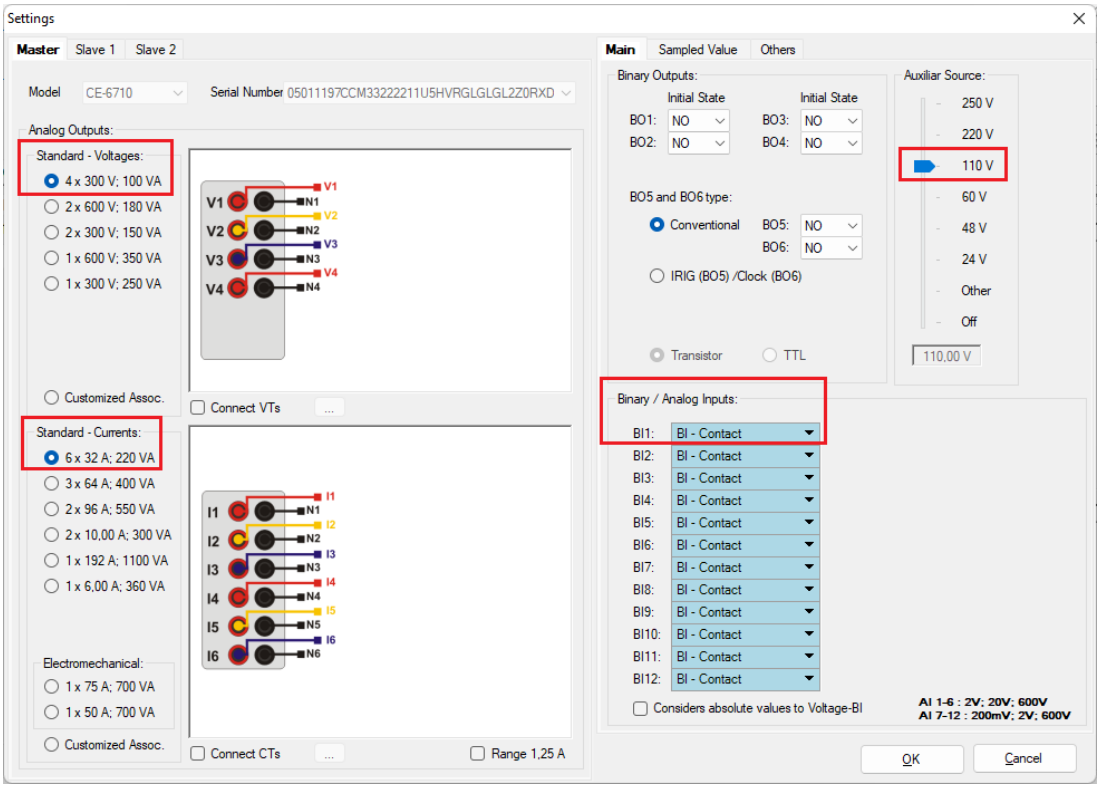


Figure 34

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

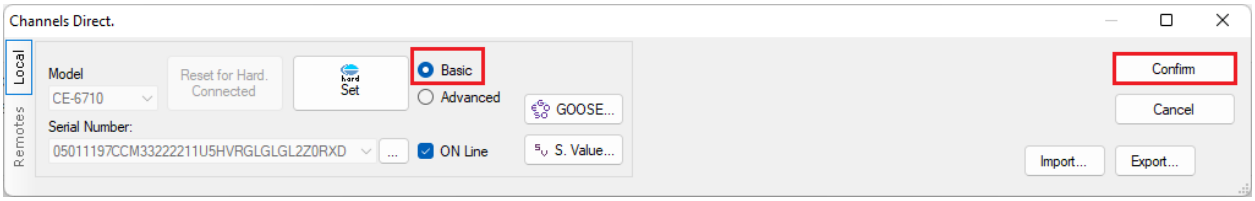


Figure 35

6. Test structure for function 67

6.1. *Test Settings*

On this tab, you must configure the pickup and trip signal direction with the binary inputs, in addition to configuring the generation channels. Insert a pre-fault with rated voltage and current.

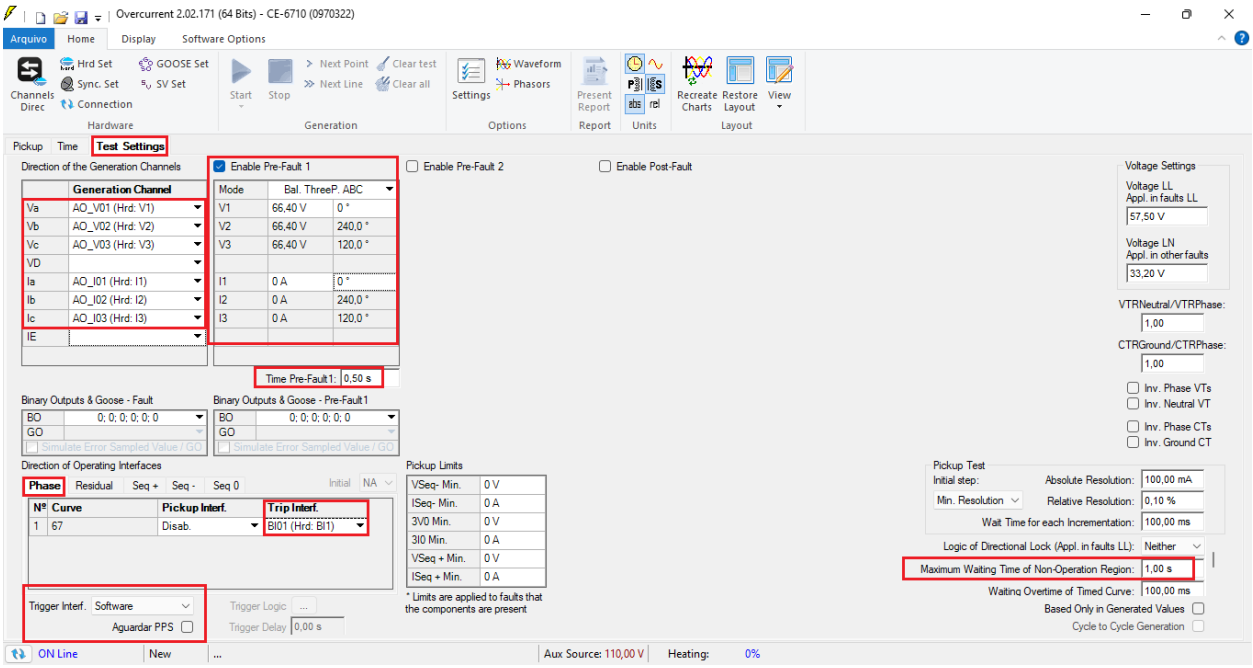


Figure 36

6.2. Pickup Screen

In this tab, click on “New Point” and choose the type of fault (all types available) and may also test dropout. The software searches for pickup and dropout (if selected) fully automatically. In the figure below, the “Type of Fault” ABC was chosen with an angle of 0° (you must choose an angle greater than 340° and less than 160°).

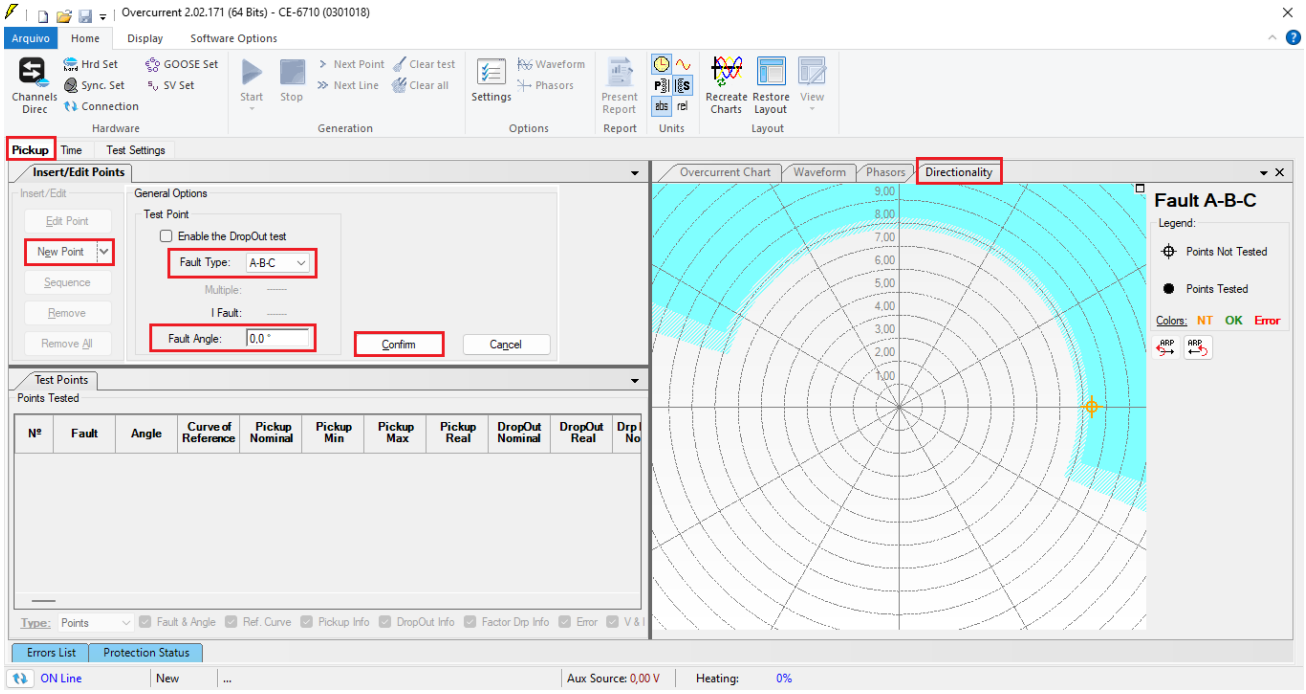


Figure 37

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

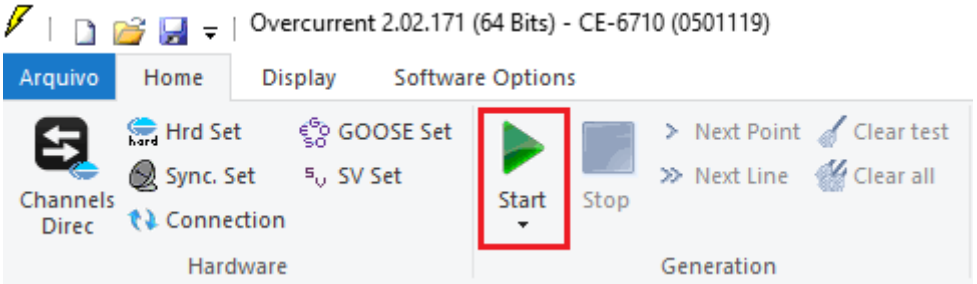


Figure 38

6.3. Final Result of the Pickup Test

In this test, the values found for pickup, dropout and in addition to 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.

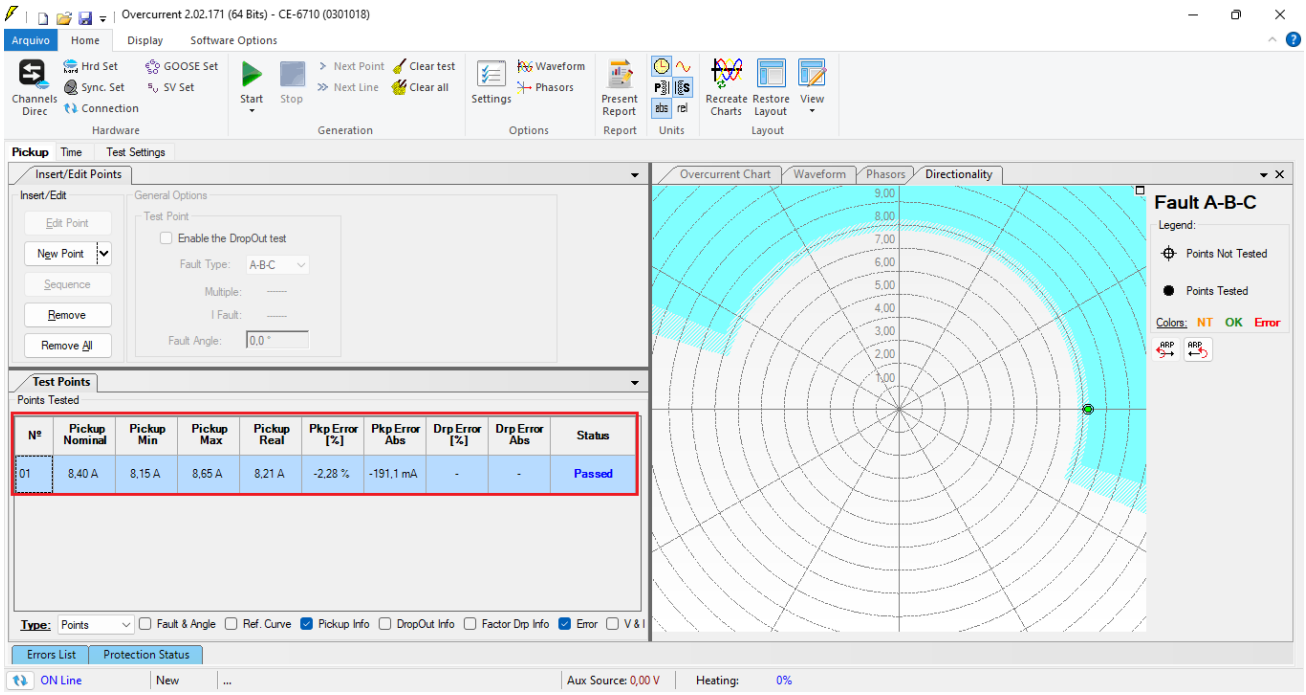


Figure 39

6.4. *Time Screen*

On this tab, directionality and operating times are evaluated. For convenience, a sequence of values will be inserted, with current and angle variation. The value 10.00A was chosen as the initial value, 15.00A as the final value and 5.00A as the increment step and the ABC fault. In the angles choose 0.0° as initial value, for the step choose 25° and final value choose 360.0°.

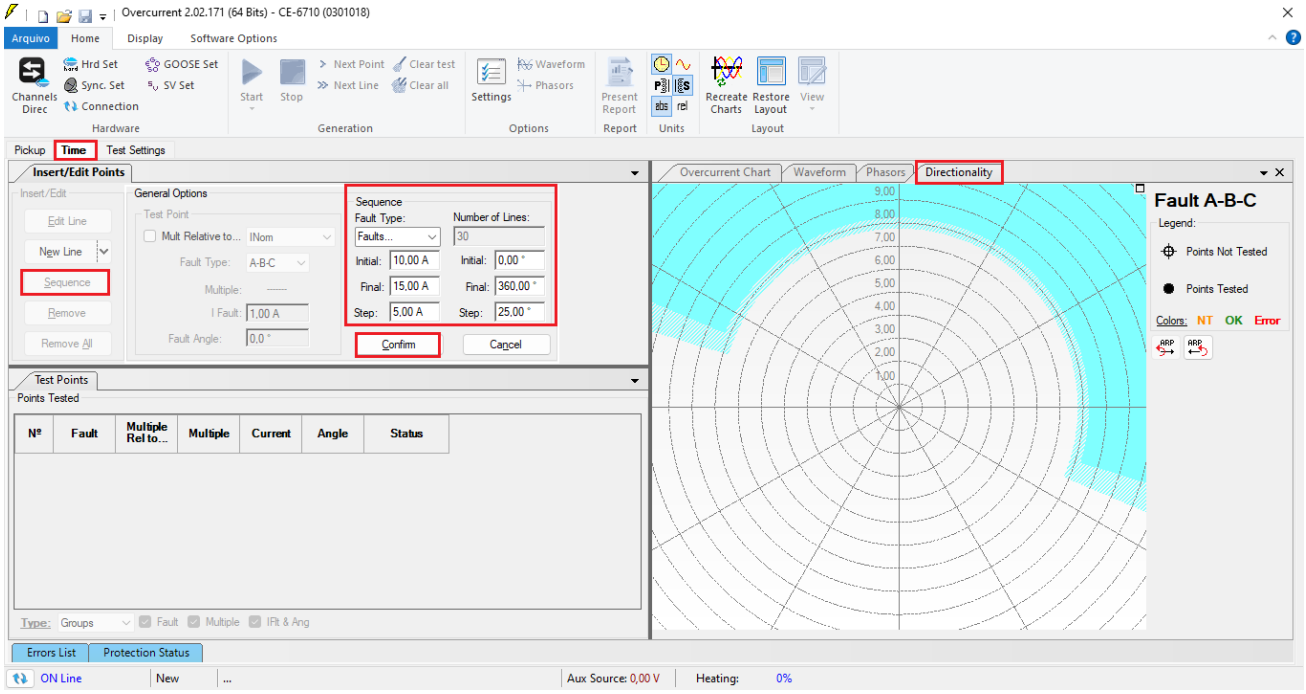


Figure 40

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

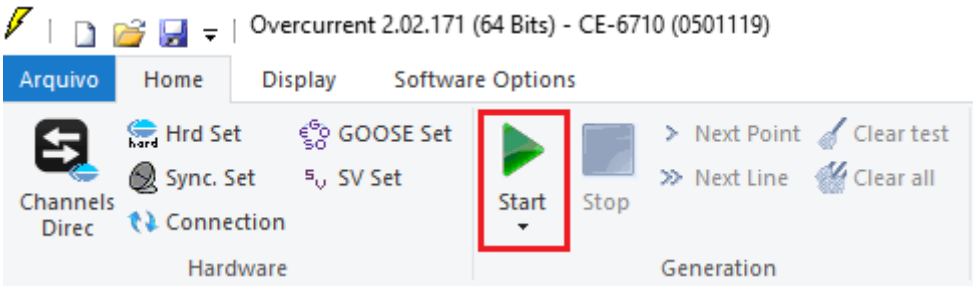
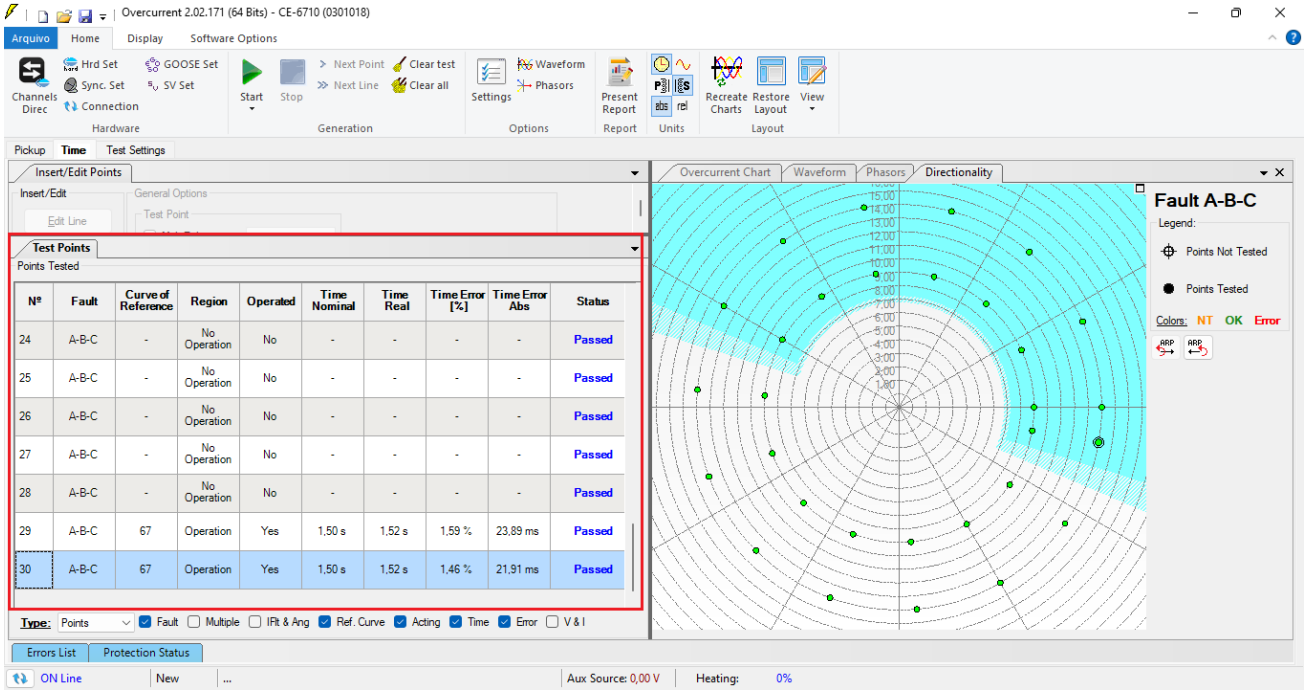


Figure 41

6.5. Final Result of the Time Test



Nº	Fault	Curve of Reference	Region	Operated	Time Nominal	Time Real	Time Error [%]	Time Error Abs	Status
24	A-B-C	-	No Operation	No	-	-	-	-	Passed
25	A-B-C	-	No Operation	No	-	-	-	-	Passed
26	A-B-C	-	No Operation	No	-	-	-	-	Passed
27	A-B-C	-	No Operation	No	-	-	-	-	Passed
28	A-B-C	-	No Operation	No	-	-	-	-	Passed
29	A-B-C	67	Operation	Yes	1,50 s	1,52 s	1,59 %	23,89 ms	Passed
30	A-B-C	67	Operation	Yes	1,50 s	1,52 s	1,46 %	21,91 ms	Passed

Figure 42

It is verified that all times in the operating region (direct) are within the range allowed by the relay manufacturer and that in the reverse region there is no actuation.

7. 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.

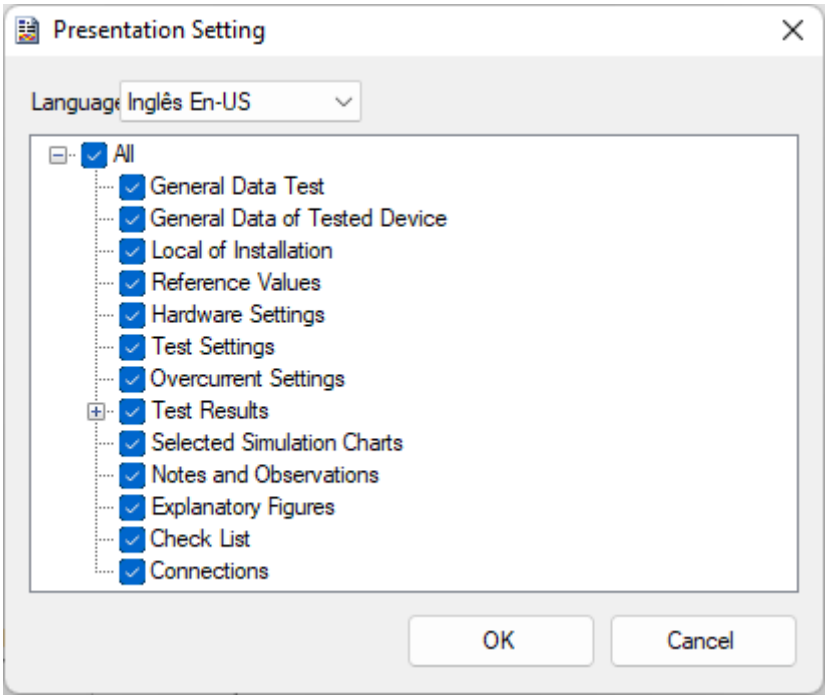


Figure 43

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, this last 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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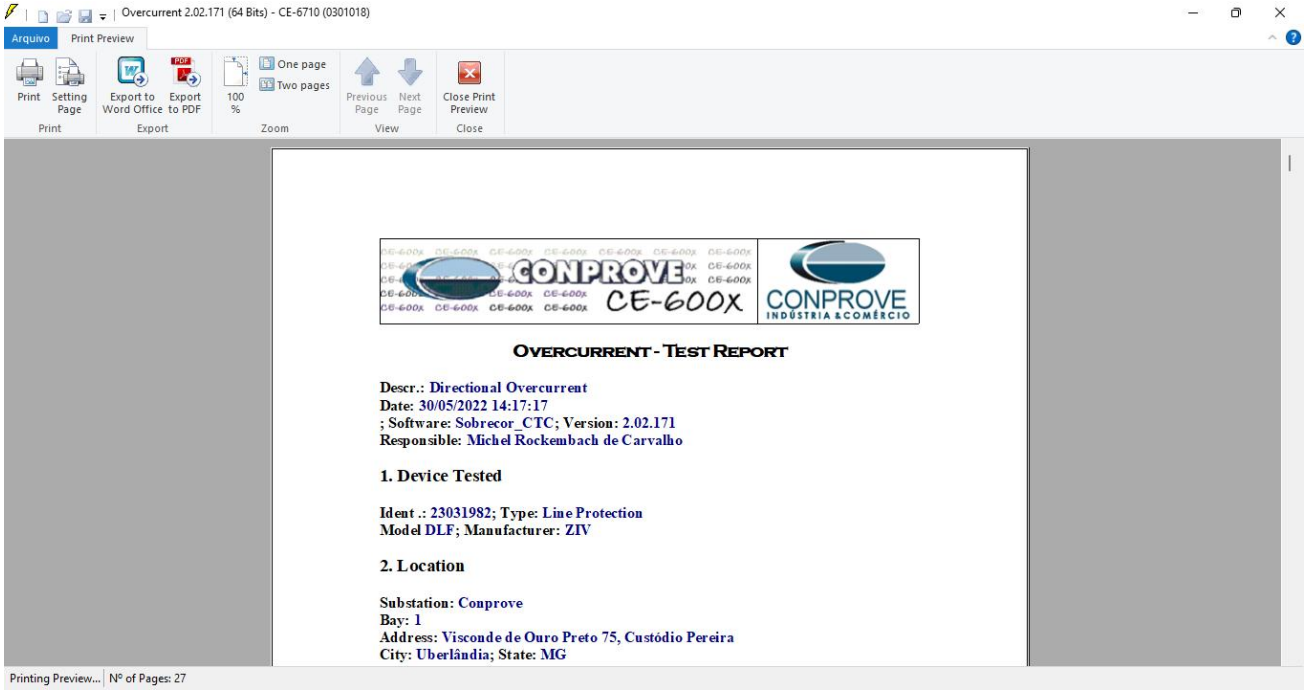

Figure 44

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)

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 (*)

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

Time Measurement

Mode	Time Setting	Times Pick up	Time Measurement *	
			50Hz	60Hz
Fixed Time	0 s	1.5	±22 ms	±21 ms
		5	±13 ms	±13 ms
		15	±12 ms	±12 ms
Fixed Time	> 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)	

(*) The trip time, when the setting is 0 s, is reduced up to 5 ms using digital HSHD outputs.

Measuring time of a curve depending overcurrent unit is influenced not only by the time tolerance but also by the current pickup so both tolerances will be taken into account to calculate the accuracy of the unit.

Figure 45

9. 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 46

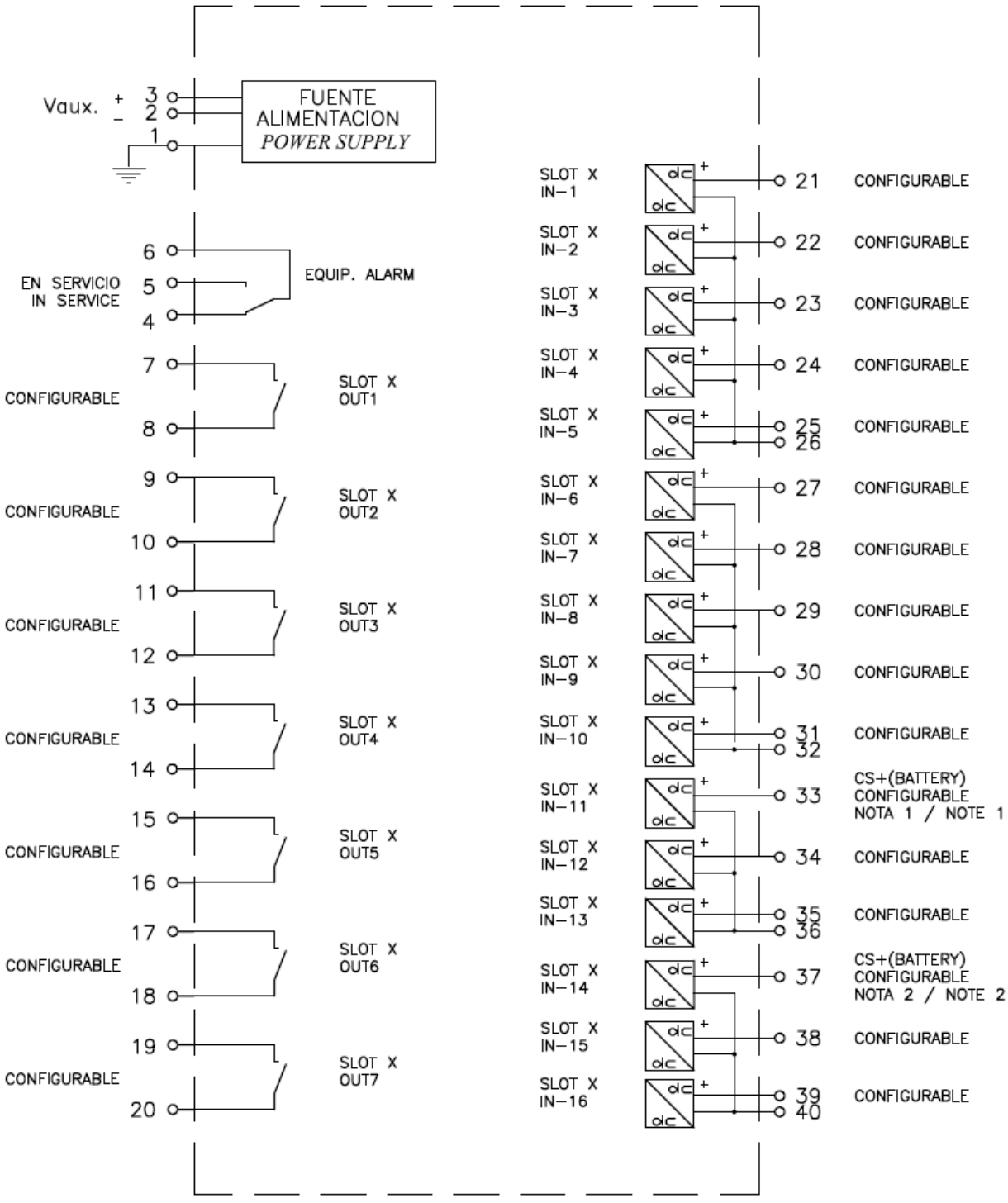
Vaux.
+
3
2
−
1
FUENTE
ALIMENTACION
POWER SUPPLY
6
5
4
EN SERVICIO
IN SERVICE
EQUIP. ALARM
7
8
CONFIGURABLE
SLOT X
OUT1
9
10
CONFIGURABLE
SLOT X
OUT2
11
12
CONFIGURABLE
SLOT X
OUT3
13
14
CONFIGURABLE
SLOT X
OUT4
15
16
CONFIGURABLE
SLOT X
OUT5
17
18
CONFIGURABLE
SLOT X
OUT6
19
20
CONFIGURABLE
SLOT X
OUT7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

Figure 47

10. Appendix C - Parameter Equivalence between Relay and Software

Table 2

Overcurrent Software		ZIV DLF Relay	
Parameter	**Figure**	**Parameter**	**Figure**
Pol. :	27	Phase IOC Direct Unit	16
67 Pkp	29	Phase IOC Pickup	16
67 Dial/Time	29	Phase IOC Delay	16
Direc	31	Phase IOC Direction	16
ATM	31	Phase Characteristic	17