INSTRUMENTOS PARA TESTES ELÉTRICOS

Test Tutorial

Equipment Type: Protection Relay

Brand: Siemens

Model: 7SJ61

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	11/08/2021	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

Sequence for 7SJ61 relay tests in Overcurrent software

1. Relay connection to CE-6006

1.1 *Auxiliary Source*

Connect the positive (red terminal) of the Vdc Aux. Source to pin F1 (UH+) of the relay and the negative (black terminal) of the Vdc Aux. Source to pin F2 (UH-) of the relay.

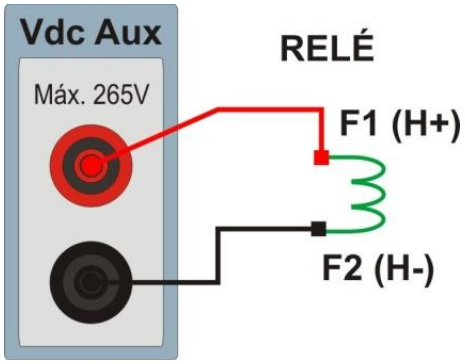

Figure 1

1.2 *Current Coils*

Connect I1, I2 and I3 current channels of the CE-6006 to pins Q1, Q3 and Q5 of the relay respectively, if the commons of the relay are short circuited, just connect the commons of the test set channels to that point, otherwise connect the three common CE-6006 to Q2 pins, Q4 and Q6 of the relay.

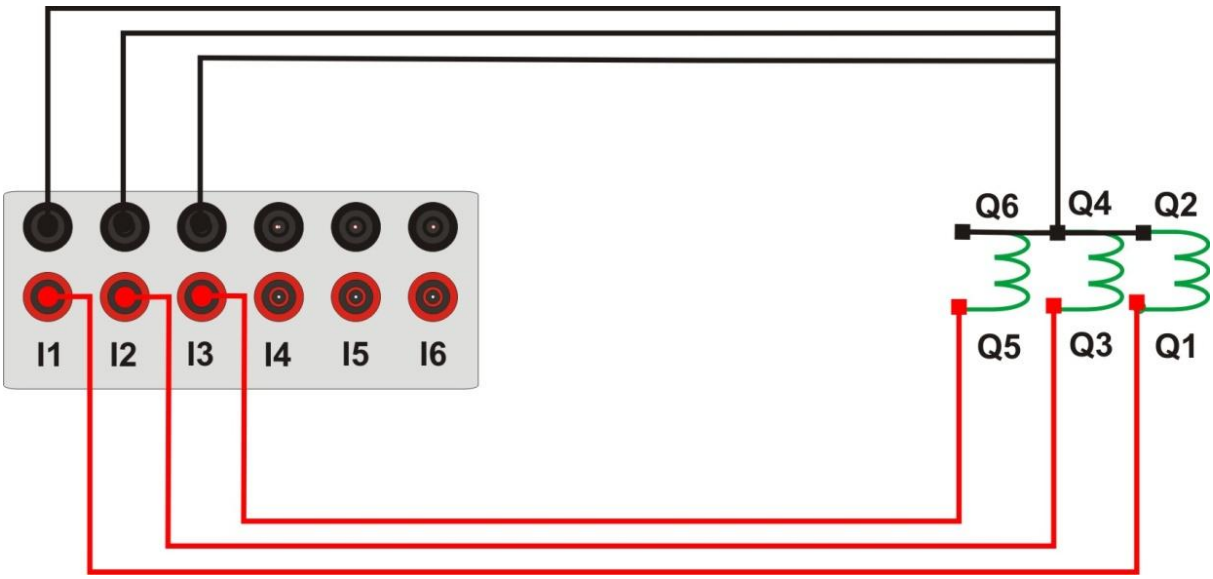

Figure 2

1.3 *Binary Inputs*

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

- BI1 to pin F7 and its common to pin F6;
- BI2 to pin F9 and its common to pin F8;
- BI3 to pin F11 and its common to pin F10.

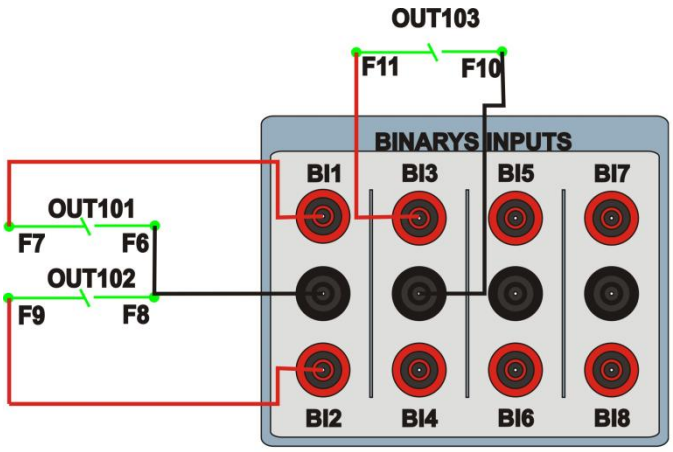

Figure 3

2. Communication with 7SJ61 relay

First, open the *"DIGSI"* and connect an Ethernet cable (or serial) from the notebook with the relay. Then double click on the software icon.

Figure 4

When opening the program, the substation that contains the relay is selected (7SJ61). After selecting the relay, click the right button and select the *"Open Object"* and then select the connection mode, as is shown in s following figures.

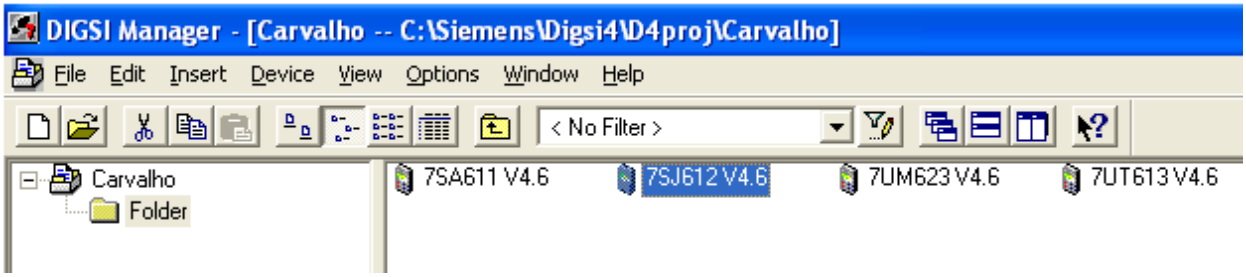

Figure 5

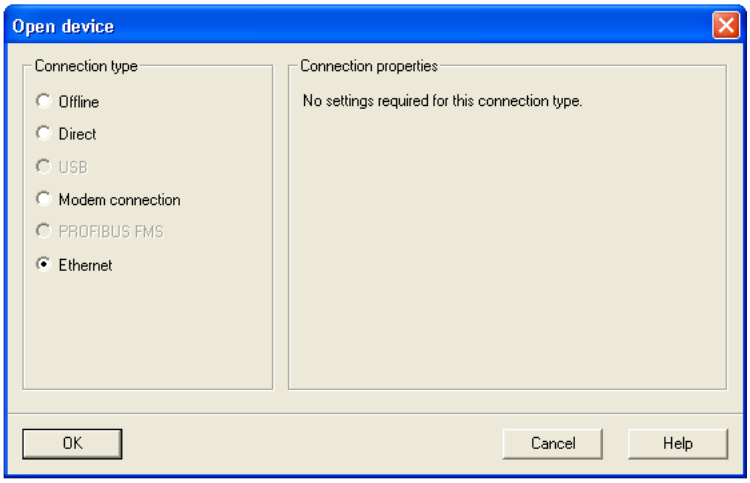

Figure 6

3. Parameterization of the relay 7SJ61

3.1 *Device Configuration*

After the connection has been established, access the general settings of the relay by double left-clicking on *"Settings"* and repeat the operation for *"Device Configuration"*.

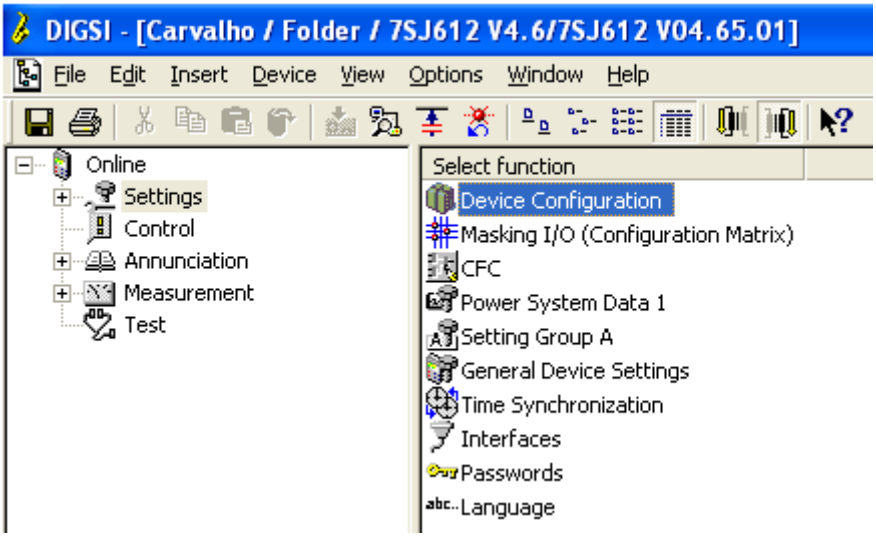

Figure 7

In the *"Functional Scope"* screen, disable all functions leaving only the *"50/51"* function enabled in the *"Time Overcurrent Curve IEC"* option. This does testing easier as it prevents the use of the trip signal from other functions. After the adjustments click *"OK"*.

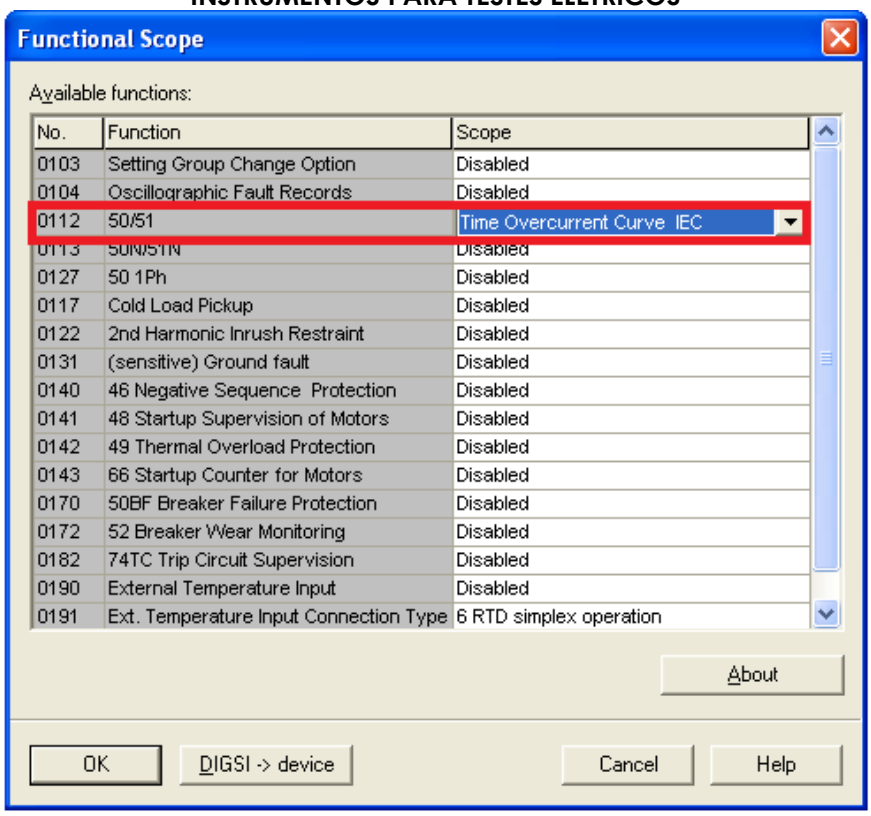

Figure 8

3.2 *Masking I/O*

The next step is to adjust the binary outputs of the relay. To access these parameters, double-click with the left button on *"Masking I/O (Configuration Matrix)"* as illustrated in the next figure.

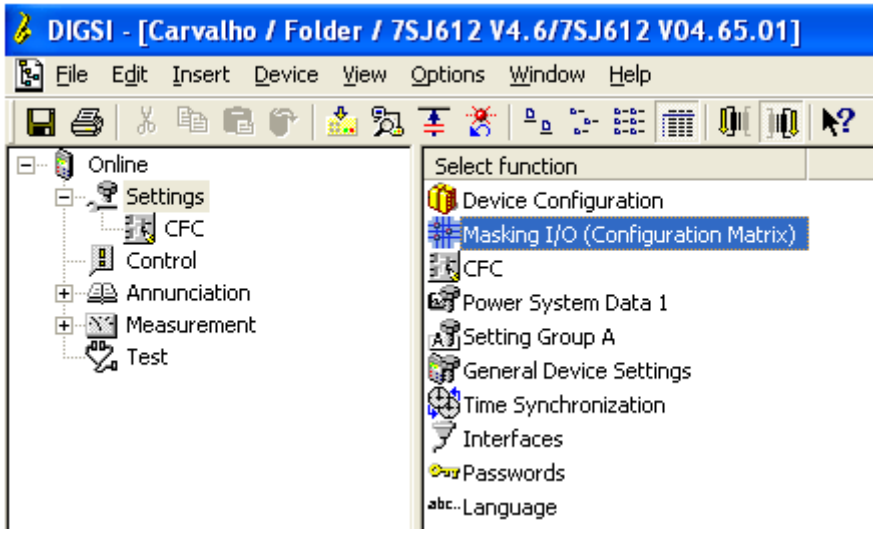

Figure 9

The trip signal of function 50-1 will be directed to the output binary *"BO3"* of the relay, the trip from 51 to *"BO2"* and the pickup of function 51 to *"BO1"*. To facilitate monitoring of that test the led's 1, 2 and 3 were assigned to these functions. The option *"U"* must be used, which means *" Unlatched "* , that is, the relay activates and when the problem ceases , it automatically returns to the binary initial state. If the user chooses the *"L"* or *"Latched"* option, the relay activates and remains activated even if the problem has been extinguished. (This option is not suitable for testing).

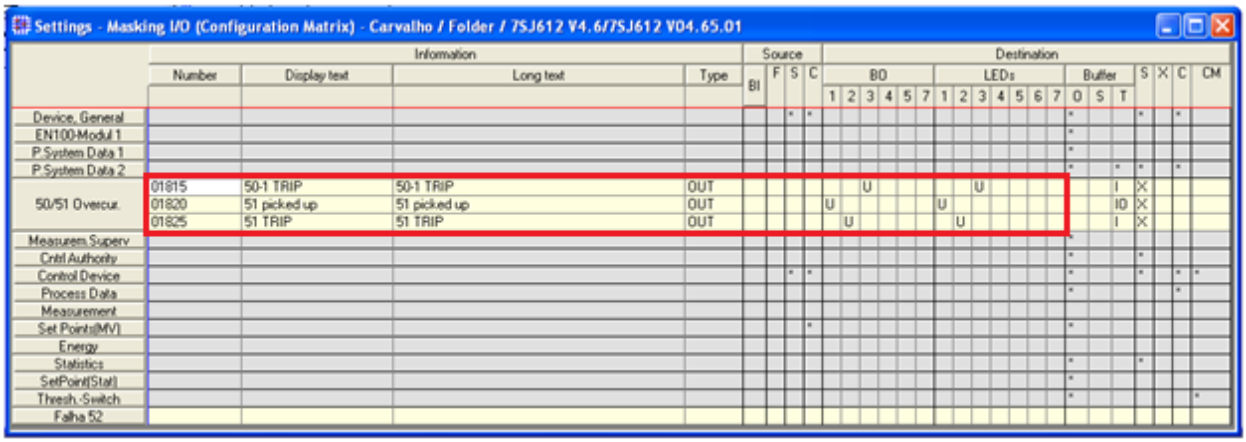

Figure 10

3.3 *Power System Data 1*

Continuing the settings, double-click on *"Power System Data 1"*.

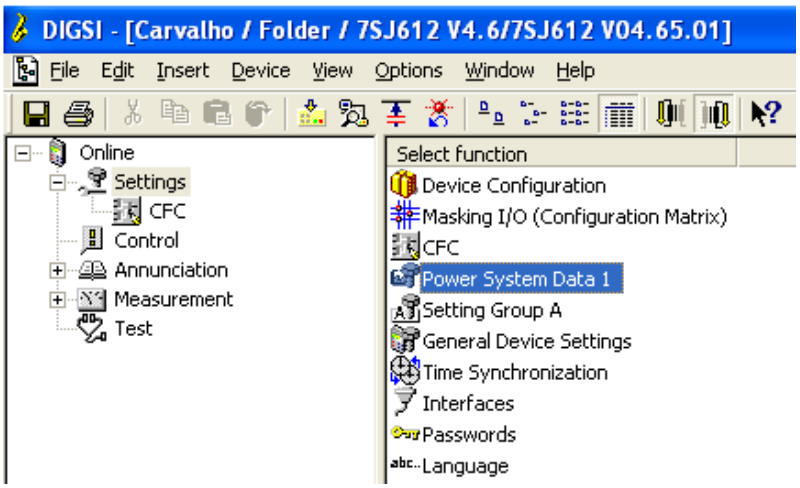

Figure 11

3.3.1 Power System

In the *"Power System"* tab, the system frequency, the phase sequence and where the CT star is being closed are configured, that is, in the busbar direction or in the line direction.

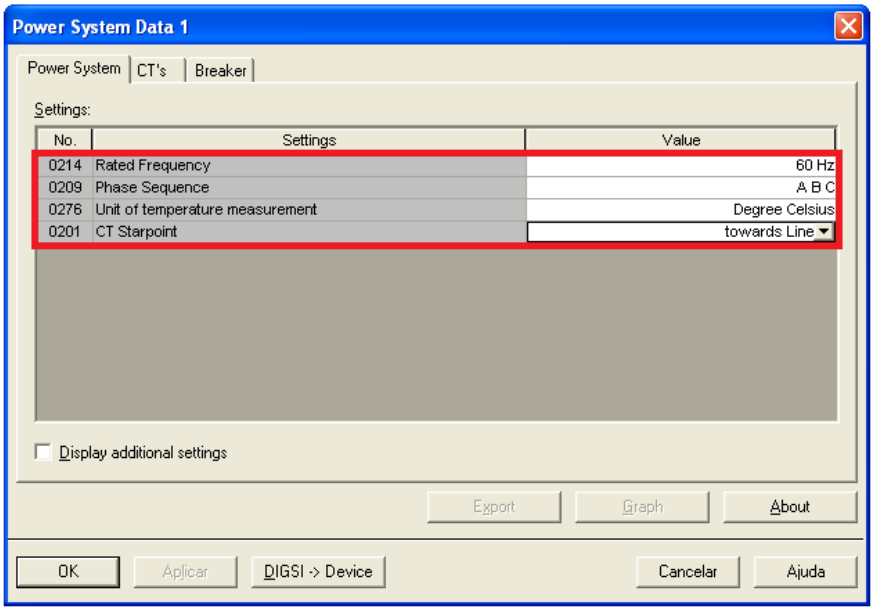

Figure 12

3.3.2 CT's

In this tab the nominal values of primary and secondary of the phase and ground current transformers are inserted.

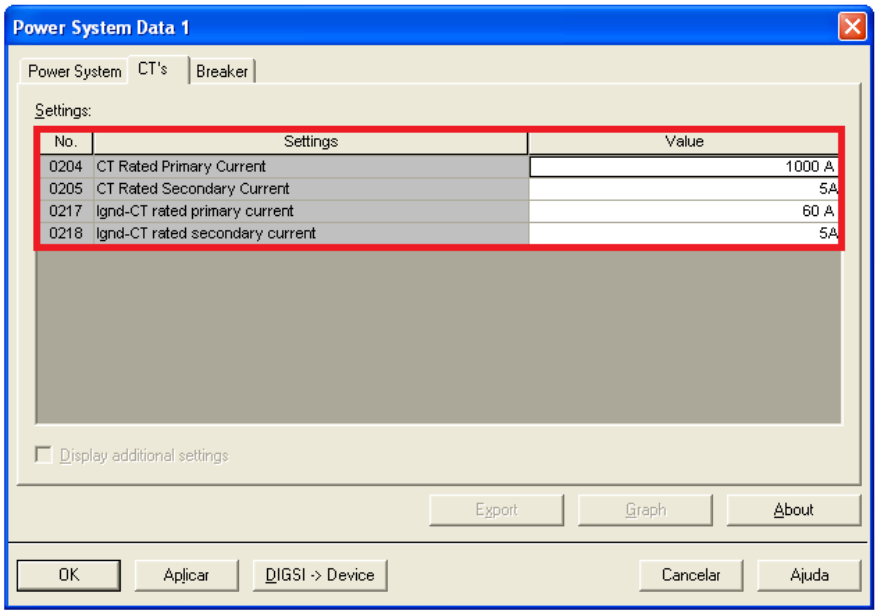

Figure 13

3.4 *Setting Group A*

In this option are the protection settings.

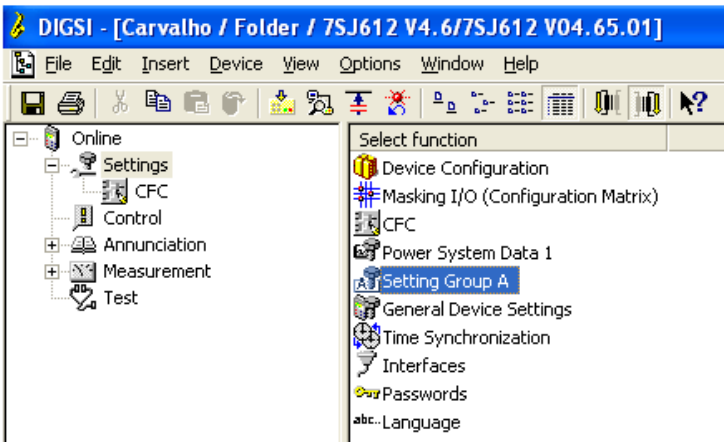

Figure 14

3.5 *50/51 Phase/Ground Overcurrent*

In this option to adjust overcurrent functions.

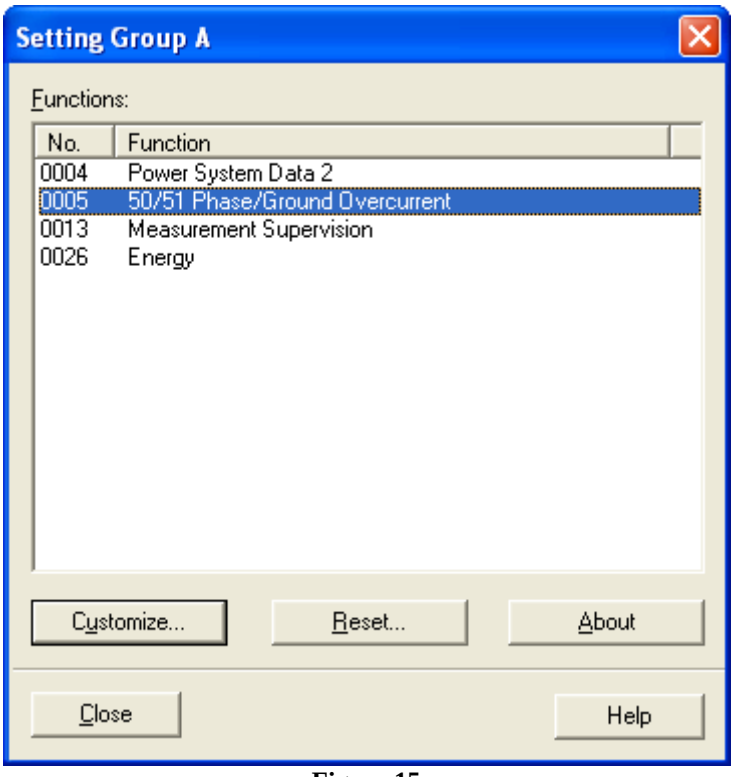

Figure 15

3.5.1 General

Address 1201 activates the overcurrent function. The other options will not be tested and should be set to *"Inactive"*.

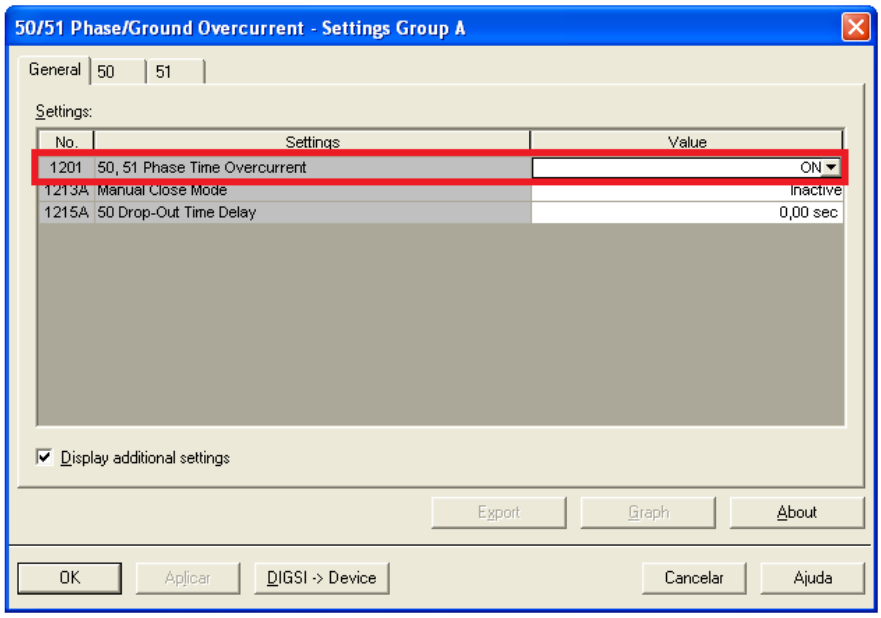

Figure 16

3.5.2 50

This field sets up the 50-1 pick-up value as well as their respective operating times. The 50-2 pick-up and time settings must be parameterized to infinity as they will not be used.

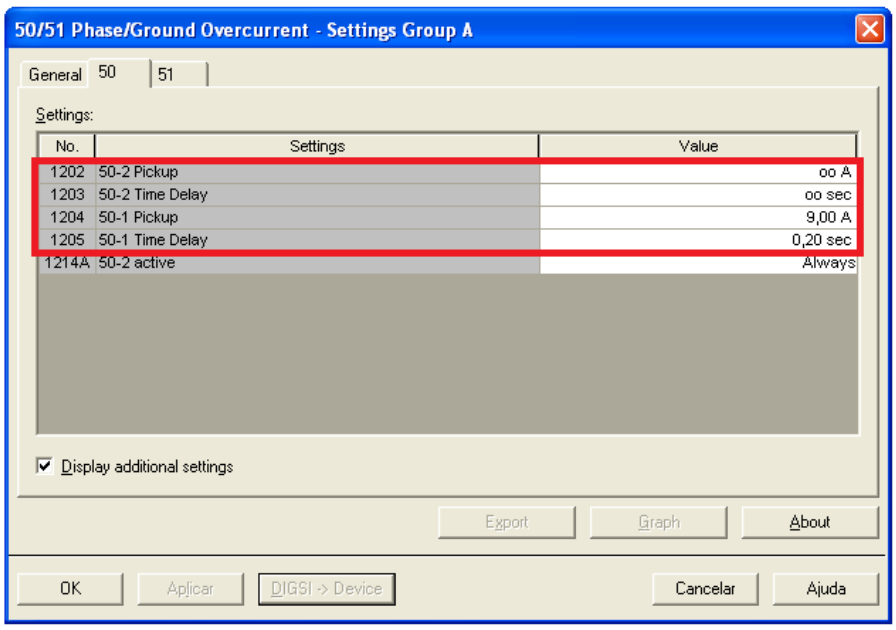

Figure 17

3.5.3 51

In this option, set up the parameters of the inverse curve overcurrent, pick up, time dial and curve type.

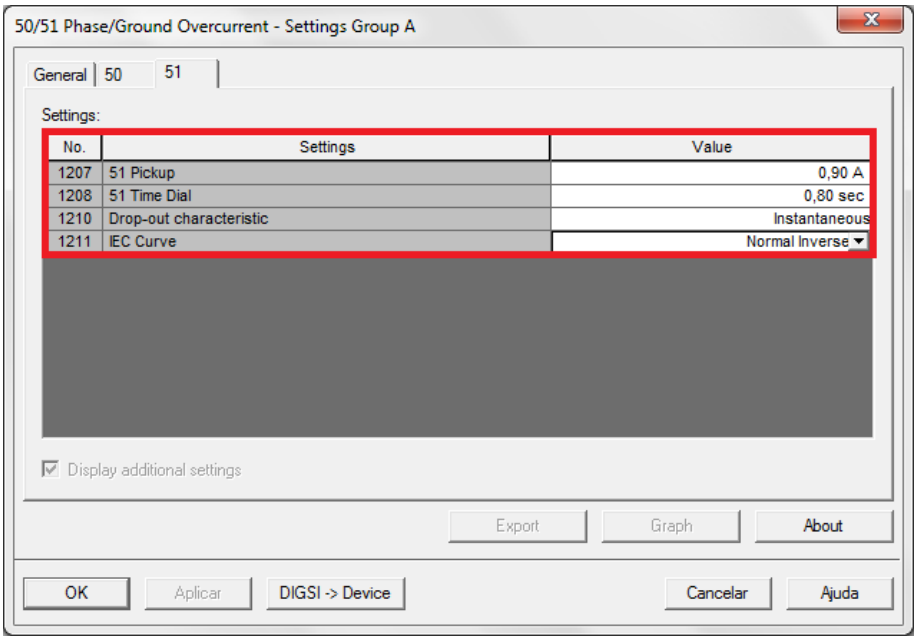

Figure 18

The next step is to submit the changes. To do this click on the highlighted icon below:

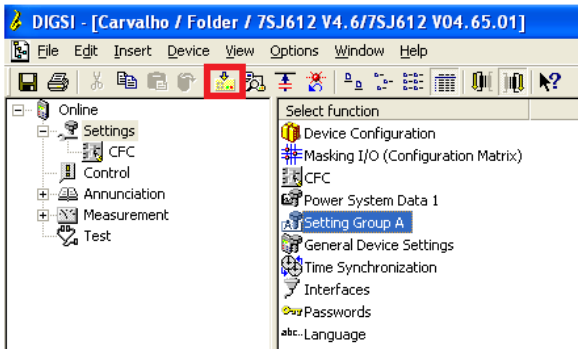

Figure 19

Then enter the password (**SIEMENS default: 000000**) and click on *"OK"* .

Figure 20

4. Overcurrent software adjustments

4.1 *Opening the Overcurrent*

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

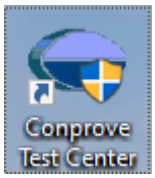

Figure 21

Click on the software icon *"Overcurrent"*.

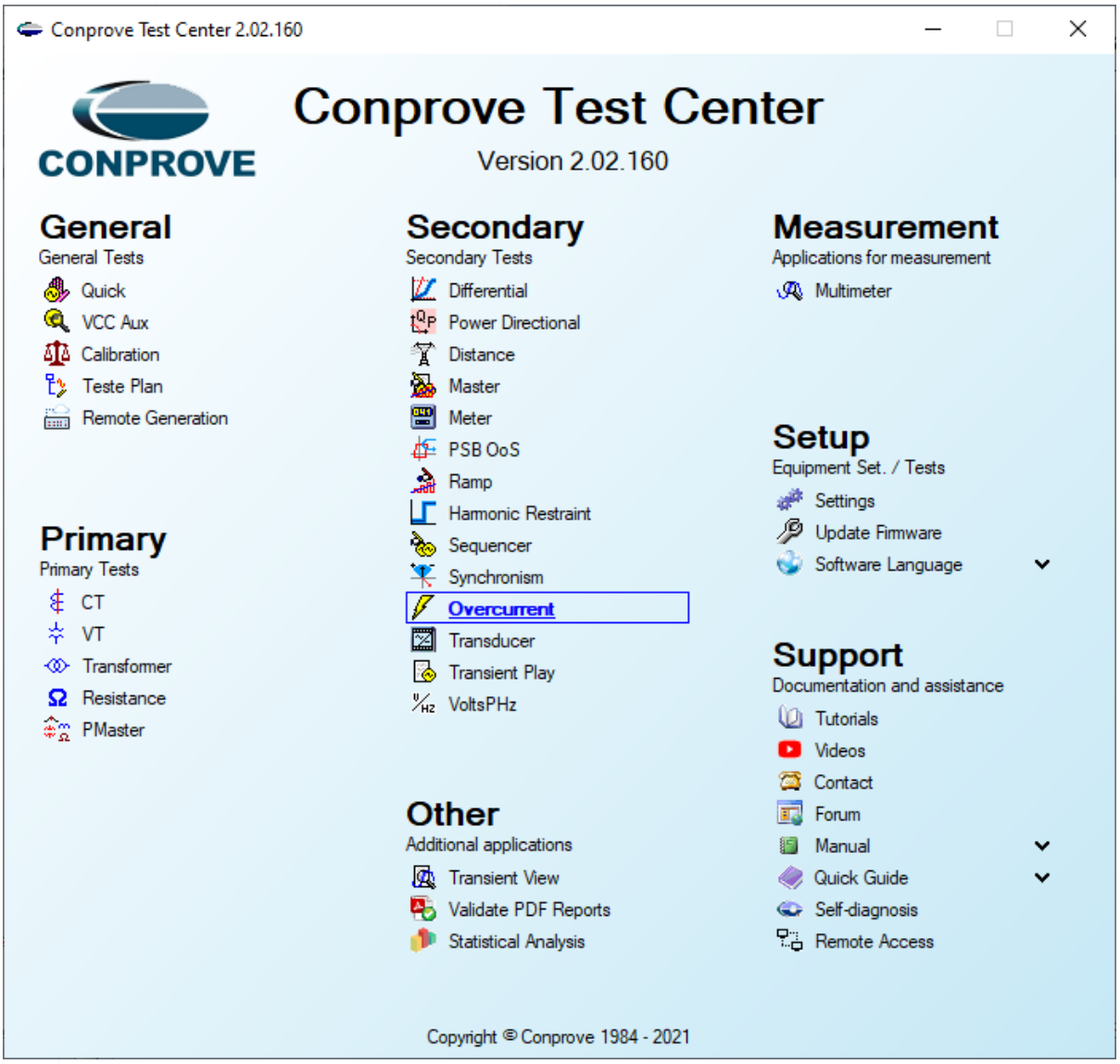

Figure 22

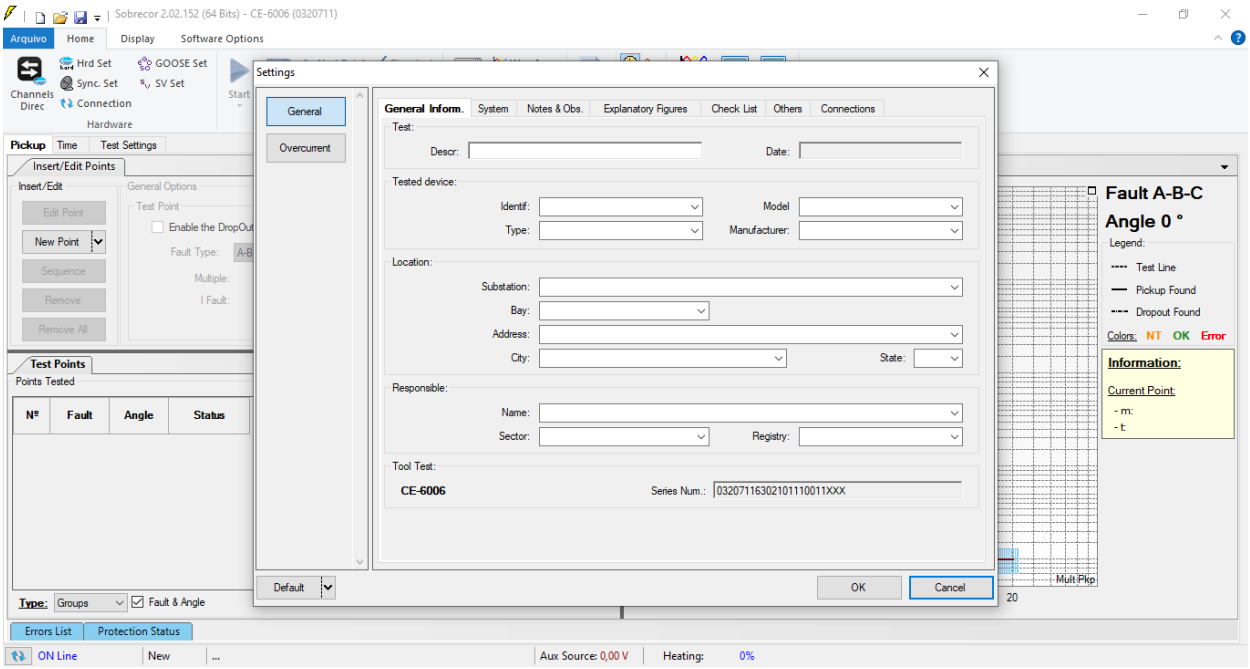

Figure 23

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.

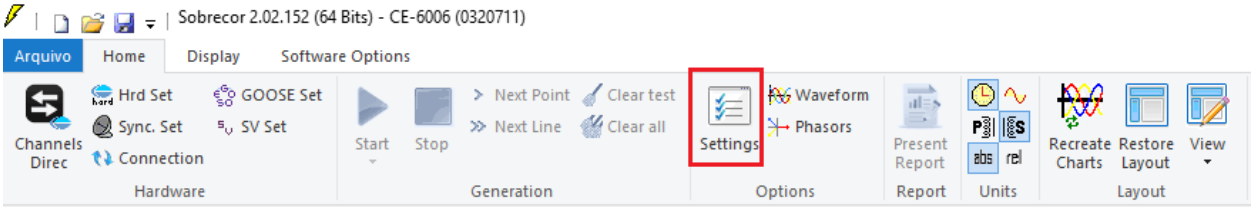

Figure 24

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.

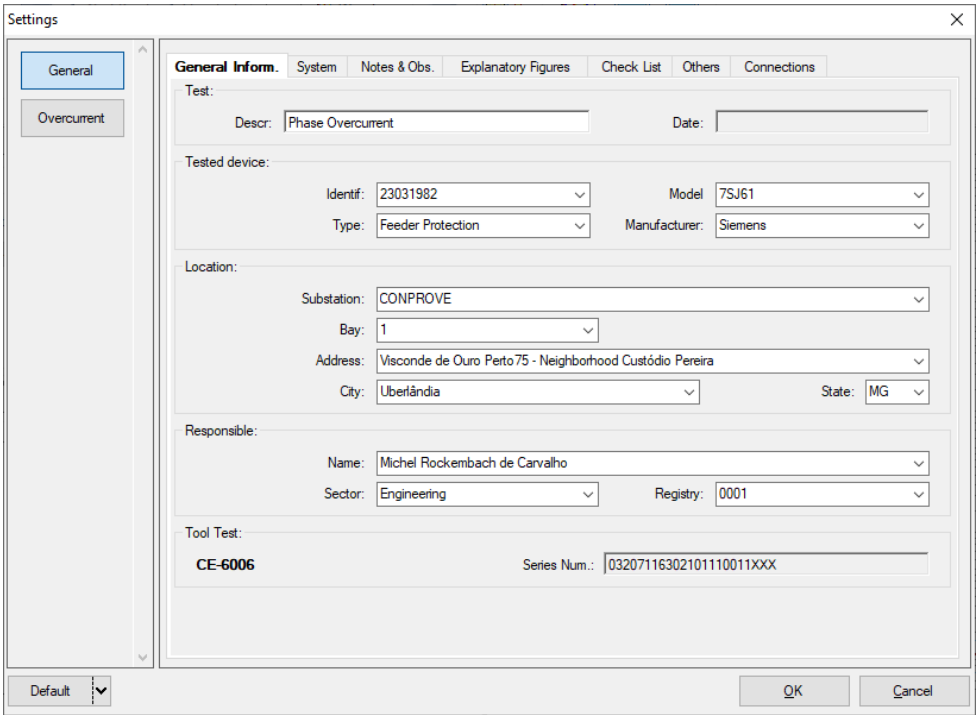

Figure 25

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.

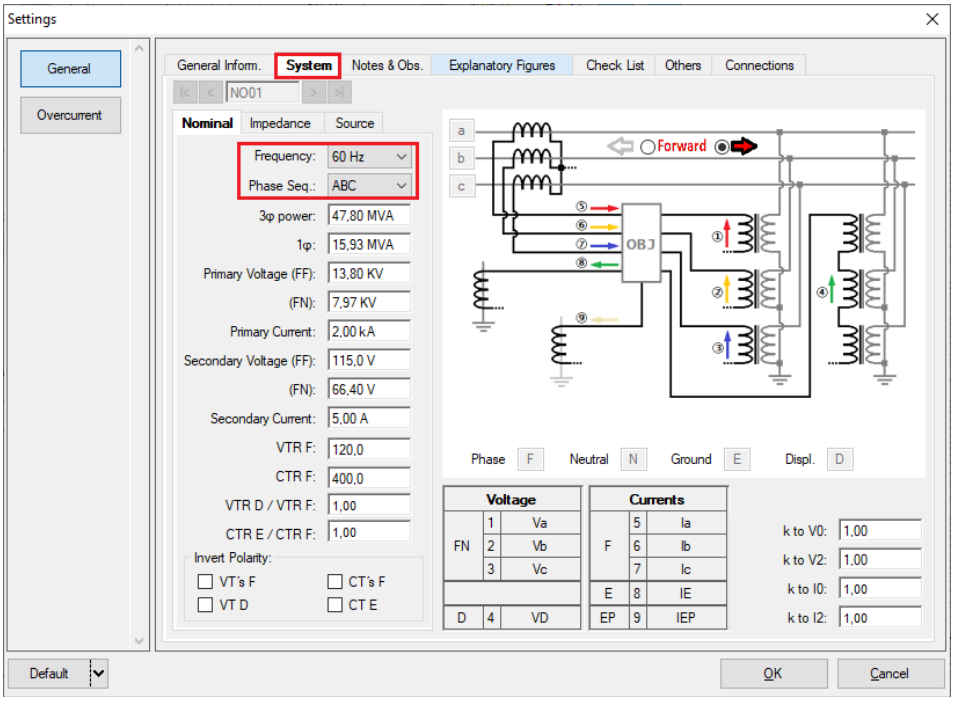

Figure 26

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 by time, current and angle. These tolerances should be consulted in the relay manufacturer's manual.

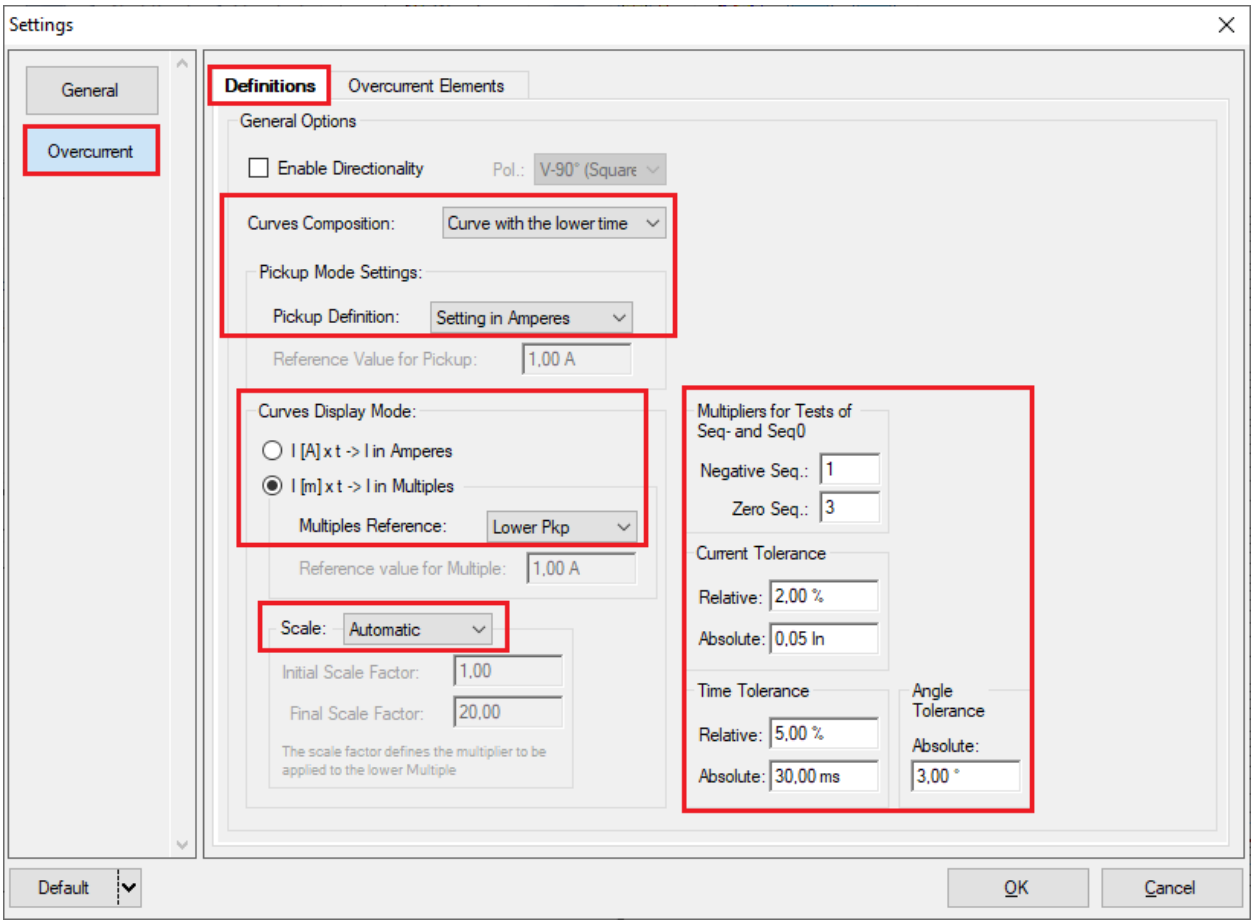

Figure 27

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 clicking two times on the highlighted icon.

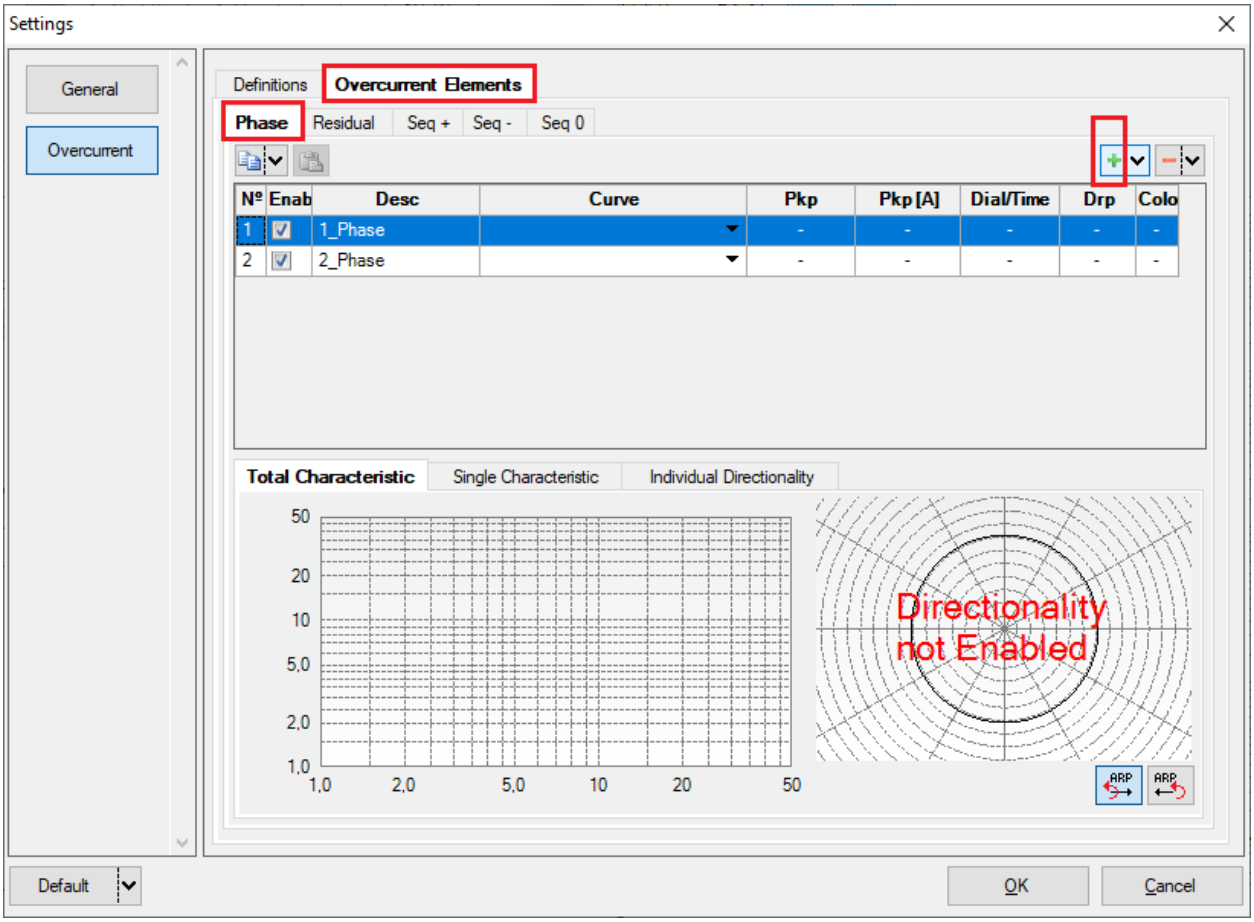

Figure 28

For the first element change the name to *"51"* choose the curve type, pickup value, time dial and dropout factor. Repeat the same procedure for the second element changing the name to *"50-1",* choosing definite time and parameterization the values of *"Pkp", "Tmp"* and *"Drp".*

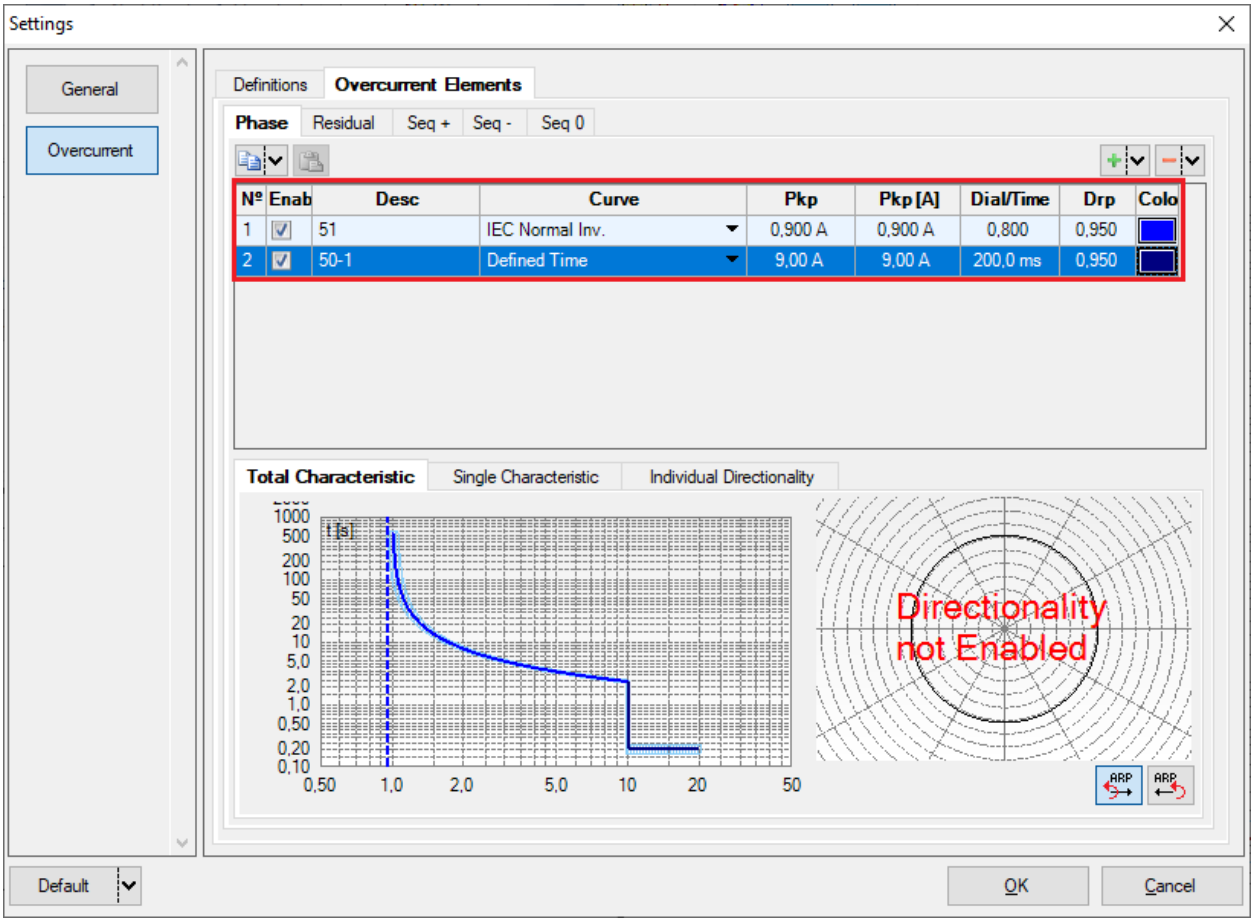

Figure 29

This relay has a particularity for actuating its pick-up that is worth 10% of the set value. Select the *"51"* element and then click on the *"Single Characteristic"* tab and make the following adjustment.

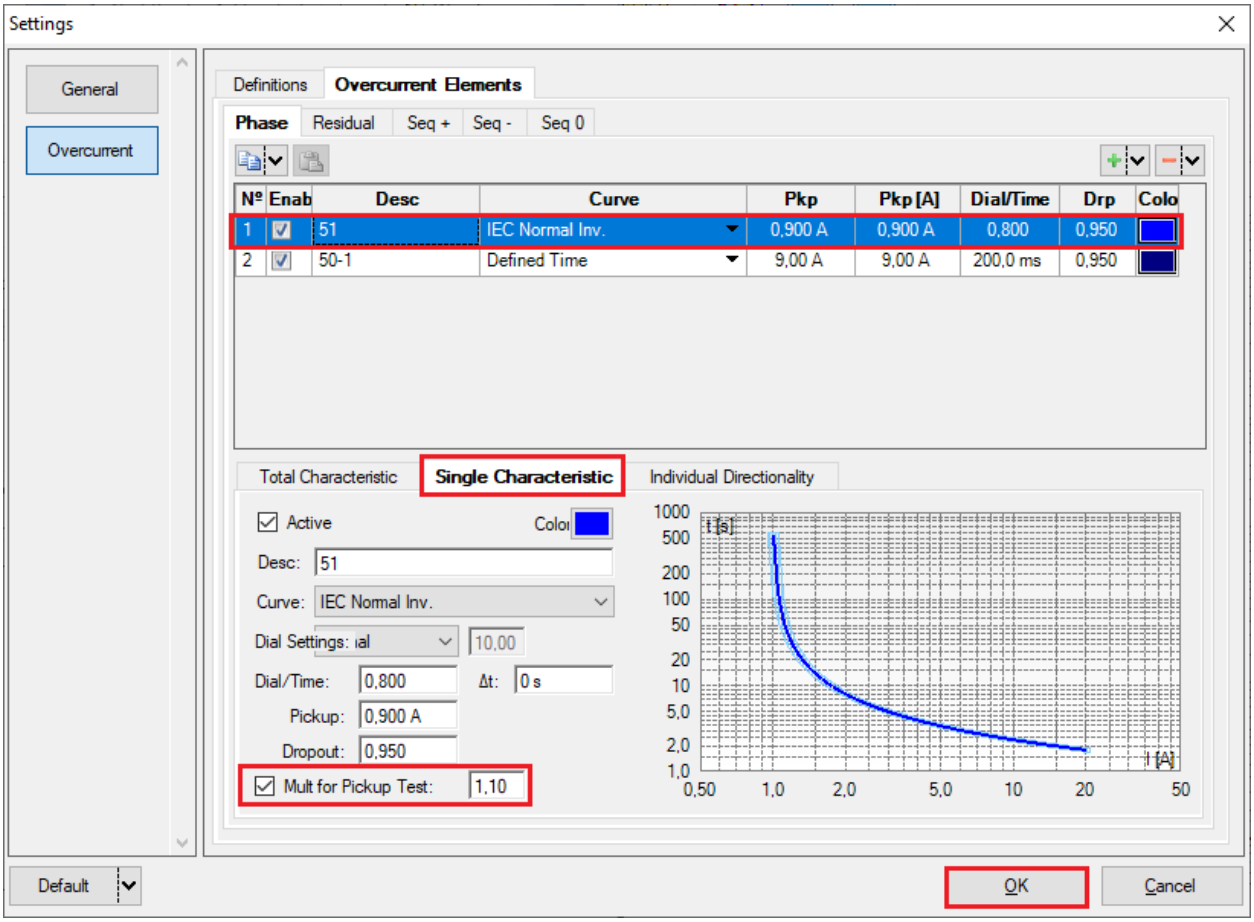

Figure 30

6. Channel Targeting and Hardware Configurations

Click on the icon illustrated below.

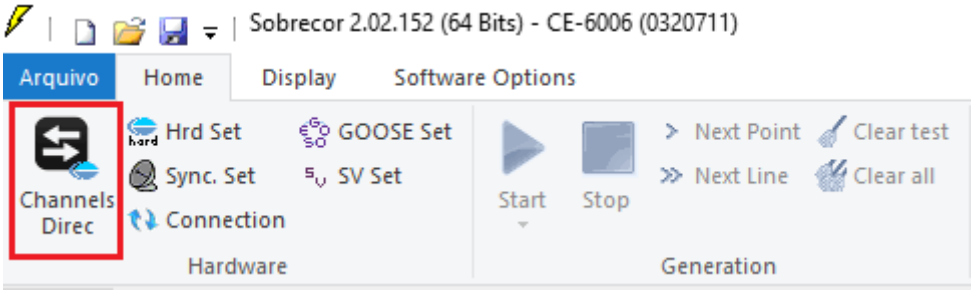

Figure 31

Then click on the highlighted icon to configure the hardware.

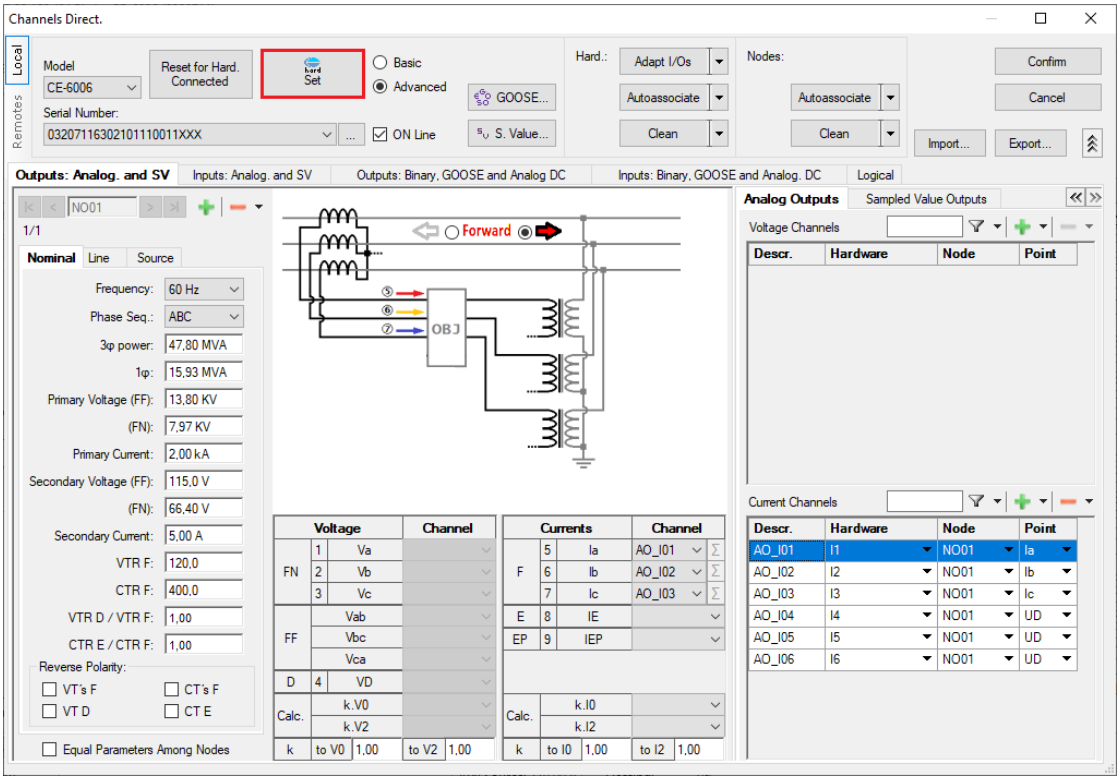

Figure 32

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

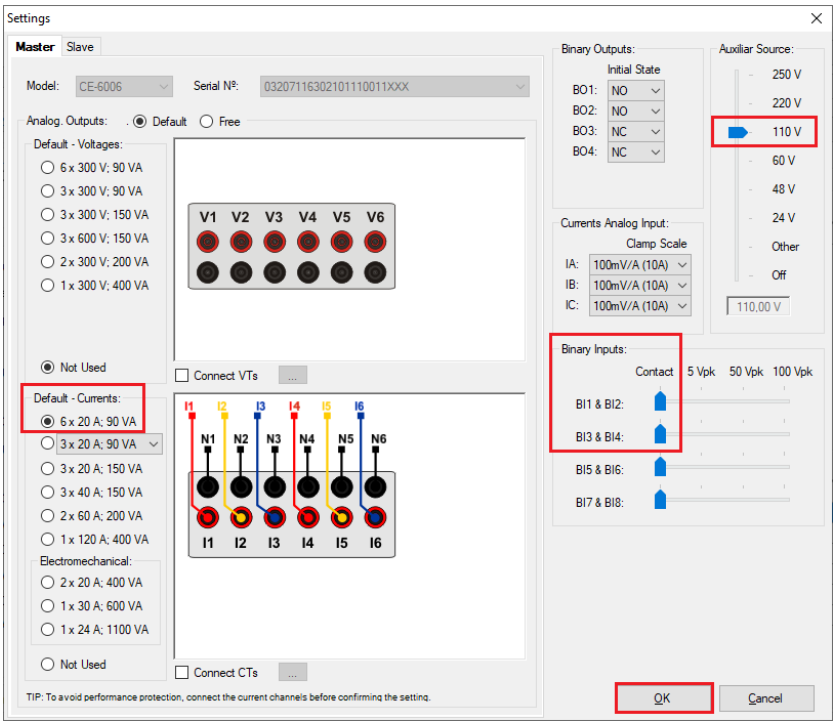

Figure 33

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

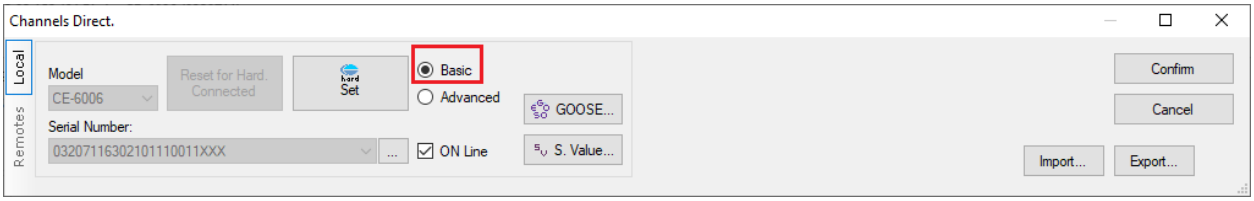

Figure 34

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.

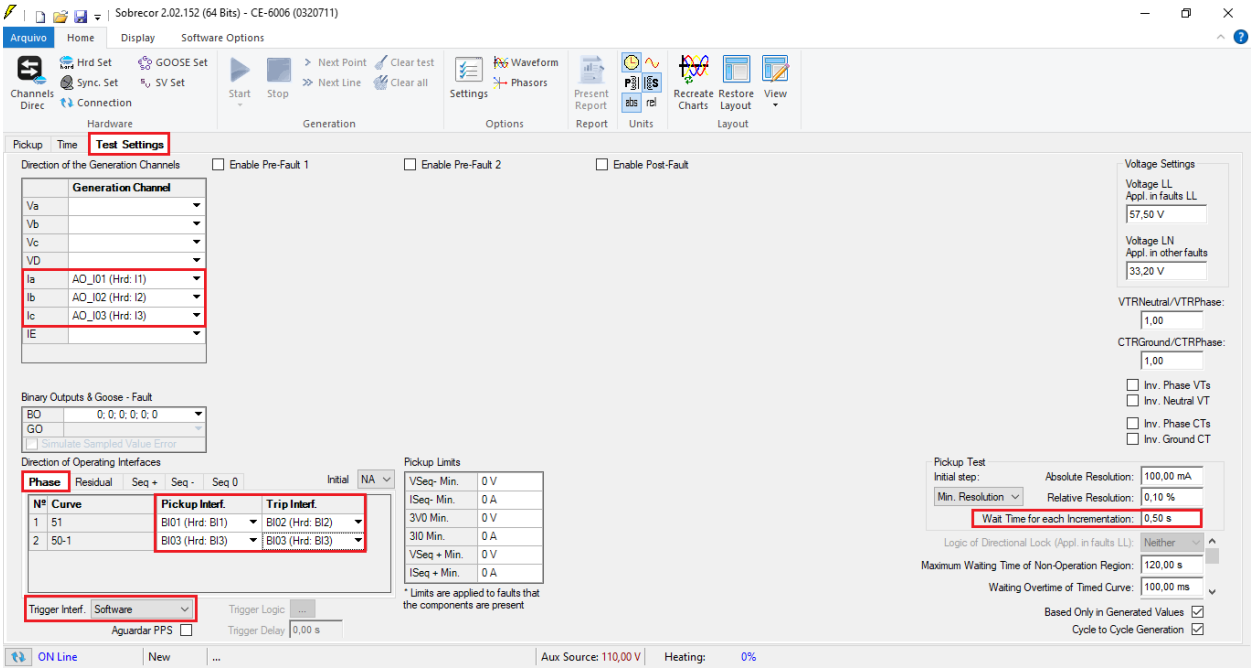

Figure 35

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.

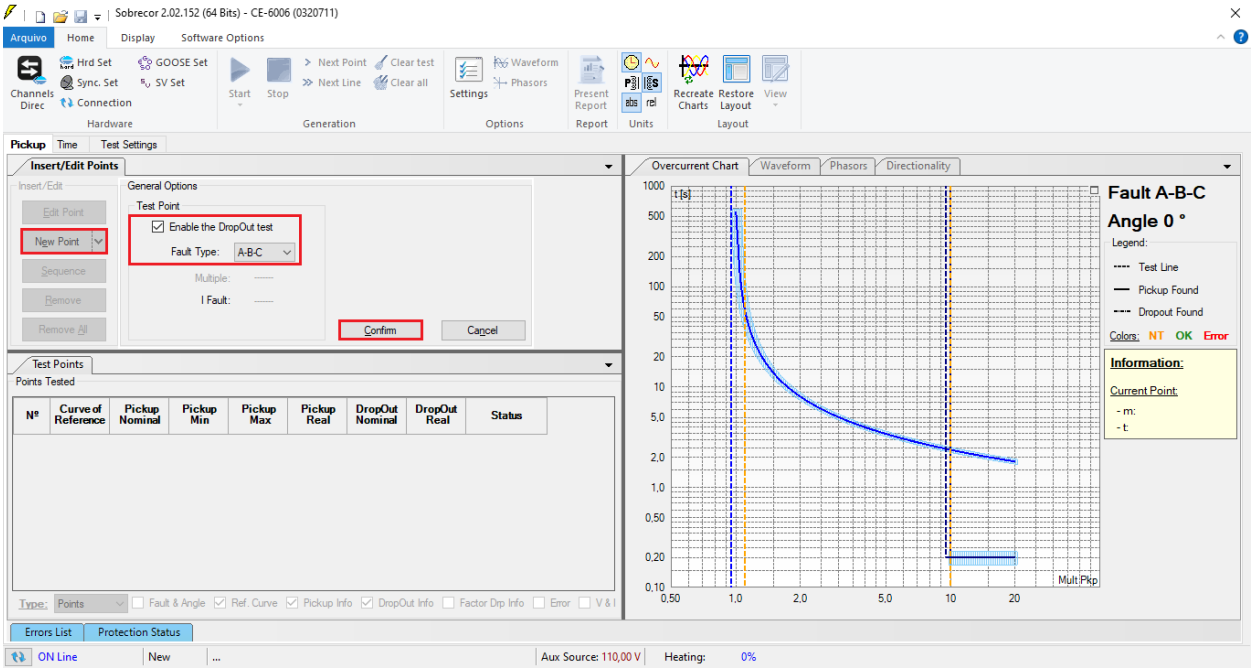

Figure 36

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

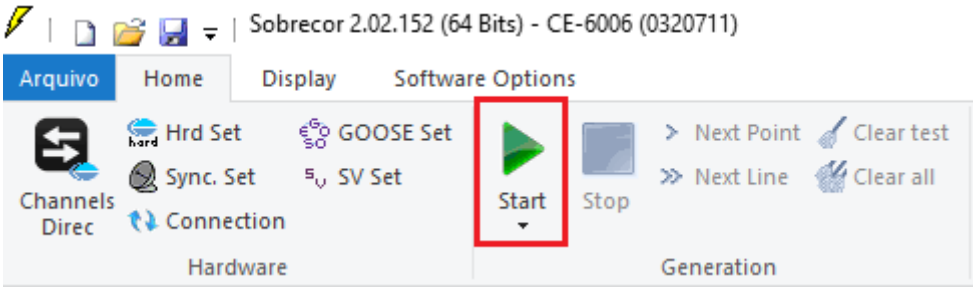

Figure 37

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.

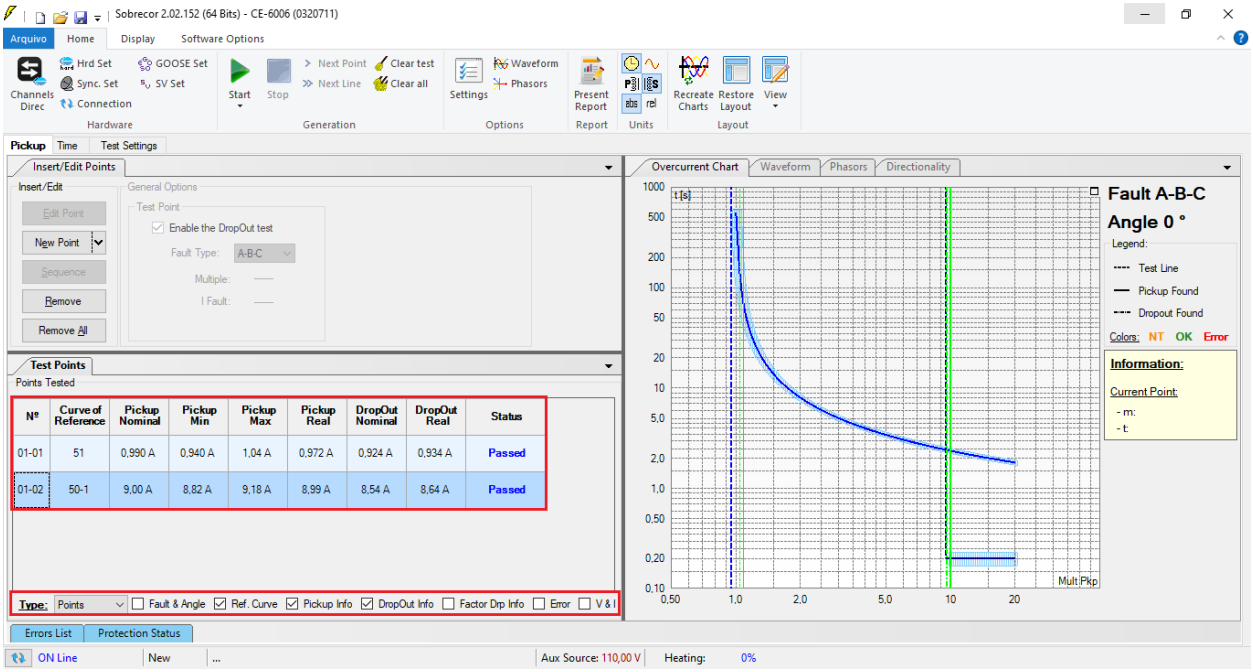

Figure 38

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 9,00A (one time for each element). For convenience, a sequence of current values will be inserted for time evaluation. It was chosen value 1,80A as the initial value, 18,00A final value and the 2,00A as increment step and the fault ABC.

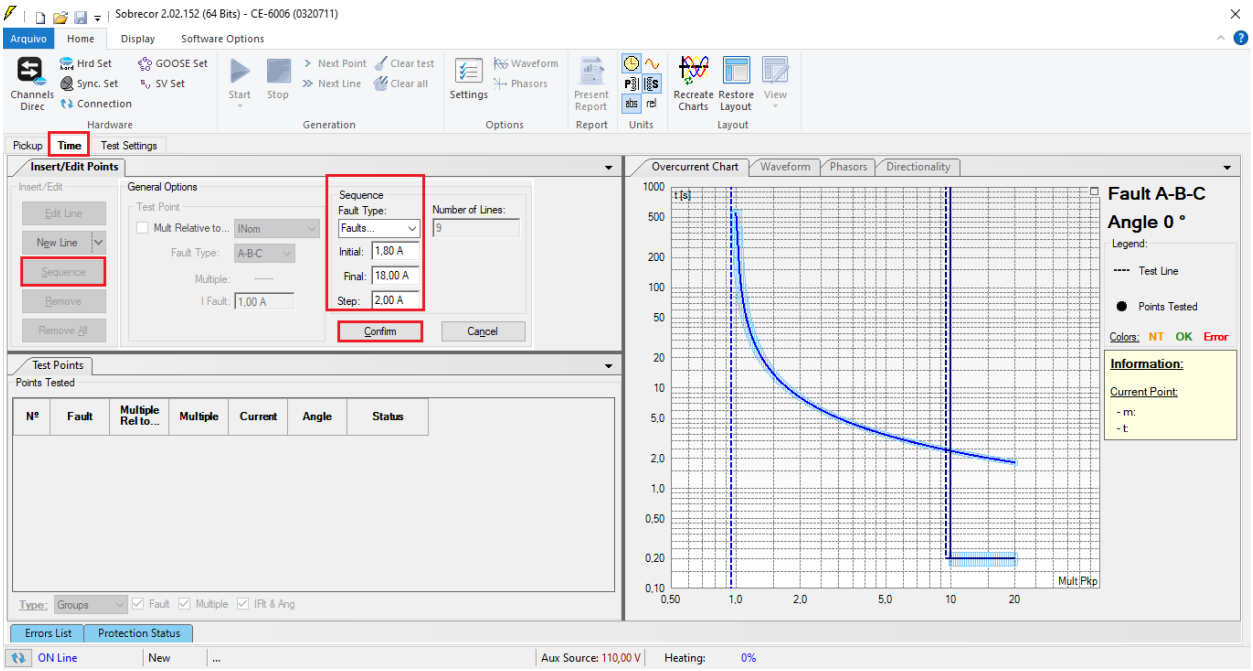

Figure 39

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

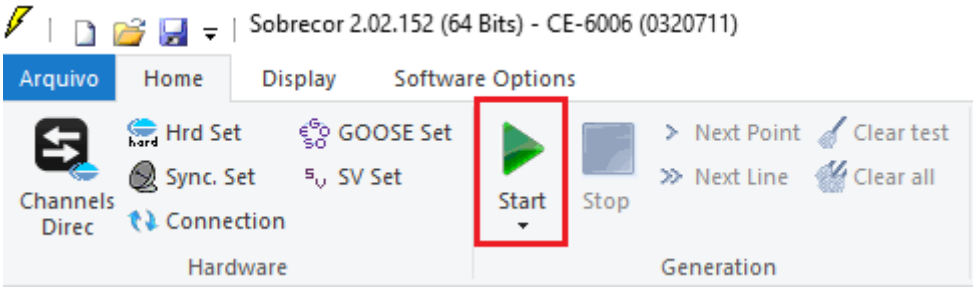

Figure 40

7.5 *Final Result of the Time Test*

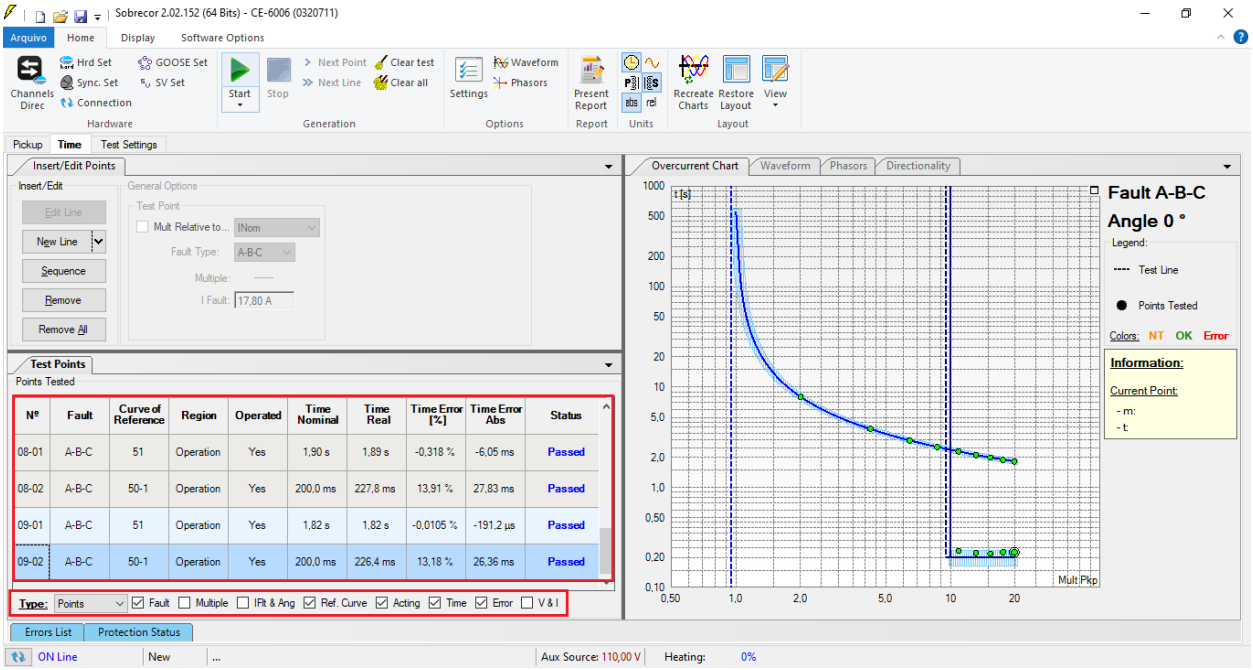

Figure 41

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.

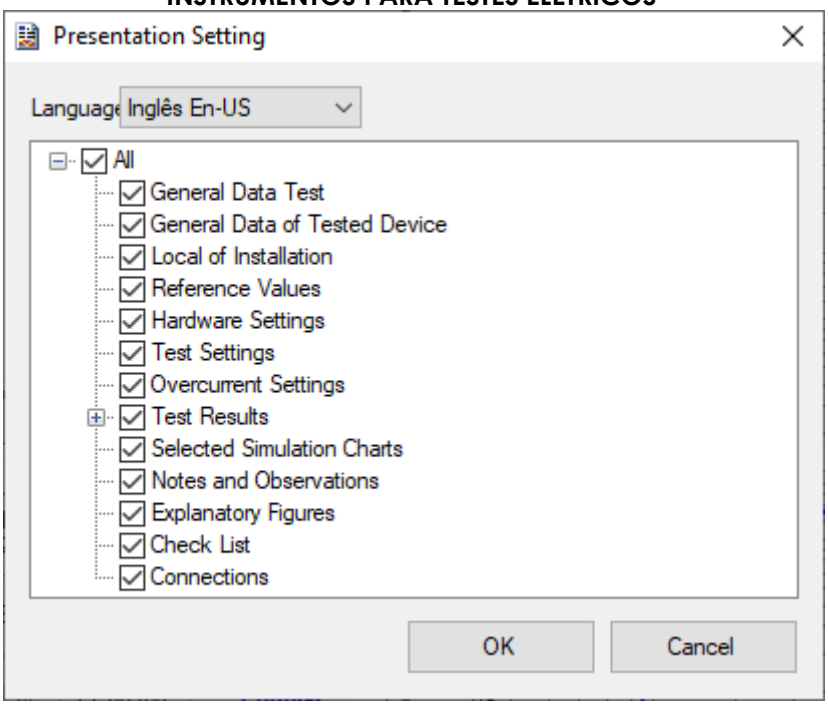

Figure 42

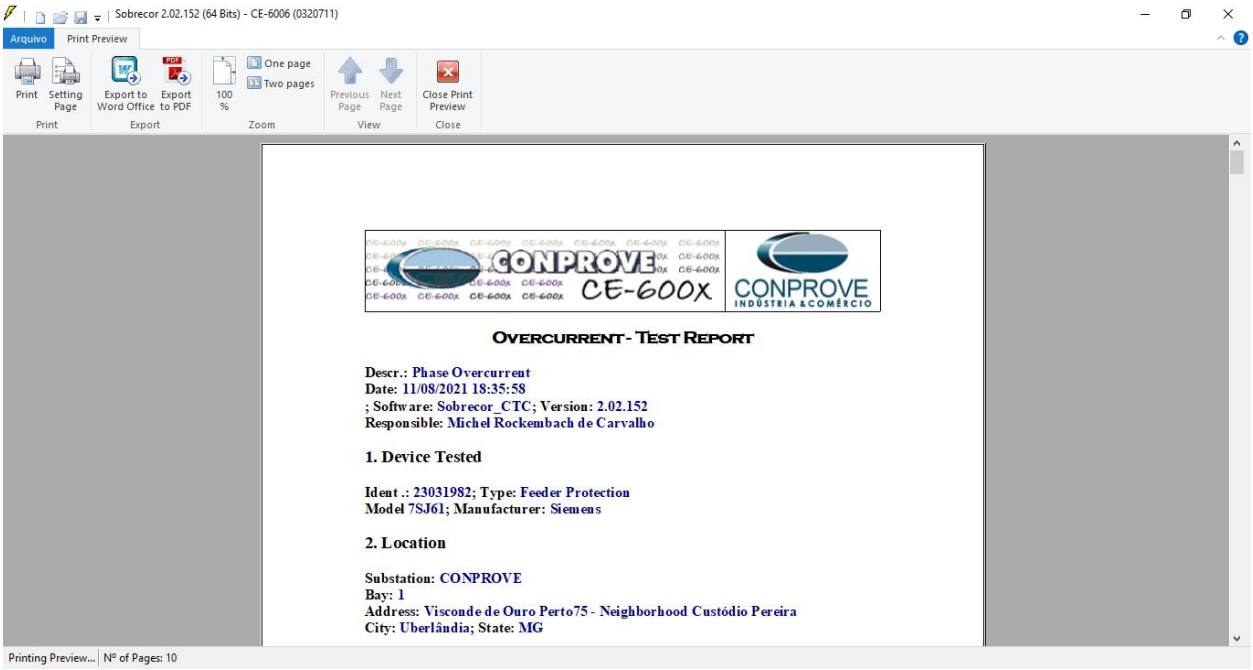

Figure 43

APPENDIX A

A.1 Terminal Designations

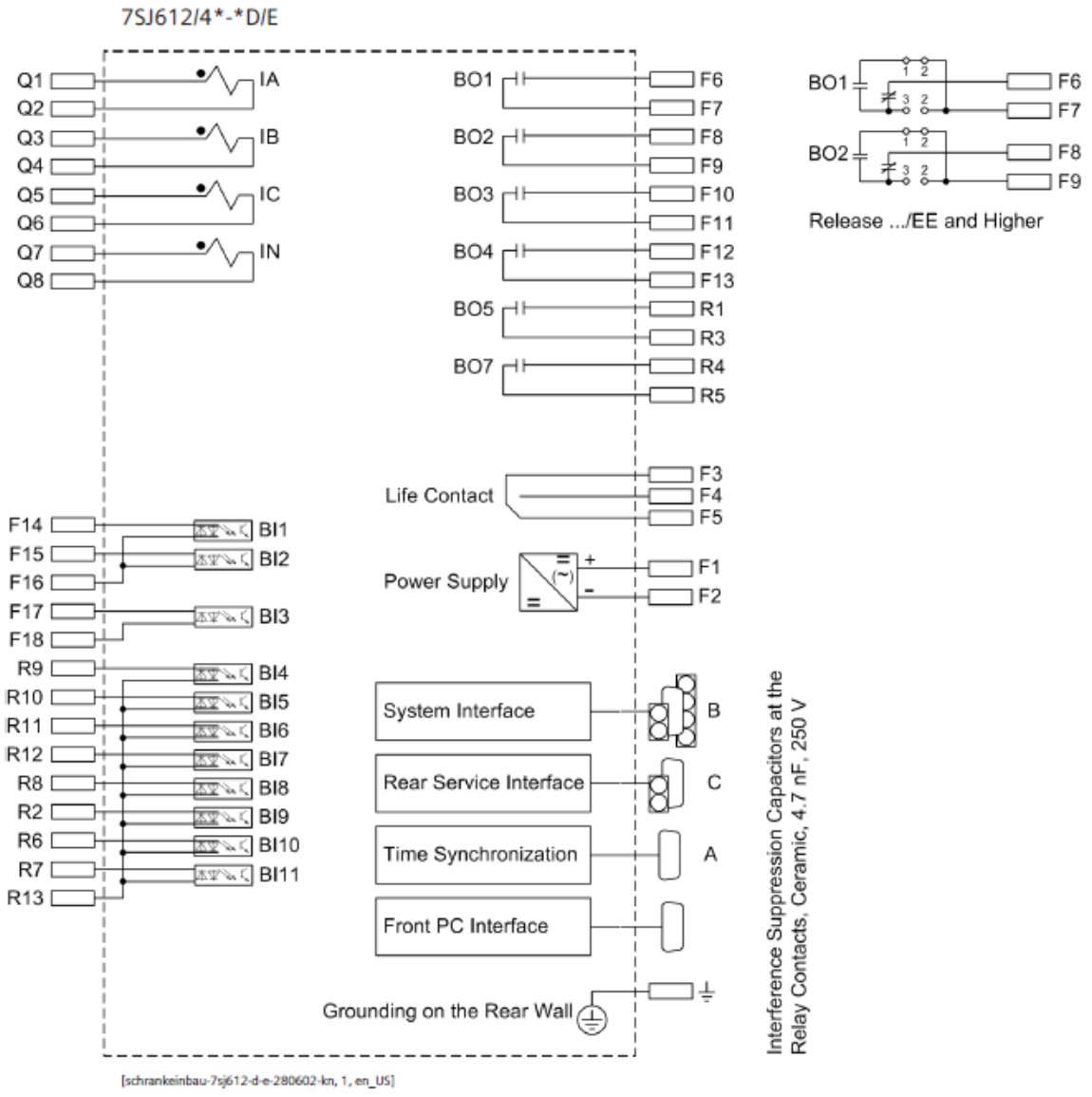

Figure B-3 Connection diagram for 7SJ612/4*–*D/E (panel flush mounted or cubicle mounted)

Double commands cannot be directly allocated to BO5 / BO7. If these outputs are used for issuing a double command, it has to be divided into two single commands via CFC.

Figure 44

A.2 Technical data

Trip Time Curves acc. to IEC

Acc. to IEC 60255-3 or BS 142, Section 3.5.2 (see also *Figure 4-1* and *Figure 4-2*)	
INVERSE (Type A)	$t = \frac{0.14}{(I/I_p)^{0.02} - 1} \cdot T_p$ [s]
VERY INVERSE (Type B)	$t = \frac{13.5}{(I/I_p)^{1} - 1} \cdot T_p$ [s]
EXTREMELY INV. (Type C)	$t = \frac{80}{(I/I_p)^{2} - 1} \cdot T_p$ [s]
LONG INVERSE (Type B)	$t = \frac{120}{(I/I_p)^{1} - 1} \cdot T_p$ [s]
Where: t Trip time in seconds T_p Setting Value of the Time Multiplier I Fault Current I_p Setting Value of the Pickup Current	
The tripping times for $I/I_p \geq 20$ are identical with those for $I/I_p = 20$	
For zero sequence current, read 3I0p instead of I_p and T_{3I0p} instead of T_p for ground fault, read I_{Ep} instead of I_p and T_{IEp} instead of T_p	
Pickup threshold	approx. 1.10 · I_p

Dropout Setting

IEC without Disk Emulation	approx. 1.05 · setting value I_p for $I_p/I_N \geq 0.3$, this corresponds to approx. 0.95 · pickup value

Tolerances

Pickup/dropout thresholds I_p, I_{Ep}	2% of setting value or 10 mA for I_{Nom} = 1 A or 50 mA for I_{Nom} = 5 A
Trip time for $2 \leq I/I_p \leq 20$	5 % of reference (calculated) value + 2 % current tolerance, or 30 ms
Dropout time for$I/I_p \leq 0.90$	5 % of reference value + 2 %, or 30 ms

APPENDIX B

Equivalence of software parameters and the relay under test.

Table 1

Overcurrent Software		Siemens 7SJ61 Relay	
Parameters	**Figure**	**Parameter**	**Figure**
Frequency	26	Rated Frequency	12
51			
Pkp	29	51 Pickup	18
Dial / Time	29	51 Time Dial	18
Curve	29	51 IEC Curve	18
50-1			
Pkp	29	50-1 Pickup	17
Dial / Time	29	50-1 Time Delay	17