

TEST TUTORIAL

EQUIPMENT TYPE: Protection Relay.

BRAND: ZIV.

MODEL: IDF.

FUNCTION: 87 or PDIF Differential.

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

OBJECTIVE: Point Test and Slope Characteristic Survey.



VERSION CONTROL:

Version	Descriptions	Date	Author	Reviewer
1.0	Initial Version	17/11/2021	M.R.C.	M.P.S



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Statement of responsibility

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



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INSTRUMENTOS PARA TESTES ELÉTRICOS PROCEDURE FOR TESTING THE ZIV IDF RELAY ON DIFFERENTIAL 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 IDF 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 Analog Outputs I1, I2 and I3 to terminals 07, 09 and 11 of the D slot of the relay and their commons to terminals 08, 10 and 12, respectively. Connect channels I4, I5 and I6 to terminals 13, 15 and 17 and their common channels to terminals 14, 16 and 18. The following figure shows the procedure.







1.3. Binary Input

Connect the Binary Input to the binary output of the slot A relay as instructed in the table and figure below.

Table 1		
CE-6710 (Binary Inputs)	IDF (<i>Slot A</i>)	
BI1	OUT 1 (07 e 08)	





Figure 3

2. First steps with the IDF 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"*.

🎌 Identificati	on	×
User	zivercom	
Password	×××	
Access level		-
	OK	Cancel
	Figure 5	

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

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Figure 6

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



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	C # # File Version S/S Example # # Subestation Text 1 # Protocol 2 # Tipo de comunicación (2, red) 1 #(UCS ZIV=0, Transparente=1, telnet=2) 0 # (ipv4=0, ipv6=1) 184.0.0.10 # IPv4 32001 , 5000 # Puerto TCPIP, t mensaje red	^

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.



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Installation	Text			
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Data bits:	8 🔻	Set defau	ilt values	s
Stop bits:	1 👻	First character time	1200 Time betw	een retries
Parity:	Even 💌	Message time (ms)	⁸⁰ Numberof	retrys 3
PSTN-				
Moden	n:		Telephone ****	
- LAN	Transparent	IP Address: 10.	0.0.181 Port:	32001
			Messa	ge time (ms) 5000



When clicking on the *"OK"* button, figure 7 is returned. Select the file again and click on *"Communicate"*.

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Click "OK" again.

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S/S Example	
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OK Cance	el



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".

🎌 Dirección: ()	×
Usuário: (MAX=32)		

Senha: (MAX=32)		
*******	Annihar	Concelar
	Aceitar	Lancelar
	Figure 11	

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3. Parameterization of the ZIV IDF 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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🕞 💼 S/S Example 🔒	Text	1T Current value	New value Ur	Inits	Information		
000-IDFA-2A24732C000000000000000000000000000000000000	- 🖳 Nominal IABC1	# 5	A		(Causes device reboot)min=1, max=5, inc=4,		
Status Generation	- 🗖 Nominal IABC2	# 5	A		(Causes device reboot)min=1, max=5, inc=4,		
E Settings	— 🛄 Nominal IG	# 5	A		(Causes device reboot)min=1, max=5, inc=4,		
	- 🗖 Nominal VABC	# 110	V		(Causes device reboot)min=50, max=230, inc		
Date and Time	🖵 🛄 Nominal Freq.	# 50	Hz	z I	(Causes device reboot)min=50, max=60, inc=		
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Trip Enable							
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Coll Circuit Supervision							
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Figure 12

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







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 adjust the transformer ratio values for the current transformers and the voltage transformer.



INSTRUMENTOS PARA TESTES ELÉTRICOS ZIVercomPlus-2.13.3.1 db[3.55.3.0] File View IEDs Configuration Help 🔳 🗗 🗗 Group 1 🔹 🛛 Group 1 active 🛛 🧏 🖳 🕼 🛛 🖨 🗁 \S/S Example\000-IDFA-2A247320 Tex 1T Current value New value Units Information - ab 🚺 Max cars=20, def= ab Breaker Max cars=5, def= ab Division Max cars=64, def= ab Zone Max cars=64. def= Max cars=64, def= ab Description 1 ab Description 2 Max cars=64, def= Autodimming General Imputs Outputs LEDs Operation Mode Whase 1 CT Ratio 0=On, 1=Blocked, 2=Test, 3=Test blocked, 4=... min=1, max=100000, inc=0.01, def=1 Instatut </ 🗵 Phase 2 CT Ratio min=1, max=100000, inc=0.01, def=1 Sround C.T. Ratio min=1, max=100000, inc=0.01, def=1 R Phase VT Ratio min=1, max=100000, inc=0.01, def=1 ▼ Phase Sequence 0=ABC, 1=ACB, def=ABC 🖽 📑 Angle Reference 🖽 📑 Invert Polarity PLL Enable 0=No, 1=Yes, def=Yes Simultaneous Commands 0=No, 1=Yes, def=Yes Records TD 🔲 RD 📕 logs 🗆 🊧 🗭 🔀 11/16/2021 18:09 // $\widehat{\mathbf{z}}$



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

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S/S Example 🔒	Text	1T Current value	New value	Units Information	
- 000-IDFA-2A24732C00000000000000	- ab Name	#		Max cars=20, def=	
	b Breaker	#		Max cars=5, def=	
🖻 🙀 Settings	ab Division	#		Max cars=64, def=	
Nominal Values	- BD Zone	#		Max cars=64, def=	
Date and Time Date and Time	- ab Description 1	#		Max cars=64, def=	
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· ···································	- 🗵 Phase 1 CT Ratio	# 1		min=1, max=100000, inc=0.01, def=1	
General Trafo	- 🖂 Phase 2 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	
Trip Enable	- 🖂 Phase VT Ratio	# 1		min=1, max=100000, inc=0.01, def=1	
Trip Outputs	Phase Sequence	# ABC		0=ABC, 1=ACB, def=ABC	
Control	🕀 🎦 Angle Reference	#			
Coll Circuit Supervision	🖽 🎦 Invert Polarity	*			
Generative or time	- 🖶 PLL Enable	¥ Yes		0=No, 1=Yes, def=Yes	
Buttons P1-P6	🗌 🗏 🗄 Simultaneous Commands	¥ Yes		0=No, 1=Yes, def=Yes	
🚽 Voltage Transducer Monitoring					
H					
ie} Records					
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Figure 15

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Set the Phase 1 CT Transformer Ratio value to 80.0 and the Phase 2 CT Ratio to 1200.0. For the Phase VT Ratio, set the value of 2000.0.

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E Barran	- 🗠 Phase 1 CT Ratio	# 1	80	min=1, max=100000, inc=0.01, def=1	
Inputs Uutputs LEDs	- 🔤 Phase 2 CT Ratio	# 1	1200	min=1, max=100000, inc=0.01, def=1	
	- 🖂 Ground C.T. Ratio	# 1	1	min=1, max=100000, inc=0.01, def=1	
Trip Enable	- 🖅 Phase VT Ratio	# 1	2000	min=1, max=100000, inc=0.01, def=1	
Lockout Permission	 Phase Sequence 	# ABC	ABC	0=ABC, 1=ACB, def=ABC	
	🖽 👎 Angle Reference	#			
E Coil Circuit Supervision	🖽 📑 Invert Polarity	#			
Schedule of Time	- 🖨 PLL Enable	# Yes	Yes	0=No, 1=Yes, def=Yes	
	🗏 🖶 Simultaneous Commands	# Yes	Yes	0=No, 1=Yes, def=Yes	
Voltage Transducer Monitoring					
⊞					
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3.3. Outputs

Click on the *"+"* signs until you reach the *"Logical OR signals"* option. This option must configure the operating signals of the differential function.



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E-E+ 000-IDFA-2A24732C000000000000000000000000000000000000	- 🖃 Signal 1	# None	None					
Status	- 🖃 Signal 2	# None	None					
⊟ âre Settings	- 모 Signal 3	# None	None					
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g= Kaccaning 	Gignal 7	# None	None					
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Inputs	Signal 10	None	None					
	- 🗹 Signal 11	# None	None					
🔁 📲 Digital Output 1	- 🛡 Signal 12	# None	None					
Logic OR signals	- 💌 Signal 13	# None	None					
	- 🗹 Signal 14	# None	None					
🕀 📲 Digital Output 3	- 🔽 Signal 15	# None	None					
⊞ — 🚰 Digital Output 4	Signal 16	# None	None					
🗄 🔤 📲 Digital Output 6								
🗄 🏪 Digital Output 7								
😟								
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🕀 📲 🚰 Protection								
Trip Enable								
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⊞— ° ∰∎ Oscillography								
Buttons P1-P6								
	,					TD RD logs	F 🗙 🗩 🐻 11	1/16/2021 18:22 //

Figure 17

Click on the *"None"* option highlighted in the previous figure and make the following adjustment.

💽 Signal 1	×
Signals	
Overfrequency Unit 1 Tr Overfrequency Unit 2 Tr Overfrequency Unit 3 Tr Overfrequency Unit 4 Tr OverVoltage of Voltage Phase A Differential Unit Phase A Instantaneous Phase A Instantaneous	ip ip ip Transd. tTrin Differential Unit Trip Unit 1 Trip Unit 2 Trip Unit 3 Trip Unit 4 Trip Unit 5 Trip Unit 6 Trip
Signals groups	🦳 All signals
Trip protection outputs	•
<-	OK Cancel

Figure 18

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Repeat the above procedure for phases B and C and also input the *"Differential Unit Trip"* signal. Then send the settings to the relay.

🔀 ZlVercomPlus-2.13.3.1 db[3.55.3.0]				- 🗆 ×
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X	Group 1 💽 Group	1 active 🧏 🗏 📭 🖬	🖆 🚭 🛛ettings\Inputs Outputs	LEDs\Outputs\Slot A\Digital Output 1\Logic OR signals
Automming Synchronization Synchro	Text Group 1 Group 1	I active Image: Constraint value Ne 11 Current value Ne 2 Differential Unit. Phase A Instant 4 Phase B Instant Phi 5 Phase B Instant Phi 6 Phase C Instant Diff 7 None No 8 None No 6 None No 7 None No 8 None No 9 None No 10 None No 11 None No 12 None No 13 None No 14 None No 15 None No 16 None No 17 None No 18 None No 19 None No 10 No No 11 No No <t< td=""><td></td><td>LEDs\Outputs\\Slot A\Digital Output 1\Logic OR signals Units Information Information Information Image: Image:</td></t<>		LEDs\Outputs\\Slot A\Digital Output 1\Logic OR signals Units Information Information Information Image:
Cold Load				
				TD RD Iogs 🕂 📯 🖸 11/16/2021 18:45:17

Figure 19

Click on "General Trafo" in this option to adjust the nominal values of voltages, power, connection and phase shift of the power transformer windings. The "Type of Tap" field defines how the Taps will be calculated, which can be "Automatic" or "Manual". If the "Manual" option is used, the taps will be defined by the fields "Tap winding 1" and "Tap winding 2".



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🖃 📩 🖬 S/S Example 🔒	Text	1T Current value	New value	Units	Information	
	- 🖳 Wndg 1 connection	# WYE	WYE		0=WYE, 1=DELTA, 2=ZIGZAG, def=WYE	
E Status	- 🖶 ZS Filter wndg 1	# Yes	Yes		0=No, 1=Yes, def=Yes	
Configuration	Wndg 2 connection	# WYE	DELTA		0=WYE, 1=DELTA, 2=ZIGZAG, def=WYE	
	- Windg 2 phase ang	# 0	1		min=0, max=11, inc=1, def=0	
Date and Time	- 🗒 ZS Filter wndg 2	# Yes	No		0=No. 1=Yes. def=Yes	
Communications	- ▼ Zero Seg Filter Type	# Phase Channels	Phase Channels		0=Phase Channels 1=IG Channels def=Phas	
	Reference Wodg	# Winding 1	Winding 1		0-Winding 1 1-Winding 2 def-Winding 1	
🗈 📲 🚰 General	Type of Tan	# Automatic	Manual		0-Automatic 1-Manual def-Automatic	
🖨 🃲 🖕 Inputs Outputs LEDs	R Davies Tarfa	# 100	150	MAVA	min=0.2 max=10000 inc=0.1 def=100	
Transducers	Power Iraro	# 100	150	IVIVA	min=0.2, max=10000, mc=0.1, del=100	
III IIII IIIIIIIIIIIIIIIIIIIIIIIIIIIII	Voltage 1	* 400	230	KV	min=0.4, max=1200, inc=0.1, det=400	
i⊒ Sot A	Voltage 2	400	13.8	ĸv	min=0.4, max=1200, inc=0.1, det=400	
🕀 🃲 Digital Output 1	Tap winding 1	* 1	1.5	A	min=0.02, max=150, inc=0.01, def=1	
📺 🔤 📑 🖬 Digital Output 2	Tap winding 2	# 1	2	Α	min=0.02, max=150, inc=0.01, def=1	
□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □	- EX Gnd C Winding	# 1	1		min=0, max=2, inc=1, def=1	
The Digital Output 5	- 🖶 Autotransformer	# No	No		0=No, 1=Yes, def=No	
🕀 📲 Digital Output 6				1		
庄 🔤 📲 Digital Output 7						
🖽 🔤 Slot B						
H Slot D						
🕀 📲 Leds						
[®] <mark>General Trafo</mark>						
Protection						
Schedule of Time						
Buttons P1-P6						
Voltage Transducer Monitoring						

Figure 20

Click the "+" sign near to "Protection" and select the "Differential Units" option. This option defines how the restriction current will be calculated in the "Restraint Type" field. Be careful, as there are two different methods.



ZIVercomPlus-2.13.3.1 db[3.55.3.0] × Configuration Help General File View IEDs Configuration Help S \times 💽 🛛 Group 1 active 🛛 🐴 🗳 🖉 🔳 🕩 🗗 🛛 Group 1 ...0-IDFA-2A24732C000000XXX0-2010752\S Text 1T Current value New value Units Information # (I1+I2-Id)/2 # Yes 0=(11+12-1d)/2. 1=(11+12)/2. def=(11+12-1d)/2 - 🖃 🚺 (I1+I2-Id)/2 Fault Detector Supervision 0=No, 1=Yes, def=Yes Yes Diff curr measure # Times Tap Times Tap 0=Times Tap, 1=x Ref Tap, def=Times Tap 🗄 🎦 Differential 🗄 📲 Instantaneous Differential TD 🔲 RD 🔲 logs 🗆 🔆 🗩 🔀 11/17/2021 08:53:50 $\widehat{\mathbf{z}}$

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Figure 21

Click the "+" sign near to "Differential Unit" and select the "Differential" option and make the following adjustments.



ZIVercomPlus-2.13.3.1 db[3.55.3.0] × File View IEDs Configuration Help S 🔳 📴 📑 Group 1 🖌 | Group 1 active | 🛂 🖳 📭 | 🖨 🖨 | ferential Units\D Text 1T Current value New value Units Information A24732C000000000000 000-IDFA-2A247320 Diff En No 0=No. 1=Yes. def=No Yes Status Configuration Settings - B xta... min=0.05, max=1, inc=0.01, def=0.3 0.3 0.3 Sensitivity Restraint slope 25 25 % min=5, max=100, inc=0.01, def=25 R Slope 1 Start 0 0 xta... min=0, max=2, inc=0.01, def=0 75 Restraint slope 2 75 % min=5, max=200, inc=0.01, def=75 R Slope 2 Start xta... min=2, max=20, inc=0.01, def=5 Ext Fault Block Enable Yes Yes 0=No. 1=Yes. def=Yes 2nd Restr. Enab. 0=No, 1=Yes, def=No No No 2nd Restraint PU 0.2 0.2 min=0.05, max=0.8, inc=0.01, def=0.2 🖶 3rd Restr. Enab. No No 0=No. 1=Yes. def=No 2 3rd Restraint PU min=0.05, max=0.8, inc=0.01, def=0.35 0.35 0.35 4th Restr. Enab. No No 0=No, 1=Yes, def=No 2 4th Restraint PU 0.2 0.2 min=0.05, max=0.8, inc=0.01, def=0.2 0=No, 1=Yes, def=No Sth Restr. Enab. No No 또 5th Restraint PU 0.35 0.35 min=0.05, max=0.8, inc=0.01, def=0.35 Harmonic Restraint Mode Continuous Continuous 0=Continuous, 1=Dynamic, def=Continuous X Diff Time Delay min=0, max=300, inc=0.01, def=0 s H Blocking Logic 2 OUT OF 3 2 OUT OF 3 0=1 OUT OF 3, 1=None, 2=2 OUT OF 3, 4=3P.. 🕅 Cross Blocking Time 0.1 0.1 s min=0.05, max=300, inc=0.01, def=0.1 0=No, 1=Yes, def=Yes 2nd Block. Enab. Yes Yes 또 2nd Blocking PU 20 20 % min=5, max=100, inc=1, def=20 5th Block. Enab. Yes Yes 0=No, 1=Yes, def=Yes % min=5, max=100, inc=1, def=35 XY 5th Blocking PU 35 35 ■ <mark>| Different</mark> ■ | Instantar ous Differentia Harmonic Blocking Mode Continuous 0=Continuous, 1=Dynamic, def=Continuous Continuous External Fault Detector Winding 1 Winding 2 Directional Inhibition Time for Harmonics 80 80 s min=1, max=300, inc=0.01, def=80 0=No, 1=Yes, def=No Parallel Transformer No No Voltage Restrained Overcurrent Voltage Restrained Overcurrent TD 🔲 RD 🔲 logs 🗆 🚧 💁 11/17/2021 08:59:30

INSTRUMENTOS PARA TESTES ELÉTRICOS

Figure 22

Click on the option "Instantaneous Differential" and make the following configuration.



ZIVercomPlus-2.13.3.1 db[3.55.3.0]				- 🗆 X
File View IEDs Configuration Help				3
	🔳 🗗 🕶 Group 1 🛛 🔹 Group '	lactive 📑 🖺 🗓	2 🖻 🍯	X0-2010752\Settings\Protection\Differential Units\Instantaneous Differential
🖃 💼 S/S Example 🔒 📃 🔥	Text -	1T Current value	New value	Units Information
	- 🖨 Inst Diff Enable	No	Yes	0=No, 1=Yes, def=No
Status G	- 🗷 Inst Diff Pickup	8	4.5	xta min=1, max=20, inc=0.01, def=8
E- Settings	- 🗵 Inst Diff Delay	0	0	s min=0, max=300, inc=0.01, def=0
Nominal Values	Ext Fault Block Enable	Yes	Yes	0=No, 1=Yes, def=Yes
Date and Time				
🕀 📲 📲 General				
😑 🖕 Inputs Outputs LEDs				
+				
🛱 🚥 📲 Slot A				
🕀 📲 📴 Digital Output 1				
🕁 📲 📲 Digital Output 5				
🗄 📲 📲 Digital Output 6				
😟 🔤 🖬 🖬 Digital Output 7				
Heren Stor B				
⊕ " ∰= Leds				
General Trafo				
Protection Differential Units				
Differential				
Instantaneous Differential				
External Fault Detector				
Winding 1				
□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □				
i• Overload				
p is in the state of the state	11			
				TD 🔲 RD 🔲 logs 🍼 📯 🖬 11/17/2021 09:05:42

Figure 23

4. Application Manager

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



Figure 24

4.1. Differential software adjustments

Open the Differential application within the Conprove Test Center (CTC) software area, as highlighted in the figure below.







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.



🗶 🗋 🞯 🛃 🚽 Differential 2.02.162 (64 Bits) - CE-6710 (0151117)		– a ×
Arquivo Home Display Software Options		^ (
Channels Direc. V Connection	Indirut test all Min Maveform ∞ System → Phasors → Relay Settings Settings Min Maveform ∞ System → Phasors → Relay SEL Negent Nege	
Hardware Settings	X	
lest Set Point lest Search lest lest		
Insert/Edit Points General Ontione General	General Inform. System Notes & Obs. Explanatory Figures Check List Others Connections	ors
Edit Point Data Entry: Differential	Descr: Differential Date:	Test Points: Colors:
New Point V Winding 1	Tested device:	Phase A Not Test. Phase B Passed Phase C Fail
Sequence Fault Location: Winding2	Identr: 23131992 Model IDF V Type: Transformer Protection V Manufacturer: ZIV V	
Fault Type: Remove All A.R.C.	Location: Substation: CONPROVE V	Phase A - IDiff.
Test Points Points Tested	Bay: 1 ~ Address: Visconde de Ouro Preto, N°75 - Custódio Pereira Neighborhood ~	- IRest Phase B
No. Fault IDiff IRest	City: Uberlândia V State: MG V	- IDIIT: - IRest
	Responsible: Name: Michel Rockembach de Carvalho V Sector: Engineering V Registry: 00001 V Tool Test: CE-6710 Series Num:: 01511177CCIM33222211U5HVRGLGLGL220RXO	Phase C - IDiff: - IRest
Diff and iRest Operating Region		IRest [in] 00 9.00 10.00 11.
Errors List Protection Status Default V	Preferences OK Cancel	

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 VT's and CT's are configured. There are also two sub tabs *"Impedance"* and *"Source"*, whose data is not used for this test.







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. Differential screen > Protected Equipment / CT's

In this tab you must inform the protected equipment, the number of windings, rated voltages, rated powers, the primary and secondary currents of the main CT's and the currents of the auxiliary CT's, if necessary. This test uses the settings for a relay that is protecting a transformer. However, it is possible to test the bus, generator, motor and line protections. For transformer protection there is the possibility of testing up to four windings automatically.





Figure 28

4.3. Differential Screen > Adjust Prot. Differential > Settings

The first option in the *"Data Entry"* field is set to *"User"*, thus all other settings such as TAP, lag compensation, mismatch correction, measurement current type, reference winding for calculations and option Zero sequence elimination are enabled so that the user can, according to the relay, perform the adjustment correctly (Free Configuration). This method allows the user to test any type of differential relay, but it requires more knowledge of the relay.

To facilitate configuration, the settings of the main relays available on the market have already been standardized. When selecting one of the relays from the list, only



parameterizable settings will be enabled. In this tutorial, the mask "ZIV IDF / IDV / IDX" is used.

Settings





Parameterize the "Differential" and "Instantaneous" settings and the operating times as zero (0.0s). Use the tolerances for current and time given in Appendix A. Note that the formula for calculating the "Restriction Current" must be parameterized equal to the relay setting. Another detail is whether the "TAP's" field is calculated or defined by the user. In the second case, it is necessary to adjust the values of each tap.



ings	
General Protected	Equipment/CTs Adjust Prot. Differential
Differential	Slope Definition Data Entry: ZIV IDF/IDV/IDX
	Differential Settings Instantaneous Settings Current Tolerance Pickup: 0,30 ln Pickup: 4,50 ln
	Time: 0.00 s Absolute: 0.05 ln
	Restriction Current Tolerance Tolerance
	K: 2 Absolute: Absolute: 4000 ms
	General Options Phase Shift Compensation: TAPs: User Def. V Set Fixed Angle Refore Leg:
	Side: 1 Image: Side: Image: Side: Image: Side: Image: Side: Image: Side: Image: Side: Side: Image: Side: Si
	Zero Sequence Elimination
Vefault V	Preferences <u>O</u> K <u>C</u> ancel

Figure 30

By clicking on the *"Set..."* icon, the tap values are configured.



Set TAPs ×							
	Use CT Mult. TAPs						
	Descr.	TAP					
	Wnd. 1	1,50 A					
	Wnd. 2	2,00 A					
	<u>O</u> k <u>C</u> ancel						

Figure 31

4.4. Differential Screen > Adjust Prot. Differential > Slope Definition

On this screen, the values of the slopes and the star of each slope are entered.





Figure 32

5. Channel Direction and Hardware Configurations

Click on the icon illustrated below.



💯 📄 🗃 🚽 = Differential 2.02.162 (64 Bits) - CE-6710 (0151117)						
Arquivo	Home	Display	Softwa	re Option	IS	
Channels Direc.	😭 Hrd Se 🗶 Sync. S 📢 Conne	et ∉ ^G o GC Set ⁵, SV ection	OOSE Set Set	Start	Stop	> Next Point Clear test
Hardware					Gene	ration
		г	iauro 22	,		

Figure 33

Then click on the highlighted icon to configure the hardware.



Figure 34

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





Figure 35

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

Cha	hannels Direct.	— 🗆 X
es Local	Model Reset for Hard. CE:6710 Certain Connected Set	Confirm
ote	Serial Number:	
Rem	01511177CCM33222211U5HVRGLGLGL2Z0RX0 ∨ Volue 5, S. Value	Import Export

Figure 36

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6. Test Structure for Function 87

6.1. Test Settings

In this tab, the test set channels are associated with the relay phases the trip signal is configured with the binary input. An important detail is to insert a pre-fault with nominal values as shown below.

I Differential 2.02.10 Arquivo Home Display Soft	52 (64 Bits) - CE-6710 (0151117) ware Options		- ¤ × ^ ()
Hrd Set ∰ GOOSE Si Channels Direc. ♥ Connection	et > Next Point Start Stop Clear test Clear all	₩ Waveform @ System ₩ Phasors Palage Ittings Fresent SEL Present Recreate Restore View Charts Layout View	
Hardware	Generation	Options Report Units Layout	
Test Set Point Test Search Test	Test Settings	C Factor Bar Factor 2	Test Cat
Generation Channels Direc.	Made Naminal	Enable Pre-Fault 2	Test Set
	11 471 A -150 0 °	4	Wait Time for Data Entry: 60,00 s
01 lb AD 102 (Hrd: 12)	12 4.71 A 90.00°		Mult. Tolerance: 1,00
01 lc AO_103 (Hrd: I3)	I3 4,71 A -30,00 °		Point Test
02 Ia AO_104 (Hrd: 14) -	14 5,23 A 0 °	-	Wait Time for Operation: 100.00 ms
02 Ib AO_105 (Hrd: 15)	I5 5,23 A -120,0 °		That fine for operation. Too, or ma
02 Ic AO_106 (Hrd: 16) -	16 5,23 A 120,0 °		Search Test
01 Va AO_V01 (Hrd: V1)			Initial step: Absolute Resolution: 100,00 mA
01 Vb AO_V02 (Hrd: V2) 💌			Min. Resolution V Relative Resolution: 0.50 %
01 Vc AD_V03 (Hrd: V3)	-		Weit Time for Operation: 100.00 mm
02 Va AO_V04 (Hrd: V4) -	-11		Wait Time for Operation. 400,00 ms
02 Vb			Disconsider the characteristic in Search
U2 Vc			Pulsed Search (Stop every increment)
Binary Outputs & Goose - Fault	Time Pre-Fault 1: 100,00 ms Binary Outputs & Goose - Pre-Fault 1	J	Multiple of Tolerance for Verification Test: 1,10
BO 0; 0; 0; 0; 0; 0	BO 0; 0; 0; 0; 0 🔻		General Reset Time: 100,00 ms
GO T	GO GO	-	Nº of repetitions in case of generation error: 2
Generation Limits	Teet Mode		Ston the test at the first failure
Max Gen per Chn by hard	Mode Intelligent -	7	
Use Hardware Limit	Variation of RMS and Angle		_
Stop Interf. BI01 (Hrd: BI1) V	Stop Logic Initial NA 🗸		Ignore Pre-Fault operation
Trigger Interf. Software 🗸 🗸	Trigger Logic		Based Only on Generated Values
Wait for PPS	Trigger Delay 0,00 s		Cycle to Cycle Generation
1 ON Line New	 	Aux Source: 110.00 V Heating: 0%	

Figure 37

6.2. Point Test

For the point test, click on the *"New Point"* field choose the fault type and the differential and restraint current values. Then click on the confirm button.





Another way is to use the *"Sequence"* feature of points by choosing the values of *"Initial", "End"* and *"Step".* In this way the software automatically creates the points.





Figure 39

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



Figure 40



6.3. Final Score Test Result

It is verified that in the operating region the relay acted within the expected time. In the non-operation region, the relay does not actuate.



Figure 41

6.4. Search Test

To perform the search test, click on the "New Line" field, choose the fault type, the restraint current value and confirm.





Figure 42

There is also another way to add test lines, by adding a search string. To do this, just click on the *"Sequence"* button and select the initial and final restriction current of the search and the step between them.





Figure 43

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



Figure 44

6.5. Final Search Test Result

It is verified that all differential current values found are within tolerance.







7. 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 46

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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 "Preferences", which allows the user to insert a figure to fill the report header image with the company 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.



Figure 47



8. Appendix A - Manufacturer Tolerances

Differential Units

Pickup and Reset

±3 % or **±50mA** of the theoretical value (the greater) (In = 1A and 5A)

Туре	Enabled	Times I0	Measuring Times (**)	
		(Sensitivity)	50Hz	60Hz
Blocking or		1.5	32 ms	28 ms
Harmonic	YES	5	31 ms	28 ms
Restraint		15	31 ms	28 ms
Blocking or		1.5	28 ms	27 ms
Harmonic	NO*	5	17 ms	16 ms
Restraint		15	15 ms	14 ms
When the Block	king type / Harmo	onic Restraint setting is	s in Dynamic mode, I	blocking / restrair

Figure 48



9. Appendix B - Terminal Diagram

• Analog Channels IDF-A (2 Sets of Three-Phase Current)

Magnitude	Analog Channels	Analog Channel description	SLOT (1/2 rack)	PINS
PHASE VOLTAGE AG	VA	VOLTAGE INPUT 1	С	1-2
PHASE VOLTAGE BG	VB	VOLTAGE INPUT 2	С	3-4
PHASE VOLTAGE CG	VC	VOLTAGE INPUT 3	С	5-6
PHASE A CURRENT WINDING 1	IA1	CURRENT INPUT 1	С	7-8
PHASE B CURRENT WINDING 1	IB1	CURRENT INPUT 2	С	9-10
PHASE C CURRENT WINDING 1	IC1	CURRENT INPUT 3	С	11-12
PHASE A CURRENT WINDING 2	IA2	CURRENT INPUT 4	С	13-14
PHASE B CURRENT WINDING 2	IB2	CURRENT INPUT 5	С	15-16
PHASE C CURRENT WINDING 2	IC2	CURRENT INPUT 6	С	17-18
GROUNDING CURRENT	IG1	CURRENT INPUT 7	С	19-20

Figure 49





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10. Appendix C - Parameter Equivalence between Relay and Software

Differential Software		ZIV IDF Relay	
Parameter	Figure	Parameter	Figure
Voltage (Wind. 1)	28	Voltage 1	20
Voltage (Wind. 2)	28	Voltage 2	20
Power (Wind. 1)	28	Power Trafo	20
Power (Wind. 2)	28	Power Trafo	20
Connection (Wind. 1)	28	Wndg 1 connection	20
Connection (Wind. 2)	28	Wndg 2 connection	20
Vector Group (Wind. 2)	28	Wndg 2 phase ang	20
Ip Prim (Wind. 1)	28	Phase 1 CT Ratio (x 5,0A)	16
Ip Prim (Wind. 2)	28	Phase 2 CT Ratio (x 5,0A)	16
Is Sec (Wind. 1)	28	Relay part number	
Is Sec (Wind. 2)	28	Relay part number	
Differential Settings	30	Sensitivity	22
Instantaneous Settings	30	Inst Diff Pickup	23
Restriction Current	30	Restraint Type	21
General Options / TAPs	30	Type of Tap	20
TAP (Wind. 1)	31	Tap Winding 1	20
TAP (Wind. 2)	31	Tap Winding 2	20
Slope 1	32	Restraint Slope 1	22

Table 2

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Slope 1 Start	32	R Slope 1 Start	22
Slope 2	32	Restraint Slope 2	22
Slope 2 Start	32	R Slope 2 Start	22