INSTRUMENTOS PARA TESTES ELÉTRICOS

Test Tutorial

Equipment Type: Protection Relay

Brand: GE

Model: D60

Functions: 21 or PDIS – Distance

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

Objective: Search and Point Test of Zones with MHO Characteristics

Version Control:

Version	Descriptions	Date	Author	Reviewer
1.0	Initial Version	15/09/2021	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 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

Rua Visconde de Ouro Preto, 77 - Bairro Custódio Pereira - Uberlândia – MG - CEP 38405-202.
Fone (34) 3218-6800 Fax (34) 3218-6810
Home Page: www.conprove.com.br - E-mail: conprove@conprove.com.br

Sequence for testing the D60 relay in the Distance software

1. Relay connection to CE-6006

1.1 *Auxiliary Source*

Connect the positive (red terminal) of the Vdc Aux. Source to pin B5b of the relay and the negative (black terminal) of the Vdc Aux. Source to pin B6a of the relay.

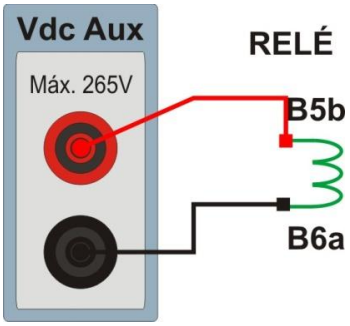


Figura 1

1.2 *Current and Voltage Coils*

To establish the voltage coil connection, connect the V1, V2 and V3 voltage channels to the relay pins F5a, F6a and F7a and connect the common voltage channels to the relay pins F5b, F6b and F7b: Connect the I1, I2 and I3 current channels of CE-6006 to pins F1a, F2a and F3a of the relay respectively, connect the three commons of CE-6006 to pins F1b, F2b and F3b for relay completing a connection.

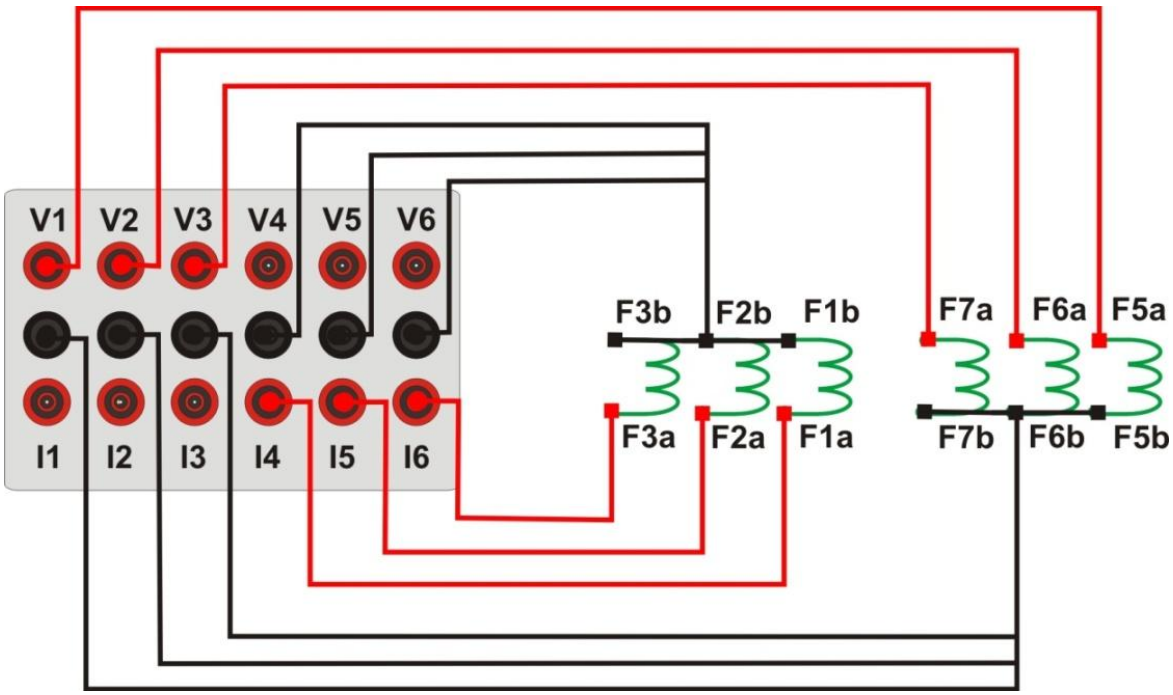


Figure 2

1.3 *Binary Inputs*

Connect the binary input of the CE-6006 to the binary output relay.

- BI1 to pin P1b and its common to pin P1c.
- BI2 to pin P2b and its common to pin P2c.

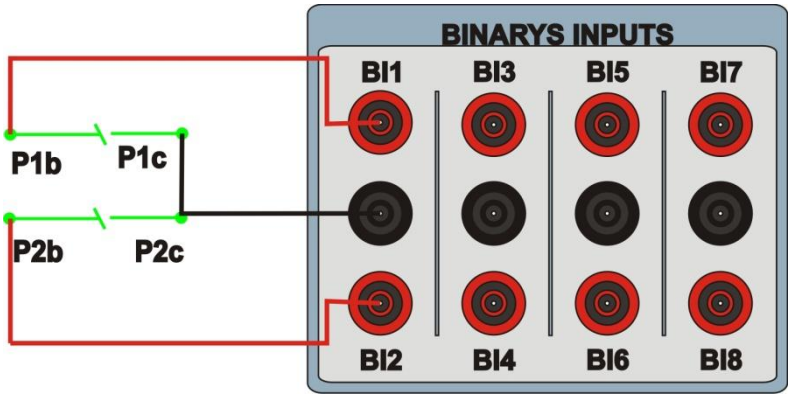


Figure 3

2. Communication with D60 relay

Before starting the D60 relay test, open the *"EnerVista"* software and download the UR series software, if you already have, click directly on:

Figure 4

Check the relay IP and set this value in *"Device Setup"* after inserting a new system. Then read the relay code by clicking *"Read Order Code"* and finish by clicking *"OK"*.

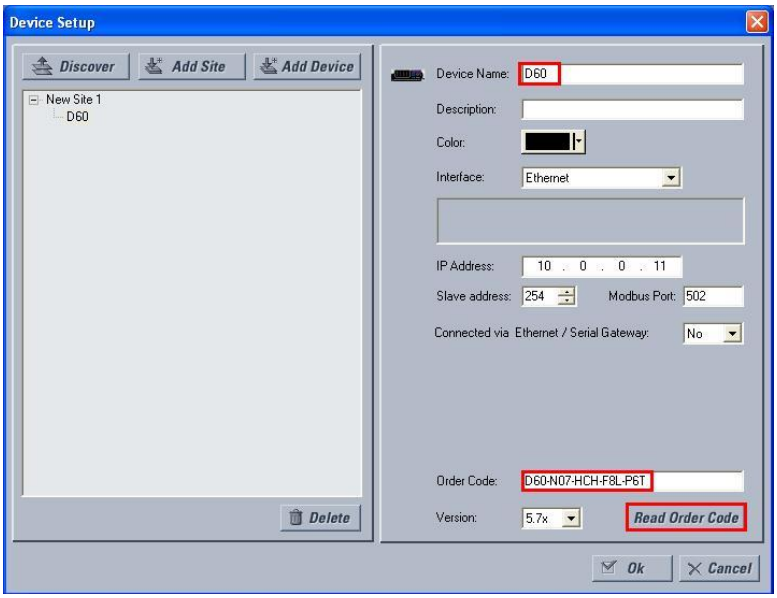


Figure 5

Then click on *"New Site 1"* and on *"D60"* to access the relay configuration and close the *"Offline Window"* by clicking on the button highlighted in green.

Figure 6

3. Parameterization of the D60 relay

3.1 *Current*

After the connection has been established, click on the *"+"* signs near *"Settings > System Setup > AC Input"* and double-click on *"Current"*, in it adjust the primary and secondary current values of the current transformer.

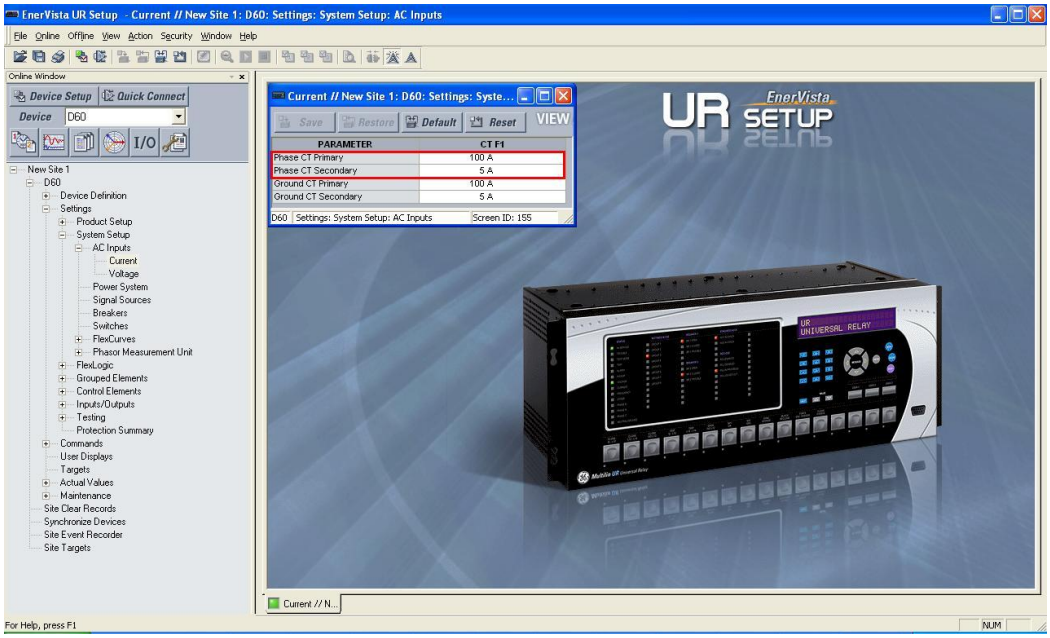


Figure 7

3.2 *Voltage*

Click on *"Voltage"* and adjust the primary and secondary voltage values of the potential transformer.

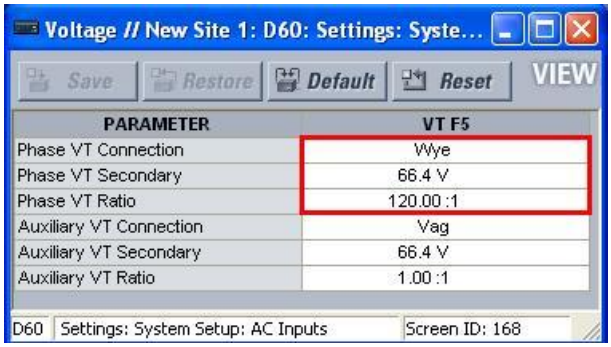


Figure 8

3.3 *Power system*

In this field, the nominal frequency, the phase sequence and the side used as reference are set.

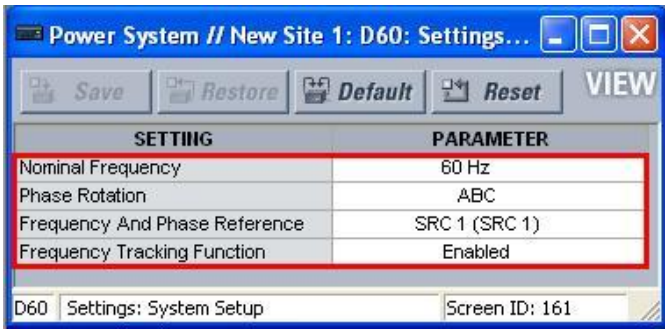


Figure 9

3.4 *Signal Source*

Set the current transformer as *"F1"* and the voltage transformer as *"F5"* in *"Source 1"*.

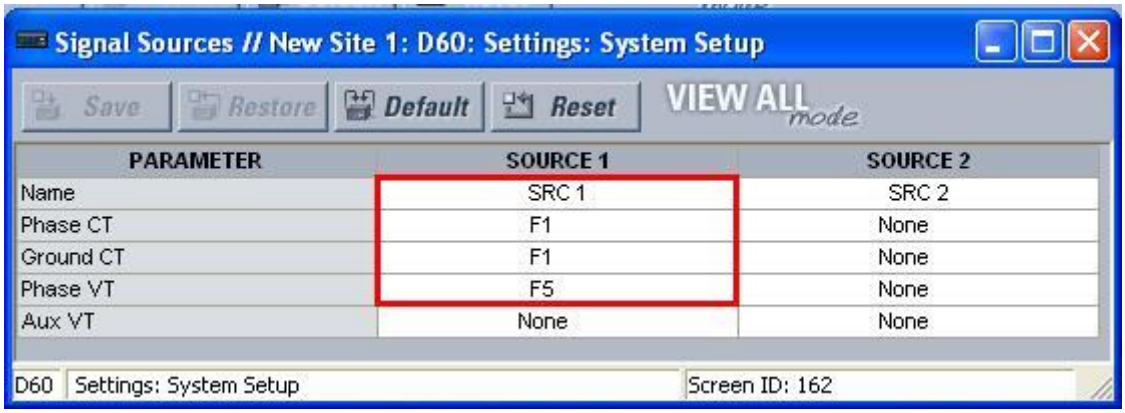


Figure 10

3.5 *Distance*

Click on the *"+"* sign near to *"Grouped Elements > Group1 > Distance"* and double-click on *"Distance"*. In this option the *"Source"* is defined with *"SRC1"*.

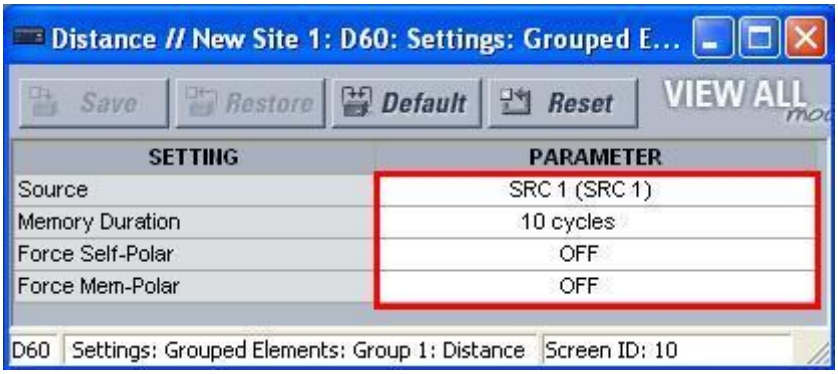


Figure 11

3.6 *Phase Distance*

Click on the *"+"* sign near to *"Grouped Elements > Group1 > Distance"* and double-click on *"Phase Distance"*. This option defines the zone settings, directionality and operating time of the phase elements.

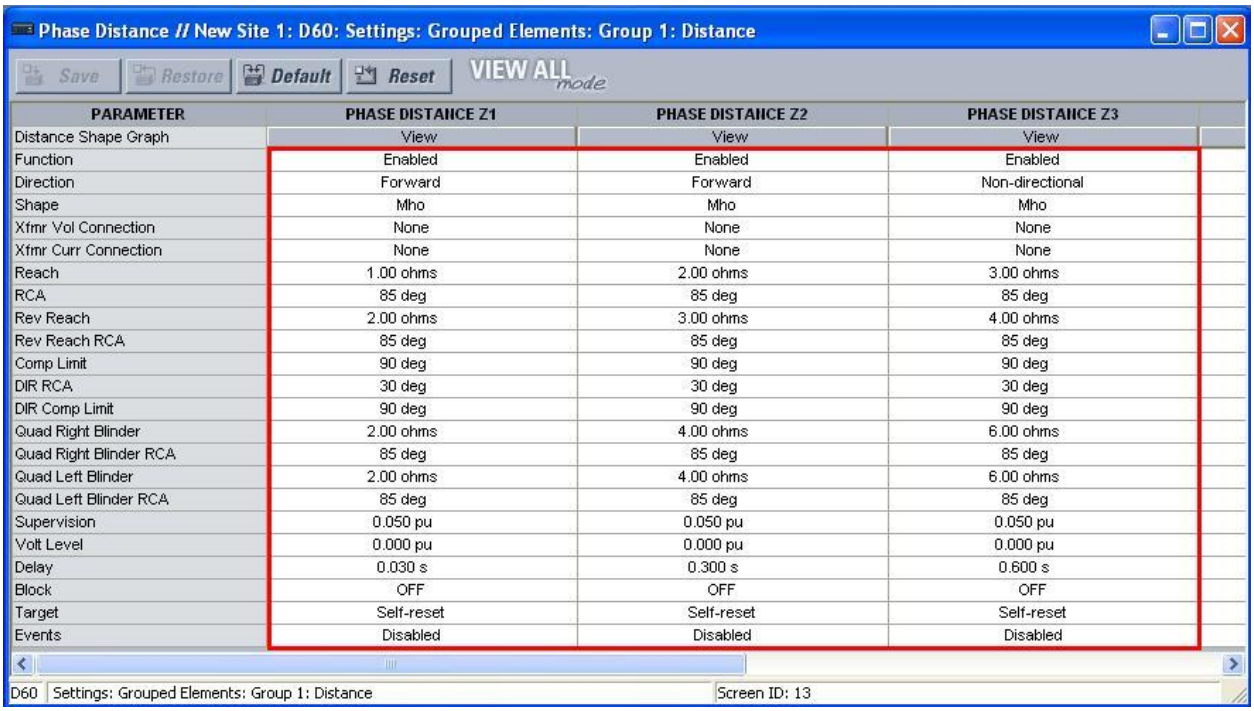


Figure 12

3.7 *Ground Distance*

Click on the *"+"* sign near to *"Grouped Elements > Group1 > Distance"* and double-click on *"Ground Distance"*. In this option the zone, directionality and operating time settings of the ground elements.

Ground Distance // New Site 1: D60: Settings: Grouped Elements: Group 1: Distance

Save | Restore | Default | Reset | VIEW ALL mode

PARAMETER	GROUND DISTANCE Z1	GROUND DISTANCE Z2	GROUND DISTANCE Z3
Distance Shape Graph	View	View	View
Function	Enabled	Enabled	Enabled
Direction	Forward	Forward	Non-directional
Shape	Mho	Mho	Mho
Z0/Z1 Mag	2.70	2.70	2.70
Z0/Z1 Ang	0 deg	0 deg	0 deg
Z0M Z1 Mag	0.00	0.00	0.00
Z0M Z1 Ang	0 deg	0 deg	0 deg
Reach	2.00 ohms	3.00 ohms	4.00 ohms
RCA	85 deg	85 deg	85 deg
Rev Reach	2.00 ohms	3.00 ohms	4.00 ohms
Rev Reach RCA	85 deg	85 deg	85 deg
POL Current	Zero-seq	Zero-seq	Zero-seq
Non-Homogen Ang	0.0 deg	0.0 deg	0.0 deg
Comp Limit	90 deg	90 deg	90 deg
DIR RCA	30 deg	30 deg	30 deg
DIR Comp Limit	90 deg	90 deg	90 deg
Quad Right Blinder	10.00 ohms	10.00 ohms	10.00 ohms
Quad Right Blinder RCA	85 deg	85 deg	85 deg
Quad Left Blinder	10.00 ohms	10.00 ohms	10.00 ohms
Quad Left Blinder RCA	85 deg	85 deg	85 deg
Supervision	0.200 pu	0.200 pu	0.200 pu
Volt Level	0.000 pu	0.000 pu	0.000 pu
Delay	0.060 s	0.400 s	0.700 s
Block	OFF	OFF	OFF
Target	Self-reset	Self-reset	Self-reset
Events	Disabled	Disabled	Disabled

D60 | Settings: Grouped Elements: Group 1: Distance | Screen ID: 11

Figure 13

4. Binary Output Adjustments

4.1 *FlexLogic Equation Editor*

Click on the *"+"* sign near to *"FlexLogic"* and double-click on *"FlexLogic Equation Editor"*. On this screen, two logics are programmed. The first creates an *"OR"* logic between the phase distance elements associating to virtual output 1. The second is also an *"OR"* logic associating the ground distance elements to virtual output 2.

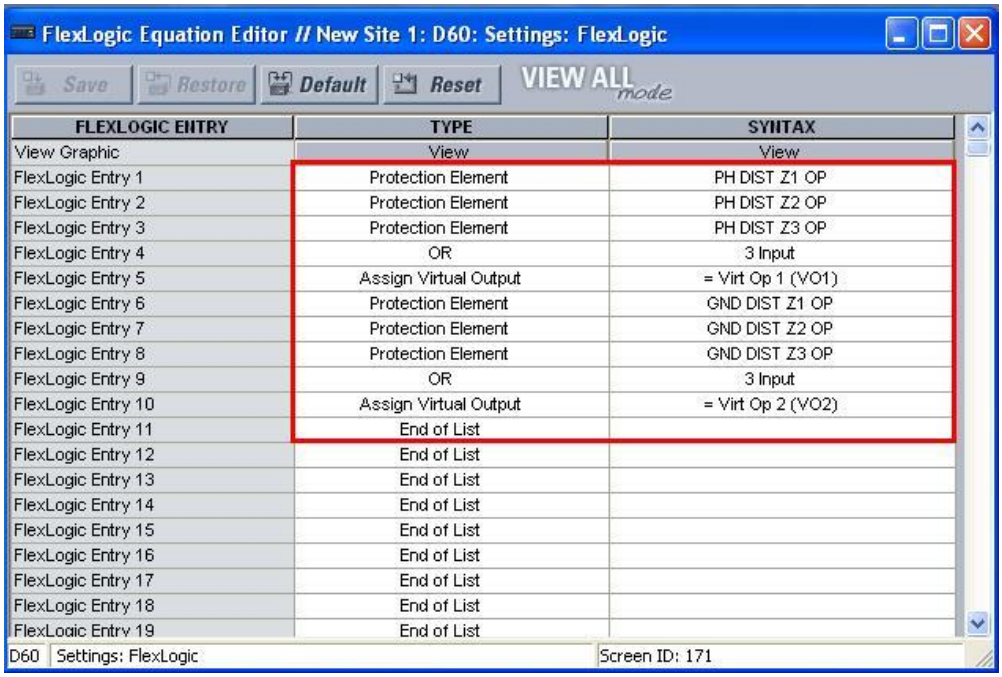


Figure 14

4.2 *Contact Outputs*

Click on the *"+"* sign near to *"Inputs/Outputs"* and double-click on *"Contact Outputs"*. In this screen, the trips of the virtual outputs are designated as the binary outputs of the relay.

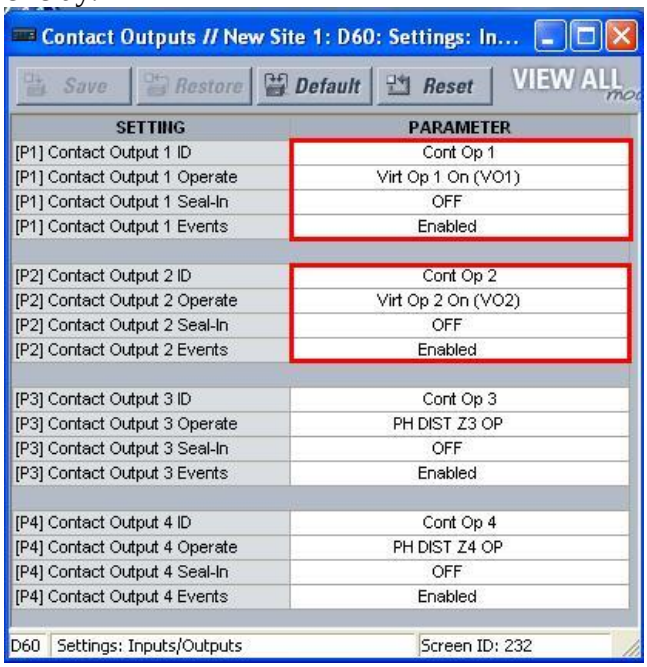


Figure 15

In Appendix B the user finds a table of equivalence between the software settings of the relay and the test set.

5. Distance software adjustments

5.1 *Opening the Distance*

Click on the CTC application manager icon.

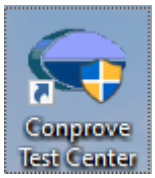


Figure 16

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

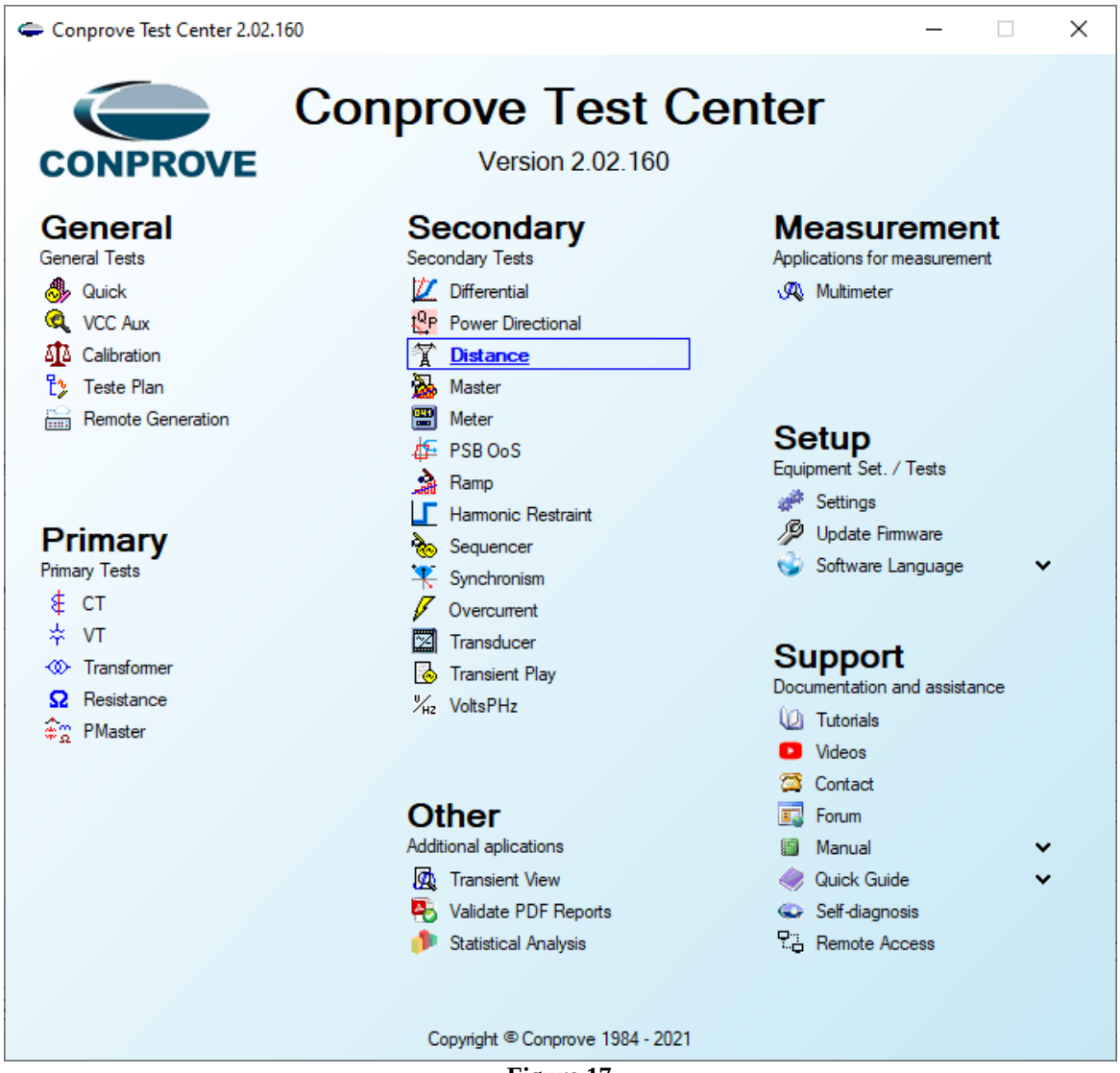


Figure 17

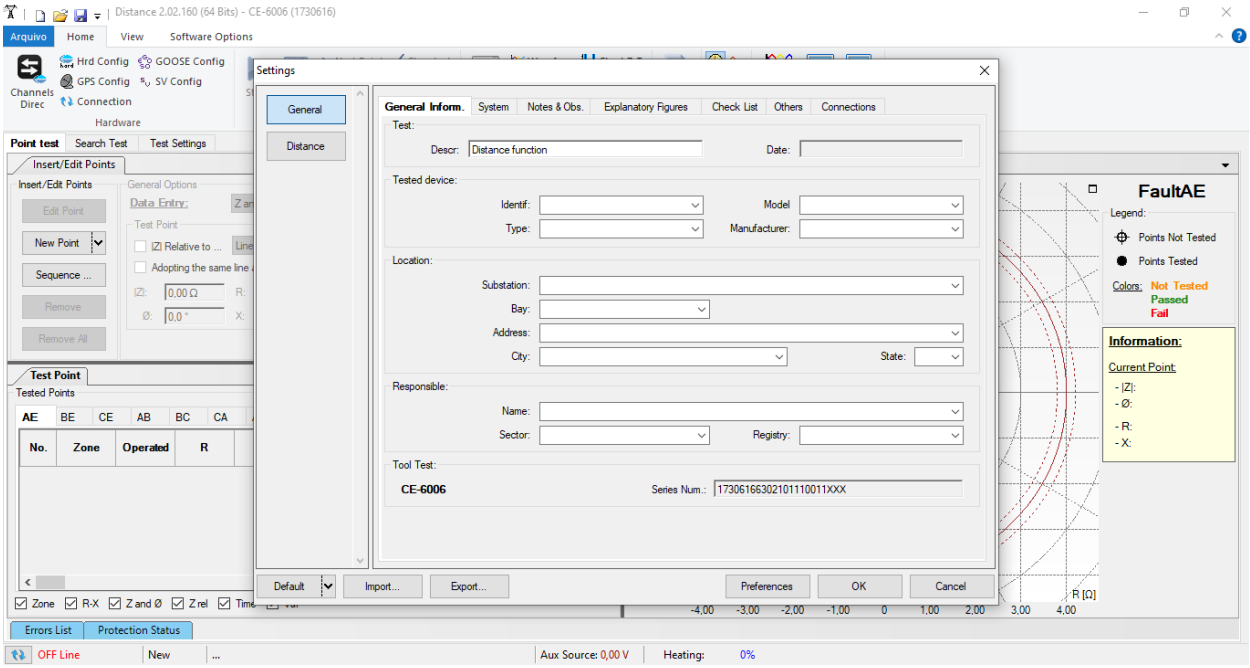


Figure 18

5.2 *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.

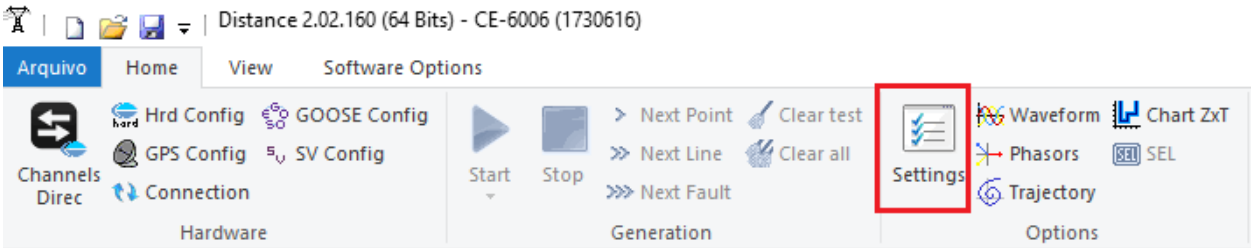


Figure 19

Inside the *"Settings"* screen, fill in the *"General Inform."* with details of the tested device, installation location and the person responsible. This facilitates the elaboration of the report as this tab will be the first to be shown.

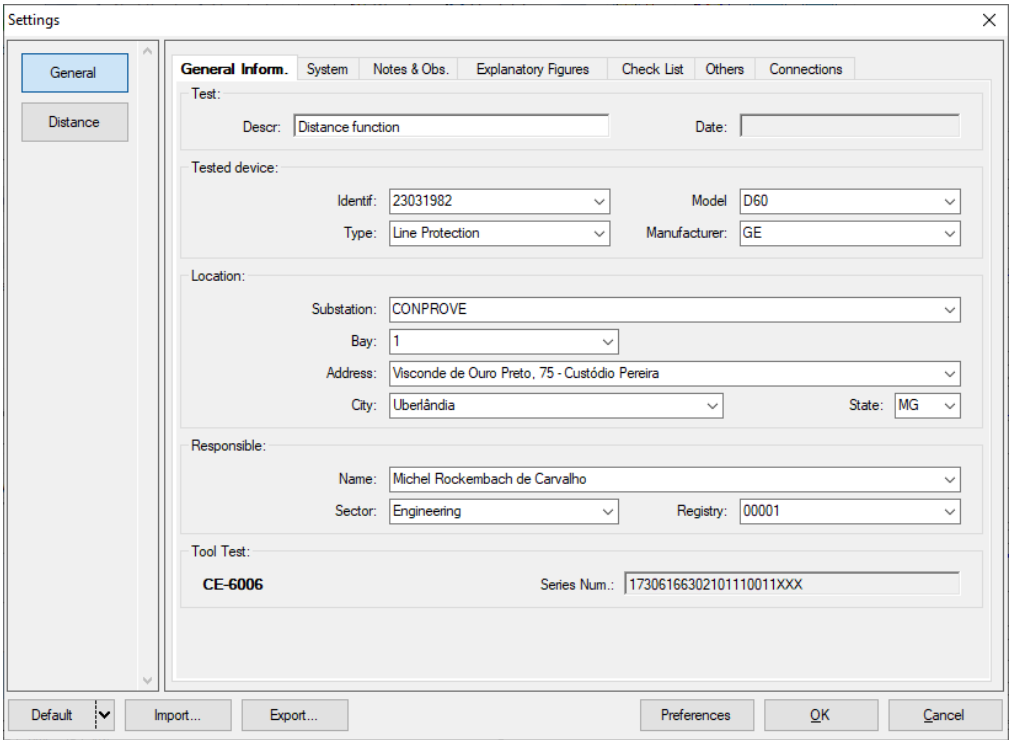


Figure 20

5.3 *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 is not relevant for this test.

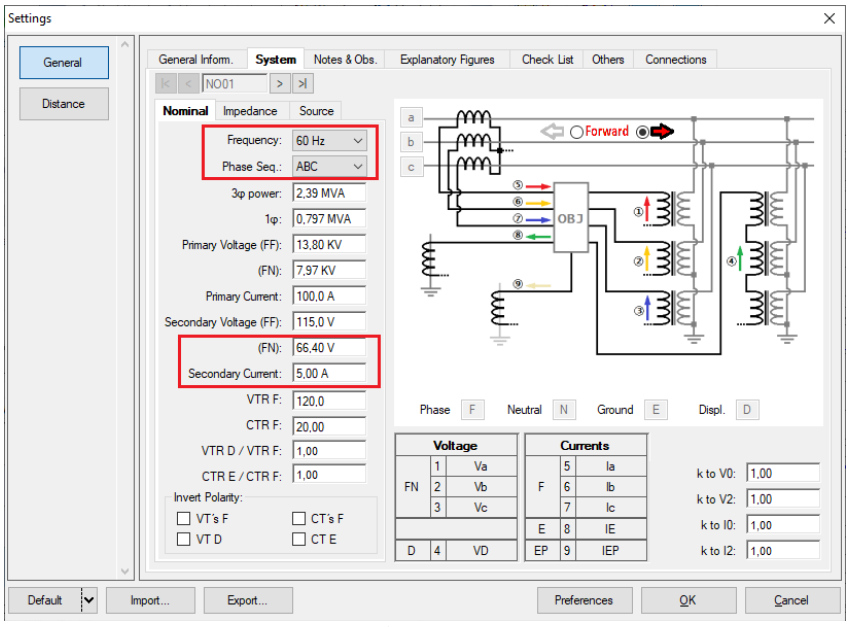


Figure 21

There are other tabs where the user can enter notes and observations, 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.

6. Distance Adjustments

Note: The GE D60 relay will be parameterized differently for phase-ground faults in relation to two-phase and three-phase faults. For the software to perform the test properly, 6 types of zones must be inserted, the first three for two-phase and three-phase faults and the last three for phase-ground faults.

6.1 *Distance Screen > Distance Prot. Settings*

The first step is to adjust the ground compensation factor.

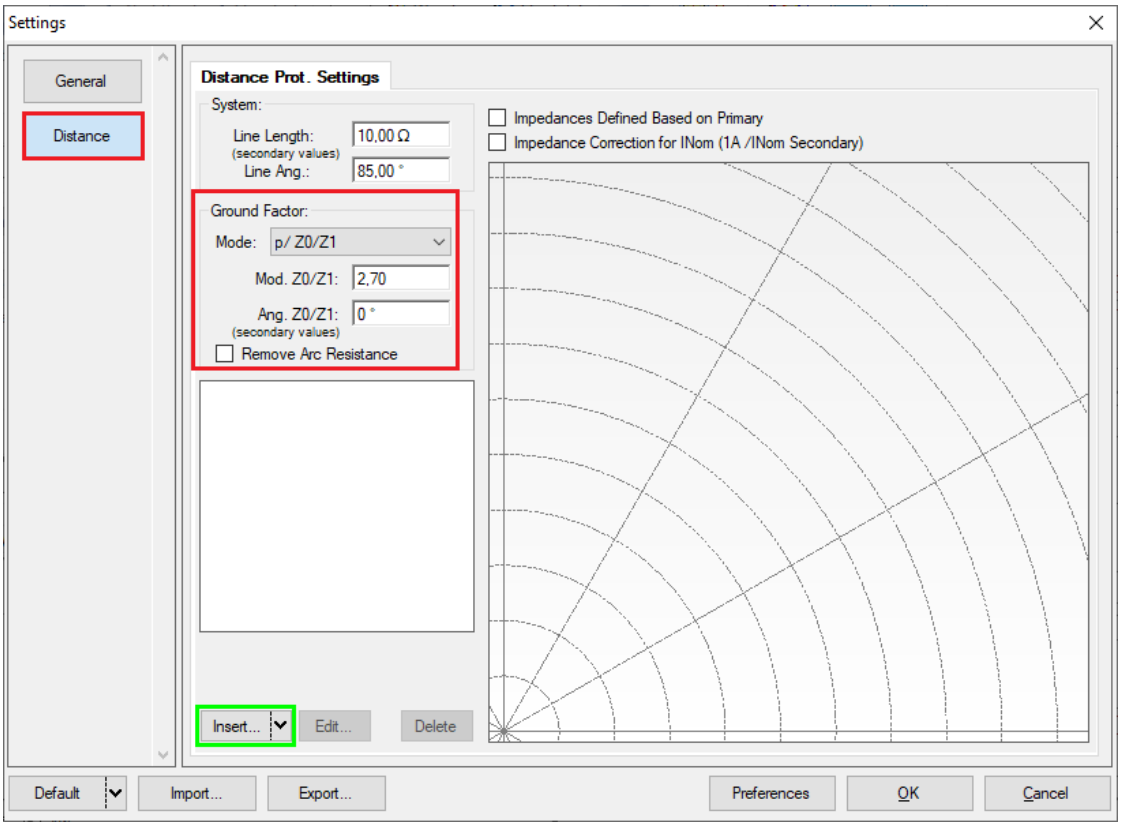


Figure 22

6.2 *Inserting Phase Zones*

The first zone to be entered will be zone-1 (Phase). Click on the *"Insert"* field highlighted in green in the previous figure. In the settings screen, first select the relay mask *"GE D60-Mho"*. You must adjust the actuation time, choose the type of fault (loop), and enter the zone characteristics and directionality. Adjust the tolerance values and finally click on *"OK"*.

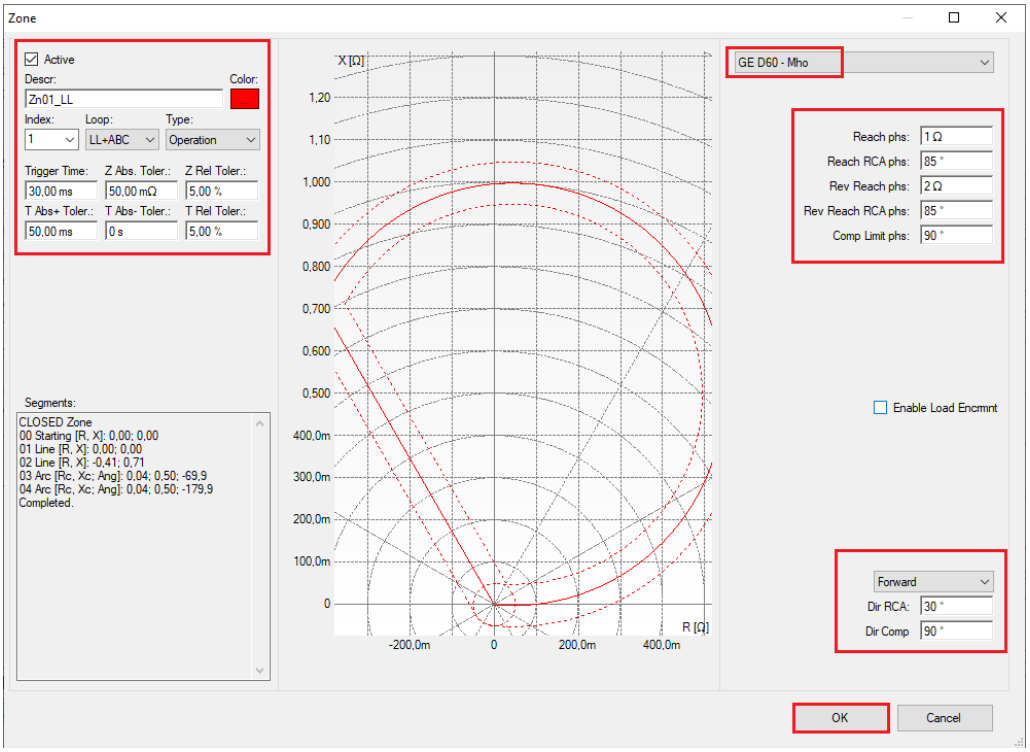


Figure 23

Clicking *"Insert"* again adjusts the values for zone 2.

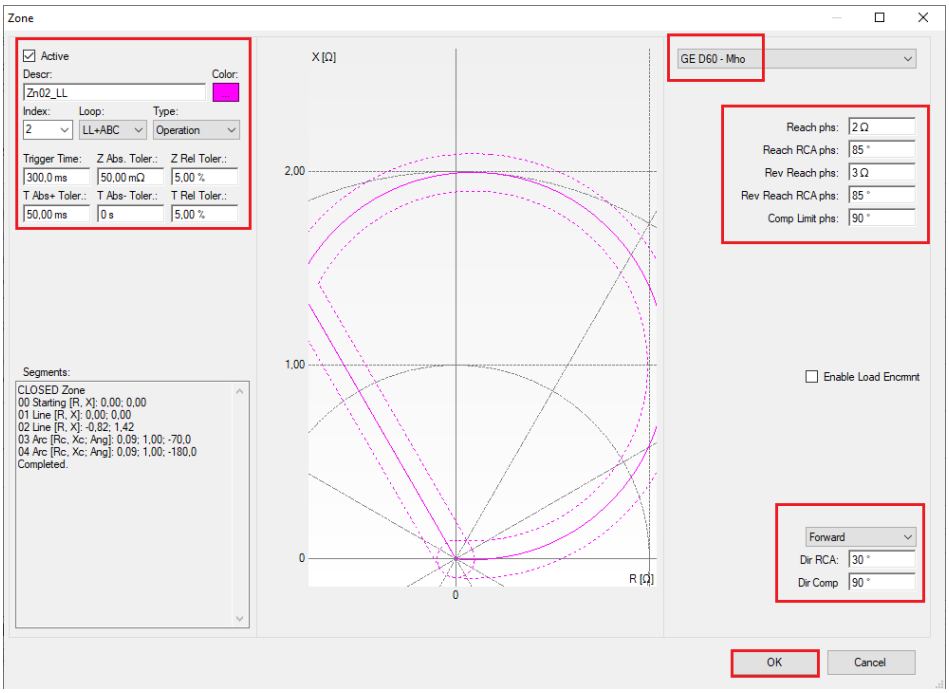


Figure 24

Clicking *"Insert"* again adjusts the values for zone 3.

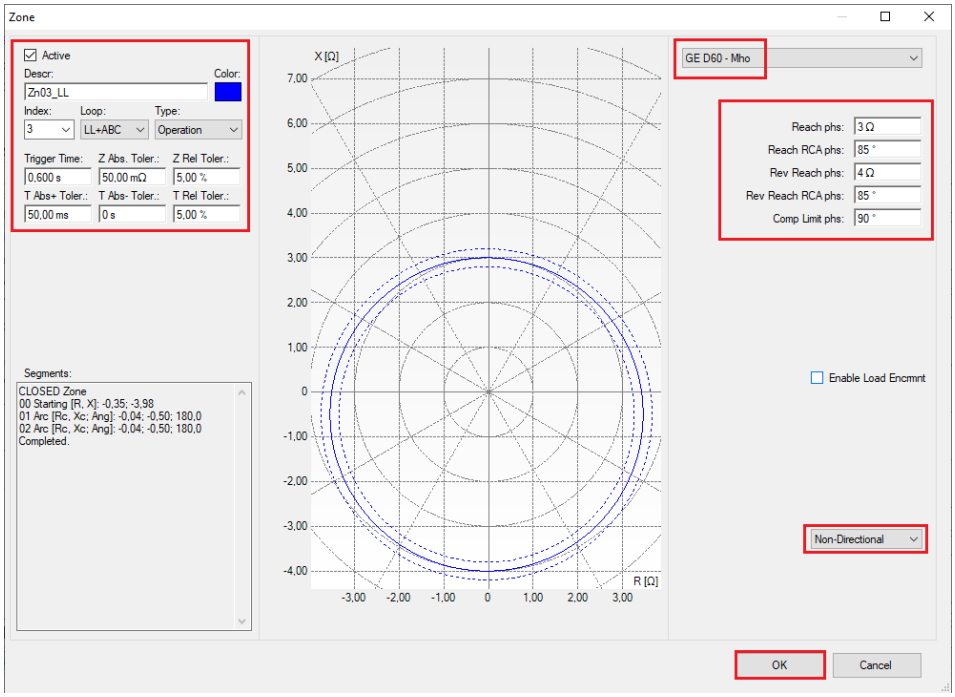


Figure 25

6.3 *Inserting Zones (Phase-Earth)*

Zone 4 entered in the software is equivalent to zone 1 phase-ground of the relay, zone 5 is equivalent to zone 2 phase-ground and zone 6 is equivalent to zone 3 phase-ground set in the relay. Change the name of each zone and make the following adjustments for each of the zones.

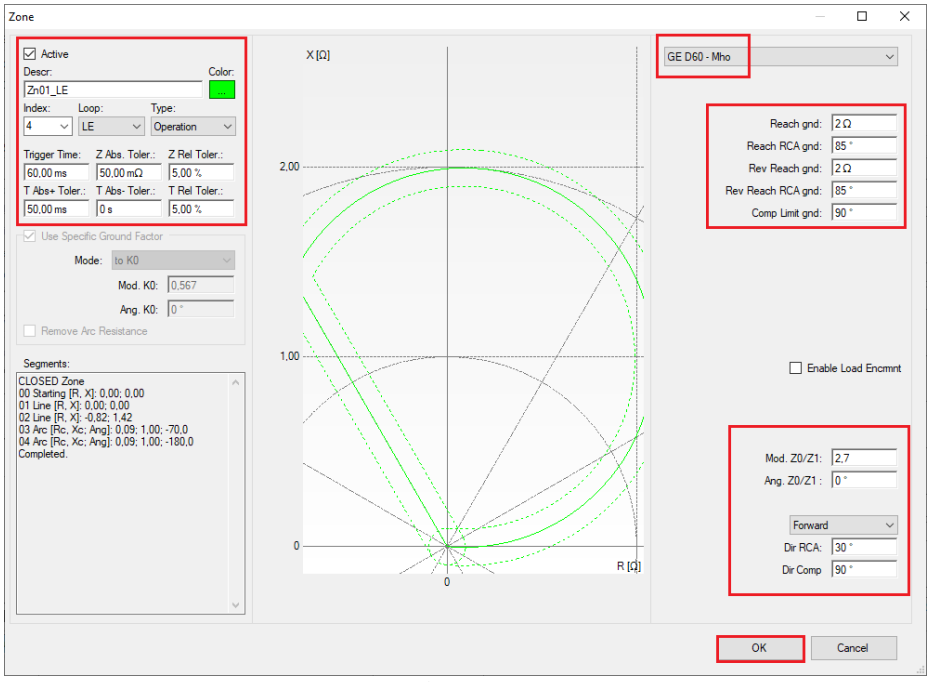


Figure 26

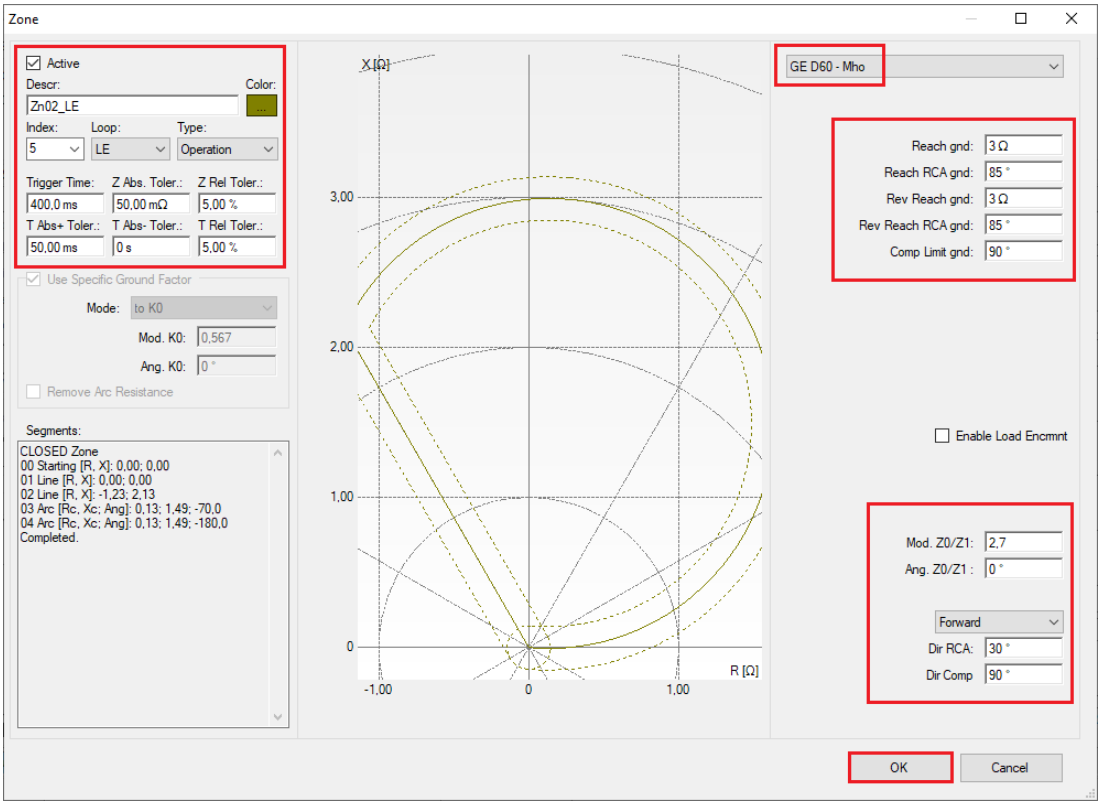


Figure 27

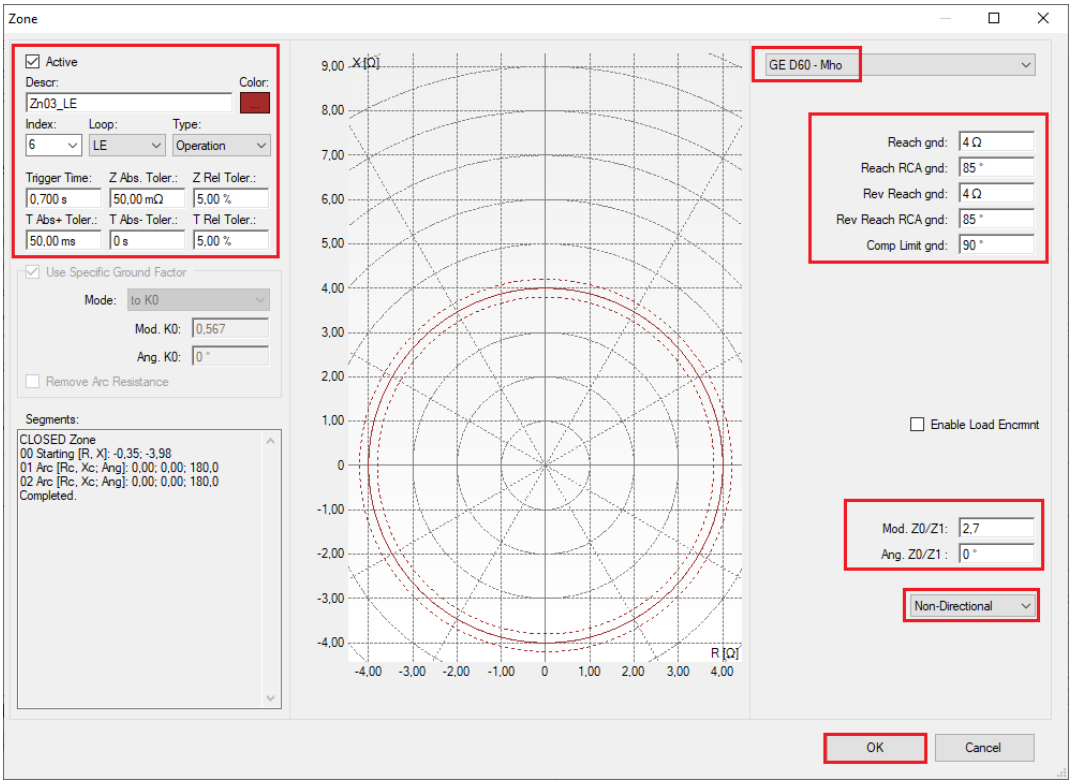


Figure 28

7. Channel Direction and Hardware Configurations

Click on the icon illustrated below.

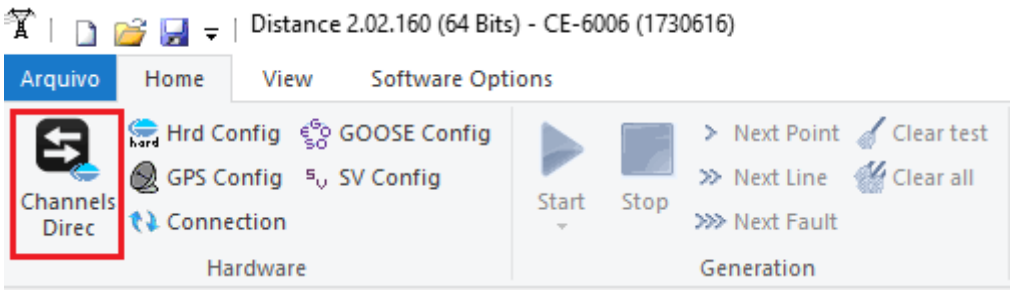


Figure 29

Then click on the highlighted icon to configure the hardware.

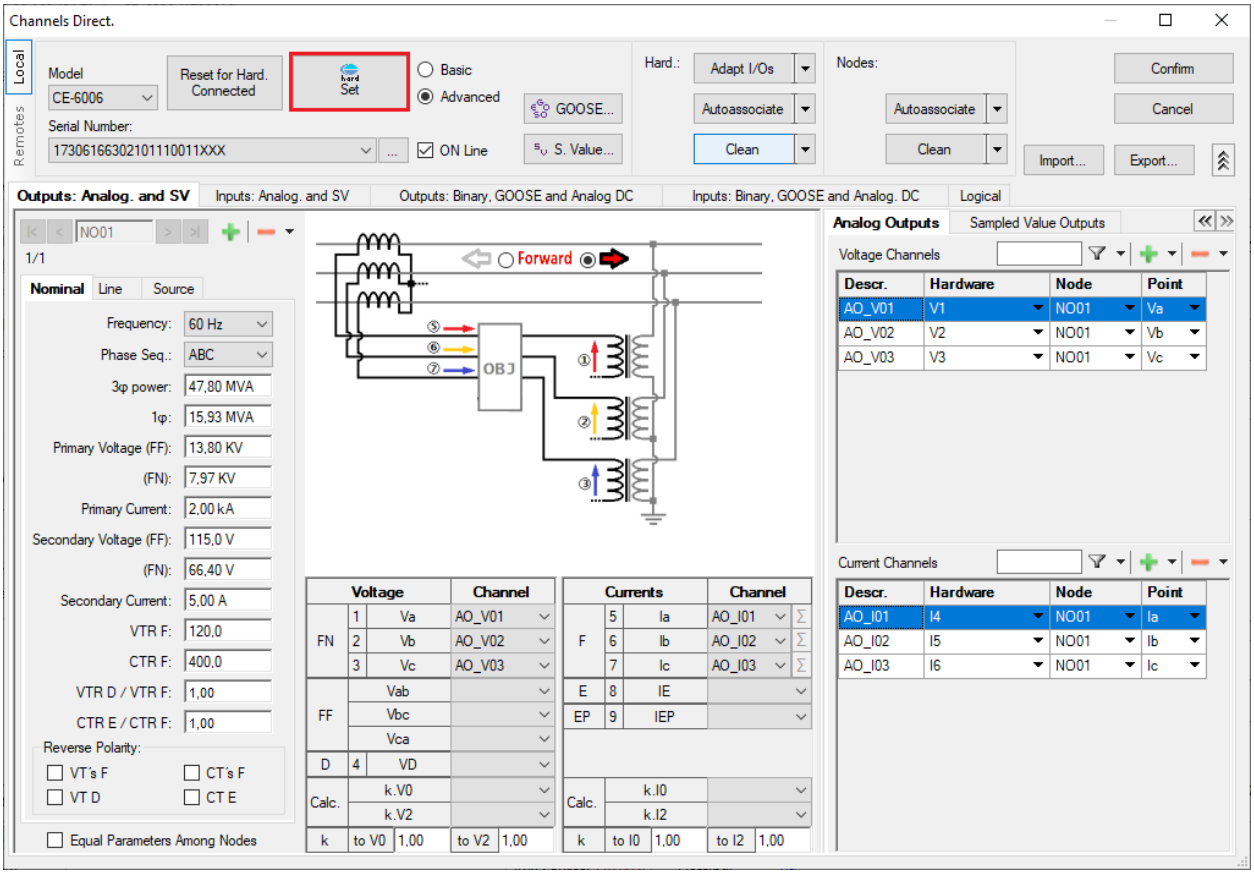


Figure 30

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

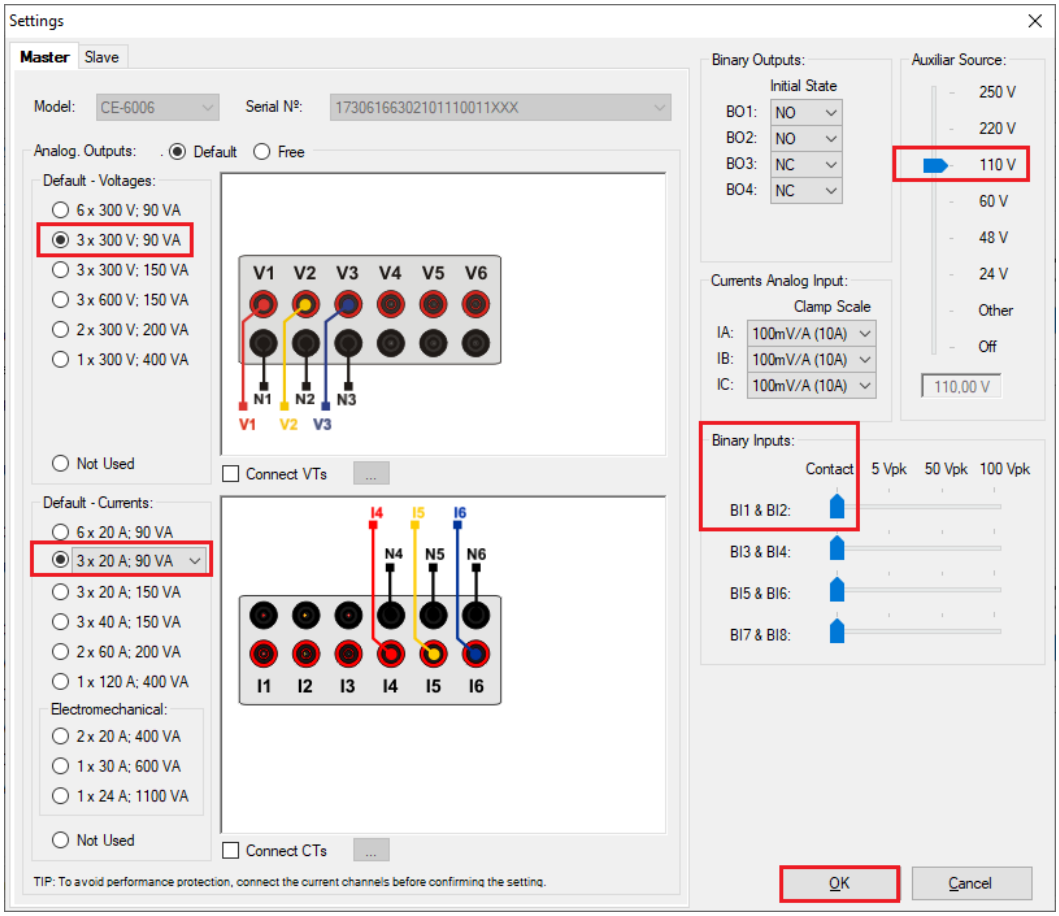


Figure 31

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

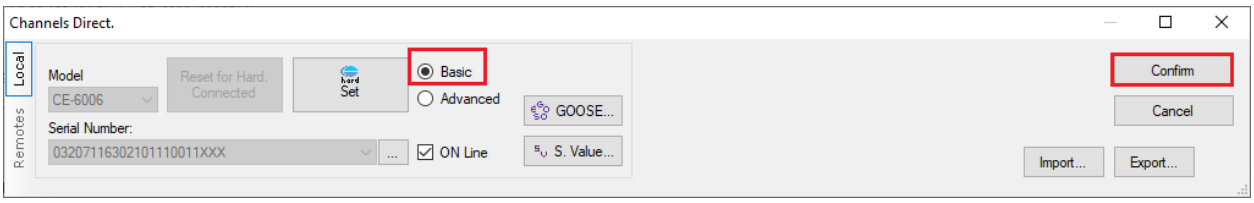


Figure 32

8. Test structure for function 21

8.1 *Test Settings*

By clicking on the settings tab set the test mode to *"Intelligent"* and use binary input 1 for stop interface. Insert a pre-fault with nominal voltage and current equal to zero.

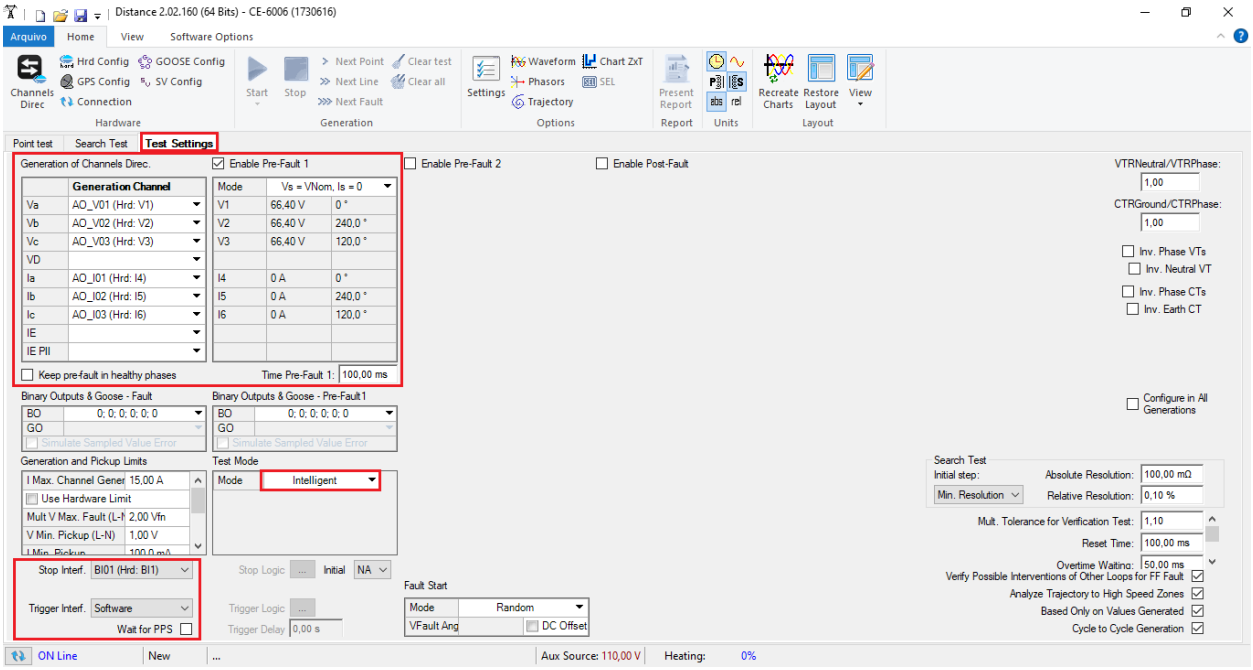


Figure 33

8.2 *Two-Phase and Three-Phase Loop*

Click on the *"Search Test"* and then on the *"Insert/Edit Points"* tab click on the *"Sequence"* button. Choose the fault types in this case only three-phase and two-phase faults: ABC, AB, BC and CA.

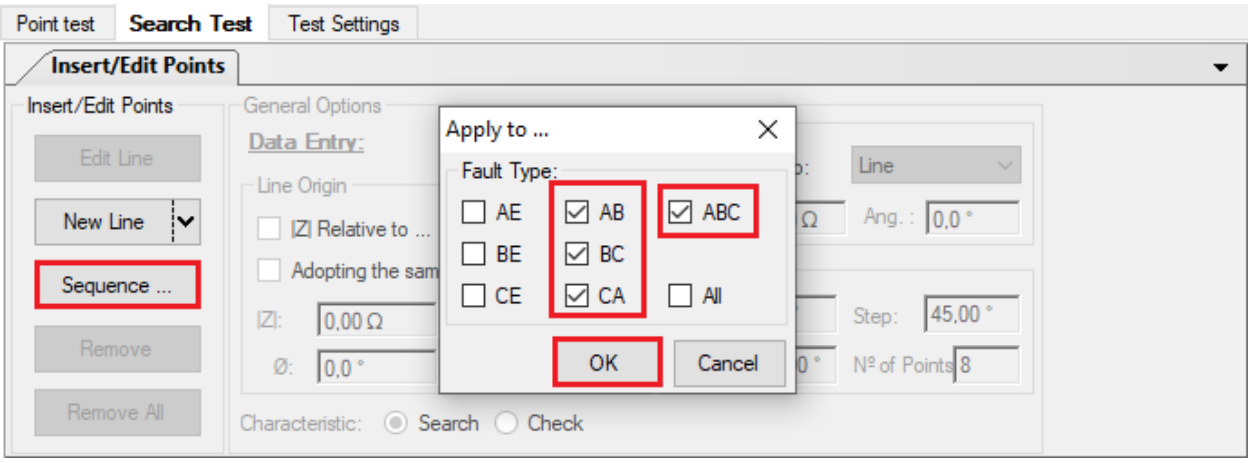


Figure 34

Enter a new sequence whose starting point is |Z| equal to 0.6Ω and θ equal to 70°. The search line length is 6.0Ω and the angle ranges from 0 to 360° with a 60° step.

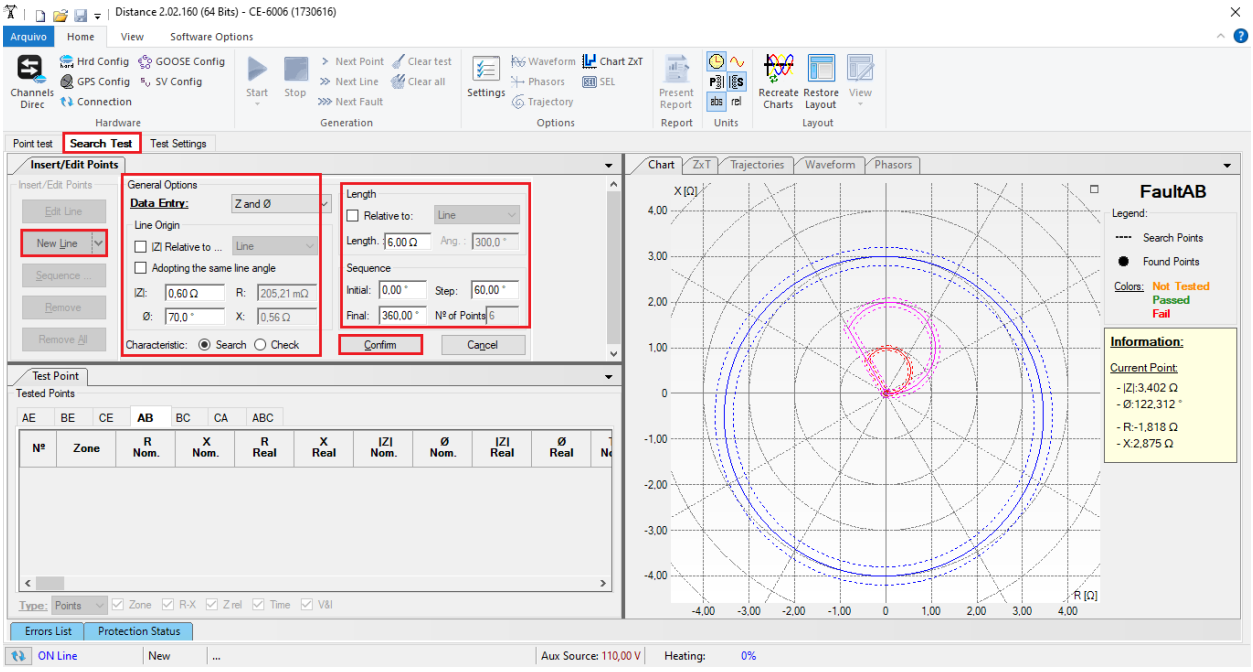


Figure 35

By clicking on the *"Confirm"* button the following search lines are created.

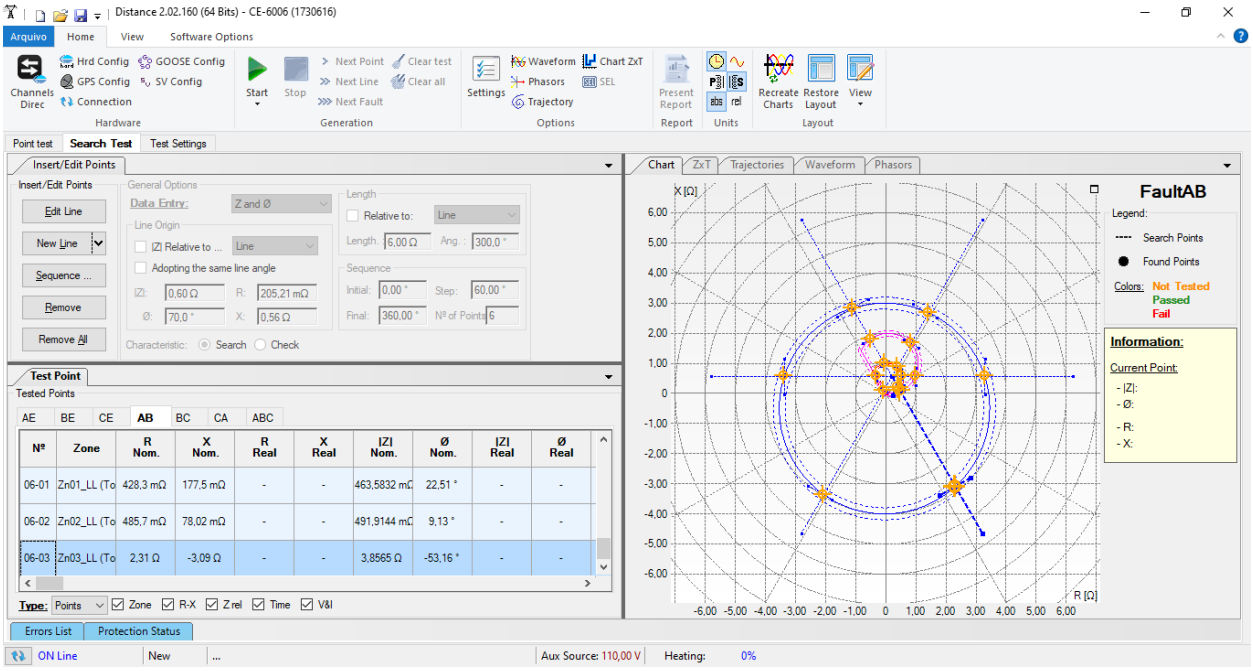


Figure 36

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

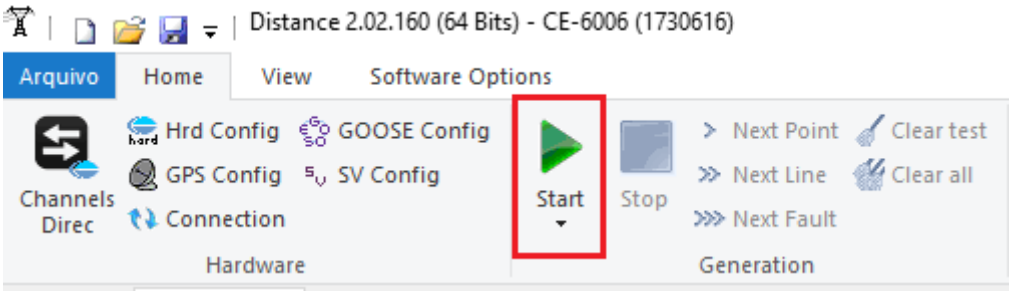


Figure 37

8.3 *Final Result Fault AB*

By clicking on the tab *"AB"* the final result is verified. It is observed that all points are within the tolerances given by the manufacturer so that the test is approved.

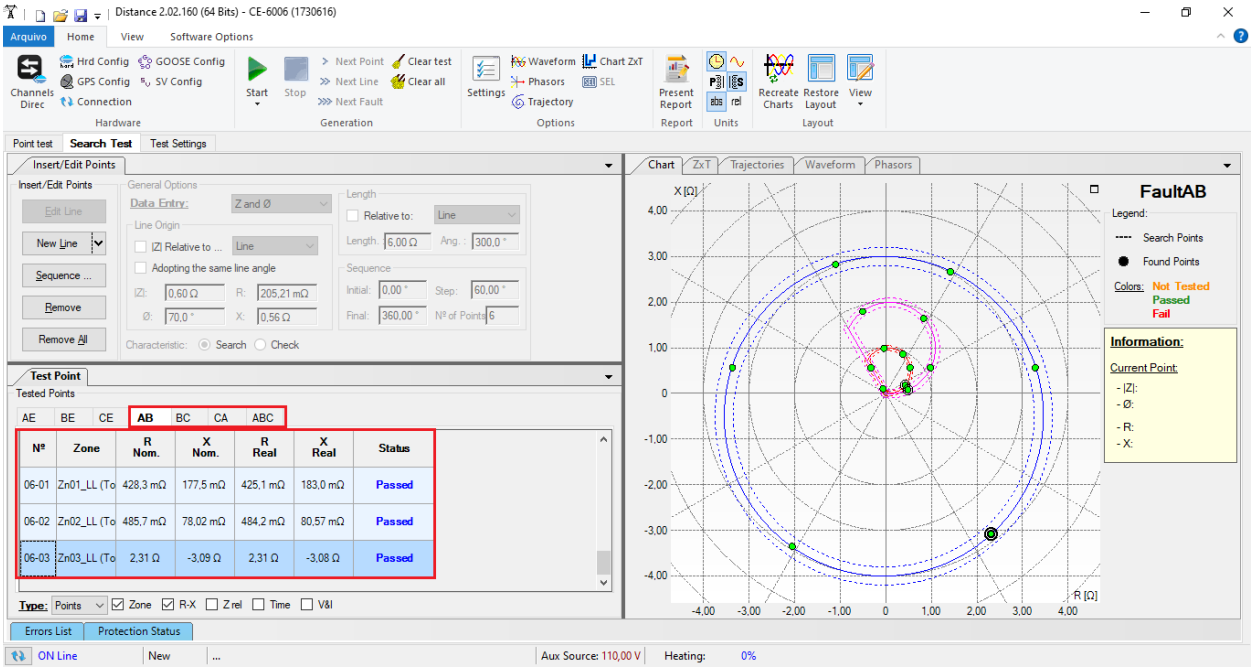


Figure 38

The other fault types can be visualized, for this click on the corresponding tab. Save the test and remove the tests in order to test the phase-ground characteristics. In this test, you should change the stop interface to BI2 in the option *"Test Settings"*.

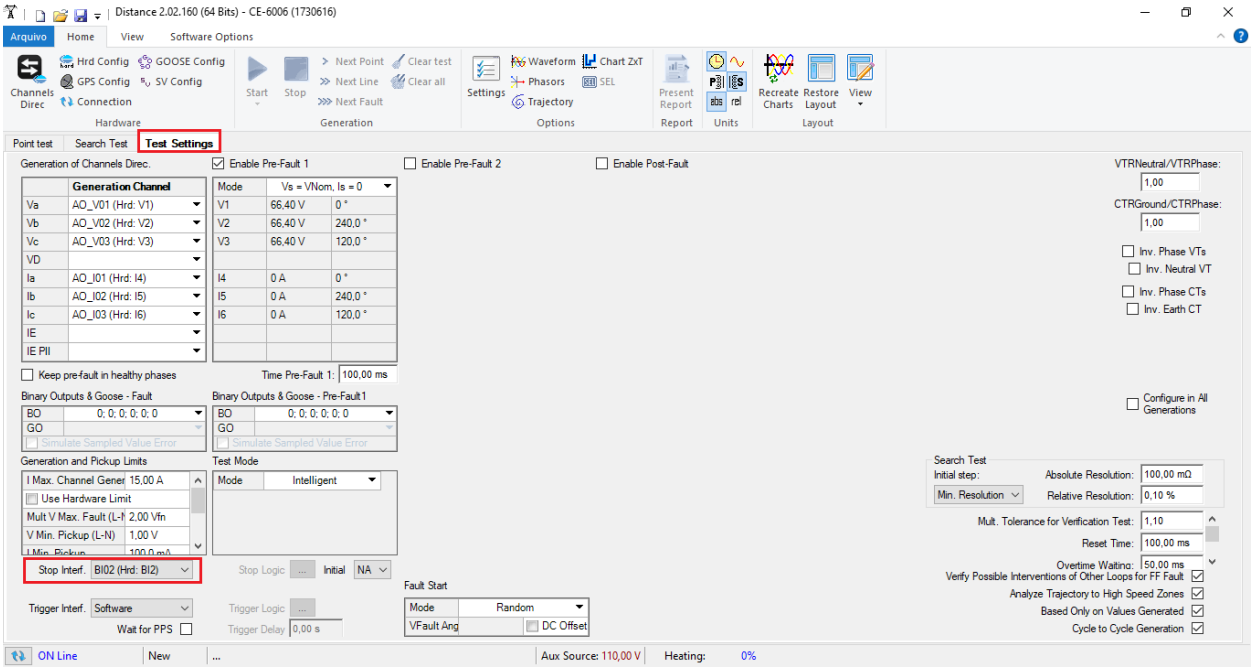


Figure 39

8.4 *Single-phase Loop*

Click on the *"Point Test"* tab and then *"Sequence"* chooses the fault types in this case only single-phase faults: AE, BE and CE.

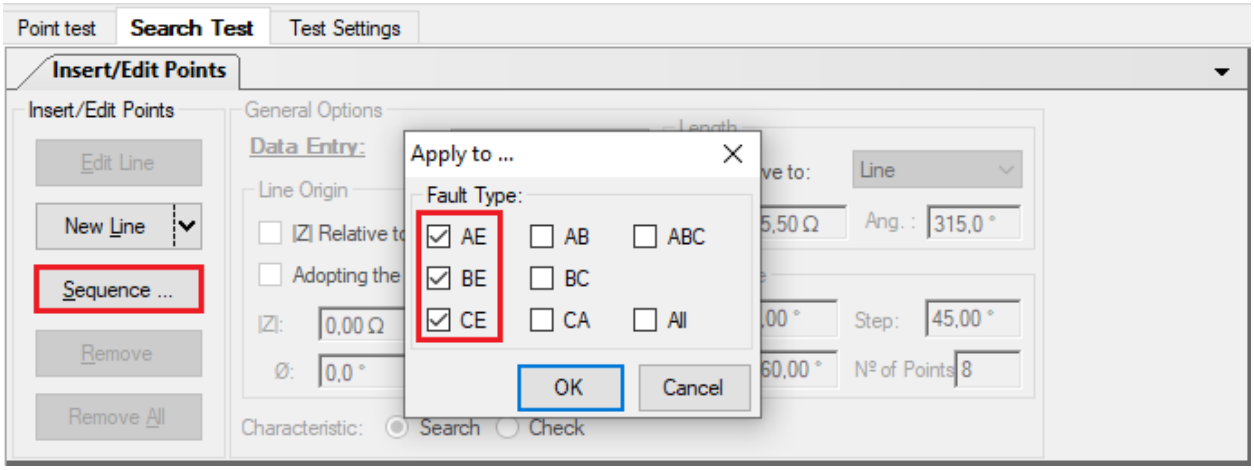


Figure 40

Enter a new sequence whose starting point is |Z| equal to 1.2Ω and θ equal to 70°. The search line length is 6.0Ω and the angle ranges from 0 to 360° with a 60° step.

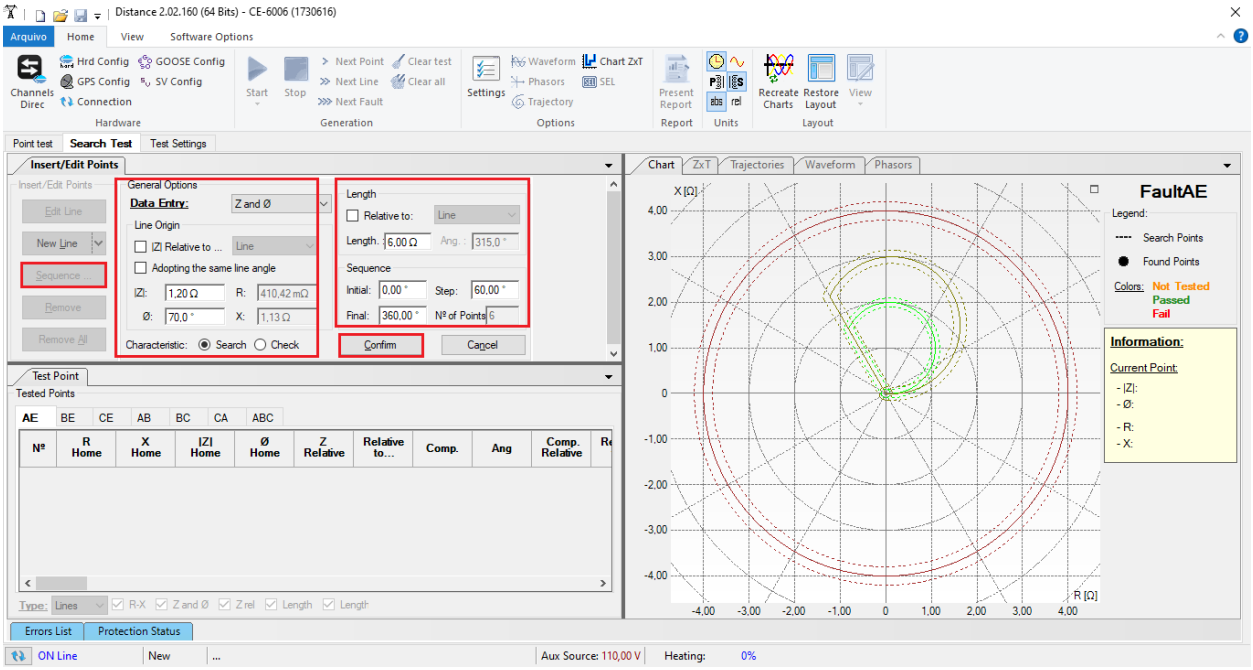


Figure 41

By clicking the *"Confirm"* button the following search lines are automatically created.

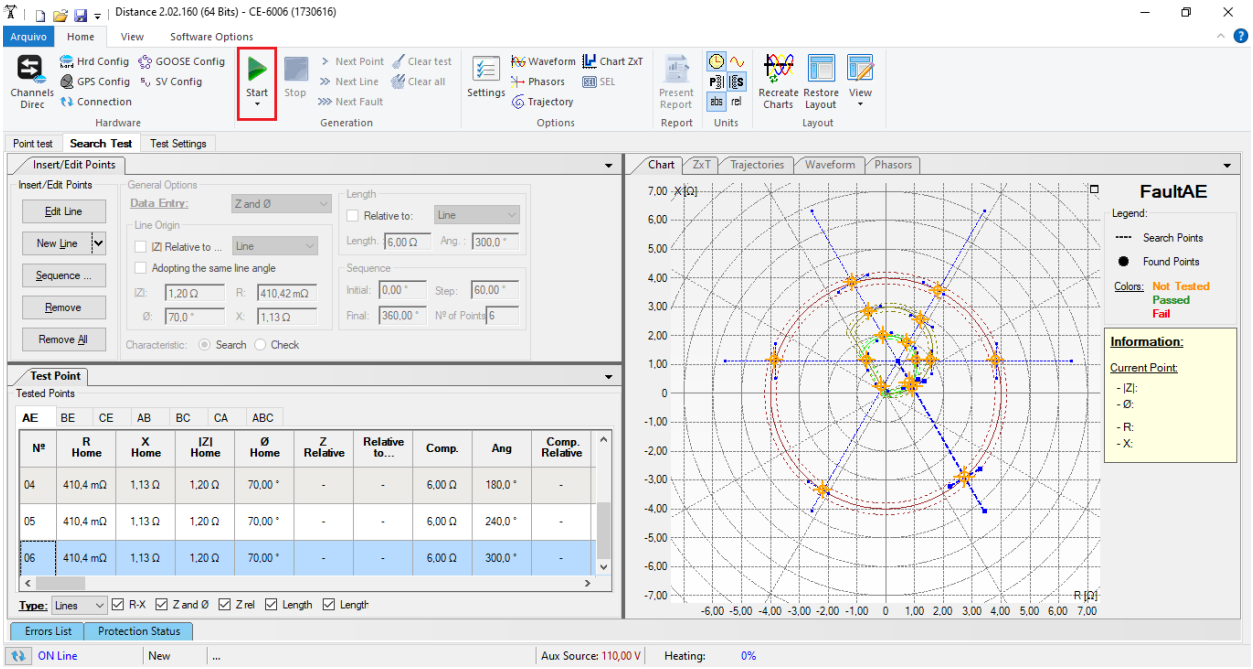


Figure 42

Start the generation and the final result is shown below.

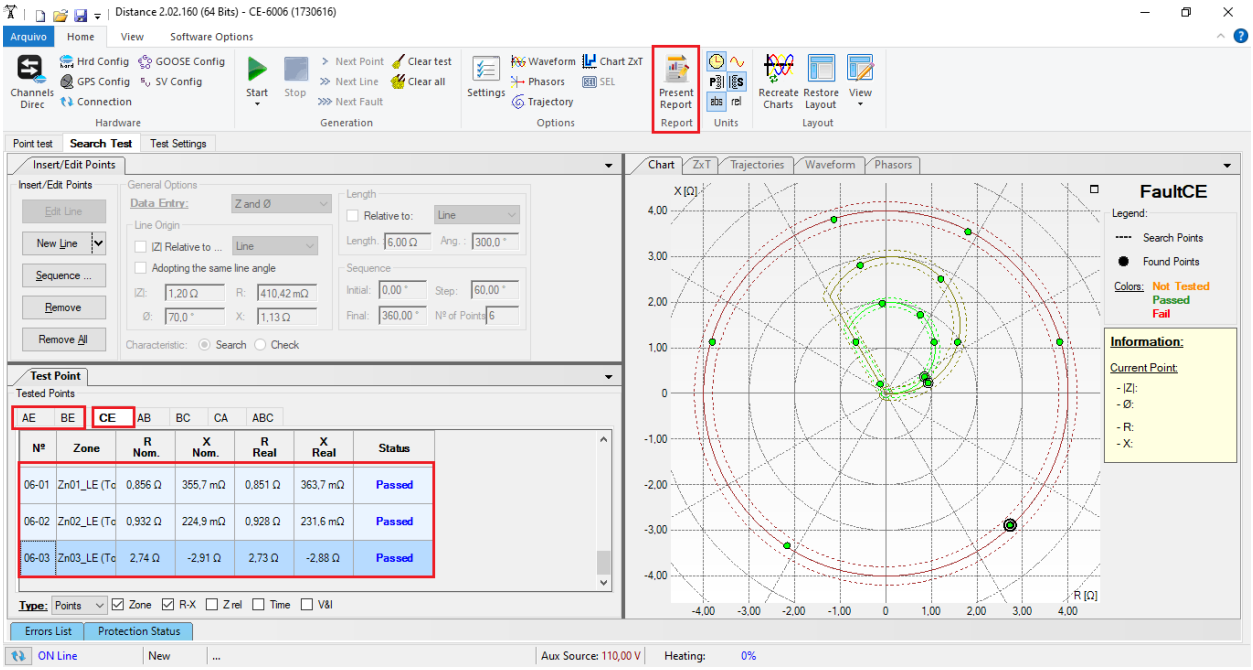


Figure 43

It is verified in both searches that the values found are within the tolerance provided by the manufacturer.

9. Report

After finishing the test, click on the icon highlighted 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.

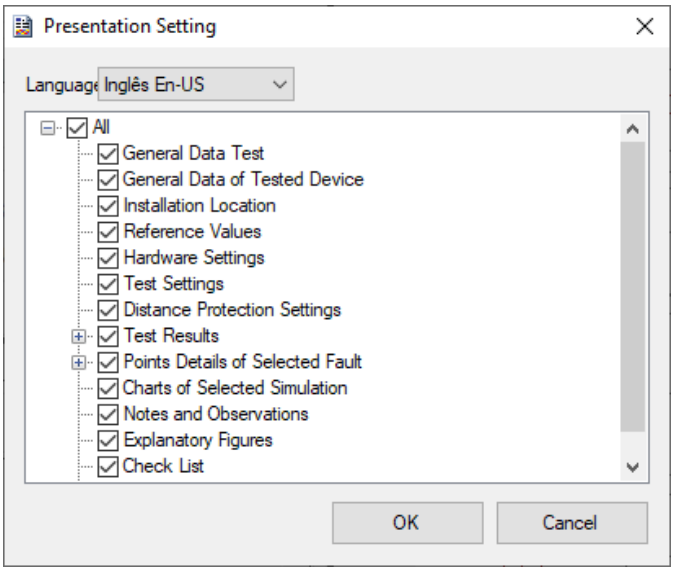


Figure 44


Distanc 2.0.0.6 - CE-6006 (0731212)
Visualizar Impressão
Imprimir
Configuração de Página
Exportar para Office Word
100 %
Uma página
Duas páginas
Página Anterior
Próxima Página
Fechar Visualização de Impressão
Imprimir
Exportar
Zoom
Visualização
Fechar
CONPROVE
CE-600X
CONPROVE
INDÚSTRIA &COMÉRCIO
DISTÂNCIA - RELATÓRIO DE TESTES
Descr: Distância
Data: 13/04/2015 12:24:26
CE-6006: 07312126302101110011XXX; Software: Distancia; Versão: 2.0.0.6
Responsável: Engº Michel Rockembach de Carvalho
1. Dispositivo Testato
Ident.: 23031982; Tipo: Relé Mult. função - Prot. Gerador
Modelo: P343; Fabricante: Schneider
2. Local de Instalação
Subestação: CONPROVE
Bay: 1
Endereço: Rua Visconde de Ouro Preto, Nº75 - Bairro Custódio Pereira
Cidade: UberlândiaEstado: MG
Visualizando Impressão...
Nº de Páginas: 31

Figure 45

APPENDIX A

A.1 Terminal Designations

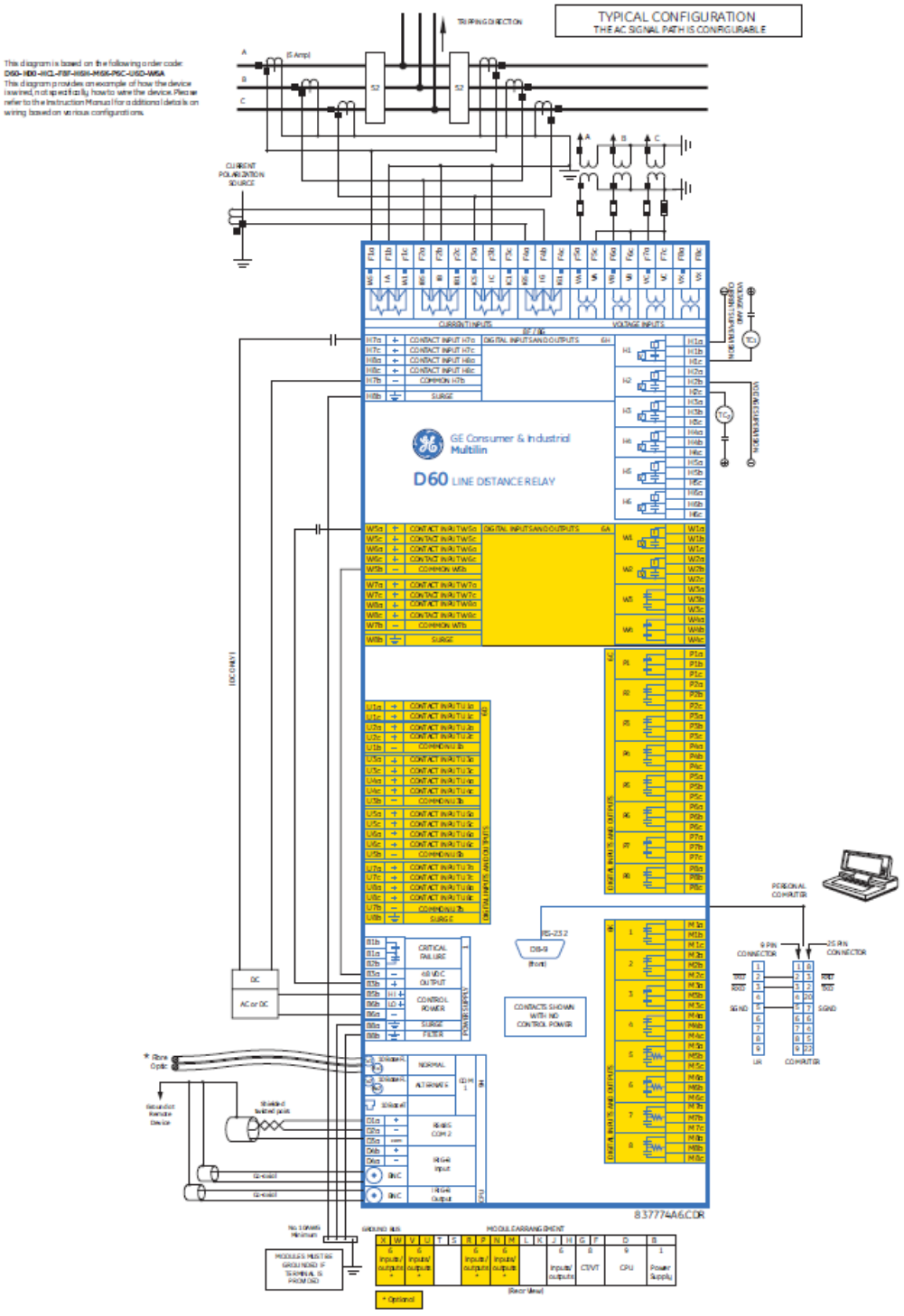


Figure 3–12: TYPICAL WIRING DIAGRAM

Figure 46

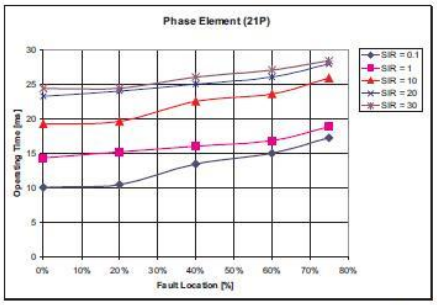
A.2 Technical data

PHASE DISTANCE

Characteristic:	mho (memory polarized or offset) or quad (memory polarized or non-directional), selectable individually per zone
Number of zones:	5
Directionality:	forward, reverse, or non-directional per zone
Reach (secondary Ω):	0.02 to 500.00 Ω in steps of 0.01
Reach accuracy:	±5% including the effect of CVT transients up to an SIR of 30
Distance:	
Characteristic angle:	30 to 90° in steps of 1
Comparator limit angle:	30 to 90° in steps of 1
Directional supervision:	
Characteristic angle:	30 to 90° in steps of 1
Limit angle:	30 to 90° in steps of 1
Right blinder (Quad only):	
Reach:	0.02 to 500 Ω in steps of 0.01
Characteristic angle:	60 to 90° in steps of 1
Left Blinder (Quad only):	
Reach:	0.02 to 500 Ω in steps of 0.01
Characteristic angle:	60 to 90° in steps of 1
Time delay:	0.000 to 65.535 s in steps of 0.001
Timing accuracy:	±3% or 4 ms, whichever is greater
Current supervision:	
Level:	line-to-line current
Pickup:	0.050 to 30.000 pu in steps of 0.001
Dropout:	97 to 98%
Memory duration:	5 to 25 cycles in steps of 1
VT location:	all delta-wye and wye-delta transformers
CT location:	all delta-wye and wye-delta transformers
Voltage supervision pickup (series compensation applications):	0 to 5.000 pu in steps of 0.001

PHASE DISTANCE OPERATING TIME CURVES

The operating times are response times of a microprocessor part of the relay. See output contacts specifications for estimation of the total response time for a particular application. The operating times are average times including variables such as fault inception angle or type of a voltage source (magnetic VTs and CVTs).

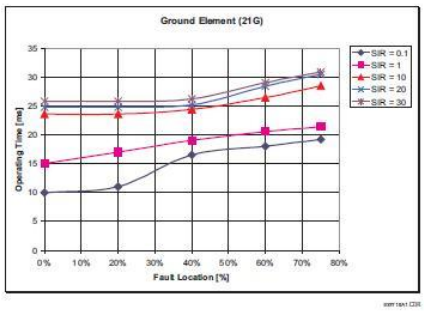


GROUND DISTANCE

Characteristic:	Mho (memory polarized or offset) or Quad (memory polarized or non-directional), selectable individually per zone
Reactance polarization:	negative-sequence or zero-sequence current
Non-homogeneity angle:	–40 to 40° in steps of 1
Number of zones:	5
Directionality:	forward, reverse, or non-directional per zone
Reach (secondary Ω):	0.02 to 500.00 Ω in steps of 0.01
Reach accuracy:	±5% including the effect of CVT transients up to an SIR of 30
Distance characteristic angle:	30 to 90° in steps of 1
Distance comparator limit angle:	30 to 90° in steps of 1
Directional supervision:	
Characteristic angle:	30 to 90° in steps of 1
Limit angle:	30 to 90° in steps of 1
Zero-sequence compensation	
Z0/Z1 magnitude:	0.00 to 10.00 in steps of 0.01
Z0/Z1 angle:	–90 to 90° in steps of 1
Zero-sequence mutual compensation	
Z0M/Z1 magnitude:	0.00 to 7.00 in steps of 0.01
Z0M/Z1 angle:	–90 to 90° in steps of 1
Right blinder (Quad only):	
Reach:	0.02 to 500 Ω in steps of 0.01
Characteristic angle:	60 to 90° in steps of 1
Left blinder (Quad only):	
Reach:	0.02 to 500 Ω in steps of 0.01
Characteristic angle:	60 to 90° in steps of 1
Time delay:	0.000 to 65.535 s in steps of 0.001
Timing accuracy:	±3% or 4 ms, whichever is greater
Current supervision:	
Level:	neutral current (3I_0)
Pickup:	0.050 to 30.000 pu in steps of 0.001
Dropout:	97 to 98%
Memory duration:	5 to 25 cycles in steps of 1
Voltage supervision pickup (series compensation applications):	0 to 5.000 pu in steps of 0.001

GROUND DISTANCE OPERATING TIME CURVES

The operating times are response times of a microprocessor part of the relay. See output contacts specifications for estimation of the total response time for a particular application. The operating times are average times including variables such as fault inception angle or type of a voltage source (magnetic VTs and CVTs).



APPENDIX B

Software parameter equivalence and the relay under test

Table 1

Distance Software		D60 Relay		
Parameter	**Figure**	**Parameter**	**Screen ID**	**Figure**
Mod Z0/Z1	22	Z0/Z1 Mag	11	13
Ang Z0/Z1	22	Z0/Z1 Ang	11	13
Zn1_Fase		Phase Distance Z1		
Reach phs	23	Reach	13	12
Reach RCA phs	23	RCA	13	12
Rev Reach phs	23	Rev Reach	13	12
Rev Reach RCA phs	23	Rev Reach RCA	13	12
Comp Limit phs	23	Comp Limit	13	12
Dir RCA	23	Dir RCA	13	12
Dir Comp	23	Dir Comp Limit	13	12
Zn2_Fase		Phase Distance Z2		
Reach phs	24	Reach	13	12
Reach RCA phs	24	RCA	13	12
Rev Reach phs	24	Rev Reach	13	12
Rev Reach RCA phs	24	Rev Reach RCA	13	12
Comp Limit phs	24	Comp Limit	13	12
Dir RCA	24	Dir RCA	13	12
Dir Comp	24	Dir Comp Limit	13	12
Zn3_Fase		Phase Distance Z3		
Reach phs	25	Reach	13	12
Reach RCA phs	25	RCA	13	12
Rev Reach phs	25	Rev Reach	13	12
Rev Reach RCA phs	25	Rev Reach RCA	13	12
Comp Limit phs	25	Comp Limit	13	12
Dir RCA	25	Dir RCA	13	12
Dir Comp	25	Dir Comp Limit	13	12
Zn1_Terra		Ground Distance Z1		
Reach gnd	26	Reach	11	13
Reach RCA gnd	26	RCA	11	13
Rev Reach gnd	26	Rev Reach	11	13
Rev Reach RCA gnd	26	Rev Reach RCA	11	13
Comp Limit gnd	26	Comp Limit	11	13
Dir RCA	26	Dir RCA	11	13
Dir Comp	26	Dir Comp Limit	11	13

Table 2

Distance Software		D60 Relay		
Parameters	**Figure**	**Parameter**	**Screen ID**	**Figure**
Zn2_Terra		**Ground Distance Z2**		
Reach gnd	27	Reach	11	13
Reach RCA gnd	27	RCA	11	13
Rev Reach gnd	27	Rev Reach	11	13
Rev Reach RCA gnd	27	Rev Reach RCA	11	13
Comp Limit gnd	27	Comp Limit	11	13
Dir RCA	27	Dir RCA	11	13
Dir Comp	27	Dir Comp Limit	11	13
Zn3_Terra		**Ground Distance Z3**		
Reach gnd	28	Reach	11	13
Reach RCA gnd	28	RCA	11	13
Rev Reach gnd	28	Rev Reach	11	13
Rev Reach RCA gnd	28	Rev Reach RCA	11	13
Comp Limit gnd	28	Comp Limit	11	13
Dir RCA	28	Dir RCA	11	13
Dir Comp	28	Dir Comp Limit	11	13