

Test Tutorial

Equipment Type: Protection Relay

Brand: Siemens

Model: <u>7UT86</u>

Function: 87 or PDIF Differential Percentage

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

Objective: <u>Test Settings, Testing Point and Survey of</u> <u>Feature Slope</u>

Version control:

Version	Descriptions	Date	Author	Reviewer
1.0	Initial release	17/09/2021	M.R.C.	M.P.S



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Statement of responsibility

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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.



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.

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INSTRUMENTOS PARA TESTES ELÉTRICOS Sequence for 7UT86 relay tests in DIFFERENTIAL software

1. Relay connection to CE-6006

Appendix A shows the relay terminal designations.

1.1 Auxiliary Source

Connect the positive (red terminal) of the Vdc Aux. Source to pin B1 of slot 2B of the relay and the negative (black terminal) of the Vdc Aux. Source to pin B2 of slot 2B.



1.2 Current Coils

Connect I1, I2 and I3 current channels of the CE-6006 to pins A1, A3 and A5 of slot 1A of the relay respectively, if the commons of the relay are short circuited, just connect the commons of the channels to that point, otherwise connect the three common of the CE-6006 to pins A2, A4 and A6 of slot 1A of the relay thus forming the winding 1 connection. Similarly, to establish the winding 2 connection, connect I4, I5 and I6 current channels to pins B1, B3 and B5 of the relay slot 1B respectively, connecting the three common to pins B2, B4 and B6.





1.3 Binary Inputs

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

• BI1 to pin D1 and its common to pin D2;



2. Communication with 7UT86 relay

First connect a USB cable from the notebook with the relay. Then double-click on the relay software icon.



When opening the program, click on the "Project" option and choose the "New" option.





Figure 5

Enter a name for the project and then click "Create" as highlighted below.

Create a new project	×
Project name:	PDIF
Path:	C:\Users\Michel\Documents\Automation
Author:	Michel
Comment:	
	Create Cancel

Figure 6

When creating the project, add the relay that will be tested, double-click on "*Add New Device*" as highlighted below.



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Figure 7

Enter the relay short code located on its side, then click "Verify" as highlighted below.

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→	Step 1: Select device type		
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	or configure in Hardware and protocols Editor:	Configure	1
0	Step 2: Select device properties		
	Voltage variant:	▼	
	Integrated Ethernet interface (port J):		j
	Significant feature:		j
	Select function-point class:		
0	Step 3: Select application template Application-template selection:		
0	Step 4: Select communication versions Communication configuration:)
	Open Hardware and protocols Editor after device creation		
	Update short product code (TNS) list	OK Cancel	

Figure 8

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Select the highlighted "*Template*" whose firmware version is consistent with that of the relay (To verify, just look at the relay HMI when it is turned on). Then click "*OK*".

Add	new device				×
0	Step 1: Select device type				
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	or configure in Hardware and protocols Editor:	Configure			
0	Step 2: Select device properties				
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	Integrated Ethernet interface (port J):	Only DIGSI 5 connection			-
	Significant feature:	No significant feature available for selected device	type>		T.
	Select function-point class:	Base + 75	71		÷.
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	Application-template selection:	Application templates	Configuration	Status	
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		Two-winding transformer basic (871)	V06.03.02		
		Two-winding transformer (87T, 50BF, 87N)	V07.31.03	ĕ	
		Two-winding transformer (87T, 50BF, 87N)	V07.00.15	•	*
v	Step 4: Select communication versions				
	Communication configuration:	V07.31			-
	Open Hardware and protocols Editor after device creation				
E	Update short product code (TNS) list		ОК	Cancel	

Figure 9

Note that a generic relay has been added (highlighted in green below). The next step is to establish communication with the equipment, for that go to the "Online" menu and choose the option "Connect to device and retrieve data".



DIGSI 5 V7.50 - C:\Users\Michel\Documents\Automation\PDIF\PDIF Project Edit View Insert Online Options Window Tools Help 🝠 Connect to device and retrieve data Alt+Ctrl+O 🛉 📑 🔚 Save project 🛛 9 🛃 Disconnect device Alt+Ctrl+ Project tree Devices & networks Refresh configuration from device Devices Remove assignment 📑 O O 👯 🖭 🔍 ± Network 🏂 Reset LED Show open source software information 🔻 📄 PDIF Initialize device 🕂 Single-line configura Load configuration to devices 7UT86 💣 Add new device Load firmware to devices 7UT86 🚠 Devices and networ Device-production log ٠ 🔚 7UT86 • EC 61850 stations 🚚 Load configuration to devices 攣 Load firmware to devices

Figure 10

After establishing communication with the relay, it is necessary to read the parameterized settings. Right-click on the relay icon (highlighted in green in the previous figure) and choose the option "Update configuration from target device".

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Figure 11

Click on "Yes" for the following message:



There will be other warning messages (didn't shown), click *"Yes"* on all. If the procedure is carried out properly, the following screen will be reached.

Update	configuration from target device X
Update	configuration from target finished successfully.
0	
Status	I View
Status	
v	Successfully updated the offline configuration from the target device.
	Save result
	OK

Figure 13

Export the created file in .dex5 format in order to have a backup of the settings. Right-click on the relay icon and choose the *"Export..."* option.



Figure 14



There are other ways to extract information from Siemens Siprotec 5 relays, but the displayed mode is practical for those who will commission a relay already parameterized and installed in a panel.

3. Parameterization of the 7UT86 relay

3.1 Device Settings

After the connection has been established, open the device section "7UT86". Then open the "Settings" section, finally choose the "Device Settings" option. Check that group 1 is active, that the nominal frequency is 60Hz and the minimum operating time is zero seconds.

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Figure 15

3.2 Power System - General

Open the "Power System" section and select the "General" option. Check the parameterized phase sequence.



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Figure 16

3.3 Meas. Point I-3ph 1

Select the option "*Meas. Point I-3ph 1*". Adjust the values of primary, secondary and magnitude compensation factor for the first winding and disable the supervision functions. Click on the "*Info*" tab to hide it and enlarge the settings window.

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Figure 19



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Figure 20

3.4 Meas. Point I-3ph 2

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Figure 22

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Devices and networks		a
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Device information	11.932.2491.101 Release threshold: 0.500	A
Hardware and protocols	11 932 2491 102 Threshold min/max: 0.50	
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😺 General		
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Recording	11.932.2551.6 Delay supervision alarm: 5.00	5
Transformer side 1		
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Figure 23



Project Edit View Insert Online Options Tools V	Mindow Help → ← 🖥 🗙	= 11 👳	Energy Automation DIGSI 5 Premium
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▼ 4 7UT86	3	Sunv. sum l	5
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Test sequences	*	Properties Linto L	Diagnostics

Figure 24

3.5 General

Open the "*Transformer side 1*" option and double-click the "*General*" option to adjust the voltage, power, winding type and vector group.

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▼ 🔄 PDIF	^	General	
🗧 🕂 Single-line configuration		Rated values	_
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d Devices and networks		911.91.103 Rated apparent power: 38.10 M	/A 🔼 Te
▼ 🛄 7UT86	1	911.91.102 Rated voltage: 110.00 kV	AS O
Device information		911 91 101 Rated current: 200 A	
Hardware and protocols			
Evention aroun connections		Side data	
the Information routing			
Communication manning		911.91.149 Neutral point: isolated	
 Settings 		911 91 104 Winding configuration: D (Delta)	
Device settings		Viniting coniguration. D (Dena)	
Time settings		911.91.163 Vector group numeral: 0	AÖ
		911.91.130 Side number: Side 1	Aõ
Second Second		911.91.210 MI3ph1 usesMeasP with ID: 1	AN
Meas.point I-3ph 1		911.91.215 CT mismatch MI-3ph 1: 1.000	
Meas.point I-3ph 2			<u>no</u>
Recording		Tan changer	
Transformer side 1		·	
😜 General		911.91.44 Tap changer: No function block available	
Process monitor			
😜 49 Th.overlA 1		Tap changer phase	
Circuit-breaker interaction			
Transformer side 2		911.91.45 Tap changer: No function block available 🔻	~
Transformer diff. 1		<	>
Gircuit breaker 1	~	🔍 Properties 🕅 🗓 Info 🔒	🖁 Diagnostics 🔤 🗖 🚍 📥
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Figure 25



3.6 General

Open the "*Transformer side 2*" option and double-click the "*General*" option to adjust the voltage, power, winding type and vector group.

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🐔 🕂 Function-group connections	hated values			F		
🗱 Information routing	912.91.103	Rated apparent power: 38.10	MVA	2.		
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▼ Los Settings	012.01.102	Pater average 2000				
Device settings	912.91.101	Rated current: 2000	^	AO		
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Weas.point I-3ph 1	512.51.145	Neutral point. grounded	-			
Weas.point i-spn 2	912.91.104	Winding configuration: Y (Wye)	-			
Recording	912.91.163	Vector group numeral: 1		R		
• • • • • • • • • • • • • • • • • • •	912.91.130	Side number: Side 2		R		
Process monitor	912 91 210	MBph1 usesMeasP with ID: 2				
b 49 Th overl -A 1	012.01.215	CT minmatch MU Pack 1: 1 000				
Circuit-breaker interaction	912.91.215	CI mismatch MI-sph 1: 1.000		AS		
Transformer side 2	Transformer					
Seneral Second	Tap changer					
Process monitor	012 01 44	Tap changer: No function block available				
😜 50/51 OC-3ph-A1	212.21.44	ing changer. Indianendri block avanable				
😜 Inrush detect.	Help E Image: Polif > 70186 > Settings > Transformer side 2 > General Image: Polif > 70186 > Settings > Transformer side 2 > General Image: Polif > 70186 > Settings > Transformer side 2 > General Image: Polif > 70186 > Settings > Transformer side 2 > General Image: Polif > 70186 > Settings > Transformer side 2 > General Image: Polif > 70186 > Settings > Transformer side 2 > General Image: Polif > 70186 > Settings > Transformer side 2 > General Image: Polif > 70186 > Settings > Transformer side 2 > General Image: Polif > 70186 > Settings > Transformer side 2 > General Image: Polif > 70186 > Settings > Transformer side 2 > General Image: Polif > 70186 > Settings > Transformer side 2 > General Image: Polif > 70186 > Settings > Transformer side 2 > General Image: Polif > 70186 > Settings > Transformer side 2 > General Image: Polif > 70186 > Settings > Transformer side 2 > General Image: Polif > 70186 > Settings > Tap changer: No function block available < Polif > 718 properties Image: Polif > 7180183 Image: Pol					
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Figure 26

3.7 87T diff. Prot. 1

Open the option "*Transformer diff. 1*" and double-click the "87T diff. Prot.1" to perform differential function adjustments.

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😜 General	General				
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Circuit-breaker interaction	901.1691.11041.6	Operate delay:	0.00	s	
 Transformer side 2 					
😜 General	Operate curve				
Process monitor					
Inrush detect.	901.1691.11041.3	Threshold:	0.30	l/lrObj	
😜 50/51 OC-3ph-A1	901.1691.11041.100	Slope 1:	0.30		
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🔻 🍕 Transformer diff. 1					
😺 87T diff. prot. 1	901.1691.11041.102	Slope 2:	0.60		
😷 Circuit-breaker interaction	901.1691.11041.103	Intersection 2 Irest:	5.00	l/lrObj	
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Qircuit breaker 1	Starting detection				
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Charts	901.1691.11041.106	Starting detection:	no	-	
Display pages	901.1691.11041.107	Thresh, startup detection:	0.1	l/IrObi	v
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📙 Device settin 👂 6 General 🔺				The project PDIF was saved su	iccessfully.



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



Adjust the field "*Threshold add-on stabiliz*." to 20.00 so this feature will not influence the test. Disable "*I-DIFF fast*" and set "*I-DIFF unrestr*" to 7.50A.

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😜 General		901.1691.11071.3	Threshold:	7.5 l/lrObj	
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Figure 28

3.8 Information Routing

In the "*Information Routing*" option, the trip signal of the differential function is associated with the physical outputs of the relay. For easier viewing maximize the window.

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T Function-group connections		Device	4171			
Information routing		Alarm handling	5971			
Communication mapping		Fime managem.	8821			
Settings		Fime sync.	8851			
Device settings		Res, binary outputs	4711			
Time settings		Res. LED not in Grp.	7411			
		Power system	11			
Seneral Second		Recording	51			
Meas.point I-3ph 1		J:Onboard Ethernet	101			
Meas.point I-3ph 2		Gransformer side 1	911			
Recording		Transformer side 2	912			
▼ 🐨 Transformer side 1		Itansformer diff, 1	901			
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Process monitor		Gircuit breaker 2	202			
9 49 Th.overlA 1		E:ETH-BB-2FO	102			
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* Circuit-breaker interaction						
▼ 🙀 Transformer diff 1	*				🖳 🖳 Properties 🛛 🚺 Info 🚺 🖏 Diagno	stics =





The first columns are associated with the binary inputs of the relay. In that case they will not be used. Double click on the *"Source"* option to hide these adjustments.

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Figure 30

Enter the options "Transformer diff. 1 > 87T diff. Protection 1 > I-DIFF".

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J:Onboard Ethernet	101																												
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Behavior	901.1691.1	ENS																											
Health	901.1691.1	ENS																											
Pickup	901.1691.1	ACD																											
Operate delay expired	901.1691.1	ACT																											
Operate	901.1691.1	ACT																											
Slope 1	901.1691.1	MV																											
Incr. of char. (Start)	901.1691.1	SPS																											
Increase of char. (DC)	901.1691.1	SPS																											





Associate the "general" signal within "Operate delay expired" to output 1.1. Look at the columns for this signal "Destination > Binary output > Base module".

Point Use variable Point Point <th>ŀ</th> <th>DIGSI 5 V7.50 - C:\Users\Michel\Docum</th> <th>ents\Automati</th> <th>on\PDI</th> <th>F\PDIF</th> <th></th> <th>٦X</th>	ŀ	DIGSI 5 V7.50 - C:\Users\Michel\Docum	ents\Automati	on\PDI	F\PDIF																									٦X
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Image: State Point Stat	П					Bina	ry outpu	t								► LEDs														
Signals Number Type 1.1 1.2 1.3 1.4 2.1 2.2 3.3 3.4 3.5 3.6 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 1.0 1.11 1.12 1.3 1.4 1.5 1.6 1.7 1.8 1.9 1.0 1.11 1.12 1.3 1.4 1.5 1.6 1.7 1.8 1.9 1.0 1.11 1.12 1.3 1.4 1.5 1.6 1.7 1.8 1.9 1.0 1.11 1.12 1.3 1.4 1.5 1.6 1.7 1.8 1.9 1.0 1.11 1.12 1.3 1.4 1.5 1.6 1.7 1.8 1.9 1.0 1.11	Ξ					▶ Base	module	_			▶ Expa	nsion mo	dule 3			Base	modu	le												
(Al)	ž	Signals	Number	Туре		1.1	1.2 1	.3 1.	.4 2.1	2.2	3.1	3.2 3.	3 3.4	3.5	3.6	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	0 1.1	1 1.12	1.13	1.	1 Ei
 ▶ © Restet ELD Group 901.7831 ▶ © Group indicat. 901.1691 ▶ © Group indicat. 901.1691.4 ▶ © General 901.1691.1 ▶ © Group indicat. 901.1691.1 ▶ © Beneral 901.1691.1 > Behavior 901.1691.1 > ACT > © Generate delay expired 901.1691.1 > ACT > © general SPS > © Joerate delay expired SPS > © Joerate delay expired	ш	(All)	• (All) •	• 💌	-	💌	💌	. 💌	• •	• •	💌	💌	▼ !	• •	• 💌	💌	💌	💌	💌	💌	🔻	🔻		·	• •	• •	• •	• 💌	^	ari
• Ø 87 diff prot. 1 901.1691 • • Ø Group indicat. 901.1691.4 • Ø Group indicat. 901.1691.4 • Ø Group indicat. 901.1691.1 • Ø Beneral 901.1691.1 • Ø Pickup 901.1691.1 • Ø Pickup 901.1691.1 • Ø Pickup 901.1691.1 • Ø picate delay expired • Ø 1.1691.1 • Ø picate • Ø 1.1691.1		Reset LED Group	901.7381																											es
• • Group indicat. 901.1691.4 • • • General 901.1691.2 • • • Ioliff 901.1691.1 • • • Block stage 901.1691.1 • • • Block stage 901.1691.1 • • • Block stage 901.1691.1 • • • Point 901.1691.1 • • • • Point 901.1691.1 • • • • • • • • • • • • • • • • • • •		🔻 😜 87T diff. prot. 1	901.1691			*																								
• • General 901.16912 • • block stage 901.16911 • • prickup 901.16911 • • operate delay expired 901.16911 • • pht A 5P5 • • pht B 5P5 • • pht B 5P5 • • pht B 5P5 • • pht C 5P5 • • pht A 5P5 • • pht B 5P5 • • pht C 5P5 • • pht C 5P5 • • pht G 5P5		Group indicat.	901.1691.4																											
▼ • 001FF 901.1691.1		🕨 🦆 General	901.1691.2																											
• >Block tage 901.1691.1 SP5 • Behavior 901.1691.1 EN5 • Pickup 901.1691.1 ACT • Operate delay expired SP5 U • Pickup 901.1691.1 ACT • Operate delay expired SP5 U • Pickup 901.191.1 ACT • Operate delay expired SP5 U • Pickup 901.191.1 ACT • Operate delay expired SP5 U • Pickup 901.191.1 ACT • Operate 901.191.1 ACT Image: Act of the set of the		🔻 🦆 I-DIFF	901.1691.1			*																								
Inactive 901.1691.1 5F5 Imachine 901.1 ENS Imachine		>Block stage	901.1691.1	SPS																										
 		Inactive	901.1691.1	SPS																										
Image: Second		Behavior	901.1691.1	ENS																									=	
→ Pickup 901.1691.1 ACT ✓ Operate delay expired → phx A 5F5 → phx B 5F5 → phx B 5F5 → phx C 5F5 → phx B 5F5 → phx B 5F5 → phx B 5F5 → phx C 5F5 → phx G 5F5 → operate 901.1691.1 ACT ■ ■ ● incr.ofchar.(Start) 901.1691.1 SF5 ● blocked by innuxh 901.1691.1 SF5 ● blocked by 2.Harmon. 901.1691.1 SF5 ● blocked by 2.Harmon. 901.1691.1 ACT		🕨 🔷 Health	901.1691.1	ENS																										
• Operate delay expired 901.1691.1 ACT • • phs A 5P5 • phs B 5P5 • phs C 5P5 • phs C 5P5 • Operate 901.1691.1 • Blocked by 2.Harmon. 901.1691.1 • Blocked by 2.Harmon. 901.1691.1		Pickup	901.1691.1	ACD																										
• general 5F5 U • phs A 5F5 • phs B 5F5 • Operate 901.691.1 ACT • Slope 1 901.691.1 ACT • Blocked by 701.691.1 SF5 • • Blocked by 71.691.1 SF5 •		🔻 🔷 Operate delay expired	901.1691.1	ACT		*																								
		🔷 general		SPS		U																								
• phs B 5P5 • phs C 5P5 • Operate 901.1691.1 ACT • Slope 1 901.1691.1 MV • Increase of char. (Start) 901.1691.1 5P5 • Blocked by inrush 901.1691.1 5P5 • Blocked by 2.Harmon. 901.1691.1 ACT		🔷 phs A		SPS																										
• • • • • • • • • • • • •		🔷 phs B		SPS																										
Image: Second		🔷 phs C		SPS																										
Slope 1 901.1691.1 MV Incr. ofchar, (Start) 901.1691.1 SP5 Increase of char, (CO, O) 901.1691.1 SP5 Blocked by inrush 901.1691.1 SP5 Blocked by 2.Harmon. 901.1691.1 SP5		Operate	901.1691.1	ACT																										
Incr. ofchar. (Start) 901.1691.1 5F5 Increase of char. (OC) 901.1691.1 5F5 Blocked by innuth 901.1691.1 5F5 Blocked by 2.Harmon. 901.1691.1 ACT		Slope 1	901.1691.1	MV																										
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♦ Blocked by inrush 901.1691.1 SFS ♦ Blocked by 2.Harmon. 901.1691.1 ACT		Increase of char. (DC)	901.1691.1	SPS																										
Bocked by 2.Harmon. 901.1691.1 ACT		Blocked by inrush	901.1691.1	SPS																										
C Departies Mileta () U Dispersion		 Blocked by 2.Harmon. 	901.1691.1	ACT																									~	1
		<								111																			>	
roperties Linio L Diagnostics																			Q Pro	operti	es	1	nfo	1	Dia	gnost	ics			
🃸 Devices & ne 🔛 Devices settin 😺 6 General 🦼 🍀 Information	đ.	Devices & ne 🔛 Device settin 😺	6 General 🔒	🇱 Inf	ormat	ion																	The p	roject	PDIF w	as save	ed succ	essfully.		



The option "U" must be used, which means "Unlatched", that is, the relay activates and when the fault ceases, it automatically returns to the initial binary state. If the user chooses the "L" or "Latched" option, the relay activates and remains activated even if the fault has been extinguished. (This option is not suitable for testing).

Click on the "Start" option to show the main window again.

3.9 Sending adjustments

To send the parameterization changes, right-click on the "7UT86" relay icon and choose the "Load configuration to device" option.



ŀ	DIGSI 5 V7.50 - C:\Users\Michel\Documents\Automation\PDIF\PDIF		_ • ×
P	roject Edit View Insert Online Options Tools Window Help		Energy Automation
E	🗄 📑 🖬 Save project 📑 🐰 🗐 🖆 🗙 🏷 ± (주 ± 📑 🕂 🖥 🛠	🗄 💷 🦻	DIGSI 5 Premium
	Project tree 🛛 🖾 🗸		_∎≣×∢
	Devices		a
	B Devices and estimate	Binancoutout	N LED
÷		Base module Expansion n	andule 3
Į	Ctrl+X	Signals Number Type 1,1 1,2 1,3 1,4 2,1 2,2 3,1 3,2	3.3 3.4 3.5 3.6 1.1
	Hardware and The Party Ctrip		
	Measuring-poir	Reset LED Group 901.7381	Ties
	T Function-group Delete Del	▼ 🖕 87T diff. prot. 1 901.1691 *	
	Kename F2	Group indicat. 901.1691.4	
	Communicatio 🔿 Export	General 901.1691.2	
	👻 👆 Settings	▼ 😺 I-DIFF 901.1691.1 *	
	Device sett Upgrade configuration version	♦ >Block stage 901.1691.1 SPS	
	Time settin Compare devices	Inactive 901.1691.1 SPS	
		♦ Behavior 901.1691.1 ENS	=
	Seneral	▶ ♦ Health 901.1691.1 ENS	
	Meas.pc Load configuration to device	▶ ♦ Pickup 901.1691.1 ACD	
	Meas.pd Load firmware to device	Operate delay expired 901.1691.1 ACT *	
	Recording Update configuration from target device	general SPS U	
	🔻 🍕 Transforme Initialize device	phs A SPS	
	Seneral Assign device	phs B SPS	
	Process Remove assignment	phs C SPS	
	Upgrade device functionality	• Operate 901.1691.1 ACI	
	E Circuit-b	Slope 1 901.1691.1 NV	
	Conternation Print Conternation	Increase of char. (DC) 901.1691.1 SPS	
	Property and Prope	Riocked by increase 901.1691.1	
	So/51 Or stopper	Blocked by 2 Harmon 901 1691 1 ACT	
	Sign detect		~
	Circuit-breaker interaction		
	✓ Iransformer diff 1	😟 Properties 🔂 Info 🔒 🐰	Diagnostics 🗖 🗏 📥
<u></u>	🛓 Devices & ne 🛛 🛄 Device settin 🛛 😜 6 General 💦 🎎 Information	✓ The project F	DIF was saved successfully.

Figure 33

Remembering the default password of Siemens SIPROTE 5: "222222".

En	iter confirmation ID	X
Ye pr Er Se	our requested action for device 7UT86 requires the confirmation ID for roceeding further. nter the confirmation ID for anyone of the following users: ettings / operation	
	Enter confirmation ID: ******	
	OK Cancel	
	T! 04	

Figure 34

In the next two windows didn't shown, choose the option "Yes".

4. Difference software settings

4.1 Opening the Differential

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





Make a click on the software icon "Differential".







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4.2 Configuring the Settings

When opening the software the "Settings" screen will open automatically (provided that the option "Open Settings when Start" found in the "Software Options" menu is selected). Otherwise click directly on the "Settings" icon.



Inside the "Settings" screen, fill in the "General Inform." with data from the "Tested device", "Installation location" and the "Responsible". This makes reporting easier, as this tab will be the first to be shown.

ieneral	General Inform.	System No	otes & Obs. Explanatory Figures	Check List Oth	ners Connections	
	Test:					
ferential	Descr: Di	fferential Fun	ction	Date	e	
	Tested device:					
		Identif:	23031982	∼ Mode	H 7UT86	· · · ·
		Type:	Transformer Protection	 Manufacturer 	: Siemens	`
	Location:					
		Substation:	CONPROVE			``````````````````````````````````````
		Bay:	1	~		
		Address:	Visconde de Ouro Preto, 75 - Cust	ódio Pereira		`
		City:	Uberlândia	~	State	e: MG 🕓
	Responsible:					
		Name:	Michel Rockembach de Carvalho			```
		Sector:	Engineering	 Registry 	: 00001	`
	Tool Test:					
	CE-6006		Series N	um.: 1730616630210	01110011XXX	

Figure 39

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4.3 System

In the following screen, within the "*Nominal*" sub tab, the values of frequency, phase sequence, primary and secondary voltages, primary and secondary currents, transformation ratios of VTs and CTs are configured. There are also two sub tabs "*Impedance*" and "*Source*" whose data is not relevant for this test.



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 schematic with all the schematic of the connections between the test set and the test equipment.

5. Differential Adjustment

5.1 Differential Screen > Protected Equipment/CTs

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 CTs and the currents of the auxiliary CTs 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 41

5.2 Differential Screen > Adjust Prot. Differential > Settings

The initial default for 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 Zero sequence elimination options 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 data entry, 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. Choose the mask *"SIEMENS 7UT8x (Siprotec 5)"*.





Parameterize the "*Differential Settings*" and "*Instantaneous Settings*". Set the time to 0.0s. Use the tolerances for current and time given in the Appendix A.

al Protected E	quipment/CTs Adjust Prot. Differential		
Settings	Slope Definition		
tial	Data Entry: SIEMENS 7UT8x (Sip	rotec 5) V	
	Differential Settings	antaneous Settings –	Current Tolerance
	Pickup: 0.30 In Picku	p; 7,50 ln	Relative: 3.00 %
	Time: 0.00 s	e: 0.00 s	Absolute: 0.05 lp
	Restriction Current	Angle Tolerance	Time Tolerance
	lo - higher among lp e ls $\qquad \lor$	Absolute:	Relative: 1,00 %
	K: 1	3.00 °	Absolute: 30,00 ms
	General Options		
	TAPs: Calculated	Phase Shift Compensati	ion:
		Side: 1	Before <u>Leq:</u> After 12 345
	Reference Wnd. for Calculations (In):	User Def.:	
	Zara Saguanaa Eliminatian		

Figure 43

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5.3 Differential Screen > Adjust Prot. Differential > Slope Definition

In this screen, the values of the Slopes and Intersection must be entered.



6. Channel Direction and Hardware Configurations

Click on the icon illustrated below.



8. . .

Then click on the highlighted icon to configure the hardware.





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





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

Cha	nnels Direct.			— —	\times
Local	Model Reset for Hard. CE-6006 V Connected	Set O Advanced	- ⁶ - 00005	Confirm	
motes	Serial Number:		so GOOSE	Cancel	
Re	03207110302101110011777		0 3. Value	Import Export	.:1

Figure 48

7. Test Structure for Function 87

7.1 Test Settings

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

I Differential 2.02.	60 (64 Bits) - CE-6006 (1730616) ware Options		- 0 ×
GOOSE Sorrection Gamma Sync. Set Sorrection Gamma Sync. Set Sorrection Hardware	tt Stop (Clear all Generation Options Repo	t Units Layout	
Test Set Point Test Search Test	Test Settings		
Generation Channels Direc.	Enable Pre-Fault 1 Enable Pre-Fault 2		Test Set
Wnd Phas Gen. Channel	Mode Nominal 💌		Wait Time for Data Entry: 120,00 s
01 la AO_I01 (Hrd: I1)	11 1.000 A 30,00 °		Mult Tolerance: 1.00
01 Ib AO_I02 (Hrd: I2)	12 1,000 A -90,00 °		
01 Ic AO_I03 (Hrd: I3)	13 1,000 A 150,0 °		Point Test
02 lb AO_104 (Hrd: 14)	15 1 000 A 60 00 °		Wait Time for Operation: 100,00 ms
02 Ic AO_I06 (Hrd: I6)	I6 1,000 A -60,00 °		Search Test
01 Va			Initial step: Absolute Resolution: 100,00 mA
01 Vb			Min. Resolution V Relative Resolution: 0.50 %
01 Vc			Wait Time for Operation: 400.00 me
02 Va			Wak Time for Operation. 1400,00 ma
02 VB			Disconsider the characteristic in Search
02 00	Tora Da Ca \$1, 100.00 mm		Pulsed Search (Stop every increment)
Binary Outputs & Goose - Fault	Binary Outruits & Goose - Pre-Fault 1		Multiple of Tolerance for Verification Test: 1,10
BO 0: 0: 0: 0: 0	BO 0; 0; 0; 0; 0; 0		General Reset Time: 100,00 ms
GO	GO		NS of repetitions in case of generation error: 2
Generation Limits	Test Node		Stop the test at the first failure
I Max. Gen. per Chn. 100,0 A	Mode Intelligent		Protection Only VetBestian Orest (Feed of Test
Use Hardware Limit	Variation of RMS and Angle		Protection Status Vernication Status for or Test
Stop Interf. BI01 (Hrd: BI1) V	Stop Logic Initial NA 🗸		ignore Pre-Pault operation
Trigger Interf. Software V Wait for PPS	Trigger Logic Trigger Delay 0,00 s		Based Only on Generated Values 🗹 Cycle to Cycle Generation 🗹
🚯 ON Line New	Aux Sour	e: 110,00 V Heating: 0%	
	T		

Figure 49

8. Test Set

The general idea of the configuration test is to verify that the relay settings and the settings parameterized in the software are compatible, as the software aims to simulate the behavior of the relay. To do so, enter a "*New Point*" according to the data below:



Point 1:

- Data Entry: IDiff e iRest
 - IDiff: 1,00 In
 - IRest: 2,00 In
- Source Location: Winding 1
- Fault Location: Winding 2
- Fault Type: ABC

By clicking on the option "*Chart*" you can see where the tested point is. For this test the point is in the operating region.



Click on the icon highlighted below or use the command "Alt + G".





After starting the test, the user must enter the differential and restraint current values read in the relay, which must be in the range of values calculated in the software that will perform the automatic data comparison.

Test Set Evaluation					×
Test Data <u>Data Entry:</u>	Idiff and IRest	∨ <u>Ope</u>	r <mark>ation:</mark>) No	
L1		L2		L3	
ldiff:	1,00 ln	ldiff:	1,00 ln	ldiff:	1,00 ln
Irest:	1,99 In	lrest:	1,99 ln	lrest:	2,00 ln
Auto Fill				<u>E</u> valuate	<u>N</u> ot Evaluate

Figure 52

Passing the configuration test makes it possible for the other two tests to be carried out successfully. If there is a discrepancy between the values calculated by the software and those presented by the relay, the user must review its connections and settings.

9. Point Test

After the configuration test has passed, this means that the adjustment parameters passed to the software faithfully correspond to the behavior of the relay, in this way, the point test can be performed, since it analyzes not only the operation of the relay, but also the shooting time.

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





Figure 53

Another way is to use the "Sequence" feature of points by choosing the values of "Initial", "Final" and "Step". This way the software automatically creates the points.



Click on the icon highlighted below or use the command "Alt + G".





It is verified that all points were successfully approved



10. Search Test

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





Figure 57

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.



Click on the icon highlighted below or use the command "Alt + G".





It is verified that all lines were successfully approved



11. 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.



	Presentation Setting	×	
	Language Inglês En-US 🗸 🗸		
	All General Data Test General Data of Tested Device General Device General Data of Tested Device General Device Device General Device Device Device Device General Device Device Device Device Device General Device Dev		
	OK Cancel		
L	Figure 61		
Z □ □ □ □ = ↓ Differential 2.02.160 (6 Dist Remine	4 Bits) - CE-6006 (1730616)	- 0 ×	0
Print Setting Page Word Office to PDF	Im One page Image: Previous Next Image: Previous Next 00 Previous Next Close Print 9% Previous Next Close Print		
Print Export	Zoom View Close		
	CE-GOR CE-GOR CE-GOR CE-GOR CE-GOR CE-GOR		
	DIFFERENTIAL-TEST REPORT		
	Descr.: Differential Function Date: 17/09/2021 15:15:46 ; Software: Differenc_CTC; Version: 2.02.160 Responsible: Michel Rockembach de Carvalho		
	1. Device Tested		
	Ident :: 23031982; Type: Transformer Protection Model 7UT86; Manufacturer: Siemens		
	2. Location Substation: CONPROVE		
	Bay: 1 Address: Visconde de Ouro Preto, 75 - Custódio Pereira City: Uberlândia; State: MG		
Printing Preview Nº of Pages: 10			

Figure 62



APPENDIX A

A.1 Terminal Designations



²⁾ Use these terminals to root the binary inputs.

Positions for printed circuit board assemblies on the rear side





A.2 Technical Data

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 Harmonic Restraint		1.5	32 ms	28 ms
	YES	5	31 ms	28 ms
		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



APPENDIX B

Equivalence of software parameters and the relay under test.

	Table	1	
Differential Software		Siemens 7UT86 Relay	
Parameter	Figure	Parameter	Figure
Voltage (Wind. 1)	41	Rated Voltage	25
Voltage (Wind. 2)	41	Rated Voltage	26
Power (Wind. 1)	41	Rated apparent power	25
Power (Wind. 2)	41	Rated apparent power	26
Connection (Wind. 1)	41	Winding configuration	25
Connection (Wind. 2)	41	Winding configuration	26
Vector Group (Wind. 2)	41	Vector group numeral	26
I Prim (Wind. 1)	41	Rated primary current	17
l Prim (Wind. 2)	41	Rated primary current	21
I Sec (Wind. 1)	41	Rated secondary current	17
I Sec (Wind. 2)	41	Rated secondary current	21
Connection CT (Wind. 1)	41	Neutr. Point in dir. of ref. obj	17
Connection CT (Wind. 2)	41	Neutr. Point in dir. of ref. obj	21
Differential Settings (pickup)	43	Threshold	27
Instantaneous Settings (pickup)	43	Threshold	28
Slope 1	44	Slope 1	27
Intersection 1	44	Intersection 1 Irest	27
Slope 2	44	Slope 2	27
Intersection 2	44	Intersection 2 Irest	27