# TEST TUTORIAL

**EQUIPMENT TYPE**: Protection Relay.

**BRAND:** ZIV.

**MODEL:** Reyrolle 7SR10.

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

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

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.br – www.conprove.com.br/forum – suporte@conprove.com.br

# VERSION CONTROL:

| Version | Descriptions | Date | Author | Reviewer |
|---|---|---|---|---|
| 1.0 | Initial Version | 23/11/2021 | 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.br – www.conprove.com.br/forum – suporte@conprove.com.br

## 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 to be 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 to be tested and still be aware of safety rules and regulations.

## Copyright

# PROCEDURE FOR TESTING THE REYROLLE 7SR10 RELAY ON OVERCURRENT SOFTWARE

## 1. Relay Connection to CE-6710

This section covers all the connections needed to run the test in question. In appendix A of this document you can find the terminal designations of the 7SR10 relay

### 1.1. Auxiliary Source

For relay power, connect the positive terminal (red) of the Aux. Vdc source of the test set to terminal 1 of slot X3 of the relay and the negative terminal (black) to terminal 2 of slot X3, as shown in the following figure.

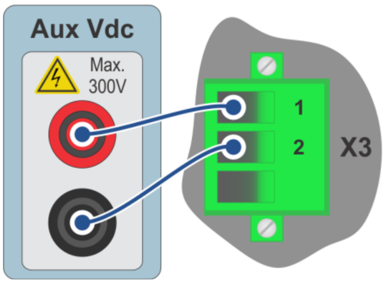


Figura 1

### 1.2. Analog Outputs

Connect the analog outputs I1, I2 and I3 of the CE-6710 to terminals 2, 5 and 8, and their common ones to terminals 1, 4 and 7 of slot X5 of 7SR10, respectively. The following figure shows the procedure.

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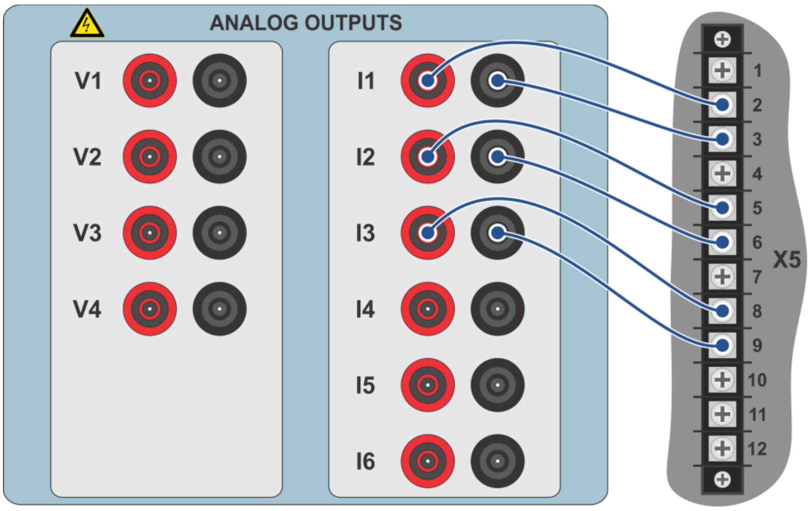


Figure 2

## 1.3. Binary Inputs

Connect the binary inputs to the relay binary outputs located in slot X4. Details of these connections are presented in the table and figure below:

Table 1

| CE-6710 (*Binary Inputs*) | 7SR10 (X4) |
|---|---|
| BI1 | BO1 (1 and 3) |
| BI2 | BO2 (4 and 6) |
| BI3 | BO3 (7 and 8) |

Rua Visconde de Ouro Preto, 75 – Bairro Custódio Pereira – CEP 38405-202
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Telefone: (34) 3218-6800 - Fax: (34) 3218-6810
www.conprove.com.br – www.conprove.com.br/forum – suporte@conprove.com.br

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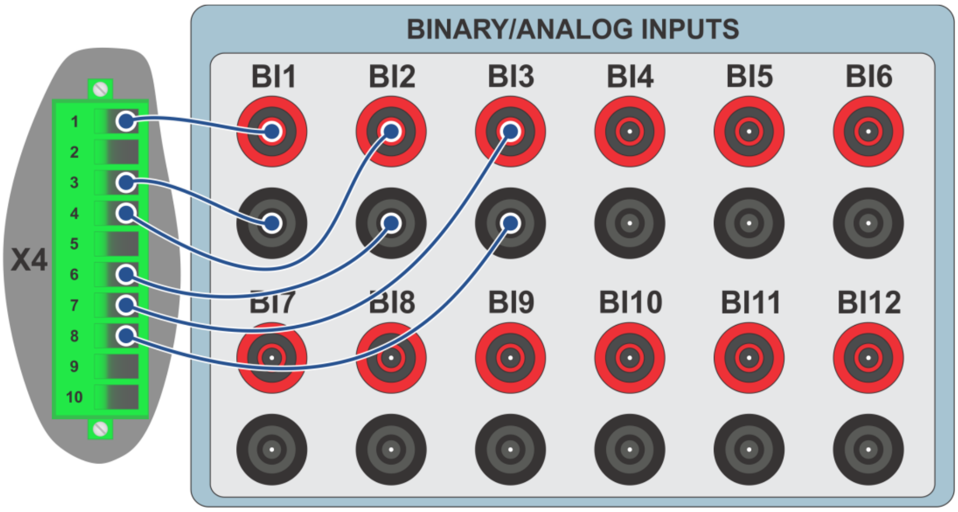


Figure 3

## 2. First steps with the 7SR10 relay

### 2.1. Communication between PC and relay

Communication with the relay is done through a USB cable connected between the front port of the relay and the computer that has the Reydisp Evolution 32 software. Run the software by double clicking on its icon.


Figure 4

Establish communication via the *"Connect"* option. Then, Ethernet or USB communication is chosen, as shown in the following figure:

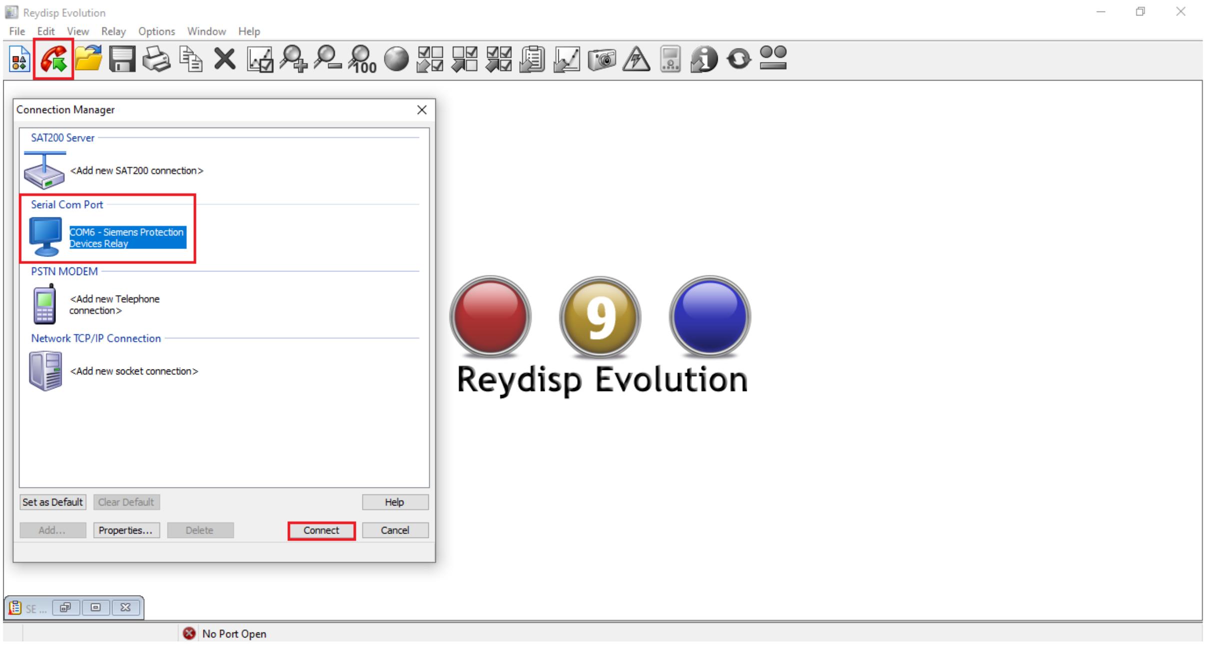


Figure 5

## 2.2. Creation of adjustments file

In this step, click on the *"Get Settings"* icon of the software and, after loading, click on number 1 on the following screen:

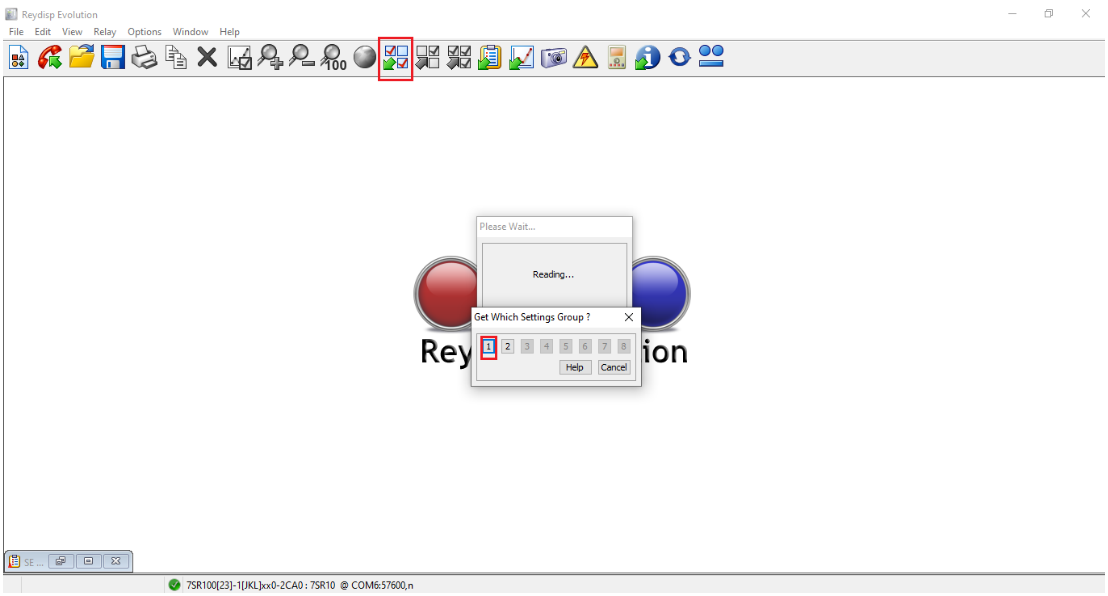


Figure 6

# 3. Parameterization of the 7SR10 relay

## 3.1. SYSTEM CONFIG

Having established the communication, in the left column of the screen, select the option *"System Config"* in *"Settings"*. Adjust the frequency to 60Hz and ensure that the current parameters configured for the display are referenced to the nominal, as shown below.

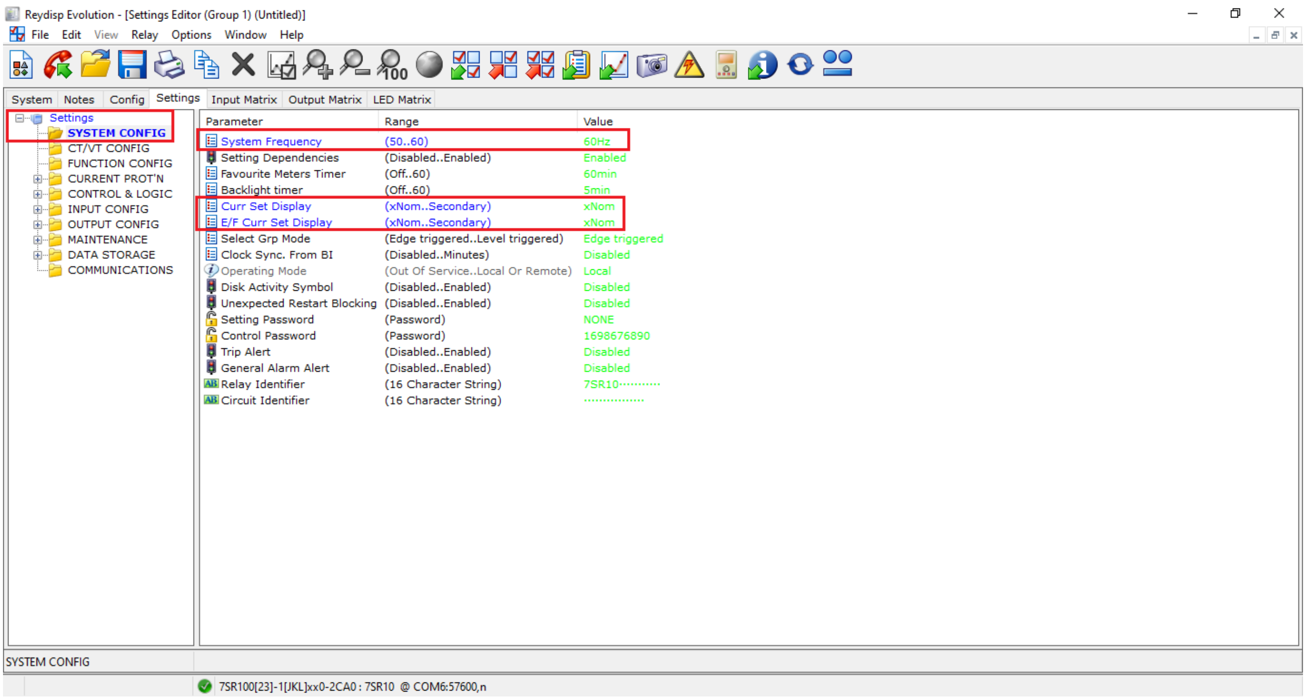


Figure 7

## 3.2. CT/VT CONFIG

In the *"CT/VT CONFIG"* area configure the values referring to the CTs and the phase sequence, as shown in the figure below.

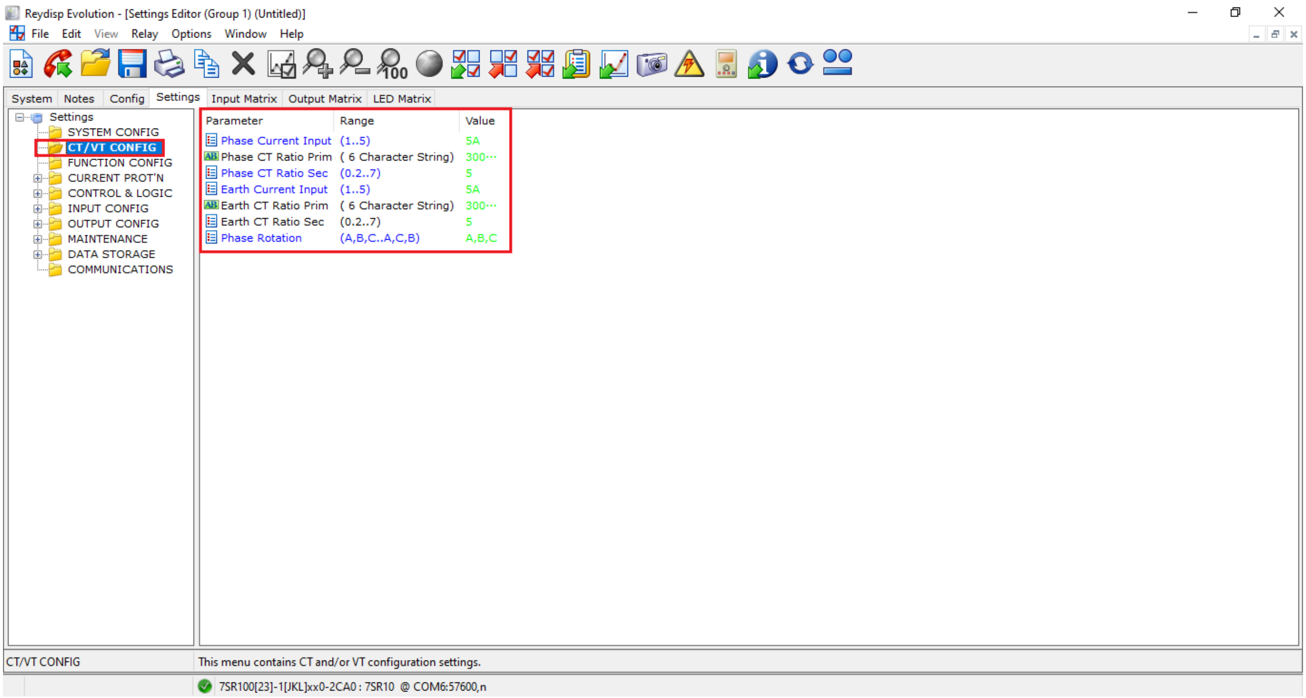


Figure 8

## 3.3. FUNCTION CONFIG

In this area, try to enable the phase overcurrent function (51/50). The respective function is highlighted in the figure below.

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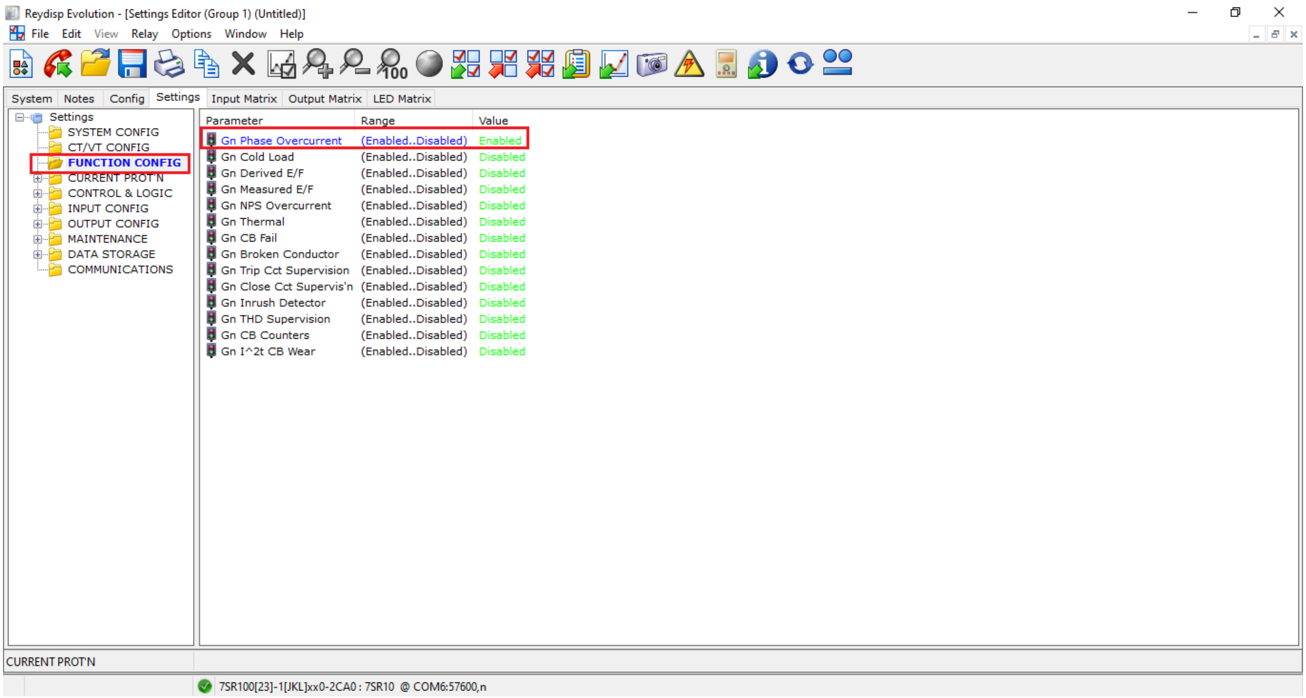


Figure 9

## 3.4. PHASE OVERCURRENT

In the option *"PHASE OVERCURRENT"* it must be ensured that the measurements are made in RMS, as shown in the figure below.

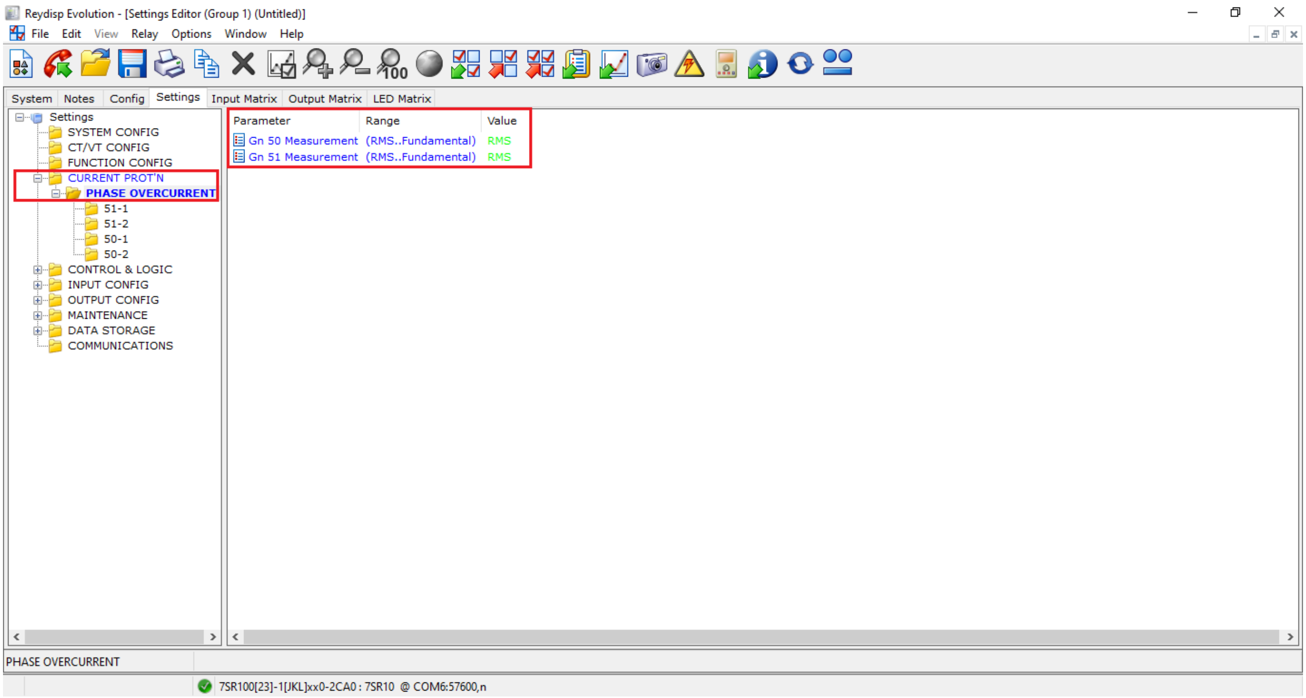


Figure 10

The next step is to adjust the overcurrent elements that will dictate the relay's actuation characteristic under a fault condition. A composition of 3 overcurrent curves, 1 inverse time and 2 definite time curves will be discussed.

## 3.5. 51-1 – Inverse time curve phase overcurrent

In this area, enable inverse time curve 1 of function (51-1). Set the pickup to 1.0xIn, opt for the IEC NI (Normally Inverse IEC) curve and set the time multiplier to 0.5. The remaining adjustments must be kept as shown in the figure below.

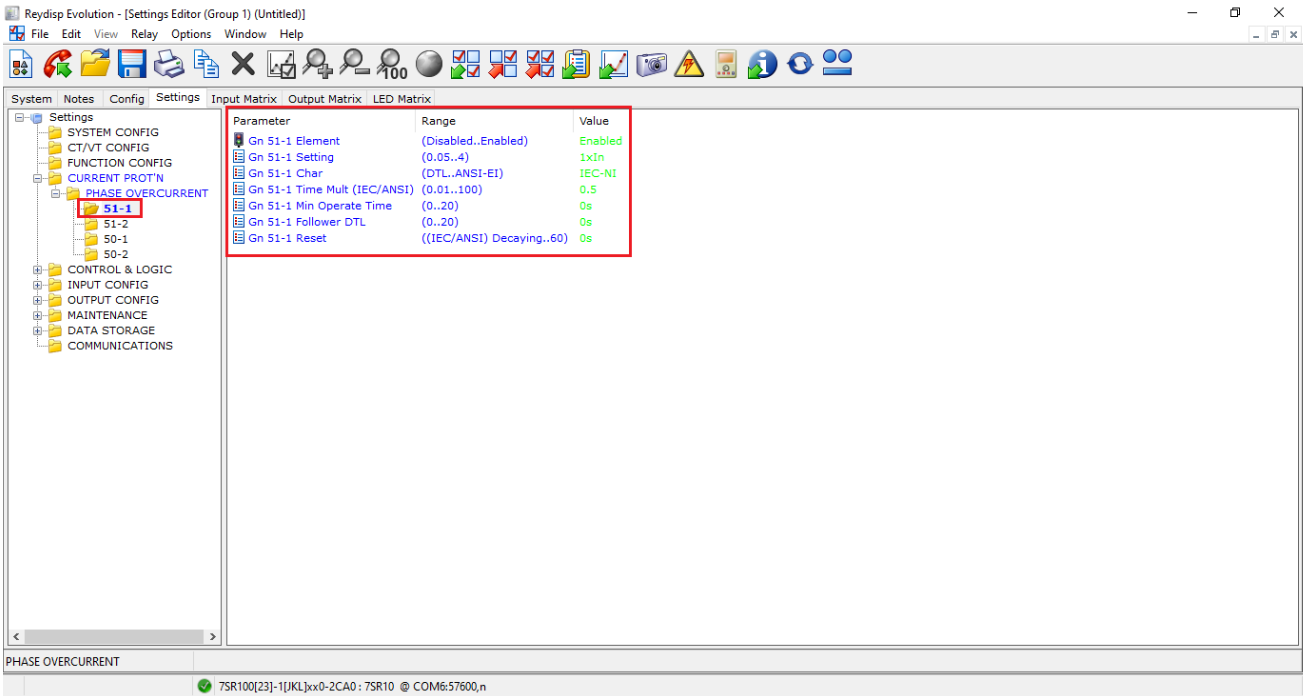


Figure 11

### 3.6. 50-1 – Phase overcurrent in definite time curve

The adjustment of the first definite time curve must be done as directed in the sequence. Enable the timed element, set a pickup level of 5xIn and an actuation time of 0.5 seconds.

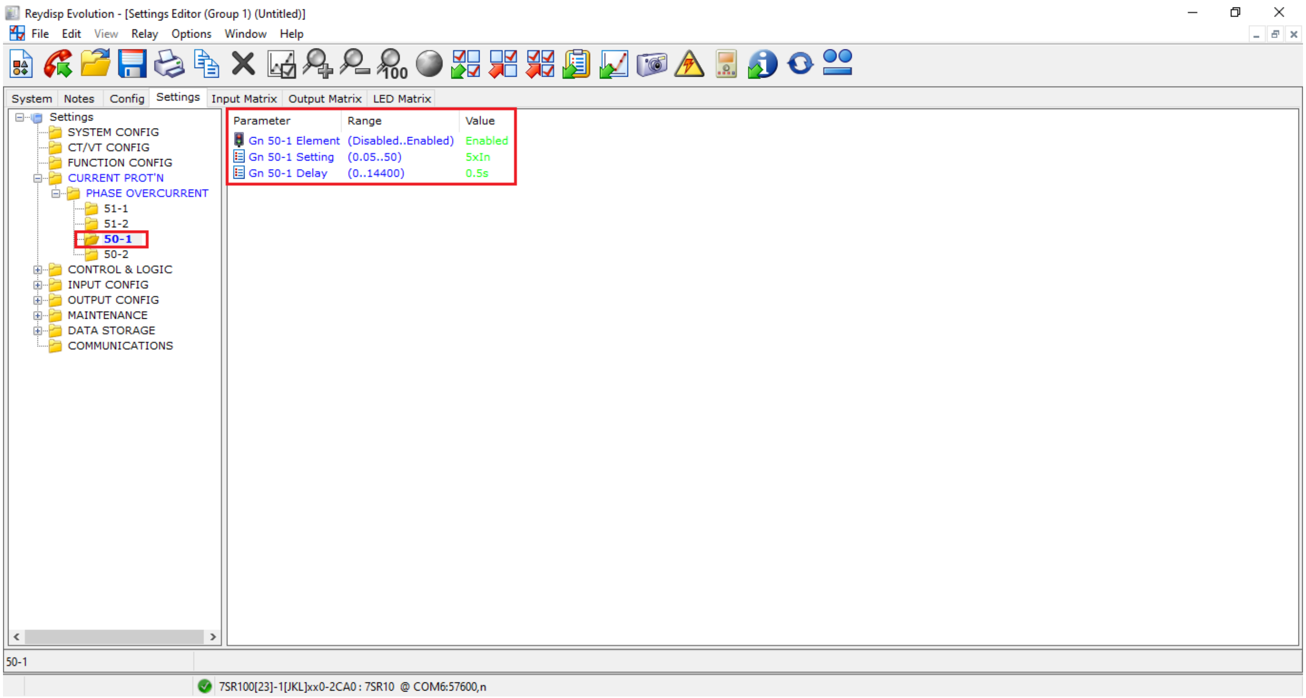


Figure 12

## 3.7. 50-2 – Phase overcurrent in definite time curve

For the fastest overcurrent element in terms of actuation, enable the curve, set the pickup to 6xIn and set an actuation time of 0 seconds, as is done in the following figure.

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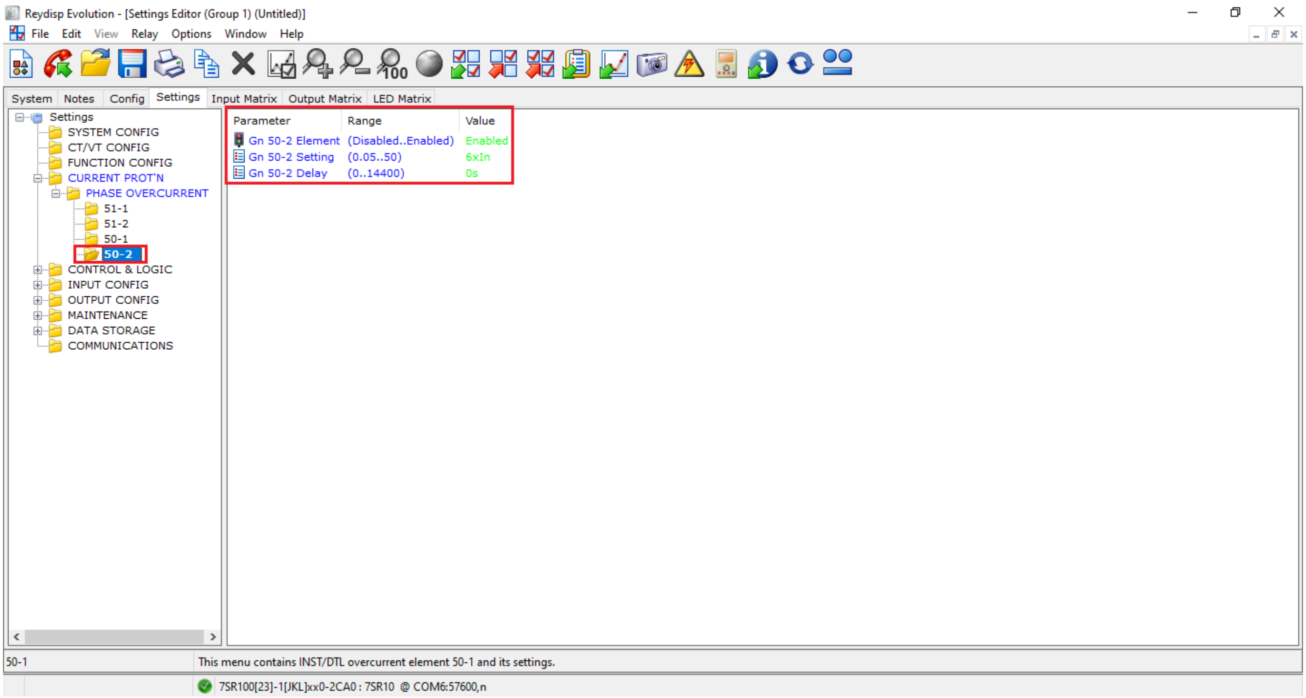


Figure 13

Once the parameters that will characterize the action of the overcurrent function have been defined, it is necessary to direct the Pickup and Trip signals in the binary outputs of the relay. This way, when one of these binaries acts, the test set will be able to identify this condition in its input binaries.

## 3.8. OUTPUT MATRIX

Within *"OUTPUT CONFIG"*, in the *"OUTPUT MATRIX"* option, define lines 50-1, 50-2 and General Pickup as shown in the following figure. From these directions, it will be possible to perform pickup tests of each curve element in later steps.

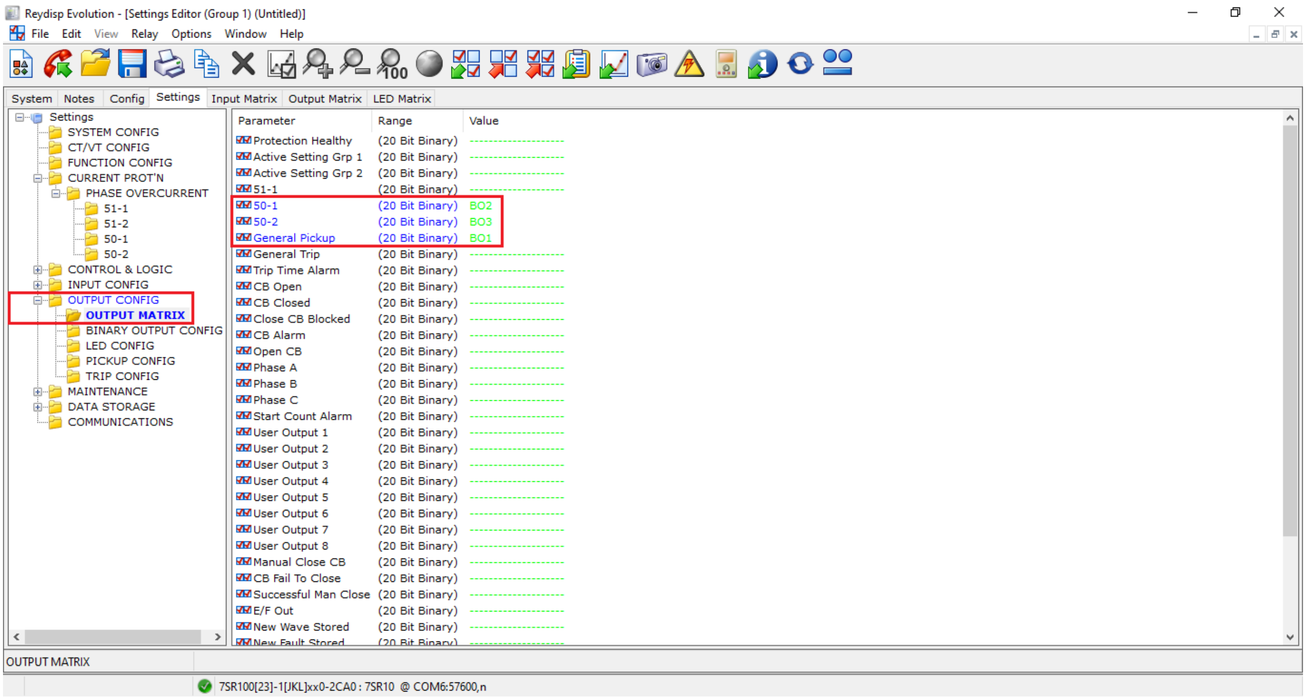


Figure 14

## 3.9. PICKUP CONFIG

Defined the output binaries that will provide the signal of *"General Pickup"* (B01) and Trips (50-1 and 50-2), in the *"PICKUP CONFIG"* area, configure so that element 51-1 is the only element to command the pickup signal at output B01, as shown below.

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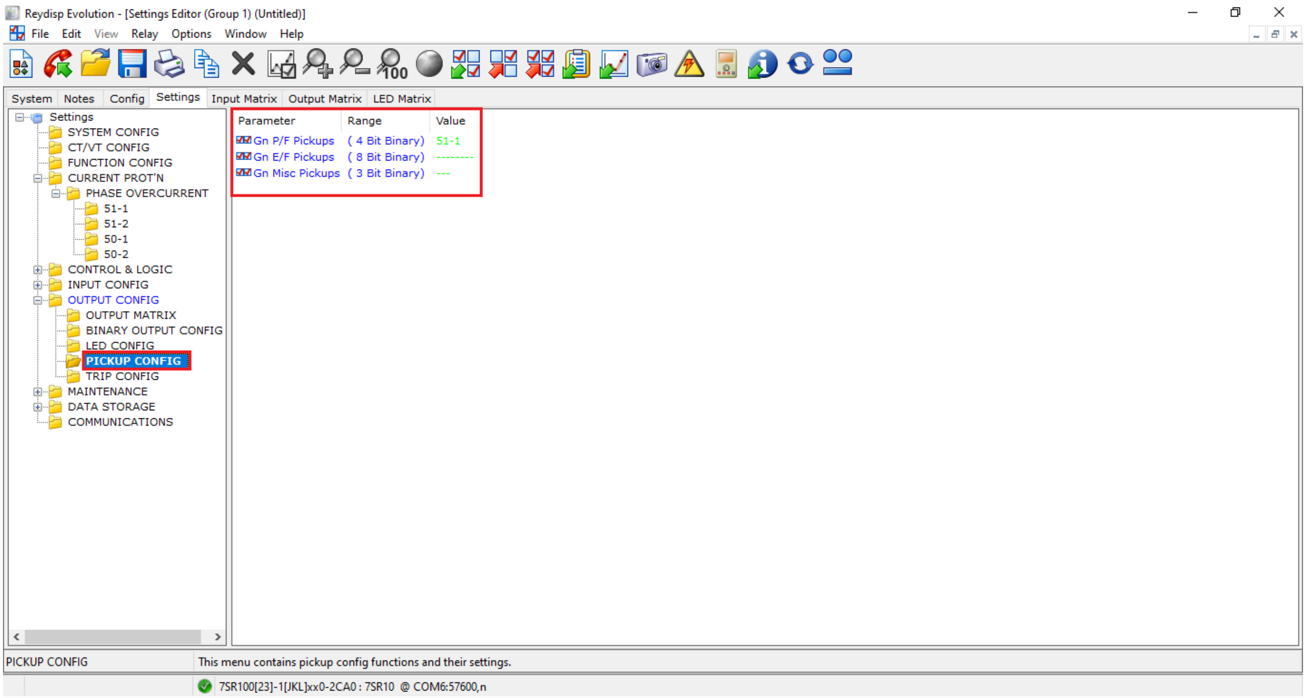


Figure 15

## 3.10. TRIP CONFIG

For Trip signaling, select binary BO2 as a trip contact, as shown in the figure below. This way, whenever there is a trip in the relay, the standard trip LED of the relay will light up.

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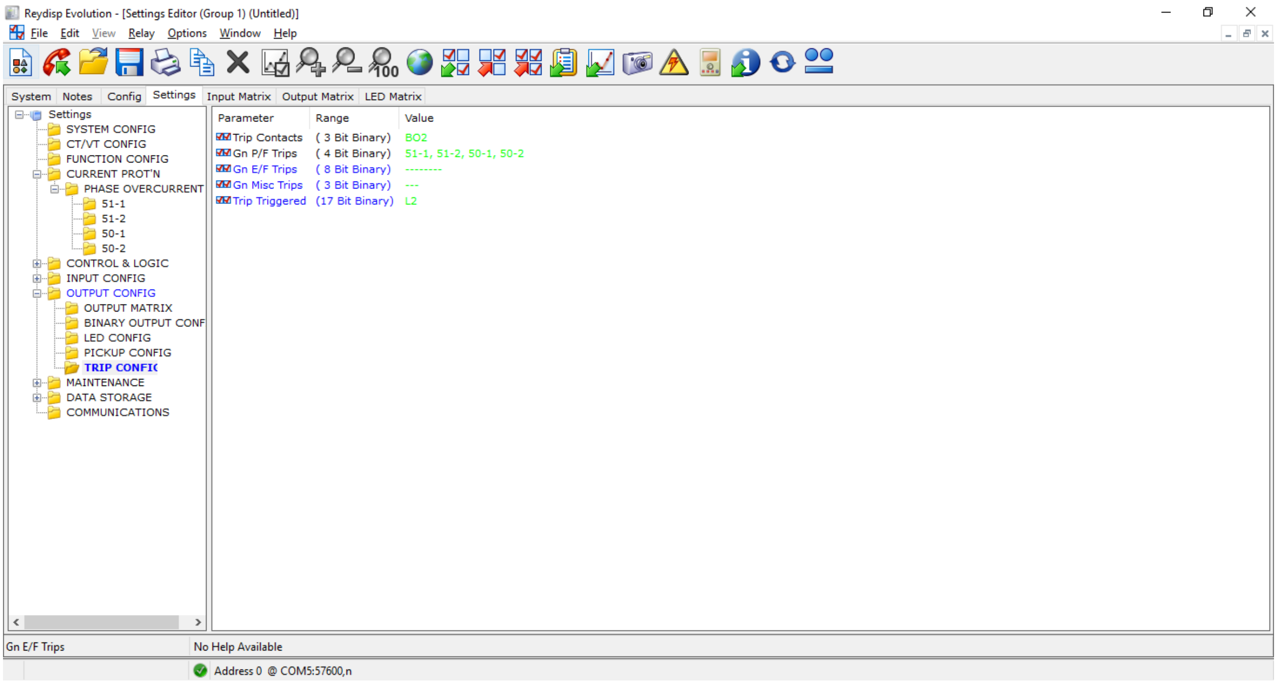

Figure 16

## 4. Sending the settings to the relay

As highlighted in the figure below, select the option *"Send All Settings",* highlighted by square, and then choose Setting Group 1 and confirm the action and send the settings to the relay.

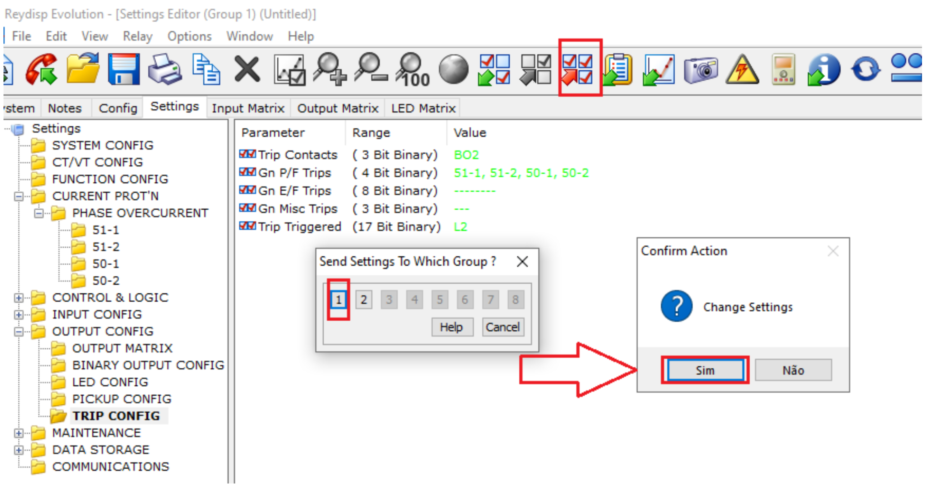

Figure 17

# 5. Overcurrent software adjustments

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

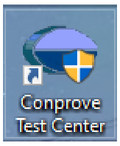


Figure 18

## 5.1. First Steps in Overcurrent

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

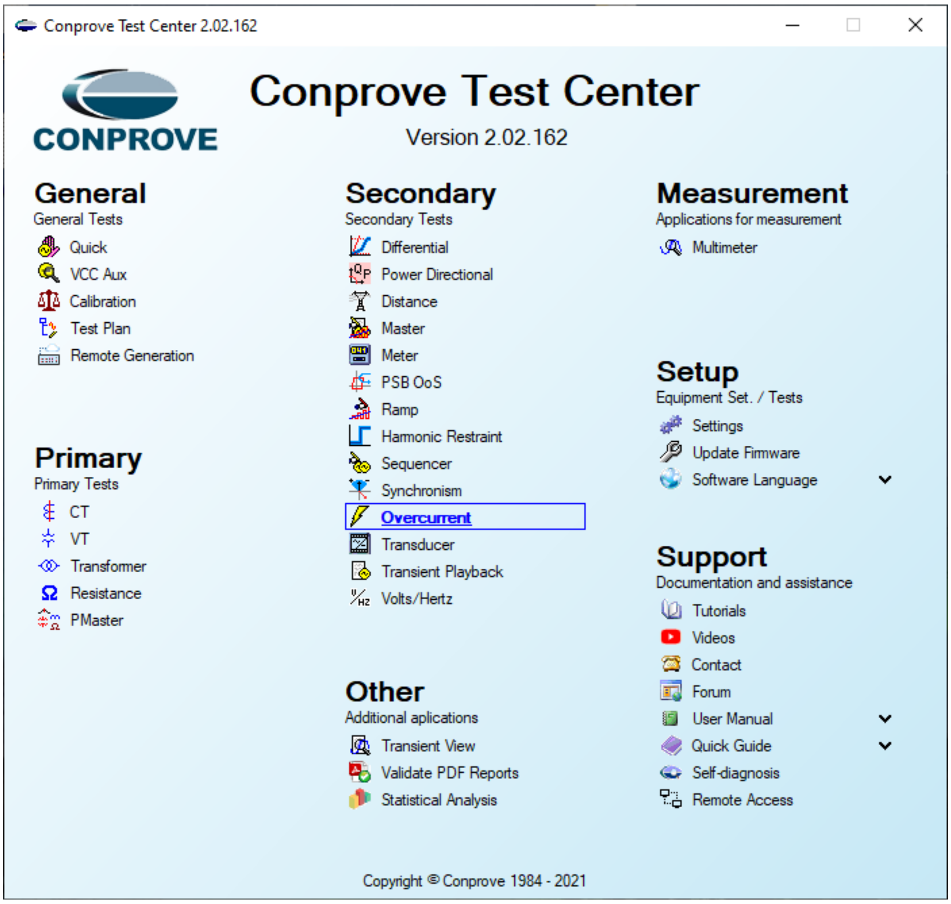


Figure 19

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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.

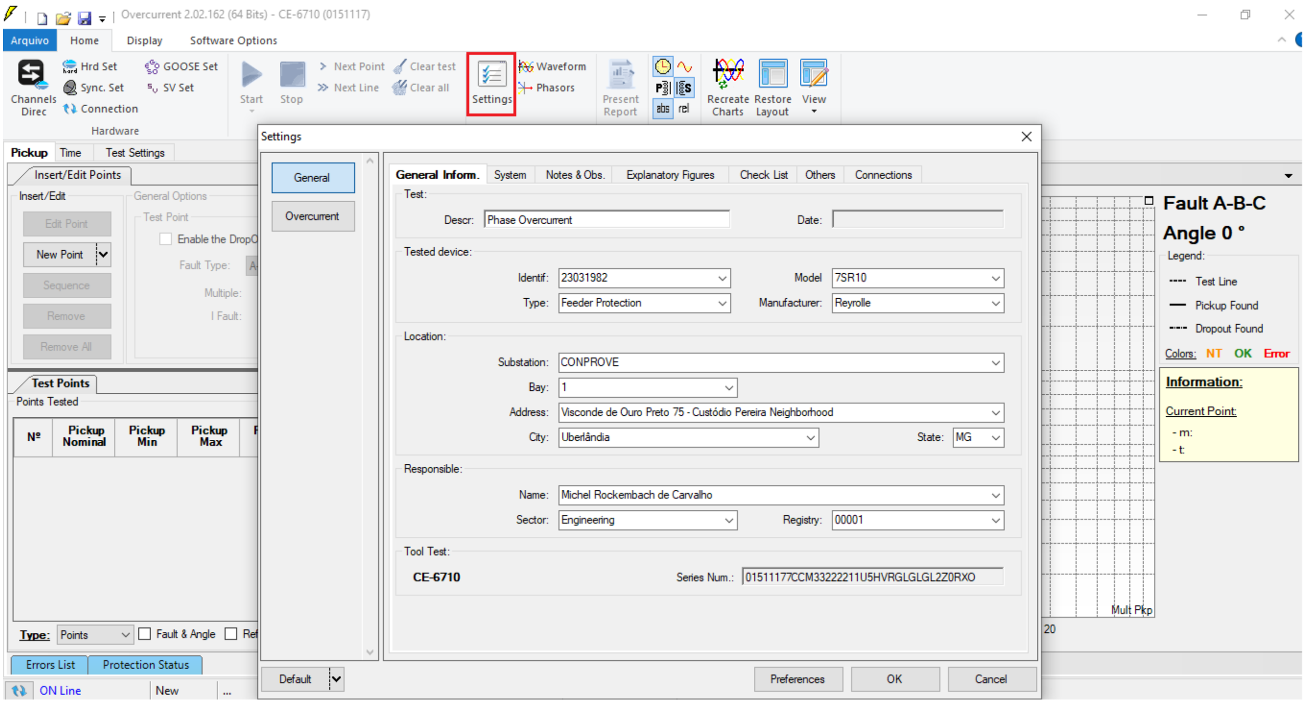

Figure 20

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.

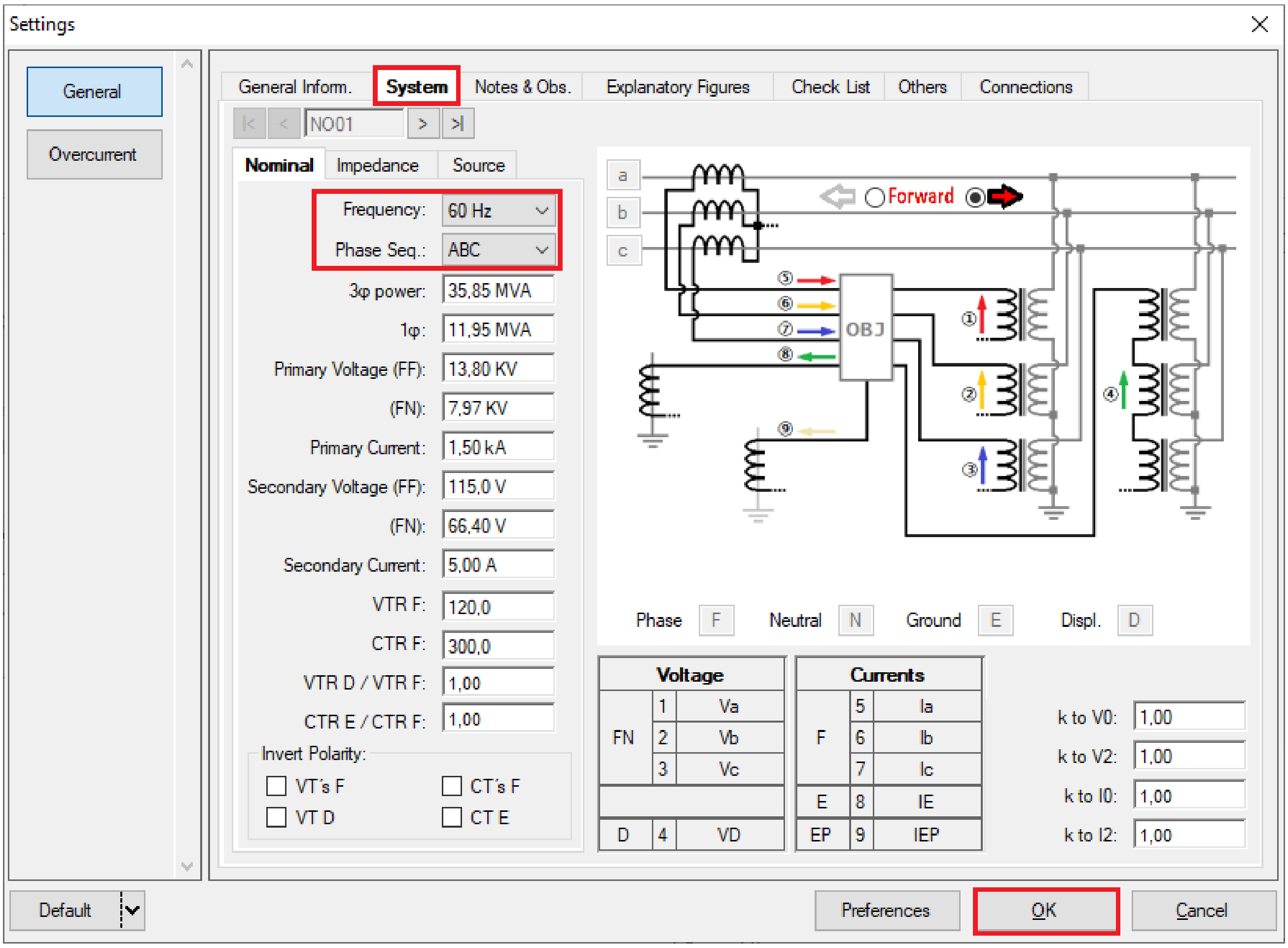


Figure 21

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.

## 5.2. Overcurrent Screen > Definitions

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

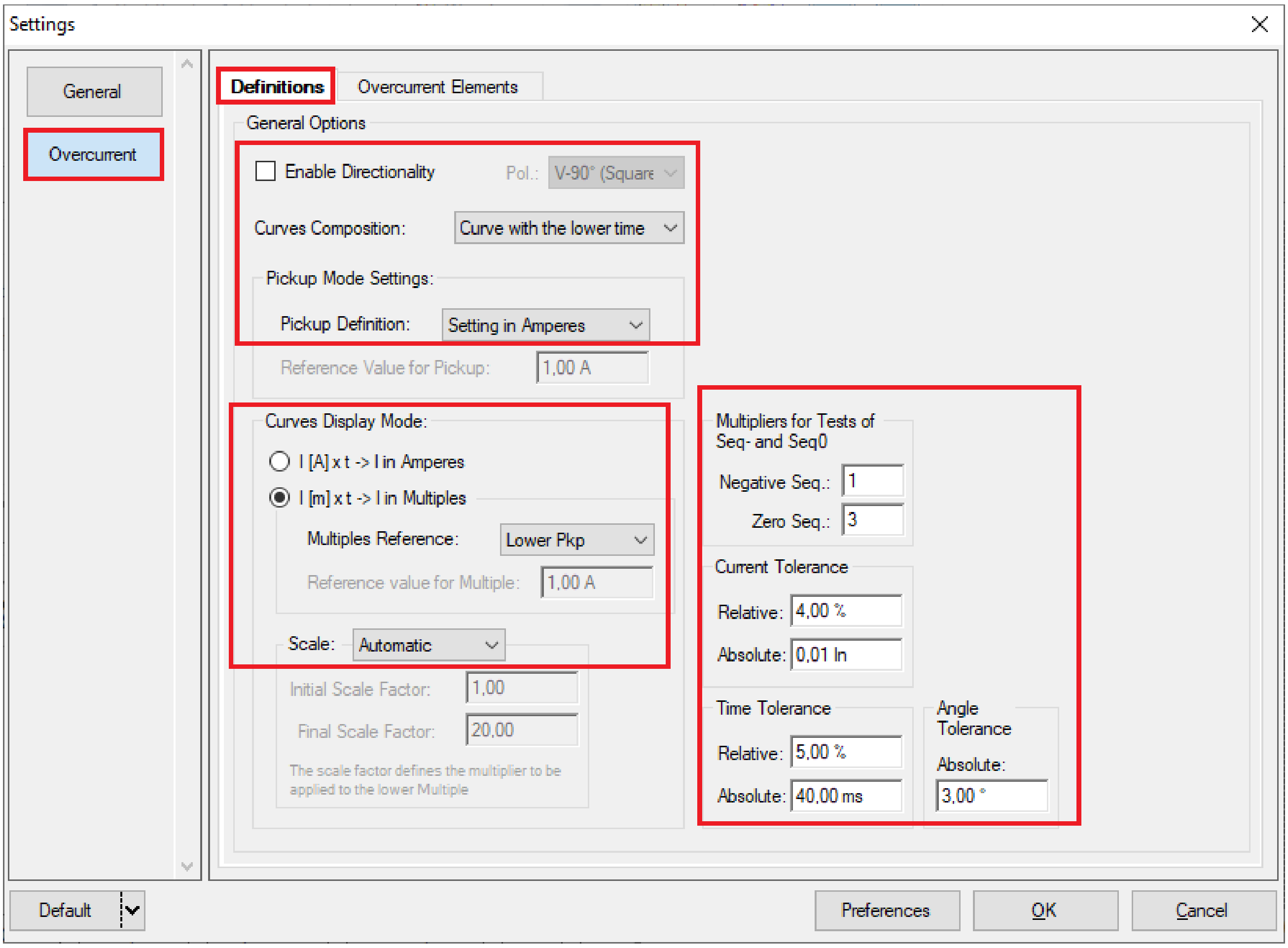


Figure 22

## 5.3. Overcurrent Screen > Overcurrent Elements > Phase

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

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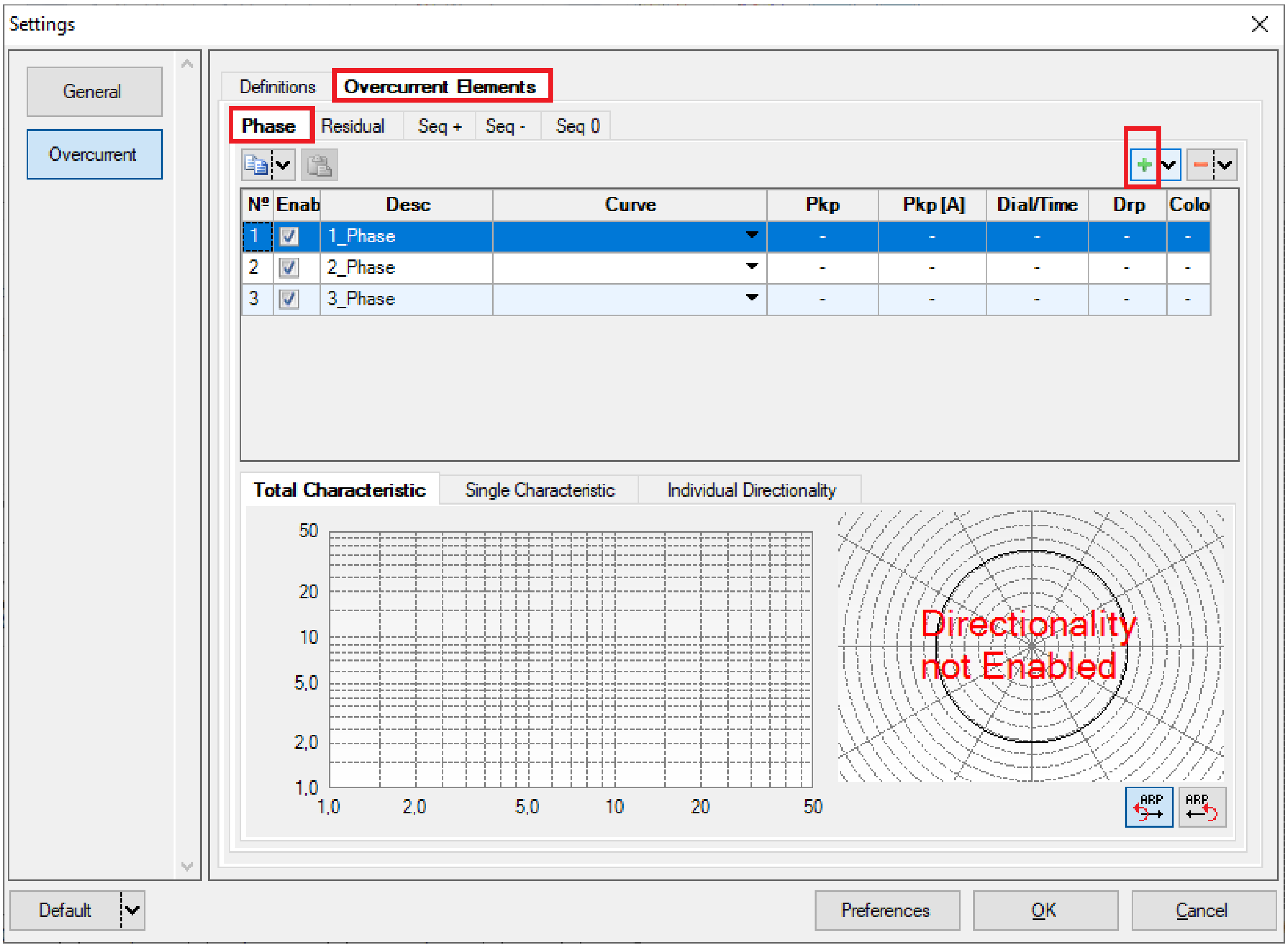


Figure 23

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

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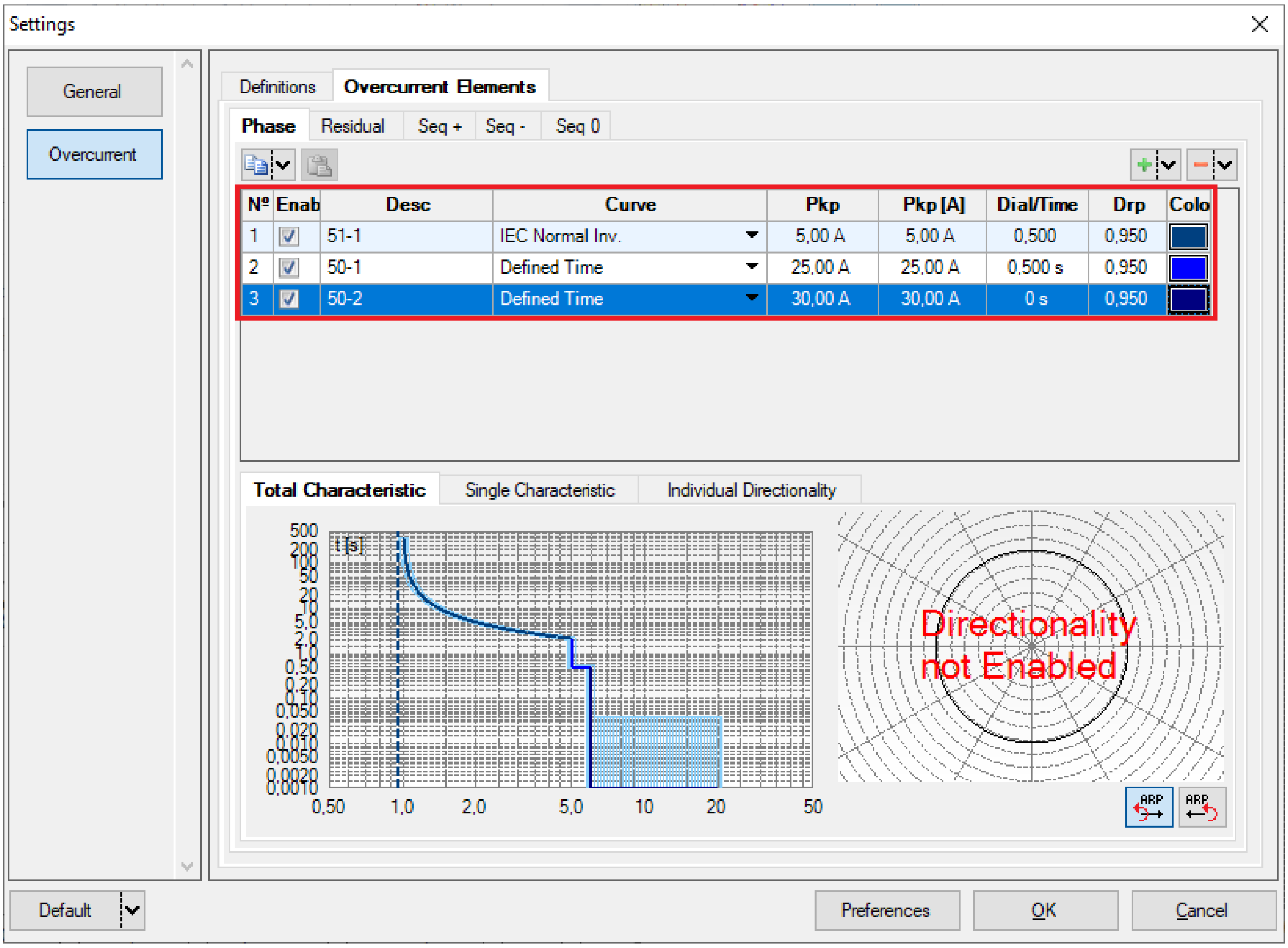


Figura 24

Due to a specific feature of the overcurrent function in Siemens Reyrolle relays of setting the timed curve pickup to a value of 1.05 x Ipickup (pickup level set in the relay), we need the value set for curve 51-1 to be of 5.25A and not 5A. In this way, access the *"Single Characteristics"* tab, highlighted in the figure below, select the box *"Mult for Pickup Test:"* and type "1.05" in the space provided.

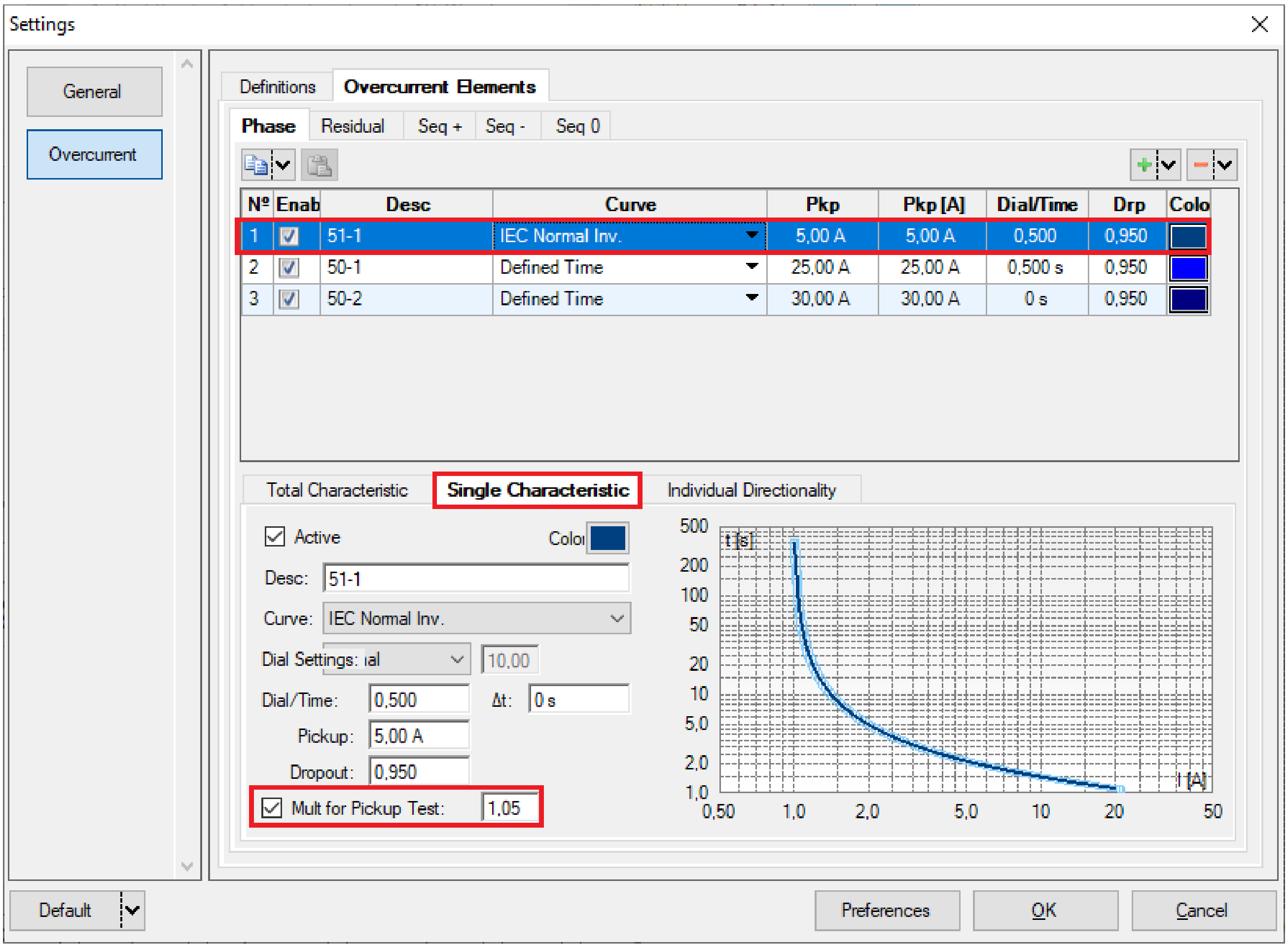


Figure 25

## 6. Channel Targeting and Hardware Configurations

Click on the icon illustrated below.

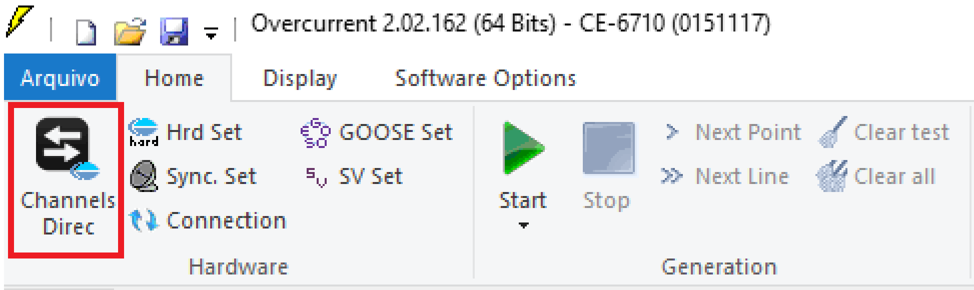


Figure 26

Then click on the highlighted icon to configure the hardware.

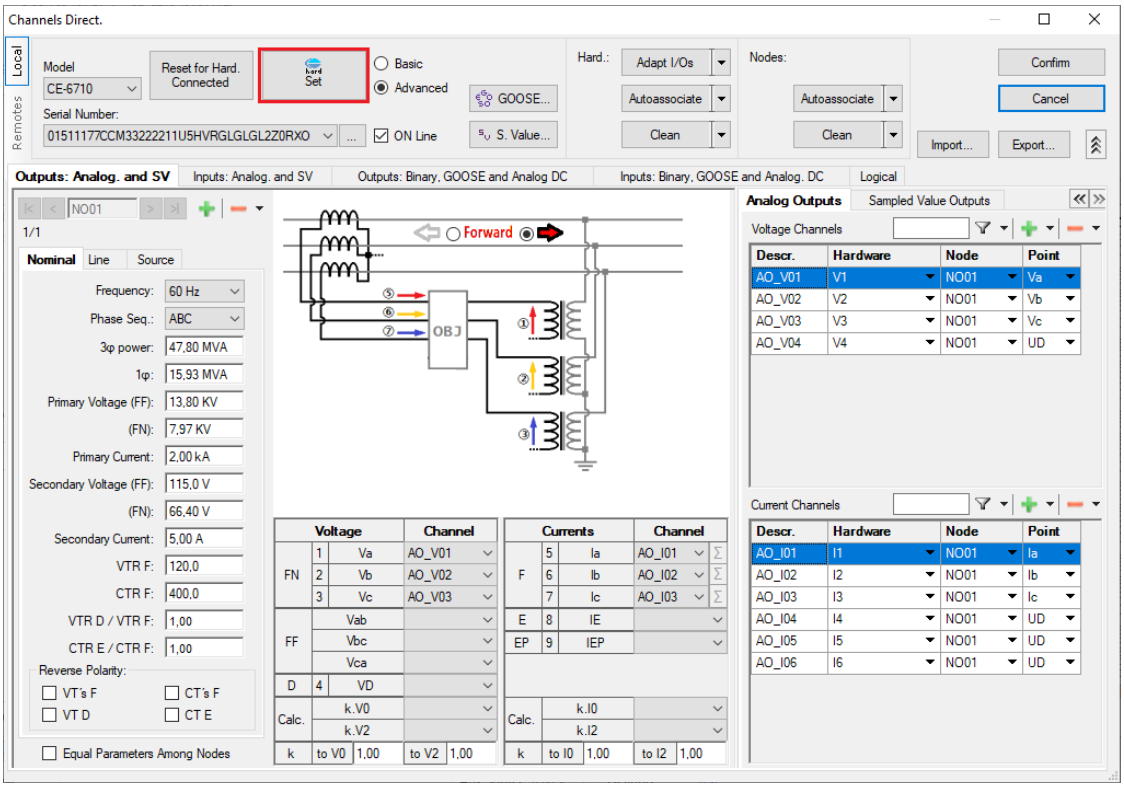


Figura 27

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

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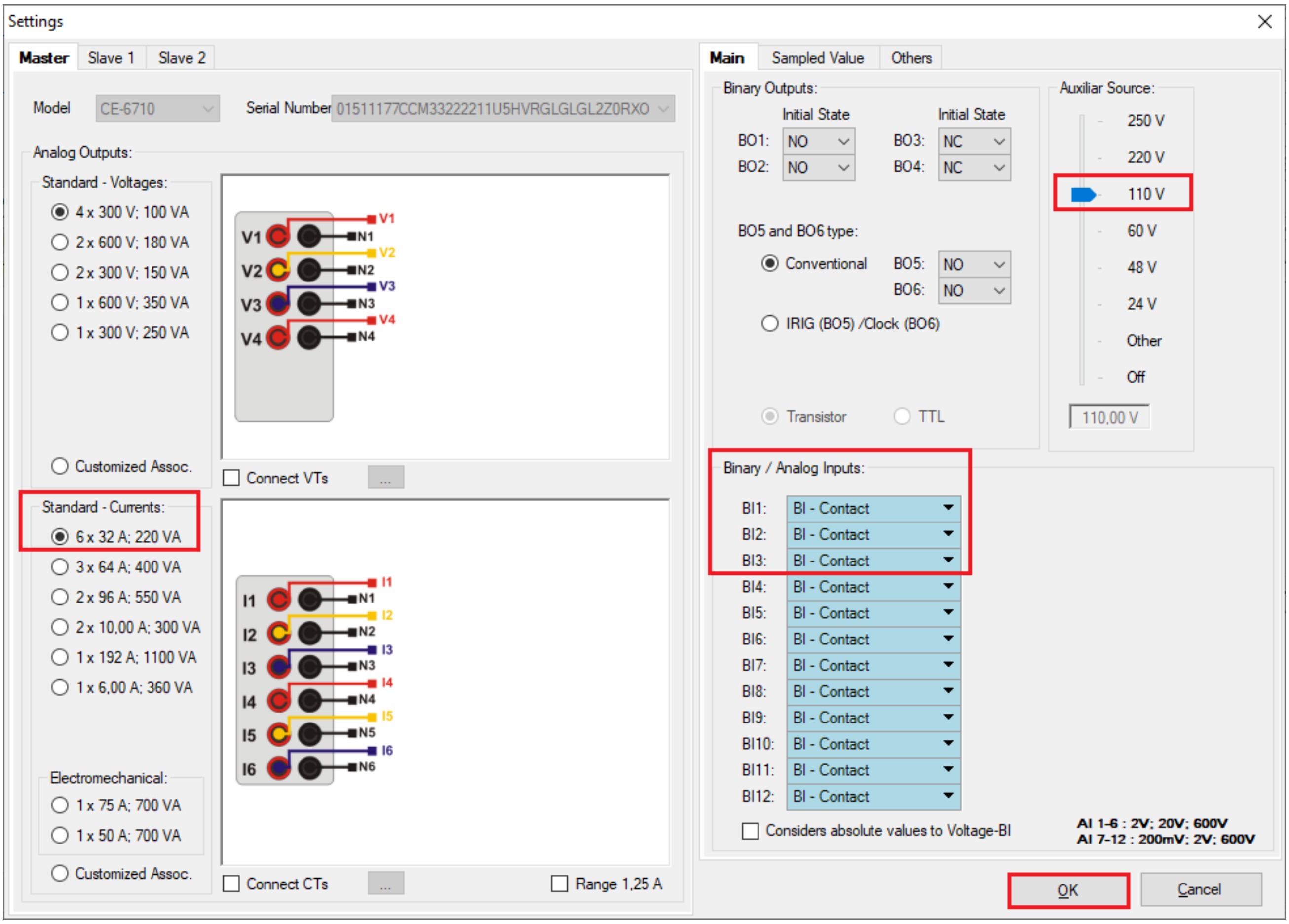


Figure 28

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

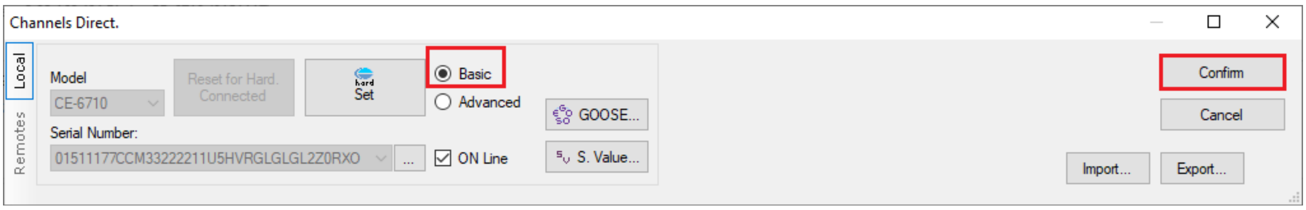


Figure 29

# 7. Test Structure for 50/51

## 7.1. Test Settings

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

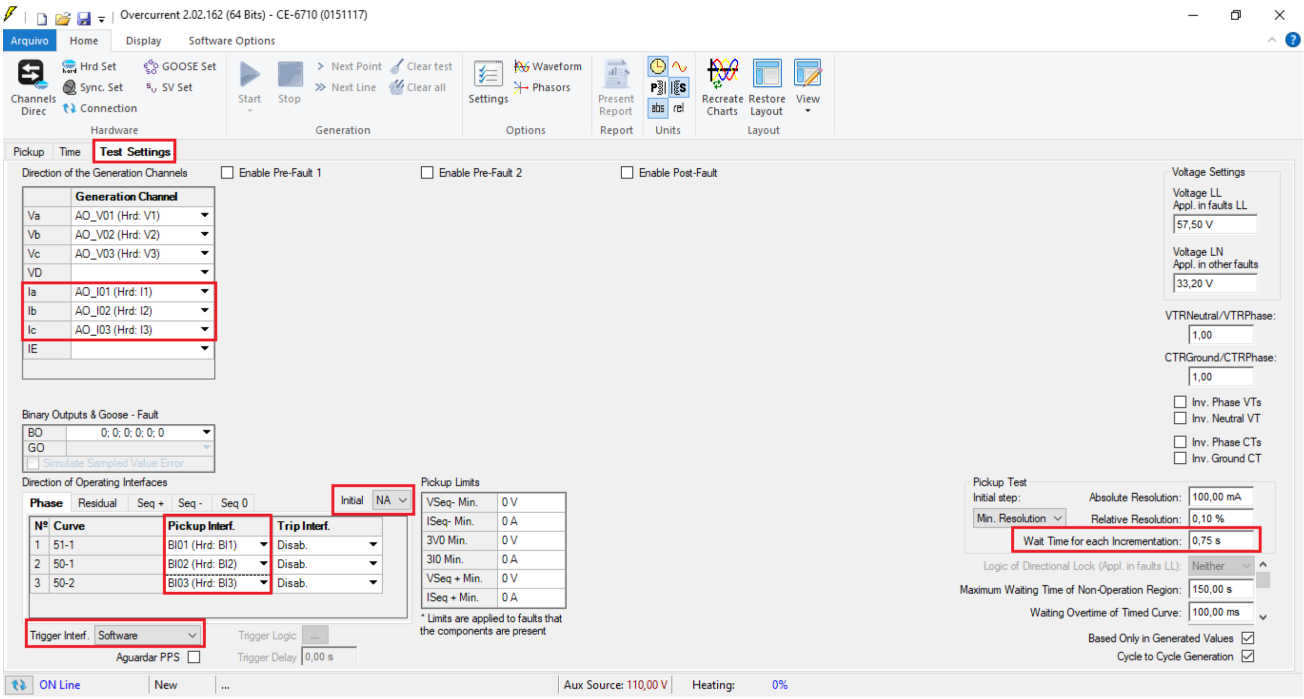


Figura 30

## 7.2. Pickup screen

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

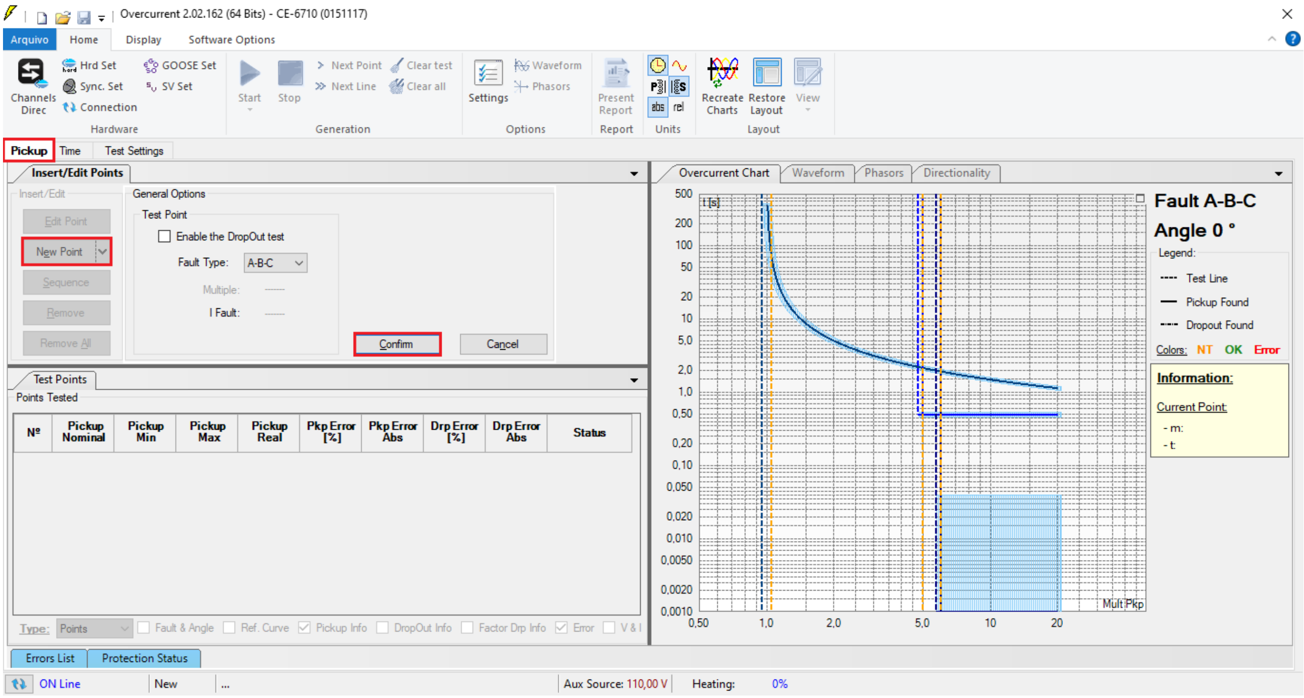


Figura 31

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

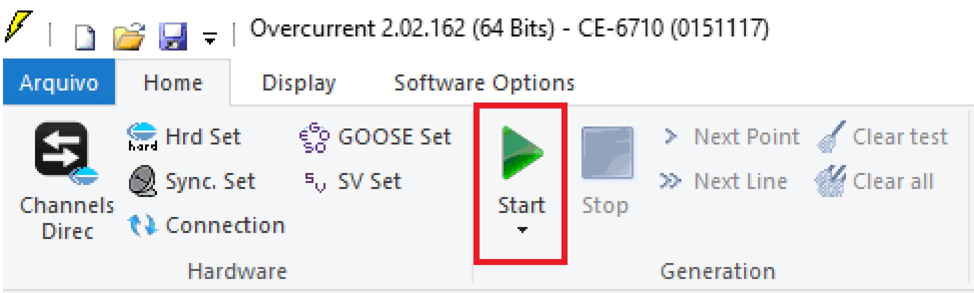


Figure 32

## 7.3. Pickup Test Final Result

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

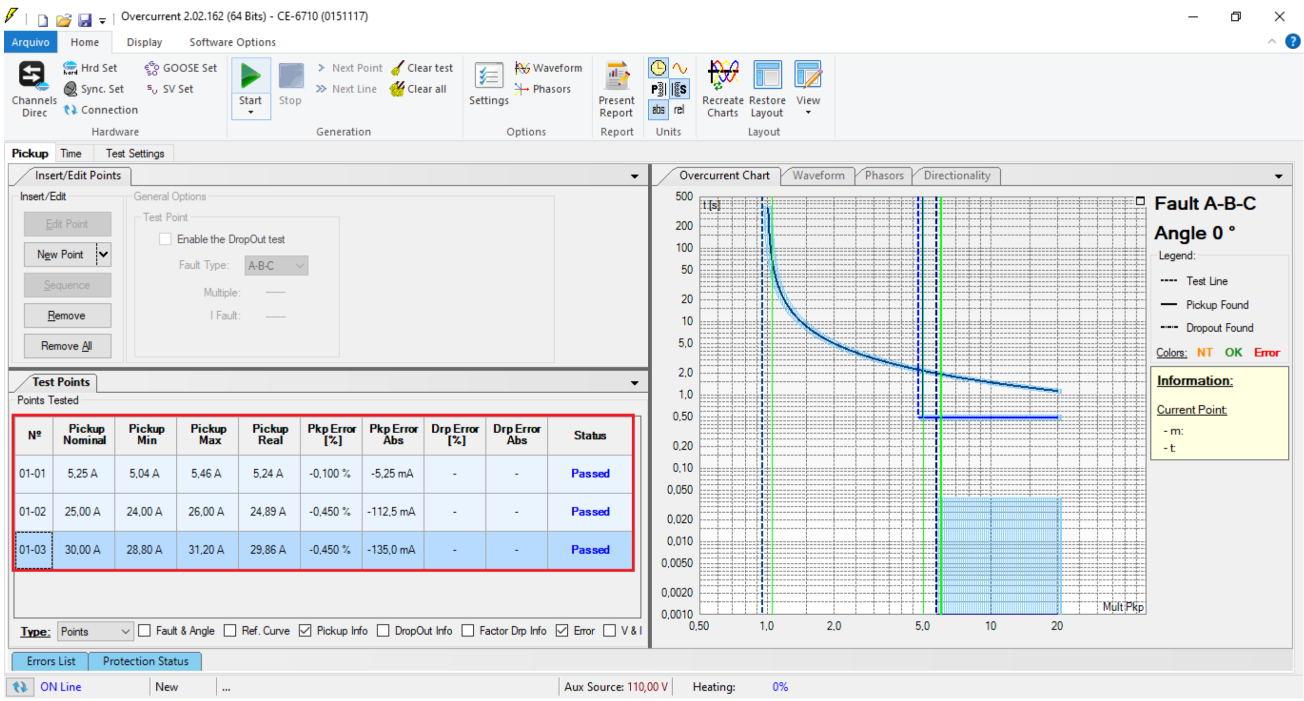


Figure 33

## 7.4. Time screen

In this step, it will be necessary to change the output torques of the function in the relay. As shown in the figure below, change the operating/trip torques of elements 51-1, 50-1 and 50-2 to BO1 by accessing the *"OUTPUT MATRIX"* area in the relay software. As only one output binary was defined for the three elements, the curve with the shortest actuation time for the applied current value will be the basis for actuation of the function in time.

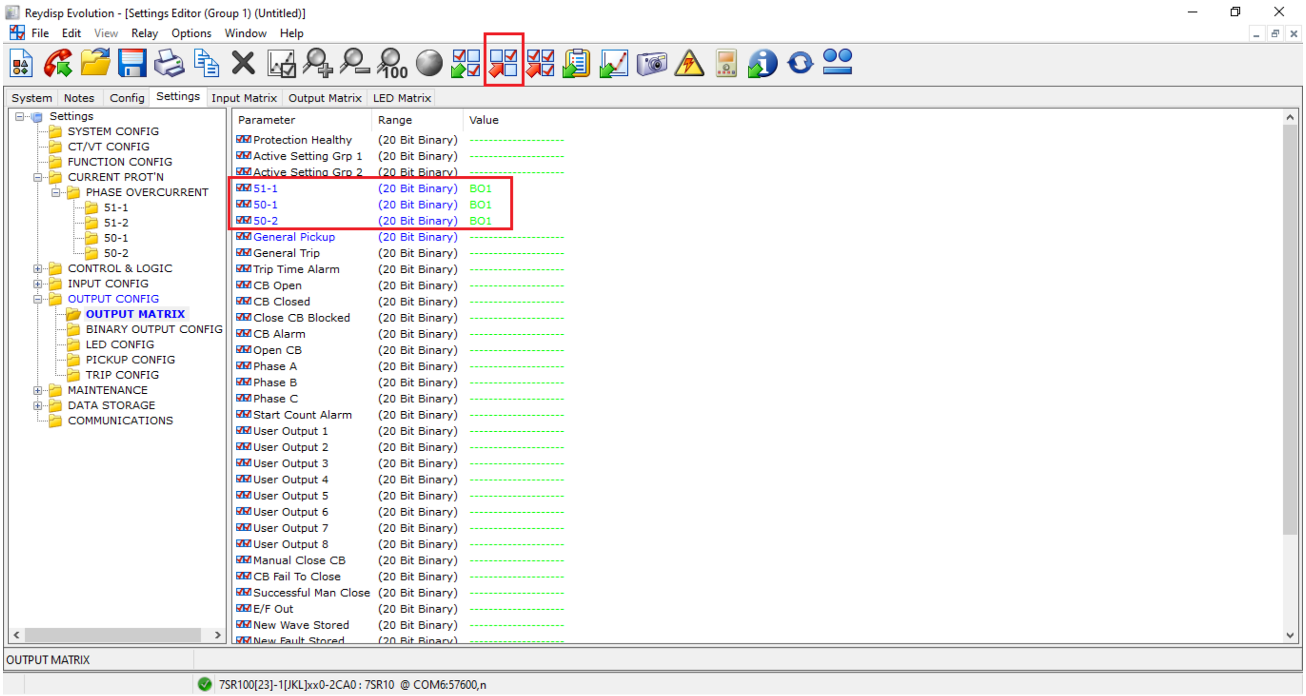


Figure 34

Once the relay has been adjusted, on the *"Test Settings"* tab, also change the test set input binaries that will receive the trip signals, as instructed in the figure below.

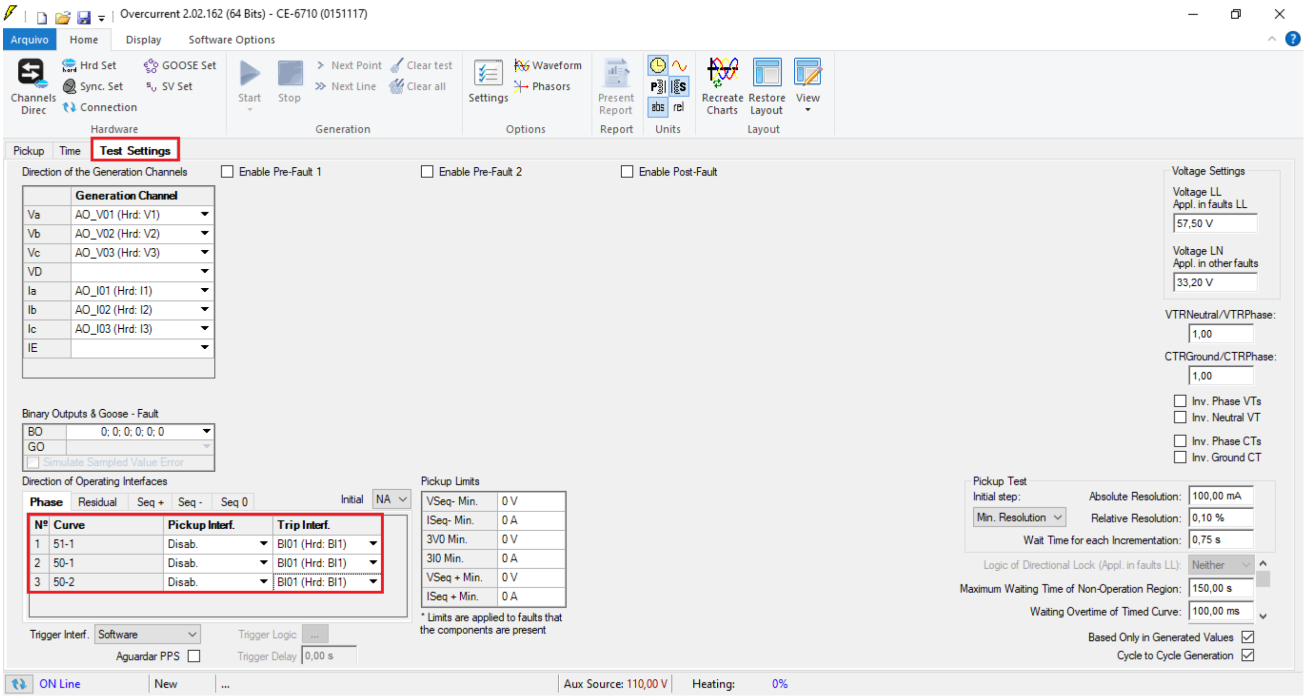

Figure 35

Access the *"Time"* tab and choose to create a sequence of points to be tested. Click on the button *"Sequence"* in the tab *"Insert/Edit Points"* Select the type of fault to be executed as *"ABC"*, adjust the initial, step and final of the sequence and, finally, confirm the inclusion of the sequence in the graph. The following figure highlighted this process.

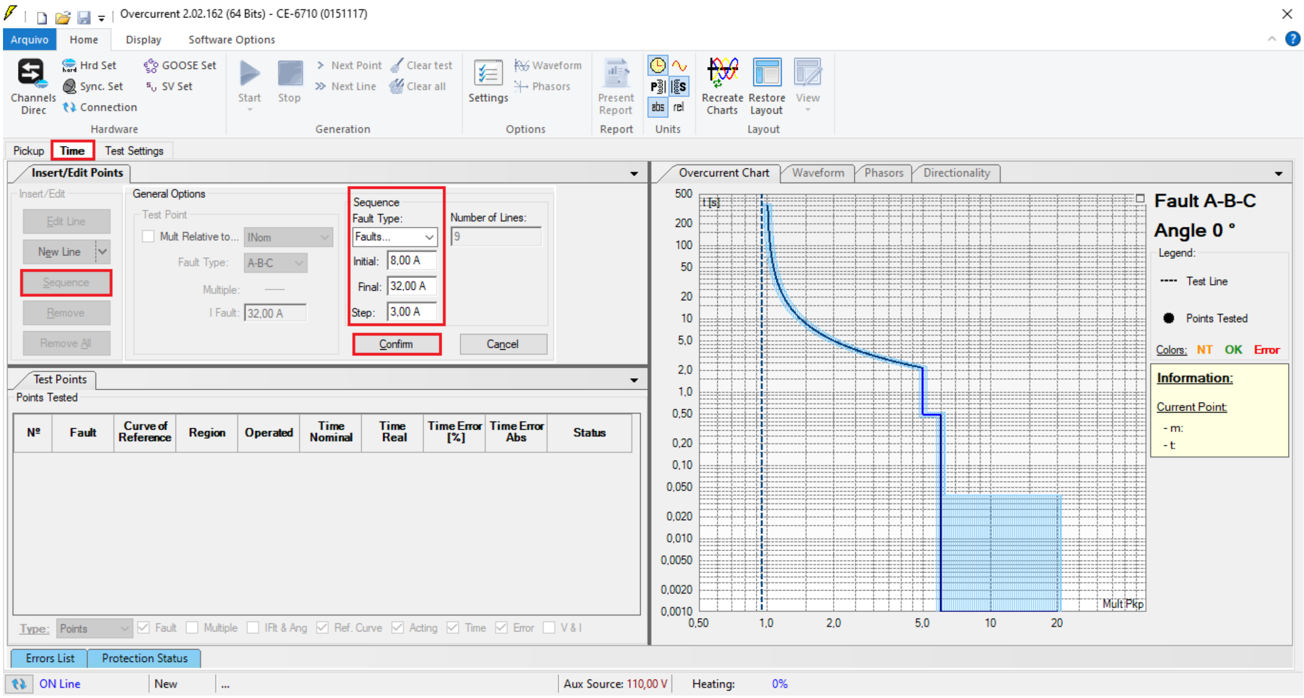


Figure 36

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

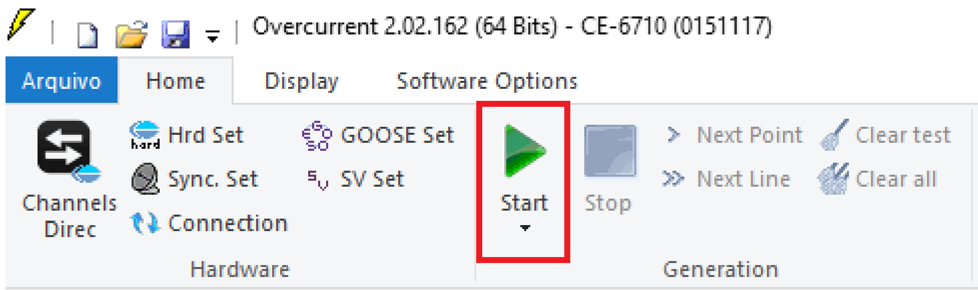


Figure 37

## 7.5. Final Result of the Test of Time

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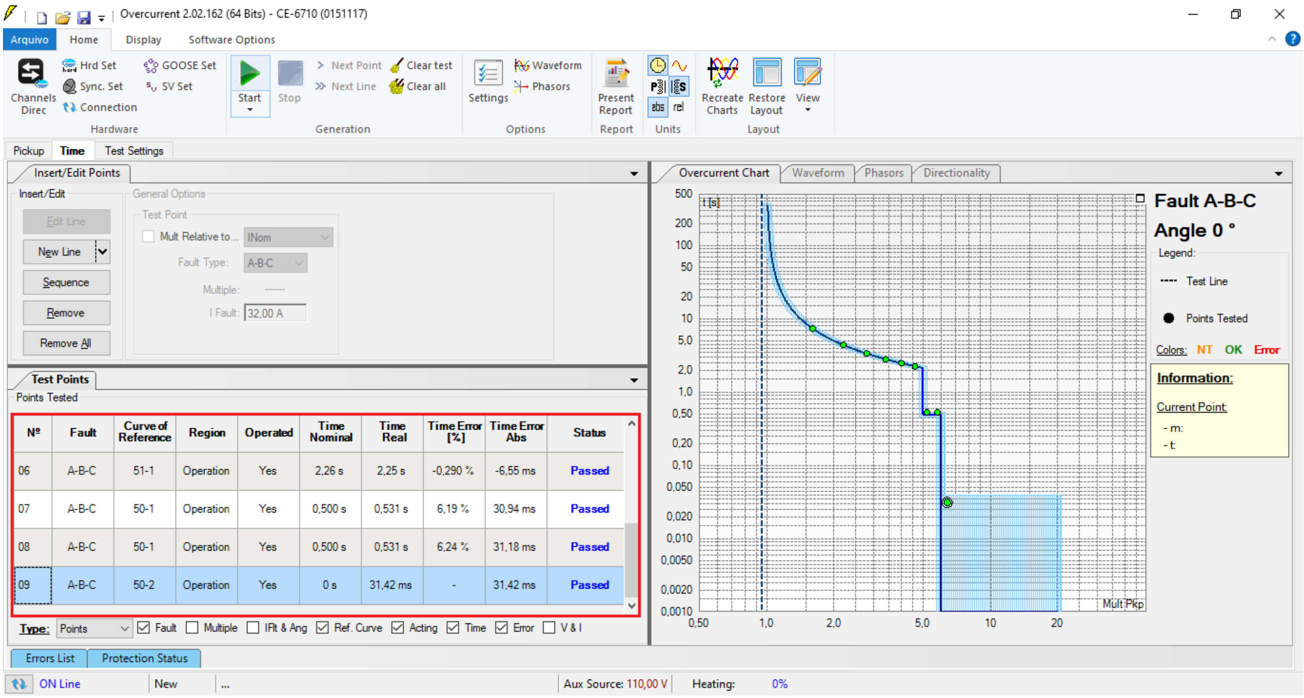

Figure 38

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

## 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.

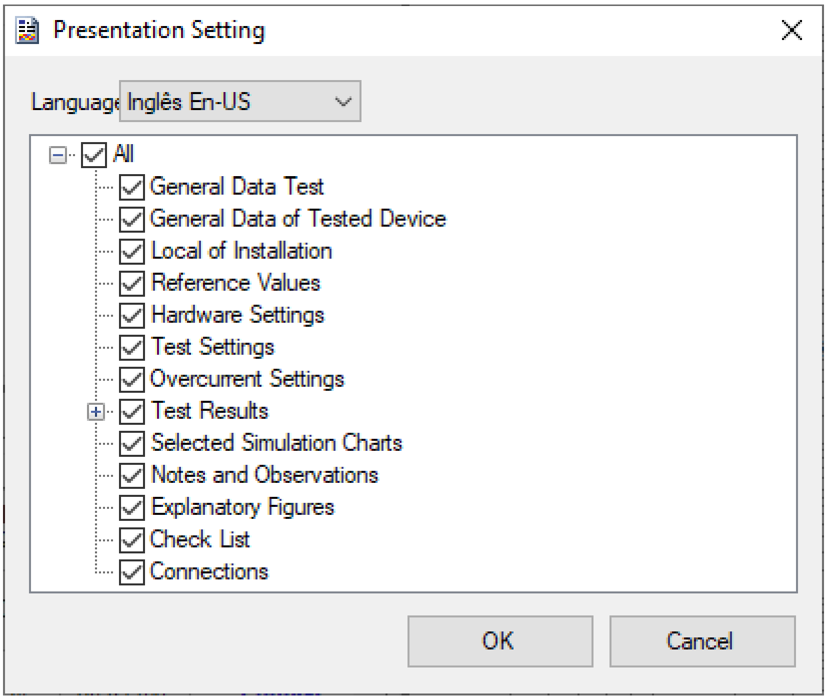


Figure 39

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.

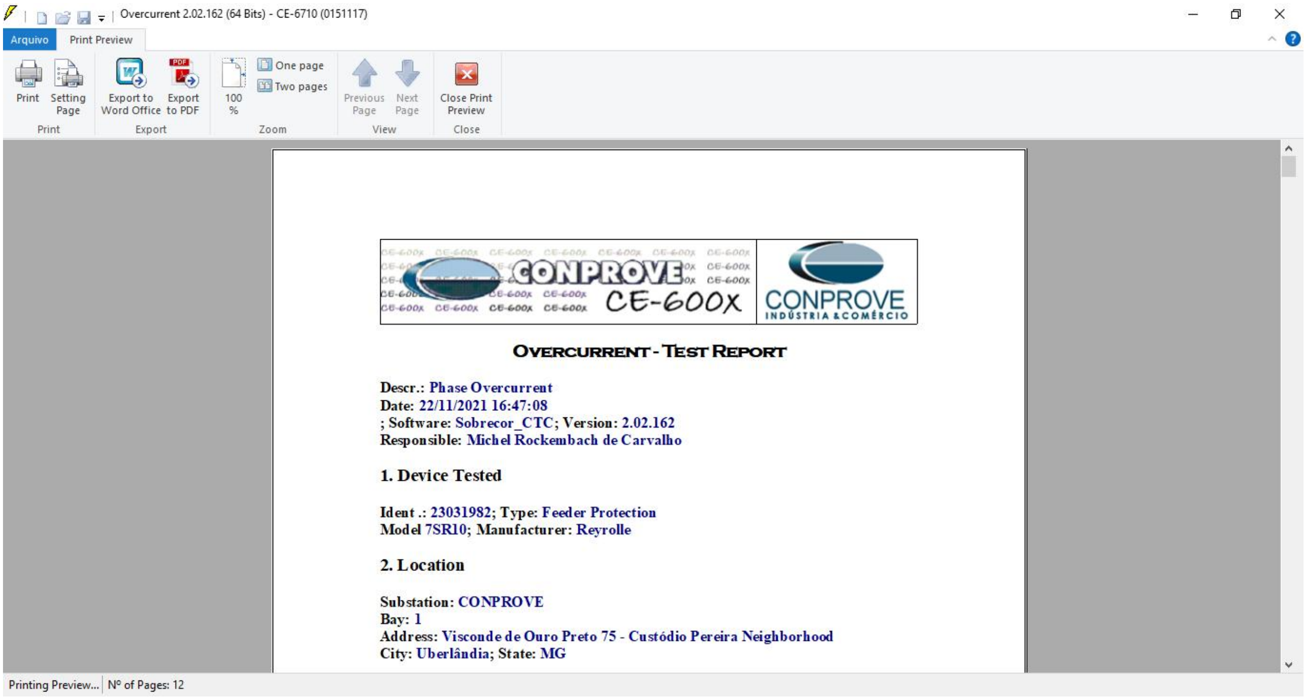
Overcurrent 2.02.162 (64 Bits) - CE-6710 (0151117)
Arquivo
Print Preview
Print
Setting Page
Export to Word Office
Export to PDF
100 %
One page
Two pages
Previous Page
Next Page
Close Print Preview
Print
Export
Zoom
View
Close
CE-600X
CONPROVE
OVERCURRENT - TEST REPORT
Descr.: Phase Overcurrent
Date: 22/11/2021 16:47:08
; Software: Sobrecor_CTC; Version: 2.02.162
Responsible: Michel Rockembach de Carvalho
1. Device Tested
Ident .: 23031982; Type: Feeder Protection
Model 7SR10; Manufacturer: Reyrolle
2. Location
Substation: CONPROVE
Bay: 1
Address: Visconde de Ouro Preto 75 - Custódio Pereira Neighborhood
City: Uberlândia; State: MG
Printing Preview...
Nº of Pages: 12

Figure 40

## Appendix A - Terminal Diagram

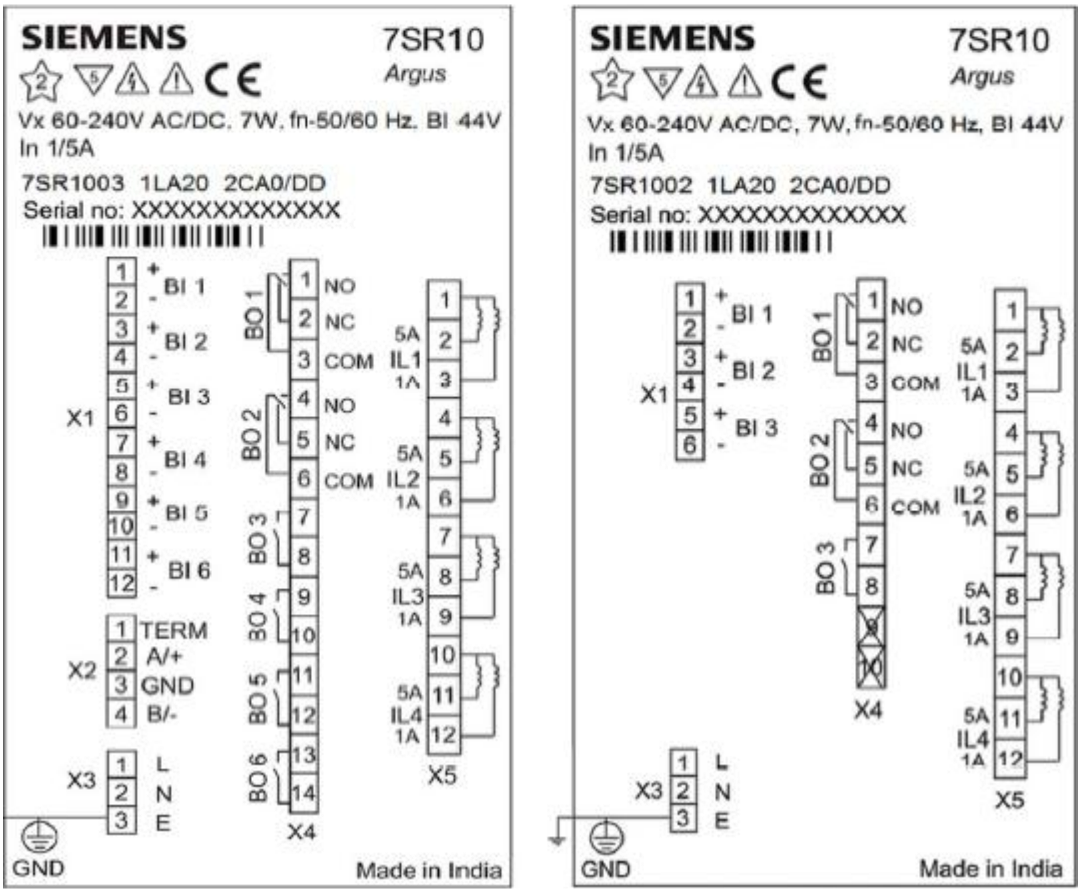


Figure 41

CONPROVE
INDÚSTRIA & COMÉRCIO

INSTRUMENTOS PARA TESTES ELÉTRICOS

# Appendix B - Technical Specifications

### 2.15.2 Operate and Reset Level

| | Attribute | | Value |
|---|---|---|---|
| $I_{op}$ | Operate level | | 105 % $I_s$, ± 4 % or ± 1 % $I_n$ |
| | Reset level | | ≥ 95 % $I_{op}$ |
| | Repeatability | | ± 1 % |
| | Variation | -10 °C to +60 °C | ≤ 5 % |
| | | $f_{nom}$ ± 5 % | ≤ 5 % |

### 2.15.3 Operate and Reset Time

| | Attribute | | Value |
|---|---|---|---|
| | Starter operate time (≥ 2xIs) | | 20 ms, ± 20 ms |
| $t_{op}$ | Operate time | char = IEC-NI, IEC-VI, IEC-EI, IEC-LTI | $t_{op} = \frac{K}{\left[\frac{I}{Is}\right]^{\alpha} - 1} \times Tm$ ,<br>± 5 % absolute or ± 40 ms for TMS setting (0.01 to 0.245)<br>± 5 % absolute or ± 30 ms for TMS setting (0.25 to 100)<br>for char = IEC-NI : K = 0.14, α = 0.02<br>IEC-VI : K = 13.5, α = 1.0<br>IEC-EI : K = 80.0, α = 2.0<br>IEC-LTI : K = 120.0, α = 1.0 |
| | | char = ANSI-MI, ANSI-VI, ANSI-EI | $t_{op} = \left[\frac{A}{\left[\frac{I}{Is}\right]^{P} - 1} + B\right] \times Tm$ ,<br>± 5 % absolute or ± 40 ms for TMS setting (0.01 to 0.245)<br>± 5 % absolute or ± 30 ms for TMS setting (0.25 to 100)<br>for char = ANSI-MI : A = 0.0515, B = 0.114, P = 0.02<br>ANSI-VI : A = 19.61, B = 0.491, P = 2.0<br>ANSI-EI : A = 28.2, B = 0.1217, P = 2.0 |
| | | char = DTL | $t_d$, ± 1 % or ± 20 ms |

Figure 42

# Appendix C - Parameter Equivalence between Relay and Software

Table 2

| Overcurrent Software | | Siemens Reyrolle 7SR10 Relay | |
|---|---|---|---|
| Parameter | Figure | Parameter | Figure |
| 51-1 Curve | Figure 24 | Gn 51-1 Char | Figure 11 |

| | | | |
|---|---|---|---|
| 51-1 Pkp | | Gn 51-1 Setting | |
| 51-1 Dial/Time | | Gn Time Mult (IEC/ANSI) | |
| 50-1 Pkp | | Gn 50-1 Setting | Figure 12 |
| 50-1 Dial/Time | | Gn 50-1 Delay | |
| 50-2 Pkp | | Gn 50-2 Setting | Figure 13 |
| 50-2 Dial/Time | | Gn 50-2 Delay | |