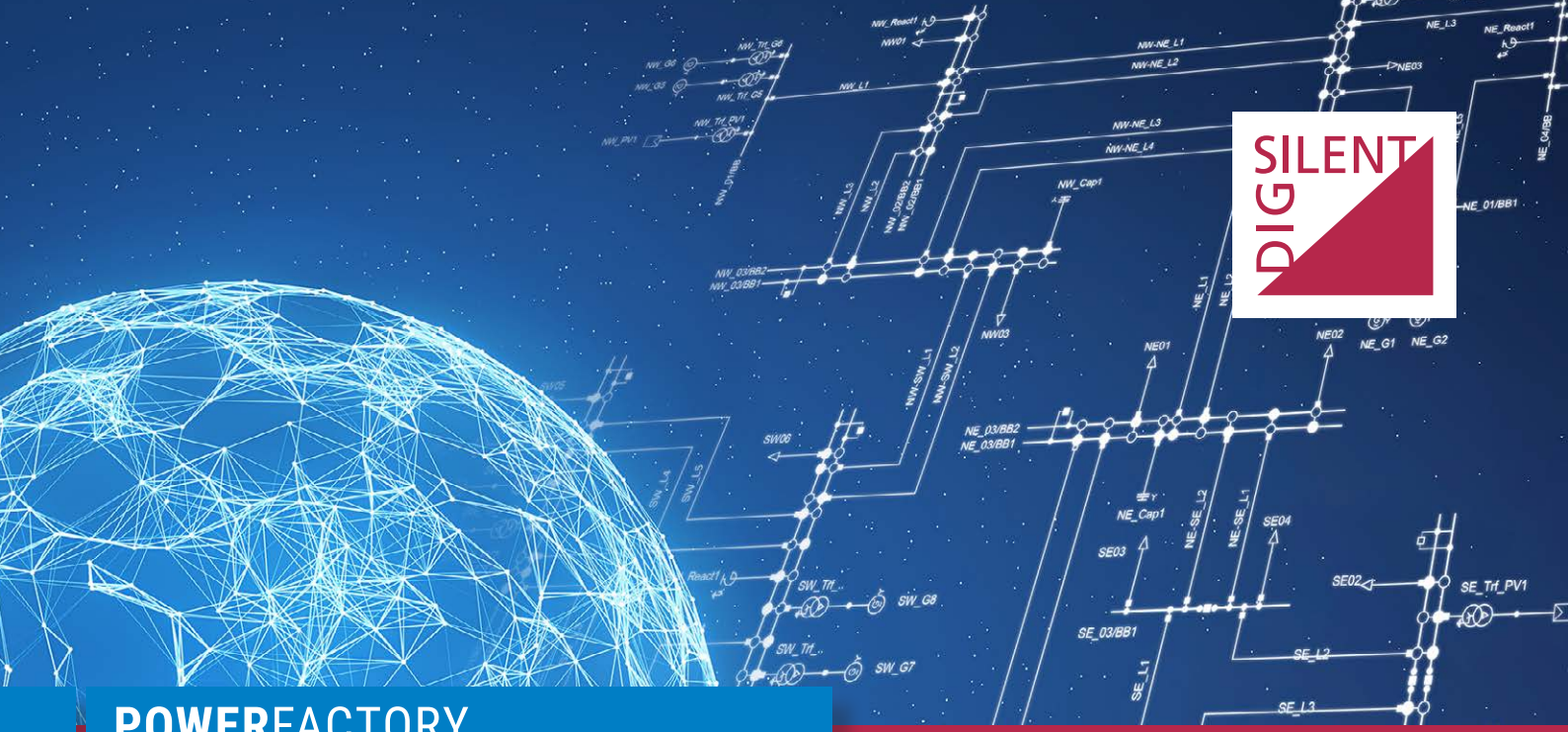

POWERFACTORY

PowerFactory 2021

Technical Reference

SEL 700G

PF2021

POWER SYSTEM SOLUTIONS

MADE IN GERMANY

Publisher:
DIgSILENT GmbH
Heinrich-Hertz-Straße 9
72810 Gomaringen / Germany
Tel.: +49 (0) 7072-9168-0
Fax: +49 (0) 7072-9168-88
info@digsilent.de

Please visit our homepage at:
https://www.digsilent.de

Copyright © 2021 DIgSILENT GmbH
All rights reserved. No part of this publication may be reproduced or distributed in any form without written permission of DIgSILENT GmbH.

November 15, 2019
PowerFactory 2021
Revision 924

Contents

1 Model information

Manufacturer SEL

Model 700G

Variants The SEL 700G PowerFactory relay models can be used to simulate the Schweitzer SEL-700G0, SEL-700G1, SEL-700GT, SEL-700GW relay. However please consider that the models have been implemented with a reduced set of the features available in the relays.

2 General description

The SEL-700G Relay is designed to provide comprehensive protection, integration and control features in a flexible, compact, and cost-effective package. The SEL-700G0 and SEL-700G1 relays provide basic to full generator protection for small to large machines. The SEL-700GT relay provides complete intertie and generator protection. The SEL-700GW relay provides dual feeder protection for a multimachine wind generator network application, including overcurrent protection to feeders, transformers, etc.

The SEL 700G PowerFactory relay models consist of a main relay and thirteen sub relays:

- Ground differential and REF
- Impedance
- Neutral Overcurrent
- Overflux
- Phase Differential
- Power
- Thermal Image V Toc and Neg seq
- X-Side Frequency
- X-Side Overcurrent
- X-Side Voltage
- Y-Side Frequency
- Y-Side Overcurrent
- Y-Side Voltage

Two model versions are available, one for each available rated currennt; the two versions are identical except for the current setting ranges. The model versions are:

- SEL 700G 1A
- SEL 700G 5A

The SEL 700G PowerFactory relay models have been implemented trying to simulate the most commonly used protective functions. The main relay model contains the measurement and acquisition units,the output logic and all other sub relays. The model implementation has been based on the information available in the relay manual [1].

3 Supported features

3.1 Measurement and acquisition

The currents are converted by two three phase current transformer (”Ct X” and ”Ct Y” block), and one single phase current transformer (”Ct In” block); the voltages are converted by three 3 phase voltage transformers (”Vt X”, ”Vt Y”, and ”Vt Open Delta” block).

Eight measurement units (”X-Side Measurement”, ”Y-Side Measurement”, ”X- Side Measurement Seq”, ”Y- Side Measurement Seq”, ”X-Side Phase-Phase Measurement”, ”Y-Side Phase-Phase Measurement”, ”Meas Neutral I”, and ”Measurement VT open Delta” block) are fed by these CTs and these VTs.

3.1.1 Available Units

- Two three phase current transformers (”Ct X” and ”Ct Y” block).
- Three three phase voltage transformers (”Vt X”, ”Vt Y”, and ”Vt Open Delta” block).
- One single phase current transformer (”Ct In” block).
- Two three phase measurement elements calculating both the current and voltage values (”X-Side Measurement”, and ”Y-Side Measurement” block).
- Two three phase measurement elements calculating phase-phase voltage values (”X-Side Phase-Phase Measurement”, and ”Y-Side Phase-Phase Measurement” block).
- Two three phase measurement elements calculating the current and the voltage sequence vectors (”X- Side Measurement Seq”, and ”Y- Side Measurement Seq” block).
- One single phase measurement element (”Meas Neutral I” block).

3.1.2 Functionality

Two separated Vt/CT and measurement sets are available in the relay model to simulate the voltage and current conversion and measurement which is performed by the relay at the X-Side and at the Y-Side of the generator windings.

The input current and voltage values are sampled at 32 samples/cycle. The average values are processed by a DFT filter, operating over a cycle, which then calculates the voltage and current values used by the protective elements.

3.1.3 Data input

Specific relay model versions are available for the 1A and the 5A secondary rated current relay versions so no user input is required for the rated current value but the right relay model version must be used. The nominal voltage values MUST be entered in any measurement block which models a voltage measurement.

3.2 Ground Differential and REF subrelay

The *Ground Differential and REF* subrelay models the restricted earth fault feature and the ground differential feature.

3.2.1 Available Units

- Two single phase time delayed differential element (”Ground Differential 1” and ”Ground Differential 2” block).
- One single phase differential element (’REF” block).
- Three differential ancillary single phase measurement elements (”Ground Differential 1 RMS Measure”, ”Ground Differential 2 RMS Measure”, and ”REF RMS Measure” block).
- One single phase directional element (”REF angle” block).
- One subrelay trip element (”Output logic” block).

3.2.2 Functionality

The *Ground Differential and REF* subrelay contains a restricted earth fault (REF)element and two ground differential elements. The elements compare the residual current calculated by the measurement block adding the phase currents with the neutral current measured buy the single phase CT. The REF element discriminates the internal fault using a directional element which compares the angle between the residual current and the neutral current.

3.2.3 Data input

The relationships between the relay settings and the model parameters can be found in the following table (the relay model parameter names are listed between brackets):

Address	Relay Setting	Model block	Model setting	Note
	GND DIFF EN (Y, N) E87N	Ground Differential 1	Out of Service (outserv)	
		Ground Differential 2	Out of Service (outserv)	
	LVL1 GND DIFF PU 87N1P	Ground Differential 1	Release Threshold (Idiff)	
	LVL1 GND DIFF DLY 87N1D	Ground Differential 1	Time Setting (Tset)	
	LVL2 GND DIFF PU 87N2P	Ground Differential 2	Release Threshold (Idiff)	
	LVL2 GND DIFF DLY 87N2D	Ground Differential 2	Time Setting (Tset)	
	REF ENABLE (Y, N) EREF	REF	Out of Service (outserv)	
	REF1 CURR LEVEL 50REF1P	REF	Release Threshold (Idiff)	
	REF1 TRQCTRL REF1TC	REF angle	Out of Service (outserv)	

3.3 Impedance subrelay

The *Impedance subrelay* subrelay simulate a set of polarizing elements, blinders and mho distance elements connected together to model the SEL 700G relay loss of field, underimpedance and out of step features.

3.3.1 Available Units

- Two under impedance elements (”Z1” and ”Z2” block).
- Two under impedance minimum current elements (”Z1 CURRENT FD”, and ”Z2 CURRENT FD” block).
- Two under impedance timers (”Z1 TIME DLY”, ”Z2 TIME DLY” block).
- Two loss of field elements (”LOSS OF FIELD Z1” and ”LOSS OF FIELD Z2” block).
- Two loss of field timers (”LOSS OF FIELD Z1 TIME DELAY” and ”LOSS OF FIELD Z2 TIME DELAY” block).
- One out of step mho detection element (”OOS mho” block).
- Six out of step blinder detection elements (”Right blinder”, ”Left blinder”, ”Outer blinder”,”Inner blinder”, ”Outer blinder-”, and ”Inner blinder-” block).
- Four timers (”OSS DELAY 1”, ”OSS DELAY 2”, ”OSS TRIP DELAY”, and ”OOS TRIP DUR” block).
- One out of step logic element (”oos logic”’ block).
- Two polarizing elements (”Polarizing distance backup” and ”Polarizing field failure/oos”block).
- One subrelay output logic element (”Output Logic” block).

3.3.2 Functionality

Underimpedance elements The *Underimpedance elements* are modeled by two PowerFactory impedance elements which simulate two mho elements with user configurable offset and minimum operation current. The elements are fed by the ”Polarizing distance backup” element which calculates the phase-ground loop operating voltages and currents used to calculate the impedance value. A separate timer is associated to each impedance element.
The impedance elements are blocked by the X-Side load encroachment element (”X-Side Overcurrent” subrelay).

Loss of field elements The *Loss of field elements* are modeled by two PowerFactory mho elements which simulate two offset mho with offset set along the negative part of the X axis in the R-X diagram. The elements are fed by the ”Polarizing field failure/oos” block which calculates the single phase operating current and voltage and the polarizing voltage used by the mho vectorial calculation. A separate timer is associated to each mho element.

Power swing detection elements The power swing detection area is modeled by one PowerFactory mho element and by six impedance blinders. Both the *Single-Blinder Scheme* and the *Double-Blinder Scheme* is supported.

The elements are fed by the ”Polarizing field failureoos” block which calculates the single phase operating current and voltage and the polarizing voltage used by the mho and the blinders vectorial calculation.

The trip signals of the mho element and of the impedance blinders are combined by the ”oos logic” element which calculates the trip signal of *zone A and C* and of *zone B*. The mho and the blinder elements are controlled by a minimum current release element. The zone trip signals are them processed by the ”OOS” element which implements the out of step logic. The output signal is on when an out of step has been detected. An user configurable trip delay and an user configurable trip reset delay are available. The *Single Blinder* and the *Double Blinder* scheme is supported. Please notice that when the *Single Blinder* scheme is used the ”Outer blinder”,”Inner blinder”, ”Outer blinder-”, and”Inner blinder-” blocks must be disabled. When the *Double Blinder* scheme is used the ”Right blinder”, and the ”Left blinder” block must be disabled.

3.3.3 Data input

The relationships between the relay settings and the model parameters can be found in the following tables (the relay model parameter names are listed between brackets):

Address	Relay Setting	Model block	Model setting	Note
	BACKUP PROT EN	Z1	Out of Service (outserv)	
		Z2	Out of Service (outserv)	
	Z1 COMP REACH	Z1	Replica Impedance (Zm)	
	Z1 COMP OFFSET	Z1	Offset Impedance (Zoff)	
	Z1 COMP TIME DLY	LOSS OF FIELD Z1 TIME DELAY	Time Setting (Tdelay)	
	Z1 CURRENT FD	Z1	Current I>> (Ip2)	
	Z1 POS-SEQ ANGLE	Z1	Relay Angle (phi)	
	Z2 COMP REACH	Z2	Replica Impedance (Zm)	
	Z2 COMP OFFSET	Z2	Offset Impedance (Zoff)	
	Z2 COMP TIME DLY	LOSS OF FIELD Z2 TIME DELAY	Time Setting (Tdelay)	
	Z2 CURRENT FD	Z2	Current I>> (Ip2)	
	Z2 POS-SEQ ANGLE	Z2	Relay Angle (phi)	
	LOSS OF FIELD EN E40	LOSS OF FIELD Z1	Out of Service (outserv)	
		LOSS OF FIELD Z2	Out of Service (outserv)	
	Z1 MHO DIAMETER 40Z1P	LOSS OF FIELD Z1	Replica Impedance (Zm)	
	Z1 OFFSET 40XD1	LOSS OF FIELD Z1	Offset Impedance (Zoff)	40XD1 = -Zoff
	Z1 TIME DELAY 40Z1D	LOSS OF FIELD Z1	Time Setting (Tdelay)	
	Z2 MHO DIAMETER 40Z2P	LOSS OF FIELD Z2	Replica Impedance (Zm)	
	Z2 OFFSET 40XD2	LOSS OF FIELD Z2	Offset Impedance (Zoff)	40XD2 = -Zoff
	Z2 TIME DELAY 40Z2D	LOSS OF FIELD Z2	Time Setting (Tdelay)	
	Z2 DIR ANGLE	LOSS OF FIELD Z2 DIR ANGLE	Directional Angle (phi)	
	OUT-OF-STEP PROT E78	OOS mho	Out of Service (outserv)	Activation of some blinders if *1B* or *2B*

Address	Relay Setting	Model block	Model setting	Note
		Left Blinder	Out of Service (outserv)	
		Right Blinder	Out of Service (outserv)	
		Inner Blinder	Out of Service (outserv)	
		Outer Blinder	Out of Service (outserv)	
		Inner Blinder-	Out of Service (outserv)	
		Outer Blinder-	Out of Service (outserv)	
	FORWARD REACH 78FWD	OOS mho	Replica Impedance (Zm)	
	REVERSE REACH 78REV	OOS mho	Offset Impedance (Zoff)	
	RIGHT BLINDER 78R1	Right blinder	Resistance (R)	
	LEFT BLINDER 78R2	Left blinder	Resistance (R)	
	OUTER BLINDER 78R1	Outer Blinder	Resistance (R)	
		Outer Blinder-	Resistance (R)	
	INNER BLINDER 78R2	Inner Blinder	Resistance (R)	
		Inner Blinder-	Resistance (R)	
	OOS DELAY 78D	OSS DELAY 1	Time Setting (Tdelay)	
		OSS DELAY 2	Time Setting (Tdelay)	
	OOS TRIP DELAY 78TD	OSS TRIP DELAY	Time Setting (Tdelay)	
	OOS TRIP DUR 78TDURD	OOS TRIP DUR	Time Setting (Tdelay)	
	POS-SEQ CURRENT 50ABC			

3.4 Neutral Overcurrent subrelay

The *Neutral Overcurrent* sub relay model simulates the inverse time and definite time neutral overcurrent elements fed by the current measured in the neutral connection at the generator X-side.

3.4.1 Available Units

- One single phase (neutral) directional inverse time overcurrent element (”Neut Toc” block).
- Two single phase (neutral) directional definite time overcurrent elements (”Neut Ioc1”, and ”Neut Ioc2” block).
- One output logic element (”Output Logic” block).

3.4.2 Functionality

The *Neutral Overcurrent* sub relay simulates the complete set of neutral overcurrent elements available in the SEL 700G relay. The neutral current is converted by the ”Ct In” Ct and measured by the ”Meas Neutral I” measurement block.

The inverse time element supports the following inverse time and definite time trip characteristics (each characteristic is also associate to an inverse time reset characteristic):

- C1 - IEC Class A (Standard Inverse)
- C2 - IEC Class B (Very Inverse)
- C3 - IEC Class C (Extremely Inverse)
- C4 - IEC Long Time Inverse
- C5 - IEC Short Time Inverse
- U1 - U.S. Moderately Inverse
- U2 - U.S. Inverse
- U3 - U.S. Very Inverse
- U4 - U.S. Extremly Inverse
- U5 - U.S. Short Time Inverse

The delayed reset characteristic can be enabled or disabled by the user for each inverse time overcurrent element. The inverse time element trip characteristic equations comply with the IEC 60255-3 and the ANSI standards.

3.4.3 Data input

The relationships between the relay settings and the model parameters can be found in the following table (the relay model parameter names are listed between brackets):

Address	Relay Setting	Model block	Model setting	Note
	NEUT IOC LEVEL 50N1P	Res Ioc1	Pickup Current (Ipsetr)	
			Out of Service (outserv)	outserv=1 when 50N1P = OFF
	NEUT IOC DELAY 50N1D	Res Ioc1	Time Setting (Tset)	
	NEUT IOC TRQCTRL 50N1TC	Res Ioc1	Tripping Direction (idir)	
	NEUT IOC LEVEL 50N2P	Res Ioc2	Pickup Current (Ipsetr)	
			Out of Service (outserv)	outserv=1 when 50N2P = OFF
	NEUT IOC DELAY 50N2D	Res Ioc2	Time Setting (Tset)	
	NEUT IOC TRQCTRL 50N2TC	Res Ioc2	Tripping Direction (idir)	
	NEUT TOC LEVEL 51NP	Res Toc	Current Setting (Ipsetr)	
			Out of Service (outserv)	outserv=1 when 51NP = OFF
	NEUT TOC CURVE 51NC	Res Toc	Characteristic (pcharac)	
	RNEUTES TOC TDIAL 51NTD	Res Toc	Time Dial (Tpset)	
	EM RESET DELAY 51NRS	Res Toc	Reset Characteristic (resetdis)	
	CONST TIME ADDER 51NCT	Res Toc	Time Adder (Tadder)	
	MIN RESPONSE TIM 51NMR	Res Toc	Min. Response Time (minresptime)	
	NEUT TOC TRQCTRL 51NTC	Res Toc	Tripping Direction (idir)	

3.5 Overflux subrelay

The *Overflux* subrelay simulates the overfluxing protective elements.

3.5.1 Available Units

- One inverse time over flux elements (”LVL2 INV” block).
- Three definite time over flux elements (”LVL1”, ”LVL2 DT1”, and ”LVL2 DT2” block).
- One frequency calculation element (”Meas Freq” block).
- One flux calculation element (”V/Hz calculator” block).
- One max voltage selector element (”Max U” block).
- One sub relay output logic element (”Output Logic” block).

3.5.2 Functionality

The frequency is calculated by the ”Meas Freq”block which uses by default the phase A-phase B voltage for its calculation (the parameter is user configurable). The calculated frequency value is then used by the ”V/Hz calculator” block to calculate the flux value.
The flux is calculated using the highest voltage value.

An user configurable characteristic is available and can be used in the ”LVL2 INV” block.

3.5.3 Data input

The relationships between the relay settings and the model parameters can be found in the following table (the relay model parameter names are listed between brackets):

Address	Relay Setting	Model block	Model setting	Note
	ENABLE V/HZ PROT E24	LVL1	Out of Service (outserv)	
		LVL2 INV	Out of Service (outserv)	
		LVL2 DT1	Out of Service (outserv)	
		LVL2 DT2	Out of Service (outserv)	
	LVL1 V/HZ PICKUP 24D1P	LVL1	Input Setting (Ipset)	
	LVL1 TIME DLY 24D1D	LVL1	Time Dial (Tpset)	
	LVL2 INV-TM PU 24IP	LVL2 INV	Input Setting (Ipset)	
	LVL2 INV-TM CURV 24IC	LVL2 INV	Characteristic (pcharac)	
	LVL2 INV-TM FCTR 24ITD	LVL2 INV	Time Dial (Tpset)	
	LVL2 PICKUP 1 24D2P1	LVL2 DT1	Input Setting (Ipset)	
	LVL2 TIME DLY 1 24D2D1	LVL2 DT1	Time Dial (Tpset)	
	LVL2 PICKUP 2	LVL2 DT2	Input Setting (Ipset)	
	LVL2 TIME DLY 2	LVL2 DT2	Time Dial (Tpset)	
	LVL2 RESET TIME 24CR	LVL2 INV	Reset Delay (ResetT)	
		LVL2 DT1	Reset Delay (ResetT)	
		LVL2 DT2	Reset Delay (ResetT)	

The LVL2 element s must be enabled or disabled accordingly with the LVL2 CURVE SHAPE 24CCS value. When LVL2 CURVE SHAPE 24CCS is equal to ’U’ disable the ” LVL2 DT1 ” block

and the ” LVL2 DT2” block and select the *24IC U* characteristic in the ”LVL2 INV” block. When LVL2 CURVE SHAPE 24CCS is equal to ’DD’ disable the ”LVL2 INV” block and enable the ”LVL2 DT1” block and the ” LVL2 DT2” block. When LVL2 CURVE SHAPE 24CCS is equal to ’ID’ disable the ”LVL2 DT2” block and enable the ”LVL2 INV” block and the ” LVL2 DT1” block. When LVL2 CURVE SHAPE 24CCS is equal to ’I’ disable the ”LVL2 DT1” block and the ”LVL2 DT2” block and enable the ”LVL2 INV” block .

3.6 Thermal Image V Toc and Neg seq subrelay

The *Thermal Image V Toc and Neg seq* sub relay model simulates the thermal image protective function, the voltage control/voltage restrained inverse time overcurrent element and the negative sequence overcurrent elements.

3.6.1 Available Units

- Two thermal image overcurrent elements (”Thermal image 1” , and ”Thermal image 2” block).
- One negative sequence inverse time overcurrent element (”Current Unbalance Level 2” block).
- One negative sequence definite time overcurrent element (”Current Unbalance Level 1” block).
- One 3 phase inverse time overcurrent element with voltage restrained feature(”Volt-Restrained TOC”, and ”V restraint” block).
- One 3 phase inverse time overcurrent element with voltage control feature(”Volt-Control TOC”, and ”V control” block).
- One output logic element (”Output Logic” block).

3.6.2 Functionality

The *Thermal Image V Toc and Neg* sub relay simulates the thermal image feature using two block: one for each thermal image constant.

The inverse time element supports the following inverse time and definite time trip characteristics (each characteristic is also associate to an inverse time reset characteristic):

- C1 - IEC Class A (Standard Inverse)
- C2 - IEC Class B (Very Inverse)
- C3 - IEC Class C (Extremely Inverse)
- C4 - IEC Long Time Inverse
- C5 - IEC Short Time Inverse
- U1 - U.S. Moderately Inverse
- U2 - U.S. Inverse
- U3 - U.S. Very Inverse
- U4 - U.S. Extremly Inverse
- U5 - U.S. Short Time Inverse

The delayed reset characteristic can be enabled or disabled by the user for each inverse time overcurrent element. The inverse time element trip characteristic equations comply with the IEC 60255-3 and the ANSI standards.

3.6.3 Data input

The relationships between the relay settings and the model parameters can be found in the following table (the relay model parameter names are listed between brackets):

Address	Relay Setting	Model block	Model setting	Note
	THERM OVERLD EN E49T	Thermal image 1	Out of Service (outserv)	
		Thermal image 2	Out of Service (outserv)	
	THERM OL TRIP PU 49TTP	Thermal image 1	Current Setting (Ipsetr)	
	TIME CONSTANT1 GTC1	Thermal image 1	Time Dial (Tpset)	
	TIME CONSTANT2 GTC2	Thermal image 2	Time Dial (Tpset)	
	NEG-SEQ OC ENBL E46	Current Unbalance Level 1	Out of Service (outserv)	
		Current Unbalance Level 2	Out of Service (outserv)	
	LVL1 NEQ-SEQ O/C 46Q1P	Current Unbalance Level 1	Pickup Current (Ipsetr)	
			Out of Service (outserv)	Set outserv=1 when 46Q1P = OFF
	LVL1 TIME DELAY 46Q1D	Current Unbalance Level 1	Time Setting (Tset)	
	LVL2 NEQ-SEQ O/C 46Q2P	Current Unbalance Level 2	Current Setting (Ipsetr)	
			Out of Service (outserv)	Set outserv=1 when 46Q2P = OFF
	LVL2 TIME DIAL 46Q2K	Current Unbalance Level 2	Time Dial (Tpset)	
	46Q TRQCTRL 46QTC	Current Unbalance Level 1	Tripping Direction (idir)	
		Current Unbalance Level 2	Tripping Direction (idir)	
	V-CTRL TOC LVL 51CP	Volt-Control TOC	Current Setting (Ipsetr)	
			Out of Service (outserv)	Set outserv=1 when 51CP = OFF
	V-CTRL TOC CURVE 51CC	Volt-Control TOC	Characteristic (pcharac)	
	V-CTRL TOC TDIAL 51CTD	Volt-Control TOC	Time Dial (Tpset)	
	V-CTR TOC EM RST 51CRS	Volt-Control TOC	Reset Characteristic (resetdis)	
	51C TOC TRQCTRL 51CTC	Volt-Control TOC	Tripping direction (idir)	
	V-RESTR TOC LVL 51VP	Volt-Restrained TOC	Current Setting (Ipsetr)	
			Out of Service (outserv)	Set outserv=1 when 51VP = OFF
	V-RESTR TOC CURV 51VC	Volt-Restrained TOC	Characteristic (pcharac)	
	V-RESTR TOC TDIAL 51VTD	Volt-Restrained TOC	Time Dial (Tpset)	
	V-RES TOC EM RST 51VRS	Volt-Restrained TOC	Reset Characteristic (resetdis)	
	51V TOC TRQCTRL 51VTC	Volt-Restrained TOC	Tripping direction (idir)	

3.7 Phase Differential subrelay

The *Phase Differential* subrelay contains one 3 phase differential with double slope current restrained threshold, 2^{nd} unrestrained differential threshold and 2^{nd}, 4^{th} and 5^{th} harmonic blocking. The Ct ratios, voltage levels and winding connections can be compensated using two *Ct adapter* elements. The 2^{nd}, and the 4^{th} harmonic blocking have a phase interblocking feature (Common blocking prevents all restrained elements (87Rn) from tripping if any blocking element is picked up). An independent blocking is used for the fifth harmonic current.
For harmonic restraint, the values of the second- and fourth-harmonic currents are summed, and that value is used in the relay characteristic.

3.7.1 Available Units

- One 3 phase differential element (”Generator Differential” block).
- One differential ancillary 3 phase measurement element (”Diff RMS Measure” block).
- Three harmonic measurement elements (”Diff 2nd Harmonic Measure”, ”Diff 4th Harmonic Measure”, and ”Diff 5th Harmonic Measure” block).
- Two ct adaption elements (”Adapter 1”, and ”Adapter 2” block).
- One subrelay output logic element (”Output Logic” block).

3.7.2 Functionality

The *Differential* subrelay implements a segregated 3 phase differential element with double slope bias restraint characteristic, with 2^{nd}, 4^{th} and 5^{th} harmonic blocking and restraint. An additional unrestrained differential threshold is also available.

3.7.3 Data input

The relationships between the relay settings and the model parameters can be found in the following table (the relay model parameter names are listed between brackets):

Address	Relay Setting	Model block	Model setting	Note
	PHASE DIFF EN E87	Differential	Out of Service (outserv)	outserv=1 when NONE
	MAX XFMR CAP MVA	Differential	Max Rated Power (maxpower)	
	X PH CT RATIO CTRX	Adapter 1	Current Transformer Ratio (CTratio)	
	X SIDE PT CONN DELTAY_X	Adapter 1	Current Transformer Connection(icontype)	
	WDG-X L-L VOLTS VWDGX	Adapter 1	Nominal Terminal Line-Line Voltage (LLVolt)	
	Y PH CT RATIO CTRY	Adapter 2	Current Transformer Ratio (CTratio)	
	Y SIDE PT CONN DELTAY_Y	Adapter 2	Current Transformer Connection(icontype)	
	WDG-Y L-L VOLTS VWDGY	Adapter 2	Nominal Terminal Line-Line Voltage (LLVolt)	
	Y SIDE CT COMP CTCY	Adapter 2	Transformer Group (trasfgroup)	
	X SIDE CURR TAP TAPX	Differential	Tap 1 (tap1)	In the *Tap* tab page
	Y SIDE CURR TAP TAPY	Differential	Tap 2 (tap2)	In the *Tap* tab page
	OPERATE CURR LVL O87P	Differential	Release Threshold (Idiffr2)	

Address	Relay Setting	Model block	Model setting	Note
	UNRES CURR LVL U87P	Differential	Unrestrained Differential Threshold (Idiffunrestr2)	
	RESTRAINT SLOPE1 SLP1	Differential	Restraint 1st Slope (Irestrpercent1)	
	RESTRAINT SLOPE2 SLP2	Differential	Restraint 2nd Slope (Irestrpercent2)	
	RES SLOPE1 LIMIT IRS1	Differential	Restraint 2nd Slope Threshold	
	2ND HARM BLOCK PCT2	Differential	2nd Harmonic Blocking Threshold (H2threshold)	In the *Harmonic Blocking* tab page
	4TH HARM BLOCK PCT4	Differential	4th Harmonic Blocking Threshold (H4threshold)	In the *Harmonic Blocking* tab page
	5TH HARM BLOCK PCT5	Differential	5th Harmonic Blocking Threshold (H5threshold)	In the *Harmonic Blocking* tab page
	HARMONIC BLOCK HBLK	Differential	Disable Harmonic blocking (harmblockdisable)	In the *Harmonic Blocking* tab page
	HARMONIC RESTRNT HRSTR	C calculator	HARMONIC_RESTRNT	In the *Logic* tab page

3.8 Power subrelay

The *Power* subrelay simulates the complete set of forward/reverse active overpower, and forward/reverse active underpower, forward/reverse reactive overpower, and forward/reverse reactive underpower elements which are available in the relay.

3.8.1 Available Units

- Four forward active over power definite time elements (”PWR ELEM P FWD 1”, ”PWR ELEM P FWD 2”, ”PWR ELEM P FWD 3”, and ”PWR ELEM P FWD 4” block).
- Four reverse active over power definite time elements (”PWR ELEM P REV 1”, ”PWR ELEM P REV 2”, ”PWR ELEM P REV 3” and ”PWR ELEM P REV 4” block).
- Four forward reactive over power definite time elements (”PWR ELEM Q FWD 1”, ”PWR ELEM Q FWD 2”, ”PWR ELEM Q FWD 3”, and ”PWR ELEM Q FWD 4” block).
- Four reverse reactive over power definite time elements (”PWR ELEM Q REV 1”, ”PWR ELEM Q REV 2”, ”PWR ELEM Q REV 3” and ”PWR ELEM Q REV 4” block).
- One output logic element (”Output Logic” block).

3.8.2 Functionality

Four stages of 3 phase power protection are present in the relay, these can be independently selected as either reverse or forward, active or reactive power, over power or under power protective elements.

In the relay model for each power protective element 4 blocks have been implemented: an active forward over power element, a reactive forward over power element, an active reverse over power element, and a reactive reverse over power element. The overpower/underpower logic can be simulated in the ”Output Logic” block: in the ”Logic” tab page any output logic can be inserted; to simulate an under power element simply negate the output value of the relevant overpower element.

The forward active power and the reverse active power are calculated by the ”PQ calc” block which processes the 3 phase active and reactive power values calculated by the ”Power Calculator’ block.

3.8.3 Data input

The relationships between the relay settings and the model parameters can be found in the following table (the relay model parameter names are listed between brackets):

Address	Relay Setting	Model block	Model setting	Note
	ENABLE PWR ELEM EPWRX	PWR ELEM j[1]1	Out of Service (outserv)	
		PWR ELEM j[1]2	Out of Service (outserv)	
		PWR ELEM j[1]3	Out of Service (outserv)	
		PWR ELEM j[1]4	Out of Service (outserv)	
	3PH PWR ELEM PU 3PWRX1P	PWR ELEM j[1]1	Input Setting (Ipsetr)	

[1] j = P FWD, P REV, Q FWD, Q REV

Address	Relay Setting	Model block	Model setting	Note
	PWR ELEM TYPE PWRX1T	PWR ELEM j[1]1	Out of Service (outserv)	Enable PWR ELEM P FWD 1 when PWRX1T = WATTS, PWR ELEM P REV 1 when PWRX1T = -WATTS, PWR ELEM Q FWD 1 when PWRX1T = VARS, PWR ELEM Q REV 1 when PWRX1T = -VARS
	PWR ELEM DELAY PWRX1D	PWR ELEM j[1]1	Time Dial (Tpset)	
	3PH PWR ELEM PU 3PWRX2P	PWR ELEM j[1]2	Input Setting (Ipsetr)	
	PWR ELEM TYPE PWRX2T	PWR ELEM j[1]2	Out of Service (outserv)	Enable PWR ELEM P FWD 2 when PWRX1T = WATTS, PWR ELEM P REV 2 when PWRX1T = -WATTS, PWR ELEM Q FWD 2 when PWRX1T = VARS, PWR ELEM Q REV 2 when PWRX1T = -VARS
	PWR ELEM DELAY PWRX2D	PWR ELEM j[1]2	Time Dial (Tpset)	
	3PH PWR ELEM PU 3PWRX3P	PWR ELEM j[1]3	Input Setting (Ipsetr)	
	PWR ELEM TYPE PWRX3T	PWR ELEM j[1]3	Out of Service (outserv)	Enable PWR ELEM P FWD 3 when PWRX1T = WATTS, PWR ELEM P REV 3 when PWRX1T = -WATTS, PWR ELEM Q FWD 3 when PWRX1T = VARS, PWR ELEM Q REV 3 when PWRX1T = -VARS
	PWR ELEM DELAY PWRX3D	PWR ELEM j[1]3	Time Dial (Tpset)	
	3PH PWR ELEM PU 3PWRX4P	PWR ELEM j[1]4	Input Setting (Ipsetr)	
	PWR ELEM TYPE PWRX4T	PWR ELEM j[1]4	Out of Service (outserv)	Enable PWR ELEM P FWD 4 when PWRX1T = WATTS, PWR ELEM P REV 4 when PWRX1T = -WATTS, PWR ELEM Q FWD 4 when PWRX1T = VARS, PWR ELEM Q REV 4 when PWRX1T = -VARS
	PWR ELEM DELAY PWRX4D	PWR ELEM j[1]4	Time Dial (Tpset)	

3.9 X-Side Frequency subrelay

The *X-Side Frequency* subrelay simulates the set of overfrequency , underfrequency, and rate of change of frequency protective elements which monitor the frequency measured at the generator X winding side.

3.9.1 Available Units

- Six definite time over/under frequency elements (”FREQ TRIP1”, ”FREQ TRIP2”, ”FREQ TRIP3”, ”FREQ TRIP4”, ”FREQ TRIP5” and ”FREQ TRIP6” block).
- Four definite time rate of change of frequency elements (”FREQX ROC1”, ”FREQX ROC2”, ”FREQX ROC3”, and ”FREQX ROC4” block).
- One frequency calculation element (”Meas Freq” block).
- One output logic element (”Output Logic” block).

3.9.2 Functionality

The frequency is calculated by the ”Meas Freq”block which uses by default the phase A-phase B voltage for its calculation (the parameter is user configurable). The calculated frequency value is then used by the overfrequency/underfrequency elements and by the rate of change of frequency elements.
The each frequency element operates as over frequency elements when the frequency threshold is greater than the system rated frequency, as under frequency element when the frequency threshold is smaller than the system rated frequency.

3.9.3 Data input

The relationships between the relay settings and the model parameters can be found in the following table (the relay model parameter names are listed between brackets):

Address	Relay Setting	Model block	Model setting	Note
	ENABLE 81X	FREQ TRIP y[2]	Out of Service (outserv)	
	FREQX TRIPy[2]L	FREQ TRIP y[2]	Frequency (Fset)	
	FREQX TRIPy[2]Y	FREQ TRIP y[2]	Time Delay (Tdel)	
	ENABLE 81RX E81RX	FREQX ROC x[3]	Out of Service (outserv)	
	FREQX ROC LEVEL 81RXx[3]	FREQX ROC x[3]	Gradient df/dt (dFset)	
	FREQX ROC PU DLY 81RXx[3]	FREQX ROC x[3]	Time Delay (Tdel)	

[2] y = 1,2,3,4,5,6
[3] x = 1,2,3,4

3.10 X-Side Overcurrent subrelay

The *X-Side Overcurrent* sub relay model simulates the phase, residual, and negative sequence overcurrent elements which protect the ”X” winding side of the generator.

3.10.1 Available Units

- One 3phase directional inverse time overcurrent element (”Phase Toc” block).
- Three 3phase directional definite time overcurrent elements (”Phase Ioc1”, ”Phase Ioc2”, and ”Phase Ioc3” block).
- One residual directional inverse time overcurrent element (”Res Toc” block).
- Two residual directional definite time overcurrent elements (”Res Ioc1”, and ”Res Ioc2” block).
- One residual directional inverse time overcurrent element (”Res Toc” block).
- Two residual directional definite time overcurrent elements (”Res Ioc1”, and ”Res Ioc2” block).
- One negative sequence directional inverse time overcurrent element (”Nseq Toc” block).
- Two negative sequence directional definite time overcurrent elements (”Nseq Ioc1”, and ”Nseq Ioc2” block).
- One directional element (”Sel Dir” block).
- One 3 phase load encroachment block (”Load encroachment” block).
- One 3 phase polarizing block (”Polarizing” block).
- One output logic element (”Output Logic” block).

3.10.2 Functionality

The *X-Side Overcurrent* sub relay simulate the complete set of 3phase , residual current and negative sequence current available in the SEL 700G relay. Any element can be set as forward or reverse directional or as non directional. Each overcurrent element can be separately set to be blocked or not by the load encroachment feature.

The inverse time elements support the following inverse time and definite time trip characteristics (each characteristic is also associate to an inverse time reset characteristic):

- C1 - IEC Class A (Standard Inverse)
- C2 - IEC Class B (Very Inverse)
- C3 - IEC Class C (Extremely Inverse)
- C4 - IEC Long Time Inverse
- C5 - IEC Short Time Inverse
- U1 - U.S. Moderately Inverse
- U2 - U.S. Inverse

- U3 - U.S. Very Inverse
- U4 - U.S. Extremly Inverse
- U5 - U.S. Short Time Inverse

The delayed reset characteristic can be enabled or disabled by the user for each inverse time overcurrent element. The inverse time element trip characteristic equations comply with the IEC 60255-3 and the ANSI standards.

3.10.3 Data input

The relationships between the relay settings and the model parameters can be found in the following table (the relay model parameter names are listed between brackets):

Address	Relay Setting	Model block	Model setting	Note
	PHASE IOC LEVEL 50PX1P	Phase Ioc1	Pickup Current (Ipsetr)	
			Out of Service (outserv)	outserv=1 when 50PX1P = OFF
	PHASE IOC DELAY 50PX1D	Phase Ioc1	Time Setting (Tset)	
	PH IOC TRQCTRL 50PX1TC	Phase Ioc1	Tripping Direction (idir)	
	PHASE IOC LEVEL 50PX2P	Phase Ioc2	Pickup Current (Ipsetr)	
			Out of Service (outserv)	outserv=1 when 50PX2P = OFF
	PHASE IOC DELAY 50PX2D	Phase Ioc2	Time Setting (Tset)	
	PH IOC TRQCTRL 50PX2TC	Phase Ioc2	Tripping Direction (idir)	
	PHASE IOC LEVEL 50PX3P	Phase Ioc3	Pickup Current (Ipsetr)	
			Out of Service (outserv)	outserv=1 when 50PX3P = OFF
	PHASE IOC DELAY 50PX3D	Phase Ioc3	Time Setting (Tset)	
	PH IOC TRQCTRL 50PX3TC	Phase Ioc3	Tripping Direction (idir)	
	RES IOC LEVEL 50GX1P	Res Ioc1	Pickup Current (Ipsetr)	
			Out of Service (outserv)	outserv=1 when 50GX1P = OFF
	RES IOC DELAY 50GX1D	Res Ioc1	Time Setting (Tset)	
	RES IOC TRQCTRL 50GX1TC	Res Ioc1	Tripping Direction (idir)	
	RES IOC LEVEL 50GX2P	Res Ioc2	Pickup Current (Ipsetr)	
			Out of Service (outserv)	outserv=1 when 50GX2P = OFF
	RES IOC DELAY 50GX2D	Res Ioc2	Time Setting (Tset)	
	RES IOC TRQCTRL 50GX2TC	Res Ioc2	Tripping Direction (idir)	
	NSEQ IOC LEVEL 50QX1P	Nseq Ioc1	Pickup Current (Ipsetr)	
			Out of Service (outserv)	outserv=1 when 50QX1P = OFF
	NSEQ IOC DELAY 50QX1D	Nseq Ioc1	Time Setting (Tset)	
	NSEQ IOC TRQCTRL 50QX1TC	Nseq Ioc1	Tripping Direction (idir)	

Address	Relay Setting	Model block	Model setting	Note
	NSEQ IOC LEVEL 50QX2P	Nseq Ioc2	Pickup Current (Ipsetr)	
			Out of Service (outserv)	outserv=1 when 50QX2P = OFF
	NSEQ IOC DELAY 50QX2D	Nseq Ioc2	Time Setting (Tset)	
	NSEQ IOC TRQCTRL 50QX2TC	Nseq Ioc2	Tripping Direction (idir)	
	PHASE TOC LEVEL 51PXP	Phase Toc	Current Setting (Ipsetr)	
			Out of Service (outserv)	outserv=1 when 51PX1P = OFF
	PHASE TOC CURVE 51PXC	Phase Toc	Characteristic (pcharac)	
	PHASE TOC TDIAL 51PXTD	Phase Toc	Time Dial (Tpset)	
	EM RESET DELAY 51PXRS	Phase Toc	Reset Characteristic (resetdis)	
	CONST TIME ADDER 51PXCT	Phase Toc	Time Adder (Tadder)	
	MIN RESPONSE TIM 51PXMR	Phase Toc	Min. Response Time (minresptime)	
	PH TOC TRQCTRL 51PXTC	Phase Toc	Tripping Direction (idir)	
	RES TOC LEVEL 51GXP	Res Toc	Current Setting (Ipsetr)	
			Out of Service (outserv)	outserv=1 when 51GX1P = OFF
	RES TOC CURVE 51GXC	Res Toc	Characteristic (pcharac)	
	RES TOC TDIAL 51GXTD	Res Toc	Time Dial (Tpset)	
	EM RESET DELAY 51GXRS	Res Toc	Reset Characteristic (resetdis)	
	CONST TIME ADDER 51GXCT	Res Toc	Time Adder (Tadder)	
	MIN RESPONSE TIM 51GXMR	Res Toc	Min. Response Time (minresptime)	
	RES TOC TRQCTRL 51GXTC	Res Toc	Tripping Direction (idir)	
	NSEQ TOC LEVEL 51QXP	Nseq Toc	Current Setting (Ipsetr)	
			Out of Service (outserv)	outserv=1 when 51QX1P = OFF
	NSEQ TOC CURVE 51QXC	Nseq Toc	Characteristic (pcharac)	
	NSEQ TOC TDIAL 51QXTD	Nseq Toc	Time Dial (Tpset)	
	EM RESET DELAY 51QXRS	Nseq Toc	Reset Characteristic (resetdis)	
	CONST TIME ADDER 51QXCT	Nseq Toc	Time Adder (Tadder)	
	MIN RESPONSE TIM 51QXMR	Nseq Toc	Min. Response Time (minresptime)	
	NSEQ TOC TRQCTRL 51QXTC	Nseq Toc	Tripping Direction (idir)	
	LOAD ENCROACH EN	Load encroachment	Out of Service (outserv)	
	FWD LD IMPEDANCE ZLFX	Load encroachment	ZLF (ZLF)	
	POS-FWD LD ANGLE PLAFX	Load encroachment	PLAF (PLAF)	
	NEG-FWD LD ANGLE NLAFX	Load encroachment	NLAF (NLAF)	

Address	Relay Setting	Model block	Model setting	Note
	POS SQ LN Z MAG Z1MAGX	Sel Dir	Positive Sequence Line Impedance Magnitude Z1MAG (Zm)	In the ”Negative sequence” tab page
	POS SQ LN Z ANG Z1ANGX	Sel Dir	Positive sequence line impedance angle Z1ANG (phi)	In the ”Negative sequence” tab page
	ZERO SQ LN Z MAG Z0MAGX	Sel Dir	Zero sequence line impedance magnitude Z0MAG (Z0)	In the ”Ground” tab page
	ZERO SQ LN Z ANG Z0ANGX	Sel Dir	Zero sequence line impedance angle Z0ANG (phi0)	In the ”Ground” tab page
	DIR CONTROL LVL1 DIR1X	Sel Dir	Level 1 direction (DIR1)	In the ”Basic settings" tab page
	DIR CONTROL LVL2 DIR2X	Sel Dir	Level 2 direction (DIR2)	In the ”Basic settings" tab page
	GND DIR PRIORITY ORDERX	Sel Dir	Ground directional element priority(ORDER)	In the ”Basic settings” tab page
	PH DIR 3PH LVL 50PDIRPX	Sel Dir	Phase directional element 3-phase pickup 50P32P (s50P32P)	In the ”Phase” tab page
	FWD DIR Z2 LVL Z2FX	Sel Dir	Forward directional Z2 threshold Z2F	In the ”Negative sequence” tab page
	REV DIR Z2 LVL Z2RX	Sel Dir	Reverse directional Z2 threshold Z2R	In the ”Negative sequence” tab page
	FWD DIR NSEQ LVL 50QFPX	Sel Dir	Forward directional current threshold (s50QF)	In the ”Negative sequence” tab page
	REV DIR NSEQ LVL 50QRPX	Sel Dir	Reverse directional current threshold (s50QR)	In the ”Negative sequence” tab page
	I1 RST FAC I2/I1 a2X	Sel Dir	Positive sequence current restraint factor a2=I2/I1	In the ”Negative sequence” tab page
	I0 RST FAC I2/I0 k2X	Sel Dir	Zero sequence current restraint factor k2=I2/I0	In the ”Negative sequence” tab page
	FWD DIR RES LVL 50GFPX	Sel Dir	Forward directional residual ground pickup 50GFP (s50GFP)	In the ”Ground” tab page
	REV DIR RES LVL 50GRPX	Sel Dir	Reverse directional residual ground pickup 50GRP (s50GRP)	In the ”Ground” tab page
	I1 RST FAC I0/I1 a0X	Sel Dir	Zero sequence current restraint factor a0=I0/I1	In the ”Ground” tab page
	FWD DIR Z0 LVL Z0FX	Sel Dir	Forward directional Z0 threshold Z0F	In the ”Ground” tab page
	REV DIR Z0 LVL Z0RX	Sel Dir	Reverse directional Z0 threshold Z0R	In the ”Ground” tab page

3.11 X-Side Voltage subrelay

The *X-Side Voltage* subrelay simulates the set of definite time three phase-ground, phase-phase, positive sequence, neutral and negative sequence overvoltage elements and the set of three phase and positive sequence undervoltage elements fed by a VT which measures the voltage at the generator X-Side.

3.11.1 Available Units

- Two definite time phase-phase undervoltage elements (”Ph_Ph UV 1”, and ”Ph_Ph UV 2” block).
- Two definite time phase-phase overvoltage elements (”Ph_Ph OV 1”, and ”Ph_Ph OV 2” block).
- Two definite time phase-ground undervoltage elements (”Phase UV 1”, and ”Phase UV 2” block).
- Two definite time phase-ground overvoltage elements (”Phase OV 1”, and ”Phase OV 2” block).
- Six definite time positive sequence undervoltage elements (”POS SEQ UV 1”, ”POS SEQ UV 2”, ”POS SEQ UV 3”, ”POS SEQ UV 4”, ”POS SEQ UV 5”, and ”POS SEQ UV 6” block).
- Six definite time positive sequence overvoltage elements (”POS SEQ OV 1”, ”POS SEQ OV 2”, ”POS SEQ OV 3”, ”POS SEQ OV 4”, ”POS SEQ OV 5”, and ”PhS SEQ OV 6” block).
- Two definite time neutral voltage displacements elements (”GND OV 1”, and ”GND OV 2” block).
- Two definite time negative sequence voltage displacements elements (”NSEQ OV 1”, and ”NSEQ OV 2” block).
- One output logic element (”Output Logic” block).

3.11.2 Functionality

The *X-Side Voltage* subrelay models a whole set of phase-phase and phase-gound over/undervoltage elements irrespective of the delta or wye VT connections. When the delta VT connections is used the phase-ground over/undervoltage elements should be manually disabled in the model.

The neutral voltage displacements elements can be fed by the zero sequence voltage calculated using the phase-ground phase voltage or by the zero sequence voltage calculated by an open delta Vt (EXT3V0_X := VS or VN).

3.11.3 Data input

The relationships between the relay settings and the model parameters can be found in the following table (the relay model parameter names are listed between brackets):

Address	Relay Setting	Model block	Model setting	Note
	PHASE UV LEVEL 27PX1P	Phase UV 1	Input Setting (Ipsetr)	
			Out of Service (outserv)	Set when 27PX1P is *OFF*
	PHASE UV DELAY 27PX1D	Phase UV 1	Time Dial (Tpset)	

Address	Relay Setting	Model block	Model setting	Note
	PHASE UV LEVEL 27PX2P	Phase UV 2	Input Setting (Ipsetr)	
			Out of Service (outserv)	Set when 27PX2P is *OFF*
	PHASE UV DELAY 27PX2D	Phase UV 2	Time Dial (Tpset)	
	PHASE UV LEVEL 27PPX1P	Ph_Ph UV 1	Input Setting (Ipsetr)	
			Out of Service (outserv)	Set when 27PPX1P is *OFF*
	PHASE UV DELAY 27PPX1D	Ph_Ph UV 1	Time Dial (Tpset)	
	PHASE UV LEVEL 27PPX2P	Ph_Ph UV 2	Input Setting (Ipsetr)	
			Out of Service (outserv)	Set when 27PPX2P is *OFF*
	PHASE UV DELAY 27PPX2D	Ph_Ph UV 2	Time Dial (Tpset)	
	PHASE OV LEVEL 59PX1P	Phase OV 1	Input Setting (Ipsetr)	
			Out of Service (outserv)	Set when 59PX1P is *OFF*
	PHASE OV DELAY 59PX1D	Phase OV 1	Time Dial (Tpset)	
	PHASE OV LEVEL 59PX2P	Phase OV 2	Input Setting (Ipsetr)	
			Out of Service (outserv)	Set when 59PX2P is *OFF*
	PHASE OV DELAY 59PX2D	Phase OV 2	Time Dial (Tpset)	
	PHASE OV LEVEL 59PPX1P	Ph_Ph OV 1	Input Setting (Ipsetr)	
			Out of Service (outserv)	Set when 59PPX1P is *OFF*
	PHASE OV DELAY 59PPX1D	Ph_Ph OV 1	Time Dial (Tpset)	
	PHASE OV LEVEL 59PPX2P	Ph_Ph OV 2	Input Setting (Ipsetr)	
			Out of Service (outserv)	Set when 59PPX2P is *OFF*
	PHASE OV DELAY 59PPX2D	Ph_Ph OV 2	Time Dial (Tpset)	
	ENABLE P-SEQ UV E27V1X	POS SEQ UV 1	Out of Service (outserv)	
		POS SEQ UV 2	Out of Service (outserv)	
		POS SEQ UV 3	Out of Service (outserv)	
		POS SEQ UV 4	Out of Service (outserv)	
		POS SEQ UV 5	Out of Service (outserv)	
		POS SEQ UV 6	Out of Service (outserv)	
	POS SEQ UV LEVEL 27V1X1P	POS SEQ UV 1	Input Setting (Ipsetr)	
	POS SEQ UV DELAY 27V1X1D	POS SEQ UV 1	Time Dial (Tpset)	
	POS SEQ UV LEVEL 27V1X2P	POS SEQ UV 2	Input Setting (Ipsetr)	
	POS SEQ UV DELAY 27V1X2D	POS SEQ UV 2	Time Dial (Tpset)	
	POS SEQ UV LEVEL 27V1X3P	POS SEQ UV 3	Input Setting (Ipsetr)	
	POS SEQ UV DELAY 27V1X3D	POS SEQ UV 3	Time Dial (Tpset)	
	POS SEQ UV LEVEL 27V1X4P	POS SEQ UV 4	Input Setting (Ipsetr)	
	POS SEQ UV DELAY 27V1X4D	POS SEQ UV 4	Time Dial (Tpset)	
	POS SEQ UV LEVEL 27V1X5P	POS SEQ UV 5	Input Setting (Ipsetr)	
	POS SEQ UV DELAY 27V1X5D	POS SEQ UV 5	Time Dial (Tpset)	
	POS SEQ UV LEVEL 27V1X6P	POS SEQ UV 6	Input Setting (Ipsetr)	
	POS SEQ UV DELAY 27V1X6D	POS SEQ UV 6	Time Dial (Tpset)	
	ENABLE P-SEQ OV E59V1X	POS SEQ OV 1	Out of Service (outserv)	
		POS SEQ OV 2	Out of Service (outserv)	
		POS SEQ OV 3	Out of Service (outserv)	
		POS SEQ OV 4	Out of Service (outserv)	
		POS SEQ OV 5	Out of Service (outserv)	
		POS SEQ OV 6	Out of Service (outserv)	
	POS SEQ OV LEVEL 59V1X1P	POS SEQ OV 1	Input Setting (Ipsetr)	
	POS SEQ OV DELAY 59V1X1D	POS SEQ OV 1	Time Dial (Tpset)	
	POS SEQ OV LEVEL 59V1X2P	POS SEQ OV 2	Input Setting (Ipsetr)	
	POS SEQ OV DELAY 59V1X2D	POS SEQ OV 2	Time Dial (Tpset)	
	POS SEQ OV LEVEL 59V1X3P	POS SEQ OV 3	Input Setting (Ipsetr)	
	POS SEQ OV DELAY 59V1X3D	POS SEQ OV 3	Time Dial (Tpset)	
	POS SEQ OV LEVEL 59V1X4P	POS SEQ OV 4	Input Setting (Ipsetr)	
	POS SEQ OV DELAY 59V1X4D	POS SEQ OV 4	Time Dial (Tpset)	
	POS SEQ OV LEVEL 59V1X5P	POS SEQ OV 5	Input Setting (Ipsetr)	
	POS SEQ OV DELAY 59V1X5D	POS SEQ OV 5	Time Dial (Tpset)	

Address	Relay Setting	Model block	Model setting	Note
	POS SEQ OV LEVEL 59V1X6P	POS SEQ OV 6	Input Setting (Ipsetr)	
	POS SEQ OV DELAY 59V1X6D	POS SEQ OV 6	Time Dial (Tpset)	
	NSEQ OV LEVEL 59QX1P	NSEQ OV 1	Input Setting (Ipsetr)	
			Out of Service (outserv)	Set when 59QX1P is *OFF*
	NSEQ OV DELAY 59QX1D	NSEQ OV 1	Time Dial (Tpset)	
	NSEQ OV LEVEL 59QX2P	NSEQ OV 2	Input Setting (Ipsetr)	
			Out of Service (outserv)	Set when 59QX2P is *OFF*
	NSEQ OV DELAY 59QX2D	NSEQ OV 2	Time Dial (Tpset)	
	GND OV LEVEL 59GX1P	GND OV 1	Input Setting (Ipsetr)	
			Out of Service (outserv)	Set when 59GX1P is *OFF*
	GND OV DELAY 59GX1D	GND OV 1	Time Dial (Tpset)	
	GND OV LEVEL 59GX2P	GND OV 2	Input Setting (Ipsetr)	
			Out of Service (outserv)	Set when 59GX2P is *OFF*
	GND OV DELAY 59GX2D	GND OV 2	Time Dial (Tpset)	

3.12 Y-Side Frequency subrelay

The *Y-Side Frequency* subrelay simulates the set of overfrequency , underfrequency, and rate of change of frequency protective elements which monitor the frequency measured at the generator Y winding side. It's identical to the *X-Side Frequency* subrelay.

3.12.1 Available Units

- Six definite time over/under frequency elements ("FREQ TRIP1", "FREQ TRIP2", "FREQ TRIP3", "FREQ TRIP4", "FREQ TRIP5" and "FREQ TRIP6" block).
- Four definite time rate of change of frequency elements ("FREQX ROC1", "FREQX ROC2", "FREQX ROC3", and "FREQX ROC4" block).
- One frequency calculation element ("Meas Freq" block).
- One output logic element ("Output Logic" block).

3.12.2 Functionality

The frequency is calculated by the "Meas Freq"block which uses by default the phase A-phase B voltage for its calculation (the parameter is user configurable). The calculated frequency value is then used by the overfrequency/underfrequency elements and by the rate of change of frequency elements.
The each frequency element operates as over frequency elements when the frequency threshold is greater than the system rated frequency, as under frequency element when the frequency threshold is smaller than the system rated frequency.

3.12.3 Data input

The relationships between the relay settings and the model parameters can be found in the following table (the relay model parameter names are listed between brackets):

Address	Relay Setting	Model block	Model setting	Note
	ENABLE 81Y	FREQ TRIP y[4]	Out of Service (outserv)	
	FREQY TRIPy [4]L	FREQ TRIP y[4]	Frequency (Fset)	
	FREQY TRIPy [4]Y	FREQ TRIP y[4]	Time Delay (Tdel)	
	ENABLE 81RY E81RY	FREQX ROC x[5]	Out of Service (outserv)	
	FREQY ROC LEVEL 81RYx[5]	FREQX ROC x	Gradient df/dt (dFset)	
	FREQY ROC PU DLY 81RYx[5]	FREQX ROC x	Time Delay (Tdel)	

[4]y = 1,2,3,4,5,6
[5]x = 1,2,3,4

3.13 Y-Side Overcurrent subrelay

The *Y-Side Overcurrent* sub relay model simulates the phase, residual, and negative sequence overcurrent elements which protect the ”Y” winding side of the generator. It’s identical to the *Y-Side Overcurrent* sub relay except for the ”Load encroachment” block which contains some additional parameters.

3.13.1 Available Units

- One 3phase directional inverse time overcurrent element (”Phase Toc” block).
- Three 3phase directional definite time overcurrent elements (”Phase Ioc1”, ”Phase Ioc2”, and ”Phase Ioc3” block).
- One residual directional inverse time overcurrent element (”Res Toc” block).
- Two residual directional definite time overcurrent elements (”Res Ioc1”, and ”Res Ioc2” block).
- One residual directional inverse time overcurrent element (”Res Toc” block).
- Two residual directional definite time overcurrent elements (”Res Ioc1”, and ”Res Ioc2” block).
- One negative sequence directional inverse time overcurrent element (”Nseq Toc” block).
- Two negative sequence directional definite time overcurrent elements (”Nseq Ioc1”, and ”Nseq Ioc2” block).
- One directional element (”Sel Dir” block).
- One 3 phase load encroachment block (”Load encroachment” block).
- One 3 phase polarizing block (”Polarizing” block).
- One output logic element (”Output Logic” block).

3.13.2 Functionality

The *Y-Side Overcurrent* sub relay simulates the complete set of 3phase , residual current and negative sequence overcurrent current available in the SEL 700G relay. Any element can be set as forward or reverse directional or as non directional. Each overcurrent element can be separately set to be blocked or not by the load encroachment feature.

The inverse time elements are supporting the following inverse time and definite time trip characteristics (each characteristic is also associate to an inverse time reset characteristic):

- C1 - IEC Class A (Standard Inverse)
- C2 - IEC Class B (Very Inverse)
- C3 - IEC Class C (Extremely Inverse)
- C4 - IEC Long Time Inverse
- C5 - IEC Short Time Inverse
- U1 - U.S. Moderately Inverse

- U2 - U.S. Inverse
- U3 - U.S. Very Inverse
- U4 - U.S. Extremly Inverse
- U5 - U.S. Short Time Inverse

The delayed reset characteristic can be enabled or disabled by the user for each inverse time overcurrent element. The inverse time element trip characteristic equations comply with the IEC 60255-3 and the ANSI standards.

3.13.3 Data input

The relationships between the relay settings and the model parameters can be found in the following table (the relay model parameter names are listed between brackets):

Address	Relay Setting	Model block	Model setting	Note
	PHASE IOC LEVEL 50PY1P	Phase Ioc1	Pickup Current (Ipsetr)	
			Out of Service (outserv)	outserv=1 when 50PY1P = OFF
	PHASE IOC DELAY 50PY1D	Phase Ioc1	Time Setting (Tset)	
	PH IOC TRQCTRL 50PY1TC	Phase Ioc1	Tripping Direction (idir)	
	PHASE IOC LEVEL 50PY2P	Phase Ioc2	Pickup Current (Ipsetr)	
			Out of Service (outserv)	outserv=1 when 50PY2P = OFF
	PHASE IOC DELAY 50PY2D	Phase Ioc2	Time Setting (Tset)	
	PH IOC TRQCTRL 50PY2TC	Phase Ioc2	Tripping Direction (idir)	
	PHASE IOC LEVEL 50PY3P	Phase Ioc3	Pickup Current (Ipsetr)	
			Out of Service (outserv)	outserv=1 when 50PY3P = OFF
	PHASE IOC DELAY 50PY3D	Phase Ioc3	Time Setting (Tset)	
	PH IOC TRQCTRL 50PY3TC	Phase Ioc3	Tripping Direction (idir)	
	RES IOC LEVEL 50GY1P	Res Ioc1	Pickup Current (Ipsetr)	
			Out of Service (outserv)	outserv=1 when 50GY1P = OFF
	RES IOC DELAY 50GY1D	Res Ioc1	Time Setting (Tset)	
	RES IOC TRQCTRL 50GY1TC	Res Ioc1	Tripping Direction (idir)	
	RES IOC LEVEL 50GY2P	Res Ioc2	Pickup Current (Ipsetr)	
			Out of Service (outserv)	outserv=1 when 50GY2P = OFF
	RES IOC DELAY 50GY2D	Res Ioc2	Time Setting (Tset)	
	RES IOC TRQCTRL 50GY2TC	Res Ioc2	Tripping Direction (idir)	
	NSEQ IOC LEVEL 50QY1P	Nseq Ioc1	Pickup Current (Ipsetr)	
			Out of Service (outserv)	outserv=1 when 50QY1P = OFF
	NSEQ IOC DELAY 50QY1D	Nseq Ioc1	Time Setting (Tset)	

Address	Relay Setting	Model block	Model setting	Note
	NSEQ IOC TRQCTRL 50QY1TC	Nseq Ioc1	Tripping Direction (idir)	
	NSEQ IOC LEVEL 50QY2P	Nseq Ioc2	Pickup Current (Ipsetr)	
			Out of Service (outserv)	outserv=1 when 50QY2P = OFF
	NSEQ IOC DELAY 50QY2D	Nseq Ioc2	Time Setting (Tset)	
	NSEQ IOC TRQCTRL 50QY2TC	Nseq Ioc2	Tripping Direction (idir)	
	PHASE TOC LEVEL 51PYP	Phase Toc	Current Setting (Ipsetr)	
			Out of Service (outserv)	outserv=1 when 51PY1P = OFF
	PHASE TOC CURVE 51PYC	Phase Toc	Characteristic (pcharac)	
	PHASE TOC TDIAL 51PYTD	Phase Toc	Time Dial (Tpset)	
	EM RESET DELAY 51PYRS	Phase Toc	Reset Characteristic (resetdis)	
	CONST TIME ADDER 51PYCT	Phase Toc	Time Adder (Tadder)	
	MIN RESPONSE TIM 51PYMR	Phase Toc	Min. Response Time (minresptime)	
	PH TOC TRQCTRL 51PYTC	Phase Toc	Tripping Direction (idir)	
	RES TOC LEVEL 51GYP	Res Toc	Current Setting (Ipsetr)	
			Out of Service (outserv)	outserv=1 when 51GY1P = OFF
	RES TOC CURVE 51GYC	Res Toc	Characteristic (pcharac)	
	RES TOC TDIAL 51GYTD	Res Toc	Time Dial (Tpset)	
	EM RESET DELAY 51GYRS	Res Toc	Reset Characteristic (resetdis)	
	CONST TIME ADDER 51GYCT	Res Toc	Time Adder (Tadder)	
	MIN RESPONSE TIM 51GYMR	Res Toc	Min. Response Time (minresptime)	
	RES TOC TRQCTRL 51GYTC	Res Toc	Tripping Direction (idir)	
	NSEQ TOC LEVEL 51QYP	Nseq Toc	Current Setting (Ipsetr)	
			Out of Service (outserv)	outserv=1 when 51QY1P = OFF
	NSEQ TOC CURVE 51QYC	Nseq Toc	Characteristic (pcharac)	
	NSEQ TOC TDIAL 51QYTD	Nseq Toc	Time Dial (Tpset)	
	EM RESET DELAY 51QYRS	Nseq Toc	Reset Characteristic (resetdis)	
	CONST TIME ADDER 51QYCT	Nseq Toc	Time Adder (Tadder)	
	MIN RESPONSE TIM 51QYMR	Nseq Toc	Min. Response Time (minresptime)	
	NSEQ TOC TRQCTRL 51QYTC	Nseq Toc	Tripping Direction (idir)	
	LOAD ENCROACH EN	Load encroachment	Out of Service (outserv)	
	FWD LD IMPEDANCE ZLFY	Load encroachment	ZLF (ZLF)	
	POS-FWD LD ANGLE PLAFY	Load encroachment	PLAF (PLAF)	

Address	Relay Setting	Model block	Model setting	Note
	NEG-FWD LD ANGLE NLAFY	Load encroachment	NLAF (NLAF)	
	REV LD IMPEDANCE ZLRY	Load encroachment	ZLR (ZLR)	
	POS-REV LD ANGLE PLARY	Load encroachment	PLAR (PLAR)	
	NEG-REV LD ANGLE NLARY	Load encroachment	NLAR (NLAR)	
	POS SQ LN Z MAG Z1MAGY	Sel Dir	Positive Sequence Line Impedance Magnitude Z1MAG (Zm)	In the ”Negative sequence” tab page
	POS SQ LN Z ANG Z1ANGY	Sel Dir	Positive sequence line impedance angle Z1ANG (phi)	In the ”Negative sequence” tab page
	ZERO SQ LN Z MAG Z0MAGY	Sel Dir	Zero sequence line impedance magnitude Z0MAG (Z0)	In the ”Ground” tab page
	ZERO SQ LN Z ANG Z0ANGY	Sel Dir	Zero sequence line impedance angle Z0ANG (phi0)	In the ”Ground” tab page
	DIR CONTROL LVL1 DIR1Y	Sel Dir	Level 1 direction (DIR1)	In the ”Basic settings" tab page
	DIR CONTROL LVL2 DIR2Y	Sel Dir	Level 2 direction (DIR2)	In the ”Basic settings" tab page
	GND DIR PRIORITY ORDERY	Sel Dir	Ground directional element priority(ORDER)	In the ”Basic settings” tab page
	PH DIR 3PH LVL 50PDIRPY	Sel Dir	Phase directional element 3-phase pickup 50P32P (s50P32P)	In the ”Phase” tab page
	FWD DIR Z2 LVL Z2FY	Sel Dir	Forward directional Z2 threshold Z2F	In the ”Negative sequence” tab page
	REV DIR Z2 LVL Z2RY	Sel Dir	Reverse directional Z2 threshold Z2R	In the ”Negative sequence” tab page
	FWD DIR NSEQ LVL 50QFPY	Sel Dir	Forward directional current threshold (s50QF)	In the ”Negative sequence” tab page
	REV DIR NSEQ LVL 50QRPY	Sel Dir	Reverse directional current threshold (s50QR)	In the ”Negative sequence” tab page
	I1 RST FAC I2/I1 a2Y	Sel Dir	Positive sequence current restraint factor a2=I2/I1	In the ”Negative sequence” tab page
	I0 RST FAC I2/I0 k2Y	Sel Dir	Zero sequence current restraint factor k2=I2/I0	In the ”Negative sequence” tab page
	FWD DIR RES LVL 50GFPY	Sel Dir	Forward directional residual ground pickup 50GFP (s50GFP)	In the ”Ground” tab page
	REV DIR RES LVL 50GRPY	Sel Dir	Reverse directional residual ground pickup 50GRP (s50GRP)	In the ”Ground” tab page
	I1 RST FAC I0/I1 a0Y	Sel Dir	Zero sequence current restraint factor a0=I0/I1	In the ”Ground” tab page
	FWD DIR Z0 LVL Z0FY	Sel Dir	Forward directional Z0 threshold Z0F	In the ”Ground” tab page
	REV DIR Z0 LVL Z0RY	Sel Dir	Reverse directional Z0 threshold Z0R	In the ”Ground” tab page

3.14 Y-Side Voltage subrelay

The *Y-Side Voltage* subrelay simulates the set of definite time three phase-ground, phase-phase, positive sequence, neutral and negative sequence overvoltage elements and the set of three phase and positive sequence undervoltage elements fed by a VT which measures the voltage at the generator ”Y” winding side. The subrelay is identical to the *X-Side Voltage* subrelay except for the neutral voltage displacements elements which can be fed only by the neutral voltage calculated by the phase-ground phase voltages.

3.14.1 Available Units

- Two definite time phase-phase undervoltage elements (”Ph_Ph UV 1”, and ”Ph_Ph UV 2” block).
- Two definite time phase-phase overvoltage elements (”Ph_Ph OV 1”, and ”Ph_Ph OV 2” block).
- Two definite time phase-ground undervoltage elements (”Phase UV 1”, and ”Phase UV 2” block).
- Two definite time phase-ground overvoltage elements (”Phase OV 1”, and ”Phase OV 2” block).
- Six definite time positive sequence undervoltage elements (”POS SEQ UV 1”, ”POS SEQ UV 2”, ”POS SEQ UV 3”, ”POS SEQ UV 4”, ”POS SEQ UV 5”, and ”POS SEQ UV 6” block).
- Six definite time positive sequence overvoltage elements (”POS SEQ OV 1”, ”POS SEQ OV 2”, ”POS SEQ OV 3”, ”POS SEQ OV 4”, ”POS SEQ OV 5”, and ”PhS SEQ OV 6” block).
- Two definite time neutral voltage displacements elements (”GND OV 1”, and ”GND OV 2” block).
- Two definite time negative sequence voltage displacements elements (”NSEQ OV 1”, and ”NSEQ OV 2” block).
- One output logic element (”Output Logic” block).

3.14.2 Functionality

The *Y-Side Voltage)* subrelay models a whole set of phase-phase and phase-gound over/undervoltage elements irrespective of the delta or wye VT connections. When the delta VT connections is used the phase-ground over/undervoltage elements should be manually disabled in the model.

The neutral voltage displacements elements are fed by the zero sequence voltage calculated using the phase-ground phase voltage. Id VT delta connection is present the neutral voltage displacements element must be manually disabled.

3.14.3 Data input

The relationships between the relay settings and the model parameters can be found in the following table (the relay model parameter names are listed between brackets):

Address	Relay Setting	Model block	Model setting	Note
	PHASE UV LEVEL 27PY1P	Phase UV 1	Input Setting (Ipsetr)	
			Out of Service (outserv)	Set when 27PY1P is *OFF*
	PHASE UV DELAY 27PY1D	Phase UV 1	Time Dial (Tpset)	
	PHASE UV LEVEL 27PY2P	Phase UV 2	Input Setting (Ipsetr)	
			Out of Service (outserv)	Set when 27PY2P is *OFF*
	PHASE UV DELAY 27PY2D	Phase UV 2	Time Dial (Tpset)	
	PHASE UV LEVEL 27PPY1P	Ph_Ph UV 1	Input Setting (Ipsetr)	
			Out of Service (outserv)	Set when 27PPY1P is *OFF*
	PHASE UV DELAY 27PPY1D	Ph_Ph UV 1	Time Dial (Tpset)	
	PHASE UV LEVEL 27PPY2P	Ph_Ph UV 2	Input Setting (Ipsetr)	
			Out of Service (outserv)	Set when 27PPY2P is *OFF*
	PHASE UV DELAY 27PPY2D	Ph_Ph UV 2	Time Dial (Tpset)	
	PHASE OV LEVEL 59PY1P	Phase OV 1	Input Setting (Ipsetr)	
			Out of Service (outserv)	Set when 59PY1P is *OFF*
	PHASE OV DELAY 59PY1D	Phase OV 1	Time Dial (Tpset)	
	PHASE OV LEVEL 59PY2P	Phase OV 2	Input Setting (Ipsetr)	
			Out of Service (outserv)	Set when 59PY2P is *OFF*
	PHASE OV DELAY 59PY2D	Phase OV 2	Time Dial (Tpset)	
	PHASE OV LEVEL 59PPY1P	Ph_Ph OV 1	Input Setting (Ipsetr)	
			Out of Service (outserv)	Set when 59PPY1P is *OFF*
	PHASE OV DELAY 59PPY1D	Ph_Ph OV 1	Time Dial (Tpset)	
	PHASE OV LEVEL 59PPY2P	Ph_Ph OV 2	Input Setting (Ipsetr)	
			Out of Service (outserv)	Set when 59PPY2P is *OFF*
	PHASE OV DELAY 59PPY2D	Ph_Ph OV 2	Time Dial (Tpset)	
	ENABLE P-SEQ UV E27V1Y	POS SEQ UV 1	Out of Service (outserv)	
		POS SEQ UV 2	Out of Service (outserv)	
		POS SEQ UV 3	Out of Service (outserv)	
		POS SEQ UV 4	Out of Service (outserv)	
		POS SEQ UV 5	Out of Service (outserv)	
		POS SEQ UV 6	Out of Service (outserv)	
	POS SEQ UV LEVEL 27V1Y1P	POS SEQ UV 1	Input Setting (Ipsetr)	
	POS SEQ UV DELAY 27V1Y1D	POS SEQ UV 1	Time Dial (Tpset)	
	POS SEQ UV LEVEL 27V1Y2P	POS SEQ UV 2	Input Setting (Ipsetr)	
	POS SEQ UV DELAY 27V1Y2D	POS SEQ UV 2	Time Dial (Tpset)	
	POS SEQ UV LEVEL 27V1Y3P	POS SEQ UV 3	Input Setting (Ipsetr)	
	POS SEQ UV DELAY 27V1Y3D	POS SEQ UV 3	Time Dial (Tpset)	
	POS SEQ UV LEVEL 27V1Y4P	POS SEQ UV 4	Input Setting (Ipsetr)	
	POS SEQ UV DELAY 27V1Y4D	POS SEQ UV 4	Time Dial (Tpset)	
	POS SEQ UV LEVEL 27V1Y5P	POS SEQ UV 5	Input Setting (Ipsetr)	
	POS SEQ UV DELAY 27V1Y5D	POS SEQ UV 5	Time Dial (Tpset)	
	POS SEQ UV LEVEL 27V1Y6P	POS SEQ UV 6	Input Setting (Ipsetr)	
	POS SEQ UV DELAY 27V1Y6D	POS SEQ UV 6	Time Dial (Tpset)	
	ENABLE P-SEQ OV E59V1Y	POS SEQ OV 1	Out of Service (outserv)	
		POS SEQ OV 2	Out of Service (outserv)	
		POS SEQ OV 3	Out of Service (outserv)	
		POS SEQ OV 4	Out of Service (outserv)	
		POS SEQ OV 5	Out of Service (outserv)	
		POS SEQ OV 6	Out of Service (outserv)	
	POS SEQ OV LEVEL 59V1Y1P	POS SEQ OV 1	Input Setting (Ipsetr)	
	POS SEQ OV DELAY 59V1Y1D	POS SEQ OV 1	Time Dial (Tpset)	
	POS SEQ OV LEVEL 59V1Y2P	POS SEQ OV 2	Input Setting (Ipsetr)	
	POS SEQ OV DELAY 59V1Y2D	POS SEQ OV 2	Time Dial (Tpset)	
	POS SEQ OV LEVEL 59V1Y3P	POS SEQ OV 3	Input Setting (Ipsetr)	
	POS SEQ OV DELAY 59V1Y3D	POS SEQ OV 3	Time Dial (Tpset)	
	POS SEQ OV LEVEL 59V1Y4P	POS SEQ OV 4	Input Setting (Ipsetr)	

Address	Relay Setting	Model block	Model setting	Note
	POS SEQ OV DELAY 59V1Y4D	POS SEQ OV 4	Time Dial (Tpset)	
	POS SEQ OV LEVEL 59V1Y5P	POS SEQ OV 5	Input Setting (Ipsetr)	
	POS SEQ OV DELAY 59V1Y5D	POS SEQ OV 5	Time Dial (Tpset)	
	POS SEQ OV LEVEL 59V1Y6P	POS SEQ OV 6	Input Setting (Ipsetr)	
	POS SEQ OV DELAY 59V1Y6D	POS SEQ OV 6	Time Dial (Tpset)	
	NSEQ OV LEVEL 59QY1P	NSEQ OV 1	Input Setting (Ipsetr)	
			Out of Service (outserv)	Set when 59QY1P is *OFF*
	NSEQ OV DELAY 59QY1D	NSEQ OV 1	Time Dial (Tpset)	
	NSEQ OV LEVEL 59QY2P	NSEQ OV 2	Input Setting (Ipsetr)	
			Out of Service (outserv)	Set when 59QY2P is *OFF*
	NSEQ OV DELAY 59QY2D	NSEQ OV 2	Time Dial (Tpset)	
	GND OV LEVEL 59GY1P	GND OV 1	Input Setting (Ipsetr)	
			Out of Service (outserv)	Set when 59GY1P is *OFF*
	GND OV DELAY 59GY1D	GND OV 1	Time Dial (Tpset)	
	GND OV LEVEL 59GY2P	GND OV 2	Input Setting (Ipsetr)	
			Out of Service (outserv)	Set when 59GY2P is *OFF*
	GND OV DELAY 59GY2D	GND OV 2	Time Dial (Tpset)	

3.15 Output logic

The output logic is the interface between the relay and the power system.

3.15.1 Available Units and Signals

The trip logic is implemented by the ”Output Logic” following blocks located in the main relay.

The relay output signals are:

- *OUT1*
- *OUT2*
- *OUT3*
- *OUT4*
- *OUT5*
- *OUT6*
- *OUT7*
- *OUT8*
- *OUT9*
- *OUT10*
- *OUT11*

3.15.2 Functionality

The ”Output Logic” block operates the power breaker when a trip command has been issued by any protective element. The trip Logic can be configured in the ”Logic” tab page. As default configuration all relay output signals trips with the same logic. A three phases trip logic is implemented.

3.15.3 Data input

Please disable the ”Output Logic” block in the main relay to disable the relay model ability to open the power circuit.

4 Features not supported

The following features are not supported:

- Single phase trip.
- Check synchronization functions.
- Circuit breaker failure protection.
- 100% stator earth fault protection (3rd harmonic method) (27TN/59TN).
- 100% stator earth fault protection (low frequency injection method) (64S).
- Thermal element alarm thresholds.
- Off-Frequency Accumulators;
- Dead machine.

5 References

[1] SCHWEITZER ENGINEERING LABORATORIES, 2350 NE HOPKINS COURT PULLMAN, WA USA 99163-5603. *SEL-700G Generator and Intertie Protection Relays Instruction Manual SEL-700G0 SEL-700G1 SEL-700GT SEL-700GW 20120903*, February 2001.