INSTRUMENTOS PARA TESTES ELÉTRICOS

Test Tutorial

Equipment Type: Protection Relay

Brand: GE

Model: SR745

Function: 50 or PIOC- Instantaneous Overcurrent and 51 or PTOC – Time Overcurrent

Tool Used: CE- 6003; CE-6006; CE6707; CE-6710; CE-7012 or CE-7024

Objective: Timed pickup test of the units of Phase (51), timed curve survey, instantaneous pickup test of phase units (50).

Version control:

Version	Descriptions	Date	Author	Reviewer
1.0	Initial Version	13/09/2021	M.R.C.	M.P.S

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 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

Summary

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 of the relay and the negative (black terminal) of the Vdc Aux. Source to pin H11 of the relay.

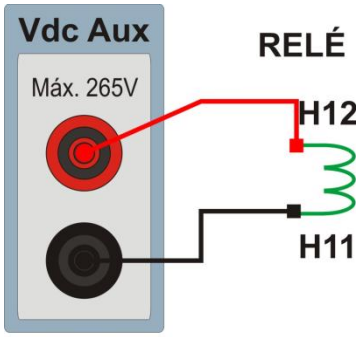

Figure 1

1.2 *Current Coils*

Connect I1, I2 and I3 current channels of the CE-6006 to pins H1, H2 and H3 of the relay respectively, if the commons of the relay are short circuited, just connect the commons of the trunk channels to that point, otherwise connect the three common CE-6006 to G1 pins, G2 and G3 of the relay.

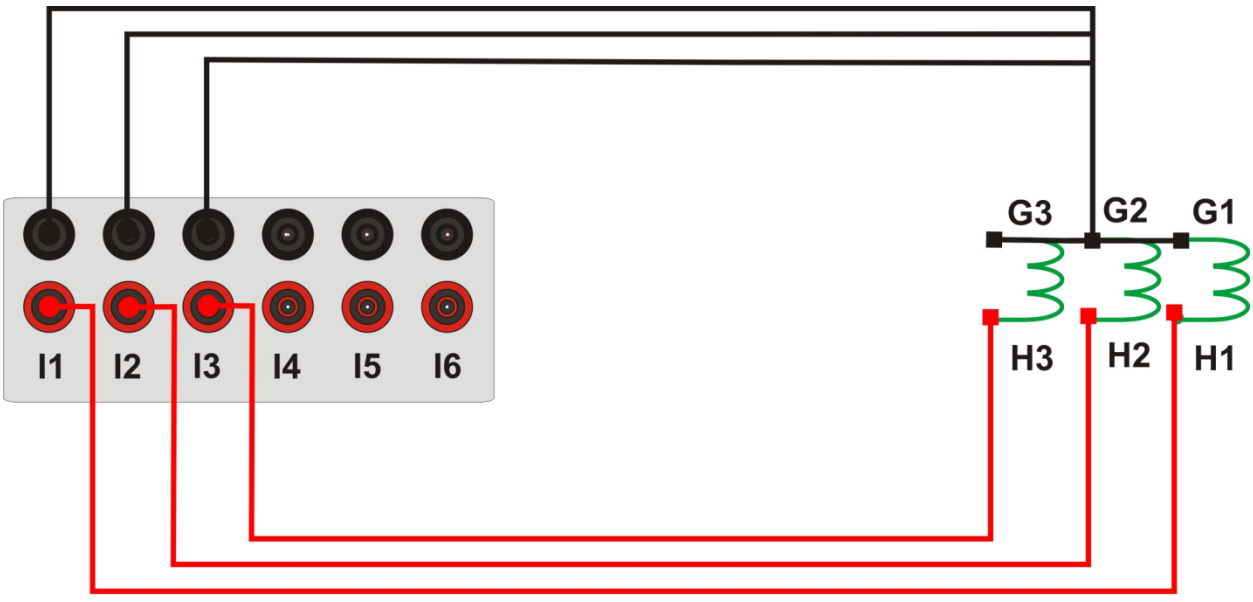

Figure 2

1.3 *Binary Inputs*

Connect the binary inputs of the equipment to the binary outputs of the relay:

- BI1 to pin E2 and its common to pin F2;
- BI2 to pin E3 and its common to pin F3;
- BI3 to pin E4 and its common to pin F4;
- BI4 to pin E5 and its common to pin F5;

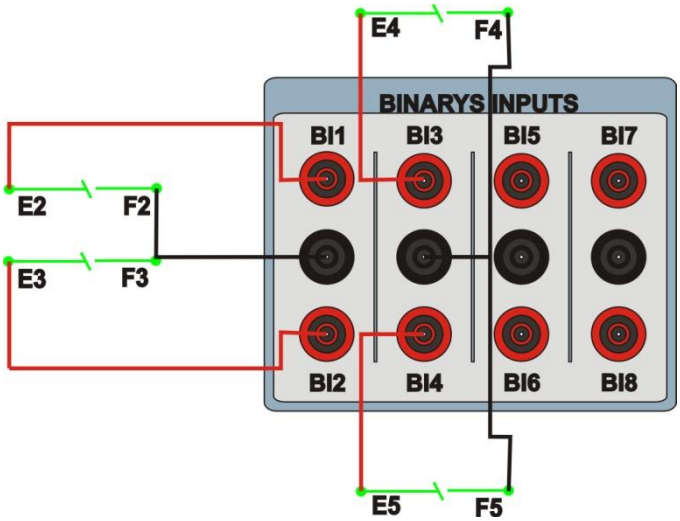

Figure 3

2. Communication with SR745 relay

Before starting the 745 relay test, open the EnerVista software and download the *"EnerVista 745"* software, if you already have it click directly on:

Figure 4

In the *"EnerVista 745"* software click on *"Quick Connect"*.

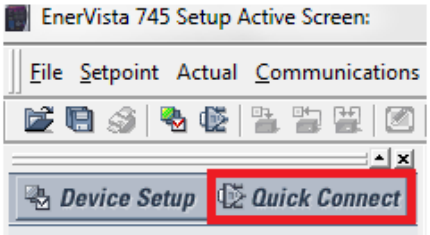

Figure 5

Then click on *"Connect"* and choose the port being used and the baud rate read on the relay. In this case COM5 and 19200.

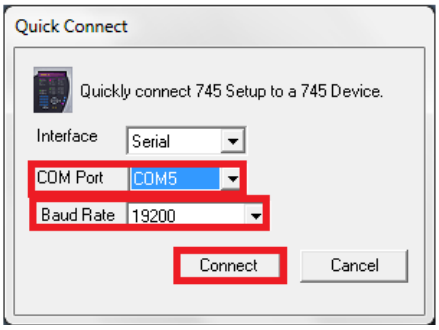

Figure 6

The following figure shows the message after connecting.

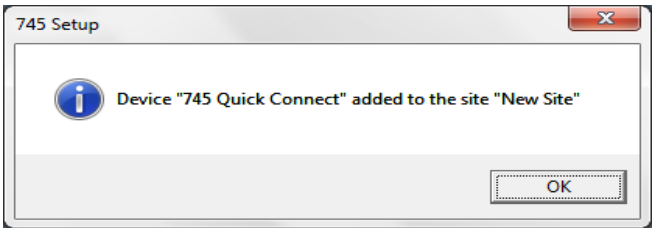

Figure 7

3. Parameterization of the relay SR745

3.1 *System Setup*

After the connection has been established, click on the *"+"* signs near to *"New Site" >"745 Quick Connect" > "Settings" > "System Setup"* and double-click on *"Transformer"*, in it adjust the values nominal system frequency, phase sequence, primary/secondary connection as well as its angular offset. If you change any data, click on *"Save"* to send it to the relay.

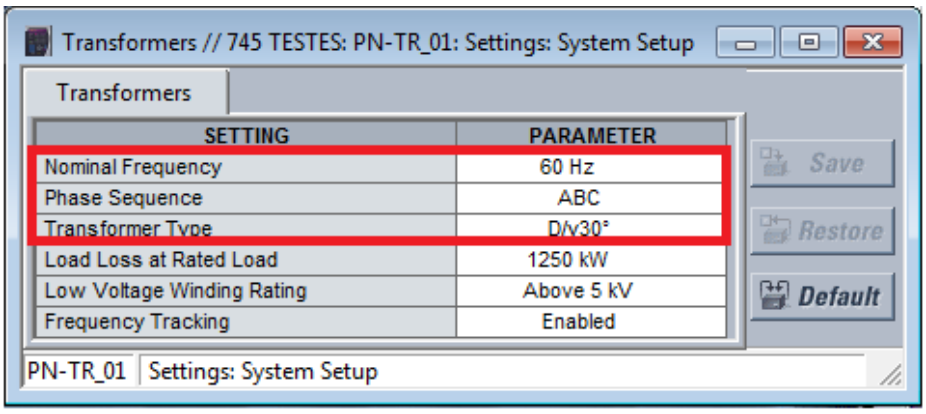

Figure 8

3.2 *Winding 1*

In this field, the nominal voltage of the primary side, the nominal power and the transformation ratio of the phase and ground CTs are adjusted.

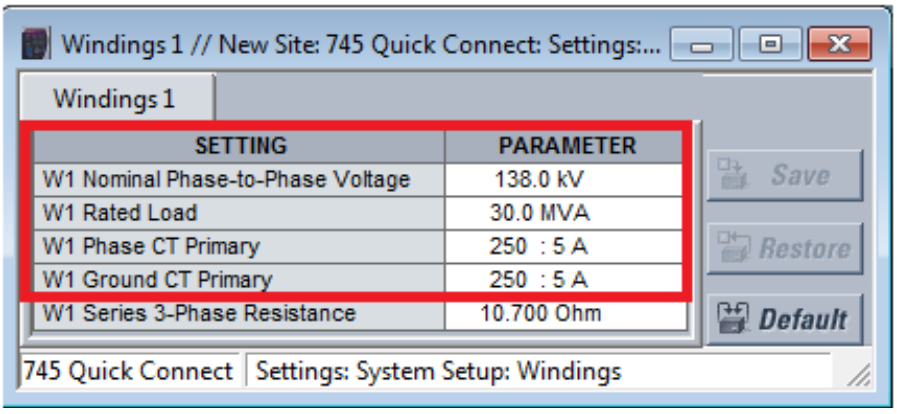

Figure 9

3.3 *Winding 2*

In this field, the nominal voltage of the secondary side, the nominal power and the transformation ratio of the phase and ground CTs are set.

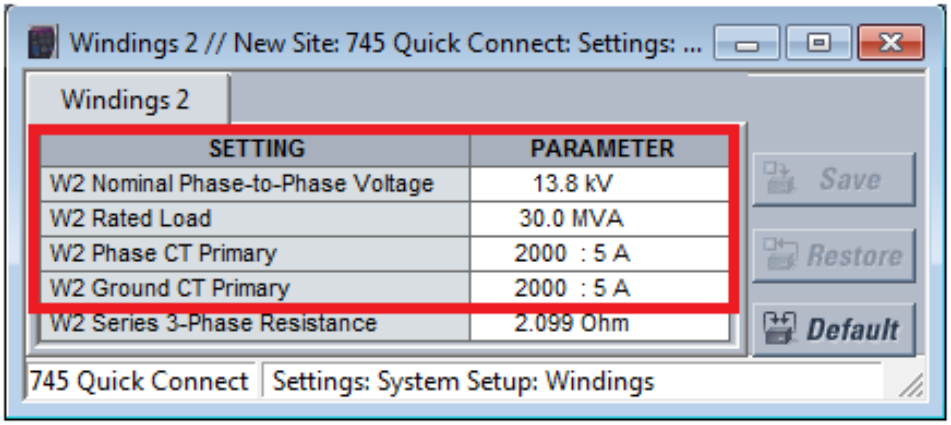

Figure 10

3.4 *W1 Phase Time OC*

Click on the *"+"* sign near to "*Elements" > "Phase Overcurrent"* and double-click on *"W1 Phase Time OC"*. This option sets the pick-up value, the curve type and the time dial. The 745 allows only one curve to be used, responsible for monitoring winding 1. Remembering that *"1 x CT"* is equal to 5A. The binary output will be set to *"Relay 2"*.

For the timed function, the following settings are configured:

Table 1

Pickup Current	0,2 x CT = (1,0A)
Curve Standard	IAC
Type of curve	Very Inverse
Time dial	7

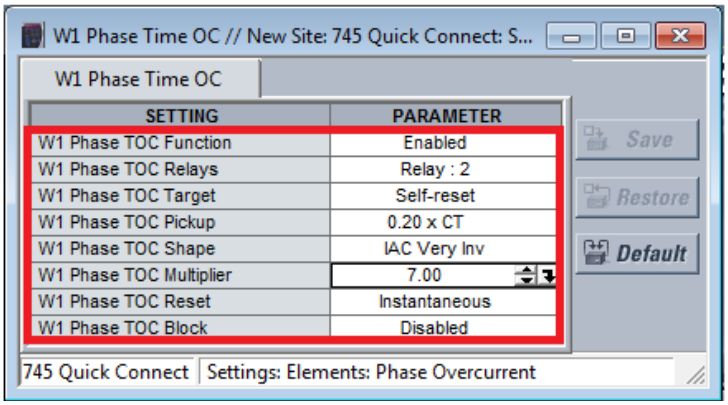

Figure 11

3.5 *W1 Phase inst. OC*

Click on the *"+"* sign near to *"Elements" > "Phase Overcurrent"* and double-click on *"W1 Phase Inst. OC"*. On this tab the pick-up values of the definite time elements are set. Since it is possible to use up to 2 elements, in this test only one element with the following parameters is used. Remembering that *"1 x CT"* is equal to 5A. The binary output will be set to *"Relay 3"*.

Table 2

	Instantaneous -1
Pick-up	3,0 x CT= (15A)
Time delay	300ms

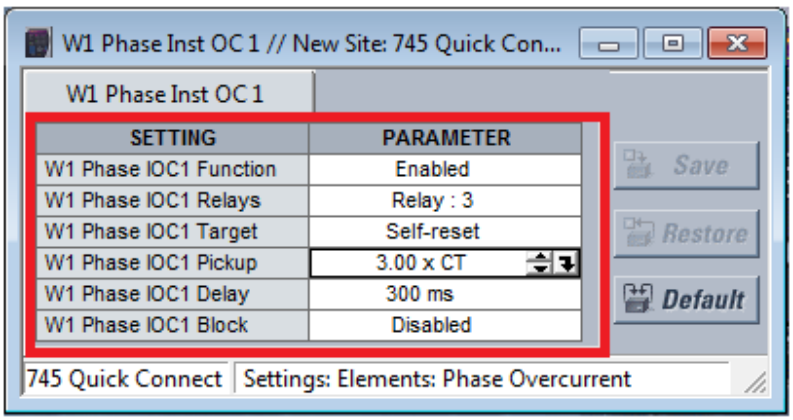

Figure 12

3.6 *Relay 4*

Click on the *"+"* sign near to *"Outputs > Outputs Relays"* and double-click on *"Relay 4".* On this tab we will direct the pickup signal of function 51 to output relay 4. In the line *"Output 4 Flexlogic equation 1"* chooses the option *"W1 Phase Time OC Pickup",* as shown below.

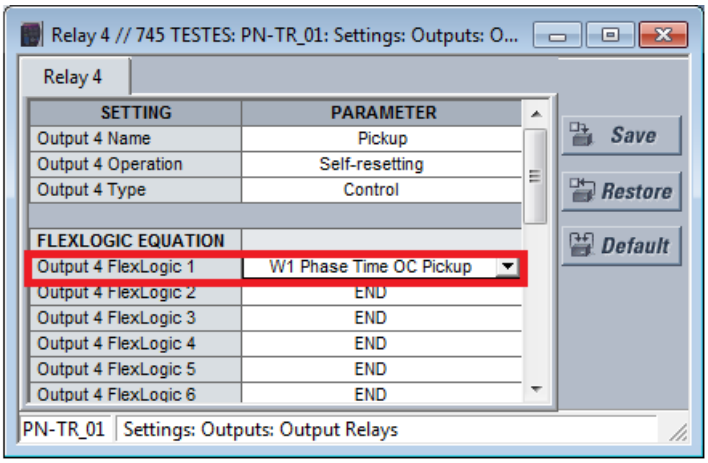

Figure 13

3.7 *Relay 5*

Click on the *"+"* sign near to *"Outputs > Outputs Relays"* and double-click on *"Relay 5".* On this tab we will direct the pickup signal of function 50 to output relay 5. In the line *"Output 5 Flexlogic equation 1"* chooses the option "*W1 Phase Inst OC Pickup",* as shown below.

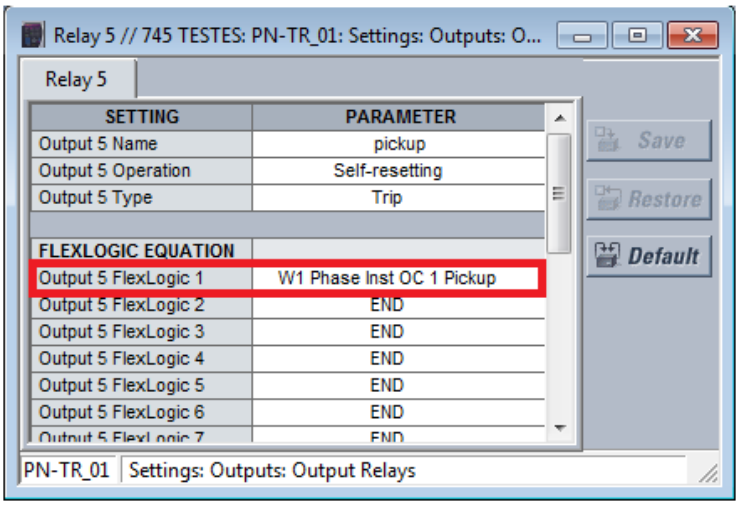

Figure 14

4. Overcurrent software adjustments

4.1 *Opening the Overcurrent*

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

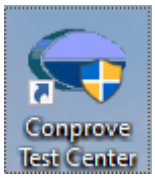

Figure 15

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

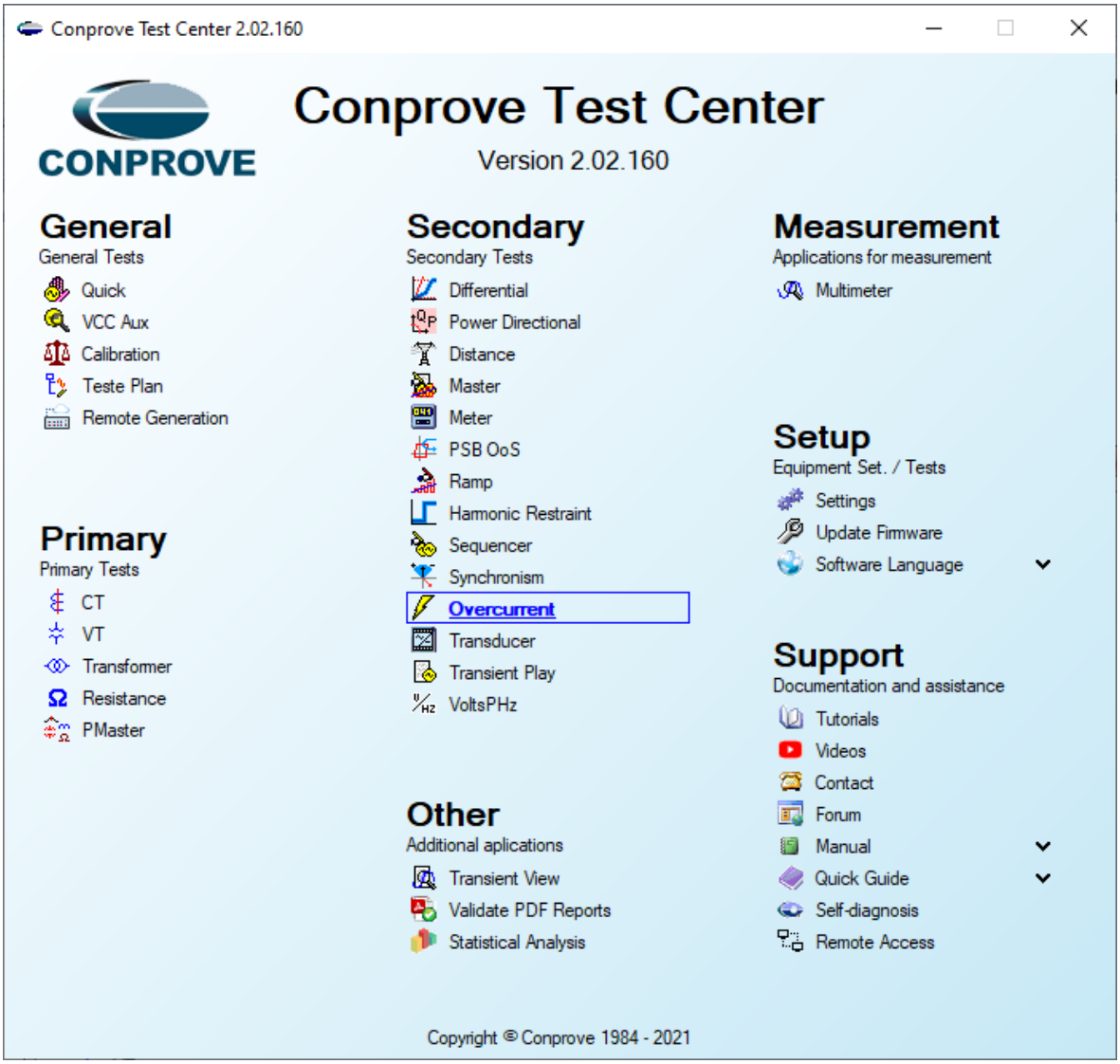

Figure 16

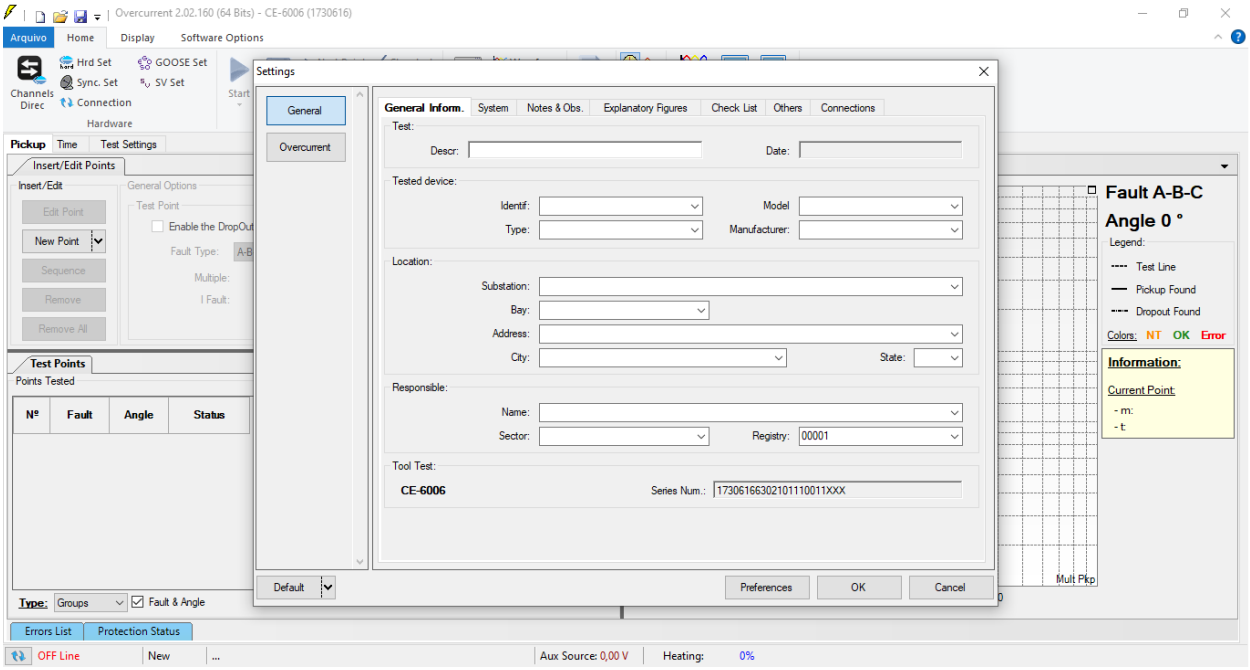

Figure 17

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.

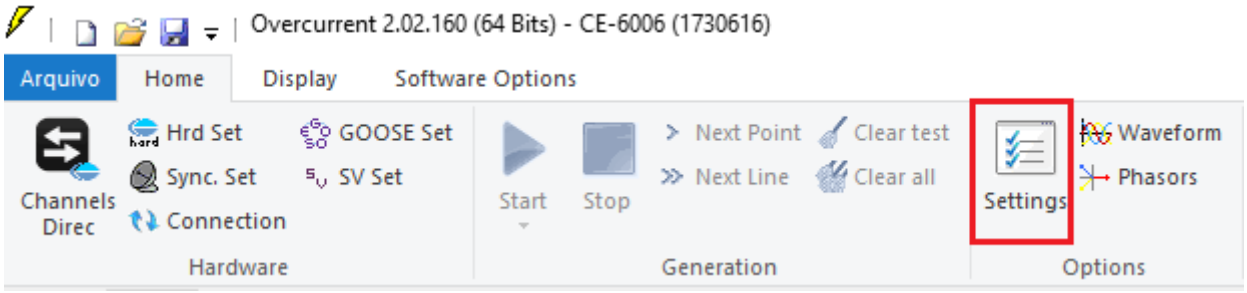

Figure 18

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.

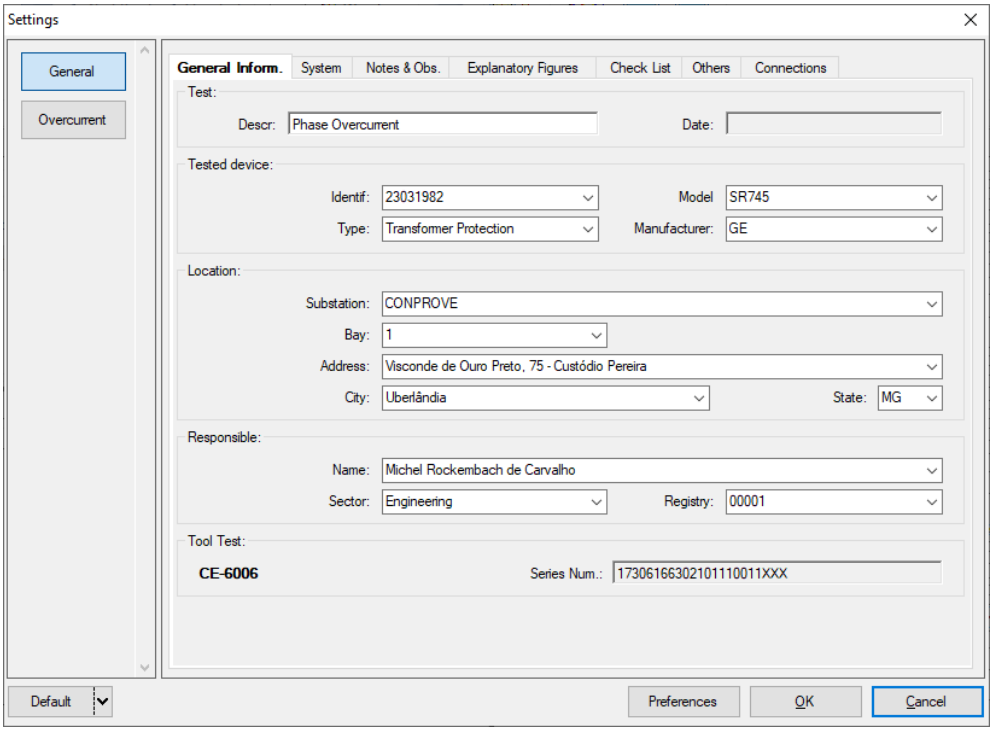

Figure 19

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.

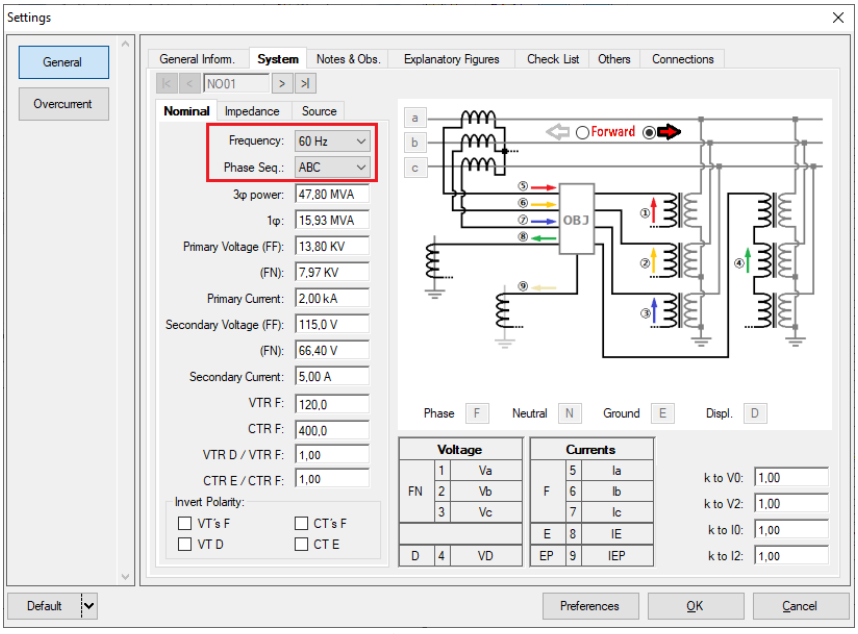

Figure 20

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 test equipment.

5. Overcurrent Adjustments

5.1 *Overcurrent Screen > Settings*

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

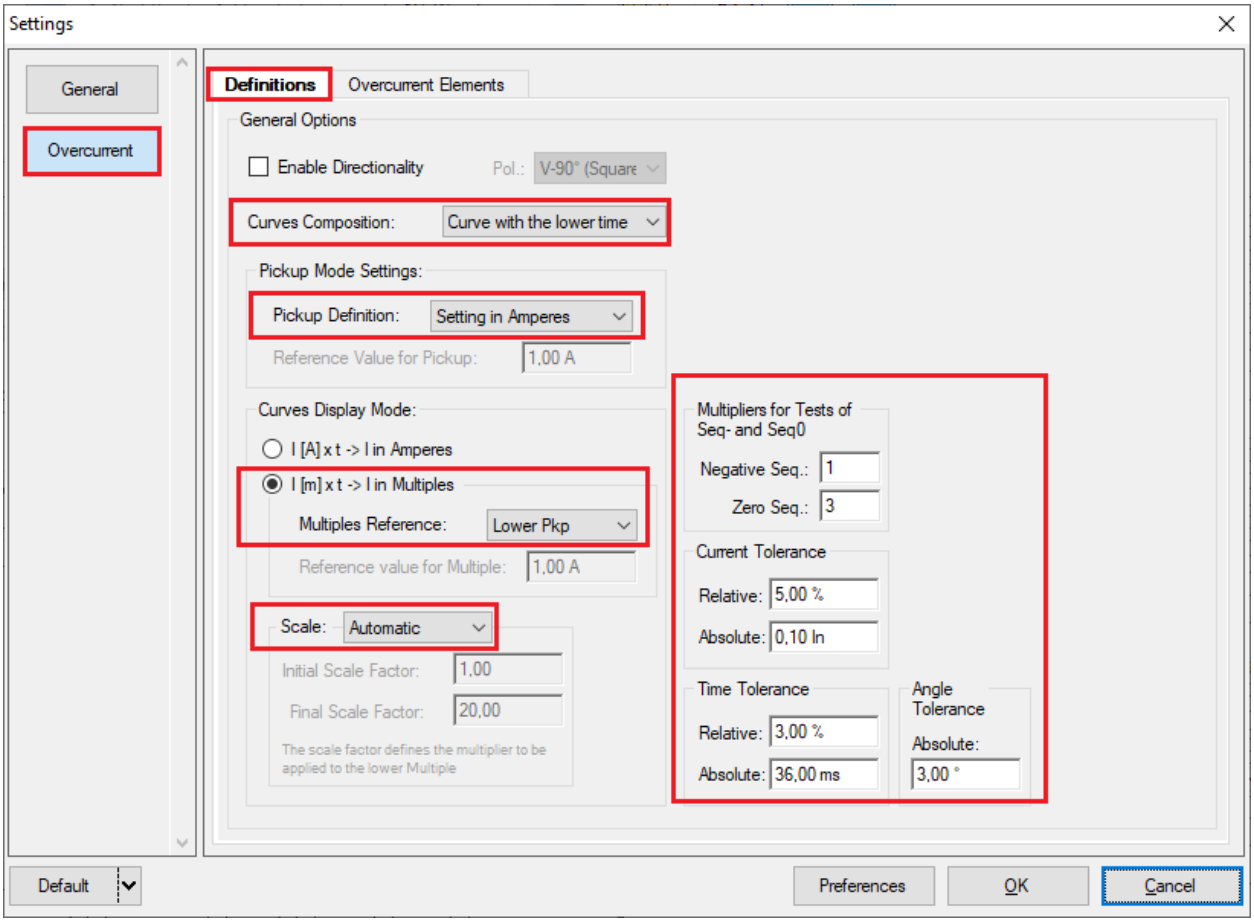

Figure 21

5.2 *Overcurrent Screen > Overcurrent Elements > Phase*

Here you must configure the two overcurrent elements, one with an inverse curve and one with a definite time. To do this double clicks on the highlighted icon.

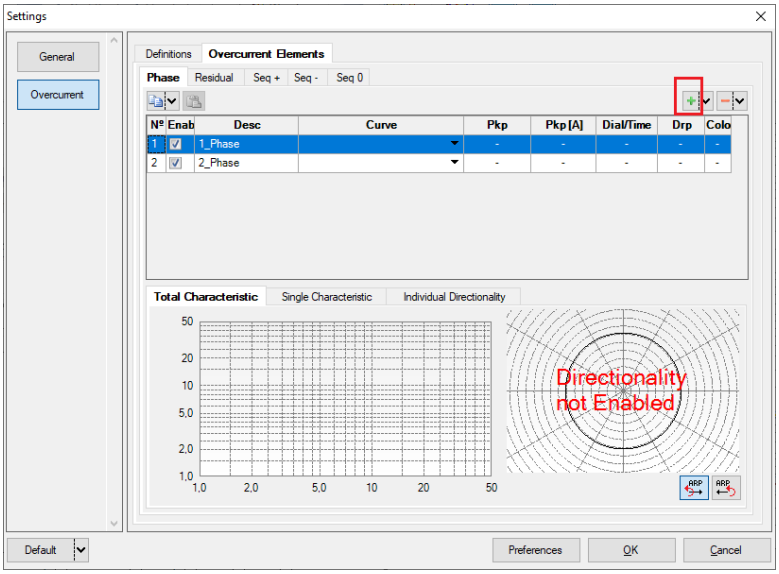

Figure 22

For the first element change the name to *"TOC"* choose the curve type, pickup value, time dial and dropout factor. Repeat the same procedure for the second changing the name to *"IOC1"*, choosing definite time and parameterization the values of *"Pkp"*, *"Tmp"* and *"Drp"*.

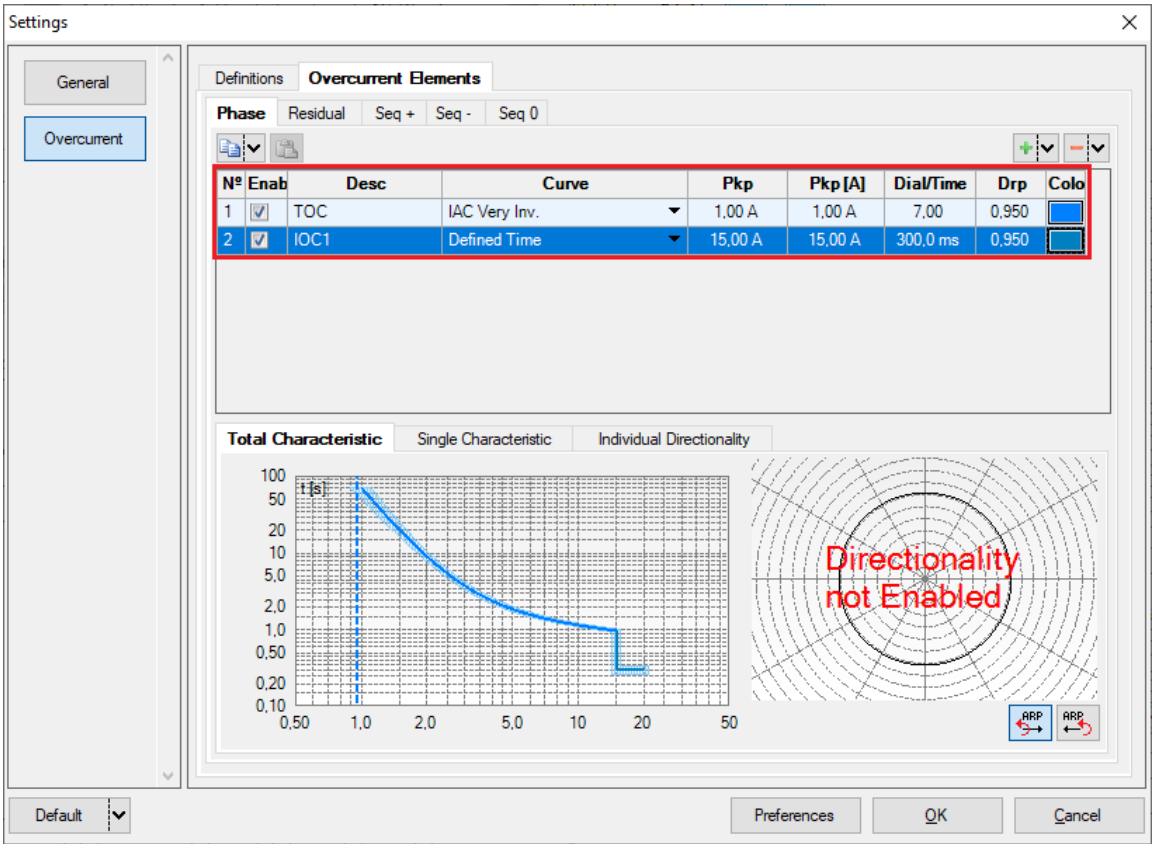

Figure 23

6. Channel Targeting and Hardware Configurations

Click on the icon illustrated below.

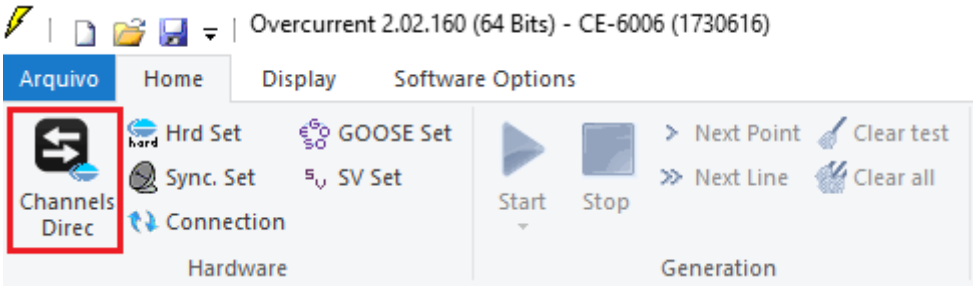

Figure 24

Then click on the highlighted icon to configure the hardware.

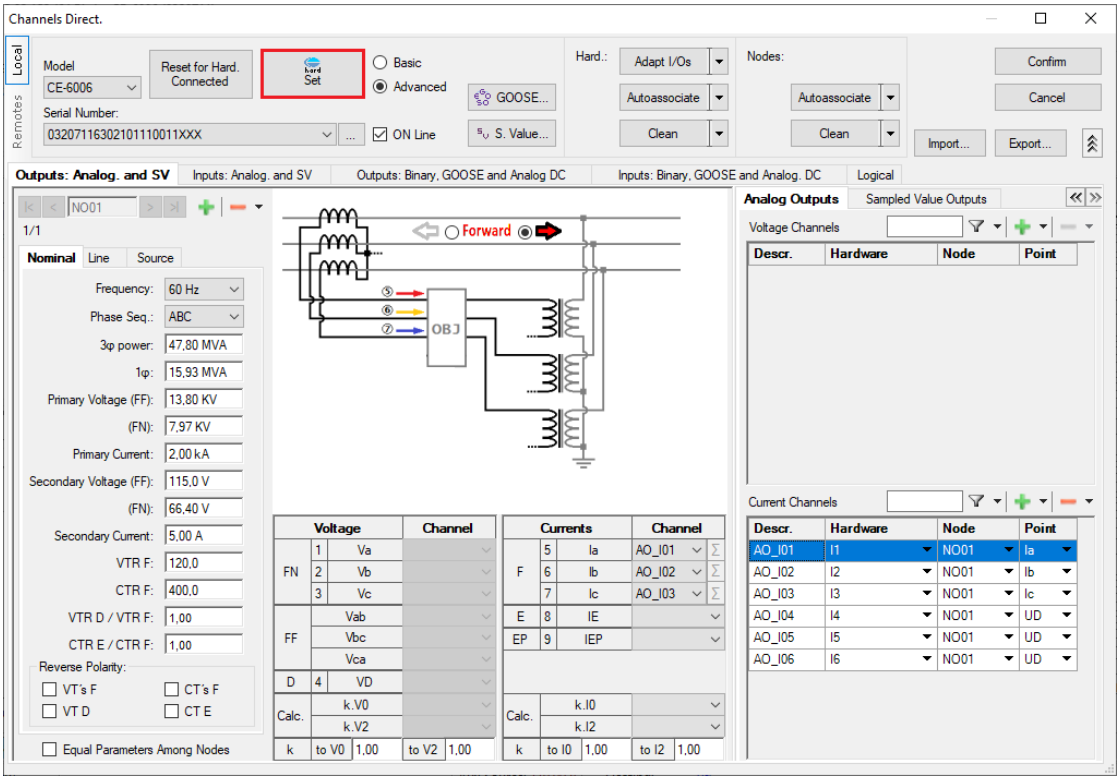

Figure 25

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

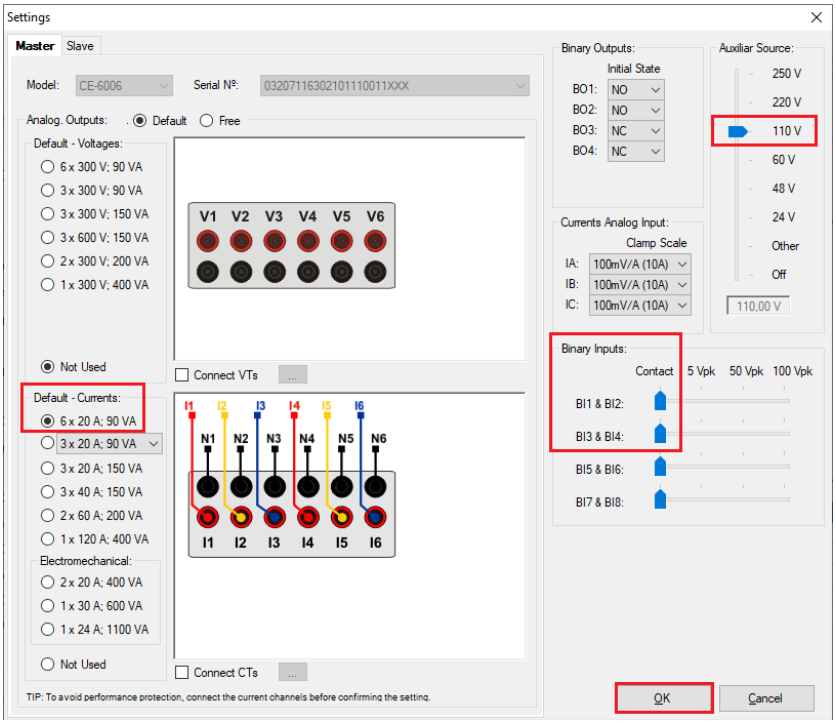

Figure 26

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

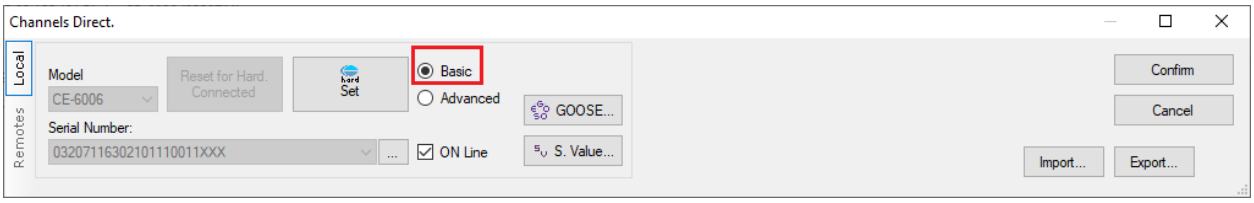

Figure 27

7. Test Structure for Function 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.

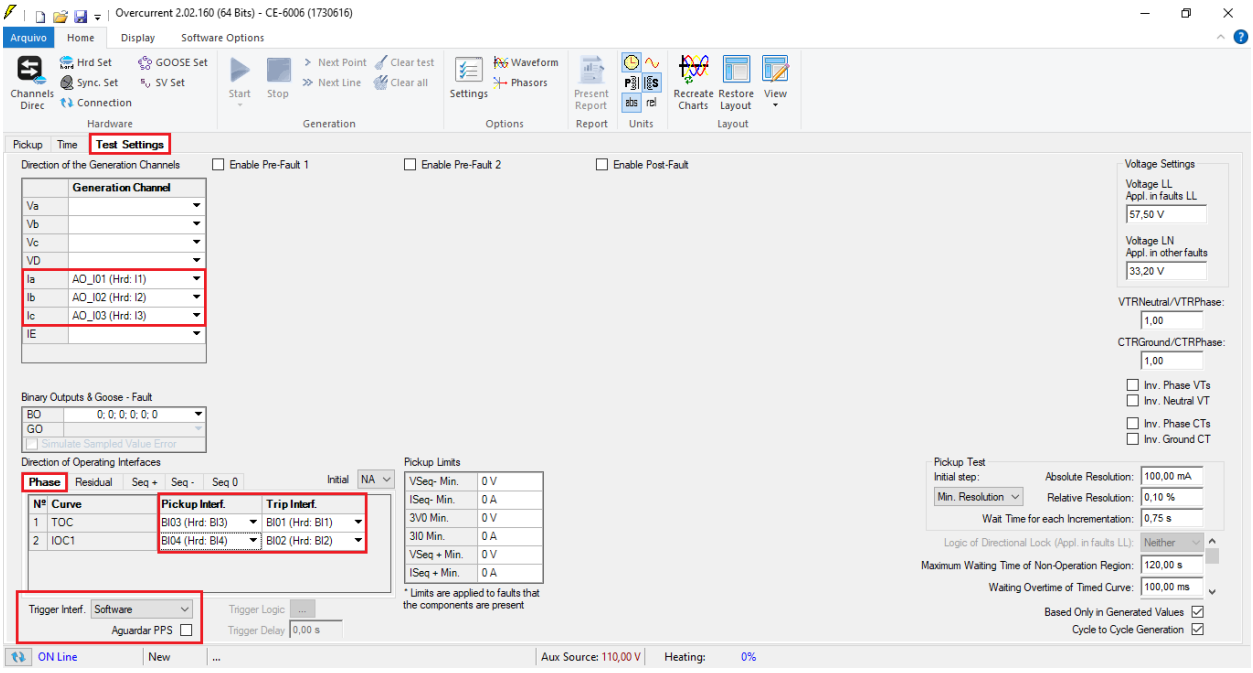

Figure 28

7.2 *Pickup Screen*

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

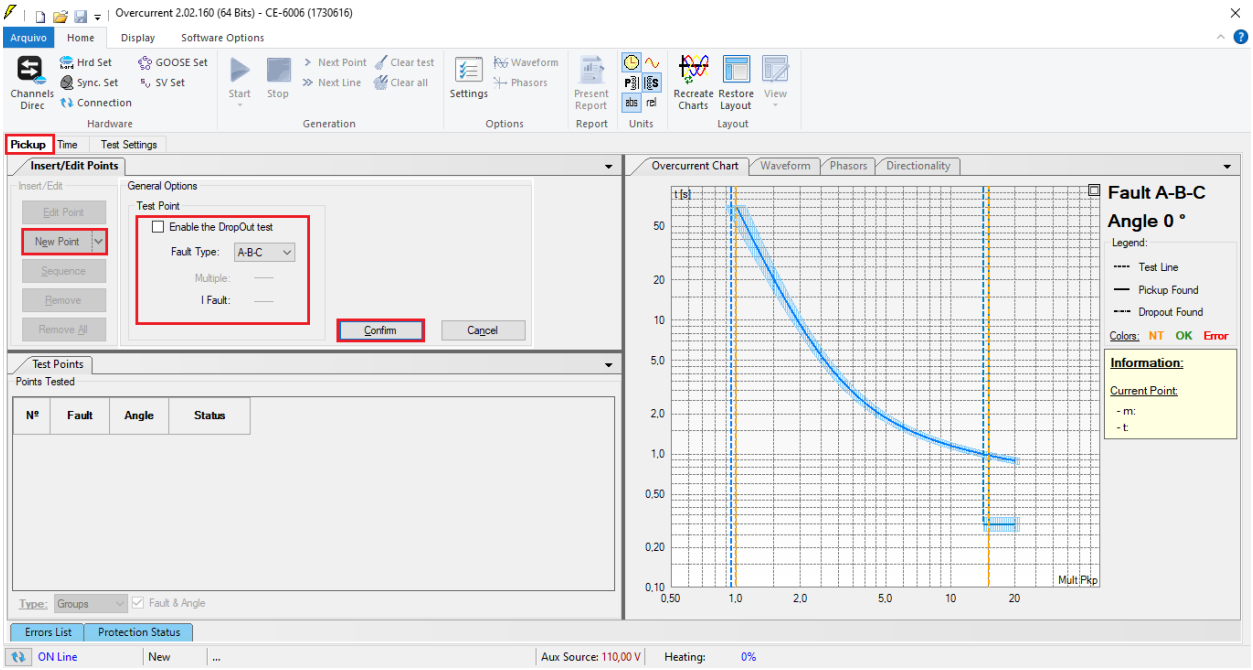

Figure 29

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

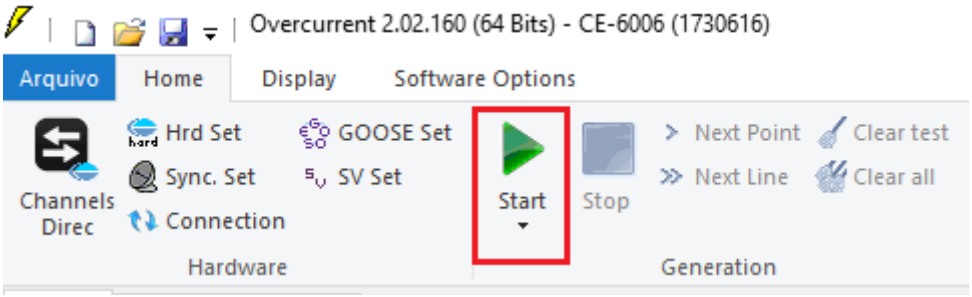

Figure 30

7.3 *Final Result of the Pickup Test*

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

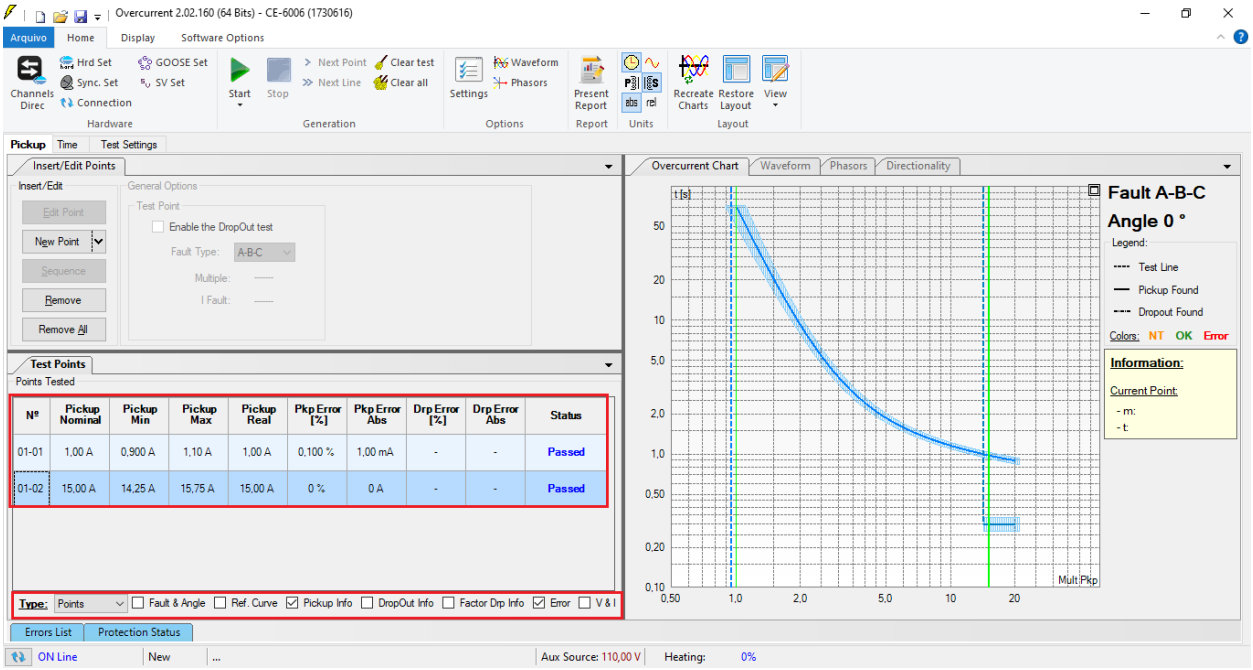

Figure 31

7.4 *Time Screen*

On this tab, the operating times are evaluated. As the binary outputs of the curve and set time are separated there will be two evaluations of time in higher ratings to 15,00A (one time for each element). For convenience, a sequence of current values will be inserted for time evaluation. It was chosen value 2,00A as the initial value, 20,00A and the final value 2,00A as increment step and the fault ABC.

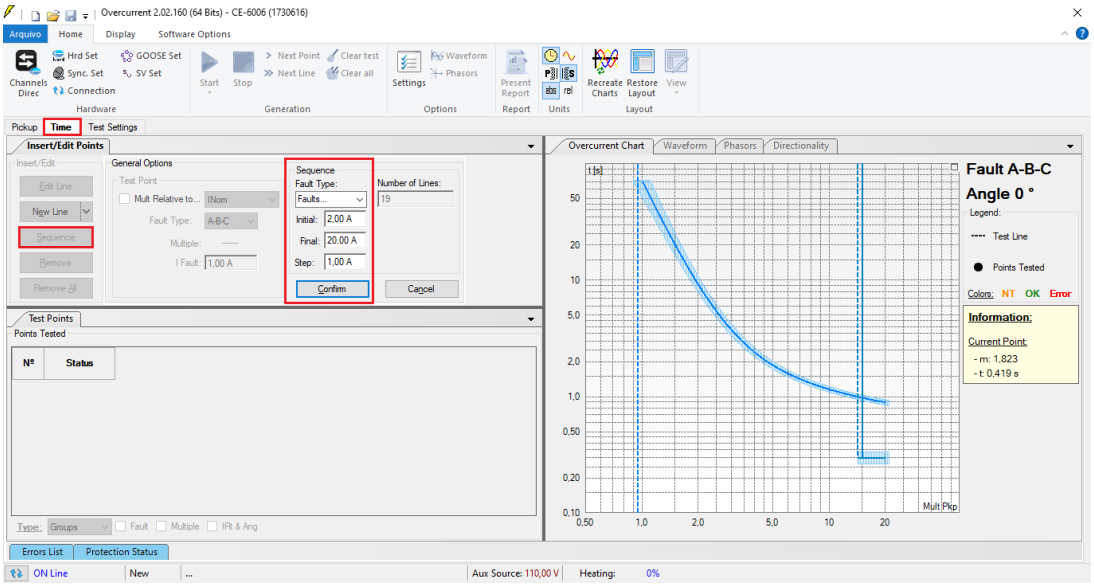

Figure 32

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

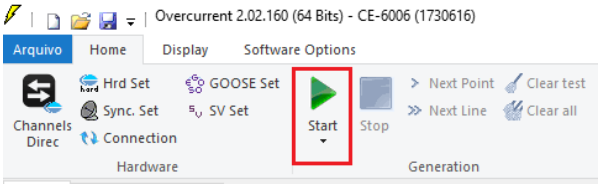

Figure 33

7.5 *Final Result of the Time Test*

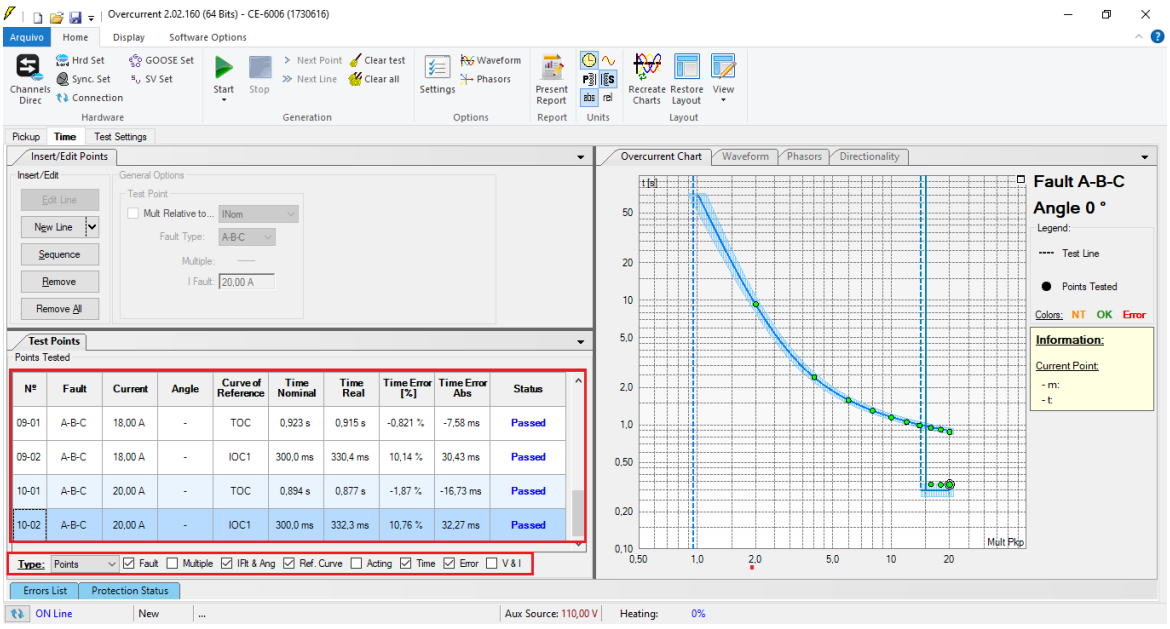

Figure 34

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.

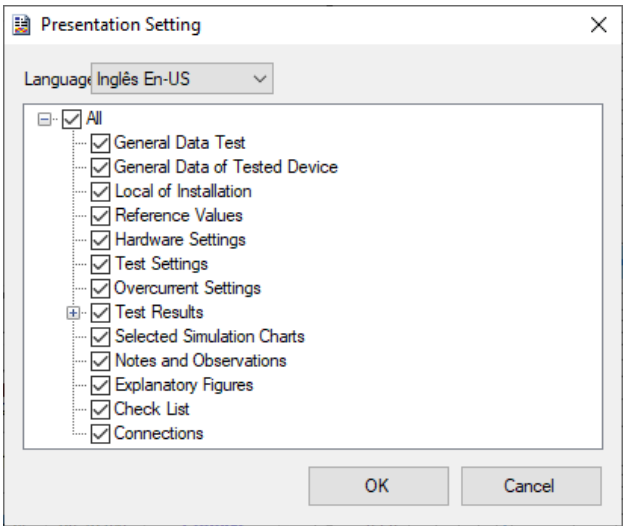

Figure 35

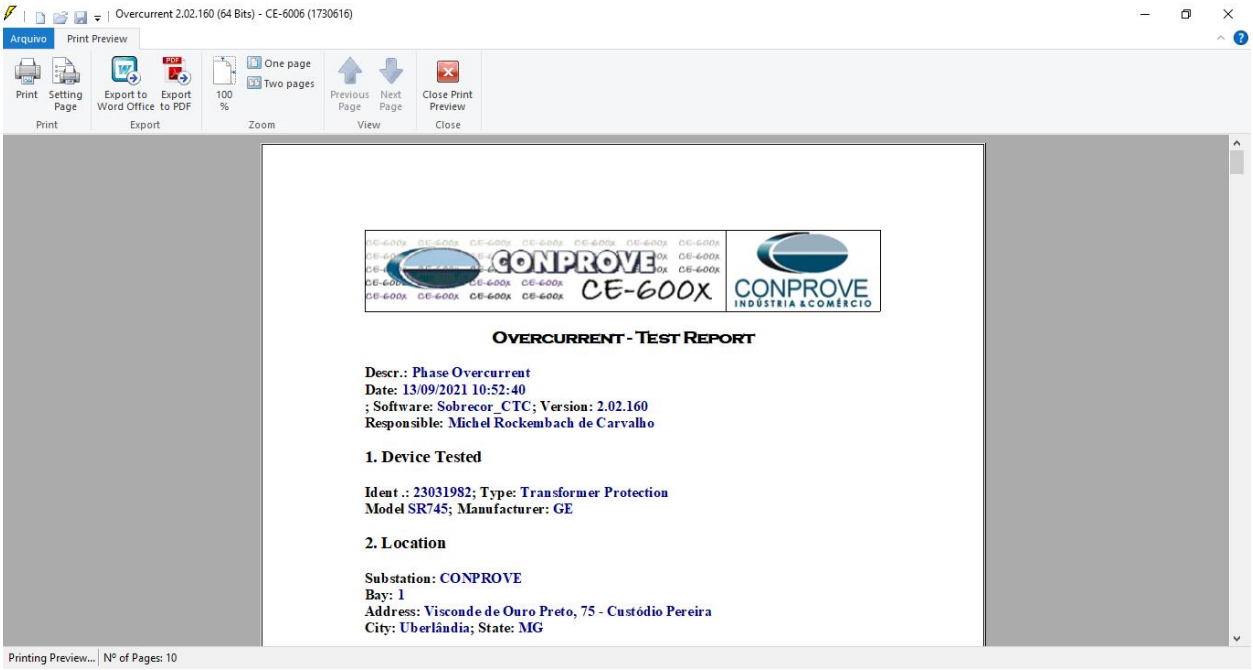

Figure 36

APPENDIX A

A.1 Terminal Designations

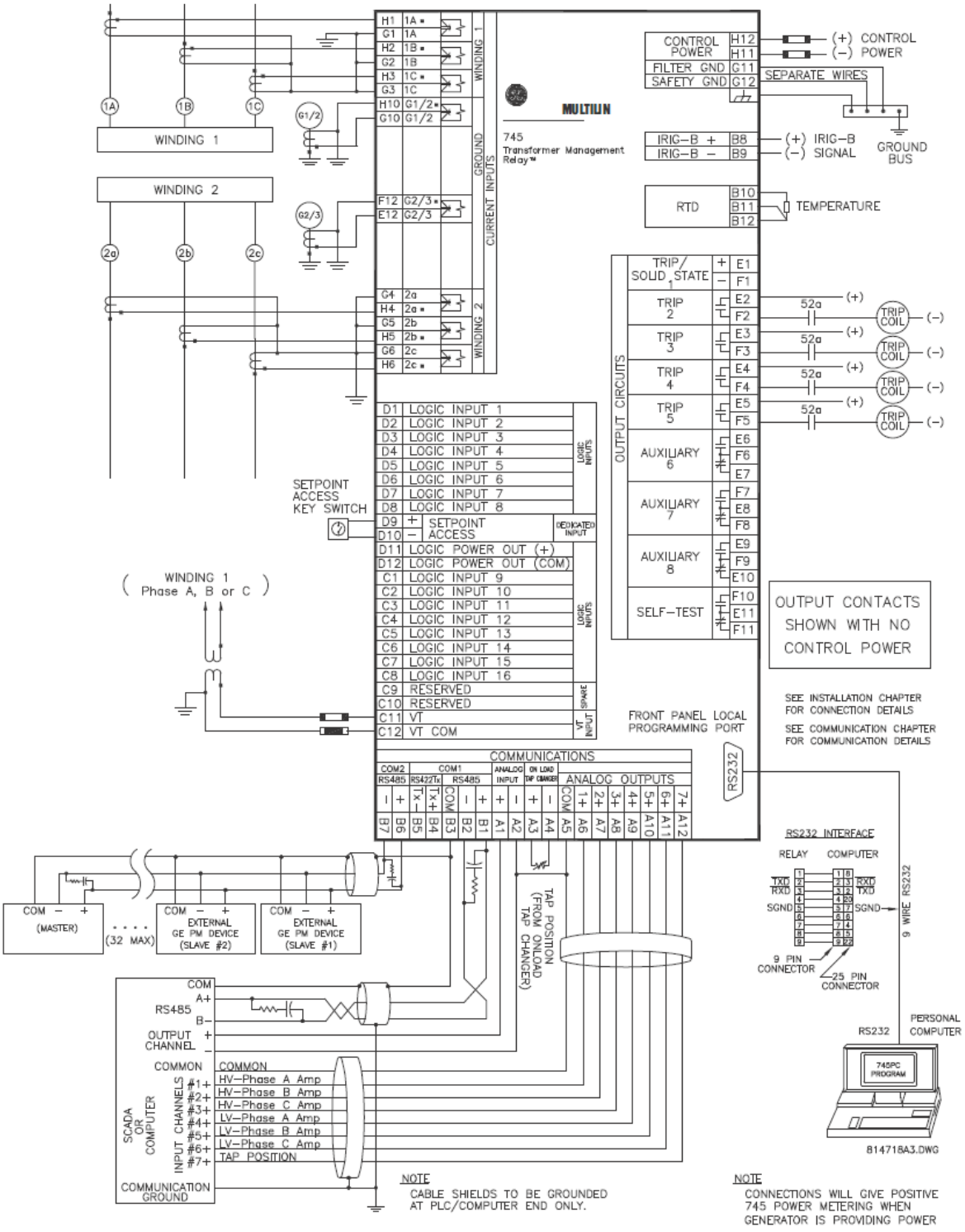

Figure 37

A.2 Technical data

PHASE / NEUTRAL / GROUND / NEGATIVE SEQUENCE TIME OVERCURRENT

Pickup level: ..... 0.05 to 20.00 × CT in steps of 0.01
Dropout level: ..... 97 to 98% of pickup
Curve shapes: ..... ANSI extremely/very/moderately/normally inverse; definite time (0.1 s base curve); IEC curve A/B/C and short; FlexCurve™ A/B/C (programmable curves); IAC extreme/ very/inverse/short
Curve multiplier: ..... 0.00 to 100.00 in steps of 0.01
Reset type: ..... instantaneous or linear
Level accuracy: ..... per current input
Timing accuracy: ..... ±3% of trip time or ±20 ms (whichever is greater) at ≥ 1.03 × pickup

PHASE / NEUTRAL / GROUND / NEGATIVE SEQUENCE INSTANTANEOUS OVERCURRENT

Pickup level: ..... 0.05 to 20.00 × CT in steps of 0.01
Dropout level: ..... 97 to 98% of pickup
Time delay: ..... 0 to 60000 ms in steps of 1
Level accuracy: ..... per current input
Solid state output operate time:
- at 1.2 × pickup: ..... 22 to 30 ms
- at 2.0 × pickup: ..... 18 to 26 ms
- at 4.0 × pickup: ..... 11 to 19 ms

Relay outputs 2 to 5 operate time:
- at 1.2 × pickup: ..... 28 to 36 ms
- at 2.0 × pickup: ..... 24 to 32 ms
- at 4.0 × pickup: ..... 17 to 25 ms

APPENDIX B

Equivalence of software parameters and the relay under test.

Table 3

Overcurrent Software		GE 745 Relay	
Parameter	**Figure**	**Parameter**	**Figure**
Frequency	20	Nominal Frequency	08
Phase Seq.	20	Phase Rotation	08
51			
Pkp	23	Pickup TOC1	11
Dial / Time	23	TD Multiplier	11
Curve	23	Curve	11
50-1			
Pkp	23	Pickup IOC1	12
Dial / Time	23	Delay IOC1	12