Test Tutorial

Equipment Type: Protection Relay

Brand: Schneider (Areva)

Model: P632

Function: 87 or PDIF Differential Percentage

Tool Used: CE-6006; CE-6710; CE-7012 or CE-7024

Objective: Test Settings, Testing Point and Survey of Feature Slope

Version control:

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

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Summary

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Statement of responsibility

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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 should be noted that the user must have satisfactory training in maintenance procedures, a good knowledge of the equipment under tested and also be aware of safety standards and regulations.

Copyright

1. Relay connection to CE-6006

Appendix A shows the relay terminal designations.

1.1 *Auxiliary Source*

Connect the positive (red terminal) of the Vdc Aux. Source to pin 7 on relay terminal (module X093) and the negative (black terminal) of Vdc Aux. Source to pin 8 of relay terminal (module X093).
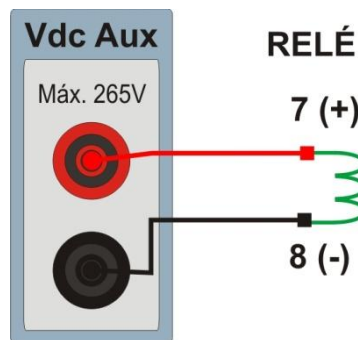

Figure 1

1.2 *Current Coils*

To establish the connection of the current coils, connect I1, I2 and I3 channels to pins 1, 3 and 5 of the relay terminal (module X032) and those common to pins 2, 4 and 6 (module X032) . Connect I4, I5 and I6 channels to pins 1, 3 and 5 of the relay terminal (module X052) and the common ones to pins 2, 4 and 6 (module X052).
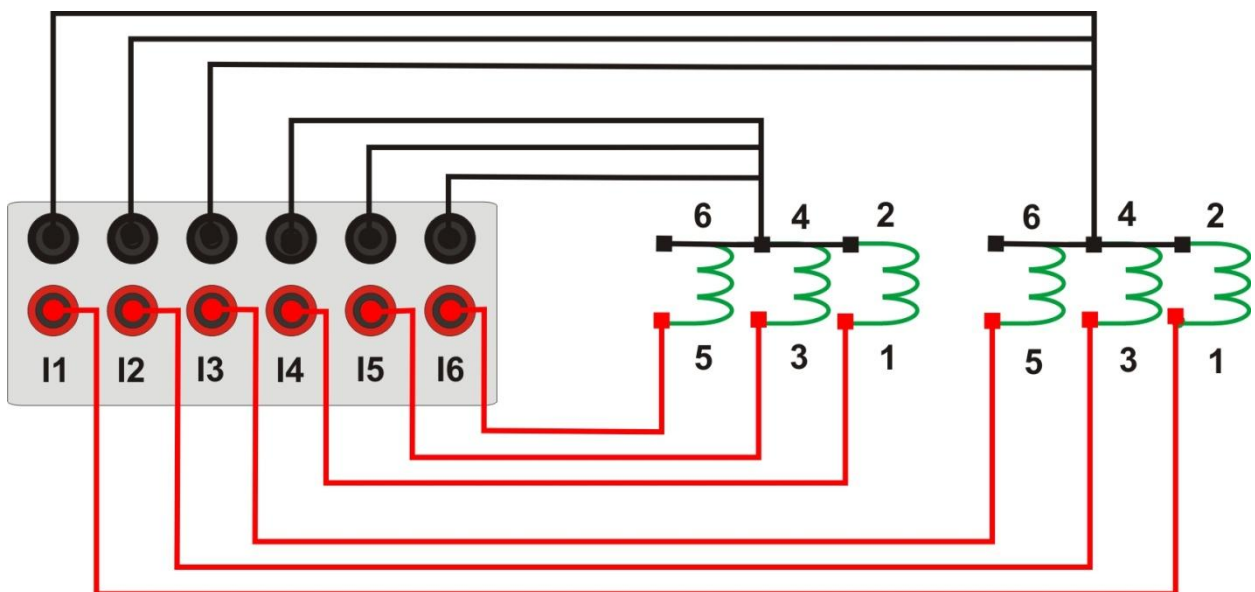

Figure 2

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1.3 *Binary Inputs*

Connect the CE-6006 binary inputs to the relay binary outputs.

- BI1 to pin 2 and its common to pin 1 of relay module X092.
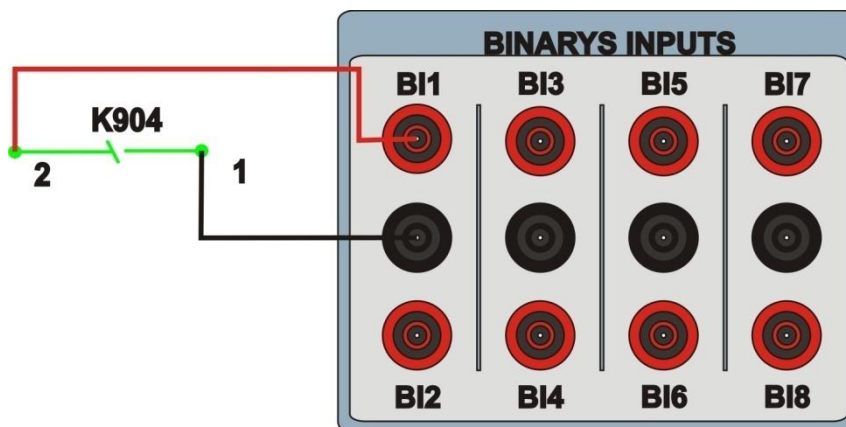
The following figure shows the details of the connections.

Figure 3

2. Communication with P632 relay

First, open the ***MICOM S1 Studio*** and connect a serial cable from the notebook to the relay. Then double click on the software icon.

Figure 4

Then make the connection with the relay. The next step is to extra go all the information set in the relay. Right-click *"Settings"* and *"Extract Settings"*.
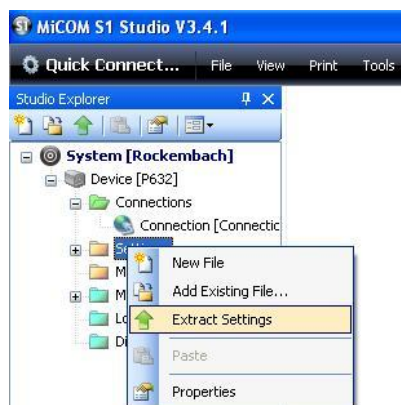

Figure 5

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The reading of the settings will appear with the name of *"000"* and can be modified if necessary. In this case the file name was changed to *"Diferenc"*.
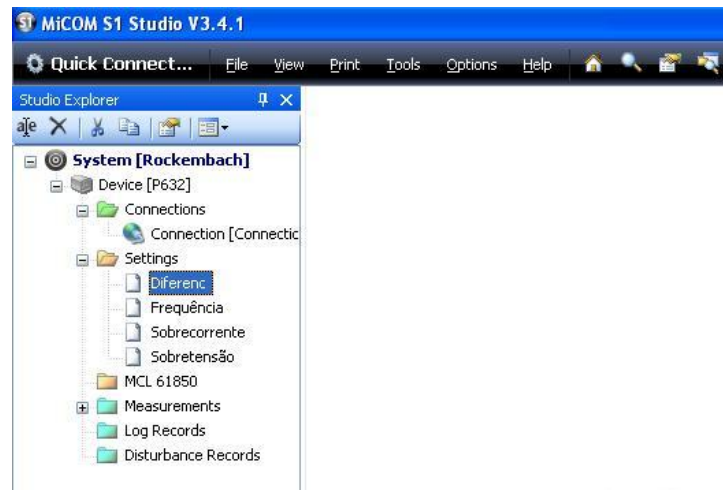

Figure 6

3. Parameterization of the P632 relay

3.1 *Function group DIFF*

After double-clicking on the file, go to *"Parameters > Config. Parameters"* and then *"Function group DIFF"*. This option allows working with the differential.
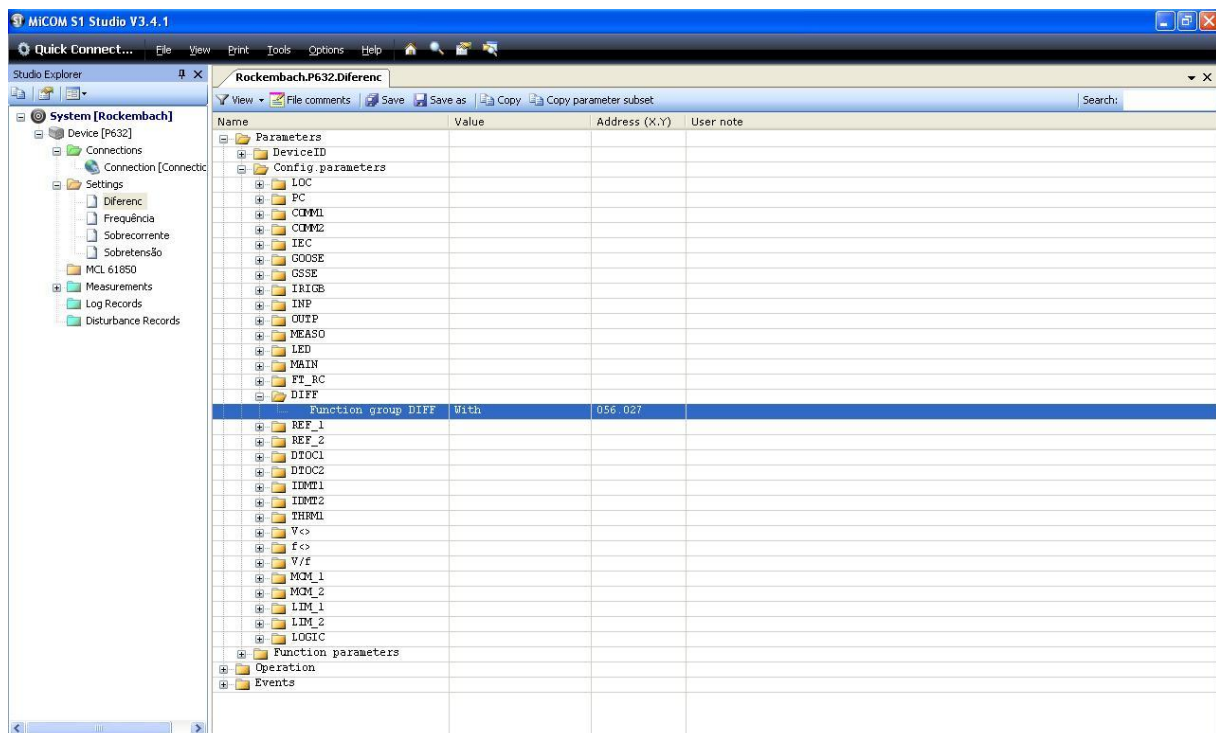

Figure 7

3.2 *Main*

Click on the *"+ > Functional parameters > Main"*. This screen adjusts the nominal frequency, the phase sequence, primary currents and voltages, and the secondary currents and voltages.
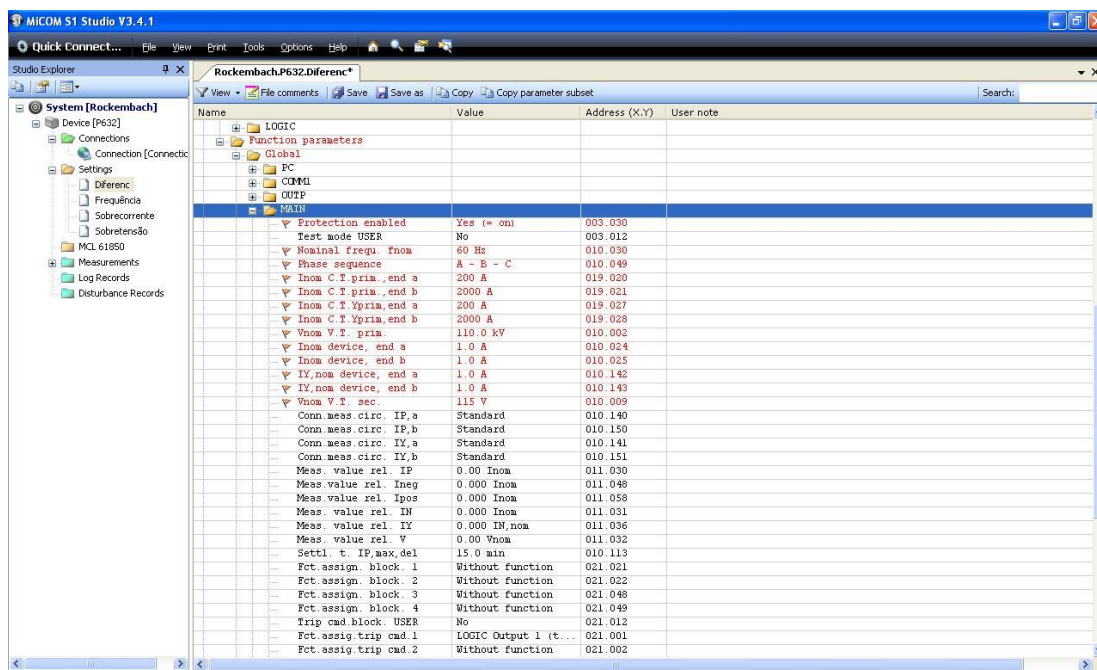

Figure 8

3.3 *PPS*

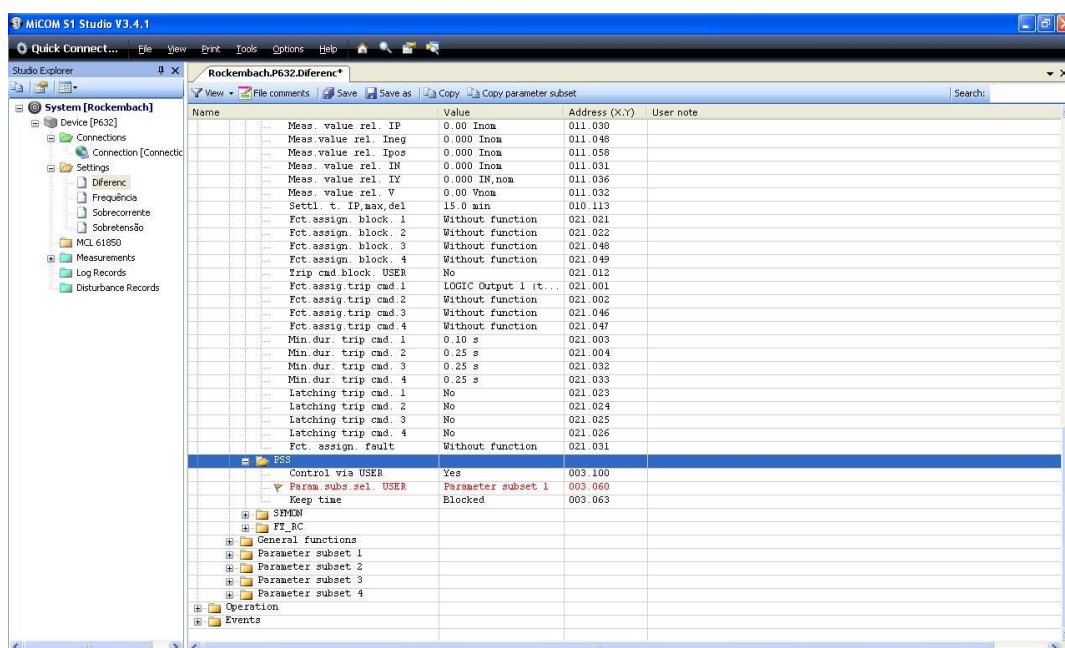Make sure that group one is active, click on the *"PPS"* option and make the following adjustment:

Figure 9

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3.4 *Main*

Click on the *"+ > General functions > Main"*. In this option, the nominal voltages on each side of the transformer are adjusted.

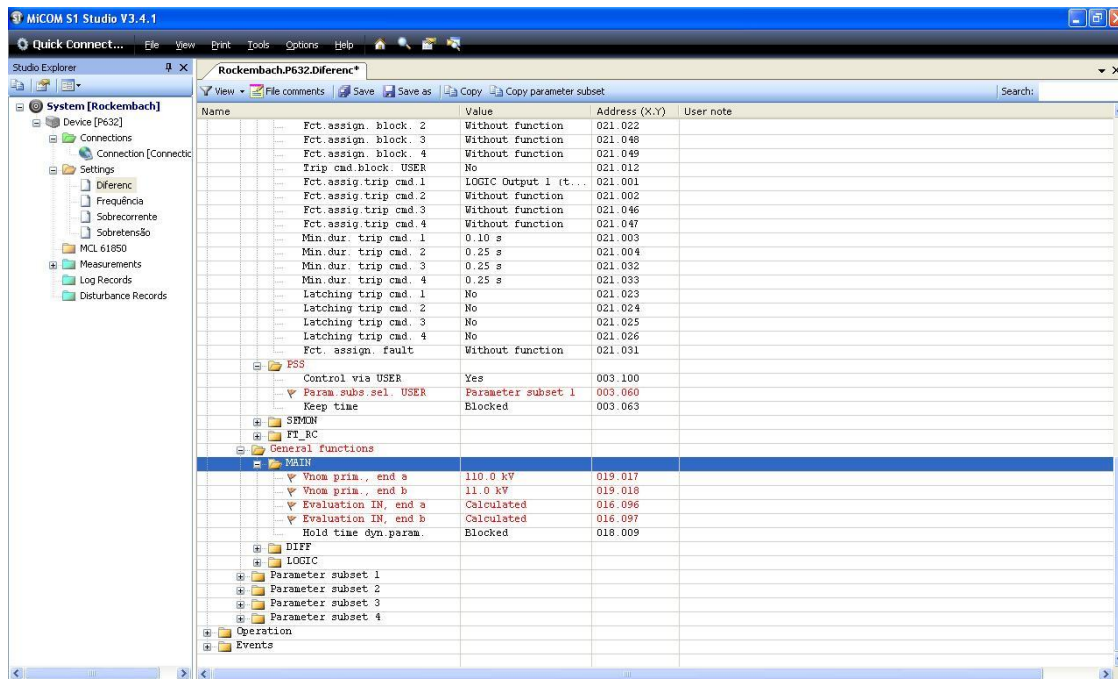**Figure 10**

3.5 *Diff*

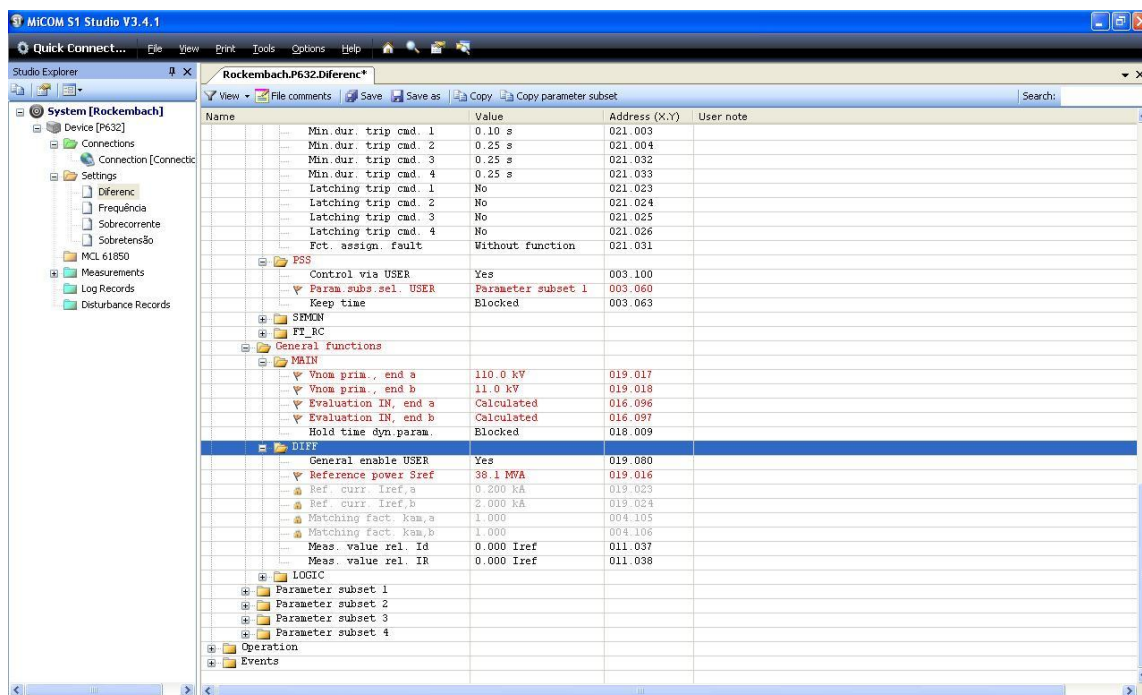In this field, the nominal power of the transformer is set.

Figure 11

3.6 *Main*

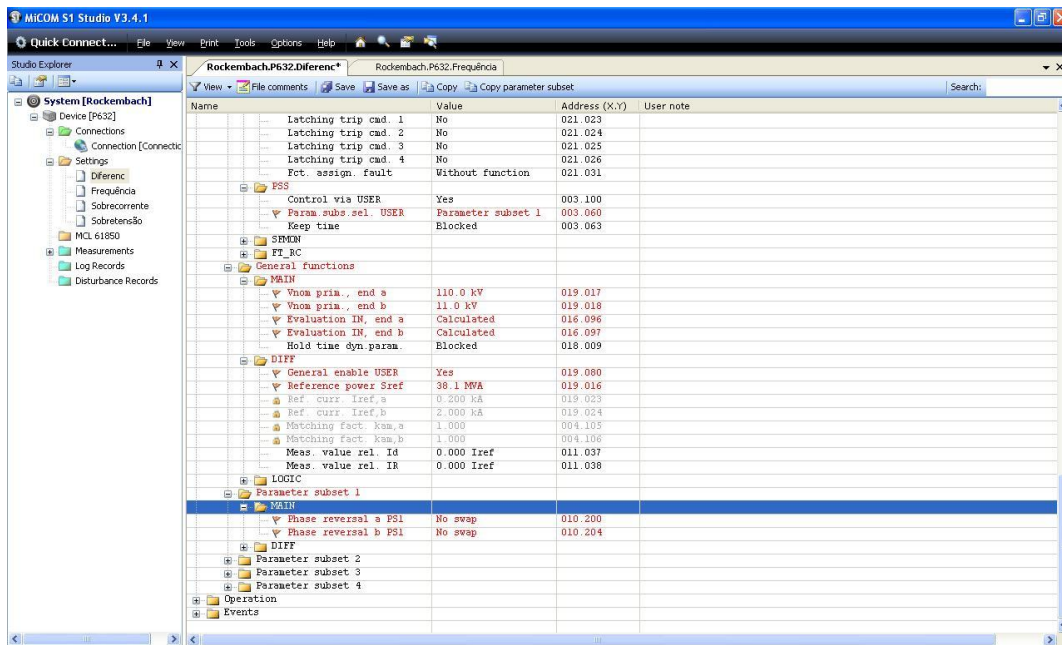Click on the *"+ > Parameter subset 1 > Main"* to adjust the CT connections.

Figure 12

3.7 *DIFF*

Click on the *"+"* sign near to *"Diff"* and then adjust the lag between the windings, percentage differential values, instantaneous differential, slopes and knee point.
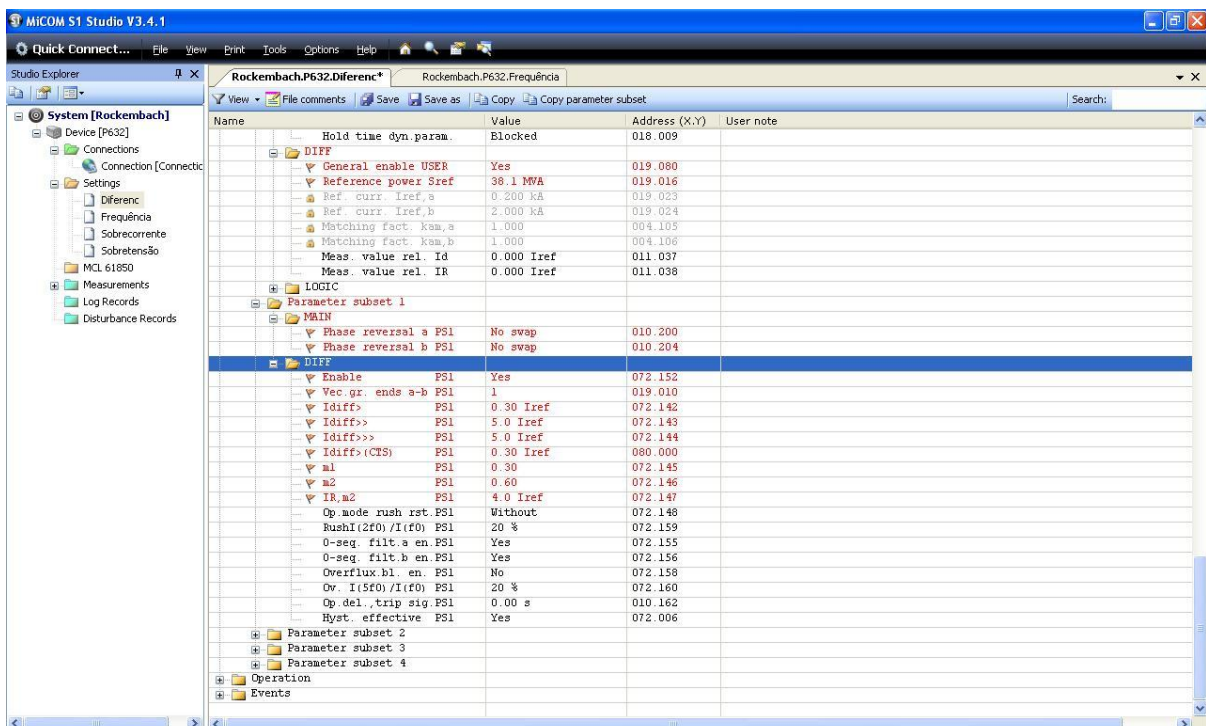

Figure 13

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3.8 *OUT*

Click on *"Config. Parameters"* and then *"OUT"*. In this option, the binary outputs are designated with the trip signals.
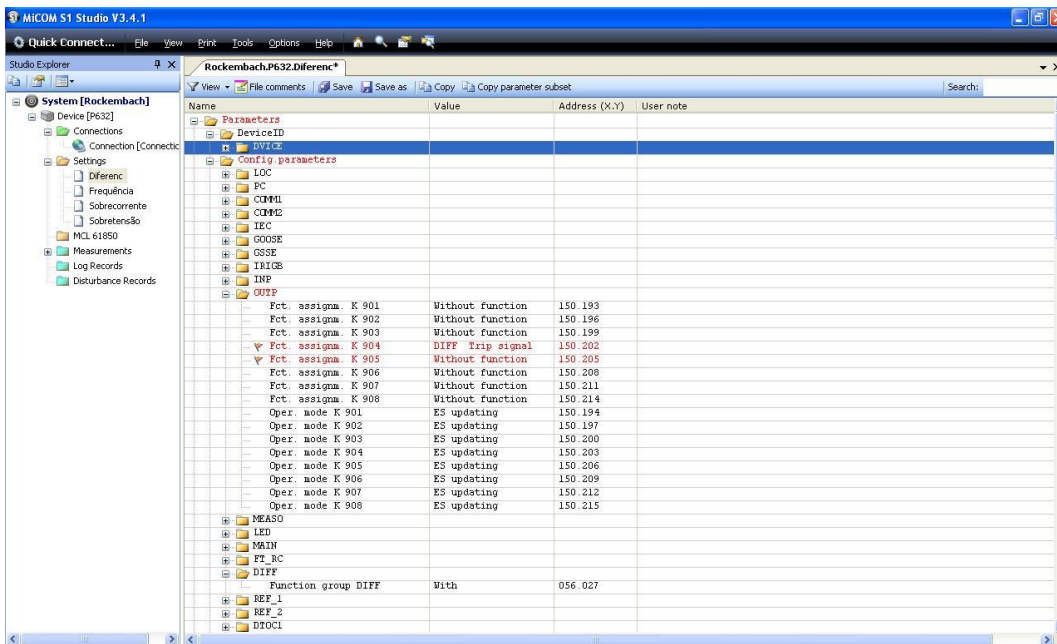

Figure 14

After making all the adjustments, right-click on the *"Parameters"* folder and send the changes to the relay.
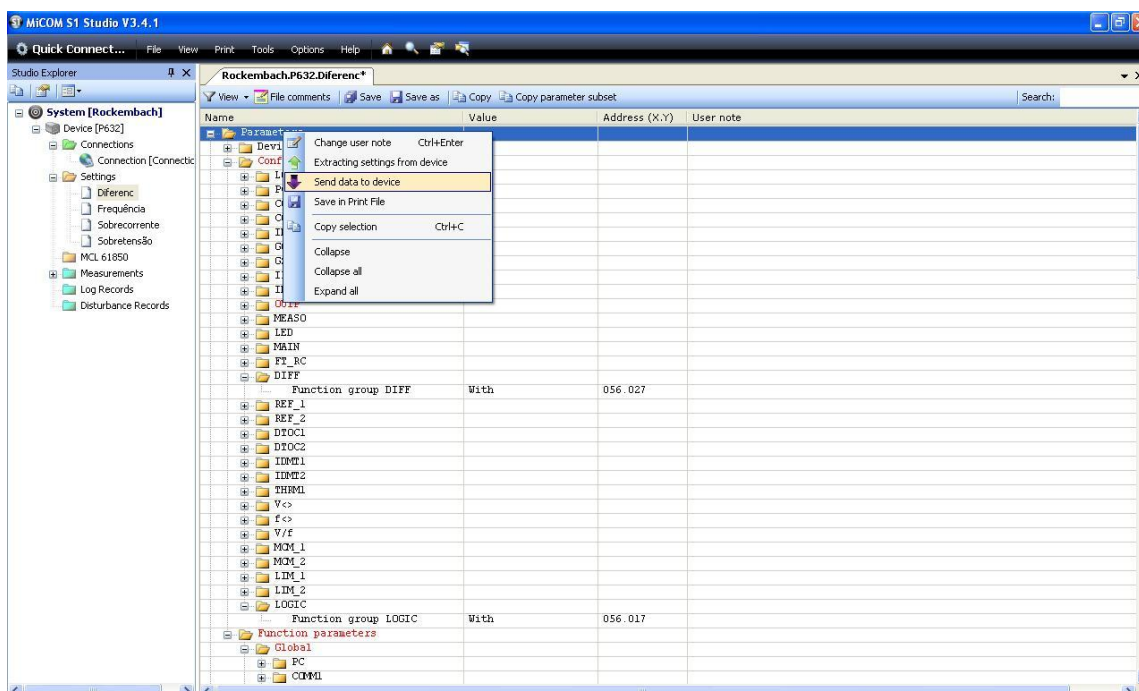

Figure 15

4. Differential software settings

4.1 *Opening the Differential*

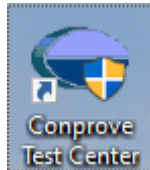Click on the *"Conprove Test Center"* application manager icon.

Figure 16

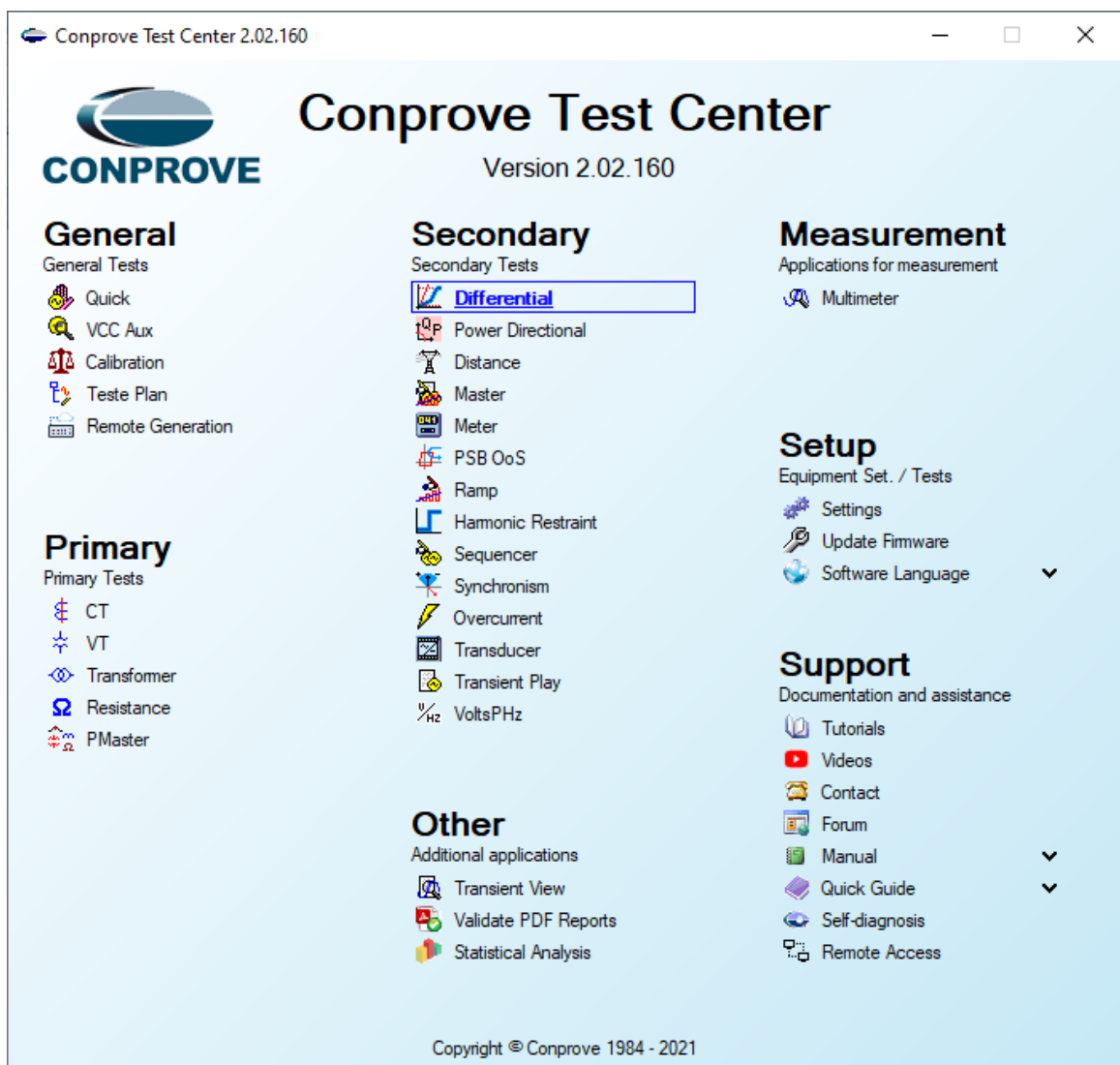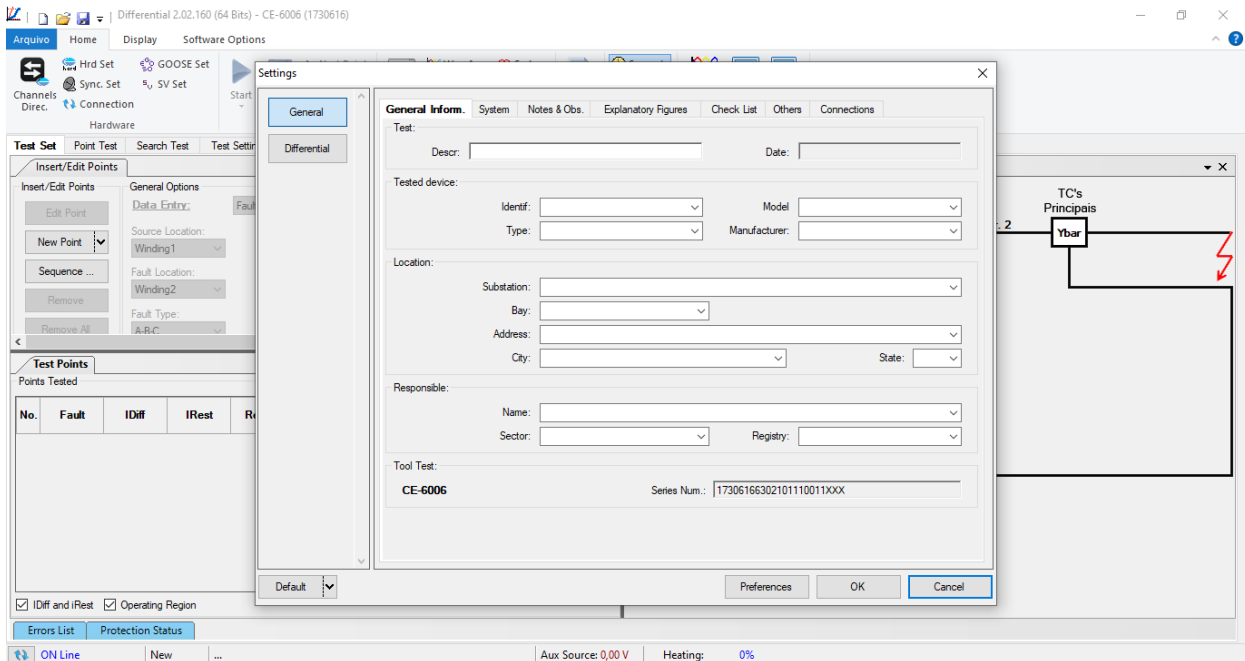Make a click on the software icon *"Differential"*.

Figure 17

Figure 18

4.2 *Configuring the Settings*

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.
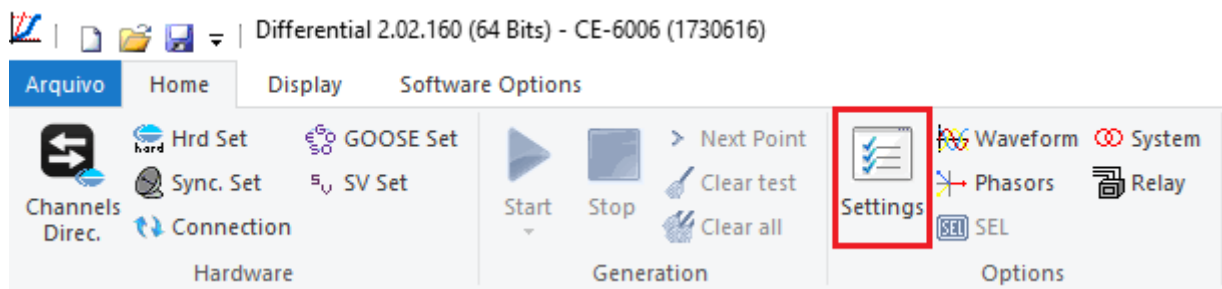

Figure 19

Inside the *"Settings"* screen, fill in the *"General Inform."* with details of the tested device, installation location and the person responsible. This makes reporting easier, as this tab will be the first to be shown.

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Figure 20

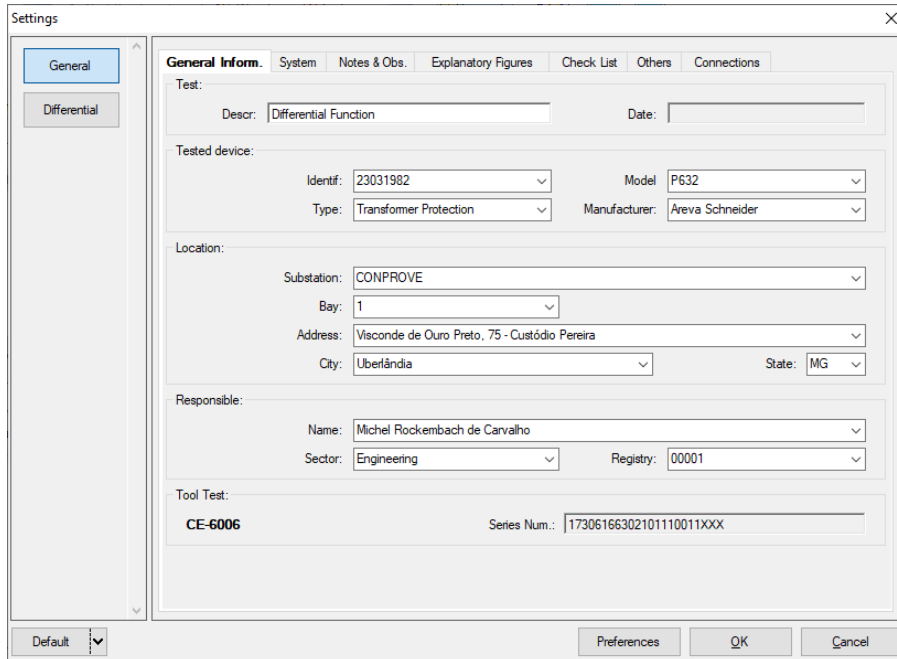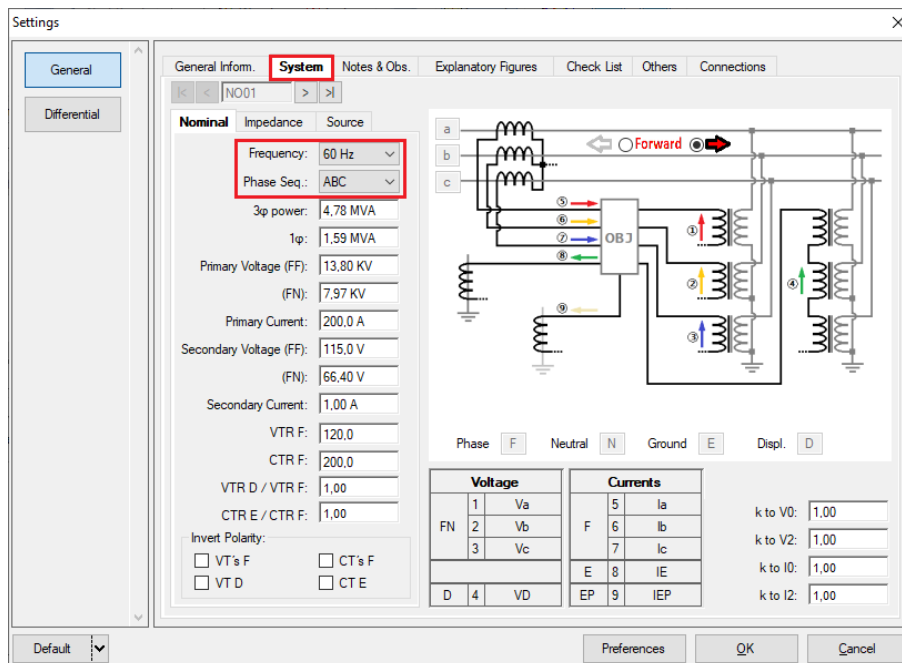### 4.3 *System*

In the following screen, within the *"Nominal"* sub 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 are not relevant for this test.

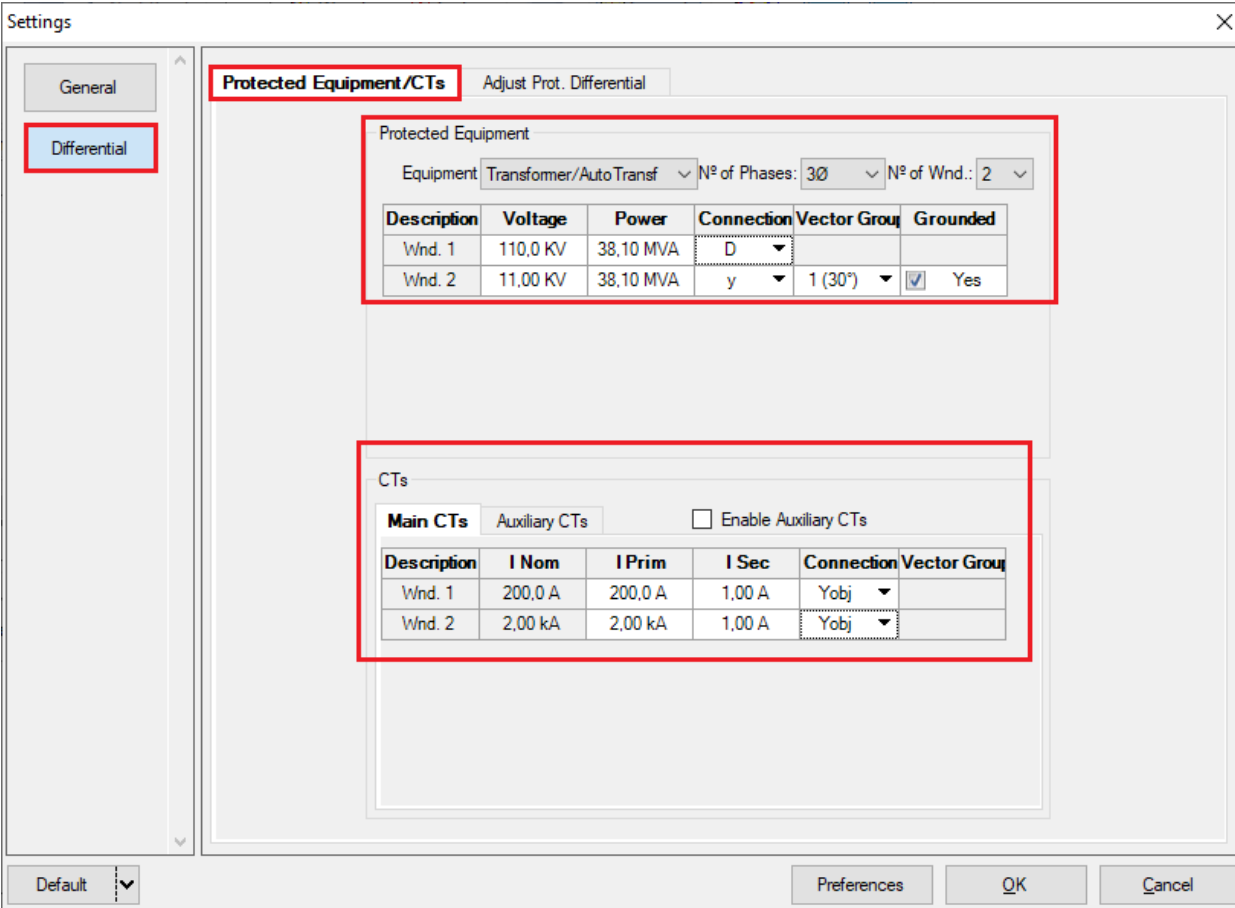**Figure 21**

There are other tabs where the user can enter notes and observations, explanatory figures, can create a *"check list"* of the procedures for carrying out the test and even create a schematic with all the schematic of the connections between the test set and the test equipment.

5. Differential Adjustment

5.1 *Differential Screen > Protected Equipment/CTs*

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

Figure 22

5.2 *Differential Screen > Adjust Prot. Differential > Settings*

The initial default for 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 Zero sequence elimination options 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 data entry, the settings of the main relays available on the market have already been standardized. When selecting one of the lists of relays, only the configurable settings are enabled. Choose the *"AREVA MiCOM P631/P632"* mask.
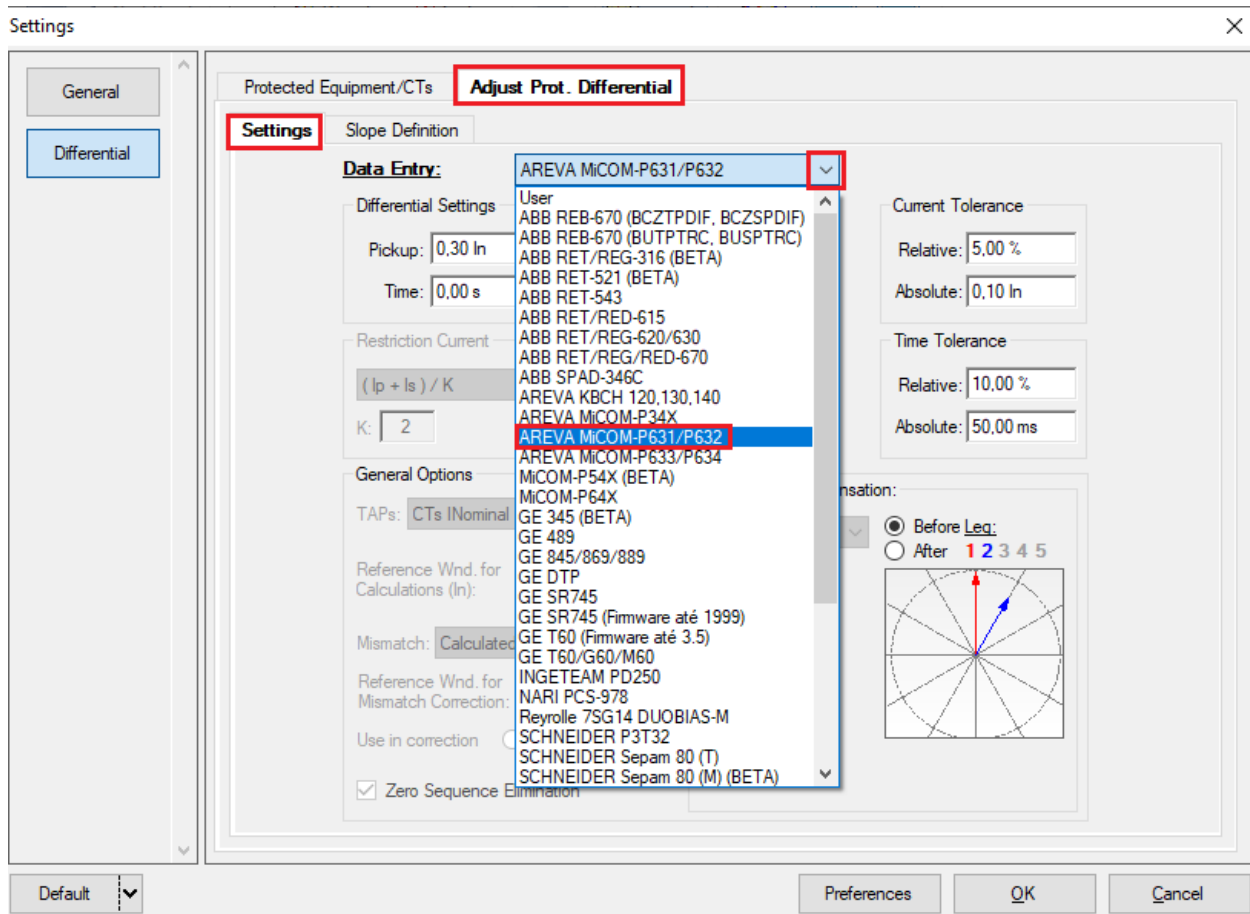

Figure 23

Parameterize the *"Differential Settings"* and *"Instantaneous Settings"*. Set the time to 0.0s. Use the tolerances for current and time given in the Appendix A.
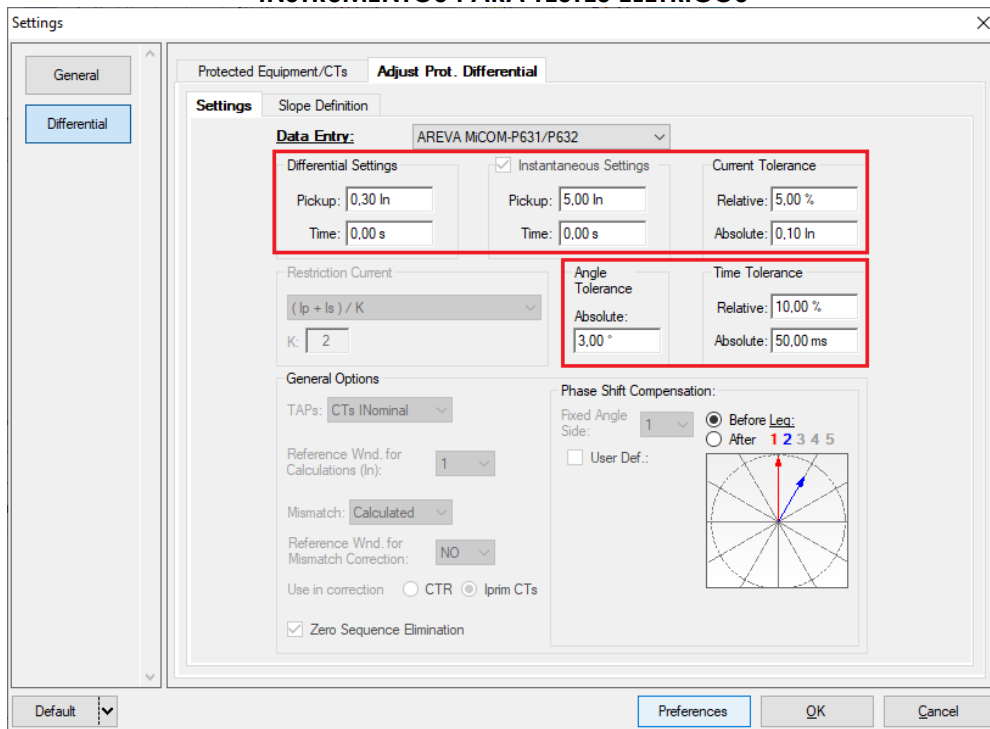
Figure 24

5.3 *Differential Screen > Adjust Prot. Differential > Slope Definition*

On this screen, the values of the slopes and the *"Ir,m2"* must be entered.

Figure 25

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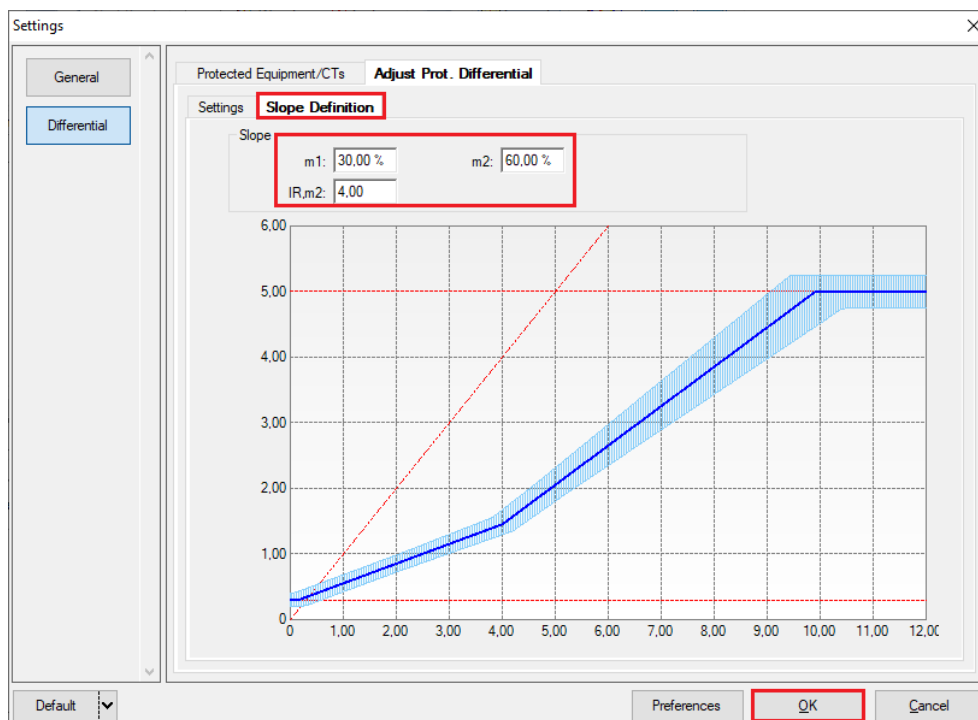Home Page: www.conprove.com.br   -   E-mail: conprove@conprove.com.br

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6. Channel Direction and Hardware Configurations
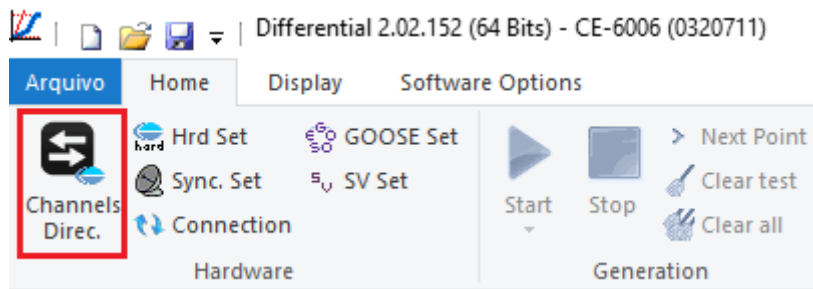
Click on the icon illustrated below.

Figure 26

Then click on the highlighted icon to configure the hardware.
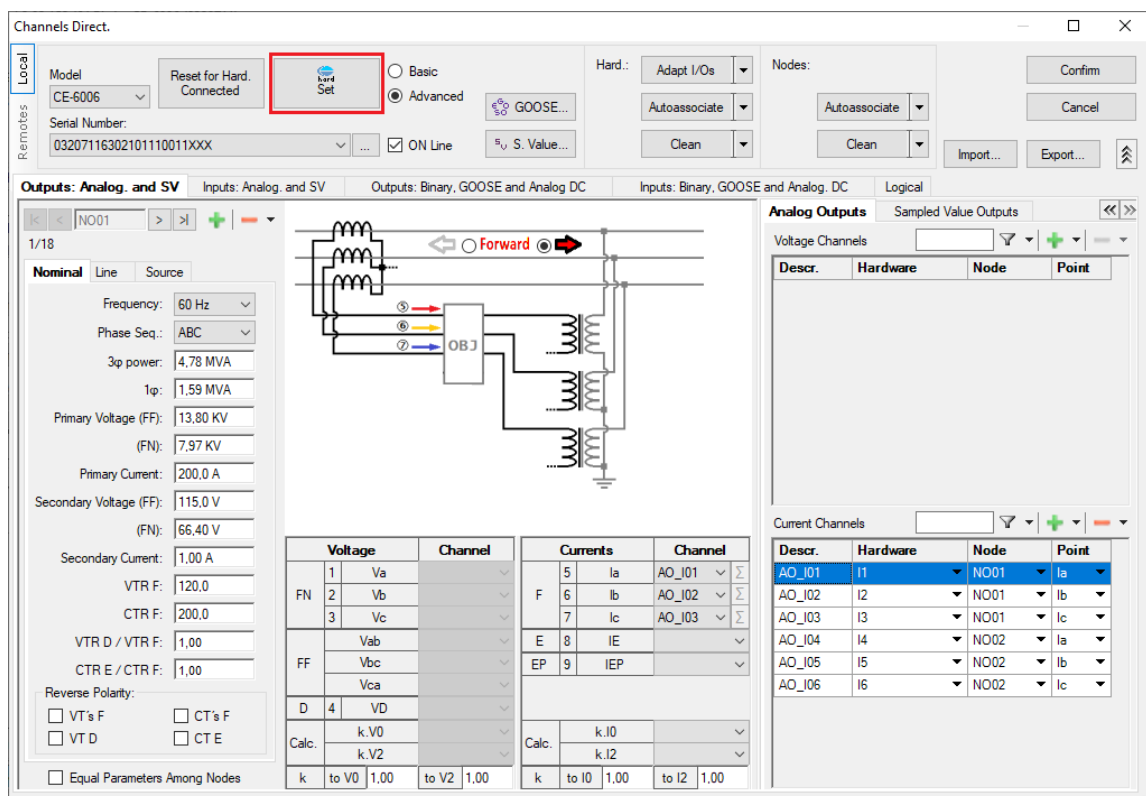

Figure 27

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

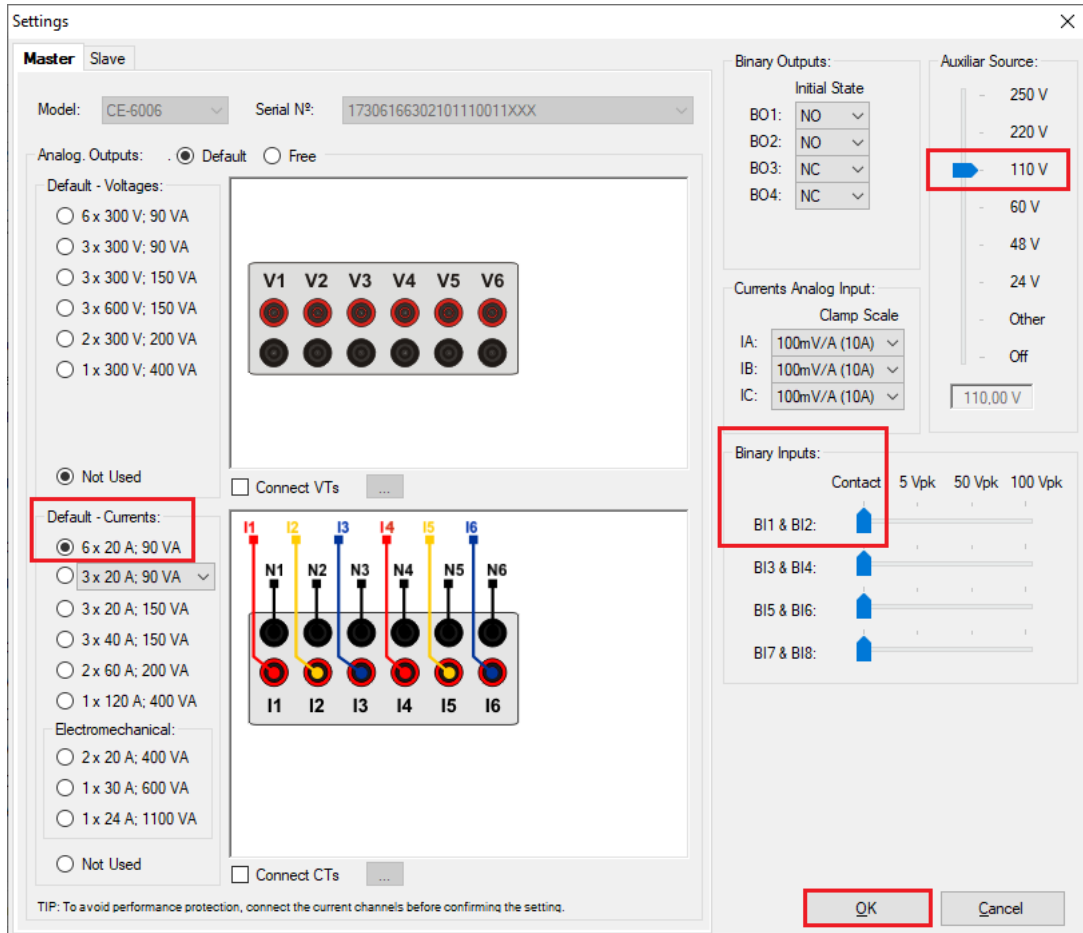Rua Visconde de Ouro Preto, 77 - Bairro Custódio Pereira - Uberlândia – MG - CEP 38405-202.
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Figure 28

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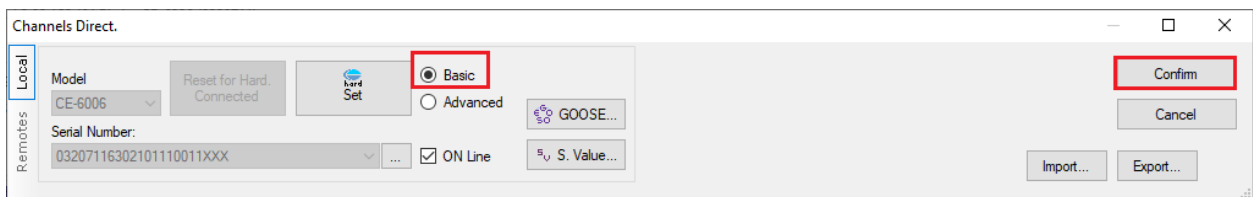

Figure 29

7. Test Structure for Function 87

7.1 *Test Settings*

In this tab, the trunk channels are associated with the relay phases; the trip signal is configured with the binary input.

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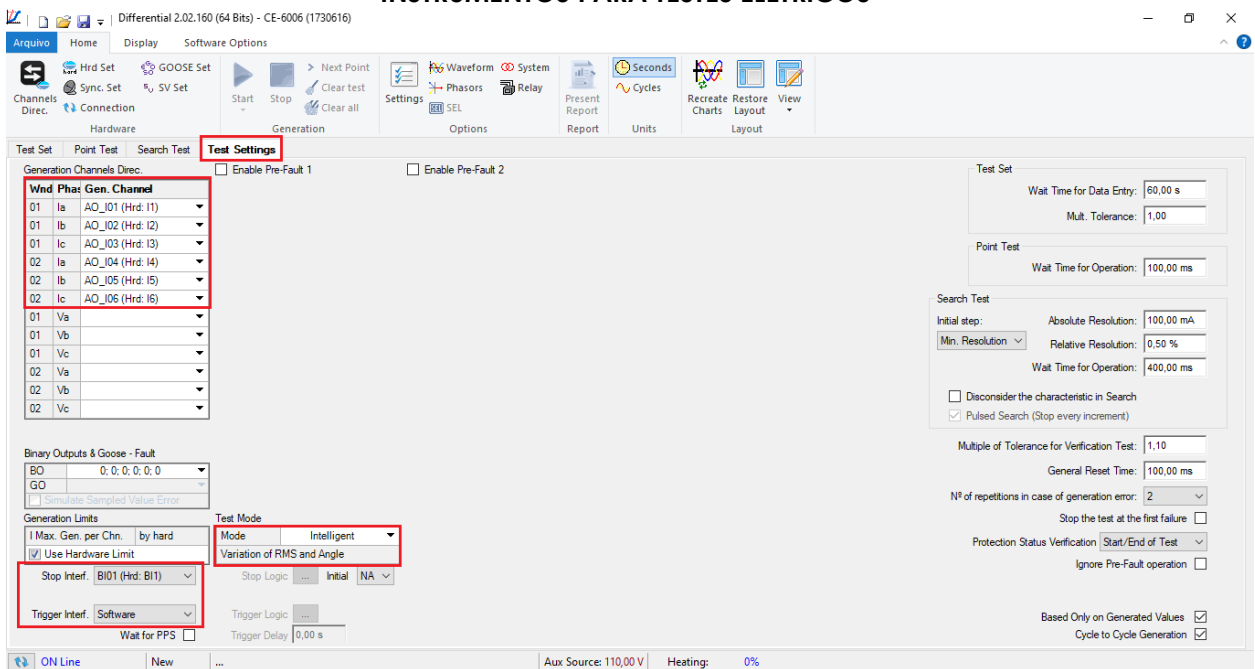Home Page: www.conprove.com.br   -   E-mail: conprove@conprove.com.br

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Figure 30

8. Point Test

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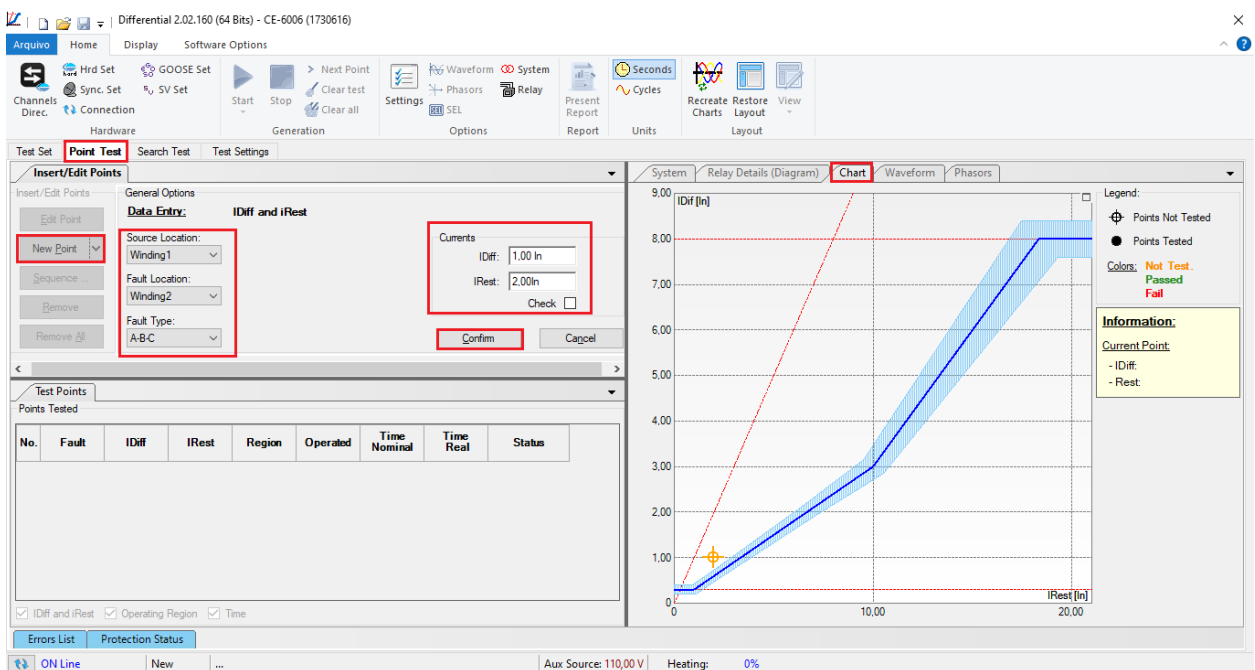

Figure 31

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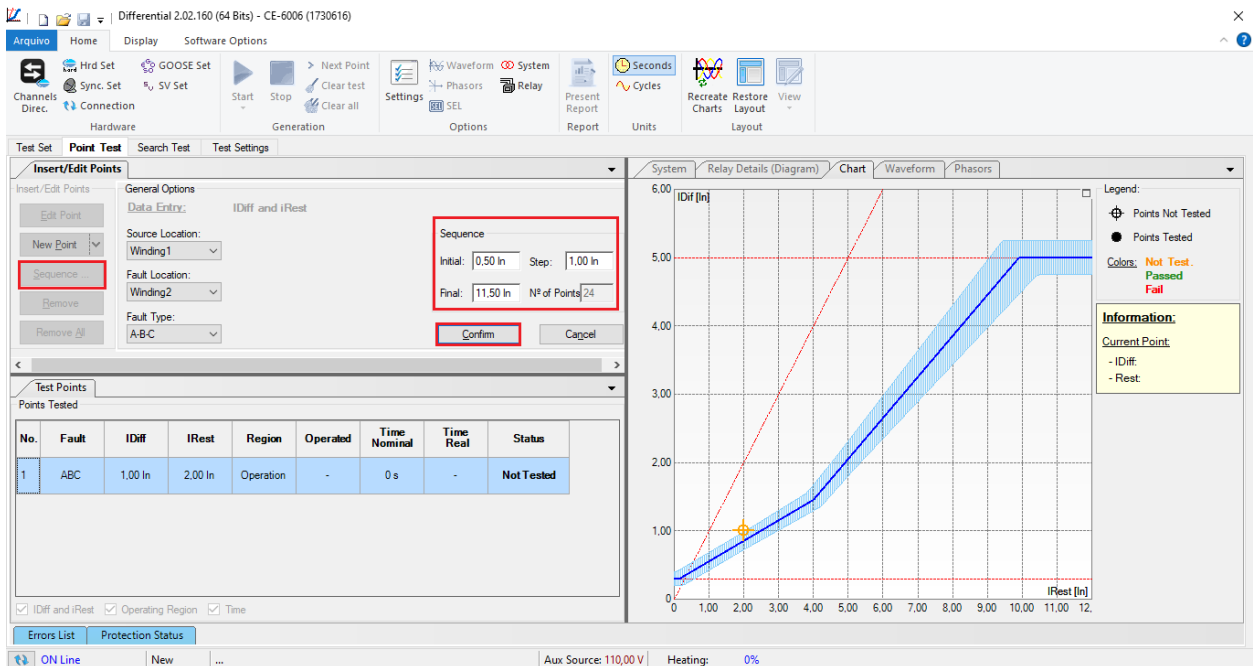

Figure 32

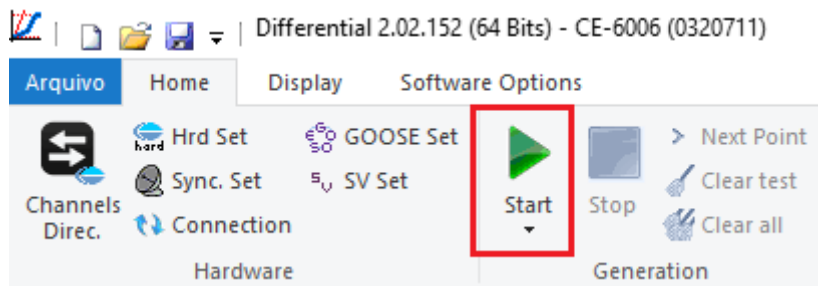Click on the icon highlighted below or use the command *"Alt +G".*

Figure 33

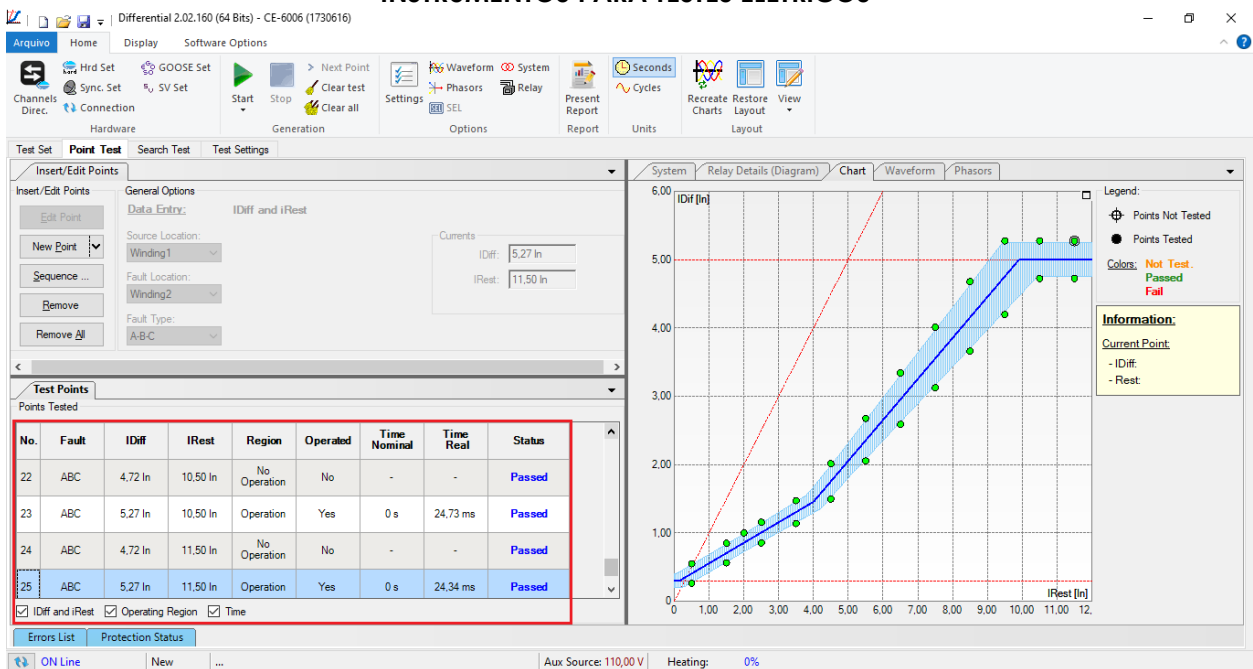It is verified that all points were successfully approved.

Figure 34

9. Search Test

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

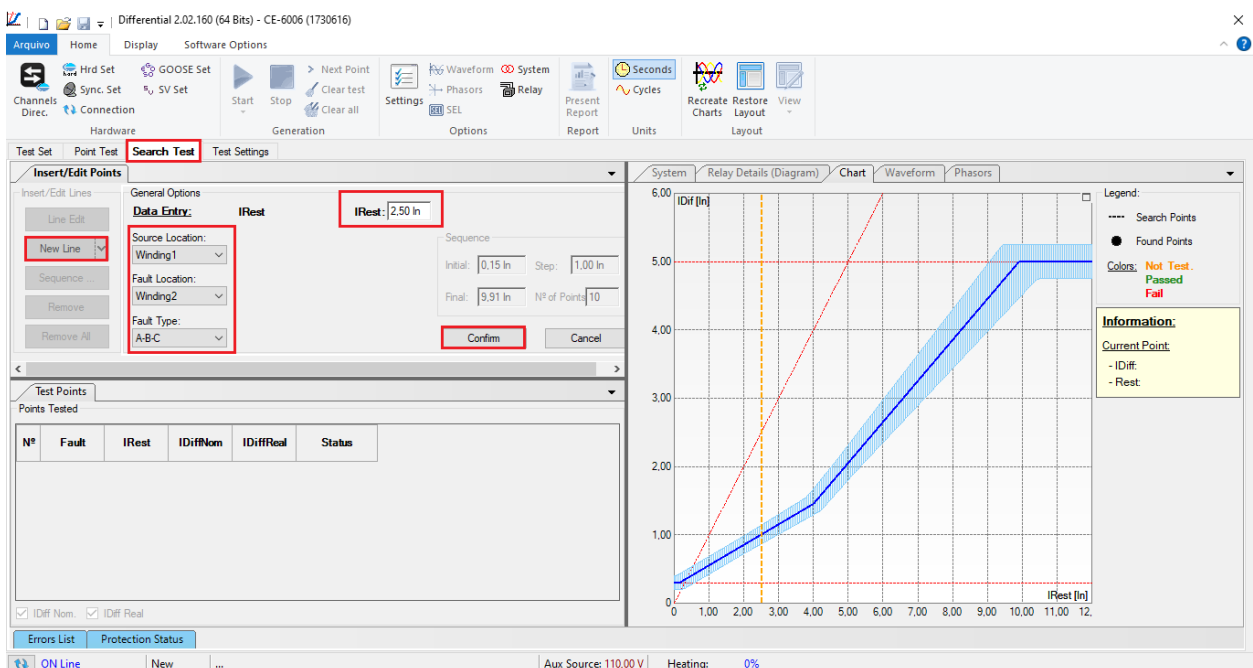**Figure 35**

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 currents of the search and the step between them.
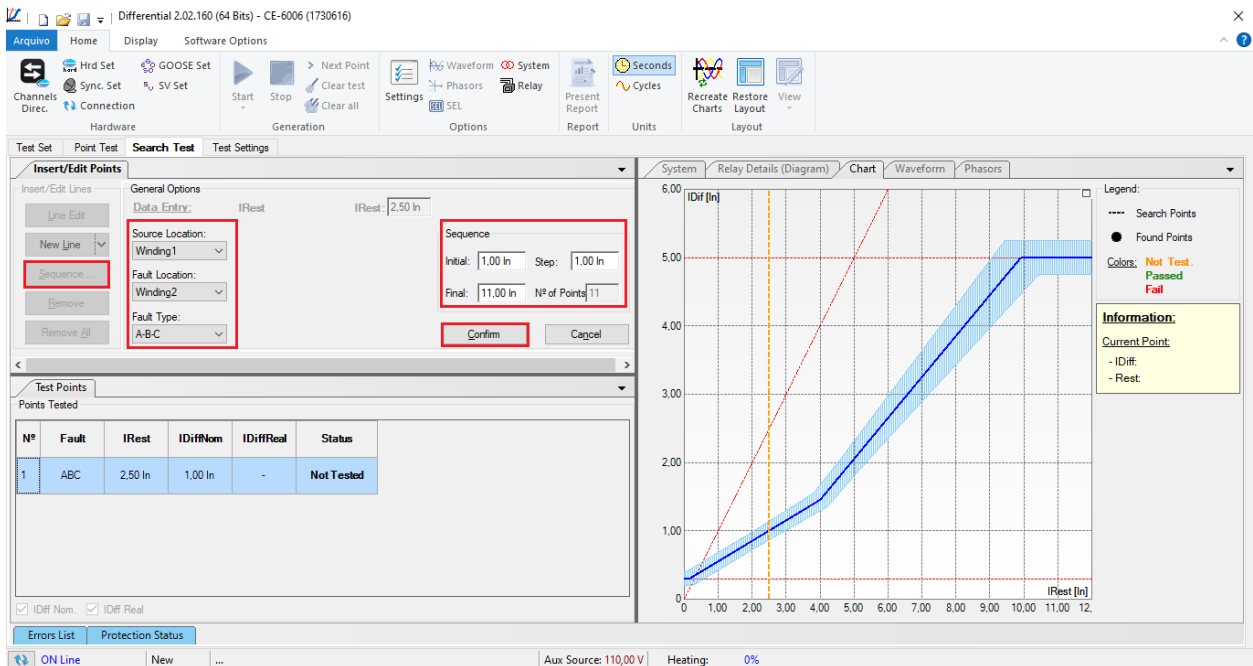

Figure 36

Click on the icon highlighted below or use the command *"Alt +G"*.
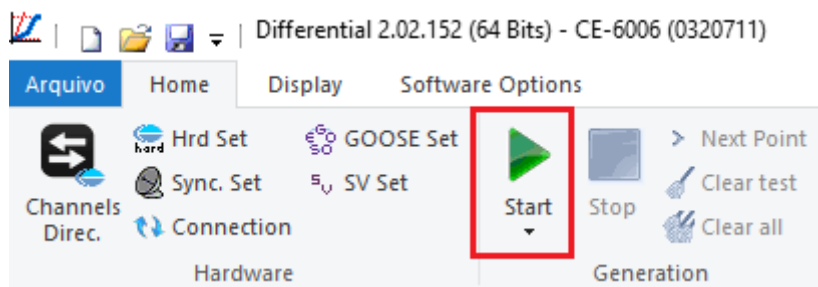
Figure 37

It is verified that all lines were successfully approved.
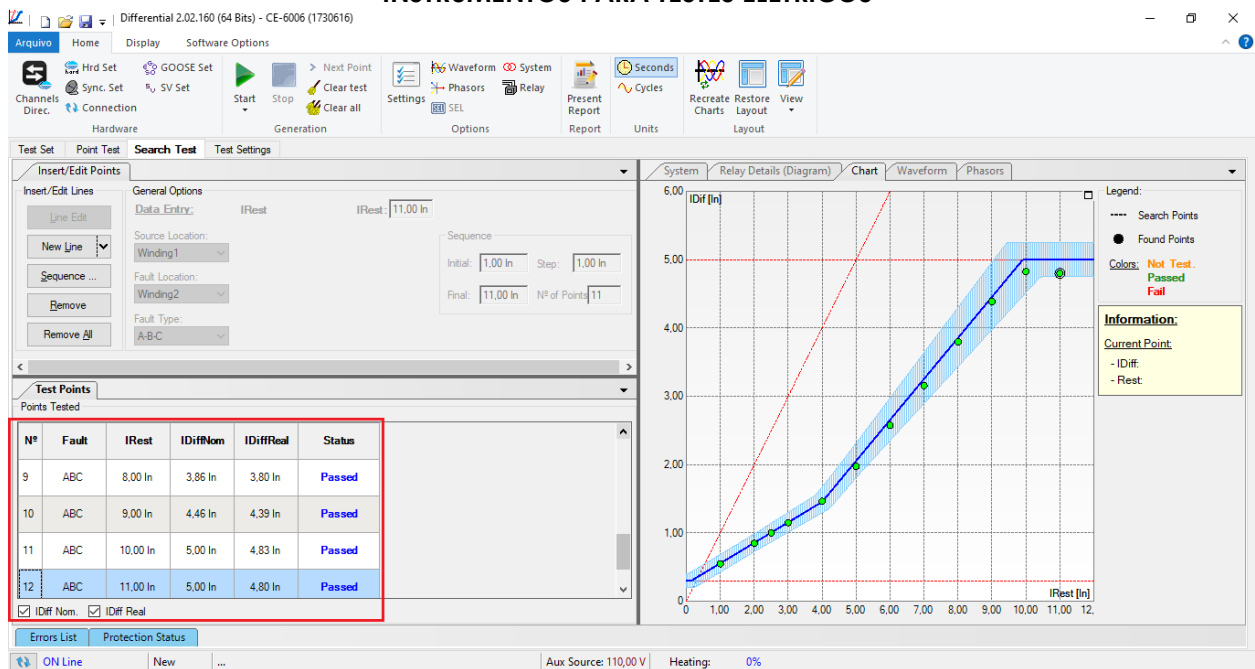
Figure 38

10. Report

After finishing the test, click on the icon highlighted 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 39

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Figure 40

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APPENDIX A

A.1 Terminal Designations

Figure 41

Figure 42

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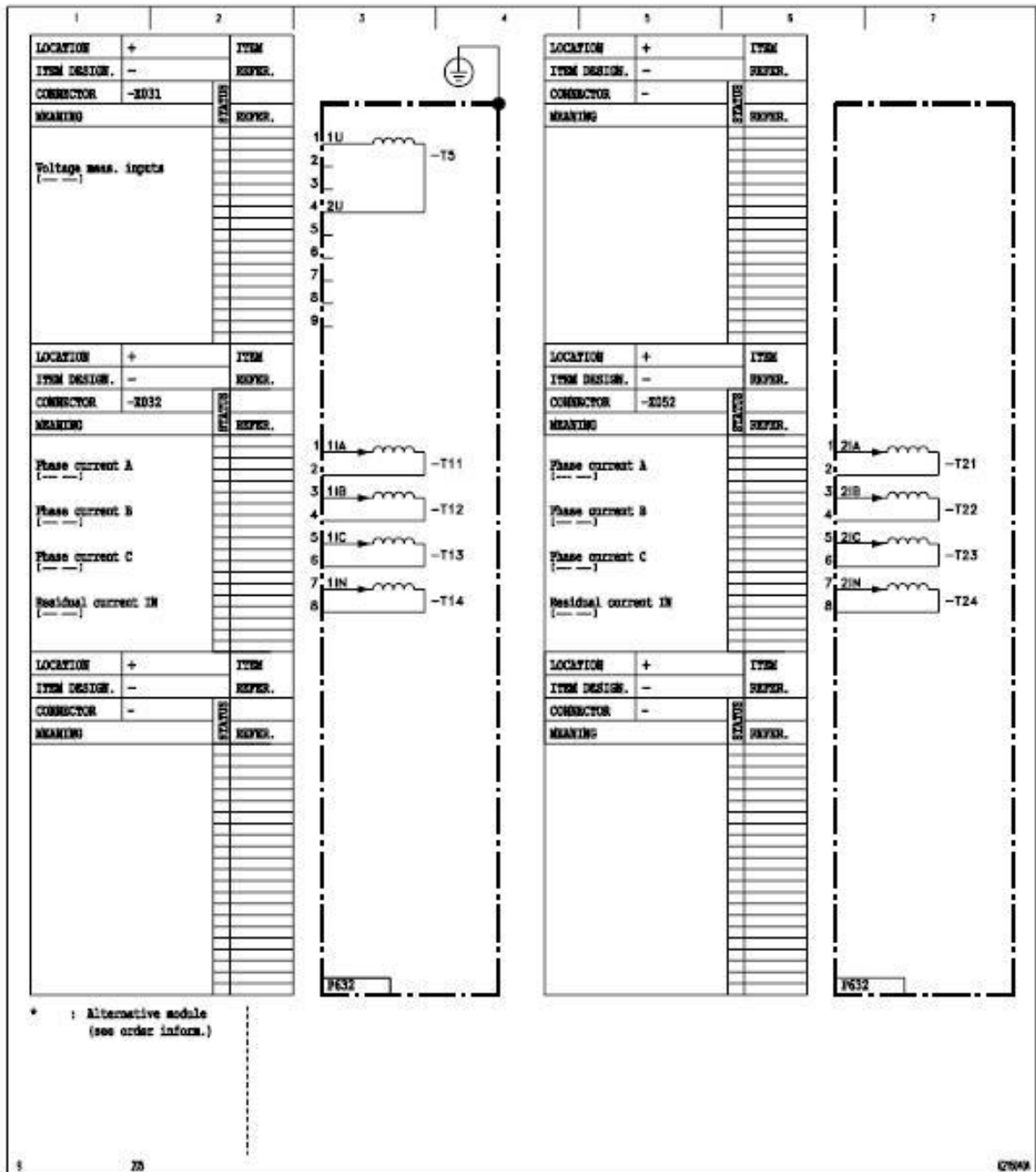
A.2 Technical Data

Differential protection

Measuring System
Deviation for $I_{diff} \geq 0.2\ I_{ref}$: ± 5 %

Inrush Stabilization
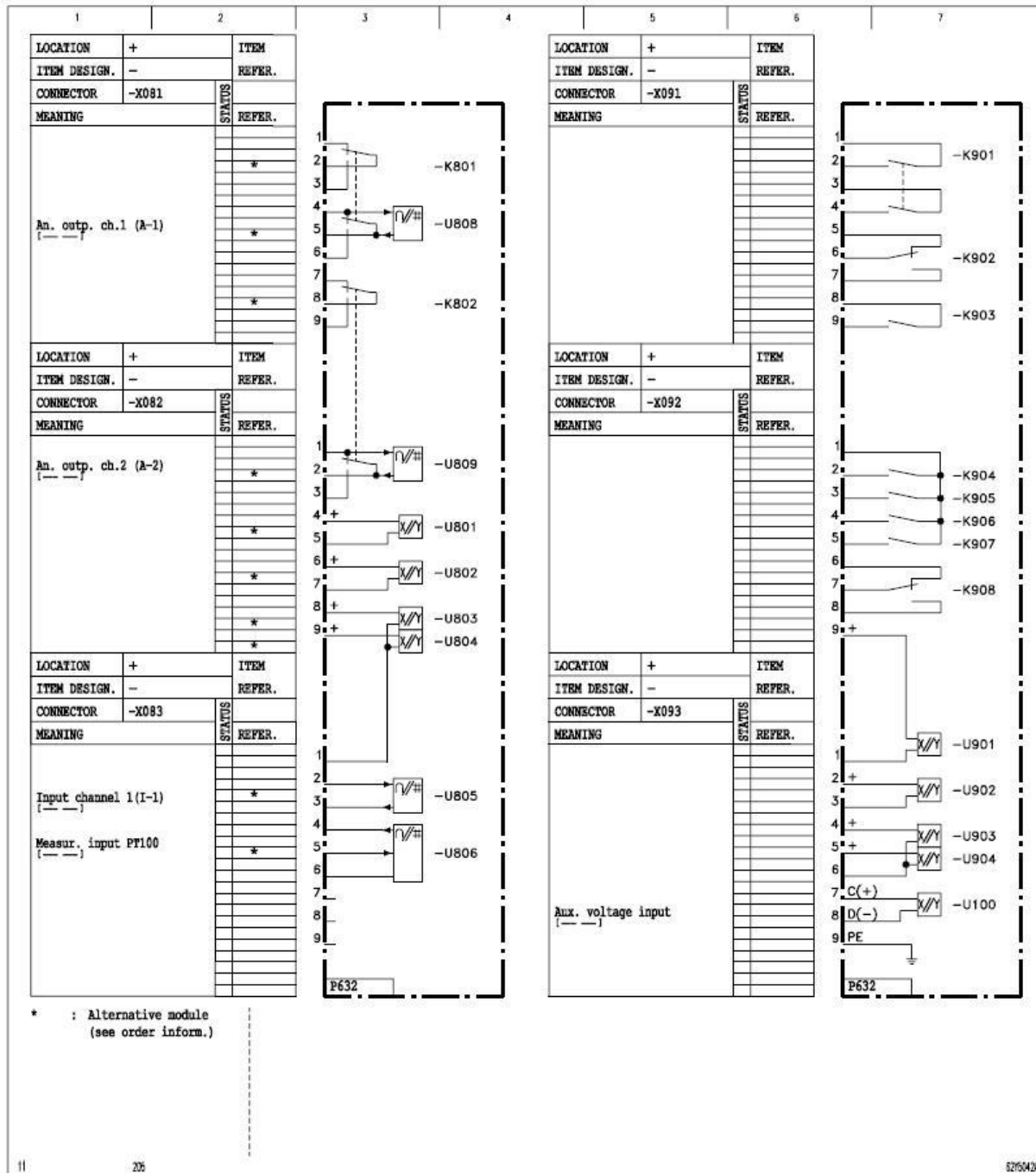Deviation: ± 10 %

Figure 43

Differential Protection
Operating time at $I_d = 10 \cdot I_{diff}>$ with harmonic blocking disabled or at $I_d > I_{diff}>>>$:
    min. 13 ms / typ. 15 ms
Operating time at $I_d = 2.5 \cdot I_{diff}>$ with harmonic blocking disabled:
    min. 19 ms / typ. 21 ms
Operating time at $I_d = 2.5 \cdot I_{diff}>$ with harmonic blocking enabled:
    min. 30 ms / typ. 33 ms

Figure 44

APPENDIX B

Equivalence of software parameters and the relay under test.

Table 1

Differential Software		Areva P632 Relay		
Parameter	**Figure**	**Parameter**	**Address**	**Figure**
Voltage (Wind. 1)	**22**	**Vnom prim. , end a**	**019.017**	**10**
Voltage (Wind. 2)	**22**	**Vnom prim. , end b**	**019.018**	**10**
Power (Wind. 1 and 2)	**22**	**Reference power Sref**	**019.016**	**11**
Vector Group (Wind. 2)	**22**	**Vec. Gr. end a-b**	**019.010**	**13**
I Prim (Wind. 1)	**22**	**Inom C.T. prim. , end a**	**019.020**	**08**
I Prim (Wind. 2)	**22**	**Inom C.T. prim. , end b**	**019.021**	**08**
I Sec (Wind. 1)	**22**	**Inom device, end a**	**010.024**	**08**
I Sec (Wind. 2)	**22**	**Inom device, end b**	**010.025**	**08**
Differential Settings (pickup)	**24**	**Idiff >**	**072.142**	**13**
Instantaneous Settings (pickup)	**24**	**Idiff >>>**	**072.144**	**13**
m1	**25**	**m1**	**072.145**	**13**
m2	**25**	**m2**	**072.146**	**13**
IR, m2	**25**	**IR, m2**	**072.147**	**13**

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