

INSTRUMENTOS PARA TESTES ELÉTRICOS Test Tutorial

Equipment Type: Protection Relay

Brand: Schneider

Model: SEPAM T87

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	27/10/2021	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.



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 T87 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 1 of module A of the relay and the negative (black terminal) of the Vdc Aux. Source to pin 2 of module A of relay.



# **1.2** Current Coils

To establish the connection of the current coils, connect the current channels I1, I2 and I3 to pins 4, 5 and 6 of the relay module B1 (Appendix A) and connect the common of the current channels to pins 1, 2 and 3 of relay module B1. For current channels I4, I5 and I6 to pins 4, 5 and 6 of module B2 (Appendix A) of the relay and connect the commons of current channels to pins 1, 2 and 3 of module B2 of the relay.



Figure 2

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# **1.3** Binary Inputs

Connect the CE-6006 binary inputs to the relay binary outputs.

• BI1 to pin 4 and its common to pin 5;

The following figure shows the details of the connections.



# 2. Communication with the SEPAM T87 relay

First, a serial cable from the notebook is connected to the relay. Then double-click on the *SFT2841* software icon.



When opening the program, the following screen is shown:



SFT2841 v 17.2	X
English	(UK)
Welcome to SFT2841,	
your Sepam configuration software.	
Do you want to	
Connectio	n
Sepam	Easergy Sepam
Series 20 Series 40 Applications 20 Applications 40 and 50	Series 60 Series 80 Applications 60 Applications 80
Com	parison
E	2
Exit S	FT2841

Figure 5

To start the communication click on the icon illustrated below:



Then the main screen appears where the tab *"Sepam hardware"* is already selected. In this tab the user indicates if there are additional modules in the relay for the software. The relay used for this tutorial has the following settings:





#### Figure 7

#### 3. Parameterization of the SEPAM T87 relay

The next step is to set the nominal frequency, phase rotation and setting group values. The values of these parameters are in the table below:

Table 1			
Network frequency	60Hz		
Phase rotation direction	1_2_3		
Active setting group	А		

#### 3.1 General characteristics

In this tab, the values described above are adjusted in addition to other fields. What is highlighted in red in the next figure needs special attention so that the test takes place properly.



SFT2841 v 17.2 - Easergy Sepam series 80 - [Connection wir	ndow]	– 🗆 X
Eile Edit Operation Sepam Application Options	Win <u>d</u> ow ?	_ <i>8</i> ×
🕶 🗅 🖻 🗟 💁 🔂 🍃 🖬 🗠 🗊 Fot 🍃	📍 🏗 🕂 👻 🛕 😽 🚄 🕞 😰 🛛	
Sepam hardware General characteristics CT-VT sensors CT/VT	Supervision Particular characteristics Control	logic   Logic I/Os   GOOSE
General characteristics		Apply Cancel
Electrical network Network frequency C 50 Hz G 50 Hz	UMI Sepam working language	English C Local language
Incomer/feeder © Feeder © Incomer Phase rotation 1_2_3	Time synchronization mode	
Active setting group for all protection functions.	Remote control and monitoring	
Metering	Remote control with select before op	erate (SBU)
Integration period 5 💌 min	Auxiliary voltage monitoring (Vaux)	
Meter increment	🗌 🗖 On	
Active energy 0.1 kWh 📩	Rated Vaux	48 Vdc
Reactive energy 0.1 kVARh ·	Low threshold alarm	80 % Vaux
Temperatures C C F	High threshold alarm	120 % Vaux
Cumulative breaking current 65535 kA2 alarm threshold		
	Edit Sepam label	Password
🗭 🕻 Connected Transformer T87 Sepam xxxx	Parameter setting Re	mote controls inhibited 26/10/2021 16:37 //

Figure 8

After configuring the settings, click on the "*Apply*" icon highlighted in green in the previous figure for the software to send the modifications to the relay. Before the settings are sent a password is requested.

Identification	×		
Password level : Parameter setting			
XXXX	_		
ОК	Cancel		
Figure 9			

Enter your password for the changes to take place.

#### Note: The default password is 0000.



# 3.2 CT-VT sensors

In this field, adjust the nominal currents of the CTs and the transformation ratios.

SFT2841 v 17.2 - Easergy Sepam series 80 - [Connection wi	indow]		-	- 🗆	×	
File Edit Operation Sepam Application Options	Wind	low ?			. 8 ×	
🕶 🗅 🖻 🖩 🍒 🖏 🖕 🖬 🗠 🗊 Fot 🍃	12	' 🕂 👻 🚹 😽 🚄 🍉 😰 -				
Sepam hardware   General characteristics   CT-VT sensors   CT-VT	Superv	vision   Particular characteristics   Control	logic   Logic I/Os   GC	)OSE		
CT-VT sensors Single-li	ine type		Apply	Cano		
		CT rating	1A CT	-		
r 3V	1 - I	Rated current (In)	200 A	÷		
νο Σ		Base current (Ib)	200 A	÷		
. 31	10	Residual current	None		-	
μ <sub>Σ</sub> [1],12,13 –	10					
	"0	Residual current	None		-	
	10					
		CT rating	1A CT	<b>-</b>		
	ľ	Rated current (I'n)	2 kA	T÷		
		Rated primary voltage (Unp)	110 k\	7÷		
$\pm \mathbf{Y}$	v	Rated secondary voltage (Uns)	115 V	_		
- Residual /	Vo	Residual voltage	3V sum	~		
31						
Connected Transformer T87 Sepam xxxx	174	Operation Re	mote controls inhibited	26/10/2021	17:01	

# 3.3 CT/VT Supervision

In this tutorial this functionality is not used.



File Edi	it Operation Sepam Application Options V	Window ?	- 5
 الا	🖃 🛅 🔁 🔚 🖬 🗠 🗊 Fot 🆌	🖅 🕂 २ 🛕 😽 🔫 📿 🕅	
Sepam hardw	are General characteristics CT-VT sensors CT-VT S	upervision   Particular characteristics   Contr	ol logic   Logic I/Os   GOOSE
CT/V	T circuit supervision	Close advanced paramet	ers Apply Cancel
		Main	Additional
	On		
СТ	CT time delay	150 ms ÷	150 ms ÷
Behavior	21B/46/40/51N/32P/37P/32Q/67N/78PS/64REF	C No action  Inhibition	C No action C Inhibition
	On		
	Partial voltage loss (linv,Vinv) Time delay linv, Vinv line therefold	500 ms :	
VT	Vinv threshold	10 %Vn	
	Loss of all voltages (3V/2U) 3V/2U time delay Voltage presence detected by Test presence of current	C.B. position C Logic equation	
Behavior	218,27,27D,27TN,32P,32Q,37P,40 47,50/27,50V/51V,59,59N,78PS	C No action C Inhibition	
	67	<ul> <li>Non-directional</li> <li>C Inhibition</li> </ul>	
	67N	Non-directional     C Inhibition	

Figure 11

#### 3.4 Particular characteristics

In this field, the nominal voltages of the transformer, its nominal power and the angular difference between the two windings are adjusted.



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# 3.5 Control logic

Disable the options in this field.

SFT2841 v 17.2 - Easergy Sepam series 80 - [Connection window	]	_		×
File Edit Operation Sepam Application Options Win	dow ?		-	e ×
🖘 🗅 🛎 🖬 🏷 🏷 📮 🖵 노 🕼 So 🕮 Fot 🏄 🕻	ि 🕂 😌 🛕 😽 🚄 📂 😰			
Sepam hardware   General characteristics   CT-VT sensors   CT-VT Supe	rvision Particular characteristics Con	trol logic   Logic 1/0s   GOC	DSE	
Predefined control logic		Apply	Cancel	
Switchgear control	- Automatic transfer			
Circuit breaker	Voltage return time	3 s	Ш	
C Contactor	Normal coupling position	Normally open	<u> </u>	
Closing with synchro-check		Informally open		
Closing request time 200 ms 🔹				
Synchro confirmation time 0 ms ÷				
Logic discrimination				
🗖 On				
C Connected Transformer T87 Sepam xxxx	Operation	Remote controls inhibited	27/10/2021	13:58 //

# 3.6 Logic I/O s

Figure 13

In this field, the initial states of the binary outputs are set.



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The next step is to adjust the parameters of the differential function. To do this click on the icon below:



# 3.7 87T: Transformer differential

In this window, configure the data of the differential function. There is the possibility to choose the "*Conventional*" option that releases the harmonic restraint settings, or the "*Adaptive*" option whose harmonic restraint adjustments are made by the relay. The purpose of this tutorial is to test function 87 so this adjustment will not influence the test. The table below shows the slope settings, the shift point, the percent differential element pick-up setting, and the instantaneous.

Table 2			
87-1	30%In1		
87-2	5,0In1		
Slope 1	30%		
Slope 2	60%		
Slope change point	3In1		



Note: The other functions are all disabled so as not to interfere with the 87 test.



3.8 Matrix

Click on the icon illustrated below to specify the binary output of each relay function.



In the *"Protection"* field and in the *"Outputs"* tab, configure the trip of each function with a certain binary output.

SFT2841 v 17.2	- Easergy Sepam series 80	- [Connection window]		-	- 🗆 X
🔄 <u>F</u> ile <u>E</u> dit O	peration <u>S</u> epam <u>A</u> pplic	ation <u>O</u> ptions Win <u>d</u>	ow <u>?</u>		_ & ×
🖘 🗋 🚔 🖬 🕯	🏷 🖏 🖬 🗠 🕬	' 🎭 🏢 Fet   🖋 🎞	🕂 😢 📤 😽 🔫 🍉	·   2	
<b>.</b>	Jutputs				
Protection					1
Logic	01 02 0 50N/51N - 8 50BF - 1	03 04 05 🔨			
Inputs	46 · 1 46 · 2 49RMS · 1				
Equations	49RMS - inhibit 49RMS - alarm 64REF - 1				
GOOSE	64REF - 2 87T - 1 × 67 - 1 67 - 2 67N - 1				
	67N - 2 32P - 1 32P - 2	v			
	Selection enable (fur Already used by SEF Selection enable Already used by Log	nction not activated) AM function ipam		Apply Can	cel
🜻 🚨 Connected	Transformer T87	Sepam xxxx	Parameter setting	Remote controls inhibited	27/10/2021 14:47
		Fi	gure 18		

# 4. Differential software adjustments

# 4.1 Opening the Differential

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





Click on the Differential software icon.





💯   📄 쯜 🛃 🚽   Differential 2.02.160 (64 Bits)	CE-6006 (1730616)	-	o ×
Arquivo Home Display Software Opti	ns		~ 🕐
Channels Direc. Hrd Set \$\$ 600SE Set Sync. Set \$\$ 5V Set Connection Hardware	Settings General Inform. System Notes & Obs. Explanatory Figures Ch	eck List Others Connections	
Test Set Point Test Search Test Test Sett	Differential	Date:	
Insert/Edit Points       Insert/Edit Points       Beneral Options       Edit Point       Sequence       Bemove All		Manufacturer:	Colors: Not Test. Passed Fail
C Test Points Points Tested No. Fault IDiff IRest F	Responsible:		
Diff and iReat Operating Region Errors List Protection Status ON Line New	Default V Aux Source: 0,00 V Heating:	Preferences         OK         Cancel         IRest [in]           9.00         10.00         11.	

Figure 21

### 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.



Figure 22

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



^		· · · · ·								
ieneral	General Inform.	System	Notes & Obs.	Explanatory Figures	Chec	k List   C	thers	Connections		
	Test:									
ferential	Descr:	Differential				Dat	:e: [			
	Tested device:									
		Identi	f: 23031982		~	Мос	lel 1	F87		~
		Туре	e: Transformer	r Protection	~ N	lanufactur	er: S	Schneider		~
	Location:									
		Substation	n: CONPROV	E						~
		Bay	y: 1		$\sim$					
		Address	s: Visconde d	e Ouro Preto 75 - Custo	ódio Pereira	Neighbor	hood			~
		City	y: Uberlândia			`	<ul> <li>/</li> </ul>		State:	MG ~
	Responsible:									
		Name	e: Michel Roc	kembach de Carvalho						~
		Secto	r: Engineering	1	~	Regist	ry: C	00001		~
	Tool Test:									
	CE-6006			Series N	um.: 1730	06166302	0111	0011XXX		
$\checkmark$										

Figure 23

#### 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 are not relevant for this test.

Ajustes		×
Ajustes	ais Sistema Notas & Obs. O01 > >I Impedância Fonte Frequência: 60 Hz V Seq. de Fase: ABC V Potência 39: 38,11 MVA	Figuras Explicativas Check List Outros Conexões
Tensão Com Tensão Correntu	1φ:         12,70 MVA           Primária (FF):         110.0 KV           (FN):         63,51 KV           rente Primária:         200.0 A           Secund. (FF):         115.0 V           (FN):         66,40 V           e Secundária:         1.00 A	
RT Inverter TP TP	RTP F:         1956.5           RTC F:         200.0           IP D / RTP F:         1.00           TC E / RTC F:         1.00           Polandade:         *           s F         Image: TC's F           D         Image: TC E	Fase         F         Neutro         N         Terra         E         Desloc.         D           Tensões         5         ia         kp/V0:         1.00         kp/V0: <t< th=""></t<>
Default V		Preferências QK <u>C</u> ancelar

Figure 24

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There are other tabs where the user can insert "*Notes & Obs.*", *Explanatory Figures, and* "*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.

#### 5. Differential Adjustments

#### 5.1 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 transformer. However, it is possible to test protections of bus, generator, motor and line. For transformer protection there is the possibility of testing up to four windings automatically.

Settings	×
General	Protected Equipment/CTs Adjust Prot. Differential
Differential	Protected Equipment
	Equipment Transformer/AutoTransf ~ Nº of Phases: 30 ~ Nº of Wnd.: 2 ~
	Description Voltage Power Connection Vector Group Grounded
	Wnd. 1 110,0 KV 38,10 MVA D 💌
	Wnd. 2 11,00 KV 38,10 MVA y ▼ 11 (330°) ▼ Ø Yes
	CTs Main CTs Auxiliary CTs Enable Auxiliary CTs
	Description I Nom I Prim I Sec Connection Vector Group
	Wnd. 1 200,0 A 200,0 A 1,00 A Ybar 🕶
	Wnd. 2 2,00 kA 2,00 kA 1,00 A Ybar 👻
~	
Default 🗸	Preferences <u>O</u> K <u>C</u> ancel
	Figure 25



#### INSTRUMENTOS PARA TESTES ELÉTRICOS 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 lists of relays, only the configurable settings are enabled. Choose the "Schneider SEPAM 80 (T)" mask.



Parameterize the "Differential Settings" and "Instantaneous Settings". Set the time and use the tolerances for current and time given in the Appendix A.



· · · · · · · · · · · · · · · · · · ·	Equipment/Cls Adjust Prot. Differential
Settings	Slope Definition
	Data Entry: SCHNEIDER Sepam 80 (T)
	Differential Settings  V Instantaneous Settings Current Tolerance
	Pickup: 0,30 ln Pickup: 5,00 ln Relative: 5,00 %
	Time: 45,00 ms Time: 45,00 ms Absolute: 0,10 ln
	Restriction Current Angle Time Tolerance
	Iolerance Relative: 2.00 %
	K: 1 3.00 ° Absolute: 25.00 ms
	Phase Shift Compensation:
	TAPs: Calculated Fixed Angle Side: Before Leg: After 1 2 3 4 5
	Reference Wind. for Calculations (in): 1 User Def.:
	Zan Sequence Elimination

Figure 27

# 5.3 Differential Screen > Adjust Prot. Differential > Slope Definition

On this screen, the values of the slopes and the change in inclination "Change Point" must be entered.





#### **INSTRUMENTOS PARA TESTES ELÉTRICOS** 6. Channel Direction and Hardware Configurations

Click on the icon illustrated below.



Then click on the highlighted icon to configure the hardware.

Channels Direct.				
Model         Reset for Hard.           CE-6006         Connected           Serial Number:         17306166302101110011XXX	Set O Basic Advanced V V ON Line	term solution soluti solution solution solution solution solution solution solution	Nodes:	Confirm Cancel Export
Outputs: Analog. and SV Inputs: Analog	and SV Outputs: Binary, GOOS	E and Analog DC Inputs: Binary, GOOSE	and Analog. DC Logical	
K < NO01 > > +			Analog Outputs Sampled Value Outputs	<b>«</b> »
1/18		irward 💿 🗭	Voltage Channels	* • •
Nominal Line Source	-I[m]	, <u>, , , , , , , , , , , , , , , , </u>	Descr. Hardware Node	Point
Frequency: 60 Hz 🗸	└╎╴╴ᢆᢀ᠆᠆			
Phase Seq.: ABC 🗸		¥¥∐		
3φ power: 38,11 MVA				
1φ: 12,70 MVA		M M M		
Primary Voltage (FF): 110.0 KV				
(FN): 63,51 KV		m		
Primary Current: 200,0 A				
Secondary Voltage (FF): 115,0 V				
(FN): 66,40 V	Veltage Changel	Currente Channel		Paint
Secondary Current: 1,00 A	1 Va	$\sim$ 5 la AO I01 $\sim$ 5	AO I01 I1 VOOL	rom. ∕la ▼
VTR F: 0,957 k	FN 2 Vb	F 6 Ib AO_102 < Σ	AO_102 12 - NO01 -	r lb ▼
CTR F: 200,0	3 Vc	7 Ic AO_103 ~ Σ	AO_103 13 - NO01 -	r Ic ▼
VTR D / VTR F: 1,00	Vab	✓ E 8 IE ✓	AO_I04 I4 ▼ NO02 ▼	la 🔻
CTR E / CTR F: 1,00	FF Vbc	EP 9 IEP V	AO_105 15 VN002 V	
Reverse Polarity:	D 4 VD	~		
	Calc k.V0	V Calo k.IO V		
	k.V2	× k.l2 ×		
Equal Parameters Among Nodes	k to V0 1.00 to V2 1.00	k to 10 1,00 to 12 1,00	]	
				.11

Figure 30

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







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

CI	annels Direct.	-		Х
l ocal	Model Reset for Hard.	] [	Confirm	
v	CE-6006 Connected Set O Advan	් දේද GOOSE	Cancel	
to to	Serial Number:	50		
Ren	17306166302101110011XXX ON Lin	<sup>s</sup> <sub>o</sub> S. Value	Export	





# 7. Test Structure for Function 87

# 7.1 Test Settings

On this tab, the correct direction of the current generation channels and the stop interface must be done. The binary input responsible for stopping the stopwatch due to the trip signal is BI01. Insert a pre-fault with nominal currents.

🔟   🗋 🥁 🚽   Differential 2.02.1	0 (64 Bits) - CE-6006 (1730616)			- • ×
Channels Direc. 10 Connection	t Start Stop Clear all	form © System prs Relay Present Report	Recreate Restore View Charts Layout	
Hardware	Generation Op	ons Report Units	Layout	
Test Set Point Test Search Test		5.40		Test Cat
Generation Channels Direc.	Mada Neminal	-raut 2		Test Set
01 Ja AO I01 (Hrd: 11)	11 1 000 A 150.0 °			Wait Time for Data Entry: 120,00 s
01 Ib AO I02 (Hrd: I2)	12 1,000 A 30,00 °			Mult. Tolerance: 1,00
01 Ic AO_I03 (Hrd: I3)	13 1,000 A -90,00 °			Point Test
02 la AO_104 (Hrd: I4)	14 1,000 A 0 *			Wait Time for Operation: 100.00 ms
02 Ib AO_105 (Hrd: 15)	15 1,000 A -120,0 °			
02 Ic AO_106 (Hrd: 16)	16 1,000 A 120,0 °			Search Test
01 Va				Initial step: Absolute Resolution: 100,00 mA
01 V6				Min. Resolution V Relative Resolution: 0,50 %
				Wait Time for Operation: 400,00 ms
02 Vb				
02 Vc				Disconsider the characteristic in Search
	Time Pre-Fault 1: 100.00 ms			Pulsed Search (Stop every increment)
Binary Outputs & Goose - Fault	Binary Outputs & Goose - Pre-Fault 1			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	GO			Nº of exactilians is ease of conception error 2
Simulate Sampled Value Error	Simulate Sampled Value Error			No or repeations in case of generation error. 2
LMax Gen per Chn by bard	Mode Intelligent			Stop the test at the first failure
V Use Hardware Limit	Variation of RMS and Angle			Protection Status Verification Start/End of Test V
Stop Interf. BI01 (Hrd: BI1) V	Stop Logic Initial NA 🗸			Ignore Pre-Fault operation
Trigger Interf. Software  V Wait for PPS	Trigger Logic Trigger Delay 0,00 s			Based Only on Generated Values 🗹 Cycle to Cycle Generation 🗹
1 ON Line New		Aux Source: 110.00 V	eating: 0%	
		Figure 33	3	

# 7.2 Point Test

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. To visualize the point, click on the "*Chat*" tab.





Figure 34

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









#### It is verified that all points were successfully approved.



# 7.3 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 38

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

# 8. 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.



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Z   □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □	54 Bits) - CE-6006 (1730616)	- 0 ×
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Figure 43



# **APPENDIX A**

# **A.1 Terminal Designations**



Figure 44



# A.2 Technical Data

Characteristi	CS					
Settings						
Low set point Ids			1.000			
Setting range			30 % to 100	% of In1		
Accuracy <sup>(1)</sup>			±2 %			
Resolution			1%			
Drop-out/pick-up rat	lio		93.5 % ±5 %			
Percentage-based	d characteri	stic Id/It				
Setting range			15 % to 50 %			
Accuracy			12%			
Resolution			1%			
Drop-out/pick-up rai	110 d abaraatari	intin Id/It?	93.5 % I5 %			
Percentage-based	a characteri	stic id/it2	Name EO P/	400.9/		
Setting range			None, 50 %	0 100 %		
Accuracy 1-7			12 70			
Presolution	tio		00 E 0/ +E 0/	3		
Slope change poi	int		93.5 % 15 %			
Softing range	in.		None Int to	10 101		
Accuracy (1)			+5.%	10 111		
Decolution			0.1.01			
Resolution	tio		0.1111	4		
Toet mode	00		93.0 % 10 %			
Sotting range			Active/blot or	tivo		
Advanced cetti	nae		Active/Not ac	AIVE .		
Advanced setti	iigs		0	Dell edent		
Selection of restrain	IL		Conventiona	voen-adaptive	9	
Restraint on CT Id	188		A other that	the		
Setting range	ing		Active/Not ac	aive		
Hestraint on closi	ing		A ative the t	tive		
Setting range	0		Active/Not ac	tive		
Magnetization	Setting ra	nge	1 % to 10 %			
sinr	Resolution		±5% 1%			
Suns						
	Drop-out/pick-up ratio		90 % ±5 % 0	r 0.5 % In1		
l ime delay	Setting range		0 to 300 s			
	Accuracy (1)		±2 % or -10 i	ns to +25 ms	â.	
	Resolution	n	10 ms			
High set point idn	nax					
Setting range	Conventio	onal restraint	3 to 18 In1			
	Self-adap	tive restraint	None, 3 to 18	3 In1		
Accuracy (1)			12%			
Accuracy (1)	Resolution			2		
Resolution	i.e.		93.3 70 13 70			
Resolution Drop-out/pick-up rai	tio	er conventional r	actualist			
Resolution Drop-out/pick-up rai Second-harmonic	tio set point f	or conventional r	estraint	2.0/		
Resolution Drop-out/pick-up rat Second-harmonic Setting range	tio : set point f	or conventional r	None, 5 to 4	) %		
Recouracy (1) Resolution Drop-out/pick-up rai Second-harmonic Setting range Accuracy (1)	tio : set point fo	or conventional r	estraint None, 5 to 40 ±5 %	) %		
Resolution Propout/pick-up rai Second-harmonic Setting range Accuracy <sup>(1)</sup> Resolution	tio : set point fo	or conventional r	estraint None, 5 to 40 ±5 % 1 %	) %		
Resolution Drop-out/pick-up rai Second-harmonic Setting range Accuracy <sup>(1)</sup> Resolution Drop-out/pick-up rai	tio set point fo	or conventional r	estraint None, 5 to 40 ±5 % 1 % 90 % ±5 %	)%		
Resolution Drop-out/pick-up rai Second-harmonic Setting range Accuracy <sup>(1)</sup> Resolution Drop-out/pick-up rai Second-harmonic	tio set point fo tio restraint fo	or conventional r	estraint None, 5 to 40 ±5 % 1 % 90 % ±5 % estraint	)%		
Resolution Prop-out/pick-up rai Second-harmonic Setting range Accuracy (1) Resolution Prop-out/pick-up rai Second-harmonic Setting range	tio set point fo tio restraint fo	or conventional r	estraint None, 5 to 40 ±5 % 1 % 90 % ±5 % estraint Phase-specif	) % ic/Global		
Resolution Prop-out/pick-up rai Second-harmonic Setting range Accuracy <sup>(1)</sup> Resolution Drop-out/pick-up rai Second-harmonic Setting range Fifth-harmonic se	tio c set point for tio c restraint for t point for c	or conventional r	estraint None, 5 to 40 ±5 % 1 % 90 % ±5 % estraint Phase-specif raint	) % ic/Global		
Record y '' Resolution Trop-out/pick-up rai Second-harmonic Setting range Accuracy (') Resolution Drop-out/pick-up rai Second-harmonic Setting range Fifth-harmonic se Setting range	tio c set point f tio c restraint fo t point for c	or conventional r	estraint None, 5 to 40 ±5 % 1 % 90 % ±5 % estraint Phase-specification raint None, 5 to 40	) % ic/Global ) %		
Accuracy <sup>(7)</sup> Resolution Trop-out/pick-up rai Second-harmonic Setting range Accuracy <sup>(1)</sup> Resolution Drop-out/pick-up rai Second-harmonic Setting range Fifth-harmonic se Setting range Accuracy <sup>(1)</sup>	tio c set point f tio c restraint for t point for c	or conventional r	estraint None, 5 to 40 ±5 % 1 % 90 % ±5 % estraint Phase-specif raint None, 5 to 40 ±5 %	0 % ic/Global 0 %		
Accuracy <sup>(1)</sup> Resolution Second-harmonic Setting range Accuracy <sup>(1)</sup> Resolution Trop-out/pick-up rai Second-harmonic Setting range Fifth-harmonic se Setting range Accuracy <sup>(1)</sup> Resolution	tio e set point f tio e restraint for at point for a	or conventional r	estraint None, 5 to 40 ±5 % 1 % 90 % ±5 % estraint Phase-specification None, 5 to 40 ±5 % 1 %	) % ic/Global ) %		
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Accuracy <sup>117</sup> Resolution Second-harmonic Setting range Accuracy <sup>110</sup> Resolution Drop-out/pick-up rai Second-harmonic Setting range Fifth-harmonic se Setting range Accuracy <sup>110</sup> Resolution Drop-out/pick-up rai Fifth-harmonic re Setting range Characteristic t	tio tio restraint for t point for o tio straint for c imes	or conventional r or conventional rest conventional rest	estraint None, 5 to 40 ±5 % 1 % 90 % ±5 % estraint Phase-specif raint None, 5 to 40 ±5 % 1 % 90 % ±5 % raint Phase-specif	0 % ic/Global 0 %		
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Rua Visconde de Ouro Preto, 77 - Bairro Custódio Pereira - Uberlândia – MG - CEP 38405-202.<br/>Fone (34) 3218-6800Fone (34) 3218-6800Fax (34) 3218-6810Home Page: www.conprove.com.br-E-mail: conprove@conprove.com.br



### **APPENDIX B**

# Equivalence of software parameters and the relay under test.

Table 3						
Differential Software	SEPAM T87 Relay					
	-		-			
Parameter	Figure	Parameter	Figure			
Voltage (Wind. 1)	25	Rated Voltage Un1	12			
Voltage (Wind. 2)	25	Rated Voltage Un2	12			
Power (Wind. 1 and 2)	25	Rated apparent power	12			
Vector group	25	Vector shift	12			
I Prim (Wind. 1)	25	Rated current (In)	10			
l Prim (Wind. 2)	25	Rated current (I'n)	10			
I Sec (Wind. 1)	25	CT rating	10			
I Sec (Wind. 2)	25	CT rating	10			
Differential Settings (pickup)	27	lds threshold	16			
Instantaneous Settings (pickup)	27	High set	16			
ld/lt	28	ld/It threshold	16			
Id/It2	28	Id/It2 threshold	16			
Change Point	28	Slope change point	16			