



Reyrolle
Protection
Devices

7SR21 & 7SR22 Argus

Overcurrent Relay

Energy Management

SIEMENS

Contents

Technical Manual Sections

1. Description of Operation
2. Configuration Guide
3. 7SR210 Instrumentation Guide
4. 7SR220 Instrumentation Guide
5. Performance Specification
6. Data Communications Definitions
7. Installation Guide
8. Commissioning and Maintenance Guide
9. Applications Guide

The copyright and other intellectual property rights in this document, and in any model or article produced from it (and including any registered or unregistered design rights) are the property of Siemens Protection Devices Limited. No part of this document shall be reproduced or modified or stored in another form, in any data retrieval system, without the permission of Siemens Protection Devices Limited, nor shall any model or article be reproduced from this document unless Siemens Protection Devices Limited consent.

While the information and guidance given in this document is believed to be correct, no liability shall be accepted for any loss or damage caused by any error or omission, whether such error or omission is the result of negligence or any other cause. Any and all such liability is disclaimed.

© 2013 Siemens Protection Devices Limited

7SR210 Non-Directional Relay
7SR220 Directional Relay
Description Of Operation

Unrestricted The copyright and other intellectual property rights in this document, and in any model or article produced from it (and including any registered or unregistered design rights) are the property of Siemens Protection Devices Limited. No part of this document shall be reproduced or modified or stored in another form, in any data retrieval system, without the permission of Siemens Protection Devices Limited, nor shall any model or article be reproduced from this document unless Siemens Protection Devices Limited consent.

While the information and guidance given in this document is believed to be correct, no liability shall be accepted for any loss or damage caused by any error or omission, whether such error or omission is the result of negligence or any other cause. Any and all such liability is disclaimed.

Document Release History

This document is issue 2018/09. The list of revisions up to and including this issue is: -

2011/05	First issue.
2013/01	Typographical revisions and added data. Updated in line with software release.
2014/06	Typographical revisions and added data. Updated in line with software release.
2015/06	Typographical revisions amended drawings and added data. Updated in line with software release.
2015/07	Amended drawings.
2016/02	Typographical revisions and added data. Updated in line with software release.
2016/11	Redundancy added to electrical ethernet interface
2017/08	Typographical revisions and added data. Updated in line with software release.
2017/12	Typographical revisions and added data.
2018/09	Typographical revisions.

Software Revision History

2011/05	2435H85008R7a-7a (7SR210) 2435H85009R7a-7a (7SR220)	First Release
2013/01	2435H85008R7c-7b (7SR210) 2435H85009R7c-7b (7SR220)	Introduced journaling file system. Added 61850 logical nodes for CB Counters, metering, 50BF, 46BC, 81HBL2 and line check. Added Line Check on non-AR devices. Added 74CCS Close Circuit Supervision.
2014/06	2435H85008R7f-7d (7SR210) 2435H85009R7f-7d (7SR220)	Added Fault Locator feature and Check Sync feature. Fault data transmission over IEC 60870-5-103. Additional communications data, control features, meters.
2015/06	2435H85008R8a-7f (7SR210) 2435H85009R8a-7f (7SR220)	Added Power Factor Meters, Load Blinding feature, Arc Flash Detector. Over current TM Setting Range extended.
2016/02	2435H85008R8b-7f (7SR210) 2435H85009R8b-7f (7SR220)	EN100+ Compatibility.
2017/08	2435H85008R8e-8a (7SR210) 2435H85009R8e-8a (7SR220)	Added 32 Directional Power, 32S Sensitive Power, 55 Power Factor, 81HLB5 Overfluxing, 67SEF Compensated Network, 67SEF Wattmetric. Increased I/O. Event Data on LCD.

Contents

Document Release History....2
Software Revision History....2
Contents....3
List of Figures....5
Section 1: Introduction....8
1.1 Current Transformer Circuits....8
1.2 External Resistors....8
1.3 Fibre Optic Communication....8
1.4 Front Cover....8
1.5 Disposal....8
Section 2: Hardware Description....15
2.1 General....15
2.2 Case....16
2.3 Front Cover....16
2.4 Power Supply Unit (PSU)....16
2.5 Operator Interface/ Fascia....16
2.6 Current Inputs....21
2.7 Voltage Inputs....21
2.8 Binary Inputs....21
2.9 Binary Outputs (Output Relays)....22
2.10 Virtual Input/Outputs....23
2.11 Self Monitoring....23
2.11.1 Protection Healthy/Defective....24
Section 3: Protection Functions....25
3.1 Current Protection: Phase Overcurrent (67, 51, 50)....25
3.1.1 Directional Control of Overcurrent Protection (67) – 7SR22....25
3.1.2 Instantaneous Overcurrent Protection (50)....27
3.1.3 Time Delayed Overcurrent Protection (51)....28
3.2 Current Protection: Voltage Controlled Overcurrent (51V) – 7SR22....30
3.3 Current Protection: Derived Earth Fault (67N, 51N, 50N)....31
3.3.1 Directional Control of Derived Earth Fault Protection (67N) – 7SR22....31
3.3.2 Instantaneous Derived Earth Fault Protection (50N)....32
3.3.3 Time Delayed Derived Earth Fault Protection (51N)....33
3.4 Current Protection: Measured Earth Fault (67G, 51G, 50G)....35
3.4.1 Directional Control of Measured Earth Fault Protection (67G) – 7SR22....35
3.4.2 Instantaneous Measured Earth Fault Protection (50G)....36
3.4.3 Time Delayed Measured Earth Fault Protection (51G)....37
3.5 Current Protection: Sensitive Earth Fault (67SEF, 51SEF, 50SEF)....38
3.5.1 Directional Control of Sensitive Earth Fault Protection (67SEF) – 7SR22....38
3.5.2 Instantaneous Sensitive Earth Fault Protection (50SEF)....39
3.5.3 Time Delayed Sensitive Earth Fault Protection (51SEF)....41
3.6 Current Protection: High Impedance Restricted Earth Fault (64H)....43
3.7 Current Protection: Cold Load (51c)....44
3.8 Current Protection: Negative Phase Sequence Overcurrent (46NPS)....45
3.9 Current Protection: Under-Current (37, 37G & 37SEF)....46
3.10 Current Protection: Under-Current Guarded (37)....46
3.11 Current Protection: Thermal Overload (49)....47
3.12 Current Protection: Arc Flash Detector (50 AFD)....49
3.13 Voltage Protection: Phase Under/Over Voltage (27/59) - 7SR22....50
3.14 Voltage Protection: Negative Phase Sequence Overvoltage (47) – 7SR22....51
3.15 Voltage Protection: Neutral Overvoltage (59N) – 7SR22....52
3.16 Voltage Protection: Under/Over Frequency (81) – 7SR22....53
3.17 Power Protection: Power (32) – 7SR22....54
3.18 Power Protection: Sensitive Power (32S) – 7SR22....55
3.19 Power Protection: Power Factor (55) – 7SR22....56
Section 4: Control & Logic Functions....57
4.1 Auto-Reclose (79)....57
4.1.1 Overview....57
4.1.2 Auto Reclose sequences....59
4.2 Autoreclose Prot'n Menu....60
4.3 Autoreclose Config Menu....60
4.4 P/F Shots Sub-Menu....62
4.5 E/F Shots Sub-Menu....62
4.6 SEF Shots Sub-Menu....62

4.7 Extern Shots Sub-Menu 63
4.8 Manual Control 65
4.9 Synchronising 66
4.9.1 Reclosure Modes 66
4.9.2 Charge Delays 66
4.9.3 Voltage monitoring elements 66
4.9.4 Check Synchronising Mode 68
4.9.5 System Split Detector 69
4.9.6 System Sync Reversion 69
4.9.7 System Synchronising Mode 70
4.9.8 Close on Zero Mode 70
4.10 Live/Dead Indication 71
4.11 Circuit Breaker 72
4.12 Quick Logic 75
Section 5: Supervision Functions 77
5.1 Circuit Breaker Failure (50BF) 77
5.2 VT Supervision (60VTS) – 7SR22 78
5.3 Busbar VT Fail (60VTF-Bus) – 7SR22 79
5.4 CT Supervision (60CTS & 60CTS-I) 80
5.4.1 (60CTS-I) – 7SR21 & 7SR22 80
5.4.2 (60CTS) – 7SR22 80
5.5 Broken Conductor (46BC) 81
5.6 Trip / Close Circuit Supervision (74TCS & 74CCS) 81
5.7 Inrush Restraint (81HBL2) 82
5.8 Over Fluxing Detector (81HLB5) 83
5.9 Load Blinder (21) 84
5.9.1 Load Blinder (21) Three-Phase 84
5.9.2 Load Blinder (21) Single-Phase. 85
Section 6: Other Features 87
6.1 Data Communications 87
6.2 Maintenance 87
6.2.1 I^2t CB Wear 88
6.2.2 Output Matrix Test 88
6.3 Data Storage 89
6.3.1 General 89
6.3.2 Event Records 89
6.3.3 Waveform Records. 89
6.3.4 Fault Records 90
6.3.5 Demand 90
6.3.6 Data Log 90
6.3.7 Energy Storage 91
6.3.8 Fault Locator 92
6.4 Metering 92
6.5 Operating Mode 93
6.6 Control Mode 93
6.7 Real Time Clock 93
6.7.1 Time Synchronisation - Data Communication Interface 94
6.7.2 Time Synchronisation – Binary Input 94
6.7.3 Time Synchronisation – IRIG-B (Optional) 94
6.8 Settings Groups 94
6.9 Password Feature 94

 ©2018 Siemens Protection Devices Limited

List of Figures

Figure 1.5-1 Functional Diagram of 7SR21 Relay 10
Figure 1.5-2 Connections Diagram for 7SR21 Relay 11
Figure 1.5-3 Functional Diagram of 7SR22 Relay 13
Figure 1.5-4 Connection Diagram for 7SR22 Relay 14
Figure 2.5-1 7SR21 with 3 + 8 LEDs in E6 Case 17
Figure 2.5-2 7SR220 with 3 + 16 LEDs in E8 Case 17
Figure 2.5-3 7SR22 with Function Keys and 3 + 8 LEDs in E8 Case 17
Figure 2.5-4 7SR22 with Function Keys & 3 + 8 LEDs in E8 Case and Ethernet Communication Interface 18
Figure 2.8-1 Binary Input Logic 21
Figure 2.9-1 Binary Output Logic 22
Figure 2.11-1 Start-up Counter Meter 23
Figure 2.11-2 Start-up Counter Meter 23
Figure 2.11-3 Start-up Counter Meter Events 24
Figure 3.1.1-1 Logic Diagram: Directional Overcurrent Element (67) 26
Figure 3.1.2-1 Logic Diagram: Instantaneous Over-current Element 27
Figure 3.1.3-1 Logic Diagram: Time Delayed Overcurrent Element 29
Figure 3.2-1 Logic Diagram: Voltage Controlled Overcurrent Protection 30
Figure 3.3.1-1 Logic Diagram: Derived Directional Earth Fault Element 32
Figure 3.3.2-1 Logic Diagram: Derived Instantaneous Earth Fault Element 33
Figure 3.3.3-1 Logic Diagram: Derived Time Delayed Earth Fault Protection 34
Figure 3.4.1-1 Logic Diagram: Measured Directional Earth Fault Protection 35
Figure 3.4.2-1 Logic Diagram: Measured Instantaneous Earth-fault Element 36
Figure 3.4.3-1 Logic Diagram: Measured Time Delayed Earth Fault Element (51G) 37
Figure 3.5.1-1 Logic Diagram: SEF Directional Element (67SEF) 39
Figure 3.5.2-1 Logic Diagram: 50 SEF Instantaneous Element 40
Figure 3.5.2-2 Logic Diagram: 50 SEF Instantaneous Element Compensated Networks 40
Figure 3.5.3-1 Logic Diagram: 51 SEF Time Delayed Element 42
Figure 3.5.3-2 Logic Diagram: 51 SEF Time Delayed Element Compensated Networks 42
Figure 3.6-1 Logic Diagram: High Impedance REF (64H) 43
Figure 3.7-1 Logic Diagram: Cold Load Settings (51c) 44
Figure 3.8-1 Logic Diagram: Negative Phase Sequence Overcurrent (46NPS) 45
Figure 3.9-1 Logic Diagram: Undercurrent Detector (37, 37G & 37SEF) 46
Figure 3.10-1 Logic Diagram: Undercurrent Guarded Detector (37) 46
Figure 3.11-1 Logic Diagram: Thermal Overload Protection (49S) 48
Figure 3.12-1 Logic Diagram: Arc Flash Detector (50 AFD) 49
Figure 3.13-1 Logic Diagram: Under/Over Voltage Elements (27/59) 50
Figure 3.14-1 Logic Diagram: NPS Overvoltage Protection (47) 51
Figure 3.15-1 Logic Diagram: Neutral Overvoltage Element 52
Figure 3.16-1 Logic Diagram: Under/Over Frequency Detector (81) 53
Figure 3.17-1 Logic Diagram: Power Protection (32) 54
Figure 3.18-1 Logic Diagram: Sensitive Power Protection (32S) 55
Figure 3.19-1 Logic Diagram: Power Factor Protection (55) 56
Figure 4.1.2-1 Typical Sequence with 3 Instantaneous and 1 Delayed trip 59
Figure 4.7-1 Basic Auto-Reclose Sequence Diagram 64
Figure 4.9.3-1 Voltage Detector Operation 67
Figure 4.9.4-1 Check Sync Function 68
Figure 4.9.7-1 System Sync Function 70
Figure 4.9.8-1 Close On Zero Function 71
Figure 4.9.8-2 Close On Zero Timing 71
Figure 4.10-1 Voltage Detector Operation 72
Figure 4.11-1 Logic Diagram: Circuit Breaker Status 73
Figure 4.12-1Sequence Diagram: Quick Logic PU/DO Timers (Counter Reset Mode Off) 76
Figure 5.1-1 Logic Diagram: Circuit Breaker Fail Protection (50BF) 77
Figure 5.2-1 Logic Diagram: VT Supervision Function (60VTS) 79
Figure 5.4.1-1 Logic Diagram: CT Supervision Function (60CTS-I) – 7SR21 & 7SR22 80
Figure 5.4.2-1 Logic Diagram: CT Supervision Function (60CTS) – 7SR22 80
Figure 5.5-1 Logic Diagram: Broken Conductor Function (46BC) 81

Figure 5.6-1 Logic Diagram: Trip Circuit Supervision Feature (74TCS) 81
Figure 5.6-2 Logic Diagram: Close Circuit Supervision Feature (74CCS) 82
Figure 5.7-1 Logic Diagram: Harmonic Block Feature (81HBL2) 82
Figure 5.8-1 Logic Diagram: Over Fluxing Detector (81HLB5) 83
Figure 5.9.1-1 Logic Diagram: Load Blinder Three-Phase 84
Figure 5.9.2-1 Logic Diagram: Load Blinder Single-Phase 85
Figure 5.9.2-2 Load Blinder and Angle 86
Figure 6.3.7-1 Energy Direction Convention 91

LIST OF TABLES

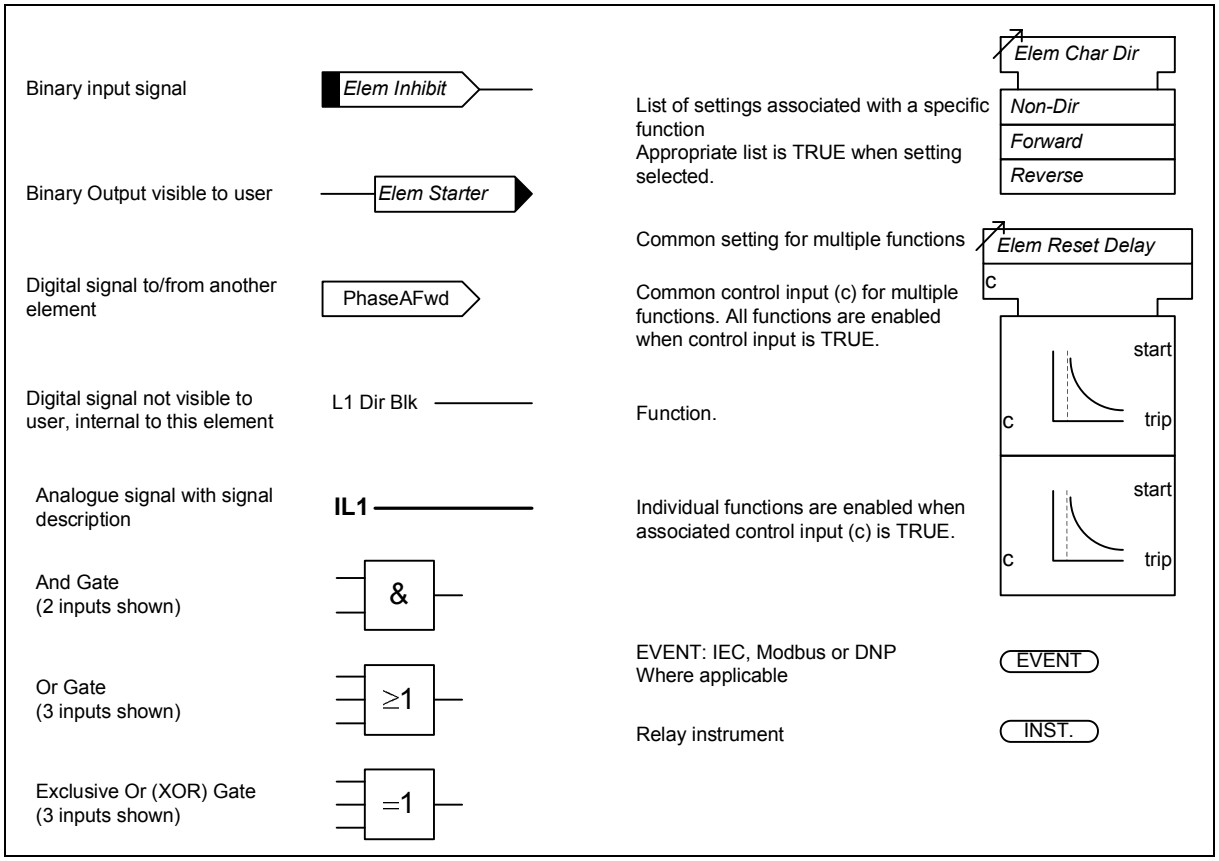
Table 1.5-1 Ordering Information – 7SR21 Non-Directional Overcurrent 9
Table 1.5-2 Ordering Information – 7SR22 Directional Overcurrent 12
Table 2.1-1 Summary of Overcurrent Relay Configurations 15
Table 6.5-1 Operation Mode 93

 ©2018 Siemens Protection Devices Limited

Symbols and Nomenclature

The following notational and formatting conventions are used within the remainder of this document:

- Setting Menu Location MAIN MENU>SUB-MENU
- **Setting:** *Elem name -Setting*
- Setting value: value
- **Alternatives:** [1st] [2nd] [3rd]



Section 1: Introduction

This manual is applicable to the following relays:

- 7SR210 Multi-Function Non-directional Overcurrent and Earth Fault Relay
- 7SR220 Multi-Function Directional Overcurrent and Directional Earth Fault Relay

The 7SR210 and 7SR220 relays integrate the protection and control elements required to provide a complete overcurrent based protection.

The 'Ordering Options' Tables summarise the features available in each model.

General Safety Precautions

1.1 Current Transformer Circuits



The secondary circuit of a live CT must not be open circuited. Non-observance of this precaution can result in injury to personnel or damage to equipment.

1.2 External Resistors



Where external resistors are fitted to the circuit, these may present a danger of electric shock or burns, if touched.

1.3 Fibre Optic Communication



Where fibre optic communication ports are fitted, the lasers are Class 1 devices but recommend they should not be viewed directly. Optical power meters should be used to determine the operation or signal level of the device.

1.4 Front Cover



The front cover provides additional securing of the relay element within the case. The relay cover should be in place during normal operating conditions.

1.5 Disposal



The Relay should be disposed of in a manner which does not provide a threat to health or the environment. All laws and regulations specific to the country of disposal should be adhered to.

The relays and protection systems manufactured under the Reyrolle brand currently do not come within the scope of either the European WEEE or RoHS directives as they are equipment making up a fixed installation.

©2018 Siemens Protection Devices Limited

Table 1.5-1 Ordering Information – 7SR21 Non-Directional Overcurrent

Product description	Variants	Order No.
		7 S R 2 1 0 - 1 A - 0 A 0
Protection Product Family		
Overcurrent - Non Directional		1
Relay Type		
		0
Case, I/O and Fascia [1)]		
E6 case, 4 CT, 9 Binary Inputs, 8 Binary Outputs, 8 LEDs		2
E8 case, 4 CT, 19 Binary Inputs, 16 Binary Outputs, 16 LEDs		3
E8 case, 4 CT, 19 Binary Inputs, 16 Binary Outputs, 8 LEDs + 6 keys		4
E12 case, 4 CT, 39 Binary Inputs / 16 Binary Outputs, 32 LEDs		5
E12 case, 4 CT, 39 Binary Inputs / 16 Binary Outputs, 16 LEDs, 12 keys		6
Measuring input		
1 A or 5 A, 50 Hz or 60 Hz		1
Auxiliary voltage		
PSU Rated: 30 to 220V DC. Binary Input threshold 19V DC (Rated: 24-250V DC)		A
PSU Rated: 30 to 220V DC. Binary Input threshold 88V DC (Rated: 110-250V DC)		B
PSU Rated: 24-250V DC / 100-230V AC. Binary Input threshold 19V DC (Rated: 24-250V DC)		M
PSU Rated: 24-250V DC / 100-230V AC. Binary Input threshold 88V DC (Rated: 110-250V DC)		N
Spare		
		A
Communication Interface		
Standard version - included in all models, USB front port, RS485 rear port		1
Standard version - plus additional rear F/O ST connectors (x2) and IRIG-B		2
Standard version - plus additional rear RS485 and IRIG-B		3
Standard version - plus additional rear RS232 and IRIG-B		4
Standard version - plus additional rear Electrical Ethernet RJ45 (x2)		7 7
Standard version - plus additional rear Optical Ethernet Duplex (x2)		8 7
Protocol		
IEC 60870-5-103 and Modbus RTU (user selectable)		1
IEC 60870-5-103 and Modbus RTU and DNP 3.0 (user selectable)		2
IEC 60870-5-103 and Modbus RTU and DNP 3.0 (user selectable) and IEC61850	7-8	7
Spare		
		0
Protection Function Packages		
Standard version - included in all models		C
37	Undercurrent	
46BC	Broken conductor/load unbalance	
46NPS	Negative phase sequence overcurrent	
49	Thermal overload	
50	Instantaneous phase fault overcurrent	
50BF	Circuit breaker fail	
50G/50N	Instantaneous earth fault/SEF	
50 AFD	Arc Flash Detector	
51	Time delayed phase fault overcurrent	
51G/51N	Time delayed earth fault/SEF	
60CTS-I	CT supervision	
64H	High impedance REF	
74TC/CCS	Trip & close circuit supervision	
81HBL2	Inrush Detector	
81HBL5	Overfluxing Detector	
86	Lockout	
	Cold load pickup	
	Programmable logic	
	CB Control	
Standard version - plus		D
79	Autoreclose	
Additional Functionality		
No additional functionality		A
Spare		
		0

Export Data
HS: 8536900
ECCN: N
AL: N

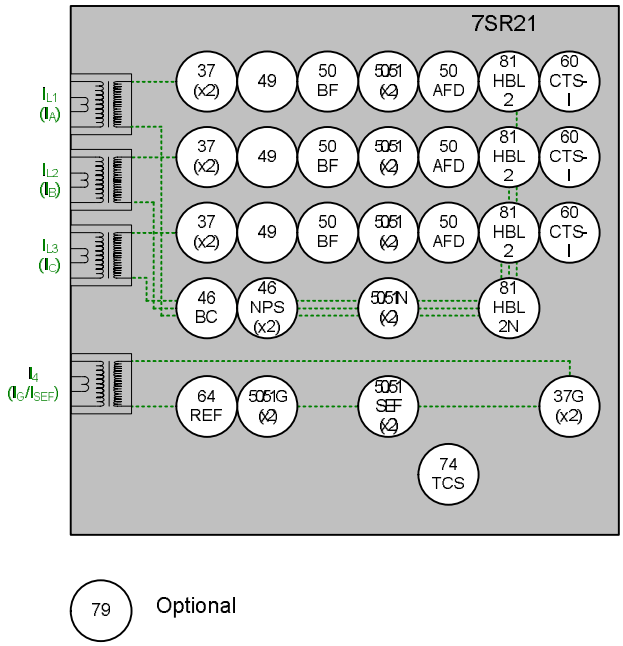
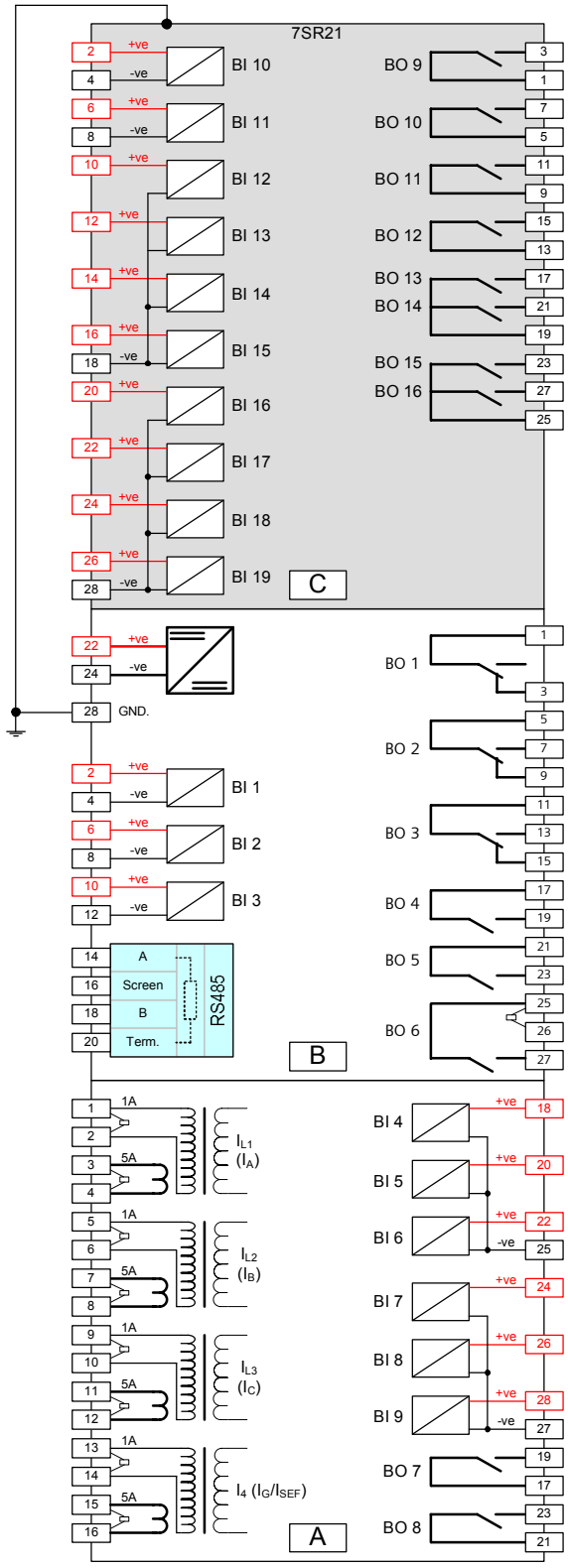
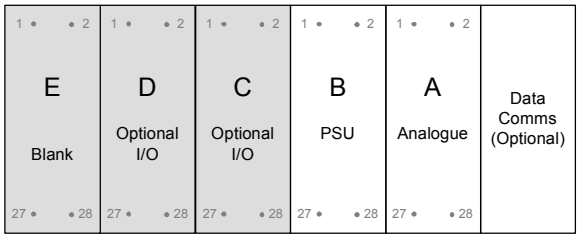
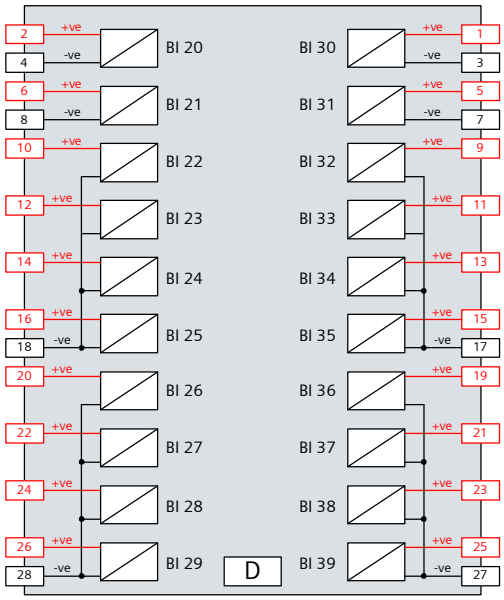


Figure 1.5-1 Functional Diagram of 7SR21 Relay



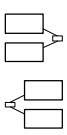


Rear View
Arrangement of terminals and modules



NOTES

BI = Binary Input
BO = Binary Output

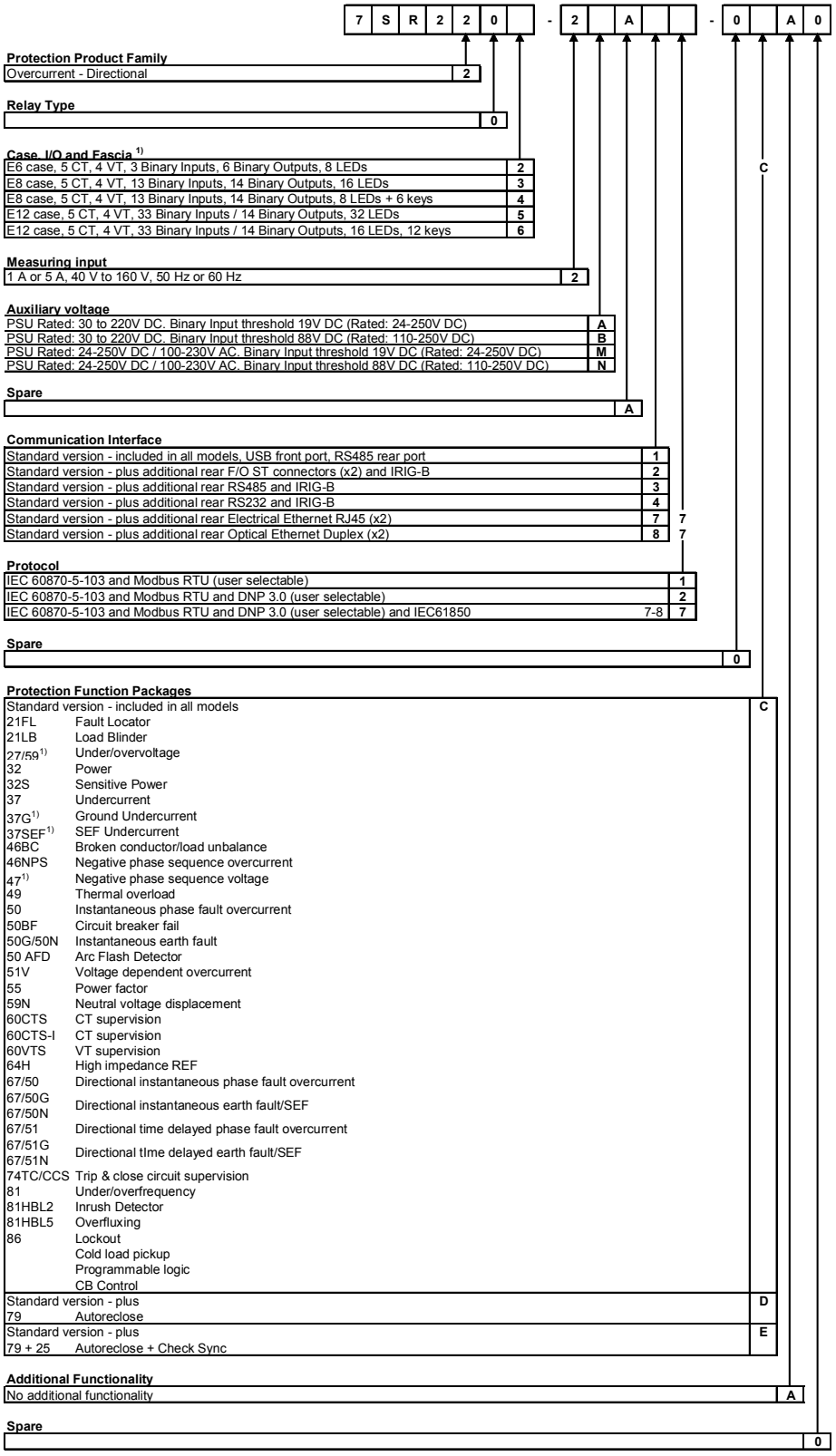


Shows contacts internal to relay case assembly.
Contacts close when the relay chassis is withdrawn from case

Figure 1.5-2 Connections Diagram for 7SR21 Relay

Table 1.5-2 Ordering Information – 7SR22 Directional Overcurrent

Product description	Variants	Order No.



1) 5CT is configured as 3PF + EF/SEF + EF/SEF (user selectable setting).

Export Data
HS: 8536900
ECCN: N
AL: N

©2018 Siemens Protection Devices Limited

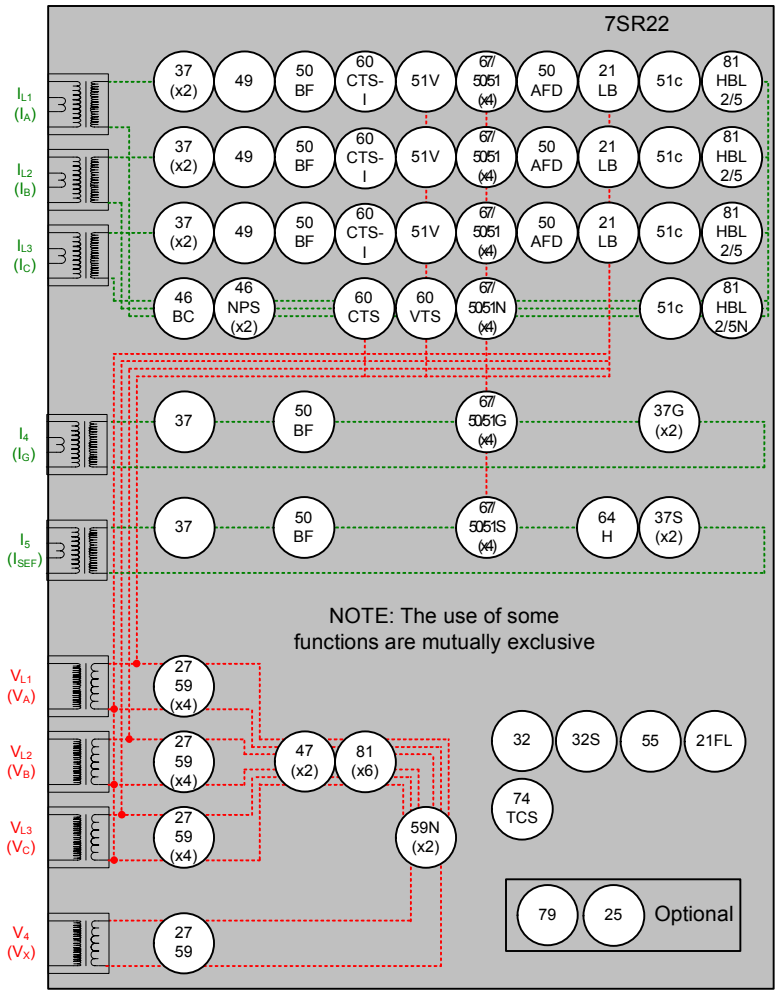
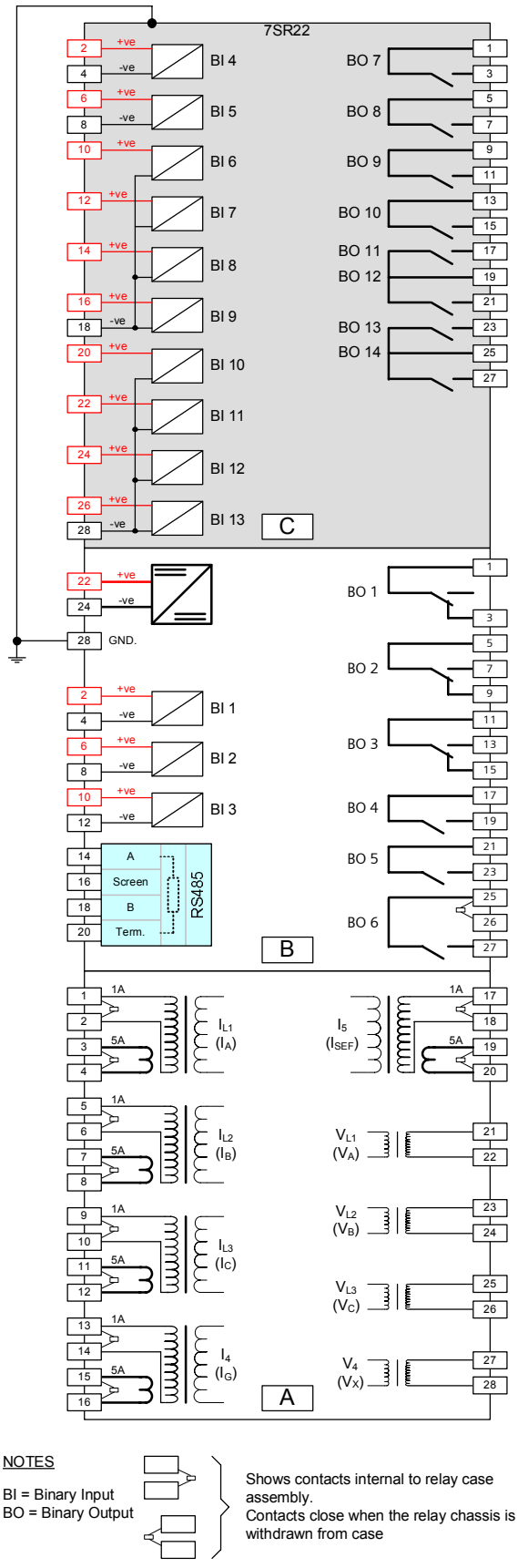


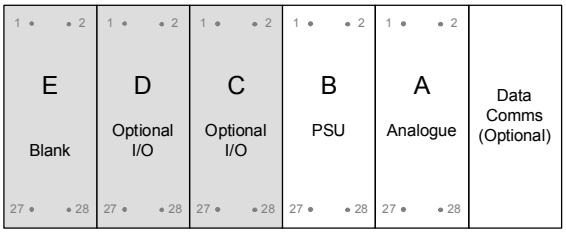
Figure 1.5-3 Functional Diagram of 7SR22 Relay



NOTES

BI = Binary Input
BO = Binary Output

Shows contacts internal to relay case assembly.
Contacts close when the relay chassis is withdrawn from case



Rear View
Arrangement of terminals and modules

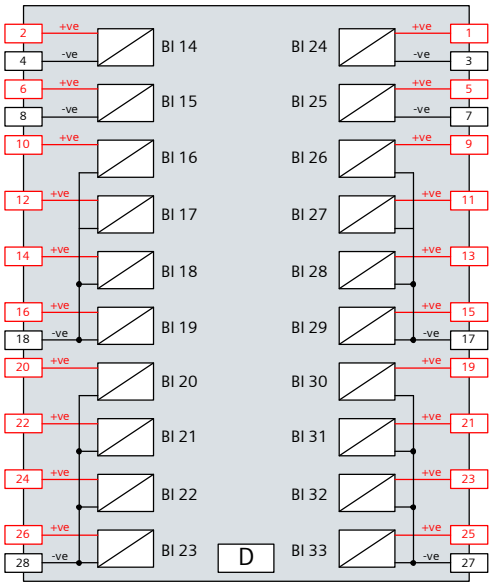


Figure 1.5-4 Connection Diagram for 7SR22 Relay

©2018 Siemens Protection Devices Limited

Section 2: Hardware Description

2.1 General

The structure of the relay is based upon the Multi-function hardware platform. The relays are supplied in either size E6 or size E8 cases (where 1 x E = width of 26 mm). The hardware design provides commonality between products and components across the Multi-function range of relays.

Table 2.1-1 Summary of Overcurrent Relay Configurations

Relay	Current Inputs	Voltage Inputs	Binary Inputs	Output Relays	LEDs	Function Keys	Case
7SR2102	4		9	8	8		E6
7SR2103	4		19	16	16		E8
7SR2104	4		19	16	8	6	E8
7SR2105	4		39	16	32		E12
7SR2106	4		39	16	16	12	E12
7SR2202	5	4	3	6	8		E6
7SR2203	5	4	13	14	16		E8
7SR2204	5	4	13	14	8	6	E8
7SR2205	5	4	33	14	32		E12
7SR2206	5	4	33	14	16	12	E12

Relays are assembled from the following modules: -

1. Front Fascia with three fixed function LEDs and ordering options of configurable LEDs/Function Keys.
2. Processor module
3. Analogue Input module, either
   - 4 x Current + 6 x Binary Inputs + 2 x Binary Outputs (7SR21), or
   - 5 x Current + 4 x Voltage (7SR22).
4. Power Supply and 3 x Binary Inputs (BI) and 6 x Binary Outputs (BO).
5. Optional Binary Input/Output Module
   - 10 x Binary Inputs + 8 x Binary Outputs
   - 20 x Binary Inputs
6. Optional Communications Module (2x rear fibre optic + 1x IRIG-B ports), (1x rear RS485 + 1x IRIG-B port), (1x rear RS232 + 1x IRIG-B port), (2x Electrical Ethernet for IEC 61850), (2x Optical Ethernet for IEC 61850).

2.2 Case

The relays are housed in cases designed to fit directly into standard panel racks. The three case options have widths of 156 mm (E6), 208 mm (E8) and 304 mm (E12), with a height of 177 mm (4U). The required panel depth (with wiring clearance) is 242 mm. An additional 75 mm depth clearance should be allowed to accommodate the bending radius of fibre optic data communications cables if fitted. Relays with IEC 61850 communications option require a depth of 261.5 mm to allow for the communication module and a clearance from devices fitted below the relay of 75 mm to accommodate fitment of the Ethernet cables.

The complete relay assembly is withdrawable from the front of the case. Contacts in the case ensure that the CT circuits remain short-circuited when the relay is removed. For the IEC 61850 variant options the rear retaining screw must be re-fitted following re-insertion to ensure relay performance claims.

The rear terminal blocks comprise M4 female terminals for wire connections. Each terminal can accept two 4 mm crimps. Located at the top rear of the case is a screw-clamp earthing point, this must be connected to the main panel earth.

2.3 Front Cover

With the transparent front cover in place the user only has access to the ▼ and **TEST/RESET►** buttons, via blue push buttons, allowing all areas of the menu system to be viewed, but preventing setting changes and control actions. The only 'action' that is permitted is to reset the Fault Data display, latched binary outputs and LEDs by using the **TEST/RESET** ▸ button. The front cover is used to secure the relay assembly in the case.

2.4 Power Supply Unit (PSU)

The relay PSU can be directly connected to any substation dc system rated from 24 V dc to 250 V dc / 100 V ac to 230 V ac.

In the event of the station battery voltage level falling below the relay minimum operating level, the PSU will automatically switch itself off and latch out – this prevents any PSU overload conditions occurring. The PSU is reset by switching the auxiliary supply off and on.

Typically the PSU is connected to the auxiliary supply via an external HRC fuse rated at 6A (BS88/IEC60259). Isolation links may also be installed in accordance with user requirements.

2.5 Operator Interface/ Fascia

The operator interface is designed to provide a user-friendly method of controlling, entering settings and retrieving data from the relay.

The warning and information labels on the relay fascia provide the following information: -



Dielectric Test Voltage 2kV



Impulse Test Above 5kV



Caution: Refer to Equipment Documentation



Caution: Risk of Electric Shock

©2018 Siemens Protection Devices Limited



Figure 2.5-1 7SR21 with 3 + 8 LEDs in E6 Case



Figure 2.5-2 7SR220 with 3 + 16 LEDs in E8 Case



Figure 2.5-3 7SR22 with Function Keys and 3 + 8 LEDs in E8 Case

NOTE: Pushbuttons on cover not shown

The fascia is an integral part of the relay. Handles are located at each side of the element to allow it to be withdrawn from the relay case.



Figure 2.5-4 7SR22 with Function Keys & 3 + 8 LEDs in E8 Case and Ethernet Communication Interface

Relay Information

Above the LCD three labels are provided, these provide the following information: -

1) Product name and order code.
2) Nominal current rating, rated frequency, voltage rating, auxiliary dc supply rating, binary input supply rating, configuration and serial number.
3) Blank label for user defined information.

A 'template' is available to allow users to create and print customised labels.

Liquid Crystal Display (LCD)

A 4-line by 20-character liquid crystal display indicates settings, instrumentation, fault data and control commands.

To conserve power the display backlighting is extinguished when no buttons are pressed for a user defined period. A setting within the "SYSTEM CONFIG" menu allows the timeout to be adjusted from 1 to 60 minutes and "Off" (backlight permanently on). Pressing any key will re-activate the display.

The LCD contrast can be adjusted using a flat blade screwdriver to turn the screw located below the contrast symbol ◑. Turning the screw clockwise increases the contrast, anti-clockwise reduces the contrast.

User defined indentifying text can be programmed into the relay using the ***System config/Relay Identifier*** setting. The 'Relay Identifier' text is displayed on the LCD display at the top level of the menu structure and is used in communication with Reydisp to identify the relay. Pressing the Cancel button several times will always return the user to this screen.

'PROTECTION HEALTHY' LED

This green LED is steadily illuminated to indicate that DC voltage has been applied to the relay power supply and that the relay is operating correctly. If the internal relay watchdog detects an internal fault then this LED will continuously flash.

 ©2018 Siemens Protection Devices Limited

'PICKUP' LED

This yellow LED is illuminated to indicate that a user selectable function(s) has picked up. The LED will self reset after the initiating condition has been removed. The same LED can be assigned two different colours dependent upon whether a Pickup (PU) or Operate condition exists.

Functions are assigned to the PICKUP LED in the OUTPUT CONFIG>PICKUP CONFIG menu.

'TRIP' LED

This red LED is steadily illuminated to indicate that a user selectable function has operated to trip the circuit breaker. Functions are assigned to the 'Trip' LED using the OUTPUT CONFIG>Trip Contacts setting.

Operation of the LED is latched and can be reset by either pressing the TEST/RESET► button, energising a suitably programmed binary input, or, by sending an appropriate command over the data communications channel(s).

Indication LEDs (Numbered 1 to 8, 1 to 16 or 1 to 32)
Relays have either 8, 16 or 32 user programmable Tri-colour (red, green or yellow) LED indicators, depending upon the variant ordered. They are configured via the menu: -

Settings\ Output Config\LED Config menu or
LED tab in Reydisp Evolution.

They can be designated as either: -

Pick-Up (PU) LEDs (they respond upon the detection of a condition i.e. overcurrent detection), or
Operation LEDs (they respond to the action of a condition i.e. CB trip operation).

Configuration options are: -

Self Reset LEDs	- automatically reset upon loss of initiating condition.
PU Self Reset LEDs	- automatically reset upon loss of initiating condition
Green LEDs	- illuminate green
Red LEDs	- illuminate red
Yellow LEDs	- illuminate yellow (when both red and green are selected)
PU Green LEDs	- illuminate green in response to the detection of a condition
PU Red LEDs	- illuminate red in response to the detection of a condition

Colour selection is achieved by checking (ticking) the appropriate box i.e. red or green. To select yellow, check both red & green boxes.

Functions are assigned to the LEDs in the OUTPUT CONFIG>OUTPUT MATRIX menu.
Each LED can be labelled by withdrawing the relay and inserting a label strip into the pocket behind the front fascia. A 'template' is available to allow users to create and print customised legends.
This can be found in: -

Reydisp Evolution\Help\Open Relay LED Template\Open RM LED Template

Each LED can be user programmed as hand or self –resetting. Hand reset LEDs can be reset by either pressing the TEST/RESET► button, energising a suitably programmed binary input, or, by sending an appropriate command over the data communications channel(s).
The status of hand reset LEDs is maintained by a back up storage capacitor in the event of an interruption to the d.c. supply voltage.

Standard Pushbuttons

The relay is supplied as standard with five pushbuttons. The buttons are used to navigate the menu structure and control relay functions. They are labelled: -

▲	Increases a setting or moves up menu.
▼	Decreases a setting or moves down menu.
TEST/RESET►	Moves right, can be used to reset selected functionality and for LED test (at relay identifier screen).
ENTER	Used to initiate and accept settings changes.
CANCEL	Used to cancel settings changes and/or move up the menu structure by one level per press.

NOTE: All settings and configuration of LEDs, BI, BO and function keys can be accessed and set by the user using these keys. Alternatively configuration/settings files can be loaded into the relay using 'Reydisp Evolution'.

Function Keys/ LEDs (Ordering Option)

Six additional programmable pushbuttons can be specified. These can be configured by the user to initiate selected functions from the Control menu (INPUT CONFIG > FUNCTION KEY MATRIX).

Each pushbutton has an associated LED. LEDs can be programmed as hand or self reset and can be illuminated as green, yellow or red (OUTPUT CONFIG > LED CONFIG).

Function keys can be used with Quick Logic.

©2018 Siemens Protection Devices Limited

2.6 Current Inputs

Four current inputs are provided in the 7SR21 relay and five inputs are provided in the 7SR22 relay. Current inputs are located on the Analogue Input module. Terminals are available for both 1 A and 5 A inputs. Current is sampled at 1600 Hz for both 50 Hz and 60 Hz system frequencies. Protection and monitoring functions of the relay use either the Fundamental Frequency RMS or the True RMS value of current appropriate to the individual function. The waveform recorder samples and displays current input waveforms at 1600 Hz.

NB: The Relay has a flat frequency response measuring harmonic currents up to and including the 50th Harmonic but does not measure the content at the aliasing frequencies i.e. 800 Hz (16th harmonic) + 1600 Hz (32nd harmonic) + 2400 Hz (48th harmonic).

2.7 Voltage Inputs

Four voltage inputs are provided in the 7SR22 relay. Voltage inputs are located on the Analogue Input module. Voltage is sampled at 1600 Hz for both 50 Hz and 60 Hz system frequencies. Protection and monitoring functions of the relay use fundamental frequency voltage measurement. The waveform recorder samples and displays voltage input waveforms at 1600 Hz.

2.8 Binary Inputs

The binary inputs are operated from a suitably rated dc supply.

Relays are fitted with 3, 9, 13, 19, 33 or 39 binary inputs (BI). The user can assign any binary input to any of the available functions (INPUT CONFIG > INPUT MATRIX).

The Power Supply module includes the relay basic I/O. The module includes 3 x BI and 6 x BO.

Non-directional (7SR21) relays have an additional 6 x BI on the analogue module.

Additional I/O modules may be fitted, these provide 10 x BI.

Pick-up (PU) and drop-off (DO) time delays are associated with each binary input. Where no pick-up time delay has been applied the input may pick up due to induced ac voltage on the wiring connections (e.g. cross site wiring). The default pick-up time of 20 ms provides ac immunity. Each input can be programmed independently.

Each input may be logically inverted to facilitate integration of the relay within the user scheme. When inverted the relay indicates that the BI is energised when no d.c. is applied. Inversion occurs before the PU & DO time delay, see fig. 2.8-1.

Each input may be mapped to any front Fascia indication LED and/or to any Binary output contact and can also be used with the internal user programmable logic. This allows the relay to provide panel indications and alarms.

The binary inputs are sampled every 5 ms.

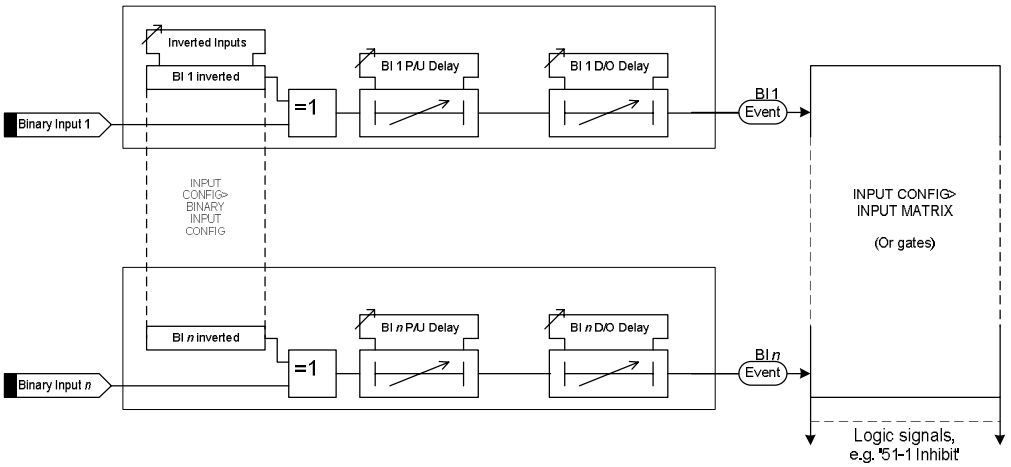


Figure 2.8-1 Binary Input Logic

2.9 Binary Outputs (Output Relays)

Relays are fitted with 6, 8, 14 or 16 binary outputs (BO). All outputs are fully user configurable and can be programmed to operate from any or all of the available functions.

The Power Supply module includes the relay basic 6 x BO contacts configured as 1 x normally closed (NC), 2 x change-over (CO) and 3 x normally open (NO) contacts.

Non-directional (7SR21) relays have two additional binary outputs providing 2 x NO contacts on the analogue module. Additional I/O modules may be fitted providing an extra 8 x NO contacts.

In the default mode of operation binary outputs are self reset and remain energised for a user configurable minimum time of up to 60 seconds. If required, outputs can be programmed to operate as ‘hand reset’ or ‘pulsed’. If the output relay is programmed to be ‘hand reset’ and ‘pulsed’ then the output will be ‘hand reset’ only.

The binary outputs can be used to operate the trip coils of the circuit breaker directly where the trip coil current does not exceed the 'make and carry' contact rating. The circuit breaker auxiliary contacts or other in-series auxiliary device must be used to break the trip coil current.

Any BO can be assigned as a ‘Trip Contact’ in the OUTPUT CONFIG>TRIP CONFIG menu. Operation of a ‘Trip Contact’ will operate any LED or virtual assigned from the trip triggered feature in the same menu and will initiate the fault record storage, actuate the ‘Trip Alert’ screen where enabled and CB Fail protection when enabled.

When the relay is withdrawn from the case all normally closed contacts will be open circuited. This should be considered in the design of the control and protection circuitry.

Notes on Pulsed Outputs

When operated, the output will reset after a user configurable time of up to 60 seconds regardless of the initiating condition.

Notes on Self Reset Outputs

Self reset operation has a minimum reset time of 100 ms.

With a failed breaker condition the relay may remain operated until current flow is interrupted by an upstream device. When the current is removed the relay will then reset and attempt to interrupt trip coil current flowing via its output contact. Where this current level is above the break rating of the output contact an auxiliary relay with heavy-duty contacts should be utilised in the primary system to avoid damage to the relay.

Notes on Hand Reset Outputs

Hand reset outputs can be reset by either pressing the **TEST/RESET►** button, by energising a suitably programmed binary input, or, by sending an appropriate command over the data communications channel(s).

On loss of the auxiliary supply hand-reset outputs will reset. When the auxiliary supply is re-established the binary output will remain in the reset state unless the initiating condition is still present.

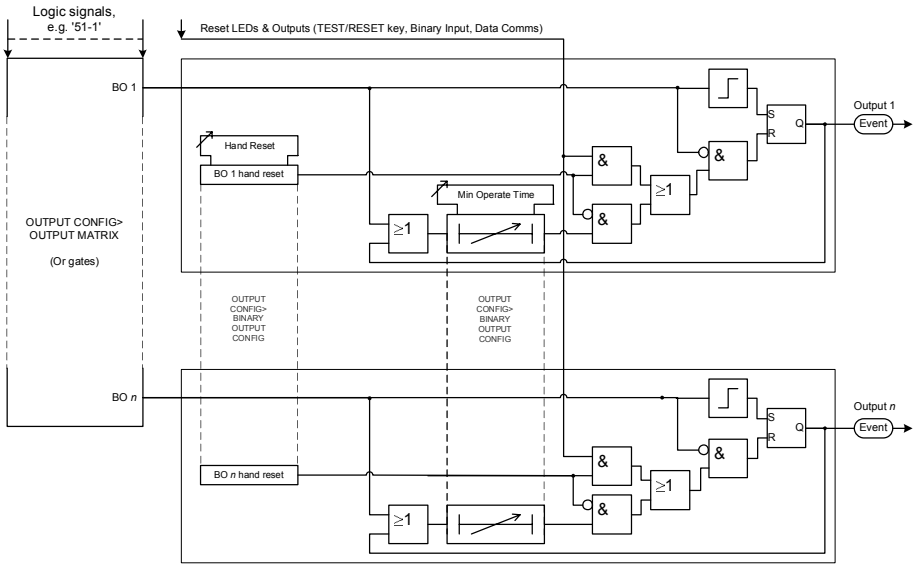


Figure 2.9-1 Binary Output Logic

 ©2018 Siemens Protection Devices Limited

2.10 Virtual Input/Outputs

The relays have 16 virtual input/outputs, these are internal logic states. Virtual I/O is assigned in the same way as physical Binary Inputs and Binary Outputs. Virtual I/O is mapped from within the INPUT CONFIG > INPUT MATRIX and OUTPUT CONFIG > OUTPUT MATRIX menus.

The status of the virtual inputs and outputs is volatile i.e. not stored during power loss.

2.11 Self Monitoring

The relay incorporates a number of self-monitoring features. Each of these features can initiate a controlled reset recovery sequence.

Supervision includes a power supply watchdog, code execution watchdog, memory checks by checksum and processor/ADC health checks. When all checks indicate the relay is operating correctly the 'Protection Healthy' LED is illuminated.

If an internal failure is detected, a message will be displayed. The relay will reset in an attempt to rectify the failure. This will result in de-energisation of any binary output mapped to 'protection healthy' and flashing of the protection healthy LED. If a successful reset is achieved by the relay the LED and output contact will revert back to normal operational mode, and the relay will restart, therefore ensuring the circuit is protected for the maximum time.

A Start-up Counter Meter is provided to display the number of start-ups the relay has performed. Once the number of start-ups has exceeded a set number, an Alarm output can be given.



Figure 2.11-1 Start-up Counter Meter

Reset of the counter can be done from the meter or via a binary input or a command.

Various types of start-up are monitored by the relay:

1. **power-on starts** (auxiliary supply initiation)
2. **expected starts** (user initiated via comms, language changes, custom protection curve etc.)
3. **unexpected starts** (caused by the relay watchdog)

Any combination of these can be selected for the start-up count. This is done in the MAINTENANCE MENU>START COUNT menu using the ***Start Up Types*** setting. All the start-up types selected will be added to the overall start-up count.

The number of restarts before the alarm output is raised is set in the MAINTENANCE MENU>START COUNT menu using the ***Start Up Count Target*** setting.

When the number of relay start-ups reaches the target value an output is raised, OUTPUT MATRIX>***Start Up Count Alarm***, which can be programmed to any combination of binary outputs, LED's or virtual outputs.

As a further safeguard, if the Relay performs a number of unexpected starts **SYSTEM CONFIG>*Unexpected Restart Count*** in a given time **SYSTEM CONFIG>*Unexpected Restart Period***, it can be configured using the **SYSTEM CONFIG>*Unexpected Restart Blocking*** setting to remove itself from service. In this case the Relay will display a typical error message such as: -



Figure 2.11-2 Start-up Counter Meter

The relay will enter a locked-out mode, while in this mode it will disable operation of all LED's, Binary Outputs, including Protection Healthy, pushbuttons and any data communications activity. Once the Relay has failed in this manner, it is non-recoverable at site and must be returned to the manufacturer for repair.

A meter, Miscellaneous Meters>Unexpected Restarts, is provided to show how many Unexpected Restarts have occurred during the previous Unexpected Restart Period. This is resettable from the front fascia.

The following screen-shot shows the events, which are generated when the relay re-starts. The highlighted events show the cause of the re-start. The event which comes next shows the type of restart followed by the relay: Warm, Cold or Re-Start.

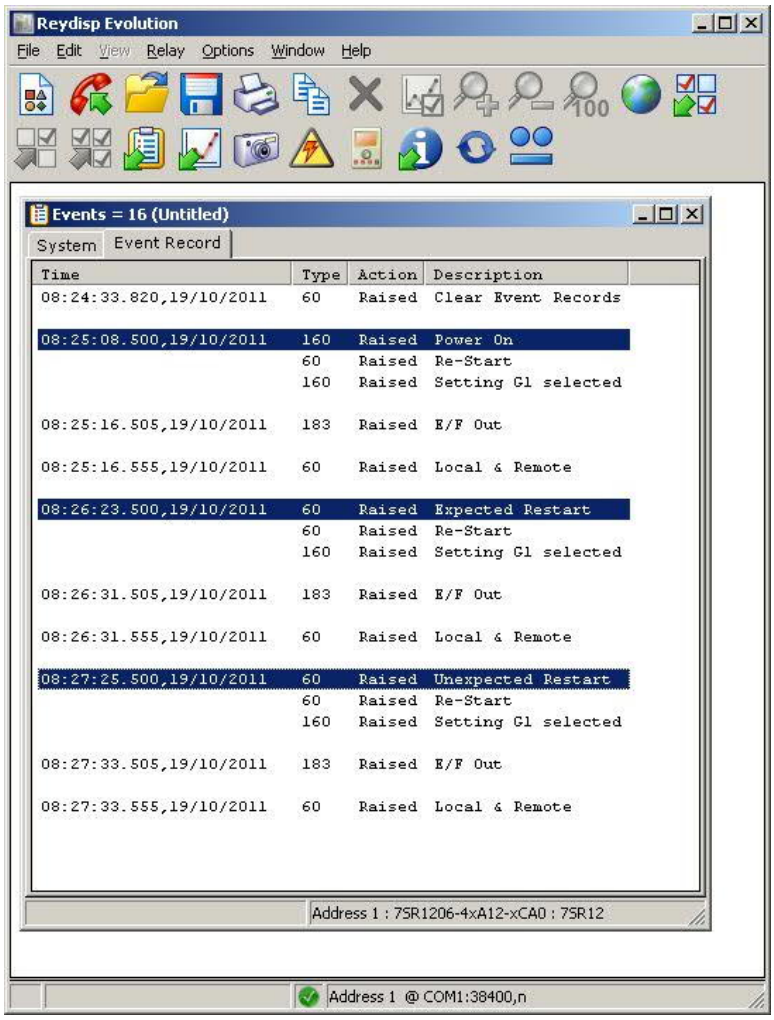


Figure 2.11-3 Start-up Counter Meter Events

2.11.1 Protection Healthy/Defective

When the relay has an auxiliary DC supply and it has successfully passed its self-checking procedure then the front facia Protection Healthy LED is turned on.

A normally open contact can be used to signal protection healthy. When the relay has DC supply and it has successfully passed its self-checking procedure then the Protection Healthy contacts are made.

A changeover or normally closed contact can be mapped via the binary output matrix to provide an external protection defective signal. With the 'Protection Healthy' this contact is open. When the auxiliary DC supply is not applied to the relay or a problem is detected within the relay then this output contact closes to provide external indication.

An alarm can be provided if the relay is withdrawn from the case. A contact is provided in the case at positions 25-26 of the PSU module, this contact closes when the relay is withdrawn.

 ©2018 Siemens Protection Devices Limited

Section 3: Protection Functions

3.1 Current Protection: Phase Overcurrent (67, 51, 50)

All phase overcurrent elements can be set to measure either fundamental frequency RMS or True RMS current i.e.

True RMS current: -	***50 Measurement* = RMS**
	***51 Measurement* = RMS**
Fundamental Frequency RMS current: -	***50 Measurement* = Fundamental**
	***51 Measurement* = Fundamental**

3.1.1 Directional Control of Overcurrent Protection (67) – 7SR22

The directional element produces forward and reverse outputs for use with overcurrent elements. These outputs can then be mapped as controls to each shaped and instantaneous over-current element.

If a protection element is set as non-directional then it will operate independently of the output of the directional detector. However, if a protection element is programmed for forward directional mode then operation will occur only for a fault lying within the forward operate zone. Conversely, if a protection element is programmed for reverse directional mode then operation will occur only for a fault lying within the reverse operate zone. Typically the forward direction is defined as being 'away' from the busbar or towards the protected zone.

The Characteristic angle is the phase angle by which the polarising voltage must be adjusted such that the directional detector gives maximum sensitivity in the forward operate zone when the current is in phase with it. The reverse operate zone is the mirror image of the forward zone.

Voltage polarisation is achieved for the phase-fault elements using the quadrature voltage i.e. at unity power factor I leads V by 90°. Each phase current is compared to the voltage between the other two phases: -

$$I_{L1} \sim V_{23} \qquad I_{L2} \sim V_{31} \qquad I_{L3} \sim V_{12}$$

The characteristic angle can be user programmed to any angle between -95° and +95° using the ***67 Char Angle*** setting. The voltage is the reference phasor (V_{ref}) and the ***67 Char Angle*** setting is added to this to adjust the forward and reverse zones.

The centre of the forward zone is set by (V_{ref} Angle + ***67 Char Angle***) and should be set to correspond with I_{fault} Angle for maximum sensitivity i.e.

For fault current of -60° (I lagging V by 60°) a ***67 Char Angle*** of **+30°** is required for maximum sensitivity (i.e. due to quadrature connection 90° - 60° = 30°)

OR

For fault current of -45° (I lagging V by 45°) a ***67 Char Angle*** of **+45°** is required for maximum sensitivity (i.e. due to quadrature connection 90° - 45° = 45°).

Two-out-of-three Gate

When the ***67 2-Out-Of-3 Logic*** setting is set to **Enabled**, the directional elements will only operate for the majority direction, e.g. if I_{L1} and I_{L3} are detected as forward flowing currents and I_{L2} is detected as reverse current flow, phases L1 and L3 will operate forwards, while phase L2 will be inhibited.

Minimum Polarising Voltage

The ***67 Minimum Voltage*** setting defines the minimum polarising voltage level. Where the measured polarising voltage is below this level no directional output is given and operation of protection elements set as directional will be inhibited. This prevents mal-operation under fuse failure/MCB tripped conditions where noise voltages can be present.

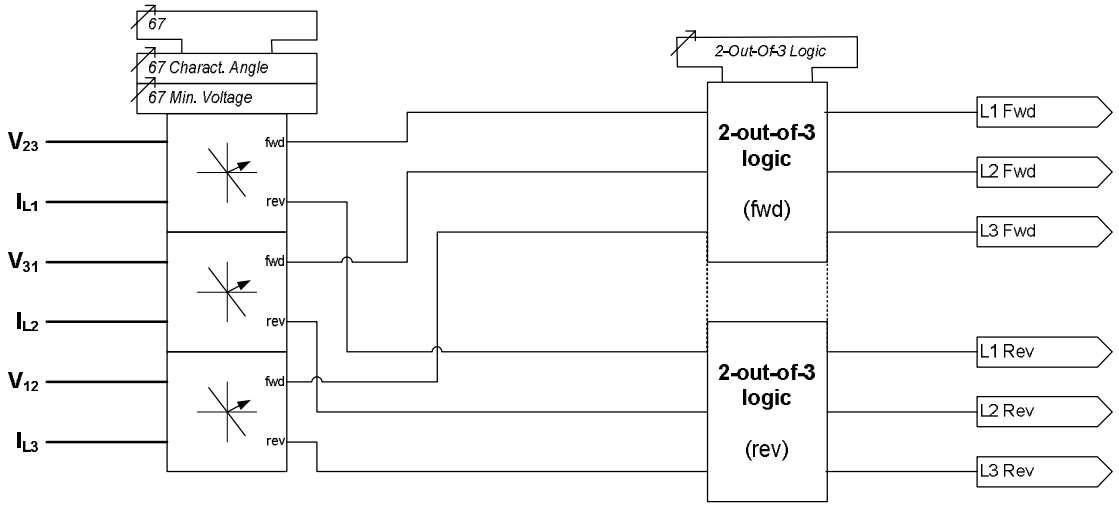


Figure 3.1.1-1 Logic Diagram: Directional Overcurrent Element (67)

©2018 Siemens Protection Devices Limited

3.1.2 Instantaneous Overcurrent Protection (50)

Two instantaneous overcurrent elements are provided in the 7SR21 relay. Four elements are provided in the 7SR22 e.g. giving the option of using two elements set to forward and two to reverse.

Each instantaneous element (50-n) has independent settings. ***50-n Setting*** for pick-up current and ***50-n Delay*** follower time delay. The instantaneous elements have transient free operation.

Where directional elements are present the direction of operation can be set using ***50-n Dir. Control*** setting. Directional logic is provided independently for each 50-n element.

Operation of the instantaneous overcurrent elements can be inhibited from:

Inhibit 50-n	A binary input, virtual input, function key or remote data Comms.
79 P/F Inst Trips: **50-n**	When 'delayed' trips only are allowed in the auto-reclose sequence (***79 P/F Prot'n Trip n*** = **Delayed**).
50-n Inrush Action: **Inhibit**	Operation of the inrush current detector function.
50-n VTS Action: **Inhibit**	Operation of the VT Supervision function (7SR22).

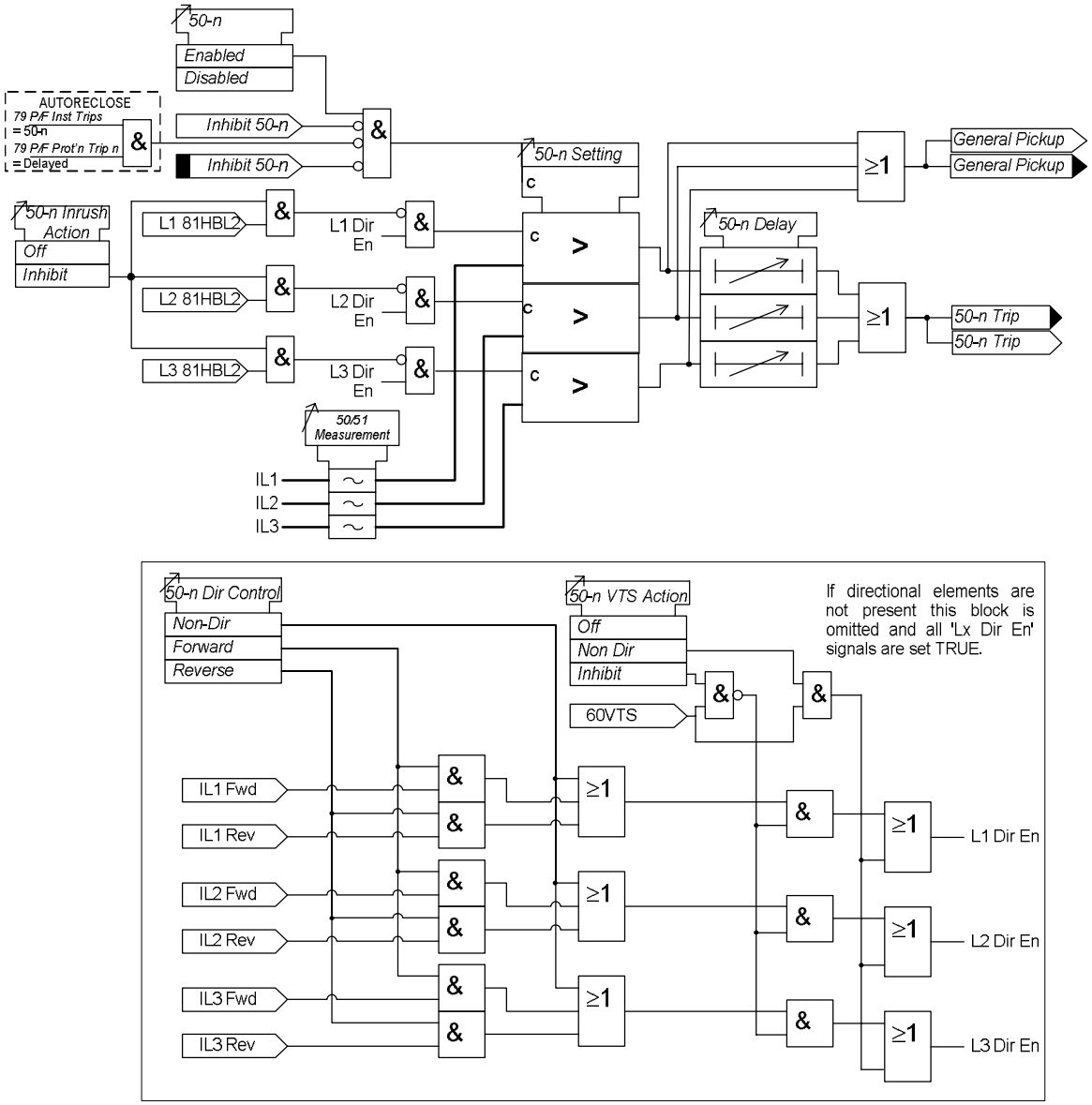


Figure 3.1.2-1 Logic Diagram: Instantaneous Over-current Element

3.1.3 Time Delayed Overcurrent Protection (51)

Two time delayed overcurrent elements are provided in the 7SR21 relay. Four elements are provided in the 7SR22 relay e.g. giving the option of using two elements set to forward and two to reverse.

51-n Setting sets the pick-up current level. Where the voltage controlled overcurrent function (51VCO) is used (7SR22 relays only) a multiplier is applied to this setting where the voltage drops below the setting ***VCO Setting***, see section 3.2.

A number of shaped characteristics are provided. An inverse definite minimum time (IDMT) characteristic is selected from IEC and ANSI curves using ***51-n Char***. A time multiplier is applied to the characteristic curves using the ***51-n Time Mult*** setting. Alternatively, a definite time lag delay (DTL) can be chosen using ***51-n Char***. When Delay (DTL) is selected the time multiplier is not applied and the ***51-n Delay (DTL)*** setting is used instead.

The ***51-n Reset*** setting can apply a **definite time delayed** reset**,** or when configured as an ANSI characteristic an **ANSI (DECAYING)** reset. If ANSI (DECAYING) reset is selected for an IEC characteristic, the reset will be instantaneous. The reset mode is significant where the characteristic has reset before issuing a trip output – see 'Applications Guide'.

A minimum operate time for the characteristic can be set using ***51-n Min. Operate Time*** setting.

A fixed additional operate time can be added to the characteristic using ***51-n Follower DTL*** setting.

Where directional elements are present the direction of operation can be set using ***51-n Dir. Control*** setting. Directional logic is provided independently for each 51-n element.

Operation of the time delayed overcurrent elements can be inhibited from: -

Inhibit 51-n	A binary input, virtual input, function key or remote data Comms
79 P/F Inst Trips: **51-n**	When 'delayed' trips only are allowed in the auto-reclose sequence (***79 P/F Prot'n Trip n*** = **Delayed**).
51c	Activation of the cold load settings (see section 3.7).
51-n Inrush Action: **Inhibit**	Operation of the inrush current detector function.
51-n VTSAction: **Inhibit**	Operation of the VT Supervision function (7SR22).

©2018 Siemens Protection Devices Limited

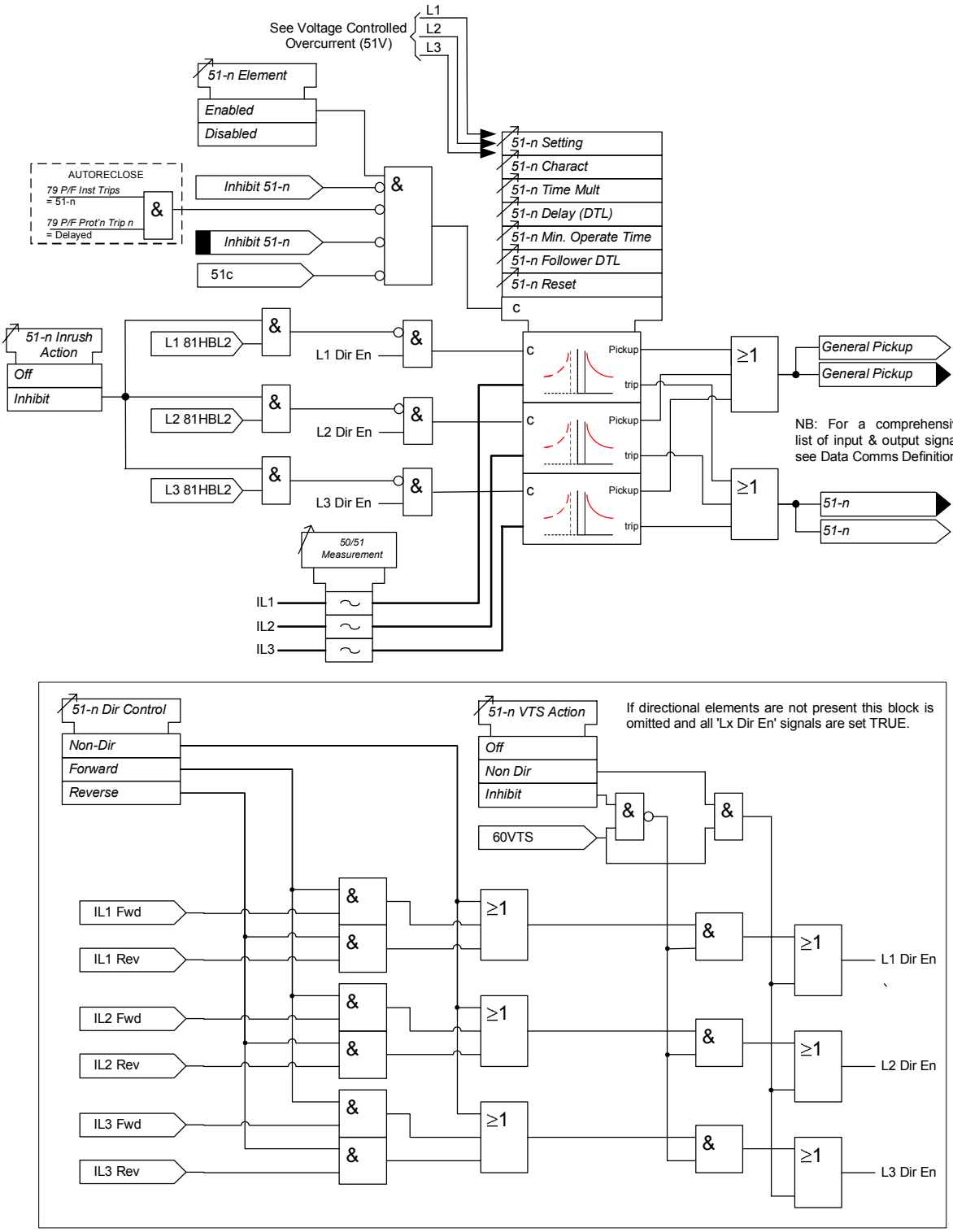


Figure 3.1.3-1 Logic Diagram: Time Delayed Overcurrent Element

3.2 Current Protection: Voltage Controlled Overcurrent (51V) – 7SR22

Voltage controlled overcurrent is available in the 7SR22 relay.

Each shaped overcurrent element ***51-n Setting*** can be independently controlled by the level of measured (control) input voltage.

For applied voltages above ***VCO Setting*** the 51-n element operates in accordance with its normal current setting (see 3.1.3). For input Ph-Ph control voltages below ***VCO Setting*** a multiplier (***51-n Multiplier***) is applied to reduce the 51-n pickup current setting.

51-n Multiplier is applied to each phase independently when its control phase-phase voltage falls below ***VCO Setting.*** The voltage levels used for each phase over-current element are shown in the table below. Relays with a Ph-N connection automatically calculate the correct Ph-Ph control voltage.

Current Element	Control Voltage
I_{L1}	V_{12}
I_{L2}	V_{23}
I_{L3}	V_{31}

The Voltage Controlled Overcurrent function (51V) can be inhibited from: -

VCO VTSAction: **Inhibit** Operation of the VT Supervision function.

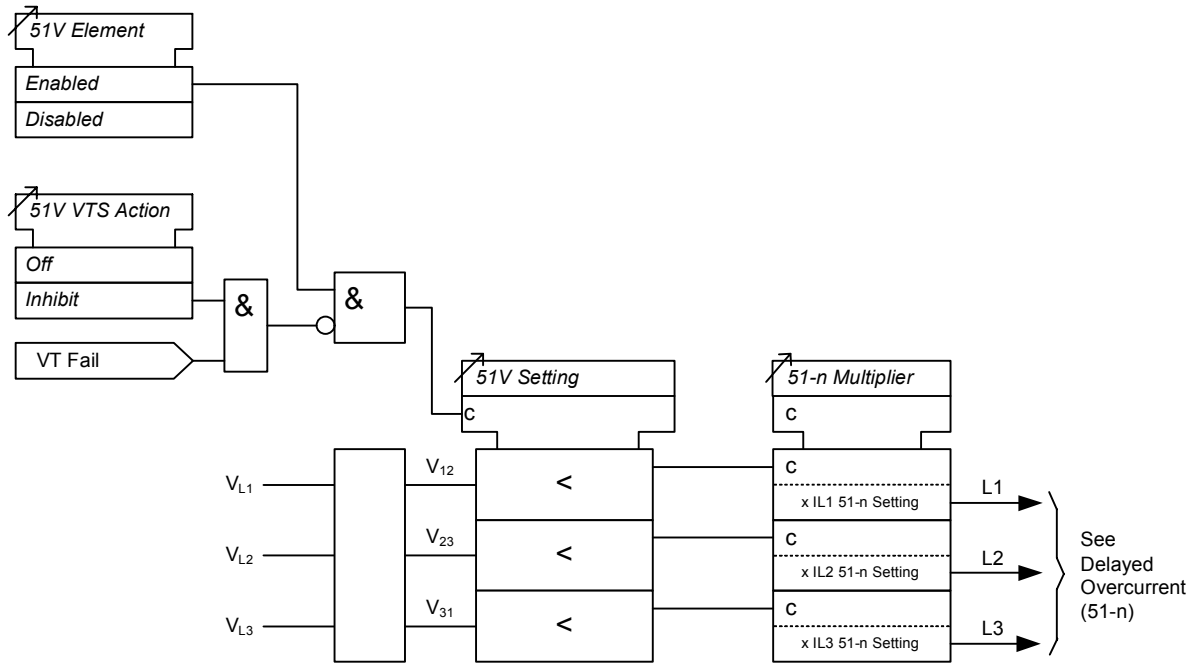


Figure 3.2-1 Logic Diagram: Voltage Controlled Overcurrent Protection

©2018 Siemens Protection Devices Limited

3.3 Current Protection: Derived Earth Fault (67N, 51N, 50N)

The earth current is derived by calculating the sum of the measured line currents. The elements measure the fundamental frequency RMS current.

3.3.1 Directional Control of Derived Earth Fault Protection (67N) – 7SR22

The directional element produces forward and reverse outputs for use with derived earth fault elements. These outputs can be mapped as controls to each shaped and instantaneous element.

If a protection element is set as non-directional then it will operate independently of the output of the directional detector. However, if a protection element is programmed for forward directional mode then operation will occur only for a fault lying within the forward operate zone. Conversely, if a protection element is programmed for reverse directional mode then operation will occur only for a fault lying within the reverse operate zone. Typically the forward direction is defined as being 'away' from the busbar or towards the protected zone.

The Characteristic angle is the phase angle by which the polarising voltage must be adjusted such that the directional detector gives maximum sensitivity in the forward operate zone when the current is in phase with it. The reverse operate zone is the mirror image of the forward zone.

The derived directional earth fault elements can use either zero phase sequence (ZPS) or negative phase sequence (NPS) polarising. This is selected using the ***67N Polarising Quantity*** setting. Whenever a zero-sequence voltage is available (a five-limb VT that can provide a zero sequence path or an open-delta VT connection) the earth-fault element can use zero-sequence voltage and current for polarisation. If zero-sequence polarising voltage is not available e.g. when a two phase (phase to phase) connected VT is installed, then negative-sequence voltage and negative-sequence currents must be used. The type of VT connection is specified by ***Voltage Config*** (CT/VT CONFIG menu). Settings advice is given in the Applications Guide.

Voltage polarisation is achieved for the earth-fault elements by comparison of the appropriate current with its equivalent voltage: -

***67N Polarising Quantity*: ZPS** $I_0 \sim V_0$

***67N Polarising Quantity*: NPS** $I_2 \sim V_2$

The characteristic angle can be user programmed to any angle between -95° and +95° using the ***67N Char Angle*** setting. The voltage is the reference phasor (V_{ref}) and the ***67N Char Angle*** setting is added to this to adjust the forward and reverse zones.

The centre of the forward zone is set by (V_{ref} Angle + ***67N Char Angle***) and should be set to correspond with I_{fault} Angle for maximum sensitivity e.g.

For fault current of -15° (I lagging V by 15°) a ***67N Char Angle*** of **-15°** is required for maximum sensitivity

OR

For fault current of -45° (I lagging V by 45°) a ***67 Char Angle*** of **-45°** is required for maximum sensitivity.

Minimum Polarising Voltage

The ***67N Minimum Voltage*** setting defines the minimum polarising voltage level. Where the measured polarising voltage is below this level no directional output is given and operation of protection elements set as directional will be inhibited. This prevents mal-operation under fuse failure/MCB tripped conditions where noise voltages can be present.

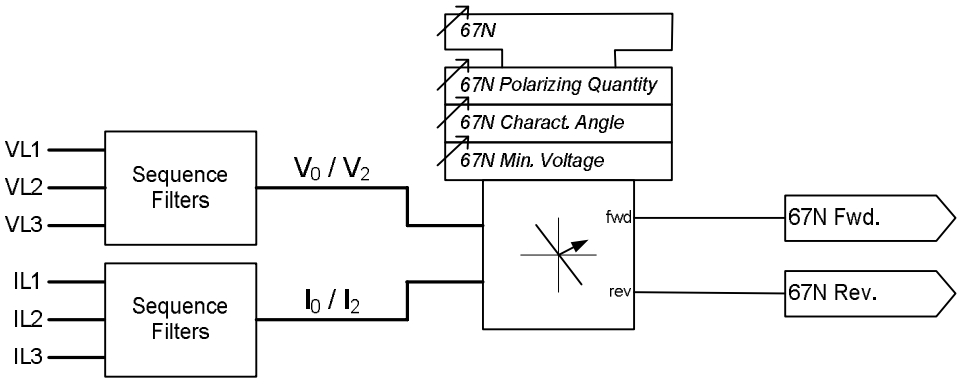


Figure 3.3.1-1 Logic Diagram: Derived Directional Earth Fault Element

3.3.2 Instantaneous Derived Earth Fault Protection (50N)

Two instantaneous derived earth fault elements are provided in the 7SR21 relay. Four elements are provided in the 7SR22 relay e.g. giving the option of using two elements set to forward and two to reverse.

Each instantaneous element has independent settings for pick-up current ***50N-n Setting*** and a follower time delay ***50N-n Delay***. The instantaneous elements have transient free operation.

Where directional elements are present the direction of operation can be set using ***50N-n Dir. Control*** setting. Directional logic is provided independently for each 50-n element.

Operation of the instantaneous earth fault elements can be inhibited from: -

Inhibit 50N-n	A binary input, virtual input, function key or remote data Comms.
79 E/F Inst Trips: **50N-n**	When 'delayed' trips only are allowed in the auto-reclose sequence (***79 E/F Prot'n Trip n*** = **Delayed**).
50N-n VTSAction: **Inhibit**	Operation of the VT Supervision function (7SR22).
50N-n Inrush Action: **Inhibit**	Operation of the current inrush detector function.

 ©2018 Siemens Protection Devices Limited

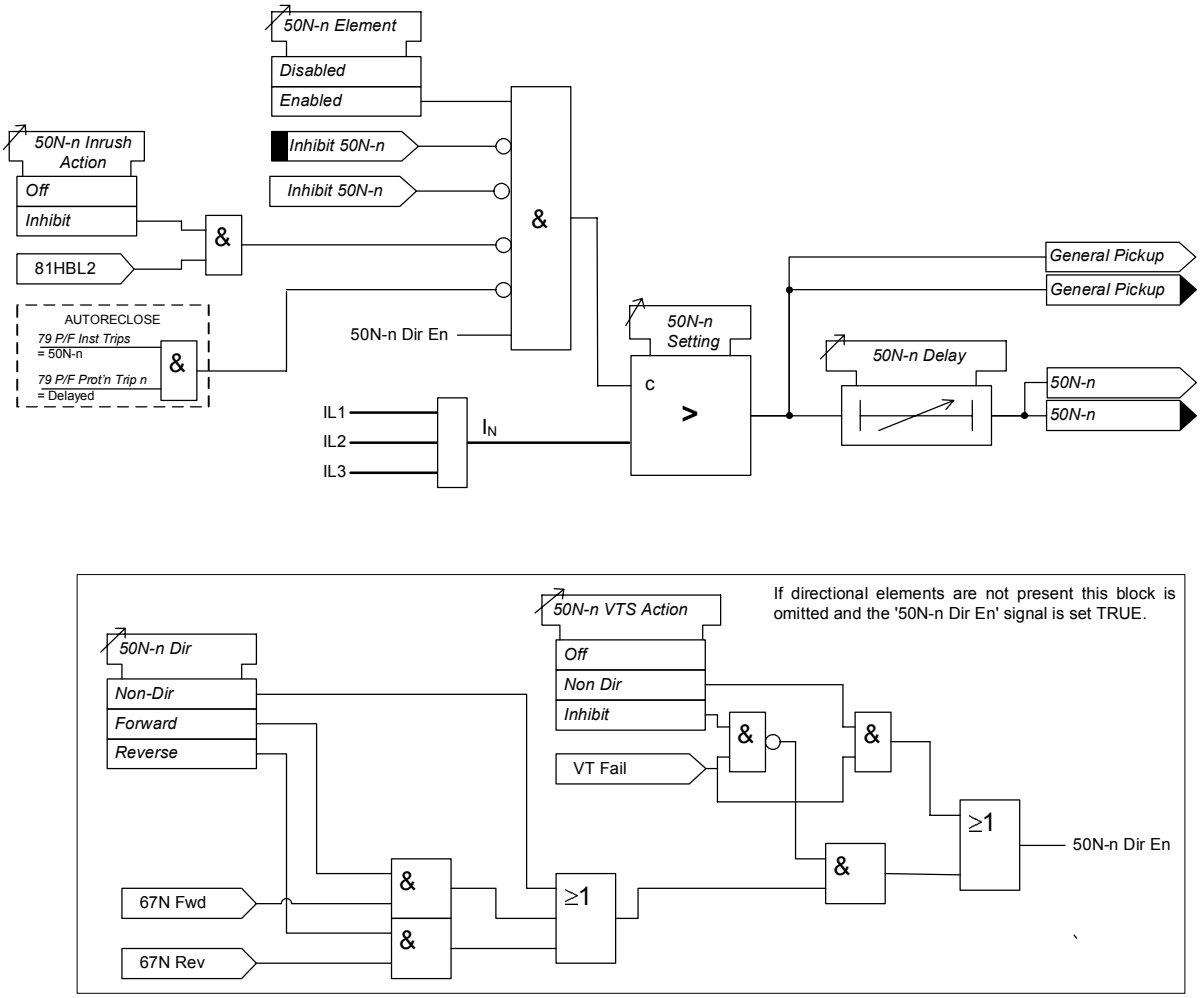


Figure 3.3.2-1 Logic Diagram: Derived Instantaneous Earth Fault Element

3.3.3 Time Delayed Derived Earth Fault Protection (51N)

Two time-delayed derived earth fault elements are provided in the 7SR21 relay. Four elements are provided in the 7SR22 relay e.g. giving the option of using two elements set to forward and two to reverse.

51N-n Setting sets the pick-up current level.

A number of shaped characteristics are provided. An inverse definite minimum time (IDMT) characteristic is selected from IEC and ANSI curves using ***51N-n Char***. A time multiplier is applied to the characteristic curves using the ***51N-n Time Mult*** setting. Alternatively, a definite time lag delay (DTL) can be chosen using ***51N-n Char***. When Delay (DTL) is selected the time multiplier is not applied and the ***51N-n Delay (DTL)*** setting is used instead.

The ***51N-n Reset*** setting can apply a **definite time delayed** reset**,** or when configured as an ANSI characteristic an **ANSI (DECAYING)** reset. If ANSI (DECAYING) reset is selected for an IEC characteristic, the reset will be instantaneous. The reset mode is significant where the characteristic has reset before issuing a trip output – see 'Applications Guide'.

A minimum operate time for the characteristic can be set using the ***51N-n Min. Operate Time*** setting.

A fixed additional operate time can be added to the characteristic using the ***51N-n Follower DTL*** setting.

Where directional elements are present the direction of operation can be set using ***51N-n Dir. Control*** setting. Directional logic is provided independently for each 51N-n element.

Operation of the time delayed earth fault elements can be inhibited from: -

Inhibit 51N-n	A binary or virtual input, function key or remote data Comms.
79 E/F Inst Trips: **51N-n**	When 'delayed' trips only are allowed in the auto-reclose sequence (***79 E/F Prot'n Trip n*** = **Delayed**).
51N-n Inrush Action: **Inhibit**	Operation of the current inrush detector function.
51N-n VTSAction: **Inhibit**	Operation of the VT Supervision function (7SR22).

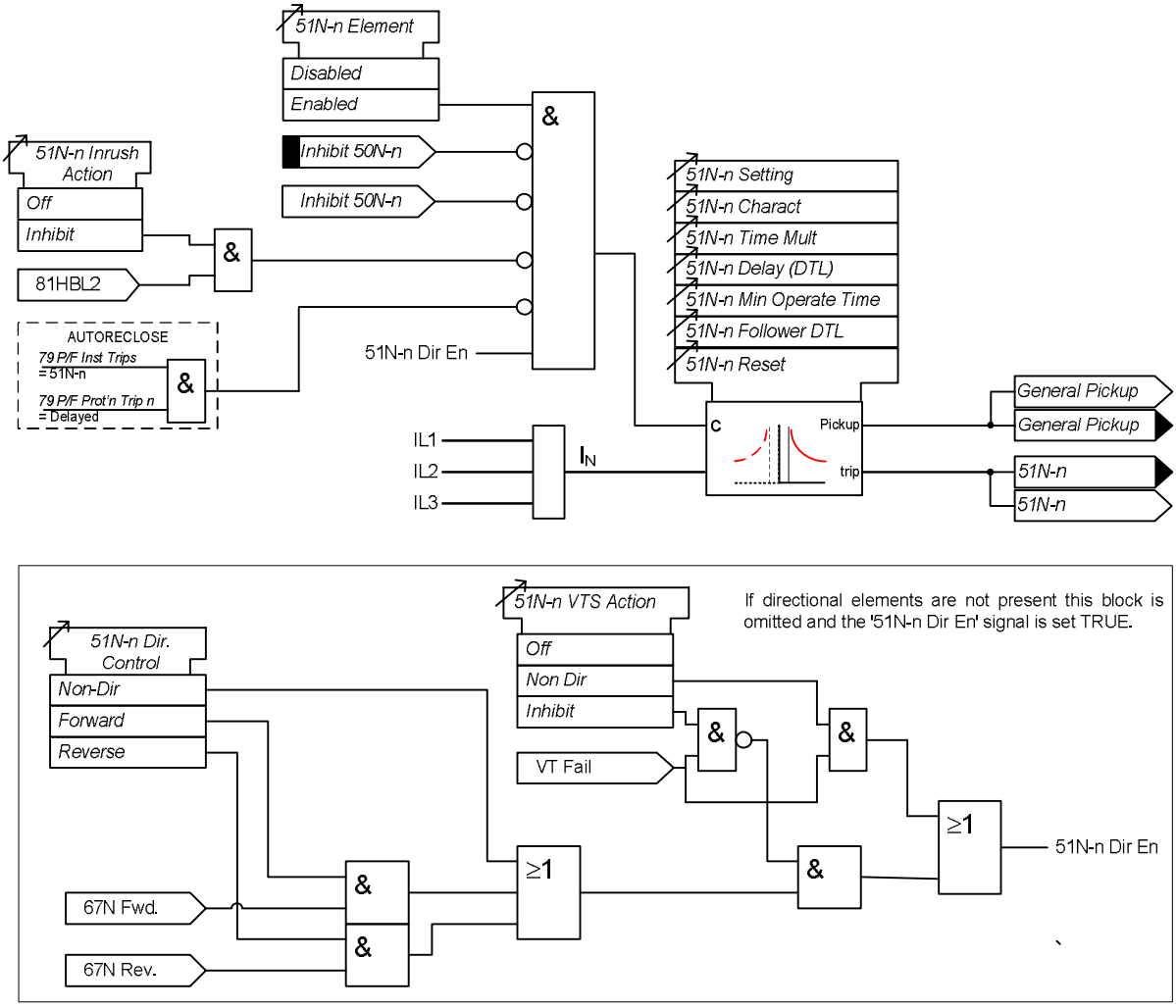


Figure 3.3.3-1 Logic Diagram: Derived Time Delayed Earth Fault Protection

©2018 Siemens Protection Devices Limited

3.4 Current Protection: Measured Earth Fault (67G, 51G, 50G)

The earth current is measured directly via a dedicated current analogue input.

All phase overcurrent elements can be set to measure either fundamental frequency RMS or True RMS current i.e.

True RMS current: -	***50 Measurement* = RMS**
	***51 Measurement* = RMS**
Fundamental Frequency RMS current: -	***50 Measurement* = Fundamental**
	***51 Measurement* = Fundamental**

3.4.1 Directional Control of Measured Earth Fault Protection (67G) – 7SR22

The directional element produces forward and reverse outputs for use with measured earth fault elements. These outputs can be mapped as controls to each shaped and instantaneous element.

If a protection element is set as non-directional then it will operate independently of the output of the directional detector. However, if a protection element is programmed for forward directional mode then operation will occur only for a fault lying within the forward operate zone. Conversely, if a protection element is programmed for reverse directional mode then operation will occur only for a fault lying within the reverse operate zone. Typically the forward direction is defined as being 'away' from the busbar or towards the protected zone.

The Characteristic angle is the phase angle by which the polarising voltage must be adjusted such that the directional detector gives maximum sensitivity in the forward operate zone when the current is in phase with it. The reverse operate zone is the mirror image of the forward zone.

The measured directional earth fault elements use zero phase sequence (ZPS) polarising.

Voltage polarisation is achieved for the earth-fault elements by comparison of the appropriate current with its equivalent voltage: -

$I_0 \sim V_0$

The characteristic angle can be user programmed to any angle between -95° and +95° using the ***67G Char Angle*** setting. The voltage is the reference phasor (V_{ref}) and the ***67G Char Angle*** setting is added to this to adjust the forward and reverse zones.

The centre of the forward zone is set by (V_{ref} Angle + ***67G Char Angle***) and should be set to correspond with I_{fault} Angle for maximum sensitivity e.g.

For fault current of -15° (I lagging V by 15°) a ***67G Char Angle*** of **-15°** is required for maximum sensitivity, OR

For fault current of -45° (I lagging V by 45°) a ***67G Char Angle*** of **-45°** is required for maximum sensitivity.

Minimum Polarising Voltage

The ***67G Minimum Voltage*** setting defines the minimum polarising voltage level. Where the measured polarising voltage is below this level no directional output is given and. Operation of protection elements set as directional will be inhibited. This prevents mal-operation under fuse failure/MCB tripped conditions where noise voltages can be present.

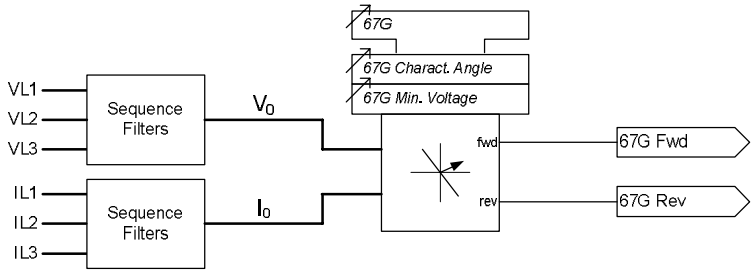


Figure 3.4.1-1 Logic Diagram: Measured Directional Earth Fault Protection

3.4.2 Instantaneous Measured Earth Fault Protection (50G)

Two instantaneous measured earth fault elements are provided in the 7SR21 relay. Four elements are provided in the 7SR22 relay e.g. giving the option of using two elements set to forward and two to reverse.

Each instantaneous element has independent settings for pick-up current ***50G-n Setting*** and a follower time delay ***50G-n Delay***. The instantaneous elements have transient free operation.

Where directional elements are present the direction of operation can be set using ***50G-n Dir. Control*** setting. Directional logic is provided independently for each 50G-n element.

Operation of the instantaneous measured earth fault elements can be inhibited from: -

Inhibit 50G-n	A binary or virtual input, function key or remote data Comms.
79 E/F Inst Trips: **50G-n**	When 'delayed' trips only are allowed in the auto-reclose sequence (***79 E/F Prot'n Trip n*** = **Delayed**).
50G-n Inrush Action: **Inhibit**	Operation of the current inrush detector function.
50G-n VTSAction: **Inhibit**	Operation of the VT Supervision function (7SR22).

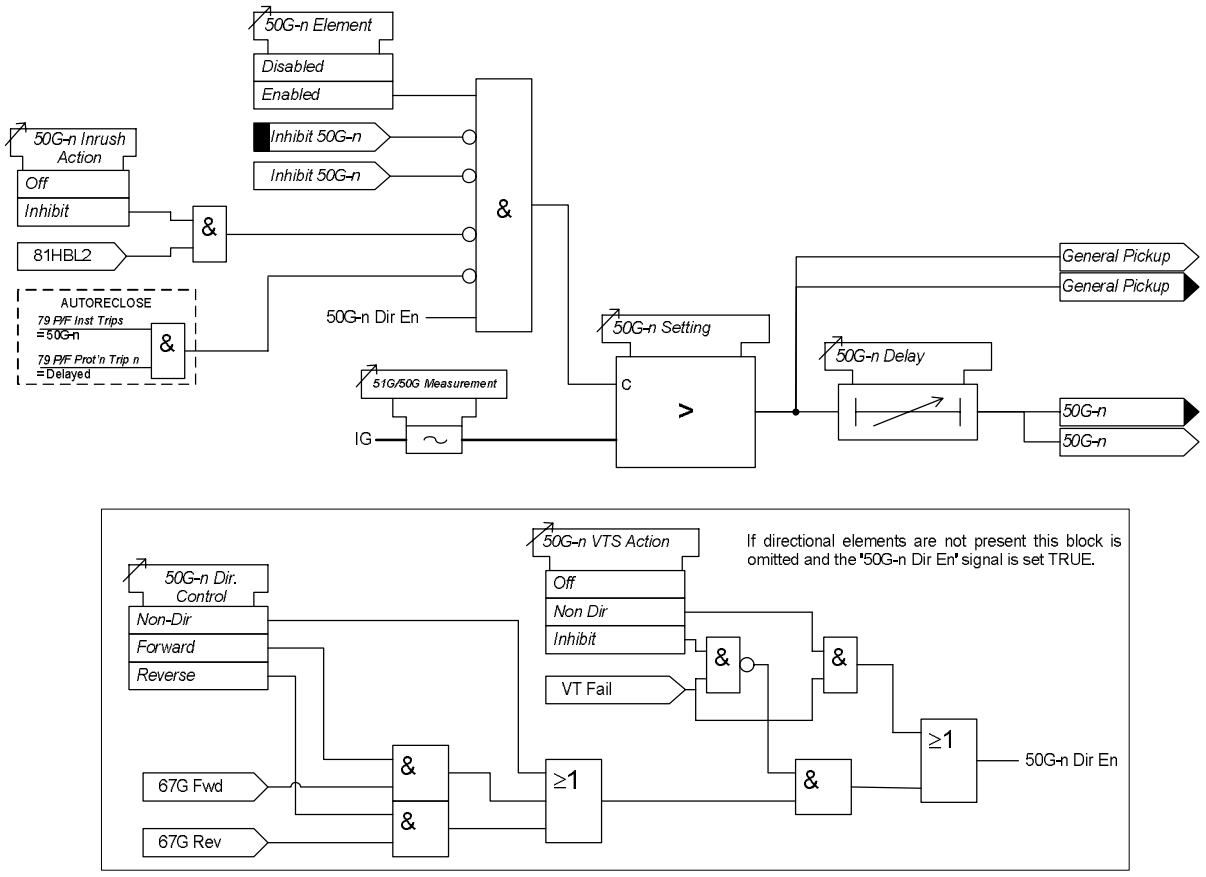


Figure 3.4.2-1 Logic Diagram: Measured Instantaneous Earth-fault Element

©2018 Siemens Protection Devices Limited

3.4.3 Time Delayed Measured Earth Fault Protection (51G)

Two time delayed measured earth fault elements are provided in the 7SR21 relay. Four elements are provided in the 7SR22 relay e.g. giving the option of using two elements set to forward and two to reverse.

51G-n Setting sets the pick-up current level.

A number of shaped characteristics are provided. An inverse definite minimum time (IDMT) characteristic is selected from IEC and ANSI curves using ***51G-n Char***. A time multiplier is applied to the characteristic curves using the ***51G-n Time Mult*** setting. Alternatively, a definite time lag (DTL) can be chosen using ***51G-n Char***. When DTL is selected the time multiplier is not applied and the ***51G-n Delay (DTL)*** setting is used instead.

The ***51G-n Reset*** setting can apply a **definite time delayed** reset**,** or when configured as an ANSI characteristic an **ANSI (DECAYING)** reset. If ANSI (DECAYING) reset is selected for an IEC characteristic, the reset will be instantaneous. The reset mode is significant where the characteristic has reset before issuing a trip output – see 'Applications Guide'.

A minimum operate time for the characteristic can be set using ***51G-n Min. Operate Time*** setting.

A fixed additional operate time can be added to the characteristic using ***51G-n Follower DTL*** setting.

Where directional elements are present the direction of operation can be set using ***51G-n Dir. Control*** setting. Directional logic is provided independently for each 51G-n element.

Operation of the time delayed measured earth fault elements can be inhibited from:

Inhibit 51G-n	A binary or virtual input, function key or remote data Comms.
79 E/F Inst Trips: **51G-n**	When 'delayed' trips only are allowed in the auto-reclose sequence (***79 E/F Prot'n Trip n*** = **Delayed**).
51G-n Inrush Action: **Inhibit**	Operation of the inrush current detector function.
51G-n VTSAction: **Inhibit**	Operation of the VT Supervision function (7SR22).

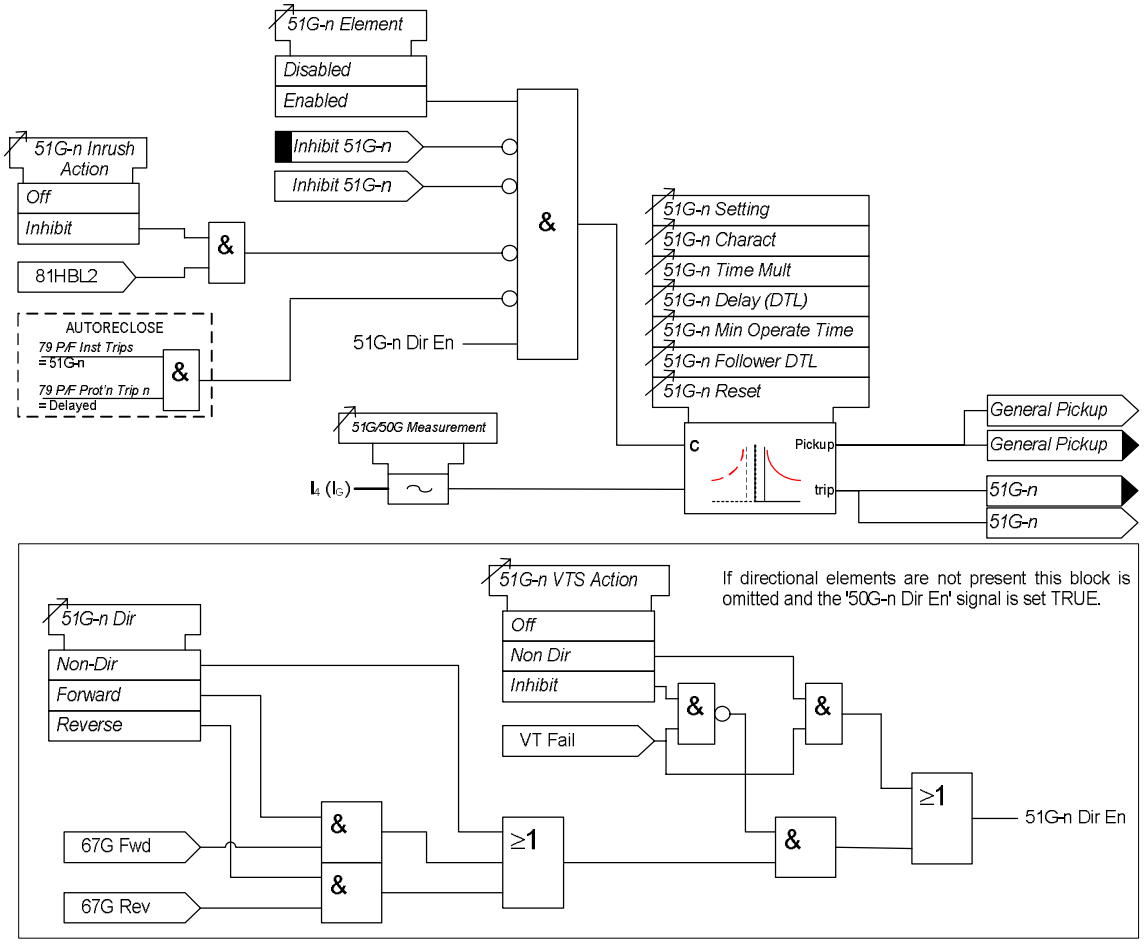


Figure 3.4.3-1 Logic Diagram: Measured Time Delayed Earth Fault Element (51G)

3.5 Current Protection: Sensitive Earth Fault (67SEF, 51SEF, 50SEF)

Current for the Sensitive Earth Fault (SEF) elements is measured directly via a dedicated current analogue input. SEF elements measure the fundamental frequency RMS current.

3.5.1 Directional Control of Sensitive Earth Fault Protection (67SEF) – 7SR22

The directional element produces forward and reverse outputs for use with SEF elements. These outputs can be mapped as controls to each shaped and instantaneous element.

If a protection element is set as non-directional then it will operate independently of the output of the directional detector. However, if a protection element is programmed for forward directional mode then operation will occur only for a fault lying within the forward operate zone. Conversely, if a protection element is programmed for reverse directional mode then operation will occur only for a fault lying within the reverse operate zone. Typically the forward direction is defined as being 'away' from the busbar or towards the protected zone.

The Characteristic angle is the phase angle by which the polarising voltage must be adjusted such that the directional detector gives maximum sensitivity in the forward operate zone when the current is in phase with it. The reverse operate zone is the mirror image of the forward zone.

The directional sensitive earth fault elements use zero phase sequence (ZPS) polarising.

Voltage polarisation is achieved for the earth-fault elements by comparison of the appropriate current with its equivalent voltage: -

$I_0 \sim V_0$

The characteristic angle can be user programmed to any angle between -95° and +95° using the ***67SEF Char Angle*** setting. The voltage is the reference phasor (V_{ref}) and the ***67SEF Char Angle*** setting is added to this to adjust the forward and reverse zones.

The centre of the forward zone is set by (V_{ref} Angle + ***67SEF Char Angle***) and should be set to correspond with I_{fault} Angle for maximum sensitivity i.e.

For fault current of -15° (I lagging V by 15°) a ***67SEF Char Angle*** of **-15°** is required for maximum sensitivity

OR

For fault current of -45° (I lagging V by 45°) a ***67SEF Char Angle*** of **-45°** is required for maximum sensitivity.

For resonant grounded systems where compensation (Petersen) coils are fitted, earth fault current is deliberately reduced to zero and therefore is difficult to measure for protection purposes. However, the wattmetric component in the capacitive charging currents, which are close to the directional zone boundary, can be used to indicate fault location. It is advantageous to increase the directional limits towards ±90º so that the directional boundary can be used to discriminate between faulted and healthy circuits. A ***67SEF Compensated Network Enable*** user setting is provided to provide this feature for use with compensated networks only.

Minimum Polarising Voltage

The ***67SEF Minimum Voltage*** setting defines the minimum polarising voltage level. Where the measured polarising voltage is below this level no directional output is given and. Operation of protection elements set as directional will be inhibited. This prevents mal-operation under fuse failure/MCB tripped conditions where noise voltages can be present.

©2018 Siemens Protection Devices Limited

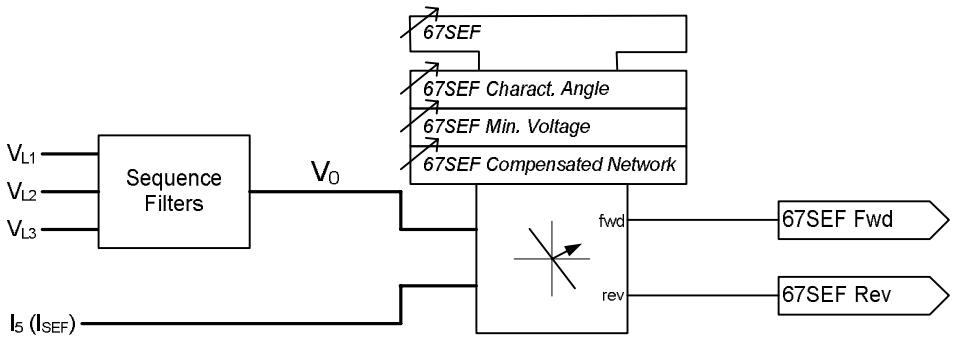


Figure 3.5.1-1 Logic Diagram: SEF Directional Element (67SEF)

3.5.2 Instantaneous Sensitive Earth Fault Protection (50SEF)

Two instantaneous SEF elements are provided in the 7SR21 relay. Four elements are provided in the 7SR22 relay e.g. giving the option of using two elements set to forward and two to reverse.

Each instantaneous element has independent settings for pick-up current ***50SEF-n Setting*** and a follower time delay ***50SEF-n Delay***. The instantaneous elements have transient free operation.

Where directional elements are present the direction of operation can be set using ***50SEF-n Dir. Control*** setting. Directional logic is provided independently for each 50SEF-n element.

Operation of the instantaneous earth fault elements can be inhibited from: -

Inhibit 50SEF-n	A binary or virtual input, function key or remote data Comms
79 SEF Inst Trips: **50SEF-n**	When 'delayed' trips only are allowed in the auto-reclose sequence (***79 SEF Prot'n Trip n*** = **Delayed**).
50SEF-n VTSAction: **Inhibit**	Operation of the VT Supervision function (7SR22).

Directional elements will not operate unless the zero sequence voltage (V_0) is above the ***67SEF Minimum Voltage*** setting i.e. the residual voltage is greater than 3 times this setting and the phase is in the Forward/Reverse operating range. If ***67SEF Wattmetric*** is set to Enabled, the calculated residual real power must be above the ***67SEF Wattmetric Power*** setting for any SEF element operation. The residual power P_{res} is equal to the wattmetric component of $3V_0I_{SEF}$ and therefore the wattmetric component of $9V_0I_0$

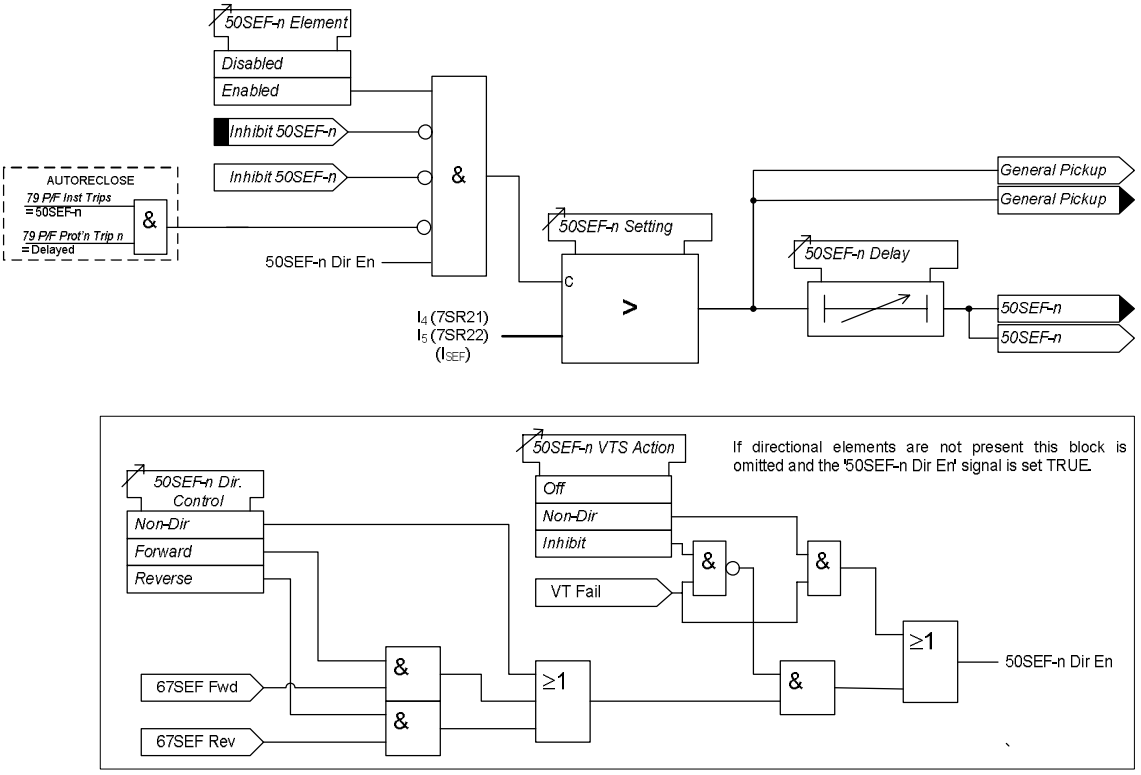


Figure 3.5.2-1 Logic Diagram: 50 SEF Instantaneous Element

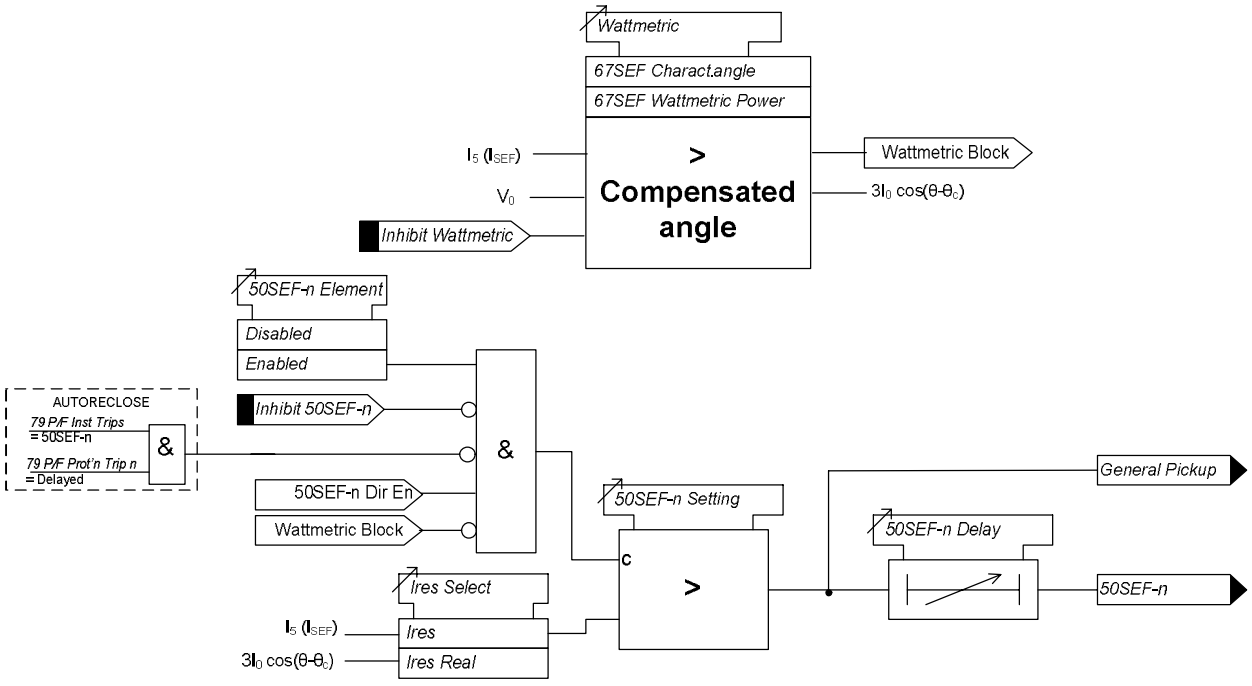


Figure 3.5.2-2 Logic Diagram: 50 SEF Instantaneous Element Compensated Networks

©2018 Siemens Protection Devices Limited

3.5.3 Time Delayed Sensitive Earth Fault Protection (51SEF)

Two time delayed sensitive earth fault elements are provided in the 7SR21 relay. Four elements are provided in the 7SR22 relay e.g. giving the option of using two elements set to forward and two to reverse.

51SEF-n Setting sets the pick-up current level.

A number of shaped characteristics are provided. An inverse definite minimum time (IDMT) characteristic is selected from IEC and ANSI curves using ***51SEF-n Char***. A time multiplier is applied to the characteristic curves using the ***51SEF-n Time Mult*** setting. Alternatively, a definite time lag (DTL) can be chosen using ***51SEF-n Char***. When DTL is selected the time multiplier is not applied and the ***51SEF-n Delay (DTL)*** setting is used instead.

The ***51SEF-n Reset*** setting can apply a **definite time delayed** reset**,** or when configured as an ANSI characteristic an **ANSI (DECAYING)** reset. If ANSI (DECAYING) reset is selected for an IEC characteristic, the reset will be instantaneous. The reset mode is significant where the characteristic has reset before issuing a trip output – see 'Applications Guide'.

A minimum operate time for the characteristic can be set using ***51SEF-n Min. Operate Time*** setting.

A fixed additional operate time can be added to the characteristic using ***51SEF-n Follower DTL*** setting.

Where directional elements are present the direction of operation can be set using ***51SEF-n Dir. Control*** setting. Directional logic is provided independently for each 51SEF-n element.

Operation of the time delayed earth fault elements can be inhibited from: -

Inhibit 51SEF-n	A binary or virtual input, function key or remote data Comms
79 SEF Inst Trips: **51SEF-n**	When 'delayed' trips only are allowed in the auto-reclose sequence (***79 SEF Prot'n Trip n*** = **Delayed**).
51SEF-n VTSAction: **Inhibit**	Operation of the VT Supervision function (7SR22).

Directional elements will not operate unless the zero sequence voltage (V_0) is above the ***67SEF Minimum Voltage*** setting i.e. the residual voltage is greater than 3 times this setting and the phase is in the Forward/Reverse operating range. If ***67SEF Wattmetric*** is set to Enabled, the calculated residual real power must be above the ***67SEF Wattmetric Power*** setting. The residual power P_{res} is equal to the wattmetric component of $3V_0I_{SEF}$ and therefore the wattmetric component of $9V_0I_0$

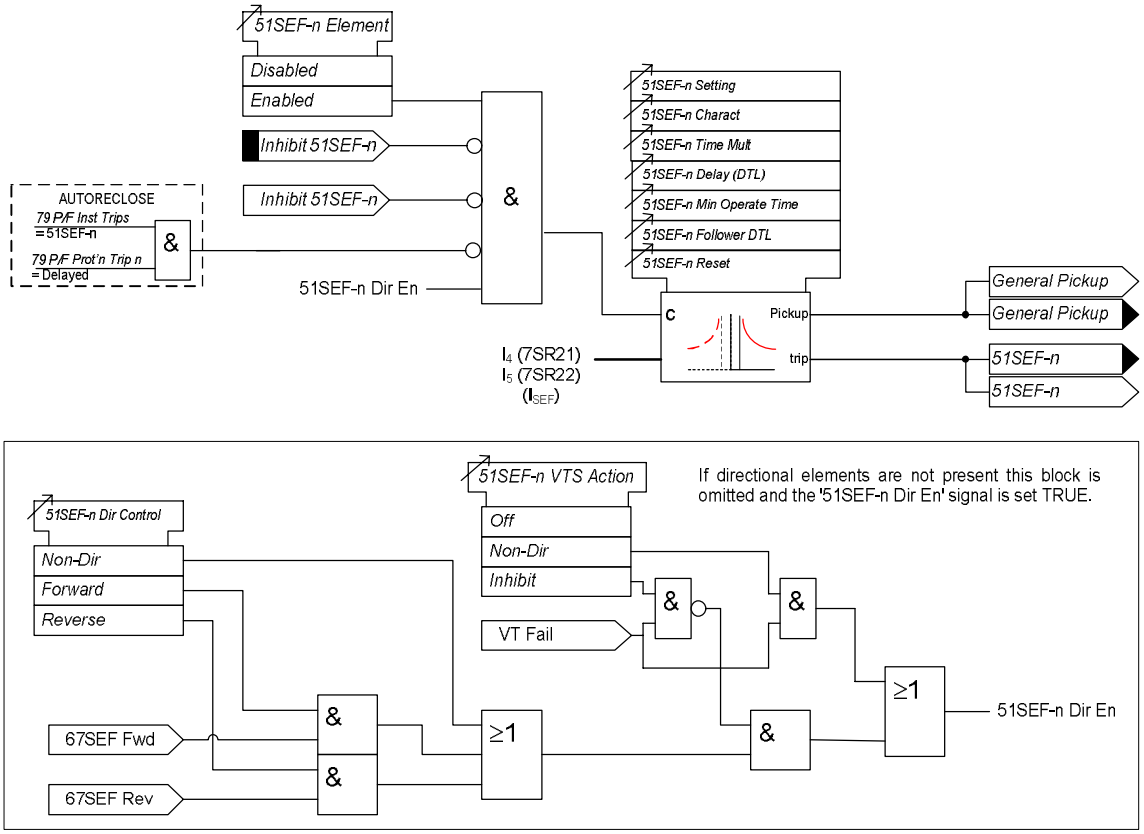


Figure 3.5.3-1 Logic Diagram: 51 SEF Time Delayed Element

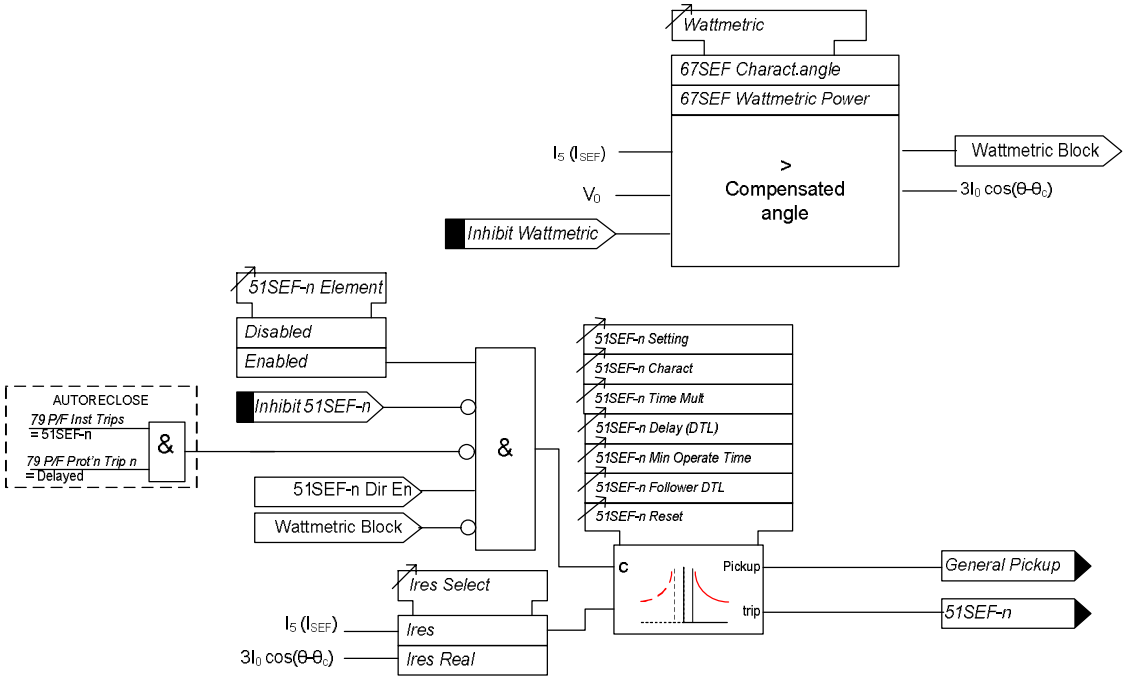


Figure 3.5.3-2 Logic Diagram: 51 SEF Time Delayed Element Compensated Networks

©2018 Siemens Protection Devices Limited

3.6 Current Protection: High Impedance Restricted Earth Fault (64H)

One high impedance Restricted Earth Fault (REF) element is provided.

The relay utilises fundamental current measurement values for this function.

The single phase current input is derived from the residual output of line/neutral CTs connected in parallel. An external stabilising resistor must be connected in series with this input to ensure that this element provides a high impedance path.

64H Current Setting sets the pick-up current level. An output is given after elapse of the ***64H Delay*** setting.

External components – a series stabilising resistor and a non-linear resistor – are used with this function. See 'Applications Guide' for advice in specifying suitable component values.

Operation of the high impedance element can be inhibited from: -

Inhibit 64H A binary or virtual input, function key or remote data Comms

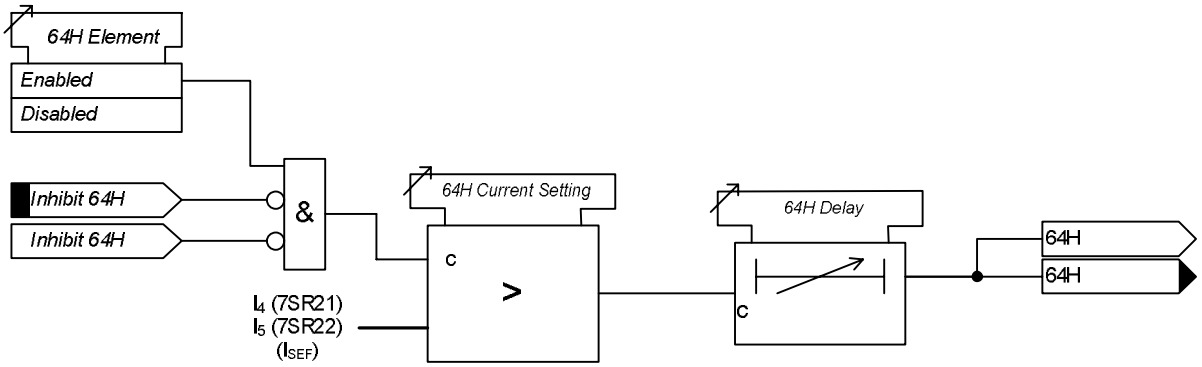


Figure 3.6-1 Logic Diagram: High Impedance REF (64H)

3.7 Current Protection: Cold Load (51c)

The setting of each shaped overcurrent element (51-n) can be inhibited and alternative 'cold load' settings (51c-n) can be applied for a period following circuit switch in.

The Cold Load settings are applied after the circuit breaker has been open for longer than the ***Pick-Up Time*** setting.

Following circuit breaker closure the 'cold load' overcurrent settings will revert to those defined in the Phase Overcurrent menu (51-n) after either elapse of the ***Drop-Off Time*** setting or when the measured current falls below the ***Reduced Current Level*** setting for a time in excess of ***Reduced Current Time*** setting.

During cold load settings conditions any directional settings applied in the Phase Overcurrent menu are still applicable.

A CB 'Don't Believe It' (DBI) condition is not acted on, causing the element to remain operating in accordance with the relevant 51-n settings. Where the ***Reduced Current*** setting is set to **OFF** reversion to 51-n settings will only occur at the end of the ***Drop-Off Time***. If any element is picked up on expiry of ***Drop-Off Time*** the relay will issue a trip (and lockout if a recloser is present).

If the circuit breaker is re-opened before expiry of the ***Drop-Off Time*** the drop-off timer is held but not reset. Resetting the timer for each trip could result in damaging levels of current flowing for a prolonged period during a rapid sequence of trips/closes.

Cold load trips use the same binary output(s) as the associated 51-n element.

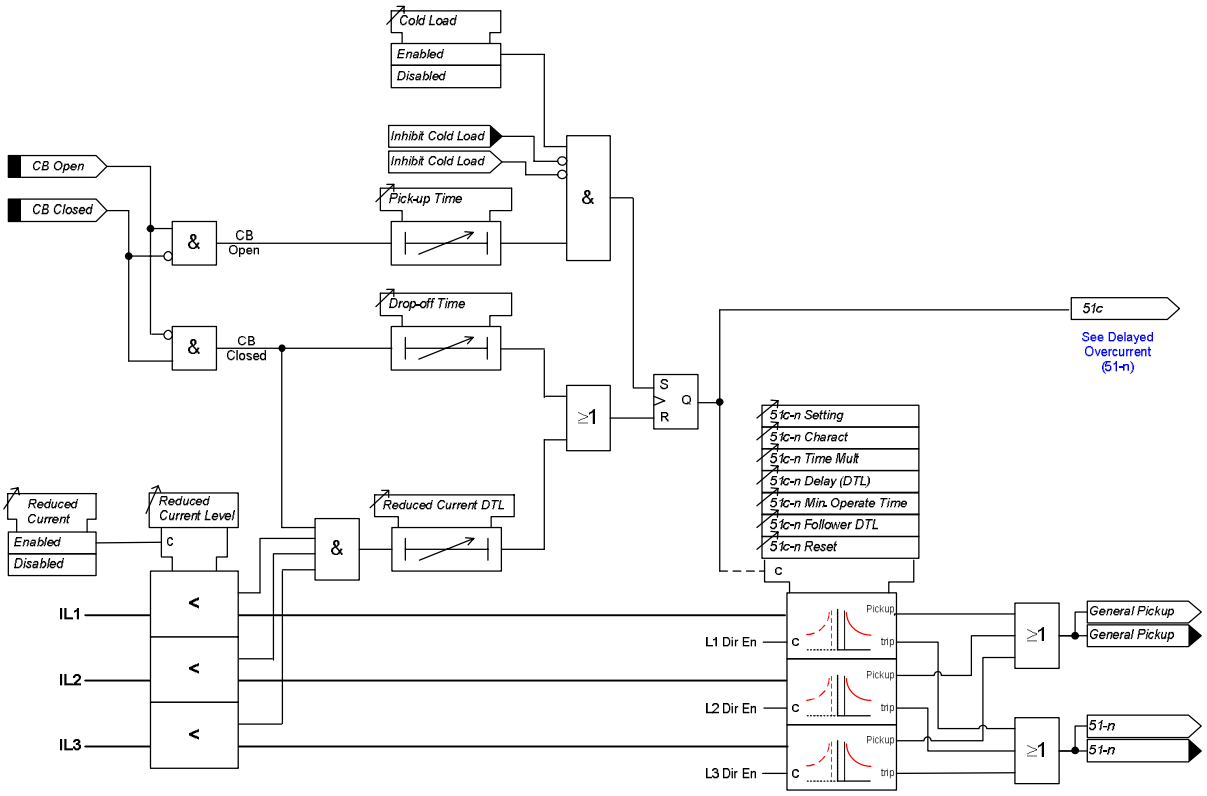


Figure 3.7-1 Logic Diagram: Cold Load Settings (51c)

©2018 Siemens Protection Devices Limited

3.8 Current Protection: Negative Phase Sequence Overcurrent (46NPS)

The negative sequence phase (NPS) component of current (I2) is derived from the three phase currents. It is a measure of the quantity of unbalanced current in the system.

Two NPS current elements are provided – 46IT and 46DT.

The 46IT element can be configured to be either definite time lag (DTL) or inverse definite minimum time (IDMT),

46IT Setting sets the pick-up current level for the element.

A number of shaped characteristics are provided. An inverse definite minimum time (IDMT) characteristic is selected from IEC and ANSI curves using ***46IT Char***. A time multiplier is applied to the characteristic curves using the ***46IT Time Mult*** setting. Alternatively, a definite time lag delay (DTL) can be chosen using ***46ITChar***. When Delay (DTL) is selected the time multiplier is not applied and the ***46IT Delay (DTL)*** setting is used instead.

The ***46IT Reset*** setting can apply a, **definite time delayed** or **ANSI (DECAYING)** reset.

The 46DT element has a DTL characteristic. ***46DT Setting*** sets the pick-up current and ***46DT Delay*** the follower time delay.

Operation of the negative phase sequence overcurrent elements can be inhibited from:

Inhibit 46IT	A binary or virtual input, function key or remote data Comms
Inhibit 46DT	A binary or virtual input, function key or remote data Comms

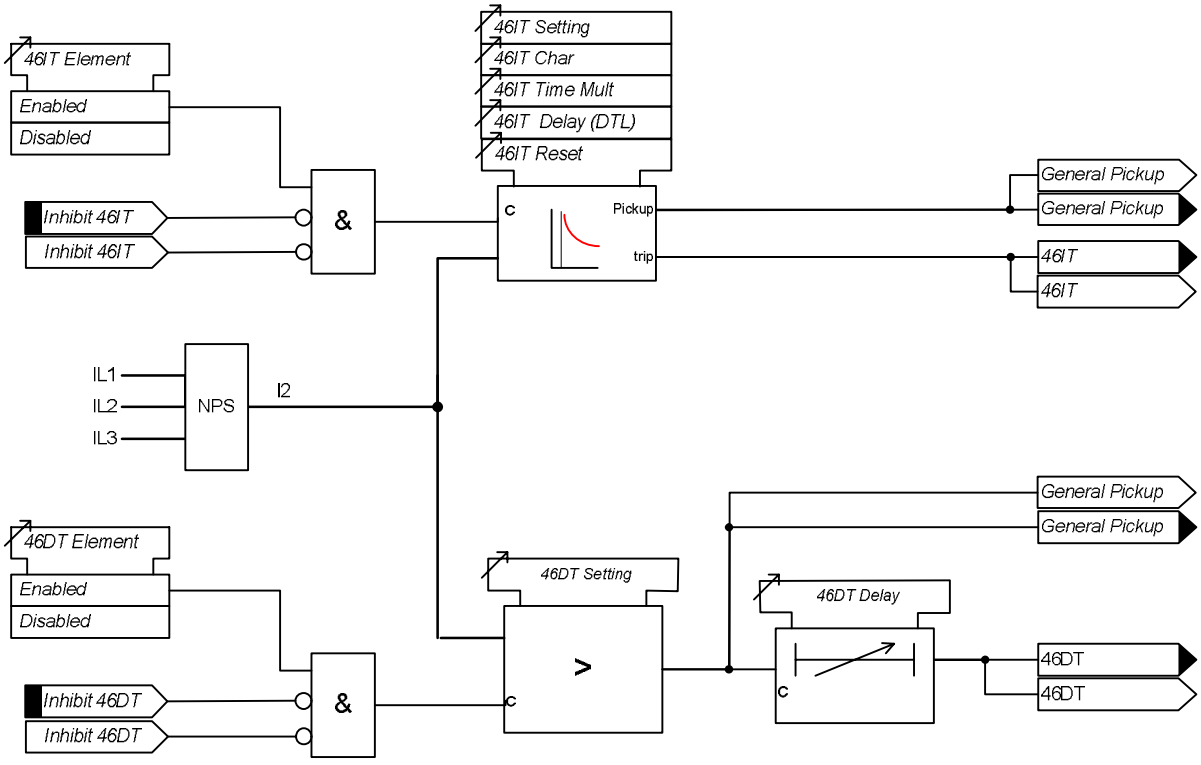


Figure 3.8-1 Logic Diagram: Negative Phase Sequence Overcurrent (46NPS)

3.9 Current Protection: Under-Current (37, 37G & 37SEF)

Two under-current elements are provided for each 37, 37G & 37SEF protection function.

Each phase has an independent level detector and current-timing element. ***37-n Setting*** sets the pick-up current. An output is given after elapse of the ***37-n Delay*** setting.

Operation of the under-current elements can be inhibited from: -

Inhibit 37-n A binary or virtual input, function key or remote data Comms

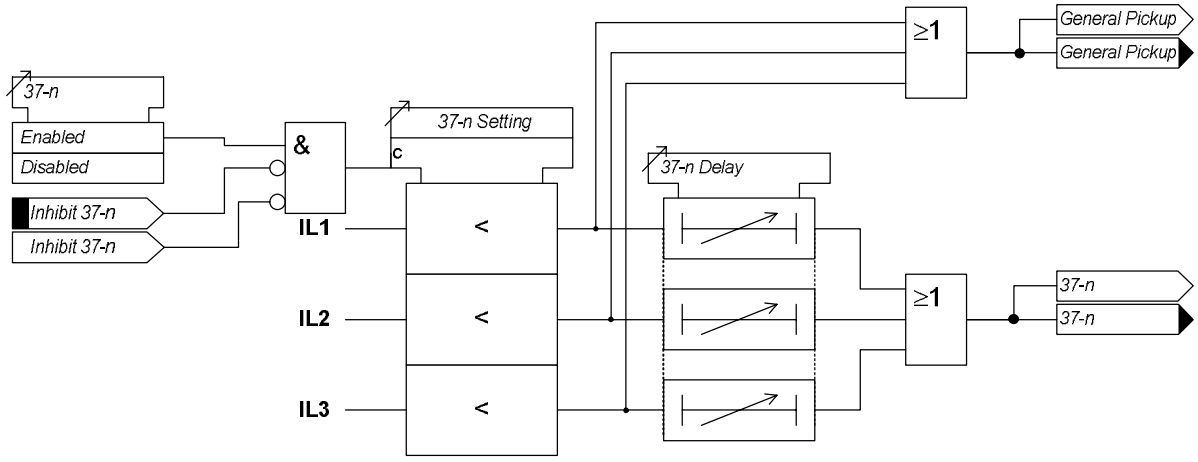


Figure 3.9-1 Logic Diagram: Undercurrent Detector (37, 37G & 37SEF)

3.10 Current Protection: Under-Current Guarded (37)

A level detector ***37-n U/I Guard Setting*** sets the pick-up current.

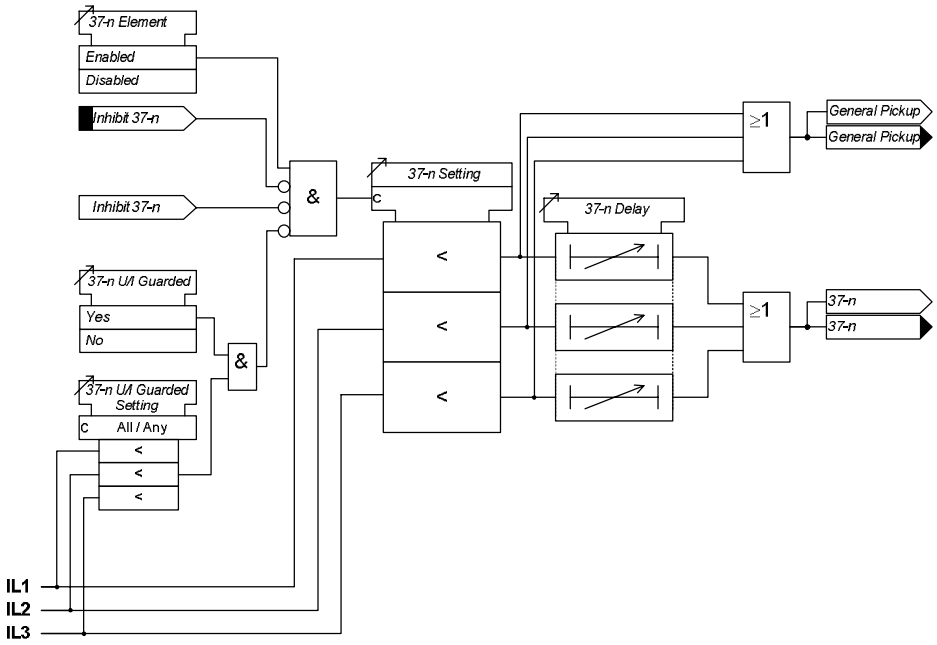


Figure 3.10-1 Logic Diagram: Undercurrent Guarded Detector (37)

©2018 Siemens Protection Devices Limited

3.11 Current Protection: Thermal Overload (49)

The relay provides a thermal overload suitable for the protection of static plant. Phase segregated elements are provided. The temperature of the protected equipment is not measured directly. Instead, thermal overload conditions are calculated using the measure True RMS current.

Should the current rise above the ***49 Overload Setting*** for a defined time an output signal will be initiated.

Operate Time (t): -

$$t = \tau \times \ln\left\{\frac{I^2 - I_P^2}{I^2 - (k \times I_B)^2}\right\}$$

Where

T = Time in minutes

τ = ***49 Time Constant*** setting (minutes)

In = Log Natural

I = measured current

I_P = Previous steady state current level

k = Constant

I_B = Basic current, typically the same as In

$k.I_B$ = ***49 Overload*** Setting (I_θ)

Additionally, an alarm can be given if the thermal state of the system exceeds a specified percentage of the protected equipment's thermal capacity ***49 Capacity Alarm*** setting.

For the heating curve: -

$$\theta = \frac{I^2}{I_\theta^2} \cdot (1 - e^{-t/\tau}) \times 100\%$$

Where: θ = thermal state at time t

I = measured thermal current

I_θ = ***49 Overload*** setting (or $k.I_B$)

The final steady state thermal condition can be predicted for any steady state value of input current where $t > \tau$,

$$\theta_F = \frac{I^2}{I_\theta^2} \times 100\%$$

Where: θ_F = final thermal state before disconnection of device

49 Overload Setting I_θ is expressed as a multiple of the relay nominal current and is equivalent to the factor $k.I_B$ as defined in the IEC255-8 thermal operating characteristics. It is the value of current above which 100% of thermal capacity will be reached after a period of time and it is therefore normally set slightly above the full load current of the protected device.

The thermal state may be reset from the fascia or externally via a binary input.

Thermal overload protection can be inhibited from: -

Inhibit 49 A binary or virtual input, function key or remote data Comms.

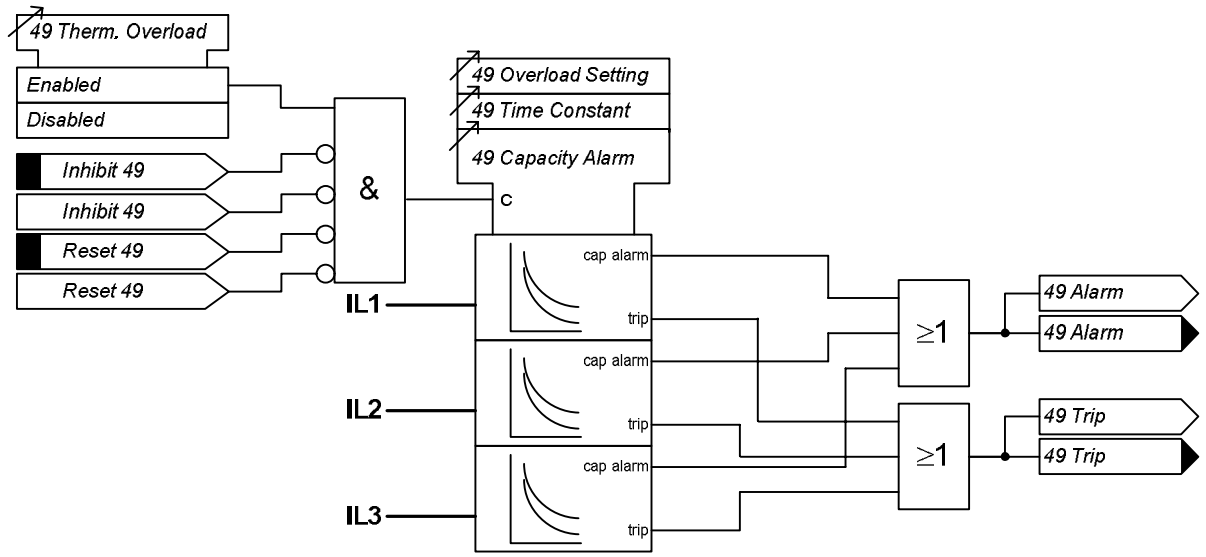


Figure 3.11-1 Logic Diagram: Thermal Overload Protection (49S)

©2018 Siemens Protection Devices Limited

3.12 Current Protection: Arc Flash Detector (50 AFD)

By employing an optical detection technique, Arc Fault Protection results in fast clearance of arcing faults.

Arc fault protection is achieved in the relays via the 7XG31xx series of equipment being connected to the binary inputs.

Should the sensor operate when the current is above the ***50AFD Setting*** then an output signal will be initiated.

Refer to 7XG31 documentation for further details.

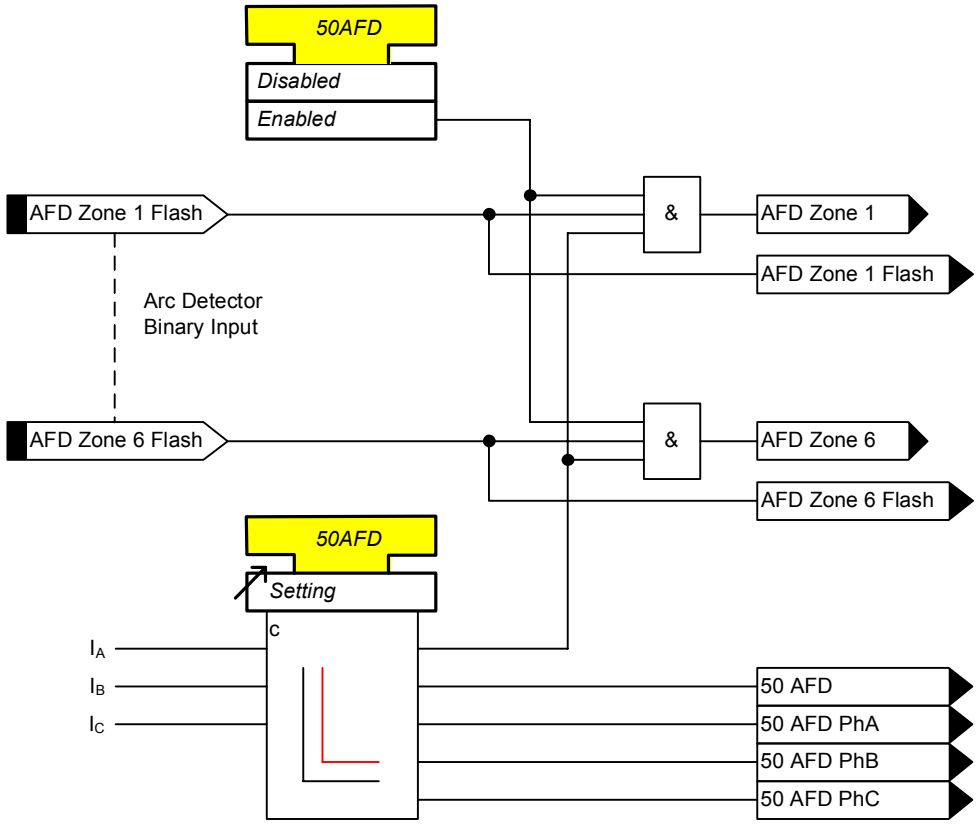


Figure 3.12-1 Logic Diagram: Arc Flash Detector (50 AFD)

3.13 Voltage Protection: Phase Under/Over Voltage (27/59) - 7SR22

In total five under/over voltage elements are provided in the 7SR22 relay. Four elements are provided for the 'Phase' Voltages and one for the 'Auxiliary' input voltage.

The relay utilises fundamental frequency RMS voltage for this function. All under/over voltage elements have a common setting to measure phase to phase **(Ph-Ph)** or phase to neutral **(Ph-N)** voltage using the ***Voltage Input Mode*** setting.

Voltage elements can be blocked if all phase voltages fall below the ***27/59 U/V Guard*** setting.

27/59-n (27/59-Vx) Setting sets the pick-up voltage level for the element.

The sense of the element (undervoltage or overvoltage) is set by the ***27/59-n Operation*** (***27/59-Vx Operation)*** setting.

The ***27/59-n O/P Phases*** setting determines whether the time delay is initiated for operation of any phase or only when all phases have detected the appropriate voltage condition. An output is given after elapse of the ***27/59-n Delay*** (***27/59-Vx Delay)*** setting.

The ***27/59-n Hysteresis*** (***27/59-Vx Hysteresis)*** setting allows the user to vary the pick-up/drop-off ratio for the element.

Operation of the under/over voltage elements can be inhibited from: -

Inhibit 27/59-n	A binary or virtual input, function key or remote data Comms.
27/59-n VTSInhibit: **Yes**	Operation of the VT Supervision function.
27/59-n U/V Guarded	Under voltage guard element.

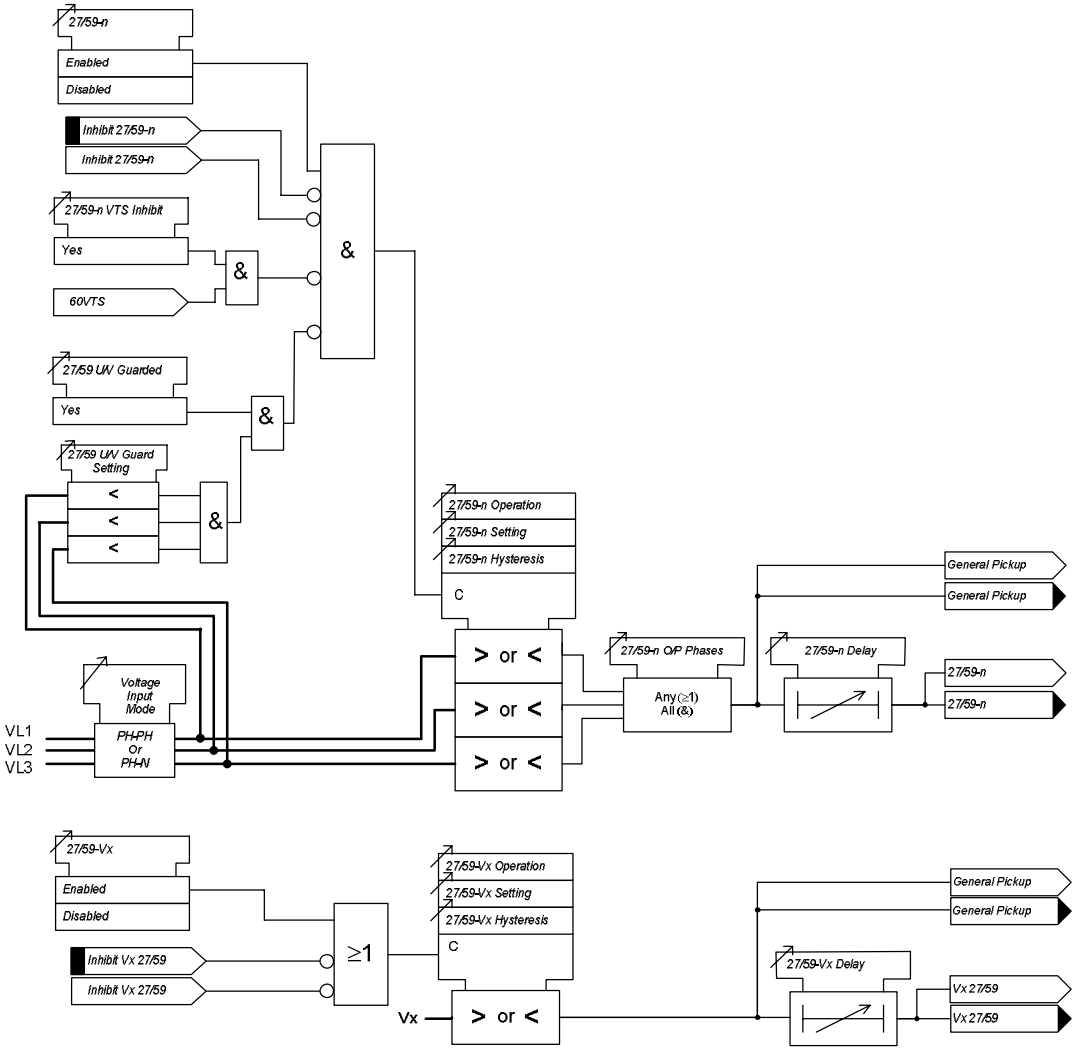


Figure 3.13-1 Logic Diagram: Under/Over Voltage Elements (27/59)

 ©2018 Siemens Protection Devices Limited

3.14 Voltage Protection: Negative Phase Sequence Overvoltage (47) – 7SR22

Negative phase sequence (NPS) voltage (V2) is a measure of the quantity of unbalanced voltage in the system. The relay derives the NPS voltage from the three input voltages (VL1, VL2 and VL3).

Two elements are provided in the 7SR22 relay.

47-n Setting sets the pick-up voltage level for the element.

The ***47-n Hysteresis*** setting allows the user to vary the pick-up/drop-off ratio for the element.

An output is given after elapse of the ***47-n Delay*** setting.

Operation of the negative phase sequence voltage elements can be inhibited from: -

Inhibit 47-n A binary or virtual input, function key or remote data Comms.

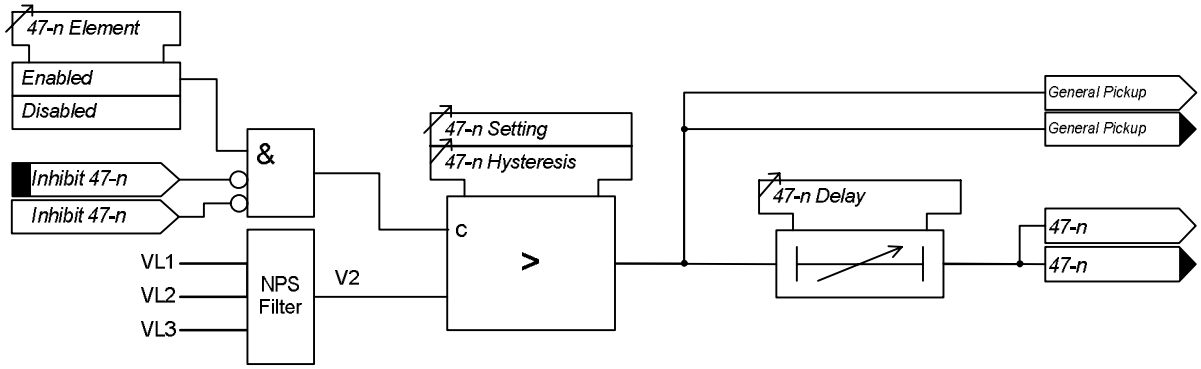


Figure 3.14-1 Logic Diagram: NPS Overvoltage Protection (47)

3.15 Voltage Protection: Neutral Overvoltage (59N) – 7SR22

Two Neutral Overvoltage (or Neutral Voltage Displacement) elements are provided in the 7SR22 relay.

59N Voltage Source setting selects the source of the residual voltage to be measured. The voltage is measured directly from the Vx input or derived from the line voltages where suitable VT connections are present. The relay utilises fundamental voltage measurement values for this function.

One of the elements can be configured to be either definite time lag (DTL) or inverse definite minimum time (IDMT).

The Neutral Inverse Time Lag ***59NIT Setting*** sets the pick-up voltage level ($3V_0$) for the element.

An inverse definite minimum time (IDMT) can be selected using ***59NIT Char***. A time multiplier is applied to the characteristic curves using the ***59NIT Time Mult*** setting (M): -

$$t_{op} = \left[\frac{M}{\left[\frac{3Vo}{Vs}\right] - 1} \right] s$$

Alternatively, a definite time lag delay (DTL) can be chosen using ***59NITChar***. When Delay (DTL) is selected the time multiplier is not applied and the ***59NIT Delay (DTL)*** setting is used instead.

An instantaneous or definite time delayed reset can be applied using the ***59NIT Reset*** setting.

The second element has a DTL characteristic. The Neutral Definite Time Lag ***59NDT Setting*** sets the pick-up voltage ($3V_0$) and ***59NDT Delay*** the follower time delay.

Operation of the neutral overvoltage elements can be inhibited from:

Inhibit 59NIT	A binary or virtual input, function key or remote data Comms.
Inhibit59NDT	A binary or virtual input, function key or remote data Comms.

It should be noted that neutral voltage displacement can only be applied to VT arrangements that allow zero sequence flux to flow in the core i.e. a 5-limb VT or 3 single phase VTs. The VT primary winding neutral must be earthed to allow the flow of zero sequence current.

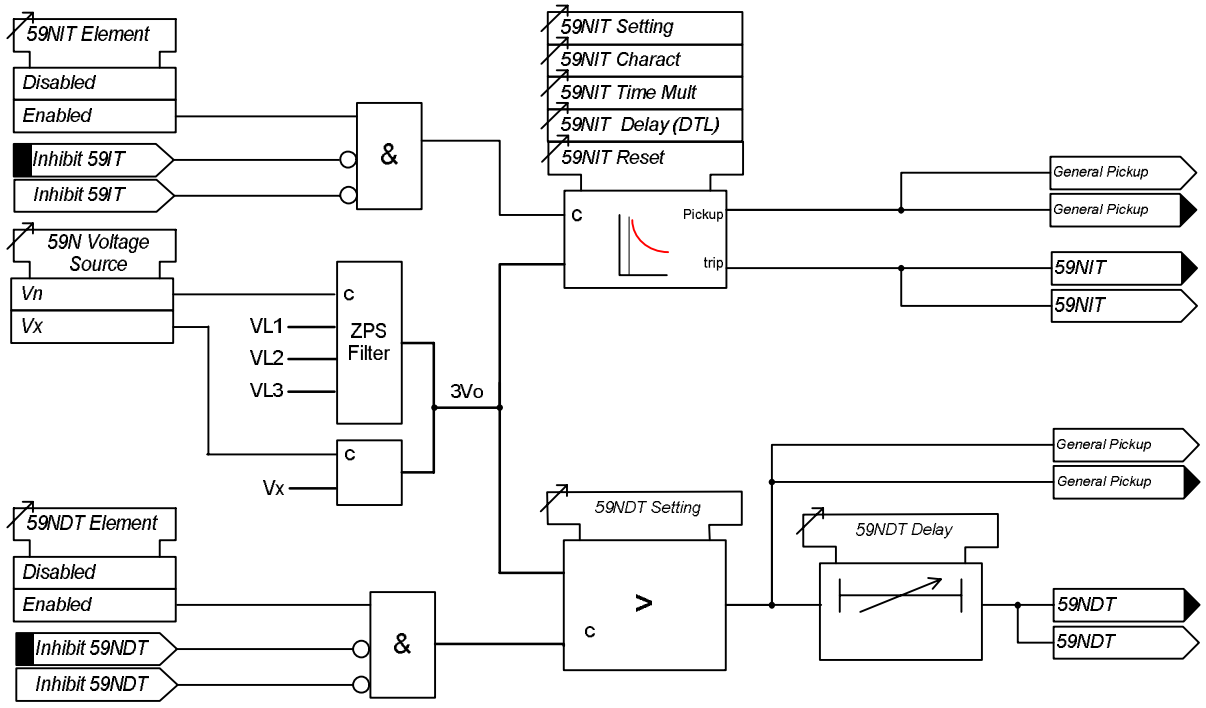


Figure 3.15-1 Logic Diagram: Neutral Overvoltage Element

©2018 Siemens Protection Devices Limited

3.16 Voltage Protection: Under/Over Frequency (81) – 7SR22

Six under/over frequency elements are provided in the 7SR22 relay.

The relay utilises fundamental voltage measurement values for this function. The frequency calculation is based on the highest input voltage derived from the voltage selection algorithm.

Frequency elements are blocked if all phase voltages fall below the ***81 U/V Guard*** setting.

The sense of the element (under-frequency or over-frequency) is set by the ***81-n Operation*** setting.

81-n Setting sets the pick-up voltage level for the element.

An output is given after elapse of the ***81-n Delay*** setting.

The ***81-n Hysteresis*** setting allows the user to vary the pick-up/drop-off ratio for the element.

Operation of the under/over frequency elements can be inhibited from: -

Inhibit 81-n	A binary or virtual input, function key or remote data Comms.
81-n U/V Guarded	Under voltage guard element.

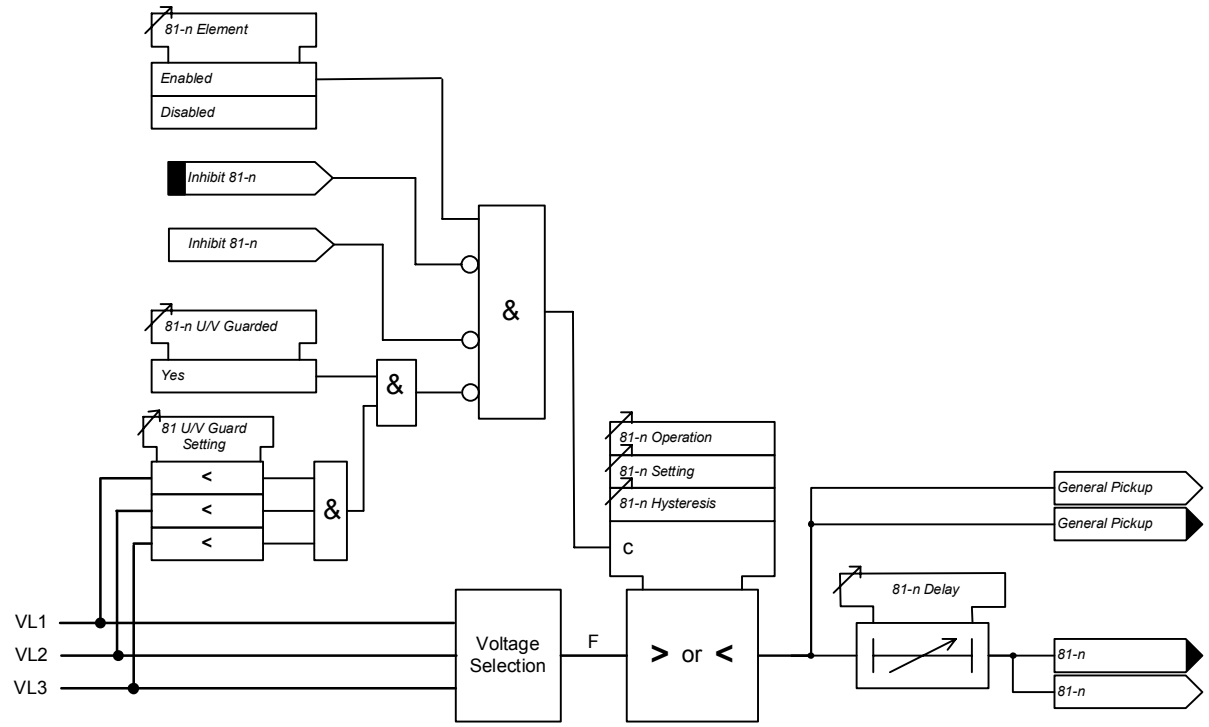


Figure 3.16-1 Logic Diagram: Under/Over Frequency Detector (81)

3.17 Power Protection: Power (32) – 7SR22

Two under/over power elements are provided and can measure real, reactive or apparent power.

Gn 32-n Setting sets the pick-up power level for the element.

Under-power or over-power operation can be set by the ***Gn 32-n Operation*** setting.

Gn 32-n 1ph/3ph Power allows the settings to be based on any one phase exceeding the power pick up level or on the total power of all three phases.

An output is given after elapse of the ***Gn 32-n Delay*** setting.

Operation of the under/over power elements can be inhibited when:

The measured current is below the ***Gn 32-n U/C Guard*** setting

A VT Fail condition is detected

Inhibit 32-n A binary or virtual input.

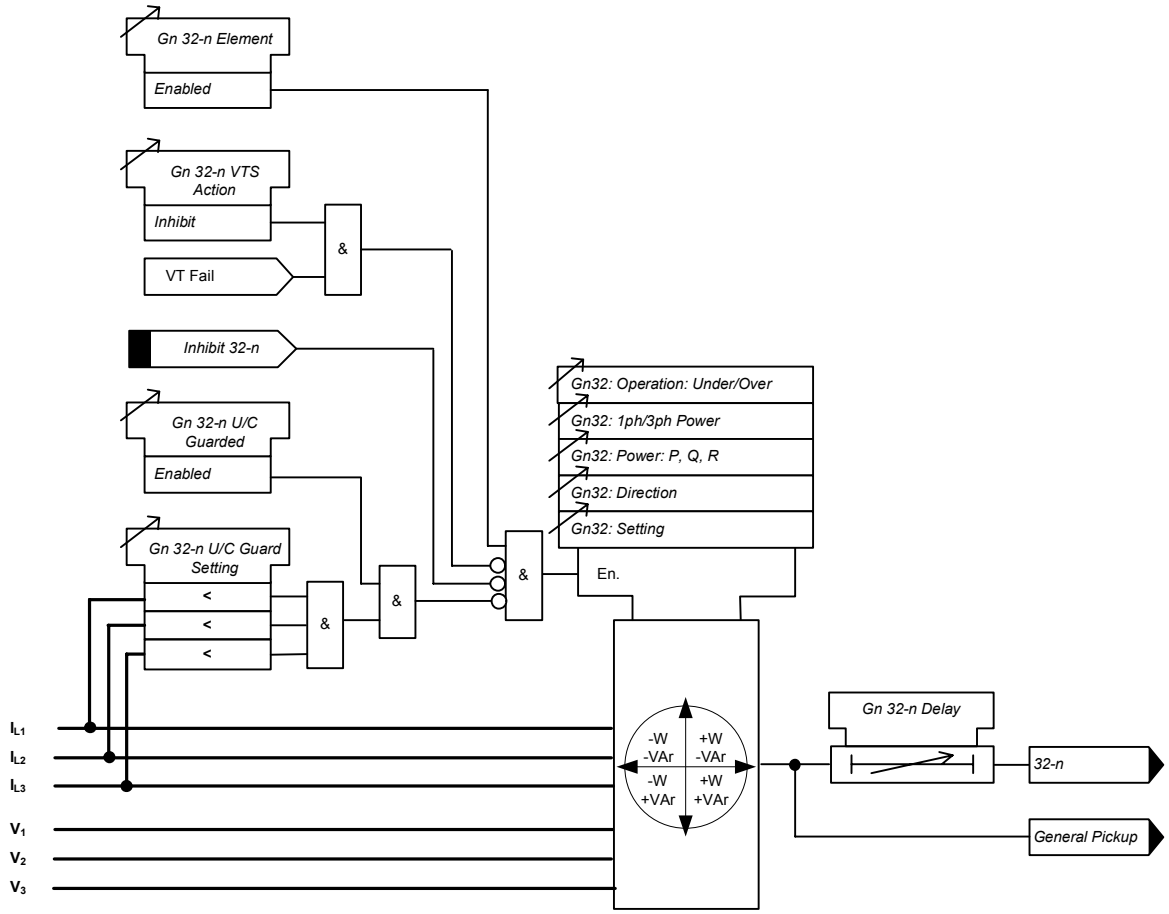


Figure 3.17-1 Logic Diagram: Power Protection (32)

©2018 Siemens Protection Devices Limited

3.18 Power Protection: Sensitive Power (32S) – 7SR22

Two under/over sensitive power elements are provided in the 7SR22 models. The elements can measure real, reactive or apparent power.

Sensitive power functionality utilises the I_{SEF} current input i.e. a single CT input is used. Balanced load conditions are assumed. Any one of the three phase currents can be wired to the I_G current input – the POWER PROT'N > SENSITIVE POWER > ***Gn 32S Phase Selection*** setting is used to ensure that the correct power is measured.

Gn 32S-n Setting sets the pick-up power level for the element.

Under-power or over-power operation can be set by the ***Gn 32S-n Operation*** setting.

An output is given after elapse of the ***Gn 32S-n Delay*** setting.

Operation of the under/over power elements can be inhibited when:

The measured current is below the ***Gn 32S U/C Guard*** setting

A VT Fail condition is detected

Inhibit 32S-n A binary or virtual input.

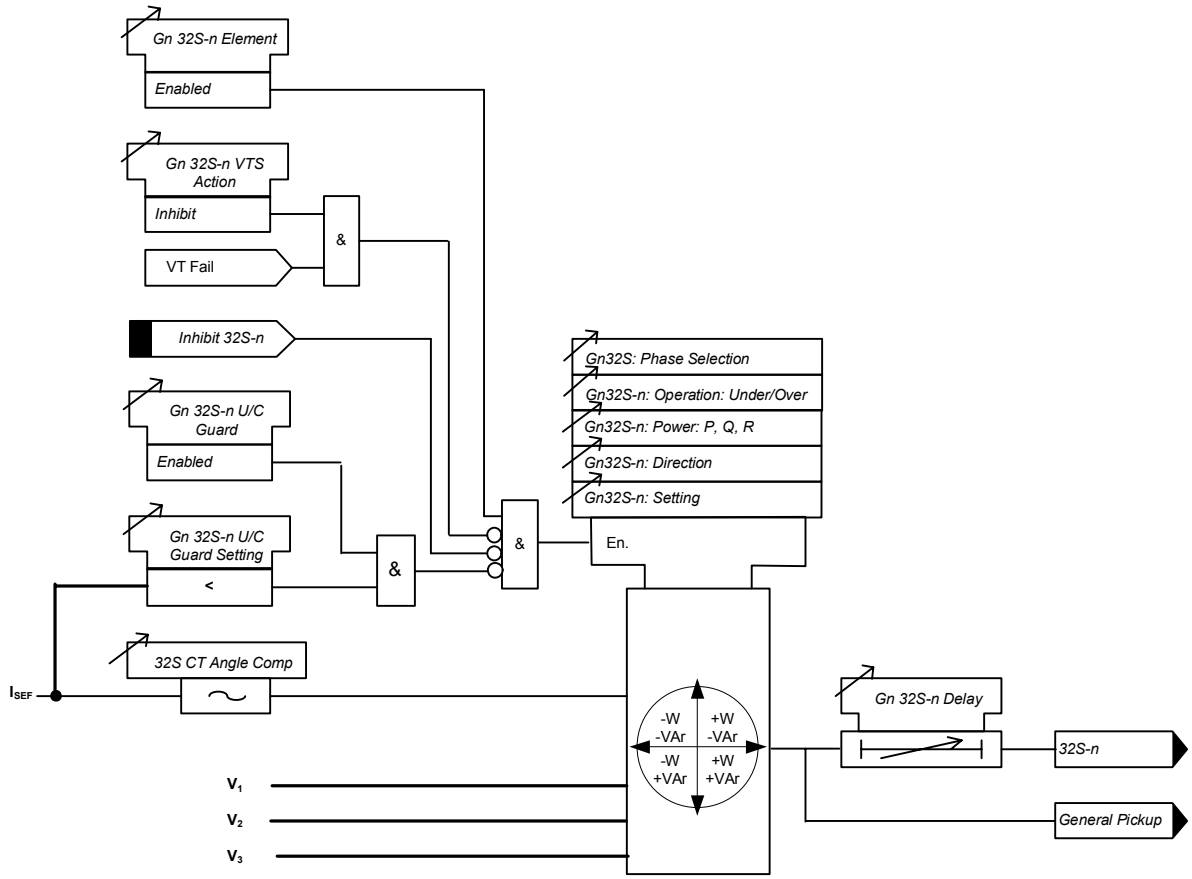


Figure 3.18-1 Logic Diagram: Sensitive Power Protection (32S)

3.19 Power Protection: Power Factor (55) – 7SR22

Two power factor elements are provided.

Gn 55-n Setting sets the pick-up power factor of the element.

Under-power factor or over-power factor operation can be set by the ***Gn 55-n Operation*** setting.

Gn 55-n 1ph/3ph Power allows the settings to be based on any one phase power factor or the average power factor of all three phases.

An output is given after elapse of the ***Gn 55-n Delay*** setting.

Operation of the power factor elements can be inhibited when:

The measured current is below the ***Gn 55 U/C Guard*** setting

A VT Fail condition is detected

Inhibit 55-n A binary or virtual input.

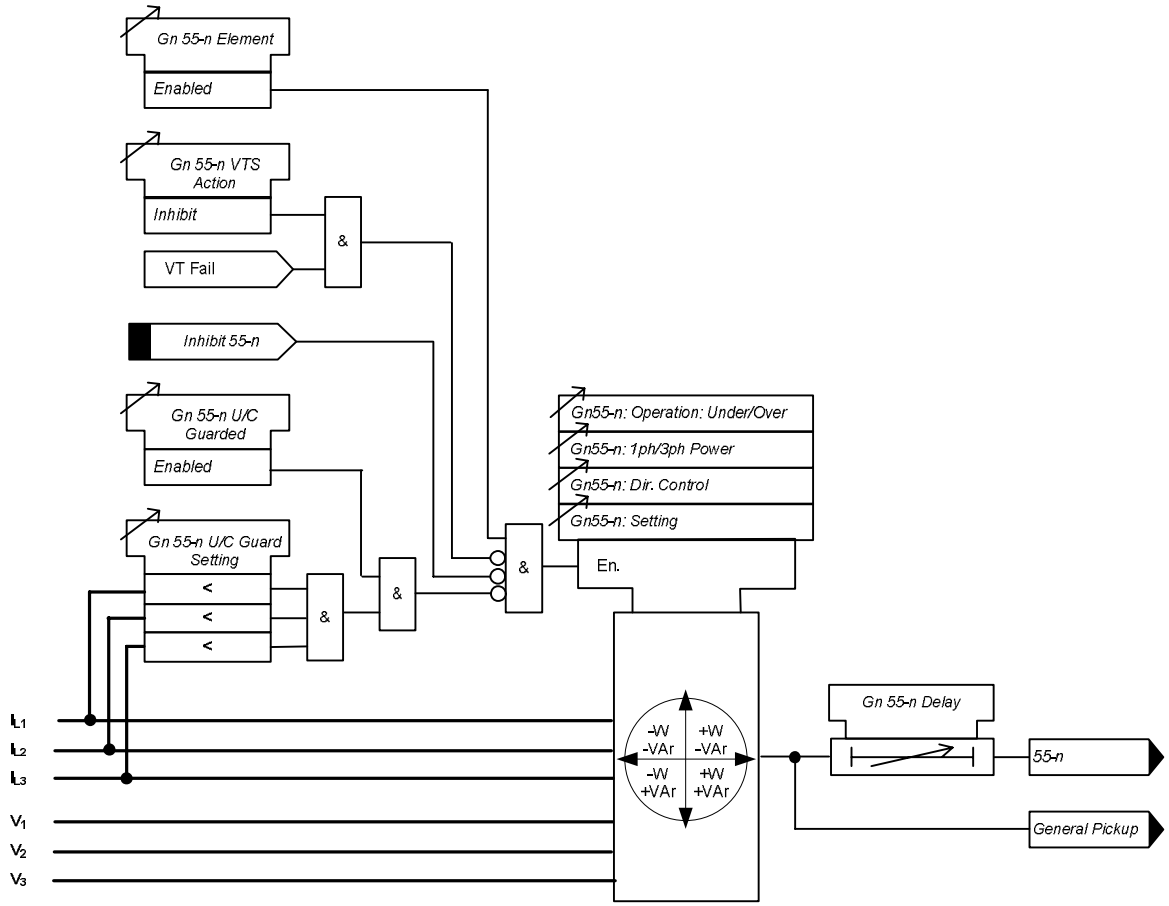


Figure 3.19-1 Logic Diagram: Power Factor Protection (55)

©2018 Siemens Protection Devices Limited

Section 4: Control & Logic Functions

4.1 Auto-Reclose (79)

4.1.1 Overview

A high proportion of faults on an Overhead Line (OHL) network are transient. These faults can be cleared and the network restored quickly by using Instantaneous (Fast) Protection trips followed by an automated sequence of Circuit Breaker (CB) re-closures after the line has been dead for a short time. This 'deadtime' allows the fault current arc to fully extinguish.

Typically this auto reclose (AR) sequence of Instantaneous Trip(s) and Reclose Delays (Dead times) followed by Delayed Trip(s) provide the automatic optimum method of clearing all types of fault i.e. both Transient and Permanent, as quickly as possible and achieving the desired outcome of keeping as much of the Network in-service as possible.

The AR function, therefore, has to: -

Control the type of Protection trip applied at each stage of a sequence

Control the Auto Reclose of the Circuit Breaker to provide the necessary network Dead times, to allow time for Arc extinction

Co-ordinate its Protection and Auto Reclose sequence with other fault clearing devices.

A typical sequence would be – 2 INST+1Delayed+HighSet Trips with 1 sec & 10 sec dead times.

The Auto Reclose feature may be switched in and out of service by a number of methods, these are:

79 Autoreclose **ENABLE/DISABLE** (AUTORECLOSE CONFIG menu)

A keypad change from the CONTROL MODE

Via the data communications channel(s),

From a ***79 OUT*** binary input. Note the ***79 OUT*** binary input has priority over the ***79 IN*** binary input - if both are raised the auto-reclose will be Out of Service.

Knowledge of the CB position status is integral to the auto-reclose functionality. CB auxiliary switches must be connected to ***CB Closed*** and ***CB Open*** binary inputs. A circuit breaker's service status is determined by its position i.e. from the binary inputs programmed ***CB Open*** and ***CB Closed***. The circuit breaker is defined as being in service when it is closed. The circuit memory functionality prevents autoreclosing when the line is de-energised, or normally open.

AR is started by a valid protection operation that is internally mapped to trip in the 79 Autoreclose protection menu or an external trip received via a binary input ***79 Ext Trip***, while the associated circuit breaker is in service.

The transition from AR started to deadtime initiation takes place when the CB has opened and the protection pickups have reset and the trip relay has reset. If any of these do not occur within the ***79 Sequence Fail Timer*** setting the relay will Lockout. This prevents the AR being primed indefinitely. ***79 Sequence Fail Timer*** can be switched to **0** (= OFF).

Once an AR sequence has been initiated, up to 4 reclose operations can be attempted before the AR is locked-out. The relay is programmed to initiate a number of AR attempts, the number is determined by ***79 Num Shots***. Each reclosure (shot) is preceded by a time delay - ***79 Elem Deadtime n*** - giving transient faults time to clear. Separate dead-time settings are provided for each of the 4 recloses and for each of the four fault types – P/F, E/F, SEF and External.

Once a CB has reclosed and remained closed for a specified time period (the Reclaim time), the AR sequence is re-initialised and a Successful Close output issued. A single, common Reclaim time is used (***Reclaim Timer***). When an auto-reclose sequence does not result in a successful reclosure the relay goes to the lockout state.

Indications

The Instruments Menu includes the following meters relevant to the status of the Auto-Reclose and Manual Closing of the circuit breaker: -

Autoreclose Status

Out of Service

Close Shot.

CB Open Countdown Timer

CB Close Countdown Timer

Inputs

External inputs to the recloser functionality need to be wired to the binary inputs. Functions which can be mapped to these binary inputs include: -

79 Out (edge triggered)

79 In (edge triggered)

CB Closed

CB Open

79 Ext Trip

79 Ext Pickup

79 Block Reclose

Block Close CB

Close CB

79 Trip & Reclose

79 Trip & Lockout

79 Line Check

Hot Line In

Hot Line Out

Outputs

Outputs are fully programmable to either binary outputs or LEDs. Programmable outputs include: -

79 Out Of Service

79 In Service

79 In Progress

79 AR Close CB

79 Successful AR

79 Lockout

79 Close Onto Fault

79 CB Fail to Close

79 Trip _Reclose

79 Trip _Lockout

79 Block Extern

 ©2018 Siemens Protection Devices Limited

4.1.2 Auto Reclose sequences

The CONTROL & LOGIC>AUTO RECLOSE PROT'N and CONTROL & LOGIC>AUTORECLOSE CONFIG' menus, allow the user to set independent Protection and Auto Reclose sequences for each type of fault i.e. Phase Fault (P/F), Derived/Measured Earth Fault (E/F), Sensitive Earth Fault (SEF) or External Protections (EXTERN). Each Auto Reclose sequence can be user set to up to four-shots i.e. five trips + four reclose sequence, with independently configurable type of Protection Trip. Overcurrent and earth fault elements can be assigned to any combination of Fast (**Inst**), **Delayed** or highset **(HS)** trips**.** ***Deadtime*** Delay time settings are independent for each AR shot. The user has programming options for Auto Reclose Sequences up to the maximum shot count i.e.:-

Inst or **Delayed** Trip 1 + (***DeadTime 1*: 0.1s-14400s**)
\+ **Inst** or **Delayed** Trip 2 + (***DeadTime 2:* 0.1s-14400s**)
\+ **Inst** or **Delayed** Trip 3 + (***DeadTime 3*: 0.1s-14400s**)
\+ **Inst** or **Delayed** Trip 4 + (***DeadTime 4*: 0.1s-14400s**)
\+ **Inst** or **Delayed** Trip 5 – Lockout.

The AR function recognizes developing faults and, as the shot count advances, automatically applies the correct type of Protection and associated Dead time for that fault-type at that point in the sequence.

A typical sequence would consist of two **Inst** trips followed by at least one **Delayed** trip. This sequence enables transient faults to be cleared quickly by the **Inst** trip(s) and permanent fault to be cleared by the combined Delayed trip. The delayed trip must be 'graded' with other Recloser/CB's to ensure system discrimination is maintained, ie. that as much of the system as possible is live after the fault is cleared.

A ***HS trips to lockout*** setting is provided such that when the number of operations of elements assigned as HS trips reach the setting the relay will go to lockout.

The number of Shots (Closes) is user programmable, note: - only one Shot Counter is used to advance the sequence, the Controller selects the next Protection characteristic/Dead time according to the type of the last Trip in the sequence e.g. PF, EF, SEF or EXTERNAL.

Reclose Dead Time

User programmable dead times are available for each protection trip operation.

The dead time is initiated when the trip output contact reset, the pickup is reset and the CB is open.

The CB close output relay is energised after the dead time has elapsed.

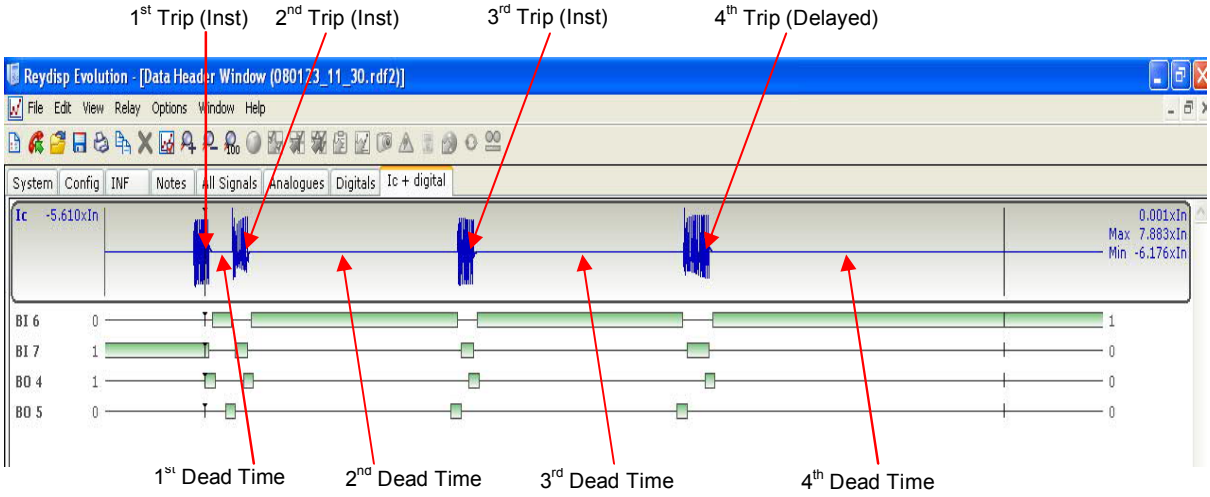


Figure 4.1.2-1 Typical Sequence with 3 Instantaneous and 1 Delayed trip

4.2 Autoreclose Prot'n Menu

This menu presents the Overcurrent Protection elements available for each type of Fault i.e. P/F, E/F or SEF and allows the user to select those that are to be applied as **Inst trips**; those that are to be applied as **Delayed Trips**; and those that are to be applied as **HS Trips** (HighSet), as required by the selected sequence. There is no corresponding setting for External as the External protection type is not normally controlled by the Auto Reclose Relay. The resultant configuration enables the Auto Reclose function to correctly apply the required Protection for each shot in a sequence.

4.3 Autoreclose Config Menu

This menu allows the following settings to be made:-

79 Autoreclose **Enabled** turns ON all AutoReclose Functions.

79 Num Shots Sets the allowed number of AutoReclose attempts in a sequence.

79 Retry Enable **Enabled** configures the relay to perform further attempts to automatically Close the Circuit Breaker where the CB has initially failed to close in response to a Close command. If the first attempt fails the relay will wait for the ***79 Retry Interval*** to expire then attempt to Close the CB again.

79 Retry Attempts Sets the maximum number of retry attempts.

79 Retry Interval Sets the time delay between retry attempts.

79 Reclose Blocked Delay If the CB is not ready to receive a Close command or if system conditions are such that the CB should not be closed immediately e.g. a close-spring is not charged, then a Binary input mapped to **Reclose Block** can be raised and the Close pulse will not be issued but will be held-back. The ***79 Reclose Blocked Delay*** sets the time **Reclose Block** is allowed to be raised, if this time delay expires the Relay will go to Lockout. If Reclose Block is cleared, before this time expires, then the CB Close pulse will be issued at that point in time. Dead Time + Reclose Blocked Delay = Lockout.

79 Sequence Fail Timer Sets the time that AutoReclose start can be primed. Where this time expires before all the DAR start signals are not received i.e. the CB has opened, protection pickups have reset and the trip relay has reset, the Relay goes to Lockout.

79 Minimum LO Delay Sets the time that the Relay's Lockout condition is maintained. After the last allowed Trip operation in a specific sequence the Circuit Breaker will be left locked-out in the open position and can only be closed by manual or remote SCADA operation. The ***79 Minimum Lockout Delay*** timer can be set to delay a too-fast manual close after lockout, this prevents an operator from manually closing onto the same fault too quickly and thus performing multiple sequences and possibly burning-out Plant.

79 Reset LO by Timer Set to **Enabled** this ensures that the Lockout condition is reset when the timer expires, Lockout indication will be cleared; otherwise, set to Disabled, the Lockout condition will be maintained until the CB is Closed by a Close command.

79 Sequence Co-Ord When set to **Enabled** the Relay will co-ordinate its sequence and shot count such that it automatically keeps in step with downstream devices as they advance through their sequence. The Relay detects that a pickup has operated followed by current switch-off. It then increments its Shot count and advances to the next stage of the auto-reclose sequence without issuing a trip. This is repeated as long as the fault is being cleared by the downstream device such that the Relay moves through the sequence bypassing the INST Trips and moving on to the Delayed Trip to maintain Grading margins.

©2018 Siemens Protection Devices Limited

Notes on the 'Lockout' State

The Lockout state can be reached for a number of reasons. Lockout will occur for the following: -

- **At the end of the** 79 Sequence Fail Timer**.**
- At the end of the *Reclaim timer* if the CB is in the open position.
- A protection operates during the final Reclaim time.
- If a Close Pulse is given and the CB fails to close.
- The *79 Lockout* binary input is active.
- At the end of the *79 Reclose Blocked Delay* due to presence of a persistent Block signal.
- When the *79 Elem HS Trips to Lockout* count is reached.
- **When the** 79 Elem Delayed Trips to Lockout **count is reached.**

Once lockout has occurred, an alarm (***79 Lockout***) is issued and all further Close commands, except manual close, are inhibited.

If the Lockout command is received while a Manual Close operation is in progress, the feature is immediately locked-out.

Once the Lockout condition has been reached, it will be maintained until reset. The following will reset lockout: -

- By a Manual Close command, from fascia, comms or *Close CB* binary input.
- By a *79 Reset Lockout* binary input, provided there is no signal present that will cause Lockout.
- At the end of the *79 Minimum LO Delay* time setting if *79 Reset LO by Timer* is selected to ENABLED, provided there is no signal present which will cause Lockout.
- Where Lockout was entered by an A/R Out signal during an Autoreclose sequence then a *79 In* signal must be received before Lockout can reset.
- By the *CB Closed* binary input, provided there is no signal present which will cause Lockout.

The Lockout condition has a delayed drop-off time of 2s. The Lockout condition cannot be reset if there is an active lockout input.

Note: If the 'CB Total Trip Count' or the 'CB Frequent Ops Count' target is reached the relay will do one delayed tip and lockout.

4.4 P/F Shots Sub-Menu

This menu allows the Phase fault trip/reclose sequence to be parameterized:-

79 P/F Prot'n Trip1 The first protection Trip in the P/F sequence can be set to either **Inst** or **Delayed.**

79 P/F Deadtime 1 Sets the first Reclose Delay (Dead time) in the P/F sequence.

79 P/F Prot'n Trip2 The second protection Trip in the P/F sequence can be set to either **Inst** or **Delayed.**

79 P/F Deadtime 2 Sets the second Reclose Delay (Dead time) in the P/F sequence.

79 P/F Prot'n Trip3 The third protection Trip in the P/F sequence can be set to either **Inst** or **Delayed.**

79 P/F Deadtime 3 Sets the third Reclose Delay (Dead time) in the P/F sequence.

79 P/F Prot'n Trip 4 The fourth protection Trip in the P/F sequence can be set to either **Inst** or **Delayed.**

79 P/F Deadtime 4 Sets the fourth Reclose Delay (Dead time) in the P/F sequence.

79 P/F Prot'n Trip5 The fifth and last protection Trip in the P/F sequence can be set to either **Inst** or **Delayed.**

79 P/F HighSet Trips to Lockout Sets the number of allowed HighSet trips. The relay will go to Lockout on the last HighSet Trip. This function can be used to limit the duration and number of high current trips that the Circuit Breaker is required to perform, if the fault is permanent and close to the Circuit Breaker then there is no point in forcing a number of Delayed Trips before the Relay goes to Lockout – that sequence will be truncated.

79 P/F Delayed Trips to Lockout Sets the number of allowed Delayed trips, Relay will go to Lockout on the last Delayed Trip. This function limits the number of Delayed trips that the Relay can perform when the Instantaneous protection Elements are externally inhibited for system operating reasons - sequences are truncated.

4.5 E/F Shots Sub-Menu

This menu allows the Earth Fault trip/reclose sequence to be parameterized:-

As above but E/F settings.

4.6 SEF Shots Sub-Menu

This menu allows the Sensitive Earth trip/reclose sequence to be parameterized:-

As above but SEF Settings, Note: - SEF does not have HighSets

 ©2018 Siemens Protection Devices Limited

4.7 Extern Shots Sub-Menu

This menu allows the External Protection auto-reclose sequence to be parameterized:-

79 P/F Prot'n Trip1	**Not Blocked/Blocked** - Blocked raises an output which can be mapped to a Binary output to Block an External Protection's Trip Output.
79 P/F Deadtime 1	Sets the first Reclose Delay (Deadtime) for the External sequence.
79 P/F Prot'n Trip2	**Not Blocked/Blocked** - Blocked raises an output which can be mapped to a Binary Output to Block an External Protection's second Trip output.
79 P/F Deadtime 2	Sets the second Reclose Delay (Deadtime) in the External sequence.
79 P/F Prot'n Trip3	**Not Blocked/Blocked -** Blocked raises an output which can be mapped to a Binary output to Block an External Protection's third Trip Output.
79 P/F Deadtime 3	Sets the third Reclose Delay (Deadtime) in the External sequence.
79 P/F Prot'n Trip4	**Not Blocked/Blocked** - Blocked raises an output which can be mapped to a Binary output to Block an External Protection's fourth Trip Output.
79 P/F Deadtime 4	Sets the fourth Reclose Delay (Deadtime) in the External sequence.
79 P/F Prot'n Trip5	**Not Blocked/Blocked** - Blocked raises an output which can be mapped to a Binary output to Block an External Protection's fifth Trip Output.
79 P/F Extern Trips to Lockout	- Sets the number of allowed External protection' trips, Relay will go to Lockout on the last Trip.

These settings allow the user to set-up a separate AutoReclose sequence for external protection(s) having a different sequence to P/F, E/F or SEF protections. The ***' Blocked '*** setting allows the Autoreclose sequence to raise an output at any point in the sequence to Block further Trips by the External Protection thus allowing the Overcurrent P/F or Earth Fault or SEF elements to apply Overcurrent Grading to clear the fault.

Other Protection Elements in the Relay can also be the cause of trips and it may be that AutoReclose is required; the External AutoReclose sequence can be applied for this purpose. By setting-up internal Quick Logic equation(s) the user can define and set what should occur when any one of these other elements operates.

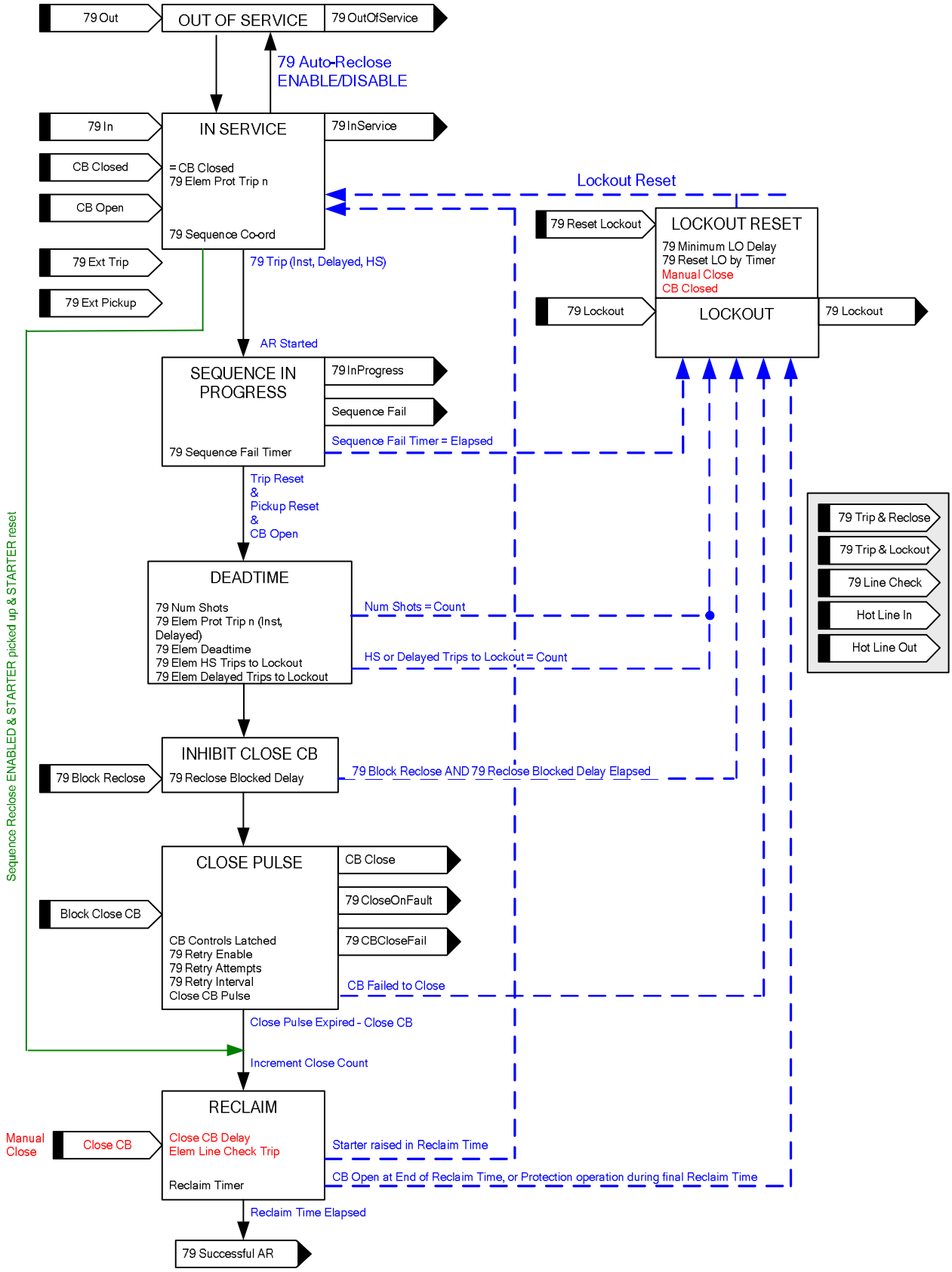


Figure 4.7-1 Basic Auto-Reclose Sequence Diagram

©2018 Siemens Protection Devices Limited

4.8 Manual Control

A Manual Close Command can be initiated in one of three ways: via a ***Close CB*** binary input, via the data communication Channel(s) or from the relay CONTROL MODE menu. It causes an instantaneous operation via ***Manual Close CB*** binary output, over-riding any DAR sequence in progress.

Repeated Manual Closes are avoided by checking for Positive edge triggers. Even if the Manual Close input is constantly energised the relay will only attempt one close.

A Manual Close will initiate Line Check if ***Line Check Trip*** is enabled. If a fault appears on the line during the Close Pulse or during the Reclaim Time with Line Check enabled, the relay will initiate a Trip and Lockout. This prevents a CB being repeatedly closed onto a faulted line. Where ***Line Check Trip*** = **DELAYED** then instantaneous protection is inhibited until the reclaim time has elapsed.

Manual Close resets Lockout, if the conditions that caused Lockout have reset, i.e. there is no trip or Lockout input present.

Manual Close cannot proceed if there is a Lockout input present.

With the Autoreclose function set to Disabled the Manual Close control is still active.

Close CB Delay

The Close CB Delay is applicable to manual CB close commands received through a ***Close CB*** binary input or via the Control Menu. Operation of the ***Manual Close CB*** binary output is delayed by the ***Close CB Delay*** setting. The status of this delay is displayed on the relay fascia as it decrements towards zero. Only when the delay reaches zero will the close command be issued and related functionality initiated.

Blocked Close Delay

The close command may be delayed by a ***Block Close CB*** signal applied to a binary input. This causes the feature to pause before it issues the CB close command and can be used, for example, to delay CB closure until the CB energy has reached an acceptable level. If the Block signal has not been removed before the end of the defined time, ***Blocked Close Delay***, the relay will go to the lockout state. The output ***Close CB Blocked*** indicates this condition.

Open CB Delay

The Open CB Delay setting is applicable to CB trip commands received through an ***Open CB*** binary input or via the Control Menu. Operation of the ***Open CB*** binary output is delayed by the ***Open CB Delay*** setting. The status of this delay is displayed on the relay fascia as it decrements towards zero. Only when the delay reaches zero will the trip command be issued and related functionality initiated.

It should be noted that a CB trip initiated by an *Open CB* command is fundamentally different from a CB trip initiated by a protection function. A CB trip caused by a *CB Open* command will not initiate functionality such as circuit-breaker fail, fault data storage, I^2t measurement and operation counter.

CB Controls Latched

CB controls for manually closing and tripping can be latched for extra security.

With Reset operation, the control resets when the binary input drops off. This can lead to multiple control restarts due to bounce on the binary input signal.

With Latch operation, the close or trip sequence always continues to completion (or sequence failure) and bounce on the binary input is ignored.

Reset operation can be useful, however, as it allows a close or trip sequence to be aborted by dropping off the binary input signal.

4.9 Synchronising

The optional Synchronising function is used to check that the voltage conditions, measured by the voltage transformers on either side of the open circuit breaker, indicate that it is safe to close without risk of damage to the circuit breaker of disturbance to the system. The timing of closure, for charging lines which are dead following fault clearance, is controlled to co-ordinate with other devices.

The window of time in which voltage conditions must be met is applied as a setting or can be disabled such that an indefinite period is allowed.

4.9.1 Reclosure Modes

The Synchronising element can be set to allow the autoreclose sequence to proceed for various system voltage conditions. The voltage conditions selected must be met within the *Synch Close Window* time if this is Enabled, this time can be set and starts at the end of the deadtime for autoreclose or the receipt of a Close CB command.

The voltage applied to the V_4 input is considered to be the BUSBAR voltage and the voltages applied to inputs V_1,V_2 & V_3 are the LINE voltage.

79 Dead Bar Charge, when set to Enabled, allows AR to proceed when the Line voltage is live and the Busbar is dead.

Manual Close DBC, when set to Enabled, allows MC to proceed when the Line voltage is live and the Busbar is dead.

79 Dead Line Charge, when set to Enabled, allows AR to proceed when the Busbar voltage is live and the Line is dead.

Manual Close DLC, when set to Enabled, allows MC to proceed when the Busbar voltage is live and the Line is dead.

79 Dead Line & Dead Bar Close, when set to Enabled, allows AR to proceed when the Line voltage and the Busbar voltage are dead.

Manual Close DLDB, when set to Enabled, allows MC to proceed when the Line voltage and the Busbar voltage are dead.

79 Check Sync Close, when set to Enabled, allows AR to proceed when both the Line and Busbar are considered live AND other synchronising requirements are met.

Manual Close CS, when set to Enabled, allows MC to proceed when both the Line and Busbar are considered live AND other synchronising requirements are met.

79 Unconditional Close, when set to Enabled, allows AR to proceed regardless of the voltage condition of the Bus or Line.

Unconditional Manual Close, when set to Enabled, allows MC to proceed regardless of the voltage condition of the Bus or Line.

Separate Enable/Disable settings are thus provided for each option for Autoreclose and Manual Close.

4.9.2 Charge Delays

Separate autoreclose delay settings are provided for Dead Line Charge and Dead Bus Charge closure by the ***79 DLC Delay*** and ***79 DBC Delay*** settings. These are applied after the autoreclose Dead Time when voltage conditions are checked and met, at the Close Inhibit stage of the sequence. This feature effectively allows the dead time to be set differently for faults on each side of the recloser.

4.9.3 Voltage monitoring elements

The single phase voltage source used for synchronising can be selected as any phase-to-phase or phase-to-earth voltage for flexibility. The voltage is compared to the corresponding voltage from the three-phase arrangement on the other side of the circuit-breaker. Voltage settings are set as a percentage of the nominal voltage specified in the CT/VT Config menu.

©2018 Siemens Protection Devices Limited

Voltage detectors

Voltage detectors determine the status of the line or bus. If the voltages on either the line or bus are below a set threshold level they can be considered to be 'dead'. If the voltages are within a setting around the nominal voltage they are classed as 'live'. Independent voltage detectors are provided for both line and bus.

If a voltage is in the dead band range then it will be classed as dead until it has reached the live band area. Similarly, if a voltage is live, it continues to be live until it has reached the dead band area. This effectively allows for variable amounts of hysteresis to be set. Figure 4.9.3-1 illustrates the voltage detector operation.

Note: the area between the dead and live zones is not indeterminate. When any voltage is applied to the relay it will ramp up the software RMS algorithm and always pass through the dead zone first.

A wide range is provided for live and dead voltage detector levels but the live and dead zones must not overlap.

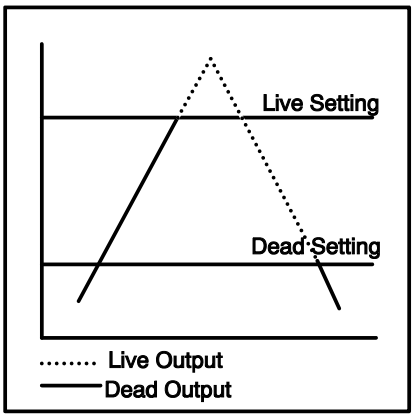


Figure 4.9.3-1 Voltage Detector Operation

Under-voltage detectors

The under-voltage detectors, if enabled, can block a close output command if either the line voltage is below the ***25 Line Undervolts*** setting value or the bus voltage is below the ***25 Bus Undervolts*** setting value. Both line and bus have their own independent settings and are applied to the single-phase voltage inputs.

Differential voltage detectors

The differential voltage detector, if enabled, can block a close output command if the difference between the line and bus voltages is greater than the differential voltage setting value.

4.9.4 Check Synchronising Mode

The ***Man Override Sync*** input is provided to bypass the voltage and synchronising checks to provide an emergency close function. Similarly, check synchronising can be overridden by the ***79 Override Sync*** input during autoreclose. Override can be set by binary inputs, Control commands and the function keys.

For the relay to issue a Check Sync Close the following conditions have to be met: -

The Line and Bus voltages must both be considered live.

25 Check Sync Angle – the phase difference between the line and bus voltages has to be less than the phase angle setting value. Whilst within the limits the phase angle can be increasing or decreasing and the element will still issue a valid close signal.

25 Check Sync Slip, [if enabled] – the frequency difference between line and bus has to be less than the slip frequency setting value.

25 Check Sync Timer, [if enabled] – the phase angle and voltage blocking features have to be within their parameters for the length of the slip timer setting. If either the phase angle or the voltage elements fall outside of their limits the slip timer is reset. If they subsequently come back in then the slip timer has to time out before an output is given. (This ensures that a close output will not be given if there is a transient disturbance on the system due to e.g. some remote switching operations).

25 Line Undervolts, [if enabled] – the line voltage has to be above the line under-voltage setting value and also above 5V for an output to be given.

25 Bus Undervolts, [if enabled] – the bus voltage has to be above the bus under-voltage setting value and also above 5V for an output to be given.

25 Volt Differential, [if enabled] – the difference between the line and bus voltages has to be less than the differential voltage detector setting value for an output to be given.

The synchronising is always started in the Check Synchronising mode of operation and the Check Synchronising limits are applied. To proceed to System Synchronisation a system split must be detected as described in section 4.9.5

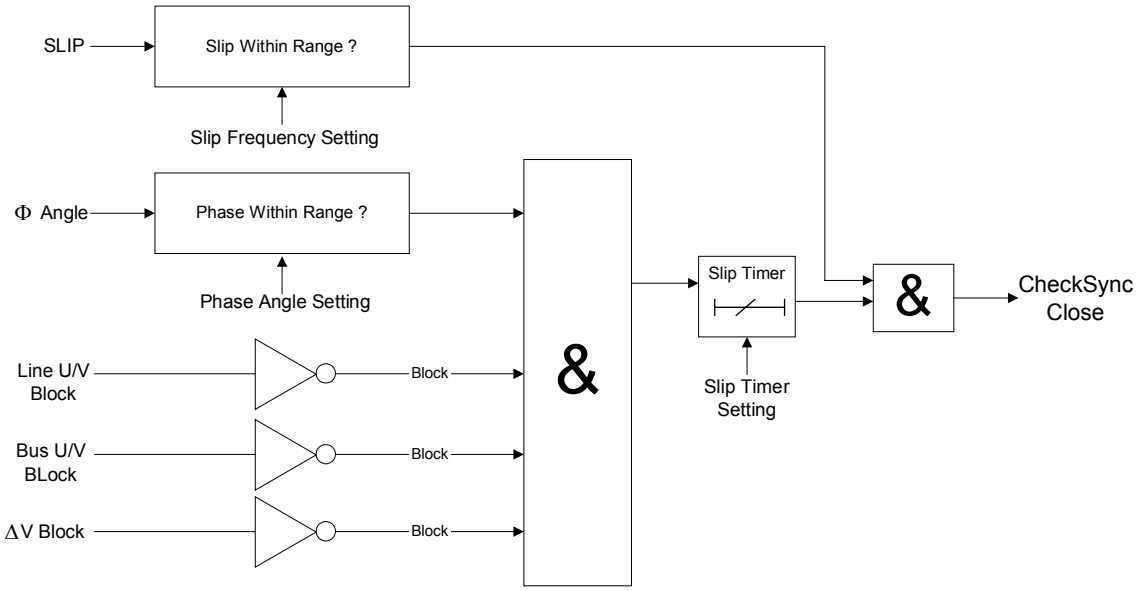


Figure 4.9.4-1 Check Sync Function

©2018 Siemens Protection Devices Limited

4.9.5 System Split Detector

A system split occurs where part of the system becomes islanded and operates separately. Under these conditions the frequencies of the voltages either side of the breaker are asynchronous and therefore high phase angle differences can occur as the voltage phasors slip past each other.

The decision to change to System Split settings, apply Close on Zero function, Lockout or ignore, during autoreclose and manual closing is set separately by the ***25 DAR Split Mode*** and ***25 MC Split Mode*** *settings*. The System Split condition is detected when either the measured phase difference angle exceeds the pre-set ***25 Slip Angle*** value or if the slip frequency exceeds a pre-set ***25 Split Slip*** rate based on the selection of ***25 System Split Mode*** setting.

Note : the system split setting is effectively an absolute value and therefore a split will occur at the value regardless of the direction of the frequency slip e.g. if an angle of 170° is selected, then starting from 0°, a split will occur at +170° or -170° (effectively +190°).

If a system split occurs during an autoreclose Check Sync operation, with ***25 System Sync*** set to *Enabled*, the following events occur: -

- A System Split event is recorded.
- If the ***25 DAR Split Mode*** *is set to CS,* Check Sync will continue.
- If the ***25 DAR Split Mode*** setting has been set to *SS*, the System Sync function is started. The ***25 SS In Progress*** can be mapped to an output relay or led for alarm indication. The mapped LED will stay on for a minimum time, or can be latched using non self reset LEDs.
- If the ***25 DAR Split Mode*** setting has been set to COZ, the Close On Zero function is started. The ***25 COZ In Progress*** can be mapped to an output relay or led for alarm indication.
- If the **25 DAR Split Mode** has been set to LO, then, a ***25 System Split LO*** output is given which can be mapped to an output relay or led for alarm indication. The relay will stay in this lockout mode until one of the following methods of resetting it is performed: -
- 1. The relay is reset from Lockout by binary input or a command.
- 2. The CB is manually closed

Similarly if a system split occurs during a Manual Close Check Sync operation, with ***25 System Sync*** set to *Enabled*, the following events occur: -

- A System Split event is recorded.
- If the ***25 MC Split Mode*** *is set to CS,* Check Sync will continue.
- If the ***25 MC Split Mode*** setting has been set to *SS*, the System Sync function is started. The ***25 SS In Progress*** can be mapped to an output relay or led for alarm indication.
- If the ***25 DAR Split Mode*** setting has been set to COZ, the Close On Zero function is started. The ***25 COZ In Progress*** can be mapped to an output relay or led for alarm indication.

4.9.6 System Sync Reversion

If the close conditions of System Sync are not met and a zero slip condition is subsequently detected, by the slip falling below the *25 Split Slip* setting, the relay will exit from System Sync mode and revert to Check Synchronising mode. The reversion allows the device to use the wider Check Sync parameters, to allow a close following the restoration of normal operation when the islanded network has been reconnected to the main network by successful reclosure of a parallel connection.

4.9.7 System Synchronising Mode

For the relay to issue a System Sync Close the following conditions have to be met: -

Both the Bus and Line voltages must be considered Live by the Voltage Monitoring elements.

25 System Sync Angle – the phase difference between the line and bus voltages has to be less than the phase angle setting value **and the phase angle has to be decreasing** before the element will issue a valid close signal.

25 System Sync Slip, [if Enabled] – the frequency difference between line and bus has to be less than the slip frequency setting value. Slip frequency must be above the *25 Split Slip* setting to avoid reversion to Check Synchronising conditions. The settings for *25 System Sync Slip* and *25 Split Slip* must differ by at least 20 mHz.

25 System Sync Timer, [if Enabled] – the phase angle and voltage blocking features have to be within their parameters for the length of the slip timer setting. If either the phase angle or the voltage elements fall outside of their limits the slip timer is reset. If they subsequently come back in then the slip timer has to time out before an output is given. (This ensures that a close output will not be given if there is a transient disturbance on the system due to e.g. some remote switching operations).

25 Line Undervolts, [if Enabled] – the line voltage has to be above the line under-voltage setting value and also above 5V for an output to be given.

25 Bus Undervolts, [if Enabled] – the bus voltage has to be above the line under-voltage setting value and also above 5V for an output to be given.

25 Volt Differential, [if Enabled] – the difference between the line and bus voltages has to be less than the □V detector setting value for an output to be given.

The System Synchronising operation of the relay will only be started after a System Split is detected as described in section 4.9.6 during an autoreclose or manual close sequence.

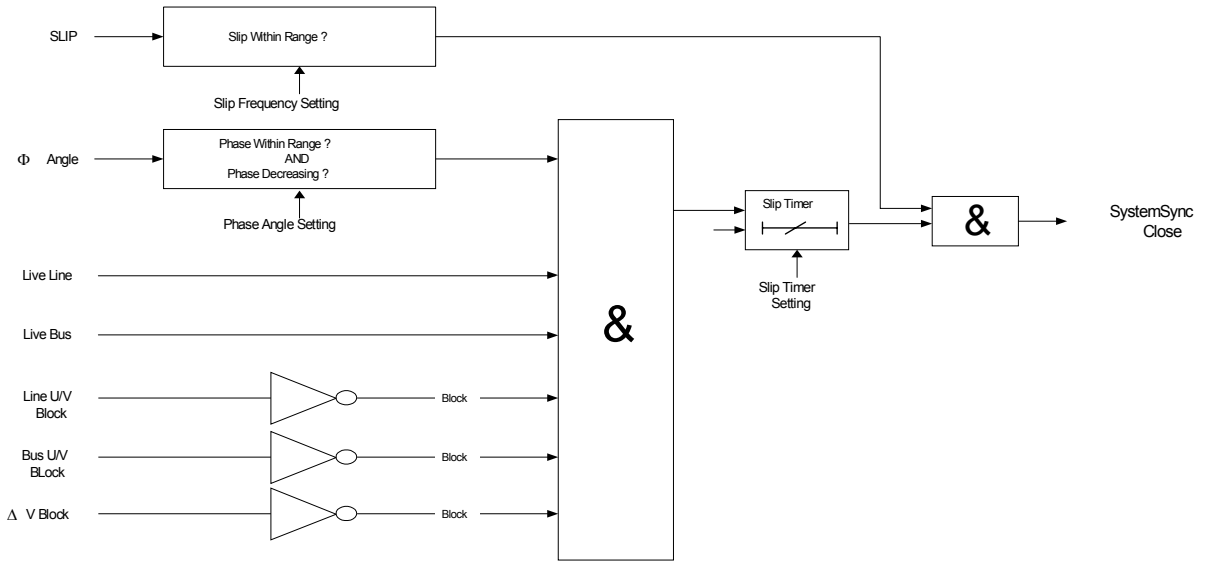


Figure 4.9.7-1 System Sync Function

4.9.8 Close on Zero Mode

If the *25 DAR Split Mode* or *25 MC Split Mode* is set *to COZ* the relay will apply a Close-On-Zero to the respective closing operation if the synchronising mode changes to System Split. The measured slip frequency and the measured phase difference are used to provide a Close Pulse which will close the CB when the phase difference is reducing and timed with the setting *25 CB Close Time* such that the instant of closure is when the phase difference is zero. The slip frequency must be less than the *25 COZ Slip Freq* but greater than the *25 Split Slip* setting to avoid reversion to Check Synchronising conditions.

Since this feature is part of the System Synchronising function, *25 System Sync* must also be set to *Enabled*.

 ©2018 Siemens Protection Devices Limited

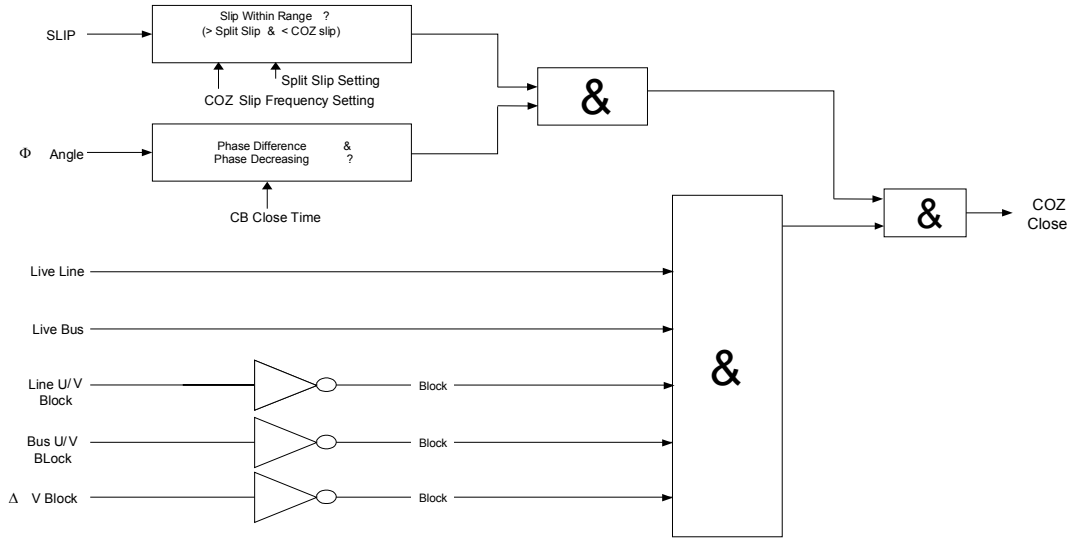


Figure 4.9.8-1 Close On Zero Function

Close on Zero will not be accurate if slow CB times are applied in conjunction with fast slip rates during testing. Practical application limits are shown below: -

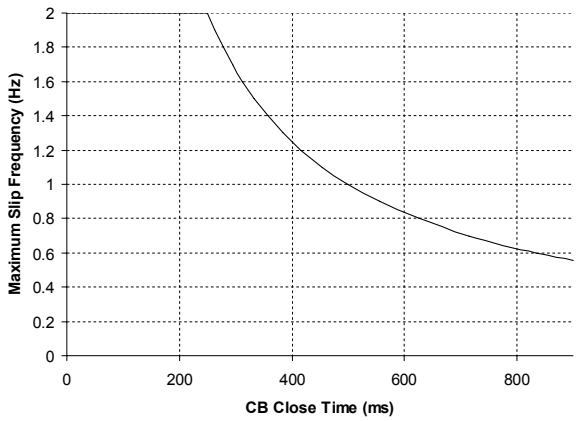


Figure 4.9.8-2 Close On Zero Timing

4.10 Live/Dead Indication

Outputs are provided to identify each voltage input as either Live or Dead using voltage user settings. These outputs are controlled independently of the 25 Check Synchronising Voltage monitoring elements but operate in the same way.

Voltage detectors are provided for each phase input A, B, C & X and inputs Y & Z when fitted. If the voltage on the respective input is below a set threshold level they can be considered to be 'dead'. If the voltages are above a voltage setting they are classed as 'live'. Independent voltage detectors are provided for both line and bus.

If a voltage is in the dead band range then it will be classed as dead until it has reached the live band area. Similarly, if a voltage is live, it continues to be live until it has reached the dead band area. This effectively allows for variable amounts of hysteresis to be set. Figure 4.10-1 illustrates the voltage detector operation.

Note: the area between the dead and live zones is not indeterminate. When any voltage is applied to the relay it will ramp up the software RMS algorithm and always pass through the dead zone first.

A wide range is provided for live and dead voltage detector levels but the live and dead zones must not overlap.

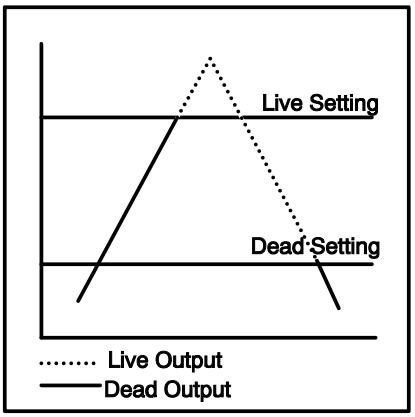


Figure 4.10-1 Voltage Detector Operation

Live and Dead outputs are provided for each voltage input:

A Live, B Live, C Live, A Dead, B Dead, C Dead, X Live, Y Live, Z Live, X Dead, Y Dead & Z Dead,

Combined outputs are also provided separately to indicate ALL phases Live or Dead:

ABC Live, ABC Dead, XYZ Live & XYZ Dead

4.11 Circuit Breaker

This menu includes relay settings applicable to both manual close (MC) and auto-reclose (AR) functionality.

CB Controls Latched

CB controls for closing and tripping can be latched i.e. until confirmation that the action has been completed i.e. binary input is edge triggered when latched.

Close CB Delay

The Close CB Delay is applicable to manual CB close commands received through a ***Close CB*** binary input or via the Control Menu. Operation of the ***Manual Close CB*** binary output is delayed by the ***Close CB Delay*** setting.

NB: During the close countdown period the operation can be terminated by pressing 'Cancel' on the fascia.

Close CB Pulse

The duration of the ***CB Close Pulse*** is settable to allow a range of CBs to be used. The Close pulse will be terminated if any protection pick-up operates or a trip occurs. This is to prevent Close and Trip Command pulses existing simultaneously. A ***79 Close On Fault*** Output is given if a pick-up or trip operates during the Close Pulse. This can be independently wired to Lockout.

'CB Failed To Open' and 'CB Failed to Close' features are used to confirm that a CB has not responded correctly to each Trip and Close Command. If a CB fails to operate, the AR feature will go to lockout.

'79 CB Close Fail' is issued if the CB is not closed at the end of the close pulse, ***CB Close Pulse***.

Reclaim Timer

The 'Reclaim time' will start each time a Close Pulse has timed out and the CB has closed.

Where a protection pickup is raised during the reclaim time the relay advances to the next part of the reclose sequence.

The relay goes to the Lockout state if the CB is open at the end of the reclaim time or a protection operates during the final reclaim time.

 ©2018 Siemens Protection Devices Limited

Blocked Close Delay

The close command may be delayed by a ***Block Close CB*** signal applied to a binary input. This causes the feature to pause before it issues the CB close command and can be used, for example, to delay CB closure until the CB energy has reached an acceptable level. If the Block signal has not been removed before the end of the defined time, ***Blocked Close Delay***, the relay will go to the lockout state.

Open CB Delay

The Open CB Delay setting is applicable to CB trip commands received through an ***Open CB*** binary input or via the Control Menu. Operation of the ***Open CB*** binary output is delayed by the ***Open CB Delay*** setting.

NB: During the open countdown period the operation can be terminated by pressing 'Cancel' on the fascia.

Open CB Pulse

The duration of the CB open Command pulse is user settable to allow a range of CBs to be used.

CB Failed to Open is taken from the Circuit Breaker Failure Element.

CB Travel Alarm (DBI)

The ***CB Open*** and ***CB Closed*** binary inputs are continually monitored to track the CB Status.

The CB should only ever be in 3 states:

CB Status	***CB Open*** **binary input**	***CB Closed*** **binary input**
CB is Open	1	0
CB is Closed	0	1
CB is Travelling between the above 2 states	0	0

The Relay goes to Lockout and the ***CB Alarm*** output is given where the Travelling condition exists for longer than the ***CB Travel Alarm*** setting.

An instantaneous ***CB Alarm*** is given for a 1/1 state – i.e. where the CB indicates it is both Open and Closed at the same time.

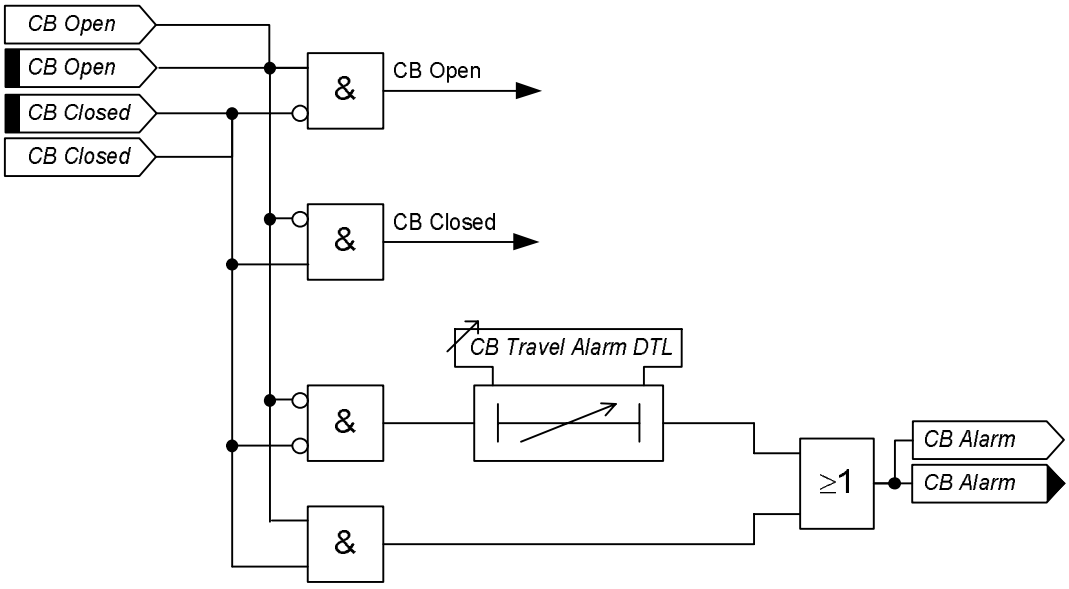


Figure 4.11-1 Logic Diagram: Circuit Breaker Status

Trip Time Alarm

The CB Trip Time meter displays the measured time between the trip being issued and the CB auxiliary contacts changing state. If this measured time exceeds the ***Trip Time Alarm*** time, a Trip Time Alarm output is issued.

Trip Time Adjust

This allows for the internal delays caused by the relay – especially the delay before a binary input operates – to be subtracted from the measured CB trip time. This gives a more accurate measurement of the time it took for the CB to actually trip.

Hot Line In/Out

The *Hot Line* function can be used to provide an immediate trip and auto-reclose inhibit for any Overcurrent, Earth Fault or Sensitive Earth Fault detection. This function is used to increase safety when personnel are working in the vicinity of live primary equipment.

When *Hot Line* is enabled, pickup of any 50, 51, 50G, 51G, 50SEF or 51SEF element will cause an instantaneous trip, bypassing any time delay setting of the element. Any auto-reclose sequence will be inhibited and Auto-reclose Lockout will be raised. This feature is not triggered by pick-up or operation of other protection elements such as under/over voltage, frequency, thermal or negative sequence over-current.

Additionally, when *Hot Line* is *In*, Manual Close is inhibited. This can help to prevent unintended energisation of a dead circuit whilst personnel are working nearby. Hot Line must be switched to Out before the Manual Close action will be successful.

Hot Line can be configured to be switched In/Out by binary inputs, function keys or by commands via the communications protocols. There are no other configurable options for Hot Line.

©2018 Siemens Protection Devices Limited

4.12 Quick Logic

The 'Quick Logic' feature allows the user to input up to 16 logic equations (E1 to E16) in text format. Equations can be entered using Reydisp or at the relay fascia.

Each logic equation is built up from text representing control characters. Each can be up to 20 characters long. Allowable characters are: -

0, 1, 2, 3, 4, 5, 6, 7, 8, 9	Digit
( )	Parenthesis
!	'NOT' Function
.	'AND' Function
^	'EXCLUSIVE OR' Function
+	'OR' Function
E*n*	Equation (number)
F*n*	Function Key (number)
	'1' = Key pressed, '0' = Key not pressed
I*n*	Binary Input (number)
	'1' = Input energised, '0' = Input de-energised
L*n*	LED (number)
	'1' = LED energised, '0' = LED de-energised
O*n*	Binary output (number)
	'1' = Output energised, '0' = Output de-energised
V*n*	Virtual Input/Output (number)
	'1' = Virtual I/O energised, '0' = Virtual I/O de-energised

Example Showing Use of Nomenclature

***E1*= ((I1^F1).!O2)+L1**

Equation 1 = ((Binary Input 1 XOR Function Key 1) AND NOT Binary Output 2) OR LED 1

When the equation is satisfied (=1) it is routed through a pick-up timer (***En Pickup Delay***), a drop-off timer (***En Dropoff Delay***), and a counter which instantaneously picks up and increments towards its target (***En Counter Target***).

The counter will either maintain its count value ***En Counter Reset Mode*** = **OFF**, or reset after a time delay: -

En Counter Reset Mode = **Single Shot**: The ***En Counter Reset Time*** is started only when the counter is first incremented (i.e. counter value = 1) and not for subsequent counter operations. Where ***En Counter Reset Time*** elapses and the count value has not reached its target the count value is reset to zero.

En Counter Reset Mode = **Multi Shot**: The ***En Counter Reset Time*** is started each time the counter is incremented. Where ***En Counter Reset Time*** elapses without further count increments the count value is reset to zero.

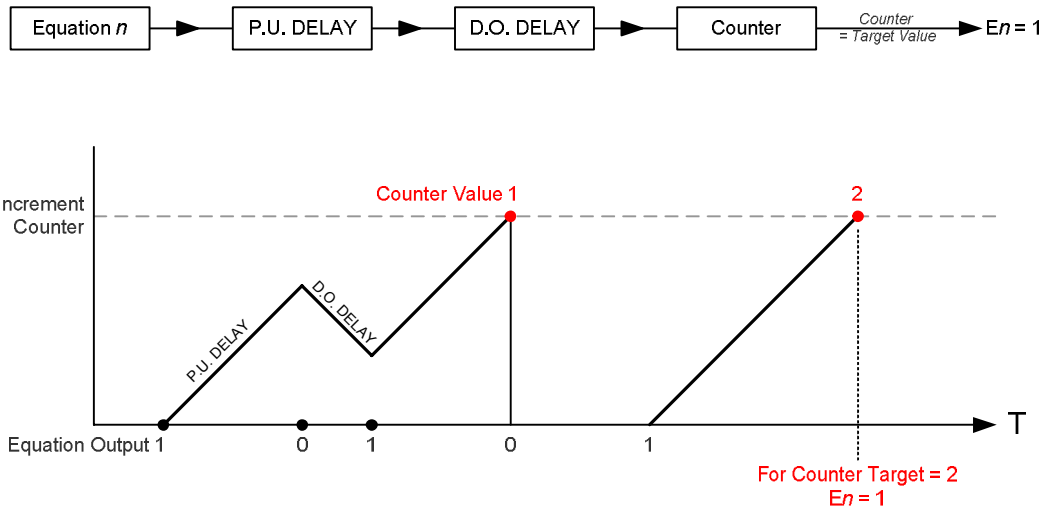


Figure 4.12-1Sequence Diagram: Quick Logic PU/DO Timers (Counter Reset Mode Off)

When the count value = ***En Counter Target*** the output of the counter (En) = 1 and this value is held until the initiating conditions are removed when En is instantaneously reset.

The output of E*n* is assigned in the OUTPUT CONFIG>OUTPUT MATRIX menu where it can be programmed to any binary output (O), LED (L) or Virtual Input/Output (V) combination.

Protection functions can be used in Quick Logic by mapping them to a Virtual Input / Output.

Refer to Applications Guide for examples of Logic schemes.

©2018 Siemens Protection Devices Limited

Section 5: Supervision Functions

5.1 Circuit Breaker Failure (50BF)

The circuit breaker fail function has two time delayed outputs that can be used for combinations of re-tripping or back-tripping. CB Fail outputs are given after elapse of the ***50BF-1 Delay*** or ***50BF-2 Delay*** settings. The two timers run concurrently.

The circuit breaker fail protection time delays are initiated either from: -

An output **Trip Contact** of the relay (MENU: OUTPUT CONFIG\BINARY OUTPUT CONFIG\Trip Contacts), or

A binary or virtual input assigned to **50BF Ext Trig** (MENU: INPUT CONFIG\INPUT MATRIX\50BF Ext Trig).

A binary or virtual input assigned to **50BF Mech Trip** (MENU: INPUT CONFIG\INPUT MATRIX\ 50BF Mech Trip).

CB Fail outputs will be issued providing any of the 3 phase currents are above the ***50BF Setting*** or the current in the fourth CT is above ***50BF-I4*** for longer than the ***50BF-n Delay*** setting, or for a mechanical protection trip the circuit breaker is still closed when the ***50BF-n Delay*** setting has expired – indicating that the fault has not been cleared.

Both ***50BF-1*** and ***50BF-2*** can be mapped to any output contact or LED.

If the ***CB Faulty*** input (MENU: INPUT CONFIG\INPUT MATRIX\50BF CB Faulty) is energised when a CB trip is given the time delays ***50BF-n Delay*** will be by-passed and the output given immediately.

Operation of the CB Fail elements can be inhibited from: -

Inhibit 50BF A binary input, virtual input or remote data Comms.

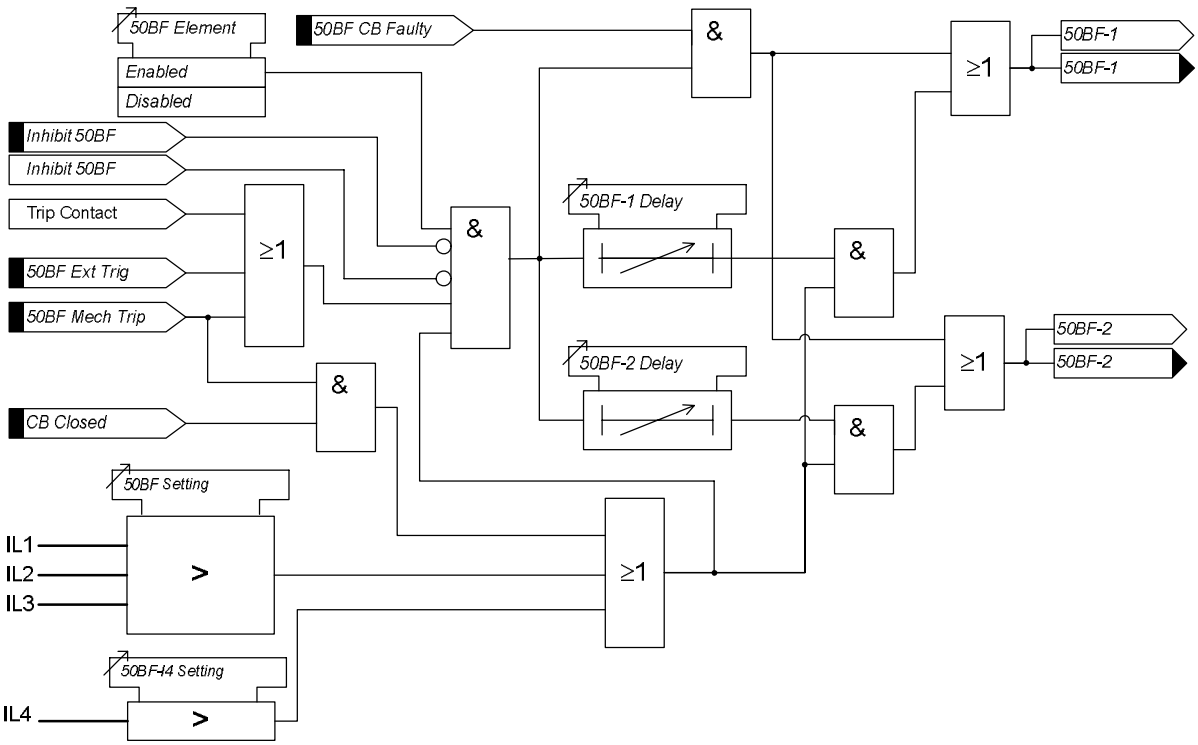


Figure 5.1-1 Logic Diagram: Circuit Breaker Fail Protection (50BF)

5.2 VT Supervision (60VTS) – 7SR22

1 or 2 Phase Failure Detection

Normally the presence of negative phase sequence (NPS) or zero phase sequence (ZPS) voltage in a power system is accompanied by NPS or ZPS current. The presence of either of these sequence voltages without the equivalent level of the appropriate sequence current is used to indicate a failure of one or two VT phases.

The ***60VTS Component*** setting selects the method used for the detection of loss of 1 or 2 VT phases i.e. **ZPS** or **NPS** components. The sequence component voltage is derived from the line voltages; suitable VT connections must be available. The relay utilises fundamental voltage measurement values for this function.

The element has user settings ***60VTS V*** and ***60VTS I.*** A VT is considered to have failed where the voltage exceeds ***60VTS V*** while the current is below ***60VTS I*** for a time greater than ***60VTS Delay***.

3 Phase Failure Detection

Under normal load conditions rated PPS voltage would be expected along with a PPS load current within the circuit rating. Where PPS load current is detected without corresponding PPS voltage this could indicate a three phase VT failure. To ensure these conditions are not caused by a 3 phase fault the PPS current must also be below the fault level.

The element has a ***60VTS*** V_{PPS} setting, an ***60VTS*** I_{PPS} ***Load*** setting and a setting for ***60VTS*** I_{PPS} ***Fault***. A VT is considered to have failed where positive sequence voltage is below ***60VTS*** V_{PPS} while positive sequence current is above I_{PPS} ***Load*** and below I_{PPS} ***Fault*** level for more than ***60VTS Delay*** then a VT failure will be detected.

External MCB

A binary input can be set as ***Ext_Trig 60VTS*** to allow the ***60VTS Delay*** element to be started from an external MCB operating.

Once a VT failure condition has occurred the output is latched on and is reset by any of the following: -

Voltage is restored to a healthy state i.e. above V_{PPS} setting while NPS voltage is below V_{NPS} setting.

Ext Reset 60VTS	A binary or virtual input, or function key and a VT failure condition no longer exists.
Inhibit 60VTS	A binary, virtual input, function key or remote data Comms.

©2018 Siemens Protection Devices Limited

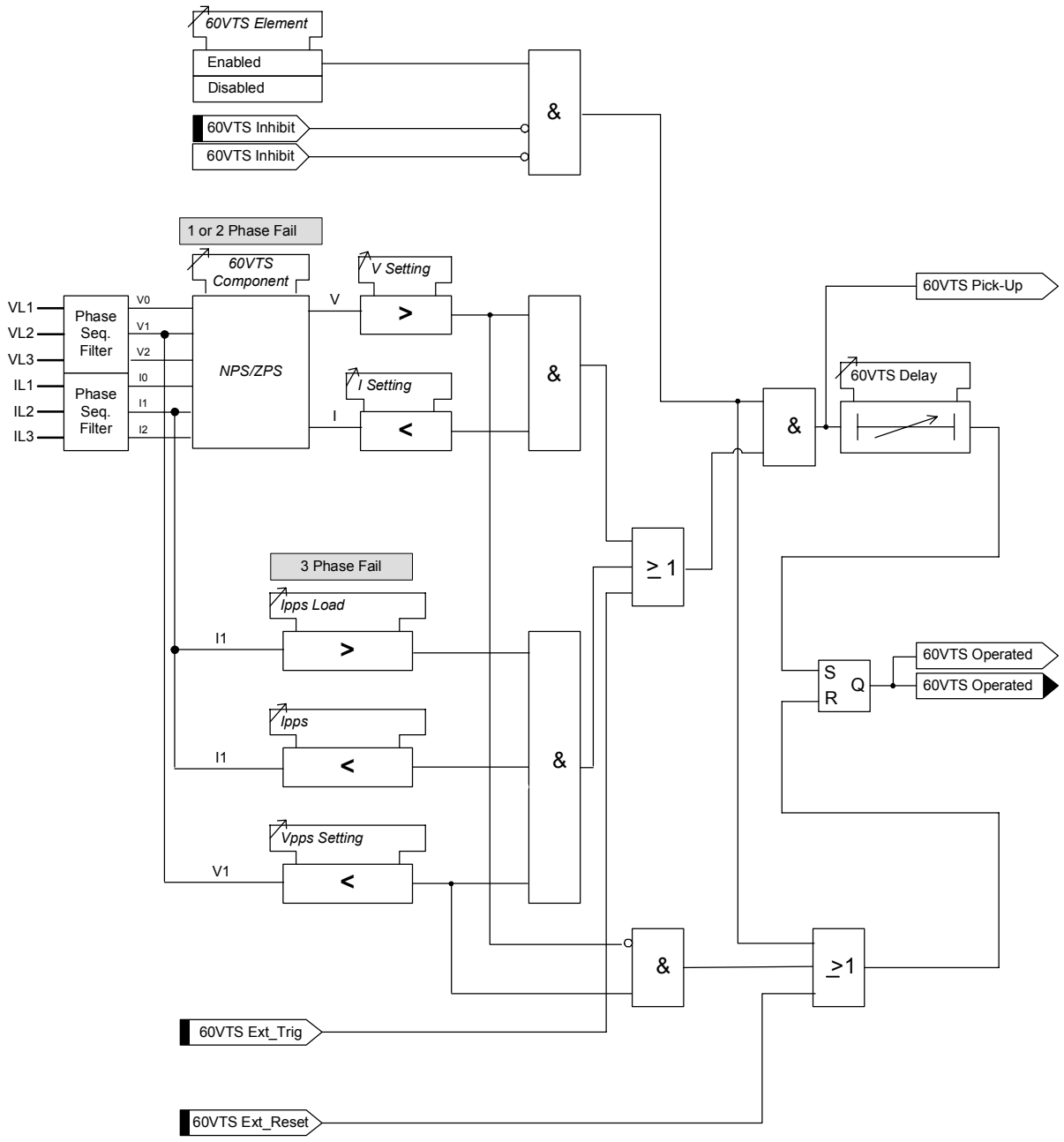


Figure 5.2-1 Logic Diagram: VT Supervision Function (60VTS)

5.3 Busbar VT Fail (60VTF-Bus) – 7SR22

When the optional synchronising function is fitted, the synchronising voltage transformer is utilised to provide an additional monitoring function to check the validity of the measured line and busbar voltages. When the circuit breaker is closed, both voltages should be either Live or Dead. If the Bus voltage indicates that the VT is Dead but the corresponding Line voltage is Live, this raises the Bus VT Fail output. A time delay setting is provided to avoid spurious operations during transient switching conditions. Additionally, this output can be enabled by a setting, *79 LO Bus VT Fail*, to apply a Lockout signal to the autoreclose function so that a sequence will not be attempted after a trip occurs if it is known that the voltage measurement is not reliable. A similar setting is available, *79 LO Line VT Fail,* which when Enabled will provide a Lockout for a Line VT failure detected by the *60VTS* function.

5.4 CT Supervision (60CTS & 60CTS-I)

The relay has two methods of detecting a CT failure, depending on the relay variant.

5.4.1 (60CTS-I) – 7SR21 & 7SR22

The current from each of the Phase Current Transformers is monitored. If one or two of the three input currents falls below the CT supervision current setting ***CTS-I*** for more than ***60CTS-I Delay*** then a CT failure output (***60CTS-I Operated***) is given. If all three input currents fall below the setting, CT failure is not raised.

Operation of the CT supervision elements can be inhibited from: -

Inhibit 60CTS-I A binary input, virtual input or remote data Comms.

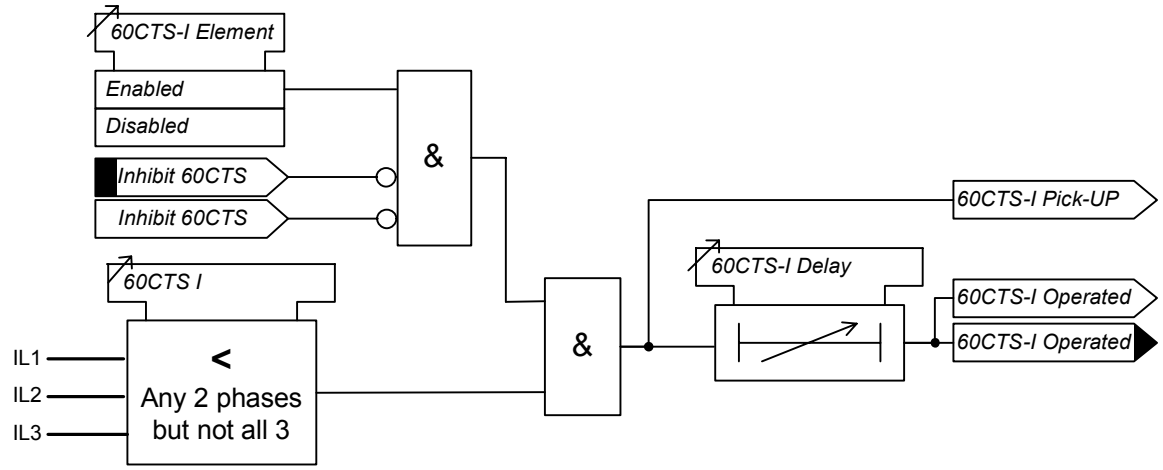


Figure 5.4.1-1 Logic Diagram: CT Supervision Function (60CTS-I) – 7SR21 & 7SR22

5.4.2 (60CTS) – 7SR22

Normally the presence of negative phase sequence (NPS) current in a power system is accompanied by NPS voltage. The presence of NPS current without NPS voltage is used to indicate a current transformer failure.

The element has a setting for NPS current level ***60CTS Inps*** and a setting for NPS voltage level ***60CTS Vnps.*** If the negative sequence current exceeds its setting while the negative sequence voltage is below its setting for more than ***60CTS Delay*** then a CT failure output (***60CTS Operated***) is given.

Operation of the CT supervision elements can be inhibited from: -

Inhibit 60CTS A binary input, virtual input or remote data Comms.

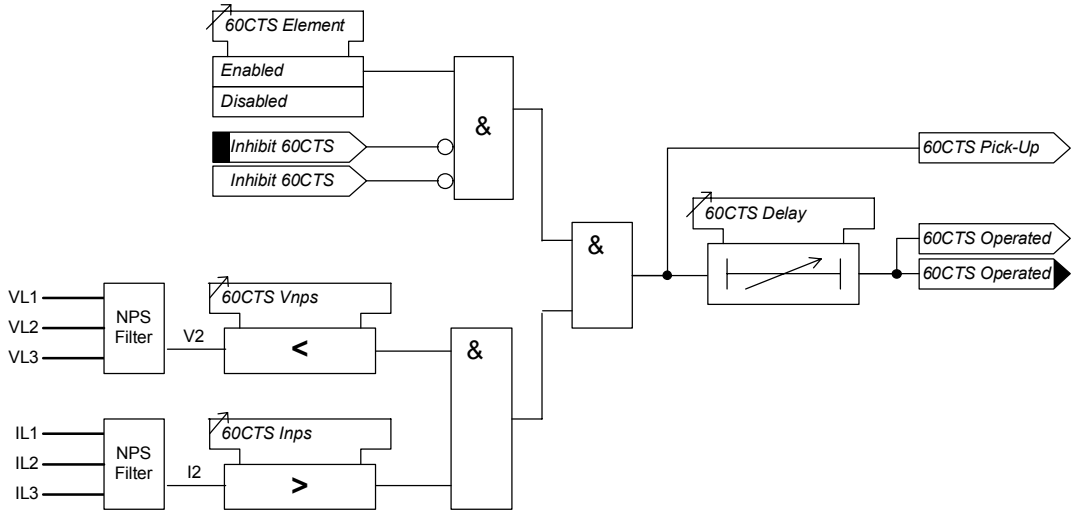


Figure 5.4.2-1 Logic Diagram: CT Supervision Function (60CTS) – 7SR22

©2018 Siemens Protection Devices Limited

5.5 Broken Conductor (46BC)

The element calculates the ratio of NPS to PPS currents. Where the NPS:PPS current ratio is above ***46BC Setting*** an output is given after the ***46BC Delay***.

The Broken Conductor function can be inhibited from: -

Inhibit 46BC	A binary input, virtual input or remote data Comms.
Gn 46BC U/I Guarded	Operation of the undercurrent guard function.

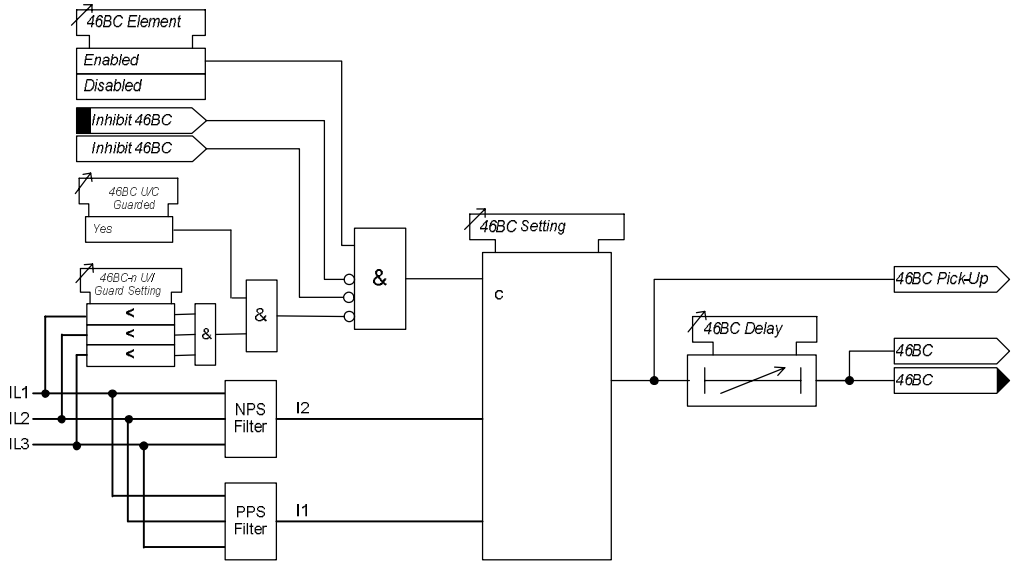


Figure 5.5-1 Logic Diagram: Broken Conductor Function (46BC)

5.6 Trip / Close Circuit Supervision (74TCS & 74CCS)

The relay provides three trip and three close circuit supervision elements. All elements are identical in operation and independent from each other allowing three trip and three close circuits to be monitored.

One or more binary inputs can be mapped to ***74TCS-n.*** The inputs are connected into the trip circuit such that at least one input is energised when the trip circuit wiring is intact. If all mapped inputs become de-energised, due to a break in the trip circuit wiring or loss of supply an output is given.

The ***74TCS-n Delay*** setting prevents failure being incorrectly indicated during circuit breaker operation. This delay should be greater than the operating time of the circuit breaker.

The use of one or two binary inputs mapped to the same Trip Circuit Supervision element (e.g. 74TCS-n) allows the user to realise several alternative monitoring schemes – see 'Applications Guide'.

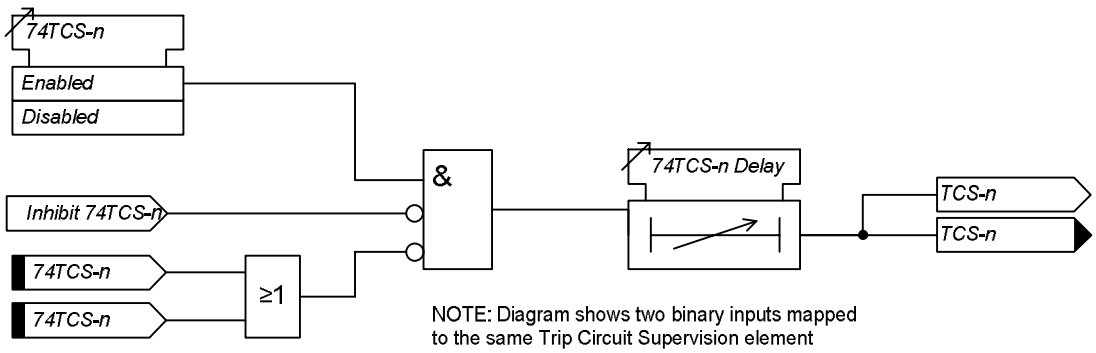


Figure 5.6-1 Logic Diagram: Trip Circuit Supervision Feature (74TCS)

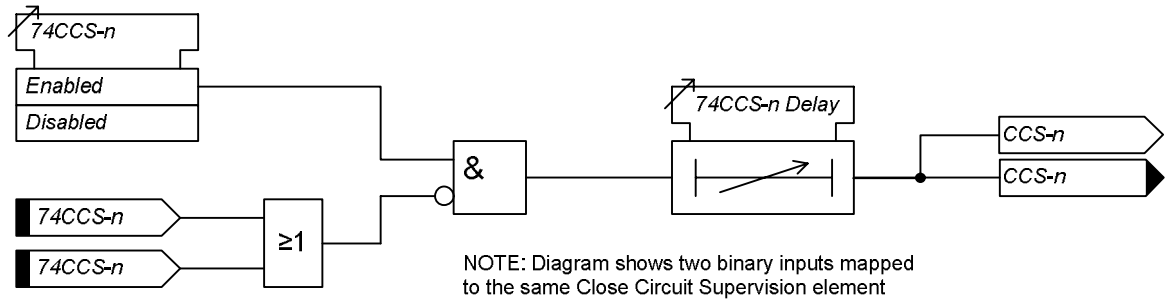


Figure 5.6-2 Logic Diagram: Close Circuit Supervision Feature (74CCS)

5.7 Inrush Restraint (81HBL2)

Inrush restraint detector elements are provided, these monitor the line currents.

The inrush restraint detector can be used to block the operation of selected elements during transformer magnetising inrush conditions.

The ***81HBL2 Bias*** setting allows the user to select between **Phase**, **Sum** and **Cross** methods of measurement:

Phase Each phase is inhibited separately.

Sum With this method the square root of the sum of the squares of the second harmonic in each phase is compared to each operate current individually.

Cross All phases are inhibited when any phase detects an inrush condition.

An output is given where the measured value of the second harmonic component is above the **81HBL2** setting.

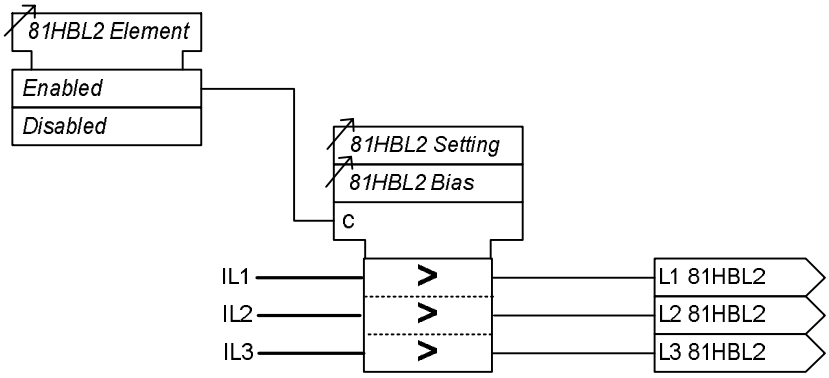


Figure 5.7-1 Logic Diagram: Harmonic Block Feature (81HBL2)

 ©2018 Siemens Protection Devices Limited

5.8 Over Fluxing Detector (81HLB5)

Over fluxing detector elements monitor the line currents.

The inrush restraint detector can be used to block the operation of selected elements during transformer magnetising inrush conditions.

The ***81HBL5 Bias*** setting allows the user to select between **Phase**, **Sum** and **Cross** methods of measurement:

Phase Each phase is inhibited separately

Sum The inrush current from each phase is summated and compared to each operate current individually

Cross All phases are inhibited when any phase detects an inrush condition

An output is given where the measured fifth harmonic component content is above the **81HBL5** setting.

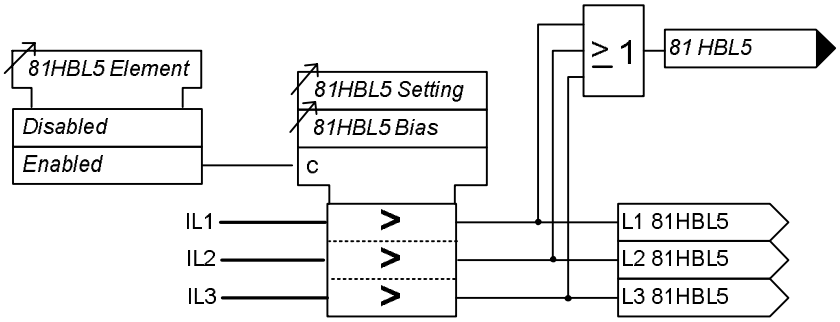


Figure 5.8-1 Logic Diagram: Over Fluxing Detector (81HLB5)

5.9 Load Blinder (21)

Load Blinders are used with directional overcurrent protection elements to block tripping during sustained heavy load periods in distribution networks.

A Load Blinder element is provided in the 7SR22 relay with two operating modes, three-phase and single-phase.

5.9.1 Load Blinder (21) Three-Phase

Three-phase mode uses positive sequence impedance Z1. Both the negative sequence overcurrent threshold (Blinder I2 > Block) and the under-voltage threshold (Blinder V< Block) are used to block the function.

21LB-3P Angle sets the angle for the load blinder region.

21LB-3P Impedance sets the impedance of the load blinder region.

21LB-3P VPPS sets the level of positive phase sequence voltage.

21LB-3P IPPS sets the level of negative phase sequence current.

Operation of the element can be inhibited from: -

Inhibit LB A binary input, virtual input, function key or remote data communications

The design of Load Blinder 3Ph makes consideration that protection blocking should be issued only during definable allowable system power flow conditions i.e. an overcurrent blocking signal can only be issued when: -

a. Positive Sequence Voltage **Vpps** is not significantly changed, when the **Vpps** is above the ***21LB-3P VPPS Setting.***
   AND
b. Negative Sequence Current **Inps** is lower than ***21LB-3P INPS Setting***
   AND
c. Distributed generators feed in PPS current into the system. In case of high load in system due to distributed generation hence resulting in change of **Zpps.**
   Zpps is calculated from **Vpps** and **Ipps**. The magnitude and angle of **Zpps** is compared with ***21LB-3P Impedance*** and ***21LB-3P Angle*** to determine if the impedance is in operate or block and/or FWD or REV zone.

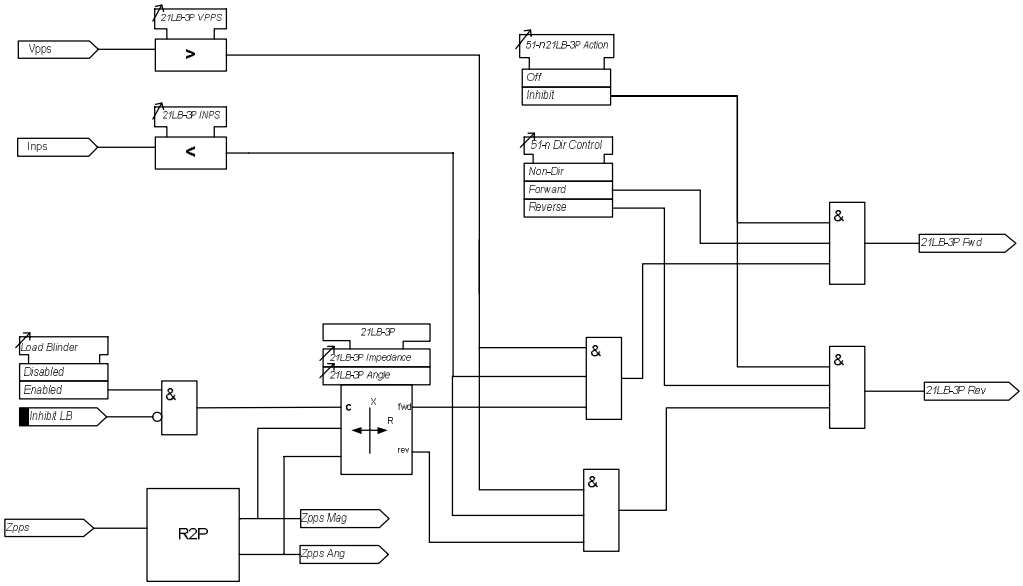


Figure 5.9.1-1 Logic Diagram: Load Blinder Three-Phase

©2018 Siemens Protection Devices Limited

5.9.2 Load Blinder (21) Single-Phase.

Single-phase mode uses the normal impedance (Z) of each phase. The overcurrent blocking is phase segregated and is dependent on the individual overcurrent settings per phase. Only the under-voltage threshold (Blinder V < block) can block the function.

Distributed generation can cause power flow in reverse direction to normal system operation. Load Impedance Blinders are used to block overcurrent operation for loads above a particular level and angle.

A Blinder is an impedance sensing element with a straight-line characteristic when plotted on the R – X plane

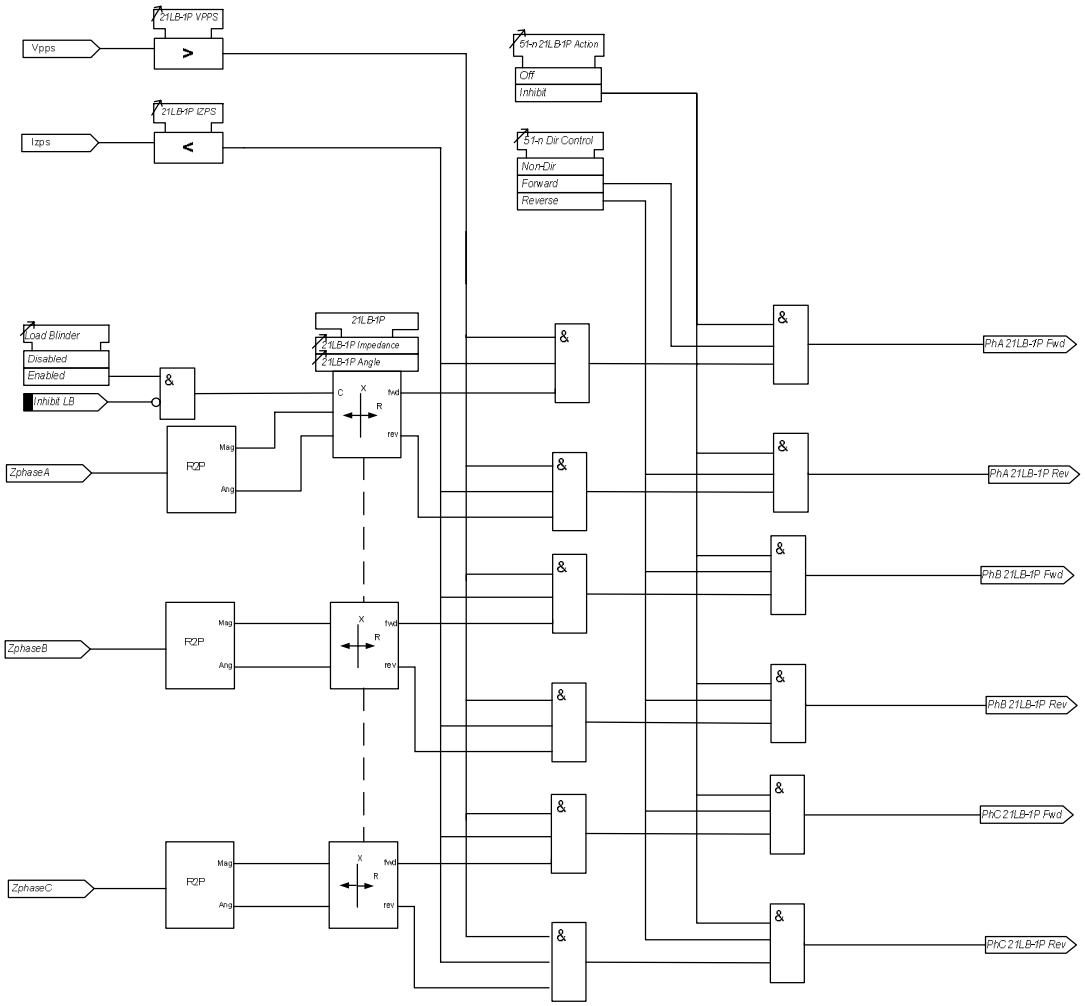


Figure 5.9.2-1 Logic Diagram: Load Blinder Single-Phase

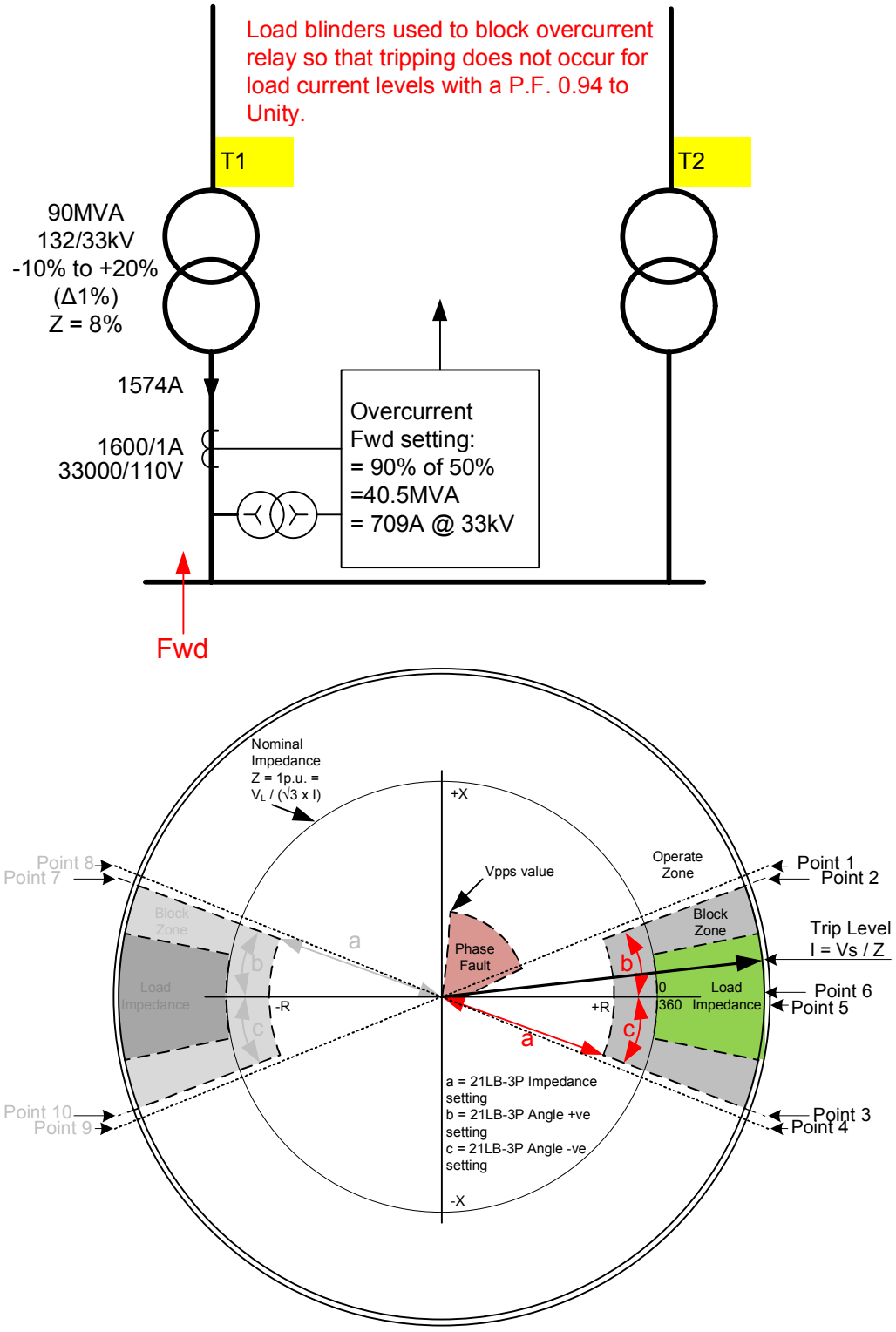


Figure 5.9.2-2 Load Blinder and Angle

©2018 Siemens Protection Devices Limited

Section 6: Other Features

6.1 Data Communications

Two communication ports, COM1 and COM2 are provided. RS485 connections are available on the terminal blocks at the rear of the relay (COM1). A USB port, COM 2, is provided at the front of the relay for local access using a PC.

Optionally, additional communication ports are available: -

2x fibre optic with ST connectors and 1x IRIG-B – (COM3 and COM 4),

1x RS485 and 1x IRIG-B – (COM 3),

1x RS232 and IRIG-B – (COM 3),

2x Electrical Ethernet with RJ45 connectors IEC 61850 - (COM 3 and COM 4),

2x Optical Ethernet with Duplex LC 100BaseF connectors IEC 61850 - (COM 3 and COM 4).

Communication is compatible with Modbus-RTU, IEC60870-5-103 FT 1.2, DNP 3.0 and IEC 61850 transmission and application standards.

For communication with the relay via a PC (personal computer) a user-friendly software package, Reydisp Evolution, is available to allow transfer of relay settings, waveform records, event records, fault data records, Instruments/meters and control functions. Reydisp Evolution is compatible with IEC60870-5-103.

Data communications operation is described in detail in the Data Communications Definitions section.

6.2 Maintenance

The following CB maintenance counters are provided:

CB Total Trip Count:	Increments on each trip command issued.
CB Total Trip Manual Open	Selects whether the CB Total Trip Counter is incremented for Manual Open Operations. If disabled, the CB Total Counter will only increment for protection trip commands.
CB Delta Trip Count:	Additional counter which can be reset independently of the Total Trip Counter. This can be used, for example, for recording trip operations between visits to a substation.
CB Delta Trip Manual Open	Selects whether the CB Delta Trip Counter is incremented for Manual Open Operations. If disabled, the CB Delta Trip Counter will only increment for protection trip commands.
CB Count to AR Block: (Only in Auto-reclose models)	Displays the number of CB trips experienced by the CB before the AR is blocked. When the target is reached the relay will only do 1 Delayed Trip to Lockout. An output is available to reset this value.
CB Count to AR Block Manual Open: (Only in Auto-reclose models)	Selects whether the CB Count to AR Block is incremented for Manual Open Operations. If disabled, the CB Count to AR Block will only increment for protection trip commands.
CB Frequent Ops Count	Logs the number of trip operations in a rolling window period of one hour. An output is available to reset this counter.

Binary outputs can be mapped to each of the above counters, these outputs are energised when the user defined ***Count Target*** or ***Alarm Limit*** is reached.

The above counters can be triggered and reset from a binary input or command.

6.2.1 I^2t CB Wear

An I^2t counter is also included; this can provide an estimation of contact wear and maintenance requirements. The algorithm works on a per phase basis, measuring the arcing current during faults. The I^2t value at the time of trip is added to the previously stored value and an alarm is given when any one of the three phase running counts exceeds the set ***Alarm limit***. The (t) value is the time between CB contacts separation when an arc is formed, ***Separation Time,*** and the CB ***Clearance time***.

The I^2t value can also triggered and reset from a binary input or command.

6.2.2 Output Matrix Test

The feature is only visible from the Relay fascia and allows the user to operate the relays functions. The test of the function will automatically operate any Binary Inputs or LED's already assigned to that function. Any protection function which is enabled in the setting menu will appear in the Output Matrix Test.

©2018 Siemens Protection Devices Limited

6.3 Data Storage

6.3.1 General

The relay stores three types of data records: relay event records, analogue/digital waveform records and fault records. Data records are backed up in non-volatile memory and are permanently stored even in the event of loss of auxiliary d.c. supply voltage.

6.3.2 Event Records

The event recorder feature allows the time tagging of any change of state (Event) in the relay. As an event occurs, the actual event condition is logged as a record along with a time and date stamp to a resolution of 1 millisecond. There is capacity for a maximum of 5000 event records that can be stored in the relay and when the event buffer is full any new record will over-write the oldest. Stored events can be erased using the DATA STORAGE>***Clear Events*** setting.

The following events are logged: -

Change of state of Binary outputs.

Change of state of Binary inputs.

Change of Settings and Settings Group.

Change of state of any of the control functions of the relay.

Protection element operation.

All events can be blocked or made available and uploaded over the data communications channel(s) and can be displayed in the 'Reydisp Evolution' package in chronological order, allowing the sequence of events to be viewed. Events are also made available spontaneously to an IEC 60870-5-103, Modbus RTU or DNP3.0 compliant control system. The function number and event number can also be changed. The events are selected and edited using the Reydisp software tool.

6.3.3 Waveform Records.

Waveform records provide a trace of the instantaneous magnitude of each analogue input channel and the status of each binary channel i.e. each binary input, binary output, virtual I/O and LED, against time for the duration of the record. The values are recorded at every digital sampling point used by the relay software.

Each recorded analogue waveform displays an input identifier, minimum value, maximum value and the instantaneous values at both cursor positions (user variable). Each binary waveform displays the input/output number and the initiating condition(s) e.g. external input or protection element.

Triggering of waveform storage is configured from the 'Settings > DATA STORAGE > WAVEFORM STORAGE' menu. Triggering is automatically initiated from operation of any of the selected protection or control elements. Waveform storage can also be triggered from the relay fascia, from a suitably programmed binary input or via the data comms channel(s).

Waveforms are sampled at a rate of 32 samples per cycle.

The latest 10 records are stored; the most recent is waveform 1. Records are archived by the relay during quiescent periods. The duration of each stored record is 1s, 2s, 5s or 10s. The user can also specify the percentage of waveform storage prior to waveform triggering. When the waveform archive buffer is full (i.e. 10 records are stored) the triggering of a new waveform record causes the oldest record - waveform 10 – to be overwritten.

Stored waveforms can be deleted from the relay fascia using the DATA STORAGE > *Clear Waveforms* setting or via Reydisp.

6.3.4 Fault Records

Up to one-hundred fault records can be stored and displayed on the Fascia LCD.

Fault records provide a summary of the relay status at the time of trip, i.e. the element that issued the trip, any elements that were picked up, the fault type, LED indications, date and time. The ***Max Fault Rec. Time*** setting sets the time period from fault trigger during which the operation of any LEDs is recorded.

The relay can be set to automatically display the fault record on the LCD when a fault occurs by enabling the SYSTEM CONFIG> ***Trip Alert*** setting. When the trip alert is enabled the fault record will be displayed until the fault is removed.

When examined together the event records and the fault records will detail the full sequence of events leading to a trip.

Fault records are stored in a rolling buffer, with the oldest faults overwritten. The fault storage can be cleared with the DATA STORAGE>***Clear Faults*** setting or using Reydisp Evolution via Relay > Data Records > Reset Data Log Record.

6.3.5 Demand

The Demand feature can be used to build trend and maximum/minimum demand records. Up to 10,080 individual time stamped records can be stored at a user defined rate e.g. 35 days @ 5 minute intervals and > 1 year @ 1 hour intervals.

Maximum, minimum and mean values of line current, voltage and power (where applicable) are available as instruments which can be read in the relay INSTRUMENTS MENU or via Reydisp Evolution.

In the menu ***DATA STORAGE > DEMAND / DATA LOG: -***

The ***Data Log Period*** setting is used to define the period between stored samples.

The ***Gn Demand Window*** setting defines the maximum period of time over which the demand values are calculated. A new set of demand values is established after expiry of the set time.

The ***Gn Demand Window Type*** is the mode used to calculate demand values and can be set to **FIXED** or **PEAK** or **ROLLING**: -

When set to **FIXED** the maximum, minimum and mean values demand statistics are calculated over fixed Window duration. At the end of each window the internal statistics are reset and a new window is started.

When set to **PEAK** the maximum and minimum values since the feature was reset are recorded.

When set to **ROLLING** the maximum, minimum and mean values demand statistics are calculated over a moving Window duration. The internal statistics are updated when the window advances.

The statistics can be reset from a binary input or communication command, after a reset the update period and window are immediately restarted.

6.3.6 Data Log

The Data log feature can be used to build trend and maximum/minimum demand records. Up to 10,080 individual time stamped records of each phase current and voltage (where fitted) analogue signal are recorded and stored at a user defined rate e.g. 35 days @ 5 minute intervals and > 1 year @ 1 hour intervals.

©2018 Siemens Protection Devices Limited

6.3.7 Energy Storage

The measured Power is continuously integrated (over a one-second window) to produce 4 Energy quantities: -

- Active Export Energy (W)
- Active Import Energy (W)
- Reactive Export Energy (VAr)
- Reactive Import Energy (VAr)

The Direction of Energy transfer is set by: SYSTEM CONFIG> **Export Power/Lag VAr**. With both ***Export Power*** (W) and ***Lag VAr*** (VAr) set to be **+ve**, the Direction of Energy transfer will follow the IEC convention, as shown in the figure.

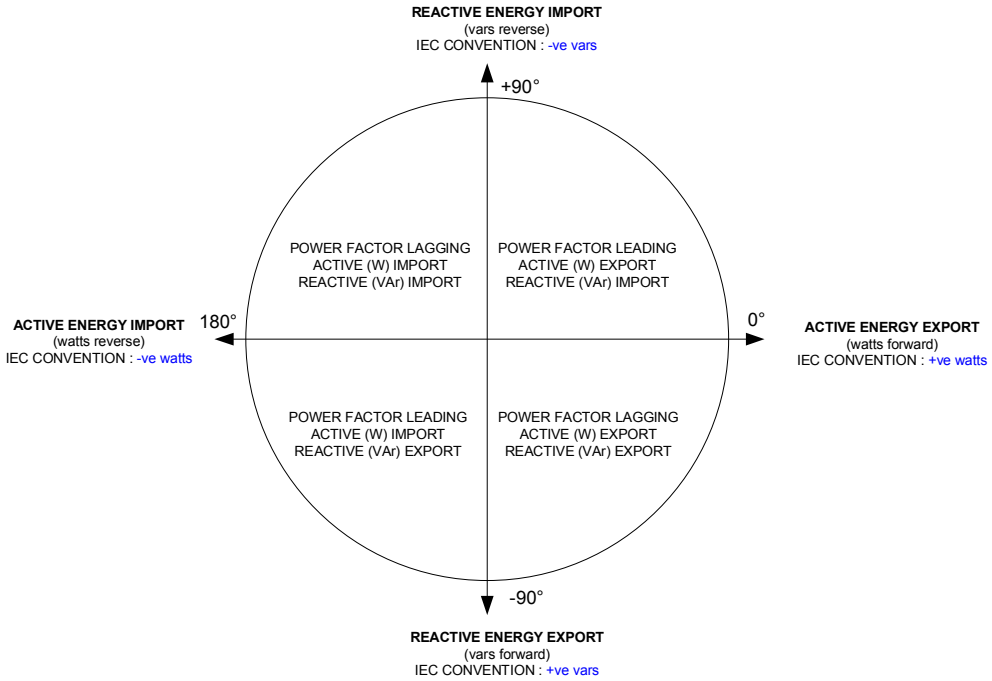


Figure 6.3.7-1 Energy Direction Convention

Setting either the ***Export Power*** (W) or ***Lag VAr*** (VAr) to be **-ve**, will reverse the Direction of the Energy transfer for these quantities. So forward VAr will then be reported as Imported Reactive Energy, and forward Watts will be reported as Exported Active Energy.

When the accumulated Energy quantities reach a set increment, the Relay issues a pulse to the binary outputs: OUTPUT CONFIG/OUTPUT MATRIX> ***Active Exp Pulse***, ***Active Imp Pulse***, ***Reactive Exp Pulse*** and ***Reactive Imp Pulse***.

The Energy increments are set by the settings: DATA STORAGE/ENERGY STORAGE> ***Active Exp Energy Unit***, ***Active Imp Energy Unit***, ***Reactive Exp Energy Unit*** and ***Reactive Imp Energy Unit***. These setting also define the resolution of the stored energy values reported by instruments and communications protocols. The value is stored in the range 0-999999 which continues from zero automatically when 999999 is reached.

6.3.8 Fault Locator

The relay provides a single-end type fault locator which is able to estimate the fault position using analogue information measured by the relay at one end of the protected circuit during the short duration of the fault.

Following relay operation due to a system fault, the fault waveform record is automatically evaluated to establish the fault type in terms of the phase(s) affected and the relevant current and voltage is used to calculate the fault impedance. The relay compares this information to a line model based on characteristic impedance parameters which are input to the relay as settings and provides an output estimate of the fault location. This data is presented as a percentage of line length or a distance in miles or kilometres.

The Positive Sequence Impedance on the protected line must be provided to the relay as settings for impedance magnitude and characteristic phase angle to enable the distance to fault to be calculated.

The Earth Fault return impedance is specified in terms of the ratio of zero to positive sequence impedance magnitudes and the characteristic phase angle of the zero sequence impedance. The characteristic angle of the zero sequence impedance is often significantly different to that of the positive sequence impedance.

When power systems are earthed through compensation (Peterson) coils, the earth fault currents are extremely low and are not proportional to fault location. Impedance based fault location cannot be used for earth faults. Phase-to-phase fault location can be estimated. On networks of this type it is possible to have two earth-faults on the network simultaneously on different phases of the same circuit which will appear as a phase-to-phase fault. This is known as a Cross-Country fault. In these cases the measured impedance cannot give an accurate estimate of the fault condition. The 7SR22 relay provides detection of this condition using the measured zero sequence voltage to positive sequence voltage ratio (U0/U1) to allow the possible cross-country fault to be reported. This threshold is adjustable by a user setting.

Fault Location is reported for faults calculated in a zone which extends to 200 % of the forward line impedance and 10 % in the reverse direction. High resistance fault results where fault resistance is calculated as up to 20 times the line impedance are reported. For faults beyond these limits, the message ‘No Location’ is reported.

The Fault Location estimation is initiated by operation of the ***Trip Output.*** Some protection elements may be set to provide tripping for system conditions where a fault location is not applicable. The initiation of the Fault Locator can be inhibited by user settings.

The settings for the Fault Locator are found as a sub-menu in the Data Storage menu.

The Fault Locator result data is available in the Fault Data records and can be viewed at the relay fascia and downloaded from the relay.

6.4 Metering

The metering feature provides real-time data available from the relay fascia in the ‘Instruments Mode’ or via the data communications interface.

The Primary values are calculated using the CT and VT ratios set in the ***CT/VT Config*** menu.

The text displayed in the relays ‘Instruments Mode’ associated with each value can be changed from the default text using the Reydisp software tool.

The user can add the meters that are most commonly viewed to a ‘Favourites’ window by pressing the ‘ENTER’ key when viewing a meter. The relay will scroll through these meters at an interval set in the ***System Config/Favourite Meters Timer*** menu.

©2018 Siemens Protection Devices Limited

6.5 Operating Mode

The relay has three operating modes, Local, Remote and Out of Service. The following table identifies the functions operation in each mode.

The modes can be selected by the following methods: -

SYSTEM CONFIG>***RELAY MODE*** setting, a Binary Input or Command

Table 6.5-1 Operation Mode

OPERATION	REMOTE MODE	LOCAL MODE	SERVICE MODE
Control			
Rear Ports	Enabled	Disabled	Disabled
Fascia (Control Mode)	Disabled	Enabled	Disabled
USB	Disabled	Enabled	Disabled
Binary Inputs	Setting Option	Setting Option	Enabled
Binary Outputs	Enabled	Enabled	Disabled
Reporting			
Spontaneous			
IEC	Enabled	Enabled	Disabled
DNP	Enabled	Enabled	Disabled
General Interrogation			
IEC	Enabled	Enabled	Disabled
DNP	Enabled	Enabled	Disabled
MODBUS	Enabled	Enabled	Disabled
Changing of Settings			
Rear Ports	Enabled	Disabled	Enabled
Fascia	Enabled	Enabled	Enabled
USB	Disabled	Enabled	Enabled
Historical Information			
Waveform Records	Enabled	Enabled	Enabled
Event Records	Enabled	Enabled	Enabled
Fault Information	Enabled	Enabled	Enabled
Setting Information	Enabled	Enabled	Enabled

6.6 Control Mode

This mode provides convenient access to commonly used relay control and test functions. When any of the items listed in the Control Mode list are selected, control is initiated by pressing the ENTER key. The user is prompted to confirm the action, again by pressing the ENTER key, before the command is executed.

Control Mode commands are password protected using the Control Password function – see section 6.9.

6.7 Real Time Clock

Time and date can be set either via the relay fascia using appropriate commands in the System Config menu, via the data comms channel(s) or via the optional IRIG-B input. Time and date are maintained while the relay is de-energised by a back up storage capacitor.

In order to maintain synchronism within a substation, the relay can be synchronised to the nearest second or minute using the IEC 60870-5-103 protocol, optional IRIG-B input or binary input.

The default date is set at 01/01/2000 deliberately to indicate the date has not yet been set. When editing the **Time**, only the hours and minutes can be edited. When the user presses **ENTER** after editing the seconds are zeroed and the clock begins running.

6.7.1 Time Synchronisation - Data Communication Interface

Where the data comms channel(s) is connected the relay can be directly time synchronised using the global time synchronisation. This can be from a dedicated substation automation system or from 'Reydisp Evolution' communications support software.

6.7.2 Time Synchronisation – Binary Input

A binary input can be mapped ***Clock Sync from BI***. The seconds or minutes will be rounded up or down to the nearest value when the BI is energised. This input is leading edge triggered.

6.7.3 Time Synchronisation – IRIG-B (Optional)

A BNC connector on the relay rear provides an isolated IRIG-B time synchronisation port. The IRIG-B input expects a modulated 3-6 Volt signal and provides time synchronisation to the nearest millisecond.

6.8 Settings Groups

The relay provides eight groups of settings – Group number (Gn) 1 to 8. At any one time only one group of settings can be 'active' – SYSTEM CONFIG>***Active Group*** setting.

It is possible to edit one group while the relay operates in accordance with settings from another 'active' group using the ***View/Edit Group*** setting.

Some settings are independent of the active group setting i.e. they apply to all settings groups. This is indicated on the top line of the relay LCD – where only the Active Group No. is identified. Where settings are group dependent this is indicated on the top line of the LCD by both the Active Group No. and the View Group No. being displayed.

A change of settings group can be achieved either locally at the relay fascia, remotely over the data comms channel(s) or via a binary input. When using a binary input an alternative settings group is selected only whilst the input is energised (***Select Grp Mode*: Level triggered**) or latches into the selected group after energisation of the input (***Select Grp Mode*: Edge triggered**).

6.9 Password Feature

The relay incorporates two levels of password protection – one for settings, the other for control functions.

The programmable password feature enables the user to enter a 4 character alpha numeric code to secure access to the relay functions. A Password of NONE indicates that a Password has not been set and that the Password feature is disabled. Where a Relay is delivered with the Password already set, this will be AAAA. The password must be entered twice as a security measure against accidental changes. Once a password has been entered then it will be required thereafter to change settings or initiate control commands. Passwords can be de-activated by using the password to gain access and by entering the password **NONE**. Again this must be entered twice to de-activate the security system.

As soon as the user attempts to change a setting or initiate control the password is requested before any changes are allowed. Once the password has been validated, the user is 'logged on' and any further changes can be made without re-entering the password. If no more changes are made within 1 hour then the user will automatically be 'logged off', re-enabling the password feature.

The Settings Password prevents unauthorised changes to settings from the front fascia or over the data comms channel(s). The Control Password prevents unauthorised operation of controls in the relay Control Menu from the front fascia.

The password validation screen also displays a numerical code. If the password is lost or forgotten, this code should be communicated to Siemens Protection Devices Ltd. and the password can be retrieved.

 ©2018 Siemens Protection Devices Limited

7SR210 Non-Directional Relay
7SR220 Directional Relay
Configuration Guide

Unrestricted The copyright and other intellectual property rights in this document, and in any model or article produced from it (and including any registered or unregistered design rights) are the property of Siemens Protection Devices Limited. No part of this document shall be reproduced or modified or stored in another form, in any data retrieval system, without the permission of Siemens Protection Devices Limited, nor shall any model or article be reproduced from this document unless Siemens Protection Devices Limited consent.

While the information and guidance given in this document is believed to be correct, no liability shall be accepted for any loss or damage caused by any error or omission, whether such error or omission is the result of negligence or any other cause. Any and all such liability is disclaimed.

© 2018 Siemens Protection Devices Limited

Document Release History

This document is issue 2017/12. The list of revisions up to and including this issue is: -

2011/05	First issue
2013/01	Typographical revisions and added data. Updated in line with software release.
2014/06	Typographical revisions and added data. Updated in line with software release.
2015/06	Typographical revisions amended drawings and added data. Updated in line with software release.
2016/02	Typographical revisions and added data. Updated in line with software release.
2016/11	Typographical revisions and format.
2017/08	Typographical revisions and added data. Updated in line with software release.
2017/12	Typographical revisions.

Software Revision History

2011/05	2435H85008R7a-7a (7SR210) 2435H85009R7a-7a (7SR220)	First Release
2013/01	2435H85008R7c-7b (7SR210) 2435H85009R7c-7b (7SR220)	Introduced journaling file system. Added 61850 logical nodes for CB Counters, metering, 50BF, 46BC, 81HBL2 and line check. Added Line Check on non-AR devices. Added 74CCS Close Circuit Supervision.
2014/06	2435H85008R7f-7d (7SR210) 2435H85009R7f-7d (7SR220)	Added Fault Locator feature and Check Sync feature. Fault data transmitted over 103. Additional communications data, control features, meters.
2015/06	2435H85008R8a-7e (7SR210) 2435H85009R8a-7f (7SR220)	Added Power Factor Meters, Load Blinding feature, Arc Flash Detector. Over current TM Setting Range extended.
2016/02	2435H85008R8b-7f (7SR210) 2435H85009R8b-7f (7SR220)	EN100+ Compatibility.
2017/08	2435H85008R8e-8a (7SR210) 2435H85009R8e-8a (7SR220)	Added 32 Directional Power, 32S Sensitive Power, 55 Power Factor, 81HLB5 Overfluxing, 67SEF Compensated Network, 67SEF Wattmetric. Increased I/O. Event Data on LCD.

© 2018 Siemens Protection Devices Limited

Contents

Document Release History....2
Software Revision History....2
Contents....3
Section 1: Introduction....4
1.1 Relay Menus And Display....4
1.2 Operation Guide....6
1.2.1 User Interface Operation....6
Section 2: Configuring the Relay Using Reydisp Evolution....9
2.1 Physical Connection....9
2.1.1 Front USB connection....9
2.1.2 Standard rear RS485 connection....10
2.1.3 Optional rear fibre optic connection....10
2.1.4 Optional rear RS485 + IRIG-B connection....11
2.1.5 Optional rear RS232 + IRIG-B connection....11
2.1.6 Optional Rear EN100 Ethernet Module....12
2.1.7 Configuring Relay Data Communication....12
2.1.8 Connecting to the Relay via Reydisp Evolution....14

List of Figures

Figure 1.1-1 Menu Navigation....4
Figure 1.1-2 Fascia Contrast symbol....4
Figure 1.1-3 Relay Fascia (Please note fascia may differ from illustration)....5
Figure 1.2.1-1 Relay Identifier Screen....6
Figure 1.2.1-2 Typical Menu Structure for 7SR21 relay....7
Figure 1.2.1-3 Typical Menu Structure for 7SR22 relay....8
Figure 2.1.1-1 USB connection to a PC....9
Figure 2.1.2-1 Standard rear RS485 connection to a PC....10
Figure 2.1.3-1 Additional (Optional) rear fibre optic connection to a PC....10
Figure 2.1.4-1 Additional (Optional) rear RS485 + IRIG-B connection to a PC....11
Figure 2.1.5-1 Additional (Optional) rear RS232 + IRG-B connection to a PC....11
Figure 2.1.6-1 EN100 Ethernet Module....12
Figure 2.1.8-1 PC Comm Port Selection....14

 © 2018 Siemens Protection Devices Limited

Section 1: Introduction

1.1 Relay Menus And Display

All relay fascias contain the same access keys although the fascias may differ in appearance from model to model. The basic menu structure is also the same in all products and consists of four main menus, these being,

Settings Mode - allows the user to view and (if allowed via the settings mode password) change settings in the relay.

Instruments Mode - allows the user to view the relay meters e.g. current, voltage etc.

Fault Data Mode - allows the user to view the type and data of any fault that the relay has detected.

Control Mode - allows the user to control external plant under the relays control for example the CB (if allowed via the control mode password)

Event Data Mode - allows the user to view the events which have occured within the relay.

The menus can be viewed via the LCD by pressing the access keys as below,

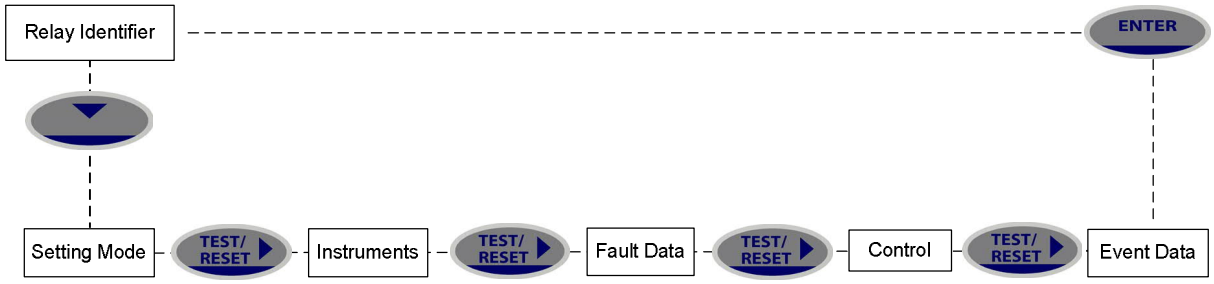


Figure 1.1-1 Menu Navigation

Pressing CANCEL returns to the Identifier screen

LCD Contrast

To change the contrast on the LCD insert a flat nosed screwdriver into the screwhead below the contrast symbol, turning the screwhead left or right decreases and increases the contrast of the LCD.



Figure 1.1-2 Fascia Contrast symbol

© 2018 Siemens Protection Devices Limited

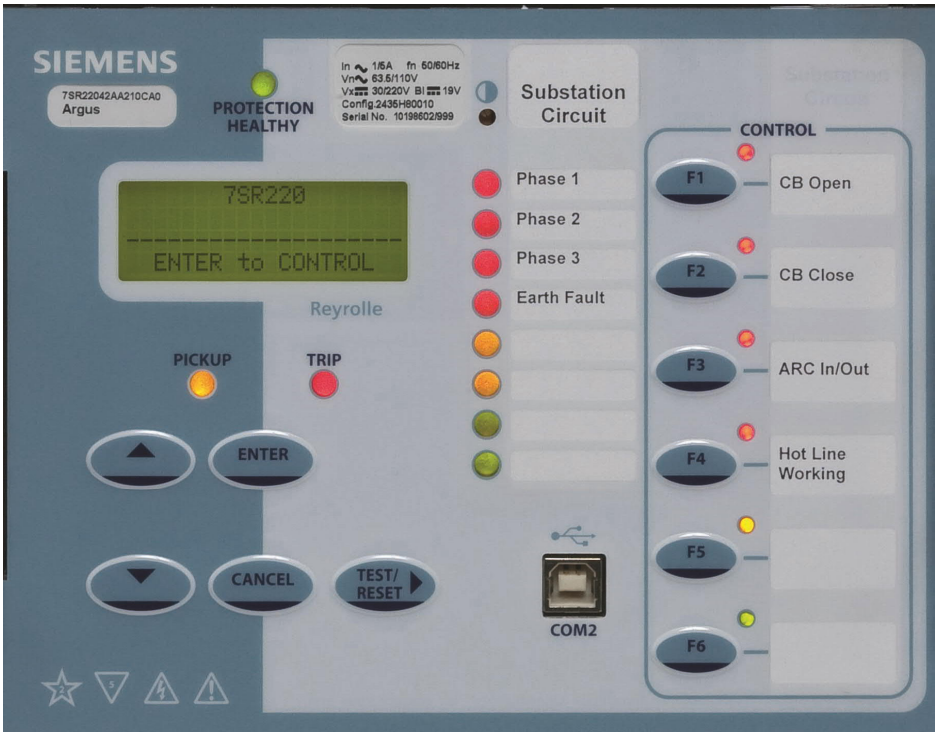


Figure 1.1-3 Relay Fascia (Please note fascia may differ from illustration)

1.2 Operation Guide

1.2.1 USER INTERFACE OPERATION

The basic menu structure flow diagram is shown in Figure 1.2-2. This diagram shows the main modes of display: Settings Mode, Instrument Mode, Fault Data Mode and Control Mode.

When the relay leaves the factory all data storage areas are cleared and the settings set to default as specified in settings document.

When the relay is first energised the user is presented with the following message: -

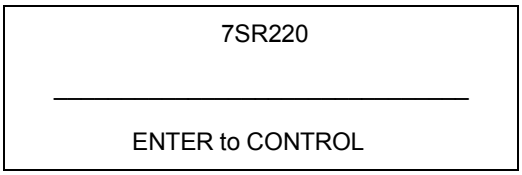


Figure 1.2.1-1 Relay Identifier Screen

On the factory default setup the relay LCD should display the relay identifier, on each subsequent power-on the screen that was showing before the last power-off will be displayed.

The push-buttons on the fascia are used to display and edit the relay settings via the LCD, to display and activate the control segment of the relay, to display the relays instrumentation and Fault data and to reset the output relays and LED's.

The five push-buttons have the following functions:

 **READ DOWN**  **READ UP**

Used to navigate the menu structure.



ENTER

The ENTER push-button is used to initiate and accept setting changes.

When a setting is displayed pressing the ENTER key will enter the edit mode, the setting will flash and can now be changed using the▲ or ▼ buttons. When the required value is displayed the ENTER button is pressed again to accept the change.

When an instrument is displayed pressing ENTER will toggle the instruments favourite screen status.



CANCEL

This push-button is used to return the relay display to its initial status or one level up in the menu structure. Pressed repeatedly will return to the Relay Identifier screen. It is also used to reject any alterations to a setting while in the edit mode.



TEST/RESET

This push-button is used to reset the fault indication on the fascia. When on the Relay Identifier screen it also acts as a lamp test button, when pressed all LEDs will momentarily light up to indicate their correct operation. It is also moves the cursor right ► when navigating through menus and settings.

© 2018 Siemens Protection Devices Limited

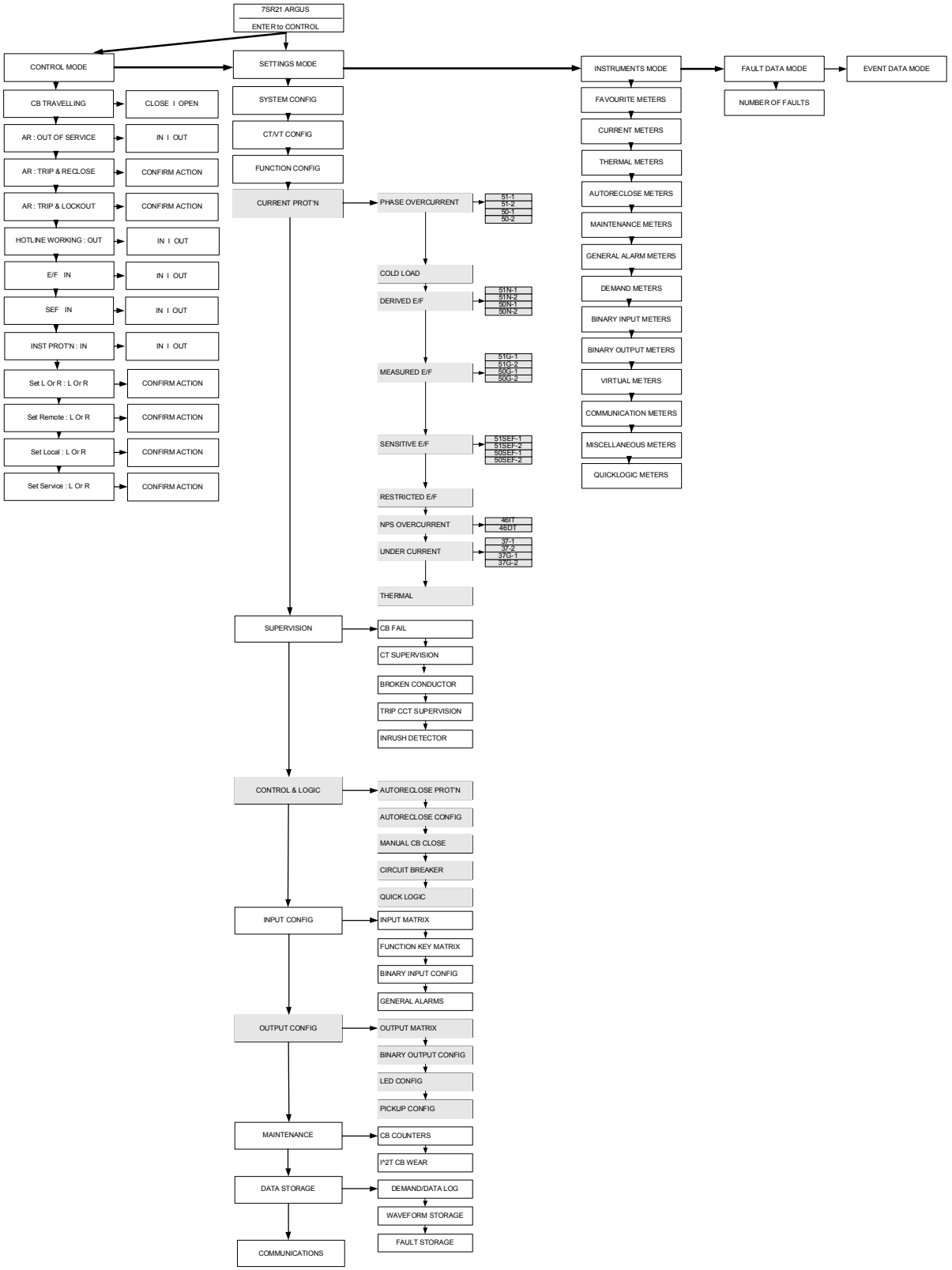


Figure 1.2.1-2 Typical Menu Structure for 7SR21 relay

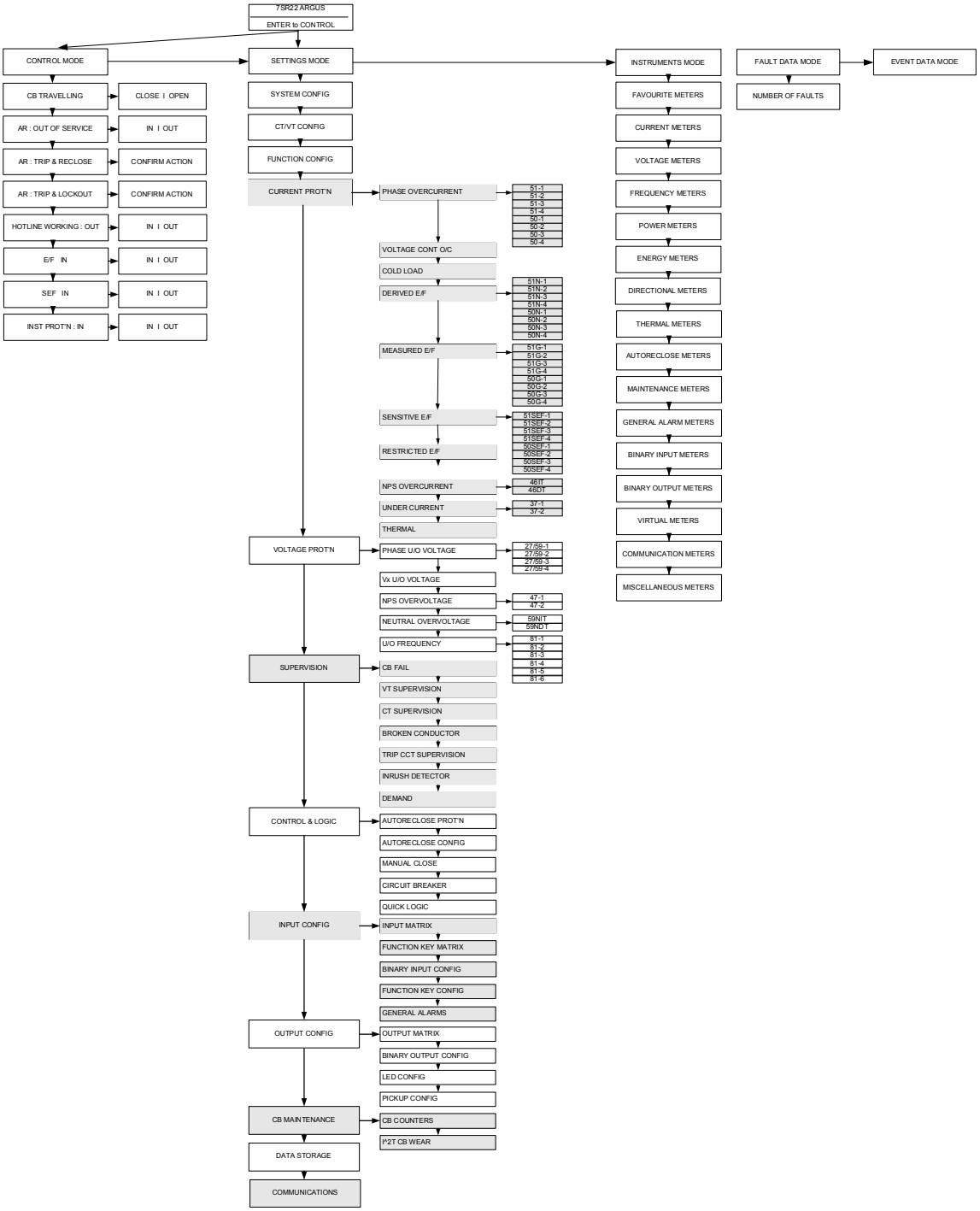


Figure 1.2.1-3 Typical Menu Structure for 7SR22 relay

© 2018 Siemens Protection Devices Limited

Section 2: Configuring the Relay Using Reydisp Evolution

To set the relay using the communication port the user will need the following:-

PC with Reydisp Evolution Installed. (This can be download from our website www.energy.siemens.com and found under the submenu 'Software'). This software requires windows 2000-service pack 4 or above, or windows XP with service pack 2 or above.

2.1 Physical Connection

The relay can be connected to Reydisp Evolution via any of the communication ports on the relay. Suitable communication Interface cable and converters are required depending which port is being used.

2.1.1 FRONT USB CONNECTION

To connect your pc locally via the front USB port.

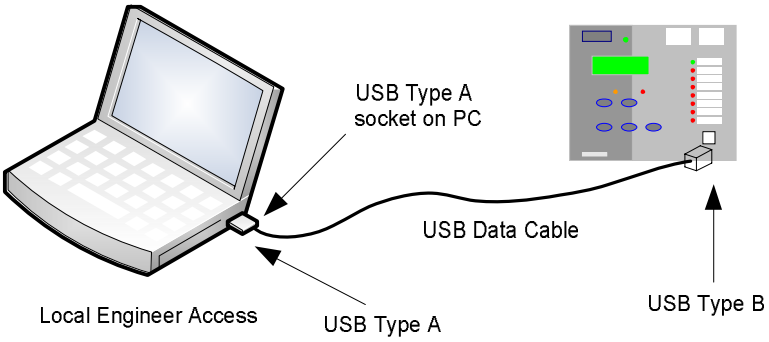


Figure 2.1.1-1 USB connection to a PC

2.1.2 STANDARD REAR RS485 CONNECTION

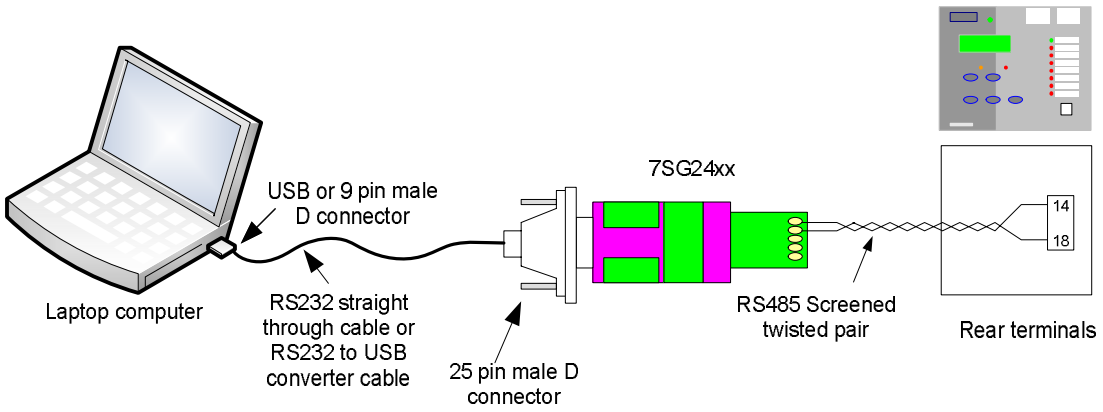


Figure 2.1.2-1 Standard rear RS485 connection to a PC

2.1.3 OPTIONAL REAR FIBRE OPTIC CONNECTION

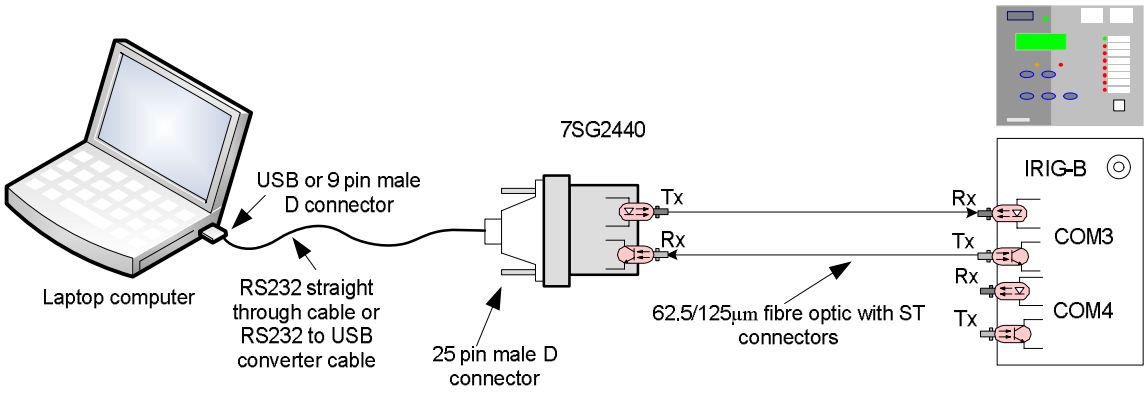


Figure 2.1.3-1 Additional (Optional) rear fibre optic connection to a PC

Sigma devices have a 25 pin female D connector with the following pin out.

Pin	Function
2	Transmit Data
3	Received Data
4	Request to Send
5	Clear to Send
6	Data set ready
7	Signal Ground
8	Received Line Signal Detector
20	Data Terminal Ready

© 2018 Siemens Protection Devices Limited

2.1.4 OPTIONAL REAR RS485 + IRIG-B CONNECTION

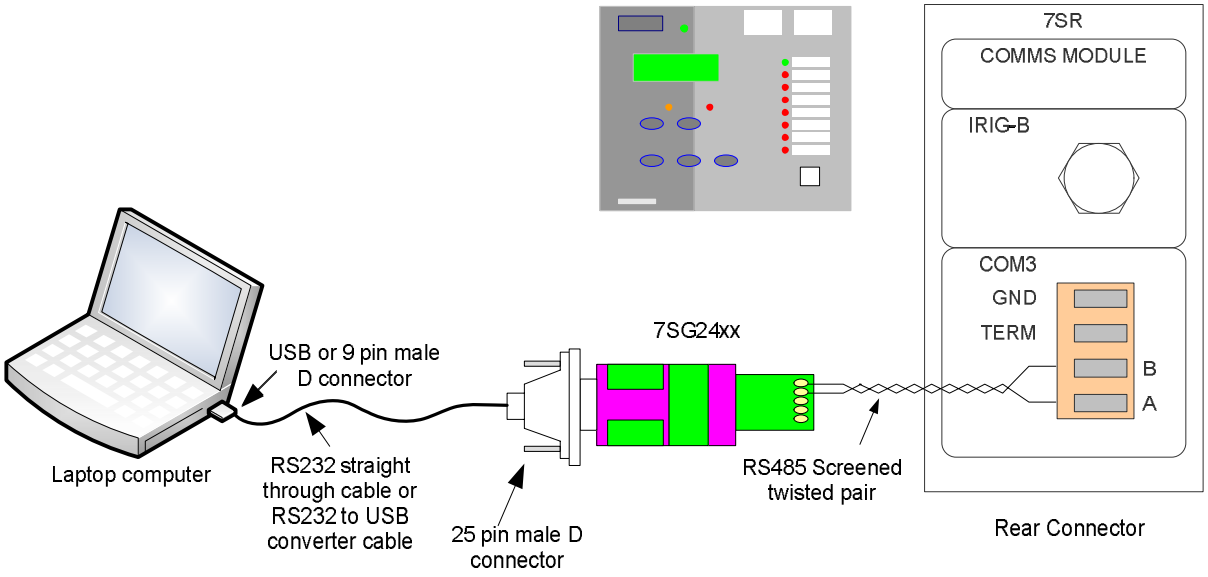


Figure 2.1.4-1 Additional (Optional) rear RS485 + IRIG-B connection to a PC

2.1.5 OPTIONAL REAR RS232 + IRIG-B CONNECTION

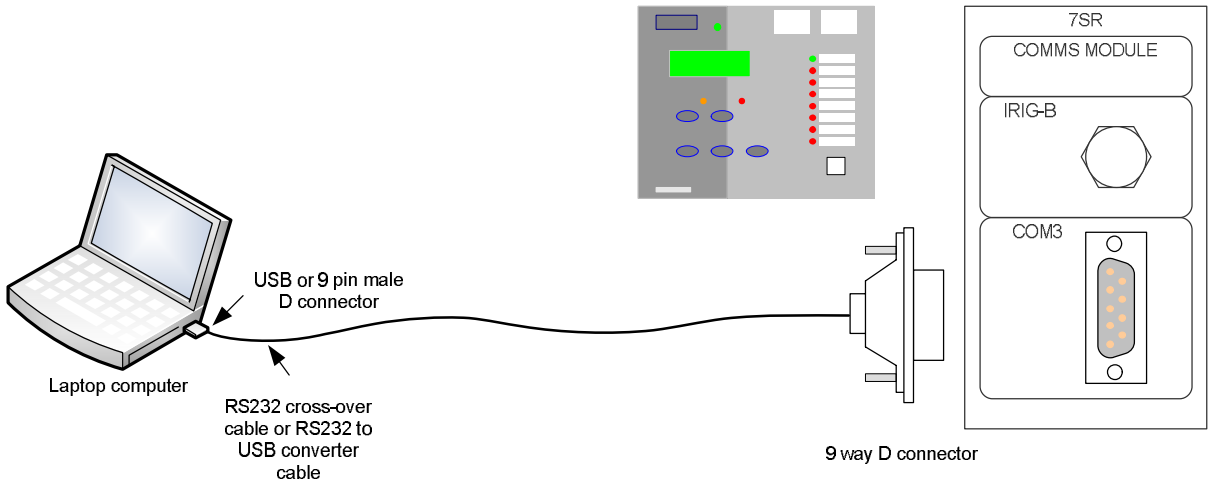
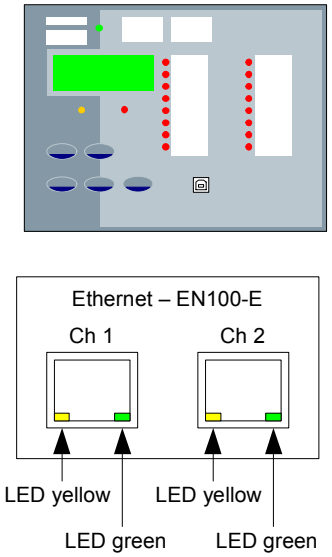


Figure 2.1.5-1 Additional (Optional) rear RS232 + IRG-B connection to a PC

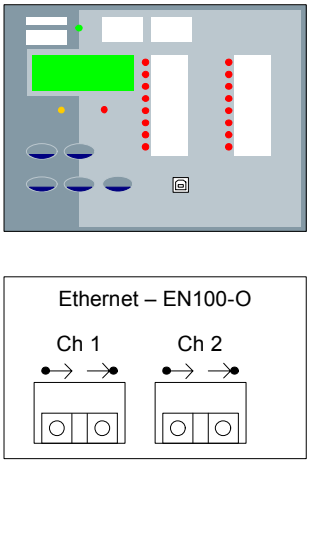
Pin	Function
1	Carrier Direct (CD)
2	Receive Data (RXD)
3	Transmit Data (TXD)
4	Data Terminal Ready (DTR)
5	Signal Ground (GND)
6	Data set ready (DSR)
7	Request to send (RTS)
8	Clear to Send (CTS)
9	Ring Indicator (RI)

2.1.6 OPTIONAL REAR EN100 ETHERNET MODULE

Connections are made on the rear underside of the relay either RJ45 sockets (electrical) or Duplex LC (fibre optic) connectors depending on the option ordered.



EN100 Module – RJ45 Interface



EN100 Module – Duplex-LC Interface

Green LED (Physical Link)
Off – No link
On – Link present

Yellow LED (Activity)
Off – No traffic
On/flashing - Traffic

Figure 2.1.6-1 EN100 Ethernet Module

2.1.7 CONFIGURING RELAY DATA COMMUNICATION

Using the keys on the relay fascia scroll down the settings menu's into the 'communications' menu and change the settings for the communication port used on the relay. All of the below settings may not be available in all relay types. Reydisp Evolution software uses IEC60870-5-103 protocol to communicate.

COM1 – Standard RS485 Rear Port

COM2 - USB Port

COM3 – Optional Fibre Optic, RS485, RS232 or Ethernet Port

COM4 – Additional (Optional) Rear Connection**

LAN – Optional Ethernet Ports

© 2018 Siemens Protection Devices Limited

Setting name	Range	Default	Units	Notes
Station Address	1 – 254 for IEC60870-5-103 0 – 247 for Modbus RTU 0 – 65520 for DNP3.0	0		Address given to relay to identify that relay from others which may be using the same path for communication as other relays for example in a fibre optic hub
COM1-RS485 Protocol	OFF, IEC60870-5-103, MODBUS-RTU, DNP3.0	IEC60870-5-103		COM1 is the rear mounted RS485 port
COM1-RS485 Baud Rate	75 110 150 300 600 1200 2400 4800 9600 19200 38400	19200		
COM1-RS485 Parity	NONE, ODD, EVEN	EVEN		
COM2-USB Protocol	OFF, IEC60870-5-103, DNP3.0, MODBUS-RTU, ASCII	IEC60870-5-103		COM2 is the front USB port
COM2-USB Baud Rate	75 110 150 300 600 1200 2400 4800 9600 19200 38400 57600 115200 230400 460800 921600	Auto detects		Auto detects baud rate via Connection Manager Setting
COM2-USB Parity	NONE, ODD, EVEN	EVEN		
COM3 Protocol	OFF, IEC60870-5-103, MODBUS-RTU, DNP3.0	IEC6-0870-5-103		COM3 This is an optional rear mounted connection
COM3 Baud Rate	75 110 150 300 600 1200 2400 4800 9600 19200 38400 57600 115200	57600		
COM3 Parity	NONE, ODD, EVEN	EVEN		
COM3 Line Idle*	LIGHT ON, LIGHT OFF	LIGHT OFF		
COM3 Data echo*	ON, OFF	OFF		
COM4 Protocol**	OFF, IEC60870-5-103, MODBUS-RTU, DNP3.0	OFF		COM4 This is an optional rear mounted connection
COM4 Baud Rate**	75 110 150 300 600 1200 2400 4800 9600 19200 38400	19200		
COM4 Parity**	NONE, OFF, EVEN	EVEN		
COM4 Line Idle**	LIGHT ON, LIGHT OFF	LIGHT OFF		
COM4 Data echo**	ON, OFF	OFF		
DNP3 Unsolicited Events	ENABLED, DISABLED	DISABLED		Setting is only visible when a port protocol is set to DNP3.
DNP3 Destination Address	0 … 65534	0		Setting is only visible when a port protocol is set to DNP3.
DNP3 Application Timeout	5, 6 ... 299, 300	10s	Seconds	Setting is only visible when a port Protocol is set to DNP3

*Not applicable for RS485 or RS232 interface modules.
**Fibre Optic Module only

2.1.8 CONNECTING TO THE RELAY VIA REYDISP EVOLUTION

When Reydisp Evolution software is running all available communication ports of the PC will automatically be detected.
On the start page tool bar open up the sub-menu File > Connect.

The 'Communication Manager' window will display all available communication ports. With the preferred port highlighted, select the 'Properties' option and ensure the baud rate and parity match that selected in the relay Data Comms settings. Select 'Connect' to initiate the relay-PC connection.

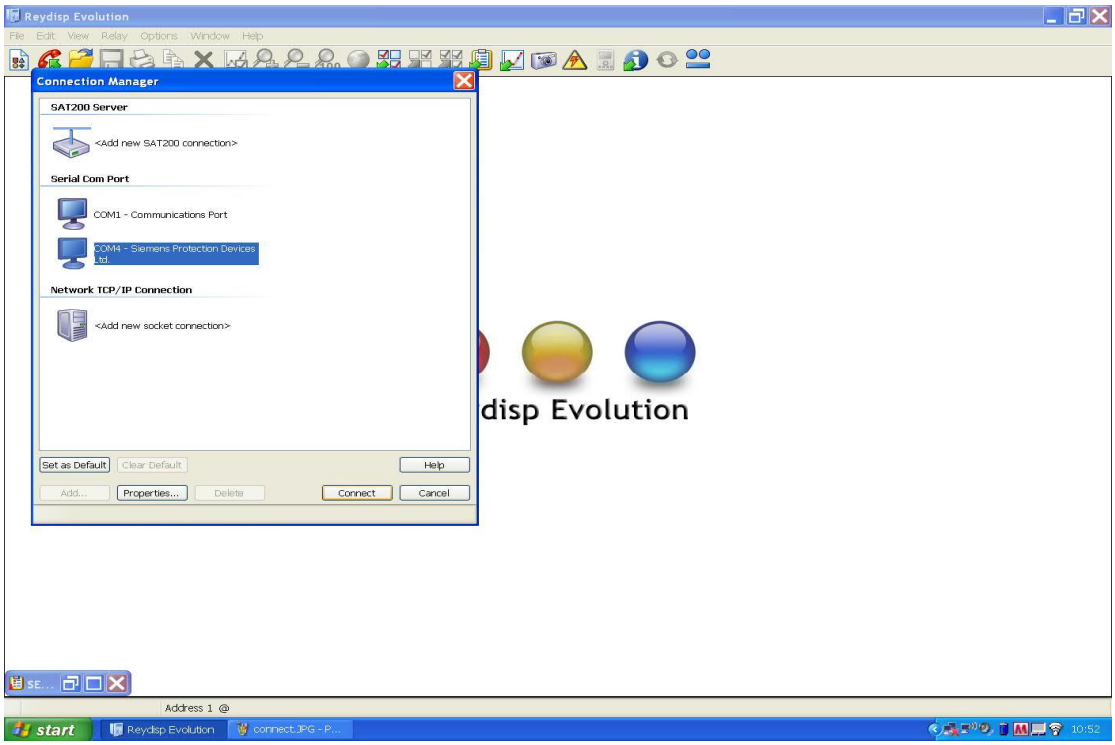


Figure 2.1.8-1 PC Comm Port Selection

Via the Relay > Set Address > Address set the relay address (1-254) or alternatively search for connected devices using the Relay > Set Address > Device Map. The relay can now be configured using the Reydisp Evolution software. Please refer to the Reydisp Evolution Manual for further guidance.

© 2018 Siemens Protection Devices Limited

7SR210 Non-Directional Relay
7SR220 Directional Relay
Installation Guide

Unrestricted The copyright and other intellectual property rights in this document, and in any model or article produced from it (and including any registered or unregistered design rights) are the property of Siemens Protection Devices Limited. No part of this document shall be reproduced or modified or stored in another form, in any data retrieval system, without the permission of Siemens Protection Devices Limited, nor shall any model or article be reproduced from this document unless Siemens Protection Devices Limited consent.

While the information and guidance given in this document is believed to be correct, no liability shall be accepted for any loss or damage caused by any error or omission, whether such error or omission is the result of negligence or any other cause. Any and all such liability is disclaimed.

©2018 Siemens Protection Devices Limited

Document Release History

This document is issue **2018/07.** The list of revisions up to and including this issue is: -

2011/05	First issue
2013/01	Typographical revisions and added data. Updated in line with software release.
2014/06	Typographical revisions and added data. Updated in line with software release.
2015/06	Typographical revisions amended drawings and added data. Updated in line with software release.
2015/07	Amended drawings.
2016/02	Typographical revisions and added data. Updated in line with software release.
2016/11	Redundancy added to electrical ethernet interface
2017/08	Typographical revisions and added data. Updated in line with software release.
2017/12	Typographical revisions and added data.
2018/05	Amended RS485 connection diagrams.
2018/07	Addition of Disposal information

Software Revision History

2011/05	2435H85008R7a-7a (7SR210) 2435H85009R7a-7a (7SR220)	First Release
2013/01	2435H85008R7c-7b (7SR210) 2435H85009R7c-7b (7SR220)	Introduced journaling file system. Added 61850 logical nodes for CB Counters, metering, 50BF, 46BC, 81HBL2 and line check. Added Line Check on non-AR devices. Added 74CCS Close Circuit Supervision.
2014/06	2435H85008R7f-7d (7SR210) 2435H85009R7f-7d (7SR220)	Added Fault Locator feature and Check Sync feature. Fault data transmitted over 103. Additional communications data, control features, meters.
2015/06	2435H85008R8a-7f (7SR210) 2435H85009R8a-7f (7SR220)	Added Power Factor Meters, Load Blinding feature, Arc Flash Detector. Over current TM Setting Range extended.
2016/02	2435H85008R8b-7f (7SR210) 2435H85009R8b-7f (7SR220)	EN100+ Compatibility.
2017/08	2435H85008R8e-8a (7SR210) 2435H85009R8e-8a (7SR220)	Added 32 Directional Power, 32S Sensitive Power, 55 Power Factor, 81HLB5 Overfluxing, 67SEF Compensated Network, 67SEF Wattmetric. Increased I/O. Event Data on LCD.

©2018 Siemens Protection Devices Limited

Table of Contents

Document Release History **2**

Software Revision History **2**

Section 1: Installation **5**

1.1 Unpacking, Storage and Handling 5
1.2 Recommended Mounting Position 5
1.3 Wiring 5
1.4 Earthing 5
1.5 Ancillary Equipment 5

Section 2: Equipment Operating Conditions **6**

2.1 Current Transformer Circuits 6
2.2 External Resistors 6
2.3 Fibre Optic Communication 6
2.4 Front Cover 6
2.5 Disposal 6
2.5.1 Environmental Protection Hints 6

Section 3: Dimensions and Panel Fixings **8**

3.1 Relay Dimensions and Weight 8
3.2 Fixings 11
3.2.1 Crimps 11
3.2.2 Panel Fixings 11
3.2.3 Fibre Optic Connectors 11
3.2.4 Connectors Ethernet Option 11

Section 4: Rear Terminal Drawings **12**

4.1 E6 Case 12
4.2 E8 Case 14
4.3 E12 Case 16

Section 5: Connection/Wiring/Diagrams **19**

5.1 Wiring Diagram: 7SR21 OC/EF Relay 19
5.2 Wiring Diagram: 7SR22 Directional OC/EF Relay 20

Section 6: Data Comms Connections **21**

6.1 Standard RS485 Connections 21
6.2 IRIG-B Connections 21
6.3 Additional (Optional) Fibre Optic Connections 22
6.4 Additional (Optional) RS485 Connections 23
6.5 Additional (Optional) RS232 Connections 23
6.6 Additional (Optional) Ethernet Connection for IEC 61850 24
6.7 Ethernet Network Redundancy IEC 61850 25
6.7.1 RSTP – Rapid Spanning Tree Protocol 26
6.7.2 PRP – Parallel Redundancy Protocol 26
6.7.3 HSR – High Availability Seamless Redundancy Protocol 28

Section 7: Connection Diagrams **29**

7.1 Typical Connection: 7SR22 Directional OC/EF and REF 29
7.2 Typical Connection: 7SR22 Directional OC/EF and NVD 30
7.3 Typical Connection: 7SR22 Directional OC/EF and NVD 31
7.4 Typical Connection: 7SR22 Directional OC/EF and NVD 32
7.5 Typical Connection: 7SR22 Directional OC and EF 33
7.6 Typical Connection: 7SR22 Connected to VTs and Capacitor Cone Unit 34

7.7 Voltage Transformer Configurations 35

LIST OF FIGURES

Figure 3.1-1 Overall Dimensions (mm) and panel Drilling for Size E6 Epsilon case 8
Figure 3.1-2 Overall Dimensions (mm) and Panel Drilling for Size E8 Epsilon Case 9
Figure 3.1-3 Overall Dimensions (mm) and Panel Drilling for Size E12 Epsilon Case 10
Figure 4.1-1 E6 Standard Comms (USB Front Port, Rear RS485) (See Note 2) 12
Figure 4.1-2 E6 Standard + Additional Comms (IRIG-B, 2 x F.O. (ST Connectors)) (See Note 2) 12
Figure 4.1-3 E6 Standard + Additional Comms (IRIG B + RS485) (See Note 2) 13
Figure 4.1-4 E6 Standard + Additional Comms (IRIG B + RS232) (See Note 2) 13
Figure 4.2-1 E8 Standard Comms (USB Front Port, Rear RS485) (See Note 2) 14
Figure 4.2-2 E8 Standard + Additional Comms (IRIG B, 2 x F.O. (ST Connectors)) (See Note 2) 14
Figure 4.2-3 E8 Standard + Additional Comms (IRIG B + RS485) (See Note 2) 15
Figure 4.2-4 E8 Standard + Additional Comms (IRIG B + RS232) (See Note 2) 15
Figure 4.3-1 E12 Standard + Additional Comms (IRIG B, 2 x F.O. (ST Connectors)) (See Note 2) 16
Figure 4.3-2 E12 Standard + Additional Comms (IRIG B + RS485) (See Note 2) 16
Figure 4.3-3 E12 Standard + Additional Comms (IRIG B + RS232) (See Note 2) 17
Figure 4.3-4 E12 Standard + Additional Comms (RS485 + Ethernet (x2)) (See Note 2) 17
Figure 4.3-5 Standard Comms + Additional Ethernet Ports (RJ45 shown, Duplex LC Fibre Optic similar) 18
Figure 5.1-1 Connection Diagram for 7SR21 Relay 19
Figure 5.2-1 Connection Diagram for 7SR22 Relay 20
Figure 6.1-1 RS485 Data Comms Connections Between Relays 21
Figure 6.3-1 Data Comms to Multiple Devices Using 7SG24 and F.O. Star Network 22
Figure 6.3-2 Data Comms to Multiple Devices Using 7SG24 and F.O. Ring Network 22
Figure 6.4-1 RS485 Data Comms Connections Between Relays 23
Figure 6.5-1 RS232 Data Comms Pin Connections 23
Figure 6.6-1 Ethernet connection for IEC 61850 (star connection) 24
Figure 6.6-2 Ethernet connection for IEC 61850 (ring connection) 24
Figure 6.7-1 EN100 Redundancy Availability 25
Figure 7.1-1 7SR22 Applied to Transformer Incomer 29
Figure 7.2-1 7SR22 Applied to Transformer Incomer Including HV NVD Protection 30
Figure 7.3-1 7SR22 Applied to Feeder Including NVD Protection 31
Figure 7.4-1 7SR22 Applied to Feeder 32
Figure 7.5-1 7SR22 Applied to Feeder - No Zero Sequence Voltage Source 33
Figure 7.6-1 7SR22 Applied to Feeder with Capacitor Cones Fitted 34
Figure 7.7-1 7SR22 VT Connections 35

 ©2018 Siemens Protection Devices Limited

Section 1: Installation

1.1 Unpacking, Storage and Handling

On receipt remove the relay from the container in which it was received and inspect it for obvious damage. It is recommended that the relay not be removed from its case.

If damage has been sustained a claim should be immediately be made against the carrier, also inform Siemens Protection Devices Limited, and to the nearest Siemens agent, using the Defect Report Form in the Maintenance section of this manual.

When not required for immediate use, the relay should be returned to its original carton and stored in a clean, dry place.

The relay contains static sensitive devices, which are susceptible to damage due to static discharge. The relay's electronic circuits are protected from damage by static discharge when the relay is housed in its case.

There can be no requirement to disassemble any relay, since there are no user serviceable parts in the relay. If any modules have been tampered with, then the guarantee will be invalidated. Siemens Protection Devices Limited reserves the right to charge for any subsequent repairs.

1.2 Recommended Mounting Position

The relay uses a liquid crystal display (LCD) which is used in the programming and for operation. The LCD has a vertical viewing angle of ± 30° and is back–lit. However, the best viewing position is at eye level, and this is particularly important given its control features.

The relay should be mounted on the circuit breaker (or protection panel) to allow the operator the best access to the relay functions.

1.3 Wiring

The product should be wired according to the scheme requirements, with reference to the appropriate wiring diagram. Refer to the appropriate Diagrams and Parameters document for a cross-reference of wiring diagrams and models.

1.4 Earthing

Terminal 28 of the PSU (Power Supply Unit) should be solidly earthed by a direct connection to the panel earth. The Relay case earth stud connection should be connected to terminal 28 of the PSU.

It is normal practice to additionally 'daisy chain' together the case (safety) earths of all the Relays installed in a panel to prevent earth current loops posing a risk to personnel.

1.5 Ancillary Equipment

The relay can be interrogated locally or remotely. For local interrogation a portable PC with suitable version of MS Windows (2000 SP4 or XP SP2)and Reydisp Evolution™ s/w (Latest Version available 32 bit) using USB port situated on front of the relay.

Section 2: Equipment Operating Conditions

2.1 Current Transformer Circuits

The secondary circuit of a live CT must not be open circuited. Non-observance of this precaution can result in injury to personnel or damage to equipment.

2.2 External Resistors

Where external resistors are fitted to relays, these may present a danger of electric shock or burns, if touched.

2.3 Fibre Optic Communication

Where fibre optic communication devices are fitted, these should not be viewed directly. Optical power meters should be used to determine the operation or signal level of the device.

2.4 Front Cover

The front cover provides additional securing of the relay element within the case. The relay cover should be in place during normal operating conditions.

2.5 Disposal

The Relay should be disposed of in a manner which does not provide a threat to health or the environment. All laws and regulations specific to the country of disposal should be adhered to.

2.5.1 Environmental Protection Hints

Disposal of Old Equipment and Batteries (Applicable only for European Union and Countries with a Recycling System)

The disposal of our products and possible recycling of their components after decommissioning has to be carried out by an accredited recycling company, or the products/components must be taken to applicable collection points. Such disposal activities must comply with all local laws, guidelines and environmental specifications of the country in which the disposal is done. For the European Union the sustainable disposal of electronic scrap is defined in the respective regulation for "waste electrical and electronic equipment" (WEEE).



The crossed-out wheelie bin on the products, packaging and/or accompanying documents means that used electrical and electronic products and batteries must not be mixed with normal household waste.

According to national legislation, penalties may be charged for incorrect disposal of such waste.

©2018 Siemens Protection Devices Limited

By disposing of these products correctly you will help to save valuable resources and prevent any potential negative effects on human health and the environment.

NOTE: Our products and batteries must not be disposed of as household waste. For disposing batteries it is necessary to observe the local national/international directives.

Disposal of Mobile Storage Devices (e.g. USB Sticks and Memory Cards)

When disposing of/transferring mobile storage devices, using the **format** or **delete** functions only changes the file management information and does not completely delete the data from your mobile storage device. When disposing of or transferring a mobile storage device, Siemens strongly recommends physically destroying it or completely deleting data from the mobile storage device by using a commercially available computer data erasing software.

REACH/RoHS Declaration

You can find our current **REACH/RoHS** declarations at:

https://www.siemens.com/global/en/home/products/energy/ecotransparency/ecotransparency-downloads.html

NOTE: You can find more information about activities and programs to protect the climate at the EcoTransparency website:

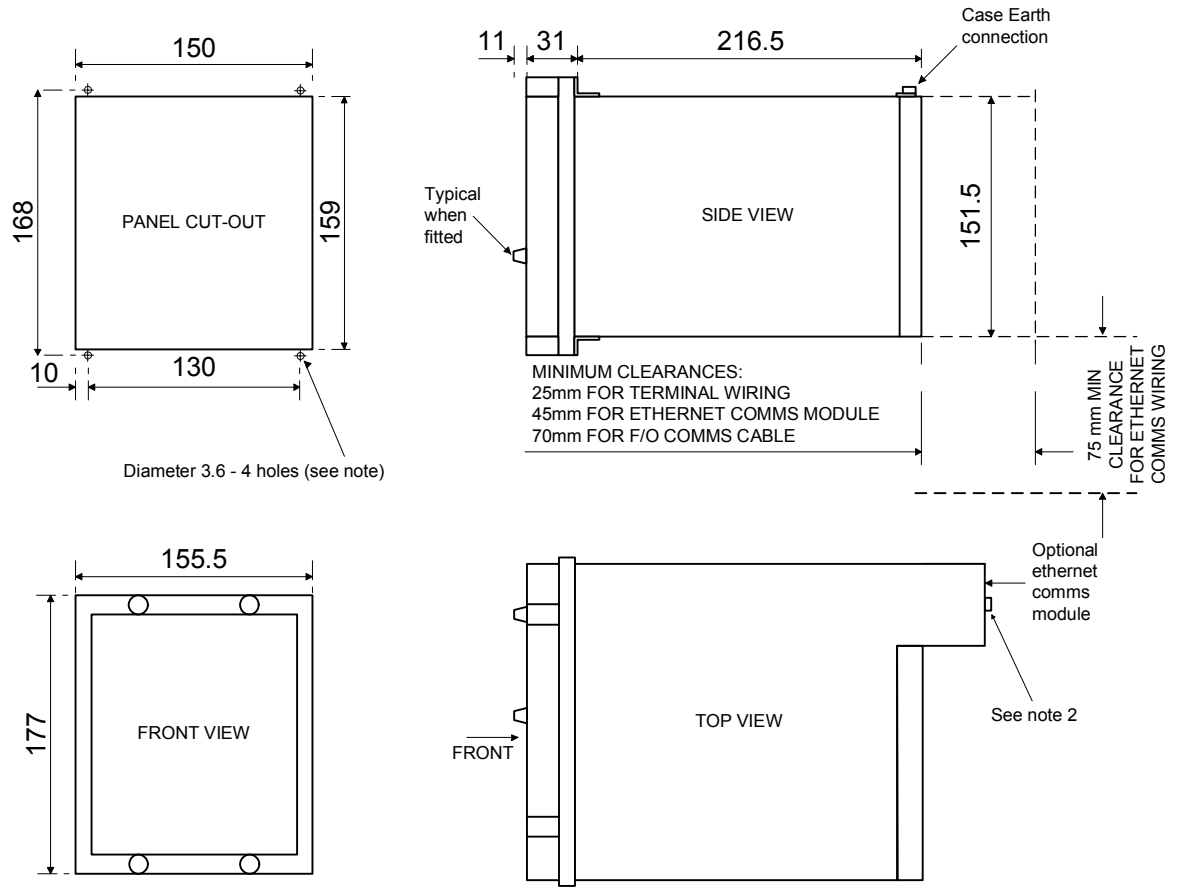
https://www.siemens.com/global/en/home/products/energy/ecotransparency.html

Section 3: Dimensions and Panel Fixings

3.1 Relay Dimensions and Weight

Relays are supplied in the modular size E6, E8 or E12

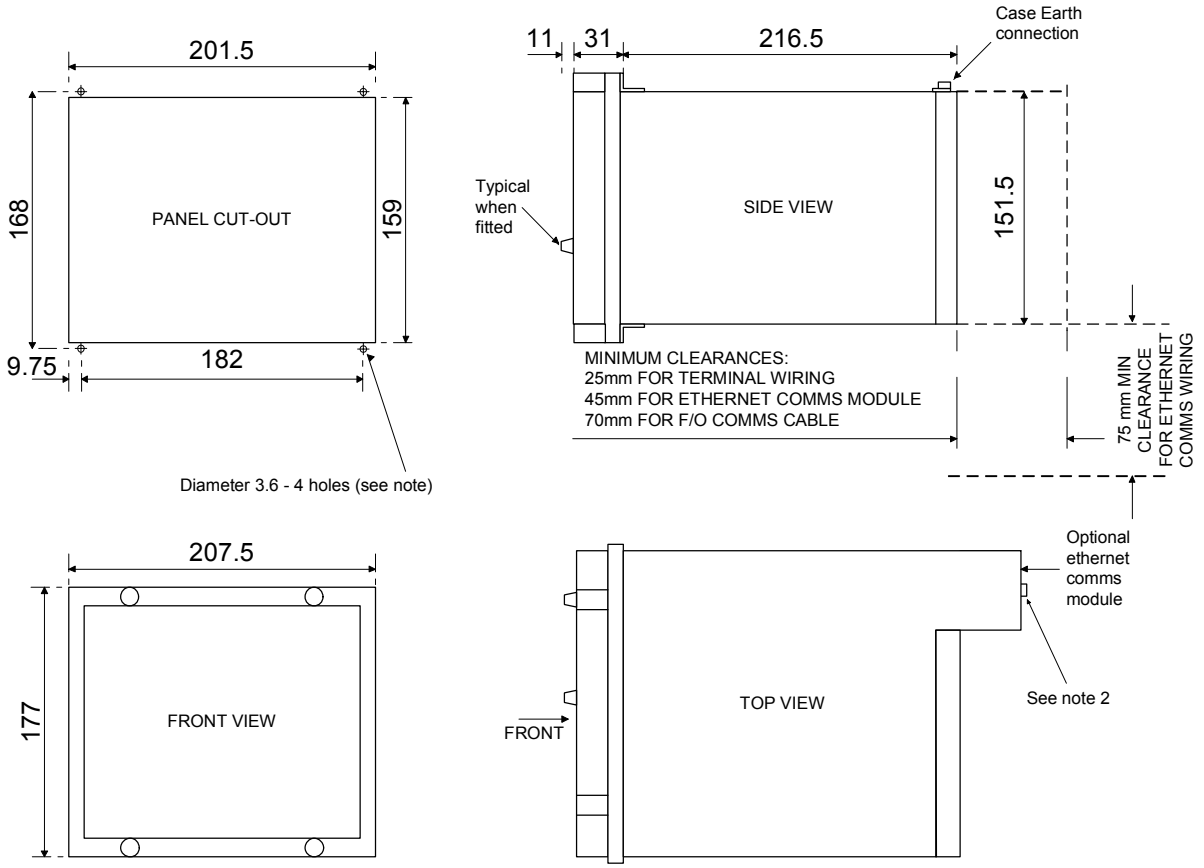
The following drawings are available which give panel cut-out and mounting details.



NOTE:
THE 3.6 HOLES ARE FOR M4 THREAD FORMING (TRILOBULAR) SCREWS. THESE ARE SUPPLIED AS STANDARD AND ARE SUITABLE FOR USE IN FERROUS / ALUMINIUM PANELS 1.6mm THICK AND ABOVE. FOR OTHER PANELS, HOLES TO BE M4 CLEARANCE (TYPICALLY 4.5 DIAMETER) AND RELAYS MOUNTED USING M4 MACHINE SCREWS, NUTS AND LOCKWASHERS (SUPPLIED IN PANEL FIXING KIT).
2) ACCESS CLEARANCE REQUIRED FOR OPTIONAL ETHERNET COMMS MODULE RETAINING SCREW

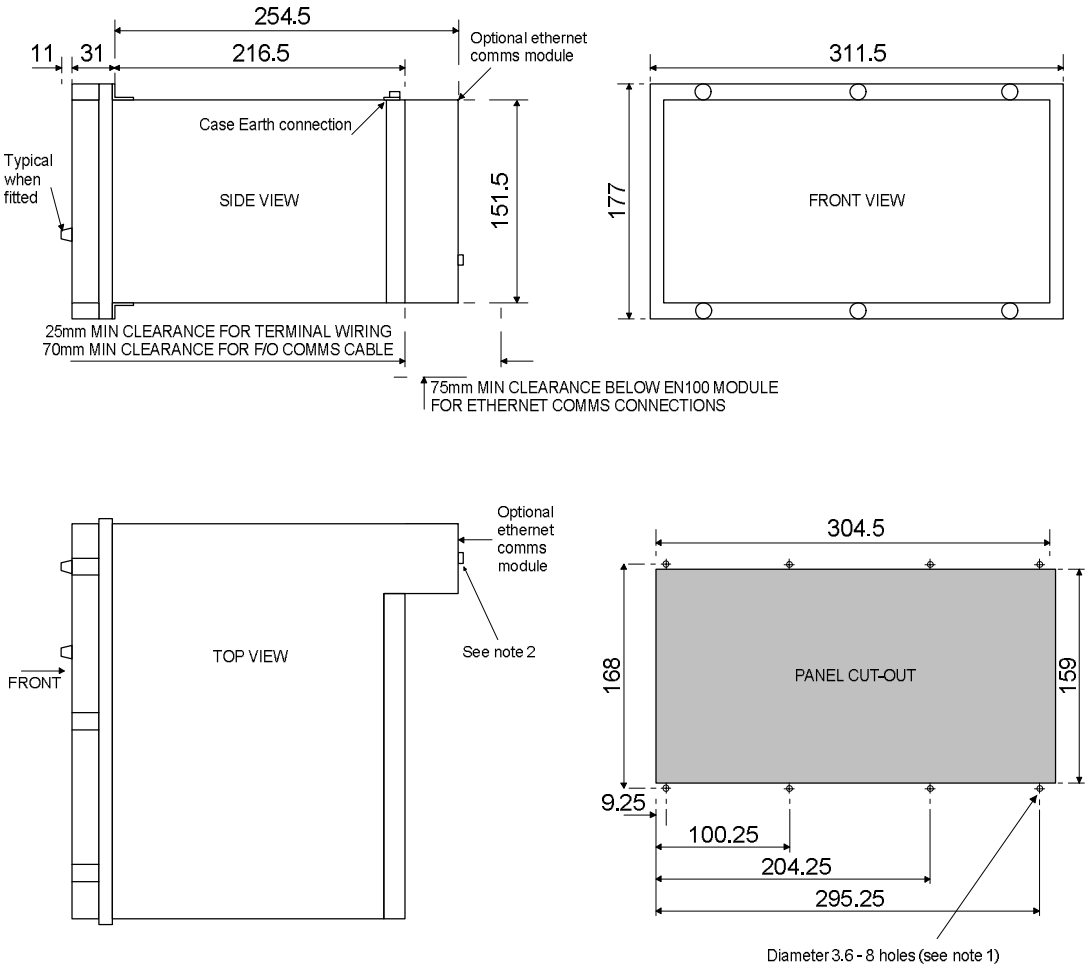
Figure 3.1-1 Overall Dimensions (mm) and panel Drilling for Size E6 Epsilon case

©2018 Siemens Protection Devices Limited



NOTE:
THE 3.6 HOLES ARE FOR M4 THREAD FORMING (TRILOBULAR) SCREWS. THESE ARE SUPPLIED AS STANDARD AND ARE SUITABLE FOR USE IN FERROUS / ALUMINIUM PANELS 1.6mm THICK AND ABOVE. FOR OTHER PANELS, HOLES TO BE M4 CLEARANCE (TYPICALLY 4.5 DIAMETER) AND RELAYS MOUNTED USING M4 MACHINE SCREWS, NUTS AND LOCKWASHERS (SUPPLIED IN PANEL FIXING KIT).
2) ACCESS CLEARANCE REQUIRED FOR OPTIONAL ETHERNET COMMS MODULE RETAINING SCREW

Figure 3.1-2 Overall Dimensions (mm) and Panel Drilling for Size E8 Epsilon Case



NOTES:

1) THE 3.6 HOLES ARE FOR M4 THREAD FORMING (TRILOBULAR) SCREWS. THESE ARE SUPPLIED AS STANDARD AND ARE SUITABLE FOR USE IN FERROUS / ALUMINIUM PANELS 1.6mm THICK AND ABOVE. FOR OTHER PANELS, HOLES TO BE M4 CLEARANCE (TYPICALLY 4.5 DIAMETER) AND RELAYS MOUNTED USING M4 MACHINE SCREWS, NUTS AND LOCKWASHERS (SUPPLIED IN PANEL FIXING KIT).

2) ACCESS CLEARANCE REQUIRED FOR OPTIONAL ETHERNET COMMS MODULE RETAINING SCREW

Figure 3.1-3 Overall Dimensions (mm) and Panel Drilling for Size E12 Epsilon Case

Hardware Model	Typical Net Weight (kg)
7SR2102	4.2
7SR2103	4.6
7SR2104	4.8
7SR2105	8.4
7SR2106	8.4
7SR2202	4.8
7SR2203	4.9
7SR2204	5.3
7SR2205	8.4
7SR2206	8.4

NB:
For relays supplied with additional (optional) communication interface devices, please add an additional 0.165 kg to the figures in the above table.
For relays supplied with Ethernet EN100 interface (optional) please add 0.1 kg to the figures in the above table.

©2018 Siemens Protection Devices Limited

3.2 Fixings

3.2.1 Crimps

Ring tongued crimps with 90˚ bend are recommended.

3.2.2 Panel Fixings

Typical mounting screw kit per Relay

Consists of 4 off M4x10 mm Screws

4 off M4 Nuts

4 off M4 Lock Washers

Typical rear terminal block fixing kit (1 kit per terminal block fitted to relay) consists of: -

28 x M4, 8 mm Screws

28 x M4 Lock Washers

3.2.3 Fibre Optic Connectors

The relay has Fibre-Optic ST™ (BFOC/2.5) bayonet connectors fitted when specified.

3.2.4 Connectors Ethernet Option

The relay has RJ45 connectors for electrical Ethernet and Duplex LC Fibre Optic connectors for optical Ethernet.

Section 4: Rear Terminal Drawings

4.1 E6 Case

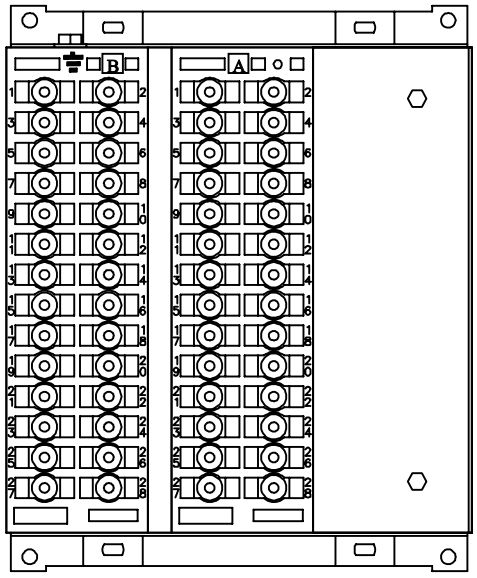


Figure 4.1-1 E6 Standard Comms (USB Front Port, Rear RS485) (See Note 2)

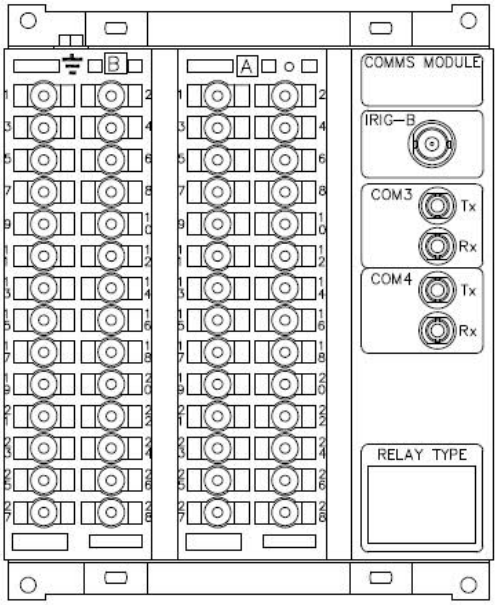


Figure 4.1-2 E6 Standard + Additional Comms (IRIG-B, 2 x F.O. (ST Connectors)) (See Note 2)

Notes

1) Recommended terminations are pre-insulated & must be crimped using approved tooling.

2) RS485 (block ”B” terms 14, 16, 18, 20) connections to this communication facility is by screened, twisted pair cable. On site when wiring other facilities ensure that these terminals are not obscured by other wiring runs. Cable should be RS485 compliant.

©2018 Siemens Protection Devices Limited

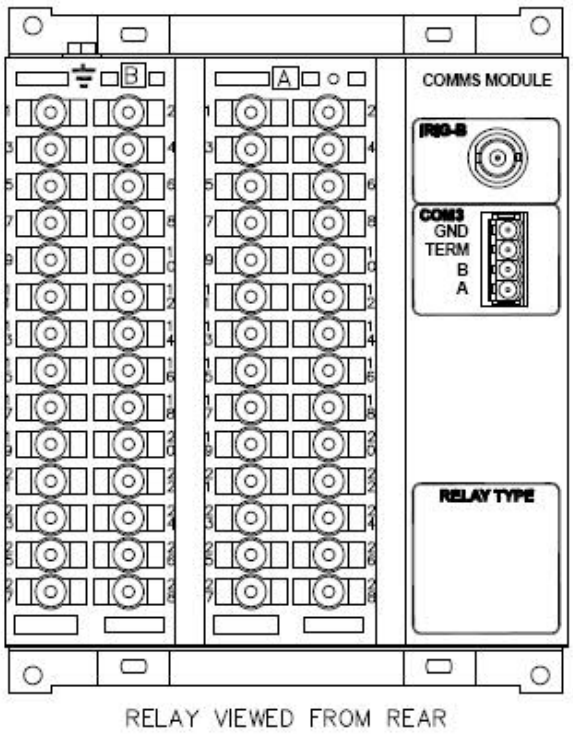


Figure 4.1-3 E6 Standard + Additional Comms (IRIG B + RS485) (See Note 2)

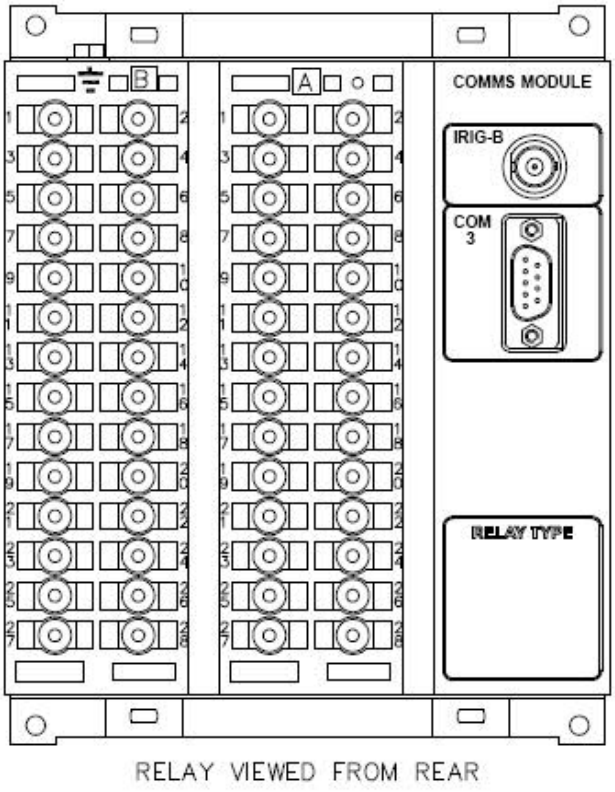


Figure 4.1-4 E6 Standard + Additional Comms (IRIG B + RS232) (See Note 2)

4.2 E8 Case

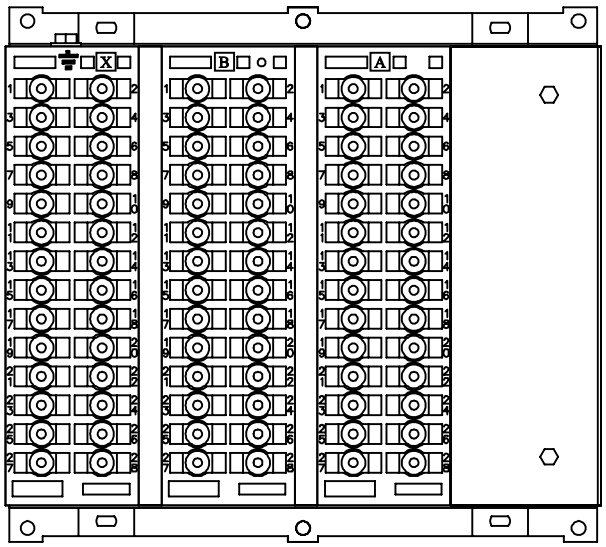


Figure 4.2-1 E8 Standard Comms (USB Front Port, Rear RS485) (See Note 2)

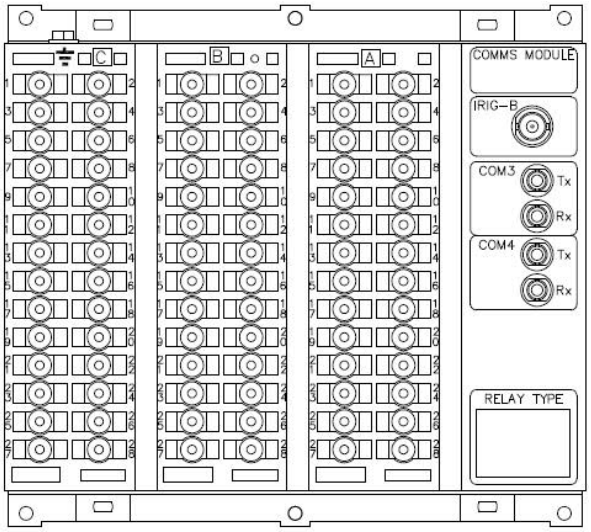


Figure 4.2-2 E8 Standard + Additional Comms (IRIG B, 2 x F.O. (ST Connectors)) (See Note 2)

©2018 Siemens Protection Devices Limited

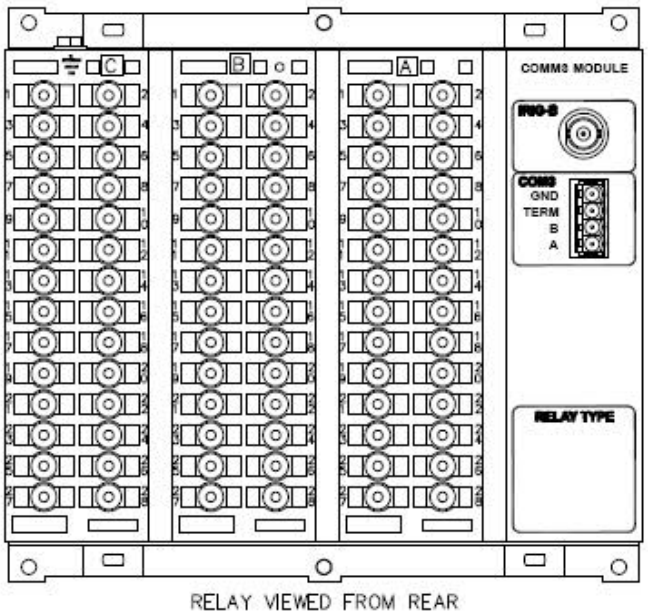


Figure 4.2-3 E8 Standard + Additional Comms (IRIG B + RS485) (See Note 2)

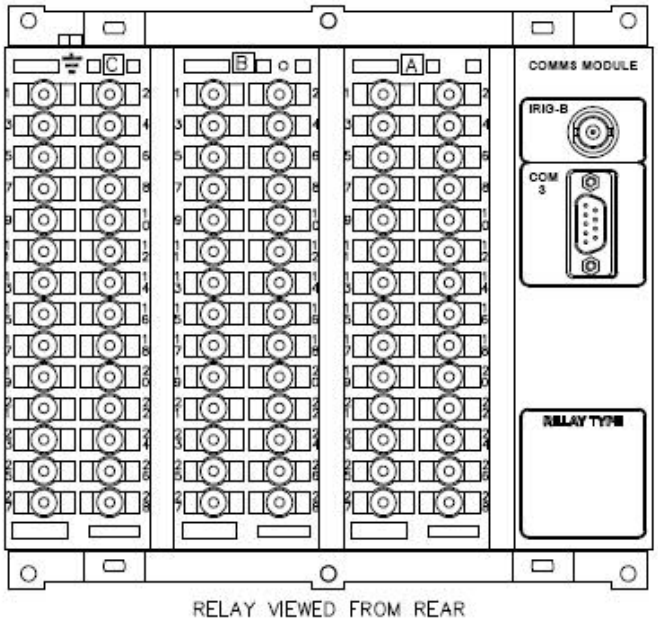


Figure 4.2-4 E8 Standard + Additional Comms (IRIG B + RS232) (See Note 2)

4.3 E12 Case

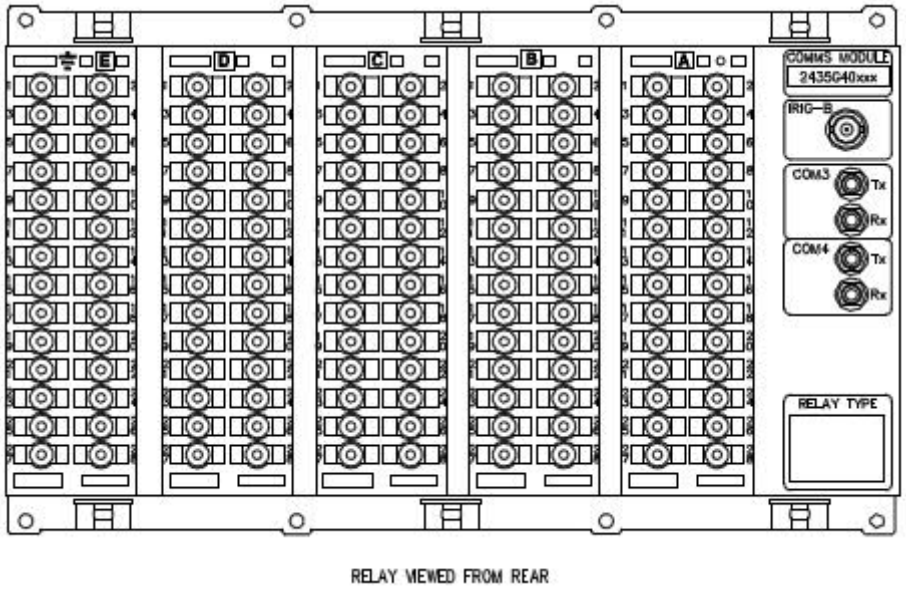


Figure 4.3-1 E12 Standard + Additional Comms (IRIG B, 2 x F.O. (ST Connectors)) (See Note 2)

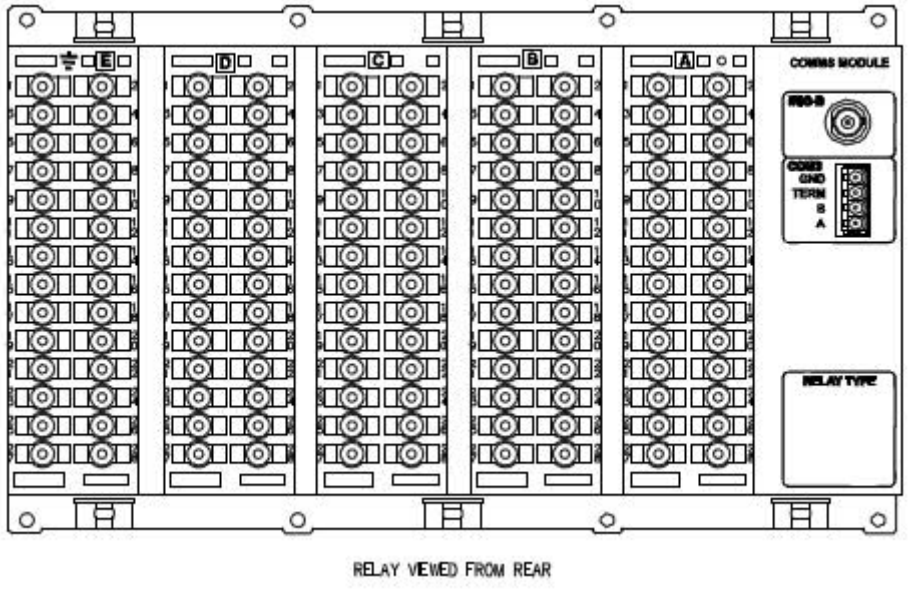


Figure 4.3-2 E12 Standard + Additional Comms (IRIG B + RS485) (See Note 2)

©2018 Siemens Protection Devices Limited

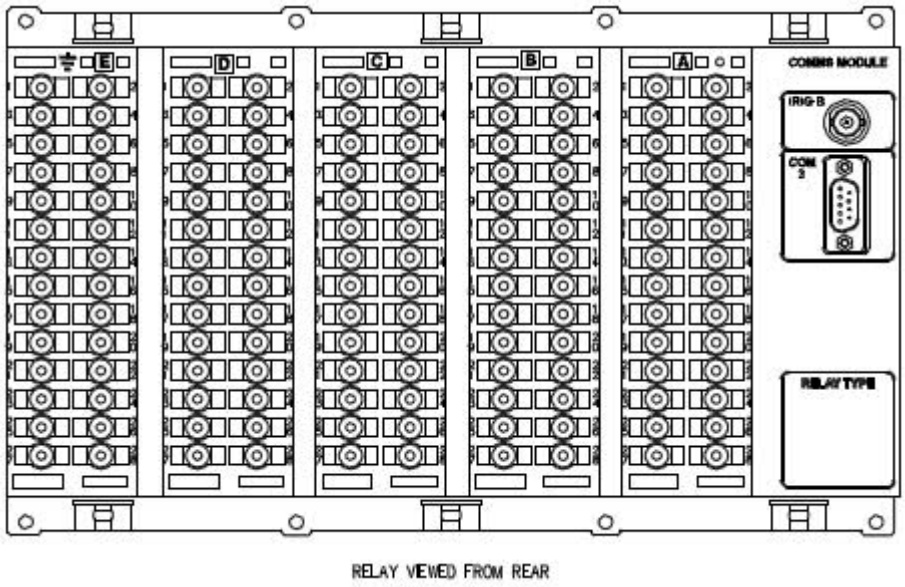


Figure 4.3-3 E12 Standard + Additional Comms (IRIG B + RS232) (See Note 2)

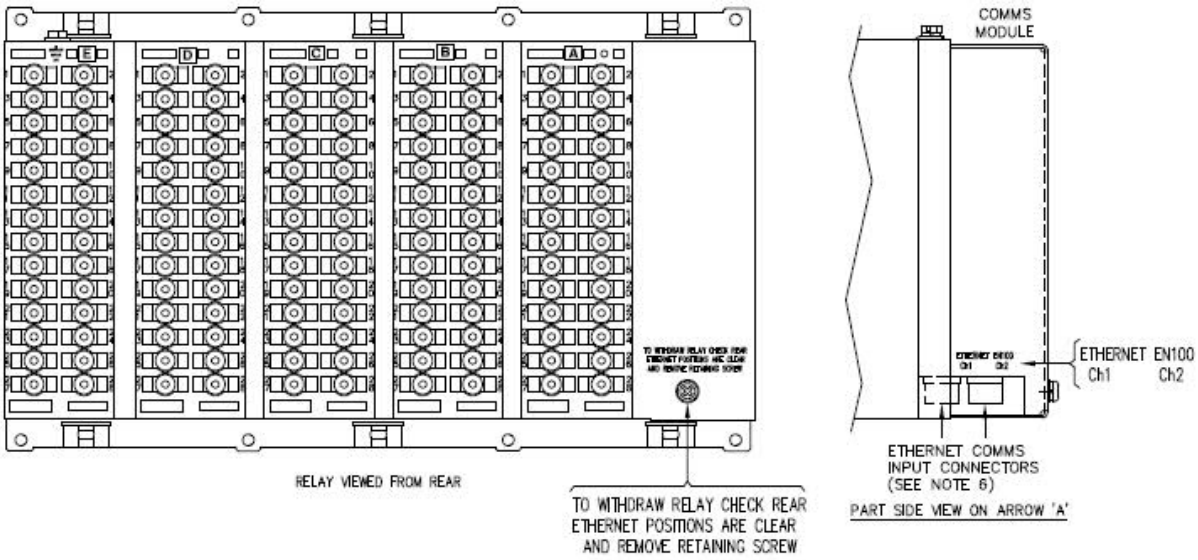


Figure 4.3-4 E12 Standard + Additional Comms (RS485 + Ethernet (x2)) (See Note 2)

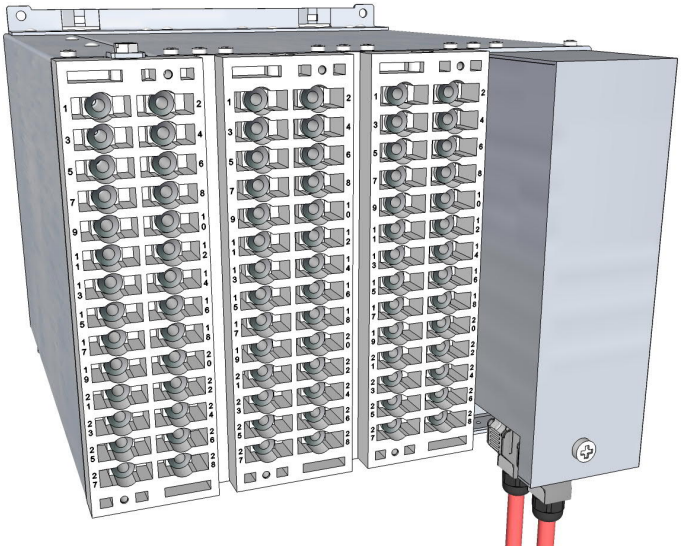


Figure 4.3-5 Standard Comms + Additional Ethernet Ports (RJ45 shown, Duplex LC Fibre Optic similar)

Notes

1) Recommended terminations are pre-insulated & must be crimped using approved tooling.

2) RS485 (block ”B” terminals 14, 16, 18, 20 and optional COMMS MODULE) connections are by screened, twisted pair cable.

Ensure that these terminals are not obscured by other wiring runs.

Cable should be RS485 compliant.

©2018 Siemens Protection Devices Limited

Section 5: Connection/Wiring/Diagrams

5.1 Wiring Diagram: 7SR21 OC/EF Relay

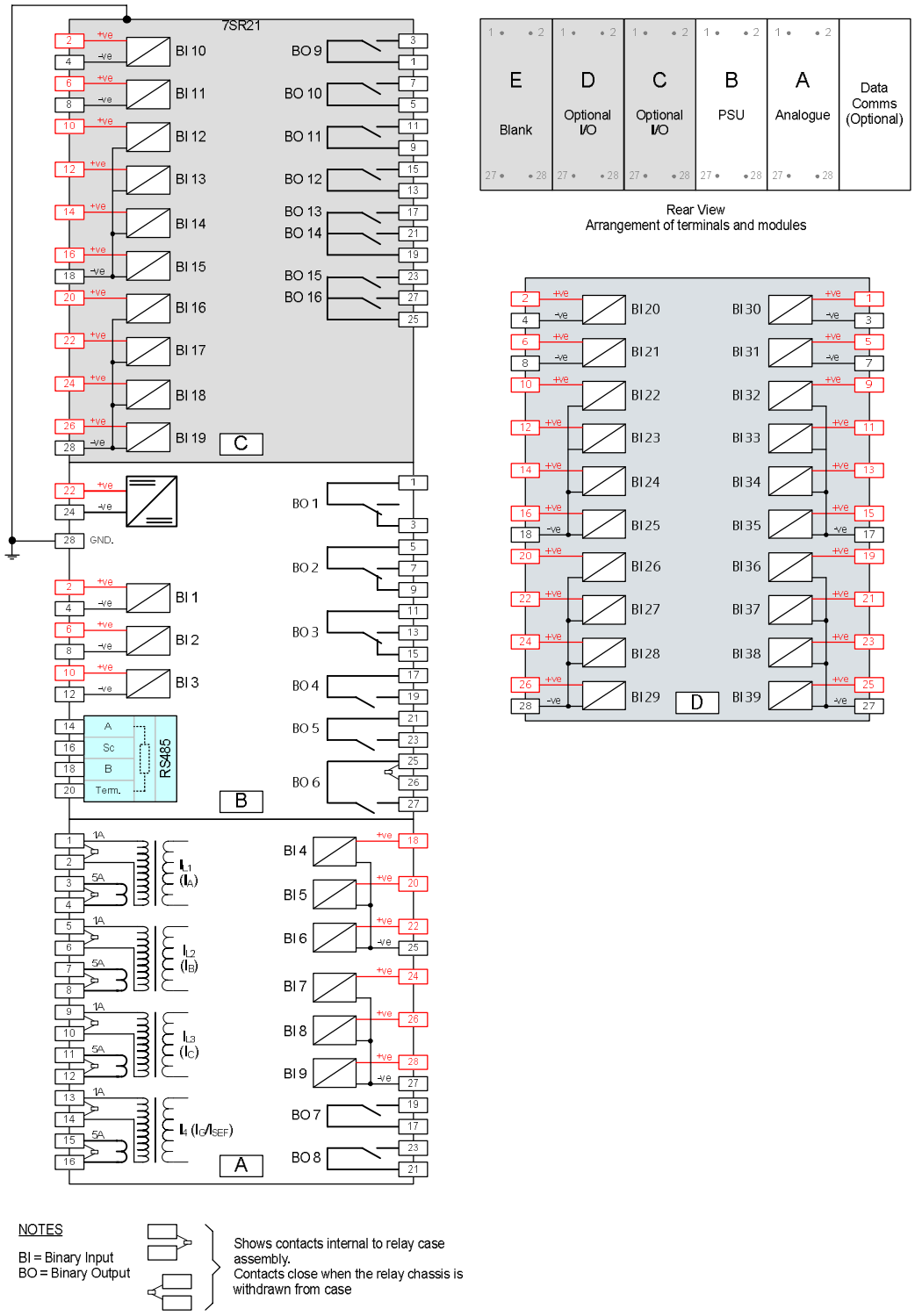
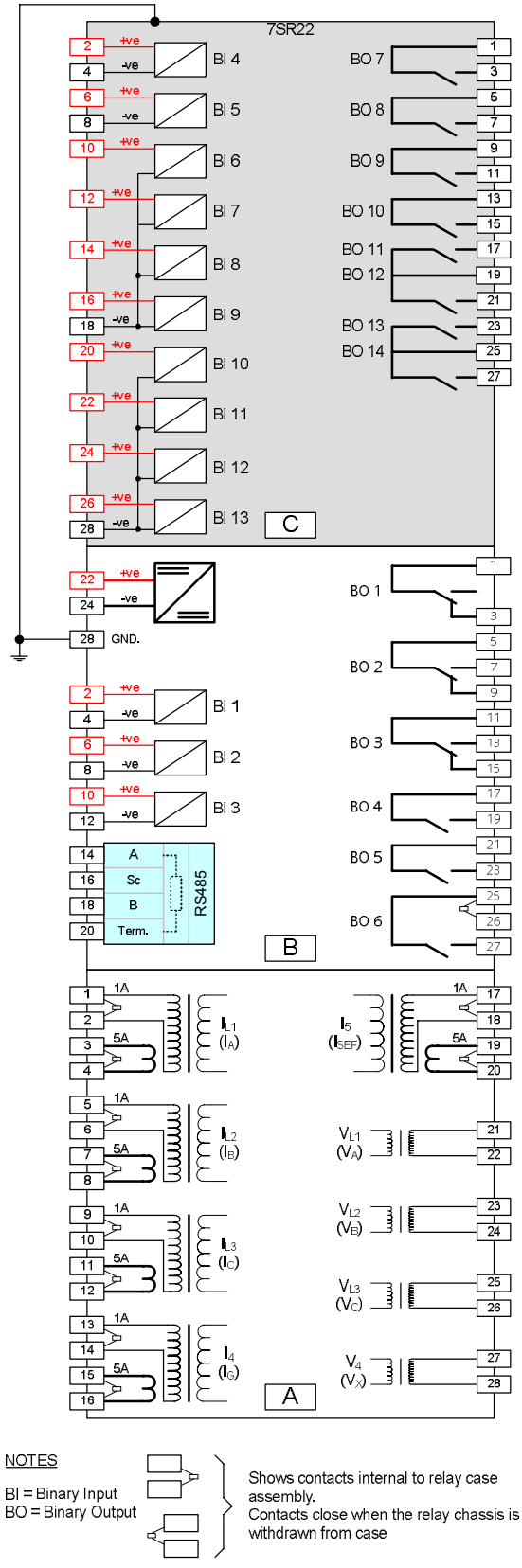
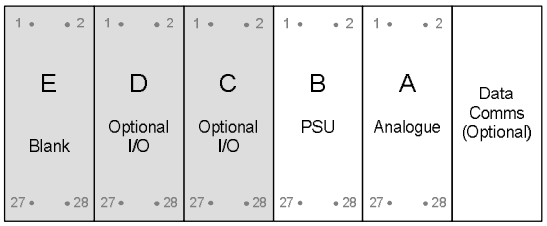


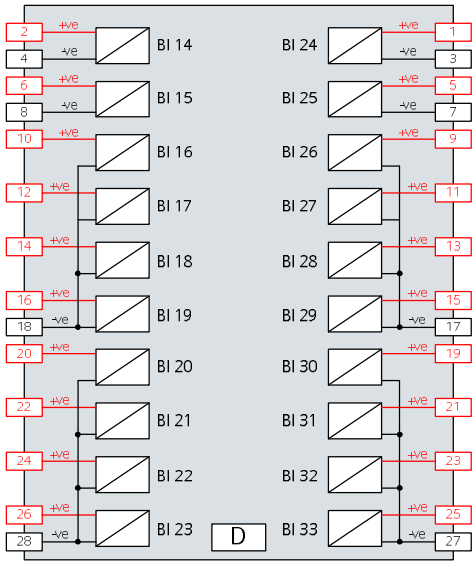
Figure 5.1-1 Connection Diagram for 7SR21 Relay

5.2 Wiring Diagram: 7SR22 Directional OC/EF Relay





Rear View
Arrangement of terminals and modules



NOTES

BI = Binary Input
BO = Binary Output

Shows contacts internal to relay case assembly.
Contacts close when the relay chassis is withdrawn from case

Figure 5.2-1 Connection Diagram for 7SR22 Relay

©2018 Siemens Protection Devices Limited

Section 6: Data Comms Connections

6.1 Standard RS485 Connections

The standard RS485 communication port is located on terminal block 2 at the rear of the relay and can be connected using a suitable RS485 120 Ohm screened twisted pair cable.

The RS485 electrical connection can be used in a single or multi-drop configuration. The RS485 master must support and use the Auto Device Enable (ADE) feature.

The last device in the connection must be terminated correctly in accordance with the master driving the connection. A terminating resistor is fitted in each relay, when required this is connected in circuit using an external wire loop between terminals 18 and 20 of the power supply module.

Up to 64 relays can be connected to the RS485 bus.

The RS485 data communications link with a particular relay will be broken if the relay element is withdrawn from the case, all other relays will still communicate.

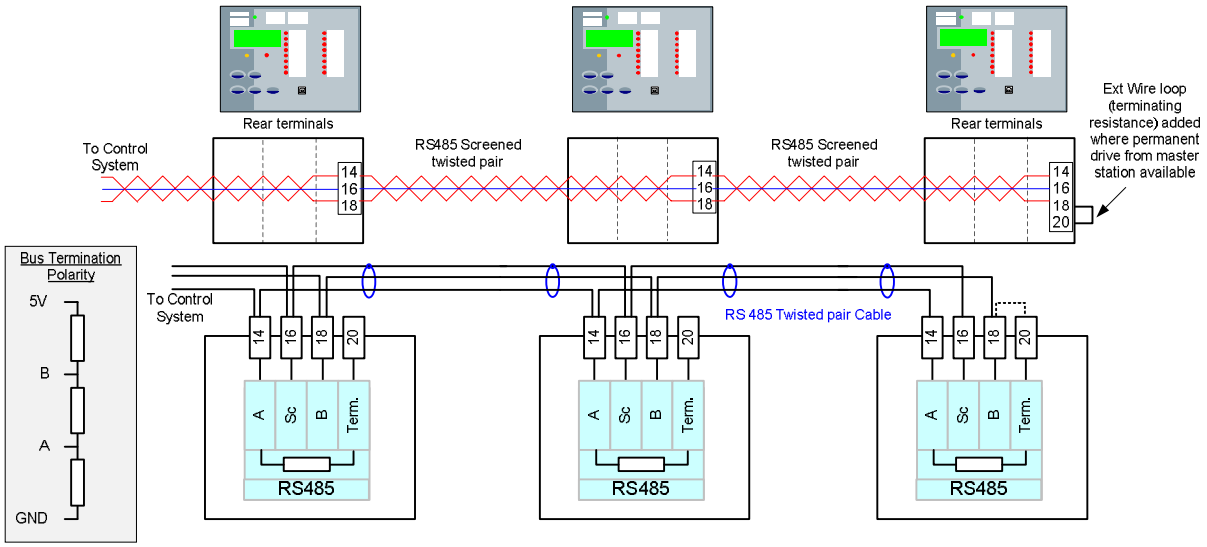


Figure 6.1-1 RS485 Data Comms Connections Between Relays

6.2 IRIG-B Connections

A BNC plug is provided on the optional additional communication interface modules to connect a co-axial cable carrying IRIG-B time synchronisation signals. Ensure that the stub length is minimised by connecting the tee-connector directly to the rear of the relay. A suitable co-axial cable would be type RG58 50 Ohms.

6.3 Additional (Optional) Fibre Optic Connections

Rear Com ports 3 and 4 comprise Fibre–Optic ST™ (BFOC/2.5) bayonet connectors-4 per product. 62.5 / 125 µm glass fibre is recommended for all distances.

When installing fibre, ensure that the fibres' bend radii comply with the recommended minimum for the fibre used-typically 50 mm is acceptable.

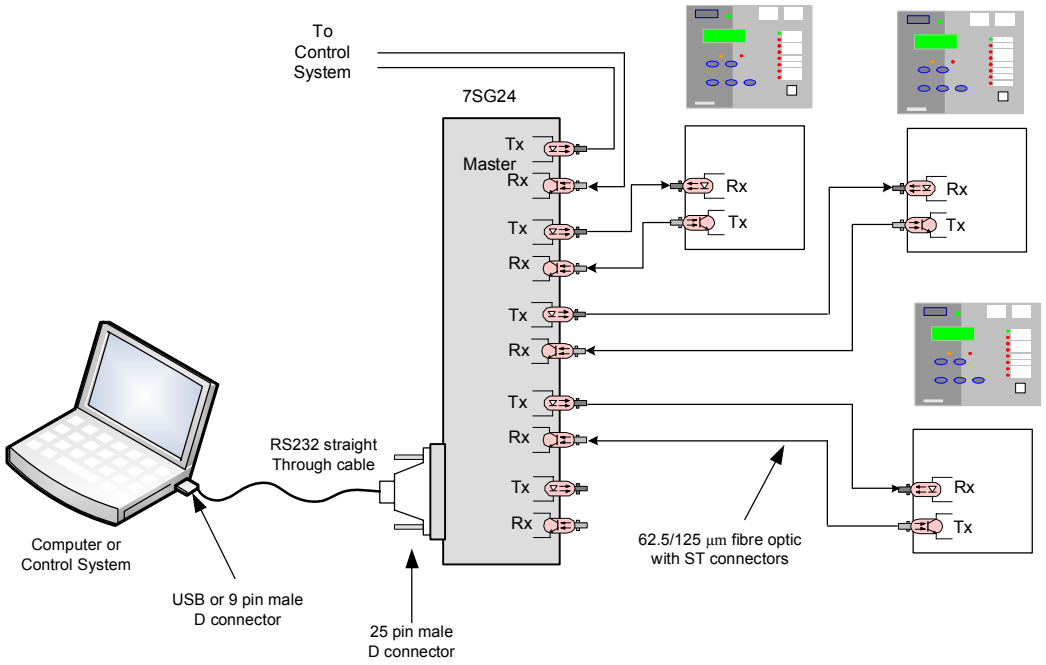


Figure 6.3-1 Data Comms to Multiple Devices Using 7SG24 and F.O. Star Network

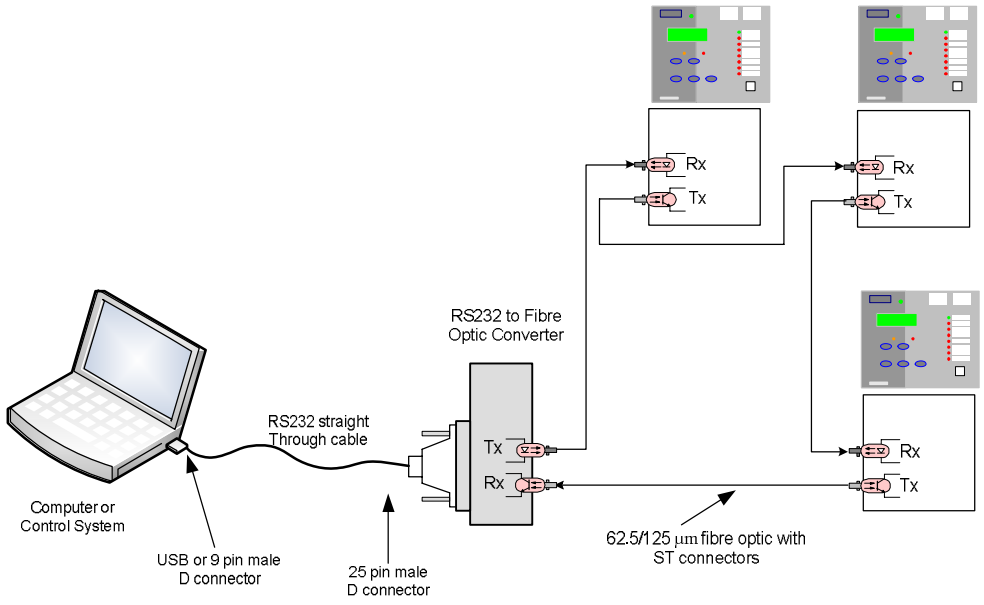


Figure 6.3-2 Data Comms to Multiple Devices Using 7SG24 and F.O. Ring Network

The F.O. data communications link with a particular relay will be broken if the relay element is withdrawn from the case, all other relays will still communicate.

©2018 Siemens Protection Devices Limited

6.4 Additional (Optional) RS485 Connections

The additional (optional) RS485 communication port is located at the rear of the relay and can be connected using a suitable RS485 120 Ohm screened twisted pair cable.

The RS485 electrical connection can be used in a single or multi-drop configuration. The RS485 master must support and use the Auto Device Enable (ADE) feature.

The last device in the connection must be terminated correctly in accordance with the master device driving the connection. The relays are fitted with an internal terminating resistor which can be connected between the A and B by fitting an external wire loop between terminals 18 and 20 on the power supply module.

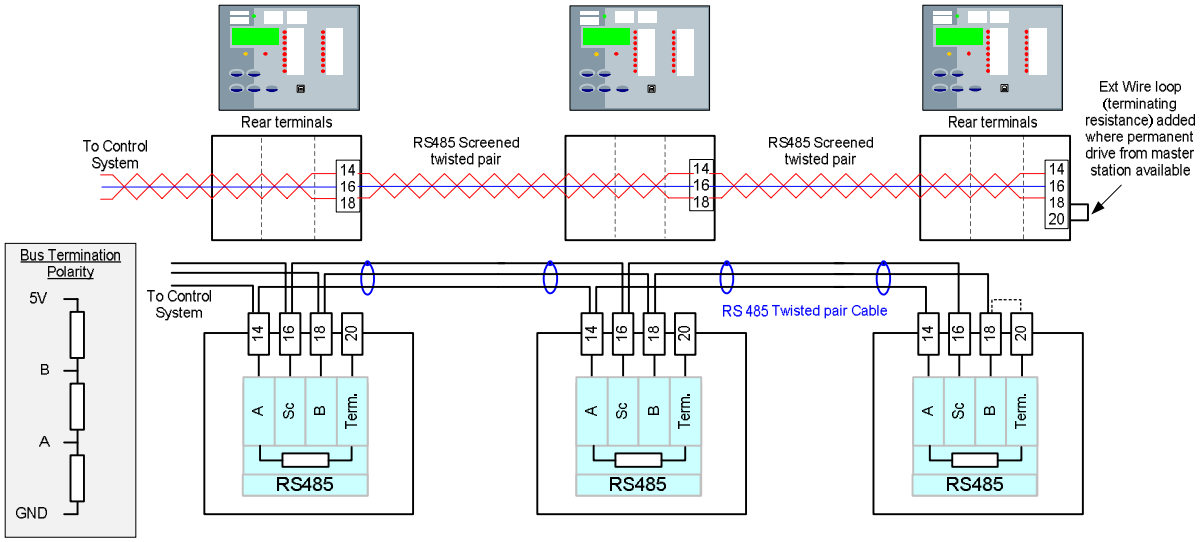


Figure 6.4-1 RS485 Data Comms Connections Between Relays

6.5 Additional (Optional) RS232 Connections

The additional (optional) RS232 (9 pin plug) (DTE) communication port is located at the rear of the relay and can be connected using a suitable RS232 cable.

Where there is a requirement for multi-drop RS232 connection, a suitable device to facilitate this should be obtained.

Pin	Relay Function
1	Not Connected
2	Receive Data (RXD)
3	Transmit Data (TXD)
4	Input Supply +5 V
5	Signal Ground (GND)
6	Input Supply +5 V
7	Linked to 8 (volts free)
8	Linked to 7 (volts free)
9	Output Supply +5 V 50 mA

Figure 6.5-1 RS232 Data Comms Pin Connections

6.6 Additional (Optional) Ethernet Connection for IEC 61850

Rear Ethernet Comms port Ch 1 and Ch 2 comprises Duplex LC 100BaseF in acc. With IEEE802.3 Fibre–Optic or RJ45 100BaseF in acc. With IEEE802.3 electrical connectors.

When installing fibre, ensure that the fibres' bend radii comply with the recommended minimum for the fibre used- typically 50 mm is acceptable, 62.5/125 μm glass fibre with Duplex-LC connector recommended for all distances.

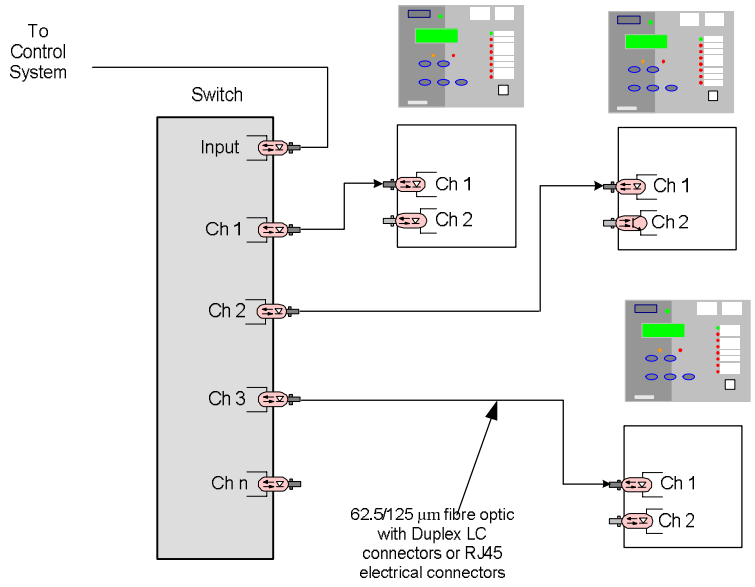


Figure 6.6-1 Ethernet connection for IEC 61850 (star connection)

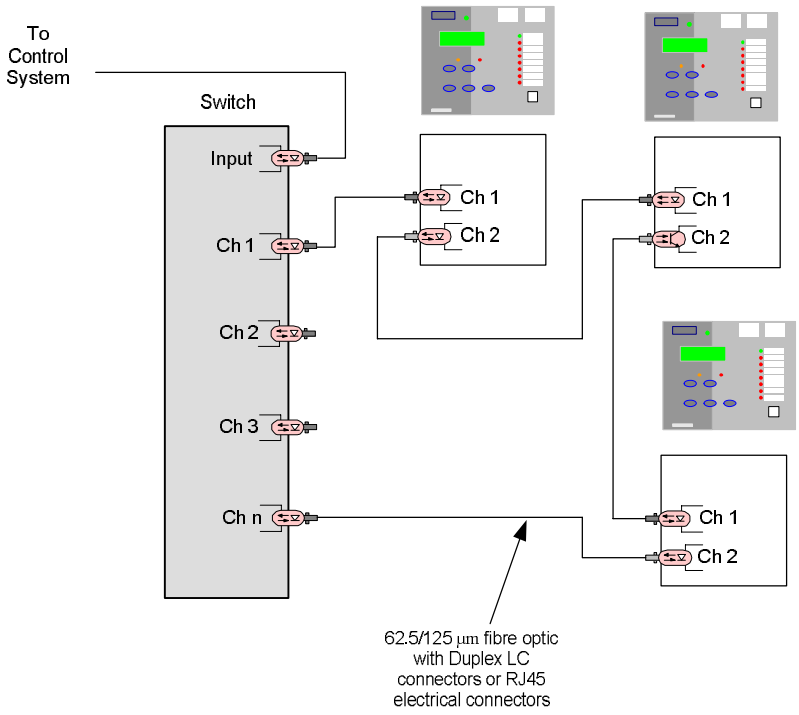


Figure 6.6-2 Ethernet connection for IEC 61850 (ring connection)

©2018 Siemens Protection Devices Limited

6.7 Ethernet Network Redundancy IEC 61850

The EN100+ module is used on current Reyrolle devices (from 7SR21/22 hardware /DD) to provide Ethernet/IEC61850 functionality. The RJ45 electrical EN100+ supports PRP redundancy protocols. The Duplex-LC Optical EN100+ also supports RSTP and HSR redundancy protocols.

Earlier 7SR21/22 (/CC) devices were manufactured with the EN100 (not EN100+) module and the electrical version cannot support redundancy. The optical version can support redundancy if firmware is updated. Earlier devices do not support the EN100+ module cannot be updated by simply exchanging the EN100 module.

All current 7SR21/22 IEC61850 variants are delivered with the EN100+ (Plus) module and firmware 4.24 or later.

The EN100 module firmware can be updated by connecting to the relay via the rear Ethernet port. For more information on connecting to the relay via the Ethernet port, please see the Reydisp Manager User guide. Depending on the EN100 module type and Firmware version, the following protocol options are available:

Interface Type	EN100 Firmware	Line Mode	Switch Mode			
			RSTP	OSM	PRP	HSR
Electrical RJ45 EN100+	4.21and later	✓	✓	✓	✓	✓
Optical EN100+	4.21and later	✓	✓	✓	✓	✓
Electrical RJ45 EN100+	4.08 or earlier	✓	✓	✓	×	×
Optical EN100+	4.08 or earlier	✓	✓	✓	×	×
Electrical RJ45 EN100	4.21and later	✓	×	×	×	×
Optical EN100	4.21and later	✓	✓	✓	✓	✓
Electrical RJ45 EN100	4.08 or earlier	✓	×	×	×	×
Optical EN100	4.08 or earlier	✓	✓	✓	×	×

Figure 6.7-1 EN100 Redundancy Availability

6.7.1 RSTP – Rapid Spanning Tree Protocol

RSTP is a redundancy protocol with a minimal response time that has been standardized in IEEE-802.1D (2004). The reconfiguration time depend on the topology and start at 50 ms.

RSTP need to be enabled on the device within Reydisp Manager (See Reydisp Manager user guide). Network rings with up to 30 devices is possible.

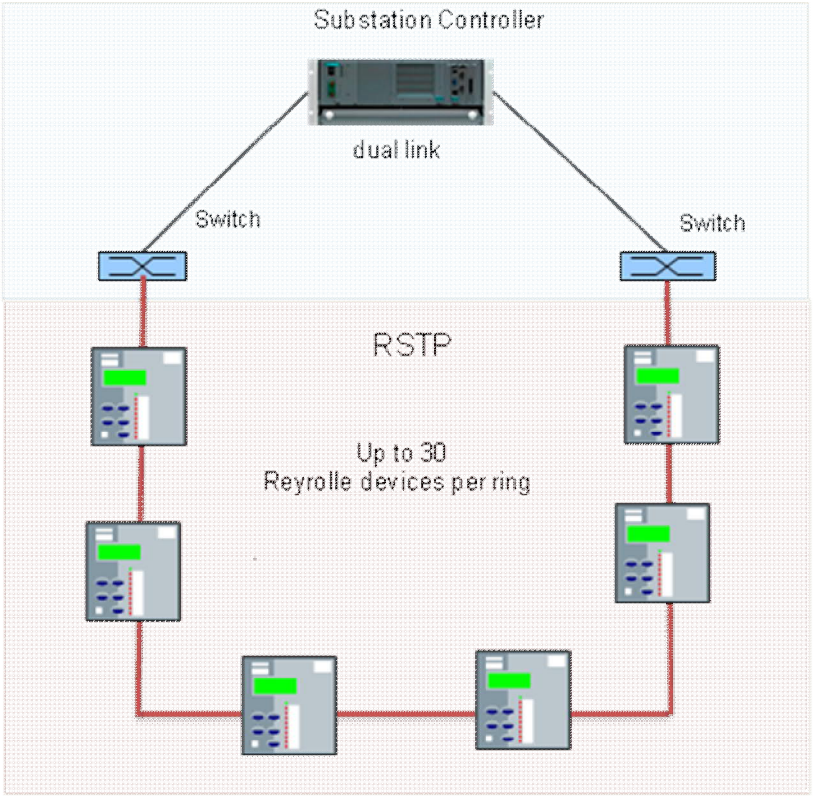


Figure: 6.7.1-1 RSTP Ethernet Network Ring Configuration

6.7.2 PRP – Parallel Redundancy Protocol

The HSR redundancy protocol according to the IEC 62439-3 standard is based on double transmission of message frames over ring-topology networks in both directions. In the case of an error, the message frame will be transmitted without any delay. No reconfiguration time is necessary for the network, as is the case for RSTP.

PRP need to be enabled on the device within Reydisp Manager (See Reydisp Manager user guide).

©2018 Siemens Protection Devices Limited

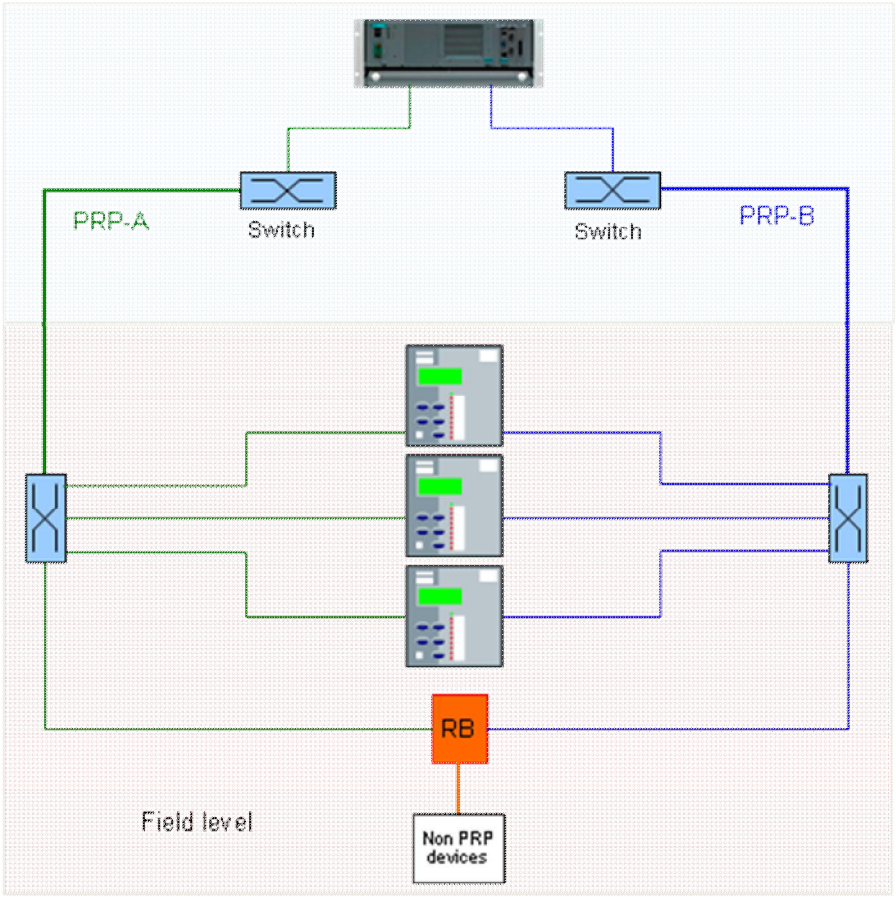


Figure: 6.7.2-1 PRP Ethernet Network Configuration

6.7.3 HSR – High Availability Seamless Redundancy Protocol

The HSR redundancy protocol according to the IEC 62439-3 standard is based on double transmission of message frames over ring-topology networks in both directions. In the case of an error, the message frame will be transmitted without any delay. No reconfiguration time is necessary for the network.

HSR needs to be enabled on the device within Reydisp Manager (See Reydisp Manager user guide). Network rings with up to 50 devices is possible.

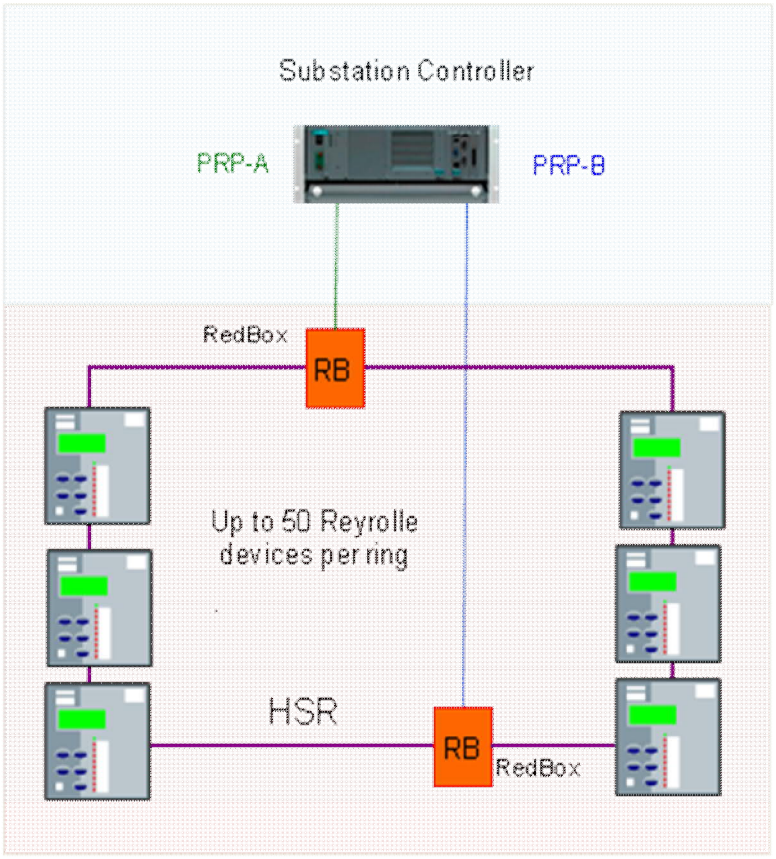


Figure: 6.7.3-1 HSR Ethernet Network Ring Configuration

©2018 Siemens Protection Devices Limited

Section 7: Connection Diagrams

7.1 Typical Connection: 7SR22 Directional OC/EF and REF

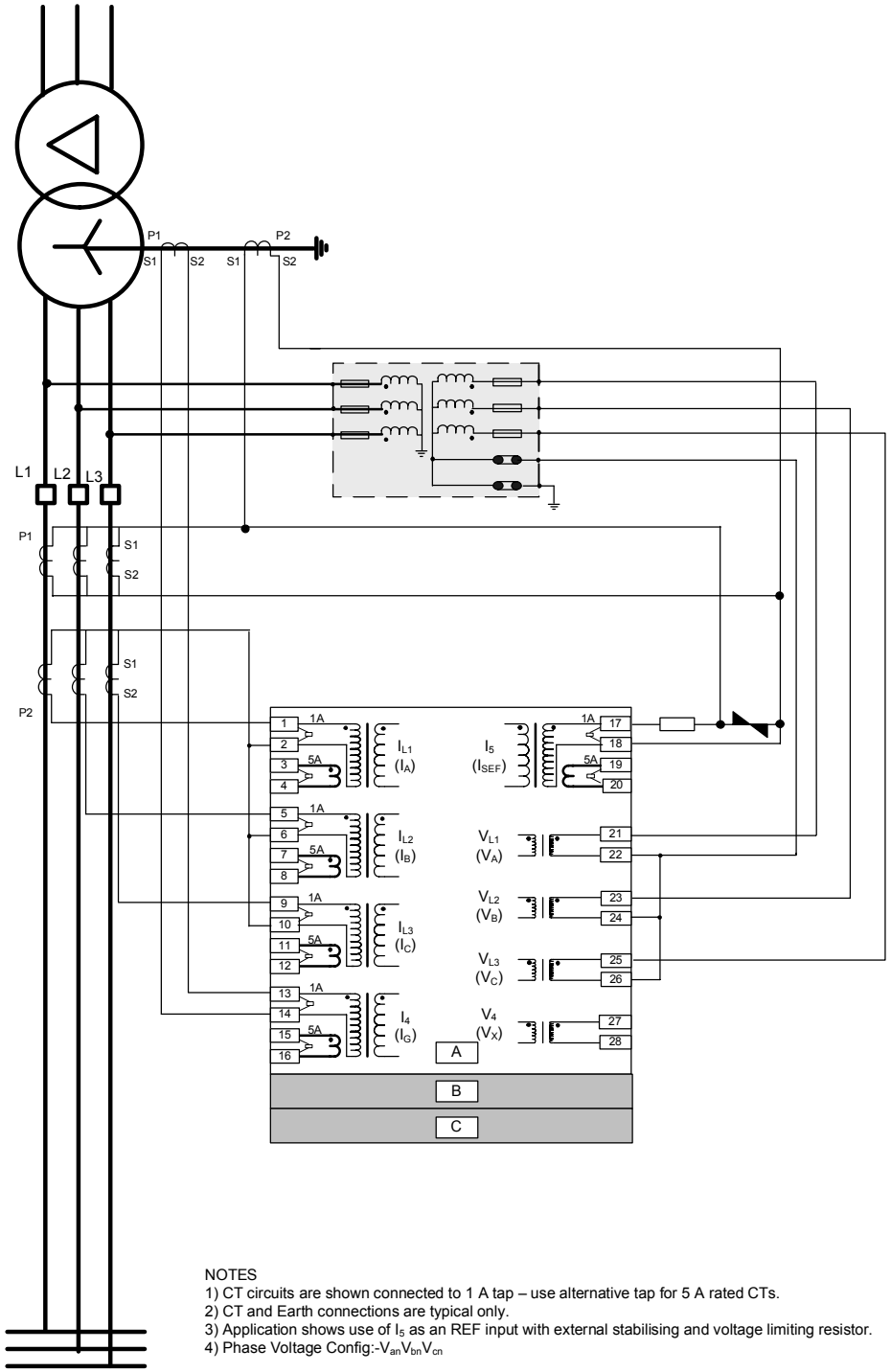


Figure 7.1-1 7SR22 Applied to Transformer Incomer

7.2 Typical Connection: 7SR22 Directional OC/EF and NVD

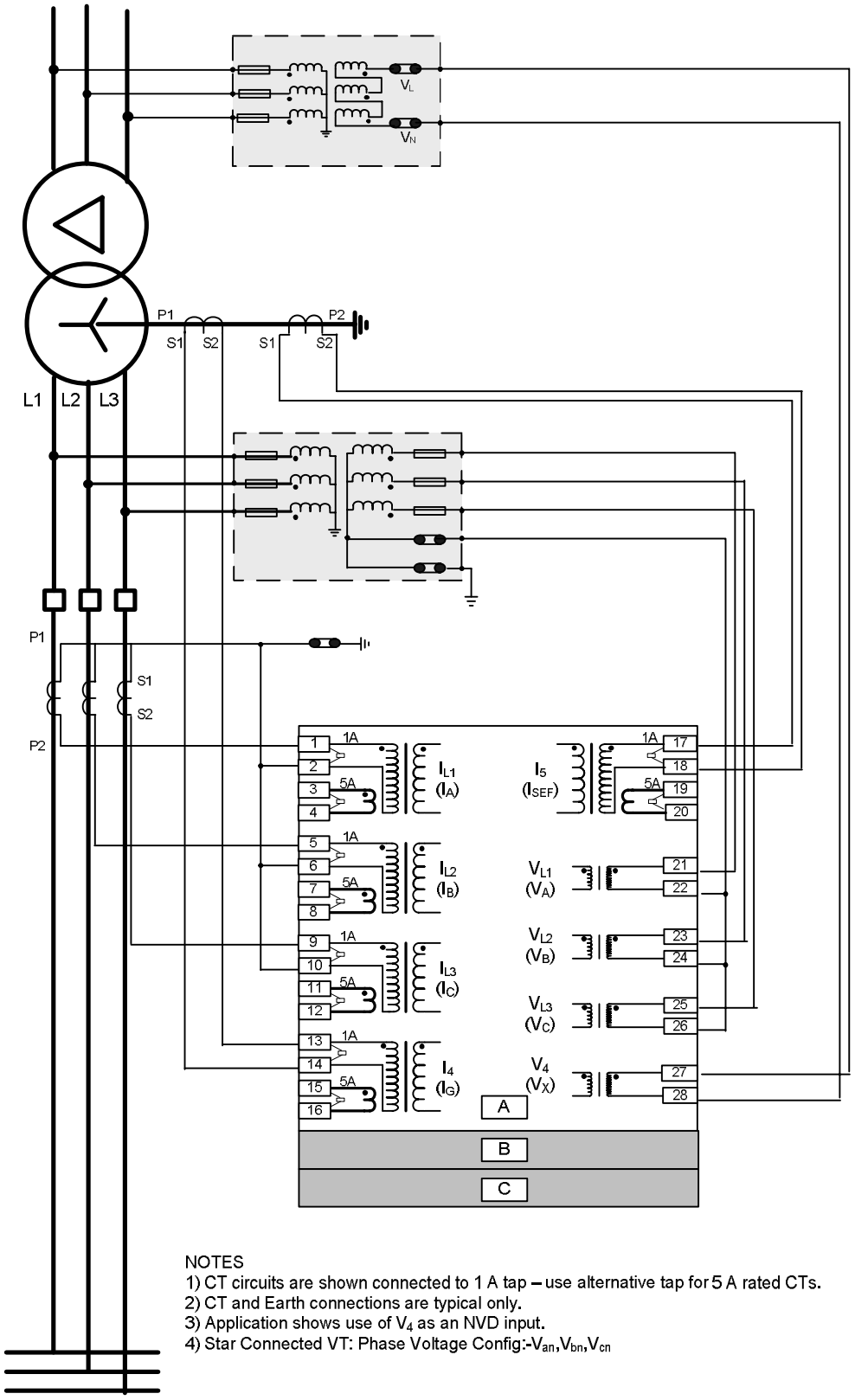
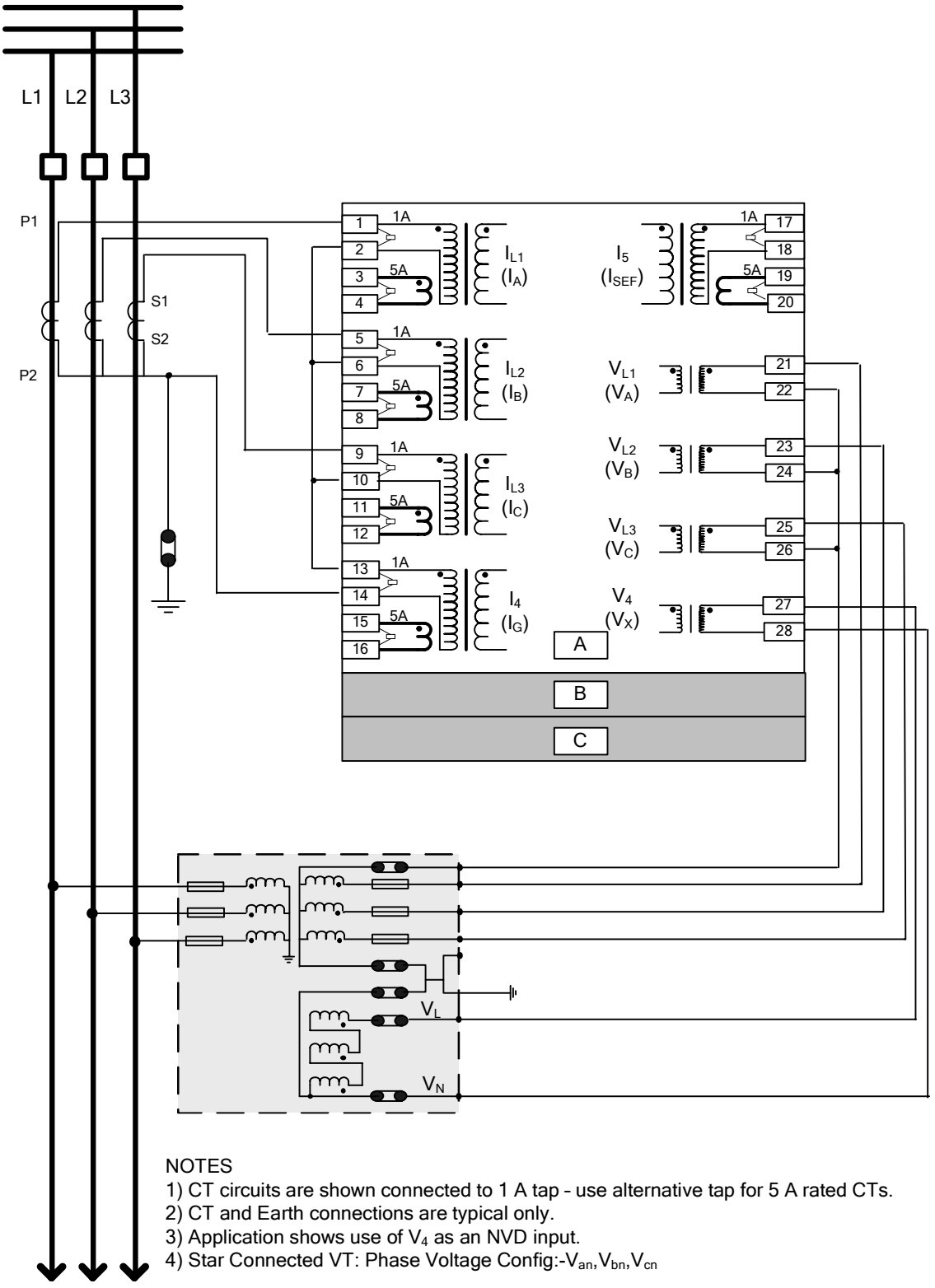


Figure 7.2-1 7SR22 Applied to Transformer Incomer Including HV NVD Protection

©2018 Siemens Protection Devices Limited

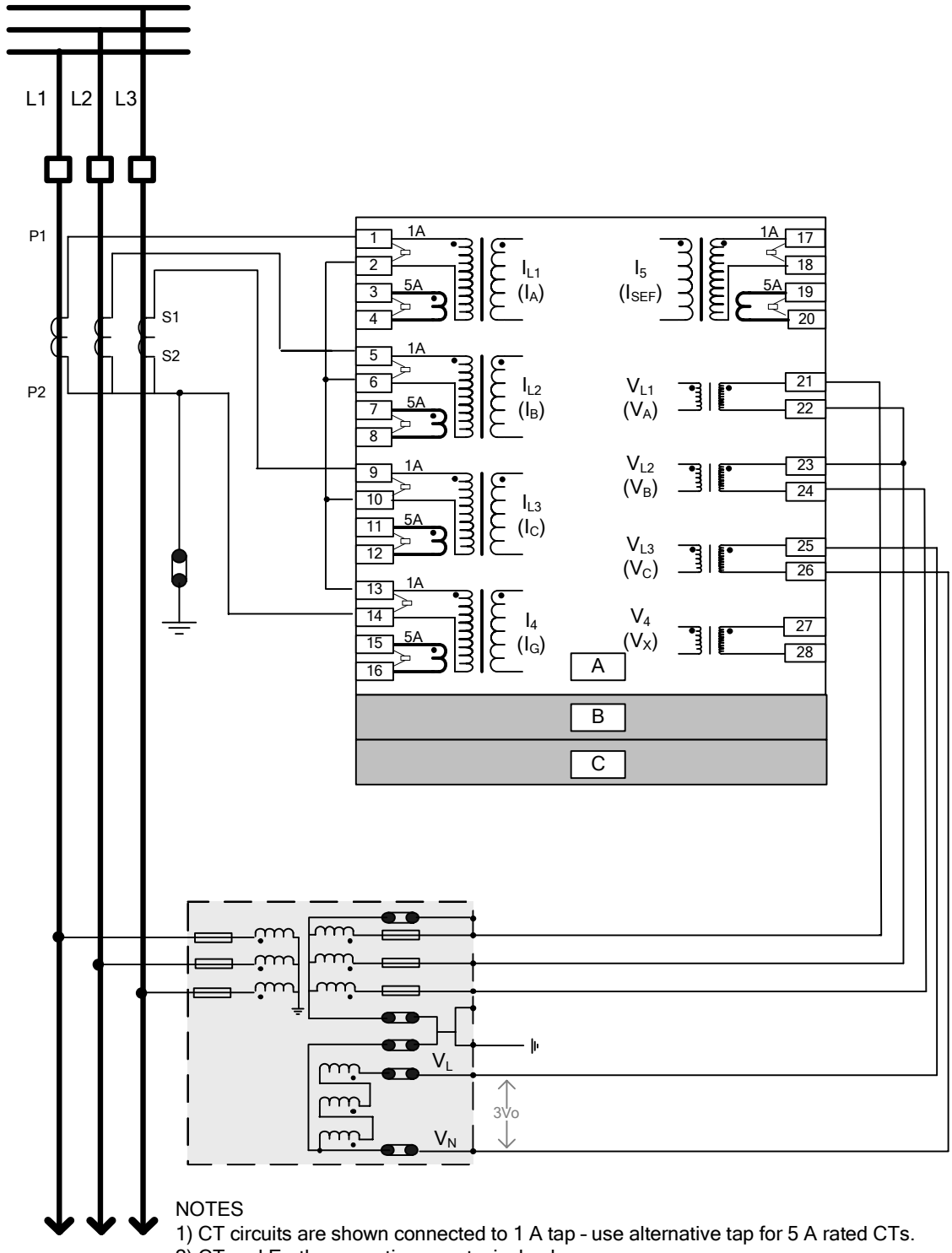
7.3 Typical Connection: 7SR22 Directional OC/EF and NVD



NOTES
1) CT circuits are shown connected to 1 A tap - use alternative tap for 5 A rated CTs.
2) CT and Earth connections are typical only.
3) Application shows use of V_4 as an NVD input.
4) Star Connected VT: Phase Voltage Config:-V_{an},V_{bn},V_{cn}

Figure 7.3-1 7SR22 Applied to Feeder Including NVD Protection

7.4 Typical Connection: 7SR22 Directional OC/EF and NVD

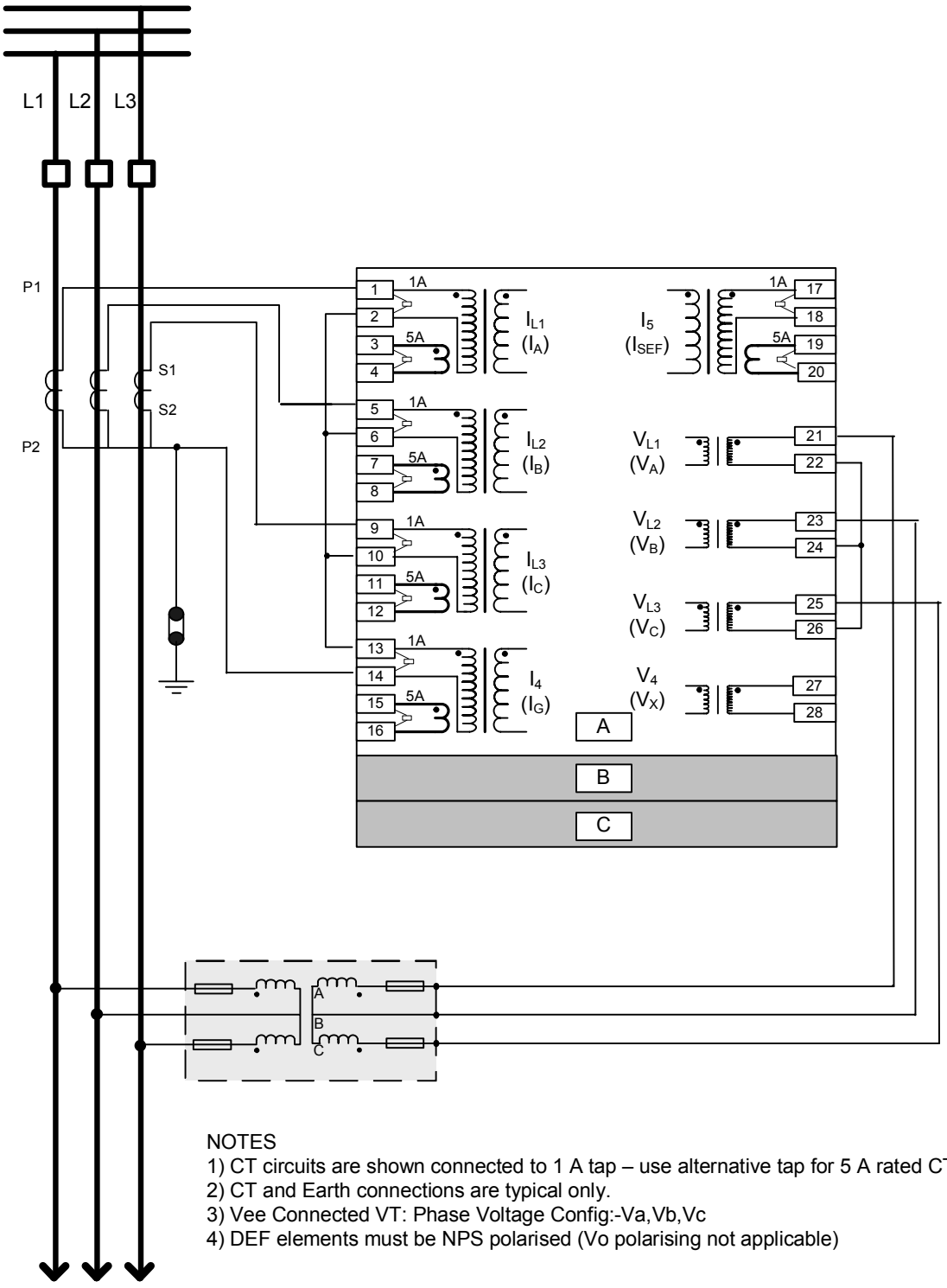


NOTES
1) CT circuits are shown connected to 1 A tap – use alternative tap for 5 A rated CTs.
2) CT and Earth connections are typical only.
3) Voltage Config:-V_{ab}, V_{bc}, $3V_0$

Figure 7.4-1 7SR22 Applied to Feeder

©2018 Siemens Protection Devices Limited

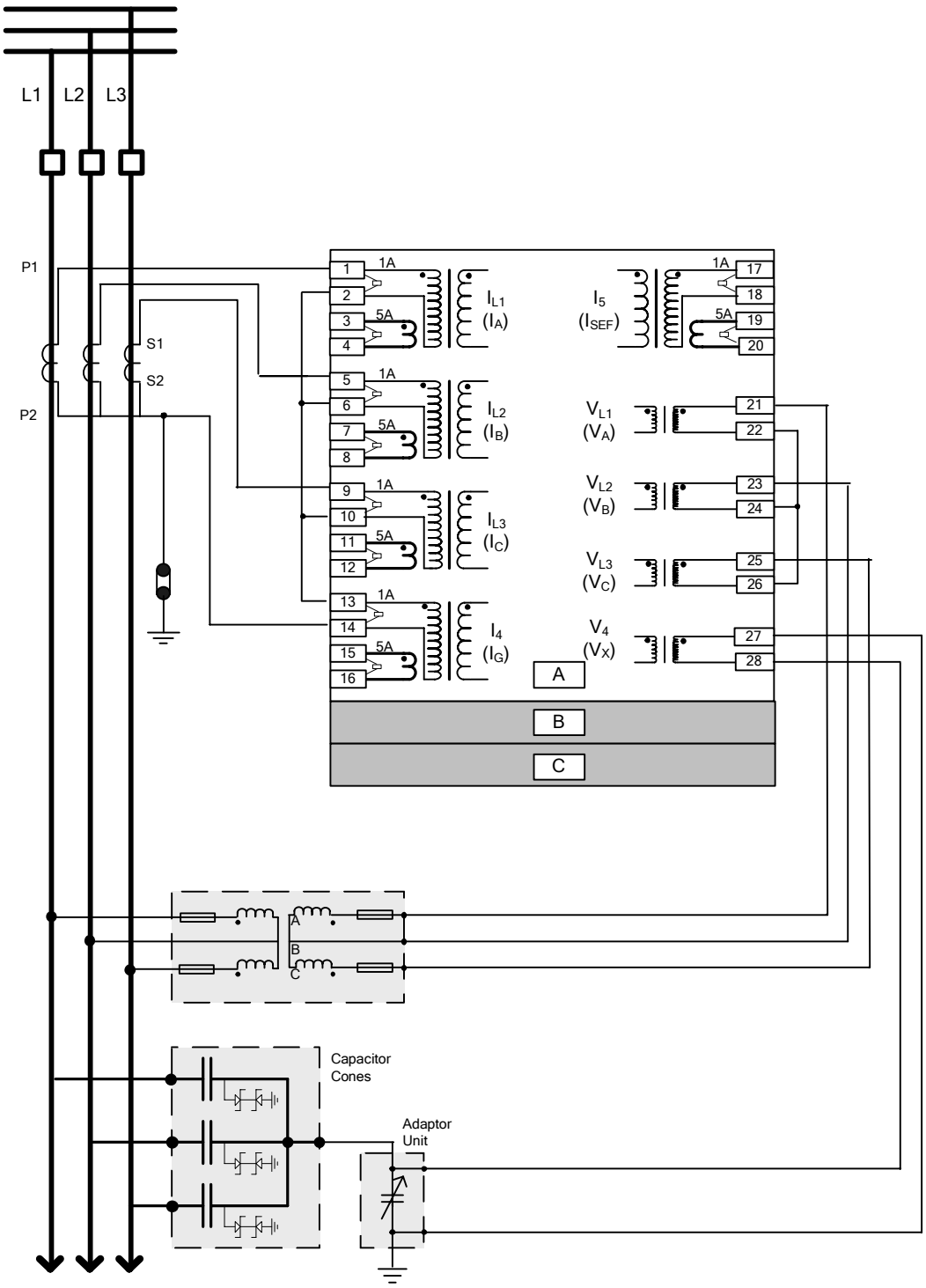
7.5 Typical Connection: 7SR22 Directional OC and EF



NOTES
1) CT circuits are shown connected to 1 A tap – use alternative tap for 5 A rated CTs.
2) CT and Earth connections are typical only.
3) Vee Connected VT: Phase Voltage Config:-Va,Vb,Vc
4) DEF elements must be NPS polarised (Vo polarising not applicable)

Figure 7.5-1 7SR22 Applied to Feeder - No Zero Sequence Voltage Source

7.6 Typical Connection: 7SR22 Connected to VTs and Capacitor Cone Unit



NOTES
1) CT circuits are shown connected to 1 A tap - use alternative tap for 5 A rated CTs.
2) CT and Earth connections are typical only.
3) Vee Connected VT: Phase Voltage Config:-Va,Vb,Vc
4) DEF elements must be NPS polarised (Vo polarising not applicable)
5) V_4 used for NVD input

Figure 7.6-1 7SR22 Applied to Feeder with Capacitor Cones Fitted

©2018 Siemens Protection Devices Limited

7.7 Voltage Transformer Configurations

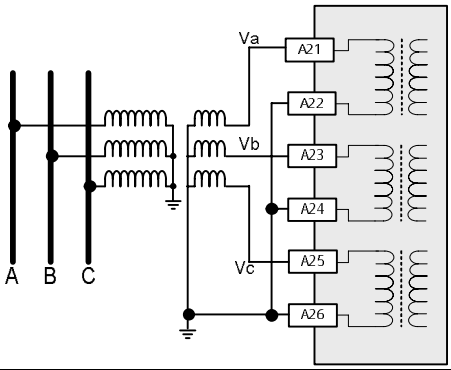
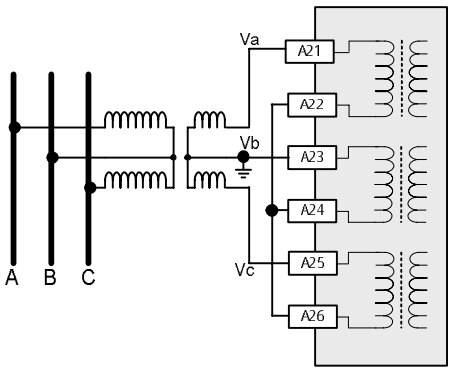
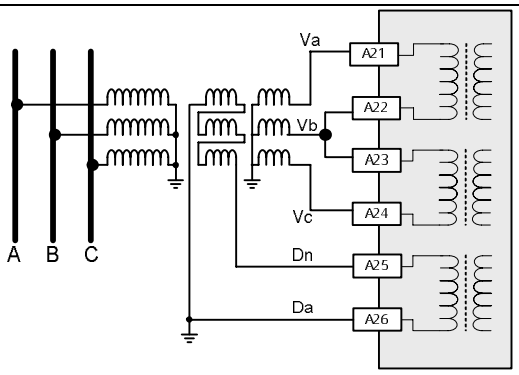
Relay Voltage Configuration Setting	Description	Connection
Van, Vbn, Vcn	67 & 67N & 67G 47, 27/59 & 81 Phase – Neutral Phase – Phase Calculated NPS ZPS	
Va, Vb, Vc	67 67N (NPS polarising) 47, 27/59 & 81 Phase – Phase Calculated NPS	
Vab, Vbc, 3V0	67 & 67N & 67G 47, 59N, 27/59 & 81 Phase – Neutral Calculated Phase – Phase Phase Vca Calculated NPS ZPS	

Figure 7.7-1 7SR22 VT Connections

©2018 Siemens Protection Devices Limited

7SR210 Non-Directional Relay
7SR220 Directional Relay
Performance Specification

Unrestricted The copyright and other intellectual property rights in this document, and in any model or article produced from it (and including any registered or unregistered design rights) are the property of Siemens Protection Devices Limited. No part of this document shall be reproduced or modified or stored in another form, in any data retrieval system, without the permission of Siemens Protection Devices Limited, nor shall any model or article be reproduced from this document unless Siemens Protection Devices Limited consent.

While the information and guidance given in this document is believed to be correct, no liability shall be accepted for any loss or damage caused by any error or omission, whether such error or omission is the result of negligence or any other cause. Any and all such liability is disclaimed.

© 2013 Siemens Protection Devices Limited

Document Release History

This document is issue **2017/12** The list of revisions up to and including this issue is: -

2011/05	First issue.
2011/08	Typographical revisions and added data.
2013/01	Typographical revisions and added data. Updated in line with software release.
2014/06	Typographical revisions and added data. Updated in line with software release.
2015/06	Typographical revisions and added data. Updated in line with software release.
2016/02	Typographical revisions and added data. Updated in line with software release.
2016/05	Amended data and reference to EATS 48-4, classes ESI 1 and ESI 2 removed.
2017/08	Typographical revisions and added data. Updated in line with software release.
2017/12	Typographical revisions and added data.

Software Revision History

2011/05	2435H85008R7a-7a (7SR210) 2435H85009R7a-7a (7SR220)	First Release
2013/01	2435H85008R7c-7b (7SR210) 2435H85009R7c-7b (7SR220)	Introduced journaling file system. Added 61850 logical nodes for CB Counters, metering, 50BF, 46BC, 81HBL2 and line check. Added Line Check on non-AR devices. Added 74CCS Close Circuit Supervision.
2014/06	2435H85008R7f-7d (7SR210) 2435H85009R7f-7d (7SR220)	Added Fault Locator feature and Check Sync feature. Fault data transmitted over 103. Additional communications data, control features, meters.
2015/06	2435H85008R8a-7f (7SR210) 2435H85009R8a-7f (7SR220)	Added Power Factor Meters, Load Blinding feature, Arc Flash Detector. Over current TM Setting Range extended.
2016/02	2435H85008R8b-7f (7SR210) 2435H85009R8b-7f (7SR220)	EN100+ Compatibility.
2017/08	2435H85008R8e-8a (7SR210) 2435H85009R8e-8a (7SR220)	Added 32 Directional Power, 32S Sensitive Power, 55 Power Factor, 81HLB5 Overfluxing, 67SEF Compensated Network, 67SEF Wattmetric. Increased I/O. Event Data on LCD.

© 2013 Siemens Protection Devices Limited

Contents

Software Revision History **2**

Section 1: Common Functions **8**

1.1 General 8
1.1.1 CE Conformity 8
1.1.2 Reference 8
1.1.3 Dimensions 8
1.1.4 Weights 9
1.2 Energising Quantities 10
1.2.1 Auxiliary Power Supply 10
1.2.2 AC Current 11
1.2.3 AC Voltage 12
1.2.4 Binary (Digital) Outputs 13
1.2.5 Binary (Digital) Inputs 14
1.3 Functional Performance 15
1.3.1 Instrumentation 15
1.3.2 USB Data Communication Interface 15
1.3.3 Fibre Optic Serial Data Communication Interface (Optional Rear Mounted Port) 15
1.3.4 RS485 Data Communication Interface (Standard Rear Port) 15
1.3.5 RS485 Data Communication Interface (Optional Rear Mounted Port) 15
1.3.6 RS232 Data Communication Interface (Optional Rear Mounted Port) 15
1.3.7 Fibre Optic Ethernet Data Communication Interface (IEC 61850 Option) 16
1.3.8 Electrical Ethernet Data Communication Interface (IEC 61850 Option) 16
1.3.9 Real Time Clock 16
1.4 Environmental Performance 17
1.4.1 General 17
1.4.2 Emissions 18
1.4.3 Immunity 18
1.4.4 Mechanical 20

Section 2: Protection Functions **21**

2.1 27/59 Phase Under/Over Voltage 21
2.1.2 Reference 21
2.1.3 Operate and Reset Level 21
2.1.4 Operate and Reset Time 21
2.2 27/59 Vx Under/Over Voltage 22
2.2.1 Reference 22
2.2.2 Operate and Reset Level 22
2.2.3 Operate and Reset Time 22
2.3 32 Power 23
2.3.1 Reference 23
2.3.2 Operate and Reset Level 23
2.3.3 Operate and Reset Time 23
2.3.4 Operate Threshold 23
2.4 32S Sensitive Power 24
2.4.1 Reference 24
2.4.2 Operate and Reset Level 24
2.4.3 Operate and Reset Time 24
2.4.4 Operate Threshold 24
2.5 37 Undercurrent 25
2.5.1 Reference 25
2.5.2 Operate and Reset Level 25
2.5.3 Operate and Reset Time 25
2.6 37G & 37SEF Undercurrent 26
2.6.1 Reference 26
2.6.2 Operate and Reset Level 26

2.6.3 Operate and Reset Time....26
2.7 46NPS Negative Phase Sequence Overcurrent....27
2.7.1 Reference (46DT)....27
2.7.2 Operate and Reset Level (46DT)....27
2.7.3 Operate and Reset Time (46DT)....27
2.7.4 Reference (46IT)....27
2.7.5 Operate and Reset Time (46IT)....28
2.8 47 Negative Phase Sequence Voltage....29
2.8.1 Reference (47)....29
2.8.2 Operate and Reset Level (47)....29
2.8.3 Operate and Reset Time (47)....29
2.9 49 Thermal Overload....30
2.9.1 Reference....30
2.9.2 Operate and Reset Level....30
2.9.3 Operate and Reset Time....30
2.10 50 Instantaneous Overcurrent....32
2.10.1 Reference....32
2.10.2 Operate and Reset Level....32
2.10.3 Operate and Reset Time....32
2.11 50G Instantaneous Measured Earth Fault....33
2.11.1 Reference....33
2.11.2 Operate and Reset Level....33
2.11.3 Operate and Reset Time....33
2.12 50N Instantaneous Derived Earth Fault....34
2.12.1 Reference....34
2.12.2 Operate and Reset Level....34
2.12.3 Operate and Reset Time....34
2.13 50SEF Instantaneous Sensitive Earth Fault....35
2.13.1 Reference....35
2.13.2 Operate and Reset Level....35
2.13.3 Operate and Reset Time....35
2.14 51 Time Delayed Overcurrent....36
2.14.1 Reference....36
2.14.2 Operate and Reset Level....36
2.14.3 Operate and Reset Time....37
2.15 51G Time Delayed Measured Earth Fault....41
2.15.1 Reference....41
2.15.2 Operate and Reset Level....41
2.15.3 Operate and Reset Time....42
2.16 51N Time Delayed Derived Earth Fault....43
2.16.1 Reference....43
2.16.2 Operate and Reset Level....43
2.16.3 Operate and Reset Time....44
2.17 51SEF Time Delayed Sensitive Earth Fault....45
2.17.1 Reference....45
2.17.2 Operate and Reset Level....45
2.17.3 Operate and Reset Time....46
2.18 51V Voltage Controlled Overcurrent (Ph-Ph)....47
2.18.1 Reference....47
2.18.2 Operate and Reset Level....47
2.19 55 Power Factor....48
2.19.1 Reference....48
2.19.2 Operate and Reset Level....48
2.19.3 Operate and Reset Time....48
2.19.4 Operate Threshold....48
2.20 59N Neutral Voltage Displacement....49
2.20.1 Reference (59NDT)....49

 © 2013 Siemens Protection Devices Limited

2.20.2 Operate and Reset Level (59NDT) 49
2.20.3 Operate and Reset Time (59NDT) 49
2.20.4 Reference (59NIT) 49
2.20.5 Operate and Reset Level (59NIT) 50
2.20.6 Operate and Reset Time (59NIT) 50
2.21 64H Restricted Earth Fault Protection 51
2.21.1 Reference 51
2.21.2 Operate and Reset Level 51
2.21.3 Operate and Reset Time 51
2.22 67/67N Directional Overcurrent & Earth Fault 52
2.22.1 Reference 52
2.22.2 Operate Angle 52
2.22.3 Operate Threshold 52
2.22.4 Operate and Reset Time 52
2.23 Directional SEF Wattmetric 53
2.23.1 Reference 53
2.23.2 Operate and Reset Level 53
2.23.3 Operate and Reset Time 53
2.24 81 Under/Over Frequency 54
2.24.1 Reference 54
2.24.2 Operate and Reset Level 54
2.24.3 Operate and Reset Time 54
2.25 50 AFD ARC Flash Detector 55
(Refer to 7XG31 Technical Manual for performance characteristics) 55
2.25.1 Reference 55
2.25.2 Operate and Reset Level 55
2.25.3 Operate and Reset Time 55
Section 3: Supervision Functions 56
3.1 46BC & 46BC U/C Broken Conductor 56
3.1.1 Reference 56
3.1.2 Operate and Reset Level 56
3.1.3 Operate and Reset Time 56
3.2 50BF & 50BF-I4 Circuit Breaker Fail 57
3.2.1 Reference 57
3.2.2 Operate and Reset Level 57
3.2.3 Operate and Reset Time 57
3.3 60CTS & CTS-I Current Transformer Supervision 58
3.3.1 Reference 58
3.3.2 Current & Voltage Threshold 58
3.3.3 Operate and Reset Time 58
3.4 60VTS Voltage Transformer Supervision 59
3.4.1 Reference 59
3.4.2 Operate and Reset Level 59
3.4.3 Operate and Reset Time 60
3.5 74TCS Trip Circuit Supervision 61
3.5.1 Reference 61
3.5.2 Operate and Reset Time 61
3.6 81HBL2 Inrush Detector 62
3.6.1 Reference 62
3.6.2 Operate and Reset Level 62
3.6.3 Operate and Reset Time 62
3.7 81HBL5 Over Fluxing Detector 63
3.7.1 Reference 63
3.7.2 Operate and Reset Level 63
3.7.3 Operate and Reset Time 63
3.8 Load Blinder (21LB – 3P) 64
3.8.1 Reference 64

3.8.2 Operate Level 64
3.8.3 Operate Angle 64
3.9 Load Blinder (21LB – 1P) 65
3.9.1 Reference 65
3.9.2 Operate Level 65
3.9.3 Operate Angle 65
Section 4: Control Functions 66
4.1 Check Synchronising 66
4.1.1 Reference 66
4.1.2 Live/Dead Line/Bus Detector Elements 66
4.1.3 Line and Bus Undervoltage Elements 67
4.1.4 Voltage Difference 67
4.1.5 General Autoreclose Timers 67
4.1.6 CS/SS/COZ Line and Bus Phase Angle Difference 67
4.1.7 CS/SS/COZ Slip Frequency 67
4.1.8 CS/SS Timer 67
4.1.9 Split Angle Detector 68
4.1.10 Split Slip Frequency Detector 68
4.2 Live/Dead 68
4.2.1 Reference 68
4.2.2 Live/Dead Detector Elements 68

 © 2013 Siemens Protection Devices Limited

List of Figures

Figure 2-1 Thermal Overload Protection Curves 31
Figure 2-2 IEC IDMTL Curves (Time Multiplier = 1) 38
Figure 2-3 ANSI IDMTL Operate Curves (Time Multiplier = 1) 39
Figure 2-4 ANSI IDMTL Reset Curves (Time Multiplier = 1) 40

Section 1: Common Functions

1.1 General

1.1.1 CE Conformity

CE This product is CE compliant to relevant EU directives.

1.1.2 Reference

This product complies with IEC 60255-3, IEC 60255-6 and IEC 60255-12.

1.1.2.1 Accuracy Reference Conditions

This product has been tested under the following conditions, unless specifically stated otherwise.

Parameter	Value
Auxiliary supply	Nominal
AC Current	Nominal
Frequency	Nominal
Ambient temperature	20 °C

1.1.3 Dimensions

Parameter		Value
Width	E6 case	155.5 mm
	E8 case	207.5 mm
	E12 case	311.5 mm
Height		177 mm
Depth behind panel, including clearance for: -		
	Wiring	241.5 mm
	Fibre Optic	286.5 mm
	Ethernet enclosure	259.5 mm
Depth below Ethernet variant for cables		75 mm
Projection (from front of panel)		31 mm

See appropriate case outline and panel drilling drawing, as specified in Diagrams and Parameters document, for complete dimensional specifications.

© 2013 Siemens Protection Devices Limited

1.1.4 Weights

Hardware Model	Typical Net Weight (kg)
7SR2102	4.2
7SR2103	4.6
7SR2104	4.8
7SR2105	8.4
7SR2106	8.4
7SR2202	4.8
7SR2203	4.9
7SR2204	5.3
7SR2205	8.4
7SR2206	8.4

NB:
For relays supplied with additional (optional) communication interface devices, please add an additional 0.165 kg to the figures in the above table.
For relays supplied with Ethernet interface (optional) please add 0.1 kg to the figures in the above table.

Unrestricted © 2013 Siemens Protection Devices Limited

1.2 Energising Quantities

1.2.1 Auxiliary Power Supply

Nominal		Operating Range	MLFB Code (column 9)
V_{AUX}	30 V DC, 48 V DC, 110 V DC, 220 V DC	24 V DC to 290 V DC	A, B
	24 V DC to 250 V DC 100 V AC to 230 V AC	24 V DC to 290 V DC 88 V AC to 242 V AC	M, N

1.2.1.1 Burden (24 V DC to 250 V DC, 100 V AC to 230 V AC) PSU

Attribute	Watts (DC)						
Voltage (V)	24	48	60	110	125	220	250
Quiescent Relay (inc. PROT HEALTHY LED)	6.0	5.8	5.8	5.5	5.5	5.4	5.5
LCD backlight on	1.4	1.3	1.2	1.2	1.2	1.2	1.2
Per LED (Red)	0.04	0.03	0.03	0.03	0.03	0.03	0.03
Per LED (Yellow)	0.08	0.06	0.06	0.06	0.06	0.06	0.06
Per Binary Output	0.35	0.3	0.3	0.3	0.3	0.28	0.28
Optional IEC61850	2.6	2.5	2.4	2.4	2.4	2.4	2.4

Attribute	VA (AC)					
Voltage (V)	100	110	115	120	200	230
Quiescent Relay (inc. PROT HEALTHY LED)	10.0	10.0	10.0	10.5	12.0	14.0
LCD backlight on	2.5	2.5	2.5	2.6	3.0	3.2
Per LED (Red)	0.06	0.06	0.06	0.06	0.06	0.07
Per LED (Yellow)	0.10	0.12	0.10	0.10	0.10	0.12
Per Binary Output	0.6	0.6	0.6	0.6	0.6	0.6
Optional IEC61850	5.0	5.0	5.0	5.0	4.5	4.5

1.2.1.2 Burden (30 V DC, 48 V DC, 110 V DC, 220 V DC) PSU

Attribute		Value
30 V DC	Quiescent (typical)	6.0 W
	Quiescent (back light)	7.0 W
48 V DC	Quiescent (typical)	5.5 W
	Quiescent (back light)	6.5 W
110 V DC	Quiescent (typical)	6.5 W
	Quiescent (back light)	7.5 W
220 V DC	Quiescent (typical)	7.5 W
	Quiescent (back light)	8.5 W

© 2013 Siemens Protection Devices Limited

1.2.1.3 Operational Features

Attribute	Value	Comments
0% Dip Withstand Period	100 ms	
Dip Immunity Acquisition Period	5 minutes	Typical time after switch on to attain claimed immunity to dips
NOTE: - Dips in supply that fall below the minimum voltage for a period greater than the 0% Dip Withstand Period, will invoke a relay reset.		
During conditions of auxiliary input voltage variations which are not described (1) in section 1.4.3.1, the relay may enter a safety protection mode where a power supply shutdown occurs. This condition is designed to protect the power supply from damage as well as prevent internal relay faults from developing into dangerous situations. Once the relay has entered this safety mode, it may be necessary to reduce the auxiliary input voltage to zero volts for up to 30 seconds before re-application of the auxiliary supply will cause the relay to power up and operate normally. (1) Using fuses as on/off switches or allowing batteries to run at very low cell voltages for extended periods and then attempting to re-charge them are examples of such auxiliary supply conditions.		

1.2.2 AC Current

Nominal		**Measuring Range**
In	1 A, 5 A Phase and earth	80 x *In*
fn	50 Hz, 60 Hz	47 Hz to 62 Hz
	Sample Rate	32 cycles / sec @ 50 Hz

Note. 1 A and 5 A nominal inputs are user selectable on each model.

1.2.2.1 Burden

Attribute	Value - Phase and Earth	
	1 A	5 A
AC Burden	≤ 0.1 VA	≤ 0.3 VA

1.2.2.2 Thermal Withstand

Overload Period	Overload Current	
	Phase and Earth	
	1 A	5 A
Continuous	3.0 *xIn*	
10 minutes	3.5 *xIn*	
5 minutes	4.0 *xIn*	
3 minutes	5.0 *xIn*	
2 minutes	6.0 *xIn*	
3 seconds	57.7 A	202 A
2 seconds	70.7 A	247 A
1 second	100 A	350 A
1 cycle	700 A	2500 A

1.2.3 AC Voltage

Nominal		Operating Range
Vn	63.5 V, 110 V	40 V rms to 160 V rms
fn	50 Hz, 60 Hz	47 Hz to 62 Hz

1.2.3.1 Burden

Attribute	Value
AC Burden	≤ 0.1 VA at 110 V

© 2013 Siemens Protection Devices Limited

1.2.4 Binary (Digital) Outputs

Contact rating to IEC 60255-0-2

Attribute		**Value**
Carry continuously		5 A AC or DC
Make and carry (L/R ≤ 40 ms and V ≤ 300 V)	for 0.5 s	20 A AC or DC
	for 0.2 s	30 A AC or DC
Break (≤ 5 A and ≤ 300 V)	AC resistive	1250 VA
	AC inductive	250 VA at p.f. ≤ 0.4
	DC resistive	75 W
	DC inductive	30 W at L/R ≤ 40ms 50 W at L/R ≤ 10 ms
Contact Operate / Release Time		7 ms / 3 ms
Minimum number of operations		1000 at maximum load
Minimum recommended load		0.5 W at minimum of 10 mA or 5 V

 © 2013 Siemens Protection Devices Limited

1.2.5 Binary (Digital) Inputs

Nominal		Operating Range
V_{BI}	19 V DC	17 V DC (minimum) to 290 V DC
	88 V DC	74 V DC (minimum) to 290 V DC

1.2.5.1 Performance

Attribute		Value
Maximum DC current for operation	V_{BI} = 19 V	1.5 mA
	V_{BI} = 88 V	1.5 mA
Reset/Operate voltage ratio		≥ 90 %
Response time		< 7 ms
Response time when programmed to energise an output relay contact (i.e. includes output relay operation)		< 20 ms
Sample Rate		Every 5 ms

The binary inputs are isolated from earth potential. They have a low minimum operate current and may be set for high speed operation. Where a binary input is both used to influence a control function (e.g. provide a tripping function) and it is considered to be susceptible to mal-operation due to capacitive currents, the external circuitry can be modified to provide immunity to such disturbances.

To achieve immunity from AC interference, a BI pick-up delay of typically one-cycle can be applied.

© 2013 Siemens Protection Devices Limited

1.3 Functional Performance

1.3.1 Instrumentation

	Instrument Value	Reference	Typical accuracy
I	Current	0.1In to 2.0In	± 1 % or ± 1 % *In*
V	Voltage	0.1Vn to 1.2Vn	± 1 % or ± 1 % *Vn*
	Power, real and apparent	V = Vn, I ≥ 0.1 xIn, pf ≥ 0.8	± 3 % Pn, where Pn = Vn x In
pf	Power factor	V = Vn, I ≥ 0.1 xIn, pf ≥ 0.8	± 0.05

1.3.2 USB Data Communication Interface

Attribute	Value
Physical layer	Electrical
Connectors	USB-Type B

1.3.3 Fibre Optic Serial Data Communication Interface (Optional Rear Mounted Port)

Attribute	Value
Physical layer	Fibre-optic
Connectors	ST™ (BFOC/2.5)
Recommended fibre	62.5/125 μm glass fibre with ST connector
Optical Wavelength	820 nm
Launch power (into recommended fibre)	-16 dBm
Receiver sensitivity	-24 dBm

1.3.4 RS485 Data Communication Interface (Standard Rear Port)

Attribute	Value
Physical layer	Electrical
Connectors	4 mm Ring Crimp

1.3.5 RS485 Data Communication Interface (Optional Rear Mounted Port)

Attribute	Value
Physical layer	Electrical
Connectors	4-way Plug

1.3.6 RS232 Data Communication Interface (Optional Rear Mounted Port)

Attribute	Value
Physical layer	Electrical
Connectors	9-way D-plug

1.3.7 Fibre Optic Ethernet Data Communication Interface (IEC 61850 Option)

Attribute	Value
Physical layer	Fibre-optic
Connectors	Duplex LC 100BaseF in acc. With IEEE802.3
Recommended fibre	62.5/125 μm glass fibre with Duplex-LC connector
Transmission Speed	100 MBits/s
Optical Wavelength	1300 nm
Bridgeable distance	2 km

1.3.8 Electrical Ethernet Data Communication Interface (IEC 61850 Option)

Attribute	Value
Physical layer	Electrical
Connectors	RJ45 100BaseF in acc. With IEEE802.3
Transmission Speed	100 MBits/s
Test Voltage (with regard to socket)	500 VAC 50 Hz
Bridgeable distance	20 m

1.3.9 Real Time Clock

1.3.9.1 Internal Clock

The specification below applies only while no external synchronisation signal (e.g. IRIG-B, IEC 60870-5-103) is being received.

Attribute	Value
Accuracy (- 10 ^{o}C to + 55 ^{o}C)	± 100 ppm

1.3.9.2 IRIG-B (Inter Range Instrumentation Group)-B

Attribute	Value
Connector	BNC
Signal Type	IRIG-B 120, 122 or 123
Applied signal level	minimum 3 V, maximum 6 V, peak-to-peak
Signal : carrier ratio	3:1
Impedance	4 kOhm

*Cable impedance is irrelevant. The cable does not need to have a termination resistor fitted.

© 2013 Siemens Protection Devices Limited

1.4 Environmental Performance

1.4.1 General

1.4.1.1 Temperature

IEC 60068-2-1, IEC 60068-2-2

Type	Level
Operating range	- 10 °C to + 55 °C
Storage range	- 25 °C to + 70 °C

1.4.1.2 Humidity

IEC 60068-2-30, IEC 60068-2-78

Type	Level
Operational test (Indoor)	56 days at +40 °C and 95 % relative humidity (r.h.)
Operational test (Outdoor)	6 cycles at 24 h between +25 °C (97% r.h.) and +55 °C (93% r.h.)

1.4.1.3 Transient Overvoltage

IEC 60255-5

Type	Level
Between all terminals and earth, or between any two independent circuits	5.0 kV, 1.2/50 μs 0.5j

1.4.1.4 Insulation

IEC 60255-5

Type	Level
Between any terminal and earth	2.5 kV AC RMS for 1 min
Between independent circuits	
Across normally open contacts	1.0 kV AC RMS for 1 min

1.4.1.5 IP Ratings

Type	Level
Installed with cover on	IP 51 from front of relay
	IP 10 from rear of relay
Installed with cover removed	IP 20 from front of relay
	IP 10 from rear of relay

1.4.2 Emissions

IEC 60255-25

1.4.2.1 Radiated Radio Frequency

Type	Limits at 10 m, Quasi-peak
30 MHz to 230 MHz	40 dB(μV/m)
230 MHz to 10000 MHz	47 dB(μV/m)

1.4.2.2 Conducted Radio Frequency

Type	Limits	
	Quasi-peak	Average
0.15 MHz to 0.5 MHz	79 dB(μV)	66 dB(μV)
0.5 MHz to 30 MHz	73 dB(μV)	60 dB(μV)

1.4.3 Immunity

1.4.3.1 Auxiliary DC Supply Variation

Quantity	Value
Allowable superimposed ac component	≤ 12 % of DC voltage
Allowable breaks/dips in supply (collapse to zero from nominal voltage)	≤ 20 ms

1.4.3.2 High Frequency Disturbance

IEC 60255-22-1 Class III

Type	Level	Variation
Common (longitudinal) mode	2.5 kV	≤ 5 %
Series (transverse) mode	1.0 kV	

1.4.3.3 Electrostatic Discharge

IEC 60255-22-2 Class IV

Type	Level	Variation
Contact discharge	8.0 kV	≤ 5 %

1.4.3.4 Radiated Immunity

IEC 60255-22-3 Class III

Type	Level	Variation
80 MHz to 1000 MHz	10 V/m	≤ 5 %

© 2013 Siemens Protection Devices Limited

1.4.3.5 Fast Transients

IEC 60255-22-4 Class A (2002)

Type	Level	Variation
5/50 ns 2.5 kHz repetitive	4 kV	≤ 5 %

1.4.3.6 Surge Immunity

IEC 60255-22-5; IEC 61000-4-5

Type	Level	Variation
Analogue Inputs. Line to Earth.	4.0 kV	≤ 10 % or 1 mA
Case, Aux Power & I/O. Line to Earth.	2.0 kV	≤ 10 % or 1 mA
RS485 Comms Port. Line to Earth.	1.0 kV	No Data Loss
Analogue Inputs. Line to Line.	1.0 kV	≤ 10 % or 1 mA
Case, Aux Power & I/O. Line to Line.	1.0 kV*	≤ 10 % or 1 mA

* Note: 45 ms pick-up delay for DTL applied to binary inputs

1.4.3.7 Conducted Radio Frequency Interference

IEC 60255-22-6

Type	Level	Variation
0.15 MHz to 80 MHz	10 V	≤ 5 %

1.4.3.8 Magnetic Field with Power Frequency

IEC 61000-4-8 level 5

100 A/m, (0.126 mT) continuous	50 Hz
1000 A/m, (1.26 mT) for 3 s	

1.4.4 Mechanical

1.4.4.1 Vibration (Sinusoidal)

IEC 60255-21-1 Class I

Type	Level	Variation
Vibration response	0.5 gn	≤ 5 %
Vibration endurance	1.0 gn	

1.4.4.2 Shock and Bump

IEC 60255-21-2 Class I

Type	Level	Variation
Shock response	5 gn, 11 ms	≤ 5 %
Shock withstand	15 gn, 11 ms	
Bump test	10 gn, 16 ms	

1.4.4.3 Seismic

IEC 60255-21-3 Class I

Type	Level	Variation
Seismic response	1 gn	≤ 5 %

1.4.4.4 Mechanical Classification

Type	Level
Durability	> 10^6 operations

© 2013 Siemens Protection Devices Limited

Section 2: Protection Functions

2.1 27/59 Phase Under/Over Voltage

2.1.2 Reference

	Parameter	Value
V_s	Setting	5, 5.5…199.5, 200 V
hyst	Hysteresis setting	0, 0.1… 80.0 %
t_d	Delay setting	0.00, 0.01…20.00, 20.50… 100, 101… 1000, 1010… 10000, 10100… 14400 s

2.1.3 Operate and Reset Level

	Attribute		Value
V_{op}	Operate level		100 % *Vs*, ± 1 % or ±0.25 V
	Reset level	Overvoltage	= (100 % - *hyst*) *x* $V_{op,}$ ± 1 % or ±0.25 V
		Undervoltage	= (100 % + *hyst*) *x* $V_{op,}$ ± 1 % or ±0.25 V
	Repeatability		± 1 %
	Variation	-10 °C to +55 °C	≤ 5 %
		f_{nom} - 3 Hz to f_{nom} + 2 Hz	≤ 5 %

2.1.4 Operate and Reset Time

	Attribute		Value
t_{basicE}	Element basic operate time	Overvoltage	Switched from 0 to 1.1 x *Vs*: 73 ms ± 10 ms
			Switched from 0 to 2.0 x*Vs*: 63 ms ± 10 ms
		Undervoltage	1.1 to 0.5 x*Vs*: 58 ms ± 10 ms
t_{op}	Operate time following delay		t_{basic} + t_d, ± 1 % or ± 10 ms
	Repeatability		± 1 % or ± 10 ms
	Disengaging time		< 80 ms

2.2 27/59 Vx Under/Over Voltage

2.2.1 Reference

	Parameter	Value
V_s	Setting	5, 5.5…199.5, 200 V
V_s *Guard*	Guard Setting	1, 1.5, …199.5, 200 V
hyst	Hysteresis setting	0, 0.1… 80.0 %
t_d	Delay setting	0.00, 0.01…20.00, 20.50… 100, 101… 1000, 1010… 10000, 10100… 14400 s

2.2.2 Operate and Reset Level

	Attribute		Value
V_{op}	Operate level		100 % *Vs*, ± 1 % or ±0.25 V
	Reset level	Overvoltage	= (100 % - *hyst*) x $V_{op,}$ ± 1 % or ± 0.25 V
		Undervoltage	= (100 % + *hyst*) x $V_{op,}$ ± 1 % or ± 0.25 V
	Repeatability		± 1 %
	Variation	-10 °C to +55 °C	≤ 5 %
		f_{nom} - 3 Hz to f_{nom} + 2 Hz	≤ 5 %

2.2.3 Operate and Reset Time

	Attribute		Value
t_{basicE}	Element basic operate time	Overvoltage	Switched from 0 to 1.1 x*Vs*: 73 ms ± 10 ms
			Switched from 0 to 2.0 x*Vs*: 63 ms ± 10 ms
		Undervoltage	1.1 to 0.5 x*Vs*: 58 ms ± 10 ms
t_{op}	Operate time following delay		t_{basic} + t_d, ± 1 % or ± 10 ms
	Repeatability		± 1 % or ± 10 ms
	Disengaging time		< 80 ms

© 2013 Siemens Protection Devices Limited

2.3 32 Power

2.3.1 Reference

	Parameter	Value
Ss	*32-n Setting*	*0.05…2 x Sn*
t_d	32-n Delay setting	0.00 … 14400 s

2.3.2 Operate and Reset Level

	Attribute		**Value**
S_{op}	Operate level		100 % Ss, ± 5% or ± 2% Sn
	Reset level	Over-power	≥ 95 % S_{op}
		Under-power	≤ 105 % S_{op}
	Variation	-10 °C to +55 °C	≤ 5 %
		f_{nom} – 3 Hz to f_{nom} + 2 Hz	≤ 5 %

2.3.3 Operate and Reset Time

	Attribute		**Value**
t_{basic}	Element basic operate time	Over-power	1.1 x *Ss*: 60 ms ± 10 ms
			2.0 x *Ss*: 45 ms ± 10ms
		Under-power	0.5 x *Ss*: 30 ms ± 10ms
t_{op}	Operate time following delay		t_{basic} + t_d, ± 1 % or ± 10ms
	Disengaging time		< 40 ms

2.3.4 Operate Threshold

	Attribute		**Value**
	Minimum levels for operation	I	2.5 % In
		V	2.5% Vn

2.4 32S Sensitive Power

2.4.1 Reference

	Parameter	Value
S_s	32S-n Setting	0.005…2 x Sn
t_d	32S-n Delay setting	0.00 … 14400 s

2.4.2 Operate and Reset Level

	Attribute		Value
S_{op}	Operate level		100 % S*s*, ± 5% or ± 2% Sn
	Reset level	Over-power	≥ 95 % S_{op}
		Under-power	≤ 105 % S_{op}
	Variation	-10 °C to +55 °C	≤ 5 %
		f_{nom} – 3 Hz to f_{nom} + 2 Hz	≤ 5 %

2.4.3 Operate and Reset Time

	Attribute		Value
t_{basicE}	Element basic operate time	Over-power	1.1 x *Ss*: 60 ms ± 10 ms
			2.0 x *Ss*: 45 ms ± 10ms
		Under-power	0.5 x *Ss*: 30 ms ± 10ms
t_{op}	Operate time following delay		t_{basic} + t_d, ± 1 % or ± 10ms
	Disengaging time		< 40 ms

2.4.4 Operate Threshold

	Attribute		Value
	Minimum levels for operation	I	2.5 % In
		V	2.5% Vn

© 2013 Siemens Protection Devices Limited

2.5 37 Undercurrent

2.5.1 Reference

	Parameter	Value
Is	Setting	0.05, 0.10…5.0 *xIn*
t_d	Delay setting	0.00, 0.01…20.00, 20.50… 100, 101… 1000, 1010… 10000, 10100… 14400 s
Is	37-n U/I Guard Setting	0.05, 0.10…5.0 *xIn*

2.5.2 Operate and Reset Level

	Attribute		Value
I_{op}	Operate level		100 % *Is*, ± 5 % or ± 1% *In*
	Reset level		≤ 105 % I_{op}
	Repeatability		± 1 %
	Variation	-10 °C to +55 °C	≤ 5 %
		f_{nom} - 3 Hz to f_{nom} + 2 Hz	≤ 5 %

2.5.3 Operate and Reset Time

	Attribute	Value
t_{basic}	Element basic operate time	1.1 to 0.5 x*Is*: 35 ms, ± 10ms
t_{op}	Operate time following delay	t_{basic} + t_d, ± 1 % or ± 10ms
	Repeatability	± 1 % or ± 10ms
	Overshoot time	< 40 ms
	Disengaging time	< 60 ms

2.6 37G & 37SEF Undercurrent

2.6.1 Reference

	Parameter	Value
Is	Setting	0.005, 0.10…5.0 *xIn*
t_d	Delay setting	0.00, 0.01…20.00, 20.50… 100, 101… 1000, 1010… 10000, 10100… 14400 s

2.6.2 Operate and Reset Level

	Attribute		Value
I_{op}	Operate level		100 % *Is*, ± 5 % or ± 1% *In*
	Reset level		≤ 105 % I_{op} or I_{op} ± 0.1 % *In*
	Repeatability		± 1 %
	Variation	-10 °C to +55 °C	≤ 5 %
		f_{nom} - 3 Hz to f_{nom} + 2 Hz	≤ 5 %

2.6.3 Operate and Reset Time

	Attribute	Value
t_{basic}	Element basic operate time	1.1 to 0.5 x*Is*: 35 ms, ± 10 ms
t_{op}	Operate time following delay	t_{basic} + t_d, ± 1 % or ± 10 ms
	Repeatability	± 1 % or ± 10 ms
	Overshoot time	< 40 ms
	Disengaging time	< 60 ms

© 2013 Siemens Protection Devices Limited

2.7 46NPS Negative Phase Sequence Overcurrent

2.7.1 Reference (46DT)

	Parameter	Value
I_s	Setting	0.05, 0.06... 4.0x*In*
t_d	Delay setting	0.00, 0.01…20.00, 20.50… 100, 101… 1000, 1010… 10000, 10100… 14400 s

2.7.2 Operate and Reset Level (46DT)

	Attribute		Value
I_{op}	Operate level		100 % *Is*, ± 5 % or ± 1% *In*
	Reset level		≥ 95 % I_{op}
	Repeatability		± 1 %
	Transient overreach (X/R ≤ 100)		≤ -5 %
	Variation	-10 °C to +55 °C	≤ 5 %
		f_{nom} - 3 Hz to f_{nom} + 2 Hz	≤ 5 %

2.7.3 Operate and Reset Time (46DT)

	Attribute	Value
t_{basic}	Element basic operate time	Switched from 0 to 2 x*Is*: 40 ms, ± 10 ms
		Switched from 0 to 5 x*Is*: 30 ms, ± 10 ms
t_{op}	Operate time following delay	t_{basic} + t_d, ± 1 % or ± 10 ms
	Repeatability	± 1 % or ± 10 ms
	Overshoot time	<40 ms
	Disengaging time	< 60 ms

2.7.4 Reference (46IT)

	Parameter	Value
char	Characteristic setting	IEC-NI, -VI, -EI, -LTI; ANSI-MI, -VI, -EI; DTL
Tm	Time Multiplier setting	0.025, 0.050 … 1.6
I_s	Setting	0.05, 0.06… 2.5x*In*
I	Applied Current (for operate time) IDMTL	2 to 20 x Is
t_d	Delay setting	0, 0.01… 20 s
t_{res}	Reset setting	ANSI DECAYING, 0, 1… 60 s

Operate and Reset Level (46IT)

	Attribute		Value
I_{op}	Operate level		105 % *Is*, ± 4 % or ± 1% *In*
	Reset level		≥ 95 % I_{op}
	Repeatability		± 1 %
	Variation	-10 °C to +55 °C	≤ 5 %
		f_{nom} - 3 Hz to f_{nom} + 2 Hz	≤ 5 %

2.7.5 Operate and Reset Time (46IT)

	Attribute		Value
	Starter operate time (≥ 2x*Is*)		35 ms, ± 10 ms
t_{op}	Operate time	*char* = IEC-NI, IEC-VI, IEC-EI, IEC-LTI	$t_{op} = \frac{K}{\left[\frac{I}{Is}\right]^{\alpha} - 1} \times Tm$, ± 5 % or ± 50 ms, for char = IEC-NI : K = 0.14, α = 0.02 IEC-VI : K = 13.5, α = 1.0 IEC-EI : K = 80.0, α = 2.0 IEC-LTI : K = 120.0, α = 1.0
		char = ANSI-MI, ANSI-VI, ANSI-EI	$t_{op} = \left[\frac{A}{\left[\frac{I}{Is}\right]^{P} - 1} + B\right] \times Tm$, ± 5 % or ± 50 ms, for char = ANSI-MI : A = 0.0515, B = 0.114, P = 0.02 ANSI-VI : A = 19.61, B = 0.491, P = 2.0 ANSI-EI : A = 28.2, B = 0.1217, P = 2.0
		char = DTL	t_d, ± 1 % or ± 20 ms
	Reset time	ANSI DECAYING	$t_{res} = \frac{R}{\left[\frac{I}{Is}\right]^{2} - 1} \times Tm$, ± 5 % or ± 50 ms, for char = ANSI-MI : R = 4.85 ANSI-VI : R = 21.6 ANSI-EI : R = 29.1
		t_{res}	t_{res}, ± 1 % or ± 20 ms
	Repeatability		± 1 % or ± 20 ms
	Overshoot time		< 40 ms
	Disengaging time		< 60 ms

© 2013 Siemens Protection Devices Limited

2.8 47 Negative Phase Sequence Voltage

2.8.1 Reference (47)

	Parameter	Value
Vs	Setting	1, 1.5… 90 V
Hyst.	Hysteresis	0, 0.1… 80 %
t_d	Delay setting	0.00, 0.01…20.00, 20.50… 100, 101… 1000, 1010… 10000, 10100… 14400 s

2.8.2 Operate and Reset Level (47)

	Attribute		Value
V_{op}	Operate level		100 % *Vs*, ± 2 % or ± 0.5 V
	Reset level		(100 % - Hyst.) x V_{op} ± 1% or ± 0.25 V
	Repeatability		± 1 %
	Variation	-10 °C to +55 °C	≤ 5 %
		f_{nom} - 3 Hz to f_{nom} + 2 Hz	≤ 5 %

2.8.3 Operate and Reset Time (47)

	Attribute	Value
t_{basic}	Element basic operate time	0 to 2 *xVs*, 80 ms, ± 20 ms
		0 to 10 *xVs*, 55 ms, ± 20 ms
t_{op}	Operate time following delay	t_{basic} + t_d, ± 2 % or ± 20 ms
	Repeatability	± 1 % or ± 20 ms
	Overshoot time	< 40 ms
	Disengaging time	< 60 ms

2.9 49 Thermal Overload

2.9.1 Reference

	Parameter	Value
Is	Overload setting	0.10, 0.11… 3 *xIn*
τ	Time constant setting	1, 1.5… 1000 min

2.9.2 Operate and Reset Level

	Attribute		Value
I_{ol}	Overload level		100 % *Is*, ± 5 % or ± 1% *In*
	Reset level		≥ 95 % I_{ol}
	Repeatability		± 1 %
	Variation	-10 °C to +55 °C	≤ 5 %
		f_{nom} - 3 Hz to f_{nom} + 2 Hz	≤ 5 %

2.9.3 Operate and Reset Time

	Attribute	Value	
t_{op}	Overload trip operate time	$t = \tau \times \ln\left\{\frac{I^2 - I_P^2}{I^2 - (k \times I_B)^2}\right\}_{\perp}$ where I_P = prior current	± 5 % or ± 100 ms, (For I_s range 0.3 xI_n to 3 xI_n)
	Repeatability	± 100 ms	

© 2013 Siemens Protection Devices Limited

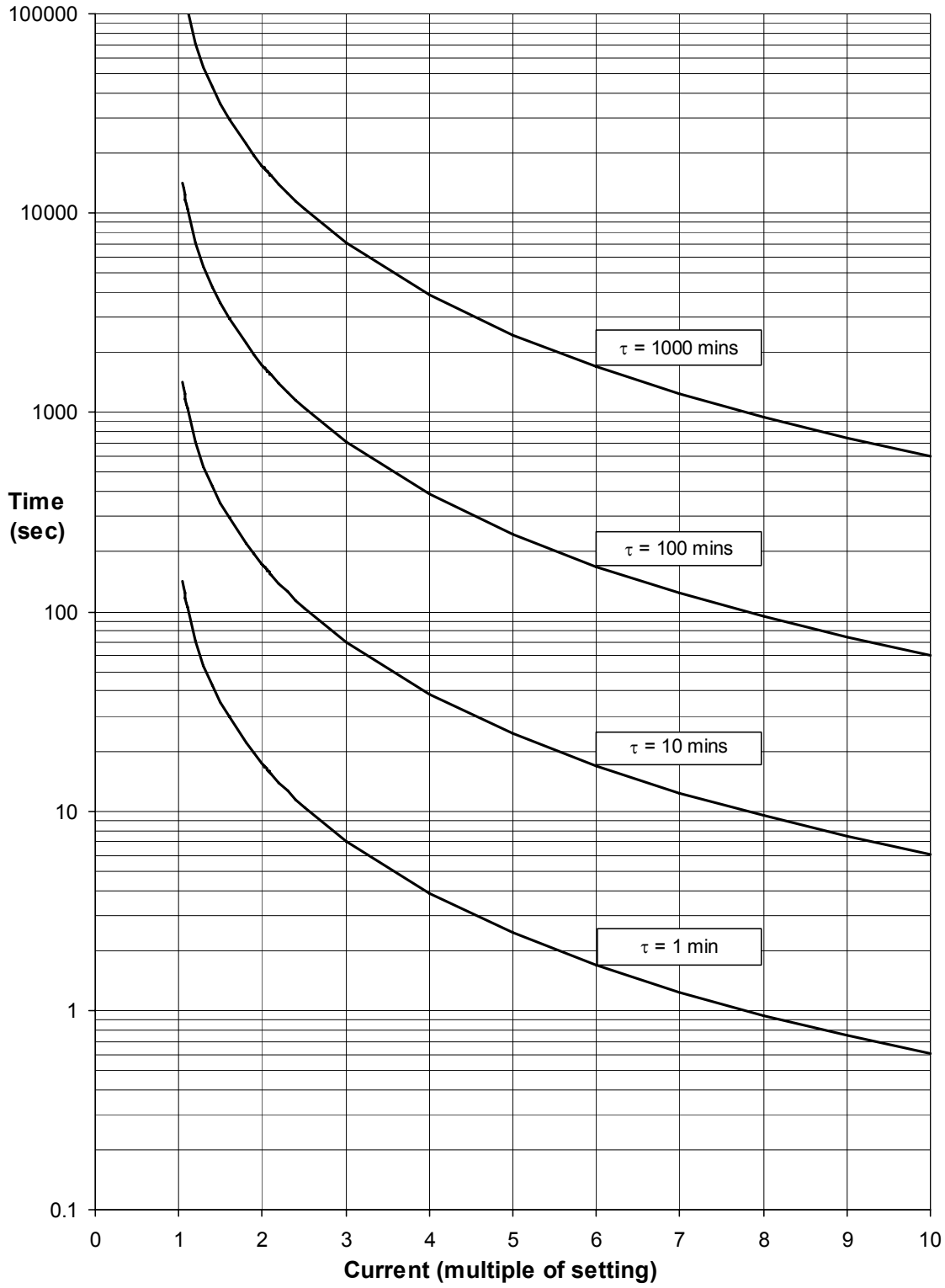


Figure 2-1 Thermal Overload Protection Curves

2.10 50 Instantaneous Overcurrent

2.10.1 Reference

	Parameter	Value
Is	Setting	0.05, 0.06… 25, 25.5… 50 x*In*
i	Applied Current (for operate time)	Current switched from below *Is* to 2x *Is*
		Current switched from below *Is* to 5x *Is*
t_d	Delay setting	0.00, 0.01…20.00, 20.50… 100, 101… 1000, 1010… 10000, 10100… 14400 s

2.10.2 Operate and Reset Level

	Attribute		Value
I_{op}	Operate level		100 % *Is*, ± 5 % or ± 1% *In*
	Reset level		≥ 95 % I_{op}
	Repeatability		± 1 %
	Transient overreach (X/R ≤ 100)		≤ -5 %
	Variation	-10 °C to +55 °C	≤ 5 %
		f_{nom} - 3 Hz to f_{nom} + 2 Hz	≤ 5 %

2.10.3 Operate and Reset Time

	Attribute	Value
t_{basic}	Element basic operate time	Switched from 0 to 2x *Is*: 40 ms, ± 10 ms
		Switched from 0 to 5x *Is*: 30 ms, ± 10 ms
t_{op}	Operate time following delay	t_{basic} + t_d, ± 1 % or ± 10 ms
	Repeatability	± 1 % or ± 10 ms
	Overshoot time	< 40 ms
	Disengaging time	< 50 ms

© 2013 Siemens Protection Devices Limited

2.11 50G Instantaneous Measured Earth Fault

2.11.1 Reference

	Parameter	Value
Is	Setting	0.005, 0.006… 25 x*In*
i	Applied Current (for operate time)	From below *Is* to 2x *Is* & from below Is to 5x *Is*
t_d	Delay setting	0.00, 0.01…20.00, 20.50… 100, 101… 1000, 1010… 10000, 10100… 14400 s

2.11.2 Operate and Reset Level

	Attribute		Value
I_{op}	Operate level		100 % *Is*, ± 5 % or ± 1% *In*
	Reset level		≥ 95 % I_{op}
	Repeatability		± 1 %
	Transient overreach (X/R ≤ 100)		≤ -5 %
	Variation	-10 °C to +55 °C	≤ 5 %
		f_{nom} - 3 Hz to f_{nom} + 2 Hz	≤ 5 %

2.11.3 Operate and Reset Time

	Attribute	Value
t_{basic}	Element basic operate time	Switched from 0 to 2x *Is*: 35 ms, ± 10 ms
		Switched from 0 to 5x *Is*: 25 ms, ± 10 ms
t_{op}	Operate time following delay	t_{basic} + t_d, ± 1 % or ± 10 ms
	Repeatability	± 1 % or ± 10 ms
	Overshoot time	< 40 ms
	Disengaging time	< 50 ms

2.12 50N Instantaneous Derived Earth Fault

2.12.1 Reference

	Parameter	Value
Is	Setting	0.05, 0.06… 25, 25.5… 50 x*In*
t_d	Delay setting	0.00, 0.01…20.00, 20.50… 100, 101… 1000, 1010… 10000, 10100… 14400 s

2.12.2 Operate and Reset Level

	Attribute		Value
I_{op}	Operate level		100 % *Is*, ± 5 % or ± 1% *In*
	Reset level		≥ 95 % I_{op}
	Repeatability		± 1 %
	Transient overreach (X/R ≤ 100)		≤ -5 %
	Variation	-10 °C to +55 °C	≤ 5 %
		f_{nom} - 3 Hz to f_{nom} + 2 Hz	≤ 5 %

2.12.3 Operate and Reset Time

	Attribute	Value
t_{basic}	Element basic operate time	Switched from 0 to 2x *Is*: 40 ms, ± 10 ms
		Switched from 0 to 5x *Is*: 30 ms, ± 10 ms
t_{op}	Operate time following delay	t_{basic} + t_d, ± 1 % or ± 10 ms
	Repeatability	± 1 % or ± 10 ms
	Overshoot time	< 40 ms
	Disengaging time	< 50 ms

© 2013 Siemens Protection Devices Limited

2.13 50SEF Instantaneous Sensitive Earth Fault

2.13.1 Reference

	Parameter	Value
Is	Setting	0.005, 0.006… 5.0 x*In*
t_d	Delay setting	**0.00**, 0.01… 20.0, 20.1 .. 100.0, 101....1000, 1010 … 10000 , 10100 … 14400
I	Applied current (for operate time)	5 x*Is*

2.13.2 Operate and Reset Level

	Attribute		Value
I_{op}	Operate level		100 % *Is*, ± 5 % or ± 1% In
	Reset level		95 % I_{op} ± 5 % or ± 0.1% In
	Repeatability		± 1 %
	Transient overreach (X/R ≤ 100)		≤ -5 %
	Variation	-10 °C to +55 °C	≤ 5 %
		f_{nom} - 3 Hz to f_{nom} + 2 Hz harmonics to f_{cutoff}	≤ 5 %

2.13.3 Operate and Reset Time

	Attribute		Value
t_{basic}	Element basic operate time		Switched from 0 to 0 to 2x *Is*: 35 ms, ± 10 ms
			Switched from 0 to 0 to 5x I*s*: 25 ms, ± 10 ms
t_{op}	Operate time following delay		t_{basic} + t_d, ± 1 % or ± 10 ms
	Repeatability		± 1 % or ± 10 ms
	Overshoot time		< 40 ms
	Disengaging time		< 50 ms
	Variation	f_{nom} - 3 Hz to f_{nom} + 2 Hz	≤ 5 %

2.14 51 Time Delayed Overcurrent

2.14.1 Reference

	Parameter		**Value**
Is	Setting		0.05, 0.06… 2.5 *xIn*
char	Characteristic setting		IEC-NI, -VI, -EI, -LTI; ANSI-MI, -VI, -EI; DTL
Tm	Time Multiplier setting		0.025, 0.05… 1.6
t_d	Delay setting		0, 0.01… 20 s
t_{res}	Reset setting		ANSI DECAYING, 0, 1… 60 s
I	Applied Current (for operate time)	IDMTL	2 to 20 x Is
		DTL	5 x Is

2.14.2 Operate and Reset Level

	Attribute		**Value**
I_{op}	Operate level		105 % *Is*, ± 4 % or ± 1 % *In*
	Reset level		≥ 95 % I_{op}
	Repeatability		± 1 %
	Variation	- 10 °C to + 55 °C	≤ 5 %
		f_{nom} - 3 Hz to f_{nom} + 2 Hz	≤ 5 %

© 2013 Siemens Protection Devices Limited

2.14.3 Operate and Reset Time

	Attribute		**Value**
	Starter operate time (≥ 2x*Is*)		20 ms, ± 20 ms
t_{op}	Operate time	*char* = IEC-NI, IEC-VI, IEC-EI, IEC-LTI	$t_{op} = \frac{K}{\left[\frac{I}{Is}\right]^{\alpha} - 1} \times Tm$, ± 5 % or ± 30 ms, for char = IEC-NI : K = 0.14, α = 0.02 IEC-VI : K = 13.5, α = 1.0 IEC-EI : K = 80.0, α = 2.0 IEC-LTI : K = 120.0, α = 1.0
		char = ANSI-MI, ANSI-VI, ANSI-EI	$t_{op} = \left[\frac{A}{\left[\frac{I}{Is}\right]^{P} - 1} + B\right] \times Tm$, ± 5 % or ± 30 ms, for char = ANSI-MI : A = 0.0515, B = 0.114, P = 0.02 ANSI-VI : A = 19.61, B = 0.491, P = 2.0 ANSI-EI : A = 28.2, B = 0.1217, P = 2.0
		char = DTL	t_d, ± 1 % or ± 20ms
	Reset time	ANSI DECAYING	$t_{res} = \frac{R}{\left[\frac{I}{Is}\right]^{2} - 1} \times Tm$, ± 5 % or ± 30 ms, for char = ANSI-MI : R = 4.85 ANSI-VI : R = 21.6 ANSI-EI : R = 29.1
		t_{res}	t_{res}, ± 1 % or ± 20 ms
	Repeatability		± 1 % or ± 20 ms
	Overshoot time		< 40 ms
	Disengaging time		< 50 ms

Figure 2.2 shows the operate times for the four IEC IDMTL curves with a time multiplier of 1. Figure 2.3 and Figure 2.4 show the ANSI operate and reset curves. These operate times apply to non-directional characteristics. Where directional control is applied then the directional element operate time should be added to give total maximum operating time.

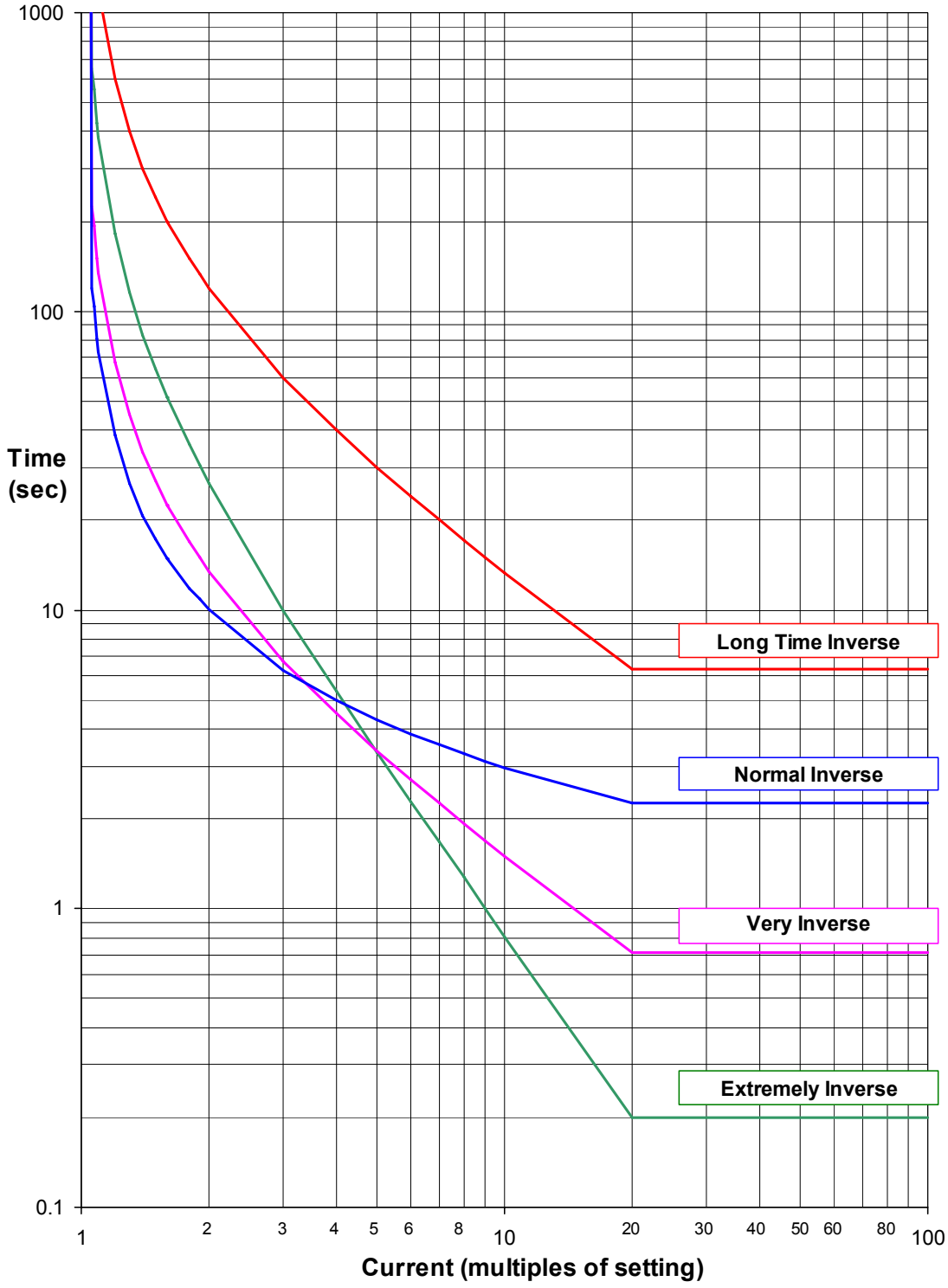


Figure 2-2 IEC IDMTL Curves (Time Multiplier = 1)

© 2013 Siemens Protection Devices Limited

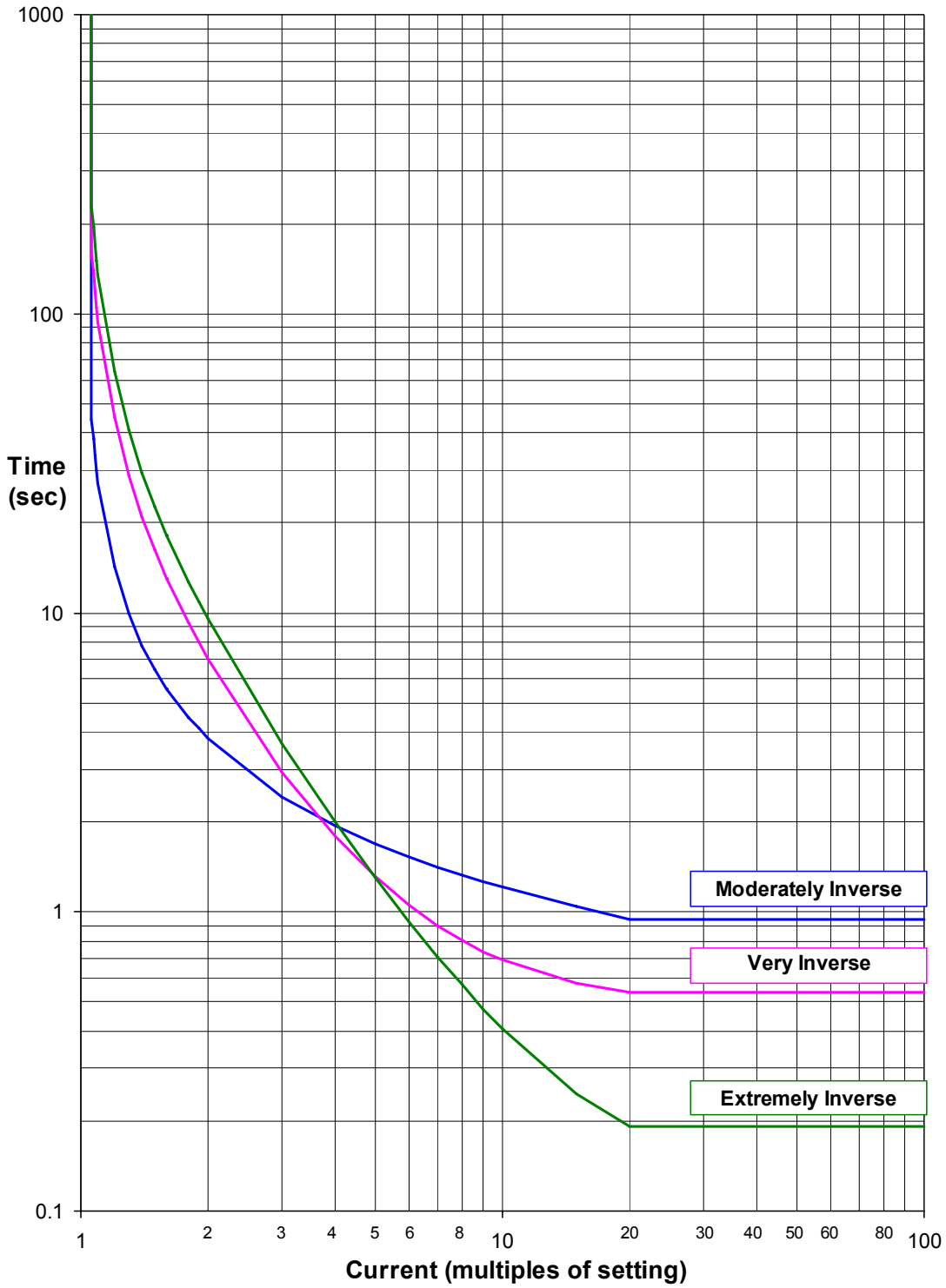


Figure 2-3 ANSI IDMTL Operate Curves (Time Multiplier = 1)

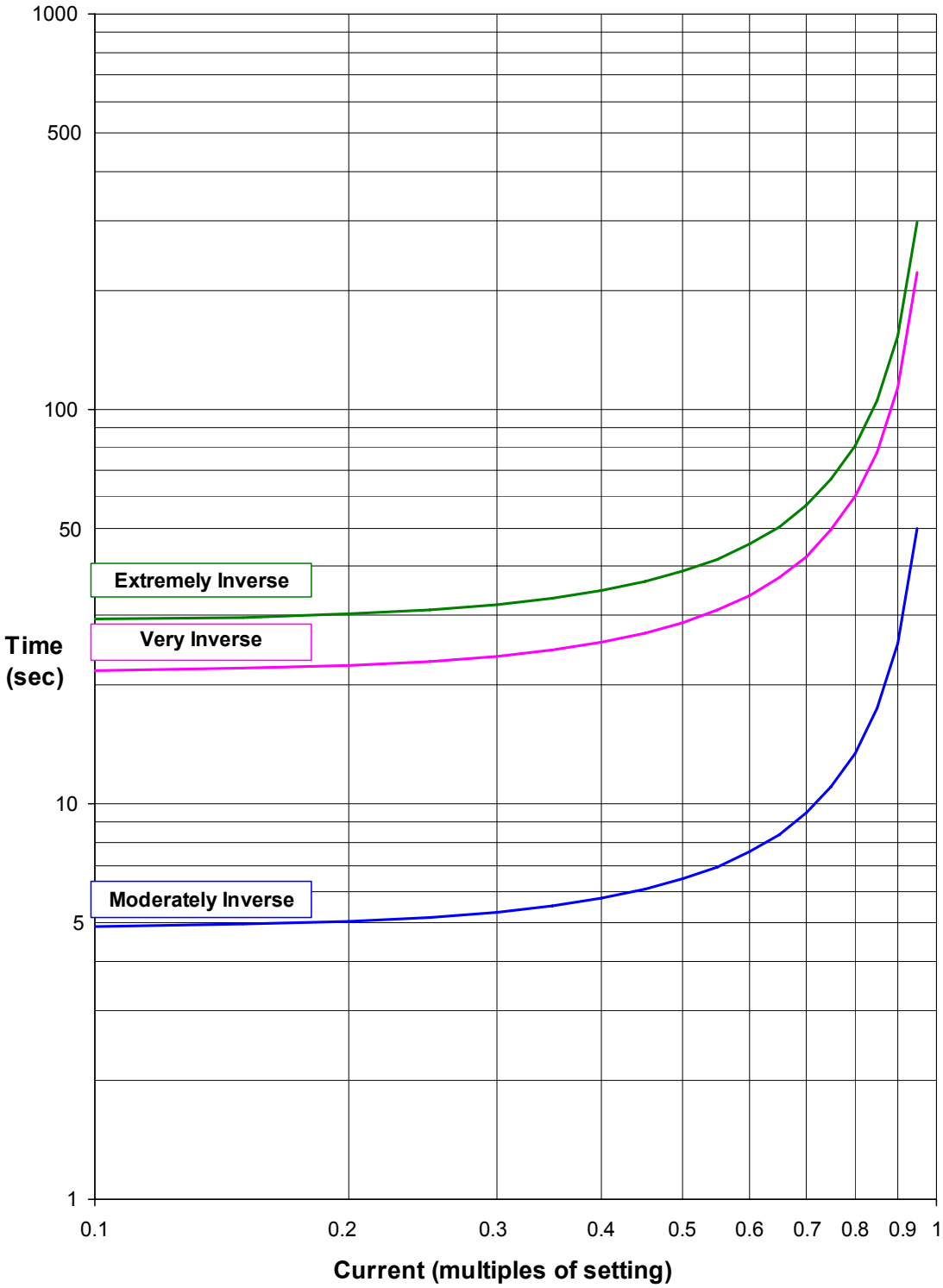


Figure 2-4 ANSI IDMTL Reset Curves (Time Multiplier = 1)

© 2013 Siemens Protection Devices Limited

2.15 51G Time Delayed Measured Earth Fault

2.15.1 Reference

	Parameter		**Value**
Is	Setting		0.005, 0.006… 1.0 *xIn*
Char	Characteristic setting		IEC-NI, -VI, -EI, -LTI; ANSI-MI, -VI, -EI; DTL
Tm	Time Multiplier setting		0.025, 0.05… 1.6
t_d	Delay setting (DTL)		0, 0.01… 20 s
t_{res}	Reset setting		ANSI DECAYING, 0, 1… 60 s
I	Applied current (for operate time)	IDMTL	2 to 20 x*Is*
		DTL	5 x*Is*

2.15.2 Operate and Reset Level

	Attribute		**Value**
I_{op}	Operate level		105 % *Is*, ± 4 % or ± 1% *In*
	Reset level		≥ 95 % I_{op}
	Repeatability		± 1 %
	Variation	-10 °C to +55 °C	≤ 5 %
		f_{nom} - 3 Hz to f_{nom} + 2 Hz	≤ 5 %

2.15.3 Operate and Reset Time

	Attribute		**Value**
	Starter operate time (≥ 2 *xIs*)		20 ms, ± 20 ms
t_{op}	Operate time	*char* = IEC-NI, IEC-VI, IEC-EI, IEC-LTI	$t_{op} = \frac{K}{\left[\frac{I}{Is}\right]^{\alpha} - 1} \times Tm$, ± 5 % or ± 30 ms, for char = IEC-NI : K = 0.14, α = 0.02 IEC-VI : K = 13.5, α = 1.0 IEC-EI : K = 80.0, α = 2.0 IEC-LTI : K = 120.0, α = 1.0
		char = ANSI-MI, ANSI-VI, ANSI-EI	$t_{op} = \left[\frac{A}{\left[\frac{I}{Is}\right]^{P} - 1} + B\right] \times Tm$, ± 5 % or ± 30 ms, for char = ANSI-MI : A = 0.0515, B = 0.114, P = 0.02 ANSI-VI : A = 19.61, B = 0.491, P = 2.0 ANSI-EI : A = 28.2, B = 0.1217, P = 2.0
		char = DTL	t_d, ± 1 % or ± 20 ms
	Reset time	ANSI DECAYING	$t_{res} = \frac{R}{\left[\frac{I}{Is}\right]^{2} - 1} \times Tm$, ± 5 % or ± 30 ms, for char = ANSI-MI : R = 4.85 ANSI-VI : R = 21.6 ANSI-EI : R = 29.1
		t_{res}	t_{res}, ± 1 % or ± 20 ms
	Repeatability		± 1 % or ± 20 ms
	Overshoot time		< 40 ms
	Disengaging time		< 50 ms

Figure 2-2 shows the operate times for the four IEC IDMTL curves with a time multiplier of 1. Figure 2-3 and Figure 2-4 show the ANSI operate and reset curves respectively. These operate times apply to non-directional characteristics. Where directional control is applied then the directional element operate time should be added to give total maximum operating time.

© 2013 Siemens Protection Devices Limited

2.16 51N Time Delayed Derived Earth Fault

2.16.1 Reference

	Parameter	**Value**
Is	Setting	0.05, 0.06… 2.5 *xIn*
char	Characteristic setting	IEC-NI, -VI, -EI, -LTI; ANSI-MI, -VI, -EI; DTL
Tm	Time Multiplier setting	0.025, 0.05… 1.6
t_d	Delay setting	0, 0.01… 20 s
t_{res}	Reset setting	ANSI DECAYING, 0, 1… 60 s

2.16.2 Operate and Reset Level

	Attribute		**Value**
I_{op}	Operate level		105 % *Is*, ± 4 % or ± 1% *In*
	Reset level		≥ 95 % I_{op}
	Repeatability		± 1 %
	Variation	- 10 °C to + 55 °C	≤ 5 %
		f_{nom} - 3 Hz to f_{nom} + 2 Hz	≤ 5 %

2.16.3 Operate and Reset Time

	Attribute		Value
	Starter operate time (≥ 2 *xIs*)		20 ms, ± 20 ms
t_{op}	Operate time	*char* = IEC-NI, IEC-VI, IEC-EI, IEC-LTI	$t_{op} = \frac{K}{\left[\frac{I}{Is}\right]^{\alpha} - 1} \times Tm$, ± 5 % or ± 30 ms, for char = IEC-NI : K = 0.14, α = 0.02 IEC-VI : K = 13.5, α = 1.0 IEC-EI : K = 80.0, α = 2.0 IEC-LTI : K = 120.0, α = 1.0
		char = ANSI-MI, ANSI-VI, ANSI-EI	$t_{op} = \left[\frac{A}{\left[\frac{I}{Is}\right]^{P} - 1} + B\right] \times Tm$, ± 5 % or ± 30 ms, for char = ANSI-MI : A = 0.0515, B = 0.114, P = 0.02 ANSI-VI : A = 19.61, B = 0.491, P = 2.0 ANSI-EI : A = 28.2, B = 0.1217, P = 2.0
		char = DTL	t_d, ± 1 % or ± 20 ms
	Reset time	ANSI DECAYING	$t_{res} = \frac{R}{\left[\frac{I}{Is}\right]^{2} - 1} \times Tm$, ± 5 % or ± 30 ms, for char = ANSI-MI : R = 4.85 ANSI-VI : R = 21.6 ANSI-EI : R = 29.1
		t_{res}	t_{res}, ± 1 % or ± 20 ms
	Repeatability		± 1 % or ± 20 ms
	Overshoot time		< 40 ms
	Disengaging time		< 50 ms

Figure 2-2 shows the operate times for the four IEC IDMTL curves with a time multiplier of 1. Figure 2-3 and Figure 2-4 show the ANSI operate and reset curves respectively. These operate times apply to non-directional characteristics. Where directional control is applied then the directional element operate time should be added to give total maximum operating time.

© 2013 Siemens Protection Devices Limited

2.17 51SEF Time Delayed Sensitive Earth Fault

2.17.1 Reference

	Parameter		**Value**
Is	Setting		0.005, 0.006…1 x*In*
char	Characteristic setting		IEC-NI, -VI, -EI, -LTI; ANSI-MI, -VI, -EI; DTL
Tm	Time multiplier		1.0
t_d	Delay setting		0.00…20.00 s
t_{res}	Reset setting		DECAYING, 0, 1…60 s
I	Applied current (for operate time)	IDMTL	2 to 20x*Is*
		DTL	5 x*Is*

2.17.2 Operate and Reset Level

	Attribute		**Value**
I_{op}	Operate level		105 % *Is*, ± 4 % or ± 1% In
	Reset level		≥ 95 % I_{op} ± 4 % or ± 1% In
	Repeatability		± 1 %
	Variation	-10 °C to +55 °C	≤ 5 %
		f_{nom} - 3 Hz to f_{nom} + 2 Hz harmonics to f_{cutoff}	≤ 5 %

2.17.3 Operate and Reset Time

	Attribute		**Value**
	Starter operate time		20 ms, ± *20* ms
t_{op}	Operate time	char = IEC-NI, IEC-VI, IEC-EI, IEC-LTI	$t_{op} = \frac{K}{\left[\frac{I}{Is}\right]^{\alpha} - 1} \times Tm$, ± 5 % or ± 30 ms, for char = IEC-NI : K = 0.14, α = 0.02 IEC-VI : K = 13.5, α = 1.0 IEC-EI : K = 80.0, α = 2.0 IEC-LTI : K = 120.0, α = 1.0
		char = ANSI-MI, ANSI-VI, ANSI-EI,	$t_{op} = \left[\frac{A}{\left[\frac{I}{Is}\right]^{P} - 1} + B\right] \times Tm$, ± 5 % or ± 30 ms, for char = ANSI-MI : A = 0.0515, B = 0.114, P = 0.02 ANSI-VI : A = 19.61, B = 0.491, P = 2.0 ANSI-EI : A = 28.2, B = 0.1217, P = 2.0
		char = DTL	t_d, ± 1 % or ± t_{cycle}
	Reset time	char = ANSI and t_{res} = DECAYING	$t_{res} = \frac{R}{\left[\frac{I}{Is}\right]^{2} - 1} \times Tm$, ± 5 % or ± 30 ms, for char = ANSI-MI : R = 4.85 ANSI-VI : R = 21.6 ANSI-EI : R = 29.1
		t_{res} ≠ DECAYING	t_{res}, ± 1 % or ± 20 ms
	Repeatability		± 1 % or ± 20 ms
	Overshoot time		< 40 ms
	Disengaging time		< 50 ms
	Variation	f_{nom} - 3 Hz to f_{nom} + 2 Hz harmonics to f_{cutoff}	≤ 5 %

Figure 2-2 shows the operate times for the four IEC IDMTL curves with a time multiplier of 1. Figure 2-3 and Figure 2-4 show the ANSI operate and reset curves. These operate times apply to non-directional characteristics. Where directional control is applied then the directional element operate time should be added to give total maximum operating time.

© 2013 Siemens Protection Devices Limited

2.18 51V Voltage Controlled Overcurrent (Ph-Ph)

2.18.1 Reference

	Parameter	**Value**
Vs	Setting	5, 5.5…199.5, 200 V
m	Multiplier	0.25, 0.3…0.95, 1
Is	Setting	1 xIn

2.18.2 Operate and Reset Level

	Attribute		**Value**
V_{op}	Operate level		100 % *Vs*, ± 1 % or ± 0.25 V
	Reset level		≤ 105 % V_{op}
	Repeatability		± 1 %
	Variation	-10 °C to +55 °C	≤ 5 %
		f_{nom} - 3 Hz to f_{nom} + 2 Hz harmonics to f_{cutoff}	≤ 5 %

Operate and Reset Time

As per Phase Fault Shaped Characteristic Element (ANSI 51).

Where Pickup Level = Is for Voltage > Vs

Pickup Level = (Is x m) for Voltage < Vs

2.19 55 Power Factor

2.19.1 Reference

	Parameter	Value
PF_s	55-n Setting	0.05…0.99
t_d	55-n Delay setting	0.00 … 14400 s

2.19.2 Operate and Reset Level

	Attribute		Value
PF_{op}	Operate Level		PF_s ± 0.05
	Reset Level	Under PF	$\leq PF_{op}$ + 0.02
		Over PF	$\geq PF_{op}$ - 0.02
	Repeatability		± 0.05
	Variation	-10 °C to +55 °C	± 0.05
		f_{nom} – 3 Hz to f_{nom} + 2 Hz	± 0.05

2.19.3 Operate and Reset Time

	Attribute	Value
t_{basic}	Element basic operate time	≤ 70 ms
t_{op}	Operate time following delay	t_{basic} + t_d, ± 1 % or ± 10ms
	Disengaging time	< 80 ms

2.19.4 Operate Threshold

	Attribute		Value
	Minimum levels for operation	I	2.5 % In
		V	2.5% Vn

© 2013 Siemens Protection Devices Limited

2.20 59N Neutral Voltage Displacement

2.20.1 Reference (59NDT)

	Parameter	**Value**
Vs	Setting	1, 1.5… 100 V
t_d	Delay setting	0.00, 0.01…20.00, 20.50… 100, 101… 1000, 1010… 10000, 10100… 14400 s

2.20.2 Operate and Reset Level (59NDT)

	Attribute		**Value**
V_{op}	Operate level		100 % *Vs*, ± 2 % or ± 0.5 V
	Reset level		≥ 95 % V_{op} or ± 0.25 V
	Repeatability		± 1 %
	Variation	-10 °C to +55 °C	≤ 5 %
		f_{nom} - 3 Hz to f_{nom} + 2 Hz	≤ 5 %

2.20.3 Operate and Reset Time (59NDT)

	Attribute	**Value**
t_{basic}	Element basic operate time	Switched from 0 to 1.5 *xVs*, 76 ms, ± 20 ms
		Switched from 0 to 10 *xVs*, 63 ms, ± 20 ms
t_{op}	Operate time following delay	t_{basic} + t_d, ± 1 % or ± 20 ms
	Repeatability	± 1 % or ± 20 ms
	Overshoot time	< 40 ms
	Disengaging time	< 50 ms

2.20.4 Reference (59NIT)

	Parameter	**Value**
M	Multiplier setting	0.1, 0.2… 10, 10.5… 140
Vs	Setting	1, 1.5… 100 V
t_d	Delay setting	0, 0.01… 20 s
t_{res}	Reset setting	0, 1…60 s

2.20.5 Operate and Reset Level (59NIT)

	Attribute		**Value**
V_{op}	Operate level		105 % *Vs*, ± 2 % or ± 0.5 V
	Reset level		≥ 95 % V_{op} or ± 0.25 V
	Repeatability		± 1 %
	Variation	-10 °C to +55 °C	≤ 5 %
		f_{nom} - 3 Hz to f_{nom} + 2 Hz	≤ 5 %

2.20.6 Operate and Reset Time (59NIT)

	Attribute		**Value**
t_{basic}	Starter operate time (≥ 2*xVs*)		65 ms, ± 20 ms
t_{op}	Operate time	char = IDMTL	$t_{op} = \frac{M}{\left[\frac{3V0}{Vs}\right] - 1}$, ± 5 % or ± 65 ms
		char = DTL	t_d, ± 1 % or ± 40 ms
	Reset Time	char = IDMTL	t_{res}, ± 5 % or ± 65 ms
		char = DTL	t_{res}, ± 1 % or ± 40 ms
	Repeatability		± 1 % or ± 20 ms
	Overshoot time		< 40 ms
	Disengaging time		< 50 ms

© 2013 Siemens Protection Devices Limited

2.21 64H Restricted Earth Fault Protection

2.21.1 Reference

	Parameter	Value
Is	Setting	0.005, 0.006… 0.95 x*In*
t_d	Delay setting	0.00, 0.01… 20.0, 20.1… 100.0, 101.…1000, 1010 … 10000 , 10100 … 14400 s

2.21.2 Operate and Reset Level

	Attribute		Value
I_{op}	Operate level		100 % *Is*, ± 5 % or ±1 % *xIn*
	Reset level		95 % I_{op}, ± 5 % or ±0.1 % *xIn*
	Repeatability		± 1 %
	Transient overreach (X/R ≤ 100)		≤ -5 %
	Variation	-10 °C to +55 °C	≤ 5 %
		f_{nom} - 3 Hz to f_{nom} + 2 Hz	≤ 5 %

2.21.3 Operate and Reset Time

	Attribute	Value
t_{basic}	Element basic operate time	
t_{op}	Operate time following delay	t_{basic} + t_d, ± 1% or ± 10 ms
	Repeatability	± 1% or ± 10 ms
	Overshoot time	< 40 ms
	Disengaging time	< 50 ms

2.22 67/67N Directional Overcurrent & Earth Fault

2.22.1 Reference

	Parameter	**Value**
υ_s	Angle setting	-95…+95 °
I	Applied current	*In*
V	Applied voltage	110 V phase-phase (63.5 V phase-earth)

2.22.2 Operate Angle

	Attribute		**Value**
CA	Characteristic angle (I with respect to V)		υ_s, ± 5 °
	Operating angle	forward	*CA* - 85 ° ± 5 ° to *CA* + 85° ± 5 °
		reverse	(*CA* - 180°) - 85° ± 5 ° to (*CA* - 180°) + 85° ± 5 °
	Variation in characteristic angle	10°C to +55°C	± 5 °
		f_{nom} - 3 Hz to f_{nom} + 2 Hz	± 5 °

2.22.3 Operate Threshold

	Attribute		**Value**
	Minimum levels for operation	I (p/f)	> 5 % In
		I (e/f)	> 10 % In
		V (p/f)	> 1 V
		V (e/f)	> 1 V

2.22.4 Operate and Reset Time

	Attribute	**Value**
	Operate time	typically 25 < 40 ms at characteristic angle
	Reset time	typically < 65 ms at characteristic angle

© 2013 Siemens Protection Devices Limited

2.23 Directional SEF Wattmetric

2.23.1 Reference

	Parameter	**Value**
P_o	Setting	0.05, 0.10,… 20.0 x*InxW* (Where In = 1A or 5A)
I	Applied current @ In = 1A	10mA…5A
V	Applied voltage	10V…200V
θ	Angle	<87.5deg
CA	67SEF Char Angle (θc)	0
f	Nominal	50/60Hz

2.23.2 Operate and Reset Level

	Attribute		**Value**
P_{op}	Operate level		100 % P_o, ± 25 % or ± 25mW
	Reset level		≥ 95 % P_{op}
	Variation	-10 °C to +55 °C	≤ 5 %

2.23.3 Operate and Reset Time

	Attribute		**Value**
t_{basic}	Element basic operate time		<50ms
	Repeatability		± 1 % or ± *10ms*

2.24 81 Under/Over Frequency

2.24.1 Reference

	Parameter	Value
Fs	Setting	40, 40.01… 69.99 Hz
Hyst	Hysteresis setting	0, 0.1… 80 %
td	Delay setting	0.00, 0.01… 20.0, 20.1… 100.0, 101.…1000, 1010 … 10000 , 10100 … 14400 s

2.24.2 Operate and Reset Level

	Attribute		Value
F_{op}	Operate level		100 % F_s, ± 10 mHz
	Reset level	overfrequency	(100 % - *hyst*) $xF_{op,}$ ± 10 mHz
		underfrequency	(100 % + *hyst*) $xF_{op,}$ ± 10 mHz
	Repeatability		± 1 %
	Variation	- 10 °C to + 55 °C	≤ 5 %

2.24.3 Operate and Reset Time

	Attribute		Value
t_{basic}	Element basic operate time (for ROCOF between 0.1 and 5.0 Hz/sec)	overfrequency	Typically < 110 ms
			Maximum < 150 ms
		underfrequency	Typically < 110 ms
			Maximum < 150 ms
t_{op}	Operate time following delay		t_{basic} + t_d, ± 1 % or ± 10 ms
	Repeatability		± 1 % or ± 10 ms
	Disengaging time		< 100 ms

© 2013 Siemens Protection Devices Limited

2.25 50 AFD ARC Flash Detector

(Refer to 7XG31 Technical Manual for performance characteristics)

2.25.1 Reference

	Parameter	**Value**
50 AFD	Setting	1, 2,...10 xIn

2.25.2 Operate and Reset Level

	Attribute	**Value**
I_{op}	Operate level	100 % *Is*, ± 10 %
	Transient overreach (X/R ≤ 100)	≤ -30 %
	Reset level	≥ 95 % I_{op}
	Repeatability	± 5 %

2.25.3 Operate and Reset Time

	Attribute	**Value**
t_{basic}	50AFD Overcurrent operate time	10 ms – 16 ms
t_{op}	AFD Zone operate time (Flash & 50AFD)	15 ms – 25 ms
	Repeatability	± 10 ms
	Disengaging time	< 50 ms

Section 3: Supervision Functions

3.1 46BC & 46BC U/C Broken Conductor

3.1.1 Reference

	Parameter	Value
	Setting (NPS to PPS ratio)	20…100 %
	U/C Guard setting	0.05, 0.1 ... 4.95, 5
t_f	Delay setting	0.02…1000 s

3.1.2 Operate and Reset Level

	Attribute		Value
I_{curr}	Operate level		100 % I_{set} ± 5 %
	Reset level		90 % I_{curr} , ± 5 %
	Repeatability		± 1 %
	Variation	- 10 °C to + 55 °C	≤ 5 %
		f_{nom} - 3 Hz to f_{nom} + 2 Hz harmonics to f_{cutoff}	≤ 5 %

3.1.3 Operate and Reset Time

	Attribute		Value
t_{basic}	Basic operate time	1x In to 0 A	40 ms
	Operate time		t_f + t_{basic}, ± 1 % or ± *20 ms*
	Repeatability		± 1 % or ± *20 ms*
	Variation	f_{nom} - 3 Hz to f_{nom} + 2 Hz harmonics to f_{cutoff}	≤ 5 %

© 2013 Siemens Protection Devices Limited

3.2 50BF & 50BF-I4 Circuit Breaker Fail

3.2.1 Reference

	Parameter	Value
Is	50BF Setting	0.050, 0.055… 2.0 x*In*
Is	50BF-I4 Setting	0.005, 0.01… 2.0 x*In*
t_{CBF1}	Stage 1 Delay setting	20, 25… 60000ms
t_{CBF2}	Stage 2 Delay setting	20, 25… 60000ms

3.2.2 Operate and Reset Level

	Attribute		Value
I_{op}	Operate level		100 % *Is*, ± 5 % or ± 1% *In*
I_{reset}	Reset level		<100 % I_{op}, ± 5 % or ± 1% *In*
	Repeatability		± 1 %
	Variation	-10 °C to +55 °C	≤ 5 %
		f_{nom} - 3 Hz to f_{nom} + 2 Hz	≤ 5 %

3.2.3 Operate and Reset Time

	Attribute	Value
t_{basic}	Element basic operate time	< 20 ms
t_{op}	Stage 1	t_{CBF1}, ± 1 % or ± 20 ms
	Stage 2	t_{CBF2}, ± 1 % or ± 20 ms
	Repeatability	± 1 % or ± 20 ms
	Overshoot	< 2 x 20 ms
	Disengaging time	< 30 ms

3.3 60CTS & CTS-I Current Transformer Supervision

3.3.1 Reference

	Parameter	**Value**
I_{thresh}	Current Threshold	0.05, 0.1… 1 x*In*
V_{thresh}	Voltage Threshold	7, 8… 110V
t_d	Delay setting	0.03, 0.04…20.00, 20.50… 100, 101… 1000, 1010… 10000, 10100… 14400 s
CTS-I I_{thresh}	Current Threshold	0.05, 0.1… 2 x*In*

3.3.2 Current & Voltage Threshold

	Attribute		**Value**
I_{op}	CT failed current level		100 % I_{thresh}, ± 5% or ± 1% In
	Reset level		90 % $I_{op,}$ ± 5% or ± 1% In
V_{op}	CT failed voltage level		100 % V_{thresh}, ± 2% or ± 0.5 V
	Reset level		110 % V_{op}, ± 2 % or ± 0.5 V
	Repeatability		± 1 %
	Variation	-10 °C to +55 °C	≤ 5 %
		f_{nom} - 3 Hz to f_{nom} + 2 Hz harmonics to f_{cutoff}	≤ 5 %

3.3.3 Operate and Reset Time

	Attribute	**Value**
t_{basic}	Basic operate time	30 ms ± 20ms
	Operate time	t_{basic}, ± 1 % or ± 20ms
	Repeatability	± 1 % or ± 20ms

© 2013 Siemens Protection Devices Limited

3.4 60VTS Voltage Transformer Supervision

3.4.1 Reference

	Parameter	Value
V_{nps}	Vnps Level	7, 8 … 110 V
I_{nps}	Inps Level	0.05, 0.1 … 1 x In
I_{pps}	Ipps Load Level	0.05, 0.1 … 1 x In
IF_{pps}	Ipps Fault Level	0.05, 0.1 … 20 x In
V_{pps}	Vpps Level	1, 2 … 110 V
t_d	60VTS Delay	0.00, 0.01…20.00, 20.50… 100, 101… 1000, 1010… 10000, 10100… 14400 s

3.4.2 Operate and Reset Level

	Attribute		Value
V_{NPSop}	Voltage NPS operate level		100 % V_{nps}, ± 5 % Vn
	Voltage NPS reset level		90 % V_{NPSop}, ± 5 % Vn
V_{PPSop}	Voltage PPS operate level		100 % V_{pps}, ± 5 % Vn
	Voltage PPS reset level		110 % V_{PPSop}, ± 5 % Vn
I_{NPSblk}	Current NPS operate level		100 % I_{nps}, ± 5 % xIn
	Current NPS reset level		90 % I_{NPSblk}, ± 5 % xIn
I_{PPSblk}	Current PPS operate level		100 % IF_{pps}, ± 5 % xIn
	Current PPS reset level		90 % I_{PPSblk}, ± 5 % xIn
$I_{PPSload}$	Current PPS operate level		100 % I_{pps}, ± 5 % xIn
	Current PPS reset level		90 % $I_{PPSload}$, ± 5 % xIn
	Repeatability		± 1 %
	Variation	-10 °C to +55 °C	≤ 5 %
		f_{nom} - 3 Hz to f_{nom} + 2 Hz	≤ 5 %

3.4.3 Operate and Reset Time

	Attribute		**Value**
t_{basic}	Basic operate time	0V to 2 x *Vs*	32 ms ± 10 ms
	Operate time		t_{basic}, ± 1 % or ± 10 ms
	Repeatability		± 1 % or ± 10 ms

© 2013 Siemens Protection Devices Limited

3.5 74TCS Trip Circuit Supervision

3.5.1 Reference

	Parameter	Value
t_d	Delay setting	0, 0.02…60 s

3.5.2 Operate and Reset Time

	Attribute		Value
t_{basic}	Element basic operate time		25 ms ± 20 ms
t_{op}	Operate time following delay		t_{basic} + t_d, ± 1 % or ± 10 ms
	Repeatability		± 1 % or ± 10 ms
	Variation	- 10 °C to + 55 °C	≤ 5 %
		f_{nom} - 3 Hz to f_{nom} + 2 Hz	≤ 5 %

3.6 81HBL2 Inrush Detector

3.6.1 Reference

	Parameter	Value
I	Setting (Ratio of 2nd Harmonic current to Fundamental component current)	0.10, 0.11... 0.5

3.6.2 Operate and Reset Level

	Attribute		Value
I_{op}	Operate level		100 % *I*, ± 4 % or ± 1 % *In*
	Reset level		100 % I_{op}, ± 4 % or ± 1 % *In*
	Repeatability		± 1 %
	Variation	- 10 °C to + 55 °C	≤ 5 %
		f_{nom} - 3 Hz to f_{nom} + 2 Hz	≤ 5 %

3.6.3 Operate and Reset Time

	Attribute	Value
t_{basic}	Element basic operate time	Will pick-up before operation of any protection element due to magnetic inrush
	Reset Time	Will operation until drop-off of any protection element due to magnetic inrush

© 2013 Siemens Protection Devices Limited

3.7 81HBL5 Over Fluxing Detector

3.7.1 Reference

	Parameter	Value
I	Setting (Ratio of 5th Harmonic current to Fundamental component current)	0.10, 0.11... 0.5

3.7.2 Operate and Reset Level

	Attribute		Value
I_{op}	Operate level		100 % *I*, ± 4 % or ± 1% *In*
	Reset level		100 % I_{op}, ± 4 % or ± 1% *In*
	Repeatability		± 1 %
	Variation	-10 °C to +55 °C	≤ 5 %
		f_{nom} - 3 Hz to f_{nom} + 2 Hz	≤ 5 %

3.7.3 Operate and Reset Time

	Attribute	Value
t_{basic}	Element basic operate time	Will pick-up before operation of any protection element due to overfluxing
	Reset Time	Will operation until drop-off of any protection element due to overfluxing

3.8 Load Blinder (21LB – 3P)

3.8.1 Reference

	Parameter	**Value**
Φ	Angle + ve setting	5 Deg to 85 Deg
Φ	Angle – ve setting	5 Deg to 85 Deg
Z	Impedance	1 Ohm to 100 Ohms
V_{pps}	Vpps Level	1 V to 110 V
I_{nps}	Inps Level	0.05 xIn to 5 xIn

3.8.2 Operate Level

	Attribute	**Value**
V_{PPS}	Voltage PPS operate level	100 % *Vs*, ± 2 % or ± 0.5 V
I_{NPS}	Current NPS operate level	100 % *Is*, ± 5 % or ± 1% *In*
	Impedance	100 % *Zs*, ± 5 % or ± 0.1 Ω
	Repeatability	± 1 %

3.8.3 Operate Angle

	Attribute		**Value**
	Operating angle	forward	(*21LB-3P Angle +ve*°) ± 5° to (*21LB-3P Angle –ve*°) ± 5°
		reverse	(180° - *21LB-3P Angle +ve*°) ± 5° to (180° + *21LB-3P Angle –ve*°) ± 5°

© 2013 Siemens Protection Devices Limited

3.9 Load Blinder (21LB – 1P)

3.9.1 Reference

	Parameter	Value
Φ	Angle + ve setting	5 Deg to 85 Deg
Φ	Angle – ve setting	5 Deg to 85 Deg
Z	Impedance	1 Ohm to 100 Ohms
V_{pps}	Vpps Level	1 V to 110 V
I_{zps}	Izps Level	0.05 xIn to 5 xIn

3.9.2 Operate Level

	Attribute	Value
V_{PPS}	Voltage PPS operate level	100 % *Vs*, ± 2 % or ± 0.5 V
	Voltage PPS reset level	110 % V_{PPSop}, ± 5 % *Vn*
I_{ZPS}	Current ZPS operate level	100 % *Is*, ± 5 % or ± 1% *In*
	Impedance	100 % Z*s*, ± 5 % or ± 0.1 Ω
	Repeatability	± 1 %

3.9.3 Operate Angle

	Attribute		Value
	Operating angle	forward	(*21LB-1P Angle +ve*°) ± 5° to (*21LB-1P Angle –ve*°) ± 5°
		reverse	(180° - *21LB-1P Angle +ve*°) ± 5° to (180° + *21LB-1P Angle –ve*°) ± 5°

Section 4: Control Functions

4.1 Check Synchronising

4.1.1 Reference

	Parameter	Value
V_{nom}	Nominal Voltage	40-160 V
f_n	Nominal Frequency	50/60 Hz
V_{live}	Live Setting	10 % - 150 %
V_{dead}	Dead Setting	10 % - 150 %
V_{sl}	Line Voltage Setting	10 % - 150 %
V_{sb}	Bus Voltage Setting	10 % - 150 %
V_{diff}	Voltage Differential Setting	5 % - 95 %
Θ_{cs}	CS Angle	1 – 90 º
Θ_{ss}	SS Angle	1 – 90 º
f_{coz}	COZ Slip	30 mHz – 250 mHz
f_{cs}	CS Slip Freq	20 mHz – 250 mHz
f_{ss}	SS Slip Freq	10 mHz – 250 mHz
t_{cs}	CS Timer	0-100 s
t_{ss}	SS Timer	0-1 s
f_{sps}	Split Slip	20 mHz – 250 mHz
t_{dlc}/t_{dbc}	DLC/DBC Delays	0-60 s
t_{cw}	Sync Close Window	1 s – 1200 s

4.1.2 Live/Dead Line/Bus Detector Elements

	Attribute		Value
$V_{live,act}$	Live operate level		100 % V_{live}, ± 1 % V_n
	Live reset level		$V_{dead,act}$, ± 1 % V_n
$V_{dead,act}$	Dead operate level		100 % V_{dead}, ± 1 % V_n
	Dead reset level		$V_{live,act}$, ± 1 % V_n
	Repeatability		± 1 %
	Variation	-10 °C to +55 °C	≤ 5 %
		f_{nom} ± 5 %	≤ 1 %

© 2013 Siemens Protection Devices Limited

4.1.3 Line and Bus Undervoltage Elements

	Attribute		Value
V_{line}	Operate level		100 % *Vsl*, ± 1 % V_n
	Reset level		≤ V_{line} + 4 %
V_{bus}	Operate level		100 % *Vsb*, ± 1 % V_n
	Reset level		≤ V_{bus} + 4 %
	Repeatability		± 1 %
	Variation	-10 °C to +55 °C	≤ 5 %
		f_{nom} ± 5 %	≤ 1 %

4.1.4 Voltage Difference

	Attribute	Value
V_{op}	Operate level	100 % V_{diff}, ± 1 % V_n
	Reset level	≥ V_{op} – 4 %
	Repeatability	± 2 %

4.1.5 General Autoreclose Timers

	Attribute	Value
t_{basic}	Element basic operate time	20 ms ± 20 ms
t_{op}	t_{dlc}/t_{dbc}/t_{cw}	t_{op} + t_{basic} ± 1%
	Repeatability	± 20 ms

4.1.6 CS/SS/COZ Line and Bus Phase Angle Difference

	Attribute	Value
θ_{op}	Operate angle	θ_{diff}, ± 1 º
	Reset angle	θ_{op}, ± 1 º
	Repeatability	± 1 º

4.1.7 CS/SS/COZ Slip Frequency

	Attribute	Value
f_{op}	Operate frequency	f_{slip}, ± 10 mHz
	Reset frequency	f_{op}, - 10 mHz
	Repeatability	± 10 mHz

4.1.8 CS/SS Timer

	Attribute	Value
t_{op}	Operate time	± 1 º, + 20 ms

Note: minimum synchronising time following restoration of voltage from a dead condition is 320 ms.

4.1.9 Split Angle Detector

	Attribute	Value
θ_{op}	Operate angle	θ_{split}, ± 1 °

4.1.10 Split Slip Frequency Detector

	Attribute	Value
f_{op}	Operate frequency	f_{slip}, ± 10 mHz
	Reset frequency	f_{op}, - 10 mHz
	Repeatability	± 10 mHz

4.2 Live/Dead

4.2.1 Reference

	Parameter	Value
V_s	Setting (ABC side)	5, 5.5…200 V
V_s	Setting (XYZ side)	5, 5.5…120 V

4.2.2 Live/Dead Detector Elements

	Attribute		Value
$V_{live,act}$	Live operate level		100 % V_{live}, ± 1 % V_n
	Live reset level		$V_{dead,act}$, ± 1 % V_n
$V_{dead,act}$	Dead operate level		100 % V_{dead}, ± 1 % V_n
	Dead reset level		$V_{live,act}$, ± 1 % V_n
	Repeatability		± 1 %
	Variation	-10 °C to +55 °C	≤ 5 %
		f_{nom} ± 5 %	≤ 1 %

© 2013 Siemens Protection Devices Limited

7SR210 Non-Directional Relay
Instrumentation Guide

Unrestricted The copyright and other intellectual property rights in this document, and in any model or article produced from it (and including any registered or unregistered design rights) are the property of Siemens Protection Devices Limited. No part of this document shall be reproduced or modified or stored in another form, in any data retrieval system, without the permission of Siemens Protection Devices Limited, nor shall any model or article be reproduced from this document unless Siemens Protection Devices Limited consent.

While the information and guidance given in this document is believed to be correct, no liability shall be accepted for any loss or damage caused by any error or omission, whether such error or omission is the result of negligence or any other cause. Any and all such liability is disclaimed.

© 2018 Siemens Protection Devices Limited

Document Release History

This document is issue 2017/12. The list of revisions up to and including this issue is: -

2011/05	First issue
2013/01	Typographical revisions and added data. Updated in line with software release.
2014/06	Typographical revisions and added data. Updated in line with software release.
2015/06	Typographical revisions and added data. Updated in line with software release.
2016/02	Typographical revisions and added data. Updated in line with software release.
2016/11	Typographical revisions and format
2017/08	Typographical revisions and added data. Updated in line with software release.
2017/12	Typographical revisions and added data.

Software Revision History

2011/05	2435H85008R7a-7a (7SR210)	First Release
2013/01	2435H85008R7c-7b (7SR210)	Introduced journaling file system. Added 61850 logical nodes for CB Counters, metering, 50BF, 46BC, 81HBL2 and line check. Added Line Check on non-AR devices. Added 74CCS Close Circuit Supervision.
2014/06	2435H85008R7f-7d (7SR210)	Fault data transmitted over 103. Additional communications data control features, meters.
2015/06	2435H85008R8a-7f (7SR210)	Added Arc Flash Detector. Over current TM Setting Range extended.
2016/02	2435H85008R8b-7f (7SR210)	EN100+ Compatibility.
2017/08	2435H85008R8e-8a (7SR210)	Event Data on LCD.

© 2018 Siemens Protection Devices Limited

Contents

Document Release History 2

Software Revision History 2

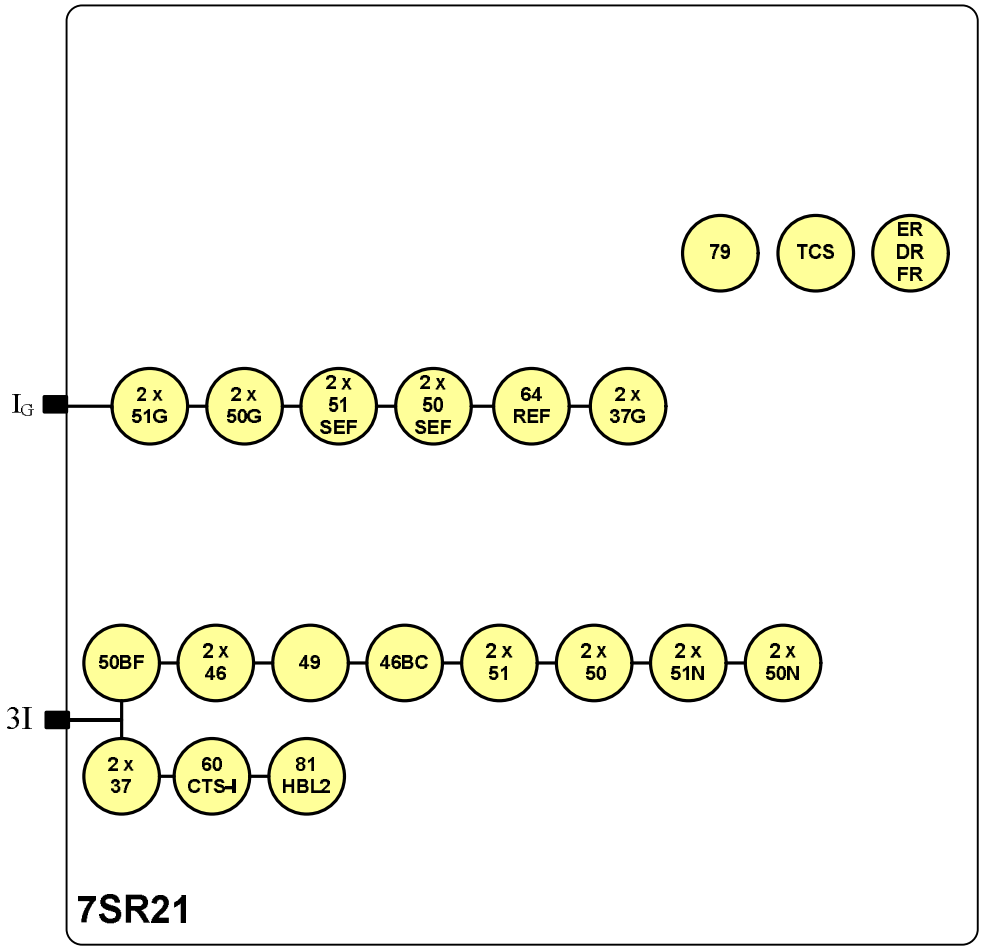
1. Function Diagram 4

2. Menu Structure 5

1. Relay Instrumentation 6

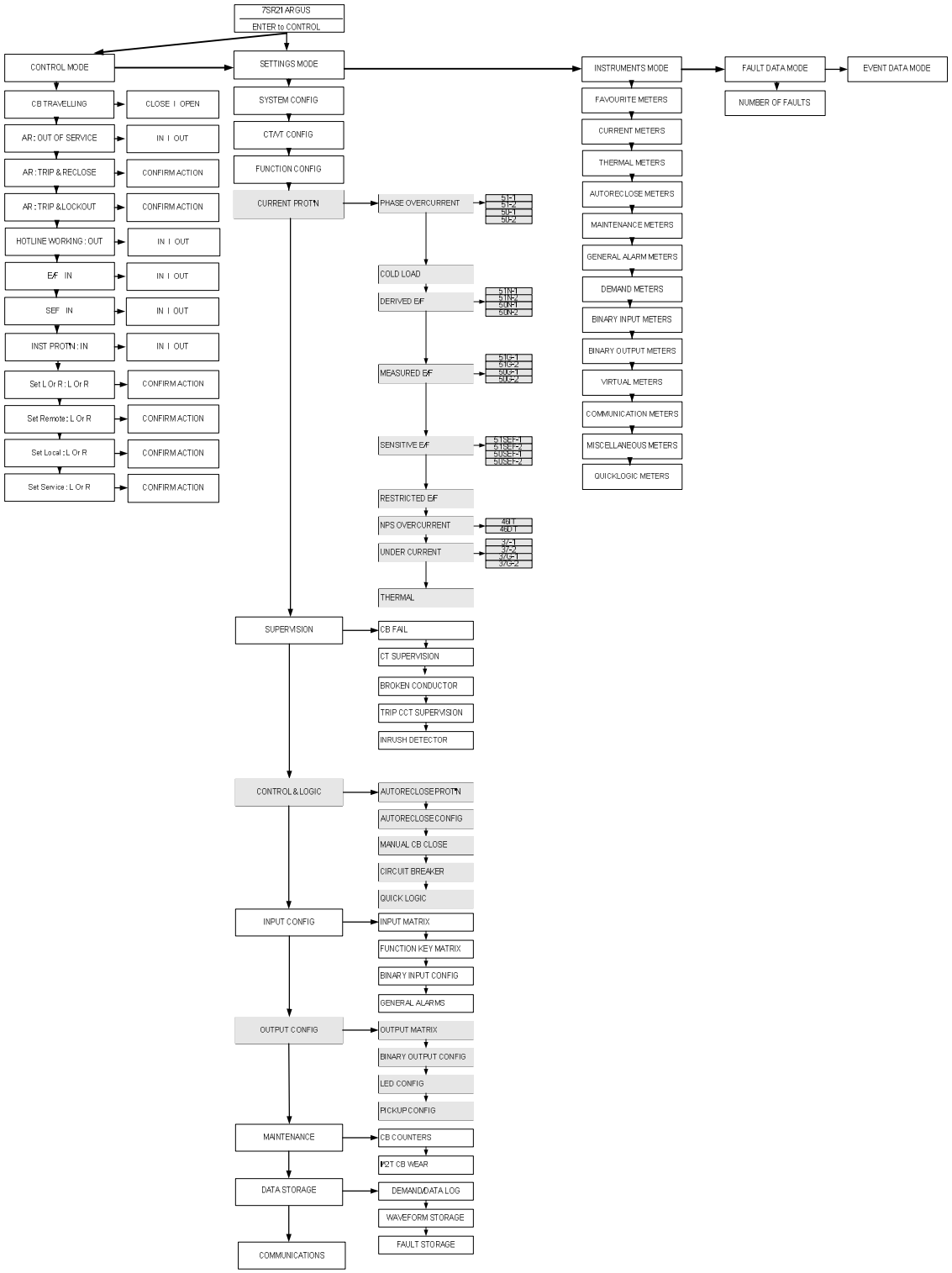
1.1. Favourite Meters 6
1.2. Current Meters 6
1.3. Thermal Meters 8
1.4. Auto-Reclose Meters 8
1.5. Maintenance Meters 8
1.6. General Alarm Meters 9
1.7. Demand Meters 9
1.8. Binary Input Meters 10
1.9. Binary Output Meters 11
1.10. Virtual Meters 11
1.11. Communication Meters 11
1.12. Miscellaneous Meters 12
1.13. Quick Logic Meters 12

1.Function Diagram



© 2018 Siemens Protection Devices Limited

2.Menu Structure



1. Relay Instrumentation

1.1. Favourite Meters

Instrument	Description
---------- FAVOURITE METERS > to view	This allows the user to view his previously constructed list of 'favourite meters' by pressing TEST/RESET ► button and the READ DOWN button to scroll though the meters added to this sub-group To construct a sub-group of favourite meters, first go to the desired meter then press ENTER this will cause a message to appear on the LCD 'Add To Favourites YES pressing ENTER again will add this to the FAVOURITE METERS Sub-menu. To remove a meter from the FAVOURITE METERS sub-menu go to that meter each in the FAVOURITE METERS sub-menu or at its Primary location press ENTER and the message 'Remove From Favourites' will appear press ENTER again and this meter will be removed from the FAVOURITE METERS sub-group

1.2. Current Meters

Instrument	Description
---------- CURRENT METERS > to view ----------	This is the sub-group that includes all the meters that are associated with Current TEST/RESET ► allows access to this sub-group
Primary Current Ia 0.00A Ib 0.00A Ic 0.00A	Displays the 3 phase currents Primary RMS values
Secondary Current Ia 0.00A Ib 0.00A Ic 0.00A	Displays the 3 phase currents Secondary RMS values
Nom Current Ia 0.00xIn ----° Ib 0.00xIn ----° Ic 0.00xIn ----°	Displays the 3 phase currents Nominal RMS values & phase angles with respect to PPS current.
Pri Earth Current In 0.000A Ig 0.000A	Displays the 3 Earth currents Primary RMS values
Sec Earth Current In 0.000A Ig 0.000A	Displays the 3 Earth currents Secondary RMS values
Nom Earth Current In 0.000xIn ----° Ig 0.000xIn ----°	Displays the 3 Earth currents Nominal RMS values & phase angles with respect to PPS current.
I Seq Components Izps 0.00xIn ----° Ipps 0.00xIn ----° Inps 0.00xIn ----°	Displays the Current Sequence components Nominal RMS values & phase angles with respect to PPS current.
2nd Harmonic Current Ia 0.00xIn Ib 0.00xIn Ic 0.00xIn	Displays the 3 phase currents 2nd Harmonic components Nominal RMS values.

© 2018 Siemens Protection Devices Limited

Instrument	Description
5th Harmonic Current Ia 0.00xIn Ib 0.00xIn Ic 0.00xIn	Displays the 3 phase currents 5th Harmonic components Nominal RMS values.
Last Trip P/F Ia 0.00A Ib 0.00A Ic 0.00A	Displays the Last Trip Fault Current..
Last Trip E/F In 0.00A Ig 0.00A	Displays the Last Trip Fault Current..

1.3. Thermal Meters

Instrument	Description
---------- THERMAL METERS > to view	This is the sub-group that includes all the meters that are associated with Thermal TEST/RESET ► allows access to this sub-group
Thermal Status Phase A 0.0% Phase B 0.0% Phase C 0.0%	Displays the thermal capacity

1.4. Auto-Reclose Meters

Instrument	Description
---------- AUTORECLOSE METERS > to view ----------	This is the sub-group that includes all the meters that are associated with Autoreclose TEST/RESET ► allows access to this sub-group. Only seen on models that have the 79 option
Autoreclose Status Out Of Service Close Shot 0	Status of the autoreclose.

1.5. Maintenance Meters

Instrument	Description
---------- MAINTENANCE METERS > to view ----------	This is the sub-group that includes all the meters that are associated with Maintenance TEST/RESET ► allows access to this sub-group
CB Total Trips Count 0 Target 100	Displays the number of CB trips experienced by the CB
CB Phase A Trips Count 0 Target 100	Displays the number of CB Phase A Trips experienced by the CB
CB Phase B Trips Count 0 Target 100	Displays the number of CB Phase B Trips experienced by the CB
CB Phase C Trips Count 0 Target 100	Displays the number of CB Phase C Trips experienced by the CB
CB Phase E/F Trips Count 0 Target 100	Displays the number of CB Phase E/F Trips experienced by the CB
CB Delta Trips Count 0 Target 100	Displays the number of CB trips experienced by the CB

© 2018 Siemens Protection Devices Limited

Instrument	Description
CB Count To AR Block Count 0 Target 100	Displays the number of CB trips experienced by the CB. When the target is reached the relay will only do 1 Delayed Trip to Lockout.
CB Freq Ops Count Count 0 Target 10	Displays the number of CB trips experienced by the CB over the last rolling 1 hr period. When the target is reached the relay will only do 1 Delayed Trip to Lockout.
CB Wear Phase A 0.00MA^2s Phase B 0.00MA^2s Phase C 0.00MA^2s	Displays the current measure of circuit breaker wear.
CB Wear Remaining Phase A 100% Phase B 100% Phase C 100%	Displays the current measure of circuit breaker wear remaining
CB Trip Time 0.0ms	Displays the trip time for the circuit breaker.

1.6. General Alarm Meters

Instrument	Description
---------- GENERAL ALARM METERS > to view ----------	This is the sub-group that includes all the meters that are associated with the Binary inputs TEST/RESET ► allows access to this sub-group
General Alarms ---------- ALARM 1 Cleared	Displays the state of General Alarm
…	
General Alarms ---------- ALARM 20 Cleared	

1.7. Demand Meters

Instrument	Description
---------- DEMAND METERS > to view ----------	This is the sub-group that includes all the meters that are associated with the demand metering. TEST/RESET ► allows access to this sub-group
I Phase A Demand Max 0.00A Min 0.00A Mean 0.00A	Shows the Max, Min and Mean for Phase A.
I Phase B Demand Max 0.00A Min 0.00A Mean 0.00A	Shows the Max, Min and Mean for Phase B.
I Phase C Demand	Shows the Max, Min and Mean for Phase C.

Instrument	Description
Max 0.00A Min 0.00A Mean 0.00A	
Power P 3P Demand Max 0.00W Min 0.00W Mean 0.00W	Shows the Max, Min and Mean for Power P 3P Demand.
Power Q 3P Demand Max 0.00VAr Min 0.00VAr Mean 0.00VAr	Shows the Max, Min and Mean for Power Q 3P Demand.
Power S 3P Demand Max 0.00VA Min 0.00VA Mean 0.00VA	Shows the Max, Min and Mean for Power S 3P Demand.

1.8. Binary Input Meters

Instrument	Description
---------- BINARY INPUT METERS > to view ----------	This is the sub-group that includes all the meters that are associated with the Binary inputs TEST/RESET ► allows access to this sub-group
BI 1-8 ---- ---- BI 9-16 ----.---- BI 17-24 ----.---- BI 25-32 ----.---- BI 33-39 ----.---	Displays the state of DC binary inputs 1 to 39 (The number of binary inputs may vary depending on model)

© 2018 Siemens Protection Devices Limited

1.9. Binary Output Meters

Instrument	Description
---------- BINARY OUTPUT METERS > to view ----------	This is the sub-group that includes all the meters that are associated with the Binary Outputs TEST/RESET ► allows access to this sub-group
BO 1-8 ---- ---- BO 9-16 ----.----	Displays the state of DC binary Outputs 1 to 16. (The number of binary outputs may vary depending on model)

1.10. Virtual Meters

Instrument	Description
---------- VIRTUAL METERS > to view ----------	This is the sub-group that shows the state of the virtual status inputs in the relay TEST/RESET ► allows access to this sub-group
V 1-8 ---- ---- V 9-16 ---- ----	Displays the state of Virtual Outputs 1 to 16 (The number of virtual inputs will vary depending on model)

1.11. Communication Meters

Instrument	Description
---------- COMMUNICATION METERS > to view ----------	This is the sub-group that includes all the meters that are associated with Communications ports TEST/RESET ► allows access to this sub-group
COM1 COM2 COM3 COM4	Displays which com ports are currently active
COM1 TRAFFIC Tx1 0 Rx1 0 Rx1 Errors 0	Displays traffic on Com1
COM2 TRAFFIC Tx2 0 Rx2 0 Rx2 Errors 0	Displays traffic on Com2
COM3 TRAFFIC Tx3 0 Rx3 0 Rx3 Errors 0	Displays traffic on Com3
COM4 TRAFFIC Tx4 0 Rx4 0 Rx4 Errors 0	Displays traffic on Com4

1.12. Miscellaneous Meters

Instrument	Description
---------- MISCELLANEOUS METERS > to view ----------	This is the sub-group that includes indication such as the relays time and date, the amount of fault and waveform records stored in the relay TEST/RESET ► allows access to this sub-group
Start Alarm Count 0 Target 100	This meter displays the Start Alarm count.
Hrs In Service Time Time 0Hrs	This meter displays the amount of time in service
Date 01/01/2000 Time 22:41:44 Waveform Recs 0 Fault Recs 0	This meter displays the Date, Time, the number of Waveform Records and Fault Records stored in the relay.
Event Recs 0 Data Log Recs 0 Settings Group 1	This meter displays the number of Event Records, Data Log Records and the Active Settings Group number stored in the relay.

1.13. Quick Logic Meters

Instrument	Description
---------- QUICK LOGIC METERS > to view ----------	This is the sub-group that includes all the meters that are associated with QuickLogic. TEST/RESET ► allows access to this sub-group
E 1-8 ---- ---- E 9-16 ---- ----	Shows the state of all the equations
E1 Equation EQN =0 TMR 0-0 =0 CNT 0-1 =0	Shows the state of an individual equation. EQN shows the equation state. TMR shows the timer progress and state for the equation. CNT shows the count progress and state for the equation.
…	
E16 Equation EQN =0 TMR 0-0 =0 CNT 0-1 =0	Shows the state of an individual equation. EQN shows the equation state. TMR shows the timer progress and state for the equation. CNT shows the count progress and state for the equation.

© 2018 Siemens Protection Devices Limited

7SR210 Non-Directional Relay
Settings Guide

Unrestricted The copyright and other intellectual property rights in this document, and in any model or article produced from it (and including any registered or unregistered design rights) are the property of Siemens Protection Devices Limited. No part of this document shall be reproduced or modified or stored in another form, in any data retrieval system, without the permission of Siemens Protection Devices Limited, nor shall any model or article be reproduced from this document unless Siemens Protection Devices Limited consent.

While the information and guidance given in this document is believed to be correct, no liability shall be accepted for any loss or damage caused by any error or omission, whether such error or omission is the result of negligence or any other cause. Any and all such liability is disclaimed.

© 2018 Siemens Protection Devices Limited

Document Release History

This document is issue 2017/12. The list of revisions up to and including this issue is: -

2011/05	First issue
2013/01	Typographical revisions and added data. Updated in line with software release.
2014/06	Typographical revisions and added data. Updated in line with software release.
2015/06	Typographical revisions and added data. Updated in line with software release.
2016/02	Typographical revisions and added data. Updated in line with software release.
2016/11	Typographical revisions and formatting
2017/08	Typographical revisions and added data. Updated in line with software release.
2017/12	Typographical revisions and added data.

Software Revision History

2011/05	2435H85008R7a-7a (7SR210)	First Release
2013/01	2435H85008R7c-7b (7SR210)	Introduced journaling file system. Added 61850 logical nodes for CB Counters, metering, 50BF, 46BC, 81HBL2 and line check. Added Line Check on non-AR devices. Added 74CCS Close Circuit Supervision.
2014/06	2435H85008R7f-7d (7SR210)	Fault data transmission over IEC 60870-5-103. Additional communications data, control features, meters.
2015/06	2435H85008R8a-7f (7SR210)	Added Arc Flash Detector. Over current TM Setting Range extended.
2016/02	2435H85008R8b-7f (7SR210) 2435H85009R8b-7f (7SR220)	EN100+ Compatibility.
2017/08	2435H85008R8e-8a (7SR210) 2435H85009R8e-8a (7SR220)	Added 32 Directional Power, 32S Sensitive Power, 55 Power Factor, 81HLB5 Overfluxing. Increased I/O.

© 2018 Siemens Protection Devices Limited

Contents

Document Release History 2

Software Revision History 2

1. Function Diagram 5

2. Menu Structure 6

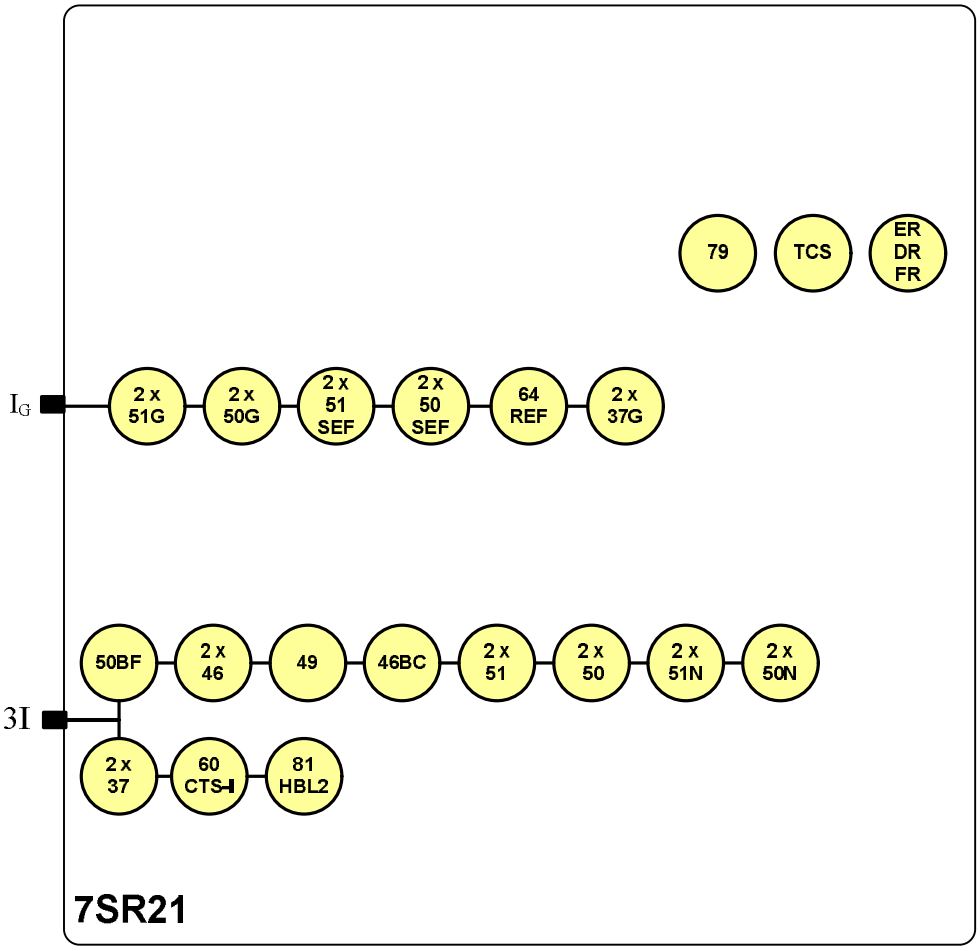
3. Relay Settings 7

3.1. System Config 7
3.2. CT/VT Config 8
3.3. Function Config 8
3.4. Current Protection 10
3.4.1. Phase Overcurrent 10
3.4.1.1. 51-1 10
3.4.1.2. 51-2 10
3.4.1.3. 50-1 11
3.4.1.4. 50-2 11
3.4.2. Cold Load 11
3.4.3. Derived E/F 12
3.4.3.1. 51N-1 12
3.4.3.2. 51N-2 13
3.4.3.3. 50N-1 13
3.4.3.4. 50N-2 13
3.4.4. Measured E/F 14
3.4.4.1. 51G-1 14
3.4.4.2. 51G-2 14
3.4.4.3. 50G-1 15
3.4.4.4. 50G-2 15
3.4.5. Sensitive E/F 15
3.4.5.1. 51SEF-1 15
3.4.5.2. 51SEF-2 16
3.4.5.3. 50SEF-1 16
3.4.5.4. 50SEF-2 16
3.4.6. Restricted E/F 17
3.4.7. NPS Overcurrent 17
3.4.7.1. 46IT 17
3.4.7.2. 46DT 17
3.4.8. Under Current 18
3.4.8.1. 37-1 18
3.4.8.2. 37-2 18
3.4.8.3. 37G-1 18
3.4.8.4. 37G-2 18
3.4.9. Thermal 19
3.4.10. ARC Flash Detector 19
3.5. Supervision 19
3.5.1. CB Fail 19
3.5.2. CT Supervision 19

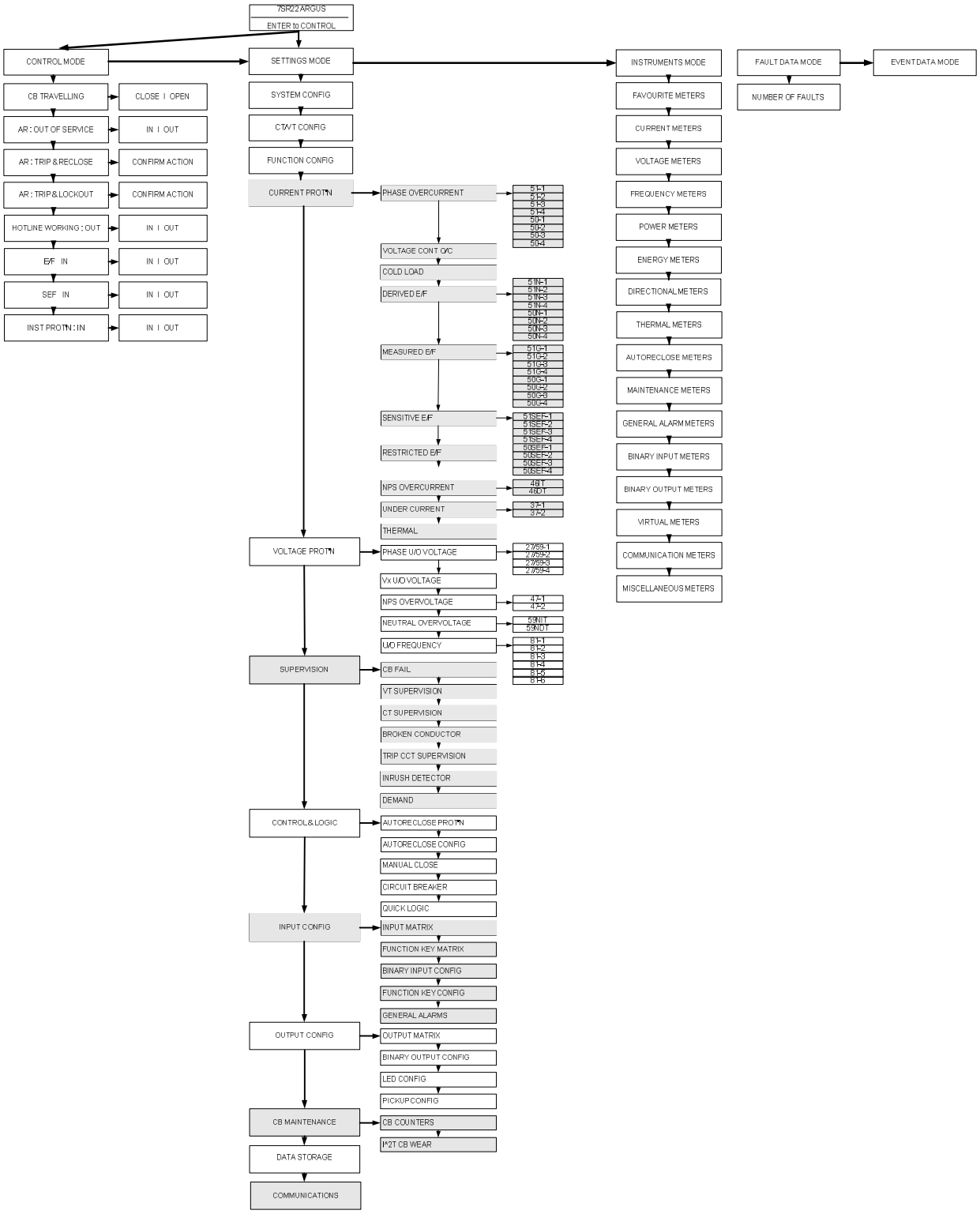
3.5.3. Broken Conductor 20
3.5.4. Trip CCT Supervision 20
3.5.5. Close CCT Supervision 20
3.5.6. Inrush Detector 21
3.6. Control & Logic 21
3.6.1. Autoreclose Prot'n 21
3.6.2. Autoreclose Config 22
3.6.2.1. P/F Shots 22
3.6.2.2. E/F Shots 23
3.6.2.3. SEF Shots 24
3.6.2.4. Extern Shots 24
3.6.3. Manual Close 24
3.6.4. Circuit Breaker 25
3.6.5. QUICK LOGIC 25
3.7. Input Config 33
3.7.1. Input Matrix 33
3.7.2. Binary Input Config 40
3.7.3. General Alarms 41
3.8. Output Config 42
3.8.1. Output Matrix 42
3.8.2. Binary Output Config 55
3.8.3. LED Config 56
3.8.4. Pickup Config 56
3.9. CB Maintenance 57
3.9.1. CB Counters 57
3.9.2. I^2T CB Wear 58
3.9.3. START COUNT 58
3.10. Data Storage 58
3.10.1. Demand Data/Log 58
3.10.2. Waveform Storage 59
3.10.3. Fault Storage 59
3.10.4. Event Storage 59
3.10.5. Communications 60

© 2018 Siemens Protection Devices Limited

1.Function Diagram



2.Menu Structure



© 2018 Siemens Protection Devices Limited

3.Relay Settings

3.1. System Config

Description	Range	Default
Active Group *Selects which settings group is currently activated*		
System Frequency *Selects the Power System Frequency from 50 or 60 Hz*	50, 60	50 Hz
View/Edit Group *Selects which settings group is currently being displayed*		
Setting Dependencies *When enabled only active settings are displayed and all others hidden*	Disabled, Enabled	Enabled
Favourite Meters Timer *Selects the time delay after which, if no key presses have been detected, the relay will begin to poll through any screens which have been selected as favourite instruments*	Off, 1, 2, 5, 10, 15, 30, 60	60 min
Backlight timer *Controls when the LCD backlight turns off*	Off, 1, 2, 5, 10, 15, 30, 60	5 min
Date *Sets the date, this setting can only be changed on the fascia or via Relay->Control->Set Time and Date*		
Time *Sets the time, this setting can only be changed on the fascia or via Relay->Control->Set Time and Date*		
Curr Set Display *Select whether the Pickup values are shown in terms of x Nominal, Primary or Secondary values on the Relay Fascia*	xNom, Primary, Secondary	xNom
E/F Curr Set Display *As Above*	xNom, Primary, Secondary	xNom
Select Grp Mode *Mode of operation of the group change from status input. Edge triggered ignores the status input once it has changed to the relevant group, where as with Level triggered the relay will only stay in the group it has changed to whilst the status input is being driven, after which it returns to the previous group.*	Edge triggered, Level triggered	Edge triggered
Clock Sync. From BI *Real time clock may be synchronised using a binary input (See Clock Sync. in Binary Input Menu)*	Disabled, Seconds, Minutes	Minutes
Operating Mode *Selects the current operating mode of the relay. This can also be changed by a binary input mode selection.*	Out Of Service, Local, Remote, Local Or Remote	Local Or Remote
Setting Password *Allows a 4 character alpha code to be entered as the password. Note that the display shows a password dependant encrypted code on the second line of the display*	(Password)	NONE
Control Password *As Above*	(Password)	NONE
Trip Alert *When Enabled the occurrence of a Trip will cause the relay to display the Trip Alert Screen, the only way to leave this screen is by acknowledging the trip through the TEST/RESET button on the relay fascia*	Disabled, Enabled	Enabled
General Alarm Alert	Disabled, Enabled	Enabled

Description	Range	Default
Relay Identifier *An alphanumeric string shown on the LCD normally used to identifier the circuit the relay is attached to or the relays purpose*	(16 Character String)	7SR210
Circuit Identifier	(16 Character String)	

3.2. CT/VT Config

Description	Range	Default
Phase Current Input *Selects whether 1 or 5 Amp terminals are being used for phase inputs*	1, 5	1 A
Phase CT Ratio Prim *Phase CT ratio to scale primary current instruments*	(6 Character String)	2000 A
Phase CT Ratio Sec *Phase CT ratio to scale secondary current instruments*	0.2, 0.21 ... 2, 2.1.....7	1
Earth Current Input *Selects whether 1 or 5 Amp terminals are being used for Measured Earth inputs*	1, 5	1 A
Earth CT Ratio Prim *Measured Earth CT ratio to scale primary current instruments*	(6 Character String)	2000 A
Earth CT Ratio Sec *Measured Earth CT ratio to scale secondary current instruments*	0.2, 0.21 ... 2, 2.1.....7	1

3.3. Function Config

Description	Range	Default
Gn Phase Overcurrent *When set to Disabled, no Phase Overcurrent elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn Cold Load *When set to Disabled, no Cold Load elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn Derived E/F *When set to Disabled, no Derived E/F elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn Measured E/F *When set to Disabled, no Measured E/F elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn Sensitive E/F *When set to Disabled, no Sensitive E/F elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn Restricted E/F *When set to Disabled, no Restricted E/F elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn NPS Overcurrent *When set to Disabled, no NPS Overcurrent elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled

© 2018 Siemens Protection Devices Limited

Description	Range	Default
Gn Under Current *When set to Disabled, no Under Current elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn Thermal *When set to Disabled, no Thermal elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn CT Supervision *When set to Disabled, no CT Supervision elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn CB Fail *When set to Disabled, no CB Fail elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn Broken Conductor *When set to Disabled, no Broken Conductor elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn Trip Cct Supervision *When set to Disabled, no Trip Cct Supervision elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn Close Cct Supervision *When set to Disabled, no Close Cct Supervision elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn Inrush Detector *When set to Disabled, no Inrush Detector elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn CB Counters *When set to Disabled, no Gn CB Counter elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn I^2t CB Wear *When set to Disabled, no Gn I^2t CB Wear elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn Arc Flash Detector *When set to Disabled, no Arc Flash Detector elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled

3.4. Current Protection

3.4.1. Phase Overcurrent

Description	Range	Default
Gn 51/50 Measurement *Selects whether the RMS value used by the 51 & 50 elements is True RMS or only calculated at fundamental frequency*	RMS, Fundamental	RMS

3.4.1.1. 51-1

Description	Range	Default
Gn 51-1 Element *Selects whether the 51-1 IDMTL Overcurrent element is enabled*	Disabled, Enabled	Disabled
Gn 51-1 Setting *Pickup level*	0.05, 0.06 ... 2.49, 2.5	1 xIn
Gn 51-1 Char *Selects characteristic curve to be IEC or ANSI IDMTL or DTL*	DTL, IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI	IEC-NI
Gn 51-1 Time Mult (IEC/ANSI) *Time multiplier (applicable to IEC and ANSI curves but not DTL selection)*	0.025, 0.03 ... 1.595, 1.6 , 1.7 ... 4.9, 5, 6 ... 100	1
Gn 51-1 Delay (DTL) *Delay (applicable only when DTL is selected for characteristic)*	0, 0.01 ... 19.99, 20	5 s
Gn 51-1 Min Operate Time *Minimum operate time of element.*	0, 0.01 ... 19.99, 20	0 s
Gn 51-1 Follower DTL *Additional definite time added after characteristic time*	0, 0.01 ... 19.99, 20	0 s
Gn 51-1 Reset *Selects between an ANSI decaying reset characteristic or a definite time reset*	(ANSI) Decaying, 0 ... 59, 60	0 s
Gn 51-1 Inrush Action *Selects if the 51-1 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off

3.4.1.2. 51-2

Description	Range	Default
Gn 51-2 Element *Selects whether the 51-2 IDMTL Overcurrent element is enabled*	Disabled, Enabled	Disabled
Gn 51-2 Setting *Pickup level*	0.05, 0.06 ... 2.49, 2.5	1 xIn
Gn 51-2 Char *Selects characteristic curve to be IEC or ANSI IDMTL or DTL*	DTL, IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI	IEC-NI
Gn 51-2 Time Mult (IEC/ANSI) *Time multiplier (applicable to IEC and ANSI curves but not DTL selection)*	0.025, 0.03 ... 1.595, 1.6 , 1.7 ... 4.9, 5, 6 ... 100	1
Gn 51-2 Delay (DTL) *Delay (applicable only when DTL is selected for characteristic)*	0, 0.01 ... 19.99, 20	5 s
Gn 51-2 Min Operate Time *Minimum operate time of element.*	0, 0.01 ... 19.99, 20	0 s
Gn 51-2 Follower DTL *Additional definite time added after characteristic time*	0, 0.01 ... 19.99, 20	0 s

© 2018 Siemens Protection Devices Limited

Description	Range	Default
Gn 51-2 Reset *Selects between an ANSI decaying reset characteristic or a definite time reset*	(ANSI) Decaying, 0 ... 59, 60	0 s
Gn 51-2 Inrush Action *Selects if the 51-2 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off

3.4.1.3. 50-1

Description	Range	Default
Gn 50-1 Element *Selects whether the INST/ DTL Overcurrent element is enabled*	Disabled, Enabled	Disabled
Gn 50-1 Setting *Pickup level*	0.05, 0.06 ... 49.5, 50	1 xIn
Gn 50-1 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0 s
Gn 50-1 Inrush Action *Selects if the 50-1 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off

3.4.1.4. 50-2

Description	Range	Default
Gn 50-2 Element *Selects whether the INST/ DTL Overcurrent element is enabled*	Disabled, Enabled	Disabled
Gn 50-2 Setting *Pickup level*	0.05, 0.06 ... 49.5, 50	1 xIn
Gn 50-2 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0 s
Gn 50-2 Inrush Action *Selects if the 50-2 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off

3.4.2. Cold Load

Description	Range	Default
Cold Load *Selects whether the Cold Load element is enabled*	Disabled, Enabled	Disabled
Pick-up Time *Cold Load operate time delay*	1, 1.1 ... 14100, 14400	600 s
Drop-off Time *Cold Load reset time delay*	1, 1.1 ... 14100, 14400	600 s
Reduced Current *Selects whether reduced current functionality is to be used*	Disabled, Enabled	Disabled
Reduced Current Level *Selects current level below which Reduced Current Time is used for Cold Load reset delay*	0.05, 0.1 ... 2.45, 2.5	0.25 xIn
Reduced Current Time *Cold Load reset time delay used when reduced current active*	1, 1.1 ... 14100, 14400	600 s
Gn 51c-1 Setting *51-1 element parameter used when Cold Load operates*	0.05, 0.06 ... 2.49, 2.5	1 xIn
Gn 51c-1 Char *51-1 element parameter used when Cold Load operates*	DTL, IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI	IEC-NI

Description	Range	Default
Gn 51c-1 Time Mult (IEC/ANSI) *51-1 element parameter used when Cold Load operates*	0.025, 0.03 ... 1.595, 1.6 , 1.7 ... 4.9, 5, 6 ... 100	1
Gn 51c-1 Delay (DTL) *51-1 element parameter used when Cold Load operates*	0, 0.01 ... 19.99, 20	5 s
Gn 51c-1 Min Operate Time *51-1 element parameter used when Cold Load operates*	0, 0.01 ... 19.99, 20	0 s
Gn 51c-1 Follower DTL *51-1 element parameter used when Cold Load operates*	0, 0.01 ... 19.99, 20	0 s
Gn 51c-1 Reset *51-1 element parameter used when Cold Load operates*	(ANSI) Decaying, 0 ... 59, 60	0 s
Gn 51c-2 Setting *51-2 element parameter used when Cold Load operates*	0.05, 0.06 ... 2.49, 2.5	1 xIn
Gn 51c-2 Char *51-2 element parameter used when Cold Load operates*	DTL, IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI	IEC-NI
Gn 51c-2 Time Mult (IEC/ANSI) *51-2 element parameter used when Cold Load operates*	0.025, 0.03 ... 1.595, 1.6 , 1.7 ... 4.9, 5, 6 ... 100	1
Gn 51c-2 Delay (DTL) *51-2 element parameter used when Cold Load operates*	0, 0.01 ... 19.99, 20	5 s
Gn 51c-2 Min Operate Time *51-2 element parameter used when Cold Load operates*	0, 0.01 ... 19.99, 20	0 s
Gn 51c-2 Follower DTL *51-2 element parameter used when Cold Load operates*	0, 0.01 ... 19.99, 20	0 s
Gn 51c-2 Reset *51-2 element parameter used when Cold Load operates*	(ANSI) Decaying, 0 ... 59, 60	0 s

3.4.3. Derived E/F

3.4.3.1. 51N-1

Description	Range	Default
Gn 51N-1 Element *Selects whether the 51N-1 IDMTL derived Earth Fault element is enabled*	Disabled, Enabled	Disabled
Gn 51N-1 Setting *Pickup level*	0.05, 0.06 ... 2.49, 2.5	0.5 xIn
Gn 51N-1 Char *Selects characteristic curve to be IEC or ANSI IDMTL or DTL*	DTL, IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI	IEC-NI
Gn 51N-1 Time Mult (IEC/ANSI) *Time multiplier (applicable to IEC and ANSI curves but not DTL selection)*	0.025, 0.03 ... 1.595, 1.6 , 1.7 ... 4.9, 5, 6 ... 100	1
Gn 51N-1 Delay (DTL) *Delay (applicable only when DTL is selected for characteristic)*	0, 0.01 ... 19.99, 20	5 s
Gn 51N-1 Min Operate Time *Minimum operate time of element.*	0, 0.01 ... 19.99, 20	0 s
Gn 51N-1 Follower DTL *Additional definite time added after characteristic time*	0, 0.01 ... 19.99, 20	0 s
Gn 51N-1 Reset *Selects between an ANSI decaying reset characteristic or a definite time reset*	(ANSI) Decaying, 0 ... 59, 60	0 s

© 2018 Siemens Protection Devices Limited

Description	Range	Default
Gn 51N-1 Inrush Action *Selects if the 51N-1 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off

3.4.3.2. 51N-2

Description	Range	Default
Gn 51N-2 Element *Selects whether the 51N-2 IDMTL derived Earth Fault element is enabled*	Disabled, Enabled	Disabled
Gn 51N-2 Setting *Pickup level*	0.05, 0.06 ... 2.49, 2.5	0.5 xIn
Gn 51N-2 Char *Selects characteristic curve to be IEC or ANSI IDMTL or DTL*	DTL, IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI	IEC-NI
Gn 51N-2 Time Mult (IEC/ANSI) *Time multiplier (applicable to IEC and ANSI curves but not DTL selection)*	0.025, 0.03 ... 1.595, 1.6 , 1.7 ... 4.9, 5, 6 ... 100	1
Gn 51N-2 Delay (DTL) *Delay (applicable only when DTL is selected for characteristic)*	0, 0.01 ... 19.99, 20	5 s
Gn 51N-2 Min Operate Time *Minimum operate time of element.*	0, 0.01 ... 19.99, 20	0 s
Gn 51N-2 Follower DTL *Additional definite time added after characteristic time*	0, 0.01 ... 19.99, 20	0 s
Gn 51N-2 Reset *Selects between an ANSI decaying reset characteristic or a definite time reset*	(ANSI) Decaying, 0 ... 59, 60	0 s
Gn 51N-2 Inrush Action *Selects if the 51N-2 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off

3.4.3.3. 50N-1

Description	Range	Default
Gn 50N-1 Element *Selects whether the DTL derived Earth fault element is enabled*	Disabled, Enabled	Disabled
Gn 50N-1 Setting *Pickup level*	0.05, 0.06 ... 49.5, 50	0.5 xIn
Gn 50N-1 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0 s
Gn 50N-1 Inrush Action *Selects if the 50N-1 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off

3.4.3.4. 50N-2

Description	Range	Default
Gn 50N-2 Element *Selects whether the DTL derived Earth fault element is enabled*	Disabled, Enabled	Disabled
Gn 50N-2 Setting *Pickup level*	0.05, 0.06 ... 49.5, 50	0.5 xIn
Gn 50N-2 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0 s
Gn 50N-2 Inrush Action *Selects if the 50N-2 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off

3.4.4. Measured E/F

Description	Range	Default
Gn 51G/50G Measurement *Selects whether the RMS value used by the 51G & 50G elements is True RMS or only calculated at fundamental frequency*	RMS, Fundamental	RMS

3.4.4.1. 51G-1

Description	Range	Default
Gn 51G-1 Element *Selects whether the 51G-1 IDMTL measured Earth Fault element is enabled*	Disabled, Enabled	Disabled
Gn 51G-1 Setting *Pickup level*	0.005, 0.006 ... 0.995, 1	0.5 xIn
Gn 51G-1 Char *Selects characteristic curve to be IEC or ANSI IDMTL or DTL*	DTL, IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI	IEC-NI
Gn 51G-1 Time Mult (IEC/ANSI) *Time multiplier (applicable to IEC and ANSI curves but not DTL selection)*	0.025, 0.03 ... 1.595, 1.6 , 1.7 ... 4.9, 5, 6 ... 100	1
Gn 51G-1 Delay (DTL) *Delay (applicable only when DTL is selected for characteristic)*	0, 0.01 ... 19.99, 20	5 s
Gn 51G-1 Min Operate Time *Minimum operate time of element.*	0, 0.01 ... 19.99, 20	0 s
Gn 51G-1 Follower DTL *Additional definite time added after characteristic time*	0, 0.01 ... 19.99, 20	0 s
Gn 51G-1 Reset *Selects between an ANSI decaying reset characteristic or DTL reset*	(ANSI) Decaying, 0 ... 59, 60	0 s
Gn 51G-1 Inrush Action *Selects if the 51G-1 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off

3.4.4.2. 51G-2

Description	Range	Default
Gn 51G-2 Element *Selects whether the 51G-2 IDMTL measured Earth Fault element is enabled*	Disabled, Enabled	Disabled
Gn 51G-2 Setting *Pickup level*	0.005, 0.006 ... 0.995, 1	0.5 xIn
Gn 51G-2 Char *Selects characteristic curve to be IEC or ANSI IDMTL or DTL*	DTL, IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI	IEC-NI
Gn 51G-2 Time Mult (IEC/ANSI) *Time multiplier (applicable to IEC and ANSI curves but not DTL selection)*	0.025, 0.03 ... 1.595, 1.6 , 1.7 ... 4.9, 5, 6 ... 100	1
Gn 51G-2 Delay (DTL) *Delay (applicable only when DTL is selected for characteristic)*	0, 0.01 ... 19.99, 20	5 s
Gn 51G-2 Min Operate Time *Minimum operate time of element.*	0, 0.01 ... 19.99, 20	0 s
Gn 51G-2 Follower DTL *Additional definite time added after characteristic time*	0, 0.01 ... 19.99, 20	0 s
Gn 51G-2 Reset *Selects between an ANSI decaying reset characteristic or DTL reset*	(ANSI) Decaying, 0 ... 59, 60	0 s

© 2018 Siemens Protection Devices Limited

Description	Range	Default
Gn 51G-2 Inrush Action *Selects if the 51G-2 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off

3.4.4.3. 50G-1

Description	Range	Default
Gn 50G-1 Element *Selects whether the DTL measured Earth fault element is enabled*	Disabled, Enabled	Disabled
Gn 50G-1 Setting *Pickup level*	0.005, 0.006 ... 24.95, 25	0.5 xIn
Gn 50G-1 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0 s
Gn 50G-1 Inrush Action *Selects if the 50G-1 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off

3.4.4.4. 50G-2

Description	Range	Default
Gn 50G-2 Element *Selects whether the DTL measured Earth fault element is enabled*	Disabled, Enabled	Disabled
Gn 50G-2 Setting *Pickup level*	0.005, 0.006 ... 24.95, 25	0.5 xIn
Gn 50G-2 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0 s
Gn 50G-2 Inrush Action *Selects if the 50G-2 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off

3.4.5. Sensitive E/F

3.4.5.1. 51SEF-1

Description	Range	Default
Gn 51SEF-1 Element *Selects whether the 51SEF-1 IDMTL Sensitive Earth Fault element is enabled*	Disabled, Enabled	Disabled
Gn 51SEF-1 Setting *Pickup level*	0.005, 0.006 ... 0.995, 1	0.2 xIn
Gn 51SEF-1 Char *Selects characteristic curve to be IEC or ANSI IDMTL or DTL*	DTL, IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI	IEC-NI
Gn 51SEF-1 Time Mult (IEC/ANSI) *Time multiplier (applicable to IEC and ANSI curves but not DTL selection)*	0.025, 0.03 ... 1.595, 1.6 , 1.7 ... 4.9, 5, 6 ... 100	1
Gn 51SEF-1 Delay (DTL) *Delay (applicable only when DTL is selected for characteristic)*	0, 0.01 ... 19.99, 20	5 s
Gn 51SEF-1 Min Operate Time *Minimum operate time of element.*	0, 0.01 ... 19.99, 20	0 s
Gn 51SEF-1 Follower DTL *Additional definite time added after characteristic time*	0, 0.01 ... 19.99, 20	0 s

Description	Range	Default
Gn 51SEF-1 Reset *Selects between an ANSI decaying reset characteristic or DTL reset*	(ANSI) Decaying, 0 ... 59, 60	0 s

3.4.5.2. 51SEF-2

Description	Range	Default
Gn 51SEF-2 Element *Selects whether the 51SEF-2 IDMTL derived Earth Fault element is enabled*	Disabled, Enabled	Disabled
Gn 51SEF-2 Setting *Pickup level*	0.005, 0.006 ... 0.995, 1	0.2 xIn
Gn 51SEF-2 Char *Selects characteristic curve to be IEC or ANSI IDMTL or DTL*	DTL, IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI	IEC-NI
Gn 51SEF-2 Time Mult (IEC/ANSI) *Time multiplier (applicable to IEC and ANSI curves but not DTL selection)*	0.025, 0.03 ... 1.595, 1.6 , 1.7 ... 4.9, 5, 6 ... 100	1
Gn 51SEF-2 Delay (DTL) *Delay (applicable only when DTL is selected for characteristic)*	0, 0.01 ... 19.99, 20	5 s
Gn 51SEF-2 Min Operate Time *Minimum operate time of element.*	0, 0.01 ... 19.99, 20	0 s
Gn 51SEF-2 Follower DTL *Additional definite time added after characteristic time*	0, 0.01 ... 19.99, 20	0 s
Gn 51SEF-2 Reset *Selects between an ANSI decaying reset characteristic or DTL reset*	(ANSI) Decaying, 0 ... 59, 60	0 s

3.4.5.3. 50SEF-1

Description	Range	Default
Gn 50SEF-1 Element *Selects whether the DTL measured Earth fault element is enabled*	Disabled, Enabled	Disabled
Gn 50SEF-1 Setting *Pickup level*	0.005, 0.006 ... 4.995, 5	0.2 xIn
Gn 50SEF-1 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0 s

3.4.5.4. 50SEF-2

Description	Range	Default
Gn 50SEF-2 Element *Selects whether the DTL measured Earth fault element is enabled*	Disabled, Enabled	Disabled
Gn 50SEF-2 Setting *Pickup level*	0.005, 0.006 ... 4.995, 5	0.2 xIn
Gn 50SEF-2 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0 s

© 2018 Siemens Protection Devices Limited

3.4.6. Restricted E/F

Description	Range	Default
Gn 64H Element *High impedance restricted earth fault current element*	Disabled, Enabled	Disabled
Gn 64H Setting *Pickup level*	0.005, 0.006 ... 0.945, 0.95	0.2 xIn
Gn 64H Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0 s

3.4.7. NPS Overcurrent

3.4.7.1. 46IT

Description	Range	Default
Gn 46IT Element *Selects whether the 46IT IDMTL/DTL negative phase sequence current element is enabled*	Disabled, Enabled	Disabled
Gn 46IT Setting *Pickup level*	0.05, 0.06 ... 2.49, 2.5	0.25 xIn
Gn 46IT Char *Selects characteristic curve to be IEC or ANSI IDMTL or DTL*	DTL, IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI	IEC-NI
Gn 46IT Time Mult (IEC/ANSI) *Time multiplier (applicable to IEC and ANSI curves but not DTL selection)*	0.025, 0.03 ... 1.595, 1.6 , 1.7 ... 4.9, 5, 6 ... 100	1
Gn 46IT Delay (DTL) *Delay (applicable only when DTL is selected for characteristic)*	0, 0.01 ... 19.99, 20	5 s
Gn 46IT Reset *Selects between an ANSI decaying reset characteristic or a definite time reset*	(ANSI) Decaying, 0 ... 59, 60	0 s

3.4.7.2. 46DT

Description	Range	Default
Gn 46DT Element *Selects whether the 46DT INST/DTL negative sequence current element is enabled*	Disabled, Enabled	Disabled
Gn 46DT Setting *Pickup level*	0.05, 0.06 ... 3.99, 4	0.1 xIn
Gn 46DT Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0.02 s

3.4.8. Under Current

3.4.8.1. 37-1

Description	Range	Default
Gn 37-1 Element *Phase under current element 37-1*	Disabled, Enabled	Disabled
Gn 37-1 Setting *Pickup level*	0.05, 0.1 ... 4.95, 5	0.25 xIn
Gn 37-1 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0 s

3.4.8.2. 37-2

Description	Range	Default
Gn 37-2 Element *Phase under current element 37-2*	Disabled, Enabled	Disabled
Gn 37-2 Setting *Pickup level*	0.05, 0.1 ... 4.95, 5	0.25 xIn
Gn 37-2 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0 s

3.4.8.3. 37G-1

Description	Range	Default
Gn 37G-1 Element	Disabled, Enabled	Disabled
Gn 37G-1 Setting	0.005, 0.006 ... 4.995, 5	0.2 xIn
Gn 37G-1 Delay	0, 0.01 ... 14300, 14400	0 s

3.4.8.4. 37G-2

Description	Range	Default
Gn 37G-2 Element	Disabled, Enabled	Disabled
Gn 37G-2 Setting	0.005, 0.006 ... 4.995, 5	0.2 xIn
Gn 37G-2 Delay	0, 0.01 ... 14300, 14400	0 s

© 2018 Siemens Protection Devices Limited

3.4.9. Thermal

Description	Range	Default
Gn 49 Thermal Overload *Selects whether the thermal overload protection element is enabled*	Disabled, Enabled	Disabled
Gn 49 Overload Setting *Pickup level*	0.1, 0.11 ... 2.99, 3	1.05 xIn
Gn 49 Time Constant (Minutes) *Thermal time constant*	1, 1.5 ... 999.5, 1000	10 minutes
Gn 49 Capacity Alarm *Selects whether thermal capacity alarm enabled*	Disabled, 50 ... 99, 100	Disabled
49 Reset Therm State *Control that allows thermal state to be manually reset*		

3.4.10. ARC Flash Detector

Description	Range	Default
Gn 50AFD *Selects whether the ARC Flash Detector element is enabled*	Disabled, Enabled	Disabled
Gn 50AFD Setting *Pickup level*	1, 2,...10	2 xIn

3.5. Supervision

3.5.1. CB Fail

Description	Range	Default
Gn 50BF Element *Selects whether the Circuit Breaker Fail element is enabled*	Disabled, Enabled	Disabled
Gn 50BF Setting *Breaker Fail Current Pickup level. If the current falls below this level then the CB is deemed to have opened and the element is reset.*	0.05, 0.055 ... 1.995, 2	0.2 xIn
Gn 50BF-I4 Setting	0.005, 0.01 ... 1.995, 2	0.05 xIn
Gn 50BF-1 Delay *Delay before Circuit Breaker Fail stage 1 operates*	20, 25 ... 59995, 60000	60 ms
Gn 50BF-2 Delay *Delay before Circuit Breaker Fail stage 2 operates*	20, 25 ... 59995, 60000	120 ms

3.5.2. CT Supervision

Description	Range	Default
Gn 60CTS-I Element	Disabled, Enabled	Disabled
Gn 60CTS-I Setting	0.05, 0.1 ... 1.95, 2	0.05 xIn
Gn 60CTS-I Delay	0.03, 0.04 ... 14300, 14400	10 s

3.5.3. Broken Conductor

Description	Range	Default
Gn 46BC U/C Guard Setting	0.05, 0.1 ... 4.95, 5	0.25 xIn
Gn 46BC U/C Guarded	No, Yes	No
Gn 46BC Element *Selects whether the definite time broken conductor element is enabled*	Disabled, Enabled	Disabled
Gn 46BC Setting *NPS Current to PPS Current ratio*	20, 21 ... 99, 100	20 %
Gn 46BC Delay *Sets operate delay time*	0.03, 0.04 ... 14300, 14400	20 s

3.5.4. Trip CCT Supervision

Description	Range	Default
Gn 74TCS-1 *Selects whether the trip circuit supervision element 74TCS-1 is enabled*	Disabled, Enabled	Disabled
Gn 74TCS-1 Delay *Time delay before trip circuit supervision operates*	0, 0.02 ... 59.98, 60	0.4 s
Gn 74TCS-2 *Selects whether the trip circuit supervision element 74TCS-2 is enabled*	Disabled, Enabled	Disabled
Gn 74TCS-2 Delay *Time delay before trip circuit supervision operates*	0, 0.02 ... 59.98, 60	0.4 s
Gn 74TCS-3 *Selects whether the trip circuit supervision element 74TCS-3 is enabled*	Disabled, Enabled	Disabled
Gn 74TCS-3 Delay *Time delay before trip circuit supervision operates*	0, 0.02 ... 59.98, 60	0.4 s

3.5.5. Close CCT Supervision

Description	Range	Default
Gn 74CCS-1 *Selects whether the trip circuit supervision element 74CCS-1 is enabled*	Disabled, Enabled	Disabled
Gn 74CCS-1 Delay *Time delay before trip circuit supervision operates*	0, 0.02 ... 59.98, 60	0.4 s
Gn 74CCS-2 *Selects whether the trip circuit supervision element 74CCS-2 is enabled*	Disabled, Enabled	Disabled
Gn 74CCS-2 Delay *Time delay before trip circuit supervision operates*	0, 0.02 ... 59.98, 60	0.4 s
Gn 74CCS-3 *Selects whether the trip circuit supervision element 74CCS-3 is enabled*	Disabled, Enabled	Disabled
Gn 74CCS-3 Delay *Time delay before trip circuit supervision operates*	0, 0.02 ... 59.98, 60	0.4 s

© 2018 Siemens Protection Devices Limited

3.5.6. Inrush Detector

Description	Range	Default
Gn 81HBL2 Element *Selects whether the phase inrush detector 81HBL2 is enabled*	Disabled, Enabled	Disabled
Gn 81HBL2 Bias *Selects the bias method used for magnetising inrush. Phase – Segregated, each phase blocks itself. Cross – Blocked, each phase can block the operation of other phases. Sum - Of Squares, each phase blocks itself using the square root of the sum of squares of the 2nd harmonic.*	Phase, Cross, Sum	Cross
Gn 81HBL2 Setting *The magnetising inrush detector operates when the 2nd harmonic current exceeds a set percentage of the fundamental current*	0.1, 0.11 ... 0.49, 0.5	0.2 xl

3.6. Control & Logic

3.6.1. Autoreclose Prot'n

Description	Range	Default
Gn 79 P/F Inst Trips *Selects which phase fault protection elements are classed as Instantaneous elements and start an autoreclose sequence. These will be blocked from operating during Delayed autoreclose sequences. See autoreclose section of manual for detail of what elements can cause only Delayed protection to be used.*	Combination of (51-1, 51-2, 50-1, 50-2)	----
Gn 79 E/F Inst Trips *Selects which earth fault protection elements are classed as Instantaneous elements and start an autoreclose sequence. These will be blocked from operating during Delayed autoreclose sequences. See autoreclose section of manual for detail of what elements can cause only Delayed protection to be used.*	Combination of (51N-1, 51N-2, 50N-1, 50N-2, 51G-1, 51G-2, 50G-1, 50G-2)	--------
Gn 79 SEF Inst Trips *Selects which sensitive earth fault protection elements are classed as Instantaneous elements and start an autoreclose sequence. These will be blocked from operating during Delayed autoreclose sequences. See autoreclose section of manual for detail of what elements can cause only Delayed protection to be used.*	Combination of (51SEF-1, 51SEF-2, 50SEF-1, 50SEF-2)	----
Gn 79 P/F Delayed Trips *Selects which phase fault protection are classed as Delayed elements, any selected elements operating will start an autoreclose sequence.*	Combination of (51-1, 51-2, 50-1, 50-2)	51-1, 51-2, 50-1, 50-2
Gn 79 E/F Delayed Trips *Selects which earth fault protection are classed as Delayed elements, any selected elements operating will start an autoreclose sequence.*	Combination of (51N-1, 51N-2, 50N-1, 50N-2, 51G-1, 51G-2, 50G-1, 50G-2)	51N-1, 51N-2, 50N-1, 50N-2, 51G-1, 51G-2, 50G-1, 50G-2
Gn 79 SEF Delayed Trips *Selects which sensitive earth fault elements are classed as Delayed elements, any selected elements operating will start an autoreclose sequence.*	Combination of (51SEF-1, 51SEF-2, 50SEF-1, 50SEF-2)	51SEF-1, 51SEF-2, 50SEF-1, 50SEF-2
Gn 79 P/F HS Trips *Selects which phase fault elements are classed as High Set elements, any selected elements operating will start an autoreclose sequence.*	Combination of (50-1, 50-2)	--
Gn 79 E/F HS Trips *Selects which earth fault elements are classed as High Set elements, any selected elements operating will start an autoreclose sequence.*	Combination of (50N-1, 50N-2, 50G-1, 50G-2)	----

3.6.2. Autoreclose Config

Description	Range	Default
Gn 79 Autoreclose *If disabled then all attempts to control the AR IN/OUT status will fail and the AR will be permanently Out Of Service. When enabled the AR IN/OUT state may be controlled via the CONTROL MODE menu option, via Binary Input or via local or remote communications.*	Disabled, Enabled	Disabled
Gn 79 Num Shots *Selects the number of auto-reclose attempts before the Autorecloser locks out*	1, 2, 3, 4	1
Gn 79 Retry Enable *Selects whether the Retry close functionality is enabled*	Disabled, Enabled	Disabled
Gn 79 Retry Attempts *Selects the number of retries allowed per shot*	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10	1
Gn 79 Retry Interval *Time delay between retries*	0, 1 ... 599, 600	60 s
Gn 79 Reclose Blocked Delay *Specifies the maximum time that the Autorecloser can be blocked before proceeding to the lockout state. (NOTE: The block delay timer only starts after the Deadtime.)*	0, 1 ... 599, 600	60 s
Gn 79 Sequence Fail Timer *Time before lockout occurs on an incomplete reclose sequence. (i.e Trip & starter conditions have not been cleared after Sequence Fail Time.)*	0, 1 ... 599, 600	60 s
Gn 79 Sequence Co-ord *Selects whether Sequence co-ordination functionality is used or not.*	Disabled, Enabled	Enabled
Gn 79 Cold Load Action *Selects whether the relay will perform Delayed Trips or not when Cold Load is active.*	Off, Delayed	Off

3.6.2.1. P/F Shots

Description	Range	Default
Gn 79 P/F Prot'n Trip 1 *Selects whether the first phase fault trip is Instantaneous (Fast) or Delayed. When set to Delayed all P/F Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Inst
Gn 79 P/F Deadtime 1 *Time period between the fault being cleared and the close pulse being issued*	0, 0.1 ... 14300, 14400	5 s
Gn 79 P/F Prot'n Trip 2 *Selects whether the second phase fault trip is Instantaneous (Fast) or Delayed. When set to Delayed all P/F Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Inst
Gn 79 P/F Deadtime 2 *Time period between the fault being cleared and the close pulse being issued*	0, 0.1 ... 14300, 14400	5 s
Gn 79 P/F Prot'n Trip 3 *Selects whether the third phase fault trip is Instantaneous (Fast) or Delayed. When set to Delayed all P/F Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Delayed
Gn 79 P/F Deadtime 3 *Time period between the fault being cleared and the close pulse being issued*	0, 0.1 ... 14300, 14400	5 s

© 2018 Siemens Protection Devices Limited

Description	Range	Default
Gn 79 P/F Prot'n Trip 4 *Selects whether the fourth phase fault trip is Instantaneous (Fast) or Delayed. When set to Delayed all P/F Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Delayed
Gn 79 P/F Deadtime 4 *Time period between the fault being cleared and the close pulse being issued*	0, 0.1 ... 14300, 14400	5 s
Gn 79 P/F Prot'n Trip 5 *Selects whether the fifth phase fault trip is Instantaneous (Fast) or Delayed. When set to Delayed all P/F Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Delayed
Gn 79 P/F HS Trips To Lockout *Selects how many High Set trips are allowed before going to Lockout*	1, 2, 3, 4, 5	5
Gn 79 P/F Delayed Trips To Lockout *Selects how many Delayed trips are allowed before going to Lockout*	1, 2, 3, 4, 5	5

3.6.2.2. E/F Shots

Description	Range	Default
Gn 79 E/F Prot'n Trip 1 *Selects whether the first earth fault trip is Instantaneous (Fast) or Delayed. When set to Delayed all E/F Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Inst
Gn 79 E/F Deadtime 1 *Time period between the fault being cleared and the close pulse being issued*	0, 0.1 ... 14300, 14400	5 s
Gn 79 E/F Prot'n Trip 2 *Selects whether the second earth fault trip is Instantaneous (Fast) or Delayed. When set to Delayed all E/F Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Inst
Gn 79 E/F Deadtime 2 *Time period between the fault being cleared and the close pulse being issued*	0, 0.1 ... 14300, 14400	5 s
Gn 79 E/F Prot'n Trip 3 *Selects whether the third earth fault trip is Instantaneous (Fast) or Delayed. When set to Delayed all E/F Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Delayed
Gn 79 E/F Deadtime 3 *Time period between the fault being cleared and the close pulse being issued*	0, 0.1 ... 14300, 14400	5 s
Gn 79 E/F Prot'n Trip 4 *Selects whether the fourth earth fault trip is Instantaneous (Fast) or Delayed. When set to Delayed all E/F Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Delayed
Gn 79 E/F Deadtime 4 *Time period between the fault being cleared and the close pulse being issued*	0, 0.1 ... 14300, 14400	5 s
Gn 79 E/F Prot'n Trip 5 *Selects whether the fifth earth fault trip is Instantaneous (Fast) or Delayed. When set to Delayed all E/F Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Delayed
Gn 79 E/F HS Trips To Lockout *Selects how many High Set trips are allowed before going to Lockout*	1, 2, 3, 4, 5	5
Gn 79 E/F Delayed Trips To Lockout *Selects how many Delayed trips are allowed before going to Lockout*	1, 2, 3, 4, 5	5

3.6.2.3. SEF Shots

Description	Range	Default
Gn 79 SEF Prot'n Trip 1 *Selects whether the first sensitive earth fault trip is Instantaneous or Delayed. When set to Delayed all SEF Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Inst
Gn 79 SEF Deadtime 1 *Time period between the fault being cleared and the close pulse being issued*	0, 0.1 ... 14300, 14400	5 s
Gn 79 SEF Prot'n Trip 2 *Selects whether the second sensitive earth fault trip is Instantaneous or Delayed. When set to Delayed all SEF Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Inst
Gn 79 SEF Deadtime 2 *Time period between the fault being cleared and the close pulse being issued*	0, 0.1 ... 14300, 14400	5 s
Gn 79 SEF Prot'n Trip 3 *Selects whether the third sensitive earth fault trip is Instantaneous or Delayed. When set to Delayed all SEF Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Delayed
Gn 79 SEF Deadtime 3 *Time period between the fault being cleared and the close pulse being issued*	0, 0.1 ... 14300, 14400	5 s
Gn 79 SEF Prot'n Trip 4 *Selects whether the fourth sensitive earth fault trip is Instantaneous or Delayed. When set to Delayed all SEF Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Delayed
Gn 79 SEF Deadtime 4 *Time period between the fault being cleared and the close pulse being issued*	0, 0.1 ... 14300, 14400	5 s
Gn 79 SEF Prot'n Trip 5 *Selects whether the fifth sensitive earth fault trip is Instantaneous or Delayed. When set to Delayed all SEF Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Delayed
Gn 79 SEF Delayed Trips To Lockout *Selects how many Delayed trips are allowed before going to Lockout*	1, 2, 3, 4, 5	5

3.6.2.4. Extern Shots

3.6.3. Manual Close

Description	Range	Default
Gn Line Check Trip *Selects whether line check trip is enabled, if enabled no AR sequence initiated*	Disabled, Enabled	Enabled
Gn P/F Line Check Trip *Selects whether a phase fault line check trip is Instantaneous (Fast) or Delayed. When set to Delayed all P/F Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Inst
Gn E/F Line Check Trip *Selects whether an earth fault line check trip is Instantaneous or Delayed. When set to Delayed all E/F Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Inst
Gn SEF Line Check Trip *Selects whether a sensitive earth fault line check trip is Instantaneous or Delayed. When set to Delayed all SEF Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Inst

© 2018 Siemens Protection Devices Limited

Description	Range	Default
Gn Extern Line Check Trip *Selects whether an external line check trip is Instantaneous (Fast) or Delayed*	Not Blocked, Blocked	Not Blocked
Gn Close CB Delay *Delay between a Close CB control being received and the Close CB contacts being operated to allow operator walk away.*	0, 0.1 ... 899, 900	10 s
Gn Blocked Close Delay *Selects the maximum time that the manual Close CB may be blocked by interlocking before the command or control is cancelled. The relay will signal "Blocked by Interlocking".*	0, 1 ... 599, 600	5 s
Gn Open CB Delay *Delay between an Open CB control being received and the Open CB contacts being operated.*	0, 0.1 ... 899, 900	10 s
Gn CB Controls Latched *Selects whether Binary Input triggers of Close CB and Open CB are latched.*	Latch, Reset	Latch

3.6.4. Circuit Breaker

Description	Range	Default
Gn Close CB Pulse *Specifies the duration of the circuit breaker close pulse*	0, 0.1 ... 19.9, 20	2 s
Gn Reclaim Timer *The period of time after a CB has closed and remained closed before the reclosure is deemed to be successful and the AR is re-initialised. If the CB remains open at the end of the reclaim time then the AR goes to lockout.*	0, 1 ... 599, 600	2 s
Gn Minimum LO Delay	0, 1 ... 599, 600	2 s
Gn Reset LO By Timer	Disabled, Enabled	Enabled
Gn Trip Time Alarm *An alarm is issued when the Trip time is exceeded*	0, 0.01 ... 1.99, 2	0.2 s
Gn Trip Time Adjust *Adjustment to take into account any binary input delays for Trip Time Alarm*	0, 0.005 ... 1.995, 2	0.015 s
Gn CB Travel Alarm *Selects the maximum time that the CB should take to either Open or Close before a failure is recorded.*	0.01, 0.02 ... 1.99, 2	1 s
Gn Open CB Pulse *Selects the maximum time of the Open CB pulse. If the CB is not closed when this timer expires then an alarm will be raised to signify failure to close.*	0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1, 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 2	1 s
Gn CB DBI Delay *Selects the Delay before relay goes to Lockout following a simultaneous Open and Close condition indication.*	0, 0.01, ... 1.1, 1.11 ... 2	0 s

3.6.5. QUICK LOGIC

Description	Range	Default
Quick Logic *Enable or Disable all logic equations*	Disabled, Enabled	Disabled
E1 Equation *Enable or Disable logic equation E1*	Disabled, Enabled	Disabled

Description	Range	Default
E1 *Specify logic equations of the form En = <Operand><Operator><Operand>using the following:0123456789=Digit() = Parenthesis! = NOT operation. = AND operation^ = EXCLUSIVE OR operationE(followed by a digit) = Equation numberF (Followed by a digit) = Function Key numberI(Followed by a digit) = Binary Input numberL(Followed by a digit) = LED numberO(Followed by a digit) = output relay numberV(Followed by a digit) =Virtual Input/Output number.ExamplesMake a function key LED toggle when function key is pressed (requires E1 to drive L11 in output matrix)E1 = F3^L11*	(20 Character String)	
E1 Pickup Delay *Time before equation output operates, after equation satisfied*	0, 0.01 ... 14300, 14400	0 s
E1 Dropoff Delay *Time before equation output resets, after equation nolonger satisfied*	0, 0.01 ... 14300, 14400	0 s
E1 Counter Target *Select number of times equation must be satisfied before equation output operates*	1, 2 ... 998, 999	1
E1 Counter Reset Mode *Select type of counter reset mode*	Off, Multi-shot, Single-shot	Off
E1 Counter Reset Time *Select counter reset time*	0, 0.01 ... 14300, 14400	0 s
E2 Equation *Enable or Disable logic equation E2*	Disabled, Enabled	Disabled
E2 *Specify logic equations of the form En = <Operand><Operator><Operand>using the following:0123456789=Digit() = Parenthesis! = NOT operation. = AND operation^ = EXCLUSIVE OR operationE(followed by a digit) = Equation numberF (Followed by a digit) = Function Key numberI(Followed by a digit) = Binary Input numberL(Followed by a digit) = LED numberO(Followed by a digit) = output relay numberV(Followed by a digit) =Virtual Input/Output number.ExamplesMake a function key LED toggle when function key is pressed (requires E1 to drive L11 in output matrix)E1 = F3^L11*	(20 Character String)	
E2 Pickup Delay *Time before equation output operates, after equation satisfied*	0, 0.01 ... 14300, 14400	0 s
E2 Dropoff Delay *Time before equation output resets, after equation nolonger satisfied*	0, 0.01 ... 14300, 14400	0 s
E2 Counter Target *Select number of times equation must be satisfied before equation output operates*	1, 2 ... 998, 999	1
E2 Counter Reset Mode *Select type of counter reset mode*	Off, Multi-shot, Single-shot	Off
E2 Counter Reset Time *Select counter reset time*	0, 0.01 ... 14300, 14400	0 s
E3 Equation *Enable or Disable logic equation E3*	Disabled, Enabled	Disabled
E3 *Specify logic equations of the form En = <Operand><Operator><Operand>using the following:0123456789=Digit() = Parenthesis! = NOT operation. = AND operation^ = EXCLUSIVE OR operationE(followed by a digit) = Equation numberF (Followed by a digit) = Function Key numberI(Followed by a digit) = Binary Input numberL(Followed by a digit) = LED numberO(Followed by a digit) = output relay numberV(Followed by a digit) =Virtual Input/Output number.ExamplesMake a function key LED toggle when function key is pressed (requires E1 to drive L11 in output matrix)E1 = F3^L11*	(20 Character String)	

© 2018 Siemens Protection Devices Limited

Description	Range	Default
E3 Pickup Delay *Time before equation output operates, after equation satisfied*	0, 0.01 ... 14300, 14400	0 s
E3 Dropoff Delay *Time before equation output resets, after equation nolonger satisfied*	0, 0.01 ... 14300, 14400	0 s
E3 Counter Target *Select number of times equation must be satisfied before equation output operates*	1, 2 ... 998, 999	1
E3 Counter Reset Mode *Select type of counter reset mode*	Off, Multi-shot, Single-shot	Off
E3 Counter Reset Time *Select counter reset time*	0, 0.01 ... 14300, 14400	0 s
E4 Equation *Enable or Disable logic equation E4*	Disabled, Enabled	Disabled
E4 *Specify logic equations of the form En = <Operand><Operator><Operand>using the following:0123456789=Digit() = Parenthesis! = NOT operation. = AND operation^ = EXCLUSIVE OR operationE(followed by a digit) = Equation numberF (Followed by a digit) = Function Key numberI(Followed by a digit) = Binary Input numberL(Followed by a digit) = LED numberO(Followed by a digit) = output relay numberV(Followed by a digit) =Virtual Input/Output number.ExamplesMake a function key LED toggle when function key is pressed (requires E1 to drive L11 in output matrix)E1 = F3^L11*	(20 Character String)	
E4 Pickup Delay *Time before equation output operates, after equation satisfied*	0, 0.01 ... 14300, 14400	0 s
E4 Dropoff Delay *Time before equation output resets, after equation nolonger satisfied*	0, 0.01 ... 14300, 14400	0 s
E4 Counter Target *Select number of times equation must be satisfied before equation output operates*	1, 2 ... 998, 999	1
E4 Counter Reset Mode *Select type of counter reset mode*	Off, Multi-shot, Single-shot	Off
E4 Counter Reset Time *Select counter reset time*	0, 0.01 ... 14300, 14400	0 s
E5 Equation *Enable or Disable logic equation E5*	Disabled, Enabled	Disabled
E5 *Specify logic equations of the form En = <Operand><Operator><Operand>using the following:0123456789=Digit() = Parenthesis! = NOT operation. = AND operation^ = EXCLUSIVE OR operationE(followed by a digit) = Equation numberF (Followed by a digit) = Function Key numberI(Followed by a digit) = Binary Input numberL(Followed by a digit) = LED numberO(Followed by a digit) = output relay numberV(Followed by a digit) =Virtual Input/Output number.ExamplesMake a function key LED toggle when function key is pressed (requires E1 to drive L11 in output matrix)E1 = F3^L11*	(20 Character String)	
E5 Pickup Delay *Time before equation output operates, after equation satisfied*	0, 0.01 ... 14300, 14400	0 s
E5 Dropoff Delay *Time before equation output resets, after equation nolonger satisfied*	0, 0.01 ... 14300, 14400	0 s
E5 Counter Target *Select number of times equation must be satisfied before equation output operates*	1, 2 ... 998, 999	1

Description	Range	Default
E5 Counter Reset Mode *Select type of counter reset mode*	Off, Multi-shot, Single-shot	Off
E5 Counter Reset Time *Select counter reset time*	0, 0.01 ... 14300, 14400	0 s
E6 Equation *Enable or Disable logic equation E6*	Disabled, Enabled	Disabled
E6 *Specify logic equations of the form En = <Operand><Operator><Operand>using the following:0123456789=Digit() = Parenthesis! = NOT operation. = AND operation^ = EXCLUSIVE OR operationE(followed by a digit) = Equation numberF (Followed by a digit) = Function Key numberI(Followed by a digit) = Binary Input numberL(Followed by a digit) = LED numberO(Followed by a digit) = output relay numberV(Followed by a digit) =Virtual Input/Output number.ExamplesMake a function key LED toggle when function key is pressed (requires E1 to drive L11 in output matrix)E1 = F3^L11*	(20 Character String)	
E6 Pickup Delay *Time before equation output operates, after equation satisfied*	0, 0.01 ... 14300, 14400	0 s
E6 Dropoff Delay *Time before equation output resets, after equation nolonger satisfied*	0, 0.01 ... 14300, 14400	0 s
E6 Counter Target *Select number of times equation must be satisfied before equation output operates*	1, 2 ... 998, 999	1
E6 Counter Reset Mode *Select type of counter reset mode*	Off, Multi-shot, Single-shot	Off
E6 Counter Reset Time *Select counter reset time*	0, 0.01 ... 14300, 14400	0 s
E7 Equation *Enable or Disable logic equation E7*	Disabled, Enabled	Disabled
E7 *Specify logic equations of the form En = <Operand><Operator><Operand>using the following:0123456789=Digit() = Parenthesis! = NOT operation. = AND operation^ = EXCLUSIVE OR operationE(followed by a digit) = Equation numberF (Followed by a digit) = Function Key numberI(Followed by a digit) = Binary Input numberL(Followed by a digit) = LED numberO(Followed by a digit) = output relay numberV(Followed by a digit) =Virtual Input/Output number.ExamplesMake a function key LED toggle when function key is pressed (requires E1 to drive L11 in output matrix)E1 = F3^L11*	(20 Character String)	
E7 Pickup Delay *Time before equation output operates, after equation satisfied*	0, 0.01 ... 14300, 14400	0 s
E7 Dropoff Delay *Time before equation output resets, after equation nolonger satisfied*	0, 0.01 ... 14300, 14400	0 s
E7 Counter Target *Select number of times equation must be satisfied before equation output operates*	1, 2 ... 998, 999	1
E7 Counter Reset Mode *Select type of counter reset mode*	Off, Multi-shot, Single-shot	Off
E7 Counter Reset Time *Select counter reset time*	0, 0.01 ... 14300, 14400	0 s
E8 Equation *Enable or Disable logic equation E8*	Disabled, Enabled	Disabled

© 2018 Siemens Protection Devices Limited

Description	Range	Default
E8 *Specify logic equations of the form En = <Operand><Operator><Operand>using the following:0123456789=Digit() = Parenthesis! = NOT operation. = AND operation^ = EXCLUSIVE OR operationE(followed by a digit) = Equation numberF (Followed by a digit) = Function Key numberI(Followed by a digit) = Binary Input numberL(Followed by a digit) = LED numberO(Followed by a digit) = output relay numberV(Followed by a digit) =Virtual Input/Output number.ExamplesMake a function key LED toggle when function key is pressed (requires E1 to drive L11 in output matrix)E1 = F3^L11*	(20 Character String)	
E8 Pickup Delay *Time before equation output operates, after equation satisfied*	0, 0.01 ... 14300, 14400	0 s
E8 Dropoff Delay *Time before equation output resets, after equation nolonger satisfied*	0, 0.01 ... 14300, 14400	0 s
E8 Counter Target *Select number of times equation must be satisfied before equation output operates*	1, 2 ... 998, 999	1
E8 Counter Reset Mode *Select type of counter reset mode*	Off, Multi-shot, Single-shot	Off
E8 Counter Reset Time *Select counter reset time*	0, 0.01 ... 14300, 14400	0 s
E9 Equation *Enable or Disable logic equation E9*	Disabled, Enabled	Disabled
E9 *Specify logic equations of the form En = <Operand><Operator><Operand>using the following:0123456789=Digit() = Parenthesis! = NOT operation. = AND operation^ = EXCLUSIVE OR operationE(followed by a digit) = Equation numberF (Followed by a digit) = Function Key numberI(Followed by a digit) = Binary Input numberL(Followed by a digit) = LED numberO(Followed by a digit) = output relay numberV(Followed by a digit) =Virtual Input/Output number.ExamplesMake a function key LED toggle when function key is pressed (requires E1 to drive L11 in output matrix)E1 = F3^L11*	(20 Character String)	
E9 Pickup Delay *Time before equation output operates, after equation satisfied*	0, 0.01 ... 14300, 14400	0 s
E9 Dropoff Delay *Time before equation output resets, after equation nolonger satisfied*	0, 0.01 ... 14300, 14400	0 s
E9 Counter Target *Select number of times equation must be satisfied before equation output operates*	1, 2 ... 998, 999	1
E9 Counter Reset Mode *Select type of counter reset mode*	Off, Multi-shot, Single-shot	Off
E9 Counter Reset Time *Select counter reset time*	0, 0.01 ... 14300, 14400	0 s
E10 Equation *Enable or Disable logic equation E10*	Disabled, Enabled	Disabled
E10 *Specify logic equations of the form En = <Operand><Operator><Operand>using the following:0123456789=Digit() = Parenthesis! = NOT operation. = AND operation^ = EXCLUSIVE OR operationE(followed by a digit) = Equation numberF (Followed by a digit) = Function Key numberI(Followed by a digit) = Binary Input numberL(Followed by a digit) = LED numberO(Followed by a digit) = output relay numberV(Followed by a digit) =Virtual Input/Output number.ExamplesMake a function key LED toggle when function key is pressed (requires E1 to drive L11 in output matrix)E1 = F3^L11*	(20 Character String)	

Description	Range	Default
E10 Pickup Delay *Time before equation output operates, after equation satisfied*	0, 0.01 ... 14300, 14400	0 s
E10 Dropoff Delay *Time before equation output resets, after equation nolonger satisfied*	0, 0.01 ... 14300, 14400	0 s
E10 Counter Target *Select number of times equation must be satisfied before equation output operates*	1, 2 ... 998, 999	1
E10 Counter Reset Mode *Select type of counter reset mode*	Off, Multi-shot, Single-shot	Off
E10 Counter Reset Time *Select counter reset time*	0, 0.01 ... 14300, 14400	0 s
E11 Equation *Enable or Disable logic equation E11*	Disabled, Enabled	Disabled
E11 *Specify logic equations of the form En = <Operand><Operator><Operand>using the following:0123456789=Digit() = Parenthesis! = NOT operation. = AND operation^ = EXCLUSIVE OR operationE(followed by a digit) = Equation numberF (Followed by a digit) = Function Key numberI(Followed by a digit) = Binary Input numberL(Followed by a digit) = LED numberO(Followed by a digit) = output relay numberV(Followed by a digit) =Virtual Input/Output number.ExamplesMake a function key LED toggle when function key is pressed (requires E1 to drive L11 in output matrix)E1 = F3^L11*	(20 Character String)	
E11 Pickup Delay *Time before equation output operates, after equation satisfied*	0, 0.01 ... 14300, 14400	0 s
E11 Dropoff Delay *Time before equation output resets, after equation nolonger satisfied*	0, 0.01 ... 14300, 14400	0 s
E11 Counter Target *Select number of times equation must be satisfied before equation output operates*	1, 2 ... 998, 999	1
E11 Counter Reset Mode *Select type of counter reset mode*	Off, Multi-shot, Single-shot	Off
E11 Counter Reset Time *Select counter reset time*	0, 0.01 ... 14300, 14400	0 s
E12 Equation *Enable or Disable logic equation E12*	Disabled, Enabled	Disabled
E12 *Specify logic equations of the form En = <Operand><Operator><Operand>using the following:0123456789=Digit() = Parenthesis! = NOT operation. = AND operation^ = EXCLUSIVE OR operationE(followed by a digit) = Equation numberF (Followed by a digit) = Function Key numberI(Followed by a digit) = Binary Input numberL(Followed by a digit) = LED numberO(Followed by a digit) = output relay numberV(Followed by a digit) =Virtual Input/Output number.ExamplesMake a function key LED toggle when function key is pressed (requires E1 to drive L11 in output matrix)E1 = F3^L11*	(20 Character String)	
E12 Pickup Delay *Time before equation output operates, after equation satisfied*	0, 0.01 ... 14300, 14400	0 s
E12 Dropoff Delay *Time before equation output resets, after equation nolonger satisfied*	0, 0.01 ... 14300, 14400	0 s
E12 Counter Target *Select number of times equation must be satisfied before equation output operates*	1, 2 ... 998, 999	1

© 2018 Siemens Protection Devices Limited

Description	Range	Default
E12 Counter Reset Mode *Select type of counter reset mode*	Off, Multi-shot, Single-shot	Off
E12 Counter Reset Time *Select counter reset time*	0, 0.01 ... 14300, 14400	0 s
E13 Equation *Enable or Disable logic equation E13*	Disabled, Enabled	Disabled
E13 *Specify logic equations of the form En = <Operand><Operator><Operand>using the following:0123456789=Digit() = Parenthesis! = NOT operation. = AND operation^ = EXCLUSIVE OR operationE(followed by a digit) = Equation numberF (Followed by a digit) = Function Key numberI(Followed by a digit) = Binary Input numberL(Followed by a digit) = LED numberO(Followed by a digit) = output relay numberV(Followed by a digit) =Virtual Input/Output number.ExamplesMake a function key LED toggle when function key is pressed (requires E1 to drive L11 in output matrix)E1 = F3^L11*	(20 Character String)	
E13 Pickup Delay *Time before equation output operates, after equation satisfied*	0, 0.01 ... 14300, 14400	0 s
E13 Dropoff Delay *Time before equation output resets, after equation nolonger satisfied*	0, 0.01 ... 14300, 14400	0 s
E13 Counter Target *Select number of times equation must be satisfied before equation output operates*	1, 2 ... 998, 999	1
E13 Counter Reset Mode *Select type of counter reset mode*	Off, Multi-shot, Single-shot	Off
E13 Counter Reset Time *Select counter reset time*	0, 0.01 ... 14300, 14400	0 s
E14 Equation *Enable or Disable logic equation E14*	Disabled, Enabled	Disabled
E14 *Specify logic equations of the form En = <Operand><Operator><Operand>using the following:0123456789=Digit() = Parenthesis! = NOT operation. = AND operation^ = EXCLUSIVE OR operationE(followed by a digit) = Equation numberF (Followed by a digit) = Function Key numberI(Followed by a digit) = Binary Input numberL(Followed by a digit) = LED numberO(Followed by a digit) = output relay numberV(Followed by a digit) =Virtual Input/Output number.ExamplesMake a function key LED toggle when function key is pressed (requires E1 to drive L11 in output matrix)E1 = F3^L11*	(20 Character String)	
E14 Pickup Delay *Time before equation output operates, after equation satisfied*	0, 0.01 ... 14300, 14400	0 s
E14 Dropoff Delay *Time before equation output resets, after equation nolonger satisfied*	0, 0.01 ... 14300, 14400	0 s
E14 Counter Target *Select number of times equation must be satisfied before equation output operates*	1, 2 ... 998, 999	1
E14 Counter Reset Mode *Select type of counter reset mode*	Off, Multi-shot, Single-shot	Off
E14 Counter Reset Time *Select counter reset time*	0, 0.01 ... 14300, 14400	0 s
E15 Equation *Enable or Disable logic equation E15*	Disabled, Enabled	Disabled

Description	Range	Default
E15 *Specify logic equations of the form En = <Operand><Operator><Operand>using the following:0123456789=Digit() = Parenthesis! = NOT operation. = AND operation^ = EXCLUSIVE OR operationE(followed by a digit) = Equation numberF (Followed by a digit) = Function Key numberI(Followed by a digit) = Binary Input numberL(Followed by a digit) = LED numberO(Followed by a digit) = output relay numberV(Followed by a digit) =Virtual Input/Output number.ExamplesMake a function key LED toggle when function key is pressed (requires E1 to drive L11 in output matrix)E1 = F3^L11*	(20 Character String)	
E15 Pickup Delay *Time before equation output operates, after equation satisfied*	0, 0.01 ... 14300, 14400	0 s
E15 Dropoff Delay *Time before equation output resets, after equation nolonger satisfied*	0, 0.01 ... 14300, 14400	0 s
E15 Counter Target *Select number of times equation must be satisfied before equation output operates*	1, 2 ... 998, 999	1
E15 Counter Reset Mode *Select type of counter reset mode*	Off, Multi-shot, Single-shot	Off
E15 Counter Reset Time *Select counter reset time*	0, 0.01 ... 14300, 14400	0 s
E16 Equation *Enable or Disable logic equation E16*	Disabled, Enabled	Disabled
E16 *Specify logic equations of the form En = <Operand><Operator><Operand>using the following:0123456789=Digit() = Parenthesis! = NOT operation. = AND operation^ = EXCLUSIVE OR operationE(followed by a digit) = Equation numberF (Followed by a digit) = Function Key numberI(Followed by a digit) = Binary Input numberL(Followed by a digit) = LED numberO(Followed by a digit) = output relay numberV(Followed by a digit) =Virtual Input/Output number.ExamplesMake a function key LED toggle when function key is pressed (requires E1 to drive L11 in output matrix)E1 = F3^L11*	(20 Character String)	
E16 Pickup Delay *Time before equation output operates, after equation satisfied*	0, 0.01 ... 14300, 14400	0 s
E16 Dropoff Delay *Time before equation output resets, after equation nolonger satisfied*	0, 0.01 ... 14300, 14400	0 s
E16 Counter Target *Select number of times equation must be satisfied before equation output operates*	1, 2 ... 998, 999	1
E16 Counter Reset Mode *Select type of counter reset mode*	Off, Multi-shot, Single-shot	Off
E16 Counter Reset Time *Select counter reset time*	0, 0.01 ... 14300, 14400	0 s

© 2018 Siemens Protection Devices Limited

3.7. Input Config

3.7.1. Input Matrix

Description	Range	Default
Inhibit Cold Load	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ---
Inhibit 51-1 *Selects which inputs inhibit the 51-1 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ---
Inhibit 51-2 *Selects which inputs inhibit the 51-2 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ---
Inhibit 50-1 *Selects which inputs inhibit the 50-1 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ---
Inhibit 50-2 *Selects which inputs inhibit the 50-2 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ---
Inhibit 51N-1 *Selects which inputs inhibit the 51N-1 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ---
Inhibit 51N-2 *Selects which inputs inhibit the 51N-2 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ---
Inhibit 50N-1 *Selects which inputs inhibit the 50N-1 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ---
Inhibit 50N-2 *Selects which inputs inhibit the 50N-2 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ---
Inhibit 51G-1 *Selects which inputs inhibit the 51G-1 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ---
Inhibit 51G-2 *Selects which inputs inhibit the 51G-2 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ---
Inhibit 50G-1 *Selects which inputs inhibit the 50G-1 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ---
Inhibit 50G-2 *Selects which inputs inhibit the 50G-2 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ---
Inhibit 51SEF-1 *Selects which inputs inhibit the 51SEF-1 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ---

Description	Range	Default
Inhibit 51SEF-2 *Selects which inputs inhibit the 51SEF-2 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 50SEF-1 *Selects which inputs inhibit the 50SEF-1 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 50SEF-2 *Selects which inputs inhibit the 50SEF-2 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 64H *Selects which inputs inhibit the 64H element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 46IT *Selects which inputs inhibit the 46IT element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 46DT *Selects which inputs inhibit the 46DT element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 37-1 *Selects which inputs inhibit the 37-1 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 37-2 *Selects which inputs inhibit the 37-2 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 37G-1	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 37G-2	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 49 *Selects which inputs inhibit the 49 thermal element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Reset 49 *Selects which inputs resets the 49 thermal model element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 60CTS-I	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 46BC *Selects which inputs inhibit the 46 Broken Conductor element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
74TCS-1 *Selects which inputs are monitoring trip circuits*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
74TCS-2 *As Above*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------

© 2018 Siemens Protection Devices Limited

Description	Range	Default
74TCS-3 *As Above*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ---
74CCS-1 *Selects which inputs are monitoring trip circuits*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ---
74CCS-2 *As Above*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ---
74CCS-3 *As Above*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ---
Trig Trip Contacts *Selects which inputs will trigger the Trip contacts*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ---
Inhibit 50BF *Selects which inputs inhibit the 50BF element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ---
50BF CB Faulty *Selects which input bypasses the 50BF timer due to a fault CB*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ---
50BF Mech Trip *Selects which input allows a mechanical trip to start the 50BF element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ---
50BF Ext Trip *Selects which inputs can also start the 50BF element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ---
Reset CB Total Trip *Selects which inputs Reset the CB Total Trip count*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ---
Reset CB Delta Trip *Selects which inputs Reset the CB Delta Trip count*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ---
Reset ARBlock Count *Selects which inputs Reset the AR Block count*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ---
Reset Freq Ops Count *Selects which inputs Reset the Frequent Ops count*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ---
Reset I^2t CB Wear *Selects which inputs Reset the I^2t CB Wear element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ---
Trigger I^2t CB Wear *Selects which inputs will cause an external trigger of the I^2t CB Wear element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ---
Reset Trip Time *Selects which inputs will reset the CB trip time alarm*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ---

Description	Range	Default
General Alarm 1 *Selects which inputs will activate the General Alarm 1 text*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
General Alarm 2 *Selects which inputs will activate the General Alarm 2 text*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
General Alarm 3 *Selects which inputs will activate the General Alarm 3 text*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
General Alarm 4 *Selects which inputs will activate the General Alarm 4 text*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
General Alarm 5 *Selects which inputs will activate the General Alarm 5 text*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
General Alarm 6 *Selects which inputs will activate the General Alarm 6 text*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
General Alarm 7 *Selects which inputs will activate the General Alarm 7 text*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
General Alarm 8 *Selects which inputs will activate the General Alarm 8 text*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
General Alarm 9 *Selects which inputs will activate the General Alarm 9 text*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
General Alarm 10 *Selects which inputs will activate the General Alarm 10 text*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
General Alarm 11 *Selects which inputs will activate the General Alarm 11 text*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
General Alarm 12 *Selects which inputs will activate the General Alarm 12 text*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
CB Open *Selects which inputs are connected to the circuit breaker open contacts*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
CB Closed *Selects which inputs are connected to the circuit breaker closed contacts*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Reset Demand *Selects which inputs will rest the Demand elements.*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Close CB *Selects which inputs will issue a close to the circuit breaker.*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------

© 2018 Siemens Protection Devices Limited

Description	Range	Default
Block Close CB *Selects which inputs will block the manual closing of the circuit breaker.*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Open CB *Selects which inputs will issue an open to the circuit breaker.*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
79 Out *Selects which inputs will switch the Auto-recloser out of service*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
79 In *Selects which inputs will switch the Auto-recloser in service*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
79 Trip & Reclose *Selects which inputs will trigger a trip & reclose*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
79 Trip & Lockout *Selects which inputs will trigger a trip & lockout*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
79 Ext Trip *Selects which input will start the external an Auto-relose sequence*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
79 Ext Pickup *Selects which input should be connected to the pickup of the external elements required to start an Auto-reclose sequence*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
79 Block Reclose *Selects which inputs will block the Auto-recloser*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
79 Reset Lockout *Selects which inputs will force the Auto-recloser into the Lockout state*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
79 Line Check *Selects which inputs will start the Line Check functionality of the Auto-recloser*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
79 Lockout *Selects which inputs will force the Auto-recloser into the Lockout state*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Hot Line Out *Selects which inputs will switch out Hot Line Working*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Hot Line In *Selects which inputs will switch in Hot Line Working*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inst Prot'n Out *Selects which inputs will switch out the instantaneous protection elements*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inst Prot'n In *Selects which inputs will switch in the instantaneous protection elements*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------

Description	Range	Default
E/F Out *Selects which inputs will switch out the E/F protection elements.*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
E/F In *Selects which inputs will switch in the E/F protection elements.*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
SEF Out *Selects which inputs will switch out the SEF protection elements*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
SEF In *Selects which inputs will switch in the SEF protection elements*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Trigger Wave Rec *Selects which inputs can trigger a waveform record*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Trigger Fault Rec *Selects which inputs can trigger a fault record*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Select Group 1 *Switches active setting group to group 1*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Select Group 2 *Switches active setting group to group 2*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Select Group 3 *Switches active setting group to group 3*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Select Group 4 *Switches active setting group to group 4*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Select Group 5 *Switches active setting group to group 5*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Select Group 6 *Switches active setting group to group 6*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Select Group 7 *Switches active setting group to group 7*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Select Group 8 *Switches active setting group to group 8*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Out Of Service Mode *Selects which inputs will put the relay into Out Of Service Mode*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Local Mode *Selects which inputs will put the relay into Local Mode*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------

© 2018 Siemens Protection Devices Limited

Description	Range	Default
Remote Mode *Selects which inputs will put the relay into Remote Mode*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Local Or Remote Mode *Selects which inputs will put the relay into Local Or Remote Mode*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Clock Sync. *Selects which input is used to synchronise the real time clock*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Reset LEDs & O/Ps *Selects which inputs will reset the latched LEDs and binary outputs*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inverted Inputs *Selects which inputs will be inverted*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13)	----------
Enable In Local *Selects which inputs will be enabled in local mode*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13)	BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13
Enable In Remote *Selects which inputs will be enabled in remote mode*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13)	BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13

3.7.2. Binary Input Config (Variants may differ)

Description	Range	Default
Inverted Inputs *Selects which inputs pickup when voltage is removed.*	Combination of (1, 2, 3, 4, 5, 6, 7, 8, 9)	---------
BI 1 Pick-up Delay *Delay on pickup of DC Binary Input 1*	0, 0.005 ... 14300, 14400	0.02 s
BI 1 Drop-off Delay *Delay on dropoff of DC Binary Input 1*	0, 0.005 ... 14300, 14400	0 s
-		
BI 39 Pick-up Delay *Delay on pickup of DC Binary Input 9*	0, 0.005 ... 14300, 14400	0.02 s
BI 39 Drop-off Delay *Delay on dropoff of DC Binary Input 9*	0, 0.005 ... 14300, 14400	0 s
Enabled In Local *Selects which inputs are enabled when the relay is in Operating Mode 'Local' or 'Local Or Remote'*	Combination of (1, 2, 3, 4, 5, 6, 7, 8, 9)	1, 2, 3, 4, 5, 6, 7, 8, 9
Enabled In Remote *Selects which inputs are enabled when the relay is in Operating Mode 'Remote' or 'Local Or Remote'*	Combination of (1, 2, 3, 4, 5, 6, 7, 8, 9)	1, 2, 3, 4, 5, 6, 7, 8, 9

© 2018 Siemens Protection Devices Limited

3.7.3. General Alarms

Description	Range	Default
General Alarm-1 *Defines the text to be displayed for General Alarm 1*	(16 Character String)	ALARM 1
General Alarm-2 *Defines the text to be displayed for General Alarm 2*	(16 Character String)	ALARM 2
General Alarm-3 *Defines the text to be displayed for General Alarm 3*	(16 Character String)	ALARM 3
General Alarm-4 *Defines the text to be displayed for General Alarm 4*	(16 Character String)	ALARM 4
General Alarm-5 *Defines the text to be displayed for General Alarm 5*	(16 Character String)	ALARM 5
General Alarm-6 *Defines the text to be displayed for General Alarm 6*	(16 Character String)	ALARM 6
General Alarm-7 *Defines the text to be displayed for General Alarm 7*	(16 Character String)	ALARM 7
General Alarm-8 *Defines the text to be displayed for General Alarm 8*	(16 Character String)	ALARM 8
General Alarm-9 *Defines the text to be displayed for General Alarm 9*	(16 Character String)	ALARM 9
General Alarm-10 *Defines the text to be displayed for General Alarm 10*	(16 Character String)	ALARM 10
General Alarm-11 *Defines the text to be displayed for General Alarm 11*	(16 Character String)	ALARM 11
General Alarm-12 *Defines the text to be displayed for General Alarm 11*	(16 Character String)	ALARM 12
General Alarm-13 *Defines the text to be displayed for General Alarm 11*	(16 Character String)	ALARM 13
General Alarm-14 *Defines the text to be displayed for General Alarm 11*	(16 Character String)	ALARM 14
General Alarm-15 *Defines the text to be displayed for General Alarm 11*	(16 Character String)	ALARM 15
General Alarm-16 *Defines the text to be displayed for General Alarm 11*	(16 Character String)	ALARM 16
General Alarm-17 *Defines the text to be displayed for General Alarm 11*	(16 Character String)	ALARM 17
General Alarm-18 *Defines the text to be displayed for General Alarm 11*	(16 Character String)	ALARM 18
General Alarm-19 *Defines the text to be displayed for General Alarm 11*	(16 Character String)	ALARM 19
General Alarm-20 *Defines the text to be displayed for General Alarm 12*	(16 Character String)	ALARM 20

3.8. Output Config

3.8.1. Output Matrix (Variants may differ)

Description	Range	Default
Protection Healthy *Relays selected are energised whilst relay self-monitoring does NOT detect any hardware or software errors and DC Supply is healthy. A changeover contact or normally closed contact may be used to generate Protection Defective from this output*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	BO1
Active Setting Grp 1	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	Grp 1
Active Setting Grp 2	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	
Active Setting Grp 3	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	
Active Setting Grp 4	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	
Active Setting Grp 5	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	
Active Setting Grp 6	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	
Active Setting Grp 7	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	
Active Setting Grp 8	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	

© 2018 Siemens Protection Devices Limited

Description	Range	Default
51-1 *51-1 IDMTL/DTL Overcurrent operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
51-2 *51-2 IDMTL/DTL Overcurrent operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
50-1 *50-1 INST/DTL Overcurrent operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
50-2 *50-2 INST/DTL Overcurrent operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
51N-1 *51N-1 IDMTL/DTL derived Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L4
51N-2 *51N-2 IDMTL/DTL derived Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L4
50N-1 *50N-1 INST/DTL derived Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L4
50N-2 *50N-2 INST/DTL derived Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L4
51G-1 *51G-1 IDMTL/DTL measured Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L4
51G-2 *51G-2 IDMTL/DTL measured Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L4
50G-1 *50G-1 INST/DTL measured Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L4
50G-2 *50G-2 INST/DTL measured Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L4
51SEF-1 *51SEF-1 IDMTL/DTL Sensitive Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L5

Description	Range	Default
51SEF-2 *51SEF-2 IDMTL/DTL Sensitive Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L5
50SEF-1 *50SEF-1 INST/DTL Sensitive Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L5
50SEF-2 *50SEF-2 INST/DTL Sensitive Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L5
64H *64H Restricted Earth Fault element operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Cold Load Active *Cold Load settings are active*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
46IT *IDMTL/DTL NPS Overcurrent operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
46DT *INST/DTL NPS Overcurrent operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
37-1 *37-1 Under Current operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
37-2 *37-2 Under Current operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
37G-1	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
37G-2	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
49 Trip *Thermal capacity trip operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
49 Alarm *Thermal capacity alarm operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------

© 2018 Siemens Protection Devices Limited

Description	Range	Default
60CTS-I	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
46BC *46 Broken Conductor element operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
74TCS-1 *Trip Circuit 1 fail operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
74TCS-2 *Trip Circuit 2 fail operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
74TCS-3 *Trip Circuit 3 fail operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
74CCS-1 *Close Circuit 1 fail operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
74CCS-2 *Close Circuit 2 fail operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
74CCS-3 *Close Circuit 3 fail operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
81HBL2	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
General Pickup *General Pickup operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
50BF-1 *Circuit Breaker Fail stage 1 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
50BF-2 *Circuit Breaker Fail stage 2 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------

Description	Range	Default
50BF PhA *Circuit Breaker Fail Phase A*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
50BF PhB *Circuit Breaker Fail Phase B*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
50BF PhC *Circuit Breaker Fail Phase C*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
50BF EF *Circuit Breaker Fail Earth Fault*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
CB Total Trip Count *Total CB trip count exceeded*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
CB Ph A Trip Count *Total CB Ph A trip count exceeded*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
CB Ph B Trip Count *Total CB Ph B trip count exceeded*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
CB Ph C Trip Count *Total CB Ph C trip count exceeded*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
CB E/F Trip Count *Total CB E/F trip count exceeded*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
CB Delta Trip Count *Delta CB trip count exceeded*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------

© 2018 Siemens Protection Devices Limited

Description	Range	Default
CB Count To ARBlock *Count To AR Block CB trip count exceeded*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
CB Freq Ops Count *CB Frequent Operations count exceeded*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
I^2t CB Wear *I^2t CB Wear limit exceeded*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Trip Time Alarm *Trip Time Alarm operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
CB Open *Indicates that the circuit breaker is in the open position.*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
CB Closed *Indicates that the circuit breaker is in the closed position.*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Close CB Blocked *Indicates that the Close CB control is blocked by its interlocking logic.*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
CB Alarm *Indicates the CB is either in an illegal state or is stuck neither open or closed.*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Open CB *Open pulse due to Manual Open being issued.*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Phase A *A phase A element operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L1
Phase B *A phase B element operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L2
Phase C *A phase C element operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L3

Description	Range	Default
Derived E/F *Derive E/F element operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
Measured E/F *Measured E/F element operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
Sensitive E/F *Sensitive E/F element operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
Start Count Alarm	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
50AFD PhA *Arc Flash Detector Phase A operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
50AFD PhB *Arc Flash Detector Phase B operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
50AFD PhC *Arc Flash Detector Phase C operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
50AFD	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
AFD Zone 1 Flash	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------

© 2018 Siemens Protection Devices Limited

Description	Range	Default
AFD Zone 1	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
AFD Zone 2 Flash	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
AFD Zone 2	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
AFD Zone 3 Flash	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
AFD Zone 3	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
AFD Zone 4 Flash	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
AFD Zone 4	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
AFD Zone 5 Flash	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
AFD Zone 5	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------

Description	Range	Default
AFD Zone 6 Flash	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
AFD Zone 6	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
User Output 1 *User Output 1 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
---		
User Output 32 *User Output 32 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
En100 Life *Raised when the En100 is communicating correctly with the Protection CPU*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
En100 Error *Raised when the En100 has detected an Error*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
IEC61850 Configured *Raised when the En100 and Protection CPU are configured for IEC 61850.*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
En100 Ch1 Link Down *Raised when En100 Ch 1 Link Down*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
En100 Ch2 Link Down *Raised when En100 Ch 2 Link Down*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------

© 2018 Siemens Protection Devices Limited

Description	Range	Default
Manual Close CB *Close pulse due to Manual close being issued*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
79 AR Close CB *Close pulse due to auto-reclose sequence*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
79 Trip & Reclose *Indicates the Trip & Reclose sequence being performed*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
79 Trip & Lockout *Indicates the Trip & Lockout sequence being performed*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
79 Lockout *Indicates the auto-recloser is in the Lockout state*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
79 Out Of Service *Indicates the auto-recloser is out of service*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
79 In Service *Indicates the auto-recloser is in service*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
79 In Progress *Indicates an auto-reclose sequence is in progress*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
79 Block Extern *Indicates that Extern for the current shot has been selected to be delayed. (This may be used to block external tripping elements in the same way as the internal protection elements are blocked to achieve Instantaneous / Delayed operation.)*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
79 CB Fail To Close *Indicates the CB was not closed at the end of the Close Pulse*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
79 Close Onto Fault *Indicates an element starter or trip operated during the Close Pulse*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
79 Successful AR *Indicates that after a reclose and at the end of the Reclaim time the CB was closed and there were no auto-reclose trip elements operated. (This is issued for 2 secs)*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Successful Man Close *Indicates that after a manual close and at the end of the Reclaim time the CB was closed and there were no auto-reclose trip elements operated. (This is issued for 2 secs)*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------

Description	Range	Default
Hot Line Working *Indicates that Hot LineWorking functionality has been selected*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inst Prot'n Out *Indicates that the protection elements selected to be Instantaneous elements are switched out*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
E/F Out *Indicates that the instantaneous protection elements are switched out.*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
SEF Out *Indicates that the SEF protection elements are switched out*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
New Wave Stored *The waveform recorder has stored new information Note: this is a pulsed output*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
New Fault Stored *The fault recorder has stored new information Note: this is a pulsed output*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Out Of Service Mode *Indicates the relay is in Out Of Service Mode*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Local Mode *Indicates the relay is in Local Mode*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Remote Mode *Indicates the relay is in Remote Mode*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
BI 1 Operated *DC Binary Input 1 has operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
BI 2 Operated *DC Binary Input 2 has operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
BI 3 Operated *DC Binary Input 3 has operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
BI 4 Operated *DC Binary Input 4 has operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------

© 2018 Siemens Protection Devices Limited

Description	Range	Default
BI 5 Operated *DC Binary Input 5 has operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
BI 6 Operated *DC Binary Input 6 has operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
BI 7 Operated *DC Binary Input 7 has operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
BI 8 Operated *DC Binary Input 8 has operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
BI 9 Operated *DC Binary Input 9 has operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
E1 *Quick Logic equation 1 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
E2 *Quick Logic equation 2 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
E3 *Quick Logic equation 3 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
E4 *Quick Logic equation 4 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
E5 *Quick Logic equation 5 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
E6 *Quick Logic equation 6 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
E7 *Quick Logic equation 7 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
E8 *Quick Logic equation 8 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------

Description	Range	Default
E9 *Quick Logic equation 9 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
E10 *Quick Logic equation 10 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
E11 *Quick Logic equation 11 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
E12 *Quick Logic equation 12 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
E13 *Quick Logic equation 13 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
E14 *Quick Logic equation 14 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
E15 *Quick Logic equation 15 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
E16 *Quick Logic equation 16 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, L1, L2, L3, L4, L5, L6, L7, L8, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Trip Contacts *Assigns Output Contact as trip contact for fault trigger*	BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14	----------
Hand Reset Outputs *Assigns Output Contact as hand reset contact*	BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14	----------
Pickup Outputs *Selects which outputs can operate because a pickup condition exists*	BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14	----------
Pulsed Outputs *Selects which outputs are pulsed. The pulse width is set by the Min Operate Time setting for each output*	BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14	----------

© 2018 Siemens Protection Devices Limited

3.8.2. Binary Output Config (Variants may differ)

Description	Range	Default
Trip Contacts *The Binary Outputs selected by this setting are classed as Trip contacts. (When any of these BOs operate the Trip LED is lit, CB Fail is started, if enabled, & a Fault Record is stored)*	Combination of (BO1, to B16)	--------
Hand Reset Outputs *Relays selected, as Hand Reset will remain latched until manually reset from front panel or via communications link or by removing DC Supply. By default relays are Self Resetting and will reset when the driving signal is removed.*	Combination of (1, to 16)	--------
Min Operate Time 1 *Minimum operate time of output relay if set to self reset, if also set to be pulsed then this is the pulse width*	0, 0.01 ... 59, 60	0.1 s
-		
Min Operate Time 8 *Minimum operate time of output relay 8 if set to self reset, if also set to be pulsed then this is the pulse width*	0, 0.01 ... 59, 60	0.1 s
Pick-up Outputs *Selects which outputs can operate because a pickup condition exists*	Combination of (1 to 16)	--------
Pulsed Outputs *Selects which outputs are pulsed. The pulse width is set by the Min Operate Time setting for each output*	Combination of (1 to 16)	--------

3.8.3. LED Config

Description	Range	Default
Self Reset LEDs *LEDs selected, as Self Reset will automatically reset when the driving signal is removed. By default all LEDs are Hand Reset and must be manually reset either locally via the front fascia or remotely via communications.*	Combination of (1 to 32)	--------
PU Self Reset LEDs *LEDs selected, as Self Reset will automatically reset when the driving signal is removed. By default all PU LEDs are Self Reset.*	Combination of (1 to 32)	1 to 32
Green LEDs *Selects which LEDs will be green when driven*	Combination of (1 to 32)	--------
Red LEDs *Selects which LEDs will be red when driven*	Combination of (1 to 32)	1 to 32
PU Green LEDs *Selects which LEDs will be green when driven by a pickup*	Combination of (1 to 32)	1 to 32
PU Red LEDs *Selects which LEDs will be red when driven by a pickup*	Combination of (1 to 32)	1 to 32

3.8.4. Pickup Config

Description	Range	Default
Gn P/F Pickups *When any of the selected pickups operate General Pickup is driven.*	Combination of (51-1, 51-2, 50-1, 50-2)	51-1, 51-2, 50-1, 50-2
Gn E/F Pickups *As Above*	Combination of (51N-1, 51N-2, 50N-1, 50N-2, 51G-1, 51G-2, 50G-1, 50G-2)	51N-1, 51N-2, 50N-1, 50N-2, 51G-1, 51G-2, 50G-1, 50G-2
Gn SEF/REF Pickups *As Above*	Combination of (51SEF-1, 51SEF-2, 50SEF-1, 50SEF-2, 64H)	51SEF-1, 51SEF-2, 50SEF-1, 50SEF-2, 64H
Gn Misc Pickups *As Above*	Combination of (46IT, 46DT, 37-1, 37-2, 37G-1, 37G-2)	46IT, 46DT, 37-1, 37-2, 37G-1, 37G-2

© 2018 Siemens Protection Devices Limited

3.9. CB Maintenance

3.9.1. CB Counters

Description	Range	Default
Gn CB Total Trip Count *Selects whether the CB Total Trip Count counter is enabled*	Disabled, Enabled	Disabled
Gn CB Total Trip Count Target *Selects the number of CB trips allowed before CB Total Trip Count counter output operates*	0, 1 ... 9999, 10000	100
Gn CB Total Trip Count Reset *Resets CB Total Trip Count counter*		
Gn CB Total Trip Manual Open *Selects whether the CB Total Trip Manual Open is enabled*	Disabled, Enabled	Disabled
Gn CB Phase Trip Counters *Selects whether the CB Phase Trip Counters is enabled*	Disabled, Enabled	Disabled
Gn CB Ph A Trip Count Target *Selects the number of CB trips allowed before CB Ph A Trip Count counter output operates*	0, 1 ... 9999, 10000	100
Gn CB Ph B Trip Count Target *Selects the number of CB trips allowed before CB Ph B Trip Count counter output operates*	0, 1 ... 9999, 10000	100
Gn CB Ph C Trip Count Target *Selects the number of CB trips allowed before CB Ph C Trip Count counter output operates*	0, 1 ... 9999, 10000	100
Gn CB E/F Trip Count Target *Selects the number of CB trips allowed before CB E/F Trip Count counter output operates*	0, 1 ... 9999, 10000	100
Gn CB Delta Trip Count *Selects whether the CB Delta Trip Count counter is enabled*	Disabled, Enabled	Disabled
Gn CB Delta Trip Count Target *Selects the number of CB trips allowed before CB Delta Trip Count counter output operates*	0, 1 ... 9999, 10000	100
Gn CB Delta Trip Count Reset *Resets CB Delta Trip Count counter*		
Gn CB Count To AR Block *Selects whether the CB Count To AR Block counter is enabled*	Disabled, Enabled	Disabled
Gn CB Count To AR Block Target *Selects the number of CB trips allowed before CB Count To AR Block counter output operates. While count is above target the Autorecloser will only perform 1 x Delayed Shot and Lockout*	0, 1 ... 9999, 10000	100
Gn CB Count To AR Block Reset *Resets CB Count To AR Block counter*		
Gn CB Freq Ops Count *Selects whether the CB Frequent Operations Counter is enabled*	Disabled, Enabled	Disabled
Gn CB Freq Ops Count Target *Selects the number of CB trips allowed before CB Frequent Operations Counter output operates. While count is above target the Autorecloser will only perform 1 x Delayed Shot and Lockout*	0, 1 ... 9999, 10000	10
Gn CB Freq Ops Count Reset *Resets CB Frequent Operations Counter*		

3.9.2. I^2T CB Wear

Description	Range	Default
Gn I^2t Counter *Selects whether the I^2t CB Wear monitor is enabled*	Disabled, Enabled	Disabled
Gn Alarm Limit *Sets limit before alarm is issued*	10, 11 ... 99000, 100000	10 MA^2 s
Gn Separation Time *Sets the time for CB mechanism to start moving, time before contacts start to separate*	0, 0.001 ... 0.199, 0.2	0.02 s
Gn Clearance Time *Time for CB to clear fault*	0, 0.001 ... 0.199, 0.2	0.04 s
Reset I^2t Count *Reset the CB wear count*		

3.9.3. START COUNT

Description	Range	Default
Start Types(s) *Selects which type of start-up*	Power On, Expected, Unexpected	All
Start Count Target *Selects number of times star-up has occurred before output operatest*	0, ...10000	100

3.10. Data Storage

3.10.1. Demand Data/Log

Description	Range	Default
Data Log Period *Selects period between stored samples*	5, 6, 7, 8, 9, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60	5 min
Clear Data Log *Clear the Data Log*		
Gn Demand Window *The time window over which the Min, Max and Mean values are calculated.*	1, 2 ... 23, 24	24 hrs
Gn Demand Window Type *Method used to calculate Demand values.*	Fixed, Peak, Rolling	Fixed
Gn Demand Reset *Reset all Demand values*		

© 2018 Siemens Protection Devices Limited

3.10.2. Waveform Storage

Description	Range	Default
Gn P/F Trig Storage *Select which elements trigger a waveform record*	Combination of (51-1, 51-2, 50-1, 50-2)	51-1, 51-2, 50-1, 50-2
Gn E/F Trig Storage *As Above*	Combination of (51N-1, 51N-2, 50N-1, 50N-2, 51G-1, 51G-2, 50G-1, 50G-2)	51N-1, 51N-2, 50N-1, 50N-2, 51G-1, 51G-2, 50G-1, 50G-2
Gn SEF/REF Trig Storage *As Above*	Combination of (51SEF-1, 51SEF-2, 50SEF-1, 50SEF-2, 64H)	51SEF-1, 51SEF-2, 50SEF-1, 50SEF-2, 64H
Gn Misc Current Storage *As Above*	Combination of (46IT, 46DT, 37-1, 37-2, 49 Trip, 49 Alarm, 37G-1, 37G-2)	--------
Gn AFD Trig Storage *As Above*	Combination of (AFD-1, AFD-2, AFD-3, AFD-4, AFD-5, AFD-6)	------
Pre-trigger Storage *Select Percentage of waveform record stored before the fault is triggered*	10, 20, 30, 40, 50, 60, 70, 80, 90	20 %
Record Duration *Select waveform record duration*	10 Rec x 1 Sec, 5 Rec x 2 Sec, 2 Rec x 5 Sec, 1 Rec x 10 Sec	10 Rec x 1 Sec
Trigger Waveform *Trigger waveform storage*		
Clear Waveforms *Clear all stored waveform records*		

3.10.3. Fault Storage

Description	Range	Default
Gn Max Fault Rec Time *Maximum time Fault record information will be stored and classed as same fault*	0, 1 ... 59900, 60000	2000 ms
Clear Faults *Clear all stored fault records*		

3.10.4. Event Storage

Description	Range	Default
Clear Events *Clear all stored event records*		
Data Log *Selects whether the Data Logger is enabled*		

3.10.5. Communications

Description	Range	Default
Station Address *IEC 60870-5-103 Station Address*	0, 1 ... 65533, 65534	0
COM1-RS485 Protocol *Selects protocol to use for COM1-RS485*	OFF, IEC60870-5-103, MODBUS-RTU, DNP3	IEC60870-5-103
COM1-RS485 Baud Rate *Sets the communications baud rate for COM1-RS485*	75, 110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400	19200
COM1-RS485 Parity *Selects whether parity information is used*	NONE, ODD, EVEN	EVEN
COM1-RS485 Mode	Local, Remote, Local Or Remote	Remote
COM2-USB Protocol *Selects protocol to use for COM2-USB*	IEC60870-5-103	IEC60870-5-103
COM2-USB Mode	Local	Local
COM3 Protocol *Selects protocol to use for COM3*	OFF, IEC60870-5-103, MODBUS-RTU, DNP3	IEC60870-5-103
COM3 Baud Rate *Sets the communications baud rate for COM3*	75, 110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200	19200
COM3 Parity *Selects whether parity information is used*	NONE, ODD, EVEN	EVEN
COM3 Line Idle *Selects the communications line idle sense*	LIGHT OFF, LIGHT ON	LIGHT OFF
COM3 Data Echo *Enables echoing of data from RX port to TX port when operating relays in a Fibre Optic ring configuration*	OFF, ON	OFF
COM3 Mode	Local, Remote, Local Or Remote	Remote
COM4 Protocol *Selects protocol to use for COM4*	OFF, IEC60870-5-103, MODBUS-RTU, DNP3	OFF
COM4 Baud Rate *Sets the communications baud rate for COM4*	75, 110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400	19200
COM4 Parity *Selects whether parity information is used*	NONE, ODD, EVEN	EVEN
COM4 Line Idle *Selects the communications line idle sense*	LIGHT OFF, LIGHT ON	LIGHT OFF
COM4 Data Echo *Enables echoing of data from RX port to TX port when operating relays in a Fibre Optic ring configuration*	OFF, ON	OFF
COM4 Mode	Local, Remote, Local Or Remote	Remote
DNP3 Unsolicited Events *Allows unsolicited event support in the relay. When Enabled, unsolicited event transmission can be controlled by the Master. When Disabled, Master requests are ignored.*	Disabled, Enabled	Disabled
DNP3 Destination Address *The address of the master to which unsolicited events will be sent.*	0, 1 ... 65533, 65534	0

© 2018 Siemens Protection Devices Limited

7SR220 Directional Relay
Instrumentation Guide

The copyright and other intellectual property rights in this document, and in any model or article produced from it (and including any registered or unregistered design rights) are the property of Siemens Protection Devices Limited. No part of this document shall be reproduced or modified or stored in another form, in any data retrieval system, without the permission of Siemens Protection Devices Limited, nor shall any model or article be reproduced from this document unless Siemens Protection Devices Limited consent.

While the information and guidance given in this document is believed to be correct, no liability shall be accepted for any loss or damage caused by any error or omission, whether such error or omission is the result of negligence or any other cause. Any and all such liability is disclaimed.

© 2017 Siemens Protection Devices Limited

Document Release History

This document is issue 2017/12. The list of revisions up to and including this issue is: -

2011/05	First issue
2013/01	Typographical revisions and added data. Updated in line with software release.
2014/06	Typographical revisions and added data. Updated in line with software release.
2015/06	Typographical revisions and added data. Updated in line with software release.
2016/02	Typographical revisions and added data. Updated in line with software release.
2016/11	Typographical revisions and format
2017/08	Typographical revisions and added data. Updated in line with software release.
2017/12	Typographical revisions and added data.

Software Revision History

2011/05	2435H85009R7a-7a (7SR220)	First Release
2013/01	2435H85009R7c-7b (7SR220)	Introduced journaling file system. Added 61850 logical nodes for CB Counters, metering, 50BF, 46BC, 81HBL2 and line check. Added Line Check on non-AR devices. Added 74CCS Close Circuit Supervision.
2014/06	2435H85009R7f-7d (7SR220)	Added Fault Locator feature and Check Sync feature. Fault data transmitted over 103. Additional communications data, control features, meters.
2015/06	2435H85009R8a-7f (7SR220)	Added Power Factor Meters, Load Blinding feature, Arc Flash Detector. Over current TM Setting Range extended.
2016/02	2435H85009R8b-7f (7SR220)	EN100+ Compatibility.
2017/08	2435H85008R8e-8a (7SR210) 2435H85009R8e-8a (7SR220)	Added 32 Directional Power, 32S Sensitive Power, 55 Power Factor, 81HLB5 Overfluxing, 67SEF Compensated Network, 67SEF Wattmetric. Increased I/O. Event Data on LCD.

© 2017 Siemens Protection Devices Limited

Contents

Document Release History 2

Software Revision History 2

1. Function Diagram 4

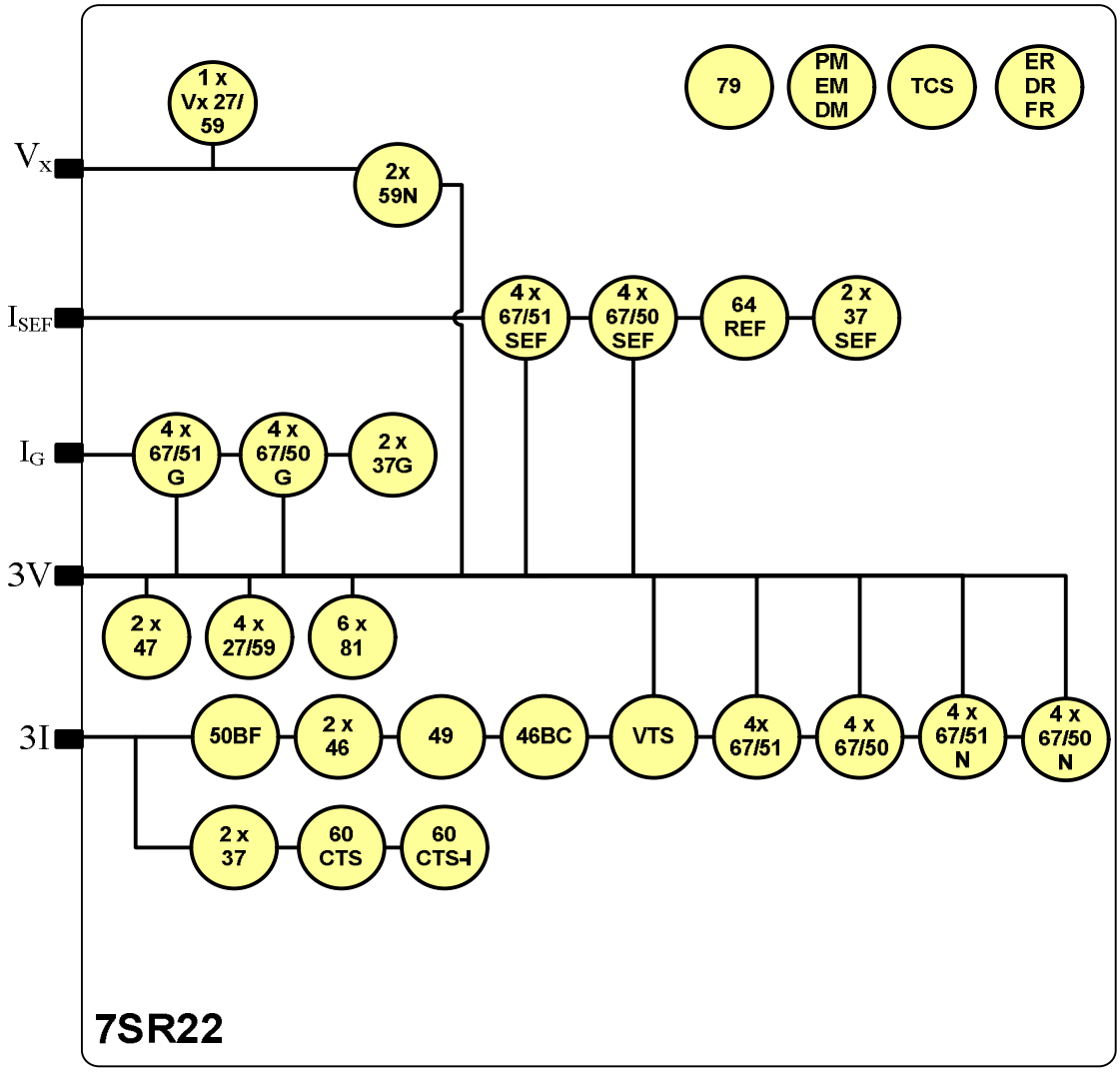
2. Menu Structure 5

1. Relay Instrumentation 6

1.1. Favourite Meters 6
1.2. Current Meters 6
1.3. Voltage Meters 8
1.4. Frequency Meters 8
1.5. Power Meters 10
1.6. Energy Meters 12
1.7. WATTMETRIC Meters 12
1.8. Directional Meters 12
1.9. Thermal Meters 12
1.10. Auto-Reclose Meters 14
1.11. Synchronising Meters 14
1.12. Maintenance Meters 14
1.13. General Alarm Meters 16
1.14. Demand Meters 16
1.15. Binary Input Meters 17
1.16. Binary Output Meters 17
1.17. Virtual Meters 19
1.18. Communication Meters 19
Miscellaneous Meters 20
1.19. Quick Logic Meters 20
1.20. Fault Locator 20

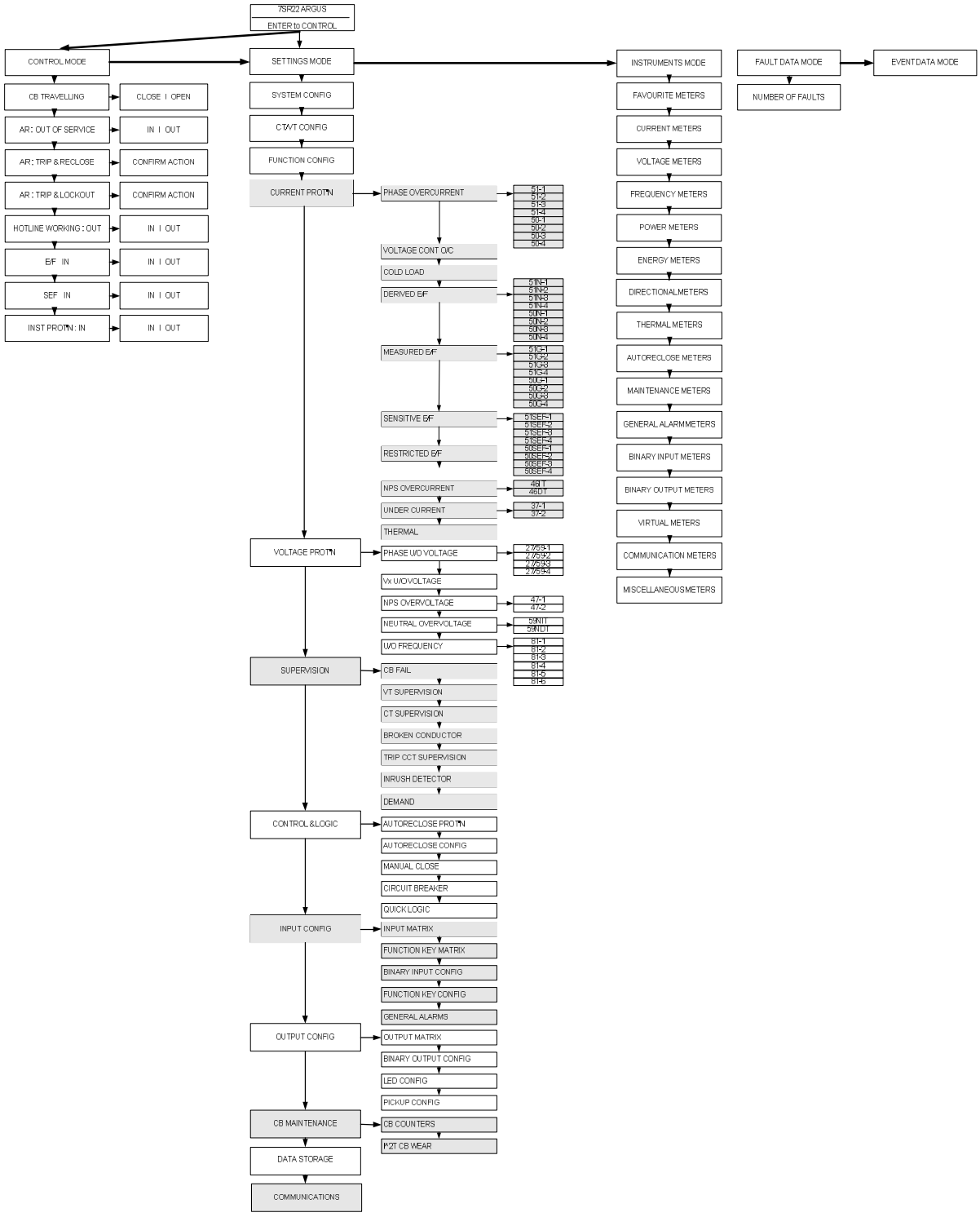
© 2017 Siemens Protection Devices Limited

1.Function Diagram



© 2017 Siemens Protection Devices Limited

2.Menu Structure



© 2017 Siemens Protection Devices Limited

1. Relay Instrumentation

1.1. Favourite Meters

Instrument	Description
---------- FAVOURITE METERS > to view	This allows the user to view his previously constructed list of 'favourite meters' by pressing TEST/RESET ► button and the READ DOWN button to scroll though the meters added to this sub-group To construct a sub-group of favourite meters, first go to the desired meter then press ENTER this will cause a message to appear on the LCD 'Add To Favourites YES pressing ENTER again will add this to the FAVOURITE METERS Sub-menu. To remove a meter from the FAVOURITE METERS sub-menu go to that meter each in the FAVOURITE METERS sub-menu or at its Primary location press ENTER and the message 'Remove From Favourites' will appear press ENTER again and this meter will be removed from the FAVOURITE METERS sub-group

1.2. Current Meters

Instrument	Description
---------- CURRENT METERS > to view ----------	This is the sub-group that includes all the meters that are associated with Current TEST/RESET ► allows access to this sub-group
Primary Current Ia 0.00A Ib 0.00A Ic 0.00A	Displays the 3 phase currents Primary RMS values
Secondary Current Ia 0.00A Ib 0.00A Ic 0.00A	Displays the 3 phase currents Secondary RMS values
Nom Current Ia 0.00xIn ----° Ib 0.00xIn ----° Ic 0.00xIn ----°	Displays the 3 phase currents Nominal RMS values & phase angles with respect to PPS current.
Pri Earth Current In 0.000A Ig 0.000A	Displays the 3 Earth currents Primary RMS values
Sec Earth Current In 0.000A Ig 0.000A	Displays the 3 Earth currents Secondary RMS values
Nom Earth Current In 0.000xIn ----° Ig 0.000xIn ----°	Displays the 3 Earth currents Nominal RMS values & phase angles with respect to PPS current.
I Seq Components Izps 0.00xIn ----° Ipps 0.00xIn ----° Inps 0.00xIn ----°	Displays the Current Sequence components Nominal RMS values & phase angles with respect to PPS current.
2nd Harmonic Current Ia 0.00xIn Ib 0.00xIn Ic 0.00xIn	Displays the 3 phase currents 2nd Harmonic components Nominal RMS values.

© 2017 Siemens Protection Devices Limited

Instrument	Description
5th Harmonic Current Ia 0.00xIn Ib 0.00xIn Ic 0.00xIn	Displays the 3 phase currents 5th Harmonic components Nominal RMS values.
Last Trip P/F Ia 0.00A Ib 0.00A Ic 0.00A	Displays the Last Trip Fault Current..
Last Trip E/F In 0.00A Ig 0.00A	Displays the Last Trip Fault Current..

© 2017 Siemens Protection Devices Limited

1.3. Voltage Meters

---------- VOLTAGE METERS > to view ----------	This is the sub-group that includes all the meters that are associated with Voltage TEST/RESET ► allows access to this sub-group
Prim Ph-Ph Voltage Vab 0.00V Vbc 0.00V Vca 0.00V	Displays the Phase to Phase Voltage Primary RMS values
Sec Ph-Ph Voltage Vab 0.00V Vbc 0.00V Vca 0.00V	Displays the Phase to Phase Voltage Secondary RMS values & Angles with respect to PPS voltage.
Nominal Ph-Ph Voltage Vab 0.00xVn ----o Vbc 0.00xVn ----o Vca 0.00xVn ----o	Displays the Phase to Phase Voltage Nominal RMS values
Prim Ph-N Voltage Va 0.00V Vb 0.00V Vc 0.00V	Displays the Phase to Neutral Voltage Primary RMS values
Sec Ph-N Voltage Va 0.00V Vb 0.00V Vc 0.00V	Displays the Phase to Neutral Voltage Secondary RMS values & Angles with respect to PPS voltage.
Nom Ph-N Voltage Va 0.00xVn ----o Vb 0.00xVn ----o Vc 0.00xVn ----o	Displays the Phase to Neutral Voltage Nominal RMS values
V Seq Components Izps 0.00V ----o Ipps 0.00V ----o Inps 0.00V ----o	Displays the Voltage Sequence components Nominal RMS values & phase angles with respect to PPS voltage.
Calc Earth Voltage Pri 0.00V Sec 0.00V ----o	Displays the calculated Earth voltage both primary and secondary which also shows the secondary angle
CS/NVD Voltage (Vx) Pri 0.00V Sec 0.00V ----o	Displays the 4th voltage (Vx) both primary and secondary which also shows the secondary angle. This voltage can be used for NVD, Vx 27/59 or where available Checksync.
Last Trip Voltage Va 0.00V Vb 0.00V Vc 0.00V	Displays the Phase to Neutral Voltage Nominal RMS values from Last Trip

1.4. Frequency Meters

Instrument	Description
---------- FREQUENCY METERS > to view ----------	This is the sub-group that includes all the meters that are associated with Frequency TEST/RESET ► allows access to this sub-group
	Displays the power system frequency.

© 2017 Siemens Protection Devices Limited

Frequency 0.000Hz	

© 2017 Siemens Protection Devices Limited

1.5. Power Meters

Instrument	Description
---------- POWER METERS > to view ----------	This is the sub-group that includes all the meters that are associated with Power TEST/RESET ► allows access to this sub-group
Primary Power (P) Phase A 0.0W Phase B 0.0W Phase C 0.0W	Displays Primary Real Power
Secondary Power (P) Phase A 0.0W Phase B 0.0W Phase C 0.0W	Displays Secondary Real Power
Nominal Power (P) Phase A 0.00xSn Phase B 0.00xSn Phase C 0.00xSn	Displays Nominal Real Power
Primary Power (Q) Phase A 0.0VAr Phase B 0.0VAr Phase C 0.0VAr	Displays Primary Reactive Power
Secondary Power (Q) Phase A 0.0VAr Phase B 0.0VAr Phase C 0.0VAr	Displays Secondary Reactive Power
Nominal Power (Q) Phase A 0.00xSn Phase B 0.00xSn Phase C 0.00xSn	Displays Nominal Reactive Power
Primary Power (S) Phase A 0.0VA Phase B 0.0VA Phase C 0.0VA	Displays Primary Apparent Power
Secondary Power (S) Phase A 0.0VAr Phase B 0.0VAr Phase C 0.0VAr	Displays Secondary Apparent Power
Nominal Power (S) Phase A 0.00xSn Phase B 0.00xSn Phase C 0.00xSn	Displays Nominal Apparent Power
Primary Power (3P) P 0.0W Q 0.0VAr S 0.0VA	Displays 3-Phase Primary Power
Secondary Power (3P) P 0.0W Q 0.0VAr S 0.0VA	Displays 3-Phase Secondary Power
Power Factor PF A 0.00 PF B 0.00 PF C 0.00	Displays Power factor

© 2017 Siemens Protection Devices Limited

PF (3P)	0.00	
Primary Power (32S) P (32S) Q (32S) S (32S)	 0.0W 0.0VAr 0.0VA	Displays 3-Phase Primary Power (32S)
Secondary Power (32S) P (32S) Q (32S) S (32S)	 0.0W 0.0VAr 0.0VA	Displays 3-Phase Secondary Power (32S)
Nominal Power (32S) P (32S) Q (32S) S (32S)	 0.00xSn 0.00xSn 0.00xSn	Displays 3-Phase Nominal Power (32S)
Power Factor (32S) PF (32S)	 0.00	Displays Power Factor (32S)

© 2017 Siemens Protection Devices Limited

1.6. Energy Meters

Instrument	Description
---------- ENERGY METERS > to view ----------	This is the sub-group that includes all the meters that are associated with Energy TEST/RESET ► allows access to this sub-group
Active Energy Exp 000000x10kWh Imp 000000x10kWh	Displays both imported and exported Active Energy
Reactive Energy Exp 000000x10kVArh Imp 000000x10kVArh	Displays both imported and exported Reactive Energy

1.7. WATTMETRIC Meters

Instrument		Description
---------- WATTMETRIC METERS > to view ----------		This is the sub-group that includes all the meters that are associated with Wattmetric TEST/RESET ► allows access to this sub-group sub-group
Ires R	0.0xIn W	The Wattmetric component of residual current
Pres	0.0 xIn W	Wattmetric residual power
Ires R Angle	0.0º	Compensated residual phase angle
I0-V0 Angle	0.0º	Applied residual phase angle

1.8. Directional Meters

Instrument	Description
---------- DIRECTIONAL METERS > to view ----------	This is the sub-group that includes all the meters that are associated with Directional elements TEST/RESET ► allows access to this sub-group. Only seen on models that have the 67 option
P/F Dir (67) ---------- No Dir	The appropriate values from the selection will be displayed. No Dir, PhA Fwd, PhA Rev, PhB Fwd, PhB Rev, PhC Fwd, PhC Rev
Calc E/F Dir (67N) ---------- No Dir	The appropriate values from the selection will be displayed. No Dir, E/F Fwd, E/F Rev
Meas E/F Dir (67G) ---------- No Dir	The appropriate values from the selection will be displayed. No Dir, E/F Fwd, E/F Rev
SEF Dir (67SEF) ---------- No Dir	The appropriate values from the selection will be displayed. No Dir, SEF Fwd, SEF Rev

1.9. Thermal Meters

Instrument	Description
----------	This is the sub-group that includes all the meters that are associated with

© 2017 Siemens Protection Devices Limited

Instrument	Description
THERMAL METERS > to view	Thermal TEST/RESET ► allows access to this sub-group
Thermal Status Phase A 0.0% Phase B 0.0% Phase C 0.0%	Displays the thermal capacity

© 2017 Siemens Protection Devices Limited

1.10. Auto-Reclose Meters

Instrument	Description
---------- AUTORECLOSE METERS > to view ----------	This is the sub-group that includes all the meters that are associated with Autoreclose TEST/RESET ► allows access to this sub-group. Only seen on models that have the 79 option
Autoreclose Status Out Of Service Close Shot 0	Status of the autoreclose.

1.11. Synchronising Meters

SYNC METERS →to view	This is the sub-group that includes all the meters that are associated with Synchronising TEST/RESET ► allows access to this sub-group
Line Volts 0.00V Bus Volts 0.00V Line Freq 0.000Hz Bus Freq 0.000Hz	Displays the voltages used for synchronising in models that include this function
Phase Diff 0.0Deg Slip Freq 0.000Hz Voltage Diff 0%	Displays the calculated synchronising parameters in models that include this function

1.12. Maintenance Meters

Instrument	Description
---------- MAINTENANCE METERS > to view ----------	This is the sub-group that includes all the meters that are associated with Maintenance TEST/RESET ► allows access to this sub-group
CB Total Trips Count 0 Target 100	Displays the number of CB trips experienced by the CB
CB Phase A Trips Count 0 Target 100	Displays the number of CB Phase A Trips experienced by the CB
CB Phase B Trips Count 0 Target 100	Displays the number of CB Phase B Trips experienced by the CB
CB Phase C Trips Count 0 Target 100	Displays the number of CB Phase C Trips experienced by the CB
CB Phase E/F Trips Count 0 Target 100	Displays the number of CB Phase E/F Trips experienced by the CB
CB Delta Trips Count 0 Target 100	Displays the number of CB trips experienced by the CB
CB Count To AR Block Count 0	Displays the number of CB trips experienced by the CB. When the target is reached the relay will only do 1 Delayed Trip to Lockout.

© 2017 Siemens Protection Devices Limited

Instrument	Description
Target 100	
CB Freq Ops Count Count 0 Target 10	Displays the number of CB trips experienced by the CB over the last rolling 1 hr period. When the target is reached the relay will only do 1 Delayed Trip to Lockout.
CB Wear Phase A 0.00MA^2s Phase B 0.00MA^2s Phase C 0.00MA^2s	Displays the current measure of circuit breaker wear.
CB Wear Remaining Phase A 100% Phase B 100% Phase C 100%	Displays the current measure of circuit breaker wear remaining
CB Trip Time 0.0ms	Displays the trip time for the circuit breaker.

© 2017 Siemens Protection Devices Limited

1.13. General Alarm Meters

Instrument	Description
---------- GENERAL ALARM METERS > to view ----------	This is the sub-group that includes all the meters that are associated with the Binary inputs TEST/RESET ► allows access to this sub-group
General Alarms ---------- ALARM 1 Cleared	Displays the state of General Alarm
…	
General Alarms ---------- ALARM 20 Cleared	

1.14. Demand Meters

Instrument	Description
---------- DEMAND METERS > to view ----------	This is the sub-group that includes all the meters that are associated with the demand metering. TEST/RESET ► allows access to this sub-group
V Phase A Demand Max 0.00V Min 0.00V Mean 0.00V	Shows the Max, Min and Mean Voltage for Phase A.
V Phase B Demand Max 0.00V Min 0.00V Mean 0.00V	Shows the Max, Min and Mean Voltage for Phase AB.
V Phase C Demand Max 0.00V Min 0.00V Mean 0.00V	Shows the Max, Min and Mean Voltage for Phase AC.
V Phase AB Demand Max 0.00V Min 0.00V Mean 0.00V	Shows the Max, Min and Mean Voltage for Phase AB.
V Phase BC Demand Max 0.00V Min 0.00V Mean 0.00V	Shows the Max, Min and Mean Voltage for Phase BC.
V Phase CA Demand Max 0.00V Min 0.00V Mean 0.00V	Shows the Max, Min and Mean Voltage for Phase CA.
I Phase A Demand Max 0.00A Min 0.00A Mean 0.00A	Shows the Max, Min and Mean for Phase A.

© 2017 Siemens Protection Devices Limited

Instrument	Description
I Phase B Demand Max 0.00A Min 0.00A Mean 0.00A	Shows the Max, Min and Mean for Phase B.
I Phase C Demand Max 0.00A Min 0.00A Mean 0.00A	Shows the Max, Min and Mean for Phase C.
I Phase Ig Demand Max 0.00A Min 0.00A Mean 0.00A	Shows the Max, Min and Mean for Phase Ig.
Power P 3P Demand Max 0.00W Min 0.00W Mean 0.00W	Shows the Max, Min and Mean for Power P 3P Demand.
Power Q 3P Demand Max 0.00VAr Min 0.00VAr Mean 0.00VAr	Shows the Max, Min and Mean for Power Q 3P Demand.
Power S 3P Demand Max 0.00VA Min 0.00VA Mean 0.00VA	Shows the Max, Min and Mean for Power S 3P Demand.
Frequency Demand Max 0.000Hz Min 0.000Hz Mean 0.000Hz	Shows the Max, Min and Mean for System Frequency Demand.
Power Factor 3P Demand Max 0.00 Min 0.00 Mean 0.00	Shows the Max, Min and Mean for System Power Factor 3P Demand.

1.15. Binary Input Meters

Instrument	Description
---------- BINARY INPUT METERS > to view ----------	This is the sub-group that includes all the meters that are associated with the Binary inputs TEST/RESET ► allows access to this sub-group
BI 1-8 ---- ---- BI 9-9 -	Displays the state of DC binary inputs 1 to 9 (The number of binary inputs may vary depending on model)

1.16. Binary Output Meters

Instrument	Description
---------- BINARY OUTPUT METERS > to view	This is the sub-group that includes all the meters that are associated with the Binary Outputs TEST/RESET ► allows access to this sub-group

© 2017 Siemens Protection Devices Limited

Instrument	Description

BO 1-8 ---- ----	Displays the state of DC binary Outputs 1 to 8. (The number of binary outputs may vary depending on model)

© 2017 Siemens Protection Devices Limited

1.17. Virtual Meters

Instrument	Description
---------- VIRTUAL METERS > to view ----------	This is the sub-group that shows the state of the virtual status inputs in the relay TEST/RESET ► allows access to this sub-group
V 1-8 ---- ---- V 9-16 ---- ----	Displays the state of Virtual Outputs 1 to 16 (The number of virtual inputs will vary depending on model)

1.18. Communication Meters

Instrument	Description
---------- COMMUNICATION METERS > to view ----------	This is the sub-group that includes all the meters that are associated with Communications ports TEST/RESET ► allows access to this sub-group
COM1 COM2 COM3 COM4	Displays which com ports are currently active
COM1 TRAFFIC Tx1 0 Rx1 0 Rx1 Errors 0	Displays traffic on Com1
COM2 TRAFFIC Tx2 0 Rx2 0 Rx2 Errors 0	Displays traffic on Com2
COM3 TRAFFIC Tx3 0 Rx3 0 Rx3 Errors 0	Displays traffic on Com3
COM4 TRAFFIC Tx4 0 Rx4 0 Rx4 Errors 0	Displays traffic on Com4
EN100 INFORMATION Version : EN100 Version Info Part# BF1111111111	Displays EN100 information
Network Config Mac 00000000 IP 000.000.000.000 NM 255.255.255.000	Displays EN100 network information
Gateway: 000.000.000.000 EN100 NTP info: EN100 Link ½ status info: EN100 Rx/Tx Count	Displays further EN100 61850 information
En100 Rx/Tx Error En100 Rx/Tx 10s CPU Load % EN100 Info Meters : 1-n	Displays further EN100 61850 information

© 2017 Siemens Protection Devices Limited

Miscellaneous Meters

Instrument	Description
---------- MISCELLANEOUS METERS > to view ----------	This is the sub-group that includes indication such as the relays time and date, the amount of fault and waveform records stored in the relay TEST/RESET ► allows access to this sub-group
Start Alarm Count 0 Target 100	This meter displays the Start Alarm count.
Hrs In Service Time Time 0Hrs	This meter displays the amount of time in service
Date 01/01/2000 Time 22:41:44 Waveform Recs 0 Fault Recs 0	This meter displays the Date, Time, Waveform Records and the number of Fault Records stored in the relay
Event Recs 0 Data Log Recs 0 Settings Group 1	This meter displays the Event Records, Data Log Records and Active Settings Group number stored in the relay

1.19. Quick Logic Meters

Instrument	Description
---------- QUICK LOGIC METERS > to view ----------	This is the sub-group that includes all the meters that are associated with QuickLogic. TEST/RESET ► allows access to this sub-group
E 1-8 ---- ---- E 9-16 ---- ----	Shows the state of all the equations
E1 Equation EQN =0 TMR 0-0 =0 CNT 0-1 =0	Shows the state of an individual equation. EQN shows the equation state. TMR shows the timer progress and state for the equation. CNT shows the count progress and state for the equation.
E16 Equation EQN =0 TMR 0-0 =0 CNT 0-1 =0	Shows the state of an individual equation. EQN shows the equation state. TMR shows the timer progress and state for the equation. CNT shows the count progress and state for the equation.

1.20. Fault Locator

Instrument	Description
---------- FAULT LOCATOR METER > to view ----------	This is the sub-group that includes all the meters that are associated with the Fault Locator TEST/RESET ► allows access to this sub-group
Distance 0.0% Impedance 0.0ohms Reactance 0.0ohms	Displays the Fault Location.

© 2017 Siemens Protection Devices Limited

7SR220 Directional Relay
Settings Guide

Unrestricted The copyright and other intellectual property rights in this document, and in any model or article produced from it (and including any registered or unregistered design rights) are the property of Siemens Protection Devices Limited. No part of this document shall be reproduced or modified or stored in another form, in any data retrieval system, without the permission of Siemens Protection Devices Limited, nor shall any model or article be reproduced from this document unless Siemens Protection Devices Limited consent.

While the information and guidance given in this document is believed to be correct, no liability shall be accepted for any loss or damage caused by any error or omission, whether such error or omission is the result of negligence or any other cause. Any and all such liability is disclaimed.

© 2013 Siemens Protection Devices Limited

Document Release History

This document is issue 2017/12. The list of revisions up to and including this issue is: -

2011/05	First issue
2013/01	Typographical revisions and added data. Updated in line with software release.
2014/06	Typographical revisions and added data. Updated in line with software release.
2015/06	Typographical revisions and added data. Updated in line with software release.
2016/02	Typographical revisions and added data. Updated in line with software release.
2016/02	Typographical revisions and added data. Updated in line with software release.
2017/12	Typographical revisions and added data.

Software Revision History

2011/05	2435H85009R7a-7a (7SR220)	First Release
2013/01	2435H85009R7c-7b (7SR220)	Introduced journaling file system. Added 61850 logical nodes for CB Counters, metering, 50BF, 46BC, 81HBL2 and line check. Added Line Check on non-AR devices. Added 74CCS Close Circuit Supervision.
2014/06	2435H85009R7f-7d (7SR220)	Added Fault Locator feature and Check Sync feature. Fault data transmitted over 103. Additional communications data, control features, meters.
2015/06	2435H85009R8a-7f (7SR220)	Added Power Factor Meters, Load Blinding feature, Arc Flash Detector. Over current TM setting range extended.
2016/02	2435H85009R8b-7f (7SR220)	EN100+ Compatibility.
2017/08	2435H85008R8e-8a (7SR210) 2435H85009R8e-8a (7SR220)	Added 32 Directional Power, 32S Sensitive Power, 55 Power Factor, 81HLB5 Overfluxing. Increased I/O.

© 2013 Siemens Protection Devices Limited

Contents

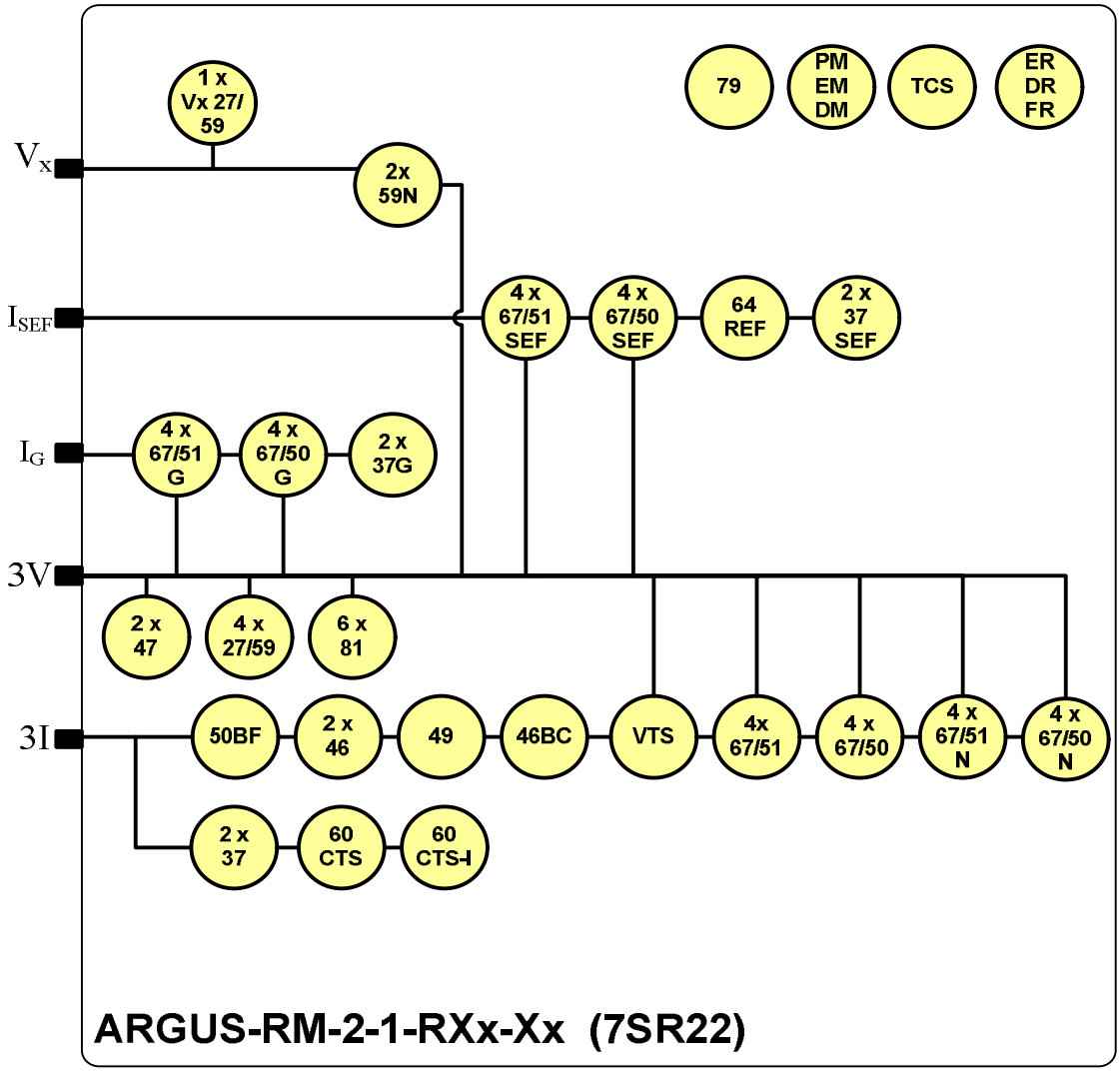
Document Release History 2
Software Revision History 2
1. Function Diagram 6
2. Menu Structure 7
3. Relay Settings 8
3.1. System Config 8
3.2. CT/VT Config 9
3.3. Function Config 10
3.4. Current Prot'n 12
3.4.1. Phase Overcurrent 12
3.4.1.1. 51-1 12
3.4.1.2. 51-2 13
3.4.1.3. 51-3 14
3.4.1.4. 51-4 15
3.4.1.5. 50-1 15
3.4.1.6. 50-2 16
3.4.1.7. 50-3 16
3.4.1.8. 50-4 17
3.4.2. Voltage Controlled O/C 17
3.4.3. Cold Load 18
3.4.4. Derived E/F 19
3.4.4.1. 51N-1 19
3.4.4.2. 51N-2 20
3.4.4.3. 51N-3 20
3.4.4.4. 51N-4 21
3.4.4.5. 50N-1 22
3.4.4.6. 50N-2 22
3.4.4.7. 50N-3 22
3.4.4.8. 50N-4 23
3.4.5. Measured E/F 23
3.4.5.1. 51G-1 23
3.4.5.2. 51G-2 24
3.4.5.3. 51G-3 25
3.4.5.4. 51G-4 25
3.4.5.5. 50G-1 26
3.4.5.6. 50G-2 26
3.4.5.7. 50G-3 26
3.4.5.8. 50G-4 27
3.4.6. Sensitive E/F 27
3.4.6.1. 51SEF-1 27
3.4.6.2. 51SEF-2 28
3.4.6.3. 51SEF-3 28
3.4.6.4. 51SEF-4 29

3.4.6.5. 50SEF-1 30
3.4.6.6. 50SEF-2 30
3.4.6.7. 50SEF-3 30
3.4.6.8. 50SEF-4 30
3.4.7. Restricted E/F 31
3.4.8. NPS Overcurrent 31
3.4.8.1. 46IT 31
3.4.8.2. 46DT 31
3.4.9. Under Current 32
3.4.9.1. 37-1 32
3.4.9.2. 37-2 32
3.4.9.3. 37G-1 32
3.4.9.4. 37G-2 32
3.4.9.5. 37SEF-1 33
3.4.9.6. 37SEF-2 33
3.4.10. Thermal 33
3.4.11. ARC Flash Detector 33
3.5. Voltage Protection 33
3.5.1. Phase U/O Voltage 33
3.5.2. 27/59-1 34
3.5.3. 27/59-2 34
3.5.4. 27/59-3 35
3.5.5. 27/59-4 35
3.6. Vx U/O Voltage 36
3.7. NPS Overvoltage 36
3.7.1. 47-1 36
3.7.2. 47-2 36
3.8. Neutral Overvoltage 37
3.8.1. 59NIT 37
3.8.2. 59NDT 37
3.9. U/O Frequency 37
3.9.1. 81-1 38
3.9.2. 81-2 38
3.9.3. 81-3 38
3.9.4. 81-4 39
3.9.5. 81-5 39
3.9.6. 81-6 40
3.10. Supervision 40
3.10.1. CB Fail 40
3.10.2. VT Supervision 40
3.10.3. CT Supervision 41
3.10.4. Broken Conductor 41
3.10.5. Trip CCT Supervision 42
3.10.6. Close CCT Supervision 42
3.10.7. Inrush Detector 42
3.10.8. Load Blinder 43

 © 2013 Siemens Protection Devices Limited

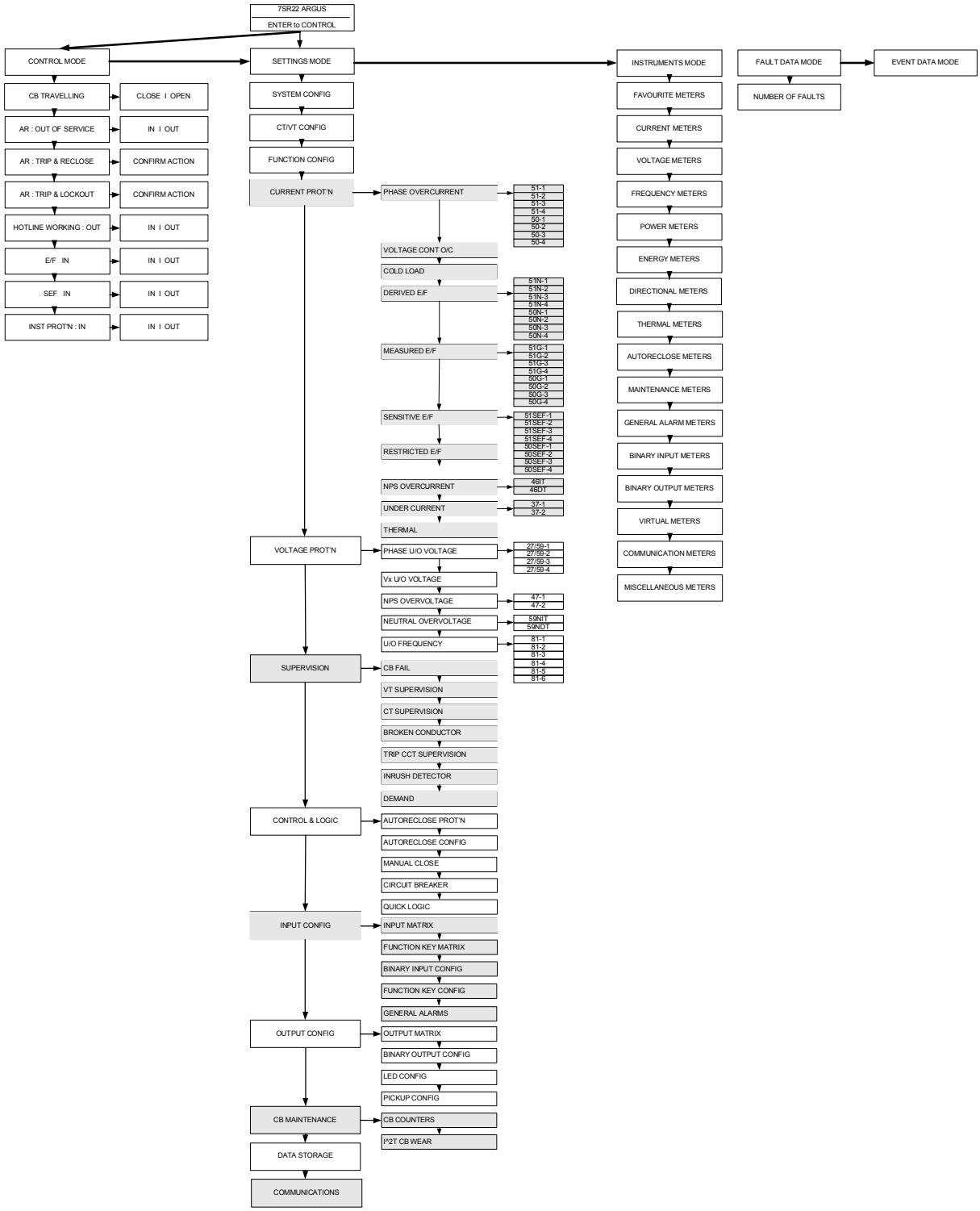
3.10.8.1. 21LB-3P 43
3.10.8.2. 21LB-1P 43
3.11. Control & Logic 43
3.11.1. Autoreclose Prot'n 43
3.11.2. Autoreclose Config 44
3.11.2.1. P/F Shots 45
3.11.2.2. E/F Shots 45
3.11.2.3. SEF Shots 46
3.11.2.4. Extern Shots 47
3.11.3. Synchronising Check 47
3.11.4. Manual CB Control 48
3.11.5. Circuit Breaker 49
3.11.6. QUICK LOGIC 49
3.12. Input Config 58
3.12.1. Input Matrix 58
3.12.2. Function Key Matrix 71
3.12.3. Binary Input Config 73
3.12.4. Function Key Config 74
3.12.5. General Alarms 75
3.13. Output Config 76
3.13.1. Output Matrix 76
3.13.2. Binary Output Config 99
3.13.3. LED Config 100
3.13.4. Pickup Config 101
3.14. Maintenance 101
3.14.1. CB Counters 102
3.14.2. I^2T CB Wear 102
3.14.3. START COUNT 103
3.15. Data Storage 103
3.15.1. Demand Data/Log 103
3.15.2. Waveform Storage 103
3.15.3. Fault Storage 104
3.15.4. Event Storage 104
3.15.5. Energy Storage 104
3.15.6. Fault Locator 105
3.15.7. Communications 106

1.Function Diagram



© 2013 Siemens Protection Devices Limited

2.Menu Structure



3.Relay Settings

3.1. System Config

Description	Range	Default
Active Group *Selects which settings group is currently activated*		
System Frequency *Selects the Power System Frequency from 50 or 60 Hz*	50, 60	50Hz
View/Edit Group *Selects which settings group is currently being displayed*		
Setting Dependencies *When enabled only active settings are displayed and all others hidden*	Disabled, Enabled	Enabled
Favourite Meters Timer *Selects the time delay after which, if no key presses have been detected, the relay will begin to poll through any screens which have been selected as favourite instruments*	Off, 1, 2, 5, 10, 15, 30, 60	60 min
Backlight timer *Controls when the LCD backlight turns off*	Off, 1, 2, 5, 10, 15, 30, 60	5 min
Date *Sets the date, this setting can only be changed on the fascia or via Relay->Control->Set Time and Date*		
Time *Sets the time, this setting can only be changed on the fascia or via Relay->Control->Set Time and Date*		
Curr Set Display *Select whether the Pickup values are shown in terms of x Nominal, Primary or Secondary values on the Relay Fascia*	xNom, Primary, Secondary	xNom
E/F Curr Set Display *As Above*	xNom, Primary, Secondary	xNom
SEF/REF Curr Set Display *As Above*	xNom, Primary, Secondary	xNom
Export Power/Lag VAr *Selects the signs required for exporting power and lagging VArs*	+ve/+ve, +ve/-ve, -ve/+ve, -ve/-ve	+ve/+ve
Select Grp Mode *Mode of operation of the group change from status input. Edge triggered ignores the status input once it has changed to the relevant group, where as with Level triggered the relay will only stay in the group it has changed to whilst the status input is being driven, after which it returns to the previous group.*	Edge triggered, Level triggered	Edge triggered
Clock Sync. From BI *Real time clock may be synchronised using a binary input (See Clock Sync. in Binary Input Menu)*	Disabled, Seconds, Minutes	Minutes
Operating Mode *Selects the current operating mode of the relay. This can also be changed by a binary input mode selection.*	Out Of Service, Local, Remote, Local Or Remote	Local Or Remote
Setting Password *Allows a 4 character alpha code to be entered as the password. Note that the display shows a password dependant encrypted code on the second line of the display*	(Password)	NONE
Control Password *As Above*	(Password)	NONE

© 2013 Siemens Protection Devices Limited

Description	Range	Default
Trip Alert *When Enabled the occurance of a Trip will cause the relay to display the Trip Alert Screen, the only way to leave this screen is by acknowledging the trip through the TEST/RESET button on the relay fascia*	Disabled, Enabled	Enabled
General Alarm Alert	Disabled, Enabled	Enabled
Relay Identifier *An alphanumeric string shown on the LCD normally used to identify the relay or the relays purpose*	(16 Character String)	ARGUS-M 7SR22
Circuit Identifier *An alphanumeric string shown on the LCD normally used to identifier the circuit the relay is attached to or the relays purpose*	(16 Character String)	

3.2. CT/VT Config

Description	Range	Default
Phase Nom Voltage *Selects the nominal voltage setting Vn of the voltage input*	40, 40.1 ... 159.9, 160	63.5 V
Phase Voltage Trim Magnitude *Allows trimming of voltage magnitude, the setting value should be the voltage required to be added to get back to Phase Nom Voltage.*	-20, -19.9 ... 19.9, 20	0 V
Phase Voltage Trim Angle *Allows trimming of voltage angle, the setting value is added to the current voltage angle*	-45, -44.9 ... 44.9, 45	0 deg
Phase Voltage Config *Required to allow for different types of physical VT connections.*	Van,Vbn,Vcn, Vab,Vbc,3V0, Va,Vb,Vc	Van,Vbn,Vcn
Phase VT Ratio Prim	(6 Character String)	132000 V
Phase VT Ratio Sec	40, 40.5 ... 159.5, 160	110 V
Vx Nom Voltage *Selects the nominal voltage setting Vn of the voltage input*	40, 40.1 ... 159.9, 160	63.5 V
Vx Voltage Trim Magnitude *Allows trimming of voltage magnitude, the setting value should be the voltage required to be added to get back to Vx Nom Voltage.*	-20, -19.9 ... 19.9, 20	0 V
Vx Voltage Trim Angle *Allows trimming of voltage angle, the setting value is added to the current voltage angle*	-45, -44.9 ... 44.9, 45	0 deg C
Vx VT Ratio Prim	(6 Character String)	132000 V
Vx VT Ratio Sec	40, 40.5 ... 159.5, 160	110 V
Phase Current Input *Selects whether 1 or 5 Amp terminals are being used for phase inputs*	1, 5	1 A
Phase CT Ratio Prim *Phase CT ratio to scale primary current instruments*	(6 Character String)	1600 A
Phase CT Ratio Sec *Phase CT ratio to scale secondary current instruments*	0.2, 0.21 ... 2, 2.1.....7	1

Description	Range	Default
Earth Current Input *Selects whether 1 or 5 Amp terminals are being used for Measured Earth inputs*	1, 5	1 A
Earth CT Ratio Prim *Measured Earth CT ratio to scale primary current instruments*	(6 Character String)	2000 A
Earth CT Ratio Sec *Measured Earth CT ratio to scale secondary current instruments*	0.2, 0.21 ... 2, 2.1.....7	1
SEF/REF Current Input *Selects whether 1 or 5 Amp terminals are being used for SEF/REF inputs*	1, 5	1 A
SEF/REF CT Ratio Prim *SEF/REF CT ratio to scale primary current instruments*	(6 Character String)	2000 A
SEF/REF CT Ratio Sec *SEF/REF CT ratio to scale primary current instruments*	0.2, 0.21 ... 2, 2.1.....7	1

3.3. Function Config

Description	Range	Default
Gn Phase Overcurrent *When set to Disabled, no Phase Overcurrent elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn Voltage Cont O/C *When set to Disabled, no Voltage Cont O/C elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn Cold Load *When set to Disabled, no Cold Load elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn Derived E/F *When set to Disabled, no Derived E/F elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn Measured E/F *When set to Disabled, no Measured E/F elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn Sensitive E/F *When set to Disabled, no Sensitive E/F elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn Restricted E/F *When set to Disabled, no Restricted E/F elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn NPS Overcurrent *When set to Disabled, no NPS Overcurrent elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled

© 2013 Siemens Protection Devices Limited

Description	Range	Default
Gn Under Current *When set to Disabled, no Under Current elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn Thermal *When set to Disabled, no Thermal elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn Phase U/O Voltage *When set to Disabled, no Phase U/O Voltage elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn Vx U/O Voltage *When set to Disabled, no Vx U/O Voltage elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn NPS Overvoltage *When set to Disabled, no NPS Overvoltage elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn Neutral Overvoltage *When set to Disabled, no Neutral Overvoltage elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn U/O Frequency *When set to Disabled, no U/O Frequency elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn CB Fail *When set to Disabled, no CB Fail elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn VT Supervision *When set to Disabled, no VT Supervision elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn CT Supervision *When set to Disabled, no CT Supervision elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn Broken Conductor *When set to Disabled, no Broken Conductor elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn Trip Cct Supervision *When set to Disabled, no Trip Cct Supervision elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled

Description	Range	Default
Gn Close Cct Supervision *When set to Disabled, no Close Cct Supervision elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn Inrush Detector *When set to Disabled, no Inrush Detector elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn Load Blinder *When set to Disabled, no Load Blinder elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn CB Counters *When set to Disabled, no Gn CB Counter elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn I^2t CB Wear *When set to Disabled, no Gn I^2t CB Wear elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled
Gn Arc Flash Detector *When set to Disabled, no Arc Flash Detector elements will be functional and all associated settings will be hidden. (The Setting Dependencies setting being set to Disabled will make all settings visible but will not allow them to operate).*	Enabled, Disabled	Disabled

3.4. Current Prot'n

3.4.1. Phase Overcurrent

Description	Range	Default
Gn 67 Char Angle *Maximum torque angle for phase overcurrent elements*	-95, -94 ... 94, 95	45 deg
Gn 67 Minimum Voltage *Selects the directional elements minimum voltage, below which the element will be inhibited*	1, 1.5 ... 19.5, 20	1 V
Gn 67 2-out-of-3 Logic *Selects whether 2 out of 3 voting logic is enabled for phase overcurrent elements*	Enabled, Disabled	Disabled
Gn 50 Measurement *Selects whether the RMS value used by the 50 elements is True RMS or only calculated at fundamental frequency*	RMS, Fundamental	RMS
Gn 51 Measurement *Selects whether the RMS value used by the 51 elements is True RMS or only calculated at fundamental frequency*	RMS, Fundamental	RMS

3.4.1.1. 51-1

Description	Range	Default
Gn 51-1 Element *Selects whether the 51-1 IDMTL Overcurrent element is enabled*	Disabled, Enabled	Disabled

© 2013 Siemens Protection Devices Limited

Description	Range	Default
Gn 51-1 Dir. Control *Selects whether 51-1 element is non-directional, forward or reverse*	Non-Dir, Forward, Reverse	Non-Dir
Gn 51-1 Setting *Pickup level*	0.05, 0.06 ... 2.49, 2.5	1 xIn
Gn 51-1 Char *Selects characteristic curve to be IEC or ANSI IDMTL or DTL*	DTL, IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI	IEC-NI
Gn 51-1 Time Mult (IEC/ANSI) *Time multiplier (applicable to IEC and ANSI curves but not DTL selection)*	0.025, 0.03 ... 1.595, 1.6 , 1.7 ... 4.9, 5, 6 ... 100	1
Gn 51-1 Delay (DTL) *Delay (applicable only when DTL is selected for characteristic)*	0, 0.01 ... 19.99, 20	5 s
Gn 51-1 Min Operate Time *Minimum operate time of element.*	0, 0.01 ... 19.99, 20	0 s
Gn 51-1 Follower DTL *Additional definite time added after characteristic time*	0, 0.01 ... 19.99, 20	0s
Gn 51-1 Reset *Selects between an ANSI decaying reset characteristic or a definite time reset*	(ANSI) Decaying, 0 ... 59, 60	0 s
Gn 51-1 VTS Action *Selects whether 51-1 element is blocked or made non-directional when VTS operates*	Off, Inhibit, Non-Dir	Off
Gn 51-1 Inrush Action *Selects if the 51-1 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off
Gn 51-1 21LB-3P Action *Selects if operation of the 51-1 element is blocked for defined load conditions*	Off, Inhibit	Inhibit
Gn 51-1 21LB-1P Action *Selects if operation of the 51-1 element is blocked for defined load conditions*	Off, Inhibit	Off

3.4.1.2. 51-2

Description	Range	Default
Gn 51-2 Element *Selects whether the 51-2 IDMTL Overcurrent element is enabled*	Disabled, Enabled	Disabled
Gn 51-2 Dir. Control *Selects whether 51-2 element is non-directional, forward or reverse*	Non-Dir, Forward, Reverse	Non-Dir
Gn 51-2 Setting *Pickup level*	0.05, 0.06 ... 2.49, 2.5	1 xIn
Gn 51-2 Char *Selects characteristic curve to be IEC or ANSI IDMTL or DTL*	DTL, IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI	IEC-NI
Gn 51-2 Time Mult (IEC/ANSI) *Time multiplier (applicable to IEC and ANSI curves but not DTL selection)*	0.025, 0.03 ... 1.595, 1.6 , 1.7 ... 4.9, 5, 6 ... 100	1
Gn 51-2 Delay (DTL) *Delay (applicable only when DTL is selected for characteristic)*	0, 0.01 ... 19.99, 20	5 s
Gn 51-2 Min Operate Time *Minimum operate time of element.*	0, 0.01 ... 19.99, 20	0 s
Gn 51-2 Follower DTL *Additional definite time added after characteristic time*	0, 0.01 ... 19.99, 20	0 s

Description	Range	Default
Gn 51-2 Reset *Selects between an ANSI decaying reset characteristic or a definite time reset*	(ANSI) Decaying, 0 ... 59, 60	0 s
Gn 51-2 VTS Action *Selects whether 51-2 element is blocked or made non-directional when VTS operates*	Off, Inhibit, Non-Dir	Off
Gn 51-2 Inrush Action *Selects if the 51-2 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off
Gn 51-2 21LB-3P Action *Selects if operation of the 51-2 element is blocked for defined load conditions*	Off, Inhibit	Inhibit
Gn 51-2 21LB-1P Action *Selects if operation of the 51-2 element is blocked for defined load conditions*	Off, Inhibit	Off

3.4.1.3. 51-3

Description	Range	Default
Gn 51-3 Element *Selects whether the 51-3 IDMTL Overcurrent element is enabled*	Disabled, Enabled	Disabled
Gn 51-3 Dir. Control *Selects whether 51-3 element is non-directional, forward or reverse*	Non-Dir, Forward, Reverse	Non-Dir
Gn 51-3 Setting *Pickup level*	0.05, 0.06 ... 2.49, 2.5	1 xIn
Gn 51-3 Char *Selects characteristic curve to be IEC or ANSI IDMTL or DTL*	DTL, IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI	IEC-NI
Gn 51-3 Time Mult (IEC/ANSI) *Time multiplier (applicable to IEC and ANSI curves but not DTL selection)*	0.025, 0.03 ... 1.595, 1.6 , 1.7 ... 4.9, 5, 6 ... 100	1
Gn 51-3 Delay (DTL) *Delay (applicable only when DTL is selected for characteristic)*	0, 0.01 ... 19.99, 20	5 s
Gn 51-3 Min Operate Time *Minimum operate time of element.*	0, 0.01 ... 19.99, 20	0 s
Gn 51-3 Follower DTL *Additional definite time added after characteristic time*	0, 0.01 ... 19.99, 20	0 s
Gn 51-3 Reset *Selects between an ANSI decaying reset characteristic or a definite time reset*	(ANSI) Decaying, 0 ... 59, 60	0 s
Gn 51-3 VTS Action *Selects whether 51-3 element is blocked or made non-directional when VTS operates*	Off, Inhibit, Non-Dir	Off
Gn 51-3 Inrush Action *Selects if the 51-3 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off
Gn 51-3 21LB-3P Action *Selects if operation of the 51-3 element is blocked for defined load conditions*	Off, Inhibit	Inhibit
Gn 51-3 21LB-1P Action *Selects if operation of the 51-3 element is blocked for defined load conditions*	Off, Inhibit	Off

© 2013 Siemens Protection Devices Limited

3.4.1.4. 51-4

Description	Range	Default
Gn 51-4 Element *Selects whether the 51-4 IDMTL Overcurrent element is enabled*	Disabled, Enabled	Disabled
Gn 51-4 Dir. Control *Selects whether 51-4 element is non-directional, forward or reverse*	Non-Dir, Forward, Reverse	Non-Dir
Gn 51-4 Setting *Pickup level*	0.05, 0.06 ... 2.49, 2.5	1 xIn
Gn 51-4 Char *Selects characteristic curve to be IEC or ANSI IDMTL or DTL*	DTL, IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI	IEC-NI
Gn 51-4 Time Mult (IEC/ANSI) *Time multiplier (applicable to IEC and ANSI curves but not DTL selection)*	0.025, 0.03 ... 1.595, 1.6 , 1.7 ... 4.9, 5, 6 ... 100	1
Gn 51-4 Delay (DTL) *Delay (applicable only when DTL is selected for characteristic)*	0, 0.01 ... 19.99, 20	5 s
Gn 51-4 Min Operate Time *Minimum operate time of element.*	0, 0.01 ... 19.99, 20	0 s
Gn 51-4 Follower DTL *Additional definite time added after characteristic time*	0, 0.01 ... 19.99, 20	0 s
Gn 51-4 Reset *Selects between an ANSI decaying reset characteristic or a definite time reset*	(ANSI) Decaying, 0 ... 59, 60	0 s
Gn 51-4 VTS Action *Selects whether 51-4 element is blocked or made non-directional when VTS operates*	Off, Inhibit, Non-Dir	Off
Gn 51-4 Inrush Action *Selects if the 51-4 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off
Gn 51-4 21LB-3P Action *Selects if operation of the 51-4 element is blocked for defined load conditions*	Off, Inhibit	Inhibit
Gn 51-4 21LB-1P Action *Selects if operation of the 51-4 element is blocked for defined load conditions*	Off, Inhibit	Off

3.4.1.5. 50-1

Description	Range	Default
Gn 50-1 Element *Selects whether the INST/ DTL Overcurrent element is enabled*	Disabled, Enabled	Disabled
Gn 50-1 Dir. Control *Selects whether 50-1 element is non-directional, forward or reverse*	Non-Dir, Forward, Reverse	Non-Dir
Gn 50-1 Setting *Pickup level*	0.05, 0.06 ... 49.5, 50	1 xIn
Gn 50-1 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0 s
Gn 50-1 VTS Action *Selects whether 50-1 element is blocked or made non-directional when VTS operates*	Off, Inhibit, Non-Dir	Off

Description	Range	Default
Gn 50-1 Inrush Action *Selects if the 50-1 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off
Gn 50-1 21LB-3P Action *Selects if operation of the 50-1 element is blocked for defined load conditions*	Off, Inhibit	Inhibit
Gn 50-1 21LB-1P Action *Selects if operation of the 50-1 element is blocked for defined load conditions*	Off, Inhibit	Off

3.4.1.6. 50-2

Description	Range	Default
Gn 50-2 Element *Selects whether the INST/ DTL Overcurrent element is enabled*	Disabled, Enabled	Disabled
Gn 50-2 Dir. Control *Selects whether 50-2 element is non-directional, forward or reverse*	Non-Dir, Forward, Reverse	Non-Dir
Gn 50-2 Setting *Pickup level*	0.05, 0.06 ... 49.5, 50	1 xIn
Gn 50-2 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0 s
Gn 50-2 VTS Action *Selects whether 50-2 element is blocked or made non-directional when VTS operates*	Off, Inhibit, Non-Dir	Off
Gn 50-2 Inrush Action *Selects if the 50-2 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off
Gn 50-2 21LB-3P Action *Selects if operation of the 50-2 element is blocked for defined load conditions*	Off, Inhibit	Inhibit
Gn 50-2 21LB-1P Action *Selects if operation of the 50-2 element is blocked for defined load conditions*	Off, Inhibit	Off

3.4.1.7. 50-3

Description	Range	Default
Gn 50-3 Element *Selects whether the INST/ DTL Overcurrent element is enabled*	Disabled, Enabled	Disabled
Gn 50-3 Dir. Control *Selects whether 50-3 element is non-directional, forward or reverse*	Non-Dir, Forward, Reverse	Non-Dir
Gn 50-3 Setting *Pickup level*	0.05, 0.06 ... 49.5, 50	1 xIn
Gn 50-3 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0 s
Gn 50-3 VTS Action *Selects whether 50-3 element is blocked or made non-directional when VTS operates*	Off, Inhibit, Non-Dir	Off
Gn 50-3 Inrush Action *Selects if the 50-3 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off

© 2013 Siemens Protection Devices Limited

Description	Range	Default
Gn 50-3 21LB-3P Action *Selects if operation of the 50-3 element is blocked for defined load conditions*	Off, Inhibit	Inhibit
Gn 50-3 21LB-1P Action *Selects if operation of the 50-3 element is blocked for defined load conditions*	Off, Inhibit	Off

3.4.1.8. 50-4

Description	Range	Default
Gn 50-4 Element *Selects whether the INST/ DTL Overcurrent element is enabled*	Disabled, Enabled	Disabled
Gn 50-4 Dir. Control *Selects whether 50-4 element is non-directional, forward or reverse*	Non-Dir, Forward, Reverse	Non-Dir
Gn 50-4 Setting *Pickup level*	0.05, 0.06 ... 49.5, 50	1 xIn
Gn 50-4 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0 s
Gn 50-4 VTS Action *Selects whether 50-4 element is blocked or made non-directional when VTS operates*	Off, Inhibit, Non-Dir	Off
Gn 50-4 Inrush Action *Selects if the 50-4 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off
Gn 50-4 21LB-3P Action *Selects if operation of the 50-4 element is blocked for defined load conditions*	Off, Inhibit	Inhibit
Gn 50-4 21LB-1P Action *Selects if operation of the 50-4 element is blocked for defined load conditions*	Off, Inhibit	Off

3.4.2. Voltage Controlled O/C

Description	Range	Default
Gn 51V Element (Ph-Ph)	Disabled, Enabled	Disabled
Gn 51V Setting *The voltage below which 51V operates*	5, 5.5 ... 199.5, 200	30 V
Gn 51V VTS Action *Selects whether or not the 51V element is blocked when VTS operates*	Off, Inhibit	Off
Gn 51-1 Multiplier *Multiplier applied to the 51-1 element when VCO element has operated*	0.25, 0.3, 0.35, 0.4, 0.45, 0.5, 0.55, 0.6, 0.65, 0.7, 0.75, 0.8, 0.85, 0.9, 0.95, 1	0.5
Gn 51-2 Multiplier *Multiplier applied to the 51-2 element when VCO element has operated*	0.25, 0.3, 0.35, 0.4, 0.45, 0.5, 0.55, 0.6, 0.65, 0.7, 0.75, 0.8, 0.85, 0.9, 0.95, 1	0.5
Gn 51-3 Multiplier *Multiplier applied to the 51-3 element when VCO element has operated*	0.25, 0.3, 0.35, 0.4, 0.45, 0.5, 0.55, 0.6, 0.65, 0.7, 0.75, 0.8, 0.85, 0.9, 0.95, 1	0.5
Gn 51-4 Multiplier *Multiplier applied to the 51-4 element when VCO element has operated*	0.25, 0.3, 0.35, 0.4, 0.45, 0.5, 0.55, 0.6, 0.65, 0.7, 0.75, 0.8, 0.85, 0.9, 0.95, 1	0.5

3.4.3. Cold Load

Description	Range	Default
Cold Load *Selects whether the Cold Load element is enabled*	Disabled, Enabled	Disabled
Pick-up Time *Cold Load operate time delay*	1, 1.1 ... 14100, 14400	600 s
Drop-off Time *Cold Load reset time delay*	1, 1.1 ... 14100, 14400	600 s
Reduced Current *Selects whether reduced current functionality is to be used*	Disabled, Enabled	Disabled
Reduced Current Level *Selects current level below which Reduced Current Time is used for Cold Load reset delay*	0.05, 0.1 ... 2.45, 2.5	0.25 xIn
Reduced Current Time *Cold Load reset time delay used when reduced current active*	1, 1.1 ... 14100, 14400	600 s
Gn 51c-1 Setting *51-1 element parameter used when Cold Load operates*	0.05, 0.06 ... 2.49, 2.5	1 xIn
Gn 51c-1 Char *As Above*	DTL, IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI	IEC-NI
Gn 51c-1 Time Mult (IEC/ANSI) *As Above*	0.025, 0.03 ... 1.595, 1.6 , 1.7 ... 4.9, 5, 6 ... 100	1
Gn 51c-1 Delay (DTL) *As Above*	0, 0.01 ... 19.99, 20	5 s
Gn 51c-1 Min Operate Time *As Above*	0, 0.01 ... 19.99, 20	0 s
Gn 51c-1 Follower DTL *As Above*	0, 0.01 ... 19.99, 20	0 s
Gn 51c-1 Reset *As Above*	(ANSI) Decaying, 0 ... 59, 60	0 s
Gn 51c-2 Setting *51-2 element parameter used when Cold Load operates*	0.05, 0.06 ... 2.49, 2.5	1 xIn
Gn 51c-2 Char *As Above*	DTL, IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI	IEC-NI
Gn 51c-2 Time Mult (IEC/ANSI) *As Above*	0.025, 0.03 ... 1.595, 1.6 , 1.7 ... 4.9, 5, 6 ... 100	1
Gn 51c-2 Delay (DTL) *As Above*	0, 0.01 ... 19.99, 20	5 s
Gn 51c-2 Min Operate Time *As Above*	0, 0.01 ... 19.99, 20	0 s
Gn 51c-2 Follower DTL *As Above*	0, 0.01 ... 19.99, 20	0 s
Gn 51c-2 Reset *As Above*	(ANSI) Decaying, 0 ... 59, 60	0 s
Gn 51c-3 Setting *51-3 element parameter used when Cold Load operates*	0.05, 0.06 ... 2.49, 2.5	1 xIn
Gn 51c-3 Char *As Above*	DTL, IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI	IE C-NI
Gn 51c-3 Time Mult (IEC/ANSI) *As Above*	0.025, 0.03 ... 1.595, 1.6 , 1.7 ... 4.9, 5, 6 ... 100	1

© 2013 Siemens Protection Devices Limited

Description	Range	Default
Gn 51c-3 Delay (DTL) *As Above*	0, 0.01 ... 19.99, 20	5 s
Gn 51c-3 Min Operate Time *As Above*	0, 0.01 ... 19.99, 20	0 s
Gn 51c-3 Follower DTL *As Above*	0, 0.01 ... 19.99, 20	0 s
Gn 51c-3 Reset *As Above*	(ANSI) Decaying, 0 ... 59, 60	0 s
Gn 51c-4 Setting *51-4 element parameter used when Cold Load operates*	0.05, 0.06 ... 2.49, 2.5	1 xIn
Gn 51c-4 Char *As Above*	DTL, IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI	IEC-NI
Gn 51c-4 Time Mult (IEC/ANSI) *As Above*	0.025, 0.03 ... 1.595, 1.6 , 1.7 ... 4.9, 5, 6 ... 100	1
Gn 51c-4 Delay (DTL) *As Above*	0, 0.01 ... 19.99, 20	5 s
Gn 51c-4 Min Operate Time *As Above*	0, 0.01 ... 19.99, 20	0 s
Gn 51c-4 Follower DTL *As Above*	0, 0.01 ... 19.99, 20	0 s
Gn 51c-4 Reset *As Above*	(ANSI) Decaying, 0 ... 59, 60	0 s

3.4.4. Derived E/F

Description	Range	Default
Gn 67N Polarizing Quantity *Allows the directional element to select which quantities to use.*	ZPS, NPS	ZPS
Gn 67N Char Angle *Maximum torque angle for derived earth fault elements*	-95, -94 ... 94, 95	-15 deg
Gn 67N Minimum Voltage *Selects the directional elements minimum voltage, below which the element will be inhibited*	0.33, 0.5, 1, 1.5, 2, 2.5, 3	0.33 V

3.4.4.1. 51N-1

Description	Range	Default
Gn 51N-1 Element *Selects whether the 51N-1 IDMTL derived Earth Fault element is enabled*	Disabled, Enabled	Disabled
Gn 51N-1 Dir. Control *Selects whether 51N-1 element is non-directional, forward or reverse*	Non-Dir, Forward, Reverse	Non-Dir
Gn 51N-1 Setting *Pickup level*	0.05, 0.06 ... 2.49, 2.5	0.5 xIn
Gn 51N-1 Char *Selects characteristic curve to be IEC or ANSI IDMTL or DTL*	DTL, IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI	IEC-NI
Gn 51N-1 Time Mult (IEC/ANSI) *Time multiplier (applicable to IEC and ANSI curves but not DTL selection)*	0.025, 0.03 ... 1.595, 1.6 , 1.7 ... 4.9, 5, 6 ... 100	1

Description	Range	Default
Gn 51N-1 Delay (DTL) *Delay (applicable only when DTL is selected for characteristic)*	0, 0.01 ... 19.99, 20	5 s
Gn 51N-1 Min Operate Time *Minimum operate time of element.*	0, 0.01 ... 19.99, 20	0 s
Gn 51N-1 Follower DTL *Additional definite time added after characteristic time*	0, 0.01 ... 19.99, 20	0 s
Gn 51N-1 Reset *Selects between an ANSI decaying reset characteristic or a definite time reset*	(ANSI) Decaying, 0 ... 59, 60	0 s
Gn 51N-1 VTS Action *Selects whether 51N-1 element is blocked or made non-directional when VTS operates*	Off, Inhibit, Non-Dir	Off
Gn 51N-1 Inrush Action *Selects if the 51N-1 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off

3.4.4.2. 51N-2

Description	Range	Default
Gn 51N-2 Element *Selects whether the 51N-2 IDMTL derived Earth Fault element is enabled*	Disabled, Enabled	Disabled
Gn 51N-2 Dir. Control *Selects whether 51N-2 element is non-directional, forward or reverse*	Non-Dir, Forward, Reverse	Non-Dir
Gn 51N-2 Setting *Pickup level*	0.05, 0.06 ... 2.49, 2.5	0.5xIn
Gn 51N-2 Char *Selects characteristic curve to be IEC or ANSI IDMTL or DTL*	DTL, IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI	IEC-NI
Gn 51N-2 Time Mult (IEC/ANSI) *Time multiplier (applicable to IEC and ANSI curves but not DTL selection)*	0.025, 0.03 ... 1.595, 1.6 , 1.7 ... 4.9, 5, 6 ... 100	1
Gn 51N-2 Delay (DTL) *Delay (applicable only when DTL is selected for characteristic)*	0, 0.01 ... 19.99, 20	5 s
Gn 51N-2 Min Operate Time *Minimum operate time of element.*	0, 0.01 ... 19.99, 20	0 s
Gn 51N-2 Follower DTL *Additional definite time added after characteristic time*	0, 0.01 ... 19.99, 20	0s
Gn 51N-2 Reset *Selects between an ANSI decaying reset characteristic or a definite time reset*	(ANSI) Decaying, 0 ... 59, 60	0 s
Gn 51N-2 VTS Action *Selects whether 51N-2 element is blocked or made non-directional when VTS operates*	Off, Inhibit, Non-Dir	Off
Gn 51N-2 Inrush Action *Selects if the 51N-2 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off

3.4.4.3. 51N-3

Description	Range	Default
Gn 51N-3 Element *Selects whether the 51N-3 IDMTL derived Earth Fault element is enabled*	Disabled, Enabled	Disabled

© 2013 Siemens Protection Devices Limited

Description	Range	Default
Gn 51N-3 Dir. Control *Selects whether 51N-3 element is non-directional, forward or reverse*	Non-Dir, Forward, Reverse	Non-Dir
Gn 51N-3 Setting *Pickup level*	0.05, 0.06 ... 2.49, 2.5	0.5 xIn
Gn 51N-3 Char *Selects characteristic curve to be IEC or ANSI IDMTL or DTL*	DTL, IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI	IEC-NI
Gn 51N-3 Time Mult (IEC/ANSI) *Time multiplier (applicable to IEC and ANSI curves but not DTL selection)*	0.025, 0.03 ... 1.595, 1.6 , 1.7 ... 4.9, 5, 6 ... 100	1
Gn 51N-3 Delay (DTL) *Delay (applicable only when DTL is selected for characteristic)*	0, 0.01 ... 19.99, 20	5 s
Gn 51N-3 Min Operate Time *Minimum operate time of element.*	0, 0.01 ... 19.99, 20	0 s
Gn 51N-3 Follower DTL *Additional definite time added after characteristic time*	0, 0.01 ... 19.99, 20	0 s
Gn 51N-3 Reset *Selects between an ANSI decaying reset characteristic or a definite time reset*	(ANSI) Decaying, 0 ... 59, 60	0 s
Gn 51N-3 VTS Action *Selects whether 51N-3 element is blocked or made non-directional when VTS operates*	Off, Inhibit, Non-Dir	Off
Gn 51N-3 Inrush Action *Selects if the 51N-3 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off

3.4.4.4. 51N-4

Description	Range	Default
Gn 51N-4 Element *Selects whether the 51N-4 IDMTL derived Earth Fault element is enabled*	Disabled, Enabled	Disabled
Gn 51N-4 Dir. Control *Selects whether 51N-4 element is non-directional, forward or reverse*	Non-Dir, Forward, Reverse	Non-Dir
Gn 51N-4 Setting *Pickup level*	0.05, 0.06 ... 2.49, 2.5	0.5 xIn
Gn 51N-4 Char *Selects characteristic curve to be IEC or ANSI IDMTL or DTL*	DTL, IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI	IEC-NI
Gn 51N-4 Time Mult (IEC/ANSI) *Time multiplier (applicable to IEC and ANSI curves but not DTL selection)*	0.025, 0.03 ... 1.595, 1.6 , 1.7 ... 4.9, 5, 6 ... 100	1
Gn 51N-4 Delay (DTL) *Delay (applicable only when DTL is selected for characteristic)*	0, 0.01 ... 19.99, 20	5 s
Gn 51N-4 Min Operate Time *Minimum operate time of element.*	0, 0.01 ... 19.99, 20	0 s
Gn 51N-4 Follower DTL *Additional definite time added after characteristic time*	0, 0.01 ... 19.99, 20	0 s
Gn 51N-4 Reset *Selects between an ANSI decaying reset characteristic or a definite time reset*	(ANSI) Decaying, 0 ... 59, 60	0 s
Gn 51N-4 VTS Action *Selects whether 51N-4 element is blocked or made non-directional when VTS operates*	Off, Inhibit, Non-Dir	Off

Description	Range	Default
Gn 51N-4 Inrush Action *Selects if the 51N-4 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off

3.4.4.5. 50N-1

Description	Range	Default
Gn 50N-1 Element *Selects whether the DTL derived Earth fault element is enabled*	Disabled, Enabled	Disabled
Gn 50N-1 Dir. Control *Selects whether 50N-1 element is non-directional, forward or reverse*	Non-Dir, Forward, Reverse	Non-Dir
Gn 50N-1 Setting *Pickup level*	0.05, 0.06 ... 49.5, 50	0.5 xIn
Gn 50N-1 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0s
Gn 50N-1 VTS Action *Selects whether 50N-1 element is blocked or made non-directional when VTS operates*	Off, Inhibit, Non-Dir	Off
Gn 50N-1 Inrush Action *Selects if the 50N-1 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off

3.4.4.6. 50N-2

Description	Range	Default
Gn 50N-2 Element *Selects whether the DTL derived Earth fault element is enabled*	Disabled, Enabled	Disabled
Gn 50N-2 Dir. Control *Selects whether 50N-2 element is non-directional, forward or reverse*	Non-Dir, Forward, Reverse	Non-Dir
Gn 50N-2 Setting *Pickup level*	0.05, 0.06 ... 49.5, 50	0.5 xIn
Gn 50N-2 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0 s
Gn 50N-2 VTS Action *Selects whether 50N-2 element is blocked or made non-directional when VTS operates*	Off, Inhibit, Non-Dir	Off
Gn 50N-2 Inrush Action *Selects if the 50N-2 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off

3.4.4.7. 50N-3

Description	Range	Default
Gn 50N-3 Element *Selects whether the DTL derived Earth fault element is enabled*	Disabled, Enabled	Disabled
Gn 50N-3 Dir. Control *Selects whether 50N-3 element is non-directional, forward or reverse*	Non-Dir, Forward, Reverse	Non-Dir
Gn 50N-3 Setting *Pickup level*	0.05, 0.06 ... 49.5, 50	0.5 xIn

© 2013 Siemens Protection Devices Limited

Description	Range	Default
Gn 50N-3 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0 s
Gn 50N-3 VTS Action *Selects whether 50N-3 element is blocked or made non-directional when VTS operates*	Off, Inhibit, Non-Dir	Off
Gn 50N-3 Inrush Action *Selects if the 50N-3 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off

3.4.4.8. 50N-4

Description	Range	Default
Gn 50N-4 Element *Selects whether the DTL derived Earth fault element is enabled*	Disabled, Enabled	Disabled
Gn 50N-4 Dir. Control *Selects whether 50N-4 element is non-directional, forward or reverse*	Non-Dir, Forward, Reverse	Non-Dir
Gn 50N-4 Setting *Pickup level*	0.05, 0.06 ... 49.5, 50	0.5 xIn
Gn 50N-4 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0 s
Gn 50N-4 VTS Action *Selects whether 50N-4 element is blocked or made non-directional when VTS operates*	Off, Inhibit, Non-Dir	Off
Gn 50N-4 Inrush Action *Selects if the 50N-4 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off

3.4.5. Measured E/F

Description	Range	Default
Gn 67G Char Angle *Maximum torque angle for measured earth fault elements*	-95, -94 ... 94, 95	-15 deg
Gn 67G Minimum Voltage *Selects the directional elements minimum voltage, below which the element will be inhibited*	0.33, 0.5, 1, 1.5, 2, 2.5, 3	0.33 V
Gn 50G Measurement *Selects whether the RMS value used by the 50G elements is True RMS or only calculated at fundamental frequency*	RMS, Fundamental	RMS
Gn 51G Measurement *Selects whether the RMS value used by the 51G elements is True RMS or only calculated at fundamental frequency*	RMS, Fundamental	RMS

3.4.5.1. 51G-1

Description	Range	Default
Gn 51G-1 Element *Selects whether the 51G-1 IDMTL measured Earth Fault element is enabled*	Disabled, Enabled	Disabled
Gn 51G-1 Dir. Control *Selects whether 51G-1 element is non-directional, forward or reverse*	Non-Dir, Forward, Reverse	Non-Dir
Gn 51G-1 Setting *Pickup level*	0.005, 0.006 ... 0.995, 1	0.5 xIn

Description	Range	Default
Gn 51G-1 Char *Selects characteristic curve to be IEC or ANSI IDMTL or DTL*	DTL, IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI	IEC-NI
Gn 51G-1 Time Mult (IEC/ANSI) *Time multiplier (applicable to IEC and ANSI curves but not DTL selection)*	0.025, 0.03 ... 1.595, 1.6 , 1.7 ... 4.9, 5, 6 ... 100	1
Gn 51G-1 Delay (DTL) *Delay (applicable only when DTL is selected for characteristic)*	0, 0.01 ... 19.99, 20	5 s
Gn 51G-1 Min Operate Time *Minimum operate time of element.*	0, 0.01 ... 19.99, 20	0 s
Gn 51G-1 Follower DTL *Additional definite time added after characteristic time*	0, 0.01 ... 19.99, 20	0 s
Gn 51G-1 Reset *Selects between an ANSI decaying reset characteristic or DTL reset*	(ANSI) Decaying, 0 ... 59, 60	0 s
Gn 51G-1 VTS Action *Selects whether 51G-1 element is blocked or made non-directional when VTS operates*	Off, Inhibit, Non-Dir	Off
Gn 51G-1 Inrush Action *Selects if the 51G-1 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off

3.4.5.2. 51G-2

Description	Range	Default
Gn 51G-2 Element *Selects whether the 51G-2 IDMTL measured Earth Fault element is enabled*	Disabled, Enabled	Disabled
Gn 51G-2 Dir. Control *Selects whether 51G-2 element is non-directional, forward or reverse*	Non-Dir, Forward, Reverse	Non-Dir
Gn 51G-2 Setting *Pickup level*	0.005, 0.006 ... 0.995, 1	0.5 xIn
Gn 51G-2 Char *Selects characteristic curve to be IEC or ANSI IDMTL or DTL*	DTL, IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI	IEC-NI
Gn 51G-2 Time Mult (IEC/ANSI) *Time multiplier (applicable to IEC and ANSI curves but not DTL selection)*	0.025, 0.03 ... 1.595, 1.6 , 1.7 ... 4.9, 5, 6 ... 100	1
Gn 51G-2 Delay (DTL) *Delay (applicable only when DTL is selected for characteristic)*	0, 0.01 ... 19.99, 20	5 s
Gn 51G-2 Min Operate Time *Minimum operate time of element.*	0, 0.01 ... 19.99, 20	0 s
Gn 51G-2 Follower DTL *Additional definite time added after characteristic time*	0, 0.01 ... 19.99, 20	0 s
Gn 51G-2 Reset *Selects between an ANSI decaying reset characteristic or DTL reset*	(ANSI) Decaying, 0 ... 59, 60	0 s
Gn 51G-2 VTS Action *Selects whether 51G-2 element is blocked or made non-directional when VTS operates*	Off, Inhibit, Non-Dir	Off
Gn 51G-2 Inrush Action *Selects if the 51G-2 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off

© 2013 Siemens Protection Devices Limited

3.4.5.3. 51G-3

Description	Range	Default
Gn 51G-3 Element *Selects whether the 51G-3 IDMTL measured Earth Fault element is enabled*	Disabled, Enabled	Disabled
Gn 51G-3 Dir. Control *Selects whether 51G-3 element is non-directional, forward or reverse*	Non-Dir, Forward, Reverse	Non-Dir
Gn 51G-3 Setting *Pickup level*	0.005, 0.006 ... 0.995, 1	0.5 xIn
Gn 51G-3 Char *Selects characteristic curve to be IEC or ANSI IDMTL or DTL*	DTL, IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI	IEC-NI
Gn 51G-3 Time Mult (IEC/ANSI) *Time multiplier (applicable to IEC and ANSI curves but not DTL selection)*	0.025, 0.03 ... 1.595, 1.6 , 1.7 ... 4.9, 5, 6 ... 100	1
Gn 51G-3 Delay (DTL) *Delay (applicable only when DTL is selected for characteristic)*	0, 0.01 ... 19.99, 20	5 s
Gn 51G-3 Min Operate Time *Minimum operate time of element.*	0, 0.01 ... 19.99, 20	0 s
Gn 51G-3 Follower DTL *Additional definite time added after characteristic time*	0, 0.01 ... 19.99, 20	0 s
Gn 51G-3 Reset *Selects between an ANSI decaying reset characteristic or DTL reset*	(ANSI) Decaying, 0 ... 59, 60	0 s
Gn 51G-3 VTS Action *Selects whether 51G-3 element is blocked or made non-directional when VTS operates*	Off, Inhibit, Non-Dir	Off
Gn 51G-3 Inrush Action *Selects if the 51G-3 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off

3.4.5.4. 51G-4

Description	Range	Default
Gn 51G-4 Element *Selects whether the 51G-4 IDMTL measured Earth Fault element is enabled*	Disabled, Enabled	Disabled
Gn 51G-4 Dir. Control *Selects whether 51G-4 element is non-directional, forward or reverse*	Non-Dir, Forward, Reverse	Non-Dir
Gn 51G-4 Setting *Pickup level*	0.005, 0.006 ... 0.995, 1	0.5 xIn
Gn 51G-4 Char *Selects characteristic curve to be IEC or ANSI IDMTL or DTL*	DTL, IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI	IEC-NI
Gn 51G-4 Time Mult (IEC/ANSI) *Time multiplier (applicable to IEC and ANSI curves but not DTL selection)*	0.025, 0.03 ... 1.595, 1.6 , 1.7 ... 4.9, 5, 6 ... 100	1
Gn 51G-4 Delay (DTL) *Delay (applicable only when DTL is selected for characteristic)*	0, 0.01 ... 19.99, 20	5 s
Gn 51G-4 Min Operate Time *Minimum operate time of element.*	0, 0.01 ... 19.99, 20	0 s
Gn 51G-4 Follower DTL *Additional definite time added after characteristic time*	0, 0.01 ... 19.99, 20	0 s

Description	Range	Default
Gn 51G-4 Reset *Selects between an ANSI decaying reset characteristic or DTL reset*	(ANSI) Decaying, 0 ... 59, 60	0 s
Gn 51G-4 VTS Action *Selects whether 51G-4 element is blocked or made non-directional when VTS operates*	Off, Inhibit, Non-Dir	Off
Gn 51G-4 Inrush Action *Selects if the 51G-4 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off

3.4.5.5. 50G-1

Description	Range	Default
Gn 50G-1 Element *Selects whether the DTL measured Earth fault element is enabled*	Disabled, Enabled	Disabled
Gn 50G-1 Dir. Control *Selects whether 50G-1 element is non-directional, forward or reverse*	Non-Dir, Forward, Reverse	Non-Dir
Gn 50G-1 Setting *Pickup level*	0.005, 0.006 ... 24.95, 25	0.5 xIn
Gn 50G-1 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0 s
Gn 50G-1 VTS Action *Selects whether 50G-1 element is blocked or made non-directional when VTS operates*	Off, Inhibit, Non-Dir	Off
Gn 50G-1 Inrush Action *Selects if the 50G-1 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off

3.4.5.6. 50G-2

Description	Range	Default
Gn 50G-2 Element *Selects whether the DTL measured Earth fault element is enabled*	Disabled, Enabled	Disabled
Gn 50G-2 Dir. Control *Selects whether 50G-2 element is non-directional, forward or reverse*	Non-Dir, Forward, Reverse	Non-Dir
Gn 50G-2 Setting *Pickup level*	0.005, 0.006 ... 24.95, 25	0.5 xIn
Gn 50G-2 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0 s
Gn 50G-2 VTS Action *Selects whether 50G-2 element is blocked or made non-directional when VTS operates*	Off, Inhibit, Non-Dir	Off
Gn 50G-2 Inrush Action *Selects if the 50G-2 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off

3.4.5.7. 50G-3

Description	Range	Default
Gn 50G-3 Element *Selects whether the DTL measured Earth fault element is enabled*	Disabled, Enabled	Disabled

© 2013 Siemens Protection Devices Limited

Description	Range	Default
Gn 50G-3 Dir. Control *Selects whether 50G-3 element is non-directional, forward or reverse*	Non-Dir, Forward, Reverse	Non-Dir
Gn 50G-3 Setting *Pickup level*	0.005, 0.006 ... 24.95, 25	0.5 xIn
Gn 50G-3 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0 s
Gn 50G-3 VTS Action *Selects whether 50G-3 element is blocked or made non-directional when VTS operates*	Off, Inhibit, Non-Dir	Off
Gn 50G-3 Inrush Action *Selects if the 50G-3 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off

3.4.5.8. 50G-4

Description	Range	Default
Gn 50G-4 Element *Selects whether the DTL measured Earth fault element is enabled*	Disabled, Enabled	Disabled
Gn 50G-4 Dir. Control *Selects whether 50G-4 element is non-directional, forward or reverse*	Non-Dir, Forward, Reverse	Non-Dir
Gn 50G-4 Setting *Pickup level*	0.005, 0.006 ... 24.95, 25	0.5 xIn
Gn 50G-4 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0 s
Gn 50G-4 VTS Action *Selects whether 50G-4 element is blocked or made non-directional when VTS operates*	Off, Inhibit, Non-Dir	Off
Gn 50G-4 Inrush Action *Selects if the 50G-4 element is blocked from operating when 2nd Harmonic Inrush Detector operates*	Off, Inhibit	Off

3.4.6. Sensitive E/F

Description	Range	Default
Gn 67SEF Char Angle *Maximum torque angle for sensitive earth fault elements*	-95, -94 ... 94, 95	-15 deg
Gn 67SEF Minimum Voltage *Selects the directional elements minimum voltage, below which the element will be inhibited*	0.33, 0.5, 1, 1.5, 2, 2.5, 3	0.33 V

3.4.6.1. 51SEF-1

Description	Range	Default
Gn 51SEF-1 Element *Selects whether the 51SEF-1 IDMTL Sensitive Earth Fault element is enabled*	Disabled, Enabled	Disabled
Gn 51SEF-1 Dir. Control *Selects whether 51SEF-1 element is non-directional, forward or reverse*	Non-Dir, Forward, Reverse	Non-Dir
Gn 51SEF-1 Setting *Pickup level*	0.005, 0.006 ... 0.995, 1	0.2 xIn

Description	Range	Default
Gn 51SEF-1 Char *Selects characteristic curve to be IEC or ANSI IDMTL or DTL*	DTL, IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI	IEC-NI
Gn 51SEF-1 Time Mult (IEC/ANSI) *Time multiplier (applicable to IEC and ANSI curves but not DTL selection)*	0.025, 0.03 ... 1.595, 1.6 , 1.7 ... 4.9, 5, 6 ... 100	1
Gn 51SEF-1 Delay (DTL) *Delay (applicable only when DTL is selected for characteristic)*	0, 0.01 ... 19.99, 20	5 s
Gn 51SEF-1 Min Operate Time *Minimum operate time of element.*	0, 0.01 ... 19.99, 20	0 s
Gn 51SEF-1 Follower DTL *Additional definite time added after characteristic time*	0, 0.01 ... 19.99, 20	0 s
Gn 51SEF-1 Reset *Selects between an ANSI decaying reset characteristic or DTL reset*	(ANSI) Decaying, 0 ... 59, 60	0 s
Gn 51SEF-1 VTS Action *Selects whether 51SEF-1 element is blocked or made non-directional when VTS operates*	Off, Inhibit, Non-Dir	Off

3.4.6.2. 51SEF-2

Description	Range	Default
Gn 51SEF-2 Element *Selects whether the 51SEF-2 IDMTL derived Earth Fault element is enabled*	Disabled, Enabled	Disabled
Gn 51SEF-2 Dir. Control *Selects whether 51SEF-2 element is non-directional, forward or reverse*	Non-Dir, Forward, Reverse	Non-Dir
Gn 51SEF-2 Setting *Pickup level*	0.005, 0.006 ... 0.995, 1	0.2 xIn
Gn 51SEF-2 Char *Selects characteristic curve to be IEC or ANSI IDMTL or DTL*	DTL, IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI	IEC-NI
Gn 51SEF-2 Time Mult (IEC/ANSI) *Time multiplier (applicable to IEC and ANSI curves but not DTL selection)*	0.025, 0.03 ... 1.595, 1.6 , 1.7 ... 4.9, 5, 6 ... 100	1
Gn 51SEF-2 Delay (DTL) *Delay (applicable only when DTL is selected for characteristic)*	0, 0.01 ... 19.99, 20	5 s
Gn 51SEF-2 Min Operate Time *Minimum operate time of element.*	0, 0.01 ... 19.99, 20	0 s
Gn 51SEF-2 Follower DTL *Additional definite time added after characteristic time*	0, 0.01 ... 19.99, 20	0 s
Gn 51SEF-2 Reset *Selects between an ANSI decaying reset characteristic or DTL reset*	(ANSI) Decaying, 0 ... 59, 60	0 s
Gn 51SEF-2 VTS Action *Selects whether 51SEF-2 element is blocked or made non-directional when VTS operates*	Off, Inhibit, Non-Dir	Off

3.4.6.3. 51SEF-3

Description	Range	Default
Gn 51SEF-3 Element *Selects whether the 51SEF-3 IDMTL derived Earth Fault element is enabled*	Disabled, Enabled	Disabled

© 2013 Siemens Protection Devices Limited

Description	Range	Default
Gn 51SEF-3 Dir. Control *Selects whether 51SEF-3 element is non-directional, forward or reverse*	Non-Dir, Forward, Reverse	Non-Dir
Gn 51SEF-3 Setting *Pickup level*	0.005, 0.006 ... 0.995, 1	0.2 xIn
Gn 51SEF-3 Char *Selects characteristic curve to be IEC or ANSI IDMTL or DTL*	DTL, IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI	IEC-NI
Gn 51SEF-3 Time Mult (IEC/ANSI) *Time multiplier (applicable to IEC and ANSI curves but not DTL selection)*	0.025, 0.03 ... 1.595, 1.6 , 1.7 ... 4.9, 5, 6 ... 100	1
Gn 51SEF-3 Delay (DTL) *Delay (applicable only when DTL is selected for characteristic)*	0, 0.01 ... 19.99, 20	5 s
Gn 51SEF-3 Min Operate Time *Minimum operate time of element.*	0, 0.01 ... 19.99, 20	0 s
Gn 51SEF-3 Follower DTL *Additional definite time added after characteristic time*	0, 0.01 ... 19.99, 20	0 s
Gn 51SEF-3 Reset *Selects between an ANSI decaying reset characteristic or a definite time reset*	(ANSI) Decaying, 0 ... 59, 60	0 s
Gn 51SEF-3 VTS Action *Selects whether 51SEF-3 element is blocked or made non-directional when VTS operates*	Off, Inhibit, Non-Dir	Off

3.4.6.4. 51SEF-4

Description	Range	Default
Gn 51SEF-4 Element *Selects whether the 51SEF-4 IDMTL derived Earth Fault element is enabled*	Disabled, Enabled	Disabled
Gn 51SEF-4 Dir. Control *Selects whether 51SEF-4 element is non-directional, forward or reverse*	Non-Dir, Forward, Reverse	Non-Dir
Gn 51SEF-4 Setting *Pickup level*	0.005, 0.006 ... 0.995, 1	0.2 xIn
Gn 51SEF-4 Char *Selects characteristic curve to be IEC or ANSI IDMTL or DTL*	DTL, IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI	IEC-NI
Gn 51SEF-4 Time Mult (IEC/ANSI) *Time multiplier (applicable to IEC and ANSI curves but not DTL selection)*	0.025, 0.03 ... 1.595, 1.6 , 1.7 ... 4.9, 5, 6 ... 100	1
Gn 51SEF-4 Delay (DTL) *Delay (applicable only when DTL is selected for characteristic)*	0, 0.01 ... 19.99, 20	5 s
Gn 51SEF-4 Min Operate Time *Minimum operate time of element.*	0, 0.01 ... 19.99, 20	0 s
Gn 51SEF-4 Follower DTL *Additional definite time added after characteristic time*	0, 0.01 ... 19.99, 20	0 s
Gn 51SEF-4 Reset *Selects between an ANSI decaying reset characteristic or a definite time reset*	(ANSI) Decaying, 0 ... 59, 60	0 s
Gn 51SEF-4 VTS Action *Selects whether 51SEF-4 element is blocked or made non-directional when VTS operates*	Off, Inhibit, Non-Dir	Off

3.4.6.5. 50SEF-1

Description	Range	Default
Gn 50SEF-1 Element *Selects whether the DTL measured Earth fault element is enabled*	Disabled, Enabled	Disabled
Gn 50SEF-1 Dir. Control *Selects whether 50SEF-1 element is non-directional, forward or reverse*	Non-Dir, Forward, Reverse	Non-Dir
Gn 50SEF-1 Setting *Pickup level*	0.005, 0.006 ... 4.995, 5	0.2 xIn
Gn 50SEF-1 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0 s
Gn 50SEF-1 VTS Action *Selects whether 50SEF-1 element is blocked or made non-directional when VTS operates*	Off, Inhibit, Non-Dir	Off

3.4.6.6. 50SEF-2

Description	Range	Default
Gn 50SEF-2 Element *Selects whether the DTL measured Earth fault element is enabled*	Disabled, Enabled	Disabled
Gn 50SEF-2 Dir. Control *Selects whether 50SEF-2 element is non-directional, forward or reverse*	Non-Dir, Forward, Reverse	Non-Dir
Gn 50SEF-2 Setting *Pickup level*	0.005, 0.006 ... 4.995, 5	0.2 xIn
Gn 50SEF-2 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0 s
Gn 50SEF-2 VTS Action *Selects whether 50SEF-2 element is blocked or made non-directional when VTS operates*	Off, Inhibit, Non-Dir	Off

3.4.6.7. 50SEF-3

Description	Range	Default
Gn 50SEF-3 Element *Selects whether the DTL measured Earth fault element is enabled*	Disabled, Enabled	Disabled
Gn 50SEF-3 Dir. Control *Selects whether 50SEF-3 element is non-directional, forward or reverse*	Non-Dir, Forward, Reverse	Non-Dir
Gn 50SEF-3 Setting *Pickup level*	0.005, 0.006 ... 4.995, 5	0.2 xIn
Gn 50SEF-3 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0 s
Gn 50SEF-3 VTS Action *Selects whether 50SEF-3 element is blocked or made non-directional when VTS operates*	Off, Inhibit, Non-Dir	Off

3.4.6.8. 50SEF-4

Description	Range	Default
Gn 50SEF-4 Element *Selects whether the DTL measured Earth fault element is enabled*	Disabled, Enabled	Disabled

© 2013 Siemens Protection Devices Limited

Description	Range	Default
Gn 50SEF-4 Dir. Control *Selects whether 50SEF-4 element is non-directional, forward or reverse*	Non-Dir, Forward, Reverse	Non-Dir
Gn 50SEF-4 Setting *Pickup level*	0.005, 0.006 ... 4.995, 5	0.2 xIn
Gn 50SEF-4 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0 s
Gn 50SEF-4 VTS Action *Selects whether 50SEF-4 element is blocked or made non-directional when VTS operates*	Off, Inhibit, Non-Dir	Off

3.4.7. Restricted E/F

Description	Range	Default
Gn 64H Element *High impedance restricted earth fault current element*	Disabled, Enabled	Disabled
Gn 64H Setting *Pickup level*	0.005, 0.006 ... 0.945, 0.95	0.2 xIn
Gn 64H Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0 s

3.4.8. NPS Overcurrent

3.4.8.1. 46IT

Description	Range	Default
Gn 46IT Element *Selects whether the 46IT IDMTL/DTL negative phase sequence current element is enabled*	Disabled, Enabled	Disabled
Gn 46IT Setting *Pickup level*	0.05, 0.06 ... 2.49, 2.5	0.25 xIn
Gn 46IT Char *Selects characteristic curve to be IEC or ANSI IDMTL or DTL*	DTL, IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI	IEC-NI
Gn 46IT Time Mult (IEC/ANSI) *Time multiplier (applicable to IEC and ANSI curves but not DTL selection)*	0.025, 0.03 ... 1.595, 1.6 , 1.7 ... 4.9, 5, 6 ... 100	1
Gn 46IT Delay (DTL) *Delay (applicable only when DTL is selected for characteristic)*	0, 0.01 ... 19.99, 20	5 s
Gn 46IT Reset *Selects between an ANSI decaying reset characteristic or a definite time reset*	(ANSI) Decaying, 0 ... 59, 60	0 s

3.4.8.2. 46DT

Description	Range	Default
Gn 46DT Element *Selects whether the definite time NPS overvoltage element is enabled*	Disabled, Enabled	Disabled
Gn 46DT Setting *Pickup level*	0.05, 0.06 ... 4	0.1 xIn
Gn 46DT Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0.02 s

3.4.9. Under Current

Description	Range	Default
Gn 37 U/I Guard Setting	0.05, 0.1 ... 4.95, 5	0.1 xIn

3.4.9.1. 37-1

Description	Range	Default
Gn 37-1 Element *Phase under current element 37-1*	Disabled, Enabled	Disabled
Gn 37-1 Setting *Pickup level*	0.05, 0.1 ... 4.95, 5	0.25 xIn
Gn 37-1 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0 s
Gn 37-1 U/I Guarded *Selects whether to use the 37-1 guard element*	No, Yes	Yes
Gn 37-1 Start Option *Selects whether 31-1 element operates for any phase picked up or only when all phases are picked up*	All, Any	All

3.4.9.2. 37-2

Description	Range	Default
Gn 37-2 Element *Phase under current element 37-2*	Disabled, Enabled	Disabled
Gn 37-2 Setting *Pickup level*	0.05, 0.1 ... 4.95, 5	0.25 xIn
Gn 37-2 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0 s
Gn 37-2 U/I Guarded *Selects whether to use the 37-2 guard element*	No, Yes	Yes
Gn 37-2 Start Option *Selects whether 31-2 element operates for any phase picked up or only when all phases are picked up*	All, Any	All

3.4.9.3. 37G-1

Description	Range	Default
Gn 37G-1 Element *E/F under current element 37G-1*	Disabled, Enabled	Disabled
Gn 37G-1 Setting *Pickup level*	0.005, 0.006 ... 4.995, 5	0.2 xIn
Gn 37G-1 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0 s

3.4.9.4. 37G-2

Description	Range	Default
Gn 37G-2 Element *E/F under current element 37G-2*	Disabled, Enabled	Disabled
Gn 37G-2 Setting *Pickup level*	0.005, 0.006 ... 4.995, 5	0.2 xIn
Gn 37G-2 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0 s

© 2013 Siemens Protection Devices Limited

3.4.9.5. 37SEF-1

Description	Range	Default
Gn 37SEF-1 Element *SEF under current element 37SEF-1*	Disabled, Enabled	Disabled
Gn 37SEF-1 Setting *Pickup level*	0.005, 0.006 ... 4.995, 5	0.2 xIn
Gn 37SEF-1 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0 s

3.4.9.6. 37SEF-2

Description	Range	Default
Gn 37SEF-2 Element *SEF under current element 37SEF-2*	Disabled, Enabled	Disabled
Gn 37SEF-2 Setting *Pickup level*	0.005, 0.006 ... 4.995, 5	0.2 xIn
Gn 37SEF-2 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0 s

3.4.10. Thermal

Description	Range	Default
Gn 49 Thermal Overload *Selects whether the thermal overload protection element is enabled*	Disabled, Enabled	Disabled
Gn 49 Overload Setting *Pickup level*	0.1, 0.11 ... 2.99, 3	1.05 xIn
Gn 49 Time Constant (Minutes) *Thermal time constant*	1, 1.5 ... 999.5, 1000	10 minutes
Gn 49 Capacity Alarm *Selects whether thermal capacity alarm enabled*	Disabled, 50 ... 99, 100	Disabled
49 Reset Therm State *Control that allows thermal state to be manually reset*		

3.4.11. ARC Flash Detector

Description	Range	Default
Gn 50AFD *Selects whether the ARC Flash Detector element is enabled*	Disabled, Enabled	Disabled
Gn 50AFD Setting *Pickup level*	1, 2,...10	2 xIn

3.5. Voltage Protection

3.5.1. Phase U/O Voltage

Description	Range	Default
Gn Voltage Input Mode *Selects Ph-Ph or Ph-N voltages for U/V guard element & 27/59 elements operation.*	Ph-N, Ph-Ph	Ph-N

Description	Range	Default
Gn 27/59 U/V Guard Setting *Selects voltage level below which the guard element is applied.*	1, 1.5 ... 199.5, 200	5 V

3.5.2. 27/59-1

Description	Range	Default
Gn 27/59-1 Element *Selects whether the Under/Over voltage element stage 1 is enabled*	Disabled, Enabled	Disabled
Gn 27/59-1 Operation *Selects between Undervoltage and Overvoltage pickup for this element*	Under, Over	Over
Gn 27/59-1 Setting *Under or over voltage pickup level*	5, 5.5 ... 199.5, 200	80 V
Gn 27/59-1 Hysteresis *Sets the pickup to dropoff thresholds e.g. 3% on Overlevel picks up above pickup setting and drops off below 97% of setting, 3% on Underlevel picks up below setting and drops off above 103% of setting*	0, 0.1 ... 79.9, 80	3 %
Gn 27/59-1 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0.1 s
Gn 27/59-1 U/V Guarded *Selects whether U/V Guard element can block the operation of this element*	No, Yes	No
Gn 27/59-1 VTS Inhibit *Selects whether element is blocked or not when VTS operates*	No, Yes	No
Gn 27/59-1 O/P Phases *Selects whether element operates for any phase picked up or only when all phases are picked up*	Any, All	Any

3.5.3. 27/59-2

Description	Range	Default
Gn 27/59-2 Element *Selects whether the Under/Over voltage element stage 2 is enabled*	Disabled, Enabled	Disabled
Gn 27/59-2 Operation *Selects between Undervoltage and Overvoltage pickup for this element*	Under, Over	Over
Gn 27/59-2 Setting *Under or over voltage pickup level*	5, 5.5 ... 199.5, 200	80 V
Gn 27/59-2 Hysteresis *Sets the pickup to dropoff thresholds e.g. 3% on Overlevel picks up above pickup setting and drops off below 97% of setting, 3% on Underlevel picks up below setting and drops off above 103% of setting*	0, 0.1 ... 79.9, 80	3 %
Gn 27/59-2 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0.1 s
Gn 27/59-2 U/V Guarded *Selects whether U/V Guard element can block the operation of this element*	No, Yes	No
Gn 27/59-2 VTS Inhibit *Selects whether element is blocked or not when VTS operates*	No, Yes	No

© 2013 Siemens Protection Devices Limited

Description	Range	Default
Gn 27/59-2 O/P Phases *Selects whether element operates for any phase picked up or only when all phases are picked up*	Any, All	Any

3.5.4. 27/59-3

Description	Range	Default
Gn 27/59-3 Element *Selects whether the Under/Over voltage element stage 3 is enabled*	Disabled, Enabled	Disabled
Gn 27/59-3 Operation *Selects between Undervoltage and Overvoltage pickup for this element*	Under, Over	Under
Gn 27/59-3 Setting *Under or over voltage pickup level*	5, 5.5 ... 199.5, 200	50 V
Gn 27/59-3 Hysteresis *Sets the pickup to dropoff thresholds e.g. 3% on Overlevel picks up above pickup setting and drops off below 97% of setting, 3% on Underlevel picks up below setting and drops off above 103% of setting*	0, 0.1 ... 79.9, 80	3 %
Gn 27/59-3 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0.1 s
Gn 27/59-3 U/V Guarded *Selects whether U/V Guard element can block the operation of this element*	No, Yes	Yes
Gn 27/59-3 VTS Inhibit *Selects whether element is blocked or not when VTS operates*	No, Yes	No
Gn 27/59-3 O/P Phases *Selects whether element operates for any phase picked up or only when all phases are picked up*	Any, All	Any

3.5.5. 27/59-4

Description	Range	Default
Gn 27/59-4 Element *Selects whether the Under/Over voltage element stage 4 is enabled*	Disabled, Enabled	Disabled
Gn 27/59-4 Operation *Selects between Undervoltage and Overvoltage pickup for this element*	Under, Over	Under
Gn 27/59-4 Setting *Under or over voltage pickup level*	5, 5.5 ... 199.5, 200	50 V
Gn 27/59-4 Hysteresis *Sets the pickup to dropoff thresholds e.g. 3% on Overlevel picks up above pickup setting and drops off below 97% of setting, 3% on Underlevel picks up below setting and drops off above 103% of setting*	0, 0.1 ... 79.9, 80	3 %
Gn 27/59-4 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0.1 s
Gn 27/59-4 U/V Guarded *Selects whether U/V Guard element can block the operation of this element*	No, Yes	Yes
Gn 27/59-4 VTS Inhibit *Selects whether element is blocked or not when VTS operates*	No, Yes	No

Description	Range	Default
Gn 27/59-4 O/P Phases *Selects whether element operates for any phase picked up or only when all phases are picked up*	Any, All	Any

3.6. Vx U/O Voltage

Description	Range	Default
Gn Vx 27/59 U/V Guard Setting	1, 1.5 ... 199.5, 200	5 V
Gn Vx 27/59 Element *Selects whether the Under/Over voltage element for Vx is enabled*	Disabled, Enabled	Disabled
Gn Vx 27/59 Operation *Selects between Undervoltage and Overvoltage pickup for this element*	Under, Over	Over
Gn Vx 27/59 Setting *Under or over voltage pickup level*	5, 5.5 ... 199.5, 200	80 V
Gn Vx 27/59 Hysteresis *Sets the pickup to dropoff thresholds e.g. 3% on Overlevel picks up above pickup setting and drops off below 97% of setting, 3% on Underlevel picks up below setting and drops off above 103% of setting*	0, 0.1 ... 79.9, 80	3 %
Gn Vx 27/59 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0.1 s
Gn Vx 27/59 U/V Guarded	No, Yes	No

3.7. NPS Overvoltage

3.7.1. 47-1

Description	Range	Default
Gn 47-1 Element *Selects whether the definite time NPS overvoltage element is enabled*	Disabled, Enabled	Disabled
Gn 47-1 Setting *Pickup level*	1, 1.5 ... 89.5, 90	20 V
Gn 47-1 Hysteresis *Sets the pickup to drop-off thresholds e.g. 3% picks up at setting and drops off below 97% of setting*	0, 0.1 ... 79.9, 80	3 %
Gn 47-1 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	1 s

3.7.2. 47-2

Description	Range	Default
Gn 47-2 Element *Selects whether the definite time NPS overvoltage element is enabled*	Disabled, Enabled	Disabled
Gn 47-2 Setting *Pickup level*	1, 1.5 ... 89.5, 90	20 V

© 2013 Siemens Protection Devices Limited

Description	Range	Default
Gn 47-2 Hysteresis *Sets the pickup to drop-off thresholds e.g. 3% picks up at setting and drops off below 97% of setting*	0, 0.1 ... 79.9, 80	3 %
Gn 47-2 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0.5 s

3.8. Neutral Overvoltage

Description	Range	Default
Gn 59N Voltage Source *Selects voltage source between calculated 3V0 (Vn) or measured 3V0 through Vx input*	Vn, Vx	Vn

3.8.1. 59NIT

Description	Range	Default
Gn 59NIT Element *Selects whether the inverse time neutral over voltage element is enabled*	Disabled, Enabled	Disabled
Gn 59NIT Setting *Pickup level*	1, 1.5 ... 99.5, 100	5 V
Gn 59NIT Char *Selects characteristic curve to be IDMTL or DTL*	DTL, IDMTL	IDMTL
Gn 59NIT Time Mult (IDMTL) *Time multiplier (applicable to IDMTL curve but not DTL selection)*	0.1, 0.2 ... 139.5, 140	1
Gn 59NIT Delay (DTL) *Delay (applicable only when DTL is selected for characteristic)*	0, 0.01 ... 19.99, 20	5 s
Gn 59NIT Reset *Selects between an instantaneous reset characteristic or a definite time reset*	(ANSI) Decaying, 0 ... 59, 60	0 s

3.8.2. 59NDT

Description	Range	Default
Gn 59NDT Element *Selects whether the definite time neutral over voltage element is enabled*	Disabled, Enabled	Disabled
Gn 59NDT Setting *Pickup level*	1, 1.5 ... 99.5, 100	5 V
Gn 59NDT Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0.01 s

3.9. U/O Frequency

Description	Range	Default
Gn 81 U/V Guard Setting *Selects voltage level below which the guard element is applied.*	5, 5.5 ... 199.5, 200	5 V

3.9.1. 81-1

Description	Range	Default
Gn 81-1 Element *Selects whether the Under/Over frequency element stage 1 is enabled*	Disabled, Enabled	Disabled
Gn 81-1 Operation *Selects between Underfrequency and Overfrequency pickup for this element*	Under, Over	Under
Gn 81-1 Setting *Under or over frequency pickup level*	40, 40.01 ... 69.98, 69.99	49.5 Hz
Gn 81-1 Hysteresis *Sets the pickup to dropoff thresholds e.g. 3% on Overlevel picks up above pickup setting and drops off below 97% of setting, 3% on Underlevel picks up below setting and drops off above 103% of setting*	0, 0.1 ... 79.9, 80	0.1 %
Gn 81-1 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	1 s
Gn 81-1 U/V Guarded *Selects whether U/V Guard element can block the operation of this element*	No, Yes	Yes

3.9.2. 81-2

Description	Range	Default
Gn 81-2 Element *Selects whether the Under/Over frequency element stage 2 is enabled*	Disabled, Enabled	Disabled
Gn 81-2 Operation *Selects between Underfrequency and Overfrequency pickup for this element*	Under, Over	Under
Gn 81-2 Setting *Under or over frequency pickup level*	40, 40.01 ... 69.98, 69.99	49 Hz
Gn 81-2 Hysteresis *Sets the pickup to dropoff thresholds e.g. 3% on Overlevel picks up above pickup setting and drops off below 97% of setting, 3% on Underlevel picks up below setting and drops off above 103% of setting*	0, 0.1 ... 79.9, 80	0.1 %
Gn 81-2 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0.8 s
Gn 81-2 U/V Guarded *Selects whether U/V Guard element can block the operation of this element*	No, Yes	Yes

3.9.3. 81-3

Description	Range	Default
Gn 81-3 Element *Selects whether the Under/Over frequency element stage 3 is enabled*	Disabled, Enabled	Disabled
Gn 81-3 Operation *Selects between Underfrequency and Overfrequency pickup for this element*	Under, Over	Under
Gn 81-3 Setting *Under or over frequency pickup level*	40, 40.01 ... 69.98, 69.99	48 Hz

© 2013 Siemens Protection Devices Limited

Description	Range	Default
Gn 81-3 Hysteresis *Sets the pickup to dropoff thresholds e.g. 3% on Overlevel picks up above pickup setting and drops off below 97% of setting, 3% on Underlevel picks up below setting and drops off above 103% of setting*	0, 0.1 ... 79.9, 80	0.1 %
Gn 81-3 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0.6 s
Gn 81-3 U/V Guarded *Selects whether U/V Guard element can block the operation of this element*	No, Yes	Yes

3.9.4. 81-4

Description	Range	Default
Gn 81-4 Element *Selects whether the Under/Over frequency element stage 4 is enabled*	Disabled, Enabled	Disabled
Gn 81-4 Operation *Selects between Underfrequency and Overfrequency pickup for this element*	Under, Over	Under
Gn 81-4 Setting *Under or over frequency pickup level*	40, 40.01 ... 69.98, 69.99	47.5 Hz
Gn 81-4 Hysteresis *Sets the pickup to dropoff thresholds e.g. 3% on Overlevel picks up above pickup setting and drops off below 97% of setting, 3% on Underlevel picks up below setting and drops off above 103% of setting*	0, 0.1 ... 79.9, 80	0.1 %
Gn 81-4 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0.4 s
Gn 81-4 U/V Guarded *Selects whether U/V Guard element can block the operation of this element*	No, Yes	Yes

3.9.5. 81-5

Description	Range	Default
Gn 81-5 Element *Selects whether the Under/Over frequency element stage 5 is enabled*	Disabled, Enabled	Disabled
Gn 81-5 Operation *Selects between Underfrequency and Overfrequency pickup for this element*	Under, Over	Under
Gn 81-5 Setting *Under or over frequency pickup level*	40, 40.01 ... 69.98, 69.99	47.5 Hz
Gn 81-5 Hysteresis *Sets the pickup to dropoff thresholds e.g. 3% on Overlevel picks up above pickup setting and drops off below 97% of setting, 3% on Underlevel picks up below setting and drops off above 103% of setting*	0, 0.1 ... 79.9, 80	0.1 %
Gn 81-5 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0.4 s
Gn 81-5 U/V Guarded *Selects whether U/V Guard element can block the operation of this element*	No, Yes	Yes

3.9.6. 81-6

Description	Range	Default
Gn 81-6 Element *Selects whether the Under/Over frequency element stage 6 is enabled*	Disabled, Enabled	Disabled
Gn 81-6 Operation *Selects between Underfrequency and Overfrequency pickup for this element*	Under, Over	Under
Gn 81-6 Setting *Under or over frequency pickup level*	40, 40.01 ... 69.98, 69.99	47.5 Hz
Gn 81-6 Hysteresis *Sets the pickup to dropoff thresholds e.g. 3% on Overlevel picks up above pickup setting and drops off below 97% of setting, 3% on Underlevel picks up below setting and drops off above 103% of setting*	0, 0.1 ... 79.9, 80	0.1 %
Gn 81-6 Delay *Sets operate delay time*	0, 0.01 ... 14300, 14400	0.4 s
Gn 81-6 U/V Guarded *Selects whether U/V Guard element can block the operation of this element*	No, Yes	Yes

3.10. Supervision

3.10.1. CB Fail

Description	Range	Default
Gn 50BF Element *Selects whether the Circuit Breaker Fail element is enabled*	Disabled, Enabled	Disabled
Gn 50BF Setting *Breaker Fail Current Pickup level. If the current falls below this level then the CB is deemed to have opened and the element is reset.*	0.05, 0.055 ... 1.995, 2	0.2 xIn
Gn 50BF-I4 Setting	0.005, 0.01 ... 1.995, 2	0.05 xIn
Gn 50BF-1 Delay *Delay before Circuit Breaker Fail stage 1 operates*	20, 25 ... 59995, 60000	60 ms
Gn 50BF-2 Delay *Delay before Circuit Breaker Fail stage 2 operates*	20, 25 ... 59995, 60000	120 ms

3.10.2. VT Supervision

Description	Range	Default
Gn 60VTS Element *Selects whether the VT supervision element is enabled*	Disabled, Enabled	Disabled
Gn 60VTS Component *Selects whether NPS or ZPS quantities are used by the VT supervision element*	NPS, ZPS	NPS
Gn 60VTS V *Level above which there is a possible 1 or 2 phase VT fuse failure*	7, 8 ... 109, 110	7 V
Gn 60VTS I *Level above which a 1 or 2 phase fault condition is assumed so VTS inhibited*	0.05, 0.1, 0.15, 0.2, 0.25, 0.3, 0.35, 0.4, 0.45, 0.5, 0.55, 0.6, 0.65, 0.7, 0.75, 0.8, 0.85, 0.9, 0.95, 1	0.1 xIn

© 2013 Siemens Protection Devices Limited

Description	Range	Default
Gn 60VTS Vpps *Level below which there is a possible 3 phase VT fuse failure*	1, 2 ... 109, 110	15 V
Gn 60VTS Ipps Load *Level current must be above before 3 phase VTS will be issued*	0.05, 0.1, 0.15, 0.2, 0.25, 0.3, 0.35, 0.4, 0.45, 0.5, 0.55, 0.6, 0.65, 0.7, 0.75, 0.8, 0.85, 0.9, 0.95, 1	0.1 xIn
Gn 60VTS Ipps Fault *Level above which 3 phase fault is assumed so VTS inhibited*	0.05, 0.1 ... 19.95, 20	10 xIn
Gn 60VTS Delay *Sets operate delay time*	0.03, 0.04 ... 14300, 14400	10 s
Gn 60VTF-Bus Element *Selects whether the Bus VT Fail element is enabled. Element based on voltages and circuit breaker position*	Enabled, Disabled	Disabled
Gn 60VTF-Bus Delay *Sets operate delay time*	0, 0.1 ... 99.9, 100	2s

3.10.3. CT Supervision

Description	Range	Default
Gn 60CTS Element *Selects whether the CT supervision element is enabled (NPS current in the absence of NPS voltage)*	Disabled, Enabled	Disabled
Gn 60CTS Inps *Arm if NPS Current (Inps) is above this level*	0.05, 0.1, 0.15, 0.2, 0.25, 0.3, 0.35, 0.4, 0.45, 0.5, 0.55, 0.6, 0.65, 0.7, 0.75, 0.8, 0.85, 0.9, 0.95, 1	0.1 xIn
Gn 60CTS Vnps *Inhibit if NPS Voltage (Vnps) is above this level*	7, 8 ... 109, 110	10 V
Gn 60CTS Delay *CTS Operate delay*	0.03, 0.04 ... 14300, 14400	10 s
Gn 60CTS-I Element	Disabled, Enabled	Disabled
Gn 60CTS-I Setting	0.05, 0.1 ... 1.95, 2	0.05 xIn
Gn 60CTS-I Delay	0.03, 0.04 ... 14300, 14400	10 s

3.10.4. Broken Conductor

Description	Range	Default
Gn 46BC U/C Guard Setting	0.05, 0.1 ... 4.95, 5	0.25 xIn
Gn 46BC Element *Selects whether the definite time broken conductor element is enabled*	Disabled, Enabled	Disabled
Gn 46BC Setting *NPS Current to PPS Current ratio*	20, 21 ... 99, 100	20 %
Gn 46BC Delay *Sets operate delay time*	0.03, 0.04 ... 14300, 14400	20 s
Gn 46BC U/C Guarded	No, Yes	No

3.10.5. Trip CCT Supervision

Description	Range	Default
Gn 74TCS-1 *Selects whether the trip circuit supervision element 74TCS-1 is enabled*	Disabled, Enabled	Disabled
Gn 74TCS-1 Delay *Time delay before trip circuit supervision operates*	0, 0.02 ... 59.98, 60	0.4 s
Gn 74TCS-2 *Selects whether the trip circuit supervision element 74TCS-2 is enabled*	Disabled, Enabled	Disabled
Gn 74TCS-2 Delay *Time delay before trip circuit supervision operates*	0, 0.02 ... 59.98, 60	0.4 s
Gn 74TCS-3 *Selects whether the trip circuit supervision element 74TCS-3 is enabled*	Disabled, Enabled	Disabled
Gn 74TCS-3 Delay *Time delay before trip circuit supervision operates*	0, 0.02 ... 59.98, 60	0.4 s

3.10.6. Close CCT Supervision

Description	Range	Default
Gn 74CCS-1 *Selects whether the trip circuit supervision element 74CCS-1 is enabled*	Disabled, Enabled	Disabled
Gn 74CCS-1 Delay *Time delay before trip circuit supervision operates*	0, 0.02 ... 59.98, 60	0.4 s
Gn 74CCS-2 *Selects whether the trip circuit supervision element 74CCS-2 is enabled*	Disabled, Enabled	Disabled
Gn 74CCS-2 Delay *Time delay before trip circuit supervision operates*	0, 0.02 ... 59.98, 60	0.4 s
Gn 74CCS-3 *Selects whether the trip circuit supervision element 74CCS-3 is enabled*	Disabled, Enabled	Disabled
Gn 74CCS-3 Delay *Time delay before trip circuit supervision operates*	0, 0.02 ... 59.98, 60	0.4 s

3.10.7. Inrush Detector

Description	Range	Default
Gn 81HBL2 Element *Selects whether the phase inrush detector 81HBL2 is enabled*	Disabled, Enabled	Disabled
Gn 81HBL2 Bias *Selects the bias method used for magnetising inrush. Phase – Segregated, each phase blocks itself. Cross – Blocked, each phase can block the operation of other phases. Sum - Of Squares, each phase blocks itself using the square root of the sum of squares of the 2nd harmonic.*	Phase, Cross, Sum	Cross
Gn 81HBL2 Setting *The magnetising inrush detector operates when the 2nd harmonic current exceeds a set percentage of the fundamental current*	0.1, 0.11 ... 0.49, 0.5	0.2 xI

© 2013 Siemens Protection Devices Limited

3.10.8. Load Blinder

3.10.8.1. 21LB-3P

Description	Range	Default
Gn 21LB-3P Angle +ve *Selects the boundary region.*	5 degrees to 85 degrees	20 Degrees
Gn 21LB-3P Angle -ve *Selects the boundary region.*	5 degrees to 85 degrees	20 Degrees
Gn 21LB-3P Impedance *Selects the impedance of the region.*	1, 1.1,...50, 50.5, 51...100 Ohms	10 Ohms
Gn 21LB-3P VPPS *Sets the level of 21LB-3P VPPS setting*	1, 1.5 ...110 V	50 V
Gn 21LB-3P INPS *Sets the level of 21LB-3P INPS setting.*	0.05, 0.1 ... 0.45, 5	0.5 xI

3.10.8.2. 21LB-1P

Description	Range	Default
Gn 21LB-1P Angle +ve *Selects the boundary region.*	5 degrees to 85 degrees	20 Degrees
Gn 21LB-1P Angle -ve *Selects the boundary region.*	5 degrees to 85 degrees	20 Degrees
Gn 21LB-1P Impedance *Selects the impedance of the region.*	1, 1.1,...50, 50.5, 51...100 Ohms	10 Ohms
Gn 21LB-1P VPPS *Sets the level of 21LB-1P VPPS setting*	1, 1.5 ...110 V	50 V
Gn 21LB-1P IZPS *Sets the level of 21LB-1P ZNPS setting.*	0.05, 0.1 ... 0.45, 5	0.5 xI

3.11. Control & Logic

3.11.1. Autoreclose Prot'n

Description	Range	Default
Gn 79 P/F Inst Trips *Selects which phase fault protection elements are classed as Instantaneous elements and start an autoreclose sequence. These will be blocked from operating during Delayed autoreclose sequences. See autoreclose section of manual for detail of what elements can cause only Delayed protection to be used.*	Combination of (51-1, 51-2, 51-3, 51-4, 50-1, 50-2, 50-3, 50-4)	--------
Gn 79 E/F Inst Trips *Selects which earth fault protection elements are classed as Instantaneous elements and start an autoreclose sequence. These will be blocked from operating during Delayed autoreclose sequences. See autoreclose section of manual for detail of what elements can cause only Delayed protection to be used.*	Combination of (51N-1, 51N-2, 51N-3, 51N-4, 50N-1, 50N-2, 50N-3, 50N-4, 51G-1, 51G-2, 51G-3, 51G-4, 50G-1, 50G-2, 50G-3, 50G-4)	----------
Gn 79 SEF Inst Trips *Selects which sensitive earth fault protection elements are classed as Instantaneous elements and start an autoreclose sequence. These will be blocked from operating during Delayed autoreclose sequences. See autoreclose section of manual for detail of what elements can cause only Delayed protection to be used.*	Combination of (51SEF-1, 51SEF-2, 51SEF-3, 51SEF-4, 50SEF-1, 50SEF-2, 50SEF-3, 50SEF-4)	--------

Description	Range	Default
Gn 79 P/F Delayed Trips *Selects which phase fault protection are classed as Delayed elements, any selected elements operating will start an autoreclose sequence.*	Combination of (51-1, 51-2, 51-3, 51-4, 50-1, 50-2, 50-3, 50-4)	51-1, 51-2, 51-3, 51-4, 50-1, 50-2, 50-3, 50-4
Gn 79 E/F Delayed Trips *Selects which earth fault protection are classed as Delayed elements, any selected elements operating will start an autoreclose sequence.*	Combination of (51N-1, 51N-2, 51N-3, 51N-4, 50N-1, 50N-2, 50N-3, 50N-4, 51G-1, 51G-2, 51G-3, 51G-4, 50G-1, 50G-2, 50G-3, 50G-4)	51N-1, 51N-2, 51N-3, 51N-4, 50N-1, 50N-2, 50N-3, 50N-4, 51G-1, 51G-2, 51G-3, 51G-4, 50G-1, 50G-2, 50G-3, 50G-4
Gn 79 SEF Delayed Trips *Selects which sensitive earth fault elements are classed as Delayed elements, any selected elements operating will start an autoreclose sequence.*	Combination of (51SEF-1, 51SEF-2, 51SEF-3, 51SEF-4, 50SEF-1, 50SEF-2, 50SEF-3, 50SEF-4)	51SEF-1, 51SEF-2, 51SEF-3, 51SEF-4, 50SEF-1, 50SEF-2, 50SEF-3, 50SEF-4
Gn 79 P/F HS Trips *Selects which phase fault elements are classed as High Set elements, any selected elements operating will start an autoreclose sequence.*	Combination of (50-1, 50-2, 50-3, 50-4)	----
Gn 79 E/F HS Trips *Selects which earth fault elements are classed as High Set elements, any selected elements operating will start an autoreclose sequence.*	Combination of (50N-1, 50N-2, 50N-3, 50N-4, 50G-1, 50G-2, 50G-3, 50G-4)	--------

3.11.2. Autoreclose Config

Description	Range	Default
Gn 79 Autoreclose *If disabled then all attempts to control the AR IN/OUT status will fail and the AR will be permanently Out Of Service. When enabled the AR IN/OUT state may be controlled via the CONTROL MODE menu option, via Binary Input or via local or remote communications.*	Disabled, Enabled	Enabled
Gn 79 Num Shots *Selects the number of auto-reclose attempts before the Autorecloser locks out*	1, 2, 3, 4	1
Gn 79 Retry Enable *Selects whether the Retry close functionality is enabled*	Disabled, Enabled	Disabled
Gn 79 Retry Attempts *Selects the number of retries allowed per shot*	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10	1
Gn 79 Retry Interval *Time delay between retries*	0, 1 ... 599, 600	60 s
Gn 79 Reclose Blocked Delay *Specifies the maximum time that the Autorecloser can be blocked before proceeding to the lockout state. (NOTE: The block delay timer only starts after the Deadtime.)*	0, 1 ... 599, 600	60 s
Gn 79 Sequence Fail Timer *Time before lockout occurs on an incomplete reclose sequence. (i.e Trip & starter conditions have not been cleared after Sequence Fail Time.)*	0, 1 ... 599, 600	60 s
Gn 79 Sequence Co-ord *Selects whether Sequence co-ordination functionality is used or not.*	Disabled, Enabled	Enabled

© 2013 Siemens Protection Devices Limited

Description	Range	Default
Gn 79 Cold Load Action *Selects whether whist Cold Load is active the relay will perform only Delayed Trips or not.*	Off, Delayed	Off

3.11.2.1. P/F Shots

Description	Range	Default
Gn 79 P/F Prot'n Trip 1 *Selects whether the first phase fault trip is Instantaneous (Fast) or Delayed. When set to Delayed all P/F Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Inst
Gn 79 P/F Deadtime 1 *Time period between the fault being cleared and the close pulse being issued*	0, 0.1 ... 14300, 14400	5 s
Gn 79 P/F Prot'n Trip 2 *Selects whether the second phase fault trip is Instantaneous (Fast) or Delayed. When set to Delayed all P/F Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Inst
Gn 79 P/F Deadtime 2 *Time period between the fault being cleared and the close pulse being issued*	0, 0.1 ... 14300, 14400	5 s
Gn 79 P/F Prot'n Trip 3 *Selects whether the third phase fault trip is Instantaneous (Fast) or Delayed. When set to Delayed all P/F Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Delayed
Gn 79 P/F Deadtime 3 *Time period between the fault being cleared and the close pulse being issued*	0, 0.1 ... 14300, 14400	5 s
Gn 79 P/F Prot'n Trip 4 *Selects whether the fourth phase fault trip is Instantaneous (Fast) or Delayed. When set to Delayed all P/F Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Delayed
Gn 79 P/F Deadtime 4 *Time period between the fault being cleared and the close pulse being issued*	0, 0.1 ... 14300, 14400	5 s
Gn 79 P/F Prot'n Trip 5 *Selects whether the fifth phase fault trip is Instantaneous (Fast) or Delayed. When set to Delayed all P/F Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Delayed
Gn 79 P/F HS Trips To Lockout *Selects how many High Set trips are allowed before going to Lockout*	1, 2, 3, 4, 5	5
Gn 79 P/F Delayed Trips To Lockout *Selects how many Delayed trips are allowed before going to Lockout*	1, 2, 3, 4, 5	5

3.11.2.2. E/F Shots

Description	Range	Default
Gn 79 E/F Prot'n Trip 1 *Selects whether the first earth fault trip is Instantaneous (Fast) or Delayed. When set to Delayed all E/F Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Inst
Gn 79 E/F Deadtime 1 *Time period between the fault being cleared and the close pulse being issued*	0, 0.1 ... 14300, 14400	5 s
Gn 79 E/F Prot'n Trip 2 *Selects whether the second earth fault trip is Instantaneous (Fast) or Delayed. When set to Delayed all E/F Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Inst

Description	Range	Default
Gn 79 E/F Deadtime 2 *Time period between the fault being cleared and the close pulse being issued*	0, 0.1 ... 14300, 14400	5 s
Gn 79 E/F Prot'n Trip 3 *Selects whether the third earth fault trip is Instantaneous (Fast) or Delayed. When set to Delayed all E/F Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Delayed
Gn 79 E/F Deadtime 3 *Time period between the fault being cleared and the close pulse being issued*	0, 0.1 ... 14300, 14400	5 s
Gn 79 E/F Prot'n Trip 4 *Selects whether the fourth earth fault trip is Instantaneous (Fast) or Delayed. When set to Delayed all E/F Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Delayed
Gn 79 E/F Deadtime 4 *Time period between the fault being cleared and the close pulse being issued*	0, 0.1 ... 14300, 14400	5 s
Gn 79 E/F Prot'n Trip 5 *Selects whether the fifth earth fault trip is Instantaneous (Fast) or Delayed. When set to Delayed all E/F Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Delayed
Gn 79 E/F HS Trips To Lockout *Selects how many High Set trips are allowed before going to Lockout*	1, 2, 3, 4, 5	5
Gn 79 E/F Delayed Trips To Lockout *Selects how many Delayed trips are allowed before going to Lockout*	1, 2, 3, 4, 5	5

3.11.2.3. SEF Shots

Description	Range	Default
Gn 79 SEF Prot'n Trip 1 *Selects whether the first sensitive earth fault trip is Instantaneous or Delayed. When set to Delayed all SEF Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Inst
Gn 79 SEF Deadtime 1 *Time period between the fault being cleared and the close pulse being issued*	0, 0.1 ... 14300, 14400	5 s
Gn 79 SEF Prot'n Trip 2 *Selects whether the second sensitive earth fault trip is Instantaneous or Delayed. When set to Delayed all SEF Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Inst
Gn 79 SEF Deadtime 2 *Time period between the fault being cleared and the close pulse being issued*	0, 0.1 ... 14300, 14400	5 s
Gn 79 SEF Prot'n Trip 3 *Selects whether the third sensitive earth fault trip is Instantaneous or Delayed. When set to Delayed all SEF Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Delayed
Gn 79 SEF Deadtime 3 *Time period between the fault being cleared and the close pulse being issued*	0, 0.1 ... 14300, 14400	5 s
Gn 79 SEF Prot'n Trip 4 *Selects whether the fourth sensitive earth fault trip is Instantaneous or Delayed. When set to Delayed all SEF Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Delayed
Gn 79 SEF Deadtime 4 *Time period between the fault being cleared and the close pulse being issued*	0, 0.1 ... 14300, 14400	5 s

© 2013 Siemens Protection Devices Limited

Description	Range	Default
Gn 79 SEF Prot'n Trip 5 *Selects whether the fifth sensitive earth fault trip is Instantaneous or Delayed. When set to Delayed all SEF Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Delayed
Gn 79 SEF Delayed Trips To Lockout *Selects how many Delayed trips are allowed before going to Lockout*	1, 2, 3, 4, 5	5

3.11.2.4. Extern Shots

Description	Range	Default
Gn 79 Extern Prot'n Trip 1 *Selects whether the first external trip is Instantaneous or Delayed*	Not Blocked, Blocked	Not Blocked
Gn 79 Extern Deadtime 1 *Time period between the fault being cleared and the close pulse being issued*	0, 0.1 ... 14300, 14400	5 s
Gn 79 Extern Prot'n Trip 2 *Selects whether the second external trip is Instantaneous or Delayed*	Not Blocked, Blocked	Not Blocked
Gn 79 Extern Deadtime 2 *Time period between the fault being cleared and the close pulse being issued*	0, 0.1 ... 14300, 14400	5 s
Gn 79 Extern Prot'n Trip 3 *Selects whether the third external trip is Instantaneous or Delayed*	Not Blocked, Blocked	Not Blocked
Gn 79 Extern Deadtime 3 *Time period between the fault being cleared and the close pulse being issued*	0, 0.1 ... 14300, 14400	5 s
Gn 79 Extern Prot'n Trip 4 *Selects whether the fourth external trip is Instantaneous or Delayed*	Not Blocked, Blocked	Not Blocked
Gn 79 Extern Deadtime 4 *Time period between the fault being cleared and the close pulse being issued*	0, 0.1 ... 14300, 14400	5 s
Gn 79 Extern Prot'n Trip 5 *Selects whether the fifth external trip is Instantaneous or Delayed*	Not Blocked, Blocked	Not Blocked
Gn 79 Extern Trips To Lockout *Selects how many external trips are allowed before going to Lockout*	1, 2, 3, 4, 5	5

3.11.3. Synchronising Check

Description	Range	Default
Gn 25 Sync Voltages	V_{an}, V_{bn}, V_{cn}, V_{ab}, V_{bc}, V_{ca}	V_{bn}
Gn 25 Dead Line	0 % to 150 %	20 %
Gn 25 Live Line	0 % to 150 %	90 %
Gn 25 Dead Bus	0 % to 150 %	20 %
Gn 25 Live Bus	0 % to 150 %	90 %
Gn 25 Line U/V	Disabled, Enabled	Enabled
Gn 25 Line Undervolts	0 % to 150 %	90%
Gn 25 Bus U/V	Disabled, Enabled	Enabled
Gn 25 Bus Undervolts	0 % to 150 %	90%
Gn 25 Voltage Diff	Disabled, Enabled	Enabled

Description	Range	Default
Gn 25 Volt Differential	0 % to 100 %	10%
Gn 25 Check Sync	Disabled, Enabled	Enabled
Gn 25 Check Sync Angle	0 Deg to 90 Deg	20 Deg
Gn 25 Check Sync Slip Freq	Disabled, Enabled	Enabled
Gn 25 Check Sync Slip	0 Hz to 2 Hz	0.05 Hz
Gn 25 Check Sync Timer	0 s to 100 s	2 s
Gn 25 System Split Mode	Phase, Slip	Phase
Gn 25 Split Angle	0 Deg to 180 Deg	175 Deg
Gn 25 Split Slip	0 Hz to 2 Hz	0.02 Hz
Gn 25 System Sync	Disabled, Enabled	Enabled
Gn 25 System Sync Angle	0 Deg to 90 Deg	10 Deg
Gn 25 System Sync Slip	0 Hz to 2 Hz	0.125 Hz
Gn 25 System Sync Timer	0 s to 100 s	0.2 s
Gn 25 Close On Zero	Disabled, Enabled	Enabled
Gn 25 COZ Slip Freq	0 Hz to 2 Hz	0.125 Hz
Gn 25 CB Close Time	0 ms to 900 ms	60 ms
Gn 25 DAR Split Mode	CS, SS, COZ, LO	CS
Gn 25 MC Split Mode	CS, SS, COZ	CS

3.11.4. Manual CB Control

Description	Range	Default
Gn Line Check Trip *Selects whether line check trip is enabled, if enabled no AR sequence initiated*	Disabled, Enabled	Enabled
Gn P/F Line Check Trip *Selects whether a phase fault line check trip is Instantaneous (Fast) or Delayed. When set to Delayed all P/F Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Inst
Gn E/F Line Check Trip *Selects whether an earth fault line check trip is Instantaneous or Delayed. When set to Delayed all E/F Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Inst
Gn SEF Line Check Trip *Selects whether a sensitive earth fault line check trip is Instantaneous or Delayed. When set to Delayed all SEF Inst Trips will be Inhibited for this shot.*	Inst, Delayed	Inst
Gn Extern Line Check Trip *Selects whether an external line check trip is Instantaneous (Fast) or Delayed*	Not Blocked, Blocked	Not Blocked
Gn Close CB Delay *Delay between a Close CB control being received and the Close CB contacts being operated to allow operator walk away.*	0, 0.1 ... 899, 900	10 s
Gn Blocked Close Delay *Selects the maximum time that the manual Close CB may be blocked by interlocking before the command or control is cancelled. The relay will signal "Blocked by Interlocking".*	0, 1 ... 599, 600	5 s
Gn Open CB Delay *Delay between an Open CB control being received and the Open CB contacts being operated.*	0, 0.1 ... 899, 900	10 s
Gn CB Controls Latched *Selects whether Binary Input triggers of Close CB and Open CB are latched.*	Latch, Reset	Latch

© 2013 Siemens Protection Devices Limited

3.11.5. Circuit Breaker

Description	Range	Default
Gn Close CB Pulse *Specifies the duration of the circuit breaker close pulse*	0, 0.1 ... 19.9, 20	2 s
Gn Reclaim Timer *The period of time after a CB has closed and remained closed before the reclosure is deemed to be successful and the AR is re-initialised. If the CB remains open at the end of the reclaim time then the AR goes to lockout.*	0, 1 ... 599, 600	2 s
Gn Minimum LO Delay	0, 1 ... 599, 600	2 s
Gn Reset LO By Timer	Disabled, Enabled	Enabled
Gn CB Control Trip Time	Disabled, Enabled	Enabled
Gn Trip Time Alarm *An alarm is issued when the Trip time is exceeded*	0, 0.01 ... 1.99, 2	0.2 s
Gn Trip Time Adjust *Adjustment to take into account any binary input delays for Trip Time Alarm*	0, 0.005 ... 1.995, 2	0.015 s
Gn CB Travel Alarm *Selects the maximum time that the CB should take to either Open or Close before a failure is recorded.*	0.01, 0.02 ... 1.99, 2	1 s
Gn Open CB Pulse *Selects the maximum time of the Open CB pulse. If the CB is not closed when this timer expires then an alarm will be raised to signify failure to close.*	0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1, 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 2	1 s
Gn CB DBI Delay *Selects the Delay before relay goes to Lockout following a simultaneous Open and Close condition indication.*	0, 0.01, ... 1.1, 1.11 ... 2	0 s

3.11.6. QUICK LOGIC

Description	Range	Default
Quick Logic *Enable or Disable all logic equations*	Disabled, Enabled	Disabled
E1 Equation *Enable or Disable logic equation E1*	Disabled, Enabled	Disabled
E1 *Specify logic equations of the form En = <Operand><Operator><Operand>using the following:0123456789=Digit() = Parenthesis! = NOT operation. = AND operation^ = EXCLUSIVE OR operationE(followed by a digit) = Equation numberF (Followed by a digit) = Function Key numberI(Followed by a digit) = Binary Input numberL(Followed by a digit) = LED numberO(Followed by a digit) = output relay numberV(Followed by a digit) =Virtual Input/Output number.ExamplesMake a function key LED toggle when function key is pressed (requires E1 to drive L11 in output matrix)E1 = F3^L11*	(20 Character String)	
E1 Pick-up Delay *Time before equation output operates, after equation satisfied*	0, 0.01 ... 14300, 14400	0 s
E1 Drop-off Delay *Time before equation output resets, after equation nolonger satisfied*	0, 0.01 ... 14300, 14400	0 s

Description	Range	Default
E1 Counter Target *Select number of times equation must be satisfied before equation output operates*	1, 2 ... 998, 999	1
E1 Counter Reset Mode *Select type of counter reset mode*	Off, Multi-shot, Single-shot	Off
E1 Counter Reset Time *Select counter reset time*	0, 0.01 ... 14300, 14400	0 s
E2 Equation *Enable or Disable logic equation E2*	Disabled, Enabled	Disabled
E2 *Specify logic equations of the form En = <Operand><Operator><Operand>using the following:0123456789=Digit() = Parenthesis! = NOT operation. = AND operation^ = EXCLUSIVE OR operationE(followed by a digit) = Equation numberF (Followed by a digit) = Function Key numberI(Followed by a digit) = Binary Input numberL(Followed by a digit) = LED numberO(Followed by a digit) = output relay numberV(Followed by a digit) =Virtual Input/Output number.ExamplesMake a function key LED toggle when function key is pressed (requires E1 to drive L11 in output matrix)E1 = F3^L11*	(20 Character String)	
E2 Pick-up Delay *Time before equation output operates, after equation satisfied*	0, 0.01 ... 14300, 14400	0 s
E2 Drop-off Delay *Time before equation output resets, after equation nolonger satisfied*	0, 0.01 ... 14300, 14400	0 s
E2 Counter Target *Select number of times equation must be satisfied before equation output operates*	1, 2 ... 998, 999	1
E2 Counter Reset Mode *Select type of counter reset mode*	Off, Multi-shot, Single-shot	Off
E2 Counter Reset Time *Select counter reset time*	0, 0.01 ... 14300, 14400	0 s
E3 Equation *Enable or Disable logic equation E3*	Disabled, Enabled	Disabled
E3 *Specify logic equations of the form En = <Operand><Operator><Operand>using the following:0123456789=Digit() = Parenthesis! = NOT operation. = AND operation^ = EXCLUSIVE OR operationE(followed by a digit) = Equation numberF (Followed by a digit) = Function Key numberI(Followed by a digit) = Binary Input numberL(Followed by a digit) = LED numberO(Followed by a digit) = output relay numberV(Followed by a digit) =Virtual Input/Output number.ExamplesMake a function key LED toggle when function key is pressed (requires E1 to drive L11 in output matrix)E1 = F3^L11*	(20 Character String)	
E3 Pick-up Delay *Time before equation output operates, after equation satisfied*	0, 0.01 ... 14300, 14400	0 s
E3 Drop-off Delay *Time before equation output resets, after equation nolonger satisfied*	0, 0.01 ... 14300, 14400	0 s
E3 Counter Target *Select number of times equation must be satisfied before equation output operates*	1, 2 ... 998, 999	1
E3 Counter Reset Mode *Select type of counter reset mode*	Off, Multi-shot, Single-shot	Off
E3 Counter Reset Time *Select counter reset time*	0, 0.01 ... 14300, 14400	0 s

© 2013 Siemens Protection Devices Limited

Description	Range	Default
E4 Equation *Enable or Disable logic equation E4*	Disabled, Enabled	Disabled
E4 *Specify logic equations of the form En = <Operand><Operator><Operand>using the following:0123456789=Digit() = Parenthesis! = NOT operation. = AND operation^ = EXCLUSIVE OR operationE(followed by a digit) = Equation numberF (Followed by a digit) = Function Key numberI(Followed by a digit) = Binary Input numberL(Followed by a digit) = LED numberO(Followed by a digit) = output relay numberV(Followed by a digit) =Virtual Input/Output number.ExamplesMake a function key LED toggle when function key is pressed (requires E1 to drive L11 in output matrix)E1 = F3^L11*	(20 Character String)	
E4 Pick-up Delay *Time before equation output operates, after equation satisfied*	0, 0.01 ... 14300, 14400	0 s
E4 Drop-off Delay *Time before equation output resets, after equation nolonger satisfied*	0, 0.01 ... 14300, 14400	0 s
E4 Counter Target *Select number of times equation must be satisfied before equation output operates*	1, 2 ... 998, 999	1
E4 Counter Reset Mode *Select type of counter reset mode*	Off, Multi-shot, Single-shot	Off
E4 Counter Reset Time *Select counter reset time*	0, 0.01 ... 14300, 14400	0 s
E5 Equation *Enable or Disable logic equation E5*	Disabled, Enabled	Disabled
E5 *Specify logic equations of the form En = <Operand><Operator><Operand>using the following:0123456789=Digit() = Parenthesis! = NOT operation. = AND operation^ = EXCLUSIVE OR operationE(followed by a digit) = Equation numberF (Followed by a digit) = Function Key numberI(Followed by a digit) = Binary Input numberL(Followed by a digit) = LED numberO(Followed by a digit) = output relay numberV(Followed by a digit) =Virtual Input/Output number.ExamplesMake a function key LED toggle when function key is pressed (requires E1 to drive L11 in output matrix)E1 = F3^L11*	(20 Character String)	
E5 Pick-up Delay *Time before equation output operates, after equation satisfied*	0, 0.01 ... 14300, 14400	0 s
E5 Drop-off Delay *Time before equation output resets, after equation nolonger satisfied*	0, 0.01 ... 14300, 14400	0 s
E5 Counter Target *Select number of times equation must be satisfied before equation output operates*	1, 2 ... 998, 999	1
E5 Counter Reset Mode *Select type of counter reset mode*	Off, Multi-shot, Single-shot	Off
E5 Counter Reset Time *Select counter reset time*	0, 0.01 ... 14300, 14400	0 s
E6 Equation *Enable or Disable logic equation E6*	Disabled, Enabled	Disabled

Description	Range	Default
E6 *Specify logic equations of the form En = <Operand><Operator><Operand>using the following:0123456789=Digit() = Parenthesis! = NOT operation. = AND operation^ = EXCLUSIVE OR operationE(followed by a digit) = Equation numberF (Followed by a digit) = Function Key numberI(Followed by a digit) = Binary Input numberL(Followed by a digit) = LED numberO(Followed by a digit) = output relay numberV(Followed by a digit) =Virtual Input/Output number.ExamplesMake a function key LED toggle when function key is pressed (requires E1 to drive L11 in output matrix)E1 = F3^L11*	(20 Character String)	
E6 Pick-up Delay *Time before equation output operates, after equation satisfied*	0, 0.01 ... 14300, 14400	0 s
E6 Drop-off Delay *Time before equation output resets, after equation nolonger satisfied*	0, 0.01 ... 14300, 14400	0 s
E6 Counter Target *Select number of times equation must be satisfied before equation output operates*	1, 2 ... 998, 999	1
E6 Counter Reset Mode *Select type of counter reset mode*	Off, Multi-shot, Single-shot	Off
E6 Counter Reset Time *Select counter reset time*	0, 0.01 ... 14300, 14400	0 s
E7 Equation *Enable or Disable logic equation E7*	Disabled, Enabled	Disabled
E7 *Specify logic equations of the form En = <Operand><Operator><Operand>using the following:0123456789=Digit() = Parenthesis! = NOT operation. = AND operation^ = EXCLUSIVE OR operationE(followed by a digit) = Equation numberF (Followed by a digit) = Function Key numberI(Followed by a digit) = Binary Input numberL(Followed by a digit) = LED numberO(Followed by a digit) = output relay numberV(Followed by a digit) =Virtual Input/Output number.ExamplesMake a function key LED toggle when function key is pressed (requires E1 to drive L11 in output matrix)E1 = F3^L11*	(20 Character String)	
E7 Pick-up Delay *Time before equation output operates, after equation satisfied*	0, 0.01 ... 14300, 14400	0 s
E7 Drop-off Delay *Time before equation output resets, after equation nolonger satisfied*	0, 0.01 ... 14300, 14400	0 s
E7 Counter Target *Select number of times equation must be satisfied before equation output operates*	1, 2 ... 998, 999	1
E7 Counter Reset Mode *Select type of counter reset mode*	Off, Multi-shot, Single-shot	Off
E7 Counter Reset Time *Select counter reset time*	0, 0.01 ... 14300, 14400	0 s
E8 Equation *Enable or Disable logic equation E8*	Disabled, Enabled	Disabled

© 2013 Siemens Protection Devices Limited

Description	Range	Default
E8 *Specify logic equations of the form En = <Operand><Operator><Operand>using the following:0123456789=Digit() = Parenthesis! = NOT operation. = AND operation^ = EXCLUSIVE OR operationE(followed by a digit) = Equation numberF (Followed by a digit) = Function Key numberI(Followed by a digit) = Binary Input numberL(Followed by a digit) = LED numberO(Followed by a digit) = output relay numberV(Followed by a digit) =Virtual Input/Output number.ExamplesMake a function key LED toggle when function key is pressed (requires E1 to drive L11 in output matrix)E1 = F3^L11*	(20 Character String)	
E8 Pick-up Delay *Time before equation output operates, after equation satisfied*	0, 0.01 ... 14300, 14400	0 s
E8 Drop-off Delay *Time before equation output resets, after equation nolonger satisfied*	0, 0.01 ... 14300, 14400	0 s
E8 Counter Target *Select number of times equation must be satisfied before equation output operates*	1, 2 ... 998, 999	1
E8 Counter Reset Mode *Select type of counter reset mode*	Off, Multi-shot, Single-shot	Off
E8 Counter Reset Time *Select counter reset time*	0, 0.01 ... 14300, 14400	0 s
E9 Equation *Enable or Disable logic equation E9*	Disabled, Enabled	Disabled
E9 *Specify logic equations of the form En = <Operand><Operator><Operand>using the following:0123456789=Digit() = Parenthesis! = NOT operation. = AND operation^ = EXCLUSIVE OR operationE(followed by a digit) = Equation numberF (Followed by a digit) = Function Key numberI(Followed by a digit) = Binary Input numberL(Followed by a digit) = LED numberO(Followed by a digit) = output relay numberV(Followed by a digit) =Virtual Input/Output number.ExamplesMake a function key LED toggle when function key is pressed (requires E1 to drive L11 in output matrix)E1 = F3^L11*	(20 Character String)	
E9 Pick-up Delay *Time before equation output operates, after equation satisfied*	0, 0.01 ... 14300, 14400	0 s
E9 Drop-off Delay *Time before equation output resets, after equation nolonger satisfied*	0, 0.01 ... 14300, 14400	0 s
E9 Counter Target *Select number of times equation must be satisfied before equation output operates*	1, 2 ... 998, 999	1
E9 Counter Reset Mode *Select type of counter reset mode*	Off, Multi-shot, Single-shot	Off
E9 Counter Reset Time *Select counter reset time*	0, 0.01 ... 14300, 14400	0 s
E10 Equation *Enable or Disable logic equation E10*	Disabled, Enabled	Disabled

Description	Range	Default
E10 *Specify logic equations of the form En = <Operand><Operator><Operand>using the following:0123456789=Digit() = Parenthesis! = NOT operation. = AND operation^ = EXCLUSIVE OR operationE(followed by a digit) = Equation numberF (Followed by a digit) = Function Key numberI(Followed by a digit) = Binary Input numberL(Followed by a digit) = LED numberO(Followed by a digit) = output relay numberV(Followed by a digit) =Virtual Input/Output number.ExamplesMake a function key LED toggle when function key is pressed (requires E1 to drive L11 in output matrix)E1 = F3^L11*	(20 Character String)	
E10 Pick-up Delay *Time before equation output operates, after equation satisfied*	0, 0.01 ... 14300, 14400	0 s
E10 Drop-off Delay *Time before equation output resets, after equation nolonger satisfied*	0, 0.01 ... 14300, 14400	0 s
E10 Counter Target *Select number of times equation must be satisfied before equation output operates*	1, 2 ... 998, 999	1
E10 Counter Reset Mode *Select type of counter reset mode*	Off, Multi-shot, Single-shot	Off
E10 Counter Reset Time *Select counter reset time*	0, 0.01 ... 14300, 14400	0 s
E11 Equation *Enable or Disable logic equation E11*	Disabled, Enabled	Disabled
E11 *Specify logic equations of the form En = <Operand><Operator><Operand>using the following:0123456789=Digit() = Parenthesis! = NOT operation. = AND operation^ = EXCLUSIVE OR operationE(followed by a digit) = Equation numberF (Followed by a digit) = Function Key numberI(Followed by a digit) = Binary Input numberL(Followed by a digit) = LED numberO(Followed by a digit) = output relay numberV(Followed by a digit) =Virtual Input/Output number.ExamplesMake a function key LED toggle when function key is pressed (requires E1 to drive L11 in output matrix)E1 = F3^L11*	(20 Character String)	
E11 Pick-up Delay *Time before equation output operates, after equation satisfied*	0, 0.01 ... 14300, 14400	0 s
E11 Drop-off Delay *Time before equation output resets, after equation nolonger satisfied*	0, 0.01 ... 14300, 14400	0 s
E11 Counter Target *Select number of times equation must be satisfied before equation output operates*	1, 2 ... 998, 999	1
E11 Counter Reset Mode *Select type of counter reset mode*	Off, Multi-shot, Single-shot	Off
E11 Counter Reset Time *Select counter reset time*	0, 0.01 ... 14300, 14400	0 s
E12 Equation *Enable or Disable logic equation E12*	Disabled, Enabled	Disabled

© 2013 Siemens Protection Devices Limited

Description	Range	Default
E12 *Specify logic equations of the form En = <Operand><Operator><Operand>using the following:0123456789=Digit() = Parenthesis! = NOT operation. = AND operation^ = EXCLUSIVE OR operationE(followed by a digit) = Equation numberF (Followed by a digit) = Function Key numberI(Followed by a digit) = Binary Input numberL(Followed by a digit) = LED numberO(Followed by a digit) = output relay numberV(Followed by a digit) =Virtual Input/Output number.ExamplesMake a function key LED toggle when function key is pressed (requires E1 to drive L11 in output matrix)E1 = F3^L11*	(20 Character String)	
E12 Pick-up Delay *Time before equation output operates, after equation satisfied*	0, 0.01 ... 14300, 14400	0 s
E12 Drop-off Delay *Time before equation output resets, after equation nolonger satisfied*	0, 0.01 ... 14300, 14400	0 s
E12 Counter Target *Select number of times equation must be satisfied before equation output operates*	1, 2 ... 998, 999	1
E12 Counter Reset Mode *Select type of counter reset mode*	Off, Multi-shot, Single-shot	Off
E12 Counter Reset Time *Select counter reset time*	0, 0.01 ... 14300, 14400	0 s
E13 Equation *Enable or Disable logic equation E13*	Disabled, Enabled	Disabled
E13 *Specify logic equations of the form En = <Operand><Operator><Operand>using the following:0123456789=Digit() = Parenthesis! = NOT operation. = AND operation^ = EXCLUSIVE OR operationE(followed by a digit) = Equation numberF (Followed by a digit) = Function Key numberI(Followed by a digit) = Binary Input numberL(Followed by a digit) = LED numberO(Followed by a digit) = output relay numberV(Followed by a digit) =Virtual Input/Output number.ExamplesMake a function key LED toggle when function key is pressed (requires E1 to drive L11 in output matrix)E1 = F3^L11*	(20 Character String)	
E13 Pick-up Delay *Time before equation output operates, after equation satisfied*	0, 0.01 ... 14300, 14400	0 s
E13 Drop-off Delay *Time before equation output resets, after equation nolonger satisfied*	0, 0.01 ... 14300, 14400	0 s
E13 Counter Target *Select number of times equation must be satisfied before equation output operates*	1, 2 ... 998, 999	1
E13 Counter Reset Mode *Select type of counter reset mode*	Off, Multi-shot, Single-shot	Off
E13 Counter Reset Time *Select counter reset time*	0, 0.01 ... 14300, 14400	0 s
E14 Equation *Enable or Disable logic equation E14*	Disabled, Enabled	Disabled

Description	Range	Default
E14 *Specify logic equations of the form En = <Operand><Operator><Operand>using the following:0123456789=Digit() = Parenthesis! = NOT operation. = AND operation^ = EXCLUSIVE OR operationE(followed by a digit) = Equation numberF (Followed by a digit) = Function Key numberI(Followed by a digit) = Binary Input numberL(Followed by a digit) = LED numberO(Followed by a digit) = output relay numberV(Followed by a digit) =Virtual Input/Output number.ExamplesMake a function key LED toggle when function key is pressed (requires E1 to drive L11 in output matrix)E1 = F3^L11*	(20 Character String)	
E14 Pick-up Delay *Time before equation output operates, after equation satisfied*	0, 0.01 ... 14300, 14400	0 s
E14 Drop-off Delay *Time before equation output resets, after equation nolonger satisfied*	0, 0.01 ... 14300, 14400	0 s
E14 Counter Target *Select number of times equation must be satisfied before equation output operates*	1, 2 ... 998, 999	1
E14 Counter Reset Mode *Select type of counter reset mode*	Off, Multi-shot, Single-shot	Off
E14 Counter Reset Time *Select counter reset time*	0, 0.01 ... 14300, 14400	0 s
E15 Equation *Enable or Disable logic equation E15*	Disabled, Enabled	Disabled
E15 *Specify logic equations of the form En = <Operand><Operator><Operand>using the following:0123456789=Digit() = Parenthesis! = NOT operation. = AND operation^ = EXCLUSIVE OR operationE(followed by a digit) = Equation numberF (Followed by a digit) = Function Key numberI(Followed by a digit) = Binary Input numberL(Followed by a digit) = LED numberO(Followed by a digit) = output relay numberV(Followed by a digit) =Virtual Input/Output number.ExamplesMake a function key LED toggle when function key is pressed (requires E1 to drive L11 in output matrix)E1 = F3^L11*	(20 Character String)	
E15 Pick-up Delay *Time before equation output operates, after equation satisfied*	0, 0.01 ... 14300, 14400	0 s
E15 Drop-off Delay *Time before equation output resets, after equation nolonger satisfied*	0, 0.01 ... 14300, 14400	0 s
E15 Counter Target *Select number of times equation must be satisfied before equation output operates*	1, 2 ... 998, 999	1
E15 Counter Reset Mode *Select type of counter reset mode*	Off, Multi-shot, Single-shot	Off
E15 Counter Reset Time *Select counter reset time*	0, 0.01 ... 14300, 14400	0 s
E16 Equation *Enable or Disable logic equation E16*	Disabled, Enabled	Disabled

© 2013 Siemens Protection Devices Limited

Description	Range	Default
E16 *Specify logic equations of the form En = <Operand><Operator><Operand>using the following:0123456789=Digit() = Parenthesis! = NOT operation. = AND operation^ = EXCLUSIVE OR operationE(followed by a digit) = Equation numberF (Followed by a digit) = Function Key numberI(Followed by a digit) = Binary Input numberL(Followed by a digit) = LED numberO(Followed by a digit) = output relay numberV(Followed by a digit) =Virtual Input/Output number.ExamplesMake a function key LED toggle when function key is pressed (requires E1 to drive L11 in output matrix)E1 = F3^L11*	(20 Character String)	
E16 Pick-up Delay *Time before equation output operates, after equation satisfied*	0, 0.01 ... 14300, 14400	0 s
E16 Drop-off Delay *Time before equation output resets, after equation nolonger satisfied*	0, 0.01 ... 14300, 14400	0 s
E16 Counter Target *Select number of times equation must be satisfied before equation output operates*	1, 2 ... 998, 999	1
E16 Counter Reset Mode *Select type of counter reset mode*	Off, Multi-shot, Single-shot	Off
E16 Counter Reset Time *Select counter reset time*	0, 0.01 ... 14300, 14400	0 s
E16 Equation *Enable or Disable logic equation E16*	Disabled, Enabled	Disabled

3.12. Input Config

3.12.1. Input Matrix

Description	Range	Default
Inhibit 81HBL2 *Selects which inputs inhibit the 81HLB2*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit Cold Load *Selects which inputs inhibit the Cold Load element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 51-1 *Selects which inputs inhibit the 51-1 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 51-2 *Selects which inputs inhibit the 51-2 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 51-3 *Selects which inputs inhibit the 51-3 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 51-4 *Selects which inputs inhibit the 51-4 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 50-1 *Selects which inputs inhibit the 50-1 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 50-2 *Selects which inputs inhibit the 50-2 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 50-3 *Selects which inputs inhibit the 50-3 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 50-4 *Selects which inputs inhibit the 50-4 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 51N-1 *Selects which inputs inhibit the 51N-1 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------

© 2013 Siemens Protection Devices Limited

Description	Range	Default
Inhibit 51N-2 *Selects which inputs inhibit the 51N-2 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 51N-3 *Selects which inputs inhibit the 51N-3 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 51N-4 *Selects which inputs inhibit the 51N-4 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 50N-1 *Selects which inputs inhibit the 50N-1 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 50N-2 *Selects which inputs inhibit the 50N-2 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 50N-3 *Selects which inputs inhibit the 50N-3 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 50N-4 *Selects which inputs inhibit the 50N-4 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 51G-1 *Selects which inputs inhibit the 51G-1 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 51G-2 *Selects which inputs inhibit the 51G-2 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 51G-3 *Selects which inputs inhibit the 51G-3 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 51G-4 *Selects which inputs inhibit the 51G-4 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 50G-1 *Selects which inputs inhibit the 50G-1 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 50G-2 *Selects which inputs inhibit the 50G-2 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------

Description	Range	Default
Inhibit 50G-3 *Selects which inputs inhibit the 50G-3 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 50G-4 *Selects which inputs inhibit the 50G-4 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 51SEF-1 *Selects which inputs inhibit the 51SEF-1 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 51SEF-2 *Selects which inputs inhibit the 51SEF-2 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 51SEF-3 *Selects which inputs inhibit the 51SEF-3 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 51SEF-4 *Selects which inputs inhibit the 51SEF-4 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 50SEF-1 *Selects which inputs inhibit the 50SEF-1 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 50SEF-2 *Selects which inputs inhibit the 50SEF-2 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 50SEF-3 *Selects which inputs inhibit the 50SEF-3 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 50SEF-4 *Selects which inputs inhibit the 50SEF-4 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 64H *Selects which inputs inhibit the 64H element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 46IT *Selects which inputs inhibit the 46IT element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 46DT *Selects which inputs inhibit the 46DT element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------

© 2013 Siemens Protection Devices Limited

Description	Range	Default
Inhibit 37-1 *Selects which inputs inhibit the 37-1 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 37-2 *Selects which inputs inhibit the 37-2 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 37G-1 *Selects which inputs inhibit the 37G-1 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 37G-2 *Selects which inputs inhibit the 37G-2 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 37SEF-1 *Selects which inputs inhibit the 37SEF-1 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 37SEF-2 *Selects which inputs inhibit the 37SEF-2 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 49 *Selects which inputs inhibit the 49 thermal element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Reset 49 *Selects which inputs resets the 49 thermal model element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 27/59-1 *Selects which inputs inhibit the 27/59-1 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 27/59-2 *Selects which inputs inhibit the 27/59-2 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 27/59-3 *Selects which inputs inhibit the 27/59-3 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 27/59-4 *Selects which inputs inhibit the 27/59-4 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit Vx 27/59 *Selects which inputs inhibit the Vx 27/59 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------

Description	Range	Default
Inhibit 47-1 *Selects which inputs inhibit the 47-1 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 47-2 *Selects which inputs inhibit the 47-2 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 59NIT *Selects which inputs inhibit the 59N IDMTL/DTL element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 59NDT *Selects which inputs inhibit the 59N INST/DTL element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 81-1 *Selects which inputs inhibit the 81-1 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 81-2 *Selects which inputs inhibit the 81-2 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 81-3 *Selects which inputs inhibit the 81-3 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 81-4 *Selects which inputs inhibit the 81-4 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 81-5 *Selects which inputs inhibit the 81-5 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 81-6 *Selects which inputs inhibit the 81-6 element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 60CTS *Selects which inputs inhibit the CT Supervision element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 60CTS-I	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 46BC *Selects which inputs inhibit the 46 Broken Conductor element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------

© 2013 Siemens Protection Devices Limited

Description	Range	Default
74TCS-1 *Selects which inputs are monitoring trip circuits*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
74TCS-2 *As Above*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
74TCS-3 *As Above*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
74CCS-1 *Selects which inputs are monitoring close circuits*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
74CCS-2 *As Above*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
74CCS-3 *As Above*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Trig Trip Contacts *Selects which inputs will trigger the Trip contacts*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 50BF *Selects which inputs inhibit the 50BF element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
50BF CB Faulty *Selects which input bypasses the 50BF timer due to a fault CB*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
50BF Mech Trip *Selects which input allows a mechanical trip to start the 50BF element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
50BF Ext Trip *Selects which inputs can also start the 50BF element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 60VTS *Selects which inputs inhibit the VT Supervision element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Ext Trig 60VTS *Selects MCB inputs to VT Supervision element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------

Description	Range	Default
Ext Reset 60VTS *Selects which inputs reset the VT Supervision element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit 60VTF-Bus *Selects which inputs inhibit the 60VTF-Bus Supervision element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Reset CB Total Trip *Selects which inputs Reset the CB Total Trip count*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Reset CB Ph A Count *Selects which inputs Reset the CB Ph A Count*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Reset CB Ph B Count *Selects which inputs Reset the CB Ph B Count*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Reset CB Ph C Count *Selects which inputs Reset the CB Ph C Count*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Reset CB E/F Count *Selects which inputs Reset the CB E/F Count*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Reset CB Delta Trip *Selects which inputs Reset the CB Delta Trip count*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Reset ARBlock Count *Selects which inputs Reset the AR Block count*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Reset Freq Ops Count *Selects which inputs Reset the Frequent Ops count*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Reset I^2t CB Wear *Selects which inputs Reset the I^2t CB Wear element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Trigger I^2t CB Wear *Selects which inputs will cause an external trigger of the I^2t CB Wear element*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Reset Trip Time *Selects which inputs will reset the CB trip time alarm*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------

© 2013 Siemens Protection Devices Limited

Description	Range	Default
General Alarm 1 *Selects which inputs will activate the General Alarm 1 text*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
General Alarm 2 *Selects which inputs will activate the General Alarm 2 text*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
General Alarm 3 *Selects which inputs will activate the General Alarm 3 text*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
General Alarm 4 *Selects which inputs will activate the General Alarm 4 text*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
General Alarm 5 *Selects which inputs will activate the General Alarm 5 text*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
General Alarm 6 *Selects which inputs will activate the General Alarm 6 text*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
General Alarm 7 *Selects which inputs will activate the General Alarm 7 text*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
General Alarm 8 *Selects which inputs will activate the General Alarm 8 text*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
General Alarm 9 *Selects which inputs will activate the General Alarm 9 text*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
General Alarm 10 *Selects which inputs will activate the General Alarm 10 text*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
General Alarm 11 *Selects which inputs will activate the General Alarm 11 text*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
General Alarm 12 *Selects which inputs will activate the General Alarm 12 text*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
General Alarm 13 *Selects which inputs will activate the General Alarm 13 text*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------

Description	Range	Default
General Alarm 14 *Selects which inputs will activate the General Alarm 14 text*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
General Alarm 15 *Selects which inputs will activate the General Alarm 15 text*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
General Alarm 16 *Selects which inputs will activate the General Alarm 16 text*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
General Alarm 17 *Selects which inputs will activate the General Alarm 17 text*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
General Alarm 18 *Selects which inputs will activate the General Alarm 18 text*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
General Alarm 19 *Selects which inputs will activate the General Alarm 19 text*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
General Alarm 20 *Selects which inputs will activate the General Alarm 20 text*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
CB Open *Selects which inputs are connected to the circuit breaker open contacts*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
CB Closed *Selects which inputs are connected to the circuit breaker closed contacts*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Reset Demand *Selects which inputs will reset the Demand elements.*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Reset Start Count *Selects which inputs will reset the Start Count elements.*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
AFD Zone 1 Flash *Selects which inputs will are connected to ARC Flash Detector*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
AFD Zone 2 Flash *Selects which inputs will are connected to ARC Flash Detector*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------

© 2013 Siemens Protection Devices Limited

Description	Range	Default
AFD Zone 3 Flash *Selects which inputs will are connected to ARC Flash Detector*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
AFD Zone 4 Flash *Selects which inputs will are connected to ARC Flash Detector*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
AFD Zone 5 Flash *Selects which inputs will are connected to ARC Flash Detector*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
AFD Zone 6 Flash *Selects which inputs will are connected to ARC Flash Detector*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Reset AFDZone 1 Count *Selects which inputs will reset ARC Flash Detector Count*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Reset AFDZone 2 Count *Selects which inputs will reset ARC Flash Detector Count*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Reset AFDZone 3 Count *Selects which inputs will reset ARC Flash Detector Count*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Reset AFDZone 4 Count *Selects which inputs will reset ARC Flash Detector Count*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Reset AFDZone 5 Count *Selects which inputs will reset ARC Flash Detector Count*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Reset AFDZone 6 Count *Selects which inputs will reset ARC Flash Detector Count*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inhibit Fault Loc *Selects which inputs will Inhibit fault Locator.*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Close CB *Selects which inputs will issue a close to the circuit breaker.*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Block Close CB *Selects which inputs will block the manual closing of the circuit breaker.*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------

Description	Range	Default
Open CB *Selects which inputs will issue an open to the circuit breaker.*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
79 Out *Selects which inputs will switch the Auto-recloser out of service*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
79 In *Selects which inputs will switch the Auto-recloser in service*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
79 Trip & Reclose *Selects which inputs will trigger a trip & reclose*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
79 Trip & Lockout *Selects which inputs will trigger a trip & lockout*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
79 Ext Trip *Selects which input will start the external an Auto-relose sequence*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
79 Ext Pickup *Selects which input should be connected to the pickup of the external elements required to start an Auto-reclose sequence*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
79 Block Reclose *Selects which inputs will block the Auto-recloser*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
79 Reset Lockout *Selects which inputs will force the Auto-recloser into the Lockout state*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
79 Line Check *Selects which inputs will start the Line Check functionality of the Auto-recloser*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
79 Lockout *Selects which inputs will force the Auto-recloser into the Lockout state*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
79 Override Sync *Selects which inputs will start 79 Override Sync*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Man Override Sync *Selects which inputs will start Man Override Sync*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------

© 2013 Siemens Protection Devices Limited

Description	Range	Default
Ext Start 25 Sync *Selects which inputs will Ext Start 25 Sync*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Reset 25 Sync *Selects which inputs will Reset 25 Sync*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Start 25 System Sync *Selects which inputs will Start 25 System Sync*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Hot Line Out *Selects which inputs will switch out Hot Line Working*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Hot Line In *Selects which inputs will switch in Hot Line Working*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inst Prot'n Out *Selects which inputs will switch out the instantaneous protection elements*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inst Prot'n In *Selects which inputs will switch in the instantaneous protection elements*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
E/F Out *Selects which inputs will switch out the E/F protection elements.*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
E/F In *Selects which inputs will switch in the E/F protection elements.*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
SEF Out *Selects which inputs will switch out the SEF protection elements*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
SEF In *Selects which inputs will switch in the SEF protection elements*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Trigger Wave Rec *Selects which inputs can trigger a waveform record*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Trigger Fault Rec *Selects which inputs can trigger a fault record*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------

Description	Range	Default
Select Group 1 *Switches active setting group to group 1*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Reset Energy Meters	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Select Group 2 *Switches active setting group to group 2*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Select Group 3 *Switches active setting group to group 3*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Select Group 4 *Switches active setting group to group 4*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Select Group 5 *Switches active setting group to group 5*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Select Group 6 *Switches active setting group to group 6*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Select Group 7 *Switches active setting group to group 7*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Select Group 8 *Switches active setting group to group 8*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Out Of Service Mode *Selects which inputs will put the relay into Out Of Service Mode*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Local Mode *Selects which inputs will put the relay into Local Mode*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Remote Mode *Selects which inputs will put the relay into Remote Mode*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Local Or Remote Mode *Selects which inputs will put the relay into Local Or Remote Mode*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------

© 2013 Siemens Protection Devices Limited

Description	Range	Default
Clock Sync. *Selects which input is used to synchronise the real time clock*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Reset LEDs & O/Ps *Selects which inputs will reset the latched LEDs and binary outputs*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	----------
Inverted Inputs *Selects which inputs will be inverted*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13)	----------
Enable In Local *Selects which inputs will be enabled in local mode*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13)	BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13
Enable In Remote *Selects which inputs will be enabled in remote mode*	Combination of (BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13)	BI1, BI2, BI3, BI4, BI5, BI6, BI7, BI8, BI9, BI10, BI11, BI12, BI13

3.12.2. Function Key Matrix

Description	Range	Default
Open CB *Selects which function key will Open the circuit breaker*	Combination of (1, 2, 3, 4, 5, 6)	------
Close CB *Selects which function key will Close the circuit breaker*	Combination of (1, 2, 3, 4, 5, 6)	------
79 In/Out *Selects which function key will toggle Autoreclose In & Out*	Combination of (1, 2, 3, 4, 5, 6)	------
79 Trip & Reclose *Selects which function key will cause the CB to trip & reclose*	Combination of (1, 2, 3, 4, 5, 6)	------
79 Trip & Lockout *Selects which function key will cause the CB to trip & lockout*	Combination of (1, 2, 3, 4, 5, 6)	------
Hot Line Work In/Out *Selects which function key will toggle Hot Line Working In & Out*	Combination of (1, 2, 3, 4, 5, 6)	------
E/F In/Out *Selects which function key will toggle E/F protection In & Out*	Combination of (1, 2, 3, 4, 5, 6)	------
SEF In/Out *Selects which function key will toggle SEF protection In & Out*	Combination of (1, 2, 3, 4, 5, 6)	------
Inst Prot'n In/Out *Selects which function key will toggle Instantaneous protection elements In & Out*	Combination of (1, 2, 3, 4, 5, 6)	------
Out Of Service Mode	Combination of (1, 2, 3, 4, 5, 6)	------
Local Mode	Combination of (1, 2, 3, 4, 5, 6)	------
Remote Mode	Combination of (1, 2, 3, 4, 5, 6)	------
Local Or Remote Mode *Selects which inputs will put the relay into Local Or Remote Mode*	Combination of (1, 2, 3, 4, 5, 6)	------

© 2013 Siemens Protection Devices Limited

3.12.3. Binary Input Config (Variants may differ)

Description	Range	Default
Inverted Inputs *Selects which inputs pickup when voltage is removed.*	Combination of (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13)	----------
BI 1 Pick-up Delay *Delay on pickup of DC Binary Input 1*	0, 0.005 ... 14300, 14400	0.02 s
BI 1 Drop-off Delay *Delay on dropoff of DC Binary Input 1*	0, 0.005 ... 14300, 14400	0 s
BI 2 Pick-up Delay *Delay on pickup of DC Binary Input 2*	0, 0.005 ... 14300, 14400	0.02 s
BI 2 Drop-off Delay *Delay on dropoff of DC Binary Input 2*	0, 0.005 ... 14300, 14400	0 s
BI 3 Pick-up Delay *Delay on pickup of DC Binary Input 3*	0, 0.005 ... 14300, 14400	0.02 s
BI 3 Drop-off Delay *Delay on dropoff of DC Binary Input 3*	0, 0.005 ... 14300, 14400	0 s
BI 4 Pick-up Delay *Delay on pickup of DC Binary Input 4*	0, 0.005 ... 14300, 14400	0.02 s
BI 4 Drop-off Delay *Delay on dropoff of DC Binary Input 4*	0, 0.005 ... 14300, 14400	0 s
BI 5 Pick-up Delay *Delay on pickup of DC Binary Input 5*	0, 0.005 ... 14300, 14400	0.02 s
BI 5 Drop-off Delay *Delay on dropoff of DC Binary Input 5*	0, 0.005 ... 14300, 14400	0 s
BI 6 Pick-up Delay *Delay on pickup of DC Binary Input 6*	0, 0.005 ... 14300, 14400	0.02 s
BI 6 Drop-off Delay *Delay on dropoff of DC Binary Input 6*	0, 0.005 ... 14300, 14400	0 s
BI 7 Pick-up Delay *Delay on pickup of DC Binary Input 7*	0, 0.005 ... 14300, 14400	0.02 s
BI 7 Drop-off Delay *Delay on dropoff of DC Binary Input 7*	0, 0.005 ... 14300, 14400	0 s
BI 8 Pick-up Delay *Delay on pickup of DC Binary Input 8*	0, 0.005 ... 14300, 14400	0.02 s
BI 8 Drop-off Delay *Delay on dropoff of DC Binary Input 8*	0, 0.005 ... 14300, 14400	0 s
BI 9 Pick-up Delay *Delay on pickup of DC Binary Input 9*	0, 0.005 ... 14300, 14400	0.02 s
BI 9 Drop-off Delay *Delay on dropoff of DC Binary Input 9*	0, 0.005 ... 14300, 14400	0 s
BI 10 Pick-up Delay *Delay on pickup of DC Binary Input 10*	0, 0.005 ... 14300, 14400	0.02 s
BI 10 Drop-off Delay *Delay on dropoff of DC Binary Input 10*	0, 0.005 ... 14300, 14400	0 s
BI 11 Pick-up Delay *Delay on pickup of DC Binary Input 11*	0, 0.005 ... 14300, 14400	0.02 s
BI 11 Drop-off Delay *Delay on dropoff of DC Binary Input 11*	0, 0.005 ... 14300, 14400	0 s

Description	Range	Default
BI 12 Pick-up Delay *Delay on pickup of DC Binary Input 12*	0, 0.005 ... 14300, 14400	0.02 s
BI 12 Drop-off Delay *Delay on dropoff of DC Binary Input 12*	0, 0.005 ... 14300, 14400	0 s
BI 13 Pick-up Delay *Delay on pickup of DC Binary Input 13*	0, 0.005 ... 14300, 14400	0.02 s
BI 13 Drop-off Delay *Delay on dropoff of DC Binary Input 13*	0, 0.005 ... 14300, 14400	0 s
Enabled In Local *Selects which inputs are enabled when the relay is in Operating Mode 'Local' or 'Local Or Remote'*	Combination of (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
Enabled In Remote *Selects which inputs are enabled when the relay is in Operating Mode 'Remote' or 'Local Or Remote'*	Combination of (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13

3.12.4. Function Key Config

Description	Range	Default
Function Key 1 Text *User definable text that will be used in the HMI function key confirmation screen when Function key 1 is pressed.*	(20 Character String)	Function Key 1
Function Key 2 Text *User definable text that will be used in the HMI function key confirmation screen when Function key 2 is pressed.*	(20 Character String)	Function Key 2
Function Key 3 Text *User definable text that will be used in the HMI function key confirmation screen when Function key 3 is pressed.*	(20 Character String)	Function Key 3
Function Key 4 Text *User definable text that will be used in the HMI function key confirmation screen when Function key 4 is pressed.*	(20 Character String)	Function Key 4
Function Key 5 Text *User definable text that will be used in the HMI function key confirmation screen when Function key 5 is pressed.*	(20 Character String)	Function Key 5
Function Key 6 Text *User definable text that will be used in the HMI function key confirmation screen when Function key 6 is pressed.*	(20 Character String)	Function Key 6
Enabled In Remote *Selects which inputs are enabled when the relay is in Operating Mode 'Remote' or 'Local Or Remote'*	Combination of (1, 2, 3, 4, 5, 6)	------

© 2013 Siemens Protection Devices Limited

3.12.5. General Alarms

Description	Range	Default
General Alarm-1 *Defines the text to be displayed for General Alarm 1*	(16 Character String)	ALARM 1
General Alarm-2 *Defines the text to be displayed for General Alarm 2*	(16 Character String)	ALARM 2
General Alarm-3 *Defines the text to be displayed for General Alarm 3*	(16 Character String)	ALARM 3
General Alarm-4 *Defines the text to be displayed for General Alarm 4*	(16 Character String)	ALARM 4
General Alarm-5 *Defines the text to be displayed for General Alarm 5*	(16 Character String)	ALARM 5
General Alarm-6 *Defines the text to be displayed for General Alarm 6*	(16 Character String)	ALARM 6
General Alarm-7 *Defines the text to be displayed for General Alarm 7*	(16 Character String)	ALARM 7
General Alarm-8 *Defines the text to be displayed for General Alarm 8*	(16 Character String)	ALARM 8
General Alarm-9 *Defines the text to be displayed for General Alarm 9*	(16 Character String)	ALARM 9
General Alarm-10 *Defines the text to be displayed for General Alarm 10*	(16 Character String)	ALARM 10
General Alarm-11 *Defines the text to be displayed for General Alarm 11*	(16 Character String)	ALARM 11
General Alarm-12 *Defines the text to be displayed for General Alarm 12*	(16 Character String)	ALARM 12
General Alarm-13 *Defines the text to be displayed for General Alarm 13*	(16 Character String)	ALARM 13
General Alarm-14 *Defines the text to be displayed for General Alarm 14*	(16 Character String)	ALARM 14
General Alarm-15 *Defines the text to be displayed for General Alarm 15*	(16 Character String)	ALARM 15
General Alarm-16 *Defines the text to be displayed for General Alarm 16*	(16 Character String)	ALARM 16
General Alarm-17 *Defines the text to be displayed for General Alarm 17*	(16 Character String)	ALARM 17
General Alarm-18 *Defines the text to be displayed for General Alarm 18*	(16 Character String)	ALARM 18
General Alarm-19 *Defines the text to be displayed for General Alarm 19*	(16 Character String)	ALARM 19
General Alarm-20 *Defines the text to be displayed for General Alarm 20*	(16 Character String)	ALARM 20

3.13. Output Config

3.13.1. Output Matrix

Description	Range	Default
Protection Healthy *Relays selected are energised whilst relay self-monitoring does NOT detect any hardware or software errors and DC Supply is healthy. A changeover contact or normally closed contact may be used to generate Protection Defective from this output*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	BO1
Active Setting Grp 1	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	Grp 1
Active Setting Grp 2	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	
Active Setting Grp 3	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	
Active Setting Grp 4	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	
Active Setting Grp 5	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	
Active Setting Grp 6	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	
Active Setting Grp 7	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	
Active Setting Grp 8	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	

© 2013 Siemens Protection Devices Limited

Description	Range	Default
+ve P 3 Ph	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
-ve P 3 Ph	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
+ve Q 3 Ph	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
-ve Q 3 Ph	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
51-1 *51-1 IDMTL/DTL Overcurrent operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
51-2 *51-2 IDMTL/DTL Overcurrent operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
51-3 *51-3 IDMTL/DTL Overcurrent operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
51-4 *51-4 IDMTL/DTL Overcurrent operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
50-1 *50-1 INST/DTL Overcurrent operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------

Description	Range	Default
50-2 *50-2 INST/DTL Overcurrent operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
50-3 *50-3 INST/DTL Overcurrent operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
50-4 *50-4 INST/DTL Overcurrent operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
51N-1 *51N-1 IDMTL/DTL derived Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L4
51N-2 *51N-2 IDMTL/DTL derived Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L4
51N-3 *51N-3 IDMTL/DTL derived Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L4
51N-4 *51N-4 IDMTL/DTL derived Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L4
50N-1 *50N-1 INST/DTL derived Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L4
50N-2 *50N-2 INST/DTL derived Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L4

© 2013 Siemens Protection Devices Limited

Description	Range	Default
50N-3 *50N-3 INST/DTL derived Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L4
50N-4 *50N-4 INST/DTL derived Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L4
51G-1 *51G-1 IDMTL/DTL measured Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L4
51G-2 *51G-2 IDMTL/DTL measured Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L4
51G-3 *51G-3 IDMTL/DTL measured Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L4
51G-4 *51G-4 IDMTL/DTL measured Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L4
50G-1 *50G-1 INST/DTL measured Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L4
50G-2 *50G-2 INST/DTL measured Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L4
50G-3 *50G-3 INST/DTL measured Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L4

Description	Range	Default
50G-4 *50G-4 INST/DTL measured Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L4
51SEF-1 *51SEF-1 IDMTL/DTL Sensitive Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L5
51SEF-2 *51SEF-2 IDMTL/DTL Sensitive Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L5
51SEF-3 *51SEF-3 IDMTL/DTL Sensitive Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L5
51SEF-4 *51SEF-4 IDMTL/DTL Sensitive Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L5
50SEF-1 *50SEF-1 INST/DTL Sensitive Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L5
50SEF-2 *50SEF-2 INST/DTL Sensitive Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L5
50SEF-3 *50SEF-3 INST/DTL Sensitive Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L5
50SEF-4 *50SEF-4 INST/DTL Sensitive Earth Fault operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	L5

© 2013 Siemens Protection Devices Limited

Description	Range	Default
64H *64H Restricted Earth Fault element operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
Cold Load Active *Cold Load settings are active*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
46IT *IDMTL/DTL NPS Overcurrent operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
46DT *INST/DTL NPS Overcurrent operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
37 PhA *PhA Under Current operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
37 PhB *PhB Under Current operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
37 PhC *PhC Under Current operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
37-1 *37-1 Under Current operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
37-2 *37-2 Under Current operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------

Description	Range	Default
37G-1 *37G-1 Under Current operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
37G-2 *37G-2 Under Current operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
37SEF-1 *37SEF-1 Under Current operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
37SEF-2 *37SEF-2 Under Current operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
49 Trip *Thermal capacity trip operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
49 Alarm *Thermal capacity alarm operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
27/59-1 *Under/Overvoltage stage 1 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
27/59-2 *Under/Overvoltage stage 2 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
27/59-3 *Under/Overvoltage stage 3 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------

© 2013 Siemens Protection Devices Limited

Description	Range	Default
27/59-4 *Under/Overvoltage stage 4 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
Vx 27/59 *Under/Overvoltage Vx stage operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
47-1 *INST/DTL NPS Overvoltage stage 1 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
47-2 *INST/DTL NPS Overvoltage stage 2 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
59NIT *Neutral Overvoltage IDMTL/DTL operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
59NDT *Neutral Overvoltage INST/DTL operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
81-1 *Under/Over frequency stage 1 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
81-2 *Under/Over frequency stage 2 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
81-3 *Under/Over frequency stage 3 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------

Description	Range	Default
81-4 *Under/Over frequency stage 4 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
81-5 *Under/Over frequency stage 5 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
81-6 *Under/Over frequency stage 6 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
60CTS *CT Supervision element operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
60CTS-I	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
46BC *46 Broken Conductor element operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
74TCS-1 *Trip Circuit 1 fail operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
74TCS-2 *Trip Circuit 2 fail operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
74TCS-3 *Trip Circuit 3 fail operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------

© 2013 Siemens Protection Devices Limited

Description	Range	Default
74CCS-1 *Close Circuit 1 fail operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
74CCS-2 *Close Circuit 2 fail operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
74CCS-3 *Close Circuit 3 fail operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
81HBL2	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
General Pickup *General Pickup operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
50BF-1 *Circuit Breaker Fail stage 1 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
50BF-2 *Circuit Breaker Fail stage 2 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
60VTS *VT Supervision element operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
60VTF-Bus *60 VTF-Bus Supervision element operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------

Description	Range	Default
50BF PhA *Circuit Breaker Fail Phase A*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
50BF PhB *Circuit Breaker Fail Phase B*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
50BF PhC *Circuit Breaker Fail Phase C*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
50BF EF *Circuit Breaker Fail Earth Fault*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
CB Total Trip Count *Total CB trip count exceeded*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
CB Ph A Trip Count *Total CB Ph A trip count exceeded*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
CB Ph B Trip Count *Total CB Ph B trip count exceeded*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
CB Ph C Trip Count *Total CB Ph C trip count exceeded*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
CB E/F Trip Count *Total CB E/F trip count exceeded*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------

© 2013 Siemens Protection Devices Limited

Description	Range	Default
CB Delta Trip Count *Delta CB trip count exceeded*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
CB Count To ARBlock *Count To AR Block CB trip count exceeded*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
CB Freq Ops Count *CB Frequent Operations count exceeded*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
I^2t CB Wear *I^2t CB Wear limit exceeded*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
Trip Time Alarm *Trip Time Alarm operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
CB Open *Indicates that the circuit breaker is in the open position.*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
CB Closed *Indicates that the circuit breaker is in the closed position.*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
Close CB Blocked *Indicates that the Close CB control is blocked by its interlocking logic.*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
CB Alarm *Indicates the CB is either in an illegal state or is stuck neither open or closed.*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------

Description	Range	Default
Open CB *Open pulse due to Manual Open being issued.*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
Phase A *Phase A element operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
Phase B *Phase B element operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
Phase C *Phase C element operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
Derived E/F *Derive E/F element operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
Measured E/F *Measured E/F element operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
Sensitive E/F *Sensitive E/F element operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
Start Count Alarm	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
50AFD PhA *Arc Flash Detector Phase A operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------

© 2013 Siemens Protection Devices Limited

Description	Range	Default
50AFD PhB *Arc Flash Detector Phase B operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
50AFD PhC *Arc Flash Detector Phase C operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
50AFD	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
AFD Zone 1 Flash	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
AFD Zone 1	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
AFD Zone 2 Flash	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
AFD Zone 2	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
AFD Zone 3 Flash	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
AFD Zone 3	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------

Description	Range	Default
AFD Zone 4 Flash	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
AFD Zone 4	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
AFD Zone 5 Flash	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
AFD Zone 5	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
AFD Zone 6 Flash	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
AFD Zone 6	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
User Output 1 *User Output 1 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
---		
User Output 32 *User Output 32 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
En100 Life *Raised when the En100 is communicating correctly with the Protection CPU*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------

© 2013 Siemens Protection Devices Limited

Description	Range	Default
En100 Error *Raised when the En100 has detected an Error*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
IEC61850 Configured *Raised when the En100 and Protection CPU are configured for IEC 61850.*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
En100 Ch1 Link Down *Raised when En100 Ch 1 Link Down*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
En100 Ch2 Link Down *Raised when En100 Ch 2 Link Down*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
Forward P/F *The Phase fault is in the forward direction. Note this output is presented EVEN when relay elements are set to be non-directional.*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
Reverse P/F *The Phase fault is in the reverse direction. Note this output is presented EVEN when relay elements are set to be non-directional.*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
Forward E/F *The fault is in the forward direction. Note this output is presented EVEN when relay elements are set to be non-directional.*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
Reverse E/F *The fault is in the reverse direction. Note this output is presented EVEN when relay elements are set to be non-directional.*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
Forward SEF *The fault is in the forward direction. Note this output is presented EVEN when relay elements are set to be non-directional.*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------

Description	Range	Default
Reverse SEF *The fault is in the reverse direction. Note this output is presented EVEN when relay elements are set to be non-directional.*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
Manual Close CB *Close pulse due to Manual close being issued*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	BO8
79 AR Close CB *Close pulse due to auto-reclose sequence*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
79 Trip & Reclose *Indicates the Trip & Reclose sequence being performed*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
79 Trip & Lockout *Indicates the Trip & Lockout sequence being performed*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
79 Lockout *Indicates the auto-recloser is in the Lockout state*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
79 Out Of Service *Indicates the auto-recloser is out of service*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
79 In Service *Indicates the auto-recloser is in service*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
79 In Progress *Indicates an auto-reclose sequence is in progress*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------

© 2013 Siemens Protection Devices Limited

Description	Range	Default
79 Block Extern *Indicates that Extern for the current shot has been selected to be delayed. (This may be used to block external tripping elements in the same way as the internal protection elements are blocked to achieve Instantaneous / Delayed operation.)*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
79 CB Fail To Close *Indicates the CB was not closed at the end of the Close Pulse*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
79 Close Onto Fault *Indicates an element starter or trip operated during the Close Pulse*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
79 Successful AR *Indicates that after a reclose and at the end of the Reclaim time the CB was closed and there were no auto-reclose trip elements operated. (This is issued for 2 secs)*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
Successful Man Close *Indicates that after a manual close and at the end of the Reclaim time the CB was closed and there were no auto-reclose trip elements operated. (This is issued for 2 secs)*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
Man Override Sync	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
79 Override Sync	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
25 Live Line	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
25 Live bus	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------

Description	Range	Default
25 Line U/V	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
25 Bus U/V	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
25 Diff Voltage	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
25 Voltage Check	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
25 In Sync	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
25 CS In Progress	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
25 SS In Progress	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
25 COZ In Progress	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
25 System Split LO	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------

© 2013 Siemens Protection Devices Limited

Description	Range	Default
Hot Line Working *Indicates that Hot LineWorking functionality has been selected*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
Inst Prot'n Out *Indicates that the protection elements selected to be Instantaneous elements are switched out*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
E/F Out *Indicates that the instantaneous protection elements are switched out.*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
SEF Out *Indicates that the SEF protection elements are switched out*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
New Wave Stored *The waveform recorder has stored new information Note: this is a pulsed output*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
New Fault Stored *The fault recorder has stored new information Note: this is a pulsed output*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
Active Exp Pulse	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
Active Imp Pulse	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
Reactive Exp Pulse	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------

Description	Range	Default
Reactive Imp Pulse	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
Out Of Service Mode *Indicates the relay is in Out Of Service Mode*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
Local Mode *Indicates the relay is in Local Mode*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
Remote Mode *Indicates the relay is in Remote Mode*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
BI 1 Operated *DC Binary Input 1 has operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
BI 2 Operated *DC Binary Input 2 has operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
BI 3 Operated *DC Binary Input 3 has operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
BI 4 Operated *DC Binary Input 4 has operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
BI 5 Operated *DC Binary Input 5 has operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------

© 2013 Siemens Protection Devices Limited

Description	Range	Default
BI 6 Operated *DC Binary Input 6 has operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
BI 7 Operated *DC Binary Input 7 has operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
BI 8 Operated *DC Binary Input 8 has operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
BI 9 Operated *DC Binary Input 9 has operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
BI 10 Operated *DC Binary Input 10 has operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
BI 11 Operated *DC Binary Input 11 has operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
BI 12 Operated *DC Binary Input 12 has operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
BI 13 Operated *DC Binary Input 13 has operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
E1 *Quick Logic equation 1 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------

Description	Range	Default
E2 *Quick Logic equation 2 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
E3 *Quick Logic equation 3 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
E4 *Quick Logic equation 4 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
E5 *Quick Logic equation 5 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
E6 *Quick Logic equation 6 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
E7 *Quick Logic equation 7 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
E8 *Quick Logic equation 8 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
E9 *Quick Logic equation 9 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
E10 *Quick Logic equation 10 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------

© 2013 Siemens Protection Devices Limited

Description	Range	Default
E11 *Quick Logic equation 11 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
E12 *Quick Logic equation 12 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
E13 *Quick Logic equation 13 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
E14 *Quick Logic equation 14 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
E15 *Quick Logic equation 15 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
E16 *Quick Logic equation 16 operated*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16)	---------- ----------
Trip Contacts *Assigns Output Contact as trip contact for fault trigger*	BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14	---------- ----------
Hand Reset Outputs *Assigns Output Contact as hand reset contact*	BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14	---------- ----------
Pickup Outputs *Selects which outputs can operate because a pickup condition exists*	BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14	----------
Pulsed Outputs *Selects which outputs are pulsed. The pulse width is set by the Min Operate Time setting for each output*	BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14	----------

3.13.2. Binary Output Config (Variants may differ)

Description	Range	Default
Trip Contacts *The Binary Outputs selected by this setting are classed as Trip contacts. (When any of these BOs operate the Trip LED is lit, CB Fail is started, if enabled, & a Fault Record is stored)*	Combination of (BO1, BO2, BO3, BO4, BO5, BO6, BO7, BO8, BO9, BO10, BO11, BO12, BO13, BO14)	----------

Description	Range	Default
Hand Reset Outputs *Relays selected, as Hand Reset will remain latched until manually reset from front panel or via communications link or by removing DC Supply. By default relays are Self Resetting and will reset when the driving signal is removed.*	Combination of (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14)	----------
Min Operate Time 1 *Minimum operate time of output relay if set to self reset, if also set to be pulsed then this is the pulse width*	0, 0.01 ... 59, 60	0.1 s
Min Operate Time 2 *Minimum operate time of output relay 2 if set to self reset, if also set to be pulsed then this is the pulse width*	0, 0.01 ... 59, 60	0.1 s
Min Operate Time 3 *Minimum operate time of output relay 3 if set to self reset, if also set to be pulsed then this is the pulse width*	0, 0.01 ... 59, 60	0.1 s
Min Operate Time 4 *Minimum operate time of output relay 4 if set to self reset, if also set to be pulsed then this is the pulse width*	0, 0.01 ... 59, 60	0.1 s
Min Operate Time 5 *Minimum operate time of output relay 5 if set to self reset, if also set to be pulsed then this is the pulse width*	0, 0.01 ... 59, 60	0.1 s
Min Operate Time 6 *Minimum operate time of output relay 6 if set to self reset, if also set to be pulsed then this is the pulse width*	0, 0.01 ... 59, 60	0 s
Min Operate Time 7 *Minimum operate time of output relay 7 if set to self reset, if also set to be pulsed then this is the pulse width*	0, 0.01 ... 59, 60	0 s
Min Operate Time 8 *Minimum operate time of output relay 8 if set to self reset, if also set to be pulsed then this is the pulse width*	0, 0.01 ... 59, 60	0 s
Min Operate Time 9 *Minimum operate time of output relay 9 if set to self reset, if also set to be pulsed then this is the pulse width*	0, 0.01 ... 59, 60	0 s
Min Operate Time 10 *Minimum operate time of output relay 10 if set to self reset, if also set to be pulsed then this is the pulse width*	0, 0.01 ... 59, 60	0.1 s
Min Operate Time 11 *Minimum operate time of output relay 11 if set to self reset, if also set to be pulsed then this is the pulse width*	0, 0.01 ... 59, 60	0.1 s
Min Operate Time 12 *Minimum operate time of output relay 12 if set to self reset, if also set to be pulsed then this is the pulse width*	0, 0.01 ... 59, 60	0.1 s
Min Operate Time 13 *Minimum operate time of output relay 13 if set to self reset, if also set to be pulsed then this is the pulse width*	0, 0.01 ... 59, 60	0.1 s
Min Operate Time 14 *Minimum operate time of output relay 14 if set to self reset, if also set to be pulsed then this is the pulse width*	0, 0.01 ... 59, 60	0.1 s
Pickup Outputs *Selects which outputs can operate because a pickup condition exists*	Combination of (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14)	----------
Pulsed Outputs *Selects which outputs are pulsed. The pulse width is set by the Min Operate Time setting for each output*	Combination of (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14)	----------

3.13.3. LED Config

Description	Range	Default

© 2013 Siemens Protection Devices Limited

Description	Range	Default
Self Reset LEDs *LEDs selected, as Self Reset will automatically reset when the driving signal is removed. By default all LEDs are Hand Reset and must be manually reset either locally via the front fascia or remotely via communications.*	Combination of (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14)	1, 9, 10, 11, 12, 13, 14
PU Self Reset LEDs *LEDs selected, as Self Reset will automatically reset when the driving signal is removed. By default all PU LEDs are Self Reset.*	Combination of (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
Green LEDs *Selects which LEDs will be green when driven*	Combination of (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14)	----------
Red LEDs *Selects which LEDs will be red when driven*	Combination of (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
PU Green LEDs *Selects which LEDs will be green when driven by a pickup*	Combination of (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
PU Red LEDs *Selects which LEDs will be red when driven by a pickup*	Combination of (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14

3.13.4. Pickup Config

Description	Range	Default
Gn P/F Pickups *When any of the selected pickups operate General Pickup is driven.*	Combination of (51-1, 51-2, 51-3, 51-4, 50-1, 50-2, 50-3, 50-4)	51-1, 51-2, 51-3, 51-4, 50-1, 50-2, 50-3, 50-4
Gn E/F Pickups *As Above*	Combination of (51N-1, 51N-2, 51N-3, 51N-4, 50N-1, 50N-2, 50N-3, 50N-4, 51G-1, 51G-2, 51G-3, 51G-4, 50G-1, 50G-2, 50G-3, 50G-4)	51N-1, 51N-2, 51N-3, 51N-4, 50N-1, 50N-2, 50N-3, 50N-4, 51G-1, 51G-2, 51G-3, 51G-4, 50G-1, 50G-2, 50G-3, 50G-4
Gn SEF/REF Pickups *As Above*	Combination of (51SEF-1, 51SEF-2, 51SEF-3, 51SEF-4, 50SEF-1, 50SEF-2, 50SEF-3, 50SEF-4, 64H)	51SEF-1, 51SEF-2, 51SEF-3, 51SEF-4, 50SEF-1, 50SEF-2, 50SEF-3, 50SEF-4, 64H
Gn Voltage Pickups *As Above*	Combination of (27/59-1, 27/59-2, 27/59-3, 27/59-4, Vx 27/59, 47-1, 47-2, 59NIT, 59NDT)	27/59-1, 27/59-2, 27/59-3, 27/59-4, Vx 27/59, 47-1, 47-2, 59NIT, 59NDT
Gn Freq Pickups *As Above*	Combination of (81-1, 81-2, 81-3, 81-4, 81-5, 81-6)	81-1, 81-2, 81-3, 81-4, 81-5, 81-6
Gn Misc Pickups *As Above*	Combination of (46IT, 46DT, 37-1, 37-2, 37G-1, 37G-2, 37SEF-1, 37SEF-2)	46IT, 46DT, 37-1, 37-2, 37G-1, 37G-2, 37SEF-1, 37SEF-2

3.14. Maintenance

3.14.1. CB Counters

Description	Range	Default
Gn CB Total Trip Count *Selects whether the CB Total Trip Count counter is enabled*	Disabled, Enabled	Disabled
Gn CB Total Trip Count Target *Selects the number of CB trips allowed before CB Total Trip Count counter output operates*	0, 1 ... 9999, 10000	100
Gn CB Total Trip Count Reset *Resets CB Total Trip Count counter*		
Gn CB Total Trip Manual Open *Selects whether the CB Total Trip Manual Open is enabled*	Disabled, Enabled	Disabled
Gn CB Phase Trip Counters *Selects whether the CB Phase Trip Counters is enabled*	Disabled, Enabled	Disabled
Gn CB Ph A Trip Count Target *Selects the number of CB trips allowed before CB Ph A Trip Count counter output operates*	0, 1 ... 9999, 10000	100
Gn CB Ph B Trip Count Target *Selects the number of CB trips allowed before CB Ph B Trip Count counter output operates*	0, 1 ... 9999, 10000	100
Gn CB Ph C Trip Count Target *Selects the number of CB trips allowed before CB Ph C Trip Count counter output operates*	0, 1 ... 9999, 10000	100
Gn CB E/F Trip Count Target *Selects the number of CB trips allowed before CB E/F Trip Count counter output operates*	0, 1 ... 9999, 10000	100
Gn CB Delta Trip Count *Selects whether the CB Delta Trip Count counter is enabled*	Disabled, Enabled	Disabled
Gn CB Delta Trip Count Target *Selects the number of CB trips allowed before CB Delta Trip Count counter output operates*	0, 1 ... 9999, 10000	100
Gn CB Delta Trip Count Reset *Resets CB Delta Trip Count counter*		
Gn CB Count To AR Block *Selects whether the CB Count To AR Block counter is enabled*	Disabled, Enabled	Disabled
Gn CB Count To AR Block Target *Selects the number of CB trips allowed before CB Count To AR Block counter output operates. While count is above target the Autorecloser will only perform 1 x Delayed Shot and Lockout*	0, 1 ... 9999, 10000	100
Gn CB Count To AR Block Reset *Resets CB Count To AR Block counter*		
Gn CB Freq Ops Count *Selects whether the CB Frequent Operations Counter is enabled*	Disabled, Enabled	Disabled
Gn CB Freq Ops Count Target *Selects the number of CB trips allowed before CB Frequent Operations Counter output operates. While count is above target the Autorecloser will only perform 1 x Delayed Shot and Lockout*	0, 1 ... 9999, 10000	10
Gn CB Freq Ops Count Reset *Resets CB Frequent Operations Counter*		

3.14.2. I^2T CB Wear

Description	Range	Default

© 2013 Siemens Protection Devices Limited

Description	Range	Default
Gn I^2t Counter *Selects whether the I^2t CB Wear monitor is enabled*	Disabled, Enabled	Disabled
Gn Alarm Limit *Sets limit before alarm is issued*	10, 11 ... 99000, 100000	10 MA^2 s
Gn Separation Time *Sets the time for CB mechanism to start moving, time before contacts start to separate*	0, 0.001 ... 0.199, 0.2	0.02 s
Gn Clearance Time *Time for CB to clear fault*	0, 0.001 ... 0.199, 0.2	0.04 s
Reset I^2t Count *Reset the CB wear count*		

3.14.3. START COUNT

Description	Range	Default
Start Types(s) *Selects which type of start-up*	Power On, Expected, Unexpected	All
Start Count Target *Selects number of times star-up has occurred before output operatest*	0, ...10000	100

3.15. Data Storage

3.15.1. Demand Data/Log

Description	Range	Default
Data Log Period *Selects period between stored samples*	5, 6, 7, 8, 9, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60	5 min
Clear Data Log *Clear the Data Log*		
Gn Demand Window *The time window over which the Min, Max and Mean values are calculated.*	1, 2 ... 23, 24	24 hrs
Gn Demand Window Type *Method used to calculate Demand values.*	Fixed, Peak, Rolling	Fixed
Gn Demand Reset *Reset all Demand values*		

3.15.2. Waveform Storage

Description	Range	Default
Gn P/F Trig Storage *Select which elements trigger a waveform record*	Combination of (51-1, 51-2, 51-3, 51-4, 50-1, 50-2, 50-3, 50-4)	51-1, 51-2, 51-3, 51-4, 50-1, 50-2, 50-3, 50-4
Gn E/F Trig Storage *As Above*	Combination of (51N-1, 51N-2, 51N-3, 51N-4, 50N-1, 50N-2, 50N-3, 50N-4, 51G-1, 51G-2, 51G-3, 51G-4, 50G-1, 50G-2, 50G-3, 50G-4)	51N-1, 51N-2, 51N-3, 51N-4, 50N-1, 50N-2, 50N-3, 50N-4, 51G-1, 51G-2, 51G-3, 51G-4, 50G-1, 50G-2, 50G-3, 50G-4

Description	Range	Default
Gn SEF/REF Trig Storage *As Above*	Combination of (51SEF-1, 51SEF-2, 51SEF-3, 51SEF-4, 50SEF-1, 50SEF-2, 50SEF-3, 50SEF-4, 64H)	51SEF-1, 51SEF-2, 51SEF-3, 51SEF-4, 50SEF-1, 50SEF-2, 50SEF-3, 50SEF-4, 64H
Gn Misc Current Storage *As Above*	Combination of (46IT, 46DT, 37-1, 37-2, 49 Trip, 49 Alarm, 37G-1, 37G-2, 37SEF-1, 37SEF-2)	----------
Gn Voltage Trig Storage *As Above*	Combination of (27/59-1, 27/59-2, 27/59-3, 27/59-4, Vx 27/59, 47-1, 47-2, 59NIT, 59NDT)	---------
Gn Freq Trig Storage *As Above*	Combination of (81-1, 81-2, 81-3, 81-4, 81-5, 81-6)	------
Gn AFD Trig Storage *As Above*	Combination of (AFD-1, AFD-2, AFD-3, AFD-4, AFD-5, AFD-6)	------
Pre-trigger Storage *Select Percentage of waveform record stored before the fault is triggered*	10, 20, 30, 40, 50, 60, 70, 80, 90	20 %
Record Duration *Select waveform record duration*	10 Rec x 1 Sec, 5 Rec x 2 Sec, 2 Rec x 5 Sec, 1 Rec x 10 Sec	10 Rec x 1 Sec
Trigger Waveform *Trigger waveform storage*		
Clear Waveforms *Clear all stored waveform records*		

3.15.3. Fault Storage

Description	Range	Default
Gn Max Fault Rec Time *Maximum time Fault record information will be stored and classed as same fault*	0, 1 ... 59900, 60000	2000 ms
Clear Faults *Clear all stored fault records*		

3.15.4. Event Storage

Description	Range	Default
Clear Events *Clear all stored event records*		

3.15.5. Energy Storage

Description	Range	Default
Gn Active Exp Energy Unit	1kWh, 10kWh, 100kWh, 1MWh, 10MWh, 100MWh	10 kWh
Gn Active Imp Energy Unit	1kWh, 10kWh, 100kWh, 1MWh, 10MWh, 100MWh	10 kWh
Gn Reactive Exp Energy Unit	1kVArh, 10kVArh, 100kVArh, 1MVArh, 10MVArh, 100MVArh	10 kVArh

© 2013 Siemens Protection Devices Limited

Description	Range	Default
Gn Reactive Imp Energy Unit	1kVArh, 10kVArh, 100kVArh, 1MVArh, 10MVArh, 100MVArh	10 kVArh
Data Log *Selects whether the Data Logger is enabled*		

3.15.6. Fault Locator

Description	Range	Default
Fault Locator	Disabled, Enabled	Disabled
Line Angle	0 Deg to 90 Deg	75 Deg
EF Comp Z0/Z1 Ratio	0 to 10	2.5
EF Comp Z0 Angle	0 Deg to 359 Deg	75 Deg
Z+ Impedance	0.1 Ohms to 250 Ohms	10 Ohms
Sec'y Z+ Per Unit Distance	0.005 Ohms to 5 Ohms	0.5 Ohm
Display Units	Percent, kilometres, miles	Percent
System Earthing	Normal, Compensated	Normal
Gn U0/U1 Ratio	0 to 1	0.1
Gn Freq FL Inhibits	6 Bit Binary	81-1, 81-2, 81-3, 81-4, 81-5, 81-6
Gn Freq FL Inhibits	13 Bit Binary	49, 46IT, 46DT, 27/59-1, 27/59-2, 27/59-3, 27/59-4, 47-1, 47-2, 59NIT, 59NDT, 46BC, Vx 27/59

3.15.7. Communications

Description	Range	Default
Station Address *IEC 60870-5-103 Station Address*	0, 1 ... 65533, 65534	1
COM1-RS485 Protocol *Selects protocol to use for COM1-RS485*	OFF, IEC60870-5-103, MODBUS-RTU, DNP3	IEC60870-5-103
COM1-RS485 Baud Rate *Sets the communications baud rate for COM1-RS485*	75, 110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400	19200
COM1-RS485 Parity *Selects whether parity information is used*	NONE, ODD, EVEN	EVEN
COM1-RS485 Mode	Local, Remote, Local Or Remote	Remote
COM2-USB Protocol *Selects protocol to use for COM2-USB*	IEC60870-5-103	IEC60870-5-103
COM2-USB Mode	Local	Local
COM3 Protocol *Selects protocol to use for COM3*	OFF, IEC60870-5-103, MODBUS-RTU, DNP3	IEC60870-5-103
COM3 Baud Rate *Sets the communications baud rate for COM3*	75, 110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200	19200
COM3 Parity *Selects whether parity information is used*	NONE, ODD, EVEN	EVEN
COM3 Line Idle *Selects the communications line idle sense*	LIGHT OFF, LIGHT ON	LIGHT OFF
COM3 Data Echo *Enables echoing of data from RX port to TX port when operating relays in a Fibre Optic ring configuration*	OFF, ON	OFF
COM3 Mode	Local, Remote, Local Or Remote	Remote
COM4 Protocol *Selects protocol to use for COM4*	OFF, IEC60870-5-103, MODBUS-RTU, DNP3	OFF
COM4 Baud Rate *Sets the communications baud rate for COM4*	75, 110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400	19200
COM4 Parity *Selects whether parity information is used*	NONE, ODD, EVEN	EVEN
COM4 Line Idle *Selects the communications line idle sense*	LIGHT OFF, LIGHT ON	LIGHT OFF
COM4 Data Echo *Enables echoing of data from RX port to TX port when operating relays in a Fibre Optic ring configuration*	OFF, ON	OFF
COM4 Mode	Local, Remote, Local Or Remote	Remote
LAN Protocol *Selects protocol to use for LAN port*	OFF, IEC60870-5-103	IEC60870-5-103
DNP3 Unsolicited Events *Allows unsolicited event support in the relay. When Enabled, unsolicited event transmission can be controlled by the Master. When Disabled, Master requests are ignored.*	Disabled, Enabled	Disabled
DNP3 Destination Address *The address of the master to which unsolicited events will be sent.*	0, 1 ... 65533, 65534	0

© 2013 Siemens Protection Devices Limited

Description	Range	Default
DNP3 Application Timeout *The address of the master to which unsolicited events will be sent.*	5, 6 ... 299, 300	10 s

Data Communications Definitions

Overcurrent Relay

Document Release History

This document is issue **2017/07**. The list of revisions up to and including this issue is:

Date	Description
2017/07	Addition of increases I/O and 32Power, 32S Sensitive Power, Frequency.

The copyright and other intellectual property rights in this document, and in any model or article produced from it (and including any registered or unregistered design rights) are the property of Siemens Protection Devices Limited. No part of this document shall be reproduced or modified or stored in another form, in any data retrieval system, without the permission of Siemens Protection Devices Limited, nor shall any model or article be reproduced from this document unless Siemens Protection Devices Limited consent.

While the information and guidance given in this document is believed to be correct, no liability shall be accepted for any loss or damage caused by any error or omission, whether such error or omission is the result of negligence or any other cause. Any and all such liability is disclaimed.

© 2017 Siemens Protection Devices Limited

Contents

1. Introduction 5
2. Physical Connection 7
2.1 Introduction 7
2.2 USB Interface (COM2) 8
2.3 RS485 Interface (COM1) 8
2.4 Serial Fibre Optic Interface (COM3 & COM4) 10
2.5 Optional Rear RS485 (COM3) 13
2.6 Optional Rear RS232 (COM3) 14
2.7 Optional Rear EN100 Ethernet Module (COM3) 16
3. IEC 60870-5-103 Definitions 19
3.1 Introduction 19
3.2 Cause of Transmission 20
3.3 Application Service Data Unit (ASDU) Type 21
3.4 Point List 22
3.4.1 Event Function (FUN) & Information (INF) Numbers 22
3.4.2 Measurands 32
3.4.3 Disturbance Recorder Actual Channel (ACC) Numbers 33
4. MODBUS Definitions 35
4.1 Introduction 35
4.2 MODBUS Register Data Types 36
4.2.1 FLOAT_IEEE_754 36
4.2.2 FP_32BITS_3DP 37
4.2.3 UINT32 37
4.2.4 UINT16 37
4.2.5 EVENT 38
4.2.6 EVENTCOUNT 39
4.2.7 TIME_METER 39
4.2.8 STR32 & STR64 39
4.2.9 BITSTRING 39
4.3 Point List 41
4.3.1 Coils (Read Write Binary values) 41
4.3.2 Inputs (Read Only Binary values) 42
4.3.3 Input Registers (Read Only Registers) 49
4.3.4 Holding Registers (Read Write Registers) 52
5. DNP3 Definitions 53
5.1 Device Profile 53
5.2 Implementation Table 56
5.3 Point List 62
5.3.1 Binary Input Points 62
5.3.2 Double Bit Input Points 70
5.3.3 Binary Output Status Points and Control Relay Output Blocks 71
5.3.4 Counters 77
5.3.5 Analog Inputs 79
5.4 Additional Settings 83
6. Not Applicable 85

© 2017 Siemens Protection Devices Limited

7. IEC61850 Protocol Support 87
7.1 Introduction 87
8. Serial Modems 89
8.1 Introduction 89
8.2 Connecting a Modem to the Relay(s) 89
8.3 Setting the Remote Modem 89
8.4 Connecting to the Remote Modem 89
9. Not Applicable 91
10. Glossary 93
Appendix 1 95

List of Figures

Fig. 2-1 Communication to Front USB Port 8
Fig. 2-2 Communication to Multiple Devices using RS485 (Standard Port) 10
Fig. 2-3 Communication to Multiple Devices using Fibre-optic Ring Network 13
Fig. 2-4 Communication to Multiple Devices from Control System and Laptop using Fibre-optic Star Network 13
Fig. 2-5 Additional (Optional) Rear RS485 + IRIG-B Connection to a PC 14
Fig. 2-6 Additional (Optional) Rear RS232 + IRIG-B Connection to a PC 15
Fig. 2-7 RS232 Data Comms Pin Connections 15
Fig. 2-8 EN100 Ethernet Module 17
Fig. A1 Operating Mode Table 95

© 2017 Siemens Protection Devices Limited

1. Introduction

This section describes how to use the Communication Interface with a control system or interrogating computer.

The interface is compatible with control and automation systems using industry standard communications protocols ***DNP3*** , ***IEC 60870-5-103*** , ***IEC 61850*** and ***MODBUS-RTU***. Note, not all protocols are available on all devices.

Reydisp Evolution or Reydisp Manager Software is available, for computers running Microsoft Windows™, to connect to devices to provide operational information, post-fault analysis, setting interrogation and editing facilities etc. Configuration software can be downloaded from our website http://www.siemens.com/energy.

This section specifies connection details and lists the information available through the individual protocols.

© 2017 Siemens Protection Devices Limited

© 2017 Siemens Protection Devices Limited

2. Physical Connection

2.1 Introduction

The relay provides one “Front” USB communication interface (Com2) located on the fascia and one RS485 (Com1) located on the “Rear” as standard. An additional module may be fitted as an ordering option to provide extra rear serial port(s) or two Ethernet channels. Modules are available for serial fibre optic, RS232 and RS485. These modules provide one (Com3) or two (Com3 and Com4) additional ports. The optional EN100 Ethernet module, available in optical and electrical versions, supports the IEC 61850 protocol and Reydisp access through the network (LAN port) interface.

A detailed description of the ports is given below.

COM1-RS485: This port can be used for IEC60870-5-103, MODBUS-RTU or DNP3 communications to a substation SCADA or integrated control system or for engineer remote access. This port can also be used for connection to Reydisp software.

COM2-USB: This port is used for IEC60870-5-103 (default setting) communication with the Reydisp software.

An ASCII protocol is also available through this port, the main use of this protocol is to allow the Relay firmware to be updated via the front connection.

MODBUS-RTU or the optional DNP3 protocols are also available.

COM3: Where fitted, an additional rear serial fibre optic, RS232 or RS485 port.

This port can be used for IEC60870-5-103, MODBUS-RTU or DNP3 communications to a substation SCADA or integrated control system or for engineer remote access. This port can also be used for connection to Reydisp software.

COM4: As COM3.

COM3-LAN: When the Ethernet module is fitted, in addition to IEC61850 a LAN connection is provided to allow the Reydisp software to connect to the Relay via the network. This port only supports the IEC60870-5-103 protocol.

Any or all serial ports can be mapped to the IEC60870-5-103, DNP3 or MODBUS-RTU protocol at any one time, protocols available will depend upon relay model. The optional ethernet port uses IEC 61850 protocol and can also provide an IEC 60870-5-103 protocol connection to Reydisp. Any port not required can be disabled by setting its protocol to OFF.

When connecting to Reydisp Evolution software the protocol for the relevant port should be set to IEC60870-5-103.

© 2017 Siemens Protection Devices Limited

2.2 USB Interface (COM2)

The USB communication port is connected using a standard USB cable with a type B connection to the relay and type A to the PC.

The PC will require a suitable USB driver to be installed; this will be carried out automatically when the Reydisp software is installed. When the Reydisp software is running with the USB cable connected to a device an additional connection is shown. Connections to these devices are not shown when they are not connected.

The USB communication interface on the relay is labelled Com 2 and its associated settings are located in the Data communications menu. When connecting to Reydisp using this connection the default settings can be used without the need to first change any settings.

Access to the communication settings for the USB port is only available from the relay front fascia via the key pad setting menu COMMUNICATIONS MENU.

Setting Name	Range/Options	Default	Setting	Notes
COM2-USB Protocol	OFF IEC60870-5-103 MODBUS-RTU ASCII DNP3	IEC60870-5-103		Reydisp software requires IEC60870-5-103.
COM2-USB Station Address	0 - 254 for IEC60870-5-103 1 - 247 for Modbus RTU 0 - 65534 for DNP3.0	0		An address within the range of the relevant protocol must be given to identify the relay. Each relay in a network must have a unique address.
COM2-USB Mode	Local Local or Remote Remote	Local		Refer to Appendix 1, page 95, for further explanation

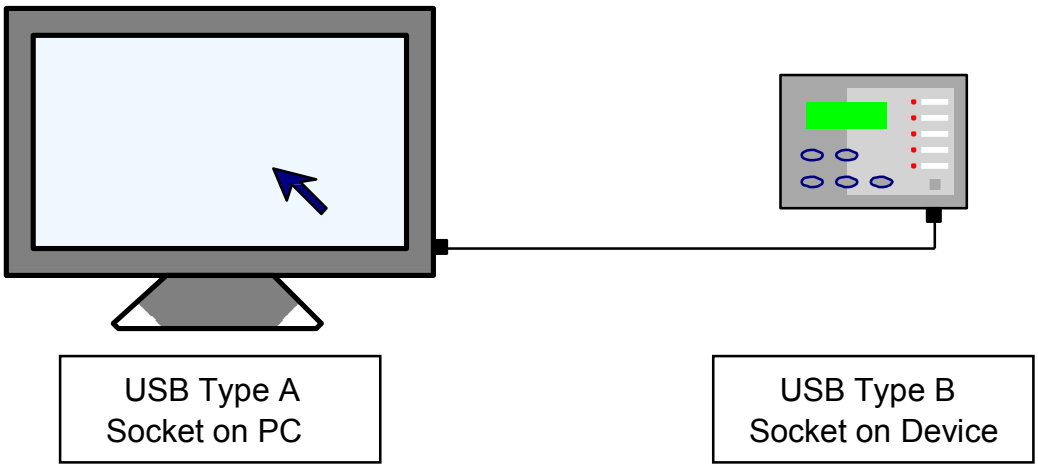


Fig. 2-1 Communication to Front USB Port

2.3 RS485 Interface (COM1)

The 2-wire RS485 communication port is located on the rear of the relay and can be connected using a suitable RS485 120 Ohm screened twisted pair cable.

© 2017 Siemens Protection Devices Limited

The RS485 electrical connection can be used in a single or multi-drop configuration. The RS485 master must support and use the Auto Device Enable (ADE) feature. The last device in the connection must be terminated correctly in accordance with the master device driving the connection. This can be done via the internal 120 ohm terminating resistor, which can be connected between 14 (A) and 18 (B) by fitting an external wire loop between terminals 18 and 20 on the power supply module.

The polarity of the signal terminals is marked as A and B in line with the RS485 standard. The polarity is that when the bus is in the quiescent state and no communication is taking place, the B terminal is more positive than A. This can be used to identify the polarity of any equipment to be connected, typically measured at each terminal in turn to ground. Connection of the device to a termination network at the end of the bus will also be to suit the quiescent state as shown in the diagram below.

The polarity marking is often found to be reversed or marked as +/- on other equipment so care is required. If the devices are connected in reverse, communication to all devices will be disturbed but no damage will occur. If problems are experienced during commissioning, the connections should be tried in reverse.

The maximum number of relays that can be connected to the bus is 64.

The RS485 data comms link will be broken for that particular relay element if it is withdrawn from the case but the chain of communication to the other relays is maintained.

The following settings, on the COMMUNICATIONS MENU, must be configured when using the RS485 interface.

Setting Name	Range/Options	Default	Setting	Notes
COM1-RS485 Protocol	OFF IEC60870-5-103 MODBUS-RTU DNP3	IEC60870-5-103		The protocol used to communicate on the standard RS485 connection.
COM1-RS485 Station Address	0 - 254 for IEC60870-5-103 1 - 247 for Modbus RTU 0 - 65534 for DNP3.0	0		An address within the range of the relevant protocol must be given to identify the relay. Each relay in a network must have a unique address.
COM1-RS485 Baud Rate	75 110 150 300 600 1200 2400 4800 9600 19200 38400	19200		The baud rate set on all of the relays connected to the control system must be the same as the one set on the master device.
COM1-RS485 Parity	NONE ODD EVEN	EVEN		The parity set on all of the relays connected to the control system must be the same and in accordance with the master device.
COM1-RS485 Mode	Local Local or Remote Remote	Remote		Refer to Appendix 1, page 95, for further explanation

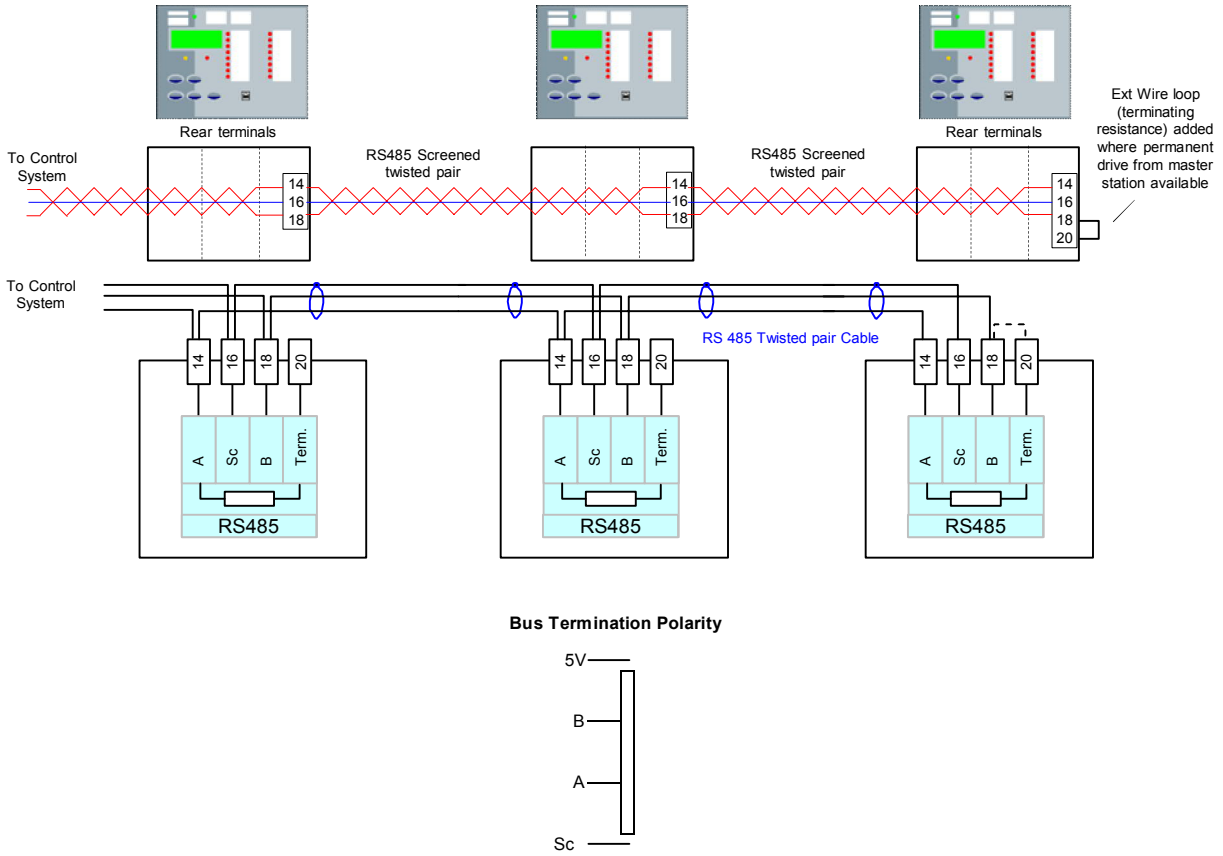


Fig. 2-2 Communication to Multiple Devices using RS485 (Standard Port)

2.4 Serial Fibre Optic Interface (COM3 & COM4)

When connecting via the optional fibre optic interface the selection of fibre-optic cable is important. Fibres must be terminated with ST™ (BFOC/2.5) connectors.

The recommended type is 62.5/125µm glass fibre. Communication distances over 1 km are achievable using this type of fibre.

A budget loss calculation should be made for all installations. The following table gives the launch power and receiver sensitivity of each of the fibre optic communication ports on the Relay when used with specific fibre optic types.

Fibre Type	Tx Launch Power (dB)		RX Receive Sensitivity (dB)	
	Min	Max	Min	Max
62.5/125µm	-11.7	-15.7	-24	-9.2
1mm Polymer	-6.4	-10.4	-24	-9.2
200µm PCS	-2.8	-6.8	-24	-9.2

Factors to be considered when calculating fibre-optic transmission distances:

- Transmitter launch power.
- Attenuation, based on light frequency, fibre material and fibre diameter. (Consult fibre manufacturers' data for actual values of fibre attenuation).
- Number of intermediate connectors and splices. Fibre cables are supplied on reels of finite length which may necessitate additional jointing. Typical losses at connectors are 0.5-1.0dB each. This allows for normal age related deterioration. Typical losses at splices are <0.3dB. (Consult fibre manufacturers' data for actual values).

© 2017 Siemens Protection Devices Limited

- Receiver sensitivity. The light power at the receiver must be above the sensitivity of the receiver in order that effective communication can occur.
- A 3dB safety margin is usually allowed after the budget calculation is performed.

Following installation and prior to putting into service the actual losses should be measured for each fibre using a calibrated light source and meter. Measured and calculated values can be compared.

The following table can be used to record budget calculations:

A	Launch power	dB
B	Fibre Type	
C	Loss (dB/km)	dB/km
D	Length	km
E	Total fibre loss (CxD)	dB
F	No. of Splices	
G	Loss at each splice	dB
H	Total loss at splices (FxG)	dB
I	No. of connectors	
J	Loss per connector	dB
K	Total loss at connectors (IxJ)	dB
L	Total losses (E+H+K)	dB
M	Receive power budget (A-L)	dB
N	Safety Margin	dB
O	Device Receive Sensitivity	dB

The following settings, on the COMMUNICATIONS MENU, must be configured when using the fibre Optic Com3 interface.

Setting Name	Range/Options	Default	Setting	Notes
COM3 Protocol	OFF IEC60870-5-103 MODBUS-RTU DNP3	IEC60870-5-103		The protocol used to communicate on the standard RS485 connection.
COM3 Station Address	0 - 254 for IEC60870-5-103 1 - 247 for Modbus RTU 0 - 65534 for DNP3.0	0		An address within the range of the relevant protocol must be given to identify the relay. Each relay in a network must have a unique address.
COM3 Baud Rate	75 110 150 300 600 1200 2400 4800 9600 19200 38400 57600 115200	19200		The baud rate set on all of the relays connected to the control system must be the same as the one set on the master device.
COM3 Parity	NONE ODD EVEN	EVEN		The parity set on all of the relays connected to the control system must be the same and in accordance with the master device.

© 2017 Siemens Protection Devices Limited

Setting Name	Range/Options	Default	Setting	Notes
COM3 Line Idle	LIGHT ON LIGHT OFF	LIGHT OFF		Sets the fibre optic line idle state.
COM3 Data Echo#1	ON OFF	OFF		Set to ON when relays are connected in a fibre-optic ring configuration.
COM3 Mode	Local Local or Remote Remote	Remote		Refer to Appendix 1, page 95, for further explanation

The following settings, on the **COMMUNICATIONS MENU**, must be configured when using the fibre Optic Com4 interface

Setting Name	Range/Options	Default	Setting	Notes
COM4 Protocol	OFF IEC60870-5-103 MODBUS-RTU DNP3	IEC60870-5-103		The protocol used to communicate on the standard RS485 connection.
COM4 Station Address	0 - 254 for IEC60870-5-103 1 - 247 for Modbus RTU 0 - 65534 for DNP3.0	0		An address within the range of the relevant protocol must be given to identify the relay. Each relay in a network must have a unique address.
COM4 Baud Rate	75 110 150 300 600 1200 2400 4800 9600 19200 38400	19200		The baud rate set on all of the relays connected to the control system must be the same as the one set on the master device.
COM4 Parity	NONE ODD EVEN	EVEN		The parity set on all of the relays connected to the control system must be the same and in accordance with the master device.
COM4 Line Idle	LIGHT ON LIGHT OFF	LIGHT OFF		Sets the fibre optic line idle state.
COM4 Data Echo#1	ON OFF	OFF		Set to ON when relays are connected in a fibre-optic ring configuration.
COM4 Mode	Local Local or Remote Remote	Remote		Refer to Appendix 1, page 95, for further explanation

#1 In ring mode, echo = on, the whole fibre optic data comms link will be interrupted if the relay element is withdrawn from the case.

© 2017 Siemens Protection Devices Limited

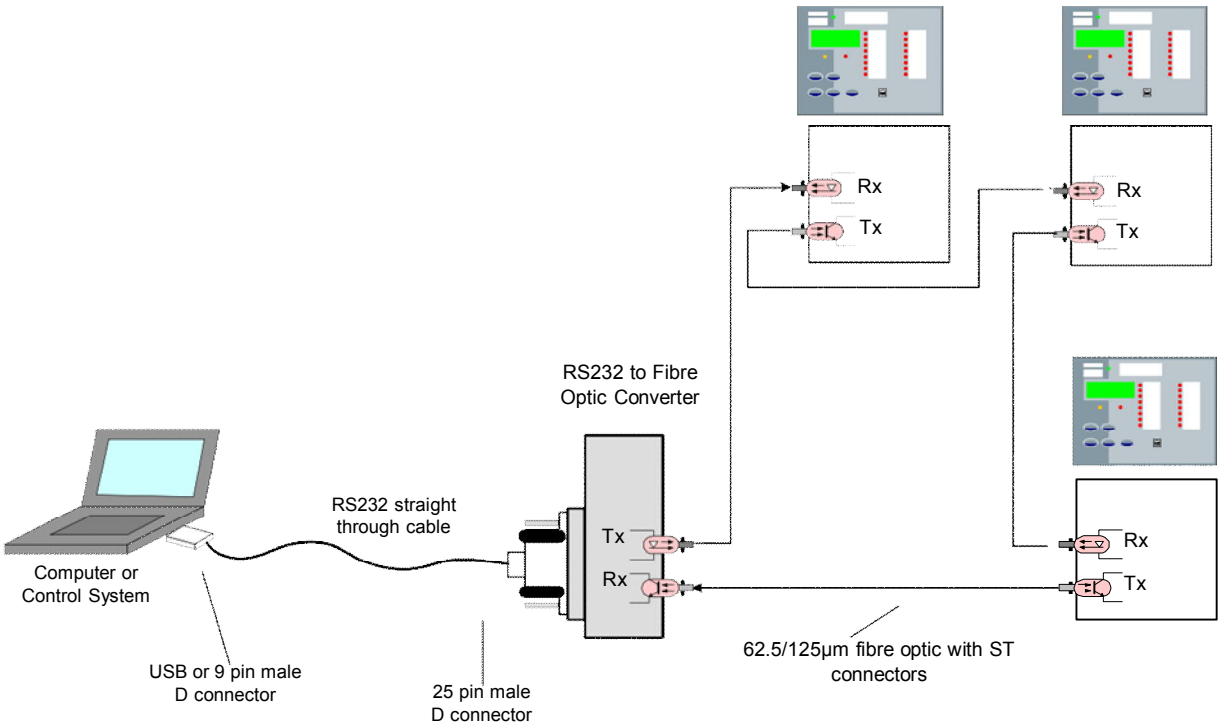


Fig. 2-3 Communication to Multiple Devices using Fibre-optic Ring Network

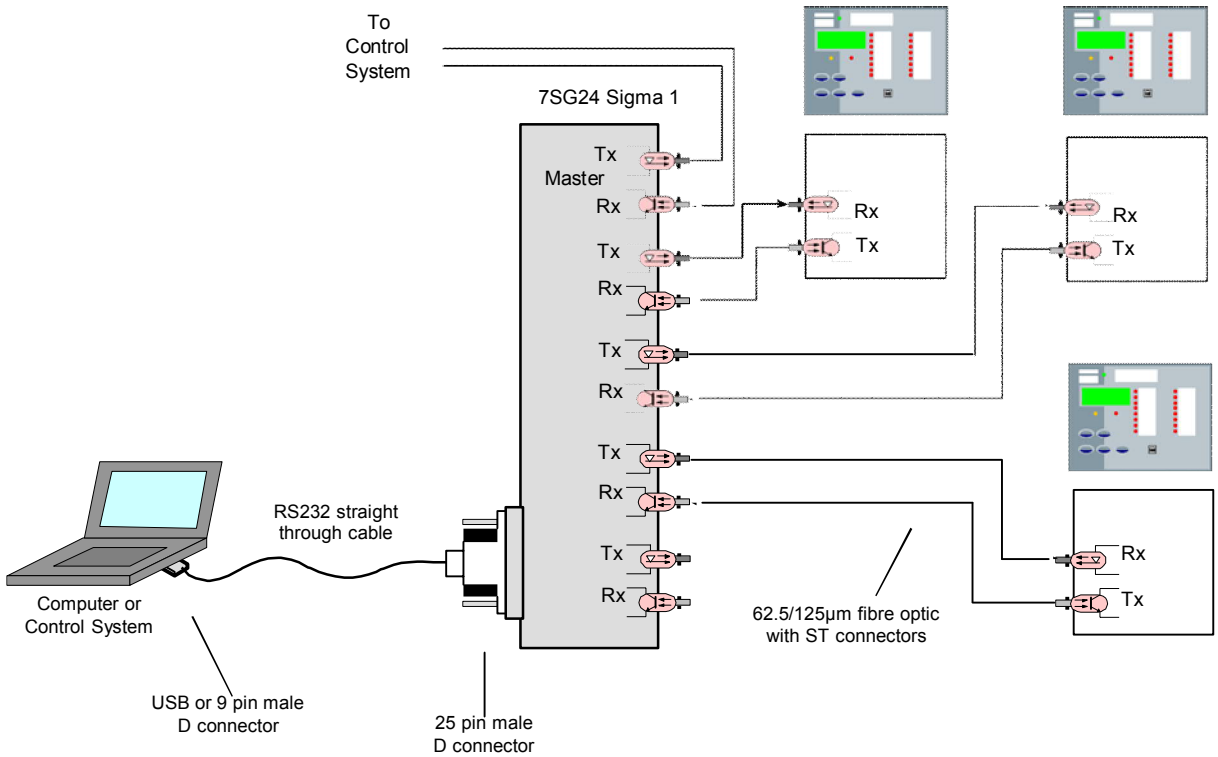


Fig. 2-4 Communication to Multiple Devices from Control System and Laptop using Fibre-optic Star Network

2.5 Optional Rear RS485 (COM3)

The following settings, on the COMMUNICATIONS MENU, must be configured when using the electrical 2-wire RS485 Com3 interface.

© 2017 Siemens Protection Devices Limited

Setting Name	Range/Options	Default	Setting	Notes
COM3 Protocol	OFF IEC60870-5-103 MODBUS-RTU DNP3	IEC60870-5-103		The protocol used to communicate on the standard RS485 connection.
COM3 Station Address	0 - 254 for IEC60870-5-103 1 - 247 for Modbus RTU 0 - 65534 for DNP3.0	0		An address within the range of the relevant protocol must be given to identify the relay. Each relay in a network must have a unique address.
COM3 Baud Rate	75 110 150 300 600 1200 2400 4800 9600 19200 38400 57600 115200	19200		The baud rate set on all of the relays connected to the control system must be the same as the one set on the master device.
COM3 Parity	NONE ODD EVEN	EVEN		The parity set on all of the relays connected to the control system must be the same and in accordance with the master device.
COM3 Line Idle	LIGHT ON LIGHT OFF	LIGHT OFF	LIGHT OFF	Not applicable for RS 485 or RS 232 option, set to OFF.
COM3 Data Echo[#1]	ON OFF	OFF	OFF	Not applicable for RS 485 or RS 232 option, set to OFF.
COM3 Mode	Local Local or Remote Remote	Remote		Refer to Appendix 1, page 95, for further explanation

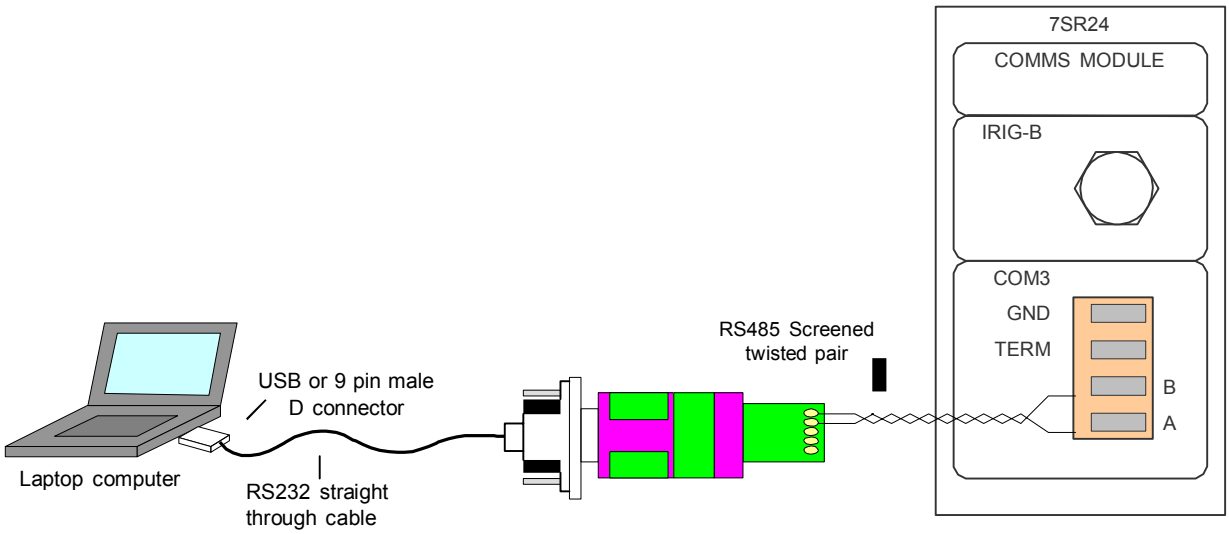


Fig. 2-5 Additional (Optional) Rear RS485 + IRIG-B Connection to a PC

2.6 Optional Rear RS232 (COM3)

The following settings, on the COMMUNICATIONS MENU, must be configured when using the electrical RS232 Com3 interface.

© 2017 Siemens Protection Devices Limited

Setting Name	Range/Options	Default	Setting	Notes
COM3 Protocol	OFF IEC60870-5-103 MODBUS-RTU DNP3	IEC60870-5-103		The protocol used to communicate on the standard RS485 connection.
COM3 Station Address	0 - 254 for IEC60870-5-103 1 - 247 for Modbus RTU 0 - 65534 for DNP3.0	0		An address within the range of the relevant protocol must be given to identify the relay. Each relay in a network must have a unique address.
COM3 Baud Rate	75 110 150 300 600 1200 2400 4800 9600 19200 38400 57600 115200	19200		The baud rate set on all of the relays connected to the control system must be the same as the one set on the master device.
COM3 Parity	NONE ODD EVEN	EVEN		The parity set on all of the relays connected to the control system must be the same and in accordance with the master device.
COM3 Line Idle	LIGHT ON LIGHT OFF	LIGHT OFF	LIGHT OFF	Not applicable for RS 485 or RS 232 option, set to OFF.
COM3 Data Echo[#1]	ON OFF	OFF	OFF	Not applicable for RS 485 or RS 232 option, set to OFF.
COM3 Mode	Local Local or Remote Remote	Remote		Refer to Appendix 1, page 95, for further explanation

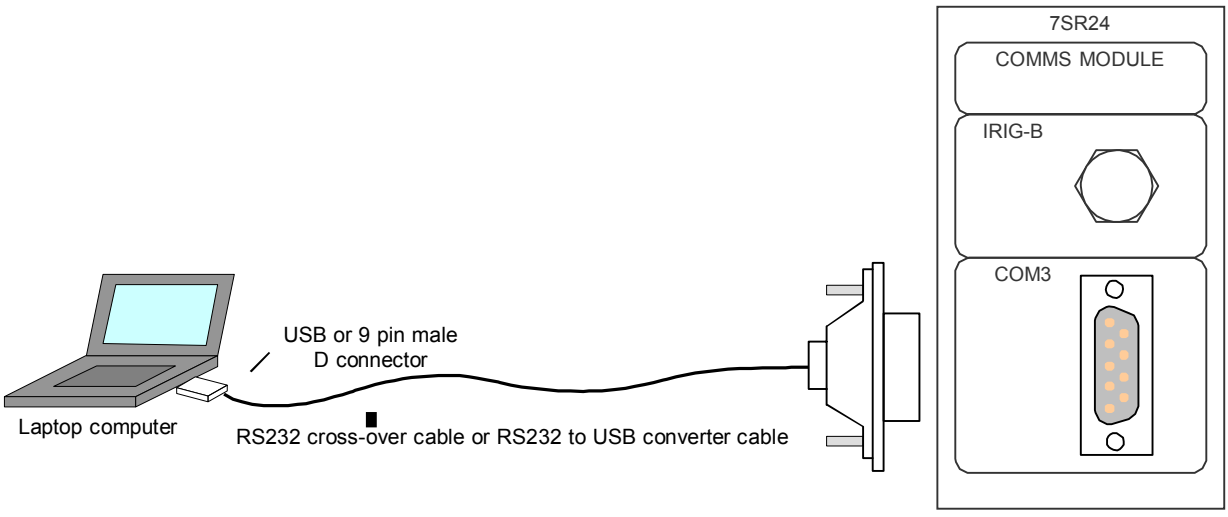


Fig. 2-6 Additional (Optional) Rear RS232 + IRIG-B Connection to a PC

Pin	Relay Function
1	Not Connected
2	Receive Data (RXD)
3	Transmit Data (TXD)

Pin	Relay Function
4	Output Supply +5V 50mA
5	Signal Ground (GND)
6	Output Supply +5V 50mA
7	Linked to 8 (volts free)
8	Linked to 7 (volts free)
9	Output Supply +5V 50mA

Fig. 2-7 RS232 Data Comms Pin Connections

2.7 Optional Rear EN100 Ethernet Module (COM3)

The optional ethernet interface is primarily provided for support of IEC 61850 Protocol. Support for IEC 60870-5-103 is also provided over this interface to allow connection with Reydisp Evolution and Reydisp Manager Software for interrogation, editing and download of relay settings and other data. Ordering options are available with two RJ45 electrical connectors or with two duplex LC fibre optic connectors.

Setting Name	Range/Options	Default	Setting	Notes
LAN Protocol	OFF IEC60870-5-103	IEC60870-5-103		Sets the protocol used to communicate on the LAN port.

If this setting is set to off, access to relay data using Reydisp Evolution and Reydisp Manager Software via the Ethernet interface is not available.

Connections to the optional EN100 Ethernet module are made on the rear underside of the relay.

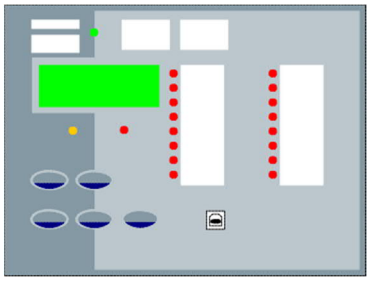
Connections are made to either RJ45 sockets (electrical) or Duplex LC (fibre optic) connectors. Fibre cables should be 62.5/125µm (or 50/125µm) multimode with LC connectors.

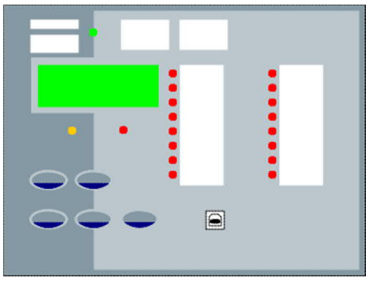
The two types of EN100 module work slightly differently. The optical version contains an Ethernet switch to control the two channels. The switch will manage data from either channel as an Ethernet switch would in a network. The electrical version connects through one channel until it detects a break in the data traffic. After a delay it will swap to the other channel to try and re-establish communication. Either method can be thought of as providing for redundancy.

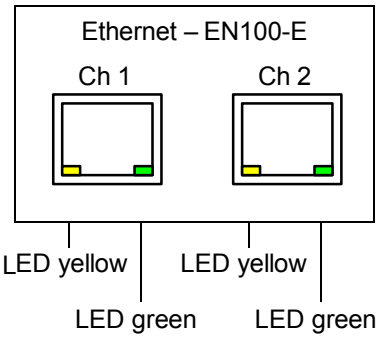
While a 61850 session is established, an operator can simultaneously connect to the device via Reydisp Evolution or a web browser through the EN100 module.

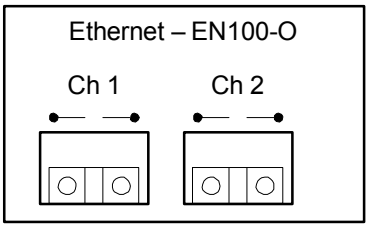
Configuration of 61850 communication is via the Reydisp Manager software package.

© 2017 Siemens Protection Devices Limited









EN100 Module – RJ45 Interface

EN100 Module – Duplex-LC Interface

Green LED (Physical Link)
Off – No link
On – Link present

Yellow LED (Activity)
Off – No traffic
On/flashing - Traffic

Fig. 2-8 EN100 Ethernet Module

© 2017 Siemens Protection Devices Limited

© 2017 Siemens Protection Devices Limited

3. IEC 60870-5-103 Definitions

3.1 Introduction

This section describes the IEC 60870-5-103 protocol implementation in the relays. This protocol is used for the communication with Reydisp software and can also be used for communication with a suitable control system. The control system or local PC acts as the master in the system with the relay operating as a slave responding to the master's commands. The implementation provides event information, time synchronising, commands and measurands and also supports the transfer of disturbance records.

This protocol can be set to use any or all of the relays hardware interfaces (USB, Fibre Optic, RS232, RS485 and Ethernet) where fitted and is the standard protocol used by the USB port. The relay can communicate simultaneously on all ports regardless of protocol used.

The Station Address of the port being used must be set to a suitable address within the range 0 - 254 to enable communication. This can be set by the **Communications Menu : COM *n-xxxxx* Station Address** setting.

© 2017 Siemens Protection Devices Limited

3.2 Cause of Transmission

The cause of transmission (COT) column of the "Information Number and Function" table lists possible causes of transmission for these frames. The following abbreviations are used:

Abbreviation	Description
SE	spontaneous event
T	test mode
GI	general interrogation
Loc	local operation
Rem	remote operation
Ack	command acknowledge
Nak	Negative command acknowledge

Note: Events listing a GI cause of transmission can be raised and cleared; other events are raised only.

© 2017 Siemens Protection Devices Limited

3.3 Application Service Data Unit (ASDU) Type

The Application Service Data Unit (ASDU) column of the "Information Number and Function" table lists the possible ASDUs returned for a point.

ASDU #	Description
1	Time tagged message (monitor direction)
2	Time tagged message (relative time) (monitor direction)
3.1	Measurands I
4	Time-tagged measurands with relative time
5	Identification message
6	Time synchronisation
7	General Interrogation Initialization
9	Measurands II
20	General command

3.4 Point List

The following sub-sections contain tables listing the data points available via the IEC60870-5-103 protocol.

The information shown below is the default configuration.

The information shown below is the default configuration.

3.4.1 Event Function (FUN) & Information (INF) Numbers

The following Event EVT and INF numbers apply to this device.

FUN	INF	Description	ASDU	COT
60	4	Remote Mode	1	SE, GI
			20	Ack, Nak
60	5	Out Of Service Mode	1	SE, GI
			20	Ack, Nak
60	6	Local Mode	1	SE, GI
			20	Ack, Nak
60	7	Local & Remote	1	SE, GI
			20	Ack, Nak
60	12	Control Received	1	SE
60	13	Command Received	1	SE
60	128	Cold Start	1	SE
60	129	Warm Start	1	SE
60	130	Re-Start	1	SE
60	131	Expected Restart	1	SE, GI
60	132	Unexpected Restart	1	SE, GI
60	133	Reset Start Count	1	SE
			20	Ack, Nak
60	135	Trigger Storage	1	SE
60	136	Clear Waveform Records	1	SE
60	137	Clear Fault Records	1	SE
60	138	Clear Event Records	1	SE
60	140	Demand metering reset	1	SE
			20	Ack, Nak
60	170	General Alarm 1	1	SE, GI
60	171	General Alarm 2	1	SE, GI
60	172	General Alarm 3	1	SE, GI
60	173	General Alarm 4	1	SE, GI
60	174	General Alarm 5	1	SE, GI
60	175	General Alarm 6	1	SE, GI
60	176	General Alarm 7	1	SE, GI
60	177	General Alarm 8	1	SE, GI
60	178	General Alarm 9	1	SE, GI
60	179	General Alarm 10	1	SE, GI
60	180	General Alarm 11	1	SE, GI
60	181	General Alarm 12	1	SE, GI
60	182	Quick Logic E1	1	SE, GI
60	183	Quick Logic E2	1	SE, GI

© 2017 Siemens Protection Devices Limited

FUN	INF	Description	ASDU	COT
60	184	Quick Logic E3	1	SE, GI
60	185	Quick Logic E4	1	SE, GI
60	186	Quick Logic E5	1	SE, GI
60	187	Quick Logic E6	1	SE, GI
60	188	Quick Logic E7	1	SE, GI
60	189	Quick Logic E8	1	SE, GI
60	190	Quick Logic E9	1	SE, GI
60	191	Quick Logic E10	1	SE, GI
60	192	Quick Logic E11	1	SE, GI
60	193	Quick Logic E12	1	SE, GI
60	194	Quick Logic E13	1	SE, GI
60	195	Quick Logic E14	1	SE, GI
60	196	Quick Logic E15	1	SE, GI
60	197	Quick Logic E16	1	SE, GI
61	1	General Alarm 13	1	SE, GI
61	2	General Alarm 14	1	SE, GI
61	3	General Alarm 15	1	SE, GI
61	4	General Alarm 16	1	SE, GI
61	5	General Alarm 17	1	SE, GI
61	6	General Alarm 18	1	SE, GI
61	7	General Alarm 19	1	SE, GI
61	8	General Alarm 20	1	SE, GI
70	5	Binary Input 5	1	SE, GI
70	6	Binary Input 6	1	SE, GI
70	7	Binary Input 7	1	SE, GI
70	8	Binary Input 8	1	SE, GI
70	9	Binary Input 9	1	SE, GI
70	10	Binary Input 10	1	SE, GI
70	11	Binary Input 11	1	SE, GI
70	12	Binary Input 12	1	SE, GI
70	13	Binary Input 13	1	SE, GI
75	1	Virtual Input 1	1	SE, GI
75	2	Virtual Input 2	1	SE, GI
75	3	Virtual Input 3	1	SE, GI
75	4	Virtual Input 4	1	SE, GI
75	5	Virtual Input 5	1	SE, GI
75	6	Virtual Input 6	1	SE, GI
75	7	Virtual Input 7	1	SE, GI
75	8	Virtual Input 8	1	SE, GI
75	9	Virtual Input 9	1	SE, GI
75	10	Virtual Input 10	1	SE, GI
75	11	Virtual Input 11	1	SE, GI
75	12	Virtual Input 12	1	SE, GI
75	13	Virtual Input 13	1	SE, GI
75	14	Virtual Input 14	1	SE, GI
75	15	Virtual Input 15	1	SE, GI
75	16	Virtual Input 16	1	SE, GI
80	1	Binary Output 1	1	SE, GI

© 2017 Siemens Protection Devices Limited

FUN	INF	Description	ASDU	COT
			20	Ack, Nak
80	2	Binary Output 2	1	SE, GI
			20	Ack, Nak
80	3	Binary Output 3	1	SE, GI
			20	Ack, Nak
80	4	Binary Output 4	1	SE, GI
			20	Ack, Nak
80	5	Binary Output 5	1	SE, GI
			20	Ack, Nak
80	6	Binary Output 6	1	SE, GI
			20	Ack, Nak
80	7	Binary Output 7	1	SE, GI
			20	Ack, Nak
80	8	Binary Output 8	1	SE, GI
			20	Ack, Nak
80	9	Binary Output 9	1	SE, GI
			20	Ack, Nak
80	10	Binary Output 10	1	SE, GI
			20	Ack, Nak
80	11	Binary Output 11	1	SE, GI
			20	Ack, Nak
80	12	Binary Output 12	1	SE, GI
			20	Ack, Nak
80	13	Binary Output 13	1	SE, GI
			20	Ack, Nak
80	14	Binary Output 14	1	SE, GI
			20	Ack, Nak
90	1	LED 1	1	SE, GI
90	2	LED 2	1	SE, GI
90	3	LED 3	1	SE, GI
90	4	LED 4	1	SE, GI
90	5	LED 5	1	SE, GI
90	6	LED 6	1	SE, GI
90	7	LED 7	1	SE, GI
90	8	LED 8	1	SE, GI
90	9	LED 9	1	SE, GI
90	10	LED 10	1	SE, GI
90	11	LED 11	1	SE, GI
90	12	LED 12	1	SE, GI
90	13	LED 13	1	SE, GI
90	14	LED 14	1	SE, GI
90	15	LED 15	1	SE, GI
90	16	LED 16	1	SE, GI
91	1	LED PU 1	1	SE, GI
91	2	LED PU 2	1	SE, GI
91	3	LED PU 3	1	SE, GI
91	4	LED PU 4	1	SE, GI
91	5	LED PU 5	1	SE, GI
91	6	LED PU 6	1	SE, GI

© 2017 Siemens Protection Devices Limited

FUN	INF	Description	ASDU	COT
91	7	LED PU 7	1	SE, GI
91	8	LED PU 8	1	SE, GI
91	9	LED PU 9	1	SE, GI
91	10	LED PU 10	1	SE, GI
91	11	LED PU 11	1	SE, GI
91	12	LED PU 12	1	SE, GI
91	13	LED PU 13	1	SE, GI
91	14	LED PU 14	1	SE, GI
91	15	LED PU 15	1	SE, GI
91	16	LED PU 16	1	SE, GI
160	2	Reset FCB	5	SE
160	3	Reset CU	5	SE
160	4	Start/Restart	5	SE
160	5	Power On	1	SE, GI
160	16	Auto-reclose active	1	SE, GI
			20	Ack, Nak
160	19	LED Reset	1	SE
			20	Ack, Nak
160	22	Settings changed	1	SE
160	23	Setting G1 selected	1	SE, GI
			20	Ack, Nak
160	24	Setting G2 selected	1	SE, GI
			20	Ack, Nak
160	25	Setting G3 selected	1	SE, GI
			20	Ack, Nak
160	26	Setting G4 selected	1	SE, GI
			20	Ack, Nak
160	27	Binary Input 1	1	SE, GI
160	28	Binary Input 2	1	SE, GI
160	29	Binary Input 3	1	SE, GI
160	30	Binary Input 4	1	SE, GI
160	36	Trip Circuit Fail	1	SE, GI
160	38	VT Fuse Failure	1	SE, GI
160	51	Earth Fault Forward/Line	2	SE, GI
160	52	Earth Fault Reverse/Busbar	2	SE, GI
160	64	Start/Pick-up L1	2	SE, GI
160	65	Start/Pick-up L2	2	SE, GI
160	66	Start/Pick-up L3	2	SE, GI
160	67	Start/Pick-up N	2	SE, GI
160	68	General Trip	2	SE
160	69	Trip L1	2	SE
160	70	Trip L2	2	SE
160	71	Trip L3	2	SE
160	73	Fault Impedance	1	SE
160	74	Fault Forward/Line	2	SE, GI
160	75	Fault Reverse/Busbar	2	SE, GI
160	84	General Start/Pick-up	2	SE, GI
160	85	Breaker Failure	2	SE

© 2017 Siemens Protection Devices Limited

FUN	INF	Description	ASDU	COT
160	90	Trip I>	2	SE
160	91	Trip I>>	2	SE
160	92	Trip In>	2	SE
160	93	Trip In>>	2	SE
160	128	CB on by auto reclose	1	SE
183	10	51-1	2	SE, GI
183	11	50-1	2	SE, GI
183	12	51N-1	2	SE, GI
183	13	50N-1	2	SE, GI
183	14	51G-1	2	SE, GI
183	15	50G-1	2	SE, GI
183	16	51-2	2	SE, GI
183	17	50-2	2	SE, GI
183	18	51N-2	2	SE, GI
183	19	50N-2	2	SE, GI
183	20	51G-2	2	SE, GI
183	21	50G-2	2	SE, GI
183	22	51-3	2	SE, GI
183	23	50-3	2	SE, GI
183	24	51N-3	2	SE, GI
183	25	50N-3	2	SE, GI
183	26	51G-3	2	SE, GI
183	27	50G-3	2	SE, GI
183	28	51-4	2	SE, GI
183	29	50-4	2	SE, GI
183	30	51N-4	2	SE, GI
183	31	50N-4	2	SE, GI
183	32	51G-4	2	SE, GI
183	33	50G-4	2	SE, GI
183	34	50BF Stage 2	2	SE, GI
183	35	49-Alarm	2	SE, GI
183	36	49-Trip	2	SE, GI
183	40	60 CTS	2	SE, GI
183	41	51SEF-1	2	SE, GI
183	42	50SEF-1	2	SE, GI
183	43	51SEF-2	2	SE, GI
183	44	50SEF-2	2	SE, GI
183	45	51SEF-3	2	SE, GI
183	46	50SEF-3	2	SE, GI
183	47	51SEF-4	2	SE, GI
183	48	50SEF-4	2	SE, GI
183	49	SEF Out	2	SE, GI
			20	Ack, Nak
183	50	46IT	2	SE, GI
183	51	46DT	2	SE, GI
183	52	64H	2	SE, GI
183	53	E/F Out	2	SE, GI
			20	Ack, Nak
183	56	50BF Stage 1	2	SE, GI

© 2017 Siemens Protection Devices Limited

FUN	INF	Description	ASDU	COT
183	60	47-1	2	SE, GI
183	61	47-2	2	SE, GI
183	62	37-1	2	SE, GI
183	63	37-2	2	SE, GI
183	64	37G-1	2	SE, GI
183	65	37G-2	2	SE, GI
183	66	37SEF-1	2	SE, GI
183	67	37SEF-2	2	SE, GI
183	70	46BC	2	SE, GI
183	81	27/59-1	2	SE, GI
183	82	27/59-2	2	SE, GI
183	83	27/59-3	2	SE, GI
183	84	27/59-4	2	SE, GI
183	85	59NIT	2	SE, GI
183	86	59NDT	2	SE, GI
183	87	Vx27/59	2	SE, GI
183	90	81-1	2	SE, GI
183	91	81-2	2	SE, GI
183	92	81-3	2	SE, GI
183	93	81-4	2	SE, GI
183	94	81-5	2	SE, GI
183	95	81-6	2	SE, GI
183	96	81HBL2	1	SE, GI
183	100	CB Alarm	1	SE, GI
183	101	Trip Circuit Fail 1	2	SE, GI
183	102	Trip Circuit Fail 2	2	SE, GI
183	103	Trip Circuit Fail 3	2	SE, GI
183	110	Setting G5 selected	1	SE, GI
			20	Ack, Nak
183	111	Setting G6 selected	1	SE, GI
			20	Ack, Nak
183	112	Setting G7 selected	1	SE, GI
			20	Ack, Nak
183	113	Setting G8 selected	1	SE, GI
			20	Ack, Nak
183	114	Close CB Failed	1	SE, GI
183	115	Open CB Failed	1	SE, GI
183	116	Reclaim	1	SE, GI
183	117	Lockout	1	SE, GI
183	119	Successful DAR Close	1	SE
183	120	Successful Man Close	1	SE
183	121	HotLine Working	1	SE, GI
			20	Ack, Nak
183	122	Inst Protection Out	1	SE, GI
			20	Ack, Nak
183	123	CB Total Trip Count	1	SE, GI
183	124	CB Delta Trip Count	1	SE, GI
183	125	CB Count To AR Block	1	SE, GI

© 2017 Siemens Protection Devices Limited

FUN	INF	Description	ASDU	COT
183	126	Reset CB Total Trip Count	1	SE
			20	Ack, Nak
183	127	Reset CB Delta Trip Count	1	SE
			20	Ack, Nak
183	128	Reset CB Count To AR Block	1	SE
			20	Ack, Nak
183	129	I^2t CB Wear	1	SE, GI
183	130	Reset I^2t CB Wear	1	SE
			20	Ack, Nak
183	131	79 AR In progress	1	SE, GI
183	132	CB Frequent Ops Count	1	SE, GI
183	133	Reset CB Frequent Ops Count	1	SE
			20	Ack, Nak
183	136	CB On By Manual Close	1	SE
183	137	CB on by auto reclose	1	SE, GI
183	140	Cold Load Active	1	SE, GI
183	141	P/F Inst Protection Inhibited	1	SE, GI
183	142	E/F Inst Protection Inhibited	1	SE, GI
183	143	SEF Inst Protection Inhibited	1	SE, GI
183	144	Ext Inst Protection Inhibited	1	SE, GI
183	163	Trip Time Alarm	1	SE
183	164	Close Circuit Fail 1	2	SE, GI
183	165	Close Circuit Fail 2	2	SE, GI
183	166	Close Circuit Fail 3	2	SE, GI
183	167	Close Circuit Fail	2	SE, GI
183	168	Distance To Fault	1	SE
183	169	Distance To Fault Percent	1	SE
183	170	Fault Reactance	1	SE
183	171	60 CTS-I	2	SE, GI
183	172	Act Energy Exp	4	SE
183	173	Act Energy Imp	4	SE
183	174	React Energy Exp	4	SE
183	175	React Energy Imp	4	SE
183	176	Reset Energy Meters	1	SE
			20	Ack, Nak
183	177	Active Exp Meter Reset	1	SE
183	178	Active Imp Meter Reset	1	SE
183	179	Reactive Exp Meter Reset	1	SE
183	180	Reactive Imp Meter Reset	1	SE
183	181	CB Total Trip Count	4	SE
183	182	CB Delta Trip Count	4	SE
183	183	CB Count To AR Block	4	SE
183	184	CB Freq Ops Count	4	SE
183	198	25 Check Sync	1	SE, GI
183	199	25 System Sync	1	SE, GI
183	200	25 Close On Zero	1	SE, GI
183	201	25 System Split	1	SE, GI
183	202	25 Live Line	1	SE, GI
183	203	25 Live Bus	1	SE, GI

© 2017 Siemens Protection Devices Limited

FUN	INF	Description	ASDU	COT
183	204	25 Line U/V	1	SE, GI
183	205	25 Bus U/V	1	SE, GI
183	206	25 Voltage Dif >	1	SE, GI
183	207	25 CS Slip Freq >	1	SE, GI
183	208	25 SS Slip Freq >	1	SE, GI
183	209	25 COZ Slip Freq >	1	SE, GI
183	210	25 In Sync	1	SE, GI
183	211	25 CS In Progress	1	SE, GI
183	212	25 SS In Progress	1	SE, GI
183	213	25 COZ In Progress	1	SE, GI
183	214	25 System Split LO	1	SE, GI
183	215	60VTF-Bus	1	SE, GI
183	217	Man Override Sync	1	SE, GI
			20	Ack, Nak
183	218	79 Override Sync	1	SE, GI
			20	Ack, Nak
183	219	Dead Line Close	1	SE, GI
183	220	Dead Bus Close	1	SE, GI
183	221	Wattmetric Po>	1	SE, GI
183	222	37-PhA	2	SE, GI
183	223	37-PhB	2	SE, GI
183	224	37-PhC	2	SE, GI
183	231	50BF-PhA	2	SE, GI
183	232	50BF-PhB	2	SE, GI
183	233	50BF-PhC	2	SE, GI
183	234	50BF-EF	2	SE, GI
183	235	79 Last Trip Lockout	2	SE, GI
183	237	CB DBI	1	SE, GI
183	238	CB Travelling	1	SE, GI
183	239	In Fault Current	4	SE
183	240	Ia Fault Current	4	SE
183	241	Ib Fault Current	4	SE
183	242	Ic Fault Current	4	SE
183	243	Ig Fault Current	4	SE
183	244	Isef Fault Current	4	SE
183	245	Va Fault Voltage	4	SE
183	246	Vb Fault Voltage	4	SE
183	247	Vc Fault Voltage	4	SE
183	249	60 CTS-I-PhA	2	SE, GI
183	250	60 CTS-I-PhB	2	SE, GI
183	251	60 CTS-I-PhC	2	SE, GI
183	252	Trip PhA	2	SE, GI
183	253	Trip PhB	2	SE, GI
183	254	Trip PhC	2	SE, GI
185	9	CB Phase A Trip Count	4	SE
185	10	CB Phase B Trip Count	4	SE
185	11	CB Phase C Trip Count	4	SE
185	12	CB E/F Trip Count	4	SE

© 2017 Siemens Protection Devices Limited

FUN	INF	Description	ASDU	COT
185	37	27/59 PhA	2	SE, GI
185	38	27/59 PhB	2	SE, GI
185	39	27/59 PhC	2	SE, GI
185	43	General Trip	2	SE, GI
185	44	32-1	1	SE, GI
185	45	32-2	1	SE, GI
185	46	32S-1	1	SE, GI
185	47	32S-2	1	SE, GI
185	48	55-1	1	SE, GI
185	49	55-2	1	SE, GI
185	171	User Output 1	1	SE, GI
185	172	User Output 2	1	SE, GI
185	173	User Output 3	1	SE, GI
185	174	User Output 4	1	SE, GI
185	175	User Output 5	1	SE, GI
185	176	User Output 6	1	SE, GI
185	177	User Output 7	1	SE, GI
185	178	User Output 8	1	SE, GI
185	179	User Output 9	1	SE, GI
185	180	User Output 10	1	SE, GI
185	181	User Output 11	1	SE, GI
185	182	User Output 12	1	SE, GI
185	183	User Output 13	1	SE, GI
185	184	User Output 14	1	SE, GI
185	185	User Output 15	1	SE, GI
185	186	User Output 16	1	SE, GI
185	187	User Output 17	1	SE, GI
185	188	User Output 18	1	SE, GI
185	189	User Output 19	1	SE, GI
185	190	User Output 20	1	SE, GI
185	191	User Output 21	1	SE, GI
185	192	User Output 22	1	SE, GI
185	193	User Output 23	1	SE, GI
185	194	User Output 24	1	SE, GI
185	195	User Output 25	1	SE, GI
185	196	User Output 26	1	SE, GI
185	197	User Output 27	1	SE, GI
185	198	User Output 28	1	SE, GI
185	199	User Output 29	1	SE, GI
185	200	User Output 30	1	SE, GI
185	201	User Output 31	1	SE, GI
185	202	User Output 32	1	SE, GI
185	238	E/F In	2	SE, GI
			20	Ack, Nak
185	239	SEF In	2	SE, GI
			20	Ack, Nak
185	241	Start Count Alarm	1	SE, GI
185	242	21LB-3P Fwd	1	SE, GI
185	243	21LB-3P Rev	1	SE, GI

© 2017 Siemens Protection Devices Limited

FUN	INF	Description	ASDU	COT
185	244	21LB-1P Fwd	1	SE, GI
185	245	21LB-1P Rev	1	SE, GI
185	246	81HBL5	1	SE, GI
186	1	50AFD PhA	1	SE, GI
186	2	50AFD PhB	1	SE, GI
186	3	50AFD PhC	1	SE, GI
186	4	50AFD	1	SE, GI
186	5	AFD Zone 1 Flash	1	SE, GI
186	6	AFD Zone 1	1	SE, GI
186	7	AFD Zone 2 Flash	1	SE, GI
186	8	AFD Zone 2	1	SE, GI
186	9	AFD Zone 3 Flash	1	SE, GI
186	10	AFD Zone 3	1	SE, GI
186	11	AFD Zone 4 Flash	1	SE, GI
186	12	AFD Zone 4	1	SE, GI
186	13	AFD Zone 5 Flash	1	SE, GI
186	14	AFD Zone 5	1	SE, GI
186	15	AFD Zone 6 Flash	1	SE, GI
186	16	AFD Zone 6	1	SE, GI
186	17	AFD Zone1 Count	4	SE
186	18	AFD Zone2 Count	4	SE
186	19	AFD Zone3 Count	4	SE
186	20	AFD Zone4 Count	4	SE
186	21	AFD Zone5 Count	4	SE
186	22	AFD Zone6 Count	4	SE
200	1	CB 1	1	SE
			20	Ack, Nak
200	6	CB 1 Opened	1	SE, GI
			20	Ack, Nak
200	7	CB 1 Closed	1	SE, GI
			20	Ack, Nak
200	150	User SP Command 1	1	SE, GI
			20	Ack, Nak
200	151	User SP Command 2	1	SE, GI
			20	Ack, Nak
200	152	User SP Command 3	1	SE, GI
			20	Ack, Nak
200	153	User SP Command 4	1	SE, GI
			20	Ack, Nak
200	154	User SP Command 5	1	SE, GI
			20	Ack, Nak
200	155	User SP Command 6	1	SE, GI
			20	Ack, Nak
200	156	User SP Command 7	1	SE, GI
			20	Ack, Nak
200	157	User SP Command 8	1	SE, GI
			20	Ack, Nak
200	158	User DP Command 1	1	SE

© 2017 Siemens Protection Devices Limited

FUN	INF	Description	ASDU	COT
			20	Ack, Nak
200	159	User DP Command 2	1	SE
			20	Ack, Nak
200	160	User DP Command 3	1	SE
			20	Ack, Nak
200	161	User DP Command 4	1	SE
			20	Ack, Nak
200	162	User DP Command 5	1	SE
			20	Ack, Nak
200	163	User DP Command 6	1	SE
			20	Ack, Nak
200	164	User DP Command 7	1	SE
			20	Ack, Nak
200	165	User DP Command 8	1	SE
			20	Ack, Nak
200	200	CB 1 Trip & Reclose	1	SE
			20	Ack, Nak
200	201	CB 1 Trip & Lockout	1	SE
			20	Ack, Nak
200	255	Blocked By Interlocking	1	SE, GI
255	0	General Interrogation (GI) Initiation	7	Init. GI
255	0	General Interrogation (GI) End	8	End of GI
255	0	Time Synchronisation	6	Time Synch.

3.4.2 Measurands

The following Measurand EVT and INF numbers apply to this device.

FUN	INF	Description	ASDU	COT
183	148	Measurand $I_{L1,2,3}$, $V_{L1,2,3}$, P, Q, F, $V_{L1-2,L2-3,L3-1}$ --- I_{L1} (2.4x) (Window 1%) I_{L2} (2.4x) (Window 1%) I_{L3} (2.4x) (Window 1%) V_{L1} (1.2x) (Window 1%) V_{L2} (1.2x) (Window 1%) V_{L3} (1.2x) (Window 1%) P (2.4x) (Window 1%) Q (2.4x) (Window 1%) F (1.2x) (Window 0.1%) V_{L1-2} (1.2x) (Window 1%) V_{L2-3} (1.2x) (Window 1%) V_{L3-1} (1.2x) (Window 1%)	9	Cyclic - Refresh rate 5 seconds or value change greater than Window x %.
183	149	Measurand Power $W_{1,2,3}$, Power $VAr_{1,2,3}$, Power $Factor_{1,2,3}$, --- W_1 (2.4x) (Window 1%) W_2 (2.4x) (Window 1%) W_3 (2.4x) (Window 1%)	9	Cyclic - Refresh rate 5 seconds or value change greater

© 2017 Siemens Protection Devices Limited

FUN	INF	Description	ASDU	COT
		VAr_1 (2.4x) (Window 1%) VAr_2 (2.4x) (Window 1%) VAr_3 (2.4x) (Window 1%) PF_1 (1.2x) (Window 1%) PF_2 (1.2x) (Window 1%) PF_3 (1.2x) (Window 1%)		than Window x %.
183	216	Measurand Vx, Bus Freq, Phase Diff, Diff Volts and Slip Freq --- Vx (1.2x) (Window 0%) Bus Freq (1.2x) (Window 0%) Phase Diff (1.2x) (Window 0%) Diff Volts (1.2x) (Window 0%) Slip Freq (1.2x) (Window 0%) --- Note - Phase difference is stored as -1 to +1 as a multiple of 180deg nominal	9	Cyclic - Refresh rate 5 seconds or value change greater than Window x %.
183	236	Measurand Max $I_{a,b,c,}$ $V_{an,bn,cn,}$ P, Q, $V_{ab,bc,ca}$ --- Ia Max (2.4x) (Window 1%) Ib Max (2.4x) (Window 1%) Ic Max (2.4x) (Window 1%) $Van\ Max_1$ (1.2x) (Window 1%) $Vbn\ Max_2$ (1.2x) (Window 1%) $Vcn\ Max_3$ (1.2x) (Window 1%) P Max (2.4x) (Window 1%) Q Max (2.4x) (Window 1%) Vab Max (1.2x) (Window 1%) Vbc Max (1.2x) (Window 1%) Vca Max (1.2x) (Window 1%) --- Voltages only supported on 7SR1915/6	9	Cyclic - Refresh rate 5 seconds or value change greater than Window x %.

3.4.3 Disturbance Recorder Actual Channel (ACC) Numbers

The following Disturbance Recorder channel numbers apply to this device.

FUN	ACC	Description
182	1	V1
182	2	V2
182	3	V3
182	4	Vx
182	5	Ia
182	6	Ib
182	7	Ic
182	8	Ig1
182	9	Ig2

© 2017 Siemens Protection Devices Limited

© 2017 Siemens Protection Devices Limited

4. MODBUS Definitions

4.1 Introduction

This section describes the MODBUS-RTU protocol implementation in the relays. This protocol is used for communication with a suitable control system.

This protocol can be set to use any or all of the relays hardware interfaces (USB, Fibre Optic, RS232 and RS485) where fitted. The relay can communicate simultaneously on all ports regardless of protocol used.

The Station Address of the port being used must be set to a suitable address within the range 1 - 247 to enable communication. This can be set by the **Communications Menu : COM *n-xxxxx* Station Address** setting.

Communication via MODBUS over Ethernet requires external devices. Please refer to the documents ***TCPIP Catalogue Sheet*** and ***TCPIP Interface Technical Guidance Notes*** for more information.

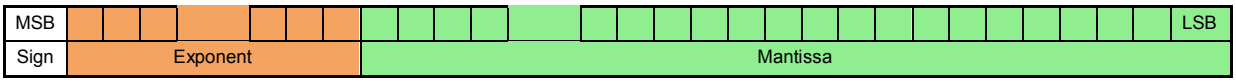
Definitions with shaded area are not available on all relay models.

© 2017 Siemens Protection Devices Limited

4.2 MODBUS Register Data Types

4.2.1 FLOAT_IEEE_754

The float data type conforms to the IEEE 754 floating point definition. This specifies that 32 bits of data will be formatted as a sign bit in the most significant bit (MSB) followed by an 8 bit exponent then a 23 bit mantissa, down to the least significant bit (LSB).



FLOAT_IEEE_754 IN DETAIL

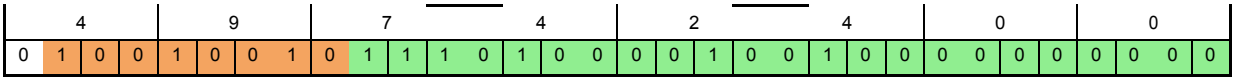
The exponent is an 8 bit unsigned integer. To allow for negative exponents, it is offset by 127. Therefore the actual exponent is e - 127. The following table shows a detailed layout of the exponent.

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
128	64	32	16	8	4	2	1

The mantissa contains the fractional part of a number normalized to the form 1.xyz i.e. in this instance xyz. The mantissa represents the binary fraction of a number; therefore the MSB represents 2^{-1} (or $1/2^1$) and its LSB 2^{-23} (or $1/2^{23}$). The following table shows a detailed layout of the mantissa.

$\frac{1}{2^1}$	$\frac{1}{2^2}$	$\frac{1}{2^3}$	$\frac{1}{2^4}$							$\frac{1}{2^{21}}$	$\frac{1}{2^{22}}$	$\frac{1}{2^{23}}$
0.5	0.25	0.125	0.0625							4.768e-7	2.384e-7	1.192e-7

As an example 1,000,000 would be represented as follows (hex 49742400).



This calculates out as:

Sign = +1

Exponent = 10010010_2 = 128 + 16 + 2 = 146, subtract 127 = 19.

$$\text{Mantissa} = 1 + \frac{1}{2^1} + \frac{1}{2^2} + \frac{1}{2^3} + \frac{1}{2^5} + \frac{1}{2^{10}} + \frac{1}{2^{13}}$$

$$= 1 + \frac{4096 + 2048 + 1024 + 256 + 8 + 1}{2^{13}} = 1 + \frac{7433}{2^{13}} = 1.907348632$$

Therefore $Sign * 2^{Exponent} * Mantissa = 1 * 2^{19} * 1.907348632 = 1000000$

FLOAT_IEEE_754 & MODBUS

In this MODBUS implementation the 32 bit float is stored in 2 16 registers in Big-Endian format. As an example, if we take the hex representation of 1,000,000 as a float (from above) we have 49742400h. Assume this is stored in the registers 30001 and 30002, it would look as follows.

Address	Value
30001	4974

© 2017 Siemens Protection Devices Limited

Address	Value
30002	2400

On reception these two registers should be interpreted in the correct order as IEEE754 floating point representation.

4.2.2 FP_32BITS_3DP

The FP_32BITS_3DP is a 32 bit integer fixed point value, containing 3 decimal places of information. It is used to send a real value to 3 decimal places as an integer. For example, if the value in a device is 123.456 it will be sent as 123456. As it is an integer, negative numbers are sent as 2's complement.

FP_32BITS_3DP & MODBUS

In this MODBUS implementation the 32 bit value is stored in 2 16 registers in Big-Endian format. As an example, if we take the hex representation of 123456, we have 1E240h. Assume this is stored in the registers 30001 and 30002, it would look as follows:

Address	Value
30001	1
30002	E240

On reception these two registers should be interpreted in the correct order as a 32 bit integer.

4.2.3 UINT32

The UINT32 is a signed 32 bit integer. As it is an integer, negative numbers are sent as 2's complement.

UINT32 & MODBUS

In this MODBUS implementation the 32 bit value is stored in 2 16 bit registers in Big-Endian format. As an example, if we take the hex representation of -123456, in 2's complement, we have FFFE1DC0h. Assume this is stored in the registers 30001 and 30002, it would look as follows:

Address	Value
30001	FFFE
30002	1DC0

On reception these two registers should be interpreted in the correct order as a 32 bit integer.

4.2.4 UINT16

The UINT16 is a signed 16 bit integer. As it is an integer, negative numbers are sent as 2's complement.

UINT16 & MODBUS

In this MODBUS implementation the 16 bit value is stored in a 16 bit register in Big-Endian format. As an example, if we take the hex representation of 5678 we have 162Eh. Assume this is stored in the register 30001, it would look as follows:

Address	Value
30001	162E

On reception this register should be interpreted as a 16 bit integer.

© 2017 Siemens Protection Devices Limited

Truncation

Calculations are performed as 32 bit. The 16 bit value is the lowest 16 bits of the 32 bit value. Therefore, when values overflow the returned value is the lowest 16 bits of the calculated value. For Example, if the value is 85400 = 14D98h, the value returned would be the lowest 16 bits = 4D98h which equals 19864.

4.2.5 EVENT

MODBUS does not define a method for extracting events; therefore a private method has been defined based on that defined by IEC60870-5-103.

The EVENT register contains the earliest event record available. The event record is 8 registers (16 bytes) of information, whose format is described below. When this record has been read it will be replaced by the next available record. Event records must be read completely; therefore the quantity value must be set to 8 before reading. Failing to do this will result in an exception code 2. If no event record is present the exception code 2 will be returned. The EVENT register should be polled regularly by the master for events.

The EVENTCOUNT register can be checked periodically to determine how many events are stored.

The format of the event record is defined by the zero byte. It signifies the type of record which is used to decode the event information. The zero byte can be one of the following.

Format

The format of the event record is defined by the zero byte. It signifies the type of record which is used to decode the event information. The zero byte can be one of the following.

Type	Description
1	Event
2	Event with Relative Time
4	Measurand Event with Relative Time

The following table describes the fields in the event record.

Key	Description
FUN	Function Type, as defined for IEC870-5-103.
INF	Information Number, as defined for IEC870-5-103.
DPI	Measurand Event with Relative Time, values 1 = OFF, 2 = ON.
ms L	Time Stamp Milliseconds low byte.
ms H	Time Stamp Milliseconds high byte.
Mi	Time Stamp Minutes (MSB = invalid, time not set > 23 hours).
Ho	Time Stamp Hours (MSB = Summer time flag).
RT L	Relative Time low byte.
RT H	Relative Time high byte.
F# L	Fault Number low byte.
F# H	Fault Number high byte.
Meas	Measurand format R32.23, sent least significant byte first.

The following tables show the fields in the different event records as they are returned.

Byte	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Content	1	0	FUN	INF	DPI	0	0	0	0	0	0	0	ms L	ms H	Mi	Ho

Event Type 1 Format.

© 2017 Siemens Protection Devices Limited

Byte	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Content	2	0	FUN	INF	DPI	RT L	RT H	F# L	F# H	0	0	0	ms L	ms H	Mi	Ho

Event Type 2 Format.

Byte	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Content	4	0	FUN	INF	Meas				0	0	0	0	ms L	ms H	Mi	Ho

Event Type 4 Format.

4.2.6 EVENTCOUNT

The EVENTCOUNT register contains the current number of events in the relay's event buffer.

On reception this register should be interpreted as a 16 bit integer.

4.2.7 TIME_METER

The TIME_METER register contains the device's time. The time must be read or written in one step; therefore the quantity should be 4 registers. Failing to do this will result in an exception code 2. The time format is 8 bytes as follows.

The following table describes the fields in the time.

Key	Description
ms L	Time Stamp Milliseconds low byte.
ms H	Time Stamp Milliseconds high byte.
Mi	Time Stamp Minutes (MSB = invalid, time not set > 23 hours).
Ho	Time Stamp Hours (MSB = Summer time flag).
Da	Time Stamp Days.
Mo	Time Stamp Months.
Ye L	Time Stamp Years low byte.
Ye H	Time Stamp Years high byte (Not Used).

The following table shows the fields in the time as they are returned.

Byte	0	1	2	3	4	5	6	7
Content	ms L	ms H	Mi	Ho	Da	Mo	Ye L	Ye H

Time Format.

4.2.8 STR32 & STR64

4.2.9 BITSTRING

A Bit-String (or Bit-Array) is a method of compactly storing a number of bits of data. In this instance we store up to 16 bit values, for example the states of binary inputs, in a single 16 bit register. The first bit value is stored in the Least Significant Bit (LSB) of the register. The 16th value would be in the Most Significant Bit (MSB). Bit values can only be zero or one. Any unused bits will be set to zero.

BITSTRING & MODBUS

© 2017 Siemens Protection Devices Limited

In this MODBUS implementation the 16 bit value is stored in a 16 bit register in Big-Endian format. As an example, assume bits 1, 3, 9 and 12 are set. The binary representation of this would be 0000100100000101_2 giving a hex representation of 0905h. Assume this is stored in the register 30001, it would look as follows:

Address	Value
30001	0905

On reception this register should be interpreted as a 16 bit integer.

© 2017 Siemens Protection Devices Limited

4.3 Point List

The information shown below is the default configuration.

4.3.1 Coils (Read Write Binary values)

Address	Description
00001	Binary Output 1
00002	Binary Output 2
00003	Binary Output 3
00004	Binary Output 4
00005	Binary Output 5
00006	Binary Output 6
00007	Binary Output 7
00008	Binary Output 8
00009	Binary Output 9
00010	Binary Output 10
00011	Binary Output 11
00012	Binary Output 12
00013	Binary Output 13
00014	Binary Output 14
00101	Setting G1 selected
00102	Setting G2 selected
00103	Setting G3 selected
00104	Setting G4 selected
00105	Setting G5 selected
00106	Setting G6 selected
00107	Setting G7 selected
00108	Setting G8 selected
00109	CB 1
00112	Auto-reclose active
00113	HotLine Working
00114	E/F Out
00115	SEF Out
00116	Inst Protection Out
00155	Remote Mode
00156	Out Of Service Mode
00157	Local Mode
00158	Local & Remote
00159	Man Override Sync
00160	79 Override Sync
00165	Reset Start Count
00180	CB 1 Opened
00181	CB 1 Closed
00200	User SP Command 1
00201	User SP Command 2
00202	User SP Command 3
00203	User SP Command 4

© 2017 Siemens Protection Devices Limited

Address	Description
00204	User SP Command 5
00205	User SP Command 6
00206	User SP Command 7
00207	User SP Command 8
00208	User DP Command 1
00209	User DP Command 2
00210	User DP Command 3
00211	User DP Command 4
00212	User DP Command 5
00213	User DP Command 6
00214	User DP Command 7
00215	User DP Command 8

4.3.2 Inputs (Read Only Binary values)

Address	Description
10001	Binary Input 1
10002	Binary Input 2
10003	Binary Input 3
10004	Binary Input 4
10005	Binary Input 5
10006	Binary Input 6
10007	Binary Input 7
10008	Binary Input 8
10009	Binary Input 9
10010	Binary Input 10
10011	Binary Input 11
10012	Binary Input 12
10013	Binary Input 13
10102	Remote Mode
10103	Out Of Service Mode
10104	Local Mode
10105	Local & Remote
10110	General Trip
10111	Trip Circuit Fail
10112	Start/Pick-up L1
10113	Start/Pick-up L2
10114	Start/Pick-up L3
10115	General Start/Pick-up
10116	VT Fuse Failure
10117	Earth Fault Forward/Line
10118	Earth Fault Reverse/Busbar
10119	Start/Pick-up N
10120	Fault Forward/Line
10121	Fault Reverse/Busbar
10122	51-1
10123	50-1
10124	51N-1

© 2017 Siemens Protection Devices Limited

Address	Description
10125	50N-1
10126	51G-1
10127	50G-1
10128	51-2
10129	50-2
10130	51N-2
10131	50N-2
10132	51G-2
10133	50G-2
10134	51-3
10135	50-3
10136	51N-3
10137	50N-3
10138	51G-3
10139	50G-3
10140	51-4
10141	50-4
10142	51N-4
10143	50N-4
10144	51G-4
10145	50G-4
10146	50BF Stage 2
10147	49-Alarm
10148	49-Trip
10149	60 CTS
10150	46IT
10151	46DT
10152	47-1
10153	47-2
10154	46BC
10155	27/59-1
10156	27/59-2
10157	27/59-3
10158	27/59-4
10159	59NIT
10160	59NDT
10161	81-1
10162	81-2
10163	81-3
10164	81-4
10165	81-5
10166	81-6
10167	64H
10168	37-1
10169	37-2
10170	Vx27/59
10171	Auto-reclose active
10172	CB on by auto reclose

© 2017 Siemens Protection Devices Limited

Address	Description
10173	Reclaim
10174	Lockout
10175	HotLine Working
10176	Inst Protection Out
10177	CB Total Trip Count
10178	CB Delta Trip Count
10179	CB Count To AR Block
10180	I^2t CB Wear
10181	79 AR In progress
10182	Cold Load Active
10183	E/F Out
10184	P/F Inst Protection Inhibited
10185	E/F Inst Protection Inhibited
10186	SEF Inst Protection Inhibited
10187	Ext Inst Protection Inhibited
10202	51SEF-1
10203	50SEF-1
10204	51SEF-2
10205	50SEF-2
10206	51SEF-3
10207	50SEF-3
10208	51SEF-4
10209	50SEF-4
10210	SEF Out
10211	Trip Circuit Fail 1
10212	Trip Circuit Fail 2
10213	Trip Circuit Fail 3
10214	CB Total Trip Count
10215	CB Delta Trip Count
10216	CB Count To AR Block
10217	CB Frequent Ops Count
10218	I^2t CB Wear
10219	CB 1 Opened
10220	CB 1 Closed
10283	Close Circuit Fail 1
10284	Close Circuit Fail 2
10285	Close Circuit Fail 3
10286	Close Circuit Fail
10290	General Alarm 1
10291	General Alarm 2
10292	General Alarm 3
10293	General Alarm 4
10294	General Alarm 5
10295	General Alarm 6
10296	General Alarm 7
10297	General Alarm 8
10298	General Alarm 9
10299	General Alarm 10
10300	General Alarm 11

© 2017 Siemens Protection Devices Limited

Address	Description
10301	General Alarm 12
10302	Quick Logic E1
10303	Quick Logic E2
10304	Quick Logic E3
10305	Quick Logic E4
10306	Quick Logic E5
10307	Quick Logic E6
10308	Quick Logic E7
10309	Quick Logic E8
10310	Quick Logic E9
10311	Quick Logic E10
10312	Quick Logic E11
10313	Quick Logic E12
10314	Quick Logic E13
10315	Quick Logic E14
10316	Quick Logic E15
10317	Quick Logic E16
10334	60 CTS-I
10335	81HBL2
10336	37G-1
10337	37G-2
10338	37SEF-1
10339	37SEF-2
10352	25 System Split
10353	25 Live Line
10354	25 Live Bus
10355	25 Line U/V
10356	25 Bus U/V
10357	25 Voltage Dif >
10358	25 CS Slip Freq >
10359	25 SS Slip Freq >
10360	25 COZ Slip Freq >
10361	25 In Sync
10362	25 CS In Progress
10363	25 SS In Progress
10364	25 COZ In Progress
10365	25 System Split LO
10366	60VTF-Bus
10367	50BF Stage 1
10368	Wattmetric Po>
10369	37-PhA
10370	37-PhB
10371	37-PhC
10378	50BF-PhA
10379	50BF-PhB
10380	50BF-PhC
10381	50BF-EF
10383	60 CTS-I-PhA

© 2017 Siemens Protection Devices Limited

Address	Description
10384	60 CTS-I-PhB
10385	60 CTS-I-PhC
10390	Trip PhA
10391	Trip PhB
10392	Trip PhC
10401	27/59 PhA
10402	27/59 PhB
10403	27/59 PhC
10410	CB Alarm
10411	General Alarm 13
10412	General Alarm 14
10413	General Alarm 15
10414	General Alarm 16
10415	General Alarm 17
10416	General Alarm 18
10417	General Alarm 19
10418	General Alarm 20
10501	Virtual Input 1
10502	Virtual Input 2
10503	Virtual Input 3
10504	Virtual Input 4
10505	Virtual Input 5
10506	Virtual Input 6
10507	Virtual Input 7
10508	Virtual Input 8
10509	Virtual Input 9
10510	Virtual Input 10
10511	Virtual Input 11
10512	Virtual Input 12
10513	Virtual Input 13
10514	Virtual Input 14
10515	Virtual Input 15
10516	Virtual Input 16
10601	LED 1
10602	LED 2
10603	LED 3
10604	LED 4
10605	LED 5
10606	LED 6
10607	LED 7
10608	LED 8
10609	LED 9
10610	LED 10
10611	LED 11
10612	LED 12
10613	LED 13
10614	LED 14
10615	LED 15
10616	LED 16

© 2017 Siemens Protection Devices Limited

Address	Description
10701	LED PU 1
10702	LED PU 2
10703	LED PU 3
10704	LED PU 4
10705	LED PU 5
10706	LED PU 6
10707	LED PU 7
10708	LED PU 8
10709	LED PU 9
10710	LED PU 10
10711	LED PU 11
10712	LED PU 12
10713	LED PU 13
10714	LED PU 14
10715	LED PU 15
10716	LED PU 16
10800	Cold Start
10801	Warm Start
10802	Re-Start
10803	Power On
10804	Expected Restart
10805	Unexpected Restart
10806	Reset Start Count
10900	User SP Command 1
10901	User SP Command 2
10902	User SP Command 3
10903	User SP Command 4
10904	User SP Command 5
10905	User SP Command 6
10906	User SP Command 7
10907	User SP Command 8
10908	User DP Command 1
10909	User DP Command 2
10910	User DP Command 3
10911	User DP Command 4
10912	User DP Command 5
10913	User DP Command 6
10914	User DP Command 7
10915	User DP Command 8
10916	32-1
10917	32-2
10918	32S-1
10919	32S-2
10920	55-1
10921	55-2
11020	User Output 1
11021	User Output 2
11022	User Output 3

© 2017 Siemens Protection Devices Limited

Address	Description
11023	User Output 4
11024	User Output 5
11025	User Output 6
11026	User Output 7
11027	User Output 8
11028	User Output 9
11029	User Output 10
11030	User Output 11
11031	User Output 12
11032	User Output 13
11033	User Output 14
11034	User Output 15
11035	User Output 16
11036	User Output 17
11037	User Output 18
11038	User Output 19
11039	User Output 20
11040	User Output 21
11041	User Output 22
11042	User Output 23
11043	User Output 24
11044	User Output 25
11045	User Output 26
11046	User Output 27
11047	User Output 28
11048	User Output 29
11049	User Output 30
11050	User Output 31
11051	User Output 32
11071	E/F In
11072	SEF In
11073	CB DBI
11074	CB Travelling
11075	Close CB Failed
11076	Open CB Failed
11077	Start Count Alarm
11078	50AFD PhA
11079	50AFD PhB
11080	50AFD PhC
11081	50AFD
11082	AFD Zone 1 Flash
11083	AFD Zone 1
11084	AFD Zone 2 Flash
11085	AFD Zone 2
11086	AFD Zone 3 Flash
11087	AFD Zone 3
11088	AFD Zone 4 Flash
11089	AFD Zone 4
11090	AFD Zone 5 Flash

© 2017 Siemens Protection Devices Limited

Address	Description
11091	AFD Zone 5
11092	AFD Zone 6 Flash
11093	AFD Zone 6
11094	21LB-3P Fwd
11095	21LB-3P Rev
11096	21LB-1P Fwd
11097	21LB-1P Rev
11098	81HBL5

4.3.3 Input Registers (Read Only Registers)

Address	Description	Format	Mult	Description
30001	Event Count	EVENTCOUNT	0.000000	Events Counter
30002	Event	EVENT	0.000000	8 Registers
30010	Vab Primary	FP_32BITS_3DP	1.000000	Vab V
30012	Vbc Primary	FP_32BITS_3DP	1.000000	Vbc V
30014	Vca Primary	FP_32BITS_3DP	1.000000	Vca V
30016	Va Primary	FP_32BITS_3DP	1.000000	Va V
30018	Vb Primary	FP_32BITS_3DP	1.000000	Vb V
30020	Vc Primary	FP_32BITS_3DP	1.000000	Vc V
30022	Va Secondary	FP_32BITS_3DP	1.000000	Va V
30024	Vb Secondary	FP_32BITS_3DP	1.000000	Vb V
30026	Vc Secondary	FP_32BITS_3DP	1.000000	Vc V
30034	Vab Nominal	FP_32BITS_3DP	1.000000	Vab Degrees
30036	Vbc Nominal	FP_32BITS_3DP	1.000000	Vbc Degrees
30038	Vca Nominal	FP_32BITS_3DP	1.000000	Vca Degrees
30040	Va Nominal	FP_32BITS_3DP	1.000000	Va Degrees
30042	Vb Nominal	FP_32BITS_3DP	1.000000	Vb Degrees
30044	Vc Nominal	FP_32BITS_3DP	1.000000	Vc Degrees
30048	Vzps	FP_32BITS_3DP	1.000000	Vzps V
30050	Vpps	FP_32BITS_3DP	1.000000	Vpps V
30052	Vnps	FP_32BITS_3DP	1.000000	Vnps V
30054	Vzps	FP_32BITS_3DP	1.000000	Vzps Degrees
30056	Vpps	FP_32BITS_3DP	1.000000	Vpps Degrees
30058	Vnps	FP_32BITS_3DP	1.000000	Vnps Degrees
30060	Frequency	FP_32BITS_3DP	1.000000	Frequency Hz
30064	Ia Primary	FP_32BITS_3DP	1.000000	Ia A
30066	Ib Primary	FP_32BITS_3DP	1.000000	Ib A
30068	Ic Primary	FP_32BITS_3DP	1.000000	Ic A
30070	Ia Secondary	FP_32BITS_3DP	1.000000	Ia A
30072	Ib Secondary	FP_32BITS_3DP	1.000000	Ib A
30074	Ic Secondary	FP_32BITS_3DP	1.000000	Ic A
30076	Ia Nominal	FP_32BITS_3DP	1.000000	Ia xIn
30078	Ib Nominal	FP_32BITS_3DP	1.000000	Ib xIn
30080	Ic Nominal	FP_32BITS_3DP	1.000000	Ic xIn
30082	Ia Nominal	FP_32BITS_3DP	1.000000	Ia Degrees
30084	Ib Nominal	FP_32BITS_3DP	1.000000	Ib Degrees

© 2017 Siemens Protection Devices Limited

Address	Description	Format	Mult	Description
30086	Ic Nominal	FP_32BITS_3DP	1.000000	Ic Degrees
30088	In Primary	FP_32BITS_3DP	1.000000	In A
30090	In Secondary	FP_32BITS_3DP	1.000000	In A
30092	In Nominal	FP_32BITS_3DP	1.000000	In xInom
30094	Ig Primary	FP_32BITS_3DP	1.000000	Ig A
30096	Ig Secondary	FP_32BITS_3DP	1.000000	Ig A
30098	Ig Nominal	FP_32BITS_3DP	1.000000	Ig xInom
30100	Izps Nominal	FP_32BITS_3DP	1.000000	Izps xIn
30102	Ipps Nominal	FP_32BITS_3DP	1.000000	Ipps xIn
30104	Inps Nominal	FP_32BITS_3DP	1.000000	Inps xIn
30106	Izps Nominal	FP_32BITS_3DP	1.000000	Izps Degrees
30108	Ipps Nominal	FP_32BITS_3DP	1.000000	Ipps Degrees
30110	Inps Nominal	FP_32BITS_3DP	1.000000	Inps Degrees
30112	Active Power A	FP_32BITS_3DP	0.000001	A Phase W
30114	Active Power B	FP_32BITS_3DP	0.000001	B Phase W
30116	Active Power C	FP_32BITS_3DP	0.000001	C Phase W
30118	P (3P)	FP_32BITS_3DP	0.000001	3 Phase W
30120	Reactive Power A	FP_32BITS_3DP	0.000001	Phase A VAr
30122	Reactive Power B	FP_32BITS_3DP	0.000001	Phase B VAr
30124	Reactive Power C	FP_32BITS_3DP	0.000001	Phase C VAr
30126	Q (3P)	FP_32BITS_3DP	0.000001	3 Phase VAr
30128	Apparent Power A	FP_32BITS_3DP	0.000001	Phase A VA
30130	Apparent Power B	FP_32BITS_3DP	0.000001	Phase B VA
30132	Apparent Power C	FP_32BITS_3DP	0.000001	Phase C VA
30134	S (3P)	FP_32BITS_3DP	0.000001	3 Phase VA
30136	Power Factor A	FP_32BITS_3DP	1.000000	Phase A
30138	Power Factor B	FP_32BITS_3DP	1.000000	Phase B
30140	Power Factor C	FP_32BITS_3DP	1.000000	Phase C
30142	Power Factor(3P)	FP_32BITS_3DP	1.000000	3 Phase
30144	Act Energy Exp	UINT32	1.000000	Act Energy Exp
30146	Act Energy Imp	UINT32	1.000000	Act Energy Imp
30148	React Energy Exp	UINT32	1.000000	React Energy Exp
30150	React Energy Imp	UINT32	1.000000	React Energy Imp
30152	Thermal Status Ph A	UINT16	1.000000	Thermal Status Ph A %
30153	Thermal Status Ph B	UINT16	1.000000	Thermal Status Ph B %
30154	Thermal Status Ph C	UINT16	1.000000	Thermal Status Ph C %
30167	Fault Records	UINT16	1.000000	Fault Records
30168	Event Records	UINT16	1.000000	Event Records
30169	Waveform Records	UINT16	1.000000	Waveform Records
30170	Vab Secondary	FP_32BITS_3DP	1.000000	Vab V
30172	Vbc Secondary	FP_32BITS_3DP	1.000000	Vbc V
30174	Vca Secondary	FP_32BITS_3DP	1.000000	Vca V
30176	Vn Primary	FP_32BITS_3DP	1.000000	Vn V
30178	Vn Secondary	FP_32BITS_3DP	1.000000	Vn V
30180	Vn Secondary	FP_32BITS_3DP	1.000000	Vn Degrees
30182	Vx Primary	FP_32BITS_3DP	1.000000	Vx V
30184	Vx Secondary	FP_32BITS_3DP	1.000000	Vx V
30186	Vx Secondary	FP_32BITS_3DP	1.000000	Vx Degrees
30193	I Phase A Max	FP_32BITS_3DP	1.000000	Ia Max Demand

© 2017 Siemens Protection Devices Limited

Address	Description	Format	Mult	Description
30195	I Phase B Max	FP_32BITS_3DP	1.000000	Ib Max Demand
30197	I Phase C Max	FP_32BITS_3DP	1.000000	Ic Max Demand
30199	P 3P Max	FP_32BITS_3DP	0.000001	Power Max Demand
30201	Q 3P Max	FP_32BITS_3DP	0.000001	VARs Max Demand
30203	Ig Max	FP_32BITS_3DP	1.000000	Ig Max Demand
30207	Isef Primary	FP_32BITS_3DP	1.000000	Isef A
30209	Isef Secondary	FP_32BITS_3DP	1.000000	Isef A
30211	Isef Nominal	FP_32BITS_3DP	1.000000	Isef xInom
30213	Fault Distance Percent	FP_32BITS_3DP	1.000000	Fault Distance Percent
30215	Fault Reactance	FP_32BITS_3DP	1.000000	Fault Reactance
30241	CB Total Trip Count	UINT32	1.000000	CB Total Trip Count
30243	CB Delta Trip Count	UINT32	1.000000	CB Delta Trip Count
30245	CB Count To AR Block	UINT32	1.000000	CB Count to AR Block
30247	CB Frequent Ops Count	UINT32	1.000000	CB Frequent Ops Count
30293	Bus Freq	FP_32BITS_3DP	1.000000	Vx Frequency
30295	Phase Diff	FP_32BITS_3DP	1.000000	25 Phase Diff
30297	Slip Freq	FP_32BITS_3DP	1.000000	25 Slip Freq
30299	Voltage Diff	FP_32BITS_3DP	1.000000	25 Voltage Diff
30301	Ia Last Trip	FP_32BITS_3DP	1.000000	Ia Fault
30303	Ib Last Trip	FP_32BITS_3DP	1.000000	Ib Fault
30305	Ic Last Trip	FP_32BITS_3DP	1.000000	Ic Fault
30307	Va Last Trip	FP_32BITS_3DP	1.000000	Va Fault
30309	Vb Last Trip	FP_32BITS_3DP	1.000000	Vb Fault
30311	Vc Last Trip	FP_32BITS_3DP	1.000000	Vc Fault
30313	In Last Trip	FP_32BITS_3DP	1.000000	In Fault
30315	Ig Last Trip	FP_32BITS_3DP	1.000000	Ig Fault
30317	Isef Last Trip	FP_32BITS_3DP	1.000000	Isef Fault
30319	V Phase A Max	FP_32BITS_3DP	1.000000	Va Max Demand
30321	V Phase B Max	FP_32BITS_3DP	1.000000	Vb Max Demand
30323	V Phase C Max	FP_32BITS_3DP	1.000000	Vc Max Demand
30325	V Phase AB Max	FP_32BITS_3DP	1.000000	Vab Max Demand
30327	V Phase BC Max	FP_32BITS_3DP	1.000000	Vbc Max Demand
30329	V Phase CA Max	FP_32BITS_3DP	1.000000	Vca Max Demand
30331	CB Ph A Trip Count	UINT32	1.000000	CB Phase A Trip Count
30333	CB Ph B Trip Count	UINT32	1.000000	CB Phase B Trip Count
30335	CB Ph C Trip Count	UINT32	1.000000	CB Phase C Trip Count
30337	CB E/F Trip Count	UINT32	1.000000	CB EF Trip Count
30341	LED1-n	BITSTRING	0.000000	Led 1-16 status
30342	LED1-n	BITSTRING	0.000000	Led 17-32 status
30343	INP1-n	BITSTRING	0.000000	Input 1-16 status
30344	INP1-n	BITSTRING	0.000000	Input 17-32 status
30345	OUT1-n	BITSTRING	0.000000	Output 1-16 status
30346	OUT1-n	BITSTRING	0.000000	Output 17-32 status
30347	VRT1-n	BITSTRING	0.000000	Virtual 1-16 status
30348	VRT1-n	BITSTRING	0.000000	Virtual 17-32 status
30349	EQN1-n	BITSTRING	0.000000	Equation 1-16 status
30350	EQN1-n	BITSTRING	0.000000	Equation 17-32 status
30352	Fault Distance Perunit	FP_32BITS_3DP	1.000000	Fault Distance Perunit

© 2017 Siemens Protection Devices Limited

Address	Description	Format	Mult	Description
30354	CB Wear A	FP_32BITS_3DP	0.000001	CB Wear A
30356	CB Wear B	FP_32BITS_3DP	0.000001	CB Wear B
30358	CB Wear C	FP_32BITS_3DP	0.000001	CB Wear C
30360	CB Wear A Remaining	FP_32BITS_3DP	1.000000	CB Wear A Remaining
30362	CB Wear B Remaining	FP_32BITS_3DP	1.000000	CB Wear B Remaining
30364	CB Wear C Remaining	FP_32BITS_3DP	1.000000	CB Wear C Remaining
30366	CB Wear Minimum	FP_32BITS_3DP	1.000000	CB Wear Minimum
30380	StartCount	FP_32BITS_3DP	1.000000	Start Count
30382	Start Count Target	FP_32BITS_3DP	1.000000	Start Count Target
30392	Active Setting Group	UINT16	1.000000	Active Setting Group
30400	Frequency Max	FP_32BITS_3DP	1.000000	Frequency Max
30402	S 3P Max	FP_32BITS_3DP	0.000010	S 3P Max
30444	Sec Active Power A	FP_32BITS_3DP	1.000000	Secondary A Phase W
30446	Sec Active Power B	FP_32BITS_3DP	1.000000	Secondary B Phase W
30448	Sec Active Power C	FP_32BITS_3DP	1.000000	Secondary C Phase W
30450	Sec P (3P)	FP_32BITS_3DP	1.000000	Secondary 3 Phase W
30452	Sec Reactive Power A	FP_32BITS_3DP	1.000000	Secondary Phase A VAr
30454	Sec Reactive Power B	FP_32BITS_3DP	1.000000	Secondary Phase B VAr
30456	Sec Reactive Power C	FP_32BITS_3DP	1.000000	Secondary Phase C VAr
30458	Sec Q (3P)	FP_32BITS_3DP	1.000000	Secondary 3 Phase VAr
30460	Sec Apparent Power A	FP_32BITS_3DP	1.000000	Secondary Phase A VA
30462	Sec Apparent Power B	FP_32BITS_3DP	1.000000	Secondary Phase B VA
30464	Sec Apparent Power C	FP_32BITS_3DP	1.000000	Secondary Phase C VA
30466	Sec S (3P)	FP_32BITS_3DP	1.000000	Secondary 3 Phase VA
30468	CB Trip Time Meter	FP_32BITS_3DP	1.000000	CB Trip Time
30482	PF 3P Max	FP_32BITS_3DP	1.000000	Power Factor 3 Phase Max

4.3.4 Holding Registers (Read Write Registers)

Address	Description	Format	Mult	Description
40001	Time	TIME_METER	0.000000	Time

© 2017 Siemens Protection Devices Limited

5. DNP3 Definitions

5.1 Device Profile

The following table provides a "Device Profile Document" in the standard format defined in the DNP 3.0 Subset Definitions Document. While it is referred to in the DNP 3.0 Subset Definitions as a "Document," it is in fact a table, and only a component of a total interoperability guide. The table, in combination with the Implementation Table provided in Section 5.2 (beginning on page 56), and the Point List Tables provided in Section 5.3 (beginning on page 62), should provide a complete configuration/interoperability guide for communicating with a device implementing the Triangle MicroWorks, Inc. DNP 3.0 Slave Source Code Library.

DNP V3.0
DEVICE PROFILE DOCUMENT
(Also see the DNP 3.0 Implementation Table in Section 5.2, beginning on page 56).

Vendor Name: **Siemens Protection Devices Ltd.**

Device Name: **7SR220, using the Triangle MicroWorks, Inc. DNP3 Slave Source Code Library, Version 3.**

Highest DNP Level Supported:	Device Function:
For Requests: **Level 3** For Responses: **Level 3**	☐ Master ☒ **Slave**

Notable objects, functions, and/or qualifiers supported in addition to the Highest DNP Levels Supported (the complete list is described in the attached table):

For static (non-change-event) object requests, request qualifier codes 07 and 08 (limited quantity), and 17 and 28 (index) are supported. Static object requests sent with qualifiers 07, or 08, will be responded with qualifiers 00 or 01.

Output Event Object 11 is supported.

Maximum Data Link Frame Size (octets):	Maximum Application Fragment Size (octets):
Transmitted: **256** Received: **256**	Transmitted: **2048** Received: **2048**

Maximum Data Link Re-tries:	Maximum Application Layer Re-tries:
☐ None ☐ Fixed (3) ☒ **Configurable from 0 to 65535 (Default 3)**	☒ **None** ☐ Configurable

Requires Data Link Layer Confirmation:
- ☐ Never
- ☐ Always
- ☐ Sometimes
- ☒ **Configurable as: Never, Only for multi-frame messages, or Always**

Requires Application Layer Confirmation:
- ☐ Never
- ☐ Always
- ☒ **When reporting Event Data (Slave devices only)**
- ☒ **When sending multi-fragment responses (Slave devices only)**
- ☐ Sometimes
- ☐ Configurable as: "Only when reporting event data", or "When reporting event data or multi-fragment messages."

Timeouts while waiting for:

Data Link Confirm:	☐ None	☐ Fixed at____	☐ Variable	☒ **Configurable (2sec)**
Complete Appl. Fragment:	☒ **None**	☐ Fixed at____	☐ Variable	☐ Configurable
Application Confirm:	☐ None	☐ Fixed at____	☐ Variable	☒ **Configurable (10sec)**
Complete Appl. Response:	☒ **None**	☐ Fixed at____	☐ Variable	☐ Configurable

Others:

Transmission Delay, (Configurable, default 0 sec)

Select/Operate Arm Timeout, (Configurable, default 5 sec)

Need Time Interval, (Configurable, default 30 minutes)

© 2017 Siemens Protection Devices Limited

DNP V3.0
DEVICE PROFILE DOCUMENT
(Also see the DNP 3.0 Implementation Table in Section 5.2, beginning on page 56).

Unsolicited Notification Delay, (Configurable, default 5 seconds)

Unsolicited Response Retry Delay, (Configurable (between 3 - 9), default 5 seconds)

Unsolicited Offline Interval, (Configurable, default 30 seconds)

Binary Change Event Scan Period, (Polled, Not Applicable)

Double Bit Change Event Scan Period, (Polled - Not Applicable)

Analog Change Event Scan Period, (Polled - Not Applicable)

Counter Change Event Scan Period, (Polled - Not Applicable)

Frozen Counter Change Event Scan Period, (Polled - Not Applicable)

String Change Event Scan Period, (Unsupported - Not Applicable)

Virtual Terminal Event Scan Period, (Unsupported - Not Applicable)

Sends/Executes Control Operations:

WRITE Binary Outputs	☒ **Never**	☐ Always	☐ Sometimes	☐ Configurable
SELECT/OPERATE	☐ Never	☒ **Always**	☐ Sometimes	☐ Configurable
DIRECT OPERATE	☐ Never	☒ **Always**	☐ Sometimes	☐ Configurable
DIRECT OPERATE - NO ACK	☐ Never	☒ **Always**	☐ Sometimes	☐ Configurable
Count > 1	☒ **Never**	☐ Always	☐ Sometimes	☐ Configurable
Pulse On	☐ Never	☐ Always	☒ **Sometimes**	☐ Configurable
Pulse Off	☐ Never	☐ Always	☒ **Sometimes**	☐ Configurable
Latch On	☐ Never	☐ Always	☒ **Sometimes**	☐ Configurable
Latch Off	☐ Never	☐ Always	☒ **Sometimes**	☐ Configurable
Queue	☒ **Never**	☐ Always	☐ Sometimes	☐ Configurable
Clear Queue	☒ **Never**	☐ Always	☐ Sometimes	☐ Configurable

Attach explanation if “Sometimes” or “Configurable” was checked for any operation.

Reports Binary Input Change Events when no specific variation requested:
- ☐ Never
- ☐ Only time-tagged
- ☐ Only non-time-tagged
- ☒ **Configurable to send one or the other**

Reports time-tagged Binary Input Change Events when no specific variation requested:
- ☐ Never
- ☐ Binary Input Change With Time
- ☐ Binary Input Change With Relative Time
- ☒ **Configurable**

Sends Unsolicited Responses:
- ☐ Never
- ☒ **Configurable**
- ☐ Only certain objects
- ☐ Sometimes (attach explanation)
- ☒ **ENABLE/DISABLE UNSOLICITED Function codes supported**

Sends Static Data in Unsolicited Responses:
- ☒ **Never**
- ☐ When Device Restarts
- ☐ When Status Flags Change

No other options are permitted.

Default Counter Object/Variation:
- ☐ No Counters Reported
- ☒ **Configurable**
- ☐ Default Object
  Default Variation: _____
- ☒ **Point-by-point list attached**

Counters Roll Over at:
- ☐ No Counters Reported
- ☐ Configurable (attach explanation)
- ☐ 16 Bits
- ☒ **32 Bits**
- ☐ Other Value: _____
- ☒ **Point-by-point list attached**

Sends Multi-Fragment Responses:
- ☒ **Yes**
- ☐ No
- ☐ Configurable

Sequential File Transfer Support:

© 2017 Siemens Protection Devices Limited

DNP V3.0
DEVICE PROFILE DOCUMENT
(Also see the DNP 3.0 Implementation Table in Section 5.2, beginning on page 56).

File Transfer Support	Yes	✖ **No**
Append File Mode	☐ Yes	☒ **No**
Custom Status Code Strings	☐ Yes	☒ **No**
Permissions Field	☐ Yes	☒ **No**
File Events Assigned to Class	☐ Yes	☒ **No**
File Events Send Immediately	☐ Yes	☒ **No**
Multiple Blocks in a Fragment	☐ Yes	☒ **No**
Max Number of Files Open	**0**	

© 2017 Siemens Protection Devices Limited

5.2 Implementation Table

The following table identifies which object variations, function codes, and qualifiers the Triangle MicroWorks, Inc. DNP 3.0 Slave Source Code Library supports in both request messages and in response messages. For static (non-change-event) objects, requests sent with qualifiers 00, 01, 06, 07, or 08, will be responded with qualifiers 00 or 01. Requests sent with qualifiers 17 or 28 will be responded with qualifiers 17 or 28. For change-event objects, qualifiers 17 or 28 are always responded.

In the table below, text shaded as 00, 01 (start stop) indicates Subset Level 3 functionality (beyond Subset Level 2).

In the table below, text shaded as 07, 08 (limited qty) indicates functionality beyond Subset Level 3.

OBJECT			REQUEST (Library will parse)		RESPONSE (Library will respond with)	
Object Number	**Variation**	**Description**	**Function Codes (dec)**	**Qualifier Codes (hex)**	**Function Codes (dec)**	**Qualifier Codes (hex)**
1	0	Binary Input - Any Variation	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)		
1	1	Binary Input	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index - see note 2)
1	2 (default - see note 1)	Binary Input with Status	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index - see note 2)
2	0	Binary Input Change - Any Variation	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
2	1	Binary Input Change without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
2	2 (default - see note 1)	Binary Input Change with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
2	3	Binary Input Change with Relative Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
3	0	Double Bit Input - Any Variation	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)		
3	1 (default - see note 1)	Double Bit Input	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index - see note 1)
3	2	Double Bit Input with Status	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index - see note 1)
4	0	Double Bit Input Change - Any Variation	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
4	1	Double Bit Input Change without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
4	2	Double Bit Input Change with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
4	3 (default - see note 1)	Double Bit Input Change with Relative Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
10	0	Binary Output - Any Variation	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)		

© 2017 Siemens Protection Devices Limited

OBJECT			REQUEST (Library will parse)		RESPONSE (Library will respond with)	
Object Number	Variation	Description	Function Codes (dec)	Qualifier Codes (hex)	Function Codes (dec)	Qualifier Codes (hex)
10	1	Binary Output	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index - see note 2)
			2 (write)	00, 01 (start-stop)		
10	2 (default - see note 1)	Binary Output Status	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index - see note 2)
11	0	Binary Output Change - Any Variation	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
11	1	Binary Output Change without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
11	2 (default - see note 1)	Binary Output Change with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
12	0	Control Relay Output Block	22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)		
12	1	Control Relay Output Block	3 (select) 4 (operate) 5 (direct op) 6 (dir. op, noack)	17, 28 (index)	129 (response)	echo of request
12	2	Pattern Control Block	3 (select) 4 (operate) 5 (direct op) 6 (dir. op, noack)	7 (limited quantity)	129 (response)	echo of request
12	3	Pattern Mask	3 (select) 4 (operate) 5 (direct op) 6 (dir. op, noack)	00, 01 (start-stop)	129 (response)	echo of request
13	0	Binary Output Command Event - Any Variation	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
13	1 (default - see note 1)	Binary Output Command Event without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
13	2	Binary Output Command Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
20	0	Binary Counter - Any Variation	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)		
			7 (freeze) 8 (freeze noack) 9 (freeze clear) 10 (frz. cl. noack)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty)		
20	1	32-Bit Binary Counter (with Flag)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index - see note 2)
20	2	16-Bit Binary Counter (with Flag)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index - see note 2)
20	3	32-Bit Delta Counter (with Flag)				
20	4	16-Bit Delta Counter (with Flag)				
20	5 (default see note 1)	32-Bit Binary Counter (without Flag)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index - see note 2)

© 2017 Siemens Protection Devices Limited

OBJECT			REQUEST (Library will parse)		RESPONSE (Library will respond with)	
Object Number	Variation	Description	Function Codes (dec)	Qualifier Codes (hex)	Function Codes (dec)	Qualifier Codes (hex)
20	6	16-Bit Binary Counter (without Flag)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index - see note 2)
20	7	32-Bit Delta Counter (without Flag)				
20	8	16-Bit Delta Counter (without Flag)				
21	0	Frozen Counter - Any Variation	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)		
21	1	32-Bit Frozen Counter (with Flag)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index - see note 2)
21	2	16-Bit Frozen Counter (with Flag)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index - see note 2)
21	3	32-Bit Frozen Delta Counter (with Flag)				
21	4	16-Bit Frozen Delta Counter (with Flag)				
21	5	32-Bit Frozen Counter (without Time Of Freeze)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index - see note 2)
21	6	16-Bit Frozen Counter (without Time Of Freeze)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index - see note 2)
21	7	32-Bit Frozen Delta Counter (with Time Of Freeze)				
21	8	16-Bit Frozen Delta Counter (with Time Of Freeze)				
21	9 (default - see note 1)	32-Bit Frozen Counter (without Flag)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index - see note 2)
21	10	16-Bit Frozen Counter (without Flag)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index - see note 2)
21	11	32-Bit Frozen Delta Counter (without Flag)				
21	12	16-Bit Frozen Delta Counter (without Flag)				
22	0	Counter Change Event - Any Variation	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
22	1 (default - see note 1)	32-Bit Counter Change Event (without Time)	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
22	2	16-Bit Counter Change Event (without Time)	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
22	3	32-Bit Delta Counter Change Event (without Time)				
22	4	16-Bit Delta Counter Change Event (without Time)				
22	5	32-Bit Counter Change Event (with Time)	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
22	6	16-Bit Counter Change Event (with Time)	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130	17, 28 (index)

© 2017 Siemens Protection Devices Limited

OBJECT			REQUEST (Library will parse)		RESPONSE (Library will respond with)	
Object Number	**Variation**	**Description**	**Function Codes (dec)**	**Qualifier Codes (hex)**	**Function Codes (dec)**	**Qualifier Codes (hex)**
					(unsol. resp)	
22	7	32-Bit Delta Counter Change Event (with Time)				
22	8	16-Bit Delta Counter Change Event (with Time)				
23	0	Frozen Counter Event (Variation 0 is used to request default variation)	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
23	1 (default - see note 1)	32-Bit Frozen Counter Event	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response)	17, 28 (index)
23	2	16-Bit Frozen Counter Event	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response)	17, 28 (index)
23	3	32-Bit Frozen Delta Counter Event				
23	4	16-Bit Frozen Delta Counter Event				
23	5	32-Bit Frozen Counter Event (with Time)	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
23	6	32-Bit Frozen Counter Event (with Time)	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
23	7	32-Bit Frozen Delta Counter Event (with Time)				
23	8	16-Bit Frozen Delta Counter Event (with Time)				
30	0	Analog Input - Any Variation	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)		
30	1	32-Bit Analog Input	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index - see note 2)
30	2 (default - see note 1)	16-Bit Analog Input	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index - see note 2)
30	3	32-Bit Analog Input (without Flag)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index - see note 2)
30	4	16-Bit Analog Input (without Flag)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index - see note 2)
30	5	short floating point	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index - see note 2)
30	6	long floating point	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index - see note 2)
31	0	Frozen Analog Input - Any Variation				
31	1	32-Bit Frozen Analog Input				
31	2	16-Bit Frozen Analog Input				
31	3	32-Bit Frozen Analog Input (with Time of freeze)				
31	4	16-Bit Frozen Analog Input (with Time of freeze)				
31	5	32-Bit Frozen Analog Input (without Flag)				
31	6	16-Bit Frozen Analog Input (without Flag)				

© 2017 Siemens Protection Devices Limited

OBJECT			REQUEST (Library will parse)		RESPONSE (Library will respond with)	
Object Number	**Variation**	**Description**	**Function Codes (dec)**	**Qualifier Codes (hex)**	**Function Codes (dec)**	**Qualifier Codes (hex)**
32	0	Analog Change Event - Any Variation)	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
32	1	32Bit-Analog Change Event (without Time)	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
32	2	16Bit-Analog Change Event (without Time)	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
32	3	32Bit-Analog Change Event (with Time)	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
32	4 (default - see note 1)	16Bit-Analog Change Event (with Time)	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
32	5	short floating point Analog Change Event (without Time)	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
32	6	long floating point Analog Change Event (without Time)	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
32	7	short floating point Analog Change Event (with Time)	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
32	8	long floating point Analog Change Event (with Time)	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
33	0	Frozen Analog Event - Any Variation				
33	1	32-Bit Frozen Analog Event (without Time)				
33	2	16-Bit Frozen Analog Event (without Time)				
33	3	32-Bit Frozen Analog Event (with Time)				
33	4	16-Bit Frozen Analog Event (with Time)				
33	5	Short Floating Point Frozen Analog Event				
33	6	Long Floating Point Frozen Analog Event				
33	7	Extended Floating Point Frozen Analog Event				
34	0	Analog Input Deadband (Variation 0 is used to request default variation)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)		
34	1	16 bit Analog Input Deadband	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index - see note 2)
			2 (write)	00, 01 (start-stop) 07, 08 (limited qty) 17, 27, 28 (index)		
34	2 (default - see note 1)	32 bit Analog Input Deadband	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index - see note 2)
			2(write)	00, 01 (start-stop) 07, 08 (limited qty) 17, 27, 28 (index)		
34	3	Short Floating Point Analog Input Deadband	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty)	129 (response)	00, 01 (start-stop) 17, 28 (index - see note 2)

© 2017 Siemens Protection Devices Limited

OBJECT			REQUEST (Library will parse)		RESPONSE (Library will respond with)	
Object Number	Variation	Description	Function Codes (dec)	Qualifier Codes (hex)	Function Codes (dec)	Qualifier Codes (hex)
				17, 27, 28 (index)		
			2 (write)	00, 01 (start-stop) 07, 08 (limited qty) 17, 27, 28 (index)		
50	0	Time and Date				
50	1 (default - see note 1)	Time and Date	1 (read)	07, 08 (limited qty)	129 (response)	07 (limited qty = 1)
			2 (write)	00, 01 (start-stop) 07, 08 (limited qty) 17, 27, 28 (index)		
50	3	Time and Date Last Recorded Time	2 (write)	07 (limited qty)		
51	1	Time and Date CTO			129 (response) 130 (unsol. resp)	(limited qty = 1)
51	2	Unsynchronized Time and Date CTO			129 (response) 130 (unsol. resp)	(limited qty = 1)
52	1	Time Delay Coarse			129 (response)	(limited qty = 1)
52	2	Time Delay Fine			129 (response)	(limited qty = 1)
60	0	Not Defined				
60	1	Class 0 Data	1 (read)	06 (no range, or all)		
60	2	Class 1 Data	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
			20 (enbl. unsol.) 21 (dab. unsol.) 22 (assign class)	06 (no range, or all)		
60	3	Class 2 Data	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
			20 (enbl. unsol.) 21 (dab. unsol.) 22 (assign class)	06 (no range, or all)		
60	4	Class 3 Data	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
			20 (enbl. unsol.) 21 (dab. unsol.) 22 (assign class)	06 (no range, or all)		
80	1	Internal Indications	1 (read)	00, 01 (start-stop)	129 (response)	00, 01 (start-stop)
			2 (write)(see note 3)	00 (start-stop) index=7		
		No Object (function code only)	13 (cold restart)			
		No Object (function code only)	14 (warm restart)			
		No Object (function code only)	23 (delay meas.)			
		No Object (function code only)	24 (record current time)			

Note 1: A Default variation refers to the variation responded when variation 0 is requested and/or in class 0, 1, 2, or 3 scans. Default variations are configurable; however, default settings for the configuration parameters are indicated in the table above.

Note 2: For static (non-change-event) objects, qualifiers 17 or 28 are only responded when a request is sent with qualifiers 17 or 28, respectively. Otherwise, static object requests sent with qualifiers 00, 01, 06, 07, or 08, will be responded with qualifiers 00 or 01. (For change-event objects, qualifiers 17 or 28 are always responded.)

Note 3: Writes of Internal Indications are only supported for index 7 (Restart IIN1-7).

© 2017 Siemens Protection Devices Limited

5.3 Point List

The tables below identify all the default data points provided by the implementation of the Triangle MicroWorks, Inc. DNP 3.0 Slave Source Code Library.

This protocol can be set to use any or all of the relays hardware interfaces (USB, Fibre Optic, RS232 and RS485) where fitted. The relay can communicate simultaneously on all ports regardless of protocol used.

The Station Address of the port being used must be set to a suitable address within the range 0 - 65534 to enable communication. This can be set by the **Communications Menu : COM *n-xxxxx* Station Address** setting.

Communication via DNP3 over Ethernet requires external devices. Please refer to the documents ***TCPIP Catalogue Sheet*** and ***TCPIP Interface Technical Guidance Notes*** for more information.

The information shown below is the default configuration.

5.3.1 Binary Input Points

The default binary input event buffer size is set to allow 100 events.

Binary inputs are by default returned in a class zero interrogation.

Note, not all points listed here apply to all builds of devices.

Binary Input Points
Static (Steady-State) Object Number: **1 (Packed Format)**
Change Event Object Number: **1 (w/o Time)**
Static Variation reported when variation 0 requested: **1 (Binary Input w/o status)**
or **2 (Binary Input with status)**
Change Event Variation reported when variation 0 requested: **1 (Binary Input Change w/o Time)**
or **2 (Binary Input Change with Absolute Time)**
or **3 (Binary Input Change with Relative Time)**

Point Index	Description	Default Change Event Assigned Class (1, 2, 3 or none)	Default Variation Static Object 1	Default Variation Event Object 2
1	Binary Input 1	0,2	2	2
2	Binary Input 2	0,2	2	2
3	Binary Input 3	0,2	2	2
4	Binary Input 4	0,2	2	2
5	Binary Input 5	0,2	2	2
6	Binary Input 6	0,2	2	2
7	Binary Input 7	0,2	2	2
8	Binary Input 8	0,2	2	2
9	Binary Input 9	0,2	2	2
10	Binary Input 10	0,2	2	2
11	Binary Input 11	0,2	2	2
12	Binary Input 12	0,2	2	2
13	Binary Input 13	0,2	2	2
35	Remote Mode	0,2	2	2
36	Out Of Service Mode	0,2	2	2
37	Local Mode	0,2	2	2
38	Local & Remote	0,2	2	2
40	General Trip	0,2	2	2
41	Trip Circuit Fail	0,2	2	2
42	Start/Pick-up L1	0,2	2	2
43	Start/Pick-up L2	0,2	2	2

© 2017 Siemens Protection Devices Limited

Binary Input Points
Static (Steady-State) Object Number: **1 (Packed Format)**
Change Event Object Number: **1 (w/o Time)**
Static Variation reported when variation 0 requested: **1 (Binary Input w/o status)**
or **2 (Binary Input with status)**
Change Event Variation reported when variation 0 requested: **1 (Binary Input Change w/o Time)**
or **2 (Binary Input Change with Absolute Time)**
or **3 (Binary Input Change with Relative Time)**

Point Index	Description	Default Change Event Assigned Class (1, 2, 3 or none)	Default Variation Static Object 1	Default Variation Event Object 2
44	Start/Pick-up L3	0,2	2	2
45	General Start/Pick-up	0,2	2	2
46	VT Fuse Failure	0,2	2	2
47	Earth Fault Forward/Line	0,2	2	2
48	Earth Fault Reverse/Busbar	0,2	2	2
49	Start/Pick-up N	0,2	2	2
50	Fault Forward/Line	0,2	2	2
51	Fault Reverse/Busbar	0,2	2	2
52	51-1	0,2	2	2
53	50-1	0,2	2	2
54	51N-1	0,2	2	2
55	50N-1	0,2	2	2
56	51G-1	0,2	2	2
57	50G-1	0,2	2	2
58	51-2	0,2	2	2
59	50-2	0,2	2	2
60	51N-2	0,2	2	2
61	50N-2	0,2	2	2
62	51G-2	0,2	2	2
63	50G-2	0,2	2	2
64	60 CTS	0,2	2	2
65	46IT	0,2	2	2
66	46DT	0,2	2	2
67	47-1	0,2	2	2
68	47-2	0,2	2	2
69	46BC	0,2	2	2
70	27/59-1	0,2	2	2
71	27/59-2	0,2	2	2
72	27/59-3	0,2	2	2
73	27/59-4	0,2	2	2
74	59NIT	0,2	2	2
75	59NDT	0,2	2	2
76	81-1	0,2	2	2
77	81-2	0,2	2	2
78	81-3	0,2	2	2
79	81-4	0,2	2	2
80	Auto-reclose active	0,2	2	2
81	CB on by auto reclose	0,2	2	2
82	Reclaim	0,2	2	2
83	Lockout	0,2	2	2
84	81-5	0,2	2	2

© 2017 Siemens Protection Devices Limited

Binary Input Points
Static (Steady-State) Object Number: **1 (Packed Format)**
Change Event Object Number: **1 (w/o Time)**
Static Variation reported when variation 0 requested: **1 (Binary Input w/o status)**
or **2 (Binary Input with status)**
Change Event Variation reported when variation 0 requested: **1 (Binary Input Change w/o Time)**
or **2 (Binary Input Change with Absolute Time)**
or **3 (Binary Input Change with Relative Time)**

Point Index	Description	Default Change Event Assigned Class (1, 2, 3 or none)	Default Variation Static Object 1	Default Variation Event Object 2
85	81-6	0,2	2	2
86	51-3	0,2	2	2
87	50-3	0,2	2	2
88	51N-3	0,2	2	2
89	50N-3	0,2	2	2
90	51G-3	0,2	2	2
91	50G-3	0,2	2	2
92	51-4	0,2	2	2
93	50-4	0,2	2	2
94	51N-4	0,2	2	2
95	50N-4	0,2	2	2
96	51G-4	0,2	2	2
97	50G-4	0,2	2	2
98	Cold Load Active	0,2	2	2
99	E/F Out	0,2	2	2
100	P/F Inst Protection Inhibited	0,2	2	2
101	E/F Inst Protection Inhibited	0,2	2	2
102	SEF Inst Protection Inhibited	0,2	2	2
103	Ext Inst Protection Inhibited	0,2	2	2
117	51SEF-1	0,2	2	2
118	50SEF-1	0,2	2	2
119	51SEF-2	0,2	2	2
120	50SEF-2	0,2	2	2
121	51SEF-3	0,2	2	2
122	50SEF-3	0,2	2	2
123	51SEF-4	0,2	2	2
124	50SEF-4	0,2	2	2
125	SEF Out	0,2	2	2
126	Trip Circuit Fail 1	0,2	2	2
127	Trip Circuit Fail 2	0,2	2	2
128	Trip Circuit Fail 3	0,2	2	2
129	CB Total Trip Count	0,2	2	2
130	CB Delta Trip Count	0,2	2	2
131	CB Count To AR Block	0,2	2	2
132	CB Frequent Ops Count	0,2	2	2
133	I^2t CB Wear	0,2	2	2
207	Close Circuit Fail 1	0,2	2	2
208	Close Circuit Fail 2	0,2	2	2
209	Close Circuit Fail 3	0,2	2	2
210	Close Circuit Fail	0,2	2	2
211	50BF Stage 1	0,2	2	2
212	50BF Stage 2	0,2	2	2

© 2017 Siemens Protection Devices Limited

Binary Input Points
Static (Steady-State) Object Number: **1 (Packed Format)**
Change Event Object Number: **1 (w/o Time)**
Static Variation reported when variation 0 requested: **1 (Binary Input w/o status)**
or **2 (Binary Input with status)**
Change Event Variation reported when variation 0 requested: **1 (Binary Input Change w/o Time)**
or **2 (Binary Input Change with Absolute Time)**
or **3 (Binary Input Change with Relative Time)**

Point Index	Description	Default Change Event Assigned Class (1, 2, 3 or none)	Default Variation Static Object 1	Default Variation Event Object 2
213	49-Alarm	0,2	2	2
214	49-Trip	0,2	2	2
215	64H	0,2	2	2
216	Vx27/59	0,2	2	2
217	37-1	0,2	2	2
218	37-2	0,2	2	2
219	CB Alarm	0,2	2	2
225	General Alarm 1	0,2	2	2
226	General Alarm 2	0,2	2	2
227	General Alarm 3	0,2	2	2
228	General Alarm 4	0,2	2	2
229	General Alarm 5	0,2	2	2
230	General Alarm 6	0,2	2	2
231	General Alarm 7	0,2	2	2
232	General Alarm 8	0,2	2	2
233	General Alarm 9	0,2	2	2
234	General Alarm 10	0,2	2	2
235	General Alarm 11	0,2	2	2
236	General Alarm 12	0,2	2	2
237	Quick Logic E1	0,2	2	2
238	Quick Logic E2	0,2	2	2
239	Quick Logic E3	0,2	2	2
240	Quick Logic E4	0,2	2	2
241	Quick Logic E5	0,2	2	2
242	Quick Logic E6	0,2	2	2
243	Quick Logic E7	0,2	2	2
244	Quick Logic E8	0,2	2	2
245	Quick Logic E9	0,2	2	2
246	Quick Logic E10	0,2	2	2
247	Quick Logic E11	0,2	2	2
248	Quick Logic E12	0,2	2	2
249	Quick Logic E13	0,2	2	2
250	Quick Logic E14	0,2	2	2
251	Quick Logic E15	0,2	2	2
252	Quick Logic E16	0,2	2	2
269	60 CTS-I	0,2	2	2
270	81HBL2	0,2	2	2
271	37G-1	0,2	2	2
272	37G-2	0,2	2	2
273	Wattmetric Po>	0,2	2	2
274	37-PhA	0,2	2	2

© 2017 Siemens Protection Devices Limited

Binary Input Points
Static (Steady-State) Object Number: **1 (Packed Format)**
Change Event Object Number: **1 (w/o Time)**
Static Variation reported when variation 0 requested: **1 (Binary Input w/o status)**
or **2 (Binary Input with status)**
Change Event Variation reported when variation 0 requested: **1 (Binary Input Change w/o Time)**
or **2 (Binary Input Change with Absolute Time)**
or **3 (Binary Input Change with Relative Time)**

Point Index	Description	Default Change Event Assigned Class (1, 2, 3 or none)	Default Variation Static Object 1	Default Variation Event Object 2
275	37-PhB	0,2	2	2
276	37-PhC	0,2	2	2
283	50BF-PhA	0,2	2	2
284	50BF-PhB	0,2	2	2
285	50BF-PhC	0,2	2	2
286	50BF-EF	0,2	2	2
287	79 Last Trip Lockout	0,2	2	2
288	60 CTS-I-PhA	0,2	2	2
289	60 CTS-I-PhB	0,2	2	2
290	60 CTS-I-PhC	0,2	2	2
291	Trip PhA	0,2	2	2
292	Trip PhB	0,2	2	2
293	Trip PhC	0,2	2	2
302	27/59 PhA	0,2	2	2
303	27/59 PhB	0,2	2	2
304	27/59 PhC	0,2	2	2
310	General Alarm 13	0,2	2	2
311	General Alarm 14	0,2	2	2
312	General Alarm 15	0,2	2	2
313	General Alarm 16	0,2	2	2
314	General Alarm 17	0,2	2	2
315	General Alarm 18	0,2	2	2
316	General Alarm 19	0,2	2	2
317	General Alarm 20	0,2	2	2
330	32-1	0,2	2	2
331	32-2	0,2	2	2
332	32S-1	0,2	2	2
333	32S-2	0,2	2	2
334	55-1	0,2	2	2
335	55-2	0,2	2	2
373	37SEF-1	0,2	2	2
374	37SEF-2	0,2	2	2
387	25 System Split	0,2	2	2
388	25 Live Line	0,2	2	2
389	25 Live Bus	0,2	2	2
390	25 Line U/V	0,2	2	2
391	25 Bus U/V	0,2	2	2
392	25 Voltage Dif >	0,2	2	2
393	25 CS Slip Freq >	0,2	2	2
394	25 SS Slip Freq >	0,2	2	2
395	25 COZ Slip Freq >	0,2	2	2
396	25 In Sync	0,2	2	2

© 2017 Siemens Protection Devices Limited

Binary Input Points
Static (Steady-State) Object Number: **1 (Packed Format)**
Change Event Object Number: **1 (w/o Time)**
Static Variation reported when variation 0 requested: **1 (Binary Input w/o status)**
or **2 (Binary Input with status)**
Change Event Variation reported when variation 0 requested: **1 (Binary Input Change w/o Time)**
or **2 (Binary Input Change with Absolute Time)**
or **3 (Binary Input Change with Relative Time)**

Point Index	Description	Default Change Event Assigned Class (1, 2, 3 or none)	Default Variation Static Object 1	Default Variation Event Object 2
397	25 CS In Progress	0,2	2	2
398	25 SS In Progress	0,2	2	2
399	25 COZ In Progress	0,2	2	2
400	25 System Split LO	0,2	2	2
401	60VTF-Bus	0,2	2	2
411	Setting G1 selected	0,2	2	2
412	Setting G2 selected	0,2	2	2
413	Setting G3 selected	0,2	2	2
414	Setting G4 selected	0,2	2	2
415	Setting G5 selected	0,2	2	2
416	Setting G6 selected	0,2	2	2
417	Setting G7 selected	0,2	2	2
418	Setting G8 selected	0,2	2	2
420	79 AR In progress	0,2	2	2
422	HotLine Working	0,2	2	2
425	Inst Protection Out	0,2	2	2
427	CB 1	0,2	2	2
434	Man Override Sync	0,2	2	2
435	79 Override Sync	0,2	2	2
501	Virtual Input 1	0,2	2	2
502	Virtual Input 2	0,2	2	2
503	Virtual Input 3	0,2	2	2
504	Virtual Input 4	0,2	2	2
505	Virtual Input 5	0,2	2	2
506	Virtual Input 6	0,2	2	2
507	Virtual Input 7	0,2	2	2
508	Virtual Input 8	0,2	2	2
509	Virtual Input 9	0,2	2	2
510	Virtual Input 10	0,2	2	2
511	Virtual Input 11	0,2	2	2
512	Virtual Input 12	0,2	2	2
513	Virtual Input 13	0,2	2	2
514	Virtual Input 14	0,2	2	2
515	Virtual Input 15	0,2	2	2
516	Virtual Input 16	0,2	2	2
601	LED 1	0,2	2	2
602	LED 2	0,2	2	2
603	LED 3	0,2	2	2
604	LED 4	0,2	2	2
605	LED 5	0,2	2	2
606	LED 6	0,2	2	2

© 2017 Siemens Protection Devices Limited

Binary Input Points
Static (Steady-State) Object Number: **1 (Packed Format)**
Change Event Object Number: **1 (w/o Time)**
Static Variation reported when variation 0 requested: **1 (Binary Input w/o status)**
or **2 (Binary Input with status)**
Change Event Variation reported when variation 0 requested: **1 (Binary Input Change w/o Time)**
or **2 (Binary Input Change with Absolute Time)**
or **3 (Binary Input Change with Relative Time)**

Point Index	Description	Default Change Event Assigned Class (1, 2, 3 or none)	Default Variation Static Object 1	Default Variation Event Object 2
607	LED 7	0,2	2	2
608	LED 8	0,2	2	2
609	LED 9	0,2	2	2
610	LED 10	0,2	2	2
611	LED 11	0,2	2	2
612	LED 12	0,2	2	2
613	LED 13	0,2	2	2
614	LED 14	0,2	2	2
615	LED 15	0,2	2	2
616	LED 16	0,2	2	2
701	LED PU 1	0,2	2	2
702	LED PU 2	0,2	2	2
703	LED PU 3	0,2	2	2
704	LED PU 4	0,2	2	2
705	LED PU 5	0,2	2	2
706	LED PU 6	0,2	2	2
707	LED PU 7	0,2	2	2
708	LED PU 8	0,2	2	2
709	LED PU 9	0,2	2	2
710	LED PU 10	0,2	2	2
711	LED PU 11	0,2	2	2
712	LED PU 12	0,2	2	2
713	LED PU 13	0,2	2	2
714	LED PU 14	0,2	2	2
715	LED PU 15	0,2	2	2
716	LED PU 16	0,2	2	2
801	Binary Output 1	0,2	2	2
802	Binary Output 2	0,2	2	2
803	Binary Output 3	0,2	2	2
804	Binary Output 4	0,2	2	2
805	Binary Output 5	0,2	2	2
806	Binary Output 6	0,2	2	2
807	Binary Output 7	0,2	2	2
808	Binary Output 8	0,2	2	2
809	Binary Output 9	0,2	2	2
810	Binary Output 10	0,2	2	2
811	Binary Output 11	0,2	2	2
812	Binary Output 12	0,2	2	2
813	Binary Output 13	0,2	2	2
814	Binary Output 14	0,2	2	2
871	Cold Start	0,2	2	2
872	Warm Start	0,2	2	2

© 2017 Siemens Protection Devices Limited

Binary Input Points
Static (Steady-State) Object Number: **1 (Packed Format)**
Change Event Object Number: **1 (w/o Time)**
Static Variation reported when variation 0 requested: **1 (Binary Input w/o status)**
or **2 (Binary Input with status)**
Change Event Variation reported when variation 0 requested: **1 (Binary Input Change w/o Time)**
or **2 (Binary Input Change with Absolute Time)**
or **3 (Binary Input Change with Relative Time)**

Point Index	Description	Default Change Event Assigned Class (1, 2, 3 or none)	Default Variation Static Object 1	Default Variation Event Object 2
873	Re-Start	0,2	2	2
874	Power On	0,2	2	2
875	Expected Restart	0,2	2	2
876	Unexpected Restart	0,2	2	2
877	Reset Start Count	0,2	2	2
890	CB 1 Opened	0,2	2	2
891	CB 1 Closed	0,2	2	2
900	User SP Command 1	0,2	2	2
901	User SP Command 2	0,2	2	2
902	User SP Command 3	0,2	2	2
903	User SP Command 4	0,2	2	2
904	User SP Command 5	0,2	2	2
905	User SP Command 6	0,2	2	2
906	User SP Command 7	0,2	2	2
907	User SP Command 8	0,2	2	2
1010	User Output 1	0,2	2	2
1011	User Output 2	0,2	2	2
1012	User Output 3	0,2	2	2
1013	User Output 4	0,2	2	2
1014	User Output 5	0,2	2	2
1015	User Output 6	0,2	2	2
1016	User Output 7	0,2	2	2
1017	User Output 8	0,2	2	2
1018	User Output 9	0,2	2	2
1019	User Output 10	0,2	2	2
1020	User Output 11	0,2	2	2
1021	User Output 12	0,2	2	2
1022	User Output 13	0,2	2	2
1023	User Output 14	0,2	2	2
1024	User Output 15	0,2	2	2
1025	User Output 16	0,2	2	2
1026	User Output 17	0,2	2	2
1027	User Output 18	0,2	2	2
1028	User Output 19	0,2	2	2
1029	User Output 20	0,2	2	2
1030	User Output 21	0,2	2	2
1031	User Output 22	0,2	2	2
1032	User Output 23	0,2	2	2
1033	User Output 24	0,2	2	2
1034	User Output 25	0,2	2	2
1035	User Output 26	0,2	2	2

© 2017 Siemens Protection Devices Limited

Binary Input Points
Static (Steady-State) Object Number: **1 (Packed Format)**
Change Event Object Number: **1 (w/o Time)**
Static Variation reported when variation 0 requested: **1 (Binary Input w/o status)**
or **2 (Binary Input with status)**
Change Event Variation reported when variation 0 requested: **1 (Binary Input Change w/o Time)**
or **2 (Binary Input Change with Absolute Time)**
or **3 (Binary Input Change with Relative Time)**

Point Index	Description	Default Change Event Assigned Class (1, 2, 3 or none)	Default Variation Static Object 1	Default Variation Event Object 2
1036	User Output 27	0,2	2	2
1037	User Output 28	0,2	2	2
1038	User Output 29	0,2	2	2
1039	User Output 30	0,2	2	2
1040	User Output 31	0,2	2	2
1041	User Output 32	0,2	2	2
1061	E/F In	0,2	2	2
1062	SEF In	0,2	2	2
1063	CB DBI	0,2	2	2
1064	CB Travelling	0,2	2	2
1065	Close CB Failed	0,2	2	2
1066	Open CB Failed	0,2	2	2
1067	Start Count Alarm	0,2	2	2
1068	50AFD PhA	0,2	2	2
1069	50AFD PhB	0,2	2	2
1070	50AFD PhC	0,2	2	2
1071	50AFD	0,2	2	2
1072	AFD Zone 1 Flash	0,2	2	2
1073	AFD Zone 1	0,2	2	2
1074	AFD Zone 2 Flash	0,2	2	2
1075	AFD Zone 2	0,2	2	2
1076	AFD Zone 3 Flash	0,2	2	2
1077	AFD Zone 3	0,2	2	2
1078	AFD Zone 4 Flash	0,2	2	2
1079	AFD Zone 4	0,2	2	2
1080	AFD Zone 5 Flash	0,2	2	2
1081	AFD Zone 5	0,2	2	2
1082	AFD Zone 6 Flash	0,2	2	2
1083	AFD Zone 6	0,2	2	2
1084	21LB-3P Fwd	0,2	2	2
1085	21LB-3P Rev	0,2	2	2
1086	21LB-1P Fwd	0,2	2	2
1087	21LB-1P Rev	0,2	2	2
1088	81HBL5	0,2	2	2

5.3.2 Double Bit Input Points

The default double bit input event buffer size is set to allow 100 events.

Double bit inputs are by default returned in a class zero interrogation.

Note, not all points listed here apply to all builds of devices.

© 2017 Siemens Protection Devices Limited

Double Bit Input Points
Static (Steady-State) Object Number: **3**
Change Event Object Number: **4**
Static Variation reported when variation 0 requested: **1 (Double Bit Input w/o status)**
or **2 (Double Bit Input with status)**
Change Event Variation reported when variation 0 requested: **1 (Double Bit Input Change w/o Time)**
or **2 (Double Bit Input Change with Absolute Time)**
or **3 (Double Bit Input Change with Relative Time)**

Point Index	Description	Default Change Event Assigned Class (1, 2, 3 or none)	Default Variation Static Object 3	Default Variation Event Object 4
0	CB 1	0,2	1	3
10	User DP Command 1	0,2	1	3
11	User DP Command 2	0,2	1	3
12	User DP Command 3	0,2	1	3
13	User DP Command 4	0,2	1	3
14	User DP Command 5	0,2	1	3
15	User DP Command 6	0,2	1	3
16	User DP Command 7	0,2	1	3
17	User DP Command 8	0,2	1	3

5.3.3 Binary Output Status Points and Control Relay Output Blocks

The following table lists both the Binary Output Status Points (Object 10) and the Control Relay Output Blocks (Object 12).

While Binary Output Status Points are included here for completeness, they are not often polled by DNP 3.0 Masters. Binary Output Status points are not recommended to be included in class 0 polls.

As an alternative, it is recommended that “actual” status values of Control Relay Output Block points be looped around and mapped as Binary Inputs. (The “actual” status value, as opposed to the “commanded” status value, is the value of the actuated control. For example, a DNP control command may be blocked through hardware or software mechanisms; in this case, the actual status value would indicate the control failed because of the blocking. Looping Control Relay Output Block actual status values as Binary Inputs has several advantages:

- it allows actual statuses to be included in class 0 polls,
- it allows change event reporting of the actual statuses, which is a more efficient and time-accurate method of communicating control values,
- and it allows reporting of time-based information associated with controls, including any delays before controls are actuated, and any durations if the controls are pulsed.

The default select/control buffer size is large enough to hold 10 of the largest select requests possible.

Binary outputs are by default **NOT** returned in a class zero interrogation.

Note, not all points listed here apply to all builds of devices.

© 2017 Siemens Protection Devices Limited

Binary Output Status Points
Static (Steady-State) Object Number: **10**
Change Event Object Number: **11**
Control Relay Output Blocks (CROB) Object Number: **12**
Binary Output Command Event Object Number: **13**
Static Variation reported when variation 0 requested: **1 (Binary Output w/o status)**
or **2 (Binary Output with status)**
Change Event Variation reported when variation 0 requested: **1 (Binary Output Event w/o Time)**
or **2 (Binary Output Event with Time)**
Command Event Variation reported when variation 0 requested: **1 (Command Status w/o Time)**
or **2 (Command Status with Time)**

Point Index	Description	Default Change Event Assigned Class (1, 2, 3 or none)	Default Variation Static Object 10	Default Variation Event Object 11	Default Command Event Object 13 Assigned Class (1, 2, 3 or none)	Default Variation Command Event Object 13	CROB Supported Operations	Default CROB Operations
1	RL 1	0	2	2	0	1	Pulse On Latch On Close	Pulse On
2	RL 2	0	2	2	0	1	Pulse On Latch On Close	Pulse On
3	RL 3	0	2	2	0	1	Pulse On Latch On Close	Pulse On
4	RL 4	0	2	2	0	1	Pulse On Latch On Close	Pulse On
5	RL 5	0	2	2	0	1	Pulse On Latch On Close	Pulse On
6	RL 6	0	2	2	0	1	Pulse On Latch On Close	Pulse On
7	RL 7	0	2	2	0	1	Pulse On Latch On Close	Pulse On
8	RL 8	0	2	2	0	1	Pulse On Latch On Close	Pulse On
9	RL 9	0	2	2	0	1	Pulse On Latch On Close	Pulse On
10	RL 10	0	2	2	0	1	Pulse On Latch On Close	Pulse On
11	RL 11	0	2	2	0	1	Pulse On Latch On Close	Pulse On
12	RL 12	0	2	2	0	1	Pulse On Latch On Close	Pulse On
13	RL 13	0	2	2	0	1	Pulse On Latch On Close	Pulse On
14	RL 14	0	2	2	0	1	Pulse On Latch On Close	Pulse On
33	LED reset, write only location.	0	2	2	0	1	Pulse On Latch On Close	Pulse On

© 2017 Siemens Protection Devices Limited

Binary Output Status Points
Static (Steady-State) Object Number: **10**
Change Event Object Number: **11**
Control Relay Output Blocks (CROB) Object Number: **12**
Binary Output Command Event Object Number: **13**
Static Variation reported when variation 0 requested: **1 (Binary Output w/o status)**
or **2 (Binary Output with status)**
Change Event Variation reported when variation 0 requested: **1 (Binary Output Event w/o Time)**
or **2 (Binary Output Event with Time)**
Command Event Variation reported when variation 0 requested: **1 (Command Status w/o Time)**
or **2 (Command Status with Time)**

Point Index	Description	Default Change Event Assigned Class (1, 2, 3 or none)	Default Variation Static Object 10	Default Variation Event Object 11	Default Command Event Object 13 Assigned Class (1, 2, 3 or none)	Default Variation Command Event Object 13	CROB Supported Operations	Default CROB Operations
34	Settings Group 1	0	2	2	0	1	Pulse On Latch On Close	Latch On
35	Settings Group 2	0	2	2	0	1	Pulse On Latch On Close	Latch On
36	Settings Group 3	0	2	2	0	1	Pulse On Latch On Close	Latch On
37	Settings Group 4	0	2	2	0	1	Pulse On Latch On Close	Latch On
38	Settings Group 5	0	2	2	0	1	Pulse On Latch On Close	Latch On
39	Settings Group 6	0	2	2	0	1	Pulse On Latch On Close	Latch On
40	Settings Group 7	0	2	2	0	1	Pulse On Latch On Close	Latch On
41	Settings Group 8	0	2	2	0	1	Pulse On Latch On Close	Latch On
42	Auto-reclose on/off	0	2	2	0	1	Pulse On Pulse Off Latch On Latch Off Close Trip	Pulse On Pulse Off Latch On Latch Off
43	Hot Line Working on/off	0	2	2	0	1	Pulse On Pulse Off Latch On Latch Off Close Trip	Pulse On Pulse Off Latch On Latch Off
44	E/F Out on/off	0	2	2	0	1	Pulse On Pulse Off Latch On Latch Off Close Trip	Pulse On Pulse Off Latch On Latch Off
45	SEF Out on/off	0	2	2	0	1	Pulse On Pulse Off Latch On Latch Off	Pulse On Pulse Off Latch On Latch Off

© 2017 Siemens Protection Devices Limited

Binary Output Status Points
Static (Steady-State) Object Number: **10**
Change Event Object Number: **11**
Control Relay Output Blocks (CROB) Object Number: **12**
Binary Output Command Event Object Number: **13**
Static Variation reported when variation 0 requested: **1 (Binary Output w/o status)**
or **2 (Binary Output with status)**
Change Event Variation reported when variation 0 requested: **1 (Binary Output Event w/o Time)**
or **2 (Binary Output Event with Time)**
Command Event Variation reported when variation 0 requested: **1 (Command Status w/o Time)**
or **2 (Command Status with Time)**

Point Index	Description	Default Change Event Assigned Class (1, 2, 3 or none)	Default Variation Static Object 10	Default Variation Event Object 11	Default Command Event Object 13 Assigned Class (1, 2, 3 or none)	Default Variation Command Event Object 13	CROB Supported Operations	Default CROB Operations
							Close Trip	
46	Inst Protection off/on	0	2	2	0	1	Pulse On Pulse Off Latch On Latch Off Close Trip	Pulse On Pulse Off Latch On Latch Off
48	Reset CB Total Trip Count, write only location.	0	2	2	0	1	Pulse On Latch On Close	Pulse On
49	Reset CB Delta Trip Count, write only location.	0	2	2	0	1	Pulse On Latch On Close	Pulse On
50	Reset CB Count To AR Block, write only location.	0	2	2	0	1	Pulse On Latch On Close	Pulse On
51	Reset CB Frequent Ops Count, write only location.	0	2	2	0	1	Pulse On Latch On Close	Pulse On
53	Reset I^2t CB Wear	0	2	2	0	1	Pulse On Latch On Close	Pulse On
54	CB 1	0	2	2	0	1	Pulse On Pulse Off Latch On Latch Off Close Trip	Pulse On Pulse Off Latch On Latch Off
55	CB 1 Trip & Reclose, write only location.	0	2	2	0	1	Pulse On Latch On Close	Pulse On
56	CB 1 Trip & Lockout, write only location.	0	2	2	0	1	Pulse On Latch On Close	Pulse On
59	Demand metering reset, write only location.	0	2	2	0	1	Pulse On Latch On Close	Pulse On
87	Reset Energy Meters	0	2	2	0	1	Pulse On Latch On Close	Pulse On
88	Remote mode	0	2	2	0	1	Pulse On Latch On Close	Pulse On
89	Service mode	0	2	2	0	1	Pulse On Latch On Close	Pulse On

© 2017 Siemens Protection Devices Limited

Binary Output Status Points
Static (Steady-State) Object Number: **10**
Change Event Object Number: **11**
Control Relay Output Blocks (CROB) Object Number: **12**
Binary Output Command Event Object Number: **13**
Static Variation reported when variation 0 requested: **1 (Binary Output w/o status)**
or **2 (Binary Output with status)**
Change Event Variation reported when variation 0 requested: **1 (Binary Output Event w/o Time)**
or **2 (Binary Output Event with Time)**
Command Event Variation reported when variation 0 requested: **1 (Command Status w/o Time)**
or **2 (Command Status with Time)**

Point Index	Description	Default Change Event Assigned Class (1, 2, 3 or none)	Default Variation Static Object 10	Default Variation Event Object 11	Default Command Event Object 13 Assigned Class (1, 2, 3 or none)	Default Variation Command Event Object 13	CROB Supported Operations	Default CROB Operations
90	Local mode	0	2	2	0	1	Pulse On Latch On Close	Pulse On
91	Local & Remote	0	2	2	0	1	Pulse On Latch On Close	Pulse On
92	Man Override Sync on/off	0	2	2	0	1	Pulse On Pulse Off Latch On Latch Off Close Trip	Pulse On Pulse Off Latch On Latch Off
93	79 Override Sync on/off	0	2	2	0	1	Pulse On Pulse Off Latch On Latch Off Close Trip	Pulse On Pulse Off Latch On Latch Off
94	Reset CB Phase A Trip Count, write only location.	0	2	2	0	1	Pulse On Latch On Close	Pulse On
95	Reset CB Phase B Trip Count, write only location.	0	2	2	0	1	Pulse On Latch On Close	Pulse On
96	Reset CB Phase C Trip Count, write only location.	0	2	2	0	1	Pulse On Latch On Close	Pulse On
97	Reset CB EF Trip Count, write only location.	0	2	2	0	1	Pulse On Latch On Close	Pulse On
98	Reset Start Count (Action)	0	2	2	0	1	Pulse On Latch On Close	Pulse On Latch On
99	User SP Command 1.	0	2	2	0	1	Pulse On Latch On Close	Pulse On
100	User SP Command 2.	0	2	2	0	1	Pulse On Latch On Close	Pulse On
101	User SP Command 3.	0	2	2	0	1	Pulse On Latch On Close	Pulse On
102	User SP Command 4.	0	2	2	0	1	Pulse On Latch On Close	Pulse On

© 2017 Siemens Protection Devices Limited

Binary Output Status Points
Static (Steady-State) Object Number: **10**
Change Event Object Number: **11**
Control Relay Output Blocks (CROB) Object Number: **12**
Binary Output Command Event Object Number: **13**
Static Variation reported when variation 0 requested: **1 (Binary Output w/o status)**
or **2 (Binary Output with status)**
Change Event Variation reported when variation 0 requested: **1 (Binary Output Event w/o Time)**
or **2 (Binary Output Event with Time)**
Command Event Variation reported when variation 0 requested: **1 (Command Status w/o Time)**
or **2 (Command Status with Time)**

Point Index	Description	Default Change Event Assigned Class (1, 2, 3 or none)	Default Variation Static Object 10	Default Variation Event Object 11	Default Command Event Object 13 Assigned Class (1, 2, 3 or none)	Default Variation Command Event Object 13	CROB Supported Operations	Default CROB Operations
103	User SP Command 5.	0	2	2	0	1	Pulse On Latch On Close	Pulse On
104	User SP Command 6.	0	2	2	0	1	Pulse On Latch On Close	Pulse On
105	User SP Command 7.	0	2	2	0	1	Pulse On Latch On Close	Pulse On
106	User SP Command 8.	0	2	2	0	1	Pulse On Latch On Close	Pulse On
107	User DP Command 1.	0	2	2	0	1	Pulse On Pulse Off Latch On Latch Off Close Trip	Pulse On Pulse Off
108	User DP Command 2.	0	2	2	0	1	Pulse On Pulse Off Latch On Latch Off Close Trip	Pulse On Pulse Off
109	User DP Command 3.	0	2	2	0	1	Pulse On Pulse Off Latch On Latch Off Close Trip	Pulse On Pulse Off
110	User DP Command 4.	0	2	2	0	1	Pulse On Pulse Off Latch On Latch Off Close Trip	Pulse On Pulse Off
111	User DP Command 5.	0	2	2	0	1	Pulse On Pulse Off Latch On Latch Off Close Trip	Pulse On Pulse Off
112	User DP Command 6.	0	2	2	0	1	Pulse On Pulse Off Latch On Latch Off Close Trip	Pulse On Pulse Off

© 2017 Siemens Protection Devices Limited

Binary Output Status Points
Static (Steady-State) Object Number: **10**
Change Event Object Number: **11**
Control Relay Output Blocks (CROB) Object Number: **12**
Binary Output Command Event Object Number: **13**
Static Variation reported when variation 0 requested: **1 (Binary Output w/o status)**
or **2 (Binary Output with status)**
Change Event Variation reported when variation 0 requested: **1 (Binary Output Event w/o Time)**
or **2 (Binary Output Event with Time)**
Command Event Variation reported when variation 0 requested: **1 (Command Status w/o Time)**
or **2 (Command Status with Time)**

Point Index	Description	Default Change Event Assigned Class (1, 2, 3 or none)	Default Variation Static Object 10	Default Variation Event Object 11	Default Command Event Object 13 Assigned Class (1, 2, 3 or none)	Default Variation Command Event Object 13	CROB Supported Operations	Default CROB Operations
113	User DP Command 7.	0	2	2	0	1	Pulse On Pulse Off Latch On Latch Off Close Trip	Pulse On Pulse Off
114	User DP Command 8.	0	2	2	0	1	Pulse On Pulse Off Latch On Latch Off Close Trip	Pulse On Pulse Off
115	CB-1 Open	0	2	2	0	1	Pulse On Latch On Close	Pulse On Latch On
116	CB-1 Close	0	2	2	0	1	Pulse On Latch On Close	Pulse On Latch On
126	E/F In on/off	0	2	2	0	1	Pulse On Pulse Off Latch On Latch Off Close Trip	Pulse On Pulse Off Latch On Latch Off
127	SEF In on/off	0	2	2	0	1	Pulse On Pulse Off Latch On Latch Off Close Trip	Pulse On Pulse Off Latch On Latch Off
128	Reset Hrs In Service, write only location.	0	2	2	0	1	Pulse On Latch On Close	Pulse On

5.3.4 Counters

The following table lists both Binary Counters (Object 20) and Frozen Counters (Object 21). When a freeze function is performed on a Binary Counter point, the frozen value is available in the corresponding Frozen Counter point. The default Binary Counter and Frozen Counter event buffer sizes are set to 30.

The “Default Deadband,” and the “Default Change Event Assigned Class” columns are used to represent the absolute amount by which the point must change before a Counter change event will be generated, and once generated in which class poll (1, 2, 3, or none) will the change event be reported.

© 2017 Siemens Protection Devices Limited

The default counter event buffer size is set 30. The counter event mode is set to Most Recent, only most recent event for each point is stored.

Counters are by default returned in a class zero interrogation.

Note, not all points listed here apply to all builds of devices.

Counters
Static (Steady-State) Object Number: **20**
Change Event Object Number: **22**
Static Variation reported when variation 0 requested: **1 (32-Bit Counter with Flag)**
or **2 (16-Bit Counter with Flag)**
or **5 (32-Bit Counter w/o Flag)**
or **6 (16-Bit Counter w/o Flag)**
Change Event Variation reported when variation 0 requested: **1 (32-Bit Counter Event with Flag)**
or **2 (16-Bit Counter Event with Flag)**
or **5 (32-Bit Counter Event with Flag and Time)**
or **6 (16-Bit Counter Event with Flag and Time)**

Frozen Counters
Static (Steady-State) Object Number: **21**
Change Event Object Number: **23**
Static Variation reported when variation 0 requested: **1 (32-Bit Frozen Counter with Flag)**
or **2 (16-Bit Frozen Counter with Flag)**
or **5 (32-Bit Frozen Counter with Flag and Time)**
or **6 (16-Bit Frozen Counter with Flag and Time)**
or **9 (32-Bit Frozen Counter w/o Flag)**
or **10 (16-Bit Frozen Counter w/o Flag)**
Change Event Variation reported when variation 0 requested: **1 (32-Bit Frozen Counter Event with Flag)**
or **2 (16-Bit Frozen Counter Event with Flag)**
or **5 (32-Bit Frozen Counter Event with Flag and Time)**
or **6 (16-Bit Frozen Counter Event with Flag and Time)**

		Counter						Frozen Counter		
Point Index	Description	Default Change Event Assigned Class (1, 2, 3 or none)	Default Variation Static Object 20	Default Variation Event Object 22	Deadband	Is Resettable	IsFreezable	Default Change Event Assigned Class (1, 2, 3 or none)	Default Variation Static Object 21	Default Variation Event Object 23
0	Waveform Records	0,3	5	1	1		✔	0,2	9	1
1	Fault Records	0,3	5	1	1		✔	0,2	9	1
2	Event Records	0,3	5	1	1		✔	0,2	9	1
3	Data Log Records	0,3	5	1	1		✔	0,2	9	1
5	StartCount	0,3	5	1	1	✔	✔	0,2	9	1
6	Start Count Target	0,3	5	1	1		✔	0,2	9	1
7	Active Setting Group	0,3	5	1	1		✔	0,2	9	1
11	CB Total Trip Count	0,3	5	1	1	✔	✔	0,2	9	1
12	CB Ph A Trip Count	0,3	5	1	1	✔	✔	0,2	9	1
13	CB Ph B Trip Count	0,3	5	1	1	✔	✔	0,2	9	1
14	CB Ph C Trip Count	0,3	5	1	1	✔	✔	0,2	9	1
15	CB E/F Trip Count	0,3	5	1	1	✔	✔	0,2	9	1
16	CB Delta Trip Count	0,3	5	1	1	✔	✔	0,2	9	1
17	CB Count To AR Block	0,3	5	1	1	✔	✔	0,2	9	1
18	CB Frequent Ops Count	0,3	5	1	1	✔	✔	0,2	9	1
21	E1 Counter	0,3	5	1	1		✔	0,2	9	1
22	E2 Counter	0,3	5	1	1		✔	0,2	9	1
23	E3 Counter	0,3	5	1	1		✔	0,2	9	1
24	E4 Counter	0,3	5	1	1		✔	0,2	9	1

© 2017 Siemens Protection Devices Limited

Counters
Static (Steady-State) Object Number: **20**
Change Event Object Number: **22**
Static Variation reported when variation 0 requested: **1 (32-Bit Counter with Flag)**
or **2 (16-Bit Counter with Flag)**
or **5 (32-Bit Counter w/o Flag)**
or **6 (16-Bit Counter w/o Flag)**
Change Event Variation reported when variation 0 requested: **1 (32-Bit Counter Event with Flag)**
or **2 (16-Bit Counter Event with Flag)**
or **5 (32-Bit Counter Event with Flag and Time)**
or **6 (16-Bit Counter Event with Flag and Time)**

Frozen Counters
Static (Steady-State) Object Number: **21**
Change Event Object Number: **23**
Static Variation reported when variation 0 requested: **1 (32-Bit Frozen Counter with Flag)**
or **2 (16-Bit Frozen Counter with Flag)**
or **5 (32-Bit Frozen Counter with Flag and Time)**
or **6 (16-Bit Frozen Counter with Flag and Time)**
or **9 (32-Bit Frozen Counter w/o Flag)**
or **10 (16-Bit Frozen Counter w/o Flag)**
Change Event Variation reported when variation 0 requested: **1 (32-Bit Frozen Counter Event with Flag)**
or **2 (16-Bit Frozen Counter Event with Flag)**
or **5 (32-Bit Frozen Counter Event with Flag and Time)**
or **6 (16-Bit Frozen Counter Event with Flag and Time)**

		Counter						Frozen Counter		
Point Index	Description	Default Change Event Assigned Class (1, 2, 3 or none)	Default Variation Static Object 20	Default Variation Event Object 22	Deadband	Is Resettable	IsFreezable	Default Change Event Assigned Class (1, 2, 3 or none)	Default Variation Static Object 21	Default Variation Event Object 23
25	E5 Counter	0,3	5	1	1		✔	0,2	9	1
26	E6 Counter	0,3	5	1	1		✔	0,2	9	1
27	E7 Counter	0,3	5	1	1		✔	0,2	9	1
28	E8 Counter	0,3	5	1	1		✔	0,2	9	1
29	E9 Counter	0,3	5	1	1		✔	0,2	9	1
30	E10 Counter	0,3	5	1	1		✔	0,2	9	1
31	E11 Counter	0,3	5	1	1		✔	0,2	9	1
32	E12 Counter	0,3	5	1	1		✔	0,2	9	1
33	E13 Counter	0,3	5	1	1		✔	0,2	9	1
34	E14 Counter	0,3	5	1	1		✔	0,2	9	1
35	E15 Counter	0,3	5	1	1		✔	0,2	9	1
36	E16 Counter	0,3	5	1	1		✔	0,2	9	1

5.3.5 Analog Inputs

The following table lists Analog Inputs (Object 30). It is important to note that 16-bit and 32-bit variations of Analog Inputs, Analog Output Control Blocks, and Analog Output Statuses are transmitted through DNP as signed numbers.

The “Default Deadband,” and the “Default Change Event Assigned Class” columns are used to represent the absolute amount by which the point must change before an Analog change event will be generated, and once generated in which class poll (1, 2, 3, or none) will the change event be reported.

The default analog input event buffer size is set 30. The analog input event mode is set to Most Recent, only most recent event for each point is stored.

Analog inputs are by default returned in a class zero interrogation.

Note, not all points listed here apply to all builds of devices.

© 2017 Siemens Protection Devices Limited

Analog Inputs
Static (Steady-State) Object Number: **30**
Change Event Object Number: **32**
Analog Input Deadband: **34**
Static Variation reported when variation 0 requested: **1 (32-Bit Analog Input with Flag)**
or **2 (16-Bit Analog Input with Flag)**
or **3 (32-Bit Analog Input w/o Flag)**
or **4 (16-Bit Analog Input w/o Flag)**
or **5 (Single Precision, floating point Analog Input with Flag)**
Change Event Variation reported when variation 0 requested: **1 (32-Bit Analog Change Event w/o Time)**
or **2 (16-Bit Analog Input w/o Time)**
or **3 (32-Bit Analog Input with Time)**
or **4 (16-Bit Analog Input with Time)**
or **5 (Single Precision, floating point Analog Input w/o Time)**
or **7 (Single Precision, floating point Analog Input with Time)**
Analog Input Reporting Deadband Variation reported when variation 0 requested: **1 (16-Bit)**
or **2 (32-Bit)**
or **3 (Single Precision, floating point)**

Point Index	Description	Default Change Event Assigned Class (1, 2, 3 or none)	Default Variation Static Object 30	Default Variation Event Object 32	Default Multiplier	Default Deadband
0	Frequency	0,3	2	4	100.000	1.000
1	Vab Primary	0,3	2	4	0.010	100.000
2	Vbc Primary	0,3	2	4	0.010	100.000
3	Vca Primary	0,3	2	4	0.010	100.000
4	Va Primary	0,3	2	4	0.010	100.000
5	Vb Primary	0,3	2	4	0.010	100.000
6	Vc Primary	0,3	2	4	0.010	100.000
7	Va Secondary	0,3	2	4	10.000	1.000
8	Vb Secondary	0,3	2	4	10.000	1.000
9	Vc Secondary	0,3	2	4	10.000	1.000
21	Vzps	0,3	2	4	10.000	1.000
22	Vpps	0,3	2	4	10.000	1.000
23	Vnps	0,3	2	4	10.000	1.000
31	Ia Primary	0,3	2	4	1.000	100.000
32	Ib Primary	0,3	2	4	1.000	100.000
33	Ic Primary	0,3	2	4	1.000	100.000
34	Ia Secondary	0,3	2	4	100.000	0.100
35	Ib Secondary	0,3	2	4	100.000	0.100
36	Ic Secondary	0,3	2	4	100.000	0.100
37	Ia Nominal	0,3	2	4	100.000	0.100
38	Ib Nominal	0,3	2	4	100.000	0.100
39	Ic Nominal	0,3	2	4	100.000	0.100
43	In Primary	0,3	2	4	1.000	100.000
44	In Secondary	0,3	2	4	100.000	0.100
45	In Nominal	0,3	2	4	100.000	0.100
46	Ig Primary	0,3	2	4	1.000	100.000
47	Ig Secondary	0,3	2	4	1000.000	0.100
48	Ig Nominal	0,3	2	4	1000.000	0.100
51	Izps Nominal	0,3	2	4	100.000	0.100
52	Ipps Nominal	0,3	2	4	100.000	0.100
53	Inps Nominal	0,3	2	4	100.000	0.100
57	Active Power A	0,3	2	4	0.000	1000000.000
58	Active Power B	0,3	2	4	0.000	1000000.000

© 2017 Siemens Protection Devices Limited

Analog Inputs
Static (Steady-State) Object Number: **30**
Change Event Object Number: **32**
Analog Input Deadband: **34**
Static Variation reported when variation 0 requested: **1 (32-Bit Analog Input with Flag)**
or **2 (16-Bit Analog Input with Flag)**
or **3 (32-Bit Analog Input w/o Flag)**
or **4 (16-Bit Analog Input w/o Flag)**
or **5 (Single Precision, floating point Analog Input with Flag)**
Change Event Variation reported when variation 0 requested: **1 (32-Bit Analog Change Event w/o Time)**
or **2 (16-Bit Analog Input w/o Time)**
or **3 (32-Bit Analog Input with Time)**
or **4 (16-Bit Analog Input with Time)**
or **5 (Single Precision, floating point Analog Input w/o Time)**
or **7 (Single Precision, floating point Analog Input with Time)**
Analog Input Reporting Deadband Variation reported when variation 0 requested: **1 (16-Bit)**
or **2 (32-Bit)**
or **3 (Single Precision, floating point)**

Point Index	Description	Default Change Event Assigned Class (1, 2, 3 or none)	Default Variation Static Object 30	Default Variation Event Object 32	Default Multiplier	Default Deadband
59	Active Power C	0,3	2	4	0.000	1000000.000
60	P (3P)	0,3	2	4	0.000	1000000.000
61	Reactive Power A	0,3	2	4	0.000	1000000.000
62	Reactive Power B	0,3	2	4	0.000	1000000.000
63	Reactive Power C	0,3	2	4	0.000	1000000.000
64	Q (3P)	0,3	2	4	0.000	1000000.000
65	Apparent Power A	0,3	2	4	0.000	1000000.000
66	Apparent Power B	0,3	2	4	0.000	1000000.000
67	Apparent Power C	0,3	2	4	0.000	1000000.000
68	S (3P)	0,3	2	4	0.000	1000000.000
71	Power Factor A	0,3	2	4	1000.000	0.100
72	Power Factor B	0,3	2	4	1000.000	0.100
73	Power Factor C	0,3	2	4	1000.000	0.100
74	Power Factor(3P)	0,3	2	4	1000.000	0.100
75	Act Energy Exp	0,3	1	3	1.000	Disabled
76	Act Energy Imp	0,3	1	3	1.000	Disabled
77	React Energy Exp	0,3	1	3	1.000	Disabled
78	React Energy Imp	0,3	1	3	1.000	Disabled
81	Thermal Status Ph A	0,1	4	4	100.000	1.000
82	Thermal Status Ph B	0,1	4	4	100.000	1.000
83	Thermal Status Ph C	0,1	4	4	100.000	1.000
95	Active Setting Group	0,3	2	4	1.000	1.000
99	Vab Secondary	0,3	2	4	10.000	1.000
100	Vbc Secondary	0,3	2	4	10.000	1.000
101	Vca Secondary	0,3	2	4	10.000	1.000
102	Vn Primary	0,3	2	4	0.010	100.000
103	Vn Secondary	0,3	2	4	10.000	1.000
105	Vx Primary	0,3	2	4	0.010	100.000
106	Vx Secondary	0,3	2	4	10.000	1.000
108	I Phase A Max	0,3	2	4	1.000	100.000
109	I Phase B Max	0,3	2	4	1.000	100.000
110	I Phase C Max	0,3	2	4	1.000	100.000
111	P 3P Max	0,3	2	4	0.000	1000000.000

© 2017 Siemens Protection Devices Limited

Analog Inputs
Static (Steady-State) Object Number: **30**
Change Event Object Number: **32**
Analog Input Deadband: **34**
Static Variation reported when variation 0 requested: **1 (32-Bit Analog Input with Flag)**
or **2 (16-Bit Analog Input with Flag)**
or **3 (32-Bit Analog Input w/o Flag)**
or **4 (16-Bit Analog Input w/o Flag)**
or **5 (Single Precision, floating point Analog Input with Flag)**
Change Event Variation reported when variation 0 requested: **1 (32-Bit Analog Change Event w/o Time)**
or **2 (16-Bit Analog Input w/o Time)**
or **3 (32-Bit Analog Input with Time)**
or **4 (16-Bit Analog Input with Time)**
or **5 (Single Precision, floating point Analog Input w/o Time)**
or **7 (Single Precision, floating point Analog Input with Time)**
Analog Input Reporting Deadband Variation reported when variation 0 requested: **1 (16-Bit)**
or **2 (32-Bit)**
or **3 (Single Precision, floating point)**

Point Index	Description	Default Change Event Assigned Class (1, 2, 3 or none)	Default Variation Static Object 30	Default Variation Event Object 32	Default Multiplier	Default Deadband
112	Q 3P Max	0,3	2	4	0.000	1000000.000
113	Ig Max	0,3	2	4	1.000	100.000
115	Isef Primary	0,3	2	4	1.000	10.000
116	Isef Secondary	0,3	2	4	1000.000	0.050
117	Isef Nominal	0,3	2	4	1000.000	0.050
118	Fault Distance Percent	0,3	2	4	100.000	Disabled
119	Fault Reactance	0,3	2	4	1000.000	Disabled
135	CB Total Trip Count	0,3	1	3	1.000	1.000
136	CB Delta Trip Count	0,3	1	3	1.000	1.000
137	CB Count To AR Block	0,3	1	3	1.000	1.000
138	CB Frequent Ops Count	0,3	1	3	1.000	1.000
162	Phase Diff	0,3	2	4	100.000	1.000
163	Slip Freq	0,3	2	4	100.000	1.000
164	Voltage Diff	0,3	2	4	100.000	1.000
165	Ia Last Trip	0,3	1	3	1.000	Disabled
166	Ib Last Trip	0,3	1	3	1.000	Disabled
167	Ic Last Trip	0,3	1	3	1.000	Disabled
168	Va Last Trip	0,3	1	3	1.000	Disabled
169	Vb Last Trip	0,3	1	3	1.000	Disabled
170	Vc Last Trip	0,3	1	3	1.000	Disabled
171	In Last Trip	0,3	1	3	1.000	Disabled
172	Ig Last Trip	0,3	1	3	1.000	Disabled
173	Isef Last Trip	0,3	1	3	1.000	Disabled
174	V Phase A Max	0,3	2	4	0.010	100.000
175	V Phase B Max	0,3	2	4	0.010	100.000
176	V Phase C Max	0,3	2	4	0.010	100.000
177	V Phase AB Max	0,3	2	4	0.010	100.000
178	V Phase BC Max	0,3	2	4	0.010	100.000
179	V Phase CA Max	0,3	2	4	0.010	100.000
180	CB Ph A Trip Count	0,3	1	3	1.000	1.000
181	CB Ph B Trip Count	0,3	1	3	1.000	1.000
182	CB Ph C Trip Count	0,3	1	3	1.000	1.000
183	CB E/F Trip Count	0,3	1	3	1.000	1.000
184	CB Wear A	0,3	1	3	0.000	1000000.000

© 2017 Siemens Protection Devices Limited

Analog Inputs
Static (Steady-State) Object Number: **30**
Change Event Object Number: **32**
Analog Input Deadband: **34**
Static Variation reported when variation 0 requested: **1 (32-Bit Analog Input with Flag)**
or **2 (16-Bit Analog Input with Flag)**
or **3 (32-Bit Analog Input w/o Flag)**
or **4 (16-Bit Analog Input w/o Flag)**
or **5 (Single Precision, floating point Analog Input with Flag)**
Change Event Variation reported when variation 0 requested: **1 (32-Bit Analog Change Event w/o Time)**
or **2 (16-Bit Analog Input w/o Time)**
or **3 (32-Bit Analog Input with Time)**
or **4 (16-Bit Analog Input with Time)**
or **5 (Single Precision, floating point Analog Input w/o Time)**
or **7 (Single Precision, floating point Analog Input with Time)**
Analog Input Reporting Deadband Variation reported when variation 0 requested: **1 (16-Bit)**
or **2 (32-Bit)**
or **3 (Single Precision, floating point)**

Point Index	Description	Default Change Event Assigned Class (1, 2, 3 or none)	Default Variation Static Object 30	Default Variation Event Object 32	Default Multiplier	Default Deadband
185	CB Wear B	0,3	1	3	0.000	1000000.000
186	CB Wear C	0,3	1	3	0.000	1000000.000
187	CB Wear A Remaining	0,3	1	3	1.000	1.000
188	CB Wear B Remaining	0,3	1	3	1.000	1.000
189	CB Wear C Remaining	0,3	1	3	1.000	1.000
190	CB Wear Minimum	0,3	1	3	1.000	1.000
191	Fault Distance Perunit	0,3	5	7	0.001	1.000
196	Frequency Max	0,3	2	4	100.000	1.000
197	S 3P Max	0,3	2	4	0.000	1000000.000
318	Sec Active Power A	0,3	2	4	1.000	10.000
319	Sec Active Power B	0,3	2	4	1.000	10.000
320	Sec Active Power C	0,3	2	4	1.000	10.000
321	Sec P (3P)	0,3	2	4	1.000	10.000
322	Sec Reactive Power A	0,3	2	4	1.000	10.000
323	Sec Reactive Power B	0,3	2	4	1.000	10.000
324	Sec Reactive Power C	0,3	2	4	1.000	10.000
325	Sec Q (3P)	0,3	2	4	1.000	10.000
326	Sec Apparent Power A	0,3	2	4	1.000	10.000
327	Sec Apparent Power B	0,3	2	4	1.000	10.000
328	Sec Apparent Power C	0,3	2	4	1.000	10.000
329	Sec S (3P)	0,3	2	4	1.000	10.000
330	CB Trip Time Meter	0,3	2	4	1000.000	0.010
337	PF 3P Max	0,3	2	4	1000.000	0.100

5.4 Additional Settings

The following relay settings are provided for configuration of the DNP 3.0 implementation when available and are common to all ports using this protocol.

Setting Name	Range/Options	Default	Setting	Notes
Unsolicited Mode	DISABLED, ENABLED	DISABLED	As Required	Setting is only visible when any port Protocol is set to DNP3.

© 2017 Siemens Protection Devices Limited

Setting Name	Range/Options	Default	Setting	Notes
Destination Address	0 - 65534	0	As Required	Setting is only visible when DNP3 Unsolicited Events set to Enabled.
DNP3 Application Timeout	5, 6 ... 299, 300	10s	As Required	Setting is only visible when any port Protocol is set to DNP3.

© 2017 Siemens Protection Devices Limited

6. Not Applicable

This section intentionally left blank.

© 2017 Siemens Protection Devices Limited

7. IEC61850 Protocol Support

7.1 Introduction

The relay can optionally be provided with IEC61850 comms.

For further details refer to the following publications:

- Model Implementation Conformance Statement (MICS)
- Protocol Implementation Conformance Statement (PICS)
- Protocol Implementation Extra Information for Testing (PIXIT)

© 2017 Siemens Protection Devices Limited

© 2017 Siemens Protection Devices Limited

8. Serial Modems

8.1 Introduction

The communications interface has been designed to allow data transfer via modems. A suitable Modem can be connected directly to the Relay's serial interface, for example RS232, RS485 or fibre-optic port where fitted.

8.2 Connecting a Modem to the Relay(s)

RS232C defines devices as being either Data Terminal Equipment (DTE) e.g. computers, or data Communications Equipment (DCE), e.g. modems, where one is designed to be connected to the other.

The optional RS232 port of the Relay is wired as a DTE device and can therefore be connected directly to a Modem.

The 7XV5652 RS232 fibre-optic converter is wired as a DCE device, the same as a Modem. Where two DCE devices e.g. the modem and the fibre-optic converter are being connected together a null terminal connector is required which switches various control lines. The fibre-optic converter is then connected to the relay Network Tx to Relay Rx and Network Rx to Relay Tx.

8.3 Setting the Remote Modem

The exact settings of the modem are dependent on the type of modem. Although most modems support the basic Hayes “AT” command format, different manufacturers use different commands for the same functions. In addition, some modems use DIP switches to set parameters, others are entirely software configured.

Before applying settings, the modem's factory default settings should be applied, to ensure it is in a known state.

Several factors must be considered to allow remote dialling to the relays. The first is that the modem at the remote end must be configured as auto answer. This will allow it to initiate communications with the relays. Next, the user should set the data configuration at the local port, i.e. baud rate and parity, so that communication will be at the same rate and format as that set on the relay and the error correction is disabled.

Auto-answer usually requires two parameters to be set. The auto-answer setting should be switched on and the number of rings after which it will answer. The Data Terminal Ready (DTR) settings should be forced on. This tells the modem that the device connected to it is ready to receive data.

The parameters of the modem's RS232C port are set to match those set on the relay, set baud rate and parity to be the same as the settings on the relay and number of data bits to be 8 and stop bits 1. Note, although the device may be able to communicate with the modem at, for example, 19200 bps, the modem may only be able to transmit over the telephone lines at 14400 bps. Therefore, a baud rate setting on which the modem can transmit should be chosen. In the above example, a baud rate of 9600 should be chosen.

As the modems are required to be transparent, simply passing on the data sent from the controller to the device and vice versa, error correction and buffering is turned off.

Finally, the settings selected for configuration should be stored in the modem's memory for power on defaults.

8.4 Connecting to the Remote Modem

Once the remote modem has been configured correctly, it should be possible to make connection to the relay.

Where a “dial-up” modem system is installed the settings on the remote modem are fixed so the local modem should negotiate with it on connection, choosing suitable matching settings. Where this is not possible the local modem should be set with settings equivalent to those of the remote modem as described above.

© 2017 Siemens Protection Devices Limited

© 2017 Siemens Protection Devices Limited

9. Not Applicable

This section intentionally left blank.

© 2017 Siemens Protection Devices Limited

© 2017 Siemens Protection Devices Limited

10. Glossary

Baud Rate
Data transmission speed.

Bit
The smallest measure of computer data.

Bits Per Second (bps)
Measurement of data transmission speed.

Data Bits
A number of bits containing the data. Sent after the start bit.

Data Echo
When connecting relays in an optical ring architecture, the data must be passed from one relay to the next, therefore when connecting in this method all relays must have the Data Echo ON.

EN100
Siemens' Ethernet communications module supporting IEC61850, available in optical and electrical versions.

Ethernet
A computer networking technology.

Full-Duplex Asynchronous Communications
Communications in two directions simultaneously.

Half-Duplex Asynchronous Communications
Communications in two directions, but only one at a time.

Hayes "AT"
Modem command set developed by Hayes Microcomputer products, Inc.

LAN
Local Area Network. A computer network covering a small geographic area.

LC
Fibre optic connector type designed by Lucent Technologies, Inc.

Line Idle
Determines when the device is not communicating if the idle state transmits light.

Modem
MOdulator / DEModulator device for connecting computer equipment to a telephone line.

Parity
Method of error checking by counting the value of the bits in a sequence, and adding a parity bit to make the outcome, for example, even.

Parity Bit
Bit used for implementing parity checking. Sent after the data bits.

RS232C
Serial Communications Standard. Electronic Industries Association Recommended Standard Number 232, Revision C.

RS485
Serial Communications Standard. Electronic Industries Association Recommended Standard Number 485.

© 2017 Siemens Protection Devices Limited

Start Bit
Bit (logical 0) sent to signify the start of a byte during data transmission.

Stop Bit
Bit (logical 1) sent to signify the end.

USB
Universal Serial Bus standard for the transfer of data.

WAN
Wide Area Network. A computer network covering a large geographic area.

© 2017 Siemens Protection Devices Limited

Appendix 1

The operating mode of the device is set via the setting, or through a command sent to a communications port. There are four options; **Local**, **Remote**, **Local or Remote** and **Service**.

The following table illustrates whether a function is Enabled (✔) or Disabled (✖) in each mode.

Function	Operation Mode		
	Local	Remote	Out of Service
Control			
Com1	✔ when Com1-Mode = Local	✔ when Com1-Mode = Remote	✖
Com2 (USB)	✔ when Com2-Mode = Local	✔ when Com2-Mode = Remote	✖
Com3	✔ when Com3-Mode = Local	✔ when Com3-Mode = Remote	✖
Com4	✔ when Com4-Mode = Local	✔ when Com4-Mode = Remote	✖
Fascia (Control Mode)	✔	✖	✖
Function Key (n)	✔	✔ when F Key(n) Mode = Remote	✖
Binary Input (n)	✔ when BI (n) Mode = Local	✔ when BI (n) Mode = Remote	✖
Binary Outputs	✔	✔	✖
Reporting			
Spontaneous			
IEC	✔	✔	✖
DNP3	✔	✔	✖
General Interrogation			
IEC	✔	✔	✖
DNP3	✔	✔	✔
MODBUS	✔	✔	✔
Change Settings			
Com1	✔ when Com1-Mode = Local	✔ when Com1-Mode = Remote	✔
Com2 (USB)	✔ when Com2-Mode = Local	✔ when Com2-Mode = Remote	✔
Com3	✔ when Com3-Mode = Local	✔ when Com3-Mode = Remote	✔
Com4	✔ when Com4-Mode = Local	✔ when Com4-Mode = Remote	✔
Fascia	✔	✔	✔
Historical Information			
Waveform Records	✔	✔	✔
Event Records	✔	✔	✔
Fault Information	✔	✔	✔
Setting Information	✔	✔	✔

Fig. A1 Operating Mode Table

© 2017 Siemens Protection Devices Limited

Siemens Protection Devices Ltd. (SPDL)
P.O. Box 8
Hebburn
Tyne and Wear
NE31 1TZ
United Kingdom

For enquiries please contact our Customer Support Centre
Tel.: +49 180/524 8437 (24hrs)
Fax.: +49 180/524 2471
E-Mail:support.ic@siemens.com
www.siemens.com/reyrolle

Template Revision 17.

 © 2017 Siemens Protection Devices Limited

7SR21 Non-Directional Relay
7SR22 Directional Relay
Commissioning & Maintenance Guide

The copyright and other intellectual property rights in this document, and in any model or article produced from it (and including any registered or unregistered design rights) are the property of Siemens Protection Devices Limited. No part of this document shall be reproduced or modified or stored in another form, in any data retrieval system, without the permission of Siemens Protection Devices Limited, nor shall any model or article be reproduced from this document unless Siemens Protection Devices Limited consent.

While the information and guidance given in this document is believed to be correct, no liability shall be accepted for any loss or damage caused by any error or omission, whether such error or omission is the result of negligence or any other cause. Any and all such liability is disclaimed.

© 2013 Siemens Protection Devices Limited

Document Release History

This document is issue 2017/12. The list of revisions up to and including this issue is: -

2011/05	First issue
2013/01	Typographical revisions and added data. Updated in line with software release.
2014/06	Typographical revisions and added data. Updated in line with software release.
2015/06	Typographical revisions, drawing amendments and added data. Updated in line with software release.
2016/02	Typographical revisions and added data. Updated in line with software release.
2017/08	Typographical revisions and added data. Updated in line with software release.
2017/12	Typographical revisions and added data.

Software Revision History

2011/05	2435H85008R7a-7a (7SR210) 2435H85009R7a-7a (7SR220)	First Release
2013/01	2435H85008R7c-7b (7SR210) 2435H85009R7c-7b (7SR220)	Introduced journaling file system. Added 61850 logical nodes for CB Counters, metering, 50BF, 46BC, 81HBL2 and line check. Added Line Check on non-AR devices. Added 74CCS Close Circuit Supervision.
2014/06	2435H85008R7f-7d (7SR210) 2435H85009R7f-7d (7SR220)	Added Fault Locator feature and Check Sync feature. Fault data transmitted over 103. Additional communications data, control features, meters.
2015/06	2435H85008R8a-7f (7SR210) 2435H85009R8a-7f (7SR220)	Added Power Factor Meters, Load Blinding feature, Arc Flash Detector. Over current TM Setting Range extended.
2016/02	2435H85008R8b-7f (7SR210) 2435H85009R8b-7f (7SR220)	EN100+ Compatibility.
2017/08	2435H85008R8e-8a (7SR210) 2435H85009R8e-8a (7SR220)	Added 32 Directional Power, 32S Sensitive Power, 55 Power Factor, 81HLB5 Overfluxing, 67SEF Compensated Network, 67SEF Wattmetric. Increased I/O. Event Data on LCD.

© 2013 Siemens Protection Devices Limited

Contents

Document Release History **2**
Software Revision History **2**
Contents **3**
Section 1: Common Functions **6**
1.1 Overview 6
1.2 Before Testing 6
1.2.1 Safety 6
1.2.2 Sequence of Tests 6
1.2.3 Test Equipment 7
1.2.4 Precautions 7
1.2.5 Applying Settings 7
1.3 Tests 9
1.3.1 Inspection 9
1.3.2 Secondary Injection Tests 9
1.3.3 Primary Injection Tests 9
1.3.4 Putting into Service 9
1.4 AC Energising Quantities 10
1.5 Binary Inputs 11
1.6 Binary Outputs 12
1.7 Relay Case Shorting Contacts 13
Section 2: Protection Functions **14**
2.1 Phase Directional Polarity Check 15
2.1.1 2 out of 3 logic 16
2.2 Phase Overcurrent (67/50,67/51) 17
2.2.1 Definite Time Overcurrent. (50) 18
2.2.2 Inverse Time Overcurrent. (51) 18
2.3 Voltage Controlled Overcurrent (51V) 20
2.4 Cold Load (51c) 22
2.4.1 Inverse Time Overcurrent. (51C) 23
2.1 Arc Flash Detection (50AFD) 25
2.2 Directional Earth Fault Polarity Check (67N) 26
2.3 Derived Earth Fault (67/50N, 67/51N) 27
2.3.1 Directional Polarity 28
2.3.2 Definite Time Overcurrent..(50N) 28
2.3.3 Inverse Time Overcurrent. (51N) 28
2.4 Measured Earth fault (67/50G,67/51G) 31
2.4.1 Directional Polarity 32
2.4.2 Definite Time Overcurrent..(67/50G) 32
2.4.3 Inverse Time Overcurrent. (67/51G) 32
2.5 Sensitive Earth fault (67/50S,67/51S) 35
2.5.1 Directional Polarity 36
2.5.2 Definite Time Overcurrent. (50SEF) 36
2.5.3 Inverse Time Overcurrent. (51SEF) 36
2.6 Restricted Earth fault. (64H) 39
2.7 Negative Phase Sequence Overcurrent (46NPS) 41
2.7.1 Definite Time NPS Overcurrent. (46DT) 42
2.7.2 Inverse Time NPS Overcurrent. (46IT) 42

© 2013 Siemens Protection Devices Limited

2.8 Undercurrent. (37) 44
2.9 Thermal Overload (49) 46
2.10 Over/Under Voltage 48
2.10.1 Phase Under/Over Voltage. (27/59) 48
2.10.2 Undervoltage Guard (27/59UVG) 50
2.10.3 Vx Under/Over Voltage. (Vx 27/59) 51
2.10.4 NPS Overvoltage (47) 53
2.10.5 Neutral Overvoltage (59N) 55
2.10.6 Definite Time (59NDT) 55
2.10.7 Inverse Time (59NIT) 56
2.10.8 Element Blocking 56
2.10.9 Under/Over Frequency (81) 57
2.11 Power (32) 59
2.12 Sensitive Power (32S) 61
2.13 Power Factor (55) 63
Section 3: Supervision Functions 65
3.1 CB Fail. (50BF) 65
3.2 Voltage Transformer Supervision. (60VTS) 67
3.2.1 1 or 2 Phase VT fail 68
3.2.2 3 Phase VT fail 68
3.3 Current Transformer Supervision. (60CTS) 69
3.3.1 Element Blocking 70
3.4 Broken Conductor. (46BC) 71
3.4.1 Element Blocking 72
3.5 Load Blinder (21) 73
3.5.1 Determining Load Blinder Regions (21LB) 75
3.5.2 Determining Trip Level 76
3.6 Trip Circuit Supervision. (74TCS) 77
3.7 Magnetising Inrush Detector. (81HBL) 78
3.1 Over Fluxing Detector. (81HBL5) 79
Section 4: Control & Logic Functions 80
4.1 Autoreclose (79) 80
4.2 Quick Logic 80
Section 5: Testing and Maintenance 81
5.1 Periodic Tests 81
5.2 Maintenance 81
5.3 Troubleshooting 82

 © 2013 Siemens Protection Devices Limited

List of Figures

Figure 2.1-1 Directional Phase Fault Boundary System Angles 16
Figure 2.2-1 Phase Overcurrent 17
Figure 2.3-1 Voltage Controlled Overcurrent 20
Figure 2.4-1 Cold Load 22
Figure 2.4-2 Cold Load Logic diagram 23
Figure 2.1-1 Arc Flash Detection 25
Figure 2.5-1 Directional Earth Fault Boundary System Angles 26
Figure 2.6-1 Derived Earth Fault 27
Figure 2.7-1 Measured Earth Fault 31
Figure 2.8-1 Sensitive Earth Fault 35
Figure 2.9-1 Restricted Earth Fault 39
Figure 2.10-1 Negative Phase Sequence Overcurrent 41
Figure 2.11-1 Undercurrent 44
Figure 2.12-1 Thermal Overload 46
Figure 2.13-1 Phase Under/Over Voltage 48
Figure 2.13-2 Vx Under/Over Voltage 51
Figure 2.13-3 NPS Overvoltage 53
Figure 2.13-4 Neutral Overvoltage 55
Figure 2.13-5 Under/Over Frequency 57
Figure 2.11-1 Power 59
Figure 2.12-1 Sensitive Power 61
Figure 2.13-1 Power Factor 63
Figure 3.1-1 CB Fail 65
Figure 3.2-1 Voltage Transformer Supervision 67
Figure 3.3-1 Current Transformer Supervision 69
Figure 3.4-1 Broken Conductor 71
Figure 3.5-1 Load Blinder (21) 73
Figure 3.5-2 Load Blinder (21) Boundary Points 74
Figure 3.6-1 Trip Circuit Supervision 77
Figure 3.7-1 Magnetising Inrush Detector 78
Figure 3.1-1 Magnetising Inrush Detector 79

© 2013 Siemens Protection Devices Limited

Section 1: Common Functions

1.1 Overview

Commissioning tests are carried out to prove: -

a) Equipment has not been damaged in transit.

b) Equipment has been correctly connected and installed.

c) Prove characteristics of the protection and settings which are based on calculations.

d) Confirm that settings have been correctly applied.

e) To obtain a set of test results for future reference.

1.2 Before Testing

1.2.1 Safety

The commissioning and maintenance of this equipment should only be carried out by skilled personnel trained in protective relay maintenance and capable of observing all the safety precautions and regulations appropriate to this type of equipment and also the associated primary plant.

Ensure that all test equipment and leads have been correctly maintained and are in good condition. It is recommended that all power supplies to test equipment be connected via a Residual Current Device (RCD), which should be located as close to the supply source as possible.

The choice of test instrument and test leads must be appropriate to the application. Fused instrument leads should be used when measurements of power sources are involved, since the selection of an inappropriate range on a multi-range instrument could lead to a dangerous flashover. Fused test leads should not be used where the measurement of a current transformer (C.T.) secondary current is involved, the failure or blowing of an instrument fuse or the operation of an instrument cut-out could cause the secondary winding of the C.T. to become an open circuit.

Open circuit secondary windings on energised current transformers are a hazard that can produce high voltages dangerous to personnel and damaging to equipment, test procedures must be devised so as to eliminate this risk.

1.2.2 Sequence of Tests

If other equipment is to be tested at the same time, then such testing must be co-ordinated to avoid danger to personnel and equipment.

When cabling and wiring is complete, a comprehensive check of all terminations for tightness and compliance with the approved diagrams must be carried out. This can then be followed by the insulation resistance tests, which if satisfactory allows the wiring to be energised by either the appropriate supply or test supplies.

When primary injection tests are completed satisfactorily, all remaining systems can be functionally tested before the primary circuit is energised. Some circuits may require further tests before being put on load.

Protection relay testing will require access to the protection system wiring diagrams; relay configuration information and protection settings. The following sequence of tests is loosely based on the arrangement of the relay menu structure. A test log based on the actual tests completed should be recorded for each relay tested.

The ‘Description of Operation’ section of this manual provides detailed information regarding the operation of each function of the relay.

 © 2013 Siemens Protection Devices Limited

1.2.3 Test Equipment

Required test equipment is: -

1. Secondary injection equipment with integral time interval meter
2. Primary injection equipment
3. A d.c. supply with nominal voltage within the working range of the relay's d.c. auxiliary supply rating
4. A d.c. supply with nominal voltage within the working range of the relay's d.c. binary input rating
5. Other equipment as appropriate to the protection being commissioned – this will be specified in the product specific documentation.

The secondary injection equipment should be appropriate to the protection functions to be tested. Additional equipment for general tests and for testing the communications channel is:

Portable PC with appropriate interface equipment: -

6. Portable PC with appropriate interface equipment.
7. Printer to operate from the above PC (Optional).

Use of PC to facilitate testing

The functions of Reydisp Evolution (see Settings Guide) can be used during the commissioning tests to assist with test procedures or to provide documentation recording the test and test parameters. One method is to clear both the waveform and event records before each test is started, then, after the test upload from the relay the settings, events and waveform files generated as a result of application of the test. These can then be saved off to retain a comprehensive record of that test.

Relay settings files can be prepared on the PC (offline) or on the relay before testing commences. These settings should be saved for reference and compared with the settings at the end of testing to check that errors have not been introduced during testing and that any temporary changes to settings to suit the test process are returned to the required service state.

A copy of the Relay Settings as a Rich Text Format (.rtf) file suitable for printing or for record purposes can be produced from Reydisp as follows. From the *File* menu select *Save As,* change the file type to *Export Default/Actual Setting (.RTF)* and input a suitable filename.

When testing is completed the event and waveform records should be cleared and the settings file checked to ensure that the required in-service settings are being applied.

1.2.4 Precautions

Before electrical testing commences the equipment should be isolated from the current and voltage transformers. The current transformers should be short-circuited in line with the local site procedure. The tripping and alarm circuits should also be isolated where practical. The provision and use of secondary injection test sockets on the panel simplifies the isolation and test procedure.

Ensure that the correct auxiliary supply voltage and polarity is applied. See the relevant scheme diagrams for the relay connections.

Check that the nominal secondary current rating of the current and voltage transformers has been correctly set in the System Config. menu of the relay.

1.2.5 Applying Settings

The relay settings for the particular application should be applied before any secondary testing occurs. If they are not available then the relay has default settings that can be used for pre-commissioning tests.

Note that the tripping and alarm contacts for any function must be programmed correctly before any scheme tests are carried out.

Relays feature multiple settings groups, only one of which is active at a time. In applications where more than one settings group is to be used it may be necessary to test the relay in more than one configuration.

Note. One group may be used as a 'Test' group to hold test-only settings that can be used for regular maintenance testing, eliminating the need for the Test Engineer to interfere with the actual in-service settings in the normally active group. This Test group may also be used for functional testing where it is necessary to disable or change settings to facilitate testing.

When using settings groups it is important to remember that the relay need not necessarily be operating according to the settings that are currently being displayed.

© 2013 Siemens Protection Devices Limited

There is an ‘active settings group’ on which the relay operates and an ‘edit/view settings group’ which is visible on the display and which can be altered. This allows the settings in one group to be altered from the relay fascia while the protection continues to operate on a different unaffected group. The ‘Active Settings Group’ and the ‘Edit Settings Group’ are selected in the ‘System Configuration Menu’.

The currently Active Group and the group currently Viewed are shown at the top of the display in the Settings display screen. If the View Group is not shown at the top of the display, this indicates that the setting is common to all groups. CT/VT ratio, I/O mapping and other settings which are directly related to hardware are common to all groups.

If the relay is allowed to trip during testing then the instruments display will be interrupted and replaced by the ‘Trip Alert’ screen which displays fault data information. If this normal operation interferes with testing then this function can be temporarily disabled for the duration of testing by use of the Trip Alert Enabled/Disabled setting in the System Config Menu.

After applying a settings change to the relay, which may involve a change to the indication and output contacts, the **TEST/RESET** key should be pressed to ensure any existing indication and output is correctly cleared.

 © 2013 Siemens Protection Devices Limited

1.3 Tests

1.3.1 Inspection

Ensure that all connections are tight and correct to the relay wiring diagram and the scheme diagram. Record any deviations. Check that the relay is correctly programmed and that it is fully inserted into the case. Refer to 'Settings Guide' for information on programming the relay.

1.3.2 Secondary Injection Tests

Select the required relay configuration and settings for the application.

Isolate the auxiliary D.C. supplies for alarm and tripping from the relay and remove the trip and inter-trip links.

Carry out injection tests for each relay function, as described in this document

For all high current tests it must be ensured that the test equipment has the required rating and stability and that the relay is not stressed beyond its thermal limit.

1.3.3 Primary Injection Tests

Primary injection tests are essential to check the ratio and polarity of the transformers as well as the secondary wiring.

Note. If the current transformers associated with the protection are located in power transformer bushings it may not be possible to apply test connections between the current transformer and the power transformer windings. Primary injection is needed, however, to verify the polarity of the CTs. In these circumstances primary current must be injected through the associated power transformer winding. It may be necessary to short circuit another winding in order to allow current to flow. During these primary injection tests the injected current is likely to be small due to the impedance of the transformer.

1.3.4 Putting into Service

After tests have been performed satisfactorily the relay should be put back into service as follows:-

Remove all test connections.

Replace all secondary circuit fuses and links, or close m.c.b.

Ensure the Protection Healthy LED is on, steady, and that all LED indications are correct. If necessary press **CANCEL** until the Relay Identifier screen is displayed, then press **TEST/RESET** to reset the indication LEDs.

The relay meters should be checked in Instruments Mode with the relay on load.

The relay settings should be downloaded to a computer and a printout of the settings produced. The installed settings should then be compared against the required settings supplied before testing began. Automated setting comparison can be carried out by Reydisp using the *Compare Settings Groups* function in the *Edit* menu. Any modified settings will be clerly highlighted.

© 2013 Siemens Protection Devices Limited

1.4 AC Energising Quantities

Voltage and current measurement for each input channel is displayed in the Instrumentation Mode sub-menus, each input should be checked for correct connection and measurement accuracy by single phase secondary injection at nominal levels. Ensure that the correct instrument displays the applied signal within limits of the Performance Specification.

	Applied Current					Applied Voltage			
	I_A	I_B	I_C	I_G	I_{SEF}	V_A/V_{AB}	V_B/V_{BC}	V_C/V_{CB}	V_X
Secondary									
Primary									

Apply 3P balanced Current and Voltage at nominal levels and ensure that the measured Zero Phase Sequence and Negative Phase Sequence quantities are approximately zero.

	ZPS	NPS
Voltage		
Current		

© 2013 Siemens Protection Devices Limited

1.5 Binary Inputs

The operation of the binary input(s) can be monitored on the 'Binary Input Meters' display shown in 'Instruments Mode'. Apply the required supply voltage onto each binary input in turn and check for correct operation. Depending on the application, each binary input may be programmed to perform a specific function; each binary should be checked to prove that its mapping and functionality is as set as part of the Scheme Operation tests.

Where the pick-up timers associated with a binary input are set these delays should be checked either as part of the scheme logic or individually. To check a binary pick-up time delay, temporarily map the binary to an output relay that has a normally open contact. This can be achieved in the Output Matrix sub-menu by utilising the *BI n Operated* settings. Use an external timer to measure the interval between binary energisation and closure of the output contacts. Similarly, to measure the drop-off delay, map to an output relay that has a normally closed contact, time the interval between binary de-energisation and closure of the output contacts.

Note. The time measured will include an additional delay, typically less than 20 ms, due to the response time of the binary input hardware, software processing time and the operate time of the output relay.

BI	Tested	DO Delay	Measured	PU Delay	Measured	Notes (method of initiation)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						

© 2013 Siemens Protection Devices Limited

1.6 Binary Outputs

A minimum of six output relays are provided. Two of these have change over contacts, BO2 & BO3, one has a normally closed contact, BO1 and the remainder have normally open contacts.

Care should be observed with regard to connected devices when forcing contacts to operate for test purposes. Short duration energisation can cause contact failure due to exceeding the break capacity when connected to inductive load such as electrically reset trip relays.

Close each output relay in turn from the Reydisp Evolution PC programme, Relay – Control - Close output relay. This function will energise the output for its minimum operate time. This time is specified in the Output Config - Binary Output Config menu for each output relay and may be too short to measure with a continuity tester.

An alternative method of energising an output permanently so that wiring can be checked is to temporarily map the relay being tested to the 'Protection Healthy' signal in the Output Matrix, as this signal is permanently energised the mapped relay will be held energised, normally open contacts will be closed and vice versa.

BO	Checked	Notes (method of test)
1NC		
2NO		
2NC		
3NO		
3NC		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		

© 2013 Siemens Protection Devices Limited

1.7 Relay Case Shorting Contacts

CT inputs and terminals B25-B26 (Relay Withdrawn Alarm) are fitted with case mounted shorting contacts which provide a closed contact when the relay is withdrawn from the case. The operation of these contacts should be checked.

CT Shorting contacts checked	
Relay Withdrawn Alarm Checked	

© 2013 Siemens Protection Devices Limited

Section 2: Protection Functions

This section details the procedures for testing each protection function of the 7SR21 & 7SR22 relays. These tests are carried out to verify the accuracy of the protection pick-ups and time delays at setting and to confirm correct operation of any associated input and output functionality.

The exact model type must be checked to confirm the functions available in each type.

Guidance for calculating test input quantities is given in the relevant test description where required. In many cases it may be necessary to disable some functions during the testing of other functions, this prevents any ambiguity caused by the operation of multiple functions from one set of input quantities. The 'Function Config' Menu provides a convenient high level point at which all elements of a particular function can be Enabled/Disabled to suit testing. The 'Config' tab in 'Reydisp Evolution' can be used to 'Enable/Disable' individual elements. Note that this screen disables functions by applying setting changes to the relay and that any changes must be sent to the relay to take effect and settings must be returned to their correct value after testing.

The table below indicates functions where function conflicts may occur during testing, consideration should be given to disabling functions to avoid interference.

Function Under Test	Phase Overcurrent	Voltage Cont O/C	Cold Load	Derived E/F	Measured E/F	Sensitive E/F	Restricted E/F	NPS Overcurrent	Undercurrent	Thermal	Phase U/O voltage	NPS Overvoltage	U/O Frequency	CB Fail	VT Supervision	CT supervision	Broken Conductor	Trip cct Supervision	Inrush Detector
Phase		O	O					O	O	O				O			O		
Voltage Cont	O		O					O	O	O				O			O		
Cold Load	O	O						O	O	O				O			O		
Derived E/F					O			O	O	O				O		O	O		
Measured E/F				O				O	O	O									
Sensitive E/F							O												
Restricted E/F						O													
NPS Overcurrent	O	O	O						O	O				O		O			
Undercurrent				O	O			O											
Thermal	O	O	O											O					
Phase U/O												O		O	O				
NPS											O			O	O				
U/O Frequency									O					O					
CB Fail	O	O	O	O	O	O		O		O									
VT Supervision											O	O							
CT supervision				O													O		
Broken				O				O	O							O			
Trip cct																			
Inrush Detector																			

Any LED can be assigned to be a General Pickup LED in the Output Matrix menu and can be used to assess operation of functions during testing if other functions are disabled or if the setting allocating General Pickup is temporarily modified.

Voltage inputs may not be required for testing of non-directional Overcurrent elements but it may be advantageous to apply balanced 3 phase nominal rated voltage to the VT inputs during testing to avoid inadvertent operation of other functions. Particular care should be taken when testing overcurrent functions that the thermal rating of the current inputs is not exceeded.

© 2013 Siemens Protection Devices Limited

It should be considered that where several overlapping elements are used simultaneously, the overall protection operate time may be dependent on the operation of different individual elements at the various levels of applied current or voltage. The resulting composite characteristic may be tested by enabling all of the relevant applicable elements or the element operations can be separated or disabled and tested individually.

All relay settings should be checked before testing begins. It is recommended that the relay settings are extracted from the relay using Reydisp Evolution software and a copy of these settings is stored for reference during and after testing. It may be necessary to disable some protection functions during the testing of other functions to allow unambiguous results to be obtained.

Care must be taken to reset or re-enable any settings that have been temporarily altered during the testing before the relay can be put into service. At the end of testing the relay settings should be compared to the file extracted at the start to ensure that errors have not been introduced.

2.1 Phase Directional Polarity Check

If the relay has Directional Overcurrent elements, the common direction polarising can be checked independently from the individual overcurrent elements and their settings.

In the INSTRUMENTS MODE display, indication is provided in the DIRECTIONAL METERS menu which displays current direction under *P/F Dir* as forward or reverse based on the output states of the directional elements, i.e. whether they see forward current, reverse current or neither for each pole with respect to the *67 Char Angle* setting in the *Phase Overcurrent* menu. This display and the equivalent Measured and Calculated Earth Fault direction meters can be used as an aid to commissioning testing.

1. Check the direction of each pole in turn by connecting to the appropriate terminals. The table below shows the polarising quantity for each pole.

Connections for Directional Polarity

Overcurrent pole	Polarising voltage
Phase A	V_{BC}
Phase B	V_{CA}
Phase C	V_{AB}

2. Inject single phase rated current and apply single phase-phase rated voltage at the Char Angle (MTA) phase angle setting, to each phase in turn. For each pole, monitor the directional display in the instrument menu and check that indication of forward current (FWD) is displayed. To achieve the required forward Characteristic Angle, the phase angle of the current should be greater than that of the polarising voltage by the angle setting.
3. Repeat all of the above with the current connections reversed. Indication should now be given of reverse (REV) current flow.

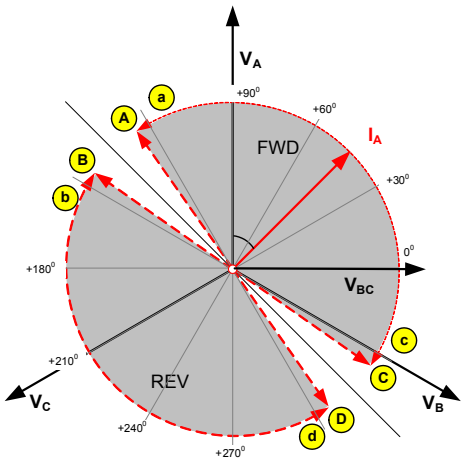
Phase	A	B	C
Forward	FWD	FWD	FWD
Reverse	REV	REV	REV

Apply balanced 3 phase rated voltage and current with Vbc voltage as a 0deg reference and Ia at the characteristic angle. Increase current phase angle until the 'Fwd' indication is extinguished. Record this angle in the table below (Forward lead DO). Continue to increase/decrease the angle until the instrument reads 'Rev'. Record the angle (Reverse lead PU). Reduce the current angle until the 'Rev' extinguishes (Reverse lead DO). and the 'Fwd' subsequently returns (Forward lead PU), recording the angles. Repeat the above tests, starting from the Characteristic Angle, but reducing the current phase angle to record the directional boundaries in the opposite (lag) direction. The recorded angle should be the angle at which the phase current leads the phase-phase polarising voltage. This measurement is greatly simplified if the polarising reference voltage is set to 0deg and the current phase angle is measured with respect to this reference.

Alternatively, the instrument can be checked at the 4 points marked a,b,c & d on Figure 2-1 only.

© 2013 Siemens Protection Devices Limited

	Forward				Reverse			
	Lag (point C)		Lead (point A)		Lead(point B)		Lag (point D)	
	Pick-up	Drop-off	Pick-up	Drop-off	Pick-up	Drop-off	Pick-up	Drop-off
MTA	**MTA-85**		**MTA+85**		**MTA-85**		**MTA-85**	
Phase A								
Phase B								
Phase C								



With balanced 3-phase system quantities:

Adjust the phase angle of the currents relative to the voltages:

Verify directional pick-up and drop off at points A, B, C and D

Alternatively,

Verify correct directional indication at points a, b, c and d (C.A $+75^0$, $+95^0$, -75^0, -95^0)

Figure 2.1-1 Directional Phase Fault Boundary System Angles

4. With the instrument reading 'Fwd' or 'Rev', reduce the voltage until the element resets. Record the minimum phase-phase operate voltage.

Minimum Voltage Setting	**Measured**

2.1.1 2 out of 3 logic

Ensure that at least 1 Phase Overcurrent element is set to Directional. Apply balanced nominal voltage. Apply current at a level above on phase A only at the characteristic angle for forward operation, normally 45º lagging. Ensure no Directional Phase Overcurrent element operation occurs. Note that non-directional Phase Overcurrent and Non-direction Earth Fault elements may operate unless disabled.
Repeat the test with Phase A current as above but also with equal current in the B phase at 180º to that in the A phase.

1 phase current		2 phase current	
No 50/51-n Operation		50/51-n operation	

© 2013 Siemens Protection Devices Limited

2.2 Phase Overcurrent (67/50,67/51)

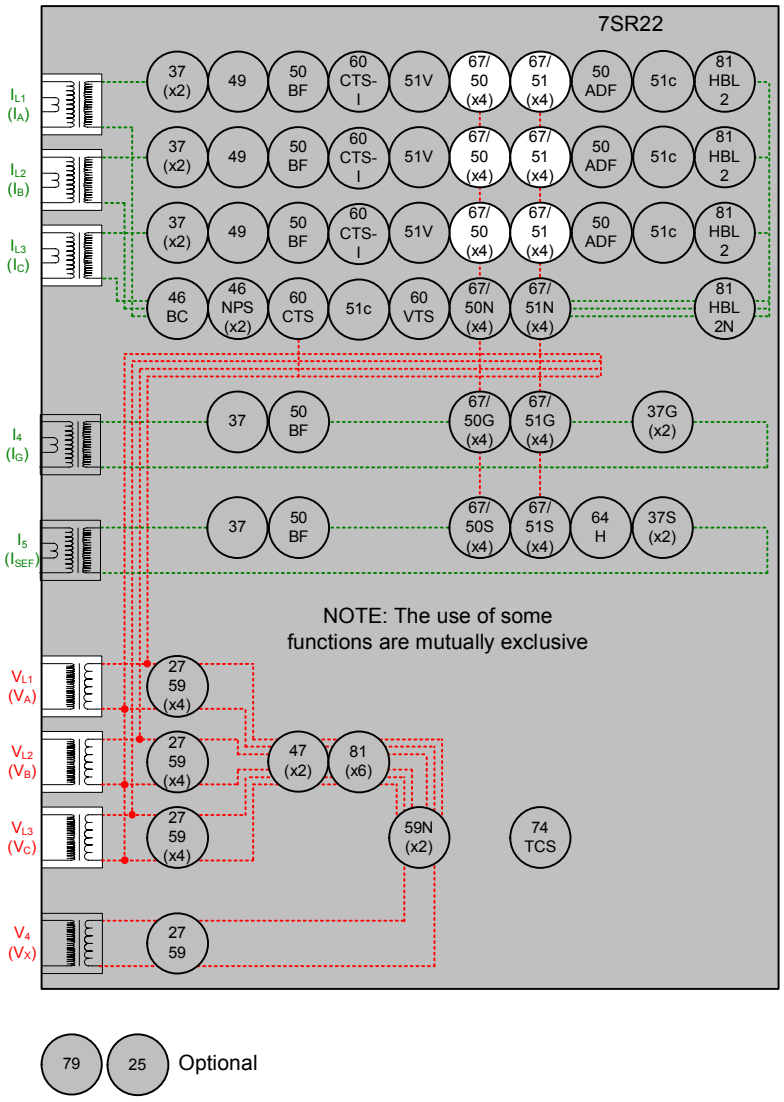


Figure 2.2-1 Phase Overcurrent

Voltage Inputs:	V_{L1} (V_A), V_{L2} (V_B), V_{L3} (V_C) for directional elements.
Current Inputs:	I_{L1} (I_A), I_{L2} (I_B), I_{L3} (I_C),
Disable:	51V, 51c, 46, 49, 50BF, 79
Map Pickup LED:	51-n/50-n - Self Reset

Other protection functions may overlap with these functions during testing, it may be useful to disable some functions to avoid ambiguity. It should be particularly noted that if the function is enabled, the 51C Cold Load settings may modify the normal 50-n and 51-n settings if the CB is open during testing.

Voltage inputs may not be required for this function if the Phase Overcurrent functions are not directional but it may be advantageous to apply balanced 3 phase nominal rated voltage to the VT inputs during testing to avoid inadvertent operation of other functions. Particular care should be taken when testing overcurrent functions that the thermal rating of the current inputs is not exceeded.

© 2013 Siemens Protection Devices Limited

2.2.1 Definite Time Overcurrent. (50)

If DTL setting is small, gradually increase current until element operates.

If DTL is large apply 0.9x setting, check for no operation, apply 1.1x setting, and check operation.

Apply 2x setting current if possible and record operating time.

Phase	Dir.	Is (Amps)	DTL (sec)	P.U. Current Amps	Tol	Operate Time 2 x Is	Tol
$I_{L1}(I_A)$							
$I_{L2}(I_B)$							
$I_{L3}(I_C)$							

Check correct indication, trip output, alarm contacts, waveform record.

2.2.2 Inverse Time Overcurrent. (51)

It will be advantageous to map the function being tested to temporarily drive the relevant Pickup output in the *Pickup Config* sub-menu in the *Output Config* menu as this will allow the Pick-up led to operate for the function.

Gradually increase current until Pickup LED operates.

Apply 2x setting current and record operating time,

Apply 5x setting current and record operating time.

Compare to calculated values for operating times

Gradually reduce current until the element drops off and record the level.

P.U. D.O. & TIMING TESTS	Ph.	Dir	Char. Curve	Is (A)	TM	Operate Current			Operate Time		
						P.U. (Amps)	D.O. (Amps)	Tol	2 x Is (sec)	5 x Is (sec)	Tol
	$I_{L1}(I_A)$										
	$I_{L2}(I_B)$										
	$I_{L3}(I_C)$										

Calculated Timing values in seconds for TM =1.0

Curve	2 xIs	5 xIs
IEC-NI	10.03	4.28
IEC-VI	13.50	3.38
IEC-EI	26.67	3.33
IEC-LTI	120.00	30.00
ANSI-MI	3.80	1.69
ANSI-VI	7.03	1.31
ANSI-EI	9.52	1.30

Note that the operate time may be subject to the **Minimum op time** setting for the element and/or may have a **Follower DTL** applied.

© 2013 Siemens Protection Devices Limited

1.1.1.1 Element Blocking

The Phase Overcurrent elements can be blocked by Binary Input Inhibit, VT Supervision and Inrush Detector operation, as well as 79 Autoreclose settings for Inst/Delayed. The Characteristic can be modified by Cold Load (51-n only) and Voltage Controlled Overcurrent and can be made non-directional by VT Supervision. This functionality should be checked.

Element	BI Inhibits	VTS action	Inrush Detector	79 Autoreclose
51-1				
51-2				
51-3				
51-4				
50-1				
50-2				
50-3				
50-4				

.

2.1.1.1 ANSI Reset

If the element is configured as an ANSI characteristic, it may have an ANSI (decaying) reset delay applied. If ANSI reset is selected for an IEC characteristic element, the reset will be instantaneous.

ANSI reset times from operated condition to fully reset are as follows for zero applied current and Time multiplier (TM) = 1.0. The reset curve characteristic type and TM is defined by the operating characteristic.

Curve	Fully operated to reset with Zero current applied & TM=1 (secs)
ANSI-MI	4.85
ANSI-VI	21.6
ANSI-EI	29.1

Apply current in the following sequence, a) 2x setting for a time to ensure element operation, b) Zero current for the reset time above (xTM), c) 2x setting for a time to ensure element operation. Check that the second operation (c) is similar to the first (a) and in line with the expected operate time for the element at this current level.

Repeat the test with the reset time (b) reduced to 50% of the previous value. Ensure that the second operate time (c) is 50% of the first (a) operate time.

Operate time (expected)	Reset time (calculated)	Operate time (measured)	50% Reset Time (calculated)	50% operate time (calculated)	50% operate time (measured)
		First test (c)			Second Test (c)

Check correct indication, trip output, alarm contacts, waveform record.

© 2013 Siemens Protection Devices Limited

2.3 Voltage Controlled Overcurrent (51V)

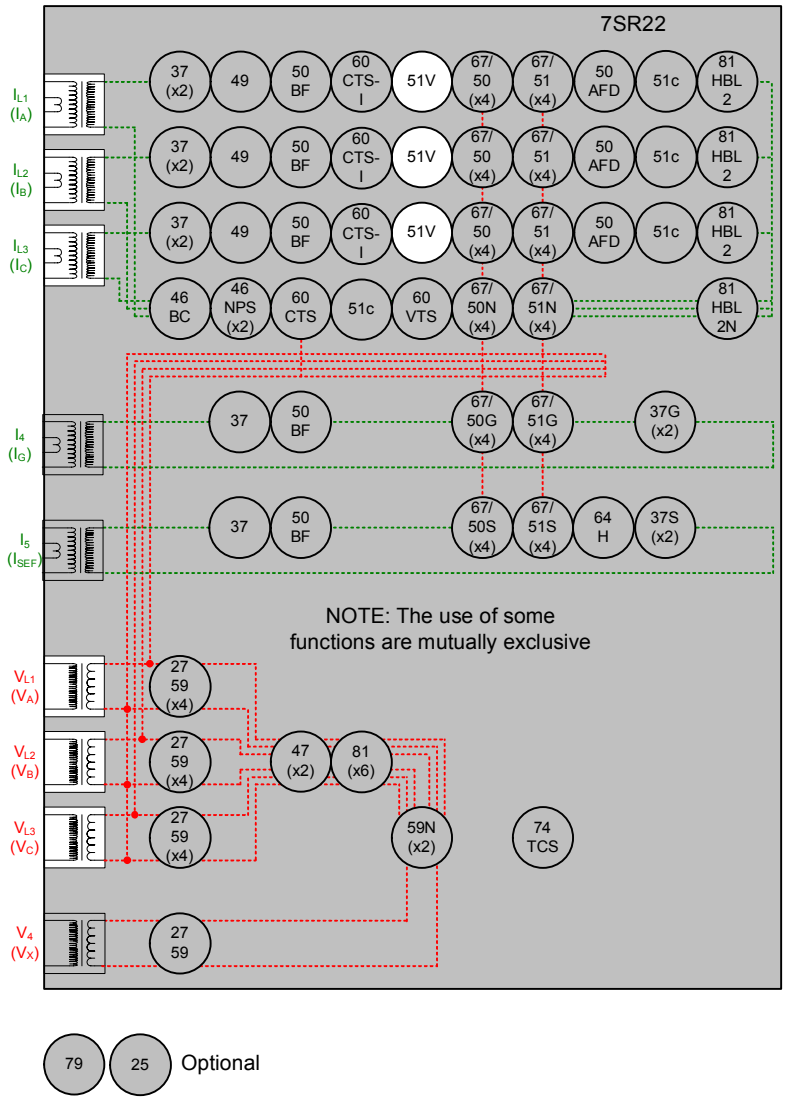


Figure 2.3-1 Voltage Controlled Overcurrent

Voltage Inputs:	V_{L1} (V_A), V_{L2} (V_B), V_{L3} (V_C)
Current Inputs:	I_{L1} (I_A), I_{L2} (I_B), I_{L3} (I_C),
Disable:	51c, 46, 37, 49, 50BF, 79
Map Pickup LED:	51-n/50-n - Self Reset

OC Phase	Control Voltage
I_{L1}(I_A)	V_{12}(V_{AB})
I_{L2}(I_B)	V_{23}(V_{BC})
I_{L3}(I_C)	V_{31}(V_{CA})

Shaped Phase Overcurrent elements 51-n should be tested for pick-up and timing before this function is tested. The General Pickup LED can be used to assess operation of this function if other functions are disabled or if the setting allocating General Pickup is temporarily modified.

Apply nominal 3 phase balanced voltage. Apply 3 phase balanced current at a level below the normal 51-n setting but above the effective 51V-n setting. Ensure that the thermal rating of the relay is not exceeded. Gradually reduce the voltage until the a-b voltage is less than the Voltage setting. Pickup LED operation can be used to confirm the Voltage setting. If the 51V-n current setting is above the continuous rating of the relay an alternative procedure should be used, apply test current in short duration shots with applied voltage being gradually reduced for each subsequent shot.

Apply nominal 3 phase balanced voltage. Reduce the voltage such that the a-b voltage is 110 % of the Voltage setting.

© 2013 Siemens Protection Devices Limited

Gradually increase the a-b phase current or balanced 3P current until Pickup LED operates. Confirm result of Phase O/C test above.

Reduce the applied voltage to a level such that $V_{12}(V_{AB})$ phase-phase voltage is less than 90 % of the setting.

Gradually increase the $I_{12}(I_{AB})$ phase-phase current until Pickup LED operates.

Note that these elements may be set as directional. If this is the case, the phase angle of the current must be set with respect to the voltage to produce operation of the elements.

Voltage Setting (V, p-p)	Measured (V, p-p)

	I Setting	Multiplier	Calculated PU	Measured	Tolerance
51-1 Pickup					
51-2 Pickup					
51-3 Pickup					
51-4 Pickup					

1.1.1.1 Element Blocking

The Voltage Controlled Overcurrent function can be set to Inhibit for VT Supervision operation. This functionality should be checked. Apply balanced voltage and current. Reduce a-phase voltage to cause a VTS condition. Increase 3P current until the element operates at its full setting, i.e. 51V settings are not used.

Element	VTS action
51-1	
51-2	
51-3	
51-4	

Check correct indication, trip output, alarm contacts.

© 2013 Siemens Protection Devices Limited

2.4 Cold Load (51c)

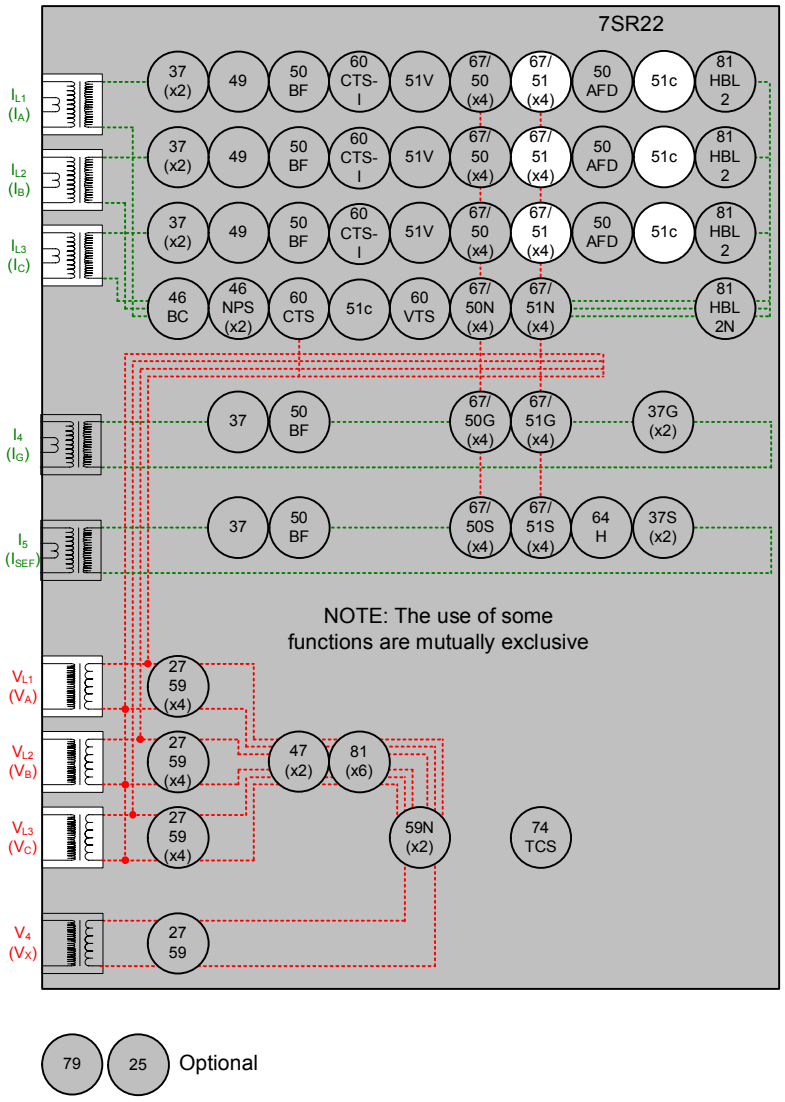


Figure 2.4-1 Cold Load

Voltage Inputs:	V_{L1} (V_A), V_{L2} (V_B), V_{L3} (V_C) for directional elements
Current Inputs:	I_{L1} (I_A), I_{L2} (I_B), I_{L3} (I_C),
Disable:	51V, 46, 49, 50BF, 79
Map Pickup LED:.	51-n - Self Reset

The CB must be open for more than the Cold Load *Pick-up Time* to allow testing of this function. It may be convenient to reduce this setting to suit the test procedure. If the CB is open throughout the tests, the Cold Load protection settings can be tested provided that the current is not allowed to fall below the level of the *Reduced Current Level* for more than the *Reduced Current Time* during testing. It may be convenient to set the *Reduced Current* setting to Disabled for the duration of the test. The Cold Load Active output is provided and can be used as an indication during testing.

© 2013 Siemens Protection Devices Limited

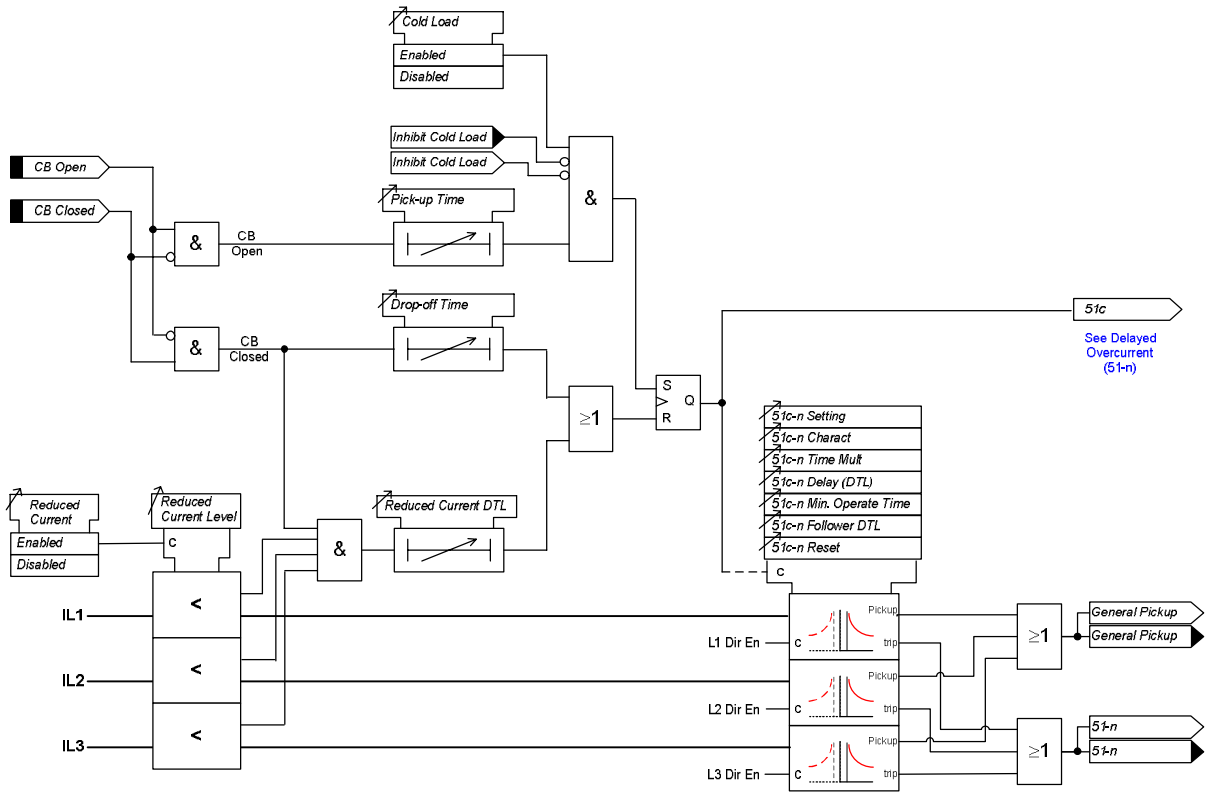


Figure 2.4-2 Cold Load Logic diagram

Ensure that the *Cold load active* is not raised. This can be reset by CB closed for more than the Cold Load *Drop-off Time* or current less than the *Reduced Current Level* for greater than the *Reduced Current Time*. Check the Cold Load Pick-up Delay by applying or simulating CB Open. Measure the time delay before *Cold Load Active* is raised. Apply current above the *Reduced Current Level* if this functionality is Enabled before applying CB Closed. Measure the time for *Cold Load Active* to reset.

2.4.1 Inverse Time Overcurrent. (51C)

It will be advantageous to map the function being tested to temporarily drive the relevant Pickup output in the *Pickup Config* sub-menu in the *Output Config* menu as this will allow the Pick-up led to operate for the function.

Gradually increase current until Pickup LED operates.

Apply 2x setting current and record operating time.

Apply 5x setting current and record operating time.

Compare to calculated values for operating times

© 2013 Siemens Protection Devices Limited

P.U. D.O. & TIMING TESTS	Ph.	Dir	Char. (NI EI VI LTI, DTL)	Is (A)	TM	Operate Current			Operate Time		
						P.U. (Amps)	D.O. (Amps)	Tol	2 x Is (sec)	5 x Is (sec)	Tol
	$I_{L1}(I_A)$										
	$I_{L2}(I_B)$										
	$I_{L3}(I_C)$										

Calculated Timing values in seconds for TM =1.0

Curve	2 xIs	5 xIs
IEC-NI	10.03	4.28
IEC-VI	13.50	3.38
IEC-EI	26.67	3.33
IEC-LTI	120.00	30.00
ANSI-MI	3.80	1.69
ANSI-VI	7.03	1.31
ANSI-EI	9.52	1.30

Note that the operate time may be subject to the *Minimum op time* setting for the element and/or may have a *Follower DTL* applied.

1.1.1.1 ANSI Reset

If the element is configured as an ANSI characteristic, it may have a reset delay applied. If ANSI reset is selected for an IEC characteristic element, the reset will be instantaneous.

ANSI reset times from operated condition to fully reset are as follows for zero applied current and TM = 1.0. The reset curve characteristic type and TM is defined by the operating characteristic.

Curve	Fully operated to reset with Zero current applied & TM=1 (secs)
ANSI-MI	4.85
ANSI-VI	21.6
ANSI-EI	29.1

Apply current in the following sequence, a) 2x setting for a time to ensure element operation, b) Zero current for the reset time above (xTM), c) 2x setting for a time to ensure element operation. Check that the second operation (c) is similar to the first (a) and in line with the expected operate time for the element at this current level.

Repeat the test with the reset time (b) reduced to 50 % of the previous value. Ensure that the second operate time (c) is 50 % of the first (a) operate time.

Operate time (expected)	Reset time (calculated)	Operate time (measured)	50 % Reset Time (calculated)	50 % operate time (calculated)	50 % operate time (measured)

Check correct indication, trip output, alarm contacts, waveform record.

© 2013 Siemens Protection Devices Limited

2.1 Arc Flash Detection (50AFD)

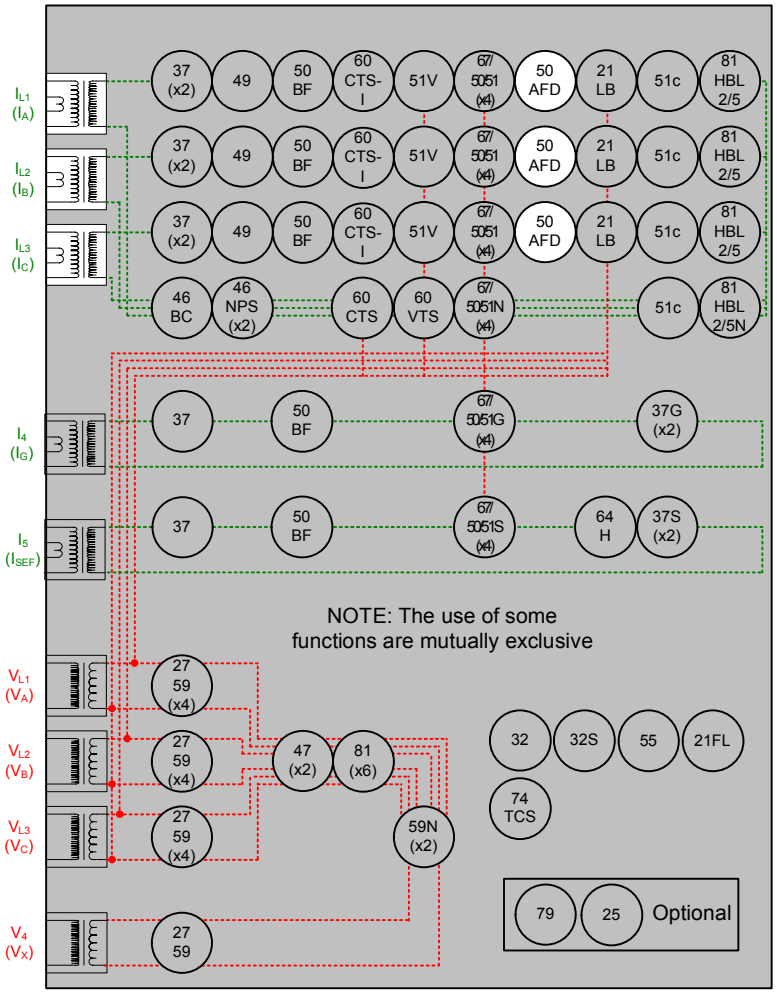


Figure 2.1-1 Arc Flash Detection

Voltage Inputs:	N/A
Current Inputs:	I_{L1} (I_A), I_{L2} (I_B), I_{L3} (I_C),
Disable:	49, 50, 51
Map Pickup LED:	50AFD Zone-n Flash - Hand Reset, 50AFD Zone-n – Hand/self Reset

The overcurrent level can be tested without an arc flash by separately energising or inverting the arc detector binary input continuously for the duration of the test for the zone being tested.

If the current setting is low, gradually increase current until element operates.

If the current level required is greater than the thermal limit of the relay, apply 0.9x setting, check for no operation, apply 1.1x setting, check operation.

Optical sensors such as 7XG31 can be tested by application of a suitable light source. Relay instrumentation can be used to indicate binary input pickup or by the 50AFD Zone-n Flash outputs.
The 7XG31 devices will typically require 10000 lx light level for 1.25ms to trigger. A high powered photographic flash is the most convenient means of initiating positive sensor operation.
Note that mobile phone or small compact camera flashes may not have sufficient power to cause sensor operation but may be suitable if held directly against the sensor.

Check correct indication, trip output, alarm contacts, waveform record.

© 2013 Siemens Protection Devices Limited

2.2 Directional Earth Fault Polarity Check (67N)

Derived Earth Fault, Measured Earth Fault and Sensitive Earth Fault elements can be set as directional. These are polarised from residual voltage, calculated from the 3 phase voltage inputs or the 3Vo input depending on the ***Phase Voltage Config*** setting in the ***CT/VT Config*** menu.

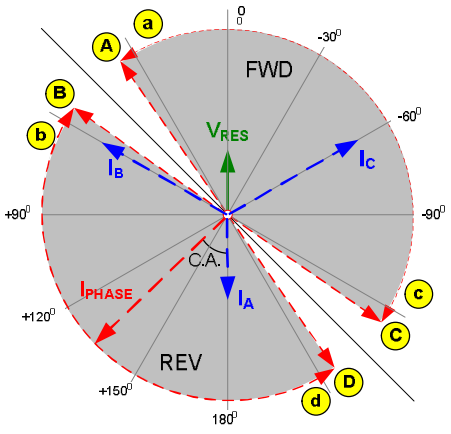
The relay Char Angle setting is the Characteristic Phase angle of the fault impedance i.e. the phase angle of the fault current with respect to the voltage driving the current. The earth fault functions are polarised from the residual voltage which is in anti-phase with the fault voltage for a single-phase to earth fault. Care is required when testing by secondary injection with regard to current and voltage polarity.

To simulate an earth fault on a relay with 3 phase-phase or 3 phase-neutral connected voltage inputs, defined by the ***Phase Voltage Config*** setting of ***Van,Vbn,Vcn*** or ***Va,Vb,Vc***, proceed as follows. Balanced 3P voltage should first be applied, then the phase-neutral voltage magnitude on the faulted phase should be reduced in magnitude with no change in phase angle to produce Vres and simulate the fault. The fault current, on the faulted phase only, should be set at the MTA with respect to the phase-neutral voltage on the faulted phase, e.g. for a relay setting of -15º, set the phase current to lag the ph-n voltage by 15º.

Alternatively, a single phase voltage source can be used in the above test. The polarity of this voltage, applied to the faulted phase-neutral alone, must be reversed to produce the same residual voltage (Vres) phase direction as that produced by the 3P voltage simulation described above.

For the ***Phase Voltage Config*** of ***Vab, Vbc, Vo,*** the single phase voltage applied to the Vo input is used as the polarising quantity**.** The inversion is once again required since this input is designed to measure the residual voltage directly, as produced by an 'open delta VT' arrangement. The current must be set at the MTA with respect to the inversion of this voltage. e.g. for a relay setting of -15º, the phase current must lag the (Vo+180º) voltage by 15º, i.e. if Vo is set at 180º, set Iph at -15º.

If the Pickup of one directional Earth Fault element is mapped to an LED, this can be used to check directional boundaries for pickup and drop-off as the current phase angle is increased and decreased. Note that the Derived Earth Fault, Measured Earth Fault and Sensitive Earth Fault have separate directional settings and must be tested individually.



The diagram opposite shows a Phase A – Earth fault.

Apply residual voltage either directly to input or by reducing voltage of faulted phase.

Adjust the phase angle of the phase current relative to the voltage:

Verify directional pick-up and drop off at points A, B, C and D

Alternatively,

Verify correct directional indication at points a, b, c and d (C.A $+75^0$, $+95^0$, -75^0, -95^0)

Figure 2.2-1 Directional Earth Fault Boundary System Angles

© 2013 Siemens Protection Devices Limited

2.3 Derived Earth Fault (67/50N, 67/51N)

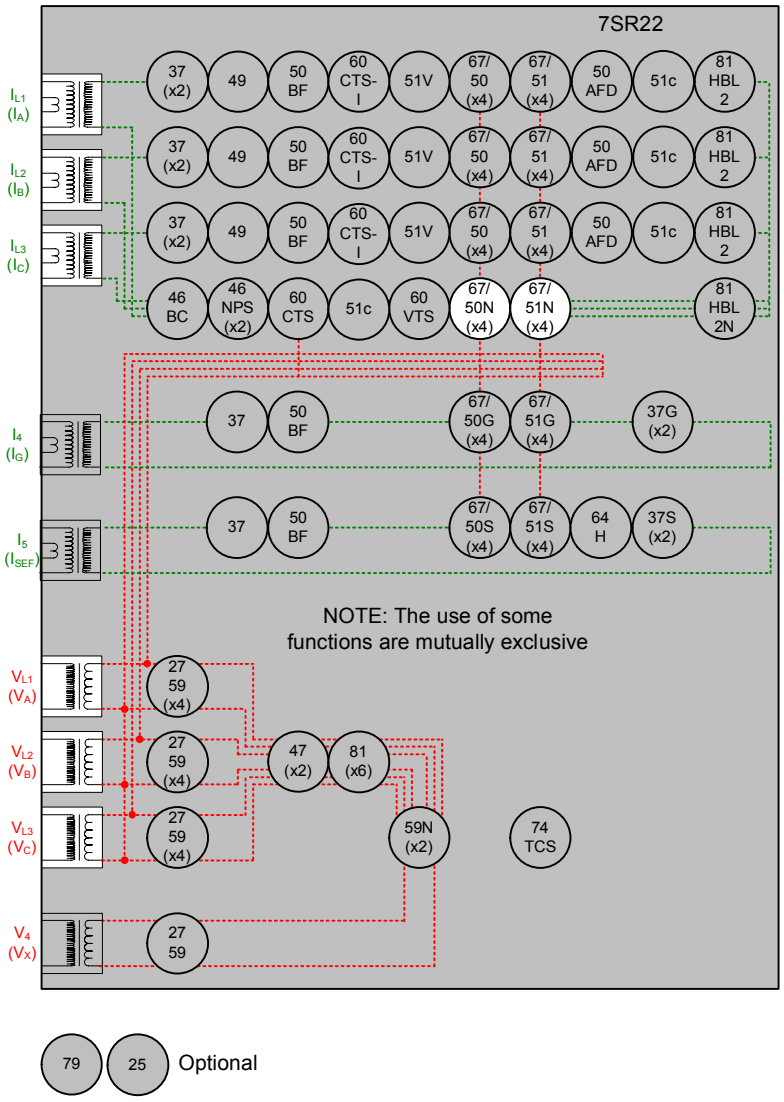


Figure 2.3-1 Derived Earth Fault

Voltage Inputs:	V_{L1} (V_A), V_{L2} (V_B), V_{L3} (V_C)
Current Inputs:	I_{L1} (I_A), I_{L2} (I_B), I_{L3} (I_C),
Disable:	37, 46, 49, 60CTS, 50BF, 60CTS, 46BC, 79
Map Pickup LED:	51N-n/50N-n - Self Reset

Other protection functions may overlap with these functions during testing; it may be useful to disable some functions to avoid ambiguity. Derived EF, Measured EF Sensitive EF & Restricted EF protections can be Enabled/Disabled individually or as groups in the 'Function Config' menu.

Derived EF elements can be separated from Measured EF and sensitive EF by arrangement of the secondary injection circuit by shorting/disconnecting I_4 and I_5 inputs.

If any of these elements are defined as directional the correct voltage phase direction will be required to produce an operation of those elements.

© 2013 Siemens Protection Devices Limited

2.3.1 Directional Polarity

See section Directional Earth Fault Polarity Check above for testing details.

MTA ……	Forward				Reverse			
	Lag (point C)		Lead (point A)		Lead(point B)		Lag (point D)	
	Pick-up MTA-85 ……..	Drop-off	Pick-up MTA+85 ……	Drop-off	Pick-up MTA-85 ……	Drop-off	Pick-up MTA-85 ……...	Drop-off
Derived EF								

2.3.2 Definite Time Overcurrent..(50N)

If DTL setting is small, gradually increase current until element operates.

If DTL is large apply 0.9x setting, check for no operation, apply 1.1x setting, and check operation

Apply 2x setting current if possible and record operating time

Check correct indication, trip output, alarm contacts, waveform record.

Note that these elements can be set to directional.

Phase	Dir.	Is (Amps)	DTL (sec)	P.U. Current Amps	Operate Time 2 x Is	NOTES
E						

If VTS action is set to BLOCK, this option should be tested. Apply balanced voltage and current. Reduce a-phase voltage to cause a VTS condition. Increase 3P current and check that the element does not operate.

If VTS action is set to Non-Directional, this option should be tested. Apply balanced voltage and current. Reduce a-phase voltage to cause a VTS condition. Increase a-phase current and check that the element operates at its normal setting. Reverse the voltage phase direction whilst checking that the element does not reset.

2.3.3 Inverse Time Overcurrent. (51N)

It will be advantageous to map the function being tested to temporarily drive the relevant Pickup output in the *Pickup Config* sub-menu in the *Output Config* menu as this will allow the Pick-up led to operate for the function.

Gradually increase current until Pickup LED operates.

Apply 2x setting current and record operating time.

Apply 5x setting current and record operating time.

Compare to calculated values for operating times

© 2013 Siemens Protection Devices Limited

P.U. D.O. & TIMING TESTS	Ph.	Dir	Char. (NI EI VI LTI, DTL)	Is (A)	TM	Operate Current			Operate Time		
						P.U. (Amps)	D.O. (Amps)	Tol	2 x Is (sec)	5 x Is (sec)	Tol
	E										

Calculated Timing values in seconds for TM =1.0

Curve	2 xIs	5 xIs
IEC-NI	10.03	4.28
IEC-VI	13.50	3.38
IEC-EI	26.67	3.33
IEC-LTI	120.00	30.00
ANSI-MI	3.80	1.69
ANSI-VI	7.03	1.31
ANSI-EI	9.52	1.30

Note that the operate time may be subject to the *Minimum op time* setting for the element and/or may have a *Follower DTL* applied.

1.1.1.1 Element Blocking

The Derived Earth Fault elements can be blocked by Binary Input Inhibit, VT Supervision and Inrush Detector operation. The Characteristic can be made non-directional by VT Supervision. This functionality should be checked.

Element	BI Inhibits	VTS action	Inrush Detector
51N-1			
51N-2			
51N-3			
51N-4			
50N-1			
50N-2			
50N-3			
50N-4			

© 2013 Siemens Protection Devices Limited

2.1.1.1 ANSI Reset

If the element is configured as an ANSI characteristic, it may have a reset delay applied. If ANSI reset is selected for an IEC characteristic element, the reset will be instantaneous.

ANSI reset times from operated condition to fully reset are as follows for zero applied current and TM = 1.0. The reset curve characteristic type and TM is defined by the operating characteristic.

Curve	Fully operated to reset with Zero current applied & TM=1 (secs)
ANSI-MI	4.85
ANSI-VI	21.6
ANSI-EI	29.1

Apply current in the following sequence, a) 2x setting for a time to ensure element operation, b) Zero current for the reset time above (xTM), c) 2x setting for a time to ensure element operation. Check that the second operation (c) is similar to the first (a) and in line with the expected operate time for the element at this current level.

Repeat the test with the reset time (b) reduced to 50% of the previous value. Ensure that the second operate time (c) is 50% of the first (a) operate time.

Operate time (expected)	Reset time (calculated)	Operate time (measured)	50% Reset Time (calculated)	50% operate time (calculated)	50% operate time (measured)
		First test (c)			Second Test (c)

Check correct indication, trip output, alarm contacts, waveform record.

© 2013 Siemens Protection Devices Limited

2.4 Measured Earth fault (67/50G,67/51G)

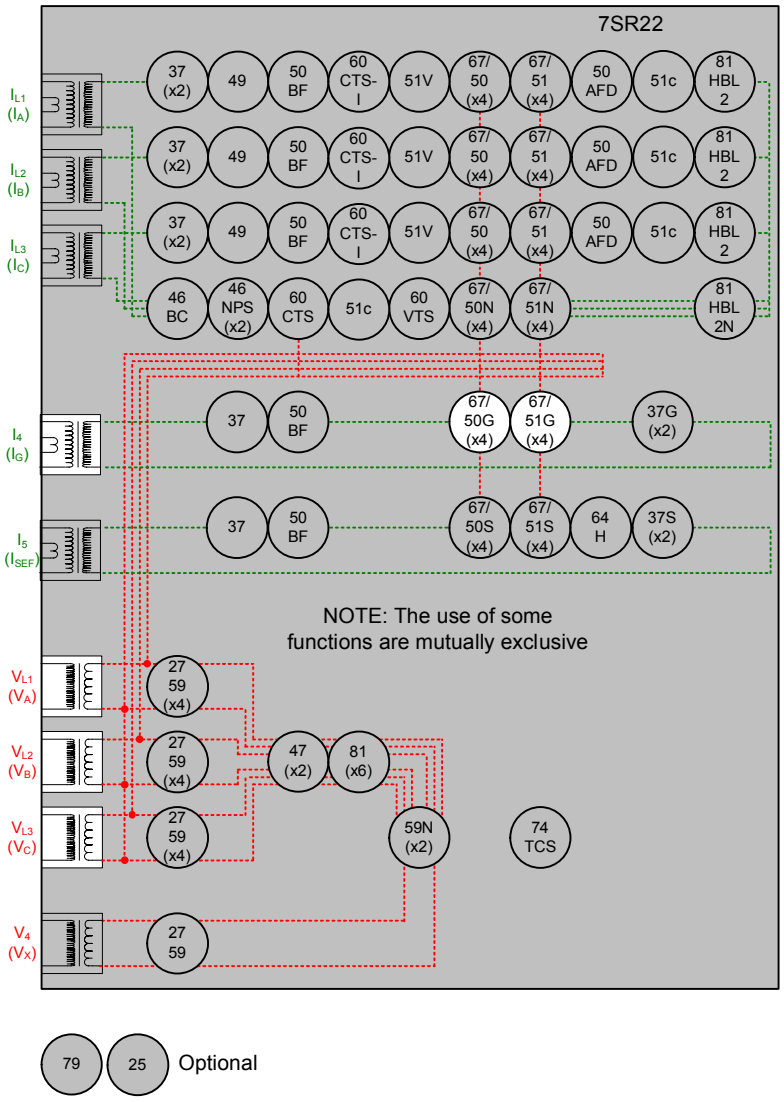


Figure 2.4-1 Measured Earth Fault

Voltage Inputs:	V_{L1} (V_A), V_{L2} (V_B), V_{L3} (V_C) for directional elements
Current Inputs:	I_4 (I_G)
Disable:	50BF, 79
Map Pickup LED: .	51G-n/50G-n - Self Reset

Other protection functions may overlap with these functions during testing, it may be useful to disable some functions to avoid ambiguity. Derived EF, Measured EF, Sensitive EF & Restricted EF protections can be Enabled/Disabled individually or as groups in the 'Function Config' menu.

Measured EF elements can be separated from Derived EF and Sensitive EF by secondary injection of current through the I_4 input circuit only.

If any of these elements are defined as directional the correct voltage phase direction will be required to produce an operation of those elements.

© 2013 Siemens Protection Devices Limited

2.4.1 Directional Polarity

See section Directional Earth Fault Polarity Check above for testing details.

MTA	Forward				Reverse			
	Lag (point C)		Lead (point A)		Lead(point B)		Lag (point D)	
	Pick-up	Drop-off	Pick-up	Drop-off	Pick-up	Drop-off	Pick-up	Drop-off
……..	MTA-85 ……..		MTA+85 ……..		MTA-85 ……..		MTA-85 ……..	
Measured EF								

2.4.2 Definite Time Overcurrent..(67/50G)

If DTL setting is small, gradually increase current until element operates.

If DTL is large apply 0.9x setting, check for no operation, apply 1.1x setting, and check operation.

Apply 2x setting current if possible and record operating time.

Phase	Dir.	Is (Amps)	DTL (sec)	P.U. Current Amps	Operate Time 2 x Is	NOTES
I_4						

Check correct indication, trip output, alarm contacts, waveform record.

Note that these elements can be set to directional.

If VTS action is set to BLOCK, this option should be tested. Apply balanced voltage and current. Reduce a-phase voltage to cause a VTS condition. Increase a-phase current and check that the element does not operate.

If VTS action is set to Non-Directional, this option should be tested..Apply balanced voltage and current. Reduce a-phase voltage to cause a VTS condition. Increase a-phase current and check that the element operates at its normal setting. Reverse the voltage phase direction whilst checking that the element does not reset.

2.4.3 Inverse Time Overcurrent. (67/51G)

It will be advantageous to map the function being tested to temporarily drive the relevant Pickup output in the *Pickup Config* sub-menu in the *Output Config* menu as this will allow the Pick-up led to operate for the function.

Gradually increase current until Pickup LED operates.

Apply 2x setting current and record operating time.

Apply 5x setting current and record operating time.

Compare to calculated values for operating times.

 © 2013 Siemens Protection Devices Limited

P.U. D.O. & TIMING TESTS	Ph.	Dir	Char. (NI EI VI LTI, DTL)	Is (A)	TM	Operate Current			Operate Time		
						P.U. (Amps)	D.O. (Amps)	Tol	2 x Is (sec)	5 x Is (sec)	Tol
	I_4										

Calculated Timing values in seconds for TM =1.0

Curve	2 xIs	5 xIs
IEC-NI	10.03	4.28
IEC-VI	13.50	3.38
IEC-EI	26.67	3.33
IEC-LTI	120.00	30.00
ANSI-MI	3.80	1.69
ANSI-VI	7.03	1.31
ANSI-EI	9.52	1.30

Note that the operate time may be subject to the *Minimum op time* setting for the element and/or may have a *Follower DTL* applied.

If VTS action is set to BLOCK, this option should be tested. Apply balanced voltage and current. Reduce a-phase voltage to cause a VTS condition. Increase a-phase current and check that the element does not operate.

If VTS action is set to Non-Directional, this option should be tested..Apply balanced voltage and current. Reduce a-phase voltage to cause a VTS condition. Increase a-phase current and check that the element operates at its normal setting. Reverse the voltage phase direction whilst checking that the element does not reset.

1.1.1.1 Element Blocking

The Measured Earth Fault elements can be blocked by Binary Input Inhibit, VT Supervision and Inrush Detector operation. The Characteristic can be made non-directional by VT Supervision. This functionality should be checked.

Element	BI Inhibits	VTS action	Inrush Detector
51G-1			
51G-2			
51G-3			
51G-4			
50G-1			
50G-2			
50G-3			
50G-4			

© 2013 Siemens Protection Devices Limited

2.1.1.1 ANSI Reset

If the element is configured as an ANSI characteristic, it may have a reset delay applied. If ANSI reset is selected for an IEC characteristic element, the reset will be instantaneous.

ANSI reset times from operated condition to fully reset are as follows for zero applied current and TM = 1.0. The reset curve characteristic type and TM is defined by the operating characteristic.

Curve	Fully operated to reset with Zero current applied & TM=1 (secs)
ANSI-MI	4.85
ANSI-VI	21.6
ANSI-EI	29.1

Apply current in the following sequence, a) 2x setting for a time to ensure element operation, b) Zero current for the reset time above (xTM), c) 2x setting for a time to ensure element operation. Check that the second operation (c) is similar to the first (a) and in line with the expected operate time for the element at this current level.

Repeat the test with the reset time (b) reduced to 50% of the previous value. Ensure that the second operate time (c) is 50% of the first (a) operate time.

Operate time (expected)	Reset time (calculated)	Operate time (measured)	50% Reset Time (calculated)	50% operate time (calculated)	50% operate time (measured)
		First test (c)			Second Test (c)

Check correct indication, trip output, alarm contacts, waveform record.

© 2013 Siemens Protection Devices Limited

2.5 Sensitive Earth fault (67/50S,67/51S)

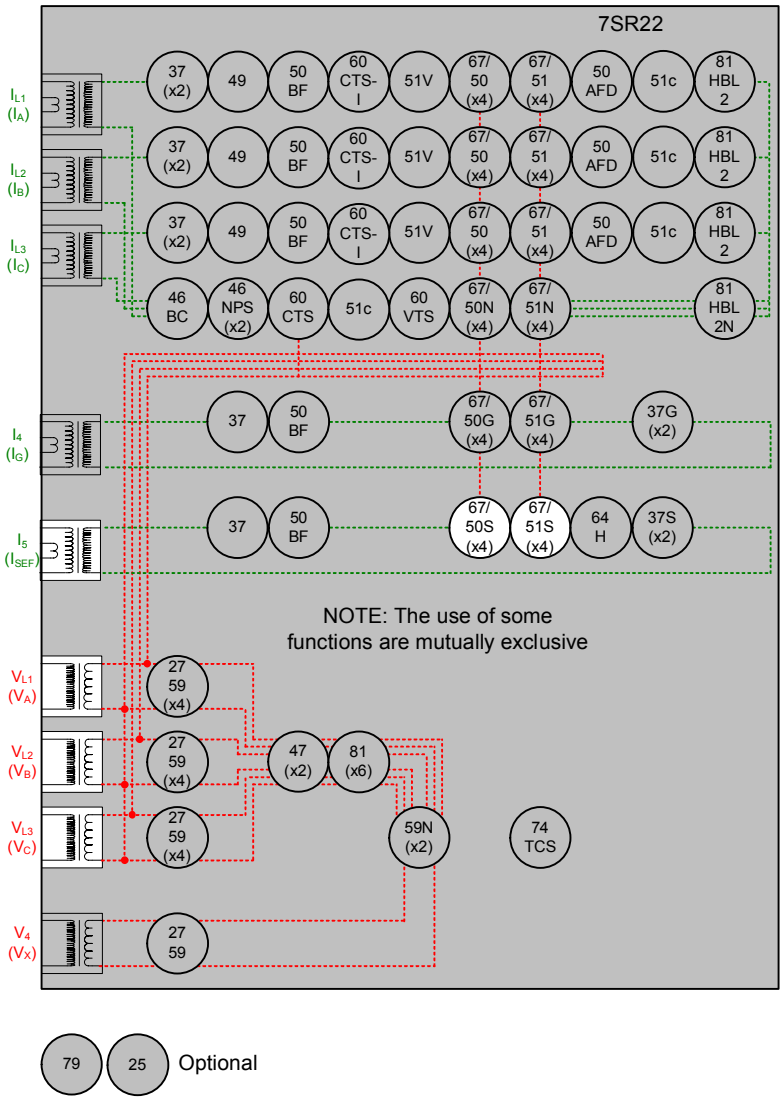


Figure 2.5-1 Sensitive Earth Fault

Voltage Inputs:	V_{L1} (V_A), V_{L2} (V_B), V_{L3} (V_C) for directional elements
Current Inputs:	I_5 (I_{SEF})
Disable:	64H, 50BF, 79
Map Pickup LED:	51SEF-n/50SEF-n - Self Reset

Other protection functions may overlap with these functions during testing; it may be useful to disable some functions to avoid ambiguity. Derived EF, Measured EF, Sensitive EF & Restricted EF protections can be Enabled/Disabled individually or as groups in the 'Function Config' menu.

Sensitive EF elements can be separated from Derived EF and Measured EF by secondary injection of current through the I_5 input circuit only.

If any of these elements are defined as directional the correct voltage phase direction will be required to produce an operation of those elements.

© 2013 Siemens Protection Devices Limited

2.5.1 Directional Polarity

See section Directional Earth Fault Polarity Check above for testing details.

MTA	Forward				Reverse			
	Lag (point C)		Lead (point A)		Lead(point B)		Lag (point D)	
	Pick-up	Drop-off	Pick-up	Drop-off	Pick-up	Drop-off	Pick-up	Drop-off
……	MTA-85 ……..		MTA+85 ……		MTA-85 ……		MTA-85 ……...	
SEF								

2.5.2 Definite Time Overcurrent. (50SEF)

If DTL setting is small, gradually increase current until element operates.

If DTL is large apply 0.9x setting, check for no operation, apply 1.1x setting, and check operation.

Apply 2x setting current if possible and record operating time.

P.U. D.O. & TIMING TESTS	Ph.	Dir	Char. (NI EI VI LTI, DTL)	Is (A)	TM	Operate Current			Operate Time		
						P.U. (Amps)	D.O. (Amps)	Tol	2 x Is (sec)	5 x Is (sec)	Tol
	$I_5(I_{SEF})$										

Check correct indication, trip output, alarm contacts, waveform record.

Note that these elements can be set to directional.

If VTS action is set to BLOCK, this option should be tested. Apply balanced voltage and current. Reduce a-phase voltage to cause a VTS condition. Increase a-phase current and check that the element does not operate.

If VTS action is set to Non-Directional, this option should be tested. Apply balanced voltage and current. Reduce a-phase voltage to cause a VTS condition. Increase a-phase current and check that the element operates at its normal setting. Reverse the voltage phase direction whilst checking that the element does not reset.

2.5.3 Inverse Time Overcurrent. (51SEF)

It will be advantageous to map the function being tested to temporarily drive the relevant Pickup output in the *Pickup Config* sub-menu in the *Output Config* menu as this will allow the Pick-up led to operate for the function.

Gradually increase current until Pickup LED operates.

Apply 2x setting current and record operating time.

Apply 5x setting current and record operating time.

Compare to calculated values for operating times.

P.U. D.O. & TIMING TESTS	Ph.	Dir	Char. (NI EI VI LTI, DTL)	Is (A)	TM	Operate Current			Operate Time		
						P.U. (Amps)	D.O. (Amps)	Tol	2 x Is (sec)	5 x Is (sec)	Tol
	E										

© 2013 Siemens Protection Devices Limited

Calculated Timing values in seconds for TM =1.0

Curve	2 xIs	5 xIs
IEC-NI	10.03	4.28
IEC-VI	13.50	3.38
IEC-EI	26.67	3.33
IEC-LTI	120.00	30.00
ANSI-MI	3.80	1.69
ANSI-VI	7.03	1.31
ANSI-EI	9.52	1.30

Note that the operate time may be subject to the *Minimum op time* setting for the element and/or may have a *Follower DTL* applied.

If VTS action is set to BLOCK, this option should be tested. Apply balanced voltage and current. Reduce a-phase voltage to cause a VTS condition. Increase a-phase current and check that the element does not operate.

If VTS action is set to Non-Directional, this option should be tested..Apply balanced voltage and current. Reduce a-phase voltage to cause a VTS condition. Increase a-phase current and check that the element operates at its normal setting. Reverse the voltage phase direction whilst checking that the element does not reset.

1.1.1.1 Element Blocking

The Sensitive Earth Fault elements can be blocked by Binary Input Inhibit and VT Supervision. The Characteristic can be made non-directional by VT Supervision. This functionality should be checked.

Element	BI Inhibits	VTS action
51SEF-1		
51SEF-2		
51SEF-3		
51SEF-4		
50SEF-1		
50SEF-2		
50SEF-3		
50SEF-4		

© 2013 Siemens Protection Devices Limited

2.1.1.1 ANSI Reset

If the element is configured as an ANSI characteristic, it may have a reset delay applied. If ANSI reset is selected for an IEC characteristic element, the reset will be instantaneous.

ANSI reset times from operated condition to fully reset are as follows for zero applied current and TM = 1.0. The reset curve characteristic type and TM is defined by the operating characteristic.

Curve	Fully operated to reset with Zero current applied & TM=1 (secs)
ANSI-MI	4.85
ANSI-VI	21.6
ANSI-EI	29.1

Apply current in the following sequence, a) 2x setting for a time to ensure element operation, b) Zero current for the reset time above (xTM), c) 2x setting for a time to ensure element operation. Check that the second operation (c) is similar to the first (a) and in line with the expected operate time for the element at this current level.

Repeat the test with the reset time (b) reduced to 5 0% of the previous value. Ensure that the second operate time (c) is 50 % of the first (a) operate time.

Operate time (expected)	Reset time (calculated)	Operate time (measured)	50% Reset Time (calculated)	50% operate time (calculated)	50% operate time (measured)
		First test (c)			Second Test (c)

Check correct indication, trip output, alarm contacts, waveform record.

© 2013 Siemens Protection Devices Limited

2.6 Restricted Earth fault. (64H)

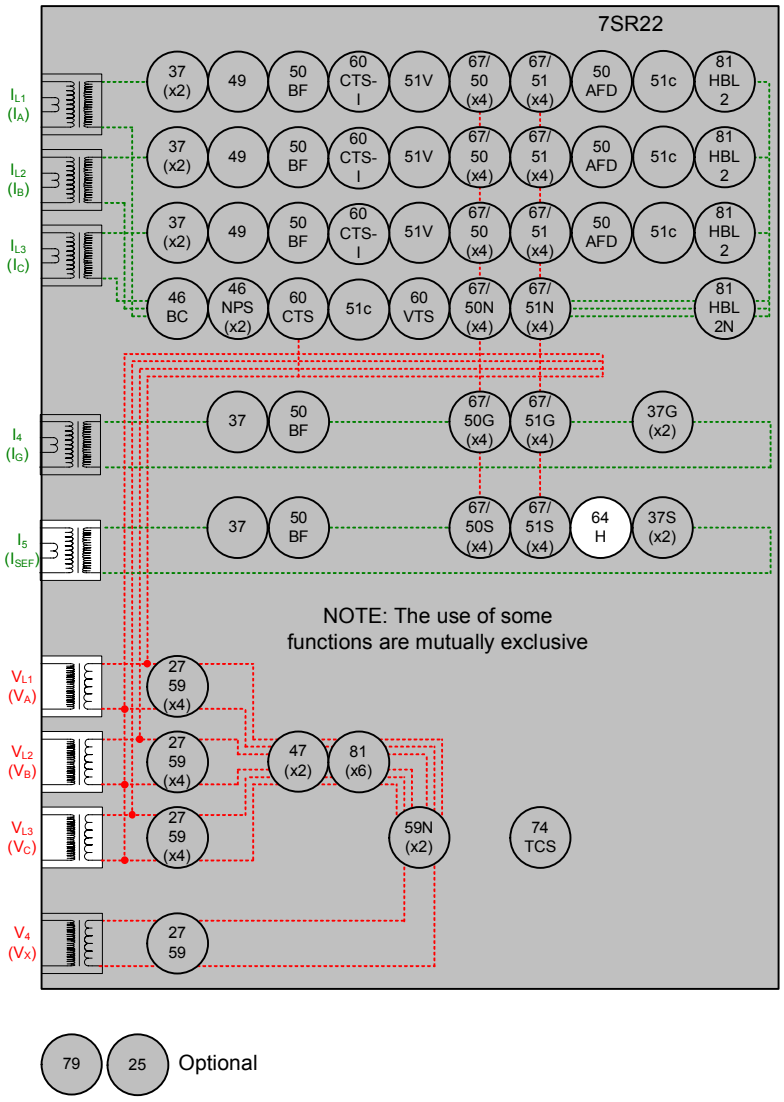


Figure 2.6-1 Restricted Earth Fault

Voltage Inputs:	n/a
Current Inputs:	I_5 (I_{REF})
Disable:	51SEF, 50SEF, 79
Map Pickup LED:.	64H - Self Reset

The setting resistance should be measured and the value compared to that specified in the settings data. Both values should be recorded.

Settings Data Resistor Value	Measured

The high value of setting resistance R will often interfere with secondary current injection when using a digital test set. It is normal practice in these cases to short out the resistor to allow testing; the shorting link should be removed after testing.

Since the DTL setting is generally small the pick-up setting can be tested by gradually increasing current until element operates. The relay should be disconnected from the current transformers for this test.

© 2013 Siemens Protection Devices Limited

Apply 2x setting current if possible and record operating time

Phase	Is (Amps)	DTL (sec)	P.U. Current Amps	Tolerance	Operate Time 2 x Is	Tolerance
REF						

It is also desirable to check the operating voltage achieved with the setting resistor and all parallel CTs connected but de-energised. A higher capacity test set will be required for this test. Adequate current must be supplied to provide the magnetising current of all connected CTs. Precautions should be taken to ensure that no personnel are at risk of contact with any of the energised secondary wiring during the test.

Settings Data Voltage Setting	Measured

To complete testing of the REF requires primary injection through the phase and residual (REF) CT in series to simulate an out of zone fault and ensure stability of the relay. The test can then be repeated with the REF CT secondary connections reversed to prove operation.

1.1.1.1 Element Blocking

The Restricted Earth Fault element can be blocked by Binary Input Inhibit. This functionality should be checked.

Element	BI Inhibits
64H	

Check correct indication, trip output, alarm contacts, waveform record.

Check that any shorting links are removed after testing.

© 2013 Siemens Protection Devices Limited

2.7 Negative Phase Sequence Overcurrent (46NPS)

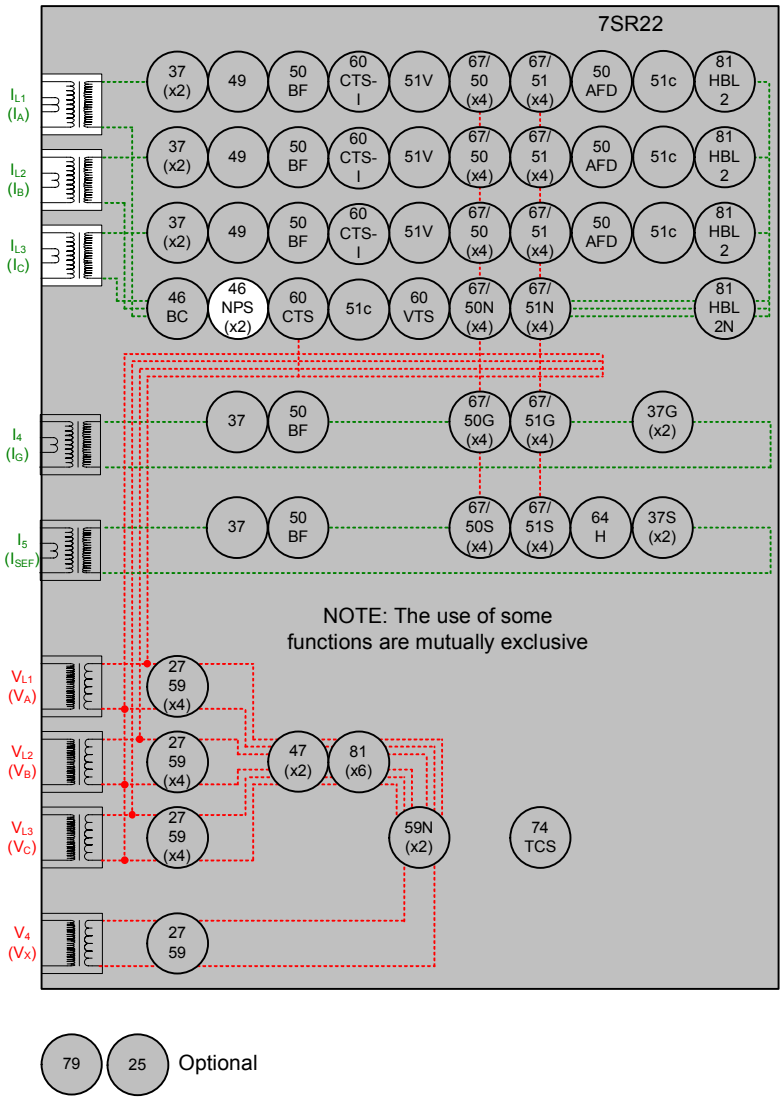


Figure 2.7-1Negative Phase Sequence Overcurrent

Voltage Inputs:	n/a
Current Inputs:	I_{L1} (I_A), I_{L2} (I_B), I_{L3} (I_C),
Disable:	51, 51V, 51c, 37, 49, 50BF, 60CTS, 46BC
Map Pickup LED:	46IT/46DT - Self Reset

Where two NPS elements are being used with different settings, it is convenient to test the elements with the highest settings first. The elements with lower settings can then be tested without disabling the lower settings. The Thermal withstand limitations of the current inputs, stated in the Performance Specification should always be observed throughout testing.

NPS Overcurrent can be tested using a normal 3P balanced source. Two phase current connections should be reversed so that the applied balanced 3P current is Negative Phase Sequence.

© 2013 Siemens Protection Devices Limited

2.7.1 Definite Time NPS Overcurrent. (46DT)

If DTL setting is small, gradually increase current until element operates.

If DTL is large apply 0.9x setting, check for no operation, apply 1.1x setting, and check operation.

Apply 2x setting current if possible and record operating time

Phase	Is (Amps)	DTL (sec)	P.U. Current Amps	Tolerance	Operate Time 2 x Is	Tolerance
NPS						

Check correct indication, trip output, alarm contacts, waveform record.

2.7.2 Inverse Time NPS Overcurrent. (46IT)

It will be advantageous to map the function being tested to temporarily drive the relevant Pickup output in the *Pickup Config* sub-menu in the *Output Config* menu as this will allow the Pick-up led to operate for the function.

Gradually increase current until Pickup LED operates.

Apply 2x setting current and record operating time.

Apply 5x setting current and record operating time.

Compare to calculated values for operating times

P.U. D.O. & TIMING TESTS	Ph.	Dir	Char. (NI EI VI LTI, DTL)	Is (A)	TM	Operate Current			Operate Time		
						P.U. (Amps)	D.O. (Amps)	Tol	2 x Is (sec)	5 x Is (sec)	Tol
	NPS										

Calculated Timing values in seconds for TM =1.0

Curve	2 xIs	5 xIs
IEC-NI	10.03	4.28
IEC-VI	13.50	3.38
IEC-EI	26.67	3.33
IEC-LTI	120.00	30.00
ANSI-MI	3.80	1.69
ANSI-VI	7.03	1.31
ANSI-EI	9.52	1.30

Note that the operate time may be subject to the *Minimum op time* setting for the element and/or may have a *Follower DTL* applied.

© 2013 Siemens Protection Devices Limited

1.1.1.1 ANSI Reset

If the element is configured as an ANSI characteristic, it may have a reset delay applied. If ANSI reset is selected for an IEC characteristic element, the reset will be instantaneous.

ANSI reset times from operated condition to fully reset are as follows for zero applied current and TM = 1.0. The reset curve characteristic type and TM is defined by the operating characteristic.

Curve	Fully operated to reset with Zero current applied & TM=1 (secs)
ANSI-MI	4.85
ANSI-VI	21.6
ANSI-EI	29.1

Apply current in the following sequence, a) 2x setting for a time to ensure element operation, b) Zero current for the reset time above (xTM), c) 2x setting for a time to ensure element operation. Check that the second operation (c) is similar to the first (a) and in line with the expected operate time for the element at this current level.

Repeat the test with the reset time (b) reduced to 50 % of the previous value. Ensure that the second operate time (c) is 50 % of the first (a) operate time.

Operate time (expected)	Reset time (calculated)	Operate time (measured)	50% Reset Time (calculated)	50% operate time (calculated)	50% operate time (measured)
		First test (c)			Second Test (c)

2.1.1.1 Element Blocking

The NPS Overcurrent elements can be blocked by Binary Input Inhibit. This functionality should be checked.

Element	BI Inhibits
46IT	
46DT	

Check correct indication, trip output, alarm contacts, waveform record.

When testing is complete reinstate any of the disabled functions.

© 2013 Siemens Protection Devices Limited

2.8 Undercurrent. (37)

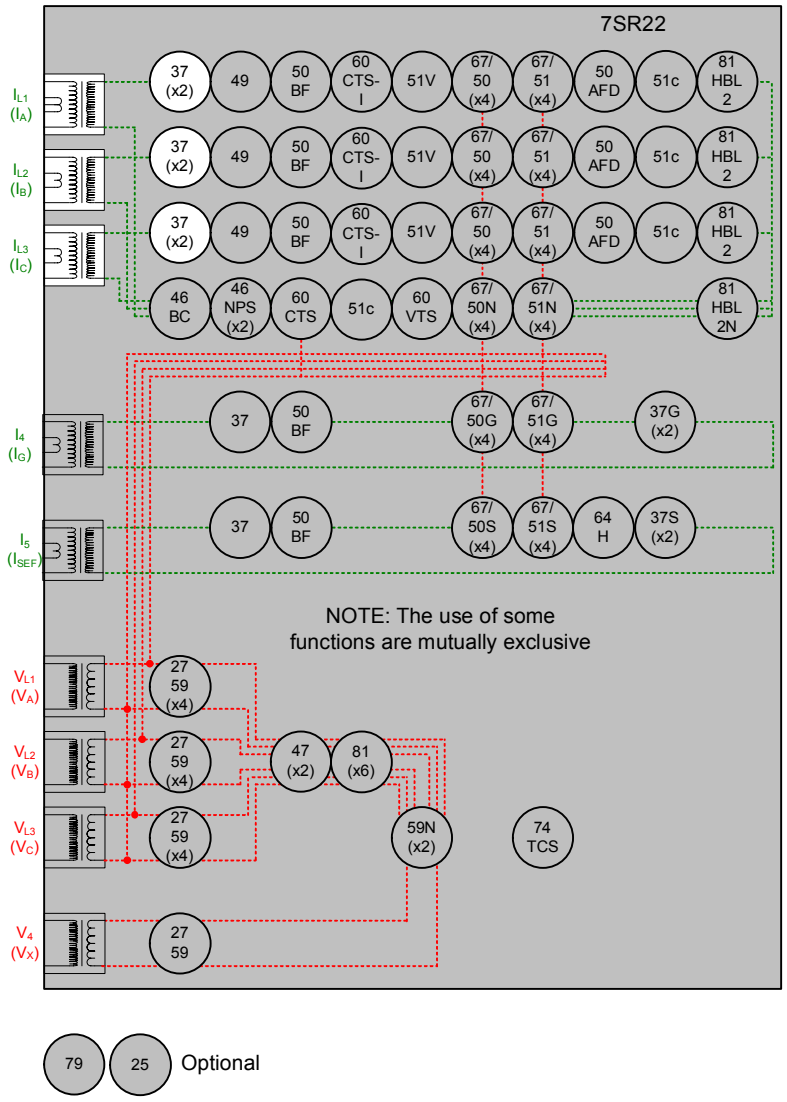


Figure 2.8-1Undercurrent

Voltage Inputs:	n/a
Current Inputs:	I_{L1} (I_A), I_{L2} (I_B), I_{L3} (I_C),
Disable:	51N, 51G, 46, 60CTS, 46BC
Map Pickup LED:	37-n - Self Reset

If two Undercurrent 37 elements are used with different settings, it is convenient to test the element with the lowest setting first. The higher setting element can then be tested without interference from the other element.

Apply 3P balanced current at a level above the Undercurrent 37-n setting until the element resets.

If DTL setting is small, gradually reduce any each phase current in turn until element operates.

If DTL is large apply 1.1x setting, check for no operation, apply 0.9x setting, and check operation

Testing of this element phase by phase may cause inadvertent operation of the 46 NPS Overcurrent elements.

Apply 0.5x setting current and record operating time.

© 2013 Siemens Protection Devices Limited

Phase	Is (Amps)	DTL (sec)	P.U. Current Amps	Tolerance	Operate Time 0.5 x Is	Tolerance
$I_{L1}(I_A)$						
$I_{L2}(I_B)$						
$I_{L3}(I_C)$						

1.1.1.1 Element Blocking

The Undercurrent elements can be blocked by Binary Input Inhibit. This functionality should be checked.

Element	BI Inhibits
37-1	
37-2	

Check correct indication, trip output, alarm contacts, waveform record.

© 2013 Siemens Protection Devices Limited

2.9 Thermal Overload (49)

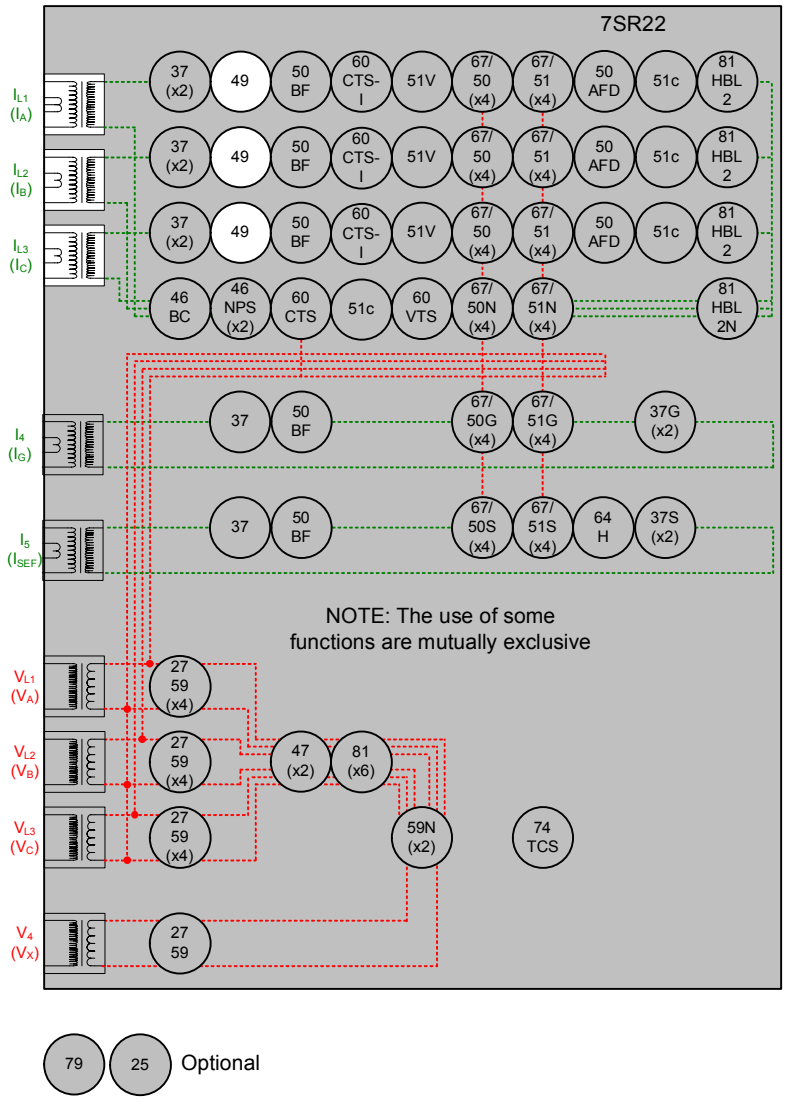


Figure 2.9-1Thermal Overload

Voltage Inputs:	n/a
Current Inputs:	I_{L1} (I_A), I_{L2} (I_B), I_{L3} (I_C),
Disable:	51, 50, 37, 50BF
Map Pickup LED:.	49Alarm

The current can be applied from a 3P balanced supply or phase by phase from a 1P supply. Alternatively the 3 phase current inputs can be connected in series and injected simultaneously from a single 1P source.

The Thermal Overload Setting and Time Constant Setting can be considered together to calculate the operating time for a particular applied current.

The following table lists operate times for a range of Time Constant Settings for an applied current of 2x the Thermal Overload setting. Ensure that the thermal rating of the relay is not exceeded during this test.

© 2013 Siemens Protection Devices Limited

Time Constant (mins)	Operate Time (sec)
1	17.3
2	34.5
3	51.8
4	69
5	86.3
10	173
15	259
20	345
25	432
30	51.8
50	863
100	1726

The Thermal State must be in the fully reset condition in order to measure the operate time correctly. This can be achieved by setting change in the Thermal protection settings menu or by pressing the Test/Reset button when the Thermal Meter is shown in the Instruments Mode.
Reset the thermal State then apply 2x the Overload Setting current.

Calculated Operate Time (s)	Measured Operate Time (s)

If the Thermal Overload Capacity Alarm is used, this can be tested by monitoring the Thermal Capacity in the instruments menu. If the Thermal time constant is longer than a few minutes, this can be assessed during the timing test above. If the Time Constant is less than a few minutes, a lower multiple of current will be required such that the rate of capacity increase is slowed to allow monitoring of the instrument to be accurate.

Capacity Alarm Setting	Measured

1.1.1.1 Element Blocking

The Thermal element can be blocked by Binary Input Inhibit. This functionality should be checked.

Element	BI Inhibits
49	

© 2013 Siemens Protection Devices Limited

2.10 Over/Under Voltage

2.10.1 Phase Under/Over Voltage. (27/59)

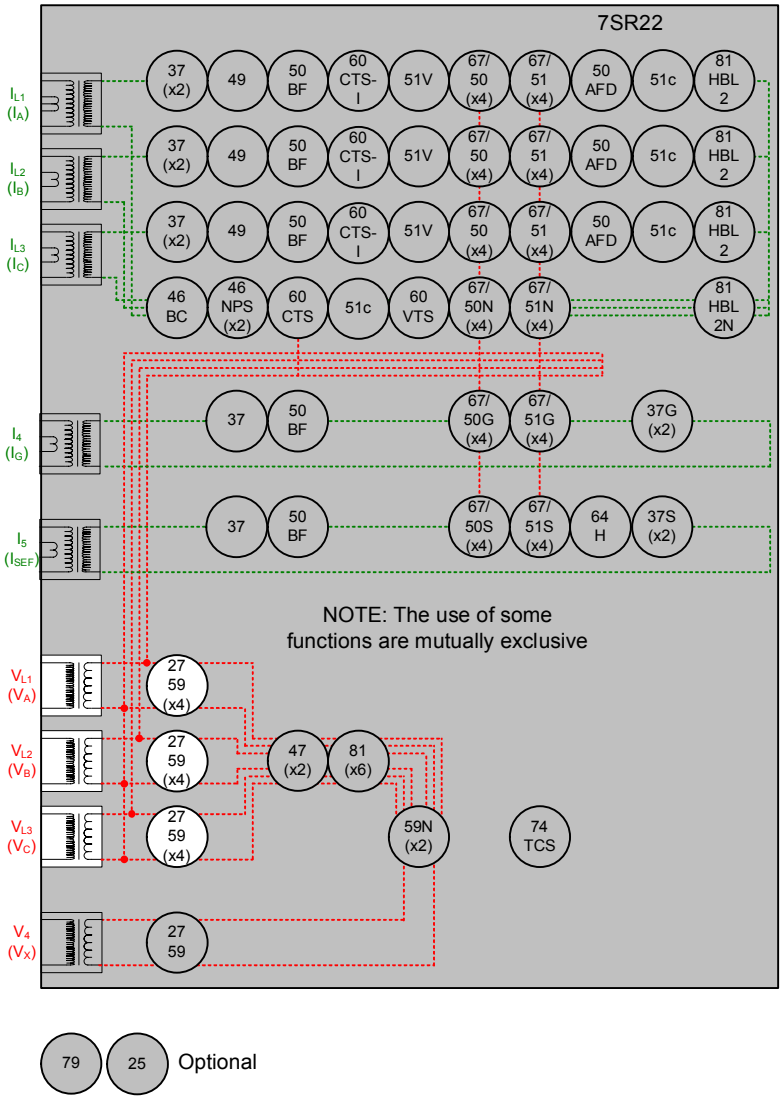


Figure 2.10-1 Phase Under/Over Voltage

Voltage Inputs:	V_{L1} (V_A), V_{L2} (V_B), V_{L3} (V_C)
Current Inputs:	n/a apply zero current to stabilize other functions
Disable:	47, 59N, 60VTS
Map Pickup LED:.	27/59-n - Self Reset

Where more than one Undervoltage (27) elements are being used with different settings, it is convenient to test the elements with the lowest settings first. The elements with higher settings can then be tested without disabling the lower settings.

Note that if the voltage is reduced below the 27UVG setting, the function may be blocked. VTS operation may also block the 27 Undervoltage function. Current inputs are not normally required to stabilise the relay during voltage element testing.

If the 'O/P Phases' is set to 'All', the voltage on all phases must be reduced simultaneously. Otherwise the 3 phases should be tested individually.

© 2013 Siemens Protection Devices Limited

If the DTL is short, starting from nominal voltage, slowly decrease the applied 3P or VL1 test voltage until the Pickup LED (temporarily mapped) is lit. Record the operate voltage. The LED should light at setting Volts +/- 5 %. Slowly increase the input voltage until the LED extinguishes. Record the reset voltage to check the 'Hysteresis' setting. If the DTL is long, the operate level level should be checked by applying a voltage of 90 % of setting voltage. Check Hysteresis by resetting element to the operate level setting plus the hysteresis setting.

Connect the relevant output contact(s) to stop the test set. Step the applied voltage to a level below the setting. The test set should be stopped at the operate time setting +/- 5 %

Test inputs VL2 and VL3 by repeating the above if necessary.

When testing is complete reinstate any of the disabled functions.

Where more than one overvoltage (59) elements are being used with different settings, it is convenient to test the elements with the highest settings first. The elements with lower settings can then be tested without disabling the higher settings.

If the 'O/P Phases' is set to 'All', the voltage on all phases must be increased simultaneously. Otherwise the 3 phases should be tested individually. If the DTL setting is short, starting from nominal voltage, slowly increase the applied 3P or VL1 test voltage until the Pickup LED (temporarily mapped) is lit. The LED should light at setting Volts +/- 5 % Decrease the input voltage to nominal Volts and the LED will extinguish. Record the reset voltage to check the 'Hysteresis' setting. If the DTL setting is long, the operate level can be checked by applying 100 % of setting to cause operation followed by setting minus the Hysteresis setting to cause reset.

Connect the relevant output contact(s) to stop the test set. Step the applied voltage to a level above the setting. The test set should be stopped at the operate time setting +/- 5 %.

Test inputs VL2 and VL3 by repeating the above if necessary.

Phase	27/59 setting (Volts)	U/O	DTL (sec)	Hyst.	D.O. (calculated)	P.U. Volts	D.O Volts	Op. Time 2x Vs (OV) 0.5x Vs (UV)	UV Guard	Tol
$V_1(V_A)$										
$V_2(V_B)$										
$V_3(V_C)$										

1.1.1.1 Element Blocking

The NPS Overcurrent elements can be blocked by Binary Input Inhibit and VT Supervision. This functionality should be checked.

Element	BI Inhibits	VT Supervision
27/59-1		
27/59-2		
27/59-3		
27/59-4		

When testing is complete reinstate any of the disabled functions.

© 2013 Siemens Protection Devices Limited

2.10.2 Undervoltage Guard (27/59UVG)

If any 27 Undervoltage element is set to be inhibited by the 27 Undervoltage Guard element, this function should be tested.

Connect the test voltage inputs to suit the installation wiring diagram utilising any test socket facilities available. It may be useful to temporarily map an LED as 'General Pickup' to assist during testing. 27UVG operation will reset the General Pickup if no other element is operated. This LED should not be set as 'Hand Reset' in the Output matrix.

Starting from nominal voltage, apply a step decrease to the applied voltage to a level below the 27 Undervoltage setting but above the 27UVG setting such that an Undervoltage element operation occurs. Slowly reduce the applied voltage until the 27 Undervoltage element resets, this can be detected by the General Pickup LED reset if no other element is operated (this includes any Undervoltage element which is not UV Guarded).

Phase	Vs (Volts)	Tol	V element Used for test	Blocked Volts	NOTES
UVG					

© 2013 Siemens Protection Devices Limited

2.10.3 Vx Under/Over Voltage. (Vx 27/59)

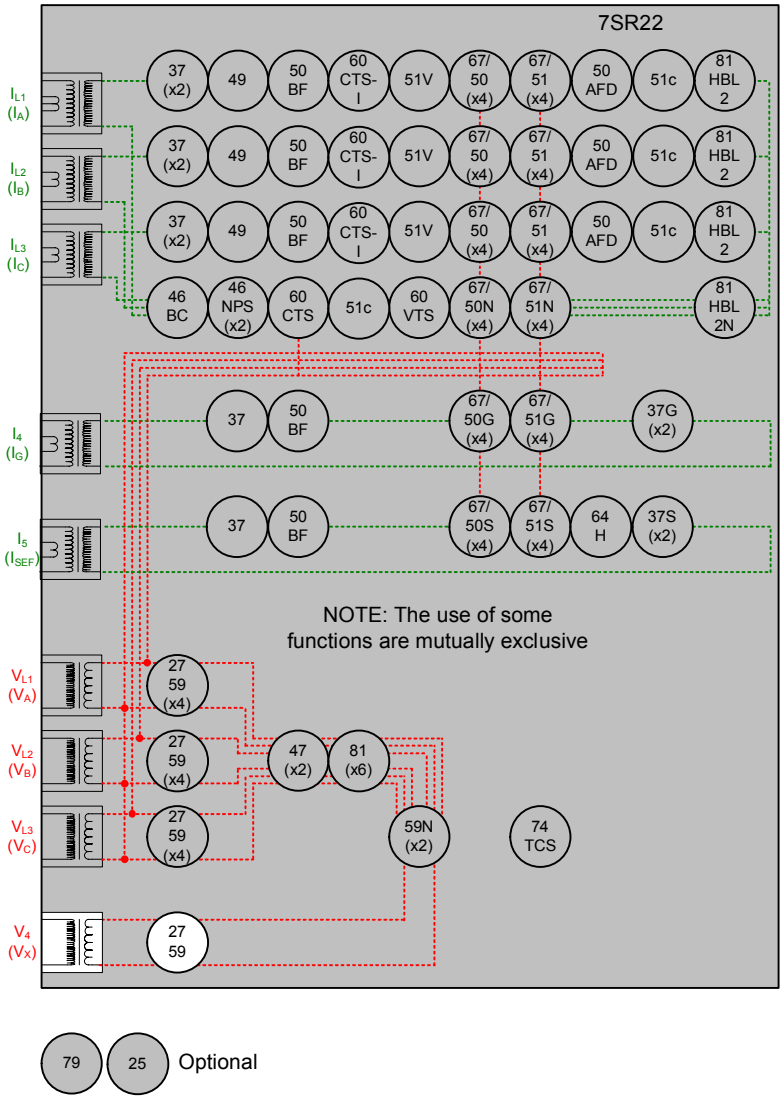


Figure 2.10-2 Vx Under/Over Voltage

Voltage Inputs:	V_4 (V_X)
Current Inputs:	n/a apply zero current to stabilize other functions
Disable:	
Map Pickup LED:.	Vx 27/59 - Self Reset

If DTL setting is small, gradually increase single phase voltage applied to Vx input until element operates if the element is Overvoltage. Alternatively, if the element is Undervoltage, increase single phase voltage applied to Vx input until element operates.

If DTL is large, for Overvoltage elements, apply 0.9x setting, check for no operation, apply 1.1x setting, check operation. For Undervoltage elements, apply 1.1x setting, check for no operation, apply 0.9x setting, check operation.

Apply 2x setting voltage if possible and record operating time.

Starting with the element in the operated condition, gradually increase or decrease the applied voltage until the element resets. Measure the reset voltage level to check the ***27/59 Hysteresis*** setting.

© 2013 Siemens Protection Devices Limited

Phase	27/59 setting (Volts)	U/O	DTL (sec)	Hyst.	D.O. (calculated)	P.U. Volts	D.O Volts	Op. Time 2x Vs (OV) 0.5x Vs (UV)	Tolerence
$V_4(V_x)$									

1.1.1.1 Element Blocking

The Vx Under/Over Voltage elements can be blocked by Binary Input Inhibit and VT Supervision. This functionality should be checked.

Element	BI Inhibits	VT Supervision
27/59x		

Check correct indication, trip output, alarm contacts, waveform record.

© 2013 Siemens Protection Devices Limited

2.10.4 NPS Overvoltage (47)

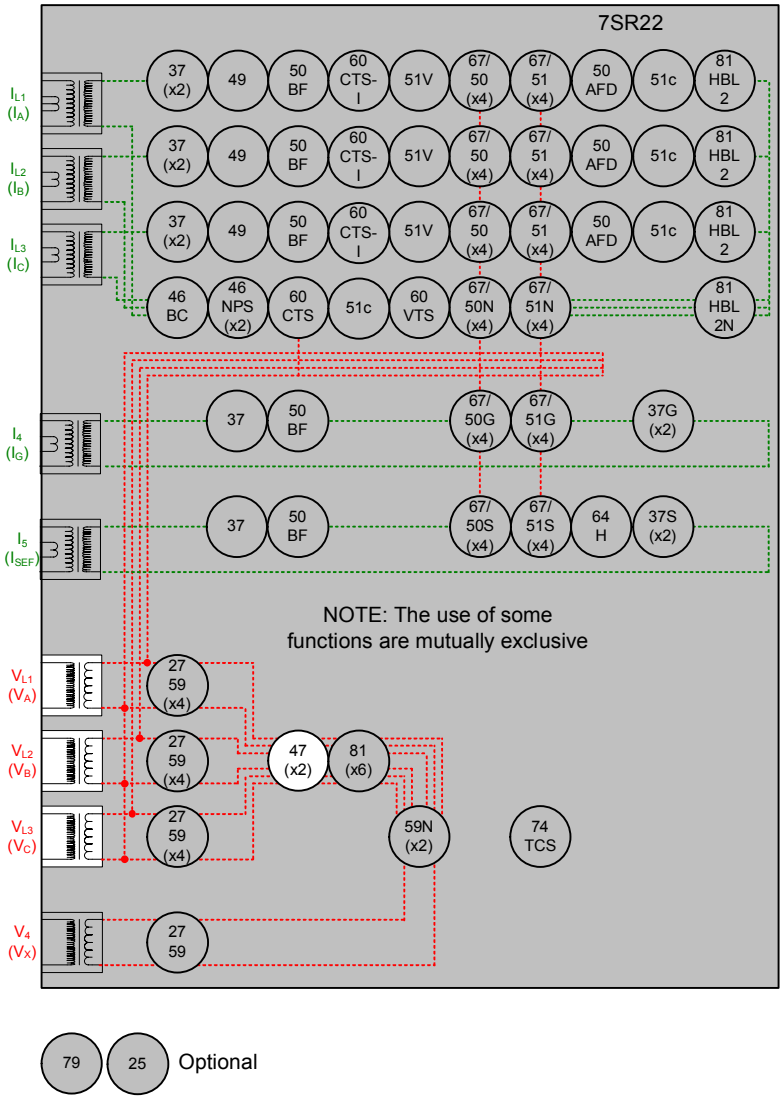


Figure 2.10-3 NPS Overvoltage

Voltage Inputs:	V_{L1} (V_A), V_{L2} (V_B), V_{L3} (V_C)
Current Inputs:	n/a apply zero current to stabilize other functions
Disable:	27/59, 59N, 60VTS
Map Pickup LED:.	47-n - Self Reset

Where two NPS elements are being used with different settings, it is convenient to test the elements with the highest settings first. The elements with lower settings can then be tested without disabling the lower settings.

NPS Overvoltage can be tested using a normal 3P balanced source. Two phase voltage connections should be reversed so that the applied balanced 3P voltage is Negative Phase Sequence.

If the 47-n delay is small, gradually increased the applied balanced 3P voltage until element operates.

If DTL is large apply 0.9x setting, check for no operation, apply 1.1x setting, and check operation.

Apply 2x setting current if possible and record operating time.

© 2013 Siemens Protection Devices Limited

Phase	27/59 setting (Volts)	U/O	DTL (sec)	Hyst.	D.O. (calculated)	P.U. Volts	D.O Volts	Op. Time 2x Vs	Tolerence
NPS									

1.1.1.1 Element Blocking

The NPS Overvoltage element can be blocked by Binary Input Inhibit. This functionality should be checked.

Element	BI Inhibits
47-1	
47-2	

Check correct indication, trip output, alarm contacts, waveform record.

© 2013 Siemens Protection Devices Limited

2.10.5 Neutral Overvoltage (59N)

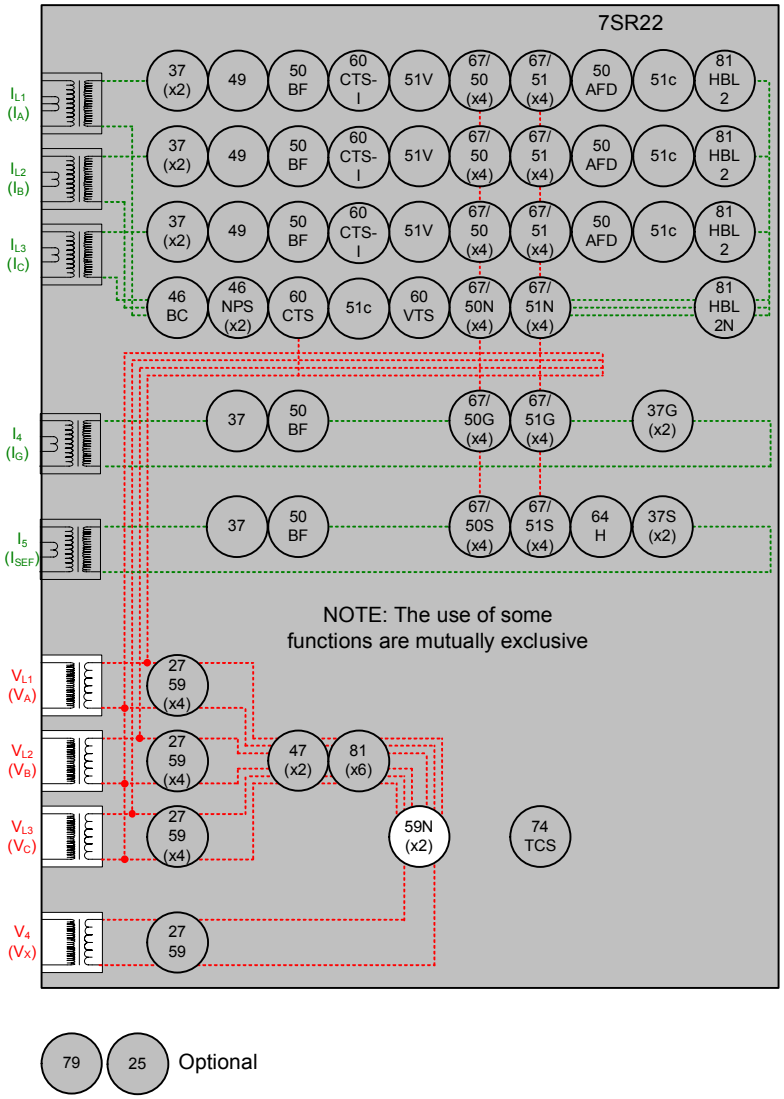


Figure 2.10-4 Neutral Overvoltage

Voltage Inputs:	V_{L1} (V_A), V_{L2} (V_B), V_{L3} (V_C)
Current Inputs:	n/a apply zero current to stabilize other functions
Disable:	27/59, 47, 60VTS
Map Pickup LED:.	59N-n - Self Reset

The voltage source for the Neutral Overvoltage 59N function can be set as either Vn , calculated from the applied 3 phase voltage inputs or Vx, the V_4 input. Apply test voltage to 1 phase input or V_4 input to suit.

2.10.6 Definite Time (59NDT)

If DTL setting is small, gradually increase single phase voltage until element operates.

If DTL is large apply 0.9x setting, check for no operation, apply 1.1x setting, and check operation.

Apply 2x setting voltage if possible and record operating time.

© 2013 Siemens Protection Devices Limited

Phase	Vs (Volts)	DTL (sec)	P.U. Current Volts	Operate Time 2x Vs	Tolerence
E					

Check correct indication, trip output, alarm contacts, waveform record.

2.10.7 Inverse Time (59NIT)

It will be advantageous to map the function being tested to temporarily drive the relevant Pickup output in the *Pickup Config* sub-menu in the *Output Config* menu as this will allow the Pick-up led to operate for the function.

Gradually increase voltage until Pickup LED operates.

Apply 2x setting voltage and record operating time,

Apply a higher multiple of setting voltage and record operating time.

Compare to calculated values for operating times from:

$$t_{op}(\text{seconds}) = M\left[\frac{1}{\left[\frac{Vn}{Vs}\right]-1}\right]$$

Where M = Time multiplier and Vn/Vs = multiple of setting.

P.U. D.O. & TIMING TESTS	Ph.	Vs (V)	TM	Operate Voltage			Operate Time		
				P.U. (Volts)	D.O. (Volts)	Tol	2.x Vs (sec)	x Vs (sec)	Tol
	E								

2.10.8 ELEMENT BLOCKING

The Neutral Overvoltage elements can be blocked by Binary Input Inhibit. This functionality should be checked.

Element	BI Inhibits
59NIT	
59NDT	

Check correct indication, trip output, alarm contacts, waveform record.

When testing is complete reinstate any of the disabled functions.

© 2013 Siemens Protection Devices Limited

2.10.9 Under/Over Frequency (81)

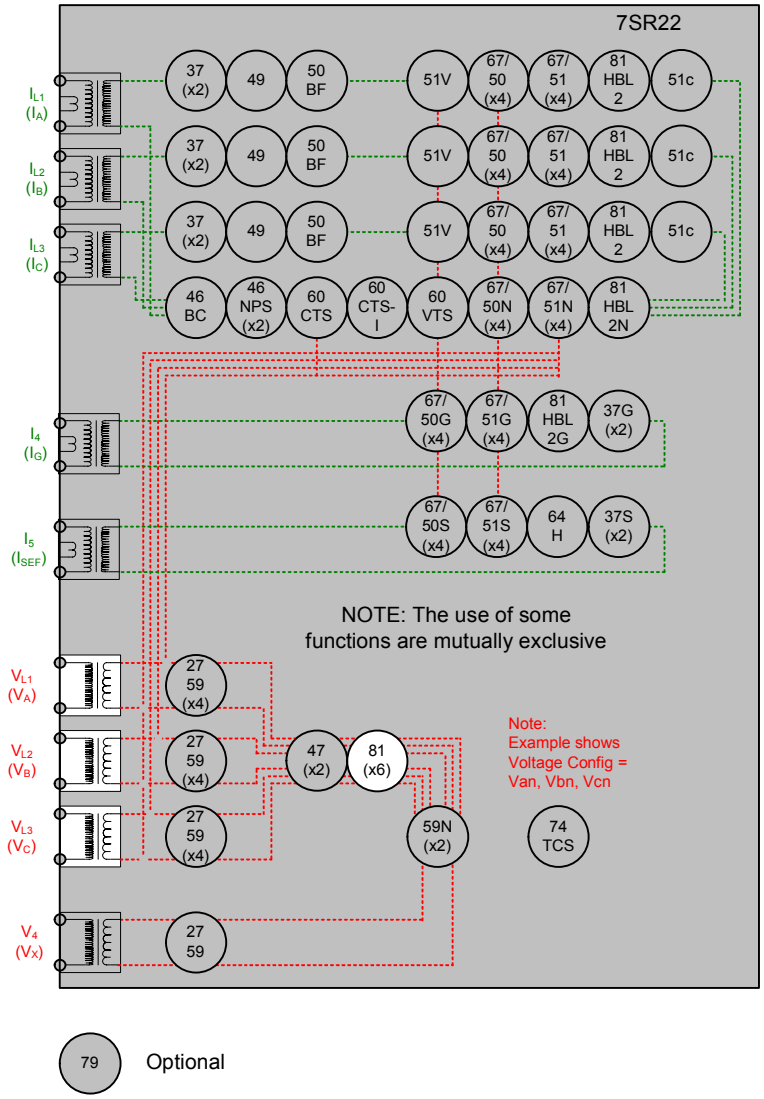


Figure 2.10-5 Under/Over Frequency

Voltage Inputs:	V_{L1} (V_A), V_{L2} (V_B), V_{L3} (V_C)
Current Inputs:	n/a apply zero current to stabilize other functions.
Disable:	
Map Pickup LED:	81-n - Self Reset.

This function can be tested by application of 1P or 3P voltage. For Over-frequency, the elements with the highest setting should be tested first and for Under-frequency the elements with the lowest settings should be tested first. The elements with other settings can then be tested without need to disable the elements already tested. Note that the relay is designed to track the gradual changes in power system frequency and that sudden step changes in frequency during testing do not reflect normal system operation. Normal 'instantaneous' operation of the frequency element is 140 ms to 175 ms in line with the Performance Specification. Application of sudden step changes to frequency can add additional delay which can produce misleading test results.

Gradually increase/decrease applied voltage frequency until 81-n operation occurs. Elements set for more extreme frequency fluctuation should be tested first with lesser elements disabled.

© 2013 Siemens Protection Devices Limited

If the 81-n Delay setting is long it will be advantageous to map the function to temporarily drive the relevant Pickup output in the *Pickup Config* sub-menu in the *Output Config* menu as this will allow the Pick-up led to operate for the function. If the delay setting is short the operation of the element can be easily checked directly.

The frequency should then be gradually decreased/increased until the element resets. The reset frequency can be used to check the Hysteresis setting.

If the element is set as ***81-n U/V Guarded***, The applied voltage must be above the ***81 UV Guard* Setting** in the ***U/O Frequency*** menu.

Apply setting frequency +0.5 Hz for Over-frequency or -0.5 Hz for Under-frequency and record operating time.

Starting with the element in the operated condition, gradually increase or decrease the applied voltage until the element resets. Measure the reset voltage level to check the ***81 Hysteresis*** setting.

F (Hertz)	U/O	DTL (sec)	Hyst.	D.O. (calc.)	P.U. Freq Hertz	D.O. Freq. Hertz	Operate Time +/- 0.5Hz	UV Guard	NOTES

If the element is set as ***81-nU/V Guarded*,** this setting can be tested by applying the test voltage at a level below the ***81 U/V Guard Setting*** at a frequency in the operate range. Increase the voltage until the relay operates.

UVG	UVG Setting (Volts)	Freq element Used for test	Blocked Volts (D.O.)	Unblocked Volts (P.U.)	NOTES
U/O Freq					

1.1.1.1 ELEMENT BLOCKING

The U/O Frequency elements can be blocked by Binary Input Inhibit. This functionality should be checked.

Element	BI Inhibits
81-1	
81-2	
81-3	
81-4	
81-5	
81-6	

Check correct indication, trip output, alarm contacts, waveform record.

When testing is complete reinstate any of the disabled functions.

 © 2013 Siemens Protection Devices Limited

2.11 Power (32)

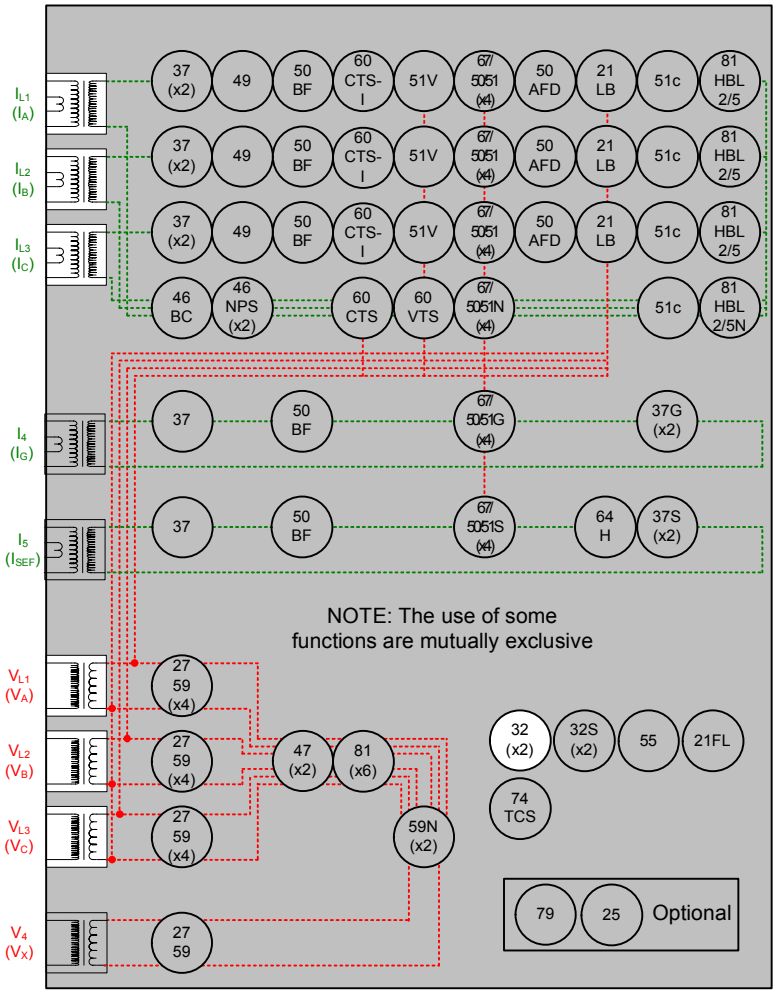


Figure 2.11-1 Power

Voltage Inputs:	V_{L1} (V_A), V_{L2} (V_B), V_{L3} (V_C)
Current Inputs:	I_{L1} (I_A), I_{L2} (I_B), I_{L3} (I_C),
Disable:	50, 51,27
Map Pickup LED:	32-n - Self Reset

This function can be tested by application 3P current and voltage. For Over-power, the elements with the highest setting should be tested first and for Under-power the elements with the lowest settings should be tested first. The elements with other settings can then be tested without need to disable the elements already tested.

From the nominal power setting Sn gradually increase/decrease applied voltage or current until 32-n operation occurs.

If the 32-n Delay setting is long it will be advantageous to map the function to temporarily drive the relevant Pickup output in the *Pickup Config* sub-menu in the *Output Config* menu as this will allow the Pick-up led to operate for the function. If the delay setting is short the operation of the element can be easily checked directly.

The current or voltage should then be decreased/increased until the element resets.

If the element is set as *32-**n** **U/C Guarded***, The applied current must be above the 32 ***U/C Guard*** **Setting**.

Apply setting power +10% for Over-power or -10% for Under-power and record operating time.

© 2013 Siemens Protection Devices Limited

	Power (xSn)	U/O	DTL (sec)	P.U. Power (xSn)	D.O. Power (xSn)	Operate Time +/- 0.5Hz	UC Guard	NOTES
32-1								
32-2								

If the element is set as 32***-n U/C Guarded*****,** the setting can be tested by applying the test current at a level below the ***32-n U/C Guard Setting*** at a power in the operate range. Increase the current until the relay operates.

UCG	UCG Setting (xIn)	Power element Used for test	Blocked Current (D.O.)	Unblocked Current (P.U.)	NOTES
U/O Power					

1.1.1.1 Element Blocking

The U/O Power elements can be blocked by Binary Input Inhibit. This functionality should be checked.

Element	BI Inhibits
32-1	
32-2	

Check correct indication, trip output, alarm contacts, waveform record.

When testing is complete reinstate any of the disabled functions.

© 2013 Siemens Protection Devices Limited

2.12 Sensitive Power (32S)

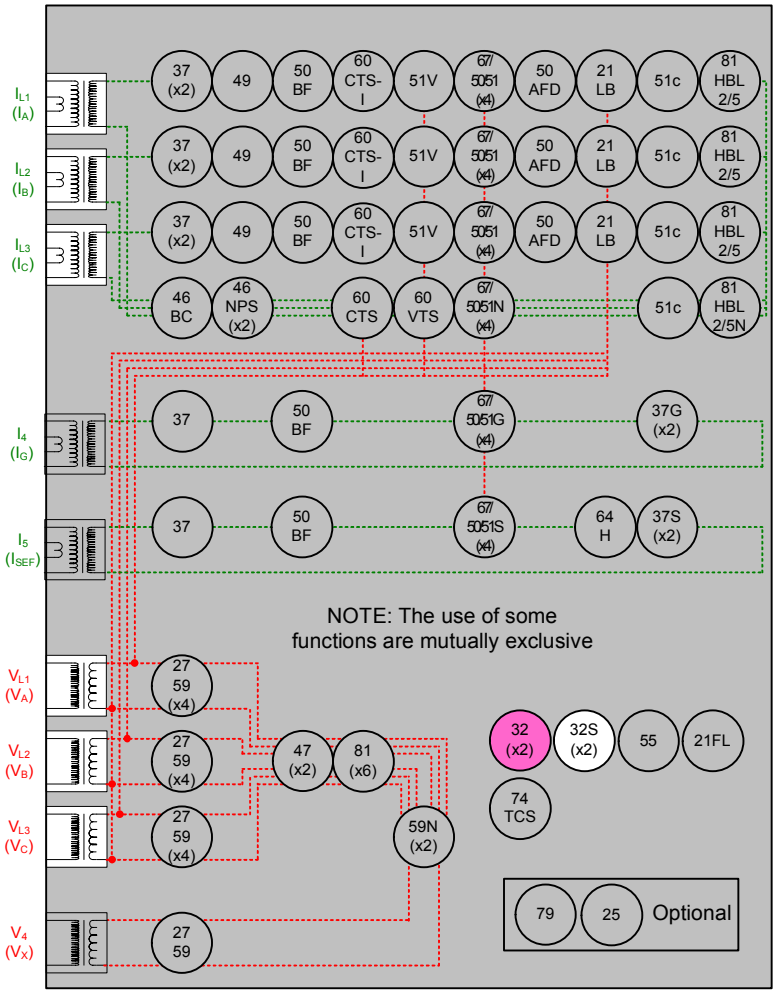


Figure 2.12-1 Sensitive Power

Voltage Inputs: V_{L1} (V_A), V_{L2} (V_B), V_{L3} (V_C)

Current Inputs: I_4 (I_{SEF})

Disable: 27

Map Pickup LED: 32S-n - Self Reset

This function can be tested by application 1P current and 3P voltage. For Over-power, the elements with the highest setting should be tested first and for Under-power the elements with the lowest settings should be tested first. The elements with other settings can then be tested without need to disable the elements already tested.

From the nominal power setting Sn gradually increase/decrease applied voltage or current until 32S-n operation occurs.

If the 32S-n Delay setting is long it will be advantageous to map the function to temporarily drive the relevant Pickup output in the *Output Config* > *Pickup Config* menu. This will allow the Pick-up led to operate for the function. If the delay setting is short the operation of the element can be easily checked directly.

The current or voltage should then be decreased/increased until the element resets.

If the element is set as *32S**-n U/C Guarded***, The applied current must be above the *32S **U/C Guard*** **Setting**.

Apply setting power +10% for Over-power or -10% for Under-power and record operating time.

© 2013 Siemens Protection Devices Limited

	Power (xSn)	U/O	DTL (sec)	P.U. Power (xSn)	D.O. Power (xSn)	Operate Time +/- 0.5Hz	UC Guard	NOTES
32S-1								
32S-2								

If the element is set as 32S***-n U/C Guarded*****,** the setting can be tested by applying the test current at a level below the ***32S-n U/C Guard Setting*** at a power in the operate range. Increase the current until the relay operates.

UCG	UCG Setting (xIn)	Power element Used for test	Blocked Current (D.O.)	Unblocked Current (P.U.)	NOTES
U/O Power					

1.1.1.1 Element Blocking

The U/O Power elements can be blocked by Binary Input Inhibit. This functionality should be checked.

Element	BI Inhibits
32S-1	
32S-2	

Check correct indication, trip output, alarm contacts, waveform record.

When testing is complete reinstate the disabled functions.

© 2013 Siemens Protection Devices Limited

2.13 Power Factor (55)

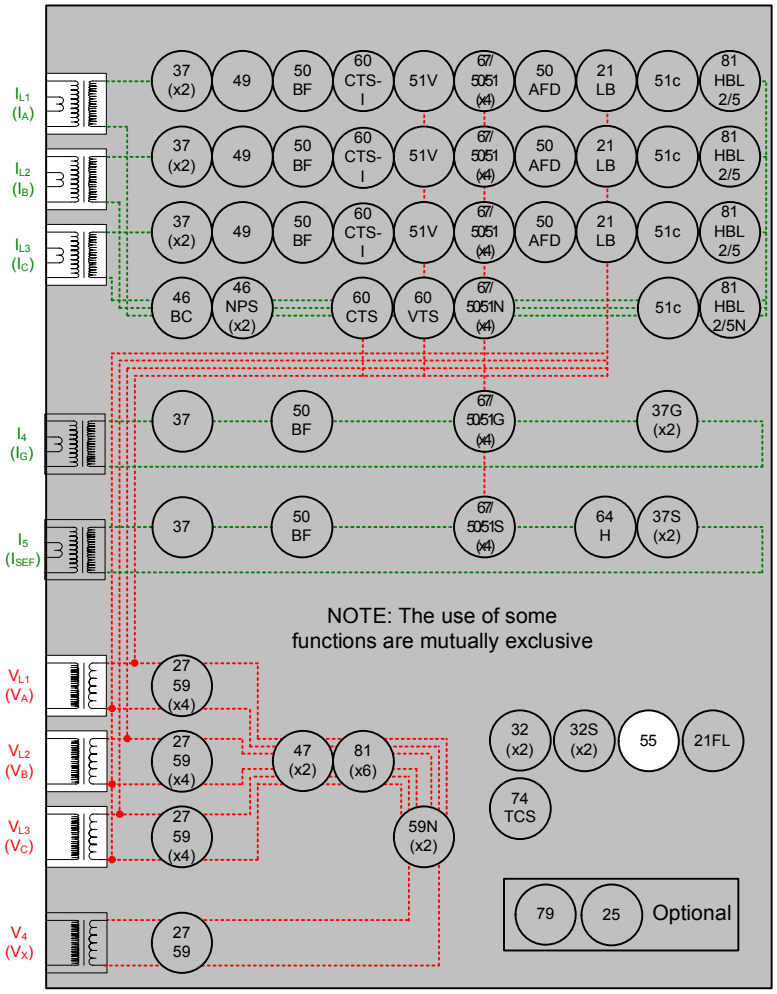


Figure 2.13-1 Power Factor

Voltage Inputs: V_{L1} (V_A), V_{L2} (V_B), V_{L3} (V_C)

Current Inputs: I_{L1} (I_A), I_{L2} (I_B), I_{L3} (I_C),

Disable: 49

Map Pickup LED: 55-n - Self Reset

Apply balanced 3 phase rated voltage and current. Increase current phase angle until the LED assigned to '55-n' is lit. Record this angle in the table below. Decrease the angle until the LED resets. Record the angle.

	55 Setting	Angle	Pick-Up	Drop-Off
55-1				
55-2				

© 2013 Siemens Protection Devices Limited

If the element is set as 55***-n U/C Guarded***, the setting can be tested by applying the test current at a level below the 55***-n U/C Guard Setting*** at a power in the operate range. Increase the current until the relay operates.

UCG	UCG Setting (xIn)	Power element Used for test	Blocked Current (D.O.)	Unblocked Current (P.U.)	NOTES
Power Factor					

1.1.1.1 Element Blocking

The Power Factor elements can be blocked by Binary Input Inhibit. This functionality should be checked.

Element	BI Inhibits
55-1	
55-2	

Check correct indication, trip output, alarm contacts, waveform record.

When testing is complete reinstate any of the disabled functions.

© 2013 Siemens Protection Devices Limited

Section 3: Supervision Functions

3.1 CB Fail. (50BF)

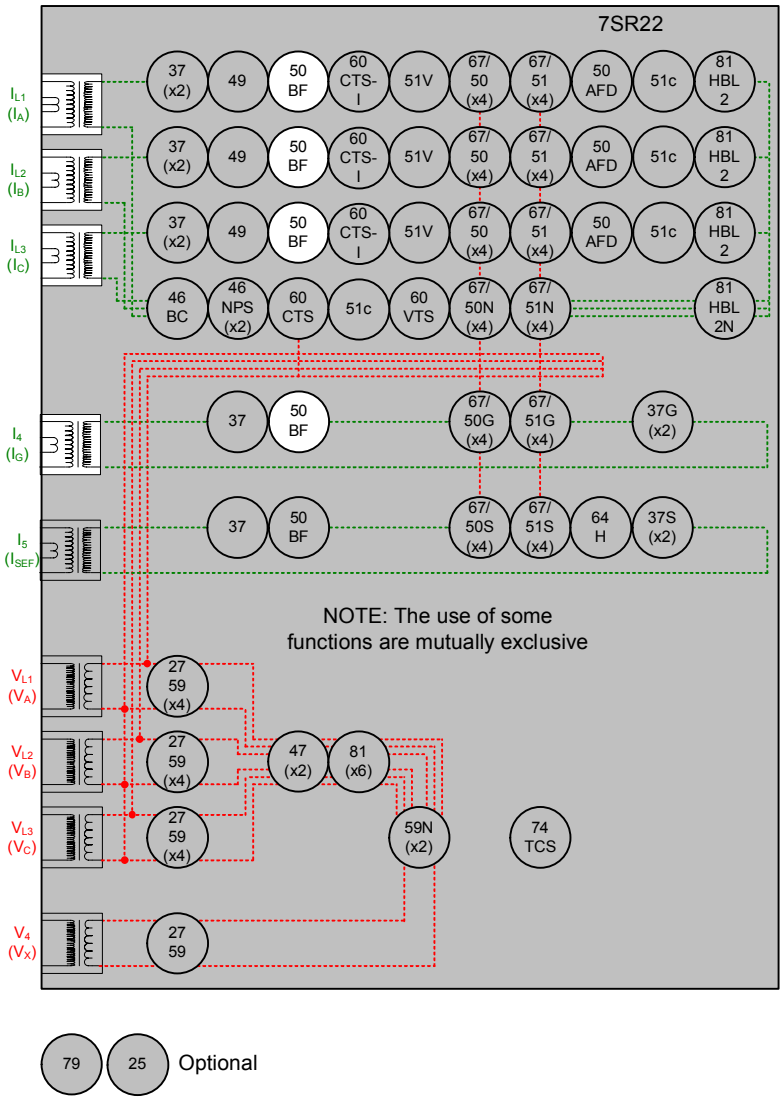


Figure 3.1-1 CB Fail

Voltage Inputs:	n/a
Current Inputs:	I_{L1} (I_A), I_{L2} (I_B), I_{L3} (I_C),
Disable:	
Map Pickup LED:	50BF-n - Self Reset

The circuit breaker fail protection time delays are initiated either from: -

A binary output mapped as **Trip Contact** in the OUTPUT CONFIG>BINARY OUTPUT CONFIG menu,

or

A binary input mapped as **50BF Ext Trip** in the INPUT CONFIG>INPUT MATRIX menu.

© 2013 Siemens Protection Devices Limited

Apply a trip condition by injection of current to cause operation of a suitable protection element. Allow current to continue after the trip at a level of 110 % of the *50BF Setting* current level on any phase. Measure the time for operation of operation of *50BF-1 Delay* and *50BF-2 Delay.* Repeat the sequence with current at 90 % of the *50BF Setting.*current level after the element trip and check for no CB Fail operation.

50BF Setting (xIn)	**Test Current**	**50BF-1 Delay**	**50BF-2 Delay**
	(110%)		
	(90%)	No Operation..□	No Operation.. □
	50BF CB Faulty	Operation No Delay □	Operation No Delay □
50BF-I4 Setting (xIn)	**Test Current**	**50BF-1 Delay**	**50BF-2 Delay**
	(110%)		
	(90%)	No Operation..□	No Operation.. □
	50BF CB Faulty	Operation No Delay □	Operation No Delay □

1.1.1.1 Element Blocking

The CB Fail function can be blocked by Binary Input Inhibit. This functionality should be checked.

Element	**BI Inhibits**
50BF	

© 2013 Siemens Protection Devices Limited

3.2 Voltage Transformer Supervision. (60VTS)

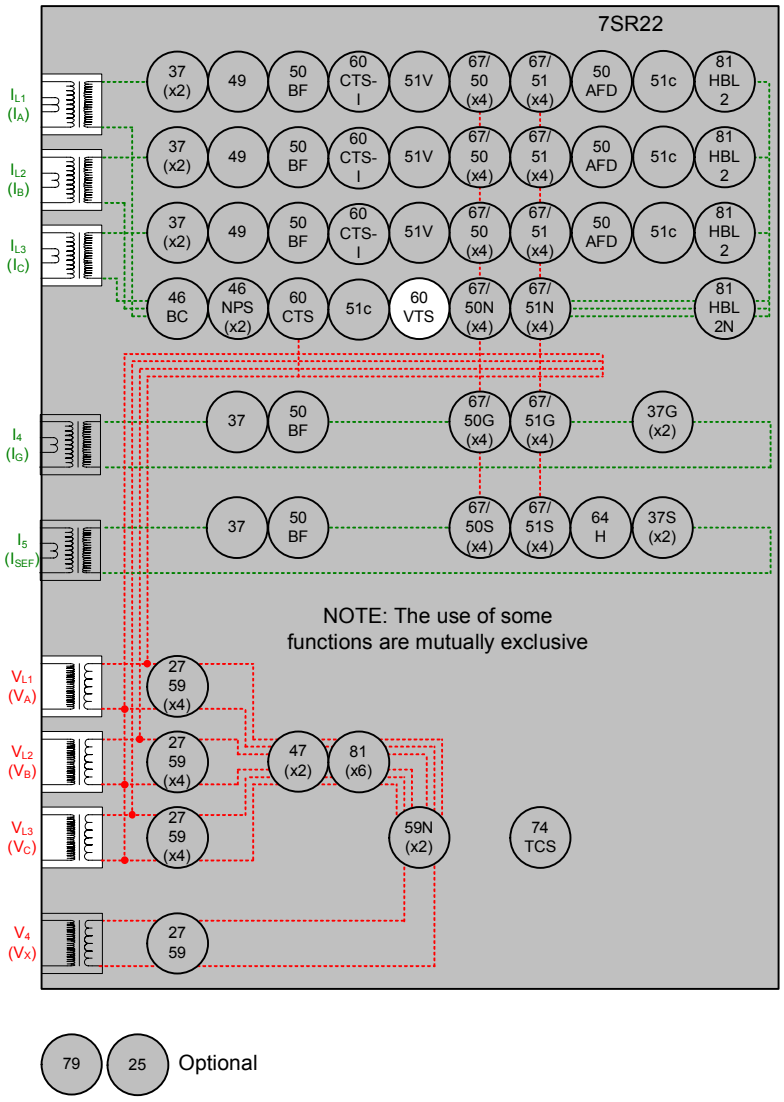


Figure 3.2-1 Voltage Transformer Supervision

Voltage Inputs:	V_{L1} (V_A), V_{L2} (V_B), V_{L3} (V_C)
Current Inputs:	I_{L1} (I_A), I_{L2} (I_B), I_{L3} (I_C),
Disable:	27, 47, 59N
Map Pickup LED:	60VTS - Self Reset

© 2013 Siemens Protection Devices Limited

3.2.1 1 or 2 Phase VT fail

Apply 3P balanced nominal current and voltage. Reduce 1 phase voltage until VTS operates, record voltage reduction level.

60VTS V Setting	Setting x 3	Measured Voltage Reduction

Increase the voltage until VTS resets. Increase current on 1 phase by 110 % of 3x the *60VTS I* setting. Reduce voltage as above and check for no operation. Return voltage to nominal. Increase current on 1 phase by 90 % of 3x the *60VTS I.*setting. Reduce voltage as above and check for VTS operation.

60VTS I Setting	Setting x 3	110% of Setting x 3	90% of Setting x 3
		No VTS. □	VTS operation.□

3.2.2 3 Phase VT fail

Apply 3P balanced nominal voltage and 3P balanced current at a level between the *60VTS Ipps Load* setting and the *60VTS Ipps Fault* setting. Reduce the balanced Voltage on all 3 phases until the VTS operates at the *60VTS Vpps* setting. Return the voltage to nominal and ensure that VTS resets.

Reduce the 3P balanced current to a level below the *60VTS Ipps Load* setting. Reduce the 3P balanced voltage to a level below the operate level above. Gradually increase the 3P balanced current until the VTS operates.

Check that the thermal rating of the relay current inputs is not exceeded during the following test. Increase the 3P balanced current to a level above the *60VTS Ipps Fault* setting. Reduce the 3P balanced voltage to a level below the operate level above. Gradually reduce the 3P balanced current until the VTS operates.

	Setting	Measured
60VTS Vpps		
60VTS Ipps Load		
60VTS Ipps Fault		

If the VTS can be started from a status input fed from an external source, this functionality should be tested.

Ext_Trig 60VTS Operation Not Applicable.

1.1.1.1 Element Blocking

The VT Supervision can be blocked by Binary Input Inhibit. This functionality should be checked.

Element	BI Inhibits
60VTS	

© 2013 Siemens Protection Devices Limited

3.3 Current Transformer Supervision. (60CTS)

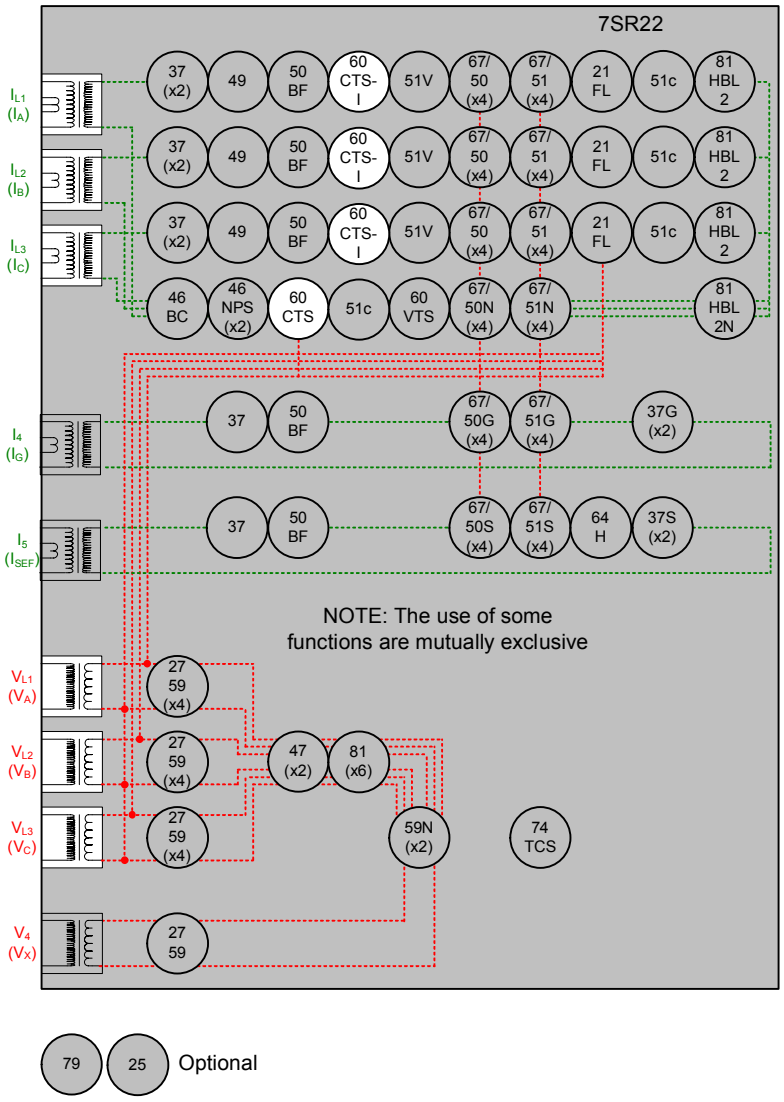


Figure 3.3-1 Current Transformer Supervision

Voltage Inputs:	V_{L1} (V_A), V_{L2} (V_B), V_{L3} (V_C) for directional elements.
Current Inputs:	I_{L1} (I_A), I_{L2} (I_B), I_{L3} (I_C),
Disable:	51N, 46IT, 46DT, 46BC
Map Pickup LED:.	60CTS - Self Reset

The presence of NPS current without NPS voltage is used to indicate a current transformer failure.

Apply normal 3P balanced current with a crossover of any two phases at a level above *60CTS Inps* setting. Measure the delay to operation.

Apply 3P balanced voltage with a similar phase crossover to the current. Increase the applied 3P voltage until the CTS element resets.

Reduce the 3P voltage to cause CTS operation again. Gradually reduce the 3P current until the element resets.

© 2013 Siemens Protection Devices Limited

Setting	Measured
60CTS Delay	
60CTS Inps	
60CTS Vnps	

3.3.1 ELEMENT BLOCKING

The CT Supervision function can be blocked by Binary Input Inhibit. This functionality should be checked.

Element	BI Inhibits
60CTS	

© 2013 Siemens Protection Devices Limited

3.4 Broken Conductor. (46BC)

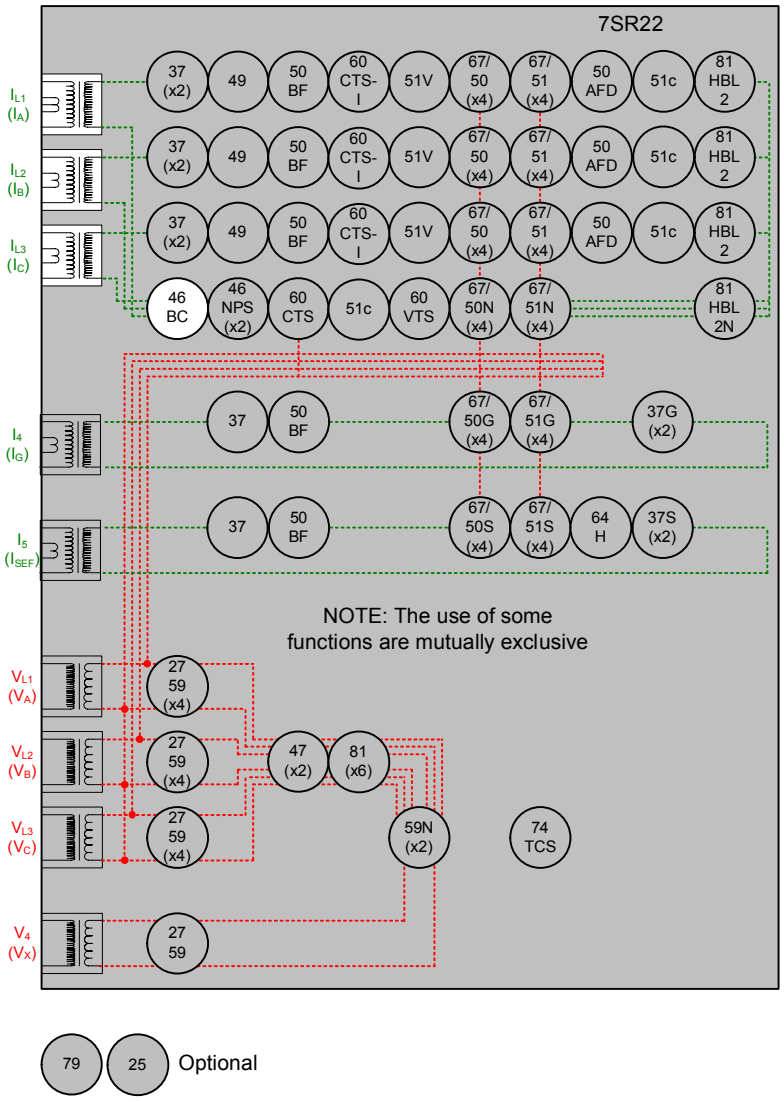


Figure 3.4-1 Broken Conductor

Voltage Inputs:	n/a
Current Inputs:	I_{L1} (I_A), I_{L2} (I_B), I_{L3} (I_C),
Disable:	51N, 46IT, 46DT
Map Pickup LED:.	46BC - Self Reset

Broken Conductor uses the ratio of NPS current to PPS current to detect an open circuit conductor. These quantities can be produced directly from many advanced test sets but with limited equipment the following approach can be applied.

Apply 3P balanced current with normal phase rotation direction. This current will consist of PPS alone, no NPS or ZPS.

Increase 1 phase current magnitude in isolation to produce NPS. The single phase unbalance current will contain equal quantities of ZPS, NPS and PPS. The NPS component will be 1/3 of the unbalance current and the total PPS component will be value of the original balanced 3P current plus 1/3 of the additional unbalance current. i.e. as the single phase unbalance current increases, the ratio of NPS to PPS will also increase. The levels of each sequence component current can be monitored in the ***Current Meters*** in ***Instruments Mode***.

© 2013 Siemens Protection Devices Limited

Inject 1 A of balanced current. Gradually increase imbalance current, operating level should be as follows:

46BC Setting	1P unbalance current (% of 3P current)
20%	75%
25%	100%
30%	129%
35%	161%
40%	200%

46BC Setting	3P balanced current (A)	1P unbalance current (A)	Measured Unbalance current

Apply 1 A 1P unbalance current without 3P balanced current. Measure 46BC operating time.

46BC Delay setting	Measured

3.4.1 ELEMENT BLOCKING

The Broken Conductor element can be blocked by Binary Input Inhibit. This functionality should be checked.

Element	BI Inhibits
46BC	

© 2013 Siemens Protection Devices Limited

3.5 Load Blinder (21)

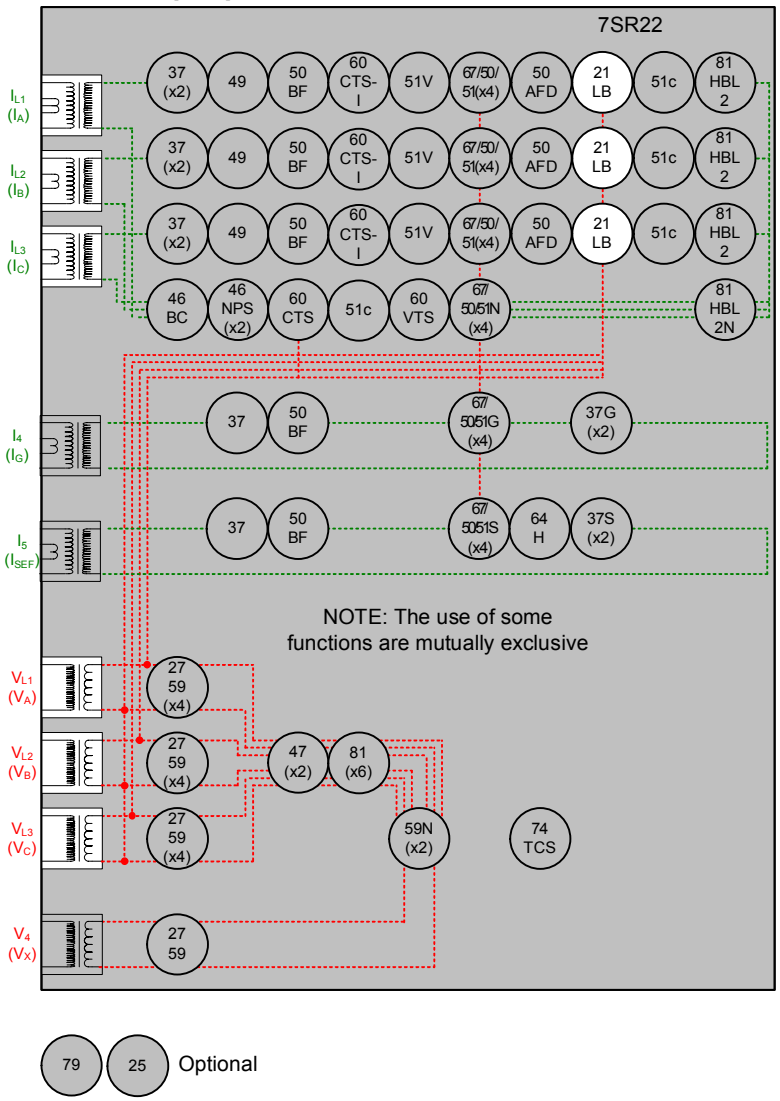


Figure 3.5-1 Load Blinder (21)

Voltage Inputs:	V_{L1} (V_A), V_{L2} (V_B), V_{L3} (V_C)
Current Inputs:	I_{L1} (I_A), I_{L2} (I_B), I_{L3} (I_C),
Disable:	51-n, 51V, 51c, 46, 49, 50BF, 79
Map Pickup LED:	21LB-3P, 21LB-1P - Self Reset

Load Blinders are designed to block Overcurrent elements from tripping in heavy load conditions.
User settings ***21LB-3P Angle*** and ***21LB-3P Impedance*** allow user to define the Blinder region depending on the networks or specifically a line's loading and fault limits.
The calculated impedance can be: -

- In Blinder Region in which case the ***Load Blinder FWD*** or ***REV*** is active depending on if the impedance is in the 1st or 4th and/or 2nd or 3rd quadrant of the R-X plot respectively.
- In operate region in which case there is no active Load Blinder block and the Overcurrent element operates depending on additional factors.
- A 5 degree Hysteresis is allowed between operate and block zone.

© 2013 Siemens Protection Devices Limited

The design of a Load Blinder 3Ph is based on the theory that protection blocking should be issued only during definable allowable system power flow conditions i.e. an overcurrent blocking signal can only be issued when:

- Positive Sequence Voltage **Vpps** is not significantly changed, when the Vpps is above the ***21LB-3P VPPS Setting.***
  AND
- Negative Sequence Current **Inps** is lower than ***21LB-3P INPS Setting***
  AND
- Distributed generators feed in PPS current into the system. In case of high load in system due to distributed generation hence resulting in change of **Zpps.**
  Zpps is calculated from **Vpps** and **Ipps**. The magnitude and angle of **Zpps** is compared with ***21LB-3P Impedance*** and ***21LB-3P Angle*** to determine if the impedance is in operate or block and/or FWD or REV zone.

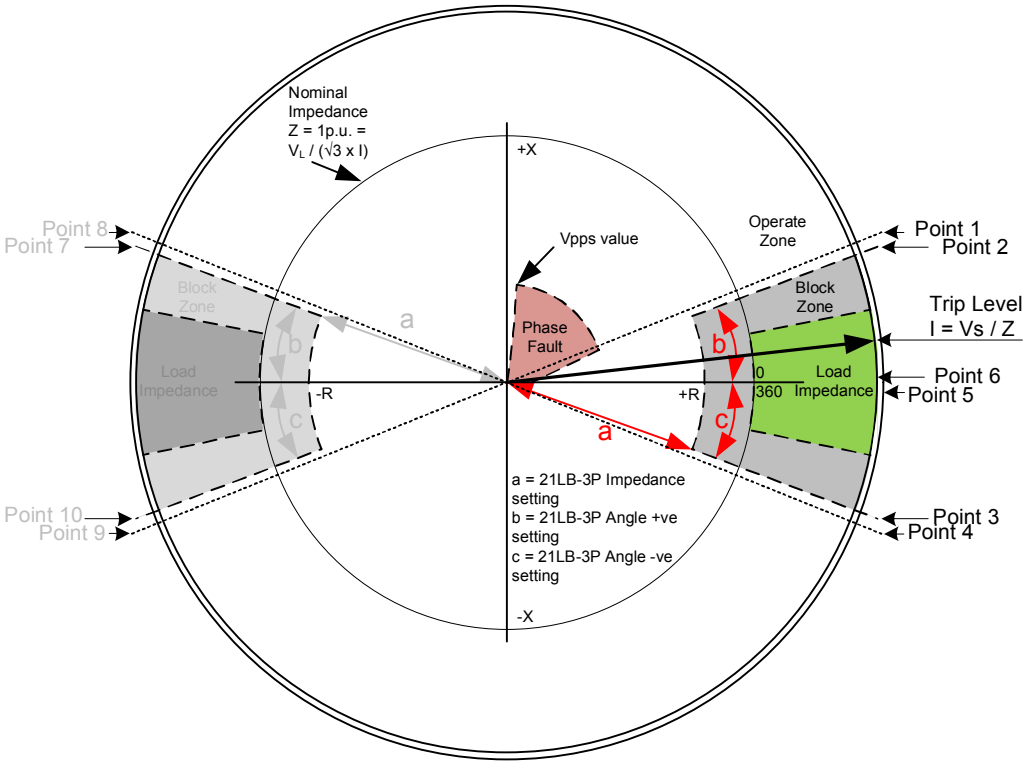


Figure 3.5-2 Load Blinder (21) Boundary Points

© 2013 Siemens Protection Devices Limited

3.5.1 DETERMINING LOAD BLINDER REGIONS (21LB)

Test Procedure (Using Omicron Relay Test Set)

1. Set-up the relay with default or appropriate parameter settings.
2. Set-up Omicron current and voltage settings e.g. 63.5 V and 0.5 A three-phase.
3. Select all three currents and set an appropriate initial angle for rotation on the Omicron.
4. Apply Omicron current and voltage to the relay.
5. Using the PC mouse click the appropriate arrow '' to rotate the angle of current in the anti-clockwise (positive degree) direction.
6. View the LEDs for indication of Load Blinder operation as the angle moves out-of or into the Load Blinder region.
7. Rotating the angle in an anti-clockwise direction will see the LEDs extinguish, this indicates the drop-off point of the Load Blinder region. Record the angle as Point1 in the table of values.
8. Rotating the angle from this point in a clockwise direction will see the LEDs illuminate which indicates the pick-up point of the Load Blinder region. Record the angle as Point 2 in the table of values.
9. Continue this process to find the other boundaries. See **Error! Reference source not found.** below.

Angle data points (b and c) Default Settings

Load Blinder region	**Forward (+) Boundary**		**Forward (-) Boundary**	
	Angle = 20 (b)		**Angle = 340 (-20) (c)**	
	PU (Raised)	**DO (Reset)**	**PU (Raised)**	**DO (Reset)**
Angle	Point 2	Point 1	Point 3	Point 4

Angle limits (b and c). Typical values.

Load Blinder region	**Forward (+) Boundary**		**Foreward (-) Boundary**	
	Angle = 20 (b)		**Angle = 340 (-20) (c)**	
	PU (Raised)	**DO (Reset)**	**PU (Raised)**	**DO (Reset)**
Angle	20	21	340	339

© 2013 Siemens Protection Devices Limited

3.5.2 DETERMINING TRIP LEVEL

Test Procedure (Using Omicron Relay Test Set)

1. Set-up the relay with default or appropriate parameter settings (see table below).
2. Set-up Omicron current and voltage settings e.g. 63.5 V and 1.0 A three-phase.
3. Select all three currents and set an appropriate initial current level for increase on the Omicron.
4. Apply Omicron current and voltage to the relay.
5. Using the PC mouse click the appropriate arrow '' to adjust current level.
6. View the LEDs for indication of Load Blinder operation as the current increases out-of the Load Blinder region. This is the DO point 5.
7. View the LEDs for indication of Load Blinder operation as the current decreases into the Load Blinder region. This is the PU point 6.

Trip Level I = Vs / Z Default Settings

Parameters	Setting	DO	PU
Impedance Ω	42	Point 5	Point 6
Voltage V	63.5		

Trip Level I = Vs / Z. Typical values.

Parameters	Setting	DO	PU
Impedance Ω	42	1.591 A	1.511 A
Voltage V	63.5		

© 2013 Siemens Protection Devices Limited

3.6 Trip Circuit Supervision. (74TCS)

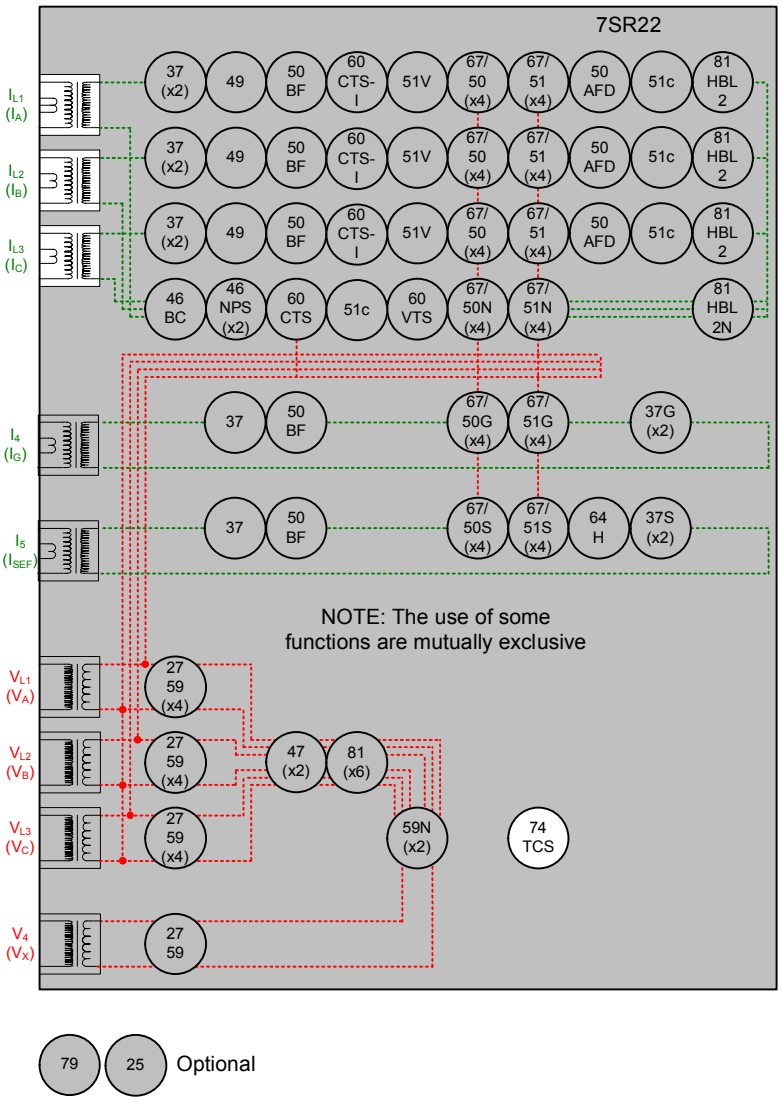


Figure 3.6-1 Trip Circuit Supervision

Voltage Inputs:	n/a
Current Inputs:	n/a
Disable:	
Map Pickup LED:	74TCS-n - Self Reset

The TCS-n Delay can be initiated by applying an inversion to the relevant status input and measured by monitoring of the alarm output.

TCS-n Delay setting	Measured

© 2013 Siemens Protection Devices Limited

3.7 Magnetising Inrush Detector. (81HBL)

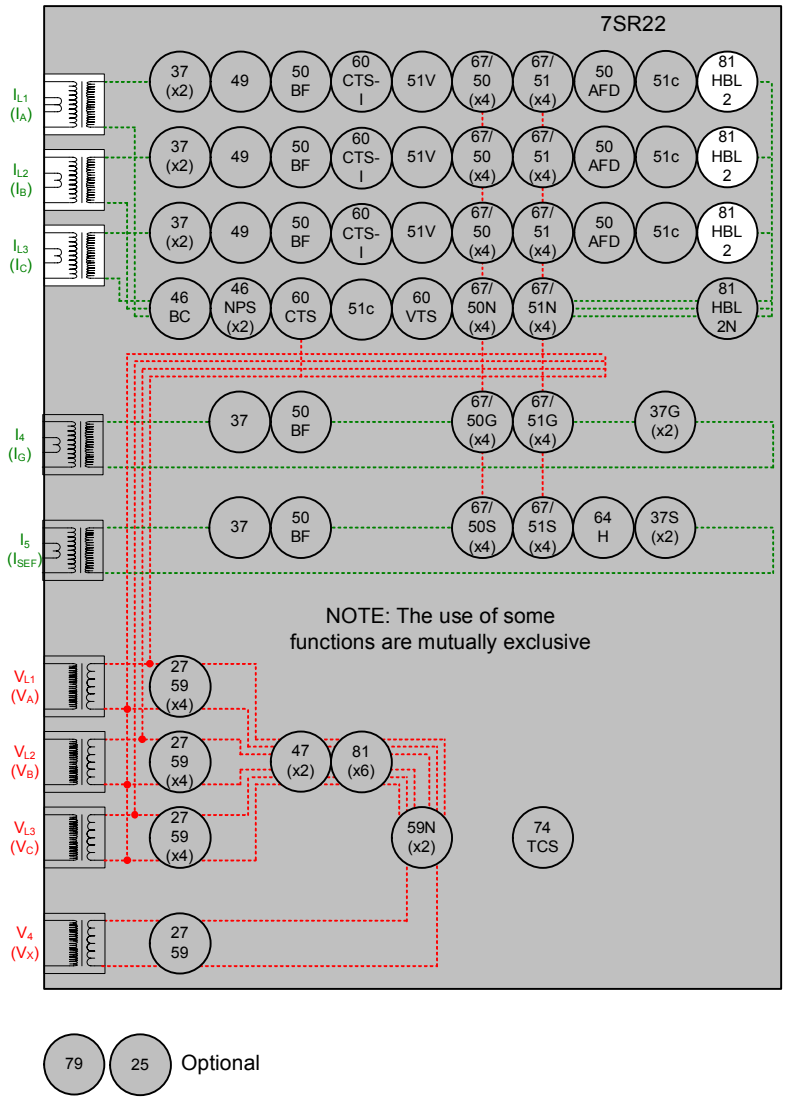


Figure 3.7-1 Magnetising Inrush Detector

Voltage Inputs: n/a

Current Inputs: I_{L1} (I_A), I_{L2} (I_B), I_{L3} (I_C),

Disable:

Map Pickup LED:

Logical operation of the harmonic blocking can be tested by current injection at 100 Hz to cause operation of the blocking signals.

© 2013 Siemens Protection Devices Limited

3.1 Over Fluxing Detector. (81HBL5)

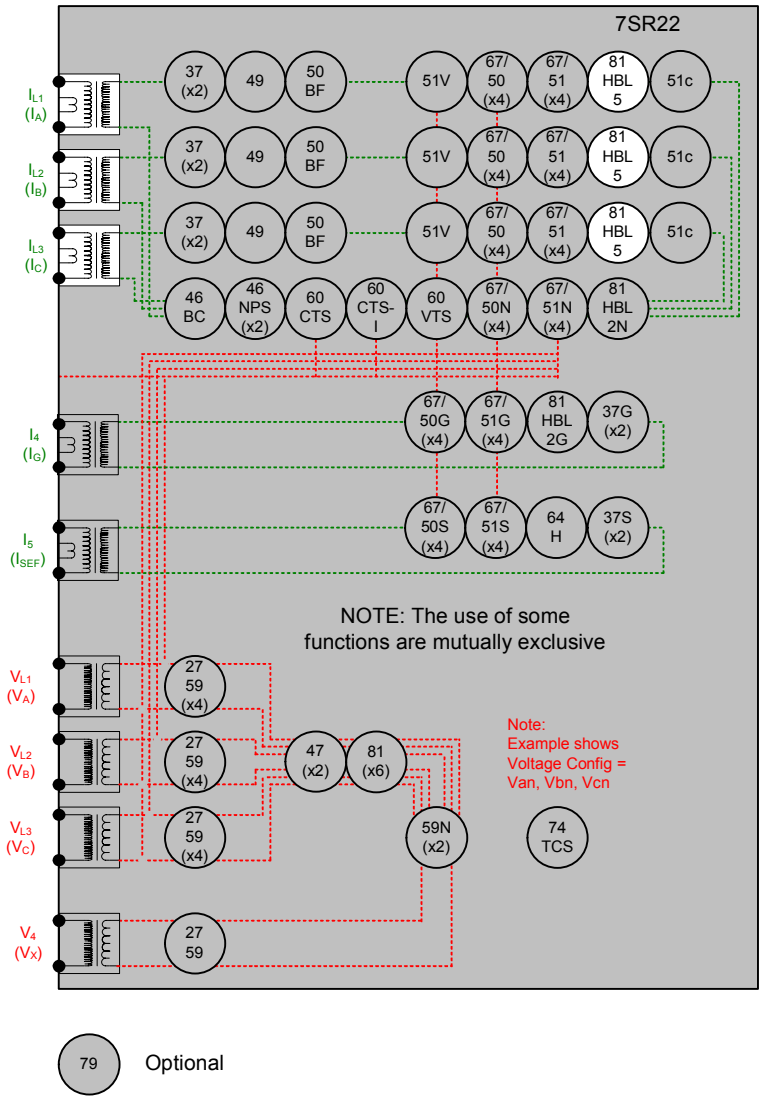


Figure 3.1-1 Magnetising Inrush Detector

Voltage Inputs: n/a

Current Inputs: I_{L1} (I_A), I_{L2} (I_B), I_{L3} (I_C),

Disable:

Map Pickup LED:

Logical operation of the harmonic blocking can be tested by injection of 5th harmonic current (at 250Hz for 50Hz relay) to cause operation of the blocking signals. Note that injection of any level of 5th harmonic alone on a current input will cause the block to be raised since the harmonic content on this input is 100%, i.e. greater than setting.

Fundamental frequency current can be injected into the other winding simultaneously to operate the 87BD or 87HS protection elements if required to test the blocking operation. Care should be taken that the thermal limits of the relay are not exceeded during these tests.

More advanced test equipment is required, with the facility to combine harmonic and fundamental frequencies of current, to test the level of the blocking element. Note that the *81HBL5 Setting* is set as a fraction of the total current. e.g. 0.25A at 250Hz combined with 1A at 50Hz gives a 5th harmonic content of 0.2 i.e. (0.25/(0.25+1.0)).

© 2013 Siemens Protection Devices Limited

Section 4: Control & Logic Functions

4.1 Autoreclose (79)

Autoreclose sequences can be specified differently for Phase. Earth, Externally Initiated and SEF faults. Sequences should be simulated for each applicable different fault type with the actual relay settings required for service installed in the relay.

The relay requires that the correct indications are received at the CB auxiliary contact inputs and that the injected current and voltage used to generate protection operations are timed to the autoreclose sequence to provide a realistic simulation of the actual system conditions.

The Instruments Menu contains Autoreclose Meters for the Autoreclose State and the Shot No. which are useful during sequence testing.

The time stamped Events listing can be downloaded from the relay to a pc to allow diagnosis of the sequence including measurements of sequence Dead Times and other timing without the use of external measuring equipment or complex connections.

4.2 Quick Logic

If this functionality is used, the logic equations may interfere with testing of other protection functions in the relay. The function of the Quick Logic equations should be tested conjunctively with connected plant or by simulation to assess suitability and check for correct operation on an individual basis with tests specifically devised to suit the particular application.

© 2013 Siemens Protection Devices Limited

Section 5: Testing and Maintenance

7SR21 & 7SR22 relays are maintenance free, with no user serviceable parts.

5.1 Periodic Tests

During the life of the relay, it should be checked for operation during the normal maintenance period for the site on which the product is installed. It is recommended the following tests are carried out: -

Visual inspection of the metering display.
1. Operation of output contacts
2. Secondary injection of each element

5.2 Maintenance

Relay failure will be indicated by the 'Protection Healthy' LED being off or flashing. A message may also be displayed on the LCD. In the event of failure Siemens Protection Devices Ltd. (or one of its agents) should be contacted – see defect report sheet in section 5.3.

The relay should be returned as a complete unit. No attempt should be made to disassemble the unit to isolate and return only the damaged sub-assembly. It may however be convenient to fit the withdrawable relay to the outer case from a spare relay, to avoid the disturbance of relay panel wiring, for return to Siemens Protection Devices Ltd. The withdrawable relay should never be transported without the protection of the outer case.

© 2013 Siemens Protection Devices Limited

5.3 Troubleshooting

Table 5-1 Troubleshooting Guide

Observation	Action
Relay does not power up.	Check that the correct auxiliary DC voltage is applied and that the polarity is correct.
Relay won't accept the password.	The Password being entered is wrong. Enter correct password. If correct password has been forgotten, note down the Numeric Code which is displayed at the Change Password screen e.g. Change password = 1234567 To retrieve the password, communicate this code to a Siemens Protection Devices Ltd. representative.
Protection Healthy LED flashes	General failure. Contact a Siemens Protection Devices Ltd. representative.
LCD screen flashes continuously.	The LCD has many possible error messages which when displayed will flash continuously. These indicate various processor card faults. General failure. Contact a Siemens Protection Devices Ltd. representative.
Backlight is on but no text can be seen.	Adjust the contrast.
Scrolling text messages are unreadable.	Adjust the contrast.
Relay displays one instrument after another with no user intervention.	This is normal operation, default instruments are enabled. Remove all instruments from the default list and only add those that are required.
Cannot communicate with the relay.	Check that all of the communications settings match those used by Reydisp Evolution. Check that the Tx and Rx fibre-optic cables are connected correctly. (Tx –> Rx and Rx –> Tx). Check that all cables, modems and fibre-optic cables work correctly. Ensure that IEC 60870-5-103 is specified for the connected port (COM1, COM2, COM3 or COM4).
Relays will not communicate in a ring network.	Check that the Data Echo setting on all relays is set to ON. Check that all relays are powered up. Check that all relays have unique addresses.
Status inputs do not work.	Check that the correct DC voltage is applied and that the polarity is correct. Check that the status input settings such as the pick-up and drop-off timers and the status inversion function are correctly set.
Relay instrument displays show small currents or voltages even though the system is dead.	This is normal. The relay is displaying calculation noise. This will not affect any accuracy claims for the relay.

If the above checklist does not help in correcting the problem please contact the local Siemens office or contact PTD 24hr Customer Support, Tel: +49 180 524 7000, Fax: +49 180 524 2471, e-mail: support.energy@siemens.com.

© 2013 Siemens Protection Devices Limited

7SR210 Non-Directional Relay
7SR220 Directional Relay
Applications Guide

The copyright and other intellectual property rights in this document, and in any model or article produced from it (and including any registered or unregistered design rights) are the property of Siemens Protection Devices Limited. No part of this document shall be reproduced or modified or stored in another form, in any data retrieval system, without the permission of Siemens Protection Devices Limited, nor shall any model or article be reproduced from this document unless Siemens Protection Devices Limited consent.

While the information and guidance given in this document is believed to be correct, no liability shall be accepted for any loss or damage caused by any error or omission, whether such error or omission is the result of negligence or any other cause. Any and all such liability is disclaimed.

© 2013 Siemens Protection Devices Limited

Document Release History

This document is issue 2018/05 The list of revisions up to and including this issue is: -

2011/05	First issue
2013/01	Typographical revisions and added data. Updated in line with software release.
2014/06	Typographical revisions and added data. Updated in line with software release.
2015/06	Typographical revisions and added data. Updated in line with software release.
2016/02	Typographical revisions and added data. Updated in line with software release.
2016/11	Typographical revisions and added data.
2017/08	Typographical revisions and added data. Updated in line with software release.
2017/12	Typographical revisions and added data.
2018/05	Typographical revisions and added data.

Software Revision History

2011/05	2435H85008R7a-7a (7SR210) 2435H85009R7a-7a (7SR220)	First Release
2013/01	2435H85008R7c-7b (7SR210) 2435H85009R7c-7b (7SR220)	Introduced journaling file system. Added 61850 logical nodes for CB Counters, metering, 50BF, 46BC, 81HBL2 and line check. Added Line Check on non-AR devices. Added 74CCS Close Circuit Supervision.
2014/06	2435H85008R7f-7d (7SR210) 2435H85009R7f-7d (7SR220)	Added Fault Locator feature and Check Sync feature. Fault data transmitted over 103. Additional communications data, control features, meters.
2015/06	2435H85008R8a-7f (7SR210) 2435H85009R8a-7f (7SR220)	Added Power Factor Meters, Load Blinding feature, Arc Flash Detector. Over current TM Setting Range extended.
2016/02	2435H85008R8b-7f (7SR210) 2435H85009R8b-7f (7SR220)	EN100+ Compatibility.
2017/08	2435H85008R8e-8a (7SR210) 2435H85009R8e-8a (7SR220)	Added 32 Directional Power, 32S Sensitive Power, 55 Power Factor, 81HLB5 Overfluxing, 67SEF Compensated Network, 67SEF Wattmetric. Increased I/O. Event Data on LCD.

© 2013 Siemens Protection Devices Limited

Contents

Document Release History **2**

Software Revision History **2**

Section 1: Common Functions **5**

1.1 Multiple Settings Groups 5
1.2 Binary Inputs 6
1.3 Binary Outputs 9
1.4 LEDs 9

Section 2: Protection Functions **11**

2.1 Time delayed overcurrent (51/51G/51N) 11
2.1.1 Selection of Overcurrent Characteristics 12
2.1.2 Reset Delay 13
2.2 Voltage dependent overcurrent (51V) 14
2.3 Cold Load Settings (51c) 14
2.4 Arc Flash Detection (50AFD) 15
2.5 Instantaneous Overcurrent (50/50G/50N) 16
2.5.1 Blocked Overcurrent Protection Schemes 16
2.6 Sensitive Earth-fault Protection (50SEF) 18
2.7 Directional Protection (67) 19
2.8 Directional Earth-Fault (50/51G, 50/51N, 51/51SEF) 22
2.9 High Impedance Restricted Earth Fault Protection (64H) 23
2.10 Negative Phase Sequence Overcurrent (46NPS) 25
2.11 Undercurrent (37) 25
2.12 Thermal Overload (49) 25
2.13 Under/Over Voltage Protection (27/59) 26
2.14 Neutral Overvoltage (59N) 27
2.14.1 Application with Capacitor Cone Units 28
2.14.2 Derived NVD Voltage 28
2.15 Negative Phase Sequence Overvoltage (47) 28
2.16 Under/Over Frequency (81) 29
2.17 Power Protection 30
2.17.1 Power (32) 30

Section 3: CT Requirements **31**

3.1 CT Requirements for Overcurrent and Earth Fault Protection 31
3.1.1 Overcurrent Protection CTs 31
3.1.2 Earth Fault Protection CTs 31
3.2 CT Requirements for High Impedance Restricted Earth Fault Protection 31

Section 4: Control Functions **32**

4.1 Auto-reclose Applications 32
4.1.1 Auto-Reclose Example 1 33
4.1.2 Auto-Reclose Example 2 (Use of Quicklogic with AR) 34
4.2 Quick Logic Applications 35
4.2.1 Auto-Changeover Scheme Example 35

Section 5: Supervision Functions **36**

5.1 Circuit-Breaker Fail (50BF) 36
5.1.1 Settings Guidelines 36
5.2 Current Transformer Supervision (60CTS) 38
5.3 Voltage Transformer Supervision (60VTS) 39
5.4 Trip-Circuit Supervision (74TCS) 40
5.4.1 Trip Circuit Supervision Connections 40

© 2013 Siemens Protection Devices Limited

5.5 Inrush Detector (81HBL2)....42
5.6 Broken Conductor / Load Imbalance (46BC)....42
5.7 Circuit-Breaker Maintenance....42
5.8 Overfluxing Detector (81HBL5)....42
5.9 Load Blinder (21)....43
5.10 Load Blinder Design....44
5.10.1 Application view....44
5.10.2 Design View....45
5.10.3 Setting Example – 3 Pole Load Blinder....47
5.10.4 Calculating the Impedance....48

List of Figures

Figure 1.1-1 Example Use of Alternative Settings Groups....5
Figure 1.2-1 Example of Transformer Alarm and Trip Wiring....6
Figure 1.2-2 Binary Input Configurations Providing Compliance with EATS 48-4 Classes ESI 1 and ESI 2....8
Figure 1.4-1 LED configuration via the LED Matrix tab....9
Figure 1.4-2 LED configuration via the Settings \ OUTPUT CONFIG \ LED CONFIG menu....10
Figure 2.1-1 IEC NI Curve with Time Multiplier and Follower DTL Applied....11
Figure 2.1-2 IEC NI Curve with Minimum Operate Time Setting Applied....12
Figure 2.1-3 Reset Delay....13
Figure 2.4-1 Arc Flash Detection....15
Figure 2.5-1 General Form of DTL Operate Characteristic....16
Figure 2.5-2 Blocking Scheme Using Instantaneous Overcurrent Elements....17
Figure 2.6-1 Sensitive Earth Fault Protection Application....18
Figure 2.7-1 Directional Characteristics....19
Figure 2.7-2 Phase Fault Angles....19
Figure 2.7-3 Application of Directional Overcurrent Protection....20
Figure 2.7-4 Feeder Fault on Interconnected Network....21
Figure 2.8-1 Earth Fault Angles....22
Figure 2.9-1 Balanced and Restricted Earth-fault protection of Transformers....23
Figure 2.9-2 Composite Overcurrent and Restricted Earth-fault Protection....24
Figure 2.12-1 Thermal Overload Heating and Cooling Characteristic....25
Figure 2.14-1 NVD Application....27
Figure 2.14-2 NVD Protection Connections....27
Figure 2.16-1 Load Shedding Scheme Using Under-Frequency Elements....29
Figure 4.1-1 Sequence Co-ordination....32
Figure 4.1-2 Example of Logic Application....34
Figure 4.2-1 Example Use of Quick Logic....35
Figure 5.1-1 Circuit Breaker Fail....36
Figure 5.1-2 Single Stage Circuit Breaker Fail Timing....37
Figure 5.1-3 Two Stage Circuit Breaker Fail Timing....37
Figure 5.4-1 Trip Circuit Supervision Scheme 1 (H5)....40
Figure 5.4-2 Trip Circuit Supervision Scheme 2 (H6)....41
Figure 5.4-3 Trip Circuit Supervision Scheme 3 (H7)....41
Figure 5.9-1 Paralleled Transformers and Feeders....43
Figure 5.10.1-1 Impedance Setting and Angle Setting....44
Figure 5.10.2.1-1 Logic Diagram 3 Phase....45
Figure 5.10.2.2-1 Logic Diagram 1 Phase....46
Figure 5.10.3-1 Scheme and Impedance Illustration....47

List of Tables

Table 2-1 Application of IDMTL Characteristics 13
Table 5-2 Determination of CT Failure (1 or 2 Phases) 37
Table 5-3 Determination of VT Failure (1 or 2 Phases) 38
Table 5-4 Determination of VT Failure (3 Phases) 38
Table 5-5 Magnetic Inrush Bias 41

 © 2013 Siemens Protection Devices Limited

Section 1: Common Functions

1.1 Multiple Settings Groups

Alternate settings groups can be used to reconfigure the relay during significant changes to system conditions e.g.

Primary plant switching in/out.

Summer/winter or day/night settings.

switchable earthing connections.

Loss of Grid connection (see below)

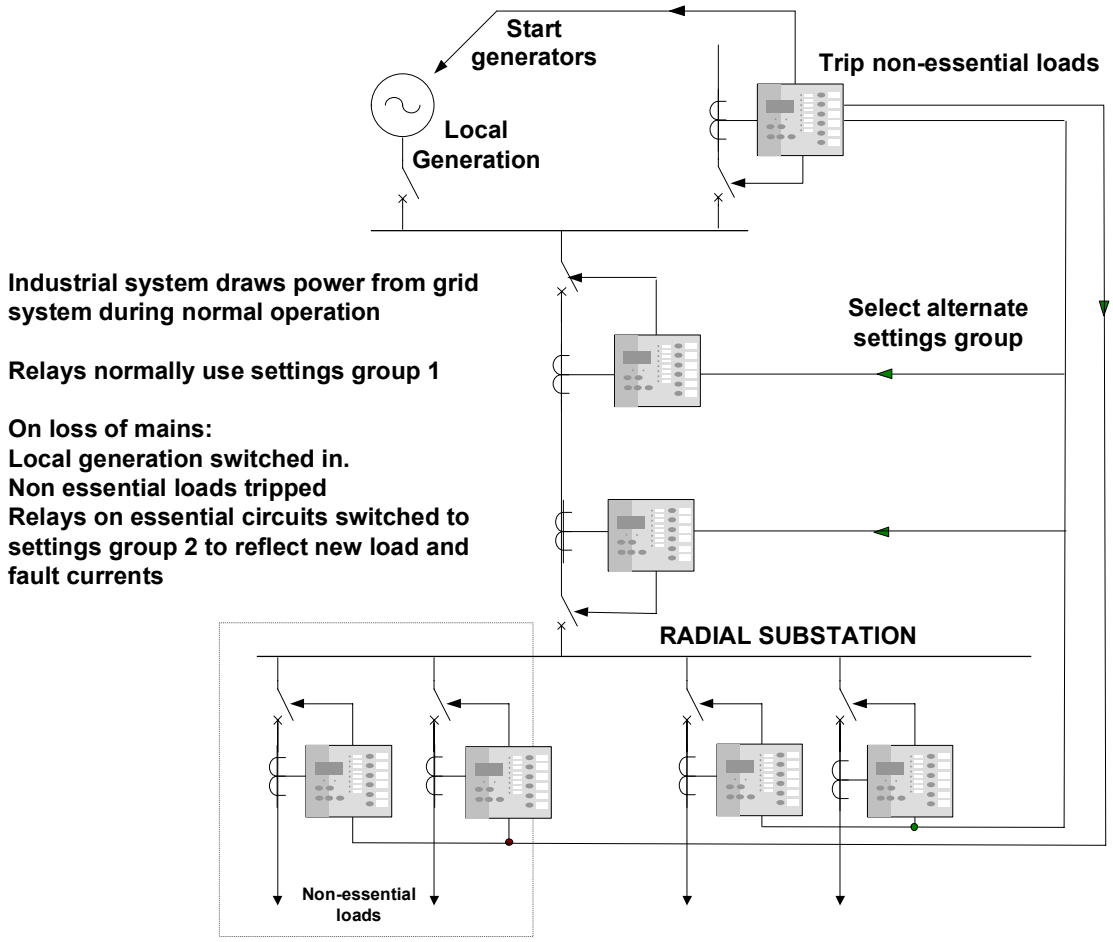


Figure 1.1-1 Example Use of Alternative Settings Groups

© 2013 Siemens Protection Devices Limited

1.2 Binary Inputs

Each Binary Input (BI) can be programmed to operate one or more of the relay functions, LEDs or output relays. These could be used to bring such digital signals as Inhibits for protection elements, the trip circuit supervision status, autoreclose control signals etc. into the Relay.

Alarm and Tripping Inputs

A common use of binary inputs is to provide indication of alarm or fault conditions e.g. transformer Buchholz Gas or Buchholz Surge conditions. The Binary Inputs are mapped to LED(s), waveform storage trigger and binary outputs. Note that transformer outputs which require high speed tripping, such as a Buchholz Surge, should be wired to a binary input to provide LED indication and also have a parallel connection wired to directly trip the circuit via a blocking diode, see fig. 1.2-1:

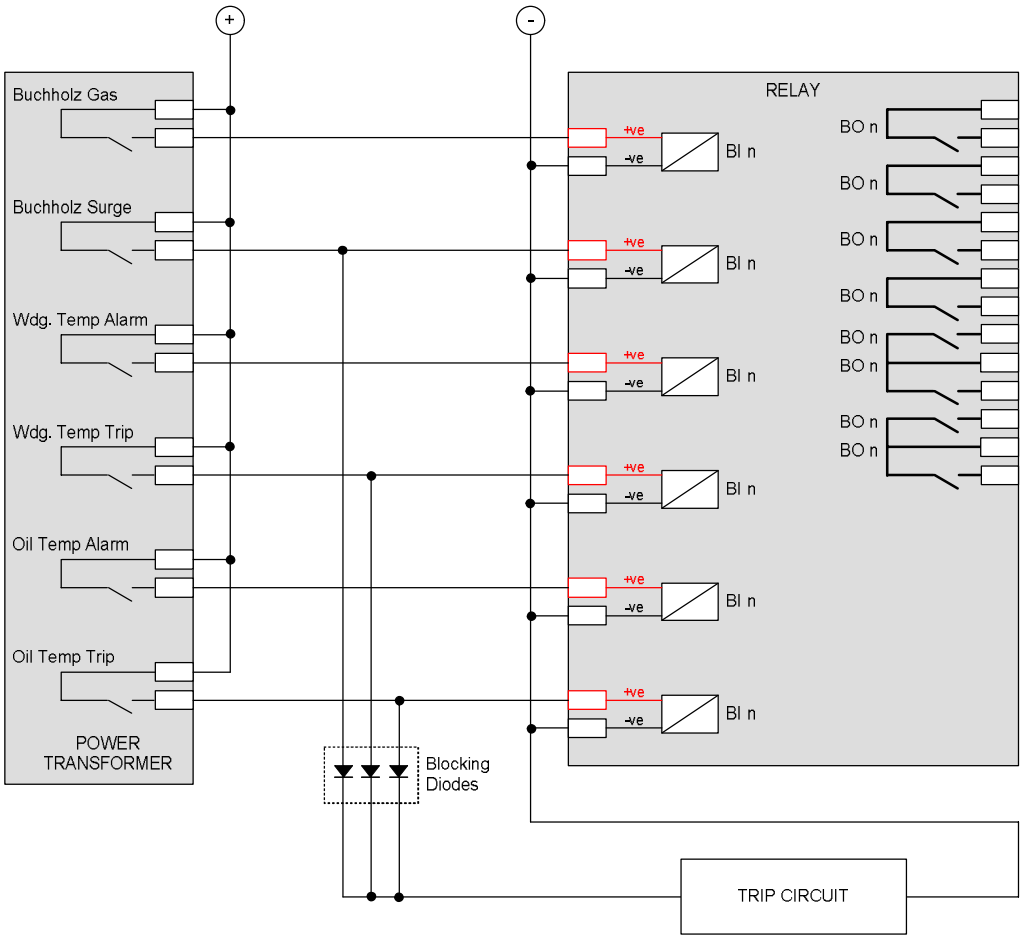


Figure 1.2-1 Example of Transformer Alarm and Trip Wiring

©2018 Siemens Protection Devices Limited

The Effects of Capacitance Current

The binary inputs have a low minimum operate current and may be set for instantaneous operation. Consideration should be given to the likelihood of mal-operation due to capacitance current. Capacitance current can flow through the BI for example if an earth fault occurs on the dc circuits associated with the relay. The binary inputs will be less likely to mal-operate if they:

1 Have both the positive and negative switched (double-pole switched).

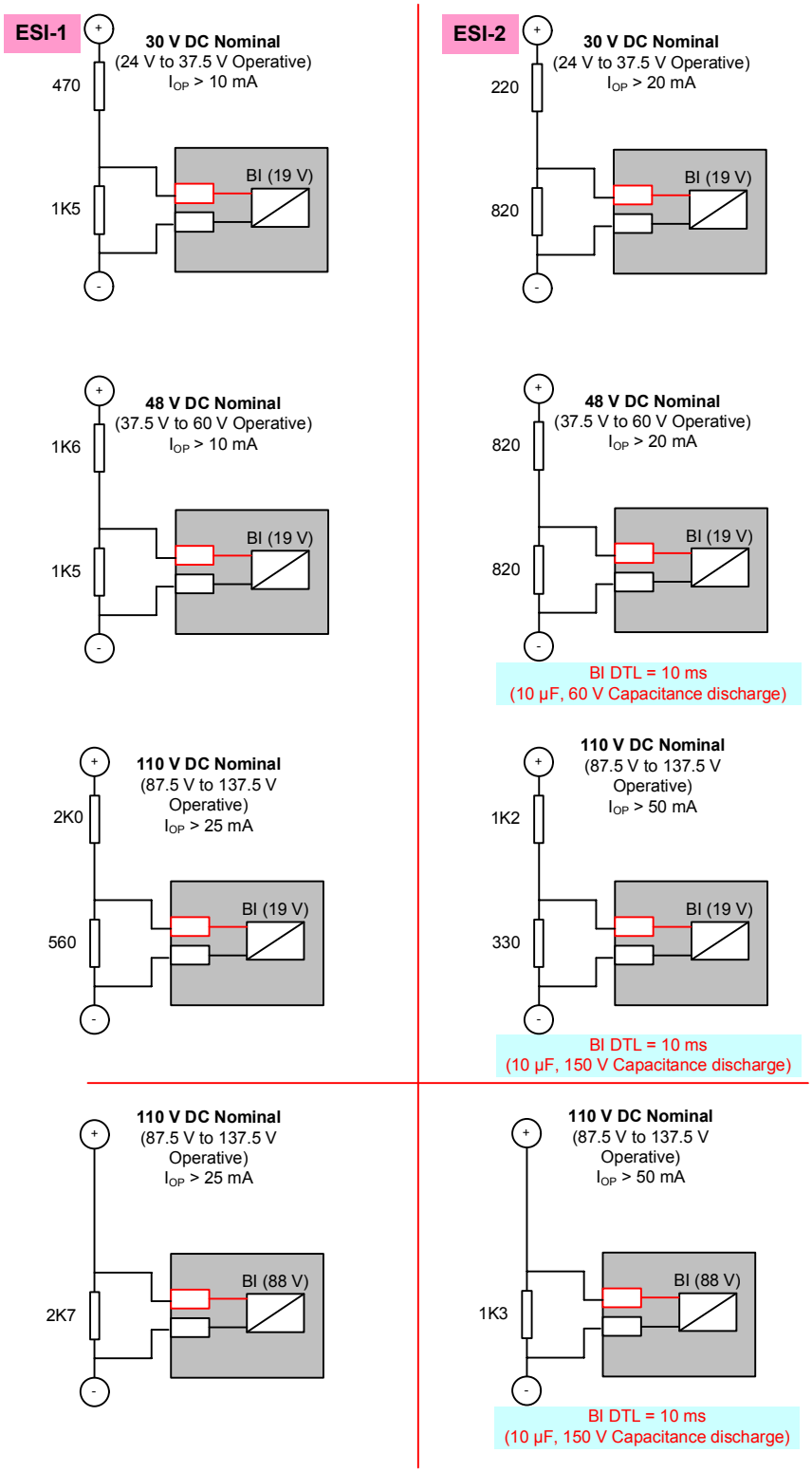
2 Do not have extensive external wiring associated with them e.g. if the wiring is confined to the relay room.

Where a binary input is both used to influence a control function (e.g. provide a tripping function) and it is considered to be susceptible to mal-operation the external circuitry can be modified to provide immunity to such disturbances, see fig 1.2-2.

AC Rejection

The default pick-up time delay of 20 ms provides immunity to ac current e.g. induced from cross site wiring.

© 2013 Siemens Protection Devices Limited



Resistor power ratings:
30 V DC Nominal >3 W
48 V DC Nominal >3 W
110 V DC Nominal >10 W (ESI-1)
110 V DC Nominal >20 W (ESI-2)

Resistors must be wired with crimped connections as they may run hot

Figure 1.2-2 Binary Input Configurations Providing Compliance with EATS 48-4 Classes ESI 1 and ESI 2

©2018 Siemens Protection Devices Limited

1.3 Binary Outputs

Binary Outputs are mapped to output functions by means of settings. These could be used to bring out such digital signals as trips, a general pick-up, plant control signals etc.

All Binary Outputs are Trip rated

Each can be defined as Self or Hand Reset. Self-reset contacts are applicable to most protection applications. Hand-reset contacts are used where the output must remain active until the user expressly clears it e.g. in a control scheme where the output must remain active until some external feature has correctly processed it.

Case contacts 26 and 27 will automatically short-circuit when the relay is withdrawn from the case. This can be used to provide an alarm that the Relay is out of service.

Notes on Self Reset Outputs

With a failed breaker condition the relay may remain operated until current flow in the primary system is interrupted by an upstream device. The relay will then reset and attempt to interrupt trip coil current flowing through an output contact. Where this level is above the break rating of the output contact an auxiliary relay with heavy-duty contacts should be utilised.

1.4 LEDs

Output-function LEDs are mapped to output functions by means of settings. These could be used to display such digital signals as trips, a general pick-up, plant control signals etc.

User Defined Function Key LEDs are used to indicate the status of Function Key operation. These do not relate directly to the operation of the Function Key but rather to its consequences. If a Function Key is depressed to close a Circuit-Breaker, the associated LED would show the status of the Circuit-Breaker closed Binary Input.

Each LED can be defined as Self or Hand Reset. Hand reset LEDs are used where the user is required to expressly acknowledge the change in status e.g. critical operations such as trips or system failures. Self-reset LEDs are used to display features which routinely change state, such as Circuit-Breaker open or close.

The status of hand reset LEDs is retained in capacitor-backed memory in the event of supply loss.

Each LED can be assigned as red, yellow or green in colour. There are two methods for doing this: -

1) In the LED Matrix tab, to assign the LED as a red colour select a box on the red row. To assign the LED as a green colour select a box on the green row. To assign the LED as a yellow colour, select boxes on both the red and green rows.

   NB: If there are no boxes selected the LED will not illuminate.

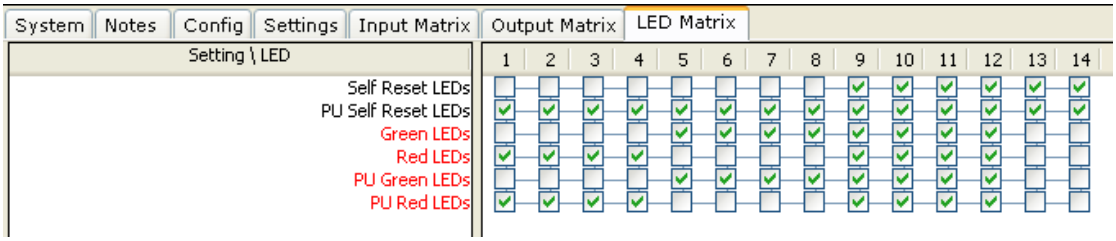


Figure 1.4-1 LED configuration via the LED Matrix tab

© 2013 Siemens Protection Devices Limited

In the OUTPUT CONFIG\LED CONFIG menu in the Settings tab, to assign the required LED as a particular colour, either red or green, type the LED number in the appropriate row. To assign the required LED as a yellow colour, type the LED number in both red and green rows.

NB: If a LED number is not assigned that particular LED will not illuminate.

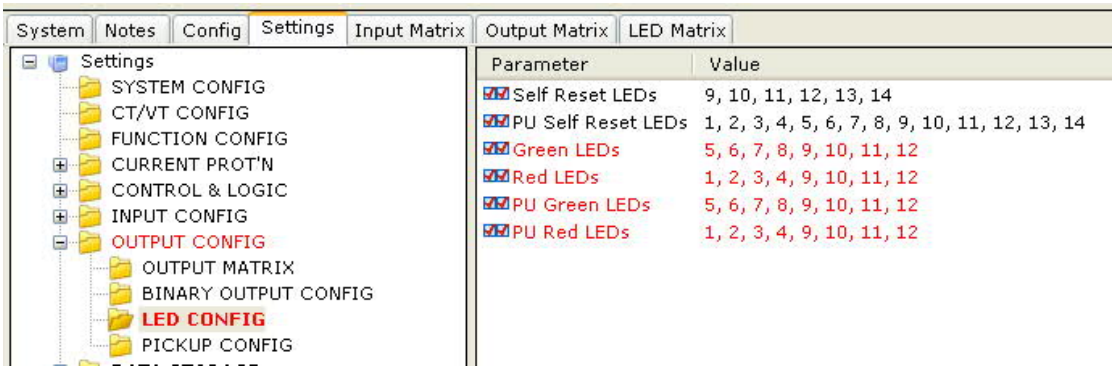


Figure 1.4-2 LED configuration via the Settings \ OUTPUT CONFIG \ LED CONFIG menu

©2018 Siemens Protection Devices Limited

Section 2: Protection Functions

2.1 Time delayed overcurrent (51/51G/51N)

The 51-n characteristic element provides a number of time/current operate characteristics. The element can be defined as either an Inverse Definite Minimum Time Lag (IDMTL) or Definite Time Lag (DTL) characteristic. If an IDMTL characteristic is required, then IEC, ANSI/IEEE and a number of manufacturer specific curves are supported.

IDMTL characteristics are defined as “Inverse” because their tripping times are inversely proportional to the Fault Current being measured. This makes them particularly suitable to grading studies where it is important that only the Relay(s) closest to the fault operate. Discrimination can be achieved with minimised operating times.

To optimise the grading capability of the relay additional time multiplier, ‘Follower DTL’ (Fig. 2.1-1) or ‘Minimum Operate Time’ (Fig. 2.1-2) settings can be applied.

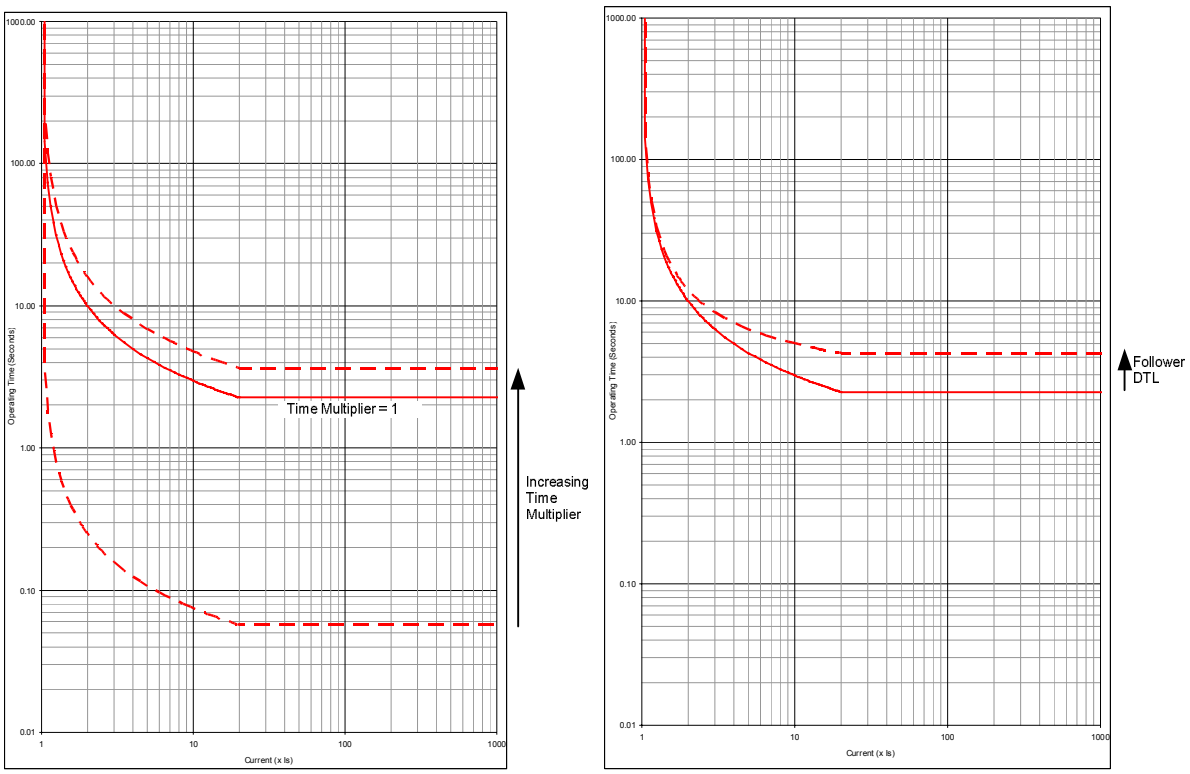


Figure 2.1-1 IEC NI Curve with Time Multiplier and Follower DTL Applied

© 2013 Siemens Protection Devices Limited

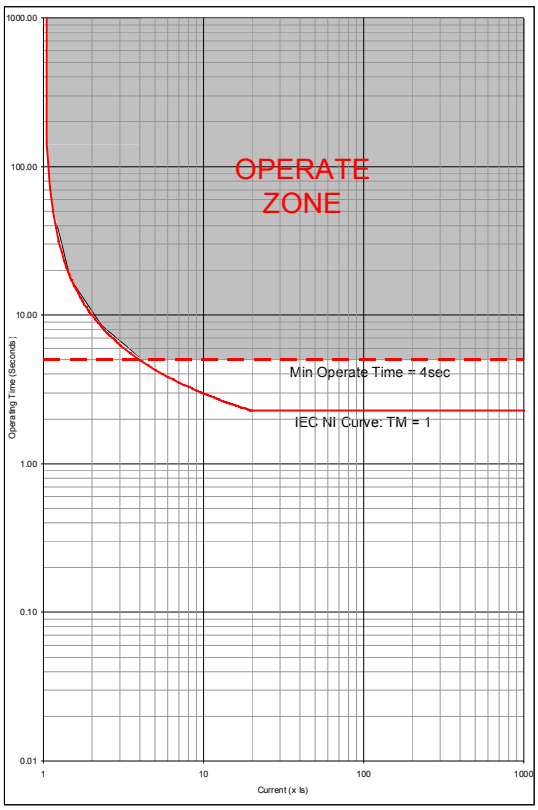


Figure 2.1-2 IEC NI Curve with Minimum Operate Time Setting Applied

To increase sensitivity, dedicated Earth fault elements are used. There should be little or no current flowing to earth in a healthy system so such relays can be given far lower pick-up levels than relays which detect excess current (> load current) in each phase conductor. Such dedicated earth fault relays are important where the fault path to earth is a high-resistance one (such as in highly arid areas) or where the system uses high values of earthing resistor / reactance and the fault current detected in the phase conductors will be limited.

2.1.1 Selection of Overcurrent Characteristics

Each pole has two independent over-current characteristics. Where required the two curves can be used:

To produce a composite curve

To provide a two stage tripping scheme

Where one curve is to be directionalised in the forward direction the other in the reverse direction.

The characteristic curve shape is selected to be the same type as the other relays on the same circuit or to grade with items of plant e.g. fuses or earthing resistors.

The application of IDMTL characteristic is summarised in the following table:

©2018 Siemens Protection Devices Limited

OC/EF Curve Characteristic	Application
IEC Normal Inverse (NI) ANSI Moderately Inverse (MI)	Generally applied
IEC Very Inverse (VI) ANSI Very Inverse (VI)	Used with high impedance paths where there is a significant difference between fault levels at protection points
IEC Extreme Inversely (EI) ANSI Extremely Inverse (EI)	Grading with Fuses
IEC Long Time Inverse (LTI)	Used to protect transformer earthing resistors having long withstand times
Recloser Specific	Use when grading with specific recloser

Table 2-1 Application of IDMTL Characteristics

2.1.2 Reset Delay

The increasing use of plastic insulated cables, both conventionally buried and aerial bundled conductors, have given rise to the number of flashing intermittent faults on distribution systems. At the fault position, the plastic melts and temporarily reseals the faulty cable for a short time after which the insulation fails again. The same phenomenon has occurred in compound-filled joint boxes or on 'clashing' overhead line conductors. The repeating process of the fault can cause electromechanical disc relays to "ratchet" up and eventually trip the faulty circuit if the reset time of the relay is longer than the time between successive faults.

To mimic an electromechanical relay the relay can be user programmed for an ANSI DECAYING characteristic when an ANSI operate characteristic is applied. Alternatively a DTL reset (0 to 60 seconds) can be used with other operate characteristics.

For protection of cable feeders, it is recommended that a 60 second DTL reset be used.

On overhead line networks, particularly where reclosers are incorporated in the protected system, instantaneous resetting is desirable to ensure that, on multiple shot reclosing schemes, correct grading between the source relays and the relays associated with the reclosers is maintained.

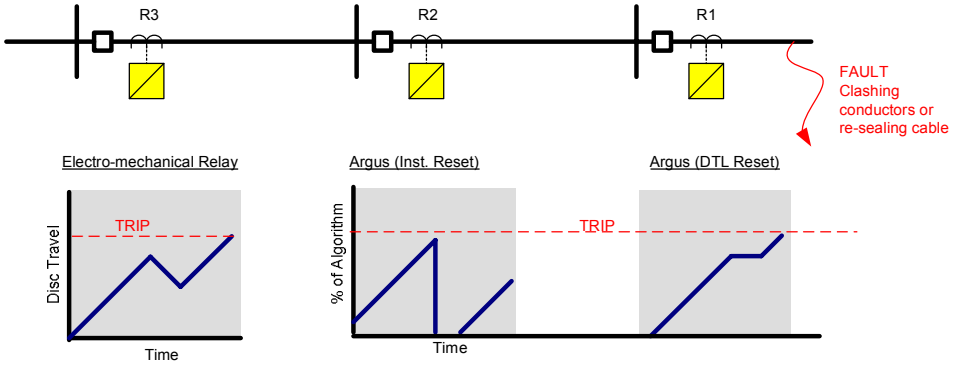


Figure 2.1-3 Reset Delay

© 2013 Siemens Protection Devices Limited

2.2 Voltage dependent overcurrent (51V)

Reduced voltage can indicate a fault on the system, it can be used to make the 51 elements more sensitive.

Typically Voltage Dependent Over-current (51V) is applied to:

Transformer Incomers: Where the impedance of the transformer limits fault current the measured voltage level can be used to discriminate between load and fault current.

Long lines: Where the impedance of the line limits fault current the measured voltage level can be used to discriminate between load and fault current.

Generator circuits: When a Generator is subjected to a short circuit close to its terminals the short-circuit current follows a complex profile. After the initial "sub-transient" value, generally in the order of 7 to 10 times full load current, it falls rapidly (around 10 ms to 20 ms) to the "transient" value. This is still about 5 to 7 times full load and would be sufficient to operate the protection's over-current elements. However the effect on armature reactance of the highly inductive short-circuit current is to increase significantly the internal impedance to the synchronous reactance value. If the Automatic Voltage Regulation (AVR) system does not respond to increase the excitation, the fault current will decay over the next few seconds to a value below the full load current. This is termed the steady state fault current, determined by the Generator's synchronous reactance (and pre-fault excitation). It will be insufficient to operate the protection's over-current elements and the fault will not be detected. Even if AVR is active, problems may still be encountered. The AVR will have a declared minimum sustained fault current and this must be above the protection over-current settings. Close-in short circuit faults may also cause the AVR to reach its safety limits for supplying maximum excitation boost, in the order of several seconds, and this will result in AVR internal protection devices such as diode fuses to start operating. The generator excitation will then collapse, and the situation will be the same as when no AVR was present. The fault may again not be detected.

Current grading remains important since a significant voltage reduction may be seen for faults on other parts of the system. An inverse time operating characteristic must therefore be used.

The VDO Level - the voltage setting below which the more sensitive operating curve applies - must be set low enough to discriminate between short-circuits and temporary voltage dips due to overloads. However, it must also be high enough to cover a range of voltage drops for different circuit configurations, from around 0.6Vn to almost zero. Typically it will be set in the range 0.6 to 0.8Vn.

2.3 Cold Load Settings (51c)

Once a Circuit-Breaker has been open for a period of time ed, higher than normal levels of load current may flow following CB re-closure e.g. heating or refrigeration plant. The size and duration of this current is dependent upon the type of load and the time that the CB is open.

The feature allows the relay to use alternative Shaped Overcurrent (51c) settings when a Cold Load condition is identified. The cold load current and time multiplier settings will normally be set higher than those of the normal overcurrent settings.

The relay will revert to its usual settings (51-n) after elapse of the cold load period. This is determined either by a user set delay, or by the current in all 3-phases falling below a set level (usually related to normal load levels) for a user set period.

©2018 Siemens Protection Devices Limited

2.4 Arc Flash Detection (50AFD)

The overcurrent setting should be set above maximum load current and below the minimum expected arc fault current.

Optical sensor location should be arranged to provide full coverage of the protected chambers. See 7XG31 technical documentation.

Sensor inputs are configured in Zones to provide the required tripping. i.e. the line circuit breaker alone should be tripped for arc faults in the cable termination and CT compartment. The whole busbar must be cleared for arc faults which cannot be identified as being on the line side of the circuit breaker.

Overcurrent supervision can only be applied if the arrangement ensures that current will be measured for all arc faults. In Figure , Zone 2 can only be supervised by current if the feeders are radial and cannot supply fault current with CB A open. Arc sensor pickup can be transferred between relays using IEC 61850 GOOSE allowing Zone2 50AFD to be duplicated in all relays.

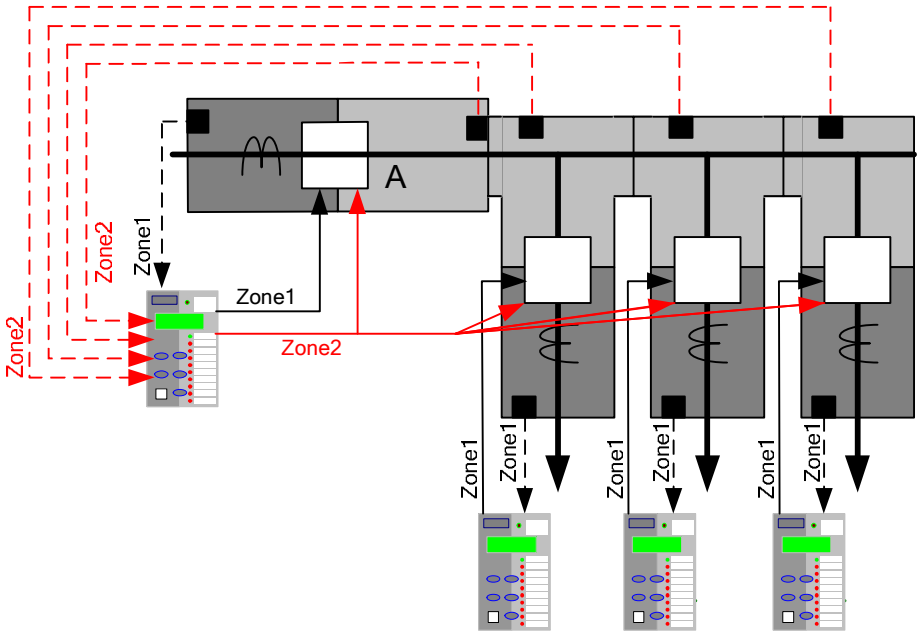


Figure 2.4-1 Arc Flash Detection

© 2013 Siemens Protection Devices Limited

2.5 Instantaneous Overcurrent (50/50G/50N)

Each instantaneous element has an independent setting for pick-up current and a follower definite time lag (DTL) which can be used to provide time grading margins, sequence co-ordination grading or scheme logic. The “instantaneous” description relates to the pick-up of the element rather than its operation.

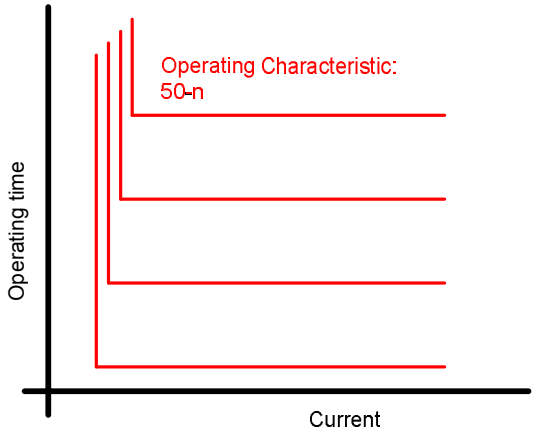


Figure 2.5-1 General Form of DTL Operate Characteristic

Instantaneous elements can be used in current graded schemes where there is a significant difference between the fault current levels at different relay point. The Instantaneous element is set to pick up at a current level above the maximum Fault Current level at the next downstream relay location, and below its own fault current level. The protection is set to operate instantaneously and is often termed ‘Highset Overcurrent’. A typical application is the protection of transformer HV connections – the impedance of the transformer ensuring that the LV side has a much lower level of fault current.

The 50-n elements have a very low transient overreach i.e. their accuracy is not appreciably affected by the initial dc offset transient associated with fault inception.

2.5.1 Blocked Overcurrent Protection Schemes

A combination of instantaneous and DTL elements can be used in blocked overcurrent protection schemes. These protection schemes are applied to protect substation busbars or interconnectors etc. Blocked overcurrent protection provides improved fault clearance times when compared against normally graded overcurrent relays.

The blocked overcurrent scheme of busbar protection shown in Figure 2.4-2 illustrates that circuit overcurrent and earth fault protection relays can additionally be configured with busbar protection logic.

The diagram shows a substation. The relay on the incomer is to trip for busbar faults (F1) but remain inoperative for circuit faults (F2).

In this example the overcurrent and earth fault settings for the incomer 50-1 element are set to below the relevant busbar fault levels. 50-1 time delay is set longer than it would take to acknowledge receipt of a blocking signal from an outgoing circuit.

Close up faults on the outgoing circuits will have a similar fault level to busbar faults. As the incomer 50-1 elements would operate for these faults it is necessary to provide a blocking output from the circuit protections. The 50-1 elements of the output relays are given lower current settings than the incomer 50-1 settings, the time delay is set to 0ms. The output is mapped to a contact. The outgoing relay blocking contacts of all circuits are wired in parallel and this wiring is also connected to a BI on the incomer relay. The BI on the incomer relay is mapped to block its 50-1 element.

©2018 Siemens Protection Devices Limited

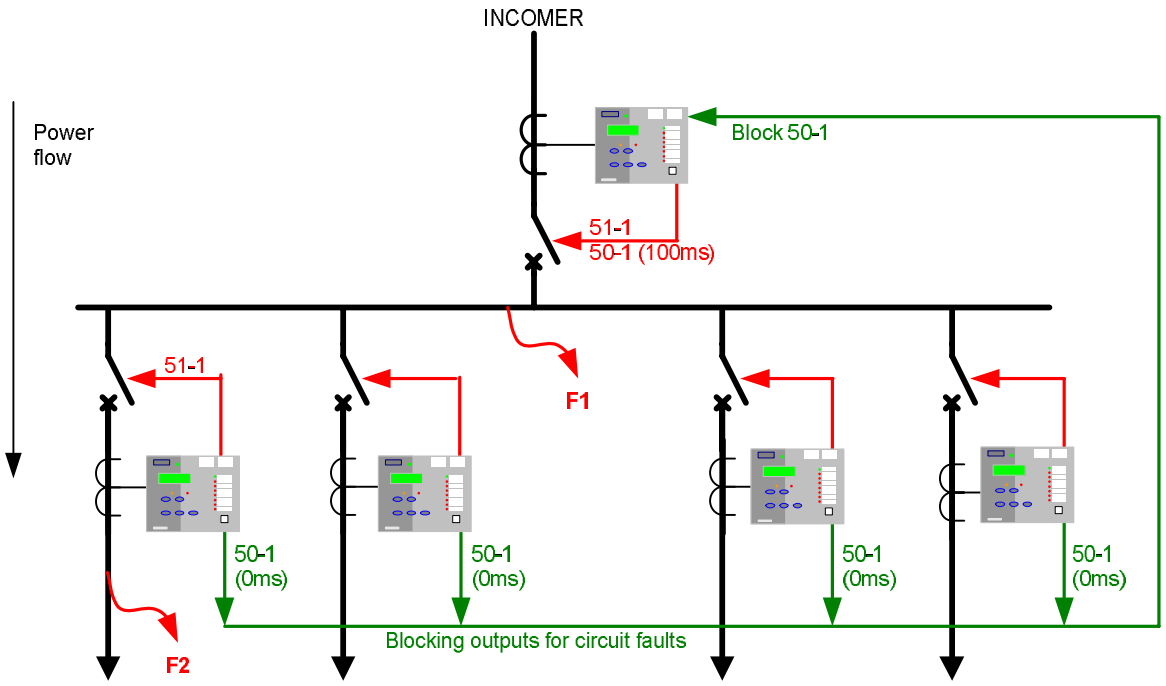


Figure 2.5-2 Blocking Scheme Using Instantaneous Overcurrent Elements

Typically a time delay as low as 50 ms on the incomer 50-1 element will ensure that the incomer is not tripped for outgoing circuit faults. However, to include for both equipment tolerances and a safety margin a minimum time delay of 100 ms is recommended.

This type of scheme is very cost effective and provides a compromise between back-up overcurrent busbar protection and dedicated schemes of busbar protection.

Instantaneous elements are also commonly applied to autoreclose schemes to grade with downstream circuit reclosers and maximise the probability of a successful auto-reclose sequence – see section 4.

© 2013 Siemens Protection Devices Limited

2.6 Sensitive Earth-fault Protection (50SEF)

Earth fault protection is based on the assumption that fault current levels will be limited only by the earth fault impedance of the line and associated plant. However, it may be difficult to make an effective short circuit to earth due to the nature of the terrain e.g. dry earth, desert or mountains. The resulting earth fault current may therefore be limited to very low levels.

Sensitive earth fault (SEF) protection is used to detect such faults. The RM range of relays have a low burden, so avoiding unacceptable loading of the CTs at low current settings.
SEF provides a backup to the main protection. A DTL characteristic with a time delay of several seconds is typically applied ensuring no interference with other discriminative protections. A relatively long time delay can be tolerated since fault current is low and it is impractical to grade SEF protection with other earth fault protections. Although not suitable for grading with other forms of protection SEF relays may be graded with each other.

Where very sensitive current settings are required then it is preferable to use a core balance CT rather than wire into the residual connection of the line CTs. The turns ratio of a core balance CT can be much smaller than that of phase conductors as they are not related to the rated current of the protected circuit. Since only one core is used, the CT magnetising current losses are also reduced by a factor of 3.

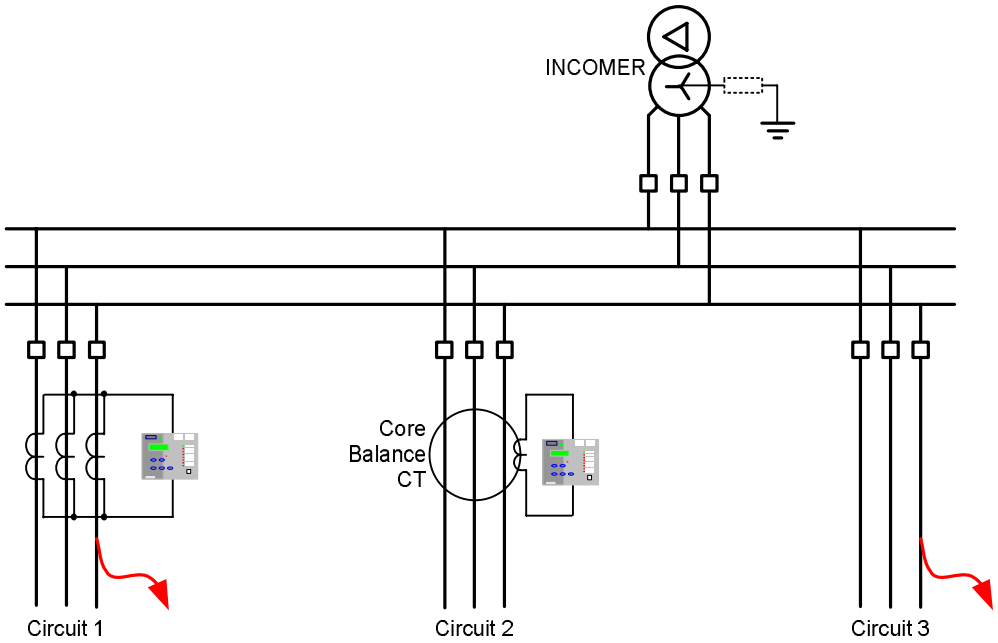


Figure 2.6-1 Sensitive Earth Fault Protection Application

There are limits to how sensitive an SEF relay may be set since the setting must be above any line charging current levels that can be detected by the relay. On occurrence of an out of zone earth fault e.g. on circuit 3 the elevation of sound phase voltage to earth in a non-effectively earthed system can result in a zero sequence current of up 3 times phase charging current flowing through the relay location.

The step change from balanced 3-phase charging currents to this level of zero sequence current includes transients. It is recommended to allow for a transient factor of 2 to 3 when determining the limit of charging current. Based on the above considerations the minimum setting of a relay in a resistance earthed power system is 6 to 9 times the charging current per phase.

©2018 Siemens Protection Devices Limited

2.7 Directional Protection (67)

Each overcurrent stage can operate for faults in either forward or reverse direction. Convention dictates that forward direction refers to power flow away from the busbar, while reverse direction refers to power flowing towards the busbar.

The directional phase fault elements, 67/50 and 67/51, work with a Quadrature Connection to prevent loss of polarising quantity for close-in phase faults. That is, each of the current elements is directionalised by a voltage derived from the other two phases.

This connection introduces a 90° Phase Shift (Current leading Voltage) between reference and operate quantities which must be allowed for in the Characteristic Angle setting. This is the expected fault angle, sometimes termed the Maximum Torque Angle (MTA) as an analogy to older Electro-mechanical type relays

Example: Expected fault angle is -30º (Current lagging Voltage) so set Directional Angle to: +90° -30° = +60°.

A fault is determined to be in the selected direction if its phase relationship lies within a quadrant +/- 85° either side of the Characteristic Angle setting.

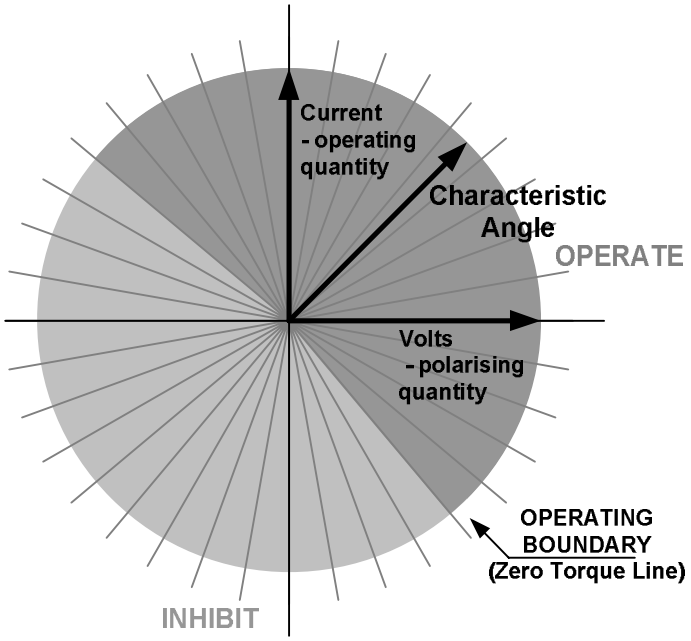


Figure 2.7-1 Directional Characteristics

A number of studies have been made to determine the optimum MTA settings e.g. W.K Sonnemann's paper "A Study of Directional Element Connections for Phase Relays". Figure 2.6-2 shows the most likely fault angle for phase faults on Overhead Line and Cable circuits.

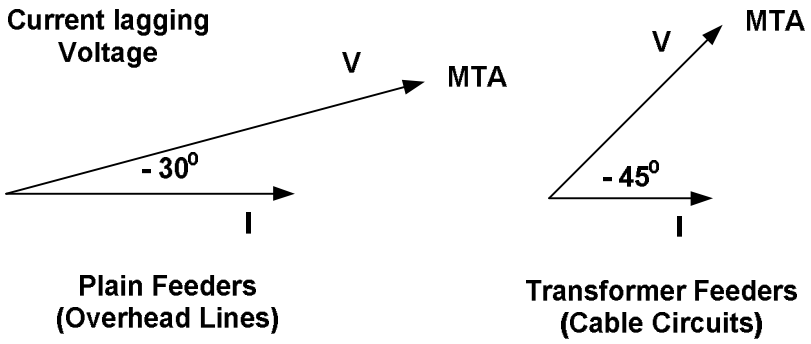


Figure 2.7-2 Phase Fault Angles

© 2013 Siemens Protection Devices Limited

Directional overcurrent elements allow greater fault selectivity than non-directional elements for interconnected systems where fault current can flow in both directions through the relaying point. Consider the network shown in fig. 2.6-3.

The Circuit breakers at A, B, E and G have directional overcurrent relays fitted since fault current can flow in both directions at these points. The forward direction is defined as being away from the busbar and against the direction of normal load current flow. These forward looking IDMTL elements can have sensitive settings applied i.e. low current and time multiplier settings. Note that 7SR22 relays may be programmed with forward, reverse and non-directional elements simultaneously when required by the protection scheme.

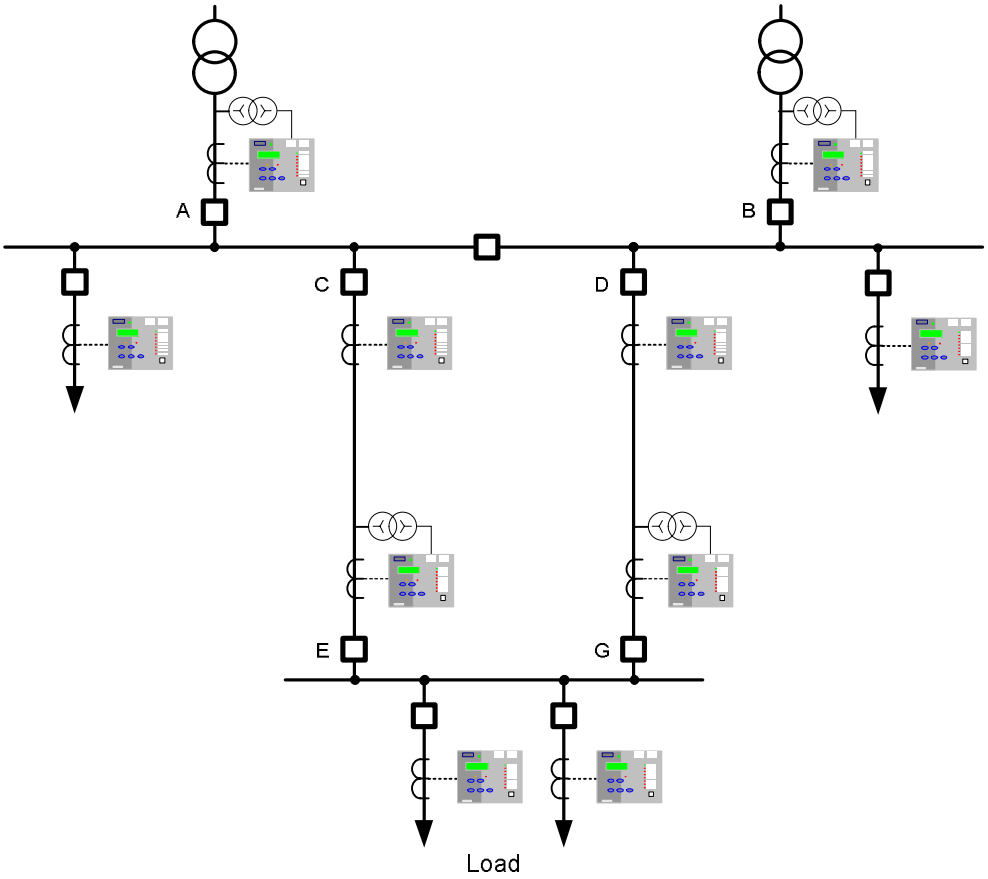


Figure 2.7-3 Application of Directional Overcurrent Protection

©2018 Siemens Protection Devices Limited

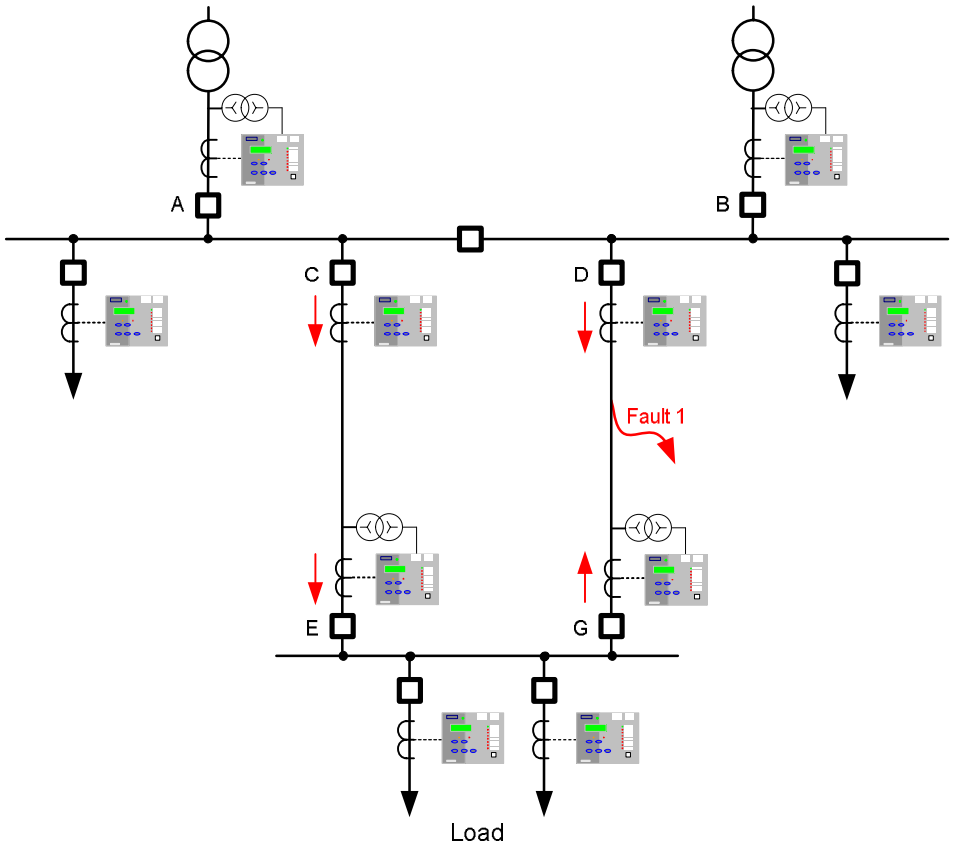


Figure 2.7-4 Feeder Fault on Interconnected Network

Considering the D-G feeder fault shown in fig. 2.6-4: the current magnitude through breakers C and D will be similar and their associated relays will similar prospective operate times. To ensure that only the faulted feeder is isolated G FWD must be set to be faster than C. Relay G will thus Trip first on FWD settings, leaving D to operate to clear the fault. The un-faulted Feeder C-E maintains power to the load.

Relays on circuits C and D at the main substation need not be directional to provide the above protection scheme. However additional directional elements could be mapped to facilitate a blocked overcurrent scheme of busbar protection.

At A and B, forward looking directional elements enable sensitive settings to be applied to detect transformer faults whilst reverse elements can be used to provide back-up protection for the relays at C and D.

By using different settings for forward and reverse directions, closed ring circuits can be set to grade correctly whether fault current flows in a clockwise or counter clockwise direction i.e. it may be practical to use only one relay to provide dual directional protection.

2 Out of 3 Logic

Sensitive settings can be used with directional overcurrent relays since they are directionalised in a way which opposes the flow of normal load current i.e. on the substation incomers as shown on fig. 2.6-4. However on occurrence of transformer HV or feeder incomer phase-phase faults an unbalanced load current may still flow as an un balanced driving voltage is present. This unbalanced load current during a fault may be significant where sensitive overcurrent settings are applied - the load current in one phase may be in the operate direction and above the relay setting.

Where this current distribution may occur then the relay is set to CURRENT PROTECTION>PHASE OVERCURRENT> ***67 2-out-of-3 Logic*** **= ENABLED**

Enabling 2-out-of-3 logic will prevent operation of the directional phase fault protection for a single phase to earth fault. Dedicated earth-fault protection should therefore be used if required.

© 2013 Siemens Protection Devices Limited

2.8 Directional Earth-Fault (50/51G, 50/51N, 51/51SEF)

The directional earth-fault elements, either measure directly or derive from the three line currents the zero sequence current (operate quantity) and compare this against the derived zero phase sequence voltage (polarising quantity). The Technical Manual 'Description of Operation' details the method of measurement. The required setting is entered directly as dictated by the system impedances.

Example: -

Expected fault angle is -45° (i.e. residual current lagging residual voltage) therefore ***67G Char Angle* = -45°**

However directional earth elements can be selectable to use either ZPS or NPS Polarising. This is to allow for the situation where ZPS voltage is not available; perhaps because a 3-limb VT is being used. Care must be taken as the Characteristic Angle will change if NPS Polarising is used.

Once again the fault angle is completely predictable, though this is a little more complicated as the method of earthing must be considered.

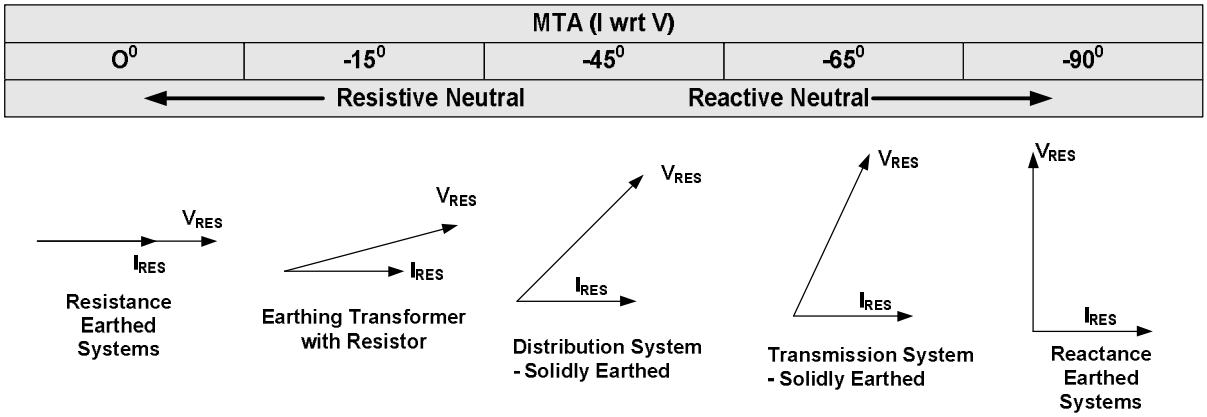


Figure 2.8-1 Earth Fault Angles

©2018 Siemens Protection Devices Limited

2.9 High Impedance Restricted Earth Fault Protection (64H)

Restricted Earth Fault (REF) protection is applied to Transformers to detect low level earth faults in the transformer windings. Current transformers are located on all connections to the transformer. During normal operation or external fault conditions no current will flow in the relay element. When an internal earth fault occurs, the currents in the CTs will not balance and the resulting unbalance flows through the relay.

The current transformers may saturate when carrying high levels of fault current. The high impedance name is derived from the fact that a resistor is added to the relay leg to prevent relay operation due to CT saturation under through fault conditions.

The REF Trip output is configured to provide an instantaneous trip output from the relay to minimise damage from developing winding faults.

The application of the element to a Argus RM-Star transformer is shown in Figure 2.8-1. Although the connection on the Argus RM winding is more correctly termed a Balanced Earth-Fault element, it is still usually referred to as Restricted Earth Fault because of the presence of the transformer.

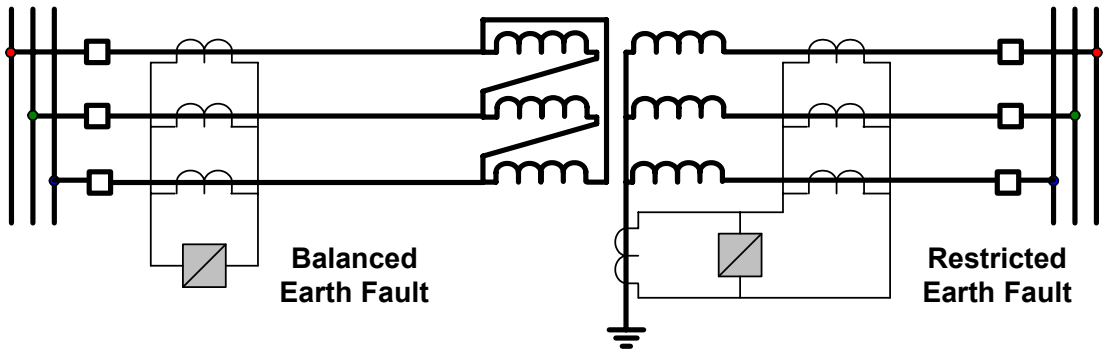


Figure 2.9-1 Balanced and Restricted Earth-fault protection of Transformers

The calculation of the value of the Stability Resistor is based on the worst case where one CT fully saturates and the other balancing CT does not saturate at all. A separate Siemens Protection Devices Limited Publication is available covering the calculation procedure for REF protection. To summarise this: -

The relay Stability (operating) Vs voltage is calculated using worst case lead burden to avoid relay operation for through-fault conditions where one of the CTs may be fully saturated. The required fault setting (primary operate current) of the protection is chosen; typically, this is between 10 % and 25 % of the protected winding rated current. The relay setting current is calculated based on the secondary value of the operate current, note, however, that the summated CT magnetising current @ Vs must be subtracted to obtain the required relay operate current setting.

Since the relay operate current setting and stability/operating voltage are now known, a value for the series resistance can now be calculated.

A check is made as to whether a Non-Linear Resistor is required to limit scheme voltage during internal fault conditions – typically where the calculated voltage is in excess of 2 kV.

The required thermal ratings for external circuit components are calculated.

© 2013 Siemens Protection Devices Limited

Composite overcurrent and REF protection can be provided using a multi-element relay as.

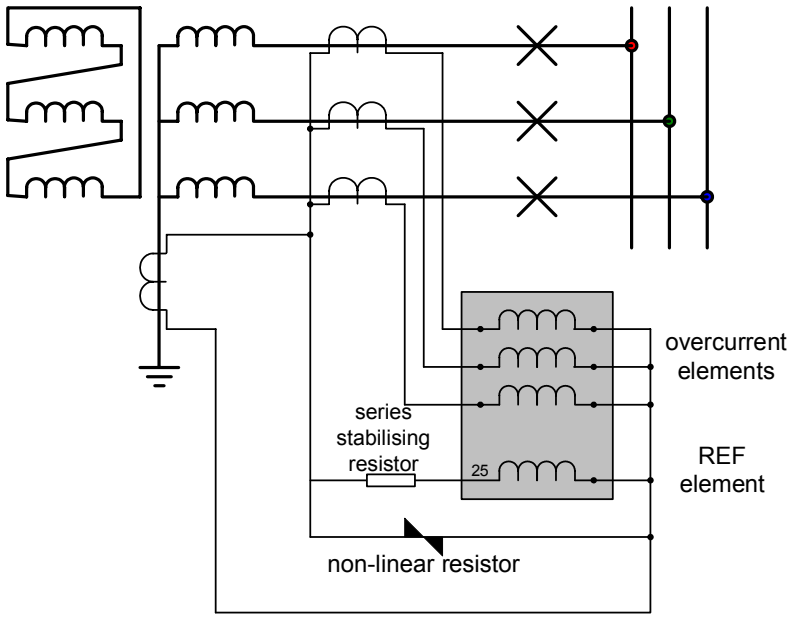


Figure 2.9-2 Composite Overcurrent and Restricted Earth-fault Protection

Although core-balance CTs are traditionally used with elements requiring sensitive pickup settings, cost and size usually precludes this on REF schemes. Instead single-Phase CTs are used and their secondary's connected in parallel.

Where sensitive settings are required, the setting must be above any line charging current levels that can be detected by the relay.

On occurrence of an out of zone earth fault the elevation of sound phase voltage to earth in a non-effectively earthed system can result in a zero sequence current of up 3 times phase charging current flowing through the relay location.

The step change from balanced 3-phase charging currents to this level of zero sequence current includes transients. It is recommended to allow for a transient factor of 2 to 3 when determining the limit of charging current. Based on the above considerations the minimum setting of a relay in a resistance earthed power system is 6 to 9 times the charging current per phase.

High impedance differential protection is suitable for application to auto transformers as line currents are in phase and the secondary current through the relay is balanced to zero by the use of CTs ratios at all three terminals. High impedance protection of this type is very sensitive and fast operating for internal faults.

©2018 Siemens Protection Devices Limited

2.10 Negative Phase Sequence Overcurrent (46NPS)

The presence of Negative Phase Sequence (NPS) current indicates an unbalance in the phase currents, either due to a fault or unbalanced load.

NPS current presents a major problem for 3-phase rotating plant. It produces a reaction magnetic field which rotates in the opposite direction, and at twice the frequency, to the main field created by the DC excitation system. This induces double-frequency currents into the rotor which cause very large eddy currents in the rotor body. The resulting heating of the rotor can be severe and is proportional to $(I_2)^2$ t.

Generators and Motors are designed, manufactured and tested to be capable of withstanding unbalanced current for specified limits. Their withstand is specified in two parts; continuous capability based on a figure of I_2, and short time capability based on a constant, K, where K = $(I_2)^2$ t. NPS overcurrent protection is therefore configured to match these two plant characteristics.

2.11 Undercurrent (37)

Undercurrent elements are used in control logic schemes such as Auto-Changeover Schemes, Auto-Switching Interlock and Loss of Load. They are used to indicate that current has ceased to flow or that a low load situation exists. For this reason simple Definite Time Lag (DTL) elements may be used.

For example, once it has been determined that fault current has been broken – the CB is open and no current flows – an auto-isolation sequence may safely be initiated.

2.12 Thermal Overload (49)

The element uses measured 3-phase current to estimate the real-time Thermal State, θ, of cables or transformers. The Thermal State is based on both past and present current levels.

θ = 0% for unheated equipment, and θ = 100% for maximum thermal withstand of equipment or the Trip threshold.

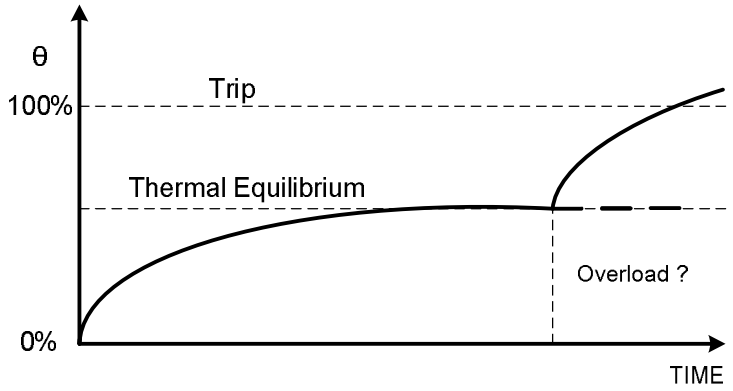


Figure 2.12-1 Thermal Overload Heating and Cooling Characteristic

For given current level, the Thermal State will ramp up over time until Thermal Equilibrium is reached when Heating Effects of Current = Thermal Losses.

The heating / cooling curve is primarily dependent upon the Thermal Time Constant. This must be matched against that quoted for the item of plant being protected. Similarly the current tripping threshold, I_θ is related to the thermal withstand of the plant.

Thermal Overload is a slow acting protection, detecting faults or system conditions too small to pick-up fast acting protections such as Phase Overcurrent. An Alarm is provided for θ at or above a set % of capacity to indicate that a potential trip condition exists and that the system should be scrutinised for abnormalities.

© 2013 Siemens Protection Devices Limited

2.13 Under/Over Voltage Protection (27/59)

Power system under-voltages on may occur due to:

System faults.

An increase in system loading,

Non-energized power system e.g. loss of an incoming transformer

During normal system operating conditions regulating equipment such as transformer On Load Tap Changers (OLTC) and generator Automatic Voltage Regulators (AVR) ensure that the system runs within acceptable voltage limits.

7SR24 undervoltage/DTL elements can be used to detect abnormal undervoltage conditions due to system overloads. Binary outputs can be used to trip non-essential loads - returning the system back to its normal operating levels. This 'load shedding' should be initiated via time delay elements so avoiding operation during transient disturbances. An under voltage scheme (or a combined under frequency/under voltage scheme) can provide faster tripping of non-essential loads than under-frequency load shedding so minimising the possibility of system instability.

Where a transformer is supplying 3-phase motors a significant voltage drop e.g. to below 80% may cause the motors to stall. An undervoltage element can be set to trip motor circuits when the voltage falls below a preset value so that on restoration of supply an overload is not caused by the simultaneous starting of all the motors. A time delay is required to ensure voltage dips due to remote system faults do not result in an unnecessary disconnection of motors.

To confirm presence/loss of supply, the voltage elements should be set to values safely above/below that where a normal system voltage excursion can be expected. The switchgear/plant design should be considered. The 'Dead' level may be very near to the 'live' level or may be significantly below it. The variable hysteresis setting allows the relay to be used with all types of switchgear.

System over-voltages can damage component insulation. Excessive voltage may occur for: -

Sudden loss of load

A tap changer run-away condition occurs in the high voltage direction,

Generator AVR equipment malfunctions or

Reactive compensation control malfunctions.

System regulating equipment such as transformer tap changers and generator AVRs may correct the overvoltage – unless this equipment mal-functions. The overvoltage/DTL elements can be used to protect against damage caused by system overvoltages.

If the overvoltage condition is small a relatively long DTL time delay can be used. If the overvoltage is more severe then another element, set at a higher pickup level and with a shorter DTL can be used to isolate the circuit more quickly. Alternatively, elements can be set to provide alarm and tripping stages, with the alarm levels set lower than the tripping stages.

The use of DTL settings allows a grading system to be applied to co-ordinate the network design, the regulating plant design, system plant insulation withstand and with other overvoltage relays elsewhere on the system. The DTL also prevents operation during transient disturbances.

The use of IDMTL protection is not recommended because of the difficulty of choosing settings to ensure correct co-ordination and security of supply.

 ©2018 Siemens Protection Devices Limited

2.14 Neutral Overvoltage (59N)

Neutral Overvoltage Displacement (Residual Overvoltage) protection is used to detect an earth fault where little or no earth current flows.

This can occur where a feeder has been tripped at its HV side for an earth fault, but the circuit is still energised from the LV side via an unearthed transformer winding. Insufficient earth current would be present to cause a trip, but residual voltage would increase significantly; reaching up to 3-times the normal phase-earth voltage level.

If Neutral Overvoltage protection is used, it must be suitably time graded with other protections in order to prevent unwanted tripping for external system earth faults.

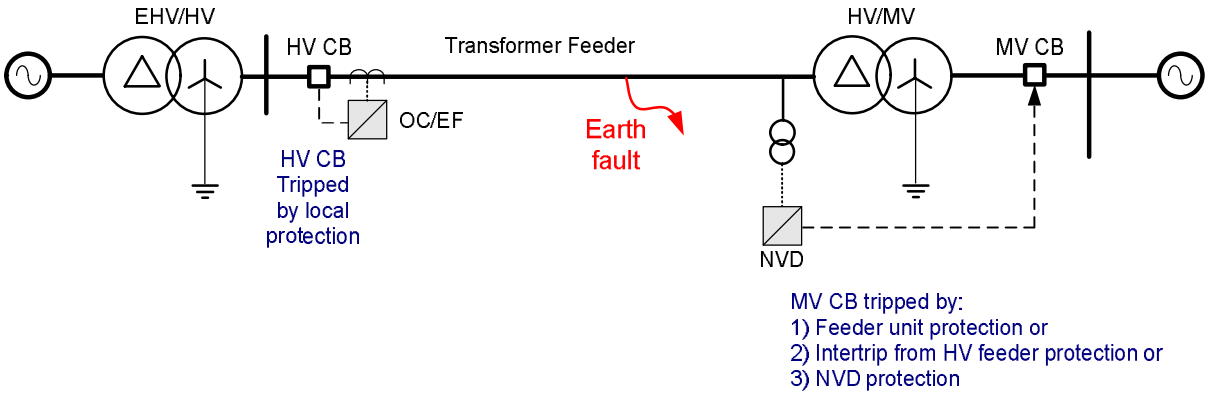


Figure 2.14-1 NVD Application

Typically NVD protection measures the residual voltage ($3V_0$) directly from an open delta VT or from capacitor cones – see fig. 2.13-2 below.

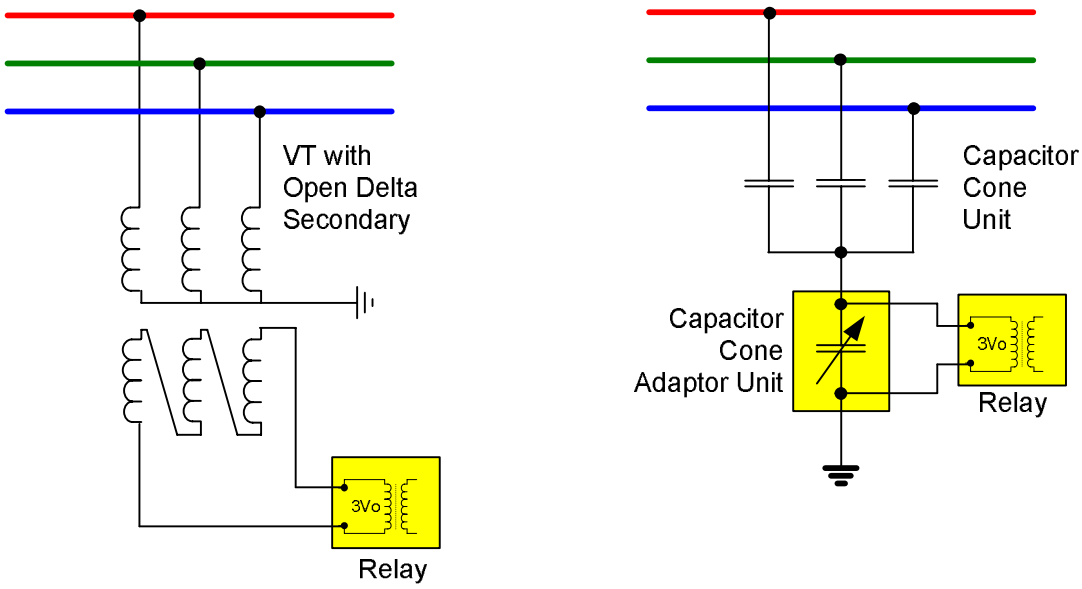


Figure 2.14-2 NVD Protection Connections

© 2013 Siemens Protection Devices Limited

2.14.1 Application with Capacitor Cone Units

Capacitor cones provide a cost effective method of deriving residual voltage. The wide range of capacitor cone component values used by different manufacturer's means that the relay cannot be connected directly to the cones.

The external adaptor unit contains parallel switched capacitors that enable a wide range of values to be selected using a DIL switch and hence the Capacitor Cone output can be scaled to the standard relay input range.

2.14.2 Derived NVD Voltage

Alternatively NVD voltage can be derived from the three phase to neutral voltages, this setting is available within the relay. Note with this method the NVD protection may mal-operate during a VT Fail condition.

2.15 Negative Phase Sequence Overvoltage (47)

Negative Phase Sequence (NPS) protection detects phase unbalances and is widely used in protecting rotating plant such as motors and generators. However such protection is almost universally based on detecting NPS Current rather than Voltage. This is because the NPS impedance of motors etc. is much less than the Positive Phase Sequence (PPS) impedance and therefore the ratio of NPS to PPS Current is much higher than the equivalent ratio of NPS to PPS Voltage.

NPS Voltage is instead used for monitoring busbar supply quality rather than detecting system faults. The presence of NPS Voltage is due to unbalanced load on a system. Any system voltage abnormality is important since it will affect every motor connected to the source of supply and can result in mass failures in an industrial plant.

The two NPS Voltage DTL elements should therefore be used as Alarms to indicate that the level of NPS has reached abnormal levels. Remedial action can then be taken, such as introducing a Balancer network of capacitors and inductors. Very high levels of NPS Voltage indicate incorrect phase sequence due to an incorrect connection.

©2018 Siemens Protection Devices Limited

2.16 Under/Over Frequency (81)

During normal system operation the frequency will continuously vary over a relatively small range due to the changing generation/load balance. Excessive frequency variation may occur for: -

Loss of generating capacity, or loss of mains supply (underfrequency): If the governors and other regulating equipment cannot respond to correct the balance, a sustained underfrequency condition may lead to a system collapse.

Loss of load – excess generation (overfrequency): The generator speeds will increase causing a proportional frequency rise. This may be unacceptable to industrial loads, for example, where the running speeds of synchronous motors will be affected.

In the situation where the system frequency is falling rapidly it is common practise to disconnect non-essential loads until the generation-load balance can be restored. Usually, automatic load shedding, based on underfrequency is implemented. Underfrequency relays are usually installed on the transformer incomers of distribution or industrial substations as this provides a convenient position from which to monitor the busbar frequency. Loads are disconnected from the busbar (shed) in stages until the frequency stabilises and returns to an acceptable level.

The relay has six under/over frequency elements.

An example scheme may have the first load shedding stage set just below the nominal frequency, e.g. between 49.0 Hz and 49.5 Hz. A time delay element would be associated with this to allow for transient dips in frequency and to provide a time for the system regulating equipment to respond. If the first load shedding stage disconnects sufficient plant the frequency will stabilise and perhaps return to nominal. If, however, this is not sufficient then a second load shedding stage, set at a lower frequency, will shed further loads until the overload is relieved. This process will continue until all stages have operated. In the event of the load shedding being unsuccessful, a final stage of underfrequency protection should be provided to totally isolate all loads before plant is damaged, e.g. due to overfluxing.

An alternative type of load shedding scheme would be to set all underfrequency stages to about the same frequency setting but to have different length time delays set on each stage. If after the first stage is shed the frequency doesn't recover then subsequent stages will shed after longer time delays have elapsed.

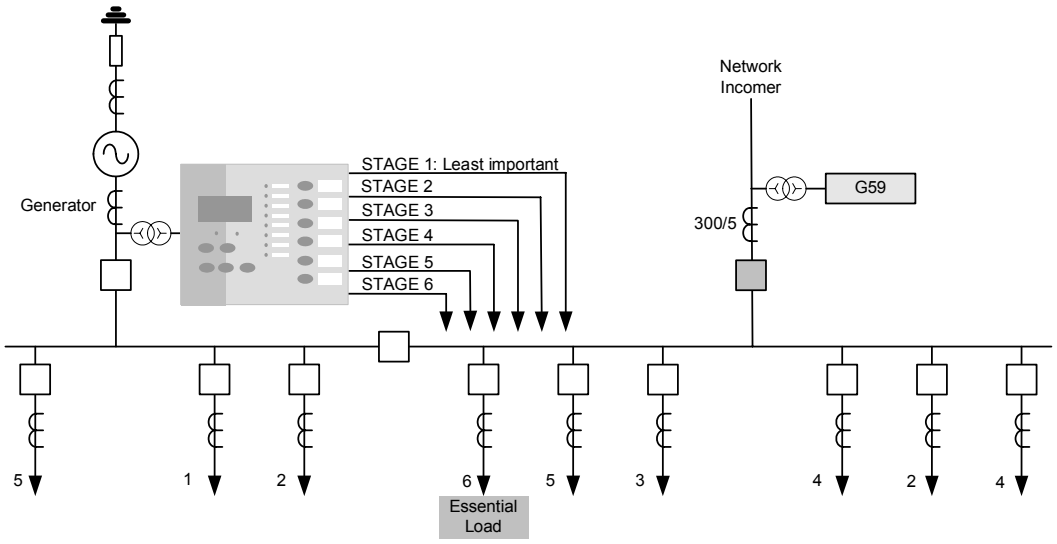


Figure 2.16-1 Load Shedding Scheme Using Under-Frequency Elements

© 2013 Siemens Protection Devices Limited

2.17 Power Protection

2.17.1 Power (32)

Parallel Busbar Feeder

If power is fed to a busbar through two parallel infeeds, then in the event of any fault on one of these infeeds it should be selectively interrupted. This ensures a continued supply to the busbar through the remaining the remaining infeed. For this purpose directional devises are needed which detect a shortcircuit current or a power flow from the busbar in the direction of the infeed. Reverse-power protection can be set far below the rated power.

Motor Protection

An under power element protects against a loss of load condition by measuring the real power flow. This feature provides an alternative to under current measurement as load loss may result in only a small change in current.

The under power output is initiated by a voltage element operating after a definite time delay. The applied power setting will typically be 10-20% below minimum load, the power and time delay settings must take into account:

> Where rated power cannot be reached during starting (for example where the motor is started with no connected load) it may be necessary to inhibit this function for a set time. This feature requires a 52a circuit breaker auxiliary contact mapped to an opto input to get the information CB Closed/CB Open.
>
> Directional power measurement may operate on occurrence of a system power supply fail or system fault. Power flow into the motor will reverse since the motor will act as a generator due to the inertia of the connected load.

General Calculation

Real, apparent or reactive power is set in the relay as a multiple of the relay (or secondary) nominal power where: -

Nominal relay power (secondary) = relay nominal current x relay nominal voltage.

Example:

CT ratio = 400:1

VT ratio = 33000:110

Nominal secondary apparent power (S):

Nominal 3-phase VA (secondary) = $\sqrt{3} \times V_L \times I_L$
= $\sqrt{3} \times 110 \times 1$
= 190.53 VA
= 1 xSn

When calculating the required operate value in primary quantities the CT and VT ratios must be considered i.e. where the above corresponds to a nominal primary 3-phase apparent power (S) of:

Nominal 3-phase VA (primary) = $\sqrt{3} \times V_L \times I_L$
= $\sqrt{3} \times 330000 \times 400$
= 22.863 MVA
= 1 xSn

The primary nominal VA calculated above may not match that of the protected primary plant and so settings should be adjusted accordingly.

 ©2018 Siemens Protection Devices Limited

Section 3: CT Requirements

3.1 CT Requirements for Overcurrent and Earth Fault Protection

3.1.1 Overcurrent Protection CTs

a) For industrial systems with relatively low fault current and no onerous grading requirements - a class 10P10 with VA rating to match the load.

b) For utility distribution networks with relatively high fault current and several grading stages - a class 5P20, with VA rating to match the load.

Note: If an accuracy limit factor is chosen which is much lower than the maximum fault current it will be necessary to consider any effect on the protection system performance and accuracy e.g. grading margins.

For i.d.m.t.l. applications, because the operating time at high fault current is a definite minimum value, partial saturation of the CT at values beyond the overcurrent factor has only a minimal effect. However, this must be taken into account in establishing the appropriate setting to ensure proper grading.

c) For dtl applications utilities as for (b) above - a class 5P10 (or 20), with rated burden to suit the load.

Note: Overcurrent factors do not need to be high for definite time protection because once the setting is exceeded magnitude accuracy is not important. Often, however, there is also the need to consider instantaneous HighSet overcurrent protection as part of the same protection system and the settings would normally be of the order of 10x the CT rating or higher. Where higher settings are to be used then the overcurrent factor must be raised accordingly, e.g. to P20.

3.1.2 Earth Fault Protection CTs

Considerations and requirements for earth fault protection are the same as for Phase fault. Usually the relay employs the same CT's e.g. three phase CTs star connected to derive the residual earth fault current.

The accuracy class and overcurrent accuracy limit factors are therefore already determined and for both these factors the earth fault protection requirements are normally less onerous than for overcurrent.

3.2 CT Requirements for High Impedance Restricted Earth Fault Protection

For high impedance REF it is recommended that: -

Low reactance CTs to IEC 60044 Class PX are used, this allows a sensitive current setting to be applied.

All CT's should, if possible have identical turns ratios.

The knee point voltage of the CTs must be greater than 2 x 64H setting voltage Vs.

Where the REF function is used then this dictates that the other protection functions are also used with class PX CTs.

A full explanation of how to specify CTs for use with REF protection, and set REF relays is available on our website: www.siemens.com/energy

© 2013 Siemens Protection Devices Limited

Section 4: Control Functions

4.1 Auto-reclose Applications

Automatic circuit reclosing is extensively applied to overhead line circuits where a high percentage of faults that occur are of a transient nature. By automatically reclosing the circuit-breaker the function attempts to minimise the loss of supply to the customer and reduce the need for manual intervention.

The function supports up to 4 ARC sequences. That is, 4 x Trip / Recloses followed by a Trip & Lockout. A lockout condition prevents any further attempts, automatic or manual, to close the circuit-breaker. The number of sequences selected depends upon the type of faults expected. If there are a sufficient percentage of semi-permanent faults which could be burnt away, e.g. fallen branches, a multi shot scheme would be appropriate. Alternatively, if there is a high likelihood of permanent faults, a single shot scheme would minimise the chances of causing damage by reclosing onto a fault. In general, 80% of faults will be cleared by a single Trip and Reclose sequence. A further 10% will be cleared by a second Trip and Reclose. Different sequences can be selected for different fault types (Phase/Earth/Sensitive Earth faults).

The Deadtime is the interval between the trip and the CB close pulse being issued. This is to allow for the line to go 'dead' after the fault is cleared. The delay chosen is a compromise between the need to return the line to service as soon as possible and prevented unnecessary trips through re-closing too soon. The Reclaim Time is the delay following a re-closure before the line can be considered back in service. This should be set long enough to allow for protection operation for the same fault, but not so long that two separate faults could occur in the same Autoreclose (ARC) sequence and cause unnecessary lockouts.

Since large fault currents could potentially damage the system during a prolonged ARC sequence, there are also settings to identify which protection elements are High-sets and these can cause an early termination of the sequence.

Where a relay is to operate as part of an ARC scheme involving a number of other relays, the feature attempts to clear any faults quickly without regard to normal fault current grading. It does this by setting each Trip element to be either Delayed or Instantaneous. Instantaneous Trips are set to operate at just above maximum load current with small delays while Delayed Trips are set to suit actual fault levels and with delays suitable for current grading.

A typical sequence would be 2 Instantaneous Trips followed by a Delayed Trip & Lockout: -

- When any fault occurs, the relay will trip instantaneously and then reclose.
- If this does not clear the fault, the relay will do the same again.
- If this still does not clear the fault, the fault is presumed to be permanent and the next Trip will be Delayed and so suitable for grading with the rest of the network. Thus allowing downstream protection time to operate.
- This Trip will Lockout the ARC sequence and prevent further recloses.

It is important that all the relays in an ARC scheme shadow this process – advancing through their own ARC sequences when a fault is detected by an element pickup even though they are not actually causing a trip or reclose. This is termed Sequence Co-ordination and prevents an excessive number of recloses as each successive relay attempts to clear the fault in isolation. For this reason each relay in an ARC scheme must be set with identical Instantaneous and Delayed sequence of trips.

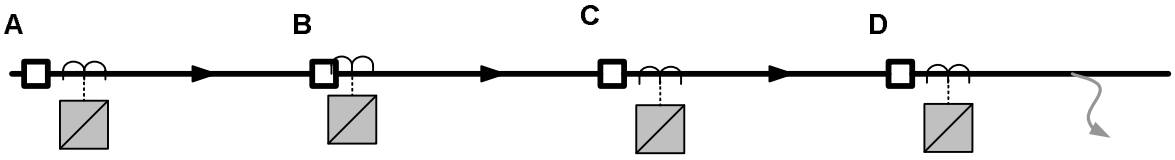


Figure 4.1-1 Sequence Co-ordination

©2018 Siemens Protection Devices Limited

The relay closest to the fault (D) would step through its Instantaneous Trips in an attempt to clear the fault. If unsuccessful, the relay would move to a Delayed Trip sequence.

The other relays in the network (A, B and C) would recognise the sequence of Pick-up followed by current switch-off as ARC sequences. They would therefore also step to their Delayed Trip to retain co-ordination with the respective downstream devices.

The next Trip would be subject to current grading and Lockout the ARC sequence such that the fault is cleared by the correct CB.

4.1.1 Auto-Reclose Example 1

Requirement: Settings shall provide four phase fault recloses – two instantaneous and two delayed - and only two recloses for faults detected by the SEF protection.

Proposed settings include:

CONTROL & LOGIC > AUTORECLOSE PROT'N:

***79 P/F Inst Trips*: 50-1**

***79 P/F Delayed Trips*: 51-1**

***79 SEF Delayed Trips*: 51SEF-1**

CONTROL & LOGIC > AUTORECLOSE CONFIG

***79 Num Shots*: 4**

CONTROL & LOGIC > AUTORECLOSE CONFIG > P/F SHOTS

***79 P/F Prot'n Trip 1* : Inst**

***79 P/F Prot'n Trip 2* : Inst**

***79 P/F Prot'n Trip 3* : Delayed**

***79 P/F Prot'n Trip 4* : Delayed**

***79 P/F Delayed Trips to Lockout* : 3**

CONTROL & LOGIC > AUTORECLOSE CONFIG > SEF SHOTS

***79 SEF Prot'n Trip 1* : Delayed**

***79 SEF Prot'n Trip 2* : Delayed**

***79 SEF Delayed Trips to Lockout* : 3**

Note that Instantaneous' shots are inhibited if the shot is defined as 'Delayed'

© 2013 Siemens Protection Devices Limited

4.1.2 Auto-Reclose Example 2 (Use of Quicklogic with AR)

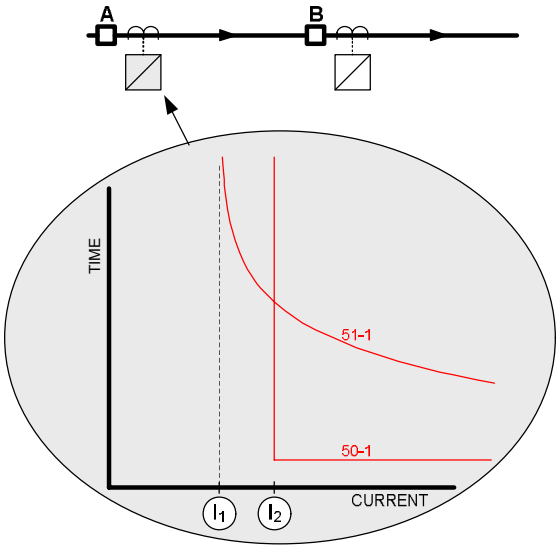


Figure 4.1-2 Example of Logic Application

Requirement: The relay at location 'A' it is required to provide a reclose sequence of 2 Instantaneous followed by 2 delayed recloses. Where the fault current level is between the values 'I1' and 'I2' and the first trip is initiated from the 51-1 (IDMT) element, the IDMT characteristic should trip the CB and lockout the auto-reclose.

Typical settings are:

CONTROL & LOGIC > AUTORECLOSE PROT'N:

***79 P/F Inst Trips*: 50-1**

***79 P/F Delayed Trips*: 51-1**

CONTROL & LOGIC > AUTORECLOSE CONFIG > P/F SHOTS

***79 P/F Prot'n Trip 1* : Inst**

***79 P/F Prot'n Trip 2* : Inst**

***79 P/F Prot'n Trip 3* : Delayed**

***79 P/F Prot'n Trip 4* : Delayed**

The above settings are suitable at values of fault current above 'I2' however were a fault to occur with a current value between 'I1' and 'I2' this would be detected by the 51-1 element only. As ***Prot'n Trip 1*** = **Inst** then the relay would trip and reclose whereas it is required to lockout for this occurrence.

To provide a lockout for the above faults an additional element 50-2 with identical settings to 50-1 is assigned as a Delayed Trip and is used in conjunction with the Quick Logic feature i.e.

OUTPUT CONFIG>OUTPUT MATRIX: ***51-1*** = **V1**

OUTPUT CONFIG>OUTPUT MATRIX: ***50-2*** = **V2**

OUTPUT CONFIG>OUTPUT MATRIX: ***E1*** = **V3**

CONTROL & LOGIC>QUICK LOGIC: ***E1*** = **V1.!V2**

INPUT CONFIG>INPUT MATRIX: ***79 Lockout*** = **V3**

©2018 Siemens Protection Devices Limited

4.2 Quick Logic Applications

4.2.1 Auto-Changeover Scheme Example

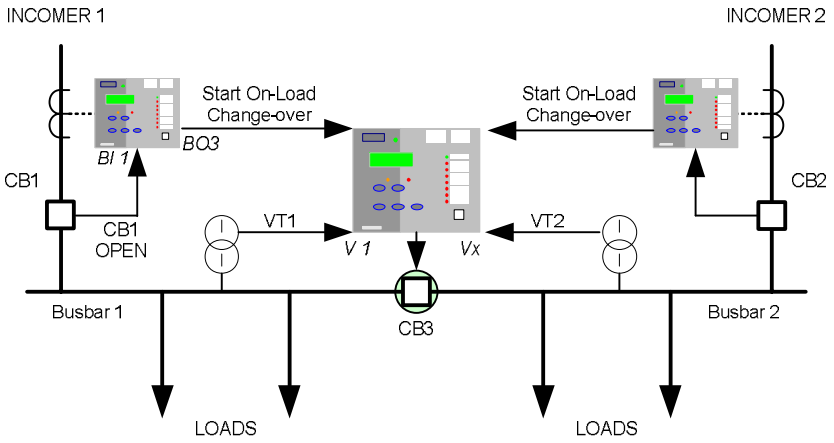


Figure 4.2-1 Example Use of Quick Logic

The MV installation illustrated above is fed from two incomers. To limit the substation fault level the busbar is run with CB3 open. When a fault occurs on one of the incomers it is isolated by the circuit protection. To re-supply the disconnected loads from the remaining incomer CB3 is closed.

If the line fault occurs on incomer 1 it must be confirmed that CB 1 has opened before CB3 can be closed. The relay on incomer 1 confirms that a trip has been issued to CB1 (e.g. Binary Output 2), that CB 1 has opened (e.g. Binary Input 1) and that no current flows in the circuit (e.g. 37-1 = Virtual 1): -

Incomer 1 Relay is Configured:

CB1 Open auxiliary switch wired to B.I. 1

Trip output to CB1 = B.O. 2

OUTPUT CONFIG>OUTPUT MATRIX: ***37-1*** = **V1**

OUTPUT CONFIG>OUTPUT MATRIX: ***E1*** = **BO3**

CONTROL & LOGIC>QUICK LOGIC: ***E1*** = **O2.I1.V1**

The output from Incomer 1 (BO3) relay is input to the relay on CB 3 (Binary Input 1). A panel switch may be used to enable the On-Load Change-over scheme (Binary Input 2). Before Closing CB3 a check may be made that there is no voltage on busbar 1 (27/59-1 = Virtual 1). CB 3 is closed from Binary Output 3.

CB3 Relay is Configured:

Panel switch (ON-Load Change-over Enabled) wired to B.I. 1

OUTPUT CONFIG>OUTPUT MATRIX: ***27/59-1*** = **V1**

OUTPUT CONFIG>OUTPUT MATRIX: ***E1*** = **BO3**

CONTROL & LOGIC>QUICK LOGIC: ***E1*** = **I1.I2.V1**

If required a time delay can be added to the output using the CONTROL & LOGIC > QUICK LOGIC: ***E1 Pickup Delay*** setting.

© 2013 Siemens Protection Devices Limited

Section 5: Supervision Functions

5.1 Circuit-Breaker Fail (50BF)

Where a circuit breaker fails to operate to clear fault current the power system will remain in a hazardous state until the fault is cleared by remote or back-up protections. To minimise any delay, CB Failure protection provides a signal to either re-trip the local CB or back-trip 'adjacent' CBs.

The function is initiated by the operation of user selectable protection functions or from a binary input. Current flow is monitored after a tripping signal has been issued if any of the 50BF current check elements have not reset before the timers have expired an output is given. For CB trips where the fault is not current related an additional input is provided (50BF Mech Trip) which monitors the CB closed input and provides an output if the circuit breaker has not opened before the timers expire.

The relay incorporates a two-stage circuit breaker fail feature. For some systems, only the first will be used and the CB Failure output will be used to back-trip the adjacent CB(s). On other systems, however, this output will be used to re-trip the local CB to minimise potential disruption to the system; if possible via a secondary trip coil and wiring. The second CB Failure stage will then be used to back-trip the adjacent CB(s).

If the CB is faulty and unable to open, a faulty contact can be wired to the CB faulty input of the relay and if a trip occurs while this input is raised the CB fail delay timers may be by-passed to allow back tripping to occur without delay.

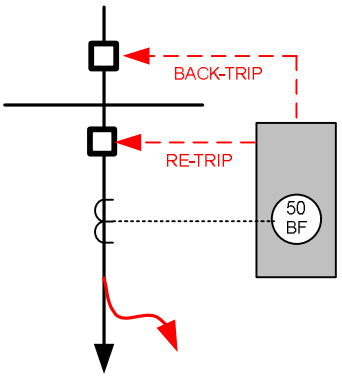


Figure 5.1-1 Circuit Breaker Fail

5.1.1 Settings Guidelines

50BF Setting

The phase current setting must be set below the minimum protection setting current.

50BF Setting-I4

The EF or SEF current setting must be set below the minimum protection setting current.

50BF Ext Trig

Any binary input can be mapped to this input to trigger the circuit breaker fail function. Note current must be above setting for the function to operate.

50BF Mech Trip

Any binary input can be mapped to this input to trigger the circuit breaker fail function. Note for the function to operate the circuit breaker closed input is used to detect a failure, not the current.

50BF CB Faulty

Any binary input can be mapped to this input, if it is energised when a trip initiation is received an output will be given immediately (the timers are by passed).

©2018 Siemens Protection Devices Limited

50BF DTL1/50BF DTL2

The time delays run concurrently within the relay. The time delay applied to the CB Fail protection must be in excess of the longest CB operate time + relay reset time + a safety margin.

First Stage (Retrip)	
Trip Relay operate time	10 ms
Reset Time	20 ms
CB Tripping time	50 ms
Safety Margin	40 ms
Overall First Stage CBF Time Delay	**120 ms**

Second Stage (Back Trip)	
First CBF Time Delay	120 ms
Trip Relay operate time	10 ms
CB Tripping time	50 ms
Reset Time of measuring element	20 ms
Margin	60 ms
Overall Second Stage CBF Time Delay	**260 ms**

The safety margin is extended by 1 cycle for the second CBF stage as this will usually involve a back-trip of a Busbar tripping scheme.

The timing sequence for each stage of the circuit breaker fail function is as below.

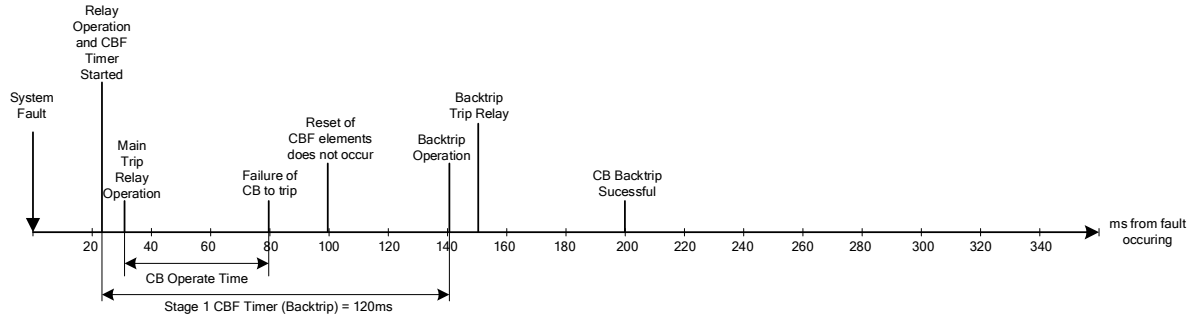


Figure 5.1-2 Single Stage Circuit Breaker Fail Timing

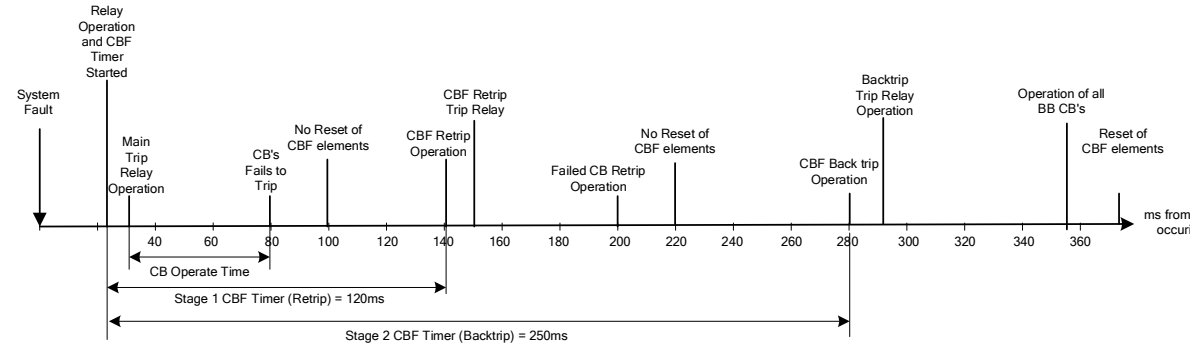


Figure 5.1-3 Two Stage Circuit Breaker Fail Timing

© 2013 Siemens Protection Devices Limited

5.2 Current Transformer Supervision (60CTS)

When a CT fails, the current levels seen by the protection become unbalanced. A large level of NPS current is therefore detected - around 0.3 x In for one or two CT failures. However this condition would also occur for a system fault. To differentiate between the two conditions, the element uses NPS voltage to restrain the CTS algorithm as show in the accompanying table.

NPS Current	NPS Voltage	Decision
> Setting	> Setting	System Fault
> Setting	< Setting	CT Failure

Table 5-2 Determination of CT Failure (1 or 2 Phases)

Following a CT Failure, there should be little or no NPS voltage. Perhaps 0.1 x Vn as a maximum.

Operation is subject to a time delay to prevent operation for transitory effects.

A 3-phase CT failure is considered so unlikely (these being independent units) that this condition is not tested for.

©2018 Siemens Protection Devices Limited

5.3 Voltage Transformer Supervision (60VTS)

Although VTs rarely fail themselves, VT Supervision presents a common application because of the failure of protective Fuses connected in series with the VTs.

When a VT failure occurs on one or two phases, the voltage levels seen by the protection become unbalanced. A large level of NPS voltage is therefore detected - around 0.3 x Vn for one or two VT failures. However this condition would also occur for a system fault. To differentiate between the two conditions, the element uses NPS current to restrain the VTS algorithm as show in the accompanying table.

NPS Voltage	NPS Current	Decision
> Setting	> Setting	System Fault
> Setting	< Setting	VT Failure

Table 5-3 Determination of VT Failure (1 or 2 Phases)

Following a VT Failure, the level of NPS current would be dependent solely upon load imbalance - perhaps 0.1 x In as a maximum.

Operation is subject to a time delay to prevent operation for transitory effects.

NPS voltage and current quantities are used rather than ZPS since the latter makes it difficult to differentiate between a VT failure and a Phase-Phase fault. Both conditions would generate little or no ZPS current. However the element provides an option to use ZPS quantities to meet some older specifications.

There are possible problems with using NPS quantities due to load imbalances. These would also generate significant levels of NPS current and so possibly cause a VT failure to be missed. This problem can be overcome by careful selection of settings, however, setting the NPS current threshold above the level expected for imbalance conditions.

If a failure occurs in all 3 Phases of a Voltage Transformer, then there will be no NPS or ZPS voltage to work with. However the PPS Voltage will fall below expected minimum measurement levels.

This could also be due to a ‘close in’ fault and so PPS Current must remain above minimum load level BUT below minimum fault level.

PPS Voltage	PPS Current	Decision
< Setting	> Minimum Fault Level	System Fault
< Setting	Minimum Load Level < AND < Minimum Fault Level	VT Failure

Table 5-4 Determination of VT Failure (3 Phases)

Operation is again subject to a time delay to prevent operation for transitory effects.

Alternatively a 3 Phase VT failure can be signalled to the relay via a Binary Input taken from the Trip output of an external MCB. This can also be reset by a Binary Input signal.

VTS would not normally be used for tripping - it is an alarm rather than fault condition. However the loss of a VT would cause problems for protection elements that have voltage dependant functionality. For this reason, the relay allows these protection elements - under-voltage, directional over-current, etc. - to be inhibited if a VT failure occurs.

© 2013 Siemens Protection Devices Limited

5.4 Trip-Circuit Supervision (74TCS)

Binary Inputs may be used to monitor the integrity of the CB trip circuit wiring. A small current flows through the B.I. and the trip circuit. This current operates the B.I. confirming the integrity of the auxiliary supply, CB trip coil, auxiliary switch, C.B. secondary isolating contacts and associated wiring. If monitoring current flow ceases the B.I. drops off and if it is user programmed to operate one of the output relays, this can provide a remote alarm. In addition, an LED on the relay can be programmed to operate. A user text label can be used to define the operated LED e.g. “Trip CCT Fail”.

The relevant Binary Input is mapped to 74TCS-n in the INPUT CONFIG>INPUT MATRIX menu. To avoid giving spurious alarm messages while the circuit breaker is operating the input is given a 0.4 s Drop-off Delay in the INPUT CONFIG>BINARY INPUT CONFIG menu.

To provide an alarm output a normally open binary output is mapped to 74TCS-n.

5.4.1 Trip Circuit Supervision Connections

The following circuits are derived from UK ENA S15 standard schemes H5, H6 and H7.

For compliance with this standard: -

Where more than one device is used to trip the CB then connections should be looped between the tripping contacts. To ensure that all wiring is monitored the binary input must be at the end of the looped wiring.

Resistors must be continuously rated and where possible should be of wire-wound construction.

Scheme 1 (Basic)

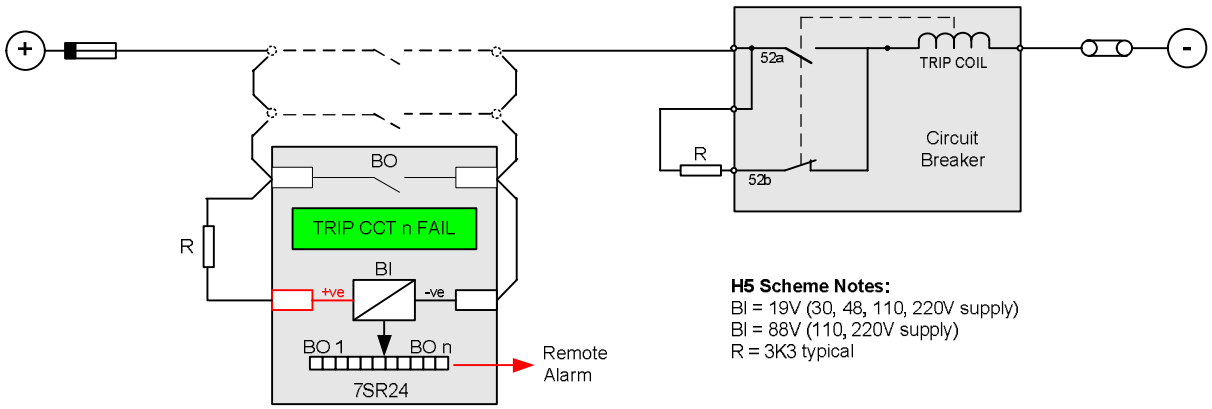


Figure 5.4-1 Trip Circuit Supervision Scheme 1 (H5)

Scheme 1 provides full Trip supervision with the circuit breaker Open or Closed.

Where a ‘Hand Reset’ Trip contact is used measures must be taken to inhibit alarm indications after a CB trip.

©2018 Siemens Protection Devices Limited

Scheme 2 (Intermediate)

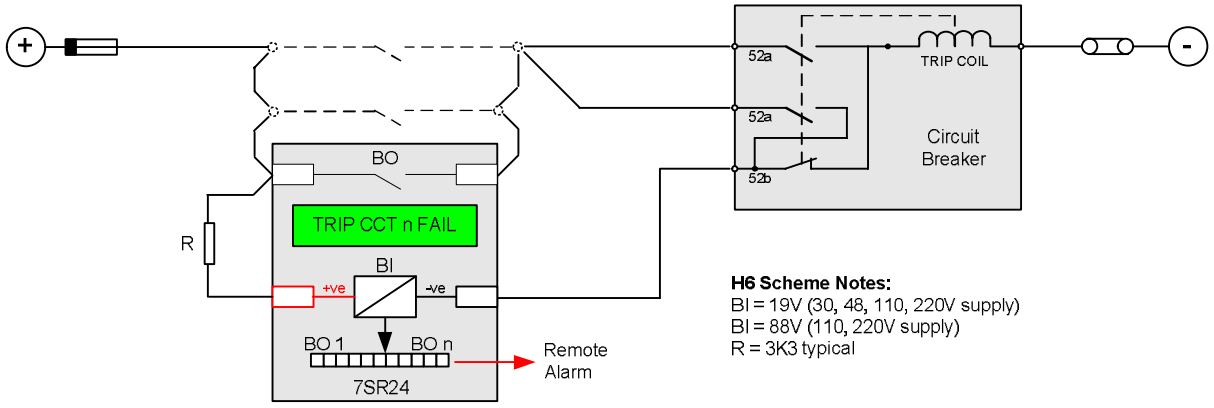


Figure 5.4-2 Trip Circuit Supervision Scheme 2 (H6)

Scheme 2 provides continuous Trip Circuit Supervision of trip coil with the circuit breaker Open or Closed. It does not provide pre-closing supervision of the connections and links between the tripping contacts and the circuit breaker and may not therefore be suitable for some circuits which include an isolating link.

Scheme 3 (Comprehensive)

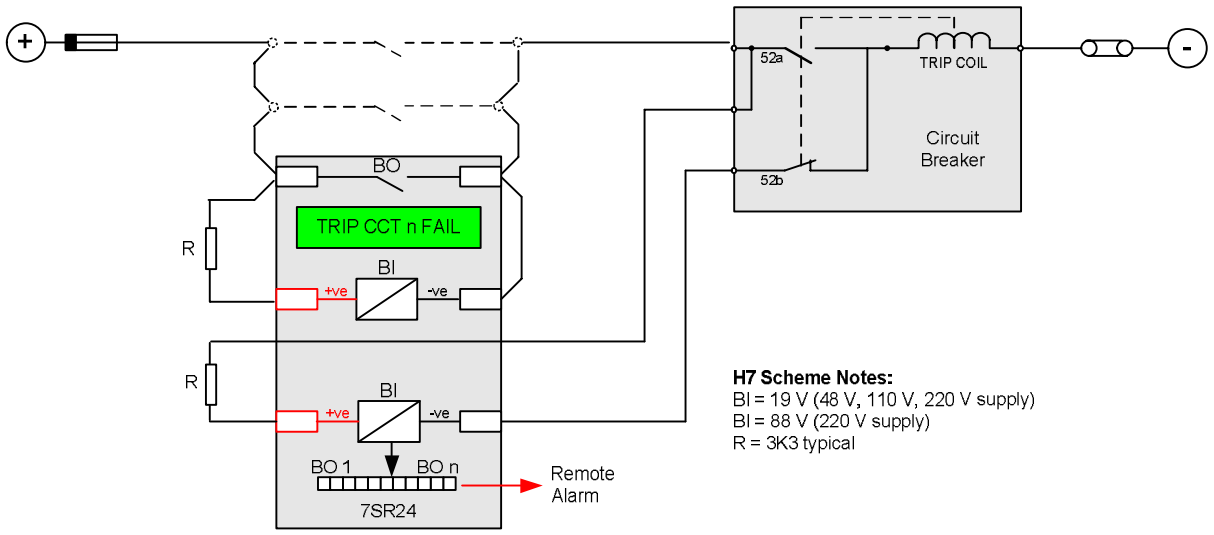


Figure 5.4-3 Trip Circuit Supervision Scheme 3 (H7)

Scheme 3 provides full Trip supervision with the circuit breaker Open or Closed.

© 2013 Siemens Protection Devices Limited

5.5 Inrush Detector (81HBL2)

This element detects the presence of high levels of 2nd Harmonic current which is indicative of transformer Inrush current at switch-on. These currents may be above the operate level of the overcurrent elements for a short duration and it is important that the relay does not issue an incorrect trip command for this transient network condition.

If a magnetic inrush condition is detected operation of the overcurrent elements can be blocked.

Calculation of the magnetising inrush current level is complex. However a ratio of 20% 2^{nd} Harmonic to Fundamental current will meet most applications without compromising the integrity of the Overcurrent protection.

There are 3 methods of detection and blocking during the passage of magnetising inrush current.

Phase	Blocking only occurs in those phases where Inrush is detected. Large, Single Phase Transformers – Auto-transformers.
Cross	All 3-phases are blocked if Inrush is detected in any phase. Traditional application for most Transformers but can give delayed operation for Switch-on to Earth Fault conditions.
Sum	Composite 2nd Harmonic content derived for all 3-phases and then compared to Fundamental current for each individual phase. Provides good compromise between Inrush stability and fast fault detection.

Table 5-5 Magnetic Inrush Bias

5.6 Broken Conductor / Load Imbalance (46BC)

This feature is used to detect an open circuit condition when a conductor breaks or a mal-operation occurs in phase segregated switchgear.

There will be little or no fault current and so overcurrent elements will not detect the condition. However the condition can be detected because there will be a high content of NPS (unbalance) current present.

An NPS / PPS ratio > 50% will result from a Broken Conductor condition.

Operation is subject to a time delay to prevent operation for transitory effects.

5.7 Circuit-Breaker Maintenance

The Relay provides CB Total Trip Count, CB Delta Trip Count, CB Count to AR Block and CB Frequent Operation Counters along with an I^2t CB Wear Counter to estimate the amount of wear and tear experienced by a Circuit-Breaker. Alarm can be provided once set levels have been exceeded.

Typically estimates obtained from previous circuit-breaker maintenance schedules or manufacturers data sheets are used for setting these alarm levels. The relay instrumentation provides the current values of these counters.

5.8 Overfluxing Detector (81HBL5)

An increase in transformer or decrease in system frequency may result in the transformer becoming over-excited. The 81HBL5 element can be used to prevent protection operation e.g. prevent differential protection operation during acceptable over-excitation conditions.

 ©2018 Siemens Protection Devices Limited

5.9 Load Blinder (21)

NB: It is important to observe the convention regarding Forward and Reverse directions of current.

Load Blinders are used with directional overcurrent elements to block forward tripping during periods of high load currents that can occur in distribution networks. The blinder is operated during user defined load conditions and is used in conjunction with the relay protection elements.

One of the major factors contributing to high load conditions is an increase of distributed generation capacity which can feed power back into the network contrary to the 'normal' direction of power flow. This can result in current levels above the relay setting and can cause tripping of overcurrent elements.

One typical example is on paralleled incoming transformer circuits, forward directional overcurrent elements are parametised such that they detect faults on the transformer LV connections for currents flowing in the direction contrary to the 'normal' load flow. These forward elements have a relatively low current setting, typically <45% of transformer rating, as current normally only flows in this direction during fault conditions. When embedded generation is connected into the downstream network, these relays limit the level of current that can be fed back into the grid.

Load Blinders measure the system impedance and are set to differentiate between a fault having a relatively low impedance and a fault having a relatively high impedance. Additional measurands are also considered to increase the security of operation.

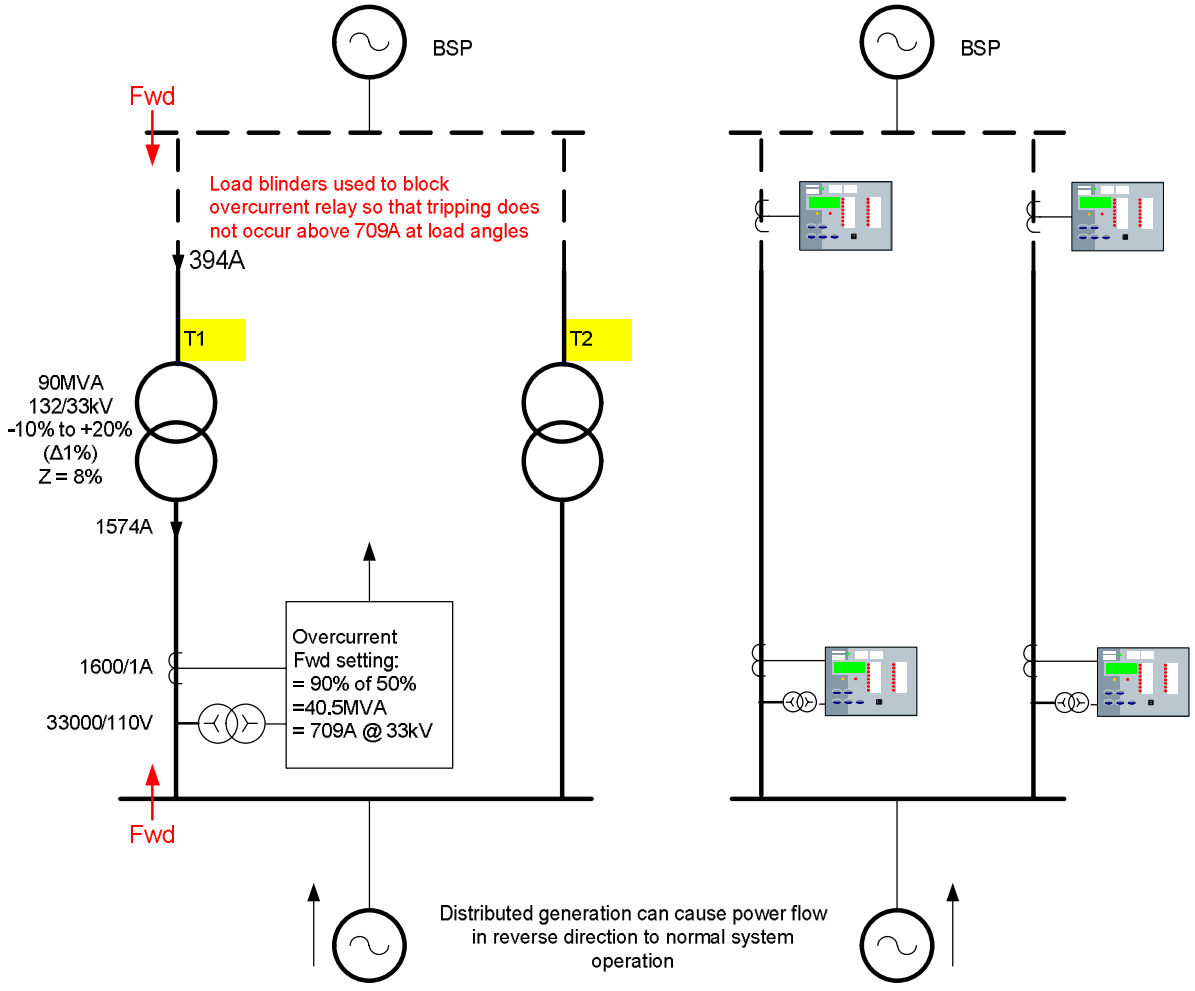


Figure 5.9-1 Paralleled Transformers and Feeders

© 2013 Siemens Protection Devices Limited

5.10 Load Blinder Design

5.10.1 Application view

It is important to observe the convention regarding Forward and Reverse directions of current.

Load Blinders are designed to block forward overcurrent elements from tripping during defined load conditions.

User settings ***21LB-1/3P Impedance***, ***21LB-1/3P Angle +ve*** and ***21LB-1/3P Angle -ve*** ('a', 'b' and 'c' in Figure 5.10.1-1 Impedance Setting and Angle Setting) allow the user to define the Blinder region depending on the network configuration - specifically the line loading and fault levels.

The measured impedance:

a. Is used to confirm the forward or reverse flow of current i.e. load blinder operated.
b. Is used to confirm that current flow is outside the defined limits of load flow i.e. load blinder not operated.

The transition between operated and non-operated is subject to a 5 degree hysteresis adjustment.

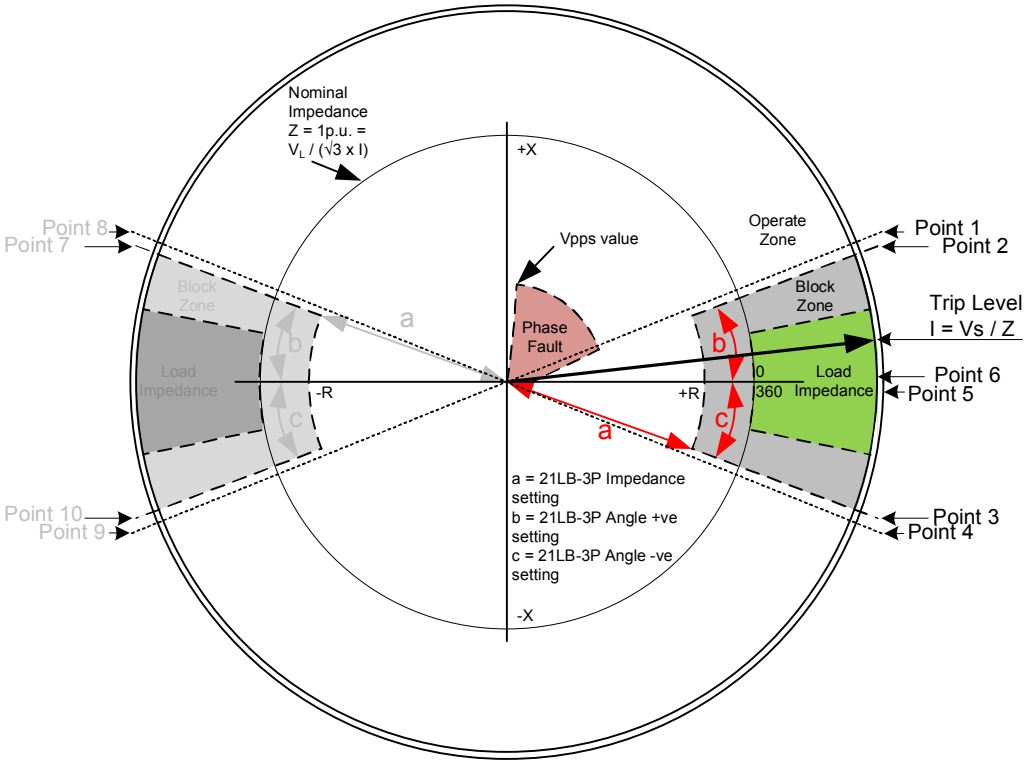


Figure 5.10.1-1 Impedance Setting and Angle Setting

©2018 Siemens Protection Devices Limited

5.10.2 Design View

5.10.2.1 Load Blinder 3Ph

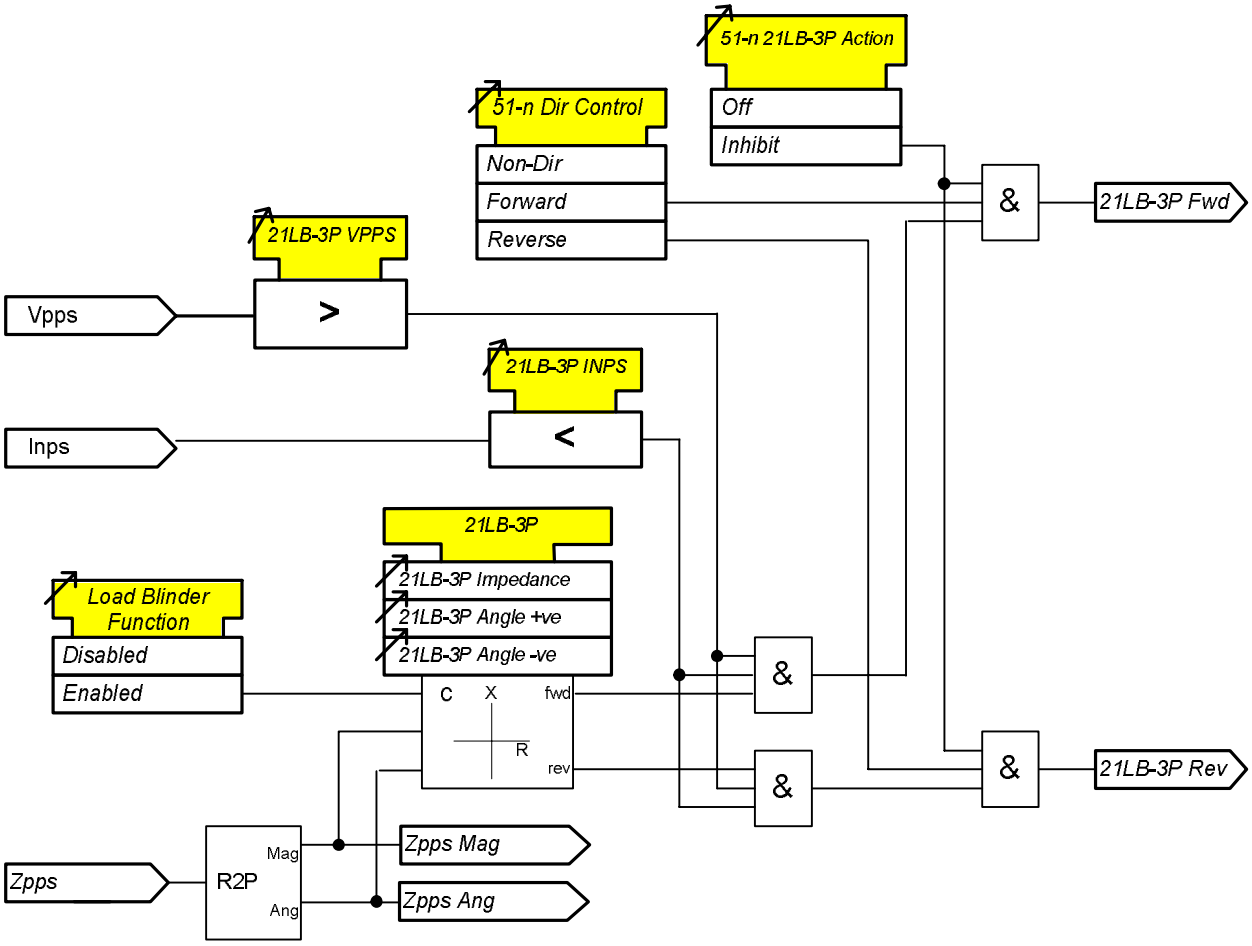


Figure 5.10.2.1-1 Logic Diagram 3 Phase

The 3-phase load blinder has the following setting parameters:

21LB – 3P Angle +ve
21LB – 3P Angle -ve
21LB – 3P Impedance
21LB – 3P VPPS
21LB – 3P INPS

The design of Load Blinder 3Ph takes into consideration that the protection blocking should only be issued during definable allowable system power flow conditions i.e. an overcurrent blocking signal can only be issued when:

a. Positive Sequence Voltage **Vpps** is not significantly reduced i.e. is above the ***21LB-3P VPPS Setting.***
AND
b. Negative Sequence Current **Inps** is lower than ***21LB-3P INPS Setting***
AND
c. The impedance measured in all phases is within the operate zone.
Zpps is calculated from **Vpps** and **Ipps**. The calculated **Zpps** is used to determine if the impedance is in the operate zone i.e. greater than the ***21LB-3P Impedance*** setting and less than the ***21LB-3P Angle*** settings. Suitable settings can be chosen to provide overcurrent blocking in the forward or reverse directions.

© 2013 Siemens Protection Devices Limited

5.10.2.2 Load Blinder 1Ph

The single phase Load Blinder provides phase segregated blocking outputs. The **Inps** level is not considered whereas operation of the load blinder is inhibited during earth fault conditions i.e. when the **Izps** level exceeds the **I21LB-1P IZPS** setting.

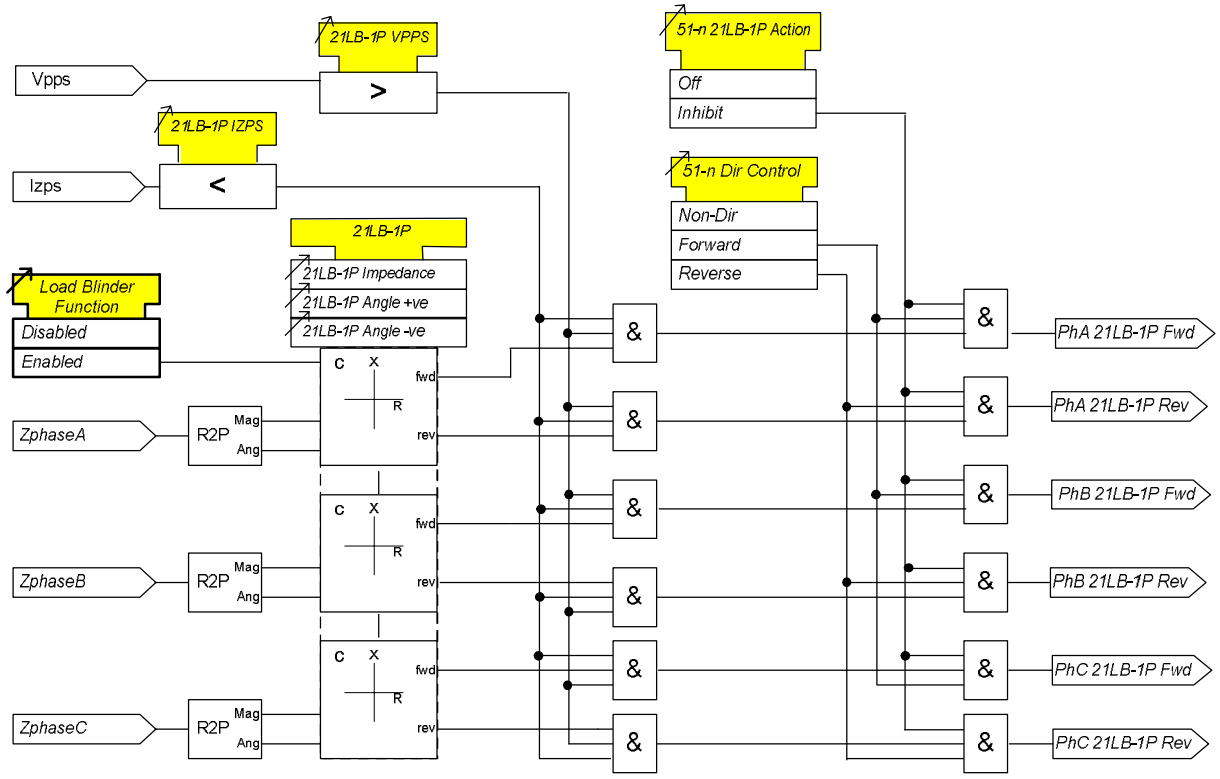


Figure 5.10.2.2-1 Logic Diagram 1 Phase

The single phase load blinder has the following setting parameters:

21LB – 1P Angle +ve
21LB – 1P Angle -ve
21LB – 1P Impedance
21LB – 1P VPPS
21LB – 1P IZPS

The design of single phase load blinder takes into consideration the following effects of a high unbalanced load non-fault condition. The blinder is operated when:

a. Positive Sequence Voltage **Vpps** is not significantly changed. A high ***21LB-1P VPPS setting*** will allow inhibiting Load Blinders in case of larger voltage drops (representing fault situation).
AND
b. Zero Sequence Current **Izps** is lower than ***21LB-1P IZPS Setting.***,
AND
c. The impedance measured per phase is within the operate zone.
Zphase is calculated from Vphase (peak) and Iphase (peak). The calculated Zphase is used to determine if the impedance for that phase is in the operate zone i.e. greater than ***21LB-1P Impedance*** setting and less than ***21LB-1P Angle*** settings.
Suitable settings can be chosen to provide outputs in the forward or reverse directions.

©2018 Siemens Protection Devices Limited

5.10.3 Setting Example – 3 Pole Load Blinder

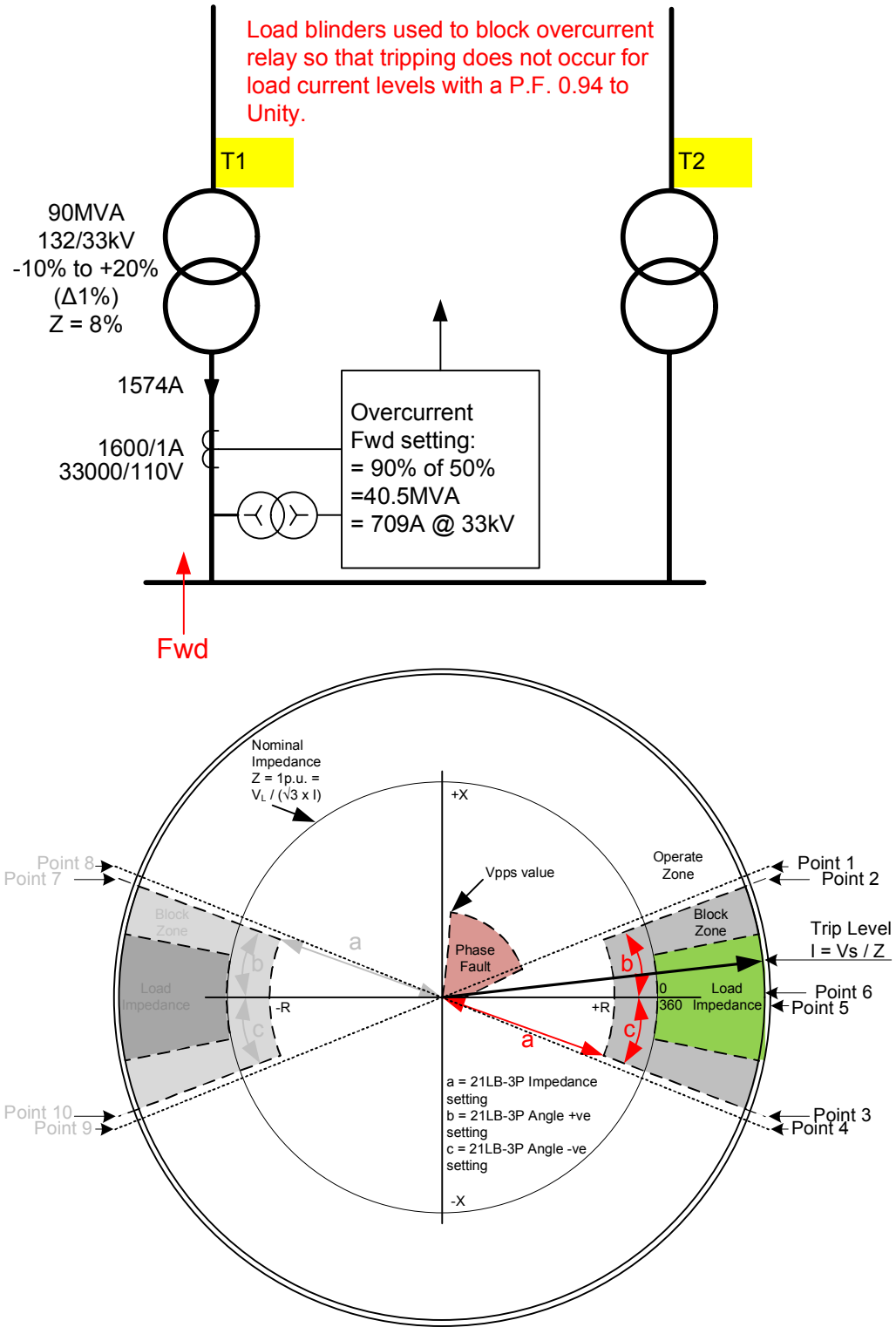


Figure 5.10.3-1 Scheme and Impedance Illustration

© 2013 Siemens Protection Devices Limited

5.10.4 Calculating the Impedance

21LB-3P Impedance setting ('a')

This is the minimum system impedance that allows operation of the load blinder; it is set in secondary Ohms. To enable blocking of the overcurrent element for values of current up to say 1.5 times the nominal load current value (to allow for temporary reverse overload conditions) the setting is calculated from: -

$$Z_S = \frac{V_{Lsecy}}{I_{secy}} = \frac{110}{\sqrt{3} \times 1.5} = 42\Omega$$

Note: the equivalent primary impedance to the above: -

$$Z_P = Z_S \times \frac{CT_{Asecy}}{CT_{prim}} \times \frac{V_{Lprim}}{V_{Lsecy}} = 42 \times \frac{1}{1600} \times \frac{33000}{110} = 7.88\Omega$$

21LB-3P Angle setting ('b' and 'c')

A setting of 20 degrees will allow blocking of the overcurrent element for system load power factors between 0.94 and Unity.

21LB-3P VPPS setting

The Blinder is only operational during normal load levels of reverse load flow. Where reverse current flow is caused by a system fault the positive sequence voltage will reduce significantly. To facilitate Load Blinder operation the system should be substantially balanced i.e. positive phase sequence voltage will be high.

A setting of 0.95 Vn is selected i.e. ***21LB-VPPS*** setting = 0.95 x 63.5 = 60 V.

21LB-3P INPS setting

The Blinder is only operational during normal load levels of reverse load flow. The system should be substantially balanced i.e negative phase sequence current will be low.

A ***21LB-3P INPS*** setting = 0.05 In is selected.

©2018 Siemens Protection Devices Limited

Unrestricted

Siemens Protection Devices Limited
P.O. Box 8, North Farm Road
Hebburn, Tyne & Wear
NE31 1TZ
United Kingdom
Phone: +44 (0)191 401 7901
Fax: +44 (0)191 401 5575
E-mail: marketing.spdl.gb@siemens.com

For enquires please contact our Customer Support Center
Phone: +49 180/524 8437 (24hrs)
Fax: +49 180/524 2471
E-mail: support.energy@siemens.com

EMEA-T10050-00-76GB

September 2018