INSTRUMENTOS PARA TESTES ELÉTRICOS

Test Tutorial

Equipment Type: Protection Relay

Brand: General Electric - GE

Model: SR750

Function: 25 or RSYN – Synchronism Check

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

Objective: Test when two systems can connect, respecting voltage, frequency and angle limits, that is, if they are in synchronism.

Version control:

Version	Descriptions	Date	Author	Reviewer
1.0	Initial Version	31/01/2022	M.R.C.	M.P.S

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 must 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 must 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-1 shows the relay terminal designations.

1.1 *Auxiliary Source*

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

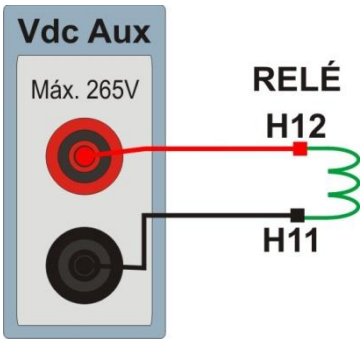

Figura 1

1.2 *Voltage Coils*

Connect current channels V1, V2 and V3 of CE-6006 to pins G5, H5 and G6 of the relay respectively, connect the three commons of CE-6006 to pin H6 of the relay. Connect channel V4 to pin G4 and its common to pin H4.

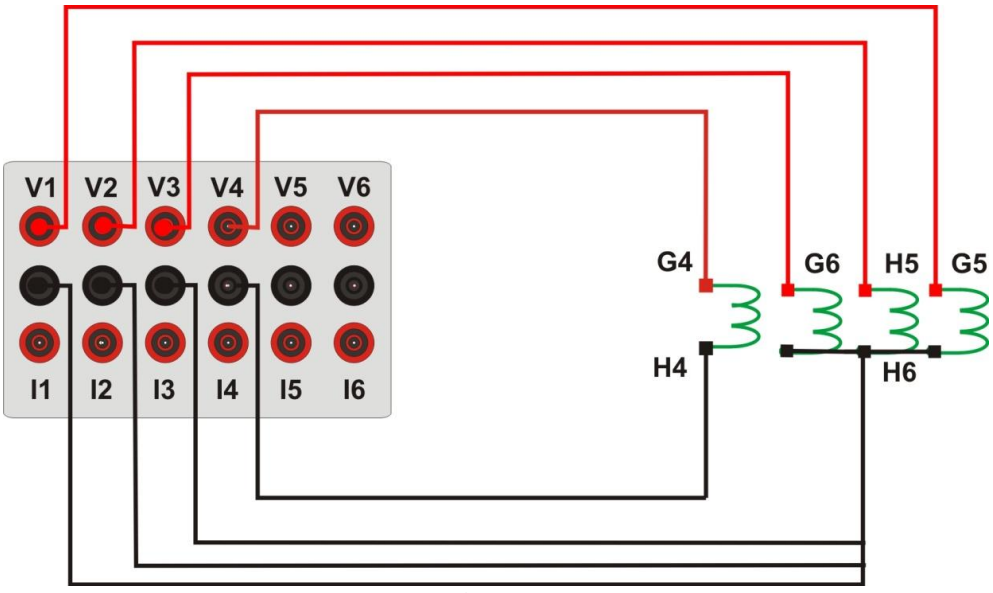

Figure 2

1.3 *Binary Inputs*

Connect the CE-6006's binary input to the relay's binary output.

- BI3 to pin E4 and its common to pin F4.

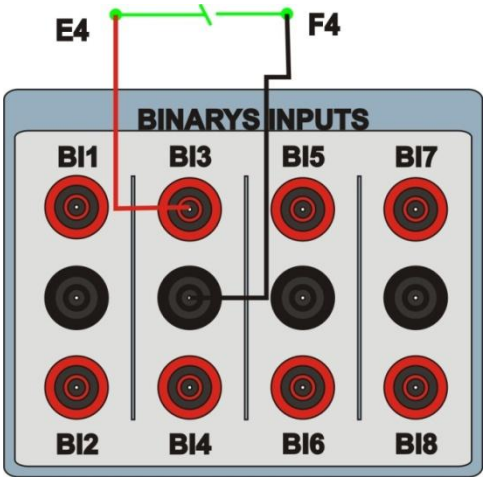

Figure 3

1.4 *Access*

To get access to the relay parameters without the need to use a password, short circuit pins C10 and C11.

Figure 4

2. Communication with SR750 relay

Before starting the SR 750 relay test, open the *"EnerVista"* software and download the *"SR 750"* relay software, if you already have it, click directly on:

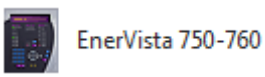

Figure 5

In the *"EnerVista SR 750"* software select: *"Communications –> Quick Connect"*.

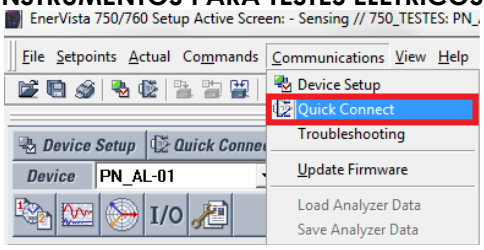

Figure 6

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

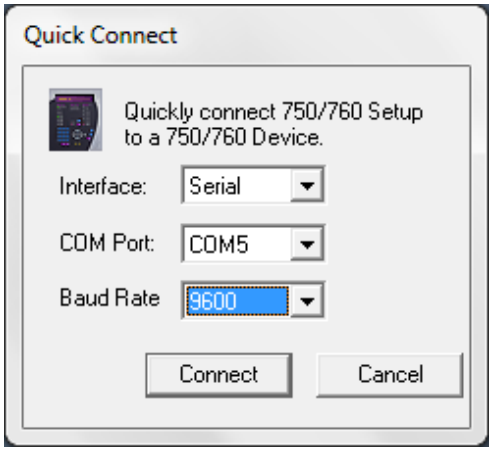

Figure 7

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

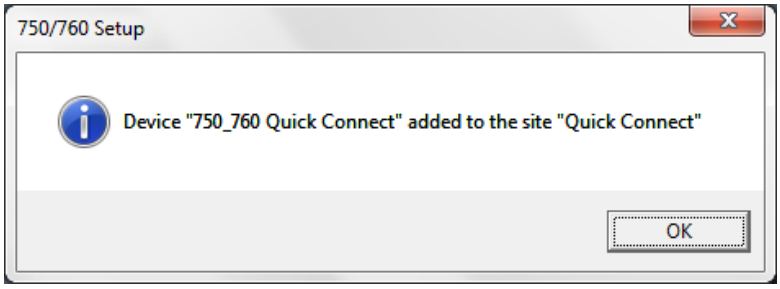

Figure 8

3. Parameterization of the relay SR750

3.1 *750 Quick Connect*

General relay settings will be available after clicking the *"+"* sign beside to *"Quick Connect"* and *"750_760 Quick Connect"* as shown below.

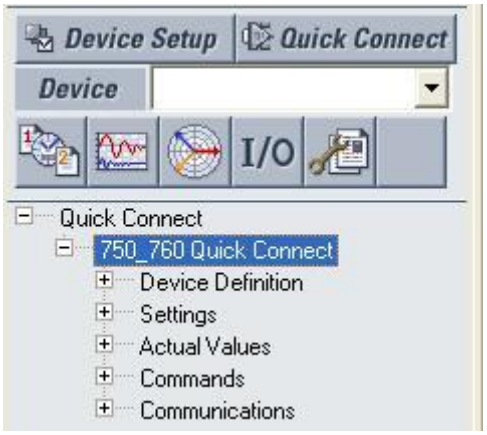

Figure 9

3.2 *System Setup*

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

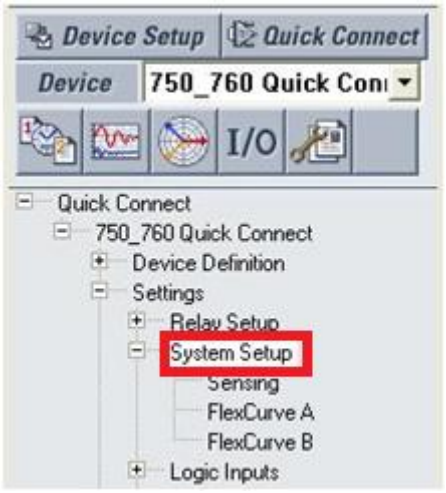

Figure 10

3.3 *Sensing*

With a double click on *"Sensing"* the window below will be opened, where the values of the nominal frequency, phase sequence and the value of the secondary voltage must be adjusted, both for the bus and for the line.

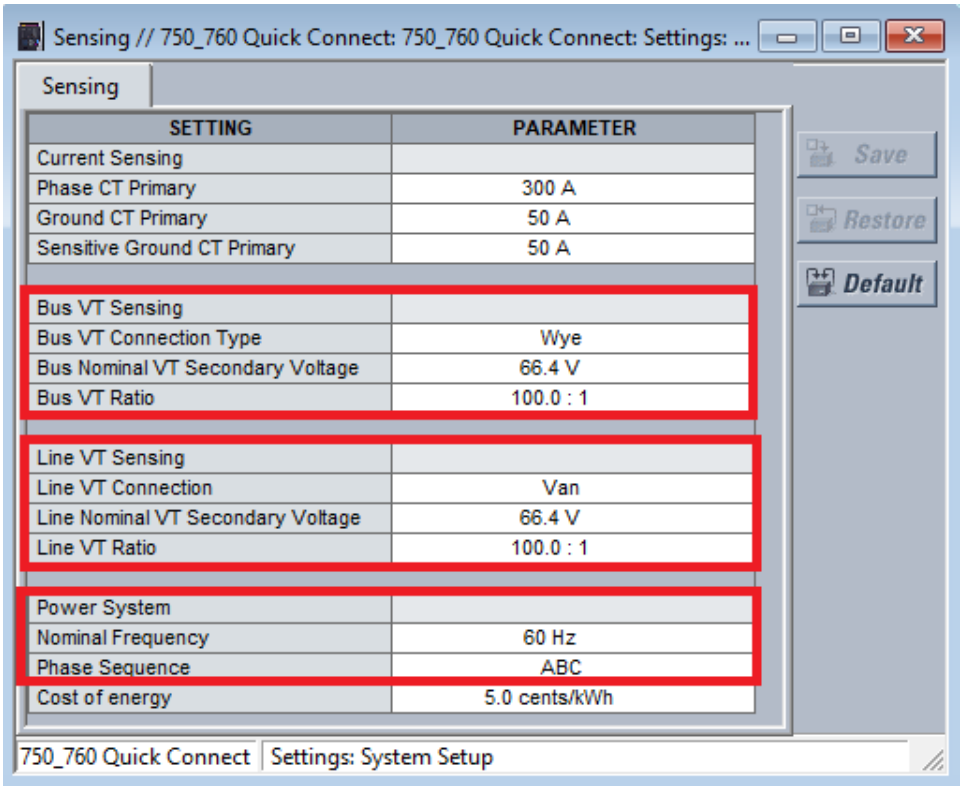

Figure 11

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).**

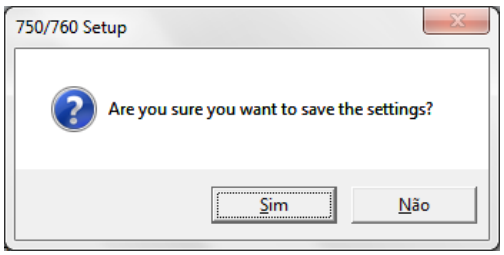

Figure 12

3.4 *Synchrocheck*

Now adjust the values of the synchronism function. To do this, click on the *"+"* signs next to *"Control"* and then *"Synchrocheck"*.

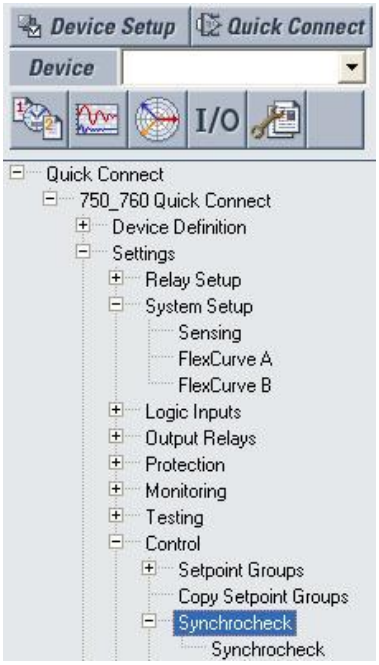

Figure 13

3.5 *Synchrocheck - Adjustment*

Double-click on *"Synchrocheck"*. In this option, the ranges of voltage difference, angle difference and frequency difference between the two systems are adjusted so that synchronism occurs.

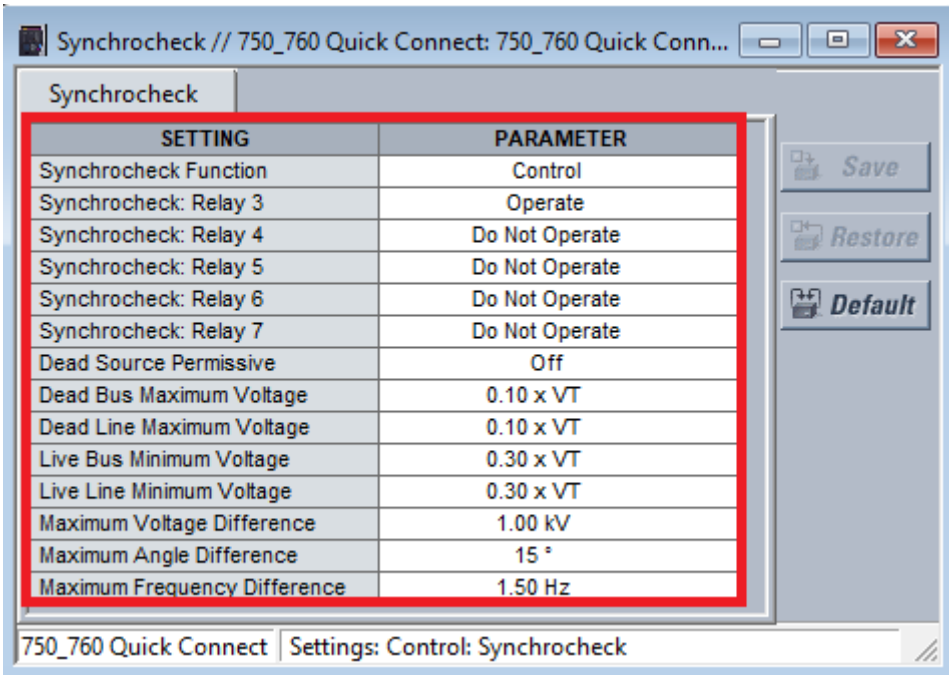

Figure 14

3.6 *Output Relays – 3 auxiliary*

Click on the *"+"* signs next to *"Output Relays"* and then *"3 Auxiliary"*. All non-synchronism conditions, including bus and de-energized line, cause the relay to enter the *"Out of Sync"* state, in this way, auxiliary relay 3 will always be activated (staying open in a synchronism situation).On this screen, the state of the contact will be changed from *"De-energized"* to *"Energized"*. In this way, when the relay enters the *"Out of Sync"* state, the contact will not act and when a synchronism situation is met, the relay will close the contact.

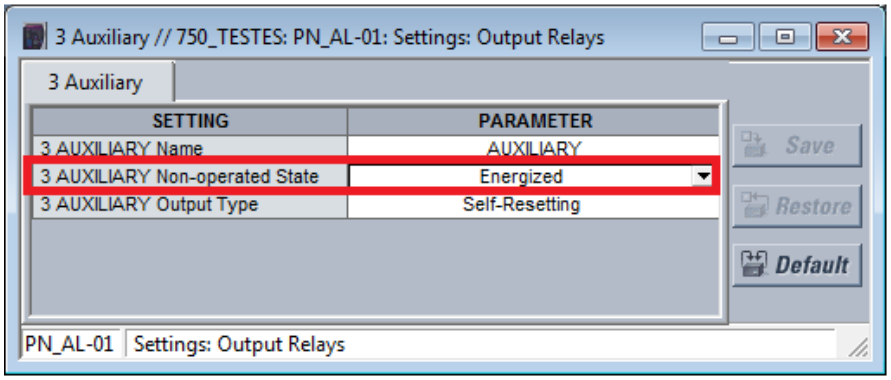

Figure 15

4. Synchronism software adjustment

4.1 *Opening the software*

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

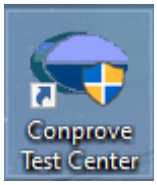

Figure 16

Click on the Synchronism software icon.

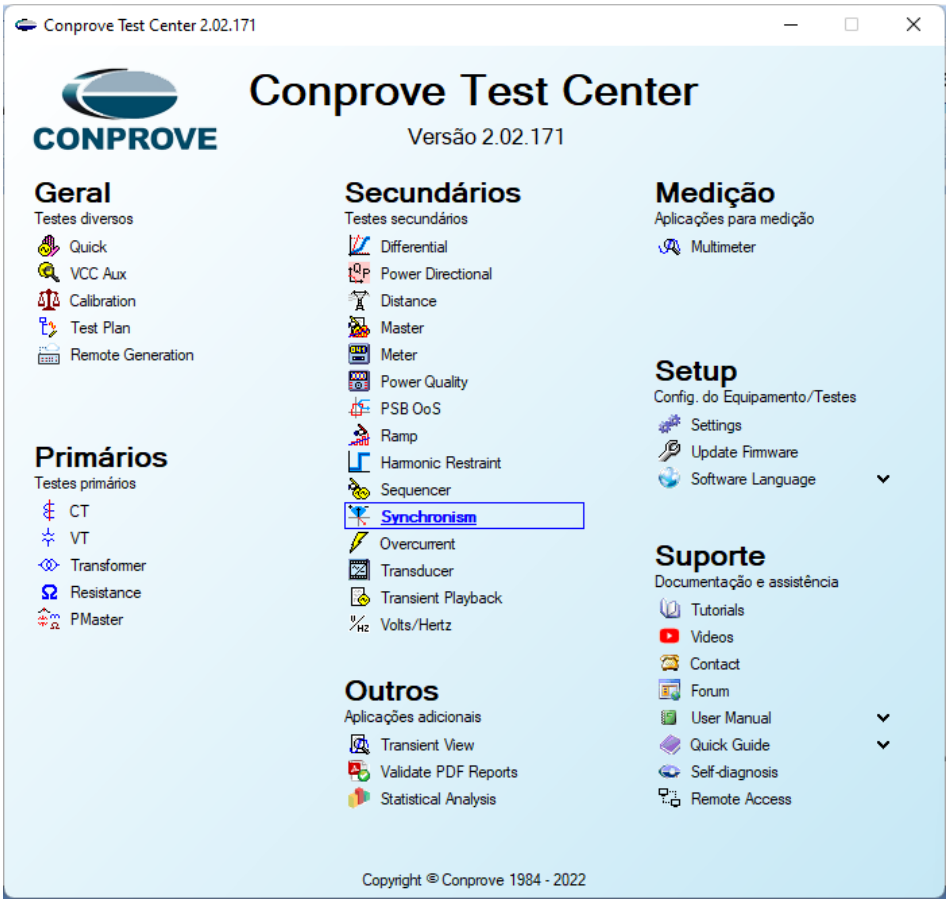

Figura 17

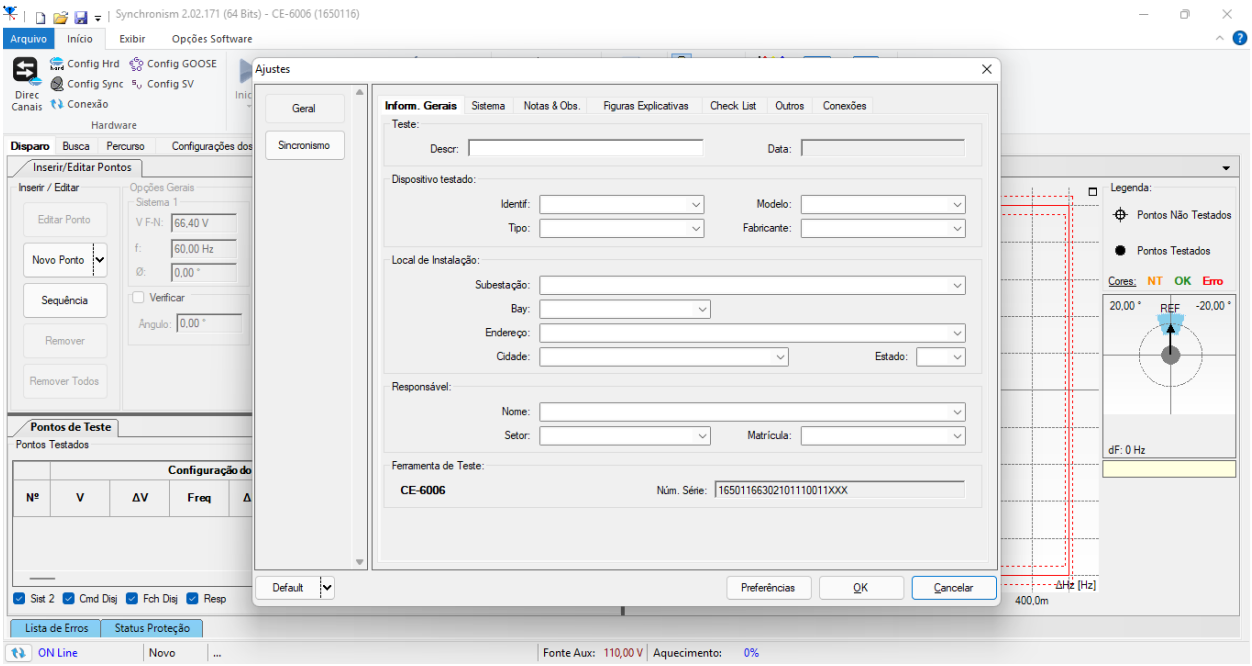

Figure 18

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.

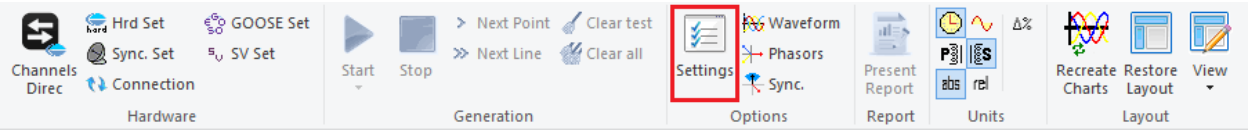

Figure 19

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.

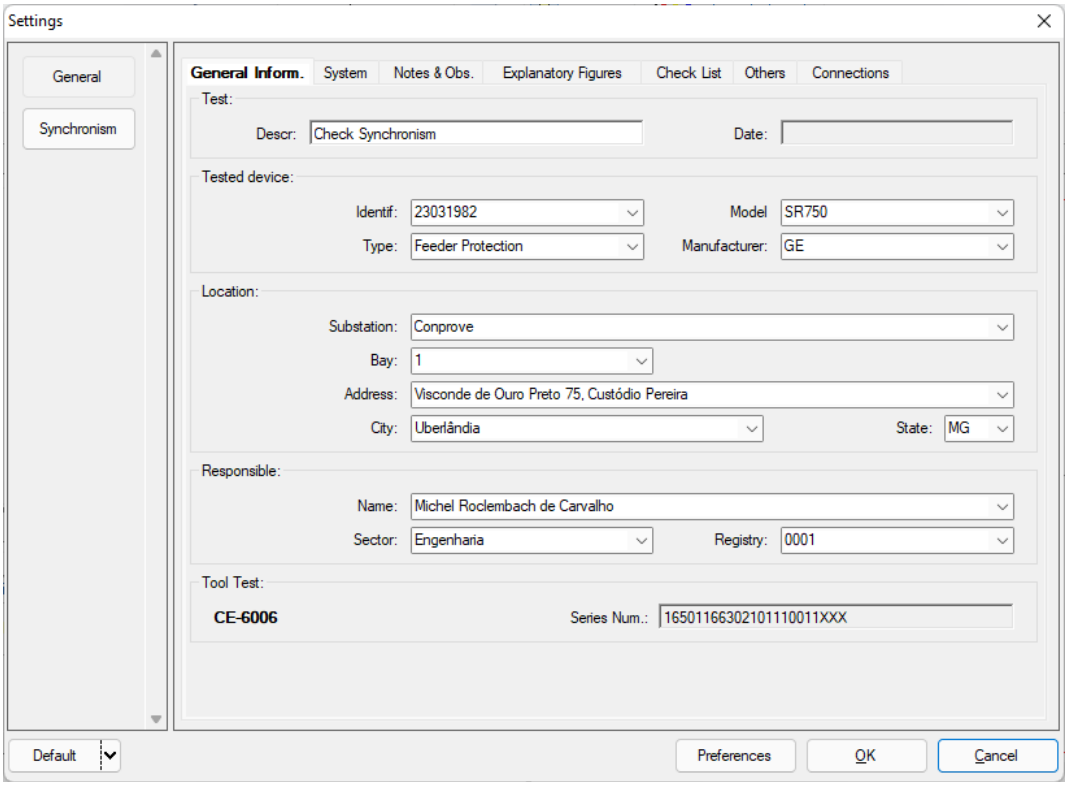

Figure 20

4.3 *System*

In the following screen, within the *"Nominal"* sub tab, the frequency values, 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.

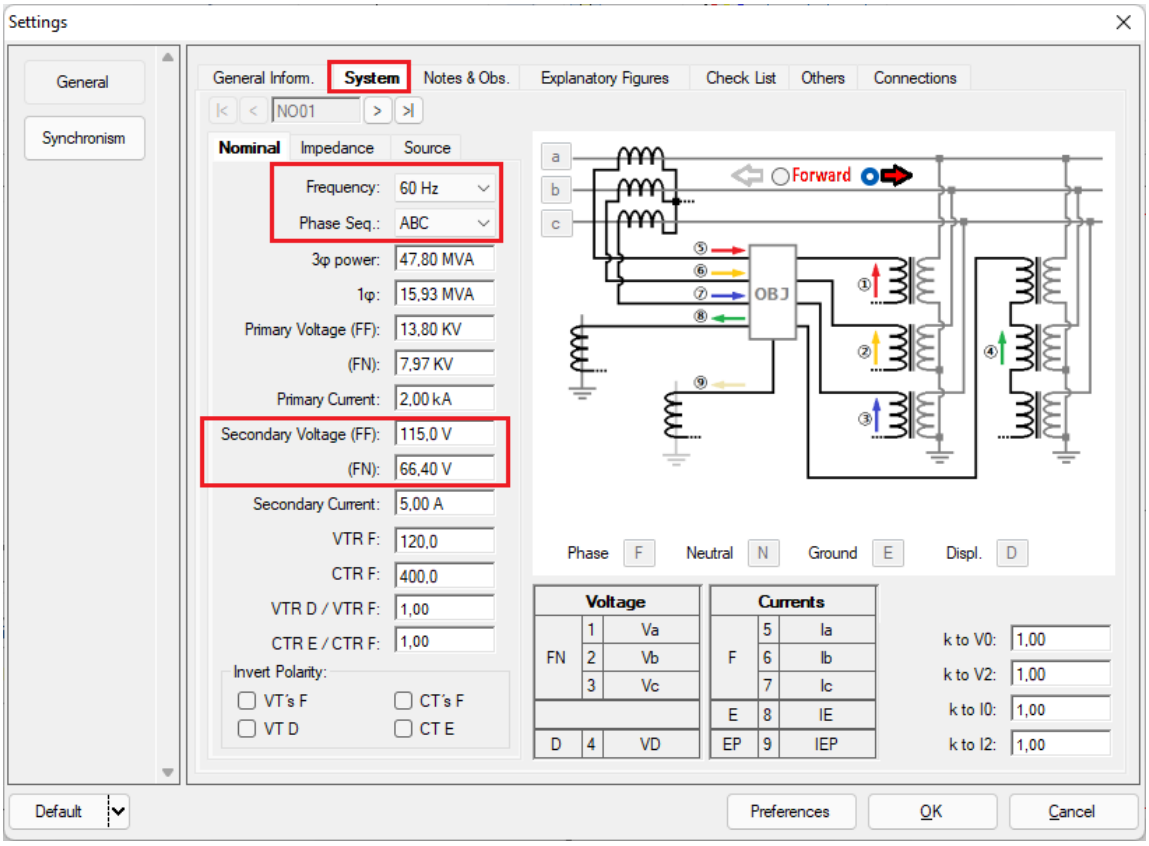

Figure 21

There are other tabs where the user can enter *"Notes & Obs.", Explanatory Figures"*, can create a *"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 tested equipment.

5. Channel Targeting and Hardware Configurations

Click on the icon illustrated below.

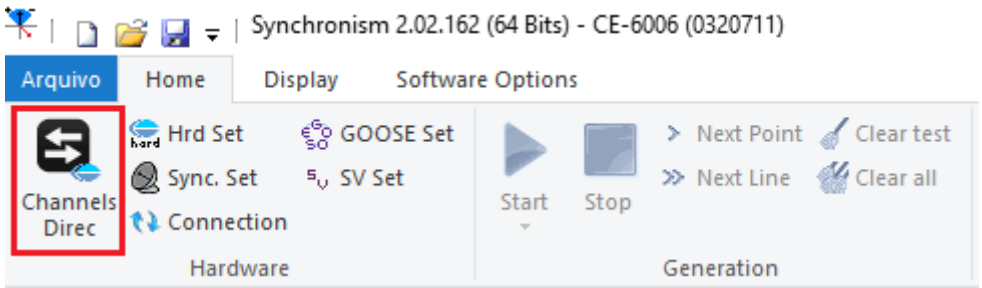

Figure 22

Then click on the highlighted icon to configure the hardware.

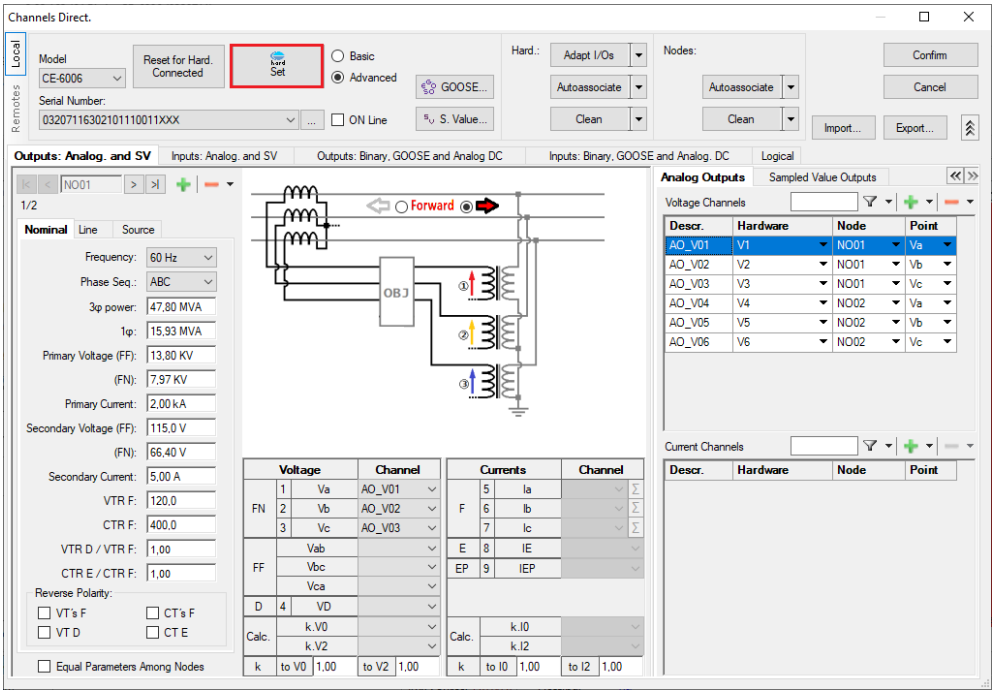

Figure 23

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

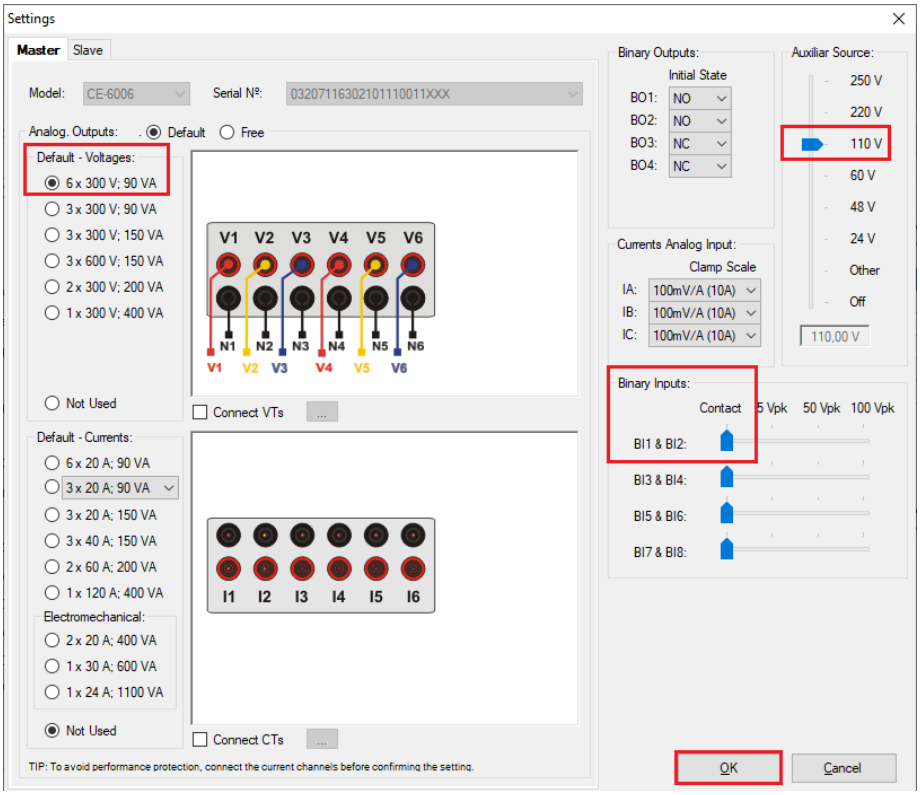

Figure 24

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

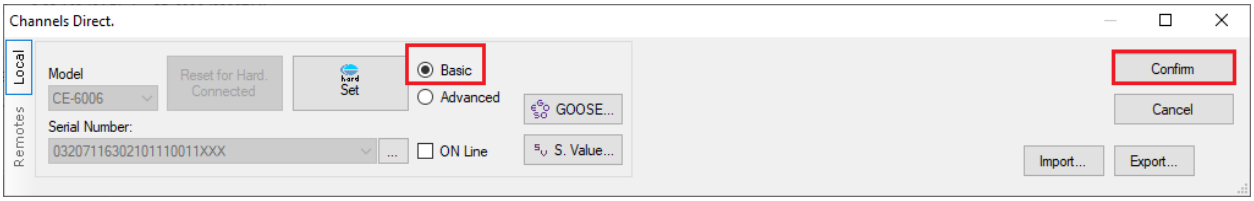

Figure 25

6. Synchronism Adjustments

6.1 *Synchronism > Systems Screen*

In this tab, enter the data of system 1, specifying its composition: Single-phase, Three-phase FN or Three-phase FF. The reference voltage must be adjusted and, depending on the case, it is necessary to compensate for the phase shift introduced by the transformer.

For system 2, it must be configured similarly to system 1 regarding its composition and reference voltage. In this same screen, the values of primary and secondary voltage are adjusted, in addition to the primary and secondary currents. For the circuit breaker, enter the time value for its effective closing to occur. There is also the field *"Equal levels to System 1"* which, when selected, equals the voltages of system 2 to that of system 1.

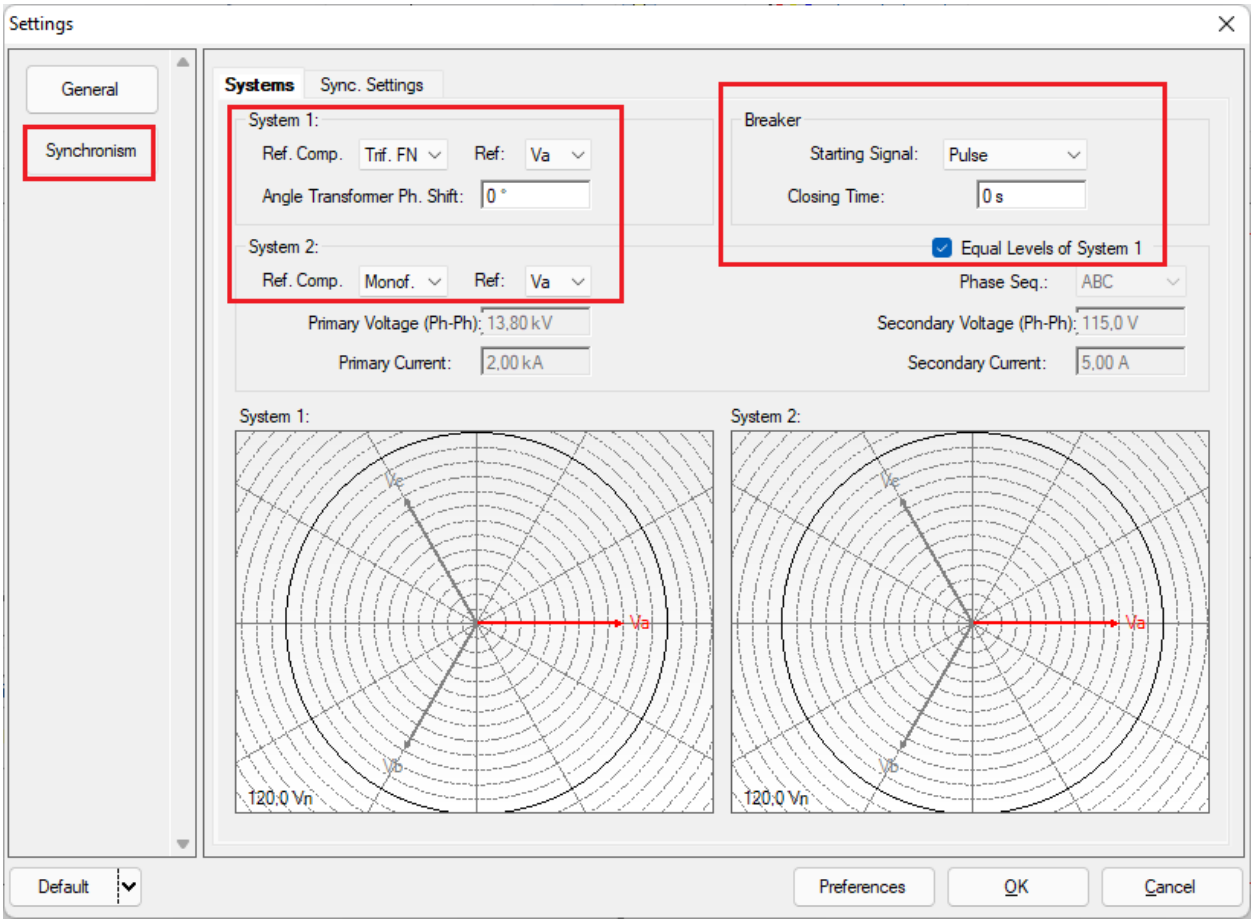

Figure 26

6.2 *Synchronism > Sync. Settings*

This screen stipulates the differences in voltage, frequency and the maximum tolerable angle for synchronism to occur. The maximum and minimum values allowed for voltage and frequency are also adjusted for synchronism to occur. These values are adjusted in percentage referring to the nominal values of system 1. The maximum time for synchronism to occur (adopted 10.0s) and the relative and absolute tolerances of voltage, frequency, time and the absolute tolerance for the angle. Tolerances are adjusted to the values in Appendix A.

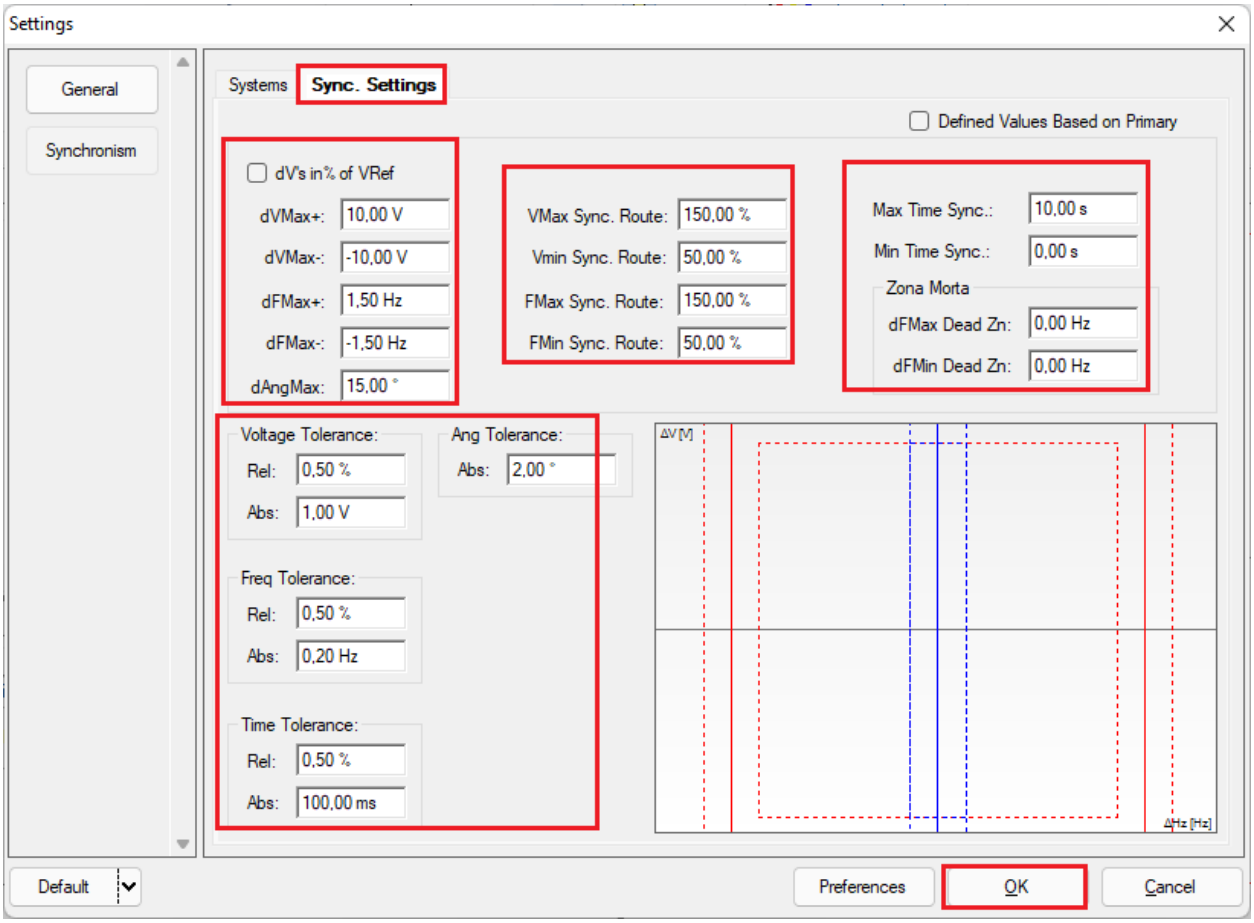

Figure 27

7. Test Settings

On the *"Test Settings"* tab, the voltage generation channels and the stopwatch interface must be correctly directed. The binary input responsible for the synchronization function is BI3. Check the *"Enable Pre-Simulation 1"* option in *"Independent"* mode. for 100ms.

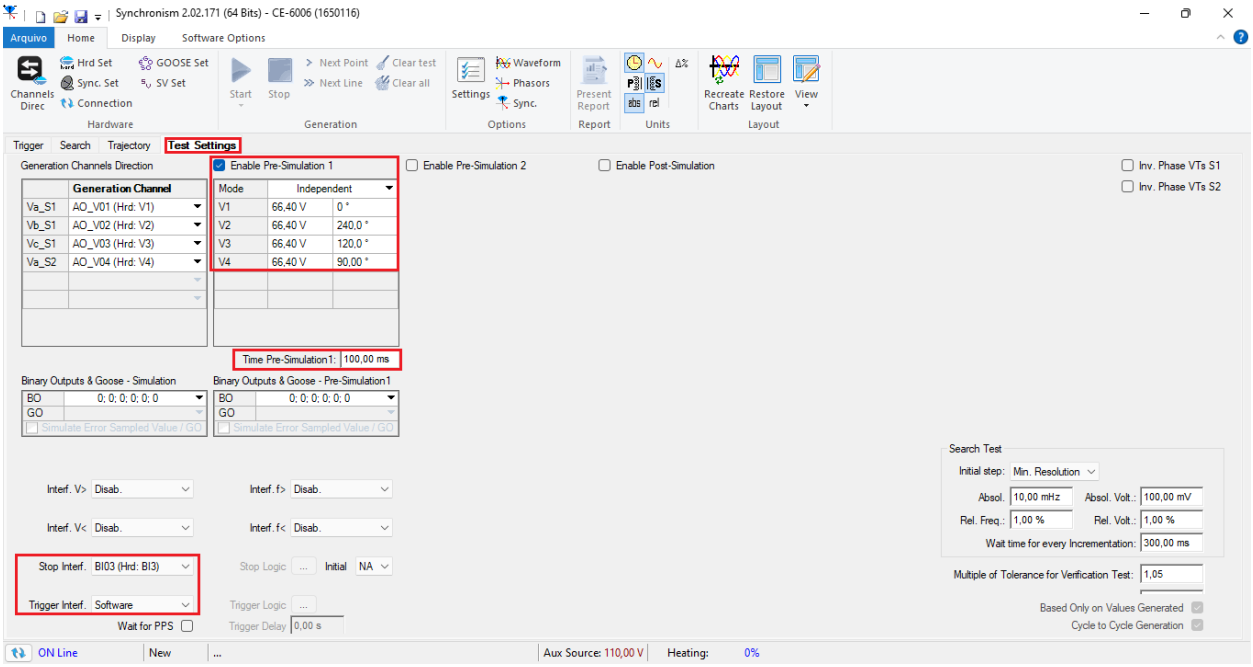

Figure 28

8. Trigger Test

In the trigger test, test points inside and outside the synchronism zone. Point's difference of two and frequency with respect to system 1. You can also specify an angle difference for the systems. To insert the points, click on *"New Point"* and choose a point directly on the graph and then on the item *"Confirm"*. Another option is to choose voltage difference values, frequency and planning values in their respective fields. The last option would be to click on the *"Sequence"* option and choose an angle step so that multiple points are automatically created on the sync edges. The voltage and frequency nominal values of system 1 must be set. The figure below illustrates this situation.

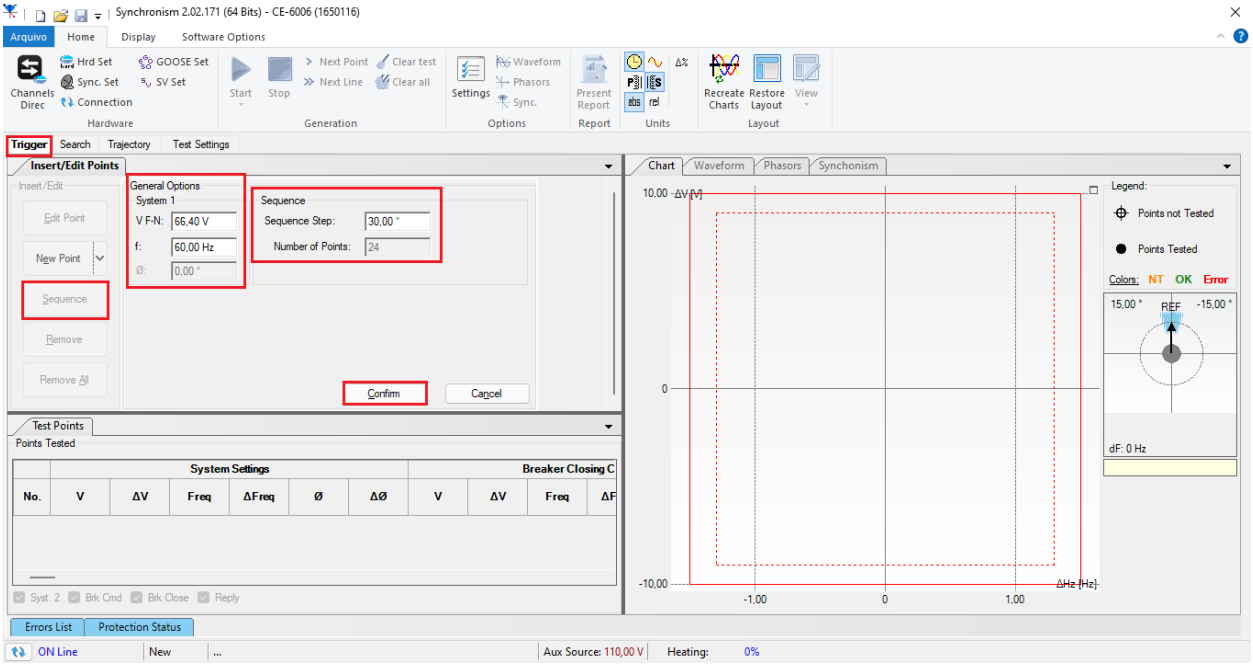

Figure 29

Choosing the sequence with a step of 30.00°, phase-to-neutral voltage of 66.40 volts, frequency of 60.00Hz and clicking on the *"Confirm"* button the following points are created:

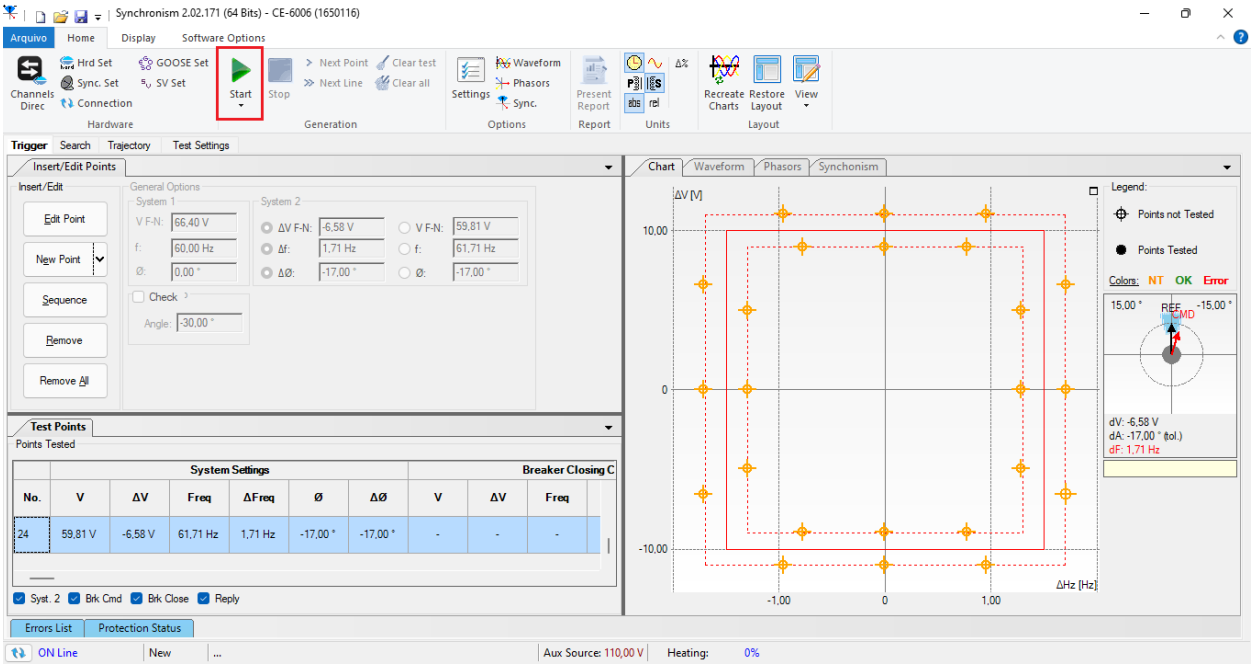

Figure 30

The next step is to start the generation through the *"Start"* button or the shortcut *"Alt + G"*. The figure below shows the final test result.

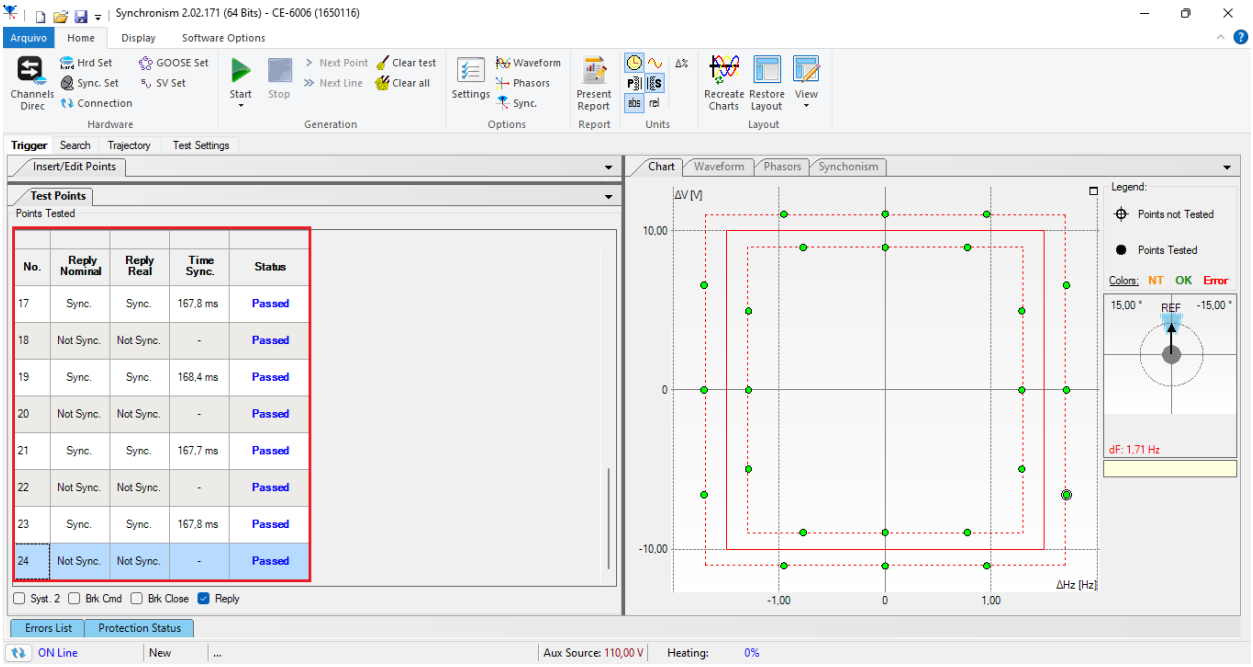

Figure 31

9. Trajectory Test

This test has the same objective as the *"Trigger Test"*, finding the moment of synchronism, however the difference is that the voltage and current values of system 2 vary by time. Differently from what happens in the *"Trigger Test"* where these values are fixed. To perform the test, use the *"Sequence"* option with the step equal to 30.0° reaching the following screen.

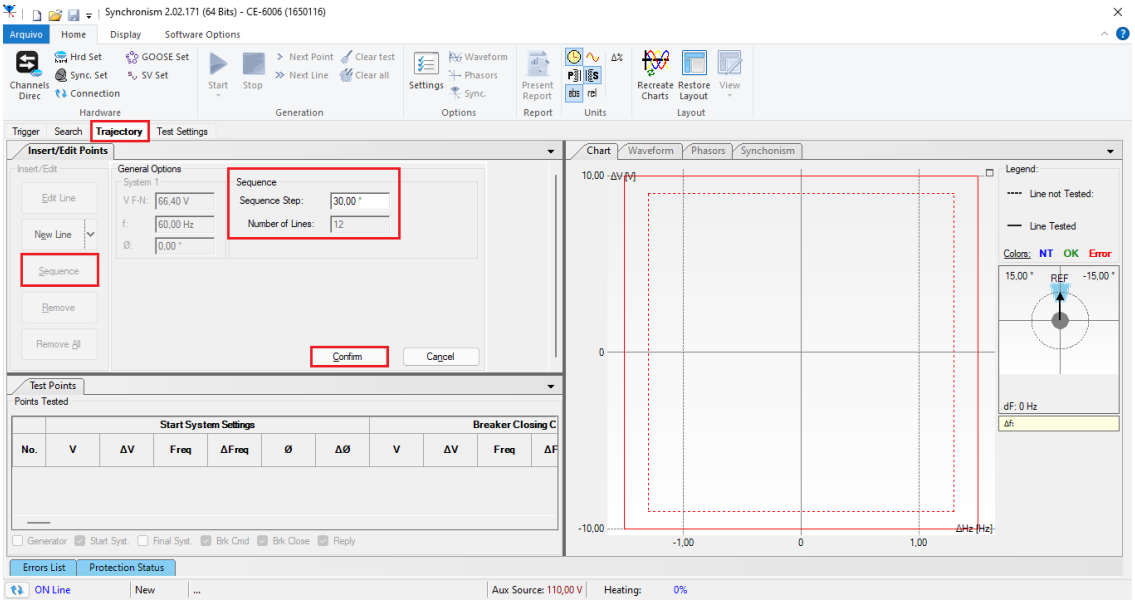

Figure 32

Clicking on the “Confirm” button automatically creates the lines shown below:

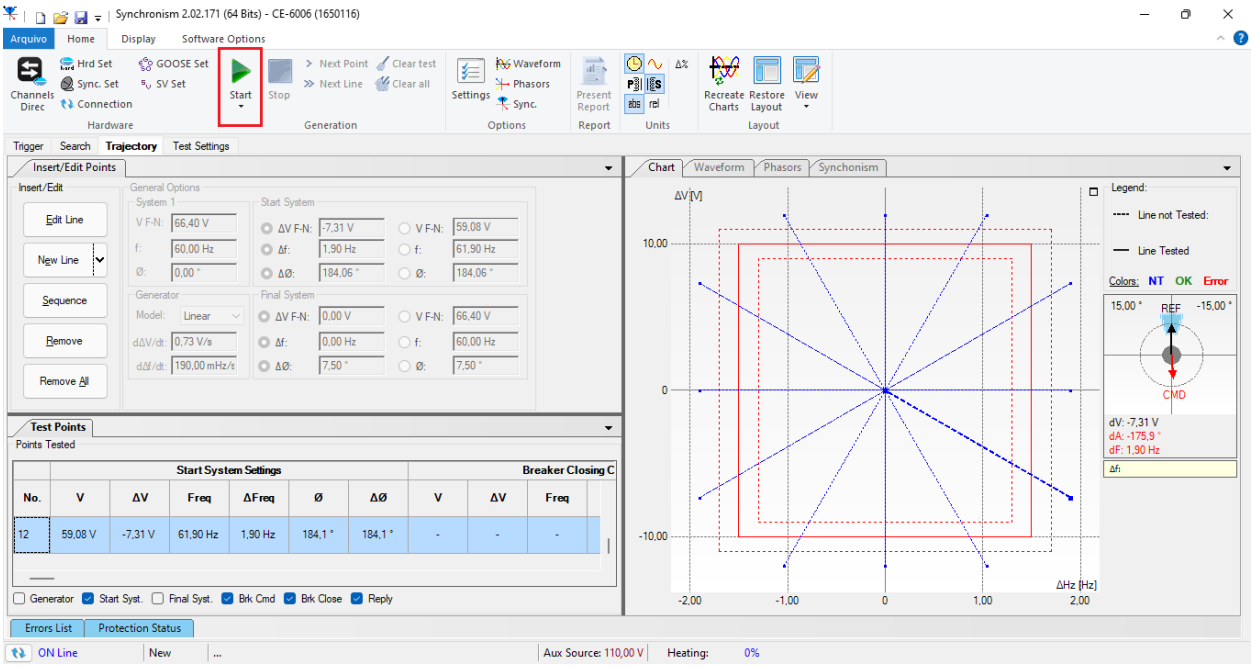

Figure 33

The next step is to start the generation through the *“Start”* button or the shortcut *“Alt + G”*. The figure below shows the final test result.

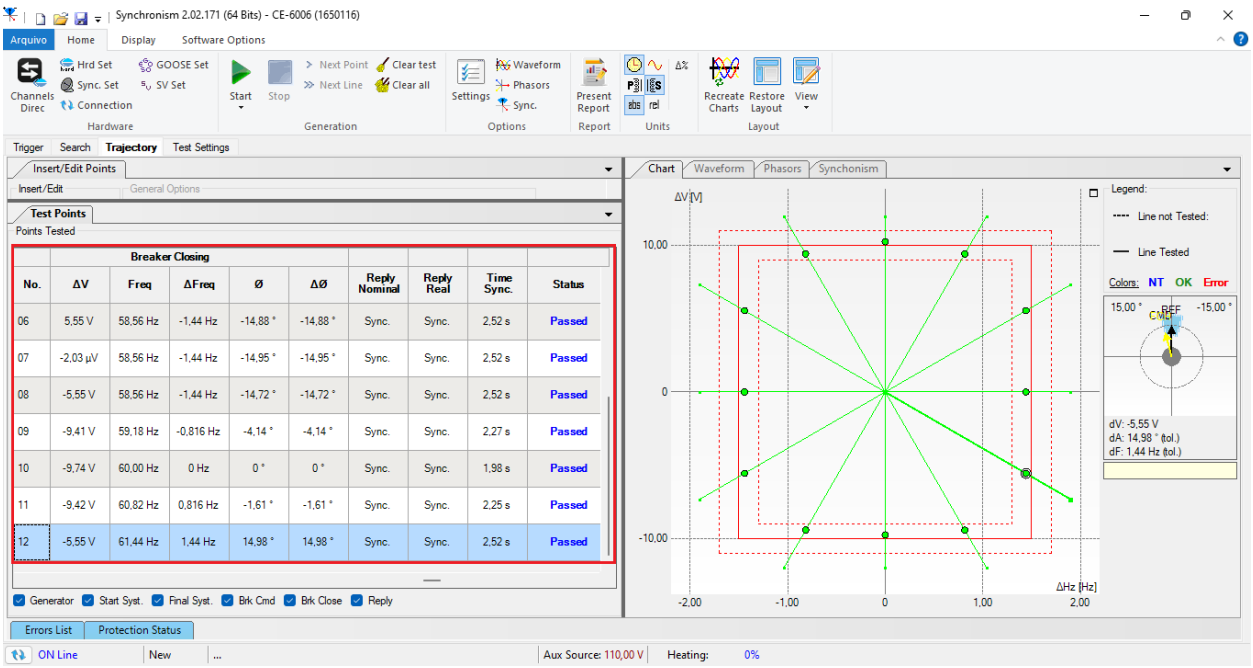

Figure 34

10. 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.

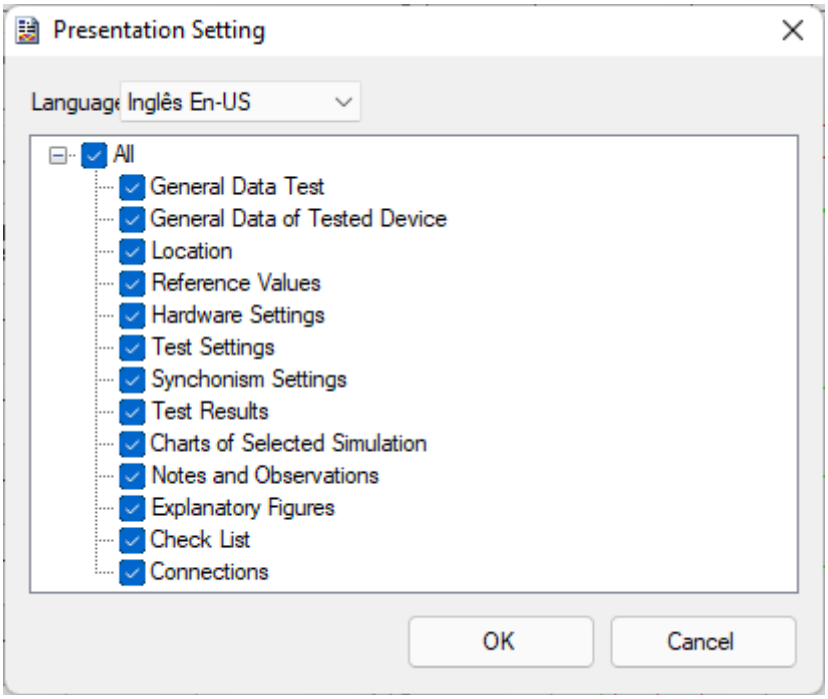

Figure 35

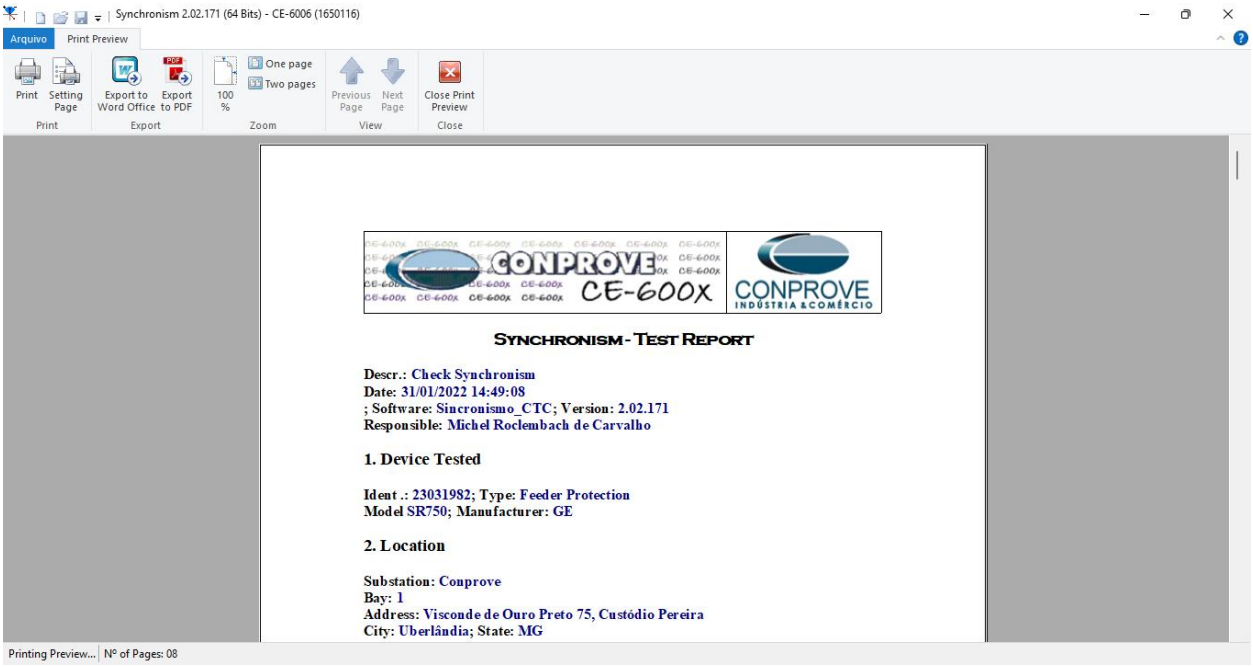

Figure 36

APPENDIX A

A.1 Terminal Designations

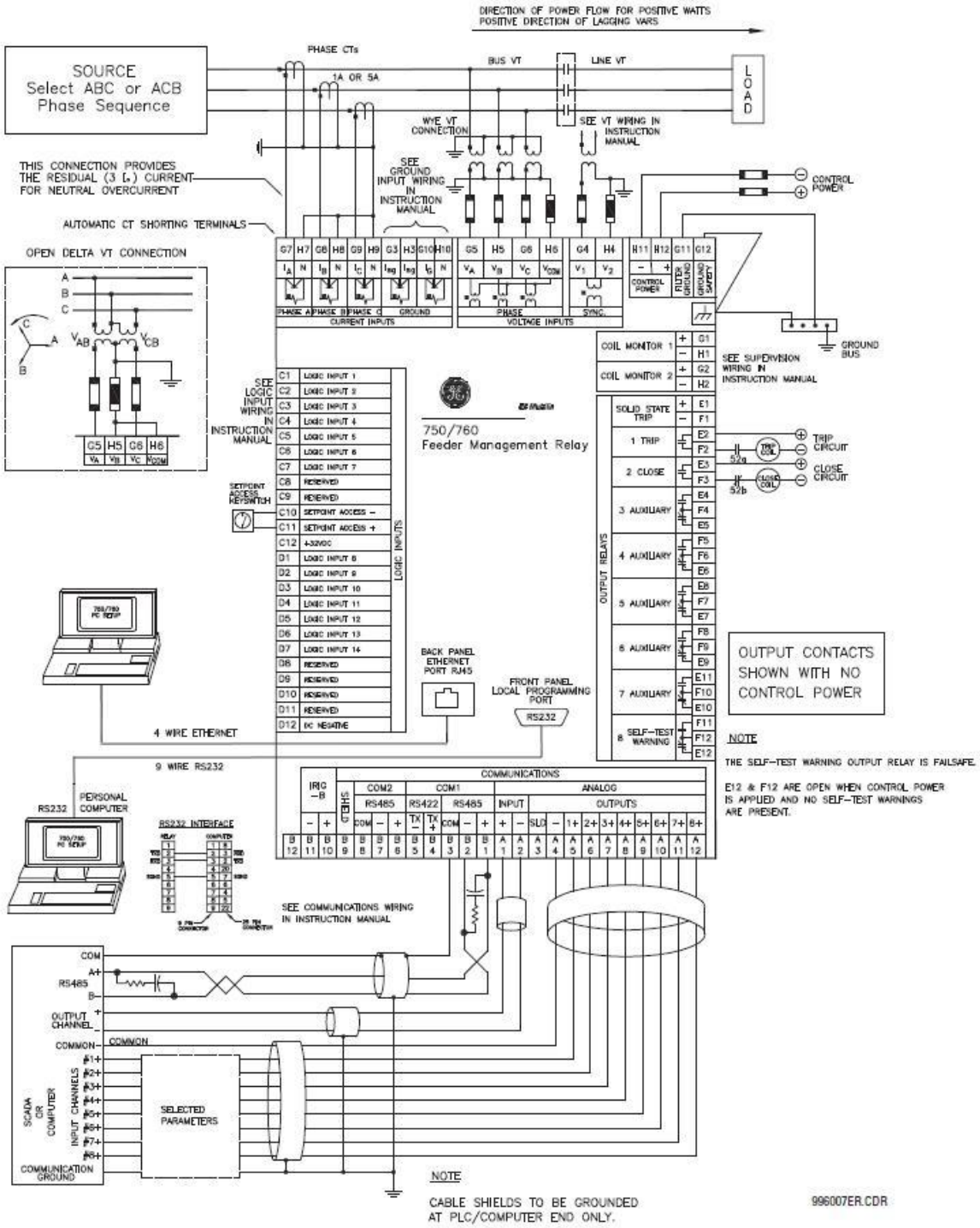

Figure 37

A.2 Technical Data

SYNCHROCHECK

Voltage difference: ..... 0.01 to 100.00 kV in steps of 0.01
Phase difference: ..... 0 to 100° in steps of 1
Frequency difference: ..... 0.00 to 5.00 Hz in steps of 0.01
Operate time: ..... up to 140 ms for 60 Hz
up to 160 ms for 50 Hz
Bypass permissives: ..... DB & DL (dead bus and dead line)
LL & DB (live line and dead bus)
DL & LB (dead line and live bus)
DL | DB (dead line or dead bus)
DL x DB (either dead line or dead bus)

APPENDIX B

Equivalence of software parameters and the relay under test.

Table 1

Synchronism Software		GE SR 750 Relay	
Parameter	**Figure**	**Parameter**	**Figure**
Secondary Voltage (F-F)	21	Bus Nominal VT Secondary Voltage	11
Ref	26	Line VT Connection	11
Secondary Voltage (Ph-Ph)	26	Line Nominal VT Secondary Voltage	11
dVMax+	27	Maximum Voltage Difference	14
dVMax-	27	Maximum Voltage Difference (negative signal)	14
dFMax+	27	Maximum Frequency Difference	14
dFMax-	27	Maximum Frequency Difference (negative signal)	14
dAngMax	27	Maximum Angle Difference	14