



INSTRUMENTOS PARA TESTES ELÉTRICOS

Test Tutorial

Equipment Type: Protection Relay

Brand: General Electric - GE

Model: SR 469

Function: 32R or PDOP – Power Directional

Tool Used: CE-6006; CE-6707; CE-6710; CE-7012 or CE-7024

Objective: Perform tests on the reverse power function to verify its directionality.

Version control:

Version	Descriptions	Date	Author	Reviewer
1.0	Initial release	12/05/2022	M.R.C.	G.C.D.P.

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Statement of responsibility

The information contained in this tutorial is constantly verified. However, differences in description cannot be completely excluded; in this way, CONPROVE disclaims any responsibility for errors or omissions contained in the information transmitted.

Suggestions for improvement of this material are welcome, just user contacts us via email suporte@conprove.com.br.

The tutorial contains knowledge gained from the resources and technical data at the time was writing. Therefore, CONPROVE reserves the right to make changes to this document without prior notice.

This document is intended as a guide only; the manual of the equipment under test should always be consulted.



ATTENTION!

The equipment generates high current and voltage values during its operation. Improper use of the equipment can result in material and physical damage.

Only suitably qualified people should handle the instrument. It should be noted that the user must have satisfactory training in maintenance procedures a good knowledge of the equipment under test and also be aware of safety standards and regulations.

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Sequence for testing the GE SR469 relay in the Power Directional software

1. Relay connection to CE-6710

Appendix A shows the relay terminal designations.

1.1 Auxiliary Source

Connect the positive (red terminal) of the Aux Source. Vdc to pin H12 on the relay terminal and the negative (black terminal) of the Aux Source Vdc to pin H11 of the relay terminal.

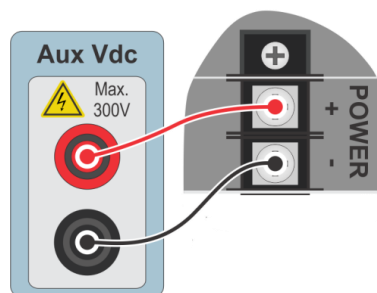
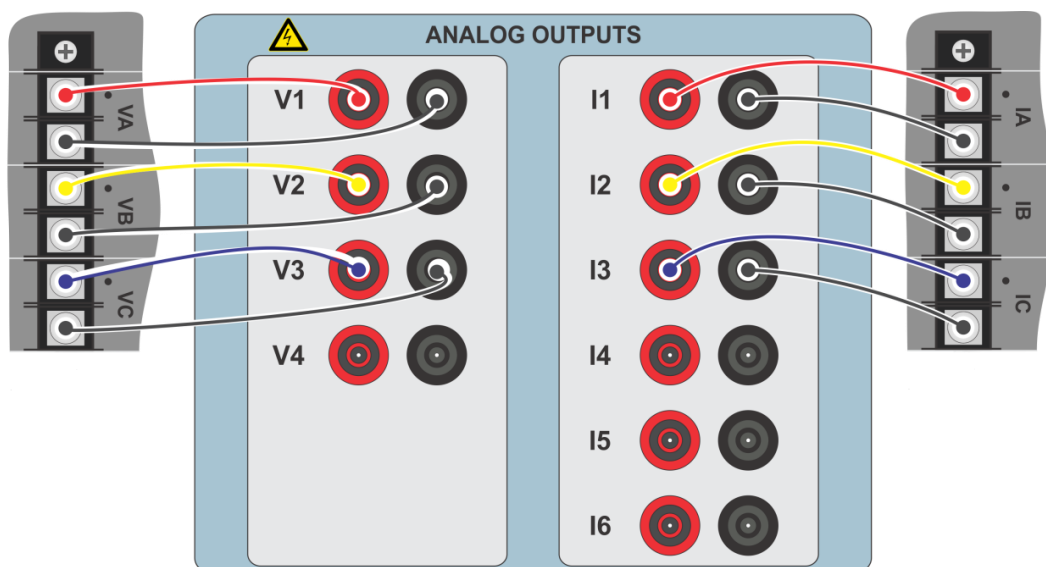


Figure 1

1.2 Current and Voltage Coils

To establish the connection of current coils, connect current channels I1, I2 and I3 to pins G6, G7 and G8 and connect the commons of current channels to pins H6, H7 and H8 of the relay terminal. In the same way, to establish the connection of the voltage coils, connect the voltage channels V1, V2 and V3 to the relay pins G2, H1 and H2 respectively, connecting the three common ones to the G1 pin.



1.3 Binary Inputs

Connect the CE-6710 binary inputs to the relay binary outputs.

- BI1 to pin E2 and its common to pin F1.

The following figure shows the details of the connection.

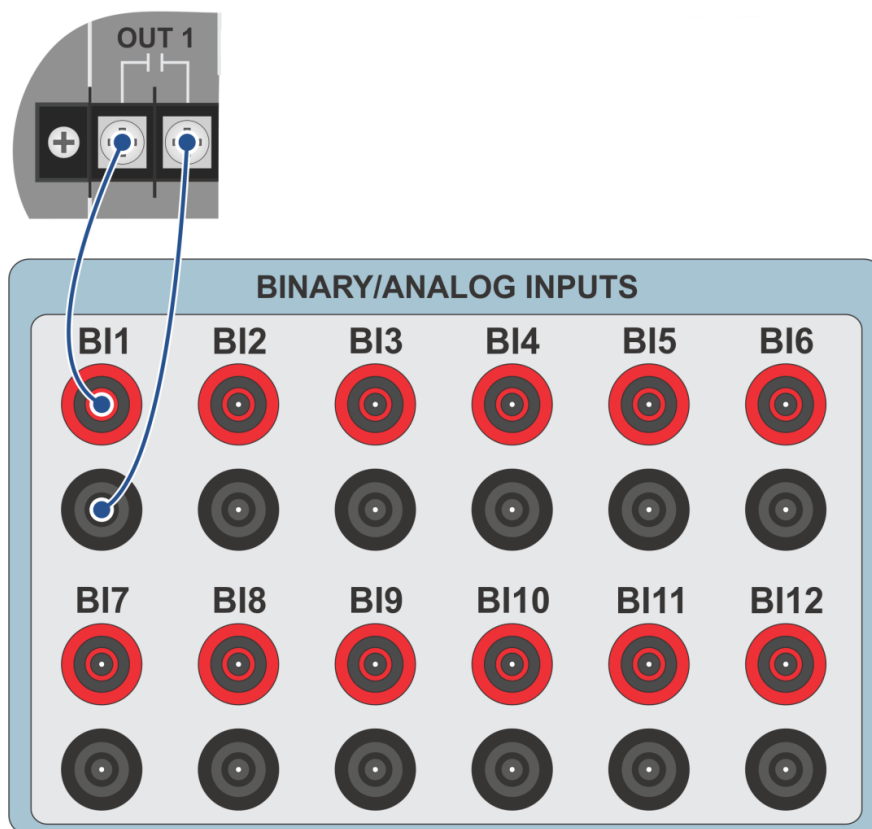


Figure 3

1.4 Access

To gain access to the relay parameters without the need to use a password, short circuit pins C1 and C2.

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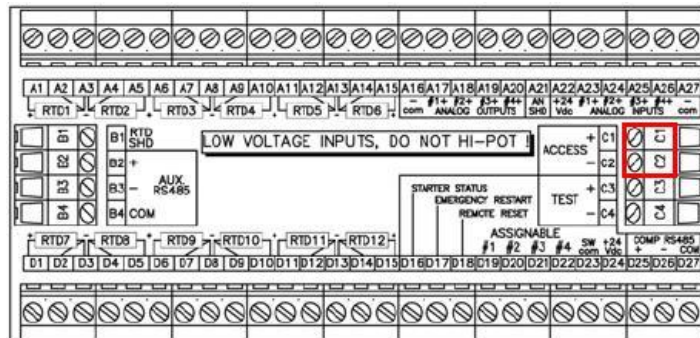


Figure 4

2. Communication with the SR 469 relay

Before starting the test, open the “EnerVista” software and download the SR 469 relay software, if you already have it, click on the icon below:

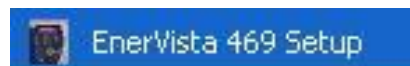


Figure 5

In the “EnerVista SR 469” software select: “Communications → Quick Connect”.



Figure 6

On the next screen choose the serial option, check which port is being used (in this case COM 1) and in “Baud Rate” choose 9600.

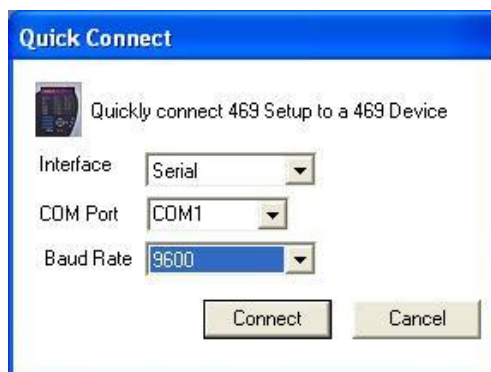


Figure 7

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Then click on “*Connect*”. The following figure shows the message after connecting.



Figure 8

3. SR 469 Relay Settings

3.1 469 Quick Connect

General relay settings will be available after clicking the “+” sign next to “*Quick Connect*” and “*469 Quick Connect*” as shown below.

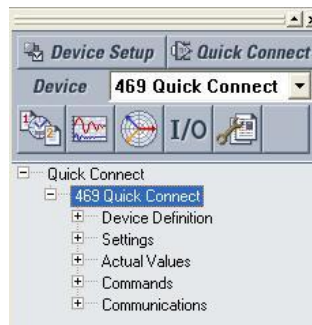


Figure 9

3.2 System Setup

The next step is to configure the voltage, current, rated frequency, voltage and current transformer ratio as well as the phase sequence. To do this, click on the “+” signs next to “*Settings*” and “*System Setup*”.

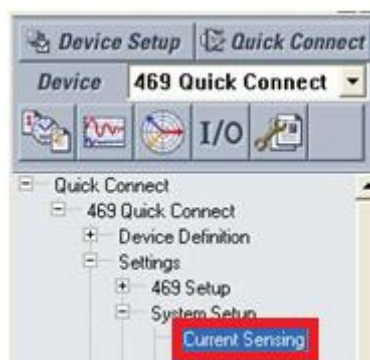


Figure 10

3.3 Current Sensing

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With a double click on “*Current Sensing*” the window below will be opened, where the values of the CT, the nominal current of the motor must be adjusted and the option to enable two speeds for the motor must be turned off.

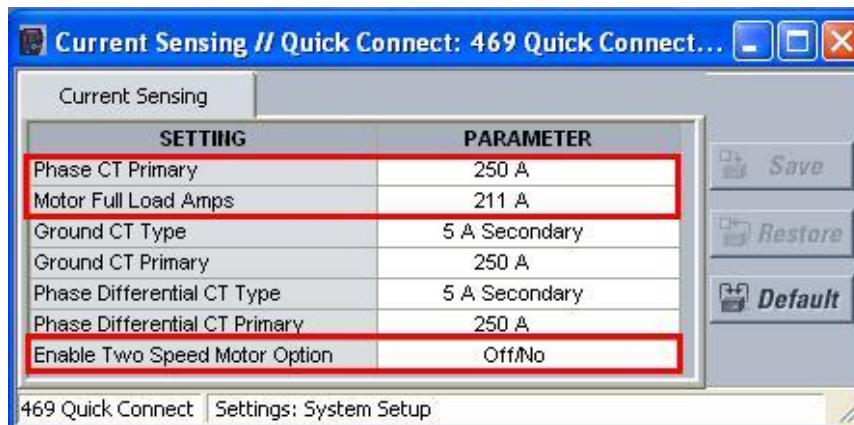


Figure 11

After the necessary modifications, click on “*Save*” and in the following message, click on “*Yes*” (This process must be repeated whenever a change is made to any parameter).

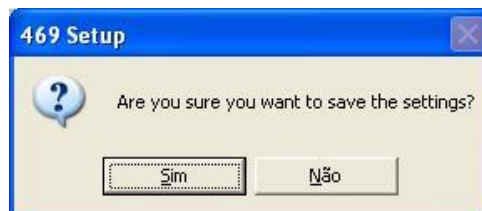


Figure 12

3.4 Voltage Sensing

Now double click on “*Voltage Sensing*” the following screen should be adjusted. It adjusts the type of connection with the VT, the transformation ratio, remembering that 3300/115 is equal to 28.69, and finally the rated voltage of the motor.

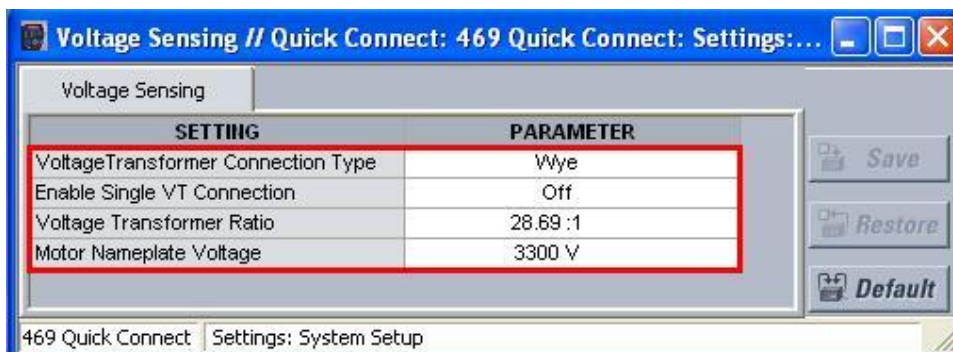


Figure 13

3.5 Power System

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With a double click on “*Power System*” the nominal frequency and the phase sequence are set.

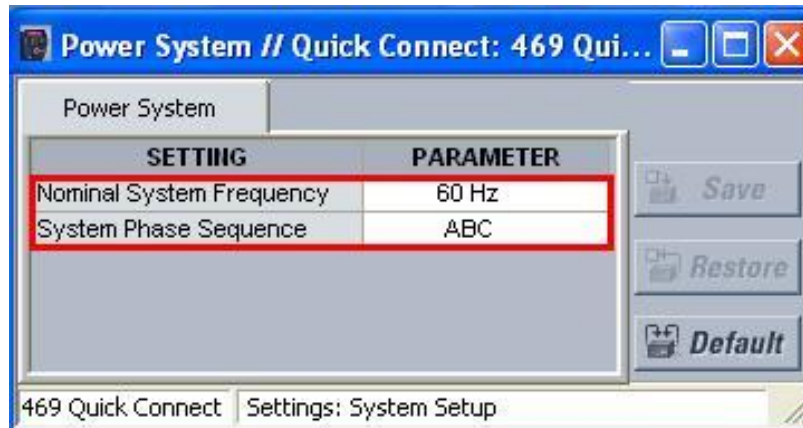


Figure 14

3.6 Reverse Power

The next step is to configure the pickup and actuation time values of the underfrequency and overfrequency functions. To do this, click on the “+” signs next to “*Protection*” and “*Power Elements*”.

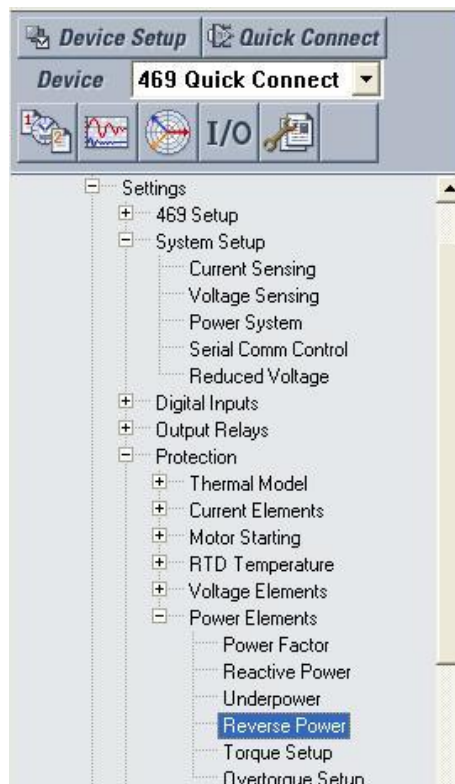


Figure 15

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With a double click on “Reverse Power” perform the following adjustments. Pay attention for the value of 100 kW referred to the primary.

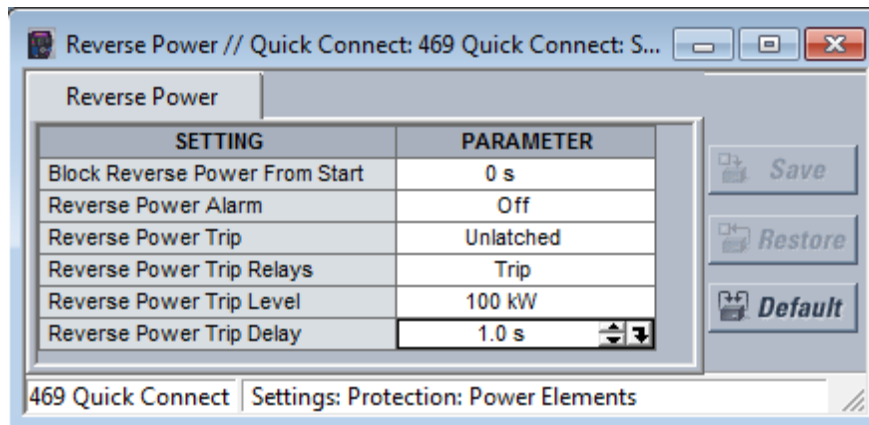


Figure 16

4. Power Directional software adjustments

4.1 Opening the Power Directional

Click on the “Conprove Test Center” application manager icon.



Figure 17

Click on the Power Directional software icon.

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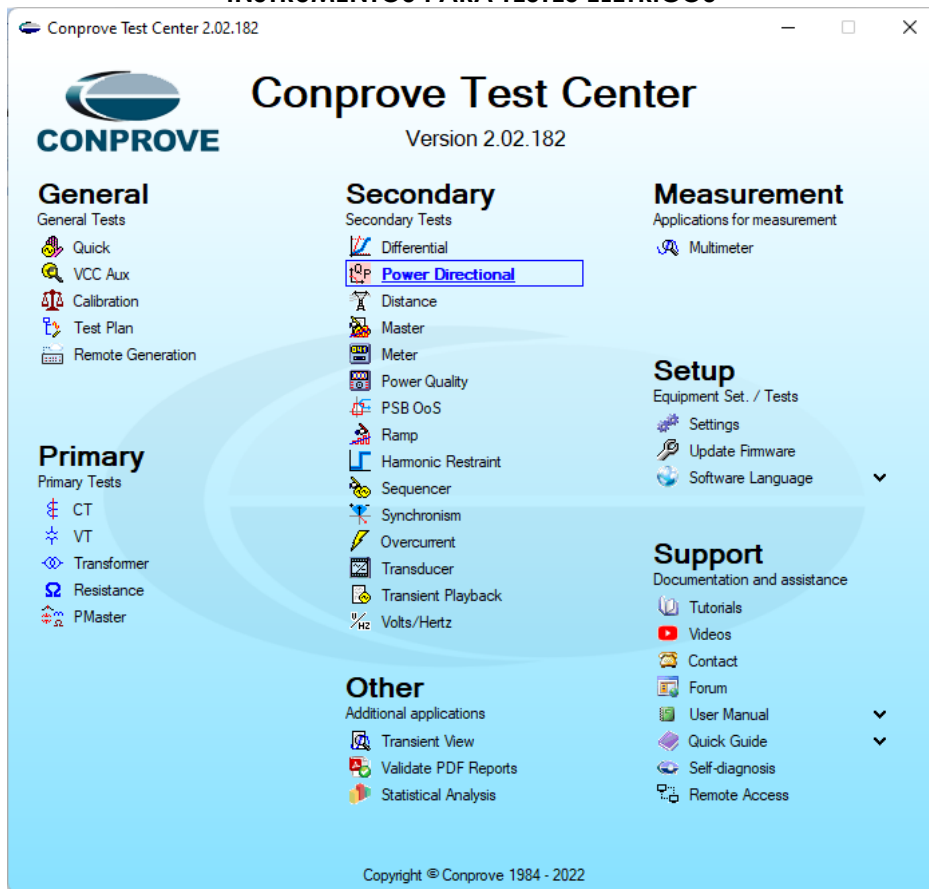


Figure 18

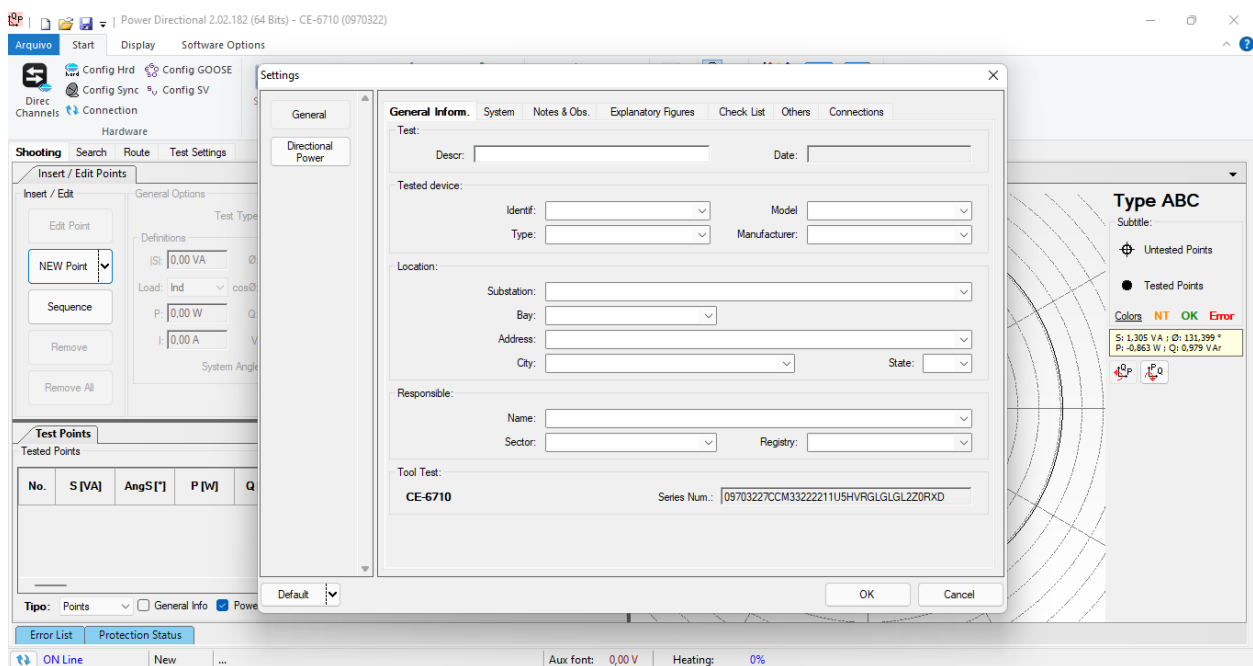


Figure 19

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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.

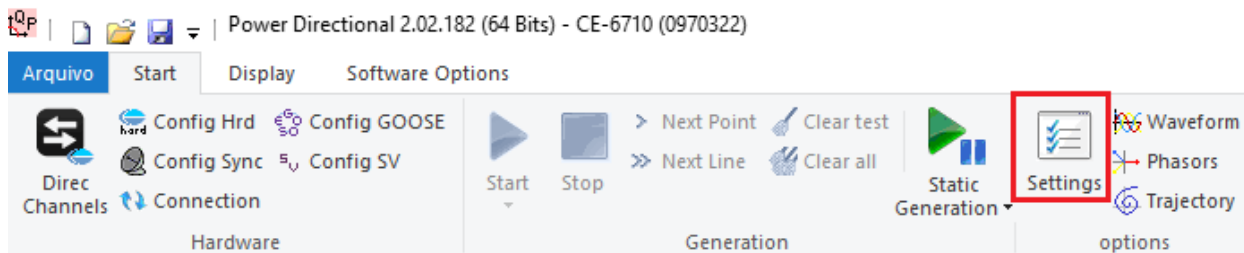


Figure 20

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.

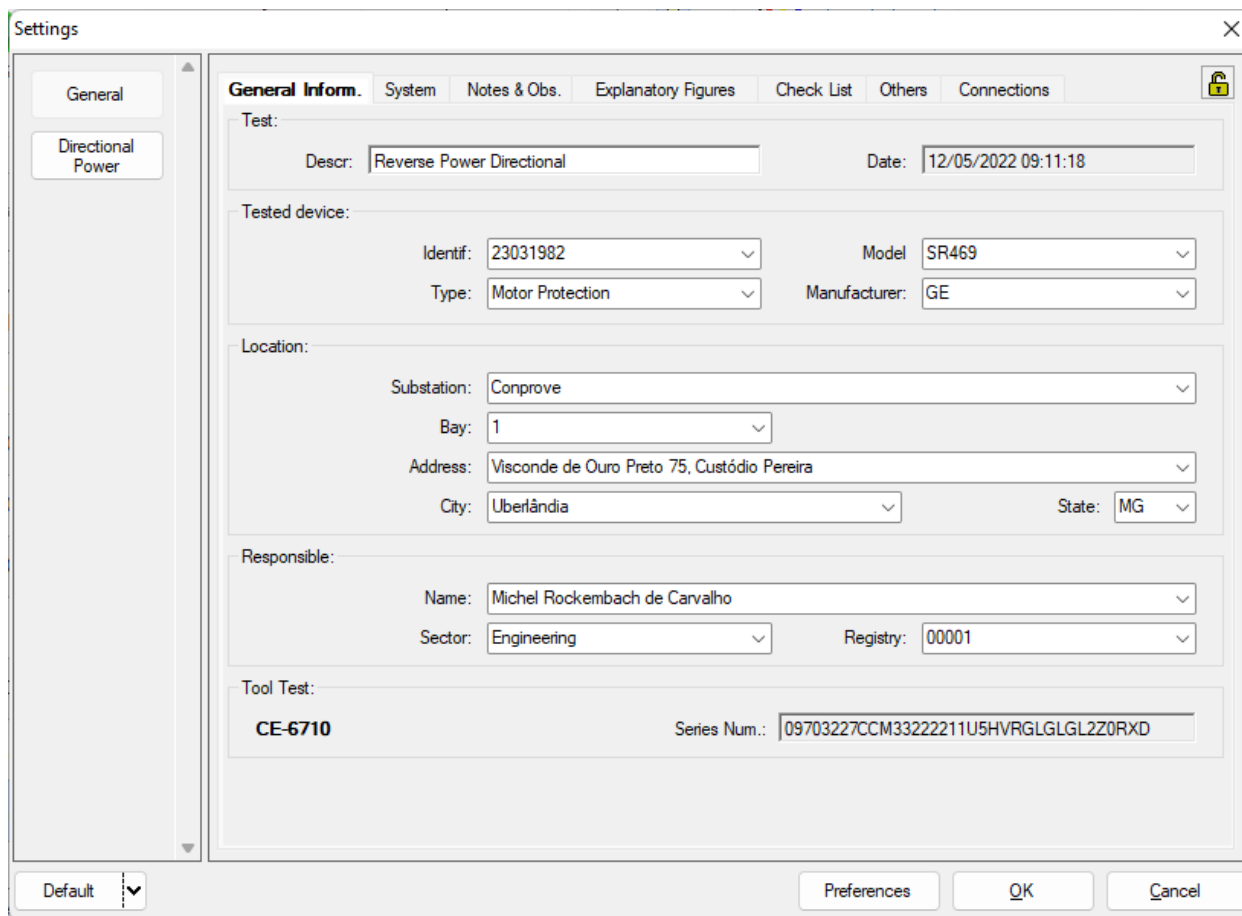


Figure 21

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.

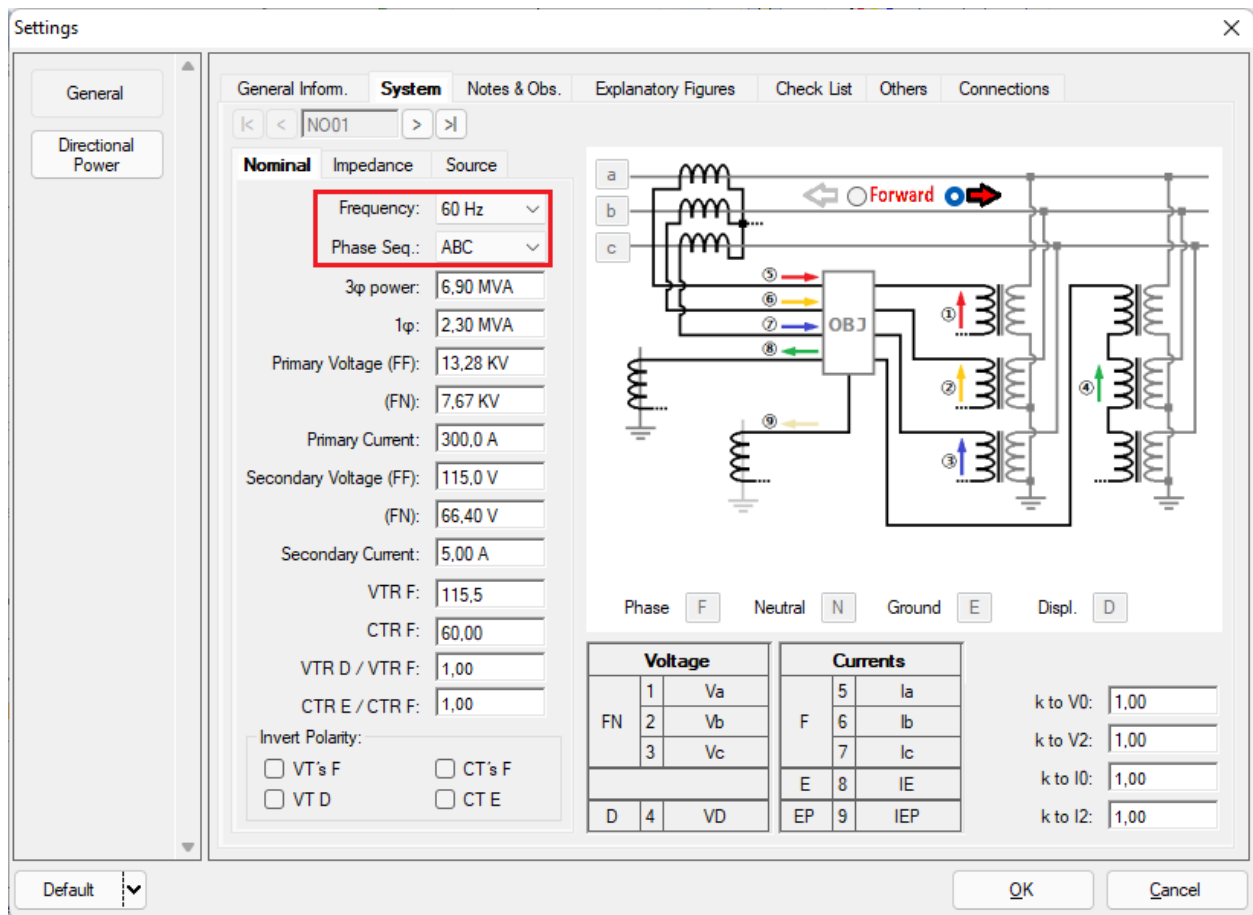


Figure 22

There are other tabs where the user can insert “Notes & Obs.”, “Explanatory Figures”, and “Check List” of the procedures for carrying out the test and even create a diagram with all the schematic of the connections between the test set and the test equipment.

5. Channel Direction and Hardware Configurations

Click on the icon illustrated below.

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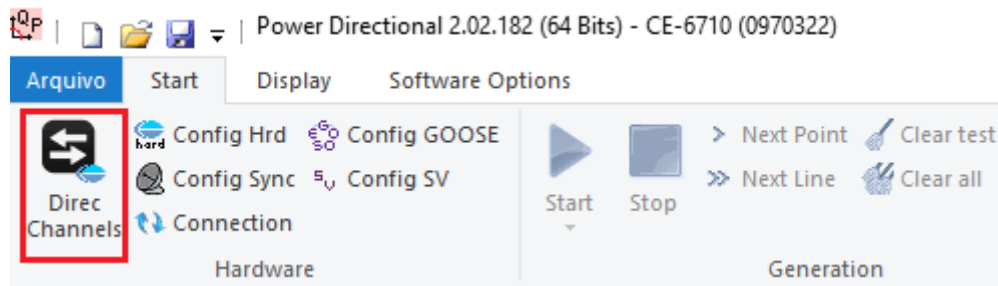


Figure 23

Then click on the highlighted icon to configure the hardware.

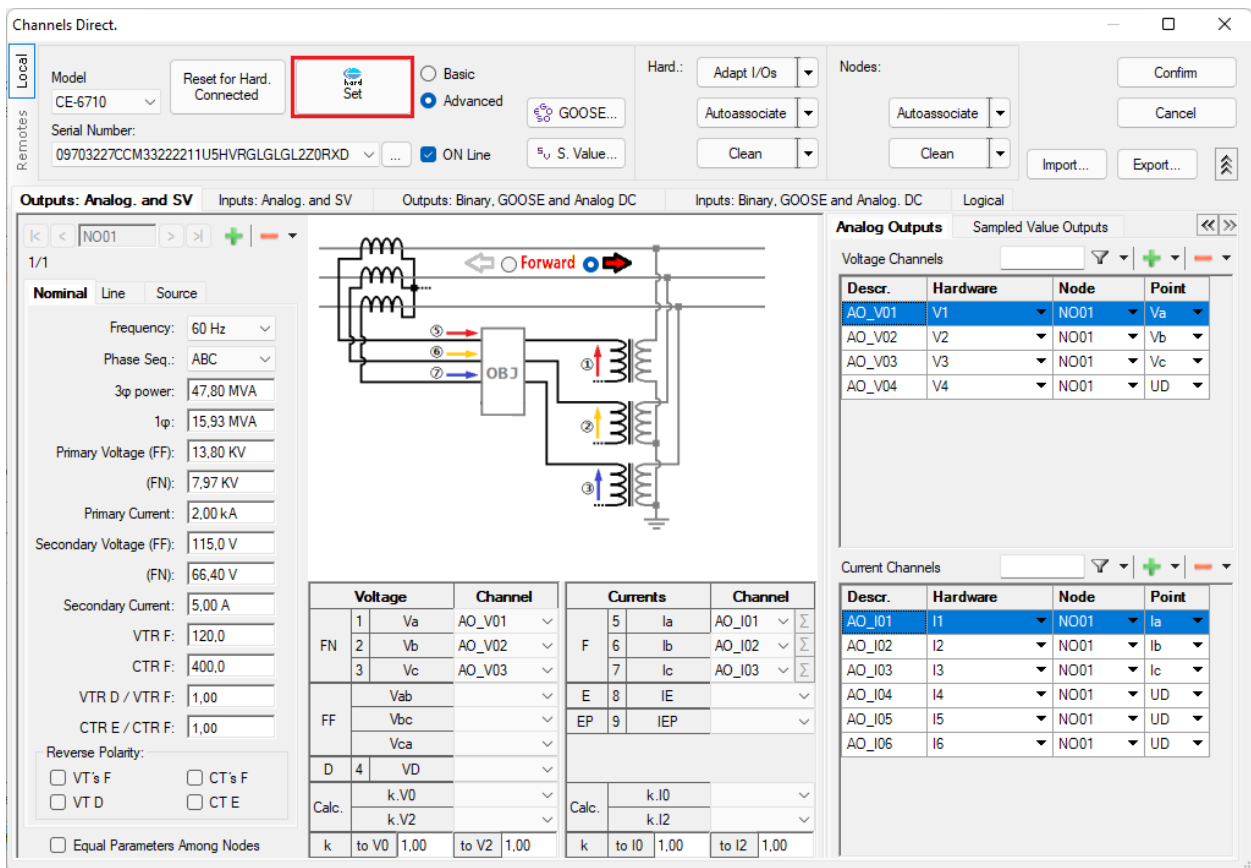


Figure 24

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

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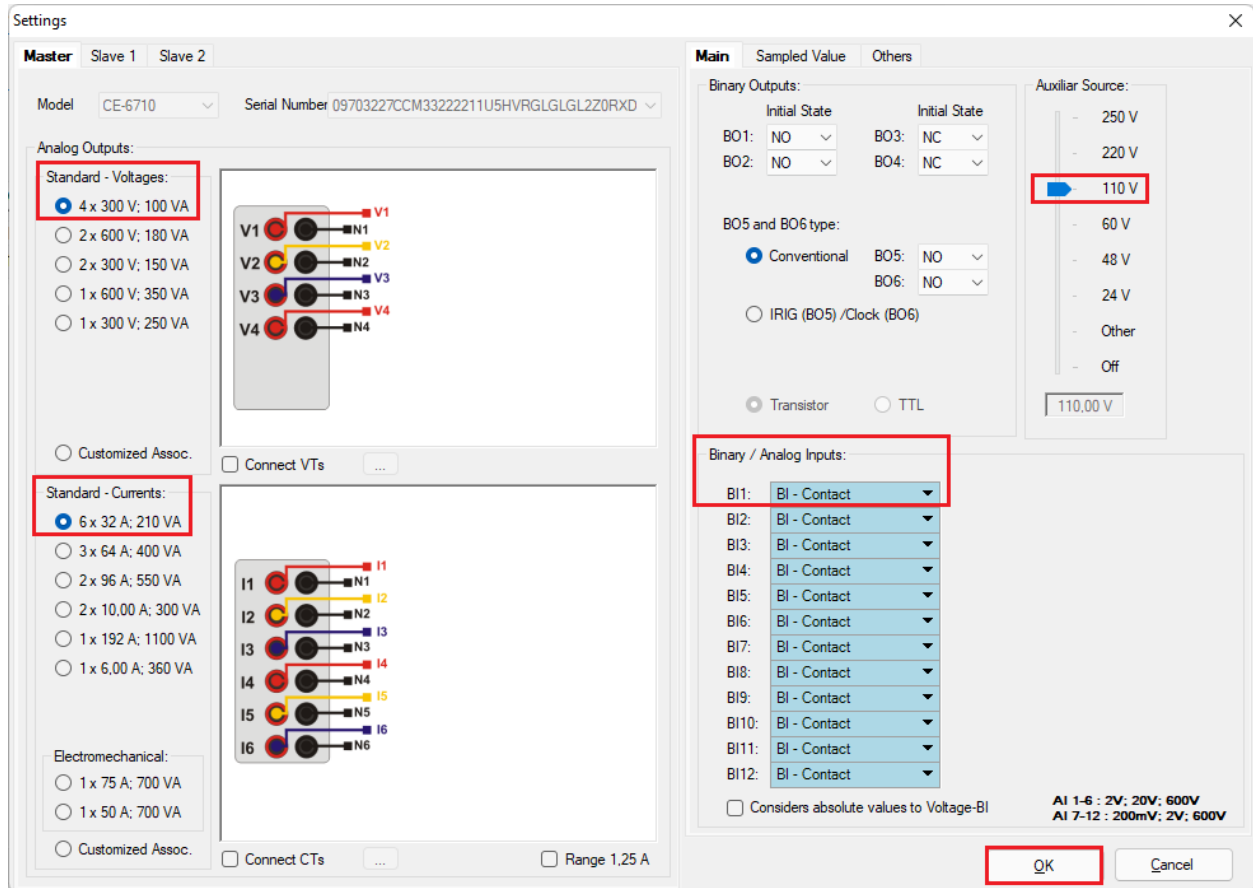


Figure 25

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

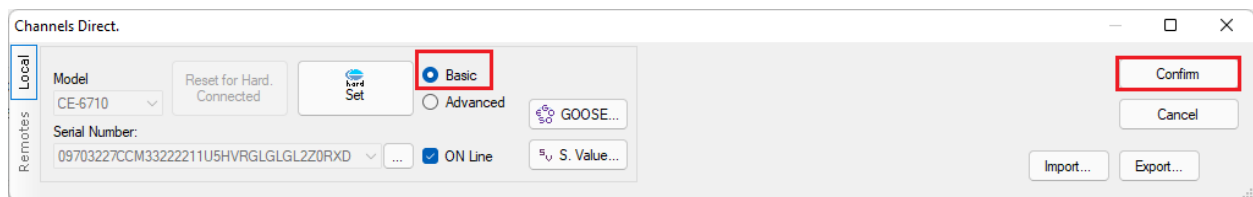


Figure 26

6. Power Directional Adjustment

6.1 Directional Power Screen > Definitions

In this tab you can adjust the pickup definition, power, time and angle tolerances. These tolerances should be consulted in the relay manufacturer's manual (available in Appendix A). There is also the option of limiting a maximum value for both voltage and current.

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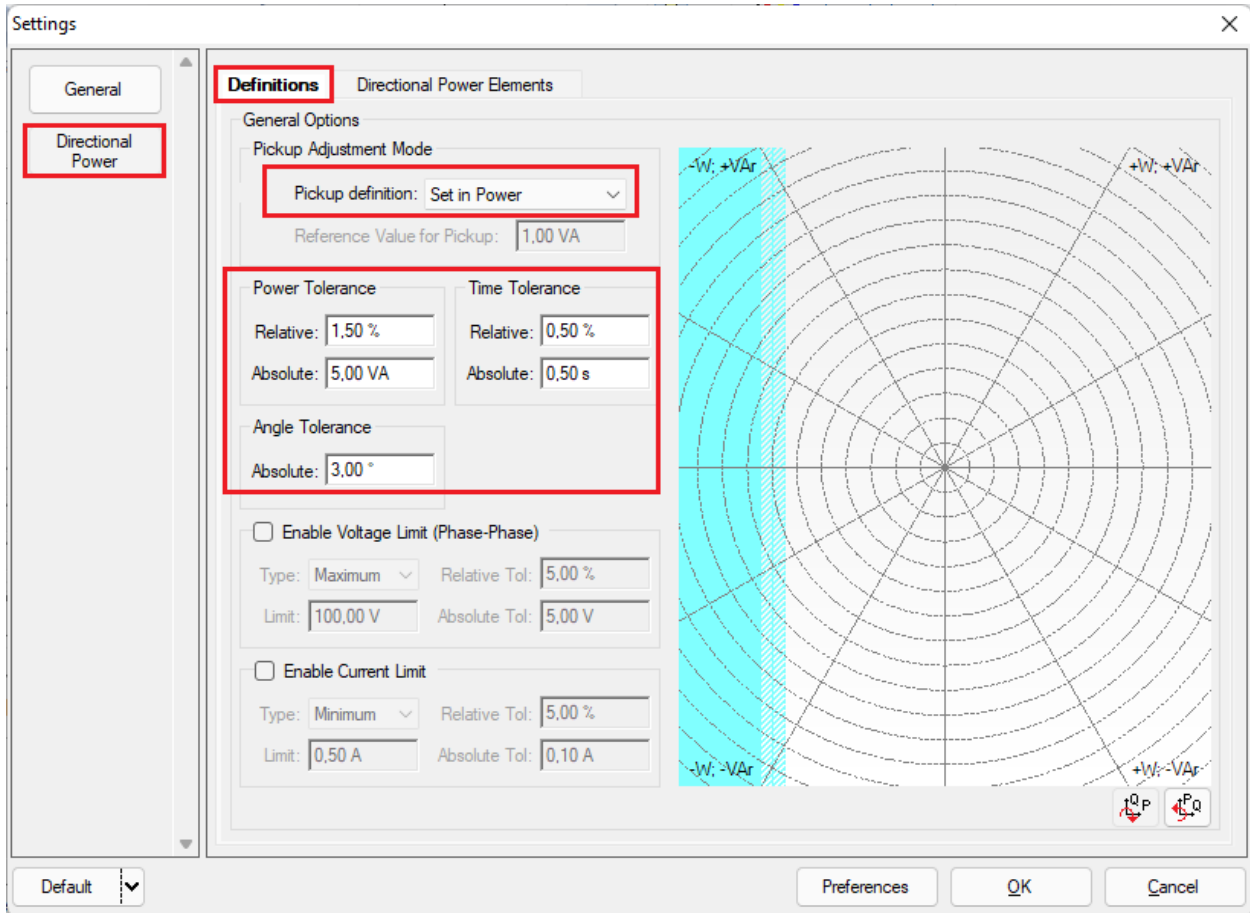


Figure 27

6.2 Directional Power Screen > Directional Power Elements > Active

Here the reverse power directional element is configured. Click once on the highlighted “+” icon.

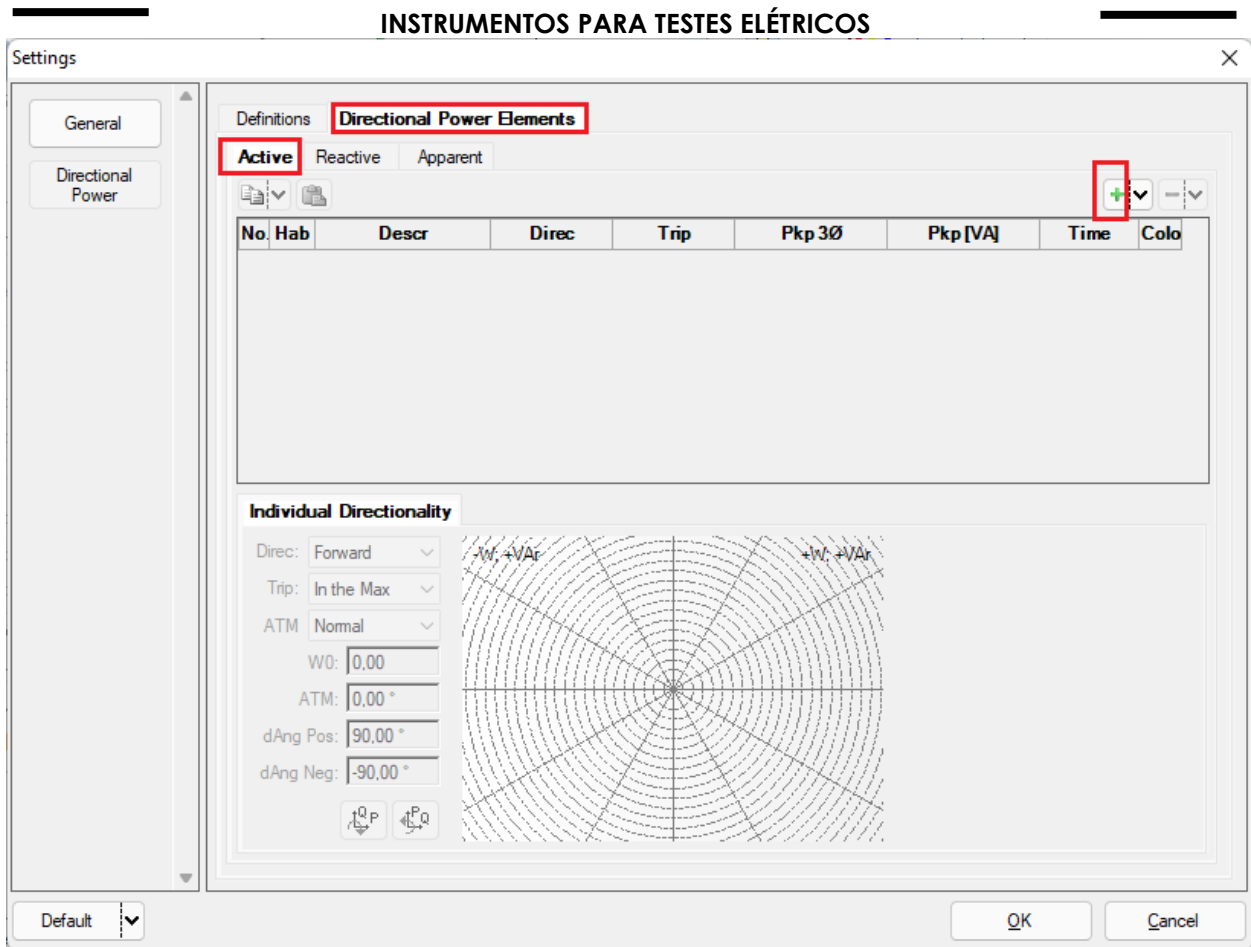


Figure 28

For the first element change the name to 32R, choose the directionality as reverse, set the pickup value and the run time. Remembering that the pickup value must be referenced to the secondary according to the following formula:

$$P_{secondary} = \frac{P_{primary}}{VTR * CTR}$$

$$P_{secondary} = \frac{100k}{(28,69) * \left(\frac{250}{5}\right)}$$

$$P_{secondary} = 69,71W$$

In the “*Individual Directionality*” tab set the “*Reverse*” option, the maximum torque angle “*ATM*” should be set “*Normal*” and the positive and negative angular offset as 90° and -90°.

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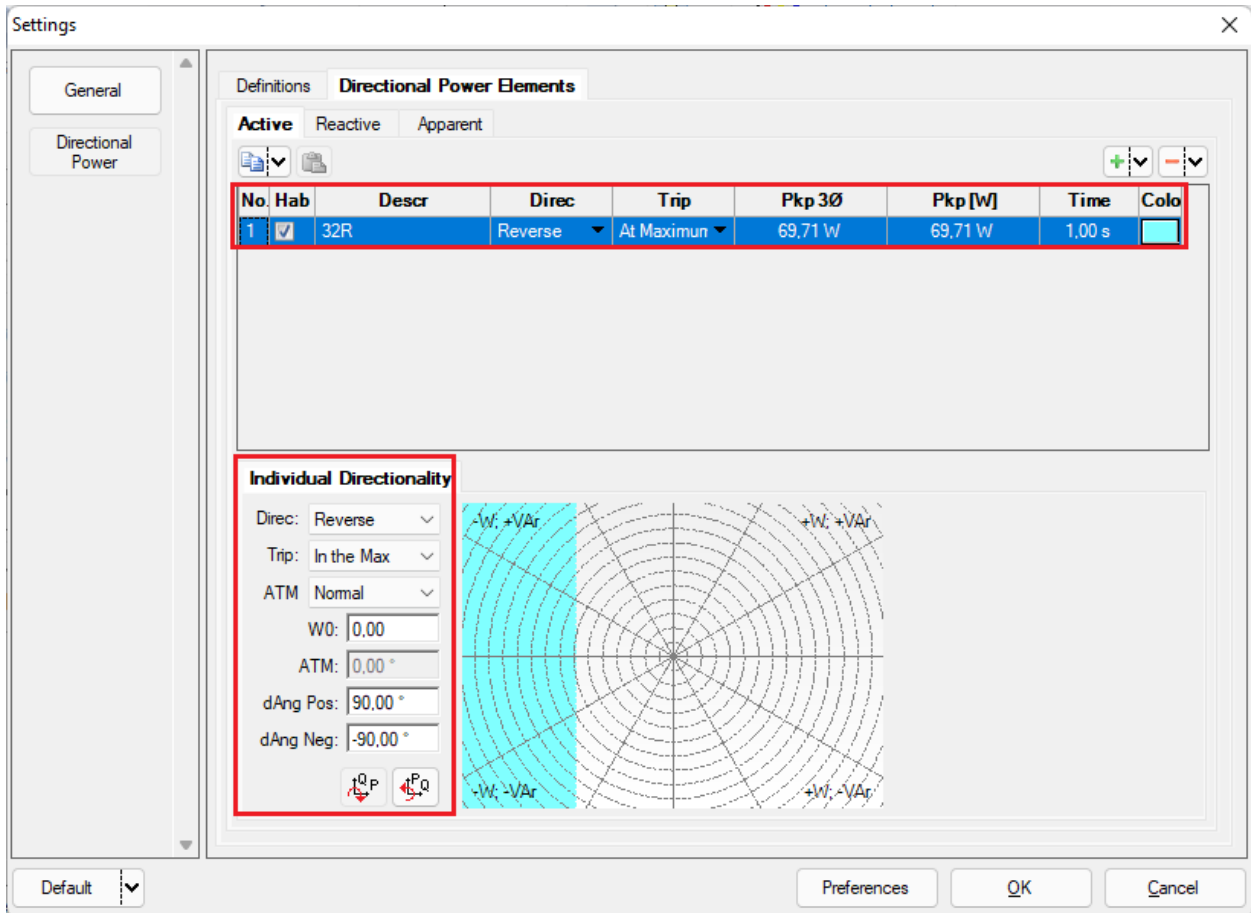


Figure 29

7. Test Structure for function 32

7.1 Test Settings

In this tab, you must configure the trip signal directed to the binary input, in addition to configuring the generation channels. Enter a pre-fault with rated voltage and current with a time of 100ms.

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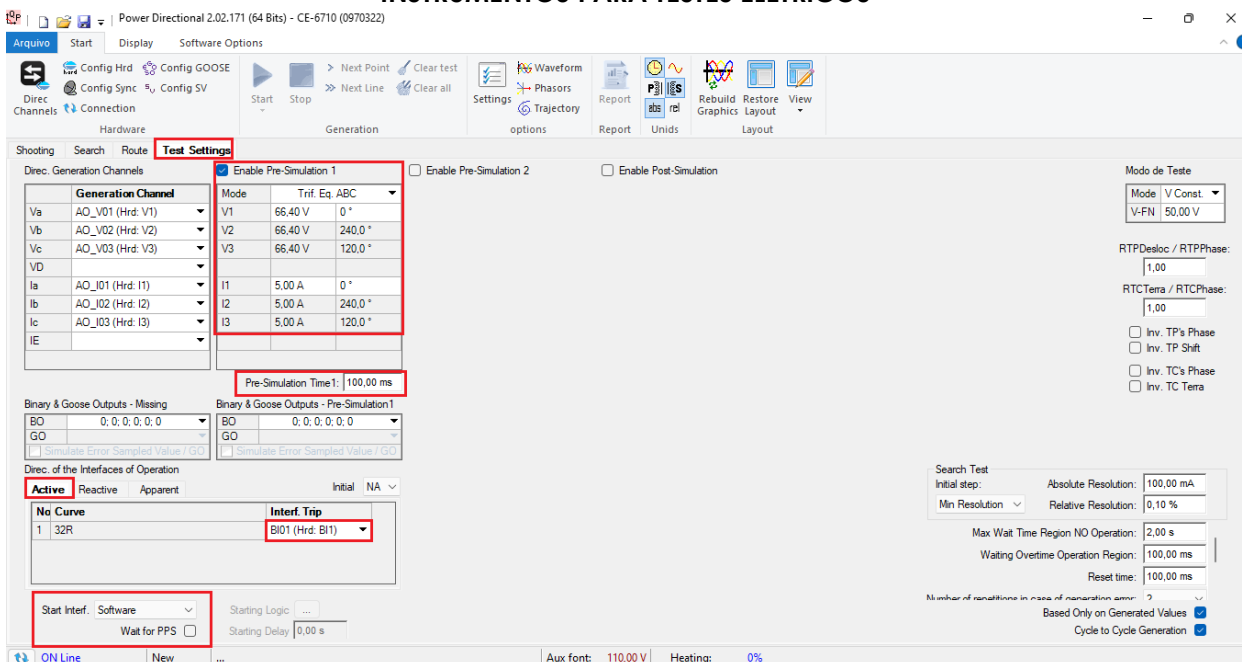


Figure 30

7.2 Shooting Screen

In this tab click on “Sequence” and choose the value of the initial and final power and the step. Repeat the process for the angles as shown in the following figure.

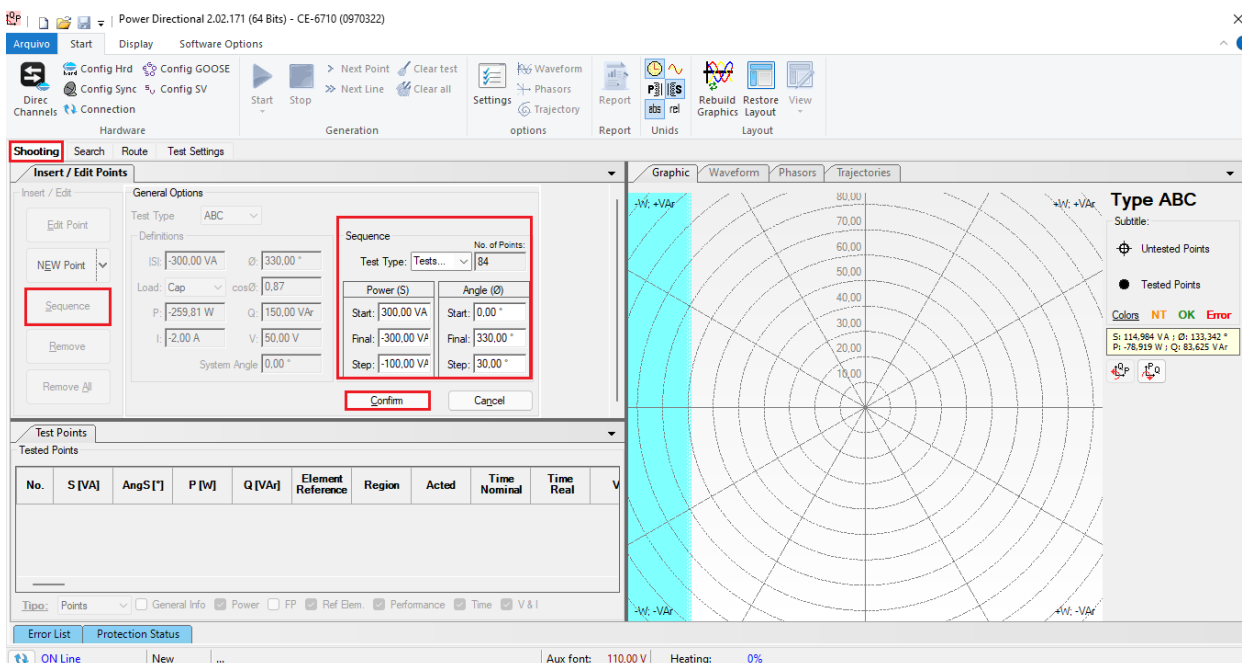


Figure 31

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

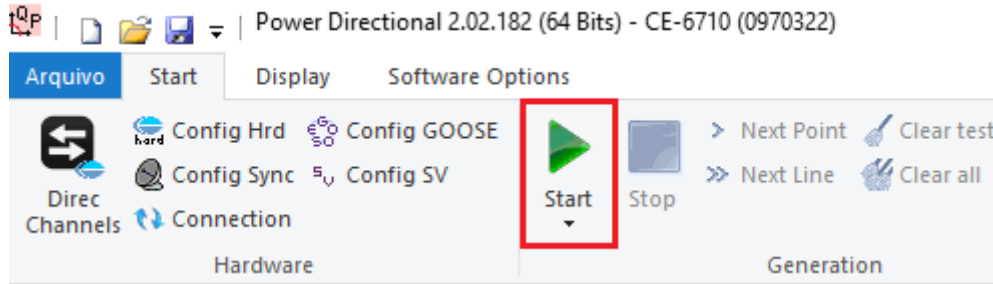


Figure 32

7.3 Final Result of the Shooting Test

In this test, it can be verified that within the operating region the relay operates within the predicted time plus its tolerance. In the case of the non-operation region, the relay does not act, proving the correct functioning of the function.

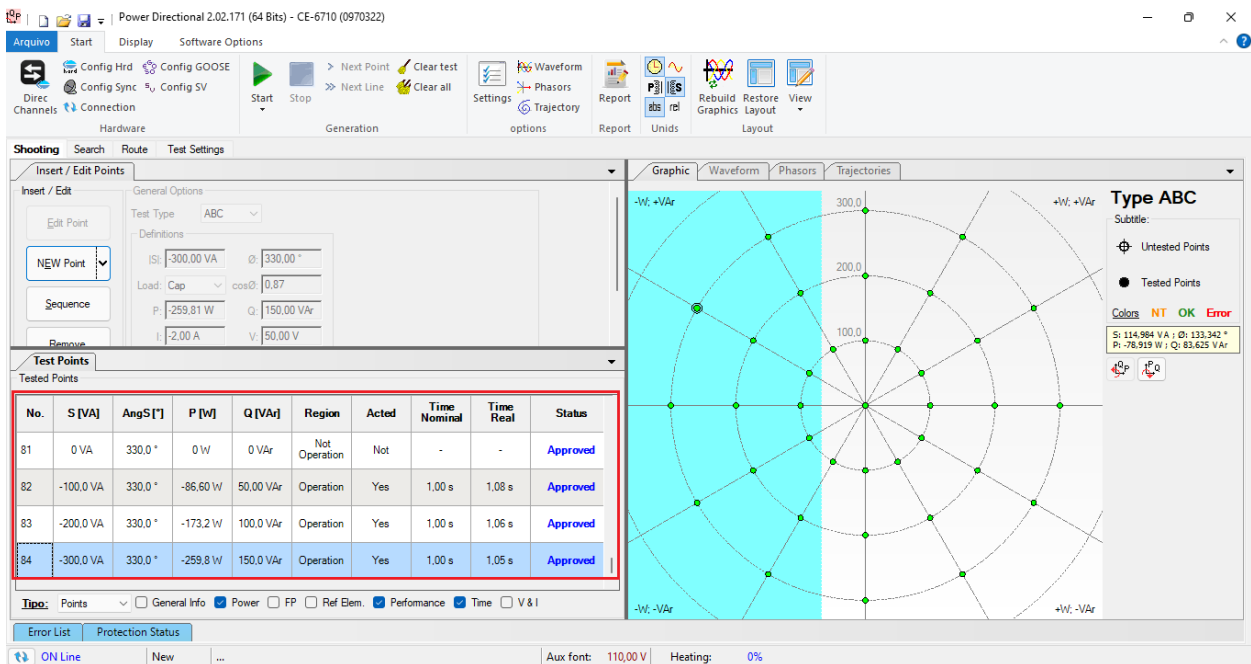


Figure 33

7.4 Search screen

In this tab, the power value that starts the relay is evaluated. For convenience, a sequence of values will be inserted, set the “*Test Type*” field to “*ABC*”. The field “*Line Definition*” was defined as “*P*”, with an initial value of 0.0W and a final value of -150.0W. In the “*Variable (Q)*” field, the initial value was 600.0Var, the final value was -600.0Var and with a step of -200.0Var.

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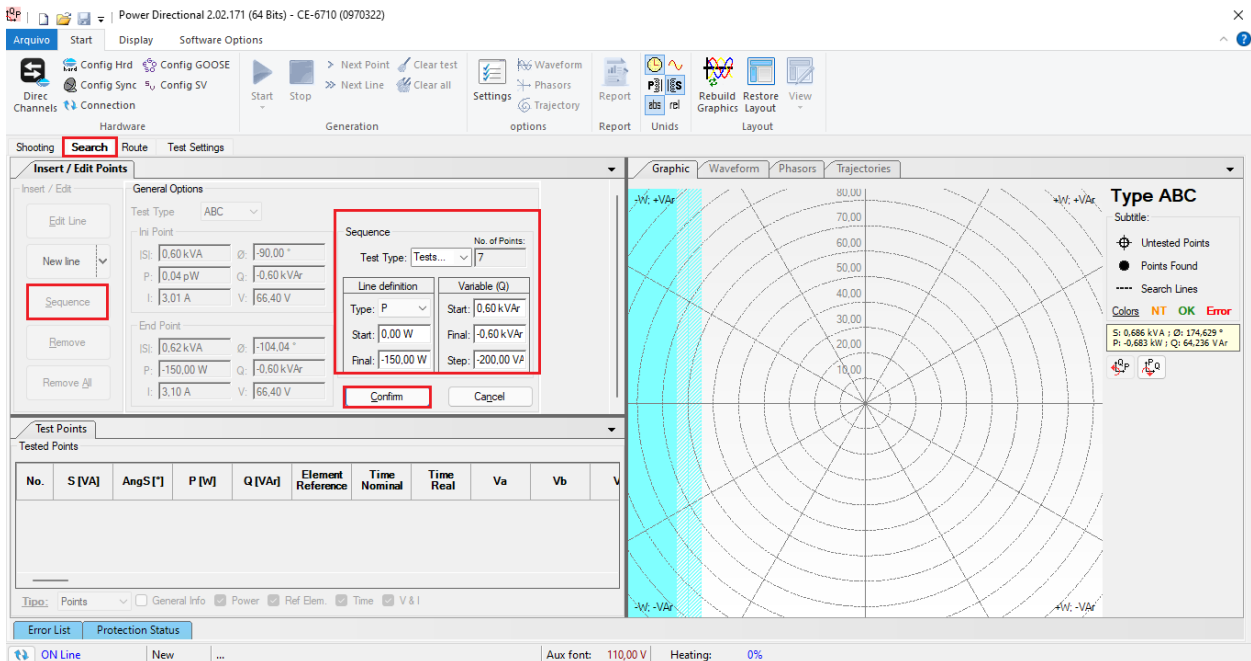


Figure 34

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

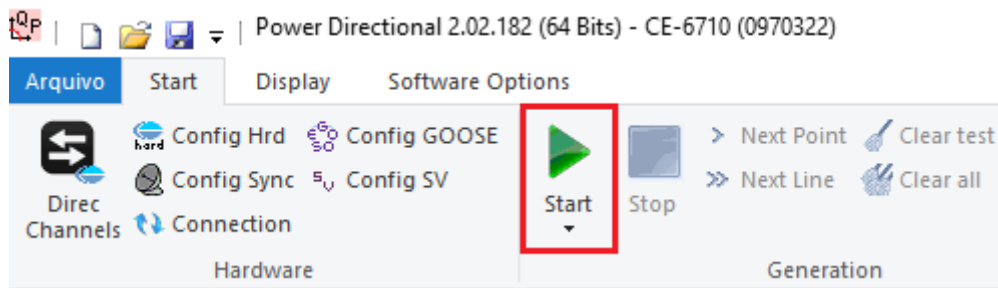


Figure 35

7.5 Final search test result

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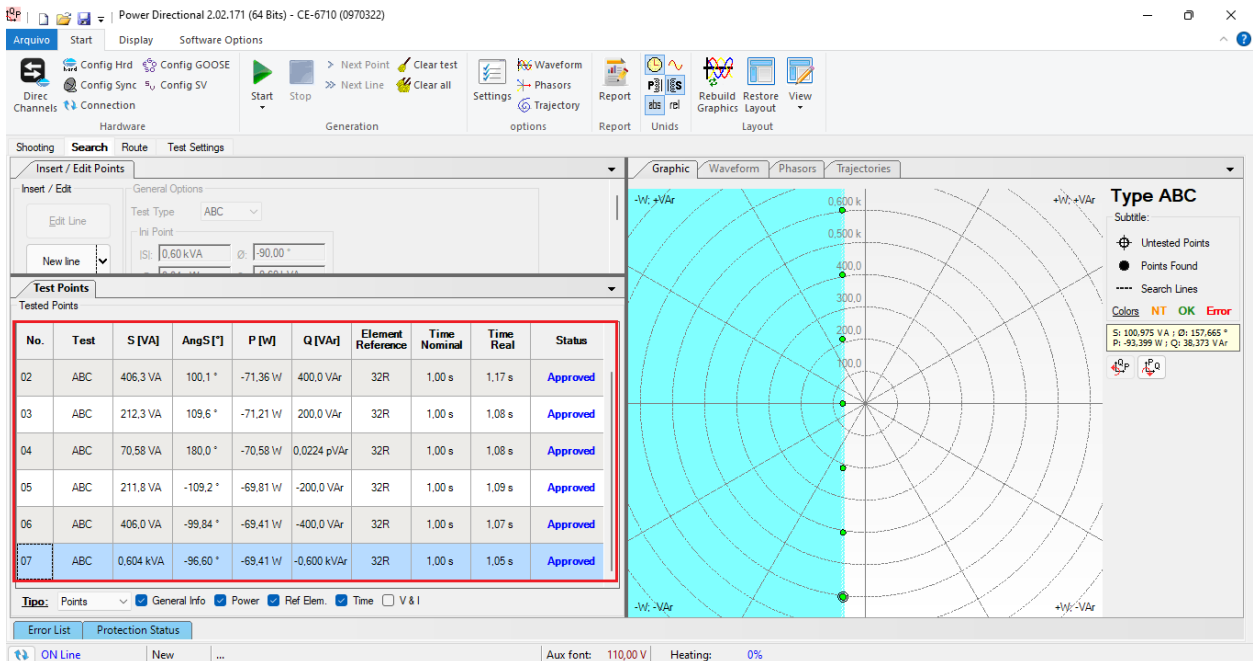


Figure 36

It is verified that all active power values are then within the tolerance region provided by the manufacturer.

8. Report

After finishing the test, click on the “Present Report” icon in the previous figure or using the “Ctrl +R” command to call up the report pre-configuration screen. Choose the desired language as well as the options that should be part of the report.

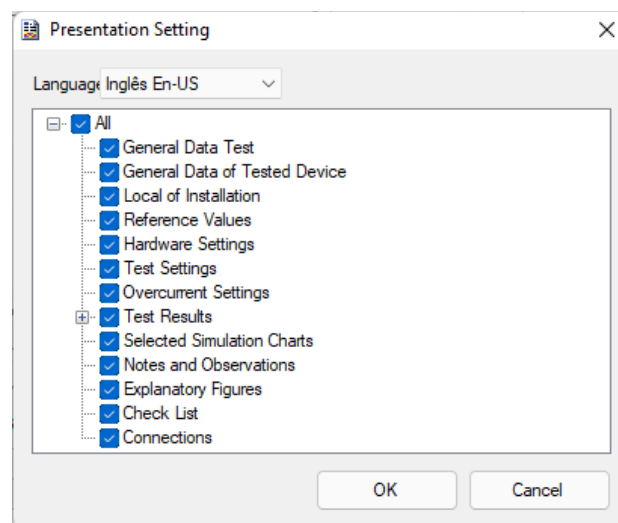


Figure 37

INSTRUMENTOS PARA TESTES ELÉTRICOS

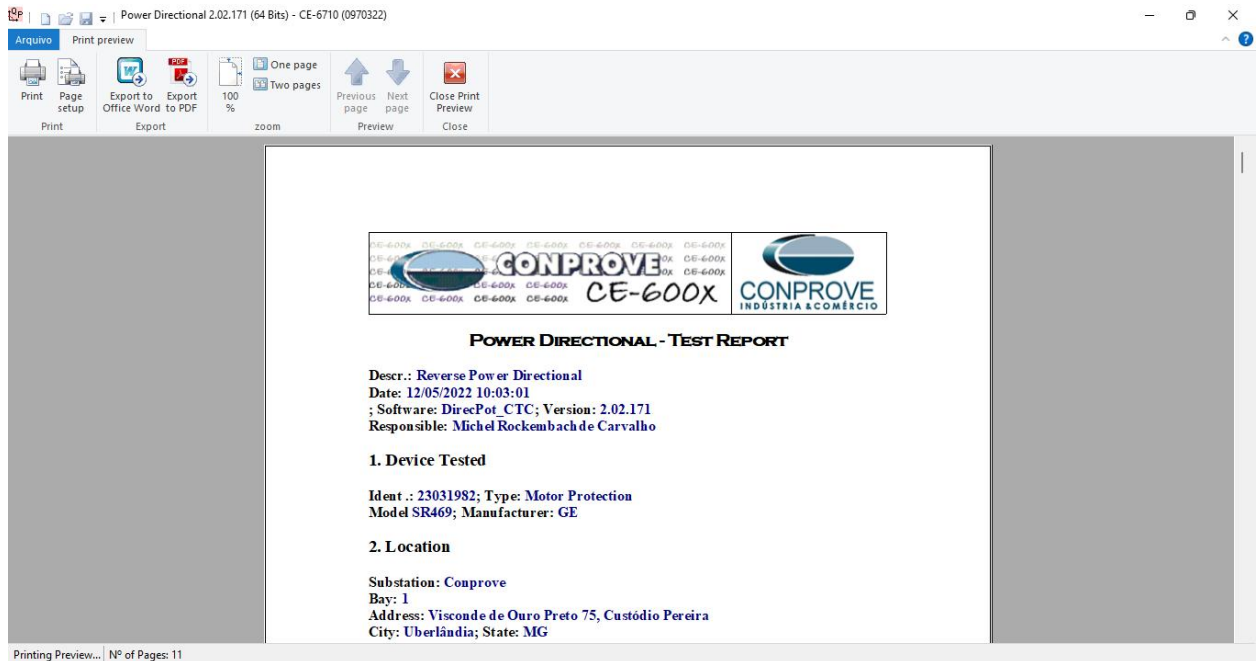


Figure 38

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APPENDIX A

A.1 Terminal Designations

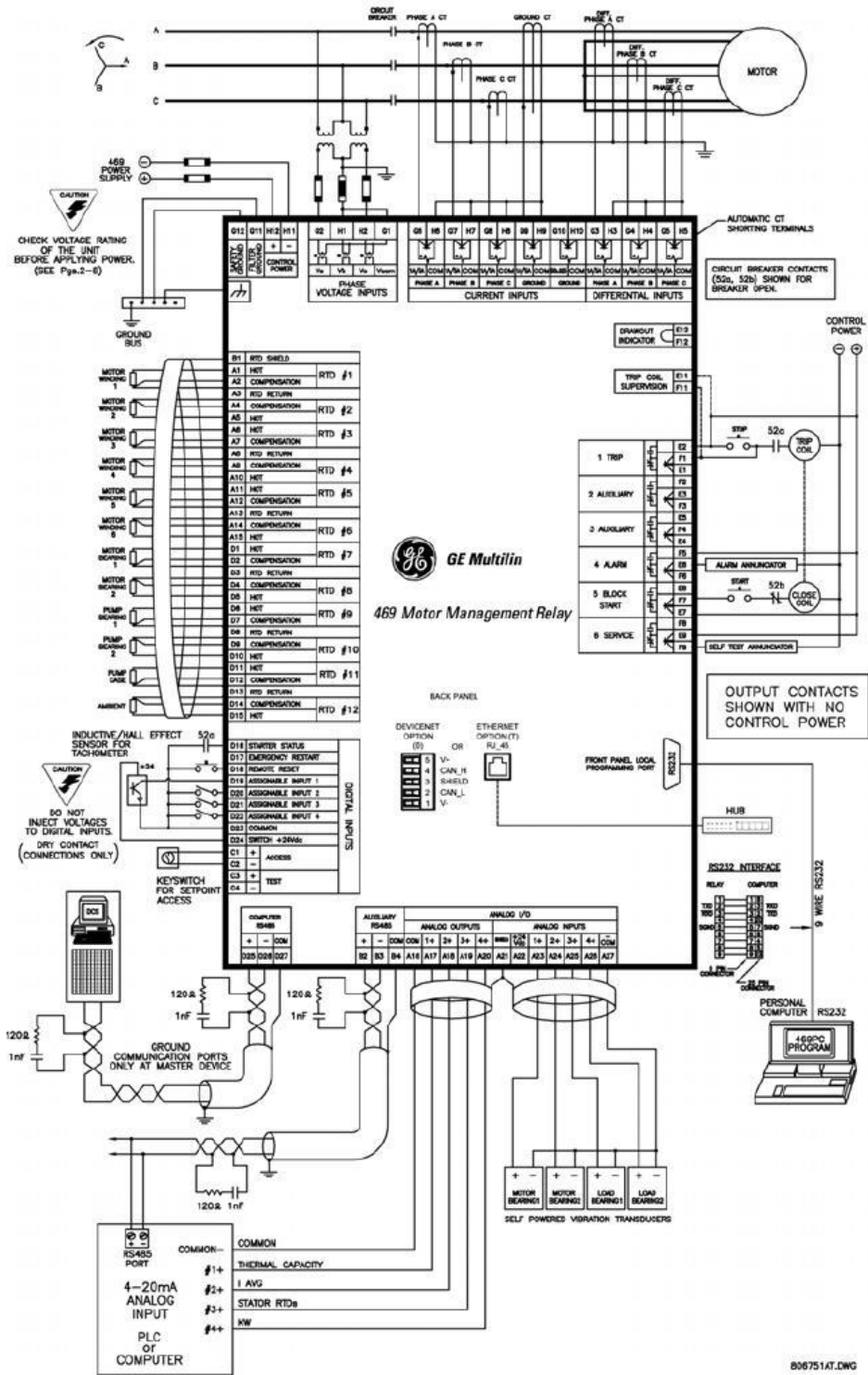


Figure 39

A.2 Technical Data

THREE-PHASE REAL POWER

Range:0 to ± 99999 kW

Pickup:1 to 25000 kW in steps of 1

Time delay:1 to 30 s in steps of 1

Block from start:0 to 15000 s in steps of 1

Pickup Accuracy:at $I_{avg} < 2 \times CT: \pm 1\%$ of $\sqrt{3} \times 2 \times CT \times VT \times VT_{full\ scale}$
at $I_{avg} > 2 \times CT: \pm 1.5\%$ of $\sqrt{3} \times 20 \times CT \times VT \times VT_{full\ scale}$

Timing accuracy: ± 0.5 s or $\pm 0.5\%$ of total time

APPENDIX B

Equivalence of software parameters and the relay under test.

Table 1

Power Directional Software		GE SR 469 Relay	
Parameter	Figure	Parameter	Figure
Pkp 3Φ	29	Reverse Power Trip Level	16