

INSTRUMENTOS PARA TESTES ELÉTRICOS

TEST TUTORIAL

EQUIPMENT TYPE: Protection Relay.

BRAND: ZIV.

MODEL: DLF.

FUNCTION: 21 or PDIS - Distance.

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

OBJECTIVE: Zone search test with MHO characteristics.

VERSION CONTROL:

Rua Visconde de Ouro Preto, 75 – Bairro Custódio Pereira – CEP 38405-202

Uberlândia/MG

Telefone: (34) 3218-6800 - Fax: (34) 3218-6810

www.conprove.com – <https://forum.conprove.com> – suporte@conprove.com.br



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Version	Descriptions	Date	Author	Reviewer
1.0	Initial Version	09/11/2021	M.R.C.	M.P.S

Rua Visconde de Ouro Preto, 75 – Bairro Custódio Pereira – CEP 38405-202

Uberlândia/MG

Telefone: (34) 3218-6800 - Fax: (34) 3218-6810

www.conprove.com – <https://forum.conprove.com> – suporte@conprove.com.br

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Rua Visconde de Ouro Preto, 75 – Bairro Custódio Pereira – CEP 38405-202

Uberlândia/MG

Telefone: (34) 3218-6800 - Fax: (34) 3218-6810

www.conprove.com – <https://forum.conprove.com> – suporte@conprove.com.br

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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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Rua Visconde de Ouro Preto, 75 – Bairro Custódio Pereira – CEP 38405-202

Uberlândia/MG

Telefone: (34) 3218-6800 - Fax: (34) 3218-6810

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**PROCEDURE FOR TESTING THE ZIV DLF RELAY
ON DISTANCE 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 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.

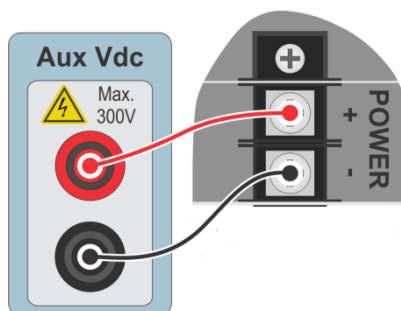


Figure 1

1.2. Analog Outputs

Connect the CE-6710 Analog Outputs V1, V2 and V3 to terminals 01, 03 and 05 of the D slot of the relay and their common ones to terminals 02, 04 and 06. Then I1, I2 and I3 connect 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.

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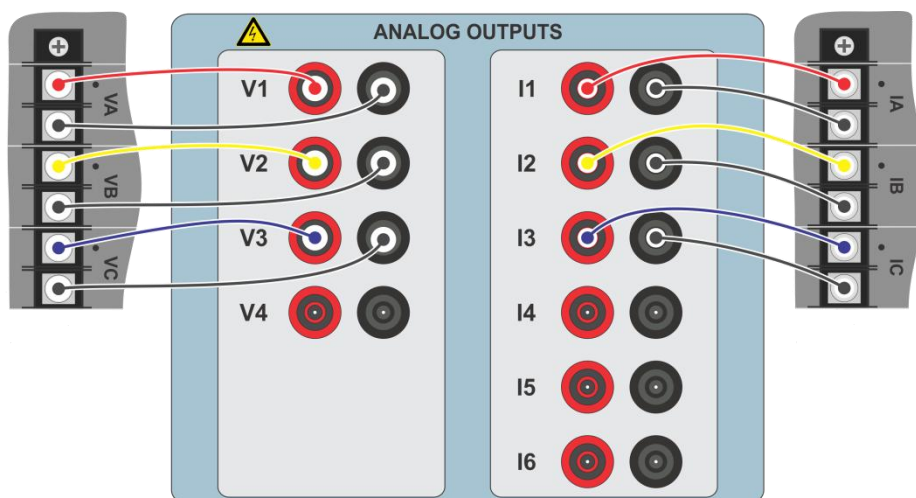


Figure 2

1.3. Binary Input

Connect the Binary Input to the binary output of the slot A relay 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)

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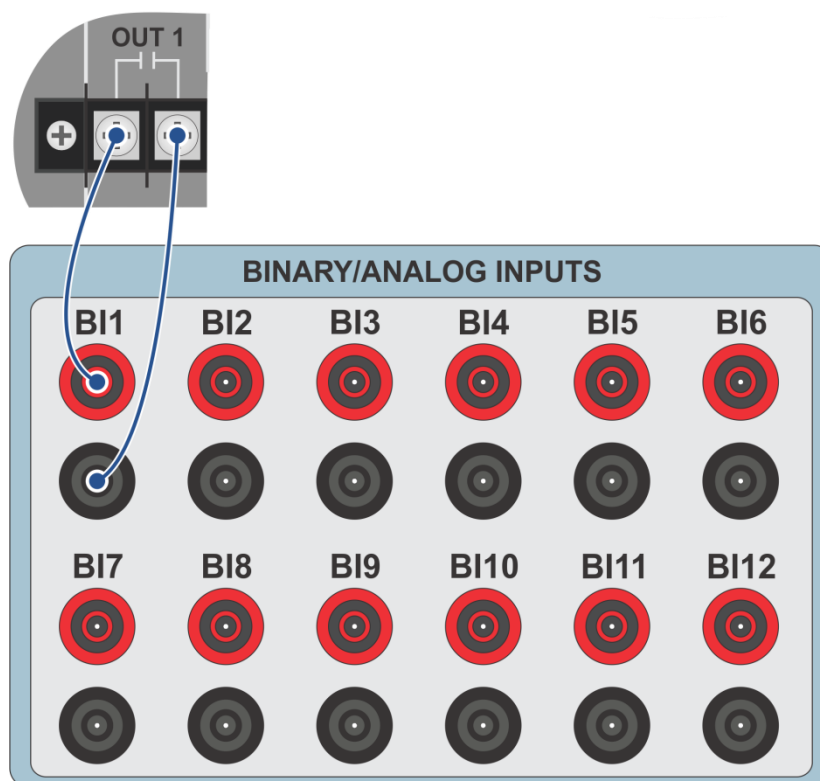


Figure 3

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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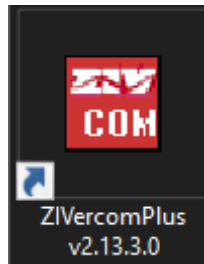


Figure 4

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

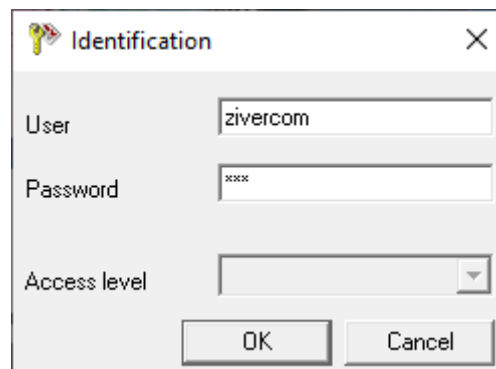


Figure 5

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

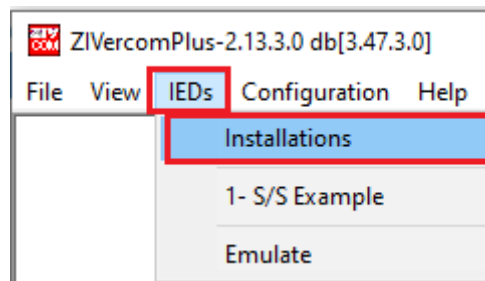


Figure 6

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

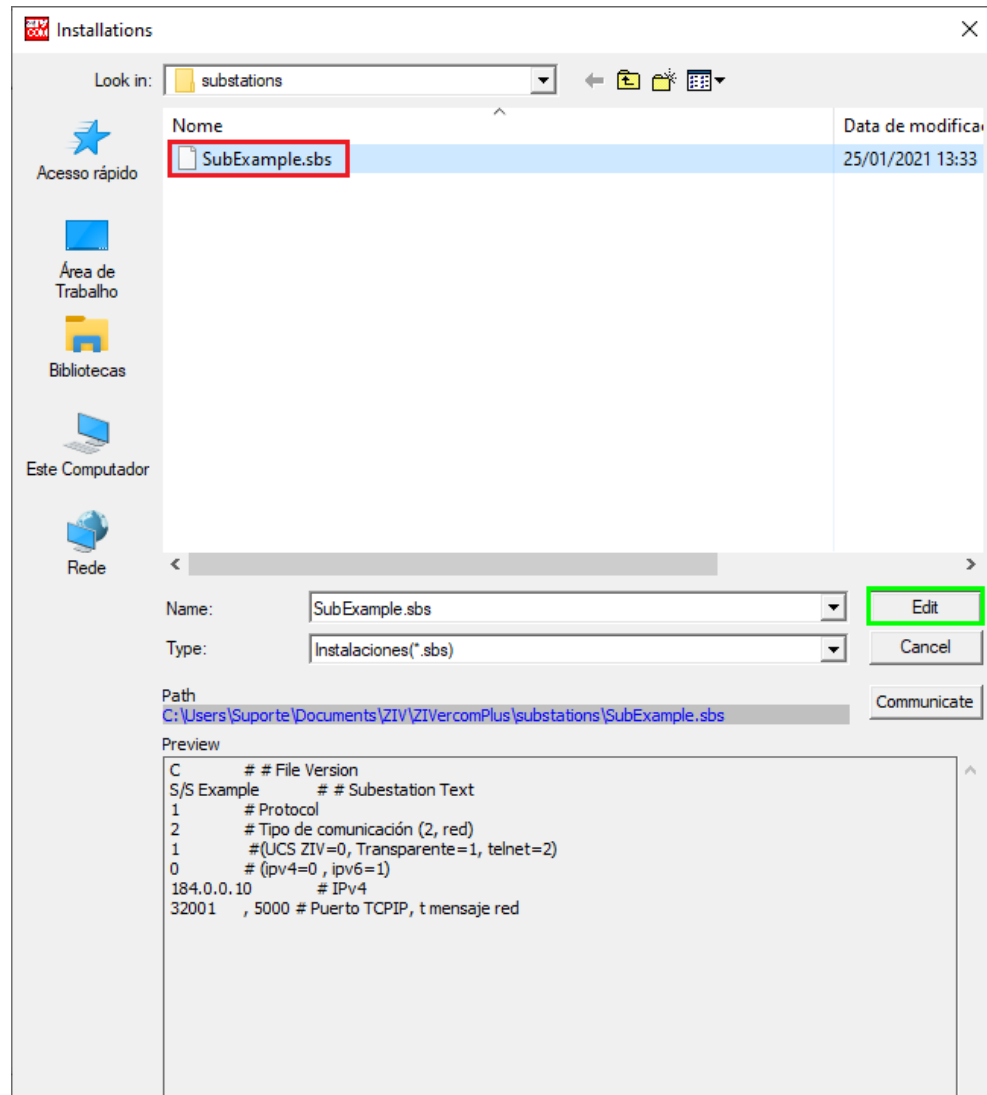
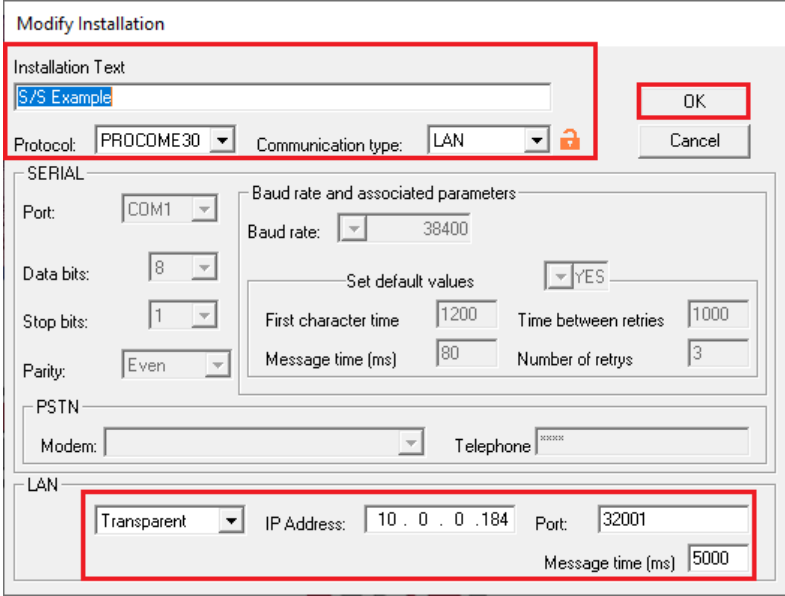


Figure 7

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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Modify Installation

Installation Text
S/S Example

Protocol: PROCOM30 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 retries: 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”.

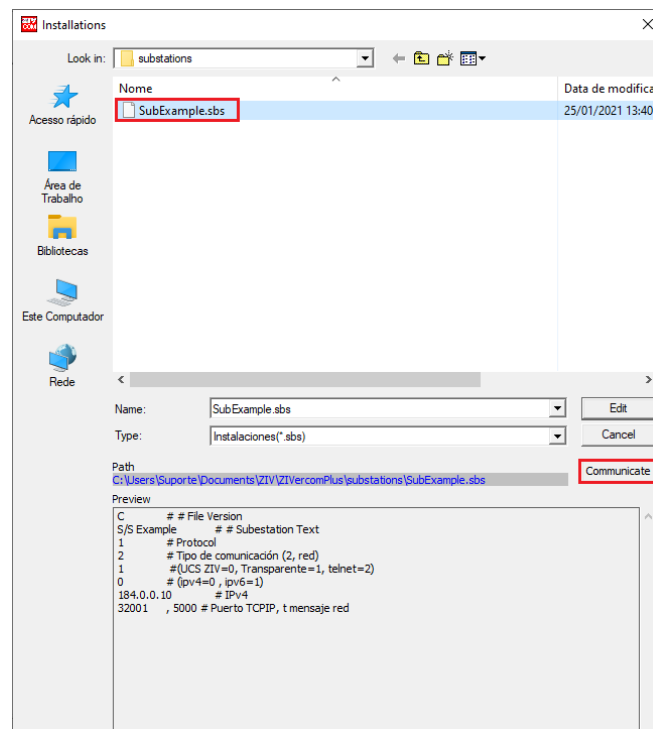


Figure 9

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Uberlândia/MG

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Click "OK" again.

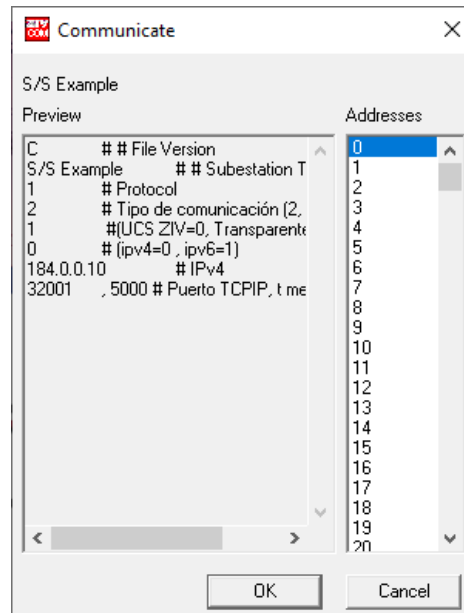


Figure 10

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"*.

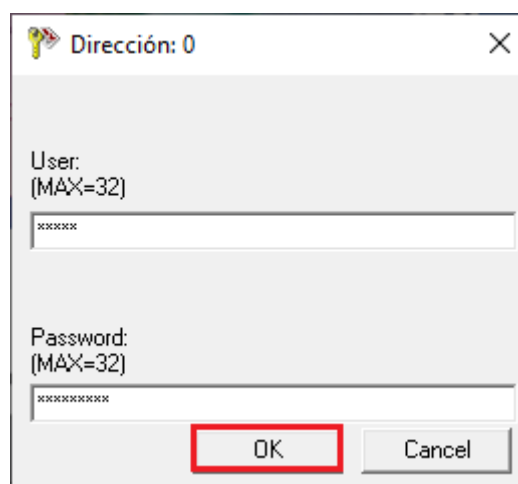


Figure 11

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

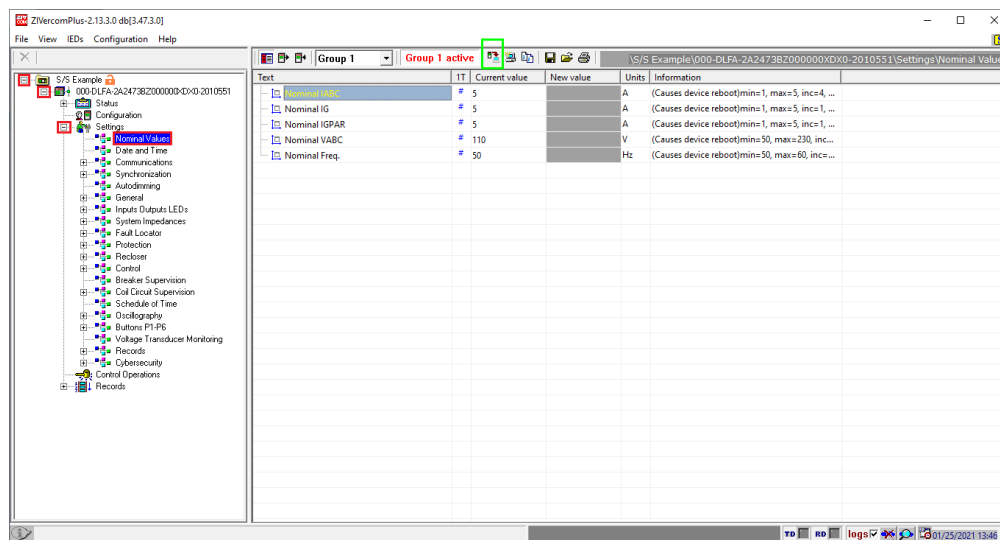


Figure 12

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

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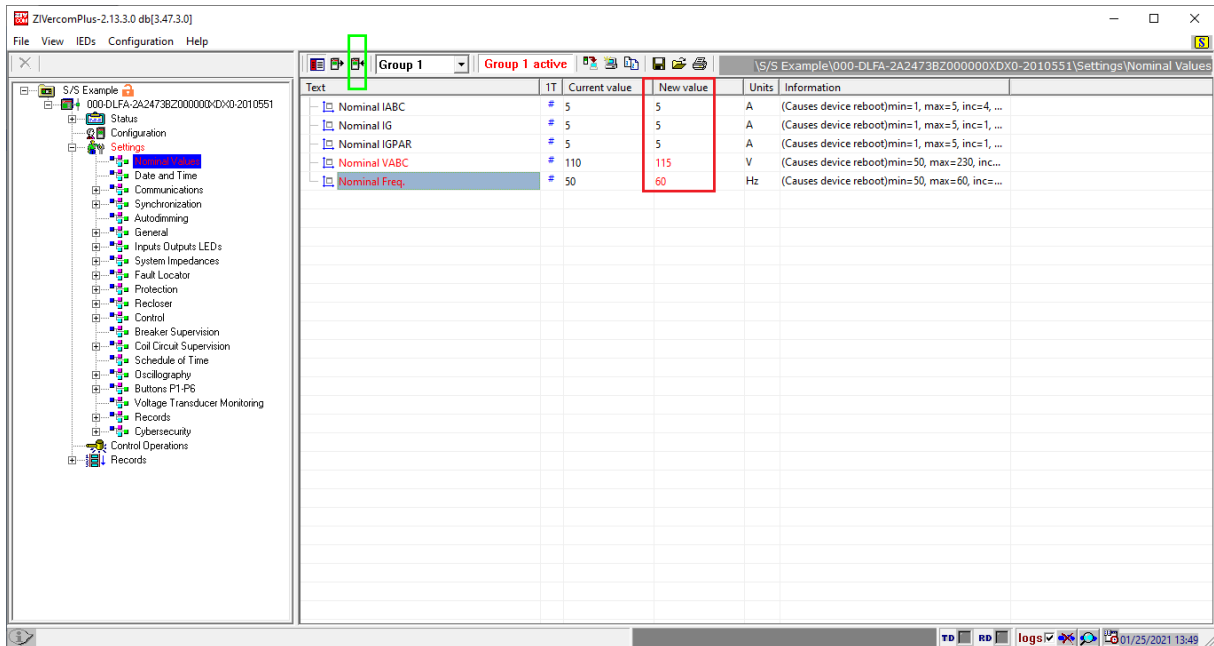


Figure 13

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.

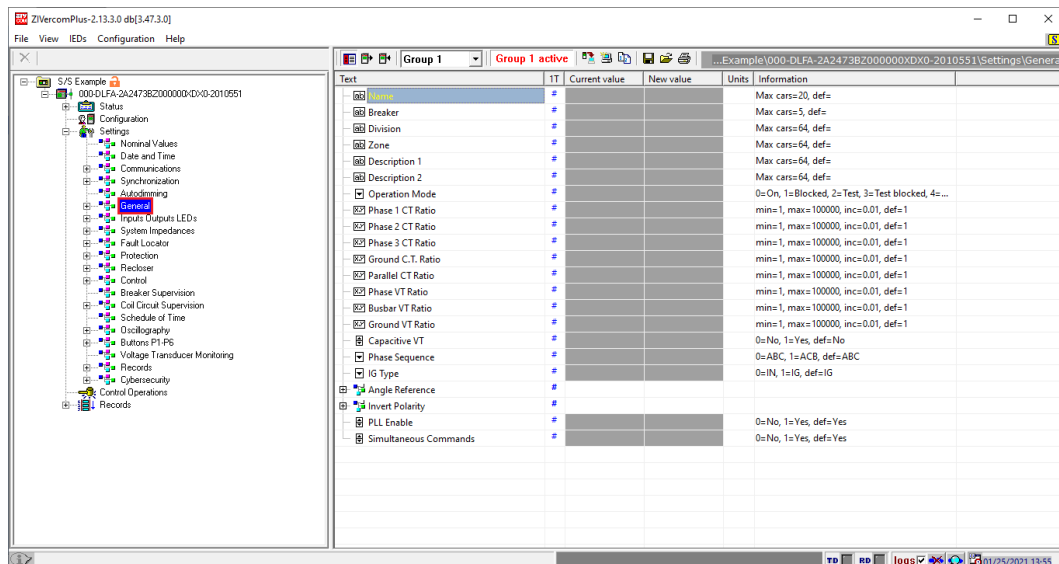


Figure 14

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

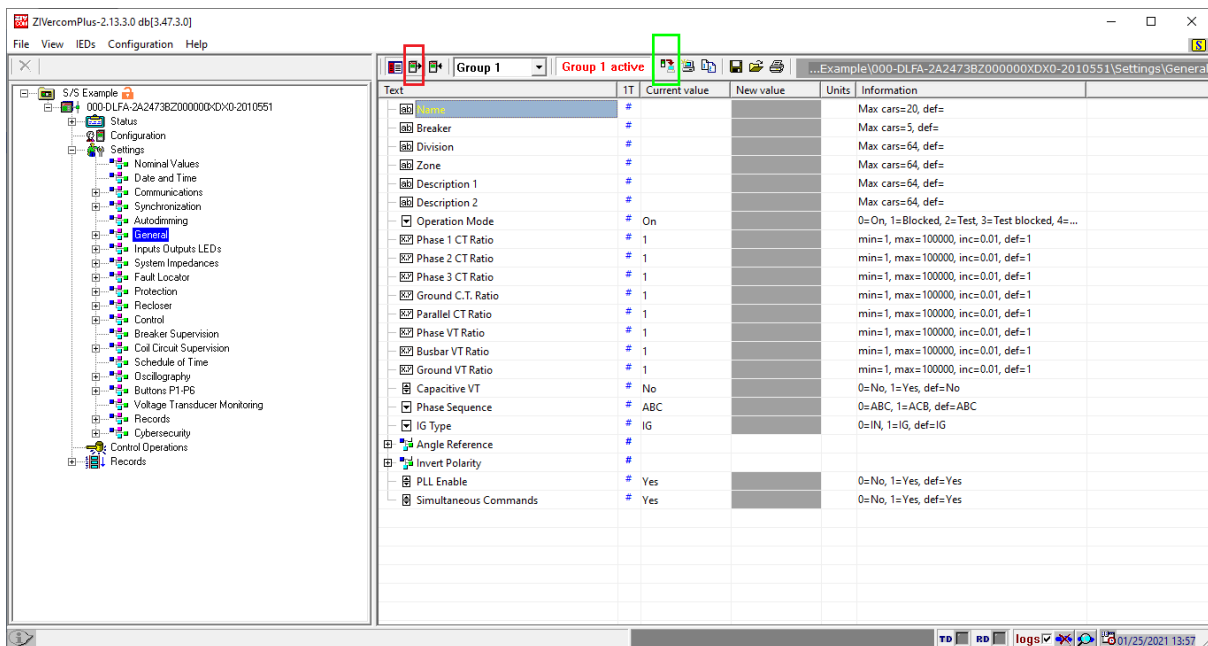


Figure 15

3.3. Characteristic

Click on the “+” signs until you reach the “*Characteristic*” option. In this option, zone types such as MHO are set. Then send the adjustments by clicking on the icon highlighted in green.

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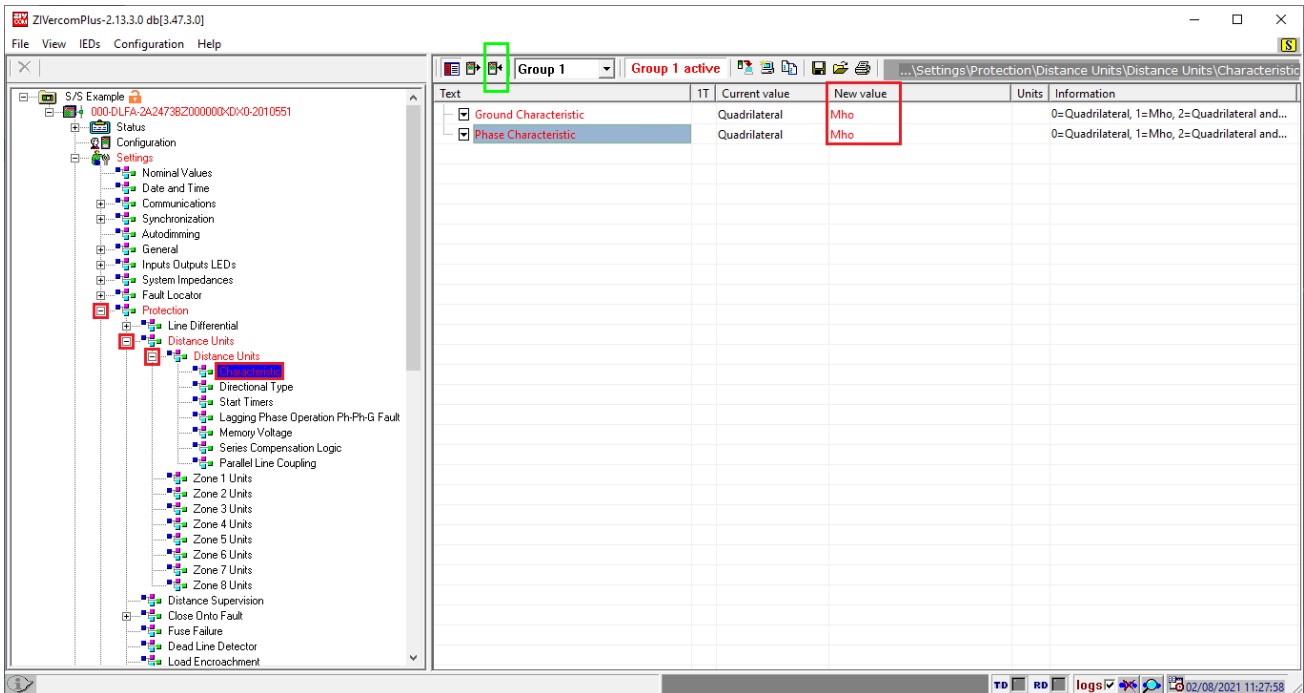


Figure 16

3.4. Zone 1 Units

Select “*Zone 1 Units*” option, enable neutral and phase element, directionality, zone reach, timing, positive and zero sequence angles, ground compensation factor, and zone blocking due to power swing. Submit the adjustments by clicking on the icon highlighted in green.

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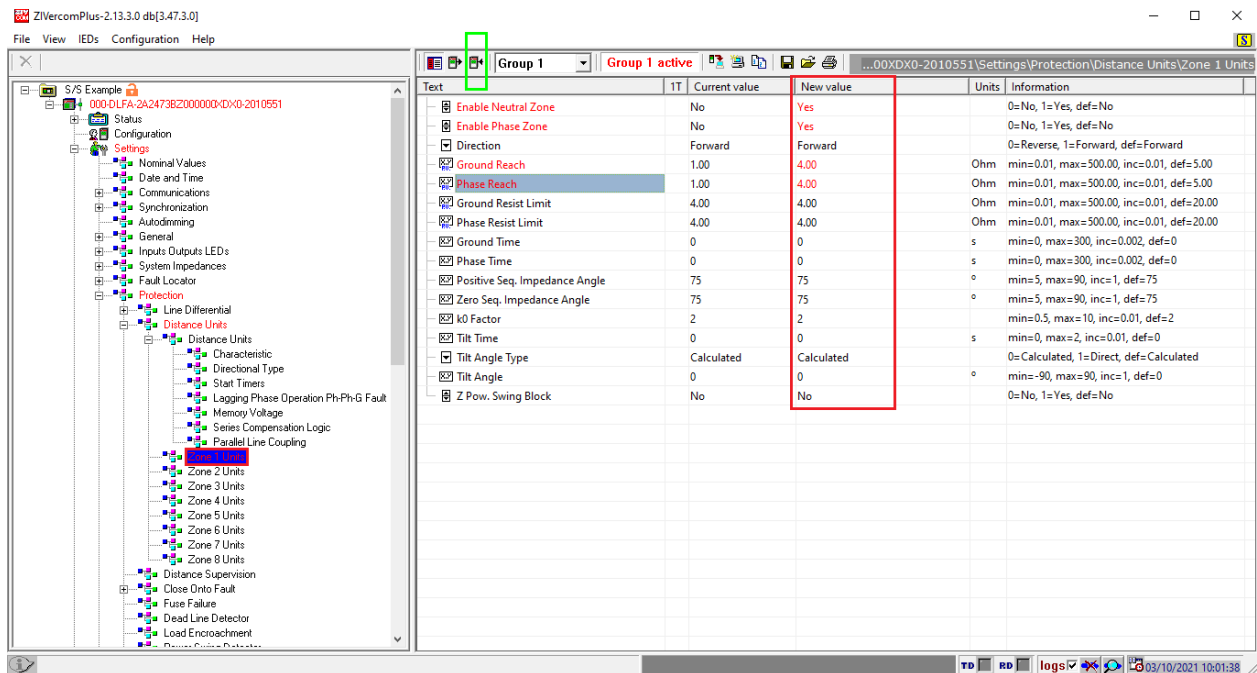


Figure 17

3.5. Zone 2 Units

Select “Zone 2 Units” option, enable neutral and phase element, directionality, zone reach, timing, positive and zero sequence angles, ground compensation factor and zone blocking due to power swing. Submit the adjustments by clicking on the icon highlighted in green.

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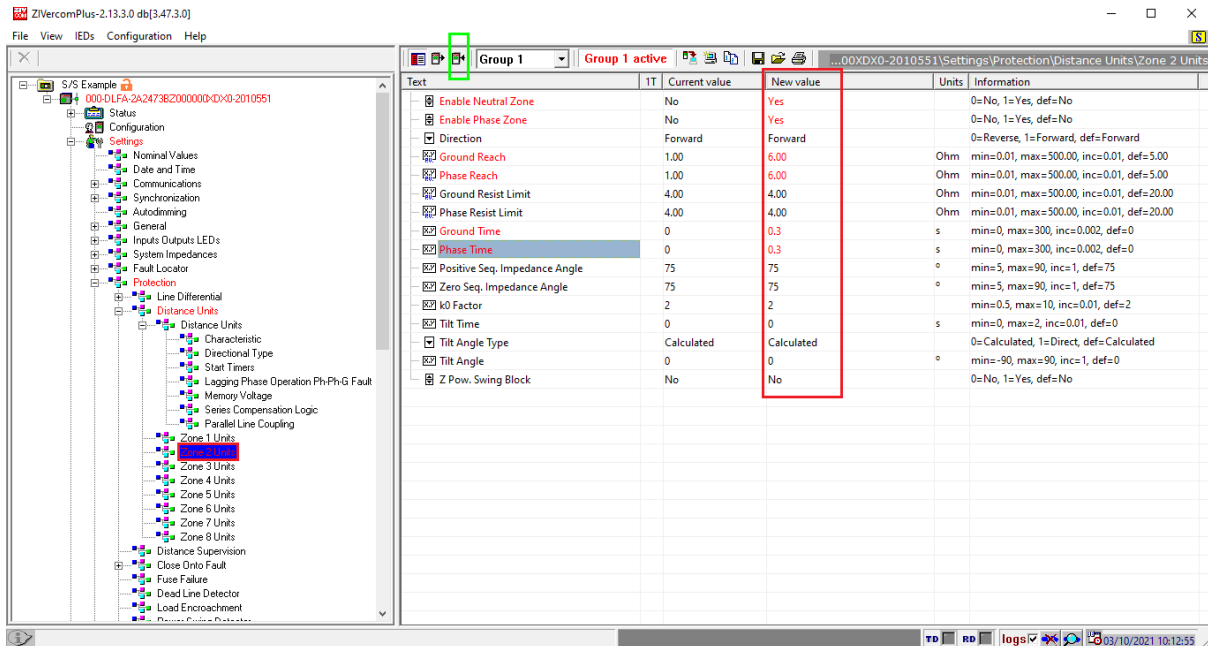


Figure 18

3.6. Zone 3 Units

Select “Zone 3 Units” option, enable neutral and phase element, directionality, zone reach, timing, positive and zero sequence angles, ground compensation factor and zone blocking due to power swing. Submit the adjustments by clicking on the icon highlighted in green.

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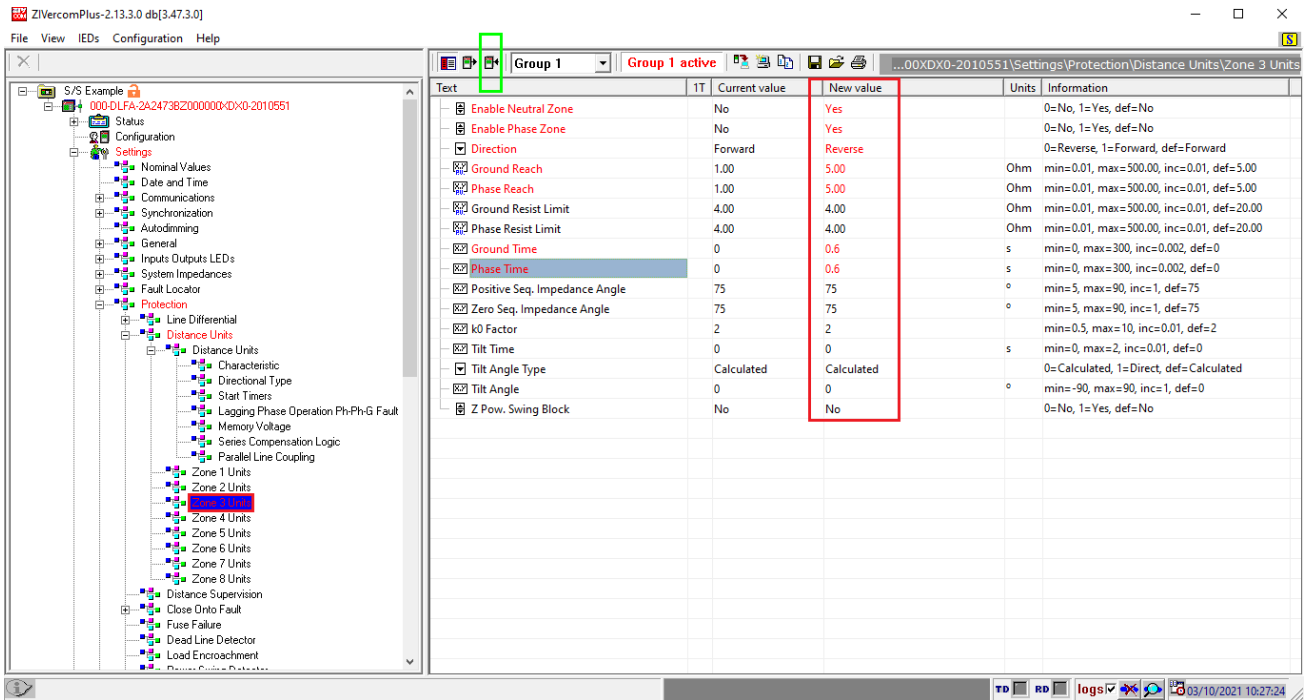


Figure 19

3.7. Distance Directional

Click on the “+” sign and select the “Distance Directional” option and set the angle.

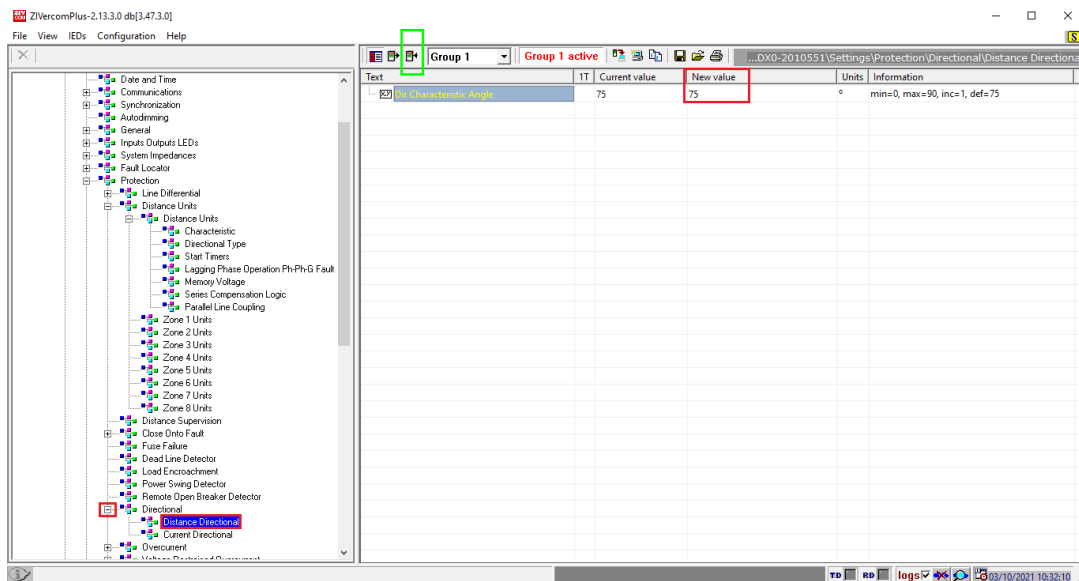


Figure 20

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3.8. Outputs

In order to test the trip signal of function 21, a binary output of the relay will be used to collect this signal by the test set. In the figure below, configure the first output as the trip of zones 1, 2 and 3, both neutral and phase.

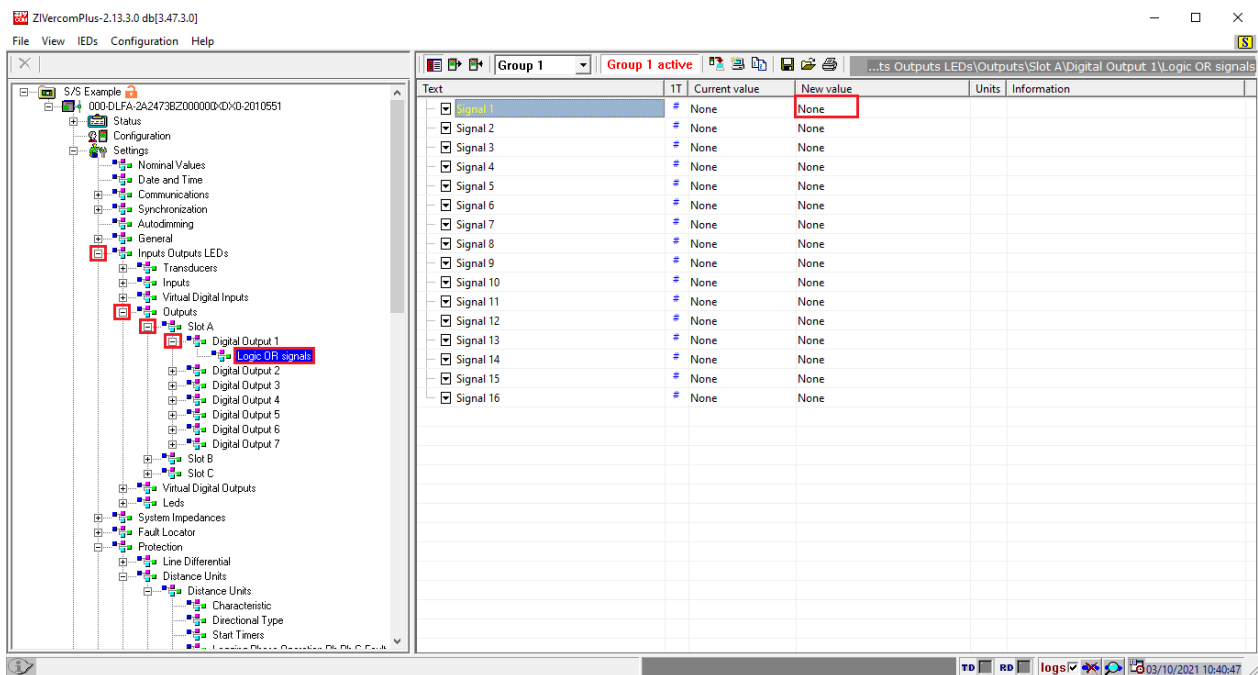


Figure 21

By clicking on the option “None”, highlighted in the previous figure, make the following adjustment.

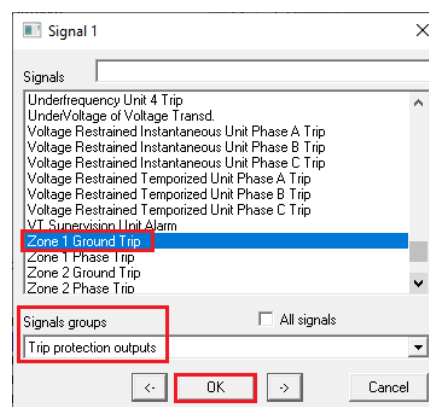


Figure 22

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Repeat the above procedure for the phase trip and zones 2 and 3.

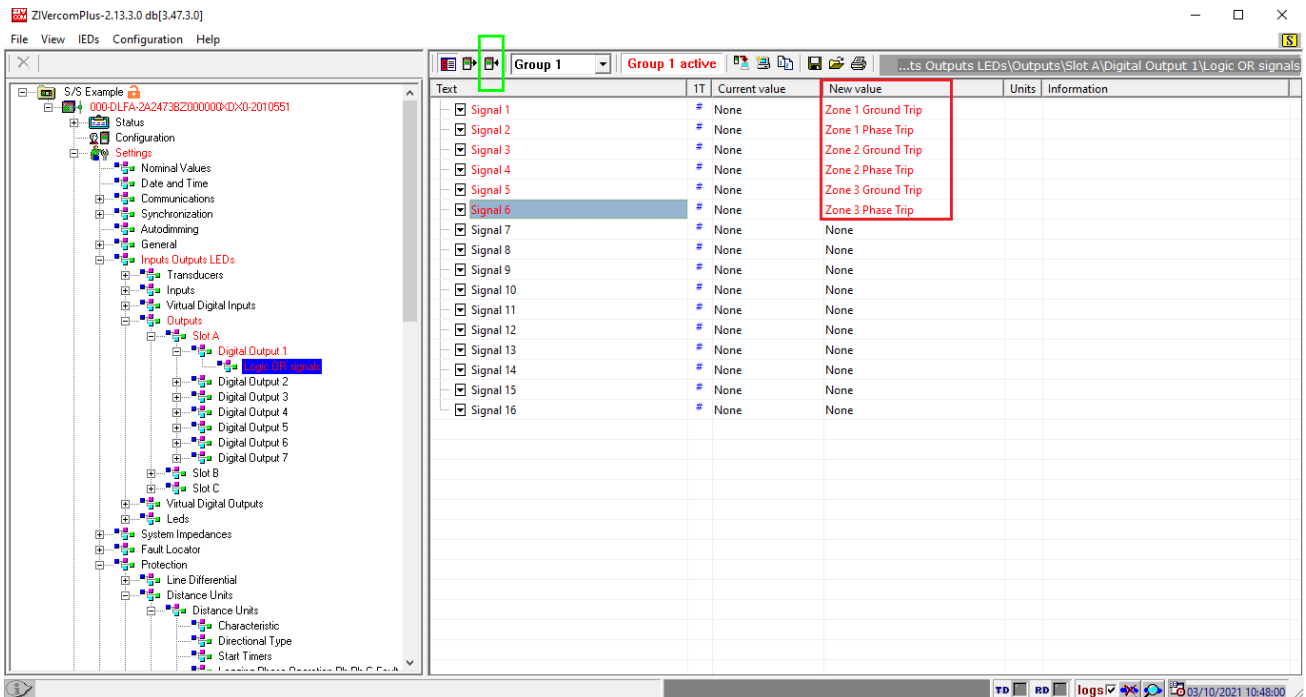


Figure 23

4. Application Manager

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

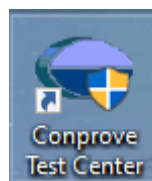


Figure 24

4.1. Distance software settings

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

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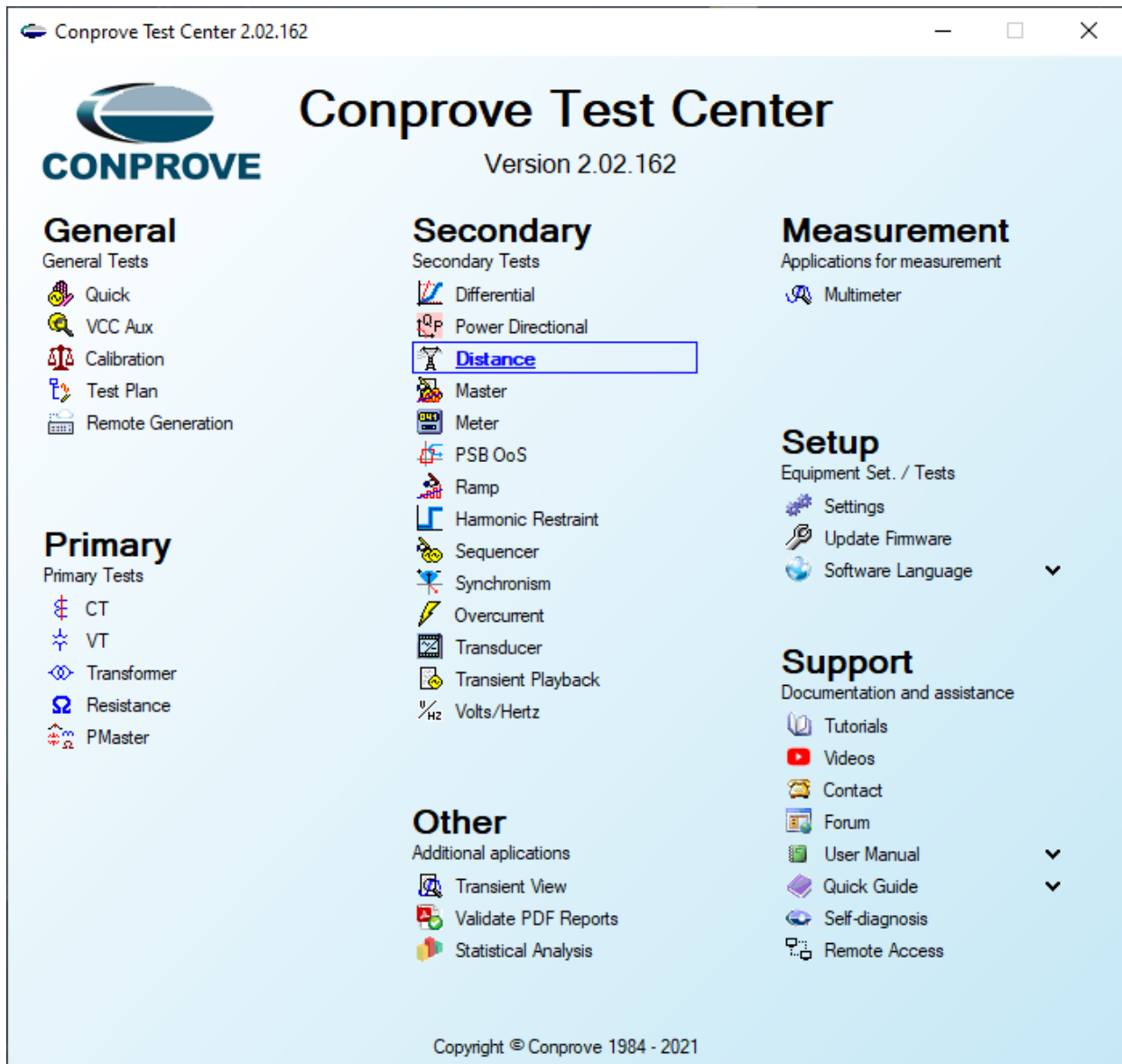


Figure 25

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.

Rua Visconde de Ouro Preto, 75 – Bairro Custódio Pereira – CEP 38405-202

Uberlândia/MG

Telephone: (34) 3218-6800 - Fax: (34) 3218-6810

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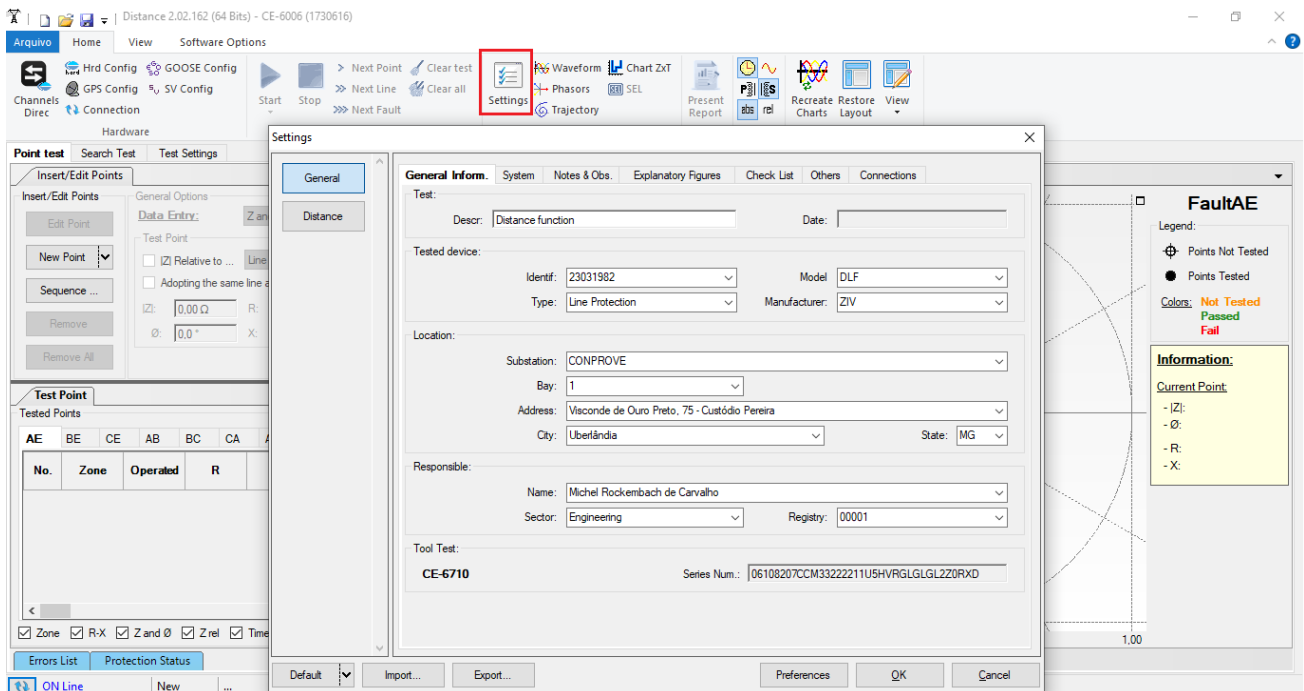


Figure 26

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.

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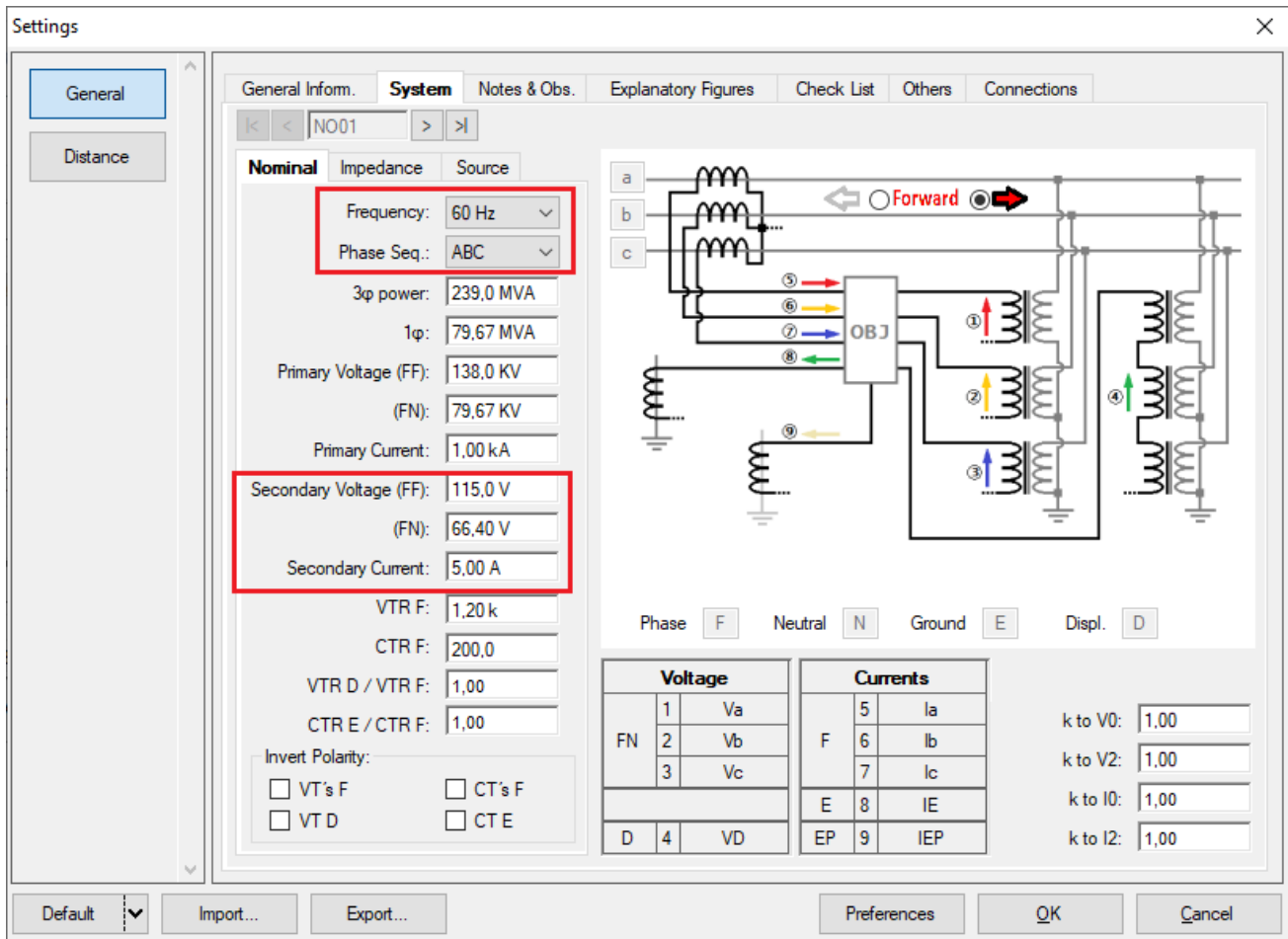


Figure 27

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. Distance screen > Distance Prot. Settings

Click on the “Distance” button, the screen shows the parameters of length, line angle and ground compensation factor. For this specific test you only need to configure the ground compensation factor.

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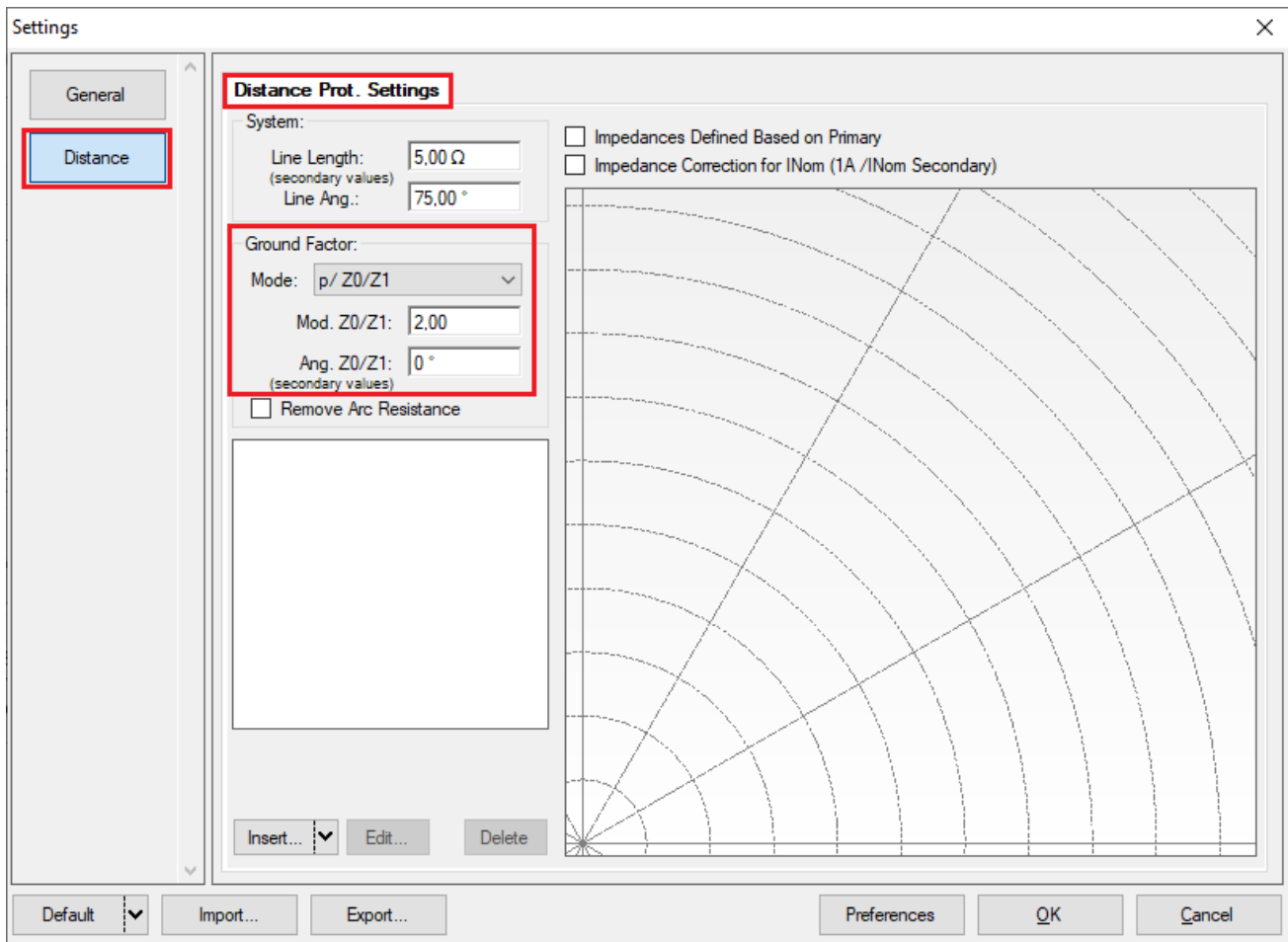


Figure 28

4.3. Entering Zone 1

Click on the “*Insert*” field highlighted in the previous figure. In the settings screen, first choose the relay mask “*ZIV DLF – Mho*”. You must adjust the actuation time, choose the type of fault (loop), enter the zone characteristics and directionality. Adjust the tolerance values and finally click on “*OK*”.

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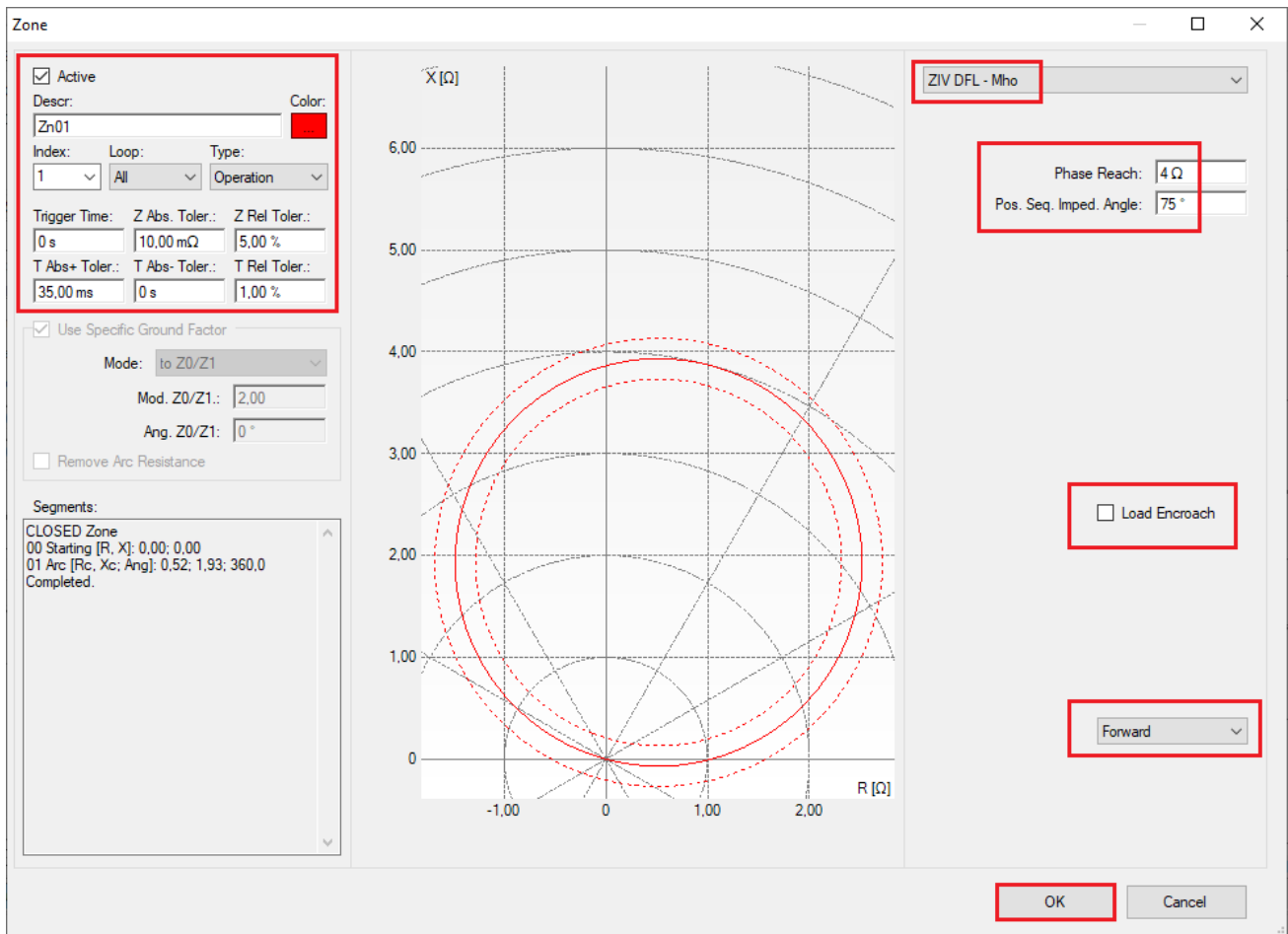


Figure 29

4.4. Entering Zone 2

Repeat the procedure and choose the relay mask “ZIV DLF – Mho”. You must adjust the actuation time, choose the type of fault (loop), enter the zone characteristics and directionality. Adjust the tolerance values and finally click on “OK”.

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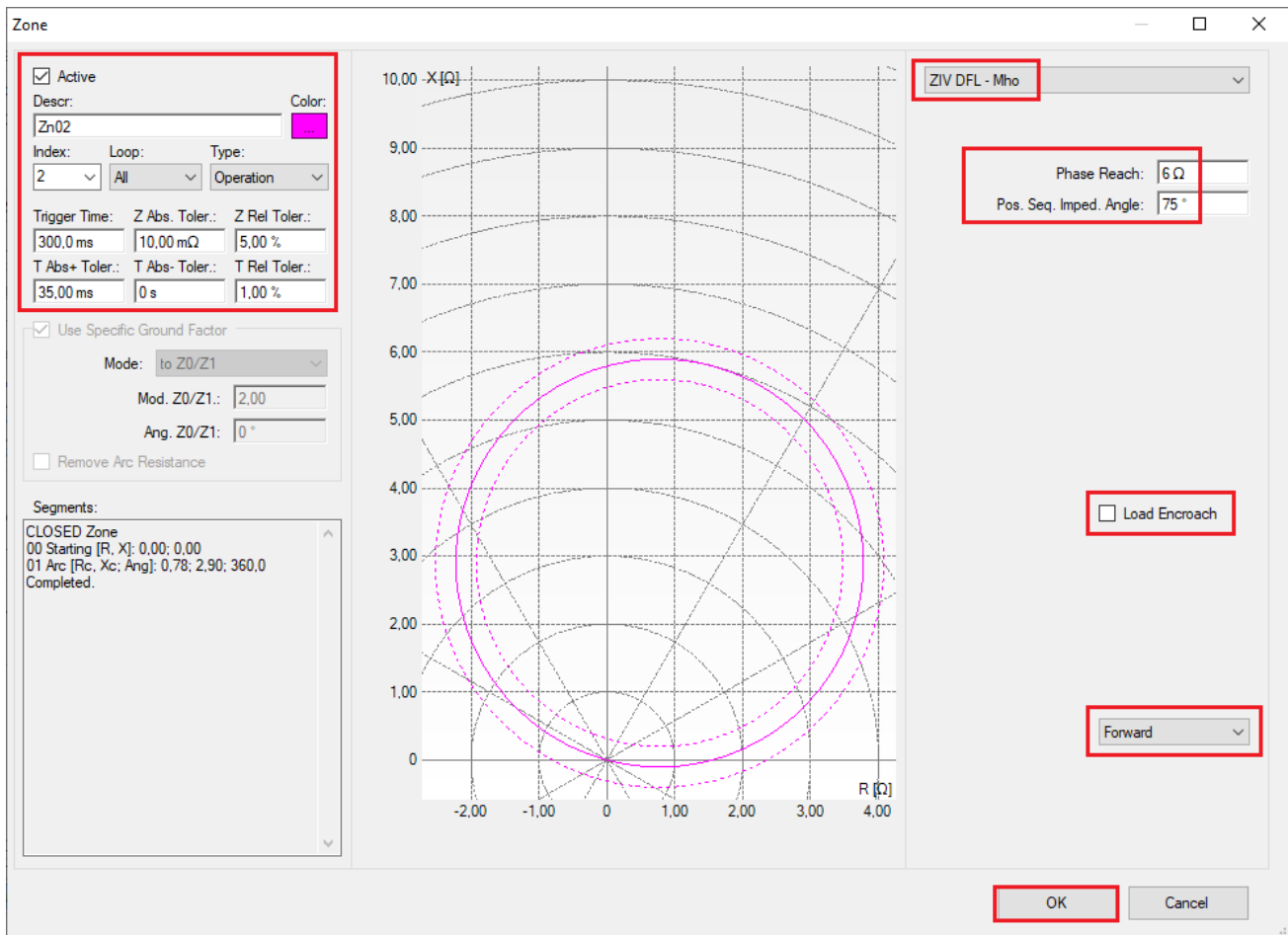


Figure 30

4.5. Entering Zone 3

Repeat the procedure and choose the relay mask “ZIV DLF – Mho”. You must adjust the actuation time, choose the type of fault (loop), enter the zone characteristics and directionality. Adjust the tolerance values and finally click on “OK”.

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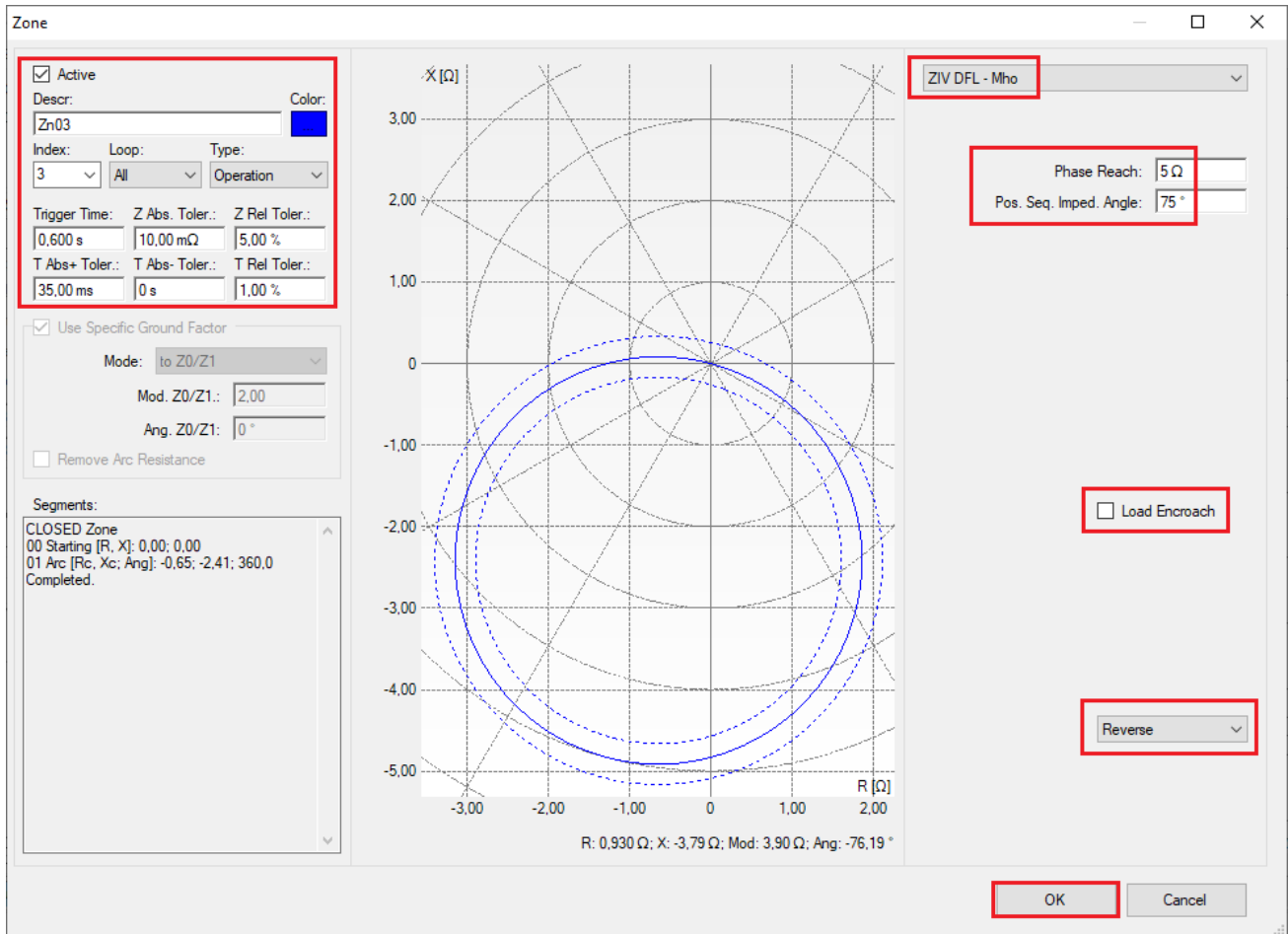


Figure 31

5. Channel Direction and Hardware Configurations

Click on the icon illustrated below.

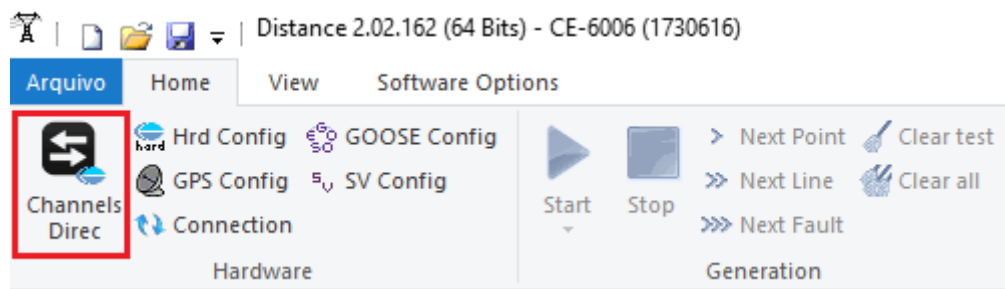


Figure 32

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Then click on the highlighted icon to configure the hardware.

Channels Direct.

Local

Model: CE-6710

Reset for Hard. Connected

Hard Set Basic Advanced

Hard.: Adapt I/Os

Nodes: Autoassociate

Serial Number: 06108207CCM3322211U5HVRGLGL2Z0RXD

ON Line S. Value...

GOOSE... Clean

Confirm Cancel

Autoassociate Clean Import... Export...

Outputs: Analog. and SV Inputs: Analog. and SV Outputs: Binary, GOOSE and Analog DC Inputs: Binary, GOOSE and Analog DC Logical

1/1

Nominal Line Source

Frequency: 60 Hz

Phase Seq.: ABC

3 ϕ power: 239.0 MVA

1 ϕ : 79.67 MVA

Primary Voltage (FF): 138.0 KV

(FN): 79.67 KV

Primary Current: 1.00 kA

Secondary Voltage (FF): 115.0 V

(FN): 66.40 V

Secondary Current: 5.00 A

VTR F: 1.20 k

CTR F: 200.0

VTR D / VTR F: 1.00

CTR E / CTR F: 1.00

Reverse Polarity:

VT's F CT's F

VT D CT E

Equal Parameters Among Nodes

Diagram showing transformer connections and current flow (Forward).

Voltage		Channel		Currents		Channel	
FN	1	Va	AO_V01	5	Ia	AO_I01	Σ
	2	Vb	AO_V02	6	Ib	AO_I02	Σ
	3	Vc	AO_V03	7	Ic	AO_I03	Σ
FF		Vab		E	8	IE	
		Vbc		EP	9	IEP	
		Vca					
D	4	VD					
Calc.		k.V0		Calc.		k.I0	
		k.V2				k.I2	
k	to V0	1.00	to V2	1.00	k	to I0	1.00
						to I2	1.00

Analog Outputs

Sampled Value Outputs

Descr.	Hardware	Node	Point
AO_V01	V1	NO01	Va
AO_V02	V2	NO01	Vb
AO_V03	V3	NO01	Vc
AO_V04	V4	NO01	UD

Current Channels

Descr.	Hardware	Node	Point
AO_I01	I1	NO01	Ia
AO_I02	I2	NO01	Ib
AO_I03	I3	NO01	Ic
AO_I04	I4	NO01	UD
AO_I05	I5	NO01	UD
AO_I06	I6	NO01	UD

Figure 33

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

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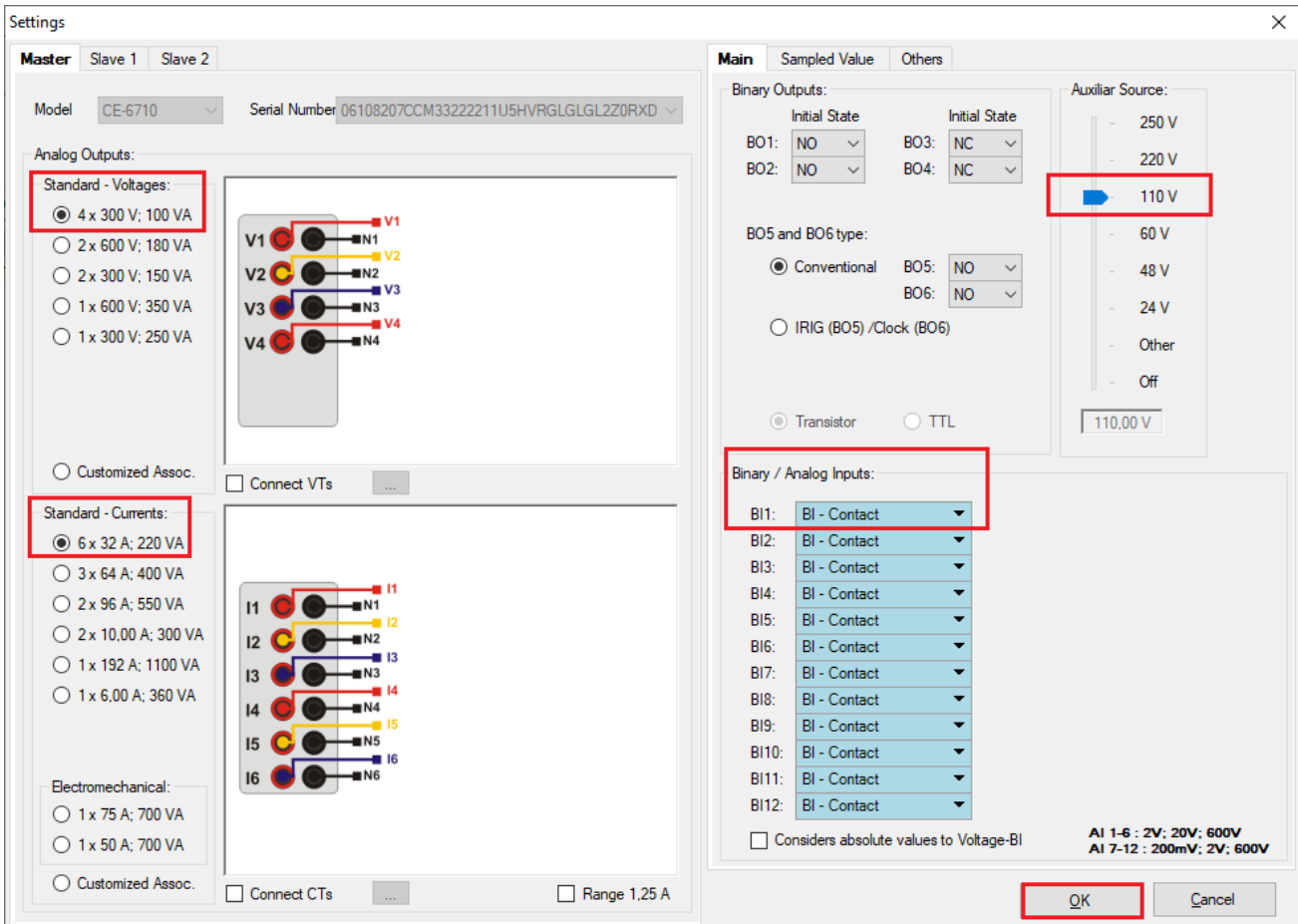


Figure 34

On the next screen choose “Basic” and on the next window (didn’t show) choose “YES”, finally click on “Confirm”.

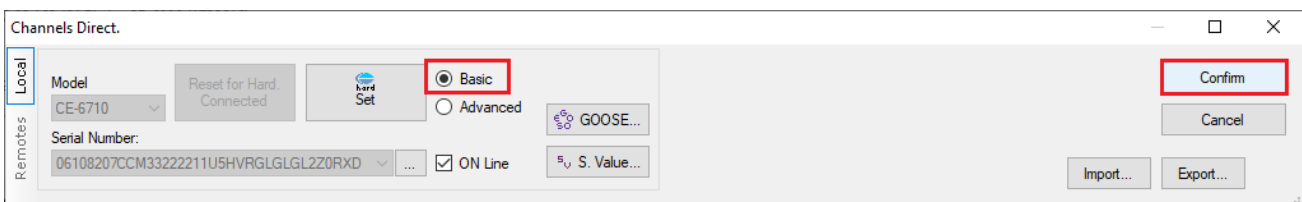


Figure 35

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6. Restore Layout

Due to the great flexibility that the software presents, allowing the user to choose which windows are displayed and in which position, the command is used to restore the default settings. Click on the *“Recreate Charts”* button and then click on *“Restore Layout”*.

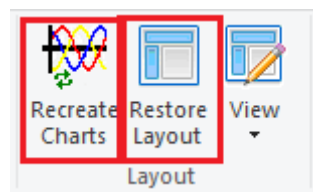


Figure 36

7. Test structure for function 21

7.1. Test Settings

By clicking on the *“Test Settings”* tab, the user must insert a pre-fault with balanced nominal voltages and currents with null values so that the test takes place properly. Another important setting is the binary input used as a stopwatch which for ground units is set to *“BI01”*.

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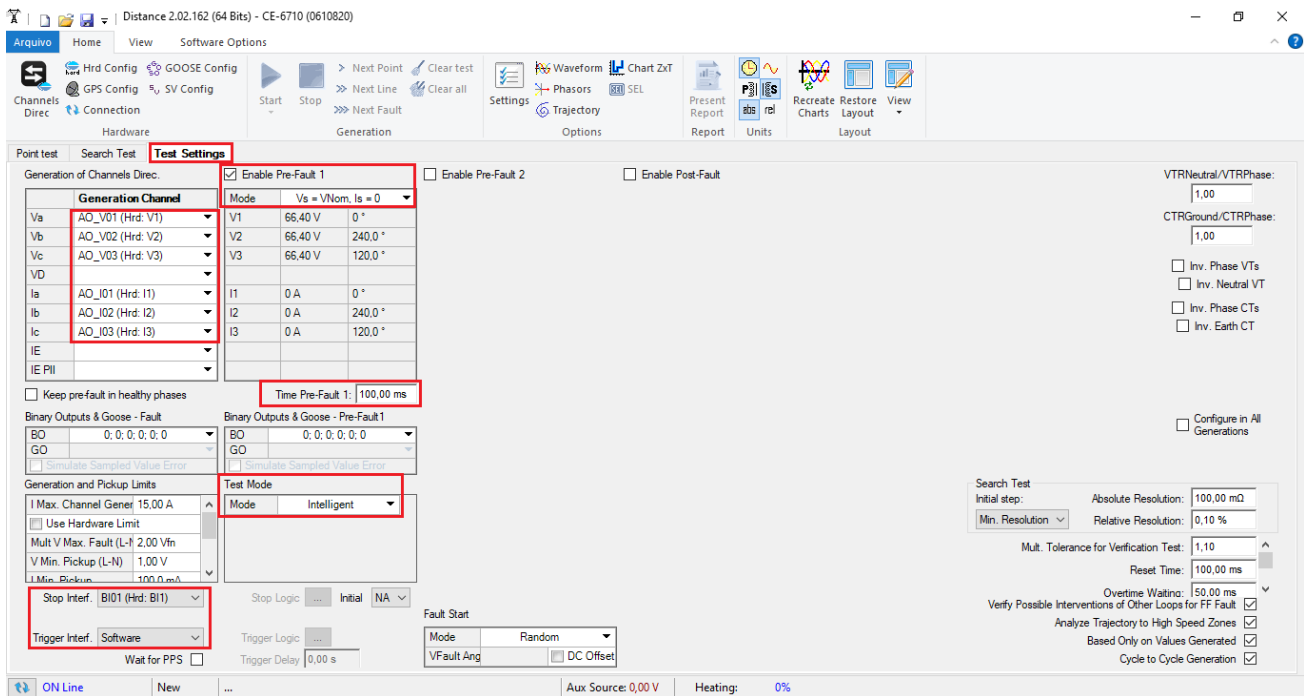


Figure 37

7.2. Search Test

There are two types of tests, the “*Point Test*” and the “*Search Test*”, however only the search will be presented.

INSTRUMENTOS PARA TESTES ELÉTRICOS

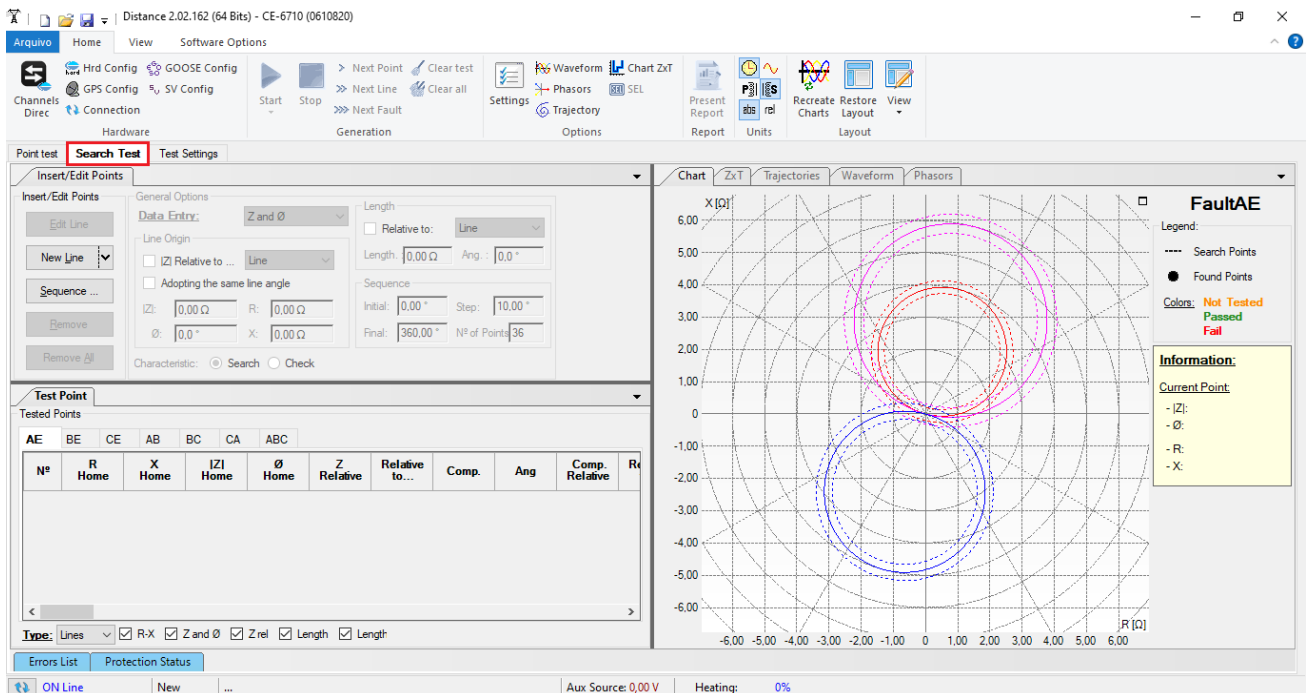


Figure 38

On the “*Insert/Edit Points*” tab, click on the “*Sequence*” button. Choose the types of faults, in this case, for simplicity, AE, AB and ABC were chosen.

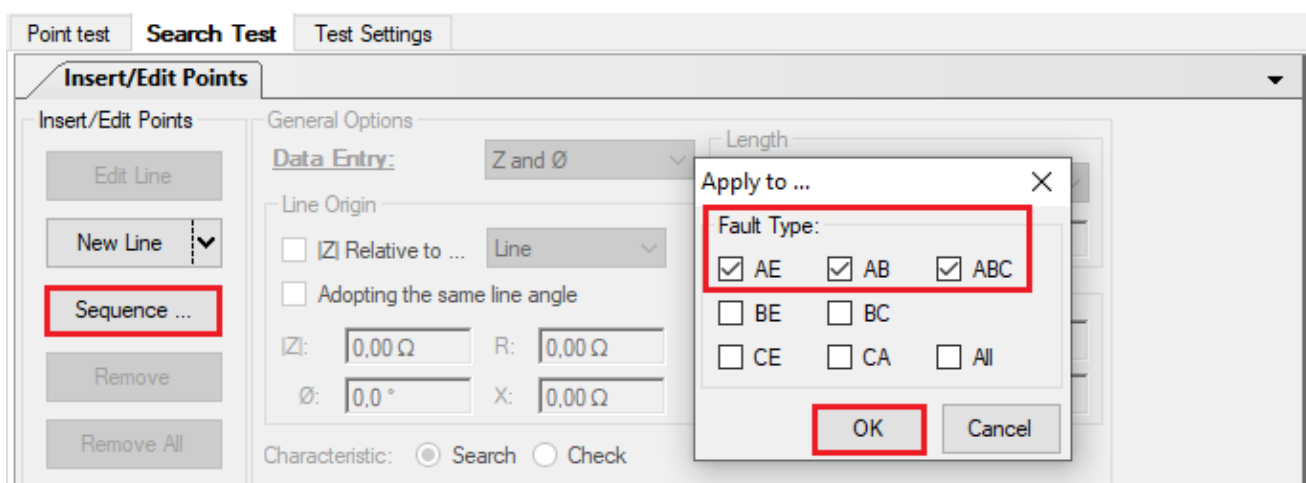


Figure 39

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Choose a start point as the origin, set a length value, choose a start angle, end angle, and pitch. In this way the search lines are drawn automatically.

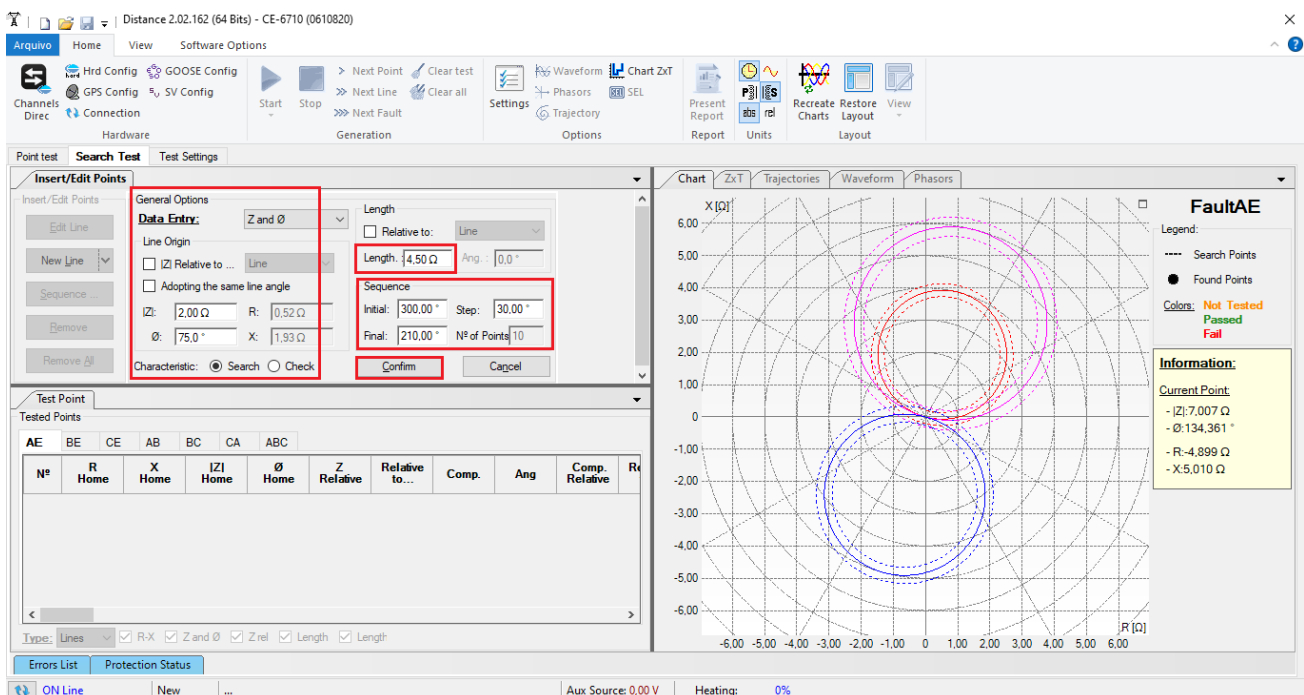


Figure 40

Click on the “*Confirm*” button to create the search lines for zones 1 and 2. For zone 3 a new sequence must be entered by repeating the procedure.

INSTRUMENTOS PARA TESTES ELÉTRICOS

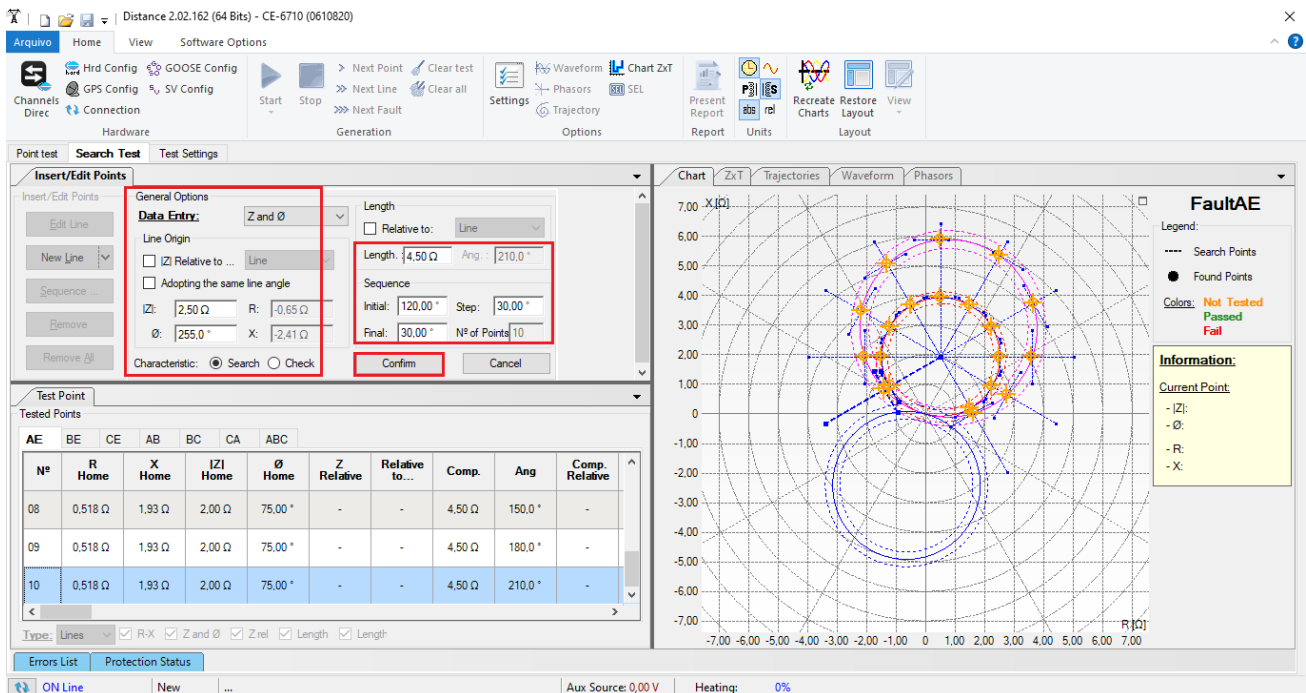


Figure 41

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

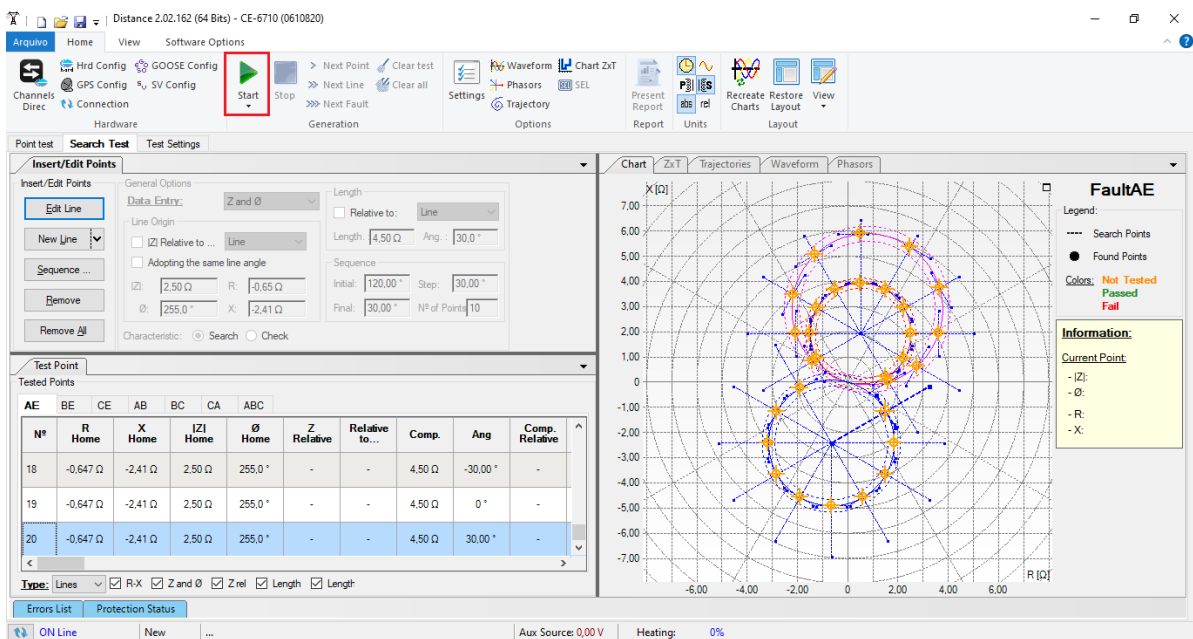


Figure 42

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7.3. Final result fault AE

By clicking on the “AE” tab, the final result is verified. It is observed that all points are within the tolerances given by the manufacturer so that the test is approved.

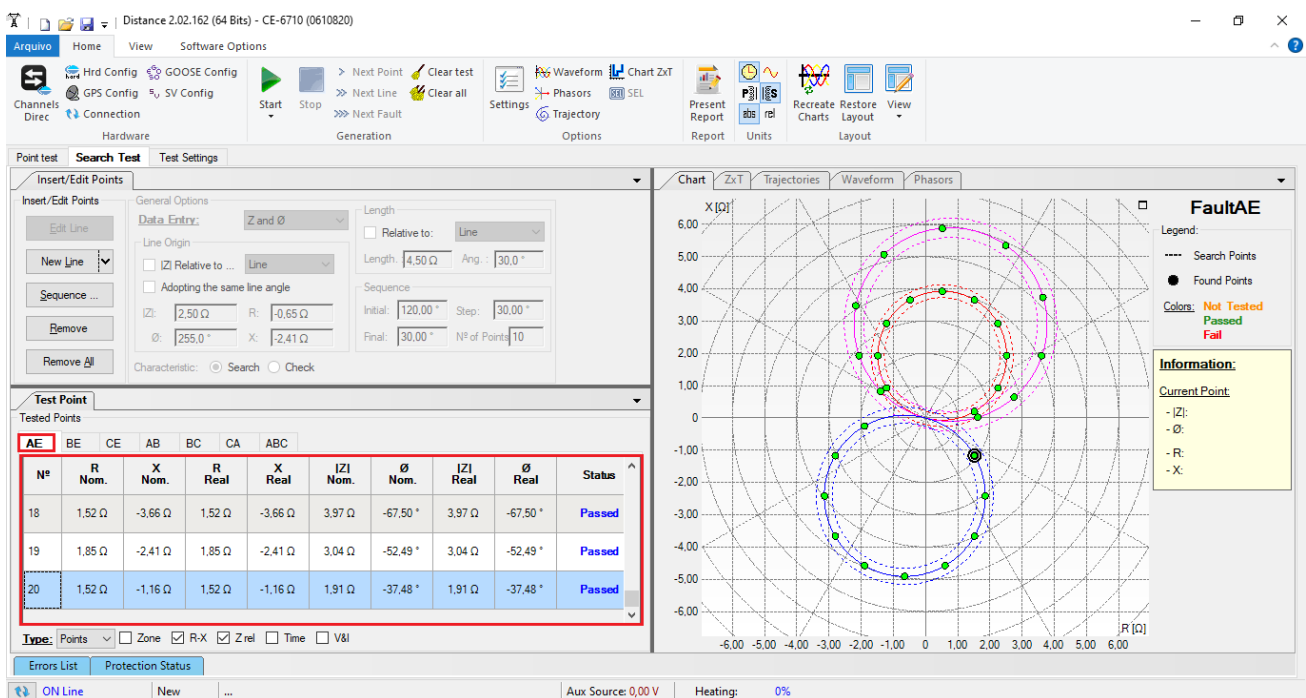


Figure 43

7.4. Final result fault AB

By clicking on the “AB” tab, the final result is verified. It is observed that all points are within the tolerances given by the manufacturer so that the test is approved.

INSTRUMENTOS PARA TESTES ELÉTRICOS

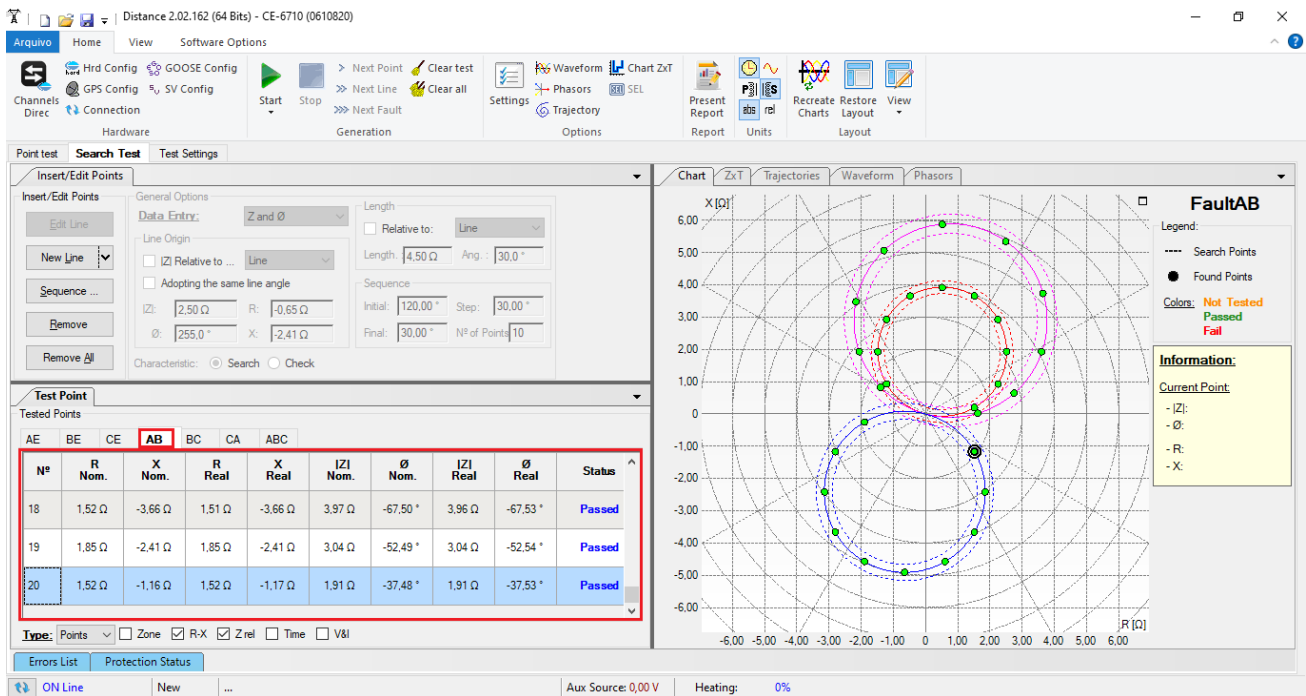


Figure 44

7.5. Final result fault ABC

By clicking on the “ABC” tab, the final result is verified. It is observed that all points are within the tolerances given by the manufacturer so that the test is approved.

INSTRUMENTOS PARA TESTES ELÉTRICOS

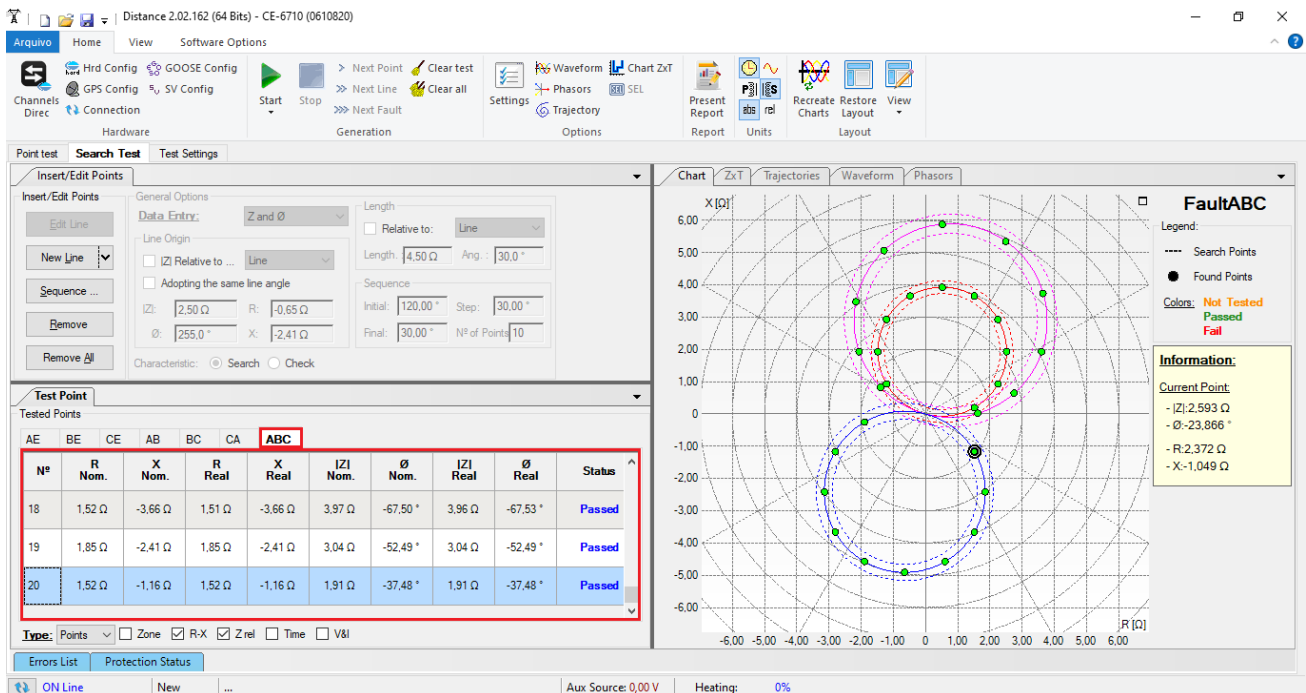


Figure 45

8. 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.

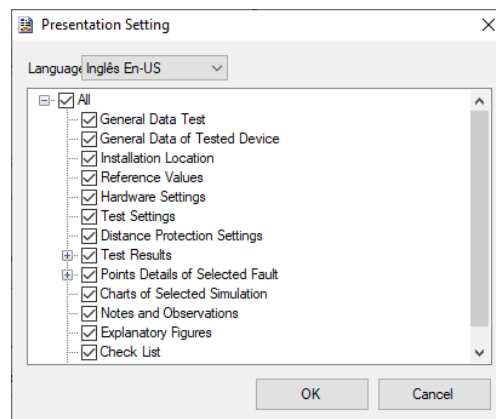


Figure 46

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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.

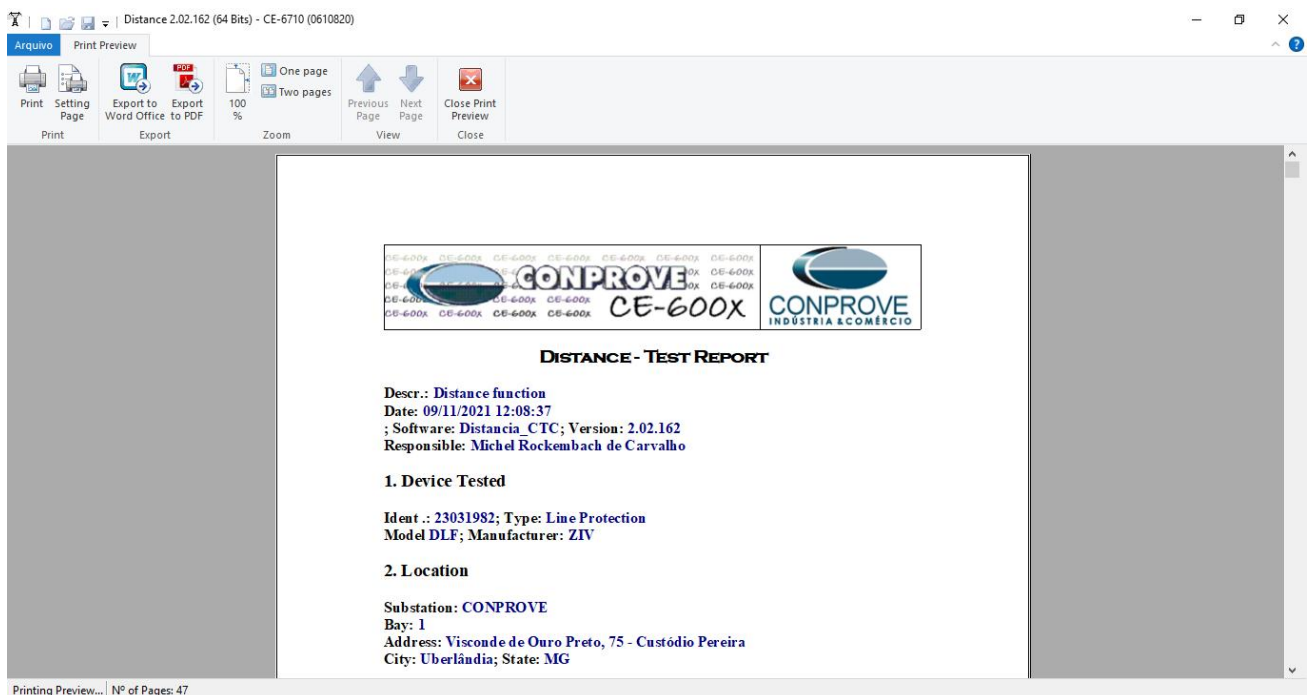


Figure 47

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9. Appendix A - Manufacturer Tolerances

Distance Elements	Pickup in Line Angle (static test)	$\pm 5\%$ or $\pm 0.01 \Omega$ ($V > 0.5 V$) of the theoretical value (the greater)
Time Measurement	Fixed Time	$\pm 1\%$ of the setting or $\pm 35 ms$ (the greater)

Figure 48

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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 49

INSTRUMENTOS PARA TESTES ELÉTRICOS

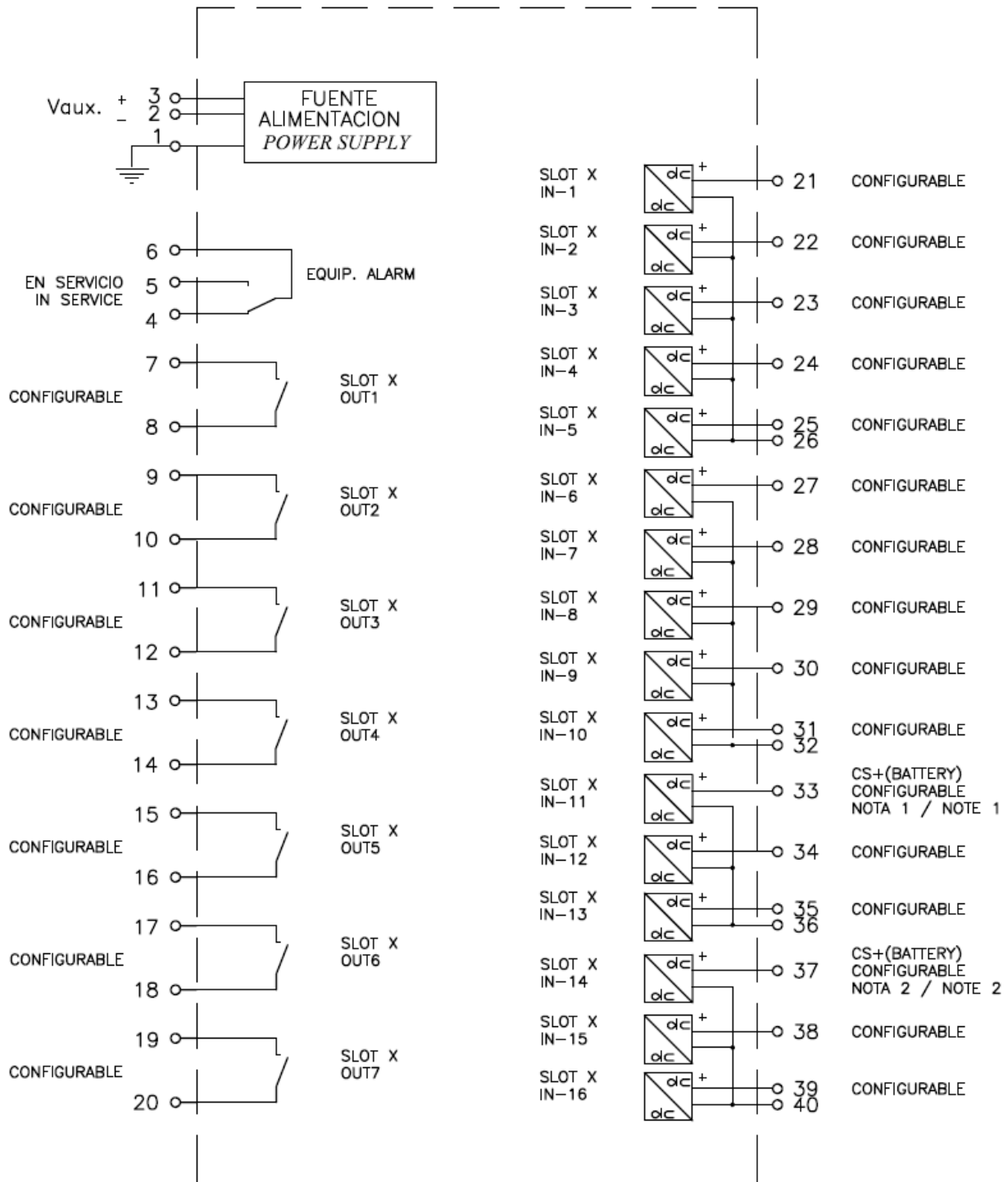


Figure 50

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11. Parameter Equivalence between Relay and Software

Table 2

Distance Software		ZIV DLF Relay	
Parameter	Figure	Parameter	Figure
Mod. Z0/Z1	28	K0 factor	17
Ang. Z0/Z1	28	Zero Seq. Impedance Angle subtracted Positive Seq. Impedance Angle	17
Zn01		Zone 1 Units	
Phase Reach	29	Phase Reach	17
Pos. Seq. Imped. Angle	29	Positive Seq. Impedance Angle	17
Trigger Time	29	Ground Time = Phase Time	17
Zn02		Zone 2 Units	
Phase Reach	30	Phase Reach	18
Pos. Seq. Imped. Angle	30	Positive Seq. Impedance Angle	18
Trigger Time	30	Ground Time = Phase Time	18
Zn03		Zone 3 Units	
Phase Reach	31	Phase Reach	19
Pos. Seq. Imped. Angle	31	Positive Seq. Impedance Angle	19
Trigger Time	31	Ground Time = Phase Time	19