

TEST TUTORIAL

EQUIPMENT TYPE: Protection Relay.

BRAND: ZIV.

MODEL: DLF.

FUNCTION: 68 or RPSB - Power Swing Blocking (PSB) & 78 or PPAM - Out of step (OoS).

TOOL USED: CE-6006, CE-6707, CE-6710, CE-7012 or CE-7024.

OBJECTIVE: Test of PSB and OoS in Conditions of Synchronous and Asynchronous Power Oscillations.



VERSION CONTROL:

Version	Descriptions	Date	Author	Reviewer
1.0	Initial Version	15/03/2022	M.R.C.	G.C.D.P.



SUMMARY

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Statement of responsibility

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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 testshould 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 is noted that the user must have satisfactory training in maintenance procedures a good knowledge of the equipment under test and still be aware of safety rules and regulations.



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PROCEDURE FOR TESTING THE ZIV DLF RELAY IN PSB_OoS SOFTWARE

1. Relay Connection to CE-6710

In this section, all the connections necessary to run the test in question are discussed. In appendix B of this document you can find the terminal designations of the ZIV DLF relay used.

1.1. Auxiliary Source

For relay power, connect the positive terminal (red) of the Aux. Vdc Source of the test set to terminal 3 of slot A of the relay and the negative terminal (black) to terminal 2 of slot A, as shown in the following figure.



Figure 1

1.2. Analog Outputs

Connect the CE-6710's analog outputs V1, V2 and V3 to terminals 01, 03 and 05 of the relay's D slot and their common to terminals 02, 04 and 06. Then I1, I2 and I3 go to terminals 11, 13 and 15 of the relay and their common to terminals 12, 14 and 16, respectively. The figure below shows the procedure.







1.3. Binary Inputs

Connect the binary inputs to the binary outputs of the relay in slot A as shown in the table and figure below.

CE-6710 (Binary Inputs)	DLF (<i>Slot A</i>)			
BI1	OUT 1 (07 and 08)			
BI2	OUT 2 (09 and 10)			
BI3	OUT 3 (11 and 12)			

Table 1







2. First steps with the DLF relay

2.1. Communication between PC and relay

Communication with the relay is done through an Ethernet cable connected between the relay and the computer that has the ZivercomPlus software. Double click on the relay software icon.





Enter the username and password. To gain access use *"zivercom"* and the password *"ziv"*.

р Identification		
User	zivercom	
Password	XXX	
Access level		~
	OK	Cancel
	Figure 5	

Then, from the main menu, go to "IEDs" > "Installations".

🔣 ZlVercomPlus-2.13.3.0 db[3.47.3.0]					
File View	IEDs	IEDs Configuration Help			
		Installations			
		1- S/S Example			
	Emulate				

Figure 6

Select the default file "SubExamples.sds" and click "Edit".



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Figure 7

The next step is to check the data set for communication on the relay front panel. This data must be entered into the software for successful communication to occur.



Modify Installation					
Installation Text					
S/S Example	ОК				
Protocol: PROCOME30 💌	Communication type: LAN 💽 🔒 Cancel				
SERIAL	Baud rate and associated parameters				
Port: COM1 🔽	Baud rate: 38400				
Data bits:	Set default values				
Stop bits:	First character time 1200 Time between retries 1000				
Parity: Even	Message time (ms) 80 Number of retrys 3				
PSTN					
Modem:	Telephone XXXX				
Transparent IP Address: 10.0.0.184 Port: 32001					
	Message time (ms) 5000				

Figure 8

By clicking on the *"OK"* button, you will return to figure 7, select the file again and click on *"Communicate".*

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		Figu	ire 9			

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Click "OK" again.

🚟 Communicate	×
S/S Example	Addresses
C # # File Version	
S/S Example # # Subestation T 1 # Protocol	1
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	10
	12
	14
	16
· · · · · · · · · · · · · · · · · · ·	18
>	20 V
OK	Cancel

Figure 10

If the field "Communications type" is configured as "LAN-TLS", a second level of access will be requested, use the default user "admin" and the default password "Passwd@02".



р Dirección: 0	×
llear	
(MAX=32)	
Password: (MAX=32)	
*****	Cancel
<u> </u>	

Figure 11

3. Parameterization of the ZIV DLF relay

3.1. Nominal Values

Click on the highlighted "+" signs until you reach the "Nominal Values" option. In this option, nominal voltage 115.0V, nominal phase current 5.0A and nominal frequency 60.00Hz must be set.

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Figure 12

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To change the voltage and frequency value, click on the icon highlighted in green in the previous figure.

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, (1)	1				TD 🔲 RD	∎ logs⊽ 🔆 🗩 🗳 01/22/20	21 12:08



After changing the new value, click again on the icon highlighted in green in the previous figure to send the adjustment to the relay.

3.2. General

Click on the *"General"* option and configure the transformer ratios of the phase, neutral, voltage transformer current transformers and the phase sequence.



🔣 ZIVercomPlus-2.13.3.0 db[3.47.3.0]					- 🗆 X
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×	🔲 🗗 🗗 Group 1 🔄 🖣	Group 1 active 📲 🕮 🗤		\S/S Example\000-IDFA-2A24732C00	0000XXX0-2010752\Settings\General
😑 💼 S/S Example 🔒	Text	1T Current value	New value	Units Information	
E E+ 000-IDFA-2A24732C0000000↔0-2010752	- BD Name	#		Max cars=20, def=	
- GR Configuration	ab Breaker	*		Max cars=5, def=	
E- W Settings	- ab Division	#		Max cars=64, def=	
	- ab Zone	# ()		Max cars=64, def=	
Date and Time	ab Description 1	*		Max cars=64, def=	
⊕ • • • • • • • • • • • • • • • • • • •	- BD Description 2	#		Max cars=64, def=	
	 Operation Mode 	2		0=On, 1=Blocked, 2=Test, 3=Test blocked, 4=	
E General	- EP Phase 1 CT Ratio	#		min=1, max=100000, inc=0.01, def=1	
H → Tg= Inputs Dutputs LED's	- KP Phase 2 CT Ratio	#		min=1, max=100000, inc=0.01, def=1	
Protection	- EP Ground C.T. Ratio	#		min=1, max=100000, inc=0.01, def=1	
Trip Enable	- KY Phase VT Ratio	#		min=1, max=100000, inc=0.01, def=1	
	Phase Sequence	2		0=ABC, 1=ACB, def=ABC	
	🖽 📑 Angle Reference	#			
E Coil Circuit Supervision	🕀 🎏 Invert Polarity				
Generation Schedule of Time	PLL Enable	#		0=No, 1=Yes, def=Yes	
E Buttons P1-P6	Simultaneous Commands	# (1)		0=No, 1=Yes, def=Yes	
B - G = Records					
Control Diservations					
	1				
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Figure 14

It can be seen in the previous figure that the values in the column *"Current Value"* and *"New value"* are hidden. To allow visualization and configuration click on the buttons highlighted in red and then green.

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E =	- ab Name	#		Max cars=20, def=	
Configuration	ab Breaker	#		Max cars=5, def=	
E Settings	ab Division	#		Max cars=64, def=	
- Nominal Values	ab Zone	#		Max cars=64, def=	
Date and Time	ab Description 1	#		Max cars=64, def=	
Synchronization	ab Description 2	#		Max cars=64, def=	
	 Operation Mode 	≠ On		0=On, 1=Blocked, 2=Test, 3=Test blocked, 4=	
General General General General	- 🕅 Phase 1 CT Ratio	# 1		min=1, max=100000, inc=0.01, def=1	
System Impedances	- 🕅 Phase 2 CT Ratio	# 1		min=1, max=100000, inc=0.01, def=1	
Fault Locator	- 🕅 Phase 3 CT Ratio	# 1		min=1, max=100000, inc=0.01, def=1	
Protection	- 🖾 Ground C.T. Ratio	# 1		min=1, max=100000, inc=0.01, def=1	
Control	- 🖙 Parallel CT Ratio	# 1		min=1, max=100000, inc=0.01, def=1	
	- 🖙 Phase VT Ratio	# 1		min=1, max=100000, inc=0.01, def=1	
Coll Circuit Supervision	- 🖙 Busbar VT Ratio	# 1		min=1, max=100000, inc=0.01, def=1	
Scriedule of Time Scriedule of Time	- 🖙 Ground VT Ratio	# 1		min=1, max=100000, inc=0.01, def=1	
🖶 🃲 Buttons P1-P6	- 🗟 Capacitive VT	# No		0=No, 1=Yes, def=No	
Voltage Transducer Monitoring	- 🚽 Phase Sequence	# ABC		0=ABC, 1=ACB, def=ABC	
Hecolds	— 🛡 IG Type	# IG		0=IN, 1=IG, def=IG	
	🖽 📑 Angle Reference	#			
i	🖽 🈼 Invert Polarity	#			
	- 🖶 PLL Enable	# Yes		0=No, 1=Yes, def=Yes	
	Simultaneous Commands	# Yes		0=No, 1=Yes, def=Yes	
<u> </u>					
				TD 🔲 RD 🔲 logs 🗸 🔆	> 🔁 01/22/2021 12:17

Figure 15

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3.3. Characteristic

Click on the "+" signs until you reach the "Characteristic" option. In this option, the zone types are set as MHO. Then send the adjustments by clicking on the icon highlighted in green.

W ZIVercomPlus-2.13.3.0 db[3.47.3.0]							-	
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	Text	ter a tat		1T Current value	New value	Units	Information	[]
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	- endse	Characteristic		Quadrilateral	IVINO		v=Quaumaterai, 1=ivinto, 2=Quaur	naterar ariu
Date and Time								
Communications								
General								
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📴 🖶 Distance Units								
Lagging Phase Operation Ph-Ph-G Fault								
Series Compensation Logic								
Zone 7 Units								
Distance Supervision								
E Close Onto Fault								
Load Encroachment								
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Figure 16

3.4. Zone 1 Units

Select the *"Zone 1 Units"* option, activate the neutral and phase unit, directionality, zone reach, timing, positive and zero sequence angles, earth compensation factor and zone blocking due to power swing. Submit the adjustments by clicking on the icon highlighted in green.







3.5. Power Swing Detector

Activate the synchronous and asynchronous oscillation detection units. Configure zone ranges: outer, middle, and inner. Adjust the timings and send the settings to the relay.



🐷 ZlVercomPlus-2.13.3.0 db[3.47.3.0] - 🗆 🗙				
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$ \times $	Group 1 Group 1	active 🛛 🔁 🕮 🗈 🗐	🖬 🖻 🎒 !00000>	DX0-2010551\Settings\Protection\Power Swing Detector
Configuration	Text	1T Current value	New value	Units Information
🖻 💼 🙀 Settings	- 🖶 PS Detec Enable	No	Yes	0=No, 1=Yes, def=No
- Torres and Time	— 🖶 PS Trip Enable	No	Yes	0=No, 1=Yes, def=No
	- 🙀 Right Ext Resist Limit	10.00	10.00	Ohm min=0.10, max=500.00, inc=0.01, def=50.00
	- 🔛 Right Med Resist Limit	5.00	5.00	Ohm min=0.10, max=500.00, inc=0.01, def=25.00
Autodimming	Right Int Resist Limit	1.00	1.00	Ohm min=0.10, max=500.00, inc=0.01, def=5.00
H	- 🔛 Left Ext Resist Limit	10.00	10.00	Ohm min=0.10, max=500.00, inc=0.01, def=50.00
	- 🔛 Left Med Resist Limit	5.00	5.00	Ohm min=0.10, max=500.00, inc=0.01, def=25.00
E Fault Locator	- 協力 Left Int Resist Limit	1.00	1.00	Ohm min=0.10, max=500.00, inc=0.01, def=5.00
🖹 — 🚰 Protection	- W Resist Limit Angle	75	90	o min=0, max=90, inc=1, def=75
Energy Line Differential	- Bill Forward Ext Reach	10.00	10.00	Ohm min=0.10 max=500.00 inc=0.01 def=50.00
i internet units	- Bill Forward Med Reach	5.00	5.00	Obm min=0.10 max=500.00 inc=0.01 def=25.00
	- Bill Forward Int Reach	1.00	2.00	Obm min=0.10 max=500.00 inc=0.01 def=5.00
Grant Type	- Set Payers Ext Payer	10.00	10.00	Ohm min=0.10 max=500.00 inc=0.01 def=50.00
	82 Reverse Mad Reach	5.00	5.00	Ohm min=0.10, max=500.00, inc=0.01, def=35.00
	XX Deverse let Des et	1.00	3.00	Ohm min=0.10, max=500.00, inc=0.01, def=5.00
	Reverse Int Reach	0.00	2.00	0 min min=0.10, max=300.00, mc=0.01, def= 3.00
Parallel Line Coupling	- Will IT Supervision	0.20	0.20	A min=0.04, max=30.00, inc=0.01, del=0.04
	NY PS Detec Time	0.03	0.03	s min=0, max=2, inc=0.002, def=0.03
	S Block Reset Time	1	1	s min=0.1, max=5, inc=0.1, det=1
Zone 4 Units	PS Trip Type	Slow trip	Slow trip	0=Fast trip, 1=Slow trip, def=Slow trip
Zone 5 Units	- KP Fast Trip Time	0.05	0.05	s min=0, max=2, inc=0.002, def=0.05
	- EV PS Cond Reset Time	0.05	0.05	s min=0.02, max=2, inc=0.002, def=0.05
P 🚰 Zone 8 Units	- 🖙 Time Delay for Ground Fault detection	40	40	ms min=0, max=200, inc=1, def=40
Distance Supervision				
E Give Failure				
Dead Line Detector				
Load Encroachment				
Power Swing Detector				
Hemote Upen Breaker Detector				
	I)			
				TD RD III logs 🗸 🐝 💬 🖾 02/08/2021 11:44:51

Figure 18

3.6. Outputs

In order to test the tripping signal of function 21, as well as the blocking and tripping signals of the Power swing, 3 relay output binaries will be used to collect these signals by the test set. In the figure below, configure the first output as a zone 1 trip for both neutral and phase.



W ZIVercomPlus-2.13.3.0 db[3.47.3.0]			- 🗆 X
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×	🔳 🗗 🗗 Group 1 💽 Group 1	active 🛂 🖳 🔛 层 ൙ 🚑 🔤ts Outputs LEDs\Outputs	s\Slot A\Digital Output 1\Logic OR signals
S/S Example • • <td< td=""><td>Text </td><td>IT Current value New value Units 7 None None Image: Second Second</td><td>Information</td></td<>	Text	IT Current value New value Units 7 None None Image: Second	Information
		TD T BD	🔲 logs 🖓 🌺 🔀 02/08/2021 12:07:47 //

Figure 19

Clicking on the "None" option highlighted in the previous figure, make the following adjustment.

💽 Signal 1		×
Signals		
Underfrequency Unit 4 T UnderVoltage of Voltage Voltage Restrained Insta Voltage Restrained Insta Voltage Restrained Test Voltage Restrained Tem Voltage Restrained Tem Voltage Restrained Tem Voltage Restrained Tem Voltage Restrained Tem	rip Transd. Intaneous Unit Phase A Trip Intaneous Unit Phase B Trip Intaneous Unit Phase C Trip porized Unit Phase A Trip porized Unit Phase B Trip porized Unit Phase C Trip m	^
Zone 1 Phase Trip Zone 2 Ground Trip Zone 2 Phase Trip		v
Zone z Phase Thb		
Signals groups	All signals	
Trip protection outputs		-
<-	OK →	Cancel
	Figure 20	

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Repeat the previous procedure for the phase trip.

W ZIVercomPlus-2.13.3.0 db[3.47.3.0]				- 🗆 X
File View IEDs Configuration Help				<u>[5]</u>
$ \times $	🔲 🗗 🕶 Group 1 🛛 🔽 Group 1	active 🧏 🖹 🗈	🛾 🚔 🎒 🛛ts Outputs LED	s\Outputs\Slot A\Digital Output 1\Logic OR signals
🖃 💼 S/S Example 🔒 📃	Text	1T Current value	New value	Units Information
E	- 💌 Signal 1	# None	Zone 1 Ground Trip	
• Status	- 💌 Signal 2	# None	Zone 1 Phase Trip	
🖶 🦓 Settings	- 💌 Signal 3	# None	None	
	- 👻 Signal 4	# None	None	
Date and Time	— 모 Signal 5	# None	None	
	- 💌 Signal 6	# None	None	
	- 🗟 Signal 7	# None	None	
🖅 📲 🚰 General	- Signal 8	# None	None	
Inputs Outputs LEDs	Signal 9	# None	None	
	Signal 10	# None	None	
Virtual Digital Inputs	Signal 11	# None	None	
E	Signal 12	# None	None	
E Slot A	Ginard 12	# News	None	
	Signal 15	* None	None	
	Signal 14	* None	None	
🕀	Signal 15	* None	None	
🗈 📲 Digital Dutput 4	🗆 🖃 Signal 16	* None	None	
₩				
🕮 📲 Slot B				
😟 🔤 📲 Slot C				
Electric Leds				
E Protection				
Line Differential				
Directional Type				
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			т	10 🔳 RD 📕 logs 🗹 🚧 💬 📅 02/08/2021 13:38:04 🖉

Figure 21

On the second output configure the 78 or OoS trip signal.



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File View IEDs Configuration Help				S
	🔳 🗗 🗗 Group 1 💽 Group 1	active 🧏 🖲 📭 🖬 🖨	Outputs LEDs\Outputs\Slot A\Digital Outpu	it 2\Logic OR signals
S/S Example Image: Configuration Image: Configuration Status Image: Configuration Image: Configuration Image: Configuration	Text Signal 1 • Signal 2 Signal 3 • Signal 3 Signal 4 • Signal 5 Signal 6 • Signal 7 Signal 7 • Signal 7 Signal 9 • Signal 10 Signal 12 • Signal 12 Signal 12 • Signal 12 Signal 15 • Signal 15 Signal 16	IT Current value New value # None Power Swing Tr # None None # None	Image:	
				02/00/2021 00:42:54



On the third output, configure the Power swing blocking signal (68).



Figure 23

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4. Application Manager

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



Figure 24

4.1. PSB_OoS software adjustments

Open the PSB_OoS software within the Conprove Test Center (CTC) software area, as shown in the figure below.

	Conprove Test Ce	enter	
CONPROVE	Version 2.02.171		
General General Tests & Quick	Secondary Secondary Tests	Measurement Applications for measurement R Multimeter	
 VCC Aux Calibration Test Plan Remote Generation 	Power Directional		
	Meter Power Quality PSB OoS Ramp L Hamonic Bestraint	Setup Equipment Set. / Tests Settings Dupdate Firmware	
Primary Tests	Image: Sequencer Image: Synchronism Image: Sy	Software Language Support Documentation and assistance	*
	Other Additional applications Transient View Validate PDF Reports 	 Videos Contact Forum User Manual Quick Guide Self-diagnosis 	* *
	Statistical Analysis Convicte @ Concerning 1004 2000	Kara Remote Access	

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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. Fill in the "General Inform." with details of the tested device, installation location and the person responsible. This facilitates the preparation of the report, and this tab will be the first to be shown.

	Bits) - CE-6710 (0301018) re Options	- 0 ×
Goose Set Sync. Set Sync. Set Sync. Set Direc Channels HardWare	tinos → Next Point ✓ Clear test Start Stop → Next group ✓ Clear all Start Stop → Phasors Settings ← Phasors © Trajectory Present But rel clear test Present But rel clear test Present Present But rel clear test Present But rel clear test Present Present But rel clear test Present Prese	
System Simulation Trajectories Simul Insert/Edit Points Insert/Edit General Options	General General Inform. System Notes & Obs. Explanatory Figures Check List Others Connections Distance Descr. Power Swing Block and Out of Step Date:	Legend:
Edit Trajectory S New Trajectory Zie Ø ✓ Trajectory Trajectory S New Trajectory Zie Ø ✓ Trajectories Zie Ø ✓	Tested device: Model DLF V Type: Line Protection Manufacturer: ZIV V	- Traj. Not Tested - Traj. Tested Colors: Not Test. Passed Fail
Groups dZ/dt Const Remove 250.0 Ω/s	Location: Substation: Conprove Bay: 1 Address: Visconde de Ouro Preto 75, Custódio Pereira	Information: Atual Point - 121: - 0:
Test Points Points Tested	City: Uberländia State: MG ~ Responsible: Name: Michel Rockembach de Carvalho ~	-R -X
No. Nº of Points Trajectory Enabled Fault Time Trajectory 03 2 Yes 266.0 n	Sector: Engineering Registry: 0001 Image: CE-6710 Series Num.: 03010187CCM33222211U5HVRGLGLGL2Z0RXO	
Iype: Individual Image: General Info. Errors List Protection Status Image: General Info. Changed	Default V Import Export Preferences QK Cancel	R[0] 10.00

Figure 26

Also in the *"Settings"* area, there are other useful tabs for the user. In the figure below, within the *"System"* 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 used for this test.





Figure 27

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 also create a schematic of the connections between the test set and the test equipment.



4.2. Distance screen > Distance Prot. Settings

Click on the "Distance" button, the screen shows the parameters of length, line angle and ground compensation factor. For this specific test there is no need to adjust these values.



Figure 28

4.3. Entering Zone 1

Click on the *"Insert"* field highlighted in the previous figure. In the settings screen, first choose the relay mask *"ZIV DLF – Mho"*. You must adjust the actuation time, choose the



type of fault (loop) enter the zone characteristics and directionality. Adjust the tolerance values and finally click on *"OK".*





4.4. Inserting the zones: inner, middle and outer

Click on the *"Insert"* field again. In the settings screen, choose the generic mask *"Quadrilateral"* then adjust the resistance and reactance values according to the relay settings for the internal zone. Remove the tolerances and change the name to *"INNER"*.





Figure 30

Repeat the procedure and adjust the middle zone. Change your name to "MIDDLE".





Figure 31

The last zone to be entered is the outer. Change your name to "OUTER".





Figure 32

5. Channel Direction and Hardware Configurations

Click on the icon illustrated below.

🍄 🗋 📂 🛃 🚽 PSB OoS 2.02.171 (64 Bits) - CE-6710 (0301018)				
Arquivo Home Display Software Options				
Channels Image: Channels Image	Start Stop Next Point Clear test			
Hardware Generation				
Figure 33				

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Then click on the highlighted icon to configure the hardware.



Figure 34

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



INSTRUMENTOS PARA TESTES ELÉTRICOS Settings Master Slave 1 Slave 2 Main Sampled Value Others Binary Outputs: Auxiliar Source: Model CE-6710 Serial Number 03010187CCM33222211U5HVRGLGLGL2Z0RX0 Initial State Initial State 250 V BO3: NC 🗸 BO1: NO 🗸 Analog Outputs: 220 V BO2: NO \sim BO4: NC \sim Standard - Voltages: 110 V 4 x 300 V; 100 VA BO5 and BO6 type: 60 V O 2 x 600 V; 180 VA Conventional BO5: NO \sim 48 V O 2 x 300 V; 150 VA V3 BO6: NO 🗸 O 1 x 600 V; 350 VA •N3 24 V O IRIG (BO5) /Clock (BO6) O 1 x 300 V; 250 VA Other Off 🔿 TTL Transistor 110,00 V Customized Assoc. Binary / Analog Inputs: Connect VTs Standard - Currents: BI1: BI - Contact BI - Contact BI2: O 6 x 32 A; 220 VA BI3: BI - Contact 3 x 64 A; 400 VA BI4: BI - Contact O 2 x 96 A; 550 VA BI5: BI - Contact O 2 x 10,00 A; 300 VA -N2 BI - Contact BI6: 1 x 192 A: 1100 VA N3 BI7: BI - Contact O 1 x 6,00 A; 360 VA BI8: BI - Contact •N4 BI9 BI - Contact **N**5 BI10: BI - Contact BI11: BI - Contact Electromechanical: BI12: BI - Contact O 1 x 75 A; 700 VA AI 1-6 : 2V; 20V; 600V AI 7-12 : 200mV; 2V; 600V Considers absolute values to Voltage-BI O 1 x 50 A; 700 VA O Customized Assoc. Connect CTs Range 1,25 A <u>0</u>K Cancel

Figure 35

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

Cha	inels Direct.		– D X
Remotes Local	Model Reset for Hard. Ce-6710 Connected Set O Advanced	4 ⁵ 0 CODEE	Confirm
	Serial Number: 03010187CCM33222211U5HVRGLGLGL2Z0RX0 V V ON Line	50 S. Value	Import Export

Figure 36

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×



6. Restore Layout

Due to the great flexibility that the software presents allowing the user to choose which windows are displayed and in which position the command is used to restore the default settings. Click on the *"Recreate Charts"* button and then click on *"Restore Layout"*.



Figure 37

7. Test Structure for PSB and OoS functions

7.1. Test Settings

In this tab you must configure the generation channels, enable a pre-simulation with nominal conditions and adjust the binary inputs with the trip signals.





Figure 38

7.2. Trajectories Simulation

The *"Trajectories Simulation"* test makes it possible to create the same tests as the *"System Simulation"* however it has the convenience of not having to make an equivalent of the system (in some cases the necessary data are difficult to obtain). In the *"Trajectories Simulation"* option, the user has complete freedom to control the impedance trajectory (dZ/dt). In this way, it is possible to simulate fault conditions where function 21 must act, conditions of synchronous power swing where function 68 must act and even conditions of asynchronous power swing where function 78 must act.

7.3. Trajectories Simulation > Synchronous Oscillation

For the Power Swing signal to occur, the trajectory time between the external zone (OUTER) and the intermediate zone (MIDDLE), whose difference is 5.0 Ω , must be greater than the setting in *"PS Detec Time"*, that is, 0.03s. So 5/0.03 is equal to 166.67 Ω /s so you must use a dZ/dt lower than 166.67 Ω /s, in this case use 150 Ω /s.



In the following test, a synchronous oscillation is simulated, where the activation of the Power Swing Alarm is expected. To perform the test click on *"New Trajectory"* then choose the number of points, impedance and angle values. It is important to point out that these points can be obtained just by clicking on the graph, in order to produce the trajectory. The next step is to enter the impedance rate of change which must be different from *"O"* and less than 166.67.



Figure 39

The next step is to parameterize the "System" tab.



Insert/Edit Points	
Insert/Edit	General Options
<u>E</u> dit Trajectory	Trajectory System Fault Evaluation
N <u>e</u> w Trajectory	E : 115.0 V 0 °
Trajectories <u>G</u> roups	Set Z by: ZS; KS ✓ Mod. ZS 4,00 Ω Mod. KS 1,00
<u>R</u> emove	Ang ZS 80.00 ° Ang KS 0 °
Remove <u>A</u> ll	

Figure 40

It is not necessary to make any adjustments in the *"Fault"* tab. The next step in the *"Evaluation"* tab is to set the *"Operation"* field to *"Yes"* and the *"Interface"* to *"PSB Alarm"*. Then click on *"Confirm"*.



nsert/Edit	General Options	
Edit Trajectory	Trajectory System Fault Evaluation	
New	Operation: O No O Yes	Interface: PSB Alarm \checkmark
Trajectory	Evaluation Time	
Trajectories <u>G</u> roups	Reference for Start Time Count:	Pre-Simulation 1 $$
	Nominal Time: 50,00 ms	
Remove	Positive Time Tolerance: 30,00 ms	
Remove <u>A</u> ll	Negative Time Tolerance: 30,00 ms	
		<u>C</u> onfirm Ca <u>n</u> cel

Figure 41

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



Figure 42

It is verified that the blocking of the distance function and the actuation of the blocking by synchronous power oscillation occurred.







7.4. Trajectories Simulation > Asynchronous Oscillation

To verify the *"OoS"* tripping, the PSB signal must be active and the time to cross the internal region (INNER) must be greater than the time set in the *"Fast Trip Time"* field. As the zone width is 2.0 Ω and the time is 0.05s, 2/0.05 comes to 40 Ω /s, so dZ/dt must be less than 40 Ω /s.

In the following test, an asynchronous oscillation is simulated, where the OoS Trip actuation is expected. To perform the test click on *"New Trajectory"* then choose the number of points, impedance and angle values. It is important to point out that these points can be obtained just by clicking on the graph, in order to produce the trajectory.





Figure 44

The next step is to parameterize the "System" tab.

Insert/Edit Points	
Insert/Edit	General Options
Edit Trajectory	Trajectory System Fault Evaluation
N <u>e</u> w Trajectory	E : 115,0 V 0 °
Trajectories <u>G</u> roups	Set Z by: ZS; KS ✓ Mod. ZS 4,00 Ω Mod. KS 1,00
Remove	Ang ZS 80,00 ° Ang KS 0 °
Remove <u>A</u> ll	

Figure 45

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It is not necessary to make any adjustments in the *"Fault"* tab. The next step in the *"Evaluation"* tab is to set the *"Operation"* field to *"Yes"* and the *"Interface"* to *"Trip OoS"*. Then click on *"Confirm"*.

Insert/Edit Points		
Insert/Edit	General Options	
Edit Trajectory	Trajectory System Fault Evaluation	
New	Operation: O No O Yes Interface: Trip OoS V	
Trajectory	Evaluation Time	
Trajectories <u>G</u> roups	Reference for Start Time Count: Pre-Simulation 1 ~	
	Nominal Time: 50,00 ms	
<u>R</u> emove	Positive Time Tolerance: 30,00 ms	
Remove <u>A</u> ll	Negative Time Tolerance: 30,00 ms	
	<u>C</u> onfirm Ca <u>n</u> ce	

Figure 46

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





It is verified that the OoS trip occurred.







7.5. Trajectories Simulation > Fault Situation

In this test, the performance of the distance trip is verified. To do so, click on *"New Oscillation"* and on the *"Trajectory"* tab, make the following adjustments. It is important to remember that the impedance variation rate must be greater than 166.67 Ω /s.





Figure 49

The next step is to parameterize the "System" tab.

Insert/Edit Points	
Insert/Edit	General Options
Edit Trajectory	Trajectory System Fault Evaluation
N <u>e</u> w Trajectory	E : 115.0 V 0 °
Trajectories <u>G</u> roups	Set Z by: ZS; KS ~ Mod. ZS 4.00 Ω Mod. KS 1.00
<u>R</u> emove	Ang ZS 80.00 ° Ang KS 0 °
Remove <u>All</u>	

Figure 50

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The next step is to set an ABC fault, so click on the *"Fault"* tab and then on *"Enable Fault"*. Set the *"Constant Current"* value to 15A and the fault duration time to 100ms. The fault time must always be greater than the protection zone delay. In this case, the activation time for zone 1 is 100ms. Another detail is the *"Fault Location"* which must be set to 0.1 ensuring that the fault occurs in zone 1.



Figure 51

The next step in the *"Evaluation"* tab is to set the *"Operation"* field to *"Yes"* and the *"Interface"* to *"Trip Dist"*. Then click on *"Confirm"*.



System Simulation	Trajectories Simulation Test Settings				
Insert/Edit Points					
Insert/Edit	General Options				
Edit Trajectory	Trajectory System Fault Evaluation	n			
New	Operation: 🔵 No 🧿 Yes	Interface: Trip Dist 🗸 🗸			
Trajectory	Evaluation Time				
Trajectories Groups	Reference for Start Time Count:	Pre-Simulation 1 $$ $$ $$			
	Nominal Time: 50,00 ms				
<u>R</u> emove	Positive Time Tolerance: 30,00 m	15			
Remove <u>A</u> II	Negative Time Tolerance: 30,00 m	IS			
		<u>C</u> onfirm Ca <u>n</u> cel			

Figure 52

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



Figure 53

It is verified that the trip of the distance function has occurred.







8. Report

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



Presentation Setting	\times
Languag∈ Inglês En-US ∨	
 All General Data Test General Data of Tested Device Location Reference Values Hardware Settings Test Settings Obstance Settings V Tests Selected Simulation Charts Notes and Observations Explanatory Figures Check List Connections 	
OK Cancel	

Figure 55

The figure below shows the beginning of a report. It is worth mentioning that within the Conprove Test Center (CTC) there is a tool called *"Settings"*, which allows the user to insert a figure to fill the report header image with the company's logo, for example. In addition, as the figure below highlights, it is possible to convert the report to .pdf and .rtf, therefore, this last format allows editing through Microsoft Office Word, even if the characteristics that make the report a fully produced document by Conprove software are lost.





Figure 56



9. Appendix A - Manufacturer Tolerances

1.3.12 Accuracy of the Pickup and Reset of the Distance Elements

Distance Elements

Pickup in Line Angle (static test)

 \pm 5% or \pm 0.01 Ω (V>0.5 V) of the theoretical value (the greater)

Time Measurement Fixed Time

±1% of the setting or ±35 ms (the greater)



10. Appendix B - Terminal Diagram

Analog Channels DLF-A

Magnitude	Analog Channels	Analog Analog Channels Channels description		PINS
PHASE AG VOLTAGE	VA	VOLTAGE INPUT 1	D	1-2
PHASE BG VOLTAGE	VB	VOLTAGE INPUT 2	D	3-4
PHASE CG VOLTAGE	VC	VOLTAGE INPUT 3	D	5-6
SYNCHRONISM VOLTAGE	VSYNC	VOLTAGE INPUT 4	D	7-8
NEUTRAL VOLTAGE	VG	VOLTAGE INPUT 5	D	9-10
PHASE A CURRENT	IA	CURRENT INPUT 1	D	11-12
PHASE B CURRENT	IB	CURRENT INPUT 2	D	13-14
PHASE C CURRENT	IC	CURRENT INPUT 3	D	15-16
PARALLEL LINE NEUTRAL CURRENT	IPAR	CURRENT INPUT 4	D	17-18
GROUNDING CURRENT	IG	CURRENT INPUT 5	D	19-20

Figure 57





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11. Parameter Equivalence between Relay and Software

Table 2 **PSB_OoS Software** ZIV DLF Relay Parameter Figure Parameter Figure Zn01 Zone 1 Units Phase Reach 29 Phase Reach 17 Pos. Seq. Imped. Angle 29 Pos. Seq. Impedance Angle 17 29 Phase Time 17 **Trigger Time** INNER INT R1 30 18 Right Int Resit Limit 30 Ang 1 Resist Limit Angle 18 R2 30 18 Left Int Resit Limit Ang 2 30 **Resist Limit Angle** 18 X1 30 Forward Int Reach 18 30 Ang 3 no equivalent X2 30 Reverse Int Reach 18 30 Ang 4 no equivalent MIDDLE MID **R1** 31 **Right Mid Resit Limit** 18 Ang 1 31 Resist Limit Angle 18 R2 31 Left Mid Resit Limit 18 Ang 2 31 Resist Limit Angle 18

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Forward Mid Reach

18

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X1



Ang 3	31	no equivalent		
X2	31	Reverse Mid Reach	18	
Ang 4	31	no equivalent		
OUTER		EXT		
R1	32	Right Ext Resit Limit	18	
Ang 1	32	Resist Limit Angle	18	
R2	32	Left Ext Resit Limit	18	
Ang 2	32	Resist Limit Angle	18	
X1	32	Forward Ext Reach	18	
Ang 3	32	no equivalent		
X2	32	Reverse Ext Reach	18	
Ang 4	32	no equivalent		