

INSTRUMENTOS PARA TESTES ELÉTRICOS Test Tutorial

Equipment Type: Protection Relay

Brand: Schneider

Model: SEPAM T42

Functions: <u>27 or PTUV – Undervoltage & 59 or PTOV –</u> <u>Overvoltage</u>

Tool Used: <u>CE-6003, CE-6006, CE-6707, CE-6710, CE-7012 or</u> <u>CE-7024</u>

Objective: <u>Test the pick-up and actuation time of the</u> <u>undervoltage and overvoltage elements using the Quick software</u>

Version Control:

Version	Descriptions	Date	Author	Reviewer
1.0	Initial Version	25/07/2022	M.R.C.	G.C.D.P.



Sun	nmary	
1.	Relay connection to CE-6710	5
1.1	Auxiliary Source	5
1.2	Voltage Coils	5
1.3	Binary Inputs	6
2.	Communication with the SEPAM T42 relay	6
3.	Parameterization of the SEPAM_T42 relay	8
3.1	General characteristics	8
3.2	CT/VT Supervision	10
3.3	Program logic	10
3.4	27/27S: Undervoltage	11
3.5	59: Overvoltage	12
3.6	Set control matrix	12
4.	Quick software adjustments	13
4.1	Opening the Quick	13
4.2	Configuring the Settings	15
4.3	System	16
5.	Channel Direction and Hardware Configurations	16
6.	Test structure for function 27/59	18
6.1	Voltage x Time > Overvoltage screen	18
6.2	General Adjustments 59	18
6.3	Timed Element 59-1 Pick-up Test	19
6.4	Element 59-1 point test	22
6.5	Timed Element 59-2 Pick-up Test	22
6.6	Element 59-2 point test	24
6.7	Voltage x Time > Undervoltage screen	24
6.8	General Adjustments 27	25
6.9	Timed Element 27-1 Pick-up Test	26
6.10) Element 27-1 point test	28
6.11	Timed Element 27-2 Pick-up Test	29
6.12	Element 27-2 point test	31
7.	Report	31
APF	PENDIX A	33
A.1	Terminal Designations	33



	INSTRUMENTOS PARA TESTES ELÉTRICOS	
A.2 Technical data		



Statement of responsibility

The information contained in this tutorial is constantly verified. However, differences in description cannot be completely excluded; in this way, CONPROVE disclaims any responsibility for errors or omissions contained in the information transmitted.

Suggestions for improvement of this material are welcome, just user contacts us via email suporte@conprove.com.br

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

This document is intended as a guide only; the manual of the equipment under test 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 test and also be aware of safety standards and regulations.

Copyright

Copyright © CONPROVE. All rights reserved. The dissemination, total or partial reproduction of its content is not authorized, unless expressly permitted. Violations are punishable by law.



INSTRUMENTOS PARA TESTES ELÉTRICOS Sequence for testing the SEPAM T42 relay in the Quick software

1. Relay connection to CE-6710

Appendix A-1 shows the relay terminal designations.

1.1 Auxiliary Source

Connect the positive (red terminal) of the Aux Source. Vdc to pin 1 on the CSH terminal of the relay and the negative (black terminal) of the Aux Source Vdc to pin 2 of the CSH terminal of the relay.



1.2 Voltage Coils

Connect voltage channels V1, V2 and V3 to pins 1, 2 and 6 of the relay respectively, connecting the three common ones to pin 3. Note: Voltage pins 3 and 5 must be short-circuited.



Figure 2



1.3 Binary Inputs

Connect the binary input of the CE-6710 to the binary output of the relay slot CSH.

- BI1 to pin 05 and its common to pin 04;
- BI2 to pin 08 and its common to pin 07;
- BI3 to pin 11 and its common to pin 10;
- BI4 to pin 14 and its common to pin 13.

The following figure shows the details of these connections.



2. Communication with the SEPAM T42 relay

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



When opening the program the following screen is shown:



SFT2841 v 17.3	×				
English (U	K) 🔽				
Welcome to SFT2841,					
your Sepam configuration software.					
Do you want to					
Connection.					
Sepam	Easergy Sepam				
Series 20 Series 40 Applications 20 Applications 40 and 50	Series 60 Series 80 Applications 60 Applications 80				
Compar	ison				
	2				
Exit SFT	2841				

Figure 5

To initiate communication click on the icon illustrated below:



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



INSTRUMENTOS P	PARA TESTES ELÉTRICOS		
SFT2841 v 17.3 - Sepam series 40 - [Connection window]	-		×
File Edit Operation Sepam Application Options Windo	w ?	-	8,
» 🗅 🛎 🖶 🎒 🖬 노 콰 🟥 Fot 🎽 🏦 🕁 兌 🛕	$\forall \lhd \triangleright$		
Sepam hardware configuration General characteristics CT/VT Supervisio	on Program logic Password		
Hardware configuration	Apply	Cancel	
C C			-
Transformer T42	Sepam model		
Application type	C MX model (without fixed advanced UMI)		
Sepam label Sepam xxxx	 MD model (with fixed advanced UMI) 		
– Optional modules			
MES (Input / output module)	Synchronisation mode Network		
MES (input / output inodule)			
C MES114 (101 + 40 module)			
ME I 148 (8 temperature sensors module) humber 1			
MET148 (8 temperature sensors module) number 2			
MSA141 (1 analog output module)			
DSM303 (Front panel UMI module)			
ACExxx (Communication interface)			
	1		
C Connected Transformer T42 Sepam xxxx	Operation Remote controls en 25/07/2022	2 09:16:30	_
F	Figure 7		

3. Parameterization of the SEPAM_T42 relay

The next step is to adjust the rated frequency, rated primary voltage and rated secondary voltage values. The values of these parameters are in the table below:

Table 1					
Network frequency	60Hz				
Rated primary voltage	13,8KV				
Rated secondary voltage	115V				

3.1 General characteristics

In this tab, the values described above are adjusted, in addition to other fields. What is highlighted in red is vitally important for the test to run properly.



IN	ISTRUMENTOS PARA TES	TES ELETRICOS	
SFT2841 v 17.3 - Sepam series 40 - [Connec	tion window]		– 🗆 X
File Edit Operation Sepam Application	tion Options Window ?		_ 8 ×
🕶 🗅 🖻 🗏 🎒 🖬 노 🗞 🕮 Fct	🖋 🏦 🕂 원 🛕 😽 🚄 🖡	2	
Sepam hardware configuration General characte	ristics CT/VT Supervision Program l	ogic Password	
General characteristics			Apply Cancel
Network frequency	Current transformers		Meter increment
C 50 Hz	Rated secondary current	5A CT 💌	
© 60 Hz	Number of CTs	11,12,13	O.1 kW.h
Selection of active setting group	Rated primary current (In)	500 A ·	
active for all the protections.	Base current (Ib)	400 A .	Reactive energy
Setting group A	Integration period	5 💌 min	U.I kVar.h 💽
Remote setting enabled	Residual current No	ne 💌	
© No ○ Yes	Rated residual current (In0)	1 A ÷	
Sepam working language	-Voltage transformers		
English	Rated primary voltage (Unp)	13.8 kV 🔹	
C Local language	Rated secondary voltage (Uns)	115 💌 V	
Incomer/feeder	VT connection type	V1,V2,V3 -	
C Feeder	Residual voltage measurement	sum of 3V 🔍	
Edit Sepam label			
E Connected Transformer T42	Sepam xxxx	Parameter setting Remote contro	is en 25/07/2022 09:19:36

Figure 8

After the settings are configured, click on the "*Apply*" icon highlighted in green in the previous figure so that the software sends the changes to the relay. Before this occurs a password is required.

Identification	×
Password	
ОК	Cancel
Fi	gure 9

Enter your password for the changes to take effect. Whenever a parameter is changed its password must be entered.

Note: the default password is 0000.



3.2 CT/VT Supervision

In this field, disable all functions, so that they do not interfere with the test.

SFT2841 v 17.3 - Sepam series 40 - [Connectio	n window] —		×
File Edit Operation Sepam Application	Options Window ?	-	8 ×
🕶 🗅 🐸 🖬 🎒 🖬 노 🗞 🛍 Fot 🥖	॰ ☆ ☆ ☆ ☆ 🐳 🚄 🕨		
Sepam hardware configuration General characteristi	cs CT/VT Supervision Program logic Password		
CT/VT supervision	Open advanced parameters Apply	Cancel	
Current transformer supervision, CTS	Voltage transformer supervision, VTS		
On 🗖	On 🗖		
CTS Time delay 150 ms 📩	Use linv,Vinv criterion No Yes Ime delay, linv Vinv 1 s •		
Behaviour on 46/468C/51N/32P/32Q C No action C Inhibition	Check loss of 3V/2U Time delay, loss 3V/2U ি No Time delay, loss 3V/2U C Yes 1		
	- Behaviour on 27/27D/32P/32Q/47/59/59N/51V C No action Inhibition		
	Behaviour on 67 Behaviour on 67 No directional Inhibition		
Connected Transformer T42 Se	pam xxxx Parameter setting Remote controls en 25/07/2022 Figure 10	09:33:48	- //

3.3 Program logic

In this field, the nominal state of the binary outputs is set.

Prog	gram lo	gic				-	- 1	Apply	Cance	el
		_								
- Circuit b	oreaker contr	ol								
0	, ,				Stan	dard assignmer	nt			
0	res	_								
– Logic d	iscrimination	_		/	Assignmen	t of logic inputs			_	
•	No					Logic Inp: 4		 Negative Later	T	
0	íes					Logic Input		Negative Latch.	1	
			1							
Relay o	utput parame	eters								
	Used	Caracteristics	Impuls.							
01	Yes	normally open								
02	Yes	normally open								
03	Yes	normally open								
04	Yes	normally open								



The next step is to adjust the undervoltage and overvoltage functions. To do this click on the icon below:



3.4 27/27S: Undervoltage

Up to two definite-time stages can be set for this function. For this tutorial, the settings shown in the following table are used. Where element 27-1 uses binary output O3 and element 27-2 uses binary output O4 for trip signals.

Table 2							
Element	Voltage %	Voltage	Delay				
27-1	90% Vnp	59,76V	2s				
27-2	60% Vnp	39,84V	1s				

SFT2841 v 17.3 - Sepam series 40 - [Connection window] -	×
File Edit Operation Sepam Application Options Window ?	- 8 ×
🖘 🗅 🖻 🖶 🎒 🖬 📐 🗞 🏥 Fot 🌽 🏦 🕂 🗹 🚣 😽 🔍 🛧	
50/51 50N/51N 50BF 46 49RMS 67 67N 27/27S 59 59N 47 81 38/49T	
27/27S : Undervoltage	el
On Latching Voltage mode Voltage threshold Delay Element 1 Image: Comparison of the state of the st	
Tripping behaviour 01 02 03 04 L1 L2 L3 L4 L5 L6 L7 L8 L9 English Local Rec. Element 1 X	
C Connected Transformer T42 Sepam xxxx Parameter setting Remote controls en 25/07/2022 09:39: Etimune 12	19

Note: The other functions are all disabled so as not to interfere with the function 27 test.



3.5 59: Overvoltage

Up to two definite-time stages can be set for this function. For this tutorial, the settings shown in the following table are used. Where element 59-1 uses binary output O1 and element 59-2 uses binary output O2 for trip signals.

Table 3						
Element	Voltage %	Voltage	Delay			
59-1	110% Vnp	73,04	2s			
59-2	140% Vnp	92,96	1s			

SFT2841 v 17.3 - Sepa	am series 40 - [Connec	tion window]			_		×	
🗐 File Edit Operatio	on Sepam Applicat	ion Options Windo	N ?			-	ъ×	
🛋 🗅 🖻 🖶 🎒	🖬 📐 🎭 🕮 Fct	🎤 🏗 🕂 👻 🚹	❤ ◀ ▷					
50/51 50N/51N 50B	F 46 49RMS	67 67N 27/27S	59 59N 47	81 38/49T				
59 : Overvo	59 : Overvoltage							
	On Lato	ning	Voltage mode – V	oltage threshold	Delay			
Element 1			Phase-to-neutral 💌	110 %Vnp	2 s 📩			
Element 2			Phase-to-neutral	140 %Vnp	1 s 🕂			
				<u></u>				
Tripping behaviour	02 03 04 L1 L2 L X	3 L4 L5 L6 L7 L8 L9	English OVERVOLTAGE 508 OVERVOLTAGE 508	Local Re RETENSÃO × RETENSÃO ×	C.			
C Connected	Transformer T42	Sepam xxxx	Paramete	r setting Remote cor	ntrols en 25/07/2022	09:43:54		
		Fi	oure 1 4					

Note: The other functions are all disabled so as not to interfere with the function 59 test.

3.6 Set control matrix

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





In the "*Protections*" field and in the "*Outputs*" tab, the tripping of the functions with the binary outputs is configured.

🗐 SFT2841 v 17.3 - Sep	am series 40 - [Connection window]		– o x
🗐 File Edit Operati	on Sepam Application Options Window ?		_ B ×
=> 🗅 🖻 🖩 🎒	🖬 노 🐌 🏢 Fot 🎽 🏦 🕂 😧 🚹 😽	$\triangleleft \triangleright$	
	Characteristics Outputs Indicators Events		
Protections	Characteristics Duputs Indicators Events		1
	01 02 0	3 04	
Control functions	50N/51N - 3		
	50N/51N - 4		
Logic inputs	50BF		
	46 - 1		
Equations	46 - 2		
	67-1 X		
	67 - 2		
	67N - 1		
	67N - 2		
	49RMS - 1		
	- close inhibit		
	- alarm		
	27/27S - 1	(
	27/275 - 2	X	
	59-1 ×		
	59-2 ×		
Apply	59N - 1		
	59N - 2		
Cancel	47		
	Transformer T42 Senam yyyy	Operation	te controls en 25/07/2022 09:50:51
	Figure	16	te controls ell 25/07/2022 09.50.51

4. Quick software adjustments

4.1 Opening the Quick

Click on the "CTC" application manager icon.



Click on the "Quick" software icon.



	- 🗆 X
onprove Test Ce	enter
Version 2.02.190	
Secondary Secondary Tests	Applications for measurement
Power Directional Constance Master Meter Power Quality PSB OoS	Setup Equipment Set. / Tests # Settings
Harmonic Restraint Sequencer Synchronism Overcurrent Transducer	Update Firmware Software Language Support Dog importation and assistance
Transient Playback Vitz Volts/Hertz	Image: Optimizer and the district record Image: Image: Optimizer and the district record Image: Image: Optimizer and the district record Image: Optimizer and the distribution of t
Additional aplications Image: Additional applications Image: Transient View Image: Validate PDF Reports Image: Statistical Analysis	Lig Forum User Manual ✓ Quick Guide ✓ Self-diagnosis P: Hemote Access
	Secondary Tests Secondary Tests Secondary Tests Differential Power Directional Distance Master Master Power Quality PSB OoS Ramp Harmonic Restraint Sequencer Synchronism Vorecurrent Transducer Transient Playback Volts/Hertz Other Additional aplications Transient View Voltade PDF Reports Statistical Analysis





Figure 19



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.

) Start	Stop	Image: Settings Image: Set			
Gener	ation	Options			
Figure 20					

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.

General	General Inform. System Notes & Obs. Explanatory Figures Check List Others Connections
	Test:
	Descr: Under and Overvoltage Date:
	Tested device:
	Identif: 23031982 V Model T42 V
	Type: Transformer Protection V Manufacturer: Schneider V
	Location:
	Substation: Conprove
	Bay: 1
	Address: Visconde de Ouro Preto 75, Custódio Pereira
	City: Uberlândia V State: MG V
	Responsible:
	Name: Michel Rockembach de Carvalho
	Sector: Engineering V Registry: 00001 V
	Tool Test:
	CE-6710 Series Num.: 03010187CCM33222211U5HVRGLGLGL2Z0RX0

Figure 21



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.

ettings					×
General	General Inform. System k < NO01 > Nominal Impedance Frequency: Phase Seq.: 3φ power: 1φ: 1φ: Primary Voltage (FF): (FN): Secondary Voltage (FF): (FN): Secondary Current: VTR F: CTR F:	Notes & Obs. ≫ Source 60 Hz ~ ABC ~ 47.80 MVA 15.93 MVA 13.80 KV 7.97 KV 2.00 kA 115.0 V 66.40 V 5.00 A 120.0 400.0	Explanatory Figures	Check List Others Conne Constant Conne Constant Conne Constant Conne Connect Con	ctions
	VTR D / VTR F: CTR E / CTR F: Invert Polarity: VT's F VT b	1,00 1,00 CT's F CT E	Vortage 1 Va FN 2 Vb 3 Vc D 4 VD	5 Ia 6 Ib 7 Ic E 8 IE EP 9 IEP	k to V0: 3.00 k to V2: 1.00 k to I0: 1.00 k to I2: 1.00
Default V				Preferences	<u>O</u> K <u>C</u> ancel

Figure 22

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. Channel Direction and Hardware Configurations

Click on the icon illustrated below.





Then click on the highlighted icon to configure the hardware.





Figure 24

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

Settings		×
Master Slave 1 Slave 2	Main Sampled Value Others	
Model CE-6710 Serial Number 03010187CCM33222211U5HVRGLGLGL2Z0RXO Analog Outputs: Standard - Voltages: 4x 300 V: 100 VA 0 4x 300 V: 100 VA V1 0 2x 600 V: 180 VA V1	Binary Outputs: Auxilia Initial State Initial State B011: NO< B02: NO< B04: NC B05 and B06 type:	ar Source: - 250 V - 220 V → 110 V - 60 V
 2 x 300 V: 150 VA 1 x 600 V: 350 VA 1 x 300 V: 250 VA V3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Conventional BO5: NO ~ BO6: NO ~ O IRIG (BO5) /Clock (BO6) Transistor OTTL 1	 48 V 24 V Other Off 10,00 V
Customized Assoc. Standard - Currents: 6 6x 32 A; 210 VA 3 x 64 A; 400 VA 2 x 96 A; 550 VA 2 x 10.00 A; 300 VA 1 x 192 A; 1100 VA 1 x 6,00 A; 360 VA Electromechanical: 1 x 75 A; 700 VA 1 x 50 A; 700 VA	Binary / Analog Inputs: BI1: BI - Contact BI2: BI - Contact BI3: BI - Contact BI4: BI - Contact BI5: BI - Contact BI6: BI - Contact BI7: BI - Contact BI8: BI - Contact BI9: BI - Contact BI8: BI - Contact BI9: BI - Contact BI1: BI - Contact BI1: BI - Contact BI1: BI - Contact BI11: BI - Contact BI12: BI - Contact Considers absolute values to Voltage-BI Al	1-6 : 2V; 20V; 600V 7-12 : 200mV; 2V; 600V
Customized Assoc. Connect CTs Range 1.25 A	Ōĸ	

Figure 25



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

Cha	nnels Direct.					— D X	
Local	Model	Reset for Hard.	hard	 Basic 		Confirm]
	CE-6710 ~	Connected	Set	Advanced	6 GOOSE	Cancel	
ote	Serial Number:				50 00002		
er	03010187CCM3322	2211U5HVRGLGLGI	L2Z0RXO 🗸 🛄	🕗 ON Line	^s _v S. Value	Impart	
L.							

Figure 26

6. Test structure for function 27/59

6.1 Voltage x Time > Overvoltage screen

Click on the tab "Protection > Voltage x time > Overvoltage" so that the data set in the relay are configured in the software. Next to the voltage "V" chooses a node as a reference, in this case "AO V01". Only after choosing the node are the fields for setting function 59 active.

		- 0	×
Channels Connection Channels Convection	An Editing	Waveform Lu, Harmonics Set Ispc Offset kccumulation Evaluations Set Vspc Offset Passors Present Recreate Retore	
Dra-fault Fault	Monitoring - Y	Insuite Rin. GOOSE and Analog. Waveform Accumulations Playout Protection	= ×
Fault	Angle Ref: Arte	Current x time Voltage x time Differential Harm Restr. Directional Frequency	• ^
Non	August Net. Auto		
▼ N001	▼ N001		
Analog. DC Output		An V AO_V01 V Edit Curve Graph with respect to Pkp Temp. Chart	
Binary Outputs		1,00 t	
GOUSE Outputs		0,800	
		0.600	
		0,000	
	Timers	0,400	
	Chronometer 1:	0,200	
	Stop Interf. On Wait		v
	Disable v 0 s	1,00 2,00	
	Chronometer 2:	Canture Time by: O Chron 01 O Chron 02 Simulation:	
	Stop Interf.		
	Disable 🗸		
		V % Tol:: 5,00 %	
	Actuation Lock Wait betw. Timers: 0 s	Pkp Expected Drp Expected t Expected V Absol. Tol.: U.SU V	_
	Fix Max. Generation Time: : : :	Inst. 1: P. d P. d t * Tol: 5002	
	Man Increase Amni Angle Clean	Inst. 2: Pd Pd t Absol. Tol.: 30.00	ms
	N001 ~ ~ + 45,00		
Error List Protection Status			
Son Line New	Aux. Source 110,00 V	/ Heating: 0%	
	E:	anno 27	

Figure 27

6.2 General Adjustments 59

According to the relay software settings, these values are entered in the Quick software. The 59-1 element pick-up is equal to 73.04V (1.1* V_{np}) with actuation time equal to 2.0s and the pick-up of the element 59-2 is equal to 92.96V (1.40 * V_{np}) with actuation time equal to 1.0s.



There are also fields where the absolute and relative tolerances for both voltage and time must be entered. These values are taken from Appendix A.2. There is also a field where the type of simulation is required, being possible single-phase-ground, two-phase and three-phase.

rrent x time	Voltage x time	Differential	Harm. Restr.	Directional Frequency		
vervoltage	Undervoltage					
An ~ V	: AO_V01	∼ Edi	t Curve	Graph with res	pect to Pkp Temp. Chart	~
2.00 t [s	1			•		
2,00						
1,00						
0						VIV
0 60	.00	70,00	80,00	90,00	100,0	¥ [M 110.0
0 60	,00	70,00 Capture	80,00 e Time by: O Chron	90,00 . 01 () Chron. 02	100,0 Simulation:	V [V] 110,0 ABC ~
0 60 Dial Time	.00	70,00 Capture	80,00 e Time by: O Chron	90,00 . 01 O Chron. 02 Clear	100,0 Simulation:	¥ [M 110,0 ABC ~
0 60 Dial Time Timed Curve	.00	70,00 Capture	80,00 e Time by: O Chron	90,00 .01 O Chron. 02 Clear	100.0 Simulation: // V % Tol.: //	¥[M] 110,0 ABC ∽ 2,00 %
0 60 Dial Time Timed Curve	,00 : : Pkp Expected	70,00 Capture	80,00 e Time by: • Chron	90,00 .01 O Chron. 02 Clear P d 10 t Expected	100,0 Simulation: V % Tol.: V Absol. Tol.:	¥ [V] 110,0 ABC ∽ 2,00 % 0,58 V
060 Dial Time Timed Curve	,00	70,00 Capture	80,00 Time by: O Chron	90,00 . 01 O Chron. 02 Clear P d M t Expected	100,0 Simulation: V % Tol.: V Absol. Tol.:	V [M 110,0 ABC ~ 2,00 % 0,58 V
0 60 Dial Time Timed Curve Timed Inst. 1	.00 Pkp Expected 1 73.04 V	70,00 Capture	80,00 Time by: O Chron	90,00 .01 O Chron. 02 Clear P I So t Expected 2,00 s	100.0 Simulation: V % Tol.: V Absol. Tol.: t % Tol.:	¥ [V, 110.0 ABC ∽ 2,00 % 0,58 V 2,00 %



6.3 Timed Element 59-1 Pick-up Test

For the pick-up test, a ramp is used to increase the voltage value. To do this, choose the "*Ramp*" option on the "*Fault* > N01" tab and click on the highlighted icon.



🤣 🗋 🚔 🚽 Quick 2.02.190 (64 Bits) - CE-6710 (0301018)		- 0 ×
Arquivo Home Display Software Options		^ (?
Hrd Set. Socose set Orec Channels Connection Hrdware Hrdware	On Editing elete Test elete All UIS Generation	aveform Lu, Harmonics IC Set Ispc Offset cumulation III Set Vspc Offset asors Options Report III Set Vspc Offset Report III Set Vspc Offset
Pre-fault Fault × X		Inputs Bin, GOOSE and Analog , Waveform Accumulations Phasors Harmonics Protection
Fault	Angle Ref.: Auto	Current x time Voltage x time Differential Harm. Restr. Directional Frequency
	× NO01	Overvoltage Undervoltage
Point Channel Definitions Va A0_V01 Modules Vb A0_V01 Modules Vc A0_V01 Informations Ia A0_U01 Informations Ia A0_U01 Informations Ib A0_U01 Informations ID U002 A0_U04 UD03 A0_U05 IUD04 UD04 A0_U05 IUD04	Times × X Oronometer 1: Stop tref. On Wat Deable V 10 0 s	An V: A0_V01 Est Curve Graph with respect to Pkp Temp. Onat 2.00 1.00 1.00 1.00 1.00 V/V/V/V/V/V/V/V/V/V/V/V/V/V/V/V/V/V/V/
Analog, DC Output Analog, DC Output Binary Outputs GOOSE Outputs Time and Advancement Error List Protection Status	Chronometer 2: Stop Interf. Daable State	Capture Time by: O Chron. 01 Simulation: ABC Dial Time: Clear Clear V %, Tol:: 2.00 %, Timed Curve: P & M >> V %, Tol:: 2.00 %, Pkp Expected Dp Expected t Expected V Absol. Tol:: 0.58 V Timed: P & M P & M 2.00 %, t %, Tol:: 2.00 %, Inst. 1: 73.04 V P & M P & M 1.00 %, t Absol. Tol:: 35.00 ms
New	Aux. Source 110,00 V	Heating: 0%
	Fie	mro 70

Figure 29

For the initial value, set 72.54V, for limit value 73.54V, with an increment of 100mV and a time of 3.0s.

Ram	р												×
Rar	np Typ	be			Direct				🖂 Res	et Timers to E	ach increm	enting	Generation Approx. Time of Each Incr.: 3 s
Mo	odules			~	O Pulsed				🗹 Kee	p Harmonic D	uring Increr	menting	
Initi	al Valu	185				Lin	uits and li	ocreases					Reset
		la / Dofini	tion					Limit	Incr.	d/dt	N Steps	Time	
	anne	is/ Defini	lion		-		Va	73.54 V	100,0 mV	33,33 mV/s	11.00	33,00 s	
Pe	oint	Channel	Mod.	Ang.	Freq.		Vb	73.54 V	100.0 mV	33.33 mV/s	11.00	33.00 s	
Va	•	AO_V01	72,54 V	0.	60,00 Hz		Vc	73.54 V	100.0 mV	33.33 mV/s	11.00	33.00 s	
Vt		AO_V02	72,54 V	-120,0 °	60,00 Hz		la						
Vo	: /	AO_V03	72,54 V	120,0 °	60,00 Hz		lb						
la	4	AO_I01	0 A	0.	60,00 Hz		lc						
lb		AO_102	0 A	0 *	60,00 Hz		UD01						
lc	4	AO_103	0 A	0°	60,00 Hz		11002						
U	D01	AO_V04	0 V	0°	60,00 Hz		11003						
U	002	AO_104	0 A	0°	60,00 Hz		UD04						
U	003	AO_105	0 A	0°	60,00 Hz		0004						
U	D04	AO_106	0 A	0°	60,00 Hz								
Bina	ary Out	tputs				GC)OSE Ou	tputs				Attention:	The Reset Chron settings. Each the Incr., Direct or Pulsed and
	Cha	nnel	Incr.				Chan	nel In	cr.				nici times, and reset will be the same for all houes.
	BO01	1											T TT
	BO02	2											Incr. T
	BO03	3											Limit
	BO04	4										Initial va	lue
	BOOS	5											
	BOOR	6											Generation
	BOOT	7											Time Every
	BOO	3											
													OK <u>C</u> ancel

Figure 30



Set the stop interface, which in this case is "*BI01*" and start the generation by clicking on the icon highlighted below or using the shortcut "Alt + G".

8	0	D 💕	🚽 🚽 Qu	iick 2.02.190 (64 B	its) - CE-6710 (030	1018)									-	ð	×
A	۱rqui	vo H	ome D	isplay Softwa	are Options												^ 🕐
c	Dire	ec nels	Hrd Set. Sync. Set. Connectior	୍ର୍ର୍ବିତ GOOSE Set ^s ତ SV Set n	Add Reedit Test Test	De 🕅 De	On Editing	Start Stop	Settings	Waveform 🔐 Hawking Hawking Hawking Hawking Waveform Hawking H	larmonics 🚹 S valuations 🗽 S	et Ispc Offse et Vspc Offs	et et Present Report	Recreate Restore Charts Layout	View		
	_		Hardwar	e		Resu	its	Generation		Opti	ons		Report Units	Layout			
	/ P	re-fault	Fault			•×	Monitoring		• X	Inputs Bin., C	SOOSE and Analo	og 🛛 Wa	veform Accumulatio	ns Phasors Ha	monics Protection		₹×
		Fault					Angle Ref.:	Auto	~	Current x time	Voltage x time	Differentia	al Harm. Restr. Dire	ectional Frequency			
E	~	Channe	ls/ Definiti	ion Ramp	~		✓ NO01			Overvoltage	Undervoltage						
L		Point	Channel	Definitions						An V:	AO_V01	~	Edit Curve	Graph with r	espect to Pkp Temp. Ch	nart	~
L		Va	AO_V01	Modules													
L		Vb .	AO_V02	tincr 3,00 s						2.00 t [s]							
L		Vc	AO_V03														
L		la .	AO_I01														
L		Ib .	AO_102	_													
Ι,	- -	IC I	AO_103	-						1,00							
		10001		-			Timers		→ ×								
L		UD03	AO_105	-			Chronometer 1:										
L		UD04	AO_106	-			Stop Interf.	On	Wat	0							ÝМ
L							BIUT	✓ 0	5	60,	00	70,00	80,00	90,00	100,0	1	10.0
L							Chronometer 2:					Capt	ure Time by: 🗿 Chron. (1 O Chron, 02	Simulation	ABC	~
L							Stop Interf.			Dial Time:				Class			
L							Disable	←		Timed Curve:							
L										Timed Corve.				3- 40 ×1	V % Tol	.: 2,00 %	_
Ŀ	~	Analog. [OC Output				Actuation Lock	Wait betw. Tir	mers: 0 s		Pkp Expected		Drp Expected	t Expected	V Absol. Tol	.: 0,58 V	
Ŀ	~	Binary Ou	itputs				Fix Max. Genera	ion Time: :	:	Timed:	/*	6	Pø				
Ē	~	GOOSE	Outputs				[hh:mm:ss] (App	oximate)		Inst. 1:	73.04 V	6	P &	2.00 s	t % Tol	.: 2,00 %	_
Ē	~	Time and	Advanceme	ent		-	Man. Increase	Ampl. 🗌 Angle	Clean	Inst. 2:	92,96 V 🖌	6	P &	1,00 s	t Absol. Tol	.: 35,00 n	ns
							N001 ~		45,00								
	Em	or List	Protecti	on Status													
	6 7	ON Line	2	New				Au	ix. Source 110,00	V Heating:	0%						

Figure 31

To view the values being generated, click on "N01" within the "Monitoring" tab. After the actuation, click on the highlighted icon to capture the point.

 Quick 2.02.190 (64 Bits) - CE-6710 (0301018) Arquivo Home Display Software Options 	-	0 × ^ ?
Grade Channels Connection Channels Chan	nr Editing • Aete Test start Stop Start Stop Phasors • · · · · · · · · · · · · · · · · · ·	
Hardware Resu	Its Generation Options Report Units Layout	
Pre-fault Pault	Monitoring V Inputs bin, 0005c and Analog P Waveform P Accumulations P Phasons Pharmonics Protection	• *
Channels/ Definition Ramp Point Channel Definitions	Channels/ Definition Overvoltage Point Channel Mod. Ang.	~
Va AO_V01 Modules Vb AO_V02 ther 3.00 s Vc AO_U03 Ib AO_U02 UD01 AO_U04 UD02 AO_U05 UD04 AO_U06	Va AQ_V01 73,14 V 240,0° Va AQ_V02 73,14 V 240,0° Va AQ_U02 73,14 V 240,0° Va AQ_U03 73,14 V 120,0° Ia AQ_U03 73,14 V 120,0° Ia AQ_U02	YM 110.0 ABC ✓
Analog. DC Output Binary Outputs GOOSE Outputs Time and Advancement	Actuaton Lock Wait betw. Timers: 0 s Pix Max. Generation Time: ::::::::::::::::::::::::::::::::::::	1.58 V 2.00 % 35.00 ms
Error List Protection Status Image: Status Image: Status Image: Status New	Aux. Source 110.00 V Heating: 0%	

Figure 32



In this case, the pickup found was 73.14V, being within the tolerance range given by the relay manufacturer.

6.4 Element 59-1 point test

To check the operating time of element 59-1, remove the "*Ramp*" by choosing the "*Direct*" option and inject voltage values above the pick-up value. Keep the stop interface at "*BI01*". The following figure shows the value of 75.00V already captured and the value of 90.00V to be captured.



It is verified that the operating times are within the tolerance provided by the manufacturer.

6.5 Timed Element 59-2 Pick-up Test

Click on the "*Fault*" tab, choose the "*Ramp*" option and the "..." icon and enter an initial value of 92.46V, limit value of 93.46V, with an increment of 100.0mV and a time of 2.0s.





Figure 34

Change the interface to "BI02" and start the generation through the shortcut "Alt + G".





The pick-up value found for element 59-2 was 92.96V, being exactly the value set in the relay.

6.6 Element 59-2 point test

Return the "*Channels/Definition*" field to "*Direct*" to check the operating time of element 59-2. Points with voltage values above the pick-up must be tested. The following figure shows the value of 95.00V already captured and the value of 110.00V not yet captured.



It is verified that the operating times are within the tolerance provided by the relay manufacturer.

6.7 Voltage x Time > Undervoltage screen

First, click on the tab "*Protection* > *Voltage x time* > *Undervoltage*" so that the data set in the relay are configured in the software. Next to the voltage "V" chooses a node as a reference, in this case " AO_V01 ". Only after choosing the node are the fields for setting function 27 active.





Figure 37

6.8 General Adjustments 27

According to the relay software settings, these values are entered in the Quick software. The element 27-1 pick-up equal to 59.76V (0.90* V_{np}) with actuation time equal to 2.0s and element 27-2 equal to $39.84V (0.60 * V_{np})$ with actuation time equal to 1.0s.

There are also fields where the absolute and relative tolerances for both voltage and time must be entered. These values are taken from Appendix A.2. There is also a field where the type of simulation is required, being possible single-phase-ground, twophase and three-phase.





Figure 38

6.9 Timed Element 27-1 Pick-up Test

First change the stop binary to "*BI03*". For the pick-up test, a ramp is used to decrease the voltage value. To do this, choose the "*Ramp*" option on the "*Fault* > N01" tab and click on the highlighted icon.

4	Image: Second state → Quick 2.02.190 (64 Bits) - CE-6710 (0301018) Arquivo Home Display Software Options Image: Second state Signal Second state Signal Second state Signal Second state Image: Second state Signal Second state Signal Second state Signal Second state Signal Second state	On Editing	0 X ^ (?)
c	Channels () Connection Test Test	elete All Start Stop Settings + Phasors Report as rel Charts Layout -	
	Hardware Resu	ults Generation Options Report Units Layout	
4	Pre-fault Fault ×	Monitoring X / Inputs Bin., GOOSE and Analog Y Waveform Y Accumulations Y Phasors Y Harmonics / Protection	₹×
H	Fault	Angle Ref.: Auto Voltage x time Differential Harm. Hestr. Directional Frequency	
Ľ	▲ Channels/ Definition Ramp ✓	Channels / Definition Uvervoitage Undervoitage	
L	Point Channel Definitions	Point Channel Mod. Ang. An V: A0_V01 V Edit Curve Graph with respect to Pkp Temp. Chart	~
L	Va AO_V01 Modules		
L	Vc AO_V03	Ve A0_V03 200	
L	la AO_I01	la AO_I01	
L	lb AO_102		
	5 UD01 AO V04		
9	Q UD02 AO_104		
L	UD03 AO_105	Stop Interf. On Wait	VM
L	0004 A0_06	BI03 V 0s 0 40,00 50,00 60,00	70,00
L		Chronometer 2: Canture Time by: O Chron 01 O Chron 02 Simulation: 7	ABC
L		Stop Interf.	
L		Disable V Tried Curve:	
H		Annulation of Mail Annual Parameter V 4 101:12	2,00 %
F	Analog. DC Output		7,50 V
E	Binary Outputs	[ht:mm:ss] (Approximate) Inst. 1: 59,76 V P & P & 2,00 s t % Tol.: 2	2,00 %
E	GUUDE UNIPUTS	Man. Increase Ampl. Angle Clean Inst. 2: 39,84 V P & P & 1.00 s t Absol. Tol.:	35,00 ms
	Inite and Advancement	N001 V 45,00	
ſ	Error List Protection Status		
2	🖘 ON Line New	Aux. Source 110,00 V Heating: 0%	
		T ! 20	

Figure 39



Enter an initial value of 60.26V, threshold value of 59.26V, with a decrement of -100.0mV and a time of 3.0s.

Ramp												×		
Ramp	Туре			O Direct					Reset Timers to E	ach increm	enting	Generation Approx. Time of Each Incr.: 3 s		
Modul	es		\sim	O Pulsed		Keep Harmonic During Incrementing								
lotial V	(aluan				13							Parat		
	diues				─┐┍╸	mits and	Limit	s Incr.	d/dt	N Steps	Time			
Chan	neis/ Derin	tion		-		Va	59,26	V -100,0	mV -33,33 mV/	11.00	33,00 s			
Poin	Channel	Mod.	Ang.	Freq.	17	Vb	59.26	V -100.0	mV -33.33 mV/	11.00	33.00 s			
Va	AO_V01	60,26 V	0 *	60,00 Hz		Vc	59.26	V -100.0	mV -33.33 mV/	11.00	33.00 s			
Vb	AO_V02	60,26 V	-120,0 °	60,00 Hz	1	la								
Vc	AO_V03	60,26 V	120,0 °	60,00 Hz) 16] b	_							
la	AO_101	0 A	0 *	60,00 Hz			_	_						
lb	AO_102	0 A 0	0 °	60,00 Hz			1							
lc	AO_103	0 A	0 °	60,00 Hz			2							
UD01	AO_V04	0 V	0°	60,00 Hz			2	_						
UD02	AO_104	0 A	0 *	60,00 Hz			3							
UD03	AO_105	0 A 0	0 *	60,00 Hz		000	•							
UD04	AO_106	0 A	0 *	60,00 Hz										
Binary	Outputs				G	OOSE	Outputs				Attention: I	Incr times, and Reset will be the same for all nodes.		
C	hannel	Incr.				Cha	nnel	Incr.						
BC	001													
BC	002											Incr. 1		
BC	003											T Limit		
BC	004										Initial valu	ue		
BC	005											*॑ <u></u>		
B	006											Generation		
BC	007											Ime Every Incr.		
BC	800											OK Cancel		

Figure 40

NOTE: An important detail is that pre-fault voltage must be entered so that the relay performs the drop-out. For this, click on "Actuation Lock".

ا 🚯	Lì 🚰 uivo	Garage Qu Home D	iick 2.02.19 isplay	0 (64 Bits) Software	- CE-6710 (0 Options	301018)															_	ð	× ^ ?
Cha	irec innels	Hrd Set. Sync. Set. Connection Hardwar	୍ବର GOO ⁼, SV Se n e	ISE Set (Add Reed Test Test	it 🔛 Di Resu	On Edit elete Te elete A ults	ting est II	Sta	art Stop	Settings	Waveform Accumulation Phasors	Dptio	armonics 🚹 S raluations 🗽 S ns	Set Ispc Of Set Vspc C	ifset Iffset Pres Rep Rep	ent ort bs	rel Ch	reate Restor arts Layou Layou	re View t •			
I	Pre-faul	t Fault				▼ ×		Monitorin	9		• ×	Inputs B	in., G	OOSE and Anal	og /	Waveform	Accumul	lations	Phasors	Harmonics	Protection		₹×
	Pre-	fault			1,00 s			Angle Ref	: Auto		~	Current x tim	e	Voltage x time	Differe	ntial Harr	n. Restr.	Direction	al Freque	ncy			
^	Chann	els/Definiti	i on Dir	rect	~		^	Channel	s/Definiti	ion		Overvoltag	e	Undervoltage									
	Point	Channel	Mod.	Ang.	Freq.			Point (Channel	Mod. A	ng.	An 🗸	V:	AO_V01	~	Edit Curve.			Graph v	with respect to	o Pkp Temp. Ch	art	~
	Va	AO_V01	66,40 V	0*	60,00 Hz			Va /	AO_V01		-										n		
	Vb	AO_V02	66,40 V	-120,0 °	60,00 Hz			Vb A	V02		· ['	2,00	tisj					-					
	Vc	AO_V03	66,40 V	120,0 °	60,00 Hz			Vc A	AO_V03		·												
	la lb	AO_101	0.4	0.0	60,00 Hz				10_102														
	lc	AO_102	0 A	0.	60,00 Hz				AO_102			1.00											
5	UD01	AO_V04	0 V	0 °	60,00 Hz			Timers			- X	1,00											
Z	UD02	AO_104	0 A	0°	60.00 Hz		E a	hronometer	mater 1:														
	UD03	AO_105	0 A	0*	60.00 Hz		s	top Interf.		On Wa	t												VDA
	UD04	AO_106	0 A	0 °	60,00 Hz			BI03	~	/ 0 s		0			40.00		50	0.00		60.00		70	00
									_														
								hronometer.	2:						Ca	apture Time by	y: 🗿 Chro	on. 01 🔿	Chron. 02		Simulation	ABC	~
								top interr. Disable				Dial	ime:						Clear				
								Distanc	_			Timed Ci	irve:					ŕ	9 16 19		V % Tol.	2,00 %	_
~	Analog.	DC Output				-		Actuation Loc	sk Wa	ait betw. Timers	0 s			Pkp Expected		Drp Expe	cted	t E	Expected		V Absol. Tol.	0,58 V	
v	Binary (Outputs						Fix Max. Ger	eration Time:			п	ned:	1	0 1		PØ	(
T.	GOOCE Outpute [hh:m::s] (Approximate)								·]	In	st. 1:	59,76 V	P &		PØ	1 2	2,00 s		t % Tol.	2,00 %			
÷	Time an	d Advanceme	ent			-	Mar	n. Increase	Ampl.	Angle	Clean	In	st. 2:	39,84 V 🖉	0 1		PØ	1	,00 s		t Absol. Tol.	35,00 n	ns
		a ratario di locine					NO	01 ~		~ [45,00												
E	rror List	Protecti	on Status																				
47	ON Lir	ne	New							Aux. S	ource 110,00	V Heating		0%									

Figure 41



Start the generation by clicking on the "Start" icon or via the shortcut "Alt + G".

م م	P D 💣 🛃 〒 Quick 2.02.190 (64 Bits) - CE-6710 (0301018)	-	o x
Ch	Image: Sync. Set. Sync.	In Editing In Editing It is tart Stop Kin Waveform Au, Harmonics Setting: Setting: Setting: How Source at the form How Source at the form	
	Pre-fault Fault × X	Its Generation Options Report Units Layout Monitoring • X Inputs Bin. GOOSE and Analog Waveform Accumulations Phasors Protection	₹×
É	Fault	Angle Ref: Auto	
		Overvoltage Undervoltage	
N001	Point Channels/ Definition Hamp ✓ Point Channels/ Definitions ✓ Va AO_V01 Modules … Vb AO_V02 thner 3.00 s … Vc AO_V03 … … Is AO_U01 … … Vc AO_V03 … … UD01 AO_V04 … … UD02 AO_U04 … … UD03 AO_06 … …	Channels/ Definition Via AQ_V01 58.5 V 0* Via AQ_V01 59.85 V 240.0* Is AQ_U01 59.86 V 240.0* Is AQ_U01 59.86 V 240.0* Is AQ_U01	nt ~
	Analog, DC Output Bnary Outputs GODSE Outputs Time and Advancement	Chronometer 2: Capture Time by: Capture Time	ABC ∨ 2.00 % 0.58 V 2.00 % 35,00 ms
	Error List Protection Status	Aux Source 110.00 V Heating: 0%	
2		Figure 42	
		rigure 42	

In this case, the pickup found was 59.86V, being within the tolerance range given by the relay manufacturer.

6.10 Element 27-1 point test

Return the "*Channels/Definition*" field to "*Direct*" to check the operating time of element 27-1. Points with voltage values below the pick-up must be tested. The figure below shows the value of 55.00V already captured and the value of 41.00V not yet captured.

NOTE: Remember to always block the first actuation.





It is verified that the operating times are within the tolerance provided by the manufacturer.

6.11 Timed Element 27-2 Pick-up Test

Change the binary to BI04, click on the *"Fault"* tab, choose the *"Ramp"* option and the "..." icon and enter an initial value of 40.34V, limit value of 39.34V, with a decrement of -100,0mV and the time of 2.0s.





Figure 44

Check the field "Actuation Lock" and start the generation through the shortcut "Alt + G".





The pick-up found for element 27-2 was 39.94V, within the range of values given by the manufacturer.

6.12 Element 27-2 point test

The following figure shows the value of 38.00V already captured and the value of 33.00V not yet captured.



It is verified that the operating times are within the tolerance given by the manufacturer.

7. Report

At the end of the test, you can request an automatic report, just click on the icon illustrated below or use the shortcut "Ctrl + R".



When requesting the report, a screen opens where the user chooses the information that should be shown in the report.



😫 Presentation Setting	9	×
Language Inglês En-US	~	
 → ✓ All → ✓ General Da → ✓ Local of Ins → ✓ Local of Ins → ✓ Reference → ✓ Values → ✓ Values → ✓ Test Result → ✓ Notes and 0 → ✓ Explanatory → ✓ Check List ✓ Connection 	ta of Test ta of Tested Device stallation Values Settings Settings s Observations y Figures is	Cancel
-	Figure 48	
🧶 🗋 🥁 🚽 Quick 2.02.190 (64 Bits) - CE-6710 (0301018)		- 0 ×
Arquivo Print Preview		^ ()
Print Page Export to Export Setup Word Office to PDF 5%	nt	
Descr.: Under and		
Date: 25/07/2022 1 ; Software: Manua Responsible: Mich	4:28:23 I_CTC; Version: 2.02.190 el Rockembach de Carvalho	
1. Device Tested		
Ident .: 23031982; Model T42; Manuf	Type: Transformer Protection acturer: Schneider	
2. Location		
Substation: Coupr Bay: 1 Address: Visconde Cite: Thealendie	de Ouro Preto 75, Custódio Pereira State: MG	
Printing Preview Nº of Pages: 15		

Figure 49



APPENDIX A

A.1 Terminal Designations

Installation

Base unit Connection

Sepam components

- base unit (1)
- □ (A) base unit connector:
- power supply

- output relay
 CSH30, 120, 200 or ACE990 input.
 Screw-type connector shown (CCA620), or ring lug connector (CCA622)
- (B) 1/5 CT A current input connector (CCA630 or CCA634) or LPCT current input connector (CCA670)
- C communication module link connection (green)
- D remote inter-module link connection (black)
- voltage input connection, screw-type connector shown (CCA626) or ring lug connector (CCA627)
- optional input/output module (2) (MES114)
- □ ① M MES114 module connectors □ K MES114 module connector.



Figure 50



A.2 Technical data

Overvoltage

Characteristics	
Settings	
Measurement Origin	
Setting range	Main channels (VLL) / Additional channels (VLL')
Voltage Mode	
Setting range	Phase-to-phase voltage / Phase-to-neutral voltage
V _{LL} s (or V _{Ln} s) Set Point	
Setting range	50% of V _{LL} p (or V _{Ln} p) to 150% of V _{LL} p (or V _{Ln} p)
Accuracy ⁽¹⁾	±2%
Resolution	1%
Drop out/pick up ratio	97% ±1%
Time Delay T	
Setting range	50 ms to 300 s
Accuracy ⁽¹⁾	±2% or ±25 ms
Resolution	10 ms or 1 digit
Characteristic Times	
Operation time	Pick-up < 40 ms from 0.9 $V_{LL}s$ ($V_{Ln}s$) to 1.1 $V_{LL}s$ ($V_{Ln}s$) (typically 25 ms)
Overshoot time	< 40 ms from 0.9 $V_{LL}s$ ($V_{Ln}s$) to 1.1 $V_{LL}s$ ($V_{Ln}s$)
Reset time	$< 50 \text{ ms from } 1.1 \text{ V}_{LL} \text{s} (\text{V}_{Ln} \text{s}) \text{ to } 0.9 \text{ V}_{LL} \text{s} (\text{V}_{Ln} \text{s})$
	Figure 51

Undervoltage

Characteristics	
Settings	
Measurement Origin	
Setting range	Main channels (VLL) / Additional channels (VLL')
Voltage Mode	
Setting range	Phase-to-phase voltage / Phase-to-neutral voltage
Tripping Curve	
Setting range	Definite / IDMT
V _{LL} s (or V _{Ln} s) Set Point	
Setting range	5% of V _{LL} p (or V _{Ln} p) to 100% of V _{LL} p (or V _{Ln} p)
Accuracy ⁽¹⁾	±2% or ±0.005 V _{LL} p
Resolution	1%
Drop out/pick up ratio	103% ±2%
Time Delay T (Tripping Time for Zero Vo	oltage)
Setting range	50 ms to 300 s
Accuracy ⁽¹⁾	±2% or ±25 ms
Resolution	10 ms or 1 digit
Characteristic Times	
Operation time	Pick-up < 40 ms from 1.1 V _{LL} s (V _{Ln} s) to 0.9 V _{LL} s (V _{Ln} s) (typically 25 ms)
Overshoot time	< 40 ms from 1.1 V _{LL} s (V _{Ln} s) to 0.9 V _{LL} s (V _{Ln} s)
Reset time	< 50 ms from 0.9 VLLs (VLns) to 1.1 VLLs (VLns)
	Figure 52



APPENDIX B

Equivalence of software parameters and the relay under test.

Table 4											
Quick Sof	tware	SEPAM T42 Relay									
Parameter	Figure	Parameter	Figure								
	Ov	vervoltage									
Pkp_Inst.1	28	Voltage threshold	14								
Pkp_Inst.2	28	Voltage threshold	14								
t Expected	28	Delay	14								
t Expected	28	Delay	14								
	Un	dervoltage									
Pkp_Inst.1	38	Voltage threshold	13								
Pkp_Inst.2	38	Voltage threshold	13								
t Expected	38	Delay	13								
t Expected	38	Delay	13								