# TEST TUTORIAL

**EQUIPMENT TYPE**: Protection Relay.

**BRAND:** ZIV.

**MODEL:** IDF.

**FUNCTION:** 87 or PDIF Differential.

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

**OBJECTIVE:** Point Test and Slope Characteristic Survey.

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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 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 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.

## Copyright

# PROCEDURE FOR TESTING THE ZIV IDF RELAY ON DIFFERENTIAL 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 IDF 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.

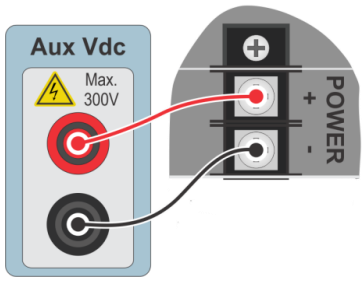


Figure 1

### 1.2. Analog Outputs

Connect the CE-6710 Analog Outputs I1, I2 and I3 to terminals 07, 09 and 11 of the D slot of the relay and their commons to terminals 08, 10 and 12, respectively. Connect channels I4, I5 and I6 to terminals 13, 15 and 17 and their common channels to terminals 14, 16 and 18. The following figure shows the procedure.

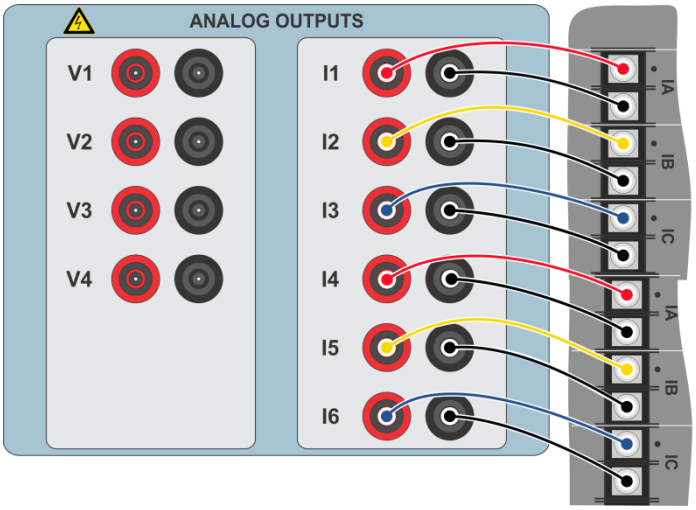


Figure 2

## 1.3. Binary Input

Connect the Binary Input to the binary output of the slot A relay as instructed in the table and figure below.

Table 1

| CE-6710 (*Binary Inputs*) | IDF (*Slot A*) |
|---|---|
| BI1 | OUT 1 (07 e 08) |

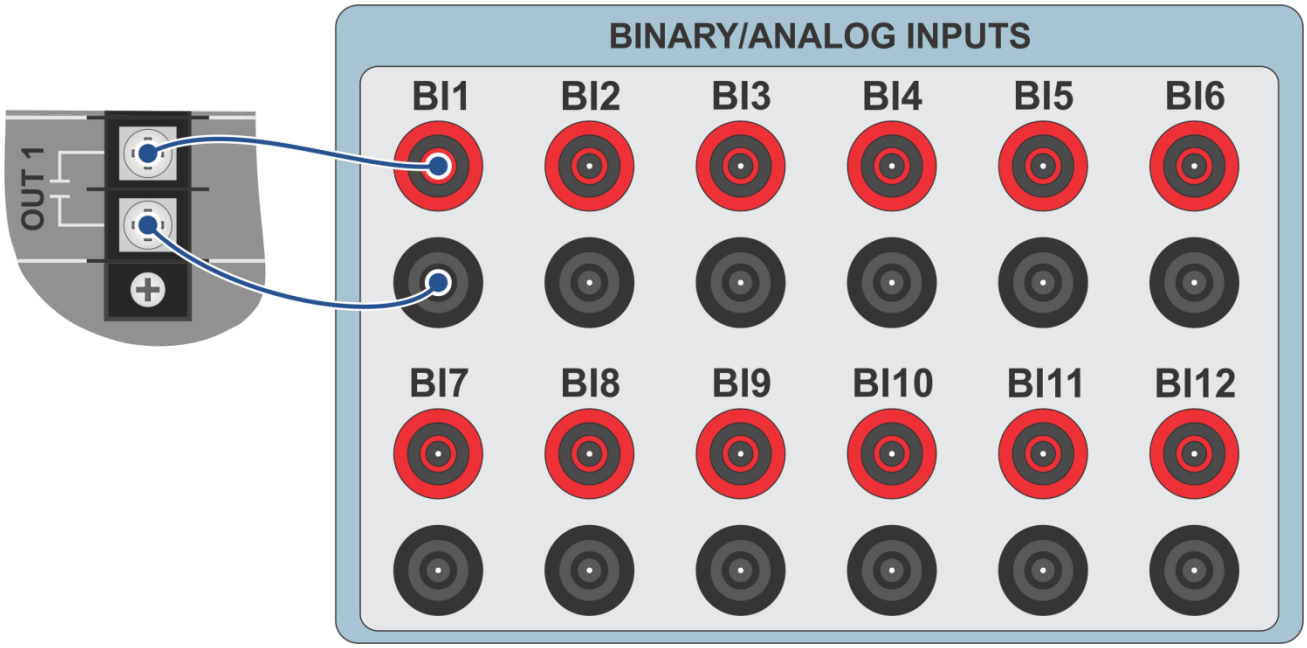


Figure 3

## 2. First steps with the IDF 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.

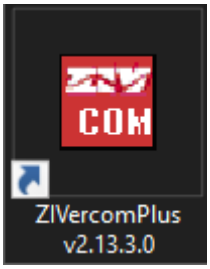


Figure 4

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

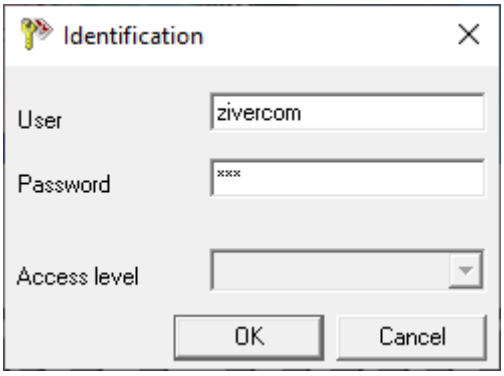


Figure 5

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

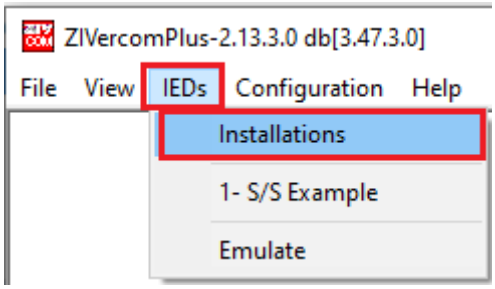


Figure 6

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

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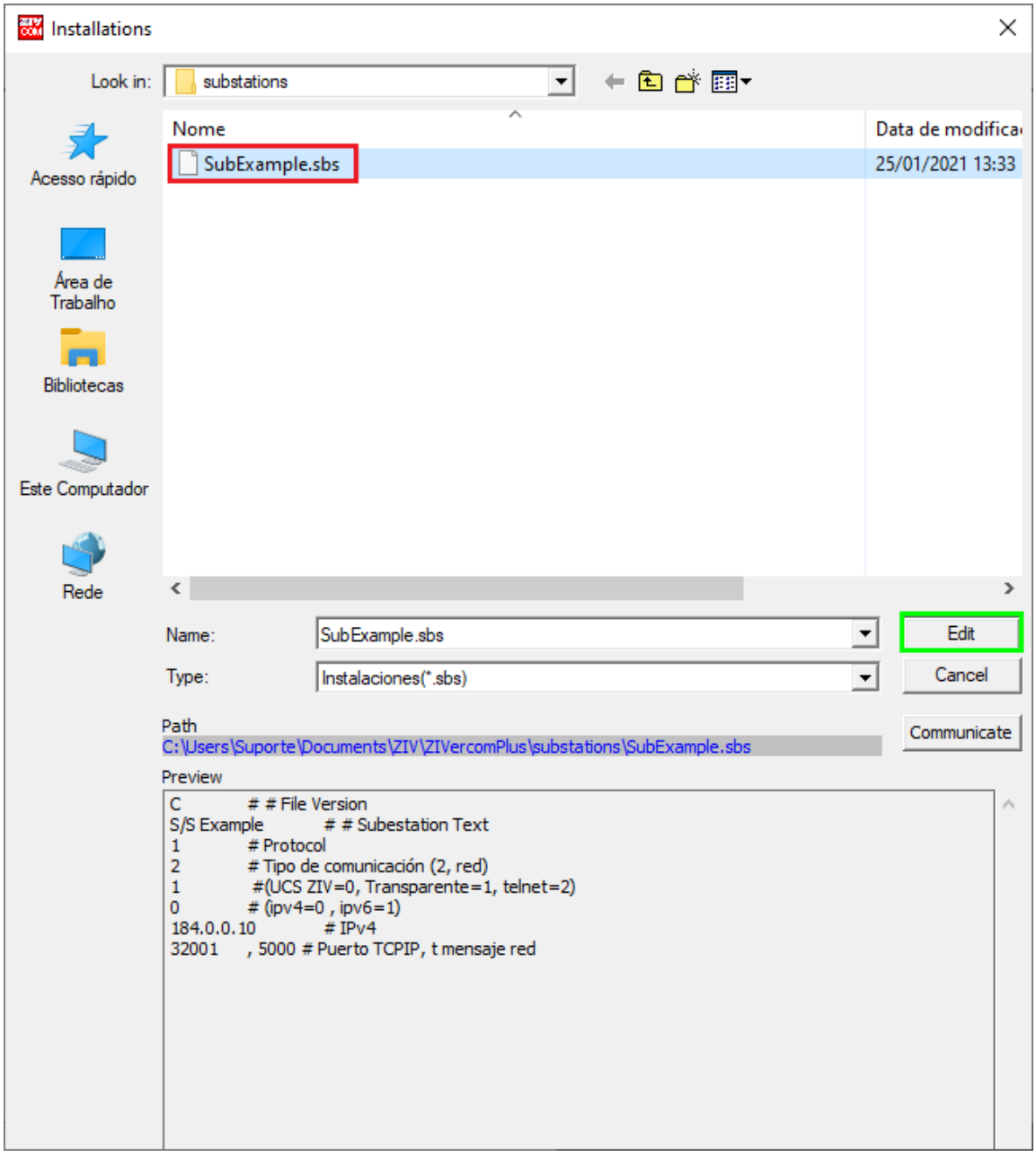


Figure 7

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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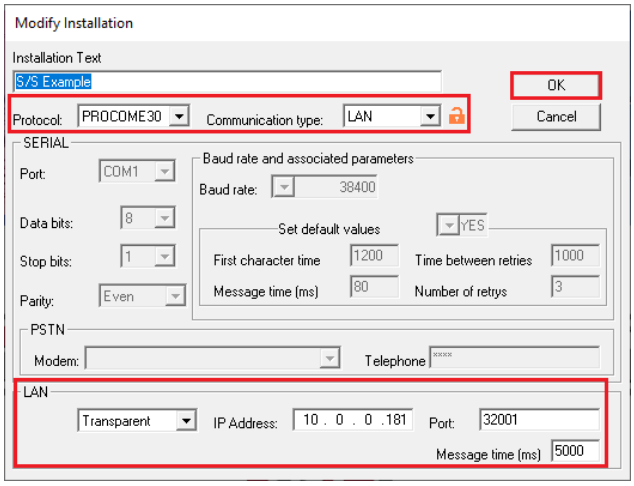


Figure 8

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

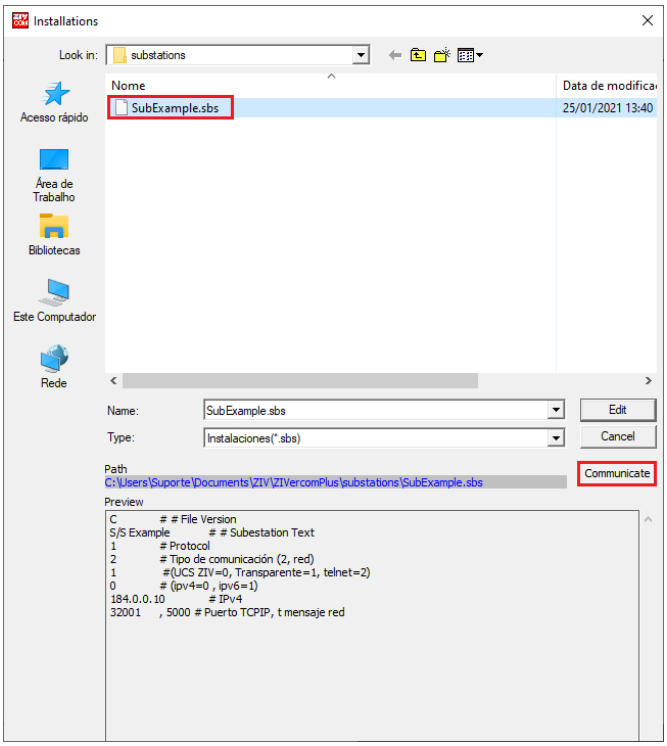


Figure 9

Click *"OK"* again.

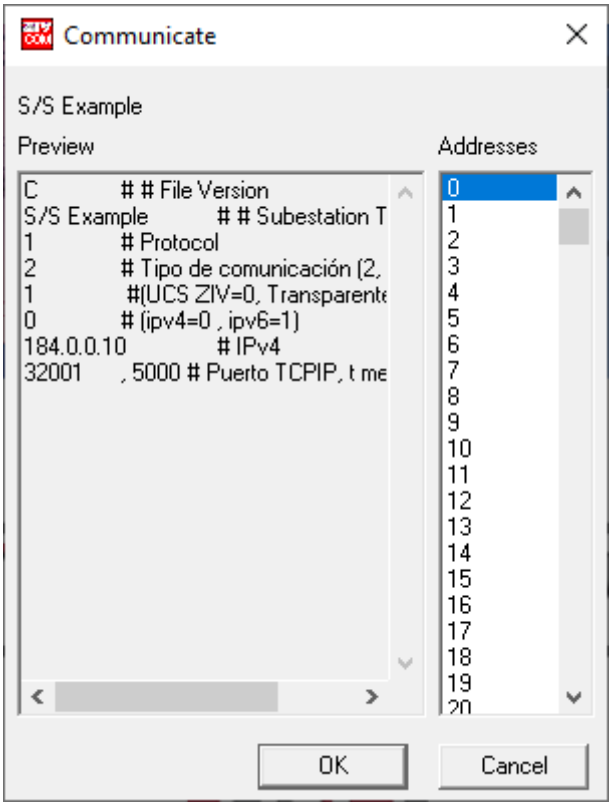


Figure 10

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".***

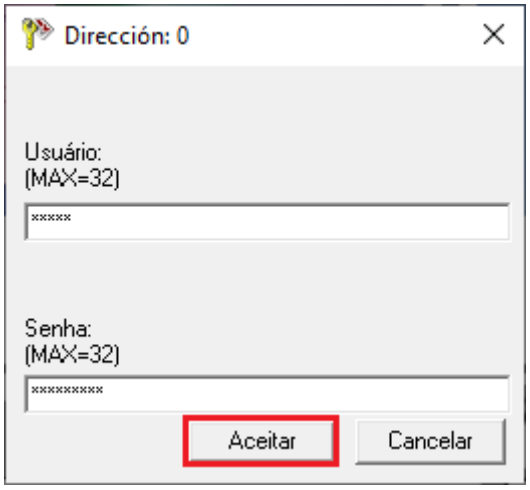


Figure 11

# 3. Parameterization of the ZIV IDF 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.

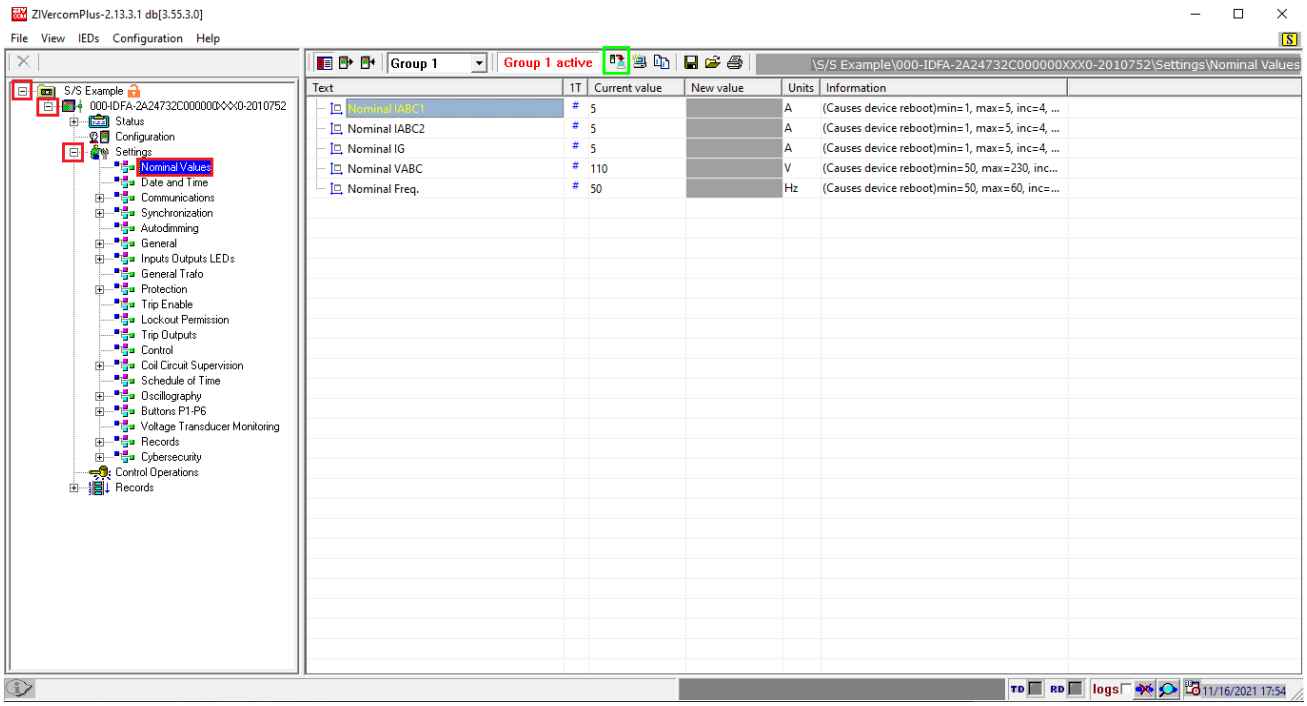


Figure 12

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

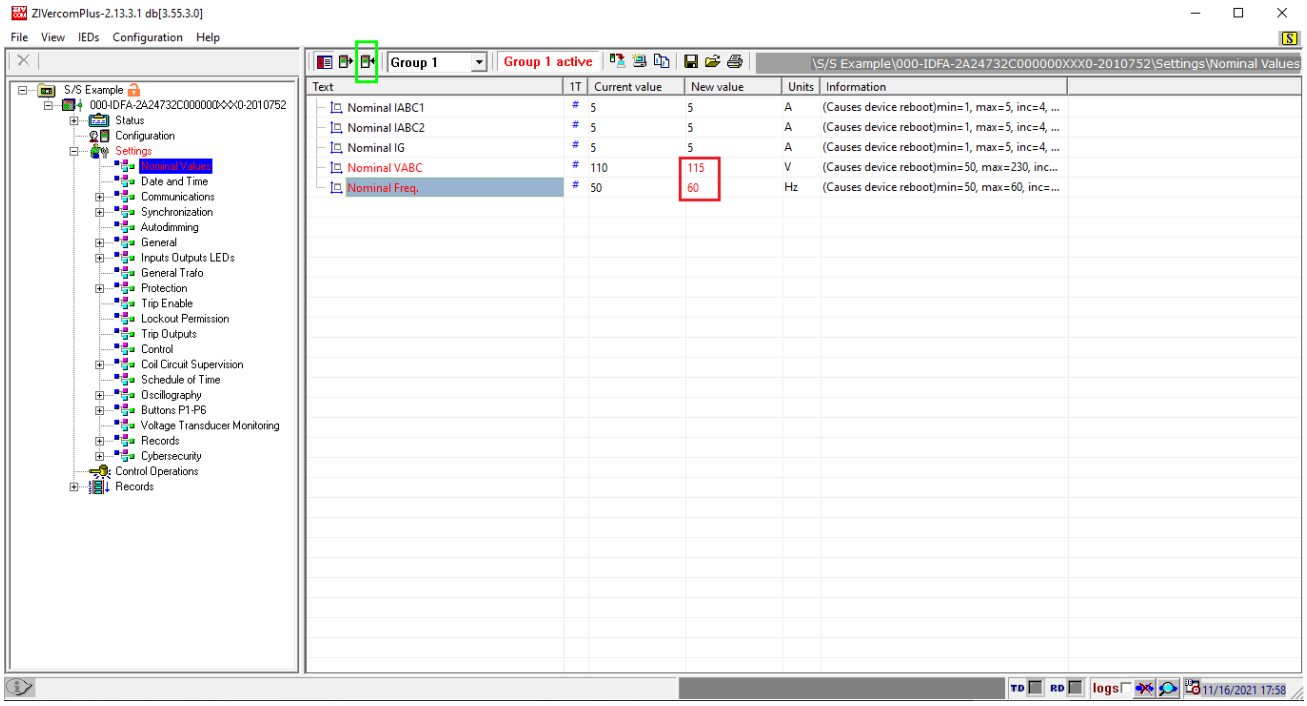


Figure 13

After changing the new value, 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 adjust the transformer ratio values for the current transformers and the voltage transformer.

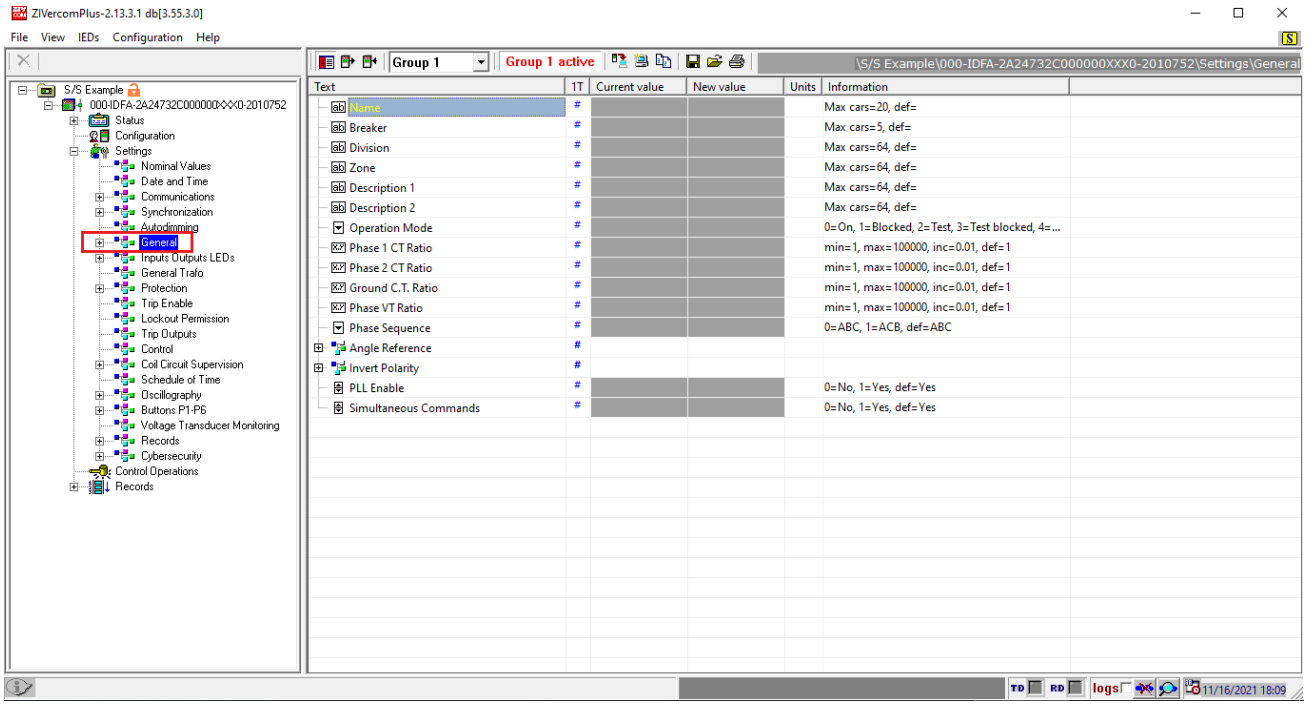


Figure 14

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.

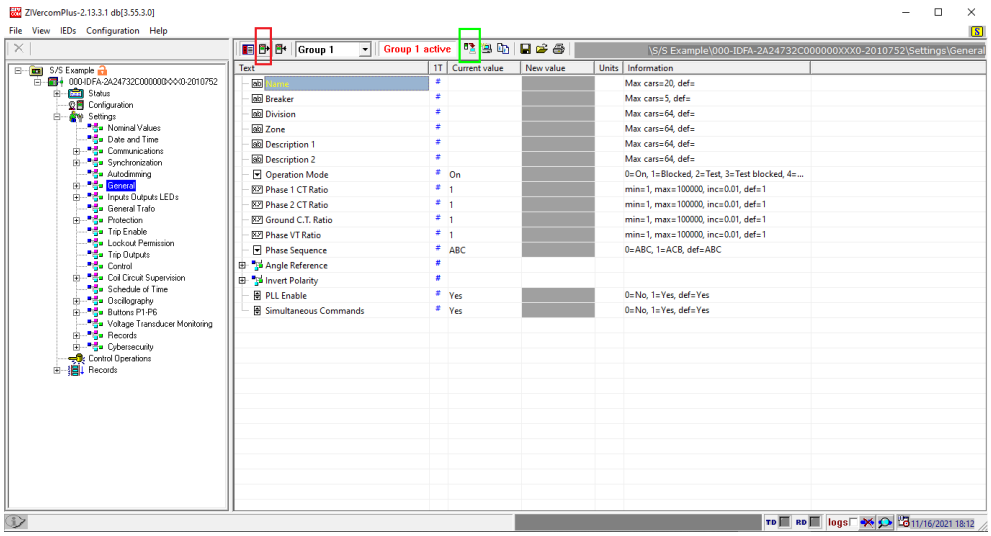


Figure 15

Set the Phase 1 CT Transformer Ratio value to 80.0 and the Phase 2 CT Ratio to 1200.0. For the Phase VT Ratio, set the value of 2000.0.

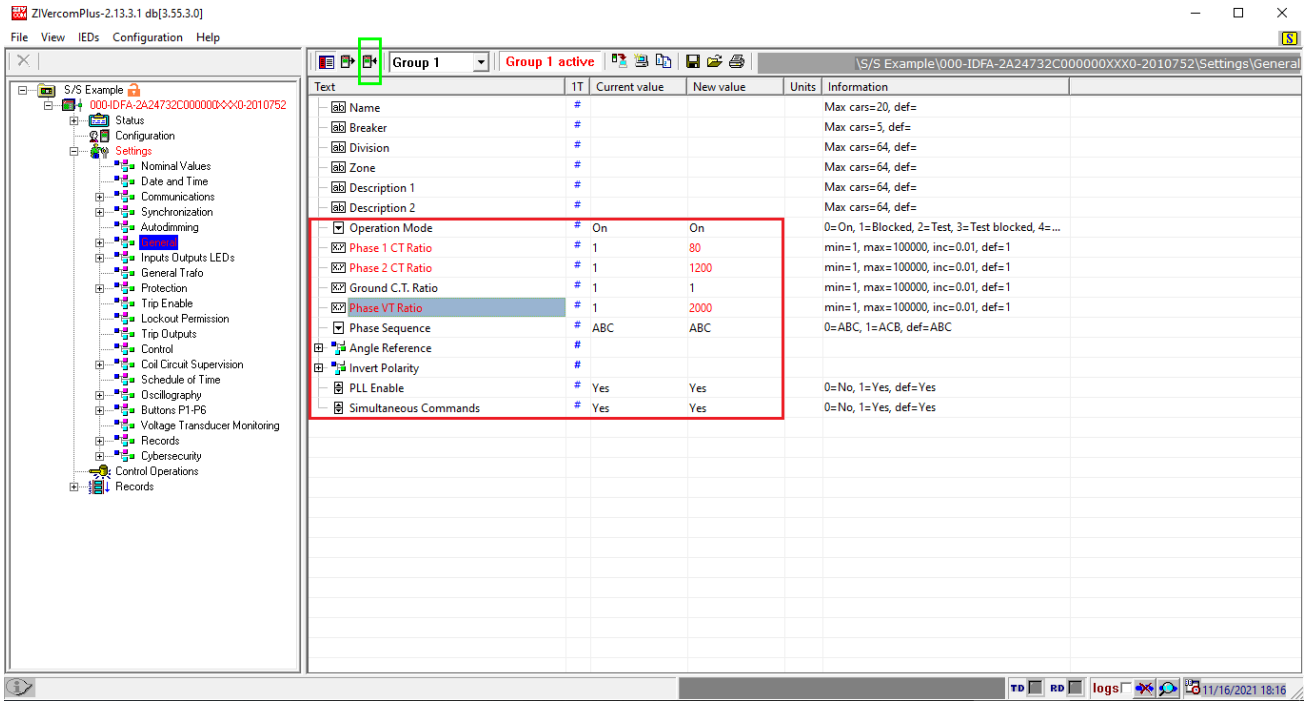


Figure 16

## 3.3. Outputs

Click on the *"+"* signs until you reach the *"Logical OR signals"* option. This option must configure the operating signals of the differential function.

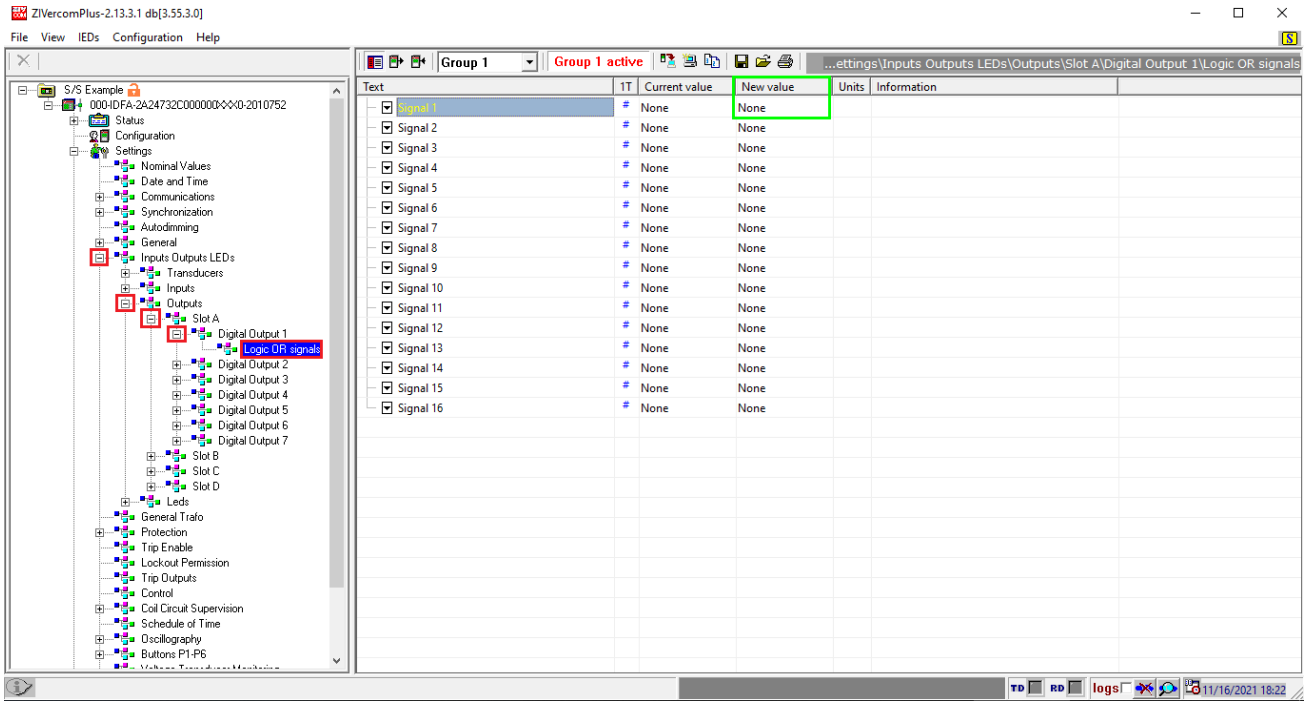


Figure 17

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

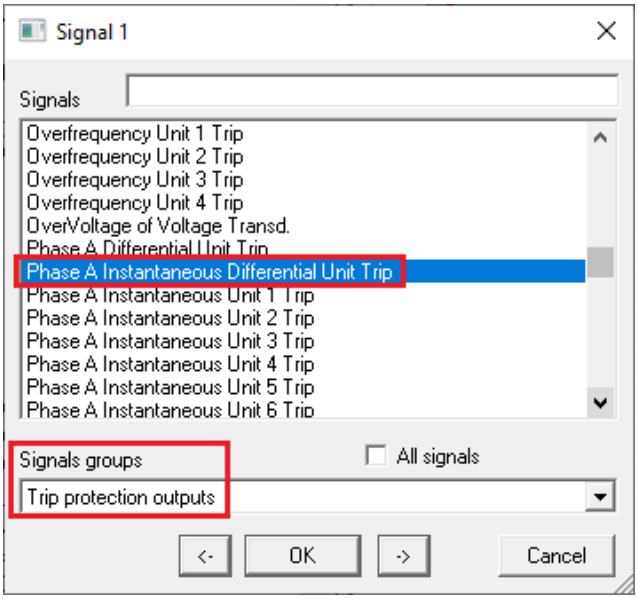


Figure 18

Repeat the above procedure for phases B and C and also input the *"Differential Unit Trip"* signal. Then send the settings to the relay.

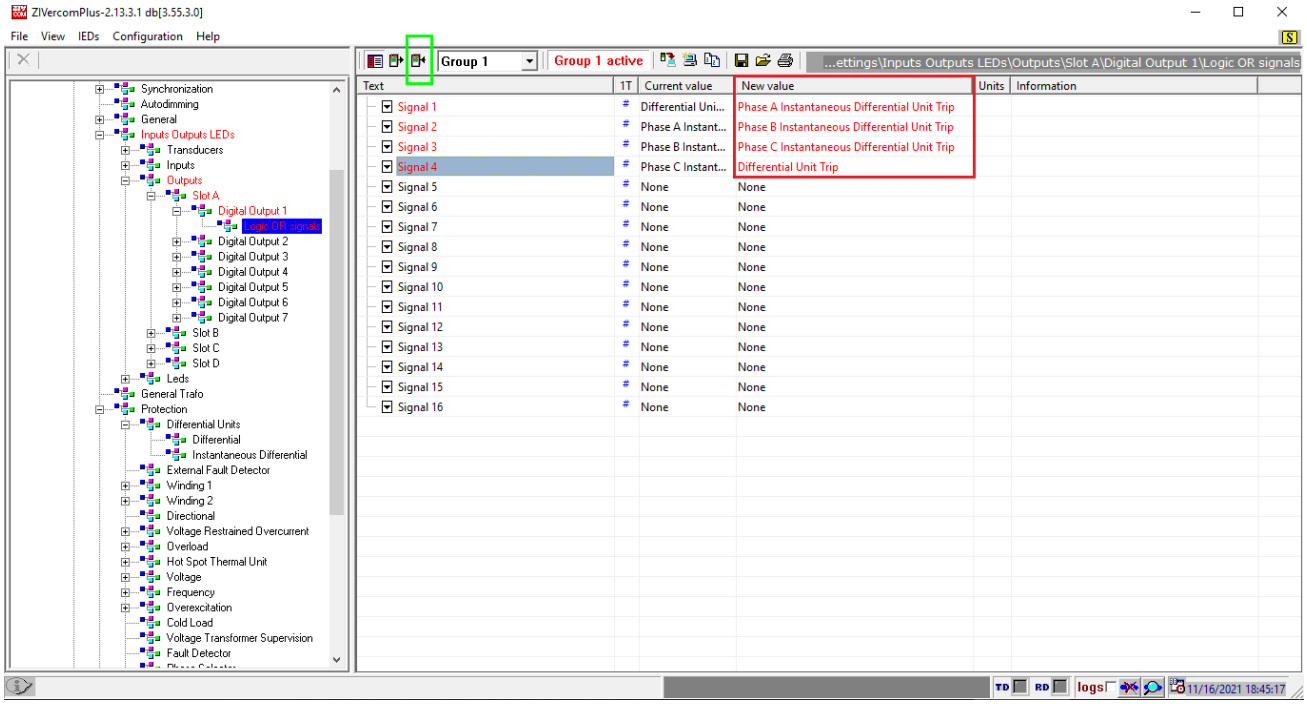


Figure 19

Click on "General Trafo" in this option to adjust the nominal values of voltages, power, connection and phase shift of the power transformer windings. The "Type of Tap" field defines how the Taps will be calculated, which can be "Automatic" or "Manual". If the "Manual" option is used, the taps will be defined by the fields "Tap winding 1" and "Tap winding 2".

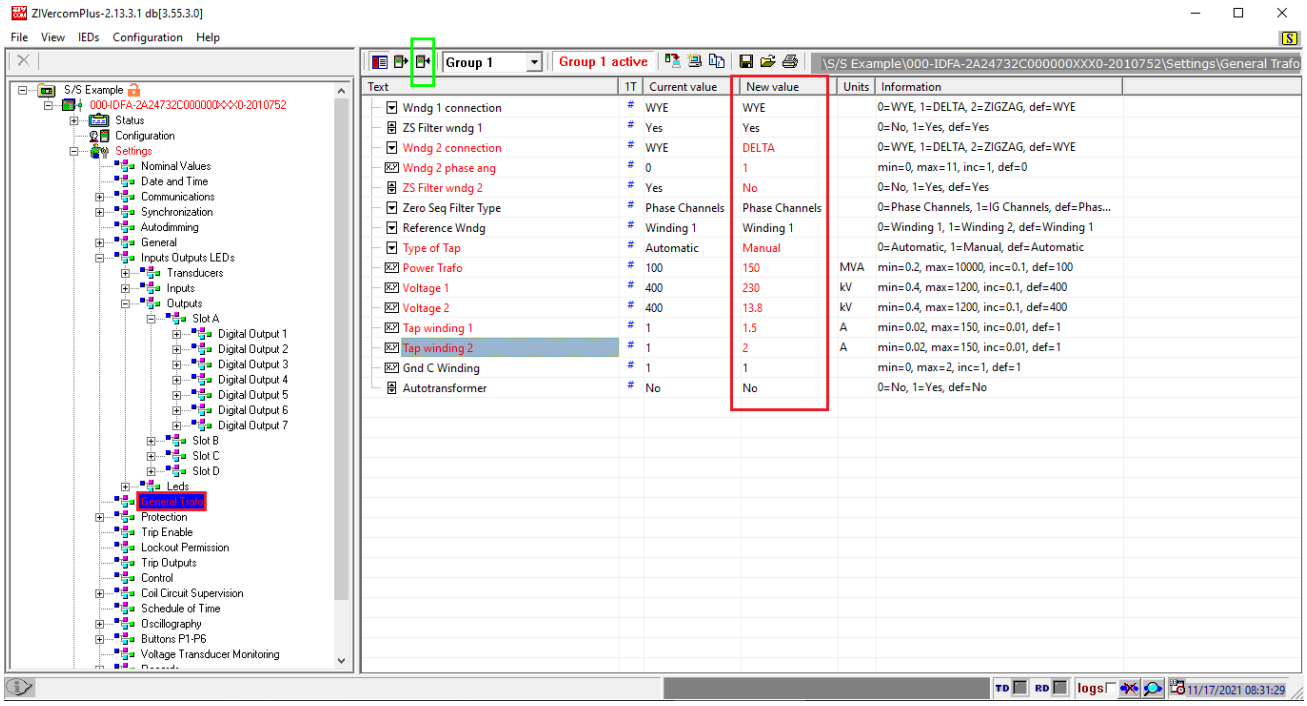


Figure 20

Click the *"+"* sign near to *"Protection"* and select the *"Differential Units"* option. This option defines how the restriction current will be calculated in the *"Restraint Type"* field. Be careful, as there are two different methods.

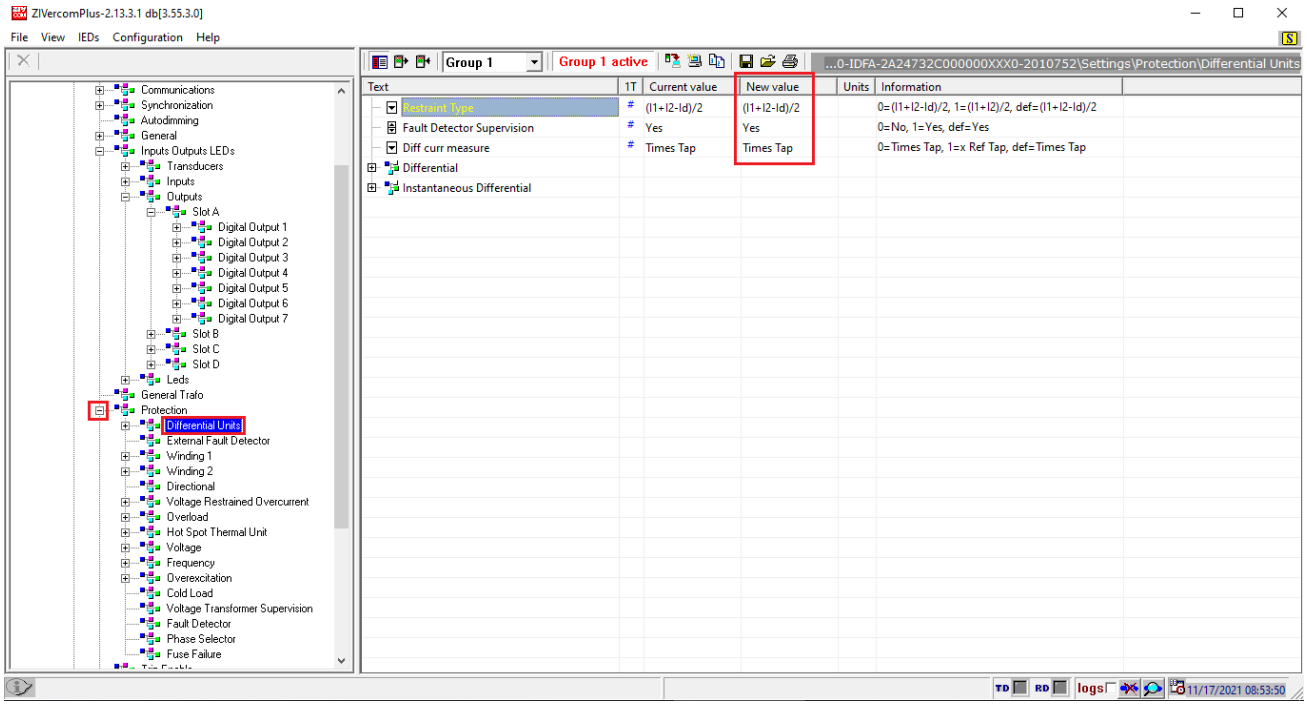


Figure 21

Click the *"+"* sign near to *"Differential Unit"* and select the *"Differential"* option and make the following adjustments.

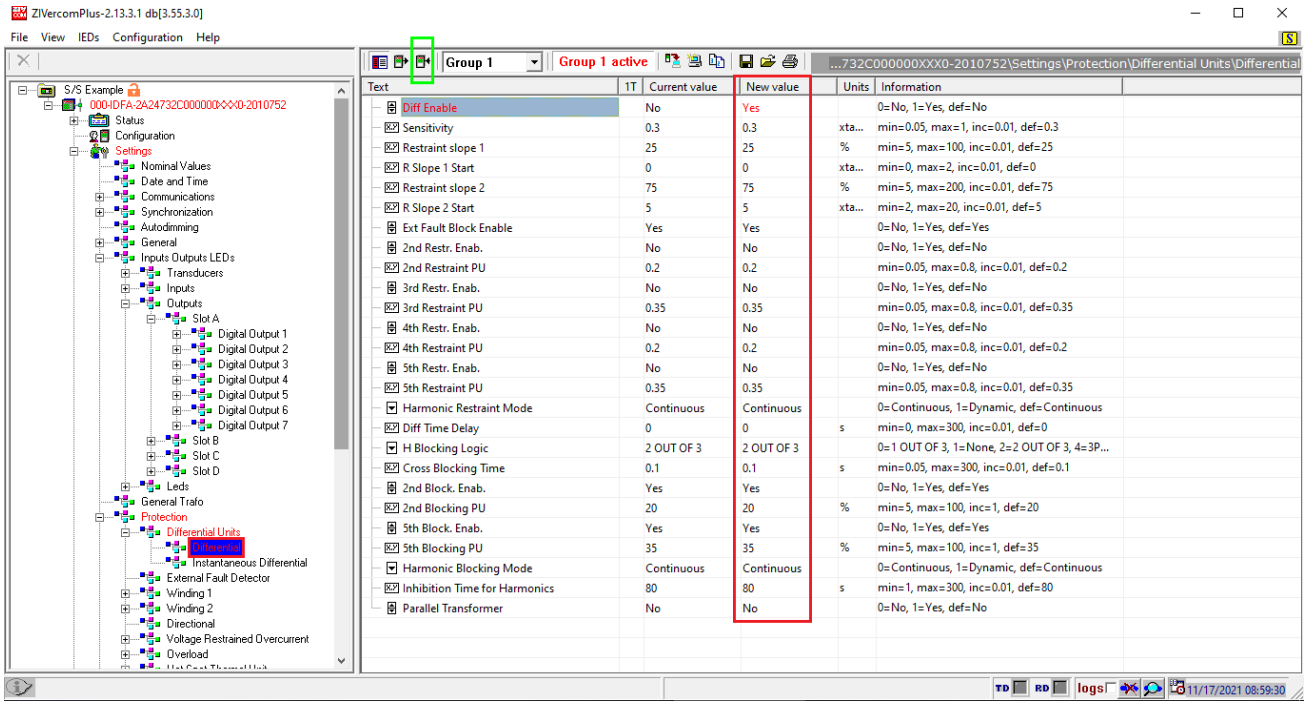


Figure 22

Click on the option *"Instantaneous Differential"* and make the following configuration.

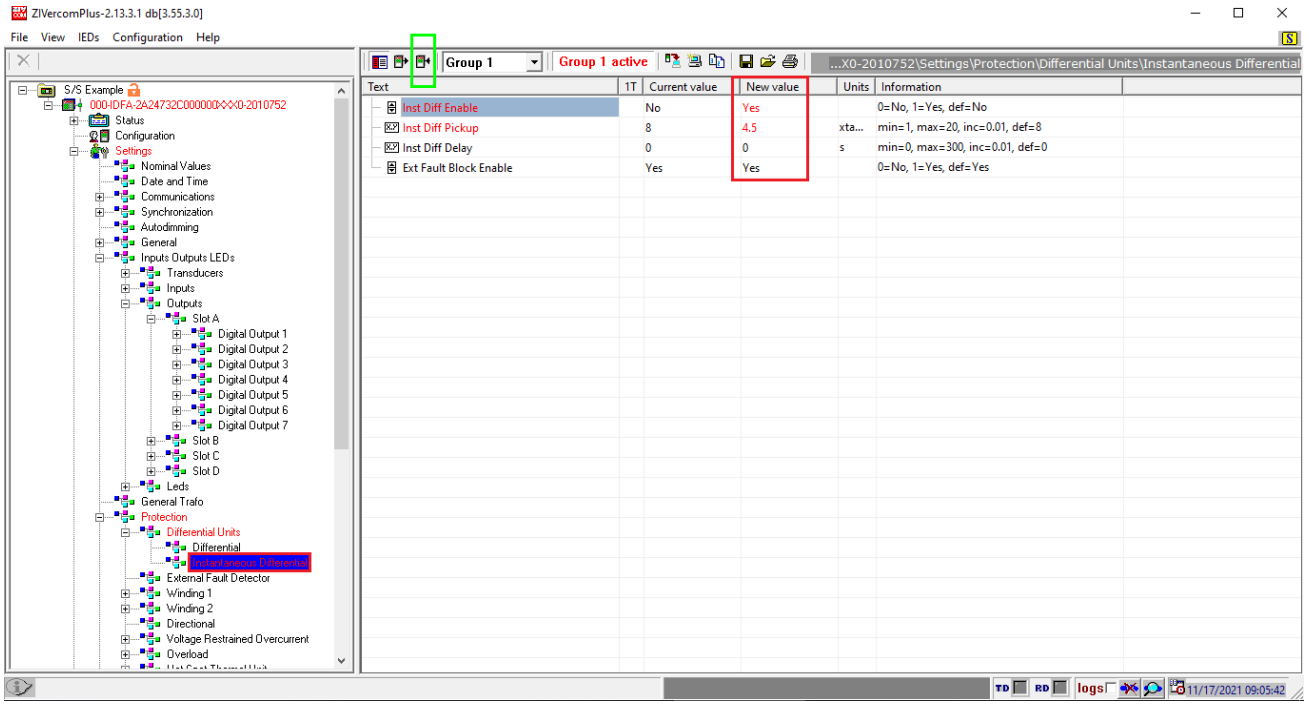


Figure 23

## 4. Application Manager

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

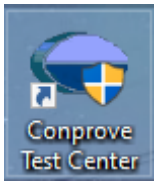


Figure 24

### 4.1. Differential software adjustments

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

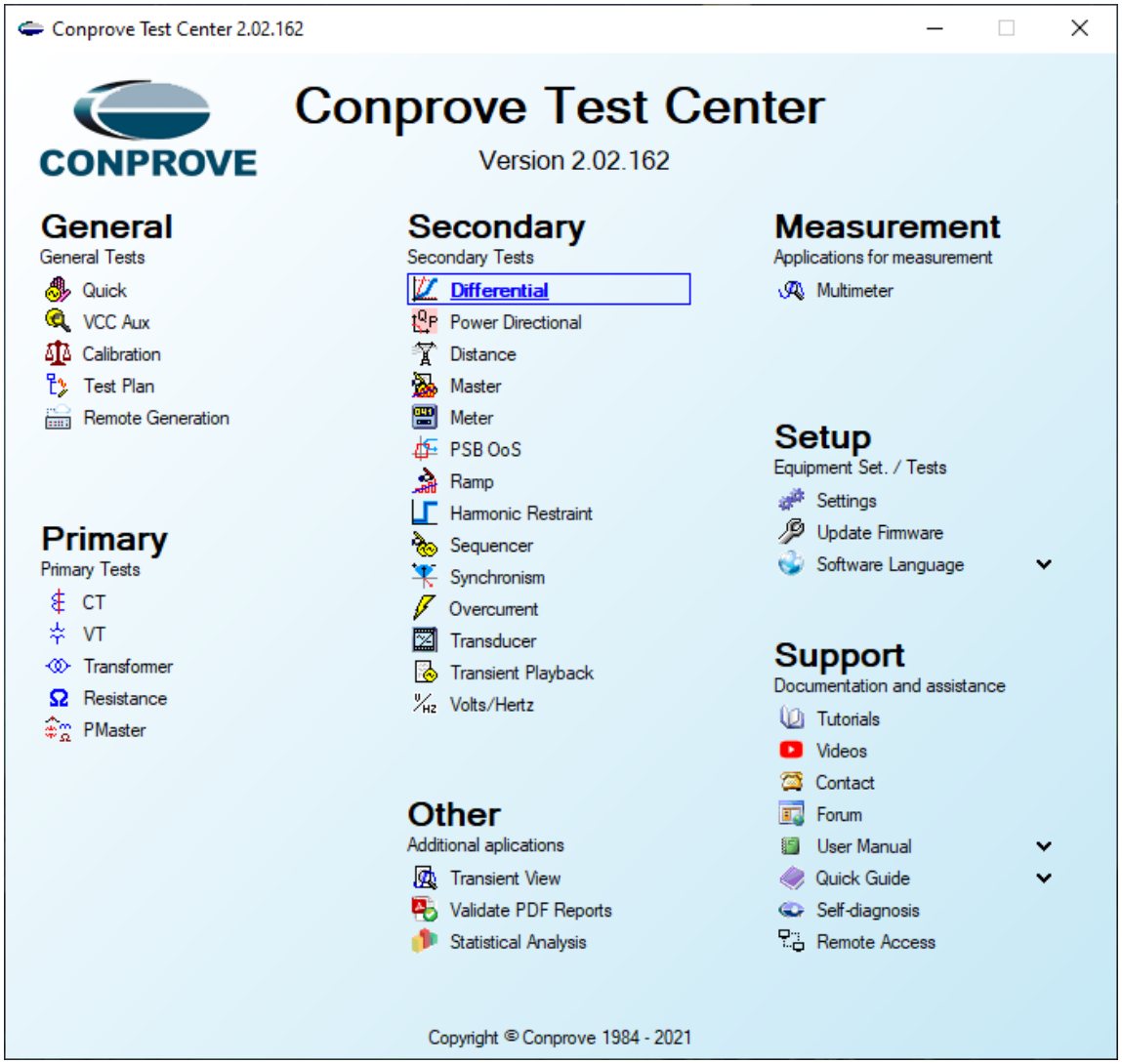


Figure 25

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.

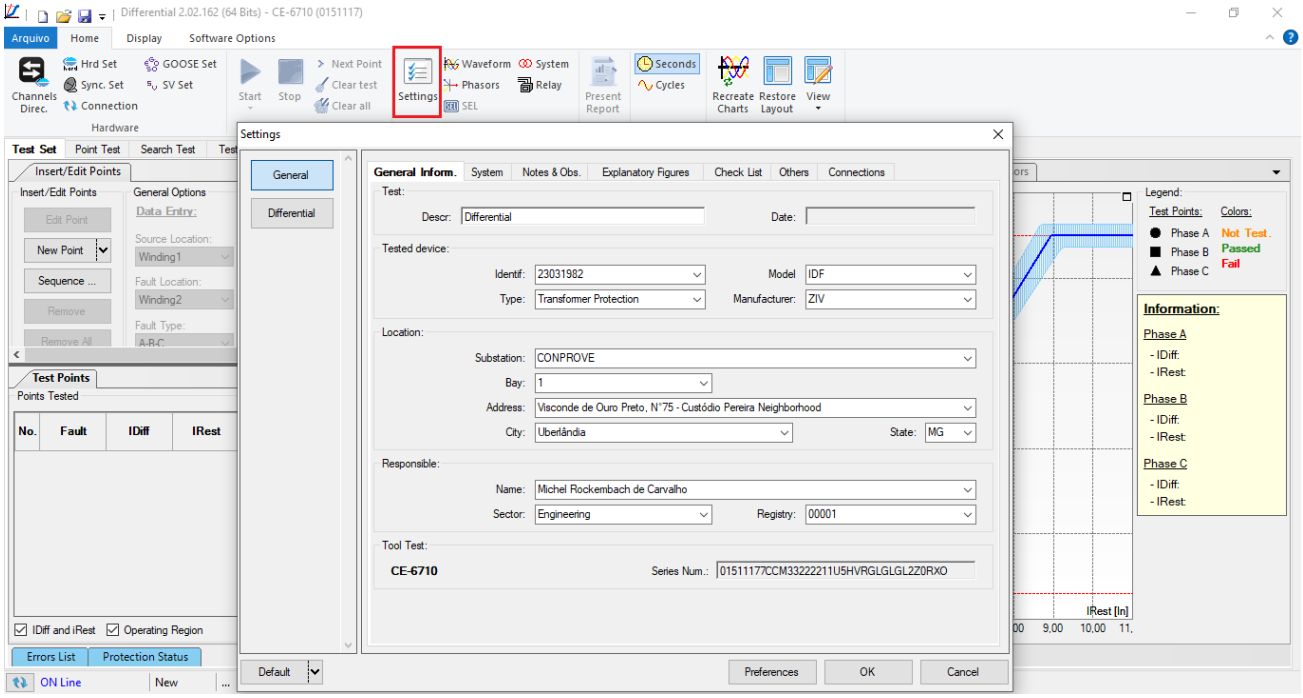


Figure 26

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

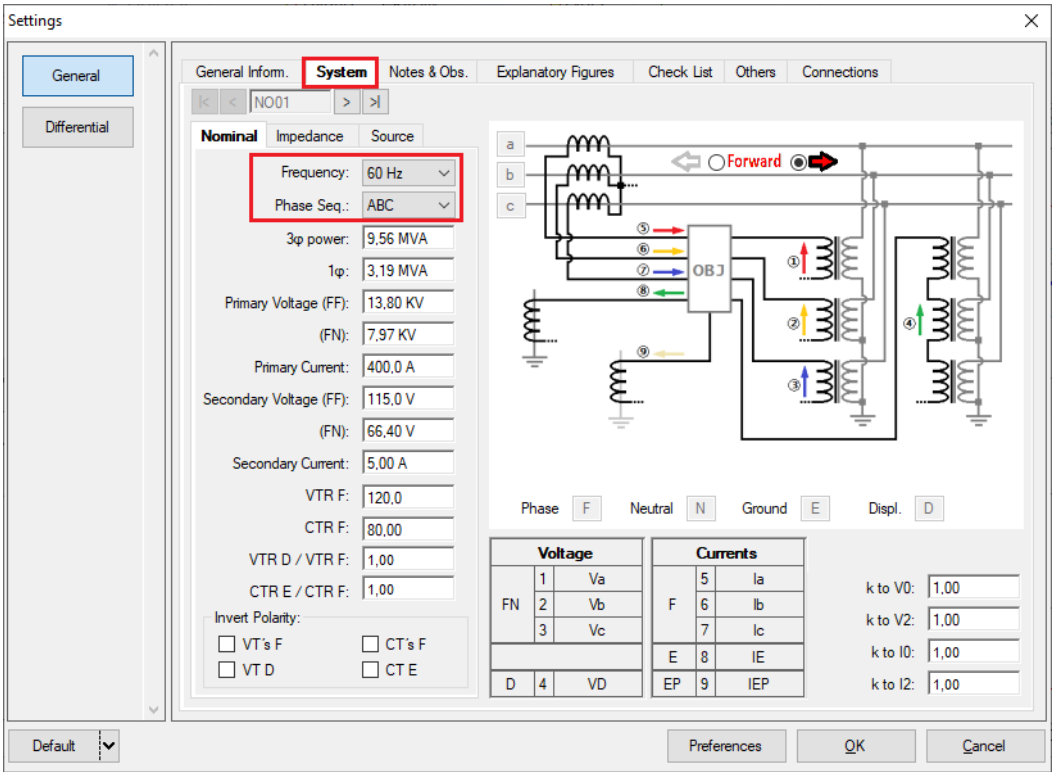


Figure 27

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. Differential screen > Protected Equipment / CT's

In this tab you must inform the protected equipment, the number of windings, rated voltages, rated powers, the primary and secondary currents of the main CT's and the currents of the auxiliary CT's, if necessary. This test uses the settings for a relay that is protecting a transformer. However, it is possible to test the bus, generator, motor and line protections. For transformer protection there is the possibility of testing up to four windings automatically.

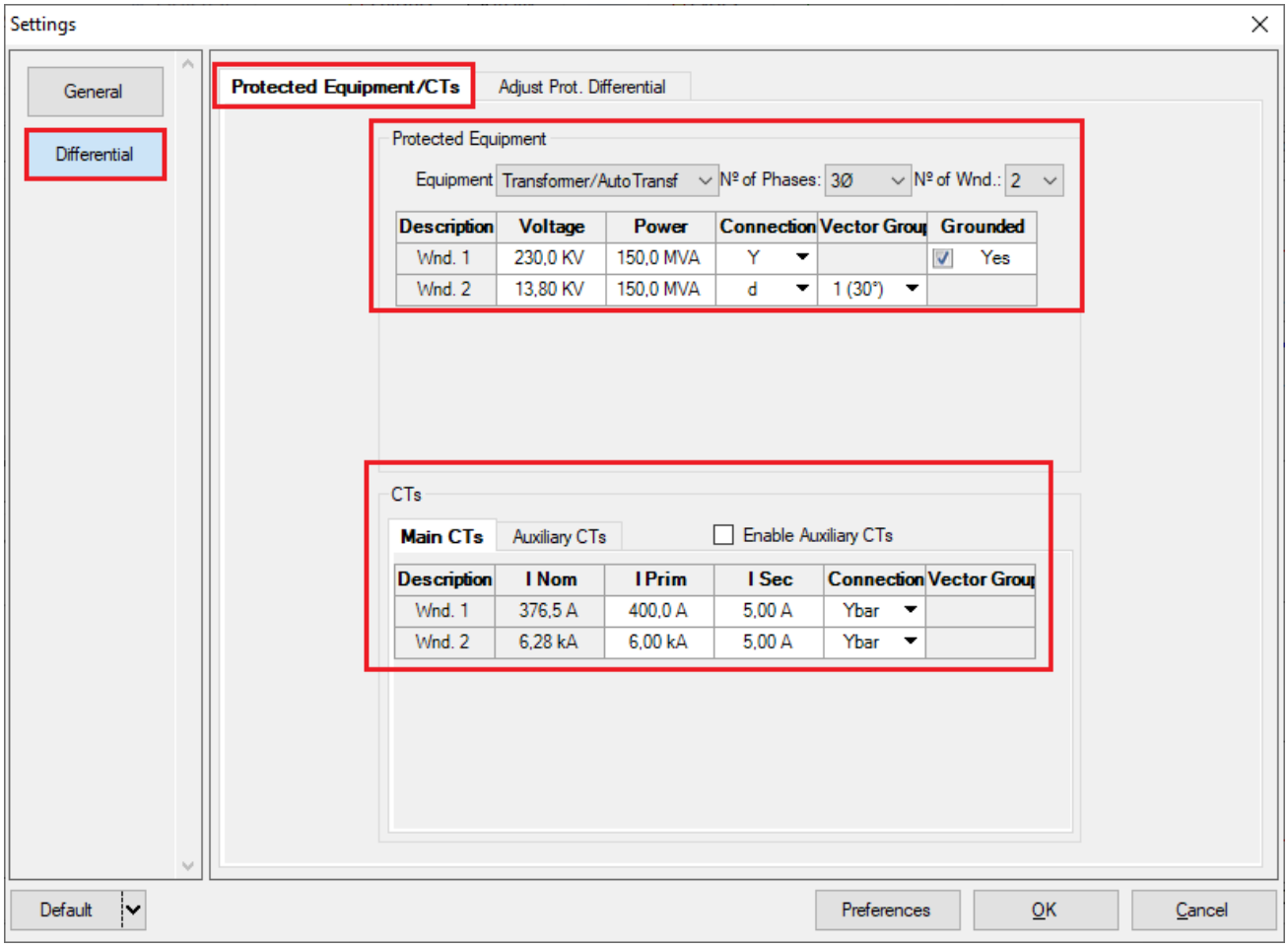


Figure 28

## 4.3. Differential Screen > Adjust Prot. Differential > Settings

The first option in the *"Data Entry"* field is set to *"User",* thus all other settings such as TAP, lag compensation, mismatch correction, measurement current type, reference winding for calculations and option Zero sequence elimination are enabled so that the user can, according to the relay, perform the adjustment correctly (Free Configuration). This method allows the user to test any type of differential relay, but it requires more knowledge of the relay.

To facilitate configuration, the settings of the main relays available on the market have already been standardized. When selecting one of the relays from the list, only

parameterizable settings will be enabled. In this tutorial, the mask *"ZIV IDF / IDV / IDX"* is used.

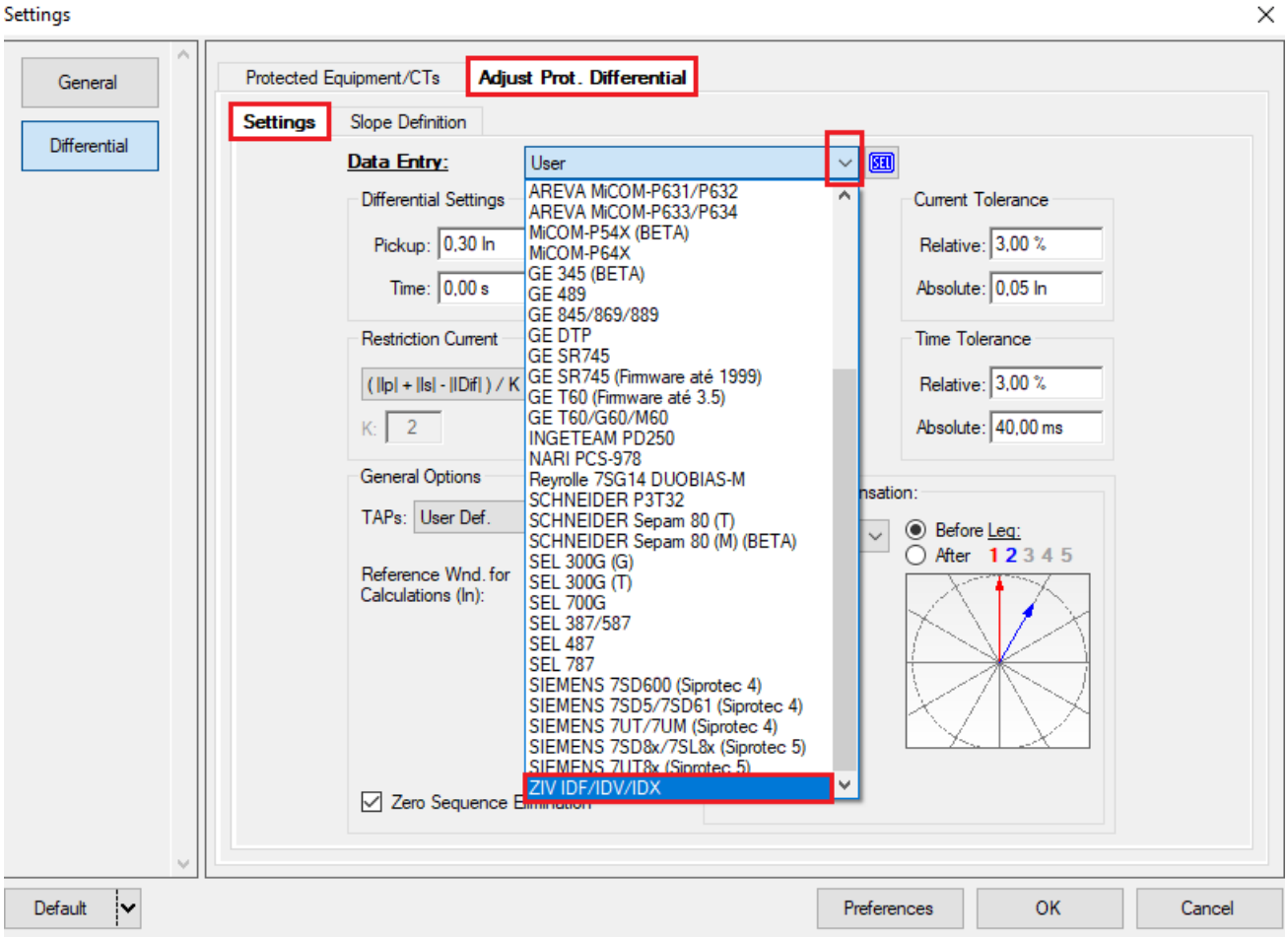


Figure 29

Parameterize the *"Differential"* and *"Instantaneous"* settings and the operating times as zero (0.0s). Use the tolerances for current and time given in Appendix A. Note that the formula for calculating the *"Restriction Current"* must be parameterized equal to the relay setting. Another detail is whether the *"TAP's"* field is calculated or defined by the user. In the second case, it is necessary to adjust the values of each tap.

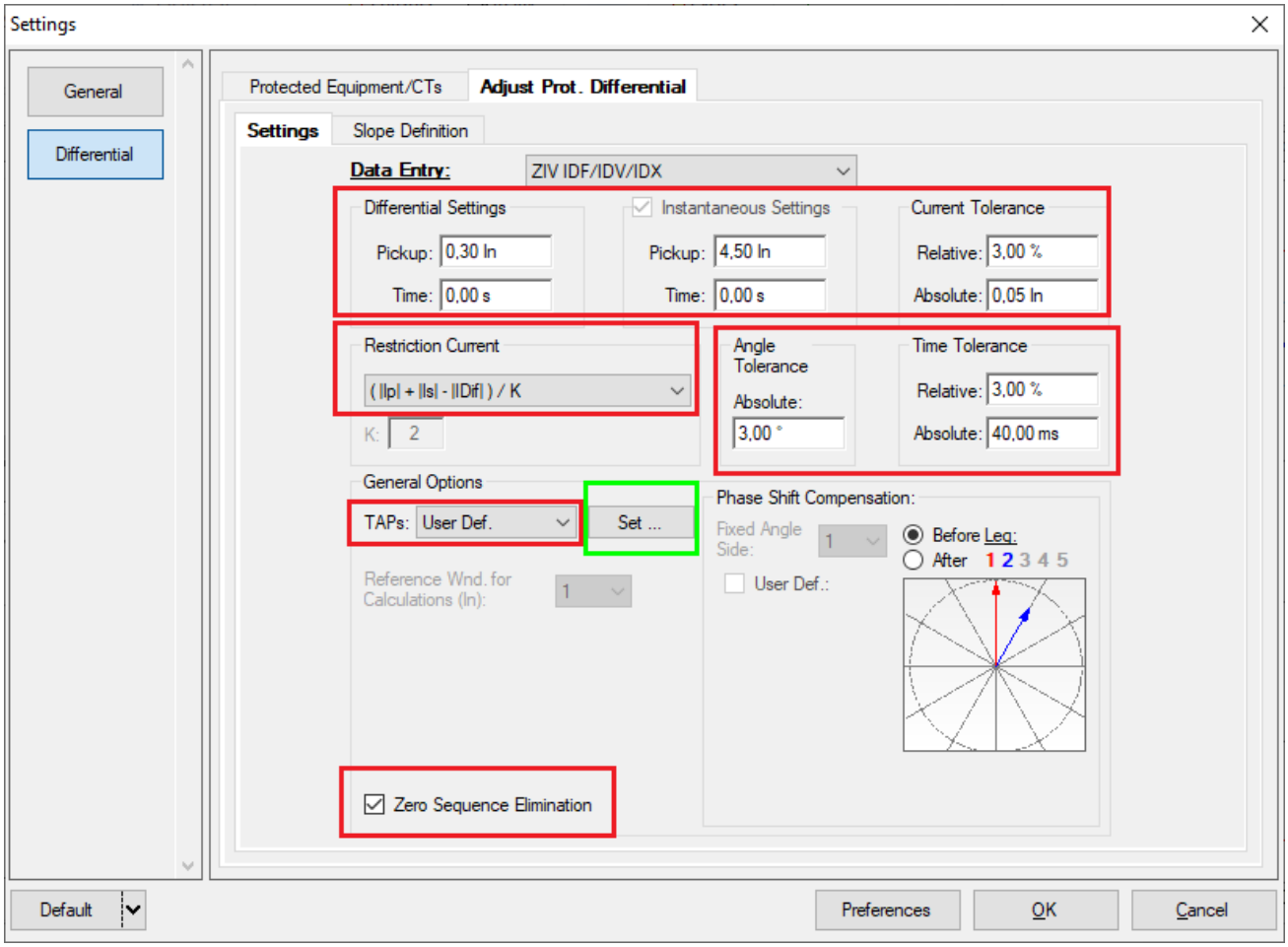


Figure 30

By clicking on the *"Set..."* icon, the tap values are configured.

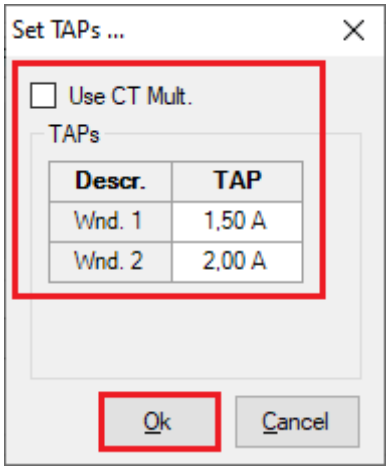


Figure 31

## 4.4. Differential Screen > Adjust Prot. Differential > Slope Definition

On this screen, the values of the slopes and the star of each slope are entered.

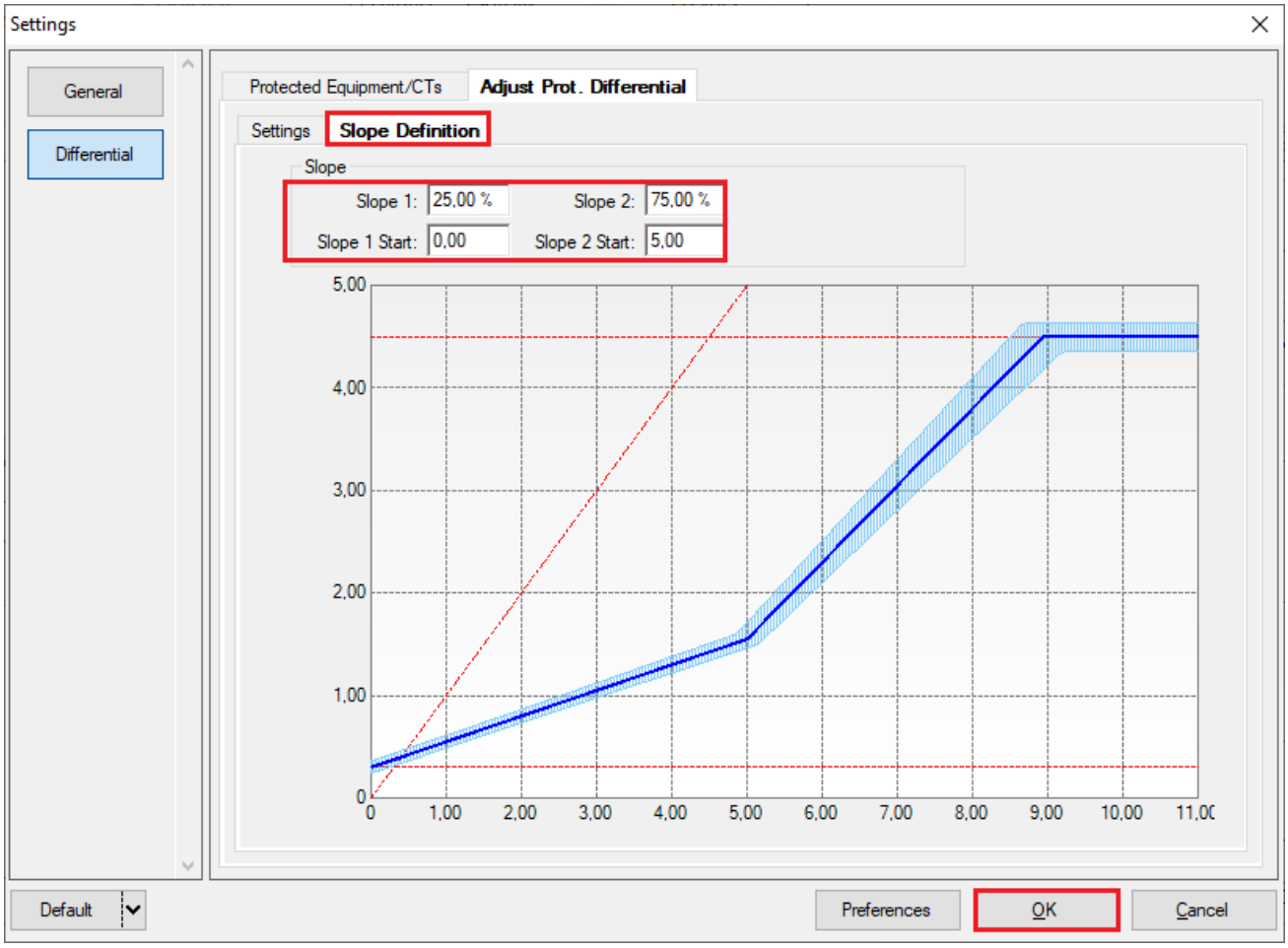


Figure 32

## 5. Channel Direction and Hardware Configurations

Click on the icon illustrated below.

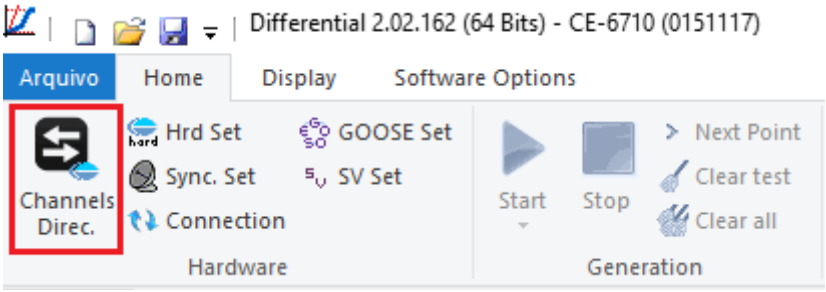


Figure 33

Then click on the highlighted icon to configure the hardware.

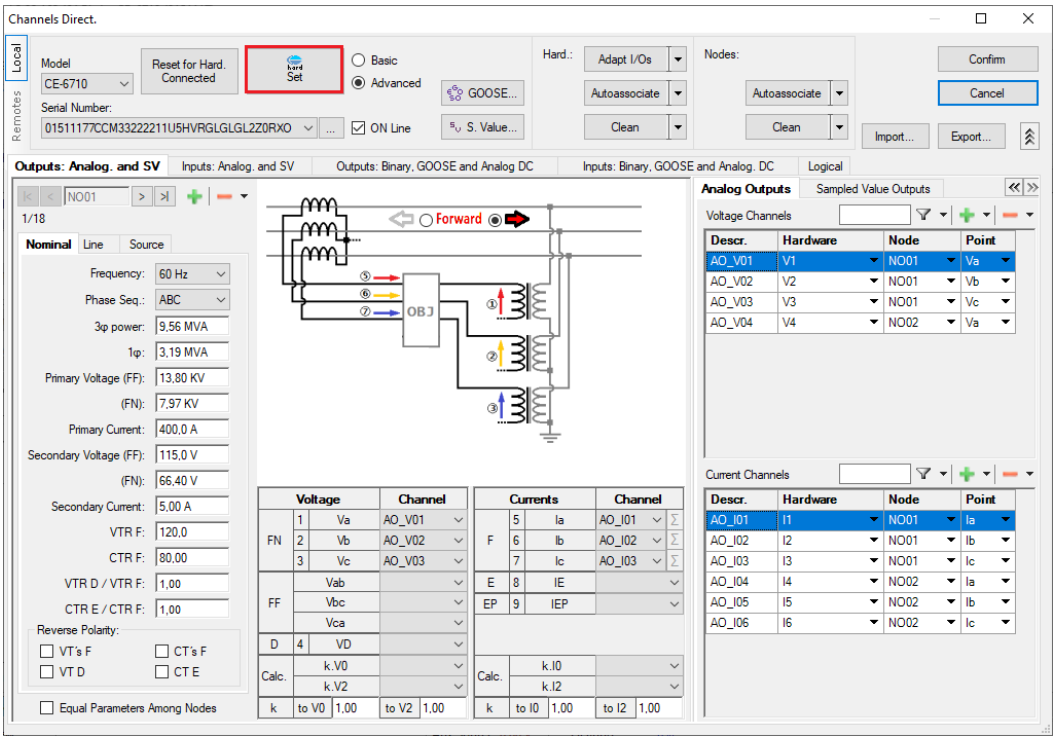


Figure 34

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

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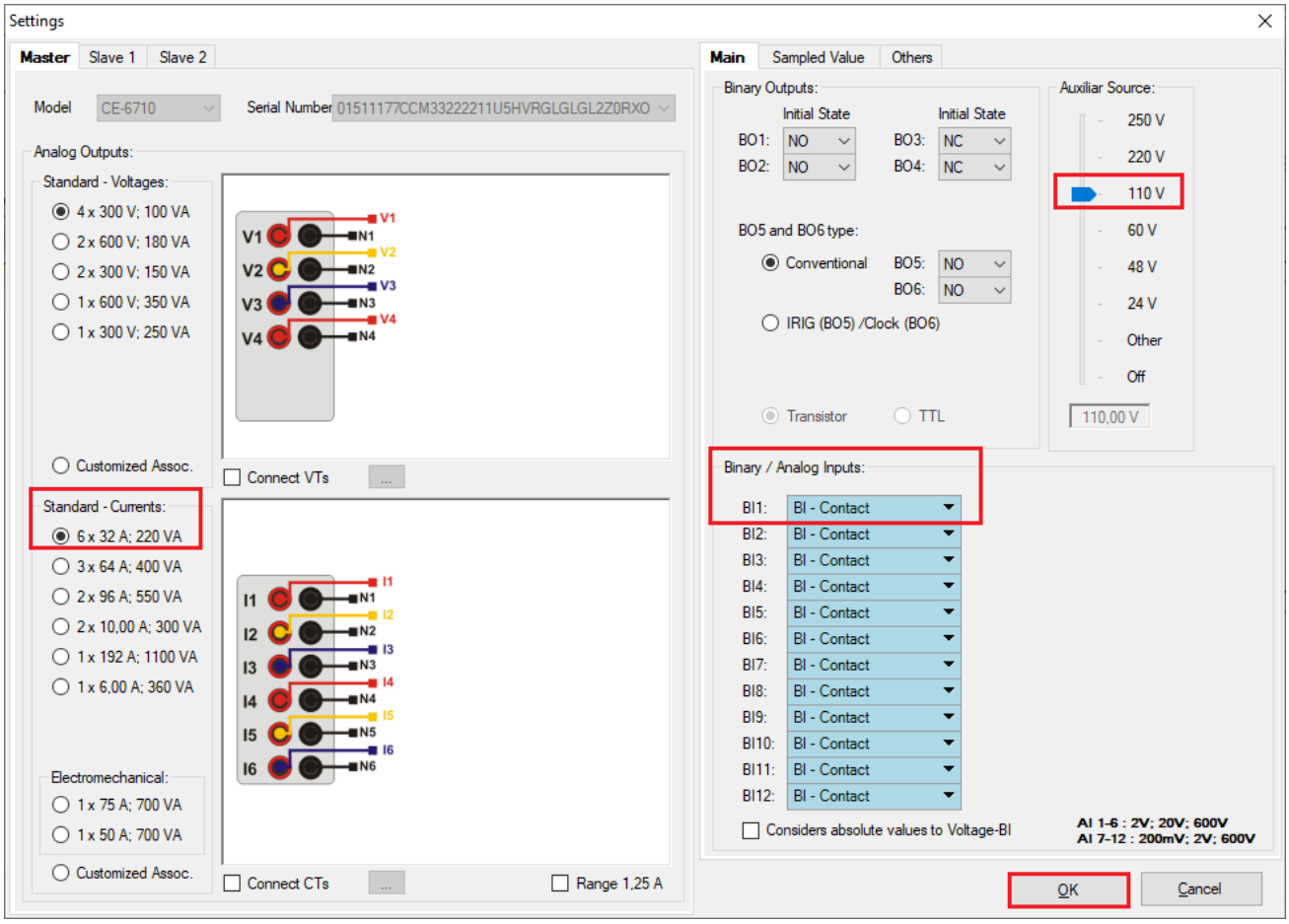


Figure 35

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


Figure 36

# 6. Test Structure for Function 87

## 6.1. Test Settings

In this tab, the test set channels are associated with the relay phases the trip signal is configured with the binary input. An important detail is to insert a pre-fault with nominal values as shown below.

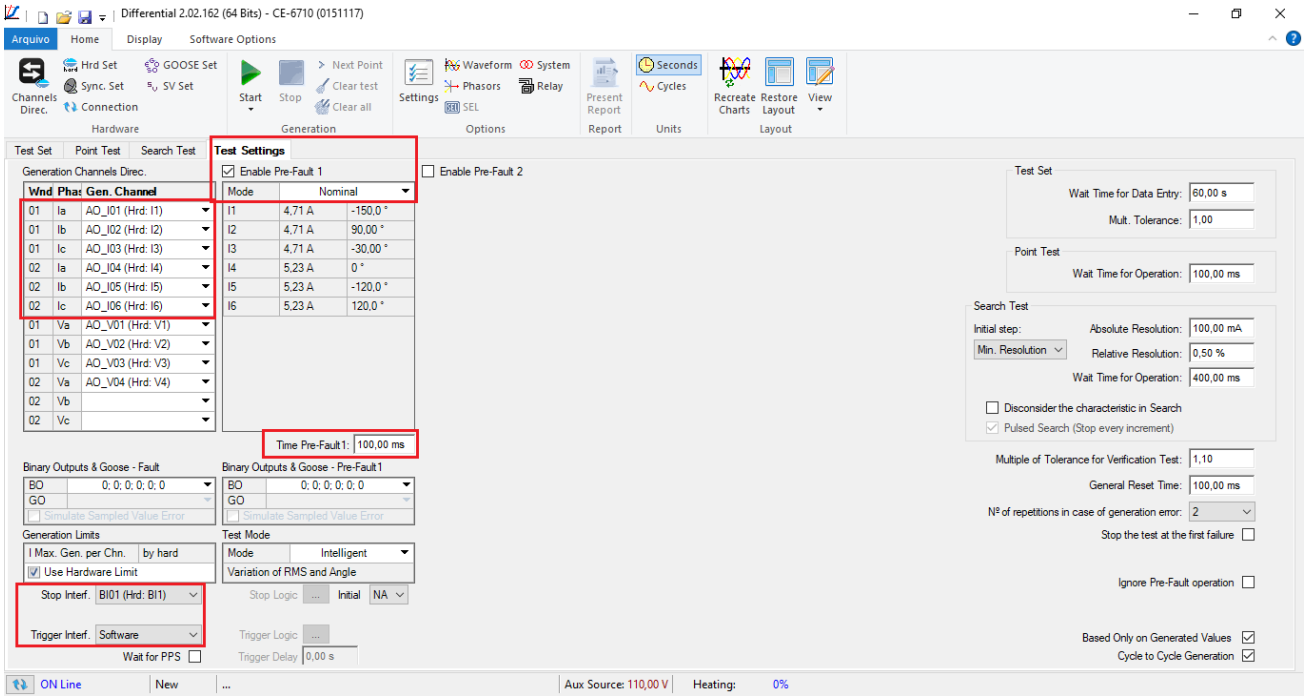


Figure 37

## 6.2. Point Test

For the point test, click on the *"New Point"* field choose the fault type and the differential and restraint current values. Then click on the confirm button.

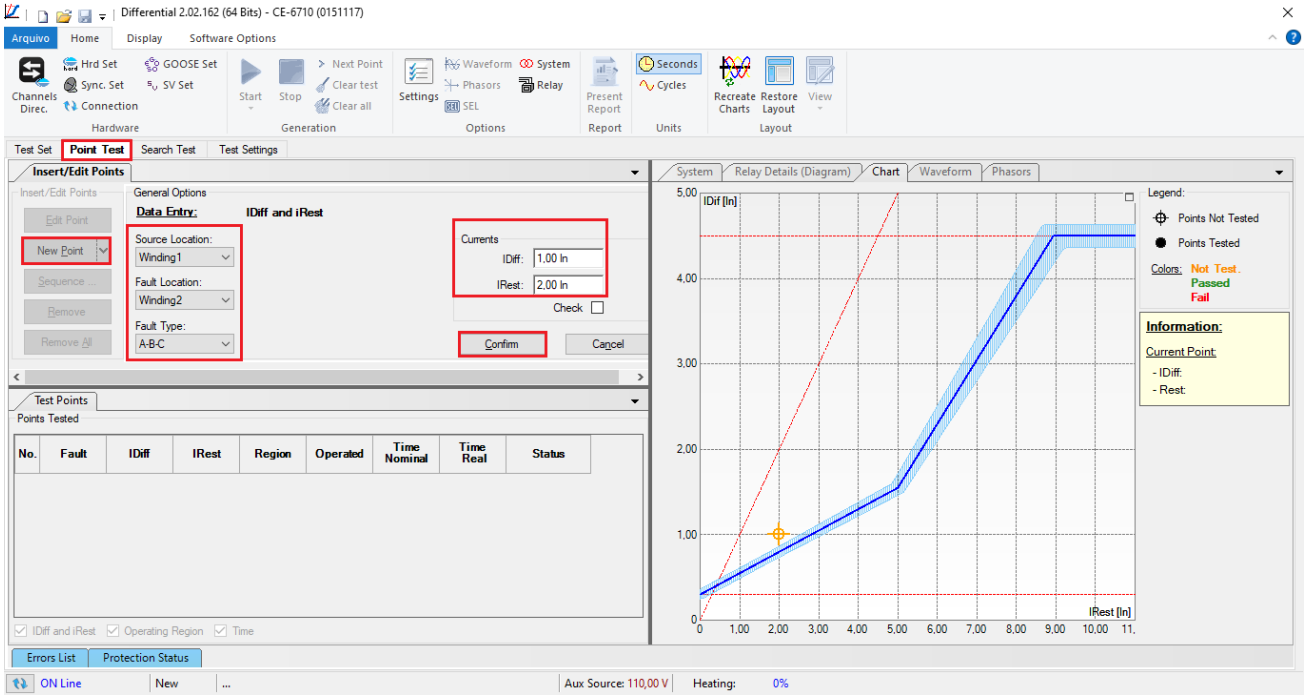


Figure 38

Another way is to use the *"Sequence"* feature of points by choosing the values of *"Initial"*, *"End"* and *"Step"*. In this way the software automatically creates the points.

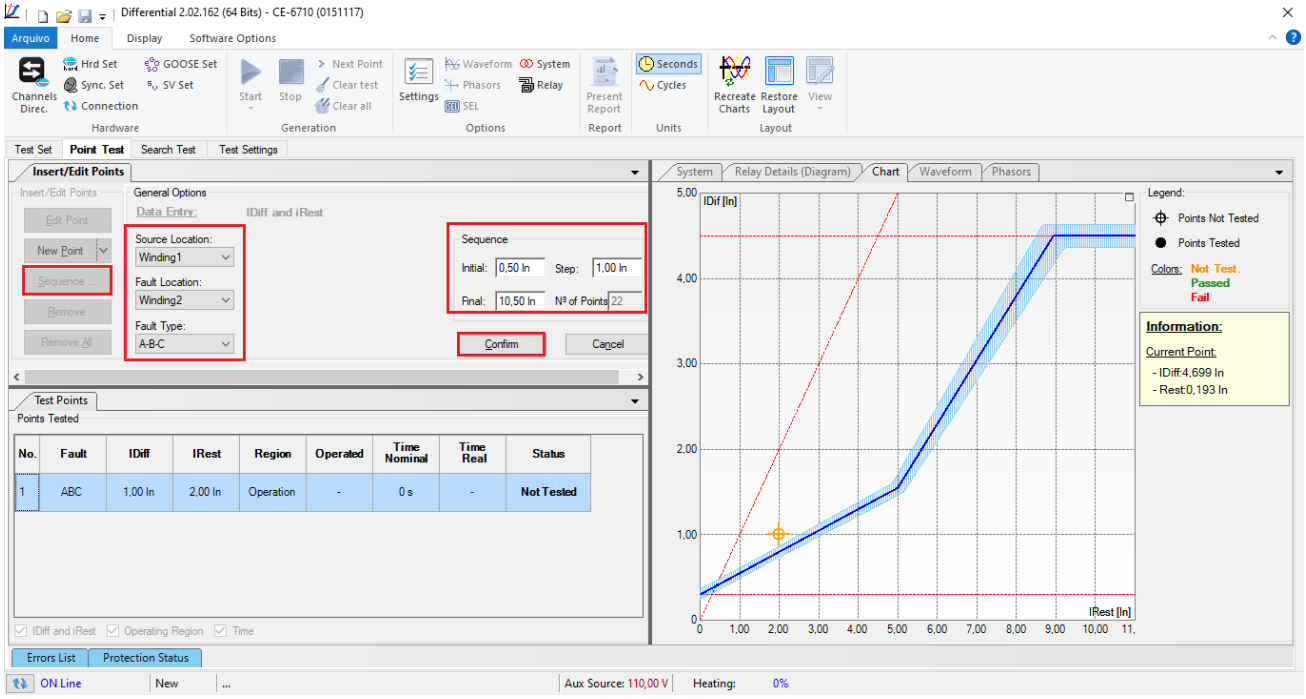


Figure 39

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

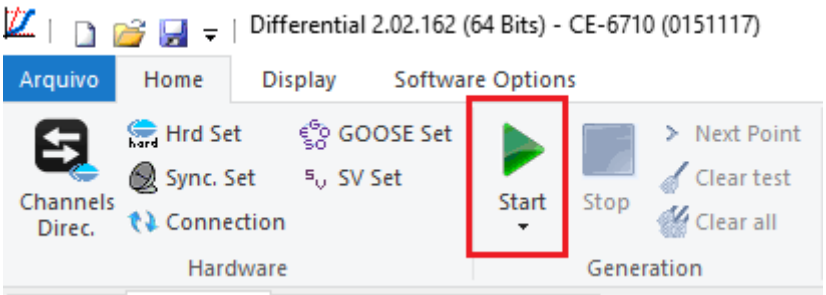


Figure 40

## 6.3. Final Score Test Result

It is verified that in the operating region the relay acted within the expected time. In the non-operation region, the relay does not actuate.

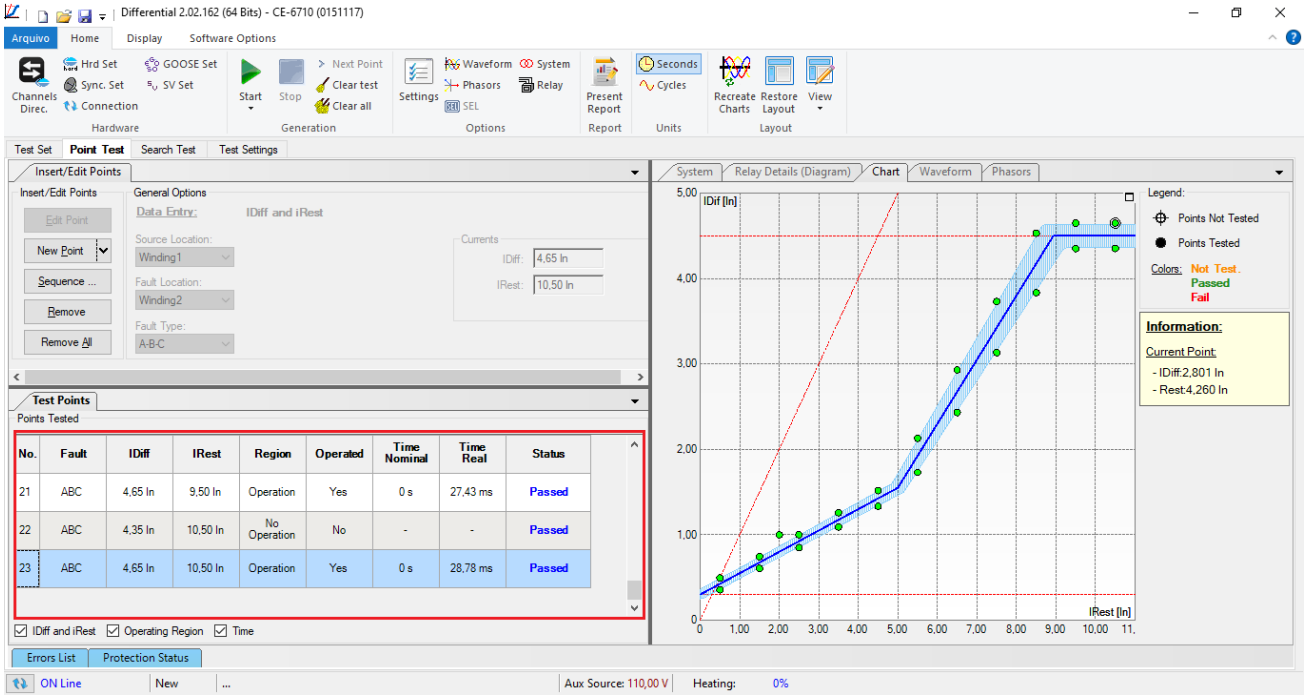


Figure 41

## 6.4. Search Test

To perform the search test, click on the *"New Line"* field, choose the fault type, the restraint current value and confirm.

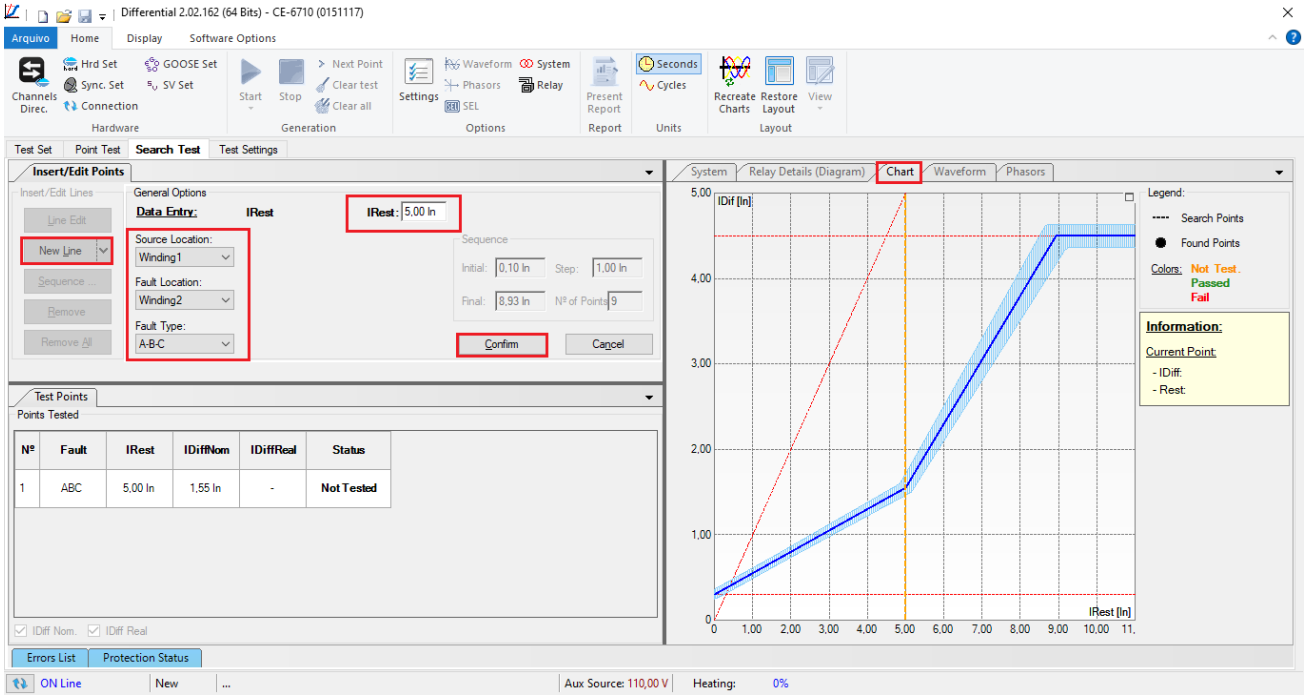


Figure 42

There is also another way to add test lines, by adding a search string. To do this, just click on the *"Sequence"* button and select the initial and final restriction current of the search and the step between them.

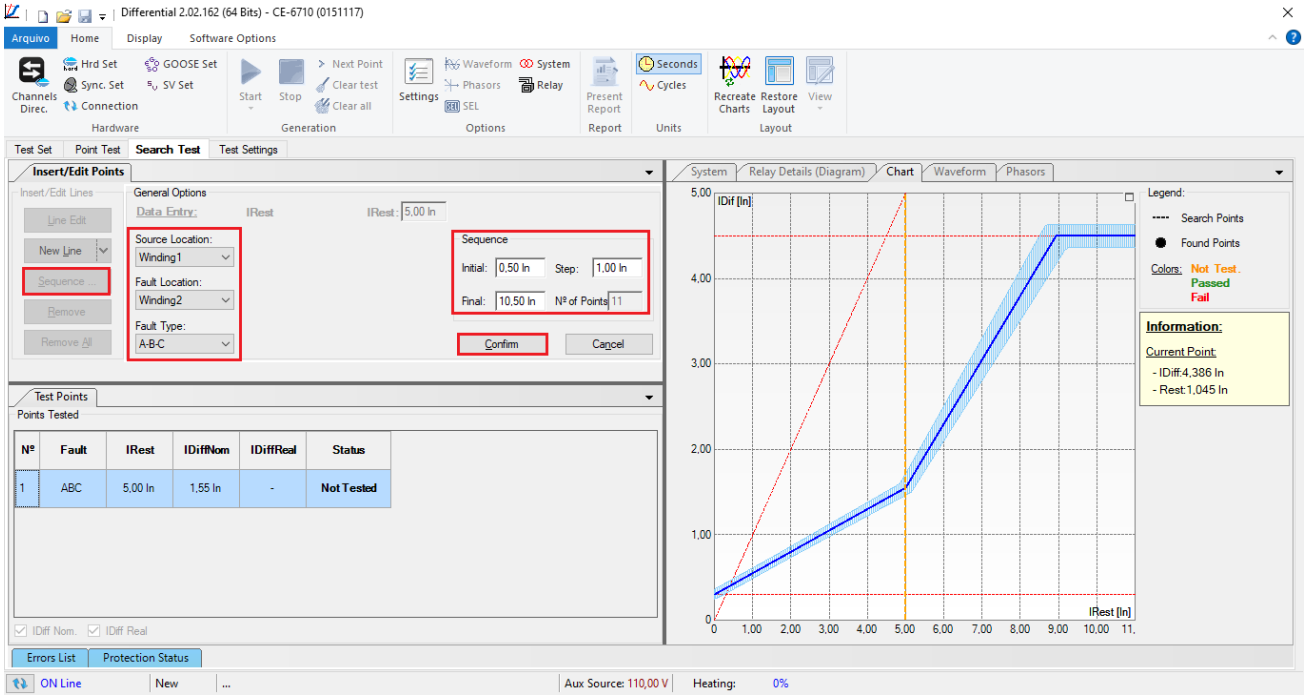


Figure 43

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

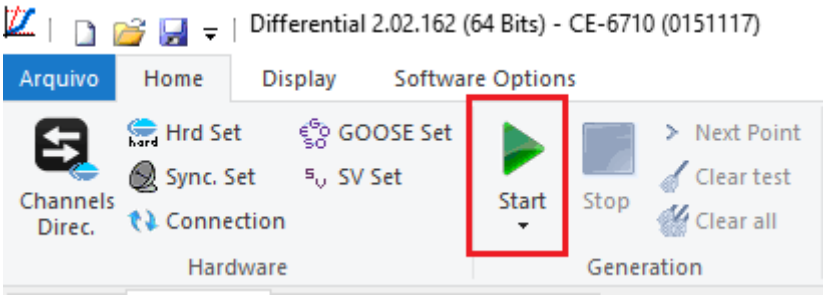


Figure 44

## 6.5. Final Search Test Result

It is verified that all differential current values found are within tolerance.

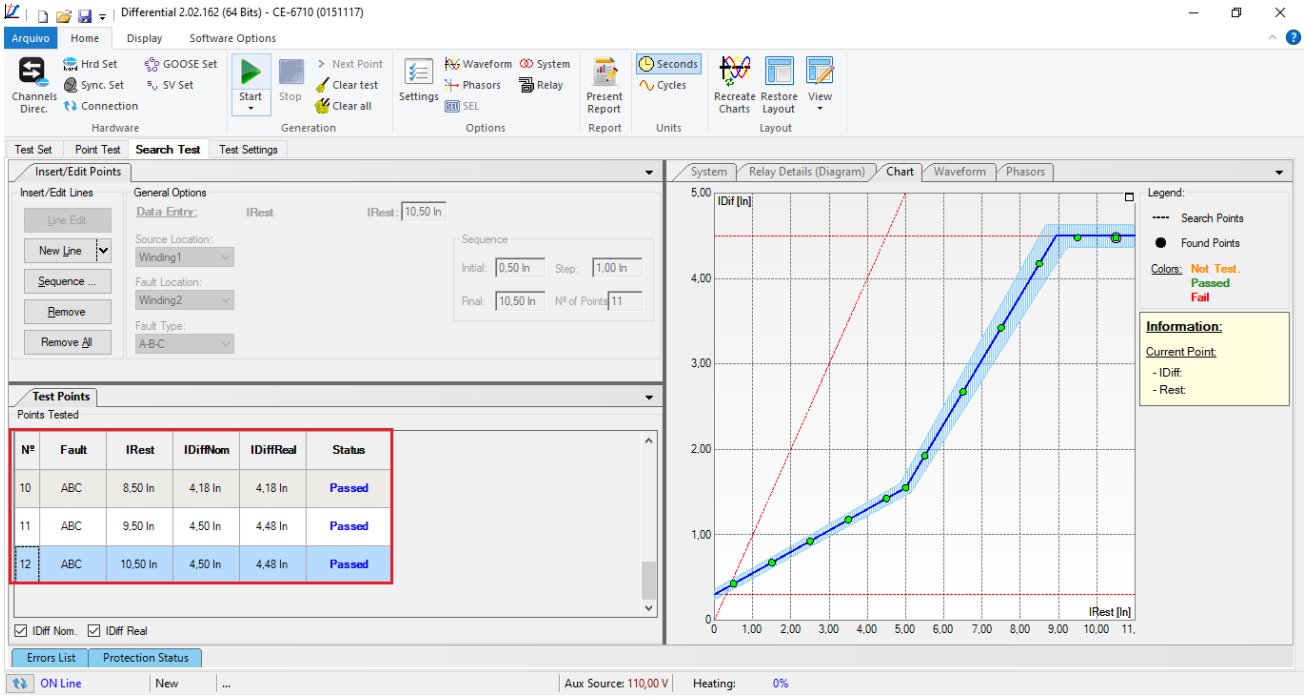


Figure 45

## 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.

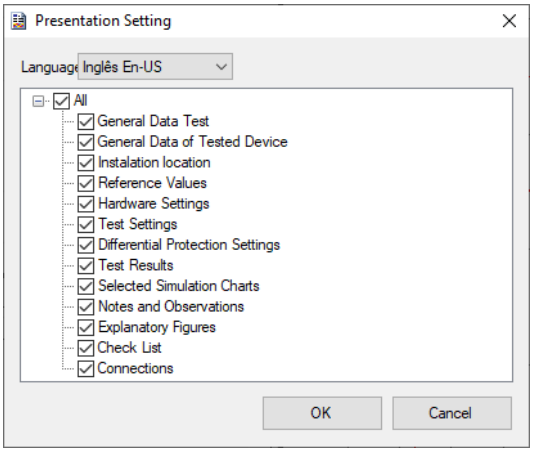


Figure 46

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. 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.

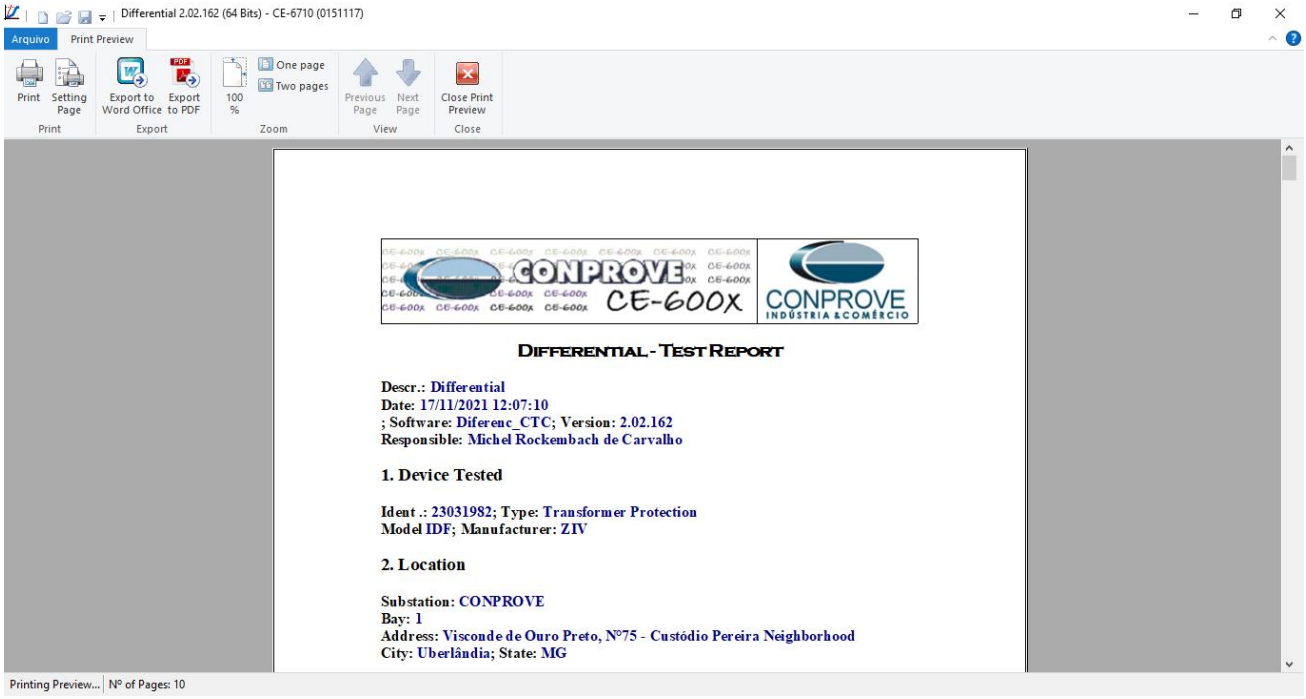


Figure 47

# 8. Appendix A - Manufacturer Tolerances

| | |
|---|---|
| **Differential Units** | |
| Pickup and Reset | **±3 %** or **±50mA** of the theoretical value (the greater) (In = 1A and 5A) |

**Measurement of average times of the differential unit with restraint**

| Type | Enabled | Times I0 (Sensitivity) | Measuring Times (**) | |
|---|---|---|---|---|
| | | | 50Hz | 60Hz |
| Blocking or Harmonic Restraint | YES | 1.5 | 32 ms | 28 ms |
| | | 5 | 31 ms | 28 ms |
| | | 15 | 31 ms | 28 ms |
| Blocking or Harmonic Restraint | NO* | 1.5 | 28 ms | 27 ms |
| | | 5 | 17 ms | 16 ms |
| | | 15 | 15 ms | 14 ms |

(*) When the ***Blocking type*** / ***Harmonic Restraint*** setting is in Dynamic mode, blocking / restraint by harmonics will be disabled in internal fault conditions.

Figure 48

# 9. Appendix B - Terminal Diagram

- **Analog Channels IDF-A (2 Sets of Three-Phase Current)**

| Magnitude | Analog Channels | Analog Channel description | SLOT (1/2 rack) | PINS |
|---|---|---|---|---|
| PHASE VOLTAGE AG | VA | VOLTAGE INPUT 1 | C | 1-2 |
| PHASE VOLTAGE BG | VB | VOLTAGE INPUT 2 | C | 3-4 |
| PHASE VOLTAGE CG | VC | VOLTAGE INPUT 3 | C | 5-6 |
| PHASE A CURRENT WINDING 1 | IA1 | CURRENT INPUT 1 | C | 7-8 |
| PHASE B CURRENT WINDING 1 | IB1 | CURRENT INPUT 2 | C | 9-10 |
| PHASE C CURRENT WINDING 1 | IC1 | CURRENT INPUT 3 | C | 11-12 |
| PHASE A CURRENT WINDING 2 | IA2 | CURRENT INPUT 4 | C | 13-14 |
| PHASE B CURRENT WINDING 2 | IB2 | CURRENT INPUT 5 | C | 15-16 |
| PHASE C CURRENT WINDING 2 | IC2 | CURRENT INPUT 6 | C | 17-18 |
| GROUNDING CURRENT | IG1 | CURRENT INPUT 7 | C | 19-20 |

Figure 49

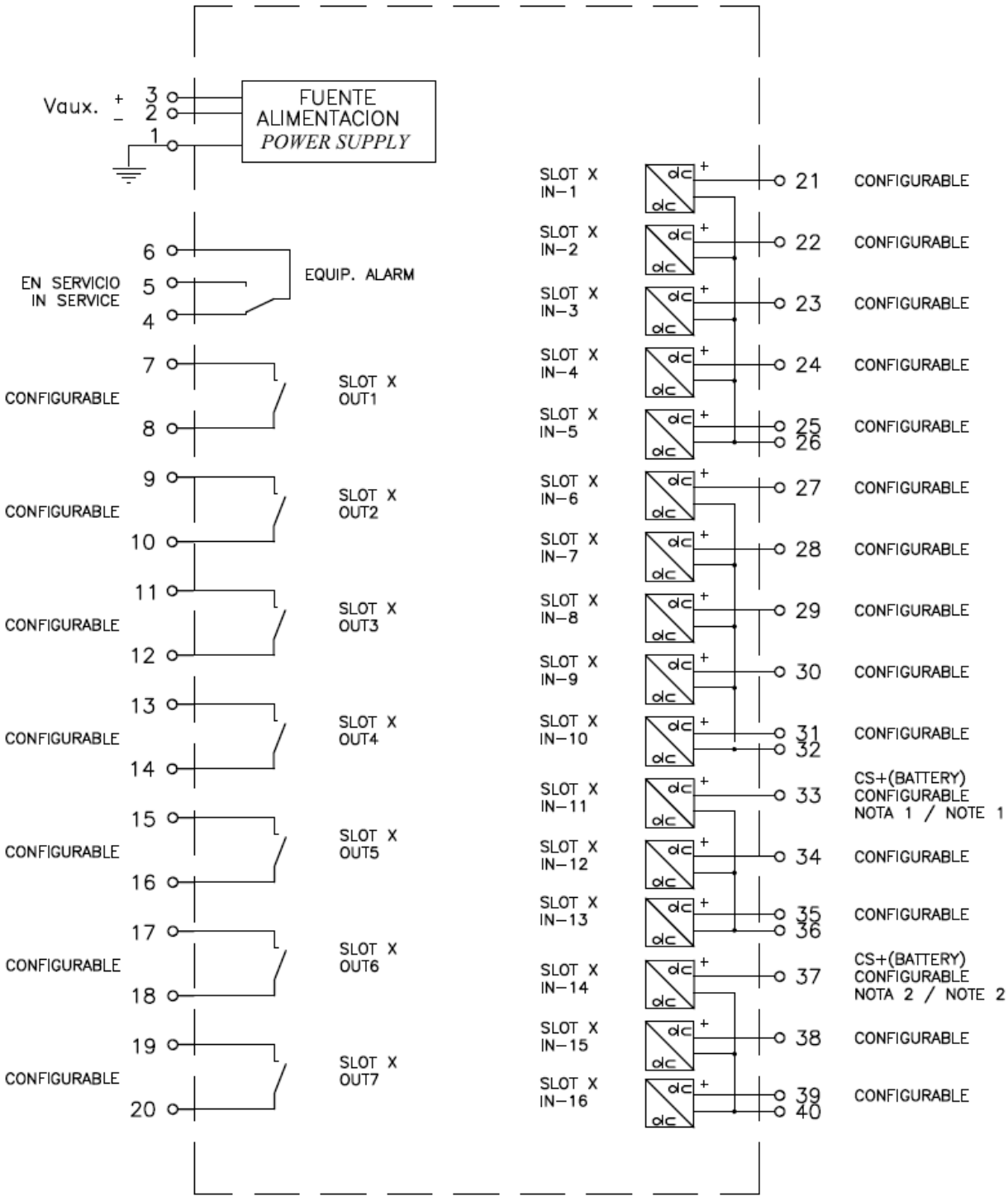
Vaux.
+
3
2
−
1
FUENTE
ALIMENTACION
POWER SUPPLY
6
5
4
EN SERVICIO
IN SERVICE
EQUIP. ALARM
7
8
CONFIGURABLE
SLOT X
OUT1
9
10
CONFIGURABLE
SLOT X
OUT2
11
12
CONFIGURABLE
SLOT X
OUT3
13
14
CONFIGURABLE
SLOT X
OUT4
15
16
CONFIGURABLE
SLOT X
OUT5
17
18
CONFIGURABLE
SLOT X
OUT6
19
20
CONFIGURABLE
SLOT X
OUT7
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 50

# 10. Appendix C - Parameter Equivalence between Relay and Software

Table 2

| Differential Software | | ZIV IDF Relay | |
|---|---|---|---|
| Parameter | Figure | Parameter | Figure |
| Voltage (Wind. 1) | 28 | Voltage 1 | 20 |
| Voltage (Wind. 2) | 28 | Voltage 2 | 20 |
| Power (Wind. 1) | 28 | Power Trafo | 20 |
| Power (Wind. 2) | 28 | Power Trafo | 20 |
| Connection (Wind. 1) | 28 | Wndg 1 connection | 20 |
| Connection (Wind. 2) | 28 | Wndg 2 connection | 20 |
| Vector Group (Wind. 2) | 28 | Wndg 2 phase ang | 20 |
| Ip Prim (Wind. 1) | 28 | Phase 1 CT Ratio (x 5,0A) | 16 |
| Ip Prim (Wind. 2) | 28 | Phase 2 CT Ratio (x 5,0A) | 16 |
| Is Sec (Wind. 1) | 28 | Relay part number | -- |
| Is Sec (Wind. 2) | 28 | Relay part number | -- |
| Differential Settings | 30 | Sensitivity | 22 |
| Instantaneous Settings | 30 | Inst Diff Pickup | 23 |
| Restriction Current | 30 | Restraint Type | 21 |
| General Options / TAPs | 30 | Type of Tap | 20 |
| TAP (Wind. 1) | 31 | Tap Winding 1 | 20 |
| TAP (Wind. 2) | 31 | Tap Winding 2 | 20 |
| Slope 1 | 32 | Restraint Slope 1 | 22 |

| | | | |
|---|---|---|---|
| Slope 1 Start | 32 | R Slope 1 Start | 22 |
| Slope 2 | 32 | Restraint Slope 2 | 22 |
| Slope 2 Start | 32 | R Slope 2 Start | 22 |