

INSTRUMENTOS PARA TESTES ELÉTRICOS Test Tutorial

Equipment Type: Protection Relay

Brand: SEL

Model: <u>787</u>

Function: <u>87-1 or PDIF-1 Percent Differential and 87-2 or PDIF-2</u> Instantaneous Differential.

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

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

Version control:

Version	Descriptions	Date	Author	Reviewer
1.0	Initial release	13/08/2021	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 the user contacts us via email suporte@conprove.com.br.

The tutorial contains knowledge gained from the resources and technical data at the time was writing. Therefore, CONPROVE reserves the right to make changes to this document without prior notice.

This document is intended as a guide only; the manual of the equipment under tested must 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 must 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 787 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 the "*Power* +" pin (A01) of the relay, connect the negative (black terminal) of the Vdc Aux. Source to the "*Power* -" pin (A02) of the relay.



1.2 Current Coils

Connect the I1, I2 and I3 current channels of the CE-6006 to pins Z01, Z03 and Z05 of the relay respectively, connect the three common of CE-6006 to pin Z02 of the relay, thus forming the connection of winding one. In the same way, to establish the connection of winding 2, connect I4, I5 and I6 current channels to relay pins Z07, Z09 and Z011 respectively, connecting the three common to pin Z08.





1.3 Binary Input

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

• BI1 to pin A03 and its common to pin A04 of the relay.



2. Communication with relay

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



When opening the program, the relay file is selected if communication has already been carried out. Otherwise click on *"New"*.



Figure 5

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In the next screen, adjust the model and version of the tested relay. Check on the front panel via the following path *"Status > Relay Status > FID"*.

🛃 Settings Ed	itor Selection - Setting	js Database		Х	
Device Family SEL-551 SEL-587 SEL-651 SEL-700 SEL-701 SEL-710 SEL-710 SEL-713 SEL-734 SEL-749 SEL-749 SEL-749 SEL-749 SEL-751 SEL-849 SEL-2100 SEL-2411 SEL-2414 SEL-2431 SEL-2440 SEL-2523 ✓	Device Model SEL-787 SEL-787-4	Version 001 002 003 004	Example FID SEL-787-RXXX-VX-Z003XXX-DXXXXXXX The first three numbers following the -Z make up the Device Setting Version Number (SVN). Driver Information Name: SEL-787 003 Settings Driver Version: 6.10.2.3 Date: 17/12/2020 22:56:30		
Install Devices QK Cancel					

Figure 6

Then the "*Part Number*" must be set. Use the following path to view "*Status* > *Relay Status* > *PART NUM*".

Device Part Number
Part Number: 0787 * * * * C * C * 1 * 8 5 * 4 1 *
C = 4 Fast High Current Interrupting Digital Output, 4 Digital Inp V
C = 4 Fast High Current Interrupting Digital Output, 4 Digital Inp V
Position E 1* = 4 Electromechanical Digital Output, 4 Digital Input
Position Z 85 = 5 A Winding 1, 5 A Winding 2
Communications Ports and Protocols
<u>E</u> dit

Figure 7



Then click on the highlighted icon according to the figure below:

🛃 AcSELerator® QuickSet - [Settings Editor - New Settings 1 (SEL-787 003 v6.10.2.3)]					
撞 File Edit View Co	m <u>muni</u> cations Tools Windows Help Language				
6) 🚳 🖺 💋 📕 🗐					
 Global Group 1 Group 2 Group 3 Group 4 Front Panel Port F Port 1 Port 2 Port 3 Port 4 	S Read Settings From Device S Transformer Protection Relay				
> · 🕘 DNP Maps					

Figure 8

3. Parameterization of the SEL 787 relay

3.1. General

After the connection has been established, click on "Global" and "General" and adjust the value of the phase sequence and frequency.

😭 AcSELerator® QuickSet - [Settings Editor - SERF -	- TRAF01 - SEL787 - TUTORIAL (SEL-787 003 v6.4.0.2)]	
Arquivo Editar Visualizar Comunicações Ferramentas	Janelas Ajuda Idioma	_ & ×
🚳 🍇 🖺 💋 🖬 🕼 🚽 🖻 🕑 🚱		
Biobal General Setting Group Selection String Group Selection Gro	General PHROT Phase Rotation ABC Select: ABC, ACB PNOM Rated Frequency (ht) 60 Select: S0, 60 DATE_F Date Format DMY Select: MDY, YMD, DMY FAULT Fault Condition (SElogic) SIPIP OR SIGP OR SIGP OR SIGP OR SIGP OR SINIP OR TRIP	
Part#: 07870X1ACACX1X850410 Global : General		🛃 Conprove.rdb
TXD RXD Abrir: Conectado COM3: Pro	lific USB-to-Serial Comm Port 19200 8-Nenhum-1 Terminal = Serial EIA-232 Transferência de arquivo = YModem	

Figure 9



3.2. Configuration

Click on "Group 1 > Set 1" and choose the "Configuration" option. This window adjusts: the rated power of the power transformer, if the offset compensation is done by the relay itself, the type of CT connection, the CT transformation ratio, the angular compensation matrices and the rated voltage of each winding. The other adjustments in this window are not active.



Figure 10

3.3. Transformer Differential Elements

In this option, the differential function is enabled, the TAP's values are displayed (automatically calculated) and the minimum differential current value is adjusted for TRIP and for alarm, the two slopes, the knee point and the current of the unrestricted differential. The other settings are related to the harmonic restraint function and they are not relevant for this tutorial.





Figure 11

4. Binary Output Adjustments

4.1. *Slot A*

Click on "Logic l > Outputs" and select the option "Slot A" and make the following adjustment for the field "OUT101".



Figure 12



4.2. Submitting the Adjustments

Click on the selected icon and submit at least the following adjustments.



Figure 14



5. Differential software settings

5.1. Opening the Differential

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



Click on the "Differential" software icon.



Figure 16

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💯 📑 📂 🛃 🚽 Differential 2.02.152 (64 Bits)	- CE-6006 (0320711)	– 0 ×
Arquivo Home Display Software Optic	ins	~ 3
Image: Sync. Set Sync. Set	Settings	<
Chainers Connection	General Inform. System Notes & Obs. Explanatory Figures Check List Others Connections Test:	
Insert/Edit Points	Descr: Descr: Date: Descr: Des	- X
Insert/Edit Points General Options	Tested device:	
Edit Point Data Entry; Fau	Identif: V Model V	Principais
New Point V Source Location: Winding1	Type: V Manufacturer. V	: 2 Ybar
Sequence Fault Location:	Location:	Z
Remove Winding2 ~	Substation:	
Fault Type:	Bay:	
Kemove All A-B-C V	Address:	
Test Points	City: V State: V	
Points Tested	Responsible:	
No. Fault IDiff IRest R	Name: V	
	Sector: V Registry: V	
	Tool Test:	
	CE-6006 Series Num.: 03207116302101110011XXX	
	v	
	Default V Preferences OK Cancel	
☑ IDiff and iRest ☑ Operating Region		
Errors List Protection Status		
New	Aux Source: 0,00 V Heating: 0%	

Figure 17

5.2. Configuring the Settings

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

Arquivo Home Display Software Options Arquivo Home Software Options Next Point Arquivo Channels Sync. Set Sync. Set Start Stop Next Point Arquivo	🔟 I 🗋 I	<i>i</i> 🚽 🗧	Differential 2.02.1	52 (64 Bits) - CE-	6006 (0320711)		
Image: Specific channels Image: Specific	Arquivo	Home	Display Soft	ware Options			
	Channels Direc.	😭 Hrd Se 🗶 Sync. S 📢 Conne	et ද ⁶ o GOOSE S Set ^s v SV Set ection	et Start St	> Next Point Clear test	Settings	₩ Waveform © System → Phasors 🗃 Relay SEL
Hardware Generation Options	Hardware		G	eneration		Options	



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



neral	General Inform.	System N	lotes & Obs. Explanate	ry Figures Ch	eck List Other	s Connection	15	
	Test:							
rential	Descr:	Differential Fur	nction		Date:			
	Tested device:							
		Identif:	23031982	~	Model	787		~
		Type:	Transformer Protection	~	Manufacturer:	Schweitzer		~
	Location:							
		Substation:	CONPROVE					~
		Bay:	1	~				
		Address:	Visconde de Ouro Perto	75 - Neighborhood	Custódio Pereira	I		~
		City:	Uberlândia		~		State: MG	~
	Responsible:							
		Name:	Michel Rockembach de	Carvalho				~
		Sector:	Engineering	~	Registry:	0001		~
	Tool Test:							
	CE-6006			Series Num.: 03	207116302101	10011XXX		
× •	-				Preferences	ОК		Cance

5.3. System

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

Settings		×
General Inform. Syste	Notes & Obs.	Explanatory Figures Check List Others Connections
Differential Impedance Frequency: Phase Seq.: 3φ power: 1φ: Primary Voltage (FF): (FN): Primary Current: Secondary Voltage (FF): (FN): Secondary Voltage (FF): (FN): Secondary Current: VTR F: CTR F: VTR D / VTR F: CTR E / CTR F: Invert Polanty: VT's F VT D	Source 60 Hz ABC 4.78 MVA 1.59 MVA 1.59 MVA 13.80 KV 7.97 KV 200.0 A 115.0 V 66.40 V 1.00 A 120.0 200.0 1,00 1,00 1,00 CT's F CT E	Phase F Neutral N Ground E Displ. D $Voltage F S Ia F S$
Default V		Preferences QK Cancel

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There are other tabs where the user can insert "*Notes & Obs.*", *Explanatory Figures*, "*Check List*" of the procedures for carrying out the test and even create a diagram with all the schematic of the connections between the test set and the test equipment.

6. Differential Adjustments

6.1. "Differential" screen > "Adjust Prot. Differential" > "Settings"

The initial default for the "*Data Entry*" field is defined as "*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 lists of relays, only the configurable settings are enabled.

Settings	>	<
Settings General Differential	Protected Equipment/CTs Adjust Prot. Differential Settings Slope Definition Data Entry: User Image: Current Tolerance Differential Settings AREVA MICOM-P631/P632 Relative: 5.00 % Pickup: 0.30 In AREVA MICOM-P633/P634 Relative: 5.00 % Time: 0.00 s MICOM-P64X BETA) AREVA MICOM-P64X Restriction Current GE 345 (BETA) Time Tolerance Relative: 1.00 % (IIb) + IIs) / K GE DTP Relative: 1.00 % Relative: 1.00 %	<
	GE SR745 GE SR745 (Firmware até 1999) GE SR745 (Firmware até 1999) GE T60/G60/M60 General Options INGETEAM PD250 TAPs: Calculated Reference Wnd. for Calculations (In): SCHNEIDER Sepam 80 (M) (BETA) SEL 300G (T) SEL 300G (T) SEL 377587 SEL 487 SIEMENS 7SD50/ZSD61 (Signatec 4)	
Default 🗸	SIEMENS 7UT/7UM (Siprotec 4) SIEMENS 7D8x/7SL&x (Siprotec 5) SIEMENS 7UT8x (Siprotec 5) Zero Sequence Elimination	

Figure 21



Choosing the "SEL 787" template makes adjustments easier. Current and time tolerances are taken from Appendix A.

Settings		X
General	Equipment/CTs Adjust Prot. Differential	
Differential	Slope Definition	
	Data Entry: SEL 787	<u>~</u>
	Differential Settings	gs Current Tolerance
	Pickup: 0.60 ln Pickup: 10.00 ln	Relative: 5.00 %
	Time: 0,00 s Time: 0,00 s	Absolute: 0,10 In
	Restriction Current	Time Tolerance
	(lp + ls) / K	Relative: 5.00 %
	K: 1 3,00 *	Absolute: 50,00 ms
	General Options	
	TAPs: Calculated V Eved Angle	Compensation:
	Side:	After 12345
	Reference Wnd. for Calculations (In): 1 ∨ Rotação: Descr Wind. 1 Wnd. 2	
	Zero Sequence Elimination	
Default 🗸		Preferences <u>O</u> K <u>C</u> ancel
	Figure 22	

6.2. Differential screen > Adjust Prot. Differential > Slope Definition

In this screen the values of the slopes ("Slope 1" and "Slope 2") and the "Knee Point" must be entered.







6.3. Differential screen > Protected Equipment / CT's

This tab should inform the protected equipment, the number of windings, nominal voltage, nominal power, the primary and secondary currents of the main CTs and the currents of the auxiliary CT, if necessary. This test uses the settings for a relay that is protecting a two-winding transformer. However, it is possible to test, in addition to the differential protection of transformers, the busbar, generator, motor and line protections. For transformer protection there is the possibility of testing up to four windings, using two test set simultaneously.



ngs									
General	Protected Equip	ment/CTs	Adjust Prot. Di	fferential					
Differential		Protected Equi	pment						
Differential		Equipment	Transformer//	Auto Transf $$	Nº of Phase	s: 3Ø ~ N ^g	of Wnd.: 2	\sim	
		Description	Voltage	Power	Connection	Vector Group	Grounded]	
		Wnd. 1	138,0 KV	32,00 MVA	1				
		Wnd. 2	13,80 KV	32,00 MVA					
		CTs Main CTs	Auxiliary CTs	3	Enable A	uxiliary CTs			
		CTs Main CTs Description	Auxiliary CTs	s I Prim	Enable A	uxiliary CTs	Vector Grou]	
		CTs Main CTs Description Wnd. 1	Auxiliary CTs I Nom 133,9 A	s I Prim 0,800 kA	Enable A	uxiliary CTs Connection	Vector Grou		
		CTs Main CTs Description Wnd. 1 Wnd. 2	Auxiliary CTs I Nom 133,9 A 1,34 kA	8 1 Prim 0,800 kA 2,00 kA	Enable A I Sec 5,00 A 5,00 A	uxiliary CTs Connection Y T Y T	Vector Grou		
		CTs Main CTs Description Wnd. 1 Wnd. 2	Auxiliary CTs I Nom 133,9 A 1,34 kA	s 1 Prim 0,800 kA 2,00 kA	Enable A I Sec 5,00 A 5,00 A	uxiliary CTs Connection Y T	Vector Grou		
		CTs Main CTs Description Wnd. 1 Wnd. 2	Auxiliary CTs I Nom 133,9 A 1,34 kA	8 0,800 kA 2,00 kA	Enable A	uxiliary CTs Connection Y V Y V	Vector Grou		

Figure 24

7. Channel Targeting and Hardware Configurations

Click on the icon illustrated below.



Then click on the highlighted icon to configure the hardware.





Figure 26

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



Figure 27

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

C	Channels Direct.	— 🗆 X
	Model Reset for Hard. CE-6006 Connected Set O Advanced Construction	Confirm
	Serial Number:	
	b 2207116302101110011XXX	Import Export

Figure 28

8. Test Settings

In the test settings tab, the important thing is the correct direction of the generation channels and the selection of the stopwatch interface for "*BI01*". Enable a pre-fault with nominal values with a time of 500ms so that the "*Point Test*" is done properly.

🔟 📑 🥁 🚽 Differential 2.02.15	i2 (64 Bits) - CE-6006 (03	20711)					- 0 x
Channels Direc. Hrd Set Sync. Set Channels Channels Hrd Set Sync. Set Channels No SV Set Hrd Set Sync. Set No SV Set Hrd Set	tt Start Stop Generation	Next Point Clear test Clear all n	Ettings Waveform System	Present Report Report Units	Recreate Restore Charts Layout		
Test Set Point Test Search Test	Test Settings						
Generation Channels Direc.	Enable Pre-Fault 1		Enable Pre-Fault 2			Test Set	
Wnd Pha: Gen. Channel	Mode No	minal •	<u>.</u>			Wait Time for Data Entry:	60,00 s
01 la AO_I01 (Hrd: I1) -	11 0.837 A	-150.0 °				Mult. Tolerance:	1,00
01 Ib AO_102 (Hrd: 12)	12 0.837 A	90,00*	_				
01 IC AU_103 (Hrd: 13)	13 0,837 A	-30,00 *	_			Point Test	
02 lb AO 105 (Hrd: 15)	15 3.35 4	-120.0 °				Wait Time for Operation:	100,00 ms
02 Ic AO_106 (Hrd: 16)	16 3.35 A	120.0 °				Search Test	
01 Va -						Initial step: Absolute Resolution:	100,00 mA
01 Vb 👻						Min. Resolution > Relative Resolution:	0.50.%
01 Vc -							
02 Va -						Wait Time for Operation:	400,00 ms
02 Vb						 Disconsider the characteristic in Search 	
U2 Vc			<u>_</u>			Pulsed Search (Stop every increment)	
	Time Pre-Fau	ult1: 0,50 s				Multiple of Tolerance for Vertication Test:	1.10
Binary Outputs & Goose - Fault	Binary Outputs & Goose	Pre-Fault1	-			Count Pour Pour	400.00
GO 0,0,0,0,0	GO 0, 0, 0,	0,0,0				General Neset Time:	100,00 ms
Simulate Sampled Value Error	Simulate Sampled	Value Error				N ² of repetitions in case of generation error:	2 ~
Generation Limits	Test Mode		_			Stop the test at the	first failure
I Max. Gen. per Chn. by hard	Mode Int	elligent	<u>-</u>			Protection Status Ventication Start/En	d of Test 🗸 🗸
V Use Hardware Limit	Variation of RMS and A	Angle	_			Ignore Pre-Faul	t operation
Stop Interf. BI01 (Hrd: BI1) V	Stop Logic	Initial NA ~					
Trigger Interf Software	Trigger Logic					Proof Only on Comment	
Wait for PPS	Trigger Delay 0,00 s					Cycle to Cycle	Generation
	1						
Ve ON Line New			AL	ix source: 110,00 V H	eaung: 0%		

Figure 29

9. 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 this, enter the new point according to the data below:

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







When starting the test, the user must enter the values of differential and restraint current read in the relay, which must be within the range of tolerance values given by the manufacturer in relation to the values calculated in the software. To view the values measured by the relay choose the "Human Machine Interface" and choose "Differential" in software "AcSELerator".

🚰 AcSELerator® QuickSet - [Dev	ice ID: SERF - TRAFO	1 (SEL-	787 001 HM	[Driver)]								
Arquivo Editar Visualizar Comunicações Ferramentas Janelas Ajuda Idioma												
Device Overview Phasors	Differential Metering Values											
Fundamental												
Min/Max	SERF - TRAFO	1			Γ	Date: 13/03/2017 Time: 11:52:29.449						
Demand	UMTR1				Т	ime Source: Internal						
Peak						-						
···· Differential		(pu)	IOP1	IOP2 1.00	IOP3							
Synchrophasor Metering	Operate		1.00 IRT1		1.00							
Through Fault Event												
Energy Metering				IRT2	IRT3							
Thermal	Restraint	(pu)	1.99	1.99	2.00							
Math Variables			TOP1 F2	TOP2E2	TOPSES	-						
- Analog Inputs	2nd Harmonic	(%)	0.00	0.78	0.00							
Load Profile	2	(• /	0.00									
Targets			IOP1F4	IOP2F4	IOP3F4							
Status	4th Harmonic	(%)	0.58	0.58	0.00							
SER												
····· Control Window			IOP1F5	IOP2F5	IOP3F5							
	5th Harmonic	(%)	0.00	0.58	0.59							





When entering the data, the software will perform this automatic data comparison.



Figure 33

Passing the configuration test makes it possible for the other two tests to be carried out successfully. If the result is *"Failed"*, check all connections and adjustments between the test set and the relay.

10. Point Test

For the point test, click on the "Sequence" field and choose the type of fault, the initial and final value of the restraint current.





Figure 34

When starting the test all points will be tested sequentially and the status will update automatically. The following figure shows the result of a test where 8 points were tested. The detail to be observed is that the tested points must be within the generation limit of the current channels, otherwise the point will not be tested and a status informing that the point is outside the generation limit will be presented.

🗾 📄 Arquivo) Home	Differentia Display	ll 2.02.152 (64 Software	4 Bits) - CE-600 Options	06 (0320711)													-	٥	× ^ ?
Channe Direc	Hrd Set	୍ଦ୍ରେତ GI ⁵ ୍ୟ S\ Ion	OOSE Set / Set	Start Stop	> Next Poin Clear test	t 📁 Settings	₩ Waveform → Phasors EEE SEL	n 🐼 System 🗃 Relay	Present Report	Cycles	ds Recreat Charts	Restore Layout	View							
	Hardw	are		Gene	ration		Options		Report	Units		Layout								
Test Se	t Point Test	Search	Test Tes	t Settings							-					0.000				
	sert/Edit Points		0.1							-	System	Relay	Details (Di	agram) / Chart	Waveforr	n Phasors		1 1		•
-insert/	Edit Points	Data E	intry:	IDiff and iF	lest						10.00 IDi	f (In)		/			19	- - Points No	t Tested	
Ne	ew <u>P</u> oint 🔽	Source I Winding	Location: g1 · ·				-Currents	Diff: 5,57 In			9.00							Points Ter Colors: Not Ter	sted est.	
S	equence <u>R</u> emove	Fault Lor Winding	cation: g2				IB	est: 10.00 In			8.00							Passe Fail	d	
F	lemove <u>A</u> ll	Fault Typ A-B-C	pe: ~								7.00							Information: Current Point:		
Te: Points	st Points Tested									•	6.00			/				- IDiff: - Rest:		
No.	Fault	IDiff	IRest	Region	Operated	Time Nominal	Time Real	Status		^	5,00									
17	ABC	3,83 In	9.00 In	No Operation	No	-	-	Passed			4,00		/	• •						
18	ABC	4,90 In	9,00 In	Operation	Yes	0 s	39,31 ms	Passed			3,00	_/		0						
19	ABC	4,37 In	10.00 In	No Operation	No		-	Passed			2.00	1	20	,						
20	ABC	5,57 In	10,00 In	Operation	Yes	0 s	36,45 ms	Passed		Ţ	1.00	88	6				IR ant fini			
	fand iRest 🗹	Operating	Region 🔽 1	Time							0			10.00)		20,00			
Erro	rs List Prot	ection Sta	itus																	
(1) (1)	N Line	Nev	N					Au	ix Source:	110,00 V	Heating:	0%								
									Fig	ure 3	35									

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It is verified that the points within the operating region acted within the expected time, whereas the points outside the operating region did not act.

11. Search Test

To perform the search test, click on the "Sequence" field, choose the type of fault, the source location, the location of the short and the initial, final and step restraint current values.



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



11.1. Final Search Test Result

In this test, the values found for differential current can be viewed, if they are within the tolerance range given by the manufacturer, they are approved, otherwise they are disapproved.



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Arquivo	Home	Display	Software	Options								~ ?
Channe Direc.	Hrd Set Sync. Se Connec	ඳිං GC t ෙ ෙ SV tion	OOSE Set / Set	Start	> Next Point Clear test Clear all	K Waveform ∞ System → Phasors Relay () SEL	Present Report	Second	Recreate Restore View Charts Layout	2		
	Hardy	/are		Gener	ation	Options	Report	Units	Layout			
Test Se	Point Test	Search	Test Test	t Settings								
/ Ins	ert/Edit Points							•	System Relay Detail	Is (Diagram) Chart Waveform Phasors		-
Insert/ Ne	Edit Lines	General (Data E Source L Winding Fault Loc Winding Fault Typ A-B-C	Options ntry: .ocation: .1 .0 .ocation: .1 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0	IRest	IRes	4: 11.50 ln Sequence Initial: 1.50 ln Step: Final: 11.50 ln Nº of	1,00 In Points 11		11.00 IDif [In] 10.00 9.00 8.00 7.00 6.00		Legend: Search Points Found Points Colors: Not Test. Passed Fail Information: Current Point: - IDiff: - Best	
Points	ested								5.00			
N⁰	Fault	IRest	IDiffNom	IDiffReal	Status				5,00	A		
8	ABC	8,50 In	4,05 ln	4,05 In	Passed				4,00			
9	ABC	9,50 IN	4,60 IN	4,65 IN	Passed					18		
10	ABC	10,50 In	5,25 In	5,25 In	Passed				2,00	<u>/8</u>		
11	ABC	11,50 In	5,85 In	5,85 In	Passed				1.00			
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12. 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 Instalation location Reference Values Hardware Settings Test Settings Differential Protection Settings Test Results Selected Simulation Charts Notes and Observations Explanatory Figures Connections 	
OK Cancel	

Figure 39





Printing Preview... Nº of Pages: 08

Figure 40



APPENDIX A

A.1 Terminal Designations



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A.2 Technical Data

Differential (87)

Unrestrained Pickup Range: 1.0-20.0 in per unit of TAP Restrained Pickup Range: 0.10-1.00 in per unit of TAP Pickup Accuracy (A secondary): 5 A Model: ±5% plus ±0.10 A 1 A Model: ±5% plus ±0.02 A Unrestrained Element Pickup Time: 0.8/1.0/1.9 cycles (Min/Typ/Max) Restrained Element (with harmonic blocking) Pickup Time: 1.5/1.6/2.2 cycles (Min/Typ/Max) Restrained Element (with harmonic restraint) Pickup Time: 2.62/2.72/2.86 cycles (Min/Typ/Max)



APPENDIX B

Equivalence of software parameters and the relay under test.

	Table 1		
Differential Software	•	SEL 787 Relay	
Parameter	Figure	Parameter	Figure
Voltage (Wind. 1)	24	VWDG1 Winding 1 Line-to-Line Voltage	10
Voltage (Wind. 2)	24	VWDG2 Winding 2 Line-to-Line Voltage	10
Power (Wind. 1)	24	MVA Maximum Transformer Capacity	10
Power (Wind. 2)	24	MVA Maximum Transformer Capacity	10
I Prim (Wind. 1)	24	CTR1 Winding CT Ratio (*5,0A)	10
I Prim (Wind. 2)	24	CTR2 Winding CT Ratio(*5,0A)	10
Differential Settings (pickup)	22	O87P Restrained Element Operation Current PU	11
Differential Settings (time)	22	A.2 Technical Data	
Instantaneous Settings (pickup)	22	U87P Unrestrained Element Current PU	11
Instantaneous Settings (time)	22	A.2 Technical Data	
Enr.1 (CTC)	24	W1CTC Winding 1 CT Conn. Compensation	11
Enr.2 (CTC)	24	W2CTC Winding 2 CT Conn. Compensation	11
Slope 1	22	SLP1 Restraint Slope 1 Percentage	11
Slope 2	22	SLP2 Restraint Slope 2 Percentage	11
Knee Point	22	IRS1 Restraint Current Slope1 Limit	11